ALTERNATIVE PROJECT DELIVERY METHODS FOR INFRASTRUCTURE PROJECTS

11th Arizona Pavements/Materials Conference
November 20, 2014 - Session 3: Quality Assurance

Wylie Bearup, PE, PhD
Executive Director, Alliance for Construction Excellence
Beaver Ames Heavy Civil Chair, Del E. Webb School of Construction

Agenda

1. City of Phoenix Use of APDM for Infrastructure Projects
2. ASU Research on APDM Use for Transportation Projects
3. National Industry Trends
4. Summary and Q&A

CITY OF PHOENIX USE OF ALTERNATIVE PROJECT DELIVERY METHODS

Typical Uses of APDM

METHOD	PROJECT TYPE
Design-Bid-Build **DBB**	Typical streets improvements, storm drains, waterlines
Design-Build **DB**	Fast tracked projects, speed premium
Construction Manager at Risk **CMAR**	Buildings, water/wastewater & aviation facilities; complex horizontal jobs
Job Order Contracts **JOC**	Renovation, remodel, small new construction < $2M

GOAL: Use the right tool for the job.

Delivery Method Experience

METHOD	Projects		Amount	
	Number	%	Total	%
Design-Build	76	1%	$762M	10%
Const. Mgr @ Risk	336	4%	$3,726M	50%
Design-Bid-Build	3,474	38%	$2,191M	30%
Job Order Contracts	5,372	58%	$754M	10%
TOTAL	9,258	100%	$7,433M	100%

NOTE: Completed from Jan 2001 through Oct 2013. Construction value shown.

Delivery Method Experience by Project Type

METHOD	Total Projects	Infrastructure		Transportation	
		No.	%	No.	%
Design-Build	76	16	21%	1	1%
Const. Mgr @ Risk	336	177	53%	13	4%
TOTAL	412	193	47%	14	3%

NOTES:

1. Major projects completed using DB and CMAR since Jan 2001.
2. Transportation projects included within Infrastructure project total.

City of Phoenix – APDM Transportation Projects

CONSTRUCTION MANAGER AT RISK:

1. Downtown Traffic Management System
2. Camelback Road Underpass
3. Sonoran Boulevard
4. Avenida Rio Salado
5. Historic Street Lights
6. 19th Ave Bridge over CAP
7. Arcadia Area Drainage Project, Phase 1
8. Lower Buckeye: 43rd to 35th
9. Regional ITS FOB Phase A
10. South Phoenix Village Sidewalks
11. Greenway Parkway Bridge
12. Pinnacle Peak: 55th to 45 Avenue
13. 64th Street: Mayo Blvd to L101

DESIGN-BUILD:

1. Centennial Way

JOB ORDER CONTRACTING:

- Approximately 400 projects

APDM for Infrastructure Projects

- City of Phoenix, vast majority of APDM projects were vertical
- Vast majority of APDM research done on vertical projects
- Therefore, need exists for more research related to horizontal use of APDM

→Evan Bingham, PhD Candidate, at ASU proposed research to fill void, address use of APDM on transportation projects

  - Research successful, degree awarded
  - Present very small portion of research results

UNIVERSITY RESEARCH ON USE OF ALTERNATIVE PROJECT DELIVERY METHODS

Research Objectives

- Provide better decision basis for project delivery method selection
- Identify tested best management practices for delivery methods
- Increase agency understanding and knowledge of APDM
- Develop guide for pre-construction services and CMAR use

Literature Findings

Delivery Time

- DB: 14% – 33% faster than DBB
- CMAR: 13% faster than DBB
- DB: 23% faster than CMAR

Unit Cost

- DB: 3% –13% less than DBB in eight studies
- CMAR: 4.5% less than DBB in one study

Schedule Growth

- DB: 15% higher to 12% lower growth
- CMAR: no growth measures found

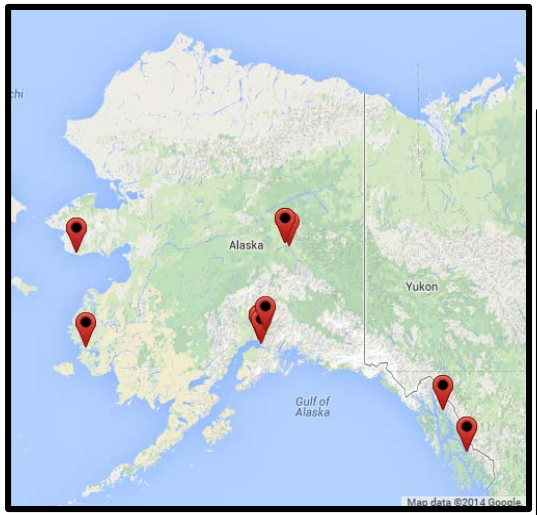
Cost Growth

- DB: less cost growth than DBB in 12 studies
- CMAR: more cost effective than DBB in one study

Gaps in APDM literature

- Large transportation study
- Best management practices
- Pre-construction services
- CMAR application and processes

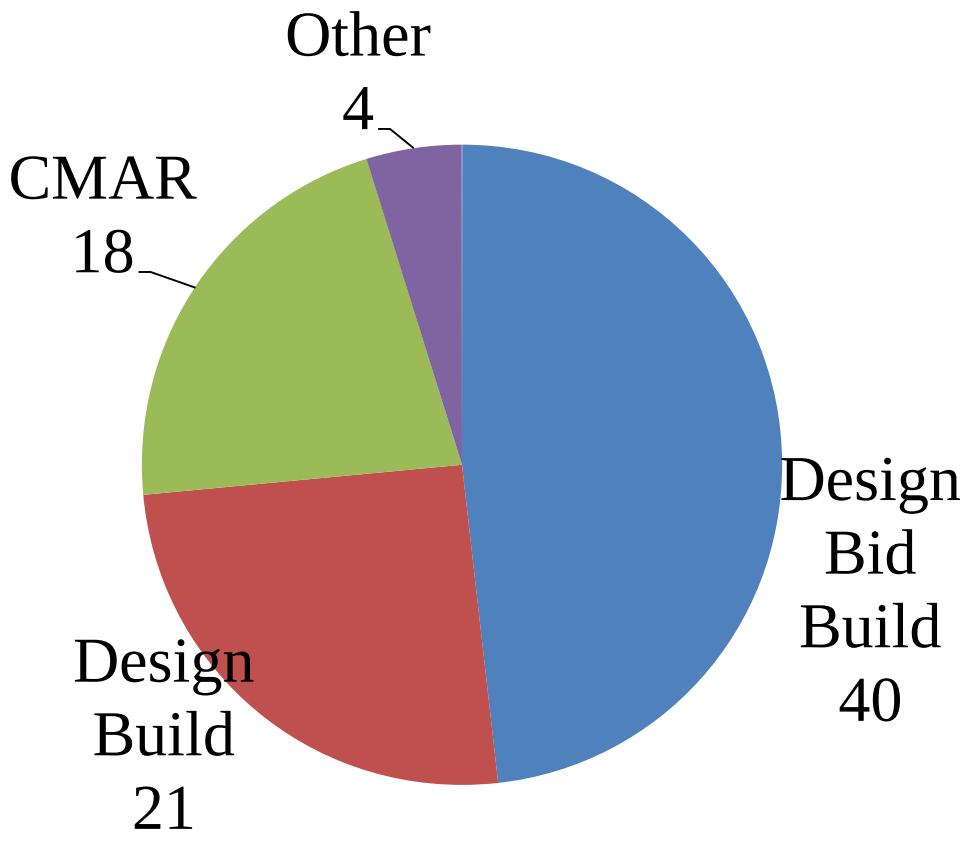
Project Locations

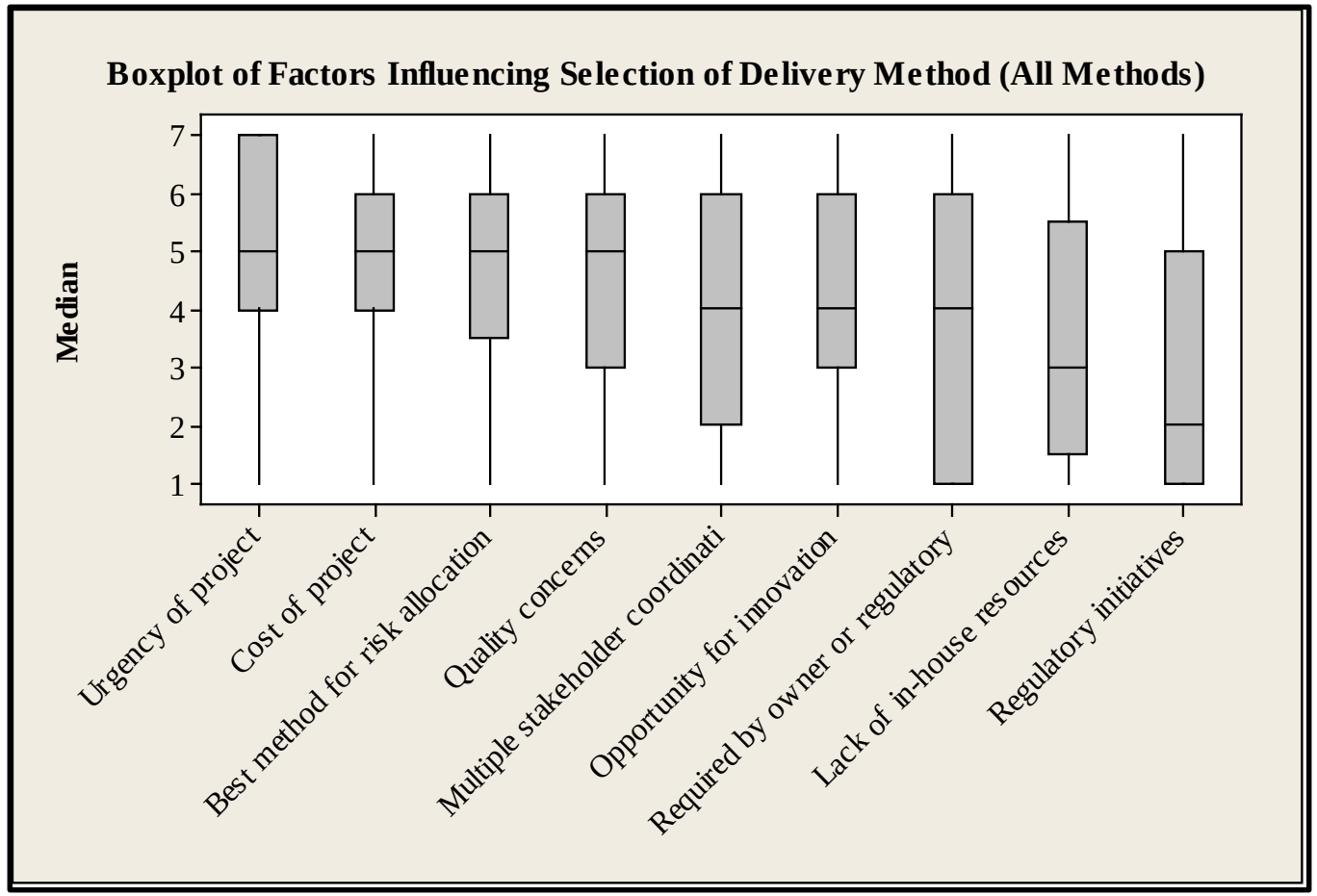


83 National Transportation Projects

State/Federal District	Number of Projects
Alaska	11
Arizona	13
California	3
Colorado	1
Delaware	2
Florida	7
Georgia	9
Idaho	6
Louisiana	2
Maryland	8
Michigan	1
Minnesota	1
Montana	1
Tennessee	4
Utah	9
Washington, DC	1
Wyoming	4

Delivery Methods Used

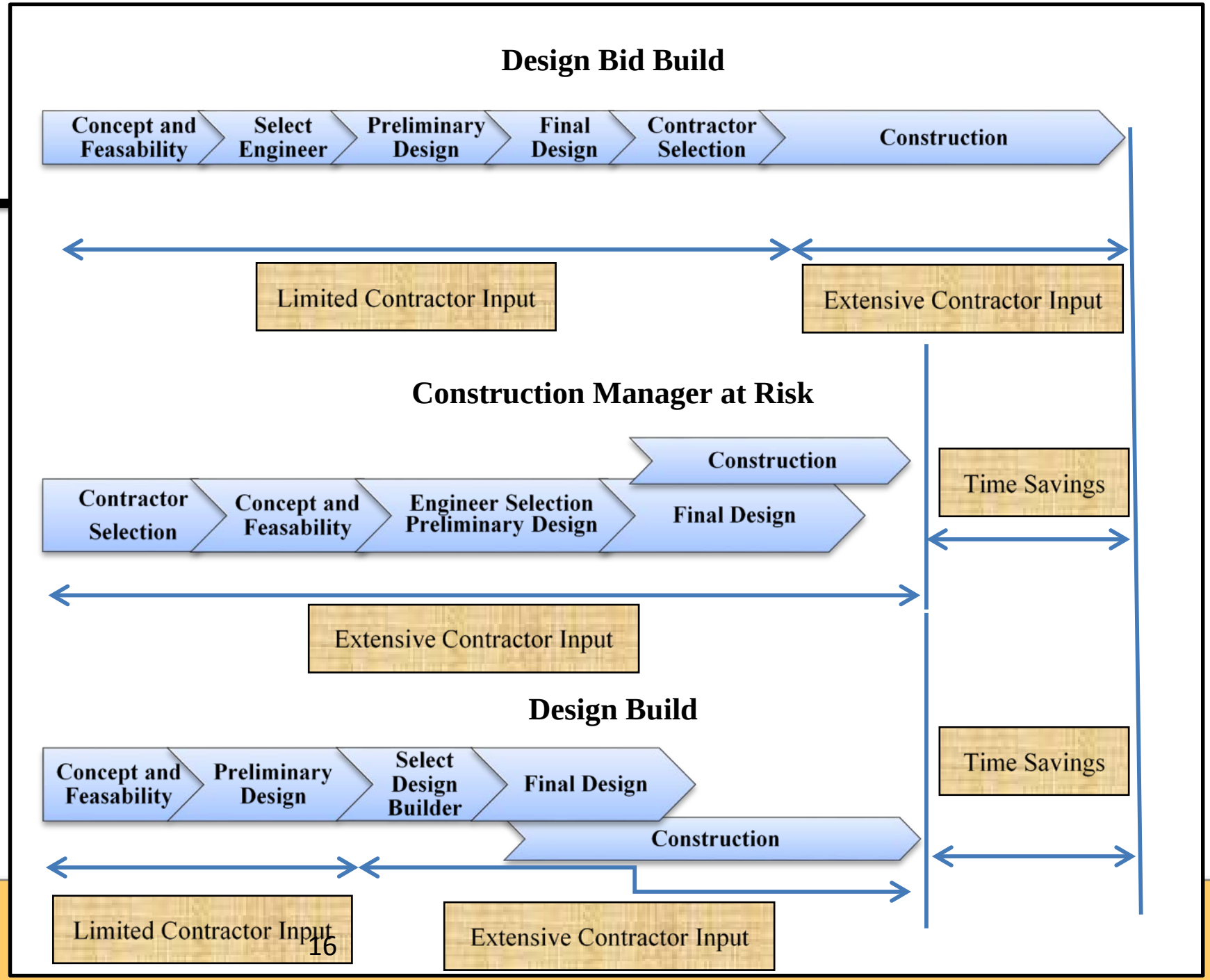




Delivery Method Satisfaction

Delivery Method	Number Projects	Yes, best fit	No, not best fit	Selected Alternative
Design-Bid-Build	33	91%	9%	CMAR 67%, DB 33%
Design-Build	17	88%	12%	DBB 100%
Constr. Mgr @ Risk	15	100%	0%	N/A

Schedule Comparison



Challenges for Successful Project Completion

CMAR	
Public Involvement	2
Cumulative Impact of Change Orders	1
Decision Complexity	1
Environmental Impacts	1
Owner Changes/Approvals	1
Project Funding	1
Project Schedule	1

(N = 8)

DBB	
Environmental Impacts	6
Existing Conditions	3
Project Schedule	3
Public Involvement	3
Constructability Procedure	2
Differing Site Conditions	2
Schedule Acceleration	2
Decision Complexity	1
Long Lead Items/Procurement	1
Owner Changes/Approvals	1
Project Schedule	1
Right of Way	1
Safety Hazards	1
Unclear Project Purpose	1

(N = 30)

DB	
Construction Site Access	3
Differing Site Conditions	2
Environmental Impacts	2
Project Schedule	2
Constructability Procedure	1
Cumulative Impact of Change Orders	1
Decision Complexity	1
Equipment Complications/Availabilit	1
Owner-Mandated Subcontract	1
Public Involvement	1
Right of Way	1
Schedule Acceleration	1
Team Member Coordination	1

(N = 18)

Practices to Improve Project Outcomes

PRACTICE	FREQUENCY
Front end planning	12
Project risk assessment	7
Alignment of project participants	6
Disputes prevention and resolution	5
Constructability	4
Partnering	4
Team building	4
Change management process	3
Use of lessons learned system	3
Materials management	3
Planning for startup	2
Quality management techniques	2
Other from the previous question	2
Benchmarking of other projects	1
Value engineering	1
Life cycle costing	1
Zero accidents techniques	0
Sustainable design and construction	0

Improvements to Avoid Changes

CMAR	
Agency coordination and estimating	1
Cost estimating	1
Design management	1
Multiple bid package planning	1
Risk identification and assessment	1
Site logistics planning	1
Value analysis/engineering	1

(N = 7)

DBB	
Constructability/bidability analysis	4
Design management	2
Identification of project objectives	2
Risk mitigation	2
Agency coordination and estimating	1
Construction phase sequencing	1
Disruption avoidance planning	1
Real-time cost feedback	1
Risk identification and assessment	1
Site logistics planning	1
Stakeholder management	1
Value analysis/engineering	1

(N = 18)

DB	
Risk identification and assessment	5
Constructability/bidability analysis	3
Design management	2
Agency coordination and estimating	1
Schedule development	1
Stakeholder management	1

(N = 13)

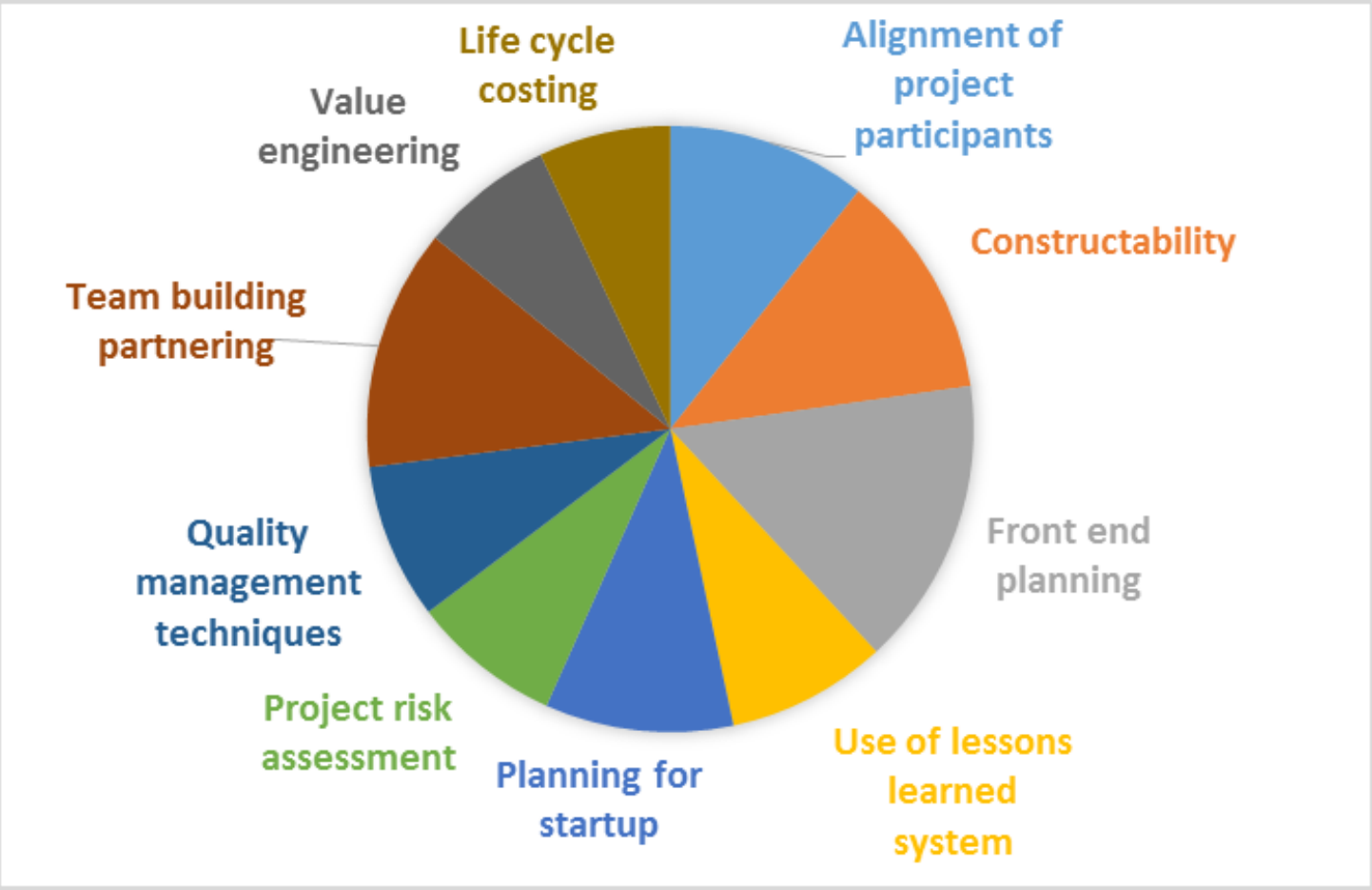
Most Beneficial Aspect to Team Alignment

ASPECT	FREQ'CY
Established expectations	12
Established team trust, honesty, and shared values	10
Communicated effectively with stakeholders	8
Developed individual and group roles and responsibilities	8
Conducted productive team meetings	4
Resolved conflicts appropriately	4
Defined project leadership and accountability	3
Defined project success	3
Established project priorities such as costs, schedule, public relations, etc.	3
Evaluated risk	3
Involved all project stakeholders appropriately	2
Addressed concerns	1
Effectively used planning tools	1
Measured team alignment	1
Conducted adequate pre-construction or front end planning practices	0
Documented project details, including shortcomings and successes	0
Instituted effective team building programs	0

Best Practices

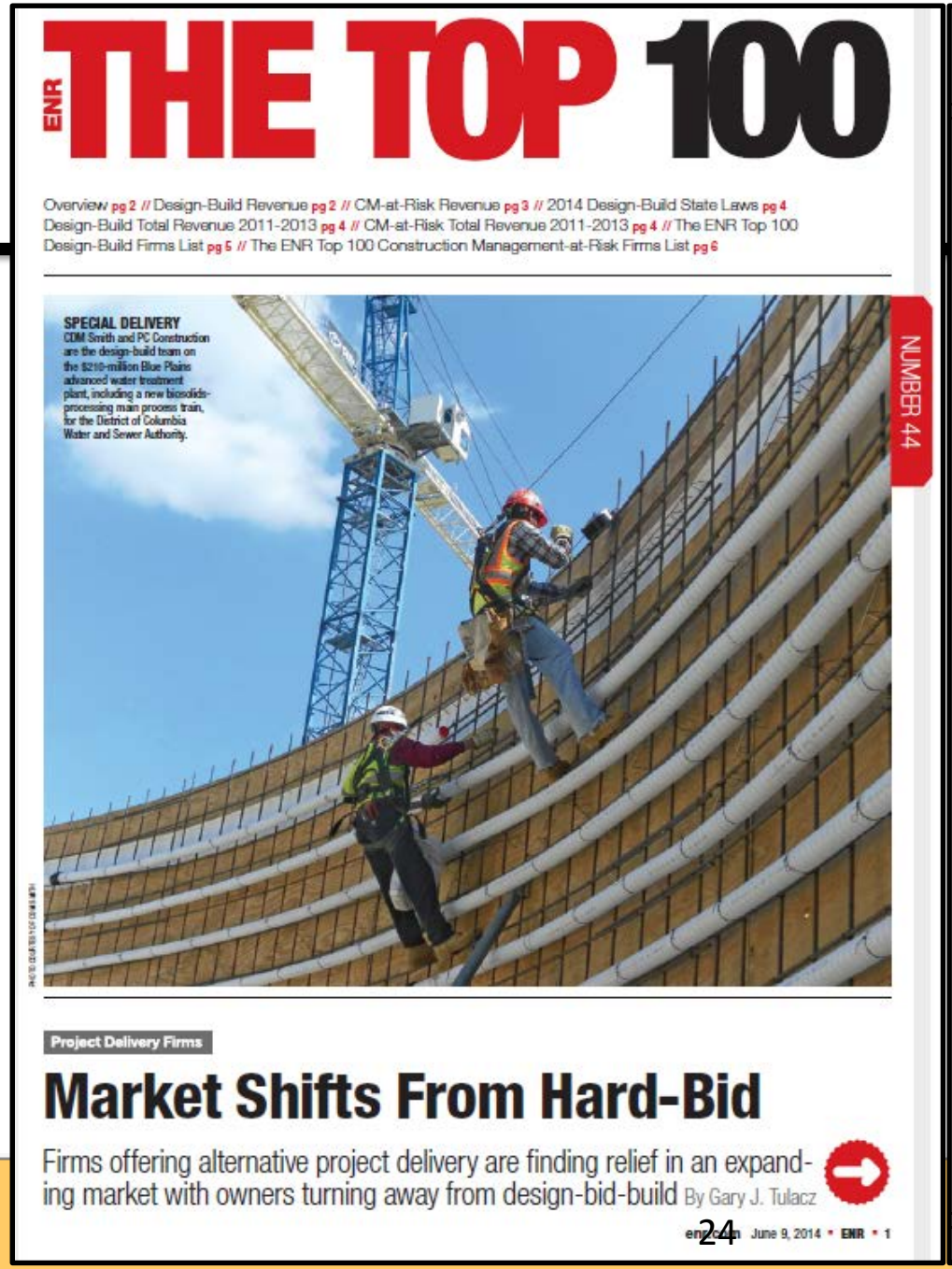
- Alignment and Partnering
- Benchmarking & Metrics
- Change Management
- Constructability
- Disputes Prevention & Resolution
- Front End Planning
- Lessons Learned
- Materials Management
- Planning for Startup
- Project Risk Assessment
- Quality Management
- Zero Accidents Techniques
- Sustainable Construction
- Value Engineering
- Life Cycle Costing

Best Overall Practice



NATIONAL TRENDS ON USE OF ALTERNATIVE PROJECT DELIVERY METHODS

Industry Trends



ENR

THE TOP 100

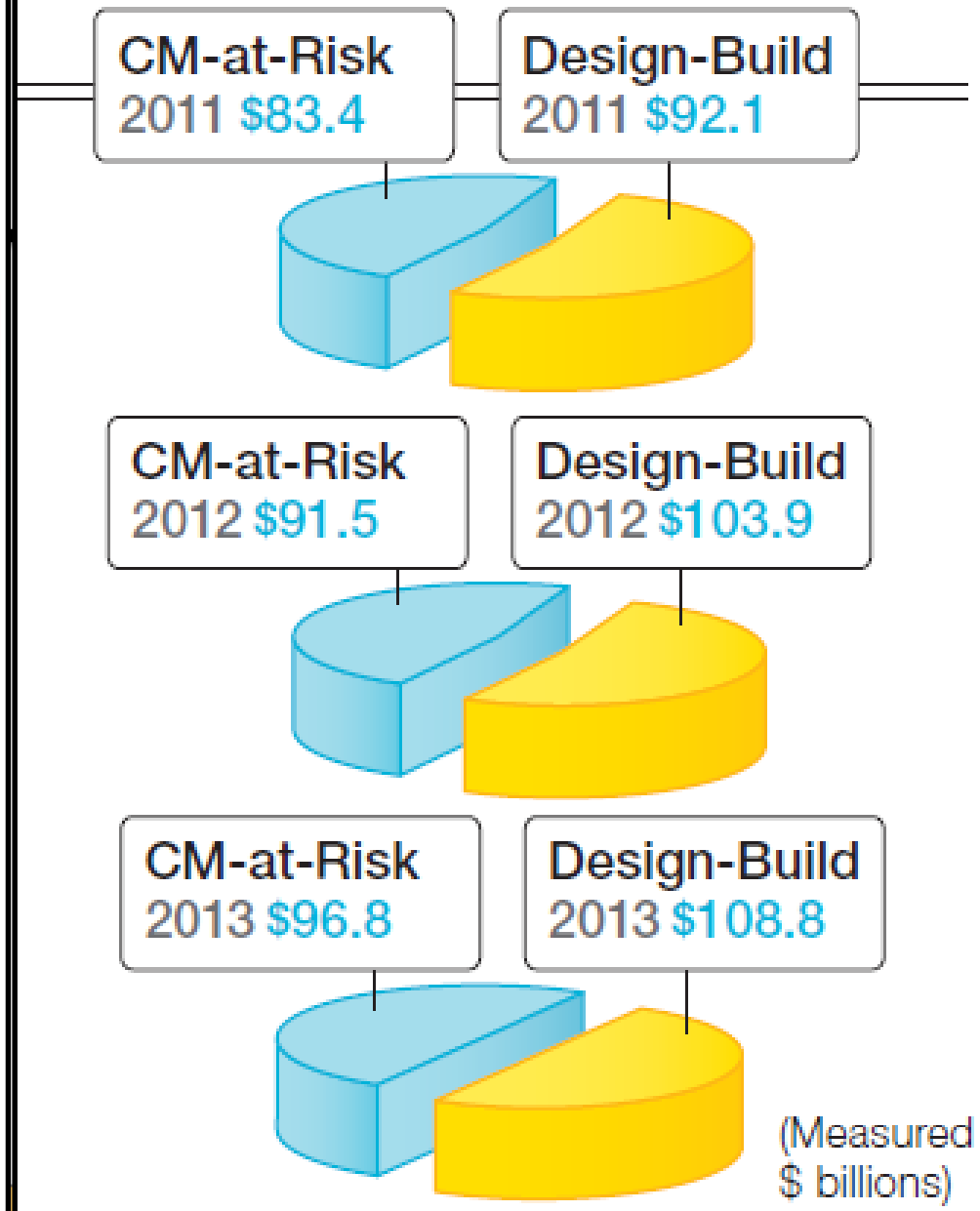
SPECIAL DELIVERY
CDM Smith and PC Construction are the design-build team on the $210-million Blue Plains advanced water treatment plant, including a new biosolids-processing main process train, for the District of Columbia Water and Sewer Authority.

NUMBER 44

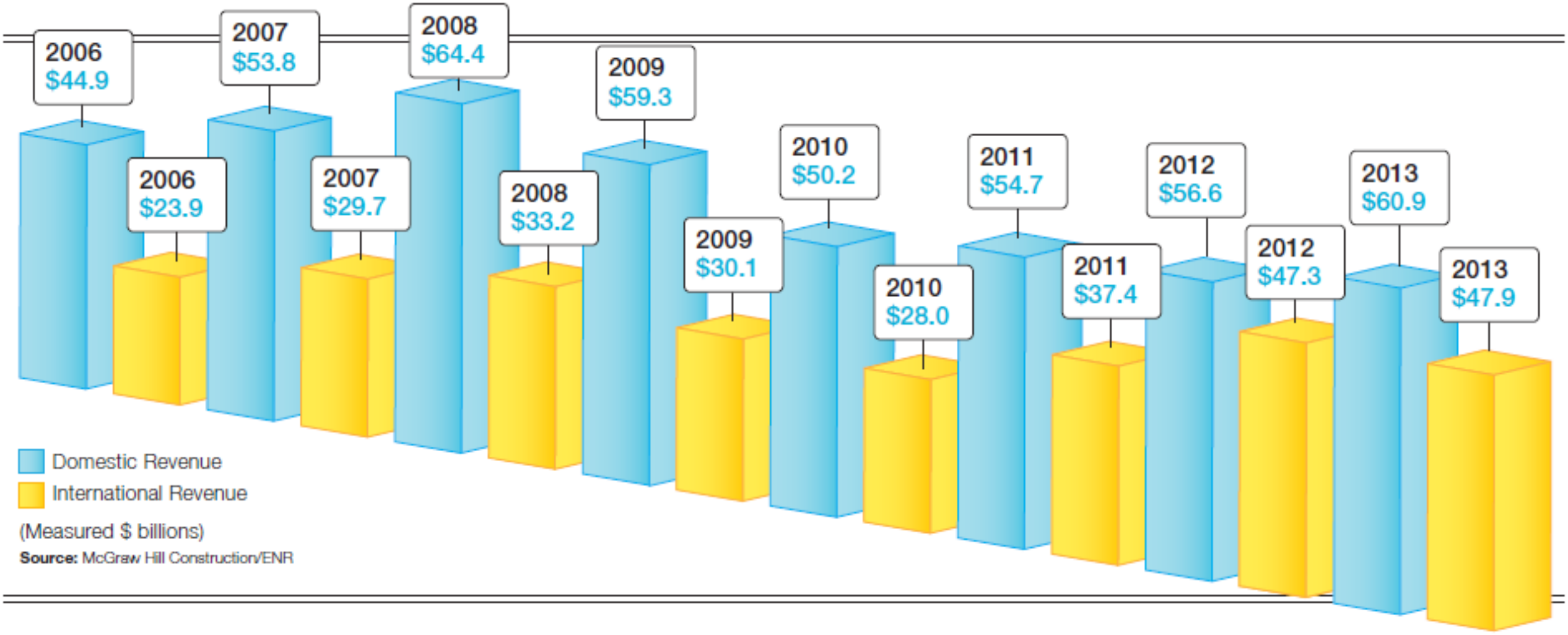
Project Delivery Firms

Market Shifts From Hard-Bid

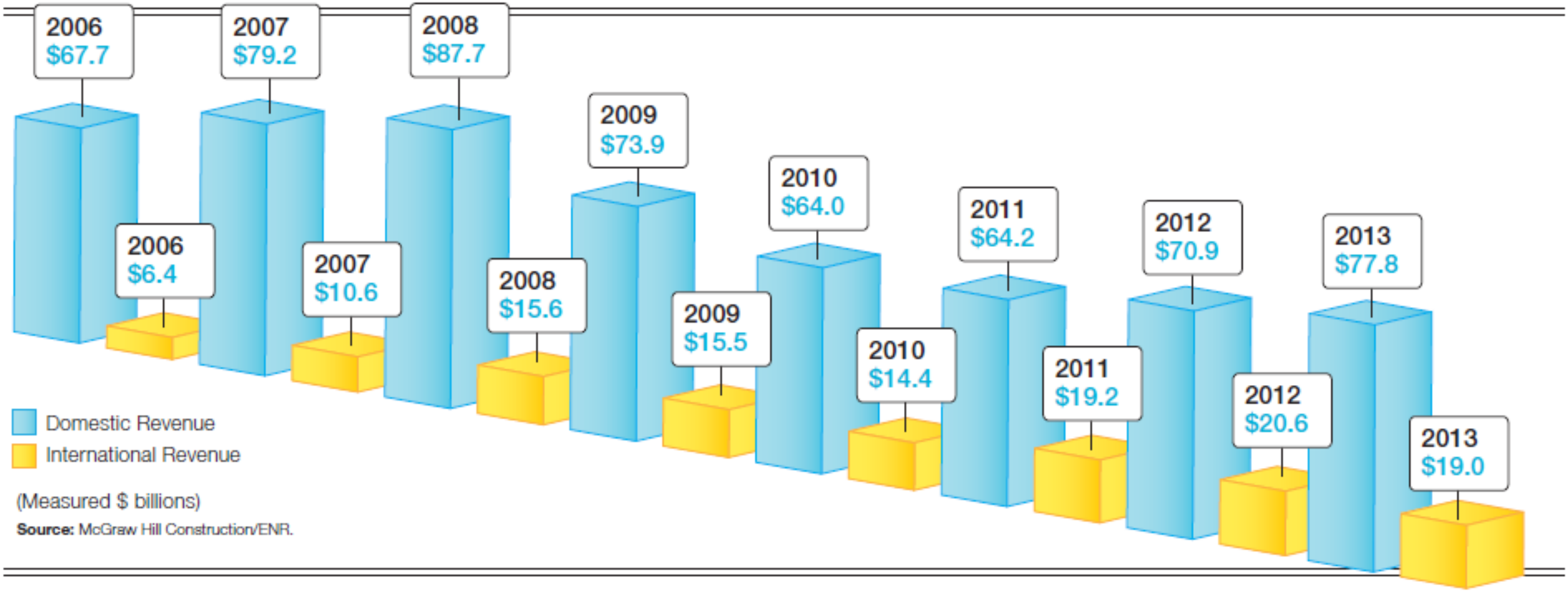
Firms offering alternative project delivery are finding relief in an expanding market with owners turning away from design-bid-build By Gary J. Tulacz



Design-Build Revenue Rises Yet Again



Domestic CM-at-Risk Leads Gains



Reasons for Recent Shift to APDM

Now, as the market is impro
absorbing some hard-won lesso
One is that disregarding the
project delivery to seek savings v
bid-build approach often costs

"There were a lot of owners that thought they would save money on initial bids by going the design-bid-build route and some of them doubtless did save some up-front costs," says Jim Whitaker, principal for Dallas-based architectural firm HKS and this year's board chairman of the Design-Build Institute of America (DBIA), Washington, D.C. "Any savings were enough to buy plenty of aspirins for all the headaches many owners experienced from poor performance, change orders and schedule problems from using a less efficient project delivery system," he says.

Source: ENR June 9, 2014.

Voters Are Willing to Pay for Infrastructure. Is Congress?

Ballot initiatives in several states were approved last week to improve transportation systems.

BY FAWN JOHNSON

Follow on Twitter

Source: National Journal website; Nov 20,2014

Infrastructure Financing Challenges

- As industry shifts to APDM for infrastructure projects, the bigger issue looms:

  Where's the money?? What will be the source of funding??

- Transportation funding has traditionally been from gas taxes both at national and local level
  - This model is unsustainable, rates haven't increased since 1990s
- Must find new model to fund infrastructure, new and O&M
- Public-Private Partnerships one option; AZ needs TIF

QUESTIONS?

Contact Information:

Wylie Bearup, PE, PhD

Executive Director, Alliance for Construction Excellence
Del E. Webb School of Construction
School of Sustainable Engineering and the Built Environment
Ira A. Fulton Schools of Engineering
Arizona State University
Phone: 480-965-9284
Email: wylie.bearup@asu.edu