

Wah Yan College, Kowloon

Mathematical Modelling Activities

Ramps on our campus

Name: _____ Class: _____ () Date: _____

Introduction

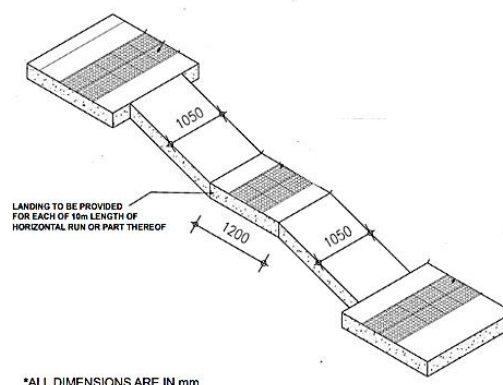
Have you tried to use the ramp besides St. Ignatius Chapel? In your opinion, is it a good ramp in design?



First, the ramp besides St. Ignatius Chapel has a gradient less than 1:12 and width of at least 1.05 m. Also, the ramp has provided with horizontal platform for every 10 m of inclined roads, which fulfils the safety regulation in Hong Kong.

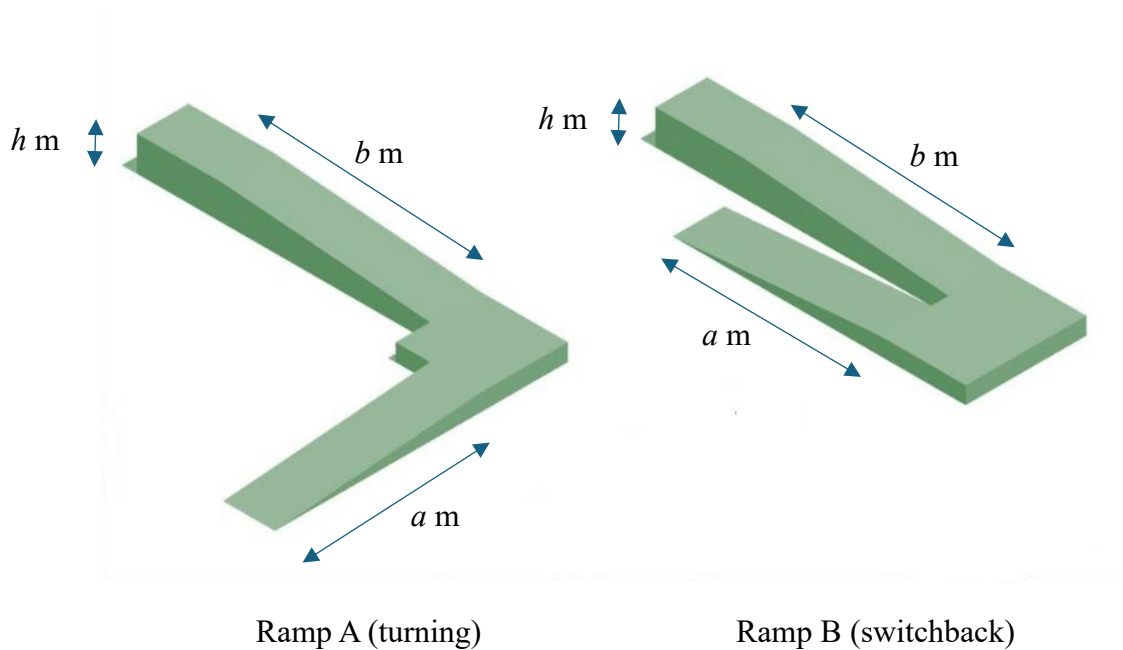
(Source: https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/BFA2008_e.pdf)

However, how can we justify whether a ramp is good in design besides the safety factors?



Task 1.1: Defining the question

The figure below shows the two ramps, A and B, with both fulfil the safety regulation:



Each ramp consists of two inclined planes with horizontal distance a and b (in metres) respectively, and their total vertical distance is h (in metres). In order to fulfil the safety regulation, each ramp has a horizontal platform between the two inclined planes.

Question 1: Which ramp, A or B, has a better design?
Please state clearly the factor(s) you have considered.

Task 1.2: Defining parameters and mathematical model

Now let us consider the time required for users to travel up the ramp with wheelchairs.
The travelling speed with different gradients of the ramp are suggested below:

Gradient of the ramp	1 : 20	1 : 15	1 : 12
Speed (ms^{-1}) for the user to travel the ramp upwards	2	1	0.5

Question 2: In addition to the above data, do you require further information for you to calculate the time required for users to travel up the ramp with wheelchairs?
If yes, please briefly describe them below.

Now you need to use the above information to estimate the time required (in second) for users with wheelchairs to travel the ramp upwards

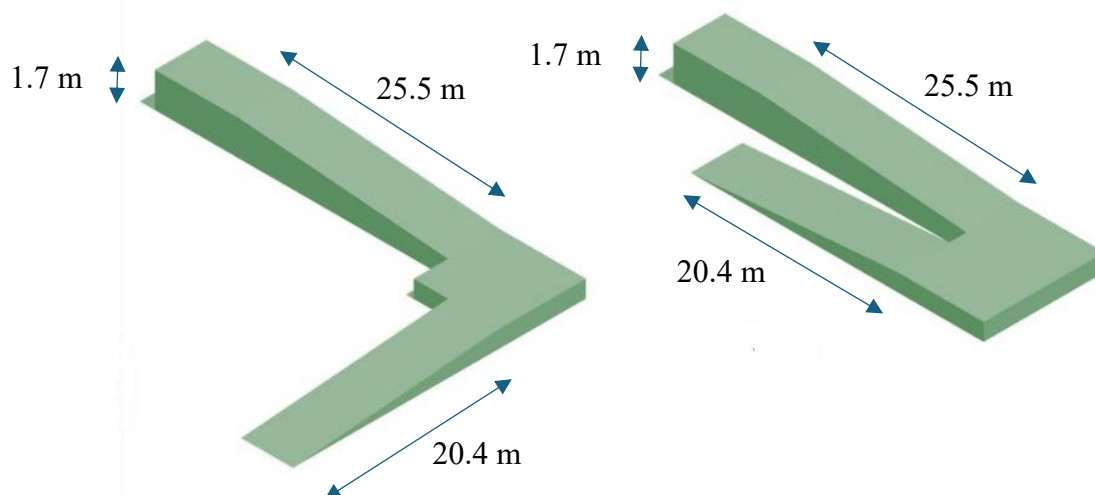
Question 3: With reference to the above information, set up formulas to estimate the time required (in second) for users with wheelchairs to travel up Ramp A (turning) and Ramp B (switchback).

(Note: It will be great if you can set up a formula which can be used to estimate the travelling time in both ramps.)

Task 2.1: Solving mathematical problems

Question 4:

Consider the ramp A and B below. Using your formulas, estimate the time required (in second) for users to travel the ramp upwards.



	Ramp A (turning)	Ramp B (switchback)
Time required to travel upwards		

Task 2.2: Drawing appropriate conclusions

Question 5: Which ramp, A or B, has a better design? Explain your answer.
(Note: Would you consider other factors besides the travelling time?)

Extra Task:

Try to justify whether the ramp besides St. Ignatius Chapel is good in design.