



NEW PIANC GUIDELINES FOR MARINE OIL & PETROCHEMICAL TERMINAL DESIGN

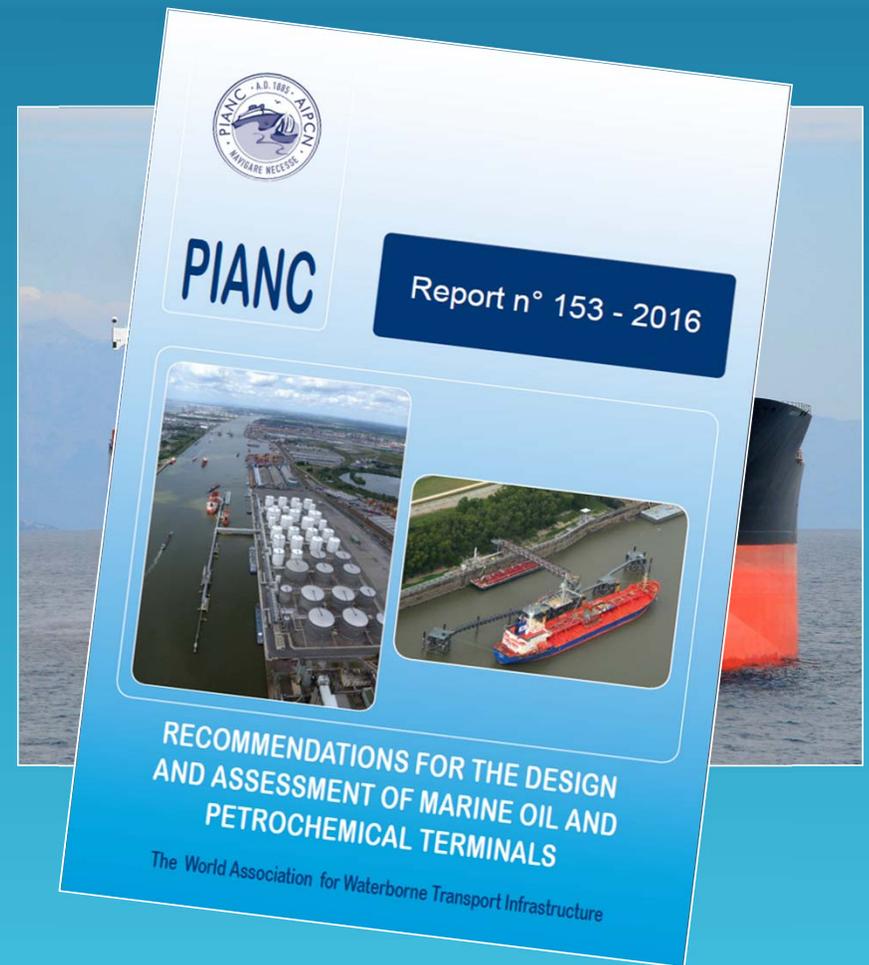
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September 2016

Presentation Outline

- Need and Purpose
- History and Background
- Scope
- The Team
- Content of the Guidelines
- Conclusion



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 operationally focused**
- California Marine Oil Terminal Engineering & Maintenance Standards (MOTEMS)
 - **Applicable to the State of California**



History and Background

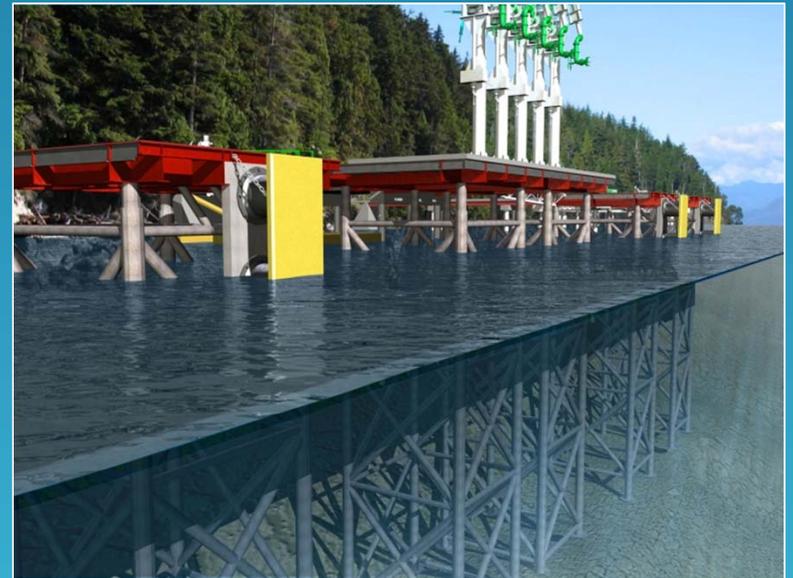
MOTEMS

- 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 of New Guidelines

- **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 of New Guidelines

- **Applicability:**
 - Existing and new marine oil & petrochemical terminals
 - At-shore and Nearshore 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

- 22 members representing 12 countries:
 - Australia
 - Belgium
 - France
 - Indonesia
 - Japan
 - Kazakhstan
 - Netherlands
 - Norway
 - Singapore
 - Spain
 - 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

USA Team Members

Ron Heffron – M&N (Chairman)

**Bill Asante – ExxonMobil
(representing OCIMF)**

**Martin Eskijian – Independent
Consultant/M&N**

Gayle Johnson – SGH

Jerko Kocijan – SGH

Luis Palacios - SGH



Content of the Guidelines

Part I – Design of New and Upgrade of Existing Terminals

- Functional Requirements, Basis of Design and Design Phases
- Risk and Hazard Analysis
- Scope and Layout
- Structural Design Codes, Loads and Load Combinations
- Mooring and Berthing
- Structural Materials and Construction
- Geotechnical Design
- Seismic Design
- Piping and Pipelines
- Mechanical Equipment
- Electrical Systems, Instrumentation & Controls
- Fire Protection and Emergency Evacuation



Content of the Guidelines

Part II – Inspection and Assessment of Existing Terminals

- Records, Baseline Inspection and Assessment
- Reassessment of Existing Facilities
- Periodic Inspections
- Post-Event Inspection



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Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Functional Requirements, Basis of Design and Design Phases**
 - **Concept of Operations**
 - Defines the Objectives of the Facility, Including Operational Requirements
 - **Functional Requirements**
 - Throughput parameters
 - Storage capacity
 - Crude or product mix
 - Number of berths
 - Anticipated occupancy
 - **Site Characteristics**
 - **Basis of Design**
 - Design life
 - Vessel characteristics
 - Applicable codes
 - Basic terminal dimensions
 - Proximity issues
 - Loading requirements
 - Equipment requirements
 - Construction phasing



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

- **Risk and Hazard Analysis**
 - **Data Gathering and Hazard Identification**
 - **Structured Method of Identifying and Evaluating Project Risk Issues**
 - **Quantitative Risk Assessment Method and Risk Contour**
 - **Key Risk Parameters Include:**
 - Geographic risks
 - Environmental hazards
 - Port traffic
 - Vessel-specific issues
 - Human factors
 - Product transfer
 - Security
 - **Exclusion Zones**
 - **Security Risk Mitigation/Intl Ship and Port Facility Code Requirements**



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

- **Scope and Layout**

- **Siting and Layout Considerations**
- **Hazardous Area Classification Layout Considerations**
- **Navigation and Vessel Maneuvering**
- **Overall Configuration Issues**
 - Terminal dimensions
 - Depths
 - Elevations
 - Emergency egress
- **Interface Management Issues**



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Structural Design Codes, Loads and Load Combinations**
 - **Load and Load Combinations Tailored to Marine Oil & Petrochemical Terminals**
 - **Load and Resistance Methodology is Unique to Specific Design Codes and Jurisdictions**
 - **Guidance Provided For:**
 - Europe
 - American
 - General Guidance for Others



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Mooring and Berthing**

- **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**
 - F_{ZA} Equation



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

• Mooring and Berthing

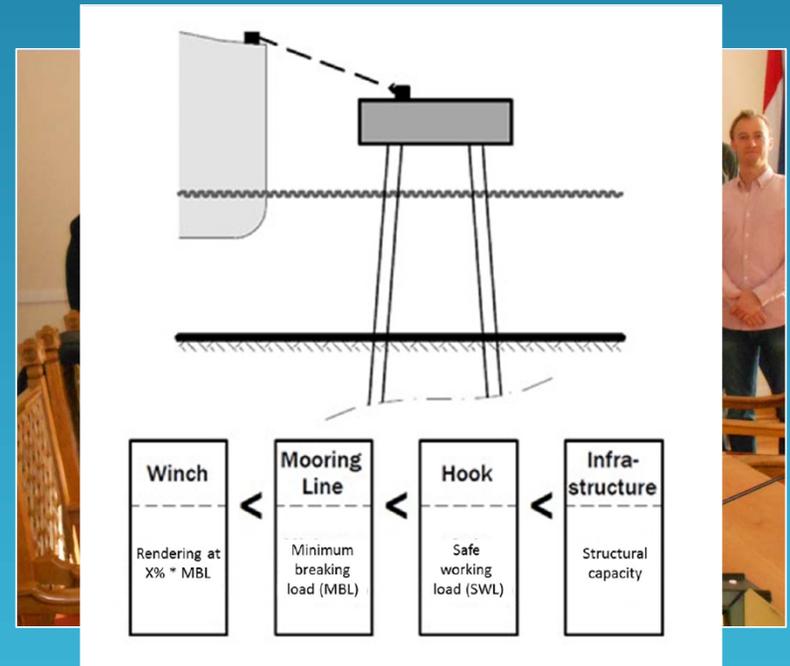
• **Structural Design of Support Structure(s)**

- Fail-safe progressive failure philosophy
- Use vessels with strongest mooring line MBLs to determine WRH SWL
- Use SWL to determine loads on structure
- Exception may be appropriate where MBLs are higher than required for design of the MOPT
- Design must prevent sudden failure or breakout of equipment/hooks
- European Union vs United States approach

• **Zagreb Accord**

$$F_{ZA} = SWL [1.0 + 0.6 \times (n-1)]$$

[Equation 7-1]



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Structural Materials and Construction**
 - **Structural Materials**
 - **Pile-supported Structures**
 - **Concrete Caissons**
 - **Cellular Sheet Pile Structures**



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Geotechnical Loads, Hazards and Criteria**
 - **Geotechnical Risk Registry and Risk Management Plan**
 - **Guidance for Geotechnical and Geophysical Site Investigations**
 - **Guidance for Establishing Site-Specific Design Criteria**
 - Static loading
 - Dynamic loading
 - Dredge material management
 - Settlement
 - Seismic loading



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Seismic Design**

- **Design Philosophy**
- **Difference between MOPT Practice and Conventional Building Codes**
- **Performance Levels**
- **Earthquake Motion Level**
- **Classification of Structures**
- **Acceptable Levels of Damage**
- **Definition of Damage Levels**
- **Seismic Analysis Methods**
- **Topsides Systems**
- **Seismic Detailing**
- **Evolving Issues**
 - Multiple Earthquakes
 - Combination of Mooring and Earthquake Loads
 - Combination of Inertial and Kinematic Loading



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Piping and Pipelines**

- **Guidance for Determining Loads and Displacements**

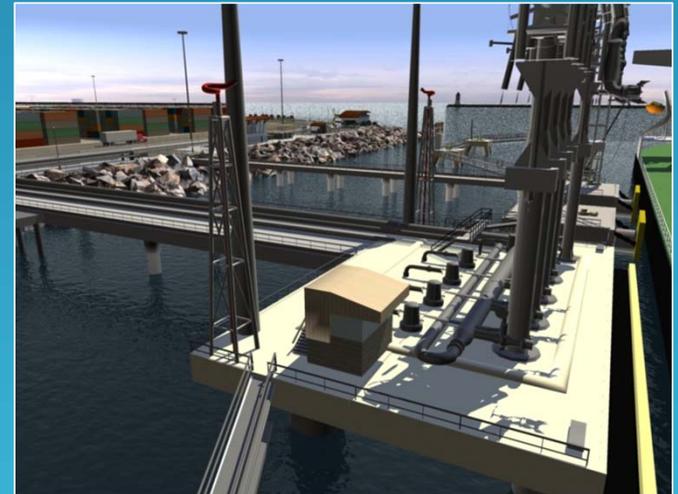
- Operational
 - Thermal
 - Transient
 - Seismic

- **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



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Mechanical Equipment**

- **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



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

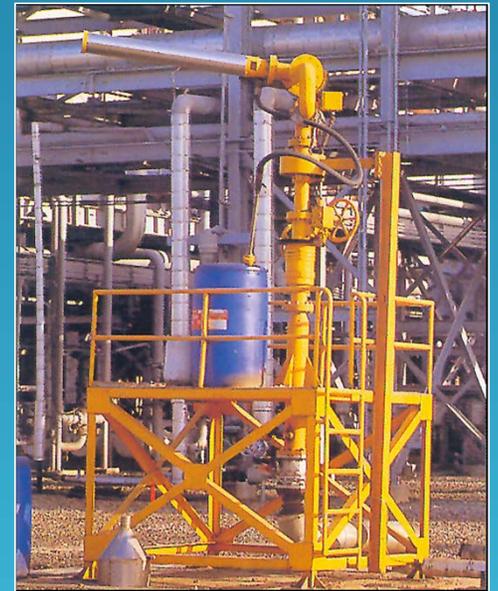
- **Electrical Systems, Instrumentation & Controls**
 - **Electrical Design Philosophy**
 - **Design and Equipment Selection**
 - **Guidance on Hazardous Area Classification**
 - **Guidance on System Design**
 - Power supply and distribution
 - Emergency back-up power
 - Emergency shutdown
 - Lightning protection
 - Grounding
 - Lighting and navigation aids
 - Cathodic protection
 - Instrumentation and control



Content of the Guidelines – Part I

Design of New and Upgrade of Existing Terminals

- **Fire Protection and Emergency Evacuation**
 - **Guidance on Standards, Types of Fires, and Typical Extinguishing Materials**
 - **Fire Prevention and Isolation**
 - Materials, spacing, ignition sources
 - Focus on isolation
 - **Alarm and Signaling Systems**
 - **Fire Detection**
 - Smoke, gas & flame detection
 - Alarm and signal systems
 - **Fire Suppression**
 - **Emergency Egress**



Content of the Guidelines – Part II

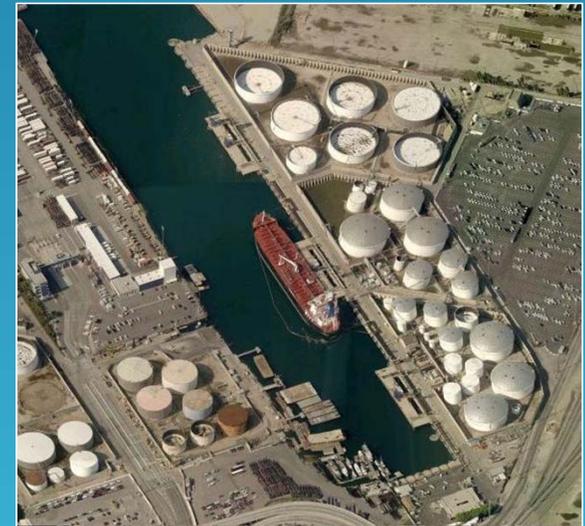
Inspection and Assessment of Existing Systems

- **Records, Baseline Inspection and Assessment**

- **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**



Content of the Guidelines – Part II

Inspection and Assessment of Existing Systems

- **Reassessment of Existing Facilities**
 - **Guidance on “Triggers” for Assessment**
 - **Functional Changes at Terminal**
 - Change in vessel size (sail area, deeper draft)
 - Change in water depth (and resulting allowable vessel draft)
 - Equipment upgrades for code compliance
 - Increase of loads due to dual-purpose use or new equipment
 - External factors such as new large vessels passing terminal
 - **Issues Arising through Vetting or from the Purchase or Lease of a Terminal**
 - **Significant Deterioration**
 - **Extraordinary Events**
 - **Water Level and Channel Bottom Changes**
 - **Regulatory Compliance**



Content of the Guidelines – Part II

Inspection and Assessment of Existing Systems

- **Periodic Inspections**

- **Choosing an Inspection Philosophy**

- Time-based inspection philosophy
 - Risk-based inspection philosophy

- **Limits of Inspection**

- **Structural Boundaries, Components and Systems**

- **Guidance on:**

- Inspection frequency
 - Inspection team qualifications
 - Scope of the inspection effort
 - Evaluation and ratings
 - Follow-up activities
 - Documentation
 - Reporting



Content of the Guidelines – Part II

Inspection and Assessment of Existing Systems

- **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:**

- Qualifications of the inspection team
 - Scope and focus of the inspection effort
 - Rating system
 - Follow-up activities



What's Next?

- **PIANC Working Group 153**
 - **Group Lives On!**
 - **Update to Incorporate LNG Terminals**
 - **Updates to Address Issues and Feedback**





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Report n° 153 - 2016



RECOMMENDATIONS FOR THE DESIGN AND ASSESSMENT OF MARINE OIL AND PETROCHEMICAL TERMINALS

The World Association for Waterborne Transport Infrastructure

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PRESS RELEASE



September 16, 2016

NEW PIANC PUBLICATION AVAILABLE

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The World Association for Waterborne
Transport Infrastructure



Title:

'Recommendations for the Design and Assessment of Marine Oil and Petrochemical Terminals'

Author's:

MarCom Working Group 153

Price:

€ 195.00 (198 pages)

Available at:

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Questions?



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