EARTH COVERED-MAGAZINES STRUCTURAL INTEGRITY ASSESSMENTS (ECMSIA)

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09 August 2018

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OVERVIEW OF PRESENTATION

- Need for Assessments

- ECM Structural Integrity Assessments: What is it?

- Approach – Three Phased Approach
  - Phase 1 (Three Parts): ECM Structural Health Integrity Assessments
  - Structural Health Guidelines/Ratings
  - Assessment Reports/Deliverable

- Back-Up Information
WHY IS AN ECMSIA NEEDED?

➢ To determine “structural health” of aging storage magazines
  • Approximately 25,000 ECMs in DoD
  • Most are 75+ years old
  • Located on installations with varying environmental/operational conditions

➢ To assess if U.S. munition storage is at risk
  • Has aging structurally degraded the ECMs to a point where they do not meet ECM structural designation criteria set forth in DoD 6055.09-M?

➢ To provide input to Munitions-Related Infrastructure Recapitalization Plan
  • Monitor,
  • Repair,
  • Replace,
  • Re-warehouse
ECMSIA: WHAT IS IT?

- A hands-on assessment that will assist the Army in developing a status system (Green, Amber, Red, Black) for ECMs;
- ECMSIA Team will:
  - Use a common structural checklist to ensure consistency of results;
  - Will include engineers and safety professionals with specialized experience in:
    - Inspection of concrete structures; and
    - Explosives safety standards for ECM
- ECMSIA will:
  - Provide a base line for the structural health and integrity of the ECMs that may be used for scheduling maintenance and developing recapitalization plans; and
  - Assess the adequacy of each structure to safely store the net explosive weight (NEW) currently authorized for storage
ECMSIA APPROACH

- Army supports this DDESB funded effort (FY19 - FY23) – Planned start date March 2019
- Multi-organization Government Team
  DDESB, DA, AMC, JMC, DAC, USATCES, USACE, NOSSA, NAVFAC-Atlantic
- Three Phase Approach
  - Phase 1: Earth Covered-Magazine Structural Integrity Assessment
    - Part 1 - Facilities Assessment: establish types/quantity of ECMs
    - Part 2 - Structural Health Visual Inspection (SHVI): establish ‘Structural Health’ Rating
    - Part 3 - Concrete Coring/Testing: project remaining service life
  - Phase 2: Site Planning (ESQD Analysis)
  - Phase 3: Load Plan Analysis (Account for stockpile)
- Initial Installations (approximately 5,000 ECMs)
  - Crane Army Ammunition Activity (CAAAA)
  - McAlester Army Ammunition Plant (MCAAP)
  - Tooele Army Depot (TEAD)
Establish types and quantity of ECMs:

- ESMSIA will visit and walk through 100% of the ECMs to capture and confirm physical dimensions and construction type.
- Information captured on an Facilities Assessment Record provided by NAVFAC-Atlantic.
- ECMs will be categorized by types (physical dimensions and construction type) and quantities of each type will be developed.
- A baseline of each types and associated quantity will be established.
- ESMSIA will use the information gathered during Phase I, Parts 2 and 3; and Phases 2 and 3.
ECMSIA
PHASE 1, PART 2: STRUCTURAL HEALTH VISUAL INSPECTIONS (SHVI)

SHVI will establish a structural health rating for the ECMs based on representative sampling

- Will be representative of the totality of ECMs at an installation
- Will use the baseline of types and number established in Part 1
- Use Simple Proportion Sampling Method from Miller and Freund’s Probability and Statistics for Engineers
  - Goal is to obtain a 95% confidence level in results;
  - Confidence level consistent with private industry standard practice
- Quantity will be 20% to 30% of total number of ECMs from the Part 1 baseline
- Different quantities of each “type” strongly influences the number of ECMs to be inspected (sampled)
ECMSIA
PHASE 1, PART 2 (CONTINUED)

- Numerical Code: (0 – 9)
- Assigned indicates an overall structural health rating for the ECM
- Used to assign a rating ‘similar’ to an Installation Status Rating (ISR) adapted to ECM use
  - **Green** (7 to 9): continue to use, but monitor minor deterioration noted
  - **Amber** (5 to 6): continue to use, but make noted repairs to prevent further deterioration
  - **Red** (3 to 4): discontinue use until noted repairs are made
  - **Black** (0 to 2): un-repairable, do not use
- Rating provides a recommendation for the installation’s and Army’s consideration for planning and management
- Repair costs and methods provided
ECMSIA

OBSERVATIONS FROM PREVIOUS ASSESSMENTS

Spalling

Spalling: Exposed Rebar in Sidewall

Cracking

Transverse @ Sidewall  Transverse @ Arch
Establish structural properties; and

Project remaining service life

ECMSIA Team will:

• Sample a representative quantity of each type and quantity based on the baseline established in Part 1
• Use Miller and Freund’s Simple Proportion Sampling Method from Probability and Statistics for Engineers
  – Goal is to obtain a 70% confidence level in results;
  – Quantity will be 8% to 12% of total number of ECMs established in Part 1
ECMSIA - PHASE 1, PART 3 (CONTINUED)

- Close coordination with the installation’s explosives safety manager is required
- Extract cores from ‘empty’ ECMs when possible
- Take measures to prevent the need to handle munitions (e.g., re-warehouse or move)
- Use Ground Penetrating Radar (GPR) to find and confirm all reinforcement prior to core drilling
- Core Drilling is a ‘wet’ process
- Lab Testing per ASTM test methods
ECMSIA - SAMPLE RETRIEVAL

Ground Penetrating Radar

Concrete Coring
ECMSIA - DELIVERABLES

- Executive Summary
  - Project Background
  - Parts 1, 2 and 3 Summary
- Part 1 Report
  - Summary spreadsheet
  - Form for each type of ECM
  - Site Map with each type indicated with legend
- Part 2 Report
  - Inspection form for each ECM with Structural Health rating
  - Recommended Repair Methods with Costs
  - Site Map with structural health rating indicated with legend
- Part 3 Report
  - Report for each site
  - Lab results
  - Projected remaining service life
  - Site Map with service life indicated with legend
- Electronic Data Base (OTS Software)
Questions/Comments
Backup
ECMSIA

STRUCTURAL HEALTH ‘COLOR’ RATINGS CATEGORIES

- **Green**: ECM receiving a rating of 7 or above. **New condition, minor nonstructural issues identified, no significant deterioration.** Structural Health is adequate for the assigned structural designation. **Continued to use.**

- **Amber**: ECM receiving a rating of 5 or 6. **Primary structural components are sound, some minor section loss, cracking and spalling.** Structural Health is adequate for the assigned structural designation. Continued use is as is, but **needed repairs should be completed to prevent further deterioration.**

- **Red**: ECM receiving a rating of 3 or 4. **Significant deterioration** of primary structural components, advanced section loss and spalling. Structural Health is **not adequate for the assigned structural strength designation. Do not use until repairs are made.**

- **Black**: magazines receiving a of 0, 1 or 2. **Major deterioration or sections have lost critical structural components.** Beyond repair, do not use for munitions storage.
<table>
<thead>
<tr>
<th>Building #</th>
<th>Type</th>
<th>Year Constructed</th>
<th>Description</th>
<th>Dimensions</th>
<th>Tenant</th>
<th>Use Status</th>
<th>QD Siting</th>
<th>Life Expectancy</th>
<th>Structural Designation</th>
<th>Structural Health Rating</th>
<th>Structural Health Description</th>
<th>Date Inspected</th>
<th>Structural Recommendations</th>
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<tbody>
<tr>
<td>#1</td>
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<td>1941</td>
<td>Arch</td>
<td>44x32x9</td>
<td>Army</td>
<td>Empty</td>
<td>ECM</td>
<td>Year TBD</td>
<td>Undefined</td>
<td>Green - 7</td>
<td>Use: None or Minor repairs needed</td>
<td>15-Jan-13</td>
<td>Mark and monitor hairline cracks, repair floor cracks</td>
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<tr>
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<td>2</td>
<td>1941</td>
<td>Box</td>
<td>44x32x9</td>
<td>Army</td>
<td>In Use</td>
<td>ECM</td>
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<td>Undefined</td>
<td>Amber - 6</td>
<td>Use: Major Repairs needed</td>
<td>16-Jan-13</td>
<td>Exterior repairs; mark and monitor hairline cracks; repair floor cracks</td>
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<td>ECM</td>
<td>NA</td>
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<td>Do not use for AE storage</td>
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<td>Green - 8</td>
<td>Interior and exterior repairs; mark and monitor hairline cracks; repair floor cracks</td>
<td>20-Dec-12</td>
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ECMSIA CONDITION ASSESSMENT (SERVICE LIFE EXPECTANCY)
ECMSIA CONDITION ASSESSMENT (STRUCTURAL HEALTH)