

CECW-EC

Regulation  
No. 1110-2-8161

1 February 2020

Engineering and Design  
STRUCTURAL DESIGN AND EVALUATION OF CIVIL WORKS BUILDINGS

1. Purpose. This regulation establishes the criteria for the structural design of new civil works buildings and the structural evaluation of existing civil works buildings.
2. Applicability. This regulation applies to the structural design and evaluation of all civil works buildings. This regulation applies to all methods of project delivery.
3. Distribution Statement. Approved for public release; distribution is unlimited.
4. References.
  - a. Unified Facility Criteria (UFC) 01-200-01, “DoD Building Code,” (General Building Requirements), latest edition, <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-1-200-01>.
  - b. UFC 3-301-01, “Structural Engineering,” latest edition, <http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-301-01>.
  - c. Engineer Regulation 1110-2-1806, “Earthquake Design and Evaluation for Civil Works Projects,” [https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER\\_1110-2-1806.pdf](https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1110-2-1806.pdf).
  - d. Engineer Manual (EM) 1110-2-3001, “Planning and Design of Hydroelectric Power Plant Structures” [https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM\\_1110-2-3001.pdf](https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-3001.pdf).
  - e. EM 1110-2-3104, “Structural and Architectural Design of Pumping Stations” [https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM\\_1110-2-3104.pdf](https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-3104.pdf)
5. Records Management (Record Keeping) Requirements. The records management requirement for all members, associated forms, and reports required by this regulation are

addressed in the Army (RRS-A). Detailed information for all related record numbers are located in Army Records Information Management System (ARIMS)/RRS-A at <https://www.arims.army.mil>. If any record numbers, forms, and reports are not current, addressed, and/or published correctly in ARIMS/RRS-A, see Department of the Army (DA) Pamphlet 25-403. Guide to Recordkeeping in the Army.

6. Background. The U.S. Army Corps of Engineers has a wide range of building types in the Civil Works Directorate Building Portfolio. While most civil works buildings can be designed or analyzed directly using UFC, there are some types of buildings that will require an enhanced level of analysis or design. Buildings that require this additional level of analysis or design are buildings that are founded on mass concrete foundations or substructures, examples would be powerhouses and pump stations.

7. Policy. Structural design for new civil works buildings and the structural evaluation of existing civil works buildings will be done in line with UFC 3-301-01 and UFC 1-200-01. Please note that antiterrorism, security, blast and progressive collapse criteria apply to civil works buildings, if applicable.

a. Buildings on mass concrete substructures will also be designed per the UFCs except that force and displacement values may be affected for relatively flexible structures constructed on top of massive concrete substructures. In the specific case of powerhouses and pump stations, they will be designed in line with the UFCs supplemented by requirements contained in EM 1110-2-3104 and EM 1110-2-3001. Use the most stringent requirements if a conflict occurs between the UFCs and EMs.

b. For the design or analysis of major non-building structures such as intake towers, see relevant U.S. Army Corps of Engineers criteria. Engineer Regulation 1110-2-1806 will be used to determine seismic requirements for major non-building structures. For design of minor non-building structures, use the UFCs. The provisions in this manual are minimum requirements.

8. Additional Considerations. For buildings constructed on top of mass concrete structures, the influence of the mass of the substructure must be considered on the seismic force and displacement demands placed on the superstructure and all related components. It is possible that the substructure will not affect the seismic demands. Note that a site-specific seismic study can always be performed to refine the design or analysis in the event that prescriptive methods indicate inadequate or marginal performance.

a. For any building, if the roof system is incapable of acting as a diaphragm, then the structural elements supporting the roof structure must be designed/analyzed as independent cantilever elements.

b. For buildings constructed on mass concrete substructures prior to 1947, particular attention must be directed toward inadequate development and splice lengths and the absence of “high-bond” deformation patterns as exhibited by modern reinforced concrete structures.

9. Exceptions and Waivers. All exceptions or waivers to this Engineer Regulation must be approved by the United States Army Corps of Engineers (USACE) Chief of Engineering and Construction, or their delegated authority.

FOR THE COMMANDER:



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COL, EN  
Chief of Staff