Coastal Engineering and Shore Protection: Breakwaters, Revetments and Marine Structures

8 – 12 March 2027
Dubai - Five-star CBD venue



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Introduction:

Coastal engineering decisions on waterfront projects are often made without reliable design water levels, wave climates or sediment budgets, so breakwaters overtop, revetments slump, groynes starve neighbouring beaches and quay structures corrode long before their design life. This Core Concept course gives civil, port and waterfront engineers the coastal hydraulics, shore protection selection and marine structure inspection practice needed to choose, size and maintain coastal works. Participants assemble a Shore Protection Concept and Marine Structure Inspection File for a frontage from their own portfolio.

Course Objectives:

- Derive design water levels and nearshore wave conditions from tide, surge, wave and sea-level allowances for a coastal site
- Estimate longshore sediment transport and shoreline change to predict how a frontage will respond to new structures
- Select between breakwaters, revetments, seawalls, groynes, beach nourishment and managed retreat for a given erosion or flooding problem
- Size rubble-mound breakwater and revetment armour, underlayers and toe using Hudson's equation and the Van der Meer approach
- Plan above-water and underwater inspections of quay walls, jetties and piers and rate the condition of concrete and steel elements in the marine environment
- Prepare a Shore Protection Concept and Marine Structure Inspection File that links design choices, climate allowances and a repair programme

Target Audience:

- Civil and coastal engineers who design or check shore protection and reclamation edges
- Port and harbour engineers responsible for breakwaters, quay walls and berthing structures
- Waterfront development engineers who plan marinas, promenades and beachfront schemes
- Asset maintenance engineers who inspect and repair jetties, piers and sheet pile walls
- Consultant and contractor engineers who prepare coastal design reports and method statements

Course Outline:

Day 1: Coastal Processes, Water Levels and Wave Climate

- Coastal Zone Anatomy: Nearshore, Surf Zone, Beach Profile and Backshore
- Astronomical Tide Levels, Storm Surge and Joint Probability of Design Still Water Level
- Wave Generation, Significant Wave Height, Peak Period and Wave Climate Statistics
- Wave Transformation: Shoaling, Refraction, Diffraction and Depth-Limited Breaking
- Wave-Induced Currents: Longshore Current, Rip Currents and Stokes Drift

Day 2: Sediment Transport, Shoreline Change and Protection Options

- Longshore Drift by Swash and Backwash and Littoral Cell Sediment Budgets
- Cross-Shore Profile Response, Storm Erosion and Beach Recovery Cycles
- Shoreline Change Mapping from Satellite Imagery and Beach Profile Surveys
- Hard Protection Options: Breakwaters, Seawalls, Revetments and Groynes Compared
- Soft Options: Beach Nourishment Fill Matching, Renourishment Cycles and Managed Retreat

Day 3: Rubble-Mound Breakwater and Revetment Design Basics

- Rubble-Mound Cross-Section: Core, Underlayers, Armour Layer, Crest and Toe Berm
- Hudson's Equation and Van der Meer Approach for Armour Stone Weight and Grading
- Concrete Armour Units: Tetrapod, Dolos, Xbloc and Cube Selection Criteria
- Wave Run-Up, Overtopping Allowances and Crest Level Setting for Revetments and Seawalls
- Physical Hydraulic Model Testing and Numerical Wave Models in Detailed Design

Day 4: Quay Walls, Jetties, Piers and Marine Structure Deterioration

- Caisson, Blockwork, Sheet Pile and Piled Deck Quay Wall Types at Overview
- Open Piled Jetties and Piers: Deck, Fender and Mooring Load Paths at Overview
- Marine Exposure Zones: Submerged, Tidal, Splash and Atmospheric Attack on Concrete
- Accelerated Low Water Corrosion, Pitting and Section Loss on Steel Piles and Sheet Piles
- Toe Scour, Armour Displacement and Settlement Failure Modes on Coastal Structures

Day 5: Inspection Walkthrough and the Shore Protection Concept File

- Inspection Walkthrough: Breakwater Armour Survey, Crest Settlement and Toe Scour Case File
- Diver and ROV Underwater Inspection Planning with Ultrasonic Steel Thickness Gauging
- Marine Structure Condition Rating Matrix and Repair Options: Pile Jacketing, Sacrificial Anodes and Armour Reinstatement
- Coastal Zone Planning Check: Setback Lines, Sea-Level Allowance and Adaptation Pathways for a Waterfront Scheme
- Shore Protection Concept and Marine Structure Inspection File Drafting and Peer Review Panel

Skills You Will Gain:

- Design Water Level Derivation
- Nearshore Wave Transformation
- Littoral Sediment Budgeting
- Shore Protection Option Appraisal
- Armour Layer Sizing
- Overtopping and Crest Level Checking
- Underwater Inspection Planning
- Marine Corrosion Assessment

Why Attend This Course:

- Take back a Shore Protection Concept and Marine Structure Inspection File built around a frontage you are responsible for
- Question consultant wave, water level and armour calculations with clear checks before designs go to tender
- Avoid shore protection that moves erosion to the next beach by reading the sediment budget first
- Compare coastal practice with engineers from ports, real estate waterfronts, industrial outfalls and public coastal authorities

Conclusion:

Coastal structures last when water levels, waves and sediment movement are understood before a single stone is placed. The week moves from tides, surge, wave transformation and nearshore currents, through longshore drift, shoreline change and the choice between hard and soft protection, to rubble-mound armour sizing, overtopping and crest setting. It then covers quay walls, jetties, piers and marine deterioration, and closes with an inspection walkthrough, climate allowances and a Shore Protection Concept and Marine Structure Inspection File for each participant.