MINNESOTA DEPARTMENT OF TRANSPORTATION

THE COUNTY OF OLMSTED

CONSTRUCTION PLAN FOR GRADING, AGG. BASE, & 12'x6' P.C. BOX CULVERT

LOCATED ON C.S.A.H. 31 AT JCT. C.S.A.H. 31 AND T.H. 52 APPROX. 3 MILES N.W. OF ORONOCO **(GEOGRAPHIC DESCRIPTION)**

FROM 1,315' S. CENTER SEC. 2 T.108N. - R.15W. **TO** 377' N. CENTER SEC. 2 T.108N. - R.15W. **(LEGAL DESCRIPTION)**

STATE PROJ. NO. -

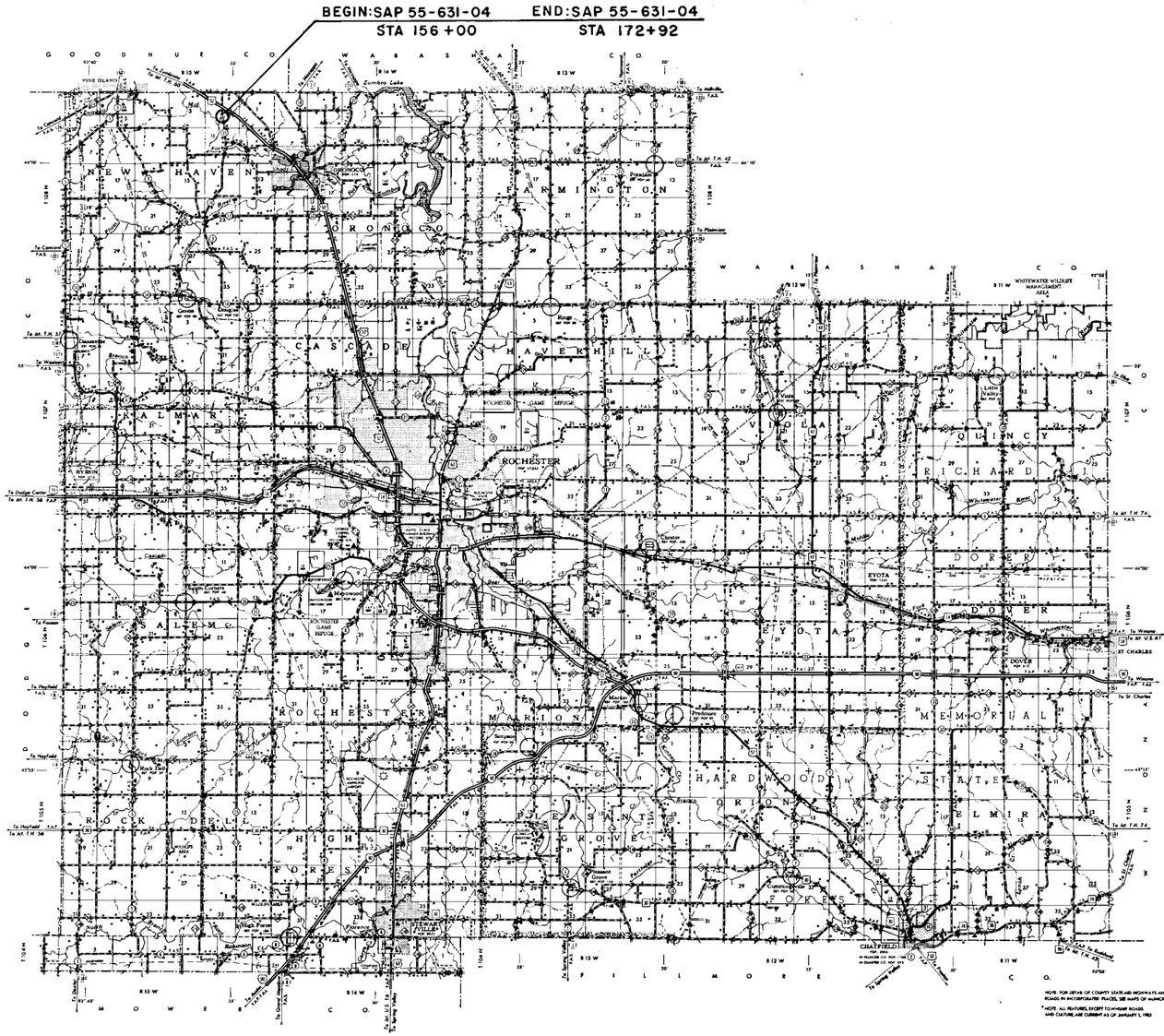
GROSS LENGTH	FEET		MILES
BRIDGES-LENGTH	FEET		MILES
EXCEPTIONS-LENGTH	FEET		MILES
NET LENGTH	FEET		MILES

STATE AID PROJ. NO. 55-631-04

GROSS LENGTH	1692.00	FEET 0.320	MILES
BRIDGES-LENGTH	0.00	FEET 0.00	MILES
EXCEPTIONS-LENGTH	0.00	FEET 0.00	MILES
NET LENGTH	1692.00	FEET 0.320	MILES

BEGIN: SAP 55-631-04 STA 156+00

END: SAP 55-631-04 STA 172+92



PLANS SYMBOLS

STATE LINE
COUNTY LINE
TOWNSHIP OR RANGE LINE
SECTION LINE
QUARTER LINE
SIXTEENTH LINE
RIGHT-OF-WAY LINE
PRESENT RIGHT-OF-WAY LINE
CONTROL OF ACCESS LINE
PROPERTY LINE (Except Land Lines)
VACATED PLATTED PROPERTY
CORPORATE OR CITY LIMITS
TRUNK HIGHWAY CENTER LINE
RETAINING WALL
RAILROAD
RAILROAD RIGHT-OF-WAY LINE
RIVER OR CREEK (NAME)
DRY RUN
DRAINAGE DITCH (SIZE)
DRAIN TILE
CULVERT
DROP INLET
GUARD RAIL
BARBED WIRE FENCE
WOVEN WIRE FENCE
CHAIN LINK FENCE
RAILROAD SNOW FENCE
STONE WALL OR FENCE
HEDGE
RAILROAD CROSSING SIGN
RAILROAD CROSSING BELL
ELECTRIC WARNING SIGN
CROSSING GATE
MEANDER CORNER
SPRINGS
MARSH
TIMBER
ORCHARD
BRUSH
NURSERY
CATCH BASIN C.B.
FIRE HYDRANT
CATTLE GUARD
OVERPASS (Highway Over)
UNDERPASS (Highway Under)
BRIDGE
BUILDING (One Story Frame)
F-FRAME C-CONCRETE
S-STONE T-TILE
B-BRICK ST-STUCCO
IRON PIPE OR ROD
MONUMENT (STONE, CONCRETE, OR METAL)
WOODEN HUB
GRAVEL PIT
SAND PIT
BORROW PIT
ROCK QUARRY
SLOPE EASEMENT

UTILITIES SYMBOLS

POWER POLE LINE
TELEPHONE OR TELEGRAPH POLE LINE
JOINT TELEPHONE AND POWER ON POWER POLES
ON TELEPHONE-POLES
ANCHOR
STEEL TOWER
STREET LIGHT
PEDESTAL(TELEPHONE CABLE TERMINAL)
GAS MAIN
WATER MAIN
CONDUIT
TELEPHONE CABLE IN CONDUIT
ELECTRICAL CABLE IN CONDUIT
TELEPHONE MANHOLE
ELECTRIC MANHOLE
BURIED TELEPHONE CABLE P-BUR
BURIED ELECTRICAL CABLE P-BUR
AERIAL TELEPHONE CABLE T-AE
SEWER, (SANITARY OR STORM)
SEWER MANHOLE

SCALES

PLAN	100' HORIZ. & VERT.
PROFILE	100' HORIZ. & 10' VERT.
INDEX MAP	10,560'
CROSS SECTIONS	10' HORIZ. & VERT.

ALBINSON MPLS 55405

72065

MINN. PROJ. NO. -

GOVERNING SPECIFICATIONS

THE 1988 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR CONSTRUCTION" AS AMENDED BY THE MAY 2, 1994 SUPPLEMENTAL SPECIFICATION SHALL GOVERN.

INDEX

SHEET 1	TITLE SHEET
SHEET 2	ESTIMATED QUANTITIES AND TYPICAL SECTION
SHEET 3	PLAN & PROFILE
SHEETS 4-9	CROSS-SECTIONS
SHEETS 10-11	BRIDGE SHEETS
SHEETS 12-14	BARREL & END SECTION DETAILS
SHEET 15	TRAFFIC CONTROL PLAN

DESIGN DESIGNATION

R
ADT (Current Year) = 152 (1994)
ADT (Future Year) = 276 (2014)
DHV (Design Hr. Vol.) =
D (Directional Distr.) = %
T (Heavy Commercial) = 6 %
SOIL FACTOR 130
SHOULDER WIDTH ULT. 4'
CLASSIFICATION LOCAL
TON DESIGN ULT. 7-9

EN18 (20)
Design Speed 55 MPH
Based on Stopping Sight Distance
Height of eye 3.5' Height of object 0.5'
Design Speed not achieved at:
STA. TO STA. MPH
STA. TO STA. MPH
STA. TO STA. MPH

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE 9-9-94 REG. NO. 19917 ENGR. Kaye M Brienick

APPROVED 9-9-94 (DATE) Michael D Sheehan (COUNTY ENGINEER)

COUNTY Olmsted

Recommended for Approval W Kramer Dt 9-12 1994 (DISTRICT STATE AID ENGINEER)

Recommended for Approval ____ 19____ (STATE AID PLANS AND SPECS ENGINEER)

Approved 9/15 19 94 Julie Stallman (ASST STATE AID ENGINEER)

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
APPROVED
DIVISION ADMINISTRATOR DATE

~~STATE AID PROJ. NO.~~

STATE AID PROJ. NO. 55-631-04 OLMSTED COUNTY **SHEET NO. 1 OF 15 SHEETS**

ESTIMATED QUANTITIES

	SPECIFICATION NO.	ITEM	UNIT	NON PARTICIPATING	PARTICIPATING	TOTAL ESTIMATED QUANTITIES
	2021.501	MOBILIZATION	LUMP SUM	1		1
	2101.502	CLEARING	TREE	5		5
	2101.507	GRUBBING	TREE	5		5
(1)	2104.501	REMOVE PIPE CULVERT	LIN. FT	124		124
(2)	2104.505	REMOVE PAVEMENT	SQ. YD.	106		106
(3)	2105.515	UNCLASSIFIED EXCAVATION	CU. YD.	5842		5842 (P)
	2105.523	COMMON BORROW (CV)	CU. YD.	2620		2620 (P)
(4)	2211.501	AGGREGATE BASE CL 2	TON	2501		2501
	2412.511	12 X 6 P. C. BOX CULVERT (6' OVERFILL)	LIN. FT.		132	132
	2412.512	12 X 6 P. C. BOX CULVERT END SECTION(TYPE III)	EACH		4	4
(5)	2442.501	REMOVE OLD BRIDGE	LUMP SUM.	1		1
	2451.507	GRANULAR BEDDING (CV)	CU. YD.		83	83 (P)
	2501.511	18" C. S. PIPE CULVERT	LIN. FT.	145		145
	2501.511	24" C. S. PIPE CULVERT	LIN. FT.	38		38
(6)	2501.567	18" C. S. PIPE SAFETY APRONS	EACH	6		6
(6)	2501.567	24" C. S. PIPE SAFETY APRONS	EACH	2		2
(7)	2511.501	RANDOM RIPRAP CL. III	CU. YD.		85	85
	0563.601	TRAFFIC CONTROL	LUMP SUM	1		1
	2575.501	SEEDING	ACRE	1.8		1.8 (P)
(8)	2575.502	SEED MIXTURE 500	POUND	90		90
(9)	2575.502	SEED MIXTURE 1100	POUND	108		108
(10)	2575.505	SODDING TYPE LAWN & BOULEVARD	SQ. YD.	676		676
(11)	2575.511	MULCH MATERIAL TYPE I	TON	3.6		3.6
	2575.519	DISK ANCHORING	ACRE	1.8		1.8 (P)

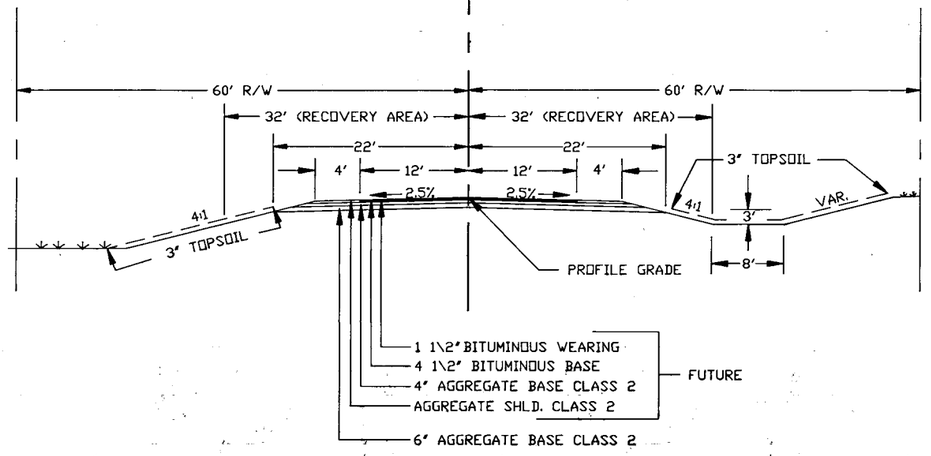
STANDARD PLATES

THE FOLLOWING STANDARD PLATES, APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION SHALL APPLY ON THIS PROJECT.

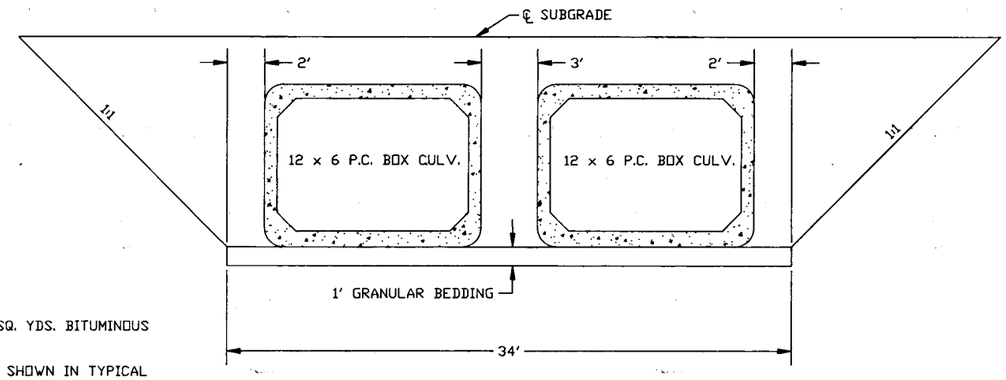
PLATE NO.	DESCRIPTION
0005 A	SPECIFICATIONS REFERENCE TO STANDARD PLATES
3007 B	SHEAR REINFORCEMENT FOR PRECAST DRAINAGE STRUCTURES
3040 F	CORRUGATED METAL PIPE CULVERT
3128 F	SAFETY APRON
3145 E	CONCRETE PIPE TIES (EYE BOLT TIES)
8000 I	STANDARD BARRICADES
9000 B	APPROACHES AND ENTRANCES

TYPICAL SECTION

STA. 156+00 TO STA. 172+92



BEDDING DETAIL



(1) INCLUDING 3 FIELD ENTRANCES AND 1 RESIDENTIAL DRIVEWAY.

(2) PAVEMENT REMOVAL INCLUDES 50 SQ. YDS. CONCRETE AND 56 SQ. YDS. BITUMINOUS ON RESIDENTIAL DRIVE RT. STA. 170+78.

(3) UNCLASSIFIED EXCAVATION INCLUDES SUBGRADE TREATMENT AS SHOWN IN TYPICAL SECTION AND CROSS SECTIONS. 797 CU. YDS. UNCLASSIFIED EXCAVATION TO BE USED AS SALVAGED TOPSOIL AND PLACED AS SHOWN IN THE PLAN.

(4) INCLUDES 2087 TON AGG. BASE CL. 2 FOR MAINLINE, 364 TON FOR TAPER, 32 TON FOR 3 FIELD ENTRANCES, AND 18 TON FOR RESIDENTIAL DRIVEWAY.

(5) BRIDGE NO. L-6329

(6) ALL SAFETY APRONS ARE LOCATED OUTSIDE THE RECOVERY AREA, GRATES ARE NOT REQUIRED.

(7) PLACE RIPRAP ON 9" GRANULAR FILTER OR GEOTEXTILE FILTER MATERIAL, WHICH SHALL BE CONSIDERED INCIDENTAL AND NO DIRECT COMPENSATION WILL BE MADE THEREFORE.

(8) APPLICATION RATE 50 POUNDS PER ACRE.

(9) APPLICATION RATE 60 POUNDS PER ACRE.

(10) REPLACE EXISITING LAWN FROM STA. 169+12 TO 172+50 AS DIRECTED BY THE ENGINEER.

(11) APPLICATION RATE 2 TONS PER ACRE.

NOTES:

1. CULVERT EXCAVATION WILL BE CONSIDERED INCIDENTAL AND WILL BE INCLUDED FOR PAYMENT UNDER UNIT PRICE FOR ITEM NO. 2412.511 AND ITEM NO. 2412.512.
2. CULVERT TO BE BACKFILLED WITH EXCESS EXCAVATION.
3. DIMENSIONS AND SLOPES SHOWN ON TYPICAL SECTION ARE NOT TO SCALE.
4. ALL UTILITY POLES AND UNYIELDING OBJECTS WILL BE RELOCATED OUTSIDE THE 32' RECOVERY AREA. (BY OTHERS) THE 32' RECOVERY AREA. (BY OTHERS)
5. ALL ENTRANCE CULVERTS SHALL BE PLACED OUTSIDE THE RECOVERY AREA.
6. ALL ENTRANCES SHALL HAVE 6:1 INSLOPES.

CERTIFIED BY Kaye M Bierwirth REG. NO. 19917 9-9 19 94
PROFESSIONAL ENGINEER

℄ CULV. 155+88
INPL. 18"x12' CMP
2'x2'x20' CONC. EXTENSIONS

NO CHANGE

Const. F.E. 157+10
No Culv. Reqd

BR. NO. L6329 STA. 161+11
INPLACE 37' STEEL BEAM SPAN
CONCRETE PIER & ABUTMENTS

REMOVE OLD BRIDGE

F.E. LT. 164+69
INPL. 15"x20' CMP.

REMOVE
24" x 38' C.S. PIPE
2-24" C.S. SAFETY APRONS

CONST. ℄ CULV. STA. 161+01.55 SKEW 15°
12'x6'x66' P.C. BOX CULV.
2-12'x6' P.C. BOX CULV. END SECTION (TYPE III)

CONST. ℄ CULV. STA. 161+18.45 SKEW 15°
12'x6'x66' P.C. BOX CULV.
2-12'x6' P.C. BOX CULV. END SECTION (TYPE III)

PLACE CULVERTS ON 83 CU. YDS. (CV)
GRANULAR BEDDING 1.0' DEPTH x 66' LONG x 34' WIDE

P.I. 157+11.75
D = 0°19'00"
℄RT. = 2°15'48"
T = 357.35'
L = 714.61'
E = 3.53'
NO SUPERELEVATION REQ'D

POT 173+07.67
NAIL ON EDGE OF SO. LANE TH 52

Δ = 58°
D = 41°
T = 77.5'
R = 139.74'

SHED

PLACE RANDOM RIPRAP CL. III 18" DEPTH
14 CU. YDS. AT INLET, 71 CU. YDS. AT OUTLET

PLACE RIPRAP ON 9" GRANULAR FILTER
OR GEOTEXTILE FILTER MATERIAL

Δ = 122°
D = 122°
T = 84.7'
R = 47.0'

BEGIN: SAP 55-631-04
STA. 156+00

END: SAP 55-631-04
STA. 172+92

P.C. 153+54.40

P.T. 160+69.01

F.E. RT. 157+94
NO CULV. INPL.

~~18"x42' C.S. PIPE~~
~~2-18" C.S. SAFETY APRONS~~
Move To: 157+10
No Culv. Reqd.

F.E. RT. 164+69
INPL. 15"x26' CMP.

REMOVE
18"x42' C.S. PIPE
2-18" C.S. SAFETY APRONS

RES. DR. RT. 170+78
INPL. 18"x78' CMP

REMOVE
18"x61' C.S. PIPE
2-18" C.S. ~~SAFETY~~ APRONS
REMOVE (8) PANELS CONC. Removed from Driveway Conc.
REMOVE BITUMINOUS

TH 52 S.B.L.
TH 52 N.B.L.

CL. 5 TREES — GR. 5 TREES

B.M. ELEV. 992.76
BENT STEEL IN CONC.
4' S.W. COR. BRIDGE

B.M. ELEV. 1025.27
SPK. IN PP LT. 29'
STA. 172+15

℄ SUBGRADE ELEVATIONS

PROFILE 75' LT.
PROFILE 75' RT.

Special Ditch Lt + Rt STA 157+00 TO STA 160+50

P.I. +00
ELEV. 93.5
400' V.C.
M = 1.575

+0.35 %

P.V.C. +00
ELEV. 92.8

P.V.T. +00
ELEV. 005

+3.5 %

P.V.C. +25.0
ELEV. 25.9

P.V.T. +75.0
ELEV. 28.5

0.0%

P.I. +00
ELEV. 28.5
150' V.C.
M = 0.65625

INLET ELEV. 982.9
OUTLET ELEV. 982.5

1030
1020
1010
1000
990
980

87.9 88.25 88.6 88.95 89.3 89.65 90.0 90.35 90.7 91.05 91.4 91.75 92.1 92.45 92.8 93.54 95.08 97.39 00.5 04.0 07.5 11.0 14.5 18.0 21.5 25.0 27.85 28.5

85.2 85.4 85.2 86.4 88.7 89.3 89.5 89.4 89.1 87.6 86.8 85.2 86.7 90.4 91.2 92.0 92.2 93.5 94.6 94.1 93.5 93.1 92.9 92.7 92.7 93.4 93.8 97.1 00.3 03.5 06.8 10.2 13.2 15.9 18.7 21.5 21.9 25.6 28.7 29.2 29.5 29.8 29.9

+45 +70 +00 +50 +65 +50 +88 +00 +50 +60 +06 +70 +78 +82 +92 +07.67

150 155 160 165 170

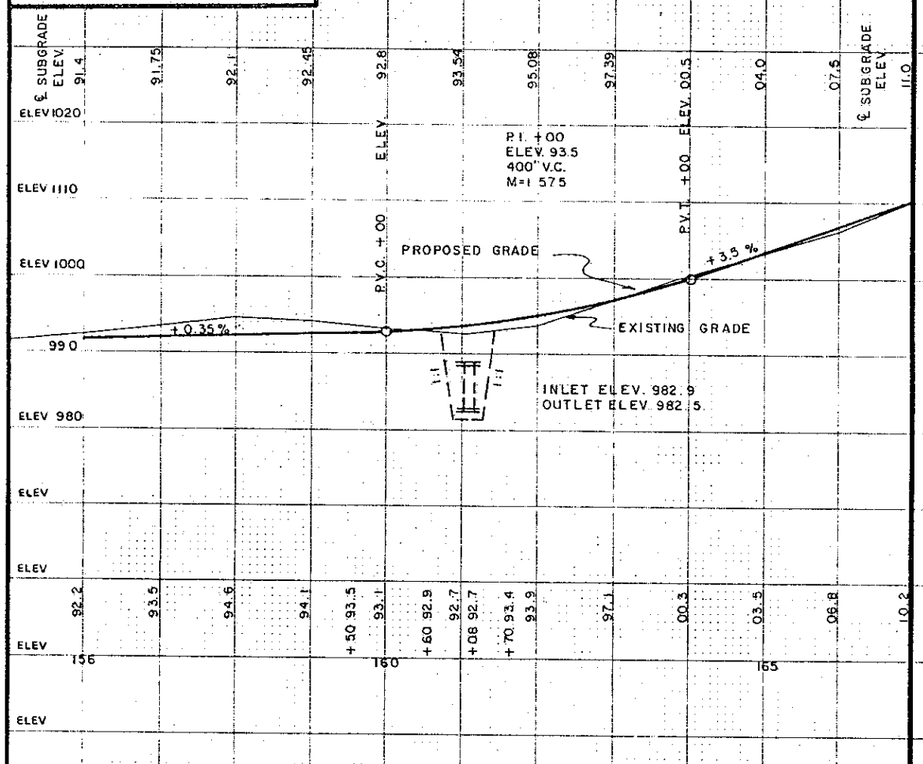
CERTIFIED BY Kaye M Briesick REG. NO. 19917 9-9 1994
PROFESSIONAL ENGINEER

~~State Proj. No.~~ SAP 55-631-04 CSAH 31 OLMSTED CO.

Sheet No. 3 **of** 15 **Sheets**

CONTRACTED PROFILE

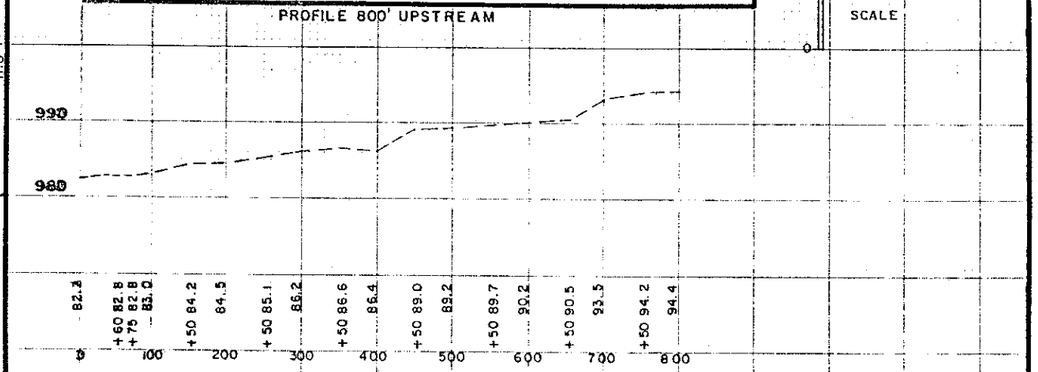
SCALE: HOR. 0' 50' 100' VER. 0' 5' 10'



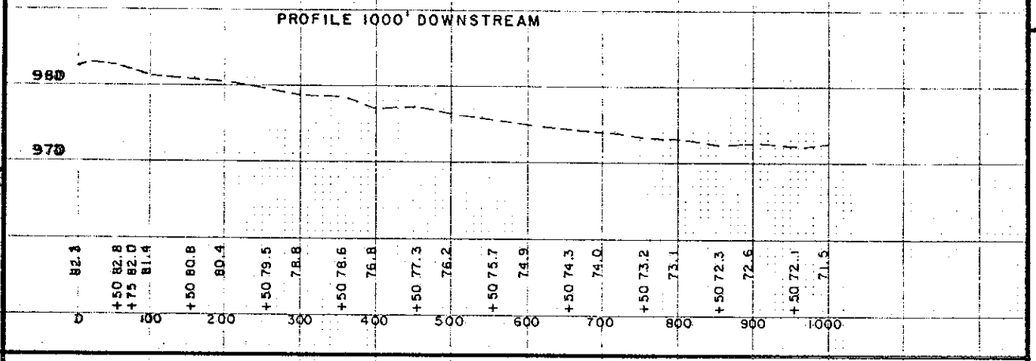
TYPICAL SECTIONS & PERTINENT DATA

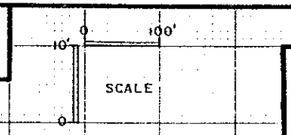
SCALES AS SHOWN

PROFILE 800' UPSTREAM



PROFILE 1000' DOWNSTREAM





Fed. Proj. No.

LOCATION ENGINEER'S OBSERVATIONS AT BRIDGE SITE

1. Special Features: Waterfalls, dams, floods, ice, debris, sliding banks, recreational boating.

2. Other bridges or culverts over the same stream (particularly structures which carry high water without overflow of roadway) :Given location, type, length, height above high water, cross-sectional area etc.

3. Apparent highwater elevation..... Obtained from.....

4. Other data: Approx. velocity of water at time of survey.....

HYDRAULIC ENGINEERS RECOMMENDATION

DATE 1-30-89

Stream or ditch designation unnamed dry run

Drainage area 1.5 sq. mi.

Max. flood on record unknown Design flood (50 yr. freq.) 670 C.F.S.

Max. observed highwater elevation unknown Design highwater elevation 987.6

Design mean velocity through structure 7.3 F.P.S. outlet

Low superstructure at or above elevation

Flowline elevation 982.4 Skew angle 15°

Waterway area req'd. below elevation ..... = ... Sq. Ft. at Rt. angles to channel

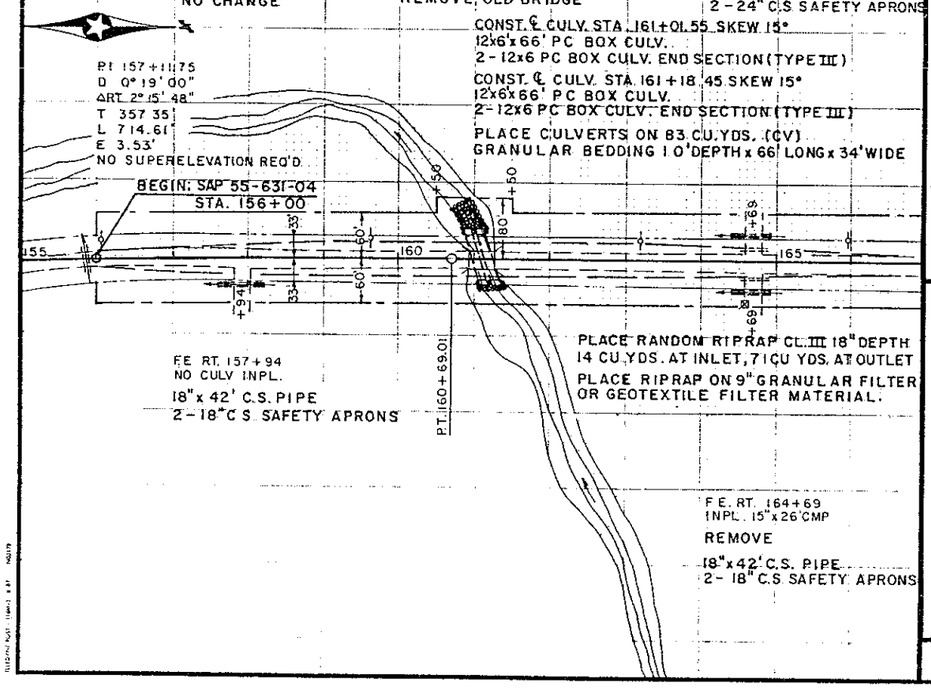
In the interest of flood plain zoning the regional flood (100 yr freq.) is 805 C.F.S. at stage 988.2 and mean velocity of 9.1 F.P.S. with 0.9 Ft. freeboard. The above recommendation will provide a structure of adequate waterway to pass the regional flood within criteria established by the Dept. of Natural Resources.

FOUNDATION ENGINEERS RECOMMENDATION

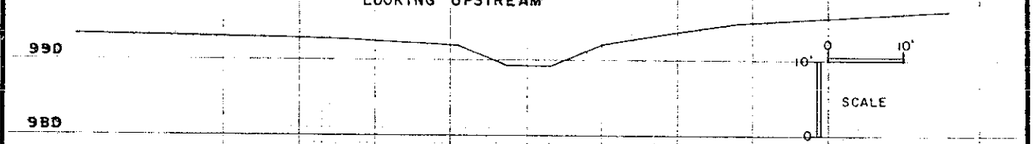
DATE .....

PLAT

SCALE: 0' 50' 100'

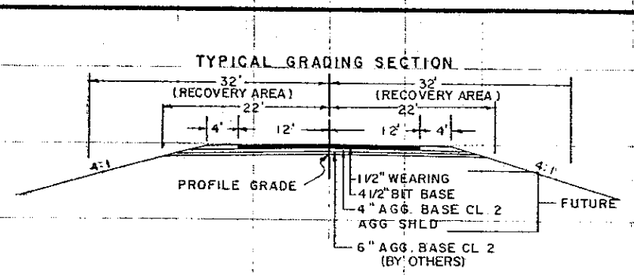


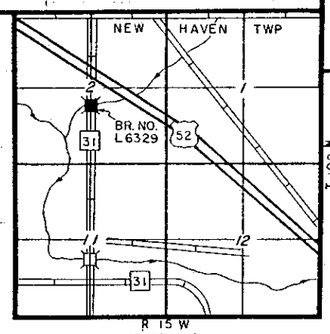
CHANNEL X-SECTION 500' UPSTREAM
LOOKING UPSTREAM



CHANNEL X-SECTION 800' DOWNSTREAM
LOOKING DOWNSTREAM

TYPICAL GRADING SECTION





Bridge survey sheets made from: BRIDGE SURVEY CONDUCTED BY OLMSTED COUNTY

Bench mark elevation..... 992.76 (M.S.L. 1929 Adj.)

Location: BENT STEEL IN CONCRETE LEFT STA. 161+96.

MINNESOTA
DEPARTMENT OF TRANSPORTATION

BRIDGE SURVEY

AT MILE POINT 30 ON C.S.A.H. 31 (T.H., C.S.A.H., C.R. etc.)

PROPOSED BRIDGE LOCATED 30 MILES NW OF ORONOCO

SEC. 2 TWP 108 N R 15 W

TOWNSHIP NEW HAVEN COUNTY OLMSTED

BRIDGE NO. 96782 ~~92235~~

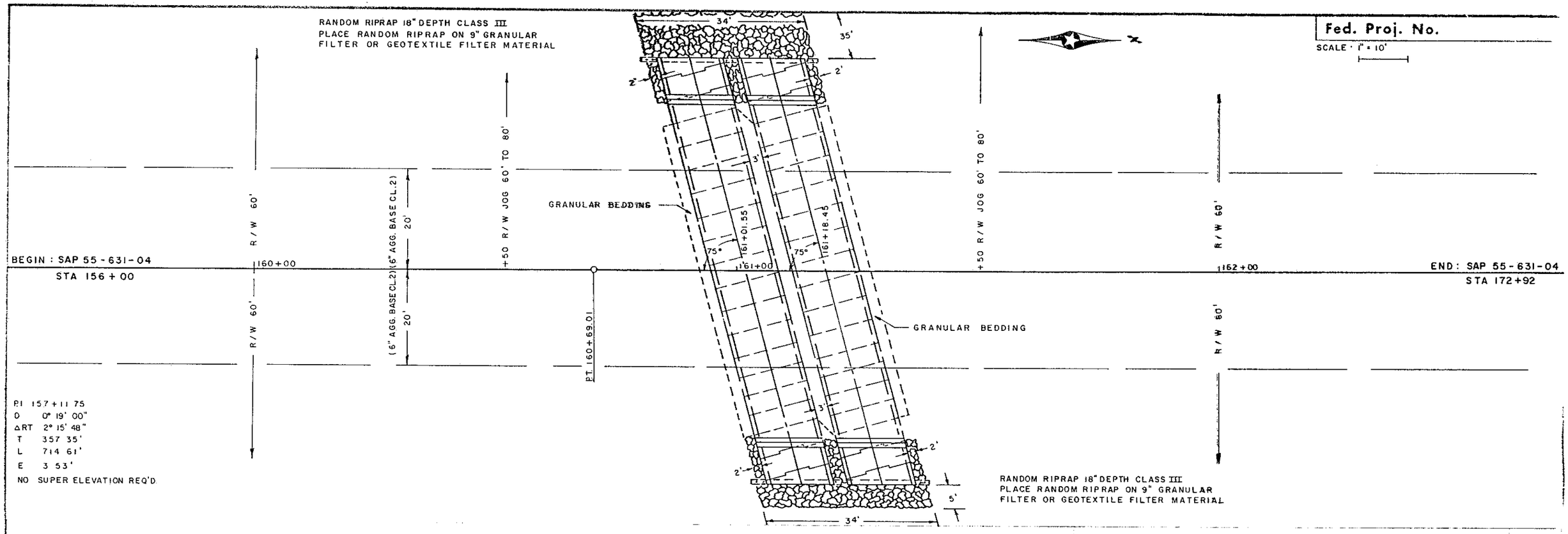
CERTIFIED BY Kay M Bremick PROFESSIONAL ENGINEER REG. NO. 19217 9-2 1994

~~State Proj. No.~~ SAP 55-631-04 C.S.A.H. 31 OLMSTED CO. Sheet No. 10 of 15 Sheets

RANDOM RIPRAP 18" DEPTH CLASS III
PLACE RANDOM RIPRAP ON 9" GRANULAR
FILTER OR GEOTEXTILE FILTER MATERIAL

Fed. Proj. No.

SCALE : 1" = 10'

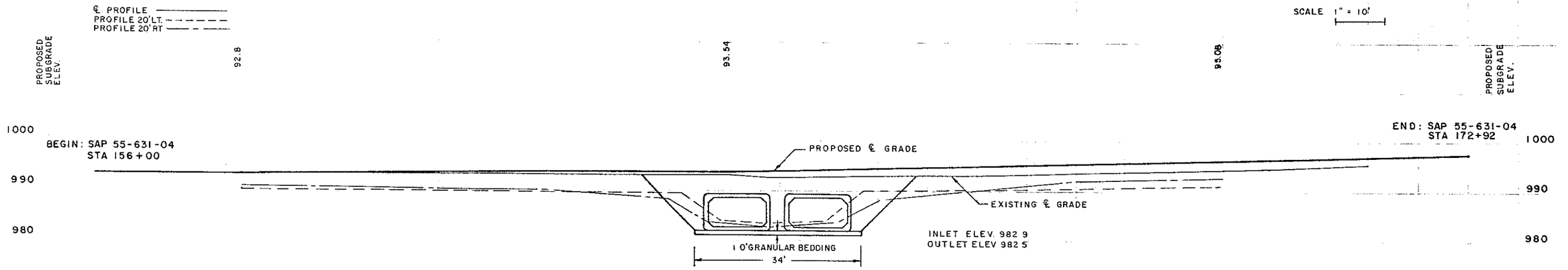


PI 157+11.75
D 0° 19' 00"
ΔRT 2° 15' 48"
T 357.35'
L 714.61'
E 3.53'
NO SUPER ELEVATION REQ'D.

RANDOM RIPRAP 18" DEPTH CLASS III
PLACE RANDOM RIPRAP ON 9" GRANULAR
FILTER OR GEOTEXTILE FILTER MATERIAL

℄ PROFILE
PROFILE 20'LT.
PROFILE 20'RT

SCALE 1" = 10'



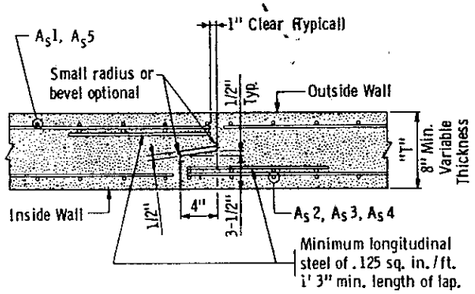
CERTIFIED BY Kaye M Bimick REG. NO. 19917 9-9 1994
PROFESSIONAL ENGINEER

SAP 55-631-04

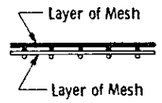
11 15

96782

Fed. Proj. No.

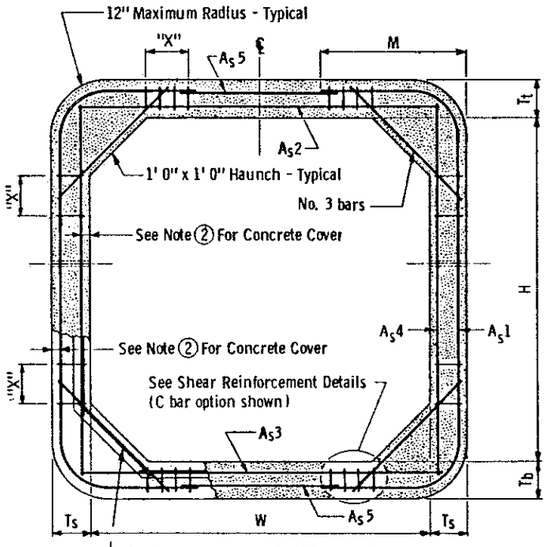


TONGUE AND GROOVE JOINT DETAIL



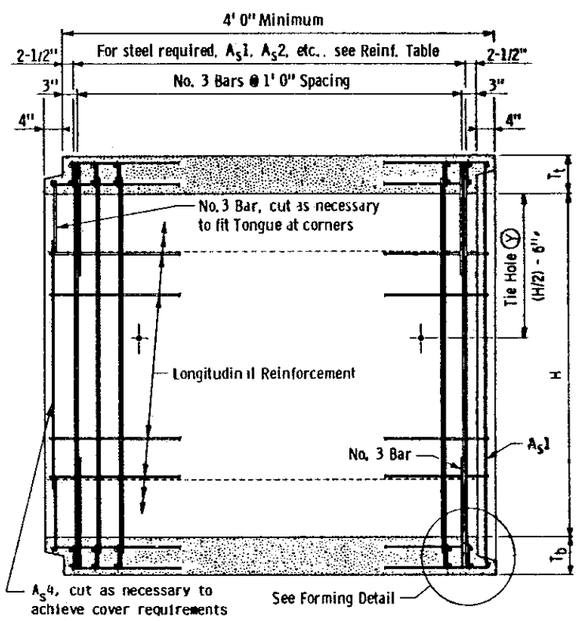
FABRIC LAYER DETAIL

When more than one layer of steel fabric is used to obtain the required reinforcement areas, the wires of the steel fabric shall be placed as shown



TRANSVERSE BARREL SECTION

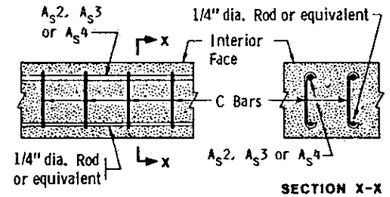
(Bar Reinforcement Option Shown)



(Y) Culvert ties are to be 1" diameter rods. See Standard Plate No. 3145 for connection details.
All holes in the barrels are to be approved by the engineer.

LONGITUDINAL BARREL SECTION

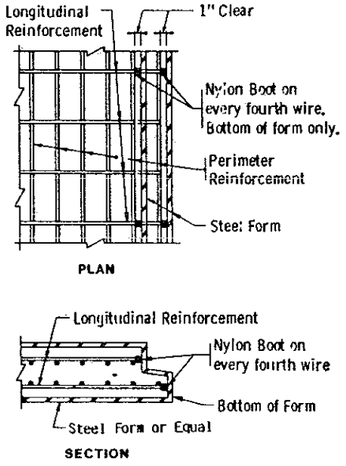
(Bar Reinforcement Option Shown)

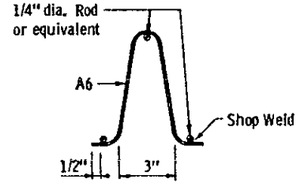


SHEAR REINFORCEMENT DETAIL

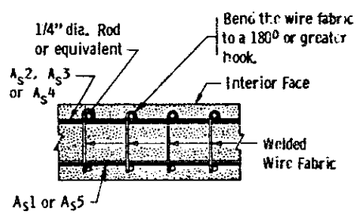
C BAR OPTION

C Bars shall have 135° Min. and 180° Max. hooks



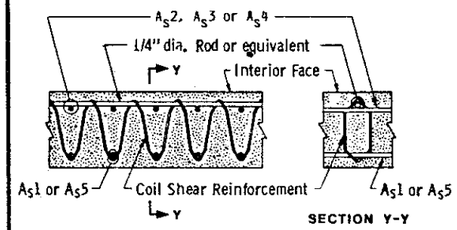


V BAR DETAIL



SHEAR REINFORCEMENT DETAIL

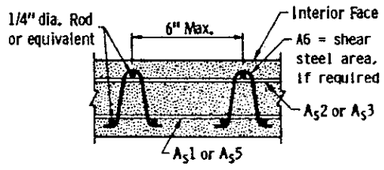
J BAR OPTION



SHEAR REINFORCEMENT DETAIL

COIL OPTION

FORMING DETAIL



SHEAR REINFORCEMENT DETAIL

V BAR OPTION

DIMENSION TABLE

Dimensions	Height of Overfill (F) 6'				
"W" (in Ft.)	12				
"H" (in Ft.)	6				
T_t (in inches)	9				
T_b (in inches)	10				
T_s (in inches)	8				
"W" (in inches)	29				
Weight (lbs./Ft.)	4540				

REINFORCEMENT TABLE

Reinforcement △	Height of Overfill (F) 6' *Area	Length	*Area	Length	*Area	Length	*Area	Length	*Area	Length
A_s1	0.538	11'4								
A_s2	0.721	12'3								
A_s3	0.783	12'3								
A_s4	0.192	6'3								
A_s5	0.192	10'0								

* Square inches per lineal foot of barrel.
△ Areas shown are based on Fy = 65,000 P.S.I.
Increase area 8% for Fy = 60,000 when reinforcement bars are used in part or total.

SHEAR REINFORCEMENT TABLE

(F) Height of Overfill	Shear Reinforcement Requirements ◇ Top of Culvert **Area	Maximum Spacing	"X" (in inches)	Bottom of Culvert **Area	Maximum Spacing	"X" (in inches)	Side of Culvert **Area	Maximum Spacing	"X" (in inches)
6'	NONE REQUIRED								

◇ When shear reinforcement is needed, a minimum shear steel of 0.06 sq. in. per sq. ft. shall be used.
** Square inches per linear foot of barrel.
"X" = Distance from end of haunch.

FIG. 5-397.701
Approved November 3, 1987

BARREL DETAILS

NOTES:

CONSTRUCTION

1. The steel fabric, shear reinforcement and reinforcement bars used shall conform to applicable requirements of AASHTO M 259.
2. 1-1/2" min. and 2" max. concrete cover on all reinforcement, including the shear reinforcement, except for tongue and groove detail.
3. One of the following combinations of steel reinforcement may be used:
   (a) 1 or 2 layers of mesh or
   (b) 1 layer of mesh and 1 layer of reinforcement bars or
   (c) 1 layer of reinforcement bars.
   The reinforcement shall be developed in accordance with applicable parts of sections 8.21 thru 8.33 of the AASHTO "Standard Specifications for Highway Bridges".
4. Longitudinal reinforcement parallel to the axis of the culvert shall have a min. of 0.06 square inches per peripheral foot on all faces of the barrel, except in tongue and groove.
5. The max. shear reinforcement spacing in the longitudinal direction shall be 6 inches.
6. The transverse steel areas in each face shall be a minimum of 0.192 sq. in. per linear feet of barrel.
7. The maximum size of reinforcement bars shall be No. 6. The maximum mesh size shall be 1/2" dia. per layer (maximum of 2 layers).
8. The spacing center to center of the circumferential wires shall not be less than 2 inches nor more than 4 inches. The spacing center to center of the longitudinal wires shall not be more than 8 inches.
9. Welding will not be allowed on reinforcement bars or steel fabric, except that the original welding required to manufacture wire fabric is acceptable.
10. When reinforcement is cut, additional reinforcement shall be added on both sides of the cut member to replace or exceed the cut steel.
11. Barrel sections which are cast with a draft in the forms shall be laid with the narrowest part of the section downstream.

BASIS OF DESIGN

A. The design shall be in accordance with 1989 and Interim AASHTO Design Specifications.
B. Live loads are based on HS25 or Military Loading as designated in FHWA PPM 20-4 Section 4C.
C. Maximum allowable Design Stresses
   F'c = 5,000 P.S.I., N = 6
   Fy = 60,000 P.S.I. reinforcement bars
   Fy = 65,000 P.S.I. steel fabric
D. Load factor design according to AASHTO standard specification Group X = 1.3 $(B_D D + B_L (L+I) + B_E E_V + B_E E_L)$ shall be used where B_D = 1.00, B_E = 1.00, B_L = 2.09 E_V = Vertical earth pressure and E_L = Lateral earth pressure. The following values have been used for this structure:
   Unit Soil Weight 130 lbs. per cu. ft.
   Maximum lateral Pressure Coefficient 50% of soil weight
   Minimum lateral Pressure Coefficient 25% of soil weight
E. Concrete shall be Mix No. 3N36 with no calcium chloride allowed.
F. Minimum overfill shall be two (2) feet, unless a reinforced concrete slab is placed over barrels.

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNED .....

DATE ..... REG. NO. .....

TRUNK HIGHWAY NO
STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION

BRIDGE NO.
CULVERT NO. ~~90782~~ 99234

IDENTIFICATION NO. 113

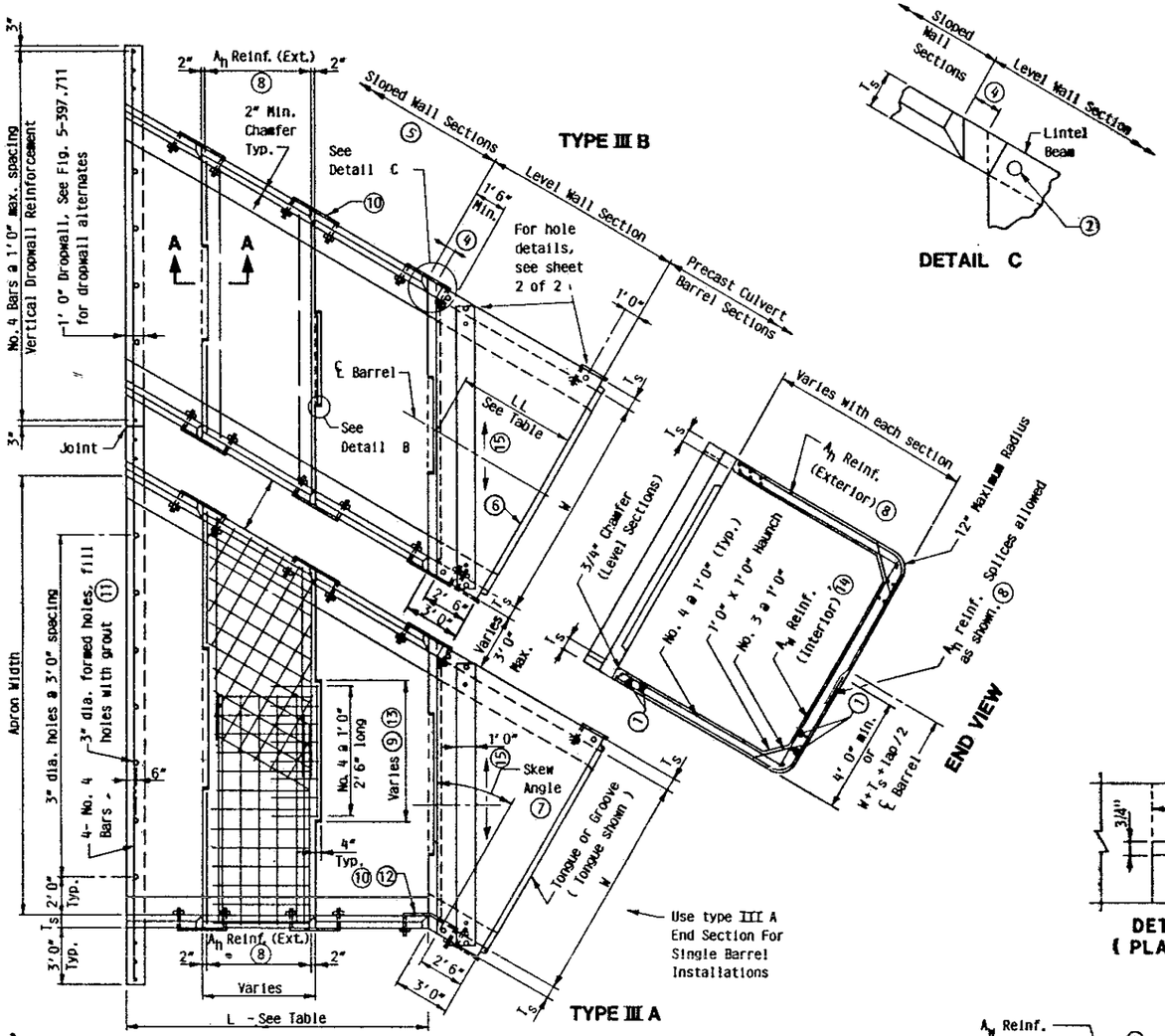
PRECAST CONCRETE BOX CULVERT

SEC. 2 T108 N R 15 W
NEW HAVEN TOWNSHIP OLMSTED COUNTY
APPROVED

BRIDGE ENGINEER

DES. DR.
CHK. CHK.

~~State Proj. No.~~ SAP 55-631-04 CSAH 31 OLMSTED COUNTY **Sheet No.** 12 **of** 15 **Sheets**



NOTES:

The steel reinforcement shall conform to the applicable requirements of AASHTO M259. The reinforcement shall be Grade 60 or better.

The maximum size of reinforcing bars shall be No. 6. The maximum mesh size shall be 1/2" dia. (1 or 2 layers).

Finish all vertical edges of concrete with 3/4" chamfer or radius unless otherwise noted.

Dropwall shall be concrete Mix 1A43,3Y43 or 3W36.

Precast Concrete Sections shall be Mix 3W36 with no calcium chloride allowed.

Limits for excavation for dropwall to be approximately the same as dropwall dimensions.

1-1/2" minimum and 2" maximum concrete cover on all reinforcement (Typical for inside and outside walls).

Culverts to be constructed as per Spec. 2411 except as noted.

See " Precast Concrete Box Culvert" Standard Sheet 9 No. 5-397.701 for additional reinforcement requirements such as laps and splice requirements.

One of the following combinations of steel reinforcement may be used:

(a) 1 or 2 layers of mesh or
(b) 1 layer of mesh and 1 layer of reinforcement bars or
(c) 1 layer of reinforcement bars.

8.16.8.2 of 1983 and Interim

If (b) or (c) are used, service load stresses shall be used in culvert design. The reinforcement shall be developed in accordance with applicable parts of 8.21 to 8.33.6.2 of 1983 AASHTO "Standard Specifications for Highway Bridges".

(1) Longitudinal reinforcement parallel to side walls of end sections shall have a minimum of 0.06 sq. in. per ft. on all faces.

(2) 1" dia. x 1'0" long steel dowel. 2" dia. hole in the top of the level wall section. Fill hole to top of lintel beam with an approved grout, see Note 11.

(3) See Embankment Protection for Box Culverts, sheet 4

(4) Variable. 6" minimum to 2'0" maximum.

(5) Number of sections varies with "H" dimensions.

(6) Check the location to determine whether a tongue or a groove is used.

(7) For a ℄ of culvert skew angle of 22-1/2° to 37-1/2°, use a 30° skew end section. For 7-1/2° to 22-1/2°, use a 15° skew end section.

(8) See sheet 2 of 2 for A_h and A_w reinforcement tables.

(9) See Section A-A for additional reinforcement.

(10) Culvert ties are to be 1" dia. rods. See Standard Plate No. 3145 for details.

(11) Grout shall consist of 1 part cement and 2 parts sand. Use Type 1A air entrained Portland Cement. Grout mix shall have a maximum slump of 4".

(12) Two ties are required at angled wall joint connections. Bend ties to fit angle. No tongue or groove required.

(13) Apron widths up to 12 ft.=5'0" tongue & 5'1" groove. Apron widths over 12 ft.=8'0" tongue & 8'1" groove. Center tongue & groove on ℄ of each apron joint. Use same size tongue & groove in each apron assembly.

(14) Based on 2'0" height at end of wingwall sections.

(15) Slope ground from center of barrel towards sides.

L TABLE (14)

CULVERT HEIGHT H	END SECTIONS L
4 ft.	4 ft.
5 ft.	6 ft.
6 ft.	8 ft.
7 ft.	10 ft.
8 ft.	12 ft.
9 ft.	14 ft.
10 ft.	16 ft.
12 ft.	20 ft.

LL TABLE

WIDTH W	SKEW ANGLE 15°	SKEW ANGLE 30°
8 ft.	3'9"	5'2-3/8"
10 ft.	4'0-1/4"	5'9-1/4"
12 ft.	4'3-7/16"	6'4-5/16"
14 ft.	4'6-11/16"	6'11-1/8"
16 ft.	4'9-7/8"	7'6-1/16"
18 ft.	5'1-1/8"	8'1"
20 ft.	5'4-5/16"	8'7-15/16"

Approved: November 3, 1987

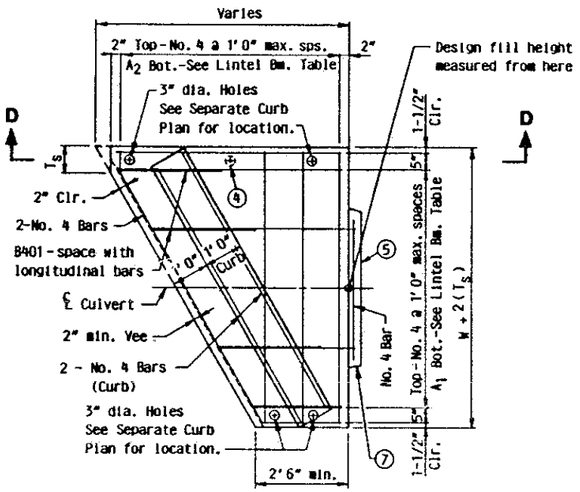
SAP 55-631-04 CSAH 31 OLMSTED COUNTY

FIG. 5-397.710 (1 of 2)

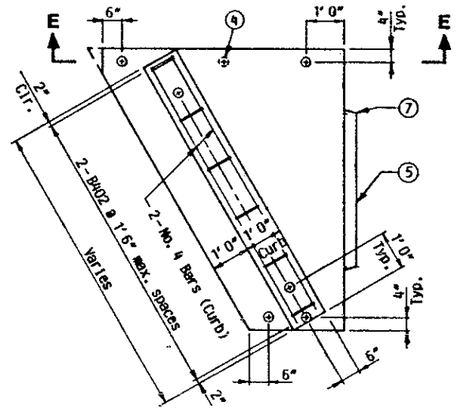
TITLE: PRECAST CONC. END SECTIONS - TYPE III SKEWED SINGLE OR MULTI-BARREL	DES:	DR:	APPROVED:	Bridge No. 92234 96782
	CHK:	CHK:		
	Sheet No. 13 of 15 Sheets			

A_w REINFORCEMENT TABLE ②

HEIGHT OF EACH END SECT.	MAXIMUM APRON WIDTH OF EACH SECTION AT THE RESPECTIVE HEIGHT														
	8' 0" - 11' 0"	12' 0"	13' 0"	14' 0"	15' 0"	16' 0"	17' 0"	18' 0"	19' 0"	20' 0"	21' 0"	22' 0"	23' 0"	24' 0"	25' 0"
2' 0"	No.4 @ 1'0"	———	———	———	———	———	———	No.4 @ 10"	No.4 @ 9"	No.4 @ 8"	No.4 @ 7"	No.5 @ 11"	No.5 @ 10"	No.5 @ 9"	No.5 @ 8-1/2"
4' 0"	No. 4 @ 1' 0"	———	———	———	———	No. 4 @ 10"	No. 4 @ 8-1/2"	No. 5 @ 11-1/2"	No. 5 @ 10"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10"	No. 6 @ 9-1/2"	No. 6 @ 8-1/2"	
5' 0"	No. 4 @ 1' 0"	———	———	No. 4 @ 11"	No. 4 @ 9-1/2"	No. 4 @ 8"	No. 5 @ 11"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 10-1/2"	No. 6 @ 9-1/2"	No. 6 @ 9"	No. 6 @ 8"	No. 6 @ 7-1/2"	
6' 0"	No. 4 @ 1' 0"	———	———	No. 4 @ 10-1/2"	No. 4 @ 9"	No. 5 @ 1' 0"	No. 5 @ 10"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10"	No. 6 @ 9"	No. 6 @ 8"			
7' 0"	No. 4 @ 1' 0"	———	No. 4 @ 11-1/2"	No. 4 @ 9-1/2"	No. 4 @ 8"	No. 5 @ 10-1/2"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 11"	No. 6 @ 10"	No. 6 @ 9"	No. 6 @ 8"			
8' 0"	No. 4 @ 1' 0"	———	No. 4 @ 11"	No. 4 @ 9"	No. 5 @ 1' 0"	No. 5 @ 10-1/2"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10-1/2"	No. 6 @ 9-1/2"					
10' 0"	No. 4 @ 1' 0"	———	No. 4 @ 10"	No. 4 @ 8"	No. 5 @ 11"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 10-1/2"							
12' 0"	No. 4 @ 1' 0"	No. 4 @ 11"	No. 4 @ 9"	No. 5 @ 11-1/2"	No. 5 @ 10"	No. 5 @ 8-1/2"									
14' 0"	No.4 @ 1'0"	No.4 @ 9"	No.4 @ 7"	No.5 @ 9-1/2"	No.5 @ 8"	No.5 @ 7-1/2"									



PLAN OF LINTEL BEAM



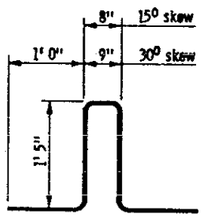
PLAN OF LINTEL BEAM

See Integral Curb Plan for
lintel beam reinforcement

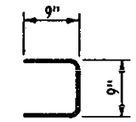
A_h REINFORCEMENT TABLE

HEIGHT H	A_h
8 ft. or less	No. 4 @ 1' 0"
10 ft.	No. 5 @ 8"
12 ft.	No. 6 @ 6"
14 ft.	No.7 @ 5"
16 ft.	No.8 @ 4-1/2"

NOTE: H is the highest vertical dimension of each section shown.



B401



B402

NOTES:

Curb is required and may be cast monolithically or cast separately.

① 1" dia. x 1'0" long steel dowel. 2" dia. hole in the top of the level wall section. 3" dia. hole in the lintel beam. Fill the hole to the top of the lintel beam with an approved grout.

② Use the largest steel area from the table across each individual section.

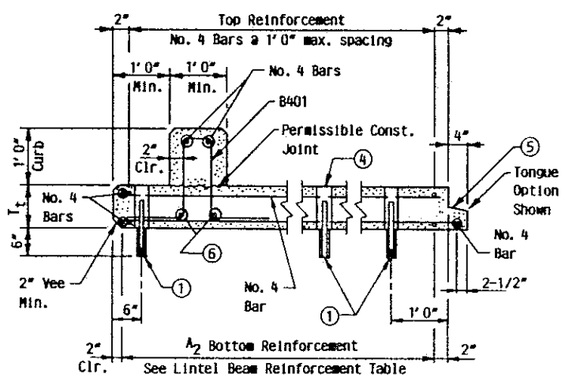
③ 1" dia. x 1'0" long steel dowel. 2" dia. hole in the top of the lintel beam. 3" dia. hole in the curb. Fill the hole to the top of the curb with an approved grout.

④ Cast an additional 3" hole at midpoint of beam when side of lintel beam is over 6 ft.

⑤ Check the location to determine whether a tongue or a groove is used.

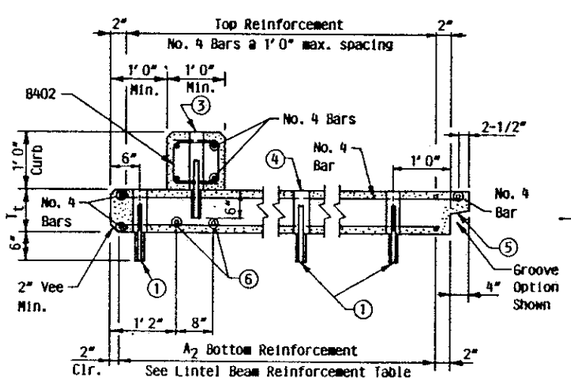
⑥ For spans under 10' use No.8 bars. For spans of 10' to 14' use No.9 bars. For spans over 14' to 18' use No.10 bars. For spans over 18' to 20' use No.11 bars, or equal.

⑦ Tongue and groove to terminate at culvert radius.



SECTION D-D

(With Integral Curb)



SECTION E-E

(With Separate Curb)

LINTEL BEAM REINFORCEMENT TABLE

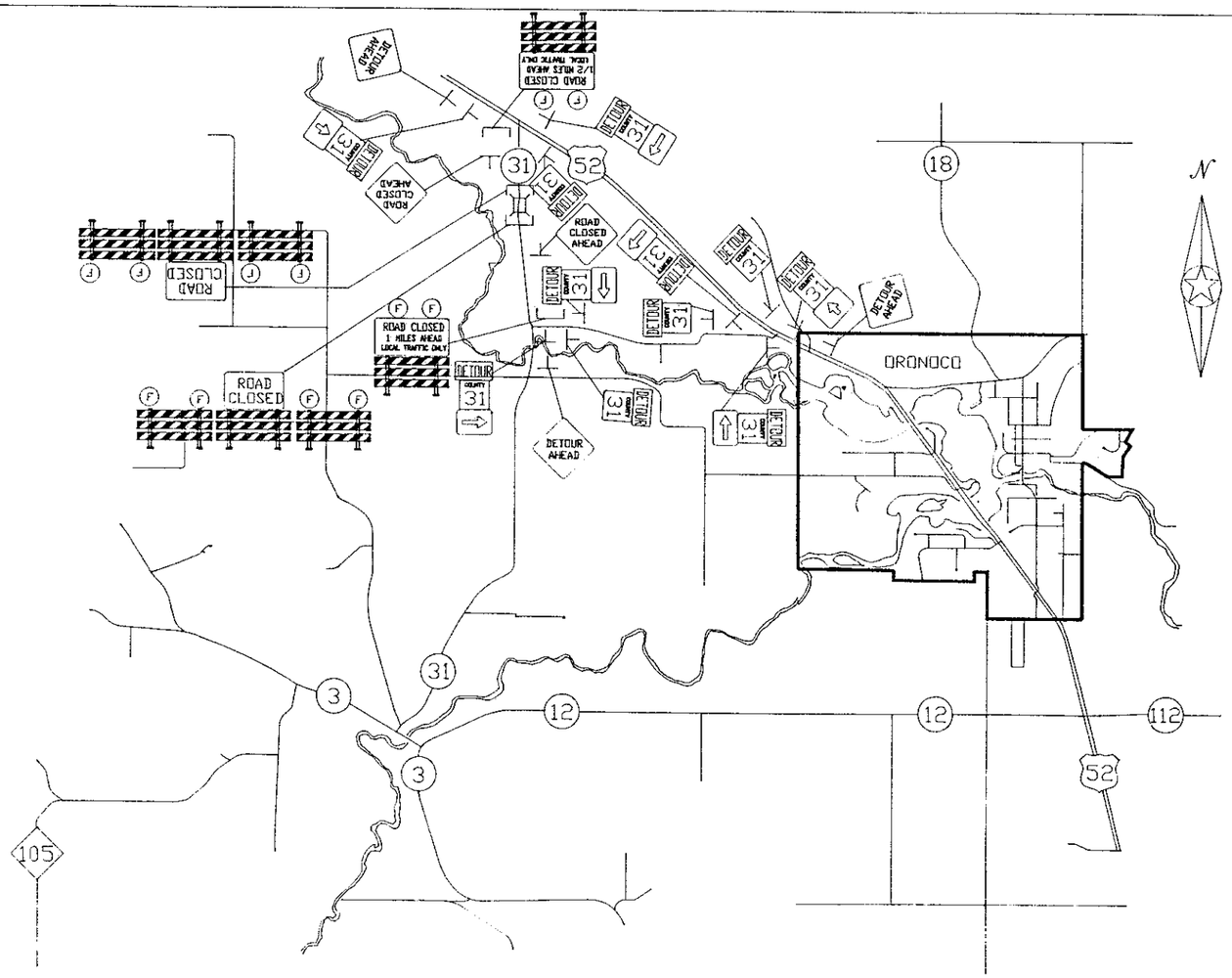
W CULVERT WIDTH	4 Ft. DESIGN FILL HEIGHT			2 Ft. DESIGN FILL HEIGHT		
	T_t	BOTTOM REINFORCEMENT		T_t	BOTTOM REINFORCEMENT	
		A_1	A_2		A_1	A_2
Under 6'	9"	No.4 @ 1'2"	No.4 @ 9-1/2"	9"	No.4 @ 1'6"	No.4 @ 1'4"
6'+ to 8'	9"	No.4 @ 8"	No.5 @ 8"	9"	No.4 @ 1'1"	No.4 @ 9"
8'+ to 10'	9"	No.5 @ 8"	No.6 @ 7-1/2"	9"	No.4 @ 9"	No.4 @ 6"
10'+ to 12'	9"	No.5 @ 6"	No.6 @ 6"	9"	No.5 @ 9"	No.5 @ 6"
12'+ to 14'	10"	No.5 @ 5"	No.6 @ 5"	9"	No.5 @ 7-1/2"	No.5 @ 5"
14'+ to 16'	11"	No.6 @ 6"	No.7 @ 5-1/2"	9"	No.5 @ 6"	No.6 @ 5-1/2"
16'+ to 18'	12"	No.6 @ 5-1/2"	No.7 @ 5"	10"	No.5 @ 5-1/2"	No.6 @ 5"
18'+ to 20'	13"	No.6 @ 5"	No.8 @ 6"	10"	No.6 @ 6"	No.7 @ 5-1/2"

NOTE: Maximum bar spacing given, reduce as necessary.

FIG. 5-397.710 (2 of 2)
Approved: November 3, 1987

SAP 55-631-04 CSAH31 OLMSTED COUNTY

TITLE	DES:	DR:	APPROVED:	Bridge No.
PRECAST CONC. END SECTIONS - TYPE III SKEWED SINGLE OR MULTI-BARREL	CHK:	CHK:		97234
	Sheet No. 14 of 15 Sheets			96782



ESTIMATE OF TRAFFIC CONTROL DEVICES									
DEVICE	NUMBER	SIZE	COLOR	QUANTITY	DEVICE	NUMBER	SIZE	COLOR	QUANTITY
ROAD CLOSED	R11-2	48 x 30	BLK/WH	2	DETOUR	M4-8	24 x 12	BLK/WH	11
ROAD CLOSED 1 MILES AHEAD LOCAL TRAFFIC ONLY	R11-3	60 x 30	BLK/WH	2	⇨	M6-1	21 x 15	BLK/WH	5
DETOUR AHEAD	W20-2	48 x 48	BLK/OR	3	⇧	M6-3	21 x 15	BLK/WH	2
ROAD CLOSED AHEAD	W20-3	48 x 48	BLK/OR	2		TYPE III	MIN. 6'	OR & BLK	8
COUNTY 31	M1-X4A	24 x 24	BLK/WH	11	(F)	TYPE A	FLASHING LAMPS	AMBER	12

TRAFFIC CONTROL LEGEND

⊥ POST OR STAND MOUNTED SIGN

└┘ TYPE III BARRICADE

TRAFFIC CONTROL NOTES

1. THE LOCATION OF SIGNS AND DEVICES WILL BE STAKED BY THE ENGINEER IN THE FIELD.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TRAFFIC CONTROL ON THIS PROJECT
3. ALL TRAFFIC CONTROL DEVICES SHALL CONFORM TO THE MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES INCLUDING APPENDIX B DATED NOV. 1992.
4. CONSTRUCTION ZONE SIGNING, WITHIN THE ROAD CLOSURE, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND WILL INCLUDE, BUT NOT BE LIMITED TO SAFTEY FENCE, CONES, AND WARNING SIGNS.
5. ALL BARRICADES ON THIS PROJECT SHALL BE REFLECTORIZED ON BOTH SIDES.

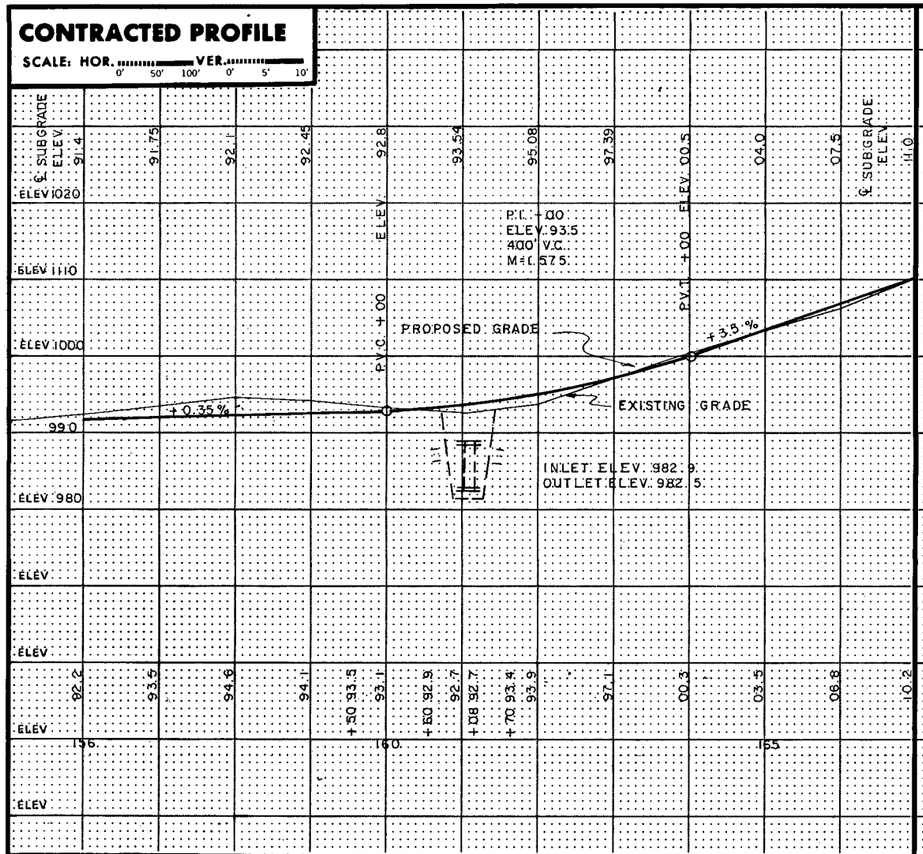
TRAFFIC CONTROL PLAN

CERTIFIED BY Kyle M Briesnick PROFESSIONAL ENGINEER REG. NO. 19917 9-9 19 94

State Aid Proj. No. 55-631-04 OLMSTED COUNTY C.S.A.H. 31 Sheet 15 of 15 Sheets

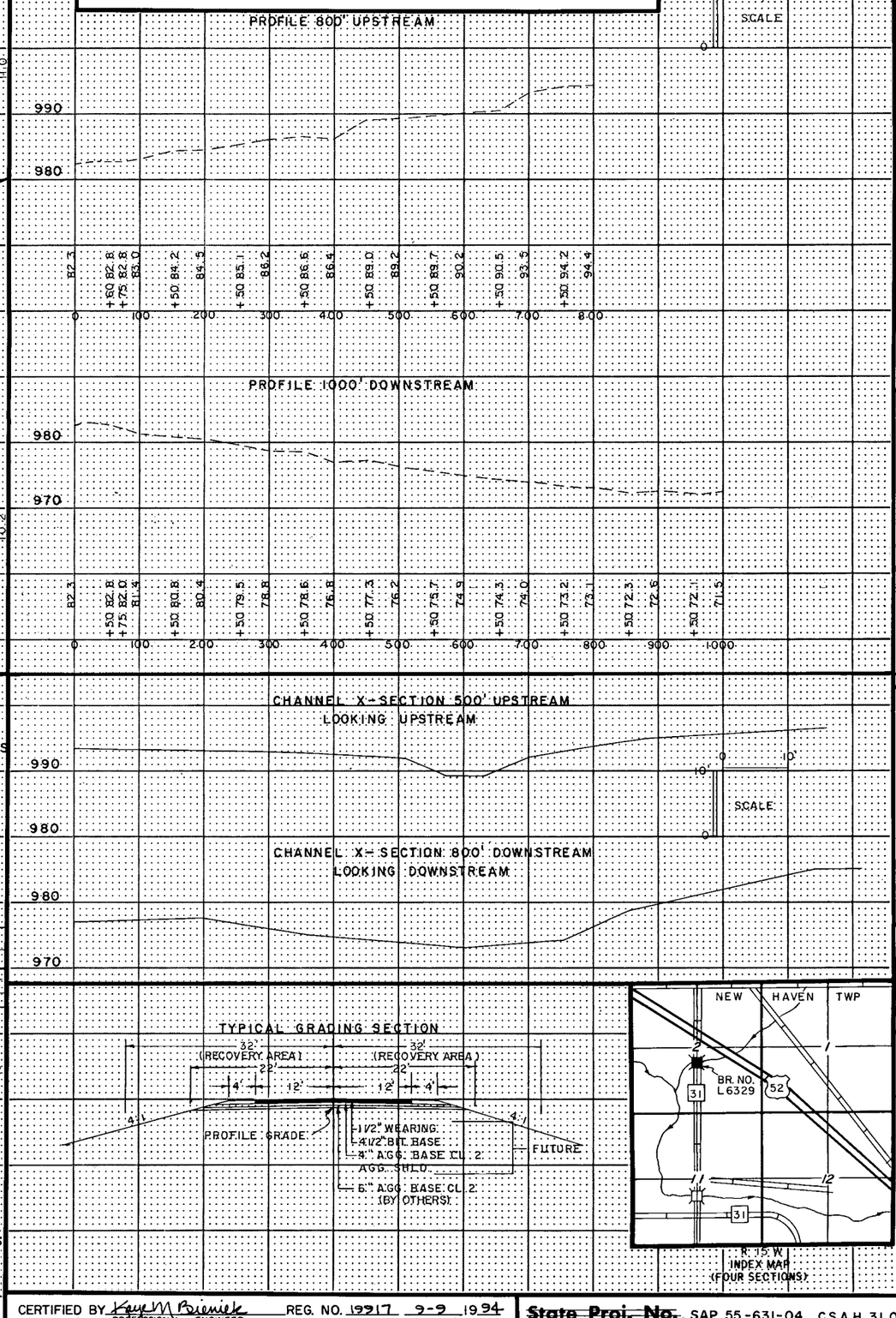
CONTRACTED PROFILE

SCALE: HOR. 0' 50' 100' VER. 0' 5' 10'



TYPICAL SECTIONS & PERTINENT DATA

SCALES AS SHOWN



Fed. Proj. No.

LOCATION ENGINEER'S OBSERVATIONS AT BRIDGE SITE

1. Special Features: Waterfalls, dams, floods, ice, debris, sliding banks, recreational boating.
2. Other bridges or culverts over the same stream (particularly structures which carry high water without overflow of roadway) :Given location, type, length, height above high water, cross-sectional area etc.
3. Apparent highwater elevation..... Obtained from.....
4. Other data: Approx. velocity of water at time of survey.....

HYDRAULIC ENGINEERS RECOMMENDATION

DATE 1-30-89

Stream or ditch designation unnamed dry run

Drainage area 1.5 sq. mi.

Max. flood on record unknown. Design flood (...50... yr. freq.) ..670...C.F.S.

Max. observed highwater elevation unknown Design highwater elevation 987.6

Design mean velocity through structure 7.3 F.P.S. outlet

Low superstructure at or above elevation .....

Flowline elevation 982.4 Skew angle 15°

Waterway area req'd. below elevation ..... = ...Sq. Ft. at Rt. angles to channel

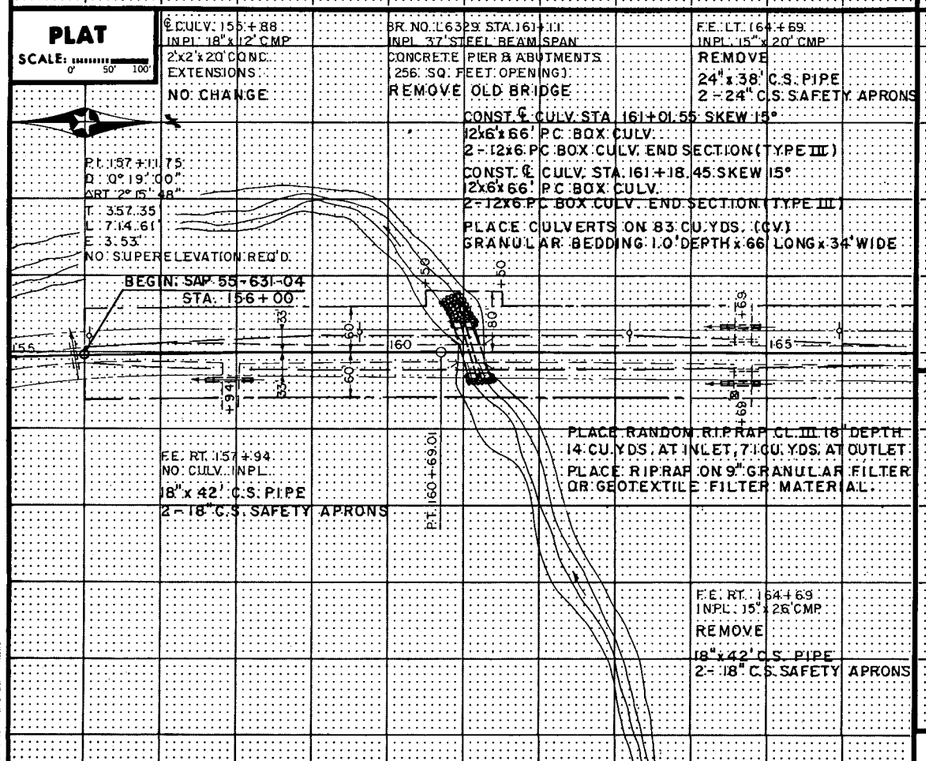
In the interest of flood plain zoning the regional flood (100 yr. freq.) is 805 C.F.S. at stage 988.2 and mean velocity of 8.1 F.P.S. with 0.8 Ft. swellhead. The above recommendation will provide a structure of adequate waterway to pass the regional flood within criteria established by the Dept. of Natural Resources.

FOUNDATION ENGINEERS RECOMMENDATION

DATE .....

PLAT

SCALE: 0' 50' 100'



Bridge survey sheets made from: BRIDGE SURVEY CONDUCTED BY OLMSTED COUNTY

Bench mark elevation 992.76 (M.S.L. 1929 Adj.)

Location: BENT STEEL IN CONCRETE LEFT STA. 161+96.

MINNESOTA
DEPARTMENT OF TRANSPORTATION

BRIDGE SURVEY

AT MILE POINT 30 ON C.S.A.H. 31 (T.H., C.S.A.H., C.R. etc.)

PROPOSED BRIDGE LOCATED 3.0 MILES NW OF ORONOCO

SEC. 2 TWP 108 N R 15 W

TOWNSHIP NEW HAVEN COUNTY OLMSTED

BRIDGE NO. ~~96782~~ 99234

CERTIFIED BY Kaye M Bremicker PROFESSIONAL ENGINEER REG. NO. 19917 9-9 1994

~~State Proj. No.~~ SAP 55-631-04 C.S.A.H. 31 OLMSTED CO.

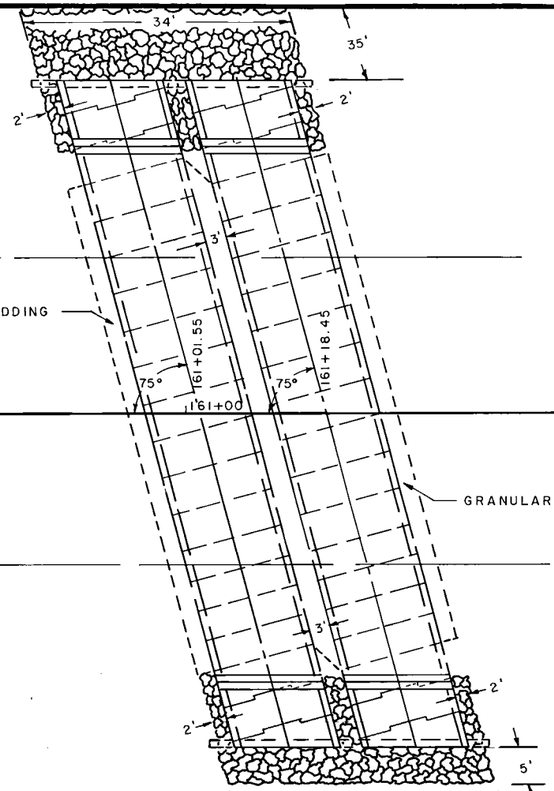
Sheet No. 10 **of** 15 **Sheets**

TELEDYNE POST - Hinds 847 HOUSTON

RANDOM RIPRAP 18" DEPTH CLASS III
PLACE RANDOM RIPRAP ON 9" GRANULAR
FILTER OR GEOTEXTILE FILTER MATERIAL

Fed. Proj. No.

SCALE : 1" = 10'



R/W 60'

+50 R/W JOG 60' TO 80'

(6" AGG. BASE CL.2) 20'

(6" AGG. BASE CL.2) 20'

BEGIN : SAP 55-631-04
STA 156+00

160+00

P.T. 160+69.01

161+00

162+00

END : SAP 55-631-04
STA 172+92

R/W 60'

+50 R/W JOG 60' TO 80'

R/W 60'

P.I. 157+11.75
D 0° 19' 00"
ΔRT. 2° 15' 48"
T 357.35'
L 714.61'
E 3.53'
NO SUPER ELEVATION REQ'D.

RANDOM RIPRAP 18" DEPTH CLASS III
PLACE RANDOM RIPRAP ON 9" GRANULAR
FILTER OR GEOTEXTILE FILTER MATERIAL

℄ PROFILE
PROFILE 20' LT.
PROFILE 20' RT.

SCALE : 1" = 10'

PROPOSED SUBGRADE ELEV.

92.8 93.54 95.08

1000
990
980

BEGIN: SAP 55-631-04
STA 156+00

PROPOSED ℄ GRADE

EXISTING ℄ GRADE

I.D. GRANULAR BEDDING
34'

INLET ELEV. 982.9
OUTLET ELEV. 982.5

END: SAP 55-631-04
STA 172+92

93.1 92.9 93.1 92.7 93.4 93.9

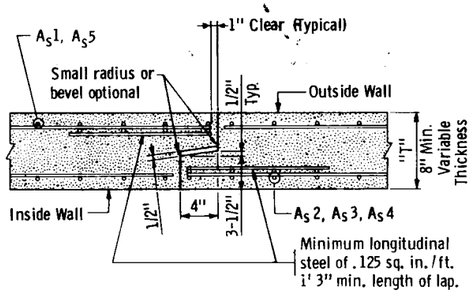
160 +60 161 +08 +70 162

BORINGS SHOWN [ ] TAKEN WITH
STD 140 LB HAMMER
30 INCH DROP
2 INCH O.D. SAMPLER

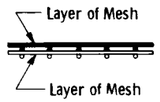
CERTIFIED BY Kyle M Primick REG. NO. 19917 9-9 1994
PROFESSIONAL ENGINEER

BRIDGE SURVEY PLAN AND PROFILE	DES:	DR:	APPROVED:	Bridge No. 97234 ~~96782~~
~~State Proj. No.~~ SAP 55-631-04	CHK:	CHK:		Sheet No. 11 of 15 Sheets

Fed. Proj. No.

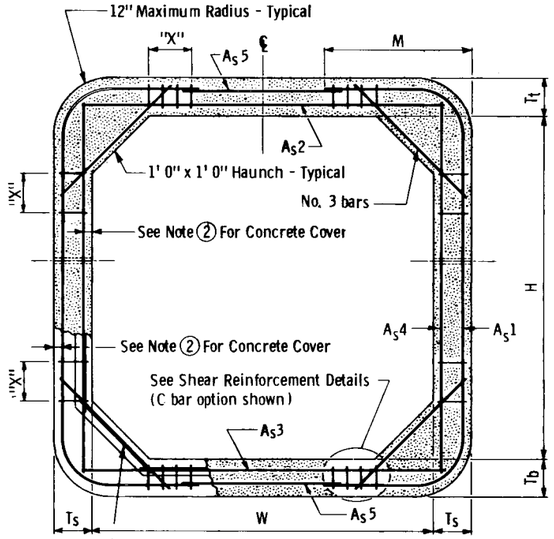


TONGUE AND GROOVE JOINT DETAIL



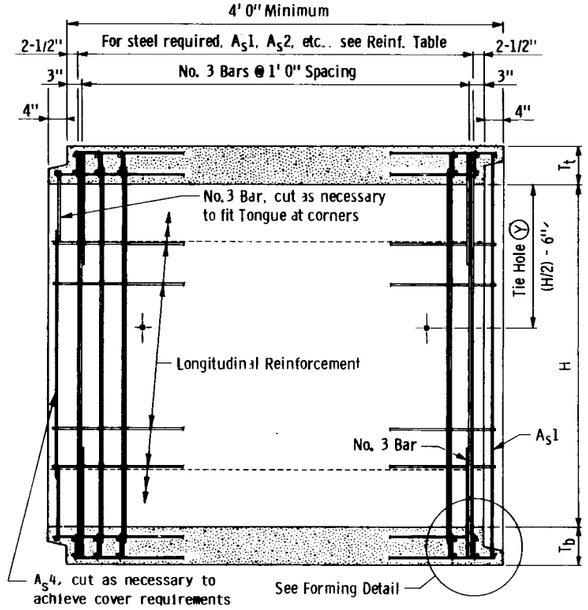
FABRIC LAYER DETAIL

When more than one layer of steel fabric is used to obtain the required reinforcement areas, the wires of the steel fabric shall be placed as shown



TRANSVERSE BARREL SECTION

(Bar Reinforcement Option Shown)



(Y) Culvert ties are to be 1" diameter rods. See Standard Plate No. 3145 for connection details. All holes in the barrels are to be approved by the engineer.

LONGITUDINAL BARREL SECTION

(Bar Reinforcement Option Shown)

NOTES:

CONSTRUCTION

1. The steel fabric, shear reinforcement and reinforcement bars used shall conform to applicable requirements of AASHTO M 259.
2. 1-1/2" min. and 2" max. concrete cover on all reinforcement, including the shear reinforcement, except for tongue and groove detail.
3. One of the following combinations of steel reinforcement may be used:
   (a) 1 or 2 layers of mesh or
   (b) 1 layer of mesh and 1 layer of reinforcement bars or
   (c) 1 layer of reinforcement bars.
   The reinforcement shall be developed in accordance with applicable parts of sections 8.21 thru 8.33 of the AASHTO "Standard Specifications for Highway Bridges".
4. Longitudinal reinforcement parallel to the axis of the culvert shall have a min. of 0.06 square inches per peripheral foot on all faces of the barrel, except in tongue and groove.
5. The max. shear reinforcement spacing in the longitudinal direction shall be 6 inches.
6. The transverse steel areas in each face shall be a minimum of 0.192 sq. in. per linear feet of barrel.
7. The maximum size of reinforcement bars shall be No. 6. The maximum mesh size shall be 1/2" dia. per layer (maximum of 2 layers).
8. The spacing center to center of the circumferential wires shall not be less than 2 inches nor more than 4 inches. The spacing center to center of the longitudinal wires shall not be more than 8 inches.
9. Welding will not be allowed on reinforcement bars or steel fabric, except that the original welding required to manufacture wire fabric is acceptable.
10. When reinforcement is cut, additional reinforcement shall be added on both sides of the cut member to replace or exceed the cut steel.
11. Barrel sections which are cast with a draft in the forms shall be laid with the narrowest part of the section downstream.

BASIS OF DESIGN

A. The design shall be in accordance with 1989 and Interim AASHTO Design Specifications.

B. Live loads are based on HS25 or Military Loading as designated in FHWA PPM 20-4 Section 4C.

C. Maximum allowable Design Stresses
   F'c = 5,000 P.S.I., N = 6
   Fy = 60,000 P.S.I. reinforcement bars
   Fy = 65,000 P.S.I. steel fabric

D. Load factor design according to AASHTO standard specification Group X = 1.3 [B_DD+B_L (L+I) + $B_E E_V$ + $B_E E_L$] shall be used where B_D = 1.00, B_E = 1.00, B_L = 2.09 E_V = Vertical earth pressure and E_L = Lateral earth pressure. The following values have been used for this structure:
   Unit Soil Weight 130 lbs. per cu. ft.
   Maximum lateral Pressure Coefficient 50% of soil weight
   Minimum lateral Pressure Coefficient 25% of soil weight

E. Concrete shall be Mix No. 3W36 with no calcium chloride allowed.

F. Minimum overfill shall be two (2) feet, unless a reinforced concrete slab is placed over barrels.

SHEAR REINFORCEMENT DETAIL

C BAR OPTION

C Bars shall have 135° Min. and 180° Max. hooks

SHEAR REINFORCEMENT DETAIL

COIL OPTION

FORMING DETAIL

V BAR DETAIL

SHEAR REINFORCEMENT DETAIL

V BAR OPTION

SHEAR REINFORCEMENT DETAIL

J BAR OPTION

DIMENSION TABLE

Dimensions	Height of Overfill (F) 6'				
"W" (in Ft.)	12				
"H" (in Ft.)	6				
Tt (in inches)	9				
Tb (in inches)	10				
Ts (in inches)	8				
"M" (in inches)	29				
Weight (lbs./Ft.)	4540				

REINFORCEMENT TABLE

Reinforcement △	Height of Overfill (F) 6' *Area	Length	*Area	Length	*Area	Length	*Area	Length	*Area	Length
A_S1	0.538	11'4								
A_S2	0.721	12'3								
A_S3	0.783	12'3								
A_S4	0.192	6'3								
A_S5	0.192	10'0								

* Square inches per lineal foot of barrel.

△ Areas shown are based on Fy = 65,000 P.S.I. Increase area 8% for Fy = 60,000 when reinforcement bars are used in part or total.

SHEAR REINFORCEMENT TABLE

(F) Height of Overfill	Shear Reinforcement Requirements ◇ Top of Culvert **Area	Top of Culvert Maximum Spacing	Top of Culvert "X" (in inches)	Bottom of Culvert **Area	Bottom of Culvert Maximum Spacing	Bottom of Culvert "X" (in inches)	Side of Culvert **Area	Side of Culvert Maximum Spacing	Side of Culvert "X" (in inches)
6'	NONE REQUIRED								

◇ When shear reinforcement is needed, a minimum shear steel of 0.06 sq. in. per sq. ft. shall be used.

** Square inches per linear foot of barrel.

"X" = Distance from end of haunch.

FIG. 5-397.701
Approved: November 3, 1987

BARREL DETAILS

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNED.....

DATE..... REG. NO. .....

TRUNK HIGHWAY NO.
STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION

BRIDGE NO.
CULVERT NO. ~~98782~~ 97234

IDENTIFICATION NO. 113

PRECAST CONCRETE BOX CULVERT

SEC. 2 T108 N R 15 W
NEW HAVEN TOWNSHIP OLMSTED COUNTY

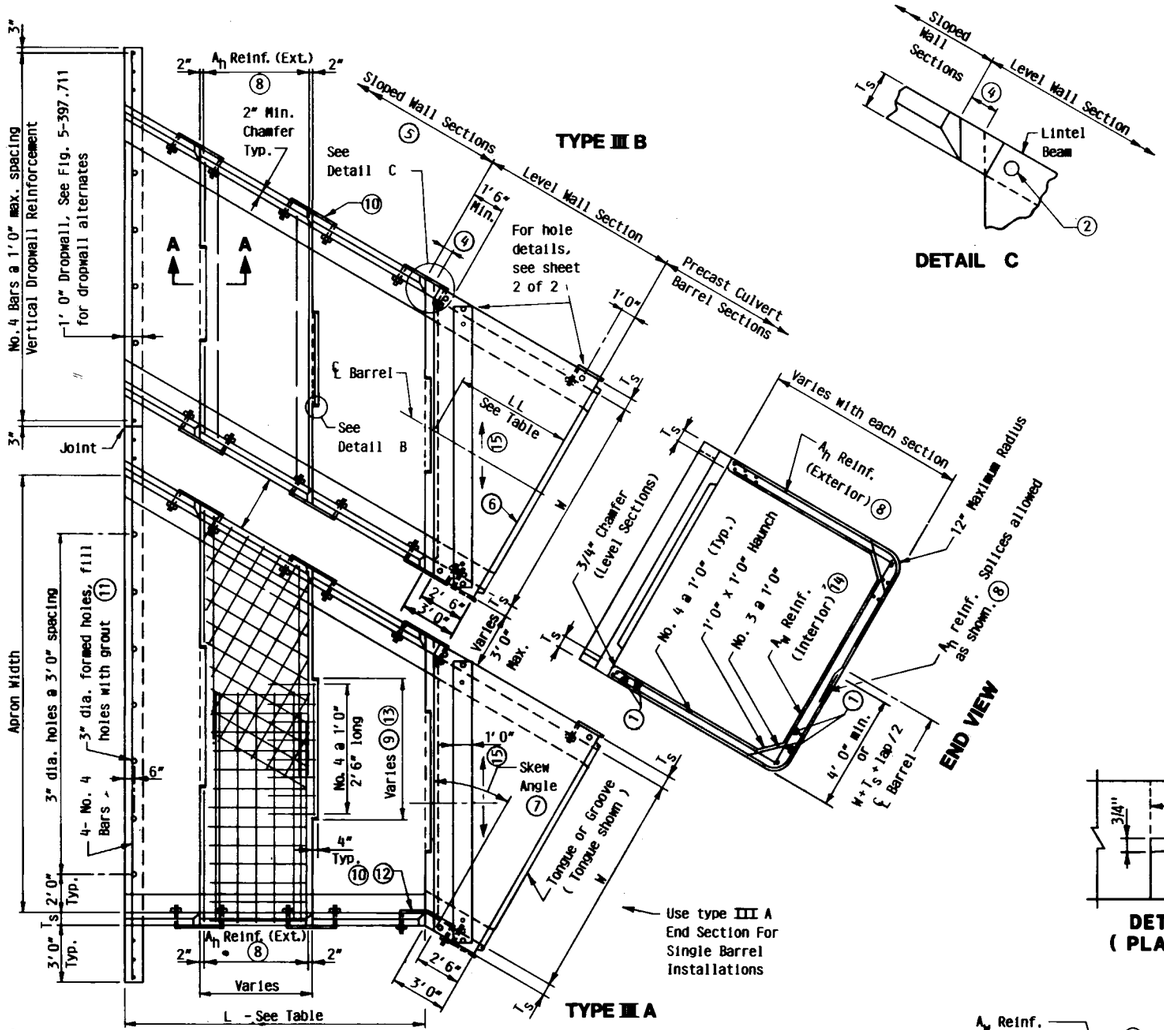
APPROVED:

BRIDGE ENGINEER ASSISTANT DIVISION DIRECTOR

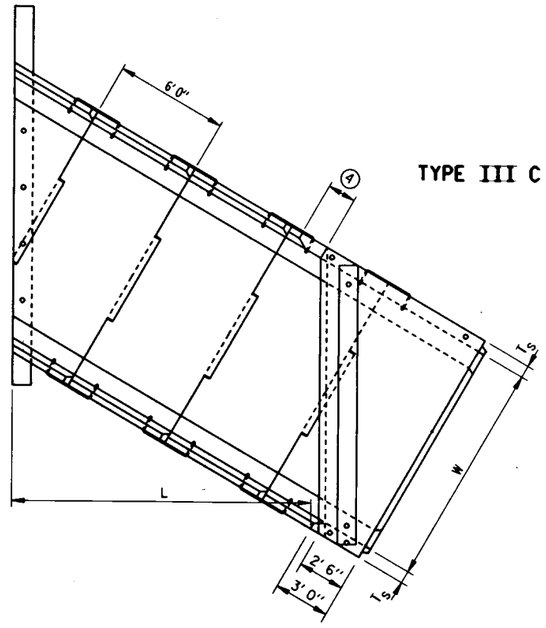
DES.	DR.
CHK.	CHK.

~~State Proj. No.~~ SAP 55-631-04 CSAH 31 OLMSTED COUNTY **Sheet No.** 12 **of** 15 **Sheets**

FORM 5

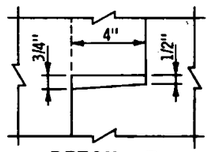


DETAIL C

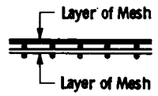


PLAN

(See Type III B for Reinforcement & Additional Information)

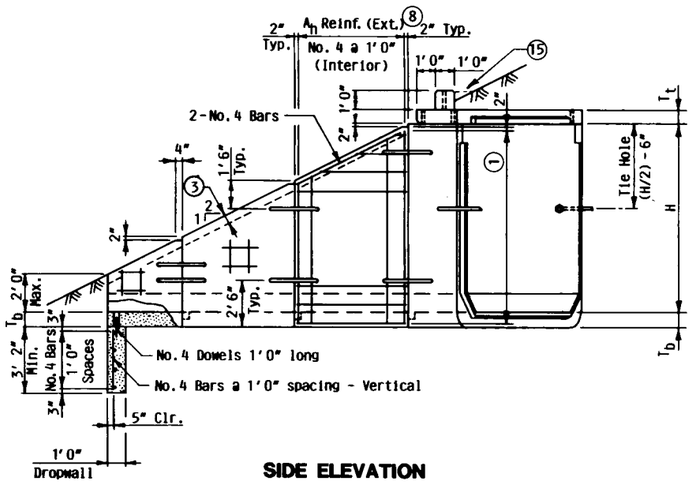


DETAIL B
(PLAN VIEW)

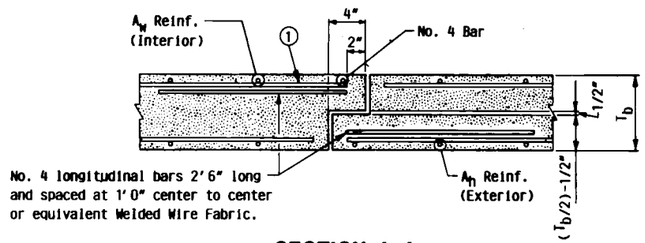


FABRIC LAYER DETAIL

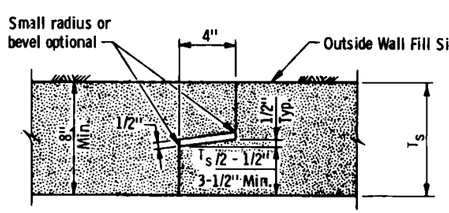
When more than one layer of steel fabric is used to obtain the required reinforcement areas, the wire of the steel fabric shall be placed as shown in the Fabric Layer Detail.



SIDE ELEVATION



SECTION A-A



TONGUE AND GROOVE JOINT

Make dimension of tongue or groove on adjacent precast barrel sections so inside walls are flush.

L TABLE (14)

CULVERT HEIGHT H	END SECTIONS L
4 ft.	4 ft.
5 ft.	6 ft.
6 ft.	8 ft.
7 ft.	10 ft.
8 ft.	12 ft.
9 ft.	14 ft.
10 ft.	16 ft.
12 ft.	20 ft.

LL TABLE

WIDTH W	SKEW ANGLE 15°	SKEW ANGLE 30°
8 ft.	3'9"	5'2-3/8"
10 ft.	4'0-1/4"	5'9-1/4"
12 ft.	4'3-7/16"	6'4-3/16"
14 ft.	4'6-11/16"	6'11-1/8"
16 ft.	4'9-7/8"	7'6-1/16"
18 ft.	5'1-1/8"	8'1"
20 ft.	5'4-5/16"	8'7-15/16"

NOTES:

The steel reinforcement shall conform to the applicable requirements of AASHTO M259. The reinforcement shall be Grade 60 or better.

The maximum size of reinforcing bars shall be No. 6. The maximum mesh size shall be 1/2" dia. (1 or 2 layers).

Finish all vertical edges of concrete with 3/4" chamfer or radius unless otherwise noted.

Dropwall shall be concrete Mix 1A43,3Y43 or 3W36.

Precast Concrete Sections shall be Mix 3W36 with no calcium chloride allowed.

Limits for excavation for dropwall to be approximately the same as dropwall dimensions.

1-1/2" minimum and 2" maximum concrete cover on all reinforcement (Typical for inside and outside walls).

Culverts to be constructed as per Spec. 2411 except as noted.

See " Precast Concrete Box Culvert" Standard Sheet 9 No. 5-397.701 for additional reinforcement requirements such as laps and splice requirements.

One of the following combinations of steel reinforcement may be used:

(a) 1 or 2 layers of mesh or
(b) 1 layer of mesh and 1 layer of reinforcement bars or
(c) 1 layer of reinforcement bars.

8.16.8.2 of 1983 and Interim

If (b) or (c) are used, service load stresses shall be used in culvert design. The reinforcement shall be developed in accordance with applicable parts of 8.21 to 8.33.6.2 of 1983 AASHTO "Standard Specifications for Highway Bridges".

(1) Longitudinal reinforcement parallel to side walls of end sections shall have a minimum of 0.06 sq. in. per ft. on all faces.

(2) 1" dia. x 1' 0" long steel dowel. 2" dia. hole in the top of the level wall section. Fill hole to top of lintel beam with an approved grout, see Note 11.

(3) See Embankment Protection for Box Culverts, sheet 4.

(4) Variable. 6" minimum to 2' 0" maximum.

(5) Number of sections varies with "H" dimensions.

(6) Check the location to determine whether a tongue or a groove is used.

(7) For a ℄ of culvert skew angle of 22-1/2° to 37-1/2°, use a 30° skew end section. For 7-1/2° to 22-1/2°, use a 15° skew end section.

(8) See sheet 2 of 2 for Ah and Aw reinforcement tables.

(9) See Section A-A for additional reinforcement.

(10) Culvert ties are to be 1" dia. rods. See Standard Plate No. 3145 for details.

(11) Grout shall consist of 1 part cement and 2 parts sand. Use Type 1A air entrained Portland Cement. Grout mix shall have a maximum slump of 4".

(12) Two ties are required at angled wall joint connections. Bend ties to fit angle. No tongue or groove required.

(13) Apron widths up to 12 ft.=5' 0" tongue & 5' 1" groove. Apron widths over 12 ft.=8' 0" tongue & 8' 1" groove. Center tongue & groove on ℄ of each apron joint. Use same size tongue & groove in each apron assembly.

(14) Based on 2' 0" height at end of wingwall sections.

(15) Slope ground from center of barrel towards sides.

Approved: November 3, 1987

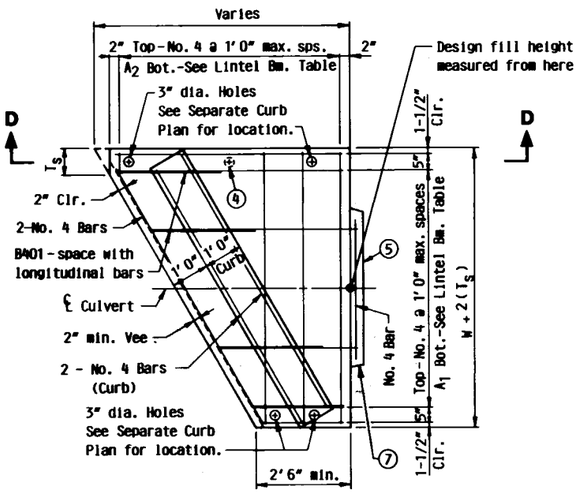
SAP 55-631-04 CSAH 31 OLMSTED COUNTY

FIG. 5-397.710 (1 of 2)

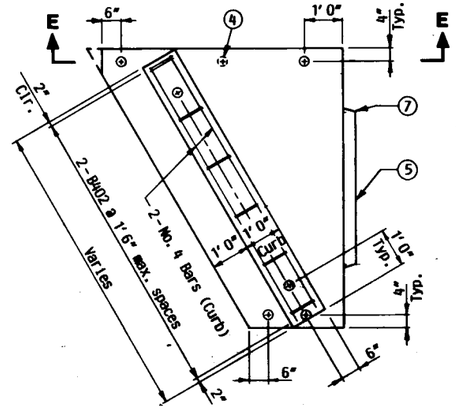
TITLE: PRECAST CONC. END SECTIONS · TYPE III SKEWED SINGLE OR MULTI-BARREL	DES:	DR:	APPROVED:	Bridge No. 97234 ~~96782~~
	CHK:	CHK:		
	Sheet No. 13 of 15 Sheets			

A_w REINFORCEMENT TABLE ②

HEIGHT OF EACH END SECT.	MAXIMUM APRON WIDTH OF EACH SECTION AT THE RESPECTIVE HEIGHT														
	8' 0" - 11' 0"	12' 0"	13' 0"	14' 0"	15' 0"	16' 0"	17' 0"	18' 0"	19' 0"	20' 0"	21' 0"	22' 0"	23' 0"	24' 0"	25' 0"
2' 0"	No.4 a 1'0"	←	←	←	←	←	←	No.4 a 10"	No.4 a 9"	No.4 a 8"	No.4 a 7"	No.5 a 11"	No.5 a 10"	No.5 a 9"	No.5 a 8-1/2"
4' 0"	No. 4 @ 1' 0"	←	←	←	←	No. 4 @ 10"	No. 4 @ 8-1/2"	No. 5 @ 11-1/2"	No. 5 @ 10"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10"	No. 6 @ 9-1/2"	No. 6 @ 8-1/2"	
5' 0"	No. 4 @ 1' 0"	←	←	No. 4 @ 11"	No. 4 @ 9-1/2"	No. 4 @ 8"	No. 5 @ 11"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 10-1/2"	No. 6 @ 9-1/2"	No. 6 @ 9"	No. 6 @ 8"	No. 6 @ 7-1/2"	
6' 0"	No. 4 @ 1' 0"	←	←	No. 4 @ 10-1/2"	No. 4 @ 9"	No. 5 @ 1' 0"	No. 5 @ 10"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10"	No. 6 @ 9"	No. 6 @ 8"			
7' 0"	No. 4 @ 1' 0"	←	No. 4 @ 11-1/2"	No. 4 @ 9-1/2"	No. 4 @ 8"	No. 5 @ 10-1/2"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 11"	No. 6 @ 10"	No. 6 @ 9"	No. 6 @ 8"			
8' 0"	No. 4 @ 1' 0"	←	No. 4 @ 11"	No. 4 @ 9"	No. 5 @ 1' 0"	No. 5 @ 10-1/2"	No. 5 @ 9"	No. 5 @ 8"	No. 6 @ 10-1/2"	No. 6 @ 9-1/2"					
10' 0"	No. 4 @ 1' 0"	←	No. 4 @ 10"	No. 4 @ 8"	No. 5 @ 11"	No. 5 @ 9-1/2"	No. 5 @ 8-1/2"	No. 6 @ 10-1/2"							
12' 0"	No. 4 @ 1' 0"	No. 4 @ 11"	No. 4 @ 9"	No. 5 @ 11-1/2"	No. 5 @ 10"	No. 5 @ 8-1/2"									
14' 0"	No.4 a 1'0"	No.4 a 9"	No.4 a 7"	No.5 a 9-1/2"	No.5 a 8"	No.5 a 7-1/2"									



PLAN OF LINTEL BEAM



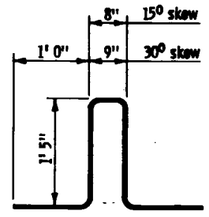
PLAN OF LINTEL BEAM

See Integral Curb Plan for lintel beam reinforcement

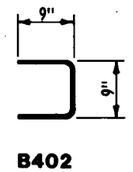
A_h REINFORCEMENT TABLE

HEIGHT H	A_h
8 ft. or less	No. 4 @ 1' 0"
10 ft.	No. 5 @ 8"
12 ft.	No. 6 @ 6"
14 ft.	No.7 a 5"
16 ft.	No.8 a 4-1/2"

NOTE: H is the highest vertical dimension of each section shown.



B401



B402

NOTES:

Curb is required and may be cast monolithically or cast separately.

① 1" dia. x 1' 0" long steel dowel. 2" dia. hole in the top of the level wall section. 3" dia. hole in the lintel beam. Fill the hole to the top of the lintel beam with an approved grout.

② Use the largest steel area from the table across each individual section.

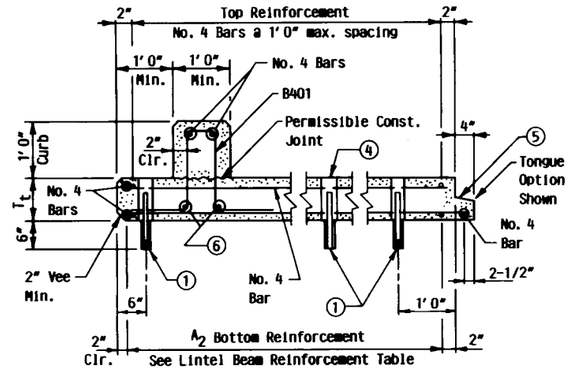
③ 1" dia. x 1' 0" long steel dowel. 2" dia. hole in the top of the lintel beam. 3" dia. hole in the curb. Fill the hole to the top of the curb with an approved grout.

④ Cast an additional 3" hole at midpoint of beam when side of lintel beam is over 6 ft.

⑤ Check the location to determine whether a tongue or a groove is used.

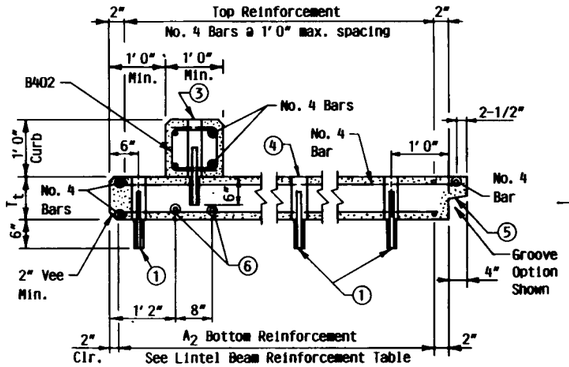
⑥ For spans under 10' use No. 8 bars. For spans of 10' to 14' use No. 9 bars. For spans over 14' to 18' use No. 10 bars. For spans over 18' to 20' use No. 11 bars, or equal.

⑦ Tongue and groove to terminate at culvert radius.



SECTION D-D

(With Integral Curb)



SECTION E-E

(With Separate Curb)

LINTEL BEAM REINFORCEMENT TABLE

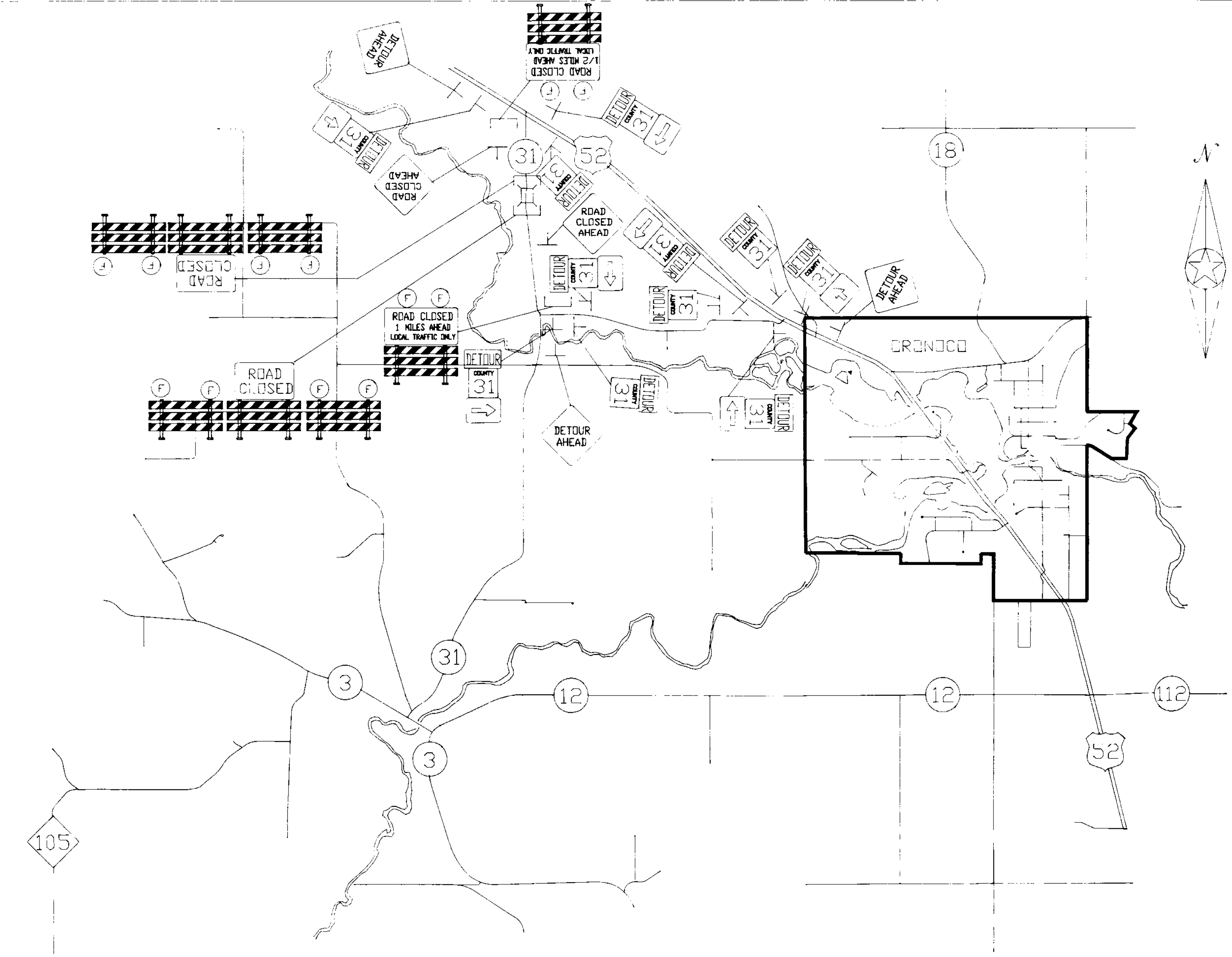
W CULVERT WIDTH	4 Ft. DESIGN FILL HEIGHT			2 Ft. DESIGN FILL HEIGHT		
	T_t	BOTTOM REINFORCEMENT		T_t	BOTTOM REINFORCEMENT	
		A_1	A_2		A_1	A_2
Under 6'	9"	No.4 a 1' 2"	No.4 a 9-1/2"	9"	No.4 a 1' 6"	No.4 a 1' 4"
6'+ to 8'	9"	No.4 a 8"	No.5 a 8"	9"	No.4 a 1' 1"	No.4 a 9"
8'+ to 10'	9"	No.5 a 8"	No.6 a 7-1/2"	9"	No.4 a 9"	No.4 a 6"
10'+ to 12'	9"	No.5 a 6"	No.6 a 6"	9"	No.5 a 9"	No.5 a 6"
12'+ to 14'	10"	No.5 a 5"	No.6 a 5"	9"	No.5 a 7-1/2"	No.5 a 5"
14'+ to 16'	11"	No.6 a 6"	No.7 a 5-1/2"	9"	No.5 a 6"	No.6 a 5-1/2"
16'+ to 18'	12"	No.6 a 5-1/2"	No.7 a 5"	10"	No.5 a 5-1/2"	No.6 a 5"
18'+ to 20'	13"	No.6 a 5"	No.8 a 6"	10"	No.6 a 6"	No.7 a 5-1/2"

NOTE: Maximum bar spacing given, reduce as necessary.

FIG. 5-397.710 (2 of 2)
Approved: November 3, 1987

SAP 55-631-04 CSAH31 OLMSTED COUNTY

TITLE:	DES:	DR:	APPROVED:	Bridge No.
PRECAST CONC. END SECTIONS - TYPE III SKEWED SINGLE OR MULTI-BARREL	CHK:	CHK:		97234 96782
	Sheet No. 14 of 15 Sheets			



ESTIMATE OF TRAFFIC CONTROL DEVICES

DEVICE	NUMBER	SIZE	COLOR	QUANTITY	DEVICE	NUMBER	SIZE	COLOR	QUANTITY
ROAD CLOSED	R11-2	48 x 30	BLK/WH	2	DETOUR	M4-8	24 x 12	BLK/WH	11
ROAD CLOSED MILES AHEAD LOCAL TRAFFIC ONLY	R11-3	60 x 30	BLK/WH	2		M6-1	21 x 15	BLK/WH	5
DETOUR AHEAD	W20-2	48 x 48	BLK/OR	3		M6-3	21 x 15	BLK/WH	2
ROAD CLOSED AHEAD	W20-3	48 x 48	BLK/OR	2		TYPE III	MIN. 6'	OR & BLK	8
COUNTY 31	M1-X4A	24 x 24	BLK/WH	11	F	TYPE A	FLASHING LAMPS	AMBER	12

TRAFFIC CONTROL NOTES

1. THE LOCATION OF SIGNS AND DEVICES WILL BE STAKED BY THE ENGINEER IN THE FIELD.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TRAFFIC CONTROL ON THIS PROJECT.
3. ALL TRAFFIC CONTROL DEVICES SHALL CONFORM TO THE MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES INCLUDING APPENDIX B DATED NOV. 1992.
4. CONSTRUCTION ZONE SIGNING, WITHIN THE ROAD CLOSURE, SHALL BE THE RESPONSIBILITY OF THE CONTRACTER AND WILL INCLUDE, BUT NOT BE LIMITED TO SAFTEY FENCE, CONES, AND WARNING SIGNS.
5. ALL BARRICADES ON THIS PROJECT SHALL BE REFLECTORIZED ON BOTH SIDES.

TRAFFIC CONTROL LEGEND

POST OR STAND MOUNTED SIGN

TYPE III BARRICADE

TRAFFIC CONTROL PLAN