Mark Gonski, PE - New Orleans District

Topics:
Project, Overview
Agenda

- **Mark Gonski, PE - New Orleans District**
  - Topics: Project, Overview

- **David Lapene, PE - URS Corporation**
  - Topics: Team Overview, Design Criteria, Operational Design

- **Dale Miller, PE - INCA Engineers, Inc**
  - Topics: Float in Construction Sequence & Design

- **Mark Gonski, PE - New Orleans District**
  - Topics: Lessons Learned from Harvey Canal, IHNC CIP Study
Inner Harbor Navigation Canal Lock Replacement Project
Project Schedule

- Feasibility Report Submitted: Mar 1997
- Construction Authorization
- Design Report Complete: Nov 2005
- P&S Completion: Jan 2007
- Lock Construction Start: Oct 2007
Construction Status

Test Pile Contract
Completed Aug 2003

Galvez St. Wharf
Completed Feb 2003

T.E.R.C. Contract
Completed Dec 2004

9 Mooring buoys
Completed Apr 2003

Test Pile Contact
Model - Looking from river side
David Lapene, PE - URS Corporation

Topics:
Team Overview, Design Criteria, Operational Design, Module Draft Study
INNER HARBOR NAVIGATION CANAL LOCK REPLACEMENT

USACE New Orleans District

URS A/E Team Major Firms Include:
URS Group, Inc.,
Brown, Cunningham, & Gannuch, Inc.,
Jacobs Civil, Inc.,
INCA Engineers, Inc.,
Ben C. Gerwick, Inc.,
The Glosten Associates, Inc., and
Eustis Engineering Company, Inc.
How Did URS Select Team Firms?

- **What expertise does the project require?**
  - Depth and breadth in project management
  - Staff with lock knowledge and experience
  - Float-in and naval architecture expertise
  - Intimate knowledge of local soil characteristics
Coordination Process

- Progress and coordination schedule
  - Developed on MS Project and distributed

- Team management teleconference every two weeks between PM’s of all offices
  - Schedule / budget / technical quality / deliverables

- URS / BCG project management face to face meeting every two weeks (or as required)
  - Client relationships / contract obligation / budget / team directives
Coordination Process Continued

- Design coordination teleconferences biweekly
  - Design methodology and philosophy / exchange of data / schedule / drawing standards / DCD / construction methodology

- Progress and coordination drawing reviews
  - Approximately every three months
Quality Control and Quality Assurance
(Every Submittal)

- **Page by page quantitative check by each firm**
  - Documentation provided to USACE

- **Independent Technical Review**
  - Qualitative review by each firm for design philosophy and methodology
  - Documentation provided to USACE

- **Project-wide ITR**
  - Qualitative check of all disciplines and designs as a whole by senior personnel with USACE lock experience
  - Documentation provided to USACE
Pile Driving

By Pass Channel
Lock Modules Floated In
Project Completed

New St. Claude Bridge
RIVER SIDE

- 10 triangular deflectors @ 28'
- 18 square deflectors @ 28'

LAKE SIDE

- 1287.67'

FLOAT-IN GATE MONOLITH 218'

FLOAT-IN CHAMBER MONOLITHS

FLOAT-IN GATE MONOLITH 218'

SECTOR GATES

LOCK FLOOR @ EL. -40.0

CULVERT 18'-3'' x 15'-0''(W)
INVERT EL. -40.0

FINAL LOCK LAYOUT
## Water Stages

<table>
<thead>
<tr>
<th>Case</th>
<th>Riverside</th>
<th>Lakeside</th>
<th>Head Difference</th>
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<tbody>
<tr>
<td>Normal Range</td>
<td>EL. 0.0 to 3.0</td>
<td>EL. 0.0 to 3.0</td>
<td></td>
</tr>
<tr>
<td>Normal Operation</td>
<td>EL. 10.0</td>
<td>EL. 1.0</td>
<td>9’</td>
</tr>
<tr>
<td>Direct Head</td>
<td>EL. 18.0</td>
<td>EL. 0.0</td>
<td>18’</td>
</tr>
<tr>
<td>Hurricane</td>
<td>EL. 0.0</td>
<td>EL. 13.0</td>
<td>13’ (Reverse Head)</td>
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<tr>
<td>Maintenance</td>
<td>EL. 10.0</td>
<td>EL. 5.0</td>
<td>64’ (Uplift Head)</td>
</tr>
<tr>
<td>Dewatering</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Operational Monolith Design Criteria

- EM 1110-2-2104 / ACI 318
- No load transfer between monoliths
- Shell $f'_c = 5000$psi
  - Structural infill = 3000psi
  - Nonstructural infill = 2000psi
  - $F_y = 60$ksi

- Normal-weight concrete
- Overstress factors
  - $O/S = 1.167 \rightarrow$ construction / usual maintenance dewatering
  - $O/S = 1.33 \rightarrow$ max. direct head / unusual maintenance dewatering

- Service load displacements
  - Settlement $\leq 0.5''$
  - Lateral displacement (usual cases) $\leq 0.5''$
  - Lateral displacement (unusual cases) $\leq 1.5''$
Infill Concrete in Base

- 24" bottom slab is not adequate to take beam shear from piles
- Considering half height structural infill concrete in cells
- Upper half to be nonstructural infill
Foundation Piles

- **48” Ø X 120’ pipe piles selected**
  - 900k compressive capacity
  - 320k tensile capacity
  - 14’ X 14’ grid at walls / 14’ X 20’ grid at chamber floor
  - Average compressive pile load → 75% capacity
  - Approximate cost in place = $47,000,000

- **Alternative pile study**
  - Considered 36” Ø X 120’ pipe piles
  - Approximately $4,000,000 more than 48” piles
Module Draft Study

Evaluate Two Drafts for the Float-in Modules

■ Shallow Draft

🎉 25’ allowable draft
🎉 Build to EL. (-) 19.75 in graving site and transport with attached cofferdam
🎉 Graving site invert EL. (-) 28.00

■ Deep Draft

🎉 32’ allowable draft
🎉 Build to minimum EL. 6.00 – no cofferdam needed at set down
🎉 Graving site invert EL. (-) 38.00
Shallow Draft Chamber Module

- Red denotes Float-in module built in graving site
- Allowable draft during transport 25’ with 2’ under keel clearance
- Attached cofferdam needed for set down
Shallow Draft Chamber Module

- Red denotes Float-in module built in graving site
- Allowable draft during transport 25’ with 2’ under keel clearance
- Attached cofferdam needed for set down
Red denotes Float-in module built in graving site

Allowable draft during transport 32’ with 2’ under keel clearance

No cofferdam needed for set down
Red denotes Float-in module built in graving site

Allowable draft during transport 32’ with 2’ under keel clearance

No cofferdam needed for set down
Draft Study Conclusions

Shallow Draft Configuration is Recommended

- Shallow draft is $3.2m less expensive
- No dredging required at Florida Ave. bridge
- Less reinforcing due to less hogging and sagging
- Easier to construct and transport
- Less construction time required
- Depth of excavation at graving site more appropriate for soils
Dale Miller, PE - INCA Engineers, Inc

Topics:

Float in Construction Sequence & Design
Lock Construction

- Graving Site
- Transport
- Set down
- Foundation Integration
- Monolith Completion
- Monolith Joints
Gate Bay Section Isometric
Concrete Shells

- 12’ to 14’ deep cellular base for transport
- Gatebays: 28’ X 28’ cells with 24” top and bottom slabs
- Chambers: 19’ X 42’ cells with 24” top and bottom slabs
- 24” bottom slab is not adequate to take beam shear from piles
- Considering half height structural infill concrete in cells
- Upper half to be nonstructural infill
Graving Site
Longitudinal Section Thru Bulkhead Slots

- Grade Beams
- Intermediate Sand Bed
Pile Plan

Key:
- Landing Pile
- Compression Piles
- Tension Piles
Landing Pile Preparation

CL PILE

GROUT OUT

+6.0

GROUT IN

+3.0

SEE "LANDING PILE DETAIL"

STEPS 1 & 2

STEP 3

STEP 4

Landing Pile Detail

GROUT, SEE NOTE 6

GROUT, SEE NOTE 6

BOTTOM OF Module AND TOP OF GROUT IN LANDING PILE

GROUT OUTSIDE OF PILE TO PREVENT BOND WITH UNDERBASE TYPICALLY CONCRETE

LandinG Pile DETAIL

SHOULDER JACK EXTENDED 3/4 TO ENGAGE LANDING PILE. JACK MAY COMPRESS AN ADDITIONAL 1/2 OF 
EXTEND AN ADDITIONAL 1/4 BASED ON THE ACTUAL LANDING PILE ELEVATION.
Mesh to Prevent Excess Tremie Infill
Compression Load to 3” x 11/2” x Continuous Shear Key
Tension Pile Connection

- Initially Retracted and Sealed
- Lowered and Grouted
Underbase Tremie Placement

- Tremie Platform by Contractor
- Tremie Pipe Sleeve
- Extension
- Tremie Sleeve Cast in Shell, Typ
- Tension Pile Cofferdam, Typ
- Brace Every 14', Typ
- Ballast Sand
- Detail 1
- Detail 2
- Detail 3
- Detail 4
- Strut Every 4', Typ
5% Negative Buoyancy on Landing Piles
SECTION A.A

STEP 1) CM2 ARRIVES AT LOCK SITE AND IS MOORED TO DOLPHINS AND THE PREVIOUSLY INSTALLED GB1. UNDERBASE TREMIE CONTAINMENT GROUT BAGS ARE WRAPPED AROUND THE MODULE.
Construction Sequence

PLAN - PREVIOUSLY INSTALLED GB1 AND INCOMING CM2
Mark Gonski, PE - New Orleans District

Topics:

Lessons Learned from Harvey Canal, IHNC CIP Study
Lessons From Harvey Sector
July 2005
Harvey Sector Gate Float-in
Low Bid =

- Insert plan of gate
Harvey Sector Gate CIP (rebid)
Low Bid =

- Insert plan of gate
Best Value Contracting Method
Best Value Lessons Learned
H.S.G. Summary of Lessons Learned
INDUSTRIAL CANAL LOCK REPLACEMENT

CIP FEASIBILITY STUDY
U.S. ARMY ENGINEER DISTRICT
NEW ORLEANS
Why is a cast-in-place option being explored?

a.) Harvey Sector Gate

I. $35 million CIP vs. $42 million Float-In.
   - $35 million cost could have been further reduced if time had permitted

II. Contractors increase cost for risk and marine costs when bidding on a Float-In construction.
   - Braddock and Olmstead costs are also significantly higher than proposed.
b.) Based on Contractor responses to URS A/E Team questionnaire.

   I. Sufficient room for CIP excavation provided cellular cofferdam is furnished on east side (need PM to further explore one-lane north by-pass as suggested by Users)

   c.) Cost comparison to float-in.

   I. Need unit costs from URS applicable to N.O. area at 95% submittal, of Phase I design

   d.) Risk

   I. With risks involved, bids may come in significantly higher than anticipated for float-in construction.
C. Foundation Design

I. Used 24” square PPC piles spaced at 8’ (10’ in chamber)
II. Gatebay

A. 2D sections taken utilizing flexible base design w/ pile capacities provided by springs.

B. Exterior walls designed as panels fixed on 3 sides and free at the top.

C. Interior walls designed as counterforts. Designed for lateral load from opposing walls and dead and live loads from top slab.

D. A 3D FE model will be developed in SAP2000 for P&S design.
I. Chamber

A. For feasibility level design, 2D analysis was performed using both CWFRAME and SAP2000.
Discuss Advantages & Disadvantages of Float-In