

SUDAS Revision Submittal Form

Status Date: As of 5/20/2025 **Topic:** Thrust blocks and anchor block sizing
Manual: Both **Manual Location:** Design Section 4C-1, K
& Spec Figure 5010.101

Requested Revision:

K. Thrust Blocks, Anchor Blocks, and Restrained Joints

Concrete thrust blocks, anchor blocks, and restrained joints are used to counteract joint movement at points where piping changes directions or at dead-ends.

- 1. Thrust Blocks:** Concrete thrust blocks are typically used on pipes ~~16~~ 12 inches in diameter or smaller on horizontal and upward bending fittings. Thrust blocks may be used on ~~other~~ pipes independently or in combination with restrained joints. Table 4C-1.01 assumes a bearing area of thrust blocks based on 1,000 psf soil pressure and 150 psi water pressure. Where water pressures are higher and/or soil conditions are poor, the designer should design the correct block size using the equation below Table 4C-1.01. No bolts should come into contact with the concrete thrust blocks. If necessary, polyethylene wrap should be wrapped around the pipe, including the bolt circle, before the concrete is placed. Concrete should have a minimum compressive strength of 4,000 psi at 28 days.

Table 4C-1.01: Thrust Block Minimum Bearing Surface (SF)

Pipe Size (inches)	Bends				Tee or Dead-end
	11.25°	22.5°	45°	90°	
4	1	1 2	2 3	4	3
6	1 2	2 3	4 5	8	6
8	2	4	7 8	14	10
10	3	6	11 12	21	15
12	4 5	8 9	16	29 30	21
14	5 6	11	21 22	39 40	28
16	7	14	27 28	50 51	36
18	9	17 18	34 35	63 64	45
20	11	21 22	42 43	78	55
24	15 16	31	60 61	111	78 79
30	24	47 48	92 93	171	121
36	34	67 68	132 133	244 245	173

Note: Areas based upon water pressure of 150 psi and allowable soil pressure of 1,000 psf. AWWA Recommends a 1.5 factor of safety (S_f), which is not part of this table or the formula below.

Required Area, $ft^2 = S_f (2) (\text{water pressure, psi})(\text{cross-sectional area of pipe outside diameter, in}^2) (\sin(\text{angle of bend} / 2)) / (\text{allowable soil pressure, psf})$

- 2. Anchor Blocks:** Anchor blocks are typically used on pipes 12 inches in diameter or smaller on vertical downward bend fittings. Mains larger than 12 inches should use restrained joints as the primary means of thrust restraint on vertical downward bend fittings. Anchor blocks may be used on pipes independently or in combination with restrained joints. Table 4C-1.02 size of the anchor block based on a 150 psi water pressure. Where water pressures are higher, the designer should design the correct block size using the equation below Table 4C-1.02. Where an anchor block is the sole means of restraint on a vertical downward bend, the plans should detail the size and shape of the anchor block. The engineer should also verify the face of the anchor block can resist the horizontal thrust component (T_x) created by the fitting. No bolts should come into contact

with the concrete thrust blocks. If necessary, polyethylene wrap should be wrapped around the pipe, including the bolt circle, before the concrete is placed. Concrete should have a minimum compressive strength of 4,000 psi at 28 days.

Table 4C-1.02: Anchor Block Sizing

Pipe Diameter	Degree Bend (Θ)	Weight (Pounds)	Volume (Cu. Yards) (V _g)	Strap Bar Size ¹	Embedment ¹
4	11.25	530	0.1	#5	18
	22.5	1,040	0.3		
	45	1,920	0.5		
6	11.25	1,100	0.3	#5	18
	22.5	2,150	0.6		
	45	3,970	1.0		
8	11.25	1,890	0.5	#5	18
	22.5	3,700	1.0		
	45	6,830	1.7		
10	11.25	2,840	0.7	#5	18
	22.5	5,560	1.4		
	45	10,270	2.6		
12	11.25	4,010	1.0	#5	18
	22.5	7,860	2.0		
	45	14,520	3.6	#7	24
14	11.25	5,390	1.4	#5	18
	22.5	10,560	2.7	#6	24
	45	19,510	4.9	#8	30
16	11.25	6,960	1.8	#5	18
	22.5	13,650	3.4	#7	24
	45	25,230	6.3	#9	30

¹ – Values were taken from the Oregon DOT Standard Detail RD250 Table C

Values in the table have a safety factor $S_f = 1$

$$V_g = S_f PA \sin\Theta / W_m \quad T_x = PA (1 - \cos\Theta)$$

23. Restrained Joints:

- For Pipe Diameters 8 inch through 12 inch:** Provide a minimum of 40 feet of restrained pipe in all directions along the pipe from the fitting for pipe diameters 8 inch through 12 inch, depths of bury of at least 5 feet, and a maximum test pressure of 150 psi.
- For Pipe Diameters Greater than ~~14~~ 12 inch:** Restrained joints are typically used on pipes larger than ~~14~~ 12 inches in diameter. They may be used on other pipe sizes independently or in combination with concrete thrust blocks. See pipe manufacturer's recommendations for determining restrained lengths of pipe required.

Reason for Revision: Questions were raised regarding the detail for vertical bends showing both restrained joints and thrust blocks.

Comments: None.

Region:	☒ Central	☐ East	☐ West
Comments:	Change “stirrup” to “strap” as that’s the term we commonly use. Leave table as is with no additional safety factor. Use restrained joints on pipes 14 inch and greater. <i>Note - done.</i>		
Action:	☐ Deferred	☐ Not Approved	☒ Approved

Region:	☐ Central	☒ East	☐ West
Comments:	Use restrained joints on pipes greater than 12 inch. <i>Note - done.</i>		
Action:	☐ Deferred	☐ Not Approved	☒ Approved

Region:	☐ Central	☐ East	☒ West
Comments:	None.		
Action:	☐ Deferred	☐ Not Approved	☒ Approved

Final Regional Action Summary: All 3 regions approved; see comments above.

Board of Directors Action: Approved.