Damage and Destruction

Design Build Process

Reconstruction of US 90 Bridges

St. Louis Bay
Harrison and Hancock Counties

Biloxi Bay
Jackson and Harrison Counties

August 1, 2007
Introduction – St. Louis Bay Bridge

- David Seyfarth, P.E.
  - District 6, Area Construction Engineer
  - Saucier, Mississippi (District 6 Field Office)

- Rodney Gray, P.E.
  - URS Resident Engineer
  - Bay St. Louis Mississippi (Field 6 Office)

- Allan Nelson
  - Granite-Archer Western Project Director
Introduction – Biloxi Bay Bridge

Kelly Castleberry, P.E.
- District 6, Area Construction Engineer
- Ocean Springs, Mississippi (District 6 Field Office)

Kent Dussom, P.E.
- URS Transportation Manager
- Field Office

Steve Underwood
- GC Constructors Project Director
Agenda

- Challenges of Hurricane Katrina
- Design-Build Process
- Bridge over the St. Louis Bay
- Bridge over the Biloxi Bay
Hurricane Katrina

- The Costliest ($81.2B)
- One of the Deadliest (1,836)
  - 238 in Mississippi
- Destruction 100 Miles from Center
On forecast tracks do not pay too much attention to the exact line, the error in track forecasts can be large.
Hurricane Katrina

Path of Destruction

On Forecast tracks do not pay too much attention to the exact line, the error in track forecasts can be large.
Monday, August 29, 2005

- Early Morning - Hurricane Katrina strikes the Mississippi Coast
- 4:00 p.m. - MDOT began clearing roadways
- 11:00 p.m. - One lane open on US 49 South

Tuesday, August 30, 2005

- 6:00 p.m. - One lane open on I 59 South from Meridian to Hattiesburg
Most routes were not passable immediately after the storm.

MDOT had every highway passable by Wednesday (8/31) evening.

All lanes were open by Friday (9/2) evening.

Personnel reallocation was required.
Debris Removal (Phases 2 & 3)

- Phase II - MDOT forces & 8 highway contractors pushed all debris off of the shoulders

- Phase III - MDOT contracted with 30+ contractors to haul debris off of state highways to approved landfills. MDOT personnel were monitors in the field.
Debris Quantity & Cost to Date

**First Pass**
- Over 6 million yd$^3$ debris removed
- Total cost: $149.4 million
  - FHWA
- Completed Jan 31, 2006

**Second Pass**
- Cost: $19.7 million thru 10/17/06
  - FEMA
Debris Removal
Debris Removal
Other Issues Immediately After Landfall

- Supply Chain
- Fuel
- Communications
- Staffing
- Personnel Housing
Damage Assessment Teams

- Documented Estimated Quantities for Repair & Cost
- Submitted by County & Route
- Items Covered such as Pavement Damage, Debris (1st pass), Signals, Signs, Guardrails, etc.
- Required for FHWA Emergency Relief funding
Emergency Bridge Repair I-10 at Pascagoula River

Barge struck the bridge during storm surge.

Replaced 300’ of bridge - out of alignment

Contractor - T L Wallace

Cost - $5,200,000  Incentive $100,000/day

Began work - September 10

Completed - October 1 – 10 days early!
Emergency Bridge Repair I-10 at Pascagoula River
Emergency Bridge Repair I-10
at Pascagoula River
Emergency Bridge Repair I-10 at Pascagoula River
Emergency Bridge Repair I-110 at Back Bay of Biloxi

Damage to an outside pile

Drove two additional piles & extended cap.

Contractor – T L Wallace

Cost - $2,500,000

Work Began – September 20

Work Completed – October 8
Emergency Bridge Repair I-110 at Back Bay of Biloxi
Emergency Bridge Repair I-110 at Back Bay of Biloxi
US 90 Bridge @ Henderson Point

Replace six spans total.

Contactor – Hill Brothers

Cost - $1,900,000

Work Began – November 7, 2005

Completion Date - February 17, 2006
US 90 Bridge @ Henderson Point
US 90 Bridge @ Henderson Point
US 90 Harrison County

- “Spot reconstruct” over 116 lane miles of pavement
- 3 paving contractors at a total cost of approximately $25 Million
- Work Began September 10, 2005
- Completion Date - December 17, 2005
US 90 Harrison County
US 90 Harrison County
Storm Drain Cleanout
Traffic Signals

- Damage to all 40 Intersections on US 90 in Harrison County
- All signals up and running by September 19.
- MDOT forces, B & B Electric, C & L Const.
- MDOT also repaired 33 intersections for cities
Traffic Signals
18,000’+ of Guardrail Damage
12,000+ Signs Damaged
Ferry Service @ Bay St. Louis

Total Cost $5 million

$987,000 for Dredging

$1.37 Million for Materials & Pile Driving

Remainder for Operations

45 minute schedule

7 days a week from 6:30 am to 6:30 pm

Operational on November 1st, 2006
Destruction of the US 90 Bridges

Combination of Events

- Storm Surge raised water level
  - Ocean Engineering Associates Report
    - 28’ at Bay St. Louis
    - 24’ at Biloxi Bay
- Bridge Panels became buoyant
- Wave Action knocked down panels
Destruction of the Bridges – St. Louis Bay
Destruction of the Bridges – Biloxi Bay
St. Louis Bay
Economic Impact of Additional Travel Time

- Up to 45 minutes reroute
- Vehicle Travel Cost - $100,000 / day
How to Fix It?

- Bridges Could Not Be Repaired
  - Extensive Damage to Bridges
  - Not to Current Standards
  - Existing Problems with Movable Spans
- Bridges Needed to Be Replaced
  - Realignment Required to Miss Debris Field
- Look at Alternative Procurement
Conventional Design-Bid-Build

- **Design**
  - 9 months to one year
- **Bidding**
  - 3 months
- **Construction**
  - 2 to 3 years
- **Total 3 to 4 years**
Conventional Design-Bid-Build

Owner

Contractor

Engineer
Design-Build

- **Bid Process Upfront**
  - 6 months from start to selection
  - Concurrent design

- **Design-Build**
  - Less than 2 years

- **Total Time to Operation**
  - 2.5 years
  - Savings of over 6 months to 1.5 years!
Partnership
Design-Bid-Build versus Design-Build

<table>
<thead>
<tr>
<th>Task</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
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<td>Bid Process</td>
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</table>

- Design: Q1 Q2
- Bidding: Q3 Q4
- Construction: Year 2 - Year 5
- Bid Process: Year 1
- Design-Build: Year 2 - Year 3

2 years
Agenda

- Challenges of Hurricane Katrina
  - Design-Build Process
  - Bridge over the St. Louis Bay
  - Bridge over the Biloxi Bay
How does Design-Build Save Time?

- Design is concurrent with bid process and construction process
- Designer works for contractor, not owner
  - Different Relationship
  - Higher Risk to Designer
- Judicious Sharing of Risk between Owner - Contractor
What does Design-Build Require?

- Owner must define what is needed:
  - “The problem”

- Owner must define the rules:
  - Design parameters/requirements to allow for flexibility in design (promote creativity)
What does Design-Build Require?

- **Owner Must Define the Project:**
  - Existing Information (Maps, topo, geotechnical)
  - Right-of-Way / Utility Agreements
  - Environmental Permits
  - Design Criteria
  - Vessel Collision Report
  - Special Provisions
  - Form of the Contract (Design-Build Contract)
Two-Step Selection Process

Request for Qualifications (RFQ)

- Step One – Equate all Bidders that are qualified to Bid on project
  - RFQ required:
    - Purpose / Overview / Scope
    - Management Approach
    - Experience of Key Personnel
    - Past Performance
    - QA / QC Plan
    - Financial Condition
Two-Step Selection Process

Request for Proposal (RFP)

- Step Two - Technical Evaluation of Design and Bid Price
  - RFP Requirements
    - Purpose / Overview / General Information
    - Stipend ($100,000)
    - Instructions to Bidders
    - Project Scope
    - Proposal Development
      - Volume 1
      - Volume 2
Volume 1 - Technical Proposal

- Summary
- Scope - Design Plans
- Management Approach
- Construction Plan
- Key Personnel
- Technical Solutions
- Quality Plan
- Schedule
- Certifications, etc.
RFP Technical Evaluation

- Compliance with the RFP Requirements
- Management Approach
- Technical Solutions
- Qualitative Considerations
- Schedule
Request for Proposals

Volume 2 – Lump Sum Price

- Lump Sum Price
- Schedule of Values
- Assumptions (Escrow Documents)
- Certifications
Incentive / Disincentive

No-Excuse Bonus for Achieving Milestone 1
- $5,000,000

Road User Penalty
- Days beyond Milestone 1 - $100,000 / Day
- Days beyond Milestone 2 - $50,000 / Day
RFP Price Evaluation

- A = Bid Price
- B = Days to Milestone 1
- C = Days from Milestone 1 to Milestone 2
- D = Technical Score (1 - 100)

Best Value Proposal = \( A + B \times 100,000 + C \times 50,000 \times \left[ 1 + \frac{D}{100} \right] \)
Development of RFQ / RFP

Timeline - St. Louis Bay

- Advertise RFQ: Sept 28
- Submit RFQ: Oct 17
- Notify Responders: Oct 24
- Issue RFP: Nov 3
- Pre-Proposal Meeting: Nov 10
- RFP Addendum 1: Nov 30
- RFP Addendum 2: Dec 22
- Submit Volume 1: Jan 13
- Submit Volume 2: Jan 23
- Award: Jan 24
- Notice to Proceed: Feb 20
Development of RFQ / RFP

Timeline - St. Louis Bay

- August: Hurricane Katrina
- September: Impact Assessment
- October: Issue RFP Nov 3
- November: Pre-Proposal Meeting Nov 10
- December: RFP Addendum 1 Nov 30
- December: RFP Addendum 2 Dec 22
- January: Submit Volume 1 Jan 13
- January: Submit Volume 2 Jan 23
- January: Award - Jan 24
- February: Notice to Proceed Feb 17

6 Months
Bid Results

- St. Louis Bay Bridge
  - Best Value - $266,782,833
  - Milestone 1 - 451 Days, Milestone 2 - 649 Days
  - Granite/Archer-Western (GAW) - Contractor
  - HNTB - Designer and CEI

- Biloxi Bay Bridge
  - Best Value - $338,631,734
  - Milestone 1 - 516 Days, Milestone 2 - 671 Days
  - Massman/Traylor/Kiewit (GCC) - Contractor
  - Parsons Transportation Group - Designer
  - Volkert - CEI
Bid Results

Annual Construction Budgets

US 90 Bridges Total $605 M
The speed at which the bid documents were prepared was amazing.

Complete Teamwork by MDOT – HQ, District

FHWA expertise – participation

URS support role – additional manpower and expertise in design-build
Agenda

- Challenges of Hurricane Katrina
- Design-Build Process
  - Bridge over the St. Louis Bay
  - Bridge over the Biloxi Bay
St. Louis Bay Bridge
PROJECT OVERVIEW

Granite Archer Western, A Joint Venture

Pass Christian, MS
Client: MISSISSIPPI DOT
NTP: February, 20, 2006
451 days to Milestone1 – May 16, 2007
685 days to Milestone2 – January 5, 2008
Value: $266,782,883 (Original)
$283,492,058 (With Change Orders)
MAJOR ITEMS OF WORK

- 463 ea 36” square precast, prestressed piles (avg 145’)
- 435 ea 30” square precast, prestressed piles (avg 125’)
- 43 ea Trestle-bent caps 95’ long on 36” piles
- 46 waterline footings on 30” piles, (6,600 cy)
- 48 Cast-in-place concrete columns from 30 - 72 ft tall (7,600 cy)
- 48 Cast-in-place hammerhead-style caps (4,500 cy)
- 3,573,000 lbs black rebar
- 9,647,000 lbs epoxy-coated rebar
- 531 Bulb-T, 78” girders on typical 150’ spans. 154 Type IV AASHTO Girders.
- Middle 250’-long mid span bracketed by 200 ft back spans; post-tensioned, spliced girders consisting of 18 haunches, and 27 drop-in/end segments.
- 1,074,000 sf bridge deck, (34,000 cy).
PILEDRIVING

![Image of pile driving equipment]

### Lift Crane Boom Capacities

<table>
<thead>
<tr>
<th>Boom Length (Ft)</th>
<th>Boom Angle (Deg)</th>
<th>Boom Capacity 1 (Tons)</th>
<th>Boom Capacity 2 (Tons)</th>
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<td>50</td>
<td>120</td>
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S/N: 413065

### Manitowoc 4100W Series-1

- Manitowoc Engineering Co.
- S/N: 10148
- Ringer Series-3

- Boom No. 27 with open throat top
- 16' Ringer attachment on blocking
- 22,400 lb. crane counterweight
- 275,000 lb. auxiliary counterweight
- Large mount - ½ degree thru 2 degree machine list
- 10% tipping - 390 degree rating
### 1 DEGREE LIST

<table>
<thead>
<tr>
<th>BOOM &amp; MAST LENGTH</th>
<th>RADIUS (FEET)</th>
<th>ANGLE (DEGREES)</th>
<th>FULL HOISTING RATING (POUNDS)</th>
<th>LIMITED HOISTING RATING (POUNDS)</th>
<th>FROM BOOM POINT TO BARGE DECK (FEET)</th>
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### 2 DEGREE LIST

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<th>RADIUS (FEET)</th>
<th>ANGLE (DEGREES)</th>
<th>FULL HOISTING RATING (POUNDS)</th>
<th>LIMITED HOISTING RATING (POUNDS)</th>
<th>FROM BOOM POINT TO BARGE DECK (FEET)</th>
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<td>60</td>
<td>74.3</td>
<td>428,930 *</td>
<td>367,810 *</td>
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<td>405,500 *</td>
<td>367,810 *</td>
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<td>334,140 *</td>
<td>310,750 *</td>
<td>263,990 *</td>
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</table>
PILEDRIVING TEMPLATE

Secondary weight: 120,000 lbs.
Primary weight: 95,000 lbs. (w/o spuds)
Pile Cutoff
Original Plan

Revised
TRESTLE CAPS
Soffit slab and formwork tubs:
WATERLINE FOOTINGS
Internal Rebar Bracing Frame
HAMMERHEAD CAPS
GIRDERS
Navigational Span
Deck Forming
DECKS:
70 spans; 4 lanes
PROGRESS TRACKING

Decking/Diaphragms-Milestone 2
(ES/LS Curves Based Upon Schedule Update UD18 5/13/07)
Safety Meeting
Agenda

- Challenges of Hurricane Katrina
- Design-Build Process
- Bridge over the St. Louis Bay
  - Bridge over the Biloxi Bay
US90 BRIDGE ACROSS BILOXI BAY
AERIAL VIEW OF DAMAGED BILOXI BAY BRIDGE

US90 BRIDGE ACROSS BILOXI BAY
US90 BRIDGE ACROSS BILOXI BAY
STATNAMIC LOAD TESTING

US90 BRIDGE ACROSS BILOXI BAY
850 TON STATIC LOAD TEST

US90 BRIDGE ACROSS BILOXI BAY
DRIVING 30” PILE AT M/S PIER 52

US90 BRIDGE ACROSS BILOXI BAY
DRIVING 30” PILE AT M/S PIER 51
INSTALLATION OF LOW LEVEL SEAL SLAB & FORMS

US90 BRIDGE ACROSS BILOXI BAY
INSTALLING SUPPORT BEAMS FOR M/S FOOTING

US90 BRIDGE ACROSS BILOXI BAY
MAIN SPAN SEAL SLAB INSTALLATION

US90 BRIDGE ACROSS BILOXI BAY
M/S PIER 52 FOOTING READY FOR REBAR

US90 BRIDGE ACROSS BILOXI BAY
LOW LEVEL

COLUMN FORMING
HIGH LEVEL & M/S

US90 BRIDGE ACROSS BILOXI BAY
CAP CONSTRUCTION ON EAST LOW LEVEL

US90 BRIDGE ACROSS BILOXI BAY
US90 BRIDGE ACROSS BILOXI BAY
ERECITION OF FIRST BT-54 GIRDER AT SPAN 4
ERECITION OF 120 FT. LONG BT-72 GIRDERS

US90 BRIDGE ACROSS BILOXI BAY
FALSEWORK FOR M/S SPLICED GIRDERS
Pier 52 Haunch Girder Erection
W/B Bridge Drop-In Girder Erection

US90 BRIDGE ACROSS BILOXI BAY
INSTALLATION OF OVERHANG BRACKETS

US90 BRIDGE ACROSS BILOXI BAY
TEMPORARY GIRDER BRACING

US90 BRIDGE ACROSS BILOXI BAY
FIRST DECK CONCRETE PLACEMENT

US90 BRIDGE ACROSS BILOXI BAY
DECK PLACEMENT SPANS 7 TO 9
TEXAS STYLE SEE-THROUGH BARRIER

US90 BRIDGE ACROSS BILOXI BAY
Construction Progress June 20, 2007

US90 BRIDGE ACROSS BILOXI BAY
## Change Order Status

### Biloxi Bay

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<tr>
<th>Description</th>
<th>Cost ($1,000's)</th>
<th>Percent of Total</th>
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<td>Original Proposal</td>
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<tr>
<td>1 Utility Agreements (3)</td>
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<tr>
<td>2 Environmental (0)</td>
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<tr>
<td>3 Value Engineering (0)</td>
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<tr>
<td>4 Dispute Review Board (0)</td>
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<tr>
<td>5 Project Additions</td>
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<tr>
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<td>Roadway Lights</td>
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<td>6 RFP Issues</td>
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<td>Finger Joint Welds</td>
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### St. Louis Bay

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Thank You!

Questions?