The Integrated Agreement for Lean Project Delivery

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Traditionally, facility owners have been presented with a standard set of project delivery options: design-bid-build, construction management (agency or at-risk), or design-build. Despite this range of options, many owners remain dissatisfied: projects take too long, they cost too much, and the work fails to meet quality expectations. In addition, construction projects continue to present serious safety risks, with nearly 1,500 accidents and four deaths per day.[1] This article explores a different project delivery opportunity—one that seeks to address some of the root causes that potentially limit the effectiveness of other models. The proposed method involves a contractual combination of "lean project delivery" and an integrated team. The Integrated Agreement for Lean Project Delivery offers improved project performance both from the owner's perspective (reduced cost and time, improved quality and safety) and from the viewpoint of the designers and contractors (increased profit and profit velocity, improved safety, and employee satisfaction). While the jury is still out, early results are very promising.

Traditional Responses to Owner Dissatisfaction with the Status Quo

Over the past 100 years, the design and construction industry has become increasingly fragmented. Each specialized participant now tends to work in an isolated silo, with no real integration of the participants' collective wisdom. As construction practitioners, we are familiar with the most common industry responses during the past thirty years. Postdesign constructability reviews and value engineering exercises, together with "partnering" and contractual efforts to shift risk, have been the most prevalent. However, these "solutions" do not attack the problem at its root cause; rather than working to avoid the problem, providing higher value and less waste, these attempts merely try to mitigate the negative impact of the problems. With due respect, they are well-intended band-aids. After a heavy investment of time, money, and ego in a proposed design, the inertia against considering the full range of solutions that might be offered by deep value analysis or constructability reviews becomes quite strong.[2]

In reality, project success requires that this fragmentation be addressed directly. A study by the Construction Industry Institute exploring the impact of different project delivery systems on cost, schedule, and quality found that:

> Projects are built by people. Research into successful projects has shown that there are several critical keys to success:
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> 1) A knowledgeable, trustworthy, and decisive facility owner/developer;
> 2) A team with relevant experience and chemistry assembled as early as possible, but certainly before 25% of the project design is complete; and
> 3) A contract that encourages and rewards organizations for behaving as a team.[3]

What Is Lean?

In the United States, the terms "lean production" and "lean manufacturing" largely derive from the Toyota Production System (TPS).[4] At Toyota, TPS represents only part of a broader business philosophy, known as the "Toyota Way." Although a number of "tools" have been developed that are often identified with TPS, the underlying philosophy and its context are important in this discussion of the use of an Integrated Agreement for Lean Project Delivery. Stated generally, the goal and philosophy of TPS are to produce value, as defined by the customer, without producing waste.

To understand TPS, one first must understand its underlying principles and the context in which it was developed. Toyota has its industrial roots as a loom manufacturer. Its initial innovation was to power the looms with a steam engine. Powered looms presented a new dilemma—the loom would continue to run even if the thread broke. Toyota devised a system that would automatically shut down the loom when the thread broke. This system eliminated the waste that would occur if the loom continued running and producing defective material. This principle of "autonomation" or self-regulation (shutting down production in the face of a defect) was carried forward into TPS as what is often referred to as one of the two pillars of TPS.

Toyota Motor Company was formed in the late 1920s and was only marginally successful. After a visit to the United States, Toyota's chairman challenged the chief engineer to meet U.S. productivity levels (a tenfold improvement) within three years. Toyota did not have the capital, supply chain, or infrastructure to support a level of productivity comparable to Ford and GM. Demand for cars in Japan was not constant, and consumer demand was more varied. As a result of these limitations, the second pillar of TPS developed: just-in-time delivery. Using just-in-time delivery, Toyota only produces items when there is an order, minimizing inventories of finished goods. Further, large stores of raw materials or work-in-process is avoided by having those goods "pulled" to the plant when an order is received. Toyota's ultimate goal is to produce a car to the requirements of a specific customer, deliver it instantly, and maintain no inventories or immediate stores.

In order to sustain a system with no inventory or work-in-process, Toyota needed to produce items without defects because a defect would require stopping the production line. Further, this would require tight coordination between all sections of the factory, using clear language and systematically requesting parts and materials at the proper time. To ensure that defective parts are not

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forced further into production, Toyota workers are now expected to act as the autonomic loom had: stopping production if they find a defect. This system decentralizes authority and empowers factory workers in ways that were previously unprecedented in the West (or in Japan, for that matter).

Finally, the implementation of just-in-time delivery shifted the focus from the productivity of each unit in the factory to the overall productivity of the system. Because no unit could individually produce parts or perform a function to create inventory, units were only as productive as the overall system. This had the benefit of keeping the entire factory focused on "throughput," the output of the entire plant.

Beyond the two pillars of autonomation and just-in-time delivery, Toyota developed a guiding business philosophy known as the "Toyota Way." After studying Toyota for a number of years, Jeffrey Liker identified Toyota's guiding principles:

1. Base your management on a long-term philosophy, even at the expense of short-term financial goals.
2. Create continuous process flow to bring problems to the surface.
3. Use "pull" systems to avoid overproduction.
4. Level out the workload (work like the tortoise, not the hare).
5. Build a culture of stopping to fix problems, to get quality right the first time.
6. Standardized tasks are the foundation for continuous improvement and employee empowerment.
7. Use visual control, so no problems are hidden.
8. Use only reliable, thoroughly tested technology that serves your people and process.
9. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.
10. Develop exceptional people and teams who follow your company's philosophy.
11. Respect your extended network of partners and suppliers by challenging them and helping them improve.
12. Go see for yourself to thoroughly understand the situation.
13. Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.
14. Become a learning organization through relentless reflection and continuous improvement.[5]

Liker also offers the following insight:

> In courses I have taught on lean manufacturing, a common question is, "How does TPS apply to my business? We do not make high-volume cars; we make low-volume, specialized products" or "We are a professional service organization, so TPS does not apply to us." This line of thinking tells me they are missing the point. Lean is not about imitating the tools used by Toyota in a particular manufacturing process. Lean is about developing principles that are right for your organization and diligently practicing them to achieve high performance that continues to add value to customers and society. This, of course, means being competitive and profitable. Toyota's principles are a great starting point. And Toyota practices these principles far beyond its high-volume assembly line.[6]

So, with TPS and the Toyota Way as the background, how do these principles apply to the design and construction industry?

The Application of TPS Principles to Design and Construction

The Lean Construction Institute (LCI) has grappled with how the ideals of TPS and lean production could be applied to design and construction. One of the fundamental differences identified in the project setting was that design and construction are not a high-volume, repetitive process like car manufacturing. As project folks will tell you immediately, they are in a "one-off" situation. What manufacturing accomplishes by the arrangement of the factory or modification of its machines cannot be replicated in design and construction.

Greg Howell and Glen Ballard, the founders of LCI, hit the proverbial nail on the head. They identified the key "item" flowing on a project is the work that is completed by one performer and handed off to his successor. Like just-in-time deliveries of materials, what was being delivered was work from one trade to another. Finding that the theories of dependence and variation[7] largely explain what happens on a project when reliable work flow between trades is not maintained, they developed a planning system that enables a project team to focus its attention on causing work to flow across the value stream.[8] This system also incorporated the idea of autonomation by distributing responsibility for developing and maintaining the planning model to the "last planners"—the individuals who, like the factory workers at Toyota, need to be in a position to stop production if the preceding work is defective.

Needless to say, the Last Planner System™ (LPS) created quite a stir in the "command and control" structure embedded in construction project management since the days of Fredrick Taylor. Its goal is to create reliable workflow by having the project team, including all affected firms, collaboratively create a phase plan for a segment of the work (e.g., foundations). Thereafter, a six-week look-ahead plan is prepared where the team identifies the constraints or prerequisites that must be satisfied for a work assignment not to be "defective." Each week, the team screens upcoming work assignments for "defects" (e.g., unanswered RFIs, incomplete prerequisite work, missing materials, lack of equipment, or labor resources) and only releases work to the field that has no constraints. Work commitments are then obtained, again from the "last planners," based on requests made to the last planners. Because the system values reliability over speed (in Liker's words, the tortoise over the hare), last planners are *expected to decline* an assignment if either the assignment is defective or they lack confidence that they actually can perform the task. By saying "no," the team is then able to replan the work and avoid the waste that is created when the downstream performer plans its staffing, deliveries, etc., based on a flow that will not happen.

At its core, "the essential work of projects is conducted as conversations . . ." and "the work of business in making and keeping commitments."[9] As such, the effectiveness of the LPS is dependent on the concept of making and securing reliable promises.[10] Before making a commitment, then, the last planner must: deter-

mine that the proposed performer is competent; estimate the time to perform; confirm availability and allocate capacity for the estimated time; ensure there are no hidden doubts about performing; and be prepared to be responsible for any failure. Obviously, to make these assessments, the last planner often may need to be in conversation with others and seek their commitments as well. Hence, as discussed below, projects become networks of commitments.

Proper use of the LPS produces reliable work flow and stabilizes the project. It results in reduced costs, shortened durations, increased quality, and increased safety. The LPS is to the project setting what just-in-time delivery is to manufacturing. As Liker says, "lowering the 'water level' of inventory exposes problems (likes rocks in the water) and you have to deal with the problems or sink. Creating flow, whether of materials or of information, lowers the water level and exposes inefficiencies that demand immediate solutions."[11] Employing the LPS produces stable work flow, allowing the project team to explore other opportunities to eliminate waste from the design and construction process. Some of these other opportunities—such as target value design and built-in quality—are described below when the terms of the Integrated Agreement are discussed.

Sutter Health's Formulation of a Lean Project Delivery Strategy

Sutter Health is a not-for-profit, community-based health care and hospital system headquartered in Sacramento, California. It has embarked on a building program that includes a contemplated $6.5 billion design and construction project to be completed by the end of 2012. With the assistance of Lean Project Consulting, Inc., Sutter Health has developed an approach to lean project delivery that strives to coherently address each level of the project delivery system—the physics of work, organizations, and contracts. This approach has become known in the lean project delivery community as the "Five Big Ideas." The Five Big Ideas are summarized in Figure 1.

Figure 1: The Five Big Ideas

The Five Big Ideas form the framework for approaching all aspects of Sutter Health's lean project delivery. The description that follows is taken from the manifesto that has been signed by members of its facility, planning, and development (FPD) and its design and construction community:[12]

1. *Collaborate; really collaborate, throughout design, planning, and execution.*
   Constructable, maintainable, and affordable design requires the participation of the range of project performers and constituencies. Since abandoning the master-builder concept and separating design from construction, we have been patching a poorly conceived design practice. Value engineering, design assist, and constructability reviews mask an underlying assumption—that design can be successful when separated from engineering and construction. Design is an iterative conversation; the choice of ends affects means, and available means affects ends. Collaborative design and planning maximizes positive iterations and reduces negative iterations.
2. *Increase relatedness among all project participants.*
   People come together on AEC projects as strangers. They too often leave as enemies. Health care facilities projects are complex and long-lived, requiring ongoing learning, innovation, and collaboration to be successful. The chief impediment to transforming the design and delivery of capital projects is an insufficient relatedness of project participants. Participants need to develop relationships founded on trust if they are to share their mistakes as learning opportunities for their project and all the other projects. This will not just happen. However, we are learning that relationships can be developed intentionally.
3. *Projects are networks of commitments.*
   Projects are not processes. They are not value streams. The work of management in project environments is the ongoing articulation and activation of unique networks of commitment. The work of leaders is bringing coherence to the network of commitments in the face of the uncertain future and cocreating the future with project participants. This contrasts with the commonsense understanding that limits planning as predicting, managing as controlling, and leadership as setting direction.
4. *Optimize the project, not the pieces.*
   Project work is messy. Projects get messier and spin out of control when contracts and project practices push every activity manager to press for speed and lower cost. Pushing for high productivity at the task level may maximize local performance but it reduces the predictable release of work downstream, increases project durations, complicates coordination, and reduces trust. In design, we incur rework and delays. In the field, this means greater danger. We have a significant opportunity and responsibility to reduce workers' exposure to hazards on construction projects. Doing so can bring about more than a 50 percent improvement in safety on the work site. As the leading community-based health care system in northern California we are committed to do all that is possible so that the people who build these projects are able to go home each night the way they came to work. The way we understand work and manage planning can increase that messiness or reduce it.
5. *Tightly couple action with learning.*
   Continuous improvement of costs, schedule, and overall project value is possible when project performers learn in action. Work can be performed in a way that the performer gets immediate feedback on how well it matched the intended conditions of satisfaction. Doing work as *single-piece flow* avoids producing batches that in some way don't meet customer expectations. The current separation of planning, execution, and control contributes to poor project performance and to declining expectations of what is possible.

Development of the Integrated Agreement for Lean Project Delivery

In order to fully embrace the Five Big Ideas, Sutter Health determined that it should develop a relational contract[13]—an agreement that would be signed by the architect, the construction manager/general contractor (CM/GC), and owner—and would

describe how they were to relate throughout the life of the project. Further, the new relational agreement also would address the underlying principles of lean project delivery and the Five Big Ideas so that all members of the "integrated project delivery team" would have a clear understanding of how the project would be administered. What follows is an "executive summary" of some of the major elements of Sutter Health's Integrated Agreement for Lean Project Delivery organized around the concepts of the Five Big Ideas.

Relationship of the Parties

The Integrated Agreement is a single contract that is signed by both the architect and the CM/GC. It is not a design-build agreement, where one entity takes total responsibility for all aspects of project delivery. Instead, the Integrated Agreement describes the relationships that are established among each of the members of the integrated project delivery (IPD) team, recognizing that different members, whether traditionally a consultant or a subcontractor, may have design responsibility. From the outset, the Integrated Agreement seeks to create coherence between the interests of the project and the participants and to align the interests of the project performers. The Integrated Agreement calls for a team to be selected based on responses to requests for proposal—it is a quality, value-based selection rather than based on lowest price. Conceptually, the primary members of the team are selected at the outset of the project. Whether the architect or CM/GC is selected first depends largely on the preference of the owner. However, since historically the architect has been selected first, an interesting message of commitment to change can be signaled by selecting the CM/GC first.

The direct parties to the Integrated Agreement are the owner, the architect, and the CM/GC. Rather than being conceived as a "three-legged stool," this primary relationship is depicted as three overlapping circles. The project representatives for each of these entities form the "core group." This group, which also may invite other members of the IPD team to join (or leave) the core group, has primary responsibility for the selection of the rest of the IPD team and for management and operation of the project. Most major project-related decisions are to be made by consensus of the core group. Only in the event of impasse does resolution of issues transfer to the owner. The core group, which is to meet regularly, also is responsible for developing and implementing various project plans that reflect the core group's strategy for communication, planning, quality, and other aspects of the project.

The core group also is responsible for joint selection of other members of the IPD team. While the owner, CM/GC, and architect each can recommend firms from whom proposals should be solicited, ultimately the list is developed and approved by the core group. Once additional IPD team members are chosen, each is expected to sign a joining agreement, acknowledging that the firm is familiar with the terms of the Integrated Agreement and agrees to participate in the project based on the described level of responsibility and collaboration. To facilitate integration into the team and the anticipated level of collaboration, the Integrated Agreement contemplates that the major consultants and subcontractors will be selected during schematic design. By bringing the team together early, the agreement seeks to gain maximum participation and innovation when the team's efforts are likely to have the greatest financial impact.[14]

The Integrated Agreement also calls for executive oversight for the core group to foster learning and a collaborative environment. Senior executive representatives are expected to join the core group meetings on at least a quarterly basis. In addition, the senior executives are expected to participate in problem solving in the event the core group is unable to promptly resolve an issue. Similarly, in addition to the core group meetings, the core group is called upon to schedule regular IPD team meetings to address project design and construction issues, to confirm that information is being shared across project teams, and to gain the benefit of having shared expertise to address preconstruction issues.[15]

Finally, the Integrated Agreement expressly sets forth the goals of forming an IPD team:

> By forming an Integrated Team, the parties intend to gain the benefit of an open and creative learning environment, where team members are encouraged to share ideas freely in an atmosphere of mutual respect and tolerance. Team members shall work together and individually to achieve transparent and cooperative exchange of information in all matters relating to the Project, and to share ideas for improving project delivery as contemplated in the Project Evaluation Criteria. Team members shall actively promote harmony, collaboration and cooperation among all entities performing on the Project.
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> The parties recognize that each of their opportunities to succeed on the Project is directly tied to the performance of other Project participants. The parties shall therefore work together in the spirit of cooperation, collaboration, and mutual respect for the benefit of the Project, and within the limits of their professional expertise and abilities. Throughout the Project, the parties shall use their best efforts to perform the work in an expeditious and economical manner consistent with the interests of the Project.

Creating a Collaborative Design and Construction Environment

Collaboration occurs best when the participants view themselves as equal in the process and when the initial collaboration centers on exploring and defining the problem, rather than commenting on another's proposed solution. The Integrated Agreement recognizes this need as follows:

> In order to achieve owner's basic value proposition, design of the Project must proceed with informed, accurate information concerning program, quality, cost and schedule. While each IPD Team Member will bring different expertise to each of these issues, all of these issues and the full weight of the entire teams' expertise will need to be integrated throughout the preconstruction process if the value proposition is to be attained. None of the parties can proceed in isolation from the others; there must be deep collaboration and continuous flow of information.
>
> In support of the goal to make the owner's value proposition

paramount, the Integrated Agreement calls for the core group to develop a target value design[16] plan and requires the IPD team members to provide target value design support services throughout development of the design. Target value design is intended to make explicit that value, cost, schedule, and constructability (including work structuring) are basic components of the design criteria. It contemplates that the owner will have a series of value propositions (e.g., a desire that each worker have access to natural light), in addition to its purely programmatic needs, which may need to be ranked to achieve the basic business case. The core group's target value design plan is expected to address formation and meeting schedule of cross-functional teams or clusters; meetings for the system or cluster leaders to share information about their system with those responsible for other systems; continuous cost model updating to ensure that ongoing design is not exceeding budget; and methods for evaluating target value design trade-offs and opportunities (including function/cost trade-offs) to maintain total project target cost.

The goal of target value design is to enable the design to proceed informed, on a real-time basis, by the cost, quality, schedule, and constructability implications of proceeding with a design concept. Traditionally, the construction team participated, if at all, only after designs have been committed to paper and thrown over the wall—performing "un-constructability analysis" and "devalue engineering." At best, this results in negative iteration and waste when designs have to be changed when they prove to be over budget or not constructable. Instead, the Integrated Agreement seeks to create the equivalent of "paired programming," where individuals with different backgrounds and expertise simultaneously, side-by-side, attack the same problem, allowing each to benefit from the expertise of the other. The team is expected to engage in design reviews with an eye toward value—constantly exploring whether other construction options will better serve the owner's value proposition.

The Integrated Agreement also permits the core group to identify which firm will have design responsibility for a given scope. It expects that major portions of the project will garner the participation of design-collaboration or design-build subcontractors (mechanical, electrical, plumbing, fire, curtain wall, skin). Again, the design process is structured to encourage the sharing of intermediate design documents, rather than just handing off large batches of drawings at extended intervals.

The Integrated Agreement also expects that the core group will collaboratively develop a joint site/existing condition investigation plan, proposing the level of investigation that the team recommends as prudent. In addition, the core group jointly develops the scope for third-party consultants and collectively assesses the resulting work product to evaluate it for completeness and sufficiency to inform design and construction.

Collaboration does not end when the contract documents are approved for construction. The Integrated Agreement also calls for the core group to develop a built-in quality plan. Although reports vary, it is estimated that up to *10 percent of project construction cost* is spent on field rework.[17] The goal of the built-in quality plan is to cause the IPD team to openly develop ways to ensure that the expectations of the firms and individuals who will be responsible for accepting the work are communicated to the workers who will be executing the work. In addition, the plan should empower workers to "stop the production line" if they determine that work is being passed along that does not meet the agreed-upon hand-off criteria. Again, the overall goal is for all project participants to collaborate in advance about what is required and put systems in place to "mistake-proof" the process and minimize the amount of rework.

Another example of focused collaboration is in the realm of problem solving and dispute resolution. Initially, problem solving is facilitated by the core group. Rather than making the architect the arbiter of project disagreements, the Integrated Agreement calls upon the core group to conciliate and resolve these issues. If they are unable to do so, then the senior management representatives are expected to join the core group in a meeting to resolve the issue. If the issue is still not resolved, the core group may elect to retain an independent expert to review the issue and provide an unbiased assessment to the core group. Each of these levels is an effort to allow the team the opportunity to resolve any issues without creating direct adversity where one among a group of equals is empowered to make a "decision."

Articulating and Activating the Network of Commitments

The Integrated Agreement acknowledges that the ability to establish reliable work flow is dependent on the making and securing of reliable promises.

> Fundamental to the success of Lean Project Delivery is the willingness and ability of all IPD Team members to make and secure reliable promises as the basis for planning and executing the Project. In order for a promise to be reliable, the following elements must be present:
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> 1) The conditions of satisfaction are clear to both parties—the performer and the customer;
> 2) The performer/promisor is competent to perform the task or has access to the competence and the wherewithal (materials, tools, equipment, instructions) to perform the task;
> 3) The performer/promisor has estimated the time to perform the task and has internally allocated adequate resources and has blocked the time on its internal schedule;
> 4) The performer/promisor is sincere in the moment that the promise is made—only making the promise if there is no current basis for believing that the promise cannot or will not be fulfilled; and
> 5) The performer/promisor is prepared to accept the legal and reasonable consequences that may ensue if the promise cannot be performed as promised and will promptly advise the IPD Team if confidence is lost that the task can be performed as promised.

One area where the Integrated Agreement seeks to implement the linguistic-action model, focusing on requests and promises, is concerning RFIs. Under the traditional model, an RFI is often submitted, logged, tracked, hot listed, and ultimately responded to without any direct conversation between the parties, without regard to the work activity affected by the RFI, and without any

promise, reliable or otherwise, being made about when a response might be forthcoming. The Integrated Agreement first makes the bold stand of stating a "zero RFI goal" given the deep level of preconstruction collaboration. In the event that clarification is needed, however, the agreement provides:

> [t]o the extent that the need for clarification does arise, the party seeking clarification should first raise the issue either in a face-to-face conversation or via telephone in accordance with the Project Communication Protocols. The initial conversation shall describe the issue, identify the area affected, and request the clarification needed. If the parties to that conversation are able to resolve the issue in the course of that conversation, they shall also agree on how the clarification shall be documented and reported to the Core Group. If the parties to that conversation are not able to resolve the issue in the course of that conversation, they shall agree on how the issue will be resolved (who, will do what, by when) and shall agree which of them will notify the Core Group concerning the issue and how they plan to resolve it. It is the parties' goal that RFI's will only be issued to document solutions, rather than raise questions that have not previously been the subject of a conversation. To the extent that resolution of the issue may affect progress of the Work, the issue shall be included in the planning system.

The Integrated Agreement also calls for the project planning system to be based on collaborative, pull planning—using the Last Planner System or an equivalent. It identifies the fundamental characteristics that must be met:

> At a minimum, the system must include a milestone schedule, collaboratively created phase schedules, "make-ready" look ahead plans, weekly work plans, and a method for measuring, recording, and improving planning reliability.

The Integrated Agreement goes on to describe each of these elements in further detail and what is required at each level of the planning system. It also describes the elements of the planning system that need to be addressed at the "weekly look ahead planning meeting" (identification and promises for removal of constraints—e.g., RFI responses that must precede identified work) and the "weekly work planning meeting" (reliable promises from last planners of what work identified in the look ahead process as constraint-free will be completed to agreed-upon, hand-off criteria each day and by week's end). Finally, the system must capture and calculate planning reliability and root causes for variance so that the IPD team can develop a plan to improve reliability.

Optimizing the Project, Not the Pieces

The Integrated Agreement seeks to create a system of shared risk, with the goal of reducing overall project risk, rather than just shifting it. In part, this goal is supported by investing significant efforts in up-front collaboration, with the owner funding early involvement of the project team in an effort to eliminate ambiguity in the documents and maximize the collective understanding of the project's conditions of satisfaction. The Integrated Agreement also strives to raise the quality of design by insisting that design fees be supported by a resource-loaded work plan. The CM/GC is compensated on a cost-plus fee basis with a guaranteed maximum price (GMP). Some subcontractors also are compensated on a cost-plus GMP basis. GMP proposals are based on drawings submitted for permit, reducing the need for added contingency.

Historically, project owners have established separate contingency amounts for design issues and construction issues. The Integrated Agreement combines these contingencies into one IPD team performance contingency. The benefit of this shared contingency is that it focuses each team member not only on its own performance, but on the quality of other team members' performance as well. In this way, the success of every team member is directly tied to the performance of all members of the IPD team. Furthermore, access to contingencies is jointly managed throughout design and construction by the core group.

In addition, as a result of their early involvement, the CM/GC and trade contractors agree to a limited basis for change orders—material scope changes, changed site conditions, or unforeseen regulatory or code interpretations. The traditional bases for many change orders—lack of document or discipline coordination—are eliminated as a result of the coordination efforts during the design phase. Despite its lean ideals, the Integrated Agreement does not contemplate perfection; the IPD team performance contingency is made available to address work that was inadvertently omitted from the GMP estimate or results from coordination mistakes.

The Integrated Agreement also eliminates the traditional "negligence" standard as the measure of the designers' financial responsibility. Instead, the owner and the core group members negotiate a deductible as a percentage of construction costs for "errors and omissions," even those resulting from negligence, that the owner will fund out of a portion of the IPD team performance contingency. Above that "deductible," the parties negotiate a percentage for which the designer will be responsible without proof of negligence (nonnegligent cap). Above these combined percentages, the owner must show negligence to recover. This system allows the parties to establish an agreed level of quality and share the risk without being forced into an adversarial system that creates significant waste. With the level of quality established, the architect is able to prepare its resource-loaded work plan accordingly.

In the past, some owners have used a "shared savings" mechanism; however, this may cause optimizing the pieces and forecloses participation of the design team. The Integrated Agreement permits the core group to adopt an incentive sharing plan "to encourage superior performance" based on the lean project delivery goals. The program must be fashioned to support the Five Big Ideas and balance between the different behaviors and results called for by those concepts. Any program is expected to consider performance in the following areas: cost, quality, safety, schedule, planning system reliability, and innovative design or construction processes. The program must provide a basis for establishing project expectations and benchmarks and continually monitoring and reviewing the project team's performance, providing the team with periodic performance information to allow corrections or modifications *during* project performance to improve the quality of the services provided. Also, the team must participate in the pool so that it supports the creation of one unified team focused on overall project performance.

The incentive program would be funded with project savings, as evidenced by both contingency preservation and reduction in the project's costs of the work as compared to the amounts contained within the GMP. These savings would create the "incentive pool," which would then be paid based on evaluation of performance against other performance criteria. For example, the core group might establish performance goals in at least the following areas: quality, safety, planning system reliability, and innovative design or construction processes. The team's goals would be expressed as a range of outcomes from "business-as-usual," to "stretch goals," to "exceptional performance." Performance would be monitored and rated, with the overall portion of the incentive pool to be paid to the team based on performance on the noncost performance criteria.

Tightly Couple Learning with Action

Too often, projects are completed without capturing the learning; "lessons learned" are discussed at project completion to be applied on the "next" project. One of the Five Big Ideas is to "tightly couple learning with action." If periodic project reviews are not performed, then the opportunity for improvement over the life of a multiyear project is lost. Moreover, the existence of financial incentives provides added motivation for individuals and organizations to stretch beyond their current levels of performance or ways of doing business and may help overcome the inertia and resignation that often exists on projects.

The concepts of continuous improvement and learning from project performance are embedded in many of the Integrated Agreement's performance requirements. As discussed above, the planning system calls for weekly assessments of planning system reliability and reasons for variance, with the IPD team responsible for determining ways to reduce variability. Similarly, monthly assessments are to be made during construction of root causes of contingency utilization and change orders with the goal of minimizing future need.

The core group is specifically charged with developing the project evaluation criteria (this may be done in conjunction with the incentive sharing plan), conducting periodic project assessments, and planning and implementing "programs to improve Project performance and performer satisfaction with the Project." Similarly, the built-in quality plan specifically must address how to assess performance, identify root causes, and continuously improve performance.

Conclusion

The Integrated Agreement for Lean Project Delivery is a significant departure from other project delivery and contractual models. It seeks to align the commercial relationships with the lean ideals. It also recognizes the highly relational nature of the interactions of a construction project's design and construction participants that are assembled as a temporary production system. Buying design and construction is not like buying a commodity. The Integrated Agreement has been developed in an effort to support the values of lean project delivery that are exemplified in the Toyota Production System—the elimination of systemwide waste and the pursuit of value from the owner's perspective. Rather than focusing on risk transfer, the Integrated Agreement seeks to establish systems and empower the IPD team to reduce or eliminate risk by employing new conceptual and autonomic approaches to project delivery. Early assessments of lean project delivery support the conclusion that risks associated with time, cost, quality, and safety issues can be reduced by implementing lean thinking. The Integrated Agreement should support deepening those efforts and further reduce those risks.

Endnotes

1. According to the U.S. Department of Labor's Injuries, Illnesses and Fatalities Program, in 2003 there were 1,131 fatal accidents and 408,300 nonfatal injuries and illnesses in the construction industry. Website report of U.S. Department of Labor, Bureau of Labor Statistics, Industry at a Glance, "NAICS 23: Construction," http://www.bls.gov/iag/construction.htm.

2. The author was recently involved with a project where the mechanical contractor became involved during the construction document phase. The project had serious budget problems and the mechanical contractor identified a number of potential cost-saving items. Among those was an idea that would have required some architectural redesign of the penthouse but would save mechanical costs of nearly $800,000. While the entire team basically agreed that the idea was valid, because of the timing and the need for "redesign," the team seriously considered not pursuing this item. Had the idea been floated during design development, there is little doubt that the design would have been modified to achieve this savings without the cost of "redesign."

3. Victor E. Sanvido and Mark D. Konchar, Selecting Project Delivery Systems: Comparing Design-Build, Design-Bid-Build and Construction Management at Risk, at 3 (1999).

4. The Toyota Production System has been described by various authors. For those interested in reading more about this topic, three excellent sources are Jeffrey K. Liker, The Toyota Way (2004); Steven Spear & H. Kent Bowen, *Decoding the DNA of the Toyota Production System*, 77:5 Harv. Bus. Rev. 96 (1999); and James P. Womack & Daniel T. Jones, Lean Thinking: Banish Waste and Create Wealth in Your Corporation (2d ed. 2003).

5. Others have formulated the core of TPS differently. The chart that follows attempts to summarize the formulations that appear in Womack & Daniel, *supra* note 4, and Spear & Bowen, *supra* note 4:

6. Liker, *supra* note 4, at 41.

7. The impact of dependence and variation on flow in the manufacturing setting was described in The Goal, by Eliyahu Goldratt, and became the basis for the Theory of Constraints. *See* Focused Performance website, http://www.focusedperformance.com/toc01.html.

8. For a detailed discussion of this topic, see Gregory A. Howell & Glenn Ballard, *What Is Lean Construction? Selected Articles from The Lean Construction Chronicle, Spring 1999*, Proceedings of the Seventh Annual Conference of the International Group for Lean Construction (2005), *available at* http://www.leanconstruction.org.

9. *See* Hal Macomber & Gregory Howell, *Linguistic Action: Contributing to the Theory of Lean Construction*, Proceedings of the 11th Annual Meeting of the International Group for Lean Construction (2003).

10. This articulation is derived from the linguistic-action model and the work, among others, of Fernando Flores. These ideas have been brought to the lean construction community by Hal Macomber, a principal in Lean Project Consulting, Inc. A full discussion of linguistic action and its relationship to LPS can be found in Macomber & Howell, *supra* note 9.

11. Liker, *supra* note 4, at 88.

12. The Five Big Ideas and the resulting manifesto were developed by Lean Project Consulting, Inc.

13. The concept of relational contracts (as opposed to transactional contracts) was developed by Ian Macneil. For a historical retrospective of Macneil's theory of relational contracts, *see* David Campbell, Ian

MACNEIL AND THE RELATIONAL THEORY OF CONTRACT (2004).

14. VICTOR E. SANVIDO & MARK D. KONCHAR, SELECTING PROJECT DELIVERY SYSTEMS: COMPARING DESIGN-BUILD, DESIGN-BID-BUILD AND CONSTRUCTION MANAGEMENT AT RISK 51 (1999).

15. Toyota has used what it refers to as "oobeya" or " big room" meetings to gain the synergy that develops when cross-functional teams are brought together under one roof to explore problems. As noted by Toyota executive Takeshi Yoshida, "There are no taboos in oobeya. Everyone in that room is an expert. They all have a part to play in building the car. With everyone being equally important to the process, we don't confine ourselves to just one way of thinking our way out of a problem." Fara Warner, *In a Word, Toyota Drives Innovation*, FAST COMPANY (August 2002).

16. Target value design is similar to target costing, but may be broadened to encompass additional design criteria beyond cost, including time, work structuring, buildability, and similar issues. For a discussion of target costing, see Glenn Ballard & Paul Reiser, *The St. Olaf College Fieldhouse Project: A Case Study in Designing to Target Cost*, Proceedings of the 12th Annual Conference of the International Group for Lean Construction (2004).

17. The Construction Industry Institute's study, entitled *Costs of Quality Deviations in Design and Construction* (Pub. 10-1), concluded that the average rework on industrial projects exceeds 12 percent, equating to waste of $17 billion annually. *See also* Construction Owner's Association of Alberta, Project Rework Reduction Tool, *available at* http://rework.coaa.ab.ca/library/prrt/default.htm.