

Pipe Design Parameters :

Pipe Cover:  $H := 6 \text{ ft}$   
 Nominal Pipe Diameter:  $D := 24 \text{ in}$   
 Cross-sectional Area:  $A := \pi \cdot \left(\frac{D}{2}\right)^2 = 452 \text{ in}^2$   
 Pipe Outside Diameter:  $D_o := 2.15 \text{ ft}$   
 Working Pressure:  $P_w := 60 \text{ psi}$   
 Unit Weight of Pipe:  $W_p := 57 \text{ plf}$

*Field Survey  
 As Builts*

*DIPRA Thrust Restraint Design - Table 2*

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Soil Characteristics :

Soil Unit Weight:  $\gamma := 120 \text{ pcf}$   
 Soil Designation: Silt 2  
 Soil Internal Friction Angle:  $\varphi := 29 \text{ deg} = 0.506 \text{ rad}$   
 Friction Factor:  $f_\varphi := .50$

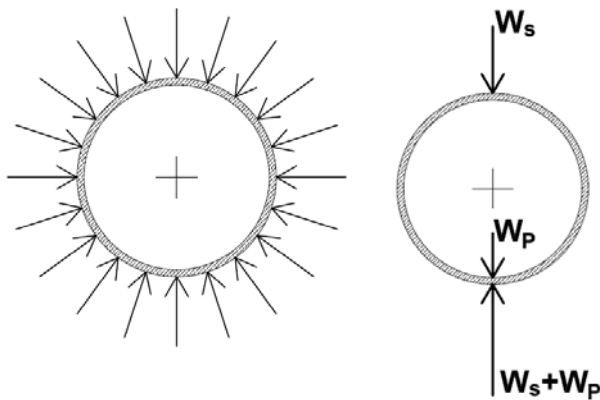
*Assumed*

*DIPRA Thrust Restraint Design - Table 3*

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Calculate Unit Frictional Force,  $F_f$  :



**Soil Pressure**

**Soil Force**

Soil Weight:

$W_s := \gamma \cdot D_o \cdot H = 1548 \text{ plf}$

Pipe Weight:

$W_p := 57 \text{ plf}$

*DIPRA Thrust  
 Restraint Design -  
 Table 2*

Unit Normal Force:

$W := 2 \cdot W_s + W_p = 3153 \text{ plf}$

$F_f := W \cdot \tan(\varphi \cdot f_\varphi) = 815 \text{ plf}$

Calculate Force To Be Restrained,  $F_u$  :

Operating Pressure:  $P_o := 60 \text{ psi}$

Factor of Safety:  $FS := 1.5$

$P_u := P_o \cdot FS = 90 \text{ psi}$

$F_u := P_u \cdot A = 40715 \text{ lbf}$

Linear Feet of Dead Pipe to Restrain Force:

$L := \frac{F_u}{F_f} = 50 \text{ ft}$