New PIANC Guidelines for Marine Oil & Petrochemical Terminal Design

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Agenda

• Need and Purpose
• History and Background
• Scope
• The Team
• Content of the Guidelines
• Schedule
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

MOTEEMS

- 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.
Content of the Guidelines – Part I
Design of New and Upgrade of Existing Terminals

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
Content of the Guidelines – Part I
Design of New and Upgrade of Existing Terminals

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
Content of the Guidelines – Part II
Inspection and Assessment of Existing 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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