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BET4733 Introduction to Coastal Infrastructures

Coastal Sediment Transport

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Chapter Description

- ## Expected Outcomes

Analyze the principles of wave mechanics, tides, littoral processes and coastal sediment transport in methods of shore protection and coastal infrastructures.

- ## References

1) Kamphuis, J. William, Introduction to Coastal Engineering and Management, Advanced Series on Ocean Engineering-Volume 30, World Scientific, 2010.
2) Reeve D., Chadwick A. and Fleming C. Coastal Engineering-Processes, Theory and Design Practice, CRC Press, 2015.
3) Kim Y.C., Design of Coastal Structures and Sea Defences, World Scientific, 2015.
4) US Army Corps of Engineers. Coastal Engineering Manual, Washington, 1998-now.
5) Rosati, J. D. and Kraus, N. C., Sediment budget analysis system (SBAS), Coastal Engineering Technical Note CETN-N-20, U.S. Army Engineer Research and Development Center, Vicksburg, MS, 1999.

CONTENTS

- Sediment Budget Analysis

Sediment Budget Analysis

- Sediment budget is a count of sediment gains (sources)and losses (sinks) over a given time within a specified control volume (Rosati and Kraus, 1999).

Sediment Budget Analysis

No	Sources	Sinks
1	Longshore sediment transport	Longshore sediment transport
2	Erosion of bluffs	Beach accretion
3	Sediment from the rivers	Dredging of beach (or nearshore)
4	Beach erosion	Mining nearshore
5	Beach fill	-
6	Dredge material	-

Sediment Budget Analysis

According to Rosati and Kraus (1999), sediment budget equation can be expressed as:

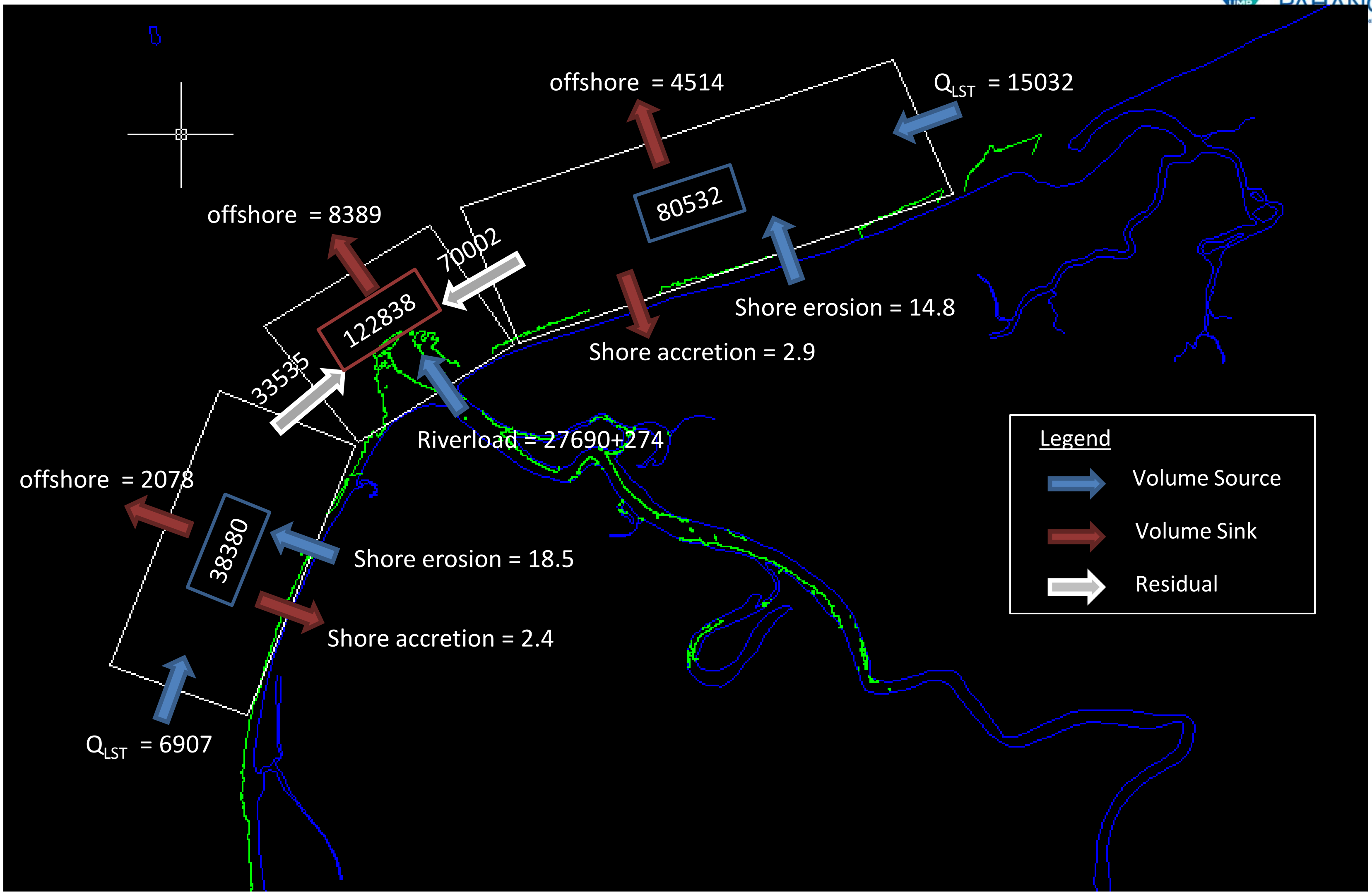
$$\Sigma Q_{source} - \Sigma Q_{source} - \Delta V + P - R = Residual$$

- All terms are expressed consistently as a volume (or as a volumetric change rate).
- Q_{source} = sources to the control volume (cv)
- Q_{sink} = sinks to the control volume
- ΔV = net change in volume within the cv
- P = amounts of material placed in cv
- R = amounts of material removed from the cv,
- *Residual* = degree to which the cv is balanced. *Residual* equal to zero if the budget of an individual cv is balanced.

Sediment Budget Analysis

No	Source	Sinks
1	Aerial photography	Understanding the site
2	Beach-profile (surveys)	Repetitive surveys to obtain volume change in the beach
3	Shoreline-position data (from topographic analysis, HWL surveys, aerial photographs, beach-profile surveys, and bathymetric data)	Beach morphology Erosion/ accretion Sediment-transport pathways
4	Bathymetry	Volume change in the beach
5	History of engineering activities	-

Schematic representation of sediment budget



Sediment Budget Analysis

	West sub-cell	Inlet sub-cell	East sub-cell
Longshore Sediment Transport	6907		15032
Sediment Load from Sungai Papar		27964	
Sediment Inflow due to shore erosion	18.6		15
Sediment Outflow due to shore accretion	-2.4		-2.7
Sediment Ouflow due to seabed erosion	-38380		-80532
Sediment Deposition		-122838	
Offshore Losses	-2078	-8389	-4514

Note: +ve indicates inflow to cell
-ve indicates outflow from cell

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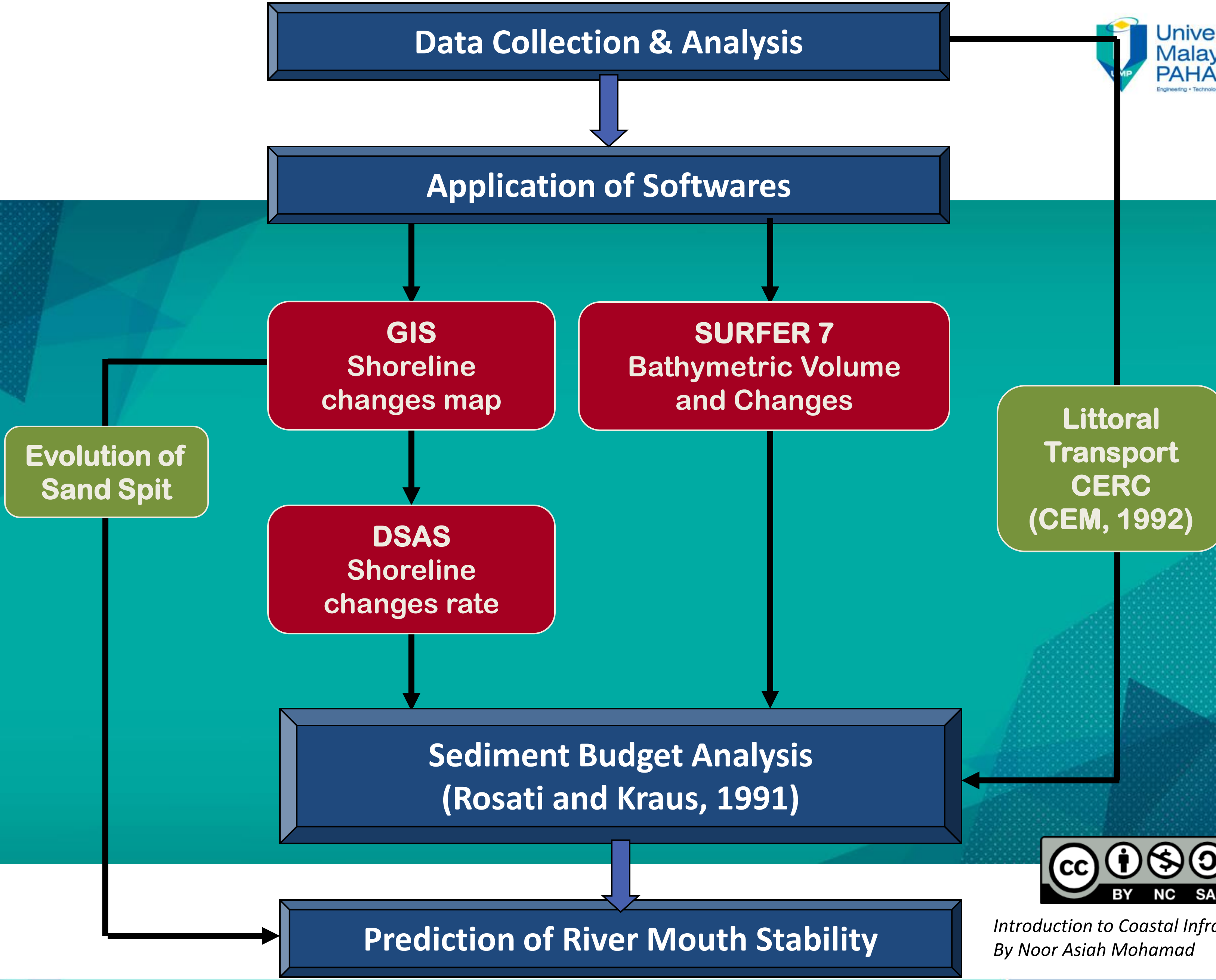

Introduction to Coastal Infrastructure
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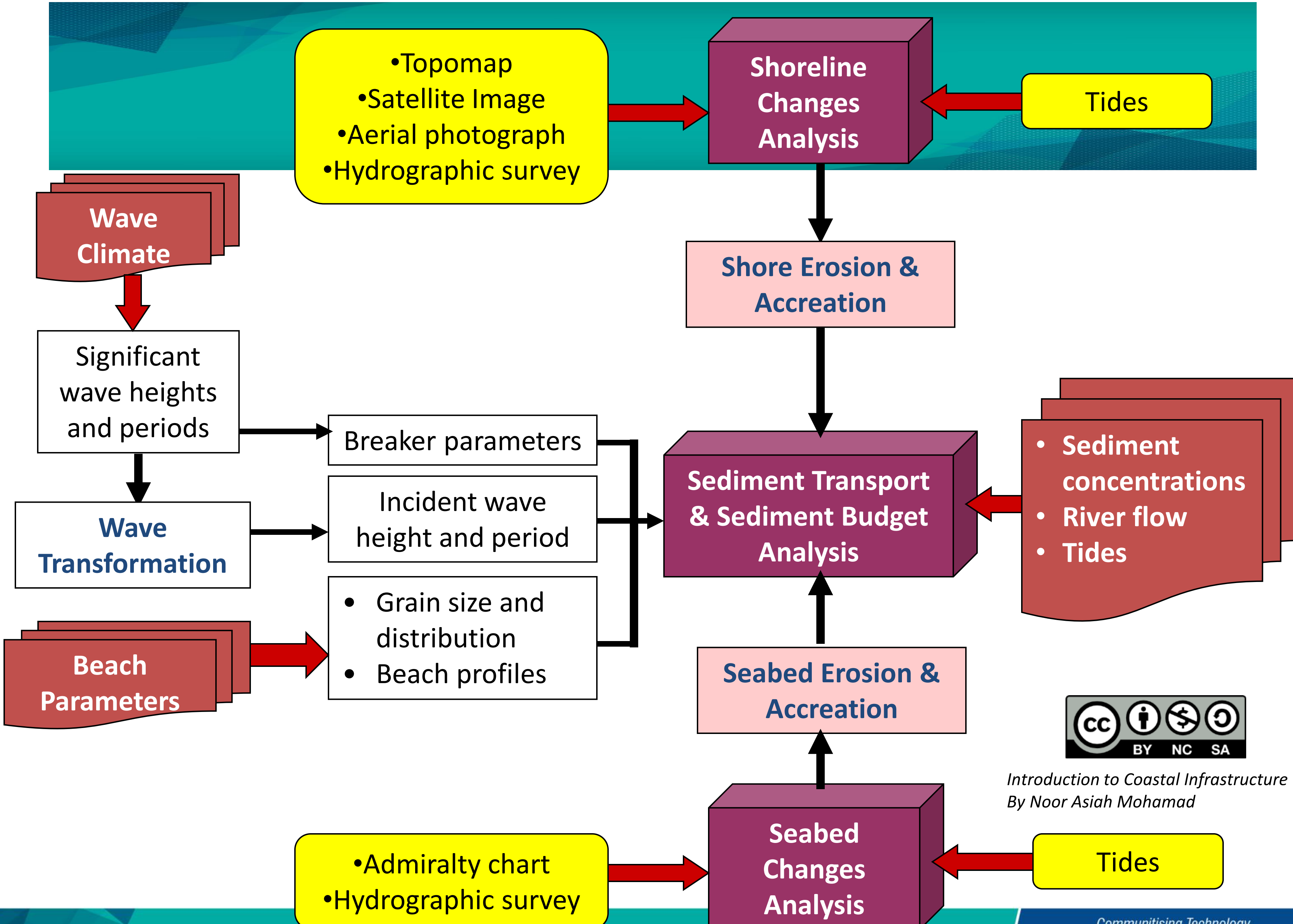
•Topomap
•Satellite Image
•Aerial photograph
•Hydrographic survey
Shoreline Changes Analysis
Tides
Wave Climate
Shore Erosion & Accreation
Significant wave heights and periods
Breaker parameters
Wave Transformation
Incident wave height and period
Sediment Transport & Sediment Budget Analysis
• Sediment concentrations
• River flow
• Tides
• Grain size and distribution
• Beach profiles
Beach Parameters
Seabed Erosion & Accreation
•Admiralty chart
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Seabed Changes Analysis
Tides

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