

Global Innovation Challenge

Innovative Solutions for Coastal Protection

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Introduction to Singapore

a. Low-lying and vulnerable to sea level

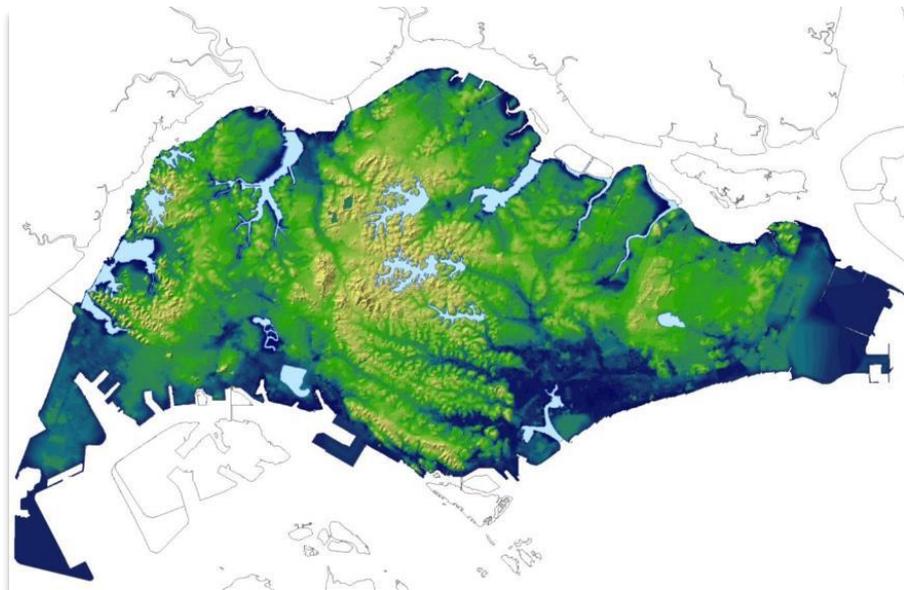
- > 30% of land area < 5m from mean sea level
- Tidal range: ~3 m

b. Surrounded by the sea

- Sheltered by Peninsular Malaysia and Indonesian Archipelago
- Affected by conditions in Andaman Sea / Malacca Straits and South China Sea

c. Highly intensified land use

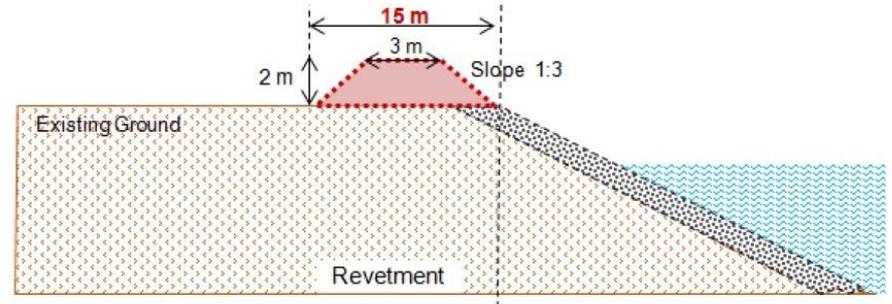
- Population density of ~8,000 / sq km (2020)
- Coastal protection measures would take up precious land space
- Being a land scarce city, Singapore is looking at innovative methods to use the land more efficiently



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Coastal Protection Measures

- Conventional coastal protection measures (seawalls, earth bunds) often takes up a lot of land space
- For eg, the slope of the earth bunds are designed as 1:3 for stability
 - Extending 1m of the earth bund's height will require additional 6m for the bund's width at the base – also accounting for the fore-slope and backslope
- Currently, we face an upper limitations on foundation strengthening, and designing with long-term re-build considerations.



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Slope Stability



Challenging the 1:3 slope requirements, would potentially compromise the slope stability.

Being able to design for a steeper slope, and addressing the slope stability issue would reduce land intake.

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Key considerations

Proposed coastal protection measure should have at least one of the following features:

- Demonstrate provisions for incremental enhancement to adapt to rising sea levels without major reconstruction (applicable to existing coastal protection structure or new designs);
- Demonstrate substantially less landtake (bonus if solution is able to incorporate nature/urban landscape features as part of the solution to increase multi-functionality);
- Use of light-weight materials suitable for coastal environment;
- Revolutionary construction methods that would reduce disruption and disturbances to existing measures;

No significant increase in Operational & Maintenance (O&M) requirements – proposals to include an estimation of the life-cycle cost for constructing, operating and maintaining (also demolition & reconstruction if applicable) the solution over a time period of 50 years or more.

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Challenge Statement

How might we deploy coastal protection measures that better utilise land (when compared with conventional measures) and are adaptable to future requirements, like from rising sea levels?

Outcome

A **Proof-of Concept** study for an innovative coastal protection measure which is validated by either numerical simulations and laboratory testing with small-scale prototype of the solution to demonstrate its feasibility.

The numerical models and laboratory tests should include sensitivity analyses covering appropriate design parameters (e.g. sea level, environmental loading, design life, local soil conditions). In addition, laboratory tests should account for the various scaling effect when applicable.

Thank
You

