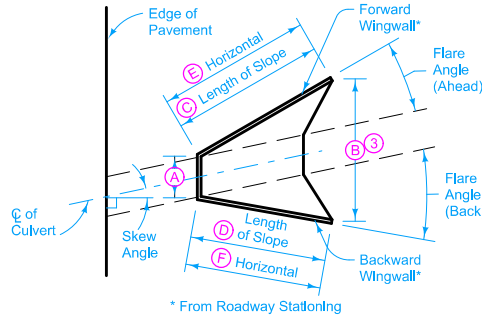
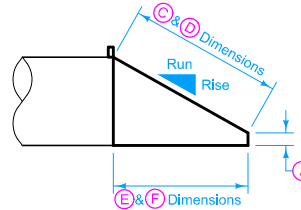


**INSTALLATION TYPES**

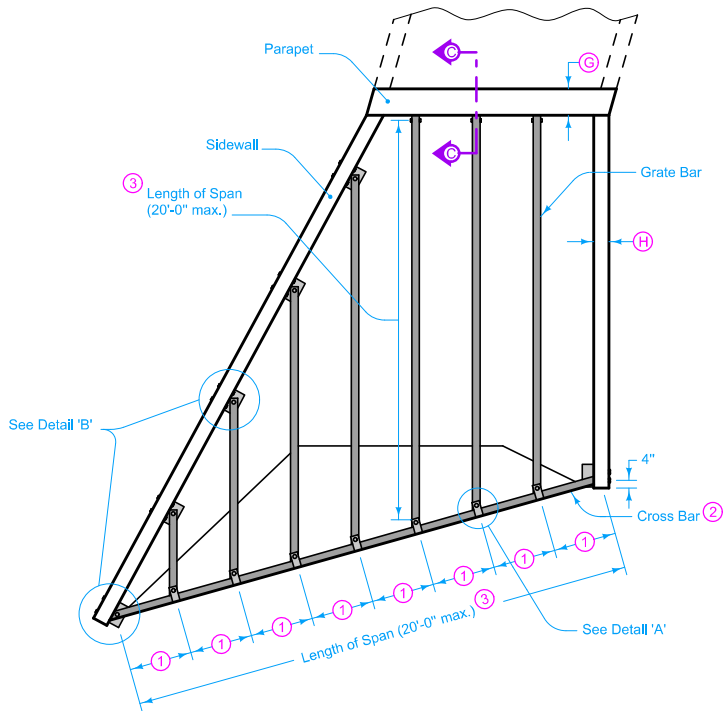
Grate bars to be perpendicular to direction of traffic flow.



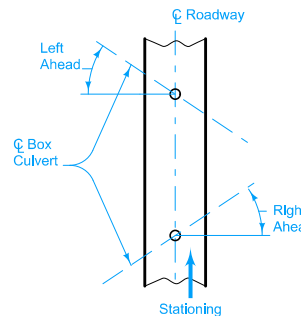
**TOP VIEW**



**SIDE VIEW  
DETAILS OF DIMENSIONS**



**INSTALLATION PLAN**



**SKEW ANGLE DETERMINATION**

GRATE & CROSS BAR SIZE REQUIREMENTS		
Length of Span	Nominal Pipe Size (2)	O.D. Size
less than 12'	3.0"	3.5"
12'-16'	3.5"	4.0"
greater than 16'	4.0"	4.5"

The dimensions shown in the "Tabulation of Safety Grate Treatment" are from the original construction plans. Verify these dimensions at the site before fabricating components.

Submit shop drawings. Approval of drawings is not required as part of the fabrication process. Drawings will be used to document the item as constructed.

Use correct pipe diameters and correct dimensions. Ensure safety grate fits properly into the headwall opening.

Reinforcing steel may be encountered when drilling holes through the existing structure wall.

Install bolts and lock nuts complying with Article 4153.06 at all locations as shown. Use brackets that comply with ASTM A36 and are galvanized per ASTM A123. Use steel washers meeting the dimensional requirements of Materials I.M. 453.07.

Furnish Schedule 40 Pipe meeting the requirements of Article 4153.05. Galvanize all pipes, fittings, and hardware after all cutting, welding, drilling and fabrication. In the shop drawings, show members planned for field cutting and drilling to provide for installation tolerances. Repair galvanizing of those members according to Materials I.M. 410.

Gas Metal-Arc and Flux-Cored Arc welding may be used for welding incidental items as indicated on this sheet, provided that the fabricator furnishes certifications for the gas, and uses approved filler metal and qualified welders approved by the Iowa DOT.

Payment for "Safety Grate, (Type 1, 2, 3, or 4), Culvert" is full compensation for furnishing all materials and work necessary to fabricate and install the grate system as required for each headwall opening.

Possible Contract Items:  
Safety Grate, (Type 1, 2, 3, or 4), Culvert

Possible Tabulation:  
108-24

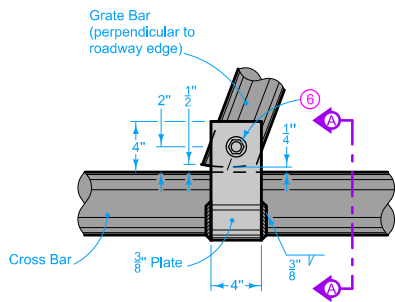
- 1 Equal spaces 24 inches minimum, 30 inches maximum, edge of sidewall to center of bracket or center to center of bracket.
- 2 Cross Bar diameter equal to or greater than Grate Bar diameter.
- 3 If more than 20 feet, midspan support is required. Refer to sheets 3 and 4.

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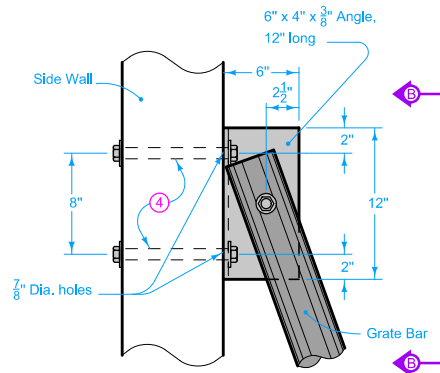
REVISIONS: Modified notes.

*Brian Smith*  
APPROVED BY DESIGN METHODS ENGINEER

**SAFETY GRATES  
FOR BOX CULVERTS**

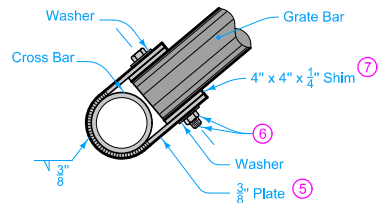


**DETAIL 'A'  
TOP VIEW**

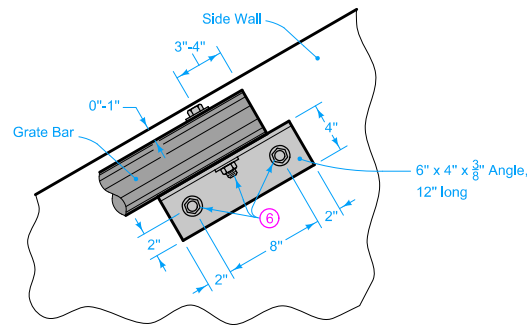


**DETAIL 'B'  
TOP VIEW**

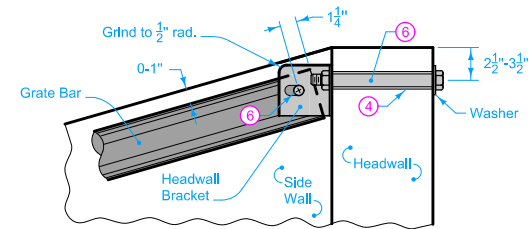
- ④ Holes are to be  $\frac{7}{8}$  inch diameter made with equipment designed to cut through concrete and reinforcing steel.
- ⑤ Bend plates or strips without cracking material.
- ⑥  $\frac{3}{4}$  inch bolt, lock nut and washers. All holes are to be  $\frac{7}{8}$  inch diameter.
- ⑦ Shim thickness equal to difference in diameters of Grate Bar and Cross Bar.



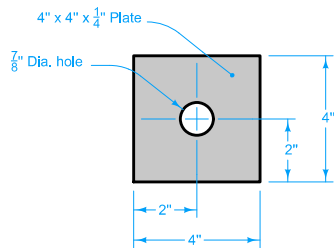
**SECTION A-A**



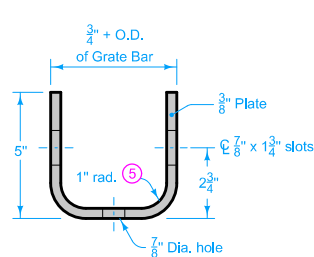
**SECTION B-B**



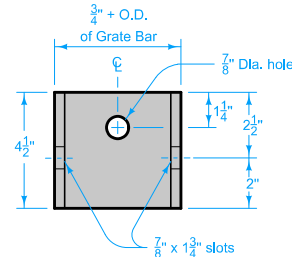
**SECTION C-C**




**SHIM DETAIL**



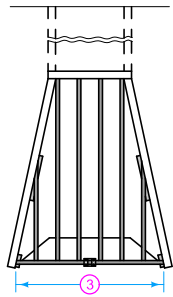
**HEADWALL BRACKET  
TOP VIEW**



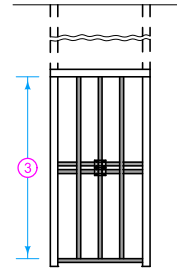
**HEADWALL BRACKET  
FRONT VIEW**

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REVISIONS: Modified notes.		SHEET 2 of 4
 APPROVED BY DESIGN METHODS ENGINEER		
<b>SAFETY GRATES FOR BOX CULVERTS</b>		

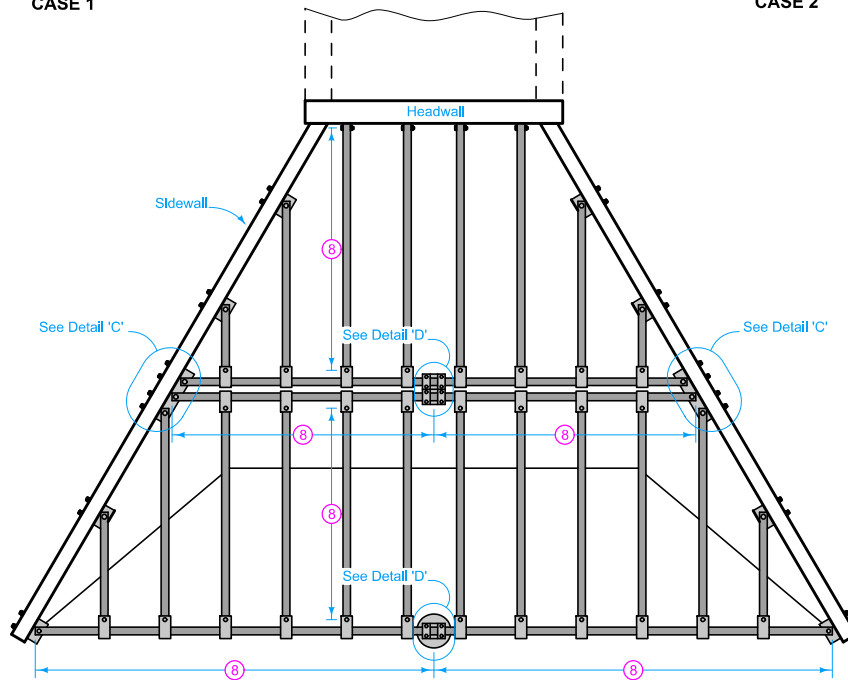
- ③ If more than 20 feet, midspan support is required. Refer to sheets 3 and 4.
- ⑧ Length of span (20 feet maximum).



CASE 1

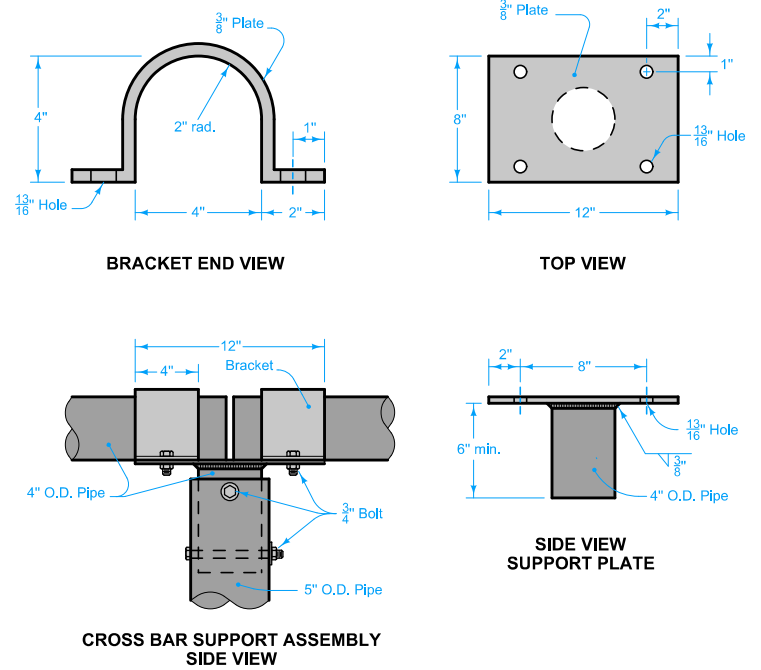
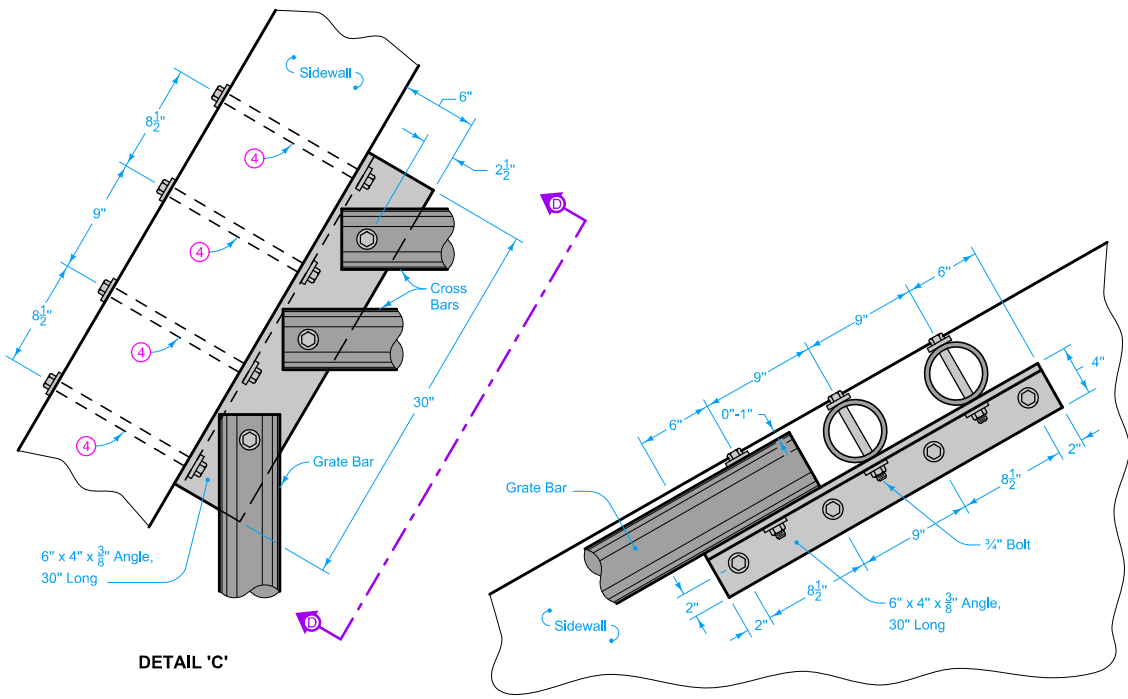


CASE 2

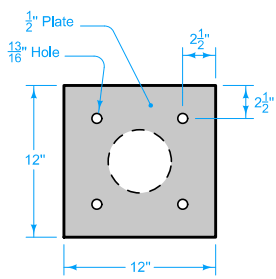
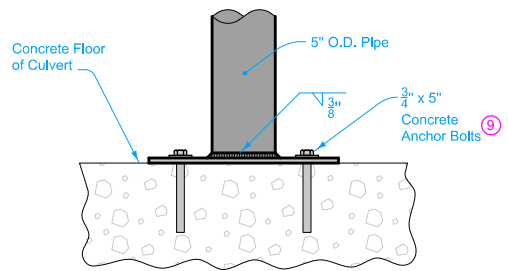
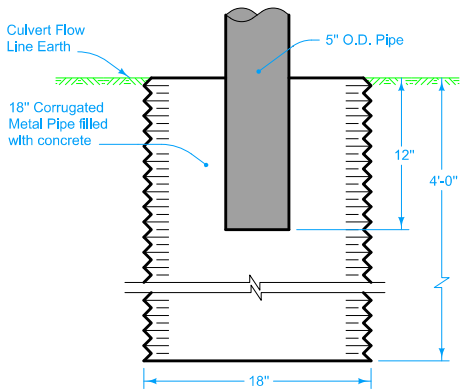


INSTALLATION PLAN WITH MIDSPAN SUPPORT


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REVISIONS: Modified notes.		
<i>Brian Smith</i>		
APPROVED BY DESIGN METHODS ENGINEER		
<b>SAFETY GRATES FOR BOX CULVERTS</b>		



**DETAIL 'D'**



- ④ Holes are to be  $\frac{7}{8}$  inch diameter made with equipment designed to cut through concrete and reinforcing steel.
- ⑨ Set approved anchor bolts using epoxy grout as described in the Materials I.M. 453.08 for anchor bolts.

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REVISIONS: Modified notes.		SHEET 4 of 4
 APPROVED BY DESIGN METHODS ENGINEER		
<b>SAFETY GRATES FOR BOX CULVERTS</b>		