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Battle of the Beach

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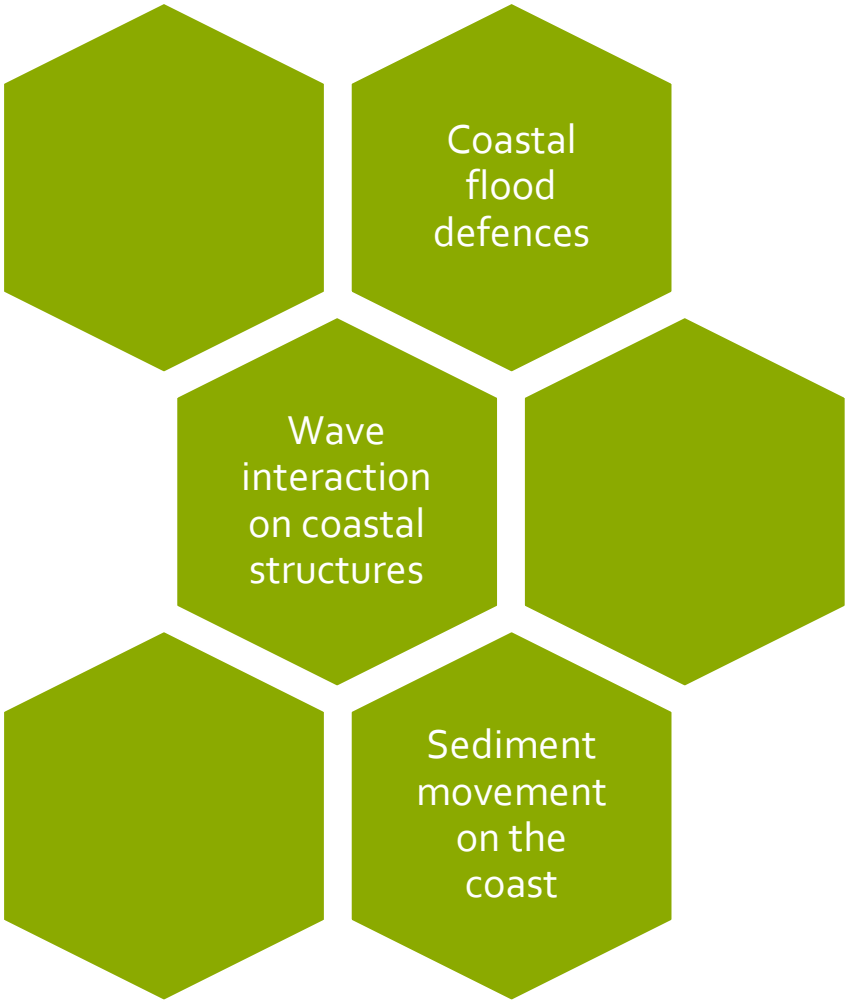
Introduction

- Skills gap in the coastal risk management sector
- Encourage young people into engineering profession
- Application of theory into real world concepts
- Bring coastal engineering into the classroom

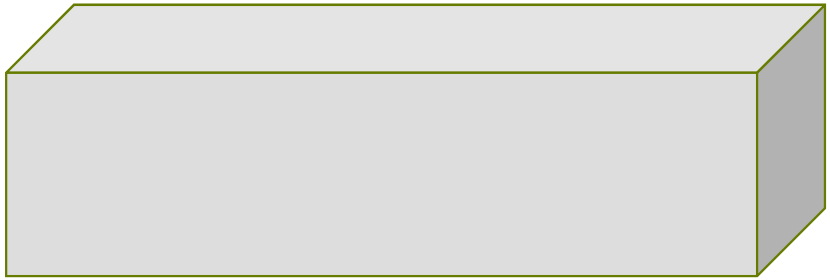
Concepts


Coastal flood defences
Wave interaction on coastal structures
Sediment movement on the coast

Flume tank

Criteria considered to decide the size of the flume tank

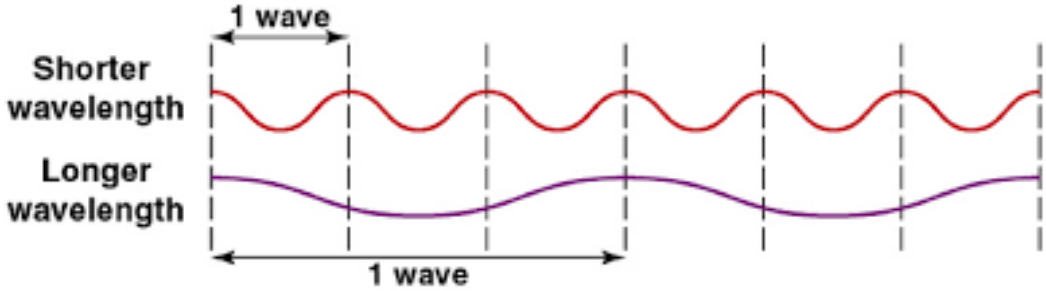
- Scaling effects
- Criteria of geometric similitude
- Length
- Width
- Height

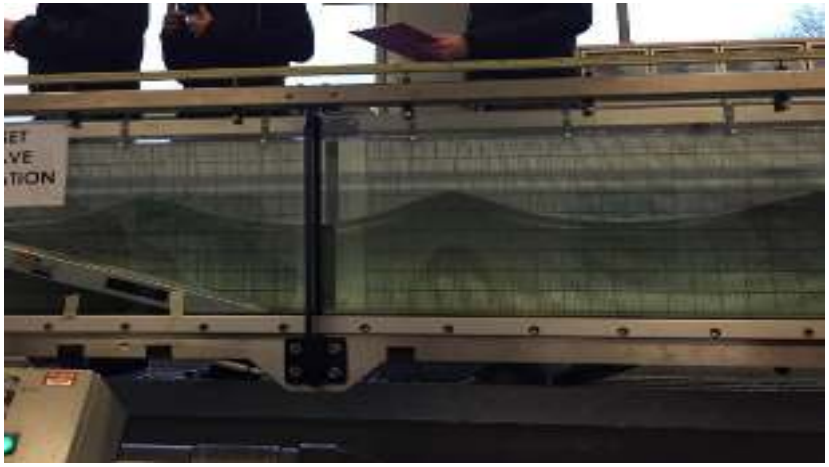


Tank dimensions will be; 1m x 0.5m x 0.4m (l x w x h).

Material; clear acrylic panes, 0.01m thick, connected by acrylic adhesive – the total mass of the tank given these dimensions would be 13kg.

Wave generator



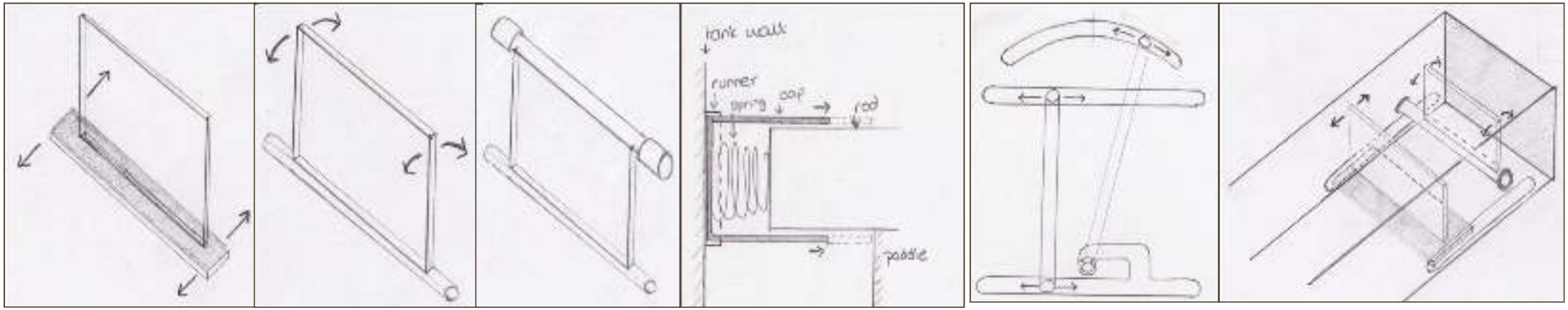


a) Short waves in deep water

b) Long waves in shallow water

Images show the set up in a University Lab, which isn't practical for the classroom.

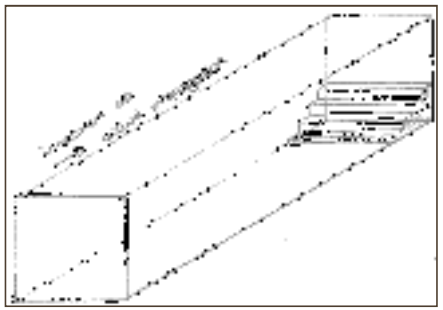
- To allow for the visual demonstration of both shallow and deep water waves
- Designed to operate as both a piston wave-maker and a hinge wave-maker
- Incorporates a "cap and spring" adjustable mechanism to allow for both types of waves to be produced with one paddle system, where the top of the paddle can be moved between runners to allow for both ranges of motion



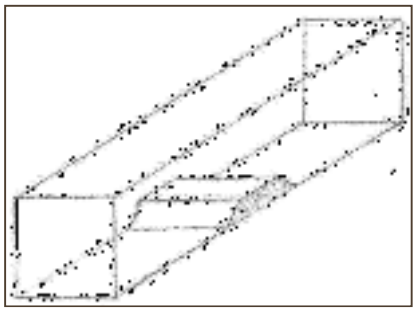
a) Piston paddle b) Hinge paddle c) Combined paddle d) Cap and spring design e) Runner design f) Range of motion

Concept 1; Coastal Defenses

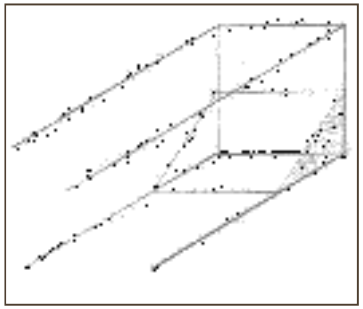
- To demonstrate is the need for coastal flood defences and the various types.
- Each of these test structures can be constructed of weighted plastic or metal to enable easy placement and removal in the tank.
- For extensive demonstration, there is potential to create each test structure with different variables (i.e. slope, step depth, height) to visualise the effectiveness of each.
- A funnel system with a tapped outflow will be placed behind the structure to collect excess water from overtopping.



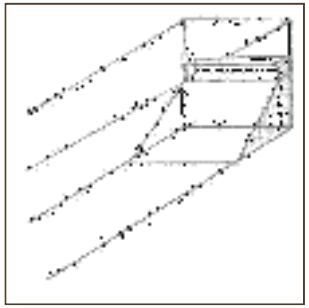
a) Stepped defence



b) Wave breaker

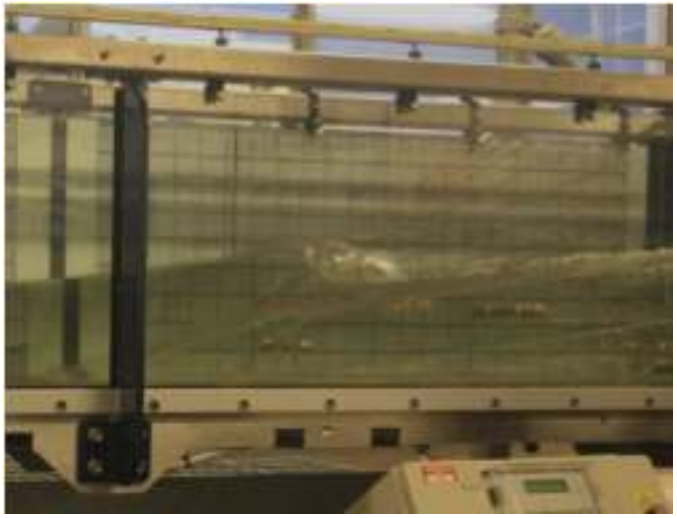


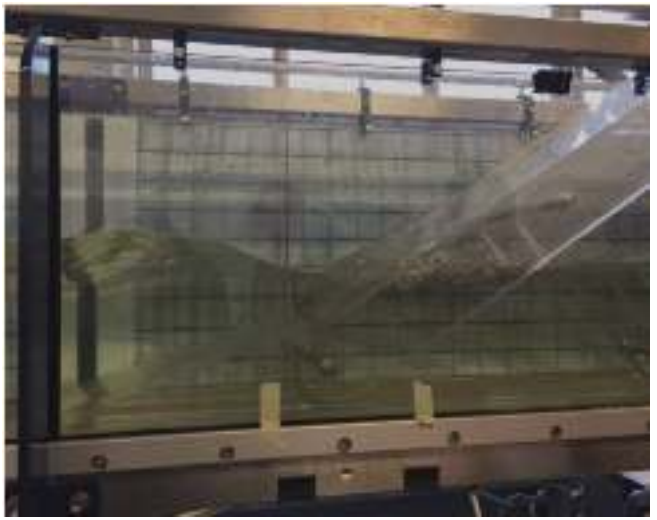
c) Sloped defence



d) Sloped defence with reflection topper

Plunging and surging waves demonstrated by different beach slopes in a University Lab can be replicated in proposed concept model

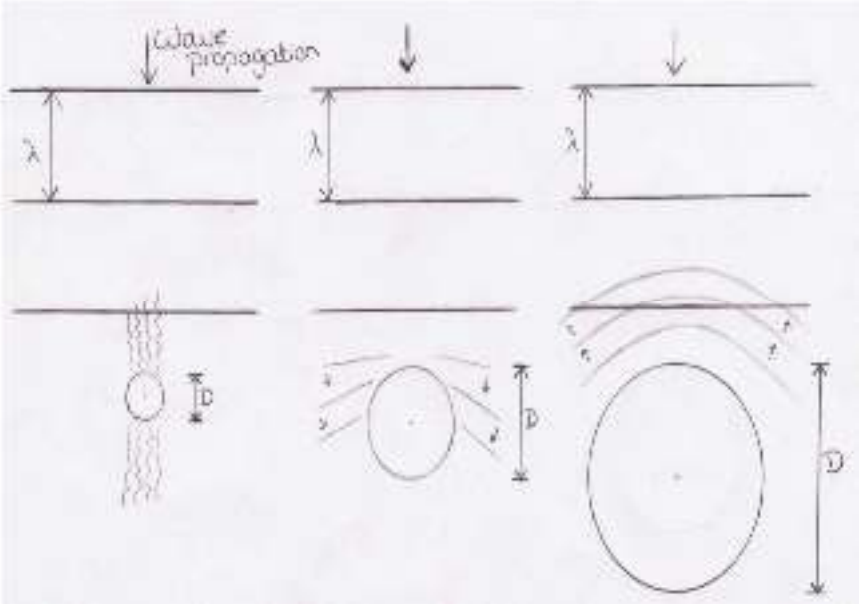




Concept 2; Wave Interactions on Coastal Structures

The effect of wave forces on structures whose diameter is a) smaller, b) similar and c) larger than the oncoming wavelengths. The expected behaviours are shown below.

- Local turbulence in the wake zone, drag is dominant force
- Waves refract around the cylinder, both forces are significant
- Waves reflect back from the cylinder in the direction they propagated from, inertia is dominant force



a) Expected wave behaviour when interacting with a cylinder

Concept 3; Sediment Movement on the Coast

- Wide, waves will need to be generated at an angle to the beach
- Would require a different tank (wider), sediment (messier) and some way of producing transverse waves
- Can be used to demonstrate use of groynes

Challenges

Scale effects that occur where it is not possible to scale every variable down by equal ratios.

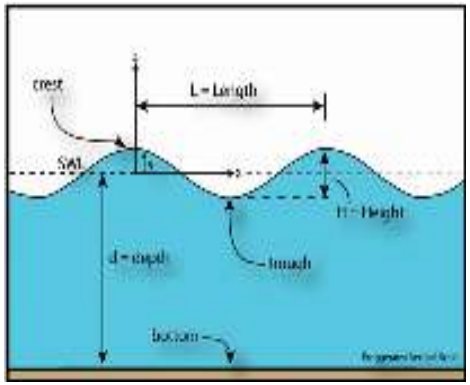
Variations can also be made to this design, for example a rotating wheel mechanism for evenly distributed waves, a range of test structure shapes, the addition of a beach structure to aid the visualisation of waves breaking on the coastline.

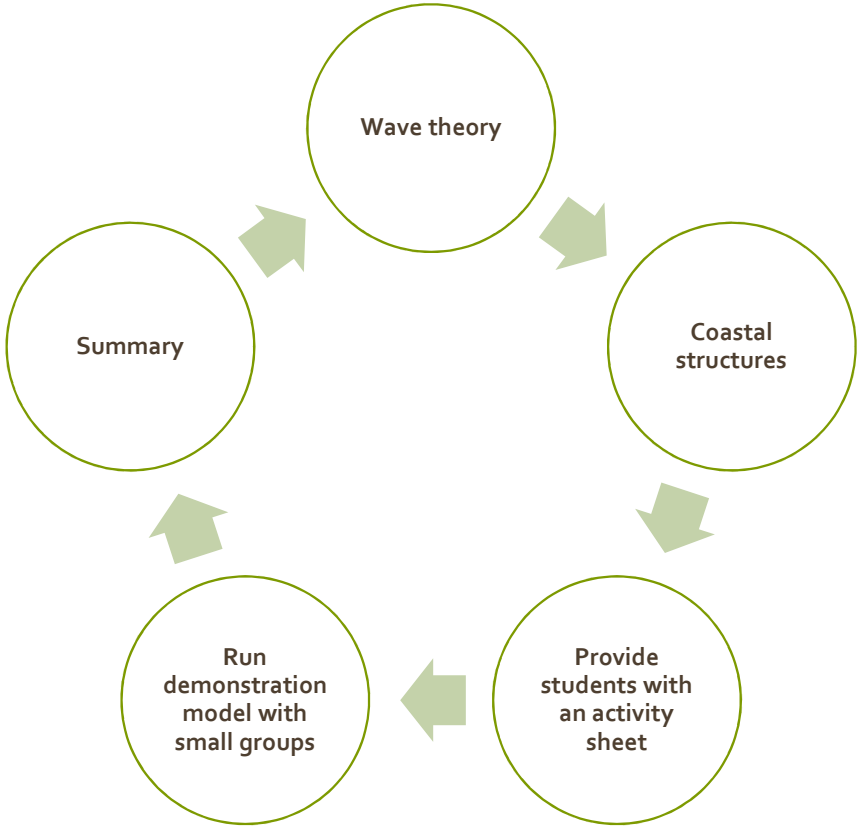
Concept 2 will also be suitable for visualising estuarine environments where structures such as bridges exist.

Opportunities

To ensure students are able to fully understand the processes demonstrated additional resources will be developed to capture learning.

- short presentation
- activity pack





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Thankyou