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STAIRS DESIGN

WMF PHASE 6



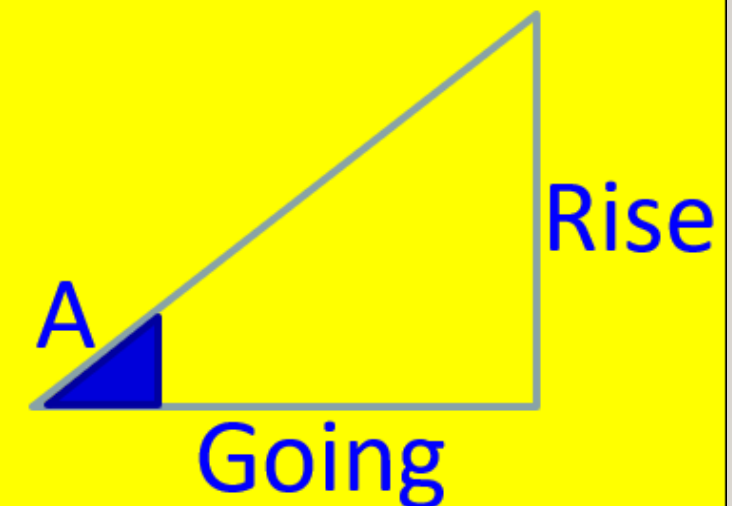
2 Maths Stair Check

- The two key regulations that must be checked out mathematically to make sure that they comply are:
- Twice the Rise plus the Going must fall between 550 and 700mm
- The Pitch must be less than 42 degrees
- **Both regulations (and all other regulations) must be satisfied for the stairs to be deemed acceptable**

$$(2R + G = 550 - 700)$$

To calculate the angle the formula used is:

$$\tan A = \frac{\text{Rise}}{\text{Going}}$$



3 Sample Calculation 1 Step 1

Two floors are 2700mm apart. Calculate the rise and going of a staircase from the lower floor to the upper floor that meets all building regulations.

Check against regulations.

First find the number of steps that divides into the total rise. Start by dividing the total rise by the **maximum number of steps**: Which is ?

$$2700 \div 16 = 168.75\text{mm}$$

This is within regulations of, but would be difficult to measure precisely, try 15.

$$2700 \div 15 = 180\text{mm}$$

Fifteen steps meets the regulations as does 180mm so now to see if it fits within the formula.

Twice the Rise plus the Going must fall between 550 and 700mm.

$$2R + G = 550 - 700\text{mm}$$



4 Sample Calculation 1 Step 2

Twice the Rise plus the Going must fall between 550 and 700mm.

$$2R + G = 550 - 700\text{mm}$$

Using the optimum going which is?

$$2(180) + \text{optimum going} = 550 - 700\text{mm}$$

$$2(180) + 250 = 610\text{mm} \quad \text{This is acceptable}$$

Therefore, we have 15 steps with a rise of 180mm and going of 250mm. Is this acceptable?

- Check Pitch

$$\begin{aligned} \bullet \quad \text{Tan } A &= \frac{\text{Rise}}{\text{Going}} & \text{Tan } A &= \frac{180}{250} & \text{Tan } A &= 0.720 & A &= \text{Tan}^{-1} 0.720 \\ & & & & & & A &= 35.75^\circ \end{aligned}$$

5 Sample Calculation 2 Step 1

- Two floors are 2035mm apart. A stairs is to be constructed between the floors with a maximum overall going of 3000mm. Calculate a rise and going that will satisfy all building regulations and allow safe passage between the floors.
- Divide the total rise by max. steps (16) to see if that will work out an even number.
- $2035 \div 16 = 127.187\text{mm}$ not a round number so try 15
- $2035 \div 15 = 135.666\text{mm}$ not a round number so try 14
- $2035 \div 14 = 145.357\text{mm}$ not a round number so try 13
- $2035 \div 13 = 156.538\text{mm}$ not a round number so try 12
- $2035 \div 12 = 169.583\text{mm}$ not a round number so try 11
- $2035 \div 11 = 185\text{mm}$ fits regulations max rise 220mm

6 Sample Calculation 2 Step 2

- Check if 11 steps will fit the building regulations that is 11 risers and 10 treads.
- Total going 3000mm \div 10 treads = 300mm Going 300mm
- Check formula $2R + G = ?$ $185 + 185 + 300 =$
- 670mm within regulations

- Check Pitch
- $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{185}{300}$ $\text{Tan } A = 0.6166$ $A = \text{Tan}^{-1} 0.6166$
 $A = 31.66^\circ$

9 Stair Maths Using Midpoint Example 2

- Select a suitable going to comply with the $2R + G$ formula of a private stairs with a total rise of 2450mm. An optimum rise of 175mm is supplied.
- Model Answer, correct method should prove whatever figures used.
 - 2450 divided by 175 = 14 (14 risers needed 13 threads formula $2R + G = 550 - 700\text{mm}$)
 - $175 + 175 = 350\text{mm}$ Mid point 625
 - $625 - 350 = 275$ going
 - (Recheck formula $175 + 175 + 275 = 625\text{mm}$ within regulations)
 - (Also check the pitch is less than 42°)
 - $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{175}{275}$ $\text{Tan } A = 0.6363$ $A = \text{Tan}^{-1} 0.6363$
 $A = 32.47^\circ$



10 Grangeegorman Visit Central Quad

Provide the 2 checks on the stairs measured in Grangeegorman

Twice the Rise plus the Going must fall between 550 and 700mm.

- Central Quad Main Stairs Ground Floor
- Rise 187mm Going 247mm
- Check Formula
- 620mm acceptable
- Check Pitch is less than 42°
- $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{187}{247}$ $\text{Tan } A = 0.757$ $A = \text{Tan}^{-1} 0.7570$
 $A = 37.12^\circ$

|| Grangeegorman Visit Central Quad

Provide the 2 checks on the stairs measured in Grangeegorman

Twice the Rise plus the Going must fall between 550 and 700mm.

- Central Quad Main Stairs 2nd level

- Rise 180mm Going 250mm

- Check Formula

- 620mm acceptable

- Check Pitch is less than 42°

- $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{180}{250}$ $\text{Tan } A = 0.72$ $A = \text{Tan}^{-1} 0.72$
 $A = 35.75^\circ$

12 Grangeegorman Visit Rathdown House

Provide the 2 checks on the stairs measured in Grangeegorman

Twice the Rise plus the Going must fall between 550 and 700mm.

- Rathdown House Lobby entrance
- Rise 150mm Going 425mm
- Check Formula
- 725mm not acceptable
- No need to check Pitch

15 Bolton St. Main Building Canteen

Provide the 2 checks on the stairs measured in Bolton St.

Twice the Rise plus the Going must fall between 550 and 700mm.

- 1st floor level Canteen stairs
- Rise 160mm Going 280mm
- Check Formula
- 600mm acceptable
- Check Pitch is less than 42°
- $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{160}{280}$ $\text{Tan } A = 0.571$ $A = \text{Tan}^{-1} 0.571$
 $A = 29.72^\circ$

17 Bolton St. Main Building Spiral Stairs

Provide the 2 checks on the stairs measured in Bolton St.

Twice the Rise plus the Going must fall between 550 and 700mm.

- Ground floor level Spiral stairs
- Rise 175mm Going 310mm
- Check Formula
- 660mm acceptable
- Check Pitch is less than 42°
- $\text{Tan } A = \frac{\text{Rise}}{\text{Going}}$ $\text{Tan } A = \frac{175}{310}$ $\text{Tan } A = 0.5645$ $A = \text{Tan}^{-1} 0.5645$
 $A = 29.44^\circ$