

Project Delivery Systems:

How They Impact Efficiency and Profitability
in the Buildings Sector



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McGraw Hill Construction Research & Analytics/ Industry Insights & Alliances

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Harvey M. Bernstein, F.ASCE, LEED AP

Senior Director, Research & Analytics

Burleigh Morton

Director, Research Communications

Michele A. Russo, LEED AP

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Project Delivery Systems: How They Impact Efficiency and Profitability in the Buildings Sector SmartMarket Report

Executive Editor

Harvey M. Bernstein, F.ASCE, LEED AP

Editorial Director

Michele A. Russo, LEED AP

Managing Editor

Donna Laquidara-Carr, LEED AP

Senior Director, Head of Marketing

William Taylor

Creative Manager, Media

Juan Ramos

Art Director

Rosa Pineda
Alison Lorenz

Contributing Art Director

AD-BOUTIQUE, INC.
Terumasa Yamada

Contributors

Belle Communications, LLC
Bruce Buckley
Katharine Logan
Jeffrey Yoders

Research Project Manager

Dana Gilmore, MRA, PRC

For further information on this
SmartMarket Report or for any
in the series, please contact:

**McGraw Hill Construction
Research & Analytics
34 Crosby Drive, Suite 201
Bedford, MA 01730**

1-800-591-4462

MHC_Analytics@mcgraw-hill.com



About McGraw Hill Construction

McGraw Hill Construction's data, analytics, and media businesses—*Dodge, Sweets, Architectural Record, and Engineering News-Record*—create opportunities for owners, architects, engineers, contractors, building product manufacturers, and distributors to strengthen their market position, size their markets, prioritize prospects, and target and build relationships that will win more business. McGraw Hill Construction serves more than one million customers through its trends and forecasts, industry news, and leading platform of construction data, benchmarks, and analytics.

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Introduction

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR

The need to improve efficiency, productivity and profitability has been a growing concern in the construction industry. McGraw Hill Construction has conducted research on critical trends in the buildings sector that address these issues, such as the use of building information modeling, the rise in information mobility and the implementation of Lean construction practices. In this study, we explore the impact of one of the most fundamental ways in which project owners can impact efficiency, productivity and profitability: the selection of a project delivery system.

The findings demonstrate, though, that there is no clear, simple recommendation for the use of a specific delivery system. Architects, contractors and owners each see value in all three of the established delivery systems included in the study.

- **Design-Bid-Build: 38% of architects and 22% of contractors find this to be the best system to reduce project cost.**
- **Design-Build: 43% of architects and 50% of contractors find this to be the best system to reduce project schedule, and a higher percentage of owners using this method report projects finishing ahead of schedule than with the other two systems.**
- **Construction Management at Risk: A higher percentage of owners doing projects that employ this system find that their projects are under budget (33%), and 60% report being very satisfied with the projects they have conducted, which is at least 20 percentage points higher than those using design-bid-build or design-build.**

These findings and others across the 11 benefits measured in the research reveal that architects, contractors and owners believe that delivery systems impact all these benefits, but the perception of which system provides the best performance often varies by player and benefit.

One consistent finding in the other studies conducted by McGraw Hill Construction is that improved collaboration, communication and the ability to share information have a profound impact on efficiency, productivity and profitability. This project delivery study suggests that these improvements are possible in all of the established delivery methods, but it also looks at an emerging system: integrated project delivery (IPD). While the incidence of its use is still somewhat low in the industry, **one-third to nearly one-half of the practitioners experienced with IPD find it to be the best system to achieve improved communication, increased process efficiency and improved productivity.**

40% of those familiar with IPD also expect to see increased use of this system in the next three years, and as industry familiarity with IPD increases, it is likely that growth will exceed expectations.

We would like to thank our premium corporate sponsor, MMC Corporation, our premium association partners—the American Institute of Architects (AIA), the Design-Build Institute of America (DBIA) and the Society for Marketing Professional Services (SMPS)—and our contributing partner Bentley Systems for their support in bringing this information to the industry.



Harvey M. Bernstein
F.ASCE, LEED AP
Vice President
Industry Insights & Alliances
McGraw Hill Construction



Donna Laquidara-Carr
Ph.D., LEED AP
Manager
Industry Insights &
Research Communications
McGraw Hill Construction

Harvey M. Bernstein, F.ASCE, LEED AP, has been a leader in the engineering and construction industry for over 30 years. Currently, he has lead responsibilities for MHC's market research group, including MHC's thought leadership initiatives in areas such as commercial and residential green building, BIM, information mobility, innovation and global construction markets. Prior to joining MHC, Bernstein served as President and CEO of

the Civil Engineering Research Foundation. He has written hundreds of papers covering innovation and sustainability and currently serves as a member of the Princeton University Civil and Environmental Engineering Advisory Council and the National Building Museum Board of Trustees. He is a visiting professor with the University of Reading's School of Construction Management and Engineering in England. Bernstein has an M.B.A.

from Loyola College, an M.S. in engineering from Princeton University and a B.S. in civil engineering from the New Jersey Institute of Technology.

Donna Laquidara-Carr, Ph.D., LEED AP, currently provides editorial direction, analysis and content to MHC's *SmartMarket Reports*, examining critical construction industry trends including BIM, risk management and green building. Prior to

starting this position in 2008, she worked for nearly 20 years with MHC's Dodge division, where she gained insight into the construction news industry. From 2005–2008, she served as Editorial Training and Policy Manager, responsible for educating over 250 reporters on key trends in the industry. Laquidara-Carr has a Ph.D. from Tulane University, an M.A. from Boston University and a B.A. from Middlebury College.

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This page:
The Governor George Deukmejian Courthouse in Long Beach, California (left) and the Perot Museum of Nature and Science in Dallas, Texas. (below)



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Data: Executive Summary

Architects, contractors and owners each have a different perspective on the advantages of the three established project delivery systems—design-bid-build, design-build and construction management at risk (CM-at-risk.)

The results of this latest research clearly demonstrate the value that firms in the buildings sector find in each system, but it reveals there is no definitive point of view on what they deliver. It also reveals growing interest in integrated project delivery, but very little knowledge about design-build-operate/maintain in the buildings sector.

Use of Project Delivery Systems in the Buildings Sector

Design-bid-build remains the most widely used delivery system for building projects, but about one quarter of contractors also report being engaged in projects using design-build and CM-at-risk. Architects report lower involvement in projects using design-build and CM-at-risk, with less than 20% using each.

The future looks bright for design-build and CM-at-risk, with a high percentage of owners, architects and contractors expecting to see increased use of these delivery systems. In addition, more than 40% of owners, architects and contractors expect to see growth in integrated project delivery, suggesting that it is strengthening its foothold in the buildings sector.

Benefits, Drivers and Obstacles of Established Delivery Systems

The findings demonstrate that there is no absolute agreement in the buildings sectors about the benefits, drivers and obstacles for established delivery systems.

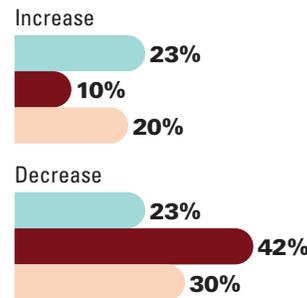
- While there are a few specific benefits that owners, architects and contractors all associate with a specific delivery system—such as the positive impact of design-build on project schedule—overall, they hold a wide range of perspectives on the benefits derived from using different delivery systems.
- The perception of benefits is critical to the factors that will encourage or discourage the use of specific delivery systems in the future, but perceptions vary greatly. Therefore, it is not surprising that there is also little over arching consensus on the key drivers and obstacles, although all recognize cost and schedule as critical factors.
- In particular, the study demonstrates that architects and contractors are not fully aware of how owners perceive these drivers and obstacles, which is critical because owners select the delivery systems.

Expected Change in Use of Established Delivery Systems in the Industry by 2017 (According to Owners, Architects and Contractors)

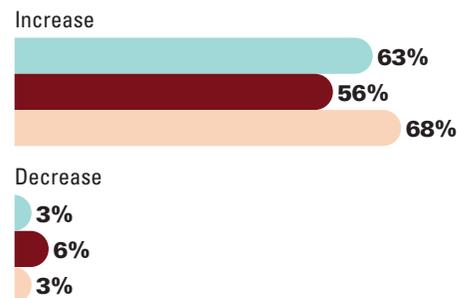
Source: McGraw Hill Construction, 2014

■ Owners ■ Architects ■ Contractors

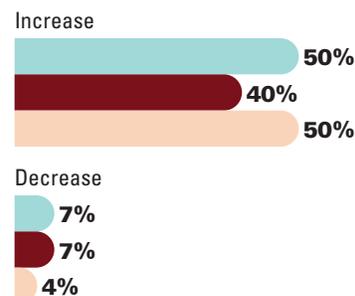
Design-Bid-Build



Design-Build



CM-at-Risk



Given these differences, the top findings for benefits, drivers and obstacles are discussed by player, with the owner findings discussed on page 6, architect findings on page 8 and contractor findings on page 9.

Emerging Project Delivery Systems

The two emerging project delivery systems included in the research—integrated project delivery (IPD) and design-build-operate/maintain (DBO/M)—have very different levels of recognition by the respondents.

IPD

For information on the benefits reported by the largest percentage of owners using IPD, including increased process efficiency and reduced risk of litigation, see page 7.

Between one-third and more than one-half of the architects and contractors who have engaged in an IPD project report that it is the best delivery system to achieve the following benefits:

- **Improved communication between the project team: 59% of architects and 39% of contractors**
- **Increased process efficiency: 48% of architects and 32% of contractors**
- **Improved productivity: 32% of architects and contractors**

As more emphasis is placed on improving process and efficiency in construction, this delivery system is likely to gain further adherents.

On the other hand, more than 70% of owners find that the abilities to address schedule concerns, control costs and improve the quality of their projects are influential drivers for them to use IPD.

DBO/M

Familiarity in the buildings sector is so low for DBO/M that few found it superior to more familiar delivery systems for producing benefits, and few expect to see it grow in the next few years.

Delivery System Benefits, Drivers and Obstacles, According to Owners, Architects and Contractors

As the findings of this research demonstrate, owners, architects and contractors experience the benefits associated with delivery systems very differently. In addition, they have different perspectives on what will drive growth in the use of these systems in the future.

These different perspectives are critical to understand. Owners set the contractual terms on a project, but the ways in which architects and contractors participate in specific delivery systems influences the profitability, efficiency and even the quality of the projects with which they are involved. Therefore, understanding the perspective of the owners, who are the decision-makers, and the architects and contractors, who work in these

systems, is essential to gain the full benefit of employing specific delivery systems in the buildings sector.

To capture all the implications of these findings, the following section is divided into three parts: owner, architect and contractor perspectives. Each section looks at the perception of the benefits of the three established delivery systems and the drivers and obstacles that will influence their use in the buildings sector over the next three years. In addition, among those familiar with IPD or those with experience in IPD, specific perceptions on benefits, drivers and obstacles are also summarized. Familiarity with DBO/M was too low for it to be included in this summary.

Owners

BENEFITS OF ESTABLISHED DELIVERY SYSTEMS

Owners were asked to evaluate the performance of a specific project using one of the three established delivery systems—design-bid-build, design-build and CM-at-risk—across three specific metrics: cost, schedule and their satisfaction with the overall project. A few clear trends emerge from their responses.

- **Cost performance for all three delivery systems is strong: 90% or more owners report that their projects were delivered at or below cost, regardless of delivery system. The highest percentage of respondents with reduced project budgets were those who employed CM-at-risk (33%).**
- **20% of owners using design-build report finishing projects ahead of schedule, compared with 13% using CM-at-risk and 7% using design-bid-build.**
- **However, owners also report a high rate of reliability in schedule on CM-at-risk projects, with 77% reporting that their projects finish on schedule.**
- **60% of owners doing CM-at-risk projects report being highly satisfied, but architects and contractors were least likely to find that delivery system best for improving client satisfaction.**

The key area of agreement between owners, architects and contractors is on the positive impact on project schedule by using design-build. **However, a more overarching conclusion that can be drawn from comparing the owner findings with those of architects and contractors is that there appear to be far more differences than shared opinion.** For example, in addition to the difference in client satisfaction noted above, architects and contractors each had much stronger opinions on the delivery system that best reduces project cost.

These findings suggest that each player views the benefits from delivery systems through its own unique lens, and that industry proponents must consider that lens when trying to create greater engagement with specific delivery systems in the future.

DRIVERS AND OBSTACLES OF ESTABLISHED DELIVERY SYSTEMS

Maximizing the budget is consistently one of the top drivers for established delivery systems for owners, even more consistently than reducing project cost.

- **Design-Bid-Build: Maximizing the budget is the top driver, followed by reducing project cost and improving quality.**

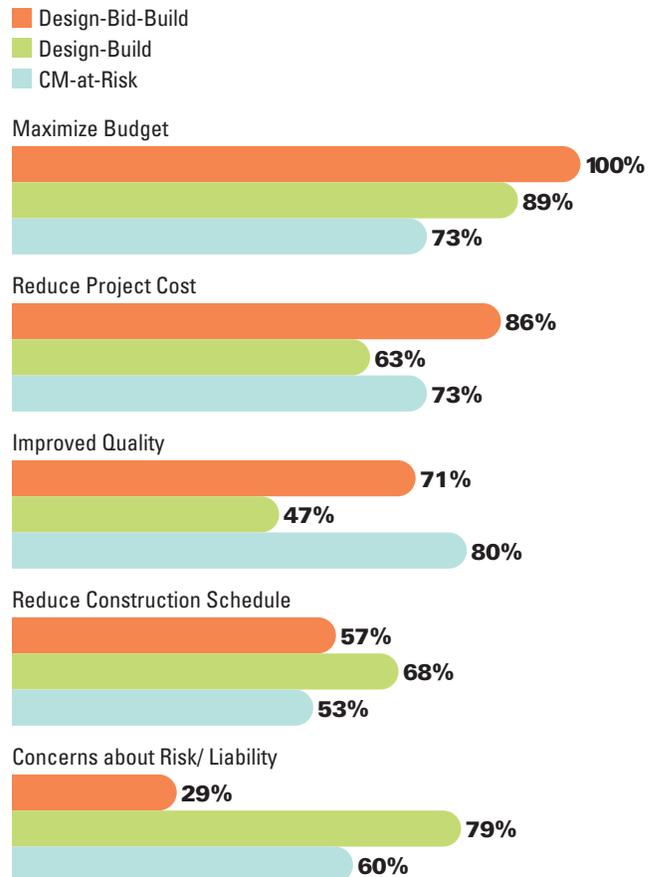
Benefits Achieved by Owners Using Established Delivery Systems

Source: McGraw Hill Construction, 2014

	Benefits Achieved
Design-Bid-Build	<ul style="list-style-type: none"> • Cost: 67% on Budget; 27% Under Budget • Schedule: 67% on Time; 13% Ahead of Schedule • Satisfaction: 40% Very Satisfied
Design-Build	<ul style="list-style-type: none"> • Cost: 67% on Budget; 23% Under Budget • Schedule: 73% on Time; 20% Ahead of Schedule • Satisfaction: 37% Very Satisfied
CM-at-Risk	<ul style="list-style-type: none"> • Cost: 60% on Budget; 33% Under Budget • Schedule: 77% on Time; 7% Ahead of Schedule • Satisfaction: 60% Very Satisfied

Most Influential Drivers for Increased Use of Delivery Systems (According to Owners)

Source: McGraw Hill Construction, 2014



- **Design-Build:** Maximizing the budget is the top driver, followed by concerns about risk and liability and reducing project schedule.
- **CM-at-Risk:** Improving project quality is the top driver, followed by maximizing the budget and reducing project cost.

Companies in the buildings sector need to take note that reliability and achieving budget are more important drivers for owners than cost or schedule reductions. The strong cost performance of all three delivery systems may help explain why the shift from design-bid-build to other delivery systems has been gradual.

The most influential obstacles that owners say prevents use of delivery systems focus on three issues: costs, familiarity with the systems and concerns about checks and balances.

- **Design-Bid-Build:** Highest concern is about the issue of checks and balances (29% consider influential), followed closely by higher cost contracts (24%) and higher cost due to length of contract (24%).
- **Design-Build:** Lack of familiarity is by far the most influential obstacle, selected by 45%.

- **CM-at-Risk:** The highest percentage of owners (43%) agree that lack of familiarity with CM-at-risk, too few checks and balances and additional costs due to project length are all influential obstacles to further use of this project delivery system.

INTEGRATED PROJECT DELIVERY BENEFITS AND DRIVERS

While more than three-quarters of the owners included in the survey have not used IPD, those who have used IPD see a variety of benefits. 80% or more of the owners who have used IPD have experienced the following benefits:

- **Increased Process Efficiency (88%)**
- **Reduced Risk of Litigation (84%)**
- **Improved Construction Quality (80%)**
- **Improved Sustainable Building Performance (80%)**
- **Reduced Construction Costs (80%)**

The opportunity to improve schedule, cost and quality are the biggest drivers for wider IPD use among owners, and their top obstacles are concerns about team members not performing and contract concerns.

Architects

BENEFITS OF ESTABLISHED DELIVERY SYSTEMS

The architects who selected the best delivery system for achieving a range of benefits—from cost and schedule reductions to improved productivity and process efficiency—reveal that each system has its proponents. A high percentage of architects, though, do find the following:

- **Design-bid-build is the best delivery system to reduce costs.**
- **Design-build is the best delivery system to reduce construction schedule, improve process efficiency and create fewer change orders.**

CM-at-risk findings are more moderate. Roughly a quarter of architects find that, among the delivery systems included in the survey, CM-at-risk has the most positive impact on schedule, quality, communication, the risk of litigation and reduction of change orders. This smaller, but notable, contingent favoring CM-at-risk is also evident in the contractor findings.

Best Delivery System for Achieving Benefits (According to Architects)

Source: McGraw Hill Construction, 2014

- Best Delivery System According to 30% or More ●
- Best Delivery System According to 20% to 29% ◐
- Best Delivery System According to Less Than 20% ○

	Design-Bid-Build	Design-Build	CM-at-Risk
Reduced Project Cost	●	◐	○
Reduced Project Schedule	○	●	◐
Improved Construction Quality	◐	○	◐
Customer Satisfaction	◐	○	○
Improved Communication Between Team Members	○	◐	◐
Improved Process Efficiency	○	●	○
Reduced Risk of Litigation	○	○	◐
Fewer Change Orders	○	●	◐

DRIVERS AND OBSTACLES OF ESTABLISHED DELIVERY SYSTEMS

Architects recognize the value owners place on cost, with reduced costs noted as the top driver for increasing use of design-bid-build and design-build in the next three years. However, maximizing the value of work put in place for the budget is a distant second. This is in sharp contrast to the owner findings.

Top obstacles vary by delivery system:

- Design-Bid-Build: High cost contracts
- Design-Build: Too few checks and balances
- CM-at-Risk: Lack of owner benefit from competitive bidding

IPD BENEFITS AND DRIVERS

More than 40% of architects who have done IPD projects select it as the best delivery system for these benefits:

- Improved Communication Between Team Members: 59%
- Less Need for Value Engineering: 44%
- Improved Sustainability Building Performance: 44%
- Increased Process Efficiency: 43%
- Improved Client Satisfaction: 41%

The percentage of architects who select improving the quality of the building (56%) exceeds those who select owner mandate (51%) as a top driver, suggesting that architects need to be able to demonstrate the impact on quality to their clients.

Contractors

BENEFITS OF ESTABLISHED DELIVERY SYSTEMS

Contractors show a marked preference for design-build:

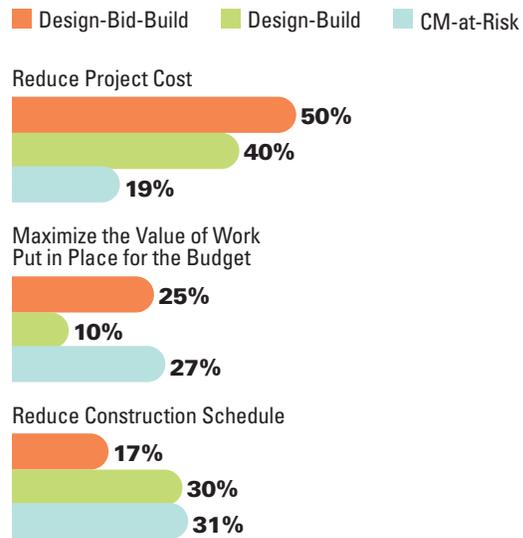
- The highest percentage selected it as the best delivery system to achieve all the benefits included in the survey.

A higher percentage selected it for each benefit, compared with the percentage of architects who also see it as the best system—often by a wide margin. The most common type of design-build is contractor-led, and

Top Drivers for Increased Use of Delivery Systems

(According to Architects)

Source: McGraw Hill Construction, 2014



contractors clearly believe that their ability to lead the project provides the greatest value.

The second most popular system for contractors is CM-at-risk, with findings very similar to those reported by architects.

Contractors also clearly find little value in design-bid-build, other than the potential for cost savings. This is no doubt due to their consignment typically to the construction phase only in a design-bid-build project.

DRIVERS AND OBSTACLES OF ESTABLISHED DELIVERY SYSTEMS

Contractors place strong weight on the ability to reduce project schedule as a key driver for design-build. However, owners report that schedule reduction is less important than maximizing the budget and their concerns about risk and liability.

Maximizing the value of work put in place for the budget is selected as the top driver by a moderate percentage of contractors. This represents another gap between contractors’ estimation of drivers and the drivers identified as influential by owners.

Lack of owner familiarity is the most common obstacle reported about the three delivery systems by contractors, with lack of owner interest also figuring strongly for design-build projects.

Best Delivery System for Achieving Benefits (According to Contractors)

Source: McGraw Hill Construction, 2014

- Best Delivery System According to 30% or More ●
- Best Delivery System According to 20% to 29% ◐
- Best Delivery System According to Less than 20% ○

	Design-Bid-Build	Design-Build	CM-at-Risk
Reduced Project Cost	◐	●	◐
Reduced Project Schedule	○	●	◐
Improved Construction Quality	○	●	◐
Customer Satisfaction	○	●	◐
Improved Communication Between Team Members	○	●	○
Improved Process Efficiency	○	●	◐
Reduced Risk of Litigation	○	●	◐
Fewer Change Orders	○	●	○

INTEGRATED PROJECT DELIVERY BENEFITS AND DRIVERS

Fewer contractors than architects, who have been involved in an IPD project, select IPD as the best delivery method for achieving most benefits. This is likely due to the high value widely placed on design-build by contractors. The following benefits were selected by more than 30% of contractors as the ones best achieved by IPD:

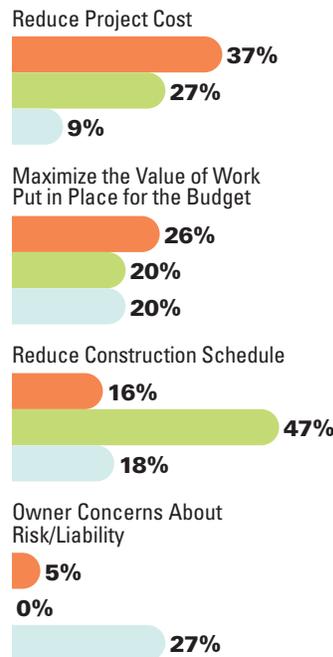
- Improved Communication Between Team Members: 39%
- Improved Quality: 32%
- Increased Process Efficiency: 32%
- Improved Productivity: 32%

Owner mandate is the top driver for greater IPD use, according to contractors, but it is followed closely by the flexibility to pursue innovative approaches.

Top Drivers for Increased Use of Delivery Systems (According to Contractors)

Source: McGraw Hill Construction, 2014

- Design-Bid-Build
- Design-Build
- CM-at-Risk



Data: Introduction

In the last few years, McGraw Hill Construction has researched several trends that focus on improving efficiency, productivity and profitability in the construction industry. *SmartMarket Reports* have included investigations on topics like prefabrication and modularization, increasing information mobility, the emergence of Lean construction approaches and a series of reports focusing on the value that building information modeling (BIM) has brought to the industry.

While each of these trends is helping to transform the industry, perhaps the most fundamental way in which the industry has addressed issues of efficiency, productivity and profitability is the delivery method through which the design and construction of a building project is procured and contracted. The selection of a delivery system sets the terms for how players interact, which can have strong cost, schedule and productivity implications, along with other impacts like risk mitigation and client satisfaction.

Concerns about inefficiencies in construction in the last few decades have led the buildings sector to consider alternatives to the design-bid-build delivery method, which was by far the dominant model since the early 1900s. Two additional delivery systems—design-build and construction management at-risk (CM-at-risk)—have become well-established in the industry. In addition, two emerging delivery systems—integrated project delivery (IPD) and design-build-operate/maintain (DBO/M)—offer even more radical departures, with IPD shifting risk and responsibilities dramatically at the beginning of a project and DBO/M expanding the reach of contractor involvement into the operational phases of the building. Each has the potential to dramatically transform the industry, but each also faces challenges.

This study takes a comprehensive look at how architects, contractors and owners perceive the expected growth or decline in the established and emerging delivery systems, the factors impacting their use and the benefits associated with each. The findings demonstrate that design-bid-build is still widely used and considered effective by a broad swath of the industry, especially architects. However, when it comes to achieving specific benefits, like a reduced schedule and costs, improved productivity and improved client satisfaction, each delivery system is perceived differently by the individual players. Understanding these unique perspectives is critical to help players take advantage of the benefits of specific delivery systems and reveals the need for more industry consensus about the best ways to employ these systems in the future.

Note About the Data

The data in this report are based on two surveys conducted from March to May 2014.

- An online survey of 125 architects and 115 contractors
- A telephone survey of 100 owners

Both surveys focused on three established and two emerging project delivery systems in the buildings sector.

■ Established Delivery Systems

- Design-Bid-Build
- Design-Build
- Construction Management at-Risk (referred to as CM-at-risk in the analysis)

■ Emerging Delivery Systems

- Integrated Project Delivery (referred to as IPD in the analysis)
- Design-Build-Operate/Maintain (referred to as DBO/M in the analysis)

Critical differences between the architect/contractor survey and the owner survey are highlighted throughout the analysis.

In addition, two factors with the emerging delivery systems should be considered when reviewing the data.

- IPD is a formal, contracted delivery system. However, individuals in the industry who pursue an integrated design approach without formal IPD contract documents will frequently identify those projects as IPD projects. It is therefore likely that some respondents answering questions about IPD may have the less formal integrated design approach in mind, which may impact the incidence of IPD projects noted in the survey. See page 52 for more information.
- The incidence of DBO/M is still very low in the industry. Because all findings on the benefits of delivery systems are reported only by those that have worked with those delivery systems in both studies, no DBO/M benefits can be reported, even as trending data, for owners.

For a more complete description of the study, see the full methodology on page 64.

Data: Use of Delivery Systems

Degree of Familiarity

With Project Delivery Systems

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

Most contractors and architects in the buildings sector are familiar with the established forms of project delivery: design-bid-build, design-build and construction management at risk (CM-at-risk). They are far less familiar with emerging forms of project delivery, such as integrated project delivery (IPD) or design-build-operate/maintain (DBO/M).

- Contractors are most familiar with design-build (95%), followed by design-bid-build (86%) and CM-at-risk (75%).
- While architects are similarly familiar with design-bid-build and design-build, only 64% of them are familiar with CM-at-risk.

These findings are somewhat surprising, since CM-at-risk, like design-bid-build, involves two contracts—one between the owner and the contractor and one between the owner and the architect or engineer—as compared with design-build, where the owner contracts with only one entity, the lead design-builder, which can be an architect, contractor, engineer or other entity, but is most commonly a contractor. So while CM-at-risk should be familiar to architects, at least contractually, it is apparently far less familiar to them than design-build, which uses a completely differently contracting strategy.

Neither contractors nor architects are very familiar with emerging forms of project delivery.

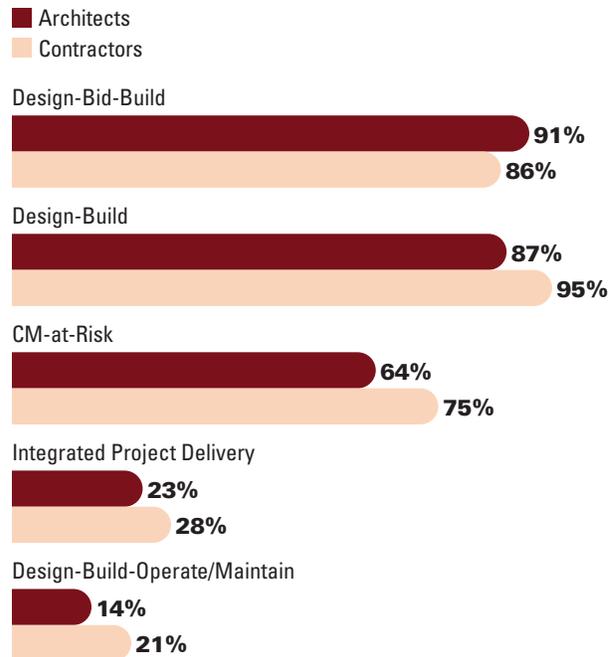
- Just 28% of contractors and only 23% of architects are familiar with IPD. Respondents are even less familiar with DBO/M.
- Just 21% of contractors report familiarity with DBO/M, while 14% of architects are familiar with this delivery approach.

Variation by Firm Size

Architects from large firms (over 50 employees) were significantly more likely than architects from smaller firms to be familiar with design-bid-build, design-build and CM-at-risk. Contractors from large firms also were significantly more likely than contractors from small firms to be familiar with design-bid-build and CM-at-risk. These findings may reflect the fact that large firms typically deal with a broader range of clients, having a wider collection of needs and expectations. Such large firms cannot afford to specialize in only one delivery system, but must demonstrate expertise in a variety of delivery strategies.

Familiarity With Project Delivery Systems (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Variation by Project Type

Respondents from firms that did much or most of their work on public projects (41% or more) had less familiarity with delivery systems other than design-bid-build. This may reflect the fact that some public entities continue to be constrained by statutes about which delivery options may be procured, although it is likely that even fewer respondents that primarily do public contracts would be knowledgeable about these systems 10 or 20 years ago. Contractors in firms doing relatively few public projects, on the other hand, are significantly more likely to have good familiarity with design-build.

Current and Future Participation in Project Delivery Systems

Current Use

Design-bid-build is by far the delivery system that architects and contractors participated in most frequently in the past three years. **60% of architects report doing design-bid-build projects, while 37% of contractors participated in this delivery system.**

- **Architects: Less than a fifth of architects engaged in either design-build (17%) or CM-at-risk (14%) projects.** Projects conducted with a design-build approach do not always include architecture firms, so it is not surprising that contractors report higher involvement with this delivery system. Also, given the lower level of familiarity with CM-at-risk reported by architects (see page 11), their lower level of involvement is not surprising.
- **Contractors: Nearly one-quarter of contractors report engaging in design-build or CM-at-risk projects over the last three years.** The high level of participation in these delivery systems reported by contractors may suggest that being able to participate in design decisions is an important consideration for a sizable percentage of them.

IPD and DBO/M projects were rarely reported in the past three years, despite increasing discussions about these emerging project delivery systems.

Future Expected Use

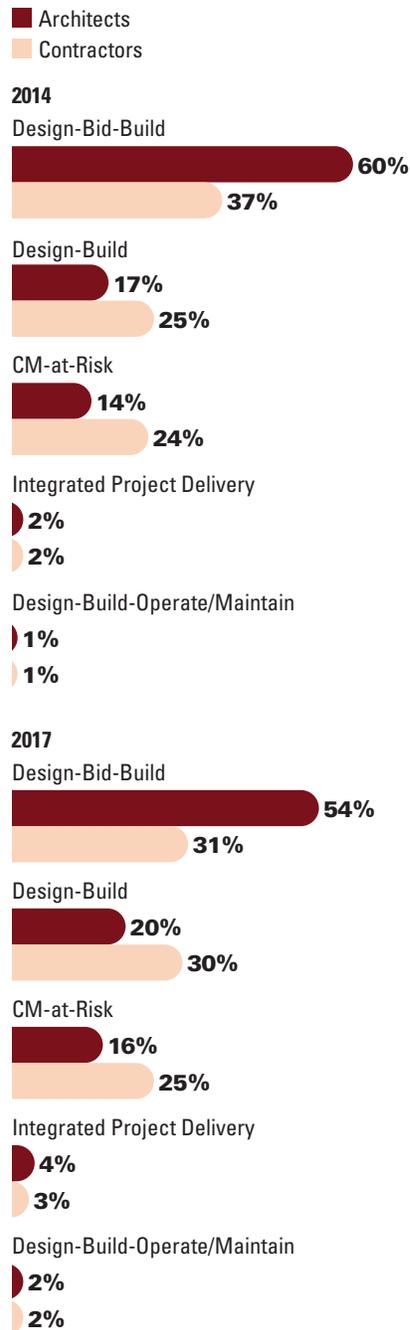
While design-bid-build is expected to remain the most widely used delivery system over the next three years, its use will decline slightly while other established delivery systems will experience modest increases. Over half of all architects (54%) expect to engage in design-bid-build projects, while 31% of contractors expect to do so. While this suggests that the industry is experiencing a modest transition to greater collaboration, it is evolving more slowly than many analysts have predicted.

Contractors are more likely than architects to engage in established systems other than design-bid-build. Perhaps in order to mitigate risk, contractors appear increasingly attracted to cooperative delivery strategies through which they are able to participate in pre-construction design meetings.

- **Nearly a third of all contractors (30%) expect to engage in a design-build project over the next three years, while 20% of architects expect to do so.**
- **25% of contractors expect to engage in a CM-at-risk project, with 16% of architects expecting the same.**
- **Less than 5% anticipate engaging in IPD or DBO/M projects.**

Current and Expected Future Involvement With Project Delivery Systems (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Professional Services: Becoming More Critical in a Hyper-Competitive Marketplace

Professional services, such as construction management and program management, allow owners to tackle challenging projects, regardless of the delivery systems that they employ for those projects. They allow owners to have the advantage of a firm with construction expertise that also directly advocates for the owners' interests in the design and construction process.

Recent years have witnessed an increase in the popularity and visibility of professional-services firms. Program management (PM) companies typically provide support for multiple related projects, often where specialized expertise is essential. Construction management for-fee firms (also known as CM-for-fee, agency construction management, construction management for hire, agency CM or CM agency) usually provide expertise on a particular project, augmenting the project staff. According to *Engineering News Record (ENR)*, revenue for the top 100 CM-for-fee and PM firms rose to \$19.41 billion in 2013, an increase of 1% from the previous year.

The CM or PM often serves as an extension of the owner's staff and acts in the owner's interest throughout every phase of the project. They typically do not contract directly with subcontractors but offer advice and staff to the owner. In most cases, these services may go well beyond basic construction tasks and include many preconstruction services, such as feasibility studies, constructability reviews, estimating, lifecycle costing, value engineering, safety, scheduling and sustainability analysis. These services can be provided regardless of what type of project delivery system is used.

Why Are Professional Services Gaining Popularity Now?

Most owners, even the most knowledgeable ones, have neither the staff nor the expertise to manage effectively every phase of the project. Many of these owners have limited hands-on experience with the intricacies of the procurement process, in evaluating change orders or dealing with permitting issues. This may be particularly true for some public-works departments when technical expertise is spread too thinly within the bureaucracy.

With regard to use of a CM, Bruce D'Agostino, president and CEO of CMAA, notes that the use is typically a reflection of the complexity of the project and the sophistication of the owner. "The biggest advantage [of CM-for-fee] is having someone to look out for the interests of the project, the needs of the owner. The only downside to this is if the CM is brought into the project too late. Ideally, the CM should be involved from the very beginning."

Many owners who use professional services, such as CM-for-fee or PM, choose to supplement their staff because of the enormous complexity of the project. Such projects may be large enough financially to create significant risks for the owner if not conceived and executed properly. David Richter, president of Hill International, as quoted in a 2014 feature story in *ENR*,

sees PM becoming an important factor for such large projects. He points to Hill's many PM projects for airports in Phoenix, Los Angeles, San Francisco and Salt Lake City, and, most notably, for the Muscat International and Salalah airports in Oman.

Even firms that have completed large projects in the past may confront new quality-control standards. It is difficult for any single individual or team to have all the requisite knowledge, experience and skills to capably design and monitor project execution. Moreover, as Rich Diggs, president of Heery International, points out, "There is an enormous amount of waste in what we do, perhaps as much as 20 to 30 percent. Having a CM or PM on board can go a long way to eliminating much of this waste."

Does Use of a Professional-Services Firm Align With a Particular Project Delivery Strategy?

One frequently asked question is whether use of professional-services firms is especially amenable to one type of project delivery strategy over another. Charles Klunker, vice president of Vanir Construction Management, says that the key to being a successful CM-for-fee or PM is being able to offer a "very flexible menu of services." The CM or PM works directly with the owner to plan

and manage the project, regardless of delivery system. Properly applied, a professional-services approach works for any delivery system.

David Bowlin, executive vice president and COO at Broaddus & Associates, feels that while CM-for-fee works for any project delivery mode, it is exceptionally useful for complex design-build projects. He notes that, in his experience, “navigating” a design-build project can be intimidating and confusing for any owner, particularly one who is a novice in design-build strategy. Design-build—and, to a comparable degree, integrated project delivery (IPD) and design-build-operate/maintain (DBO/M)—are challenging for many owners, especially in the public sector. They need staff support and guidance to take advantages of the cost savings and quality improvements offered by design-build.

Tom Rog er, vice president and senior project executive at Gilbane Building Company, emphasizes that PM services can also work with any type of delivery system. The challenge is to provide expertise throughout all stages of a project, which sometimes can be more difficult in a traditional design-bid-build effort. He notes that one of the biggest shortcomings in green building projects is that owners may not understand how to take maximum advantage of the available green features. Moreover, they often “walk away” as soon as construction is completed. An effective PM can address these challenges.

Does Using a Professional-Services Firm Add an Extra Layer of Management?

A common criticism of professional-services firms is that they add an extra layer of management to projects, thus increasing what may already be a bloated project bureaucracy. Such a redundancy could potentially drive up costs, further imperiling the project.

Chuck Thomsen, former CEO of 3D/International, emphasizes that CM-for-fee is not an extra layer of management. It is just a different way of arranging and contracting for management functions. When done properly, CM-for-fee services replace and enhance functions previously assumed by the owner or builder. So there should not be redundancy. The management chain of command just has to be clear to the entire project team.

Bruce Stephan, executive director of PMA Consultants, feels that there is an important trade-off. While CM-for-fee or PM can add an additional layer of management, that additional layer generally brings expertise and knowledge that the owner lacks. These skills may well result in lowered overall costs for the entire project. Stephan cites his firm’s work with the San Francisco Public Utilities Commission’s Tesla Treatment Facility as an example of how cost savings can be achieved even though there had been an “additional” layer of management.

Rog er offers a similar comment on this trade-off. Gilbane is currently providing PM services for the New Haven School Construction Program, which includes 46 schools at a total estimated cost (when completed) of

\$1.6 billion. One of the key elements is establishing high-performance building design criteria to improve school energy and environmental performance. To date, New Haven has increased the square footage of its public schools with essentially no increase in annual utility costs. The expertise that Gilbane is able to bring to the project is resulting in green improvements and cost savings that dwarf any additional costs deriving from any new layers of management.

When CM and PM Falls Short

Probably the greatest challenge to successfully using a professional-services firm is procurement. Bowlin points out that if the selection is determined solely by fee, then “you get what you pay for.” If the fee is unrealistically low, then the scope of services may be narrowed. This could result in the CM or PM not involved in critical preconstruction tasks or other essential elements of the project. ■

Participation in Delivery Systems by Building Type

The decision to be involved in projects using one particular delivery system over another may reflect past experience with that delivery system, as well as specific project concerns for quality, speed of construction, cost or other variables. Architects and contractors commented on the two delivery systems that they had most frequently used over the past three years across six different building types.

Design-bid-build is widely used for all building types.

Although the design and construction industry may be gradually evolving into a situation where multiple delivery options are regularly considered and used, the industry has not yet shifted fundamentally.

- While both contractors and architects report frequent involvement in design-bid-build projects, architects report engaging in design-bid-build projects more frequently than their contractor counterparts.
- There is significant variation on the second most frequent delivery system.

Commercial Projects: Office and Retail

For both office projects and retail projects, design-build project delivery is the most common delivery system after design-bid-build. Approximately half of the architects engaged in retail and office design-build projects, while contractors also were involved in commercial design-build projects in large numbers.

Design-build was reported more often in these two commercial building types than in all other building types included in the study. This may reflect the fact that commercial owners are not subject to the same constraints that many public-sector owners have when using design-build. Commercial owners may procure whatever delivery system they feel will result in the lowest cost, quickest schedule, highest quality or whatever criteria they deem most important.

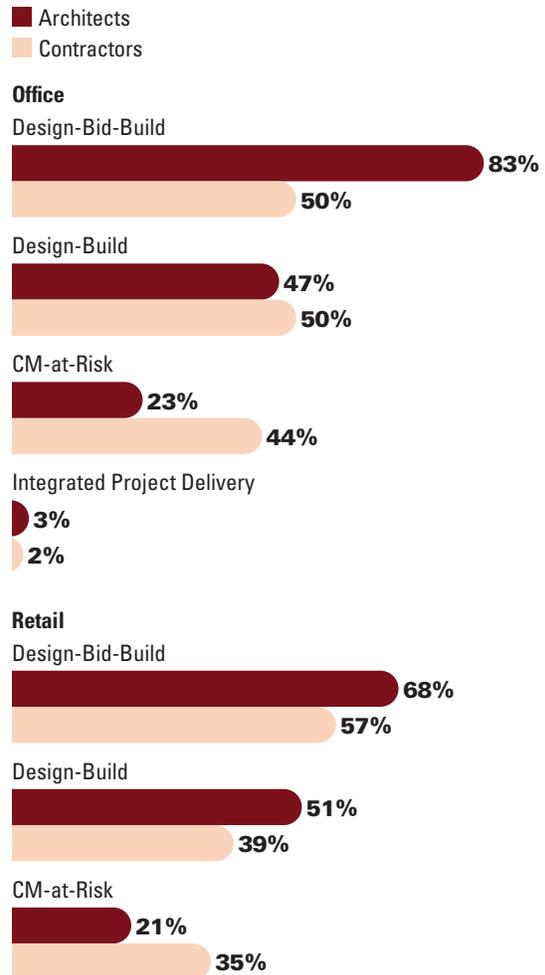
Contractors were more likely than architects to engage in commercial CM-at-risk projects. This may reflect contractor interest in being involved in preconstruction design meetings at early stages of the project.

Institutional Projects

For institutional projects (public buildings, K-12 schools, college/university projects and healthcare projects), CM-at-risk was the most common delivery system after design-bid-build. This is true for both architects and contractors, across all institutional building types.

Experience With Delivery Systems For Commercial Projects (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



- **Public Buildings: The greater participation in CM-at-risk projects rather than design-build may reflect public owners' preferences for two separate contracts rather than a single entity in order to mitigate risk or to maintain control over the design process.**

- Nearly half of both architects and contractors engaged in CM-at-risk projects (44%), which is a distant second place to design-bid-build.
- Nearly a third of all contractors (31%) engaged in design-build projects, but less than a fifth of all architects (18%) did the same.

- K-12 Schools:** Close to half of all architects and contractors were involved in K-12 projects using CM-at-risk, a number that is well behind the use of design-bid-build. As with public buildings, design-build projects were much less common than those using CM-at-risk, with only 25% of contractors and just 13% of architects reporting involvement in this delivery system for schools. While design-build is often considered a delivery system that can accelerate project schedule, this advantage may have been less salient during the past few years of economic downturn, with limited funds available for public-school construction.
- College/University Projects:** While CM-at-risk is the second most frequently used delivery system for college/university projects, the gap between CM-at-risk and design-build is narrower as compared with other institutional projects. The relatively high level of design-build participation (39% of contractors, 29% of architects) may reflect the recent increased emphasis on community-college growth and the need for rapid project completion.
- Healthcare Projects:** While design-bid-build is the most frequently used delivery system for healthcare projects, the gap between it and other established project delivery strategies is narrower than with other institutional projects.
 - Approximately one-third of both architects and contractors engaged in design-build projects, while over half of contractors (53%) and over a third of architects (36%) were involved in CM-at-risk projects.
 - IPD was used more often for healthcare projects than for any other project type, although still far less than by the three established approaches. IPD is cited by 7% of contractors and 5% of architects.

The robust use of a variety of project delivery systems reflects the explosion of healthcare construction in recent years as the “boomer” population matures. Owners need to get the work completed quickly and with high quality, so more delivery options are on the table.

Variation by Firm Size

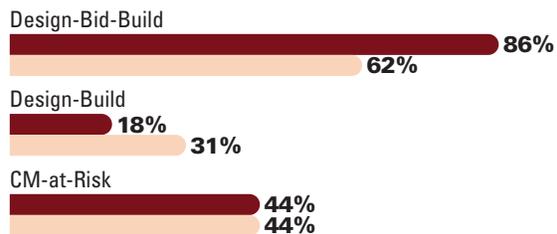
- Architects from large firms doing office, retail and college/university projects were significantly more likely than architects from smaller firms to be involved in a CM-at-risk project.
- Contractors in large firms doing office and public building projects were significantly more likely to participate in CM-at-risk or design-build projects than their colleagues in smaller firms.

Experience With Delivery Systems for Institutional Projects (According to Architects and Contractors)

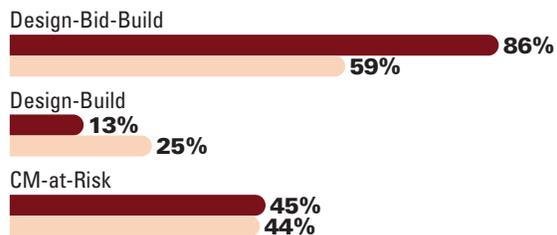
Source: McGraw Hill Construction, 2014

Architects Contractors

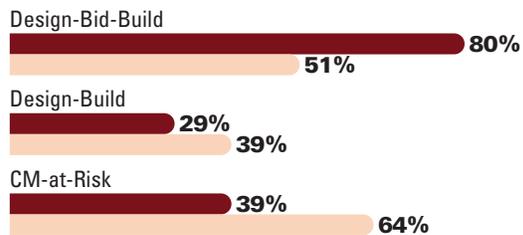
Public Buildings



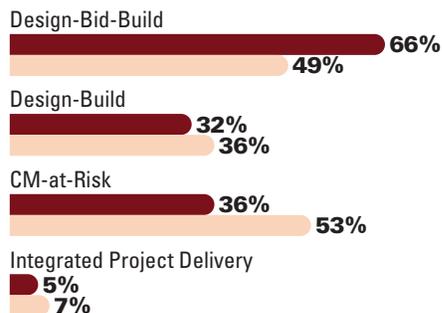
K-12 Schools



College/University



Healthcare



These trends may be a result of large firms dealing with a broader range of projects, unlike smaller firms that may specialize in one or two project delivery systems.

Expectations About Future Use of Delivery Systems in the Buildings Sector

Most owners, architects and contractors anticipate increases in the buildings sector's use of design-build and CM-at-risk delivery systems over the next three years. Architects and contractors were asked to gauge the growth in the use of delivery systems by sector, while owners were asked more generally.

These respondents also expect the use of design-bid-build to either remain the same or decrease over this period. While design-bid-build is still the most used in this sector, there appears to be a gradual but real transition taking place (see page 12).

Design-build and CM-at-risk seem to be attracting greater adherents within the industry at large.

- More than two-thirds of contractors (68%) forecast an increase in the number of design-build projects.
- Slightly smaller majorities of owners and architects expect the same trend.
- All groups expect the use of CM-at-risk to increase.
- A plurality of architects (42%) expect the use of design-bid-build to decrease in the next three years, but contractors and owners were less likely to see this decrease, thinking its use will remain the same.

A large percentage of architects (27%) were uncertain about the future use of CM-at-risk and did not want to make a prediction on its use. This reflects their relative unfamiliarity with CM-at-risk (see page 11).

Emerging Delivery Systems

41% of architects and 40% of contractors expect the use of IPD to increase over the next three years. Yet an equal number of respondents were uncertain about this trend. A large percentage of architects (42%) and contractors (39%) feel that they did not know how owners would use IPD in coming years. This comports with an earlier survey finding that only about a quarter of contractors or architects were familiar with IPD (see page 11).

This findings suggests that, despite enthusiasm among those that have used IPD for its potential growth, IPD supporters have not done a very good job of publicizing and marketing the advantages of this approach enough for it to become more mainstream.

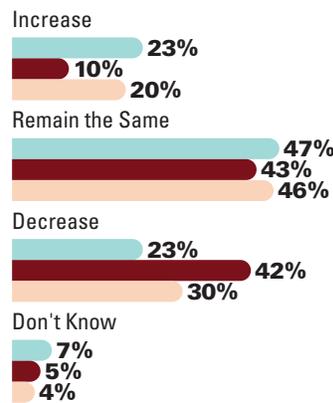
Respondents were also unsure about the use of DBO/M. Nearly two-thirds of architects (66%) and almost half of all contractors (48%) were uncertain about the direction of DBO/M use. In addition, only a few of those who have an opinion about DBO/M use expect its use to increase. Only 10% of architects and 25% of contractors expect to see an increase in the use of DBO/M by 2017.

Expected Change in Use of Established Delivery Systems in the Buildings Sector by 2017 (According to Owners, Architects and Contractors)

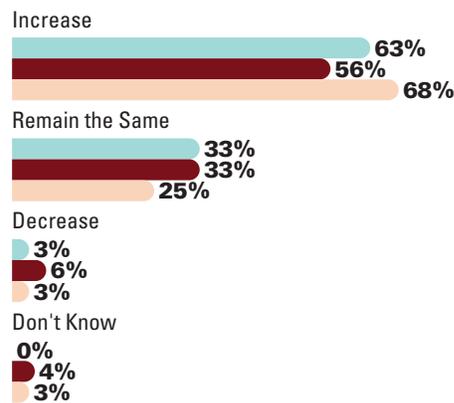
Source: McGraw Hill Construction, 2014

Owners Architects Contractors

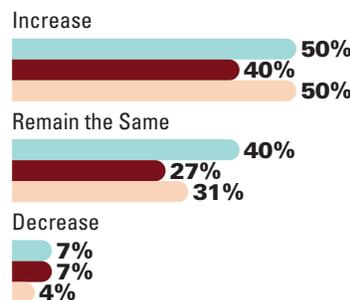
Design-Bid-Build



Design-Build



CM-at-Risk



Expectations About Future Use of Delivery Systems by Building Type

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

Predictions about the future use of particular project delivery systems across the buildings sector as a whole are often a reflection of respondents' specific experiences with those delivery systems. They may have had substantial experience with a given project delivery system or feel that certain delivery systems lend themselves better to specific types of projects. Top findings include:

- There is no consensus across all building types.
- Frequently, architects and contractors predict that the delivery systems will remain essentially the same.
- Where there are changes, respondents anticipate decline in the use of design-bid-build and increases in the use of design-build and CM-at-risk.

Commercial Projects: Office and Retail

For both office and retail projects, more respondents anticipate an increase in design-build project delivery than any other established project delivery system. Both architects and contractors feel that CM-at-risk use will also increase, though fewer respondents expect this to be true compared with those that expected increases in the use of design-build.

One possible reason for why both architects and contractors expect higher involvement in design-build projects over CM-at-risk projects is the nature of these two commercial building types. Both office and retail projects are not subject to any public statutes that may prevent or limit the use of design-build. Accordingly, both contractors and architects probably have had more opportunities to gain experience with design-build in these two sectors.

Public Buildings

The most striking finding for the public building sector is that an overwhelming number of architects (69%) and contractors (48%) foresee an increase in CM-at-risk use, with a large number anticipating increases in design-build use as well. This finding is somewhat surprising, since design-bid-build is still the dominant project delivery option by far for this building type (see page 16). What it may indicate is that public-sector owners are strongly committed to having two separate contacts to have greater control in the design process, rather than a single design-build entity, so movement from design-bid-build will lead more often to CM-at-risk.

Among those respondents who expect changes in the use of design-bid-build, nearly a fifth (18%) of architects and slightly over a quarter (27%) of contractors expect use of design-bid-build to decrease.

Delivery Systems Expected to Increase in Use With Commercial Projects (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

	Architects		Contractors	
	Increase	Decrease	Increase	Decrease
Office				
Design-Bid-Build	17%	17%	7%	20%
Design-Build	42%	8%	41%	4%
CM-at-Risk	20%	5%	27%	15%
Retail				
Design-Bid-Build	15%	15%	13%	13%
Design-Build	43%	11%	36%	8%
CM-at-Risk	18%	9%	26%	4%
Public Buildings				
Design-Bid-Build	6%	18%	18%	27%
Design-Build	42%	15%	53%	5%
CM-at-Risk	69%	0%	48%	0%
K-12 Schools				
Design-Bid-Build	6%	11%	9%	18%
Design-Build	26%	11%	63%	5%
CM-at-Risk	62%	5%	59%	5%
College/University				
Design-Bid-Build	6%	53%	13%	25%
Design-Build	40%	5%	81%	0%
CM-at-Risk	47%	6%	76%	0%
Healthcare				
Design-Bid-Build	10%	50%	10%	0%
Design-Build	25%	17%	71%	4%
CM-at-Risk	38%	8%	68%	3%

K-12 Schools

A strong majority of architects (62%) and contractors (59%) expect to see greater use of CM-at-risk project delivery for K-12 projects. This preference for CM-at-risk appears to mirror that for public building projects. Satisfaction with the two separate contract structures of both design-bid-build and CM-at-risk options may drive this expectation.

Predictions about the use of design-build are split. A majority of contractors (63%) anticipate greater use of design-build, but only a quarter (26%) of architects believe that will occur. The reason for this split among K-12 practitioners is not clear, beyond possibly the generally greater comfort level that contractors have with design-build.

Most architects (78%) believe that design-bid-build use will remain the same, but just 55% of contractors expect that to happen. Nearly a fifth of contractors (18%) expect design-bid-build use to decline for these projects.

College/University Projects

Over half (53%) of architects and 25% of contractors anticipate the use of design-bid-build will decrease for these projects. There is consensus among contractors that owners' use of both design-build (81%) and CM-at-risk (76%) will increase. Architects are not as certain, with a small plurality expecting increase rather than inertia for CM-at-risk, and a comparable plurality expecting design-build to remain about the same rather than increase.

As discussed earlier (see page 16), a possible driver for college/university projects is the recent focus on community-college development and the need for rapid project completion. Design-bid-build is seen by many observers as a slower option compared to other delivery systems.

Healthcare Projects

A large majority of contractors expect increases in the use of design-build (71%) and CM-at-risk (68%) for healthcare projects. But only 38% of architects expect increases for CM-at-risk, with a quarter anticipating increases for design-build.

One possible explanation for the difference in opinion is that, compared with all other building types, the gap between use of design-bid-build and the use of other established and emerging delivery systems in healthcare projects has been the narrowest in recent years (see page 16). Because of the need to complete a large amount of healthcare building construction quickly and efficiently, owners have worked with different delivery systems more than for any other building type.

Variation by Firm Size

Architects working in large firms were significantly more likely than their colleagues in smaller firms to predict decreases in the use of design-bid-build and increases in DBO/M. Contractors in large firms were more likely to anticipate increases in the use of IPD and DBO/M. This likely reflects the fact that larger firms have more experience in using a variety of delivery systems, including emerging ones such as DBO/M and IPD. Smaller firms may have much more limited experience with such approaches.

Project Delivery: How Infrastructure Differs From Building Delivery

Project delivery greatly varies depending on what is actually being delivered. While integrated project delivery (IPD) is rapidly changing how buildings are designed and constructed, other delivery systems are used for infrastructure projects both to control costs and ensure that design standards are met.

Design-Build in Infrastructure Projects

While traditional design-bid-build is used for most infrastructure and building projects, design-build is a fast-growing project delivery system being used more widely on roadway, bridge, railway, waterway, port and airport projects. The McGraw Hill Construction Dodge project database reflects that many of these projects available for bidding are using a design-build delivery system. A 2011 study commissioned by the Design-Build Institute of America analyzed the design-build project delivery system in the United States and showed that it was used on about 40% of nonresidential construction projects in 2010, a 10% increase since 2005.

In design-build, design and construction integration are a concrete reality reflected in the contractual relationship between the design-build team and the owner agency. The design-builder is often a general contractor, but in many cases a project is led by a design professional (architect, engineer or other professional designer). Some design-build firms employ professionals from both the design and construction sector. Where the design-builder is a general contractor, the designers are typically retained directly by the contractor. Partnership or a joint venture between a design firm and a construction firm may be created on a long-term basis or for one project only.

If there is any downside to using design-build for infrastructure, it is that the system limits the owner's involvement in design as the designer is essentially working for the general contractor. This can limit design options, but it does ensure that costs are contained in a way that design-bid-build cannot.

Use of Public-Private Partnership Funding

Many public design-build projects are also funded by a public-private partnership (PPP). A PPP involves a contract between a public authority and a private party, in which the private party assumes substantial financial, technical and operational risks in a public project. PPPs work very well with design-build because the owner/developer and its public-entity partner can achieve cost certainty more easily when using design-build.

DBO/M in Infrastructure

Design-build-operate/maintain (DBO/M) takes design-build one step further by including the operations and maintenance of the completed project in the same original contract. This is a particularly useful delivery system for projects that will require long-term maintenance, such as tunnels and bridges.

DBB-CM

What if your project design is not yet complete, but you still must solicit bids to ensure that it is completed

on time? Enter design-bid-build with construction management (DBB-CM). With partially completed contract documents, an owner will hire a construction manager to act as an agent. As substantial portions of the documents are completed, the construction manager will solicit bids from suitable subcontractors. This allows construction to proceed more quickly and allows the owner to share some of the risk inherent in the project with the construction manager, as in an IPD contract. Use of a construction manager (CM) can generally save costs because, if the project is CM-at-risk, the CM is legally responsible for delivering the project on time and on budget. Using CM Agency, the CM helps the owner make decisions about procurement and spending but does not actually commit to delivering the project on time or on budget. Michael Kenig of Holder Construction explains the agent like this: "CM 'not-at-risk' is a project management (versus 'delivery') method, a method of managing design and construction services."

What all of these delivery systems have in common is that, like IPD, they attempt to create greater connection between designers and construction professionals and reduce the silos and disconnected processes of design-bid-build. All have pros and cons, but the desire for greater collaboration and greater responsibility shared by the design and construction team is a part of all of the systems. ■

Data: Drivers and Obstacles

Overview of Key Drivers and Obstacles

This data section (pages 22–30) includes a detailed analysis of the triggers, drivers and obstacles for each delivery system. The chart at right shows an overview of the most critical drivers and obstacles for each of the three established project delivery systems, as reported by each player. Details on these findings is included in subsequent pages of this section.

Since owners select the delivery system for projects, their insights are most critical in determining the important drivers and obstacles. As demonstrated in the chart, architects and contractors are not as attuned to what is most influential in driving an owner’s choice of delivery system. Specifically, architects and contractors underestimate the importance of improved quality and concerns about the owner’s risk of liability. Instead, they believe schedule and cost impacts have the most influence in delivery system adoption. While costs are also sometimes important to owners (especially for design-bid-build), schedule concerns rarely drive the owner’s decision to adopt a particular project delivery system.

Architects and contractors also underestimate the influence of the top three obstacles that owners report prevent wider use of each of the three project delivery systems. In particular, architects and contractors underestimate the influence of the lack of checks and balances in preventing the use of all the delivery systems. It is also clear that many architects do not recognize the role that lack of familiarity with a delivery system has in discouraging the use of these systems.

Top Drivers Influencing Adoption of Established Project Delivery Systems (According to Owners, Architects and Contractors)

Source: McGraw Hill Construction, 2014

DRIVERS			
	Selected as Influential by Highest Percentage	Top Ranked	
	Owners	Architects	Contractors
Design-Bid-Build	1. Maximize Budget 2. Reduce Cost	1. Reduce Project Cost 2. Maximize Value of Work for the Budget	1. Reduce Project Cost 2. Maximize Value of Work for the Budget
Design-Build	1. Maximize Budget 2. Concerns About Risk/Liability	1. Reduce Project Cost 2. Reduce Construction Schedule	1. Reduce Construction Schedule 2. Reduce Project Cost
CM-at-Risk	1. Improve Quality 2. (tie) Reduce Project Cost/Maximize Budget	1. Reduce Construction Schedule 2. Maximize Value of Work for the Budget	1. (tie) Owner Concerns About Risk/Liability/Maximize Value of Work for the Budget

OBSTACLES			
	Selected as Influential by Highest Percentage	Top Ranked	
	Owners	Architects	Contractors
Design-Bid-Build	1. Too Few Checks and Balances 2. (tie) Higher Contract Costs/Additional Cost Due to Length of Contract	1. Higher Cost Contracts 2. Additional Cost Due to Length of Contract	1. Owner Unfamiliar With Delivery Method 2. Higher Cost Contracts
Design-Build	1. Lack of Familiarity With Delivery System 2. (tie) Higher Contract Costs/Too Few Checks and Balances	1. Too Few Checks and Balances 2. Owners Unfamiliar With Delivery System	1. Owners Unfamiliar With Delivery System 2. Lack of Owner Interest
CM-at-Risk	1. (tie) Too Few Checks and Balances/Lack of Familiarity With Delivery System/Additional Cost Due to Length of Contract	1. Owner Doesn't Benefit From Competitive Bidding 2. Higher Cost Contracts	1. Owner Unfamiliar With Delivery Method 2. Owner Doesn't Benefit From Competitive Bidding

Triggers Influencing the Use of Delivery Systems

Architects and contractors that have worked with one of the three traditional delivery systems—design-bid-build, design-build, CM-at-risk—in the past reveal that different factors have influenced the owners’ selections of delivery systems for their projects.

Design-Bid-Build

When architects and contractors that have worked on design-bid-build projects were asked to select the top three triggers with the greatest influence on the selection of that delivery system, the trigger ranked first by the highest percentage across the board is **owner mandate/contracts**. In fact, this factor is selected among the top three triggers by nearly all (96%) of the architects, a finding that is not repeated among either of the other two traditional delivery systems. This suggests that architects using design-bid-build do not consider the factors that may drive owners to select this delivery system, from cost savings to quality improvements.

Two triggers involving the cost of the project are more frequently ranked among the top three by contractors using design-bid-build than owner mandates/contracts.

- 74% select concerns about cost.
- 70% select the need for fixed construction budget/ Guaranteed Maximum Price (GMP).

Contractors clearly believe that there is a perception that design-bid-build saves money on projects. However, only 22% of contractors say that design-bid-build is the most effective delivery method for reducing construction cost (see page 35), suggesting that they perceive a gap between the reasons triggering the selection of a delivery method and the actual results of those projects.

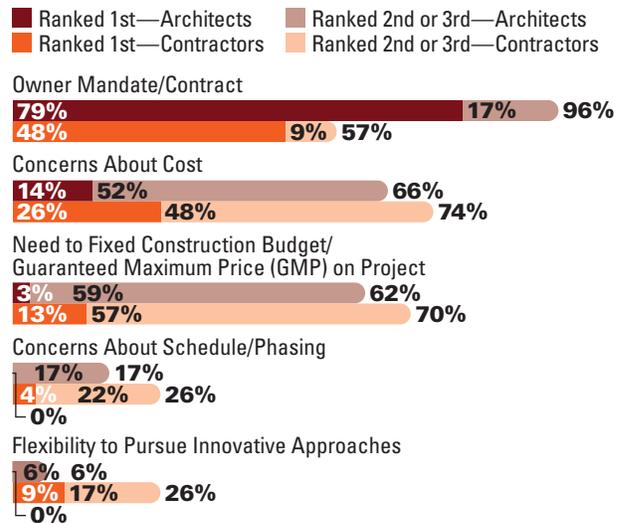
Design-Build

Unlike the owners’ choice of design-bid-build, which is largely motivated by a few key factors, the architects and contractors surveyed find that the selection of design-build is triggered by a range of factors.

- **Need for Fixed Construction Budget/GMP:** The highest percentage of architects and contractors rank this among the top three triggers. This general agreement shows that design-build is widely regarded in the buildings sector as a way to have a fixed price on a project.
- **Concerns About Cost:** The second highest percentage of architects and contractors rank this among the top three triggers. This finding demonstrates that both architects and contractors agree that there is a perception that design-build has a positive impact on project cost.

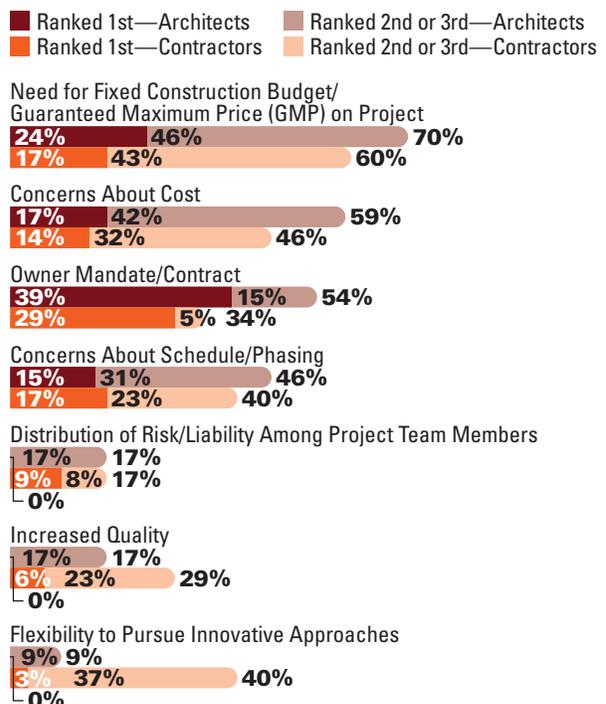
Top Triggers Influencing Selection of the Design-Bid-Build Delivery System (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Top Triggers Influencing Selection of the Design-Build Delivery System (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



- **Owner Mandate/Contract:** In addition to this trigger’s strong performance among the top three, the highest percentage of architects and contractors rank this first among all triggers. This finding is not surprising since the owner ultimately mandates the selection of each delivery system. However, the percentage who select this trigger among the top three is notably lower than the percentage selecting design-bid-build, suggesting that firms using design-build are more cognizant of factors driving owners to mandate it for their projects.
- **Concerns About Schedule/Phasing:** There is close agreement on this trigger between architects (46%) and contractors (40%). One advantage of design-build according to its proponents is its ability to reduce coordination issues and positively impact project schedules.
- **Flexibility to Pursue Innovative Approaches:** A higher percentage of contractors (40%) select this among the top three triggers compared with architects (14%). Contractors are typically the lead on design-build projects, and it is not surprising that they would consider participation in design-build projects to enhance their ability to innovate more than architects would.

It is also notable that more contractors than architects find that design-build projects are selected to enhance quality, given the fact that the contractor typically has the lead role on such projects.

CM-at-Risk

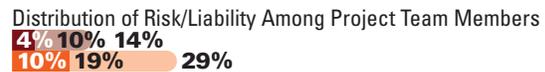
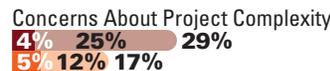
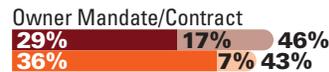
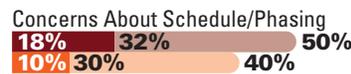
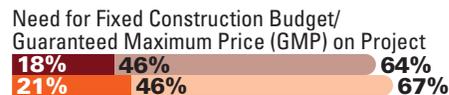
Among the three established systems of project delivery, CM-at-risk has the widest range of triggers selected by more than 20% of architects and contractors as among the top three. This indicates that there are many expectations about this delivery system in the buildings sector, rather than one dominant factor. There is also a strong level of consistency in the percentage of architects and contractors who rank these factors among their top three triggers, suggesting that among those who actively use this delivery system, there is strong agreement in the perception of its benefits in the buildings sector.

As with the other project delivery systems, owner mandate/contract is ranked first by the highest percentage of architects and contractors. The consistency of this ranking demonstrates that for many of the respondents, owner choice, regardless of other influences, is always the main reason for choosing a delivery system.

Top Triggers Influencing Selection of the CM-at-Risk Delivery System (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

■ Ranked 1st—Architects ■ Ranked 2nd or 3rd—Architects
■ Ranked 1st—Contractors ■ Ranked 2nd or 3rd—Contractors



However, two factors are ranked among the top three by a much higher percentage of respondents than those who select owner mandate/contract.

- **Need for Fixed Construction Budget/GMP:** The highest percentage of architects (64%) and contractors (66%) rank this trigger among their top three.
- **Concerns About Schedule/Phasing** has the second highest percentage of architects (50%) and the third highest percentage of contractors (40%) who rank this trigger among their top three.

The CM-at-risk delivery method typically involves the submission of a GMP during the construction documents phase, which would also typically include scheduling. This not only allows both the price and the schedule to be submitted earlier in the process but also allows them to be based on more information about the design than is typically possible with a design-build proposal.

Of all the delivery methods, CM-at-risk is also more widely triggered by increasing quality and concerns about project complexity than the other methods.

Factors Driving Increased Use of Delivery Systems

Owners were asked to consider the relative impact of a variety of factors that will drive the increased use of different project delivery systems in the buildings sector over the next three years, focusing specifically on a delivery system that they have used previously and that they reported will increase in use.

Architects and contractors were asked to rank the first, second and third most influential factors in wider adoption of specific delivery systems in the buildings sector if they believed that the use of these systems will increase in the next three years (see page 17). While there is near unanimity over drivers in design-bid-build, respondents often differed on the impact of different factors in driving the use of other project delivery strategies.

Established Project Delivery Systems

DESIGN-BID-BUILD

The need to maximize the project budget (100% of owners) and to reduce project cost (86%) are seen by owners as the primary drivers that will increase use of design-bid-build over the next three years. The prospect of improved quality is the third most highly ranked driver for using design-bid-build. Controlling costs has frequently been perceived as a strength of design-bid-build, although that may have as much to do with the comfort and experience levels of its users, rather than any intrinsic advantage of this delivery approach.

Architects and contractors also rank reducing project cost as the primary driver increasing the use of design-bid-build (see chart on page 25), with more than one half of architects ranking this as the primary driver and just over a third of contractors doing so. Maximizing the value of work put in place is the second most discussed driver.

It is not surprising that both architects and contractors point to reducing project cost as the top factor that will drive increased use of design-bid-build. The fact that this driver resonates more forcefully with architects than contractors, however, may reflect architects' general satisfaction with their role in making design decisions under design-bid-build.

DESIGN-BUILD

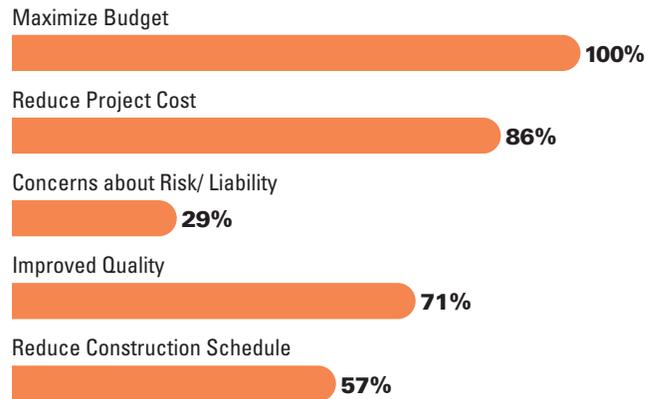
Maximizing the project budget (89%) and concerns about risk/liability (79%) are most often cited by owners as the key drivers that will cause increased use of design-build over the next three years. A third driver, reducing the construction schedule, is also cited by 68% of owners. While budget consideration is to be expected,

Drivers Influencing Increased Use of Delivery Systems

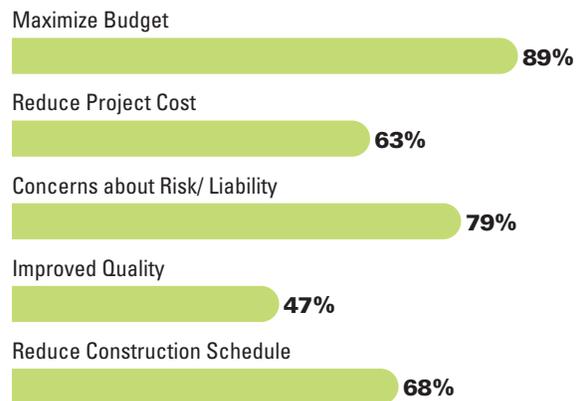
(By Percentage of Owners Using Each Delivery System Who Find The Drivers Influential)

Source: McGraw Hill Construction, 2014

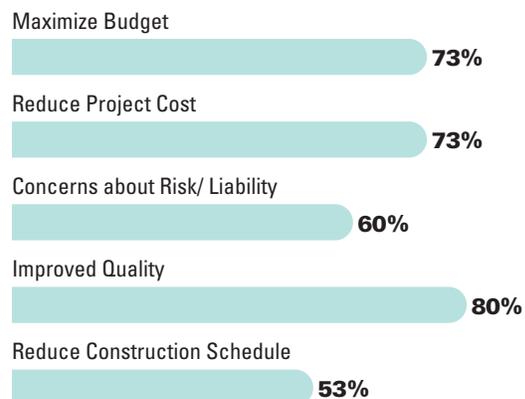
Design-Bid-Build



Design-Build



CM at-Risk



the most interesting finding is owners' high opinion of the importance of risk/liability. Design-build advocates often claim that the single-responsibility aspect is one of the delivery system's greatest strengths; apparently, many owners agree.

Architects and contractors have somewhat different perceptions of the key drivers that will produce increased use of design-build.

- **Architects: Reducing project cost is key (40%), followed by reducing project schedule.**
- **Contractors rank reducing construction schedule as the most important driver (47%), with a smaller percentage pointing to reducing project cost.**

Dissatisfaction with project scheduling and other time constraints under design-bid-build is apparently an issue for many contractors that will encourage broader use of design-build.

CM-AT-RISK

80% of owners feel that improved quality is the most important driver that will cause increased use of CM-at-risk. Maximizing the budget and reducing project cost are also important drivers, ranked nearly as high. Adherents of CM-at-risk frequently argue that improved quality accrues from having contractors participate in preconstruction decisions while maintaining two separate design and construction contracts with the owner. The study findings may support that contention.

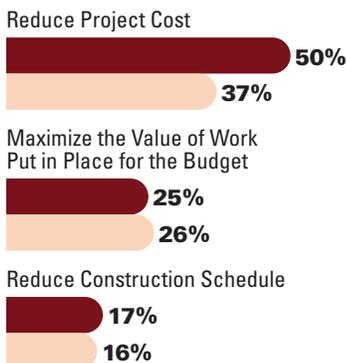
Both architects and contractors identify reducing construction schedule and maximizing the value of work put in place for the project budget as the main drivers for CM-at-risk. Combined with the architects' and contractors' comments on design-build above, this finding reaffirms one of the perceived weaknesses of design-bid-build: inadequate schedule control. Both sets of respondents believe that reducing the construction schedule is an important driver for increased use of both design-build and CM-at-risk.

Top Drivers in Increased Use of Established Delivery Systems in the Next Three Years (According to Architects and Contractors)

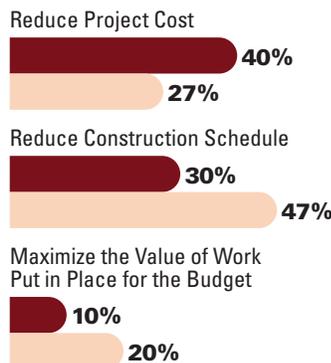
Source: McGraw Hill Construction, 2014

■ Architects ■ Contractors

Design-Bid-Build



Design-Build



CM-at-Risk



Emerging Project Delivery Systems

Owners were asked to comment solely on the drivers in the buildings sector for design-bid-build, design-build and CM-at-risk, but architects and contractors that expect to see growth in the two emerging delivery systems—integrated project delivery (IPD) and DBO/M—were asked about the same factors influencing general growth in the buildings sector as the respondents expecting growth in the established delivery systems. Architects and contractors were also asked about the factors that would encourage their firms to engage in an IPD or DBO/M project. Those findings are reported on pages 53 and 58, respectively, along with owner responses to a similar question.

IPD

Architects and contractors agree that **reducing construction schedule and maximizing the value of work put in place for the project budget are the main drivers increasing IPD use.** This perception is very similar to their comments about CM-at-risk. Although the respective responsibilities of owners, architects and contractors differ in these two delivery systems, the focus on risk allocation may be a common advantage to both.

DBO/M

Architects and contractors differ on the primary drivers in increasing use of DBO/M in coming years.

- **Architects point to reducing project cost as most important (36%), with an equal number of respondents identifying owners’ desire for fixed operations and maintenance costs and concerns about risk/liability (18%).**
- **For contractors, owners’ concerns about risk/liability were most important (28%). Reducing project cost and owners’ desire for fixed operations and maintenance costs were ranked comparably.**

DBO/M’s main selling point should be its strength in controlling operations and maintenance costs, going beyond the original demands of design and construction. The fact that this driver is ranked as one of the primary drivers, but not the highest one, suggests that relative unfamiliarity or inexperience with DBO/M is a challenge yet to be successfully addressed.

Top Drivers in Increased Use of Emerging Delivery Systems in the Next Three Years (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

- Architect
- Contractor

Integrated Project Delivery

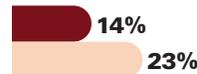
Reduce Construction Schedule



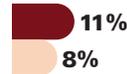
Maximize the Value of Work Put in Place for the Budget



Reduce Project Cost

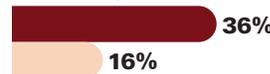


No System is Better Than Owner Concerns About Risk/Liability



Design-Build-Operate/Maintain

Reduce Project Cost



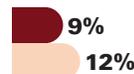
Owner Desire for Fixed Operations and Maintenance Costs



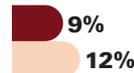
Owner Concerns About Risk/Liability



Maximize the Value of Work Put in Place for the Budget



Increased Industry Knowledge About Delivery System



Positive Influences on the Use of Delivery Systems

For the three established delivery systems, architects and contractors that use them agree that construction-industry firms are the most influential factor encouraging the use of each delivery system, more so than green building practices, professional associations, the legal profession or policy. This finding represents a challenge in promoting the use of one delivery system because of the need to win over the buildings sector firm-by-firm.

Design-Bid-Build

Architects that have used design-bid-build find many factors influential in driving the use of this delivery system, far more than contractors do.

- A high percentage of architects find that professional associations (52%), policy (52%) and the legal profession (41%) all encourage the use of design-bid-build currently.
- On the other hand, industry firms are the only positive influence selected by more than 17% of contractors.

These findings may suggest that contractors see influences like professional associations and policies pushing the buildings sector toward other delivery systems.

Design-Build

In sharp contrast to design-bid-build, contractors who have used design-build find many other factors beyond industry firms driving its use, far more than architects do.

- More than 40% of contractors find that green building practices (49%), professional associations (46%) and policy (43%) all encourage wider use of design-build.
- There is nearly a 20-point differential between the responses of architects and contractors about green building practices (26% of architects), professional associations (28%) and policy (26%).

Since contractors are typically the lead on design-build teams, they may be more directly targeted by professional associations and policies regarding design-build.

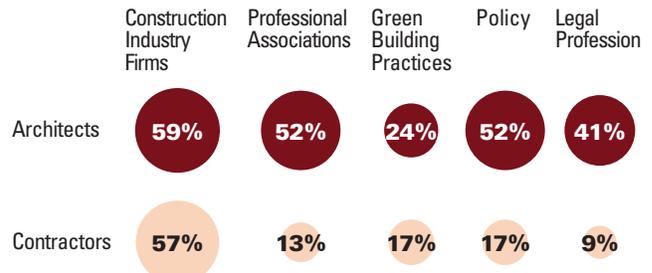
CM-at-Risk

Half of the architects and contractors find professional associations influential in encouraging the use of CM-at-risk, second only to industry firms. This demonstrates the role that professional associations can play in encouraging wider use of a delivery system, even one as established as CM-at-risk.

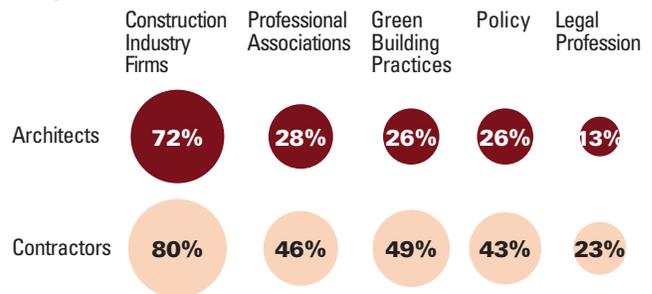
Positive Influences on the Use of Specific Project Delivery Systems (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

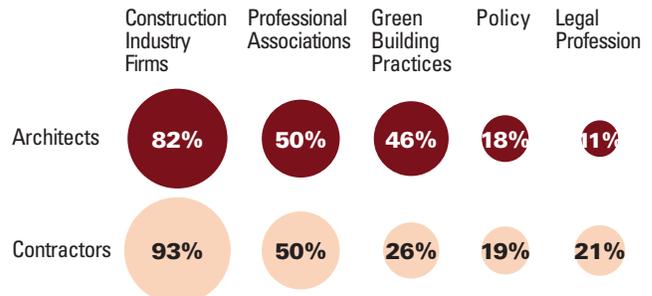
Design-Bid -Build



Design-Build



CM-at-Risk



46% of architects also find use of CM-at-risk encouraged by the adoption of green building, a number that is 20 percentage points higher than the contractors, and nearly double the percentages of architects that report green building is influential on the other two delivery systems. With the GMP determined during design, it is possible that sustainable elements of a project are less likely to be value-engineered out of a CM-at-risk project.

Obstacles Preventing Wider Adoption of Delivery Systems

Owners were asked about obstacles in a different manner from the architects and contractors. Owners were asked to determine the degree of impact of each obstacle on preventing wider adoption of specific delivery systems, while architects and contractors were asked to rank their top three obstacles.

Design-Bid-Build

OWNERS

No obstacles are selected by more than 29% of owners as highly impactful. This is probably due to the wide adoption of design-bid-build in the buildings sector, leading few owners to see significant obstacles preventing its use.

The top obstacle reported by owners (29%) is too few checks and balances associated with design-bid-build. However, that is roughly the same percentage that report too few checks and balances as an obstacle for the use of design-build (27%) and far fewer than the number that report this obstacle as impactful on the adoption of CM-at-risk. This suggests that for many owners, concerns about checks and balances are not confined to one delivery system.

However, one obstacle selected by a higher percentage of owners using design-bid-build (24%) than those using design-build (18%) is the additional cost due to the length of the contract. This finding suggests that owners do see the perception of a lengthy contract as an issue with this delivery system.

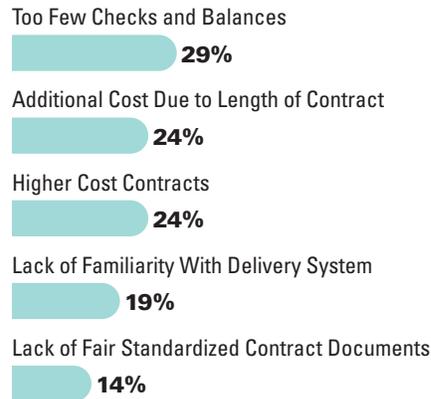
ARCHITECTS AND CONTRACTORS

Between 30% and 45% of architects and contractors rank four obstacles—higher cost contracts, additional cost due to the length of the contract, lack of owners’ interest in delivery system and too few checks and balances—as among the top three obstacles for wider adoption of the design-bid-build delivery system. This relatively diffuse response, with no significant obstacle rising to the top, no doubt reflects the widespread use of design-bid-build as demonstrated in the research (see page 12). Since this delivery system is so widely used, it is not surprising that there is no consensus around one or two big obstacles.

However, while contractors report that owners are unfamiliar with this delivery system, a much smaller percentage of architects consider this an obstacle. With 19% of owners also finding this to be an obstacle with a high impact on the adoption of this delivery system, though, it is clearly a point of consideration.

Obstacles Considered Highly Impactful on Wider Use of Design-Bid-Build (According to Owners Using Design-Bid-Build)

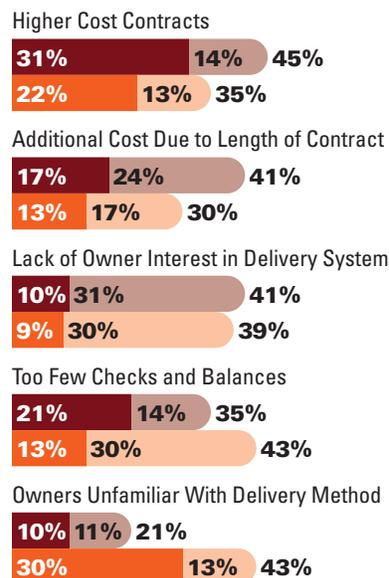
Source: McGraw Hill Construction, 2014



Top Obstacles Preventing Wider Use of Design-Bid-Build (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

■ Ranked 1st—Architects ■ Ranked 2nd or 3rd—Architects
■ Ranked 1st—Contractors ■ Ranked 2nd or 3rd—Contractors



Design-Build

OWNERS

45% of owners who have used the design-build delivery system consider lack of familiarity with design-build to have a negative impact on its adoption in the buildings sector. This finding, 18 percentage points higher than the next most important obstacle, suggests that creating awareness about the effectiveness of design-build is crucial to increasing adoption.

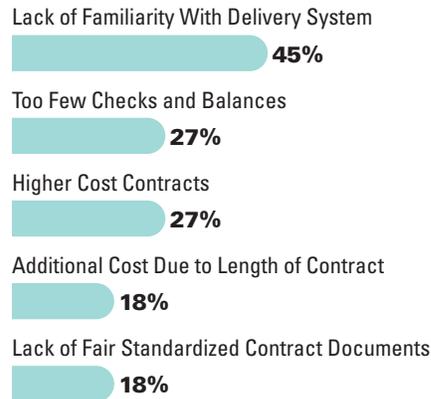
ARCHITECTS AND CONTRACTORS

Unlike with design-bid-build, in which no significant obstacle emerges, a few obstacles are ranked among the top three by a much higher percentage of architects and contractors for preventing wider adoption of design-build.

- **Architects are concerned about checks and balances: 57% rank it among their top three obstacles, and 20% rank it first.** In a contractor-led design-build scenario, the architect works for the contractor, which may reduce the architect’s influence.
- **Contractors find owners’ awareness and interest to be the top obstacles: 86% rank owners’ lack of familiarity with design-build as one of the top three obstacles.** In addition, 63% rank lack of owners’ interest as an obstacle, very high in comparison with most of the other obstacles ranked for any of the three established delivery systems. Clearly contractors consider owners the major stumbling block to wider use of design-build.

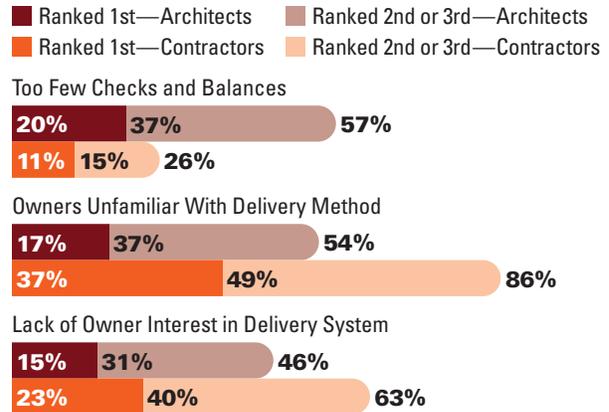
Obstacles Considered Highly Impactful on Wider Use of Design-Build (According to Owners Using Design-Build)

Source: McGraw Hill Construction, 2014



Top Obstacles Preventing Wider Use of Design-Build (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



CM-at-Risk

OWNERS

Three obstacles are considered highly impactful by 43% of owners. **Two of them, lack of familiarity with the CM-at-risk delivery system and the lack of checks and balances when using this system, demonstrate strong agreement between the obstacles identified by the architects and contractors.** With such industry agreement, these obstacles must be addressed for the buildings sector to take advantage of the benefits of this delivery systems.

However, these owners, all of whom have experience with this delivery system, also consider added cost due to the length of the contract a highly impactful obstacle.

This obstacle was ranked by a significantly smaller percentage of architects and contractors as one of the top three obstacles than the number who ranked the top obstacles as indicated on the chart. This represents a gap in the buildings sector’s understanding of owners’ concerns about this issue, which proponents of CM-at-risk must be able to address to see wider use of this delivery system in the buildings sector.

ARCHITECTS AND CONTRACTORS

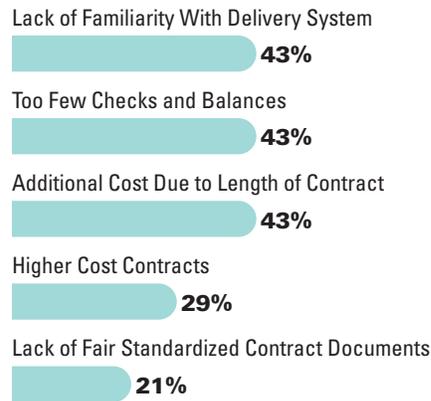
Architects and contractors who use the CM-at-risk delivery system agree that owners’ lack of familiarity is one of the top three obstacles preventing its adoption. In fact, nearly half of contractors (48%) rank it first as the top obstacle, far more than any of the other obstacles included in the survey. As with design-build, creating greater awareness of the benefits of the CM-at-risk systems among owners is important for increased adoption.

Given the emphasis on owners’ lack of familiarity by contractors, it is not surprising that a higher percentage of architects than contractors place other obstacles among their top three, including:

- **Lack of Owner Benefit From Competitive Bidding:** With 50% of architects ranking this among their top three obstacles, it appears to be as important to them as the concern about owners’ lack of familiarity with the delivery system. This is also the factor ranked first as the top obstacle by the highest percentage of architects (29%).
- **Higher Cost Contracts:** This obstacle was selected among the top three by 46% of architects, over half of whom rank it first. This high ranking is likely related to the concern about owners’ perceptions that the lack of competitive bidding will drive up costs.

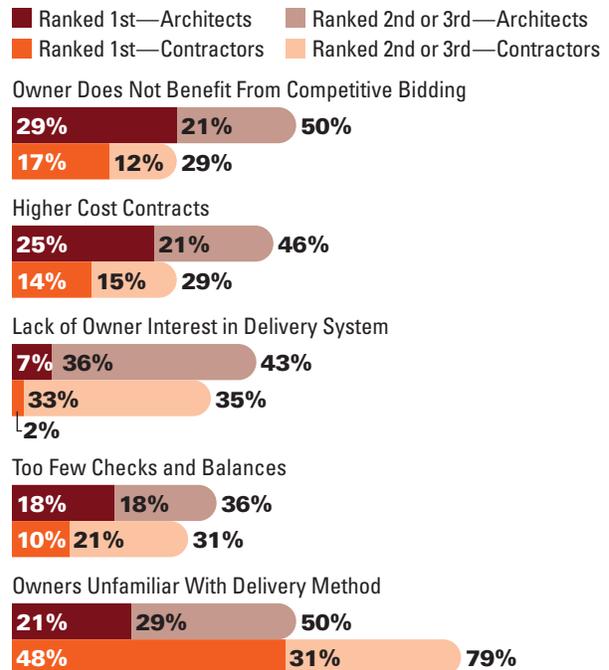
Obstacles Considered Highly Impactful on Wider Use of CM-at-Risk (According to Owners Using CM-at-Risk)

Source: McGraw Hill Construction, 2014



Top Obstacles Preventing Wider Use of CM-at-Risk (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Selecting a Delivery System to Mitigate Project Risk

The best way to mitigate risk through a project delivery system is to select the delivery system that fits the particulars of the project. That means identifying the project's sensitivities and identifying which delivery system allocates risks to the parties that are best able to control for them.

From the owner's perspective, project delivery systems generally form a spectrum of risk that correlates with the owner's level of control, according to a comparison published by the Construction Management Association of America.

A Spectrum of Risk

Design-bid-build, the delivery system most commonly used in North America, occupies the risk spectrum's mid zone. Offering owners a high degree of control over the design and reliable costing information before construction starts, the system is well understood in the industry, with the roles of each party clearly defined.

Design-bid-build's clear distinction of phases carries certain risks, however: Developing the design in the absence of reliable costing information can result in a project that is more expensive than necessary; the horizontal timeline of design-bid-build can make it a poor choice for a schedule-sensitive project; and the compartmentalization of parties and functions can generate an adversarial, rather than collaborative, culture.

Construction management at risk (CM-at-risk) can increase an owner's control of the project schedule and/or reduce overall costs by allowing for the potential for a fast-track process. The construction manager at risk (CMR) will often provide a fixed or guaranteed maximum price when the design is

50% to 90% complete and may even assume the risk of design errors discovered during construction.

The most common difficulty with CM-at-risk centers on the construction manager's shift from in-house adviser during design to CMR during construction, a shift that risks a deterioration in project team relationships.

Collaborate to Mitigate

At the low end of the risk spectrum, the enhanced collaboration in delivery systems such as design-build and integrated project delivery (IPD) can significantly reduce an owner's risk. "It can be amazing what kind of impact collaboration has on the bottom line," says John Manning, principal at Krauss-Manning, a firm of project management and construction consultants.

But that does not make these systems panaceas, notes Manning. A formal commitment to collaboration is all to the good, but an integrated partnership may achieve only limited success if partnership behaviors aren't rewarded in the project's contract structure.

Design-build's loss of owner and stakeholder involvement may pose a risk of its own: for example, reducing the ability of owners to determine whether they are getting the best value for their money or compromising building performance on specialized projects, which will then face increased operating costs for years to come. And in any

delivery system that takes risk off an owner, there will be a contingency to parties who accept that risk instead—which may or may not be justifiable in the context of a given project.

"What it comes down to is having a fundamental understanding of the pros and cons of each delivery method," says Blake Peck, president and chief operating officer of MBP, a firm of construction management consultants. "And, if you're going to try something new, you've got to train people so they know what their roles and responsibilities are, and make sure they know if they've got that ball or not."

Ultimately, it is the human factors that will determine a project's success, regardless of delivery system. "A bad team will overcome [the benefits of] any delivery method you have. A good team that works well together will figure out how to get [the project] built," says Peck. "The bottom line is what we've all known for a long time in this industry: It's a people business." ■

Data: Benefits of Delivery Systems

Overview of Key Benefits

This data section (pages 33–51) includes a detailed analysis of the benefits that different players associate with different project delivery systems. As an overview, the chart at right contains the major benefits reported in this section of the report for the established delivery systems—design-bid-build, design-build and CM-at-risk—and provides a summary of the benefits that are associated with each system by different players.

Looking at these data results in aggregate, a few key findings emerge:

- **While there are some differences, owners report strong performance on budget, schedule and overall satisfaction for all three established project delivery systems.**
- **Reduced change orders is a recognized benefit of design-build for both architects and contractors. Architects see it as a valuable system to provide the benefit of reduced schedule, while contractors see it as offering improved communication between team members.**
- **Architects view CM-at-risk as the best system to provide improved communication and construction quality benefits, while contractors emphasize it as a delivery system that offers productivity and reduced project cost benefits.**
- **Design-bid-build is seen as reducing project costs—with both architects and contractors listing it as the best delivery system to provide this benefit.**

Delivery Systems With the Best Performance for Achieving Project and Process Benefits (According to Owners, Architects and Contractors)

Source: McGraw Hill Construction, 2014

	Benefits Achieved	Selected by Highest Percentage as Best Delivery System to Achieve Benefit	
	Owners	Architects	Contractors
Design-Bid-Build	<ul style="list-style-type: none"> • Cost: 67% on Budget; 27% Under Budget • Schedule: 67% on Time; 13% Ahead of Schedule • Satisfaction: 40% Very Satisfied 	<ol style="list-style-type: none"> 1. Reducing Project Cost 2. Improve Construction Quality 	<ol style="list-style-type: none"> 1. Reducing Project Cost 2. Less Value Engineering
Design-Build	<ul style="list-style-type: none"> • Cost: 67% on Budget; 23% Under Budget • Schedule: 73% on Time; 20% Ahead of Schedule • Satisfaction: 37% Very Satisfied 	<ol style="list-style-type: none"> 1. Reduce Project Schedule 2. (Tie) Less Value Engineering/ Fewer Change Orders 	<ol style="list-style-type: none"> 1. Improve Communication Between Team Members 2. Reduce Change Orders
CM-at-Risk	<ul style="list-style-type: none"> • Cost: 60% on Budget; 33% Under Budget • Schedule: 77% on Time; 7% Ahead of Schedule • Satisfaction: 60% Very Satisfied 	<ol style="list-style-type: none"> 1. Improved Communication Between Team Members 2. Improved Construction Quality 	<ol style="list-style-type: none"> 1. Improved Productivity 2. Reducing Project Cost

Delivery Systems Offering the Best Value for Building Owners

82% of architects and 91% of contractors report using more than one delivery system in the last three years. These respondents were asked, among the delivery systems that they have used, which provides the best value for the owner.

Design-Bid-Build

The highest percentage of architects using more than one delivery system (34%) select design-bid-build as the delivery system that provides the most value to owners, which is a far higher percentage than the contractors using more than one system (14%).

While there is a higher percentage overall of architects in the study that report using this delivery system than there are contractors—95% of architects versus 87% of contractors—that differential is not enough to account for the number of architects who feel it has the highest value to owners of any delivery system. This finding corresponds with the architects’ concern about checks and balances and may even suggest some resistance to the value of more collaborative engagement by contractors during design, which may occur with the other delivery systems.

VARIATION BY SIZE OF FIRM

30% of small contractors (those with less than 50 employees) report that design-bid-build has the best value for building owners, compared with 5% of larger firms. There may be larger challenges faced by small firms seeking to use less common delivery systems.

Design-Build

By far, the highest percentage of contractors using more than one delivery system select design-build as the delivery system providing the most value to owners, at 55% compared with just 18% of architects.

In this case, a higher percentage of contractors use, and therefore were asked about, design-build than architects do—90% of contractors, compared with 78% of architects—but again, the disparity in the value placed on design-build is much larger than this difference in use could account for. Contractor-led design-build can allow for the most direct input by contractors throughout the design process, and a high percentage of contractors using this approach believe the owners benefit as a result.

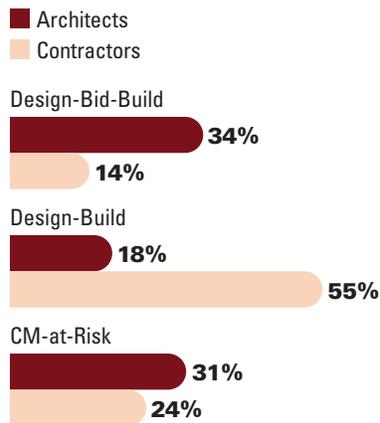
CM-at-Risk

Architects and contractors are much closer to agreement on the value of CM-at-risk for owners; 31% of architects

Delivery Systems That Offer the Best Value for Owners

(According to Architects and Contractors Who Have Used These Delivery Systems)

Source: McGraw Hill Construction, 2014



and 24% of contractors find this system to have the greatest value. The collaborative aspects of this system may be balanced against the risks of a high contingency being built into the guaranteed maximum price (GMP) offered.

VARIATION BY TYPE OF WORK

43% of architects whose firms largely do public work (more than 40% of their projects) believe that CM-at-risk offers the greatest value to owners, compared with 23% of those doing fewer public projects. This finding is in contrast to the fact that fewer firms doing public work are familiar with this delivery system (see page 11). It demonstrates the value placed on this delivery system by those that have actually been involved in a CM-at-risk project.

Emerging Delivery Systems

The emerging delivery systems, IPD and DBO/M, were included in this question, but the findings are minimal given the low number of architects and contractors currently using these systems. However, it may be worth noting that even though only 22% of architects report using IPD at all, 12% of the architects using more than one delivery system identify it as having the greatest value for owners. This demonstrates that a high percentage of architects using this system believe in its value for owners.

Construction and Project Costs:

Impact of the Use of Specific Delivery Systems

Owners

Owners were asked about the cost performance of a specific project that uses design-bid-build, design-build or CM-at-risk as its delivery system.

Performance in terms of cost of these projects was relatively equivalent across all three delivery systems, with about two-thirds of the projects finishing on budget.

The only notable difference is that a slightly higher percentage of CM-at-risk projects (33%) finished under budget, compared to 27% of design-bid-build and 23% of design-build projects. However, the similarity in overall performance is more striking than any differences.

In addition, owners who indicated that they had experience with IPD were asked about this benefit for their IPD projects in general, and **80% reported that the use of IPD reduced construction costs.**

Architects and Contractors

Unlike owners, architects and contractors were asked to select the best delivery system for reducing construction costs out of any they have worked with in the past.

ESTABLISHED DELIVERY SYSTEMS

76% of architects and 87% of contractors associate the use of specific project delivery systems with reducing construction costs, demonstrating the potential impact of delivery-system selection on cost.

Respondents were asked to select which delivery system is best for lowering project costs among the systems that they have used in the past. **There is no agreement on the most effective delivery system for lowering costs:**

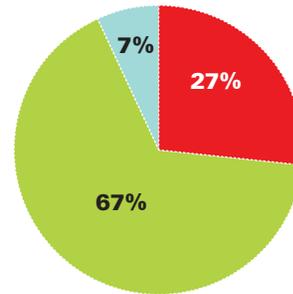
- **The highest percentage of architects (38%) select design-bid-build.** Design-bid-build is also selected by 22% of contractors, a healthy percentage. The high percentage of architects selecting this system may be influenced by the fact that architects on some projects are less aware of final costs than owners or contractors are, and they may be less aware of the role of contingencies in the final costs than owners, or even contractors, are.
- **The highest percentage of contractors (38%) select design-build.** Design-build is the second highest choice for architects, at 20%.

Impact of Delivery Systems on Project Budgets (According to Owners)

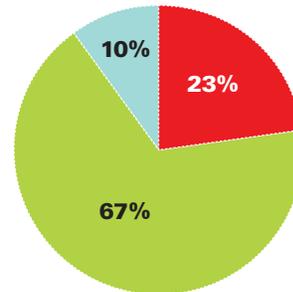
Source: McGraw Hill Construction, 2014

■ Under Budget ■ On Budget ■ Over Budget

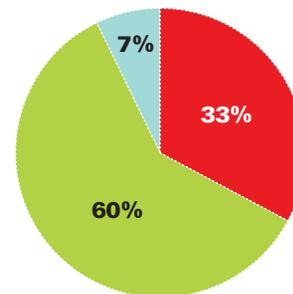
Design-Bid-Build



Design-Build



CM-at-Risk



Benefits of Delivery Systems

Construction and Project Costs: Impact of the Use of Specific Delivery Systems

CONTINUED

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

■ While roughly the same percentage of contractors find CM-at-risk (23%) to be the best for lowering construction costs as do those that select design-bid-build (22%), only 15% of architects agree. This is a notable contrast to the percentage of architects versus that of contractors who find that CM-at-risk offers the greatest value to owners (see page 33), suggesting that architects find the value that this delivery system provides to owners in factors other than reduced cost. However, the responses from the owners may suggest that architects underestimate the potential for CM-at-risk to lower costs.

The respondents who report lowered costs are more certain about the impact of design-build on project costs than other systems, with only 19% who don't know a specific amount of savings for design-build, compared with 31% who don't know for design-bid-build and 34% for CM-at-risk. These responses may be influenced by the type of design-build that respondents are most familiar with; for example, in lump-sum design-build, the design-builder would keep the savings.

The highest cost savings are evident in design-build as well, with 67% of architects and contractors reporting savings of 5% or more for that delivery system, compared with 49% for design-bid-build and 34% for CM-at-risk.

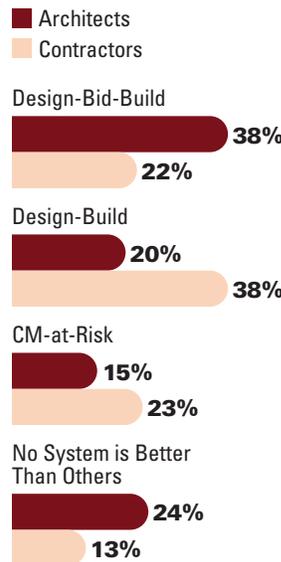
EMERGING DELIVERY SYSTEMS

While there are not sufficient responses for a full statistical analysis, the general trend among the few architects and contractors with experience with IPD and DBO/M is that few of them report experiencing cost savings on these projects.

Best Project Delivery System for Reducing Construction Costs

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014

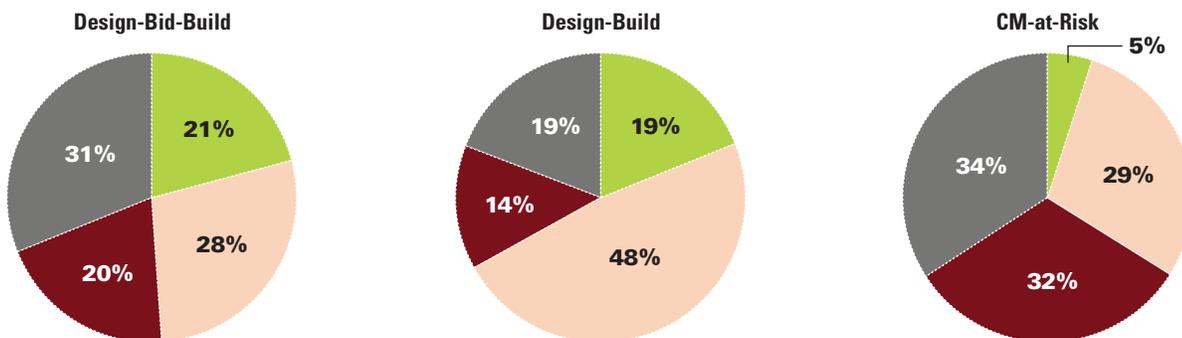


Typical Cost Savings Reported by Delivery System

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014

10% or More (Green) 5%–9% (Light Orange) Less Than 5% (Dark Red) Don't Know (Grey)



Construction Schedules: Impact of the Use of Specific Delivery Systems

Owners

Owners were asked about the schedule performance of specific projects that they have conducted using design-bid-build, design-build and CM-at-risk.

- Owners doing CM-at-risk projects report the highest percentage of projects finishing on schedule (77%), suggesting that CM-at-risk projects have a relatively high rate of reliability in schedule.
- The highest percentage of owners doing design-build projects (20%) report that the project finished ahead of schedule. They also report the lowest percentage of projects finishing behind schedule, at least 10 percentage points fewer than owners using the other two delivery systems.

Owners were not asked about the type of procurement used for their design-build projects, but typically low bid/best value procurement for design-build does not have the same implications for improving schedule that design-build procured with qualification-based selection can have.

76% of the owners who have used IPD report that they have experienced reduced schedules on IPD projects.

Architects and Contractors

Architects and contractors were asked to select the best delivery system, among those that they have worked with in the past, for reducing project schedules. **80% of architects and 89% of contractors believe that the selection of a delivery system can have an impact on the ability to reduce a construction schedule on a project.**

Unlike the wide selection of delivery systems that can best reduce project costs (see page 35), there is broad agreement between architects and contractors on the delivery systems that can positively impact schedules.

- Design-build is the delivery system selected by the highest percentage of architects (43%) and contractors (50%) as the best for reducing a construction schedule.
- CM-at-risk is seen by about 20% of architects and contractors as the best system, a notable amount, even if significantly less than those selecting design-build.
- Very few architects or contractors find design-bid-build to be the best delivery system for reducing a project schedule.

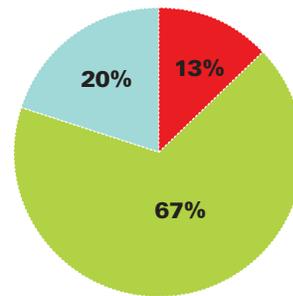
While the contractor findings are consistent with a preference for design-build as demonstrated throughout the findings, the agreement by architects is notable in this case, with more general agreement about the efficacy

Impact of Delivery Systems on Project Schedules (According to Owners)

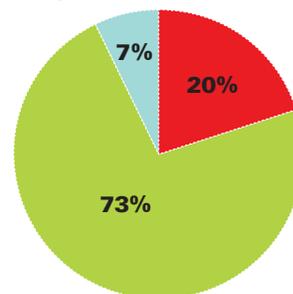
Source: McGraw Hill Construction, 2014

■ Ahead of Schedule ■ On Time ■ Behind Schedule

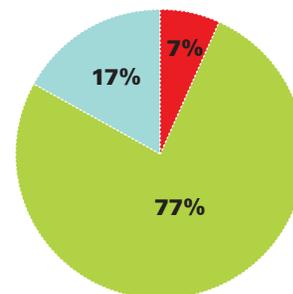
Design-Bid-Build



Design-Build



CM-at-Risk



PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

of design-build to improve schedules than the efficacy of any specific delivery system for most of the other benefits. Again, though, the type of procurement for the design-build project is important.

Among those that report seeing construction schedule reductions for each delivery system, there is a pretty strong consistency in the level of savings achieved. Design-build has a slightly higher percentage (24%) who expect to see savings of more than 10%, compared with design-bid-build and CM-at-risk (19% apiece), but the dramatic differences reported in cost savings (see page 35) are not evident here.

There is also a much lower overall percentage who do not know the degree of savings in a schedule, approximately one-fifth of the respondents for each delivery system, compared to those estimating cost savings. Part of this may be the feeling that cost savings for design-build and CM-at-risk are built into the original price offered and thus are more difficult to ascertain, whereas schedule gains are more easily tracked and measured.

EMERGING DELIVERY SYSTEMS

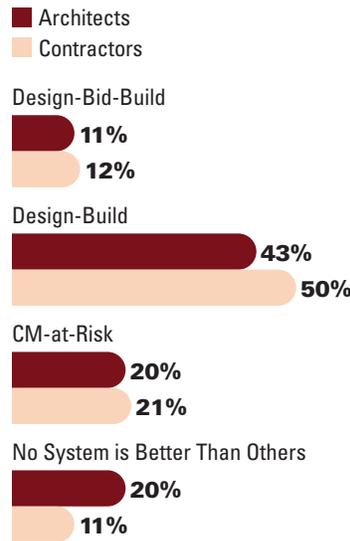
While the number of architects and contractors with experience in IPD and DBO/M are too low for a full statistical analysis, trends emerge from the eligible responses.

- Nearly one-quarter of those who have used IPD consider it the best delivery system for reducing construction schedules.
- None of the respondents who have used DBO/M select it as the best for schedule reduction.

Best Project Delivery System for Reducing Project Schedules

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014

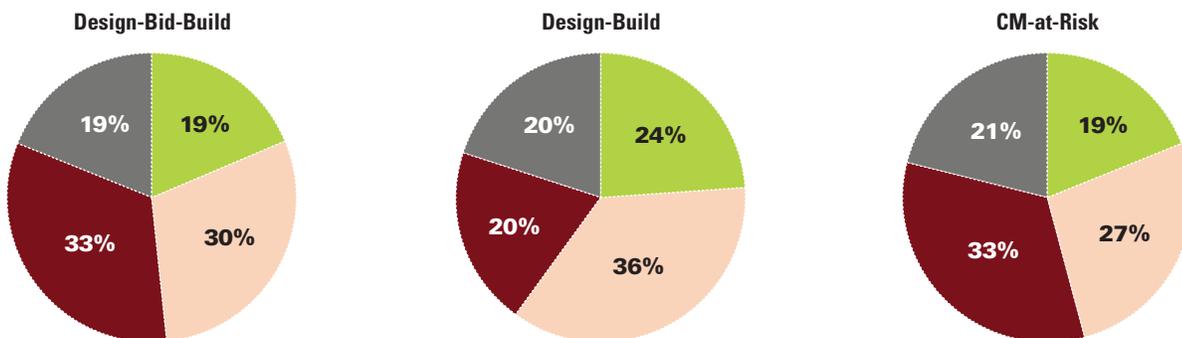


Schedule Savings by Delivery System

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014

More Than 10% 6%–10% Less Than 6% Don't Know



Slimming the Project Schedule Using Design-Build Delivery

Chobani New Greek Yogurt Facility

TWIN FALLS, IDAHO

Speed to market is essential in manufacturing and processing, but for Greek-yogurt maker Chobani, it was critical. Within its first five years of production, Chobani saw demand for its products skyrocket, placing the company among the top three producers of non-frozen yogurt in the United States. To meet rising demand and stay ahead of the competition, the New Berlin, N.Y.-based company decided to expand its processing capacity—and broaden its geographic reach—with a new 1-million-sq-ft plant in Twin Falls, Idaho. When completed, the project would be the largest of its kind in the world, featuring 12 production lines.

Feasibility studies suggested that the project could take up to two years to complete under a traditional delivery method. After interviewing eight firms that presented a variety of delivery types, Shambaugh & Sons, Fort Worth, Ind., was selected using a design-build procurement. Under terms of the contract, the project was to be delivered in 10-months, less than half the time estimated for traditional delivery. This would enable the company to get new products produced by the plant much sooner.

“Design-build, in my opinion, was the only way to accomplish a project start and continue development as the time clock went on,” says Gary Hegger, project manager at Shambaugh & Son.

Flexibility with design and installation proved critical during the project. Several design and technology enhancements had not been determined at the time that Shambaugh was selected, including

new products and packaging that were still in development.

Chobani provided functional product and plant needs as well as performance standards, but no drawings were presented to the design-build team by the owner.

Schedule Pressures

Schedule was the prime driver throughout the project. There were no contractual rewards available to the team, but there were liquidated damages for late schedule. Due to the project’s time-sensitive nature, Shambaugh brought on its two primary design and engineering partners—MSKTD & Associates and Tippmann Group—immediately. This allowed the team to collectively expand on conceptual design parameters by providing scopes of work, engineering designs, drawings, construction schedules and controlled estimate pricing within a required eight-week window.

The firms signed a project charter to formalize the team’s commitment to collaboration. To enhance collaboration during the design phase, team members co-located for up to one week at a time in 80-hour weeks of integrated, multidisciplinary design meetings. These meetings were held four

times during the project. The team followed up with webinar design coordination meetings.

During the construction phase, the team initially held separate coordination and scheduling meetings on a weekly basis. As the project moved forward, these meetings were held on a daily basis.

“Because of the schedule, we were under extreme pressure,” says Mark Shambaugh, CEO of Shambaugh & Son. “When conflicts would come up, we’d come together and say, ‘Today is the day. We’re going to collaborate until we get this right.’ On any normal job, you could tell people to come back in a week with an answer. On this project, we did everything we could immediately. At most, we gave [team members] 24 to 48 hours, but most of the time they couldn’t leave the trailer until we collaborated and got through all of the points.”

To expedite decisions and approvals, Chobani assigned Marc Abjean, senior vice president of global engineering, to the project. Shambaugh says Abjean made decisions quickly and kept the project moving ahead.

Building information modeling was an essential collaboration tool during both the design and construction



Using design-build allowed delivery of the new Chobani plant in 10 months.

CONTINUED

Chobani New Greek Yogurt Facility

TWIN FALLS, IDAHO

phases. It was used extensively for coordination and enabled prefabricated modular construction.

Accountability lists were handed out daily and measured 24 hours later for accomplishment of tasks. If delineated time tasks could not be completed, the team would agree on rescheduling tasks and, when necessary, resequencing other tasks to accommodate those changes.

Tough winter conditions added schedule pressure. The team lost 25 days due to high winds. The team moved to a seven-day weekly schedule on several occasions to ensure critical-path activities succeeded.

Site congestion required the team to pay extra attention to site coordination. At times during the project, crews exceeded 1,000 people. Shift work for key trades was implemented to mitigate congestion, reducing risks to productivity and safety.

Dynamic Development

Because Chobani continued to develop its needs throughout the project, the design and construction planning processes were very dynamic. Early on, Shambaugh developed an “owner wants versus owner needs” list to segregate cost options proactively. The team developed a value-engineering list of more than 100 items totaling \$50 million, of which not all were accepted. During construction and near completion of final design, Chobani revealed a new product launch and changes in filling and packaging that had to be incorporated into the design.

Hegger says that major changes included the addition of two new floors and new air-handling systems.



Electrical conduits (left) and chillers (above) at the new Chobani plant

Early design decisions also aided in the added capacity needed for these owner-driven decisions.

“We had oversized much of the infrastructure—such as boilers, chillers and power—for future expansion,” Shambaugh says. “As it turned out, that was needed right away, and we were able to accommodate those changes.”

Although these owner-driven changes increased the total project budget, the team was able to remain on schedule.

To help accommodate changes and delays, Shambaugh devised a plan that allowed workers to shift their attention from one portion of the project to another, as necessary. The team started in the utility wing prior to working on the process wing of the facility.

The project also included a large warehouse, which Hegger said was “simple by comparison” to other aspects of the project. “That was available for us to work on when we had to go back to design decisions or deal with delays,” he says.

Shambaugh says that although the team had to “keep the pedal to the metal and never let up,” the team did not sacrifice safety. The project logged more than 2 million manhours without a lost-time accident.

“This was the project of a lifetime for everyone involved,” he says. “Everyone realized this was something special that you might only build once in your career. That really drove people to work together and make this a success.” ■

Project Facts and Figures

Design-Builder
Shambaugh & Son

Type of Project
Manufacturing Facility

Size
1 million sq. ft.

Foundations
January 2012

Completed
November 2012

Project Highlights

- Compressed project schedule from 24 months to 10 months
- Construction commencement while project development and design was still underway
- Single point of responsibility
- \$50 million of cost-savings options from value engineering
- Two million manhours without a lost-time accident

Sustainability and Quality: Impact of the Use of Specific Delivery Systems

Most architects and contractors find that the type of delivery system can impact project costs and schedules (see pages 35 and 37), but fewer find that delivery systems impact green/sustainable building performance or construction quality.

- Only 48% of architects find that delivery systems have an impact of sustainable building performance, and 60% find that they impact construction quality.
- The percentage of contractors who report that a specific delivery system can improve these two outcomes, while much higher than the architects, is still considerably lower than those who find delivery systems impact costs or schedules.

While the percentages are different, a pattern also emerges in these responses.

- A higher percentage of architects than contractors consider design-bid-build to be the most effective to achieve these outcomes.
- A higher percentage of contractors than architects consider design-build to be the most effective to achieve these outcomes.
- A roughly equivalent, smaller percentage of both groups consider CM-at-risk to be the best system.

These findings reflect the role that each player has in the early phases of a project in terms of the delivery system that they value most.

- Architects determine the fundamental approach to green and the elements that contribute to the quality of the building in a design-bid-build project.
- Contractors are typically far more engaged and have greater authority in design-build projects.
- With a CM-at-risk project, the architect still may be engaged more in early design, but by the construction documents phase, the construction team plays a greater role than it does in design-bid-build projects.

Variation by Type of Work

22% of architects for whom public work makes up more than 40% of their total projects report that CM-at-risk is the most effective delivery system for improved sustainable building performance, compared with 8% of those doing less public work.

On the other hand, a higher percentage of contractors doing more public work believe that the choice of delivery systems has no real impact on sustainable building performance (34%) or construction quality (30%), compared with 19% and 12%, respectively, of contractors

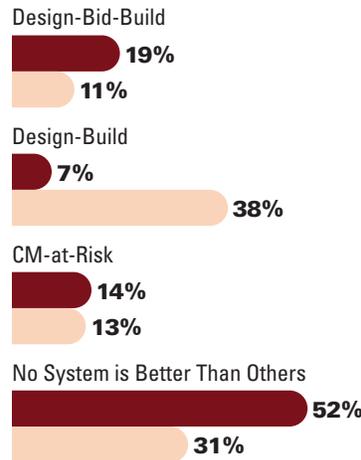
Best Project Delivery System for Improving Specific Project Outcomes

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

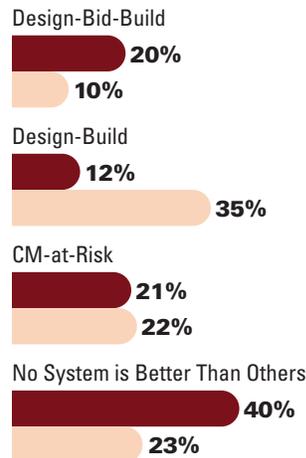
Source: McGraw Hill Construction, 2014

- Architects
- Contractors

Improved Sustainable Building Performance



Improved Construction Quality



doing less public work. One factor that may contribute to this finding is the relatively prescriptive nature of work in the public sector versus in the private sector, where the ability to be more innovative in the implementation of delivery systems may allow for better results.

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

Variation by Size of Firm

- 44% of small contractors (annual project values of less than \$50 million) think that no system is better for achieving sustainable building performance, compared with 21% of large contractors.
- 33% of small contractors think that no system is better for improving construction quality, compared with 17% of large contractors.

While many factors could contribute to the different responses, one possible influence may be the relatively low number of projects on which to base any comparisons. Construction projects are each quite individual in terms of their benefits and challenges, and a smaller sample of projects is less likely to reveal differences.

Emerging Delivery Systems

80% of owners with IPD experience report that IPD has improved sustainable building performance and construction quality on their projects.

Some trends emerge from the responses of architects and contractors that have done IPD or DBO/M projects.

- Nearly half of the architects and over one fifth of the contractors who have worked on an IPD project find that it contributes to project sustainability.
- Almost one quarter of the architects and one third of the contractors who have worked on an IPD project also find that it improves quality, findings roughly comparable with the established delivery systems.
- Few respondents with experience in DBO/M regard it as the best system for either of these outcomes.

Communication Between Team Members: Impact of the Use of Specific Delivery Systems

The highest percentage of contractors find that design-build is the best delivery system for improving communication between team members, while architects are nearly evenly split between those who believe delivery-system choice does not impact communication and those who find design-build and CM-at-risk to be the best systems. The lack of consensus suggests that architects and contractors may have different standards for what qualifies as improved communication.

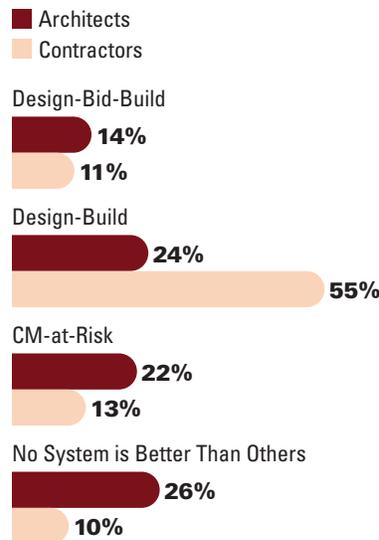
Firm size impacts the responses, with 21% of respondents from small construction firms (those with fewer than 50 employees) who do not think that the choice of delivery system impacts project team communication, compared with 3% of those from larger companies. It is possible that small construction firms do not track communication issues to the degree that large firms do.

Emerging Delivery Systems

- Over half of architects and over one-third of contractors who have used IPD think that it is the best system to improve communication among team members.
- None of the architects and few contractors who have used DBO/M report the same.

Best Delivery System for Improving Communication Between Project Team Members (According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



Owner Satisfaction: Impact of the Use of Specific Delivery Systems

Owners

Owners were asked about the level of satisfaction that they had with a specific project that employed one of the three established delivery systems: design-bid-build, design-build and CM-at-risk.

- A high percentage of owners report being satisfied with each of the three delivery systems.
- In contrast to the architect and contractor findings, CM-at-risk projects resulted in the highest percentage of satisfied owners.
 - Nearly all the owners who had done a CM-at-risk project (97%) report being satisfied with that project.
 - 60% of owners that had done a CM-at-risk project report being very satisfied, which is at least 20 percentage points higher than the owners who did projects using other delivery systems.

Not only are these findings important for proponents of the CM-at-risk delivery system, but they also suggest that the industry needs to find better ways to gauge the satisfaction of their clients.

Architects and Contractors

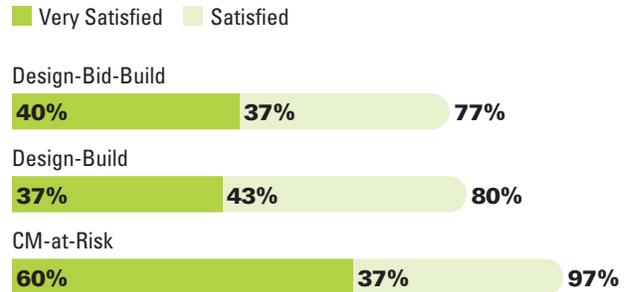
Architects are more skeptical than contractors of the impact of any delivery system on the level of client satisfaction achieved on a project, with 35% reporting that no delivery system is better than any other compared with 19% of contractors. Since a higher percentage of architects feel that project cost and schedule are impacted by the selection of a delivery system, and since cost and schedule performance would have a direct impact on client satisfaction, this result is surprising. It may suggest that architects regard the selection of a delivery system to have a greater impact on factors related to contractor performance than to their own performance.

A much smaller percentage of small contractors (66% of those with less than 50 employees) consider the delivery system selection to have an impact on client satisfaction, compared with large contractors (90% of those with 50 employees or more). Trending across delivery systems may be easier for larger contractors to track. However, no similar division exists for architectural firms.

Contractors are more unified about which delivery system they think is best than are the architects who do find that the choice of delivery system has an impact on client satisfaction.

Owner Satisfaction With Projects Using Specific Delivery Systems

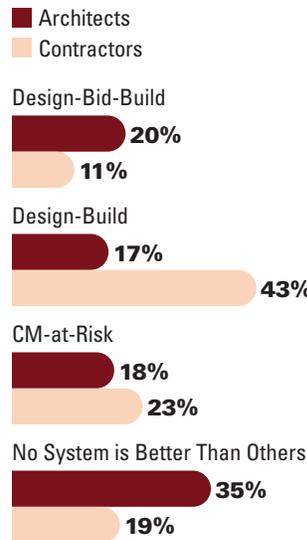
Source: McGraw Hill Construction, 2014



Best Delivery System for Improving Client Satisfaction

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



- 43% of contractors find that design-build is the best delivery system for improving client satisfaction.

This finding is consistent with general tendency of contractors to favor design-build over other delivery systems for previously discussed benefits, most of which directly contribute to creating improved client satisfaction. The percentage selecting other delivery systems as best falls at least 20 percentage points short of those selecting design-build.

Benefits of Delivery Systems

Owner Satisfaction:

Impact of the Use of Specific Delivery Systems

CONTINUED

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

- **Architects are much more evenly split between the three established delivery systems, with only a divide of three percentage points between them.**
- **When asked about the degree to which customer satisfaction was increased by a delivery system, a much higher percentage of contractors report that their customers are much more satisfied with the selected delivery system than reported by architects, and this applies to all three delivery systems.**
 - Design-Bid-Build: 25% of contractors report clients are much more satisfied, compared with 8% of architects.
 - Design-Build: 43% of contractors report clients are much more satisfied, compared with 10% of architects.
 - CM-at-Risk: 44% of contractors report clients are much more satisfied, compared with 19% of architects.

This further supports the conclusion that contractors are more directly impacted by client satisfaction associated with delivery-system selection than are architects.

Emerging Delivery Systems

While the number of respondents using IPD and DBO/M are too limited for a full statistical analysis, the findings suggest that seeing improved client satisfaction may encourage participation by architects in IPD projects, but not necessarily participation by contractors.

- **Nearly half of the architects who have been involved in an IPD project said that IPD is the best delivery system for increasing client satisfaction.** However, only a few of the contractors that have used IPD believe this.
- **Few architects or contractors that have worked on DBO/M projects regard DBO/M as the best system for increasing client satisfaction.**

Improved Productivity:

Impact of the Use of Specific Delivery Systems

As with client satisfaction, architects are far less convinced that the use of any particular delivery system impacts productivity than are contractors, with 34% reporting that the selection of a delivery system does not influence productivity, compared with 12% of contractors.

Interestingly, there was no statistical difference between large and small contractors for this question, one of the few in which even small contractors recognize the influence of the choice of delivery system on the project outcome.

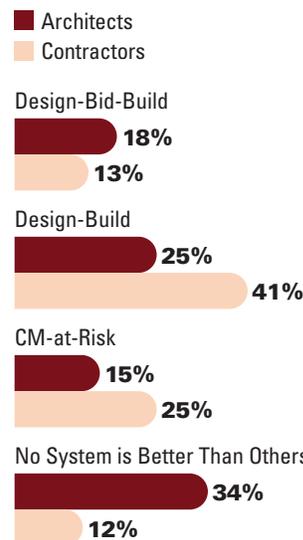
Among those who do find the choice of delivery system to make a difference, **the highest percentage of architects and contractors select design-build as the best delivery system to improve productivity.** Typical of other benefits influenced by the choice of delivery system in this study, a much higher percentage of contractors (41%) than architects (25%) select design-build. This finding mirrors and is no doubt also influenced by the perception of improved process efficiency associated with design-build by architects and contractors (see page 44).

While too few respondents have used IPD or DBO/M for a full statistical analysis, it is notable that IPD was selected as the best system by almost one-third of the architects and contractors who have used it and that DBO/M was selected by less than one-fifth of the respondents using it as the best system for improving productivity.

Best Delivery System for Improving Productivity

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



Process Efficiency: Impact of the Use of Specific Delivery Systems

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

78% of architects and 87% of contractors find that the use of a specific delivery system can improve project process efficiency. Given the complexity of a construction project, process efficiency can have implications for productivity, schedules and quality, but it may be harder to measure than straightforward impacts, like costs and schedules. Therefore, the fact that architects and contractors recognize the link between delivery systems and improved process efficiency is quite telling.

However, there are some differences among contractors about delivery-system impact on process efficiency.

- **A higher percentage of contractors (95%) at companies with less than 40% of their work in public projects find that the use of a specific delivery system improves process efficiency,** compared with firms that do more public work (83%). More flexibility in the private sector may account for this difference.
- **A higher percentage of contractors (93%) working for firms with 50 employees or more also find that delivery systems can help improve process efficiency,** compared with those with fewer employees (77%). As mentioned previously, smaller firms may find it more difficult to discern patterns by a delivery system in factors that are difficult to measure.

The highest percentage of architects (30%) and contractors (47%) consider design-build to be the delivery system that best improves process efficiency.

The selection of design-build by a higher percentage of contractors than architects is consistent with the findings across the study, which demonstrates contractors' appreciation of this delivery system. Design-build, by bringing the design and construction processes under one entity typically with a construction firm leading the process, clearly creates efficiencies.

Emerging Delivery Systems

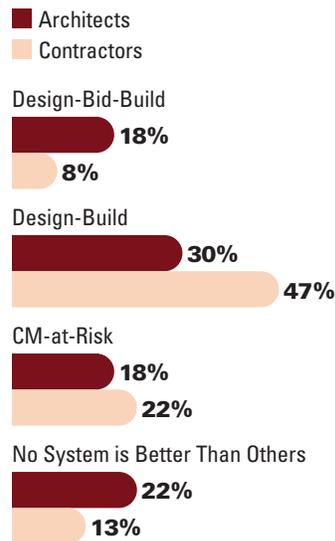
88% of owners with IPD experience have had process efficiency improved on IPD projects, a high percentage that demonstrates the efficacy of this delivery system for creating efficiencies.

While the number of architects and contractors who use, and thus were asked to evaluate, IPD and DBO/M were too low to do a full statistical analysis, it is clear that firms using IPD consider it effective in improving process efficiency.

Best Delivery System for Improving Process Efficiency

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



- **Nearly half of the architects and nearly one-third of the contractors using IPD select it as the best system for improving process efficiency.**
- **On the other hand, only a handful of those using DBO/M select it as the best system.**

The improved communication noted with IPD may also contribute to improved process efficiency, and architects in particular may feel the need to improve process efficiency because of the greater financial risk that they take on in a multi-firm contract. On the other hand, firms using DBO/M may not have enough experience with it to select it over design-build as the best delivery system to improve process efficiency.

Risk of Litigation: Impact of the Use of Specific Delivery Systems

For the most part, architects and contractors view the impact of the choice of project delivery systems on the risk of litigation very differently.

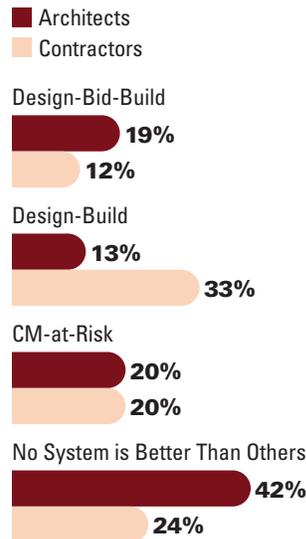
- **42% of architects do not find any one delivery system to be more effective than others at reducing their risk of litigation, compared with 24% of contractors.** Contractors may be more exposed to litigation risk in several delivery systems than architects are, which would make them more likely to find the delivery system to be an important factor in determining their risk.
- **33% of contractors find that design-build reduces their risk of litigation, which is the highest percentage of contractors for any delivery system and a much higher percentage than architects (13%).** While this is consistent with the other findings, in which the highest percentage contractors report that design-build is the best system to achieve the desired outcomes, it is surprising in this case because contractors typically lead design-build teams and would be directly responsible for all issues. Therefore, this finding suggests that the ability to have input and authority from the early phases of a project is considered by contractors to be the best way to shield themselves from litigation.
- **While architects are nearly evenly split between those that find design-bid-build and those that find CM-at-risk the best systems for reducing the risk of litigation, more architects consider design-bid-build to be the best system than do contractors.** This finding is consistent with others that demonstrate a preference for design-bid-build on the part of some architects in the study, especially when compared with contractors.
- **While CM-at-risk is the only delivery system considered equally valuable to reduce the risk of litigation by architects and contractors in general, it also has the most variation within the architect and contractor responses by size of firm and type of work.**
 - More large firms (those with 50 or more employees) consider CM-at-risk to be the best system for reducing litigation risk than do small firms: 26% of large contractors and 35% of large architects, compared with 10% of small contractors and 14% of small architects.
 - 31% of architects with more than 40% of their portfolio in public projects in consider CM-at-risk to be the best system for reducing litigation risk, compared with 13% of those doing less public work.

More research is needed to determine why the influence of CM-at-risk on litigation risk, more than other delivery systems, is experienced so differently by respondents.

Best Delivery System for Reducing the Risk of Litigation

(According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



Emerging Delivery Systems

While too few respondents used the emerging delivery systems (IPD and DBO/M) to be included in the analysis of the established delivery systems, among those who have used these systems, both are seen as influential on reducing the risk of litigation by a notable percentage of respondents.

- **Just under one-quarter of architects and over one-quarter of contractors that use IPD report that it is the best delivery system for reducing the risk of litigation.**
- **Unlike many of the other benefits, over one-quarter of contractors using DBO/M find it to be the best system for reducing the risk of litigation.** This finding makes sense since contractors that are handling operations and maintenance can address issues that arise with the building after construction and prevent them from becoming problems serious enough for litigation.

Reducing Need for Value Engineering: Impact of the Use of Specific Delivery Systems

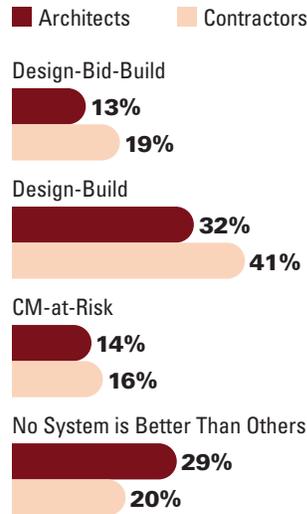
Value management, conducted throughout the lifecycle of a project, can be an important way to guarantee the best value for owners, and value engineering is included in this process. However, when value engineering is done solely to reduce costs in late design or during construction, it can result in a project that does not entirely fulfill the owner's wishes or the architect's vision.

- **The highest percentages of architects (32%) and contractors (41%) agree that design-build is the best delivery system for reducing the need for value engineering.** The design-build team makes a commitment to deliver the full project as scoped before or during the design process for a set price.
- **A higher percentage of architects (29%) than contractors (20%) believe that there is no difference between delivery systems for reducing the need for value engineering.**

Slightly over half (56%) of the owners who have used IPD find that it has reduced the need for value engineering on their projects, and nearly half of architects who have done IPD projects select it as the best delivery system.

Best Delivery System for Reducing the Need for Value Engineering (According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



Change Orders: Impact of the Use of Specific Delivery Systems

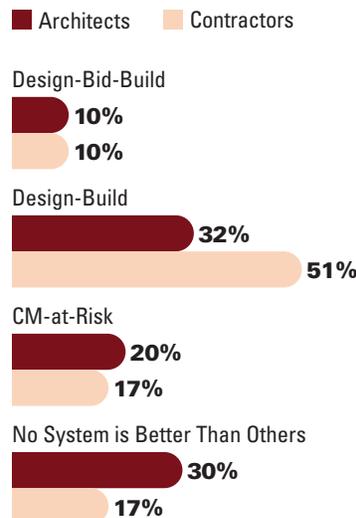
The highest percentages of both architects (32%) and contractors (51%) select design-build as the best delivery system to reduce the need for change orders. However, a majority of contractors favor design-build above any other delivery systems, while nearly as many architects as those that favor design-build report that no delivery system is preferable (30%). The high percentage of architects is surprising since design-build and CM-at-risk both have stronger guarantees of final costs for work constructed than design-bid-build has.

Contractors less engaged with public work (61%) and those with more than 50 employees (59%) are more likely to find design-build to be the best system.

76% of owners using IPD report experiencing reduced change orders on IPD projects, and 29% of architects that have been on projects using IPD find it to be the best system for reducing change orders.

Best Delivery System for Fewer Change Orders (According to Architects and Contractors Who Have Worked With These Delivery Systems)

Source: McGraw Hill Construction, 2014



Collaborating to Achieve Sustainable Outcomes

Evidence and research demonstrate that taking an integrated approach, achievable under any formal delivery system, helps to improve the sustainable outcomes of projects.

When MaineGeneral Medical Center opened in November 2013, its integrated project delivery (IPD) team had not only shaved ten months off the construction schedule and returned \$20 million to the owner in value additions and operating efficiencies, but it had also exceeded the project's sustainability target of LEED silver certification and positioned the project to qualify for LEED gold.

The project's IPD team members credit the delivery system's enhanced collaboration for enabling these achievements. "As we worked together as a team, the best ideas were brought to the table," says Stacey Yeragotelis, associate principal at TRO Jung|Brannen, architects on the project together with SMRT. "The contractors were right there modeling in real time, which allowed us to find where we could afford more value for the owner and add sustainable measures to the project."

Triple Bottom Line Benefits

The project's energy rating especially benefited from the collaboration among designers, trades and suppliers. The collaboration is what "really put us over the top" in exceeding the project's LEED target, according to Yeragotelis. Relying on real-time information to cut waste from the project, the team found that it was able to afford a heat recovery system, an upgrade to rooftop

equipment and a more efficient fan system. The team also analyzed the building envelope design to identify a breakpoint in return on investment from an energy perspective. Altogether, the owner is expecting to save close to a million dollars per year from energy savings.

The project's achievements also extend to social sustainability. The owner placed a high priority on maximizing local participation in the project, and the joint-venture construction management team of Robins & Morton and HP Cummings fostered collaborations and joint ventures to meet the project's requirements from a contractor pool that was initially thought to lack the capacity for a job of this size. Over 97% of subcontractor costs went to Maine subcontractors, with 2,700 jobs created.

Significantly, MaineGeneral's IPD contract highlighted sustainability goals from the start and included incentives to maintain quality throughout the project.

IPD is not the only way to boost sustainability outcomes through collaboration. Any project delivery system can achieve significant benefits through an explicit commitment to collaboration. Some systems, however, require more effort than others to work collaboratively, and that effort may translate into project costs.

Collaborative Attributes, Sustainable Outcomes

In a study of the influence of project

delivery methods on integration and sustainability outcomes published last year in the *Journal of Management in Engineering*, researchers Sinem Mollaoglu-Korkmaz, Lipika Swarup and David Riley establish a link between the level of integration in a project's delivery process and the project's sustainability and overall outcomes.

Delivery system per se does not account for improved sustainability outcomes; instead, the approach to the project is what counts: owner commitment, early involvement of the constructor, integrative mechanisms (such as charrettes and energy modeling), project chemistry and the overall level of team integration.

Clearly, though, a delivery system in which more of these attributes are inherent is off to a head start. The study found design-build to be inherently more integrative than construction management at risk (CM-at-risk), which in turn proved more integrative than design-bid-build. However, they did observe that informal involvement of the contractor in the early phases of the design-bid-build process could boost integration up to CM-at-risk levels.

Sustainability outcomes generally correlated with higher levels of integration, as did the probability of exceeding the intended certification target. Conversely, projects achieving a high level of integration scored high on sustainability outcomes—a pattern that the project team on the MaineGeneral Medical Center would recognize. ■

Multidisciplinary Collaboration Yields Unique Results for a Construction-Management-at-Risk Project

Perot Museum of Nature and Science

DALLAS, TEXAS

Early contractor involvement and multidisciplinary collaboration helped drive successful delivery of the highly complex Perot Museum of Nature and Science, in Dallas, Texas. Completed in April 2012 under a construction-manager-at-risk (CM-at-risk) contract, the \$95.6-million 180,000-sq-ft museum's façade features more than 700 precast, custom-molded concrete sections with ornate details. The façade wraps a 14-story structure, which includes a tower, atrium and plinth. The design called for what the team describes as "onion-like" layering—constructing a concrete interior structure surrounded by large steel framing to support the exterior precast panels.

The team, led by Balfour Beatty Construction, Dallas, and Morphosis Architects, Culver City, Calif., underwent intense budget development, constructability and coordination sessions early in the project to help it meet client expectations, says Chris Wolfe, senior project manager at Balfour Beatty. Balfour Beatty was brought on to the team during schematic design, while key subcontractors—including the electrical, mechanical, plumbing, precast concrete, curtain wall, structural glass and ornamental-steel firms—were brought on at 100% design documents.

"It was critical for [the core team] to be able to work together and come up with ideas early in the process," Wolfe says. "If we had come in after the drawings were designed, we would have had limited opportunities to pursue alternate ideas."

To help create a more collaborative environment, team members



The exterior of the museum (left) consists of 700 unique precast panels. GPS technology was employed in the modeling of the lobby ceiling (right).

co-located, bringing the architect, construction manager, owners' representative and museum staff into a shared office environment. Wolfe says that the team was better able to quickly address issues at any point in the day, on any subject without having to schedule specific meetings around busy calendars at off-site locations.

"Even when we ran into issues, the team wouldn't point fingers at each other," Wolfe says. "With some other procurement methods, like design-bid-build, there's always that adversarial aspect, where [a firm] is only looking out for its best interest. [Under design-bid-build], it's not about the good of the entire team, just what's good for me."

BIM For Collaboration

The team also committed to sharing building information models (BIM). In the years prior to its 2010 groundbreaking, BIM was still a

new technology to most firms.

"Morphosis stressed to us from day one that if we weren't using the BIM model and didn't share it, the team wouldn't understand what we're trying to build," Wolfe adds.

Balfour Beatty worked off the Morphosis models to develop its more detailed construction model. As the construction model was developed, Morphosis would pull it back into its design model to validate that everything lined up correctly.

Balfour Beatty managed the project's BIM clash-detection process, pulling subcontractor superintendents and project managers into clash-detection and coordination meetings. Wolfe said that this process—coupled with the early involvement of key subcontractors—enabled the team to know ahead of time exactly what they would be doing so that possible clashes with fellow trades would be addressed.

Perot Museum of Nature and Science

DALLAS, TEXAS

Creating the museum's signature exterior proved to be the most challenging and rewarding aspect of the project. Morphosis initially envisioned using a metal panel cladding for the exterior, which it has used on several previous projects, says Arne Emerson, project architect at Morphosis. However, after working through cost modeling, Balfour Beatty determined that the design could increase the project budget by up to 75%. As an alternative, Morphosis also recommended using shotcrete and sculpting the façade, another technique that the firm had previously used. However, the team could not find local contractors who were comfortable using that technique.

"Once we got to Dallas, we realized there are some very local conditions there and it would make a lot more sense from an economic standpoint to adhere to those [concepts]," Emerson says.

Wolfe says that the precast solution illustrated how a contractor with local knowledge can help inform the design process. To handle precast duties, the team brought in Gate Precast, which joined at the 100% design documents phase. "We do a lot of precast concrete in Texas," he adds. "Morphosis had never worked with [precast exterior panels] before, but we were able to take their vision and team them with the local providers who could accomplish it."

The façade emulates a sedimentary geologic formation. Each of the 700 panels is unique, and many panels are curved, canted and have a radius. For budget reasons, the team came up with a module concept, creating 16 different casting beds that could be quickly modified to give each of the 700 panels a

unique look while avoiding the expense of custom molds.

Although Gate Precast didn't use BIM, Wolfe says that Morphosis was able to pull Gate's information into the model. "Gate could send them 3D CAD files of each shape, and Morphosis could pull it in and confirm it matches up. Out of all 700 of those panels, only one panel was fabricated wrong."

Collaborative Design Solutions

In the theater, the Morphosis design included curves so complex that geometries changed roughly every six inches, Emerson says. The team worked with subcontractor Baker Triangle to devise a way to "slice the sections like a loaf of bread" and create a system of ribs that could be framed by just two workers. "That is one of the best examples I've seen of how you can collaborate in BIM to optimize construction and fabrication," he says.

Although the team collaborated early to help prevent issues during construction, it also had to come together to meet challenges after the project broke ground. During soil excavation, a massive abandoned concrete structure was discovered. Its location conflicted with both the museum's foundation placement and the main electrical feeds for the building. The traditional solution would be to demolish and remove the structure in order to complete the foundation as designed. This could have caused a six- to eight-week delay. Instead, the team used GPS technology, which it was already using for as-built utility installations and underground electrical and plumbing rough-ins.

Project Facts and Figures

Construction Manager
Balfour Beatty Construction

Type of Project
Museum

Size
180,000 sq. ft.

Construction Start
November 2009

Completed
April 2012

Project Highlights

- Construction manager brought on during schematic design
- Key subcontractors brought on at 100% design documents
- Enhanced collaboration through BIM use
- Innovative use of easily modifiable casting beds to create 700 unique pre-cast concrete panels
- Created simplified installation solution for complex wall and ceiling geometries

The GPS coordinates were input into the building model, surfaced and sent to the structural engineer for review. The structural engineer could evaluate all the structural components that were being impacted by this existing structure and proposed solutions to address the conflicts. By using this approach, the team was able to remain on schedule. ■

Sharing Project Information:

Effectiveness of Specific Delivery Systems

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

The lowest percentages of architects and contractors find that effective information sharing occurs on design-bid-build projects. This demonstrates that more collaborative systems help achieve better information sharing.

Currently, architects and contractors disagree about the delivery system in which information is shared most effectively.

- **77% of architects that have worked on CM-at-risk projects report that project information was shared effectively on their CM-at-risk projects**, a much higher percentage than architects who are reporting on any other delivery system. It is also a higher percentage than the 66% of contractors who find information sharing is effective when using this delivery system.
- **87% of contractors that have worked on design-build projects report that project information was shared effectively on these projects**, a much higher percentage than those reporting on other delivery systems. Only **56% of architects with design-build experience report the same effectiveness in information sharing.**

Interestingly, though, the disagreement drops when the respondents report their expectations for the effectiveness of information sharing by 2017. While design-bid-build still lags, a high percentage of architects and contractors report that information will be shared effectively on design-build and CM-at-risk projects.

This finding no doubt reflects expected improvements in information mobility in general (reported in the *Information Mobility SmartMarket Report* in 2013). However, given the fact that there is consensus that more projects will use the design-build and CM-at-risk delivery systems in the future (see page 17), it is also likely that firms anticipate greater experience with more collaborative systems in the buildings sector, which can lead to improved information sharing.

Variation by Tenure

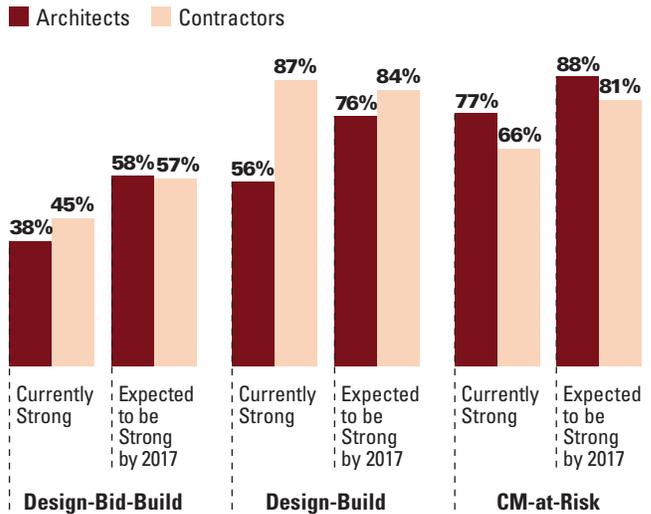
While the number of firms responding about any single delivery system is relatively low to conduct additional analysis, a trend emerges when looking at contractors rating the effectiveness of delivery systems in relation to their tenure in the industry.

- **58% of contractor respondents with 20 or more years in the industry believe that information is shared effectively on design-bid-build projects, compared with 18% of those with a shorter tenure in the industry.**

Effectiveness of Project Information Sharing by Delivery System

(According to Architects and Contractors Who Have Used These Delivery Systems)

Source: McGraw Hill Construction, 2014



- **100% of those with fewer than 20 years of experience believe that information is shared effectively on design-build projects, compared with 71% of those with 20 years of experience or more.**

This finding may indicate a generational gap in expectations in the construction industry.

- For respondents that are used to design-bid-build projects through years of experience, the information sharing that they see as typical may also seem far more sufficient than it does to younger respondents with higher expectations for improved sharing of information.
- On the other hand, CM-at-risk has enhanced collaboration, which may be accorded greater value by younger respondents.

Impact of Fee-Based Team Selection Methods Versus Qualifications-Based Methods

It appears that the days of hard, low-bid project-team selection may be waning. **Between the two choices of a qualifications-based or a fee-based/lowest-cost selection of the project team, a qualifications-based approach was by far the most popular method among owners, with 69% using this approach.** Only 19% of owners indicate that they used fee-based/lowest-cost systems for project-team selection.

An additional 12% of respondents did not know how they selected their project teams. This suggests that these owners were not directly involved in team selection. They presumably hired a program manager or owners' representative to handle this task. For more information on these professional services, see page 13.

Owners who use design-bid-build or design-build are significantly more likely to use fee-based selection.

Schedule Outcomes

Most owners report that their projects were completed on time or ahead of schedule, whether procured through a fee-based approach or a qualifications-based strategy. For both fee-based projects and qualifications-based projects, 91% of owners report that their projects were completed on time or ahead of schedule.

Owners that procured a qualifications-based project (19%) were nearly four times more likely to have their project completed ahead of schedule as compared to owners of fee-based procured projects (5%). There was no significant difference in the number of projects that were behind schedule.

Quality Outcomes

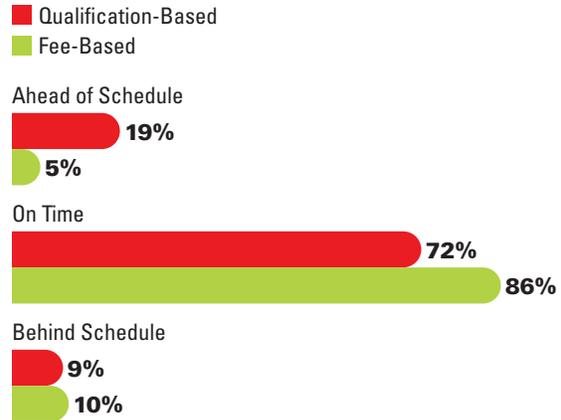
Most projects met or exceeded quality standards.

- **Most owners of fee-based procured projects (89%) report that their projects met or exceeded these standards.**
- **All owners of qualifications-based projects had these outcomes.**
- **Owners of qualifications-based projects were slightly more likely than owners of fee-based projects to have their projects exceed standards, 28% versus 21%, respectively.**
- **Owners of fee-based projects report that 11% of their projects failed to meet quality standards.**

While the outcomes are good for both team selection methods, there is still a clear pattern for better outcomes for those that use qualifications-based team selection.

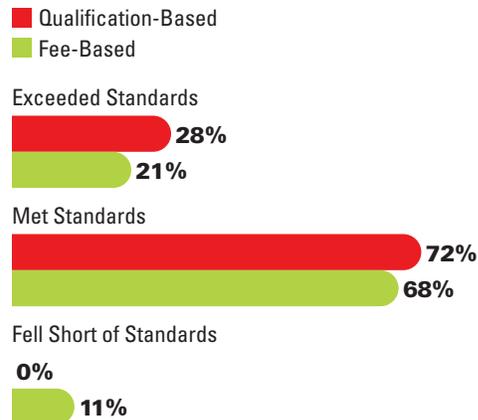
Impact of Team Selection Method on Schedule (According to Owners)

Source: McGraw Hill Construction, 2014



Impact of Team Selection Method on Quality (According to Owners)

Source: McGraw Hill Construction, 2014



Integrated Project Delivery Versus an Integrated Design Approach

Integrated project delivery (IPD) enables enhanced collaboration within project teams. However, while some are able to use contracts that share risk and reward, others look to gain benefits by employing IPD principles and practices without the contractual obligations.

To enhance collaboration within project teams, many firms are adopting the principles and practices of IPD. To date, there is considerable variance in the depth of IPD adoption and the types of techniques used. Advanced users employ multiparty agreements—also known as an integrated form of agreement (IFOA)—in which risks and rewards are shared. Many organizations are unwilling or unable to sign such agreements, yet they want the benefits of IPD and, therefore, pursue IPD-like behavior, agreeing to use collaborative techniques, but with less formalized contractual obligations.

Disney is among the owners committed to contractual IPD. Craig Russell, chief design and project-delivery executive at Walt Disney Imagineering, reports that the company is developing multiparty agreements to help it deploy IPD. Russell says Disney's main goal in the initiative is to improve predictability and efficiency in schedules and budgets. "This is not about cutting costs," he says. "We need to hit our targets."

Russell says that the company has crafted several forms that allow Disney to tailor contracts meet specific project needs. Disney is looking for "sustainable partnerships on a win-win basis" with the firms contracted on its projects, he says.

Although the initiative marks a significant shift in procurement systems for Disney, Russell says

that the company's staff sees it as an opportunity rather than a threat.

"Certainly there are risks, but we also see the opportunities relative to what we want to accomplish," he says. "It's been a very mature risk-reward assessment, not just a legal group throwing up a roadblock."

Non-Contractual IPD

Susan Klawans, vice president and director of operational excellence and planning at Gilbane Building, says that while owners are often interested in IPD, many are unwilling or unable to execute contracts. "Some public [owners] can't [use multiparty contracts] because of procurement laws," she says. "Some owners look at it as giving up control. Others take a look at it in their legal departments or risk-management departments and won't try something new and unprecedented. Yet, we have a lot of clients who can't get a [multiparty] agreement that want the principles of IPD [worked into] some of their projects."

Klawans says that IPD practices are a good fit with the firm's existing construction manager at risk methods. "IPD calls for mutual respect and trust, mutual benefit and reward, collaborative innovation and decision-making and early involvement of participants," she says. "We can do that under a CM-at-risk contract."

For the Henry J. Carter Specialty Hospital and Nursing Facility in East Harlem, Gilbane joint-ventured with McKissack & McKissack on a CM-at-risk

project that used IPD techniques. The project called for delivery in 18 months—half the estimated schedule under traditional delivery. The partners collaborated early to deliver 18 construction packages. The team collocated throughout the entire project to help enhance teamwork. Contracts also provided performance incentives and disincentives.

Kevin McCain, vice president of Skanska USA Building, has seen success with an integrated approach without an multiparty contract on hospital projects. On one project, a bond initiative would not allow the use of an IFOA. Instead, the parties signed an agreement that outlined how the team would work collaboratively. Target-value design was used, including early assistance from key subcontractors. The subs provided early cost estimates and were incentivized to maintain—or reduce—those estimates. If the final estimates ran over, their contracts could be put out for bid. "We incorporated all of the things you'd see in a multiparty agreement, except no one had skin in the game," McCain says.

Raul Rosales, project executive at Skanska, who has worked on contractual and informal IPD projects, says having an IFOA greatly enhances the level of collaboration. "When there is a contractual [agreement], you can't run away from issues," he says. "The terms of an agreement don't guarantee results, but it requires a high level of sophistication on everyone's part that improves your odds of success." ■

Data: Factors Influencing Adoption of Emerging Delivery Systems

Drivers That Would Encourage Respondents to Engage in a Project Using Integrated Project Delivery

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

All respondents—architects, contractors and owners—were asked what would or has encouraged their firms to engage in an IPD project, but they were asked in different ways. Architects and contractors were asked to rank the top three most influential drivers, while owners were asked to rate the degree of influence of each driver.

Owners

70% or more of owners rate three factors as being influential in encouraging their firms to engage in an IPD project:

- **78% would engage in an IPD project to address schedule concerns.**
- **73% would do so to be able to effectively control costs.**
- **70% would do so to be able to increase the quality of their final building.**

While several of the other drivers are also considered influential by a high percentage of owners, these three drivers clearly can encourage wider use of IPD in the buildings sector.

It is not surprising that owners would consider any delivery system that reduces schedule concerns and controls costs. However, the findings suggest that owners familiar with IPD do consider it to impact the quality of projects and consider that a critical factor in helping to drive it. The consideration of quality by nearly the same percentage of owners who considered the more easily measured drivers of cost and schedule influential suggests that proponents of IPD need to demonstrate the impact on the quality of their buildings. It also suggests that architects and contractors, but particularly contractors, need to be more conscious of the importance of this factor as a critical driver for owners.

Architects and Contractors

The chart at the right represents all of the factors ranked first, second or third by architects and contractors.

However, when looking solely at the factors ranked first, the top choice by a wide margin is owner mandate for both architects and contractors. The highest percentage of contractors also select owner mandate among their top three choices, but the highest percentage of architects (56%) rank the ability to increase the quality of the final building among the top three drivers. This finding is interesting because it reveals that architects familiar with IPD associate it with increased building quality. The third driver important to architects and contractors alike is the flexibility to pursue innovative approaches.

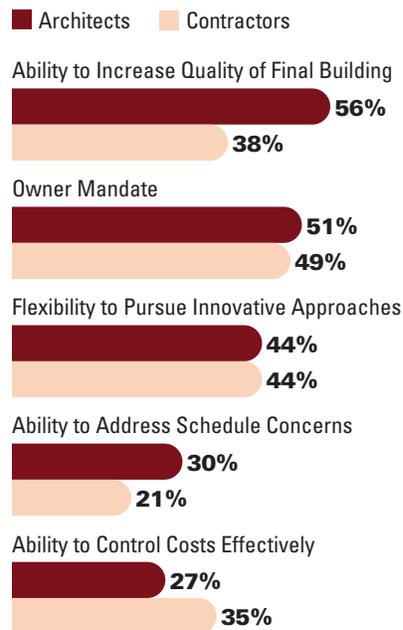
Most Influential Drivers for Respondents to Engage in a Project Using Integrated Project Delivery (According to Owners)

Source: McGraw Hill Construction, 2014



Top Drivers That Would Influence Respondents to Engage in an Integrated Project Delivery System Project (According to Architects and Contractor)

Source: McGraw Hill Construction, 2014



Positive Influences on the Use of Integrated Project Delivery

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

Architects and contractors agree that other industry firms have a large influence on the use of IPD, with over 50% of both groups selecting this as a factor with a positive influence. However, it is notable that a much higher percentage of architects and contractors find that industry firms influence the use of design-build (72% of architects and 80% of contractors) or CM-at-risk (82% of architects and 93% of contractors). (See page 27 for more information.) This is no doubt due to the relatively low familiarity with IPD by other buildings-sector firms (see page 11). If so, wider experience of IPD benefits by owners may help drive adoption of this delivery system at a higher rate than the industry currently expects.

Unlike other delivery systems, the influence of professional associations and green building practices are far closer to being on par with industry firms in driving IPD use, especially according to architects. Professional associations have played a critical role in educating the buildings sector about IPD, and this delivery system has gained a reputation for helping to achieve sustainable outcomes. (See page 47 for more information about collaboration and sustainable outcomes.)

Positive Influences on the Use of Integrated Project Delivery (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Obstacles to Wider Use of Integrated Project Delivery

Owners

Owners were asked to rate the importance of five obstacles to wider use of IPD. Strikingly, all five are considered important by about half of the owners.

The top concern is the lack of checks and balances—made clear in concerns about under-performing team members, about shared risk reward contracts or about the lack of oversight among team members—and the cost implications of that lack of oversight is also a major issue for owners.

Proponents of IPD need to be able to demonstrate to owners that their interests are better served in a collaborative environment that is enforced by contract.

Architects and Contractors

Architects and contractors were asked to rank their top three obstacles. Four obstacles, which each reflect problems due to the lack of industry experience with IPD, are most frequently ranked by both groups among the top three.

- **Lack of owner familiarity tops the list for both, and it is also the most frequently selected as the number one obstacle.** Lack of owner interest, while still one of the top four obstacles, is significantly lower for both than concerns about basic familiarity. This further supports the conclusion that wider awareness about IPD projects is the first step for wider use of IPD, which is evident throughout the findings in this report.
- **The high level of concern about lack of legal precedents and the challenges of contracts that share risks and rewards also suggest that the buildings sector needs more examples of successful IPD contracts to encourage wider adoption.** Clearly, these two are related, as concerns about shared risk/reward contracts are impacted by the lack of legal precedents. While IPD is often touted as reducing the risk of litigation, a conservative industry used to a highly litigious approach may need clearer precedents before committing to this new approach.

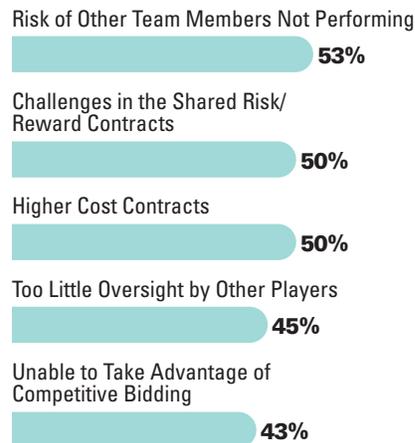
Two factors are selected by a relative high percentage of architects and contractors as the top obstacle, but they are selected by very few as the second or third most important obstacle:

- **Lack of Good Standardized Construction Documents:** Top obstacle for 9% of architects and 15% of contractors
- **Higher Cost Contracts:** Top obstacle for 9% of architects and 8% of contractors

Clearly, for a notable percentage of the industry, these are top concerns that must be addressed.

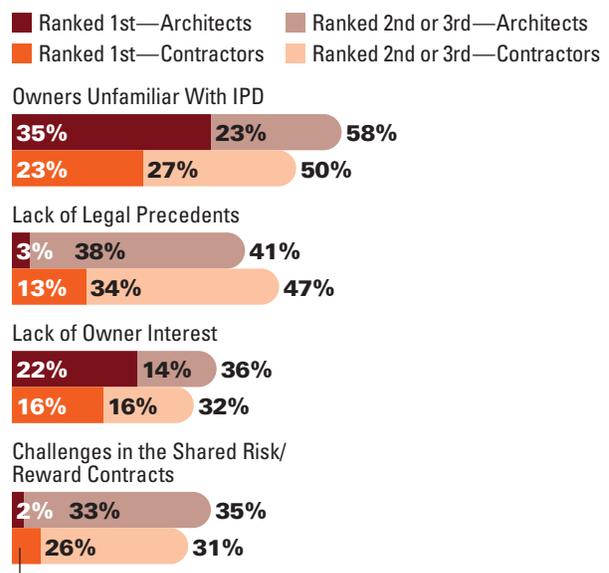
Important Obstacles Preventing Wider Adoption of Integrated Project Delivery (According to Owners)

Source: McGraw Hill Construction, 2014



Most Important Obstacles Preventing Wider Adoption of Integrated Project Delivery (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Team Win: How an Integrated Completed a New Denver Law Building Ahead of Schedule

Ralph L. Carr Colorado Judicial Center

DENVER, COLORADO

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR

On June 4, 2008, Colorado Governor Bill Ritter signed Senate Bill 206, authorizing the construction of a new state judicial complex in Denver. Named the Ralph L. Carr Colorado Judicial Center, the building occupies an entire block bordered by 13th Avenue, 14th Avenue, Lincoln Street and Broadway. The 695,000-sq-ft, \$200-million judicial building was designed and built using an inclusive and team-based process to deliver it under budget and two months early.

Taking an Integrated Approach

The State of Colorado uses a design-bid-build contract on its building projects, and officials made clear to the developer, Trammel Crow, that they were not willing to take on additional risk. However, the developer recognized the need to take an integrated design approach to this project. Trammel Crow, construction manager Mortenson Construction and Fentress Architects verbally agreed to take an integrative approach despite

the tradition contract because it was the best way to delivery the project.

"This was the only realistic way to do it," says David Kuntz, senior project manager for Mortenson Construction. "The only other avenue you could argue, even though the complexity of a job of this magnitude wouldn't have been favorable for it, would be some type of design-build. A job of this magnitude under that type of procurement method would have been... difficult, to say the least."

The 12-story state courthouse and office tower had program requirements that demanded the design team create a 100-year-lifecycle facility that both honored and revered the legacy of the Colorado court system, while representing and accommodating its future. It needed to house a more efficient state judicial system, as the complex consolidates seven judicial and legal agencies. Trammel Crow targeted a LEED-Gold certification for the facility and wanted the building delivered within a 27-month construction schedule. The design also featured an intricate

glass curtainwall and dome that became the dominant feature of the finished building.

"The contracts were silent when it came to an IPD approach and expectations of the owner, but it was very much verbalized by Trammel Crow for us to be highly collaborative," Kuntz says. "Most of these goals were perspective-based, but the relationship between Fentress, Mortenson and Trammel Crow was not. We had to make sure we were working together to meet those guidelines but also meet schedule. Sometimes we were going to step on each other's toes, the architects had to change their normal processes and so did we. We had to be cognizant that design was evolving and they had to understand, going in, that there were certain things that we couldn't build in 27 months."

Collaborative Approach to Modeling

What evolved from the early design meetings was a collaborative process that relied heavily on 3D modeling, ongoing design charrettes and early involvement of subcontractors. An office space across from the personnel from Mortenson, Fentress, Trammel Crow and key subcontractors such as the precast and MEP contractors met regularly there in the early design phases.

"There were lots of 3D models," Kuntz says. "Fentress Architects modeled everything in one BIM program, and all of their consultants followed suit. They would give us those models. We worked it out with the structural engineer that all rebar was modeled. They actually were able to produce for us rebar



An integrated approach helped deliver the \$200 million courthouse in 27 months.

Photo Credit: Jackie Shurnaker

CONTINUED

Ralph L. Carr Colorado Judicial Center DENVER, COLORADO

shop drawings. The structural model was always the latest and greatest because it included all of the necessary detail. When we would get the shop drawings from them, it was always just a day or two later when we were able to ... give those rebar shop drawings to our steel fabricator. This eliminated the procurement process of getting the drawings to a rebar guy, then having to create detailed rebar drawings, sending it in for approval, and then fabricating."

The design model and structural models were imported into Mortenson's coordination model. This model would take the design to the next level of complexity, as constructability issues were ironed out and clashes were eliminated.

More detail was entered for both glazing and precast subcontractors, as Mortenson would take their drawings and import them into the coordination model.

All stud-framing including panels of walls and kickers for above-ceiling racks were input into the model at this time. MEP engineer M-E Engineers put in linework to represent ductwork and then the installation subcontractors would take that line and use it as a basis for coordination. Coordination was performed for interior wall studs, conduit racks, fire protection, stonework, millwork and wall-mounted cabinets. Everything ¾ of an inch and larger was modeled in 3D.

Integrating to Refine the Model

Kuntz described this process as refinement, not rework. The architect and design team would take it to a point where it was sufficient enough to hand off to the construction team.

"[Engineers] had to model it enough to get it approved," Kuntz says. "When it came to millwork there were elevations, [where] they didn't put housing in, they left that to the subcontractors so it only got drawn once. There was refinement of the model as the process went on."

For the glass wall and dome, 3D models had to be detailed enough so that materials could be ordered off of them. All glass curtainwall and other building products were installed upon arrival. No field rework was performed and no part of the enclosure system was field-measured.

"I can't imagine what that job would cost if it was done today, even though it's only a few years later," Kuntz says. "The scope was millions under budget [a 4.5% overall budget savings] and that allowed the owners to add in other things they wanted because of the saving. Some of that was the millwork and other details. Everything went together without a hitch, since we built in tolerances in the models to accommodate."

An online, collaborative, PDF-based construction documentation and storage tool was used for quality control on the project. Personnel knew when a door, for instance, was ready to have hardware added and installed because of a color-coded system in the online documentation tool. Kuntz said the team had huge productivity gains through this type of collaboration, including a 50% reduction in paper on the project.

"Our subcontractors had the same innovation culture as Mortenson, [the same] technology used for process improvement and efficiency," Kuntz says. "When you have the right group of subcontractors on board you can do that." ■

Project Facts and Figures

stats

Type of Project
Courthouse/office tower

Size
695,000 square feet over 12 stories

Cost
\$200 million

Construction Schedule
27 months

Completed
December 2012

Owner/Developer
Trammel Crow Co. for the State of Colorado

Architect
Fentress Architects

Structural/Civil Engineer
Martin/Martin Consulting Engineers

MEP Engineer
M-E Engineers

Construction Manager
Mortenson Construction

Subcontractors
Mechanical: RK Mechanical

Electrical: Encore Electric

Precast: Gage Brothers Precast

Project Savings

- 4.5% overall budget savings
- 60% of building envelope design clarifications generated in early design saving

Drivers That Would Encourage Respondents to Engage in a Design-Build-Operate/Maintain Project

Owners

Owners were asked to rate the level of influence of several key drivers in encouraging their firm to engage in DBO/M projects. **The highest percentage of owners (63%) find that the ability to control costs is an influential driver for their company.** DBO/M takes the cost control provided by CM-at-risk or other delivery systems a step further, since it also extends into the cost of operating a building.

About half of the owners also find five additional factors would be influential in getting their company to use DBO/M.

- It is not surprising that controlling scheduling is the next driver since this is a critical way to judge the success of a project by an owner. However, the percentage that consider this influential for DBO/M use (52%) is significantly below those who would be influenced by the ability of IPD to control schedule (78%). (See page 53.)
- Project complexity, on the other hand, is considered influential by roughly the same percentage of owners for DBO/M (51%) as for IPD (55%). Owners may be aware that a complex building may also present operational challenges, and having the continuity between construction and operations offered by DBO/M may help address those challenges.
- Surprisingly, the lowest percentage of owners select shifting risk away from them (46%) as a top driver. With the contractor now taking on some of the operational risk, this seems like it should be an important driver. The low performance may suggest a lack of faith on the part of owners that operational risk is truly being shifted due to their lack of experience with these projects in the industry.

Architects and Contractors

Architects and contractors were asked to select up to three top factors that would encourage their firm to engage in a DBO/M project.

Two drivers are selected by the highest percentage of architects and contractors, although each carries more weight with one group than the other.

- **Owner Mandate: This is selected among the top three by the highest percentage of architects (68%) and the second highest percentage of contractors (51%).** Nearly all the respondents who select owner mandate at all rank it first. This suggests that many are unfamiliar with the specific benefits that would encourage owners to mandate this system.

Most Influential Drivers for Drivers to Respondents to Engage in a DBO/M Project (According to Owners)

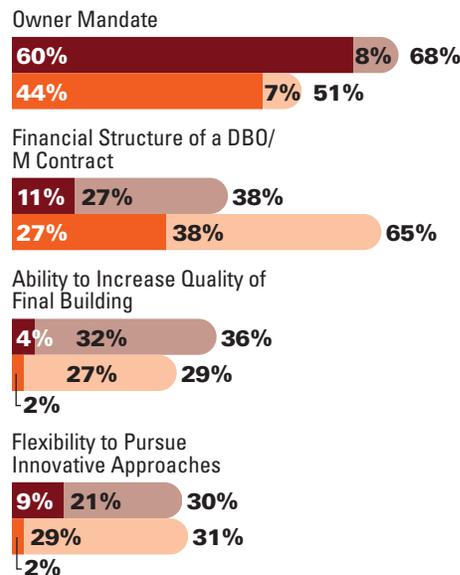
Source: McGraw Hill Construction, 2014



Top Drivers That Would Influence Respondents to Engage in a DBO/M Project (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014

■ Ranked 1st—Architects ■ Ranked 2nd or 3rd—Architects
■ Ranked 1st—Contractors ■ Ranked 2nd or 3rd—Contractors



Factors Influencing Adoption of Emerging Delivery Systems

Drivers That Would Encourage Respondents to Engage in a Design-Build-Operate/Maintain Project

CONTINUED

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR DATA

■ **Financial Structure of DBO/M contracts: The highest percentage of contractors ranked this among their top three drivers (65%), with 27% of all contractors also ranking it first.** A much lower percentage of architects (38%) rank this in their top three, with very few of all the architects (11%) ranking it first. This is not surprising since many contractors are in a position to directly benefit from working with owners on the operations and maintenance of the buildings that they construct, especially since this work often has a higher profit margin than the construction itself.

A small but notable percentage of architects and contractors find that the ability to improve the quality of a building and the ability to innovate would encourage their firm to adopt DBO/M. Certainly, both seem to be likely by-products as a DBO/M contract will encourage design and construction approaches that improve building operations. As the industry becomes more familiar with this delivery system, it will be interesting to see if these benefits can help drive DBO/M projects in the future.

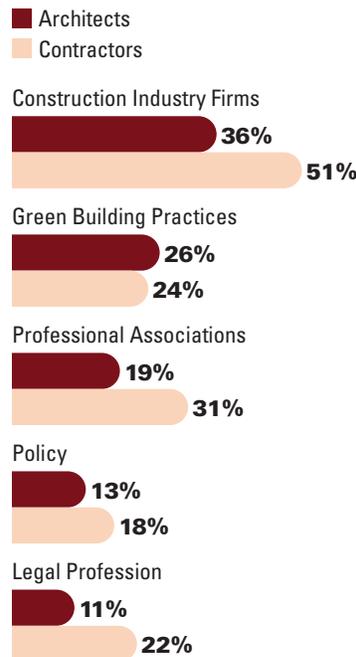
Positive Influences on the Use of Design-Build-Operate/Maintain

With the level of awareness and use so low in the industry for DBO/M, it is not surprising that a relatively low percentage of architects and contractors find any factors influential in encouraging the use of this delivery system. Even the factor rated as a positive influence by the highest percentage of respondents—industry firms, just like for the other delivery systems—is considered a positive influence by only 36% of architects. This is compared to over half of the architects and contractors who find that other industry firms encourage adoption of IPD (see page 54) and over three-quarters of respondents for other delivery systems like design-build and CM-at-risk (see page 27).

More than anything else, these findings demonstrate that most players in the buildings sector does not perceive that anything, from government policy to professional associations, is effectively demonstrating the value of this delivery system and encouraging its adoption. It demonstrates the strong need for proponents of DBO/M to find means to help inform the industry about the advantages of this approach.

Positive Influences on the Use of Design-Build-Operate/Maintain (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Obstacles to Wider Use of Design-Build-Operate/Maintain

Owners

Owners were asked to rate the importance of several obstacles.

- Overall, a lower percentage of owners rated most of the DBO/M obstacles important, compared with the ratings they gave to the IPD obstacles. Rather than suggesting that owners perceive fewer obstacles, this finding probably suggests less familiarity with DBO/M and, therefore, with the factors impeding its adoption.
- Owners share the contractors' concerns about the lack of engagement by contractors with O&M, with 48% reporting that lack of contractor interest in O&M is a major obstacle.
- Limitations on the ability to use this system on public projects are regarded by owners as an equal hindrance, with 48% considering this an important obstacle.

A little over one-third of owners consider the cost and length of DBO/M contracts an issue. This type of concern can often be assuaged by evidence of cost savings by owners with experience with a new project approach, as McGraw Hill Construction's research on other construction trends suggests.

Architects and Contractors

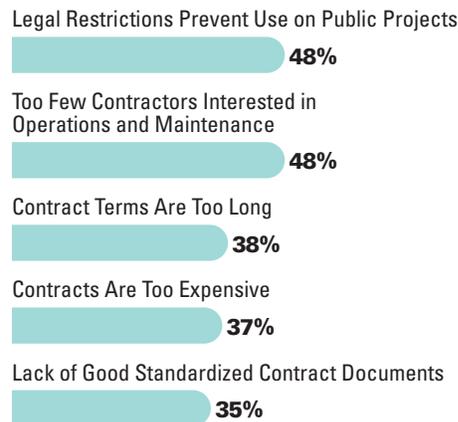
Architects and contractors were asked to rank up to three top obstacles to wider use of DBO/M. Not surprisingly, the top four obstacles, those selected by 40% or more of either architects or contractors, all reflect the lack of industry knowledge about this delivery system.

- Owners' lack of familiarity with DBO/M is selected by the highest percentage of architects (55%) and contractors (51%) as one of the top three obstacles.
- Nearly as many contractors (49%) also regard lack of operations and maintenance (O&M) experience by contractors as one of their top three obstacles.
- A high percentage of architects (49%) think that lack of contractor interest with DBO/M is an issue, but far more contractors are concerned about lack of O&M experience (49%) and lack of general industry knowledge (40%) than about contractor interest in this system (27%).

These findings suggest that industry education in the buildings sector would help advance use of this delivery system, and it suggests the need for professional contractor associations to consider ways to provide more education on O&M to their members.

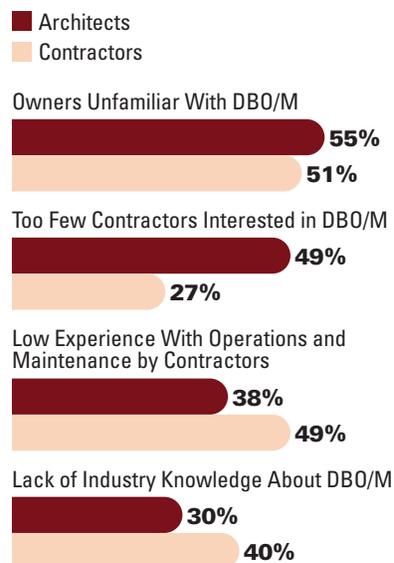
Important Obstacles Preventing Wider Adoption of Design-Build-Operate/Maintain (According to Owners)

Source: McGraw Hill Construction, 2014



Most Important Obstacles Preventing Wider Adoption of Design-Build-Operate/Maintain (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Changing the Construction Mindset Through Use of Design-Build-Operate/Maintain

Governor George Deukmejian Courthouse

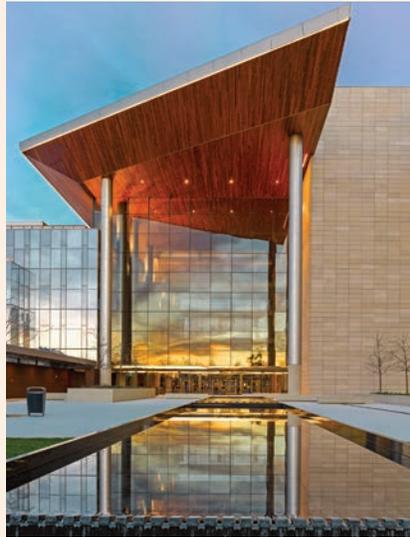
LONG BEACH, CALIFORNIA

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR

In 2007 the state courthouse in Long Beach was flagged by the judicial branch of the state of California as one of the worst courthouses in the state in terms of security and overcrowding, leading the judicial council to prioritize a replacement courthouse as an immediate need. Given the urgency and a lack of readily available public funding, the state looked to the private market for solutions. The result was a \$490-million public-private partnership deal that created the first social-infrastructure building project in the United States procured under principles of “performance-based infrastructure (PBI).”

Under the deal, a private consortium, Long Beach Judicial Partners, would finance, design, build, operate and maintain the new 545,000-sq-ft Governor George Deukmejian Courthouse. Long Beach Judicial Partners is led by private equity firm Meridiam Infrastructure with the primary team members comprised of Clark Design-Build/Edgemoor Development Group as the design-builder, AECOM as the architect of record and Johnson Controls as operating-service provider.

After completion of the courthouse in September 2013, the consortium began an agreement to operate and maintain the facility for 35 years with the state making annual payments based on capital costs as well as operating and maintenance expenses. Under the PBI arrangement, the state can reduce its service-fee payments if certain performance criteria are not met, says Jeffrey Fullerton, director of Edgemoor Development Group. For example, if the courthouse has to be



Exterior of the Governor George Deukmejian Courthouse

completely shut down, the penalty could be \$250,000 per day.

Fullerton says that the performance-based criteria represent some of the trickiest aspects of the project. In addition to considerations of the capital costs, interest costs, operations costs and maintenance costs over the 35-year term, the team had to value its risk.

“It involves an actuarial assessment of how often we could have failures,” Fullerton says. “What’s the risk of going over budget or the risk of deferred maintenance or the risks of shutting down the court? Evaluating risk is truly an actuarial art form.”

Material Choices Driven by Maintenance Factors

Chip Hastie, project manager at Clark Construction, says that these considerations factored heavily into early decisions about project aspects, such as material selection and systems architecture. For

example, Hastie says that California courthouses typically use high-traffic carpeting. Although carpeting has a lower first cost than terrazzo flooring, the carpeting would need to be replaced every five to seven years. In valuing the long-term maintenance costs, the team favored terrazzo flooring throughout most of the building.

In another example, the team considered using LED lighting, which has a longer lifecycle than conventional lighting. At the time that the project was in development, Hastie says that LED lighting was considerably more expensive than conventional lighting. After evaluating the cost, the team chose to use conventional lighting, except in areas where maintenance could be difficult, such as high ceilings.

“If you have to take an escalator out of service to replace a light bulb, you start to have issues with availability [during business hours],” Hastie adds. “Otherwise, you pay a premium to bring in the necessary equipment and workers during off-hours. Those are the types of decisions that are harder to arrive at under a more traditional delivery method.”

Fullerton says that the process requires much more intensive work up front during the project. “When you’re in pretty much every other delivery model, you generally see a focus on first cost,” he says. “So the client makes decisions that don’t completely ignore the long-term costs, but they are much more focused on first cost. When you bring the finance component into it with an operations mindset and you bring in the operator who will be responsible for the next 35 years, it changes the way you approach things.”

CONTINUED

Governor George Deukmejian Courthouse

LONG BEACH, CALIFORNIA

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR

Fullerton says that, as a result, more members of the team had to be involved in decisions. Although adding more decision-makers could put the project at risk of delay, Fullerton says that team members were motivated to make decisions quickly and keep the project moving forward.

"It's more complex, but when you have a good team, it's a much better way to delivery a project," he says. "It aligns everyone's interests and fosters teamwork. Everyone had an incentive to deliver on time."

With so many stakeholders involved, quality was a critical concern throughout the project. Independent quality-management firm Development Industries worked with the design-builder and trade subcontractors to execute its project quality-management plan throughout design, construction and closeout.

The project also utilized TMAD Taylor & Gaines as an independent building expert to ensure code compliance and quality assurance throughout design and construction.

Multiparty Collaboration

Although the design-build team required co-location of key firms to help foster collaboration, the team often needed to reach out to stakeholders in multiple locations to keep lines of communication open. In addition to weekly design review meetings and formal milestone reviews, the team used a web-based platform for all stakeholders to provide feedback and design review comments. The design phase included resolution of over 6,000 web-based design review comments from over 65 geographically diverse



Consideration of maintenance factors drove the selection of materials for the courthouse.

stakeholder and agency reviewers and international investors.

To further enhance collaboration while improving quality, the team did extensive building information modeling (BIM), followed by physical mock-ups.

"It was a cycle of validation and verification through modeling and mock-ups to ensure that workflow and quality were understood clearly," Hastie says.

The process enabled the team to use prefabrication and modular elements on the project, which aided the schedule while improving safety and quality, he adds.

The team was also intensely focused on the schedule. The fast-track project needed to be completed in 32 months. Under the agreement, the state paid nothing until the building was occupied.

"There was a huge incentive to get to the finish line on time," Hastie says. "Just getting close is not good enough. The facility needs to work in all elements by the deadline. That influenced our perspective on keeping the pedal down on production and workflow." ■

Project Facts and Figures

Design-Builder

Clark Design-Build/Edgemoor Development Group

Type of Project

State Courthouse

Size

545,000 sq. ft.

Team Selection

December 2010

Completed

September 2013

Project Highlights

- First social-infrastructure building project in the United States procured under principles of performance-based infrastructure
- Intensive up-front risk assessment
- Greater emphasis on long-term costs, rather than first costs
- Deep collaboration among multiple stakeholders
- Material selections based on long-term maintenance factors

Glossary:

Definition of Terms Used

Building Information Model (BIM):

A BIM is a digital representation of physical and functional characteristics of a facility. As such, it serves as a shared resource for information about a facility and forms a reliable basis for decisions during its lifecycle from inception onward. BIM also refers broadly to the creation and use of digital models and related collaborative processes between companies to leverage the value of the models.

Construction Management at Risk Delivery System (CM-at-Risk):

In a CM-at-risk project, a construction manager is hired during the design process. While the CM may initially act in the role of owner's advisor before the construction phase, it assumes the risk for construction performance through a guaranteed maximum price submitted to the owner. IRMI's definition of CM-at-risk includes the following: The CM-at-risk is responsible for early coordination during the design phase, value engineering, and constructability reviews as well as the selection, scheduling, and sequencing of trade subcontractors.¹

Design-Bid-Build Delivery System:

Widely used in the construction industry in the United States, design-bid-build projects involve separate contracts for the design team and the construction team with the owner. The 2012 *Owner's Guide to Project Delivery Systems* also defines these projects as proceeding in a sequential order from design to procurement to construction.²

Design-Build Delivery System:

The *AIA Design-Build State Statute Compendium* defines design-build as "a method of project delivery in which one entity signs a single contract accepting full responsibility for both design and construction services of the building facility." Design-build entities can be single firms or teams led by contractors, architects, engineers or other companies, although the most common type of design-build entity is contractor-led in the U.S. The contract procurement also varies, from best value selection to qualifications-based selection, which creates very different types of contracts under the umbrella term of design-build.

Design-Build-Operate/Maintain Delivery System (DBO/M):

A variation of the traditional design-build contract, DBO/M contracts involve the involvement of the design-build entity in the facility management and operational phase of the building.

Guaranteed Maximum Price (GMP):

The owner agrees to pay a construction management firm for the actual cost of construction, but a ceiling is applied to the price. If construction costs are greater than the price agreed to, the CM is liable for any additional costs.³

Integrated Design Process:

Active participation in all stages of design for all disciplines involved in the design, construction and, at times, the operation of the building. An integrated design team usually includes an owner's representative; architect; mechanical, electrical and structural engineers; and construction manager and/or general contractor. It can also include future building occupants, facility managers and maintenance staff, subcontractors for major trades and building product manufacturers.

Integrated Project Delivery:

The delivery of a construction project according to a contract that calls for an integrated design process and that clarifies the legal responsibilities and risks born by all members of the project team.

Value Management and Value Engineering:

The value management process is used throughout the lifecycle of a project to define and incorporate the client's aims and objects for a project. Value engineering can be a part of that, and it is an approach to define the client's needs at the lowest cost possible.⁴ However, at times, value engineering is not conducted with this rigorous intent and focuses on cost-cutting late in design or early in construction, and, when done in this manner, it has at times led to a reduction in the quality/effectiveness of the final delivered project and a loss of design intent.

1. International Risk Management Institute, Inc. (IRMI). "Construction Management at Risk." *Glossary of Insurance and Risk Management Terms*. <http://www.irmi.com/online/insurance-glossary/terms/c/construction-management-at-risk.aspx>. 2. CMAA. *An Owner's Guide to Project Delivery Methods*. 2012. <https://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf>. 3. Handfinger, Adam P. *Understanding Contractual Pricing Arrangements – Fixed Price, Cost-Plus, and Guaranteed Maximum Price*. Peckar & Abramson, P.C. http://www.pecklaw.com/images/uploads/communications/Client_Alert-Understanding_Contractual_Pricing_Arrangements.pdf. 4. Facilities Society. *Value Management and Engineering*. <http://www.facilities.ac.uk/j/cpd/61-project-management/106-value-management-and-engineering>.

Methodology:

Project Delivery Systems Study Research

PROJECT DELIVERY SYSTEMS: HOW THEY IMPACT EFFICIENCY AND PROFITABILITY IN THE BUILDINGS SECTOR

McGraw Hill Construction (MHC) conducted the 2014 Project Delivery Systems study to examine the perceptions of key players (architects, contractors and owners) of different project delivery systems and how these systems may affect project outcomes. Included in the study is the consideration of two lesser used project delivery systems: integrated project delivery (IPD) and design-build-operate/maintain (DBO/M).

Two separate surveys were used to conduct the study. Architects and contractors were reached using an online survey. Owners were surveyed using a computer-assisted telephone interview (CATI) survey. Each survey is detailed below.

Owners Survey

100 owners were interviewed using a CATI survey that was conducted between March 19 and May 9, 2014. Information from the MHC Dodge Players database was used to reach owners.

The total sample size of 100 owners obtained in this survey benchmarks at a 95% confidence interval with a margin of error of 9.79%.

Owners were asked questions about a specific project drawn from the Dodge database and its delivery method. The project had to meet the following requirements:

- Construction completed
- Value of \$5 million or more
- Vertical building project (non-infrastructure)
- Located in the United States
- Employed one of the following delivery methods: design-bid-build, design-build or construction management at risk

Owners were also asked more general questions about project delivery methods.

Architects and Contractors Survey

125 architects and 115 contractors were surveyed using an online survey conducted between March 19 and May 9, 2014. The MHC contractor and architect panels were used in conjunction with supporting association membership lists. Staff at MHC reached out to the panels and the participating associations—the American Institute of Architects (AIA), the Design-Build Institute of America (DBIA) and the Society for Marketing Professional Services (SMPS)—emailed their members with a link provided by MHC.

The chart at the right provides a more detailed breakdown of the types of firms that participated in the survey. A/E firms were included with the architects in the analysis in this report, and construction managers and design-builders were included with the contractors.

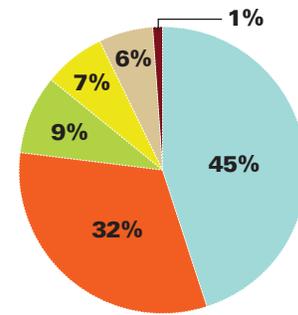
The total sample size of 240 respondents obtained in this survey benchmarks at a 95% confidence interval with a margin of error (MOE) of 6.31%. Within each group, architects have a MOE of 8.75% and contractors a MOE of 9.13%, both at a 95% confidence interval.

Respondents had to be familiar with and had to have recently worked on a project or projects using at least one of the following delivery methods: design-bid-build, design-build or construction management at risk. Firms of all sizes were included. Only firms who did work in the United States participated.

Architect and Contractor Respondents by Firm Type

Source: McGraw Hill Construction, 2014

- Architecture Firm
- General Construction/General Contractor
- Construction Management Firm
- Architecture/Engineering (A/E) Firm
- Design-Builder
- Contractor (Non-Building)



Project Delivery Systems

The delivery systems included in the two surveys were design-bid-build, design-build, construction management at risk (CM-at-risk), integrated project delivery (IPD) and design-build-operate/maintain (DBO/M). Because familiarity was included as part of the research, definitions were not provided. This is particularly relevant for IPD responses, which may reflect the use of an integrated design approach rather than a formal IPD multiparty contract.

Also, the procurement method for design-build—best value versus qualifications-based team selection—was not differentiated in the surveys. While outside the scope of this research, procurement methods can affect many of the benefits measured in this report, and further research is recommended on this topic to demonstrate its impact. ■

Resources

Organizations and websites that can help you get smarter about different project delivery systems



McGraw Hill Construction

Main Website: [construction.com](http://www.construction.com)

Dodge: [construction.com/dodge](http://www.construction.com/dodge)

Research & Analytics:

[construction.com/dodge/](http://www.construction.com/dodge/)

[dodge-market-research.asp](http://www.dodge-market-research.asp)

Architectural Record: [archrecord.com](http://www.archrecord.com)

Engineering News-Record: [enr.com](http://www.enr.com)

Sweets: [sweets.com](http://www.sweets.com)

SmartMarket Reports:

[construction.com/market_research](http://www.construction.com/market_research)

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MMC Contractors
www.mmcontractors.com



American Institute
of Architects
www.aia.org



Design-Build
Institute of America
www.dbia.org



Society for Marketing
Professional Services



FOUNDATION
Society for Marketing
Professional Services

Society for Marketing
Professional Services
www.smeps.org
www.smeps.org/foundation/

Contributing Partner

Bentley Systems: www.bentley.com

Other Resources

American Institute of Architects Contract

Documents Reference Materials:

www.aia.org/contractdocs/referencematerial/aiab099118

American Society of Civil Engineers: www.asce.org

American Subcontractors Association:

www.asaonline.com

Associated Builders & Contractors: www.abc.org

The Associated General Contractors

of America: www.agc.org

Construction Industry Institute:

www.construction-institute.org

Construction Management Association
of America: [cmaanet.org](http://www.cmaanet.org)

Construction Owners Association of
America: www.coaa.org

International Risk Management Institute:
www.irmi.com

Lean Construction Institute:
www.leanconstruction.org

Mechanical Contractors Association
of America: www.mcaa.org

National Institute of Building Sciences: www.nibs.org

National Institute of Standards and

Technology: www.nist.gov

Sheet Metal & Air Conditioning Contractors'

National Association: www.smacna.org

■ Design and Construction Intelligence

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