ALTERNATIVE DELIVERY FOR LARGE PROGRAMS & PROJECTS

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Design-Build delivery is often the “norm” for global construction and tunneling industry.

Owners, engineers, contractors, and operators are all vested stakeholders and beneficiaries of successful Project Delivery.

OUTLINE

• Introduction - What is “Alternative Delivery?”
• Key performance indicators and the “Delivery Spectrum”
• Drivers for large tunneling programs
• Trends and cases in the North American and Global tunneling
COMMONLY USED ALTERNATIVE DELIVERY OPTIONS

- Design-Build (lowest lump sum bid) and Progressive Design-Build
- Third Party Program Management and Construction Management (PM/CM)
- Construction Management at Risk (CMAR)
- Design-Build-Operate-Finance (DBOF)
- Design-Build-Operate/Maintain-Transfer (DBOT)
- Public Private Partnership (PPP)
- Alliance Contracting
- Others

Alternative delivery is intended to bridge gap between the Owner and Contractor during procurement.

McCook Tunnel Project above was awarded based on “best-value” selection.

Owners want flexibility - custom variations such as best value selection, are also used as alternative procurement though projects are delivered using traditional design-bid-build delivery.
ACKNOWLEDGE GROUND RULES

• Safety is never compromised
• Dichotomy of quality vs. price will prevail
• Schedule certainty (speed of delivery may be accelerated)
• Inherit risks do not transfer or go away, and must be properly addressed
• Market drives the price

Basic Principles of Contracting are not Alternatives.
CONTRACTING STRATEGY MUST RESULT IN BEST DELIVERY THROUGHOUT ALL PROJECT PHASES
Once qualified, Bid Price should drive the selection for alternative delivery.

**PROJECT DELIVERY MUST SATISFY INDUSTRY’S KEY PERFORMANCE INDICATORS - KPIs**

- Safe, constructible and operable systems
- Risks are well managed
- Meet the Owner’s primary delivery expectations:
  - Quality
  - Cost effective and within budget
  - On time
  - Regulatory compliant
  - Neighborhood friendly
- Cost savings through
  - Innovative ideas
  - Flexibilities in means and methods
  - Accelerated delivery
- Systems reliability, redundancy, guarantees
PROJECT DELIVERY SPECTRUM

Traditional Delivery  ?  Alternative Delivery

Alliance  DBB  CMAR  EPCM  Progr. DB  DB  PM/CM  DBOF/T
When to Decide Best Delivery Option – Project Gateways

Stage 1 – Initiation
- Program Objectives
- Program Organization
- Program Controls (budget, schedule, documentation, information technology, communications)
- Safety
- Stakeholders
- Risk Management
- Quality
- Environmental Management
- Sustainability
- Regulatory
- Technical Integrity Panel
- Legal
- Financial
- Operations
- Contract Packaging Strategy
- Delivery Options

Stage 2 – Feasibility
- Facilities Layout
- Investigations
- P&ID
- Alternatives Definition
- Alternatives Selection
- FEED
- Performance Specs
- Cost Estimates
- Schedule
- Value Analysis, Constructability Review
- Preliminary Engineering
- Guidance Documents and SOPs for Engineering and Construction
- Market Conditions
- Project Sanction Prior to Execution and Delivery Decisions

Stage 3 – Execution
- Design
- Design and Design-Build Contracts
- Construction
- CM and RE Roles
- Contractor VE Proposals
- Chartering
- Award / Penalty Criteria
- Performance Management

Stage 4 – Operations
- Substantial Completion
- Testing and Startups
- Commissioning
- O&M Manuals
- Training
- Warranty Transfers
- Facilities Acceptance and Turnover
- Project Records
- Project Awards

Owner Determines Gateways - Critical Project Milestone Accomplishments

1. Gateway 1 – Program Management Strategy and Implementation

Project Completion and Close Out
DRIVERS FOR LARGE DESIGN-BUILD PROGRAMS & PROJECTS

• Single Point Accountability
• Accelerated (speed of) Delivery
• Transfer of Risks and Fewer Change Orders
• Leveraging innovations in construction industry and flexibility in the means and methods
• Lower Price (due to shorter schedule)
• Resources (or lack thereof) including funding, project professionals, etc.

Alternative delivery drivers overlap with KPIs for successful execution
DESIGN-BUILD DELIVERY

• Front-End (Preliminary) Engineering
  • Operational criteria (regulatory compliant)
  • Site engineering (geology, geotech, utilities, hydraulics, etc.)
  • Assessment of risks
  • Permitting & easements
  • Neighborhood friendly
  • Scope of work (quantities)

• DB Procurement Contract
  • Safety, quality, cost & schedule
  • Minimum requirements, reviews, approvals
  • Bid form and payment terms (lump sum and negotiated or unit priced items)
  • Legal framework
  • Must achieve competitive bids
DB CONTRACTS MUST BE COMPLIANT WITH CODES, INDUSTRY STANDARDS AND OWNER’S SPECIFICATIONS

• Contract specifications must include owner’s typical details, state and local codes (building, fire, health department, etc.)
• References and compliance with applicable industry standards (ASTM, NASSCO, AWWA, AASHTO, DOTs, etc.)
• Completion, payment, and acceptance terms
• Warranty transfers
DESIGN-BUILD CONTRACT SETUP FOR TUNNEL CONSTRUCTION

- **Lump Sum**
  - Safety
  - Project management / administration
  - Regulatory compliance
  - General mobilization and crew setup
  - General geologic/ground conditions established
  - Length, size, type of pipeline for water tunnels
  - Early design effort and reports
  - Typical traffic control, bypass, and permits
  - Typical disposal, site cleanup, & restoration

- **Negotiated (based on contract unit prices established or change orders)**
  - Additional inspections and investigations
  - Additional *easements*
  - Dealing with unknown or concealed conditions
  - **Utility conflicts** resolution
  - Access and schedule restrictions due to operations of existing systems
  - **Community** concerns (working hours, noise, dust control, etc.)
  - Commissioning, **Operations** and Maintenance (O&M) Requirements

Partnering, disputes resolution, and contract contingencies and allowances are essential for successful implementation.
SUCCESSFUL PROCUREMENT TIPS FOR DESIGN-BUILD

- Set aside traditional processes
- Use a stringent prequalification process to limit proposers to 5 or less
- Provide full access to the site and data to qualified bidders
- Conduct a balanced evaluation
- Ask for reasonable submission requirements
- Develop succinct criteria specifications
- Limit early design in the RFP *(or allow time and money for design)*
- Conduct separate evaluation of cost and quality issues
- Use lump sum contracts, if competitive price proposal process

Owners must have the opportunity to review designs and accept/reject completed work

Pain/gain provisions in the Contract help align objectives of the parties
OTHER GOOD IDEAS!

- Early advertisement, contractor information meetings, widen early competition
- Receptive to new technologies and innovations
- Good bid forms, measurement and payment terms
- Develop consistent design documents (plans, specs, geotechnical data and baseline reports, etc.)
- Owner-furnished materials, disposal sites, in-kind services
- Stiffer penalties / better incentives
- Raise the bar on quality and cost control
- Allow contractors to take “calculated” risks with incentives
- Consider Early Contractor Involvement process
- Consider Program Management/Construction Management services for large/multiple contracts
RISK MANAGEMENT PROCESS

Legend:
- **W**: Workshops with Risk Management Committee (RMC)
- **VE**: Independent Value Engineering
- **CR**: Independent Contractor Review at 75% Design
TRENDS & CASES

SUCCESSES AND OPPORTUNITIES FOR IMPROVEMENT
OVER 65 ALTERNATIVE DELIVERY PROJECTS IN NORTH AMERICA IN THE PAST 10 YEARS

- Detroit Water Works Park II WTP
- Milwaukee, WI — Howard Avenue WTP Ozone Improvements
- San Bernardino Valley — Central Feeder Groundwater Banking/Conjunctive Use
- Bakersfield, CA — NE Bakersfield WTP
- Longmont, CO — Nelson-Flanders WTP
- San Bernardino Valley — Foothill Pump Station
- Phoenix, AZ — Lake Pleasant WTP
- Louisville, KY — Morris Forman WWTP

DBIA Award Winner
Jollyville Tunnel & Transmission Main (WTP 4)
— City of Austin, Texas

PROJECT OVERVIEW

- CMAR Delivery Method for $508M Program
- 2 Separate Design and 7 Separate Construction Contracts (GMPs)
  - Raw Water Intake
  - Intake Tunnel & Pump Station
  - 50 MGD Water Treatment Plant
  - Jollyville Transmission Main

Key Project Drivers:
- Schedule
- Cost Certainty
- Community & Environmental

Period of Services: 2009 - 2014
Tunnel Cost: $90M
Jollyville Tunnel & Transmission Main (WTP 4)
— City of Austin, Texas

- **Successes (What Went Well)**
  - Single Point of Contact for City
  - Underground Components Completed within 1 to 3% of Original Bid Price (favorable geology)

- **Opportunities for Improvement**
  - Schedule Not Being Met
  - Contract Less than Clear on who owns the Schedule Risk
  - Overlapping Tasks During Construction
MIDDLE FORK SURGE SHAFT REHABILITATION
Middle Fork Surge Shaft Rehabilitation
— Placer County Water Agency, Placer County, California

PROJECT OVERVIEW

- DB Delivery Method
- Contractor selected on qualifications
- Repair of a cracked surge shaft lining (10 ft diameter x 600 ft deep)
- Installation of an 8 ft diameter steel lining over the full depth of the shaft and grouted in place

Key Project Driver:
- Cannot dewater shaft, need to perform repairs in the “wet”

Period of Services: 2005 - 2007
Total Project Value: $ 35 M
Middle Fork Surge Shaft Rehabilitation
Placer County Water Agency

Aerial view of shaft site

Contractor developed a custom frame to hold and lower 40-ft long pipe segments
Middle Fork Surge Shaft Rehabilitation
— Placer County Water Agency, Placer County, California

- **Successes (What Went Well)**
  - Allowed “innovations” by the Contractor (quick connect mechanical couplings below water)
  - Alignment of goals between parties
  - Communication among key project participants
  - Verification test program proved certainty of means and methods reducing risks and allowing for cost savings to be incorporated into design
  - Construction completed below initial target price
TWIN FALLS HYDROPOWER PLANT ALLIANCE CONTRACT
Twin Falls Hydropower Plant
— WE Energies, Wisconsin

Project Drivers:
- Aging Infrastructure
- Power generation efficiency
- Environmental

Period of Services: 2012 – 2016
Total Project Value: $70 million

PROJECT OVERVIEW

- Alliance contract with shared risk/reward on total capital cost. B&V / CR Meyer / WE Energies
- New powerhouse includes 80 foot deep rock excavation
- Headwater and tailrace cofferdams
- New spillway
- Remove existing powerhouse
Twin Falls

- **What is Working**
  - Safety – No OSHA recordable
  - Quality – No NCRs
  - Partnering with Owner and Contractor
  - Cost is trending below budget with contingency increasing
  - On schedule with sense of urgency across team

- **What Could be Improved**
  - Always can do better on safety
  - Nothing identified at recent executive review meeting
LOWER BAKER HYDROELECTRIC POWERHOUSE
Lower Baker Hydroelectric Unit 4 Powerhouse
— Puget Sound Energy, Washington

Key Project Drivers:
- Schedule (Tax Credits)
- Cost Certainty
- Risks in Underground Construction

PROJECT OVERVIEW

- Design Build (Best Value)
- New Below Grade Powerhouse
  - 30 MW Francis turbine generator
  - 12 ft diameter, 1,000 ft long steel lined pressure tunnel
  - 108 in. butterfly valve
  - 60 in. Howell Bunger bypass valve
  - Unit and facility control systems

Period of Services: Oct 2011 – June 2013
Total Project Value: $70 M
Lower Baker Hydroelectric Unit 4 Powerhouse — Puget Sound Energy, Washington

Powerhouse Excavation

Tunnel Excavation

Rotor Installation
Successes (What Went Well)

- Owner procured equipment assured PSE got what they wanted.
- Project completed 3 months ahead of schedule (tax credits received)
- Strong safety performance
- No lost time safety incidents
- Change orders – no surprises
SINGAPORE PUB

DEEP TUNNEL SEWERAGE SYSTEM (DTSS) PHASE 2

FIVE (5) DESIGN-BUILD CONTRACTS FOR TUNNELS
DEEP TUNNEL SEWERAGE SYSTEM (DTSS)

Cost: S$3.4 billion
- 48km tunnels (3.3m to 6m ID)
- 60km link sewers (0.3m to 3m ID)
- 176 MGD plant at Changi
- 5km outfall (3m ID)

DEEP TUNNEL SEWERAGE SYSTEM
DTSS PHASE 2

- 50km sewer tunnels by TBM (3m to 6m ID)
- 50km sewers by pipe-jacking (0.3m to 3m ID)
- 176MGD plant at Tuas with 25MGD NEWater capacity

Tunnel and Link Sewers
- Sized adequately for the future
- Design for Maintenance and Resilience
DTSS PHASE 2 – SOUTH TUNNEL

- 50km of tunneling works delivered via DB contracts
- Tunnel ID ranges from 3m to 6m
- Includes construction of hydraulic structures & air management facilities

Conveyance System Key Features:
- Corrosion Protection
- Tunnel Monitoring (fiber optic)
- Air Management
- Tunnel Isolation GATES
- Tunnel Inspections
- Integrated Data Management System (IDMS)
• 50 km of pipe-jacking works delivered via DBB contracts
• Pipe ID ranges from 0.3m to 3m
Proposed system is expected to withstand the corrosive sewer environment over its design life of 100 years.

Ranges from ~10 to 20 ft (3 to 6m) dia.

*MIC – Microbiological Induced Corrosion
Tunnel Isolation with Roller Gates

- Modular Gate System
- Working Platform
- Link Sewer
- Gate System (Assembled & Lowered)
- Tunnel
- Gate Module
- Rollers
- GATE PANEL ASSEMBLY
- Gate System
- SHAFT STRUCTURE (BASE)

DEEP TUNNEL SEWERAGE SYSTEM
Fiber Optic Strain Monitoring for Structural Integrity

- Longitudinal installation
- Fiber optic cables cast directly into segments during fabrication
DTSS PHASE 2
CONTRACTS & IMPLEMENTATION TIMELINE
# DTSS PHASE 2 & IWMF OVERALL TIMELINE

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IWMF – Integrated Waste Management Facility
FIVE (5) TUNNEL CONTRACT PACKAGES

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### LINK SEWERS CONTRACT PACKAGING

#### Detailed Design Consultants from 1Q 2017

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CLOSING WITH PROGRESSIVE DESIGN-BUILD
PROGRESSIVE DESIGN BUILD

Advantages

• One contract = one point of responsibility
• Good delivery method for retrofit projects
• *Promotes Collaboration with Owner*
• 100% of the equipment and construction are competitively bid
• Early involvement of construction professionals, O&M, and value engineering occurs throughout the project
• Shared incentives if GMP pricing model is adopted
• Fast track schedule
• Owner has off-ramp prior to GMP Establishment

Disadvantage

• Not applicable for completely designed projects
PROGRESSIVE DESIGN-BUILD OFFERS SAVINGS IN TIME AND COST

TRADITIONAL DESIGN-BID-BUILD
- Management Plan
- Design
- Define DB Scope
- Proposal
- Procurement, Construction, Startup & Commissioning, Performance Testing

DESIGN-BUILD
- Management Plan
- Design
- Define DB Scope
- Proposal
- Procurement, Construction, Startup & Commissioning, Performance Testing

PROGRESSIVE DESIGN-BUILD
- Management Plan
- Design
- Define DB Scope
- Proposal
- Procurement, Construction, Startup & Commissioning, Performance Testing

Long Lead procurement
SAVE TIME, SAVE MONEY
**PROGRESSIVE DB ALLOWS “BEST FOR PROJECT” DECISIONS WITH SAME RISK MANAGEMENT LEVEL AS DB**

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<th>WHO IS AT RISK?</th>
<th>Design-Bid-Build</th>
<th>CMAR</th>
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<th>Design-Build</th>
<th>Progressive DB “Collaboration”</th>
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QUESTIONS & ANSWERS

THANK YOU.

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