Mitigation of Risk in Construction: Strategies for Reducing Risk and Maximizing Profitability

Premiere Partners:

Navigant
Pepper Hamilton LLP
Attorneys at Law
Mitigation of Risk in Construction: Strategies for Reducing Risk and Maximizing Profitability

About McGraw-Hill Construction

McGraw-Hill Construction (MHC), part of The McGraw-Hill Companies, connects people, projects and products across the design and construction industry, serving owners, architects, engineers, general contractors, subcontractors, building product manufacturers, suppliers, dealers, distributors, and adjacent markets.

A reliable and trusted source for more than a century, MHC has remained North America’s leading provider of construction project and product information, plans and specifications, industry news, market research, and industry trends and forecasts. In recent years, MHC has emerged as an industry leader in the critical areas of sustainability and interoperability as well.

In print, online, and through events, MHC offers a variety of tools, applications, and resources that embed in the workflow of our customers, providing them with the information and intelligence they need to be more productive, successful, and competitive.

Backed by the power of Dodge, Sweets, Architectural Record, Engineering News-Record (ENR), GreenSource and SNAP, McGraw-Hill Construction serves more than one million customers within the global construction community. To learn more, visit us at www.construction.com.
Introduction

Construction, like all industries today, is looking to improve business efficiencies. However, it faces unique challenges due to the complexity of construction projects. These complexities create greater risks for inefficiencies than those faced by other industries. We believe that providing research into construction risk mitigation is particularly critical in order to help the industry become more successful in overcoming its challenges.

This study examines the opinions of the industry at large—and of leaders in risk mitigation—to provide insights on the impact of risk on the construction industry and the strategies used by owners, architectural and engineering firms and contractors to mitigate the risks they face in order to improve their bottom lines and increase project productivity.

We chose to focus the research on the infrastructure sector because of the number of large and complex projects and the challenges they pose. We found in the expert in-depth interviews (see page 19) and high-profile, large building project case studies (see pages 32 and 45) that many of the key findings are applicable to other sectors when dealing with projects of similar scope.

The research identified the following unprompted factors as the most significant risks facing the industry:

• Changes in schedule/ scope creep
• Budget/cost overruns
• Project process approvals
• Safety
• Site Conditions

These top-of-mind responses are encouraging because they suggest that much of the risk facing construction industry firms are all factors under a firm’s direct control—reinforcing that mitigation strategies can directly have a positive impact.

The top-line recommendations that emerge from the research findings offer practical solutions that we hope the industry will find helpful as they seek to avoid risk and improve their bottom-line performance:

• Address risk early in the project to reap its full benefits.
• Communicate with other team members throughout the project.
• Implement a rigorous risk assessment and mitigation process.
• Embed risk management into your firm’s culture.
• Engage in activities that reduce the likelihood of litigation.
• Build a strong project team and assess the value of more formal collaboration, such as integrated design.

Ultimately, our results demonstrate that good project management must include good risk management.

We are excited to release the findings on this important topic, and we would like to thank our premier partners, Navigant Consulting Inc. and Pepper Hamilton LLP for helping bring it to the industry.

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 responsibility for MHC’s market research group as well as MHC’s thought leadership initiatives in areas such as green building, BIM, interoperability, innovation and global construction markets. Previously, Bernstein served as the President and CEO of the Civil Engineering Research Foundation. He currently serves as a member of the Princeton University Civil and Environmental Engineering Advisory Council and as 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.

Michele A. Russo, LEED AP, has been working in environmental policy and communications for 17 years. She currently is responsible for helping direct the green content across MHC’s portfolio of products and services and directing MHC’s SmartMarket Report series on key construction industry trends. Previously, she served as Executive Director of the Clean Beaches Council and Deputy Director of the National Pollution Prevention Roundtable. She has authored several articles and is a frequent speaker on green building trends. Russo has a B.S. in chemical engineering from Cornell University and a Masters of Public Policy from Harvard University.

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, public-private partnerships 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. Donna has a Ph.D. from Tulane University, an M.A. from Boston University and a B.A. from Middlebury College.
## TABLE OF CONTENTS

### 4 Executive Summary
- 4 Executive Summary
- 6 Recommendations

### 7 Data

#### 8 Impact of Risk on Infrastructure Projects
- 8 Time Overruns on Infrastructure Projects
- 9 Budget Overruns on Infrastructure Projects
- 10 Change Orders for Infrastructure Projects
- 11 Disputes Occurring with Infrastructure Projects

#### 14 Severity of Specific Risks on Construction Projects
- 14 Greatest Risks to Successful Projects (Top of Mind)
- 15 Seriousness of Specific Risks
- 17 Top Risks for Public and Private Projects
- 18 **Sidebar** Risk Management in the Energy Sector

#### 24 Adoption of Risk Assessment and Mitigation Procedures
- 24 Formal Risk Assessment Procedures in Firms
- 24 Formal Risk Mitigation Procedures in Firms
- 25 Awareness and Adoption of Risk Evaluation Strategies
- 26 Stages at Which Firms Evaluate Risk
- 27 Awareness and Adoption of Risk Mitigation Strategies
- 28 Awareness and Adoption of Tools and Technologies for Risk Assessment and Mitigation
- 29 **Sidebar** Increasing Safety in a Tough Economy
- 30 Use of External Advisory Groups or Consultants to Help Manage Risk
- 31 Percentage of Contingency Set at Bid Time by Owners
- 31 Variation of Contingency by Contract Type According to Owners

#### 35 Triggers, Obstacles and Influencers for Investment in Risk Management Practices
- 35 Triggers for the Adoption of Risk Management Practices
- 36 Obstacles to the Adoption of Risk Management Practices
- 39 Departments Involved in Risk Management
- 39 Key Influencers for Investment in Risk Assessment and Mitigation
- 40 **Sidebar** Risk Management in the Health Care Sector
- 41 **Sidebar** Risk Management for Global Construction

#### 42 Impact of New Practices and Technologies on Risk
- 42 Impact of BIM on Construction Project Risk
- 42 Impact of Public-Private Partnerships on Construction Project Risk
- 43 Impact of Using Integrated Teams on Construction Project Risk
- 44 **Sidebar** Using Collaboration and Integrated Design to Reduce Risk
47 Litigation
47 Common Causes of Claims and Disputes on Infrastructure Projects
48 Approaches for Settling Claims and Disputes for Infrastructure Projects
49 SIDEBAR Trends in Insurance
50 SIDEBAR Using Design-Build to Manage Risk
51 SIDEBAR Reducing the Risks of Sustainability

19 Data Sidebar: Opinions of Risk Experts—Risk Mitigation Factors and Approaches Based on In-Depth Interviews

Case Studies
12 Managing Risk on Innovative Infrastructure Projects: Two Lessons Learned
32 Creating an Effective and Flexible Team to Counter Risk:
   Pentagon Renovation Wedges 2–5, Arlington, Virginia
37 Using Effective Risk Management to Increase Competitiveness:
   I-15 Corridor Reconstruction, Utah County, Utah
45 Managing Risk Through Effective Coordination: World Trade Center 2,3, and 4, New York, New York

52 Methodology
53 Resources
Good risk management is a business imperative in construction.

The high number of delays, budget overruns and claims experienced in infrastructure construction demonstrates the critical need for wider adoption of rigorous risk mitigation procedures. Even in a survey group consisting only of firms that work on very large infrastructure projects, risk assessment is used more frequently than most risk mitigation strategies. Strategies to mitigate risk, such as using BIM and having integrated teams, offer an opportunity for the construction industry to increase efficiency and profitability. See page 6 for these and other strategy recommendations.

Impact of Risks on the Infrastructure Industry

Unmitigated risks lead to schedule delays, cost overruns, and in the worst case scenarios, disputes and claims. All three are experienced by over three quarters of owners, A/E firms and construction firms that do large infrastructure projects in the U.S. of $100 million and over.

- Firms experience delays on nearly one quarter (24%) of their total projects. A few firms report a very high percentage of delayed projects, increasing the average level compared to the median level of 15% for the group as a whole.
- Nearly one fifth (19%) of their projects are over budget, and the overrun averages 14% of the total project cost.
- 11% of their projects experience disputes, with an average claim of over $3 million. As with delays, a few firms report a very high percentage of disputes across their project portfolios, increasing the average level compared to the median level of disputes at 2%. A few large claims also impact the average of total claims.

The disparity between the average and the median results demonstrates that some firms experience a much greater risk of delays and disputes than others, suggesting that among those firms, there is a need for stronger risk management practices.

The data also demonstrate the potential for greater efficiency and profit in the construction industry that could be achieved through better management of the factors that result in delays, cost overruns, disputes and claims.

Biggest Construction Risks

When asked an open-ended question about the single greatest risk to a successful project, top-of-mind reported answers include:

- Design/Project Changes and Scope Creep
- Budget/Cost Overruns
- Project Process Approvals
- Safety
- Site Conditions

These responses demonstrate that the industry perceives its own processes, procedures and relationships as the greatest risks to a project, rather than external factors like the economy or labor markets. The positive implications of this result is that the industry has the ability to control risks itself.

Impact of Risks on Large Infrastructure Projects


<table>
<thead>
<tr>
<th>Impacts</th>
<th>Percentage of Respondents Who Experienced Impact</th>
<th>Average Percentage of Projects Impacted</th>
<th>Average Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed Completion</td>
<td>84%</td>
<td>24%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>Over Budget</td>
<td>86%</td>
<td>19%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>Disputes and Claims</td>
<td>76%</td>
<td>11%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$3,095,882</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$400,000</td>
</tr>
</tbody>
</table>
When asked to rank the seriousness of specific risks, the largest percentage of respondents indicated that those risks impacting their bottom line, such as changes in schedule and cost or financial risks, are considered the most serious.

However, one quarter to one third also consider specific risks related to performance to be highly serious. This supports a larger trend reflected throughout the findings of the study that the relationship a firm has with others working on its projects is a critical risk factor that must be fully addressed for a project to be successful.

Adoption of Risk Assessment and Mitigation Procedures

While the reported risk strategy adoption level is relatively high for risk assessment and mitigation procedures, far fewer believe that there is wide adoption across their profession. 62% believe that half the firms in their field or less have formal risk assessment procedures. Mitigation adoption is even lower with 43% reporting that one quarter or less of the firms in their field have formal risk mitigation procedures.

The industry reports in this study that the cost benefits of risk mitigation will drive adoption. 80% report that the need for greater project profitability will encourage adoption, and 77% believe that the increasing cost of litigation will have a significant impact. Other factors that will drive risk mitigation adoption include internal champions for risk mitigation, information about successful risk strategies, the demand for transparency and more widely available tools and technologies.

New Technologies and Practices Help Decrease Project Risk

BIM

71% of respondents state that BIM helps decrease project risk. Using BIM can encourage teams to undertake a more detailed and extensive design process. It can also reduce clashes, thus avoiding costly delays and improvised solutions on the job site. Most experts believe that BIM’s greatest value is its ability to help integrated teams work more effectively.

PUBLIC-PRIVATE PARTNERSHIPS (PPP)

54% find that PPPs decrease project risk. When used to build new projects, PPPs can help address the funding shortfalls currently faced in U.S. infrastructure. Having the entity responsible for construction also be the entity responsible for operation and maintenance is one important way that taking a PPP approach to new construction reduces risk. This practice encourages an asset lifecycle approach to costing rather than a purely project-related one, thus reducing the impact of many performance-related risks.

INTEGRATED TEAMS

77% find that using integrated teams reduces project risk. Integrated teams have been demonstrated to reduce risk by engaging all major players in the design phase, offering better communication between players, encouraging firms to take a project-focused rather than firm-focused approach, and increasing shared liability.
Effective risk management involves a commitment to risk throughout the firm and across the entire design and construction process.

Address Risk Management Early in the Project to Reap Its Full Benefits

While risk management needs to be an ongoing process, engaging in risk assessment as early as possible is critical in order to maximize its benefits. Early risk assessment increases the opportunity for innovative solutions that are also less costly. In addition, early risk identification can lead to better estimation of the cost of risk in the project budget, whether through contingencies, contractual clauses or insurance.

Communicate with Other Team Members throughout the Project Lifecycle

Without accurate, timely and complete information about projects, the best risk management team and tools cannot accurately assess risks or gauge the appropriate response. The key to effective mitigation is information, and the complexity of most construction projects means that information is constantly changing. Information needs to be provided by all relevant stakeholders to the project team, from early in the predesign process through construction. Issues that emerge need to be acknowledged quickly, and an internal communication plan must be in place for escalating risks that cannot be managed by the project team directly.

Implement a Rigorous Risk Assessment and Mitigation Process beyond Simple Checklists

Good risk management involves more than creating a simple checklist. The leading firms conduct extensive risk assessment procedures as soon as they become involved in a project. While initial mitigation efforts may be high-level, a rigorous process will get progressively more detailed as a project proceeds and new risks emerge. Regular meetings among all members of a project team, within the firm and beyond, are necessary to track those changes and update the mitigation plan.

Embed Risk Management into Your Firm’s Culture

Rigorous risk management requires altering the traditional mind set as well as investing in a different evaluation process for projects. This may include greater transparency and greater collaboration than before. The most effective way to ensure that a firm performs risk management consistently is for its leaders to prioritize and actively engage in risk management procedures—and for everyone involved in their projects to consider risk in their decisions and to communicate about risk effectively. Thus, the approach to risk must be a fundamental part of a firm’s culture, not the responsibility of a small team of experts. Players can encourage this through vendor and contractor requirements.

Assess the Value of More Formal Collaboration on Projects.

An integrated design process is not yet widely adopted in the industry, but it is widely recognized to reduce risk. When performed effectively, this process incorporates many of the recommendations already covered. It seeks the input of all players early in the project design process, allowing analysis of potential risks to occur. Since integrated teams focus on the success of the project rather than the impact on individual firms and share liability for problems that occur, communication is typically more open and transparent. The shared liability and focus on project success also helps reduce the risk of litigation.

Engage in Activities that Reduce the Likelihood of Litigation

Some factors to reduce the likelihood of litigation:
- Perform due diligence on potential clients, partners and project team members to learn how litigious they have been in the past.
- Ensure all stakeholders clearly understand the scope of work and priorities for the project.
- Create contract documents with clearly and reasonably apportioned risks.
- Try to have those most familiar with issues be actively engaged in resolving them.
- Have a plan in place for the resolution of issues that cannot be solved at the project team level.

Assess the Value of More Formal Collaboration on Projects.

An integrated design process is not yet widely adopted in the industry, but it is widely recognized to reduce risk. When performed effectively, this process incorporates many of the recommendations already covered. It seeks the input of all players early in the project design process, allowing analysis of potential risks to occur. Since integrated teams focus on the success of the project rather than the impact on individual firms and share liability for problems that occur, communication is typically more open and transparent. The shared liability and focus on project success also helps reduce the risk of litigation.

Engage in Activities that Reduce the Likelihood of Litigation

Some factors to reduce the likelihood of litigation:
- Perform due diligence on potential clients, partners and project team members to learn how litigious they have been in the past.
- Ensure all stakeholders clearly understand the scope of work and priorities for the project.
- Create contract documents with clearly and reasonably apportioned risks.
- Try to have those most familiar with issues be actively engaged in resolving them.
- Have a plan in place for the resolution of issues that cannot be solved at the project team level.
More than ever, managing construction risk effectively has become a business imperative in the construction industry. Construction has always been a high-risk industry, and the cost of risks that are not effectively mitigated are felt in project delays, cost overruns, litigation and claims, which takes their toll on an industry with traditionally small profit margins. Conversely, good risk management offers the opportunity to increase efficiency and profitability in the construction industry.

Small profit margins have been further reduced by the ongoing impacts of the recession, which continue to be felt across the construction industry. McGraw-Hill Construction’s Dodge database of construction projects shows that, in 2011, the overall construction market is down 44% from its height in 2006, with a relatively consistent reduction in projects since the start of the downturn in 2008.

The infrastructure segment, at first, was spared these dramatic drops in part due to the stimulus, which actually led to a 2% growth in infrastructure starts in 2010. The sector was also aided in the early part of the downturn by the fact that public monies committed to construction work did not dry up immediately at the start of the recession, unlike the freeze in capital for the private sector.

Currently, a slow, gradual recovery is forecasted for the construction industry as a whole. However, McGraw-Hill Construction’s economists forecast a decline in infrastructure activity in both 2011 and 2012. Political gridlock in Congress and the 2012 elections have lead to significant uncertainty as to levels of infrastructure spending in the near future.

Given the relatively low level of activity predicted for the immediate future across construction as a whole, firms need to maximize their economic viability. Many in the industry recognize that controlling risks is an important way to stay competitive in a difficult business environment.

The data in this report reveal the opinions on risk in construction of owners, architect and engineering (A/E) firms, and construction firms that work on large infrastructure projects. The infrastructure segment provides an interesting lens through which to view risk because of the multitude of factors that can impact projects, often spanning over great distances and time. However, despite this perspective, many of the risks addressed in these data results are ones facing the construction industry as a whole. This is borne out in two of the project case studies that feature building projects (see pages 32 and 45). They reveal that not only are the concerns about risk similar, but so are the approaches to mitigate them.

One key conclusion emerging from the findings in this report is that risk in construction fundamentally results from who a firm works with and the way those firms conduct their work. As a whole the report reinforces the idea that good project management must involve good risk management, including mitigation considerations.

Note about the Data

The data in this report are based on telephone interviews with 35 firms that each worked on an infrastructure project valued at $100 million or greater started in the last five years.

The analysis and some charts include breakdowns by player type. These sample sizes are smaller than the more robust size of the full survey sample. Given that small size, these data should be interpreted as indicative of trends versus industry-wide opinion for that player.

For more information and the full methodology, go to page 52.
Projects With Time Overruns
84% report that they had at least one infrastructure project that experienced a time overrun. Half of the total respondents, however, experienced delays in 20% of their projects or less, while close to a third (34%) reported experiencing delays on over 50% of all their infrastructure projects.

The average percentage of projects reported delayed was 24%, but the median percentage was much lower at 15%. This differential demonstrates that some firms are more prone to time overruns. The wide variation between the average and the median also suggests that delays are not necessarily endemic to infrastructure projects across the industry, but rather depend on the management of those projects. This finding indicates the significant impact that management and planning strategies can have on reducing time delays.

Length of Time Overrun
For the projects that reported time overruns, the average length of the delay was 17% of the total project schedule. Unlike the number of projects experiencing delays, the length of the delay has a much narrower range, with 20% reporting projects running more than 20% over the schedule, and the remainder divided nearly evenly between those reporting 11%–20% (38%) and those reporting 10% or less (42%).

Variation by Player

OWNERS
A smaller percentage of owners (11%) experience no delays as compared to A/E firms (18%) or construction firms (17%). In part, this may reflect what respondents consider to be a delay. Owners may be more likely to consider additional time authorized in a change order as a time overrun as compared to an engineer or contractor.

Time overruns can have serious repercussions for infrastructure owners. A recent survey of owners reports that they consider delays to be the greatest negative outcome for a project. Not only can delays increase the project cost, but the delay in use of that infrastructure can have serious political and/or business consequences.

A/E FIRMS
The delays experienced by A/E firms are less variable than those of the other players, with the average (24%) and the median (20%) percentage of delayed projects roughly the same. They also are the only group that does not report delays longer than 20% of the project schedule. The reduced role A/E firms play in the later phases on some projects may decrease the severity of their concern.

CONSTRUCTION FIRMS
Contractors have the widest variation between the average percentage of projects with delays (20%) and the median (7%), suggesting a wide range among firms of the likelihood of delays. However, they also have the lowest average of delayed projects. In contrast to the owners, they may not view increased schedules authorized in change orders as schedule overruns.
Projects with Budget Overruns
86% of those surveyed report that at least some of their projects did not complete on budget. The average percentage of their projects that ran over budget is 19%, which is lower than the percentage of projects that did not complete on schedule (see page 8). This suggests that some project budgets include contingencies that anticipate some of the costs associated with not completing on time.

The percentage of projects with budget overruns is relatively consistent, with the median of 15% close to the average of 19%. Far fewer respondents report that the majority of their projects experience budget overruns.

Average Budget Overrun
The average budget overrun is 14% of the total project cost. When considered as a percentage of the work of these respondents, whose largest infrastructure projects range from $100 million to over $1 billion, the implication is that millions of dollars are at stake in these overruns.

Variation by Player
All of the players report a median of 10% of the total project cost for the budget overruns they have experienced, and A/E firms and owners are strikingly close in their average reported budget overruns, at 12% and 11%, respectively.

This consistency among player groups suggests that the way projects are interpreted to be over budget is subject to much less variation than the definition of being over schedule.

CONSTRUCTION FIRMS
The percentage of projects over budget and the budget overruns reported by construction firms are more widely disparate than those of owners or A/E firms.

• Percentage of Projects
While the average percentage of projects experiencing budget overruns for construction firms is the same as for other groups (19%), the median is significantly lower (8%). Contractors are divided between two extremes:
  • 70% report 20% or less of their projects have budget overruns—far more than the other two players report (in the low to mid 50th percentile range).
  • They are also the only player group to report more than 80% of their projects completing over budget.

• Average Budget Overrun
Contractors experience a much wider differential than other players between the average amount of overrun—18% of the total project budget—and the median of 10%. While the percentage who report a low budget overrun of 1%–10% is consistent with the other players, 12% report budget overruns of 25% or more on average (the only player to report this level of overrun). Therefore, the average is influenced by this small group.

One factor that could contribute to contractors providing more extreme answers than other player groups is the low profit margins contractors typically have on the projects they build. With a current industry norm for profit margins of less than 3%, even minor budget overruns have very high impact on this segment.
Change Orders for Infrastructure Projects

All of the firms surveyed report at least some change orders on their projects, with an overall average percentage of change orders of 15%.

The fact that all of the respondents report some change orders on their projects demonstrates that they are a necessary part of the construction process. However, many industry analysts use them to benchmark the need for productivity and efficiency improvements in construction.

Change orders can also be seen as a significant risk factor for owners. In fact, some owners have expressed concern that in the highly competitive bid environment fostered by the recession, contractors may need to underbid projects to secure work, and change orders can be used to help make up the losses inherent in the bids. (See page 19 for in-depth interviews with risk management experts for more information.)

Another significant risk factor that emerged in the in-depth interviews is the increasing tendency to attempt to shorten a project’s schedule by starting construction before design is complete. Many contractors attribute the industry-wide growth in change orders to incomplete design and the lack of a public owner’s final decisions about design details before construction begins. The impact of these factors is also visible in the sharp increase in the number of submittals during construction required by the contract documents.

One of the benefits of using building information modeling software (BIM) is the reduction of change orders. In McGraw-Hill Construction’s Business Value of BIM SmartMarket Report (2009), 54% of the construction industry professionals surveyed considered the reduction of changes during construction a high-value benefit of using BIM. In addition, 71% of the respondents in this survey believe BIM decreases construction project risk. (See page 42 for more information.)

**Variation by Player**

**OWNERS**

88% of owners report a 1%–20% average of change orders on their infrastructure projects. All the rest report a 21%–40% average of change orders. These figures make owners the lowest reporters of change orders overall, with an average of 9%.

**A/E FIRMS**

Like owners, the vast majority of A/E firms (89%) report an average of 1%–20% of change orders on their projects.

However, the remaining 11% report a 61%–80% average, a striking increase. This jump leads the average percentage of change orders for A/E firms to be 15%.

This suggests that the practices of some firms may be contributing to an unusually high percentage of change orders. Shortened design schedules and starting construction with incomplete documents are often cited as factors that increase the risk of change orders during construction.

**CONSTRUCTION FIRMS**

At 19%, construction firms report the highest average percentage of change orders. They have a slightly higher percentage in the upper ranges than the other players:

- 73% report an average percentage of 1%–20% change orders.
- 18% report an average percentage of 21%–40% change orders.
- 9% report an average percentage of 61%–80% change orders.

One of the owners who participated in the in-depth interviews with risk management experts observed that some contractors issue many change orders per project and others issue fewer in similar circumstances. Therefore, the average reported percentage of change orders may merely be a reflection of the different approaches that contractors use in considering change orders rather than an industry-wide problem.
Disputes Occurring with Infrastructure Projects

Infrastructure Projects with Disputes
76% report that some of their infrastructure projects have been involved in a dispute. The average percentage of projects with disputes is 11%, but the median percentage is only 2%. Therefore, a few firms reporting a high level of disputes—12% with more than 25% of their projects engaged in disputes—are drawing the overall average up.

These results correspond with the findings of the in-depth interviews (see page 19). Both owners and contractors express concern about dealing with organizations that are highly litigious. One best practice is to investigate the history of potential partners for this characteristic before agreeing to work together on a project.

Average Size of a Claim
The average claim (or loss) was slightly over $3 million. The median is only $400,000, but nearly half (41%) of respondents were involved in disputes with claims of $1 million or more. This reveals that while the majority of claims are relatively small compared to the total project value, a sizable number are also large and potentially damaging.

One important consideration when measuring the impact of disputes on the construction industry is that the claims are only a portion of the cost. The legal fees, lost time, distraction of key personnel and dampening impact on innovation represent additional costs that may be much larger and more difficult to measure directly.

Given the prevalence of claims and their impact, it is not a surprise that 71% of respondents believe that the increased cost of litigation has a high impact as a trigger for the adoption of good risk management practices. (See page 35 for more information on triggers for risk management investments.)

Variation by Player
OWNERS
Owners are the most consistent player when it comes to the percentage of projects involved in a dispute. The average percentage of disputes for them is 5%, and none of the owners surveyed were involved in disputes on more than 25% of their projects. They also report the lowest average claim, $1.1 million.

A/E FIRMS
The average percentage of A/E firms’ infrastructure projects involved in disputes is 8%. A small percentage (9%) report that more than 25% of their projects experience disputes. Their claims average around $3 million, consistent with the overall findings.

CONSTRUCTION FIRMS
A few contractors have many of their projects involved in disputes, leading to an average of 19%, despite a median level of just 2%. This is due to the fact that 8% report engaging in disputes for over 50% of their projects and another 8% engage in disputes for over 75% of their work. This result appears to confirm that some firms are prone to litigation.
Managing Risk on Innovative Infrastructure Projects

Two Lessons Learned

TAMPA BAY SEAWATER DESALINATION PLANT, FLORIDA
SAN FRANCISCO/OAKLAND BAY BRIDGE SAS SPAN, CALIFORNIA

All large-scale infrastructure projects involve risk, but those that push the envelope pose even greater challenges, whether they employ technologies and designs not typically used in the United States or have a level of scope and complexity exceeding most other projects. Two projects undertaken in the last decade offer lessons about key steps to understand and potentially mitigate risk when undertaking large-scale, innovative infrastructure.

These lessons are critical because, as one risk experts observes, “The reality is that you might take some risks now, and it might show up with quality issues and defects in three or five years after the time the risk was taken.” (See page 19 for more information on the expert interviews conducted.)

Tampa Bay Water Desalination Plant

Because it was one of the first major desalination plants in the country, ENR magazine described this project as a “bellwether for the future of desalination in the United States.” The problems they faced and the ways those problems were remediated demonstrate that, when dealing with a new technology, it is critical to verify performance at each step and with each component in the project. In addition, the remediation strategy demonstrated the importance of keeping the project’s ultimate owner/operator fully engaged.

When construction completed on the seawater desalination plant in the spring of 2003, the project was considered to be delivered on time and on budget at $110 million. However, the project was functioning below the specified productivity levels, and it failed a critical acceptance test.

The protracted legal battles and search for a remediation solution led to a delay of three years before the plant was fully operational. The cost of the project also inflated to $148 million, and the water produced by the plant increased from the original estimate of $2.02 per thousand gallons to $3.38, due to increasing equipment costs and inflation.

The main problem with the initial design was insufficient pretreatment, due in part to lack of recognition of unique local conditions. A bigger issue, though, was that, despite the fact that desalination is a relatively new technology in the U.S., the original design and construction approach did not include ways to actively identify problems as they occurred. In fact, the low production levels in the plant after it opened were due in part to a domino effect when a problem with one filter would go undetected, causing issues that led to shutting down the entire system.

The remediation team took a very different approach. They included pilot testing of every element in the desalination system. Pilot testing is not a norm for most treatment plants in the U.S., but the complexity of a desalination plant makes it a necessity, reported Ken Herd, director of operations and facilities for Tampa Bay Water to ENR editors. Instrumentation was also added throughout the process that identified problems in the individual systems. The instrumentation allows problems to be addressed before they impact other systems, keeping the plant as a whole on line.

The original contract for the construction and operation of the plant put the risk on the contractor instead of the utility, a factor that proved critical during the significant litigation that ensued when the plant was not functioning properly. However, Herd noted, it kept the utility from being an active partner in monitoring the treatment process, and held them “at arm’s length” due to the process’s proprietary nature. He prefers the remediation design-build contract, which gave the utility greater control. He states, “Now we own the plant, and with our ownership, we have access to what is going on with it.” Proper contractual distribution of risks and roles, thus, proved to be another significant factor that made a difference in remediating the project.

SAS Span on the Bay Bridge

The biggest challenge a project faces can be getting its stakeholders to agree. Without a shared vision among stakeholders—and a good process for aligning stakeholder interest—large, high-profile public projects can get mired in delays.

After the Loma Prieta Earthquake seriously damaged the Bay Bridge in California in 1989, a temporary fix was in place in two months. But more than 20 years later, the permanent replacement is still under construction.

One of the most controversial elements, and one that added significantly to the length of the project, was the eastern portion of the bridge. In addition to the bridge needing to be able to withstand another significant seismic event, activists, especially on the Oakland side, began to demand that the east side of the bridge was the project’s “bellwether for the future of desalination in the United States.”

ENR magazine described this project as a “bellwether for the future of desalination in the United States.”

The problems they faced and the ways those problems were remediated demonstrate that, when dealing with a new technology, it is critical to verify performance at each step and with each component in the project. In addition, the remediation strategy demonstrated the importance of keeping the project’s ultimate owner/operator fully engaged.

When construction completed on the seawater desalination plant in the spring of 2003, the project was considered to be delivered on time and on budget at $110 million. However, the project was functioning below the specified productivity levels, and it failed a critical acceptance test.

The protracted legal battles and search for a remediation solution led to a delay of three years before the plant was fully operational. The cost of the project also inflated to $148 million, and the water produced by the plant increased from the original estimate of $2.02 per thousand gallons to $3.38, due to increasing equipment costs and inflation.

The main problem with the initial design was insufficient pretreatment, due in part to lack of recognition of unique local conditions. A bigger issue, though, was that, despite the fact that desalination is a relatively new technology in the U.S., the original design and construction approach did not include ways to actively identify problems as they occurred. In fact, the low production levels in the plant after it opened were due in part to a domino effect when a problem with one filter would go undetected, causing issues that led to shutting down the entire system.

The remediation team took a very different approach. They included pilot testing of every element in the desalination system. Pilot testing is not a norm for most treatment plants in the U.S., but the complexity of a desalination plant makes it a necessity, reported Ken Herd, director of operations and facilities for Tampa Bay Water to ENR editors. Instrumentation was also added throughout the process that identified problems in the individual systems. The instrumentation allows problems to be addressed before they impact other systems, keeping the plant as a whole on line.

The original contract for the construction and operation of the plant put the risk on the contractor instead of the utility, a factor that proved critical during the significant litigation that ensued when the plant was not functioning properly. However, Herd noted, it kept the utility from being an active partner in monitoring the treatment process, and held them “at arm’s length” due to the process’s proprietary nature. He prefers the remediation design-build contract, which gave the utility greater control. He states, “Now we own the plant, and with our ownership, we have access to what is going on with it.” Proper contractual distribution of risks and roles, thus, proved to be another significant factor that made a difference in remediating the project.

SAS Span on the Bay Bridge

The biggest challenge a project faces can be getting its stakeholders to agree. Without a shared vision among stakeholders—and a good process for aligning stakeholder interest—large, high-profile public projects can get mired in delays.

After the Loma Prieta Earthquake seriously damaged the Bay Bridge in California in 1989, a temporary fix was in place in two months. But more than 20 years later, the permanent replacement is still under construction.

One of the most controversial elements, and one that added significantly to the length of the project, was the eastern portion of the bridge. In addition to the bridge needing to be able to withstand another significant seismic event, activists, especially on the Oakland side, began to demand that the east side of the bridge...
bridge be as aesthetically pleasing as the west side.5

The political battle that ensued added substantial delays to the project. Steve Heminger, executive director of the Bay Area’s Metropolitan Transportation Commission, described the difficulty of dealing with stakeholders in a 2009 interview with PBS NewsHour. “We fought about the design of the bridge, we fought about whether the bridge should have a bicycle or pedestrian path, we fought about where the bridge should go, we fought about whether there ought to be train tracks on the new bridge … What was originally a limited objective, which was to build a new span that would be seismically strong, grew into a monstrosity where every interest group under the sun tried to glom onto the project and achieve their objective.”6

As the former mayor of Oakland, Willie Brown, pointed out, the issue of satisfying stakeholders did not only apply to those activists arguing for the bridge’s aesthetic appeal. He points out that any state bridge project needs to get a series of different interests in line, including those of the governor, the state legislature and Caltrans, in addition to the communities actually linked by the bridge.7

The challenges posed by the site, the need for strong seismic performance and the demand for compelling aesthetics led to the adoption of self-anchored suspension span (SAS) bridge technology. The project was initially put out to bid in spring 2004, with an official cost estimate of $780 million. However, many felt that this estimate did not reflect the rapidly rising cost of steel during that time period or the complexity of constructing an SAS bridge. Thomas Warne, head of a review group appointed by Governor Schwarzenegger to study the Bay Bridge project, stated to ENR editors in 2004 that there were only 20 SAS bridges in the world, and he cited the “lack of experience in building [one],” along with the difficulty in manufacturing the components, as significant risk factors for this project.8 Only one bid was received from that initial offering, and at $1.4 billion it was significantly higher than the original estimated cost. Amid a great deal of political controversy and uncertainty over how the project would proceed, the bid was eventually rejected.

The project took nearly another two years to be reissued for bidding, and when it came back in March 2006, the official estimate was $1.45 billion, more in line with the complexity of the project and the high price of steel. Part of that delay was due to the decision to increase the bridge tolls to pay for the higher construction cost.10 Two bids rather than one were received, and both were close to the new estimate. A joint venture of American Bridge and Fluor was selected to complete the project. Construction began in May 2006.

At this point, the project is still on target to achieve a late 2013 opening, seven years after construction started. 

SAS span of the Bay Bridge under construction.

Data: Severity of Specific Risks on Construction Projects

Greatest Risks to Successful Projects (Top of Mind)

Five factors were identified by over 10% of respondents when asked what they considered to be the greatest risks to a successful project. Since these choices were unprompted, the answers reveal as much about how respondents view risks as what concerns them most.

The majority of these reported factors are elements under the control of the project team. This suggests that when the respondents consider risk, they primarily consider things that they can impact or mitigate.

**DESIGN/PROJECT CHANGES AND SCOPE CREEP**
The most popular answer overall was also the most popular answer among the owners, with over one quarter (27%) identifying this as the greatest risk to project success. Owners ultimately are bound to a budget for most projects, and major changes can kill a project or create damaging delays if they get out of hand. They can also be exacerbated by the input of multiple stakeholders for large-scale public infrastructure projects. (See page 12 for an example of a public project experienced major delays as a result of this issue.)

One key way to address design changes and scope creep is to engage in active, open communication to ensure that stakeholders and project team members share the same vision and priorities for the project.

**BUDGET/COST OVERRUNS**
Significantly more A/E firms (25%) raised this issue than owners (18%), and no contractors offered it as a concern.

- The cost estimate an A/E firm provides is often a critical measure used by owners to gauge its performance, and overruns could impact its ability to secure future work. However, depending on their role post-design, they may have little control over cost increases incurred later in the process.
- A construction firm, on the other hand, often will be able to pass the majority of the burden for cost overruns onto the owner.

**PROJECT APPROVAL PROCESS**
This issue is also identified by more A/E firms (25%) as compared to construction firms (8%) or owners (0%).

Their involvement in pre-planning and early design can put A/E firms at risk of committing resources to a project that never makes it through the approval process, making it difficult for design firms to gauge their work pipeline and staff appropriately.

### Greatest Risks to Successful Projects (Top of Mind)


<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design / Project Changes and Scope Creep</td>
<td>17%</td>
</tr>
<tr>
<td>Budget / Cost Overruns</td>
<td>14%</td>
</tr>
<tr>
<td>Project Approval Process</td>
<td>11%</td>
</tr>
<tr>
<td>Safety</td>
<td>11%</td>
</tr>
<tr>
<td>Site Conditions</td>
<td>11%</td>
</tr>
<tr>
<td>Scheduling</td>
<td>9%</td>
</tr>
<tr>
<td>Utilities</td>
<td>6%</td>
</tr>
</tbody>
</table>

**SAFETY**
Safety is of nearly equal concern to owners (18%) and construction firms (17%), but is not considered top-of-mind as a key risk by design firms (0%). Safety omissions can lead to litigation for owners and contractors, and high-profile accidents can be damaging to their ability to do work in the future. Strict government regulation on this issue also make this risk prominent for these two groups.

**SITE CONDITIONS**
25% of A/E firms and 8% of construction firms consider site conditions a major risk, but that factor was not mentioned by any owners. This may seem surprising since the owner is typically liable for cost overruns and delays due to site conditions. However, the owner also has the greatest control over the degree to which this risk is taken into consideration. Contractors and design firms, on the other hand, typically cannot do any major site investigations before agreeing to undertake a project. Despite the owner’s liability on this issue, unexpected site conditions can have major impacts on schedule, which can affect the allocation of labor and other resources for A/E and construction firms and, in turn, impact their other projects and commitments.
Risks that directly impact a project’s bottom line are identified by respondents as the most serious. More than one third and just under one half of respondents rate changes in schedule, changes in cost and financial risks as seriously impacting the success of a construction project.

**Bottom Line Risks**
The emphasis on bottom line risks suggests that firms that do major infrastructure projects think of risk primarily as a business consideration that directly impacts profitability. This implies that, in general, demonstrated positive impacts on productivity and profitability will be the best argument for advancing investment in risk mitigation. It is important to note, though, that some risks carry more weight with specific players than others.

**Changes in Schedule**
All players recognize the seriousness of changes in schedule. Schedule changes impact a larger percentage of infrastructure projects for respondents than cost changes or disputes (see page 8).

- For A/E firms and contractors, schedule changes also may affect the ability to devote resources to other projects.
- For the owners surveyed, 86% of whom are in the public sector, the political ramifications of delays could be damaging.

**Changes in Costs**
A much higher percentage of design firms (67%) consider the risk of cost changes very serious as compared to construction firms (25%) or owners (36%). This is consistent with the results of the top-of-mind question (see page 14).

While A/E firms do not experience more cost overruns as compared to other player types (see page 9), their relationships with their clients may be impacted, potentially affecting their ability to secure future work. In the current economic climate, with infrastructure facing severe funding limits, A/E firms may be feeling increased pressure to improve the client relationships for competitive reasons.

**Financial Risks**
Financial risks include factors such as inflation, devaluation and slow economic growth. Owners (45%) and A/E firms (50%) are equally concerned about financial risk, but contractors (17%) do not seem as concerned, probably because the liability for these risks typically rests with the owner.

- For a project that extends over a period of several years, the negative impacts on an owner’s budget can be difficult to anticipate or plan for. This has been particularly true during the economic turmoil that has ensued since 2008.
- For A/E firms, financial risks may be a factor in the larger issue of changes in cost.

---

### Most Serious Risks to Project Success


<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Most Serious Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bottom Line Risks</strong></td>
<td></td>
</tr>
<tr>
<td>Changes in Schedule</td>
<td>49%</td>
</tr>
<tr>
<td>Changes in Cost</td>
<td>43%</td>
</tr>
<tr>
<td>Financial Risk</td>
<td>37%</td>
</tr>
<tr>
<td><strong>Performance Risks</strong></td>
<td></td>
</tr>
<tr>
<td>Contractual Risk</td>
<td>31%</td>
</tr>
<tr>
<td>Not Achieving Required Quality</td>
<td>26%</td>
</tr>
<tr>
<td>Not Meeting Client Expectations</td>
<td>26%</td>
</tr>
<tr>
<td>Technical/Design/Engineering Issues</td>
<td>23%</td>
</tr>
</tbody>
</table>

---

**Severity of Specific Risks on Construction Projects**

---

**SmartMarket Report**

---

McGraw-Hill Construction 15 www.construction.com
**Performance Risks**

Players in the construction industry rely on each other to deliver a successful project, but the adversarial nature that characterizes much of the industry can sometimes prevent a collaborative approach. Therefore, it is not surprising that the performance of other members of a project team is a critical risk identified repeatedly in the research, including the in-depth interviews with experts and the case studies. And it impacts all players.

The use of integrated teams has shown promise as a best practice to help minimize this risk, which this study confirms—77% report that using integrated teams reduces risk. A team approach can ensure that all members are aligned in the vision, goals and priorities of the project, which can address many of the performance risks discussed below.

**CONTRACTUAL RISK**

Owners consider this a more serious risk than other player groups, with 55% rating it as a high risk—more than double the percentage of design firms (25%) or contractors (17%). This suggests that for owners in particular, formulating contracts that reduce their liability is a high priority.

**NOT ACHIEVING REQUIRED QUALITY**

More than double the percentage of owners (45%) are concerned about this risk as compared to A/E firms (17%) or construction firms (17%). The quality of a construction asset, once built, is very difficult to improve, and quality issues can shorten the life of the asset or make it less safe for users. Owners may have some legal redress for subpar quality, but that typically cannot fully compensate them for the problems and losses incurred by this issue.

**NOT MEETING CLIENT EXPECTATIONS**

Both A/E firms (33%) and contractors (25%) see not meeting client expectations as a serious risk. Relationships with past clients play an important role in procuring new work. Even in a public bid context, a firm’s reputation can impact its selection and the work it is considered eligible to do.

**TECHNICAL, DESIGN, ENGINEERING OR OTHER CONSTRUCTION ISSUES**

All of the player segments see this issue as important—17% of A/E firms, 25% of construction firms and 27% of owners rank this as a serious concern. As with the previous two issues, concerns about technical, design, engineering or other construction issues demonstrate the need for all members of a project team to communicate clearly about the performance expectations for the project.

**Risks of High Importance to One Player Segment**

While not selected by as many respondents as the previous two categories, several external risks outside the control of the project team are considered highly serious by over 10% of the respondents. For many of these categories, though, one player segment is far more concerned than the others about the impact of the risk.

**OWNERS**

27% are highly concerned about risks due to politics and the political environment. Given the large percentage of public owners in the survey, the decline in state and local budgets makes public infrastructure more dependent on federal funding. The federal government’s inability to put together key funding initiatives and the threat of cuts to existing sources of funds make many owners highly vulnerable to the current political environment.

**A/E FIRMS**

25% express concern about payment/credit risk. The issues around the economy and funding levels for infrastructure impact the viability of proposed projects moving forward for A/E firms. This concern may represent a bellwether for construction firms since concerns about projects currently in design may translate into construction concerns in the next couple of years.

**CONSTRUCTION FIRMS**

25% find meeting sustainability goals to be a serious risk. The recent emphasis on the performance of green buildings after construction may have contractors concerned about their liability in this performance.

**Other Risks**

Large-impact but rare risks, such as natural disasters and terrorism, are considered less serious than the risks firms think they are more likely to face on a recurring basis. Also, with the current levels of high unemployment in the construction industry, it is not surprising that few are concerned about labor risks. This risk may become more urgent, however, when the economy recovers and construction work increases.
Public and private projects have different risk profiles. While the bottom line risks of greatest importance to the respondents—schedule changes, cost changes and financial risks—weigh heavily in both categories, other risks are considered more important for one of the two sectors.

**PAYMENT/CREDIT RISK**
31% of respondents regard this as one of the top three risks for private-sector projects, but only 9% regard it as a critical risk for public work. Since 2008, financing for private-sector projects has been consistently difficult to obtain. Many projects that have advanced on the expectation of financing have been forced to stop, sometimes in mid-design or mid-construction.

**TECHNICAL/DYSEIGN/ENGINEERING/OTHER CONSTRUCTION ISSUES**
51% consider this the top risks in the public sector—significantly higher than the 28% who consider it a risk for the private sector. This is even higher than any of the bottom-line risks, such as changes in schedules and costs.

One factor that may contribute to this finding is the lack of flexibility available to firms that work in the public sector to resolve issues with their clients compared to the private sector. This lack of flexibility could lead to increased concerns about the risks that may occur when technical, design or construction issues arise.

**NOT MEETING OWNER/CLIENT EXPECTATIONS**
25% consider this a high risk in the private sector, compared to just 14% in the public sector. The public sector often has clearly defined goals and agendas for projects. While some caution that these requirements and regulations need to be thoroughly understood, a firm that invests in that effort can see consistencies of approach across public projects.

Private sector goals, on the other hand, are typically less consistently defined from project to project, and they may be more influenced by the person leading the project than in the public sector. Firms must actively ensure that they understand the vision and priorities of the owner/client for each project, even those they have done business with in the past.

**POLITICAL ENVIRONMENT**
More than three times as many respondents view the political environment as a risk for public projects as compared to private ones. The current state of funding for projects, especially infrastructure projects, may be causing an increased concern about this risk. The increasingly fiscally conservative environment at the federal level, along with the ongoing challenge of gaining bipartisan support for infrastructure funding in Congress, may make this difference more prominent than it has typically been in the past.
McGraw-Hill Construction conducted a survey among a small sample of owners, contractors and designers who work in the energy sector. Although the survey group is not large enough to be statistically significant, it provides a good snapshot of attitudes and trends about risk management in the sector (see methodology on page 52).

Severity of Specific Risks

When the top risks for public and private projects are compared, certain risks carry far more weight for energy projects than for infrastructure projects.

Public-Sector Risks

(Top risk factors cited as important by respondents in the energy sector)

- Technical/Design/Engineering Issues: This factor is as important in the public energy sector as it is in infrastructure.
  - Energy: 50%
  - Infrastructure: 51%
- Labor Risks: Energy work requires more specialized labor, making workforce availability more of a concern.
  - Energy: 44%
  - Infrastructure: 6%
- Changes in Cost: Public infrastructure projects are usually publicly funded, which may create bigger hurdles with cost increases.

Energy: 31%
Infrastructure: 43%

- Partner Risk: Public energy projects involve partnerships with private firms, which are still relatively rare in the infrastructure sector.
  - Energy: 31%
  - Infrastructure: 3%
- Political Risk: Both energy and infrastructure projects face uncertain government funding.
  - Energy: 31%
  - Infrastructure: 31%

High Private-Sector Risks

(Top risk factors cited as important by respondents in the energy sector)

- Technical/Design/Engineering Issues: More technically demanding projects in the energy sector may account for the higher number reporting this as an important risk.
  - Energy: 44%
  - Infrastructure: 28%
- Financial Risks: The energy market in the private sector is typically far more volatile than the infrastructure market in the private sector.
  - Energy: 44%
  - Infrastructure: 34%
- Labor Risks: The need for specialized labor makes this more important for energy projects.
  - Energy: 38%
  - Infrastructure: 9%
- Changes in Schedules: Somewhat similar response rates demonstrate the importance of schedules in both sectors.
  - Energy: 38%
  - Infrastructure: 44%
- Risk of Not Meeting Owner/Client Expectations: As with design issues, more technically demanding projects in energy would impact the severity of this risk.
  - Energy: 38%
  - Infrastructure: 25%

Risk Management Strategies

Assessment

All respondents in the energy sector use checklists, forms and/or risk registers, compared to only 77% of infrastructure respondents. This suggests that the energy sector may have a relatively standardized approach to assessing risk as compared to infrastructure, especially since expert input (internal and external) and formal brainstorming assessment measures are far more widely adopted in infrastructure.

Mitigation

Nearly all mitigation strategies have roughly the same adoption level in both sectors. This supports the notion that strong risk management is good project management.
Data Sidebar: Opinions of Risk Experts

Risk Mitigation Factors and Approaches
Based on In-Depth Interviews

Interviews with 15 experts on risk management from some of the largest owners, engineering and contracting firms, and construction firms in the U.S. reveal that successful risk mitigation requires early engagement, a culture committed to reducing risk and well-defined, transparent and collaborative relationships among the project’s key stakeholders.

Cumulatively, the responses reveal best practices for managing risk. Respondents were asked a series of questions on the following topics:
- Impact of Risk on Project Budget and Schedule
- Factors that Impact the Types of Risks Encountered
- Risk Assessment and Mitigation Procedures
- Litigation

Impact of Risk on Project Schedule and Budget
When gauging the risk inherent in a construction project, the most commonly recognized measures are the ability to finish on time and on budget.

While these measures of risk seem relatively straightforward, several expert respondents question exactly what being “on time” and “on budget” entails. When asked to estimate the percentage of projects that typically complete on time and on budget, one contractor insisted that the figure depends on “whether you acknowledge properly handled extensions to changes that arose in the course of the project.” Even a relatively clear-cut measure of risk demonstrates the challenge of measuring the impact of mitigation efforts on the industry and determining their effectiveness.

Given the challenge of even defining “on time” and “on budget,” it is not surprising that estimates for the percentage of projects completing on time and on budget vary widely among the experts, who report that as few as 20% and as many as 90% of projects across the industry achieve on-schedule and on-budget completion.

Despite that lack of agreement, there was consensus about the factors that differentiate projects that complete on time and on budget from those that do not.

Factors that make projects more likely to finish on time and on budget
- Adequate up-front planning
- Clear scope of work and shared expectations between firms and clients
- Realistic scheduling: Over-optimism was cited by a few as a problem that needs to be avoided.
- Contract documents that clearly define risks and responsibilities for each partner: One contractor notes, “70% of whether a project will make the anticipated budget, schedule and quality is determined by the time the ink is put on the contract.”
- Familiarity with the work and the other players involved

Together, these responses reveal that learning as much as possible and as early as possible about the project, the roles of each player and the inherent risks is crucial to minimizing project risk.

Factors that make projects less likely to finish on time and on budget
- Third-party influences, including multiple stakeholders, political interest and utilities
- Concerns about labor availability due to market changes, especially on a long-term project

One expert notes that a key strategy for achieving an on-time, on-budget project is a collaborative relationship between all the players involved. Issues will inevitably arise as the project proceeds, and “without complete collaboration, there is not a unified approach to solving the issues,” he says.

Most Important Risk Factors
- A shared vision and a clear scope of work
- The financial viability and reputation of the firms you are dealing with; those with litigious tendencies should be avoided
- The ability of firms to deliver the quality of work required in the time allotted for construction
- Contractors: Subcontractors and owners, especially in the public sector, who have some sophistication and experience in the type of work undertaken
- Owners: Designers and contractors who have some sophistication and experience in the type of work undertaken

Continued
Opinions of Risk Experts

Factors That Impact the Type of Risks Encountered
A common conclusion is that the relationship with the other firms involved in the project, including partners, clients, design firms and construction firms, is more important in determining the level of project risk than project type or size. Several respondents emphasize that risks vary dramatically from project to project, while others report that certain risks typically emerge as critical across projects. However, project type as a whole was not considered a key determinant of risk.

Factors That Impact the Type of Risks Encountered
A common conclusion is that the relationship with the other firms involved in the project, including partners, clients, design firms and construction firms, is more important in determining the level of project risk than project type or size. Several respondents emphasize that risks vary dramatically from project to project, while others report that certain risks typically emerge as critical across projects. However, project type as a whole was not considered a key determinant of risk.

One aspect that many felt made a difference in the risks they faced is whether the project is public or private.

Risks of Public Versus Private Projects
Nearly all the experts interviewed report facing very different risks based on whether the owner of the project is in the public or private sector. In fact, one executive from an engineering and construction firm states that for his multinational company, public and private work are in two separate business units because their risk profiles are so different.

- **Flexibility in Types of Contracts:** Several experts note that the private sector has more flexibility in terms of how to apportion risk in its contracts. One respondent from an engineering and construction firm finds the private sector can negotiate reasonable contract terms more easily than “the bureaucrats” in the public sector. However, another sees this flexibility as a disadvantage, with less consistency in the private sector in how provisions of the contract are applied. Also, one contractor reports that the federal government has evolved from a low bid emphasis to “real value purchases” that allow them to focus on assembling the most qualified team, moving the public sector a little closer to the private sector in terms of flexibility in contracting firms.

- **Flexibility in Resolving Issues:** Private owners also can more easily resolve issues that arise during construction directly with the firms they hire as compared to their public-sector counterparts. One respondent from a construction firm notes that the work they obtain in the private sector typically comes from an already strong relationship between their firm and that client, and that relationship allows them to work directly with the client when problems appear.

- **Faster Decisions:** The level of risk faced by contractors is reduced by the ability of project owners in the private sector to make quick decisions, which owners in the public sector typically cannot do. One expert noted that public project decision makers are appointed or elected officials, which slows their ability to make critical decisions.

- **Payment Risk:** Several respondents note greater concerns about project funding and the ability of private-sector owners to pay compared to public-sector owners. In addition, one expert describes how large-scale private projects may be funded by a consortium, which raises the issue of an increased number of stakeholders to satisfy, as well as increasing the risk of payment issues. This risk may not be confined to the private sector. For one construction firm, the concern over the ability of municipalities to pay has also begun to rise, making it necessary to confirm that “the funds are properly designated and set aside in the appropriate budget” before committing to a public project.

Risks Typically Considered by Contractors at the Go/No Go Stage

- **Project Funding:** Concerns about an owner’s ability to pay have become more prominent during the economic downturn. While this risk has largely been confined to the private sector in the past, at least one firm cited concerns about some public agencies as well.

- **Contractual Agreement:** Many express concern about how the contract documents apportion risk. Being asked to assume risks they believe belong with the owner will lead some firms to decide not to pursue a project.

- **Internal Resources:** Some measure how the project will tax their internal resources and whether they can staff the project sufficiently.

- **Labor Issues:** Availability of labor is a very common risk factor. For union contractors performing public projects, having a relationship with the regional union organizations was considered important in terms of mitigating this risk.
Opinions of Risk Experts CONTINUED

- **Requirements and Restrictions:** A thorough knowledge of all requirements, such as bonding, errors and omissions insurance, and mandated green standards, is critical to minimize risk when dealing with the public sector, especially the federal government. One contractor explains that lack of experience with a government owner can lead to very costly omissions.

**DIFFICULT RISKS TO QUANTIFY**

Despite their best efforts to capture the risks with the biggest impacts, which a few referred to as the “known unknowns,” the “unknown unknowns” can create a major impact on the project as it moves forward. Several experts point out that keeping as many elements as possible from falling into this category is critical to risk mitigation. As one states: “The only thing you can do is minimize [the unknown unknowns] through a robust estimating and risk review process.”

Despite that goal, several factors can lead to the creation of more unknown unknowns:

- **Incomplete Design:** One factor that can exacerbate the risk of unknown unknowns is to expect the GC or CM to begin a project when design has not been completed.

- **The Economy:** While certain fluctuations can be anticipated, the recent decline has led to increased concerns about the impact of the economy, including uncertain project funding, market cycles during long-term construction projects possibly leading to unexpected inflation, labor shortages and reduced margins.

- **Unforeseen Site Conditions:** In addition to unexpected soil conditions, unforeseen site conditions can include the discovery of hazardous materials or an old cemetery. For most contractors, this issue can only be mitigated through strong contract documents which place this risk with the owner.

**Risk Assessment and Mitigation Procedures**

Rigorous risk assessment and mitigation procedures typically begin early in the project lifecycle and often involve metrics for tracking performance against risks. Most of the experts have rigorous risk assessment and mitigation procedures in place in their companies. Some of the largest firms state that their organization takes a scalable approach to tackling the issue of risk, in which the degree of effort and time invested in risk assessment is determined by the size and complexity of the project. One describes how they only conduct a full quantitative analysis involving simulations and forecasting on the most complex projects, but that they still evaluate the probability and impact of typical risks on their simpler projects. The limits to scalability, however, are pointed out by one respondent from an engineering and construction firm, who states, “A $3 million job could create a $10 million liability.”

**Risk Management by Project Stage**

The owners, public and private, describe the majority of their risk assessment occurring during the first go/no go decision point. They then track those risks and how they perform through the rest of the project lifecycle. One large public owner points out that risk evolves through the project stages from more general considerations to ones that are better defined. Another describes how their process for evaluating the feasibility of their projects mirrors the evolution of risk through the project lifecycle as they first consider the business perspective, then review the environmental and political risks, then assess the design risks and finally evaluate the construction risks. A large private owner affirms that after early consideration of many risk factors, they “convert [their] assumptions to reality” as the project progresses, and as a result, the risk posed by their work lessens as the project advances.

Contractors also place value on early risk assessment, although those who largely work on competitively bid infrastructure projects caution that, until they determine that they are likely to win a bid, they cannot devote significant resources to risk analysis. Bidding or submitting proposals is a resource-intensive activity, and many contractors state that determining their chance of winning the bid takes priority. However, they also report their need to price risk effectively in the bid process. Contractors, even more than owners, report that their approach to risk changes through the lifecycle of the project.

**Risk Assessment at the Go/No Go Stage**

Most firms adopt a formal review process at this stage using a list of typical, known risks to evaluate the specific challenges the new project poses. These risk registers can include well over one hundred risks to be evaluated, but these risks are...
Opinions of Risk Experts CONTINUED

**FACTORS THAT INCREASE THE RISK OF LITIGATION**

- **Firms prone to litigious behavior:** This factor was cited the most by respondents. Owners typically report trying to avoid contractors with a litigious reputation, and contractors report evaluating owners based on their history of litigation. Selecting the right team is a critical strategy for avoiding litigation.
- **An unclear defined scope of work:** Related issues include ambiguous project or contract documents.
- **Lack of familiarity with other team members:** This can lead to misunderstandings. One contractor compared this to “getting married after dating someone for a week.”
- **Insufficient project funding**
- **Ownership structure with multiple partners**
- **Certain project types:** Bridges have less schedule flexibility than other infrastructure types. Litigation of condominium projects is also more common than in other general building types.

not equal in importance. One firm reports that at the end of their process, typically about a dozen risks are identified as significant. Methods of evaluating these risks vary among the respondents—some use a more free-form evaluation by the project team while others use formal tools that assign a score to each risk.

For some, this assessment list is drawn, at least in part, from their experiences with previous projects. One engineering and construction firm describes how their completed projects are evaluated and risk factors are drawn from that evaluation to form a “watch list for risk predictors.” Most describe how mitigation strategies are provided for all of the most serious risks, and these formal documents are often reviewed, not just by the project team, but by other functions within their company, including senior management, finance, and, in some cases, legal.

**RISK ASSESSMENT AFTER PROJECT IS IN PROGRESS**

Once the original risk assessment is completed and a project begins, the key to successful risk assessment and mitigation is to engage in regular reviews of the project to assess the mitigation of risks previously identified and the appearance of new, unexpected risks. Nearly all the firms that engage in this activity report doing it at least quarterly. In addition to performing these risk assessments, one describes doing gap analyses on a regular basis that assess profit recognition and how much reserve is released on a regular basis.

For some of the respondents, senior management remains engaged throughout the lifecycle of the project. One engineering and construction firm has their CEO, CFO and chief legal officers do a deep dive on risk on all of their major projects twice a year, where they devote more than a day to examining how risk is being managed on the project.

**METRICS**

Nearly all those interviewed track costs and schedules. However, one public owner cautions that comparing these to the original estimates can reflect issues with the original estimates as much as an indication of actual issues with the project. Another reports that in addition to tracking their own performance, they benchmark that performance against other agencies.

**Performance Metrics Beyond Cost and Schedule**

**Owners**

- Decision latency: The delay before a decision is made can be a useful metric when examined both by how long the delays are and by how frequently delays occur
- Change orders across multiple contracts

**Contractors/Engineering and Construction Firms**

- Safety
- Labor utilization and productivity
- Cash management (net cash compared to gross profit)
- Profitability
- Comparison of self-performed work to subcontracted work
- Materials used

**Litigation**

There is general agreement that the best approach to litigation is avoiding it if possible. The respondents agree that litigation has a large impact on the construction industry. The most common theme to emerge, however, is that most respondents avoid allowing issues that arise on their projects to get to the point of claims and disputes. A few observe that once an issue devolves that far, they can lose control and/or face high costs. One contractor states that litigation “ties up our resources, our people, and it is a no-win situation” for any of the parties involved. A public owner agrees that early resolution of issues
Opinions of Risk Experts  

Continued

to resolve potential disputes is “key to keeping project costs down.” Only those whose work is primarily publicly bid projects seem to accept litigation as a normal part of doing business.

Another reason mentioned by a major design firm to avoid litigation is the negative impact it can have on a firm’s reputation, potentially decreasing its chances of gaining new business on top of the losses involved directly in the case.

Strategies for Reducing the Likelihood of Litigation

• Use a team approach, whether derived from greater collaboration, or a formal design-build or integrated project delivery contract.
• Create contract documents with clearly and reasonably apportioned risks.
• Conduct a constructability review on project documents before bidding a project.
• Conduct a quantitative risk analysis early.
• Resolve problems “at the lowest level possible.” When an issue arises, the most effective approach is to have those with the greatest familiarity resolve them.
• For issues that cannot be resolved at the lowest level, have a plan in place for the resolution process.

Strategies and Best Practices for Mitigating Construction Risk

A few broad strategies and best practices emerged about how to best mitigate risk in construction.

Level of Detail

One owner reported the need to “separate each risk into its component pieces at a level that is actionable.” If analysis stays at a high level, it becomes difficult to accurately measure potential and actual impacts of risks. Construction projects involve merging many different requirements for labor and materials, and this level of complexity and interdependence of different elements requires risk analysis to delve into the details.

Communication, Transparency and Accurate Reporting

Communication underlies many of the strategies discussed by the respondents, including communication between different departments, formalized review procedures, and clear lines of communication between all the major players on the project to help resolve issues before they turn into disputes.

A key part of that communication is a transparent assessment of true conditions and concerns on a project. This means ensuring all parties involved in the project recognize that reporting issues as quickly, fully and honestly as possible allows the entire team to help address them. Communication is a critical tool to minimize the impacts of risks on a project, but fully transparent communication is difficult to achieve unless prioritizing risk mitigation has been incorporated into the culture of the firm.

Incorporating Risk Management into the Culture of the Firm

Several experts emphasized that risk assessment and mitigation cannot be overlaid onto an existing project team. Even in those firms that have separate positions devoted to analyzing risk, everyone—from workers in the field to the highest level of management—must consider risk as a regular part of their job function. One contractor compared their efforts to raise risk awareness in the field to their efforts to encourage a culture of safety in their organization. Others emphasize the need to engage management at the highest level in order to ensure that risk assessment is prioritized in their approach.

Collaboration

While strong communication is important to help mitigate risk, it functions best when joined with a collaborative approach to the project. Contractors involved in joint ventures note the benefit of having the partner’s estimation of the risks involved before taking on the project and sharing of the risk profile once the project has been won. Successful collaboration shifts the focus of the definition of success from the original firm to the project as a whole. It has the added benefit of also reducing the risk of litigation because, as one owner put it, “What are you going to litigate about when you are all on the same team? You don’t sue your own partners.” Several note that industry trends, such as design-build approaches in infrastructure projects and integrated project delivery in general building, are helping the industry to mitigate the risks inherent in construction.

Methodology

15 in-depth interviews were conducted by telephone in September 2011 with leading experts on risk mitigation from the following firm types:

• 6 engineering and construction firms
• 3 construction firms
• 1 construction consultant
• 1 design firm
• 4 owners
When reporting how they perceive the level of risk assessment adoption within their own groups, the respondents show no agreement on the level of adoption overall. In fact, there is even distribution among those who perceive low, medium and high levels of adoption. However, when examined by player type, important differences emerge.

**OWNERS**
Owners are split between low and high levels of adoption, with an average adoption level of 58%—the highest of any player.

- Exactly half believe 50% or less of owners have adopted formal risk assessment procedures.
- The other half report adoption by more than 75% of firms.

**A/E FIRMS**
Average adoption is 44%, spread across the spectrum.

- At the mid-point, 42% believe that 26%–50% of firms have formal assessment procedures.

Risk mitigation is not perceived to be widely adopted in the construction industry—43% believe that one quarter or less of the firms in their field use formal procedures.

**OWNERS**
Owners are almost evenly divided between those who think most owners are not doing formal risk mitigation and those who think that more than half are, with an average perceived adoption level of 40%.

- Exactly half (50%) believe one quarter or less of owners have formal risk mitigation procedures.
- On the other extreme, 40% of firms believe more than 50% of firms have mitigation procedures.

**A/E FIRMS**
Perception of adoption is relatively evenly distributed across the spectrum for A/E firms, indicating no agreement on overall use of formal mitigation procedures. Average adoption is 46%.

### Percentage of Firms with Formal Risk Assessment Procedures
(Estimated by Respondents)

- More than 75%: 36%
- 51%-75%: 29%
- 26%-50%: 26%
- 1%-25%: 9%

**CONSTRUCTION FIRMS**
Average adoption is 38%—the lowest of any player group, with a split between low and high levels.

- 58% report low levels of 1%–25% of firms.
- Yet one quarter report levels of 75% or more.

### Percentage of Firms with Formal Risk Mitigation Procedures
(Estimated by Respondents)

- More than 75%: 18%
- 51%-75%: 43%
- 26%-50%: 21%
- 1%-25%: 18%

**CONSTRUCTION FIRMS**
Construction firms report the lowest levels of adoption. Their reported average of only 35% is influenced by the half that believe that only 1%–25% have adopted such procedures.
Awareness and Adoption of Risk Evaluation Strategies

While the respondents had a mixed response to adoption of risk assessment procedures for the industry at large, their own levels of awareness and adoption of specific strategies is very high. **Over three quarters have used all of the strategies included in the survey.**

One factor that may account for this disparity is that all respondents for the survey have been involved in at least one infrastructure project valued at $100 million or more. Over one third (37%) of the respondents had projects valued at $1 billion or more. In order to be competitive on high-value projects, a more rigorous approach to risk is essential. This investment in risk evaluation is reinforced by the 91% of respondents that report having experts on risk assessment in their firms.

**Variations by Player**

**OWNERS**

All of the owners surveyed indicate that they are aware of, are using and will use formal brainstorming with their team. In addition, all of the owners are aware of and using expert input from external sources. However, a slightly lower percentage (91%) plan to use external resources in the future. This drop could be due to a few factors, including budgetary concerns and increasing internal expertise.

**A/E FIRMS**

A lower percentage of these firms indicate that they are aware of external resources for risk management as compared to the other players. The percentage of those aware of these resources (75%) was the same percentage as those using them now or planning to use them in the next three years. This suggests that greater awareness of the resources available could encourage greater use of outside resources for this segment.

**CONSTRUCTION FIRMS**

All of the construction firms used input from internal experts and plan to do so in the future. For external resources, however, while their awareness was high (92%), only 75% are using or plan to use these resources. These firms also indicated two other strategies in addition to the list presented them:

- Using partners’ risk assessments
- Gaining third-party reviews

These strategies were also mentioned by participants in the in-depth interviews (see page 19).
Risk evaluation by A/E firms is concentrated in the pre-design and design phases, while risk evaluation by construction firms is concentrated in the bidding/negotiating and construction phases. This finding conforms with the typical level of firm involvement in a traditional design-bid-build project. It also confirms that these firms do pay strict attention to evaluating risk before committing to a project.

Risk evaluation for owners is far more concentrated in design than in the pre-design, bidding or construction phases. This suggests that owners rely on information provided during the design stages for much of their risk evaluation. It also may reflect the owners’ typical practice of holding contractors contractually responsible for much of the risk once construction is underway.

The use of integrated teams is one strategy that might alter the stage at which players become involved in risk evaluation. By its nature, an integrated team brings all players into the project at the outset, which could lead to design decisions that reduce risk and less expensive mitigation strategies.

### Stages at Which Firms Evaluate Risk

<table>
<thead>
<tr>
<th>Stage</th>
<th>A/E Firms</th>
<th>Construction Firms</th>
<th>Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Design</td>
<td>92%</td>
<td>42%</td>
<td>64%</td>
</tr>
<tr>
<td>Design</td>
<td>91%</td>
<td>50%</td>
<td>92%</td>
</tr>
<tr>
<td>Bidding/Negotiating</td>
<td>100%</td>
<td>73%</td>
<td>100%</td>
</tr>
<tr>
<td>Construction</td>
<td>83%</td>
<td>73%</td>
<td>73%</td>
</tr>
</tbody>
</table>
The awareness and adoption levels of risk mitigation strategies are also very high among all respondents.

- Over 90% of respondents (on average) are familiar with contingency planning and developing a plan to manage risk and will use these strategies in the next three years. For these high-level adopters, planning their strategy is the most consistently adopted approach.

- Over three quarters are currently doing risk prioritization and holding regular risk meetings with the full project team. These levels will stay essentially the same in the next three years. Risk prioritization is critical to assess what resources to devote to mitigation. Regular risk meetings of the full project team demonstrate a strong commitment by the firm to prioritizing risk overall.

- The areas with the greatest gap between awareness and use are tracking risk metrics across projects and using special teams, indicating a lack of industry agreement about these approaches.

  - Risk metrics across projects: Even among firms with relatively sophisticated approaches to risk, the metrics used to measure risk performance often only apply to specific projects.
  
  - Using special teams: Some argue that risk management is best handled within the project teams while others believe having staff devoted to risk mitigation improves their outcomes. Also, creation of special teams requires additional resources to be dedicated to risk. Given the current economy, firms may avoid strategies that require up-front investment.

Variation by Player

OWNERS
A lower percentage of owners have adopted several mitigation strategies compared to other players. This contrasts with their strong levels of adoption of risk assessment and suggests that some owners may choose to put the responsibility on other team members.

CONSTRUCTION FIRMS
In contrast, construction firms have a high level of adoption across nearly all mitigation strategies. They have the highest adoption levels for developing a plan to mitigate risk and holding regular risk meetings with full project teams. While risk assessment takes priority for them in the pre-construction phases, risk mitigation becomes critical during construction, so the high level of activity by construction firms is consistent with their role on projects.

Variation by Firm Size
A higher percentage of companies with an annual revenue over $500 million report adopting several risk mitigation strategies as compared to companies with revenues under $500 million. Companies with higher revenues are more likely to be involved in large, complex projects, creating a greater need for a wide range of risk mitigation strategies. Additionally, they may have more resources to dedicate to risk mitigation approaches.
Awareness and Adoption of Tools and Technologies for Risk Assessment and Mitigation

Despite the high levels of risk assessment and mitigation strategy adoption, only a medium level of tool adoption is reported by the industry. The most commonly used tool is off-the-shelf software, but it is used by 55% of respondents—significantly less than most strategies for risk assessment or mitigation (see pages 25 and 27). 17% report using no tools at all.

In the in-depth interviews, a few experts observed that the experience and knowledge of the risk assessment and mitigation team is much more important than the tools they use (see page 19).

**STATISTICAL MODELING**

Even firms that employ statistical modeling typically do so only on the largest and most complex projects. Therefore, the adoption levels reported by this group—all of whom have worked on large, complex infrastructure projects—may not reflect the overall adoption in the industry.

Monte Carlo simulation is a common approach to statistical modeling because it allows for uncertainty in the inputs and can present a range of probabilities rather than a deterministic picture. This is critical in risk assessment, in which risks need to be judged based on their likely probability as well as their likely impacts. Monte Carlo simulations allow for a large series of probable scenarios to be analyzed in order to better understand risk in complex situations.

**OFF-THE-SHELF SOFTWARE**

The kinds of off-the-shelf software used include programs specifically designed for risk analysis and more general project management software.

**Variation by Player**

**A/E FIRMS**

In all categories, A/E firms are the biggest adopters of the tools. In fact, almost three quarters report using statistical modeling tools, although that figure drops closer to two thirds when they consider the future. Again, this may be influenced by the size and complexity of the projects they anticipate working on in the next three years, in addition to their response to the effectiveness of the tools themselves.

**CONSTRUCTION FIRMS**

Only a small percentage of contractors (20%) report using or planning to use statistical modeling tools. Since these tools are typically used for risk assessment during the pre-design and design phases, this low level of adoption is likely due to greater contractor involvement in the late design and construction phases of projects.
Increasing Safety in a Tough Economy

“Doing more with less” is a familiar mantra today. Contractors, in particular, are trying to address safety concerns in the face of a difficult economy and increased government enforcement. In order to truly make their job sites safer, they are involving the subcontractors they hire in their safety efforts.

Most reputable contractors promote safety as a core value, but in a down economy, that mission can be challenged. Risk management and safety professionals see concern in the industry about how to maintain safety in a business environment where staff is expected to do more with less.

Doing More with Less
Billy Miller, risk engineering chief construction officer at Zurich, says the number one issue discussed with clients is how to cover more exposure with fewer people.

In some cases, contractors may be using fewer laborers or tradespeople to complete tasks than in the past.

“We see people asking things like, ‘How many laborers do you need to move material from one spot to another?’ and ‘Can you get by with less and still be safe?’” he says.

“Maybe you can work with suppliers about how to stage materials better to help employees manage them. How you man jobs is coming under more scrutiny, and that feeds into safety concerns.”

In response, Miller says, customers are asking carriers for more services to help them train staff on these issues. “In some cases, they have fewer people than they need to figure out how to solve these problems,” he adds.

Safety Staff
Another key concern in the construction risk management arena is the role of safety staff. Paul Becker, construction practice leader at Willis, North America, says he is uneasy about the trend among some contractors to give quality control and quality assurance duties to safety staff. In addition to helping stretch dollars, the trend reflects efforts to address increasing concerns about construction defects.

“We see it more and more,” he says. “Contractors want to better address quality control and quality assurance, but the problem is that these are not QC guys—they are fundamentally life and safety people. Their backgrounds and training have always been about worker safety, proper controls and crisis management. If you ask them to do QA/QC, they often have to be retrained. They are stretched.”

Subcontractors
In light of those issues, some contractors are focusing more intensely on subcontractor safety. Gary Amsinger, vice president of safety at McCarthy Building, says the company has changed its safety practices considerably and introduced new guidelines for subcontractors five years ago. During the economic downturn, he says, the company has put even more emphasis on those policies.

“Years ago, when you [as a contractor] hired a sub, you worried about your guys and they worried about theirs,” he says. “That’s not the approach we take anymore. We’re working on educating them more. They could do something to impact anyone on the job site.”

McCarthy’s requirements in its subcontract agreements include task hazard analysis. The company also requires regular reporting of its subcontractors’ incident rates.

“A lot of subcontractors aren’t used to this level of scrutiny, but when they are finished with our jobs and they see how it reduces their workers’ compensation, they are happy to adopt it,” he says.

Government Enforcement
At the same time that some contractors are trying to stay on top of safety through a tough market, government enforcement of safety has changed.

Scott Trethewey, executive vice president of risk management and finance at Moss & Associates, notes that under the Obama administration, the Occupational Safety and Health Administration (OSHA) has changed its approach to safety enforcement.

“They have moved from a collaborative approach to an enforcement approach,” he says, noting that OSHA has allowed several of its cooperative Voluntary Protection Programs to expire.

“OSHA is in the business of enforcement. The penalties for violations have escalated. They have gone on the offensive at a time when people are already stretched.”
Use of External Advisory Groups or Consultants to Help Manage Risk

54% of the firms surveyed engaged an external advisory group or consultant to manage risk for an infrastructure project in the last five years. External experts can provide a wide range of services for a project, including performing independent risk estimates, helping engage and coordinate multiple stakeholders, and providing critical insight and knowledge to support a firm that is venturing into a type of construction or geographical area in which it lacks experience.

The in-depth interviews with risk experts reveal that, for the most part, firms hire external advisors to help manage risk on a project-by-project basis, rather than as a regular course of action (see page 19).

Variation by Player

OWNERS
At 45%, owners report the lowest rate of using outside expertise compared to other players. When they do engage advisors or consultants, they most often do so in the design and bidding/negotiating phases of the project. These findings confirm the general trend that owners are more concerned about assessment in the early stages of a project than mitigation throughout the rest of the project lifecycle.

A/E FIRMS
Half the A/E firms report hiring an external advisory group to help manage risk. Nearly all who seek outside expertise do so in the pre-design stages, although they have relatively high rates for using external firms throughout the construction life cycle. Reported use level by project stage include:
- Pre-Design—83%
- Design—67%
- Bidding/Negotiating—50%
- Construction—50%
- Throughout the Project Lifecycle—33%
- Post-Construction—17%

CONSTRUCTION FIRMS
Contractors are most likely to engage external help, with 67% affirming that they have done so. The project stage at which they are least likely to seek outside help is bidding/negotiating (25%)—significantly less than during pre-design/design (38%) or during construction and post-construction (50%).

Given the importance of the bidding/negotiating stage to these players, this result is surprising and may be attributed to the concern about investing in risk assessment or mitigation until they have been awarded the project.

Cost Savings
71% of the firms who engaged an external advisory group or consultant found that doing so resulted in cost savings. The average cost savings they experienced is 5% of the total project cost. Given the size of the projects undertaken by the respondents to this survey, this translates into millions of dollars in savings for all of those who report cost saving benefits.
The owners surveyed set an average contingency of 9% when their projects are released for bids. However, even with a very limited sample size, these results indicate that the contingency set by owners is not consistent. 18% report that they do not set a contingency at all, and another 18% report setting a contingency of 20%-25%. No respondents report set aside a contingency of more than 25%.

Familiarity with the type of work proposed or the firms involved in bidding, as well as past experiences in general, may impact the level of contingency an owner deems necessary. Contingencies serve as a way to pay for risk, and this variation among the small group of owners demonstrates that their appetite for paying for the risks inherent in their projects varies.

Nearly all of the owners (91%) report that they vary their contingency by contract type. The contract type influences the amount of risk borne by the owner, and it also can encourage practices that minimize risk like collaboration.

**DESIGN-BID-BUILD**
Respondents report an average contingency of 20% for design-bid-build projects. Traditional design-bid-build can result in an adversarial relationship between the key players on the project, reducing vital communication about risks and the willingness to work with other stakeholders to mitigate them. It also leaves the owner more contractually exposed to risk than a design-build or construction manager at-risk approach.

**DESIGN-BUILD**
Respondents report an average contingency of 16% for design-build projects. Design-build projects can reduce risk by providing the contractor with flexibility. They can also reduce owner liability. For an example of a project in which a design-build approach significantly reduced risk, see the case study on the Pentagon renovation on page 32.

**CONSTRUCTION MANAGER AT-RISK**
Respondents report an average contingency of 7% for construction manager at-risk projects. Construction manager at-risk contracts typically have a guaranteed maximum price, which pushes the risk of cost overruns onto the construction manager rather than the owner. This pricing approach may lessen the need for a contingency.
The initial schedule for the renovation of the Pentagon Wedges 2 through 5 was 12 years. However, from the moment the design-build contract was awarded to Hensel Phelps two days after September 11, 2001, the project schedule, budget and scope of work were thrown into chaos. Despite that and other significant challenges, the project was eventually completed 14 months ahead of schedule and $100 million under budget. These successes are due to the way that the project team was selected, incentivized and engaged throughout the project, a strategy developed from the start to help deal with risk.

**Decision to Use Design-Build**

Diana Hoag, the contracting officer and deputy project manager for Wedges 2 through 5, states that, until PENREN undertook this project, “the organization had never done design-build.”

The approach to the project was initiated by Lee Evey, the program manager who originally joined the project for the Wedge 1 renovation. He explains why he wanted a new approach for Wedges 2 through 5: “When I came into the program, there was several hundred million dollars of work being done in the basement and mezzanine areas. The projects were all behind schedule and over budget. The customers, in the areas we were beginning to turn over, hated what we were providing to them. Congress was threatening to cancel the program for poor performance.”

Evey came into the program with a background in acquisitions but no direct experience with construction. In his efforts to understand how to proceed, he realized that in construction, cost and schedule overruns are considered the norm. He also faulted traditional contracts with too much attention on what goes wrong and too little attention on how to award strong performance. With these issues in mind, he decided to take a different approach to contracting the remainder of the project.

Hoag explains that before selecting a design-build approach for over $1 billion of work, she and Evey beta-tested the approach on two smaller projects within their program portfolio. “In both cases, the results were overwhelmingly positive: the projects were ahead of schedule, they were under budget, and customer satisfaction was through the roof.” With those successes to guide them, they prepared a Request For Proposal (RFP) for Wedges 2 through 5 as one large design-build contract.

**Writing the Right Contract**

Evey determined that contracts “are not a resolution for risk” in construction projects. Instead, he believed the most important element is to “hire a good team, set up a system to reward teams if they achieve your goals ... and express your goals clearly and simply.”

Instead of creating typical bid documents totalling several thousand pages as they had for...
the first Wedge, the owner’s team put together a 16-page RFP. Evey explains, “Instead of giving all these elaborate design drawings, specs and standards that tried to foreordain the future, we just communicated what our requirements were.”

John Saul, the operations manager for Hensel Phelps Construction Co., the design-build firm that eventually won the contract, called the RFP “pretty unique ... It was built around establishing a relationship and processes. It was really simple.” He states that the contract they were eventually awarded “gave us a lot of latitude to be innovative.”

Much of that flexibility came from the structure of the contract. As Hoag states, “We used a very performance-based contract to give the design-builder enough flexibility to deal with risks that materialize and unexpected events.” That flexibility was accompanied by two incentives designed to encourage the design-builder to make decisions with the best interest of the project in mind. First, the contract included an award fee that allowed the design-builder a profit margin of up to 10% if it met the goals outlined in the documents consistently. Hoag describes the purpose of this section as incentivizing “subjective behaviors” because the design-builder would be judged on how well it achieved the goals of customer satisfaction, safety, quality, cost avoidance and schedule management.

In addition to the award fee, the contract documents included an additional cost incentive, whereby the design-build team could share in the cost savings they were able to achieve, as long as they also were consistently achieving strong marks in the subjective measures covered in the award fee. Also, the owner would share in the burden of any cost overruns if the rest of the contractor performance was consistently strong.

Hoag explains the benefits of this approach: “As opposed to a low-bid competition that results in a lump sum contract where [the contractor] is basically out to protect themselves from losing money on the first day that they begin the project, we used a sharing arrangement that we thought more equitably allocated the risks of the project; we were willing to share in the overruns as well as underruns. We set up a very generous potential profit, but we told them overtly, if you want to maximize, you have to align your goals with ours.”

Incorporating Risk Management into the Contractor Selection Process

When Hoag joined the Pentagon renovation team, she brought a history of rigorous risk management from her previous work in procurement around the development and production of weapons systems. She applied that experience by developing a risk assessment for the owner’s project team.

In addition to having the owner’s team assess the risk involved in Wedges 2 through 5, she also put together a second risk assessment based on the input of firms identified as likely bidders on the RFP, using a computer system that allowed them to give input anonymously. Hoag reports that the result of these risk assessments was to “create a statement of objectives, based on where we thought the most risks were with the project. Then we used those objectives to guide the way that we selected the evaluation factors for the competition.”

The selection process also included an unconventional approach to evaluating the best team for the job, especially the proposed project manager. Typically, an RFP will describe the characteristics of a good candidate for that role. Instead, Evey explains, the RFP described the characteristics of the project and asked the firms competing for the project to explain why their choice...
of a project manager was the ideal person to meet those requirements. He reports, “Interestingly, project managers were proposed that in some cases we would never have seen,” and he believes that the candidates identified were a “significant factor for consideration in the award.”

In the end, the ability to take advantage of the flexibility offered by the contract to innovate was a major factor in the final contractor selection. Hoag describes how they cautioned the bidders that “this contract is supposed to go for 10 years; nobody can predict what it is going to be like next year.” With the selection of Hensel Phelps, she was confident that they had found “a design-build partner that could roll with the punches.”

**Risk Management through the Construction Process**

When the airplane struck the Pentagon two days before the contract was awarded, it turned out that flexibility was critical. Not only was there new work because of the damage, but soon Congress requested that the project be accelerated to 10 years rather than the original 12. Hoag describes the experience as chaotic: “Instead of starting off on this very well-planned and very methodically placed contract, we immediately started thinking about how we could change it.”

Saul explains that Hensel Phelps had originally planned to do one wedge at a time, but to make the reduced project schedule and increased scope of work viable, they resequenced the job to be 17 overlapping phases. This approach created immense programming challenges, which Hensel Phelps tackled by taking ownership of all programming aspects before the work began. “We had a million square feet under construction at any one time,” says Saul, “and our job was to build that space to the needs of the tenants but at the same time remain invisible” to avoid disrupting the work at the Pentagon during the construction period.

For him, one critical strategy was for Hensel Phelps to get actively involved in redistributing the tenants while spaces were under construction. He explains that for every half million square feet they worked on, “there could be 4,000 people that needed to be relocated.” In order to maintain their aggressive schedule, they devoted time and resources to make sure they could account for the relocation of all the current occupants before starting a new section.

During construction, the reviews created because of the award fee incentives proved highly valuable. Evey argues that the monthly reviews were critical to keep the owner team highly engaged. Saul states that what really impressed him was “that they didn’t just grade us. They would say that these are our strengths, weaknesses and recommendations for improvement ... You got constant feedback from the customer on how they felt you were managing the project, and based on that, we would make course corrections.” He credits the combination of the flexibility allowed by the contract with the steady owner feedback as key to the project’s success in managing risk, stating that the award fee system made them “highly incentivized to make the right decisions that were in the best interest of the job.”

Other strategies employed by Hensel Phelps to manage risk included surveying tenants after they moved into the space so that they could increase customer satisfaction on later parts of the job. In fact, one benefit they derived from being engaged in the full 10-year contract was the ability to learn lessons as the project advanced. Saul affirms, “We built Wedge 5 faster than any of the others because of all the lessons learned.”

---

**Project Facts and Figures**

<table>
<thead>
<tr>
<th>Owner</th>
<th>PENREN / Washington Headquarter Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design-Build Firm</td>
<td>Hensel Phelps Construction Co.</td>
</tr>
<tr>
<td>Architect</td>
<td>Shalom Baranes Associates</td>
</tr>
<tr>
<td>Design/Build Contractors</td>
<td>Electrical: M.C. Dean</td>
</tr>
<tr>
<td></td>
<td>Mechanical: Southland</td>
</tr>
<tr>
<td></td>
<td>Fire Protection: National Fire Protection</td>
</tr>
<tr>
<td>Interior Designer</td>
<td>Studio Architecture</td>
</tr>
<tr>
<td>Sustainability Consultant</td>
<td>Heller &amp; Metzger</td>
</tr>
<tr>
<td>Total Square Feet</td>
<td>4,500,000</td>
</tr>
<tr>
<td>Project Cost</td>
<td>$1,667,000,000</td>
</tr>
<tr>
<td>Construction Start Date</td>
<td>September 14, 2001</td>
</tr>
<tr>
<td>Completion Date</td>
<td>February 11, 2011</td>
</tr>
</tbody>
</table>
Mitigation of Risk in Construction: Strategies for Reducing Risk and Maximizing Profitability

Data: Triggers, Obstacles and Influencers for Investment in Risk Management Practices

There is no single factor in the marketplace currently driving the adoption of risk management practices. Two thirds of the respondents indicate that all eight triggers listed in the survey have at least some impact on a firm’s investment in risk mitigation. Construction risk is highly complex, influenced by internal and external factors, practices and contracts. It impacts project cost, schedule and quality, as well as firm reputation. Therefore, it is not surprising that firms would be influenced in their adoption of risk management practices by a broad range of triggers.

The trigger that has the greatest overall impact and the trigger that has the most significant impact both demonstrate the importance of controlling costs.

■ Largest Overall Impact: Need for Greater Project Profitability in a Down Economy (80%)
  • With projects becoming increasingly competitive, many firms need to shave their profit margins to win work and can no longer afford to pay for risk through insurance or higher costs rather than by investing in mitigation.
  • This factor is considered to have more impact by A/E and construction firms than it is by owners.

■ Most Significant Impact: Increased Litigation Cost (71%)
  • Litigation is expensive for all parties involved, from the time it costs the project teams to the impact on a firm’s reputation.
  • This is considered a key driver by all three player groups.

Variation by Player

OWNERS
Owners are most influenced by external pressures and availability of risk mitigation expertise. Two of the most influential drivers for owners are greater availability of experts/consultants/personnel that specialize in risk management, and demand for transparency on high-value projects. Owners feel that public pressure for greater transparency is driving their adoption of risk management, and they feel they need greater expertise to manage this challenge.

A/E FIRMS
A/E firms are most influenced by internal factors. Important triggers for A/E firms include more availability of experts/consultants/personnel that specialize in risk management, presence of an internal champion, and greater availability of tools and technologies for risk management. This suggest that A/E firms think the industry sees the need for risk management but that more knowledge and better internal practices to encourage greater adoption are required.

CONSTRUCTION FIRMS
Construction firms are influenced most by pressure to adopt risk management practices. They report that external pressure and internal firm leadership would have the most impact on the industry adopting higher levels of risk mitigation strategies. The largest percentage of them select the need for an internal champion and the demand for greater transparency as having a high impact on risk management adoption in the industry.
Obstacles to the Adoption of Risk Management Practices

The top four obstacles reported by over 70% of respondents reflect two major impediments to greater risk management in the construction industry—insufficient information and the perceived economic viability of investment in mitigation.

**Insufficient Information**
There are two types of knowledge necessary to mitigate risk—what risks you face and what you can do about them.

- **Lack of Information between Partners and Clients**
  Risk assessment and mitigation is impossible without accurate, complete and timely information, even if that information reveals mistakes or flaws in the project management by the team or the client. Cooperation is also important to gain sufficient knowledge and flexibility to mitigate risks.

- **Lack of Knowledge about Risk Mitigation Strategies**
  Even among the respondents to this survey who, due to their involvement with high-value infrastructure projects, have a relatively robust approach to risk management, risk assessment strategies are more widely adopted than risk mitigation ones. The industry still needs greater knowledge and expertise about how to manage risk.

- **Lack of Awareness about the Cost of Risk**
  In many ways, paying for risk is common practice, such as through insurance and contingencies. It is not necessarily common practice to view those costs as a business impact of risk. Also, without metrics gauging the impact of risk across projects, it is difficult to determine the exact cost a firm faces from its exposure to risk.

**Perceived Economic Viability**
Unless risk is fully understood and prioritized by a company, resources will not be provided for mitigation.

- **Greater Competition among Bidders**
  Identified as the most impactful by the largest percentage of respondents, this obstacle reflects the influence of difficult economic times with shrinking profit margins, where firms bidding on projects may view risk management as a luxury they cannot afford. Also, firms pushed to find profit may put factors like schedule and quality at risk, which may explain the high level of owner concern in this area.

---

### Obstacles to Risk Mitigation Adoption

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Some Impact</th>
<th>Large Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Cooperation/Information Flow Between Partners and Clients</td>
<td>37%</td>
<td>40%</td>
</tr>
<tr>
<td>Lack of Knowledge About Risk Mitigation Strategies</td>
<td>31%</td>
<td>43%</td>
</tr>
<tr>
<td>Greater Competition Among Bidders</td>
<td>17%</td>
<td>54%</td>
</tr>
<tr>
<td>Lack of Awareness about the Cost of Risk</td>
<td>31%</td>
<td>40%</td>
</tr>
<tr>
<td>Lack of Construction Industry Investment in Risk Management</td>
<td>23%</td>
<td>43%</td>
</tr>
<tr>
<td>Excluding Risk Factors That Challenge Project Viability</td>
<td>29%</td>
<td>37%</td>
</tr>
<tr>
<td>Firm/Client Culture Does Not Embrace Risk Management</td>
<td>29%</td>
<td>31%</td>
</tr>
<tr>
<td>Lack of Established Industry Risk Management Standards</td>
<td>20%</td>
<td>34%</td>
</tr>
</tbody>
</table>

---

**Variation By Player**

**A/E FIRMS**
The top risks for A/E firms all reflect concerns about sufficient knowledge—Lack of awareness about the cost of risk (58%), lack of established industry standards for evaluating and managing risks (50%) and lack of knowledge about risk mitigation strategies (50%).

**CONSTRUCTION FIRMS**
The fact that 92% believe that greater competition among bidders is a major obstacle demonstrates their concerns over the impact of the economy. As they do with the triggers, contractors also see internal leadership being needed to increase involvement in higher levels of risk management. The only other category that over 50% find highly impactful is the lack of investment by firms in evaluating/managing risk.
Using Effective Risk Management to Increase Competitiveness
I-15 Corridor Reconstruction
UTAH COUNTY, UTAH

In order to be competitive for the design-build contract for the I-15 highway reconstruction in Utah, Fluor Enterprises and its partners promised the owner an aggressive schedule for completion, as well as minimal disruption to the flow of traffic. Their approach to risk management before the bid and during construction allowed them to make these commitments. As of early November 2011, the project was 70% complete, and their approach has helped them to achieve the ambitious goals they set.

**Formulating a Competitive Bid**

Instead of asking bidders to provide the lowest price, the Utah Department of Transportation (DOT) took an unusual approach to the bid. Mark Stevens, leader of Fluor’s corporate risk group, explains that the DOT provided its budget up front and asked bidders, “How much can you give us of what we want at that budget?” In response, instead of focusing on offering the lowest price, Fluor concentrated on delivering the highest level of performance possible for the owner. According to Tuhr Barnes, the project director of the I-15 project at Fluor, their competitive advantage came from two decisions with a high impact on project risk. First, Fluor offered to “maintain the same number of lanes during construction that were there prior to construction,” even though that was not included in the project requirements. In addition, they proposed an aggressive overall construction schedule, completing design and construction worth $1.1 billion dollars in under 36 months.

The entire bid team worked together to determine this strategy after a careful look at the risk involved in the project. Barnes points out that the project faced all the usual risks of a large design-build fast-track highway project, including schedule, productivity and execution risks. Moreover, once they determined that they wanted to deliver on the two high-performance items, many of those risks were heightened. Understanding what those risks entailed and knowing that they could devise strategies to mitigate them properly made it possible to submit the winning bid.

One strategy they employed during the bid process was having their three partners do independent estimates in their expertise areas. Stevens explains that the appropriate process is necessary for this approach to be effective: “If you have pre-specified the kind of breakdown that you want each party to utilize, you can see deviations and reconcile them.” He credits this process with helping Fluor to ensure that they accounted for the project’s major risks and, just as importantly, created opportunities to draw on the expertise of their partners to take a more efficient or better approach to elements of the project.

Aggressive scheduling on the project necessitated strategies such as working at night.

**Continued**
Mitigating Risk in the MOT Plan

Once they won the contract, Fluor had to execute effectively the maintenance of traffic (MOT) plan they had proposed. This element of their bid was of particular value to the owner because there is no practical detour for this route. However, once they won the contract, Barnes explains, “Failure to maintain our MOT plan would subject us to liquidated damages.”

Because they knew the exact budget they were working with during the bid, they were able to take the extra cost of keeping these traffic lanes open into account during the pre-bid process. That extra cost included providing temporary pavement and temporary bridge widenings so that traffic flow could continue with little interruption.

Mitigating the Aggressive Schedule Risks

According to Barnes, the firm had to plan for “inefficiencies caused by the accelerated nature of the schedule,” and include them in their bidding and early design process. Those inefficiencies included:

- **Labor:** The large field crew increased the number of inexperienced workers.
- **Equipment utilization:** They paid for extra, underutilized equipment to make sure that work could be completed on multiple sections at once without schedule impact.
- **Materials:** Materials were delivered at night to minimize the impact of traffic congestion.

In order to complete the project on the proposed schedule, many sections of the highway had to be under construction at once. “One of the comments we got repeatedly from the public,” Barnes explains, “was when this project started, [we] started everywhere ... You can see construction crews all the way up and down all 24 miles.” This required intensive efforts in initial stages of the project.

Fluor’s efforts to mitigate this risk were aided by the Utah DOT’s decision to lease office space that housed the design team, the construction team and the owner’s team in one location. Barnes credits that setup with improving their ability to get this complex project “organized and moving in the first six to nine weeks.” This assisted with timely decision making, which Barnes considers key to a successful design-build project.

Temporary lanes were added to avoid disrupting the flow of traffic during the project.

---

Project Facts and Figures

**Design-Build Team**

Fluor Enterprises (Team Leader)

Ames Construction Inc.

Ralph L. Wadsworth Construction Company, Inc.

Wadsworth Brothers Construction, Inc.

**Owner**

Utah Department of Transportation

**Type of Project**

Highway Reconstruction

**Size**

24 Miles

**Value**

$1.1 billion

**Construction Start**

January 2010

**Completion**

December 2012

Stats
At least 50% of all respondents report most major departments in their firm are involved with risk management. This includes eight different types of departments, including teams directly involved in the project, senior leadership and finance. This result demonstrates the importance of a wide range of input beyond the project team to best mitigate the impacts of risk. The varied perspectives are critical, as is buy-in from senior leadership.

**Variation by Player**

**OWNERS**
Key owner departments involved in risk management:
- Project Manager/Project Team Management: 91%
- Engineering Personnel/Team: 82%
- Director or Other Senior Management: 73%
- Architect/Design Personnel/Team: 73%

The high level of involvement reported by the A/E firms is consistent with the owners’ high level of engagement in risk planning during the design stage.

**A/E FIRMS**
The departments identified by the largest percentage:
- Project Management: 75%
- Engineering Personnel/Team: 75%
- Vice President/Division Head: 67%
- Architect/Design Personnel/Team: 67%

**CONSTRUCTION FIRMS**
Departments with the highest level of involvement:
- Project Management (100%)
- Vice President/Division Head (100%)
- C-Level (92%)
- Director or Other Senior Management (92%)
- Estimating Team (92%)

They are far less engaged with engineering or architect teams, suggesting they rely most on internal expertise.

---

**Key Influencers for Investment in Risk Assessment and Mitigation**

Project managers and firm leadership are the two biggest influencers for investment in risk mitigation for respondents at their firms—both selected by 80% as highly influential. Project managers have final responsibility for prioritizing risk management in their individual projects, while firm leadership determines the overall investment firms are willing to make in mitigation.

**Variation by Player**

- **A/E Firms**: Owner/clients are critical influencers for A/E firms in particular (selected by 83%).
- **Contractors**: The greatest influence by far is firm leadership (92%), while owners/clients are less critical (58%). This is consistent with the fact that contractors look inward for leadership on risk mitigation.
- **Owners**: A larger percentage of owners are influenced by the design team (64%) than by the general contractor (45%). Since the majority of risk assessment by owners is conducted during the design stages, it is logical that the A/E firms would carry more influence.

---

**Players with High Influence on Firm’s Risk Mitigation Investment**
(By Percentage of Respondents Who Find Them Influential)


- Project Manager: 80%
- Firm Leadership (CEO, CFO, etc.): 80%
- Owner/Client: 71%
- Design Team: 57%
- General Contractor: 35%
- Third-Party Consultants: 23%
Risk Management in the Health Care Sector

Constant change and the need for flexibility make managing the risk of constructing health care facilities particularly challenging.

Significant project complexities coupled with the ever-changing programmatic requirements of the industry cause health care facilities to rank among the most difficult building types to construct from a risk management perspective.

Programming and Construction Challenges
Delivering a state-of-the-art facility is a highly dynamic process. The health care industry steadily introduces new technologies and treatments that can change a hospital’s programmatic requirements. A major hospital project can take three to five years from planning to completion, during which time owner demands may change to ensure that the latest technologies are installed.

“Integration of technology in health care is the most challenging risk to manage,” says Christopher Beck, vice president of risk management at Turner Construction. “On a multiyear project, the most important thing is staying in tune with the client to deliver the facility they need at the delivery date. The facility they thought they needed in the beginning may not be the one they want at the end.”

For owners, mitigating those risks requires proper budgeting at the front end of the project coupled with a design that allows for flexibility, says Fred Campobasso, managing director of the health care real estate practice at Navigant Consulting.

“Budgets are very sensitive, but you have to balance that with flexibility,” he says. “You need to build universal spaces and grid structures that allow for different sets of procedures.”

For contractors, health care projects present a variety of challenges. Beyond standard MEP systems, hospitals typically house a broader range of systems, such as gas lines and additional IT infrastructure. All of these need to be tightly coordinated within available space.

Additionally, existing and neighboring facilities are a concern, says Bill Noonan, vice president of risk management at Structure Tone.

“In health care, you’re dealing with a project that is typically in, around or next to an occupied building,” he says. “Projects may be in or around buildings that house people whose immunity levels are lower. The standard of care has to be at an extremely high level.”

Insurance Programs
To help manage risk, consolidated wrap-up insurance programs are often used. It is not uncommon to see owner-controlled insurance programs (OCIPs) on health care projects, particularly among large owners with in-house design and construction staff.

“Really sophisticated owners understand the risks,” says Ed Littleton, vice president of risk management at Balfour Beatty Construction. “It’s typically not a one-off situation for them. We feel comfortable with an OCIP in that situation.”

However, some owners and insurers appear to favor contractor-controlled insurance programs these days, Noonan says.

“Underwriters seem to clearly prefer when the general contractor or construction manager is the sponsor, because they have day-to-day control of the project,” he says.

Joint Ventures
In recent years, many health care megaprojects requiring joint ventures have broken ground around the country. “That can add some complexity,” Beck says. “You’ve got to have clear partnering sessions to determine roles and responsibilities,” he says. “The risk resides in the quality of communication and role clarity.”

Mitigation Strategies
In light of the recession, program managers like Navigant keep a close eye on financials, Campobasso says. “You need to be vigilant about cash-flow-troubled suppliers and subcontractors,” he says. “These days, you need to sharpen your reporting and processes to avoid unnecessary risk.”

The move toward modularization (see MHC’s Prefabrication and Modularization SmartMarket Report) also helps project teams address risk, Beck says. Building elements, such as bathrooms, can be built as modular units in a controlled environment, which, he says, improves safety, accelerates schedules, provides uniformity and reduces product damage.

“Modular construction lowers the risk profile from a construction defect and safety standpoint,” he says.
Risk Management for Global Construction

**International work entails special risks and requires a more rigorous approach to manage them.**

With the recession still reducing construction opportunities in the U.S., companies are seeking opportunities abroad. Five experts on global construction risk reveal some best practices for working internationally, as well as insights into a few specific regions.

The five experts interviewed included George Pierson, CEO at Parsons Brinckerhoff; Mike Kirchner, deputy director of risk management, and Jody Debs, enterprise risk manager, at CH2M Hill; and Nicholas Pollard, COO EMEA & AsiaPac, and Michael Stokes, managing director MENA region, at the global construction practice at Navigant Consulting.

**Best Practices for Managing Risk When Working Abroad**

**NO BUSINESS AS USUAL**

Pollard states that firms must accept that, “if you just do things as normal, you won’t succeed.” Pierson cautions, “People underestimate the different systems, the different problems that they may encounter in a [new] jurisdiction.” He adds, “The worst mistake a company can make is to go to a new region and try to impose its [home] country’s business practices straight across.”

**FIND A GOOD LOCAL PARTNER**

All consider a good local partner essential to conducting international business. Debs even recommends going into a region as a subcontractor for the first time, “so you can have a chance to learn with someone who has been successful in that market.”

**DO YOUR DUE DILIGENCE**

It is critical to understand the business customs and requirements of the region you are in. Pierson says, “Every time I’ve seen a company be unsuccessful in a new region, it is generally because they didn’t do nearly enough homework to understand how business is done locally.”

Pollard points out that it is also essential to understand everyone you do business with—clients, suppliers, partners and funders.

**Middle East/North Africa**

The credit crunch is a major risk in this region. Stokes says, “There are still many of examples of projects stopping halfway along when clients realize that a project is no longer viable, or has run out of cash.” Debs and Stokes also caution that there may not be good avenues for dispute resolution if a firm ceases to be paid.

Stokes points out that culturally, a lack of transparency in business affairs is common, making due diligence challenging in this region.

The Arab Spring has also created unique challenges. Debs points out that this is an issue both for the safety of a firm’s employees and for “the status of your contracts.” Contracts in this region are typically with a government, so active projects may suddenly face a new government “that might not have the stability, the systems or the processes that the former government had.” For Debs, the situation warrants paying attention “on a daily basis to the changing dynamics of areas with a lot of unrest.”

The key to doing business in this region, according to Debs, is forming good relationships. “Frequently, relationships determine how [contracts] are enforced and how the project will be implemented, so you need to focus on long-standing and deep relationships.”

**China**

As with the Middle East, Pierson emphasizes the critical nature of establishing long-term relationships in China. He states, “Often, you need to attempt to work together several times before you actually do, in order to build the level of understanding and trust that can cross cultures.”

The other critical issue in China is avoiding corruption. According to Pierson, “China is one of those countries where one has to be quite careful about how one conducts business to make sure it is consistent with your own culture and ethics code.”

**Europe**

As with the Middle East, the economy and the stability of work are the largest issues currently in Europe. Pollard points out that, given the problems with the euro zone, there is “little appetite for investment.”

However, he states, there are also “odd glimmers of light where people are spending money,” such as the London Underground. However, intense competition for work leads to greater risk because, “in desperate times, people resort to desperate measures.”
Mitigation of Risk in Construction: Strategies for Reducing Risk and Maximizing Profitability

71% of respondents believe that using building information modeling software (BIM) will decrease risk on construction projects. Only 6% believe it will increase risk.

The Business Value of BIM SmartMarket Report demonstrated that using BIM improves project outcomes, reduces rework and increases project profitability. A project team working in BIM can reduce clashes, thus avoiding costly delays and improvised solutions on the job site. Using BIM also encourages a more detailed and extensive design process, which increases the likelihood of identifying and assessing risk during design. Inexpensive mitigation solutions can be determined better in the design phase than during construction. BIM use also helps with more accurate budget and schedule estimates for the project.

The Green BIM SmartMarket Report revealed that modeling tools in BIM help achieve better building performance, which is particularly important when a building is mandated to achieve sustainability goals.

Most experts on BIM believe that its greatest value is as a tool that helps integrated teams work more effectively on projects. See page 44 for more information on how integrated teams help decrease design risk.

Impact of BIM on Construction Project Risk

Impact of Public-Private Partnerships on Construction Project Risk

54% believe that using a public-private partnership (PPP) will decrease the risk faced by a construction project. PPPs for infrastructure projects involve private entities designing, constructing and/or operating major infrastructure assets owned by public agencies.

In the U.S., PPPs are a relatively well-established practice for water infrastructure, but they are still emerging as a practice for transportation infrastructure, such as highways, airports and ports. With a large portion of the U.S. transportation infrastructure aging and a strong need for new capacity, especially in dense urban areas, significant funds are needed to keep U.S. infrastructure functioning effectively. However, finding that funding is a challenge faced by the industry.

Concerns are especially high currently as critical transportation funding legislation has stalled in Congress, leaving an unclear portrait of future funding levels for infrastructure projects. This political gridlock at the federal level, combined with budget shortfalls at the state and local levels, is leaving most of the industry in doubt about the levels of future funding for infrastructure work.

PPPs have been proposed as one solution to the funding shortfall, with their ability to mobilize private capital. However, use of PPPs for transportation infrastructure has been bogged down in some regions by political concerns about the cost of allowing private investment in infrastructure, especially the fear of high tolls and fees. States like Texas have struggled with strong debates about the benefits and drawbacks of PPPs. This political debate may account for why a portion (20%) of the respondents consider PPPs to increase risk on construction projects.

Impact of Public-Private Partnerships on Construction Project Risk
Impact of Using Integrated Teams on Construction Project Risk

77% of respondents believe that using integrated teams on construction projects reduces risk. Integrated teams help address or eliminate several factors associated with risk in construction:

- **Design Completion**: An integrated team typically engages all major players during the design phases, resulting in a more complete design.

- **Better Communication**: Integrating the team helps ensure better communication among players. Transparent, accurate, and timely communication is an important best practice for reducing risk on construction projects.

- **Project-Focused versus Firm-Focused**: Proponents of integrated teams report that in a successful team, all members focus on how decisions impact the success of the project as a whole rather than just the component for which they are responsible. This not only decreases the risk of schedule delays and cost overruns, but it also allows for better resolution of issues before they become disputes.

- **Shared Liability**: When the integrated team approach is formalized into an integrated project delivery (IPD) contract, the team as a whole shares liability for the project. Even when that formal relationship does not exist, the increased involvement of all team members at all stages makes the members more liable for all components.

For more information on integrated project teams and collaboration, please see the sidebar article on page 44.
Concerns about productivity increases and cost savings, as well as the desire to improving building performance, have encouraged project teams to take an integrated approach to design and construction.

**Adopting an Integrated Design Process**

It is critical to engage key disciplines and stakeholders as early as possible in the project’s lifecycle to reap the benefits of a collaborative approach. Early participation allows the project to benefit from the expertise of the entire team when creating the initial design. More importantly, successful collaboration results in the team sharing the same vision and definition for the success of the project, from cost and schedule achievements to sustainability goals.

Collaboration is most effective when the participants prioritize what is in the best interest of the project as a whole rather than what is in the best interest of their individual firms. Some industry players report that convincing firms new to an integrated approach to adopt this mind-set is their biggest challenge.

Because the risks of the project are seen as risk shared by the team as a whole, most successful integrated design teams experience far fewer formal disputes than traditional project teams.

**Formal IPD Contracts**

Despite these benefits, some industry professionals think participants in this process are inadequately protected from risk. Traditional contracts typically assign specific risks to specific parties, assuming an adversarial relationship among the team members, and insurance companies underwrite the risks taken on by firms based on those assignments.

In order to reconceptualize the shared risk of integrated design, in 2010 the American Institute of Architects (AIA) and ConsensusDOCS introduced model Integrated Project Delivery (IPD) contracts. An evaluation of these documents in *Architectural Record* magazine raises questions about how well the documents protect the participants against potential claims. The article also questions the protection of intellectual property rights under these agreements and points out the challenges of finding insurance without a traditional contract.

Adoption of these documents has been limited, even on projects taking a collaborative approach. Precedents in the courts will be needed before the effectiveness of IPD contracts can be fully understood.

**Success Stories**

Case studies from previous McGraw-Hill Construction SmartMarket Reports demonstrate the benefits of adopting an integrated design process.

**SHANGHAI TOWER, CHINA**

The project featured a complicated dual façade. Because the consultants and curtain wall manufacturers were engaged early in the process, the façade became less costly and quicker to build than originally estimated. The design team also reported that their sustainability and performance goals were easier to achieve because they engaged the engineers and contractors early in the process.

**PALOMAR MEDICAL CENTER WEST, ESCONDIDO, CA**

The project team considered the BIM-enhanced integrated design process a green design process. They emphasized the importance of getting buy-in from the entire team on the sustainability goals. In addition, input from the steel subcontractor substantially changed a key design element, a long-span green roof with a rolling design, which saved time, money and raw materials.

**TEXAS HEALTH HARRIS METHODIST ALLIANCE HOSPITAL, FORT WORTH, TX**

An integrated approach allowed the project team to explore time- and money-saving opportunities, such as the use of prefabrication. Metrics tracked by the owner, Texas Health Resources, demonstrated that using an integrated team led to “more value, quicker work and fewer change orders.”

---

Managing Risk Through Effective Coordination
World Trade Center 2,3 and 4
NEW YORK, NEW YORK

The new World Trade Center office towers are part of a larger public-private partnership to rebuild the entire complex. Multiple stakeholders, including Silverstein Properties, the Port Authority of New York and New Jersey, the Metropolitan Transit Authority (MTA) and the Memorial Foundation, not only had to agree on a master plan but coordinate construction on the 16 acre site, with the infrastructure elements impacting all of the other projects.

While the project faced significant risks due to the length of the construction schedule, the degree of public scrutiny and the economic upheavals in the local leasing market, the risk inherent in the coordination of the project has been the most challenging and impactful. Coordination efforts have included building consensus among the diverse stakeholders as well as providing an effective environment for the large project team to communicate efficiently. For the stakeholders, arbitration during the early stages of the project led to an approach to coordination that has helped to identify and eliminate problems and avoid major impacts on schedule and cost. For the project team, a simple but innovative approach has improved the ability to identify problems, create solutions and make decisions quickly—a key factor when constructing three skyscrapers simultaneously.

Interrelated Infrastructure
As David Worsley, the senior vice president and director of construction for Silverstein Properties, observes, “We [Silverstein] are not building in isolation.” All of Silverstein’s three office towers rest on infrastructure that the public partners—the Port Authority and the MTA—are responsible for, thus requiring intensive schedule coordination. Worsley describes the impact of the infrastructure and other public construction on site as “adding a level of complexity to the planning ... that you wouldn’t normally have” in a private office project. In fact, David Tortorello, managing director of the global construction practice for Navigant, the consultant brought in by Silverstein to coordinate the project among the stakeholders, affirms, “The biggest challenge was the coordination of the infrastructure projects with the towers, trying to get the public entities to support the construction schedule of the towers.”

The Need for Stakeholder Alignment
Creating stakeholder agreement proved to be a drawn-out and challenging process, the result of two arbitration processes. Bruce Ficken, a partner with the law firm Pepper Hamilton LLP, which represents Silverstein Properties, affirms the importance of stakeholder alignment for a public-private project.
“Until the interests of the public entities are aligned with the interests of the private entities so that they both have the same priorities for schedule, budget and concept of the project, there will be conflict, and it will hurt the project.”

The challenge of aligning the interests of the Port Authority, an agency funded by two different states with their own agendas, the MTA, the Memorial Foundation and Silverstein Properties was further complicated by changes in leadership at the public agencies through the course of the project. According to Worsley, “Through the course of the last six or seven years, we’ve gone through four governors in each state of New York and New Jersey. [The] fifth executive director of the Port Authority is about to be appointed, and the people [associated with the leadership changes] cause some discontinuity in the decision-making process.”

Risk Mitigation through Stakeholder Coordination

For Tortorello, “the most important part [of coordinating the stakeholders] was to develop a communications channel that would allow real-time information to get to the different stakeholders.” To accomplish this, a task force was created to perform risk reviews. After the second arbitration, these reviews were conducted semi-annually rather than sporadically.

Tortorello explains that stakeholders were each asked to identify the critical risks for their projects. Those risks were then combined “to determine where the biggest risks are going to be in the total program construction.” They discovered that sharing specific, detailed logistical risks, even years ahead of actual construction, was essential to garner the necessary support of the other stakeholders. For example, a delay in the subway line would affect the completion of the office buildings by impacting the utilities, the electrical service, the emergency evacuation routes and even traffic in and around the site. “[Frequent risk reviews] opened everyone’s eyes to say, ‘Wow, that really is going to be a problem’ and allowed them to circumvent potential delays before they occurred,” according to Tortorello. Worsley points out that the coordination was detailed enough to “make sure a concrete truck can make it through the Brooklyn Battery Tunnel and to the job site in the allotted time, [which even] involved the New York Police Department to make sure there were no unnecessary traffic issues.”

Coordinating the Project Team

In addition to coordinating with their public-sector partners, Worsley also credits the coordination of the project teams for minimizing risks and improving efficiency on the three office towers. Because of the infrastructure component, he observes, “The design coordination on a technical level was incredibly complex.” In response to that, Silverstein created a design studio floor in their offices at 7 World Trade Center that housed all the architects and engineers on the project. Worsley explains the benefits: “Having everybody work in the same room was a huge benefit to mitigating the risk of design miscoordination and schedule slip.” Questions could be answered directly, without waiting for an e-mail reply or the next meeting. This seemingly simple solution helped them “get around the logistics of the design phase” and make prompt decisions.

Project Facts and Figures

Owner/Developer
World Trade Center Properties LLC (Affiliate of Silverstein Properties)

Architect
2 WTC: Foster + Partners (UK)
3 WTC: Rogers Stirk Harbour + Partners (UK)
4 WTC: Maki and Associates (Japan)

General Contractor
2 WTC: Turner Construction
3 & 4 WTC: Tishman Construction

Risk Consultant
Navigant

Attorney Representing Silverstein Properties
Pepper Hamilton LLP
Wachtell, Lipton, Rosen & Katz

Project Schedule
2 WTC: Building’s superstructure began June 2010—Completion contingent on securing tenants
3 WTC: Foundation reaches ground level December 2011—Building opens end of 2014/early 2015
4 WTC: Steel tops out Spring 2012—Building opens Fall 2013

Stories
2 WTC: 88
3 WTC: 80
4 WTC: 72

Square Feet
2 WTC: 2.8 million (rentable)
3 WTC: 2.5 million
4 WTC: 2.3 million (rentable)
Factors impacting how and when work is done during construction are identified as causes of disputes far more than contractual terms and payments. Changes in scope of work, alterations to schedules, and technical issues related to design and construction were each selected by 40% or more of the respondents.

A few best practices from the experts in the in-depth interviews (see page 19) can help minimize the risk of these factors occurring:

- All members of the project team need to share the same priorities and goals.
- Good communication is required to provide all team members with an accurate and full understanding of project status throughout the project lifecycle.
- Design should be complete before construction begins.

Integrated teams may be one solution to help achieve these goals.

For more information on recommendations to avoid litigation or claims, please see page 23.

### Variation by Player

#### OWNERS

In addition to changes in scope of work, more owners (50%) find changes to schedules to be a common cause of disputes. Schedule changes can have serious political and/or business repercussions for owners. (For more information, see page 8.)

#### A/E FIRMS

The highest percentage of A/E firms (88%) find changes in scope of work to be a common cause of disputes. 50% also find technical issues related to design or engineering another frequent factor in disputes. Since these factors most directly relate to the A/E firms’ involvement in infrastructure projects, it is logical that they would be the most prominent for these firms.

#### CONSTRUCTION FIRMS

The largest percentage of contractors feel that schedule and time issues are the biggest causes of disputes, but far fewer construction firms (33%) select changes in scope of work compared to A/E firms and owners. For contractors, delays in schedules can result in costly penalties, but changes in the scope of work are more likely to result in change orders—a potential source of profit for these players.

No contractors find payments a source of claims and disputes. The most likely reason for this is that infrastructure work is largely publicly funded, and up to this point, construction firms in this sector have not suffered from the risks of default faced by firms that do more commercial construction.
Approaches for Settling Claims and Disputes for Infrastructure Projects

Negotiation is the most commonly used strategy for settling claims and disputes, reported by nearly all of the respondents (96%). Arbitration, mediation and litigation appear to be evenly split, but there is some variation when examined by player.

Litigation is acknowledged by most of the industry to be a very expensive strategy, in ways that extend beyond paying claims and legal fees. A highly public dispute in the courts can damage a firm’s reputation and interfere with its ability to find new clients. Involvement in litigation can also consume a great deal of time from many individuals in a firm, including leadership and project managers, which can interfere with their work and responsibilities for other clients.

Variation by Player

OWNERS
Other than negotiation, owners are most likely to engage in mediation (50%). They are the player least likely to use arbitration and litigation. In fact, the percentage of owners who select litigation (25%) is less than half that of A/E firms (50%) or contractors (67%).

A/E FIRMS
More A/E respondents report engaging in arbitration (62%) and mediation (62%) as compared to other players. However, their use of litigation is also relatively high (50%).

CONSTRUCTION FIRMS
A higher percentage of construction firms (67%) report engaging in litigation, while a smaller percentage report engaging in mediation (33%) as compared to other players.

Methods Used for Dispute Resolution on Infrastructure Projects

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negotiation</td>
<td>96%</td>
</tr>
<tr>
<td>Litigation</td>
<td>48%</td>
</tr>
<tr>
<td>Mediation</td>
<td>48%</td>
</tr>
<tr>
<td>Arbitration</td>
<td>48%</td>
</tr>
</tbody>
</table>
The tough economic climate in the construction market has many construction firms rethinking risk profiles, recalculating insurance coverage and reviewing their partners more thoroughly.

The troubled economy is the common thread that runs through all insurance requirements today, according to Paul Becker, construction practice leader at Willis, North America. “There are huge pressures on costs and keeping all expenses down, so that companies can sustain themselves until work comes back again,” he says. “Some clients aren’t buying as much insurance as they did in the past, meaning the limits of liability they can buy in certain lines of coverage like general liability, professional liability and pollution liability.”

Becker says that in lean economic times, companies are looking to better align limits with their current assets. “People question whether they need the same amount of insurance as when revenue was higher.”

Meanwhile, carriers are reviewing claims with increased scrutiny, Becker says. “The construction business is down, but our claims department is as busy as ever,” he says. Insuring against Subcontractor Default

In such an environment, many contractors are keeping closer watch on subcontractors and other partners to better manage risk. With many specialty contractors scrambling for work and profit margins getting squeezed in a competitive market, construction firms are concerned about the financial stability of their subcontractors.

Douglass Rieder, president of Sterling Risk Advisors, says that sureties are concerned about the growing trend among subcontractors to travel into new areas to pursue work. “It’s fraught with increased risk,” he says. “There are a lot of unknowns when you travel, such as regulatory issues, licensing, taxes and legal issues. Sureties really fret about this in times like these.”

Subcontractors Guard against False Workers’ Compensation Claims

At the subcontractor level, companies are keeping a close watch on employees, reports Rieder. When the economy is down, Rieder says, companies are instinctively more vigilant about questionable workers’ compensation claims.

“If employees don’t see another job on the horizon and they sense that layoffs are coming, [contractors] worry that employees will suddenly have a claim,” he says. “We see people looking to protect themselves.”

Among other techniques to reduce claims, Rieder says, some companies require signed “end of week” statements from employees. When employees collect their paychecks on a Friday, they could be asked to sign a document stating that they were not injured that week and didn’t witness an unreported accident. “It helps deter reporting injuries that happen over the weekend [when employees are off the clock] as work-related injuries on Monday,” he says.
Although still dubbed an alternative delivery system, design-build procurement has become more commonplace in recent years.

**Risk Transfer**

While design-bid-build places owners between designers and builders, design-build allows owners to transfer risk to the design-builder and create single-point accountability. Proponents believe that one of the greatest advantages of design-build is the potential to more effectively place risk with the party who can best manage that risk.

Although the single-point accountability concept represents design-build in its purest form, it is not necessarily the norm. While some owners like the transfer of risk, they may not be comfortable with the perceived loss of control that goes with design-build, says Robynne Thaxton Parkinson, a Seattle-based construction lawyer and member of the Design-Build Institute of America’s national board of directors. “They want to have their cake and eat it too,” she says. “They want to shift the risk but maintain control.”

For example, an owner might provide prescriptive specifications or a preliminary design. That design would need to be bridged to the design-build team, but the owner would retain responsibility for that information, says William Quatman, general counsel and vice president of Burns & McDonnell Engineering in Kansas City, MO.

The same holds true, Quatman says, when owners ask to provide equipment for a project to avoid a markup from the design-builder.

“They might offer to furnish the equipment and have [the design-builder] install it,” he says. “Sometimes in those situations, they ask [the design-builder] to warrant that equipment’s performance. That’s where the design-build contractor has to perk up and say, ‘We’ll install it, but you bought it, and you have to go to the vendor and get them to warrant this.’ It’s a risk design-builders have to be careful of.”

Parkinson notes that while owners can transfer risks to the design-builder, not all risks should be transferred. For example, an owner could try to transfer risks related to site conditions. “It might be an unmanageable risk, but that doesn’t mean it should be shifted to the design-builder,” she says. “The owner owns the site, so it is in the best position to manage that risk.”

While significant risk does get shifted away from the owner in design-build, Parkinson says, teams need to remember that risk still needs to be put with the party that can best manage it. “The primary objective should be to get a project delivered on time and on budget,” she says. “Putting the project interest first means creating balanced risk that benefits everyone.”

**Disputes and Claims**

In the risk arena, the benefits are evidenced by claims activity, Quatman says. If the design-build team is properly integrated, changes can be handled smoothly, resulting in less conflict.

“Design-build offers parties on construction projects more options for risk management today than traditional design-bid-build.”

“The frequency of claims is lower with design-build,” he says. “The typical errors and omissions are absorbed by the team.”

Still, claims can happen. Quatman notes that, while teams often work through minor issues, major issues can lead to disputes. As a result, claims on design-build projects tend to be more severe, he says.

**Insurance**

Along with assuming new risk, design-builders have to be more aware of possible gaps in coverage. Quatman notes that most general contractors do not carry professional liability insurance, but under a design-build contract where they are the lead, that contractor assumes responsibility for design issues.

Likewise, if an A/E firm takes the lead on a design-build contract, the firm needs to make sure insurance is in place to cover any possible construction defects, Quatman says.

While it is fairly common for owners to ask to be an additional insured on a contractor’s insurance policy, Quatman says, professional liability policies do not permit additional insureds.

Surety bonds are an issue as well. “A surety bonds the contractor’s performance, but [the surety] doesn’t see itself as a professional liability insurer,” he says. “Some state legislatures have come out with statutes saying that on a design-build project, the surety bond does not cover design services.”

---

**Sidebar: Design-Build**

Using Design-Build to Manage Risk

**Sidebar: Design-Build**

Design-build offers parties on construction projects more options for risk management today than traditional design-bid-build.

---

**Disputes and Claims**

In the risk arena, the benefits are evidenced by claims activity, Quatman says. If the design-build team is properly integrated, changes can be handled smoothly, resulting in less conflict.
Reducing the Risks of Sustainability

The emphasis on sustainability has left some wondering about their exposure to risk when working toward a high-performance building. Three steps form a best practice for minimizing that exposure.

High-performance buildings often carry high expectations. Owners may construct green buildings to reduce utility costs, create better work environments, develop more desirable tenant spaces, garner tax incentives or comply with government mandates. In order to manage the risks associated with such goals, owners, architects, engineers and contractors need to outline specific project objectives, agree on a plan, and approach certification wisely.

Outline Specific Project Objectives

“There should be a heightened awareness of the fact that everyone needs to have discussions about expectations, roles and relationships because this is all so new,” says Ken Cobleigh, managing director and counsel for the American Institute of Architects’ (AIA) contract documents.

AIA recently released its Guide for Sustainable Projects, which includes documents to “address the unique roles, risks and opportunities encountered on sustainable projects.”

The first step to managing risk in sustainability is making sure all parties understand the expectations, Cobleigh says. If the goal is to have a project certified as green by a third party, the objective is clear as long as all parties understand the steps necessary to achieve that certification. However, if a developer wants a high-performance building without going through the certification process, the expectations may be less clear-cut.

“At that point, it’s up to the architect and the consultants to work with the owner to decide what ‘high-performance’ means,” Cobleigh says. “What baseline would the project be compared to?”

Agree on a Plan

The team also needs to be sure that the owner understands the design assumptions.

“If the building is designed to allow for fluctuations in humidity or temperature, it’s important that the owner understands that they will have to operate the building within those parameters,” Cobleigh says. “They can’t have someone come in and adjust the systems to maintain a constant humidity and temperature.”

Cobbleigh suggests establishing benchmarks that all parties can agree on to determine a building’s performance. In this case, an owner may need to keep detailed maintenance and operations records, he adds.

Brian Perlberg, senior counsel of construction law and contracts at the Associated General Contractors of America (AGC), maintains that achieving high performance in a building often hinges on the interdependence of team members.

“What’s unusual about green buildings is that there are hybrid responsibilities associated with them,” he says. “Sometimes it’s the designer; sometimes it’s the contractor; sometimes it’s a product manufacturer; sometimes it’s a combination of those.”

To help address this, AGC’s ConsensusDOCS Green Building Addendum recommends assigning a “green building facilitator.” The facilitator would take the lead on coordinating efforts among all parties to ensure that the owner’s goals are met.

Approach Certification Wisely

One of the most critical risks that must be managed on a green project is the potential that it won’t achieve certification. Although this could be an owner’s main goal, AIA advises that architects and contractors should never warrant or guarantee that a certification will be achieved.

However, he adds, nothing absolves the architect or contractor from negligence or poor performance. “If the contractor performed defective work, they aren’t absolved from liability,” he says. “If the architect breached the standard of care and, as a result of that negligence, the certification fails, nothing absolves the architect.”

The certification process also presents risks. By choosing certain certification authorities, parties may have to enter into agreements required by those authorities. All parties need to be aware of these agreements, Cobleigh notes.

Cobbleigh says that there are some subjective elements of review by these certifying authorities. “Once you introduce subjectivity, you introduce risk,” he adds. “To address that element of risk, everyone needs to understand that there is some level of subjectivity.”
**Risk Mitigation Study Research**

**Infrastructure Risk Survey**
McGraw-Hill Construction conducted the 2011 Risk Mitigation Study in the infrastructure sector to assess the level of impact caused by risks, the scope of use of risk assessment and mitigation procedures and the frequency and causes of litigation.

The CATI (Computer Assisted Telephone Interview) survey was conducted in October 2011. To be eligible respondents had to be involved with risk management for construction projects at their firms. Additionally, respondents were screened based on firm type (owner, engineering/architectural and general contracting/construction management), as well as project type and size (had to have worked on an infrastructure project $100 million or greater in value that started in the last five years.)

A sample of firms for this survey was pulled from the McGraw-Hill Construction Dodge database, which tracks construction project starts across the U.S.

Firm-type quotas ensured that the total sample was almost equally divided across the three firm types. The total sample size of 35 consisted of 12 engineering/architectural firms, 12 general contracting/construction management firms and 11 infrastructure owner firms.

While 35 is a robust sample size for quantitative findings, the firm type sample sizes would be considered small. Therefore, data presented by firm type must be viewed only as trend information and not be extrapolated for that particular group.

**Energy Risk Survey**
In addition to the main survey on infrastructure, a small online survey focusing on risk management in the energy sector was carried out among CURT (Construction Users Roundtable) members.

Respondents were screened by firm type (same as infrastructure), energy construction project size (had to be involved with projects $100 million or greater in value within the last five years) and involvement with risk management at the firm.

A total of 16 responses were obtained. Findings from this module can be found on page 18 and are illustrative of trends, not representative for all firms working on energy projects.
Resources

Organizations, websites and publications that can help you get smarter about mitigating construction risk.

Acknowledgements:
The authors wish to thank our premier research partners Navigant Consulting Inc. and Pepper Hamilton LLP for helping us bring this information to the market. Specifically, we would like to thank Jim Zack, Shannon Prown, Andrew Bosman, Fred Campobasso and Dave Tortorello at Navigant Consulting; and Bruce Ficken and Bill McCusker at Pepper Hamilton.

We would also like to thank the Construction Users Roundtable (CURT) and the Construction Owners Association of America (COAA) who helped us disseminate the survey to their members. We also thank Robert Prieto at Fluor for his insights. Additional thanks to all those who were willing to be interviewed for this report, including Ed Littleton, Balfour Beatty Construction; Robynne Thaxton Parkinson, Design-Build Institute of America; William Quatman, Burns & McDonnell Engineering; George Pierson, Parsons Brinckerhoff; Mike Kirchner and Jody Debs, CH2M Hill; Nicholas Pollard and Michael Stokes, Navigant Consulting Inc.; Christopher Beck, Turner Construction; Paul Becker, Willis North America; Bill Noonan, Structure Tone; Douglas Rieder, Sterling Risk Advisors; Billy Miller, Zurich; Gary Amsinger, McCarthy Building; Scott Trethewey, Moss & Assocs.; Ken Cobleigh, AIA; and Brian Perlberg, AGC.

Finally, we thank the firms that provided information about their projects and experiences with risk mitigation as well as for their assistance in helping us secure images to supplement their project information.

Research Partners
Construction Users Roundtable: curt.org
Construction Owners Association of America: coaa.org

Other Resources:
American Bar Association: abanet.org
American Council of Engineering Companies: aec.org
The American Institute of Architects: aia.org
American Society of Civil Engineers: asce.org
Associated Builders and Contractors: abc.org
The Associated General Contractors of America: agc.org

Construction Financial Management Association: cfma.org
Construction Management Association of America: cmaanet.org
Design-Build Institute of America: dbia.org
International Risk Management Institute: irmi.com
Risk Management Association: rmahq.org
National Association of Surety Bond Producers: nasbp.org
National Council for Public-Private Partnerships: ncppp.org
National Utility Contractors Association: nuca.com
McGraw-Hill Construction SmartMarket Reports™

Get smart about the latest industry trends.

For more information on these reports and others, visit www.construction.com/market_research

Association Research Partners:

The McGraw-Hill Companies

Construction Owners Association of America