UNDERWATER INSPECTION
A BRIEF DISCUSSION ON THE IMPORTANCE OF UNDERWATER INSPECTION, DIVING MODES, TYPICAL STRUCTURAL DEFECTS, AND DOCUMENTATION
INTRODUCTION

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• Association of Dive Contractor’s International (ADCI) Surface Supplied Air Diver and Diving Supervisor
• Lead Instructor for USACE Course 035 - Working Diver Program
• Successfully performed hundreds of underwater inspections for private, state, local, and federal entities throughout CONUS and abroad.
• Hydrographic Surveyor/Underwater Acoustic Imaging
Infrastructure Overview

- AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) REPORT CARD (WWW.INFRASTRUCTUREREPORTCARD.ORG)
  - REPORT EVERY 4 YEARS ON THE CONDITION AND PERFORMANCE OF AMERICA’S INFRASTRUCTURE.
  - 2013 REPORT CARD – OVERALL GRADE D+
  - ESTIMATED $3.6 TRILLION BY 2020
    - THAT’S $3,600,000,000,000
  - PUBLIC PARKS AND RECREATION – GRADE C-
    - STATE AND LOCAL MUNICIPALITIES REPORTED $18.5 BILLION IN UNMET NEEDS IN 2011
Importance of Underwater Inspections

- Given the condition of America’s aging infrastructure, underwater inspections should part of every facility maintenance program.
- Inspections are paramount to the safety and dependability of waterfront structures.
- Lack of inspection programs and deferred maintenance can lead to loss of life and property.
- Above water problems can usually be seen by the end user or maintenance personnel and reported to facility owners.
- Underwater problems are rarely seen by the end user or maintenance personnel until the problem progresses to the point where structural components above the waterline become distressed.
UNDERWATER INSPECTION REQUIREMENTS

- PERSONNEL
  - COMMERCIAL DIVING IS GOVERNED BY
    - OSHA 29 CFR 1910 SUBPART T – COMMERCIAL DIVING OPERATIONS
  - MINIMUM THREE PERSON TEAM
  - ALL DIVE-TEAM MEMBERS MUST HAVE EXPERIENCE OR TRAINING IN THE USE OF TOOLS, EQUIPMENT, TECHNIQUES, OPERATIONS, AND EMERGENCY PROCEDURES THAT ARE PERTINENT TO, AND NECESSARY FOR, THE ASSIGNED TASKS FOR THE DIVING MODE
  - DIVING COMPANIES MUST CARRY PROPER INSURANCE
    - UNITED STATES LONGSHORE AND HARBOR WORKERS COMPENSATION ACT (OVER WATER)
    - JONES ACT (FROM A BOAT)
DIVING MODES

• SCUBA

  • Advantages
    - Light Weight, Easily Portable

  • Disadvantages
    - Limited Air Supply
DIVING MODES

• SURFACE-SUPPLIED AIR

• Advantages

• Communication, Large Air Supply, Safer
Limits of Underwater Inspection

- UNDERWATER INSPECTIONS SHOULD ENCOMPASS ALL ACCESSIBLE STRUCTURAL ELEMENTS AND TYPICALLY EXTEND FROM THE HIGHWATER MARK TO THE CHANNEL BOTTOM.
- THIS INCLUDES ELEMENTS LOCATED WITHIN THE “SPLASH ZONE”
- ABOVEWATER COMPONENTS OF STRUCTURES WITH LOW FREEBOARD OR LIMITED ACCESSIBILITY TO TOPSIDE PERSONNEL SHOULD BE INSPECTED BY UNDERWATER INSPECTION PERSONNEL
Limits of Underwater Inspection
TYPES OF UNDERWATER INSPECTIONS

- DESIGN/REPAIR INSPECTIONS
  - PRIOR TO CONSTRUCTION OR REPAIR
- CONSTRUCTION INSPECTIONS
  - DURING CONSTRUCTION (QA/QC)
- POST-EVENT
  - STORMS/EARTHQUAKES
- SPECIAL PURPOSE/RESEARCH
- ROUTINE
  - MOST COMMON
TYPES OF UNDERWATER INSPECTIONS

ROUTINE INSPECTIONS

THREE LEVELS OF ROUTINE INSPECTION

- **LEVEL 1 INSPECTION – GENERAL VISUAL/TACTILE INSPECTION**
  - General “swim-by” inspection used to determine obvious defects
  - Covers 100 percent of the structure below the waterline

- **LEVEL 2 INSPECTION – CLOSE UP VISUAL/TACTILE INSPECTION**
  - Typically performed in conjunction with a Level 1 Inspection
  - Includes removing the marine growth from 10 to 20 percent of the structural components below the waterline

- **LEVEL 3 INSPECTION – IN-DEPTH AND HIGHLY DETAILED INSPECTION**
  - Used to detect hidden or imminent damage
  - May involve specialized equipment
LEVELS OF UNDERWATER INSPECTIONS

LEVEL 1

LEVEL 2

LEVEL 3
DEFECTS FOUND BELOW THE WATERLINE

- CONCRETE
  - SPALLS, VOIDS, CRACKS IN STRUCTURAL MEMBERS
  - UNDERMINING AND SCOUR OF CONCRETE RAMPS
  - EXPOSED REINFORCING STEEL GENERALLY EXHIBITS ACCELERATED CORROSION
  - SCALING
DEFECTS FOUND BELOW THE WATERLINE

- **TIMBER**
- **DECAY**
- **MARINE BORER INFESTATION → LOSS OF SECTION**
- **CORROSION OF CONNECTION HARDWARE**
DEFECTS FOUND BELOW THE WATERLINE

- STEEL

- CORROSION AND PITTING → LOSS OF SECTION
UNDERWATER INSPECTION DELIVERABLES

UNDERWATER INSPECTION REPORT

- MINIMUM REQUIREMENTS
  - INSPECTION DATE
  - PERSONNEL
  - INSPECTION EQUIPMENT AND TECHNIQUES
  - DOCUMENTATION OF GENERAL AND SPECIFIC STRUCTURAL CONDITIONS
  - ACCOMPANYING PHOTOGRAPHS
  - EVALUATION AND ASSESSMENT
  - COMMENT ABOUT CHANGES SINCE THE LAST INSPECTION

- ADDITIONAL ITEMS
  - UNDERWATER VIDEO
  - COMPUTER GENERATED DRAWINGS
  - COST ESTIMATES
  - SPECIALIZED TESTING
  - SONAR/ACOUSTIC IMAGING
Procurement Recommendations

- Clearly Define Your Scope and Deliverables
  - Type, Level, Purpose of Inspection

- Hire Professionals with Proven Safety Record
  - Diving is Inherently Dangerous

- Request Contractor’s Diving Plan
  - EMP and JSA

- Ensure Contractor has Proper Insurance
CONCLUSION

- UNDERWATER INSPECTIONS ARE NECESSARY TO ENSURE PUBLIC SAFETY AND PROTECT CAPITAL INVESTMENT IN WATERFRONT STRUCTURES

- UNDERWATER INSPECTIONS SHOULD BE PERFORMED BY TRAINED AND COMPETENT PROFESSIONALS

- A WIDE RANGE OF TECHNOLOGY AND EQUIPMENT IS AVAILABLE FOR UNDERWATER INSPECTION

- COLLECTED INSPECTION DATA MUST BE ACCURATE AND PRESENTED IN A FORMAL INSPECTION REPORT
QUESTIONS?