New Trends for Project Delivery Methods in the United States

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"…design-build systems have significantly less design and construction cost growth when compared to design-bid-build; that design-bid-build systems have the greatest design and construction schedule growth; and that quality measurements associated with design-build, often maligned by many, is better that quality performance of design-bid-build."

- CII RS 133-1, 1997

Agenda

- Introduction
- Procurement Methods
- Selected Studies
- Research in Progress
- Conclusions and Recommendations

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Trends and Drivers (1)

Trends:

- Better understanding of benefits of different delivery systems
- "Opening" of Federal and State procurement rules
- Move by all owners to more alternative delivery systems (not just Design-Bid-Build (D-B-B))
- Promulgation by organizations such as the Design Build Institute of America (DBIA)

Trends and Drivers (2)

Drivers:

- Concurrence with new financing methods on public projects
- Loss of owner expertise
- Growing backlog of infrastructure needs (hence "need for speed")
- Large volume of work
- Active promotion by industry organizations
- Benefits of design and construction collaboration

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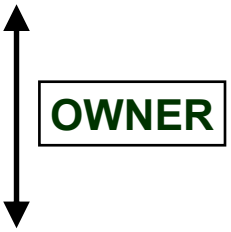
Typical Delivery Methods in US

- Design-Bid-Build (D-B-B); traditional
- Construction Manager as Agent (CM-A)
- Construction Manager at Risk (CM@Risk)
- Multi-Prime, Fast Track
- Design-Build (D-B)
- Design-Build-Operate-(Maintain) (D-B-O or D-B-O-M)

D-B Procurement

- Low-Bid
- Best Value (1 or 2 steps)
- Negotiated selection



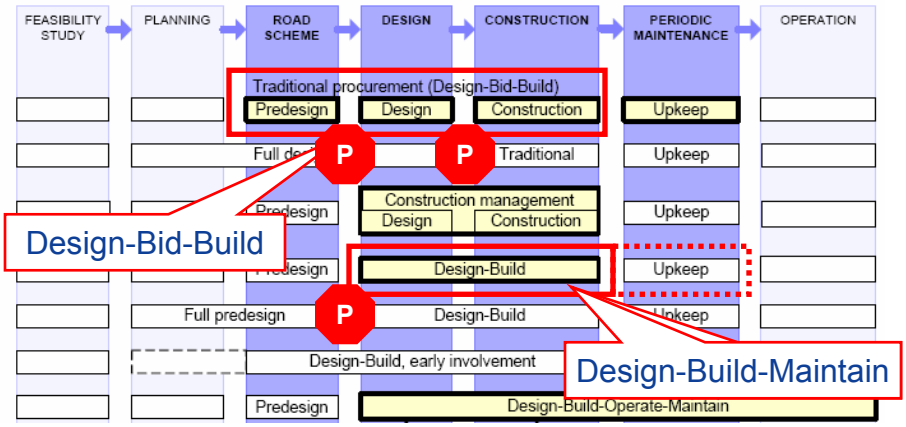
Molenaar and Gransberg, 2001

Procurement Phase

- Phase of the project's life cycle
- Project delivery method drives number procurement activities
- Select an entity for performing tendered services
- Leads to delay, good or bad

Project Delivery Methods—Highway Example

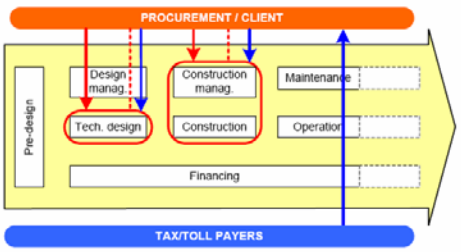
Activities Covered by Different Project Delivery Methods



Courtesy: VTT, 2004

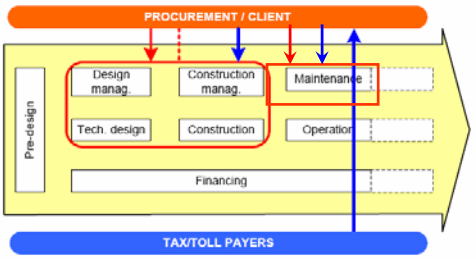
DBB versus DB

DBB Delivery



DB Delivery

- Single point of responsibility
- Coordination between different functional areas
- Shorter total project delivery time



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Project Delivery Systems: CM at Risk, Design-Build, Design-Bid-Build (CII 1997)

Research Background

- Study of D-B, D-B-B, and CM at Risk
- 350 sample projects
- Several types of facilities, e.g., buildings, light industrial, heavy industrial
- Data collected included cost, time, quality, scope, and lessons learned

Cost, Schedule and Quality Metrics

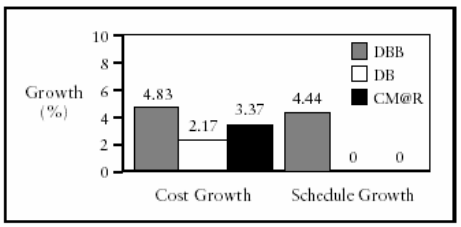


Figure 4.1. Summary of Principal Metrics

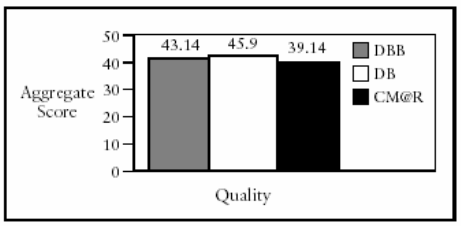


Figure 4.2. Summary of Principal Metrics (continued)

Speed

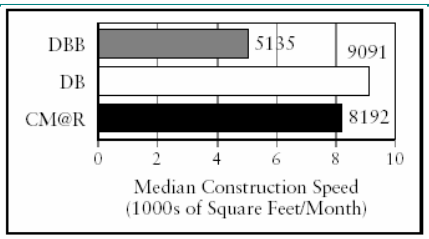


Figure 2.7. Construction Speed
Construction Speed (Sq. Ft./Mo.) = [Area/(Construction As Built Time/30)]

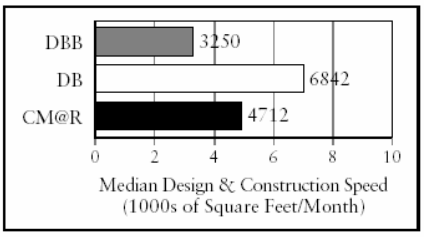


Figure 2.8. Design and Construction Speed
Design & Construction Speed (Sq. Ft./Mo.) = [Area/(Total As Built Time/30)]

An Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods

Hale 2005

Study Details

- Navy Facilities Command (NAVFAC)
- Enlisted quarters (housing)
- Large sample of D-B (38) and D-B-B (39) projects
- Completed during the same time frame (1995-2004)
- Comparisons based on cost (relative and real), time, and changes

Results (sample averages) (1)

- Design and construction duration
  - D-B: 667 calendar days
  - D-B-B: 1398 calendar days
- Duration per bed, design and construction
  - D-B: 2.64 days per bed
  - D-B-B 7.00 days per bed
- Duration for construction
  - D-B: 667 days
  - D-B-B: 771 days

Results (sample averages) (2)

- Cost growth
  - D-B: 2.00%
  - D-B-B: 4.02%
- Cost per bed
  - D-B: $57,776
  - D-B-B: $67,152

Summary Statistics

Statistics	Design/Build	Design/Bid/Build
Project Duration -Total Project Duration -Fiscal Year Duration -Project/Construction Start Duration	 667 days* 864 days* 667 days*	 1398 days 1026 days 771 days
Project Duration per Bed -Total Project Duration -Fiscal Year Duration -Project/Construction Start Duration	 2.64 days/bed* 3.55 days/bed* 2.64 days/bed*	 7.00 days/bed 5.08 days/bed 3.70 days/bed
Time Growth	76.39 days*	193.85 days
Cost per Bed with Other Costs	$60,909	$69,760
Cost per Bed	$57,776	$67,152
Cost Growth	2.00%*	4.02%

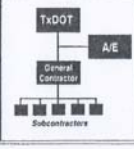
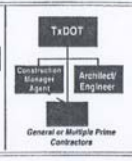
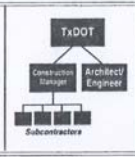
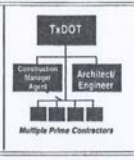
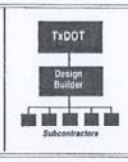
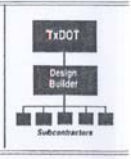
* Statistically significant at $p < 0.05$

TxDOT Delivery Methods Study (project 0-2129, 2001)

Research objectives

- Identify and determine the benefits of innovative project delivery methods and contracting approaches
- Evaluate current legal climate in terms of choosing these strategies
- Develop implementing procedures for methods available or under development
- Prepare recommendations and guidelines as needed

Table 2.3 Matrix of Project Delivery Methods

MATRIX OF PROJECT DELIVERY METHODS[1]						
Delivery Method	**Traditional Process, Design-Bid-Build**	**Construction Manager-Agent**	**Construction Manager-at-Risk**	**Multi-Prime**	**Design-Build**	**Design/Build/Operate**
Definition	A delivery method where TxDOT selects an architect/engineer based on qualifications to design and develop construction documents from which TxDOT solicits lump sum bids. Selection of the contractor is based on the lowest responsible bid and the contractor serves as a single point of responsibility for construction.	A method where the construction manager serves as an agent for the owner providing pre-construction and construction services in lieu of a general contractor. The construction manager-agent provides design phase assistance but holds no subcontracts nor provides project bonding for the construction. A GC or multiple trade contracts are held by the owner. Selection is based on the proposal offering the best value to the owner.	A method where the construction manager serves as the general contractor providing pre-construction and construction services. The construction manager-at-risk provides design phase consultation in evaluating costs, schedule,and implications of alternative designs. A guaranteed maximum price (GMP) may be issued and the CM-at-risk serves as the responsible party contracting directly with subcontractors during construction.	A method where the owner, or sometimes an agent, oversees multiple contractors as opposed to a general contractor conducting total oversight. The owner or agent assumes greater control over the project but also assumes significantly more risk. The multiple trade contracts are usually held by the owner. Selection is based on the proposal offering the best value to the owner.	A method where a single entity is contracted to provide both design and construction. The design-build team consists of contractor and architect/engineer who contract directly with the subcontractors and is responsible for delivery of the project. Selection of the design-build contractor is based on the proposal offering the best value.	A form of design/build where the investment of private capital is used to finance, design, construct, operate, and maintain a road or highway project for public use for a specific term. During the term the investor isn paid back with toll revenue and after an agreed upon time the project reverts to the public owner.
Pros	• Familiar delivery method • Defined project scope • Single point of responsibility for construction • Open, aggressive bidding • Limits graft and corruption	• Design phase assistance • Selection flexibility • Faster schedule delivery • Change flexibility • Non-adversarial relationship	• Selection flexibility • Design phase assistance • Single point of responsibility for construction • Team concept • Faster schedule delivery • Change flexibility	• Selection flexibility • Cost savings possible • Faster schedule delivery • Change flexibility • Greater control over project	• Selection flexibility • Single point of responsibility for design and construction • Faster schedule delivery • Team concept	• Single point of responsibility for all project components • No up-front public cost • Risk carried by investors • Faster schedule delivery • Life-cycle design
Cons	• No design phase assistance • Longer schedule duration • Price not established until bids • Adversarial relationship • Lack of flexibility for change	• No single point of responsibility • No guaranteed price • Owner must manage many contracts	• Adversarial relationship reduced • Difficult for owner to evaluate GMP	• No single point of responsibility • No guaranteed price • Owner must manage many contracts	• Loss of check and balance • Different management techniques required • Potential adversarial relationship between owner and Design/ Builder	• Loss of check and balance • Investment decisions rule • Difficult process to manage • Limited to toll roads
Best Suited	New projects that are not schedule sensitive or subject to potential change.	Large new or renovation projects that are schedule sensitive, difficult to define, or subject to change.	Larger new or renovation projects that are schedule sensitive, difficult to define, or subject to change.	Larger new or renovation projects that are schedule sensitive, difficult to define, or subject to change.	New or renovation projects that are schedule sensitive.	Larger new projects that lack adequate public funding.
Least Suited	Complex projects that are sequence or schedule sensitive. Projects subject to potential change.	Smaller projects	Smaller projects	Smaller projects	Projects that are difficult to define, and are less schedule sensitive.	Smaller projects and those that are not investment grade.

Findings

- Outlined project delivery methods (CM-A, CM @Risk, D-B-B, D-B, D-B-O, etc.)
- Explored innovative contracting methods available (A + B, Lane Rental, Warranty, Partnering, No-Excuse Incentives, etc)
- Developed D-B Manual

Recommendations

1. Develop D-B process guidelines and a delivery process (planning, scope, RFP, selection, management, etc.).
2. Assess the availability of the skills required
3. Train selected members of the organization in the use of the D-B project delivery system.
4. Optimize communication among the parties involved within organization on changes.
5. Optimize the front end planning process.
6. Select pilot D-B projects that have a relatively certain scope and contain well-known processes and technologies.
7. Ensure selection of qualified D-B contractors.
8. Develop succinct criteria specifications.
9. Develop a systematic way to evaluate project results.

SH 130 Study
UT-Austin, CTR

Central Texas Turnpike System

- Five new toll-roads:
  - SH130
  - SH45 N
  - SH45 SE
  - US183A
  - Loop 1 extension

CDA-DB approach

State Highway 130 (1/2)

- Backbone of the Central Texas Turnpike
- Designed to alleviate Austin traffic by diverting traffic away from city
- First project in Texas being delivered under the CDA statutory approach
  - Use of Design-Build-(Maintain) delivery method
  - 15-years maintenance option to be exercised 6 months before completion

State Highway 130 (2/2)

- **Project Characteristics**
  - 4-lanes x 91 miles (NTP issued for 49 miles)
  - 119 bridges & 4 major interchanges
  - 408 required ROW parcels
  - 310 utility adjustments
- **Cost**
  - Design, Construction, ROW services and Utility Adjustments
    - $1.3 billion (NTP issued for $1 billion)
  - ROW acquisition: $380 million
- **Schedule**
  - 5 years for design, acquire ROW, relocate utilities and construct the facility

Research Objectives (Began 2004)

- Identify opportunities for streamlining procurement process
- Identify essential elements for D-B contracts
- Analyze teams' organizational and communication structures
- Develop and implement a performance benchmarking program
- Develop and populate lessons-learned system
- Organize annual workshop to showcase innovations

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Research Motivations

- Primary reason to select D-B vs. D-B-B
  - Shorter total project delivery time
- Increasing adoption of D-B by state transportation departments (DOTs)
- No widespread culture of the new approach in DOTs
- Procurement phase duration

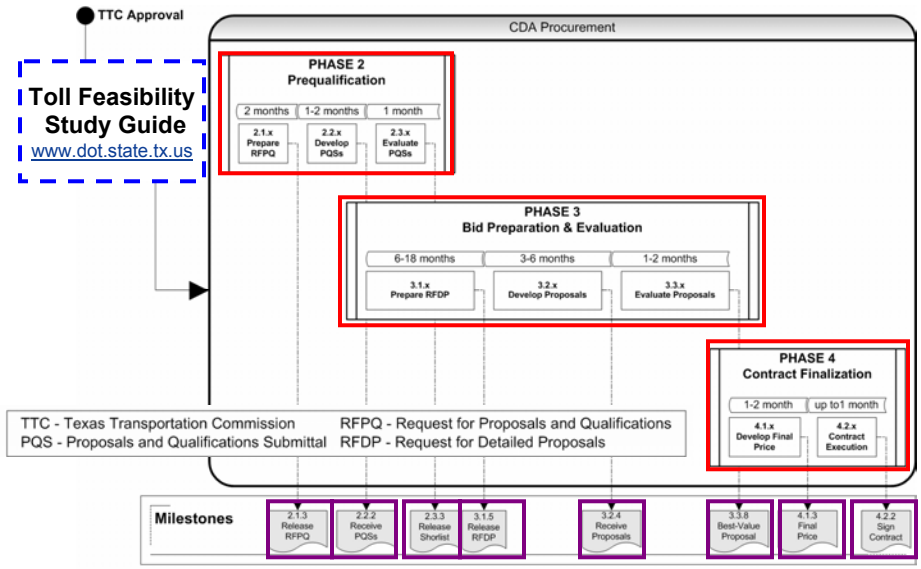
SH130: D-B-B Delivery

12-15 years

SH130: D-B Delivery

Procurement
- Design
- ROW acquisition
- Utility Adjustments
- Construction

CDA-D-B Procurement Process



Phase 2 Prequalification

- **Prepare Request for Proposals and Qualifications (RFPQ)**
  - 2 months
  - Develop evaluation process
  - Release RFPQ package
- **Develop Proposal and Qualification Submittal (PQS)**
  - 1-2 months
  - Interact with firms in PQS development
  - Receive PQS
- **Evaluate PQS**
  - 1 month
  - Evaluate PQS
  - Shortlist qualified proposers

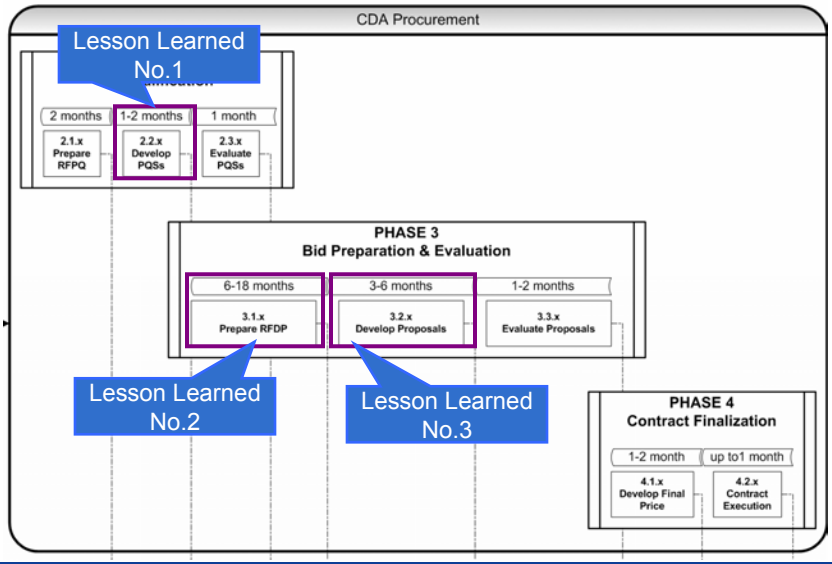
Phase 3
Bid Preparation and Evaluation

- **Prepare Request for Detailed Proposals (RFDP)**
  - 6-18 months
  - Develop evaluation process
  - Release RFPQ package
- **Develop Proposals**
  - 3-6 months
  - Interact with firms in proposal development
  - Receive Proposals
- **Evaluate Proposals**
  - 1-2 months
  - Evaluate Proposals
  - Select the firm offering the best-value to the State

Phase 4
Contract Finalization

- **Develop Final Price (optional)**
  - 1-2 months
  - Acquire Alternative Technical Concepts (ATC) from unsuccessful proposers
  - Negotiate post-proposal ATC with selected developer
  - Develop Final Price
- **Contract Execution**
  - Up to 1 month
  - Finalize details of agreement with Developer
  - Sign Contract

Selected Lessons Learned

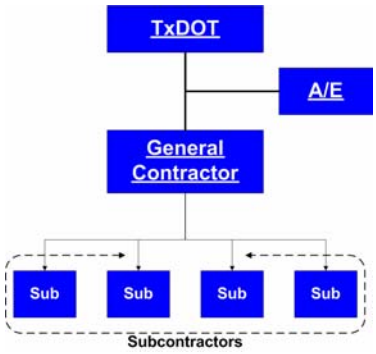


Conclusions (1)

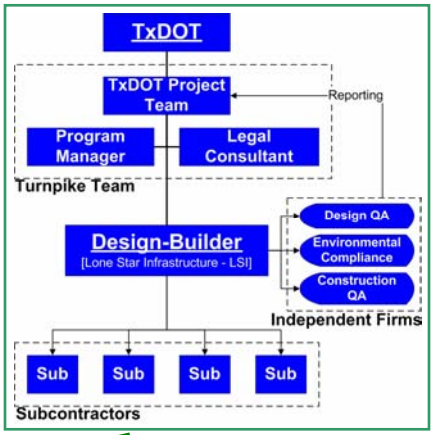
- Laid down a detailed D-B procurement process
  - Up to 69 activities
  - 8 milestones
- Draft CDA Procurement Process Manual
- Process streamlined by using lessons-learned
  - SH130 procurement - 33 months
  - Developed process - 12 to 29 months depending by project complexity
- Identified lessons learned

SH130 Project Organization

Design-Bid-Build



Design-Build: SH130



Before

Now: selected high-priority projects

Conclusions (2)

- Co-location allows to optimize communications
- Flexible organizational structures improve communications
- Overall communications between Owner and service providers are simpler
- A formal partnering approach is beneficial in regulating communication flows

CII Project Delivery and Contract Strategy (PDCS) Study 2001

PDCS Procedure

- Focuses on owner's project objectives.
- Focuses on project execution environment.
- Incorporates quantitative assessment of PDCS alternatives in decision support tool.

Research

Research conducted with:

- CII members, non-members
- Owners and contractors
- Public agencies
- Industrial and general building sectors

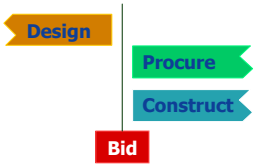
PDCS Definition

- Defines roles and responsibilities of parties in a project.
- Defines how owner pays for services.
- Establishes framework for organization of project execution.

PDCS – Typical Representation

Traditional Design-Bid-Build delivery system, PDCS 01

Phase Sequence: Serial sequence of design and construction (Procurement begins with construction)

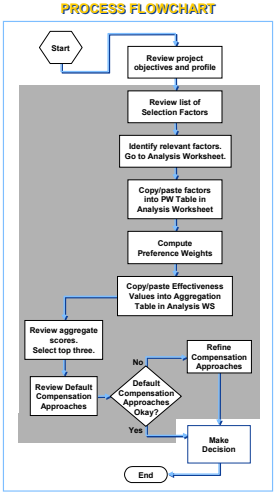


Project Team Relationships

Primary Contractual/Functional Relationships

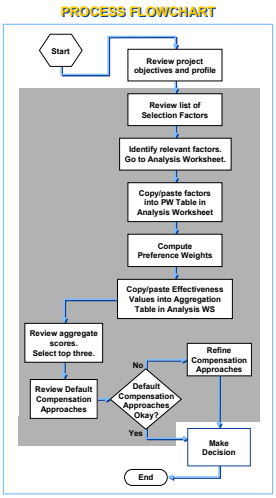
Compensation Approaches
Designer: Firm Price
Constructor: Competitive Lump Sum

PDCS Decision Support Tool (1)



- Review project objectives.
- Identify selection factors (related to owner's project objectives).
- Assign preference rank and preference weights to selected factors to reflect priority.

PDCS Decision Support Tool (2)



- Paste effectiveness values into aggregate table.
- Obtain aggregate scores from spreadsheet.
- Review results to make final decision.
- Choose from 20 selection factors, 12 PDCS alternatives.

PDCS Decision Support Tool (3)

Factor Number	Selection Factor	Factor Description for Comparing	Factor Action Statement
1	Completion within original budget is critical to project success	Delivery system facilitates control of cost growth	Control cost growth
7	Early completion is critical to project success	Delivery system ensures shortest reasonable schedule	Ensure shortest schedule
17	Project features are well defined at the award of the design and/or construction contract construction	Delivery system capitalizes on well defined project scope prior to award of design and/or	Capitalize on well defined scope

PDCS Decision Support Tool (4)

Table A-1: Compute Preference Weights

Factor Action Statement	Preference Rank	Preference Scores Weight	Normalized Preference
Control time growth	1	100	0.33
Protect confidentiality	2	80	0.27
Capitalize on familiar project conditions	3	60	0.20
Maximize owner's involvement	4	40	0.13
Efficiently coordinate project complexity or innovation	5	20	0.07
		300	

PDCS Decision Support Tool (5)

Table A-2: Compute Aggregate Scores

PDCS Alternatives	Factor →	Control time growth	Protect confidentiality	Capitalize on familiar project conditions	Maximize owner's involvement	Coordinate project complexity or innovation	EMPTY	Aggregate Score
	Preference Weight →	0.33	0.27	0.20	0.13	0.07	0.00	↓
PDCS 01	Predetermined Effectiveness Values (Table EV-1)	20	90	0	80	70		46.00
PDCS 02		50	90	50	90	60		66.67
PDCS 03		20	70	0	80	50		39.33
PDCS 04		20	70	0	80	40		38.67
PDCS 05		50	70	40	80	40		56.67
PDCS 06		70	70	70	40	70		66.00
PDCS 07		90	0	100	10	100		58.00
PDCS 08		80	40	90	30	80		64.67
PDCS 09		0	100	80	100	0		56.00
PDCS 10		0	60	10	30	0		22.00
PDCS 11		100	0	100	0	90		59.33
PDCS 12		80	80	70	100	80		80.67

Benefits of the Tool

- Relates PDCS to project objectives and success parameters.
- Provides a decision support tool to facilitate selection of most suitable PDCS.
- Expands knowledge base with well-defined, documented PDCS alternatives.
- Provides rationale for selecting PDCS, based on quantification of alternatives.

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Transition to proficiency

- Develop process guidelines and a delivery process for each option
- Assess the availability of the skills required for the use of alternative delivery methods
- Train selected members of the organization in the use of these methods
- Optimize communication among the parties involved within the organizations
- Optimize the front end planning process

Transition to proficiency

- Select pilot applications of these different methods for projects that have a relatively certain scope and contain well-known processes and technologies
- Ensure selection of qualified contractors
- Develop succinct criteria specifications
- Develop a systematic way to evaluate project results – measure and compare

Recommendations

- Innovative contracting approaches should be pursued
- Each approach has advantages and disadvantages
- Develop a systematic process to evaluate project delivery methods and contracting approaches
- Budget the necessary resources to adequately prepare staff
- Develop metrics

A new paradigm

- Need for comprehensive assessment of project delivery methods and contracting approaches
- Design-build is not the only approach beyond design-bid-build
  - TxDOT moving to Concession/D-B-O-M
- Owners need to assess the realm of project delivery methods as well as the contracting approaches available

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Questions