

THE CONSTRUCTION USERS ROUNDTABLE

"THE OWNERS VOICE TO THE CONSTRUCTION INDUSTRY"

Optimizing the Construction Process: An Implementation Strategy

R, WP, or UP-#
Month Year

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Notice:

The purpose of this publication is to make available to industry the results of research and common owner practices. The information is provided solely for the individual consideration and education of CURT members and the industry. The publication does not necessarily represent the views of every CURT member company on this topic. The booklet is offered as an informational publication

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The Mission of The Construction Users Roundtable (CURT) is to promote cost effectiveness for owners doing business in the United States by providing aggressive leadership on issues that will significantly improve project engineering, maintenance and construction processes, thereby creating value for the owners.

1. Executive Summary

This paper envisions a substantially changed project environment, where projects are undertaken by deeply collaborative teams composed of all disciplines that contribute to project fruition, and where better, faster, more capable projects—*optimized projects*—are the norm rather than the exception.

This vision will be achieved through consistent endorsement and application of principles of Owner Leadership, Integrated Project Structure, Open Information Sharing and dedicated use and development of Building Information Models. These principles are more fully explored in CURT whitepaper 1202, the initial vision of fully integrated and collaborative projects that improve quality, time and cost on which this paper builds.

Why Optimize?

Benefits of optimized project techniques to Owners include better value through improved delivery times; higher quality relationships, processes, communications, documents, and construction; improved living and working environments in safer workplaces; more efficient use of resources; less waste of time and money; and much more effective use of dollars invested in projects.

Change is Required

This paper declares that the construction industry step forward into an optimized future and realize the significant benefits reviewed above, and thus **Owners must**:

- ▲ Change the organization of projects and teams
- ▲ Change ineffective behaviors
- ▲ Demand project teams leverage, drive, and utilize technology to its fullest.

This paper will examine these areas of change and offer examples of how they might lead to maximum capitalization on unique opportunities.

Before examining these elements of transformation, this paper describes a clear hypotheses for what "optimized projects" using "optimized processes" should look like. At their core, such projects are expected to be fully collaborative, fully integrated and thus, highly productive project teams guided by principles of true collaboration, open information sharing, owner leadership, team success tied to project success, shared risk and reward, value-based decision making, and utilization of full technological capabilities and support. Based on these principles, the final section proposes a plan to develop a pilot program combined with a research element that would test these methods and concretely demonstrate the benefits of using an optimized process.

2. An Implementation Strategy

Characteristics of Optimized Projects / Teams

Fully Collaborative, Highly Productive

CURT WP 1202 refers extensively to the terms “fully collaborative” and “highly productive”. Projects that have these essential characteristics do the following:

- ▲ Assemble integrated, high functioning project teams (comprised of key life-cycle project stakeholders) early in the process.
- ▲ Develop clear, concise, mutually established and understood goals, values and objectives for the project and for all team members BEFORE design begins (*Pre-Project Planning*).
- ▲ Make decisions based on overall value and not simply lowest first cost (defining measurable outcomes).
- ▲ Use comprehensive technologies that support, not inhibit, collaboration.
- ▲ Utilize contracts that promote, not impede, high degrees of collaboration, defining new business terms
- ▲ Share information in an open, honest way as a norm, and create no disincentives to share; no information is considered proprietary within the team. This creates an open information environment.
- ▲ Match resources with the needs of the project and ebb and flow as needed. Additional knowledge and expertise is “woven in” as required, providing insight at the optimum moment.
- ▲ Assess risk continuously to evaluate each decision and manage its corresponding risk, allocating risk to the party best able to manage it.
- ▲ Share risk and reward equitably.
- ▲ Drive project process based on the owner’s needs.
- ▲ Optimize objectives of the project as a whole and do not sub-optimize results of the separate participating firms, creating a common vision of success.
- ▲ Tie participant success directly to project success
- ▲ Foster Owner leadership with new processes that reflect the above.

Achieving as much of this list of characteristics as possible is critical to optimizing the project process. Teams and projects following this prescription will realize the collaboration and integration necessary to result in the successful projects defined in the CURT WP 1202 vision.

Full Collaboration AND Integration

Is wholesale industry change necessary to achieve these ends, or can these characteristics consistently be achieved within traditional project arrangements? Consider that:

- ▲ Traditional contracts and roles often impede collaboration;
- ▲ Incentive of the parties (both financial and risk related) is often to do as little as possible;
- ▲ Team member focus is often on self-efficiency rather than project efficiency.

Thus the answer is clearly “no,” and the industry needs a “new” project structure and approach.

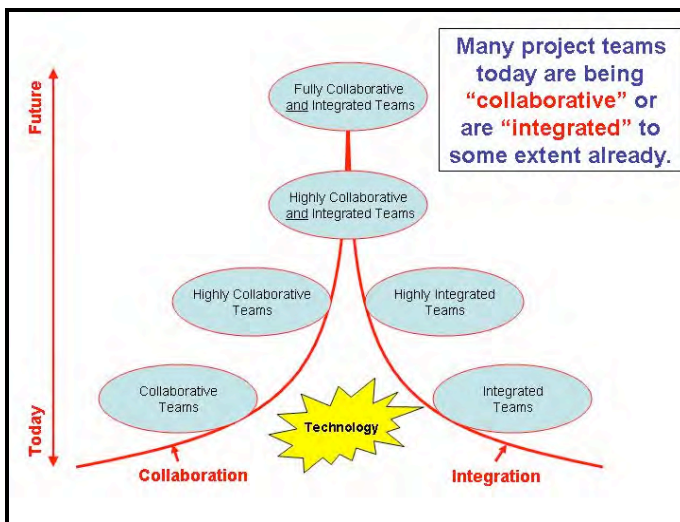
Anecdotal evidence suggests that new approaches to collaboration and integration are already being attempted by many in the industry.

For example:

- ▲ private industries that have been using creative project delivery and contracting options to bring in contractors early and increase collaboration among their team members
- ▲ project teams that have been bringing in building and manufacturing process trade contractors early in the process to share their expertise, and through this collaboration add value during the planning and design stage
- ▲ the steel industry’s growing list of projects where the engineer, the detailer, the fabricator and the installer are using technology to integrate their efforts and improve their productivity

It is clear that attempts at collaboration have progressed further than those of integration, but this is rapidly changing. Technology is the catalyst that is accelerating this change. As digital models are created with more intelligence and more interoperability, the ability to integrate disciplines, expertise and processes will be easier and easier.

The following diagram suggests an evolution of the industry, acknowledging that there are many who are already implementing various levels of collaboration strategies. The diagram also acknowledges that there are members of the industry who are beginning, primarily through technology, to integrate their processes with other members of the project team.



Though there are probably many firms that are high on the collaborative scale, there are fewer that are as high on the integration scale. The fully collaborative, fully integrated, highly productive team capable of delivering an “optimized project” will be comprised of firms that are fully collaborative and integrated.

The Team Entity

In the optimized project, integrated project teams composed of all life-cycle project stakeholders is assembled early in the process, and behave in accordance with the characteristics listed at the start of this section.

This optimized team entity ranging from loose, virtual structures. At one end of this becomes a legal entity, a options will undoubtedly supporting contractual

The entity will function as the knowledge as can be brought expertise such as the engineer, plan, estimate, and could also include the expertise to finance, maintain and operate the facility. Skill and knowledge traditionally available only at the trade and supplier level would be identified and brought into the entity wherever possible.

“Alliancing” a name applied to a delivery system that is emerging in Australia, is perhaps an early version of this team entity concept.

In the Alliancing model, many of the characteristics and principles describing the Optimized Construction Project are incorporated.

could be structured in myriad ways, and informal, to tighter legal continuum is where the entity Single Purpose Entity (SPE); other emerge as collaborative techniques as language evolves.

project “brains”, leveraging as much into it. This includes traditional knowledge necessary to design, procure, manage and build the project,

Risk Sharing

Projects have inherent risk, which impacts team members differently at different times. The ability to understand and manage risk varies accordingly through the design-to-build process. The concept of a group-based ‘gain share – pain share’ is recommended as a proper focus of the optimized projects in managing risk. Projects using this model will manage risk better, leading to less cumulative risk, fewer claims and ultimately lower costs of premiums and instances of litigation.

The risks of the project are not different in an optimized project, but how those risks are mitigated is likely to be different. For example, creative new approaches to risk might include creation of an entity that could serve as a risk “consolidator” and could work more efficiently by managing the risk of the entire project versus each individual entity trying to deal with its small part.

By using this new model, whether through legal means or not, the risks of the project can be combined as well. The incentive to manage and mitigate the risks and reduce the costs of doing so would be shared by all members of the entity. If managed well, the entity and its members would reap the reward.

Another possibility for risk management is the concept of a product handling the overall project risk, maybe called “ProjectGuard” (similar in concept to Zurich’s Subguard® product currently used for trade contractors).

Key Elements for Transformation

To realize the benefits of optimized construction projects, Owners need to behave differently. An optimized process focus extends far beyond the procurement process...it goes to proper alignment of the terms of the contract; goals, relationships, expectations, and definition of project success. Which behaviors need to change and how do they need to change?

This section addresses some of the essential elements that require transformation in order to achieve an optimized construction project. For each issue, examples, along with suggested guidance on how to make the transformation, are also provided.

Key elements for transformation necessary to achieving the optimized process include the following:

- ▲ **Focusing beyond “Cost”**
- ▲ **Technology / Building Information Modeling**
- ▲ **Information Sharing**
- ▲ **Compensation tied to Desired Outcomes**
- ▲ **Incentives that Reward Performance**
- ▲ **Preplanning – A Critical Step**
- ▲ **Contract / Legal or Regulatory Constraints**
- ▲ **Contingency / Cost Management**

Focusing beyond “Cost”

A critical concept of the optimized project process is a focus beyond cost. This applies to all parties in the team or project entity. The solution is in driving for optimum *value*, not necessarily the lowest *cost*. It is not that cost is not a driver; cost in an optimized project is one of a range of factors important to the success of the project, all of which must all be balanced. Efficiencies measured solely in cost, lead to poor decisions, actual inefficiencies, and ultimately greater cost.

Owner behavior as regards cost versus value is critical. Education of other participants in the construction process is equally important, including procurement professionals and senior management who may not be familiar with construction. Strong owner leadership and a true understanding of cost—particularly the choice of value over cost—are essential.

The recommended process is not about choosing exclusively between schedule, quality, safety, or cost but achieving the optimum balance of all four while allowing owners to define value differently. Having a process that focuses on identifying and delivering that value becomes paramount to achieving a successful project.

Technology / Building Information Modeling

The industry has at its disposal new technological tools that will allow information to be created once and used for the entire project lifecycle, rather than the generation of the same information multiple times in typical processes today. Desire for this re-use of project information beyond the design created by Architects and Engineers will be a driver in market adoption of Building Information Models. Standards will be established for how building information models are developed with regard to content and modeling methods to produce information output supporting downstream BIM automation services, aligned with the Owner’s business objectives.

Owners must set the tone for the project by requiring their design and construction teams to use the latest technologies. Including these requirements in Requests for Proposals is a simple step that Owners can start using today. Further, the Owner should use the technology as well.

Owners should support industry initiatives to create standards where they are needed. Owners should increase their awareness of the technology tools that their consultants and contractors are using on their projects. Owners need to recognize that their projects will be affected by the choice of technology solutions that are being used on their projects, not just during the development phase, but also after the project is complete during the ongoing operation of the facility.

Information Sharing

An essential element woven throughout the effective transformation of the industry to an optimized model is the ability for all parties to communicate freely. Current practices of silence due to liability must be abolished and a new process where decisions are made at the highest and most appropriate level of competency must be established, leveraging team knowledge. This may result in ‘non-traditional’ project roles and job descriptions and may vary from project to project based on the skill sets of the participants. It most certainly will be the greatest obstacle to transformation and the realization of the optimized project. Owners must demand this openness and transparency from the team entity of which they are a part.

Compensation tied to Desired Outcomes

Optimized projects should be managed through measured outcomes that are established at the project outset. These outcomes should include the traditional objectives of time, risk and cost, but may also include specific

quality and performance criteria. In one possible compensation scenario, participants in the project could be compensated in accordance with the value of their contribution to such outcomes in a gain-share/pain-share philosophy.

Outcome-based compensation may not be tied to the particular cost structure of a given project participant, but to the value of work transmitted. For example, the generation of digital assets by a consolidated project team has a value to the design, procurement and operation of an owner's project, and there could be compensation provided accordingly. In another scenario, compensation to the project team may be tied to the Owner's performance measures and business goals.

In general, compensation mechanisms proposed should respect the value of competition in the marketplace as well as applicable procurement regulations, and should be correlated to project structure, characteristics of deliverables, and approach. Compensation should be correlated to both the value (in terms of both time invested and measurable outcome) and risk ascribed to each member of the team.

Incentives that Reward Performance

Incentives can take a variety of forms, but typically are used to reward performance that is consistent with the owner's desired goals for the project. Creative uses of cost incentives to reward the kinds of performance that is desired can be extremely helpful in focusing a team on an optimized path.

Tying the team entity definition of success to the definition of project success is critical to the optimized project. Incentives may then be awarded not based on individual team member performance but based on the overall performance of the team entity and the members' level of contribution to that success. Incentives should be available to the key team members that can affect the desired outcomes.

Some owners have used incentives that are tied to performance. The U.S. General Services Administration (GSA) has successfully used incentive award fees, a type of performance based incentive. Incentives tied to achieving specific milestones that help achieve the project goals are another option.

Use of cost savings splits with caps is another option for consideration when the Owner desires to drive down construction costs. Projects with stated cost limitations that do not necessarily desire to realize savings, but rather maximize the program and the quality or decrease the delivery time, would not necessarily be encouraged to use cost savings splits. Instead, these projects should consider using performance based incentives tied to the desired outcomes such as decreased delivery times or increased program or quality.

Preplanning – A Critical Step

A factor critical to the success of the optimized project is establishing project criteria early, prior to starting design. The team entity must develop a clear, mutually held understanding of all project and team entity goals, values and objectives. A concise description of project scope and program along with a preliminary budget that is aligned with the scope is vital to setting a project up for success. This process takes time, and owners must demand it of the team entity. Attention should be given to the source of information used as the basis for the preplanning effort. In the optimized project, whenever possible, members of the eventual project team should be asked to contribute to the preplanning effort.

The decision to fund a project and approve it to move forward into the development phase is often based on information produced during the preplanning phase. In many situations, there is a delay between the execution of the preplanning and the actual receipt of both the necessary approvals and funding to move forward. Therefore, a necessary, but often ignored, step is to taking time to update the intentions of the preplanning effort prior to moving forward with project design and construction.

For example, comparing planned cost escalation must be validated against actual and anticipated escalations. If costs have escalated beyond amounts allowed for in the original preplanning estimates, a major decision must be addressed. How an owner behaves at this critical point will determine a project's ultimate success.

If the result of such an analysis suggests that project is not feasible, then the preplanning effort must be updated to reflect either a higher budget or reduced program. At minimum, a contingency plan should be developed for worst-case scenarios.

Contracts/Legal or Regulatory Constraints

Essential to an optimized project are contracts that define business terms facilitating collaboration. Fundamentally, the premise should be that the parties should determine the basis of a contract from their relationships. Out of relationships; contracts are born; not vice versa. Contract terms should be a tool to align the team member's goals with that of the project, and project relationships should be recorded in contract documents that describe desired outcomes and expectations in clear and measurable ways. The team entity should use documents as a method of recording responsibilities, rewards and consequences based on clear positive proactive language.

Contract language should reinforce the sharing of information throughout the life cycle of the project. Definitions that allow all parties of the team entity to access, use and share information that is developed over the course of the project are key. Joint and shared liability arrangements will be created to eliminate barriers that discourage the sharing of information. For example, information, drawings and Building Information Models created during the life cycle process of a project will be available to all appropriate parties in such a manner that they can carry out their individual business processes in an efficient, effective and nonredundant method. Contracts will need to address the risk associated with the data developed in BIM design as it relates to the multi-party participation in its development; re-use of the data developed in BIM design also needs to be clearly articulated.

Contract Documents will need to allow for owners to utilize different project delivery methodologies consistent with their risk tolerance, experience and corporate culture, while not dictating a limited pallet of solutions. Design professionals will likewise find opportunities to be of service in non traditional roles throughout the life cycle of a project.

While these new contractual models evolve, owners should continue to look for existing contracts that address the difficult task of describing collaboration. These would include contracts that have language addressing the use of digital information such as Building Information Modeling, describing the contractual responsibilities related to the creation and use of the model. This also includes the use of open-book, not-to-exceed or guaranteed maximum price (GMP) contracts.

Contingency / Cost Management

Project participants generally come to the table with some contingency funding in place to cover the unknowns of what they perceive to be their responsibilities. Projects themselves in design development and construction estimating carry contingency. As a result, there are on each project a range of uncoordinated contingency funds that can result in redundant coverage. While necessary in current practice, under the 'gain-share/pain-share' philosophy of the optimized world, project contingency becomes a single shared entity to be leveraged in its use. Ultimately for Owners, contingency management may result in project savings or increased quality.

Contingency management could then become the process of the effective management of this fund. At completion, the money that is left on the collective table becomes the fruit of successful contingency management. With the support of proper compensation, incentive, and business relationship models effective

contingency management can occur. In the end, it can be one significant key to managing project risk. Owners should give the team entity an appropriate level of authority to use its discretion to manage project contingencies, and communicate such to the entire team.

3. Research Scenario Description

Overview

To validate the benefits of optimized processes, it is recommended that a program of pilot projects be identified by CURT members and a research effort be put in place to evaluate the impact of using the optimized processes outlined in this whitepaper.

The research team will be selected via a Request for Proposal process and will compete based on their research methodologies. The successful research team will evaluate the previous work in this area, including CURT's whitepapers, and develop a complete research plan. The intent of this research effort anticipates one project identified as early in the planning phase as possible with the ability to implement as many of the optimized project principles as appropriate.

Simultaneously a similar project using a more traditional process would also be identified. This "traditional project" would serve as a benchmark to allow a comparison of the results achieved on the "optimized project". The successful research team shall review this concept; develop it; and implement it.

While CURT membership and industry covers a broad spectrum of projects that an 'Optimized Process' may apply to, it is not possible to implement pilot programs across that spectrum. As such, the project described below targets a building project. The research team and CURT membership will determine the availability of other project types for study and will implement their research accordingly.

Pilot program

In order to be beneficial, the research program must be accomplished in a timely, structured, meaningful, and measurable environment. To that end, suggested requirements for projects used to evaluate and test the assumptions of this whitepaper are as follows:

- a. Project Size
 - i. \$20 - \$30 Million
 - ii. No Repair & Alteration type projects as pilot
 - iii. Ideally new construction (it would be helpful something was used that could be modeled against, i.e., previous real results, good or bad)
 - iv. Office...more generic than specific
 - v. Defined requirements
- b. Process for Owner/Architect/Contractor TEAM
 - i. Communication
 - ii. Owner/Architect/Contractor Issues to Address:
 1. Coding to Schematic...Code table shared
 2. Legal Counsel...team talk
 3. Open Protocol
- c. Digital Medium
 - i. Web-based
 - ii. Common Website
 - iii. Agreed upon protocols

Metrics

The industry is driving the process; as such, metrics must be put in place to determine variables within the industry and differentiate how much is due solely to the use of the latest technology, personal skill sets, and product development and how much is attributable to an optimized process. Further, metrics and analysis of data must delineate which pieces of the hypothesis are required, optional, or unnecessary. This challenge is posed to the research entity to help determine and will best be developed at time of project development and implementation.

Below is a list of potential metrics. A modified, or more extensive, list of metrics will be developed by the research team. The basic approach is to define what “success” would be on a project; what needs to be done to achieve that success; how to measure those achievements; and how to terminate the process. In essence the following questions must be answered:

- What do we need for project success?
- What to do to achieve project success?
- Value of Liquidation...how does the process close?

Metrics to be considered include but are not limited to:

▲ **Cost**

- Cost Growth
- Cost Management

▲ **Time**

- Schedule – Overall Delivery Time (Cycle time)

▲ **Quality** (must be defined)

- Number of RFI's
- Number of Field Change Orders (FCO's)
- Rework (design and construction)

▲ **Actual versus Planned Outcomes**

- Meeting the Business Need
- Workforce (i.e. productivity, etc.)
- Resources

▲ **Other Measurable Benefits of Collaboration** (Safety, Project Closeout, etc...)

4. Glossary of Major Terms

The many uses of the common terms used in construction vary. Given the significant transition the industry is in the process of going through, and is likely to continue going through for some time, this condition is likely to worsen before it gets better. Therefore, the definitions of the following terms are offered to clarify their usage in this whitepaper.

To provide consistency and context throughout the whitepaper, attempts were made to keep the uses of these terms consistent with the following definitions:

Optimized Project – Optimized Projects are projects highlighted by their use of fully collaborative, fully integrated and thus, highly productive teams. They are characterized by their higher level of “success” as defined by the owner and shared by all of the members of the project team.

Optimized Processes – Optimized Processes are processes that have been streamlined, often using “lean principles”. Optimized processes are more efficient and have as much waste removed as possible.

Building Information Modeling (BIM) – Building Information Modeling is an evolving term generally referring to the broad use of 3D digital building models with linked parametric information to achieve the goal of integrated project data, enhanced visualization, and data sharing and reuse by various members of the project team.

As it relates to the “optimized” construction project, use of building information modeling is seen as part of the technology that is expected to enable the collaboration and integration to allow teams to become more productive.

While BIM is evolving into an accepted industry term for 3D modeling and information integration in the building industry, it is also effectively being applied in the manufacturing processes as well.

Collaboration – Collaboration is an act of working together jointly. In an “optimized” construction process, Fully Collaborative Teams are highlighted by open sharing of ideas in a non-threatening environment.

Integration – Integration is the act of combining separate parts or elements into a unified whole. In an “optimized” construction process, Fully Integrated Teams are highlighted by open communication where individual members are working toward the best interest of the project as a whole. Technology Integration is seen as the separate systems supporting individual team’s processes being “combined” into a system where information is shared.

Productivity – Productivity is the efficiency with which output is produced by a given set of inputs. Productivity is generally measured by the ratio of output to input. In an “optimized” construction process, Highly Productive Teams are working collaboratively and integrated both with their human and technological processes. They are striving for the highest level of efficiency getting the most out of all the effort being put into the project, eliminating as much wasted effort as possible.

Project Success – Project Success is defined as projects that achieve the project team’s goals and deliver to the owner the best balance of cost, schedule, quality and safety.

Gain Share/Pain Share Philosophy – A Gain Share/Pain Share Philosophy’s foundation is the fundamental concept that all parties to an optimized project bring with them business goals and objectives with the Owner objective paramount as that is the basis for the project. As those business goals are achieved or missed certain rewards are gained or missed. If Owner’s business objectives are missed, the consequences can be far reaching, and somehow missed Owner goals must be distributed to the team. On the other side, if the Owner experiences a benefit due to a highly successful project, that benefit should be shared to some extent with all those involved in achieving it. In this regard, all parties joining a project team understand the intent, urgency, and consequence of the venture they are about to embark upon and share in the gain and pain of their collective actions.

Special Purpose Entity (SPE) – A Special Purpose Entity, whether virtual or legal, is a fully collaborative, fully integrated and highly productive team that has been assembled for a specific purpose.

Construction User Roundtable Publications

The purpose of developing Construction User Roundtable (CURT) publications is to disseminate recommendations, guidelines, and reports developed by the Construction Users Roundtable. CURT is focused on improving the cost effectiveness of the U.S. construction industry. These publications have been developed from the point of view of owners or users of construction services. Efforts by all segments of the industry, however, are vital if major improvement is to be the result.

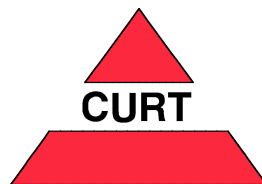
This publication is one of a series from committees or study teams addressing a problem area.

Findings and recommendations of The Construction Users Roundtable are included in publication series classified as White Papers (WP), Reports (R), or User Practices (UP). In addition to these classifications, CURT publications are numbered based on the category of the topic:

Category	Number Code
Constructability	011 to 099
Contractor Management	101 to 199
Cost	201 to 299
Interface Management	301 to 399
Workforce/Industrial Relations	401 to 499
Material Control	501 to 599
Purchasing	601 to 699
Quality	701 to 799
Safety	801 to 899
Security	901 to 999
Strategy	1001 to 1009
Work Planning and Scheduling	1101 to 1199
Technology/E-Sourcing	1201 to 1299
Special Projects	2001 to 2099

Examples:

- WP-1201: A CURT White Paper on Reverse Auction
- R-402: A CURT Report on Tripartite Initiatives
- UP -801: A CURT User Practice on Construction Safety in Contractor Prequalification



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