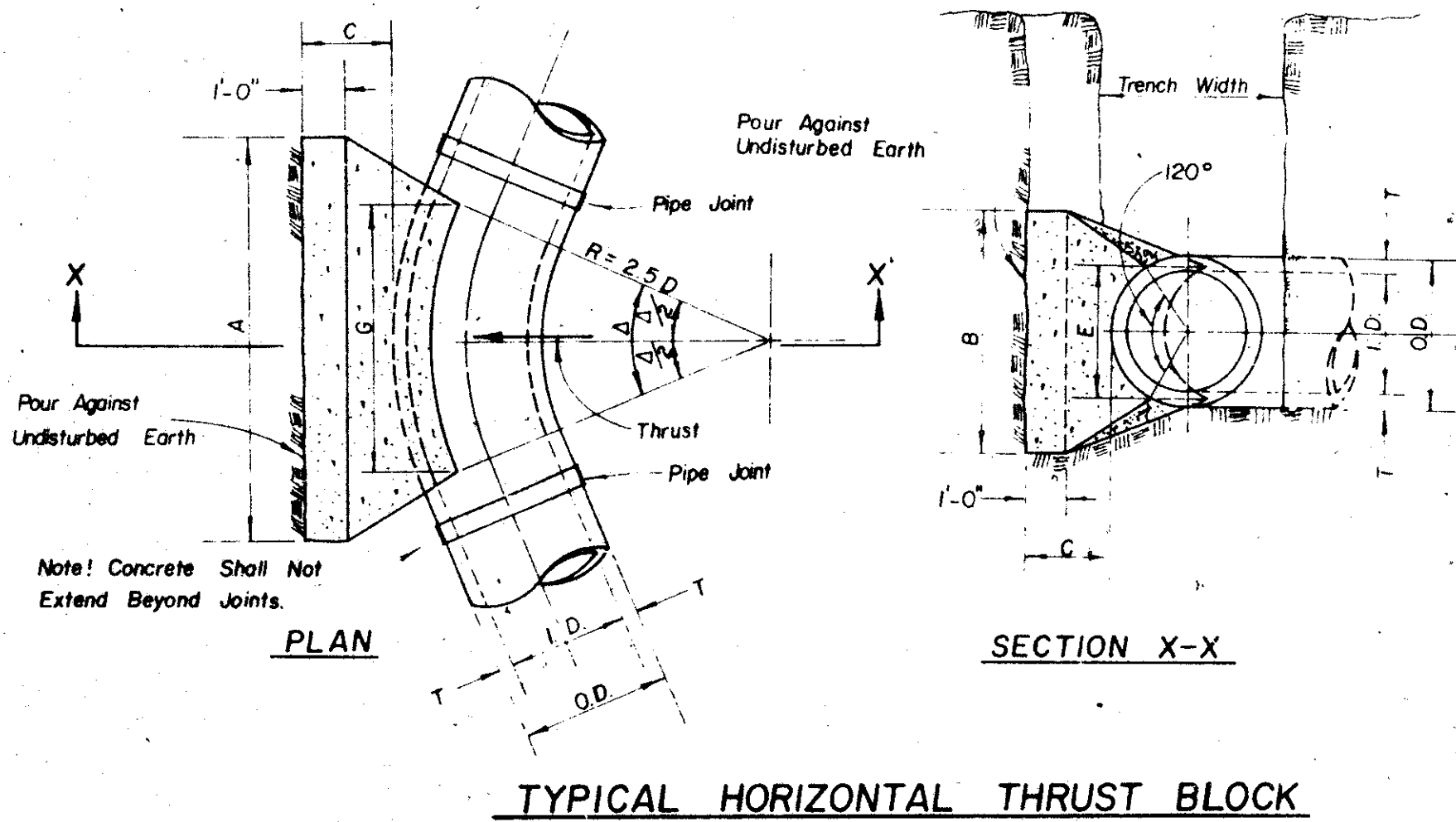


# HORIZONTAL BENDS

		$\Delta = 11.25^\circ$											$\Delta = 22.50^\circ$											$\Delta = 30^\circ$											$\Delta = 45^\circ$											$\Delta = 67.50^\circ$																																																																																																																																																																																																																																																																																		
I.D. (in.)	T in.	EARTH			ROCK			I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK			I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK			I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK			I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK			I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK																																																																																																																																																																																																																																																																														
		A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.																																																																																																																																																																																																																																																																									
4.6,8	0.4	1.5	1.5	0.9	4.6,8	0.4	1.0	1.0	1.5	C.1	1.0	1.0	0.1	4.6,8	0.8	2.0	1.5	1.5	0.1	1.0	1.0	0.1	4.6,8	1.5	3.9	2.0	2.0	0.2	1.5	1.5	0.1	4.6,8	2.1	5.6	3.0	2.0	0.3	2.0	1.5	0.2	4.6,8	2.1	5.6	3.0	2.0	0.3	2.0	1.5	0.2	4.6,8	3.1	12.6	5.5	2.5	0.8	3.5	2.0	0.4	10,12	3.1	12.6	5.5	2.5	0.8	3.5	2.0	0.4	10,12	4.7	28.3	7.5	4.0	1.9	5.0	3.0	0.9	16,18	4.7	28.3	7.5	4.0	1.9	5.0	3.0	0.9	16,18	6.2	50.3	11.5	4.5	3.5	6.5	4.0	1.6	24	6.2	50.3	11.5	4.5	3.5	6.5	4.0	1.6	24	7.8	58.9	12.0	5.0	4.8	7.5	4.0	2.2	30	7.8	58.9	12.0	5.0	4.8	7.5	4.0	2.2	30	9.4	84.9	14.5	6.0	8.2	9.5	4.5	3.8	36	9.4	84.9	14.5	6.0	8.2	9.5	4.5	3.8	36	10.9	115.5	17.0	7.0	12.8	11.0	5.5	6.3	42	10.9	115.5	17.0	7.0	12.8	11.0	5.5	6.3	42	12.5	150.9	19.0	8.0	18.4	13.0	6.0	9.2	48	12.5	150.9	19.0	8.0	18.4	13.0	6.0	9.2	48	14.0	191.0	21.5	9.0	26.0	15.0	6.5	12.9	54	14.0	191.0	21.5	9.0	26.0	15.0	6.5	12.9	54	15.6	235.9	24.0	10.0	35.6	16.0	7.5	17.6	60	15.6	235.9	24.0	10.0	35.6	16.0	7.5	17.6	60	17.1	285.3	26.0	11.0	46.0	18.0	8.0	23.0	66	17.1	285.3	26.0	11.0	46.0	18.0	8.0	23.0	66	18.7	339.5	28.5	12.0	57.8	19.0	9.0	28.4	72	18.7	339.5	28.5	12.0	57.8	19.0	9.0	28.4	72	20.2	398.5	31.0	13.0	75.7	21.0	9.5	37.4	78	20.2	398.5	31.0	13.0	75.7	21.0	9.5	37.4	78	21.8	462.1	33.0	14.0	94.7	22.0	10.5	46.5	84	21.8	462.1	33.0	14.0	94.7	22.0	10.5	46.5	84	23.3	530.5	35.5	15.0	114.4	24.5	11.0	58.2	90	23.3	530.5	35.5	15.0	114.4	24.5	11.0	58.2	90	24.9	603.6	38.0	16.0	138.9	25.5	12.0	70.0	96	24.9	603.6	38.0	16.0	138.9	25.5	12.0	70.0	96

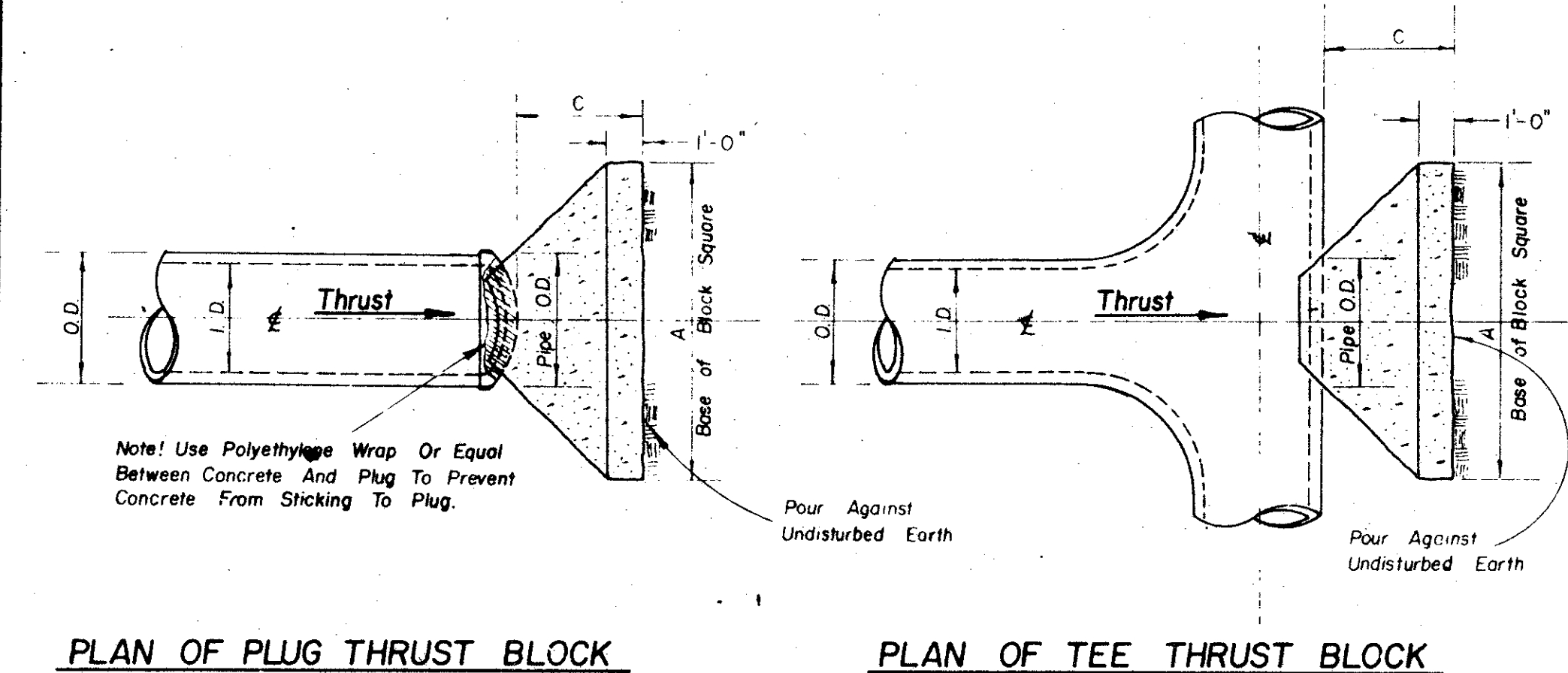
		$\Delta = 90^\circ$										
I.D. (in.)	G ft.	Thrust tons	EARTH			ROCK			I.D. (in.)			
			A ft.	B ft.	Volume c.y.	A ft.	B ft.	Volume c.y.				
4.6,8	2.7	7.1	5.0	1.5	0.4	2.0	2.0	0.2	4.6,8			
10,12	4.0	16.0	6.5	2.5	1.0	3.5	2.5	0.5	10,12			
16,18	6.0	36.0	9.0	4.0	2.4	4.5	4.0	1.0	16,18			
20	6.6	44.4	10.0	4.5	3.1	6.0	4.0	1.5	20			
24	7.9	64.0	14.5	4.5	5.0	8.0	4.0	2.1	24			
30	9.9	75.0	15.0	5.0	6.7	10.0	4.0	3.3	30			
36	11.9	108.0	18.0	6.0	11.4	12.0	4.5	5.3	36			
42	13.9	147.0	21.0	7.0	17.8	14.0	5.5	8.7	42			
48	15.9	192.0	24.0	8.0	26.2	16.0	6.0	12.4	48			
54	17.9	243.0	27.0	9.0	36.9	18.0	7.0	18.1	54			
60	19.9	298.8	30.0	10.0	50.3	20.0	7.5	24.0	60			
66	21.8	362.8	33.0	11.0	66.2	22.0	8.5	32.5	66			
72	23.8	431.8	36.0	12.0	85.6	24.0	9.0	41.0	72			
78	25.7	506.7	39.0	13.0	108.2	26.0	10.0	53.2	78			
84	27.7	587.7	42.0	14.0	134.4	28.0	10.5	64.8	84			
90	29.7	674.6	45.0	15.0	164.9	30.0	11.5	81.2	90			
96	31.6	767.5	48.0	16.0	199.0	32.0	12.0	95.1	96			



TYPICAL HORIZONTAL THRUST BLOCK

## TEES & PLUGS

I.D. (in.)	Thrust tons	C ft.	EARTH		ROCK	
			A ft.	Volume c.y.	A ft.	Volume c.y.
4.6,8	5.1	1.5	2.5	0.3	2.0	0.2
10,12	11.3	1.5	3.5	0.6	2.5	0.3
16,18	25.5	2.0	5.5	1.6	4.0	0.9
20	31.5	2.0	6.0	1.9	4.0	0.9
24	45.2	2.5	7.0	3.1	5.0	1.7
30	53.0	3.0	7.5	4.1	5.5	2.4
36	76.3	4.0	9.0	7.3	6.5	4.2
42	104.0	4.5	10.5	11.0	7.5	6.2
48	136.0	5.0	12.0	15.6	8.5	8.7
54	172.0	5.5	13.5	21.4	9.5	11.9
60	212.0	6.0	15.0	28.4	10.5	15.7
66	257.0	6.5	16.5	36.8	11.5	20.5
72	305.0	7.5	17.5	47.2	12.5	27.2
78	358.0	8.0	19.0	58.9	13.5	33.7
84	416.0	8.5	20.5	72.3	14.5	41.2
90	477.0	9.0	22.0	87.7	15.5	49.7
96	543.0	9.5	23.5	104.8	16.5	61.0

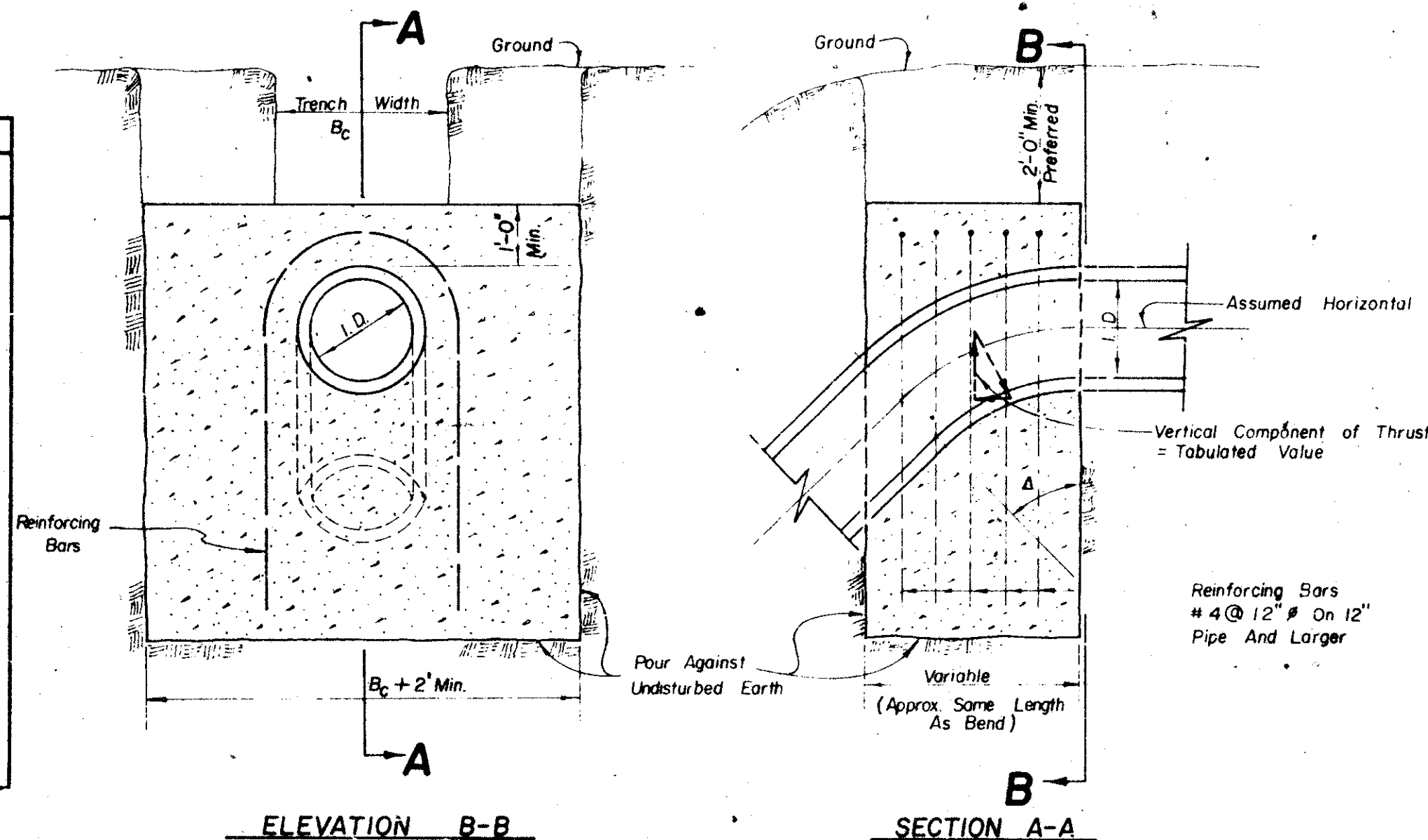


PLAN OF PLUG THRUST BLOCK

PLAN OF TEE THRUST BLOCK

## VERTICAL BENDS

$\Delta$	11.25°		22.50°		30°		45°		67.50°		90°		$-\Delta$
I.D. (in.)	Thrust tons	Volume c.y.	Thrust tons	Volume c.y.	Thrust tons	Volume c.y.	Thrust tons	Volume c.y.	Thrust tons	Volume c.y.	Thrust tons	Volume c.y.	I.D. (in.)
4.6,8	1.0	0.5	2.0	1.0	2.5	1.3	3.6	1.8	4.6	2.3	5.0	2.5	4.6,8
10,12	2.2	1.1	4.3	2.2	5.7	2.8	8.0	4.0	10.5	5.2	11.3	5.7	10,12
16,18	5.0	2.5	9.7	4.9	12.7	6.4	18.0	9.0	23.5	11.8	25.5	12.7	16,18
20	6.1	3.1	12.0	6.0	15.7	7.9	22.2	11.1	29.2	14.5	31.4	15.7	20
24	8.2	4.4	17.3	8.7	22.6	11.3	32.0	16.0	41.8	20.9	45.2	22.6	24
30	10.5	5.2	20.3	10.1	26.5	13.3	37.5	18.8	49.0	24.5	53.1	26.5	30
36	14.9	7.5	29.2	14.6	38.2	19.1	54.0	27.0	70.5	35.3	76.4	38.2	36
42	20.3	10.1	39.8	19.9	52.0	26.0	73.5	36.7	96.0	48.0	104.0	52.0	42
48	26.5	13.2	51.9	26.0	67.9	33.9	96.0	48.0	126.0	62.7	136.0	67.9	48
54	33.5	16.8	65.7	32.9	85.9	42.9	122.0	60.7	159.0	79.4	172.0	85.9	54
60	41.4	20.7	81.2	40.6	106.0	53.0	150.0	75.0	196.0	98.0	212.0	106.0	60
66	50.1	25.0	98.2	49.1	128.0	64.2	182.0	90.7	237.0	119.0	257.0	128.0	66
72	59.6	29.8	117.0	58.4	153.0	76.3	216.0	108.0	282.0	141.0	305.0	153.0	72
78	69.9	35.0	137.0	68.6	179.0	90.0	254.0	127.0	331.0	166.0	358.0	179.0	78
84	81.1	40.5	159.0	79.5	208.0	104.0	294.0	147.0	384.0	192.0	416.0	208.0	84
90	93.1	46.5	183.0	91.3	239.0	119.0	337.0	169.0	441.0	221.0	477.0	239.0	90
96	106.0	53.0	208.0	104.0	272.0	136.0	384.0	192.0	502.0	251.0	543.0	272.0	96



TYPICAL VERTICAL BEND THRUST BLOCK

### GENERAL NOTES

- All calculations are based on internal pressure of 200 p.s.i. for 24" I.D. pipe and smaller and 150 p.s.i. on 30" I.D. and larger.
- Volumes of vertical bend thrust blocks are net volumes of concrete to be furnished. The corresponding weight of the concrete (4,000 lb./c.y.) is equal to or greater than the vertical component of thrust on the vertical bend.
- All bearing surfaces of thrust blocks shall be poured against undisturbed earth or rock.
- Wall thickness (T) assumed here for estimating purposes only.
- Concrete for blocking shall be 2,000 p.s.i. concrete.
- Dimensions may be varied as required by field conditions where and as directed by the engineer. The volume of concrete blocking shall not be less than shown here.
- Payment for thrust blocks shall be made at the contract unit price per cubic yard of 2,000 p.s.i. concrete measured in place.

APPURTENANCE SHEET						
THRUST BLOCKS FOR PIPE BENDS & TEES & PLUGS						
DALLAS WATER UTILITIES DEPT.						
CITY OF DALLAS, TEXAS						
DESIGN	DRAWN	DATE	SCALE	NOTES	FILE	NO.
C.M.	R.L.	4/30/76	NONE	FOLDER	414-D	15

REVISED BY CHRIS MAURITZEN - DATE APRIL 30, 1976  
DRAWN BY R. LARA *Chris Mauritzen*