JOB# 21

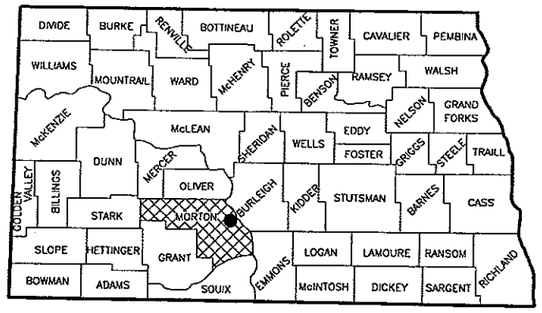
CITY OF MANDAN
BIKE TRAIL & STORM SEWER

PROJECT NO. TEU-1-988(009)020
GRADING, SURFACING, STORM SEWER, & MISCELLANEOUS ITEMS

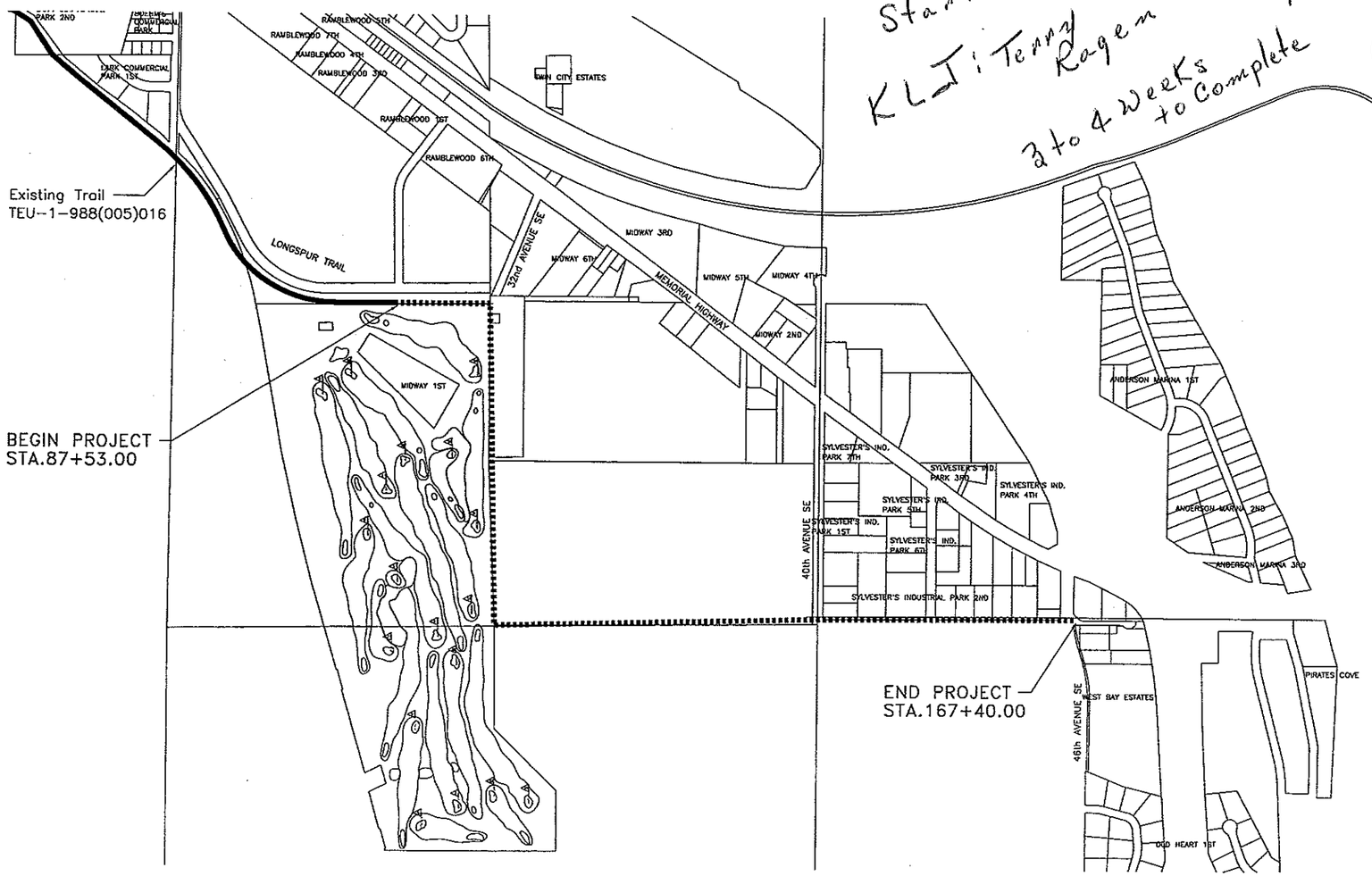
FHWA REGION	STATE	PROJECT	SHEET NO.
8	N.D.	TEU-1-988(009)020	1

GOVERNING SPECIFICATIONS:

STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, ADOPTED BY THE NORTH DAKOTA DEPARTMENT OF TRANSPORTATION, OCTOBER 1997, SHALL APPLY TO ALL NORTH DAKOTA DEPARTMENT OF TRANSPORTATION CONTRACTS, STANDARD DRAWINGS CURRENTLY IN EFFECT, AND OTHER CONTRACT PROVISIONS SUBMITTED HEREIN.



STATE OF NORTH DAKOTA



Start up Date: July 7th, 1998
KLJ: Terry Rogen
3 to 4 Weeks to Complete
Mariner (Prime) Construction
Coffel
Atlas
Green Acres Nursery

LENGTH OF PROJECT

PROJECT	MILES-GROSS	MILES-NET
TEU-1-988(009)020	1.513	1.513

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APPROVED: DATE January 22, 1998

Kadrmas Lee & Jackson Consulting Engineers and Surveyors

PROJECT ENGINEER

KADRMAS, LEE & JACKSON P.C.

BISMARCK, NORTH DAKOTA

ROBERT J. SHANNON REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA

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QUANTITIES & BASIS OF ESTIMATE

MANDAN REC. TRAIL
ESTIMATED PROJECT QUANTITIES
STA. 87+53 TO STA. 167+40

SPEC.	CODE	ITEM	UNIT	TOTAL
103	0100	Contract Bond	L.S.	1
201	0295	Clearing and Grubbing	L.F.	5,488
201	0370	Removal of 10" Trees	EA.	9
201	0380	Removal of 18" Trees	EA.	12
201	0390	Removal of 30" Trees	EA.	14
203	0101	Common Excavation, Type A	C.Y.	972
203	0109	Topsoil	C.Y.	1,903
203	0119	Topsoil - Imported	C.Y.	450
203	0140	Borrow	C.Y.	8,570
216	0100	Water	MGAL.	64
230	0183	Subgrade Preparation, Type B (6")	L.F.	8,001
408	0170	Hot Bituminous Pavement Cl. 25	TON	1,383
408	0310	85-100 Asphalt Cement	TON	90
702	0100	Mobilization	L.S.	1
704	1000	Traffic Control Signs	UNIT	396
704	1052	Type III Barricade	EA	4
704	1060	Delineator Drums	EA	8
708	1020	Riprap, Loose Rock	C.Y.	40
708	2331	Seeding Type B Special	ACRE	3.17
714	0200	Pipe Conc. Reinf. 15" Cl. II	L.F.	116
714	1100	Pipe Conc. Reinf. 48" Cl. II	L.F.	24
714	3005	End Sect. Conc. Rein. 15"	EA.	4
714	3045	End Sect. Conc. Reinf. 48"	EA.	2
714	5015	Pipe, Corr. Steel .064", 18"	L.F.	76
714	5810	End Sect. Corr. Steel (.064") 18"	E.A.	4
722	3500	Inlet, Type 1	E.A.	2
748	0100	Curb and Gutter	L.F.	1,426
752	0610	Fence Chain Link Type I	L.F.	600
754	0621	Yield Sign R1-2-24	EA.	2
754	0650	18IN x 18IN Signs	EA.	1
754	0655	24IN x 24IN Signs	EA.	5
754	0690	30IN x 30IN Signs	EA.	2
754	0695	36IN x 36IN Signs	EA.	2
970	0004	Landscape Interlocking Block	S.F.	400
970	1000	Trees	EA.	41
970	0110	Herbicide Weed Control	L.F.	8,001

BASIS OF ESTIMATE

COMMON EXCAVATION, TYPE A:

25% ADDITIONAL VOLUME HAS BEEN ADDED TO THE EMBANKMENT QUANTITIES FOR SHRINKAGE.
AN ADDITIONAL 10 CY OF BORROW PER 100 LF OF TRAIL HAS BEEN ADDED TO THE BORROW QUANTITIES. THIS WILL BE USED ALONG THE FULL LENGTH OF THE TRAIL.

WATER:

6 GALLONS PER TON OF SALVAGED BITUMINOUS BASE COURSE
5 GALLONS PER CUBIC YARD EMBANKMENT

SALVAGED BITUMINOUS BASE COURSE:

1.85 TON PER CUBIC YARD OF SALVAGED BITUMINOUS BASE COURSE

HOT BITUMINOUS PAVEMENT, CL. 25:

2 TON PER CUBIC YARD OF HOT BITUMINOUS PAVEMENT, CL. 25

85-100 ASPHALT CEMENT:

7% 85-100 ASPHALT CEMENT PER TON OF HOT BITUMINOUS PAVEMENT, CL. 25

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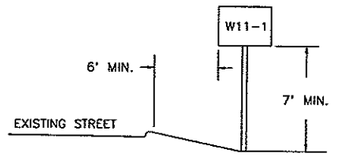
MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS DETAILS

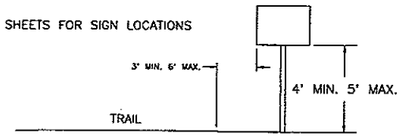
CHK'R. NO.:	DATE
TRL_DTLZ	DEC. 1997
DRWN. BY	CHK'D BY
T.R	R.S. & T.R.

SPECIAL SIGN DETAIL (WARNING)

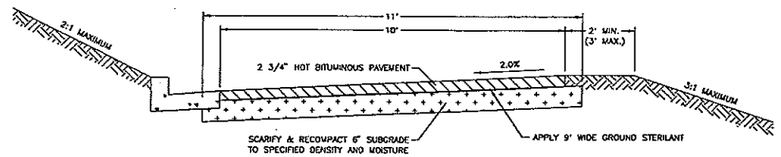


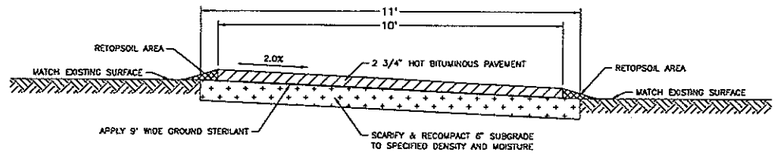
TYPICAL SIGN POSITION DETAIL
EXISTING STREET

NOTE:
SEE PLAN SHEETS FOR SIGN LOCATIONS

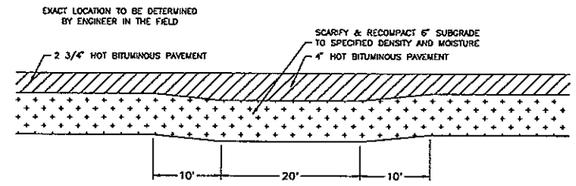


TYPICAL SIGN POSITION DETAIL
(TRAIL)



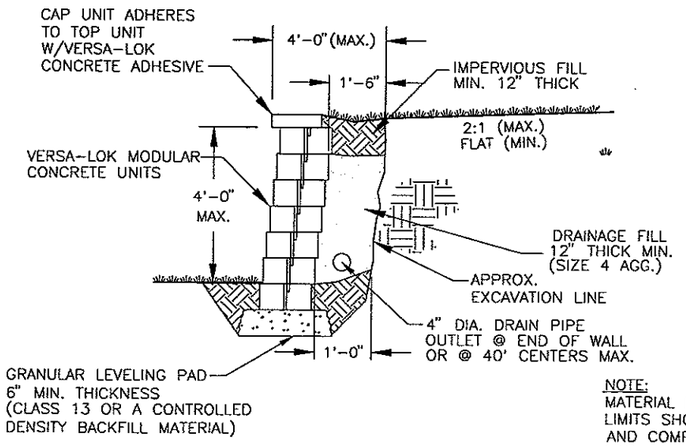


TYPICAL TRAIL SECTION



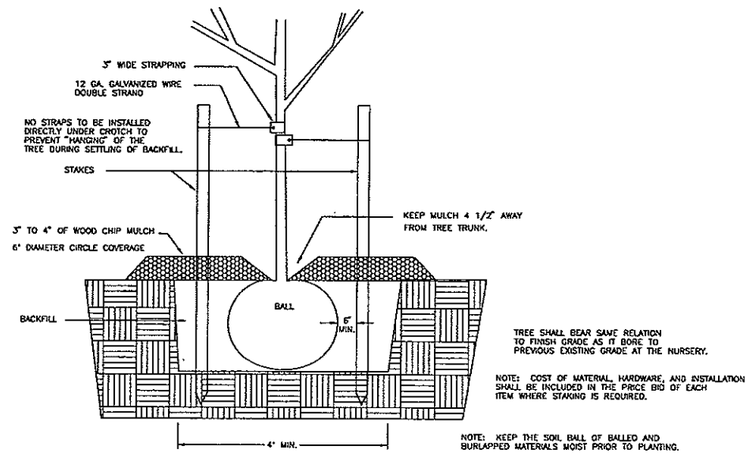
THICKENED HOT BITUMINOUS PAVEMENT SECTION
NO SCALE

NOTE:
CONTRACTOR WILL USE THE 3" SETBACK ON THE BLOCKS TO CONSTRUCT THE RETAINING WALL. THE CONTRACTOR WILL INSTALL THE BLOCK ACCORDING TO THE DESIGN AND INSTALLATION MANUFACTURER'S GUIDE.



NOTE:
MATERIAL EXCAVATED BEYOND THE LIMITS SHOWN WILL BE BACKFILLED AND COMPACTED TO 95% OF MAXIMUM STANDARD PROCTOR DENSITY

TYPICAL SECTION - RETAINING WALL
MODULAR CONCRETE UNIT
SCALE: NONE



DETAIL A: TREE PLANTING DETAIL
NO SCALE

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CONSTRUCTION NOTES

100. **UNDERGROUND UTILITIES:** THE CONTRACTOR SHALL NOTIFY THE LOCAL UTILITY COMPANIES PRIOR TO THE BEGINNING OF CONSTRUCTION, SO THEY MAY DETERMINE THE LOCATION OF ALL UTILITIES IN THE PROJECT AREA. SUBCUTTING OR SCARIFYING OVER UTILITY LINES MAY BE ELIMINATED IF, IN THE OPINION OF THE ENGINEER, A HAZARDOUS SITUATION EXISTS. SEPARATE PLANS, IF ANY, SHOWING RELOCATION OR ADJUSTMENT WORK TO BE PERFORMED BY UTILITY COMPANIES TO ACCOMMODATE HIGHWAY CONSTRUCTION WILL BE MADE AVAILABLE TO THE CONTRACTOR, UPON REQUEST TO THE ENGINEER.

100. **TREES, SHRUBS, AND NATIVE GRASSES:** THE CONTRACTOR SHALL EXERCISE CARE IN HIS CONSTRUCTION OPERATIONS TO ENSURE THAT TREES, SHRUBS, AND NATIVE GRASSES WITHIN THE RIGHT OF WAY AND OUTSIDE THE CONSTRUCTION AREA ARE NOT DISTURBED. CONTRACTOR SHALL NOT BE PERMITTED ANY UNNECESSARY EQUIPMENT OPERATION UNDER OR AROUND TREES. THIS INCLUDES PARKING OF EQUIPMENT IN THE SHADE.

100. **PRAIRIE WEST GOLF COURSE:** THE SECTION OF TRAIL ALONG THE PRAIRIE WEST GOLF COURSE PARALLELS GREENS, TEE BOXES AND FAIRWAYS. AT NO TIME SHALL THE CONTRACTOR HAVE EQUIPMENT, MATERIALS OR LABORERS ON THESE AREAS UNLESS WRITTEN PERMISSION IS RECEIVED FROM THE MANDAN PARKS AND RECREATION DEPARTMENT AND THE PRAIRIE WEST GOLF COURSE.

201. **CLEARING AND GRUBBING:** PRIOR TO PERFORMING LANDSCAPE PREPARATION, THE CONTRACTOR SHALL PERFORM CLEARING AND GRUBBING. THIS SHALL INCLUDE THE REMOVAL OF BRUSH, DEADFALL, ROCKS, GARBAGE, AND DEBRIS AND ALL OTHER SUCH ITEMS FROM THE TRAIL CONSTRUCTION CORRIDOR. THE WIDTH SHALL BE NO LESS THAN 10 FEET ON EITHER SIDE OF THE TRAIL CENTERLINE TO A MAXIMUM OF 5 FEET BEYOND THE TOE OF THE FILL SECTIONS AS SHOWN ON THE CROSS SECTIONS. THIS ITEM SHALL ALSO INCLUDE THE TRIMMING OF ANY TREE OR BRUSH LIMBS OR BRANCHES THAT WILL INTERFERE WITH TRAIL USE. BRANCHES AND LIMBS SHALL BE TRIMMED TO A DISTANCE OF 8 FEET FROM THE TRAIL CENTERLINE AND TO A HEIGHT OF 10 FEET ABOVE THE FINISHED TRAIL. ALL MATERIALS, LABOR AND INCIDENTALS TO COMPLETE THIS ITEM SHALL BE INCLUDED IN THE BID PRICE PER LINEAR FOOT OF CLEARING AND GRUBBING.

201. **REMOVAL OF TREES AND BRUSH:** CONTRACTOR SHALL DISPOSE OF ALL TREES AND BRUSH OFF SITE. REMOVAL OF TREES SHALL ALSO INCLUDE THE REMOVAL OF THE STUMP. DISPOSAL COSTS SHALL BE INCLUDED IN THE PRICE FOR REMOVAL OF TREES AND BRUSH. ANY TREES REMOVED BY THE CONTRACTOR WHICH ARE NOT MARKED FOR REMOVAL OR ANY TREES DAMAGED BEYOND THE REMOVAL LIMITS WILL BE REPLACED BY THE CONTRACTOR AT HIS OWN EXPENSE ON A TWO FOR ONE BASIS.

203. **COMMON EXCAVATION:** PAYMENT FOR COMMON EXCAVATION SHALL BE IN ACCORDANCE WITH SECTION 203.03B OF THE STANDARD SPECIFICATIONS (CONTRACT QUANTITY).

203. **BORROW:** BORROW SHALL BE OBTAINED FROM AN OFF SITE SOURCE. THE MATERIAL SHALL BE APPROVED BY THE ENGINEER PRIOR TO BEING BROUGHT ON SITE. BORROW MATERIAL SHALL BE PLACED IN ACCORDANCE TO SECTION 203.02G OF THE STANDARD SPECIFICATIONS, 1997. BORROW SHALL BE MEASURED BY THE CUBIC YARD USING THE VOLUME OF THE TRUCK. THE TRUCK BOX WILL BE MEASURED BY THE ENGINEER PRIOR TO ANY HAULING. ALL COSTS ASSOCIATED WITH OBTAINING, HAULING, PLACING AND ALL OTHER ITEMS ASSOCIATED WITH THE COMPLETION OF THIS ITEM SHALL BE INCLUDED IN THE PER CUBIC YARD BID PRICE FOR BORROW.

203. **TOPSOIL:** TOPSOIL SHALL BE REMOVED TO A DEPTH OF 3" AND A WIDTH OF 16 FEET, WITH HALF BEING BLADED TO EACH SIDE OF THE TRAIL, EXCEPT IN THOSE AREAS WHERE FILL MATERIAL IS BEING ADDED. IN FILL AREAS, TOPSOIL WILL BE REMOVED TO A WIDTH SUFFICIENT TO ACCOMMODATE THE FILL SECTION. ALL REMOVED TOPSOIL SHALL BE REPLACED. THE REPLACED TOPSOIL SHALL BE RAKED TO GRADE PRIOR TO SEEDING. ADDITIONAL RAKING MAY BE REQUIRED AFTER SEEDING. THE BID PRICE FOR TOPSOIL SHALL INCLUDE ALL COSTS ASSOCIATED WITH REMOVAL AND REPLACEMENT OF THE TOPSOIL.

230. **SUBGRADE PREPARATION, TYPE B:** THE SUBGRADE SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 6 INCHES AND COMPACTED AND SHAPED TO THE REQUIRED SECTION. THE COMPACTION SHALL BE AT ±2% OF OPTIMUM MOISTURE AND 92% OF MAXIMUM DENSITY BASED ON AASHTO T-99. TESTS SHALL BE TAKEN AT 2 PER 500 FEET WITH TEST LOCATIONS SELECTED AT RANDOM BY THE ENGINEER. TESTING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND ALL COSTS SHALL BE INCLUDED IN THE BID PRICE PER LINEAR FOOT OF SUBGRADE PREPARATION, TYPE B, MEASURED ON CENTERLINE. THREE SOIL PROCTORS SHALL BE INCLUDED IN THE PER LINEAR FOOT BID PRICE FOR SUBGRADE PREPARATION, TYPE B.

408. **HOT BITUMINOUS PAVEMENT, CL. 25:** THE CONTRACTOR SHALL HAVE AN INDEPENDENT TESTING LABORATORY PERFORM ALL MARSHALL MIX DESIGNS WITH THE AGGREGATE AND ASPHALT TO BE USED FOR THE PROJECT. THE COST SHALL BE INCLUDED IN THE PRICE BID FOR THE HOT BITUMINOUS PAVEMENT. THE MIX DESIGNS SHALL MEET THE FOLLOWING REQUIREMENTS:

STABILITY (MINIMUM) LB. ..... : 1,000
FLOW (HUNDREDTH OF AN INCH) 10-20
PERCENT AIR VOIDS % 1-5

THE CONTRACTOR SHALL FURNISH SAMPLES AND INFORM THE ENGINEER TWO WEEKS PRIOR TO PRODUCTION OF ANY STOCKPILES AS TO THE SOURCE OF AGGREGATE USED IN THE ASPHALT MIX DESIGN. ANY CHANGES IN AGGREGATE SOURCES, ASPHALT SOURCES OR OPERATIONS SHALL REQUIRE NEW OR ADDITIONAL MARSHALL MIX DESIGNS AT THE CONTRACTOR'S EXPENSE.

OTHER THAN THE MIX DESIGN PROVISIONS OUTLINED HEREIN, ALL OTHER PROVISIONS OF SECTION 408.04B SHALL REMAIN IN FORCE.

408. **ORDINARY COMPACTION OF HOT BITUMINOUS PAVEMENT:** COMPACTION SHALL BE IN ACCORDANCE TO SECTION 408.04.I.2, MODIFIED AS FOLLOWS; THE CONTRACTOR SHALL USE ONE SELF-PROPELLED, SINGLE DRUM, STEEL ROLLER OF ADEQUATE SIZE TO OBTAIN COMPACTION WITHOUT DAMAGE TO THE TRAIL SURFACE OR THE SUBGRADE.

408. **85-100 ASPHALT CEMENT:** THE HOT BITUMINOUS PAVING, CL. 25 SHALL HAVE MAXIMUM ASPHALT CONTENT OF 6.5%.

708. **SEEDING TYPE B SPECIAL:** CONTRACTOR SHALL USE A SEED MIXTURE CONSISTING OF THICK SPIKE WHEAT GRASS AT 7 LBS./ACRE PURE LIVE SEED, FAIRWAY CRESTED WHEATGRASS AT 4 LBS./ACRE PURE LIVE SEED AND BEARDLESS WILD RYE AT 4 LBS./ACRE PURE LIVE SEED. THE APPLICATION TOTAL RATE SHALL BE 15 LBS./ACRE PURE LIVE SEED. THE CONTRACTOR SHALL USE A MECHANICAL TILLER ATTACHED TO THE DRILL TO AID IN PREPARING THE SEED BED. RAKING MAY BE REQUIRED ALONG THE TRAIL UPON COMPLETION OF THE SEEDING. ALL COST OF MATERIALS AND PLACEMENT SHALL BE INCLUDED IN THE PRICE PER ACRE FOR SEEDING TYPE B SPECIAL.

714. **PIPE:** EXACT LOCATION OF PIPE SHALL BE DETERMINED BY FIELD ENGINEER SO AS TO PROVIDE POSITIVE DRAINAGE TO EXISTING DRAINAGE DITCH.

748. **CURB AND GUTTER:** NOTE #3 ON THE STANDARD DRAWINGS, SHEET D-748-1; DELETE BACKER ROD, THE JOINT SEALANT WILL BE PLACED OVER THE EXPANSION MATERIAL. NOTE #5 ON THE STANDARD DRAWINGS, SHEET D-748-1; SEALING OF CONTRACTION JOINTS ONLY, WILL NOT BE REQUIRED UNDER THIS PROJECT. THE SEALING OF EXPANSION JOINTS WILL BE AS STATED IN NOTE #5, SHEET D-748-1.

754. **SIGNS:** BID PRICE PER EACH FOR SIGNS SHALL INCLUDE POSTS AND ALL OTHER REQUIRED MATERIALS PLUS EQUIPMENT AND LABOR TO INSTALL THE SIGNS IN THE LOCATIONS SHOWN ON THE PLANS. POSTS SHALL BE 2" X 2" SQUARE TUBE PERFORATED WITH ANCHOR UNIT AND POST SLEEVE ASSEMBLY.

CONSTRUCTION NOTES

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754. **TRAFFIC SIGNING:** PERMANENT TRAFFIC SIGNING WILL BE INSTALLED BY THE CONTRACTOR. THE FOLLOWING SIGN LIST SHALL BE FOLLOWED:

MANDAN BIKE TRAIL				
STA.	**LOCATION EACH**	**SIGN NO.**	**DESCRIPTION**	**QUANTITY**
146+70	8' LT	Special	Watch For Debris On Trail	1
146+80	8' LT	R5-3	No Motor Vehicles	1
146+86	8' RT	R1-2	Yield	1
146+95	250' LT	W11-1	Advanced Bicycle Crossing	1
147+42	250' RT	W11-1	Advanced Bicycle Crossing	1
147+55	8' RT	R5-3	No Motor Vehicles	1
147+60	8' LT	R1-2	Yield	1
147+65	8' RT	Special	Watch For Debris On Trail	1
156+00	8' LT	R5-3	No Motor Vehicles	1
156+75	8" RT	R5-3	No Motor Vehicles	1
167+30	8' RT	R1-1	Stop	1
167+30	8' LT	R5-3	No Motor Vehicles	1

970. **LANDSCAPE INTERLOCKING BLOCK:** THE LANDSCAPE BLOCK ARE INTENDED TO BE USED IN A SEMI CIRCLE PATTERN AROUND OLD GROWTH COTTONWOOD TREES TO MINIMIZE IMPACTS OF ADJACENT FILL SLOPES. THE LANDSCAPE BLOCK MAY OR MAY NOT BE USED, AND THE ACTUAL LOCATIONS WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.

THE CONTRACTOR SHALL USE A VERSA-LOK BRAND RETAINING WALL OR AN APPROVED EQUAL. THE MANUFACTURER'S INSTALLATION SPECIFICATIONS SHALL BE FOLLOWED AS OUTLINED IN THE "DESIGN AND INSTALLATION GUIDE" SUPPLIED BY VERSA-LOK. WHEN DETERMINING GRID LENGTH, "H" WILL BE THE HEIGHT OF THE FILL FIVE FEET BEHIND THE WALL. (DIFFERENCE BETWEEN FINISH TRAIL AND TOP OF DIKE). FOR WALL HEIGHT GREATER THAN THREE FEET, GEOGRID SHALL BE INSTALLED 1.5 FEET BELOW TOP OF FINISHED WALL. CONTRACTOR SHALL USE A MIRAFI 5T GEOGRID WITH A LONG TERM ALLOWABLE DESIGN STRENGTH OF 662 LBS./FT. BASE MATERIAL SHALL BE A CLASS 13 AND DRAINAGE FILL SHALL BE A CLASS 4 CONCRETE ROCK. CONTRACTOR SHALL REMOVE ONLY THAT MATERIAL REQUIRED TO COMPLETE THE RETAINING WALL AS SHOWN IN THE MANUFACTURER'S HANDBOOK. BASE MATERIAL, DRAINAGE FILL, GEOGRID, AND ALL OTHER MATERIALS, LABOR AND EQUIPMENT REQUIRED TO INSTALL THE RETAINING WALL SHALL BE INCLUDED IN THE BID PRICE PER SQUARE YARD OF LANDSCAPE INTERLOCKING BLOCK. EXCAVATION SHALL BE PAID FOR UNDER COMMON EXCAVATION TYPE A. THIS ITEM MAY NOT BE REQUIRED IF THE TRAIL IS ALIGNMENT IS FIELD ADJUSTED TO AVOID CONTACT WITH EXISTING TREES. SHOULD THIS ITEM NOT BE USED, THERE WILL BE NO ADJUSTMENT IN PRICE BASED ON 25% OR MORE OF THIS ITEM NOT BEING USED.

970. **HERBICIDE WEED CONTROL:** CONTRACTOR SHALL PLACE A GRANULAR HERBICIDE IN THE AREAS WHERE THE HOT BITUMINOUS PAVEMENT TRAIL WILL BE PLACED. THE HERBICIDE SHALL BE PLACED TO A WIDTH OF 9 FEET. CONTRACTOR SHALL USE NOROSAC 106 AT AN APPLICATION RATE OF 100 - 120 LBS. PER ACRE OR 2.3 - 2.8 LBS. PER 1,000 S.F. OR DYCLOMEC 46 AT AN APPLICATION RATE OF 250-300 LBS. PER ACRE OR AN APPROVED EQUAL. THE HERBICIDE SHALL BE PLACED IMMEDIATELY AHEAD OF THE PLACEMENT OF THE HOT BITUMINOUS PAVEMENT.

970. **TREES.** CONTRACTOR SHALL USE CITY OF BISMARCK FORESTRY DEPARTMENT SPECIFICATIONS FOR TREE AND SHRUB PLANTING. REPLACEMENT SHALL BE ON A 1-FOR-1 BASIS. THE CONTRACTOR SHALL USE BARE ROOT STOCK, WITH A MINIMUM TRUNK DIAMETER OF 1-1/2 INCHES. THE FOLLOWING TYPES AND NUMBERS WILL BE USED:

GREEN ASH	9 EACH
BLACK ASH	8 EACH
AMUR MAPLE	8 EACH
FLOWERING CRAB	8 EACH
AMUR CHOKECHERRY	8 EACH

ALL TREES WILL BE PLANTED IN THE AREA ALONG EITHER SIDE THE TRAIL IN THE VICINITY OF THE GOLF COURSE AS DIRECTED BY THE ENGINEER AND MANDAN PARKS AND RECREATION EXCEPT FOR ON GREEN ASH WHICH WILL BE PLANTED AT THE END OF THE PROJECT IN THE CENTER OF THE TRAIL AS INDICATED ON THE PLANS. BID PRICE PER TREE SHALL INCLUDE COST OF TREES, TRANSPORTING AND PLACING OF TREES, MULCH AROUND TREES, WATERING OF TREES AND PROPER MAINTENANCE DURING WARRANTY PERIOD OF ONE YEAR AS SPECIFIED IN THE ABOVE-MENTIONED SPECIFICATION.

TRAFFIC CONTROL DEVICE LIST

PROJECT NO. TEU-1-988()

SIGN NUMBER	SIGN SIZE	DESCRIPTION	AMOUNT REQUIRED	UNITS PER AMOUNT	UNITS SUB-TOTAL
R1-1-30	30" X 30"	STOP		17	0
R1-1-48	48" X 48"	STOP		34	0
R2-1-48	48" X 60"	SPEED LIMIT		40	0
R2-1a-24	60" X 24"	MINIMUM FEE $40		28	0
R2-5C-48	48" X 60"	SPEED ZONE AHEAD		40	0
R4-1-48	48" X 60"	DO NOT PASS		40	0
R4-7-48	48" X 60"	KEEP RIGHT SYMBOL		40	0
R4-8-48	48" X 60"	KEEP LEFT SYMBOL		40	0
R10-6-48	48" X 72"	STOP HERE ON RED		44	0
R11-2-48	48" X 30"	ROAD CLOSED		26	0
R11-3a-60	60" X 30"	ROAD CLOSED __ MILES AHEAD LOCAL TRAFFIC ONLY		30	0
R11-3b-60	60" X 30"	BRIDGE OUT __ MILES AHEAD LOCAL TRAFFIC ONLY		30	0
R11-2a-48	48" X 30"	STREET CLOSED		26	0
R11-3a-48	48" X 30"	STREET CLOSED __ MILES AHEAD LOCAL TRAFFIC ONLY		30	0
R11-4a-60	60" X 30"	STREET CLOSED TO THRU TRAFFIC		30	0
G20-1-60	60" X 36"	ROAD CONSTRUCTION NEXT __ MILES		34	0
G20-1a-60	60" X 36"	ROAD WORK NEXT ___ MILES		34	0
G20-2-60	60" X 24"	END CONSTRUCTION	2	28	56
G20-2a-48	48" X 24"	END ROAD WORK		24	0
G20-4-36	36" X 18"	PILOT CAR FOLLOW ME		10	0
G20-50-72	72" X 36"	ROAD CONSTRUCTION NEXT __ MILES RT & LT ARROWS		38	0
G20-52-72	72" X 24"	ROAD CONSTRUCTION NEXT __ MILES RT or LT ARROWS		30	0
g20-52A-72	72" x 24"	ROAD WORK NEXT ___ MILES RT OR LT ARROWS		30	0
G20-54-48	48" X 36"	OVERHEAD BRIDGE PAINTING		30	0
G20-8-48	48" X 36"	TEMPORARY SURFACE NEXT __ MILES		30	0
M4-10-48	18" X 48"	DETOUR ARROW RIGHT OR LEFT		22	0
W1-1-48	48" X 48"	RIGHT or LEFT SHARP CURVE ARROW		34	0
W1-2-48	48" X 48"	RIGHT or LEFT CURVE ARROW		34	0
W1-3-48	48" X 48"	RIGHT or LEFT SHARP REVERSE CURVE ARROW		34	0
W1-4-48	48" X 48"	RIGHT or LEFT REVERSE CURVE ARROW		34	0
W1-6-48	48" X 24"	LARGE ARROW		26	0
W3-1a-48	48" X 48"	STOP AHEAD SYMBOL		34	0
W3-2a-48	48" X 48"	YIELD AHEAD SYMBOL		34	0
W3-3-48	48" X 48"	SIGNAL AHEAD SYMBOL		34	0
W4-2-48	48" X 48"	LANE TRANSITION SYMBOL		34	0
W5-1-48	48" X 48"	ROAD NARROWS		34	0
W6-3-48	48" X 48"	TWO WAY TRAFFIC SYMBOL		34	0
W8-1-48	48" X 48"	BUMP		34	0
W8-3a-48/W8-3a-24	48" X 48"/24" X 18"	PAVEMENT ENDS SYMBOL/PAVEMENT ENDS PLAQUE		40	0
W8-51-48	48" X 48"	UNEVEN PAVEMENT		34	0
W8-53-48	48" X 48"	TRUCKS ENTERING HIGHWAY	8	34	272
W8-54-48	48" X 48"	TRUCKS ENTERING AHEAD OR __ FT.		34	0
W8-55-48	48" X 48"	TRUCKS CROSSING AHEAD or __ FT.		34	0
W13-1-24	24" X 24"	15 MPH ADVISORY SPEED PLATE		10	0
W13-4-48	48" X 60"	RAMP ARROW		40	0
W20-1-48	48" X 48"	ROAD CONSTRUCTION - AHEAD, 1/2 MILE, or FT.	2	34	68
W20-1a-48	48" X 48"	MEN WORKING SYMBOL		34	0
W20-2-48	48" X 48"	DETOUR __ FT.		34	0
W20-3-48	48" X 48"	ROAD or STREET CLOSED AHEAD or __ FT.		34	0
W20-4-48	48" X 48"	ONE LANE ROAD AHEAD or __ FT.		34	0
W20-5-48	48" X 48"	RIGHT OR LEFT LANE CLOSED AHEAD or __ FT.		34	0
W20-7a-48	48" X 48"	FLAGGING SYMBOL		34	0
W20-8-48	48" X 48"	STREET CLOSED		34	0
W20-50-48	48" X 48"	BE PREPARED TO STOP		34	0
W20-51-48	48" X 48"	EQUIPMENT WORKING		34	0
W20-52-54	54" X 12"	NEXT __ MILES		10	0
W21-2-48	48" X 48"	FRESH OIL		34	0
W21-4-48	48" X 48"	ROAD WORK AHEAD		34	0
W21-5-48	48" X 48"	SHOULDER WORK		34	0
W21-14-48	48" X 48"	UNEVEN LANES SYMBOL		34	0
W21-51-48	48" X 48"	MATERIAL ON ROADWAY		34	0
W22-7-48	48" X 48"	SINGLE LANE AHEAD or __ FT.		34	0
W22-8-48	48" X 48"	FRESH OIL LOOSE ROCK		34	0
R1-1a-18/W22-14-18	18" X 18"	STOP and SLOW PADDLE Back to Back		8	0
M4-9-30	30" X 24"	DETOUR AHEAD		16	0
M4-8-24	24" X 12"	DETOUR		6	0
M5-1-21	21" X 15"	ARROW UP RT. OR UP LT.		6	0
M6-1-21	21" X 15"	ARROW RT. OR LT.		6	0
M4-8a-24	24" X 18"	END DETOUR		6	0
	36" X 9"	STREET NAME SIGNS		8	0
		TOTAL UNITS			396
TYPE III	8' LONG	BARRICADES	EACH		4
TYPE II	2' MIN.	BARRICADES	EACH		
TYPE I	6' TO 10'	BARRICADES	EACH		
	18" X 36" MIN.	DELINEATOR DRUMS	EACH		8
	28" MIN.	TRAFFIC CONES	EACH		
	8" TO 12" X 24"	VERTICAL PANELS	EACH		
	3" X 8"	DELINEATOR	EACH		
		SEQUENCING ARROW PANEL TYPE C	EACH		

FHWA REGION	STATE	PROJECT NO.	SHEET NO.
8	ND	TEU-1-988(009)020	6

FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	7

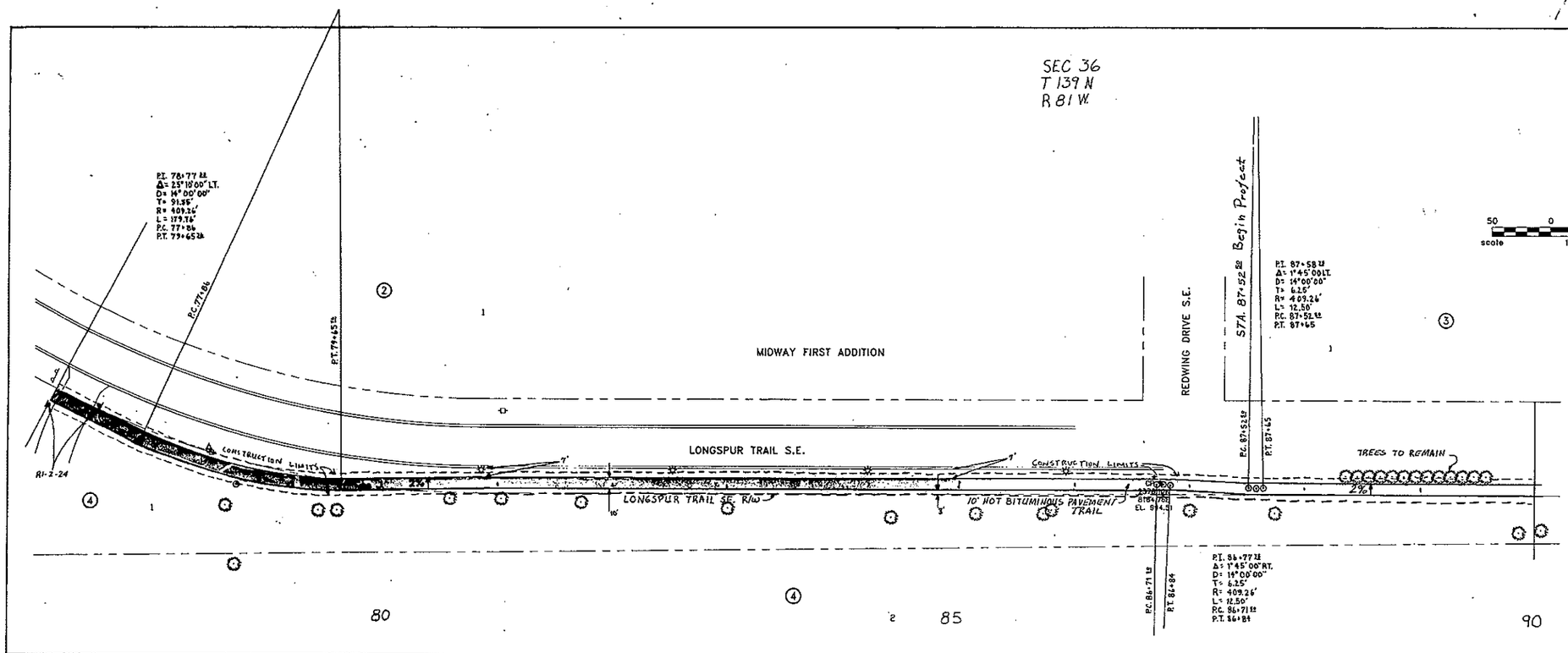
MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS PLAN & PROFILE

CMPR. NO.:	DATE:
14517	
DRWN. BY: TK	CHK'D BY: T.R./R.S.

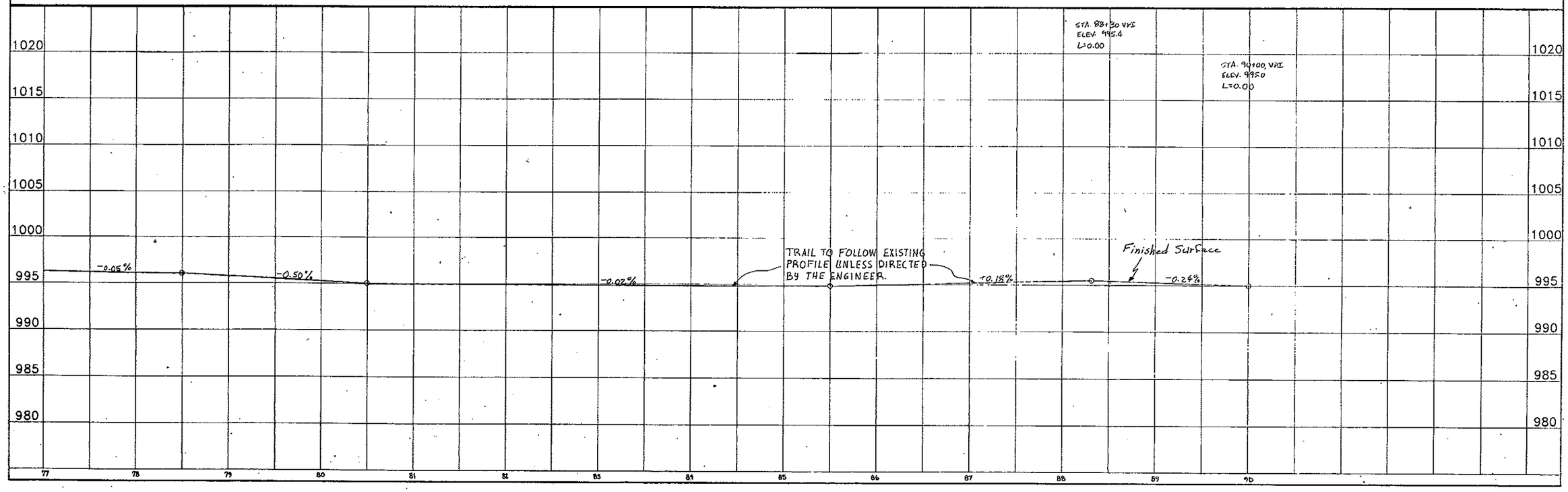
SEC 36
T 139 N
R 81 W



Clearing and Grubbing	248	L.F.
Topsoil	10	C.Y.
Borrow	75	C.Y.
Subgrade Preparation, Type B (6")	248	L.F.
Hot Bituminous Pavement, Cl. 25	43	Ton
85-100 Asphalt Cement	3	Ton
Seeding, Type B Special	.07	Acre
Herbicide Weed Control	248	L.F.

BENCH MARK LIST

NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #8 2X2 W/ NAIL	N 3187.07 E 6609.99	1005.90
2	CP #9 2X2 W/ NAIL	N 2378.12 E 8184.76	994.51
3			



FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	8

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

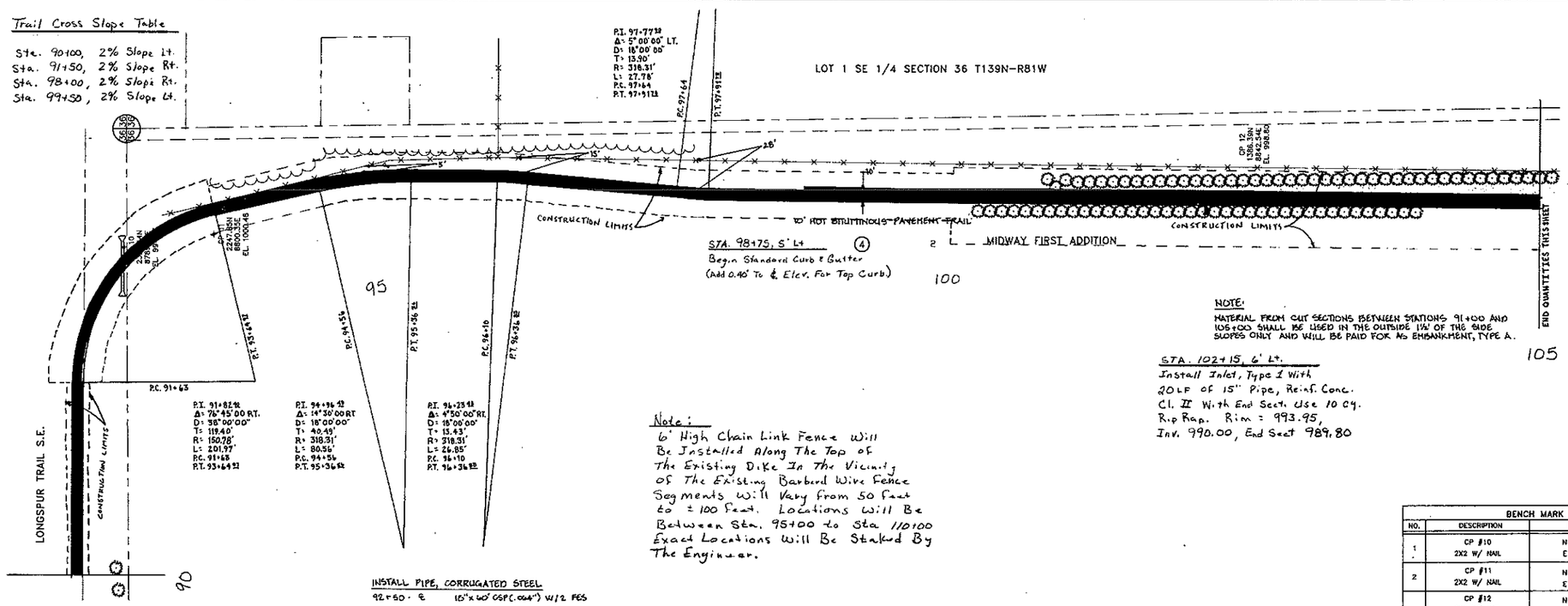
Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS
PLAN & PROFILE

CMP'R. NO.:	DATE
14517	DEC. 1997
DRWN. BY: TR	CHK'D BY: T.R./R.S.

Trail Cross Slope Table

Sta. 90+00, 2% Slope Lt.
Sta. 91+50, 2% Slope Rt.
Sta. 98+00, 2% Slope Rt.
Sta. 99+50, 2% Slope Lt.



NOTE:
MATERIAL FROM CUT SECTIONS BETWEEN STATIONS 91+00 AND 105+00 SHALL BE USED IN THE OUTSIDE 1½' OF THE SIDE SLOPES ONLY AND WILL BE PAID FOR AS EMBANKMENT, TYPE A.

STA. 102+15, 6' Lt.
Install Inlet, Type I With
20 LF of 15" Pipe, Reinf. Conc.
Cl. II With End Sect. Use 10 cy.
Rip Rap. Rim = 993.95,
Inv. 990.00, End Sect 989.80

Note:
6' High Chain Link Fence Will Be Installed Along The Top of The Existing Dike In The Vicinity of The Existing Barbard Wire Fence Segments Will Vary From 50 Feet to ± 100 Feet. Locations Will Be Between Sta. 95+00 to Sta 110+00 Exact Locations Will Be Staked By The Engineer.

INSTALL PIPE, CORRUGATED STEEL
92+50 · ℄ 15"x 40' CSP(.064") W/12 FES

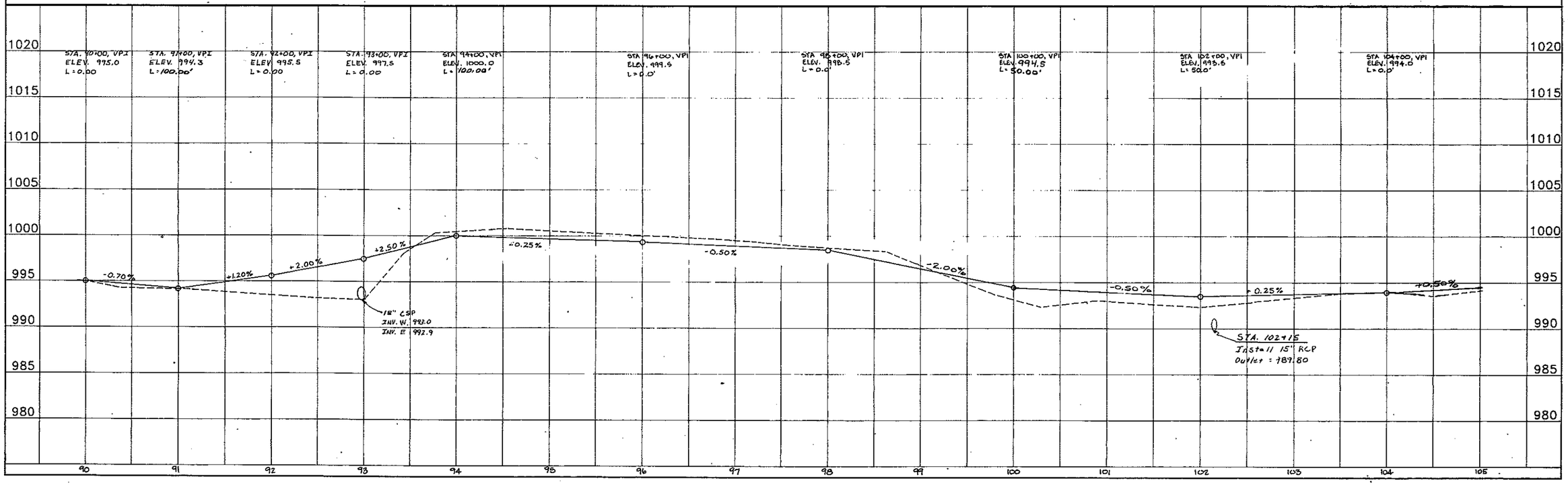
Clearing and Grubbing	1,500	L.F.
Topsoil	606	C.Y.
Excavation, Type A	747	C.Y.
Topsoil - Imported	200	C.Y.
Borrow	1,160	C.Y.
Subgrade Preparation, Type B (6")	1,500	L.F.
Hot Bituminous Pavement, Cl. 25	255	Ton
85-100 Asphalt Cement	17	Ton
Rip Rap	10	C.Y.
Seeding, Type B Special	.75	Acre
Pipe, Concrete Reinf. 15"	20	Each
End Section Conc. Reinf. 15"	1	Each
Pipe, Corr. Steel, .064", 18"	60	L.F.
End Section Corr. Steel, (.064") 18"	2	Each
Inlet, Type 1	1	Each
Curb and Gutter	625	L.F.
Landscape Interlocking Block	200	S.F.
Herbicide Weed Control	1,500	L.F.
Fence Chain Link	450	L.F.

BENCH MARK LIST

NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #10 2X2 W/ NAIL	N 2328.64 E 8789.28	994.87
2	CP #11 2X2 W/ NAIL	N 2252.85 E 8800.35	1000.48
	CP #12 2X2 W/ NAIL	N 1386.39 E 6842.54	998.80

N

50 0 50 100
scale 1"=50' feet



Trail Cross Slope Table

Sta. 105+00, 2% Slope Lt.
Sta. 107+00, 2% Slope Lt.
Sta. 108+00, 2% Slope Rt.

BENCH MARK LIST			
NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #13 2X2 W/ NAIL	N 813.49 E 8840.24	998.11
2	CP #13A 2X2 W/ NAIL	N 228.20 E 8847.93	998.94
3	CP #14 2X2 W/ NAIL	N -47.24 E 8852.09	999.45

Clearing and Grubbing	1,400	L.F.
Topsoil	457	C.Y.
Excavation, Type A	175	C.Y.
Topsoil - Imported	200	C.Y.
Borrow	5,285	C.Y.
Subgrade Preparation, Type B (6")	1,400	L.F.
Hot Bituminous Pavement, Cl. 25	239	Ton
85-100 Asphalt Cement	16	Ton
Seeding, Type B Special	.75	Acre
Curb and Gutter	550	L.F.
Landscape Interlocking Block	200	S.F.
Herbicide Weed Control	1,400	L.F.
Fence Chain Link	150	L.F.

FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)026	9

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS PLAN & PROFILE

CUP'R NO.:	DATE
14517	DEC, 1997
DRWN. BY	CHK'D BY
TR	T.R. /R.S.

scale 1"=50' feet (50 0 50 100)

P.T. 104+60.52
Δ= 9°00'00" LT.
D= 18°00'00"
T= 25.03'
R= 318.31'
L= 25.03'
P.C. 104+35.52
P.T. 104+85.52

P.C. 104+35.52

P.T. 104+85.52

STA 108+00, 5' Lt.
End Standard Curb & Gutter

LOT 1 SE 1/4 SECTION 36
T139N-R81W

STA. 116+50, 5' LT.
Begin Standard Curb & Gutter
(Add 0.40' To & Elev. For Top Curb)

END QUANTITIES THIS SHEET

P.I. 115+55.65
Δ= 30°00'00" LT.
D= 54°00'00"
T= 28.45'
R= 100.10'
L= 55.50'
P.C. 115+06.12
P.T. 115+60.68

P.C. 115+06.12

P.T. 115+60.68

5'
10'
10' HOT BITUMINOUS PAVEMENT TRAIL
CONSTRUCTION LIMITS
Construction Limits

CP 813.49 8840.24 EL. 998.11

CP 228.20 8847.93 EL. 998.94

CP -47.24 8852.09 EL. 999.45

P.C. 107+72

P.I. 107+94.25
Δ= 9°15'00" RT.
D= 18°00'00"
T= 22.96'
R= 318.31'
L= 45.83'
P.C. 107+72
P.T. 108+17.55

P.T. 108+17.55

110

MIDWAY FIRST ADDITION

115

P.I. 117+55.74
Δ= 54°00'00" RT.
D= 54°00'00"
T= 27.44'
R= 100.10'
L= 55.70'
P.C. 117+05.52
P.T. 117+62.22

P.C. 117+05.52

P.T. 117+62.22

1020
1015
1010
1005
1000
995
990
985
980

STA 106+00, VPI
ELEV. 995.0
L=0.0'

STA 109+00, VPI
ELEV. 998.6
L=0.0'

STA 116+00, VPI
ELEV. 998.6
L=0.0'

STA 117+00, VPI
ELEV. 999.0
L=50'

STA 118+00, VPI
ELEV. 998.0
L=100'

+0.50%
+1.167%
0.00%
-1.00%
-0.500%

ORIGINAL PROFILE
FINISHED GRADE

105 106 107 108 109 110 111 112 113 114 115 116 117 118 119

FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	10

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS
PLAN & PROFILE

CMPTR. NO.:	DATE
14517	DEC. 1997
DRWN. BY	CHK'D BY
TR	T.R. / R.S.

BENCH MARK LIST			
NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #14 2X2 W/ NAIL	N -47.24 E 8852.09	999.45
2	CP #15 2X2 W/ NAIL	N -379.91 E 8850.73	998.58

Clearing and Grubbing	400	L.F.
Topsoil	300	C.Y.
Excavation, Type A	50	C.Y.
Topsoil - Imported	50	C.Y.
Borrow	1,100	C.Y.
Subgrade Preparation, Type B (6")	1,513	L.F.
Hot Bituminous Pavement, Cl. 25	260	Ton
85-100 Asphalt Cement	17	Ton
Rip Rap	30	C.Y.
Seeding, Type B Special	.55	Acre
Pipe, Concrete Reinf. 15"	80	L.F.
Pipe, Concrete Reinf. 48"	24	L.F.
Pipe, Concrete End Sect. 48"	2	Each
Inlet, Type 1	1	Each
Curb and Gutter	275	Each
Herbicide Weed Control	1,513	L.F.
End Section, Conc. Reinf. 15"	1	Each

N

50 0 50 100
scale 1"=50' feet

STA 120+17 ~ 25' LT. TO 10' RT.
REMOVE EXISTING BARBED WIRE FENCE. INSTALL "H" FRAME 10' RT., INCIDENTAL TO HSP CL. 25.

STATION EQUATION
121+12.50 BK = 121+00 AHD

INSTALL PIPE, REINFORCED CONCRETE
STA 120+40 - ℄ 48"x 24' RCP, CL 2, W/ 1/2 CES
Install 20 c.y. Rip Rap.

Begin Quantities This sheet.

P.C. 119+03.75

P.T. 120+52.50

STA. 121+75, 5' LT.
End Standard Curb & Gutter.

SECTION 36
T139N
R81W

SECTION LINE

RIGHT-OF-WAY

CONSTRUCTION LIMITS

SECTION LINE

End Quantities This Sheet

CP 15
-379.91N
8850.73E
EL. 998.58

120

10'

GOV'T. LOT 2

125

SECTION 1
T138N
R81W

3'

RIGHT OF WAY

130

P.I. = 119+28.00
Δ = 89°15'00"
D = 60°00'00"
T = 94.25'
R = 95.49'
L = 148.75'
P.C. = 119+03.75
P.T. = 120+52.50

STA. 121+38, 6' LT.
Install Inlet Type I With 80 L.F. of 15" Pipe, Reinf Conc. Cl. 2 With End Sect.
Rim = 991.86, Inv. = 988.50
End Sec. 988.00

1020
1015
1010
1005
1000
995
990
985
980

STA. 120+00, VPI
ELEV. 997.0
L = 100.0'

STA. 121+00 VPI
ELEV. 991.0
L = 100.0'

STA. 122+80, VPI
ELEV. 992.5
L=0.00

STA 124+30, VPI
ELEV 992.7
L=0.00

STA. 125+50, VPI
ELEV. 992.5
L=0.00

STA. 127+50, VPI
ELEV. 992.5
L=0.00

STA 130+50, VPI
ELEV 992.5
L=0.00

STA. 131+50, VPI
ELEV 991.8
L=0.00

STA. 133+50, VPI
ELEV 991.6
L=0.00

-0.500%

-6.00%

+0.833%

+0.20%

-0.17%

0.00%

-0.07%

-0.50%

-0.10%

80 L.F. 15" RCP

48" RCP CL 2
INV. 987.45

TRAIL TO FOLLOW EXISTING GROUND PROFILE.

119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134

INSTALL 24"x24" SIGN
STA 146+86, 8'RT. R1-2 1EA
STA 147+60 8'LT R1-2 1EA

INSTALL 24"x24" SIGN
STA.146+80, 8'LT. R5-3 1EA
STA.147+55, 8'RT R5-3 1EA.

INSTALL 30"x30" SIGN
STA.146+95, 250' Lt. W11-1 1 EA
STA 147+42, 250' Rt W11-1 1 EA.

INSTALL 36"x36" SIGN (SPECIAL)
* STA 146+70, 8'RT. SPECIAL 1 EA
* STA 147+65, 8'LT SPECIAL 1 EA
*(See Detail Sheet)

BENCH MARK LIST			
NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #15 2X2 W/ NAIL	N -379.91 E 8650.73	998.58
2	CP #16 2X2 W/ NAIL	N -344.01 E 11,524.12	991.00

Clearing and Grubbing	400	L.F.
Topsoil	270	C.Y.
Borrow	300	C.Y.
Subgrade Preparation Type B (6")	1,500	L.F.
Hot Bituminous Pavement, Cl. 25	268	Ton
85-100 Asphalt Cement	17	Ton
Seeding, Type B Special	.45	Acre
18" x 18" Signs	2	Each
Herbicide Weed Control	1,500	L.F.
Pipe, Concrete Reinf. 15"	16	L.F.
End Section Concrete Reinf. 15"	2	Each

FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	11

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

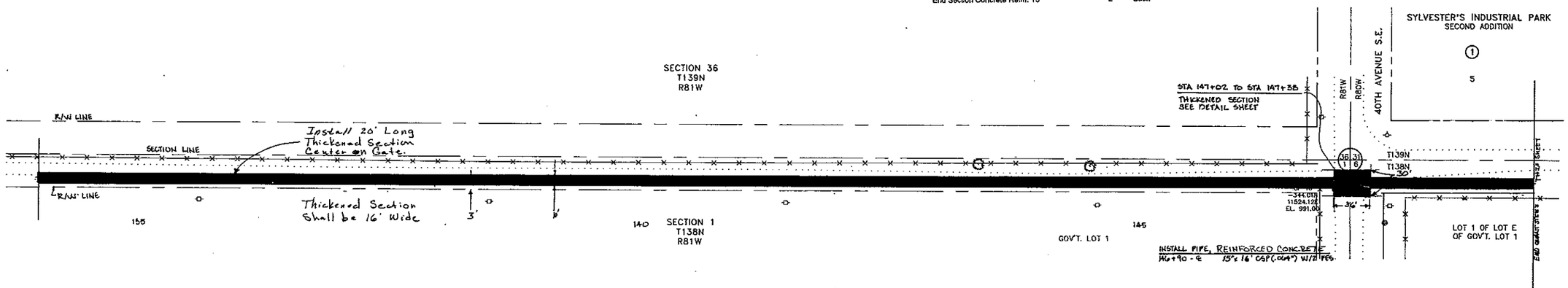
Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

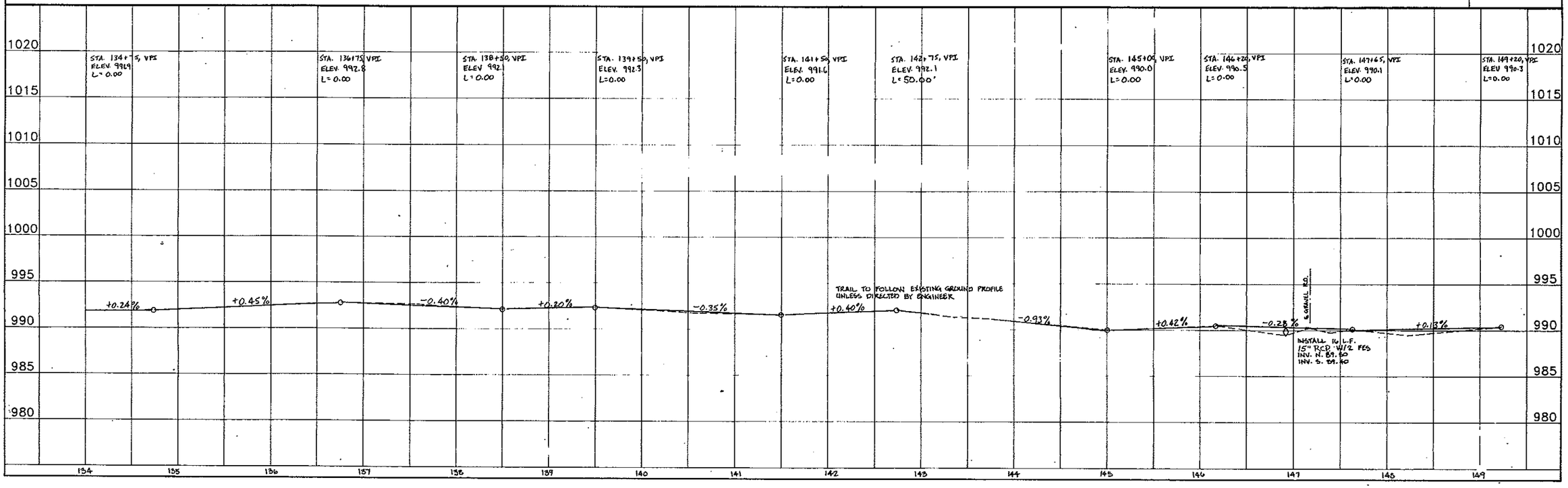
MANDAN REC. TRAILS PLAN & PROFILE

CMP'R. NO.:	DATE
14517	DEC. 1997
DRWN. BY	CHK'D BY
T.R.	T.R./R.S.

N

50 0 50 100
scale 1"=50' feet





FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	12

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS PLAN & PROFILE

CMPTR. NO.: 14517 | DATE: DEC., 1997
DRWN. BY: T.R. | CHK'D BY: T.R./K.S.

INSTALL 24" x 24" SIGN
STA 154+00, 8' LT. RS-3 1 EA.
STA 156+75, 8' RT RS-3 1 EA.

BENCH MARK LIST

NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #16 2X2 W/ NAIL	N -344.01 E 11,524.12	991.00
2	CP #17 2X2 W/ NAIL	N -354.79 E 12,736.10	994.06

Clearing and Grubbing	1,200	L.F.
Topsoil	295	C.Y.
Borrow	485	C.Y.
Subgrade Preparation, Type B (6")	1,500	L.F.
Hot Bituminous Pavement, Cl. 25	257	Ton
85-100 Asphalt Cement	16	Ton
Seeding, Type B Special	.45	Acre
Pipe Corr. Steel, .064", 18"	16	L.F.
End Section Corr. Steel (.064") 18"	2	Each
Herbicide Weed Control	1,500	L.F.

scale 50 0 50 100 feet, 1"=50'

SYLVESTER'S INDUSTRIAL PARK SECOND ADDITION

Install 40' Long Thickened Section Centered Between Fences.

PROPERTY LINE

T139N
T138N

Section Line

19TH STREET S.E.

CONSTRUCTION LIMITS

43RD AVENUE S.E.

Install 30' Long Thickened Section Centered on Existing Road

R/W LINE

Thickened Section Shall Be 16' Wide.

Thickened Section Shall Be 16' Wide, Min.

LOT 1 OF LOT E OF GOVT. LOT 1 SECTION 6 T138N-R80W

LOT E OF GOVT. LOT 1

INSTALL PIPE, CORRUGATED STEEL
STA 165+10 - ℄ 18"x16' CGP(.064") W/2 FES

END QUANTITIES

STA.	ELEV.	L
149+20, VPI	990.3	0.00
151+50, VPI	990.5	0.00
153+50, VPI	990.9	0.00
156+50, VPI	993.0	0.00
158+00 VPI	994.4	100.00'
160+00, VPI	993.3	0.00
161+00, VPI	993.7	LENGTH 0.0'

+0.09% +0.20% +0.70% +0.93% -0.55% +0.40% -1.14%

INSTALL 16 L.F. 18" CAP W/ 2 FES
INV. N. 989.90
INV. S. 989.80

INSTALL 18"x 18" SIGN
STA 167+30, 8' RT. R1-1 1 EA.

INSTALL 24"x 24" SIGN
STA 167+30, 8' LT. RS-3 1 EA.

FHWA REGION	STATE	PROJECT No.	SHEET No.
8	ND	TEU 1-988(009)020	13

MANDAN PARKS & RECREATION
MANDAN, NORTH DAKOTA

Kadrmas Lee & Jackson PC
Consulting Engineers & Surveyors

MANDAN REC. TRAILS PLAN & PROFILE

CMPR. NO.:	DATE
14517	DEC. 1997
DRWN. BY: TR	CHK'D BY: T.R./R.S.

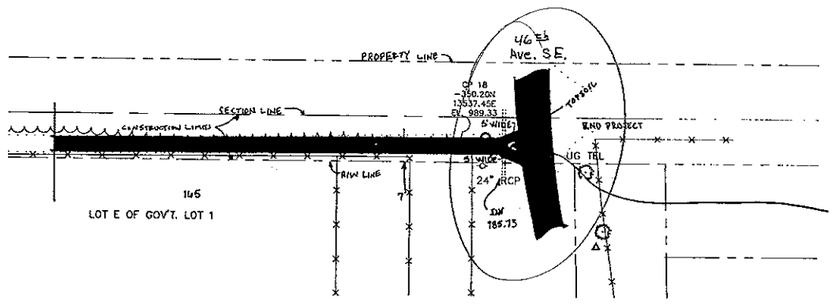
N

50 0 50 100
scale 1"=50' feet

SYLVESTER'S INDUSTRIAL PARK
SECOND ADDITION

(2)

5

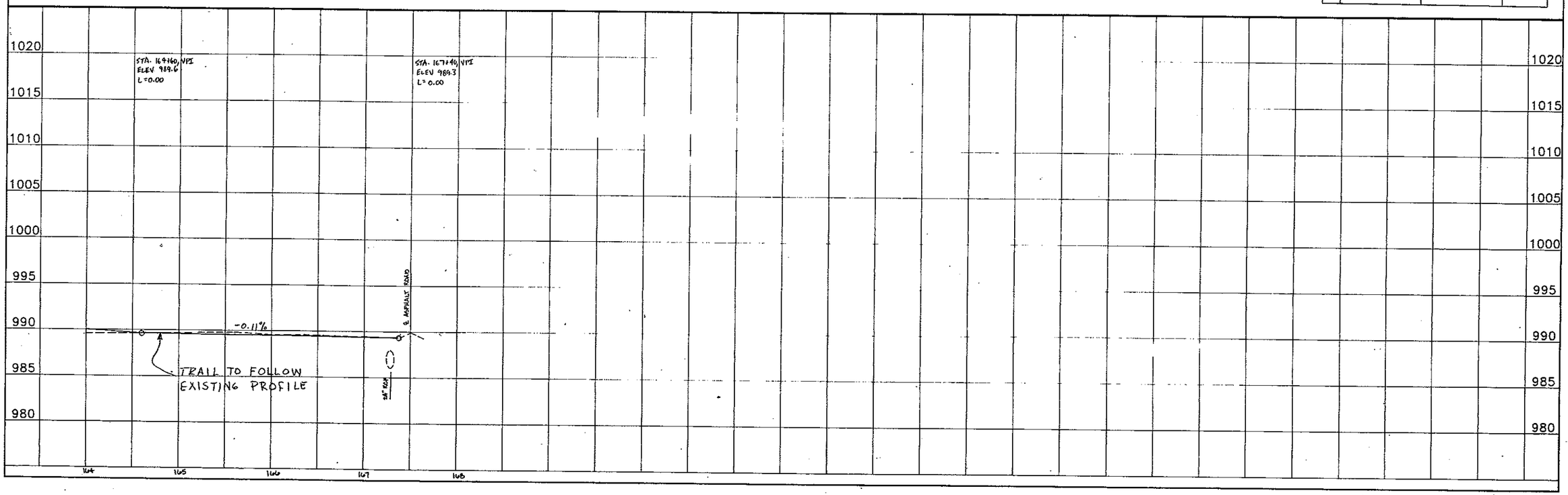


Install 1 Green Ash In Center of Topsoil Area.

Clearing and Grubbing	340	L.F.
Topsoil	65	C.Y.
Borrow	165	C.Y.
Subgrade Preparation, Type B (6")	340	L.F.
Hot Bituminous Pavement, Cl. 25	61	Ton
85-100 Asphalt Cement	4	Ton
Seeding, Type B Special	.15	Acre
18" x 18" Signs	1	Each
24" x 24" Signs	1	Each
Herbicide Weed Control	340	L.F.

BENCH MARK LIST

NO.	DESCRIPTION	LOCATION	ELEVATION
1	CP #17 2X2 W/ NAIL	N -354.79 E 12,738.10	994.06
2	CP #18 2X2 W/ NAIL	N -350.20 E 13,537.45	989.33



Kadrmas Lee & Jackson PC DICKINSON, BISMARCK, VALLEY CITY, N.D.	FHWA REGION	STATE	PROJECT NUMBER	SHEET NUMBER	TOTAL SHEETS
	8	N.D.	TEU-1-988(009)020	14	16
DRWN. BY	CK'D. BY	PROJ. NO.	DATE		

FINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
NOTE BOOK TEMPLATE		
AREAS		
NO. AREAS CHECKED		

ORIGINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
NOTE BOOK TEMPLATE		
AREAS		
NO. AREAS CHECKED		

Kadrmas Lee & Jackson PC	FHWA REGION	STATE	PROJECT NUMBER	SHEET NUMBER	TOTAL SHEETS
BISMARCK, MINOT, DICKINSON, WILLISTON, FARGO, WEST FARGO, GRAND FORKS, VALLEY CITY, N.D.	8	N.D.	TEA-1-988(009)82	15	16
	DRWN. BY	CK'D. BY	PROJ. NO.	DATE	

FINAL SURVEY — SURVEYED, PLOTTED, TEMPLATE, AREAS CHECKED, NOTE BOOK, NO., BY, DATE

ORIGINAL SURVEY — SURVEYED, PLOTTED, TEMPLATE, AREAS CHECKED, NOTE BOOK, NO., BY, DATE

TYPICAL SECTION FROM STA. 109+00 TO STA 114+00

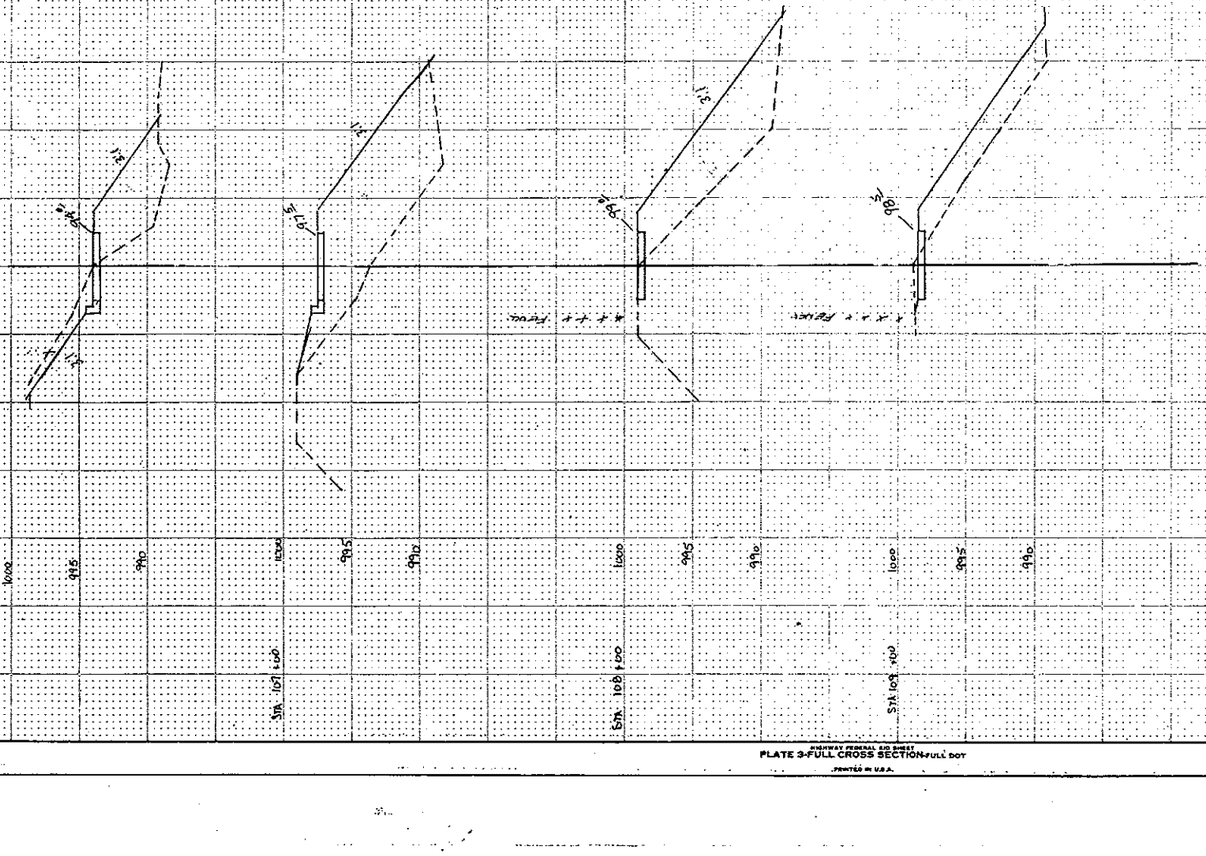


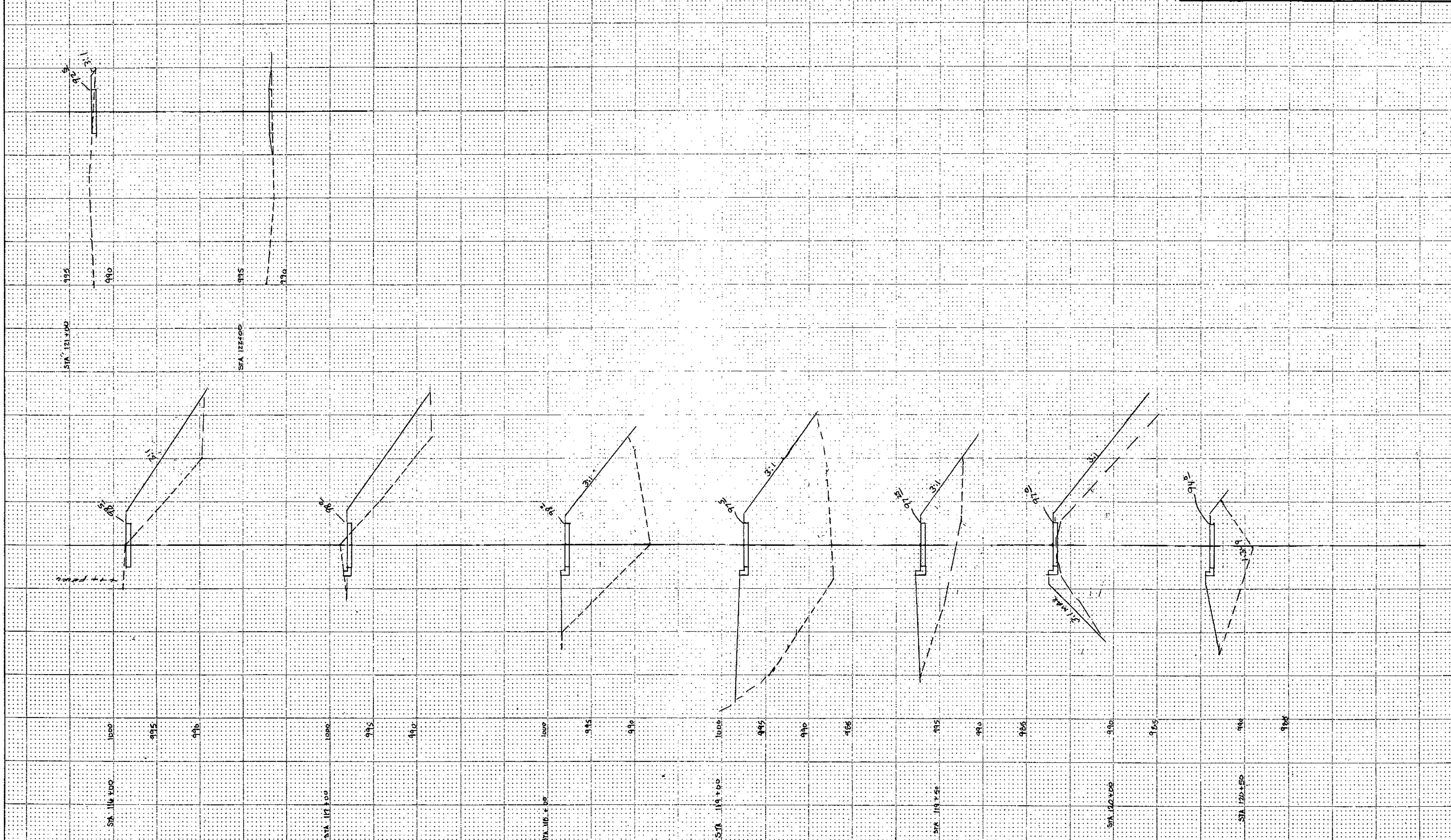
PLATE 3-FULL CROSS SECTION-FULL DOT

HIGHWAY FEDERAL AID SERIES

PRINTED IN U.S.A.

Kadrmas Lee & Jackson PC DICKINSON, BISMARCK, VALLEY CITY, N.D.	FHWA REGION	STATE	PROJECT NUMBER	SHEET NUMBER	TOTAL SHEETS
	8	N.D.	TEU-1-988(009)020	16	16
	DRWN. BY	CK'D. BY	PROJ. NO.	DATE	

FINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
NOTE BOOK	TEMPLATE	
NO.	AREAS	
	AREAS CHECKED	

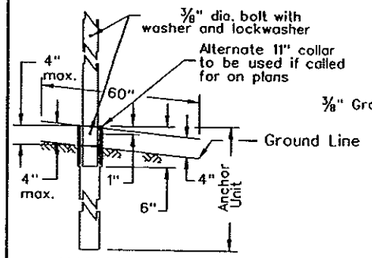


ORIGINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
NOTE BOOK	TEMPLATE	
NO.	AREAS	
	AREAS CHECKED	

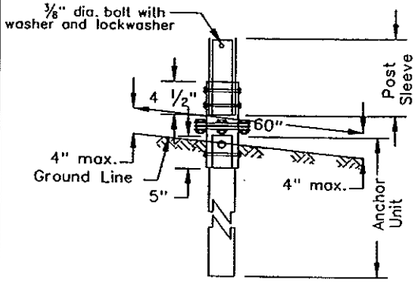
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

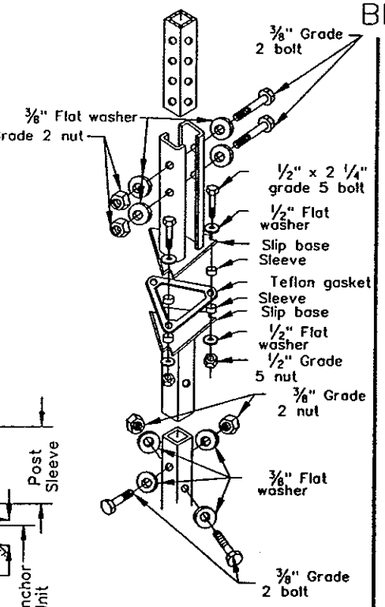
PERFORATED TUBE



ANCHOR UNIT AND POST SLEEVE ASSEMBLY



SLIP BASE ANCHOR UNIT AND POST SLEEVE ASSEMBLY



SLIP BASE ASSEMBLY DETAILS

NOTE:
Slip base bolts shall be torqued as specified by the manufacturer.

The 2 3/16" size 10 gauge is shown as 2.19" size on the plans. The 2 1\2" size 10 gauge is shown as 2.51" size on the plans.

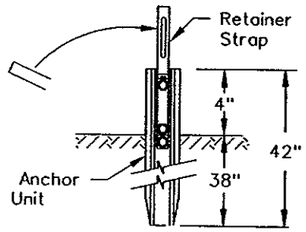
NUMBER OF POSTS	TELESCOPING PERFORATED TUBE					
	POST SIZE	WALL THICK-NESS GAUGE	SLEEVE SIZE	ANCHOR SIZE	WALL THICK-NESS GAUGE	SLIP BASE
1	2	12		2 1/4	12	NO
1	2 1/4	12		2 1/2	12	NO
1	2 3/16	10		2 1/2	12	YES
1	2 1/2	12		A	3/16	B
1	2 1/2	10		A	3/16	YES
1	2 1/4	12	2	2 1/2	12	YES
1	2 1/2	12	2 1/4	2 1/2	12	YES
2	2	12		2 1/4	12	NO
2	2 1/4	12		2 1/2	12	NO
2	2 3/16	10		2 1/2	12	YES
2	2 1/2	12		2 1/2	12	YES
2	2 1/2	10		A	3/16	YES
2	2 1/4	12	2	2 1/2	12	YES
2	2 1/2	12	2 1/4	2 1/2	12	YES
3 & 4	2 1/2	12		2 1/2	12	YES
3 & 4	2 1/2	10		A	3/16	YES
3 & 4	2 1/2	12	2 1/4	2 1/2	12	YES
3 & 4	2 1/4	12	2	2 1/2	12	YES
3 & 4	2 1/2	10	2 3/16	A	3/16	YES

TELESCOPING PERFORATED TUBES						
TUBE SIZE IN.	WALL THICKNESS IN.	U.S. STANDARD GAUGE	WEIGHT PER FOOT LBS.	MOMENT OF INERTIA IN.4	CROSS SECT. AREA IN. SQ.	SECTION MODULUS IN.3
1 1/2 x 1 1/2	.105	12	1.702	.129	.380	.172
2 x 2	.105	12	2.416	.372	.590	.372
2 1/4 x 2 1/4	.105	12	2.773	.561	.695	.499
2 3/16 x 2 3/16	.135	10	3.432	.605	.841	.590
2 1/2 x 2 1/2	.105	12	3.141	.804	.803	.643
2 1/2 x 2 1/2	.135	10	4.005	.979	1.010	.785
4 x 4	.250	1/4	6.600	3.040	1.940	1.05

A - SEE ANCHOR FOR 2 1/2" 10 GAGE POSTS DETAIL

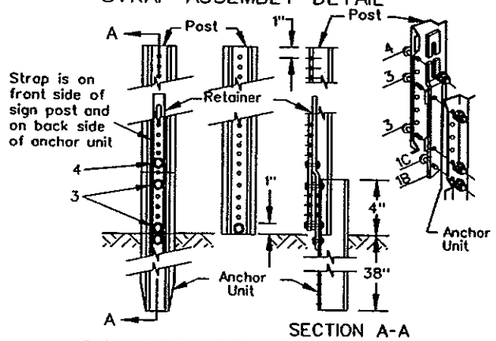
B - THE 2 1/2" 12 GAGE POST DO NOT NEED SLIP BASES WHEN PLACED IN STANDARD SOILS.
THE BREAKAWAY BASE IS REQUIRED WHEN THE SUPPORT IS PLACED IN WEAK SOILS. THE ENGINEER SHALL DETERMINE IF THE SOILS ARE WEAK. WEAK SOILS ARE DEFINED AS BOGY, WET, OR LOOSE SOIL AREAS.

FLANGED CHANNEL



1. A - Drive anchor unit to within 12" of ground level.
   B - Proper assembly established by lining up the top 3/4" slot of retainer spacer strap with top hole of anchor unit.
   C - Assemble strap to back of anchor unit using 3/8" -16 UNC x 2.0" long bolt & lock washer & nut.
   D - Rotate strap 90° to left.
2. A - Drive anchor unit to 4" dimension.
   B - Rotate strap to vertical position.

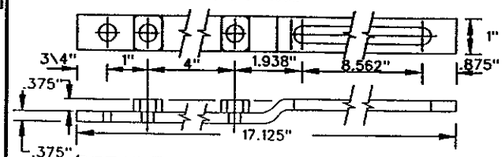
ANCHOR UNIT & STRAP ASSEMBLY DETAIL



SIGNPOST ASSEMBLY DETAIL

3. A - Place 3/8"-16 UNC x 2.0" bolt & lock washer & nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit. (This coincides with bottom 3/4" slot in strap)
   B - Alternately tighten two connector bolts.
4. A - Complete assembly by tightening 3/8"-16 UNC x 2.0" long retainer bolt. (This fastens sign post to retainer spacer strap.)

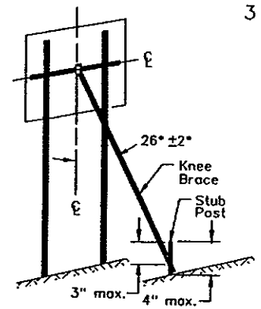
The base post, strap & sign post shall be properly nested. Proper nesting is achieved when all flat surfaces of the base post, strap & sign post at the bolts have full contact across there entire width.



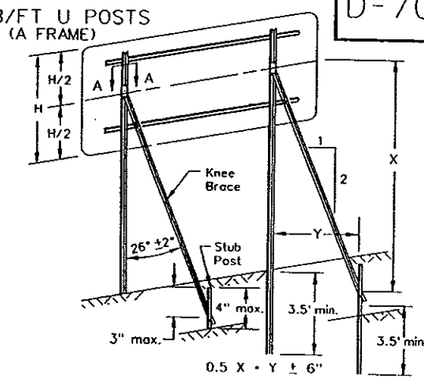
RETAINER-SPACER STRAP DETAIL

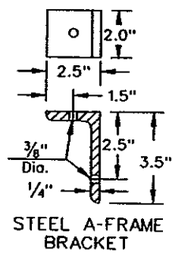
CHANNEL SIZE IN.	WALL THICKNESS IN.	WEIGHT PER FOOT LBS.	MOMENT OF INERTIA IN. 4	CROSS SECT. AREA IN. SQ.	SECTION MODULUS IN. 3
1.516 x 3.125"	.116	2.00	.179	.590	.225
1.532 x 3.125"	.124	2.25	.201	.648	.254
1.562 x 3.125"	.132	2.50	.233	.748	.289
1.578 x 3.125"	.140	2.75	.271	.819	.329
1.750 x 3.500"	.150	3.00	.372	.918	.403
1.750 x 3.500"	.175	4.00	.500	1.190	.560

3 LB/FT U POSTS (A FRAME)

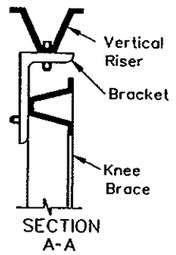


TYPICAL A-FRAME INSTALLATIONS





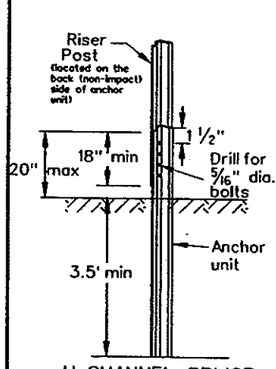
STEEL A-FRAME BRACKET



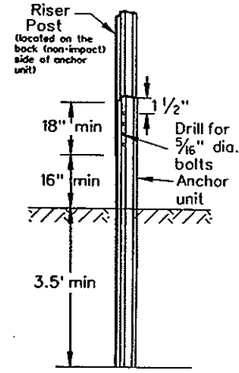
SECTION A-A

NOTES:
1. USE 3 LB/FT RISER STUB POSTS, RISERS, STRINGERS, KNEE BRACES, LATERAL BRACES AND KNEE BRACE STUB POSTS.
2. OFFSET KNEE BRACE STUB POST 1" TOWARD ROADWAY RELATIVE TO VERTICAL POST.
3. USE 5/16" BOLTS, WASHERS AND NUTS FOR ALL CONNECTIONS. A SPLICE SHALL OVERLAP 12" MIN. AND HAVE BOLTS IN THE TOP AND BOTTOM HOLES OF THE SPLICE.
4. DRIVEN RISER STUB POSTS SHALL BE AT LEAST 7' LONG AND EMBEDDED AT LEAST 3.5'. BRACING STUBS SHALL BE NO MORE THAN 4" ABOVE GROUND AND EMBEDDED AT LEAST 3.5'.

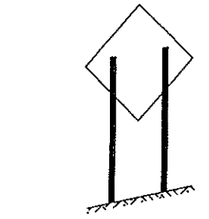
3# U POST



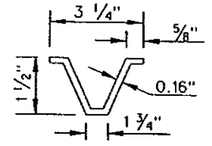
U-CHANNEL SPLICE OPTION 1



U-CHANNEL SPLICE OPTION 2



TYPICAL INSTALLATION



U-POST DETAIL (3 Lb/Ft)

NOTES:
1. USE 3 LB/FT RISER STUB POSTS AND RISERS.
2. DRIVEN RISER STUB POSTS SHALL BE AT LEAST 7' LONG AND EMBEDDED AT LEAST 3.5'.
3. USE 5/16" BOLTS, WASHERS AND NUTS FOR ALL CONNECTIONS. A SPLICE SHALL OVERLAP 18" MINIMUM.
4. ANCHOR POSTS FOR GUY WIRES SHALL BE NO MORE THAN 4" ABOVE GROUND AND EMBEDDED AT LEAST 3.5'.

REVISIONS	
DATE	CHANGE
5-11-94	U-POST
7-19-95	U-POST SPLICE
4-15-96	TABLE & ENTERN 1

7-28-93

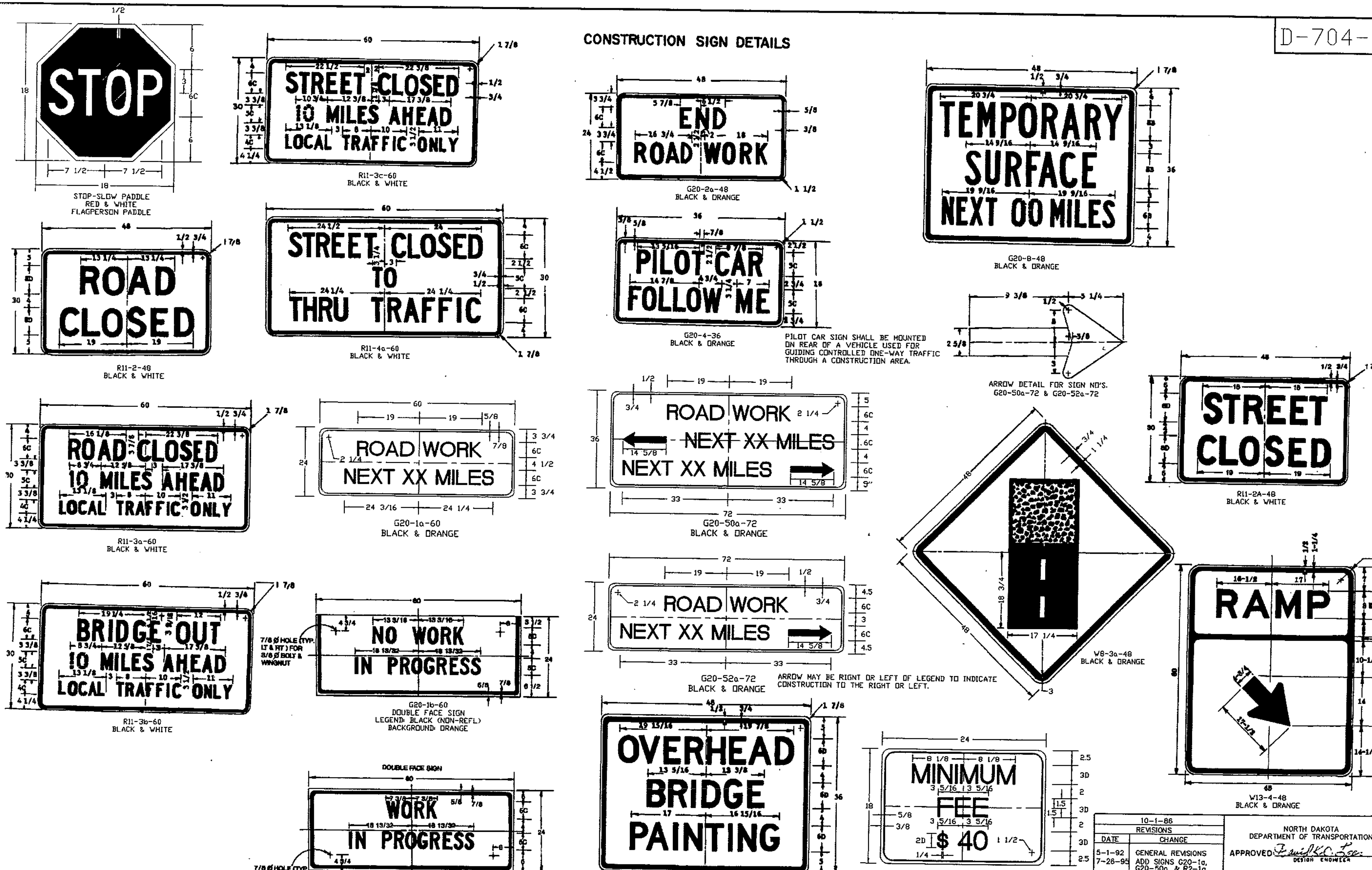
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

Kenneth E. Bird

APPROVED: DESIGN ENGINEER

D-704-9

CONSTRUCTION SIGN DETAILS



STOP-SLOW PADDLE
RED & WHITE
FLAGPERSON PADDLE

R11-3c-60
BLACK & WHITE

G20-2a-48
BLACK & ORANGE

G20-8-48
BLACK & ORANGE

R11-2-48
BLACK & WHITE

R11-4a-60
BLACK & WHITE

G20-4-36
BLACK & ORANGE

PILOT CAR SIGN SHALL BE MOUNTED ON REAR OF A VEHICLE USED FOR GUIDING CONTROLLED ONE-WAY TRAFFIC THROUGH A CONSTRUCTION AREA.

ARROW DETAIL FOR SIGN NO'S. G20-50a-72 & G20-52a-72

R11-3a-60
BLACK & WHITE

G20-1a-60
BLACK & ORANGE

G20-50a-72
BLACK & ORANGE

R11-2A-48
BLACK & WHITE

R11-3b-60
BLACK & WHITE

7/8 Ø HOLE (TYP. LT & RT) FOR 3/8 Ø BOLT & WINGNUT

G20-1b-60
DOUBLE FACE SIGN
LEGEND: BLACK (NON-REFL)
BACKGROUND: ORANGE

G20-52a-72
BLACK & ORANGE

ARROW MAY BE RIGHT OR LEFT OF LEGEND TO INDICATE CONSTRUCTION TO THE RIGHT OR LEFT.

W8-3a-48
BLACK & ORANGE

W13-4-48
BLACK & ORANGE

DOUBLE FACE SIGN

7/8 Ø HOLE (TYP. LT & RT) FOR 3/8 Ø BOLT & WINGNUT

G20-1b-60
LEGEND: BLACK (NON-REFL)
BACKGROUND: ORANGE

G20-54-48
BLACK & ORANGE

R2-1a-24
BLACK & WHITE

10-1-86

REVISIONS

DATE	CHANGE
5-1-92	GENERAL REVISIONS
7-26-95	ADD SIGNS G20-1a, G20-50a, & R2-1a
3-4-96	REMOVE G20-2-60

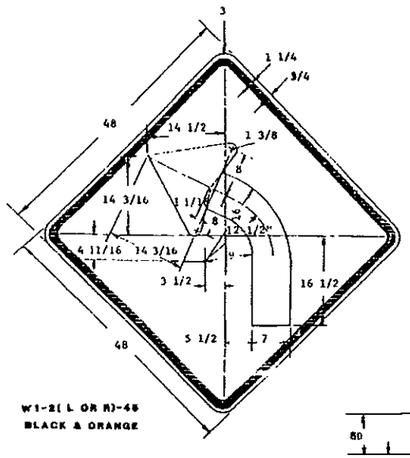
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

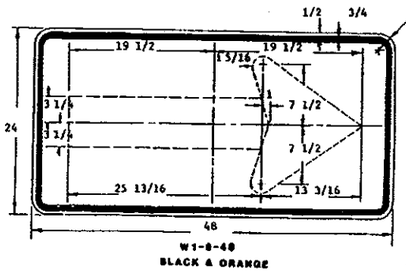
APPROVED [signature]
DESIGN ENGINEER

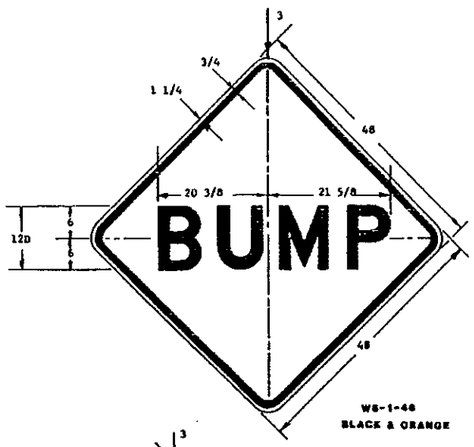
ED704-09 P=1'

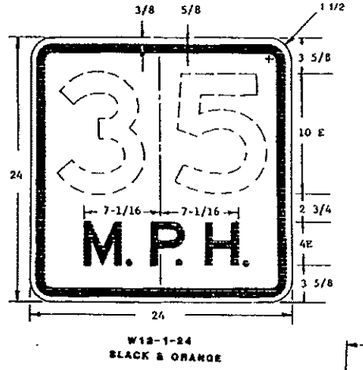
CONSTRUCTION SIGN DETAILS

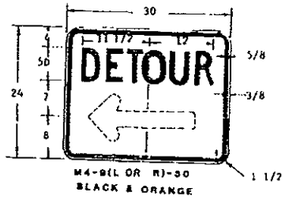
D-704-10

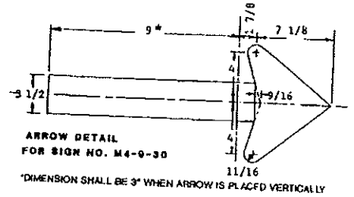


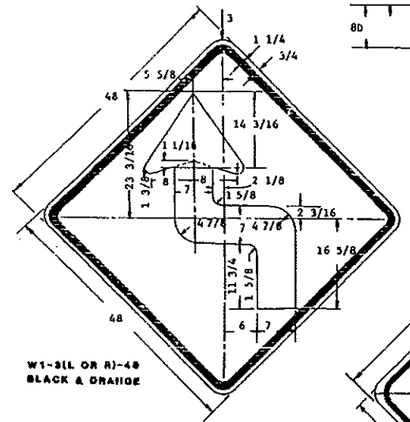


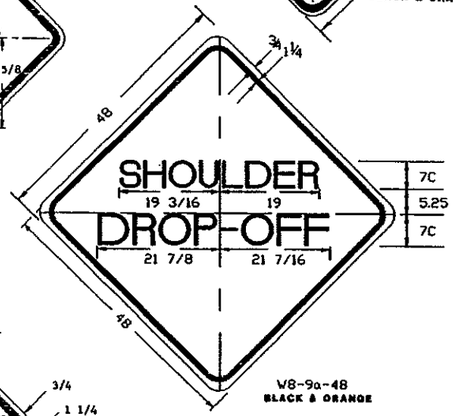


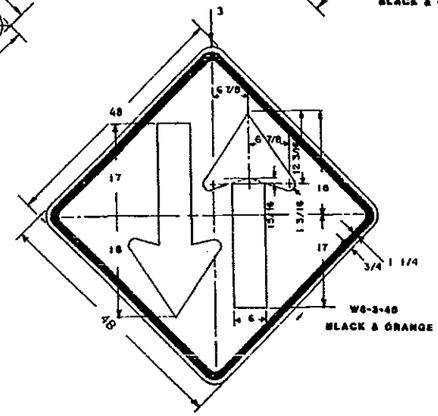


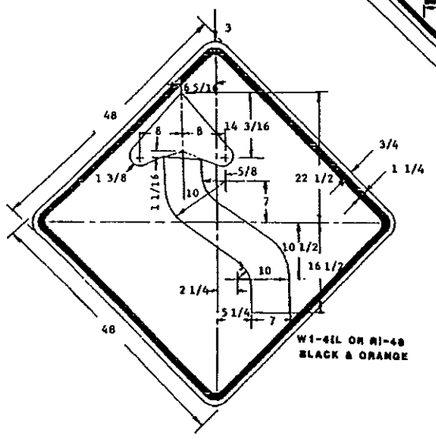


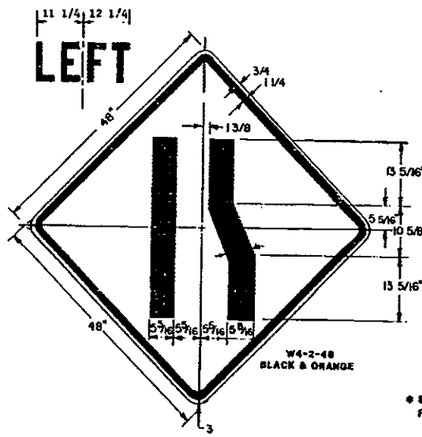


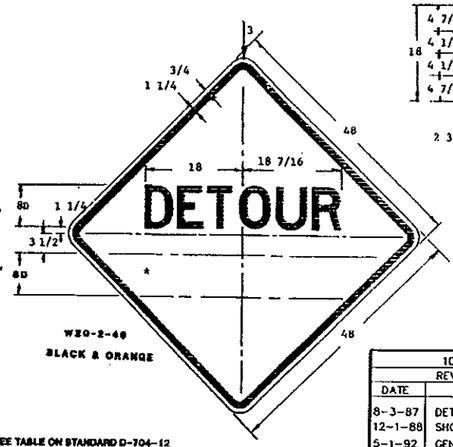




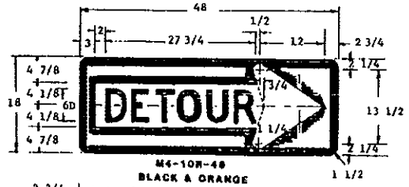


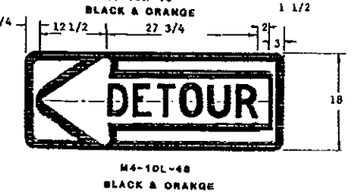






* SEE TABLE ON STANDARD D-704-12 FOR MESSAGES AND DIMENSIONS.





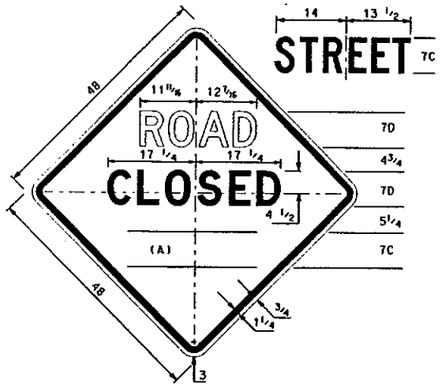
10-1-86 REVISIONS	
DATE	CHANGE
8-3-87	DETOUR NO.
12-1-88	SHOULDER DROP OFF
5-1-92	GENERAL REVISIONS
2-3-95	W8-9a-48
3-4-96	REMOVE W20-1-48

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION
APPROVED: David K.O. Leer
DESIGN ENGINEER

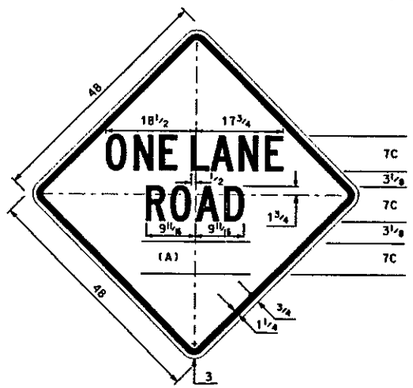
ED704-10 P=1'

CONSTRUCTION SIGN DETAIL

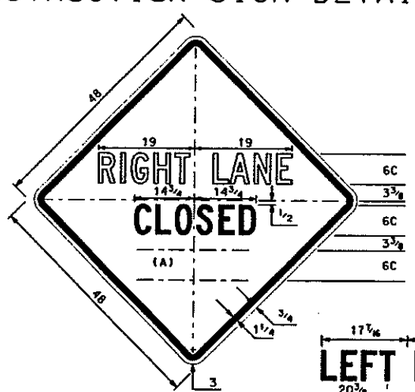
D-704-11



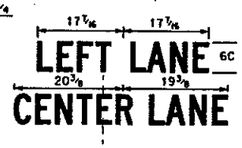
W20-3-48
Black & orange

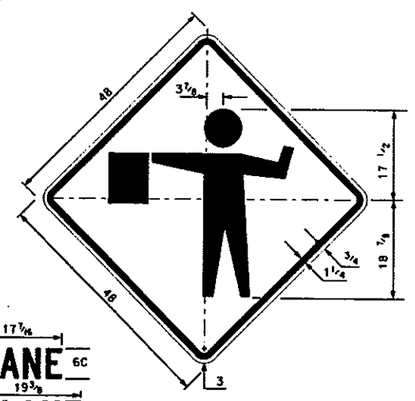


W20-4-48
Black & orange

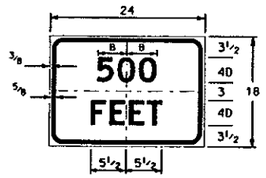


W20-5-48
Black & orange





W20-7a-48
Black & orange

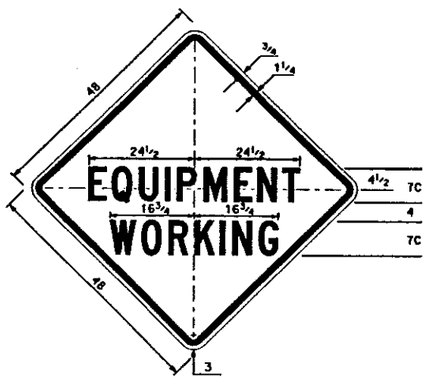


W20-7k-24
Black & orange

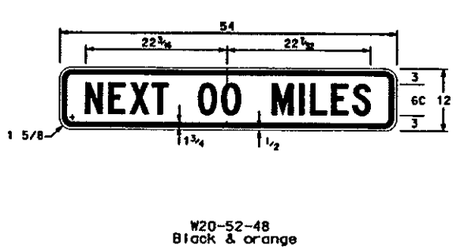
SIGN	DIMENSION B (INCHES)
500'	4 11/16
1000'	5 1/2
1500'	5 5/16

For use with
W20-7a-48 &
W21-1a-48

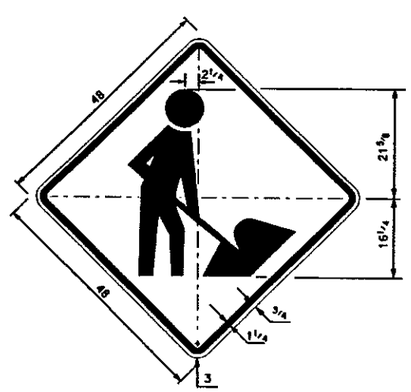
W20-8-48
Black & orange



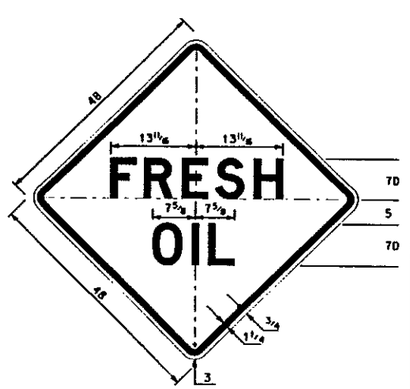
W20-51-48
Black & orange



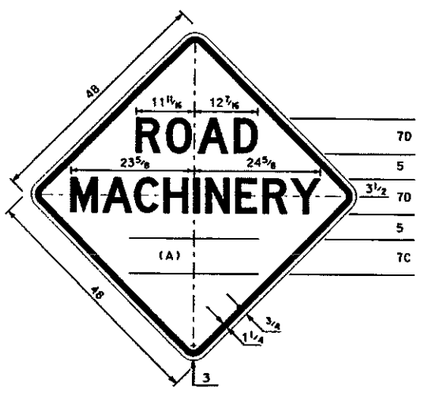
W20-52-48
Black & orange



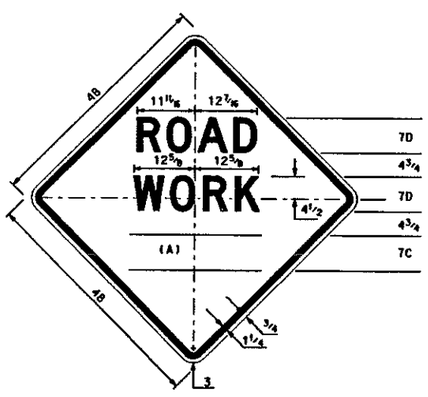
W21-1a-48
Black & orange



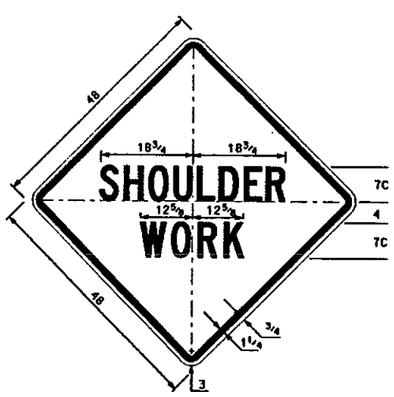
W21-2-48
Black & orange



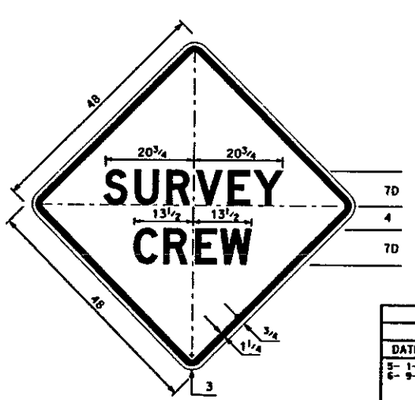
W21-3-48
Black & orange



W21-4-48
Black & orange



W21-5-48
Black & orange



W21-6-48
Black & orange

NOTES:
(A) See table on standard D-704-12 for messages and dimensions.

All dimensions are in inches

10-1-86	
REVISIONS	
DATE	CHANGE
5- 1-92	General revisions Chg 7D to 7C (Dwg W20-3, W21-3 & W21-4
6- 5-95	

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

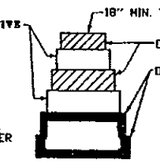
APPROVED: _____
DESIGN ENGINEER

r:\support\desstd\d704-11r.dgn Jan. 29, 1998 13:47:10

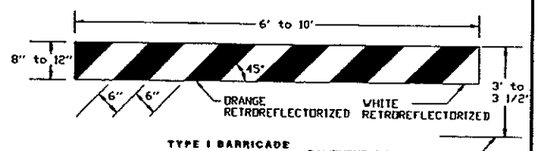
BARRICADE DETAILS

D-704-13

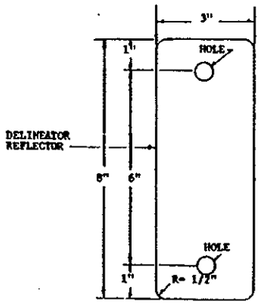
DELINEATOR DRUMS
THE MARKINGS ON DRUMS SHALL BE ORANGE AND WHITE STRIPES 4 TO 6 INCHES WIDE. THERE SHALL BE AT LEAST TWO ORANGE AND TWO WHITE STRIPES. WHERE DRUMS HAVE RIBS OR INDENTATIONS, THERE SHALL BE NO RETRO-REFLECTORIZED SHEETING IN THIS AREA. THIS SPACE SHALL BE NO MORE THAN 2 INCHES WIDE. THE DRUM SURFACE SHALL BE PREPARED AS RECOMMENDED BY THE SHEETING MANUFACTURER BEFORE RETROREFLECTIVE SHEETING IS APPLIED.



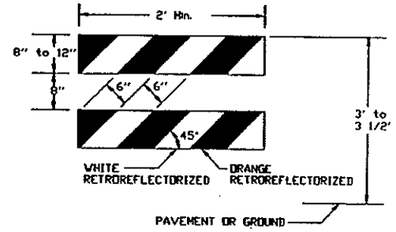
DELINEATOR DRUM
36" MIN. HEIGHT



TYPE I BARRICADE

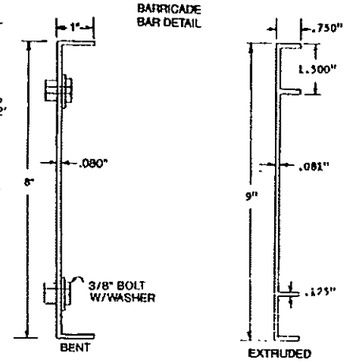


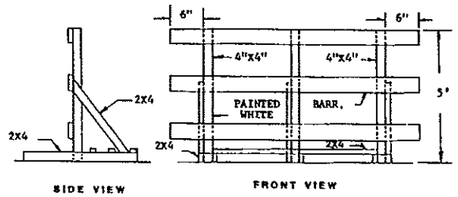
3" x 8" - 18 GAUGE GALVANIZED STEEL SHEETS OR .080" ALUMINUM PLATE WITH WHITE RETROREFLECTIVE SHEETING (TYPE 3A OR 3B) AS SPECIFIED IN SECTION 894 OF THE STANDARD SPECIFICATIONS.



TYPE II BARRICADE

ALUMINUM BARRICADE BAR DETAIL

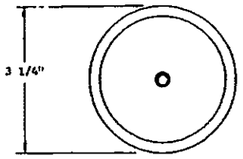




SIDE VIEW FRONT VIEW

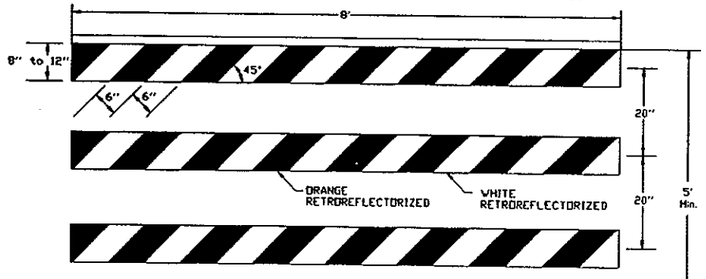
MOVABLE BARRICADE ASSEMBLY

NOTE: EACH MOVABLE BARRICADE SHALL BE WEIGHTED DOWN BY A SUFFICIENT NUMBER OF SAND BAGS SO THAT IT WILL NOT BE BLOWN OVER BY THE WIND UNLESS THE MOVABLE SUPPORTING STRUCTURE IS CONSTRUCTED IN SUCH A MANNER THAT THE WIND CANNOT BLOW IT OVER. WEIGHT USED SHALL BE APPROVED BY THE ENGINEER IN THE FIELD. THE STRIPES SHALL SLANT DOWNWARD TOWARD THE SIDE WHICH TRAFFIC IS TO PASS. BARRICADES USED AT THE BEGINNING OF A PROJECT SHALL FACE TRAFFIC ENTERING THAT PROJECT.

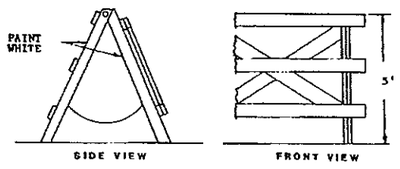


ACRYLIC PLASTIC REFLECTOR
DELINEATOR REFLECTOR SHALL MEET THE REQUIREMENTS OF SECTION 894.

NOTE: VERTICAL PANELS USED ON THE EXPRESSWAYS OR OTHER HIGH SPEED ROADWAYS SHALL BE 12" BY 24".

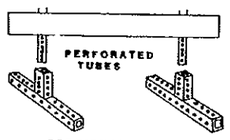


TYPE III BARRICADE
PAVEMENT OR GROUND

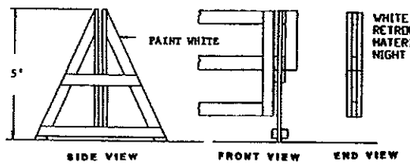


SIDE VIEW FRONT VIEW

HINGED BARRICADE ASSEMBLY

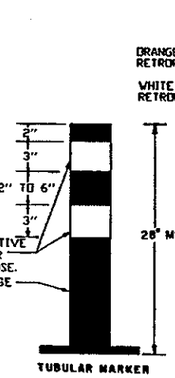


SECTIONAL BARRICADE

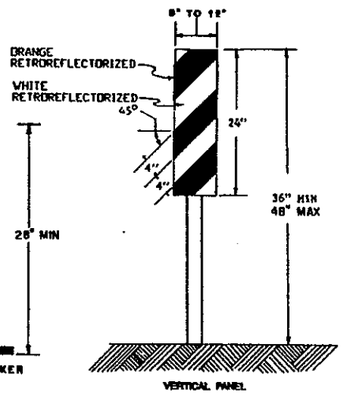


SIDE VIEW FRONT VIEW END VIEW

DEMOUNTABLE BARRICADE ASSEMBLY

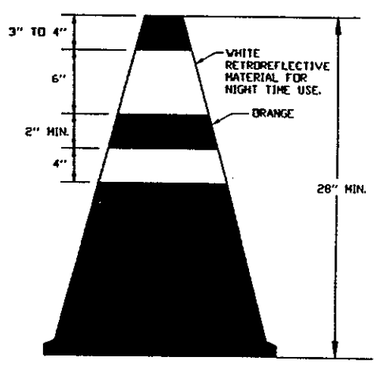


TUBULAR MARKER



VERTICAL PANEL

(RETROREFLECTIVE SHEETING SHALL BE PLACED ON BOTH SIDES)



CONE

BARRICADES: NUMBER OF RETROREFLECTORIZED RAIL FACES

TYPE I	TYPE II	TYPE III
2(One Each Direction)	4(Two Each Direction)	6(Facing in two Directions)

BARRICADE RAIL MATERIAL MAY BE 1" NOMINAL THICKNESS STANDARD LUMBER OR 3/4" PLYWOOD AND PREPARED AS RECOMMENDED BY THE SHEETING MANUFACTURER BEFORE RETROREFLECTIVE SHEETING IS APPLIED

10-1-86

REVISIONS

DATE	CHANGE
8-3-87	TYPE SHEETING
10-1-87	DELINEATOR DRUM NOTE
6-9-88	BARRICADES TYPE III
5-1-92	GENERAL REVISIONS
6-10-93	GENERAL REVISIONS
9-23-93	VERTICAL PANEL
6-9-95	RETROREFLECTIVE SHEETING

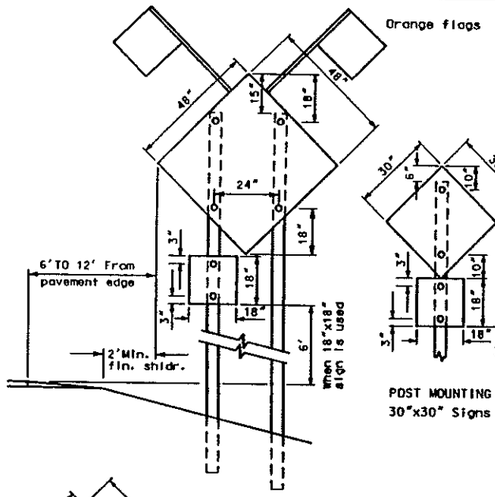
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

APPROVED: David K.O. Leer
DESIGN ENGINEER

ED704-13 P=1"

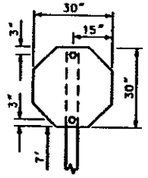
CONSTRUCTION SIGH AND BARRICADE ASSEMBLY DETAILS

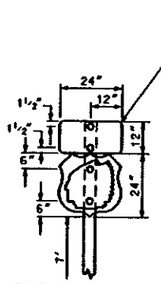
D-704-14

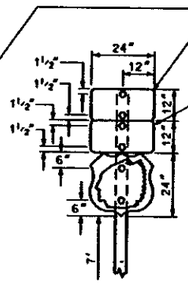


POST MOUNTING
48"x48" Signs

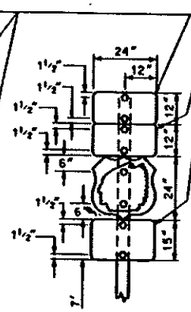
POST MOUNTING
30"x30" Signs

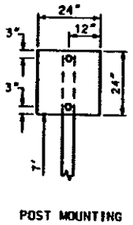

POST MOUNTING
Sign R1-1-30

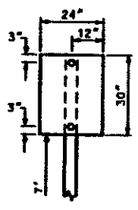

POST MOUNTING
Assemblies with one cardinal direction sign & one route marker

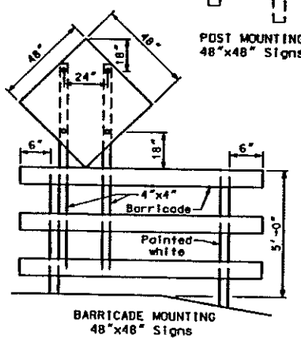


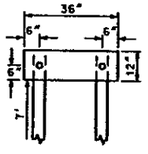
POST MOUNTING
Assemblies with one cardinal direction sign, one detour sign & one route marker

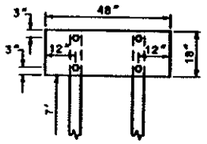

POST MOUNTING
Assemblies with one cardinal direction sign, one detour sign, one route marker & one directional arrow.

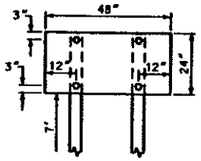

POST MOUNTING
24"x24" Signs

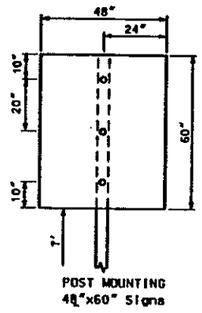

POST MOUNTING
24"x30" Signs

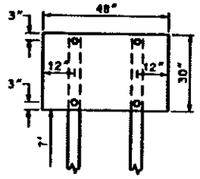

BARRICADE MOUNTING
48"x48" Signs

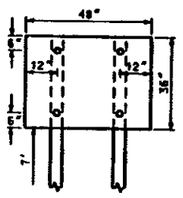

POST MOUNTING
36"x12" Signs

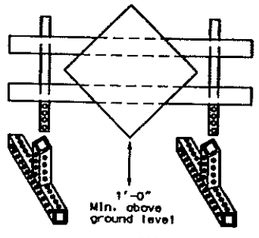

POST MOUNTING
48"x18" Signs


POST MOUNTING
48"x24" Signs

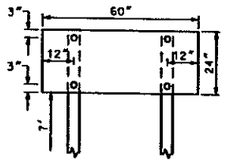

POST MOUNTING
48"x60" Signs

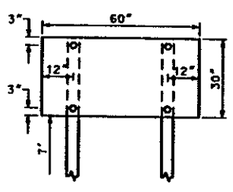

POST MOUNTING
48"x30" Signs

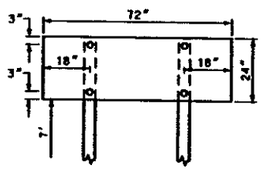

POST MOUNTING
48"x36" Signs

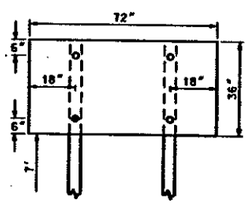


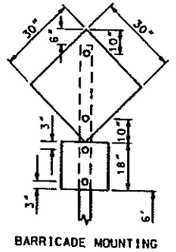
PORTABLE SIGN MOUNTING

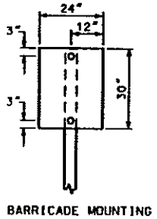

POST MOUNTING
60"x24" Signs

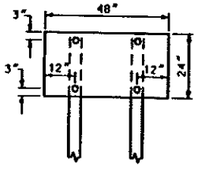

POST MOUNTING
60"x30" Signs

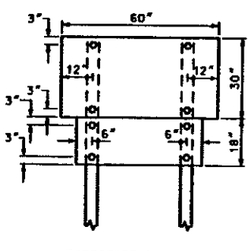

POST MOUNTING
72"x24" Signs

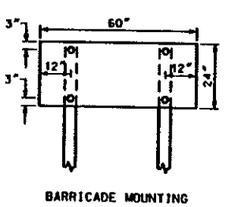

POST MOUNTING
72"x36" Signs

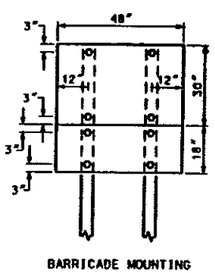

BARRICADE MOUNTING
30"x30" Signs

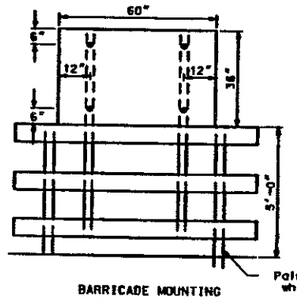

BARRICADE MOUNTING
24"x30" Signs


BARRICADE MOUNTING
48"x24" Signs

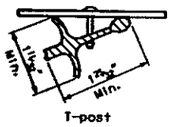

BARRICADE MOUNTING
60"x30" & 48"x18" Signs

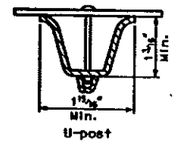

BARRICADE MOUNTING
60"x24" Signs

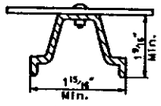

BARRICADE MOUNTING
48"x30" & 48"x18" Signs



BARRICADE MOUNTING
G20-1-60 Signs


T-post


U-post


U-post

DELINEATOR ATTACHMENT AND POST MOUNTING DETAILS

NOTES:

1. In urban areas the vertical clearance shall be increased to 7 feet on all signs, except when supplemental signs are placed below main signs. The supplemental signs shall be placed at a 6'-0" minimum clearance.
2. Barricade and Sign Supports: Wooden supports shall be painted white. Steel supports shall be galvanized or painted.
3. Barricade Mounting Signs: The bottom of the sign shall be flush with the top of the top rail. Wood sign posts shall be 4"x4" min. SFS or equivalent steel posts. All barricades and barricade mounted signs shall be assembled with ⅜" bolts.
4. Sign Supprts: Sign supports shall be 4"x4" min. SFS or equivalent steel post. The anchor for steel supports shall bave a stub height of 4" or less. Wood posts more than 4"x4" shall be breakaway. Sign supports shall be imbedded to a sufficient depth so that signs will remain plumb throughout duration of project. It is suggested that wood posts have a min. depth of embedment of 5' and steel posts be embedded a min. 3'-6".
   Material: All signs shall be 0.100" aluminum, 12 gauge steel, ½" plywood or other approved material.
   Holes: All holes to be punched round for ⅜" bolts.
5. Alternate Messages: The signs that have alternate messages may have these alternate messages placed on a reflectorized plate without a border and this plate installed and removed as required.
6. Advance Warning Flashing or Sequencing Arrow Panels: The minimum mounting height shall be 7 feet above the roadway to the bottom of the panel, except on vehicle mounted panels which shall be as high as practicable.
7. Delineator Posts: Typical fence post sections are shown in Attachment Details. Other types of metal fence posts may be substituted upon approval of the engineer. These substituted posts shall have reflectors attached similar to the ones shown.
8. Route Marker Auxiliary Signs: The route marker auxiliary signs such as the cardinal direction and directional arrows shall have background colors the same as the route marker they are used with (Interstate route markers, blue background, US and State route markers, white background, Interstate Business loop and spur, green background, and County route markers, blue background).

10-1-86	
REVISIONS	
DATE	CHANGE
8- 1-88	Sign assembly
8- 1-92	Sign assembly
3-30-93	Sign supports note
3- 6-96	Sign height
8-15-96	Note 8
7-10-97	Note Revision

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

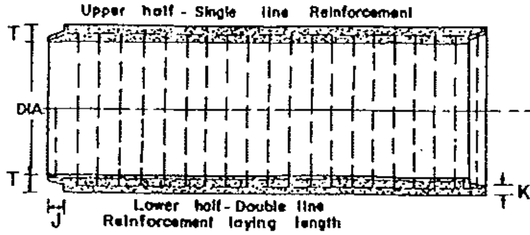
APPROVED: _____ DESIGN ENGINEER

r:\support\desstd\d704-14.dgn Jul. 10, 1997 10:33:31

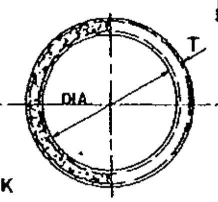
REINFORCED CONCRETE PIPE CULVERT AND END SECTIONS

D-714-1

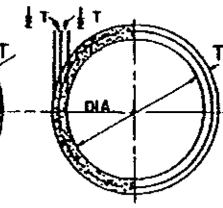
SEE STANDARD D-714-22 FOR DETAILS OF CONCRETE PIPE TIES (TIE BOLTS).



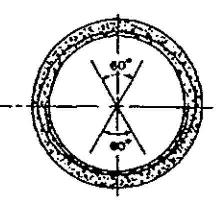
REINFORCED CONCRETE PIPE
TYPICAL LONGITUDINAL SECTION



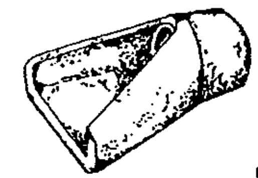
END VIEW
Double line Reinforcement



END VIEW
Single line Reinforcement

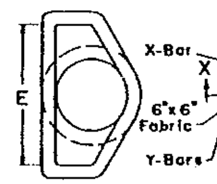


END VIEW
Top half showing Elliptical Reinforcement.
Bottom half showing Elliptical & Inner Cage Reinforcement.

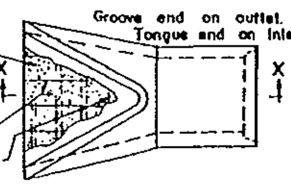


PERSPECTIVE

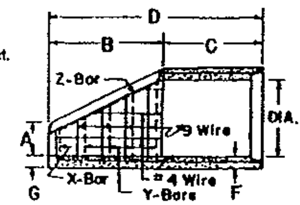
ARRANGEMENT FOR REINFORCEMENT
At end of 36" to 108" pipe. At end of 12" to 33" pipe.



END VIEW



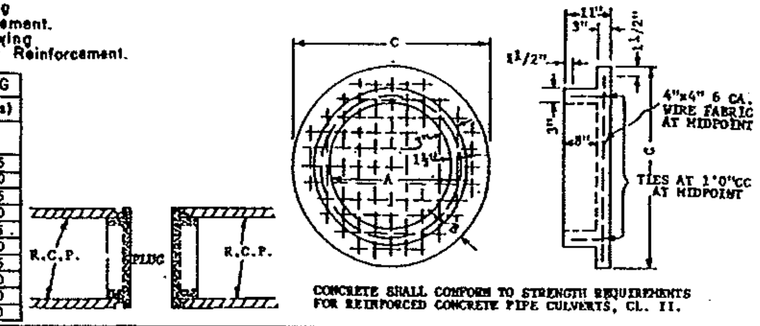
PLAN



SECTION X-X
END SECTION
Equivalent to Class III Pipe

CONCRETE PIPE PLUG			
DIMENSIONS (in inches)			
PIPE DIAMETER	A	B	C
15	8	2.25	19.5
18	11	3.0	23.0
21	14	3.25	26.5
24	17	3.50	30.0
27	20	3.75	33.5
30	23	4.0	37.0
33	26	4.25	40.5
36	29	4.50	44.0
42	35	5.0	51.0
48	41	5.30	58.0

REINFORCED CONCRETE PIPE PLUG



CONCRETE SHALL CONFORM TO STRENGTH REQUIREMENTS FOR REINFORCED CONCRETE PIPE CULVERTS, CL. II.

END SECTION										
TERMINAL DIMENSIONS								REINFORCING STEEL		
DIA	A	B	C	D	E	F	G	X	Y	Z
12	0'-4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"	2"	2"	2-¼"x 2'	6-¼"x 2' @ 6"c.c.	2-¼"x 4'
15	0'-6"	2'-3"	3'-10"	6'-1"	2'-6"	2¼"	2¼"	2-¼"x 2½'	6-¼"x 2½' @ 6"c.c.	2-⅜"x 4'
18	0'-9"	2'-3"	3'-10"	6'-1"	3'-0"	2½"	2½"	2-⅜"x 3'	6-¼"x 3' @ 6"c.c.	2-⅜"x 4'
21	0'-9"	3'-0"	3'-1½"	6'-1½"	3'-6"	2¾"	2¾"	2-⅜"x 3½'	8-¼"x 3½' @ 6"c.c.	2-⅜"x 5'
24	0'-9½"	3'-7½"	2'-6"	6'-1½"	4'-0"	3"	3"	2-½"x 4'	8-⅜"x 4' @ 8"c.c.	2-⅜"x 6'
27	0'-10½"	4'-1½"	2'-0"	6'-1½"	4'-6"	3¼"	3¼"	2-½"x 5'	8-⅜"x 5' @ 9"c.c.	2-⅜"x 6'
30	1'-0"	4'-6"	3'-7¾"	8'-1¾"	5'-0"	3½"	3½"	2-½"x 5'	12-⅜"x 5' @ 8"c.c.	2-½"x 6'
36	1'-3"	5'-3"	2'-10¾"	8'-1¾"	6'-0"	4"	4"	2-½"x 6'	18-⅜"x 6' @ 6"c.c.	2-½"x 8'
42	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	4½"	4½"	2-½"x 7'	12-½"x 7' @ 9"c.c.	2-½"x 8'
48	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	5"	5"	2-½"x 8'	16-½"x 8' @ 8"c.c.	2-½"x 8'
54	2'-3"	5'-5"	2'-9¼"	8'-2¼"	7'-6"	5½"	5½"	2-½"x 8'	16-½"x 8' @ 7"c.c.	2-½"x 8'
60	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	6"	5"	2-½"x 9'	16-½"x 9' @ 6"c.c.	2-½"x 9'
66	2'-6"	6'-0"	2'-3"	8'-3"	8'-6"	6½"	5½"	2-½"x 9'	22-½"x 9' @ 6"c.c.	2-½"x 9'
72	3'-0"	6'-6"	1'-9"	8'-3"	9'-0"	7"	6"	2-½"x 10'	24-½"x 10' @ 6"c.c.	2-½"x 9'
78	3'-0"	7'-6"	1'-9"	9'-3"	9'-6"	7½"	6½"	2-½"x 10'	28-½"x 10' @ 6"c.c.	2-½"x 10'
84	3'-0"	7'-6½"	1'-9"	9'-3½"	10'-0"	8"	6½"	4-½"x 10'	28-½"x 10' @ 6"c.c.	4-½"x 10'
90	3'-5"	7'-3½"	2'-0"	9'-3½"	11'-0"	8½"	6½"	4-½"x 11'	28-½"x 11' @ 6"c.c.	4-½"x 10'

Permissible Fill Heights
RCP-Sewer-Trench Conditions
Other than Class I

PIPE SIZE	Class II FT.	Class III FT.	Class IV FT.	Class V FT.
12" thru 54"	3-9	1-3 9-13	13-23	23+
60" thru 108"	1-9	9-13	13-23	23+

REINFORCED CONCRETE PIPE

D-LOAD TO PRODUCE A 0.01 INCH CRACK: Class I 800; Class II 1000; Class III 1350; Class IV and Class IV Alternate 2000; Class V and Class V Alternate 3000.

D-LOAD TO PRODUCE ULTIMATE LOAD: Class I 1200; Class II 1500; Class III 2000; Class IV and Class IV Alternate 3000; Class V and Class V Alternate 3750.

Pipe properties and CLASS I (1200, 4000 P.S.I.; 5000 P.S.I. for 102" and 108")

Internal Dia. of Pipe in Inches (Dia)	Cross-Sectional Water Area (Sq.ft.)	Weight per lin. foot of pipe Std. Wall (Lbs.)	Joint Groove J End Min./Max. (In.)	Joint Tongue K End Min. (In.)	Minimum Wall Thickness (In.)	Circular rein. in circular pipe Inner cage (Sq.in)	Circular rein. in circular pipe Outer cage (Sq.in)	Ellip. rein. in Cir. pipe & Cir. rein. in Ellip. pipe (Sq.in)	Height of Fill Trench Conditions (Ft.)
12	0.79	92	1⅝-2⅜	¾					
15	1.23	127	1¾-2¾	⅞	TO BE USED FOR RCP SEWER ONLY				
18	1.77	168	1⅞-2⅞	1					
21	2.40	214	1⅞-3⅛	1 1/16					
24	3.14	265	2¼-3¼	1⅛					
27	3.98	322	2¾-4	1¼	☆ Special conditions only				
30	4.91	384	3¼-4½	1¼					
33	5.94	452	3¼-4½	1½					
36	7.07	524	3¼-4½	1½					
42	9.62	685	3¾-4¾	1¾					
48	12.57	867	3⅝-4⅞	1⅞					
54	15.90	1070	4⅛-5¼	2					☆
60	19.63	1296	4½-5½	2¼	6	.21	.13	.23	6-9
66	23.76	1542	5-6	2⅝	6½	.25	.15	28	6-9
72	28.27	1810	5⅝-6¾	2⅞	7	.29	.17	.32	6-9
78	33.18	2098	6¼-7¼	2⅞	7½	.32	.19	.36	6-9
84	38.48	2410	5⅝-7¾	3⅜	8	.37	.25	41	6-9
90	44.18	2793	6¾-8¼	3⅛	8½	.41	.25	46	6-9
96	50.27	3092	7-8¼	3½	9	.46	.28	.51	6-9
102	56.75	3466	7-8½	3½	9½	.54	.32	.13 / .41	6-9
108	63.62	3864	7¼-8¾	3¾	10	.61	.32	.15 / .46	6-9

CLASS II (1500, 4000 P.S.I.; 5000 P.S.I. for 102" and 108")

Dia	Minimum Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. in Cir. pipe & Cir. rein. in Ellip. pipe (Sq.in)	Height of Fill Normal Backfill (Ft.)	Height of Fill Imperfect Trench (Ft.)
12		.07				
15		.07				
18		.07		.07		
21		.07		.07		
24		.07		.07		
27	3¼	.13		.11	3-11	11-18
30	3½	.14		.12	3-11	11-18
33	3¾	.15		.13	3-11	11-18
36	4	.12	.07	.13	3-11	11-18
42	4½	.15	.09	.17	3-11	11-18
48	5	.18	.11	.20	3-11	11-18
54	5½	.22	.13	.24	3-11	11-18
60	6	.25	.15	.28	3-11	11-18
66	6½	.31	.19	.34	3-11	11-18
72	7	.35	.21	39	3-11	11-18
78	7½	.40	.24	44	3-11	11-18
84	8	.46	.28	51	3-11	11-18
90	8½	.51	.31	57	3-11	11-18
96	9	.57	.34	63	3-11	11-18
102	9½	.66	.41	.27 / .41	3-11	11-18
108	10	.74	.46	.30 / .46	3-11	11-18

CLASS III (2000; 4000 P.S.I.; 5000 P.S.I. from 90")

Dia	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)	Height of Fill Normal Backfill (Ft.)	Height of Fill Imperfect Trench (Ft.)
12	2	.07				.07			1-16	16-31
15	2¼	.07				.07			1-16	16-31
18	2½	.07		.07		.07			1-16	16-31
21	2¾	.07		.07		.07			1-16	16-31
24	3	.07		.07	3¾	.07			1-16	16-31
27	3¼	.16		.14	4	.08			1-3 11-16	16-31
30	3½	.18		.15	4¼	.10			1-3 11-16	16-31
33	3¾	.20		.17	4½	.12			1-3 11-16	16-31
36	4	.17	.10	.19	4¾	.08	.07	.09	1-3 11-16	16-31
42	4½	.21	.13	.23	5¼	.12	.07	.13	1-3 11-16	16-31
48	5	.24	.14	.27	5¾	.16	.10	.18	1-3 11-16	16-31
54	5½	.29	.17	.32	6¼	.21	.13	.23	1-3 11-16	16-31
60	6	.34	.20	.38	6¾	.25	.15	.28	1-3 11-16	16-31
66	6½	.41	.25	.46	7¼	.31	.19	.34	1-3 11-16	16-31
72	7	.49	.29	.54	7¾	.36	.22	40	1-3 11-16	16-31
78	7½	.57	.34	.63	8¼	.42	.25	47	1-3 11-16	16-31
84	8	.64	.38	.71	8¾	.50	.30	56	1-3 11-16	16-31
90	8½	.69	.41	.77	9¼	.59	.35	66	1-3 11-16	16-31
96	9	.76	.46	.84	9¾	.70	.42	.17 / .53	1-3 11-16	16-31
102	9½	.90	.54	.36 / .54	10¼	.83	.50	.31 / .50	1-3 11-16	16-31
108	10	1.04	.65	.43 / .65	10¾	.99	.59	.40 / .59	1-3 11-16	16-31

CLASS IV (3000; 4000 P.S.I.; 5000 P.S.I. from 60" in first group and from 72" in second group)

Dia	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)
12	2	.07						
15	2¼	.10						
18	2½	.14		.11				
21	2¾	.20		.17				
24	3	.27		.23	3¾	.07	.07	.08
27	3¼	.31		.25	4	.08	.07	.09
30	3½	.35		.28	4¼	.09	.07	.10
33	3¾	.27	.16	.30	4½	.11	.07	.12
36	4	.30	.21	.33	4¾	.14	.08	.15
42	4½	.35	.21	.39	5¼	.20	.12	.22
48	5	.42	.25	.47	5¾	.26	.16	.29
54	5½	.50	.30	.55	6¼	.34	.25	38
60	6	.59	.35	.66	6¾	.41	.25	46
66	6½	.69	.41	.77	7¼	.51	.31	57
72	7	.79	.47	88	7¾	.61	.37	.68
78					8¼	.71	.43	79
84					8¾	.85	.51	.94
90								
96								
102								
108								

CLASS IV ALTERNATE (3000; 5000 P.S.I.)

Dia	Minimum Wall Thickness (In.)	Inner cage Ai (Sq.in)	Ellip. cage Ae (Sq.in)	Outer cage Ao (Sq.in)	Shear Steel N (No.)	Shear Steel S (In.)	Shear Steel Ar (Sq.in)	Height of Fill Normal Backfill (Ft.)	Height of Fill Imperfect Trench (Ft.)
12								16-24	24-43
15								16-24	24-43
18								16-24	24-43
21								16-24	24-43
24								16-24	24-43
27								16-24	24-43
30								16-24	24-43
33								16-24	24-43
36								16-24	24-43
42								16-24	24-43
48								16-24	24-43
54								16-24	24-43
60	6	.54	.27	.41	7	6	.22	16-24	24-43
66	6½	.60	30	.45	8	6	.22	16-24	24-43
72	7	.64	.32	.48	8	6	.23	16-24	24-43
78	7½	.70	.35	.53	9	6	.25	16-24	24-43
84	8	.76	.38	.57	10	6	.28	16-24	24-43
90	8½	.82	.43	.62	11	6	.31	16-24	24-43
96	9	.88	.46	.66	11	6	.34	16-24	24-43
102	9½	.94	.52	.71	12	6	.37	16-24	24-43
108	10	1.02	.57	.76	12	6	.40	16-24	24-43

CLASS V (3750; 6000 P.S.I.)

Dia	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)	Min. Wall Thickness (In.)	Inner cage (Sq.in)	Outer cage (Sq.in)	Ellip. rein. (Sq.in)
12	2	.10						
15	2¼	.14						
18	2½	.19		16				
21	2¾	24		.21				
24	3	.30		.24	3¾	.12	.07	.13
27	3¼	.38	.23	.42	4	.14	.08	.16
30	3½	.41	.23	46	4¼	.18	.11	20
33	3¾	.46	.28	51	4½	.23	.14	25
36	4	50	.30	56	4¾	.27	.16	30
42	4½	60	.36	.67	5¼	.36	.28	.40
48	5	.73	.44	81	5¾	.47	.28	52
54					6¼	.58	.35	.64
60					6¾	.70	.42	.78
66					7¼	.84	.50	93
72					7¾	.99	.57	1.10
78								
84								
90								
96								
102								
108								

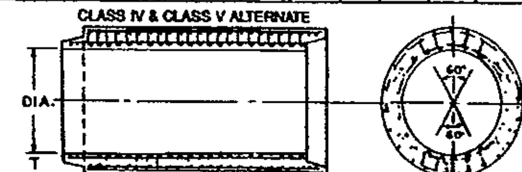
CLASS V ALTERNATE (3750; 5000 P.S.I.)

Dia	Minimum Wall Thickness (In.)	Inner cage Ai (Sq.in)	Ellip. cage Ae (Sq.in)	Outer cage Ao (Sq.in)	Shear Steel N (No.)	Shear Steel S (In.)	Shear Steel Ar (Sq.in)	Height of Fill Normal Backfill (Ft)	Height of Fill Imperfect Trench (Ft)
12								24-35	35-69
15								24-35	35-69
18								24-35	35-69
21								24-35	35-69
24								24-35	35-69
27								24-35	35-69
30								24-35	35-69
33								24-35	35-69
36								24-35	35-69
42								24-35	35-69
48	5	.66	.33	.50	8	4	.22	24-35	35-69
54	5½	74	.37	.56	9	4	22	24-35	35-69
60	6	.82	41	.62	7	6	.22	24-35	35-69
66	6½	.88	44	.66	8	6	.22	24-35	35-69
72	7	.96	48	.72	8	6	.23	24-35	35-69
78	7½	1.04	52	78	9	6	.25	24-35	35-69
84	8	1.12	56	.84	10	6	.28	24-35	35-69
90	8½	1.20	.65	.90	11	6	.31	24-35	35-69
96	9	1.32		.99	11	8	.34	24-35	35-69
102	9½	1.42		1.07	12	8	37	24-35	35-69
108									

NOTES: All reinforcement shall be electrically welded cold drawn steel wire fabric.
Circular reinforcement shall lap in accordance to A.A.S.H.T.O. M170.
All circular, longitudinal and elliptical reinforcement shall be assembled and securely fastened in cage fashion so as to maintain reinforcement in exact shape and correct positions within the forms.
Laying length of pipe: 12" to 66" (incl.) = Not less than 4 feet
66" to 108" (incl) = Not less than 6 feet

Joints shall be sealed with rubber gaskets or with sealer approved by the engineer whenever pipe are specified for storm drains or sanitary sewers.

CLASS IV & CLASS V ALTERNATE



LONGITUDINAL SECTION

Ai,Ae,Ao =Minimum circumferential reinforcement required in square inches per lineal foot of pipe.
Ar =Minimum radial reinforcement required in square inches per square foot of pipe.
N =Minimum number of rows of radial reinforcing at top and bottom of pipe.
S =Maximum circumferential spacing of rows of radial reinforcing.

10-1-86	
REVISIONS	
DATE	CHANGE
11-5-86	Note Added
7-17-87	Added Pipe Plug Detail
9-1-88	Reinforcement Cage
3-10-95	General Revisions

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

APPROVED: DESIGN ENGINEER

ED714-01 P=1"

D-714-4

CORRUGATED STEEL PIPE CULVERTS AND END SECTIONS

(ROUND PIPE)

NOTES:

Pipe and Connecting Bands shall conform to applicable sections of I'DSHD Standard Specifications and to AASHO M-36.

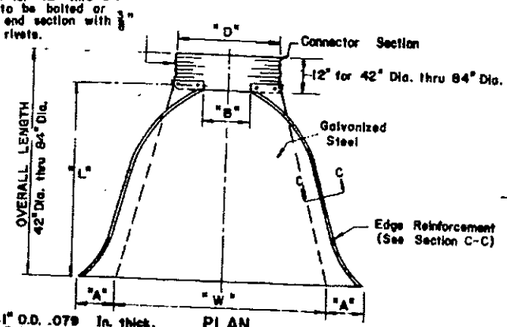
Top edge of all End Sections to have tubing reinforcement or rolled tubed reinforcement (See Section A-A). The tubing is to be supplemented with 2"x2"x ¼" Galv. Angle for 60" thru 72" Dia. and 2½"x2½"x ¼" Galv. Angle for 78" and 84" Dia. Angles to be attached by Gal. ⅞" Ø bolts and nuts. Angles are to extend from Pipe to the corner wing bend.

Elongated pipe shall be factory preformed so that the vertical diameter shall be 5% greater and the horizontal diameter 5% less than a circular pipe.

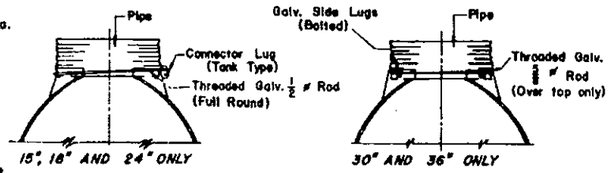
Fill Height Tables are based on the following criteria:

1. Embankment weight = 120 lb/ft³
2. Max. pipe deflection = 5 %
3. Bedding - Class C
4. Compaction = 95 % Proctor Density
5. Modulus of passive soil resistance (E') = 1400 psi
6. H-20 Live Load

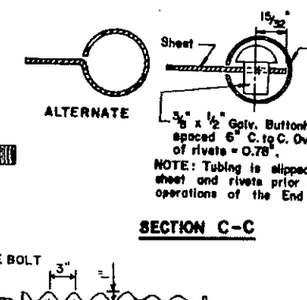
This connection for 42" thru 84" diameter pipe to be bolted or riveted to the end section with ⅞" Galv. bolts or rivets.



PLAN



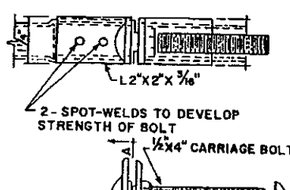
ROD CONNECTION DETAILS

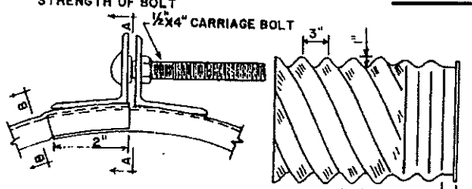


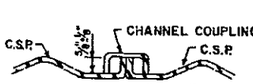
ALTERNATE

NOTE: Tubing is slipped over the sheet and rivets prior to forming operations of the End Section.

SECTION C-C

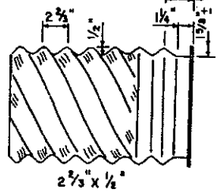






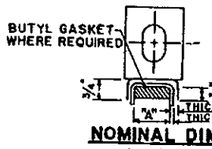
SECTION "B-B"

CHANNEL COUPLING BAND FOR USE ON FLANGED END C.S.P. (CHANNEL COUPLING BANDS SHALL BE TWO PIECE)



SPIRAL C.S.P

REFORMED TO ACCEPT FLANGE, ANNULAR, DIMPLE AND HUGGER COUPLERS



NOMINAL DIMENSIONS

THICKNESS	"A"	FOR USE WITH C.S.P.
0.079"	¾"	0.09" THICK OR LIGHTER
0.109"	1"	0.136" THICK OR HEAVIER

SECTION "A-A"

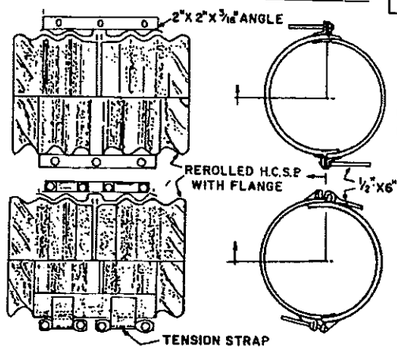
CORRUGATED STEEL PIPE FLANGE BAND DETAILS

ELEVATION

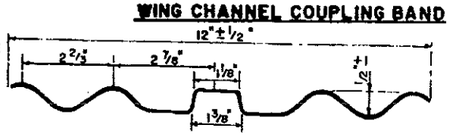
Galv. Toe Plate required on End Sections for pipe of 30" dia or larger

Thickness of Toe Plate to be same as End Section.

Where Toe Plate is needed the Toe Plate, Bolts and Nuts are to be included in price bid for End Sections.

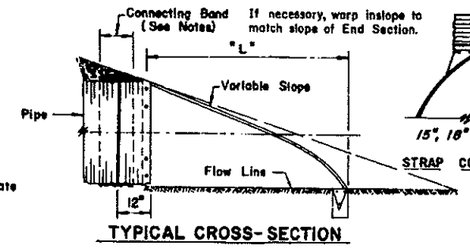


WING CHANNEL COUPLING BAND



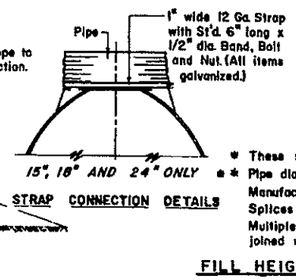
CROSS SECTION OF WING CHANNEL COUPLING BAND

WING CHANNEL COUPLING BAND FOR ANNULAR C.S.P. OR REFORMED H.C.S.P.



TYPICAL CROSS-SECTION

(Showing Connector Section)



STRAP CONNECTION DETAILS

END SECTIONS

** PIPE DIA. (In.)	GALV. THICK.	DIMENSIONS A	B	H	L	W	Approx. Slope	Body
		In.	In.	In.	In.	In.	Rate	Piece
15	.064	7	8	6	26	30	2-1/2:1	1
18	.064	8	10	6	31	36	2-1/2:1	1
24	.064	10	13	6	41	48	2-1/2:1	1
30	.079	12	16	8	51	60	2-1/2:1	1 OR 2
36	.079	14	19	9	60	72	2-1/2:1	2
42	.109	16	22	11	69	84	2-1/2:1	2
48	.109	18	27	12	78	90	2-1/4:1	2
54	.109	18	30	12	84	102	2:1	2
*60	.109	18	33	12	87	114	1-3/4:1	3
*66	.109	18	36	12	87	120	1-1/2:1	3
*72	.109	18	39	12	87	126	1-1/3:1	3
*78	.109	18	42	12	87	132	1-1/4:1	3
*84	.109	18	45	12	87	138	1-1/6:1	3

* These sizes have 0.138 in. center panels.

** Pipe diameter is equal to dimension "D" of end section.

Manufacturers tolerances of above dimensions will be allowed.

Splices to be the lap riveted type.

Multiple panel bodies shall have lap seams which are to be tightly joined with ⅜" Ø galv. bolts or rivets. Nuts to be torqued to 25 lbs. ±.

FILL HEIGHT TABLES

RIVETED, WELDED OR HELICAL FABRICATION

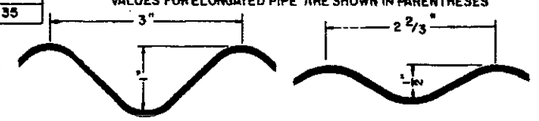
3" BY 1" CORRUGATIONS

WATERWAY AREA SQ. FT.	PIPE DIA. (IN.)	MIN. COVER (IN.)	MAX. FILL HEIGHTS OVER TOP OF PIPE — GALV. METAL THICKNESS (IN.) .064	.079	.109	.138	.168
7.1	36	12	46	60	78 (82)	89 (106)	101 (118)
9.6	42	12	41	51	64 (76)	71 (91)	79 (101)
12.6	48	12	36	45	57 (66)	61 (80)	66 (88)
15.9	54	12	32	40	52 (59)	55 (71)	59 (79)
19.6	60	12	29	36	49 (53)	51 (64)	54 (71)
23.8	66	12	26	33	47	49 (58)	51 (64)
28.3	72	12	24	30	44	47 (53)	49 (58)
33.2	78	12	22	28	41	46 (48)	47 (54)
38.5	84	12	21	26	38	45	46 (51)
44.2	90	12	19	24	35	43	45
50.3	96	12	18	22	33	40	44
56.7	102	24	17	21	31	38	42
63.6	108	24		20	30	35	39
70.9	114	24		19	28	34	37
78.5	120	24			27	32	35

2⅔" BY ½" CORRUGATIONS

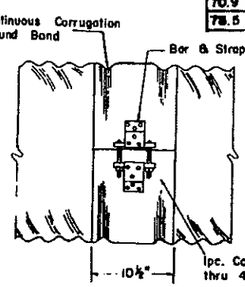
WATERWAY AREA SQ. FT.	PIPE DIA. (IN.)	MIN. COVER (IN.)	MAX. FILL HEIGHTS OVER TOP OF PIPE — GALV. METAL THICKNESS (IN.) .064	.079	.109	.138	.168
1.2	15	12	67	73			
1.8	18	12	56	61			
3.1	24	12	42	46	59		
4.9	30	12	34	36	47		
7.1	36	12	28	30	39	41	
9.6	42	12	31	43	46 (67)	48 (70)	50 (73)
12.6	48	12	27	37	45 (58)	46 (61)	47 (64)
15.9	54	12		33	43 (52)	44 (54)	45 (57)
19.6	60	12			43 (47)	43 (49)	44 (51)
23.8	66	12			42	43	43 (47)
28.3	72	12				41	43
33.2	78	12					39
38.5	84	12					35

VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESES



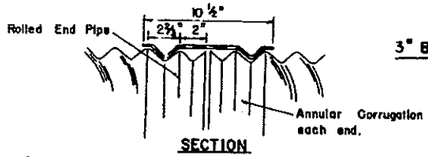
3" BY 1" CORRUGATIONS*

2⅔" BY ½" CORRUGATIONS



CONNECTING BAND DETAILS FOR HELICAL, WELDED - SEAM CULVERT

* 5"x 1" Corregation may be used in lieu of 3"x 1".



SECTION

10-1-86 REVISIONS DATE	CHANGE
4-28-89	TOE PLATE NOTE
12-6-95	CORREGATIONS

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

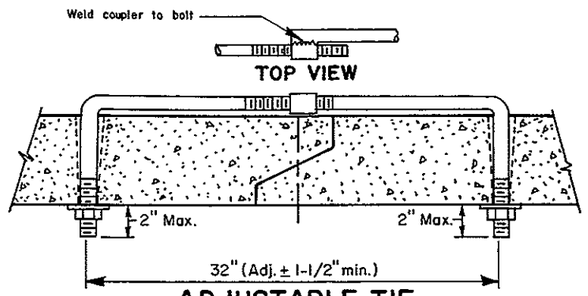
APPROVED: David K.O. Leer, DESIGN ENGINEER

ED714-04 P=1"

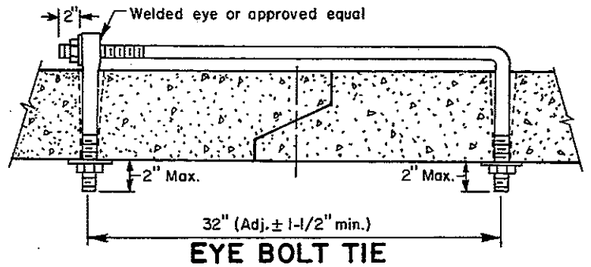
30868

CONCRETE PIPE TIES

D714-22

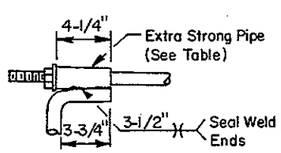


ADJUSTABLE TIE

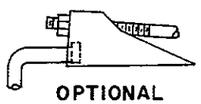


EYE BOLT TIE

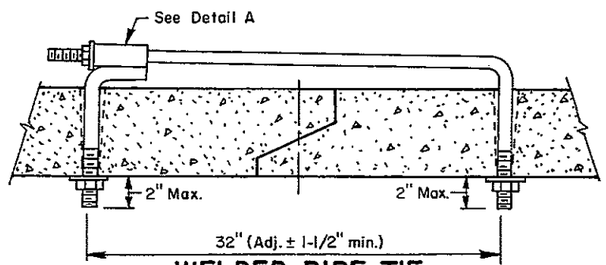
Thread Dia.	E.S. Pipe I.D.
5/8"	3/4"
3/4"	1"
1"	1-1/4"



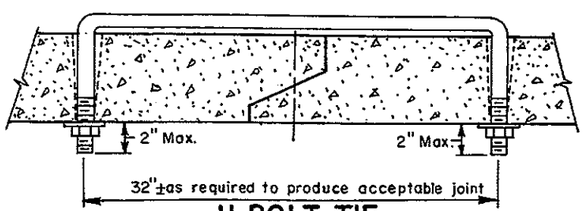
DETAIL A



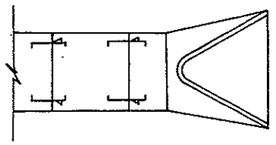
OPTIONAL CANOPY TIE

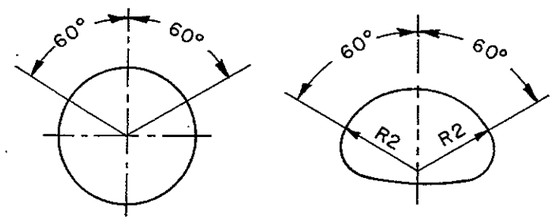


WELDED PIPE TIE



U BOLT TIE





PLACEMENT OF HOLES

REQUIRED SIZE OF TIE BOLTS					
Pipe Size (Inches)	Thread Dia.	Pipe Size (Inches)	Thread Dia.	Pipe Size (Inches)	Thread Dia.
12	5/8" (See Note 2)	30	3/4"	72	1"
15		33		78	
18		36		84	
21		42		90	
24		48		96	
27		54		102	
		60		108	
		66		120	
				132	

NOTES:

1. PIPE SIZE LISTED IS INSIDE DIAMETER OF ROUND PIPE OR EQUIVALENT DIAMETER OF PIPE ARCH.
2. NUTS AND WASHERS ARE NOT REQUIRED ON INSIDE OF 21" DIAMETER PIPE OR LESS.
3. TIES TO BE USED ONLY TO HOLD PIPE SECTIONS TOGETHER, NOT FOR PULLING SECTIONS TIGHT.
4. TIE BOLTS SHALL BE PAINTED AFTER FABRICATION WITH ONE COAT OF ZINC CHROMATE IRON OXIDE PAINT. THREADED PORTION OF RODS DO NOT HAVE TO BE PAINTED.
5. HOLES IN PIPE TO ACCOMMODATE THE TIE BOLTS CAN BE PRECAST OR DRILLED. TAPERED HOLES WILL BE PERMITTED WHEN PRECAST. WHEN EXISTING PIPE ARE EXTENDED OR SALVAGED AND RELAYED, THE CONTRACTOR WILL BE REQUIRED TO DRILL THE NECESSARY HOLES.
6. THE CONTRACTOR HAS THE OPTION OF SELECTING THE TYPE OF TIE BOLT TO BE USED. THE TYPE SELECTED SHALL BE APPROVED BY THE ENGINEER.
7. THE COST OF PRECASTING OR DRILLING THE REQUIRED HOLES AND FURNISHING AND INSTALLING THE TIE BOLTS SHALL BE INCLUDED IN THE PRICE BID FOR REINFORCED CONCRETE PIPE CULVERTS.
8. ALL CONCRETE PIPE JOINTS WILL BE TIED INCLUDING THE END SECTION JOINTS. TIE BOLTS ARE NOT REQUIRED ON STORM SEWER PIPE UNLESS SPECIFICALLY NOTED IN THE PLANS.

10-1-86

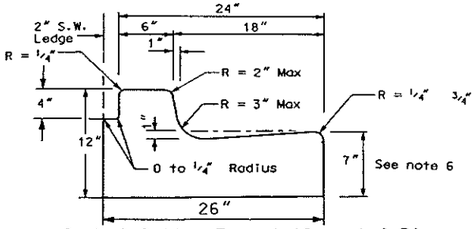
REVISIONS	
DATE	CHANGE
12-9-94	NOTES

NORTH DAKOTA
STATE HIGHWAY DEPARTMENT

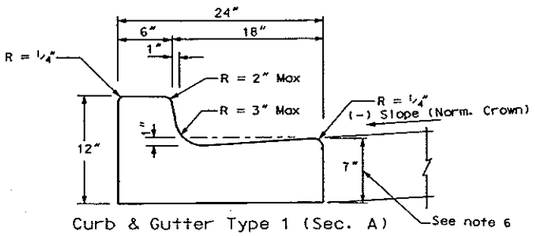
APPROVED: David K.O. Leer
DESIGN ENGINEER

D-748-1

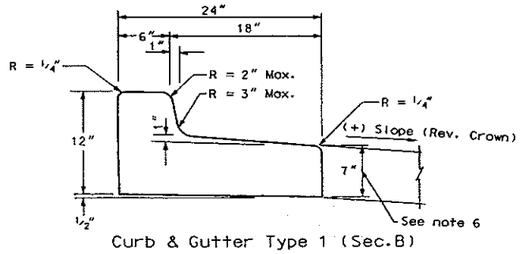
VALLEY GUTTER AND CURB & GUTTER



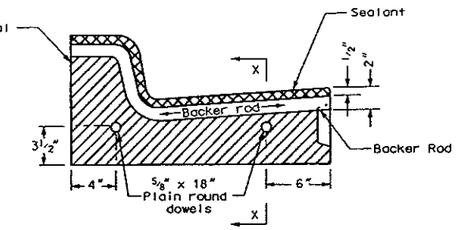
Curb & Gutter Type 1 (Sec. A & B)
Adjacent to Sidewalk



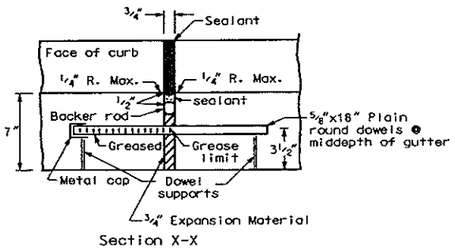
Curb & Gutter Type 1 (Sec. A)



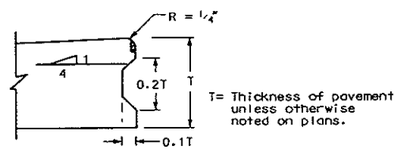
Curb & Gutter Type 1 (Sec.B)



Isolation Joint Detail

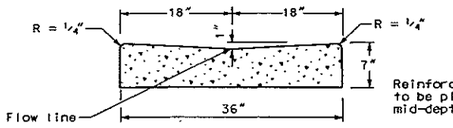


Section X-X

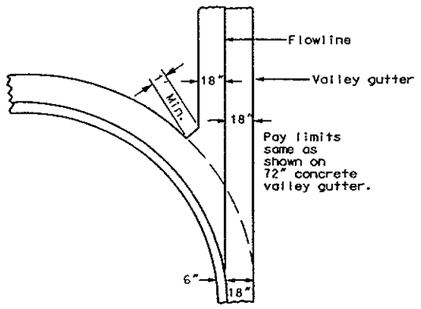


T= Thickness of pavement unless otherwise noted on plans.

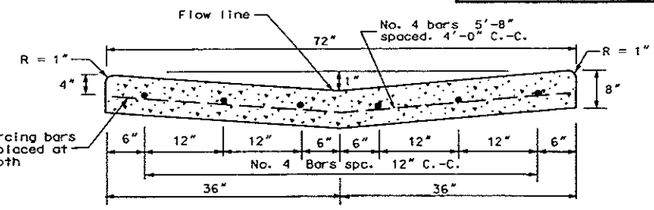
Keyway Detail For Curb & Gutter
(To be used with P.C.C. Pavement and Drives.)



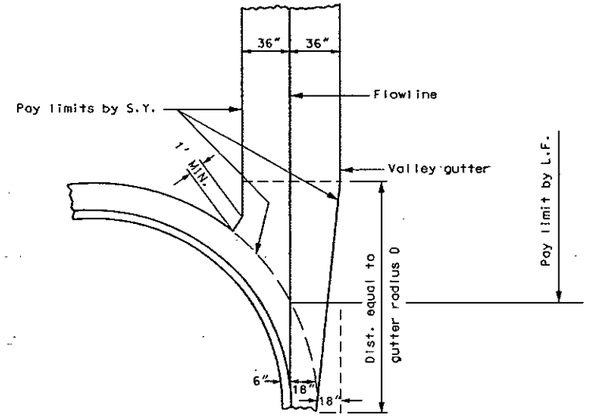
36" Concrete Valley Gutter



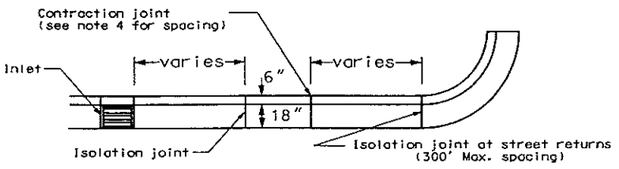
36" Concrete Valley Gutter



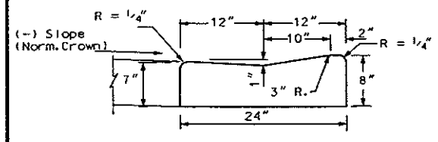
72" Concrete Valley Gutter



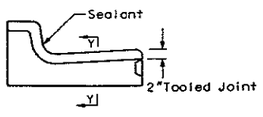
72" Concrete Valley Gutter



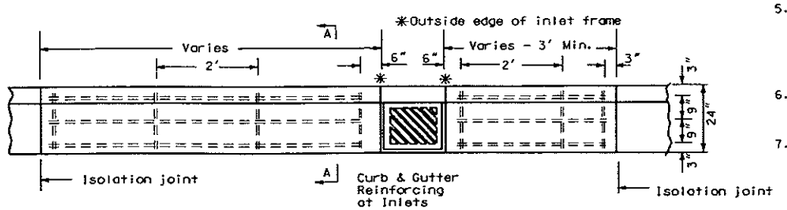
Joint Location Detail

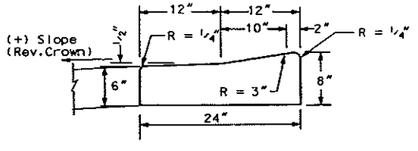


Mountable Curb & Gutter
Type 1 (Sec. A)

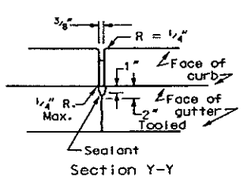


Contraction Joint Detail
(10' Max. Spacing)

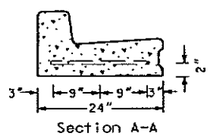




Mountable Curb & Guuter
Type 1 (Sec. B)



Section Y-Y



Section A-A

NOTE: All bars shall be #4 deformed reinforcing bars. Splices will not be permitted. Reinforcing bars at inlet locations will not be paid for separately, but shall be included in the price bid for "Curb and Gutter - Type 1."

This includes inlets located on radii. The reinforcement shall be extended to the second joint (rebar placed through the first joint) in cases where the 3' min. panel length cannot be obtained.

NOTES:

1. Curb and Gutter Type 1 to be used. Section "A" to be used with (-) pavement slopes and section "B" to be used with (+) pavement slopes.
2. Contraction Joints: Tool the Curb & Gutter 2" as shown on the contraction joint details.
3. Isolation Joints: Isolation joint material shall be 3/4" premolded conforming to section 826.02C or D of the standard specifications. The opening for the backer rod and joint sealant shall be formed by a pre-cut piece of wood or other material approved by the engineer. Dowel supports are not required on the second pour at a cold joint. metal caps and greased dowels shall be installed in the cold joint for the second pour.
4. Joint Spacing: For hot bituminous pavements the joint spacing for the curb and gutter shall be 10' max. with the panels on each side of the inlets.
   For concrete pavements the joint spacing for the curb and gutter shall match the pavement joint on PCC Pavements.
5. Joint sealing: All contraction and isolation joints shall be sealed as shown in the details. The joint sealant for contraction joints shall conform to section 826.02B. The sealant for expansion joints shall be as specified in note 3 above. The sealant shall be tooled and installed in accordance with the manufacturer's recommendations.
6. Depth of Face of Gutter: For hot bituminous pavement the depth of gutter shall be as shown. For PCC pavements the depth of gutter shall match the adjacent PCC pavement.
7. The cost for all labor, equipment, and material necessary to construct contraction & isolation joints shall be included in the price bid for curb and gutter.

10-1-86	
REVISIONS	
DATE	CHANGE
10-17-97	GENERAL REVISIONS

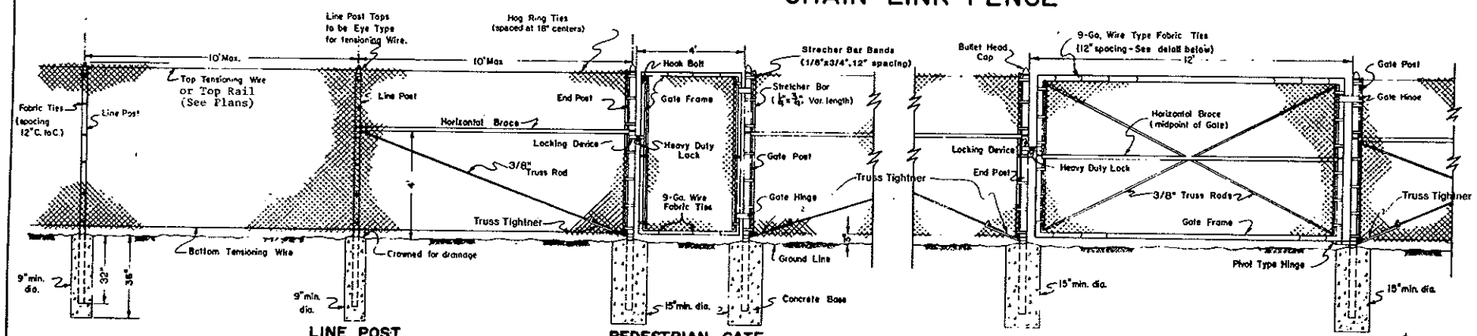
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

APPROVED: _____
DESIGN ENGINEER

r:\support\desstd\d748-01.dgn Oct. 20, 1997 16:07:50

CHAIN LINK FENCE

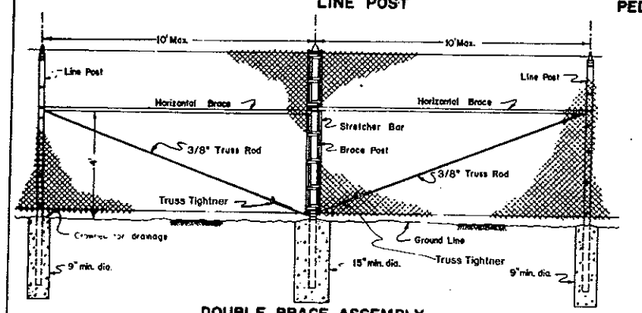
D-752-2



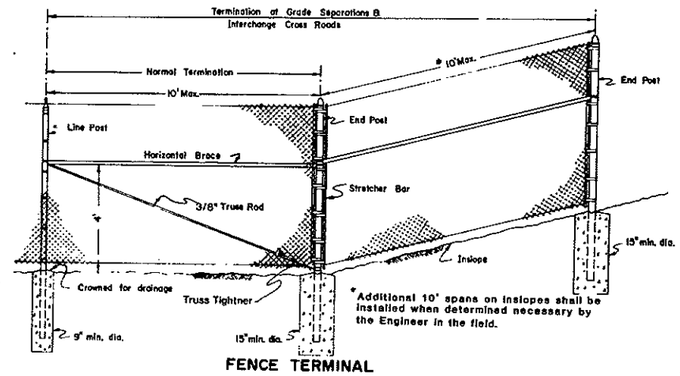
LINE POST

PEDESTRIAN GATE

VEHICLE GATE

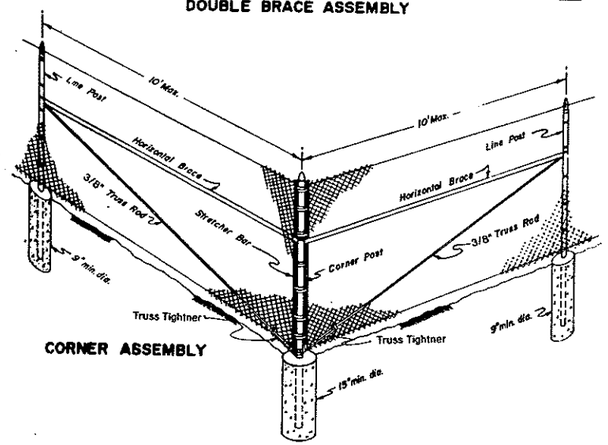


DOUBLE BRACE ASSEMBLY

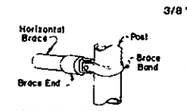


*Additional 10' spans on inslopes shall be installed when determined necessary by the Engineer in the field.

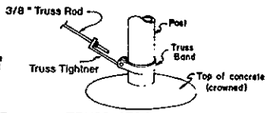
FENCE TERMINAL



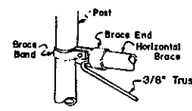
CORNER ASSEMBLY



BRACE ATTACHMENT



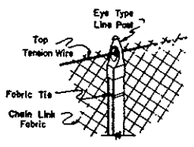
TRUSS ATTACHMENT AT TERMINAL POSTS



BRACE & TRUSS ATTACHMENT

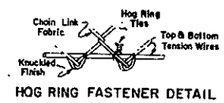
TOP VIEW

"H" COLUMN POST

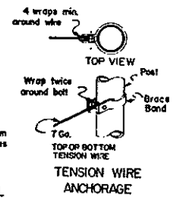


LINE POST TOP DETAIL

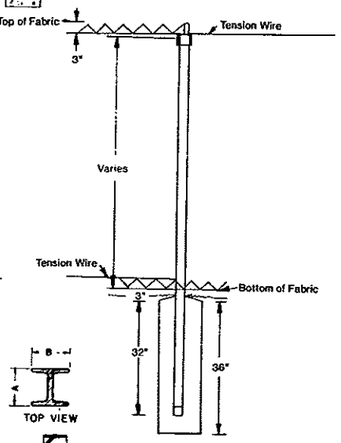
STRETCHER BAR BAND

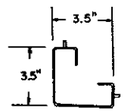


HOG RING FASTENER DETAIL



TENSION WIRE ANCHORAGE



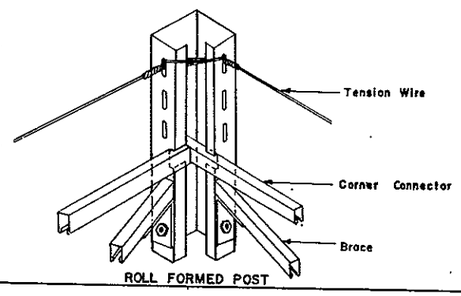


TEMINAL POST

LINE POST

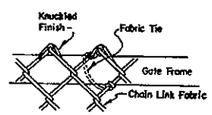
TOP & BRACE RAIL

"C" SECTION POST & RAIL



ROLL FORMED POST

"C" SECTION POST



WIRE TYPE FABRIC TIE DETAIL

DOUBLE BRACE ASSEMBLIES SHALL BE INSTALLED AT LOCATIONS SHOWN ON THE PLANS OR ESTABLISHED BY THE ENGINEER. THE DISTANCE ADJACENT FENCE TERMINALS, CORNER ASSEMBLIES, OR DOUBLE BRACE ASSEMBLIES SHALL NOT EXCEED 1000 FEET.

ALL MISCELLANEOUS FITTINGS SHALL BE OF THE TYPE AND SIZE RECOMMENDED BY THE MANUFACTURER OF THE FENCE AND APPROVED BY THE ENGINEER.

HEIGHT OF FABRIC SHALL BE 6' UNLESS OTHERWISE SHOWN ON THE PLANS.

CONCRETE FOR THE POST BASES SHALL BE CLASS YE IN ACCORDANCE WITH SEC. 802 OF THE STANDARD SPECIFICATIONS. COURSE AGGREGATE FOR CONCRETE MIX SHALL BE SIZE NO. 4 OR 5 AT THE OPTION OF THE CONTRACTOR BUT SHALL NOT BE CHANGED DURING THE WORK EXCEPT BY WRITTEN PERMISSION OF THE ENGINEER.

CHAIN LINK FABRIC SHALL BE 9-GAGE WIRE 2" MESH. KNUCKLED FINISHED TOP AND BOTTOM. WIRE SHALL HAVE A MINIMUM TENSILE STRENGTH OF 80,000 P.S.I.

EACH FENCE TERMINAL WILL BE COUNTED AND PAID FOR AS A DOUBLE BRACE ASSEMBLY.

THE CONTRACTOR SHALL HAVE THE OPTION OF USING ANY OF THE TYPES OF POSTS SHOWN IN THE TABLE OF EQUIVALENT POST SIZES AND WEIGHTS FOR THE SPECIFIED USE.

NO DEDUCTION IN MEASURED PAY LENGTH OF CHAIN LINK FENCE WILL BE MADE FOR GATES, CORNER ASSEMBLIES, DOUBLE BRACE ASSEMBLIES OR FENCE TERMINALS.

TOP AND BOTTOM TENSIONING WIRES SHALL BE 7-GAGE STEEL WIRE WITH A MINIMUM TENSILE STRENGTH OF 80,000 P.S.I.

THE FABRIC SHALL BE TIED TO THE TENSION WIRE AS RECOMMENDED BY THE MANUFACTURER.

PRIVATE FENCES SHALL NOT BE CONNECTED TO THE HIGHWAY RIGHT-OF-WAY FENCE, BUT MAY BE ABUTTED NEXT TO THE RIGHT-OF-WAY FENCE.

HOT-DIP ZINC-5% ALUMINUM-MISCHMETAL ALLOY COATING CONFORMING TO THE PERTINENT REQUIREMENTS OF ASTM A 875 MAY BE APPLIED TO GRADE 1 STEEL POSTS, RAILS, OR GATE FRAMES AS AN ALTERNATIVE TO HOT-DIPPED GALVANIZED COATING. THE WEIGHT OF THE ALLOY COATING SHALL BE 2.1 OUNCES PER SQUARE FOOT. TESTED IN ACCORDANCE WITH ASTM A 90.

ROLL-FORMED SECTIONS SHALL BE FABRICATED FROM MATERIAL MEETING THE REQUIREMENTS OF ASTM A 570, GRADE 45, AND SHALL BE GALVANIZED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM A 123, OR COATED WITH ZINC-5% ALUMINUM MISCHMETAL ALLOY IN ACCORDANCE WITH ASTM F 1234, TYPE C.

EQUIVALENT POST SIZES AND WEIGHTS

USE OF POST	SECTION	"C" SEC. STEEL		"H" COLUMN STEEL			ROUND STEEL			
		Size	Weight	Size		Weight	Size	Weight - Lbs./Ft.		
		Inch	Lbs./Ft.	A	B	Lbs./Ft.	Out. Dia.	Class 1	Class 2	
LINE POST	Fabric 6' or less	1.875 x 1.625	1.60	2.25"	1.70"	3.43	1.900"	2.72	2.28	
	Fabric over 6'	1.875 x 1.625	2.34	2.25"	1.70"	3.43	2.375"	3.65	3.12	
END, CORNER,	Fabric 6' or less	3.5 x 3.5	5.10				2.375"	3.65	3.12	
	Fabric over 6'	3.5 x 3.5	5.10				2.875"	5.79	4.64	
GATE POST	All	3.5 x 3.5	5.10				3.500"		5.71	
							4.000"	9.11		
EXTERIOR FRAME FOR GATE	Gate width 6' or less	—	—				1.315"	1.68	1.35	
	Gate width over 6'	—	—				1.900"	2.72	2.28	
HORIZONTAL BRACE		1.625 x 1.25	1.35				1.660"	2.27	1.84	
BRACE POST	Fabric 6' or less	1.875 x 1.624	2.34				2.375"	3.65	3.12	
	Fabric 6' or less	1.875 x 1.624	2.34				2.875"	5.79	4.64	

"H" COLUMN STEEL POSTS NOT PERMITTED

REVISIONS	
DATE	CHANGE
10-15-86	NOTE
12-11-86	NOTE
9-4-90	PRIVATE FENCE NOTE
1-22-92	REMOVE TOP RAIL
5-1-92	NOTE
12-31-92	H-POSTS & NOTES
7-16-93	Truss Rod & Tightner
10-31-94	GENERAL

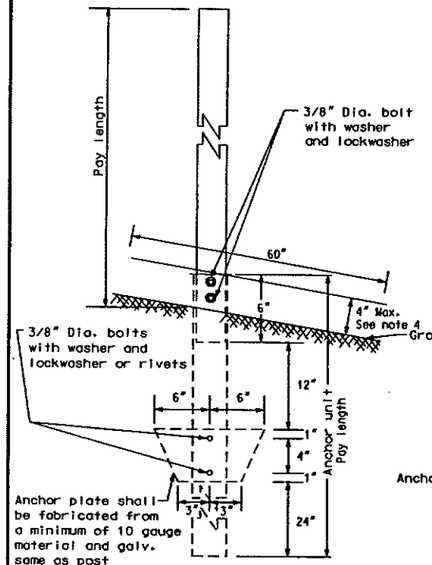
10-1-86

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

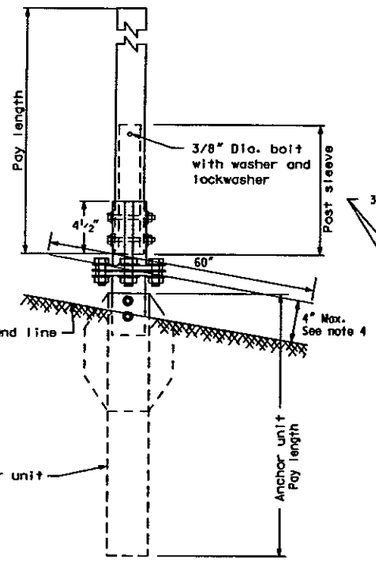
APPROVED David K.D. Leer
DESIGN ENGINEER

MOUNTING DETAILS PERFORATED TUBE

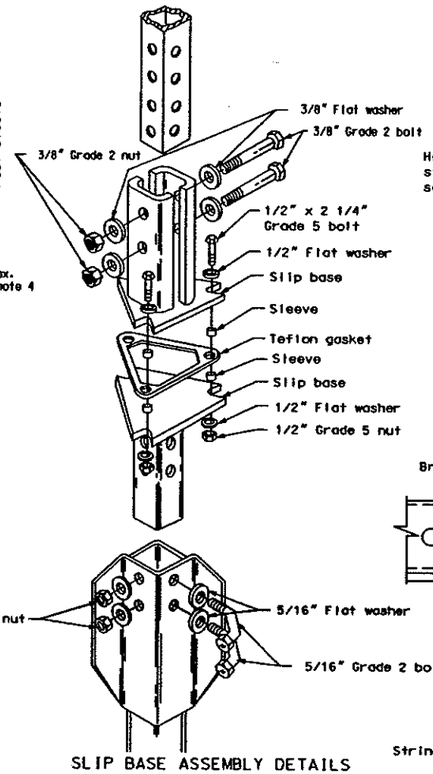
D-754-24



ANCHOR UNIT AND POST ASSEMBLY

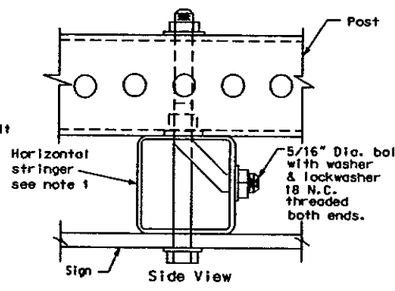


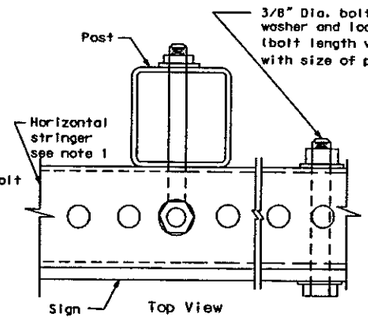
SLIP BASE ANCHOR UNIT AND POST SLEEVE ASSEMBLY



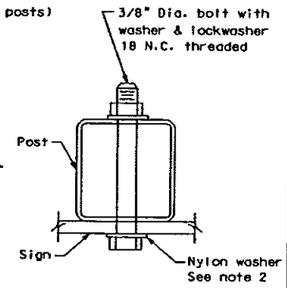
SLIP BASE ASSEMBLY DETAILS

Note: Slip base bolts shall be torqued as specified by the manufacturer.

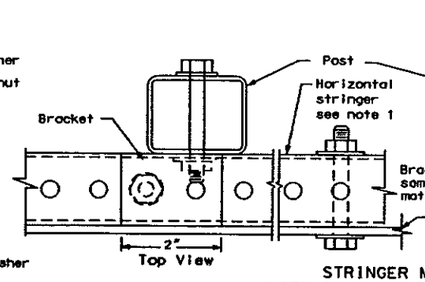


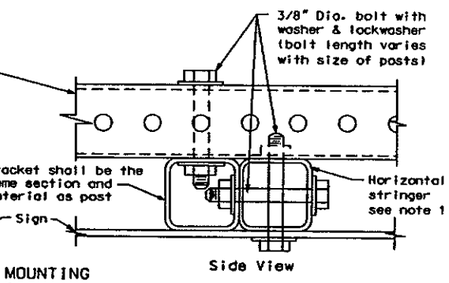


STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)

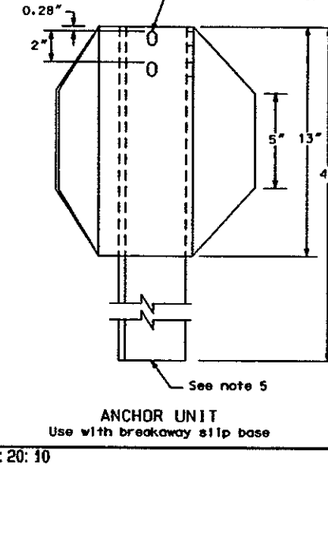


BOLT MOUNTING

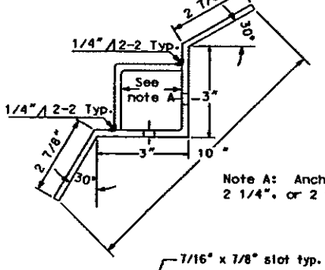


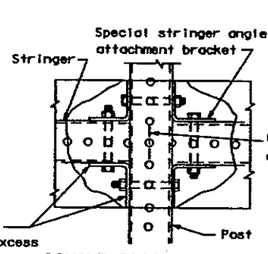


STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)
ALTERNATE

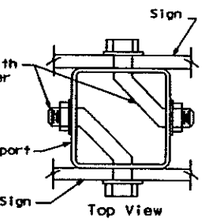


ANCHOR UNIT
Use with breakaway slip base

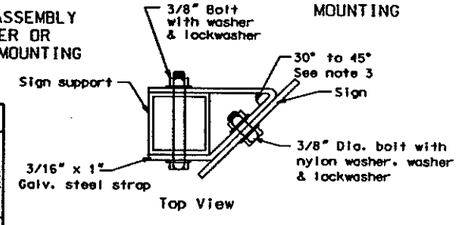


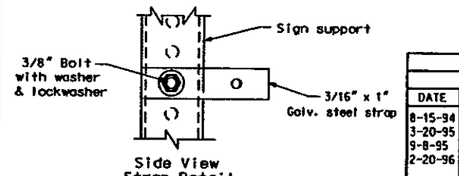


SINGLE POST ASSEMBLY
ONE STRINGER OR
BACK TO BACK MOUNTING



BACK TO BACK MOUNTING





Number of Posts	Telescoping Perforated Tube					Anchor Size Without Slip Base In.
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	
1	2	12		12	No	2 1/4
1	2 1/4	12		12	No	2 1/2
1	2 1/2	12		3/16	B	
1	2 1/2	10		3/16	Yes	
1	2 1/4	12	2	12	Yes	
1	2 1/2	12	2 1/4	12	Yes	
2	2	12		12	No	2 1/4
2	2 1/4	12		12	No	2 1/2
2	2 1/2	12		12	Yes	
2	2 1/2	10		3/16	Yes	
2	2 1/4	12	2	12	Yes	
2	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/2	12		12	Yes	
3 & 4	2 1/2	10		3/16	Yes	
3 & 4	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/4	12	2	12	Yes	
3 & 4	2 1/2	10	2 3/16	3/16	Yes	

B - The 2 1/2" 12 gauge posts do not need slip bases when placed in standard soils. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are defined as boggy, wet, or loose soil areas.

Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In.^{4}	Gross Sect. In.^{2}	Section Modulus In.^{3}
1 1/2 x 1 1/2	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
2 1/4 x 2 1/4	0.105	12	2.773	0.561	0.695	0.499
2 3/16 x 2 3/16	0.135	10	3.432	0.605	0.841	0.590
2 1/2 x 2 1/2	0.105	12	3.141	0.804	0.803	0.643
2 1/2 x 2 1/2	0.135	10	4.006	0.979	1.010	0.785
4 x 4	0.250	1/4	6.600	3.040	1.940	1.050

The 2 3/16" size 10 gauge is shown as 2.19" size on the plans. The 2 1/2" size 10 gauge is shown as 2.51" size on the plans.

Note:

1. Horizontal stringers - In lieu of perforated tubes, the contractor may substitute z bar stringers. The z bar stringers shall be 1 3/4" x 3/16" thick, 1.08 lbs./ft. aluminum or 3.16 lbs./ft. steel.

2. Metal washer and nylon washers used on sign face shall have a minimum outside diameter of 15/16" ± 1/16" and 10 gauge thickness.

3. No Parking Signs: All no parking signs with directional arrows shall be placed at a 30 to 45 degree angle with the line of traffic flow. No parking signs required at the above angles may have the support turned to the correct angle. If the no parking sign is placed with another sign that has to be placed at a 90 degree angle with the line of traffic flow, the detailed angle strap should be used to mount the no parking sign. Material used for the attachment strap shall be included in the price bid flat sheet for signs. Flat washers and lockwashers shall be used with all nylon washers.

4. 4" Vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.

5. Anchor material shall be 7 gauge(.179-.188) H.R.P.D. Commercial quality ASTM A569.

REVISIONS	
DATE	CHANGE
8-15-94	Anchor detail
3-20-95	Rev. 4x4 post
9-8-95	Pay length
2-20-96	Perforated tube table
5-13-96	B note
11-3-97	Anchor unit
2-10-98	Anchor unit

10-1-86

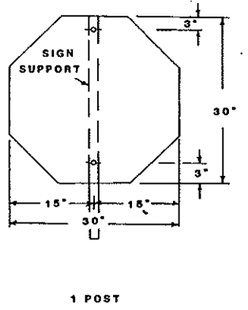
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

APPROVED: _____
DESIGN ENGINEER

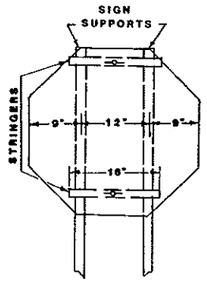
r:\support\desstd\d754-24.dgn Feb. 11, 1998 08:20:10

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS

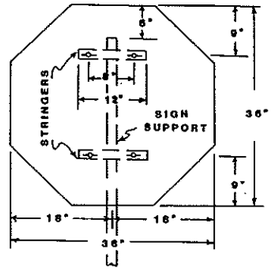
D-754-26



1 POST

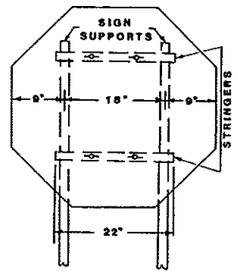


2 POSTS

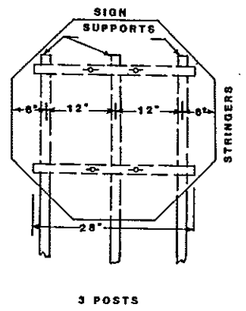


1 POST

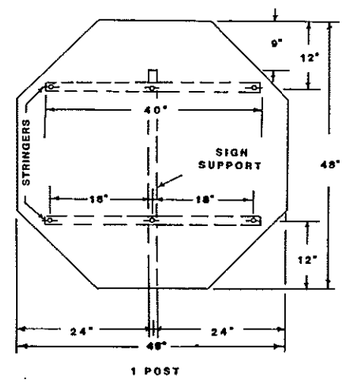
ASSEMBLY NO. 1



2 POSTS

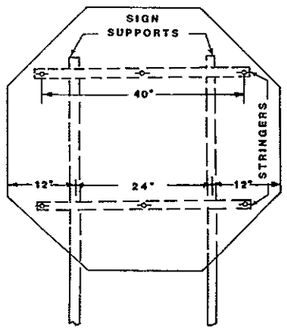


3 POSTS

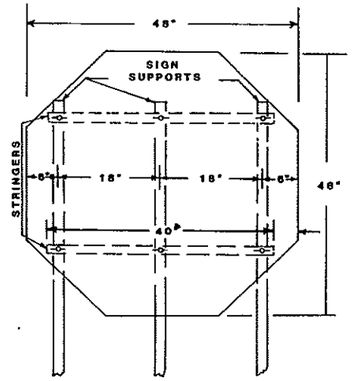


1 POST

ASSEMBLY NO. 2

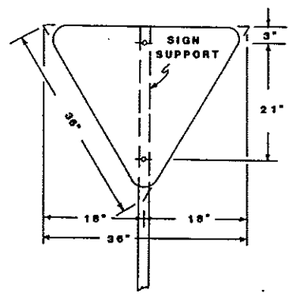


2 POSTS

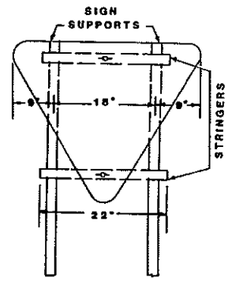


3 POSTS

ASSEMBLY NO. 3

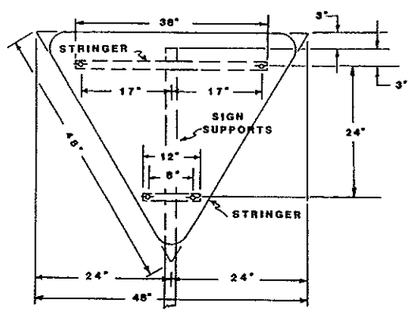


1 POST

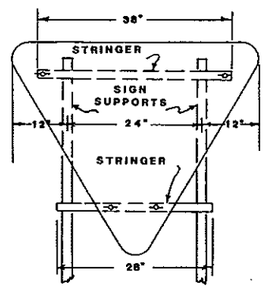


2 POSTS

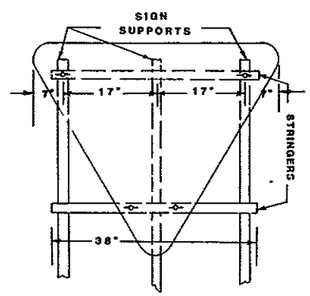
ASSEMBLY NO. 4



1 POST



2 POSTS



3 POSTS

ASSEMBLY NO. 5

NOTE:

Material:

Signing Backing: The sign backing material thickness shall be as follows.

Aluminum: Aluminum Alloy 6061-T6 and 5052 -H38 shall have the following minimum thickness: All signs shall be 0.100 inch.

Stringers:

Flange Channel : All stringers shall be flange channel 1.12# per foot and of the length shown.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Holes:

Flange Channel: All holes shall be punched round for 3/8" diameter bolts.

Square Tube, Perforated: All holes shall be punched round for 3/8" diameter bolts.

General:

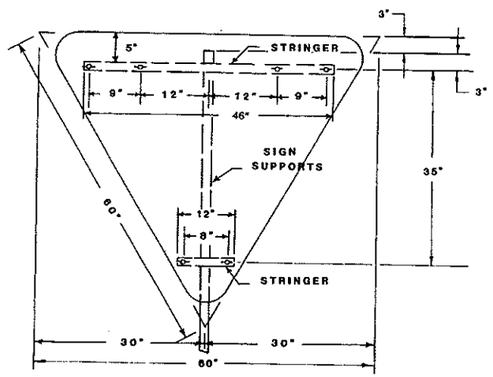
See plans for sign numbers to be used at each location.
See Std. D-754-24 square tube, perforated mounting details.
See Std. D-754-25 for flange channel mounting details.

10-1-86	
REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS

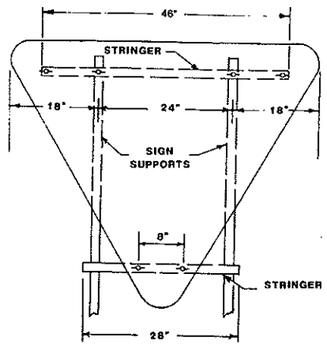
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION
APPROVED: David K.D. Kuan
DESIGN ENGINEER

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS

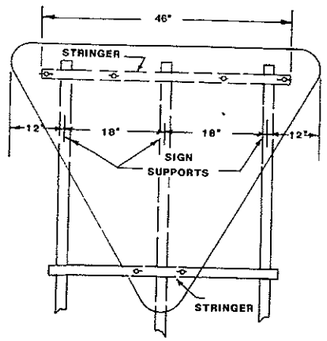
D-754-27



1 POST

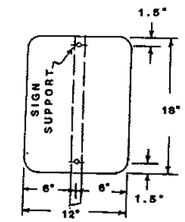


2 POSTS



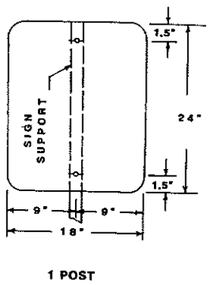
3 POSTS

ASSEMBLY NO. 6



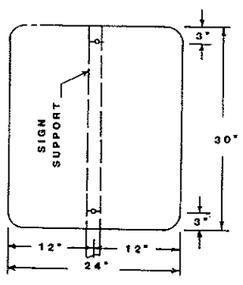
1 POST

ASSEMBLY NO. 7



1 POST

ASSEMBLY NO. 8



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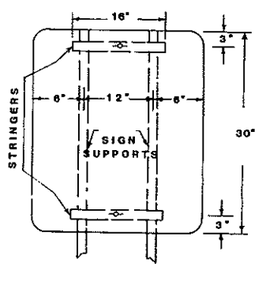
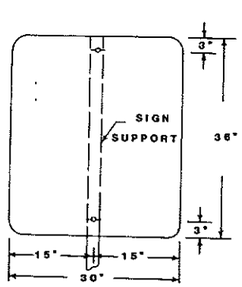
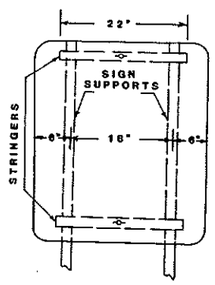


2 POSTS

ASSEMBLY NO. 9

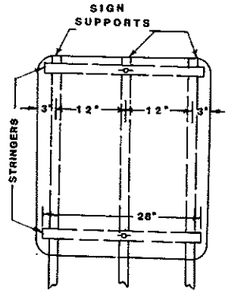


1 POST

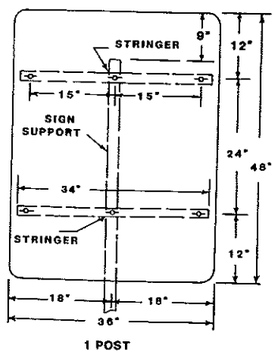


2 POSTS

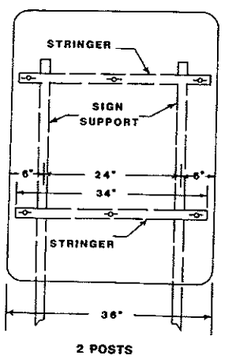
ASSEMBLY NO. 10



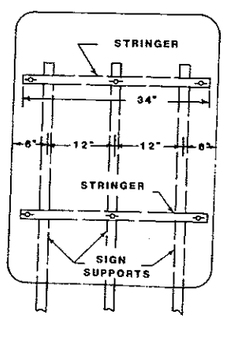
3 POSTS



1 POST



2 POSTS



3 POSTS

ASSEMBLY NO. 11

NOTE:

Material:

Sign Backing: The sign backing material thickness shall be as follows.

Aluminum: Alumium Alloy 6061-T6 and 5052-H38 shall have the following minimum thickness: All signs shall be 0.100 inch.

Stringers:

Flange Channel: All stringers shall be flange channel 1.12# per foot and of the length shown.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Holes:

Flange Channel: All holes shall be punched round for 3/8" diameter bolts.

Square Tube, Perforated: All holes shall be punched round for 3/8" diameter bolts.

General:

See plans for sign numbers to be used at each location .

See Std. D-754-24 square tube, perforated mounting details.

See Std. D-754-25 for flange channel mounting details.

10-1-86

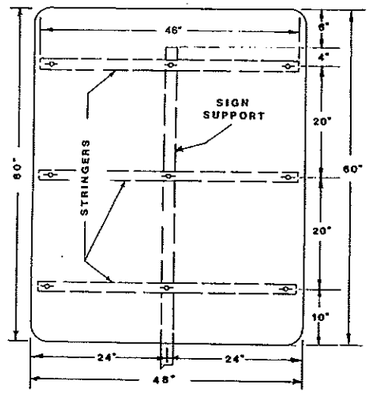
REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS
7-14-95	48" Stringer

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

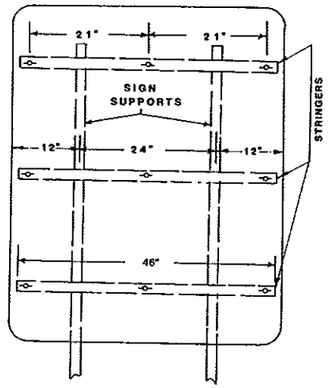
APPROVED: David K.D. Kean
DESIGN ENGINEER

D-754-28

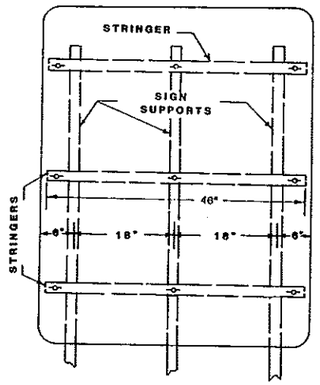
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS



1 POST

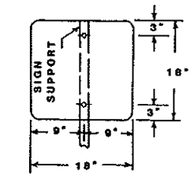


2 POSTS



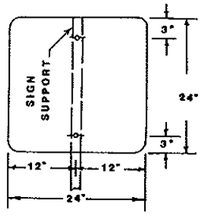
3 POSTS

ASSEMBLY NO. 12

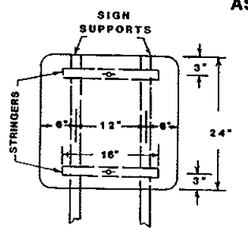


1 POST

ASSEMBLY NO. 13

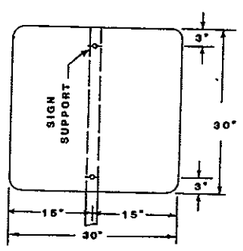


1 POST

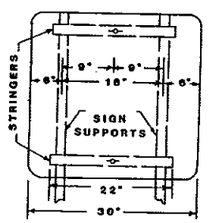


2 POSTS

ASSEMBLY NO. 14

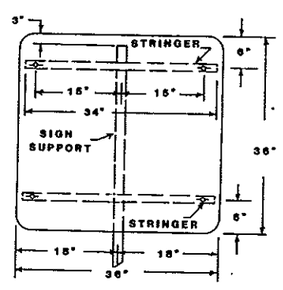


1 POST

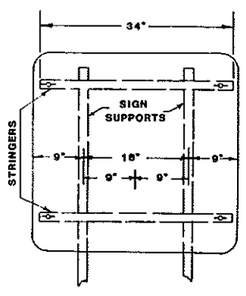


2 POSTS

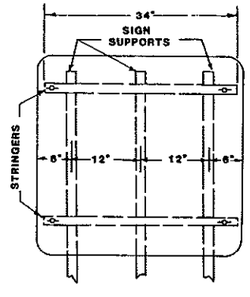
ASSEMBLY NO. 15



1 POST

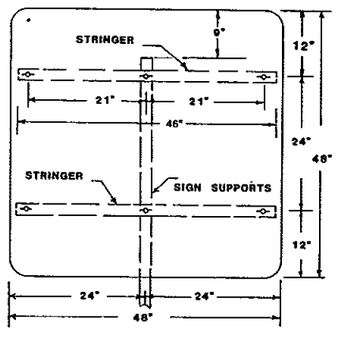


2 POSTS

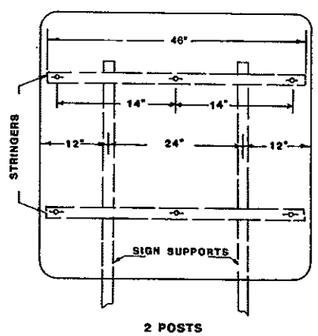


3 POSTS

ASSEMBLY NO. 16



1 POST



2 POSTS

ASSEMBLY NO. 17

NOTE:

Material

Sign Backing: The sign backing material thickness shall be as follows.

Aluminum: Aluminum Alloy 6061-T6 and 5052-H38 shall minimum thickness: All signs shall be 0.100 inch.

Stringers:

Flange Channel : All stringers shall be flange channel 1.12# per foot and of the length shown.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Holes:

Flange Channel: All holes shall be punched round for 3/8" diameter bolts.
Square Tube, Perforated: All holes shall be punched round for 3/8" diameter bolts.

General:

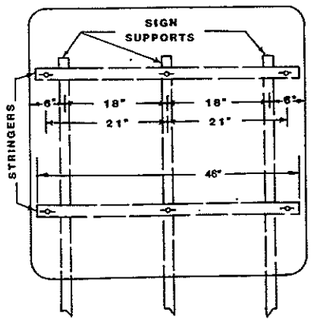
See plans for sign numbers to be used at each location.
See Std. D-754-24 for square tube, perforated mounting details.
See Std. D-754-25 for flange channel mounting details.

10-1-86 REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS
7-14-95	46" Stringer

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION
APPROVED: David K.D. Leer
DESIGN ENGINEER

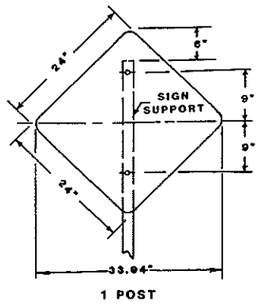
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS

D-754-29

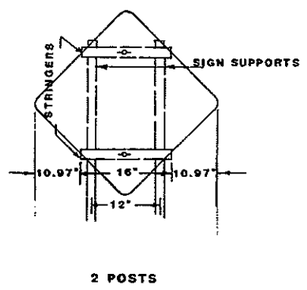


3 POSTS

ASSEMBLY NO. 17

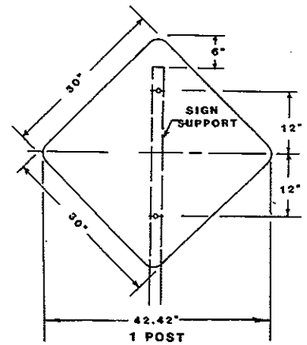


1 POST



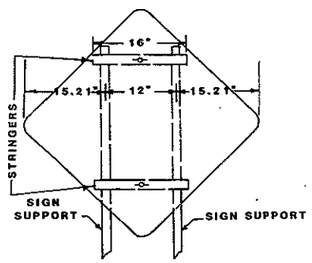
2 POSTS

ASSEMBLY NO. 18

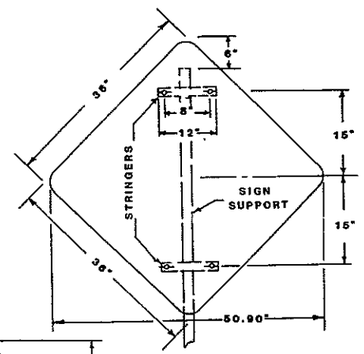


1 POST

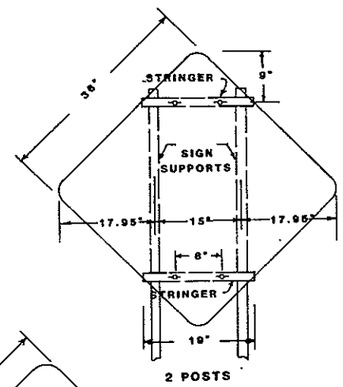
ASSEMBLY NO. 19



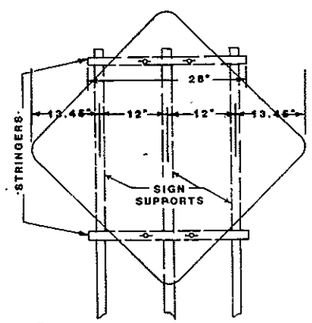
2 POSTS



1 POST

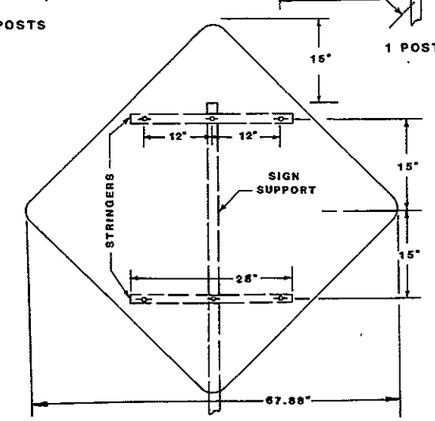


2 POSTS

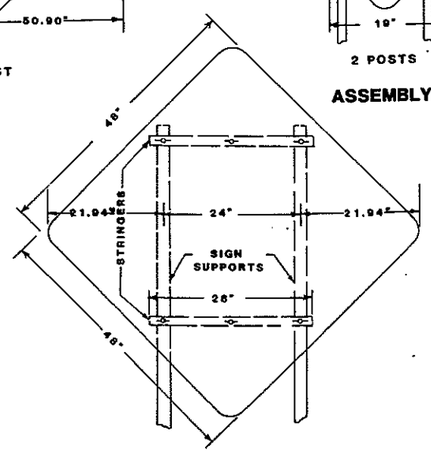


3 POSTS

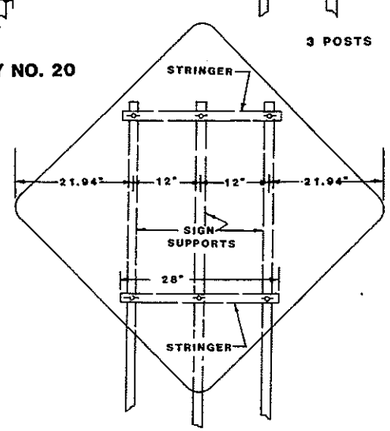
ASSEMBLY NO. 20



1 POST



2 POSTS



3 POSTS

ASSEMBLY NO. 21

NOTE:

Material:

Sign Backing: The signing backing material thickness shall be as follows.

Aluminum: Aluminum Alloy 6061-T6 and 5052-H38 shall have the following minimum thickness: All signs shall be 0.100 inch.

Stringers:

Flange Channel : All stringers shall be flange channel 1.12# per foot and of the length shown.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Hole:

Flange Channel: All holes shall be punched round for 3/8" diameter bolts.
Square Tube, Perforated: All holes shall be punched round for 3/8" diameter bolts.

General:

See plans for sign numbers to be used at each location.

See Std. D-754-24 for square tube, perforated mounting details.

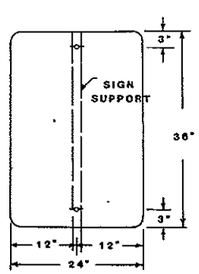
See Std. D-754-25 for flange channel mounting details.

10-1-86	
REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS
7-14-95	46" Stringer

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION
APPROVED: David K. D. Boen
DESIGN ENGINEER

D-754-30

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS



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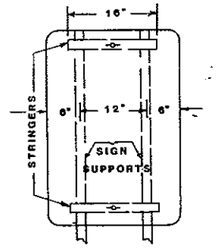
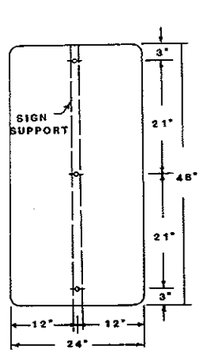
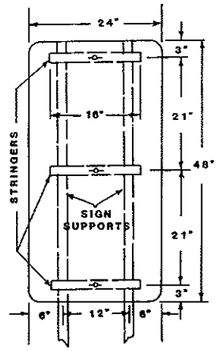


2 POSTS

ASSEMBLY NO. 22



1 POST



2 POSTS

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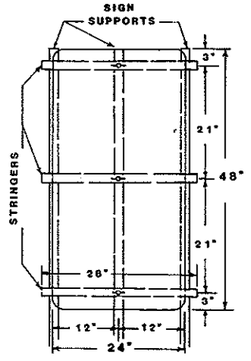


3 POSTS

ASSEMBLY NO. 23

NOTE:

Material:

Sign backing: The sign backing material thickness shall be as follows.

Aluminum: Aluminum Alloy 6061-T6 and 5052-H38 shall have the following minimum thickness: All signs shall be 0.100.inch.

Stringers:

Flange Channel: All stringers shall be flange channel 1.12# per foot and of the length shown.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Holes:

Flange Channel: All holes shall be punched round for 3/8"diameter bolts.

Square Tube, Perforated : All holes shall be punched round for 3/8" diameter bolts.

General:

See plans for sign numbers to be used at each location.

See Std. D-754-24 for square tube, perforated mounting details.

See Sta. D-754-25 for flange channel mounting details.

10-1-86

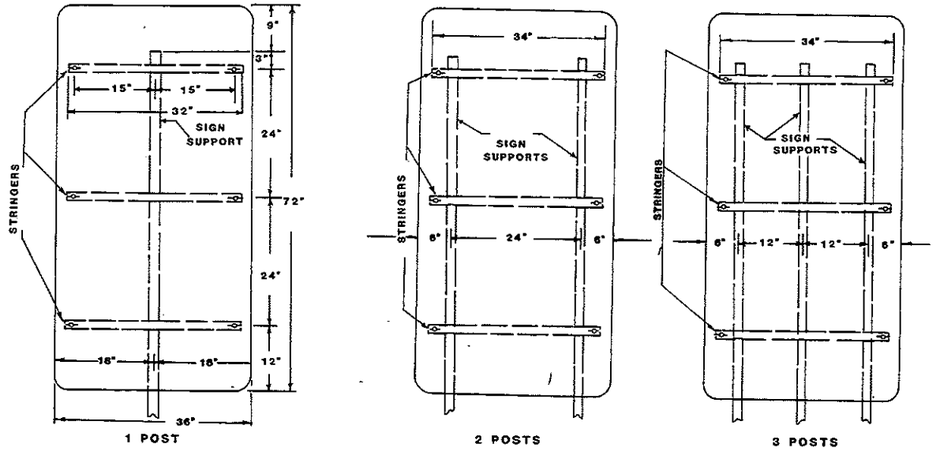
REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

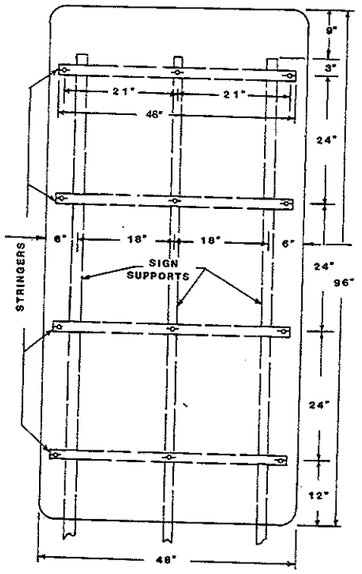
APPROVED: David K. Larson
DESIGN ENGINEER

D-754-31

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
REGULATORY, WARNING, AND GUIDE SIGNS



ASSEMBLY NO. 24



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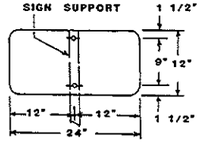

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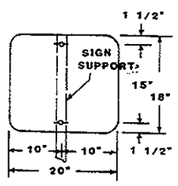

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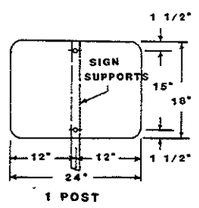

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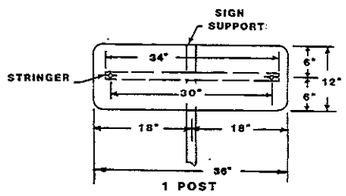

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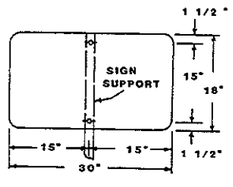

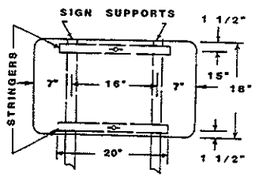

ASSEMBLY NO. 30

NOTE:

Material:

Sign Backing: The sign backing material thickness shall be as follows.

Aluminum : Aluminum Alloy 6061-T6 and 5052-H38 shall have the following minimum thickness: All signs shall be 0.100 inch.

stringers:

Flange Channel: All stringers shall be flange channel 1.12# per foot and of the length shwn.

Square Tube, Perforated: All stringers shall be square tube, perforated 1 1/2"X1 1/2" and of the length shown.

Holes:

Flange Channel : All holes shall be punched round for 3/8" diameter bolts.

Square Tube, Perforated: All holes shall be punched round for 3/8" diameter bolts.

General:

See plans for sign numbers to be used at each location.

See Std. D-754-24 for square tube, perforated mounting details.

See Std. D-754-25 for flange channel mounting details.

10-1-86

REVISIONS	
DATE	CHANGE
5-1-92	GENERAL REVISIONS
7-14-95	48" Stringer

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

APPROVED: David K. O'Toole
DESIGN ENGINEER