Olmsted Locks and Dam – Heritage In Transportation Engineering
TEAM 2018 Conference

Presenter:
Sharon Hoffmann, P.E.

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Olmsted Locks & Dam Replacement Project
Olmsted Locks and Dam on the Ohio River
Agenda

1. Overview of Inland Waterway System
2. Inland Waterway System Current Condition & Necessary Improvements
3. Ohio River Demand & Olmsted’s Importance to the Nation
4. Olmsted Dam’s Design & Innovative Method of Construction
Heritage of the U.S Inland & Intracoastal Waterways

- 25,000 miles of waterways
- 239 locks
- > Half Million Jobs
- 600 Million Tons of Cargo
- 14% of Domestic Freight

Source: ASCE Infrastructure Report Card
Nation’s Freight Network

Inland Waterways

- Shared by only 38 states
- Maintained by the USACE
- ~12,000 miles constitute the Commercially Active Inland and Intracoastal Waterway System
- 575 million tons of Cargo
- $229 Billion

Source: USACE and ASCE Infrastructure Report Card
Alternate Transportation Mode Comparison

<table>
<thead>
<tr>
<th>Mode</th>
<th>Capacity</th>
<th>Equivalent Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barge</td>
<td>1500 Ton, 52,500 Bushels, 453,000 Gallons</td>
<td>1/4 Mile</td>
</tr>
<tr>
<td>15-Barge Tow</td>
<td>22,500 Ton, 767,500 Bushels, 6,804,000 Gallons</td>
<td>2 3/4 Miles</td>
</tr>
<tr>
<td>Jumbo Hopper Car</td>
<td>100 Ton, 3,500 Bushels, 30,240 Gallons</td>
<td>2 1/4 Unit Trains</td>
</tr>
<tr>
<td>100 Car Unit Train</td>
<td>10,000 Ton, 350,000 Bushels, 3,024,000 Gallons</td>
<td>34 1/2 Miles</td>
</tr>
<tr>
<td>Large Semi</td>
<td>26 Ton, 910 Bushels, 7,865 Gallons</td>
<td>Assuming 150 Ft. Between Trucks</td>
</tr>
</tbody>
</table>

Source: USACE
Federal Role Supporting Navigation
Federal Role Supporting Navigation

U.S. Department of Transportation (DOT)

- U.S. Coast Guard
  - Vessel and Navigation Safety
  - Provides Navigation Aids
  - Search and Rescue Services

- Maritime Administration
  - U.S. ports
  - Intermodal Systems
  - Domestic Shipping
Federal Role Supporting Navigation

U.S. Army Corps of Engineers (USACE)
Facilitates the safe, reliable and economically efficient movement of vessels by constructing and maintaining navigation channels and harbors, and regulating water levels on inland waterways.
Historical Wicket Gates of the Navigable Pass
Wicket Gates of the Navigable Pass

[Diagram showing wooden wicket and prop]

[Diagram showing wicket in raised position]
Historical Wicket Gates of the Navigable Pass
Lock Chamber
Modern Day Improvements
Lock Chambers – 600 ft to 1200 ft
Ohio River - Lock & Dam 52 Beyond Service Life

Aerial Photo

Beartrap
Repairing the wicket
The Lock and Dam 52 is undergoing repairs, according to Lock Master Ron Hall. In the center a missing wooden wicket can be detected. Hall said that every year repairs have to be made to the wickets, which are 20 years old. Repairs must be done, regardless of water levels.
Ohio River - Lock & Dam 53 Beyond Service Life

- Displaced Guide Wall Panel
- Upstream Guide Wall Misalignment
- Flume Panel
Ohio River – Olmsted Locks & Dam
Importance to the Nation

Major Hub Connecting Mississippi, Tennessee, Cumberland and Ohio Rivers

Source: USACE
Ohio River – Importance to the Nation

More tonnage passes this point than any other place in America’s inland navigation system.

<table>
<thead>
<tr>
<th>SITE</th>
<th>LOCATION</th>
<th>RIVER</th>
<th>2015 TONNAGE IN MILLIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock and Dam 52</td>
<td>Brookport, Ill.</td>
<td>OHIO</td>
<td>80.8</td>
</tr>
<tr>
<td>Lock and Dam 53</td>
<td>Grand Chain, Ill.</td>
<td>OHIO</td>
<td>72.3</td>
</tr>
<tr>
<td>Soo Locks</td>
<td>Sault Ste. Marie, Mich.</td>
<td>ST. MARYS</td>
<td>69.6</td>
</tr>
<tr>
<td>Newburgh Lock and Dam</td>
<td>Newburgh, Ind.</td>
<td>OHIO</td>
<td>69.1</td>
</tr>
<tr>
<td>Smithland Lock and Dam</td>
<td>Hamletsburg, Ill.</td>
<td>OHIO</td>
<td>63.7</td>
</tr>
<tr>
<td>McAlpine Locks and Dam</td>
<td>Louisville, Ky.</td>
<td>OHIO</td>
<td>62.0</td>
</tr>
<tr>
<td>Cannelton Locks and Dam</td>
<td>Cannelton, Ind.</td>
<td>OHIO</td>
<td>61.8</td>
</tr>
<tr>
<td>Lock and Dam 27</td>
<td>Granite City, Ill.</td>
<td>MISSISSIPPI</td>
<td>60.3</td>
</tr>
<tr>
<td>John T. Myers Locks and Dam</td>
<td>Mt. Vernon, Ind.</td>
<td>OHIO</td>
<td>56.5</td>
</tr>
<tr>
<td>Melvin Price Locks and Dam</td>
<td>East Alton, Ill.</td>
<td>MISSISSIPPI</td>
<td>53.7</td>
</tr>
</tbody>
</table>

Source: USACE
Ohio River – Importance to the Nation
Locks & Dams 52 & 53 Condition & Closures

September 6 to November 10, 2017

~ 19 days of **TOTAL RIVER CLOSURE**
~ 1,117 tows moving 11,574 barges **DELAYED** 58.83 hours
~ 3050 **LOST** boat days
~ $5,000 A **DAY** to run a towboat
~ **3.4 million tons** of capacity out of the system

$40+**million** due to delays
Ohio River – Importance to the Nation
Olmsted Locks & Dam Replacement Project

**Annual Economic Benefits To The Nation**

> $640 Million

**Operation and Maintenance Costs**

*Reduced*

**Barge Traffic Will Move Faster**

Currently at 52 & 53 – 5 hours

vs.

New Olmsted Locks – 1 hour
Olmsted Locks & Dams - Components

- Fixed weir
- Left boat abutment
- Navigable pass
- Locks and approach walls
- Tainter gates
- Operations facilities
- Resident engineers office
- Dam access road

Source: U.S. Army Corps of Engineers. | GAO-17-147
Dam Method of Construction
In-the-Dry vs In-the-Wet
Dam Method of Construction
In-the-Dry

Red River Lock and Dam No. 4
USACE – Vicksburg District
Olmsted Dam Method of Construction
Lock Construction In-the-Dry
Olmsted Dam Method of Construction
Lock Construction In-the-Dry
Olmsted Dam Method of Construction
Lock Construction In-the-Dry
Olmsted Dam Method of Construction
In-the-Wet

Source:

[Logos of AECOM and Alberici Constructors]
Olmsted Construction Site Overview
Olmsted Construction Site Overview
Shell Set Down on River Bottom

- Catamaran Barge
- Landing Pads
- Lower Pier Shell
- Baffle Blocks
- Sill Shell Placement 2
- Stilling Basin Shell Placement 1
Shell Set Down on River Bottom

Note - Gates not shown for clarity
Precast Yard – Shell Construction
Precast Shell Size

ONE Stilling Basin Shell
(Six total in the Tainter Gate Section)

ONE Sill Shell
(Six total in the Tainter Gate Section)
Precast Shell Size

ONE Pier Shell (Six total in the Tainter Gate Section)
Precast Yard – Sill Shell Lift by Super Gantry Crane

Size - 125’ x 102’ x 30’ tall

Shell Dry Weight - 4100 tons
Shell & Lift Frame – 4900 tons

Shell Submerged Weight - 2600 tons
Precast Yard – Stilling Basin Shell Lift by Super Gantry Crane

Size - 125’ x 116’ x 18’ tall

Shell Dry Weight - 4000 tons
Shell & Lift Frame – 4900 tons

Submerged Weight - 2500 tons
Precast Yard – Lower Pier Shell Construction

Size - 102’ x 69’ tall x 14’ wide

Shell Dry Weight - 2300 tons

Submerged Weight - 1500 tons
Precast Yard – Lower Pier Shell Lift by Super Gantry Crane
Cradle Transport Equipment System
Cradle Transport Equipment System
Cradle Transport Equipment System
Tainter Gate Section Construction
Pier Shell In Place - Prior to Tremie Placement
Olmsted Dam Construction –
From precast yard to river bed
Design Considerations – Load Conditions for Shell Design

- Fabrication & On-Shore Handling
- Pick-up and Transport
- Set Down In-the-Wet
- Tremie Placement
- Final Configuration Service Loadings
  - Dead Load
  - Stream Forces
  - Barge Impact
  - Gate Bay Dewatering
  - Seismic
Design Considerations – Method of Construction

• Dual role for shells: tremie form and flow surface
• Shell weight & dimensions critical for sizing marine equipment
• Localized loadings on lifted shells
• Load reversal in areas of shells
• Design for flexure and shear vs. mass concrete
• Result: stiffened plate elements, 12” to 24” thick, reinforcing on both faces, dowels for composite action with tremie infill
Olmsted Dam Tainter Gate Section
Upper Pier Construction
Tainter Gate Installation
Tainter Gate Installation
Tainter Gate Installation
Tainter Gate Installation
Olmsted Dam Navigable Section
Wicket Gates
Olmsted Dam Navigable Section
Wicket Gates
Olmsted Locks & Dam Project – A Heritage in Transportation
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Thank you!
Sharon Hoffmann