U.S. Army Corps of Engineers
Louisville District
Olmsted L&D, Dam
In-the-wet Construction

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Olmsted Locks & Dam Project

1996 rendering of completed project
Navigation Projects
Ohio River
KY, IL, IN, OH, WV and PA
Olmsted Dam
Cost Reimbursable Contract

Contractor: Washington Group/Alberici

Award: 31 March 2004

Estimated Cost: $564,148,484.00

Completion Date: 30 November 2011
Olmsted Dam Cost Reimbursable Contract
(Cost –Plus- Award Fee)

- Risk is shared
- Collaboration:
  - Contractor
  - Design AE
  - Corps
- Work is Controlled with “WAD’s”
- Items purchased are Corps’ Property
- Contractor’s Award Fee based upon performance.
Brief History

Dam Construction Studies

- Cellular Cofferdam
- Braced Single – Wall Cofferdam
- Mobile Cofferdam
- In - the - Wet Construction
In – the – Wet Construction

- **Pre-cast Shell Construction**
  - On – site casting yard
  - Marine way to lower shells to river
  - Lifting frames to stiffen shells

- **Foundation Prep In – the – Wet**
- Set shells with catamaran barge
- Fill shells with tremie concrete
- Set Tainter Gates
Catamaran with Lower Pier Shell

- Catamaran Barge
- Lower Pier Shell
- Sill Shell
- Placement 2
- Baffle Blocks
- Placement 1 Stilling
- Basin Shell
- Landing Pads
- Phase 2
- Monolith 1
- Monolith 2
- Monolith 3
Placement of Upper Pier Shell Elements

Phase 2

14 ft. Pier Wall

Training Wall

NOTE: Gates not shown
Tremie Concrete Sequence

STAGE 4 POUR
SCALE: 1" = 10' - 0"
Relative Scale
Dam Site May 2005
Original Scope

+ Government only provided conceptual design on means and methods. Gave Contractor considerable latitude to propose changes.

+ Government if requested would provide design engineer to finish conceptual designs (means and methods) or redesign features of work if contractor had a better idea.
Design Changes to Tainter Gate Shells for Super Gantry Method of Construction at The Olmsted Dam Project Jacobs / Gerwick - A Joint Venture in Partnership With The Louisville District, COE

Presented By: Dale Berner, PhD, PE
Differences between the Initial and the Super Gantry Construction Methods

**INITIAL Plan**
- Precast Elements for Building the Shells.
- Shells Built on Sleds.
- Shells Can Only be Lifted Submerged.
- Tremie Reinforcing Mats Pre-Installed.
- Uses Temporary Scour Articulated Concrete Mats.
- Tremie from Floating Plant.

**SUPER-GANTRY PLAN**
- The Shells Are Cast-in-Place.
- Shells Built on Slabs.
- Shells Can be Lifted In-the-Dry.
- Tremie Mats Lifted-in with the Shells.
- Uses Permanent Grout Mats for Scour Control.
- Tremie from Land Plant.
Initial Precast Yard Concept

- Marine Skidway
- Landbase Skidway
- Precast Beds
Super Gantry Casting Bed Alignment
Preparation for Marine Skidway
Typical Casting Slab on Grade
Preparation for Pile Supported Casting Slab
Casting Sequence for Tainter Gate Shells
Casting Sequence for Navigable Pass Shells
Localized Supplemental Reinforcing in a Typical Slab
Common Types of Shells and Tremie Mat Templates
Typical Template for Tremie Concrete Reinforcing Mat
Typical Tremie Rebar Mat on Template
Typical Cross-Section of Tremie Rebar Mat on Template
Typical Shell Lifted By Super Gantry Crane onto Tremie Mat
Typical Shell / Rebar Mat / Template on Marine Skidway Cradle
Cradle for Marine Skidway

Marine Rails
Plan View of Catamaran Crane Barge & Snubbing System
Profile View of 5,000 tons Catamaran Crane Barge & Snubbing System
5,000 TONS Catamaran
Lowering Tainter Gate Sill Shell
Erection of Pre-Fabricated Tainter Gate
Navigable Pass Section of Olmsted Dam

WICKET GATE (TYP.)
140 INSTALLED
Sequence of Construction for Navigable Pass
Typical “Controlled Moment” Pile Connection

- TOP RING
- 12” DIA PILE HEAD
- 2’ DIA PILE
- CRUSHABLE FOAM
- LEVELING COURSE
- DRAINAGE
Typical Landing Pile with Flat-Jacks

- FLAT JACKS
- GROUT LINES
- LANDING PAD PILE
Sequence for tremie Concrete Placement for Navigable Pass

STAGE 1 POUR

STAGE 2 POUR
Typical Elevation of Navigable Pass

PAVING BLOCK

CONTROLLED FIXITY PILES
2005 Infrastructure Systems Conference

Design Changes to Tainter Gate Shells for Super Gantry Method of Construction at The Olmsted Dam Project Jacobs / Gerwick - A Joint Venture in Partnership With The Louisville District, COE

Presented By: Ken Burg Project Manager
Major Project Components

- Downstream Scour Protection
- Twin Locks
  - 110’ wide x 1200’ long
- Lock Tainter Gate Section
  - 654’
- Navigable Pass Section
  - 1400’
- Fixed Weir (Cells)
  - 225’
- Illinois
- Kentucky
- Sheet Pile Cutoff Wall
- 2596’
- 370’
Tainter Gate Section
Precast Shell Statistics

- **Sill Shells**
  - 125’ x 102’ x 30’, 3683 tons dry, 2151 tons wet

- **Stilling Basin Shells**
  - 125’ x 116’ x 18’, 3647 tons dry, 2130 tons wet

- **Lower Pier Shells**
  - 102’ x 69’ x 14’, 2112 tons dry

- **Upper Pier Shells**
  - 57’ x 30’ x 14’, 601 tons dry; will be cast in place with this method
Original Method of Construction

- Prepare *in-the-river* foundation, complete with piles and tremie reinforcing mat
- Cast shells on shore, self weight fully supported
- Move shells into water, self weight fully supported
- Pick up and transport shells submerged
- Set shells in place on prepared foundation and fill with tremie concrete
Super Gantry Method of Construction

- Prepare in-the-river foundation and drive piles
- Cast shells on shore, self weight fully supported
- Attach lift frame to shells and remove secondary shoring
- Lift shells in-the-dry and mate with tremie reinforcing on skidway
- Move shells into river and transport partially submerged
- Set shell and tremie reinforcing over piles and fill shells with tremie concrete
Changes in Design Requirements

- *In-the-dry* lift increases load to shells and lift frames by a minimum of 70%.

- Transport is partially submerged; center of gravity of lift changes during setdown; loads to catamaran barge increase.

- Connections between shell / lift frame and between lift frame / catamaran are much larger.

- Shell geometry and reinforcing revised for increased loading.
Revisions to Shells for Super Gantry - 1

- Increase dimensions of selected stiffening elements to accept additional reinforcing / maintain existing reinforcing
- Increase size / decrease spacing of selected reinforcing
- Revise intersection of typical stiffening element for larger connection to lift frame
- Increase “gap” between shells for increased clearance at set down
- Revise continuity reinforcing to include portions of tremie reinforcing
- Revise tremie reinforcing to clear casting supports
Revisions to Shells for Super Gantry - 2

- Revise (shorten) training walls on SBS-6 shell to clear larger catamaran
- Revise connection between Sill Shell and Lower Pier Shell for reinforcing assembly in-the-dry after mating and dewatering
- Revise underdrain details and location to clear splice location between shell continuity bars and tremie reinforcing mat
Revise Training Wall on SBS Shell
Revise Training Walls on SBS Shell
Revised Sill to Lower Pier Connection

ORIGINAL DESIGN

REVISED DESIGN
Revisions to Shells for Super Gantry

SS to SS INTERFACE

Notes:
1. Typical at SS-1 to SS-2, SS-3 to SS-4 and SS-5 to SS-6.
2. At Contractor’s option, install with shell continuity bars or tie to shear reinforcing and position after mating shell and rebar mat.
3. Using splice bars from S-72, rotate bars back and position after shells mated to rebar mat.
4. At Contractor’s option, install with continuity bars or pull back and position after shell mating with rebar mat.

REBAR CODE
1. Green rebar is shell continuity reinforcing.
2. Blue rebar is tremie rebar mat reinforcing.

C/L Pipe Pile
10'-8"
C/L Pipe Pile
10'-8"
C/L Pipe Pile
Revisions to Lift Frames for Super Gantry

- Configure Lift Frames for SBS-1 for reuse with SBS-6 with minimum rework
- Revise connection between shell / frame to meet Contractor preferences for location and orientation
- Add man door to bottom of leg for personnel access to assemble shell/frame connection; reinforce leg
- Add full area access platforms to top of lift frame to meet Contractor work plan
- Revise wall thickness and material strength for selected leg members to match demands from increased loadings
Revisions to Lift Frames for Super Gantry

Shell SBS-1
Revisions to Lift Frames for Super Gantry

Shells SBS-2 thru SBS-5
Revisions to Lift Frames for Super Gantry

Shell SBS-6
Revisions to Lift Frames for Super Gantry

Shell SS-1
Revisions to Lift Frames for Super Gantry

Shells SS-2 thru SS-5
Revisions to Lift Frames for Super Gantry

Shell SS-6
Summary

The Super Gantry Method of Construction required re-analyses of the shells and lift frames for loadings approximately 70% greater than the original design.

Modifications to the shells and lift frames have been included almost entirely within the geometric envelope of the original design.

The sequence of work has been modified drastically compared to the visible modifications to the shells and lift frames.

The Super Gantry Method of Construction provided the Contractor with the benefits of reduced operation time in the river with more mating operations completed on shore in-the-dry
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