

THRUST BLOCK CALCULATOR

A USER'S GUIDE

#1

US SI

THRUST BLOCK CALCULATOR

#2

BLOCK TYPE

BEARING

GRAVITY

#3

PIPE & PRESSURE

—	Pipe Material	Ductile Iron
d	Nominal Pipe Diameter	8"
d_o	Pipe Outside Diameter AWWA C151 outside dia.	9.05 in
—	Fitting Type	Horizontal Bend
θ	Bend Angle Given	45 deg
P	Water Pressure Hydrostatic test pressure — NFPA 24 A.10.6.1(b)	140 psi

#4

SOIL & BLOCK

—	Soil Type Site condition	Soft clay
S_u	Horizontal Bearing Strength NFPA 24 Table A.10.6.1(c)	1,000 psf
H_t	Total Depth to Bottom of Block User determined	6 ft
h_{min}	Minimum Block Height $\geq D$ and $b \leq 2h$	2.27 ft
h_{max}	Maximum Block Height $\leq H_t/2$ and $b \geq h$	3.00 ft
h	Selected Block Height Between h_{min} and h_{max}	2.75 ft

#5

DESIGN ASSUMPTIONS

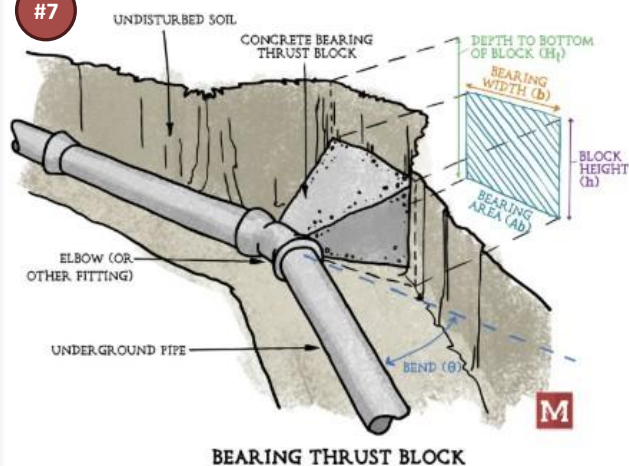
S_f	Safety Factor $S_f = 1 + \%$; usually 1.5	50 %
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#6

REFERENCES & DETAILS

Reference: NFPA 24, *Private Fire Service Mains*, 2025 Edition — A.10.6.1, Eq. [A.10.6.1a] & [A.10.6.1b], Table A.10.6.1(a) (thrust), Table A.10.6.1(c) (soil bearing), Figure A.10.6.1(b).

#7



#8

Thrust Force (T)	Required Bearing Area (A_b)	Calculated Block Width (b)
6,893 lbf	10.34 ft ²	3.76 ft ($\approx 3'-10"$)

#9

BEARING BLOCK CALCULATIONS

A	Pipe Area (Outside Diameter) $A = \pi d_o^2 / 4 = \pi (9.05 \text{ in})^2 / 4$	64.3 in ²
T	Thrust Force $T = 2 P A \sin(\theta/2) = 2 (140 \text{ psi})(64.3 \text{ in}^2) \sin(45^\circ/2)$	6,893 lbf
A_b	Required Bearing Area $A_b = T S_u / S_f = (6,893 \text{ lbf})(1.5) / (1,000 \text{ psf})$ [A.10.6.1a]	10.34 ft ²
b	Calculated Block Width $b = A_b / h$ [A.10.6.1b]	3.76 ft

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Reset

Print

DESCRIPTION

PURPOSE: The Thrust Block Calculator sizes concrete thrust blocks for underground fire mains to NFPA 24 (2025). It (1) calculates the thrust force at a bend, tee, or dead end from the pipe size, water pressure, and bend angle; (2) sizes a bearing block — the required bearing area against undisturbed soil and the resulting block dimensions; and (3) sizes a gravity block for vertical down-bends, where the block's own weight resists uplift. It supports ductile iron, PVC C900, and steel pipe, works in US or SI units, and prints a clean one-page report.

#1 UNIT TOGGLE: Switch between US customary and metric (SI). Every input and result updates instantly.

#2 BLOCK TYPE: Choose Bearing or Gravity. A bearing block resists thrust by bearing against undisturbed soil (horizontal bends, tees, dead ends, and concave-up vertical bends); a gravity block uses the block's own weight to resist uplift at concave-down vertical down-bends. The information tooltip explains when to use each.

#3 PIPE & PRESSURE: Enter the pipe material (ductile iron, PVC C900, or steel), nominal diameter, fitting type, bend angle θ , and water pressure P . The outside diameter d_o is looked up automatically. Use the hydrostatic test pressure per NFPA 24.

#4 SOIL & BLOCK: Select the soil type — its horizontal bearing strength S_b comes from NFPA 24 Table A.10.6.1(c). Enter the total depth to bottom of block H_t ; the tool then shows the allowable minimum and maximum block heights (h_{min} , h_{max}) so you can set a valid selected height h .

#5 DESIGN ASSUMPTIONS: Set the safety factor S_f — typically 50% (a 1.5 factor) for thrust-block design per NFPA 24.

#6 REFERENCES & DETAILS: Cites the governing NFPA 24 (2025) sections, equations, tables, and figure the calculation is based on.

#7 DIAGRAM: A labeled illustration of the selected block type, color-matched to the inputs and results — depth H_t , block height h , width b , bearing area A_b , and bend angle θ .

#8 RESULT CARDS: The headline outputs at a glance. Bearing: thrust force T , required bearing area A_b , and calculated block width b (with a practical rounded feet-and-inches value). Gravity: required block volume V_g in cubic yards, required weight W , and the minimum horizontal bearing area A_b .

#9 CALCULATIONS: The full step-by-step breakdown — pipe area A , thrust T , and each governing NFPA 24 equation with your values substituted, so every result is traceable.

RESET & PRINT: Reset returns every input to its default. Print produces a clean one-page report of the entire analysis in whichever unit system you've selected. (These buttons sit below the tool.)