

An **IPRF** Research Report
Innovative Pavement Research Foundation
Airport Concrete Pavement Technology Program

REPORT IPRF 01-G-002-06-1
Using Design/Build Acquisition for Airfield Pavements



IPRF

**Innovative
Pavement
Research
Foundation**



**AMERICAN CONCRETE
PAVEMENT ASSOCIATION**

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Study Review Panel

- Jim Lafrenz (IPRF)
- Craig Rutland (HQ AFCESA/CEOA)
- Gary Mitchell (ACPA)
- Carlton Lambiasi (FAA)
- Bob Benko (FAA)
- Susan Winslow (Delta Airport Consultants)
- Dean Rue (CH2M Hill)
- Mike Devoy (RW Armstrong)

Study Objectives

- Assess, document and compare merits and deficiencies between D/B and D/B/B
- Document myths and realities of D/B
- Develop a suitability template
- Develop a D/B best practices document

Study Approach

Project	Designer	Owner	Contractor
A	✓	✓	✓
B	✓	-	✓
C	✓	-	✓
D	✓	✓	✓
E	1	✓	✓
F	✓	-	✓
G	2	✓	2
H	2	✓	2

1. Declined to discuss the project.
2. Owner requested that we not discuss the projects with the designer or contractor.
 - No data available.

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Perceptions and Issues with Design/Build



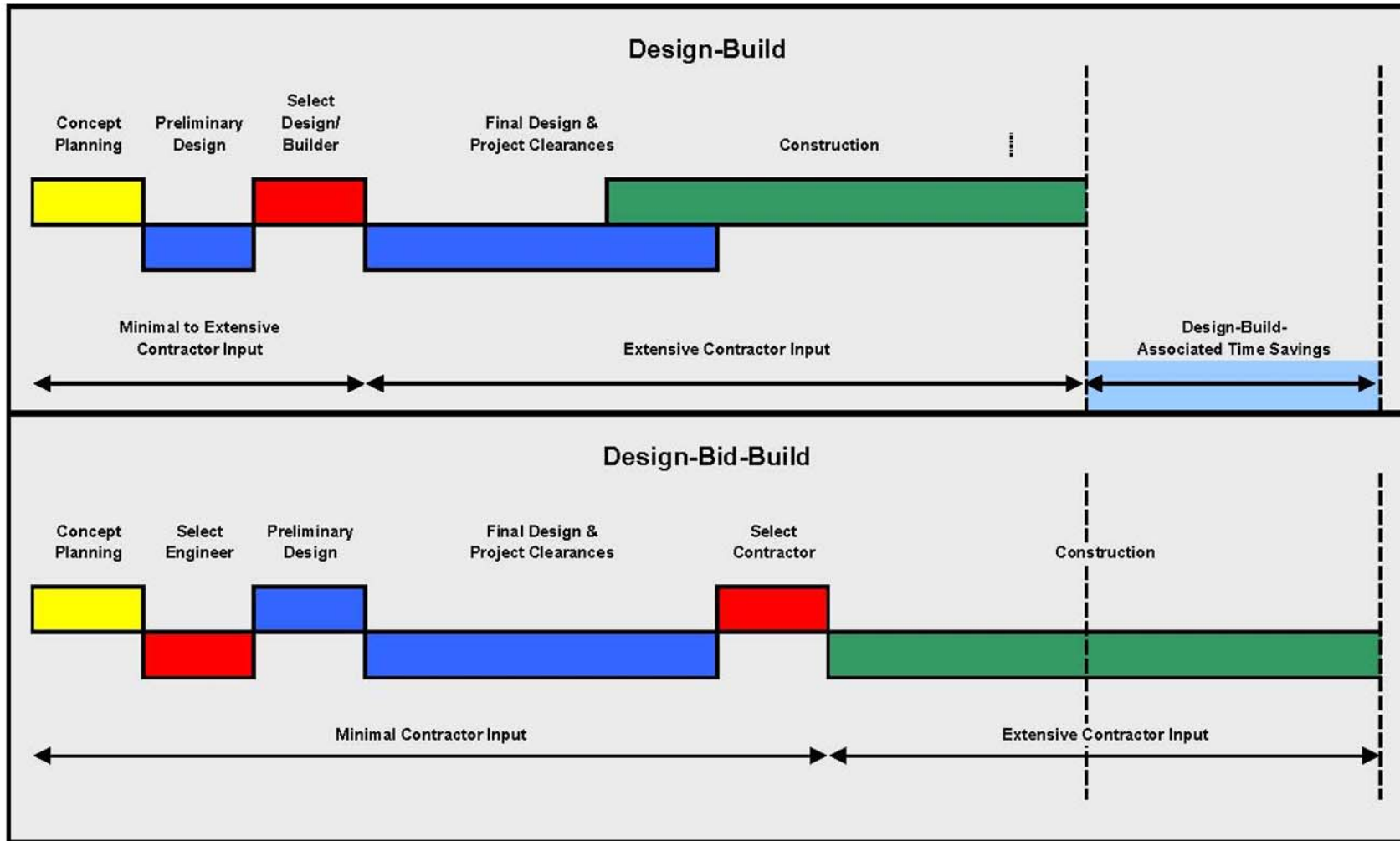
If D/B acquisition is cost-effective, why isn't it used for all construction projects?

- Not always the most cost effective
- However, can have less cost creep
- Typically selected due to schedule constraints

If D/B acquisition is cost-effective, why isn't it used for all construction projects?

- D/B projects move from conception to commission much faster than D/B/B
- Design and construction integration/overlap allows for compression of the schedule critical path

D/B versus D/B/B



Source: Dr. Keith Molenaar, University of Colorado at Boulder

Is the Owner's cost/effort higher for the preparation of the bid documents for D/B than for D/B/B?

- Design for D/B is typically advanced to only the 30 percent stage
- The level of effort and cost is therefore less

How does the design engineer's in D/B compare with traditional D/B/B?

- The design engineer is contracted to the D/B Entity
- Does not have a direct relationship with the Owner

Does D/B promote poor construction because the owner is removed from the decision process?

- D/B projects often are developed using performance-based specifications
- Owner will review the D/B entity's QC records and may do some confirmatory QA inspection and testing
- D/B quality management often is structured on the principles of the ISO

What information should the owner provide to prospective bidders?

- A minimum amount of information that must be provided
 - performance specifications
 - environmental approvals
 - geotechnical information
 - topographical survey

Typical RFP Information

Drawing Description	Information Provided		
	Minimal	Partial	Full
Cover Sheet		X	X
Location Plan/Project Site Plan	X	X	X
Contractor Access, Storage, and Haul Routes	X	X	X
Horizontal and Vertical Control		X	X
Existing Topography (if available)		X	X
Existing Utilities		X	X
Demolition Plans		X	X
Runway Geometry w/Key Elevations		X	X
Taxiway Geometry w/Key Elevations		X	X
Apron Geometry w/Key Elevations		X	X
Typical Pavement Sections	X	X	X
Phasing Plans		X	X
Conceptual Drainage Plans			X
Conceptual Grading Plans			X
Conceptual Jointing Plan			X
Joint/Sealant Detail			X

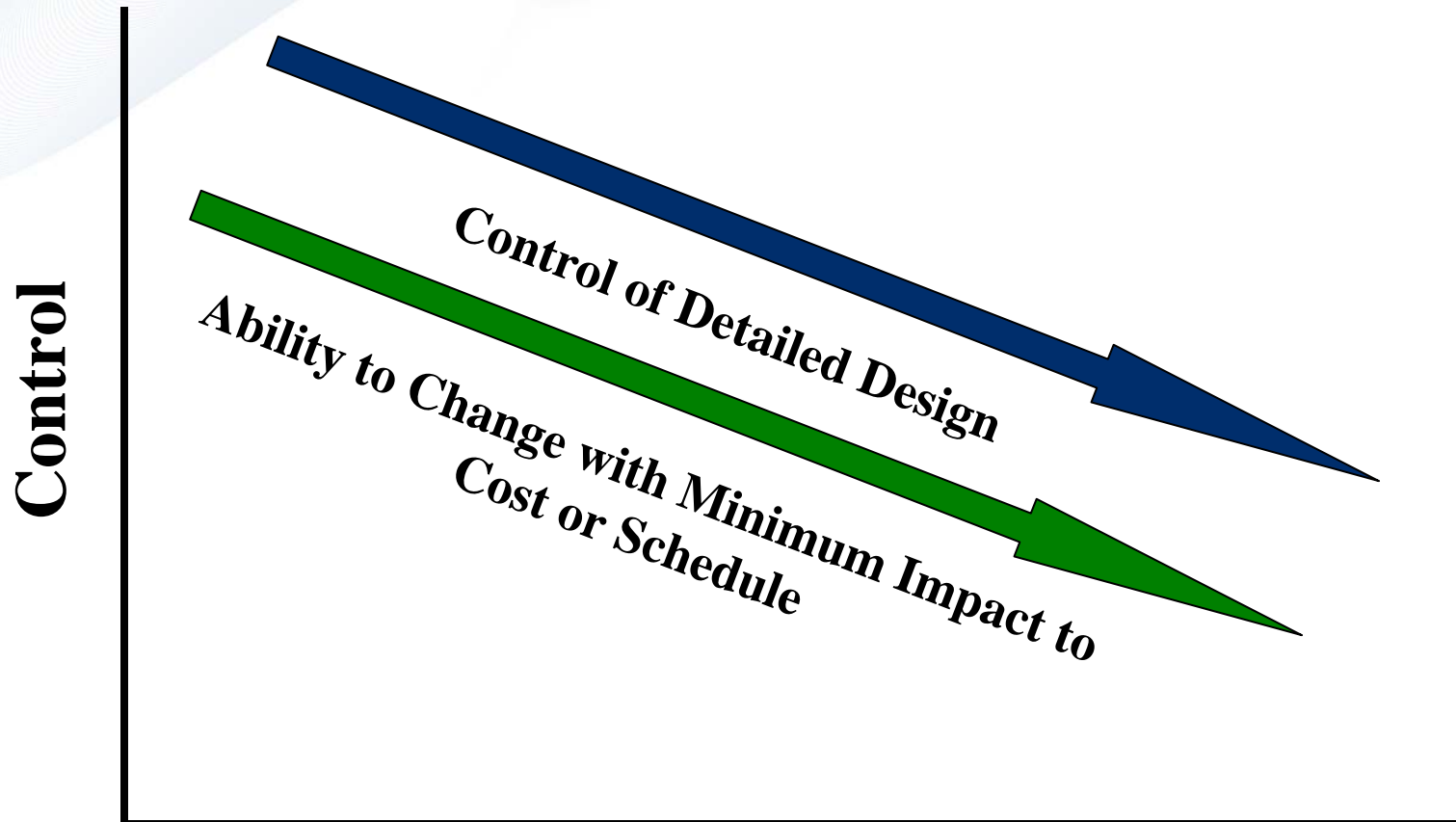
Who is the final authority in selecting options and materials?

- Base performance items and requirements are determined by the Owner as part of the RFP
- D/B Entity selects the materials and construction techniques to meet these requirements

Does the owner relinquish control of the project?

- D/B Entity assumes oversight and control of design and construction related activities
- Owner steps back, provides oversight, and reviews adherence to the contract

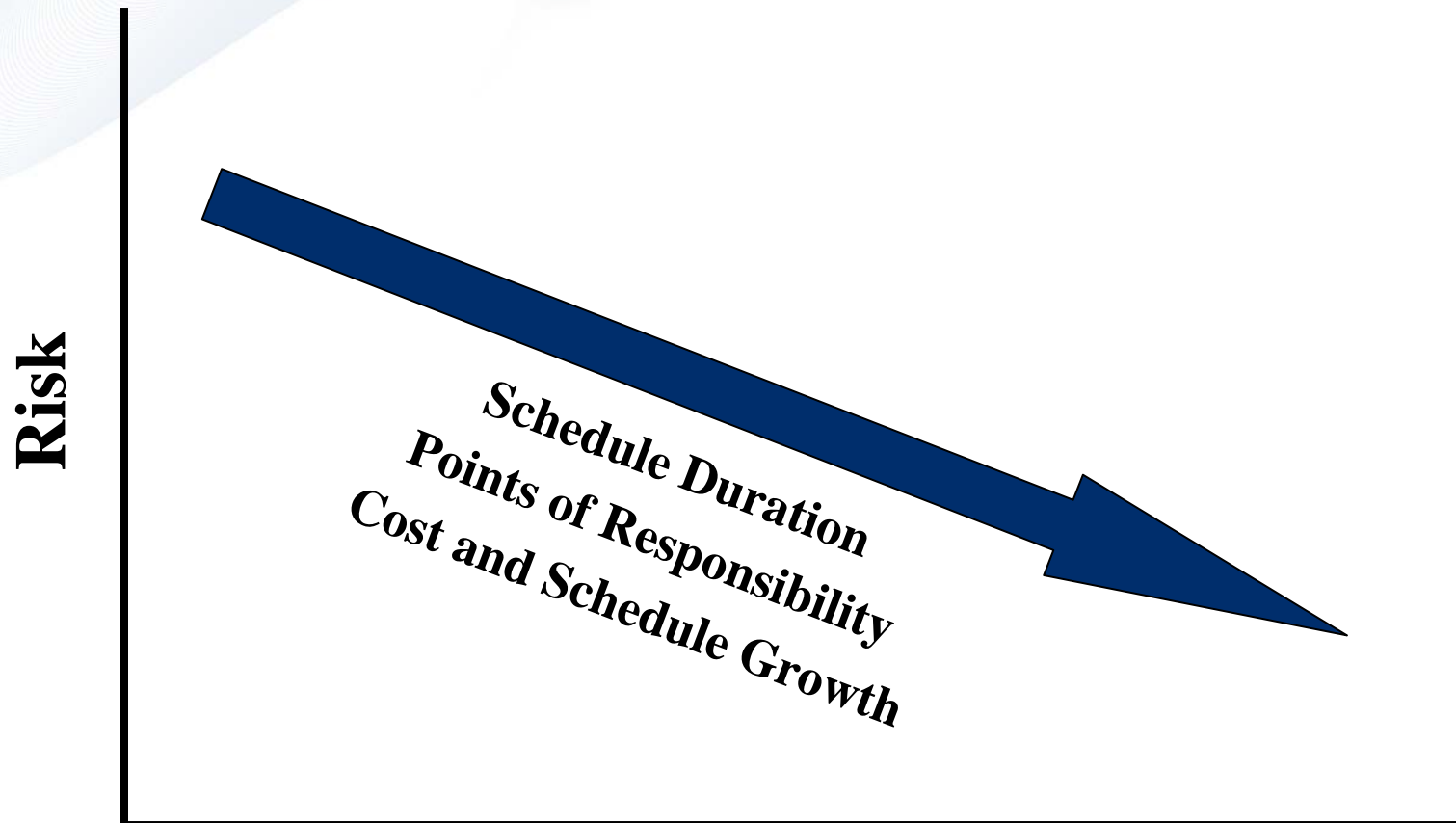
Owner's Control Profile



Design/Bid/Build → CM@Risk → Design/Build

Delivery Mechanism

Owner's Risk Profile



Design/Bid/Build → CM@Risk → Design/Build

Delivery Mechanism

Risk Allocation Matrix

RISK ²	Design/Build	
	Owner	D/B Team
Design Issues		
Definition of Scope	X	
Project Definition	X	
Establishing Performance Requirement	X	
Preliminary Survey/Base Map	X	
Geotechnical Investigation - Initial Borings based on Initial Design	X	
Geotechnical Investigation - Initial Borings based on Proposal		X
Establish/Define Initial Subsurface Conditions	X	
Initial Geotechnical Analysis Report based on Preliminary Design	X	
Proposal-specific Geotechnical Analysis/Report		X
Plan Conformance with Regulations/Guidelines/RFP		X
Plan Accuracy		X
Design Criteria	X	
Conformance to Design Criteria		X
Design Review Process		X
Design QC		X
Design QA		X
Owner Review Time	X	
Changes in Scope	X	
Constructability of Design		X
Contaminated Materials	X	

How can the integrity of the procurement process be ensured?

- Clear evaluation criteria
- Defined scoring procedures

What are the characteristics of the projects that are suitable for D/B?

- Time constraints
- Project complexity
- Opportunity for innovation
- Not having Environmental Impact Statement and Record of Decision can hamper the D/B process

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Lessons Learned



Key Aspects of D/B

- Expedited schedule
- Projects with a higher level of complexity appear to be better suited
- D/B allows participants to think outside of the box and take ownership of the final product
- Less cost creep than traditional D/B/B

Project Development

- Owners should have a clear understanding of what they want and ask for it
- A risk allocation matrix will help identify the responsibilities of the owner and of the contractor
- Owners preliminary designs should allow a contractor to do preliminary estimating

Project Development

- 30 percent designs were considered sufficient to describe the owner's requirements without compromising the possibility of innovation
- Procurement evaluation criteria should be established clearly and include decision parameters and ratings
- Pre-qualify no more than three D/B teams

Project Development

- Consider a suitable stipend to short-listed bidders commensurate with the size and complexity of the project
- A 3-year warranty was considered reasonable
- An arbitration procedure for dispute resolution should be included in the D/B contract

Contract Management

- Have regular meetings, review hardships and contingency items, ensure no surprises
- Deal with any financial issues immediately
- Design submissions need to be largely complete and accurate and have contractor buy-in before being submitted to the owner for review

Project Management

- The owners project team should be committed to the D/B process
- Owners should retain an outside independent firm to review the design submittals if they do not have the necessary in-house capabilities
- Due to compressed schedules, the owner's design reviews should be completed by reviewers highly experienced in the subject matter

Project Management

- Partnering session to establish and understand aspects of the project that need to be done
- Designers being retained by the contractor as a part of the D/B entity did not appear to be an issue
- Advantageous to have contractor personnel be an integral part of the design team

Quality Management

- D/B lead should be responsible for the overall QC of the project and QA checks of the subcontractors' QC
- QMP should include, organizational details, quality procedures, inspection and testing frequencies, corrective action plans, reporting requirements, etc
- ISO 9000 Guidelines are a good reference

Quality Management

- Subcontractors should be responsible for the QC of their own work
- The owner and/or owner's representative should provide QA oversight
- QA/QC information and test results should be readily available to all parties in the D/B project

Quality Plan Requirements

Example table of contents for quality management plans for a D/B project.

PART 1 QUALITY MANAGEMENT SYSTEM

- 1.1 Quality Management System
- 1.2 D/B Team Responsibilities
- 1.3 Quality Management System Requirements
- 1.4 Certification
- 1.5 Documentation Deliverables
- 1.6 Timing of Implementation
- 1.7 Compliance with Quality Management System
- 1.8 Continuous Improvement in Quality Management System

PART 2 QUALITY DIRECTOR

- 2.1 Appointment and General Responsibilities
- 2.2 Specific Responsibilities

PART 3 TESTING

- 3.1 Testing Requirements
- 3.2 Accreditation Standards
- 3.3 Remedial Work

PART 4 QUALITY AUDITS AND MONITORING

- 4.1 Quality Audit Plans
- 4.2 Owner's Quality Audits
- 4.3 Owner's Monitoring
- 4.4 Deficient Quality Audits
- 4.5 Third Party Audits

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Project Suitability



Project Suitability for D/B

- Set aside traditional processes and relationships
 - A unique and distinctive project delivery process
 - Best-value selection combines the best features of both professional qualitative selection and competitive price selection

Project Suitability for D/B

- Determination for Suitability of Design/Build
 - Large airport projects may be up to 3 years in the planning and funding stages
 - EIS and ROD should be in place
 - Does legislation exist to allow D/B Procurement?

Project Suitability for D/B

- Primary Considerations
 - Time constraints for project delivery
 - Environmental impact complete
 - Project complexity

Project Suitability for D/B

- Secondary Considerations (partial list)
 - Well defined scope - clear performance requirements
 - Project size
 - Owner experience and resources
 - Contractual restraints (complexity)
 - Allocation of risks

Project Suitability for D/B

- Other Considerations (partial list)
 - Operational constraints
 - Budget
 - Unforeseen subsurface conditions
 - Roles and responsibilities
 - Surety/bonding/insurance, etc

Project Suitability Template

- Considers primary, secondary, and other factors
- Assigns appropriate weighting factors
- Weighting factors based on Owner's needs and expectations

Project Suitability Template

- Outcome can range from 0 to 100
 - > 65 , suitable for D/B
 - 50 to 65, can be considered
 - < 50 , not considered suitable

A. Primary Considerations

Part A Weighting: 50

Consideration	Rating	Weighting	Weighted Value	Weighting Guidelines		
				Low	Medium	High
Time constraints for project delivery	High	33.3	33.3	Sufficient time for standard procurement	Need to accelerate project delivery	Insufficient time for standard delivery
Status of environmental approvals	Low	33.3	6.7	Not started	Underway	Complete
Project complexity	Medium	33.3	20.0	Simple project	Moderate complexity	Significant complexity
Total		100.0	60.0			
		Weighted Total:	30.0			

B. Secondary Considerations

Part B Weighting: 25

Consideration	Rating	Weighting	Weighted Value	Weighting Guidelines		
				Low	Medium	High
Well defined scope	Medium	10.0	6.0	Concept only	Scope needs refinement	Clearly defined scope
Clear performance requirements	Medium	10.0	6.0	Performance requirements unknown	Performance requirements established	Performance requirements established
Project size	High	5.0	5.0	< \$ 1 million	\$1 to \$ 5 million	> \$5 million
Available competition	Medium	10.0	6.0	< 3 possible bidders	3 to 5 possible bidders	> 5 bidders
Owner experience and resources	High	10.0	10.0	First design/build project	Some experience	Significant experience
Contractual restraints (complexity)	Medium	5.0	3.0	Complicated contracting process	Some contractual obstacles	No significant contractual issues
Ability to pay stipend	High	10.0	10.0	Cannot pay stipend	Unknown	Can pay stipend
Degree of team collaboration	High	10.0	10.0	Unknown teaming arrangements	May know some team members	Owner familiar with the teams
Number of contracts	Medium	10.0	6.0	Many separate small contracts	Several contracts but manageable	One overall contract
Allocation of risks	High	10.0	10.0	Owner retains majority of risk	Risks shared between owner and D/B	Transfer majority of risk to D/B team
Interest in innovation	Medium	10.0	6.0	Low	Medium	High
Total		100.0	78.0			
		Weighted Total:	19.5			

C. Other Considerations

Part C Weighting: 25

Consideration	Rating	Weighting	Weighted Value	Weighting Guidelines		
				Low	Medium	High
Airside security	High	8.0	8.0	Non airfield operations area work	Some airfield operations area work	Airfield operations area work
Operational constraints	High	8.0	8.0	Significant operational constraints	Some operational constraints	No operational constraints
Cost of project	Medium	6.0	3.6	No fixed budget	Some budget flexibility	Fixed budget
Utility relocations	High	6.0	6.0	Significant utility relocations	Some utility relocations	Minimal utility relocations
Availability and timing of funding	High	6.0	6.0	Unknown	Multiple funding periods/sources	Funding in place and available
QC/QA responsibilities	High	6.0	6.0	Owner's responsibility	Shared responsibility	Design/build entity responsibility
Weather conditions	Medium	6.0	3.6	Owner takes all weather related risk	Some weather risk transfer	Weather risk transferred to D/B team
Performance guarantees/warranties	High	6.0	6.0	Short term coverage	Medium term coverage	Long term warranties
Design reviews/approvals	Medium	6.0	3.6	Significant design review required	Moderate owner review required	Short turn around/minimal review
Impact of unknown site conditions	Medium	8.0	4.8	Owner's risk (geotech by owner)	Risk shared	D/B team risk (geotech by D/B)
Available competition	High	8.0	8.0	Few competitors	Many be several bidders	Many possible bidders
Ownership of intellectual property	High	6.0	6.0	Significant intellectual property	Some intellectual property	No intellectual property
Cost of preparing bid documents	Medium	6.0	3.6	High	Medium	Low
Bonding requirements	Medium	8.0	4.8	High	Medium	Low
Insurance requirements	Medium	6.0	3.6	High	Medium	Low
Total		100.0	81.6			
		Weighted Total:	20.4			

Sub Totals

A. Primary Considerations	50	30.0
B. Secondary Considerations	25	19.5
C. Other Considerations	25	20.4
Grand Total	100	69.9
Decision		Yes

Decision Range		
From	To	Consider
0	50	No
50	65	Consider
65	100	Yes

Secondary Considerations

B. Secondary Considerations

Part B Weighting: 25

Consideration	Rating	Weighting	Weighted Value
Well defined scope	Medium	10.0	6.0
Clear performance requirements	Medium	10.0	6.0
Project size	High	5.0	5.0
Available competition	Medium	10.0	6.0
Owner experience and resources	High	10.0	10.0
Contractual restraints (complexity)	Medium	5.0	3.0
Ability to pay stipend	High	10.0	10.0
Degree of team collaboration	High	10.0	10.0
Number of contracts	Medium	10.0	6.0
Allocation of risks	High	10.0	10.0
Interest in innovation	Medium	10.0	6.0
Total		100.0	78.0
		Weighted Total:	19.5

Weighting Guidelines

Weighting Guidelines

Low	Medium	High
Concept only Performance requirements unknown < \$ 1 million < 3 possible bidders First design/build project Complicated contracting process Cannot pay stipend Unknown teaming arrangements Many separate small contracts Owner retains majority of risk Low	Scope needs refinement Performance requirements established \$1 to \$ 5 million 3 to 5 possible bidders Some experience Some contractual obstacles Unknown May know some team members Several contracts but manageable Risks shared between owner and D/B team Medium	Clearly defined scope Performance requirements established > \$5 million > 5 bidders Significant experience No significant contractual issues Can pay stipend Owner familiar with the teams One overall contract Transfer majority of risk to D/B team High

Decision Range		
From	To	Consider
0	50	No
50	65	Consider
65	100	Yes

Design/Build Flowchart

Step 1

Determine
Suitability

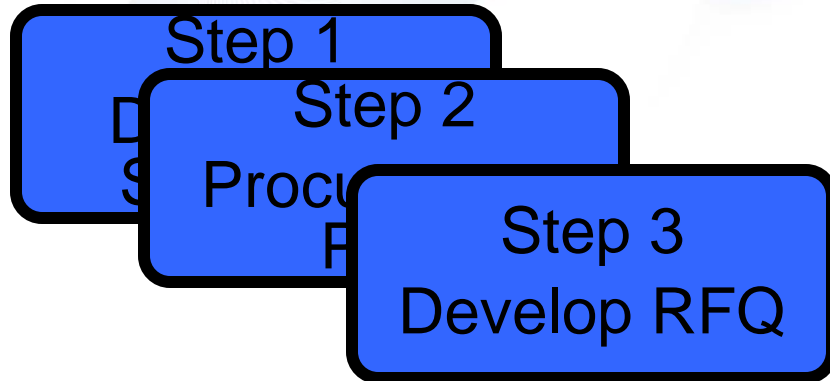
- Evaluate fatal flaws
- Complete suitability matrix

Design/Build Flowchart



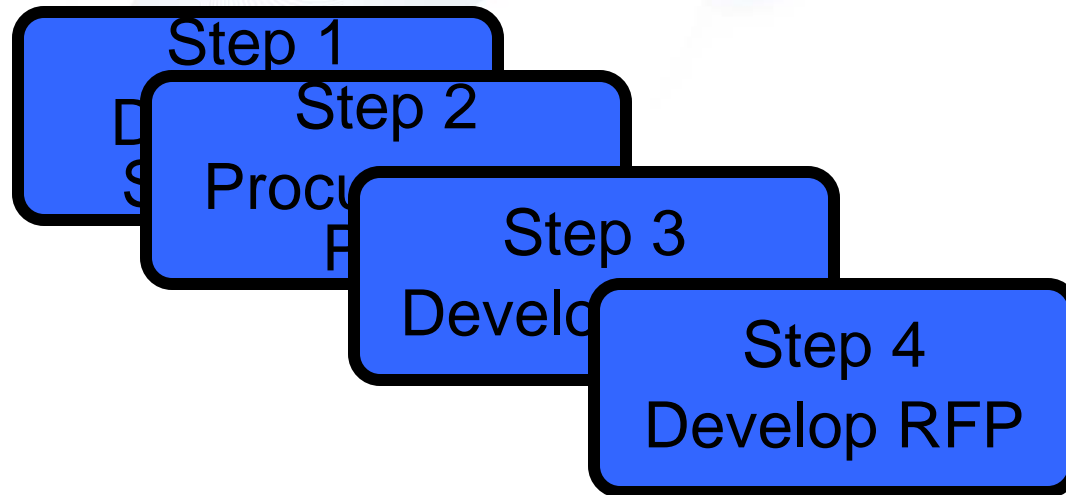
- Project description
- Assess risk
- Develop schedule and planning budget

Design/Build Flowchart



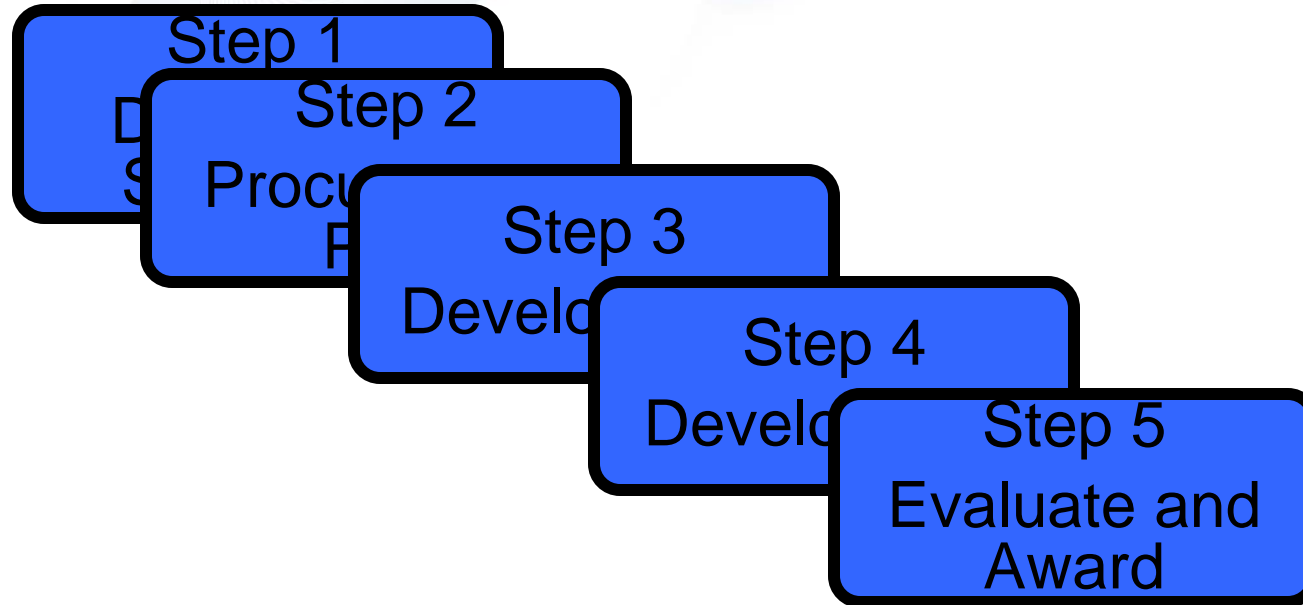
- Pre-qualification requirements
- Selection criteria and weighting
- Shortlist qualified proposers

Design/Build Flowchart



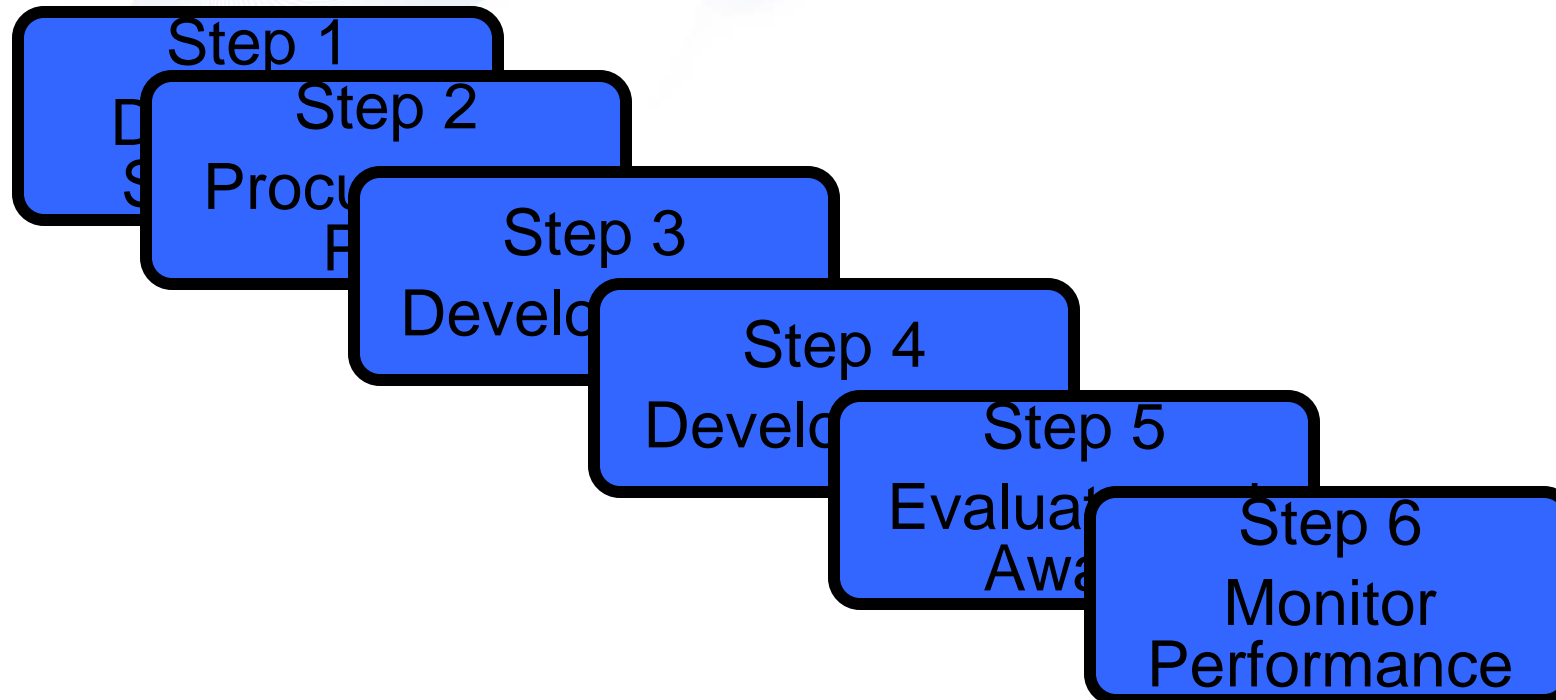
- Create knowledgeable selection panel
- Establish design guidelines
- Balanced contract language

Design/Build Flowchart



- Separate evaluate of technical and financial submission
- Promptly award contract

Design/Build Flowchart



- Hold chartering sessions
- Undertake auditing and monitoring
- Final acceptance

Technical Report and Best Practices

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BEST PRACTICES GUIDE



Draft ACC and UFC Documents



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD (AT&L) Memorandum dated 29 May 2002. This UFC is to be used for DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFCs are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCEA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet sites listed below. UFC are effective upon issuance and are distributed only in electronic media from the following source: Whole Building Design Guide web site <http://dod.wbdg.org/>. Hard copies of UFCs printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

AUTHORIZED BY:

Subject: INTRODUCTION TO
DEVELOPING DESIGN/BUILD
CONTRACTS FOR AIRFIELD
CONSTRUCTION PROJECTS

Date: 06/26/09

AC No. XX-XX

Initiated By:
ANM-XXX

1. PURPOSE. This Advisory Circular (AC) provides guidance on the preparation of design/build (D/B) alternate procurement contracts for airport pavement construction projects.

Background. Design/build is a method of project delivery in which the design and construction phases of a project are combined into one contract and awarded on either a low bid or best-value basis. D/B projects allow for greater collaboration between the designer and contractor in the delivery of transportation projects.

Advantages of the D/B methodology include:

- Single point accountability for owner
- Opportunities for increased efficiency in procurement and construction
- Reduction in construction time
- Access to private sector experience
- Opportunities for innovation and cost savings
- Transfer of delivery risk to the private sector
- Fewer construction claims

The disadvantages of the D/B methodology include:

- Best value and qualification-based selection is not conventional for most construction contracts



QUESTIONS

