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From: Commanding Officer, Naval Facilities Engineering and Expeditionary Warfare Center
To: Naval Ordinance Safety and Security Activity (NOSSA) (Attn: Timothy Uplinger)

Subj: ENDORSEMENT OF REVISED DRAWINGS FOR SINGLE-BAY CONTAINERIZED LONG WEAPONS STORAGE MAGAZINE

Ref: (a) Containerized Long Weapons Storage Navy Earth Covered Magazine, Naval Facilities Engineering Systems Command Drawing Numbers 12877610 through 12877660, dated 20 March 2023
(b) DDESB-PE Memo, Approval of 7-Bar Structural Strength Designation for the Navy Containerized Long Weapons Storage (CLWS) Magazine Constructed to Naval Facilities Engineering Systems Command Drawing Numbers 12877610 through 12877660, dated 17 May 2023
(c) "Technical Review of Protective Construction Design of Containerized Long Weapons Storage Magazine, Single Bay Configuration" TR-NAVFAC EXWC-SH2-2304, 20 March 2023
(d) Containerized Long Weapons Storage Navy Earth Covered Magazine, Naval Facilities Engineering Systems Command Drawing Numbers 12905820 through 12905870, dated 25 April 2024
(e) Minimum Requirements to Validate Explosives Safety Protective Construction, Department of Defense Explosives Safety Board (DDESB) Memorandum, dated 21 October 2008
(f) Defense Explosives Safety Regulations (DESR) 6055.09
(g) NAVFAC Report, "Design Criteria and Requirements: Containerized Long Weapons Storage Earth Covered Magazines", November 2019
(h) Unified Facilities Criteria (UFC) 3-340-02, "Structures to Resist the Effects of Accidental Explosions"
(i) DDESB-TP 15, Revision 4, "Approved Protective Construction" 26 July 2020

Encl: (1) Calculation Package "CLWS ECM – Single Bay, Headwall, Flexural Response"

1. The single bay configuration of the Containerized Long Weapons Storage (CLWS) Navy Earth-Covered Magazine (ECM) (reference (a)) was submitted by Naval Facilities Engineering Systems Command Atlantic (NAVFAC LANT) and approved for new construction as a seven-Bar ECM by the Department of Defense (DoD) Explosives Safety Board on 17 May 2023 (reference (b)). The design has been programmed for construction on existing military construction, but construction has not begun on any sites.

2. During the design review process for the double-bay configuration of the CLWS ECM, the Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) noted aspects of the CLWS ECM design which could not be constructed in a manner consistent with the design assumptions used in the analysis justifying the design's performance as a seven-Bar ECM (reference (c)). NAVFAC LANT has modified the drawing set for the single-bay CLWS

ECM to address these aspects (reference (d)), and produce a design that is constructible, and consistent with the original design analysis.

3. NAVFAC EXWC, in their role as a DoD blast design agency, as defined in reference (e) has reviewed the revised drawing set for compliance with the performance requirements for seven-Bar ECM, defined in reference (f) and structure-specific requirements defined by the Navy for the design, detailed in reference (g).

4. There are a number of minor changes to the drawing set for the magazine related to the formatting and display of the drawings (e.g., movement of dimensions to not overlap with other callouts), which are not considered to affect the design of the magazine and are not discussed further in this review. One additional change was made to Sheet E-505, to adjust the switch configuration for the door controls. This change is assumed not to affect the protective construction of the magazine and was not considered in NAVFAC EXWC's review. However, there are four aspects of the design that were updated in a manner this is considered relevant to the magazine's protective construction, which are discussed further below.

5. The clear distance between the blast door weld access holes and top of the blast door has been updated from 4-1/8" to 6-5/8" (See Detail A2/S-702 in reference (d)) to avoid overlap with the perimeter channels. The width of the outermost door cover plates has also been increased or decreased by 1/16" (See Detail A2 and C2/S-702) to align the inter-plate seams with the center of the door stiffeners/channels. The length of the pieces of expanded metal mesh installed in the concrete infill within the blast door has been updated from 46" to 45-1/4" (See Detail C1 and C3/S-703), to provide the intended 1" gap between adjacent pieces, while avoiding overlap of the mesh at the top and bottom perimeter channels. All of these changes are due to dimension errors in the original drawing sets, and the adjustments align the design with the intended configuration in the original design and analysis.

6. The layout of the reinforcement in the headwall has also been updated, such that the outer-most layer of bars are oriented in the horizontal direction, while the inner-most layer of bars are oriented in the vertical direction (See Detail A2, B4, B5, C4/S-502). This was done to eliminate a conflict between the horizontal headwall reinforcement and vertical pilaster reinforcement, which was not considered to be constructible in a manner consistent with the original design and analysis.

7. The altered reinforcement layout results in a different expected structural response for the headwall under the design blast loads. NAVFAC EXWC has re-analyzed the new headwall design, in accordance with the design guidance prescribed by the DoD for protective construction in reference (h), and the analytical assumptions described in the original protective construction analysis (reference (c). These calculations are provided in enclosure (1).

8. Under the structure-specific design loads, the new headwall reinforcing layout is calculated to deflect approximately four percent more than that calculated for the original design. However, the maximum support rotation of the component is only 1.89 degrees, and still within the two degree criteria established for the magazine. The new design also meets all other applicable design criteria for shear capacity, minimum reinforcing, and other limit states. Note that the

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Navy-mandated structure-specific design loads are significantly larger than those mandated by reference (f) and are determined to control over Defense Explosives Safety Regulations 6055.09 design load by inspection.

9. Based on their review of the updated drawing set, NAVFAC EXWC concludes that the new design provides a level of protective construction consistent with the original design, and all applicable explosive safety criteria established by the DoD for seven-Bar ECMs, and by the Navy for the specific structure.

10. NAVFAC EXWC endorses the approval of the updated drawing set as a revision to the currently approved drawing set for the single bay configuration of the CLWS ECM as a seven-Bar ECM in DoD Explosives Safety Board Technical Paper 15 (reference (i)).

11. The technical point of contact is Mr. Sean Donahue at (832) 729-8131, or sean.m.donahue14.civ@us.navy.mil.

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