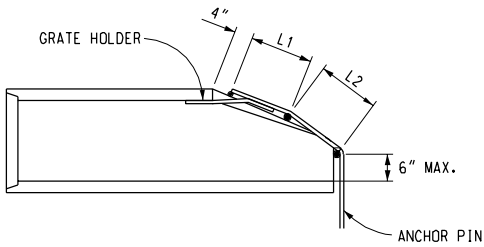


PLAN VIEW

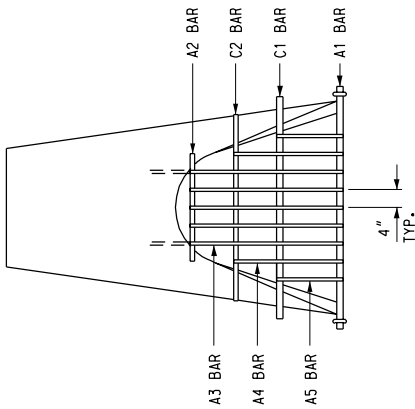


LONGITUDINAL SECTION

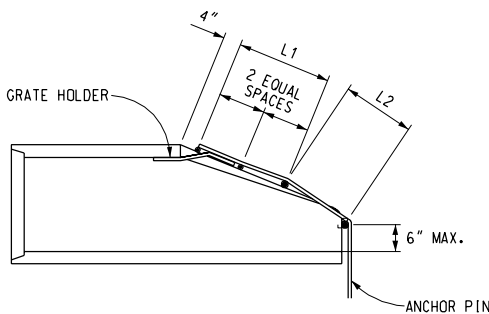
STEEL REINFORCEMENT QUANTITIES											
DIAMETER		12"			15"			18"			
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	
A1	#10	1	34"	12	1	40"	14	1	48"	17	
A2	#6	5	24"	15	5	28"	17	7	28"	24	
A3	#6				2	14"	3	2	14"	3	
C1	#10	1	36"	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			82

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

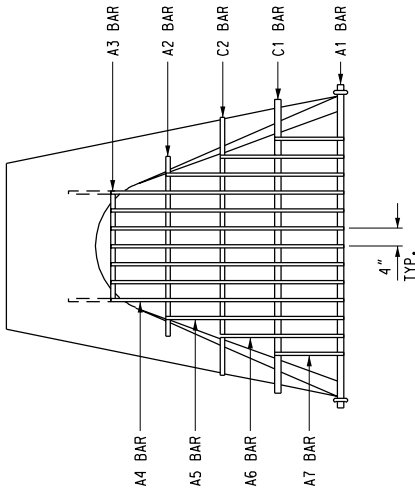
STEEL REINFORCEMENT QUANTITIES					
DIAMETER		21"			
BAR	BAR SIZE	NUMBER REQUIRED	LENGTH	WEIGHT (LBS)	
A1	#10	1	54"	19	
A2	#8	1	24"	5	
A3	#6	5	37"	23	
A4	#6	2	26 1/2"	7	
A5	#6	2	16"	4	
C1	#10	1	52"	18	
C2	#8	1	44"	9	
ANCHOR PIN	#6	2	36"	9	
GRATE HOLDER	#6	2	20"	5	
TOTAL STEEL WEIGHT (LBS)				99	

DIMENSIONS		
DIAMETER	L1	L2
21"	21"	16"

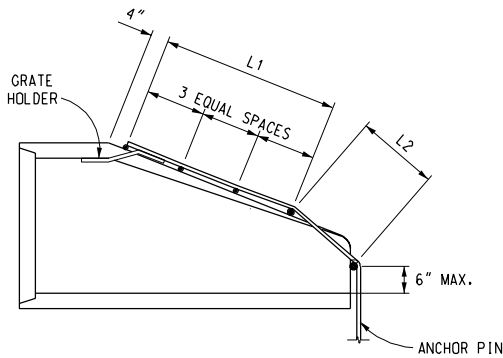
GRATE FOR 21" DIAMETER PIPE WITH CONCRETE END SECTION

	ENGINEER OF CONSTRUCTION & TECHNOLOGY _____ ENGINEER OF MAINTENANCE _____ ENGINEER OF TRAFFIC AND SAFETY _____	ENGINEER - ROAD DESIGN _____ ENGINEER OF DESIGN DEPARTMENT DIRECTOR Gregory J. Rosine BY: CHIEF ENGINEER/DEPUTY DIRECTOR BUREAU OF HIGHWAY TECHNICAL SERVICES _____	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES STANDARD PLAN FOR  <h2 style="text-align: center;">STEEL GRATES FOR END SECTIONS</h2>		
	PREPARED BY DESIGN DIVISION DRAWN BY: <u>B.L.T.</u> CHECKED BY: <u>W.K.P.</u>	9-14-2001 F.H.W.A. APPROVAL	2-26-2001 PLAN DATE	<b>R-92-C</b>	SHEET 1 OF 6

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PLAN VIEW



LONGITUDINAL SECTION

GRATE FOR 24" THROUGH 30" DIAMETER PIPE WITH CONCRETE END 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 <sup>1</sup> / <sub>4</sub> "	39	7	52 <sup>1</sup> / <sub>4</sub> "	46	7	58 <sup>1</sup> / <sub>4</sub> "	51	
A5	#6	2	34 <sup>3</sup> / <sub>4</sub> "	9	2	40 <sup>1</sup> / <sub>4</sub> "	10	2	45	11	
A6	#6	2	24 <sup>1</sup> / <sub>2</sub> "	6	2	28 <sup>1</sup> / <sub>4</sub> "	7	2	31 <sup>3</sup> / <sub>4</sub> "	8	
A7	#6				2	18 <sup>1</sup> / <sub>4</sub> "	4	2	18 <sup>1</sup> / <sub>2</sub> "	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		

DIMENSIONS

DIAMETER	L1	L2
24"	31 <sup>1</sup> / <sub>4</sub> "	14"
27"	36"	16 <sup>1</sup> / <sub>4</sub> "
30"	39 <sup>1</sup> / <sub>2</sub> "	18 <sup>1</sup> / <sub>2</sub> "

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

STEEL GRATES  
FOR END SECTIONS

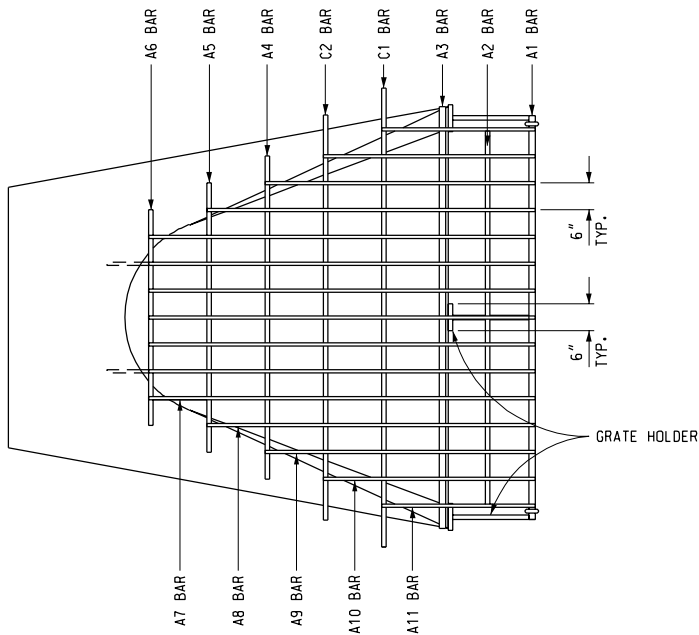
9-14-2001  
F.H.W.A. APPROVAL

2-26-2001  
PLAN DATE

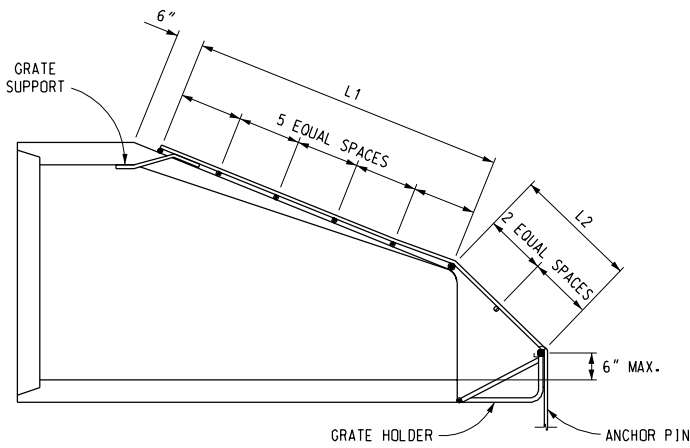
R-92-C

SHEET  
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PLAN VIEW



LONGITUDINAL SECTION

DIMENSIONS		
DIAMETER	L1	L2
36"	60"	22 <sup>1</sup> / <sub>2</sub> "
42"	60"	26 <sup>1</sup> / <sub>4</sub> "
48"	70"	27 <sup>3</sup> / <sub>4</sub> "

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 <sup>1</sup> / <sub>2</sub> "	72
A8	#6	2	70 <sup>1</sup> / <sub>2</sub> "	18
A9	#6	2	58 <sup>1</sup> / <sub>2</sub> "	15
A10	#6			
A11	#6	2	34 <sup>1</sup> / <sub>2</sub> "	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 <sup>1</sup> / <sub>4</sub> "	75	7	97 <sup>3</sup> / <sub>4</sub> "	85
A8	#6	2	74 <sup>1</sup> / <sub>4</sub> "	19	2	83 <sup>3</sup> / <sub>4</sub> "	21
A9	#6	2	62 <sup>1</sup> / <sub>4</sub> "	16	2	69 <sup>3</sup> / <sub>4</sub> "	17
A10	#6	2	50 <sup>1</sup> / <sub>4</sub> "	13	2	55 <sup>3</sup> / <sub>4</sub> "	14
A11	#6	2	38 <sup>1</sup> / <sub>4</sub> "	10	2	41 <sup>3</sup> / <sub>4</sub> "	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

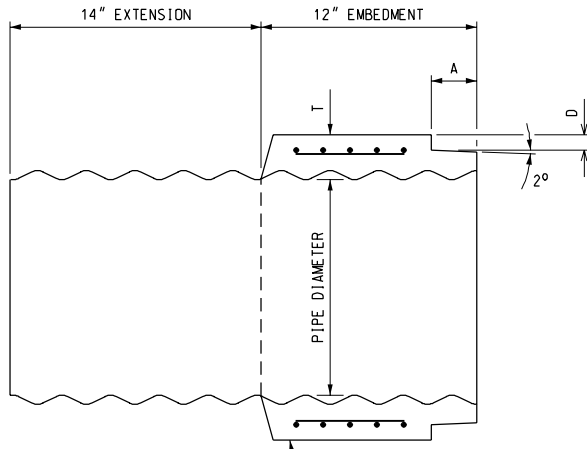
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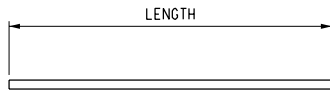


CONCRETE STRENGTH AND REINFORCEMENT SHALL BE AS SPECIFIED IN THE CURRENT A.S.T.M. C76 - 85a

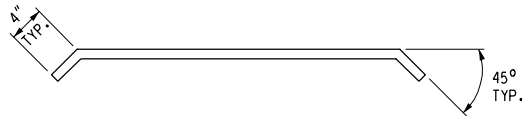
PIPE DIAMETER	DIMENSIONS		
	T	A	D
12"	2"	2 1/2"	7/8"
15"	2 1/4"	2 1/2"	7/8"
18"	2 1/2"	2 3/4"	7/8"
21"	2 3/4"	2 3/4"	7/8"
24"	3"	3"	7/8"
27"	3 1/4"	4"	3/4"
30"	3 1/2"	4 1/8"	1 1/8"
36"	4"	4 1/8"	1 1/2"
42"	4 1/2"	5"	2 1/2"
48"	5"	5"	2 3/4"

### 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

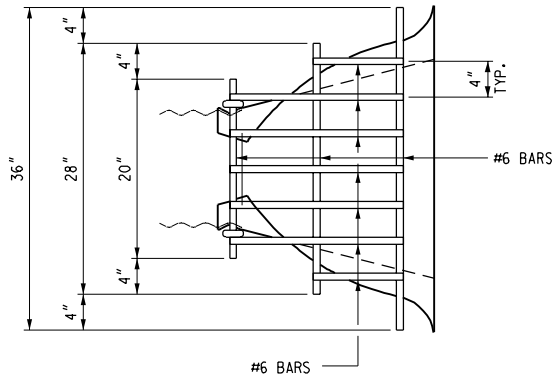
## STEEL GRATES FOR END SECTIONS

9-14-2001  
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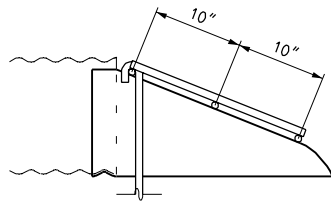
2-26-2001  
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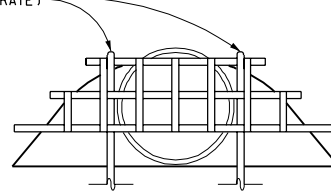


PLAN VIEW



LONGITUDINAL VIEW

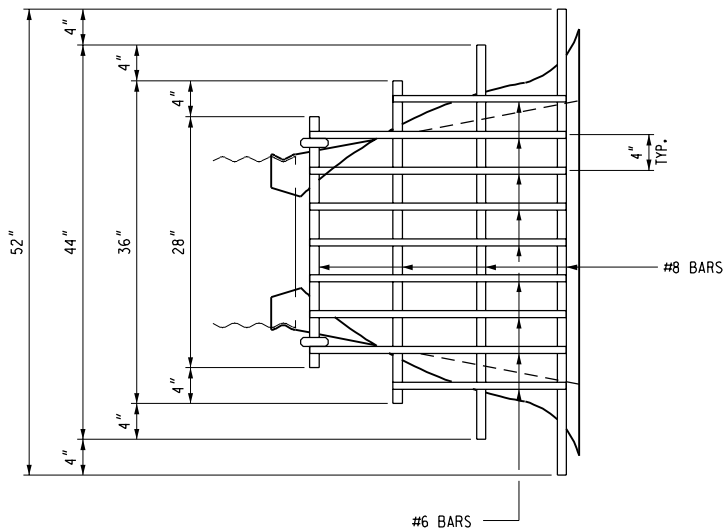
36" LONG ANCHOR PIN  
MADE FROM #6 BAR  
(2 PER GRATE)



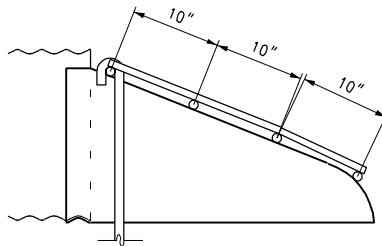
END VIEW

**GRATE FOR 12" DIAMETER PIPE WITH STEEL END SECTION**

34 LBS STEEL REQUIRED PER GRATE

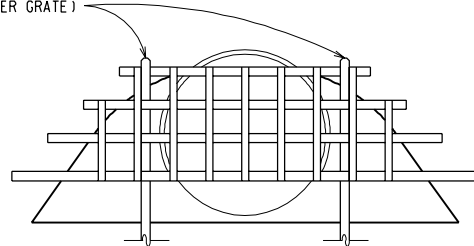


PLAN VIEW



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**

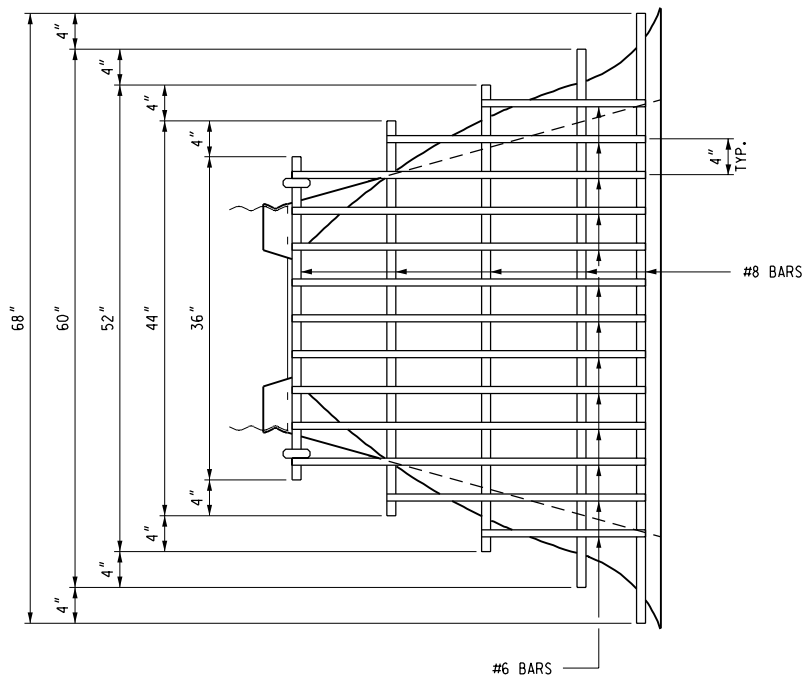
9-14-2001  
F.H.W.A. APPROVAL

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PLAN DATE

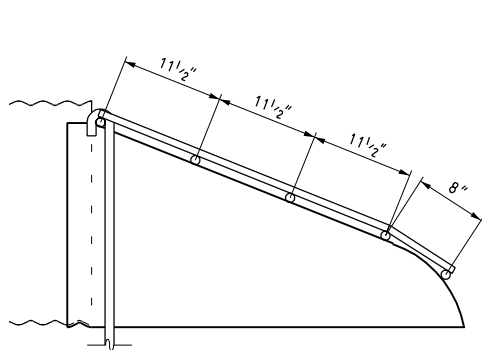
**R-92-C**

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5 OF 6

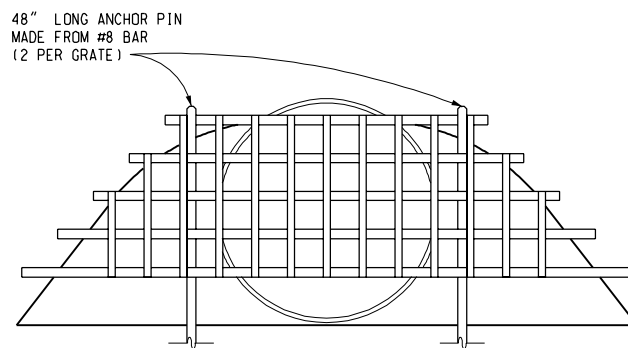
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PLAN VIEW



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

**R-92-C**

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