



New PIANC Guidelines for Marine Oil & Petrochemical Terminal Design

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Need and Purpose

- Over 5,000 marine oil & petrochemical terminals globally
- But no internationally recognized standards
- Properly designed facilities can serve 50+ yrs
- Improper design can have disastrous consequences
- Proactive maintenance pays off





Need and Purpose

"Recommendations for the Design and Assessment of Marine Oil & Petrochemical Terminals"

- Voluntary guidance, not regulatory
- Written by industry, for industry





History and Background

Building on Existing Documents:

- Waterfront design standards of several countries
 - Not specific to marine oil & petrochemical terminals
- Oil Company Standards
 - Not publicly available; not globally recognized
- Industry Standards (OCIMF, ISGOTT, etc.)
 - Touch on aspects but not comprehensive
 - Mostly operational and ship-focused
- California Marine Oil Terminal Engineering & Maintenance Standards (MOTEMS)
 - Applicable to the State of California, USA



History and Background

MOTEMS

- Published in 2005
- Focused on existing as well as new design
- First comprehensive standards, including seismic upgrades
 - Inspection, above and underwater
 - Mooring & berthing
 - Structural/geotechnical/seismic
 - Mechanical/electrical/piping
 - Fire protection





Scope

• Target audience:

- Designers of new terminals
- Engineers charged with inspecting, rehabilitating and upgrading existing terminals
- Owners and operators of terminals
- Lessors and Lessees of third party terminals
- Marine terminal equipment manufacturers





Scope

• Applicability:

- Existing and new marine oil & petrochemical terminals
- Near-shore terminals
- Sea island terminals
- Limited to marine infrastructure and ship/shore interface
 - Excludes tank farms and shoreside pipelines
- Excludes LNG terminals, floating facilities and SPMs/MBMs





The Team

• 24 members representing 12 countries:

- Australia
- Belgium
- Brazil
- France
- Indonesia
- Japan
- Kazakhstan
- Netherlands
- Norway
- Spain
- Turkey
- United Kingdom
- United States





The Team

Representing:

- Energy companies
- Consulting engineers
- Former regulators
- Equipment manufacturers
- Academia

Disciplines:

- Civil/structural
- Coastal/ocean
- Shipping
- Geotechnical
- Electrical/instrumentation
- Mechanical/piping
- Fire protection
- Risk management
- Compliance



Content of the Guidelines

Part I – Design of New and Upgrade of Existing Terminals

- Functional Requirements and Basis of Design
- Risk and Hazard Analysis
- Scope and Layout
- Loads, Load Combinations, Safety Factors and Design Codes
- Mooring and Berthing Loads, Analysis, and Design
- Geotechnical Loads, Hazards and Criteria
- Piping and Pipeline Loads, Analysis and Design
- Mechanical Equipment Loads, Analysis and Design
- Seismic Loads, Analysis and Design
- Structural Analysis and Design
- Electrical Systems and Instrumentation
- Fire Prevention, Detection and Suppression





Content of the Guidelines

Part II – Inspection and Assessment of Existing Terminals

- Records and Baseline Inspections
- Assessment of Existing Facilities
- Inspection and Condition Assessment Rating
- Post-Event Inspections





1. Functional Requirements and Basis of Design

- Defines the objectives of the facility, including operational requirements
- Functional Requirements
 - Throughput parameters
 - Storage capacity
 - Crude or product mix
 - Number of berths
 - Anticipated occupancy
- Basis of Design
 - Design life
 - Vessel characteristics
 - Applicable codes
 - Basic terminal dimensions
 - Proximity issues
 - Loading requirements
 - Equipment requirements
 - loading arms, gangways, emergency generator, fire protection systems, pig launcher, cranes, vapor recovery, etc.





2. Risk and Hazard Analysis

- Structured method of identifying and evaluating project risk issues
- Key risk parameters include:
 - Geographic risks
 - Environmental hazards
 - Port traffic
 - Vessel-specific issues
 - Human factors
 - Product transfer
 - Security





3. Scope and Layout

- Siting and layout considerations
- Navigation and vessel maneuvering
- Overall configuration issues
 - Terminal dimensions
 - Depths
 - Elevations
 - Emergency egress





4. Loads, Load Combinations, Safety Factors and Design Codes

- Load and resistance factors tailored to marine oil & petrochemical terminals
- Load and resistance methodology is unique to specific design codes and jurisdictions
- Guidance will be provided for:
 - Europe
 - American
 - Japanese
 - Russian
 - General guidance for others





- 5. Mooring and Berthing Loads, Analysis and Design
 - Philosophy of design
 - Description of function behind mooring system components
 - Analysis methodology, analysis tools procedures, and boundary conditions
 - Guidance for load determination
 - Wind
 - Waves
 - Current
 - Seiche
 - Tsunamis
 - Snow
 - Ice

• Design guidance for mooring components





6. Geotechnical Loads, Hazards and Criteria

- Guidance for geotechnical and geophysical site investigations
- Guidance for establishing site-specific design criteria
 - Static loading
 - Dynamic loading
 - Dredge material management
 - Settlement
 - Seismic loading





- 7. Piping and Pipeline Loads, Analysis and Design
 - Guidance for determining loads and displacements
 - Operational
 - Thermal
 - Transient
 - Seismic
 - Piping systems included
 - On top of jetty/quay
 - Piping immediately upland of marine terminal
 - Subsea pipelines

Components addressed

- Pigging
- Stripping and sampling
- Corrosion protection
- Vapor control
- Fire suppression
- Sump/drainage





8. Mechanical Equipment Loads, Analysis and Design

- Guidance for determining loads
 - Marine transfer arms
 - Hose handling equipment
 - Unloading equipment
 - Vessel access equipment
 - Fire protection equipment
 - Miscellaneous equipment and systems
- Guidance for selecting equipment
 - Features and options





9. Seismic Loads, Analysis and Design

- Guidance on establishing design philosophy and performance levels
 - US West Coast
 - Japan
 - Turkey
- Guidance on analysis methods
- Guidance on design detailing





10. Structural Analysis and Design

- Guidance for design of various structural systems
 - Pile-supported structures
 - Retaining structures
 - Bulkheads
 - Gravity structures
- Guidance for design using various materials
 - Reinforced concrete
 - Prestressed concrete
 - Steel
 - Timber





11. Electrical Systems and Instrumentation

- Guidance on area classification
- Guidance on system design
 - Power supply and distribution
 - Emergency back-up power
 - Emergency shutdown
 - Lightning protection
 - Grounding
 - Lighting and navigation aids
 - Cathodic protection
 - Instrumentation and control





12. Fire Prevention, Detection and Suppression

- Guidance on standards, types of fires, and typical extinguishing materials
- Fire Prevention
 - Materials, spacing, ignition sources
 - Focus on isolation
- Fire Detection
 - Smoke, gas & flame detection
 - Alarm and signal systems
- Fire Suppression
- Emergency Egress





13. Records and Baseline Inspection

- Guidance for record keeping
 - terminal layout drawings
 - structural record drawings
 - berth operational parameters and limits
 - water depth
 - fender system details
 - mooring points
 - mechanical and electrical systems
 - fire protection systems
- Guidance for Baseline Inspections





14. Assessment of Existing Facilities

- Guidance on "triggers" for assessment
 - Changes, events & circumstances
 - Vessel impact
 - Earthquake
 - Tsunami
 - Flood
 - Cyclone
 - Fire/explosion
 - Change in condition, i.e., larger vessel
 - Additional dead load
 - Significant deterioration
 - Passing vessel-induced excessive loading
 - Upgrade to systems





15. Periodic Inspections

- Guidance on what to inspect
- Guidance on how to assign overall condition assessment ratings
- Guidance on:
 - Inspection frequency
 - Inspection team qualifications
 - Scope of the inspection effort
 - Evaluation and ratings
 - Follow-up activities
 - Documentation
 - Reporting





16. Post-Event Inspections

- Guidance on providing "fitness for purpose" inspections after event
- Accidental or environmental events:
 - Vessel impact
 - Earthquakes
 - Cyclones
 - Fire or explosion
 - Flooding
 - Tsunamis or other high wave events
- Additional guidance:
 - Scope and focus of the inspection effort
 - Rating system
 - Follow-up activities





Schedule

- Started in 2011
- Document currently draft form
- Typical PIANC WG duration is three years
- Four year duration anticipated for this effort
- Completion forecast for 2015-16





QUESTIONS?

New PIANC Guidelines for Marine Oil & Petrochemical Terminals





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