Navigating a MOTEMS Audit

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Structural Engineer

Ben C. Gerwick, Inc.

September 10, 2008

Ben C. Gerwick, Inc.
Member of the COWI Group

Presentation Outline

- Introduction
  - Ben C. Gerwick, Inc
    - Audits Completed for Four High Risk Terminals
    - First two Audits Submitted and Reviewed by CSLC
- The Audit Process
- Lessons Learned
- Summary
- Questions

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The Audit Process

- Surveys, Surveys, Surveys
- Operational Capacity and Demand Analyses
- Seismic Capacity and Demand Analyses
- Checklists, Missing Information, and Deficiency Tables
- Executive Summary and Audit Submittal

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The Audit Process

- Surveys, Surveys, Surveys,…
  - Data Collection and Review
  - Above and Below Water Investigations
  - Geotechnical Investigations
  - Hydrographic and Topographic Survey
  - Material Testing

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The Audit Process

- Data Collection and Review
  - Existing As-Built Drawings
  - Existing As-Built Specifications
  - Existing Condition Survey(s)
  - Existing Geotechnical Information
  - Existing Hydrographic or Topographic Information
  - Existing Vessel Information and General Arrangements
  - Existing Terminal Operations Manual(s)
  - Available Information from Public Records

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The Audit Process

- Above and Below Water Inspections
  - PE Divers and Level of Inspections
  - Coordinate Inspections and Critical Members
  - Compile Inspection Results and Assign Ratings
  - Condition Survey Report (s)

The Audit Process

- Geotechnical Investigations
  - Borings and CPTs
    - Available borings may not meet MOTEMS 100-ft requirement
    - Map both transverse and longitudinal soil profiles
    - Consider potential repairs and upgrades to facilities
  - Seismic Analyses and Hazard Analyses
    - Site Specific Response Spectra
    - Soil Liquefaction and lateral stability
    - P-y and T-z requirements
    - Abutments

The Audit Process

- Operational Capacity and Demand Analyses
  - Operational
    - Dead and Live Loads
    - Berthing
    - Mooring
      - Winds and Currents
      - Passing Vessel Effects
    - Fender Systems
    - Mooring Hardware

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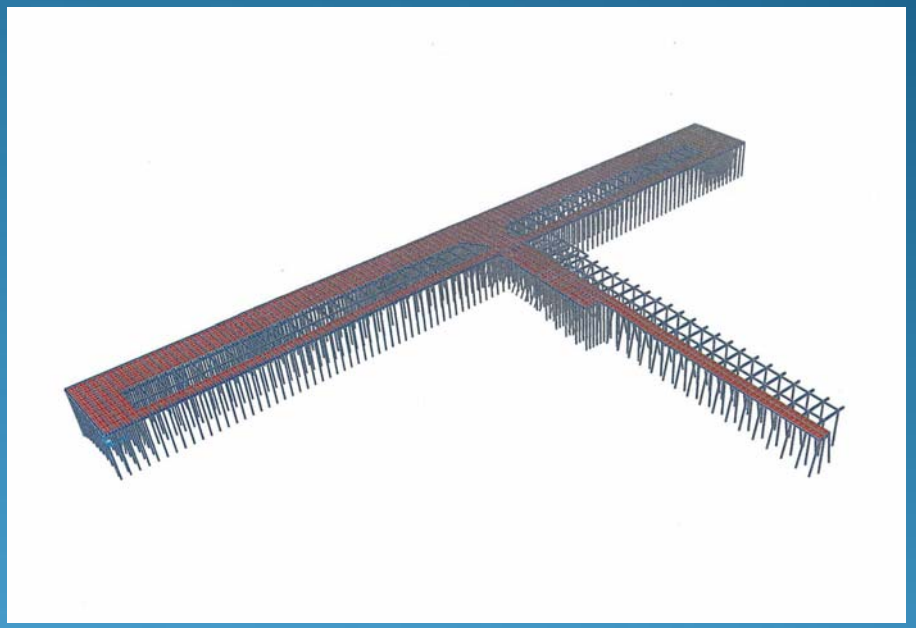
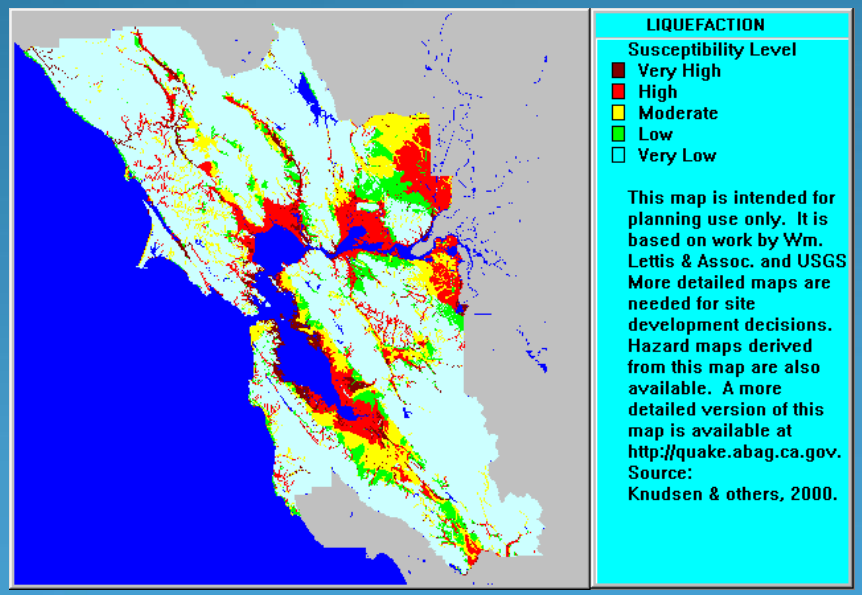
The Audit Process

- Seismic Capacity and Demand Analyses
  - Seismic
    - Dead Load and Equipment
    - Inertial and Kinematic Loads





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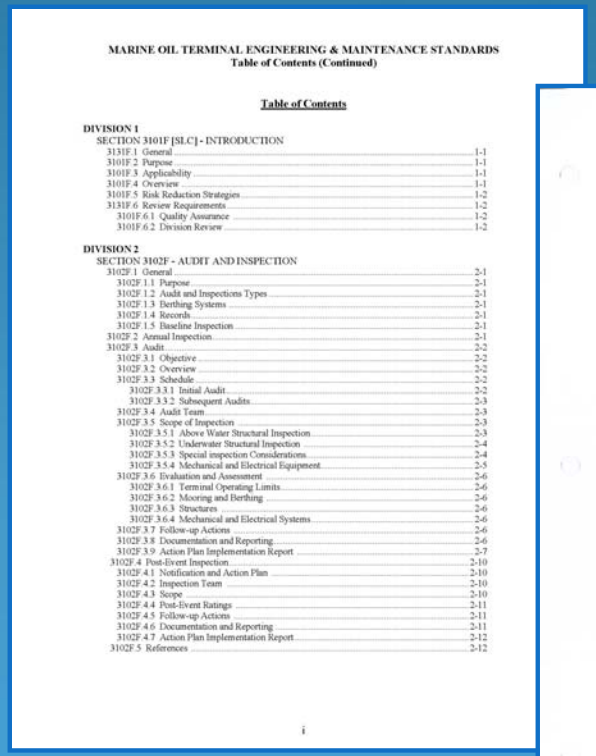
The Audit Process

- Checklists, Missing Information, and Deficiency Tables
  - CSLC Draft Audit Manual Checklists
  - Missing Information
  - Deficiency Tables



MARINE OIL TERMINAL ENGINEERING & MAINTENANCE STANDARDS
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MARINE OIL TERMINAL
ENGINEERING AND MAINTENANCE
AUDIT MANUAL

CALIFORNIA STATE LANDS COMMISSION

MARINE FACILITIES DIVISION

May 2004

Ben C. Gerwick, Inc.
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The Audit Process

- Executive Summary and Audit Submittal
  - Structural Summaries and CARs
  - Component Summaries and RAPs
  - Path Forward
    - Addresses deficiencies and scheduled repairs
  - Audit Submittal
    - Two (2) Copies and CDs to CSLC
      - 7 to 11 Volumes (4-in binders)
      - 1,200 to 3,000 pages
      - 250 - 750 MB of information

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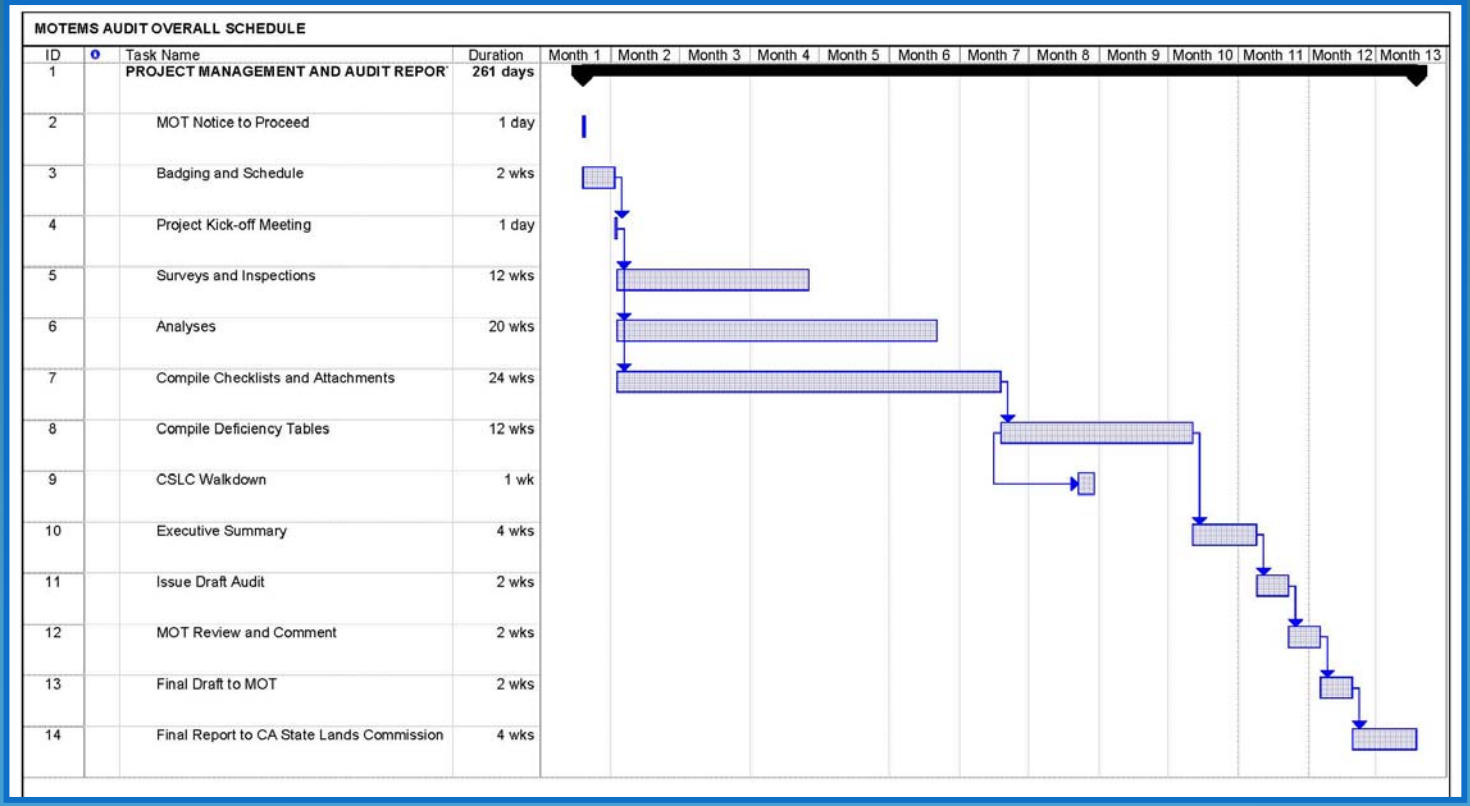
Lessons Learned

- Planning and Scheduling
- Immediate Mitigation May be Required
- Testing is knowledge
- MOTEMS Modifications
- Communication

Lessons Learned

- Planning and Scheduling
  - Recommend 12 months from inspection to submittal



Lessons Learned

- Planning and Scheduling (Continued)
  - Start Condition Surveys early
    - Currents, tides, and weather will affect inspection schedules
    - Ship schedules will interrupt inspection schedules

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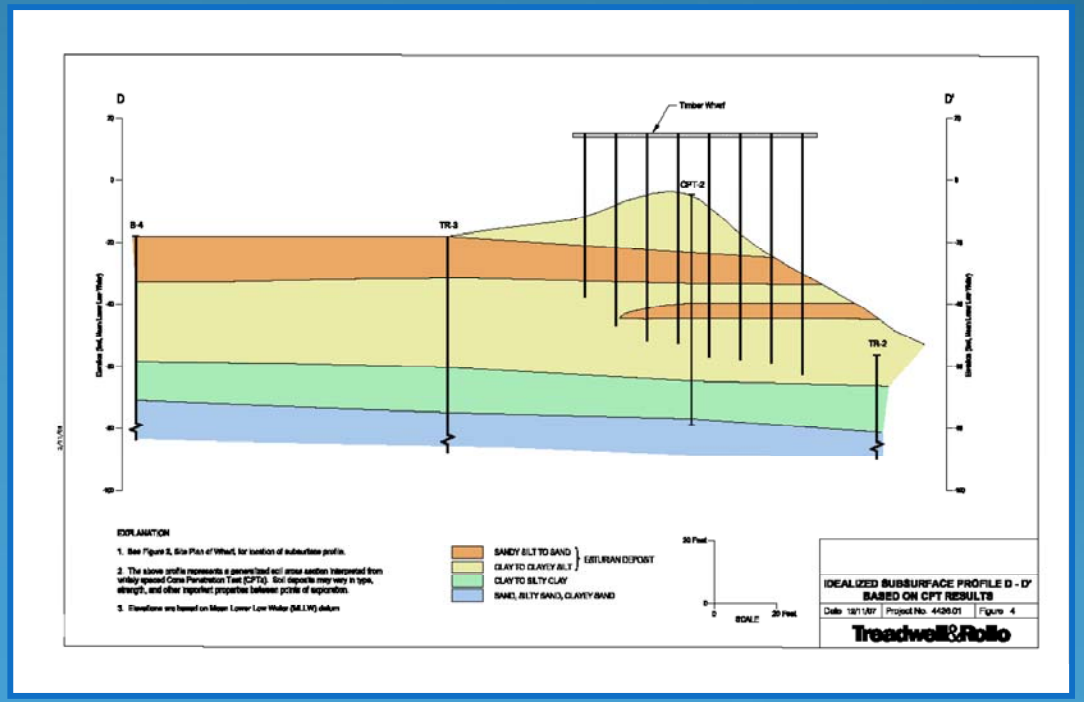
Lessons Learned

- Planning and Scheduling (Continued)
  - Start Geotechnical field investigations early also
    - Site Specific Spectra and soil parameters required for analyses
    - Potential Liquefaction and Lateral Spreading may direct mitigation measures



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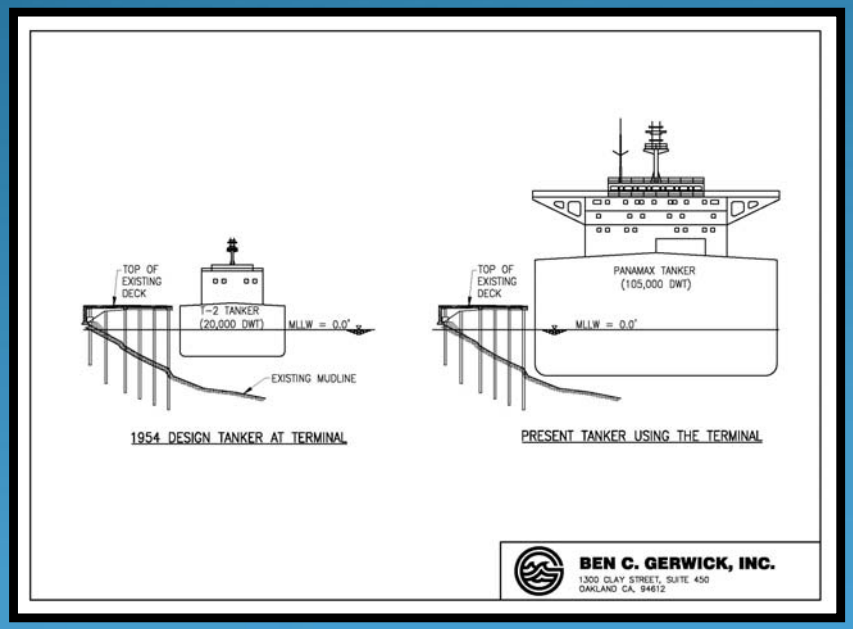
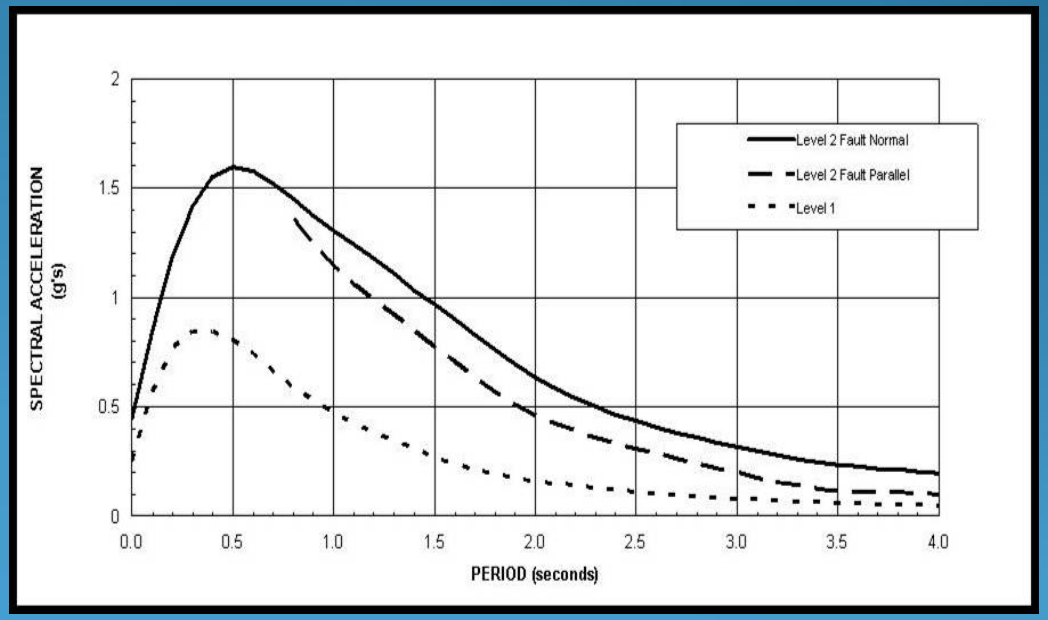
Lessons Learned

- Planning and Scheduling (Continued)
  - Compile Draft Checklists & Deficiencies
    - Develop repair design plan to eliminate operational deficiencies
    - Plan CSLC walk down after surveys and deficiency direction
  - Review Path Forward with Corporate
    - Local MOTs require input and approval from Corporate
    - CSLC will hold MOTs to Repair Plan Schedules

Lessons Learned

- Mitigations **may** be required
  - Audits are performed on circa 1950 terminals with some improvements





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Lessons Learned

- Mitigations may be required (Continued)
  - Expect Operational Deficiencies in Older Structures

Damaged Spring Fender Assembly

Relocated Mooring Hook

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Lessons Learned

- Mitigations may be required (Continued)
  - Events Happen

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Lessons Learned

- Testing is knowledge

Existing Fender Assembly

Pipeway Repair Connection

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Lessons Learned

- MOTEMS Audit Modifications
  - Executive Summary Table Modifications
    - Above and Below Water CARs
    - Follow-Up Action Items

Example

EXECUTIVE SUMMARY TABLE (ES-1)
GLOBAL STRUCTURAL CONDITION ASSESSMENT RATINGS (CAR)

Berthing System	System	Condition Assessment Rating	From this Audit[1]	From Previous Audit[1]	Next Audit Due (Mo/Yr)	Assigned Follow-Up Actions	Fit-for-Purpose?
North Wharf	Above Water Structure	4 (Fair)	4 (date)		6/2004	Upgrade Design and Implementation	No
	Underwater Structure	5 (Satisfactory)		4 (date)	10/2006		Yes
South Wharf	Above Water Structure	4 (Fair)	4 (date)		6/2004	Repair Design Inspection	No
	Underwater Structure	3 (Poor)		4 (date)	10/2006	Special Inspection; Repair Design Inspection	No
Dolphin, Trestle, etc.							

1. Place check mark and date of respective audit in proper column to indicate for each structural system, whether the system was included in the current audit or the results are summarized from a previous audit.

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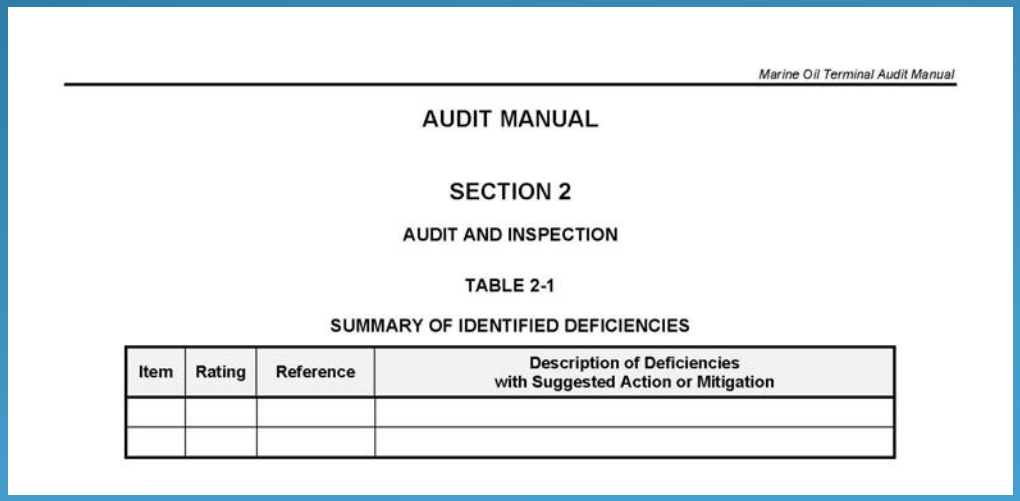
Lessons Learned

- MOTEMS Audit Modifications (Continued)
  - Deficiency Table Modifications
    - Separate columns for Deficiency and Suggested Mitigation
    - Added Date Completed column



Marine Oil Terminal Audit Manual

AUDIT MANUAL

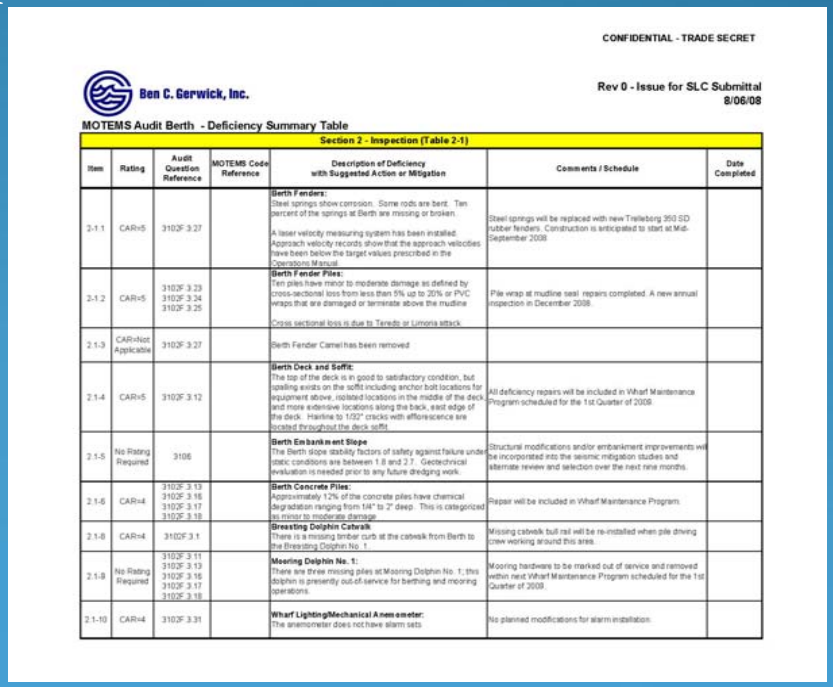
SECTION 2

AUDIT AND INSPECTION

TABLE 2-1

SUMMARY OF IDENTIFIED DEFICIENCIES

Item	Rating	Reference	Description of Deficiencies with Suggested Action or Mitigation



CONFIDENTIAL - TRADE SECRET

Ben C. Gerwick, Inc.

Rev 0 - Issue for SLC Submittal
8/06/08

MOTEMS Audit Berth - Deficiency Summary Table

Section 2 - Inspection (Table 2-1)						
Item	Rating	Audit Question Reference	MOTEMS Code Reference	Description of Deficiency with Suggested Action or Mitigation	Comments / Schedule	Date Completed
2-1.1	CAR=5	3102F 3.27		**Berth Fenders:** Steel springs show corrosion. Some rods are bent. Ten percent of the springs at Berth are missing or broken. A laser velocity measuring system has been installed. Approach velocity records show that the approach velocities have been below the target values prescribed in the Operations Manual.	Steel springs will be replaced with new Trelleborg 350 SD rubber fenders. Construction is anticipated to start at Mid-September 2008.	
2-1.2	CAR=5	3102F 3.23 3102F 3.24 3102F 3.25		**Berth Fender Piles:** Ten piles have minor to moderate damage as defined by cross-sectional loss from less than 5% up to 20% or PVC wraps that are damaged or terminate above the mudline. Cross sectional loss is due to Teredo or Limoria attack.	Pile wrap at mudline seal repairs completed. A new annual inspection in December 2008.	
2-1.3	CAR=Not Applicable	3102F 3.27		Berth Fender Camel has been removed.		
2-1.4	CAR=5	3102F 3.12		**Berth Deck and Soffit:** The top of the deck is in good to satisfactory condition, but spalling exists on the soffit including anchor bolt locations for equipment above, isolated locations in the middle of the deck, and more extensive locations along the back, east edge of the deck. Hairline to 1/32" cracks with efflorescence are located throughout the deck soffit.	All deficiency repairs will be included in Wharf Maintenance Program scheduled for the 1st Quarter of 2009.	
2-1.5	No Rating Required	3106		**Berth Embankment Slope** The Berth slope stability factors of safety against failure under static conditions are between 1.8 and 2.7. Geotechnical evaluation is needed prior to any future dredging work.	Structural modifications and/or embankment improvements will be incorporated into the seismic mitigation studies and alternate review and selection over the next nine months.	
2-1.6	CAR=4	3102F 3.13 3102F 3.16 3102F 3.17 3102F 3.18		**Berth Concrete Piles:** Approximately 12% of the concrete piles have chemical degradation ranging from 1/4" to 2" deep. This is categorized as minor to moderate damage.	Repair will be included in Wharf Maintenance Program.	
2-1.8	CAR=4	3102F 3.1		**Breasting Dolphin Catwalk** There is a missing timber curb at the catwalk from Berth to the Breasting Dolphin No. 1.	Missing catwalk bull rail will be re-installed when pile driving crew working around this area.	
2-1.9	No Rating Required	3102F 3.11 3102F 3.13 3102F 3.16 3102F 3.17 3102F 3.18		**Mooring Dolphin No. 1:** There are three missing piles at Mooring Dolphin No. 1; this dolphin is presently out-of-service for berthing and mooring operations.	Mooring hardware to be marked out of service and removed within next Wharf Maintenance Program scheduled for the 1st Quarter of 2009.	
2-1-10	CAR=4	3102F 3.31		**Wharf Lighting/Mechanical Anemometer:** The anemometer does not have alarm sets.	No planned modifications for alarm installation.	

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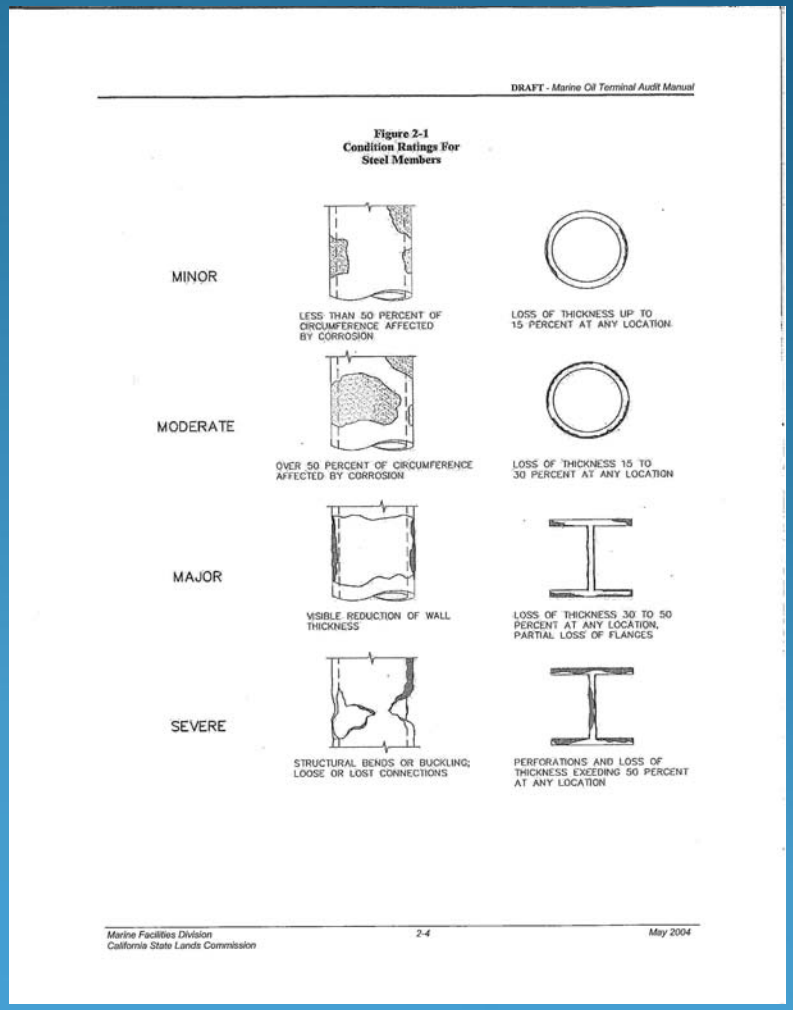
Lessons Learned

- MOTEMS Audit Modifications
  - Condition Surveys vs. Assessments
    - A CAR is a Condition Assessment Rating
    - A Condition Survey refers to loss of section
  - Underwater vs. Above water
    - MOTEMS states +3-ft MLLW for underwater survey. Above water above +3-ft MLLW



DRAFT - Marine Oil Terminal Audit Manual

Figure 2-1
Condition Ratings For Steel Members

MINOR	LESS THAN 50 PERCENT OF CIRCUMFERENCE AFFECTED BY CORROSION	LOSS OF THICKNESS UP TO 15 PERCENT AT ANY LOCATION
MODERATE	OVER 50 PERCENT OF CIRCUMFERENCE AFFECTED BY CORROSION	LOSS OF THICKNESS 15 TO 30 PERCENT AT ANY LOCATION
MAJOR	VISIBLE REDUCTION OF WALL THICKNESS	LOSS OF THICKNESS 30 TO 50 PERCENT AT ANY LOCATION, PARTIAL LOSS OF FLANGES
SEVERE	STRUCTURAL BENDS OR BUCKLING; LOOSE OR LOST CONNECTIONS	PERFORATIONS AND LOSS OF THICKNESS EXCEEDING 50 PERCENT AT ANY LOCATION

Marine Facilities Division
California State Lands Commission
2-4
May 2004

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Lessons Learned

- Communication
  - Need a Project Champion at the Terminal
  - Coordination between MOT, Audit Team, and CSLC
    - Include CSLC in schedule and walk through
    - Inform CSLC of known deficiencies and directions
  - Request Clarification from SLC, if needed.

Summary

- Audit Process includes surveys, analyses, and checklists, deficiency tables, summary, and submittal.
- Recommend 12 months to complete Audit
- Expect mitigation requirements for older facilities
- Testing may help for marginal capacities
- MOT needs a Project Manager with good communication skills

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