CRMC

COASTAL RESOURCES MANAGEMENT COUNCIL

Guidelines for Fitness of Purpose Investigations and Certifications

1.0 FITNESS OF PURPOSE INSPECTIONS

The provisions of these standards apply to all new and existing Commercial Marine Facility (CMF) in Rhode Island. Any CMF or berthing system that commences operation after adoption of these standards shall be considered "new". The addition of new structural components or systems on existing CMFs that are structurally independent of the existing components or systems, shall conform to the "new" requirements. The terms "new" and "existing", and corresponding requirements are defined in each individual Section.

The structure, system or facility for which a Fitness of Purpose certification is required is limited to commercial structures in Type 6 waters, bridges, commercial moorings, ship building or repair facilities, public ferry facilities or other commercial type structures within CRMC jurisdiction that in the opinion of the Council warrant such certification for protection of Public Trust resources.

1.1 Baseline Inspection

If "as-built" or subsequent modification drawings showing structural and mechanical systems information are not available, incomplete, or inaccurate, the Baseline Inspection shall gather data in sufficient detail to adequately evaluate the CMF. The level of detail required shall be such that structural member sizes, connection and reinforcing details are documented in the structural analysis. This may require the use of non-destructive testing, partially destructive testing and/or laboratory testing methods. All mechanical systems shall be documented as to location, capacity, operating limits, and physical conditions.

1.2 Modifications and Replacements

Where modifications and/or replacement of structural components, mechanical equipment or relevant operational changes are made, the records shall be updated.

1.3 Periodic Inspection

The objective of the Periodic Inspection is to review structural, electrical and mechanical systems on a prescribed periodic basis to verify that each berthing system is fit for its specific defined purpose. The inspection includes both above water and underwater inspections, as well as engineering analyses, as necessary, to confirm the fitness of the CMF for the defined purpose. The initial inspection (Base Line) shall stipulate the period of subsequent inspections based on findings and professional judgment, in no case shall the cycle be greater than 5 years.

2.0 SCOPE OF INSPECTIONS

2.1 Above Water Structural Inspection

The above water inspection shall include all accessible components above +2 ft MLLW. Accessible components shall be defined as those components above and below deck that are accessible without the need for excavation or extensive removal of materials that may impair visual inspection. The above water inspection shall include but not limited to the following:

- Piles
- Pile caps
- Beams
- Deck soffit
- Bracing
- Retaining walls and Bulkheads
- Connections
- Seawalls
- Slope protection
- Deck topsides and curbing
- Expansion joints
- Fender system components
- Dolphins and deadmen
- Mooring points and hardware
- Navigation aids
- Platforms, ladders, stairs, handrails and gangways
- Backfill (sinkholes/differential settlement)

2.2 Underwater Structural Inspection

The underwater inspection shall include all accessible components from +3 ft MLLW to the mudline, including the slope and slope protection, in areas immediately surrounding the CMF. The water depth at the berth(s) shall be evaluated, verifying the maximum or loaded draft of vessels that call on the CMF. The underwater structural inspection shall include the Level I, II, and III inspection efforts as determined by the previous inspection. Initial inspections (Base Line) shall be Level II / III.. The underwater inspection levels of effort are described below:

(1) Level I Effort – Includes a close visual examination, or a tactile examination using large sweeping motions of the hands where visibility is limited. Although the Level I effort is often referred to as a “Swim-By” inspection, it must be detailed enough to detect obvious major damage or deterioration due to overstress or other severe deterioration. It should confirm the continuity of the full length of all members and detect undermining or exposure of normally buried elements. A Level I effort may also include limited probing of the substructure and adjacent channel bottom.

(2) Level II Effort – A detailed inspection which requires marine growth removal from a representative sampling of components within the structure. For piles, a 12-inch high band should be cleaned at designated locations, generally near the low waterline, at the mudline, and midway between the low waterline and the mudline. On large diameter piles, 3 ft or greater, marine growth removal should be effected on 1 ft by 1ft areas at four locations approximately equally spaced around the perimeter, at each elevation. On large solid faced elements such as retaining structures, marine growth removal should be effected on 1 ft by 1 ft areas at the three specified elevations. The inspection should also focus on typical areas of weakness, such as attachment points and welds. The Level II effort is intended to detect and identify damaged and deteriorated areas that may be hidden by surface biofouling. The thoroughness of marine growth removal should be governed by what is necessary to discern the condition of the underlying structural material. Removal of all biofouling staining is generally not required.

(3) Level III Effort – A detailed inspection typically involving non-destructive or partially-destructive testing, conducted to detect hidden or interior damage, or to evaluate material homogeneity. Typical inspection and testing techniques include the use of ultrasonics, coring or boring, physical material sampling and in-situ hardness testing. Level III testing is generally limited to key structural areas, areas which are suspect, or areas which may be representative of the underwater structure.

2.3 Mechanical Equipment

The inspection of electrical and mechanical equipment shall include but not be limited to the following components and systems:

- Loading arms
- Cranes and lifting equipment, including cables
- Piping/manifolds and supports
- Oil transfer hoses
- Fire detection and suppression systems
- Sumps/sump tanks
- Vent systems
- Pumps and pump systems
- Lighting
- Communications equipment
- Gangways
- Cathodic protection systems
- Winches
- Ladders

All alarms, limit switches, load cells, current meters, anemometers, leak detection equipment, etc., shall be operated/tested and calibrated, to the extent feasible, to ensure proper function.

Table 2-1 **Underwater Inspection Levels of Effort**					
Level	**Purpose**	**Steel**	**Concrete**	**Timber**	**Composite**
I	General visual / tactile inspection to confirm as-built condition and detect severe damage	Extensive corrosion, holes, severe mechanical damage	Major spalling and cracking, Severe reinforcement corrosion, broken piles	Major loss of section, Broken piles or bracing, Severe abrasion or marine borer attack	Permanent deformation, broken piles, major cracking or mechanical damage
II	To detect surface defects normally obscured by marine growth	Moderate mechanical damage, corrosion pitting and loss of section	Surface cracking and spalling, rust staining, exposed reinforcing steel and/or prestressing strands	External pile damage due to marine borers, splintered piles, loss of bolts and fasteners, rot or insect infestation	Cracking, delamination, material degradation
III	To detect hidden or interior damage, evaluate loss of cross-sectional area or evaluate material homogeneity	Thickness of material, electrical potentials for cathodic protection	Location of reinforcing steel, beginning of corrosion of reinforcing steel, change in material strength	Internal damage due to marine borers, decrease in material strength	N/A

Table 2-2 **Scope of Underwater Inspections**									
		Steel		**Concrete**		**Timber**		**Composite**	**Slope Protection Channel Bottom or Mud line Scour**
Level		**Piles**	**Bulkheads / Walls**	**Piles**	**Bulkheads / Walls**	**Piles**	**Bulkheads / Walls**	**Piles**	
I	Sample Size	100%	100%	100%	100%	100%	100%	100%	100%
	Method	Visual/Tactile	Visual/Tactile	Visual/Tactile	Visual/Tactile	Visual/Tactile	Visual/Tactile	Visual/Tactile	Visual/Tactile
II	Sample Size	100%	Every 100 LF	10%	Every 100 LF	10%	Every 50 LF	10%	0%
	Method	Visual: Removal of Marine growth in 3 bands	Visual: Removal of marine growth in 1 SF areas	Visual: Removal of Marine growth in 3 bands	Visual: Removal of marine growth in 1 SF areas	Visual: Removal of Marine growth in 3 bands – measure remaining Diameter	Visual: Removal of marine growth in 1 SF areas	Visual: Removal of Marine growth in 3 bands	
III	Sample Size	5%	Every 200 LF	0%	0%	5%	Every 100 LF	0%	0%
	Method	Remaining Thickness measurement: electrical potential measurement	Remaining Thickness measurement: electrical potential measurement	N/A	N/A	Internal Marine Borer infestation evaluation	Internal Marine Borer infestation evaluation		

3. Inspection Team

3.1 Project Manager

All inspections shall be conducted by a multi-disciplinary team under the direction of a Project Manager representing the CMF. The Project Manager shall have specific knowledge of the CMF and may serve other roles on the Inspection Team.

3.2 Inspection Team Leader

The Team Leader shall lead the on-site team and shall be responsible for directing field activities, including the inspection of all structural and mechanical systems. The Team Leader shall be a Rhode Island registered civil or structural engineer and may serve other roles on the inspection team.

3.3 Structural Inspection Team

The structural inspection shall be conducted under the direction of a registered civil or structural engineer. For underwater inspections, the registered civil or structural engineer directing the underwater structural inspection shall also be a commercially trained diver or equivalent and shall actively participate in the inspection, by personally conducting a minimum of 25 percent of the underwater examination. All members of the structural inspection team shall be graduates of a 4-year civil/structural engineering, or closely related (ocean/coastal) engineering curriculum, and shall have been certified as an Engineer-in-Training; or shall be technicians who have completed a course of study in structural inspections. The minimum acceptable course in structural inspections shall include 80 hours of instruction specifically related to structural inspection, followed by successful completion of a comprehensive examination. An example of an acceptable course is the U.S. Department of Transportation's "Safety Inspection of In-Service Bridges". Certification as a Level IV Bridge Inspector by the National Institute of Certification in Engineering Technologies (NICET) shall also be acceptable. For underwater inspections, each underwater team member shall also be a commercially trained diver, or equivalent. Divers performing manual tasks, such as cleaning or supporting the diving operation, but not conducting or reporting on inspections may have lesser technical qualifications.

3.4 Mechanical Inspection Team

A registered engineer shall direct the on-site team performing the inspection of pipeline, mechanical and fire systems.

3.5 CRMC Representation

A CRMC representative(s) may participate in any inspection as observer(s) and may provide guidance. A 48 hour notice prior to any inspections is required.

4.0 Evaluation and Assessment

4.1 Facility Operating Limits

The physical boundaries of the facility shall be defined by the berthing system operating limits, along with the vessel size limits and environmental conditions. The inspection shall include a "**Statement of Facility Operating Limits**", which must provide a concise statement of the purpose of each berthing system in terms of operating limits. This description must at least include, the minimum and maximum vessel sizes, including LOA, beam, and maximum draft with associated displacement. In establishing limits for both the minimum and maximum vessel sizes, due consideration shall be given to water depths, dolphin spacing, fender system limitations, loading arm reach, with allowances for tidal fluctuations, surge, and drift. Maximum wind, current, or wave conditions, or combinations thereof, shall be clearly defined as limiting conditions for vessels at each berth, both with and without active cargo transfer.

4.2 Mooring and Berthing

Mooring and berthing analyses shall be performed. The analyses shall be consistent with the facility operating limits and the structural configuration of the wharf and/or dolphins and associated hardware. The results and supporting documentation shall be provided.

In general, vessels shall remain in contact with the breasting or fendering system. Vessel motion (sway) of up to 2 feet off the breasting structure may be allowed under the most severe environmental loads, unless greater movement can be justified by an appropriate mooring analysis that accounts for potential dynamic effects. The allowable movement shall be consistent with mooring analysis results, indicating that forces in the mooring lines and their supports are within the allowable safety factors. Also, a check shall be made as to whether the movement is within the limitations of the cargo transfer equipment.

The most severe combination of the environmental loads has to be identified for each mooring component. At a minimum, the following conditions shall be considered:

- Two current directions (maximum ebb and flood
- Two tide levels (highest high and lowest low)
- Two vessel loading conditions (ballast and maximum draft with sufficient underkeel clearance)
- Eight wind directions (45 degree increments)
- Two procedures, manual and numerical are available for performing mooring analyses. These procedures shall conform to either the OCIMF documents, “Mooring Equipment Guidelines” and “Prediction of Wind and Current Loads on VLCCs” or the Department of Defense “Mooring Design” document.

4.3 Structural Loading Criteria

Section 3 establishes the environmental and operating loads to be analyzed that act on the Commercial Marina Facility (CMF) structures and on moored vessel(s) as part of the Fitness for Purpose certification.

4.3a Dead Loads

The dead loads shall include the weight of entire structure, including permanent attachments such as loading arms, pipe lines, deck crane, fire monitor tower, gangway structure, control equipment and mooring hardware.

4.3b Unit Weights

The unit weights in Table 4-1 may be used for both existing and new CMFs:

Table 4-1
Unit Weights

Steel or cast steel	**490 pcf**
Cast iron	**450 pcf**
Aluminum alloys	**175 pcf**
Timber (untreated)	**40 - 50 pcf**
Timber (treated)	**45 – 60 pcf**
Concrete, reinforced (normal weight)	**145 – 155 pcf**
Concrete, reinforced (lightweight)	**90-120 pcf**
Asphalt paving	**150 pcf**
Granite Block	**165 pcf**

4.3c Vertical Live Loads

The following vertical live loading shall be considered, where appropriate:

- Uniform loading
- Truck loading
- Crane loading
- Buoyancy

In addition, CMF specific, non-permanent equipment shall be identified and used in loading computations.

Table 4-2

Location	Area Loads (psf)
Open Area’s	20*
Area’s Containing Equipment	35**
Roadway	20*

* Allowance for incidental items such as railings, lighting, miscellaneous equipment, etc.
** 35 psf is for miscellaneous general items such as walkways, pipe supports, lighting, and instrumentation. Major equipment weight shall be established and added into this weight for piping manifold, valves, deck crane, gangway structures, and similar major equipment.

4.3d Earthquake Loads

CMFs shall be capable of resisting earthquake motion; considering the seismic response of soils at the site and the dynamic response characteristics of the structure. The required level of sophistication in developing the earthquake input motion is dependent on the classification of the CMF and local soil conditions. All CMF facilities in Rhode Island are considered Seismic Hazard Group III from the RI Building Code (latest Edition).

4.3e Mooring Loads

Forces acting on a moored vessel may include: wind, current, waves, hydrodynamic forces induced by passing vessels, tidal variations, seiche and hurricanes. Forces from wind and current acting directly on the structure (not through the vessel in the form of mooring and/or breasting loads) shall be determined.

4.3f Wind Loads

Loads induced on vessels by wind, while moored at an on-shore CMF shall be calculated for each of the appropriate load cases identified during the inspection or analysis of the CMF.

The design wind speed is the maximum wind speed of 30 second duration used in the mooring analysis.

4.3g Operating Condition

An operating condition is the safe wind envelope derived from the mooring analysis. This is the design wind speed below which a vessel may conduct operations. When this maximum operating wind condition is exceeded, at an existing CMF, a vessel is required to cease operations. In the event that various vessels call on a facility, the operating condition for each vessel (or class of vessel) shall be determined.

4.3h Survival Condition

The survival condition at a new CMF is defined as the state wherein a vessel can remain safely moored at the berth during severe winds. The survival condition threshold is the maximum wind velocity, for a 30 second gust and a 25 year return period, obtained from historical data.

For an existing CMF, a reduced survival condition is acceptable, above which the vessel must leave the berth, within 30 minutes or less. The 30-second duration wind speed shall be determined from the annual maximum wind data. Average annual summaries cannot be used. Maximum wind speed data for eight directions (45-degree increments) shall be obtained. If other duration wind data is available, it shall be adjusted to a 30-second duration. The 25-year return period shall be used to establish the design wind speed for each direction. Once these wind speeds are established, the highest wind speed shall be used to determine the mooring risk classification.

4.3i Design Current Velocity

Maximum ebb and flood currents, annual river runoffs and controlled releases shall be considered when establishing the design current velocities for both existing and new CMFs. Local current velocities may be obtained from NOAA or other sources, but must be supplemented by site-specific data. If this information is not available, a safety factor of 1.25 shall be applied to the best obtainable data. If the facility is not in operation during annual river runoffs and controlled releases, the current loads may be adjusted. Operational dates need to be clearly stated in the definition of the terminal operating limits.

4.3j Wave Loads

The transverse wave induced vessel reactions shall be calculated using a simplified dynamic mooring analysis described below.

The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The water particle accelerations shall then be used to calculate the wave excitation forces to determine the static displacement of the vessel. The Froude-Krylov method may be used to calculate the wave excitation forces, by conservatively approximating the vessel as a rectangular box with dimensions similar to the actual dimensions of the vessel. The computed excitation force assumes a 90 deg incidence angle with the longitudinal axis of the vessel, which will result in forces that are significantly greater than the forces that will actually act upon the vessel from quartering seas. A load reduction factor may be used to account for the design wave incidence angle from the longitudinal axis of the ship. The overall excursion of the vessel shall be determined for each of the wave conditions by calculating the dynamic response of the linear spring mass system. The corresponding fender reactions shall be calculated from the fender unit load-excursion curves.

4.3k Passing Vessels

The sway and surge forces, as well as yaw moment, on a moored vessel, due to passing vessels, shall be established considering the following:

- Ratio of length of moored vessel to length of passing vessel
- Distance from moored vessel to passing vessel
- Ratio of mid-ship section areas of the moored and passing vessels
- Under keel clearances of the moored and passing vessels
- Draft and trim of the moored vessel and draft of the passing vessel
- Mooring line tensions

When current is present, the passing vessel speed must consider the ebb and flood current. Thus, moving against the current will increase the force. Normal operating wind and current conditions can be assumed when calculating forces due to a passing vessel. Three methods to determine forces on a moored vessel, subjected to passing vessel loads are as follows:

- A simplified theoretical analysis by Wang may be used to evaluate the surge and sway forces and yaw moment. Wang developed graphs of non-dimensional surge and sway forces and yaw moment as a function of the separation between the moored and passing vessels and the effect of water depth.

- A second method, developed by Flory can be used to calculate the surge and sway forces and yaw moment.

- A third simplified approach has been formulated by Seelig.

4.3l Berthing Loads

Berthing loads are quantified in terms of transfer of kinetic energy of the vessel into potential energy dissipated by the fender(s). The terms and equations to be used in the analysis shall be based on those in Mil-HDBK-1025/1.

The berthing velocity, V_n, is influenced by a large number of factors such as, environmental conditions of the site (wind, current, and wave), method of berthing (with or without tug boat assistance), condition of the vessel during berthing (ballast or fully laden), and human factors (experience of the tug boat captain.). The berthing velocity, normal to berth, shall be in accordance with Table 4-3.

For existing CMFs, if it can be demonstrated that lower velocities can be obtained and verified by velocity monitoring equipment, then such a velocity may be used, subject to CRMC approval. In order to obtain the normal berthing velocity V_n, approach angles, defined as the angle formed by the fender line and the longitudinal axis of the vessel must be considered. The berthing angles, used to compute the normal velocity, for various vessel sizes are shown in Table 4-4.

Table 4-3 Berthing Velocity V_n Normal to Berth				
Vessel Size (dwt)	Tug Boat Assistance	Site Conditions		
		Very Unfavorable	Moderate	Favorable
< 10,000	No	1.31 ft/sec	0.98 ft/sec	0.53 ft/sec
10,000 – 50,000	Yes	0.78 ft/sec	0.66 ft/sec	0.33 ft/sec
50,000 – 100,000	Yes	0.53 ft/sec	0.39 ft/sec	0.33 ft/sec
> 100,000	Yes	0.39 ft/sec	0.33 ft/sec	0.33 ft/sec

Table 4-4 Berthing Angle	
Vessel Size (DWT)	Angle (degree's)
Barge	15
< 10,000	10
10,000 – 50,000	8
> 50,000	6

4.3m Safety Factors for Mooring Lines

Safety factors for different material types of mooring lines are given in Table 4-5. The safety factors should be applied to the minimum number of lines specified by the mooring analysis, using the highest loads calculated. The Minimum Breaking Load (MBL) of new ropes is obtained from the certificate issued by the manufacturer. If nylon tails are used in combination with steel wire ropes, the safety factor shall be based on the weaker of the two ropes.

Table 4-5 Safety Factors for Ropes	
Rope Type	**Safety Factor on Dry MBL**
Steel Wire Rope	1.82
Nylon	2.2
Other Synthetic	2.0
Polyester Tail	2.3
Nylon Tail	2.5

4.3n Mooring Hardware

For new CMFs, a minimum of three hooks are required for each breasting line location for vessels larger than 50,000 DWT. At least two hooks at each location shall be provided for breasting lines for vessels less than 50,000 DWT. All hooks (new and existing CMFs) shall withstand the minimum breaking load (MBL) of the strongest line with a Safety Factor of 1.2 or greater. Only one mooring line shall be placed on each quick release hook.

4.3o Fittings

Marine hardware consists of mooring fittings and base bolts. Mooring fittings consist of cleats, bitts, bollards and quick release hook assemblies. The certificate issued by the manufacturer normally defines the allowable working capacity of the marine fitting. The allowable working loads are defined for mooring line angles up to 60 degrees from the horizontal. The combination of vertical and horizontal loads must be considered.

4.3o.1 Base Bolts

Base bolts are subjected to both shear and uplift. Forces on bolts shall be determined using the following factors:

- Height of load application on bitts or bollards
- Actual vertical angles of mooring lines for the highest and lowest tide and vessel draft conditions, for all sizes of vessels at each particular berth
- Actual horizontal angles from the mooring line configurations, for all vessel sizes and positions at each

particular berth

- Simultaneous loads from more than one vessel For existing CMFs, the deteriorated condition of the base bolts and supporting members shall be considered in determining the capacity of the fitting.

4.3p Wind and Current Loads on Structures

This section shall determine the loads acting on the structure directly, as opposed to forces acting on the structure from a moored vessel. ASCE 7 shall be used to establish minimum wind loads on the structure.

4.4 Hurricane

A hurricane generated by a distant source (far field event) may allow operators to have an adequate warning for mitigating the risk for departing the CMF and going into deep water. The CMF shall have a plan with specific actions for responding to hurricane events.

4.5 Manual Procedure

For Non-Volitile cargo CMFs, simplified calculations may be used to determine the mooring forces, except if any of the following conditions exist.

- Mooring layout is significantly asymmetrical
- Horizontal mooring line angles on bow and stern exceed 45 degrees
- Horizontal breast and spring mooring line angles exceed 15 and 10 degrees, respectively.
- Vertical mooring line angles exceed 25 degrees
- Mooring lines for lateral loads not grouped at bow and stern

4.6 Stability of Earth Structures

If a slope failure could affect the CMF, a stability analysis of slopes and earth retaining structures shall be performed. The analysis shall use limit equilibrium methods that satisfy all of the force and/or moment equilibrium conditions.

For slope failure, if the factor of safety is 1.2 or greater, the possibility of flow slides can be precluded. However, seismically induced ground movements shall be addressed.

For cases with the computed factor of safety less than 1.2 but greater than 1.0, seismically induced ground movements shall be evaluated.

For cases with the factor of safety is less than 1.0, mitigation measures shall be implemented

5.0 MECHANICAL EQUIPMENT

5.1 Pressure and Control Systems

- Any new or upgrade of more than 25% of the control system must have quick disconnect couplings, and the emergency release systems shall be in conformance with the provisions of the OCIMF.
- All new and existing Out-of-limit, balance and the approach of out-of limit alarms shall be located at or near the loading arm console.

5.2 Electrical Components

All electrical equipment, wiring, cables, controls and electrical auxiliaries located in hazardous areas shall comply with State of Rhode Island Electrical and Building Codes are appropriate. In addition, the following criteria shall be implemented.

- Equipment shall be provided with a safety disconnecting device to isolate the entire electrical system from the electrical mains in accordance with NEC, Article 430.
- Motor controllers and 3-pole motor overload protection shall be located and sized in accordance with NEC, Article 430.
- Control circuits shall be limited to 120 volts and shall comply with NEC, Articles 500 and 501. Alternatively, intrinsically safe wiring and controls may be provided in accordance with NEC Article 504 and ANSI/UL Std No. 913.
- Grounding and bonding shall comply with the requirements in Section 11

and NEC Article 430.

5.3 Winches

In addition to the applicable regulations, standards and codes, the following requirements shall apply:

- Winches and ancillary equipment shall be suitable for a marine environment
- Winches shall be provided with a fail-safe braking system, capable of holding the load under all conditions, including a power failure.
- Winch drums shall comply with ASME B30.7 (N).
- Winches shall be fully reversible.
- Shock, transient, and abnormal loads shall be considered when selecting winch systems.
- Winches shall have limit switches and automatic trip devices to prevent over-travel of the drum in either direction. Limit switches shall be tested, and demonstrated to function correctly under all operating conditions without inducing undue tensions or slack in the winch cables.
- Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums.

5.4 Cranes

In addition to applicable regulations, standards and codes, the following requirements shall apply:

- Cranes shall not be loaded in excess of the manufacturer's rating except during performance tests.
- Drums on load-hoisting equipment shall be equipped with positive holding devices. Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums.
- Braking equipment capable of stopping, lowering, and holding a load of at least the full test load shall be provided.
- When not in use, crane booms shall be lowered to ground level or secured to a rest support against displacement by wind loads or other outside forces.
- Safety systems including devices that affect the safe lifting and handling, such as interlocks, limit switches, load/moment and overload indicators with shutdown capability, emergency stop switches, radius and locking indicators, shall be provided.

5.4 Shore to Vessel Access

Section 5.4 applies to shore-to-vessel means of access for personnel and equipment provided. This includes ancillary structures and equipment, which support, supplement, deploy and maneuver such vessel access systems.

A Shore-to-vessel access systems shall be designed to withstand the forces from dead, live, wind, vibration, impact loads, and the appropriate combination of these loads. The design and analysis shall consider all the critical positions of the system in the stored, maintenance, maneuvering, and deployed positions, where applicable.

- The minimum live load shall be 50 psf and 25 psf for all handrails.
- The walkway shall be not less than 36 inches in width and not less than 20 inches for existing walkways.
- The shore-to-vessel access system shall be positioned so as to not interfere with the safe passage or evacuation of personnel.
- Electrical and instrumentation components shall comply with NFPA 70.
- Guardrails shall be provided on both sides of the access systems with a clearance between the inner most surfaces of the guardrails of not less than 36 inches and shall be maintained the full length of the walkway.
- Guardrails shall be at a height not less than 33 inches above the walkway surface and shall include an intermediate rail located midway between the walkway surface and the

top rail.

- The walkway surface, including self-leveling treads, if so equipped, shall be finished with a safe non-slip footing accommodating all operating gangway inclinations.
- In meeting the requirements of the operating envelope, under no circumstances shall the operating inclination of the walkway exceed 60 degrees or the maximum angle recommended by the manufacturer, whichever is less, either above or below the horizontal

5.5 Sumps, Discharge Containment and Ancillary Equipment

- Sumps for oil drainage shall be equipped with pressure/vacuum vents, automatic draining pumps and shall be tightly covered.
- Sumps which provide drainage for more than one berth should be equipped with liquid seals so that a fire on one berth does not spread via the sump.

5.6 Vapor Control Systems

Vapor control systems shall conform to the appropriate requirements of the following:

- American Petroleum Institute, 1991, API Recommended Practice 1124 (API RP 1124), "Ship, Barge, and Terminal Hydrocarbon Vapor Collection Manifolds," 1st ed., Washington, D.C.
- American Petroleum Institute, 1994, API Standard 2610 (ANSI/API STD 2610-1994), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 1st ed., Washington, D.C.

5.7 Corrosion Protection

A corrosion assessment shall be performed to determine environmental corrosivity. This assessment should include all steel or metallic components, including the structure, pipelines, supports or other ancillary equipment, with drawings and specifications for corrosion prevention/protection. The assessment shall be performed by a licensed professional engineer, using the methods and criteria prescribed by the National Association of Corrosion Engineers (NACE).

6.0 Documentation and Reporting

The inspection report shall be signed and stamped by the Audit Team Leader. Each inspection, whether partial or complete, shall be adequately documented. Partial inspections cover only specific systems or equipment examined. The resulting report shall summarize and reference relevant previous ratings and deficiencies. The contents of the report for each berthing system shall, at a minimum, include the following as appropriate:

Executive Summary – a concise summary of the inspection results and analyses conclusions. It shall include summary information for each berthing system, including an overview of the assigned follow-up actions

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Body of Report

Introduction – a brief description of the purpose and scope of the inspection, as well as a description of the inspection/evaluation methodology used for the inspection.

Existing Conditions – a brief description of the CMF, along with a summary of the observed conditions. Subsections should be used to describe the above water structure, underwater structure and mechanical systems, to the extent each are included in the scope of the inspection. Photos, plan views and sketches shall be utilized as appropriate to describe the structure and the observed conditions. Details of the inspection results such as test data, measurements data, etc. shall be documented in an appendix.

Evaluation and Assessment - a rating shall be assigned to structural systems (above and under water). Mooring and berthing analyses, structural analysis results, and all supporting calculations shall be included in appendices as appropriate to substantiate the ratings. However, the results and recommendations of the engineering analyses shall be included in this section. Mechanical deficiencies should be described and a Remedial Action Plan assigned to each.

Follow-up Actions – Specific follow-up actions shall be documented and remedial schedules included, for each system. Team Leaders shall specify which follow-up actions require a Rhode Island registered engineer to certify that the completion is acceptable.

Appendices – When appropriate, the following appendices shall be included:

- Background data on the terminal – description of the service environment (wind/waves/ currents), extent and type of marine growth, unusual environmental conditions, etc.
- Inspection/Testing Data
- Mooring and Berthing Analyses
- Structural Analyses and Calculations
- Mechanical System Analysis and Calculations
- Photographs and/or sketches shall be included to document typical conditions and referenced deficiencies, and to justify ratings (CARs) and RAPs.
- Condition Assessment Rating (CAR) – summary of the rating for each structural system. The following system shall be utilized for CAR ratings based on the analysis and Professional Engineering Judgment

Condition Assessment Ratings
6 – Good Condition
5 – Satisfactory Condition
4 – Fair Condition
3 – Poor Condition
2- Serious Condition
1- Critical Condition

- Remedial Action Priorities (RAP) – summary of the remedial priorities for mechanical deficiencies

6.1 Action Plan Implementation Report

Within 90 days of completion of the remedial measures (structural CAR less than 5) specified in the follow-up action plan(s), a report shall be submitted to the CRMC and shall include:

- A description of each action taken
- Updated CARs assigned to the structural systems (above and under water)
- Supporting documentation with calculations and/or relevant data

6.2 Post Event Inspection

A Post-Event Inspection is a focused inspection following a significant, potentially damage-causing event such as a hurricane, vessel impact, fire or explosion. The primary purpose is to assess the integrity of structural and mechanical systems. This assessment will determine the operational status and/or any remedial measures required.

6.3 Notification and Action Plan

Notification shall be provided to the CRMC. The notification shall include, as a minimum:

- Brief description of the event
- Brief description of the nature, extent and significance of any damage observed as a result of the event
- Operational status and any required restrictions.
- Statement as to whether a Post-Event Inspection will be carried-out

The CRMC may carry out or cause to be carried out, a Post-Event Inspection. In the interim, the CRMC may modify or limit the operations through Assent suspension. If a Post-Event Inspection is required, an Action Plan shall be submitted to the CRMC within five (5) days after the event. This deadline may be extended in special circumstances. The Action Plan shall include the scope of the inspection (above water, underwater, mechanical systems, physical limits, applicable berthing systems, etc.) and submission date of the final report. The Action Plan is subject to CRMC approval.

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