هيئة كفاءة الإنفاق والمشروعات الحكومية
Expenditure Efficiency & Projects Authority

EXPRO National Manual for Projects Management

Volume 6, chapter 7

Coastal Marine Design Aids

Document No. EPM-KER-GL-000001 Rev 003

Document Submittal History:

Revision:	Date:	Reason For Issue
000	29/10/2017	For Use
001	06/26/18	For Use
002	24/12/2018	For Use
003	15/08/2021	For Use

THIS NOTICE MUST ACCOMPANY EVERY COPY OF THIS DOCUMENT

IMPORTANT NOTICE

This document, (“Document”) is the exclusive property of Government Expenditure & Projects Efficiency Authority.

This Document should be read in its entirety including the terms of this Important Notice. The government entities may disclose this Document or extracts of this Document to their respective consultants and/or contractors, provided that such disclosure includes this Important Notice.

Any use or reliance on this Document, or extracts thereof, by any party, including government entities and their respective consultants and/or contractors, is at that third party’s sole risk and responsibility. Government Expenditure and Projects Efficiency Authority, to the maximum extent permitted by law, disclaim all liability (including for losses or damages of whatsoever nature claimed on whatsoever basis including negligence or otherwise) to any third party howsoever arising with respect to or in connection with the use of this Document including any liability caused by negligent acts or omissions.

This Document and its contents are valid only for the conditions reported in it and as of the date of this Document.

Table of Contents

1.0 PURPOSE

The purpose of this section is to provide the Entity-A/E the templates, checklists, design guidelines, etc. (collectively called Design Aids) to comprehensively define the Coastal Marine design of a Project and ensure that the design is complete, uses appropriate templates and has undergone the necessary checks to achieve the quality design which can be used to purchase fit for purpose material/ equipment and safely install all facilities under Entity's project.

Refer to Chapter 7, Section 1 - General Design Guideline (EPM-KE0-GL-000016) for the instructions on the use of every element of this Design Aids. Also refer Definitions and References (EPM-KE0-GL-000011) terms used on this document. This also covers non-discipline specific Design Aid such as Calculation Templates, Calculation check list, Design software list, etc. which apply to all engineering disciplines including Coastal Marine. Users are urged to carefully read the instructions provided in the above mentioned document to fully understand the purpose and use of all documents listed in this section.

The Entity-A/E shall review the list of deliverables and determine the templates, check lists, etc. applicable to the project. The list of applicable templates/ checklists/ etc. may vary from project to project depending upon the Design Scope of Work of the Project.

2.0 REFERENCES

1. EPM-KE0-GL-000016 - General Design Guideline
2. EPM-KER-GL-000002 - Coastal and Marine Design Guideline
3. EPM-KES-RG-000001 - List of Structural Deliverables
4. EPM-KE0-GL-000011 - Definitions and References

3.0 COASTAL MARINE DESIGN AIDS

The Coastal Marine Design Aids developed for use on Entity's projects are listed below, each issued as a standalone document.

3.1 Coastal Marine Design Guideline

Refer to the section on "Discipline design guidelines" in the document EPM-KE0-GL-000016 (General Design Guideline) for the purpose and the instructions on the use of discipline Design Guidelines issued for use in the design of Entity's Projects.

Refer to the Coastal Marine Design Guideline EPM-KER-GL-000002 for additional details.

3.2 Coastal Marine Design Deliverables

Refer to the section on "Discipline design guidelines" in the document EPM-KE0-GL-000016 (General Design Guideline) for the purpose and the instructions on the use of List of Design Deliverables issued for use in the design of Entity's projects.

Refer to the document EPM-KES-RG-000001 for a typical list of design deliverables applicable for the Coastal Marine design discipline.

3.3 Design Check Lists

Refer to the section on "Discipline design guidelines" in the document EPM-KE0-GL-000016 (General Design Guideline) for the purpose and the instructions on the use of Checklists issued for the use in the design of Entity's projects.

Table below lists Coastal Marine check lists issued for use on Entity's Projects

List of Coastal Marine Checklists

SN	Check List for	Document No
1	General Notes Drawing (Marine Structures)	EPM-KER-TP-000001
2	Foundation Drawing (Marine Structures)	EPM-KER-TP-000002
3	Pile Foundation Drawing (Marine Structures)	EPM-KER-TP-000003
4	Quay Wall Drawing	EPM-KER-TP-000004

3.4 Templates

Refer to the section on “Discipline design guidelines” in the document EPM-KE0-GL-000016 (General Design Guideline) for the purpose and the instructions on the use of Templates issued for the use in the design of Entity’s projects.

Table below lists Coastal Marine templates issued for use on Entity’s Projects

List of Coastal Marine Templates

SN	Template for	Document No.
1	Coastal Marine Design Criteria	EPM-KER-TP-000005

4.0 ATTACHMENTS

1. EPM-KER-TP-000001 - Checklist - General Notes Drawing (Marine Structures)
2. EPM-KER-TP-000002 - Checklist - Foundation Drawing (Marine Structures)
3. EPM-KER-TP-000003 - Checklist - Pile Foundation Drawing (Marine Structures)
4. EPM-KER-TP-000004 - Checklist - Quay Wall Drawing
5. EPM-KER-TP-000005 - Template - Coastal Marine Design Criteria

Attachment 1 - EPM-KER-TP-000001 - Checklist - General Notes Drawing (Marine Structures)

PROJECT NAME:	DRAWING NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
1	Does the drawing comply with applicable codes, standards and regulatory requirements?	☐	☐	☐	☐	☐	☐
2	Does the drawing comply with applicable Project Design Criteria, system or structural functional requirements, Scope Book, and Design Basis Documents considered?	☐	☐	☐	☐	☐	☐
3	Is the coordinate system and site arrow direction (North) on drawing correct?	☐	☐	☐	☐	☐	☐
4	Does the Allowable Bearing Capacity (ABC) on the drawing comply with geotechnical report?	☐	☐	☐	☐	☐	☐
5	Does the Specified grade of structural steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
6	Does the Specified grade of hollow steel sections comply with Project Specifications?	☐	☐	☐	☐	☐	☐
7	Does the Specified grade of cold form steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
8	Does the Specified grade of stainless steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
9	Does the specified grade of welding electrode comply with code?	☐	☐	☐	☐	☐	☐
10	Does drawing include a note for minimum fillet weld?	☐	☐	☐	☐	☐	☐
11	Does type of concrete/concrete mix comply with Project Specifications?	☐	☐	☐	☐	☐	☐
12	Does the specified compressive strength (28-days) of RCC concrete (Sub-structure and super-Structure) comply with Project Specifications?	☐	☐	☐	☐	☐	☐
13	Does the specified compressive strength (28-days) of mass concrete comply with Project Specifications?	☐	☐	☐	☐	☐	☐
14	Does the drawing specify the required compressive strength (28-days) of precast (not prestressed reasoned) concrete members, and does this comply with Project Specifications?	☐	☐	☐	☐	☐	☐
15	Does drawing specify the minimum required compressive strength of precast concrete elements at lifting stage?	☐	☐	☐	☐	☐	☐
16	Does drawing specify the required compressive strength (28-days) of non-shrink grout, and does this comply with Project Specifications?	☐	☐	☐	☐	☐	☐
17	Does drawing specify the required compressive strength (28-days) of cement/sand mortar and type of mortar, and does this comply with Project Specifications?	☐	☐	☐	☐	☐	☐
18	Does drawing specify the required compressive strength (28-days) of blinding concrete, and does this comply with Project Specifications?	☐	☐	☐	☐	☐	☐
19	Does the type and grade of anchor bolts comply with Project Specifications?	☐	☐	☐	☐	☐	☐
20	Does the type and grade of structural fasteners comply with Project Specifications?	☐	☐	☐	☐	☐	☐
21	Does the drawing include a note for the separation of two dissimilar metals to avoid corrosion?	☐	☐	☐	☐	☐	☐
22	Does the grade of reinforcement steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
23	Have the reinforcement splice lengths been checked with Codes?	☐	☐	☐	☐	☐	☐
24	Does drawing include table for splice lengths?	☐	☐	☐	☐	☐	☐
25	Does the drawing specify the limit on construction loads? Construction load shall not exceed live load considered in the design.	☐	☐	☐	☐	☐	☐

Attachment 2 - EPM-KER-TP-000002 - Checklist - Foundation Drawing (Marine Structures)

PROJECT NAME:	DRAWING NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
1	Does the drawing comply with applicable codes, standards and regulatory requirements?	☐	☐	☐	☐	☐	☐
2	Does the drawing comply with applicable Project Design Criteria, system or structural functional requirements, Scope Book, and Design Basis Documents considered?	☐	☐	☐	☐	☐	☐
3	Is the coordinate system and the site arrow direction (North) on drawing correct?	☐	☐	☐	☐	☐	☐
4	Does the Allowable Bearing Capacity (ABC) and settlement on the drawing comply with geotechnical report?	☐	☐	☐	☐	☐	☐
5	Does drawing specify subgrade preparation/condition?	☐	☐	☐	☐	☐	☐
6	Does drawing specify the footing schedule of all foundations?	☐	☐	☐	☐	☐	☐
7	Does footing schedule specify the sizes, depths, foundation levels as a minimum?	☐	☐	☐	☐	☐	☐
8	Does concrete cover to reinforcement comply with Project Specifications?	☐	☐	☐	☐	☐	☐
9	Does the specified compressive strength of in-situ & precast concrete in foundations comply with Project Specifications?	☐	☐	☐	☐	☐	☐
10	Does the specified compressive strength of concrete in grade beams comply with Project Specifications?	☐	☐	☐	☐	☐	☐
11	Does the specified compressive strength of blinding concrete comply with Project Specifications?	☐	☐	☐	☐	☐	☐
12	Does the specified compressive strength of non-shrink grout comply with Project Specifications?	☐	☐	☐	☐	☐	☐
13	Does the specified compressive strength of screed comply with Project Specifications?	☐	☐	☐	☐	☐	☐
14	Does the grade of reinforcement steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
15	Does the drawing contain a note for the separation of two dissimilar metals to avoid corrosion?	☐	☐	☐	☐	☐	☐
16	Do the reinforcement splice lengths comply with Project Specifications?	☐	☐	☐	☐	☐	☐
17	Does the dowel length (of rebars) for the column include an allowance for kicker?	☐	☐	☐	☐	☐	☐
18	Has the clash between column rebars, supplementary reinforcement and anchor bolts been checked?	☐	☐	☐	☐	☐	☐
19	Have the foundations been checked for the openings/penetrations/ pockets due to MEP?	☐	☐	☐	☐	☐	☐
20	Does the concrete coating/protection system comply with Project Specifications?	☐	☐	☐	☐	☐	☐
21	Has the clash between foundations and embedded pits been checked?	☐	☐	☐	☐	☐	☐
22	Has the location/coordinates of embeds (anchor bolts, steel plates, sections etc.) been checked with other disciplines' drawings?	☐	☐	☐	☐	☐	☐
23	Has the congestion of reinforcement at the junction of plinth beam and column been checked?	☐	☐	☐	☐	☐	☐
24	Does the backfill around the structure comply with Project Specification?	☐	☐	☐	☐	☐	☐
25	Has the dewatering note if applicable been included?	☐	☐	☐	☐	☐	☐
26	Has the drawing been checked for "Holds"?	☐	☐	☐	☐	☐	☐
27	Does the geotextile comply with Project Specifications?	☐	☐	☐	☐	☐	☐
28	Are [illegible] provided at expansion and construction joints?	☐	☐	☐	☐	☐	☐

Attachment 3 - EPM-KER-TP-000003 - Checklist - Pile Foundation Drawing (Marine Structures)

PROJECT NAME:	DRAWING NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		N/A	YES	NO	N/A	YES	NO
1	Does the drawing comply with applicable codes, standards and regulatory requirements?	☐	☐	☐	☐	☐	☐
2	Does the drawing comply with applicable Project Design Criteria, system or structural functional requirements, Scope Book, and Design Basis Documents considered?	☐	☐	☐	☐	☐	☐
3	Is the coordinate system and site direction (North) on drawing correct?	☐	☐	☐	☐	☐	☐
4	Does the drawing include coordinates of piles matching project coordinate system?	☐	☐	☐	☐	☐	☐
5	Does the specified compressive strength of concrete piles comply with Project Specifications?	☐	☐	☐	☐	☐	☐
6	Does the specified grade of reinforcement comply with Project Specifications?	☐	☐	☐	☐	☐	☐
7	Does splice length for reinforcement and anchorage length comply with Code?	☐	☐	☐	☐	☐	☐
8	Have the dowel lengths of rebars been checked with spec?	☐	☐	☐	☐	☐	☐
9	Do concrete covers to reinforcement comply with Project Specifications?	☐	☐	☐	☐	☐	☐
10	Does the concrete coating/protection system comply with Project Specifications?	☐	☐	☐	☐	☐	☐
11	Does the steel coating/protection system comply with Project Specifications?	☐	☐	☐	☐	☐	☐
12	Does vertical angle or slope of batter piles comply with Project Standards?	☐	☐	☐	☐	☐	☐
13	Does minimum distance between piles comply with code or geotechnical recommendations?	☐	☐	☐	☐	☐	☐
14	Does drawing specify test loads including pile test arrangement?	☐	☐	☐	☐	☐	☐
15	Does the grade of structural steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
16	Does the drawing include diameter and wall thickness for steel piles?	☐	☐	☐	☐	☐	☐
17	Does the drawing include external/internal shear keys for steel piles?	☐	☐	☐	☐	☐	☐
18	Have the cut off levels of steel piles been checked with general arrangement drawings?	☐	☐	☐	☐	☐	☐
19	Does the drawing include steel diaphragm detail for pile plug connection?	☐	☐	☐	☐	☐	☐
20	Does the drawing contain pile schedule including toe level, top level, length of pile, quantities of piles, diameter of pile and batter angle of pile?	☐	☐	☐	☐	☐	☐
21	Does the drawing include scour protection detail?	☐	☐	☐	☐	☐	☐
22	Does the welding connection between piles comply with code?	☐	☐	☐	☐	☐	☐
23	Have the design parameters like pile embedded length, diameter, batter, spacing, type of fixity (i.e. pin or fixed), and wall thickness been validated with calculations report?	☐	☐	☐	☐	☐	☐
24	Has list of reference drawings been provided?	☐	☐	☐	☐	☐	☐
25	Has reference of general notes drawing been provided?	☐	☐	☐	☐	☐	☐
26	Has reference of pile layout drawing been provided?	☐	☐	☐	☐	☐	☐
27	Has appropriate interdisciplinary and intradepartmental coordination been done?	☐	☐	☐	☐	☐	☐

Attachment 4 - EPM-KER-TP-000004 - Checklist - Quay Wall Drawing

PROJECT NAME:	DRAWING NO.	REV.

No.	QUESTIONS	ORIGINATOR			CHECKER		
		NA	YES	NO	NA	YES	NO
1	Does the drawing comply with applicable codes, standards and regulatory requirements?	☐	☐	☐	☐	☐	☐
2	Does the drawing comply with applicable Project Design Criteria, system or structural functional requirements, Scope Book, and Design Basis Documents considered?	☐	☐	☐	☐	☐	☐
3	Do the Allowable Bearing Capacity (ABC) and settlement on the drawing comply with geotechnical report?	☐	☐	☐	☐	☐	☐
4	Do concrete covers over reinforcement comply with Project Specifications?	☐	☐	☐	☐	☐	☐
5	Do the compressive strength of in-situ and precast concrete comply with Project Specifications?	☐	☐	☐	☐	☐	☐
6	Does the specified compressive strength of mass concrete comply with Project Specifications?	☐	☐	☐	☐	☐	☐
7	Does type of concrete/concrete mix comply with Project Specifications?	☐	☐	☐	☐	☐	☐
8	Does the grade of reinforcement steel comply with Project Specifications?	☐	☐	☐	☐	☐	☐
9	Do the splice lengths of rebars comply with code?	☐	☐	☐	☐	☐	☐
10	Does the backfill around the structure comply with Project Specifications?	☐	☐	☐	☐	☐	☐
11	Does quay wall validate the calculation report?	☐	☐	☐	☐	☐	☐
12	Is a shear key required for stability?	☐	☐	☐	☐	☐	☐
13	Does the eccentricity of wall comply the code?	☐	☐	☐	☐	☐	☐
14	Has the effect of ground water table been considered in the calculation report?	☐	☐	☐	☐	☐	☐
15	Has geotextile behind the wall been provided where required by design?	☐	☐	☐	☐	☐	☐
16	Has the stability of wall been checked for the construction stage?	☐	☐	☐	☐	☐	☐
17	Has the weight of precast blocks/sections been reduced for lifting pockets in stability calculations?	☐	☐	☐	☐	☐	☐
18	Has the effect of tidal lag been considered in the stability analysis of wall?	☐	☐	☐	☐	☐	☐
19	Have the precast sections/blocks been checked for maximum tensile stress for lifting stage?	☐	☐	☐	☐	☐	☐
20	Does the drawing specify the minimum compressive strength of precast concrete sections/blocks for lifting stage?	☐	☐	☐	☐	☐	☐
21	Do the fender & bollard spacings comply with calculations?	☐	☐	☐	☐	☐	☐
22	Does edge distance of bollard comply with code?	☐	☐	☐	☐	☐	☐
23	Does ladder spacing comply with code?	☐	☐	☐	☐	☐	☐
24	Does the length of ladder below the LAT (Lowest Astronomic Tide) comply with code?	☐	☐	☐	☐	☐	☐
25	Has the fender been checked for all correction factors (Temp., velocity and berthing angle)?	☐	☐	☐	☐	☐	☐
26	Has sufficient scour protection been provided in front of quay wall?	☐	☐	☐	☐	☐	☐
27	Has corrosion allowance been considered for sheet pile quay wall?	☐	☐	☐	☐	☐	☐
28	Has the quay wall been checked for erosion/scour from overtopping?	☐	☐	☐	☐	☐	☐
29	Has the quay wall been checked for high and low water levels as used in the design?	☐	☐	☐	☐	☐	☐
30	Has the vertical datum of quay wall been checked?	☐	☐	☐	☐	☐	☐
31	Has reference of General Notes drawing been provided?	☐	☐	☐	☐	☐	☐
32	Have references of interface drawings (MEP) been provided?	☐	☐	☐	☐	☐	☐
33	Has reference list of drawings been provided?	☐	☐	☐	☐	☐	☐

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

EXPRO
هيئة كفاءة الإنفاق والمشروعات الحكومية
Expenditure Efficiency & Projects Authority

Template - Coastal Marine Design Criteria

Table of Contents

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

EXPRO

Template - Coastal Marine Design Criteria

1.0 GENERAL

This section describes the basic format of design criteria which should be included in all types of Costal & Marine Projects.

1.1 Scope

This document covers general design criteria for coastal and marine structures.

1.2 Codes, Standards and Regulations

List the applicable:

- *National codes,*
- *International codes/standards,*
- *Regulations,*
- *Guideline specifications and*
- *Fire protection codes*

[Any deviations from the codes and regulations to be permitted only after obtaining written approval of the relevant regulatory authorities.]

1.3 Hierarchy of Specifications

[State hierarchy for the project specifications. Hierarchy will be used where a conflict or difference occurs between specification sources.]

1.4 Design Life

Describe required life of:

- *Quay wall*
- *Jetty*
- *Trestle*
- *Concrete buildings/structures*
- *Steel buildings/structures*
- *Bridges/underpasses/Road culverts*
- *Concrete platforms*
- *Steel platforms/walkways*
- *Retaining walls*
- *Steel/GRP gratings etc.*

[State the design life of each structure which is in the scope of work. The design life denotes the duration that the facility will continue to be in service. Mention that structures and elements of structures shall be designed in such a way to ensure a safe and stable behavior during the established design life under the expected loads up to the related national and international standards]

1.5 Units and Datums

Describe:

- *Unit system*
- *Dimensions*
- *Vertical and Horizontal Datums*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

1.6 Abbreviations

[Define all abbreviations which will be used in the design criteria.]

1.7 Ship Data

Describe all design vessels and for each vessel specify:

- *Overall length of Vessel between perpendiculars,*
- *Beam width of vessel,*
- *Laden & unladen drafts,*
- *Loaded displacement, and*
- *Vessel windage area.*

1.8 Approach Channel

Identify the required depth of channels based on following parameters:

- *the loaded draft of the design vessel,*
- *tidal variations, waves, vessel squat and trim,*
- *under keel clearance requirements,*
- *turning basin, and*
- *Sedimentation and maintenance depth.*

The required width of channels (width at the dredged level) shall take into account

- *the beam speed and maneuverability of the design vessel,*
- *passing criteria,*
- *channel depth,*
- *alignment, stability of channel banks,*
- *winds, waves and currents or cross currents and*
- *availability of navigational aids.*

1.9 Navigation Aids

[Aids to navigation are used to mark limits of structures such as piers, seawalls, breakwaters and dolphins, channel entrances, boundaries and turns, and hidden dangers such as shoals and rock outcrops, to act as a guide for vessels and to assist with their safe movement.]

1.10 Geotechnical Considerations

[Geotechnical investigations in accordance with project specifications. Specify additional requirements if required.]

1.11 Berthing

Specify the:

- *Approach velocity of vessel perpendicular to the berthing line*
- *Type of berthing [side berthing, quarter point, third point or mid-point]*
- *Berthing condition [Easy & Difficult Berthing- for sheltered and exposed conditions]*
- *Seawater density*
- *Tug boats assistance in berthing*
- *Type of fender system*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

EXPRO
هيئة كفاءة الإنفاق والمشروعات الحكومية
Expenditure Efficiency & Projects Authority

Template - Coastal Marine Design Criteria

1.12 Mooring

Specify the:

- *Type of mooring system [quick release hook or bollards etc.]*
- *Mooring loads*
- *Mooring lines arrangement*
- *Vertical & horizontal angles of mooring lines*

1.13 Loading Considerations

Specify the:

- *Dead loads*
- *Imposed loads*
- *Live loads [fork lift trucks, crawler cranes, reach stackers etc.]*
- *Mooring loads*
- *Berthing loads*
- *Equipment loads [marine loading arms, gangway tower etc.]*
- *Rail mounted crane loads*
- *Seismic loads*
- *Lateral earth & water pressures*
- *Surcharge behind walls*
- *Hydrostatic & Hydrodynamic loads*
- *Vessel collision loads*
- *Wind, wave and current loads*
- *Ground water table or tidal lags*
- *Buoyancy loads*
- *Thermal loads*
- *Construction loads*

1.14 Materials

1.14.1 Concrete

Specify the:

- *Concrete grade (28-day compressive strength) for all (in-situ concrete and Precast concrete) structural elements.*
- *Coefficient of thermal expansion of concrete*
- *Unit weight of mass concrete, in-situ concrete and Precast concrete.*
- *Modulus of elasticity of concrete for short term period*
- *Modulus of elasticity of concrete for long term period*
- *Concrete cover to reinforcement*
- *Concrete exposure conditions*
- *Compressive (28-day) strength of in-situ concrete*
- *Compressive (28-day) strength of precast concrete*
- *Compressive (28-day) strength of mass concrete*
- *Compressive strength of non-shrink grouts*
- *Compressive (28-day) strength of blinding concrete*
- *Compressive (28-day) strength of screed*

1.14.2 Structural Steel

Specify the:

- *Grade/yield strength of all structural rolled steel sections.*
- *Grade/yield strength of all structural rolled hollow steel sections.*
- *Grade/yield strength of all structural cold form steel sections.*
- *Grade/yield strength of all hot dipped galvanized steel sections.*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

- *Grade/yield strength of all stainless steel sections*
- *Coefficient of thermal expansion of steel*
- *Strength of welding electrodes*
- *Type and grade of connection bolts*
- *Type & grade of anchor bolts*
- *Grade/ yield strength of base plate*
- *Type and grade/ yield strength of gratings*
- *Type & grade/ yield strength of Chequered plates*

1.14.3 Reinforcement Steel

Specify the:

- *Grade and yield strength of deformed bars*
- *Grade and yield strength of plain bars.*
- *Splice lengths for tension laps*
- *Splice length compression laps*
- *Type & grade of mesh reinforcement*

1.14.4 Geotextile

Specify the:

- *Type of geotextile*
- *Geotextile properties*

1.14.5 Fill Material

Specify the:

- *Type of fill material (quarry run, crushed rock, etc.)*
- *Angle of internal friction*
- *Moist and submerged unit weights of fill materials*

1.14.6 Rock Armor

Specify the:

- *Allowable material and properties for armor stones*
- *Allowable material and properties for filter stone*
- *Allowable material and properties for bedding layers*
- *Minimum layer thickness*
- *Requirement for toe/anchor trench*
- *Methods of placement for above and below water application*

2.0 NATURAL CONDITIONS

2.1 Tide and Water Level

Specify the following tide levels and the station datum:

- *Highest Astronomic Tide*
- *Mean High Water Level*
- *Mean Low High Water Level*
- *Mean Water Level*
- *Mean High Low Water Level*
- *Mean Low Water Level*
- *Lowest Astronomic Tide*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

Provide design water level for structures including design return period or annual exceedance probability and the horizon and provision for sea level rise.

2.2 Datums

Specify the project vertical and horizontal datums and unit system

2.3 Bathymetry

Specify the required accuracy, resolution, extend, method of collection and format of bathymetry survey information to be collected and used for design

Provide the:

- *Reference of bathymetric survey drawings, if applicable.*

2.4 Wave and Currents

Specify the:

- *Operational waves*
- *Extreme waves*
- *Operational currents*
- *Extreme currents*
- *Maximum wave height for moored vessel*
- *Prevailing storm & wave directions*
- *Minimum air gap between highest wave and soffit of beam/slab for design of structures*
- *Design return periods*

2.5 Wind

Specify the:

- *Normal or operational wind speed*
- *Extreme wind speed*
- *Prevailing wind directions*
- *Design return periods*
- *Wind Gust*

3.0 WHARVES/JETTIES,QUA WALLS,BREAK WATERS AND REVETMENTS

3.1 Wharves/Jetties

Specify the:

- *Cope level*
- *Dredged level*
- *Scour protection*
- *Bollard locations*
- *Mooring rings location and elevation*
- *No. of Access ladders and spacing*
- *Fender type and specifications*
- *Equipment details*
- *Crane details, if applicable*
- *Access walkways*
- *Minimum air gap between soffit of beam and highest wave*
- *Provision of inhibit marine growth on piles*
- *Minimum strength of precast concrete at lifting stage*
- *Shear keys for connection between steel pile and concrete plug*
- *Coating/ protection requirement*
- *Crack width limit and concrete covers*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

- *Scour protection*
- *Siltation and seabed scour*

3.2 Quay Walls

Specify the:

- *Cope level of capping beam*
- *Founding level*
- *Dredged level*
- *Allowable bearing pressure for surcharge behind wall*
- *Factor of safety in sliding, overturning and eccentricity*
- *Strength of mass concrete precast blocks*
- *Construction tolerances for precast blocks*
- *Scour protection*
- *Quarry run properties*
- *Geotextile properties*
- *Bollard locations*
- *Mooring rings location and elevation*
- *No. of Access ladders and spacing*
- *Fender type and specifications*
- *Specification of rail and distance from cope line, if applicable*
- *Minimum strength of precast concrete at lifting stage*
- *Scour protection*
- *Toe protection*
- *Siltation and seabed scour*

3.3 Breakwater & Revetments

[Breakwaters are built to reduce wave action in an area in the lee of the structure. Wave action is reduced through a combination of reflection and dissipation of incoming wave energy.

When used for harbors, breakwaters are constructed to create calm waters for safe mooring and loading operations, handling of ships, and protection of harbor facilities.]

Specify the:

- *Requirement of crest level determination*
- *Crest surfacing or structure*
- *Fill Material*
- *Filter specifications*
- *Toe protection*
- *Stability factors*
- *Type of Breakwater (fully-, partially- or non-submerged)*
- *Siltation and seabed scour*

4.0 LAND RECLAMATION

[The purpose of reclamation is to provide coastal land for roadways, residential development, beach nourishment, port and industrial uses or to improve hydraulic conditions by modifying the coastline.]

4.1 Site Investigation

Specify that:

- *Site investigation shall be carried out prior to the design of reclamation.*
- *In addition to normal geotechnical investigations required for marine work, the investigations shall cover potential sources of fill materials.*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

- *In-situ and laboratory testing of soil samples from within the proposed reclamation area shall be carried out to determine the strength, settlement and permeability characteristics of the underlying soils.*
- *Investigations shall include hydrographic and hydrodynamic study of the currents, waves and sediment transport, environmental impact assessment and marine traffic impact assessment to ensure that there are no unacceptable effects with respect to:*
    - *Change in normal and extreme wave*
    - *Tidal flushing and water quality*
    - *Ecology*
    - *Siltation and seabed scour*
    - *Shoreline stability of existing beaches*
    - *Navigation of large and small vessels*
    - *Operation of piers, wharves and cargo-handling areas*
    - *Flooding due to tides combined with storm surge and wave runup*
    - *Operation of water intakes that may be affected by reduction of low water levels or sediment buildup.*

4.2 Reclamation Fill Level & Fill Material

[Fill sources include borrow material from inland areas and dredged sand. Inland borrow material may be used where it is available, however in general it may not be readily available within short haul distances.]

Requirements for hydraulic fill material obtained from dredging:

- *Sand shall be free from organic and other deleterious materials. Suitable material shall have less than 10% fines. Lenses of silty or clayey material shall be avoided.*
- *Clayey and silty sand material may be used, but may require significantly more effort for compaction to limit settlement.*
- *Contractor may be required to carry out trial dredging to identify areas where suitable fill material can be obtained.*
- *Material placed immediately behind seawalls, dikes and bulkheads shall be free draining granular material to avoid the unnecessary buildup of water pressure due to tidal lag or ground water flow.*
- *The material and method for placement under water shall be capable of achieving relatively high density fill without compaction.*

4.3 Reclamation Method

[Two main reclamation methods are commonly used for reclamation on soft marine seabed layers, the drained method and the dredged method.]

- *Specify the reclamation methods*

4.4 Stability

[The reclamation fill sequence, dredged fill placement level, spacing of vertical drains, magnitude and duration of surcharging are largely determined by stability and settlement criteria.]

- *Specify the required factor(s) of safety against instability.*

4.5 Settlement

Specify the:

- *Primary consolidation*
- *Secondary Consolidation*
- *Residual Settlement*
- *Estimation of Settlement*
- *Settlement Monitoring method*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

EXPRO

Template - Coastal Marine Design Criteria

5.0 DREDGING

The following shall be included in the planning for dredging projects:

5.1 Environmental Considerations

- *Specific requirements of impact assessment and regulated/acceptable impact levels resulting from dredging and disposal of contaminated material.*
- *Specific acceptable levels of total suspended solids resulting from sediment placement and dredging operations, and describe suitable methods of controlling the operations to ensure environmental protection.*

5.2 Surveying

[A variety of hydrographic surveys are to be performed in support of dredging operations, including: preliminary, pre- and post-dredging, acceptance, channel sweep and as-built surveys. Surveys are used to verify the need for deepening the channel, removing obstructions and estimating quantities and cost.]

Specify the:

- *Type of survey*

Surveys for planning or design may be of lower accuracy than pre-dredge or post-dredge surveys.

- *Type of dredging*

[For example, maintenance dredging of navigation channels will require less accuracy than dredging excavation for construction of underwater structure foundations.]

- *Dredging tolerances*
- *Dredge and survey equipment*

[Suction dredges are not as precisely controlled as a resulting survey are of lower accuracy. Mechanical or cutter head dredges which are capable of greater control and can more accurately excavate to the desired bottom profile.]

6.0 SHORELINE PROTECTION

6.1 Design Waves

Specify the:

- *Design wave height and period which is most critical for structures*
- *The design wave height shall be based on wave modelling, as required due to shore condition*

6.2 Design Water Levels

Specify the:

- *Tides, storm surge and*
- *Rate of future sea level rise or sea level rise for the design life of the structures*

6.3 Wave Run-up

[Wave run-up level is important factor affecting the design because it determines the design of crest level of the structures in case no overtopping is acceptable. Wave run-up is the maximum vertical extent of wave uprush on a beach or structure above the still water level (SWL)]

- *Estimate wave run-up for all shoreline protection structures*
- *Specify the acceptable methods for run-up determination and provide references.*

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

EXPRO
هيئة كفاءة الإنفاق والمشروعات الحكومية
Expenditure Efficiency & Projects Authority

Template - Coastal Marine Design Criteria

6.4 Wave Overtopping

[Wave overtopping occurs when the run-up level exceeds the structure crest height. Overtopping shall be limited where roads, storage areas, moorings or closed to the structures.]

Specify the:

- *Critical values of average overtopping discharge*
- *Method of estimation*

Overtopping shall be designed for following two conditions:

- *Operational waves Condition, with no damage*
- *Extreme waves Condition, with some damage to permanent installation*

6.5 Height of Protection

The height of protection shall be designed by considering following allowances:

- *Maximum water level*
- *Anticipated structure settlement*
- *Freeboard*
- *Wave setup*
- *Wave run-up*
- *Overtopping*
- *Sea Level Rise*

6.6 Armor Unit Stability

Specify the:

- *Reference of manual/design guides for armor unit stability.*
- *Types of armor units*
- *Specific weight of the rock, armor units or riprap shall be verified by testing prior to construction.*
- *Installation method shall not cause high impact loads during placing of armor units*
- *Tensile loads during manufacture, shipping and installations, as well as cyclic loads cause by waves, shall not cause cracking and deterioration of armor units.*

6.7 Filters

[Filter layers are defined as layers that protect the underlying base material or soil from erosion by waves and currents without excessive build-up of pore pressure in the underlying material. Filters consist of one or more layers of granular material such as gravel or small stone of various grain sizes, geotextile, or a combination of geotextile overlaid with granular material.]

Specify the:

- *Minimum thickness of granular filter layer*
- *Acceptable gradation*
- *Bedding layers*
- *Geotextile properties*
- *Materials, layer thickness and stability*

7.0 FOUNDATIONS AND EARTH RETAINING STRUCTURES

[State coefficient of lateral earth pressures for stability checks, live load surcharge behind the retaining wall and ground water table. Sliding and overturning of foundations should be checked for serviceability limit state. Actual bearing pressure under the foundations shall be less than allowable bearing pressure. Structures shall also be checked for Scouring and erosion protection.

Attachment 5 - EPM-KER-TP-000005 - Coastal Marine Design Criteria - Template

The retaining walls shall be checked for the vehicle collision loads if a road barrier is constructed monolithically on the top of wall.]

State the:

- *Minimum spacing between piles (driven piles)*
- *Allowable compression, tension and shear for piles*
- *Required factor of safety for sliding, overturning and buoyancy*
- *Required coefficient of friction between soil & concrete*
- *Minimum angle of internal friction of soil*
- *Allowable eccentricity for foundations*
- *Horizontal and vertical service loading on pile, pile group or foundation.*
- *Calculation or reference for sub grade modulus (ks) used in design.*
- *Information and reference about Allowable Bearing Pressure for soil.*
- *Effects of buoyancy and flood should be included in foundation design.*
- *Requirements for engineered fill or other specific placement criteria.*
- *Effects of lateral loading including uplift, overturning and shear transfer to soil*
- *Properties of dry and submerged soil.*
- *High and low groundwater levels including seasonal and long-term fluctuation, and future projection.*

8.0 PROTECTION SYSTEM/COATINGS

State the:

- *Protection system for steel tubular piles and steel structures*
- *Protection system for concrete structures expose to marine environment.*
- *Protection from fire*
- *Cathodic protection system if applicable*

9.0 DURABILITY

Specify the Crack width limit for:

- *Structures with a potential severe exposure condition*
- *Structures subjected to normal exposure condition*

Specify the concrete cover requirement for:

- *Severe exposure conditions*
- *Normal exposure conditions*
- *Fire Protection*