



BUILDING INNOVATION

A REPORT BY THE

New York Building Congress
Task Force on Innovation
and Best Practices

Message from the Chairman

When I was asked to serve as Chairman of the New York Building Congress, I wholeheartedly agreed, on one condition — that the Building Congress address the issue of innovation and best practices in our industry as part of its agenda.

With the City in the midst of another building boom, now is the perfect — and most important — time to devote our attention to building smarter, faster, more safely, and more economically. To accomplish these goals, we must be willing to challenge the status quo, embrace best practices, and implement new ideas and technologies.



Over the past two years, the Building Congress Task Force on Innovation and Best Practices has been fully engaged in that process of self-evaluation, thoughtfully considering what we can do as an industry to make us better in everything from procurement reform to building technology and processes, site management, and workforce development.

We have found that innovation is all around us, but unfortunately, it hasn't been as widely distributed and replicated as it needs to be. While many other industries see innovation as a fact of doing business, the building industry has been slow to adopt innovative tools and methods on a broad scale. We continue to build fundamentally the same way we did 50 years ago and arguably even earlier. Yet, imagine going out today and buying a car that was built the same way as the 1965 Studebaker or a computer with 141k of RAM (what a 1965 Univac offered).

We are stuck, in part, for the same reason many people get stuck: unquestioned habits. New York City, for example, is the envy of many cities around the world because our two-day cycle per floor enables very rapid high-rise construction. But the two-day construction cycle is so ingrained in our thinking that it can inhibit us from taking a fresh look at other solutions. Entrenched in our ways, we tend to leave untapped the great potential for improving how our built environment is designed and constructed.

This report, which provides an overview of the Task Force's efforts, shines a light on just some of the opportunities for productive change that can raise the bar while also setting benchmarks that are feasible and attainable. It is an initial step toward elevating innovation and best practices in the New York City building community on an ongoing basis by sharing what has been learned so far and offering recommendations for a path forward.

I thank the more than 40 dedicated industry professionals who have actively participated on the Task Force. Their leadership and commitment to our industry are, in and of themselves, best practices that we can all strive to emulate.

A handwritten signature in black ink, appearing to read 'Thomas Z. Scarangelo'. The signature is stylized and written in a cursive-like font.

Thomas Z. Scarangelo, P.E.
Chairman, New York Building Congress and Task Force on Innovation and Best Practices
Chairman and Chief Executive Officer, Thornton Tomasetti

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Introduction: Seeding Innovation and Best Practices

Building Innovation highlights the work and recommendations of the New York Building Congress Task Force on Innovation and Best Practices, which spearheaded a wide-ranging initiative to promote construction innovation and improve the way New York City builds.

Formed by Chairman Thomas Z. Scarangelo in 2014, the Task Force was born out of a growing awareness that the City and the building industry must do more to remain at the forefront of building technology and best practices while helping to realize a 21st century vision of New York's built environment — one that is greener, more resilient, and more responsive to human needs.

The Task Force tapped the expertise of more than 40 leading contractors, architects, engineers, government officials, and other industry leaders and organized six committees to focus on and develop practical deliverables related to building technology and project delivery, government procurement and procedures, workforce

Building Innovation is intended to inspire continuing, collaborative discussions across industry sectors.

development, product and process innovations, site management, and improved communications among stakeholders.

Participants examined topics ranging from procurement reform, alternative project delivery, and Lean principles to modular construction, construction sheds, and industry workforce supply and demand, all with the goal of identifying ways to increase efficiency and reduce the comparatively high cost of construction in the City.

The Task Force prepared *Building Innovation* to illustrate the potential for meaningful change in how the City's built environment is designed

and constructed, with examples taken from the work of three Task Force committees — the Government Procurement and Procedures Committee, Building Technology and Project Delivery Committee, and Site Management Committee — whose full reports are available on the Building Congress website.

Most importantly, *Building Innovation* is intended to inspire continuing, collaborative discussions across industry sectors to share lessons learned and best practices as well as encourage the development of a culture of innovation within the building community.

More Progressive Public Procurement

“New York City government agencies are responsible for a large capital construction program that has a significant impact on the local economy and on the ‘state of good repair’ of the local infrastructure,” said Mark Blumkin, Director — Capital Projects Consulting for Deloitte Financial Advisory Services and Co-Chairman of the Government Procurement and Procedures Committee. “Often the means by which these agencies procure and manage this capital portfolio are hampered by outdated and cumbersome regulations and methods that delay projects and increase the cost of work to the taxpayer.”

adversarial relationships between agencies and contractors, such as the City’s divided management of public works projects and approval processes for payments and change orders; and outdated project delivery methods.

The Task Force drew from best practices in the public and private sectors as well as experience in using alternative project delivery methods to create proposals for realistic, achievable reforms that would improve the public sector’s procurement and capital planning processes so that projects can be delivered faster and more cost effectively.

As a result, project funding levels are established based on limited information, leading to major cost increases when the appropriate consulting work is done and the true cost of the project revealed.

“The problem starts at the capital planning phase, because bond financing regulations prohibit the use of capital funds to pay for design until the overall project is included in the capital plan,” said Milo E. Rivero, President and Chief Executive Officer of STV Group, Inc. and Co-Chairman of the Government Procurement and Procedures Committee. “But asking for the funding for construction before putting pen to paper on a concept dooms the budget. Construction managers should be invited to participate during the design period to get the best collaboration possible from the outset so that the design can be completed and the budget formed before going to get the construction funds.”



New NY Bridge: Tappan Zee Bridge Replacement, Credit: New York State Thruway Authority

Based on various studies performed by Deloitte and others over the past decade, the Task Force identified key drivers of construction costs and delays on public works projects, including the lack of adequate capital planning and preparation; controls that are designed to prevent corruption but effectively create

CAPITAL PLANNING AND PREPARATION

Most capital projects procured by government agencies lack adequate preliminary scoping, design, and estimating, largely due to resource constraints within government agencies and the lack of funds available for consulting services until the project is funded.

In recent years, the City has taken steps, including appropriating funds, to address this problem with a program administered by the Office of Management and Budget (OMB) for Capital Project Scope Development (CPSD) services, intensive scope development and cost estimating services, that may be requested by City agencies for certain capital projects. These preliminary assessments enable the City to accurately estimate the true costs of selected projects and, if necessary, investigate less expensive alternatives prior to capital commitment.



Number 1 Subway Line Rebuild Following 9/11, Credit: Patrick Cashin/Metropolitan Transportation Authority

The Task Force recommends that the City expand the CPSD program to require all agencies in charge of major capital projects (e.g., any project with a preliminary budget estimate exceeding \$50 million) to use CPSD services. By facilitating the development of more accurate scopes, estimates, and timelines, this “Phase 0” would improve project planning and help ensure that projects are approved with appropriate budgets and schedules.

PROJECT MANAGEMENT

Too often, public sector management of capital projects is divided among more than one government agency, slowing approval processes, compromising accountability, and delaying project completion. Perhaps nowhere are

these impacts more keenly felt by contractors than in the change order and payment approval processes. Uncertainties and delays in these processes have led contractors to increase their bids on public projects to cover their costs and risk exposure.

“Multiple agencies may be necessary in the lead-up phases to establishing a capital project,” said Jay Badame, President and Chief Operating Officer of Tishman Construction — An AECOM Company and Co-Chairman of the Government Procurement and Procedures Committee. “But once the capital project is funded and launched, it would be far more efficient and improve accountability to have the responsibility and authority for delivering the project rest with a single agency.”

The Task Force recommends that the City adopt a more streamlined approach to project management that assigns oversight responsibility and authority to the agency managing the project once the budget and contingency have been set. As part of this streamlined approach, the Task Force recommends the following additional reforms:

1 The managing agency’s oversight responsibility should include budget control, with a 10 percent contingency — the industry standard — to cover change orders. In the event the managing agency needs to exceed the 10 percent contingency, then additional oversight by OMB and the New York City Comptroller’s Office should be introduced.

2 The managing agency should establish a contingency management plan that includes monitoring of expenditures as the project progresses. Any expenditure that exceeds the plan should trigger review by the agency’s Engineering Audit Officers, OMB, and the Comptroller’s Office.

3 Each agency should develop a project management plan that establishes mandatory review cycle times for processing change orders and payments as well as quarterly reviews of project costs, schedules, and safety.

ALTERNATIVE PROJECT DELIVERY METHODS

Various New York statutes generally require State and local agencies to use the traditional design-bid-build approach to public works procurement. Unless an exception to the general requirement applies, alternate methods of procurement are prohibited, placing major public works projects outside of current mainstream construction practices that often produce better value in shorter timeframes.

Alternative project delivery methods have largely superseded design-bid-build in the private sector, and they are increasingly being authorized and used by the federal government and many states. This growing trend can be attributed, in part, to the process improvements that have characterized alternative project delivery — such as early collaboration and improved coordination between design and construction disciplines, which

translate into accelerated project delivery and cost savings. Such alternative project delivery methods include design-build, design-build-finance-operate, Construction Management (CM) at Risk with a Guaranteed Maximum Price (GMP), and integrated project delivery (IPD).

While these and other methods of alternative project delivery have a record of success in New York and other jurisdictions, they have had relatively limited use in New York — particularly prior to passage of the New York State Infrastructure Investment Act in 2011. That legislation authorized five State agencies — the Department of Transportation; Thruway Authority; Office of Parks, Recreation and Historic Preservation; Department of Environment Conservation; and Bridge Authority — to manage the delivery of construction projects using design-build through the end of 2014.

In 2014, Governor Cuomo proposed that design-build be made permanent and extended to other State agencies, but the State Legislature did not act on that recommendation. Instead, in 2015, lawmakers approved an extension of the five agencies’ design-build authority through March 2017, without expanding that authority to other State agencies or local governments.

Since the Infrastructure Investment Act became law in 2011, construction has begun on the replacement of both the Tappan Zee and Kosciuszko Bridges. Using design-build, the cost and time to complete both critical infrastructure projects are estimated to fall well below initial government estimates that envisioned the use of design-bid-build.

“A one-size-fits-all approach to project delivery should be a thing of the past,” said Mysore L. Nagaraja, Partner/Co-Founder of Spartan Solutions and Co-Chairman of the Government Procurement and Procedures Committee. “Experience has shown us the benefits of using alternative project delivery strategies. For example, when I led the MTA Capital Construction Company, we used an IPD-like process to rebuild the Number 1 subway line after 9/11, which was completed in just nine months. That simply would not have been possible using design-bid-build. The problem is, public agencies are not using these alternative strategies nearly enough.”

The Task Force recommends that the State and City take the necessary steps to modernize their procurement laws and practices to allow greater use of alternative methods of project delivery. Among these steps:

1 The Cuomo administration and the State Legislature should pass legislation to make permanent design-build authority and extend it to all State agencies and local governments.

2 The City should give more routine consideration to using CM at Risk with a GMP as another way to improve coordination between contractors while reducing change orders and delays.

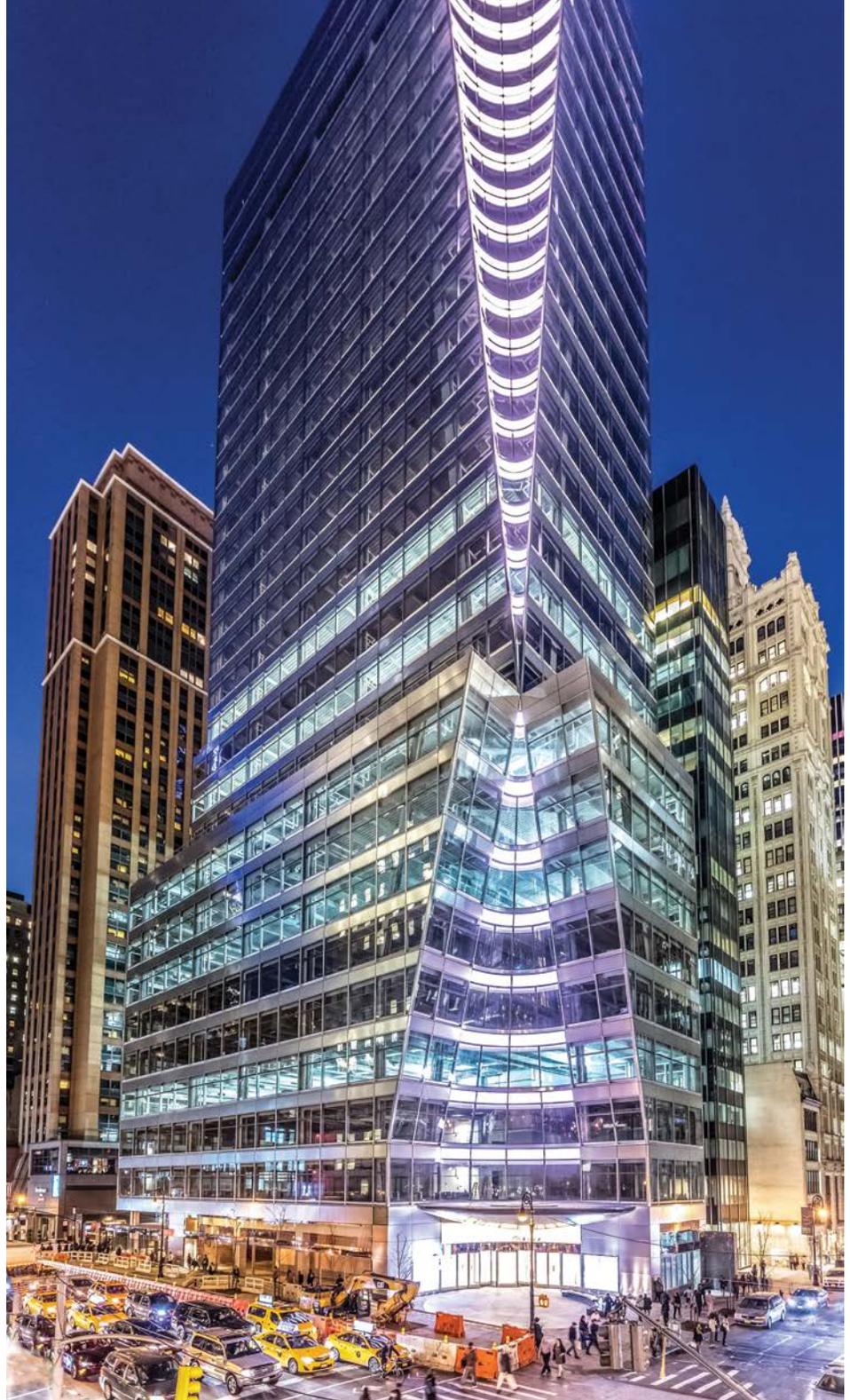
3 The City should implement an IPD pilot program, with the goal of adopting it as a standard option in delivering major public works projects.

Best Practices in Project Delivery

Everyone involved in the construction process has a stake in delivering projects faster, more safely, and at a lower cost — from the project owners who want high quality buildings and improved bottom lines, to the contractors and designers who want to satisfy clients while maximizing productivity and profitability. These goals can be advanced by increasing efficiency in every phase of a project life cycle.

“The first step towards more efficient construction is to recognize when and where there is waste in the current processes,” explained Charles F. Murphy, Senior Vice President of Turner Construction Company and Co-Chairman of the Building Technology and Project Delivery Committee. “Once those wastes are identified, long-term Lean construction strategies can be developed to address them.”

Lean is a modern approach to construction aimed at eliminating waste through continuous improvements to design and construction processes. The concept of Lean is credited to the manufacturing industry, beginning with Henry Ford’s efforts to improve efficiency in the automotive industry, which later inspired Toyota Motor Company to create a systematic approach to continuous improvement. Since it was pioneered in the construction industry more than 25 years ago, Lean construction has evolved into a transformative business strategy that embraces widespread collaboration, promotes the standardized use of advanced building practices, and leverages new technologies.



7 Bryant Park - Lean Construction Project, Credit: Turner Construction Company

The Task Force formed six working groups that used Lean concepts of Value, Value Stream, Flow, Pull, and Continuous Improvement to evaluate and find opportunities to improve the construction processes of six building systems: foundations, structure, electrical, mechanical, enclosure, and drywall/finishes.

Composed of Lean practitioners, owners, architects, engineers, trades, and general contractors to ensure a diverse range of perspectives and knowledge, each working group was assigned a building system and developed a Value Stream Map (VSM) for it. Value Stream Mapping offers a

routine method of analyzing all the steps in a process to identify the wastes, such as errors, rework, transportation, and underutilized talent, and then develop countermeasures to reduce them.

The working groups documented the steps in the current construction process of each building system and measured the following:

- **Process Time:** The number of working hours spent on process steps (not including waiting time).
- **Down Time:** The number of working hours spent making revisions or waiting for information or a deliverable.
- **Percent Complete and Accurate:** The percent of occurrences where a process step is completed without needing corrections or requesting missing information.

By looking at the process steps as a whole, the working groups were able to detect weaknesses and persistent points of failure as well as spot the areas with the greatest opportunity for improvement — namely, those steps with high Down Time and low Percent Complete and Accurate.

For example, a VSM of the current processes for foundations and structural steel from bid and award to the creation of shop drawings revealed that both typically take much longer than necessary due to rework. Foundations bid and award phases occupy 6-7 months and the development of shop drawings an additional 2-3 months, whereas the steel bid and award phases occupy 12 or more months and development of shop drawings an additional 5-6 months.

The VSM exposed areas of wasted effort, demonstrating that each process presently cycles through

at least 6 months of rework in the award and shop drawing phases alone. In particular, the VSM showed that Requests for Information (RFIs) and addendums result in overproduction and underutilized personnel. In addition, incomplete documents at the beginning of the processes cause a lack of integration and transparent communication downstream.

The foundations and structure working groups identified potential measures to improve the processes, focusing on increasing collaboration and the implementation of common standards. These include beginning both processes with a fully dimensioned and coordinated model, working with a common set of PDF standards and a common technology platform, and getting the trades involved earlier in the process.

The VSMs for the other building systems likewise exposed wastes that could be readily “leaned.” While there were some variations among the wastes associated with each building system process, the Task Force’s most striking discovery was that current construction processes are extremely duplicative and redundant across the board. The good news is that applying Lean principles and practices offers opportunities to address these and other inefficiencies, yielding tangible benefits, such as better quality, improved safety, faster completion, reduced costs, and increased value to the owner.

Unfortunately, Lean construction is not as widely adopted and implemented as it should be. According to a McGraw Hill Construction Smart-Market Report, “Lean Construction — Leveraging Collaboration and Advanced Practices to Increase Project Efficiency”, Lean practitioners

and non-practitioners alike cited lack of knowledge and understanding of Lean as the key challenges to its implementation. Employee resistance also made the list of significant challenges, though most Lean experts reported that employees become enthusiastic and engaged after they experience the benefits of Lean.

“An industry shift towards Lean requires a cultural renaissance of building practices that begins with education,” said Carl Galioto, Managing Principal of HOK and Co-Chairman of the Building Technology and Project Delivery Committee. “The industry needs to become better informed about the inefficiencies in current construction processes and the ways in which taking a Lean approach can make real and substantial improvements in the delivery and quality of projects.”

As Lean is still an emerging practice in the building industry, the Task Force recommends the following to help it gain a stronger foothold:

1 Industry associations should offer more information about Lean, including by sponsoring research to demonstrate the need for greater efficiencies and by actively promoting Lean’s core tenet of continual improvement.

2 Lean practitioners should encourage their industry partners to learn more about and adopt Lean principles and practices.

3 Public and private owners should demand the use of Lean practices in the delivery of their projects.

Better Sidewalk Sheds, Better Streetscapes

In order to grow and prosper, New York City must continuously build, whether it is brand-new construction or renovation and modernization of existing structures. While the process of building is a welcome sign of a City in a constant state of reinvention, it can come at a temporary cost to the quality of life in and around individual building sites.

Given its close proximity to neighbors and the importance of public support for its work, the building community can and should seek ways to advance improved construction site management practices, while enhancing its image as a good neighbor and a welcome and essential part of the City's evolution. Nowhere is that more apparent than with the sidewalk sheds, which currently line nearly 200 miles of New York City streets.

"While New York City's sidewalk sheds have served the practical function of protecting pedestrians



Side+Ways+Shed by Francis Cauffman

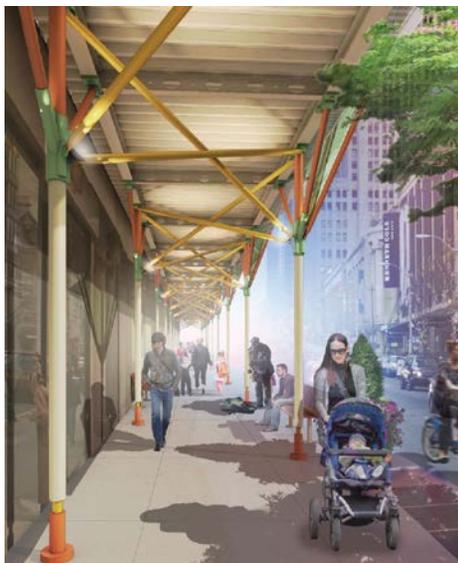
from construction taking place right over their heads, they have failed in terms of their impact on New Yorkers' quality of life," said Frank J. Sciame, Chairman and CEO of Sciame Construction LLC and Chairman of the Construction Site Management Committee "The goal of our committee was to seek fresh ideas from the industry on how to create a safe, thoughtful, and far more visually appealing sidewalk shed."



SCAFFOLDWING by Gannett Fleming Engineers and Architects, P.C.

To generate ideas for improved construction shed designs, the Task Force joined forces with the New York Building Foundation to launch an industry-wide design competition in July 2015. Members of the building community were invited to submit one conceptual or schematic design for a buildable construction shed that would be evaluated based on aesthetics, ability to meet engineering standards, functionality, safety, and constructability.

The goal was to leverage the expertise and ingenuity of the



UrbanArbor by PBDW Architects and Anastos Engineering Associates



G-Shed by Gensler

building industry to develop new shed concepts that could meet rigorous New York City Department of Buildings requirements while elevating the current standard design to address a major quality of life issue for New Yorkers, whose primary interface with the industry is passing underneath the imposing sheds.

Of 33 submissions, four winners were selected by an expert jury composed of architects, engineers, contractors, and building owners. The winning submissions met the design criteria in different ways, each presenting an innovative approach to reducing or eliminating the bracing that blocks natural light and interferes with the pedestrian experience.

The winning teams also demonstrated close attention to the aesthetics of their structures — creating off-the-shelf designs that will be more attractive than standard sheds. While elegant, all of the designs are simple to erect and use readily available materials, satisfying a key objective of the competition

that the designs minimize additional costs to building owners and be easy to assemble to encourage adoption by the industry.

Although the selection of four imaginative and innovative shed design concepts is a promising first step, the longer-term objective is to see their broad implementation throughout the City. This will require securing the City's buy-in as well as increasing awareness and promoting use of the new shed designs among owners and general contractors.

The Task Force recommends that:

1 The Building Congress, working with other industry organizations, should expand efforts to increase awareness and promote the use of the new shed designs among owners and general contractors, including by facilitating meetings with shed designers and shed supply firms and supporting measures to enhance the constructability and/or affordability of the new shed designs.

2 Government should use the new shed designs and find ways to encourage private-sector use of them on public projects.

3 Owners and contractors should consider the new shed designs and implement them, where feasible, on upcoming projects. Experiences using the new shed designs should be promoted and shared with industry colleagues.

"The New York Building Congress issued a challenge to the entire industry to use its ingenuity and expertise to offer fresh ideas for solving a vexing quality of life issue for New Yorkers," added Mr. Sciame. "The industry's collective response to that challenge has been truly inspirational and should serve as a model for the industry moving forward."

Cultivating innovation and best practices throughout the industry must be treated as a never-ending process that requires an ongoing and collective buy-in from each stakeholder in the process.



Conclusion

Cultivating innovation and best practices throughout the industry must be treated as a never-ending process that requires an ongoing and collective buy-in from each stakeholder in the process. To facilitate that effort, the Task Force offers the following overarching recommendations, all of which have been pulled directly from its discussions.

OPEN THE CONVERSATION EARLY AND KEEP IT GOING. No single person on any project team has a monopoly on good ideas. Bring all project stakeholders together early and often, and give them a voice at the table. There is no innovation without collaboration and mutual respect.

SEE OPPORTUNITY WHERE OTHERS FOCUS ON RISK. Saying “yes” to innovation means doing the work to understand, manage, and mitigate its risks, rather than taking the easy path and assuming the risk is too high. Innovators, by definition, must behave like entrepreneurs.

CHALLENGE THE BUILDING INDUSTRY TO GROW. The building community must challenge itself, clients, and colleagues to look beyond what has been done before and develop the habit of working outside comfort zones. This includes looking to other industries for best practices and innovation that can be adapted for use in the building industry.

These recommendations will help guide a new Council on Innovation and Best Practices recently established by the Building Congress to continue the conversation begun by the Task Force and advance the work already underway by its Workforce Development and Product Innovations Committees.

“What the Task Force did so effectively over its two-year term is bring together some of the best and brightest from all sectors of the industry to share information and brainstorm ideas to make the building community in New York City stronger and more effective,” said Richard T. Anderson, President of the Building Congress. “But for all that the Task Force accomplished, we should view this as the end of the beginning, rather than the beginning of the end. There’s still much more to do, and quite frankly, the process of innovation has no end date. The addition of this new, permanent Council to the Building Congress program is an important and significant next step in the right direction.”

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To see the full Task Force Committee reports, go to buildingcongress.com.

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