IMPLEMENTING MOTEEMS ON EXISTING & NEW OIL TERMINALS AT THE PORT OF LOS ANGELES

Prevention First 2008
September 10, 2008
Long Beach, CA

Angel Lim, S.E. & John Posadas, P.E.
Part 1: Existing Marine Oil Terminals

Part II: New Marine Oil Terminal
MOTEMS-Marine Oil Terminal Engineering and Maintenance Standards

a) MOTEMS attempts to “…prevent oil spills and to protect public health, safety, and the environment…”

b) 2001 California Building Code Chapter 31F (MOTEMS)

c) Effective February 6, 2006
• Structural Loading Criteria POLA 70%; Tenant 30%
• Seismic Analysis & Structural Performance POLA 80%; Tenant 20%
• Mooring and Berthing Analysis and Design POLA 80%; Tenant 20%
• Geotechnical Hazards POLA 80%; Tenant 20%
• Structural Analysis & Design of Components POLA 80%; Tenant 20%
• Audit & Inspection POLA 50%; Tenant 50%
• Fire Protection Detection and Suppression Tenant 85%; POLA 15%
• Piping and Pipelines Tenant 85%; POLA 15%
• Mechanical and Electrical Equipment Tenant 85%; POLA 15%
• Electrical Systems Tenant 85%; POLA 15%
What is important about the study?
- Unified set of ground motions and recommendations
- Provide consistency and standardization
- Everyone is on the same page
1 Berths 70-71, Moderate Risk - Earnie → URS
2 Berths 118-120, Moderate Risk - Edwin → DMJM + Harris
3 Berths 148-151, High Risk - John → PBS&J / Moffatt & Nichol
4 Berth 163, Moderate Risk - Hugo → Halcrow Inc. / BCG
5 Berth 164, Moderate Risk - Lily → Halcrow Inc. / BCG
6 Berths 167-169, Moderate Risk - Ron → DMJM + Harris
7 Berths 187-191, Moderate Risk - Chuong → PBS&J / Moffatt & Nichol
8 Berths 238-240C, High Risk - Angel → Halcrow Inc. / BCG
9 Berth 74, Low Risk - Chinh → TBD
10 Berths 408-409, High Risk - John → PBS&J / Moffatt & Nichol

Peer review BCG
BERTHS 118-120

- Built 1959
- 825 ft 2 Berths
- Timber Deck
- Timber Piles
- 13.0 ft Height
- 35.0 ft Water Depth

Moderate Risk
Initial Audit Due 2/6/2009

PART I: EXISTING MARINE OIL TERMINALS
• 11 Storage Tanks
• 498,000 Barrel Cap.
• 12.4 Acres

PART I: EXISTING MARINE OIL TERMINALS
PART I: EXISTING MARINE OIL TERMINALS

BERTHS 148-151

• Built 1955
• 2-1328 ft Berths
• Concrete Deck
• 18” Concrete Piles
• 15.2 ft Height
• 35.0 ft Water Depth

• 26 Storage Tanks
• 825,000 Barrel Cap.
• 13.5 Acres

High Risk
Initial Audit Due 8/6/2008
PART I: EXISTING MARINE OIL TERMINALS

- 26 Storage Tanks
- 825,000 Barrel Cap.
- 13.5 Acres
BERTHS 163 & 164

Berth 163
- Built 1959
- 888 ft Berth
- Timber Deck
- Timber Piles
- 13.0 ft Height
- 40.0 ft Water Depth

Berth 164
- Built 1923
- 888 ft Berth
- Timber Deck
- Timber Piles
- 13.0 ft Height
- 35.0 ft Water Depth

Moderate Risk
Initial Audit Due 2/6/2009

PART I: EXISTING MARINE OIL TERMINALS
PART I: EXISTING MARINE OIL TERMINALS

BERTHS 163 & 164

Berth 163
• 19 Storage Tanks
• 599,000 Barrel Cap.
• 5.8 Acres

Berth 164
• 17 Storage Tanks
• 947,000 Barrel Cap.
• 10.5 Acres
BERTHS 187 - 191

Berths 187-191
• 2,336 ft Total Length
• 15.0 ft Height
• 38.0 ft Water Depth

• B187 Built 1920
• Concrete Deck & Piles

• B188 Built 1921
• Concrete Deck & Piles

• B189-191 Built 1922
• Timber Deck & Piles

Moderate Risk
Initial Audit Due 2/6/2009

PART I: EXISTING MARINE OIL TERMINALS
• 60 Storage Tanks at 700,000 Barrels Cap.
• 22 Storage Tanks 1,700,000 Barrels Cap. (inland)
MOTEMS Plan

- Berthing
- Mooring
- Seismic
- Slope Stability

PART I: EXISTING MARINE OIL TERMINALS
PART I: EXISTING MARINE OIL TERMINALS
# MOTEMS Outline

<table>
<thead>
<tr>
<th>Activity</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Audit &amp; Inspection</td>
<td>6 to 10</td>
</tr>
<tr>
<td>Conceptual Plans</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Plans, Specifications &amp; Estimates (PS&amp;E)</td>
<td>6 to 18</td>
</tr>
<tr>
<td>Bid &amp; Award</td>
<td>5</td>
</tr>
<tr>
<td>Construction NTP</td>
<td>12 to 24</td>
</tr>
<tr>
<td>Future Maintenance Program</td>
<td>On Going</td>
</tr>
</tbody>
</table>

## PART I: EXISTING MARINE OIL TERMINALS
INITIAL AUDIT PROCEDURE

Start

Define Physical Boundaries of Each Berthing System

Determine the Operating Limit of the Berthing System

Determine Risk Classification (Table 31F-4-1)

Are As-Built Record Available?

Conduct Baseline Inspection

Above Water Inspection

Underwater Inspection

Mooring and Berthing Analysis & Evaluation

Structural (Seismic) Analysis & Evaluation

Electrical and Mechanical Inspection

Electrical and Mechanical Evaluation

Assign Condition Ratings & Determine Follow-Up Actions

Prepare Audit Report

Execute Follow-Up Actions As Necessary

End

Stage 1 – Initial Assessment

Stage 2 – Audit

Stage 3 – Action

PART I: EXISTING MARINE OIL TERMINALS
INITIAL AUDIT REPORT

PART I: EXISTING MARINE OIL TERMINALS

- Executive Summary
- Introduction
- Existing Conditions
- Evaluation & Assessment
- Follow Up Actions
- Path Forward
- Appendices: Site Plan, Global Structural CAR, Component Deficiency RAP, Team Organizational Chart Deficiency Tables, CSLC Check Lists, and supporting attachments
- Along with: Mooring, Berthing, Seismic, Geotechnical Reports

- Chapter 3102 F.3.8
- Table 31F-2-5 (ES-1)
- Table 31F-2-6 (ES-2)
- Table 31F-2-7
CONCEPTUAL PLAN

PART I: EXISTING MARINE OIL TERMINALS

• Interim Phase:
  Keep Tenant in Operations
  Accommodate vessel traffic with operating restrictions

• Final Phase:
  Improvements to existing terminal to bring it to MOTEMS compliance

• Items to think about:
  EIR / EIS Impacts
  Permitting Process
  Lease Negotiations
  Multiple Tenants at Site
  Future Improvements of Facility
• Comply with MOTEMS
• Prepare Plans, Specifications, and Estimates:
  New Mooring and Berthing Structures
  Independent Structural Systems
  Slope Stability
  MEP components compatible with Structural System Displacements
FUTURE MAINTENANCE PROGRAM

• On-Going Process
• Data Management System
• GIS
• Coordinate with POLA Concrete Maintenance Program
• Coordinate with POLA Construction Maintenance Division
Part II
New Marine Oil Terminal
Structural Design of the Pier 400
Crude Oil Marine Terminal
Unique Features

Facility Description

Engineering Design per MOTEMS

Mooring & Berthing per MOTEMS

Engineering Details

Design Innovation
1st New Oil Terminal Designed to MOTEMS
Designed to meet new MOTEMS & POLA Seismic Code
81 ft of water depth to accommodate VLCC’s
Material selection & modular construction
New technology to mitigate spills
Designed to ensure Green/Blue Initiatives

PART II: NEW MARINE OIL TERMINAL
MOTEMS mandated by Lempert-Keene-Seastrand Oil Spill Prevention & Response Act of 1990

California to comply with MOTEMS per 2001 CBC Chapter 31F

MOTEMS attempts to “…prevent oil spills and to protect public health, safety, and the environment…”

Uses Performance Based Design
60 ft wide x 100 ft long x 4 ft deep reinforced concrete slab
- 12-54” steel piles
- Steel piles rigidly connected to underside of slab
- 4-16” unloading arms
MOTEMS Risk Classification
Seismic Performance Criteria
Minimum Required Analytical Procedure
Structural Loading
Design Optimization
DESIGN TO MOTEEMS

- Design consistency at POLA
- Palos Verdes fault
- Site-specific design spectra and seven sets of orthogonal time history records
- POLA Port-wide Ground Motion Study produced site-specific OLE and CLE spectra
Purpose is to establish minimum seismic analysis and structural performance. Performance is evaluated at a two level criteria: Level 1 and Level 2. MOTEMS risk classification (Table 31-F-4-1). All new MOTS are classified as high risk.

1. Exposed oil $\geq 1200$ bbls

### TABLE 31F-4-1

<table>
<thead>
<tr>
<th>Risk Classification</th>
<th>Exposed Oil (bbls)</th>
<th>Transfers per Year per Berthing System</th>
<th>Maximum Vessel Size (DWTx1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>$\geq 1200$</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Moderate</td>
<td>$&lt; 1200$</td>
<td>$\geq 90$</td>
<td>$\geq 30$</td>
</tr>
<tr>
<td>Low</td>
<td>$&lt; 1200$</td>
<td>$&lt; 90$</td>
<td>$&lt; 30$</td>
</tr>
</tbody>
</table>
**Design Earthquake Motions:**

**Level 1**
- Minor or no structural damage
- Temporary or no interruption in operations

**Level 2**
- Controlled inelastic structural behavior with repairable damage
- Prevention of structural collapse
- Temporary loss of operations, restorable within months
- Prevention of major spill (≥ 1200 bbls)

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**MOTEMS SEISMIC PERFORMANCE CRITERIA**

**TABLE 31F-4-2**

<table>
<thead>
<tr>
<th>Risk Classification</th>
<th>Seismic Performance Level</th>
<th>Probability of Exceedance</th>
<th>Return Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
<td>Level 1</td>
<td>50% in 50 years</td>
<td>72 years</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>10% in 50 years</td>
<td>475 years</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>Level 1</td>
<td>65% in 50 years</td>
<td>48 years</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>15% in 50 years</td>
<td>308 years</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Level 1</td>
<td>75% in 50 years</td>
<td>36 years</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>20% in 50 years</td>
<td>224 years</td>
</tr>
</tbody>
</table>

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**PART II: NEW MARINE OIL TERMINAL**
GENERAL PLAN & ELEVATION

PART II: NEW MARINE OIL TERMINAL
SECTION AT UNLOADING PLATFORM

PART II: NEW MARINE OIL TERMINAL
PART II: NEW MARINE OIL TERMINAL
Questions?

Thank You!

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