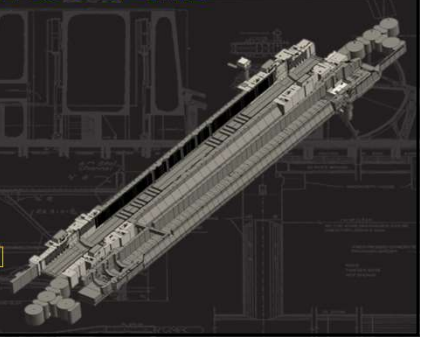
NEW LOCK AT THE SOO UPDATE



Brian A. Lucarelli, P.E.
Concrete Materials Engineer

24 October 2023

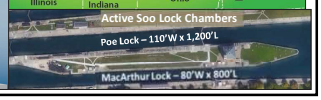
U.S. ARMY US Army Corps of Engineers

PRESENTATION OVERVIEW

- Soo Locks Background
- New Soo Lock Status:
  - Phase 1 – Upstream Channel Deepening
  - Phase 2 – Upstream Approach Wall
  - Phase 3 – New Lock Chamber
- Phase 3: Concrete Materials Design & Construction

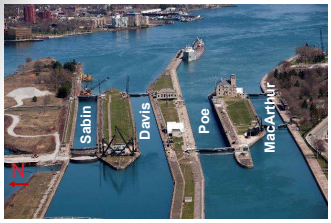
SOO LOCKS IMPORTANCE

- Nearly all domestically produced high strength steel is made with iron ore that transits the Poe Lock
- Within 2-6 weeks of an unscheduled Poe Lock outage, 75% of our nation's high strength steel production would cease
- Six-month unscheduled outage would result in 11 million jobs lost and $1.1 trillion economic impact

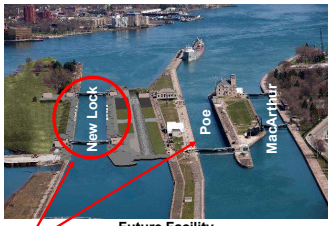


NEW LOCK AT THE SOO

U.S. ARMY



Current Facility



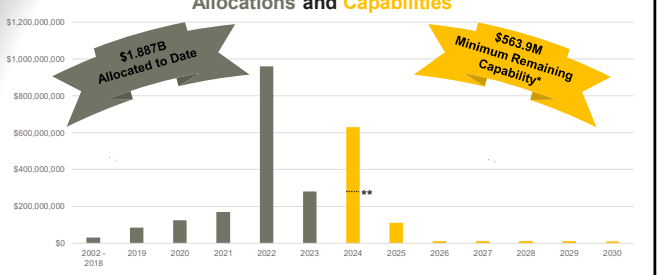
Future Facility

New lock will have **same dimensions** as existing Poe Lock (1200 ft length by 110 ft width and a depth of 32 ft)

NEW LOCK AT THE SOO ALLOCATIONS & CAPABILITIES

U.S. ARMY

Allocations and Capabilities



*An additional $768M in contingency remains within the authorized project cost of $3.219B that may be required for risks that could be realized during construction.
** Project included in FY24 President's Budget Request for $235M

NEW LOCK AT THE SOO CONSTRUCTION STATUS

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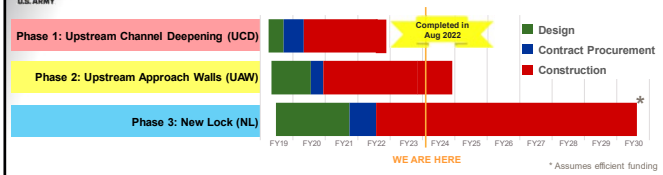
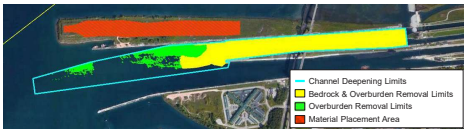


PHASE 1: UPSTREAM CHANNEL DEEPENING UPDATE



Scope: Remove 300,000 CY of bedrock and overburden to deepen the Approach Channel to depth of 30 feet

Construction Status:

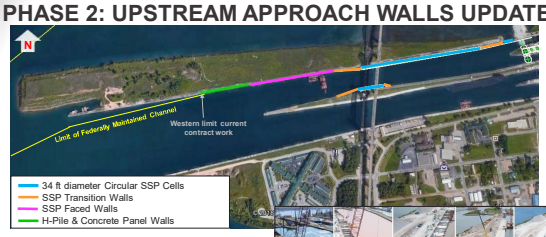
- $52.6M Contract awarded in January 2020 to Trade West Construction Co. of Nevada
- Work completed ahead of schedule on 1 August 2022
- Closeout activities in progress

PHASE 1: UPSTREAM CHANNEL DEEPENING

Bedrock from Upstream Approach Channel

Overburden from Upstream Approach Channel

PHASE 2: UPSTREAM APPROACH WALLS UPDATE



Scope: Rehabilitate approach walls upstream of new lock including reconstruction/refacing existing 100-year-old walls, installation of new lighting, bollards, and concrete cap repairs.

Construction Status:

- $117M Contract awarded in September 2020 to Kokosing-Alberici
- Contractor is generally working from East to West and has completed 83% of the required contract work.

Estimated Completion: Summer 2024

PHASE 2: UPSTREAM APPROACH WALLS

34 FT DIAMETER CELLS

Template used to construct circular steel sheet pile cells

Sheet piles are 30' strips of steel placed within coffer cell template

Concrete placement in cell

PHASE 2: UPSTREAM APPROACH WALLS

2022 PROGRESS

PHASE 3: NEW LOCK UPDATE

Scope: Construct new 1,200' long by 110' wide by 32' deep chamber, New Pump Well, and New Power Plant Bridge, and rehabilitate downstream approach walls.

Construction Status:

- Contract awarded in July 2022 to Kokosing Alberici Traylor, LLC
- Current contract award valued at $1.347B (72% of total contract cost)
- 2023 focus:
  - Demolition of aging structures
  - Extensive electrical work
  - Bridge construction
  - Coffer dam construction to allow for dewatering

Estimated Completion: Summer 2030

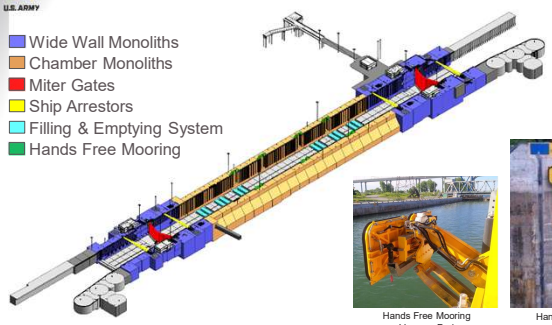
NL Construction Contract Cost

Total contract valued at $1.872B

PHASE 3: NEW LOCK KEY FEATURES

13

- Wide Wall Monoliths
- Chamber Monoliths
- Miter Gates
- Ship Arrestors
- Filling & Emptying System
- Hands Free Mooring



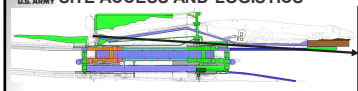
Hands Free Mooring Vacuum Pad

Hands Free Mooring Dynamic Unit

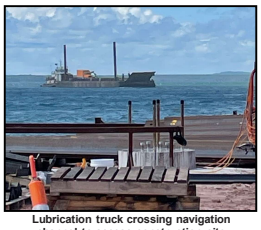
PHASE 3: NEW LOCK PROGRESS

SITE ACCESS AND LOGISTICS

14



Prefabricated bridge installed west of Unit 10, providing access to the Center Dike fill area



Lubrication truck crossing navigation channel to access construction site

Contract workers being shuttled to the construction site

PROJECT'S ECONOMIC IMPACT

15

- **1,240** jobs created on an annual basis
  - 600 direct jobs
  - 210 indirect jobs
  - 430 induced jobs
- **1,000,000** tons of limestone or granite
- **110,000** tons of American-made cement
- **25,000** tons of American-made steel

Upstream Approach Wall Tremie Concrete Placement

REGIONAL DESIGN TEAM

16

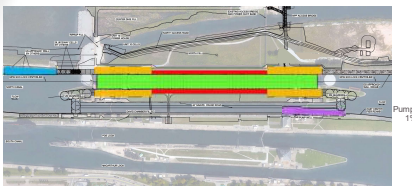
Designer of Record:
Inland Navigation Design Center

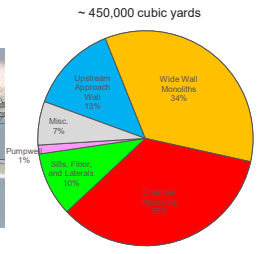
Design Support:

- Detroit District
- Huntington District
- Louisville District
- Nashville District
- Pittsburgh District

CONCRETE VOLUME BY FEATURE

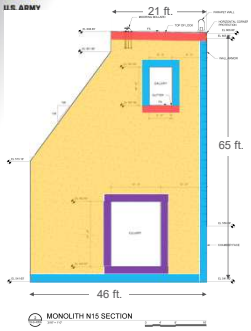
17





TYPICAL MONOLITH CROSS SECTION

18



Mix Name	Strength Requirement	Approx. Total Cementitious	Aggregate Size
Lock Wall Topping	3500 psi @ 90 d	600 pcy	1"
Exterior Mass	3500 psi @ 90 d	450 pcy	2"
High Velocity	5000 psi @ 90 d	550 pcy	1"
Interior Mass	3000 psi @ 90 d	350 pcy	2"

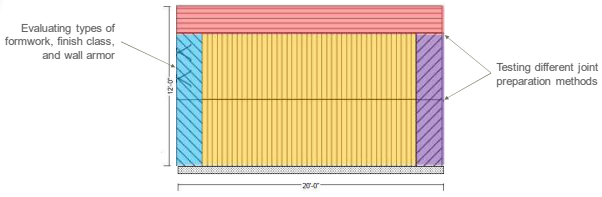
MASS CONCRETE

Mass Concrete Placement at Charleroi

Mass Concrete Monolith at Charleroi

MASS CONCRETE TEST SECTION

- Evaluate means and methods for concrete placement and consolidation
- Three lifts
- Full dimensions: 20' x 20' x 12'



NEW LOCK CHAMBER MATERIAL SELECTION

2019 - 2020	2021	2022	2023 to completion
Preconstruction Engineering & Design	Specification	Material Selection	Construction
• Evaluation & testing of available sources • Preliminary mixture proportioning with representative materials	• Minimum requirements	• Quality testing of selected aggregates • ASR evaluation • Production mixture proportioning	• Periodic quality testing

Material Change

RISK MITIGATION: CEMENTITIOUS AVAILABILITY

- Availability of fresh fly ash is an ongoing risk
- Research effort at ERDC's Geotechnical & Structures Lab (GSL) in Vicksburg, MS – availability and characterization of alternate supplementary cementitious materials
- 4 year program
- Literature review complete. Characterization phase ongoing.
- Investigation includes:
  - Reclaimed ashes
  - Limestone cements
  - Recycled glass
  - Biomass ash

Locations of Disposed Coal Ash
Image: Environmental Integrity Project

CONCRETE PRODUCTION

- On-site batch plant
- Dual 12 cubic yard tilting drum mixers
- 150 cubic yard per hour production capacity
- All materials delivered via water

Sand Delivery to Batch Plant

CONCRETE PRODUCTION: AGGREGATE

Temporary Aggregate Conditioning Building

Coarse Aggregate:

- **Conditioned** – continuously sprayed for 48+ hours
- **Wet screen** – removes small particles from aggregate surface
- **Wet belt** – cools or heats aggregate, depending on season
- **Rescreener** – Removed oversized and undersized particles, sorts aggregate into appropriate scale bin
- **Sampling** – Performed after rescreening. Testing for moisture content and gradation.

Fine Aggregate:

- **Conditioned** – covered for 48+ hours

COLD WEATHER CONCRETING

25

ACI 306R, "Guide to Cold Weather Concreting":

When air temperature has fallen to, or is expected to fall below, **40°F** during the protection period; protection period is defined as the time recommended to prevent concrete from being adversely affected by exposure to cold weather during construction

Average Temperatures in Sault Ste. Marie, MI

COLD WEATHER CONCRETING

26

Goal: Keep concrete above 40 °F.

Heated Tents

Insulated Formwork or Blankets

Combination of Methods

COLD WEATHER CONCRETING

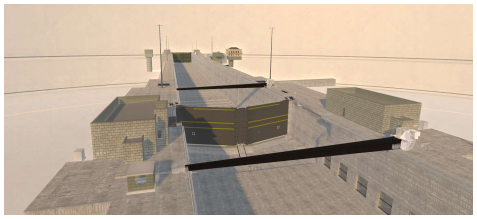
27

Insulation Installation at Batch Plant

- As-awarded specifications are prescriptive traditional methods for cold weather protection.
- Contractor is implementing methods to extend the construction season:
  - Insulation of batch plant components
  - Insulation of truck liners
- Evaluating potential implementation of performance-based cold weather protection.

QUESTIONS

28



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