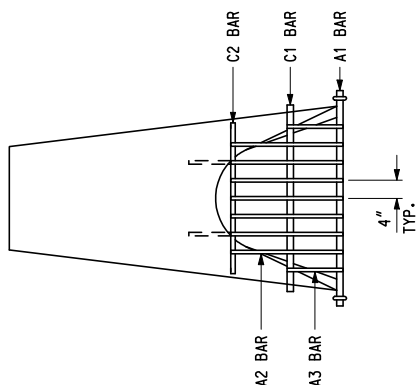
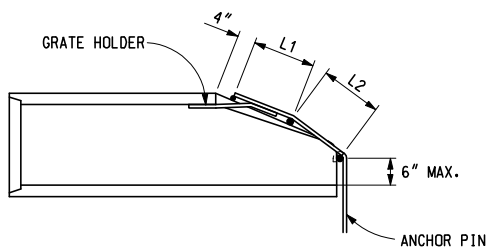




PLAN VIEW

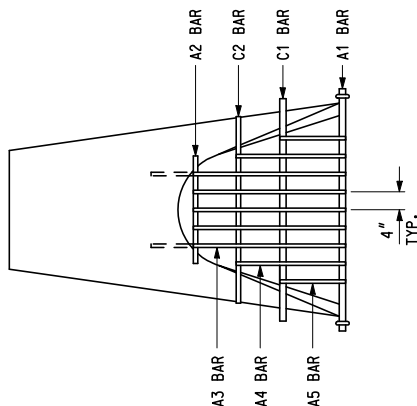


LONGITUDINAL SECTION

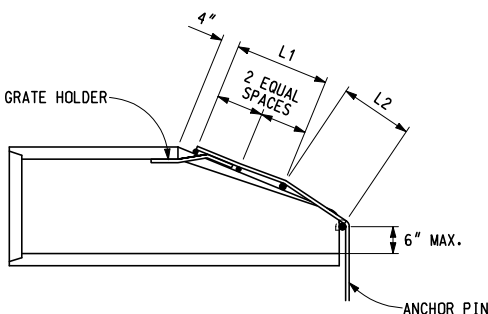
STEEL REINFORCEMENT QUANTITIES										
DIAMETER		12"			15"			18"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	34"	12	1	40"	14	1	48"	17
A2	#6	5	24"	15	5	28"	17	7	28"	24
A3	#6				2	14"	3	2	14"	3
C1	#10	1	36"	13	1	40"	14	1	44"	16
C2	#8	1	30"	6	1	34"	7	1	36"	8
ANCHOR PIN	#6	2	36"	9	2	36"	9	2	36"	9
GRATE HOLDER	#6	2	20"	5	2	20"	5	2	20"	5
TOTAL STEEL WEIGHT (LBS)				60				69		

DIMENSIONS		
DIAMETER	L1	L2
12"	12"	12"
15"	14"	14"
18"	14"	14"

GRATE FOR 12" THROUGH 18" DIAMETER PIPE WITH CONCRETE END SECTION



PLAN VIEW

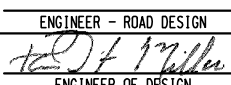
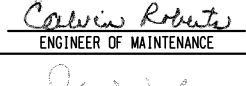
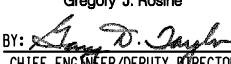


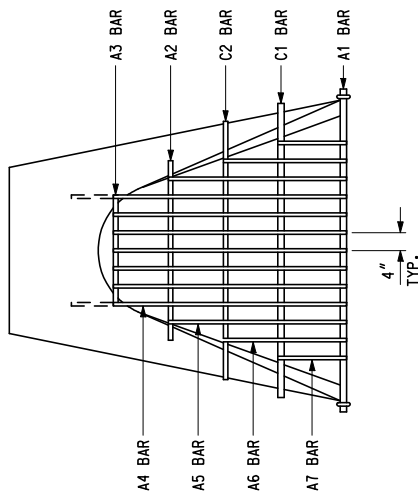
LONGITUDINAL SECTION

STEEL REINFORCEMENT QUANTITIES				
DIAMETER		21"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	54"	19
A2	#8	1	24"	5
A3	#6	5	37"	23
A4	#6	2	26 1/2"	7
A5	#6	2	16"	4
C1	#10	1	52"	18
C2	#8	1	44"	9
ANCHOR PIN	#6	2	36"	9
GRATE HOLDER	#6	2	20"	5
TOTAL STEEL WEIGHT (LBS)				99

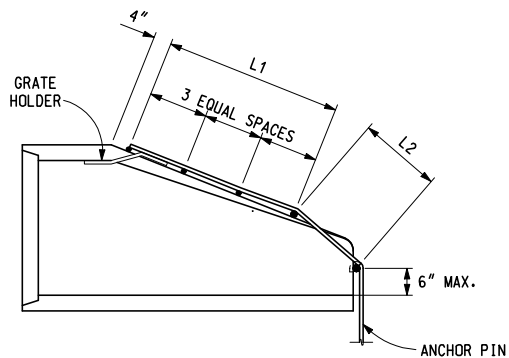
DIMENSIONS		
DIAMETER	L1	L2
21"	21"	16"

GRATE FOR 21" DIAMETER PIPE WITH CONCRETE END SECTION

 PREPARED BY DESIGN DIVISION DRAWN BY: <u>B.L.T.</u> CHECKED BY: <u>W.K.P.</u>	 ENGINEER OF CONSTRUCTION & TECHNOLOGY	 ENGINEER - ROAD DESIGN ENGINEER OF DESIGN	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR			
	 ENGINEER OF MAINTENANCE	DEPARTMENT DIRECTOR Gregory J. Rosine	STEEL GRATES FOR END SECTIONS			
	 ENGINEER OF TRAFFIC AND SAFETY	BY:  CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES				
				9-14-2001	2-26-2001	R-92-C
			F.H.W.A. APPROVAL	PLAN DATE		



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LONGITUDINAL SECTION

STEEL REINFORCEMENT QUANTITIES											
DIAMETER		24"			27"			30"			
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	
A1	#10	1	60"	21	1	66"	23	1	72"	25	
A2	#8	1	32"	7	1	34"	7	1	40"	9	
A3	#8	1	24"	5	1	24"	5	1	24"	5	
A4	#6	7	45 ¹ / ₄ "	39	7	52 ¹ / ₄ "	46	7	58 ¹ / ₄ "	51	
A5	#6	2	34 ³ / ₄ "	9	2	40 ¹ / ₄ "	10	2	45	11	
A6	#6	2	24 ¹ / ₂ "	6	2	28 ¹ / ₄ "	7	2	31 ³ / ₄ "	8	
A7	#6				2	18 ¹ / ₄ "	4	2	18 ¹ / ₂ "	5	
C1	#10	1	60"	21	1	62"	22	1	68"	24	
C2	#8	1	52"	11	1	54"	12	1	60"	13	
ANCHOR PIN	#6	2	36"	9	2	36"	9	2	36"	9	
GRATE HOLDER	#6	2	20"	5	2	20"	5	2	20"	5	
TOTAL STEEL WEIGHT (LBS)				133			150				165

DIMENSIONS		
DIAMETER	L1	L2
24"	31 $\frac{1}{4}$ "	14"
27"	36"	16 $\frac{1}{4}$ "
30"	39 $\frac{1}{2}$ "	18 $\frac{1}{2}$ "

GRATE FOR 24" THROUGH 30" DIAMETER PIPE WITH CONCRETE END SECTION

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

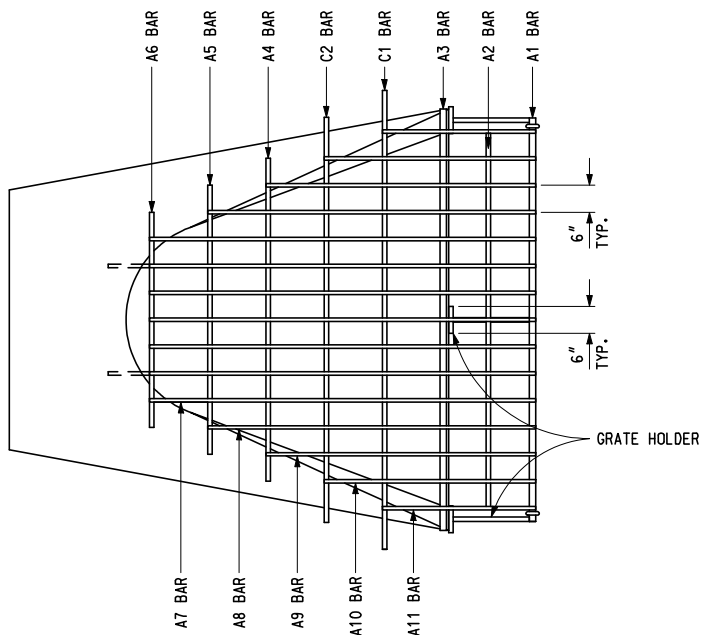
STEEL GRATES FOR END SECTIONS

9-14-2001
F.H.W.A. APPROVAL

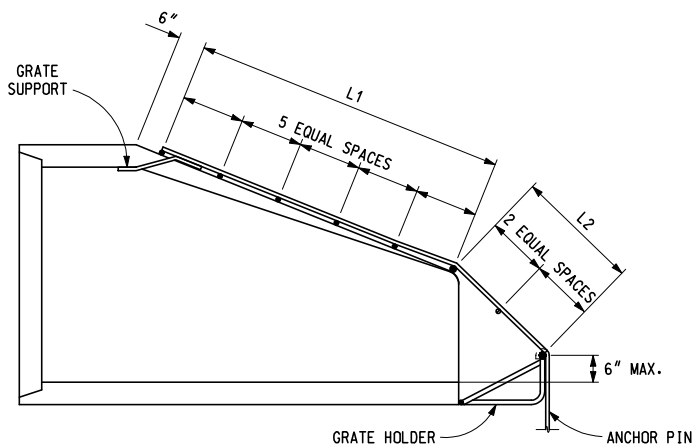
2-26-2001
PLAN DATE

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SHEET
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PLAN VIEW



LONGITUDINAL SECTION

DIMENSIONS		
DIAMETER	L1	L2
36"	60"	22 $\frac{1}{2}$ "
42"	60"	26 $\frac{1}{4}$ "
48"	70"	27 $\frac{3}{4}$ "

STEEL REINFORCEMENT QUANTITIES				
DIAMETER		36"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	78"	28
A2	#8	1	72"	16
A3	#10	1	80"	28
A4	#8	1	72"	16
A5	#8	1	60"	13
A6	#8	1	48"	10
A7	#6	7	82 $\frac{1}{2}$ "	72
A8	#6	2	70 $\frac{1}{2}$ "	18
A9	#6	2	58 $\frac{1}{2}$ "	15
A10	#6			
A11	#6	2	34 $\frac{1}{2}$ "	9
C1	#8	1	96"	21
C2	#8	1	84"	18
ANCHOR PIN	#8	2	36"	16
GRATE HOLDER	#8	2	20"	9
GRATE SUPPORT	#8	3	48"	31
TOTAL STEEL WEIGHT (LBS)				320

STEEL REINFORCEMENT QUANTITIES							
DIAMETER		42"			48"		
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)
A1	#10	1	84"	30	1	90"	32
A2	#8	1	72"	16	1	84"	18
A3	#10	1	86"	30	1	94"	33
A4	#8	1	72"	16	1	72"	16
A5	#8	1	60"	13	1	60"	13
A6	#8	1	48"	10	1	48"	10
A7	#6	7	86 $\frac{1}{4}$ "	75	7	97 $\frac{3}{4}$ "	85
A8	#6	2	74 $\frac{1}{4}$ "	19	2	83 $\frac{3}{4}$ "	21
A9	#6	2	62 $\frac{1}{4}$ "	16	2	69 $\frac{3}{4}$ "	17
A10	#6	2	50 $\frac{1}{4}$ "	13	2	55 $\frac{3}{4}$ "	14
A11	#6	2	38 $\frac{1}{4}$ "	10	2	41 $\frac{3}{4}$ "	10
C1	#8	1	96"	21	1	108"	23
C2	#8	1	96"	21	1	96"	21
ANCHOR PIN	#6	2	36"	9	2	36"	9
GRATE HOLDER	#6	2	20"	5	2	20"	5
GRATE SUPPORT	#8	3	48"	31	3	48"	31
TOTAL STEEL WEIGHT (LBS)				335	358		

GRATE FOR 36" THROUGH 48" DIAMETER PIPE WITH CONCRETE END SECTION

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

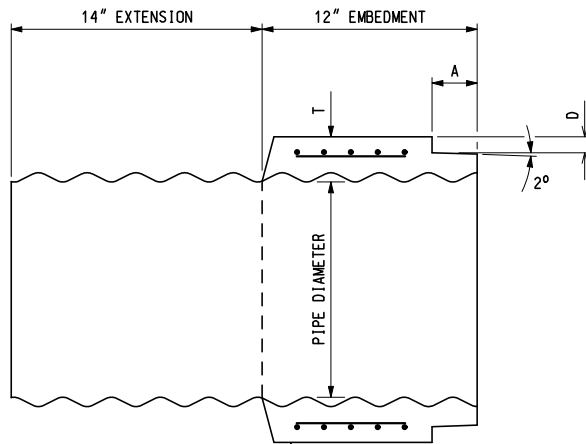
STEEL GRATES FOR END SECTIONS

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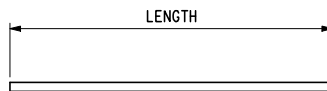
SHEET
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PIPE DIAMETER	DIMENSIONS		
	T	A	D
12"	2"	2 1/2"	7/8"
15"	2 1/4"	2 1/2"	7/8"
18"	2 1/2"	2 3/4"	7/8"
21"	2 3/4"	2 3/4"	7/8"
24"	3"	3"	7/8"
27"	3 1/4"	4"	3/4"
30"	3 1/2"	4 1/8"	1 1/8"
36"	4"	4 1/8"	1 1/2"
42"	4 1/2"	5"	2 1/2"
48"	5"	5"	2 3/4"

CONCRETE STRENGTH AND REINFORCEMENT
SHALL BE AS SPECIFIED IN THE CURRENT
A.S.T.M. C76 - 85a

CONNECTING ADAPTOR (CORRUGATED STEEL PIPE TO CONCRETE PIPE OR CONCRETE END SECTION)



A BAR



C BAR
(FOR 12" DIAMETER THROUGH 30" DIAMETER PIPE)



C BAR
(FOR 36" DIAMETER THROUGH 48" DIAMETER PIPE)

BAR DETAILS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

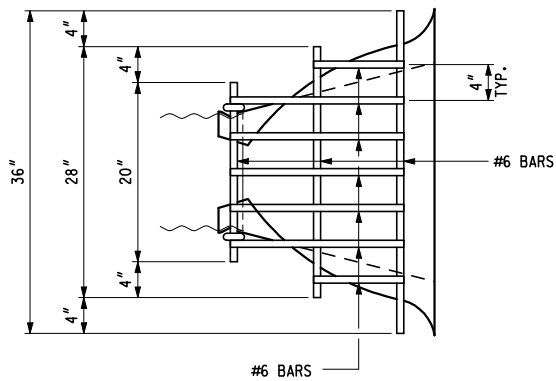
STEEL GRATES FOR END SECTIONS

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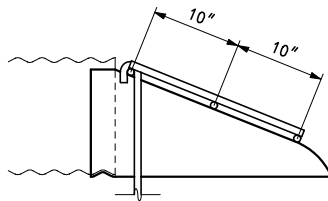
2-26-2001
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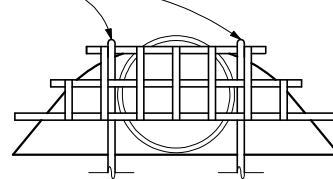


PLAN VIEW



LONGITUDINAL VIEW

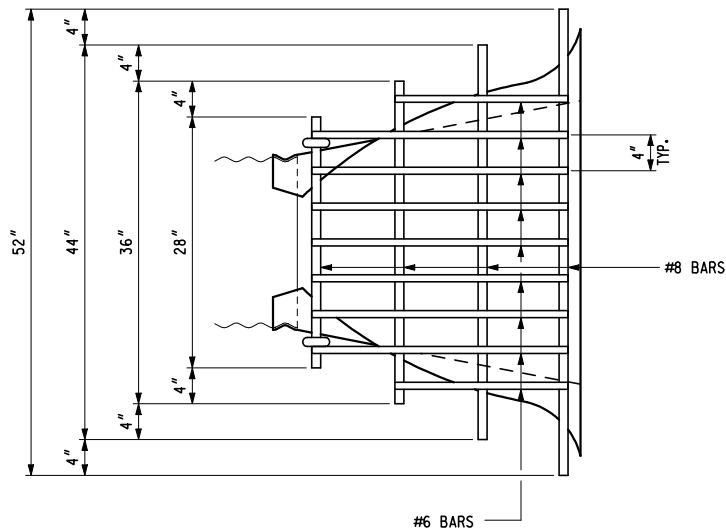
36" LONG ANCHOR PIN
MADE FROM #6 BAR
(2 PER GRATE)



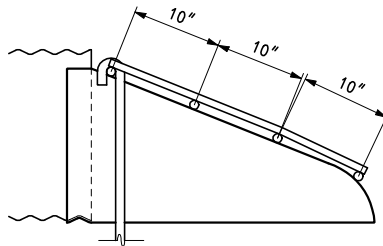
END VIEW

GRATE FOR 12" DIAMETER PIPE WITH STEEL END SECTION

34 LBS STEEL REQUIRED PER GRATE

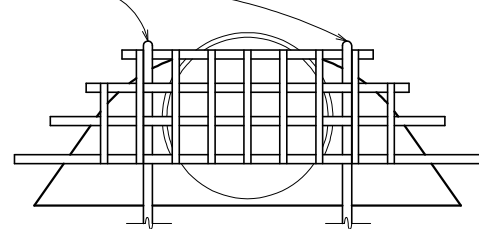


PLAN VIEW



LONGITUDINAL VIEW

42" LONG ANCHOR PIN
MADE FROM #6 BAR
(2 PER GRATE)



END VIEW

GRATE FOR 18" DIAMETER PIPE WITH STEEL END SECTION

76 LBS STEEL REQUIRED PER GRATE

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

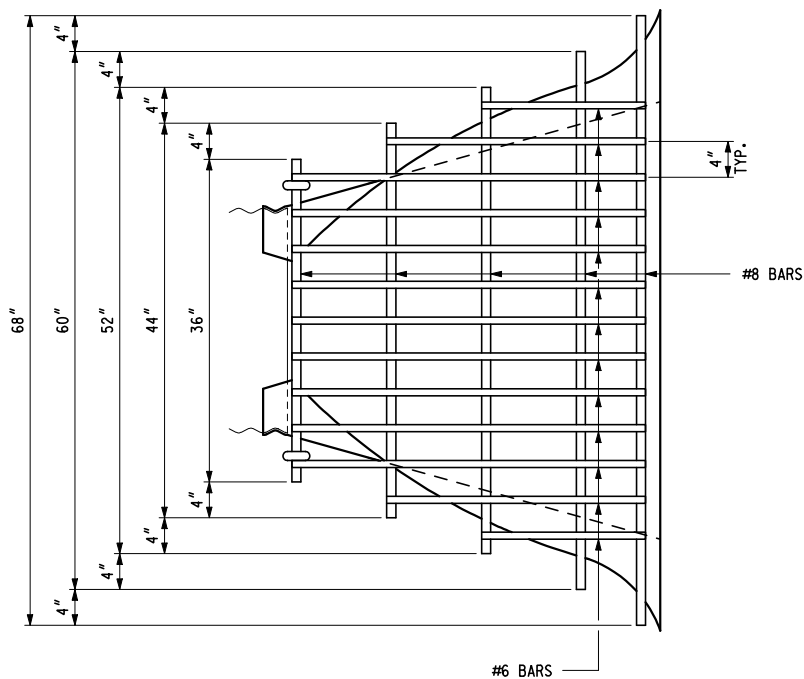
STEEL GRATES FOR END SECTIONS

9-14-2001
F.H.W.A. APPROVAL

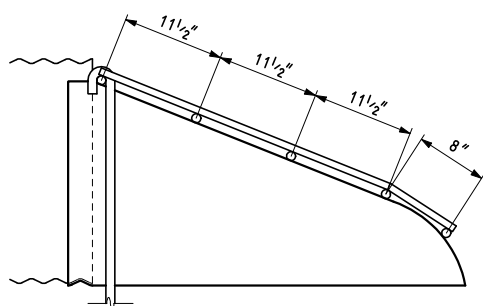
2-26-2001
PLAN DATE

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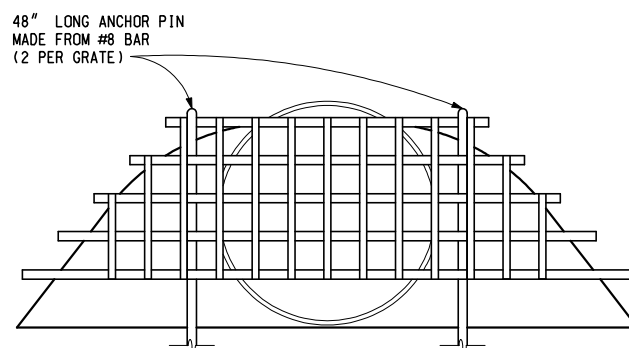
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PLAN VIEW



LONGITUDINAL VIEW



END VIEW

GRATE FOR 24" DIAMETER PIPE WITH STEEL END SECTION

137 LBS STEEL REQUIRED PER GRATE

NOTES:

ALL MATERIALS AND WORKMANSHIP SHALL BE ACCORDING TO THE CURRENT STANDARD SPECIFICATIONS.

FABRICATION OF GRATE SHALL BE BY WELDING EACH BAR INTERSECTION.

SEE STANDARD PLAN R-86-SERIES FOR PRECAST CONCRETE END SECTIONS.

PRECAST CONCRETE END SECTIONS FROM DIFFERENT MANUFACTURERS VARY IN EXACT WIDTH AND SHAPE OF THE OPENING. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE GRATE WILL ADEQUATELY COVER THE OPENING.

SEE STANDARD PLAN R-88-SERIES FOR STEEL END SECTIONS.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR

STEEL GRATES FOR END SECTIONS

9-14-2001
F.H.W.A. APPROVAL

2-26-2001
PLAN DATE

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