



**Development of Vizhinjam International
Multipurpose Seaport
Through
Public Private Partnership**

**MANUAL
OF
SPECIFICATIONS AND STANDARDS**

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Section 1
General

SECTION 1

GENERAL

- 1.1 **This Manual is applicable for construction, operation and maintenance of Vizhinjam International Multipurpose Seaport through Public Private Partnership (PPP) mode. The scope of the work shall be as defined in the Concession Agreement. This Manual shall be read harmoniously with the intent of the Concession Agreement.**
- 1.2 **The Port and the project facilities shall conform to the requirements of design and specifications set out in this Manual, which are the minimum prescribed. The project report and other information provided by the Authority shall be used by the Concessionaire only for its own reference and for carrying out further investigations. The Concessionaire shall be solely responsible for undertaking all the necessary surveys, investigations and detailed designs in accordance with Good Industry Practice and due diligence, and shall have no claim against the Authority for any loss, damage, risk, costs, liabilities or obligations arising out of or in relation to the project report and other information provided by the Authority.**
- 1.3 **At least 2 (two) weeks prior to commencement of the work, the Concessionaire shall prepare a Quality Assurance Manual (QAM) covering the Quality System (QS), Quality Assurance Plan (QAP) and documentation for all aspects of the Port work and send 3 (three) copies of each to the Independent Engineer (IE) for review. The class of quality assurance shall be in accordance with ISO 9001.**
- 1.4 **The Codes, Standards and Technical Specifications applicable for design and Construction Works are listed below (details mentioned in Appendix-2):**
 - (i) Indian Standards
 - (ii) British Standards
 - (iii) European Standard with UK National Appendices
 - (iv) American Standards
 - (v) Indian Road Congress (IRC) Codes and Standards
 - (vi) Specifications for Roads and Bridges Works issued by the Ministry of Road Transport & Highways (MORTH) hereinafter referred to as MORTH Specifications
 - (vii) International Standards and Guidelines
 - (viii) Published Guidance, including but not limited to,
 - Permanent International Association for Navigation and Congress (PIANC) Bulletin No. 45 (1984) : Annex 4.1.
 - PIANC Guidelines for the Design of Fender System, 2002.
 - PIANC Working Group No 34, Seismic Design Guideline for Port Structure.

- PIANC : Criteria for Moored Ship in Harbours, Report of Working Group No. 24, Supplement to Bulletin No. 88.
- (Oil Companies International Marine Forum) OCIMF : Mooring Equipment Guidelines.
- OCIMF : Guidelines and Recommendations for the Safe Mooring of Large Ships at Piers and Sea Islands.
- Construction Industry Research and Information Association (CIRIA) Report 103: 'Design of Laterally Loaded Piles', 1994.
- CIRIA Report C580: Embedded Retaining Walls – Guidance for Economic Design 2003.
- International Building Code.
- CIRIA C683: The Rock Manual – The Use of Rock in Hydraulic Engineering (2nd Edition), 2007.
- US Army Corps of Engineers, EM 1110-2-1100 Coastal Engineering Manual.
- Recommendations of the Committee for Waterfront Structures, Harbours and Waterways EAU 2004.
- EurOtop – Wave Overtopping of Sea Defences and Related Structures: Assessment Manual, 2007.
- National Fire Protection Association codes.
- Water Supply (Water Fittings) Regulations SI 1999 1148.
- Water Supply (Water Fittings) Regulations Amendment, SI 1999 1506 (Backflow).
- Water Regulations Advisory Scheme (WRAS), Water Regulations Guide.
- Sewers for Adoption, 7th Edition by the Water Research Council (UK).

1.5 **Latest version of the aforesaid Codes, Standards and Specifications, which have been published at least 60 (sixty) days before the last date of Bid Date submission shall be considered applicable. For Capacity Augmentation works and any other works undertaken at a later date, updated Codes and Specifications in force at the time of actual execution shall be considered. Undue advantage in design and/or execution shall not be taken by intermixing clauses/provisions for many similar codes. If multiple codes are used for any reason, onerous one shall be followed for the design and/or execution.**

1.6 **The terms 'Ministry of Surface Transport', 'Ministry of Shipping, Road Transport & Highways' and 'Ministry of Road Transport and Highways' or any successor or substitute thereof shall be considered as synonymous.**

- 1.7 **The terms 'Inspector', 'Engineer' and 'Engineer-in-charge' used in Specifications shall be deemed to be substituted by the term "Independent Engineer", to the extent it is consistent with the provisions of the Concession Agreement and this Manual. The role of the Independent Engineer shall be as defined in the Concession Agreement.**
- 1.8 **In case of any conflict or inconsistency in the provisions of the applicable IS Codes, BS Codes, IRC Codes, Standards or MORTH or any other Specifications, the provisions contained in this Manual shall apply.**
- 1.9 **In the absence of any specific provision on any particular issue in the aforesaid Codes or Specifications read in conjunction with the Specifications and Standards contained in this Manual, the following standards shall apply in order of priority.**
- (i) Bureau of Indian Standards (BIS)
 - (ii) British Standard or European Standard with UK National Appendices or American Standards or PIANC Guidelines
 - (iii) Any other specifications/standards proposed by the Concessionaire and reviewed by the Independent Engineer.
- 1.10 **All items of building works shall conform to Central Public Works Department (CPWD) Specifications for Class 1 building works¹ and standards given in the National Building Code (NBC). For this purpose, building works shall be deemed to include all Buildings within the Port, furniture, facilities, landscape elements and/ or any other works incidental to the building works.**
- 1.11 **Guidelines for Preparing Schedules of the Concession Agreement**

Certain paragraphs (full or part) in Sections 1 to 16 of this Manual refer to the Schedules of the Concession Agreement. (A list of the Paragraphs that refer to such Schedules has been provided at Appendix-I for ready reference).

1.12 **Alternative Standards and Specifications**

The requirements stated in the Manual are the minimum. The Concessionaire will, however, be free to adopt international practices, alternative specifications, materials and standards to bring in innovation in the design and construction provided they are better or comparable with the standards prescribed in the Manual. The specifications and techniques which are not included in the IS/ MORTH /IRC Specifications shall be supported with authentic standards and specifications mentioned in Para 1.9. Such a proposal shall be submitted by the Concessionaire to the Independent Engineer. In case, the Independent Engineer is of the opinion that the proposal submitted by the Concessionaire is not in conformity with any of the International Standards or Codes, then it shall record the reasons and convey the same to the Concessionaire for compliance. A record shall be kept by the Independent Engineer, of the non-compliance by the Concessionaire of the minimum Specifications and Standards specified in the Manual. Adverse consequences, if any, arising from any such non-

¹ The State Government may prescribe concerned State PWD specifications, if so desired

compliance, shall be treated as "Concessionaire Default" and shall be dealt in accordance with the provisions of the Concession Agreement.

1.13 **General considerations for planning, designing and construction**

The Concessionaire shall take measures to overcome the physical and operational constraints and plan, design and construct the Port using appropriate methods, management techniques and technologies. General consideration shall, without being limited to, be as follows:

(a) The Constraints

There may be operational constraints to local fishermen in using the existing waterfront and designated sea area while undertaking Construction Works of the Port. However, there should be no constraints imposed on the existing fishing harbour and outside 100 (hundred) metres of the proposed Breakwater outlines. Safety of local fishing boats shall be ensured by putting adequate indicators and/or barriers, informing the local community about the "restricted area" required for construction on land or in sea, etc.

Operational constraints at the Site may arise during repair works due to non-accessibility of a portion of the Site while undertaking the Construction Works. Such constraints may also arise due to allocation of portion of land for construction/safety for undertaking Capacity Augmentation. Any such area(s) shall be properly demarcated, intimated to all parties. Details of safety during Operations and Maintenance are discussed in Section 1.14 of this Manual.

The solutions evolved by the Concessionaire shall be such that these operational constraints are overcome through appropriate planning, design and construction methods and technologies and by adopting suitable traffic management measures.

(b) Safety of Design

All designs shall be safe to ensure that the Port or any part thereof (for example breakwater, berths, container yard, embankment, pavement, retaining structures, roads, bridges, culverts, etc.) does not collapse (global stability) nor its serviceability/performance (for example settlement, roughness, undulations, deflections, etc.) deteriorates below acceptable level as prescribed in relevant sections of this Manual and/or in Schedule-K of the Concession Agreement.

(c) Durability

The Port shall not only be required to be safe but also durable. This would mean that the deteriorating effects of climate and environment (for example wetting and drying, freezing and thawing, if applicable, temperature differences, aggressive environment leading to corrosion, etc.) in addition to

the Port operation and traffic shall be duly considered in design and construction to make the Port durable.

(d) Mitigating disruptive effects of Construction

The planning, design and construction of the Port shall be done in a manner that it does not have adverse impact on the environment and does not disrupt the lives and business activities of the people living close to the Port site and/or the quarry locations.

1.14 Safety during Construction, Operation and Maintenance

1.14.1 The Concessionaire shall develop, implement and administer a surveillance and safety programme for providing a safe environment on or about the Port, and shall comply with the Safety Requirements as set forth in the Concession Agreement.

1.14.2 Before taking up any construction or maintenance work, the Concessionaire shall prepare a Construction Management Plan for each work zone and furnish it to the Independent Engineer for comments duly incorporating the following:

- (i) Designate a Site Safety Team headed by a qualified Safety Officer.
- (ii) Traffic safety devices with the following specifications:
 - a) Signages of retro-reflective sheet of high intensity grade.
 - b) Delineators in the form of cones/drums (300 (three hundred) to 500 (five hundred) mm dia and 1000 (one thousand) mm high) made of plastic/ rubber having retro reflective red and white band, at a spacing of maximum 5 (five) meters along with a reflective tape (red and white band) to be tied in between the gaps of cones/drums. A bulb/ flasher using solar energy is to be placed on the top of the cone/drum for night delineation.
 - c) Barricades using iron sheet (plain) with adequate iron railing/frame painted with retro-reflective paint in alternate black and white (or yellow and black) stripes. Warning lights at 5 (five) metres spacing shall be mounted on the barricades and kept lit in the dark hours and night.
 - d) Temporary Buoys shall be used for demarcation of construction area in sea. These shall be suitably marked as per IALA guidelines. These shall be equipped with light signs for night demarcation as per the said guidelines.
- (iii) The arrangement of vehicle traffic during construction and maintenance shall conform to the requirements of Clause 112 of MORTH Specifications.
- (iv) Safety requirements as per IPMA and IALA to be met for construction and maintenance in sea.
- (v) Sprinkling of water for dust control at work zones, haul roads and plant/camp sites.
- (vi) Measures to control turbidity and residual sedimentation, oil spill, foam generation.

- (vii) Noise/Pollution suppression measures at work zones, haul roads and plant/camp sites,
- (viii) Mechanical, electrical and fire safety practices.
- (ix) Safety measures like PPE (Personal Protection Equipment) for workers engaged.
- (x) First Aid and Emergency Response Arrangements i.e. First Aid Box, Ambulance, paramedical staff, alarms, etc.
- (xi) Safety arrangements shall comply with IMCA Guidelines and HSE Part IV.
- (xii) Safety training/awareness programmes.
- (xiii) Formats to maintain the accident records/emergency response provided during accidents.
- (xiv) A penalty scheme for violations in provision of adequate traffic control devices and proper traffic management should be proposed by the Concessionaire. In case of default, the amount of penalty shall be paid by the Concessionaire to the Authority.
- (xv) A compensation scheme including insurance cover for third party workers, road users and road side residents in case of death/injury/damage to the vehicle/ property resulting from accidents in the Port, irrespective of the person at fault should be proposed by the Concessionaire.

1.14.3 The Concessionaire shall also be responsible for ensuring compliance of all labour laws and regulations including those relating to the welfare of workers engaged both directly and indirectly in the Port, besides their occupational safety and health.

1.15 **The Concessionaire shall set up field laboratory for testing of materials and finished products as stipulated in IS: 456, SP: 36 and Clause 121 of MORTH Specifications and as directed by Independent Engineer. It shall make necessary arrangements for additional/ confirmatory testing of any materials/products at the government accredited laboratory, for which facilities at site laboratory are not available.**

1.16 **Environment Mitigation Measures**

The Concessionaire shall carry out tests/ monitor various parameters impacting the environment of the Port keeping in view the guidelines of the Ministry of Environment and Forests (MoEF) and submit proposals for mitigation of adverse environment impact including provision of noise barriers, silt curtains etc. for review and comments of the Independent Engineer, if any and undertake implementation of the proposals in consultation with the Independent Engineer. (Environmental Clearance as obtained from MoEF has been provided at Appendix-3 for ready reference).

1.17 **Utilities**

The details of the utilities which are to be constructed or provided for along or across the Port shall be as specified in Schedule-B of the Concession Agreement.

1.18 **Review and Comments by the Independent Engineer**

In cases where the Concessionaire is required to send any drawings or documents to the Independent Engineer for review and comments, and in the event such comments are received back by the Concessionaire, it shall duly consider such comments in accordance with the Concession Agreement and Good Industry Practice for taking appropriate action thereon. The correspondence between the Concessionaire and the Independent Engineer shall be deemed valid only if a copy thereof is endorsed to and received by the Authority.

1.19 **Definitions and Interpretation**

1.19.1 Unless specified otherwise in this Manual, the definitions contained in the Concession Agreement (CA) shall apply.

Section 2

General Design Features

SECTION 2

GENERAL DESIGN FEATURES

2.1 General

- (i) This section describes the standards for general design features of the Port infrastructure.
- (ii) The general design of the Port shall conform to the standards set out in this section as a minimum requirement.
- (iii) As far as possible, uniformity of design standards shall be maintained in the Project.

2.2 Plan Overview

The Port development plan anticipates that the Port shall be developed in multiple phases. The Master Plan of the Port describes the development of various stages of the Project as shown in Drawing Number *CA/A/II-R*.

2.3 Breakwater

The dimensions and setting out criteria of breakwaters shall be as given in Annex I of Schedule-B.

The requirements for the breakwater shall be as shown on the layout Drawing Number *CA/B/V*. The alignment and setting out criteria of breakwaters shall be in accordance with Annex 1 of Schedule B of Concession Agreement.

2.4 Shore Protection Works

The Concessionaire shall undertake shore protection works to protect the reclaimed land body from waves, water currents, etc. This shall include but not limited to the followings:

- (i) Along the Southern and the Northern perimeter of the container terminal.
- (ii) Fishing Harbour beach as given in Drawing Number *CA/A/II-R*
- (iii) Under the deck of container berths for piled deck structure.

These shall be designed and constructed as per Standards and Specifications provided in Section 3 of this Manual.

2.5 **Design Vessel Size**

2.5.1 The Concessionaire shall adopt the Design Vessel Size of 18,000 (Eighteen thousand) TEU for engineering and construction of the Port.

2.5.2 The above mentioned design vessel shall be appropriately adopted for the design of the various geometric features of the Port including but not limited to berth, dredging, navigation channel, turning basin, etc.

2.6 **Navigational Channel**

2.6.1 The requirements for the Navigational Channel in terms of channel depth and width shall be based on standard recommendations by PIANC as well as IS: 4651 and shall be verified by ship simulation studies to cater for the design vessel.

2.7 **Container Berth**

2.7.1 The dimensions for Container berth shall be as given in Schedule-B of Concession Agreement.

2.7.2 The Concessionaire shall provide the berth with necessary quay furniture viz., quay crane rails, fenders, bollards, safety ladders, including facility for hatch laydown area as detailed out in Section 6 of this Manual.

2.8 **Refrigerated loaded containers (reefers) Racks**

2.8.1 The Concessionaire shall provide for the reefer storages as mentioned in Section 12 of this Manual.

2.9 **Container Yard**

2.9.1 The specifications and the requirements for container yard shall be as specified in Section 7 of this Manual.

2.10 **Dredging & Reclamation**

2.10.1 The Concessionaire shall undertake dredging in the areas where depth requirements exceed existing seabed depth and reclamation shall be done for the terminal area as specified in Schedule-B of Concession Agreement.

2.11 **Buildings**

The buildings required for the Port shall be as set out in Schedule-B of the Concession Agreement. The dimensions and internal arrangement of the buildings shall depend on their functional requirements.

2.12 **Fishery Harbour**

- 2.12.1 The dimensions and setting out criteria for fishery berth shall be as given in Schedule-B of the Concession Agreement and as detailed out in Section 14 of this Manual.
- 2.12.2 The Concessionaire shall design the fishery berth for the wave conditions as specified in IS: 4651 for operating conditions and for the extreme conditions based on the numerical model studies.
- 2.12.3 Navigational Aids in the form of Breakwater light shall be provided for the fishery harbour conforming to the IALA guidelines.

2.13 **Utilities**

- 2.13.1 The Concessionaire shall develop the necessary utilities and services required for operations of the Port in accordance with Good Industry Practice. This shall include power supply with adequate power back-up, internal roads, potable water, raw water and sea water supply, fire-fighting, lighting, Heating Ventilation Air-Conditioning in buildings and sewage/effluent collection treatment and disposal.

2.14 **Internal Roads**

- 2.14.1 The Concessionaire shall develop the internal roads forming part of the Port in accordance with Good Industry Practice and as specified in Schedule-B of the Concession Agreement.
- 2.14.2 Access to the Port shall be controlled and shall be provided at the intersection with the National Highway 47 bypass as mentioned in Schedule-B of the Concession Agreement.

2.15 **Port Estate Development**

- 2.15.1 The Concessionaire shall undertake Port Estate Development in accordance with and subject to the terms and conditions specified in Schedule-B of the Concession Agreement.
- 2.15.2 Port Estate Development shall be undertaken and completed by the Concessionaire in conformity with the Specifications and Standards provided in Schedule-D of Concession Agreement.

2.16 **Equipment**

The Concessionaire shall construct and/or install the Project Equipment in accordance with the provisions of Schedule-C of the Concession Agreement.

2.17 **Port Crafts and Navigational Aids**

The requirement for Port crafts and Navigational aids shall be as specified in Annex-I of Schedule-C of the Concession Agreement.

2.18 Gate Complex

The Concessionaire shall design the gate complex in accordance with the provisions of Section 8 of this Manual.

2.19 Boundary Wall and Fencing

The Concessionaire shall construct the boundary wall and fencing along the Port boundary in compliance with BS: 1722-10 and as per ISPS guidelines and requirements from local authorities.

2.20 Capacity Augmentation Requirements

2.20.1 Breakwater:

The requirements of breakwater during Capacity Augmentation shall be as set out in Annex-III of Schedule-B of the Concession Agreement.

2.20.2 Berth & Yard Augmentation:

Additional berth and corresponding yard shall be constructed by the Concessionaire while undertaking Capacity Augmentation in accordance with the provisions of Annex-III of Schedule-B of the Concession Agreement. The yard construction, additional reclamation and dredging of associated berth pockets/harbor basin shall be undertaken in accordance with the provisions of Schedule-B of the Concession Agreement.

2.20.3 Cruise/Multipurpose Berth:

The Concessionaire shall construct the cruise/multipurpose berth in accordance with the Drawing Number *CA/A/II-R* and in the area designated for the same.

The Concessionaire shall design the terminal for the design vessel size in accordance with its business forecast.

2.20.4 Additional Port Terminal

The Concessionaire shall undertake the development of Additional Port Terminal in accordance with the provisions of Annex-III of Schedule-B of the Concession Agreement.

Section 3

Breakwater and Shore Protection Works

SECTION 3

BREAKWATER AND SHORE PROTECTION WORKS

3.1 General

- (i) Breakwater shall be designed and constructed for the requirements mentioned in Schedule-B of Concession Agreement.
- (ii) The type of Breakwater proposed, shall be in operation successfully in 2 (two) comparable Ports for at least 10 (ten) years from date of its construction.
- (iii) Following types of Breakwater are covered in this manual:
 - a. Rubble Mound
 - b. Vertical Face
 - c. Composite Structure
- (iv) Design and construction of other types of breakwaters, if any proposed by the Concessionaire, shall require prior approval of Independent Engineer.

3.2 Method of Design

The Concessionaire shall undertake the design of rubble mound, vertical face, composite structure type breakwater in accordance with the Standards and Specifications mentioned in Section 3.4 of this Manual.

3.3 Design Life and First Maintenance

The design Life and First Maintenance shall be followed as set out in BS: 6349 Part 1 and Part 5.

3.4 Codes and Standards

Indian Standards shall generally be followed and wherever the details for parts of Works are not defined adequately in Indian Standards, relevant acceptable International Standards shall be adopted in the order of preference as given below:

- (i) BS: 6349 Part 7 – Guide to Design and Construction of Breakwaters
- (ii) CIRIA, “The Rock Manual” and US Army Corps of Engineers, EM 1110-2-1100 Coastal Engineering Manual.
- (iii) EurOtop Manual – ‘Wave overtopping of Sea Defences and Related Structures’
- (iv) CIRIA, C660 – Control of Contraction Induced Cracking in Concrete

The following PIANC guidelines shall be used for design of relevant components and shall govern the basis of design for them respectively.

PIANC Approach Channels – A guide to Design, Supplement to Bulletin No. 95

PIANC Guidelines for Design of Armoured Slopes under open piled Quay walls, 1997.

3.5 **Functional Requirements**

3.5.1 Functional Requirements of breakwater shall be as specified in Schedule B of the Concession Agreement.

3.5.2 Breakwater Requirements:

- (i) The Concessionaire shall ensure conformance of the location of breakwater in its proposed design with the location as shown in the Drawing Number *CA/A/II-R* and *CA/B/V*.
- (ii) The Concessionaire's shall undertake proper layout and alignment of the breakwater heads and for location of the approach channel (which shall be 300 (three hundred) metres wide) to ensure the safe design of the protected harbour in the vicinity of the approach channel.

3.5.3 Roadway:

- (i) The breakwater shall be provided with a maintenance/access roadway of at least 10 (ten meters) width on top of the breakwater that shall be sufficient to carry heavy vehicles to allow for maintenance and future developments of berths along the breakwater.
- (ii) In consideration of the potential residual settlements of the breakwater, the roadway, maintenance access and any other final or permanent works along and above the breakwater shall be designed to avoid potential delays.

3.6 **Geometric Requirements**

3.6.1 Breakwater Layout:

The breakwater shall be constructed in accordance with the requirements as shown in the layout Drawing Number *CA/B/V*. The Concessionaire shall fully comply with the definition, dimensions and setting out criteria as mentioned in Section 2 of this Manual.

3.6.2 Crest Height and Width:

The requirements for the crest height and width shall be governed by the overtopping criteria mentioned forthwith.

3.7 **Limiting Wave Height**

The limiting wave height (Hs) for different wave directions for cargo handling operations shall be as per the IS: 4651 and International Association of Ports and Harbours (IAPH) guidelines and shall apply for the worst wave periods for each direction.

3.8 **Design Criteria**

The criterion listed under this section shall be treated as the minimum design criteria. The design shall be carried out based on Concessionaire's own surveys, investigations

and studies but the derived environmental parameters used for design shall be at least more or equal to the ones mentioned in this Manual.

3.8.1 Breakwater Design:

- (i) The Concessionaire shall design the sections of breakwater at suitable intervals and based on the variation of seabed level from the root to the roundhead. The sections shall be verified in 2-D and 3-D physical hydraulic model testing for the cases stipulated in BS: 6349 Part 7.
- (ii) The Concessionaire may submit alternative design for all or parts of the breakwater. The alternative design shall be based on the design parameters specified in this Manual and shall be verified by 2-D and 3-D physical hydraulic model testing in accordance with Specifications provided in this Manual.
- (iii) The acceptance criteria of damage levels of the primary armour layer on both the seaward and leeward faces of the breakwater shall be as per BS:6349 Part 7 and CIRIA Rock Manual.

3.8.2 Extreme Water Level:

Table 1 shows the design extreme water levels and is for the Concessionaire's information only.

Table 1 Extreme Water Levels

Return Period (years)	HAT (m)	Storm Surge (m)	Sea Level Rise (m)	Total (m)
10	1.2	0.3	0.04	1.54
25	1.2	0.3	0.1	1.6
50	1.2	0.3	0.2	1.7
100	1.2	0.3	0.4	1.9
200	1.2	0.3	0.8	2.3

3.8.3 Extreme Waves:

Extreme wave conditions at the site shall be assessed by a suitable numerical modelling study.

3.8.4 Wave Conditions Impacting the Harbour Breakwater:

Table 2 shows the design wave heights for breakwater with the associated design spectral peak wave periods presented in Table 3.

Table 2 Breakwater Design Wave Heights

Water Depth (m CD)	Significant Wave Height, Hs (m) for various Return Period				
	10 Year	25 Year	50 Year	100 Year	200 Year
6	2.1	2.2	2.4	2.5	2.7
8	2.0	2.1	2.3	2.4	2.6
10	1.2	1.3	1.4	1.5	1.7
12	3.1	3.2	3.4	3.6	3.9
14	3.5	3.6	3.7	4.0	4.2
16	3.7	3.8	3.9	4.2	4.4
18	3.9	4.0	4.1	4.4	4.6
20	4.0	4.1	4.2	4.5	4.7

Table 3 Design Wave Periods

Return Period (years)	Wave period, T (s)
25	9.5
50	9.7
100	9.8
200	9.9

The above wave periods are only for guidance. Sensitivity analysis for elements of Breakwater design impacted by wave period shall be required.

Joint probability analysis be used for the extreme water levels and waves that can occur during the design life of a structure. The procedures for estimation shall be as per the recommendations given in EM 1110-2-1100 (Part II). In the absence of a detailed assessment of this combined probability, it shall be assumed that the design event is a combination of both the extreme wave and water level conditions. For example a 50 year return period event is a combination of a 50 year return period wave with a 50 year return period water level.

Waves inside the Harbour:

Table 4 shows the significant wave heights expected from penetration of the extreme waves inside the harbour.

Table 4 Extreme Wave Penetration inside Harbour

Location	Significant Wave Height, Hs (m) for various Return Period		
	50 Years	100 Years	200 Years
Container Berth 1 (North)	0.5	0.7	0.7
Container Berth 2 (South)	1.6	1.7	2.1
Revetments along south of the Port	2.3	2.4	2.5

The assessment of internal waves shall also consider:

- Ship / Vessel wakes
- Overtopping waves (if any)

3.8.5 Currents:

The maximum current of 0.89 knots was measured at the water surface and during the period of observation the current speed was in the range of 0.0 to 0.5 knots.

For all revetments inside the harbour, a propeller wash of 4(four) m/s shall also be considered as per PIANC Guidelines.

3.8.6 Tsunami:

In December 2004, the largest tsunami in recorded history struck the coast of India. Data captured during this event indicates that the Tsunami wave height in the vicinity of the Port was approximately 2m (two meters). The breakwater shall be designed to survive a tsunami wave height of 2m (two meters).

3.8.7 Earthquake Acceleration:

Specification as per IS:1893 (Part I) ‘Criteria for Earthquake design of Structures’ , PIANC ‘Seismic Design Guidelines for Port Structures’ shall be followed.

3.8.8 Roadway:

The roadway on top of breakwater shall be reinforced concrete road designed for a loading of IRC 70R. Design of road shall be as per IRC and MORTH Standards and specifications.

3.8.9 Revetments:

The reclamation revetments shall be constructed as per the specifications of BS: 6349 Part 7, with suitable sized rock armour.

3.9 **Performance Requirements**

3.9.1 Extreme Design Criteria:

An extreme design condition for the breakwater shall be based on the wind, waves, currents and water levels associated with a 200 year (two hundred) return period event as specified in BS:6349 Part 7.

3.9.2 No Damage Criteria:

Breakwater shall be designed for no damage condition as specified in Coastal Engineering Manual, 2011 and BS: 6349 Part 7.

3.9.3 Overtopping Criteria:

Allowable overtopping rates for safety and structural design shall be used as specified in the EurOtop Manual. It is not anticipated that vehicles shall access the breakwater crest during cyclonic events, but may be present at all other times.

3.9.4 Wave Wall:

Wave wall shall be designed as per BS 6349 Part 7.

3.9.5 Stability Criteria:

Overall stability of the breakwater and reclamation bunds shall comply with the requirements of BS:6349 Part 7.

3.9.6 Settlement of Breakwater:

Settlement of Breakwater shall be estimated as specified in BS: 6349 Part 7 and corrective actions shall be included in the breakwater design to keep the breakwater top at the desired level to achieve aforesaid other functional requirements and to provide stability to all infrastructure elements constructed or supported on the breakwater.

3.9.7 Physical Hydraulic Model Testing:

The 2 dimensional (2-D) and 3 dimensional (3-D) physical model testing shall be carried out as specified in BS: 6349 Part 7.

3.9.8 Geotechnical Stability

The Concessionaire shall verify the geotechnical stability of the breakwater for:

- (i) Un-drained (short-term) soil conditions, and
- (ii) Drained (long-term) soil conditions.

Analysis shall be carried out using internationally used software such as SLOPE/W (GeoStudio), SLIDE, GGU or equivalent. Use of the proposed software and its version (latest version available at the time of Bid Date shall be used) to be employed shall be approved by the Independent Engineer, prior to use.

Factor of Safety (FOS) for the geotechnical stability of the structure shall be as per BS: 6349 and BS: 6031.

3.10 **Other Considerations**

3.10.1 Setting Out of Breakwater Alignment:

The Concessionaire shall follow the Setting Out points provided in Drawing Number CA/B/V of the Concession Agreement.

3.10.2 Construction of the Breakwater:

The Concessionaire shall follow the methodology and specifications as mentioned in CIRIA Rock Manual and BS: 6349 Part 7.

3.10.3 Design and Construction of Revetments/Shore protection works:

The revetments/shore protection works shall be designed for the extreme wave and water current conditions at the specific location as estimated by numerical model study to be undertaken by the Concessionaire.

3.11 **Reports to be submitted**

The Concessionaire shall furnish reports including the following to the Independent Engineer for its review and comments.

- (i) Quarrying plans including transportation arrangement from quarry sources up to stacking areas in the project area.
- (ii) Detailed technical specification for the materials and workmanship.
- (iii) Reports on investigations and tests carried out.
- (iv) Detailed design of breakwater sections supported by the results of quarry analysis and the model tests including soft copies of the design calculations (editable), analysis input files etc., so that these could be verified by Independent Engineer.
- (v) One copy of the each licensed software shall be provided to the Authority, which shall be returned by the Authority after completion of design verification.
- (vi) A referenced list of drawings.
- (vii) AutoCAD and hard copy of drawings of the final design including the layout of the breakwater and the various cross-sections.

Section 4
Dredging Works

SECTION 4

DREDGING WORKS

4.1 General

- (i) Dredging works shall be required to provide access for the safe navigation, turning, loading and unloading of deep-draft container and non-container ships visiting the Port. The limits of the dredged area within the harbour and outside the harbour shall be developed to provide safe navigation for a one-way channel for the design vessel.
- (ii) The Concessionaire shall satisfy himself as to the nature of the material to be dredged by examination of the Site and study data obtained for the Project. The Concessionaire shall carry out any further investigations necessary to enable him to assess and foresee the nature of the material and to decide on the most suitable type of equipment and method of dredging. The Concessionaire shall make its own interpretation of any information provided by the Authority, which is given for information only and without prejudice.

4.2 Codes and Standards

The following codes (but not limited to) shall be followed for the dredging works:

- (i) BS: 6349 – Part 5 ‘Code of practice for Dredging and Land Reclamation’
- (ii) IS: 4651 – Part I ‘Code of Practice for Planning and Design of Ports and Harbours – Site Investigation’
- (iii) US Army Corps of Engineers, EM 1110-2-1100 Coastal Engineering Manual.
- (iv) PIANC “Approach Channels: A Guide for Design”.
- (v) PIANC “Guidelines for the Design of Armoured Slopes under Open Piles Quay Walls”.

4.3 Requirements

- (i) Dredging shall be carried out in any type of material which may be encountered, which may include natural bed materials, rock in varying states of weathering including fresh rock, and materials or items of a manufactured nature, such as, inter alia., chains, wires, cables, ropes, anchors, pipes, castings, steelwork, concrete, timber, tyres or similar.
- (ii) The suspended solid content anywhere in the water column measured from the dredging site shall be in compliance with the requirements of the Environmental Impact Assessment.
- (iii) The Concessionaire shall maintain the required dredged depths in the entire navigation area by adopting a suitable periodic maintenance dredging program.
- (iv) Prior to commencement of works, the Concessionaire shall submit to the Independent Engineer a comprehensive method statement for environmental mitigation measures and monitoring in compliance with the requirements of Environmental Clearance.

4.4 **Dredging Considerations**

4.4.1 Unless otherwise specified in Schedule-B of the Concession Agreement,

- (i) Over dredging alongside berth structures shall be as specified in BS:6349 Part 5.
- (ii) The Concessionaire shall maintain the side slopes of the dredged area and its stability in accordance with the specification in BS:6349 Part 5.
- (iii) Underwater/ Surface Blasting if deemed necessary, shall be done in accordance with BS:6349 Part 5, IS: 4081 and BS:5607.
- (iv) Dredging Tolerance requirements shall be as specified in BS:6349 Part 5.

4.5 **Site Surveys and Investigations**

4.5.1 Seabed and subsoil investigations shall be carried out as per BS:6349, BS:5930 and IS:4651.

4.5.2 Pre and Post Dredging Surveys and Measurements:

The Concessionaire shall follow standards and guidelines for pre and post dredging surveys and measurements as specified in BS:6349 Part 5 and other relevant standards. Raw Survey data shall be provided by the Concessionaire to the Independent Engineer/Authority if so required.

4.6 **Dredging Equipment**

The equipment to be used for dredging works shall be as per the specifications in BS: 6349.

4.7 **Disposal of Dredged Material**

The disposal of the dredged material which is unsuitable for onshore development shall be as specified in BS: 6349 Part 5. The disposal of dredged materials (method, level, etc.) shall be in compliance with the requirements of the Environmental Impact Assessment. Disposal of material shall be done in such a fashion that the disposed material shall not create any hindrance to any operation at present or future. Total disposal amount and rate of disposal shall be as approved by Independent Engineer. Pre and post-dredge survey shall include the area(s) for disposal too.

The designated disposal site shall be confined to location as indicated below:

Points	Location	
	Latitude	Longitude
A	76°59'39.07"E	8°20'25.48"N
B	77°00'25.04"E	8°19'39.23"N
C	77°00'01.82"E	8°19'16.33"N
D	76°59'15.85"E	8°20'02.59"N

4.8 **Environmental Monitoring during Dredging**

The Concessionaire shall be responsible for environmental monitoring during dredging activities as per the requirements of the Environmental Impact Assessment and MoEF guidelines.

4.9 **Safety Requirements**

The Concessionaire shall follow the following safety standards and specification:

- (i) IMO International Maritime Organization
- (ii) ISM International Safety Management Code
- (iii) SOLAS 74 International Convention for the Safety of Lives at Sea (as amended)
- (iv) STWC International Convention on Standards of Training Certification and Watch Keeping for Seafarers

4.10 **Licenses and Consents**

Relevant licenses and consents are to be obtained by the Concessionaire on its own before commencement of work for dredging of the sea bed materials and disposal of the same.

4.11 **Report to be submitted**

The Concessionaire shall furnish report including the following to the Independent Engineer for its review and comments.

- (i) Sub soil exploration, Site Survey and investigations Report
- (ii) Detailed specifications of Equipment and Dredging Methodology
- (iii) Dredging Report including Post and Pre-dredging Survey
- (iv) Dredging Environmental Management Plan covering but not limited to EH&S Plan, Water Quality Management, Ecosystem Protection, Oil Spill Management, Environmental Measures for Turbidity and Residual Sedimentation
- (v) Comprehensive method statement for environmental mitigation measures and monitoring in compliance with the requirements of the Environmental Impact Assessment.

Section 5

**Reclamation and Ground
Improvements**

SECTION 5

RECLAMATION AND GROUND IMPROVEMENTS

5.1 **General**

- (i) Reclamation works are required at the back side of the berth to create land for Container storage yard and spaces for other terminal requirements for the Port.
- (ii) The reclamation works include filling of suitable material derived from dredging or from land sources.

5.2 **Reclamation Requirement**

5.2.1 Unless otherwise specified in Schedule-B of Concession Agreement,

- (i) The Concessionaire shall carry out the reclamation works in accordance to BS:6349 Part 5 or other equivalent specification and standards.
- (ii) Final reclamation level shall be as mentioned in Schedule-B of the Concession Agreement.

5.3 **Site Surveys and Investigations**

5.3.1 Seabed, topographic and subsoil investigations shall be carried out as per BS:6349, BS:5930 and IS:4651.

5.3.2 Pre and Post Reclamation Surveys and Measurements:

The Concessionaire shall follow the specifications in BS:6349 Part 5 and other relevant standards and guidelines for pre and post reclamation surveys and measurements.

5.4 **Performance Requirements**

5.4.1 The reclaimed ground shall have suitable geotechnical properties (bearing capacity, settlement limits e.g.) for the intended use of the land as per relevant standards and specifications.

5.4.2 The reclamation bund, if any, shall be designed as per relevant standards.

5.4.3 Shore protection/revetments shall be provided to protect the reclaimed land body from waves, water currents, etc. as per specifications in Section 3 of the Manual.

5.5 **Material Requirements**

The choice of material for use in reclamation shall be as per BS:6349 Part 5 and BS:1377.

5.6 **Reclamation Equipment**

The equipment to be used for reclamation works shall be as per the specifications in BS:6349.

5.7 **Compaction**

The necessary compaction of the reclaimed material shall be carried out as specified in BS:6349 Part 1 and BS:1377.

5.8 **Ground Improvement**

5.8.1 General:

The properties of the soils across the Site are such that ground improvement measures may be required to meet the performance requirements of the reclamation area.

5.8.2 Performance Requirement:

The reclaimed and filled areas shall be treated as necessary to provide adequate stability and bearing capacity to withstand the applied loadings including seismic loads, and to provide a firm foundation for equipment and construction of terminal paving. The method(s) of ground improvement performance could be either Cone Penetration Testing (CPT) or Standard Penetration Testing (SPT) as per BS:6349 and BS:1377.

5.8.3 Ground Improvement Techniques:

The Concessionaire shall choose the type of ground improvement based on the reclamation material. The ground improvement shall be done as per IS:13094 and BS:6031.

5.9 **Safety Requirements**

Refer the requirements mentioned in Safety Requirements for Dredging & Reclamation works in previous section of this Manual.

5.10 **Report to be submitted**

The Concessionaire shall furnish report including the following to the Independent Engineer for its review and comments.

- (i) Sub soil exploration, Site Survey and investigations Report
- (ii) Detailed specifications of Equipment and Method Statement for Reclamation and ground improvement
- (iii) Reports on investigations and tests carried out.

Section 6

Design of Berth and Approach Trestle Structures

SECTION 6

DESIGN OF BERTH AND APPROACH TRESTLE STRUCTURES

6.1 General

- (i) All berths, loading/unloading platforms, mooring/berthing dolphins and approach trestles (if any) shall be designed and constructed in accordance with the relevant Codes, Standards and Specifications and Special Publications and Guidelines.
- (ii) The length of the berth shall be in accordance with the provisions of Schedule - B of the Concession Agreement such that multiple vessels can berth with adequate head and stern space between them for efficient mooring and simultaneous operation.
- (iii) The length of the approach trestles shall be sufficient to connect the berth to yard.
- (iv) Suitable provisions shall be provided on the berth for the following:
 - (a) Crane Storm Anchors – To anchor cranes from movement during storm winds;
 - (b) Tie-downs – To tie the cranes down to prevent any uplift due to storm
 - (c) Cable slot with protective cover– For all the electrical supply cables for STS Cranes;
 - (d) Cable Turn-Over Pit – For connecting supply cables to supply mains
 - (e) Crane Unloading/Jack-up area – for loading/unloading fully erected crane; and
 - (f) Crane Buffer Stop
- (v) Adequate Cross slope must be provided on deck for the natural drainage of water. The nominal cross slope shall not exceed 2% (two per cent). No ponding of water on berth at any condition shall be acceptable.
- (vi) The berth shall not be designed for any longitudinal slope.
- (vii) Approach trestle shall preferably be horizontal in longitudinal direction. If needed the longitudinal slope of approach trestle shall not be more than 1% (one per cent).
- (viii) Crash Barriers should be provided on free edges of the berth and trestle for safety purpose. No barriers shall be provided on the sea side edge of the berth.
- (ix) Plan dimensions of loading/unloading platforms shall be planned to accommodate all pipelines and utilities, adequate space around utilities for access, all equipment and machineries, landing for approach trestles, fire hydrants other safety requirements, etc.
- (x) Fenders, Bollards and/or Quick Release Mooring Hooks and safety ladders shall be provided at suitable intervals on the berth. Safety ladders shall be recessed in the deck and shall extend till 1 (one) meter below the lowest water level at the Port.
- (xi) Berthing/Mooring Dolphins if any shall be planned to have a platform at top with enough space to work around the bollard/quick release mooring hooks

required. In addition these structures shall have provision for marine access by means of ladders and intermediate landing(s), if required.

6.2 Structure Types

- (i) The type and arrangement of structure for berth shall be chosen depending on the design vessel size, subsoil condition, dredged/natural sea bed depth, mooring & berthing forces expected and their action points, crane wheel loads and deflection criteria set by manufacturer and ease of construction at site.
- (ii) The type and span arrangement of approach trestle may be fixed so as to provide riding comfort.
- (iii) The following type of structures are covered in this manual:
 - a) Piled open berths
 - b) Infill diaphragm wall berths
 - c) Block-work quay wall
 - d) Sheet piled Combi wall

6.3 Method of design

6.3.1 Piled open berths, Infill diaphragm wall, Block-work quay wall shall be designed as per the specifications contained in IS: 456, IS: 4651 and BS 6349 Part 2.

6.3.2 Sheet Piled Combi Wall shall be designed as per the specifications contained in IS: 456, IS: 2314 and BS:6349 Part 2.

6.3.3 Following additional standards shall be used:

BS 6349 Part 1 Code of practice for general criteria

CIRIA 580 Embedded Retaining Walls, Guidance for Economic Design

OCDI Technical Standards and Commentaries for Ports and Harbour facilities in Japan

API RP 2A WSD Recommended practice for Planning, Designing and Constructing Fixed Offshore Platforms

CIRIA Report 013 Design of Laterally Loaded Piles

6.4 Design Requirements

- (i) The berth and approach trestles shall be designed to carry the specified loads for all the equipment and other generic loads throughout the life of the structure.
- (ii) The design life for the maritime structures shall be in accordance with BS 6349 Part 1.

6.5 Design Loads and Stresses

6.5.1 The loading standards to be used in designing and construction of the berth and approach (if any) shall be:

6.5.2 Dead and Live loads

Self-weight of all structural elements as per relevant codes together with structures and equipment as designed.

- (i) Berth, Loading/Unloading Platforms
 - a) Dead loads
 - b) Uniform Live Load as per IS:4651 Part III
 - c) Live load due to all pipe lines and utilities in operating condition for loading/unloading platforms.
 - d) Loads due to Ship-to-Shore Gantry Cranes
 - e) Berthing force at any or multiple berthing point due to all vessels up to and including design vessels as per PIANC guidelines & BS: 6349. Design Vessel is defined in Section 02 of this Manual.
 - f) Fully loaded fork lift/reach stackers on the berth, if required
 - g) Mooring force as determined by mooring analysis for different scenarios for different vessel sizes.
 - h) Wind loads as per IS: 875 Part III
 - i) Vehicle loads as specified in IS:4651 Part III
 - j) Loading due to hatch covers for 4 stack height on the container berth
 - k) Loading due to container stacking, if required.
 - l) Provision for loaded mobile harbour crane, if required.
 - m) Load due to wave for wave height and period estimated by numerical model study for operations condition as well as extreme conditions
 - n) Load due to water current at the specific location estimated by numerical model study for operations condition as well as extreme conditions.

- (ii) Approach Trestles (if proposed by the Concessionaire)
 - a) Dead load
 - b) Uniform live load as per IS:4651 Part III
 - c) Vehicle Load as per IS:4651 Part III
 - d) Fully loaded Fork lift/reach stackers running over Approach Bridge, if required
 - e) Provision for unloaded mobile harbor crane moving on its wheels, if required
 - f) Wind loads as per IS:875 Part III
 - g) Load due to wave for wave height and period estimated by numerical model study for operations condition as well as extreme conditions
 - h) Load due to water current at the specific location estimated by numerical model study for operations condition as well as extreme conditions.

Berths and approach bridges shall be designed to serve the purpose as unloading and carrying space for all equipment/ machineries to be used in yard/Port.

(iii) Seismic Forces

This shall be in accordance with IS: 1893-2002 with Zone III considered for design.

(iv) Temperature Stresses

Temperature stresses shall be evaluated in accordance with IS:456, IS: 875 and IRC: 6.

6.5.3 Load Combinations:

The load combination for ULS and SLS as detailed in IS: 4651 Part IV, IS:456, BS:6349 Part 2 and other relevant standards shall be considered.

6.5.4 Durability Requirements:

All reinforced concrete shall be designed to resist chloride induced corrosion. Secondary cementitious materials (ground granulated blast furnace slag, fly ash, silica fume) and low water-cement ratios shall be used. In addition, specified curing and cover requirements as per standards shall be rigidly enforced.

- (i) Minimum grade of concrete shall be M40
- (ii) Crack widths in concrete structures shall be limited as follows:
 - a) Under DL + 50%LL + operational wave & current: 0.1 mm
 - b) For serviceability combinations as per IS: 4651 Part IV, crack width anywhere in the structure shall be limited to 0.004 times the cover to any reinforcement, main or secondary, subject to maximum of 0.2 mm.
- (iii) Minimum clear cover for the all reinforcement shall be 75 mm
- (iv) Ductile detailing of reinforcement as per IS: 13920 shall be followed
- (v) Deflection of beams and slab shall not exceed the values mentioned in IS:456.
- (vi) Seismic performance of the berth and approach bridges along with any building/structures built on the same shall conform to 'Seismic Design Guidelines for Port Structures', PIANC Working Group 34, 2001. The structures shall be 'Serviceable' in Level 1 Seismic Event while they shall be 'Repairable' in Level 2 Seismic Events. Definitions of terms 'Serviceable' & 'Repairable' shall be same as in the quoted standard.
- (vii) Steel Structures shall be designed to account for adequate corrosion allowance for the design life considered for the structure.

The standards listed here are not exhaustive. All requirements shall be conformed to relevant Indian Standards. Wherever Indian Standards do not adequately specify the requirements, international standards shall be applicable. The interpretation of the Independent Engineer shall be binding on the Concessionaire in this regard.

6.6 **Width of Structures**

- (i) The width of berth structure shall be determined such that it carries the following minimum:
 - a) Ship-to-Shore (STS) Crane along with all traffic lanes required for it between its rails and all utilities needed for it.
 - b) Bollards and free space around it for working.
 - c) Service vehicle lane in front of STS Crane rails.
 - d) Hatch cover laydown area
 - e) Traffic bypass lane at the rear
 - f) Lighting and other utilities space
 - g) Fire water lines and hydrants

- (ii) The width of approach bridges shall be determined such that it carries the following minimum:
 - a) Adequate number of lanes to cater to all traffic.
 - b) Space for footpath and crash barriers.
 - c) Utilities, fire water lines and hydrants
 - d) Space for high mast lightings

6.7 **Mooring study**

Mooring study for the berth and/or dolphin(s) proposed shall be carried out as specified in BS: 6349 Part 4 and PIANC Guidelines.

6.8 **Sub-Soil Investigations**

Independent sub-soil investigations shall be carried out to establish the soil parameters required for detailed design of foundations in accordance with relevant provisions of IS:4651 Specifications and BS:5930.

6.9 **Temporary Works**

Temporary works shall be designed and executed as per specifications contained in Manual of Specifications for 4 laning of Highways through Public Private Partnership, Planning Commission, Government of India.

6.10 **Foundations**

The design of foundations shall conform to relevant standards and specifications as mentioned herein below:-

6.10.1 Open Foundations:

The design of open foundations shall conform to IS: 6403.

6.10.2 Pile Foundations:

- (i) The design of pile foundations shall be done as per IS: 2911. The Concessionaire shall submit a method statement supported by the following:
 - (a) Bore-log details for each foundation;

- (b) Design assumptions;
 - (c) Design calculations both for single pile or group of piles and for pile type;
 - (d) Type of piles-Bored cast-in-situ piles and driven piles;
 - (e) Procedure adopted for installation of piles;
 - (f) Arrangements for load testing of piles;
 - (g) Format for reporting of test results.
- (ii) The Concessionaire shall submit the following information regarding proposed proprietary system of piling:
- (a) General features of the process/system along with specifications and standards.
 - (b) Authenticated copies of license/agreement, if any;
 - (c) Details of plant and equipment to be used along with the names of manufacturers and name of process/system;
 - (d) Details of projects where the process/system has been successfully used;
 - (e) Limitations, if any;
 - (f) Acceptance tests and criteria;
 - (g) Installation and maintenance procedure and schedule; and
 - (h) Performance warranty.

6.11 **Approach Slabs**

Approach slabs shall be provided as per Clause 217 of IRC: 6 and Section 2700 of MORTH Specifications.

6.12 **Superstructures**

6.12.1 The design of reinforced and pre-stressed concrete superstructures shall be as per IS: 456 and IS: 4651 respectively. The design of steel and steel-concrete composite super structures shall conform to IS: 800 and IS: 11384 respectively.

6.12.2 The Concessionaire shall submit Method Statement indicating interalia the following:

- (i) Sources of materials,
- (ii) Design, erection and removal of formwork,
- (iii) Layout of casting yard together with necessary details,
- (iv) Production, transportation, laying, compacting and curing of concrete,
- (v) Sequence of concreting in cast-in-situ construction, side shifting of girders, and placing of girders on the bearings, if applicable.
- (vi) Details of construction joints,
- (vii) Pre-stressing system, if required,
- (viii) Methodology and equipment for side shifting and launching of pre-cast girders, if applicable
- (ix) Key personnel for execution and supervision,
- (x) Testing and sampling procedure,
- (xi) Equipment details.

6.13 **Bearings**

Bearing, if required, shall be designed and installed as per specifications contained in Manual of Specifications for 4 laning of Highways through Public Private Partnership, Planning Commission, Government of India.

6.14 **Expansion Joints**

- (i) Structures shall have minimum number of expansion joints. This may be achieved by adopting longer spans, making the superstructure continuous or by adopting integrated structures. Expansion joints shall conform to IRC: SP: 69. The Concessionaire shall furnish guarantee/proprietary indemnity bonds from the manufacturers/suppliers of expansion joints for a period of 10 (ten) years.
- (ii) The expansion joints should cater for movement in both longitudinal and lateral direction in respect of berth structures more than 12 (twelve) meter wide.

6.15 **Wearing Coat**

The wearing coat may be either bituminous concrete or cement concrete. For berths, bridges and culverts, the wearing coat shall be in conformity with Section 2700 of MORTH Specifications.

6.16 **Safety Barriers**

- (i) For berth without foot paths, concrete crash barriers shall be provided at the free edge of the berth except sea face.
- (ii) The type design for the crash barriers may be adopted as per IRC:5. The design loading for the crash barriers shall be as per Clause 209.7 of IRC: 6.
- (iii) For approach bridges with foot paths, pedestrian railing shall be provided on the outer side of footpath.

6.17 **Rail-Road Bridges**

Unless otherwise specified in Schedule - B of the Concession Agreement, Road Bridges to be provided shall be as per Manual of Specifications and Standards for 4 laning of Highways through Public Private Partnership, Planning Commission, Government of India.

6.18 **Grade Separated Road Structures**

Unless otherwise specified in Schedule B of Concession Agreement, Grade separated road structures shall be as per Manual of Specifications and Standards for 4 laning of Highways through Public Private Partnership, Planning Commission, Government of India.

6.19 **Drainage**

An effective drainage system for the berth deck shall be planned, designed and installed so as to ensure that water from the deck is drained off to sea/water course by gravity. No ponding of water is allowed on deck surface and in the utility trenches/pits in any situation.

6.20 **Repairs and Strengthening**

- (i) Structures may require repair and strengthening in due course of time. The work shall be based on detailed condition survey of existing structures and shall bring out the nature and extent of repairs to be carried out, covering the following in addition to other specific requirements:
 - (a) Repair/Replacement of Fenders and/or fender accessories (chains, frontal panel, bolts, etc.), Bollards and/or Bollard accessories, Quick Release Mooring Hooks, safety ladders.
 - (b) Repair/Replacement of Cope edge protection/Rubbing Strips
 - (c) Repainting of traffic lane markings on deck
 - (d) Repositioning/Replacement of crane rails
 - (e) Repair/replacement of damaged railings and parapets, provision of crash barriers,
 - (f) Replacement of wearing coat (old wearing coat shall be removed and replaced by fresh wearing coat),
 - (g) Replacement of expansion joints,
 - (h) Replacement of bearings,
 - (i) Structural repairs to Substructure/Superstructure, including replacement or protective coating of Substructure/superstructure if required,
- (ii) The Concessionaire shall submit repairs and strengthening plan for structures in para (i) above to the Independent Engineer for review and comments, if any.
- (iii) Strengthening/rehabilitation work shall be carried out in accordance with relevant IS Codes and Guidelines.

6.21 **Design Report**

The Concessionaire shall furnish the following design report including the following to the Independent Engineer for its review and comments, if any.

- (i) Sub soil exploration report as per IS:4651
- (ii) Mathematical and physical model studies confirming the wave characteristics, water current and scouring, if any.
- (iii) Designs and drawings of temporary works, foundations, substructures and superstructure of structures.
- (iv) Method Statement

- (v) Detailed design report for each structure
- (vi) Any other information relevant to the design report.

6.22 **Responsibility for Design and Structural Adequacy**

The Concessionaire shall be fully responsible for the design, structural adequacy and detailing of berth and approach trestle structures. Review by Independent Engineer shall not relieve the Concessionaire of its responsibility.

Section 7

Yard Pavements

SECTION 7

YARD PAVEMENTS

7.1 General

- (i) The design and construction of pavement for Container yard shall be carried out in accordance with the criteria, standards and specifications given in this section. Where alternative specifications or materials are proposed to bring in innovation in design etc., those shall be approved by the Independent Engineer with specific relevance to the standards.
- (ii) The Concessionaire shall undertake the necessary soil, material and pavement investigations and traffic volume and axle load studies in accordance with the Good Industry Practice for preparing detailed designs.
- (iii) The materials, mixes and construction practice shall meet the requirements prescribed in the IRC, IS, MORTH and Interlocking Concrete Pavement Institute (ICPI) Specifications and Guidelines.

7.2 Type of Pavement

Unless otherwise specified in Schedule-B of the Concession Agreement, the Concessionaire may adopt any type of pavement structure for construction.

The type of pavement within the yard shall be classified as:

- (i) Roadways : Vehicle movement areas
- (ii) RTG runways : Specific strip of land required as RTG crane wheels path and may be separately strengthened depending on the RTG Crane wheel load specifications
- (iii) RMG runway: Land strip as required for RMG crane rails
- (iv) Stack area : Space for stacking of containers/cargo

7.3 Method of design

Flexible and rigid pavements shall be designed and constructed as per the specifications of relevant IRC Standards and MORTH Specifications. For Pavements in container stack area, effects due to sustained loading due to container stacking shall be evaluated following the recommendations of ICPI Guidelines.

Concrete Block Paving shall be designed and constructed as per the specifications in IRC SP: 63 or The Structural Design of Heavy Duty Pavements for Ports and Other Industries published by ICPI.

Runways for cranes shall be reinforced concrete beams supported on compacted ground or on piles.

Concrete Beams shall be designed and constructed as per the specifications of IS: 456.

The method of design of Precast Concrete Slab shall be done as per the specifications in IS:15916 and IS:15917.

7.4 **Design Requirements**

Design life of the yard pavements shall be as specified in ICPI manual and BS: 7533.

7.5 **Performance Requirements**

- (i) The longitudinal gradient of yard and the slope of RTG runway shall not exceed 0.5% (point five per cent).
- (ii) The pavement structure shall be capable of giving the specified performance over, the entire operation period.
- (iii) During the operation and maintenance period, the pavement strength shall be evaluated periodically through the standard testing methodologies in accordance with the procedure given in IRC: 81. Any stretches exhibiting any structural deficiency shall be rectified.

7.6 **Subgrade**

The subgrade, whether in cut or fill, shall meet the requirements specified in MORTH Specifications for roads and IRC:SP:63 and ICPI Manual for yard pavements.

7.7 **Pavement Components and Materials**

- (i) The pavement construction materials for sub-base, base course shall conform to the requirements prescribed in MORTH Specifications and IRC Standards
- (ii) Where several materials shall adequately serve as component within the pavement structure, such as a sub-base or a base course, the Concessionaire shall have the option of using any of the materials/specifications, subject to good engineering practice and product quality requirements.

7.8 **Performance Evaluation**

Performance evaluation of the pavement shall be in accordance with the procedure given in IRC: 81, unless needed earlier for stretches exhibiting severe distress during the operation and maintenance period.

7.9 **Construction, Workmanship and Quality of Works**

All materials, construction operations, workmanship, surface finish and quality of completed construction for all pavement works including sub-grade, sub-base, base course, bituminous surface course for the pavement shall conform to the specified requirements and comply, with the provisions of Section 900 of the MORTH Specifications.

7.10 **Premature Distress**

If the pavement shows premature distress in the form of cracking, rutting, patching, loss of camber or any other structural or functional distress, necessary remedial measures by strengthening/resurfacing/recycling shall be undertaken for conforming to the minimum requirements in the relevant standards. In case of repetition of the distress, reconstruction shall be resorted to after proper investigations.

7.11 **Road Markings**

For the road markings in the yard area the specification as stated in Section 8: Gate Complex shall be followed.

7.12 **Lighting**

For the lighting in the yard area the specification as stated in Section 13: Utilities shall be followed.

7.13 **Signs**

A well thought out strategy should be evolved for providing traffic signs and road markings in and around the container yard in accordance with IRC: 67 and IRC: 35.

7.14 **Drainage**

For the drainage in the yard area the specification as stated in Section 13: Utilities shall be followed.

7.15 **Detailed Design Report**

The pavement design should be formulated on the basis of the detailed investigations and such studies shall be submitted to the Independent Engineer along with Data Collection, Data Evaluation and Design Reports.

The Report shall contain the detailed design of the preferred solution along with any special treatment proposed for adoption. Any departures from the specifications stated herein shall be supported with authentic Standards and Specifications and accepted Good Industry Practice.

Section 8
Gate Complex

SECTION 8

GATE COMPLEX

8.1 General

- (i) The Concessionaire shall provide the gate complex at a suitable location near the entry to the Port. The design of gate complex should be aesthetically pleasing and efficient.
- (ii) Number of lanes in a gate complex shall be in accordance with Good Industry practice and as mentioned in Schedule-B of the Concession Agreement.
- (iii) The queuing of vehicles inside the Port should in no way create obstacles for normal operations of the Port or cause any significant threat to security.
- (iv) If queuing is expected for vehicles coming in or going out of the Port, adequate parking space should be planned for them.

8.2 Location of Gate Complex

The gate complex shall be located within the Port boundary, preferably at the entrance of the Port.

The location shall be decided keeping in view at least the following factors:

- (i) Land availability
- (ii) Stream of traffic – expected truck arrival pattern
- (iii) Visibility for the approaching traffic
- (iv) Reasonably away from road intersections and/or rail crossings
- (v) Free from risk of flooding and submergence etc.
- (vi) Preferably on flat land and away from congested Port facilities
- (vii) Provision for adequate space for capacity augmentation and truck queuing
- (viii) Ability to service all types of truck serving the Port traffic

8.3 Pre-gate complex

The pre-gate complex, shall consist of an office room and a security booth with sufficient space. Pre-gate complex shall be provided at an appropriate location before the entrance of the Port in conjunction with the parking bays.

The number of lanes at the pre gate complex shall be decided as to strictly restrict the queuing of vehicles reaching main connecting road/Highway and the queuing should not create obstacle for other vehicle movements on the Port approach road.

8.4 Layout and Design of Gate Complex

- 8.4.1 The layout shall be planned with sufficient space and arrangements for Capacity Augmentation. The other structures envisaged shall be provided in the initial stage of the Port development. These should be planned to have designed for Capacity

Augmentation. Number of lanes of gate for entry and exit shall be as mentioned in the Schedule-B of the Concession Agreement.

8.4.2 Canopy:

The gate complex shall be covered with a canopy. The canopy shall be wide enough to provide weather protection to all the facilities and all gate lanes provided underneath. Additional width of canopy may be provided to cover one or two vehicles in queue in front of the gate as estimated by the Concessionaire to speed up the paper works processing and to provide shelter in bad weather. The canopy shall be of aesthetically pleasing design with both entry and exit gate canopy as mentioned in Schedule-B of the Concession Agreement.

The vertical clearance below canopy till the road surface shall be as per the specification given in IRC: 5.

8.4.3 Drainage:

The gate complex shall be provided with surface and sub-surface drainage system so that all the storm water is drained off efficiently and no ponding or stagnation of water takes place any time at any area of the gate complex.

8.4.4 Weigh bridges:

The Weigh Bridges shall be suitably located inside the gate complex. The specifications for weigh bridges shall comply with guidelines given in IS: 1436. The weighbridge shall preferably be of “weigh in motion” type.

8.4.5 Parking bays:

The Parking Space shall be located in the vicinity of the gate complex. Parking bays design and requirement shall comply with the specifications given in IRC SP: 12.

8.4.6 Traffic signs:

A well thought out strategy should be evolved for providing traffic signs and road markings in and around the gate complex in accordance with IRC: 67 and IRC: 35. The Concessionaire shall design the configuration/placement of signs for gate complex which are not given in IRC: 67.

Stop signs shall always be used in combination with certain road markings such as stop line and the word ‘STOP’ marked on the pavement.

Appropriate Signs and Signals shall also be provided on the canopy of gate complex to properly guide the approaching vehicles about the lane in operation, lane applicable to specific category of vehicle etc.

8.4.7 Road markings:

The road markings shall be used in accordance with specifications provided in IRC: 35. The road markings for the gate complex area shall consist of lane markings,

diagonals, chevron markings. Single centre line shall be provided at the centre of carriageway at the gate complex to demarcate each service lane. Diagonal markings for central traffic island and chevron markings at side traffic island shall be provided to guide the approaching and separating traffic.

In order to control over speeding of the vehicle approaching, transverse bar markings shall be provided.

8.4.8 Lighting:

The lighting system shall consist of the following major components.

- (i) High Mast Lighting
- (ii) Lighting on both side approaches to the gate complex
- (iii) Canopy lighting of gate complex

The lighting shall comply with the standards, requirements and specifications given in Indian Standard 'Code of Practice for Lighting of Public Throughfare' IS: 1944.

Power supply shall be from the Port substation along with standby generating set of the capacity to supply the required power at the gate complex.

8.4.9 Water supply:

Adequate water supply shall be provided. Water requirement and internal drainage system shall be designed as per specifications specified in IS: 1172, IS: 5339 and IS: 1742.

8.4.10 Firefighting system:

The gate complex shall have firefighting equipment, including smoke detectors and auto visual alarm system as per Part 4 of National Building Code, so that the personnel working in the complex and the office and the road users are protected against any fire hazard. The fire alarm system shall be integrated with the Fire Control system for the entire Port.

8.4.11 Gate Complex:

Gate complex shall have a custom office building so as to provide comfortable office space for the Port personnel and customs officials. The building shall have separate rooms for TV monitors, meetings, toilets, and issue of gate passes & safety accessories, smart cards, on board units and public interactions. There shall be parking space in the same campus for vehicles for the staff and workers and other vehicles engaged in the operation of the Port.

The size of the building depends on the minimum requirements of the above facilities.

Provision for Capacity Augmentation: The building shall be designed by taking into account Capacity Augmentation of the Port.

8.5 **Report to be submitted**

The Concessionaire shall prepare and submit the design report to the Independent Engineer for its review and comments.

Section 9

Road

SECTION 9

ROAD

9.1 External Road

Design and construction of external road to Port boundaries shall be done following Manual of Specifications for 4 laning of Highways through Public Private Partnership, Planning Commission, Government of India.

9.2 Internal Road

9.2.1 The top level for all roads within the Port area shall be the same as that of the terminal yard.

9.2.2 Roads within the container yard shall generally be a part of the yard. Specifications for yard pavements shall be as mentioned in Section 7 of this Manual.

- (i) Geometric Design of roads within yard shall be done as per IRC and MORTH specifications
- (ii) Road markings (Lane, Road Edge, Directional Arrows, etc.) shall be done as per IRC and MORTH specifications
- (iii) Road side barriers may be of fixed type or removable type as per IRC and MORTH specifications and the choice of type shall depend on the overall yard area design and traffic movement planning to be done by the Concessionaire.

9.2.3 Other roads within the Port – Design and construction shall be as per relevant IRC and MORTH Standards and Specifications.

9.3 Report to be submitted

The Concessionaire shall prepare and submit the design report to Independent Engineer for its review and comments.

Section 10
Navigational Aids

SECTION 10

NAVIGATIONAL AIDS

10.1 **General**

The Concessionaire shall provide the navigational aids for the safe navigation of the vessels within the dredge channel and harbour area. The design of navigational aids shall be as per guidelines specified in the standard guidelines. The design and placement of navigational aids should be such that to safely guide the vessels to the berth and back to deep waters after being serviced at the berth.

10.2 **Navigational Requirements**

Navigational Aids required for the Port shall comprise of (but not limited to):

- (i) Channel marker buoys,
- (ii) Leading / transit lights;
- (iii) RACON, Beacons; and
- (iv) Vessel Traffic Management Information System

10.3 **Applicable Standards and Specifications**

The design of navigational aids for the Port shall comply with the recommendations prescribed in the International Association of marine aids to navigation and Lighthouse Authorities (IALA) Guidelines and PIANC Guidelines. The mentioned standards and specifications are minimum requirements to be met.

10.4 **Structures for Navigational Aids**

Structures for supporting the aforesaid navigational aids, if any shall be designed and constructed as per the standards and specifications mentioned for civil/mechanical structures Section 12 of this Manual.

10.5 **Testing of Navigational aids**

Testing and installation of all the required navigational aids for the successful operation of the Port shall be done with the guidelines provided in the IALA guidelines.

10.6 **Report to be submitted**

The Concessionaire shall prepare and submit the following report to Independent Engineer for its review and comments.

- (i) Equipment Specification and Data sheet
- (ii) Operation & Maintenance Manual
- (iii) Installation Guidelines
- (iv) Warranty Certificates
- (v) Vendor's Design Report
- (vi) Any other report relevant to the design.

Section 11
Equipment

SECTION 11

EQUIPMENT

11.1 General

The Concessionaire shall construct and/or install the Project Equipment in accordance with the relevant Specifications and Standards and the manufacturer's guidelines for the equipment.

All equipment to be procured shall be relevant efficient energy usage certificate and/or emission under control certificate from relevant authority. Equipment with stricter emission control shall be preferred even if the same over-satisfies the present Indian Emission Control norms.

All equipment handling loaded containers shall be capable of running on electric energy. All non-electric equipment shall be at the top world standard for emission control and fuel efficiency.

11.2 Type of Equipment

The Project Equipment shall include:

- (i) Rail Mounted Quay Crane (RMQC),
- (ii) Rail Mounted Gantry Crane (RMGC),
- (iii) Rubber Tyre Gantry Crane (RTGC),
- (iv) Empty Container Handlers, such as
 - a) Medium-duty forklift trucks;
 - b) Side-pick cranes;
 - c) Top-pick cranes;
 - d) Reach-stacker cranes.
- (v) Tractor trailers,
- (vi) Internal Transfer Vehicles (ITV)
- (vii) Port Crafts
- (viii) All ancillary equipment or any facility and equipment incidental or necessary for operation of the Port.

11.3 Specifications and Standards

11.3.1 The crane and its mechanisms shall be designed and constructed in compliance with the latest editions and amendments of the following standards and codes of practice. Standards equivalent or higher in BS, JIS, FEM, DIN, ISO, and IEC are also acceptable.

IS 3177 Code of Practice for Electric Overhead Traveling Cranes and Gantry Cranes other than Steel Work Cranes

IS 807 Code of Practice for Design, Erection & Testing (Structural Portion) of Cranes & Hoists.

IS 3938	Specification for Electric Wire Rope Hoists.
IS 4137	Code of Practice for Heavy Duty Electric Overhead Travelling Cranes Including Special Service Machines for use in Steel Works.
IEC standards	
IEE	Regulations for the Electrical Equipment of Buildings
IS 13367: Part I	Safe use of Cranes - Code of Practice Part 1 General
IS 4357	Methods for Stability Testing of Fork Lift Trucks
IS 4573	Specification for Power Driven Mobile Cranes
IS 13558: Part II	Cranes - Controls - Layout and Characteristics - Part ISO 7752 - 2 Mobile Cranes
IS 13834: Part II	Cranes - Classification: Part 2 Mobile cranes ISO 4301-2
IS 13870: Part II	Cranes and Lifting Appliances Selection of Wire ISO 4308 Ropes - Part 2: Mobile Cranes -Coefficient of utilization
IS 14469	Mobile Cranes - Determination of Stability ISO 4305
IS 14474: Part I	Mobile Cranes - Experimental Determination of Crane ISO 11662
ISO 4308-1	Maintenance of Lifting Appliances
ISO 4309	Cranes Wire Rope Care, Maintenance and Discard
IS 13367: Part I	Safe use of Cranes - Code of Practice Part 1 General
BS 7121-2	Code of Practice for Safe use of Cranes, Inspection, Testing & Examination
IALA Guidelines	International Association of Marine Aids to Navigation and Lighthouse Authorities, Guidelines

11.4 **Report to be submitted**

The Concessionaire shall furnish the reports including the following to the Independent Engineer for its review and comments.

- (i) Equipment Specification and Data sheet
- (ii) Operation & Maintenance Manual
- (iii) Installation Guidelines
- (iv) Warranty Certificates
- (v) Vendor's Design Report
- (vi) Any other report relevant to the design.

Section 12
Buildings and Other Structures

SECTION 12

BUILDINGS AND OTHER STRUCTURES

12.1 **General**

12.1.1 This Section lays down the standards for geometric design, general features, specifications and requirements for general building structures within the Port area.

12.1.2 The Concessionaire shall create the necessary infrastructures and buildings required for the functioning of the Port. The minimum list of buildings to be designed and constructed shall be as per Schedule B.

12.2 **Refrigerated loaded containers (reefers) Racks** **The reefer shall be stored for access via multi-level reefer racks, stacked to a maximum of four containers high. The racks shall be provided with power and maintenance access. Reefer service racks shall be dimensioned in accordance with local laws and practices, and should be sufficient to allow safe activities of reefer service mechanics.**

12.2.1 Function

Multi-level reefer racks shall be provided to allow mechanics access to plug and unplug units, to check reefer machinery status, and to perform low level maintenance and repair. Refrigerated loads shall be plugged into power receptacles, located on the reefer racks, to maintain temperature while stored in the container yard.

12.2.2 Access

Multi-level reefer racks shall be provided with service walkways to provide service personnel access to stacked reefer containers.

12.2.3 Design Elements

A reefer monitoring system shall be installed for all refrigerated container storage slots, including the reefer pre-trip slots. The reefer monitoring system shall report the following to a computer located in the Maintenance and Repair Building:

- (i). Reefer unit operating status
- (ii). Power consumption
- (iii). Reefer internal temperature
- (iv). Malfunctions

12.3 Codes and Standards

12.3.1 The following codes may be used as applicable; however, this list is not exhaustive. If relevant Indian standard codes are not available then equivalent International standards or relevant Special publications and guidelines shall be used.

12.3.2 Buildings shall also be designed in accordance with the Applicable Laws, including Kerala Panchayat Building Rules, 2011 and/or Kerala Municipality Building Rules.

Indian Standards for Structural Design

IS: 875 (Part I to V) Code of Practice for Design Loads (other than earth quake) for buildings dead loads, imposed loads, wind loads, snow loads, special loads and load combinations.

IS: 456 Code of Practice for Plain and Reinforced Concrete.

IS: 800 Code of practice for General Construction in Steel

IS: 801 Code of Practice for use of Cold Formed Light Gauge Steel Structural members in general building construction.

IS 1893: Part I Criteria for Earthquake Resistant Design of Structures Part I - General Provision and Buildings

IS 1893: Part IV Criteria for Earthquake Resistant Design of Structures - Part IV- Industrial Structures including Stack-like Structures.

IS 4326 Code of Practice for Earthquake Resistant Design and Construction of Buildings.

IS 14687 Falsework for Concrete Structures- Guidelines

IS 13920 Ductile detailing of Structures

Indian Standards for Foundation Work

IS 1080 Code of Practice for design and construction of shallow foundations on soils (other than raft, ring and shell)

IS: 2911: All parts & Sections Code of Practice for Design and Construction of Pile Foundations

IS: 2950: Part I Code of Practice for Design and Construction of Raft Foundations - Part I: Design

IS: 2974: Part I to V	Code of Practice for Design and Construction of Machine Foundations
IS: 6403	Code of Practice for determination of Bearing Capacity of Shallow Foundations
IS: 13094	Guidelines for Selection of Ground Improvement Techniques for foundation in weak soils

British Standards

BS: 8110 Part 1	Code of Practice for Design and Construction – Structural use of Concrete
BS: 8110 Part 2	Code of Practice for Special Circumstances – Structural use of Concrete
BS: 8004	Code of Practice for Foundations

Other Codes

National Building Code (NBC)

International Building Code (IBC)

12.4 **Report to be submitted**

The Concessionaire shall prepare and submit the design reports to the Independent Engineer for its review and comments.

Section 13

Utilities

SECTION 13

UTILITIES

13.1 **General**

13.1.1 This Section provides the Standards and Specifications for the utilities for the Port Project.

13.1.2 The utilities shall be designed to support the regular Port operations. Suitable redundancy in system shall be provided for the seamless Port operations.

13.1.3 The utilities shall be designed with possibility of Capacity Augmentation (both by volume and area coverage) to be built in the system.

13.1.4 This section covers the following items.

- (i) Electricals including substation
- (ii) Emergency power back up
- (iii) Data Network
- (iv) Telephone System
- (v) Closed Circuit TV System (CCTV)
- (vi) Public Address Systems
- (vii) Radio System
- (viii) Potable Water Supply
- (ix) Fire Fighting
- (x) Drainage System
- (xi) Lighting

13.1.5 Specifications and Standards for additional items, if so required for the Port operations, shall be prepared by the Concessionaire in consultation with the Authority and the Independent Engineer in accordance with Good Industry Practices, Indian and International Standards and Local Regulations, if any.

13.2 **Electricals including Substation**

13.2.1 Electrical network, equipment and installations shall be done as per relevant Indian Standards but not limited to:

IEE Regulations for the Electrical Equipment of Buildings

BIS 3043 Code of practice for Earthing

BIS 3151 Earthing Transformers

BIS 5553(Part VI) Reactor Parts - Earthing of Transformers

BIS 9921: Part I to V Specification for Alternating Current Disconnections (Isolators) and Earthing Switches for Voltages above 1000V

BIS 12776	Galvanized Strand for Earthing - Specification
BIS 14981	Live Working - Earthing or Earthing and Short-Circuiting Equipment Using Lances as a Short-Circuiting Device-Lance Earthing
BIS 14658	High Voltage Alternating Current Circuit Breakers - Guide for Short-circuit and Switching Test Procedures for Metal-enclosed and Dead Tank Circuit Breakers
BS 7671	Requirements for Electrical Installations
BIS 2309	Code of Practice for Protection of allied Structure against Lightning
BIS 732	Code of Practice for Electric Wiring Installation
BIS 694	PVC insulated Cables for working voltages up to and including 1100V
BIS 1554 (Part I)	PVC insulated (Heavy Duty) electric cables: Part 1 for working voltages up to and including 1100V
BIS 1554 (Part II)	PVC insulated (Heavy Duty) electric cables: Part 2 for working voltages from 3.3 kV up to and including 11 kV
BIS 7098: Part I to III	Cross linked Polyethylene insulated PVC sheathed cables
BIS 10118: Part I to IV	Code of Practice for selection, Installation & Maintenance of Switchgears and Control gears

13.2.2 All cabling within Yard shall be underground for ease of operations.

13.3 **Emergency Power Backup**

13.3.1 All lighting, convenience power, HVAC, PHE, Communication, Data, Office Spaces, Security Systems and Fire Fighting System shall be provided with emergency backup power supply. Power Backup can be provided in the form of Diesel/Gas based Generating Sets. Alternative green energy source with fail-safe systems can be used also. All equipment and machineries shall conform to the specifications for equipment in general mentioned in section 11 of this Manual.

13.4 **Data Network**

13.4.1 Ethernet IP network as per IEEE 802.11 including both wire line and wireless component and redundancy for high reliability and availability shall be designed and maintained across the Port for data transmission between different equipment, control centres, administration and gate systems.

13.4.2 Fast Ethernet/Ethernet Network – the characteristics of LAN and WAN cables shall follow ISO/IEC 8802-3.

13.5 **Telephone System**

The telephone system shall conform to applicable ITU-T standards. A digital Central Voice Recording System (CVRS) shall be provided in OCC to record all telephone conversations of all controllers in OCC, depot, stations, call centers and attendant consoles.

A Centralized Voice Mail System (CVMS) shall be provided and integrated with the switch to enable PABX users to leave, retrieve and broadcast voice messages to and from this single message centre.

13.6 **Closed Circuit Television**

The Closed Circuit Television (CCTV) System shall provide video surveillance and recording function for the operators to monitor all the sensitive areas.

Two types of cameras shall be provided:

- (i) Fixed cameras with fixed focal length lens and fixed orientation.
- (ii) Pan/Tilt/Zoom (PTZ) cameras with variable focal length lens with adjustable orientation in both the vertical and horizontal directions.

13.7 **Public Address System**

The characteristics to be specified and the methods of measurement for the equipment shall be in accordance with IEC-268 Part 1 to 17 - Sound System Equipment. All PA equipment in equipment rooms shall be rack-mounted on equipment cabinets conforming to EIA 31 O-C.

13.8 **Radio System**

The Radio System shall provide wireless voice and data communications channels between the various parties to support the operational and maintenance requirements of the Rail System.

The Radio System shall be a digital trunk radio system (e.g., TETRA system, other proven digital radio systems) offering high reliability, fast call setup, flexible call configuration and dynamic channel assignment to efficiently utilize the radio channels. It shall support both voice and data communications. The call setup time shall be better than 0.5 s and response time on the screen of the workstation shall be better than 0.2 s.

13.9 **Fire Fighting System**

13.9.1 All means of egress shall be in conformity with NFPA 130. The firefighting system is to be designed in accordance with IS 3218, National Building Code-2005, local codes and relevant Indian/International Standards.

13.9.2 Fire mains:

The design of the fire mains shall comply with the Local Fire Authorities' Regulations, National Building Code - 2005, and relevant Indian / International Standards.

The hydraulic design of the fire main and hydrant system shall comply with the NFPA 14 in respect of flow and pressure requirements for the maximum simultaneous operation of two hydrants.

Booster pumps shall comply with the requirements of NFPA 20.

13.9.3 Hand held portable fire extinguishers:

Portable fire extinguishers shall be located at strategic positions as agreed with the local fire authorities. The type of fire extinguishers shall be appropriate for the risk at that location. Portable fire extinguishers shall comply with NFPA 10.

13.10 **Water Supply System**

13.10.1 The water supply system shall be designed and constructed as per Central Public Health and Environmental Engineering Organisation (CPHEEO) "Manual on Water Supply and Treatment"

13.10.2 The incoming water supplies and the system they supply shall be designed and constructed as per NBC-2005, and shall include the following:

- (i) Potable water supply
- (ii) Raw water and Seawater supply
 - a) Sprinkler Supply
 - b) Hose reel supply

13.10.3 Water Tank and Pump Houses:

Underground and/or elevated water tank(s) along with necessary pumping station(s) shall be constructed for the required volume of water storage. The tank(s) shall be sub-divided into several compartments for easy cleaning and maintenance. Tank(s) shall be designed as per IS: 3370 or other International Standards for structures and shall be designed in such a way so that the water inside is not contaminated by any other source. Separate tank(s) shall be built for potable & raw water.

13.11 **Drainage System**

13.11.1 Drainage for yard:

Grading and drainage schemes need to be fully integrated with terminal operating plans so as not to create impediments to efficient operations.

The desired grades in roadways and paved container stacking areas shall not be more than 1.0%.

Surface catch basins shall be avoided in wheeled driving areas and the empty container storage areas as they require warped surfaces that reduce equipment efficiency and service life.

The use of 1% (one per cent) sloped continuous planes with slot drains within these areas should be maximized.

Site drainage is developed through a series of graded planes, creating a series of peaks and valleys. Level slot or trench drains are located in the valleys to collect runoff within the paved container stacking areas, gate area, and roadways. Peaks and valleys shall run east-west in the traffic aisles wherever possible.

RMG runways shall be designed to be level.

Run-off collected from yard shall not be drained off directly to sea, but shall be sent to effluent treatment plant first.

All drain components must be structurally capable of carrying all the incidental loads including that of travelling crane wheel load, if there comes a possibility of crossing/running of the crane wheel at any point of time over the said drain component or any part of it.

Drains must not be located close to an electrical trench/facility unless it becomes imperative.

Design of drainage network and parts of it shall follow Good Industry Practices.

13.11.2 Separate storm water and sewerage systems shall be provided with the Port which shall be designed to comply with the following requirements:

- (i) CPHEEO: Manual on Sewerage and Sewage Treatment

- (ii) BS EN 752: Drains and sewer systems outside buildings; and
- (iii) BS:8301: Code of practice for building drainage.

13.11.3 Storm / rain water drainage system from the roof terrace and various levels of the building and drains shall be by means of draining and surface run-off water to rain water recharge pits for ground water recharging.

13.11.4 Effluent treatment plant shall comprise of preliminary, secondary (chemical & biological) and tertiary treatment units. The treated effluent shall be recycled and reused for desired areas make up, flushing and for vehicle washing requirement. As per guidelines by MoEF, it shall be ensured to provide high flow UV System in tertiary effluent treatment plant.

13.11.5 Sewerage Pipe Work:

- (a) All ductile iron pipes and fittings shall be lined internally with a lining of high alumina cement mortar in accordance with BS EN 598. Where Zinc coating is proposed for the external finish, it shall be in accordance with BS EN 598 and be followed by an epoxy finish. This shall cover the internal surface of the socket.
- (b) Flanged pipes shall comply with BS EN 545. Ductile iron flanges shall have the dimensions given in the relevant tables in BS EN 1092-2. All bolts and nuts for flange joints shall be of grade 4.6 of BS:4190 and shall be hot-dipped galvanized in accordance with the requirements of BS EN 1461.

13.12 **Lighting System**

The lighting shall comply with the standards, requirements and specifications given in Indian Standard 'Code of Practice for Lighting of Public Throughfare' IS: 1944.

The level of illumination shall be as per IS: 3646 Part II.

Lighting system in Yard shall consist of the following major components:

- (i) High Mast Lighting
- (ii) Lighting on Internal Traffic Circulation roads (not included in Yard area)

Usually 30 (thirty) metres high masts with numerous luminaries of suitable type and power are used in yard. These are fitted with mechanisms to bring down the luminary assembly along with the frame to accessible height for installation/maintenance.

Lighting on internal traffic circulation roads, if not covered by high mast lighting, can be covered by standard street lights at suitable spacing to achieve the illumination level mentioned earlier.

13.13 **Report to be submitted**

The Concessionaire shall furnish the design reports including the following to the Independent Engineer for its review and comments.

- (i) Single Line Diagrams
- (ii) Equipment Specification and Data sheet
- (iii) Vendor's Design Report
- (iv) Operation & Maintenance Manual
- (v) Installation Guidelines
- (vi) Warranty Certificates
- (vii) Any other report relevant to the design.

Section 14
Fishery Harbour

SECTION 14

FISHERY HARBOUR

14.1 General

- 14.1.1 The Concessionaire shall Design and Construct the Fishery Harbour as per specifications mentioned in Schedule-B of the Concession Agreement.
- 14.1.2 The Concessionaire shall design and construct the fishery harbour in discussion with the Authority and the Harbour Engineering Division (HED).

14.2 Buildings

- 14.2.1 Standards & Specifications for buildings shall be as mentioned in Section 12 of this Manual.

14.3 Fishing Berths

- 14.3.1 Standards & Specifications for fishing berths shall be as mentioned in Section 06 of this Manual.
- 14.3.2 Design vessel for fishing berths shall be decided in discussion with the Authority and local Harbour Engineering Division.
- 14.3.3 The fishing berths shall primarily be used by country boats with freeboard as low as 0.4 (point four) meters and length 10 (ten) meters. The berth face shall be extended sufficiently low so as to accommodate the small country boats safely.
- 14.3.4 The berths shall be provided with Arch Type (or equivalent) fenders. To accommodate various size of fishing boats, the fenders shall be mounted in an inclined manner having sufficient overlaps between two consecutive fenders.
- 14.3.5 Cast-iron bollards of 5 (five) tonne capacity shall be provided at 4 (four) meters intervals all through the length of the berth for mooring. In addition to these, mooring rings/eyes shall be provided on the berth face for mooring of small boats in low tide.
- 14.3.6 Stainless steel cope edge protecting strip shall be provided for protection of cope edge from damage due to fish handling and rope friction. Cope edge shall be chamfered/ filleted suitably.
- 14.3.7 Stainless steel safety ladders shall be provided with a spacing minimum of 30(thirty) metres. These shall extend to a depth of 1 (one) meter below the lowest water level.

14.4 **Reclamation & Ground Improvements**

14.4.1 Standards & Specifications for Reclamation & Ground Improvements shall be as mentioned in Section 5 of this Manual.

14.5 **Breakwater and Revetments**

14.5.1 Standards & Specifications for Breakwater and Revetments shall be as mentioned in Section 3 of this Manual.

14.5.2 Outer layer of rock placed for revetments in the fishing harbour area in general shall be placed in a fashion so as not to damage the country boats.

14.6 **Roads**

14.6.1 Standards & Specifications for Roads shall be as mentioned in Manual of Standards and Specifications for NH works in PPP (2 lane)

14.6.2 The road shall be for undivided 3 (three) lanes of traffic as per IRC & MORTH Specifications and Guidelines

14.7 **Utilities**

14.7.1 Standards & Specifications for Utilities shall be as mentioned in Section 13 of this Manual.

14.8 **Navigational Aids**

14.8.1 Standards & Specifications for Navigational Aids shall be as mentioned in Section 10 of this Manual.

14.9 **Report to be submitted**

The Concessionaire shall furnish the design report including the following to the Independent Engineer for its review and comments.

- (i) Mathematical model studies confirming the wave characteristics, water current inside the fishing harbour.
- (ii) Designs and drawings of works for foundations, substructures and superstructure of structures.
- (iii) Detailed design report for each structure
- (iv) Any other information relevant to the design.

Section 15
Materials

SECTION 15

MATERIALS

15.1 General

- (i) Unless otherwise specified in this section, All the materials to be used in works shall be in conformity with the requirements laid down for relevant item in the Indian Standard Specifications. If the Concessionaire proposes to use any material, which is not covered in the Indian Standard Specifications, it shall conform to the relevant British Standards or equivalent. Proprietary products proposed to be used shall be proven by use in comparable international port projects, and shall be supported with authenticated licensing arrangement with the manufacturer.
- (ii) Manufacturer's instructions shall be complied for all proprietary items
- (iii) The Concessionaire shall identify the proposed sources of materials and submit the proposal prior to delivery. If it is found that proposed sources of supply do not produce uniform and satisfactory products at any time during execution, the Concessionaire shall procure acceptable materials conforming to the specifications from other sources.
- (iv) In case of manufactured items, the Concessionaire shall submit details pertaining to the product/process/system covering interalia:
 - a. Name of manufacturer and name of product/process/system;
 - b. General features of the product/process/system along with specifications and standards adopted for the product/process/system;
 - c. Authenticated copies of license/agreement;
 - d. Details of projects where the product/process/system has been successfully used;
 - e. Limitations, if any;
 - f. Acceptance tests and criteria;
 - g. Application/Installation and maintenance procedure and schedule; and
 - h. Performance warranty.
- (v) Based on this Manual, a detailed material specification shall be prepared by the Concessionaire and shall be submitted to Independent Engineer for approval in the detailed design stage.

15.2 Structural concrete

The Concrete for use in general structures shall conform to the provisions in Section 2 Clause 6 of IS: 456: 2000 Specifications.

The concrete for use in marine conditions shall conform to the specifications of IS: 4651 Part IV.

15.3 **Cement**

Any type of cement specified in IS: 456 may be used for the works subject to limitations, if any, specified therein.

For marine works, specifications of IS: 4651 Part IV to be followed.

15.4 **Coarse Aggregates**

Before commencement of the works, at least 3 (three) samples, in accordance with the procedure laid down in IS:2430, shall be taken for each quarry source to ascertain the quality, suitability and fitness of the available material for use in the works. Fresh tests shall be conducted in case there is any change in the source or the type of rock being quarried. The proposal, along with a copy of test reports, shall be submitted to the Independent Engineer for review and comments, if any.

15.5 **Armour Stones**

The specifications for the armour stones for breakwater, shore protection and revetments shall comply with the guidelines as specified in CIRIA Rock Manual.

15.6 **Sand/Fine Aggregates**

- (i) All fine aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386 (Part I to VIII). The fineness modulus of fine aggregates shall be between 2.0 and 3.5.
- (ii) Before the commencement of the works, at least 3 (three) samples as per IS:2430 shall be taken for each quarry source to ascertain the quality, suitability and fitness of the available material for use in the works and the proposal along with a copy of test reports shall be submitted to the Independent Engineer for review and comments, if any.
- (iii) Fine aggregates having positive alkali-silica reaction shall not be used.

15.7 **Water**

- (i) Water for use in the works for mixing and curing of concrete shall be in conformity with Section 2 Clause 5.4 of IS: 456: 2000.
- (ii) Water from each source shall be tested before the start of works and thereafter every 3 (three) months and after each monsoon till the completion of the works and the proposal along with a copy of test reports shall be submitted to the Independent Engineer for review and comments, if any.

15.8 **Chemical Admixtures**

15.8.1 The following guidelines shall apply in selection and use of admixtures:

- (i) Chemical admixtures shall comply with IS:9103 and meet the requirements stipulated in clause 5.5 of IS:456.
- (ii) Admixtures generating hydrogen or nitrogen or containing nitrates, sulphides, sulphates, or any other material liable to affect the reinforcement/ embedment's or concrete shall not be used.
- (iii) Compatibility of admixture with the cement being used shall be tested before actual use in the works. The test shall be repeated in case of change of type or grade or source of cement.
- (iv) Admixtures shall not impair the durability of concrete. They shall not combine with the ingredients to form harmful compounds or endanger the protection of reinforcement against corrosion.
- (v) The packaging of admixtures shall clearly indicate the name of the manufacturer/ supplier, brand name (name of the product), date of production and expiry, batch identification number.

15.8.2 In addition to the details as stipulated in Clause 1012.1 of MORTH Specifications, following information shall also be furnished:

- (i) pH value and colour.
- (ii) Latest date of test and name of the laboratory.
- (iii) Shelf life, maximum and minimum temperature for storage, precautions to be taken while mixing and any other instructions for use.

15.9 **Steel**

15.9.1 Steel for Pre-Stressing

In addition to the requirement mentioned in Clause 1009.2 of MORTH Specifications, the steel for pre-stressing shall satisfy following conditions:

- (i) Uncoated stress relieved low relaxation steel conforming to IS: 14268.
- (ii) Pre-stressing steel shall be subjected to acceptance tests in respect of modulus of elasticity, relaxation loss at 1000 hrs, minimum ultimate tensile strength, stress-strain curve etc. prior to actual use on works as per guidelines contained in BS:4447.

The modulus of elasticity value, as per acceptance tests, shall conform to the design value, which shall be within a range not more than 5% (five per cent) between the maximum and the minimum.

15.9.2 Reinforcement/Un-tensioned Steel

- (i) Only fresh steel shall be brought to the site, every bar shall be inspected before assembling on the work; and defective, brittle or burnt bars shall be

discarded, cracked ends of bars shall be cut before use. All reinforcements shall conform to the specifications of IS: 456.

- (ii) Only Thermo Mechanically Treated (TMT) bars conforming to IS: 1786 shall be used as reinforcing steel.
- (iii) Proprietary steel products may be permissible provided they conform to the minimum requirements.
- (iv) Galvanized steel bars and epoxy coated steel bars shall not be used in the construction.

15.9.3 Steel for Bearings

Mild steel, high tensile steel, cast steel, steel forgings, and stainless steel shall conform to the provisions contained in IS:2062 or in clause 925.1 of IRC:83 (Part III).

15.9.4 Structural Steel

All structural steel, castings and forgings, fasteners (bolts, nuts, washers and rivets), welding consumables and wire ropes and cables shall conform to the provisions of Section 2 of IS 800:2007.

15.10 Bitumen

Bitumen shall be paving bitumen of viscosity grade complying with Indian Standard Specifications for "Paving bitumen" IS:73-2006 of grade appropriate for the traffic and climatic conditions of the Port. Harder grade bitumen shall be used for heavily trafficked roads in hot areas.

15.11 Paints

- (i) Priming coat for temporary tide gauges shall be zinc based priming paint complying with IS: 12744. Undercoat and finishing coat for temporary tide gauges shall be micaceous iron oxide paint complying with IS:44.
- (ii) Primer for steel fittings for fendering systems shall be zinc based primer complying with IS: 12744.
- (iii) Bituminous paint for fendering systems shall comply with IS: 9862.
- (iv) Paints for buildings and structures shall be as per National Building Code.

15.12 Proprietary Items

15.12.1 Rubber for Fenders

- (i) The rubber for manufacturing fenders shall be natural or synthetic rubber or the mixture of both. The substance shall be reinforced with carbon black for resistance to ageing, abrasion, weathering, wearing, stability when repeatedly in contact with seawater.
- (ii) The rubber for fenders shall be homogeneous in quality, free from foreign materials, air bubbles, pores, injuries, cracks, defective impurities and other harmful defects.

- (iii) The rubber for fenders shall comply with the specifications of PIANC Report WG33, Supplement 01.

15.12.2 Iron & Steel Fittings

Iron and steel fittings for marine structures shall comply with the following:

- (i) Cast iron for bollards shall be Grade 150 or 180 complying with IS: 210.
- (ii) Mild steel bolts and nuts shall comply with IS: 4218.
- (iii) Mild steel washers shall comply with BS: 4320
- (iv) Mild steel chain shall be Grade 30 steel complying with IS: 2429.
- (v) Stainless steel bolts and nuts shall comply with Grade A4 and property class 80 of IS: 1367 Part 14 Section 1.
- (vi) Stainless steel washers shall be Grade 316 austenitic steel complying with BS: 1449 Part 2. The dimensions and tolerances of stainless steel washers shall comply with BS: 4320.
- (vii) Stainless steel for chains, railings, cat ladders, mooring eyes and other marine fittings shall be Grade 316 austenitic steel complying with the following:
 - a) General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels – IS: 11371
 - b) Specification for stainless and heat-resisting steel plate, sheet and strip - BS 1449: Part 2
- (viii) Anchor bolt and socket assemblies cast-in in the berth structures for fenders and rubber ladders shall be Grade 316 stainless steel and shall be supplied by the manufacturer of the fender units or ladders for which they are intended unless otherwise approved by the Independent Engineer.
- (ix) Mooring eyes shall be formed from plain round mild steel bar to IS: 432-Part I

15.13 Storage of Materials

All materials shall be stored at proper places so as to prevent their deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness. Any material, which has deteriorated or has been damaged or is otherwise considered defective after review by the Independent Engineer shall not be used and shall be removed from the Site by the Concessionaire at its cost. Such materials shall not be accepted with any modifications also.

15.14 Report to be submitted

The Concessionaire shall prepare and submit to the Authority and Independent Engineer reports containing test results of all materials and finished products proposed to be used in the Project.

Section 16

**Landscaping, Tree Plantation and
Rainwater Harvesting**

SECTION 16

LANDSCAPING, TREE PLANTATION AND RAINWATER HARVESTING

16.1 General

The Concessionaire shall plant trees and shrubs of required number and type at the appropriate locations within the Right of Way and in the land earmarked by the Authority for afforestation keeping in view the local state by-laws and IRC Guidelines on Landscaping and Tree Plantation. The Authority shall specify the number of trees which are required to be planted by the Concessionaire as compensatory afforestation or otherwise. The Concessionaire shall also maintain the trees and shrubs in good condition during the Concession Period in accordance with the Maintenance Schedule. The guidelines given in this section shall be followed in plantation of trees and shrubs.

16.2 Design considerations in various locations

16.2.1 Set-back distance of trees and other plantation:

Trees on the roadside shall be sufficiently away from the roadway so that they are not a hazard to road traffic or restrict the visibility. Most vulnerable locations in this regard are the inside of curves, medians, junction corners and cut slopes. Trees shall be placed at a minimum distance of 14 (fourteen) metres from the centre line of the extreme traffic lane to provide recovery area for the vehicle that runs off the road. A second row of trees 6 (six) metres further away shall also be planted wherever possible. Preferably the first row of trees shall consist of species with thick shade and other rows of vertical type providing thin shade. Capacity Augmentation of the Port and road connectivity shall be taken into consideration while locating the trees so that land is free of trees when further widening takes place. The distances for alternative rows of trees shall be reckoned from the nearest edge of the unidirectional carriageway. No plantation shall be allowed on the embankment slopes.

16.2.2 Set-back of Trees on Curves:

Experience has been that growth of thick vegetation close to the formation on inside of horizontal curve leads to serious reduction of sight distance and causes avoidable accidents with cattle/children suddenly emerging from the side. Uncontrolled trees/vegetation, may also affect visibility of traffic control devices and road signs. Therefore, in plain terrain a stopping sight distance of 180 (one hundred and eighty) meters corresponding to the design speed of 100 (hundred) km per hour may be ensured on all curved sections of the Port connectivity road along the innermost lane.

However, where there are Site restrictions their requirement may be reduced to 130 (one hundred and thirty) meters corresponding to the design speed of 80 (eighty) km per hour as a special case. The existing trees and vegetation on the sides have to be suitably thinned/trimmed, or even removed if necessary and a regular programme of

pruning of the offending trees shall be undertaken as part of the maintenance operations.

In all cases, location of trees shall be checked to ensure that clear vision of all signs/signals is available at all times to the motorists. Also, the foliage or trees should not come in the way of roadway lighting.

16.2.3 Vertical clearance of trees and other plantations

For safe traffic operation, a minimum 5 (five) metres of vertical clearance should be made available across the roadway and for this, the probable size of all plants should be anticipated in advance, at the time of initial planting.

To allow for the effects of growth, wind and rain, trees shall be trimmed to 6 (six) metres and 6.5 (six point five) metres above the pavement in rural and urban areas respectively.

16.2.4 Plantation in Medians:

In the sections of the Port connectivity road where median width is more than 3 (three) metres, shrubs shall be planted and maintained to cut off headlight glare from traffic in the opposite direction. Flowering plants and shrubs are eminently suited for the purposes of plantation in the medians. These shall be planted either in continuous rows or in the form of baffles. The height of shrubs shall be maintained at 1.5 (one point five) metres to cut off the effect of traffic lights coming from the opposite direction.

In the sections, where the width of median is less than 3 (three) metres, shrubs or flowery plants may be planted in between crash barriers or other means like metal/plastic strips to cut off glare shall be provided.

The shape of shrubs and plants shall be suitably regulated so that there is no overgrowth either vertically .or horizontally beyond the edge of the paved median.

Median plantation shall be avoided or restricted to low-growing varieties in the vicinity of road intersections and median openings, to ensure adequate visibility.

16.2.5 Spacing of Avenue Trees:

The spacing of avenue trees shall depend on the type and growth characteristics of trees, requirement of maintenance, penetration of distant views, etc. A range of 10 (ten) - 15 (fifteen) meters would meet the requirement for most varieties.

16.2.6 Choice of Trees:

The following guidelines shall be kept in view while selecting the species of trees to be planted:

- (i) Trees shall be selected with due regard to soil, rainfall, temperature and water level.

- (ii) Trees which become very wide shall be avoided as their maintenance would cause interference with traffic flow.
- (iii) The species must be capable of developing a straight and clean bole upto a height of 2.5 (two point five) to 3.5 (three point five) meters from the ground level.
- (iv) The selected trees shall, preferably, be fast growing and wind-firm. These shall not be thorny or drop too many leaves.
- (v) The trees shall be deep rooted, as shallow roots injure pavements.
- (vi) In urban areas, the species selected shall be of less spreading type, so that these do not interfere with overhead services, clear views of signs/signals, and efficiency of roadway lighting.

16.3 **Landscaping in Port**

The Concessionaire shall refer to BS:4428 for all operations related to general landscaping.

16.4 **Rain Water Harvesting**

The Concessionaire shall refer to Rain Water Harvesting and Conservation Manual by CPWD and BS:8515 for all works related to rain water harvesting. The area designated for rain water harvesting shall be as shown in master plan for Port available in the feasibility study report.

16.5 **Report to be submitted**

The Concessionaire shall submit scheme for plantation and maintenance of plants and trees to the Independent Engineer for review and comments, if any.

Appendices

APPENDIX – 1

(Reference Para 1.11)

List of Paras for preparing schedules of the Concession Agreement

Section	Para	Particulars to be specified
Section 1	1.10	Guidelines for preparing schedules of the Concession Agreement
	1.12 (b)	Safety of design
	1.16	Construction of utilities along or across the Port
Section 2	2.3	General Design features of Breakwater
	2.7.1	General Design features of Container Berth
	2.9.1	General Design features of Dredging & Reclamation
	2.10	General Design features of Building
	2.11.1	General Design features of Fishery Harbour
	2.13	General Design features of Internal Roads
	2.14	General Design features of PORT Estate Development
	2.15	General Design features of Equipment
	2.16	General Design features of Port crafts and Navigational Aids
	2.19.1	Augmentation requirements of Breakwater
	2.19.5	Augmentation requirements of Additional Port Terminal
Section 3	3.1 (i)	Breakwater Design and Construction requirements
	3.5	Functional requirements for Breakwater and Shore Protection Works
Section 4	4.4.1	Dredging considerations
Section 5	5.2.1	Performance requirements for Reclamation
Section 6	6.1 (ii)	Length of the Berth
	6.10.2 (ii) (g)	Installation and maintenance procedure for Pile Foundation
	6.17	Design of Rail – Road Bridges
	6.18	Design of Grade Separated Road Structures
Section 7	7.2	Type of Pavement
Section 8	8.1 (ii)	Number of lanes in a Gate Complex
	8.4.1	Layout and Design of Gate Complex
	8.4.2	Canopy of Gate Complex

Section	Para	Particulars to be specified
Section 12	12.1.2	Design and Construction of Buildings
Section 14	14.1.1	Design and Construction of Fishery Harbour
Section 15	15.1 (iv) (g)	Installation and Maintenance procedure of Manufactured items
Section 16	16.1	Maintenance of Landscaping and Tree Plantation

APPENDIX – 2

(Reference Para 1.4)

List of Codes, Standards, Guidelines and Specifications

S. No.	Code	Document No	Title
1.	Indian Specifications, Standards, Design Codes		
1.	IS	44	Iron Oxide Pigments for Paints
2.	IS	73	Specification for Paving Bitumen
3.	IS	210	Code of Practice for Grey Iron Castings
4.	IS	383	Specification for Coarse and Fine Aggregates from Natural Sources for Concrete
5.	IS	432	Specification for Mild Steel and Medium Tensile Steel Bars and Hard-Drawn Steel Wire for Concrete Reinforcement
		Part I	Mild Steel and Medium Tensile Steel Bars
		Part II	Hard-Drawn Steel Wire
6.	IS	456	Plain and Reinforced Concrete - Code of Practice
7.	IS	694	Polyvinyl Chloride Insulated Unsheathed And Sheathed Cables/cords With Rigid And Flexible Conductor For Rated Voltages Up To And Including 450/750 V
8.	IS	732	Code of Practice for Electrical Wiring Installations
9.	IS	800	General Construction In Steel - Code of Practice
10.	IS	801	Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members In General Building Construction
11.	IS	807	Design Erection and Testing (Structural portion) of Cranes and Hoists
12.	IS	875	Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures
		Part I	Dead Loads - Unit Weights of Building Materials and Stored Materials
		Part II	Imposed Loads
		Part III	Wind Loads
		Part IV	Snow Loads
		Part V	Special Loads And Combinations
13.	IS	1080	Code of Practice for Design and Construction of Shallow Foundations in Soils (other than RAFT, RING and

S. No.	Code	Document No	Title
			SHELL)
14.	IS	1172	Code of Basic Requirements for Water Supply, Drainage and Sanitation
15.	IS	1367	Threaded Steel Fasteners
		Part 14- Section 1	Mechanical Properties of Corrosion-Resistant Stainless-Steel Fasteners - Bolts, Screws and Studs
16.	IS	1436	Specifications for Weigh bridges
17.	IS	1554	PVC insulated (heavy duty) electric cables
		Part I	For working voltages up to and including 1 100 V
		Part II	for Working Voltages from 3 3 kV up to and Including 11 kV
18.	IS	1742	Code of Practice for Building Drainage
19.	IS	1786	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement
20.	IS	1893	Criteria for Earthquake Resistant Design of Structures
		Part I	General Provision and Buildings
		Part IV	Industrial Structures including Stack-like Structures
21.	IS	1944	Code of Practice for Lighting of Public Thoroughfare
22.	IS	2309	Protection of Buildings and Allied Structures Against Lightning - Code of Practice
23.	IS	2314	Steel Sheet Piling Sections
24.	IS	2386	Methods of Test for Aggregates for Concrete
		Part I	Particle Size and Shape
		Part II	Estimation of Deleterious Materials and Organic Impurities
		Part III	Specific Gravity, Density, Voids, Absorption and Bulking
		Part IV	Mechanical Properties
		Part V	Soundness
		Part VI	Measuring Mortar Making Properties of Fine Aggregate
		Part VII	Alkali Aggregate Reactivity
		Part VIII	Petrographic Examination
25.	IS	2429	Round Steel Short Link Chains (Electric Butt Welded), Grade L(3)
26.	IS	2430	Methods for Sampling of Aggregates for Concrete
27.	IS	2911	Code of Practice for Design and Construction of Pile

S. No.	Code	Document No	Title
			Foundations
		Part I	Concrete Piles
		Sec 1	Driven Cast in-Situ Concrete Piles
		Sec 2	Bored Cast in-Situ Piles
		Sec 3	Driven Precast Concrete Piles
		Sec 4	Bored Precast Concrete Piles
		Part II	Timber Piles
		Part III	Under-Reamed Piles
		Part IV	Load Test on Piles
28.	IS	2950	Code of Practice for Design and Construction of Raft Foundations
		Part I	Design
29.	IS	2974	Code of Practice for Design and Construction of Machine Foundations
		Part I	Foundation for Reciprocating Type Machines
		Part II	Foundations for Impact Type Machines (Hammer Foundations)
		Part III	Foundations for Rotary Type Machines (Medium and High frequency)
		Part IV	Foundations for Rotary Type Machines of Low Frequency
		Part V	Foundations for Impact Machines other than hammer (forging and stamping press, pig breaker, drop crusher and jolter)
30.	IS	3043	Code of Practice for Earthing
31.	IS	3151	Code of Practice for Earthing transformers
32.	IS	3177	Code of Practice for Electric Overhead Travelling Cranes and Gantry Cranes other than Steel Work Cranes
33.	IS	3218	Paralleled rulers, 150 mm (link type)
34.	IS	3646	Code of Practice for Interior Illumination
35.	IS	3370	Code of Practice for Concrete Structures for Storage of Liquids
36.	IS	3938	Specification for Electric Wire Rope Hoists
37.	IS	4081	Safety Code for Blasting and related Drilling Operations
38.	IS	4137	Code of Practice for Heavy Duty Electric Overhead Travelling Cranes including Special Service Machines for

S. No.	Code	Document No	Title
			use in Steel Works
39.	IS	4218	ISO General Purpose Metric Screw Threads
40.	IS	4309	Method of Measurement on direct reading pH meters
41.	IS	4326	Earthquake Resistant Design and Construction of Buildings - Code of Practice
42.	IS	4357	Methods for Stability Testing of Fork Lift Trucks
43.	IS	4573	Power Driven Mobile Cranes
44.	IS	4651	Code of Practice for Planning and Design of Ports and Harbours
		Part I	Site Investigation
		Part II	Earth Pressure
		Part III	Loading
		Part IV	General Design consideration
		Part V	Layout and functional requirements
45.	IS	5329	Code of Practice for Sanitary Pipe Work Above Ground for Buildings
46.	IS	5553	Reactor Parts Earthing transformers (Neutral couplers)
47.	IS	6403	Code of Practice for Determination of Breaking Capacity of Shallow Foundations
48.	IS	7098	Cross-linked Polyethylene insulated PVC sheathed cables
		Part I	For working voltage upto and including 1 100 V
		Part II	For working voltages from 66 kV upto and including 220 kV
		Part III	For Working Voltages from 3.3 kV up to and Including 33 kV
49.	IS	9103	Specifications for Concrete Admixtures
50.	IS	9862	Specifications for ready-mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting.
51.	IS	9921	Alternating Current Disconnectors (Isolators) and Earthing Switches for Voltages Above 1 000 V
		Part I	General and Definitions
		Part II	Rating
		Part III	Design and Construction
		Part IV	Type Tests and Routine Tests

S. No.	Code	Document No	Title
		Part V	Information to be Given with Tenders, Enquiries and Orders
52.	IS	10118	Code of Practice for Selection, Installation and Maintenance of Switchgear and Control gear
		Part I	General
		Part II	Selection
		Part III	Installation
		Part IV	Maintenance
53.	IS	11371	Method for macro etch test for wrought steel products
54.	IS	11384	Code of Practice for Composite Construction in Structural Steel and Concrete
55.	IS	12744	Specification for Ready Mixed Paint, Air Drying, Red Oxide – Zinc Phosphate, Priming
56.	IS	12776	Code of Practice for Galvanized Strand for Earthing
57.	IS	13094	Selection of ground improvement techniques for foundation in weak soils -Guidelines
58.	IS	13367	Safe use of cranes - Code of practice
		Part I	General
59.	IS	13558 – Part II	Cranes - Controls - Layout and characteristics
60.	IS	13834	Cranes - Classification
		Part I	General
		Part II	Mobile Cranes
		Part III	Tower Cranes
		Part IV	Jib Cranes
		Part V	Overhead Travelling and Portal Bridge Cranes
61.	IS	13870	Cranes and Lifting appliances - Selection of wire ropes
		Part I	General
		Part II	Mobile Cranes - Coefficient of Utilization
62.	IS	13920	Code of practice for Ductile detailing of reinforced concrete structures subjected to seismic forces
63.	IS	14469	Mobile cranes - Determination of stability
64.	IS	14268	Specification for Uncoated Stress Relieved Low Relaxation Seven-Ply Strand For Prestressed Concrete
65.	IS	14474	Mobile Cranes - Experimental Determination of Crane

S. No.	Code	Document No	Title
			Performance
		Part I	Tipping Loads and Radii
66.	IS	14658	High Voltage Alternating Current Circuit Breakers - Guide for Short-circuit and Switching Test Procedures for Metal-enclosed and Dead Tank Circuit Breakers
67.	IS	14981	Live Working - Earthing or Earthing and Short-Circuiting Equipment Using Lances as a Short-Circuiting Device-Lance Earthing
68.	IS	14687	False-work for Concrete Structures - Guidelines
69.	IS	15916	Code of Practice for Building Design and Erection Using Prefabricated Concrete
70.	IS	15917	Code of Practice for Building Design and Erection Using Mixed/Composite Construction
71.	SP	36	Compendium of Indian Standards on Soil
		Part I	Laboratory Testing of Soils for Civil Engineering Purposes
		Part II	Field Testing of Soils for Civil Engineering Purposes

S. No.	Code	Document No	Title
2.	British Specifications, Standards, Design Codes		
1.	BS	903	Physical Testing of Rubber
2.	BS	1377	Methods of Tests for Soils for Civil Engineering Purposes
3.	BS	1449 -2	Specification for Steel Plate, Sheet and Strip
4.	BS	1722 Part 10	Specification for Anti-Intruder Fences in Chain Links and Wire Mesh
5.	BS	4190	ISO Metric Black Hexagon Bolts, Nuts and Screws
6.	BS	4320	Specification for Metal Washers for General Engineering Purpose
7.	BS	4428	Code of Practice for General Landscape Operations (Excluding Hard Surfaces)
8.	BS	4447	Specification for the performance of Pre-stressing Anchorages for Post Tensioned Construction
9.	BS	5607	Code of practice for safe use of explosives in the construction industry
10.	BS	5930	Code of Practice for Site Investigations
11.	BS	6031	Code of Practice for Earthworks
12.	BS	6349	Code of Practice for Maritime Structures
		Part 1	Code of Practice for General Criteria
		Part 2	Design of Quay Walls, Jetties and Dolphins
		Part 3	Design of Dry-docks, Locks, Slipways, and Ship Building Berths, Shiplifts and Dock and Lock Gates
		Part 4	Code of Practice for Design of Fendering and Mooring Systems
		Part 5	Code of Practice for Dredging and Land Reclamation
		Part 6	Design of Inshore Moorings and Floating Structures
		Part 7	Guide to Design and Construction of Breakwaters
13.	BS	7121	Code of Practice for Safe Use of Cranes
		Part 2	Code of Practice for Safe use of Cranes, Inspection, Testing & Examination
14.	BS	7671	Requirements for Electrical Installations
15.	BS	7533	Pavements constructed with clay, natural stone or concrete pavers

S. No.	Code	Document No	Title
16.	BS	8004	Code of Practice for Foundations
17.	BS	8110	Structural Use of Concrete
		Part 1	Code of Practice for Design and Construction
		Part 2	Code of Practice for Special Circumstances
18.	BS	8301	Code of Practice for Building Drainage
19.	BS	8515	Code of Practice for Rain Water Harvesting Systems
20.	BS EN	545	Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods
21.	BS EN	598	Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods
22.	BS EN	752	Drains and Sewer Systems outside Buildings
23.	BS EN	1092-2	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated Copper alloy flanges
24.	BS EN ISO	1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

S. No.	Code	Document No	Title
3.	IRC Standards, Specifications and Design Codes		
1.	IRC	5	Standard Specifications and Code of Practice for Road Bridges Section 1 - General Features of Design
2.	IRC	6	Standard Specifications and Code of Practice for Road Bridges Section 2 - Loads and Stresses
3.	IRC	35	Code of Practice for Road Markings
4.	IRC	67	Code of Practice for Road Signs
5.	IRC	81	Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique
6.	IRC	83	Standard Specifications and Code of Practice for Road Bridges Section 9 - Bearings
7.	IRC	SP-12	Tentative Recommendations on the Provision of Parking.
8.	IRC	SP-63	Guidelines for the use of interlocking concrete block pavements
9.	IRC	SP-69	Guidelines Specifications for Expansion Joints
10.	MORTH		Ministry of Road Transport and Highways
11.	IEE		Regulations for the Electrical Equipment of Buildings
12.	IEEE	802.11	Specifications for Implementing Wireless Local Area Network (WLAN)
13.	IEC	268 - Part 1 to 17	Sound System Equipment
14.	ISO/IEC	8802-3	Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan area networks - Specific requirements
15.	ISO	4308-1	Maintenance of Lifting Appliances
16.	ISO	4309	Cranes Wire Rope Care, Maintenance and Discard

S. No.	Document	Title of Publication
4.	Guidelines	
1.	API RP 2A WSD	Recommended practice for planning, designing and constructing fixed offshore platforms
2.	PIANC	Approach Channels – A guide to Design, Supplement to Bulletin No. 95 Guidelines for Design of Armoured slopes under open piled Quay walls Seismic Design Guidelines for Port Structures Guidelines for the Design of Armoured Slopes Under Open Piles Quay Walls Guidelines for the Design of Fender System Criteria for Moored Ship in Harbours State of Art for Designing and Constructing Berm Breakwater
3.	CEM	Coastal Engineering Manual
4.	CIRIA	The Rock Manual Control of Contraction Induced Cracking in Concrete (Report C660) Embedded Retaining Walls, Guidance for Economic Design (Report 580) Design of Laterally Loaded piles (Report 013)
5.	EurOtop Manual	Wave Overtopping of Sea Defences and Related Structures
6.	IAPH	International Association of Ports and Harbours
7.	IMO	International Maritime Organization
8.	ISM	International Safety Management Code
9.	SOLAS 74	International Convention for the Safety of Lives at Sea (as amended)
10.	IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities, Guidelines
11.	IPMA	International Project Management Association
12.	IMCA	International Marine Contractors Association
13.	STWC	International Convention on Standards of Training Certification and Watch Keeping for Seafarers
14.	OCDI	The Overseas Coastal Area Development Institute of Japan – Technical Standards and Commentaries for Ports and Harbour facilities in Japan
15.	OCIMF	Guidelines and Recommendations for the Safe Mooring of Large Ships at Piers and Sea Islands Mooring Equipment Guidelines
16.	BPA	British Ports Association's Specifications and Guidelines
17.	ICPI	The Structural Design of Heavy Duty Pavements for Ports and Other Industries published

S. No.	Document	Title of Publication
4.	Guidelines	
18.	NBC	National Building Code
19.	NFPA	National Fire Protection Association
20.	IBC	International Building Code
21.	CPHEEO	Central Public Health and Environmental Engineering Organisation – Manual on Water Supply and Treatment
