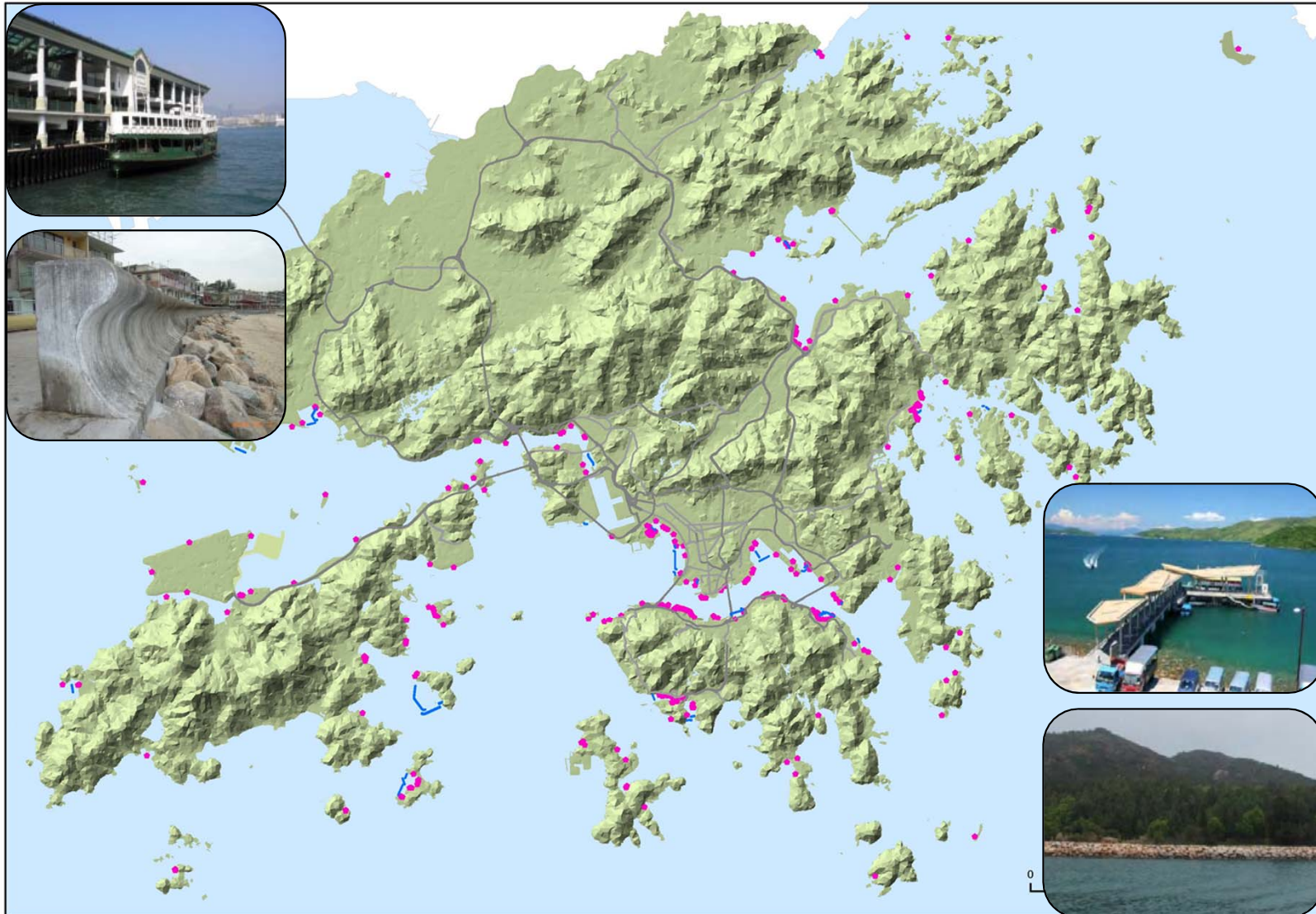


Review of Studies on Climate Change and its Implications on the Design of Coastal Structures



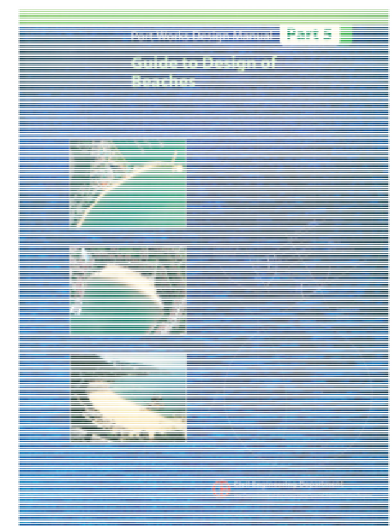
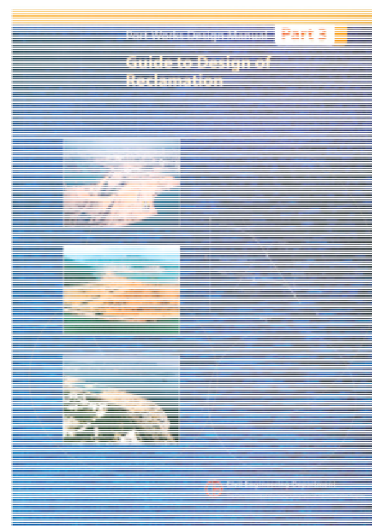
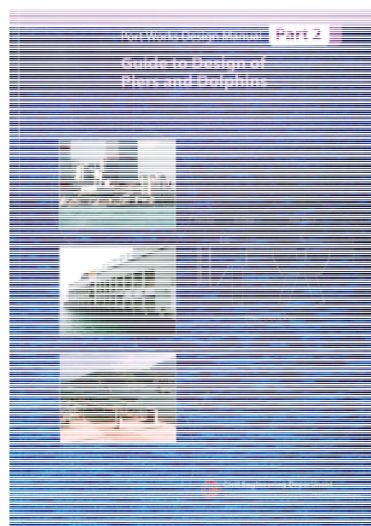
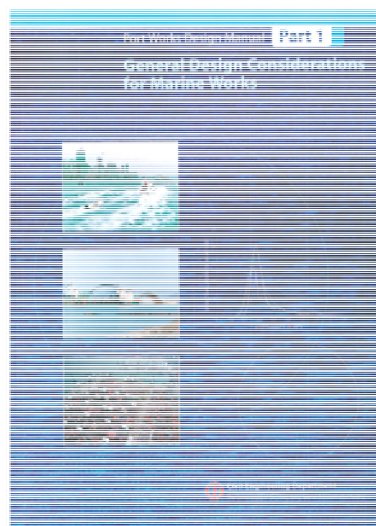
Coastline and Coastal Infrastructures (maintained by CEDD)



Current Design Standards

Port Works Design Manual (PWDM)

- Part 1 - Design Consideration
- Part 2 - Pier
- Part 3 - Reclamation
- Part 4 - Seawall and Breakwater
- Part 5 - Beaches



Current Design Standards

Main considerations in design of coastal structures:

- 1) Environmental
- 2) Geotechnical
- 3) Functional
- 4) Aesthetical



The “Studies”

Agreement No. CE 46/2011(CE)

Review of Studies on Climate Change and its Implications on the Design of Coastal Structures – Feasibility Study

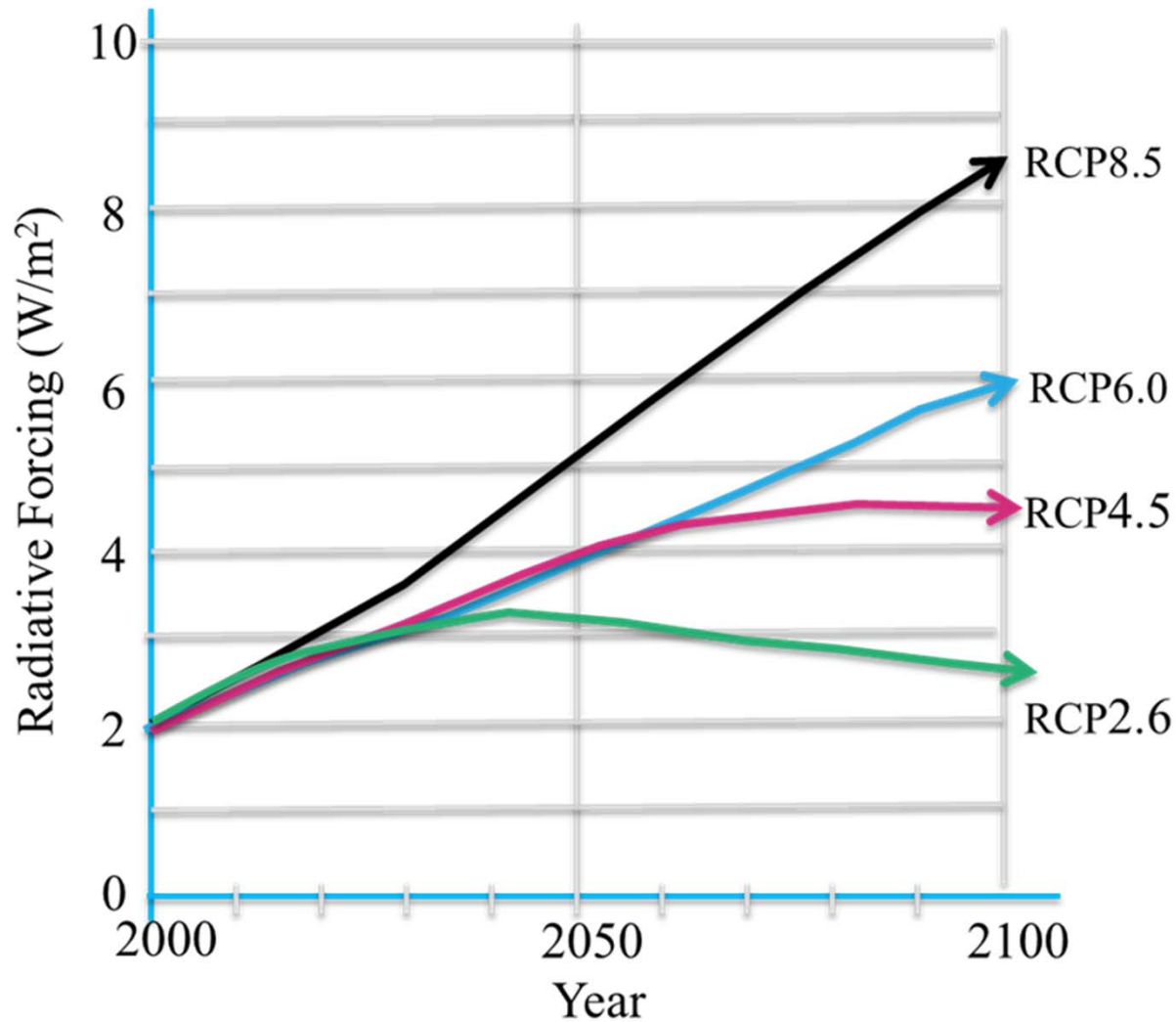
Agreement No. PW 8/2013

Further Review of Studies on Climate Change and its Implications on the Design of Coastal Structures – Feasibility Study

Objectives

- review climate change situation in Hong Kong focusing on storm surges and wind speeds; and
- recommend the update of the design standards in the PWDM.

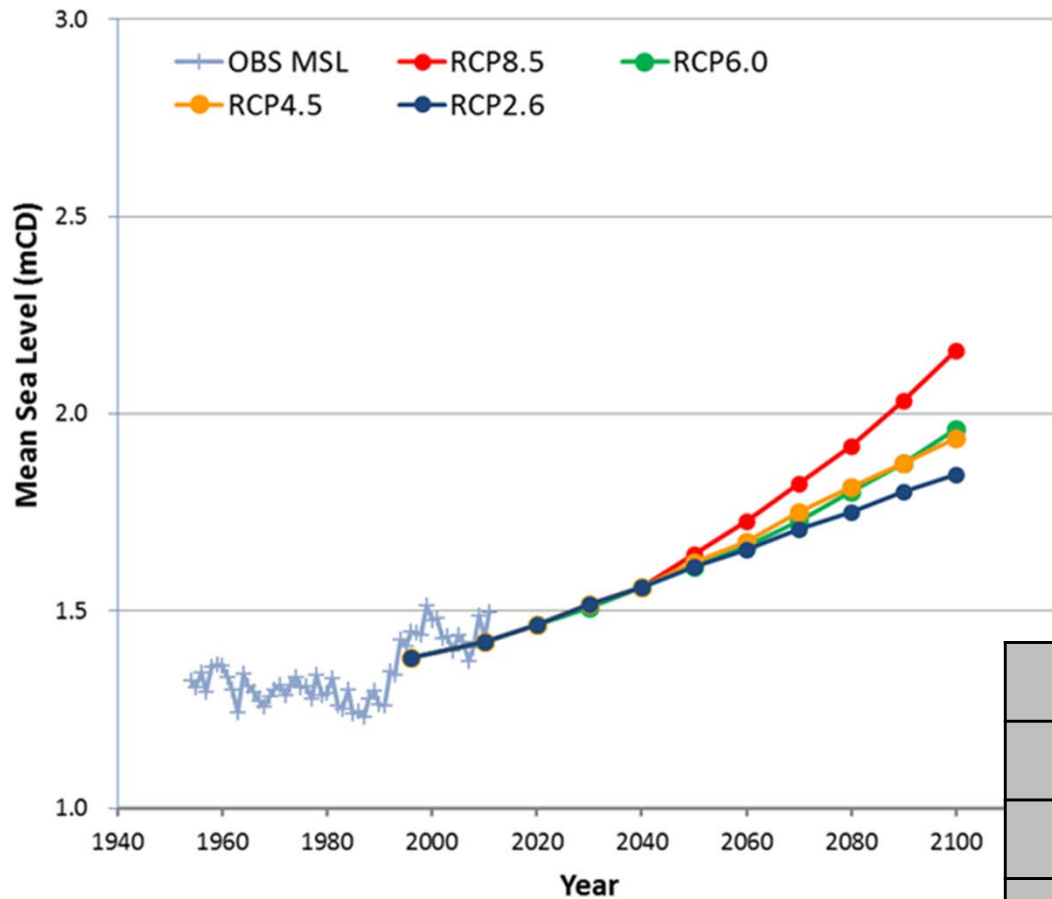
IPCC AR5 Target Radiative Forcing for 4 RCP Scenarios (2.6, 4.5, 6.0 and 8.5)



| Name | Target Radiative Forcing (W/m ²) | CO ₂ Eq. (ppm) | Temp. Anomaly (°C) |
|---------|--|---------------------------|--------------------|
| RCP 8.5 | 8.5 in 2100 | 1350 | 4.9 |
| RCP 6.0 | 6 post 2100 | 850 | 3.0 |
| RCP 4.5 | 4.5 post 2100 | 650 | 2.4 |
| RCP 2.6 | 3 before 2100 and declining to 2.6 by 2100 | 450 | 1.5 |

Projected Mean Sea Levels against Observed Mean Sea Level Data at Quarry Bay

Projected Mean Sea Level in Hong Kong without Vertical Land Movement



Projected Mean Sea Level Rise (m) with reference to Base Year 1996 (1986-2005)

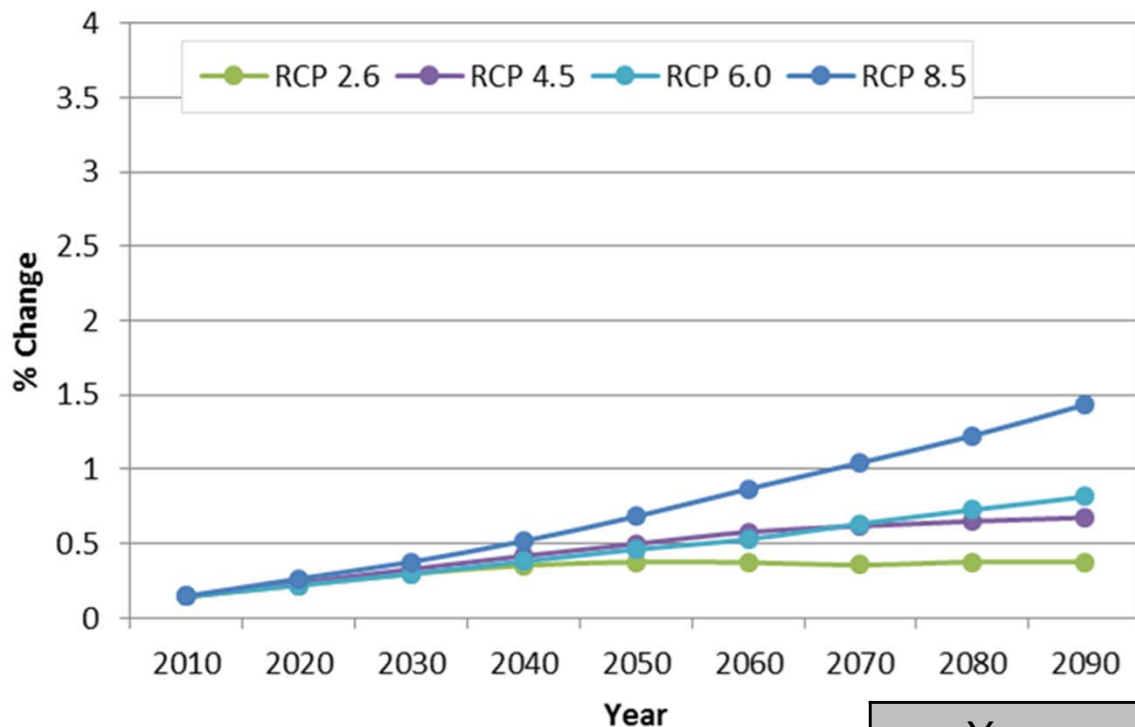
| Scenario | 2010 | 2030 | 2050 | 2100 |
|----------|------|------|------|------|
| RCP8.5 | 0.04 | 0.14 | 0.26 | 0.78 |
| RCP6.0 | 0.04 | 0.13 | 0.23 | 0.58 |
| RCP4.5 | 0.04 | 0.14 | 0.24 | 0.56 |
| RCP2.6 | 0.04 | 0.14 | 0.23 | 0.46 |

* Observed Mean Sea Level (OBS MSL)

* Chart Datum in metre (mCD)

Projected Change of 100-year Return Period Extreme Wind Speeds (%) in Hong Kong

% change of 100 year Extreme Wind Speed

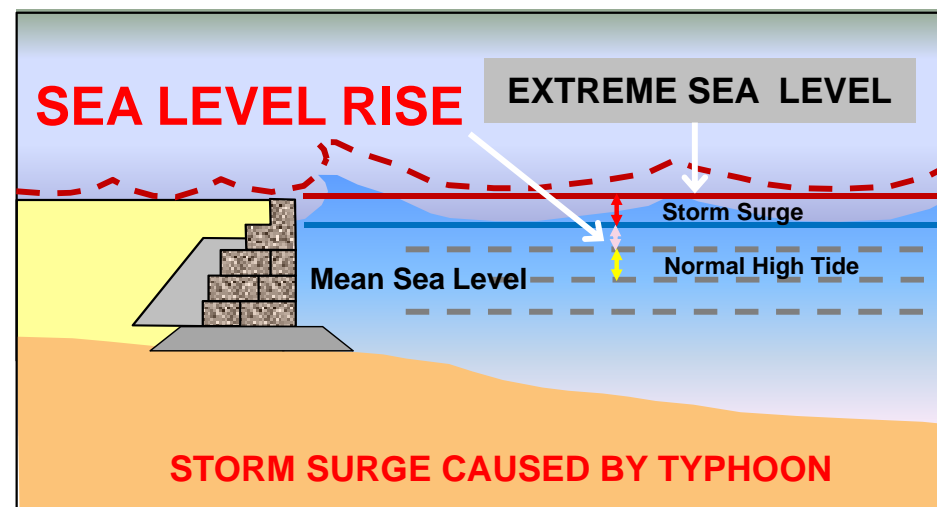
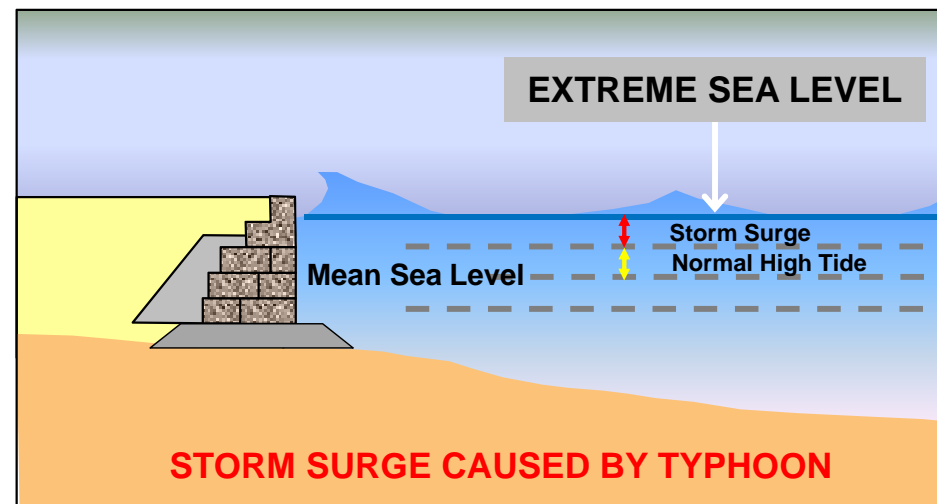


Projected Change of Extreme Wind Speeds (%) with reference to Base Year 1996 (1986-2005)

| Year | 2010 | 2030 | 2050 | 2090 |
|--------|------|------|------|------|
| RCP8.5 | 0.15 | 0.38 | 0.68 | 1.44 |
| RCP6.0 | 0.14 | 0.30 | 0.46 | 0.82 |
| RCP4.5 | 0.14 | 0.33 | 0.50 | 0.68 |
| RCP2.6 | 0.14 | 0.30 | 0.38 | 0.38 |

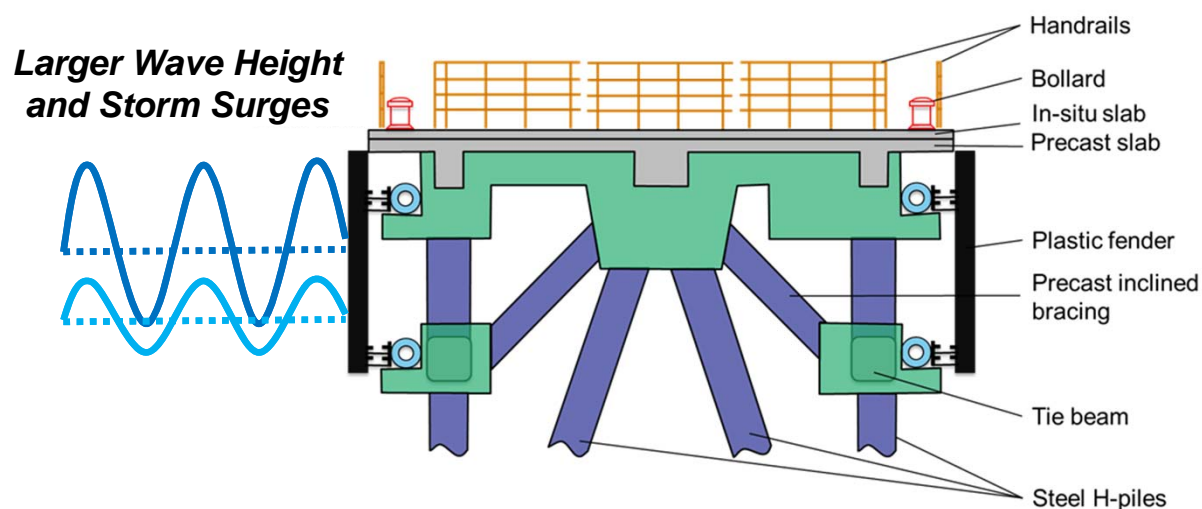
Implications on Design of Coastal Structures

- Water level and wave condition are the major design factors of coastal structures
- Climate change leads to sea level rise
- Higher sea level induced higher risk of wave overtopping and wave run-up
- Higher crest levels of seawalls and breakwaters as well as higher formation levels of new reclamation areas may be needed



Implications on Design of Coastal Structures

- Strengthening of coastal structures against stronger winds and waves may be needed



Implications on Design of Coastal Structures

- CEDD is coordinating with other relevant Government departments on the climate change parameters and their design standards before the promulgation of the new PWDM.
- Further review on the PWDM will be conducted timely as and when necessary, e.g. new report released by the IPCC or latest parameters available.

Implications on Existing Infrastructures

- An inter-departmental working group (namely “Climate Change Working Group on Infrastructure”) led by CEDD has been established.
 - To oversee and coordinate efforts amongst works departments to align the climate change parameters, review the design standards currently in use, and conduct studies for strengthening the resilience of existing infrastructures.
- CEDD commissioned a feasibility study in April 2017.
 - To holistically examine the scope of enhancement works necessary for strengthening the resilience of existing critical infrastructures under the effects of climate change and extreme weather

Thank You