



**US Army Corps
of Engineers®**

Chicago District

Great Lakes and Ohio River Division

Chicago Harbor Lock Chamber Floor Repairs

Authority: Civil Works - Operations and Maintenance

P2/Project Number: 114419

Review Plan

PREPARED
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REVIEW PLAN
ENGINEERING AND DESIGN PRODUCTS
OPERATIONS AND MAINTENANCE CHICAGO DISTRICT
Version Date: 29 JANUARY 2020

1. PURPOSE AND REQUIREMENTS

- a. Purpose. This review plan defines levels and scopes of review required for the engineering and design (E&D) for the Chicago Harbor Lock Chamber Floor Repairs project.
- b. References. This review plan is prepared in accordance with the regional business process QMS 08504 LRD (*QC/QA Procedures for Civil Works Engineering and Design Projects*) and latest versions of the guidance documents listed below:
 - (1) Engineering Regulation (ER) 415-1-11, Biddability, Constructability, Operability, Environmental and Sustainability (BCOES) Reviews
 - (2) ER 1110-1-12, Quality Management
 - (3) Engineering Circular (EC) 1165-2-217, Civil Works Review Policy
 - (4) Chicago Harbor Lock Major Rehabilitation, Project Management Plan, December 2004
- c. Requirements. The design and construction activities and documents for the Chicago Harbor Lock Chamber Floor Repairs project are required to be reviewed by independent technical experts in accordance with ER 1110-1-12 and EC 1165-2-217. Review requirements may include district quality control/assurance (DQC), agency technical review (ATR) and independent external peer (IEPR) review as indicated below:

2. REVIEW MANAGEMENT ORGANIZATION (RMO)

The RMO for this project is the Great Lakes and Ohio River Division. The RMO will provide the District with an e-mail stating concurrence with this review plan.

3. PROJECT SCOPE AND PRODUCTS

- a. The chamber of the Chicago Harbor Lock is 600 ft. long, 80 ft. wide, and has a depth of 24.4 ft. This depth is measured below zero Chicago City Datum (CCD). The existing floor of the chamber consists of 246 concrete panels, and the dimensions for the panels are 6 ft. by 27 ft. by 8 in. thick. The panels were initially placed in the wet for erosion control, and they are not keyed together or anchored to the bottom. Multi-beam bathymetric surveys show that many of the concrete panels have been dislodged and scouring has occurred within the lock chamber.

Smaller ballast blocks were used to help anchor the sector gate sill during dewatering events, and these blocks have also moved into the lock chamber. Some of the floor panels have moved as much as 30 feet. There is concern that one or more of the dislodged concrete panels or ballast blocks might move onto the sector gate sill area, causing the gates to be inoperable until the obstruction is removed. A concrete ballast block or panel could potentially be pushed out of the way by the sector gate, but it would be a problem if the obstruction becomes wedged in a location that could damage the lock or interfere with the operation of the sector gates. In order to prevent future problems for navigation or damage to the sector gates, the floor will need to be designed/repared to withstand the loads that exist within the lock chamber.

The extreme forces and loads that damaged the lock chamber floor potentially originate from different sources. One of the sources is the gate openings when there are backflow events, or whenever a large differential exists between the Lake Michigan and Chicago River water levels. Another likely source is the prop wash from large, powerful vessels or tug boats that are transporting heavy loads and/or are navigating through ice-filled waters. In addition, emergency vessels periodically need immediate access through the lock chamber, so both sets of gates must be opened simultaneously, and the emergency vessels move rapidly through the lock chamber.

The main objective of this project is to construct a more secure and solid floor for the lock chamber that will be capable of withstanding the most severe conditions that are anticipated to occur. The floor will be designed to resist the loads and water forces that have caused the existing concrete panels to become dislodged and have produced the scour holes. It is anticipated that some of the existing floor panels and ballast blocks will need to be removed to prevent them from damaging the sector gates or interfering with gate operations. The overall goal is to provide safe navigation for vessels to travel between the Chicago River and Lake Michigan.

Alternative designs for repairing the Chicago Harbor Lock floor are currently under development, but the main alternatives being considered are the placement of underwater concrete using a tremie or the placement of precast concrete panels. In addition, different methods for structurally reinforcing, anchoring, and/or fastening the concrete floor panels together are being investigated.

Table 1. Project Summary	
Project Type:	Civil Works, Operations and Maintenance
Location:	Chicago, IL
Purpose/Function:	Repair of the floor for the Chicago Harbor Lock.
Key Physical Components:	Placement of cast-in-place and/or precast concrete panels.
Estimated Construction Cost:	\$10 M (feasibility level estimate)
E&D Product Method Delivery:	In-house design
Construction Delivery Method:	Fixed price construction contract with options

- b. Engineering and Design Products. The engineering and design products to be prepared and reviewed include the following:
- (1) Plans and Specifications (P&S)
 - (2) Design Documentation Report / Design Analysis
 - (3) Engineering Considerations and Instructions for Field Personnel (ECIFP)
- c. Required Quality Reviews.
- (1) District Quality Control (DQC): DQC procedures will be performed for all E&D products following local business processes.
 - (2) Agency Technical Review (ATR): The District Chief of Engineering has determined based on Tables 3 and 4 of QMS 08504 LRD that ATR *is* required.
 - (3) Type II Independent External Peer Review (IEPR), Safety Assurance Review (SAR): The District Chief of Engineering has determined that the project *does not* pose significant life safety risks and a Type II IEPR (SAR) *is not* required.
- d. Technical Risk Analysis and Review Charge: ATR *is* required and a review charge will be prepared and issued to each review team. According to paragraph 7.4 d and Table 4 of QMS 08504 LRD, the reviews will focus on the following primary project complexities and risks:
- (1) The lock chamber will not be dewatered during construction, so the design team is evaluating underwater techniques for the repairs to the floor, such as the use of tremie concrete and/or precast concrete placement through the water column.
 - (2) The floor must be designed to resist the extreme forces that have caused the movement of the existing, 6 ft. by 27 ft. by 8 inch thick precast concrete blocks and scouring. This includes the analysis of the uplift forces caused by the differential water levels, as well as the hydraulic forces from opening and closing the gates, backflow events, prop wash, navigation during icy conditions, and emergency vessel operations, when the lock gates might need to be opened simultaneously. The floor needs to be designed prevent future scouring.
 - (3) The review will further need to evaluate the strength and durability of the different materials that are to be used for the floor, including the placement techniques, the use of cast-in-place (tremie) concrete and/or pre-cast panels, the reinforcement of the concrete, connections between the sheet piles walls and the floor, and methods for anchoring of the floor to the existing lake bottom.
 - (4) The repair work to the lock chamber floor will be restricted to the time period between November 16th and April 14th (24 hours/day, 7 days/week), so the work will not have a negative effect on the boating season. The analysis will need to take into consideration that a substantial portion of the construction

work will likely be need to be performed under the cold weather conditions that typically occur in the Chicago area during this time period.

- (5) The lock will be closed during the repair work, so an advance notice to mariners will be provided to ensure emergency responders and others that may need to use the lock during the restricted time period can make alternate arrangements to navigate between the Chicago River and Lake Michigan.
- (6) Close coordination between the Contractor performing the repair work and the lock operation manager will be necessary to ensure that there is adequate warning and appropriate steps can be taken if the lock sector gates need to be opened, such as for a backflow event.

4. PROJECT DELIVERY TEAM (PDT)

The project delivery team members are listed in Attachment A.

5. REVIEW EXECUTION

District quality control (DQC) will be performed per Chapter 3 of ER 1110-1-12 and Section 8 of EC 1165- 2-217. ATR shall be performed in accordance with Section 9 of EC 1165-2-217. Based on the review charge in paragraph 3.d, the technical discipline(s) and expertise required for the ATR are shown in Table 1. ATR reviewers are listed Attachment 1. Type II IEPR (SAR), if required, will be executed in accordance with procedures in Appendix E of EC 1165-2-217 and as directed by the RMO.

6. REVIEW SCHEDULE AND BUDGET

The schedule and budgets for reviews are shown in Table 2. Note that review dates are tentative, and dependent on other phases of work which are being conducted by other entities. Review dates must be updated if the work by others slips, or if the scope changes.

Table 2. Review Schedule and Budgets			
Review	Start Date	Finish Date	Budget (\$)
30% Design DQC / BCOES	June 1, 2020	1 week after start	\$5,000/occurrence
60% BCOES / ATR / DQC	July 15, 2020	2 weeks after start	\$5,000/occurrence
90% BCOES / ATR / DQC	September 15, 2020	4 weeks after start	\$10,000/occurrence
100% Backcheck	October 27, 2020	1 week after start	\$2,000/occurrence

7. REVIEW PLAN POINTS OF CONTACT

Questions and comments relating to this review plan can be directed to the following points of contact:

- a. District Project Leaders.
 - (1) Project Manager: Mike Nguyen, CELRC-PMD-MS, (312) 846-5555, Mike.Nguyen@usace.army.mil
 - (2) Chief of Design Branch: John Groboski, CELRC-TSD-DC, (312) 846-5417, John.A.Groboski@usace.army.mil
- b. Review Management Organization (RMO) Representative: Frank Appelfeller, RMO, 513-684-6200, Frank.A.Appelfeller@usace.army.mil

8. DISTRICT

Technical Risk Analysis has been completed for this project and the required quality reviews have been determined.

GROBOSKI.JOHN.A.JR.1
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RECOMMEND FOR APPROVAL:

John A. Groboski, P.E.
Chief of Design Branch

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DISTRICT APPROVAL:

Linda M. Sorn, P.E.
Chief of Engineering and Construction

Attachment A – TEAM MEMBERS

PROJECT DELIVERY TEAM		
Function/Discipline	Name (Last, First)	Office
Project Manager	Nguyen, Mike	CELRC-PMD-MS
Technical Lead	Saichek, Rich	CELRC-TSD-HE
Structural Engineer	Al Jawhar, Ammar	CELRC-TSD-TD
Civil Engineer	Kluza, Witold	CELRC-TSD-CC
Cost Engineer	Chartouni, George	CELRC-TSD-CC
Specifications Specialist	Bush, Leslie	CELRC-TSD-CC
Geotechnical Engineer	Pickering, Christopher	CELRC-TSD-GE
Geologist	Kissane, Joe	CELRC-TSD-GE
Environmental Engineer	Saichek, Richard	CELRC-TSD-HE
Hydraulic Engineer	Kiel, David	CELRC-TSD-HE
Geospatial Lead	Ennis, J.D.	CELRC-TSD-DC
Area Engineer	Paredes, Roberto	CELRC-TSD-NA
Real Estate Specialist	Harris, Lillian	CELRC-PMD-RE
Contract Specialist	Blair, Regina	GECT-GAC
Operations	Scott Kozak	CELRC-ORB-H
DQC REVIEWERS		
Function/Discipline	Name (Last, First)	Office
DQC Lead	Leffler, Faye	CELRC-TSD-TD
Structural Engineer	Force, Dave	CELRC-TSD-TD
Civil/Cost Engineer	Mishra, Rana	CELRC-TSD-CC
Geotechnical Engineer	Hlepas, Georgette	CELRC-TSD-GE
Hydraulic Engineer	Schmidt, Joel	CELRC-TSD-HE
Environmental Engineer	Miller, Jennifer	CELRC-TSD-HE
BCOES REVIEWERS		
Function/Discipline	Name (Last, First)	Office
Biddability	Blair, Regina	CECT-GAC
Constructability	Stavrides, Phil	CELRC-TSD-CB
Operability	Kroll, Tim	CELRC-TSD-O
Environmental	Schmidt, Joel and Miller, Jennifer	CELRC-TSD-DH
Safety	Flanagan, Pete	CELRC-GSO
Legal	Jerbi, Kevin	CELRC-GOC
ATR REVIEWER(S)		
Function/Discipline	Name (Last, First)	Office
ATR Lead/Structural Engineer	Anderson, Brent	CEMVR-EC-DM
Structural Engineer	DeLong, Cory	CEMVR-EC-DS
Geotechnical Engineer	Rudsell, Jarin	CEMVR-EC-G

Table 1A. ATR Technical Discipline(s) and Expertise	
Technical Discipline or Reviewer Name	Expertise Required
Anderson, Brent	Structural Engineer
DeLong, Cory	Structural Engineer
Rudsell, Jarin	Geotechnical Engineer