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## Topic 4

# Sediment Transport & Coastal Morphodynamics

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energising futures

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# Course Learning Outcomes

Upon completion of this course, students should be able to:

1. Evaluate the properties of offshore and near shore waves and establish design wave specification.
2. Assess currents and tidal processes.
3. Formulate sediment budget and perform shoreline evolution analysis.

Learning Objectives

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# Learning Outcomes

Upon completion of this topic, students should be able:

- To estimate littoral transports
- To evaluate sediment budget of a littoral cell
- To assess shoreline responses due to an obstacle

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# Part 4:
# Coastal Morphology


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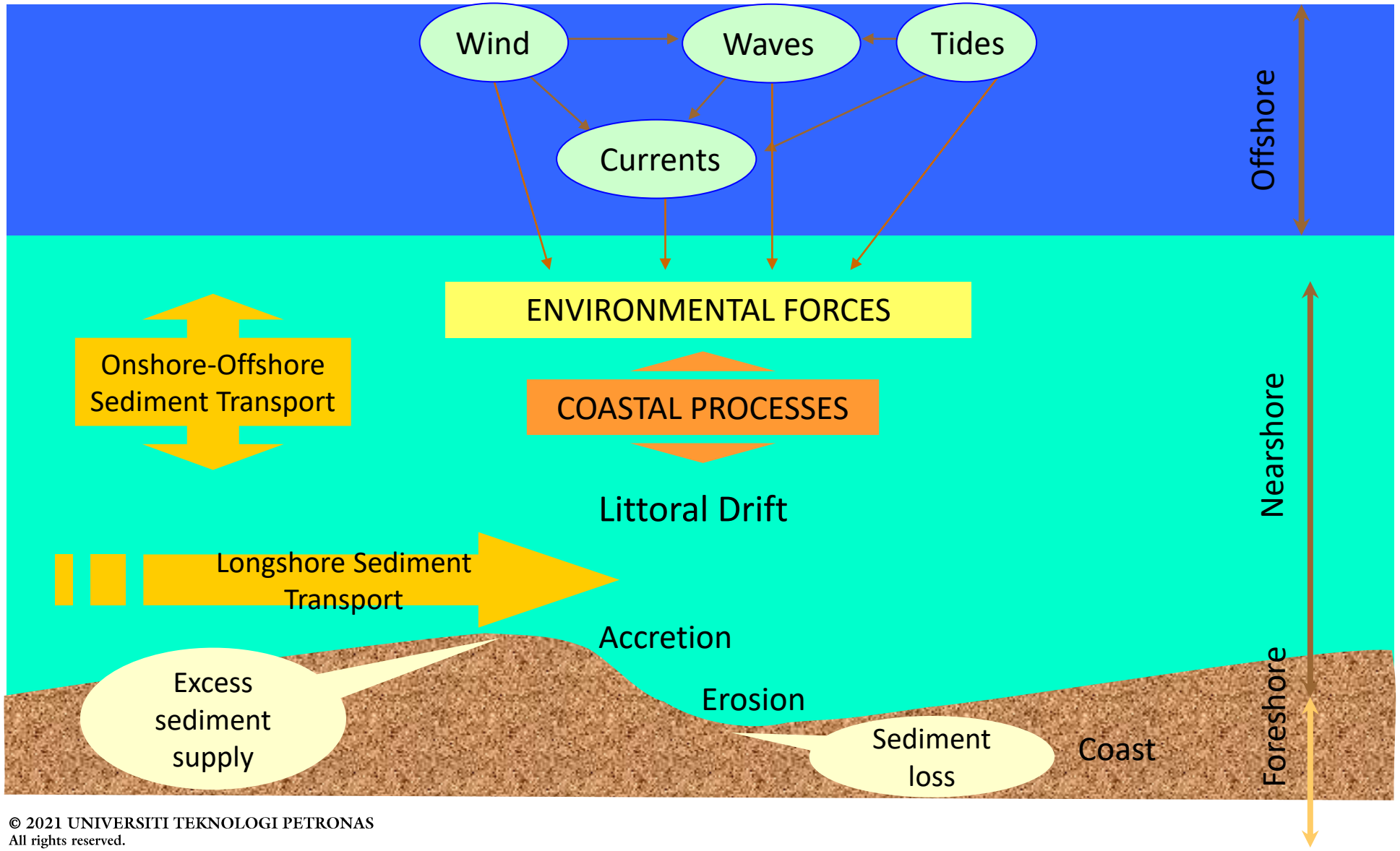
# Coastal Environment




Changes in overall coastal processes

Imbalance in sediment transport pattern

Erosion and/or sedimentation

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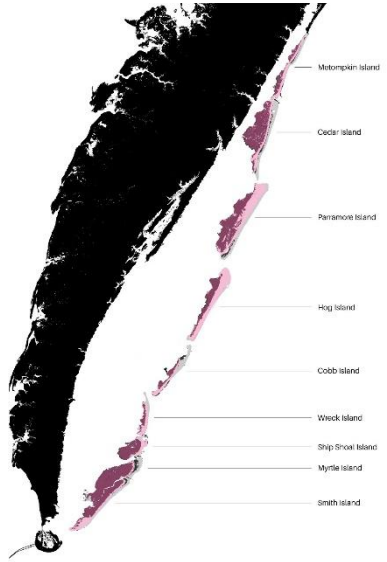
# Virginia's Barrier Islands are Constantly on the Move


https://www.ataltitudegallery.com/Client-Access/NatureConservancy/5





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# Tangier Island, Virginia


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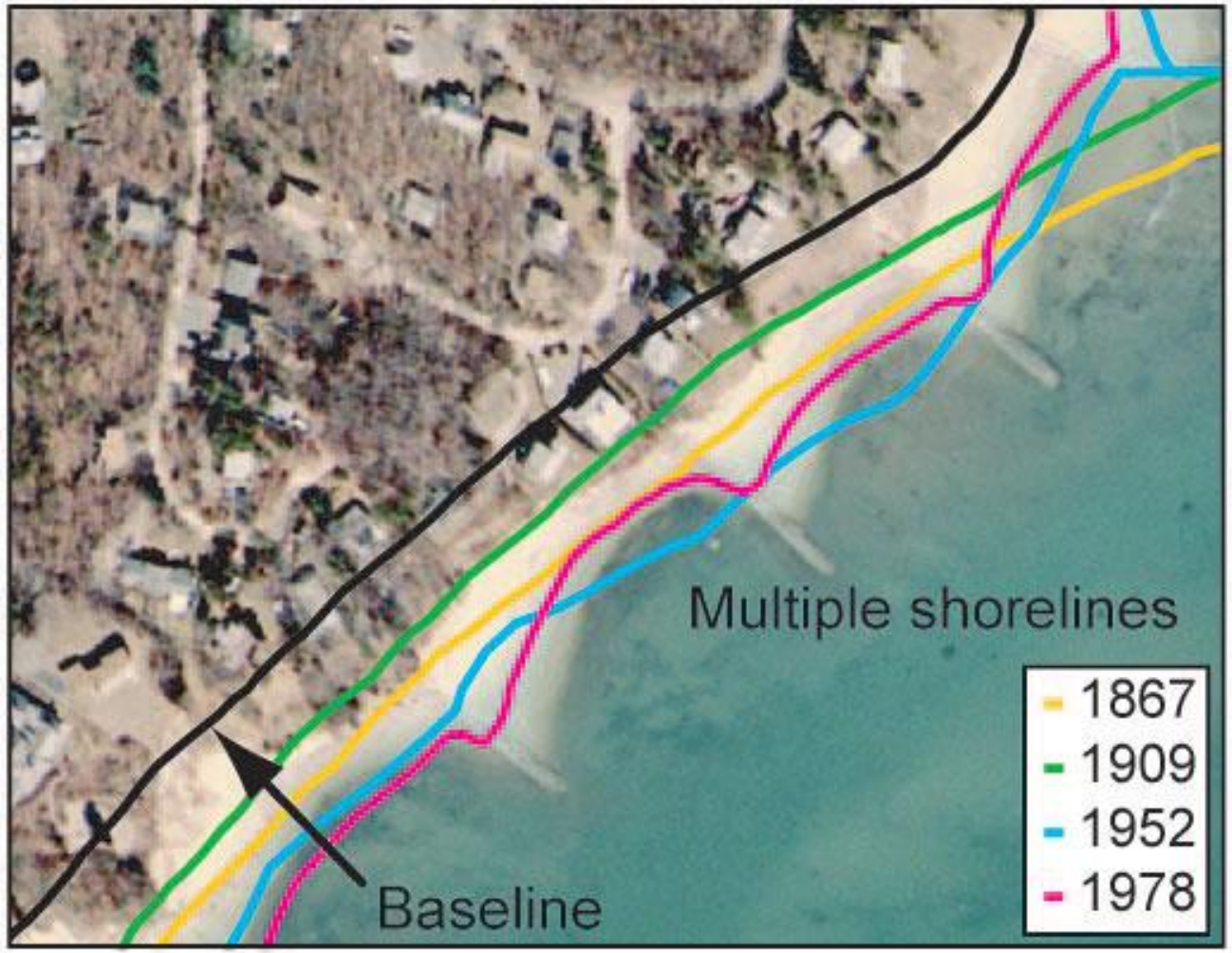
# Coastal Land Form




The magnitude of the alongshore transport at any place depends upon:

- the **wave & current conditions**
- the **offshore topography**
- the **coastal alignment**

The actual plan form of the coast at any time is the result of the **long term** erosion-accretion process.

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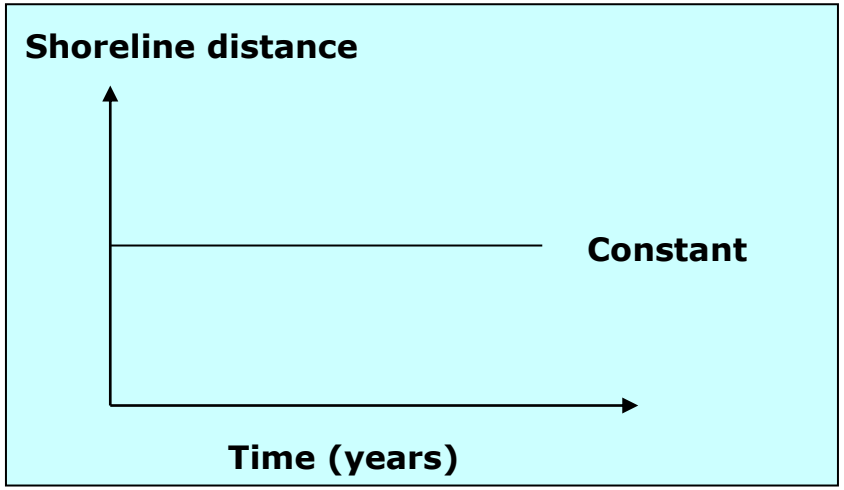
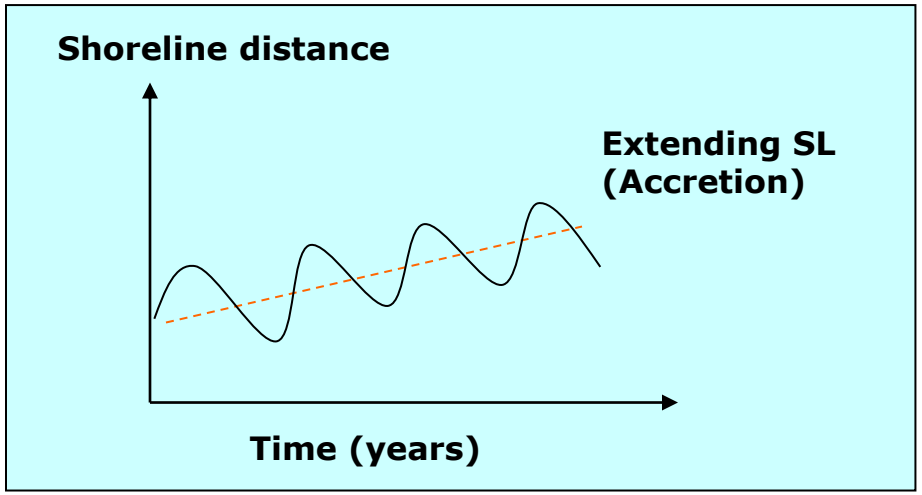
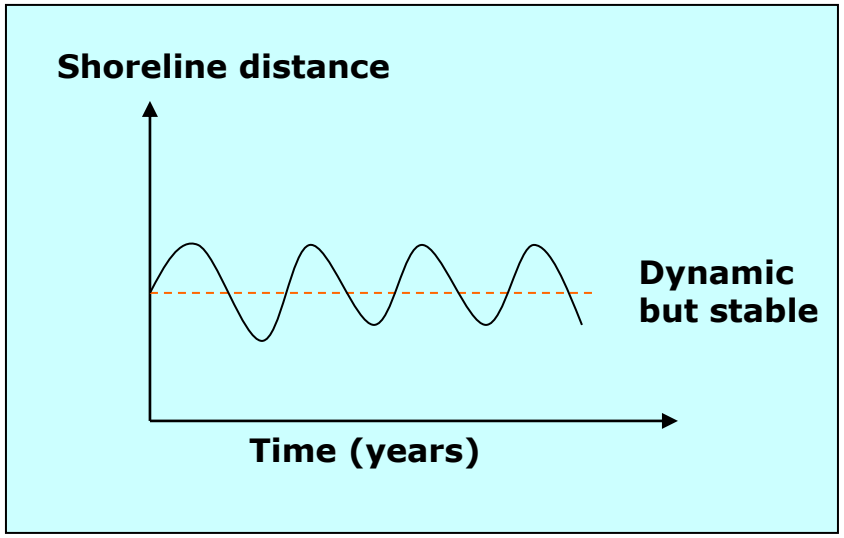
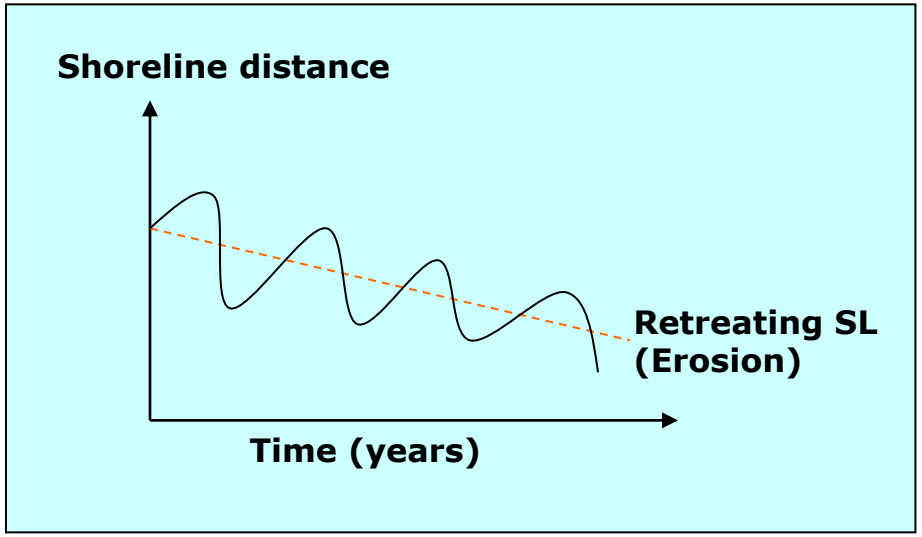
# Characteristics of Shoreline Change

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# How does beach erosion happen?

- If sediment carrying capacity of alongshore current (alongshore sediment transport) exceeds the quantity of sediments naturally supplied to the beach, beach erosion occurs.

The supply of sand to a point < the amount the waves can transport
⇒ sand is **eroded** from the beach.

The supply of sand to a point > the amount the waves can transport
⇒ sand is **deposited** from the beach.

The supply of sand to a point = the amount the waves can transport
⇒ shoreline remains **unchanged**.

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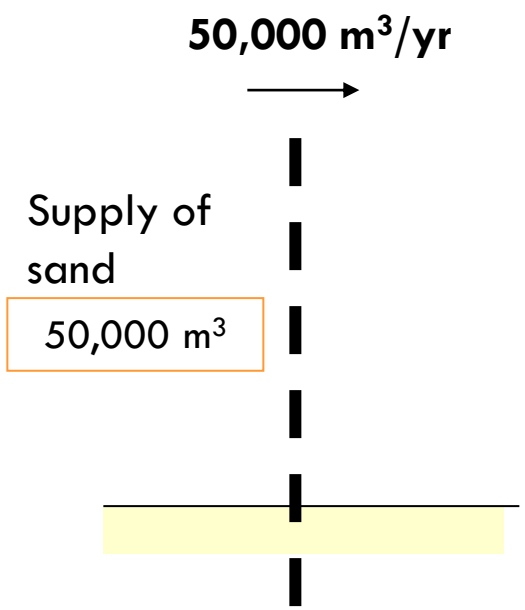
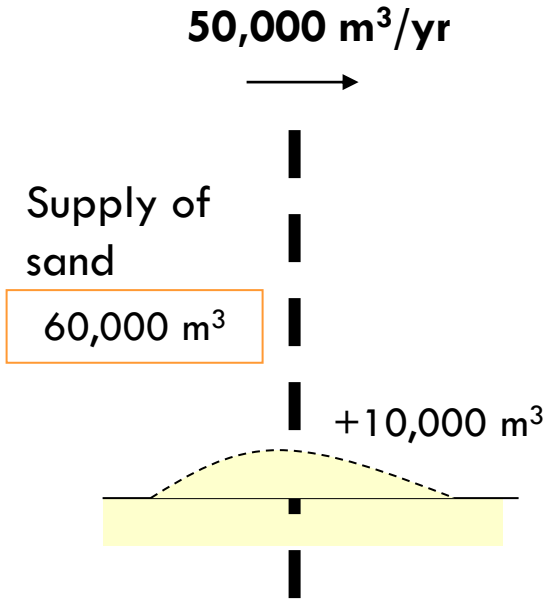
# Alongshore sediment transport



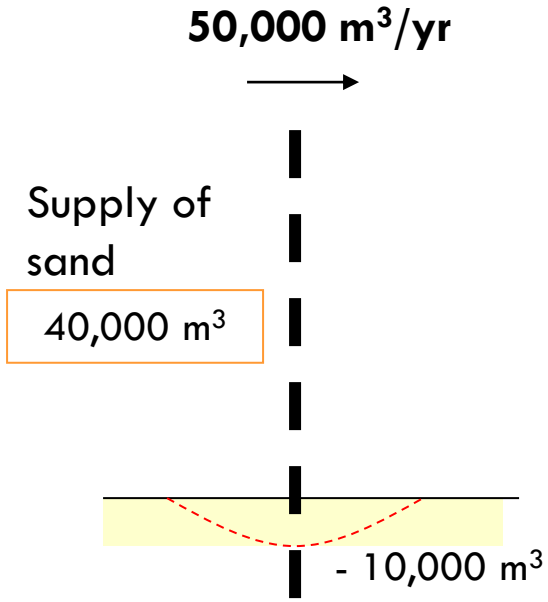

**Supply = Demand**

**Balanced!**




**Supply > Demand**

**Accretion = 10,000 m³**




**Supply < Demand**

**Erosion = 10,000 m³**

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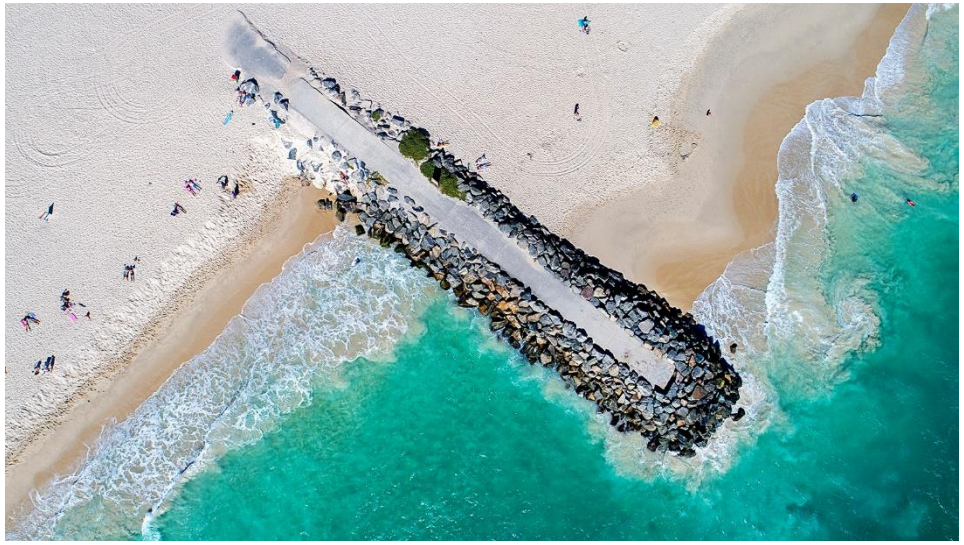
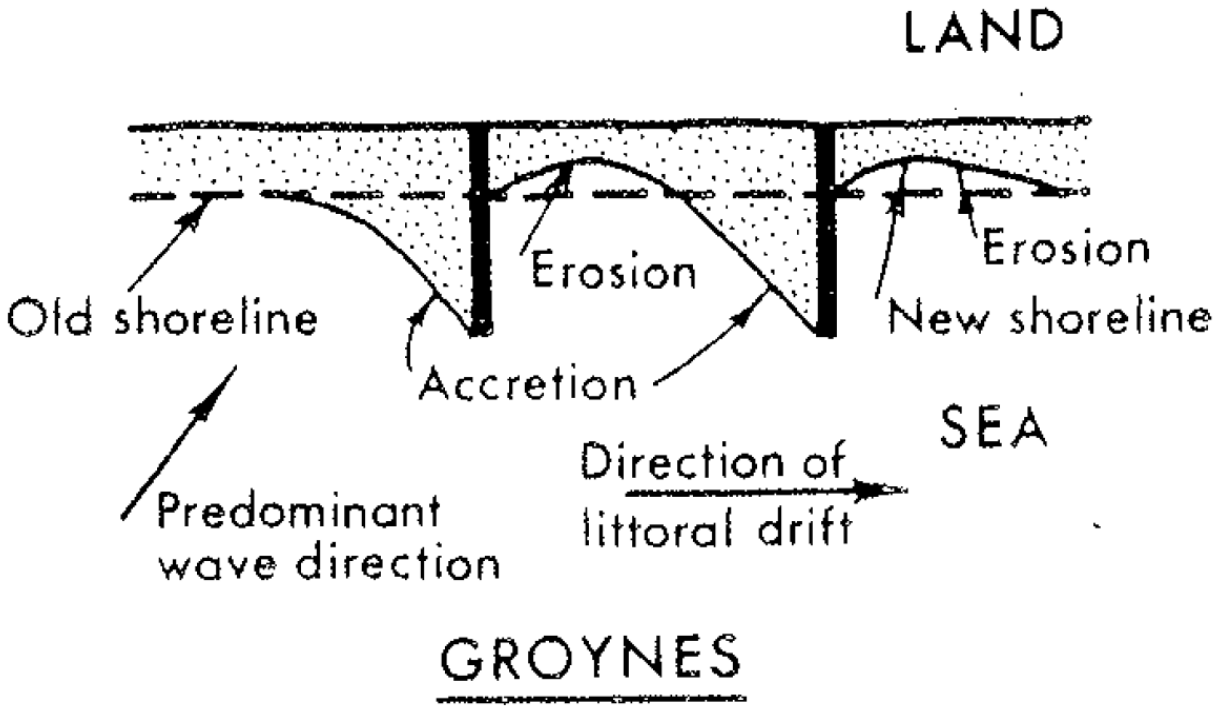
# Groyne



https://tangentmaterials.com/the-different-types-of-groynes/

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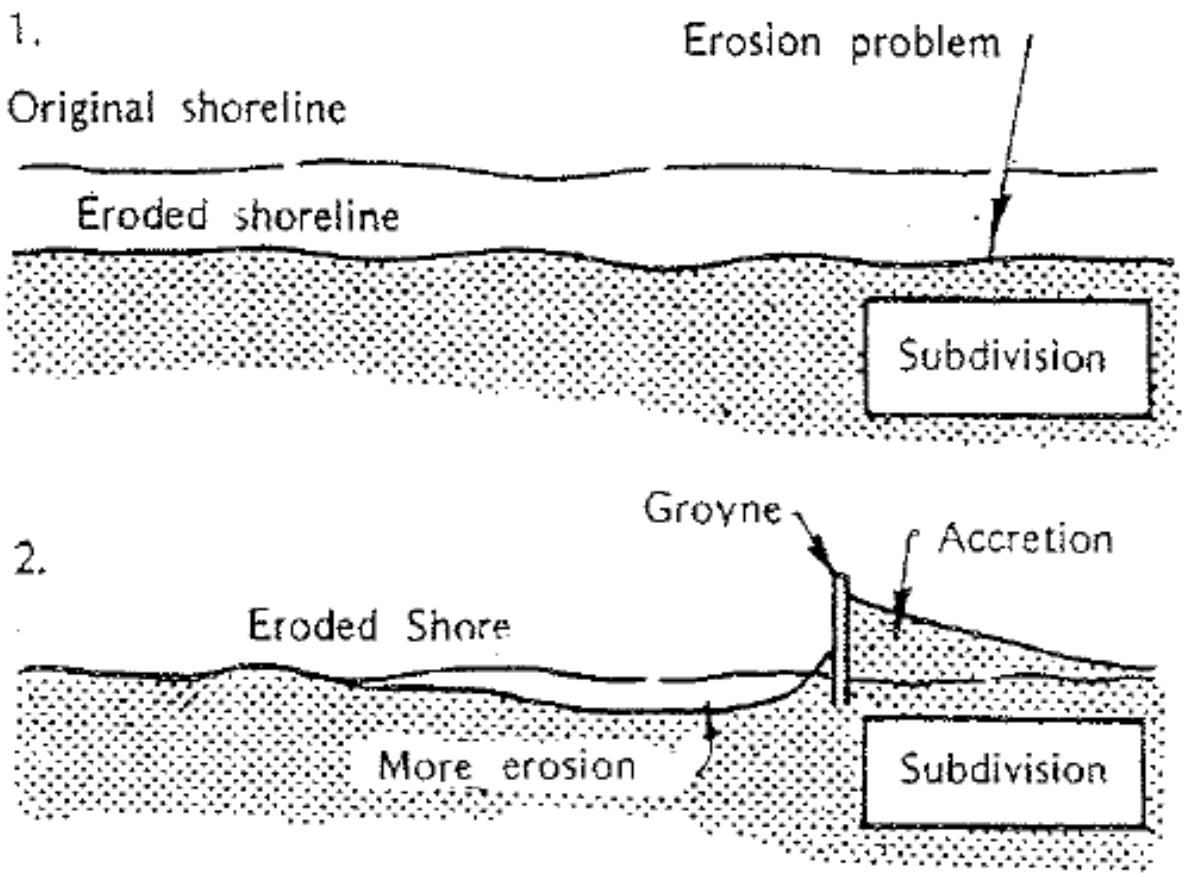
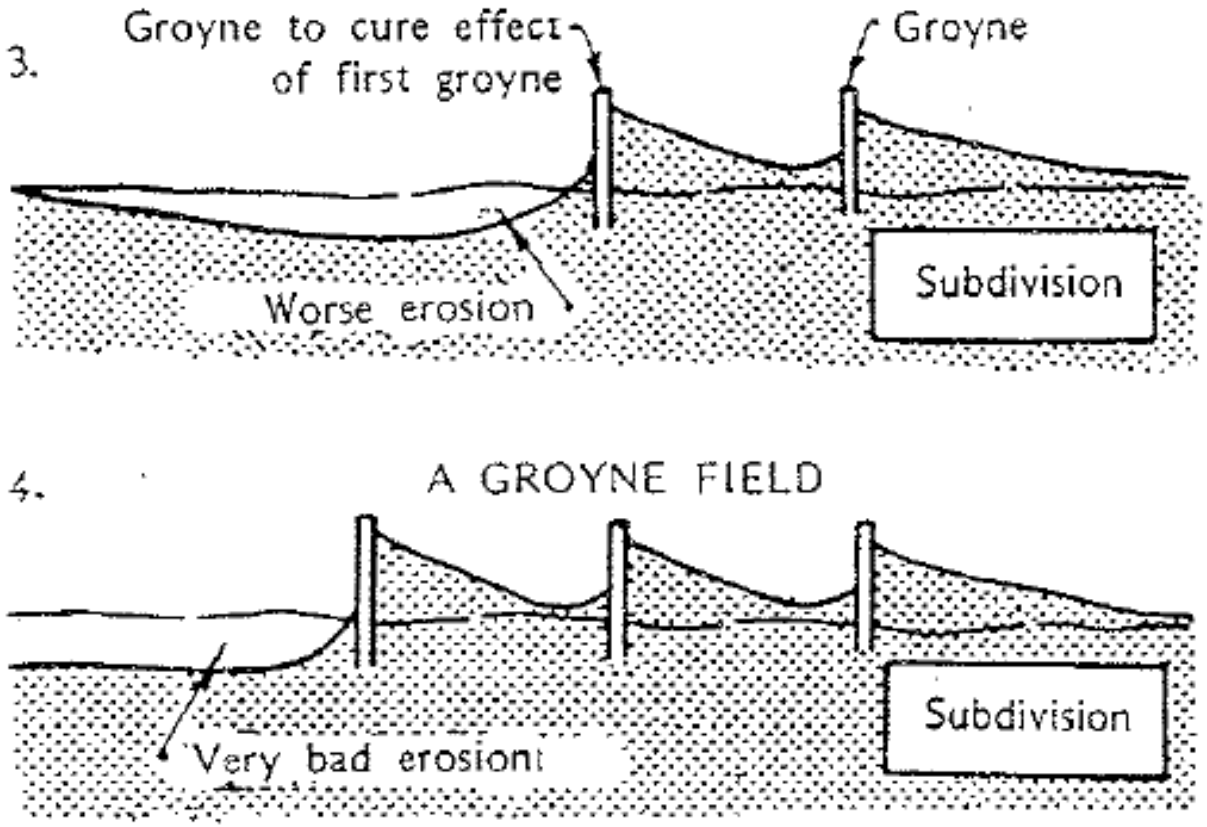
# Groyne Series

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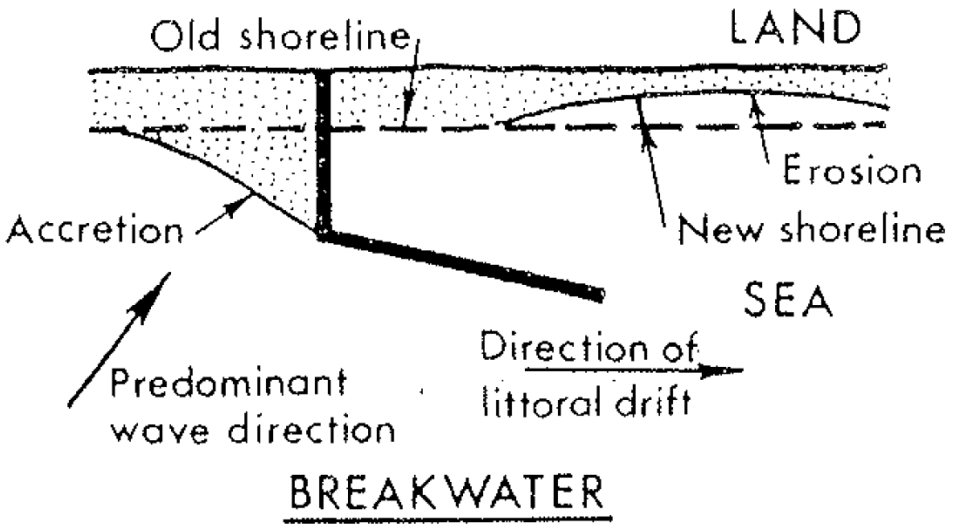
# Attached Breakwater


https://www.researchgate.net/figure/Accretion-on-updrift-and-erosion-on-down-drift-side-of-Jumeirah-Fishing-Harbor_fig1_330451409



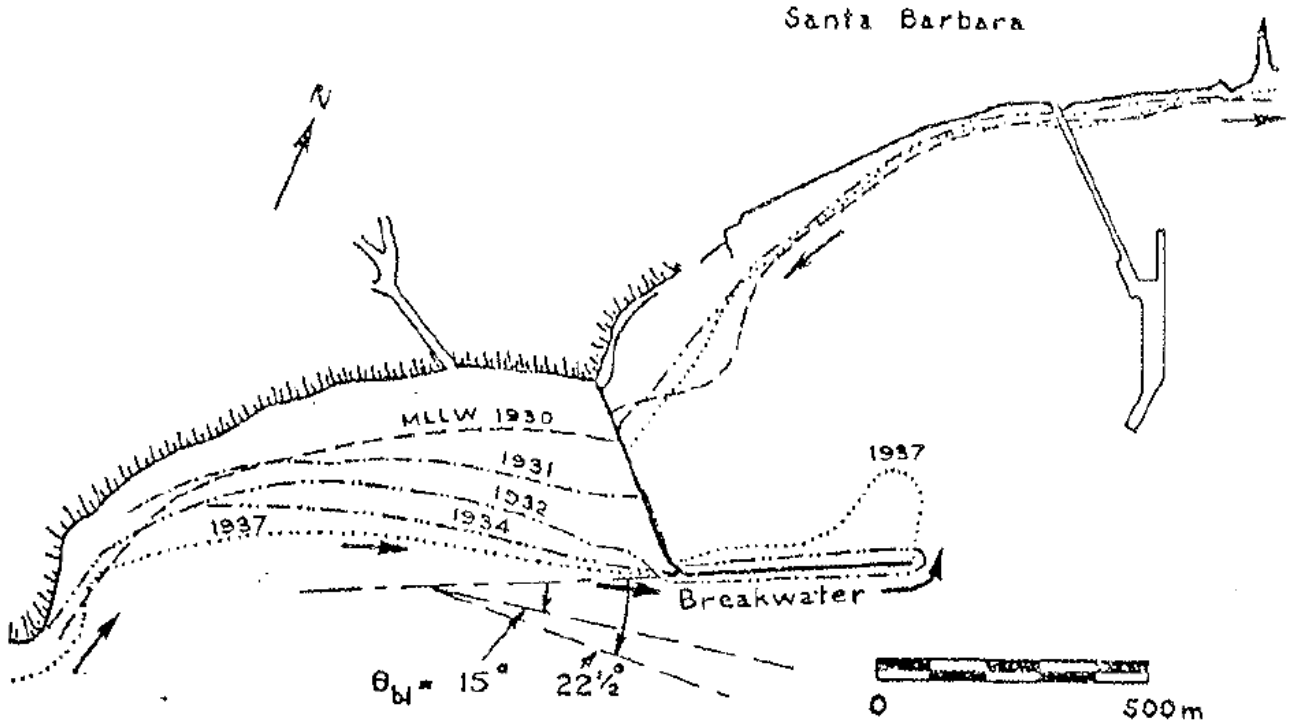




Figure 10-4 Sedimentation at Santa Barbara Harbour (From Wiegel 1964).

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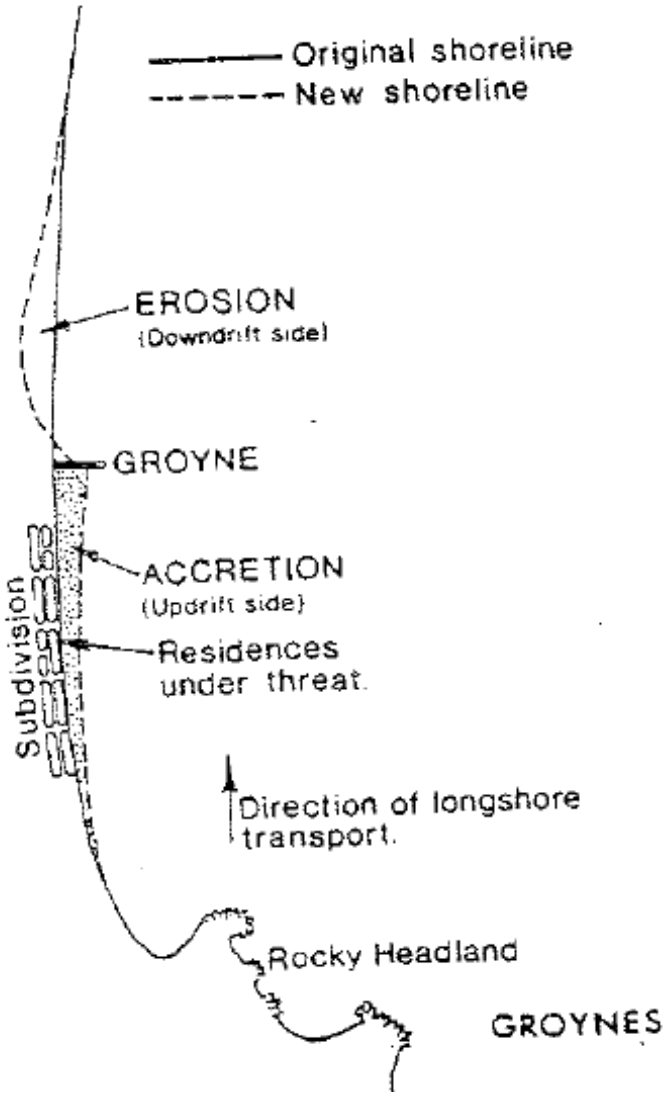
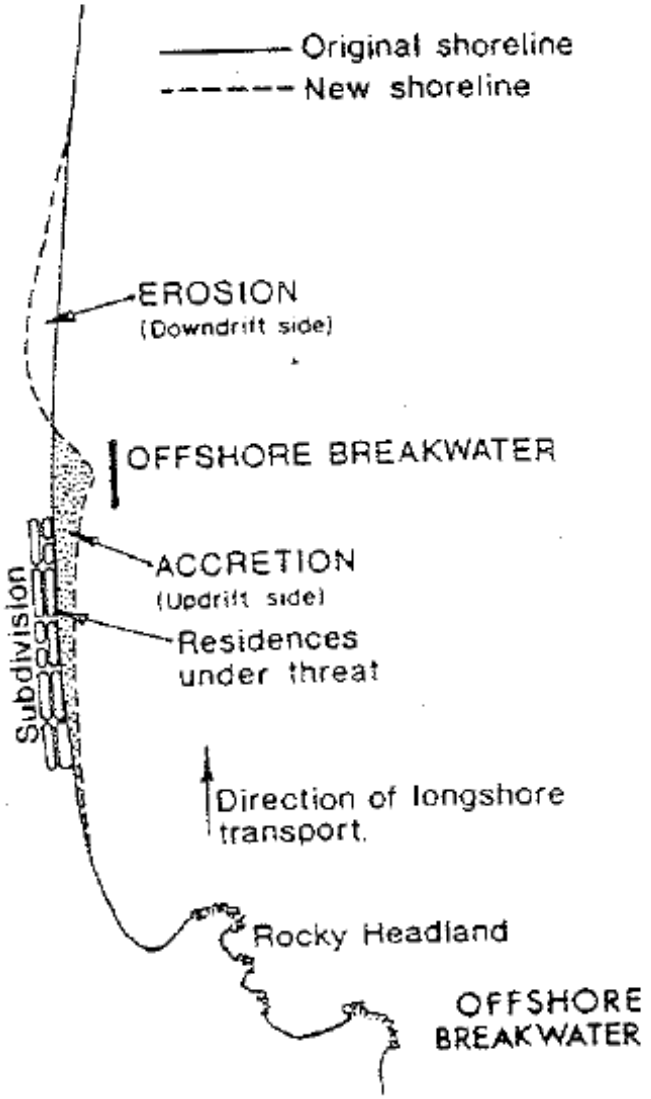
# Offshore Breakwater

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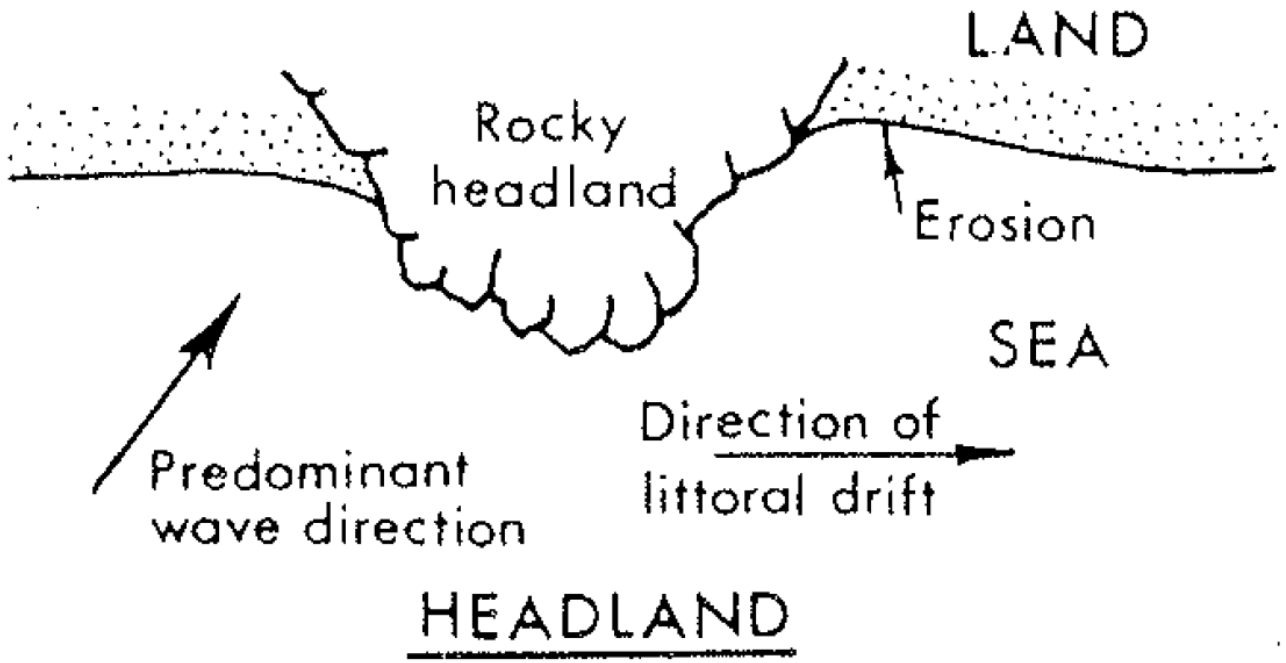
# HEADLAND


https://www.mdpi.com/2076-3263/10/5/190

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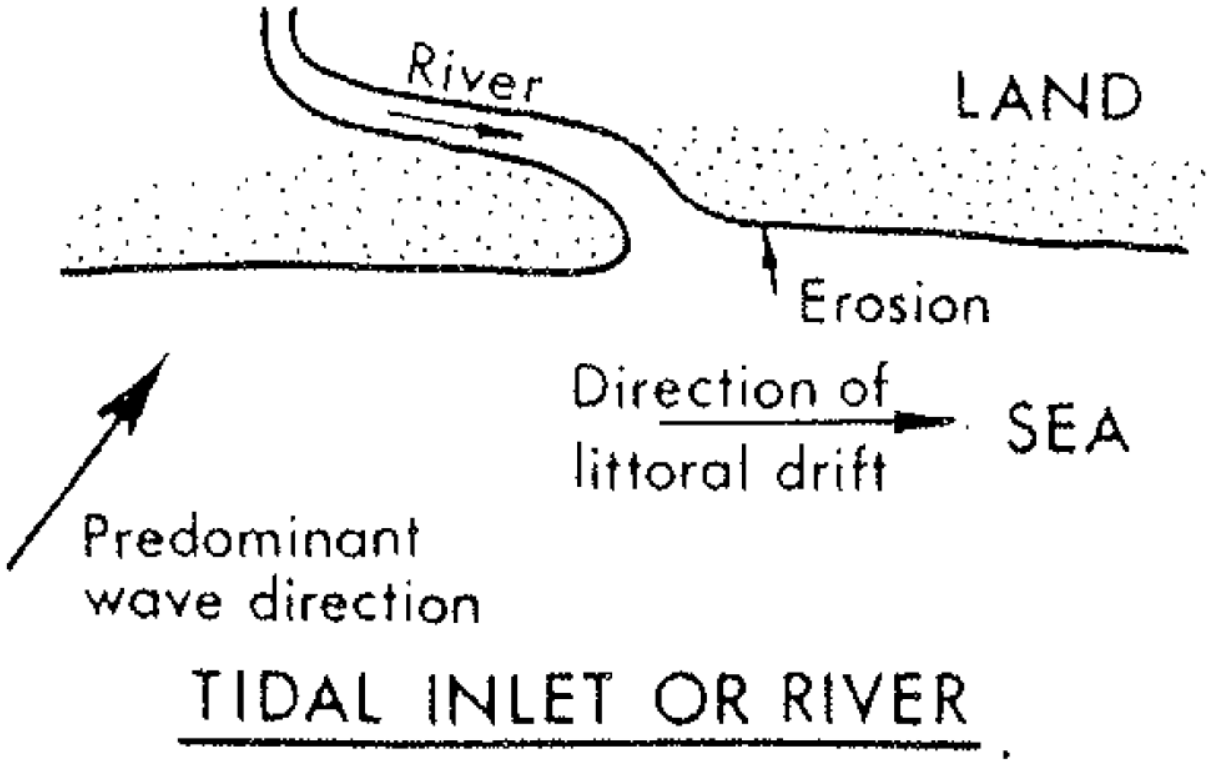
# Tidal Inlet


https://bioone.org/journals/journal-of-coastal-research/volume-69/issue-sp1/SI_69_3/Origin-Evolution-and-Classification-of-Tidal-Inlets/10.2112/SI_69_3.short

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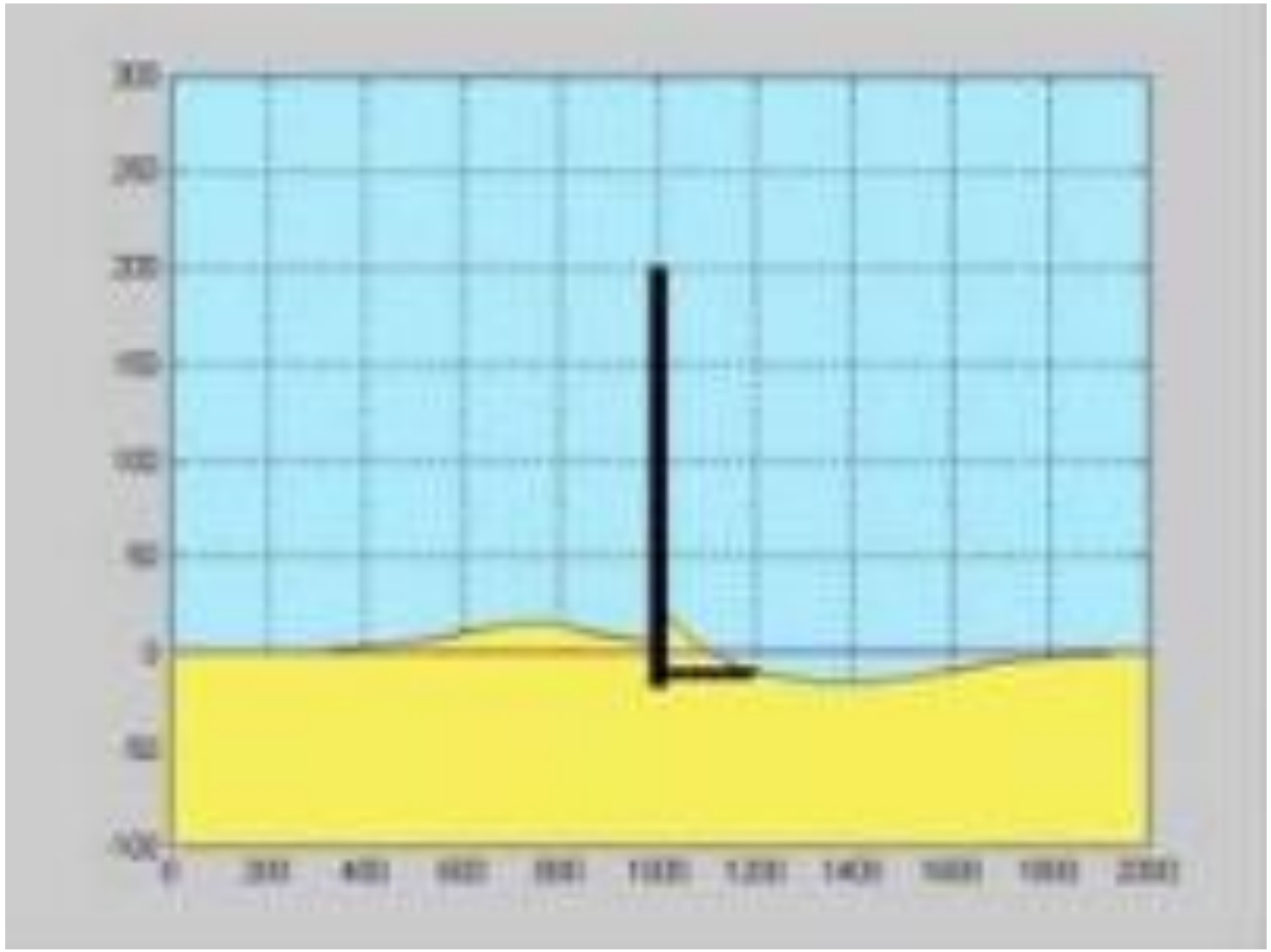
# Shoreline Change Numerical Model



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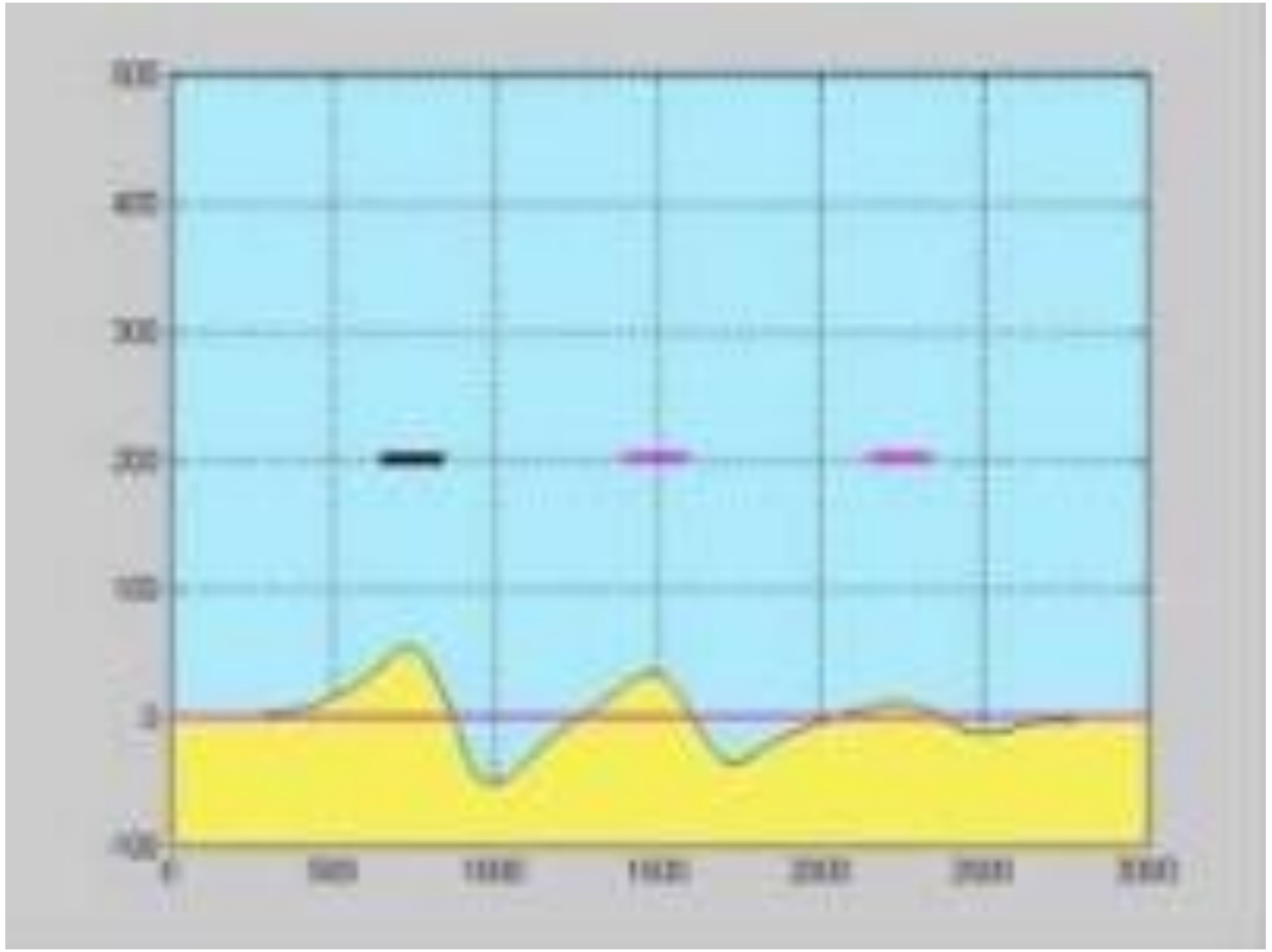
# Shoreline Change Numerical Model



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# Case Study 1

## Marina Harbor, Kuala Kedah



Influence of sediment transport (mud or fine sediment) to marina development

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# Case Study 1


## Marina Harbor, Kuala Kedah (2021)


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# Case Study 2


Influence of coastal structures (protruding land reclamation) to longshore sediment transport

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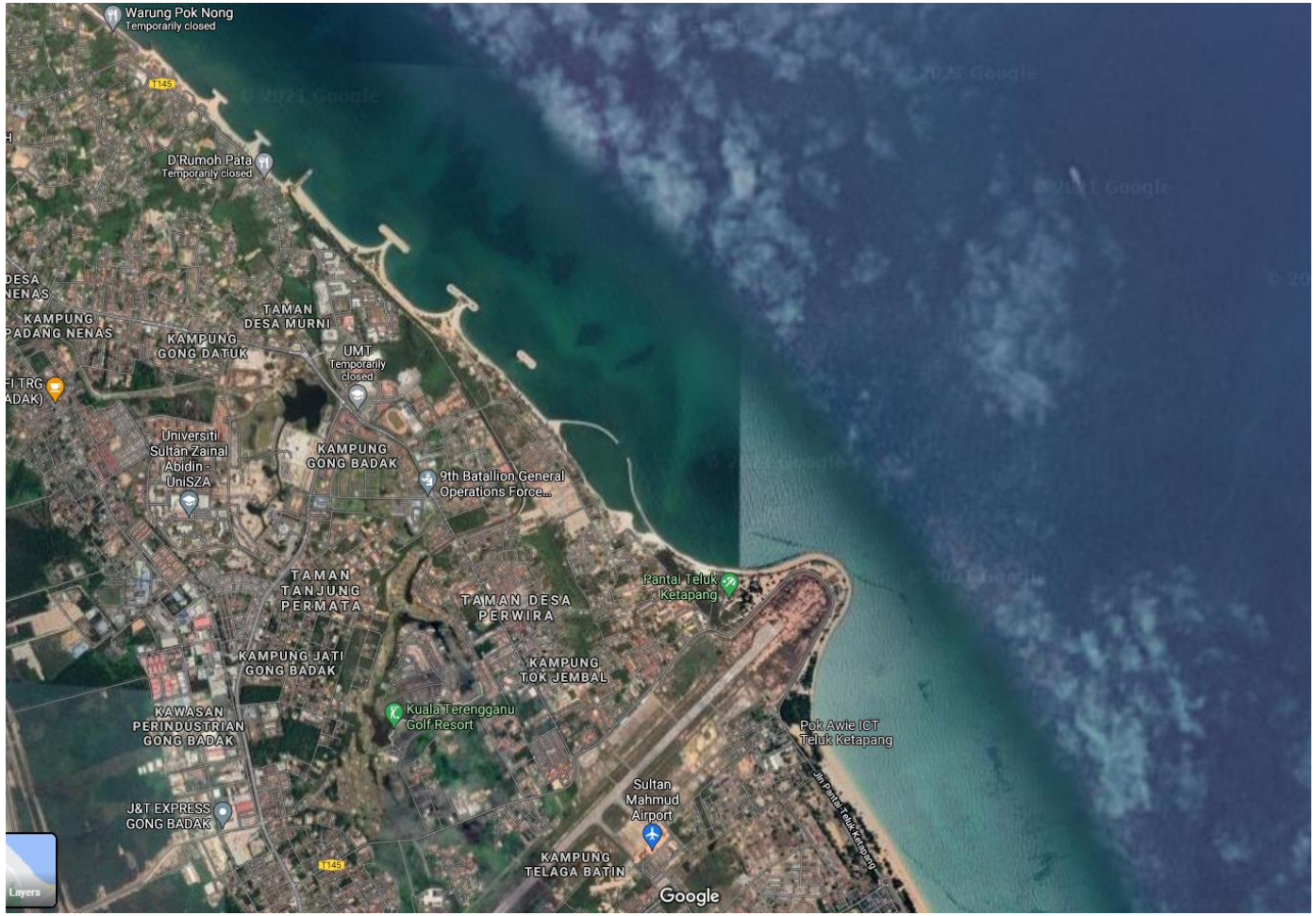
# Case Study 2




https://www.google.com.my/maps/place/UMT/@5.4047653,103.0981723,3255m/data=!3m1!1e3!4m5!3m4!1s0x31b7bca5e7ca5707:0x461b1036a195327d!8m2!3d5.4051765!4d103.0876196

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# Case Study 3


Influence of coastal structures (breakwaters) to longshore sediment transport

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# Case Study 3


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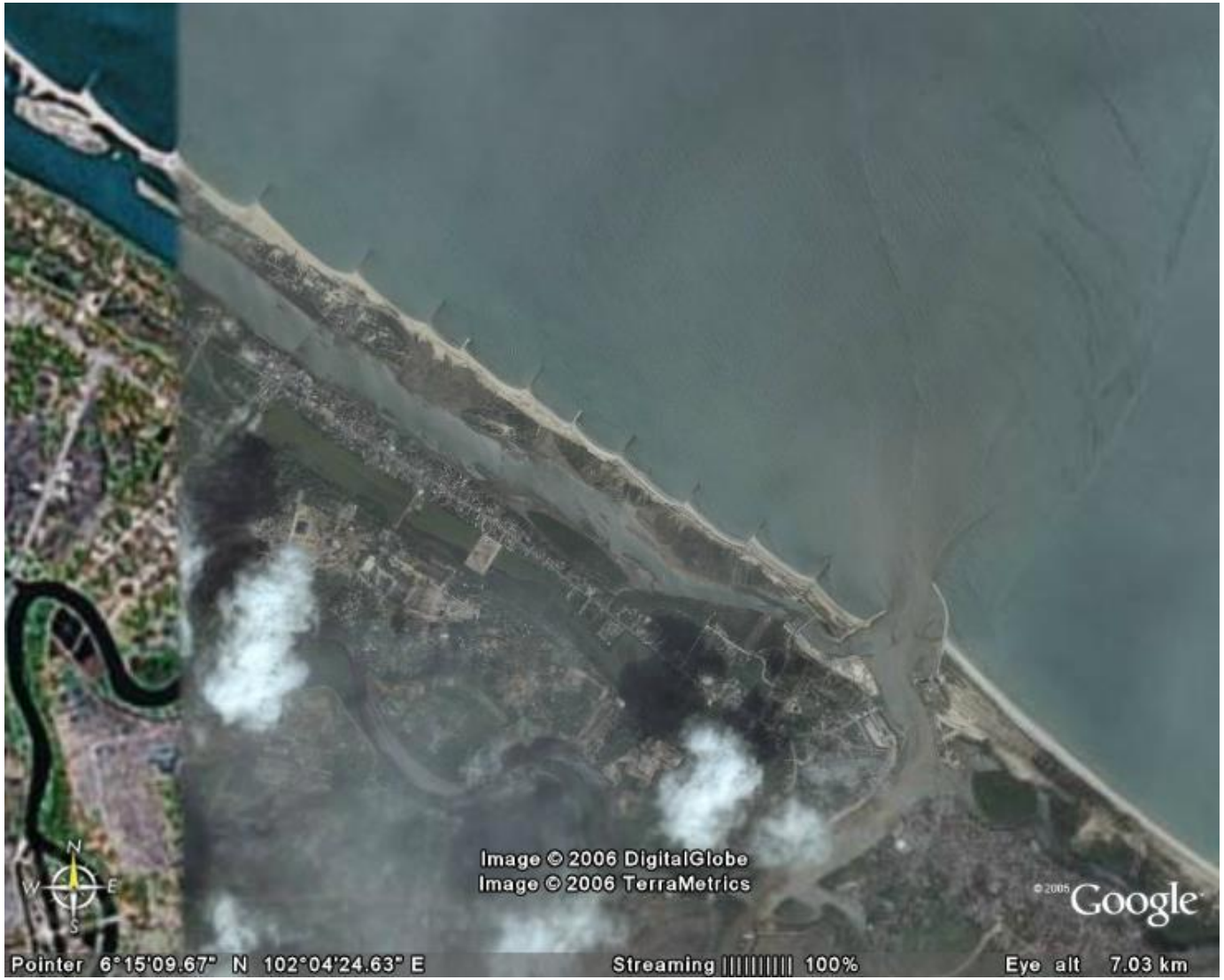
# Case Study 3

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# Case Study 3


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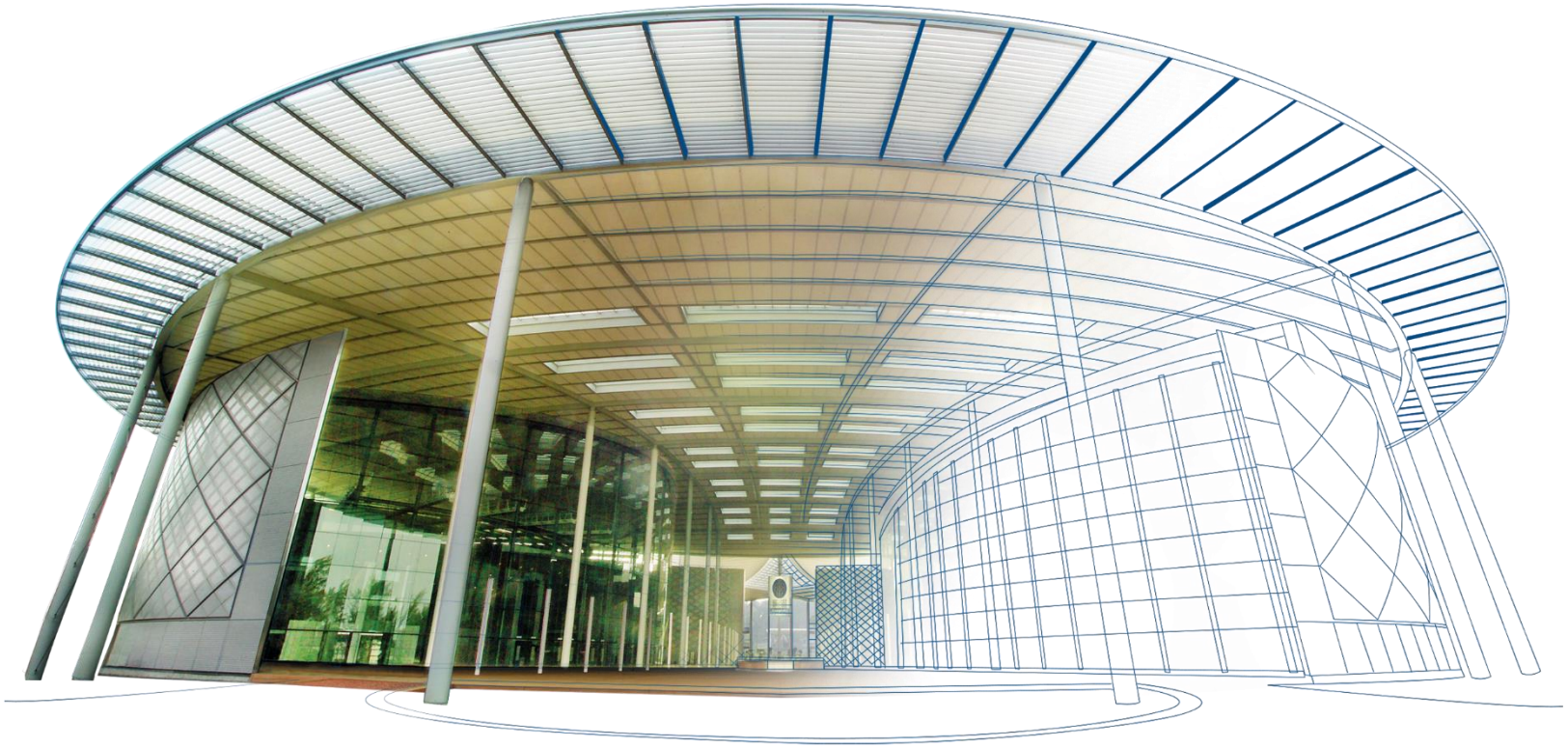

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