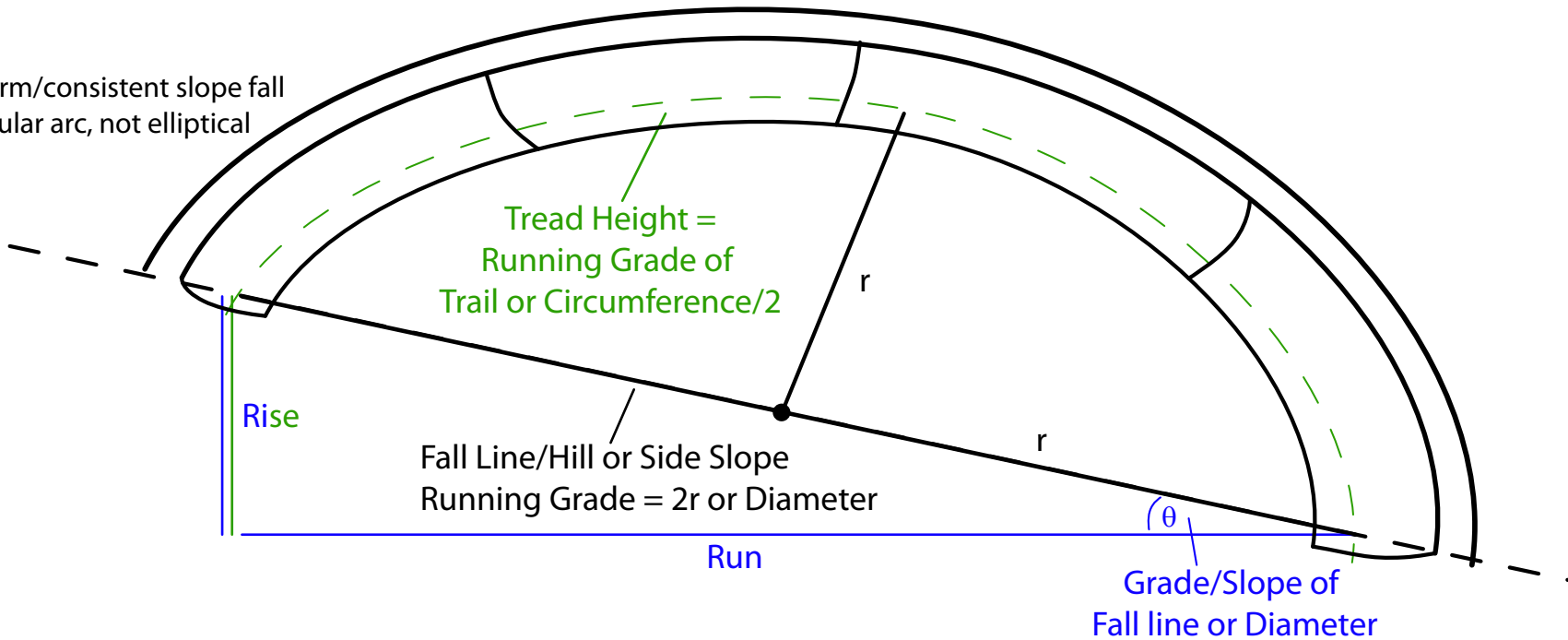


180° Turn Running Grade

(Approximate Turn Running Grade)*

*if uniform/consistent slope fall and circular arc, not elliptical



Example:

$$\text{Fall line Grade} = \text{Rise/Run} = 15\% = (15/100)\text{Tan}^{-1} = 8.53^\circ$$

$$\text{Rise} = \text{Sin } 8.53 \times 2(12 \text{ ft}) = 3.56 \text{ ft}$$

$$\text{Run} = \sqrt{24^2 - 3.56^2} = 23.73 \text{ ft}$$

$$\text{Grade} = \text{Rise/Run} = 3.56/23.73 = 0.149 = \sim 15\%$$

180 Turn Grade =

$$\text{Sin}((15/100)\text{Tan}^{-1})/(\pi/2) = 0.0944 = \sim 9.4\%$$

$$\text{or } 3.56/2\pi r / 2 = 3.56/2\pi r / 2 = 0.0944 = \sim 9.4\%$$

$$\text{Fall line Slope Grade} = \text{Rise/Run} =$$

$$\text{Rise} = \text{Sine of Fall Line} \times \text{Diameter or } 2r$$

$$\text{Run} = \sqrt{(2r)^2 - \text{Rise}^2}$$

$$\text{180 Turn Grade} = \text{Rise/Run} =$$

$$\text{Rise}/(\text{Circumference}/2) = \text{Rise}/(2\pi r)2 =$$

$$\text{Sine of Fall Line} \times 2r / ((2\pi r)/2) =$$

$$\text{Sin}((\% \text{Grade}/100)\text{Tan}^{-1})/(\pi/2)$$

or Rise/(Circumference/2)