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MARINE PORT FACILITIES:

DESIGN STANDARD – PART 1: GENERAL PRINCIPLES

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Preface

TCVN xxxx-1:2015 Mairine Port Facilities: Design standards - Part 1: General Principles are compiled based on the "Technical Standards and Commentaries for Port and Harbour Facilities" in Japan.

TCVN xxxx-1:2015 compiled Institute of Trasportation for Science and Technology (ITST), the Ministry of Transportation (MOT) Proposal, the General Department of Standardization, Metrology and Quality Appraisal, Ministry of Science and Technology Ministry Announced.

Marine Port Facilities: Design Standard - Part 1: General Principles

1. Scope

This standard part is applicable to construction, improvement and maintenant of marine port facilities.

2. Terms, definitions

2.1. Cargo handling facilities

Means the facilities provided for the use in port cargo handling, including stationary cargo handling equipment, rail- mounted cargo handling equipment, cargo handling areas and sheds.

2.2. Constructability

Means the performance which enables construction while securing safety in construction work within an appropriate construction period using suitable and reliable methods.

2.3. Design working life

Means the period during which facilities satisfy the performance requirements which were set in the design of the facilities.

2.4. Facilities for ship service

Means the facilities provided for the use of ships, including water supply facilities, fueling facilities, and coal supply facilities for ships, ship repair facilities and ship storage facilities.

2.5. Life cycle cost

Means the total amount of the initial construction cost of facilities and the expected recovery cost of disasters expected during the design working life.

2.6. Limit state design

Means the design method to verify the limit state which is defined as state when a load acts on a structure and some inconvenience on the functions or the safety of the structure occurs. The states subject to the examination are the ultimate limit state, serviceability limit state, and fatigue limit state.

2.7. Maintenanceability

Means the performance which is capable of continuously securing the required performance necessary in facilities by implementing repairs and maintenance, within the range of technically possible and

economically appropriate against the deterioration and the damage of the facilities due to the use of the facilities and expected actions.

2.8. Maintenance level

Means the level of maintenance control set for each member comprising the facilities, considering changes over time in the members comprising the facilities, the ease of inspection and diagnosis, and maintenance work, and the importance of the facilities, in accordance with the maintenance control plan for the facilities as a whole.

2.9. Mooring facilities

Means the facilities where ships moor for cargo handling and passenger embarkation/ disembarkation including quaywalls, mooring buoys, mooring piles, piers, floating piers, lighter's wharfs and slipways.

2.10. Permanent actions

Means the actions which are expected to act on facilities continuously through the design working life, including self weight, earth pressure, and environmental actions.

2.11. Port transportation facilities

Means the facilities provided for the use in transportation necessary for the use of ports and harbours, including roads, parking lots, bridges, railroads, rail tracks, canals and heliports.

2.12. Protective facilities for harbor

Means the facilities which protect waterways and basins such as breakwaters, sediment control groins, seawalls, training jetties, water gates, locks, revetments, banks, groins and parapet walls, and shore facilities such as facilities on water area, mooring facilities and cargo handling facilities.

2.13. Return period

Means the average time interval (years) from the time when an action of a certain magnitude or larger occurs until that action next occurs again.

2.14. Safety

Means the performance capable of securing the safety of human life; in the event of a certain degree of damage corresponding to the expected actions, the degree of damage shall not be fatal for the facilities, and shall be limited to a range which does not have a serious impact on securing the safety of human life.

2.15. Storage facilities

Means the facilities provided for the use in the storage of cargoes being handled in ports, including warehouses, open storage yards, timber ponds, coal storage yards, yards for hazardous cargo and oil storage facilities.

2.16. Ultimate limit state

Means the state in which failure occurs in a structure due to the maximum load.

2.17. Variable waves

Means the waves with a high possibility of attacking during the design working life of the facilities concerned, among waves expected as attacking at the location where the facilities are to be installed.

3. Abbreviations and Symbols

3.1. Abbreviations

CBR	California Bearing Ratio
CD	Consolidated Drained
CDL	Chart Datum Level
CU	Consolidated Undrained
DOL	Deviation of Out Liar
DT	Displacement Tonnage
DWT	Dead Weight Tonnage
FCL	Full Container Load
FLIP	Finite Element Analysis Program for Liquefaction Process
FRP	Fiber Reinforced Plastic
GPS	Global Positioning System
HWOST	High Water of Ordinary Spring Tide
HWL	Mean Monthly-highest Water Level
LCL	Less than Container Load
LWL	Mean monthly lowest Water Level
LWOST	Low Water of Ordinary Spring Tide
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IPCC	International Panel on Climate Change
ISO	International Organization for Standardization
MSL	Mean Sea Level
PC	Prestressed Concrete
PHC	Prestressed Hightension Concrete

PIANC	World Association for Waterborne Transport Infrastructure
RC	Reinforced Concrete
REC	Residue of Correlation Coefficient
RI	Radio Isotope
RWI	Residual Water Level
SALM	Single Anchor Leg Moring
SCP	Sand Compaction Pile
SI	International System of Unit
SRC	Steel Framed Reinforced Concrete
UU	Unconsolidated Undrained
VLCC	Very Large Crude Carrier
WTO	World Trade Organization

3.2. Symbols

B	bề rộng luồng (m)
D	đường kính phao (m)
H	chiều cao bến, chiều cao lớn nhất của công trình (m)
H_{ct}	chiều sâu chạy tàu (m)
H_{mn}	độ sâu lớn nhất của khu nước tại vị trí thả phao (m)
K_n	hệ số đảm bảo
L_{dx}	chiều dài dây xích (m)
R	tầm hiệu lực hiệu dụng (hải lý)

4. References

4.1. TCVN xxx-x: 2015 Marine port facilities – Design Standard is included following parts: Marine Port Facilities: Design Standards – Part 1: General Principles

Marine Port Facilities: Design Standards – Part 2 : Loads and actions

Marine Port Facilities: Design Standards – Part 3 : Technical requirements for materials

Marine Port Facilities: Design Standards – Part 4-1 : Foundations

Marine Port Facilities: Design Standards – Part 4-2 : Soil improvement Methods

Marine Port Facilities: Design Standards – Part 5 : Wharfs

Marine Port Facilities: Design Standards – Part 6 : Breakwaters

Marine Port Facilities: Design Standards – Part 7 : Chanels and Habours Basin

Marine Port Facilities: Design Standards – Part 8 : Dry Dock, Lock, Slipway and Shipbuilding berths

Marine Port Facilities: Design Standards – Part 9 : Dredging and Land Reclamations

Marine Port Facilities: Design Standards – Part 10 : Other Port Facilities

4.2. References

4.2.1. National Technical Regulation on Rules of Classifications and Grading of Civil and Industrial Buildings and Urban Infrastructures: QCVN 03:2012/BXD

4.2.2. Circulas No. 10/2013/TT-BXD dated 25/07/2013 : Detailed regulations on Building Works Quality Management.

4.2.3. Decree No.109/2014/ND-CP dated 20/11/2014 : Regulation for Protection of Marine port facilities and navigation chanels.

4.2.4. OCDI 2002:Technical Standards and Commentaries for Port and Habour Facilities in Japan;

4.2.5. OCDI 2009:Technical Standards and Commentaries for Port and Habour Facilities in Japan;

4.2.6. BS 6349 -1-1:2013 Maritime Work – Part 1-1 : General – Code of practice for planning and design for operations.

5. Classifications and grading of marine port facilities

5.1. Classification of Marine port facilities

Marine port facilities dealed with this standard part including: marine port facilities, jetties, poontoon berths,breakwaters, sand control works, sediment control works, shore protection revetments navigation chanels; dry dock, lock, slipway and shipbuilding berths. And some others types of marine port facilities also (if fiting to technical conditions of the standard).

5.2. Classifications and grading of marine port facilities

5.2.1. Grad of a facility or grad of a part of facility in a construction or improvement project is determined by the owner following present regulations and should be allowed by investment deciding person.

5.2.2. Grading of marine port facilities and navigation chanels following Annex A of [4.2.2].

Table 5.1 Maritime grading based on its size, capacity and importance [4.2.2]

Indeks		Work class	Grading criteria	Work grads				
				Special	I	II	III	IV
IV.6	Maritime	IV.6.1 Marine	Ship	>	70.000 ÷	30.000	5.000÷ <	<

Indeks		Work class	Grading criteria	Work grads				
				Special	I	II	III	IV
	works	port facilities	deadweight (DWT) or berth hight H (m)	100.000 or H > 25	< 100.000 or 20 < H ≤ 25	÷ < 70.000 or 15 < H ≤ 20	30.000 or 10 < H ≤ 15	5.000 or H ≤ 10
		IV.6.2 Marine Shipbuilding and Repairing Shipyards, marine docks, marine locks and other ship lifts (slipways, lift-platform…)	Ship deadweight (DWT)	> 100.000	70.000 ÷ < 100.000	30.000 ÷ < 70.000	5.000÷ < 30.000	< 5.000
		IV.6.3 Navigation Channels (one way):						
		a) Channels at estuary, open bay and sea	Channel breadth B (m) and nautical depth H_{ct} (m)	B > 210 and H_{ct} ≥ 20	190 < B ≤ 210 and 16 ≤ H_{ct} < 20	140 < B ≤190 and 14 ≤ H_{ct} < 16	80 < B ≤ 140 and 8 ≤ H_{ct} < 14	B ≤ 80 and H_{ct} ≤ 8
		b) Inland waterway channels, channels in close bays and in swamp, canals for marine navigation.		B > 230 and H_{ct} ≥ 17	210 < B ≤ 230 and 14 < H_{ct} ≤ 17	150 < B ≤ 210 and 12 < H_{ct} ≤ 14	90 < B ≤ 150 and 7 < H_{ct} ≤ 12	B ≤ 90 and H_{ct} ≤ 7
		IV.6.4 Sediment control works (Breakwaters, sand control groins, groins and shore protection revetments…):						

Indeks	Work class	Grading criteria	Work grads				
			Special	I	II	III	IV
	a) Sediment control works at estuary and along shore.	Maximum hight of work H (m)	H > 20	16 < H ≤ 20	12 < H ≤ 16	8 < H ≤ 12	H ≤ 8
	b) Sediment control works in rivers.		H > 15	12 < H ≤ 15	9 < H ≤ 12	6 < H ≤ 9	H ≤ 6
	IV.6.5 Other maritime works:						
	a) Ferry Berths, island ports, specialized berths, onsea works (pontoon berths, airpressure breakwater, multi function pontoon berths,…)	Maximum hight of work or water depth H (m)	H > 20	16 < H ≤ 20	12 < H ≤ 16	8 < H ≤ 12	H ≤ 8
	b) Navigation aid buoys system on rivers and on sea (H_{mn} (m) – Water Highest depth at buoy place)	Buoy diameter D (m) or chain length L_{dx} (m)	D > 5 or $L_{dx} \geq 3H_{mn}$	3,5 < D ≤ 5 or $2,5H_{mn} \leq L_{dx} < 3H_{mn}$	2,5 < D ≤ 3,5 or $2H_{mn} \leq L_{dx} < 2,5_{Hmn}$	2 < D ≤ 2,5 or $1,5H_{mn} \leq L_{dx} < 2H_{mn}$	D ≤ 2 or $L_{dx} \leq 1,5H_{mn}$
	c) Lighthouses	Effected distance R (miles)	R ≥ 10	8 ≤ R < 10	6 ≤ R < 8	4 ≤ R < 6	R < 4

Indeks	Work class	Grading criteria	Work grads				
			Special	I	II	III	IV
	d) Navigation light buoys	Effected distance R (miles)	R ≥ 6	4 ≤ R < 6	2,5 ≤ R < 4	1 ≤ R < 2,5	R < 1
Note : Temporary works is belong to grad 3.							

5.2.3. Consider grading criteria on durability and fire resistance levels of facilities should be also (see Annex A).

6. Design working life of marine port facilities

6.1. Design working life of marine port facilities and of their parts is decided by owner, based on grads, durability and fire resistance levels of the facility and of its parts.

6.2. For determining of Design working life of marine port facilities and of their parts may refer to experiences of foreign stadards on this matter (see Annex B).

6.3. If Higher Design working life of marine port facilities is choosen should be noted that : anticipated loads on the facility will increase, should be chose the materials having higher design work life corresponding to design work life of the facility, should be establish a suistable maintenance program to design work life requirements.

7. General principles

7.1. General

In the design standards the limit states design method is used.

7.2. Guaranteed coefficient based on the importance of structures

For considering to a importance of the structures, in design calculation should be use the guaranteed coefficients K_n following :

K_n = 1,25 for the structures of special and first grade;

K_n = 1,20 for the structures of second grade;

K_n = 1,15 for the structures of third grade;

K_n = 1,10 for the structures of fourth grade.

7.3. Probability Distribution of calculation water levels

Calculated frequency guaranteed of water level, in determining of actions and loads on the marine port structures, should be choose not greater than following:

- 1% (one time during 100 years) – for structures of first grade;

- 5% (one time during 20 years) – for structures of second and thrird;
- 10% (one time during 10 years) – for structures of fourth grade;

based on anually highest water level.

7.4. Design of the facilities should be make easy for construction, convenience for operation and having proper maintenance program to most economically maintain design life of the facilities.

Annex A

Grading of marine port facilities based on durability and fire resistance level

(Ref 4.2.2])

Table A.1 Work grads agreed to durability and fire resistance levels of houses and works

Work grad	Work construction quality	
	Durability	Fire resistance level
Special	Grad I: Working life over 100 years	Level I
I		
II	Grad II: Working life from 50 years up to 100 years	Level II
III	Grad III: Working life from 20 years up to 50 years	Level III, level IV
IV	Grad IV: Working life up to 20 năm	Level IV
NOTE: For works having special grads (the grad is higher grade 1), beside requirements noted in the table, should be included special requirements (loads and actions, fire and blasting safety…) determined specially for its design and construction.		

Annex B

Design work life of marine port facilities determined by OCDI and BS 6349.

(informative)

B.1. OCDI 2009

The standard design work life of port facilities is the one based on the values for Class 3 in the table following from ISO 2394 “General principles on realibility for structures”,1998:

Table B.1 Concept of Classification of Design Working Life Defined in ISO 2394 (1998)

Class	Expected design working life (year)	Exemple
1	1 – 5	Temporary structures
2	25	Replaceable structural elements such as bridge abutment beam and bearings
3	50	Building and other public structures, structures other than the below.
4	≥100	Memorial buildings, special or important structures, large-scale bridges.

B.2. BS 6349-1: 2000

Determined as following (not depend on facility grads) : berth walls : 60 years ; open jetty : 45 years ; superstructures : 30 years ; dry dock : 45 years ; shore protection works and breakwaters : 60 years ; flooding control works : 100 years.

B.3. BS 6349-1-1: 2013

Table B.2 Indicative design working life categories for maritime works

Design working life categories	Indicative design working life (years)	Examples
1	10	Temporary structures*
2	10 to 25	Structural parts designed to be replaceable within a structure or facility of longer design working life
3	15 to 30	Structures dedicated to non-renewable natural resources, petrochemicals or similar industrial or commercial applications (such as open-piled jetties, mooring and berthing dolphins, Ro-Ro linkspans)l
4	50	Common port infrastructure for commercial and

		industrial ports including reclamation, shore protection, breakwaters, quay walls.
5	100	Common port infrastructure including breakwaters for ports of national-significant trategic or economic value. Infrastructure for regional flood defence or coastal management infrastructure.
* Structures or parts of structures that can be dismantled with a view to being re-used should not be considered as temporary.		