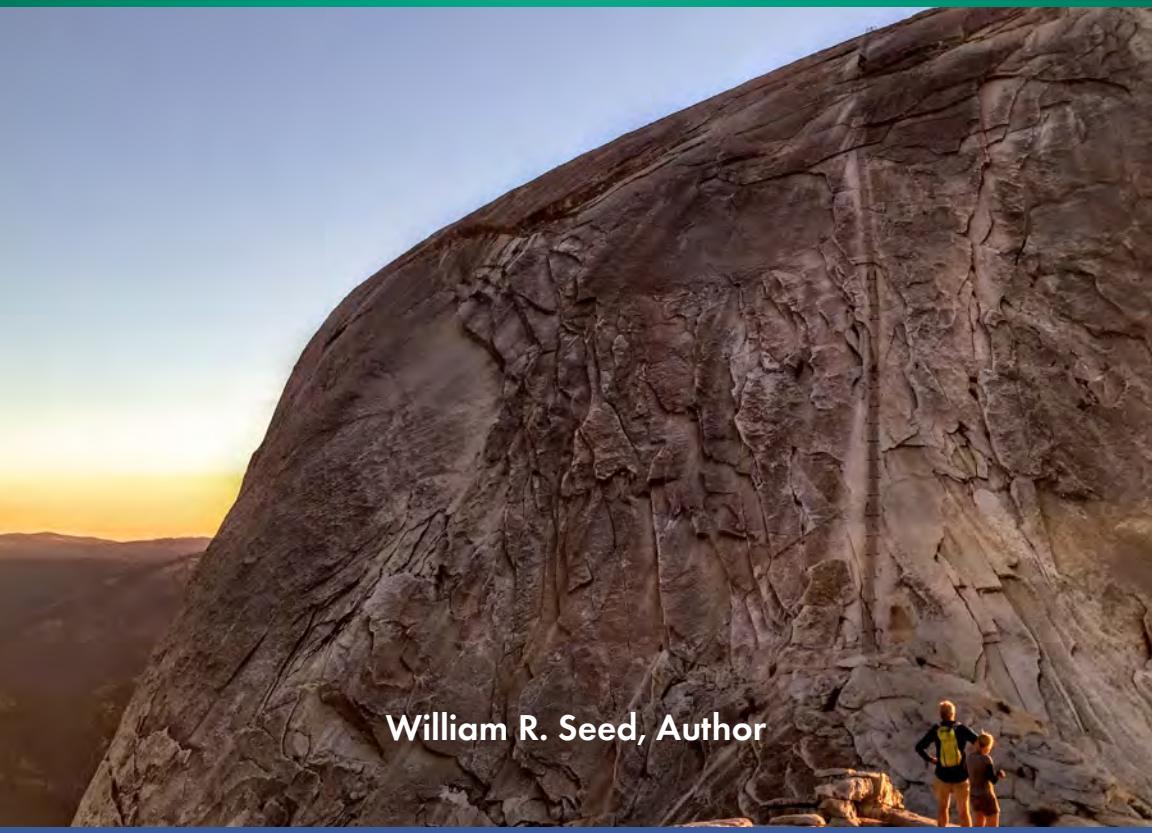
Don't Conform, Transform!

A Guide to Better Project Outcomes

Narrated by a Pioneering Leader



William R. Seed, Author

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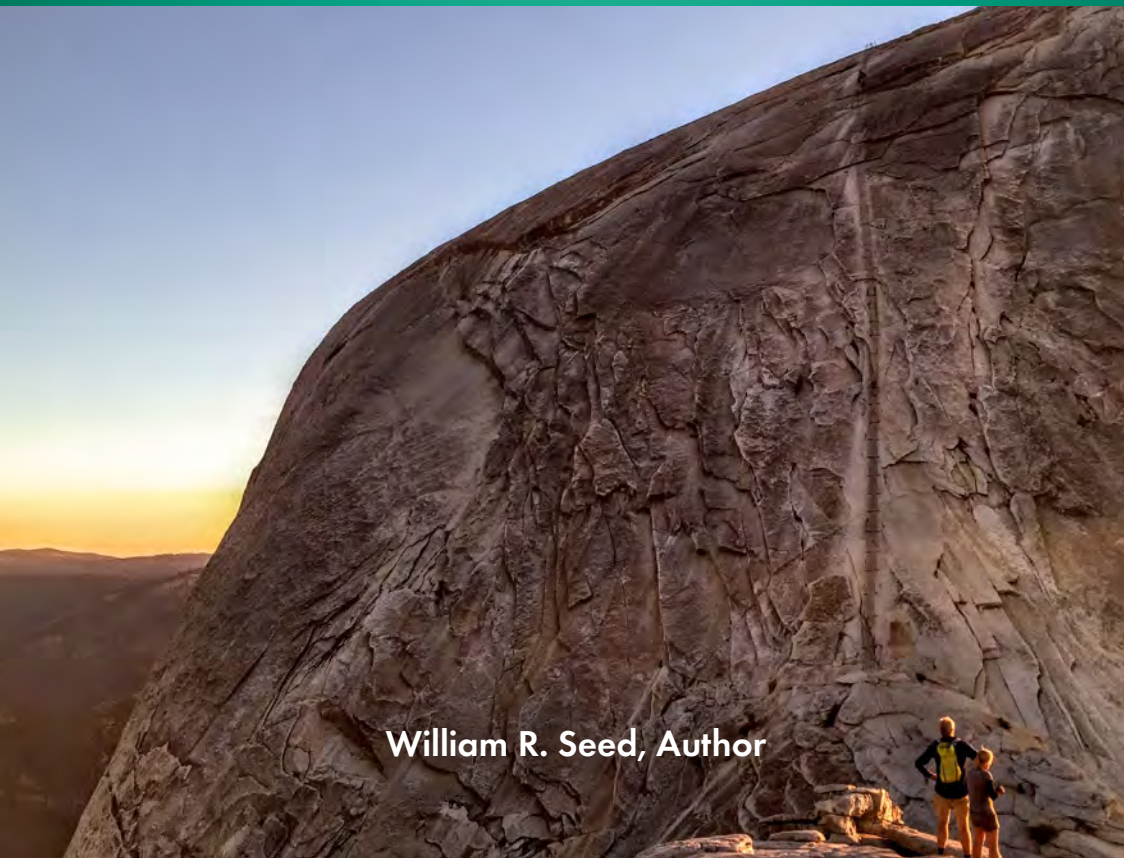

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FOREWORD

As an architect, I've spent my professional career–more than three decades– in the planning, design and construction of healthcare facilities. And, during that time, while on the consultant side, I led, joined or observed every possible approach of delivering projects. I've seen the good, the bad and the ugly of commercial construction.

And the sad reality is that commercial construction has immense opportunity for improvement; it is the only major industry in America that has declined in productivity since World War II. Many believe that there is up to 40% waste, redundant efforts, cost and inefficiencies inherent in the traditional approach to construction. That figure has understandably led many to challenge the traditional approach and to develop collaborative teams of owners, designers, contractors and trade partners to find ways to innovate in design and construction to provide value to all parties.

Fortunately, I discovered Lean and Integrated Project Delivery (IPD). Before I joined an owner group, I had opportunity to work with architectural teams that were implementing IPD. I quickly saw the opportunities to incentivize *performance* on our projects. Because of that radical shift, professionals began crawling out of their traditional silos and joining together in a new environment of trust, collaboration and innovation.

After I joined Advocate Health Care in the Planning, Design and Construction group, we retooled our methodology; we determined to adopt an IPD approach. Today, as Vice President of Planning, Design and Construction for Advocate, I have applied Lean delivery in my leadership of more than $2 billion in capital construction projects.

The drive to integrated delivery is quite naturally and logically led by owners; they hold the largest investment in doing it right. That has placed the owner companies in the position of leading change in the industry. They are helping persuade the design and construction community away from traditional approaches and toward more integrated and Lean practices.

That is why, knowing firsthand the benefits of IPD, I try to get in front of groups, like the AIA, ACHA and other design and construction forums, as often as possible to educate others on the advantages of a Lean approach.

That led me into contact with Lean Construction Institute.

As an organization for sharing best practices, LCI promotes Lean Construction initiatives across the US. Today, I am honored to be a member and co-sponsor of LCI. Together with senior construction leaders from many of America's premier companies–General Motors, Intel, Eli Lilly, Georgia-Pacific, Procter and Gamble, Cleveland Clinic, Sutter Health, Universal Health Services and numerous other organizations–LCI is leading the charge to improve the health and productivity measurements of the commercial construction industry.

LCI is moving the needle of perception and acceptance. More and more leaders and organizations know that a 40% waste factor is not sustainable. Thankfully, they also know it is not inevitable. At Advocate, back in 2014, we set a goal to reduce capital construction costs by 20% within six years. At the end of 2017, we hit 14% reduction! And five of our projects achieved between 14% and 28% savings and value. We feel confident that we will attain the 20% reduction that we once thought was a BHAG (Big Hairy Audacious Goal) when we originally established it in 2014.

Perhaps, through the application of better practices, erasing that big 40% waste factor is now a realistic goal for the whole industry. We see so much opportunity for continuing improvement. LCI serves a vital purpose by bringing many positive voices into alignment around such exciting challenges.

This book includes those voices. They are not only knowledgeable and confident, but also infectious! Readers will "catch" new vision, new methods and new stories about this revolution in commercial construction. They will also clearly see that a new and better road to the future is now open.

I hope you will be one of the first to travel that new route. Trust me; it leads to a less stressful, less expensive, less wasteful and more integrated and innovative future.

Scott Nelson
Vice President of Planning, Design and Construction
Advocate Aurora Health

CHAPTER 1

INTEGRATED PROJECT DELIVERY REQUIRES NEW LEADERSHIP

Traditional project delivery does not equip or prepare anyone to understand the relationship-based nature of Lean/IPD. The journey from conventional approaches to Lean brings transformation to the people and the processes. Naturally, that journey also demands a new kind of leadership, an Integrated Project Manager (IPM).

The IPM faces a broader, more holistic, and more integrative process than anything envisioned by the Project Manager (PM) of the past. A traditional PM was required to be technically proficient in many aspects of the project (e.g., financial management, risk and legal assessments, negotiations, task delegation).

That is no longer sufficient.

An IPM needs a strong portfolio of diverse leadership skills and the ability to communicate and manage in dynamic and shifting organizational structures.

In the past, an architectural PM functioned as the leader during project development (pre-permit phase) and then handed off the leadership position to the building team PM (post-permit phase). On an integrated project, that type of rigid division is too disjointed to provide a seamless handoff of processes from one phase to the next. "Integrated" project delivery means just that; every participant and stage must *integrate* with all others. With the implementation team joining the design team at the project concept stage, each individual needs to participate as an active leader throughout the project. Thus, early design stages become more of a concise, constructive dialogue between

critical parties to ensure alignment. Everyone must maintain institutional memory as the project shifts into different phases.

In addition, IPD leadership and participation responsibilities typically extend beyond the architect and general contractor (GC) as the number of firms signing the contract increases. Most Integrated Forms of Agreement (IFOA)[1] speak to this leadership group as the "core group" or management team. Projects using other contract types should establish a similar team. This management team must be prepared to overcome the five dysfunctions as defined by Patrick Lencioni (see Figure 1).[2]

If done correctly, a properly functioning management team creates a highly sustainable leadership model, one that is far less susceptible to personnel turnover. In addition, it offers excellent opportunities for personal growth, creates great friendships and leads to outstanding performance outcomes.

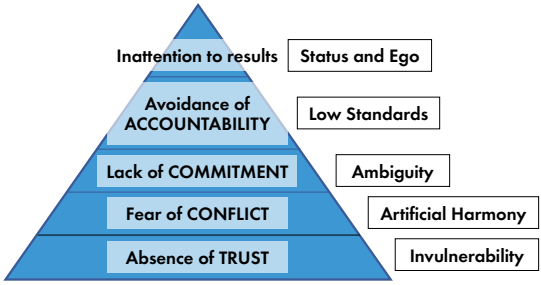

Figure 1: Five Dysfunctions of a Team, Lencioni 2002

Figure 2: Project Delivery Domains

The individual PM for this management team will need strong collaboration and facilitation skills, a clear strategic visionary capability and a robust understanding of how to effect transformational change. The most successful project will be led by a highly active, seasoned leader from the owner's side of the team as a champion of the management team. We should note here that the role of IPM will most likely be filled by multiple individuals on the project team, not one, as might be the traditional role. In the integrated project context, the IPM is typically one of five to seven individuals, usually a primary leader from each of the key partners to the integrated team. Other individuals will take on a similar role from time to time, as their area of expertise becomes a focal point. The IPM characteristics and requirements apply to the individual IPM as well as

1 The Integrated Form of Agreement or IFOA was originally developed by Sutter Health and became the foundation for the ConsensusDoc 300. UHS has used the CD 300 as the basis for its integrated projects.

2 Patrick Lencioni, *The Five Dysfunctions of a Team* (San Francisco, Jossey-Bass, 2002)

to the collective team IPM. We see the nature of the PM role changing (based upon the implementation of more than one hundred Lean/IPD projects). These changes will be described under the three project delivery domains depicted in Figure 2 above: operating system, organization and commercial terms (Thomson 2009). Each of these domains will be subdivided into pre-permit and post- permit phases, as the nature of challenges changes dramatically between these phases.

OPERATING SYSTEM

Pre-permit Phase

While the concept of an operating system is typically viewed as the management necessary to organize the building process, we see that it equally applies to the development or Target Value Design process (Ballard, 2008). The IPM strives to eliminate siloed development activities. That can be accomplished through the establishment of Work Clusters (usually developed around common building groups). They are multi-disciplinary, including architect, engineer, building expert, estimators, end users and others. They report back to their Big Room in order to share knowledge that will transcend silos. The IPM encourages the collaborative solicitation of need, input and output from all members. They build trust and respect among team members. They also drive constructive engagement so that all ideas are presented, discussed candidly and openly, considered and then either implemented or discarded. At the same time, the IPM keeps the team focused on its value proposition and appropriate topical matters, while not allowing human emotions to bring personal conflict.

Finally, the IPM leads the team in frequent Retrospectives (see Chapter 11). Perhaps the most common reflection technique is the Plus/Delta. That is best used to help identify helpful components as well as challenges to improve the process of meeting. If the Retrospectives are taken seriously and done well, they will drive significantly improved outcomes.

Post-Permit Phase

IPD faces a similar set of challenges when the project moves from the office to the field. As the size and diversity of the team increases, the IPM should develop a strategy to align a larger group of people (beyond the Work Cluster members) with varied skills and diverse viewpoints and goals.

The overarching implementation goal of integrated projects is to empower teams to plan and execute their work more successfully. Traditionally, project work has been dictated by managers. However, in the Lean/IPD approach, IPMs cultivate an environment where employee engagement can thrive. It begins with building a foundation of trust across a large, diverse and dynamic group of individuals. Because the crafts and managers are empowered to design and manage their work, the work culture establishes continuous improvement as a core value. That culture encourages input and feedback, taking it seriously, implementing suggested improvements (as well as communicating reasons why suggestions were not implemented) and rewarding the willingness to speak up. The photo below (Figure 3) shows a field communication board requesting both good and bad input and offering open communication to the team.

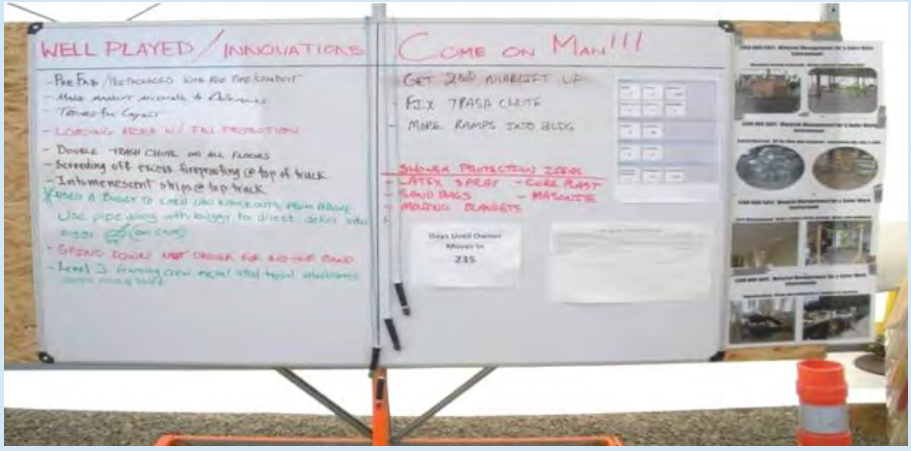

Figure 3: Field Communication Boards at UHS Temecula Valley Hospital

The premise of this learning requires a zone in which participants feel safe to fail. Trust is a critical component to the safe zone. An IPM knows how to create that trust and the more quickly he or she can do so, the more and the faster the team will benefit. The Speed of Trust, by Stephen M.R. Covey (Free Press, 2008), is a great resource for this idea. The IPM should work to stimulate improvement through realistic goal setting and measuring with dashboards directly connected to project goals and frequently updated. This enables an IPM to mentor the build team's project engineers (PE) and suppliers to collaborate with their field counterparts regularly.

Post-Permit Phase

During the build phase, this IPM must navigate multiple organizational structures. The management of an IFOA creates a functional network between signatory partners. Since these partners are equal stakeholders, it is essential that they be afforded equal say in all project management decisions. That requires consensus-driven decision making, concern for every member and willingness to help each other. It also demands open sharing, frank discussion and a conflict resolution process that breaks down barriers and builds trust.

If the IPM can create trusting relationships, this can often override self-protective behavior, even with trades that have traditional contracts. As a result, the IPM integrates the skills and knowledge of the trades not bound through relational contracts.

ORGANIZATION

Development Phase

The IPM drives change through many bold leadership roles and objectives, including:

- Encourage the release of territorial attitudes
- Foster shared learning
- Dismantle traditional command and control hierarchy
- Promote the distribution of roles and responsibilities
- Encourage open and frank ideation
- Increase the focus on project goals, while remaining cognizant of everyone's need to make a fair profit
- Facilitate discussion and definition of cost-for-service estimates from design professionals who do not normally share that information
- Help all parties discuss compensation as part of reaching fair agreements that allow the team to focus on the project, not just their company concerns
- Lead the team to review and revise this information regularly with the Budget and Burn rate tools
- Possess a thorough understanding of cost-risk assessment as it relates to the design process (see Chapter 6 on Risk)

COMMERCIAL TERMS

Given the opportunity presented by the Lean operating system and organizational structure, the IFOA's commercial terms–based on cost reimbursement, fixed profit and overhead and the notion of shared risk and reward–help to deliver real transformation. These commercial terms allow the project participants to focus on the best of project results, since that is what will drive each of their commercial outcomes on the project. When understood and implemented properly, the team can then apply all their energies to problem-solving, risk management, efficiency improvement and safety enhancement. That also re-focuses the attention and demands new skills of the IPM (see Chapter 5 on Contracts).

Pre-Permit Phase

The IPM assigns Target Cost to Work Clusters, then manages the interaction between the clusters, mediates compromise when necessary and aggregates the outcomes. IPMs regularly present the pre-permit financial forecast in a coherent program dashboard. During the design phase, IPMs will need to continually challenge where money is being allocated to development, research and documentation. They must continuously remind the team to ask, "Who is the customer of my work?" and "What level of detail do they really need?" This active reflection can significantly reduce the level of design rework.

Post-Permit Phase

The IPM finds ways to collect, understand, aggregate and report on all cost data from all team members (even though each firm typically has different cost and accounting systems). The IPM must focus team-based discussion of expenditures, rather than slip into making decisions within and for silos.

The IPM creates and communicates a vision of opportunity that engages others, resources the experimentation necessary and reports outcomes to the stakeholders. That requires the IPM to translate estimates into measurable productivity units, allowing benchmarking, and test the effectiveness of field improvement concepts. Good IPMs will consistently encourage the team to revisit its targets. As improvements are implemented and progress is made, the IPM will help the team set new goals that prevent complacency.

Conclusion

Not all individuals or firms are prepared to make the transformation in project management. We all know transformation is a collective process and can be very difficult. However, if one cannot make the change after sufficient training, it might be necessary to remove him or her in the interest of the project. Integrated projects require an engaged team effort, and one uncooperative partner can spoil the efforts of many toward this new approach of Lean project delivery.

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CHAPTER 2

DESIGN THE DELIVERY PROCESS

Go and Do:

- Build a team (and align behaviors of that team) as if forming a new company or organization.
- Align according to project value and, as possible, integrate contractual responsibility.
- Involve and empower trades, design specialists and users early in the process. Demand and respect their input and remove traditional silos.
- Establish understanding of milestones and associated risks.
- Define and align around common goals; win or lose as a team.
- Build collaborative, networked communication systems for sharing, authoring, informing and updating.
- Provide the infrastructure—tools, resources, learning, technology, space, processes, etc.—which allow the team to function efficiently and effectively.

The process of delivering a product in the built environment has become fractured and litigious over the past 50+ years. As a result, that process has given us broken organizations, trying to deliver consolidated results such as buildings, bridges, roadways, and factories.

DPR Construction team project process visually created and displayed.

The traditional approach to Design-Bid-Build seeks the lowest price performers, throws them together and expects a great outcome. That can mean 50 or more companies joining together for a few years of designing, building and delivering a project. What could go wrong? Is anyone surprised that the success metrics show this is not very effective? Yet the buyers of these projects have not demanded a better way from the industry. Many still believe the traditional process to be the best path to success.

What would a better way look like? What if we designed a system that worked? What are the top things to consider? This chapter looks at how team assembly and organizational structure can drive value through an integrated and collaborative team approach.

First, a project leader (ideally, the owner's senior representative) needs to break down the industry hierarchy and eliminate company silos. In other words, he or she must build a new type of organization, one that optimizes the whole. The new organization will establish project goals that transcend those of the individual stakeholders. The leader should work to build relationships that refuse to win at the expense of others. As much as possible, profit should be tied to value, not volume: the right person doing the right work, regardless of individual profit motive.

Project leaders must also understand that the success of the project is dependent upon input from all. Each player is tied to the others. The leader should teach *and practice* making and keeping commitments. He or she should also teach others in every situation and opportunity: teach and apply tested and proven concepts (both old or new). A good leader is also a continual learner, not just of his or her own company policies, products and processes, but also how others do business, and how each business impacts all the others. How could their practices improve your business? How might their methods help your project? Document and share the learning with new team members and the construction community.

Project leaders should pay attention to the ripple effects the work has on other people, businesses and the community. Nearly all decisions impact others. Learn about the needs and values of others, and how your work affects them. Care about each other!

"Collaborate, really collaborate":[1] find any and every way to align the goals for the common good; teach all participants how to work together for those same goals. The profit concerns of all participants must be considered essential project goals, much like cost, schedule, quality and safety. Help to find ways for all participants to attain their profit goals. Find out what other conditions are important; those could include long-term staffing planning, industry respect, published industry awards, community involvement or many others.

Industry contracts and relationships have produced an atmosphere where every participant must fight for his or her value and defend themselves. That has created significant waste. Each specialist, both designer and builder, can bring so much value to the program, given the opportunity to contribute equally. It is far better to engage the builder with the designer than to permit a culture that pits them against each other.

A building project is much like a start-up business in that people come together with a primary purpose in mind: to deliver a built environment. Ideally, each member should work with the same vision and collaborate with others to attain that goal. To do that, companies must find dedicated people and train them to work closely and well with others, offer ideas for improving the process, make work safer and treat each other fairly and professionally. Such a project would see the workers delivering value through their respective skills. And, the leadership would reward them based on the outcomes.

However, we all know that most building projects select team members based on the lowest cost to deliver pre-defined and imperfect work plans. Each specialist is asked to perform his or her work under the direction of a generalist. Each participating company

1 Tobias Guller. "5 Big Ideas Behind Lean Design and Construction" *Lean Construction Blog,* Accessed March 2, 2018. http://leanconstructionblog.com/5-Big-Ideas-behind-Lean-Design-and-Construction.html

is a separate profit center, primarily concerned with its own business health rather than the health of the whole or the final delivery of a high-quality project. By integrating the team, each member cares about and actively supports the ability of the others to be effective and efficient. Each individual is also willing to listen and accommodate rather than dictate and demand. Every participant can gain much from, and contribute to, the success of every other member.

A Time for Change

If buyers want different outcomes, they must think differently.

They must think as if they are setting up a new business. For example, today's leaders must be concerned about a common language so that all stakeholders can interact openly and fluently with each other. New cultural behaviors need to be established so that everyone can work together better. That new culture would break down silos and build integration and innovation.

New routines would help leaders and managers to stay abreast of progress and problems. They would welcome new participants into the culture, teach them, drive improvement and establish rules of behavior and engagement. The new business would offer opportunities for personal and organizational growth, create an atmosphere where leaders take responsibility and empower respect in and toward everyone. Every member of the team would care about the success of the others. Ultimately, such a culture would be measured by the degree to which everyone cares about the whole value stream more than his or her own needs and preferences.

A forward-thinking team leader would work to create an organizational structure that advances the purpose of the project rather than allowing 50 different organizations to operate under their own independent structures.

Such an organization would create networked communication, helping the doers to work closely with the planners. That would be done in a shared space where constructive (even conflictive) engagement was encouraged, and everyone's opinions were equally valued and sought. A culture of respect would release more innovation. And, a deeper understanding of the organization's values would create a decision-making structure to drive excellence and consistency across many diverse planning teams.

This organization would fully comprehend the desired outcomes of the project. Those outcomes would consider all stakeholders, the lifelong effects of the project, the impact on all who would come into contact with the project and the project's environment.

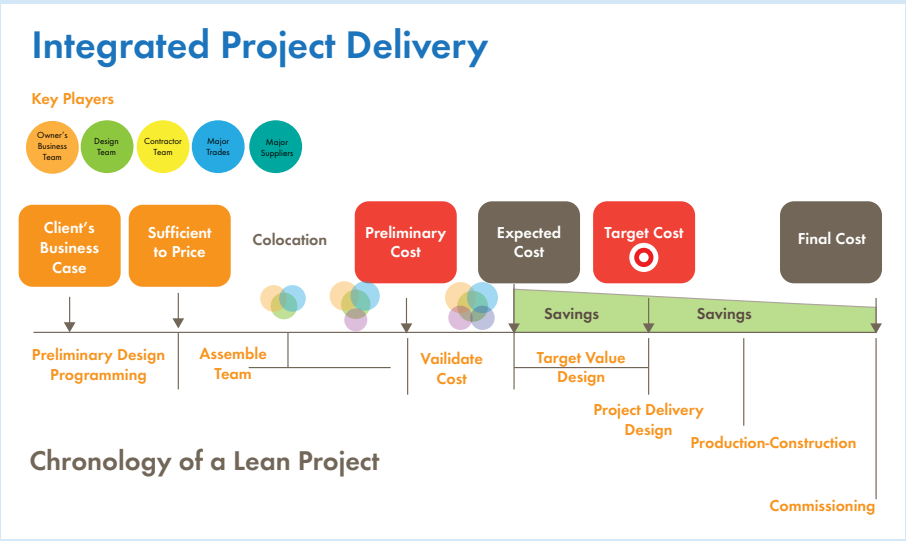


Image depicting an IPD process flow.

A Time for Alignment

The building industry has created a significant misalignment among the participants in building projects. Although the concept of master builder once provided for one individual to carry all responsibility and authority, the industry has now become fractured.

In our studies and experience, the cost of that misalignment ranges from 3-7% of the cost of work. That is why strong leaders will define the cost of misalignment. In other words, they will quantify the value of getting it right from the start.

It is essential that the participants of a project understand the principles or "higher why" of the venture they are pursuing. Each participant needs to align his or her work to the purpose of the overall product. The greater vision must be at the forefront of each decision, discussion and choice.

The clear definition and sharing of the project's approach must and will align members to the common processes behind integrated project delivery. Those processes should not be dictated to members but rather translated from their needs. That approach will include designing authoring tools, communication platforms, documentation sharing, collaboration supports, financial management instruments, dashboards, procurement strategies and many other implements and systems. The establishment and alignment of this consolidated approach can be critical to improved

outcomes. In this way, we believe that taking time to co-create or "design the design process" is vital to project success.

This approach requires in-depth preparation and seasoning. The place to start is with a "go and see" mentality. Similar to "management by walking around," to go and see is to visit the place where the work happens. Understanding that current state is critical to informing the future approach. Ignoring current reality can bring disruption, slow the learning process and even shut down participation. Unfortunately, sometimes excitement and confidence about new methods can bring disdain for the old. But, any successful organization possesses some very specific competencies that should be retained and maximized. An understanding of these areas is critical to building a new and better approach.

For example, at a project launch, how can teams best assess the current state? Should they go and see how design happens inside the design partner's firms? Perhaps they should do the same for the GC and trade partners. If they did, what would they find? How would this be used to better inform their own new working environment?

When a build team visits a design studio, they can learn about the process of design, and perhaps a new way of decision making. They may see planning boards that present a better way to process ideas. Or, they may see an interesting concept they could incorporate into the builder's submittal process. At a minimum, they can connect names and faces.

Creating a "Study Action Team" (SAT)[2] is another excellent way to align new members to work together. This participative method teaches members to speak clearly and candidly as part of coming into agreement with a new vision or idea. Perhaps, based on what they saw, they can learn one or two new strategies for their own unique challenges.

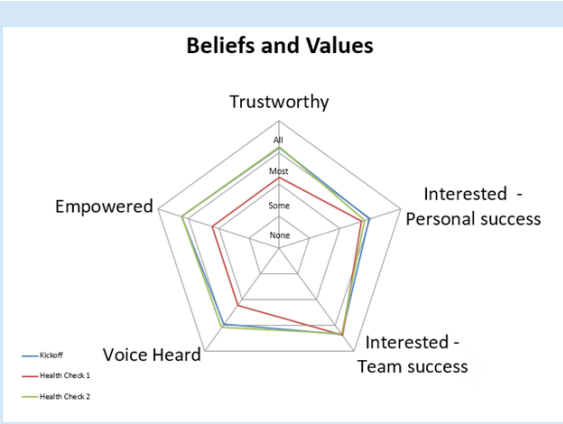
A Time for Team Building

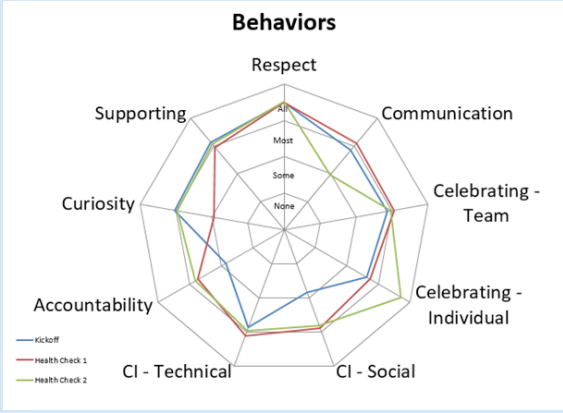
Onboarding is the first critical objective after assembling a team. More than just training, onboarding ushers new team members into the culture, behavior and practices of the new venture. It introduces new attitudes and behaviors; onboarding calibrates everyone to a new kind of accountability. And, of course, one imperative of this onboarding process is that leaders must spend time on team building. It takes time and intention to build camaraderie and a team atmosphere. Although a team sometimes

2 See Appendix

comes together naturally, it is far better to build a team through the full attention and intention from leadership.

Many people today will go to any length to avoid public speaking, especially if conflict is likely. But, avoiding conflict often produces false harmony, creating the illusion that everyone is on the same page. That permits distracting issues to send the project down a wrong path, creating waste and rework. As Lencioni references in *The Five Dysfunctions of a Team* (Jossey-Bass, 2002), false harmony blocks trust, which is foundational to team building.





Visual from team Health & Maturity Assessment showing improvement over time. Assessment tools are available on LCI Website.

Team building also requires short but frequent team health checks, a leadership examination of participation, acceptance, contribution and process value. Assessing Lean capability, developmental readiness, and Lean literacy is a critical part of the team health check. Leadership helps determine the type and level of training needed to expand and calibrate the team. Those processes can reveal the weak areas and identify the various methods of coaching, mentoring or training necessary to strengthen the weaknesses. One model to jump-start the process includes attention in four basic areas (1) behavioral alignment, (2) values alignment, (3) milestone planning and (4) guidelines for governance and team operations ("how things are going to work around here"). Smart team building will also include some assessment analyses (like Clifton StrengthsFinder® or ©The Predictive Index).

Transformation always assumes that the attitudes and behaviors of the old way will not support the purposes and objectives of the new way. That is certainly true in migrating from traditional construction to Lean/IPD. Leaders must prepare team members to behave differently, share openly, care about others, lead in new ways and embrace new ways to innovate. That change requires a major commitment and a shift in mindset. Drawing attention to that in a collaborative way early and often, from the highest leadership levels, will signal that "this project is going to be different."

In a successful team, members will not only be prepared for adjustment but will actually seek out mid-course corrections. Just as space explorations require continuous course corrections to hit the target, commercial construction projects need systems feedback and a mindset of continuous improvement. That requires various strategies and tools, such as a Start/Stop/Keep process of retrospection.

It is also necessary for team members to move from an individualistic view of the project in order to participate and expect a collaborative approach to the work. Although that change removes some of the "glory" of individual recognition, it contributes to superior outcomes, often from unexpected people or places.

A Time for a New Way

Traditional hierarchical organizational structures can impede a Lean/IPD process. Although the requisite conversion requires skill, patience and wisdom, it is nevertheless essential to replace the old approaches with a networked and Lean structure. For example, work is better performed in groups of 6 -10 people and with multiple stakeholder perspectives. That's why Work Cluster structure (see Chapter 7) provides for better management and collaboration by keeping the process close to the arena of problem-solving and decisions. As such, a Work Cluster is a subset of Big Room behavior and collaboration.

Communication is at the root of success or failure for any team effort or event. For purposes of execution, accountability and team cohesion, all stakeholders must have clear channels of communication. Visual management, dashboards, A3 working formats and collaborative software are some essential tools for clear and effective communication. Many of these tools are available through Lean Construction Institute and the appendix of this book.

Decision-making in a complex program with multiple stakeholders must be handled properly. That requires clearly defined value and Conditions of Satisfaction (see Chapter 4). The best decisions are consensus-based within a circle of the right stakeholders for a particular phase or operation.

based on a real project situation...

Design the Delivery Process

Our Project Team met with our leadership to define the milestone phases of a new project. We were trying to confirm the details of how and when we would hire design consultants and trade partners. Brent, the Construction Manager, asked George, the architect, about the design schedule.

George leaned back in his chair, paused, and said, "Well, first we will have Programming develop the space requirements and scope; then we jump to Schematic Design to nail down the overall layout, relationships between spaces, exterior design and aesthetic direction. When that is approved, we will move to Design Development. From there, we will consider details in the space, furniture and equipment layout, lights and electrical outlets, finishes and the client's special requirements. At that point, we will examine the systems and requirements for the site and the building engineering. That is the best time to get our engineers and interior designers on board. Before that, they really don't have anything to do, because the space will not be designed yet. You know, how can they lay out electrical or plumbing when there is no architectural plan?"

Amanda jumped in, "George, if we don't get our engineers and trade partners involved until design is almost finished, they can't really help us understand what they need to meet the team goals. We're all trying to build a beautiful and structurally efficient building that meets high sustainability goals, and still hits target cost. But, all that may slip away if we have the building designed before they can contribute. You know, maybe there's a new mechanical system we could implement if we understand its requirements *before* we lay out the space. And, there might be savings in plumbing if we talk to the plumbing trade partners as early as possible. Furthermore, City Planning's strict new requirements really demand that we submit our site and foundation package early if we hope to meet our construction schedule. Looking at systems options and understanding the overall building schedule and constraints *before* we design might make the design phase longer, but doing so will also give us a greater chance to meet our goals and design it right the first time."

That conversation helped the team understand we had to know the requirements and milestones in order to meet our goals for the project. The milestone schedule also helped us to clearly see when to hire trades and consultants. We also formed Target Value Delivery Cluster teams around the major design efforts of the project. In the end, all participants were able to get the system and detail requirements to the architectural design team of the project early, so they did not miss an innovation opportunity.

Over time the industry has learned to assign responsibilities to various trades. While that may shift risk and protect certain players, it is not the best lens for viewing the work. Success requires leaders to consider who has the best capability to perform and manage risk. Teams should decide, in a collaborative way, how to assign and accept risk and responsibility. It is also critically important to maintain an atmosphere wherein the team can share or swap various tasks as the needs change.

A unique set of Terms of Engagement (Big Room rules) can and should be used to drive different and improved behaviors. Transparency and willingness to share openly are critical to team success, especially when it comes to mistakes or failures. Of course, it is imperative to form a culture that allows self-reporting without reprisal. That is achieved by maintaining a focus on issues rather than people. It is also critical that variance reporting remain objective and positive. The point is always improvement, not retribution. For example, root cause analysis should simply identify and make sure new work practices provide a countermeasure to overcome repeated mistakes.

We all know that technology represents an ever-increasing sphere of the work. It can provide new insights, speed, rapid virtual experimentation, great future vision into the end product, new opportunities for pre-fabrication or early release of work, etc.

However, it can also become very intrusive and self-justifying. For those reasons, technology should only be applied within well-managed and understood functions. Otherwise, many tend to assume the "computer will handle it."

The balance of the chapters will help define the tools, strategies and transformational thinking required to create high-performing teams and deliver outstanding results. It is imperative that we never forget that respect and trust are the founding principles on which this change stands.

CHAPTER 3

PARTNER SELECTION

Go and Do:

- Bring partners on early to achieve earlier and greater benefit for the project.
- Look for skills and behaviors well beyond technical capabilities.
- Decide who best brings value to the program and make them a partner.
- Consider team definition and selection methods to build a collaborative team.
- Define the commercial terms as part of team selection.
- Create a unique RFP and interview process to select the right partners.

Traditional construction projects have historically been assembled through a low bid process. That process assumes if a project needs 25 or 50 individual contractors, selecting the lowest cost for each one will make the project more economical and achievable. The problem is that each of those 50 contractors may estimate what they believe the project will take for *their own scope of work*. But, too many are interested in doing only what is clearly written and defined for their own specialty. They see no reason to provide anything more. They don't care about other contract areas, the value of helping others, or how one partner's work impacts others. Such a silo mentality is damaging to the project and leads to gaps in the understanding of the work. That, of course, produces significant rework and waste.

In an integrated project, the team tries to view the entire spectrum of work. This approach may still require the same 25 or 50 contractors, but each carries an integrated and collaborative awareness of others. Everyone works within aligned goals and focuses on the betterment of the project and its outcomes rather than just their own specialized arena. By simple collaborative sharing of knowledge, a willingness to understand and help each other, and through optimizing strengths and identifying weaknesses, a team can perform far better than more traditional approaches to commercial construction.

In the traditional structure, an owner contracts with an architect and with a builder. But, the architect and builder have no contractual relationship. Both hire their own sub-contractors to perform trade specialties: electrical, roofing, plumbing, mechanical engineering and other "subs."

But, when several companies sign one contract, they become partners. Specifically, they sign off on a multi-party contract, not a two-party agreement. Some key partners agree to share the risk of the job. That is one way that an IPD project financially aligns everyone's incentives to the outcome of the project.

A Whole New Process

Healthy projects demand new and robust processes. And, that first requires a new partner selection process. Doing that well will focus on the creation of a team of partners that prioritize relationships, innovation, learning, problem-solving, open sharing, trust and respect. Most successful projects have learned that early involvement of specialist companies can bring vital improvements to the outcome.

The most common partner selection criteria include team strength and chemistry, ability to perform Target Value Delivery, innovation, willingness to learn-teach-lead and deep understanding of commercial terms. Many teams have found that a training event provides a great way to impart that knowledge. That event might include the following:

- A solid and sufficiently detailed description of the overall project and the IPD approach.
- A reminder that the integrated project will demand respect for each individual's knowledge, corporate integrity and contribution.
- This new IPD method will dismantle silos and traditional hierarchy in order to draw out solutions from those not usually asked to share their perspectives. The team must distribute leadership among a larger group of subject matter experts.

- The new process will create and maintain an atmosphere of commitment and accountability.
- Trust and respect will be the cornerstone behaviors in the quest for innovation.
- A challenge to traditional strategies and practices will be normal and expected.
- Honesty about capability and experience is critical for resource management.
- The new way will require the open sharing of commercial terms and each company's financial goals.

What Makes a Good Partner?

The core leadership of a delivery program must consider which participants should become partners. It is best when the partner companies represent approximately 70% of the project (often, but not always, determined by the cost of work). If 70% of the participants align with one target, they will create a tight and lean culture for the project.

The right partners will bring significant influence to improving cost, schedule, quality and outcomes. High-risk areas can also determine specific partners. For example, if working in a high seismic activity area, a knowledgeable and innovative structural engineer would be an essential partner.

Team chemistry is vital, as the team will probably work together for several years. It is hard to work with people you don't know, like or respect. When the partners are like-minded and seeking a common outcome, the whole team will perform at a higher level. That kind of team chemistry is also very hard to find or attain. Leaders must deliberately build the team. As we proposed in the Leadership chapter, leaders must cultivate an environment wherein employee engagement can thrive. That begins with building a foundation of trust across a large, diverse and dynamic group of individuals, establishing continuous improvement as a core value, so the crafts and supervisors are empowered to design and manage their work. The culture must also encourage input and feedback, take it seriously, implement suggested improvements (as well as explain why suggestions were not implemented) and reward the willingness to speak up.

The ability to innovate is another essential attribute for a team member. A member who continually looks for easier, better, faster and cost-saving solutions is an immeasurable asset. An attitude of humble inquiry is a great way to learn and drive innovation. So is a willingness to learn new ideas and then teach them to others. All of

DPR CONSTRUCTION

[redacted]

Re: Integrated Lean Project Delivery – GC Partner Proposal

Dear Catherine:

It is with great pleasure that we submit our proposal for the Project. We look forward to being a part of the team.

We have handpicked our team based on our professional experience and also for our willingness to learn and continue our Lean journey. Our team brings the right chemistry to help drive the maximum value to the project, true ILPD experience, a local presence, and a strong desire to learn. Each of us is committed to providing you with best-in-class preconstruction and construction services to ensure a successful project.

With DPR, the team you see is the team you will get from start to finish. One of our core values is "Integrity". This is not something we preach, but something we live by every day at DPR. When we say we are going to do something, we do it.

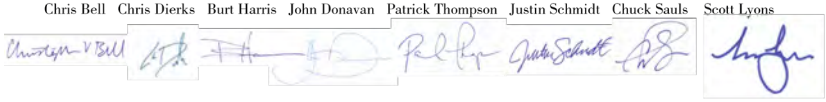
The project is an exhilarating opportunity and an exceptional fit. We've been fortunate enough to partner with over 1,100 DVC units and you'll find our proposed team is full of DVC experience we believe will bring significant value to this project. As a leading member of the forward-thinking Florida business community, we are ready to be your partner in executing excellence in every aspect of this pursuit.

The Right Project. The Right Team. The Right Time.

Sincerely,

The DPR Project Team

Chris Bell Chris Dierks Burt Harris John Donavan Patrick Thompson Justin Schmidt Chuck Sauls Scott Lyons



Tel 407-352-2233
4700 Millenia Blvd., Suite 350; Orlando, FL 32839
www.dpr.com
WE EXIST TO BUILD GREAT THINGS

DPR Construction response letter to an Request for Information all signed and committed to by the project team

these characteristics also increase leadership skills, and leadership should be sought and developed throughout the length of the program.

A solid understanding of commercial terms from each partner is also critical to the success of the team. Everyone needs a clear understanding of the profit needs of each firm from the very beginning. The same is true of understanding overhead, how it is calculated and to what it will be applied. Furthermore, clear identification of what is reimbursed as a cost and how it will be determined must be defined at the onset. It is also sometimes helpful if more experienced and knowledgeable companies can teach and mentor others on commercial terms. Several coaching sessions will benefit and strengthen this approach to identifying the right partners.

How Are Partners Selected?

Most projects start with a small group of the owner organization's confidants, whether employees or consultants. They study the business case and make educated guesses about the cost and timeline. When everything clicks, the organization agrees to move forward. At that point, the small owner group must find the right partners. They typically write some form of performance description, early process layouts, critical planning units or other general planning criteria available. From those launch documents, the team can be assembled.

One of the first steps is to define a timeline for when to bring partners to the table. Usually, a designer and a construction manager (CM) or general contractor (GC) are the first members selected. The team should quickly do a risk assessment and, based on that, determine what other partners are most critical and when those partners should come on board (when will they add value?). At that point, a partner selection timeline and process should be developed. While more an art than a science, the team should consider the risks; bringing partners on too early is a cost risk. Bringing them in too late runs the risk of not having their expertise and leadership earlier. Wisdom and experience say to err on the side of "early."

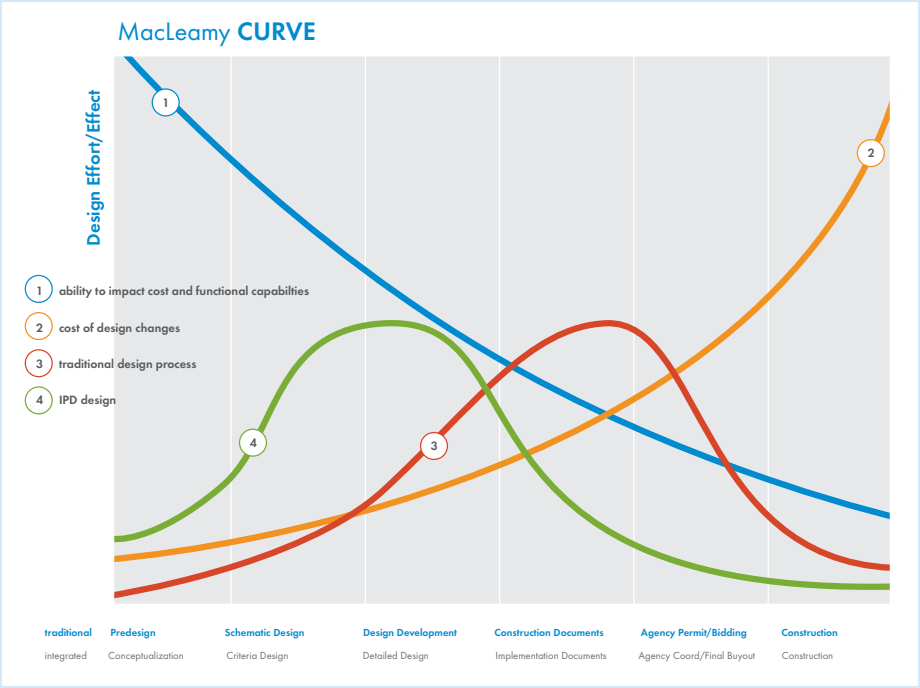
Once the timeline has been created, it is time to select the right partner firm. A prequalification pool should be established based on financial strength, success, size, resources, etc. Owners who do not build frequently may need help with that phase. If so, they should ask a qualified peer for recommendations. If procurement rules demand, this can be done through an advertised request for qualifications. Find help defining those qualifications from an experienced practitioner.

From a prequalified pool, the most critical decision to selecting the firm will be the specific teammate (look at people, not the firm). Change is hard and requires a

willingness to try. That calls for collaborative and innovative souls. Technical skills can be found easily. But, finding the right attitude and temperament takes time and wisdom. In our experience, assembling a high-performing team requires at least six strong (and compatible) change agents across the entire team. The more you can find and the faster you can find (or create) them, the sooner your team will excel.

One successful way to build the partner team is to create a self-selecting team. That means the owner chooses one partner, and then the owner and that first partner select number two and so on. That gives an excellent opportunity for members to sit on both sides of the interview table and to choose their partners through a focus on the specific project. Many have come away from this process with the new insight that the individual who performs the work – not his or her company – is the key to success.

Another way to build the team is to allow them to assemble a team. That approach is sometimes faster because they all tend to know each other. Furthermore, since they have a history, they may begin from a stronger position of trust and, right off the blocks, behave like a team.



MacLeamy Curve indicating the importance of assembling the team early in order reduce the impact and cost of design changes

One note of caution here: Previous success is not always a predictor of future outcomes. That is especially true if the team gets created from the corporate office rather than the individuals assigned to the project. Additionally, they may have been successful in utilizing a more traditional delivery methodology and, consequently, fall back into that behavior.

The Essentials for Partner Selection

Many have found these six traits to be the essentials for partner selection:

Team strength is based in the technical capability of each individual partner. The interview process should determine the weaknesses and the strengths of each individual. Then the weaknesses of one partner can be matched with the strengths of another. Furthermore, a potential partner's openness to sharing his or her weaknesses is a helpful indicator of a leader who will be compatible with the other partners.

Team chemistry, while perhaps the softest of the traits, can be the most important. If members cannot get along, it will be hard for them to perform at their best. The partners must hold a high level of respect and trust of one another. Conflict can often lead to innovation and improvement, but quick recovery from that conflict is crucial.

Target Value Delivery (TVD), detailed in a later chapter, demands the early involvement of partners. And, many of them do not typically operate in the design phase of a project. So, new languages are necessary since designers and builders plan and work in very different ways. Therefore, a partner must be willing to consider different approaches, study many alternatives and offer valuable perspectives quickly. That requires high-quality and knowledgeable people.

The best partners innovate and bring new ideas and practices to the process. Sometimes that requires educating other partners. But it always demands openness, honesty and the courage to lead. The best partners are out-of-the-box thinkers, always looking for ways to improve themselves and the project.

Perhaps the most basic characteristic of partners is a willingness to learn. That is because learning is the basis for continuous improvement and the key to changing behaviors. Learning is also the key to changing the traditional means, methods and practices that plague the industry. While education is essential for the individual, it is also a must for the team. Therefore the learner must be willing to teach what he or she learns. Teaching brings the team to a new level. Teaching then creates a leadership role.

A complete understanding of commercial terms is essential for all partners. As stated throughout this book, each partner firm will have different profit needs, different methods

of assessing overhead and different costs of doing business. Yes, this represents a difficult adjustment for some. As Michael Doiel, senior VP of HDR says, "The thought of allowing someone to look under the hood does not happen without trepidation." Therefore, that depth of transparency cannot be forced. But, for those willing, the IPD journey has confirmed that the transparency required by the partners' knowledge of everyone's situation increases the flow of trust and teamwork.

How to Begin the Partner Selection Process

A selection team should start with the understanding that new behaviors drive new outcomes, and that requires a new selection process. A coach or experienced practitioner could be beneficial to the selection team.

The team may want to start with a workshop for selection process development. The workshop should consider the overall approach, TVD, collaboration, early involvement, shared risk/reward, scope and risk mitigation, etc.

From the workshop, a Request for Proposal (RFP) can be developed. This RFP should be clear about what the organization is trying to accomplish; not just the end product, but the process and expected outcomes. It should be written in plain language: no hidden agendas, no codes, no buzzwords. The specific attributes that will be scored should be plainly defined. A detailed timeline should be proposed and followed. A quick decision and publication will show you are serious about change and relieve the participants of anxiety about how to proceed.

The RFP should be clear about what is essential to the owner organization. Ask specifically for a quick and concise response. Many RFPs request an A3 as their response, rather than a typical book of marketing material that nobody reads. It is rare to find those who think concisely enough to consolidate thoughts into one A3.[1] However, requesting an A3 response can help to reveal those who hold such rare and valuable attributes.

Only prequalified firms should be solicited for proposals. That allows the focus of the interview to be on behaviors and values rather than technical issues. The firm should be asked if they practice IPD. Will they support the project team or will the firm resist new and different practices? An important step in this pre-qualification process is the requirement for the team (or a representative) to visit the proposer's work environment.

1 "A one-page report prepared on a single 11-by-17 sheet of paper that adheres to the discipline of PDCA thinking..." William R. (Bill) Seed, Editor. *Transforming Design and Construction*. **Lean Construction Institute**

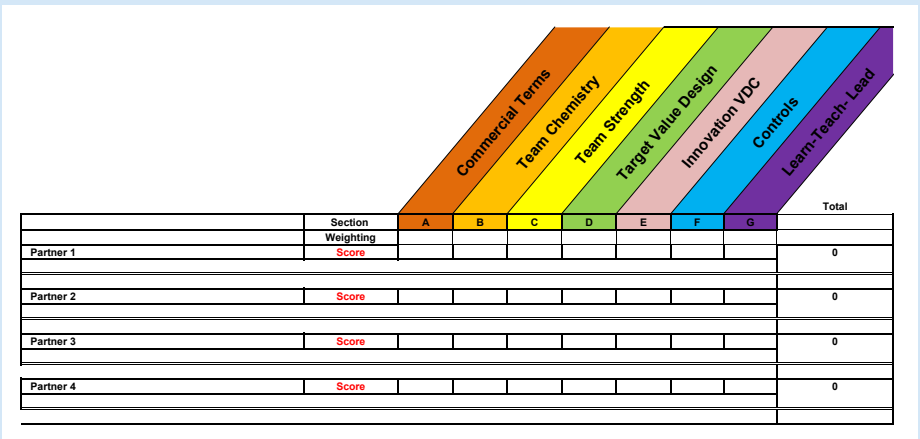
It is often helpful to ask, as part of the interview, how they project the costs with so little documentation. Their answers can give insight into their market knowledge, system expectations and other areas. It can also help the owner frame or re-frame expectations.

The interview should not be a presentation, but rather a simulated work session. In fact, some organizations actually create a real work session to assess teams in action. Of course, that requires that the actual project team participants–not the marketing or executive people–be available for the interview. Conduct the interview in a roundtable environment to eliminate the "us vs. them" atmosphere. Accept the guests as team members. Make people comfortable so they can be themselves.

Encourage interviewers to take the process and the interview seriously and be prepared to offer feedback to each participant whether they are selected or not. Score and report, drive consensus on the decision immediately after the last interview. Don't let time cloud impressions. Plus/Delta feedback should be offered to all participants in a respectful phone call or personal visit. If the owner company frequently builds in one market, this process will help drive improvement to their selection process over time.

Each interview should have a master or mistress of ceremonies. He or she should greet the participants, explain the process, make them comfortable and thank them for participating. The emcee should establish a process that is as pleasant as it is professional.

Who should participate in the interview? The number should not be overwhelming, but those who are expected to work closely with the new partner should attend. If using



Example of Partner Selection Matrix indicating factors for evaluation

UHS LANCASTER GENERAL HOSPITAL

COST/BUDGET

COST CONTROL TOOLS

Budget Tracker | Risk Log | Burn Rate Projection

CONSTRUCTION	$XX,XXX,XXX	$XXX,XXX/BED
RISK	$XXX,XXX	$X,XXX/BED
PROFESSIONAL FEE	$X,XXX,XXX	$XX,XXX/BED
SOFT COST	$XXX,XXX	$X,XXX/BED
FF&E	$X,XXX,XXX	$XX,XXX/BED
PROJECT TOTAL	$XX,XXX,XXX	$XXX,XXX/BED
PRECONSTRUCTION	$XXX,XXX	$XX,XXX/MO
GENERAL CONDITIONS	$XXX,XXX	$XX,XXX/MO

COMMERCIAL TERMS

OVERHEAD (Included Above) X.XX%

PROFIT (Included Above) X.XX%

TEAM

TOP 5 TEAM STRENGTHS:

RESPONSIBILITY
HARMONY
COMMUNICATION
ACHIEVER
CONSISTENCY

Growing the team, with constant coaching and careful consideration of process to answer the need of design and risk. The success of the project greatly depends on the selection of the **right team members,** and the speed by which we reach a high-functioning synergy.

PHOTO **Name** Project Manager

PHOTO **Name** Superintendent

PHOTO **Name** Lead Estimator/ Last Planner Coach

PHOTO **Name** Team Leader/ Lean, IPD Coach

SITE OVERVIEW

UHS Lancaster
General Hospital
XX,XXX/SQ FT

Total
$XX,XXX,XXX
$XXX,XXX/BED

RELEVANT EXPERIENCE

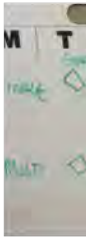
PENNSYLVANIA EXPERIENCE
Select Penn State Hershey Rehabilitation Hospital Hummelstown, PA—$XX.X million
Select Penn State Hershey Rehabilitation Hospital Addition Hummelstown, PA—$XX million
Select Specialty Hospital, Harrisburg, PA—$XX million
Select Medical Harrisburg 38-Bed Long Term Acute Care Harrisburg, PA—$X million
FEATURED LEAN, IPD, AND BEHAVIORAL HEALTH EXPERIENCE
UHS Holly Hill Hospital, Raleigh, NC—$X.X million
UHS Holly Hill Children's Inpatient Psychiatric Hospital Raleigh, NC—$XX.X million
UHS Cumberland Hall Hospital, Hopkinsville, KY—$XX.X million
UHS Springwoods Behavioral Health Fayetteville, AR—$XX.X million
UHS Old Vineyard Emerson Building Winston-Salem, NC—$XX.X million

TIME /

JUNE 2016

DESIGN/PRECON 6 MONTHS

MILES



RISKS

- Trade part
- Team syne
- Engageme
- Big Room
- Lean, IPD
- Local perm
- Sitework/s
- Single sto

TARGE

Conditions Satisfactio

Validate
Coordinate
Negotiate
Collaborate
Innovative
Mentor

TRUST PREDICTABILITY

Brasfield & Gorrie General Contractors A3 (1-page) response for proposal for UHS project.

SCHEDULE

STONE PHASE PLAN

S

ner selection
ergy/speed to trust
ent and culture transfer to field team
meeting fatigue
experience
mitting/document review
soil conditions
ry vs. multistory option

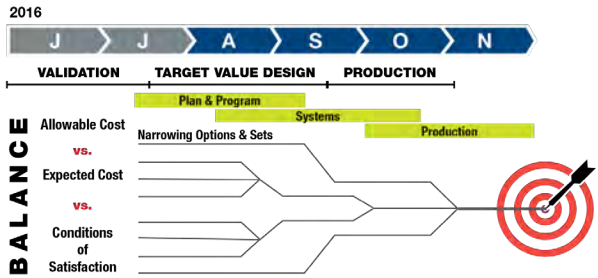
COUNTERMEASURES

- Involve Lancaster General Contractors from previous project/visit potential partner prior to interviews
- Team StrengthsFinder/team coaching
- Engagement and strategic involvement in design/planning phase and effective onboarding
- Big Room schedule based on milestone pull plan/online meetings
- Oversight and coaching from multiple levels by current team
- Involve local civil designer familiar with process or assign permitting to a partner
- Partner with local sitework contractor early in design process
- Collaborate with design team to determine best option for site early in the conceptual design process

ET VALUE DESIGN

s of
on vs. Target

- Conditions of Satisfaction
- Desired program?
- Want vs. need
- Design sets vs. options assess risk and unknowns
- Grow team organically to answer unknowns and mitigate risks
- Sharing Lean, IPD experience

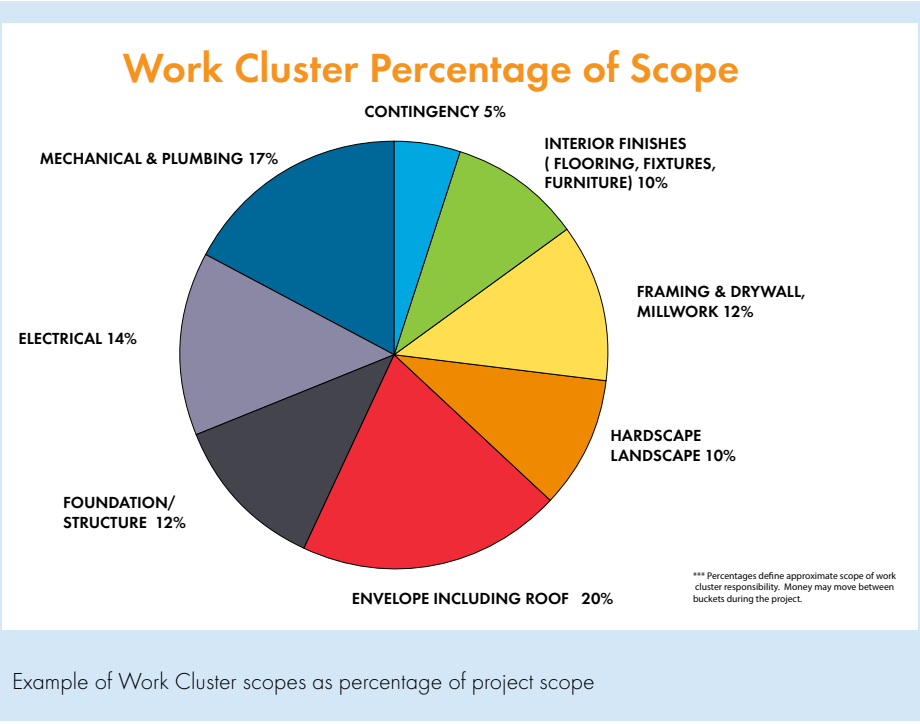


85%
REPEAT CLIENT BUSINESS

"I felt very comfortable with xxxxx and xxxxx during this phase of the project [preconstruction]. I really appreciate their professionalism and commitment to our team."
Kent Hedges, UHS Edinburg Regional Medical Center

INNOVATION VALUE

BRASFIELD & GORRIE GENERAL CONTRACTORS
STENZEL HEIL ARCHITECTURE
UHS
UHS LANCASTER GENERAL HOSPITAL
Lancaster, PA
A3 RFP RESPONSE



Example of Work Cluster scopes as percentage of project scope

a multi-party contract, any signatory may want to join since they are in effect choosing a business partner.

Take the Time; Pay the Price; Do it Right

This process can consume several months if a team of 8-10 is chosen at approximately the same time. That may feel counterproductive to a team anxious to get to the "real work." But, the team must go slow to go fast. Input from the various partners will eliminate rework, which saves time and money. Designing *once* is better than multiple times. Although it feels like it takes longer, taking the time, in the beginning, to do it right will cause the project to finish better, faster and less expensively.

Doing it right is a constant learning and improvement opportunity. Take the time to perform retrospectives on each day (or segment) of interviews. Help all participants to see the improvement opportunities for each proposing firm. That also helps the interview team become more concise with their interview process.

It is best to assign one knowledgeable leader to pay specific attention to his or her area of expertise, say Target Value Delivery. That person should ask pointed questions

based on a real project situation...

Partner Selection

The project owner asked Tom to lead the project team through selecting a structural engineering partner for his project. Because Tom was new to Integrated Project Delivery, he relied on the team he had assembled, which included Vince, the architect; Joe, the general contractor; and Janet, a Lean coach. When they all met, they realized they needed a structural engineer who would collaborate well with the team. And they also admitted they didn't know any local SEs who were experienced with IPD.

After researching structural engineering firms in their area, the team sent a one-page Request for Information to four companies. They established the criteria for the new partner: 1) personnel, 2) Lean experience, 3) enthusiasm for IPD and 4) collaboration. They requested that the responses be kept to one 11x17 page (A3) format. They wanted the firms to be very clear and precise. Three of the four companies responded. The team scheduled interviews with each firm's key project personnel.

Team 1 came to the interview, dimmed the lights and presented a dazzling PowerPoint presentation, describing their firm, awards, accolades and high-profile customers. They admitted they had not read the IPD agreement.

Team 2 arrived with their marketing and principal leads but left the key structural engineering personnel back at the office. When Tom asked if they had read the IPD Agreement sent with the RFP, they began shuffling papers, clearing throats and talking about their most prominent projects.

The third and final team arrived with no marketing people and no PowerPoint. They brought the day-to-day people. Team 3 exuded energy, enthusiasm and good ideas. They admitted to having minimal Lean and IPD experience, but they had learned all they could and were excited to learn more and to integrate with a team. As the interviewers talked, Team 3 started to capture the conversation with markers on foam-core boards. As questions and ideas flowed, it was clear that chemistry and trust enveloped the table.

Tom didn't even have to ask if they had read the IPD Agreement; they all passed a highlighted and marked copy back and forth throughout the interview. They revealed their excitement about specific phrases and ideas in the Agreement.

Can you guess which team was selected to be a partner?

and take specific notes. He or she should then rate each firm for that category and facilitate a discussion leading to consensus. That helps the team arrive at a complete partner selection in an organized and expeditious timeframe.

CHAPTER 4

ONBOARDING TEAM MEMBERS

Go and Do:

- Teach new team members/partners immediately upon selection.
- Set the stage for expectations of different behaviors.
- Define different behavior expectations and why they are being used.
- Customize onboarding to the various audiences as they appear on the project.

When we start college, we first go through freshman orientation. When we begin a job with a new firm, we first go through extensive training. Both types of institutional orientation reflect the need to bring people to a common level of understanding so they may learn quickly and engage constructively.

So, why would we not need to do that when we first join a purposeful and integrated team?

In a project-based industry, it is common for people who have never worked together to collaborate on great projects. Obviously, those individuals will not know how to work together without orientation. Everyone must quickly learn a new culture, language and collaborative tools. Perhaps more importantly, they must learn to join together in common rather than individual goals.

"Onboarding" is the means of bringing everyone "on board" a new venture. We have found that process to be the best at delivering crucial levels of learning and

project knowledge as new team members are added. In other words, all members of the team must be continually brought to and implanted in, a new way of learning and productivity. Onboarding helps to ensure that the desired cultural, behavioral and procedural ecosystems are respected and not disrupted.

Why Is Onboarding Critical to IPD?

Integrated project delivery represents a significant change from traditional delivery of capital projects. Because of the integration of people and specialties, team members will be invited to contribute beyond their own training, platform, experience and specialty. Individuals from various roles will be asked to speak outside of their normal areas of contribution. That requires IPD teams to build a culture of respect and accountability that is often missing from traditional delivery projects.

That kind of new playing field requires a serious commitment to training and enculturation. One leader described it as "teaching fixed-wing pilots to fly helicopters." Although their knowledge of flight is quite sophisticated, they must not only learn, but marinate in, an utterly new skill and discipline.

An integrated project, at least in the design and construction industry, attempts to overcome many of the traditions and behaviors that resist project improvement. That process is enhanced by engaging participants earlier so that their expertise can inform decisions at the time of lowest cost. That requires new forms of engagement, interaction and behavior, a mind shift. Such a new pattern must be communicated early and often to every participant.

Another reason onboarding is critical is that IPD joins many different firms, people and specialties together to consider the entire value stream. That requires designers, operators, builders and others to communicate in new ways, earlier in the process, and in meaningful, respectful and productive work patterns. That usually requires everyone to humble themselves as they learn about the work of others, perhaps new languages, and discover how to transfer knowledge. Those are not typical practices; they require very deliberate efforts. That affects every participant in that each will be both the customer and the provider in every different situation.

That also requires everyone to share his or her cost of doing business, approach to procurement, methods of planning and other details of the respective business partners. Because those things are not typically shared openly, an onboarding process tackles all the details of the new way. Everyone has an opportunity to voice their doubt, suspicions and other concerns about such transparent partnering.

Onboarding is also critical because leaders must make sure, at least during the pre-construction portion of the project, that all participants are aware of the nature of "The Deal." If the team is sharing the risks and rewards, they all need to understand that. If the team is risking profit together, they need to know how profit is made and lost. The team members must know how their work impacts the work of others.

Project team onboarding Introduction to Lean Project Delivery with "Airplane" Simulation to teach Lean principles.

The Levels of Onboarding

Although the training of new participants to the environment, culture, expected behaviors and logistical aspects of a project is critically important, not all need the same depth or frequency of training. As a project morphs through its phases of gestation, the nature and content of onboarding should consider who and how frequently new members join the team.

When a program is in its early forming stages, much time gets spent defining conditions of satisfaction, operating systems, software platforms, team composition, etc. At that stage, leaders work to cast and deliver the vision of the program. That period calls for a high level of onboarding to produce deep trust. Tools like Study Action Teams and Gemba Walks can be very helpful here.

But, as the team grows to include designers and builders, the season changes. Team composition and relationships begin to form the foundation of the work to come. That means collaboration and communication systems need to be created, and the method of working together needs to be defined. That season requires a different kind of onboarding. Furthermore, as the team adds specialists, the phases require a different type of learning. Then, when the work moves to the field, the onboarding calls for a shorter format and more specific focus.

However, it is critical to design and fulfill an onboarding schedule that covers the many new and changing participants. Creating a standard tool of training excellence

DPR Construction onboarding new team members. Onboarding is an ongoing process.

helps to provide a consistent message. And, it is vitally important to include owners and their users in the training. After all, their ability to communicate with the team and to share the overall project goals is critical to success.

Make It Real and Active

For the early participants, the amount of time needed for onboarding may be two full days. That is a long time for very active people to sit and listen. For that reason, successful integrated teams have learned to integrate the learning with doing. They introduce topics or concepts then put them into action immediately. For example, after teaching about collaborative planning and negotiated work handoff, quickly roll into a pull planning session around a near-term milestone. Or talk about one piece flow and proctor the Airplane Game to demonstrate it.

Onboarding should never be theoretical, but should rather help everyone gain solid traction in the work at hand. The sessions should address the real and essential

JE Dunn Construction onboarding new team members with a simulation focused on Lean Learning.

topics like project values, value-based decision making, collaboration, waste, logistics, technology and building and maintaining a culture of safety. These onboarding events should be used to set expectations for high performance, define rules of engagement and teach new a language. For example, we have "trade partners," not subs or sub-contractors; we work with "design partners," not sub-consultants; we use network communication, not a hierarchy; and we practice distributed leadership, not command and control.

The onboarding should have sufficient grip on reality that team members discover the tools they need, the practices that must be followed and the methods to gain and share information.

Even though the onboarding events will last throughout the entire program, the participants will constantly change per the specifics and phases of the process of delivery. So, each member should have ongoing training as needed and relevant to the current scope of work.

The teaching can rotate among key leaders, designers, superintendents and owners. That not only helps to share the load of teaching, but also highlights (and refreshes) the importance of each topic, drives cultural continuity and reinforces the learning at all

BIG ROOM RULES OF ENGAGEMENT

This is a Safe Zone
Everyone is encouraged to speak their mind without concern for embarrassment or ridicule by others.

No Stripes
We all have equal status and say in all matters. No one person has more authority than others.

Speak Up
Get engaged in conversation and share ideas. Your opinion is important in helping guide the team.

Listen to Others
Focusing on what others have to say helps you understand their point of view.

No Side-Bar Conversations
Only have one meeting at a time. Conversations should be heard and shared by all except for relevant conversations held away from the group outside the room or in a non-disruptive manner.

Turn Cell Phones Off
Help keep the meeting and participants on track by eliminating phone disruptions.

No Multi-tasking
Stay focused on what is going on in the meeting. This includes laptop computers and Smartphones except if you are not directly involved in the topic but must be available for engagement if requested.

Stay on Time
This includes start time, end time, break times and agenda.

Remember: "Not here – not now" and "2 minute rule" to keep us on track!

JE Dunn Construction visual display of the team's Big Room Rules of Engagement during an onboarding session.

levels of participation. For the sake of variety and new emphases, the messages can be offered via video, webinar or in person, by individuals or groups. They can include simulation training, be classroom- or field-based. A lunch and learn can also be a great way to teach and build community at the same time.

Finally, the onboarding must be continually refreshed and reinforced. It's sometimes easy for leadership to forget that the team changes continuously. In time, the project forgets to teach new members. And, as new members join, they do not have the same understanding of the "greater why" of a project. They don't understand the business value or the reason for this program. Yet they are expected to work in alignment with the corporate vision. That is why a documented and disciplined onboarding process can help set and maintain the proper discipline, perspectives and expectations.

In everything they do or say, leaders must be continual and consistent teachers. In other words, they must "walk the talk." Every day. Everywhere. Every moment. A healthy culture will create ambassadors for projects and processes. Everyone on the project has a unique role. To prevent them from getting consumed by their duties and allowing their uniqueness and fidelity to fade, put the various teaching platforms on a recurring schedule and assign many different individuals to take turns teaching.

A good onboarding program knows that teachers can gain as much as students.

CHAPTER 4a

CONDITIONS OF SATISFACTION

Go and Do:

- Set common goals to guide the team; be clear, concise and measurable.
- Take time to develop the CoS early in the program; revise and add new ones as necessary.
- Include the needs of designers, partners and trade partners.
- Socialize and make visual, assess progress towards goals.

If you think of a large building project as comprised of perhaps a million decisions, made by hundreds of people, you can quickly see it is impossible for one or a few people to oversee every decision. That simple fact brings significant inconsistencies and misunderstandings to the process. And, that creates serious and expensive rework during the project.

Creating a set of Conditions of Satisfaction can help clarify the decision-making process and avoid that waste. Simply stated, "Conditions of Satisfaction (CoS)" is "an explicit description by a customer of all the actual requirements that must be satisfied by the performer in order for the customer to feel that they received exactly what was wanted."[1]

A clear CoS provides a way to assure common language, guiding principles and orientation around true north. It is a decision-making guide. Moreover, it aligns the team's focus. Naturally, the CoS must produce team agreement early–and throughout–the process, and then be shared with new members who come into the project later.

1 Kristin Hill, Katherine Copeland, and Christian Pikel, editors, ***Target Value Delivery.*** Arlington, VA: Lean Construction Institute, 2016

The degree of CoS buy-in will help determine the effectiveness of collaboration and conflict resolution throughout the life of the project. It also keeps the team in agreement around, and focused upon, their initial values and alignment.

The owner/end-user must force the team to gather, define, document and distribute these conditions. Likewise, the conditions must include the interests of the key stakeholders, including designers, builders, trade partners, customers and community. Effective leadership must avoid or block the dynamic that causes projects to rush to the work at hand without taking the time to recognize the great need for CoS.

What Does the CoS Cover?

The CoS might include 5 to 15 measurable outcomes around various needs, including the budget, schedule and safety. Other options for CoS might be:

- That the owner is satisfied with the quantifiable details of the result
- The community expresses appreciation (favorable newspaper articles, civil club recognition, community awards, number of visitors, etc.)
- That everyone (project partners, trade partners) achieves their profit requirements
- Measurable efficiency ratings and sustainability goals (LEED, energy savings, community impression, water savings, etc.)
- Voluntary appreciative expressions from employees and end users (such as patients in a hospital or employees in an office building)
- National or trade media recognition and industry awards
- Other construction metrics: RFIs, change orders, on schedule, punch list items, budget vs. actual, improvement percentages, teamwork indices, etc.
- Rapid Mitigation Existing Condition Discoveries[2"]
- Team health assessments (trust, constructive conflict, and resolution, commitment, accountability, etc.)

The CoS could also consider the owner's desire to drive change further into the organization. Often the owner organization, interested in real transformation, will see

2 https://www.leanconstruction.org/media/docs/chapterpdf/israel/Project_Conditions_of_Satisfaction.pdf

HKS Architects Wesley Long Project Conditions of Satisfaction in development.

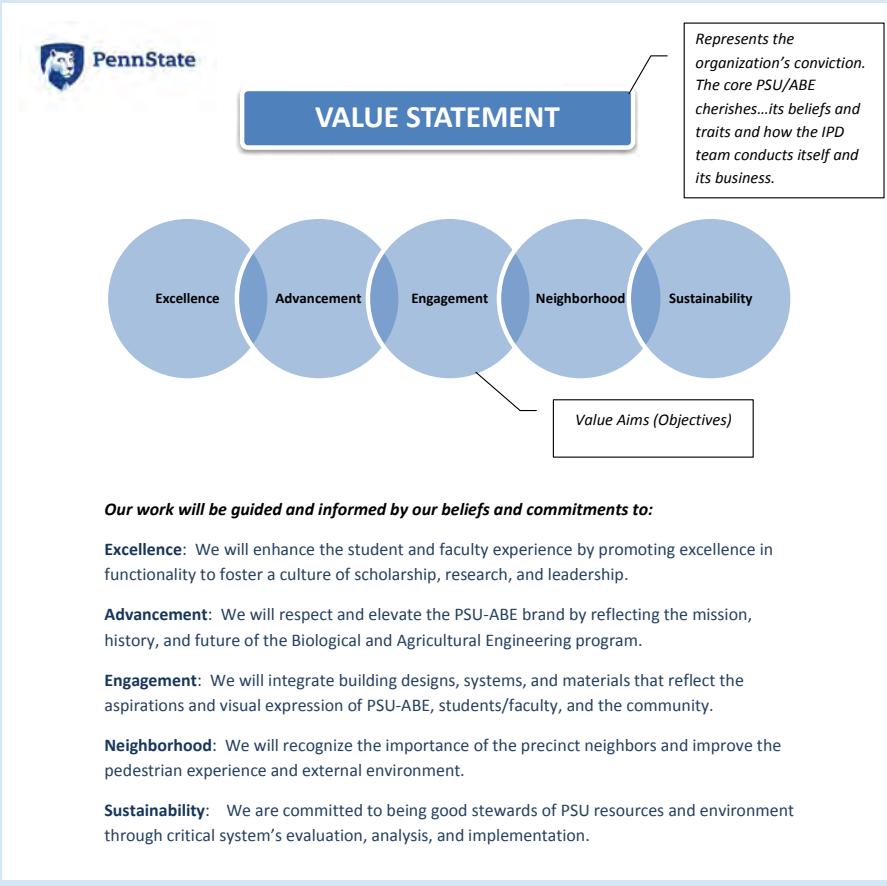
the benefit of including the employees, customers and community in the design and delivery process. That can inform and strengthen the conditions.

When Does the CoS Begin?

The project's beginning is the best time to start the CoS discussion. Those conditions must be addressed, discussed, resolved and documented as the project begins to form around a design. Furthermore, the more broadly the CoS gets shared and applied, the more consistent and useful it will be. It is often helpful for a team to visit a place – factory, medical facility or office building – where similar outcomes are being produced. They should learn about the culture, how they got there, where they are now and what it intends to be.

Every team participant has a desired outcome for his or her participation. Each of the many companies involved has a reputation to consider, a profit requirement and a desire to be involved in a successful project. The project leadership must include those desires from the very beginning.

He or she should assemble a reasonable cross-section of the team and help each to think about the purpose and carefully consider what is meaningful and essential to



Penn State University Value Statement used to guide the team in developing Conditions of Satisfaction.

each. This process should be shared with nearly everyone who touches the project; on a large project that will include hundreds of people. The CoS should always reflect the vision for the project. As appropriate, especially during the onboarding process with each new member, the vision should be shared, detailed, explained and strengthened.

How Does the CoS Become Reality for the Team?

A visual scorecard of these conditions should be prominently displayed in a common meeting space, so the team is always reminded of the purpose and guiding principles. That helps the CoS find traction in the corporate culture as a decision-making guide.

HKS Architects Riley Hospital Conditions of Satisfaction Work Cluster refining the CoS for the team.

The conditions should be measurable as the process develops. And, of course, the conditions should be used to resolve disagreement or conflict. Leaders should not only serve as advocates for the CoS, but aggressively and consistently build a culture that keeps the conditions in the forefront of everyone's thinking.

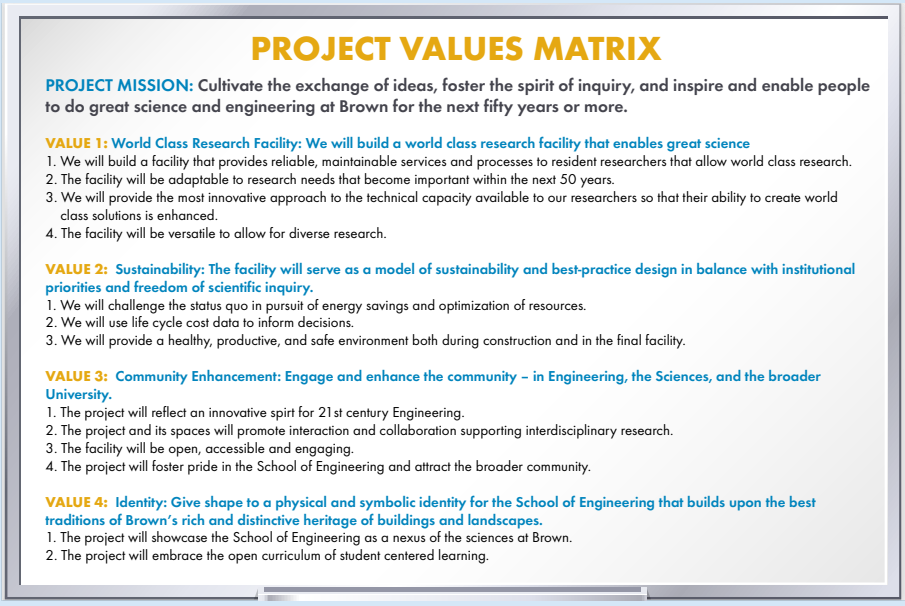
Some Conditions of Satisfaction will be accomplished early in the process. Others will appear later. Therefore, as the project progresses, the conditions should be revisited, and, as appropriate, some should be retired. Others will be added as needed in new phases of the project.

To make the CoS a reality, it is also essential to invite the proper decision makers to participate in the process. Key leaders should share their vision and desire for the project outcomes. In doing so, they should describe the business purpose for this effort; they should not assume that everyone knows.

That means they should also make sure that language (including acronyms, buzzwords, unfamiliar concepts, etc.) are defined. For example, the implementation team and the project owner work in different business sectors. So, they probably

don't know the acronyms, shorthand language and the measures of success or the challenges that face the others on the team.

Conditions of Satisfaction are the guiding light for the project and the means by which decision making can become networked within the team and not fall into the old hierarchical structure. Spending the time and effort to get this right, share it often, measure it regularly and adjust it when needed will be a significant element to the foundation of a successful project team.



PROJECT VALUES MATRIX

PROJECT MISSION: Cultivate the exchange of ideas, foster the spirit of inquiry, and inspire and enable people to do great science and engineering at Brown for the next fifty years or more.

VALUE 1: World Class Research Facility: We will build a world class research facility that enables great science

1. We will build a facility that provides reliable, maintainable services and processes to resident researchers that allow world class research.
2. The facility will be adaptable to research needs that become important within the next 50 years.
3. We will provide the most innovative approach to the technical capacity available to our researchers so that their ability to create world class solutions is enhanced.
4. The facility will be versatile to allow for diverse research.

VALUE 2: Sustainability: The facility will serve as a model of sustainability and best-practice design in balance with institutional priorities and freedom of scientific inquiry.

1. We will challenge the status quo in pursuit of energy savings and optimization of resources.
2. We will use life cycle cost data to inform decisions.
3. We will provide a healthy, productive, and safe environment both during construction and in the final facility.

VALUE 3: Community Enhancement: Engage and enhance the community – in Engineering, the Sciences, and the broader University.

1. The project will reflect an innovative spirt for 21st century Engineering.
2. The project and its spaces will promote interaction and collaboration supporting interdisciplinary research.
3. The facility will be open, accessible and engaging.
4. The project will foster pride in the School of Engineering and attract the broader community.

VALUE 4: Identity: Give shape to a physical and symbolic identity for the School of Engineering that builds upon the best traditions of Brown's rich and distinctive heritage of buildings and landscapes.

1. The project will showcase the School of Engineering as a nexus of the sciences at Brown.
2. The project will embrace the open curriculum of student centered learning.

Brown University Values Matrix used to guide the team in developing Conditions of Satisfaction.

CHAPTER 5

CONTRACTS

Go and Do:

- Create a legal mechanism that focuses on one common goal: Everyone wins or loses together.
- Bring stakeholders to the team earlier. Pay for their knowledge.
- Make the cost of finished product a design parameter and a measure of success.
- Integrate designer and builder through common goals.
- Create a culture in which the designer and builder care about each other's work and will not become adversarial.
- Clearly define cost, overhead, profit and how each is calculated.
- Blur the lines of traditional responsibility to allow innovation around "who does what," based on value.

Because they are legally enforceable agreements, contracts are frequently contentious. And, that is also true in Lean construction. When some step into the new world of IPD, they sometimes react to the new contracts:

- "We can't use an IFOA (Integrated Form of Agreement)."
- "Procurement won't let us sign this kind of contract."
- "We are a public agency."

Project team's Current Working Estimate tracking. This team is noting the estimate two times a month which is a typical cycle.

While any of those statements may be true about particular situations, the larger issue is fear of change. But, our experience with many private companies, not-for-profits and government agencies makes it clear that the cultural and behavioral changes can be made in any environment. Most organizations started their journey using old contracts with trusted relationships but continue to search for a better way. Many progress from traditional Design-Bid-Build to some form of pre-construction services, and then to perhaps Design-Build, and, ultimately, to IFOA. After seeing the benefits of the new behaviors, they convince their organization that a relationship-based contract can improve upon the old system (which was built on distrust). In time, they migrate to a new form of agreement. Legal forms and constraints do not prevent improvement. Rather, they require judicious creativity in achieving the desired result. Even if it calls for legal counsel, the added expense should just be considered part of the cost of transformation.

Those who have made the journey agree that the relationship created by the multi-party contract is better at instilling the behaviors desired. They know this kind of agreement frees the parties to share openly, to learn about each other's business practices and needs, to care about the operational health of each partner and to align all parties to the desired goals and outcomes of a given project or program.

That's why team leaders need to build a team of critical players as early as the project allows. Many organizations use a Professional Services type agreement for each party until a program reaches the maturity to define contract terms and conditions.

(see Partner Selection, Chapter 3). Projects must pay for these services. Some will always seek "free" advice, but free collaboration does not respect the provider. And, it is never as valuable as that of a vested partner.

What Should the Contract Do?

The contract terms must define a path to success, not form a basis for conflict or accusation. Rather than attempt to assign specific duties or outcomes to one individual firm, the contract should recognize and address a relationship of partners.

The contract should also start with the end in mind. What behaviors are you trying to authorize and encourage? For example, safety is the responsibility of every participant. Therefore, *project* safety, not just the safety of silos, should form the goals and drive the attention of all partners.

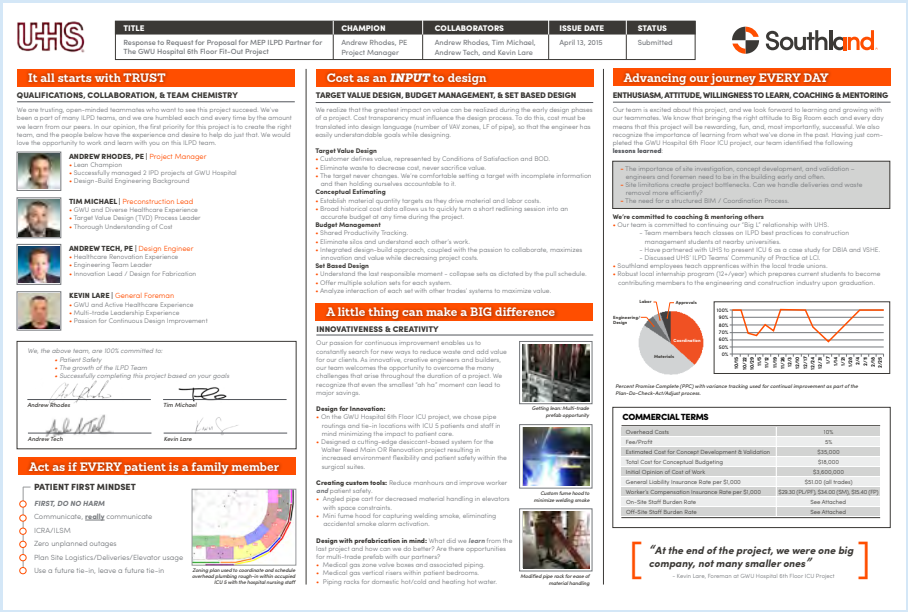
Collaboration is a cornerstone of Lean construction. For that reason, contract terms should lubricate the process and encourage ideation and innovation from all participants. Additionally, the organization and its communication technology and culture should boost direct communication among subject matter experts. Of course, that communication should be part of the atmosphere and practices of Big Room events.

Contracts should help blaze the trail into the culture change within the construction industry. For example, architect Michael Doiel, senior VP of HDR, recently spoke to us about the old traditional practice of various trade partners leasing their own ladders, scaffolds, hydraulic lifts, etc. But, many contracts for IPD projects lease all such equipment as part of the entire project. That not only reduces waste, but it emphasizes the collaborative and unified nature of the work.

If a team (and the contract) can tie financial outcomes together–i.e., win as a team/lose as a team–that helps foster communication and teamwork between the design and the build areas. That is far easier to accomplish with a multi-party contract.

Respect for each other must be encouraged. What contract terms may be unable to create in this area, focused leadership can. It starts as simply as changing language from "my engineers" to "our engineering partners," from "sub-contractor" to "trade partner." That can further be accomplished through transparency, accountability and inclusion in Big Room meetings instead of traditional OAC (owner, architect, contractor) meetings.

Lean/IPD emphasizes collaboration and teamwork. So, it is best if a contract can allow flexibility in work assignments and do so without contract modifications. That



UHS

TITLE	CHAMPION	COLLABORATORS	ISSUE DATE	STATUS
Response to Request for Proposal for MEP ILPD Partner for The GWU Hospital 6th Floor Fit-Out Project	Andrew Rhodes, PE Project Manager	Andrew Rhodes, Tim Michael, Andrew Tech, and Kevin Lare	April 13, 2015	Submitted

Southland

It all starts with TRUST

QUALIFICATIONS, COLLABORATION, & TEAM CHEMISTRY

We are trusting, open-minded teammates who want to see this project succeed. We've been a part of many ILPD teams, and we are humbled each and every time by the amount we learn from our peers. In our opinion, the first priority for this project is to create the right team, and the people below have the experience and desire to help do just that. We would love the opportunity to work and learn with you on this ILPD team.

ANDREW RHODES, PE | Project Manager
- Lean Champion
- Successfully managed 2 IPD projects at GWU Hospital
- Design-Build Engineering Background

TIM MICHAEL | Preconstruction Lead
- GWU and Diverse Healthcare Experience
- Target Value Design (TVD) Process Leader
- Thorough Understanding of Cost

ANDREW TECH, PE | Design Engineer
- Healthcare Renovation Experience
- Engineering Team Leader
- Innovation Lead / Design for Fabrication

KEVIN LARE | General Foreman
- GWU and Active Healthcare Experience
- Multi-trade Leadership Experience
- Passion for Continuous Design Improvement

We, the above team, are 100% committed to:
- *Patient Safety*
- *The growth of the ILPD Team*
- *Successfully completing this project based on your goals*

Andrew Rhodes · Tim Michael · Andrew Tech · Kevin Lare

Act as if EVERY patient is a family member

PATIENT FIRST MINDSET
- ***FIRST, DO NO HARM***
- Communicate, **really** communicate
- ICRA/ILSM
- Zero unplanned outages
- Plan Site Logistics/Deliveries/Elevator usage
- Use a future tie-in, leave a future tie-in

Zoning plan used to coordinate and schedule overhead plumbing rough-in within occupied ICU 5 with the hospital nursing staff

Cost as an *INPUT* to design

TARGET VALUE DESIGN, BUDGET MANAGEMENT, & SET BASED DESIGN

We realize that the greatest impact on value can be realized during the early design phases of a project. Cost transparency must influence the design process. To do this, cost must be translated into design language (number of VAV zones, LF of pipe), so that the engineer has easily understandable goals while designing.

Target Value Design
- Customer defines value, represented by Conditions of Satisfaction and BOD.
- Eliminate waste to decrease cost, never sacrifice value.
- The target never changes. We're comfortable setting a target with incomplete information and then holding ourselves accountable to it.

Conceptual Estimating
- Establish material quantity targets as they drive material and labor costs.
- Broad historical cost data allows us to quickly turn a short redlining session into an accurate budget at any time during the project.

Budget Management
- Shared Productivity Tracking.
- Eliminate silos and understand each other's work.
- Integrated design-build approach, coupled with the passion to collaborate, maximizes innovation and value while decreasing project costs.

Set Based Design
- Understand the last responsible moment - collapse sets as dictated by the pull schedule.
- Offer multiple solution sets for each system.
- Analyze interaction of each set with other trades' systems to maximize value.

A little thing can make a BIG difference

INNOVATIVENESS & CREATIVITY

Our passion for continuous improvement enables us to constantly search for new ways to reduce waste and add value for our clients. As innovative, creative engineers and builders, our team welcomes the opportunity to overcome the many challenges that arise throughout the duration of a project. We recognize that even the smallest "ah ha" moment can lead to major savings.

Design for Innovation:
- On the GWU Hospital 6th Floor ICU project, we chose pipe routings and tie-in locations with ICU 5 patients and staff in mind minimizing the impact to patient care.
- Designed a cutting-edge desiccant-based system for the Walter Reed Main OR Renovation project resulting in increased environment flexibility and patient safety within the surgical suites.

Creating custom tools: Reduce manhours and improve worker *and* patient safety.
- Angled pipe cart for decreased material handling in elevators with space constraints.
- Mini fume hood for capturing welding smoke, eliminating accidental smoke alarm activation.

Design with prefabrication in mind: What did we *learn* from the last project and how can we do better? Are there opportunities for multi-trade prefabs with our partners?
- Medical gas zone valve boxes and associated piping.
- Medical gas vertical risers within patient bedrooms.
- Piping racks for domestic hot/cold and heating hot water.

Getting lean: Multi-trade prefab opportunity

Custom fume hood to minimize welding smoke

Modified pipe rack for ease of material handling

Advancing our journey EVERY DAY

ENTHUSIASM, ATTITUDE, WILLINGNESS TO LEARN, COACHING & MENTORING

Our team is excited about this project, and we look forward to learning and growing with our teammates. We know that bringing the right attitude to Big Room each and every day means that this project will be rewarding, fun, and, most importantly, successful. We also recognize the importance of learning from what we've done in the past. Having just completed the GWU Hospital 6th Floor ICU project, our team identified the following **lessons learned**:
- The importance of site investigation, concept development, and validation – engineers and foremen need to be in the building early and often.
- Site limitations create project bottlenecks. Can we handle deliveries and waste removal more efficiently?
- The need for a structured BIM / Coordination Process.

We're committed to coaching & mentoring others
- Our team is committed to continuing our 'Big L' relationship with UHS.
  - Team members teach classes on ILPD best practices to construction management students at nearby universities.
  - Have partnered with UHS to present ICU 6 as a case study for DBIA and VSHE.
  - Discussed UHS' ILPD Teams' Community of Practice at LCI.
- Southland employees teach apprentices within the local trade unions.
- Robust local internship program (12+/year) which prepares current students to become contributing members to the engineering and construction industry upon graduation.

Percent Promise Complete (PPC) with variance tracking used for continual improvement as part of the Plan-Do-Check-Act/Adjust process.

COMMERCIAL TERMS

Overhead Costs	10%
Fee/Profit	5%
Estimated Cost for Concept Development & Validation	$35,000
Total Cost for Conceptual Budgeting	$18,000
Initial Opinion of Cost of Work	$3,600,000
General Liability Insurance Rate per $1,000	$51.00 (all trades)
Worker's Compensation Insurance Rate per $1,000	$28.30 (R/PP), $34.00 (SW), $15.40 (FP)
On-Site Staff Burden Rate	See Attached
Off-Site Staff Burden Rate	See Attached

"At the end of the project, we were one big company, not many smaller ones"
– Kevin Lare, Foreman at GWU Hospital 6th Floor ICU Project

Southland Industries MEP Response to a RFP for UHS George Washington University Hospital.

approach can reduce risks for all parties and improve the project's outcomes. In fact, it's not even possible to know the details of assignments before team members are selected.

There is also a significant amount of waste embedded in our traditional specification, submittal and shop drawing process. That can be addressed by assessing BIM (building information modeling) capability among the team and allowing those with higher capability to define and manage the use of these tools.

How Can the Contract Encourage Innovation and Teamwork?

The traditional delivery process tends to limit innovation to and within particular areas of work. But, that kind of isolation trains team members to avoid crossing contract boundaries. So, individual firms have learned to improve their own results, while ignoring the broader scope. Those improvements may offer those companies bid advantages, but do little to improve the program. However, the whole culture of Lean/IPD must change the focus from the individual to the larger value stream. An integrated team should examine the opportunities for innovation across multiple companies and

traditional silos. Those opportunities should be studied early to allow for incorporation into the design and planning of the program.

When that happens, an integrated project can create better information and workflow more predictably. The contract should consider ways to spur each member to care about the totality of the project's work, needs, timeframe, resource availability and capability of each member. It should allow easy and flexible ways to fill in labor gaps, improve design details and reorganize deliverables to minimize risk or improve efficiency. These concepts can require near constant re-prioritizing of work and blurring of the lines around traditional delivery responsibility. Therefore, the contract should consider limiting or waiving the ability to file claims against each other.

After all, if a team is behaving as one organization and wants to remove cross-claim activity, the contract should provide combined insurance. And, there are various ways to accomplish that. For example, liability plans can be project-specific and include all parties. Owner-controlled insurance plans can cover the risks for all builders and craft persons. Contractor-controlled insurance plans can do the same.

IPD has rendered the traditional contract methods, offering a fixed price for a predefined effort, as flawed and outmoded. For example, in a traditional contract, a designer is asked to propose a fixed price to design something when it has minimal definition. A significant amount of discovery will occur along the way that could not have been anticipated. That creates too much opportunity for contractor change orders, delays or uncoordinated work.

A contractor proposing on a predefined set of instructions is incented to count individual widgets or instructions and then claim change for those not clearly defined. Significant gray areas exist between what is truly defined, what is reasonably inferred and what is actually necessary to meet the intent of the design. That puts the designer and builder at odds, immediately creating animosity and competition rather than collaboration and innovation. In all these cases, profitability is misaligned with the project goal.

One of the key purposes of an integrated team is to create value for the whole, not individual items. When mistakes or problems occur in a traditional project, everyone hides, blame gets assessed and the person at fault bears all costs of solving and fixing. Even if others may have a better solution, they keep their mouth shut because their solution may increase their cost. The IPD contract eliminates that attitude because all costs are paid from one bucket of funds, regardless of responsibility or blame. That means everyone is motivated to find and implement the most cost-effective, best overall value solution. And, they will get paid for that.

For contracts to clarify the work and protect each team member, it is vital that everyone understand how each company makes money, executes invoices, pays and determines profit. The RFP/Partner selection process must consider this in the early stages of a program.

These contract discussions can be difficult for many reasons, but they all boil down to the fact that each firm is in a different business. They are all unique. Each has acquired its own policies and practices. Those differences must be respected and protected by every member.

Consider the design and build functions in commercial construction.

Because designers are typically a service industry, value is not directly proportional to salary plus a common multiplier. Naturally, the details of profit, marketing, travel, overtime, rent and other accounting realms are specifically designed for their operations.

On the other hand, builders usually estimate cost based on hours worked, material, subcontracts, overhead and profit. So, their business model is vastly different. These differences can be as simple or as complicated as one cares to make them. But, the underlying desire in the integrated delivery of capital projects should be to understand, respect and protect everyone's business, and way of doing business. For that reason alone, the project should include a Budget Work Cluster.

That work cluster is, in effect, the CFO of the virtual business created by the IFOA. They are responsible for creating and managing the budget, as well as validating proper invoicing and payments to the owner and each other. They measure and publish the metrics for project health, drive innovation and hold each other accountable.

Contracts should focus on rewarding innovation, usually through shared cost reduction. Because innovation generally lowers the cost of performing work, the team should be highly motivated to innovate as a vital part of driving that cost down. They do it to share in the savings, not just to protect the owner's ROI.

Contracts should ultimately define owner vs. team responsibility, along with the ability to transfer those responsibilities. After all the accounting and work assignments become clear, the art of establishing targets and when to transfer the delivery risk to the team must be decided. The team will usually have been working together for a time, estimating costs, defining details and planning the implementation together. But, the time comes when they must own those plans.

Several variables must be considered concurrently: current working estimate, needed contingency, profit sharing ratio, potential cap/minimum and final target price. These

things together will shape the ultimate deal that determines the partners' financial outcomes. When the time comes to set a contractual target, these concepts and the overall structure of the deal should be communicated sufficiently so that all partners understand them.

based on a real project situation...

Contracts Story

A Tri-Party Integrated Contract was signed by the Owner, Architect and General Contractor. The contract team established success metrics for the project to outline the Conditions of Satisfaction and created a risk and reward pool to incentivize the team for innovation and collaborative behaviors. Multiple consultants and trade partners were brought into the project early in the design phase to form the Integrated Project Delivery Team. The early team formation solidified a shared vision and helped the team overcome unforeseen obstacles during the project.

The team was in the early stages of construction of the seven-story hospital when an "unforeseen obstacle," the first major test of the Integrated Contract, developed. The excavation, concrete, electrical and plumbing contractors were setting up for the second major wall pour when the sky just opened up. With more than three inches of rain and gusty winds, the excavation began caving in. Some of the formwork completely washed away.

On a traditional project, that type of challenge would result in the contractors positioning themselves for change orders and finger pointing that would greatly delay the project.

This project was different. Because it was based on an Integrated Contract, everyone on the project was working towards common goals; everyone would win or lose together.

So, rather than days of delays and paperwork, this project team all chipped in to get the project back on track. The electricians, plumbers and concrete trades grabbed shovels and started digging out. They repositioned the concrete formwork in less than a day. Because of the contract and the culture that the team had developed, everyone cared about each other's success and not just their own.

In the end, the quick and selfless teamwork saved more than $100,000 for the project.

Rapid iterative estimating should give the team a high level of confidence in their working estimate. That should be frequently presented in the Big Room and updated by each party regularly. Milestone estimates along the way should increase confidence as the design documents progress (see Managing Budget, Chapter 10).

Despite the teamwork and integrated effort, construction projects will always face unforeseen and unknown risks. The team must pay close attention to the risks throughout the process. A reward pool should be established early in the process. Of course, the ownership of the pool will usually be determined by the ratio of contributions. The pool should grow as innovation drives financial improvement. But, it may also be at risk from cost overruns, mistakes, rework and outcomes. There are many ways to structure the pool sharing. It can be tied to Key Performance Indicators as well as cost. There could be a loss floor and/ a profit cap. Alternatively, there could be share percentages that change as the profit pool grows. A cap offers safety to the owner team. 150% is a reasonable cap. A loss floor protects team risk and, therefore, frees innovation.

These targets and opportunities help change the culture to one of innovation and thus create behaviors that last regardless of the profit motive. A team will not stop innovating because their profit maximum has been met. They know the risk doesn't end until the keys are handed over and the warranty period ends. But, the pride associated with innovative solutions and highly effective teamwork is extremely rewarding.

How Contracts Create New Work and Leadership Patterns

The successful IPD team will consistently challenge each member to be accurate, honest and effective in their pricing estimates. They should experience a growing realization of collaboration, find an increasing sense of team behavior and continually see more of how innovation can drive out waste and improve productivity. Those factors should encourage them to stretch those estimates and offer a "discount" to the working estimate. Their stretching should provide enough tension to keep the team focused on innovative practices.

While one might think that a multi-party contract would be more difficult than negotiating one-on-one, we have found that group negotiation doesn't take much, if any, more time. In fact, it usually takes less time. Often, in such contracts, the terms and conditions are established and find agreement before the price or business deal get finalized. Integrated teams usually practice open book cost verification; that certainly assists the new approach to multi-party contracts.

New leadership emerges because integrated teams share the leadership roles and responsibilities. So, whether signing a multi-party agreement or an informal team-partner agreement, the team should establish a Project Management Team (PMT) or Core Group. This PMT will be a collaborative decision-making unit, comprised of a key leader from each represented firm. Each PMT leader (ideally full time on the project) is manifestly dedicated to the project and will be responsible for the day-to-day operation of the design and construction process.

Many teams also establish a Senior Management Team (SMT)—consisting of executives or owners of represented firms—that acts as an advisory board to the Project Management Team. The SMT member must have the authority to resource the project as needed. The SMT will also be consulted when significant issues create stalemates or require adjudication.

The PMT members should hold each other accountable. They must be prepared to have difficult discussions as necessary. The PMT leaders must be dedicated to the success of the project, as well as to that of the partners. Obviously, these leaders will require a skill set that is different from traditional project management. (See Leadership, Chapter 1).

The Last Word in Contracts

Change is difficult and time-consuming. Leaders must not underestimate the time it takes to get a new contract written and signed. We have learned to set regular interval meetings to keep the effort moving forward. Give people time to understand the change desired and to assess how it might influence their behavior or the rest of their business. Be patient yet persistent.

When considering an IFOA, we have found it best not to send the document to legal counsel without educating him or her on the nature of a relational vs. transactional contract.

In fact, the new contracts –more relational than transactional– do not complicate the structure of the relationship or the deal. Whereas a transactional contract tries to define every possible situation, a relational agreement sets the tone for negotiated outcomes that benefit the project. The leadership and the contract should authorize and empower the PMT to work together for solutions, build appropriate systems and define responsibilities.

The wise team will be careful to define what is part of a contract and what can be covered by an attachment. That is especially true if the contract is drafted without all the

players available. For example, rather than dictating a BIM implementation plan, the contract should simply authorize the team to develop a plan.

Owner reps who are not familiar with industry should be educated about both the old–such as Design-Bid-Build, Guaranteed Max Price, Construction Management at Risk–and the new practices. Those familiar with construction will see significant differences in behavior and even the number of people in the room. They should also see a difference in how the owner partners with the team rather than the old "dictate and demand" methods. The new process is critical to the development of values-driven and trust-based systems.

It is helpful for anyone attempting to change the contracts to read old agreements. The study of old and new agreements will certainly reveal the differences in leadership and management philosophy. They will also help frame the working relationship of those leaders and help to better understand why the Partner Selection process is different from a traditional program.

CHAPTER 6

RISK MANAGEMENT

Go and Do:

- Acknowledge that risk must be considered and accounted for in the project budget.
- Create and continuously update a comprehensive list of risks.
- Determine (in consultation with the team) who best can manage each risk.
- Don't force people or companies to take risks they aren't willing or able to take.
- Closely track and update all perceived risk.
- Report on the status of each risk event regularly. Monetize and update each risk cost.
- Establish a regular team meeting to discuss the status of each risk, update the assigned strategy and adjust any dollar amounts budgeted to address the risk.

Traditional projects manage risk by offloading it to others. We've all seen it; the owner tries to write a contract assigning risk to the design team or the general contractor. Then, the general contractor passes the risks along to the sub-contractors. Moreover, architects often bring in additional specialists to oversee specific areas of threat, purportedly shedding the risk along with the scope.

Conversely, an integrated team endeavors to identify risks and determine which partners have the expertise and capacity to best manage them. In other words, an

DPR Construction Lean Project Board visually displayed to remind everyone that they are all responsible for the success of the project.

integrated team takes a proactive stance on risk management. It understands that threats exist in many forms, wants to see them clearly identified and discusses how to address them with the team. Furthermore, each partner usually has a different perspective and a different set of mitigation resources from which he or she views risk.

The team must stay on top of risk management. That requires a regular meeting for presenting risk, assessing it and discussing alleviation strategies. That should likely be bi-weekly during a Big Room event (see sample risk log in the appendices). Each risk must remain visible, assigned to one individual and given a resolution path and deadline. Because the risks vary as time progresses, the potential financial impact should frequently be updated; the changing details can lower (or increase) the potential impact to the project's criteria for success. The awareness of risks could also significantly change the design development timeline and process.

Honesty and transparency are critical; each member of the team must be clear and detailed about his or her view of potential risks. Early identification helps the team minimize potential problems. Early involvement of contractor and trades will significantly reduce latent design risks and coordination change orders. Everyone should respect the perspective and input of those partners, as she or he are looking further down the line of what it will take to deliver the project.

Identifying Risks

The risks for a project are vast and kaleidoscopic: labor problems, material cost increases, weather events, terrorism, oil prices or even another project that might consume significant local resources. Knowing the potential issues can and must inform strategies for avoiding, minimizing, or neutralizing disruptions. It is also essential to train the team to dig deeper into the scope of work for the true risk.

Obviously, identified risks should inform the design process. In fact, the design process should be re-organized if necessary or helpful to study and resolve the risks in the earlier stages of design. And, of course, the risk list should help establish the order of decisions and the number of resources assigned to resolution.

If a team is working in a shared risk environment, any risk could impact the collective outcome. Knowing that the risk might consume contingency funds or reduce the shared profit should motivate the team to be more creative and vigilant in brainstorming solutions. The more integrated the team, the more people are willing to step up with ideas or solutions, regardless of traditional responsibility. The risk list can also help determine the specific partners who should be considered for the shared risk/reward team. For example, if the rising cost of steel is a concern, they may want the steel

fabricator as a member of the team so that he or she can procure steel as early as possible.

Identifying risks requires that team members get comfortable sharing their own areas of concern. The silos of a traditional approach keep problems or challenges close to the vest. That merely reduces the visibility and postpones the identification of risks, and that leads to fewer and more costly or disruptive solutions. The Lean/IPD approach focuses the team on identifying potential concerns at the earliest possible moment.

The team leaders should always strive to create an atmosphere of learning. While that is essential and obvious on several levels, a learning culture also helps to reduce risk. For example, collaboration around risk spurs creativity, developing and bringing many ideas to the table. An atmosphere of trust and respect can allow very early identification of risks, leading to better mitigation planning. When possible, the creation of a shared risk/reward program incentivizes partners to care about and learn from each other as it can have a direct impact on everyone's bottom line.

Reducing Risks

By creating an atmosphere of learning *and* transparency, a team can reduce or eliminate a potential risk. Aggregating the resources of the many can often identify a better, faster or less expensive solution. A shared contingency or fully integrated contract can help foster an atmosphere of collaboration among partners. Most risk items can be solved, but too often contract responsibility or assumption of no responsibility will reinforce silos and damage the willingness to help others. Therefore, effective leadership will find a way to overcome that barrier.

The team should develop a discipline around risk that helps parse risk into specific and meaningful items rather than large buckets. For instance, "Authority Having Jurisdiction (AHJ)" identifies the responsible agency, but may be too vague to take action in certain situations.

Each risk should be defined and assigned a cost impact. Furthermore, the team must possess some understanding of the nature, cause, timing and possible impact of the risk. Knowing those dimensions will enable the team to assign the resources and responsibility necessary for managing the threat. That management role is not expected to solve the issue alone, but rather to convene the proper specialists to provide resolution at the appropriate time. Each of those details should be routinely logged (see the Risk and Opportunity Register in the appendix) and frequently shared.

The early involvement of key trade partners helps to keep an eye on cost escalation and market conditions. The trades typically know in advance of pending price increases

or shortages within their operational realms and how best to leverage the situation. They can often use vendor relationships to manage the increases at a much earlier stage than is possible in a traditional project. That awareness can also drive design sequence.

Everyone should be engaged in the effort to prevent or reduce risk. No idea is bad. No question is wrong. All members should respectfully challenge each other so that the team may find better solutions, at the lowest cost, and imposing the least impact. Risks should be kept on the Big Room agenda.

Contingency funds – pre-defined buckets of money to protect against loss from unplanned disruptions – are often necessary to offset risk. Those funds must be generated according to the team's evaluation of financial exposure, to the project and to each member. While this is a prudent and smart business concept, it may also reduce creativity by offering the easy way out of a crisis. It is always easier to pay rather than analyze the cause and *solve* the problem. However, those problems tend to come back another day, perhaps in another project. Leaders should also be aware of hidden contingency funds. Wisdom teaches them to look beyond line items to unit costs to find if hidden contingencies, for both time and money, exist.

Contract terms can play a crucial part in risk management. If partners are concerned about specific liability, they may be reluctant to make suggestions or take the lead in managing a piece of the risk. The best environment is one where everyone can offer solutions without fear of reprisal.

Company reputation is a real (and often fragile) asset; it could be costly if that asset is damaged. Everyone should know that each partner will go to extreme lengths to protect their personal and corporate reputations.

Keeping Risk in Perspective

Because risks can be life-threatening to a person, a company, any institution or other entities, the whole idea of risk can be emotional. And emotional issues tend to force a loss of perspective.

For example, overstating risk can skew the outcome. While every item considered should be logged and studied, not all dangers carry the same probability of occurring or magnitude of impact. Hurricanes certainly hit along the US Gulf of Mexico and Atlantic shorelines. While they all require careful preparation, it is difficult to predict an event's probability or impact, since most impose relatively small levels of damage.

Risk is a factor, but it should never be a crippling one. The industry has very naturally developed effective responses to threats. Wise leaders always seek resources within and beyond their own operations. For example, the Construction Industry Institute (CII) has a project risk assessment resource that can be very helpful to owners and project leaders. And, of course, many consultants can help define and control risks. Leaders should always avoid burdening a team with threats and concerns they cannot control. Some of them must be borne by the project owner and specific insurance products.

Perhaps the most critical part of keeping perspective on risk is just to know that the relevant risks to any project change frequently. That's why they must be reviewed on a frequent basis. Ideally, a risk review should be part of the Big Room agenda in order to assure that the risk and opportunity conversation remains active and meaningful. Everyone on the team should contribute to that discussion. That list, including an appropriate assigned value, can give a better and more accurate picture of the financial health of the project. A visual presentation of that condition of health is very beneficial in attaining the appropriate level of engagement into the mitigation of the challenges brought by risks. The Budget and Burn Rate chapters offer more details on keeping the list in front of the team.

CHAPTER 7

THE BIG ROOM

Go and Do:

- Create an integration event to keep the team aligned.
- Use Work Cluster (work group) structure to develop work details.
- Use the Big Room to plan work, make task assignments and manage resources.
- Drive innovation and learning, and develop team cohesion in the Big Room.
- Break down silos and barriers in the Big Room.
- Continually refine these events, understand their cost and value and make them more effective.

Most leaders know that developing an accountable community requires a clear and free flow of communication. And, that brings us to a key practice known as the Big Room.

At its heart, the Big Room is a scheduled and recurring event. It brings key stakeholders together to collaborate, plan, update, solicit resources, invite feedback, demonstrate accountability, make decisions, schedule events and compare the project's current state to published goals or Conditions of Satisfaction.

These Big Room meetings must happen frequently and face-to-face. They can range from a few hours per week to a full-time co-location throughout a cycle or entire project.

LCI Target Value Delivery book development team using Big Room to collaborate on content. This team is actively advancing work by breaking into smaller Work Cluster groups, then holding integrating events to bring the ideas together.

The frequency, time, location and participants must change as the project matures; it should frequently be reviewed for value. The size, scope and schedule of the project should inform the nature and size of the Big Room. The purpose of the Big Room is not a simple review; it *advances* the work.

What Are the Benefits of "The Big Room"?

The Big Room represents an opportunity to identify and develop leaders rather than rely on one or two traditional roles. Furthermore, the more leaders the team can create, the more resilient the team can be when coping with change or disruption. And, as per Chapter 7b, a "Work Cluster" structure enables better management and collaboration. That certainly fits into the Big Room by helping to distribute leadership, resisting the impulses of tradition and reinforcing the goals of change and improvement.

A work group of more than 8 - 10 tends to become unwieldy, especially if consensus is the general measure of progress. That is the genesis of Work Cluster organization. The detail work of actually solving problems and documenting solutions often happens better in these smaller groups than in the Big Room.

That room is also the team space, where participants come together to interact and work. It should include participants from many different companies to encourage collaboration and exchange of information. As an open and informal space, it is more conducive to the broader conversations about ideas and opportunities that lead to better decisions. Another reason for the Big Room is that it is easier to work with and commit to someone you regularly see, know and trust. As we have already emphasized, relationships and trust form the base for Lean/IPD. When properly managed and taken seriously by participants, we have found the Big Room leads to better, faster and more reliable decisions.

The real purpose of the Big Room could be described as continuously working on the right work at the right time. In other words, it's about driving the project forward within the agreed constraints (such as the Conditions of Satisfaction). The Big Room also captures the ability to share information so that producers can plan more effectively. The room provides open access to relevant information and delivery details. The results can be posted on the wall for all to see.

based on a real project situation...

Big Room Work Cluster Report Out

Guidelines

Note:

Work Cluster Leader (or alternate) give the report out

Report outs are conducted standing to keep them high energy and short

Items that need to be addressed further should be noted on a Parking Lot or Constraint Log as appropriate to the item

Report out are per work cluster and should have a goal of approximately 5 -10 (max) minutes

Structure of the Report out:

1. At an overview level, what work has the work cluster done since the last report out?
2. At an overview level, what work will the work cluster do before the next report out?
3. What constraints or needs that you need help removing, does the work cluster have from the integrated team?
4. Is the work cluster on track?

The Big Room: A New Operating System

We all know that value comes in many forms and from various perspectives. The detailed definition of value for a project should be honed and refined as designs and plans progress. This integration event, the Big Room, presents an excellent opportunity to do just that. The most current and essential perspectives of value should also be posted on the wall. They should be revisited frequently and used to educate new participants. End users should be invited to appear in Big Rooms. Hearing from those who will occupy the new space (patients, doctors, administrators and other staff) could be very helpful to the process.

The Big Room is the heart of a new operating system.

Visualize it as the hub of a wheel; the activity flows from and reports back to that hub. The operating system will be designed and continually upgraded; everyone on the project will use the latest version.

To an outsider, the Big Room can look inefficient and too large. In fact, at the onset, it often is. And, it can become that way long-term if not carefully managed. The room develops its own momentum. If not managed properly, it will cross that fine line between keeping everyone synchronized and just adding work and making little progress while spending too much money.

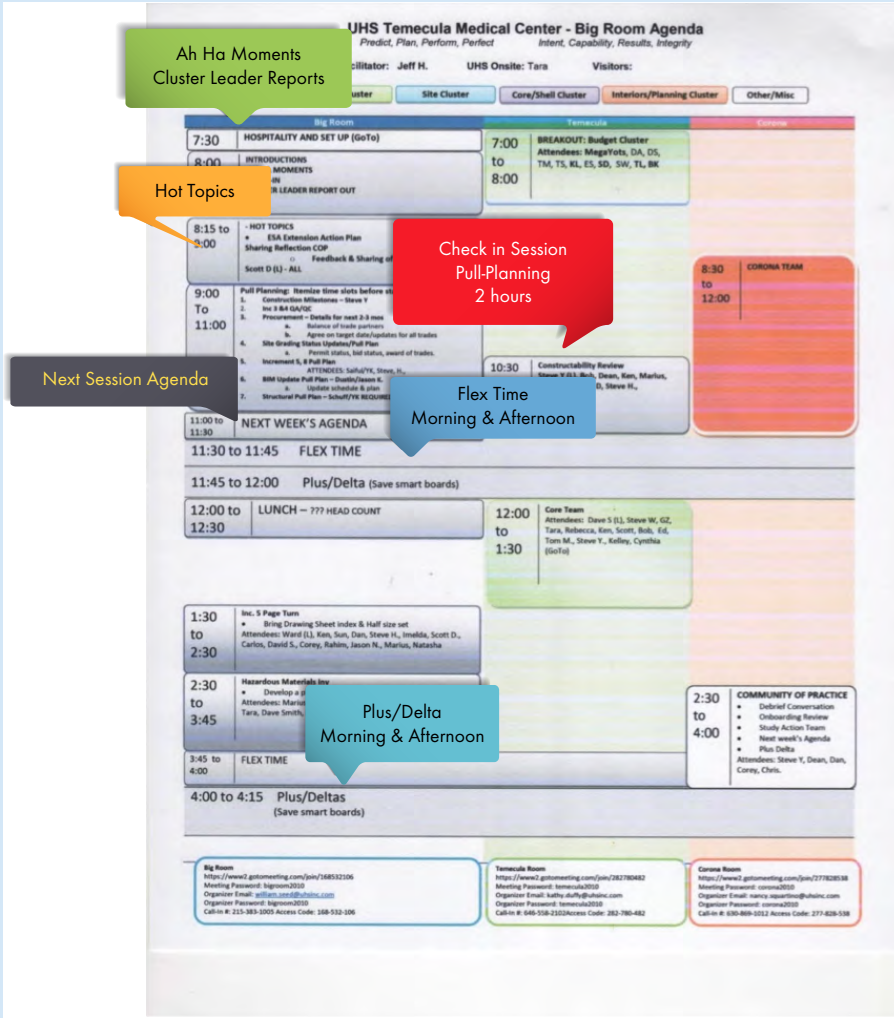
Consistent with the new operating system, the Big Rooms should be well-defined, well-facilitated events. Of course, that requires clear rules and agendas, conformity as necessary and flexibility as appropriate. Preparation for a successful big room event may take longer than the event itself. Homework assignments are crucial components of the Big Room (preparing leadership roles for various topics). Report-outs should be short and concise (stand and deliver). Continuing agenda topics should be continually monitored and evaluated, and cost data should be kept current and accurate. All information should be shared openly.

Learning, teaching and innovating should be reinforced in each event. That is often accomplished through a dedicated timeslot for learning and is intended to strengthen the culture. Icebreakers or other team-building practices should also be included rather than just jumping into the work. It is so much better and more productive if the Big Room maintains a friendly atmosphere. People are more likely to collaborate and work outside their silos if they know and understand each other and have built relationships with the team. Key ingredients of building relationships in a Big Room include essential human activities, like eating lunch together.

Who Owns the Agenda?

Creating an effective Big Room is not a simple matter. Planning is key to keeping a team of 15 to 30 people focused on the project objectives.

Let's start with a primary issue: Who owns the agenda?



UHS Temecula Valley Hospital Big Room agenda that has gone through continuous improvement cycles to make information visual and clear. The agenda is collaboratively developed by the team each week for the next week.

DPR Construction Big Room team integrating event bringing the cross discipline team into focused conversation.

In a traditional program, individual (or a select few) leaders tend to manage projects. But, integrated teams find that rotating the leadership role is helpful; it helps distribute responsibility. In addition to building team strength, rotating also develops new leadership. A Lean/IPD project works to create a safe zone conducive to personal growth and leadership development.

The critical work plan decisions and the milestone schedule must drive the agenda, including the order of topics. The same factors must determine who attends and for what part of the meeting. Team members should ask themselves, "Am I gaining or providing value by being in this meeting?" If they cannot answer yes, they should reconsider their attendance.

To facilitate an event is different from managing or leading a topic. The facilitator keeps the meeting on schedule, maintains the meeting focus and enforces the rules of the meeting. But, each topic should be led by the relevant leader. For example, the civil engineer should lead a discussion about utilities and site drainage.

Naturally, parts of the event focus more on the development of the team than on specific spheres of work. Icebreakers can be helpful in building camaraderie, relationships and vulnerability; in other words, they help to form the basis of trust.

Good leaders also use simulations to practice change thinking, pull planning, tact time, communication, etc.

The Big Room Events: Points of Integration

Work*places* are naturally and necessarily points where people integrate around work. That integration may be for planning, coordination, developing agendas, reviewing progress, debriefing or other collective purposes.

For example, Big Room planning meetings will generally be led by the designer and attended by those knowledgeable about cost impacts. Those meetings focus on outcomes more than the means to get there. Sometimes that means using set-based solutions. Those attending should be selected to help develop those concepts without getting bogged down in details. The room considers how to drive to the ultimate solution. All participants should concentrate on value as defined in Conditions of Satisfaction. Remember the goal is to provide value, first, as viewed by the owner and second, as considered by the team. The Big Room is never about a previous project or what an individual firm prefers or prioritizes. That's why the planning meetings should always keep the cost and schedule goals in mind and understand how they relate to the Target Value Design/Delivery process.

Another Big Room may carry a tighter focus on identifying a problem and a solution. Of course, the meeting should press beyond immediate or surface perceptions into the real problem. That is often done best in the Work Cluster setting or component team meetings. Those smaller and more focused groups should discuss all system-wide impacts and propose multiple solution options in a future big room event.

Other Big Room events carry highly specialized purposes, such as communicating updates to a larger group of stakeholders. That can be (and often is) just a portion of the big room event, but not its entire purpose. That meeting can also be the report in/report out of activity going on outside the big room. How is a cluster group approaching its goals? What are their needs? These can usually be presented in a stand-and-deliver format to get through them rapidly. Finally, time should be set as needed for reflection meetings, a significant way to consider and improve the meeting process itself.

The Big Room: Building the Team and the Culture

The Big Room gives an opportunity to restore a focus that has deteriorated over time, the need to consider the overall project health and success over that of individual players. At the same time, the Big Room must be a safe zone, meaning that everyone

DPR Construction Big Room team using every inch of space for visual management while in a planning session.

should have the opportunity to share their ideas freely. Most ideas are not bad; they just don't apply at a given time. If a team does not create a culture allowing that freedom of expression, it will limit the ability to innovate. It doesn't take much to shut most people down; a rude or insensitive remark and negative body language may discourage participation. Meeting facilitators should make sure that everyone feels comfortable asking questions and clarifying assumptions. They should remember that some people have not been present for every discussion or from the beginning of the project.

The simple act of just eating lunch together can create added empathy and connection. That can go a long way when pressures build or problems arise. We have found it's always good to spend time together, getting to know the teammates. Events away from your workspace – such as enjoying a beer or attending a game together – help to build personal and team relationships.

Successful Big Rooms have learned to provide breakout rooms or small team rooms for members to work on other things during the times they are not needed. After all, most consultants are working concurrently on multiple projects, and many team members have a business to run. Additionally, everyone needs the space for real life, time to talk to a spouse or doctor in comfort and privacy.

A good facilitator will notice a lack of participation. What does that mean? Why are certain individuals not engaging? It could be an attitude issue. It could also be a personal or family crisis. Whatever the cause, good facilitators will – for the sake of the project – help team members to find perspective or resolution that could set them free to interact more freely and positively.

In the same sense, watch for attendance. Is someone chronically missing? Make a call to find out why. He or she may have a good reason to be absent. Sometimes the missing member just doesn't know how to migrate to new patterns or behaviors. It is better to find out sooner than later. Don't be afraid to make a tough decision if a person or a company is not the right fit.

Consider some emotional intelligence training, awareness or expert facilitation for your team to help with communication. Consider taking assessment analyses (like Clifton StrengthsFinder® or ©The Predictive Index) and discussing the results with the team. Remember that most teams are comprised of people strong in technical training and weak in people skills.

based on a real project situation...

Big Room Story

Several years ago, when our project team hit a high level of frustration, we finally came to understand the true meaning of collaboration and the alignment of the team to the larger vision.

It all started when the project's owner, his representative, facility manager, designers, general contractor, trade partners and consultants decided to hold weekly Big Room meetings. Sara, the owner's rep, set the meetings up when she found a great space in the existing building. Unfortunately, that was all she knew to do. Since the project was still in Programming, she gave ownership of the meeting to David, the principal-in-charge for the design firm. But, David quickly became frustrated about the substantial time commitment and small value. But, he didn't know what to do differently.

Part of the problem was his agenda:

1. Review project goals
2. Current design walk-through/share with the team
3. Plan work for next week
4. Deep dive into the Schematic Design Planning conversation
5. Plus/Delta

In his frustration, David reached out to Ann, a colleague who had extensive experience in IPD. Thankfully, she helped create and facilitate the agenda for our next meeting.

Big Room with multiple activities happening simultaneously for a more rapid advancement of work.

Her agenda was much clearer and more encompassing:

Time (min)	Subject Matter	Expected Outcome	Leader
15	Introductions & Ice Breaker	Orient new folks and get to know each other, build trust and have some fun	David
10	Raise Hot Topic Items - List	List of important items to address later in the day	David
60	Silent Squares Learning Simulation	Team to recognize value of optimizing the whole	Susan
15	Break		
120	Advance the Pull Plan & Check in Huddle	Collaboratively plan out our upcoming work to the milestones and check in on how we are doing with keeping commitments	David
60	Lunch Break		
15	Review Project CoS	Keep the CoS fresh and address concerns	Ralph
30	Discuss Hot Topic Items Action	Create plan to address any hot topic needs	Susan
15	Develop next week's agenda	Collaboratively develop the next agenda	David
15	Conduct Plus/Delta	How can we improve our meetings?	David
TBD	Working time for MEP & Interior Work Clusters	Each Work Cluster to have its agenda, leader and expected outcome of the session	

Due to the clear expectations, we were able to stay on track for once! The Pull Planning went smoother from the time spent learning together about the importance of focusing on the project holistically. We realized that we had lost track of some important Conditions of Satisfaction that were focused on our team health. Spending time on the hot topics also took those concerns out of people's minds so we could focus on the tasks at hand. And, spending time working on team interactions helped us get to a place where we shared expectations and understanding of significant issues.

Looking back, we all saw that the team learned two valuable lessons through that experience:

1. When things are frustrating to the team, it's ok to reach out for help!
2. A Big Room is about much more than being in a room together. It's about bringing a team together, working together, driving collaboration and using that time to effectively move work forward.

CHAPTER 7a

VISUAL MANAGEMENT

Go and Do:

- Create a scoreboard to measure progress against goals
- Post information that is needed broadly, quickly and accurately
- Show problem-solving progress with an A3 wall
- Measure and show accountability
- Update information frequently

We all know that communication represents one of the greatest challenges in life. The ideas formed in the human mind so often find poor representation in the sounds and symbols of language. That is certainly true in the world of construction. In fact, communication is likely the root of 90% of our industry challenges or mishaps. It is, therefore, critical that a team-based project focuses on communication as a top concern and priority.

That is why integrated project teams have found that visual communication can be the best way to transfer knowledge throughout a project. Visual tools tend to both simplify and highlight information. So, of course, they should be used to support a culture of better and clearer communication. The successful leader, team and project will make sure individuals have rapid access to the *right* information needed to perform the work.

UHS Temecula Valley Hospital planning wall.

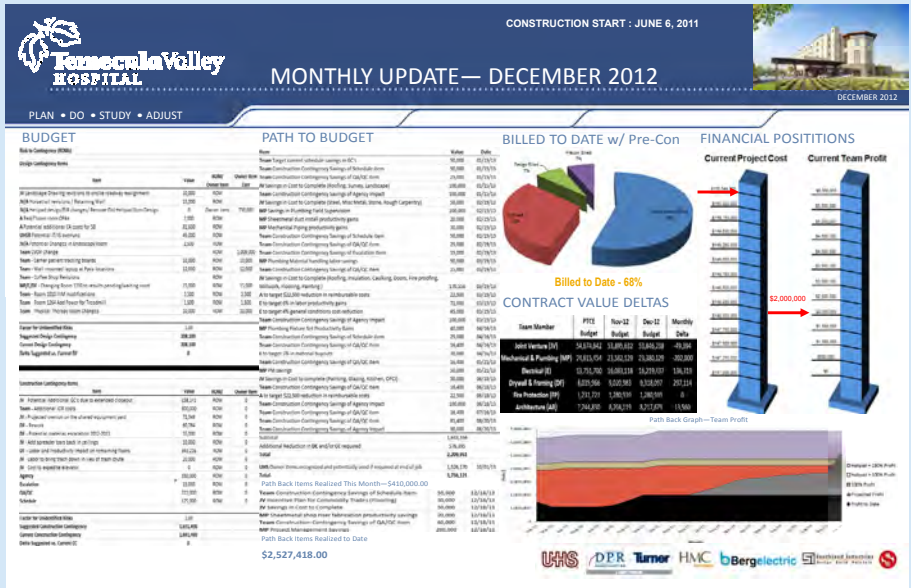
The Visual Management Tools

Much of today's business environment utilizes "dashboards" as the preferred way to keep a team informed with essential information. Just as they do in cars, trucks and other vehicles, they present critical information quickly. They can be electronic, generated through automated systems and very dynamic, or they can be simple whiteboard updates. But, regardless of the platform, a good dashboard must capture and update key performance indicators. And it should do so with universally understood icons or other language symbols.

Prominently displayed schedules help everyone to see progress without necessarily attending all schedule update meetings. Key milestone schedules are also critical to help members stay aligned with project goals.

Other visual management tools can be used for reminders of standard work or built-in quality and mistake-proofing. And, 3D renderings can, for example, show installers what a finished product should look like or how BIM can be used to show the actual installation process for difficult-to-understand products.

Appropriate and excellent visual management tools are not eye candy. They are serious instruments that help drive common knowledge among all team members and



Team A3 Dashboards to keep all informed of the status of the project particulars.

DPR Construction Big Room with visuals of the project information on walls and tables for a very interactive use of materials.

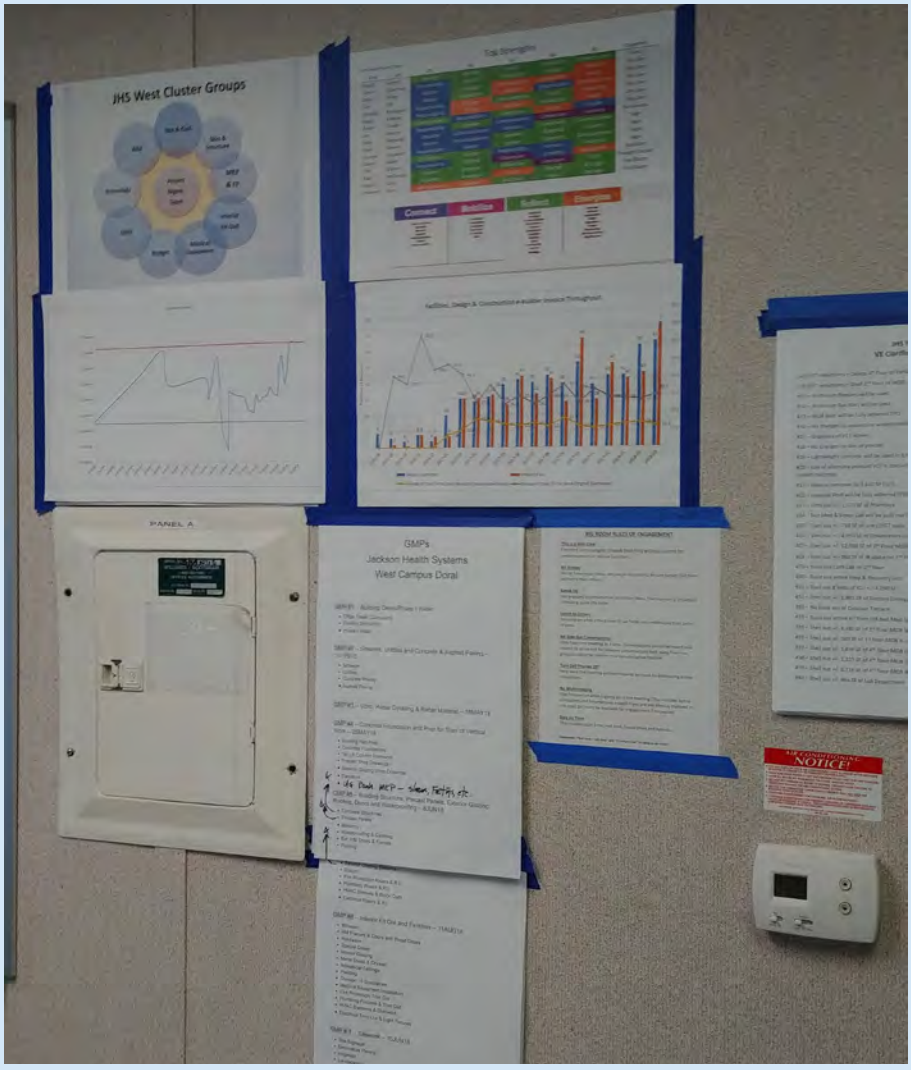
equip a team to share information more broadly. They also enable a team to share updates more quickly and efficiently than is possible through scheduled meetings or special events. Lean/IPD leaders should encourage the posting of information, soliciting of input and going to the information wall for the knowledge needed. Creating and promoting these habits can help create an atmosphere of work that releases participants to seek and provide the information required.

This view of a Big Room session in Downers Grove, Illinois, reveals numerous and diverse visual management tools as used within Lean/IPD.

In short, those tools can create a new way of visual thinking, one that is faster, more focused and less vulnerable to non-essential information.

Understand How to Use Visual Management Tools

A big part of transforming traditional delivery seeks to reduce the silo mentality and create an atmosphere of integration and accountability. KPI or other visual accountability tools help to rapidly reveal how a team is doing as an integrated whole



Jackson Health Systems Big Room use of visual management for dashboard type of information.

or even how an individual partner behaves toward others. That creates and reinforces new patterns of desired behaviors.

Visual reminders of the project goals can help everyone to focus on the Conditions of Satisfaction (see Chapter 4.a). Other visual management tools help to track schedule and financial details. That is especially helpful, since many working on the project

were not participants from the beginning. When players and circumstances change, so does the knowledge base. Visual management tools help to coordinate, educate and integrate the changing cast of players.

All visual tools must be kept current and accurate. To be useful across the board, they must communicate clearly. No euphemisms, codes or nomenclature. Complexity or confusion can seriously damage communication. Make all visual tools "tell it like it is." When things are going well, take time to celebrate. When things are bad, spend the time necessary to assess why and change it. And use the visual management tools to help with the celebrations, the assessments and the changes.

Visual Management really comes down to anything that people can see that will help them understand status or conditions, perform work, engage in a problem-solving opportunity or keep everyone up to date. Effective Visual Management tools can also help participants know where to be and what each should be doing. Leaders often forget that most people need frequent direction. It is better for everyone to provide that direction in a fast and easy visual manner.

Many project concerns just take time to implement or resolve. Good visual tools can display those items that will demand attention in the future. Displaying the relevant visual tools early may plant a seed that germinates into an idea that no one else considered. In fact, most topics and processes can be done better through visual management. Regular team health surveys and results represent another great application of visual management tools. It certainly can help to improve the atmosphere of wellness for all the project personnel.

Many basics of construction–like budget, schedule milestones, major goals (Cos), images of the final product–should be posted and kept up to date through visual tools. Many projects even post inspirational images to remind everyone of the purpose of the endeavor.

Most leaders want to reduce reporting redundancy. We recommend that they experiment with dashboards and various updating methods. They should explore the possibility that any information might be better shared through a visual posting. Doing so could shorten meetings, perhaps by 15 or more minutes, simply by asking everyone to "check the update wall."

As I'm sure you see, visual management can and should be a tool for changing corporate culture.

CHAPTER 7b

WORK CLUSTER ORGANIZATION

Go and Do:

- Build small groups to design a systems approach, not a specialist approach.
- Bring builders and designers together frequently to consider the options and implementation needs of a design.
- Consider more broadly who needs to offer input to various design systems.
- Meet frequently within a culture of accountability. Check in every few days.
- Assign a leader to represent this team to the larger group.

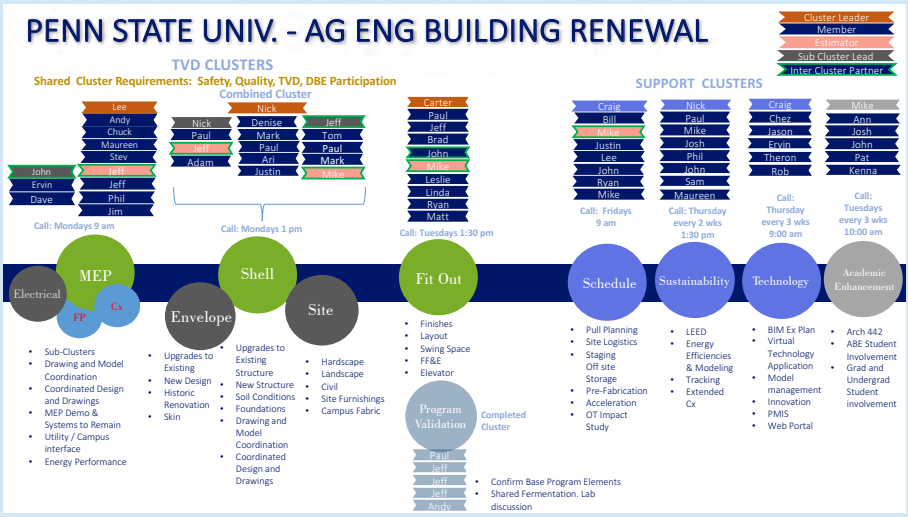
Because a commercial construction project will sometimes engage more than 50 companies, every participant, action and decision impacts others. A Lean/IPD approach works to deliver a consistent outcome by aligning the goals of each firm and participant around the larger direction and purpose.

A "Work Cluster" organization can help do that. Specifically, the cluster structure breaks down individual contract silos and fosters trust, collaboration and alignment. Wise owners and managers know that individuals, by nature, tend to have a myopic view, focusing only on their specific task. Furthermore, the traditional approaches to project delivery created silos and trained people to stay within them. So, naturally, they

do not always see what is best for the whole project. That drives significant cost and schedule impacts later. Effective leaders work to change that.

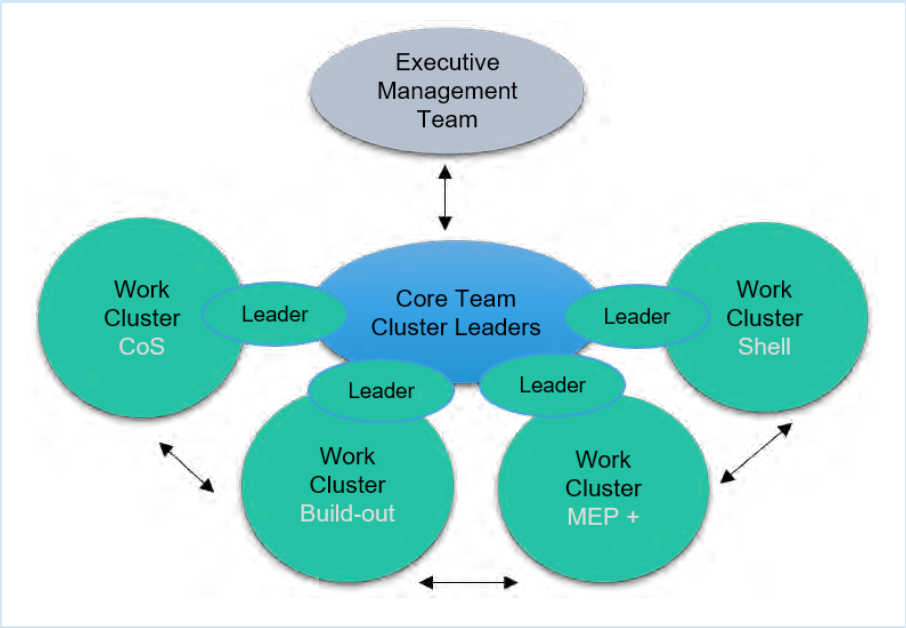
What Is a Work Cluster?

A Work Cluster is a select small group of people who represent various companies working together on a project. For example, the MEP Cluster contains reps for the mechanical, electrical and plumbing components of construction. That team usually consists of MEP engineers, representatives from the owner and architect, each of the MEP trades and estimators. The MEP Cluster also includes those responsible for fire protection, stud and drywall, as each of their tasks is impacted by the MEP and each other. Such a cross-functional team can plan more comprehensively and move more quickly to address changes or respond to design challenges or coordination conflicts.



Penn State University Project Work Cluster dashboard indicating, work cluster, team members with roles and times of regular meetings.

The cluster leader is usually the person most responsible for delivering the work associated with the cluster's name and purpose. So, the MEP Cluster could be led by the mechanical trade project manager (PM), electrical trade PM or lead engineer. The leader (or assistant) should schedule meetings, manage commitments and check-in sessions and report to the Big Room. The cluster's purpose concludes, and the group dissolves after goals are met (some may return as needed). New work clusters will form as the project moves into other phases.



LCI graphic of Work Cluster arrangement and relationship to Core Team and Executive Management Team.

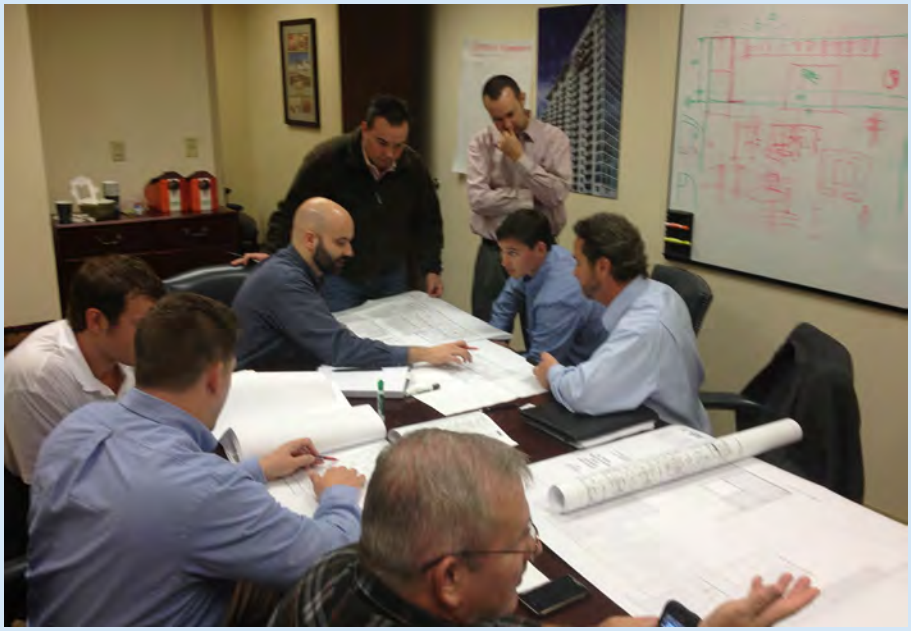
Why Are Work Clusters Effective?

Historically, commercial construction projects designed one system upon completion of its predecessor. However, finishing a floor plan before defining the structural system is inefficient, wasteful, and expensive. A collaborative design, considering the impact of any element or system on all the others, is a much more effective approach.

In a traditional design process, designers often presume to know what a builder needs or wants in order to perform his or her work. Naturally, those presumptions create miscommunication and change orders. A team approach can eliminate much of that. It is far better if the designer and builder can discuss, early and often, their respective needs, goals, risks, concerns and constraints.

Work Clusters can and should:

- Discuss before design
- Design before drawing
- Discuss before planning
- Plan before implementing



JE Dunn Construction Work Cluster teams collaboratively solving problems.

In other words, everyone should work to understand the desired outcome before charging forward with assumptions. All parties should come together as early and often as necessary in order to build the right kind of trust relationship and, thereby, gain a deeper understanding of the inter-relationship between the design and implementation of each concept and system.

The Work Cluster can and should build full scope awareness for as many stakeholders as possible. The more each individual understands the whole, the better planning and outcomes can be expected.

Optimize the Plan

The cluster is where the real work happens. And that means the designers and builders must come together to learn from each other. They should attempt to learn about each other's needs and discuss how best to fulfill those needs. In other words, they work to optimize the plan.

Ideally, the team comes together to consider value, cost, time, means and methods, the timing of activity and other dimensions of the project. When Work Clusters find they do not have everybody needed, other members should be brought into the group. If a group learns that their work impacts the work of another cluster, a meeting of both clusters should be considered.

The leader must consider all interests and inputs but also–given the larger project timeline–keep the progress moving at the right pace. The group may use micro pull plans, commitment logs, check-in calls, A3 and other tools and practices to maintain the necessary accountability within the Work Cluster and to the larger team. The whole cluster should be acutely aware of their group targets but also those of the entire team. The Work Cluster conversations are part of the Big Room activity. Sometimes they can be like a negotiation. Conversations may include variations of "We need more time to study these options. Can the program support that?"

Finally, clusters should meet consistently as long as the purpose exists. When the purpose of the group concludes, the group should disband.

That too is optimizing value.

Do It Right

The start-up of a work cluster system can be challenging. After all, it's a new way. For example, many designers are unwilling to share incomplete work, and many builders have not participated in the design process. That can lead to frustration and even conflict.

That situation often requires coaching. Neutral coaches can help specific Work Clusters develop a purpose statement and build leadership. They can also help people figure out how they fit into the team, encourage them to speak up and help them navigate through conflict to collaboration and innovation.

Take time to do it right. Design the right clusters, train the leaders and develop the strategy. Some clusters are common to most projects, like MEP, Structure, Building Skin, Budget and Equipment/IT infrastructure. Others may be project-specific or just new, such as LEED or community impact Work Clusters. Leaders should try to make most meetings face-to-face (vs. video or conference calls) to allow more and better team building and the creation of a culture of accountability.

Allow the whole process to change, based on value. Don't keep a Work Cluster together if its purpose has passed. For instance, a Contract Cluster should shut down when the leaders have signed the contract.

Work Cluster Leader Role Characteristics guidelines for considering leaders.

Leaders should be careful to keep the analysis of various options from going beyond the last responsible moment, based on the team plan. If a decision can't be made by the cluster, it should be brought to the Big Room for further discussion and council. Use of A3 problem solving can facilitate input from the larger group. It can also help document decisions for future reference.

Various leaders of the program should visit Work Clusters occasionally to confirm that the direction from the Big Room is being followed. Many of the behaviors being requested require change in habit and process. While participants may agree in concept, they may not follow through when left without cohesive leadership.

As with most issues in the work place, success requires effective, engaged and creative leadership. That is certainly true of Work Clusters.

CHAPTER 8

TARGET VALUE DELIVERY

Go and Do:

- Define as closely as possible desired outcomes (Conditions of Satisfaction).
- Define business case targets, including total investment.
- Find ways to translate design language and build cost.
- Teach members to respect the work of others and solicit input frequently.
- Update and iterate ideas and cost frequently. Make it visual.
- Read and understand Target Value Delivery, Target Value Delivery: Practitioner Guidebook to Implementation (LCI Books).

Target Value Delivery (TVD) takes a long and integrated view of the whole construction process. That process is not complete until the project is occupied by the end user. By contrast, traditional delivery methods tend to operate in isolated, insulated and opaque silos that do not understand or track performance against project targets. Distrust is baked into the very structure of the project. So, everyone involved tends to view the process from their own bunker.

However, as stated in the book *Target Value Delivery*, "TVD is a very different model from the traditional, large-batch process of design, estimate cost and value engineering – a process replete with waste...The driving force of TVD is to increase value while

Target Value Delivery diagram indicating the intention of driving value up YET driving cost down.

decreasing cost for all team members."[1] Notice that the whole process looks out for individual team members, both individuals and their respective companies.

The beginning of projects often and quite naturally includes talking to end users and sketching concepts. But, those plans and ideas are too often unaffordable. That is why early planning sessions greatly benefit from a partner with specific cost knowledge. Positive outcomes require a good understanding of all financial impacts and the total program cost.

As a program begins, the risk, opportunity and need should all play a part in prioritizing design focus (see risk chapter). Those considerations should be weighed against each other to determine the proper organization and value of all team members' work. That organization should release and authorize the team to only develop those things that they know can and will be incorporated into the final development. That, of course, requires a continuous update of the value tracker (cost model) and re-prioritizing of design tasks (see budget/burn rate chapter).

Through the early engagement of build partners, the team will have the opportunity to design for optimal production. That helps to define the construction timeline, reduce time through shop fabrication before the field is ready, drive cost down through bench top productivity vs. field labor and significantly improve quality. That process can also allow for earlier material purchase commitments, saving potential cost escalation. It can also begin fabrication of earlier installed systems as others are finalizing development, and lead to innovative solutions.

1 Kristin Hill, Katherine Copeland and Christian Pikel, editors, *Target Value Delivery*. Arlington, VA: Lean Construction Institute, 2017

The TVD Team

The TVD team can and should find agreement about material and fabrication details during design. We have found the delivery process works better if fabrication details can be captured in the design drawings. That reduces the rework of shop drawing and submittal review and can shorten the schedule by allowing fabrication to begin earlier.

Considering the desire to design together as a team and knowing the general areas of concern will help a team choose the best partners and the timing of who should be present in the Big Room. That approach will also inform the team about the skills and capabilities needed to support the team goals. And, because the team will be making thousands of decisions that impact the outcome of the program, they should establish the Conditions of Satisfaction so they can form goals in alignment with each other.

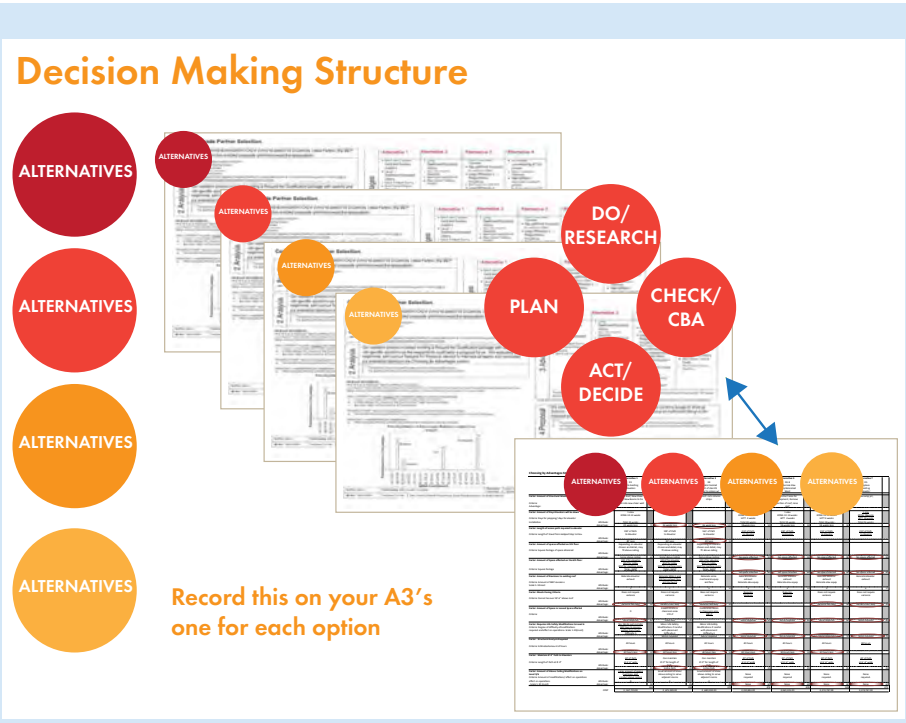
It is critical to success that the team have a desire to learn. Many experienced leaders believe they know the impacts. That may be true of their own sphere of operations, but rarely do they fully understand the needs and challenges of all the other parties. The most senior leader of the team should insist on creating an atmosphere of learning in each Big Room event. He or she should start with team-building learning, as this will have a direct impact on the outcomes. The most successful project teams are able to balance learning with project pressures.

Target Value Delivery represents a major departure from the traditional delivery practice. Unfortunately, there are not many who can claim real depth of experience in this realm. So team leaders must be prepared to build the skills into the team. That is why the desire to learn is so important for the team. TVD and the requisite training should greatly influence the partner selection practice (see Partner Selection chapter) Additional skills are required to effect the TVD process, such as the ability to share incomplete ideas and to conceptually estimate.

This process also demands an empathetic look at the work of others. In that cross-specialty view, the contractor needs to be responsible for design integrity; just as the designer should assume responsibility for construction implementation.

As the reader can see, Target Value Delivery is a defined and disciplined approach. In a rapidly changing arena, the team should seek out resources to better understand the practice. LCI has published two books[2] and offers an education course to help with that objective. And, it is often wise and helpful to arrange a visit to another team that is skilled and experienced in TVD and willing to help. An experienced coach can also be very helpful.

2 Both books –*Target Value Delivery* (LCI Institute, 2017) and *Transforming Design and Construction* (2010) – may be ordered through https://www.leanconstruction.org/learning/publications/



HKS Architects Decision Making Structure for integrating separate A3s for alternatives in set-based design and the relationship to integrating with Choosing by Advantages (CBA) to arrive at sound decisions.

Exploring the Depths and Details of TVD

Target Value Delivery has proven to be a very broad and comprehensive means of project delivery. The more successful practitioners have learned to break up target components into smaller parts, conducive for deep dives. They have also discovered how to assign the breadth of the work to Work Clusters with assigned budget and multi-disciplinary subject matter experts. Those small groups can better refine the many details needed to develop further; they perform best when they have specific tasks or deliverables.

Building information modeling (BIM), which has grown significantly in the industry over the past 10 years, represents another useful instrument for TVD. The team should discuss the application of BIM and other technologies and teach the partners to optimize them. They should understand the benefits and desired outcomes and align accordingly. Those tools can impact the partner selection criteria as well, specifically trade partners with BIM experience. They can help the design influence the field productivity.

based on a real project situation...

Target Value Delivery Story

A new Integrated Project Delivery (IPD) team was challenged to meet a very aggressive Target Cost, which they had developed in collaboration with the owner. They all agreed that cutting quality or value was not a viable approach; that was the old way. Instead, they formed a cross-discipline structural system work cluster. That cluster collaborated to meet the "bucketed" amount of savings needed. Each building system or component was proportionately challenged in order to deliver the expected value for less cost.

The Structural Work Cluster carefully explored ideas and options (set-based design) early on instead of racing to a "gut" solution. Using A3 Analysis and reporting, they explored options and impact on schedule and cost. They also held weekly work sessions on smart boards, collaborating live while sketching and weighing the possibilities. The outputs were captured on the smart boards and saved to their shared files as the notes from the sessions. That Work Cluster also committed to taking specific actions prior to significant meetings. All stakeholders–structural engineer, architect, structural fabricator, budget champion, schedule champion, owner and others–had a voice. They all knew they were empowered to contribute to the conversation. The direction of the work was not controlled or directed by any one person.

The story ended with the team designing the lightest steel frame structure accepted by the relevant jurisdictional authority. The innovation value was enormous, and the bottom line savings made great contributions to meet the aggressive Target Cost.

Furthermore, the team also saw how the creative tension between seemingly opposing Conditions of Satisfaction led to innovation. In the end, we all saw the high value of how Target Value Delivery supported that team in achieving its goal.

estimating rather than quantity take off. That requires each team member to estimate the final cost of the project before much detail about the outcome is defined. And, it just makes sense; there can be no "take off" estimating because the details don't yet exist on the plans. Each subject matter estimator needs to conceptualize the final product and estimate based on his or her experience, a rare skill.

From California Prison Receivership Program, a wall diagram mapping the structure for set-based design sets and decision making.
The map outlines: Identify Value, Log in Sets, Create A3, Analyze sets, Integrate with project as whole.

The next critical step is to gain full alignment between the design and trade partners responsible for that specialty. And, they need to discuss design concept, philosophy, details, system routing, system interface, options and many more topics and then compare those to the original assumptions. They must also make sure the cost estimate aligns. Those conversations must begin at a point of concurrence. Of course, they will change as learning grows, but a common starting point is essential.

Model-based estimating is another problematic exercise. A model is a great tool for many things, but its estimating capability is limited by the images that are embedded into the model. And, that leaves too much detail missing in the early phases, details that need to be captured in the estimate. That is why the experience of the estimators to fill in the gaps is critical.

If a team uses a BIM, they should consider a BIM execution plan at the earliest possible time. Modeling can be very helpful but also very expensive. Once something

has been modeled, design changes can add great cost to the effort. Therefore, the depth and timing of modeling must be carefully planned. This plan should be very considerate of the value of the model for each participant. Can it be used to offset other more traditional project costs like shop drawings or field detail cut sheets? We understand the finished model offers significant visual value to the craftsmen, but that value should be weighed against cost and time.

BIM is a huge consideration when assessing team member capability (see Partner Selection, Chapter 3). If the team determines that a broad use of BIM would benefit them, some team member should have experience developing and using it. Additionally, software and hardware compatibility should be explored.

A great advantage for the early participation of trades is that it allows consideration for means and methods, sequencing, timing, logistics and constructability in conversation. The BIM can be instrumental in those discussions, bringing significant impact to the overall cost of the program.

A Design Manager role will change significantly with an integrated team. While a strong DM might be used to coordinate the design team, there are many more players to consider. The DM must also consider how and when to engage the builder knowledge to the advantage of the project. The wise Design Manager must remember that builders and designers think differently. And that means he or she must try to translate those languages. The DM needs to be a dynamic leader, willing to learn, and possess strong people skills. (see leadership chapter).

The Comprehensive Scope of TVD

The foundation of success with an integrated (or any) team is open, honest, transparent trust. Because the current state of the construction industry is based on distrust, transparency and openness represent considerable challenges to the leadership. Focused and purposeful energy should be dedicated to building trust as early and as often as possible. Social events, readings, training, etc. should be provided well and often. After all, the team dynamic changes with each new player.

The team should also pay close attention to the Current Working Estimate. It should change every couple of weeks. Not every line item every cycle, of course. But, if numbers are not changing, then nothing is happening. That could be an indication that a partner is not engaged or that proper progress has stopped. Since the early estimates are very hypothetical and based more on general knowledge than on specific information, they should be refined often. Those line items should also be considered

in relation to other system developments, as they will likely impact them as well. Costs should change after every decision (see Managing Budget, Chapter 10).

The integrated team is established to break down barriers, bring a broader base of knowledge and experience and to challenge the norm. The system is not working if no new ideas, approaches or challenges appear. The Big Room should be a dynamic environment, flowing (and overflowing) with ideas that are discussed in a vigorous, but safe manner.

Most of the team members' work will change from their previous roles and experiences. If a goal of TVD is to become more deeply integrated, everyone needs to understand each other's work. Not just for the knowledge, but to find ways to communicate better, reduce duplicative efforts, learn about the needs of each other and to be more effective communicators. Each person should be prepared to take on tasks often performed by others, as well as ready to let go of other tasks that may fit better with other team members.

Constructive and respectful conflict is an essential part of most teams. In fact, in his book *The Five Dysfunctions of a Team* (Jossey-Bass, 2002), Patrick Lencioni teaches that without conflict, a team will not succeed. The ensuing false harmony allows everybody to follow personal paths, not the integrated project path. Many people are simply unwilling or afraid to engage in conflict. But, good leaders will create an atmosphere where the conflict is about the components of the work and not about the people. They must learn to manage the conflict in such a way that rapid recovery is expected and even facilitated by others. If this practice is correctly modeled by leaders early, it will foster growth within the team.

TVD doesn't stop when drawings are complete. The target is not attained until the project is occupied. In a successful integrated project, the design process incorporates much of the planning for the implementation. The plans should be, first, carried out by the implementation team, and, second, measured for appropriateness. They can be changed based on variance assessment. The team should be continuously aware of the targets as they relate to their work and the entire outcome. Everyone should be praised for success and encouraged to improve the misses. (see Last Planner System,® Chapter 9).

CHAPTER 9

THE LAST PLANNER® SYSTEM

Go and Do:

- Engage the "do-ers" in the planning process; respect and use their knowledge.
- Understand that the hand-off of work between the trades and designers is a critical negotiation. Build a process to manage it.
- Plan from the big picture backwards, but only detail the plan at intervals (about 6 weeks).
- Break design and work into manageable chunks. Predict the planning outcome and measure against the predictions.
- Understand the variance to your plan and assess the root cause. Then create a countermeasure and predict again.

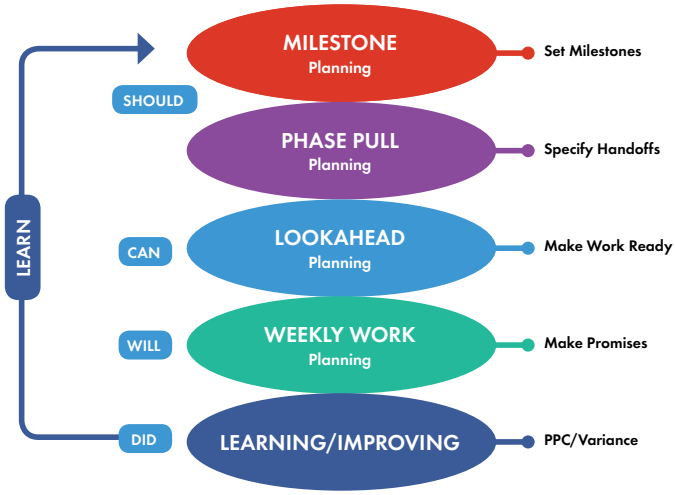
For many years, commercial construction planning has existed primarily within operational, departmental or company silos. The Last Planner® System (LPS), created by Glenn Ballard and Greg Howell, represents a new and improved system of planning. It turns planning into a collaborative endeavor. LPS is the tactical method – far beyond contract and construction documents – that helps a construction project come together.

The more traditional planning systems are, naturally and historically, based on command and control; a superintendent dictates the work with little concern about individual or organization needs or constraints. The superintendent insists that everyone provide whatever resources are necessary to meet his or her pre-determined schedule for an activity. Those who fail to deliver will be reprimanded.

Conversely, LPS encourages the ideas and opinions of the key individuals in the planning of the work, considers all project needs, negotiates appropriate time and resources and requires accountability. An integrated team engages in collaborative planning with any and all whose work might be impacted while trying to meet a milestone. Each planner will be asked to state his or her needs, planning assumptions and approach to the work. Others then have the opportunity to discuss any impacts, questions or improvements to the entire value stream.

Last Planner® System Overview:

5 Connected Conversations



The Nature and Purpose of the Last Planner® System

LPS can be best understood as an accountability-based planning system relying on the commitments of the team, rather than just the plan or desire of the one leading. Naturally, that requires a high level of reliability, achieved through commitments by team members. LPS includes a process of measuring promises kept and understanding the impact of variances from those promises. The LPS considers long-term planning, near-term preparedness and detailed planning for the next weeks of work. It recognizes that plans change frequently and that the future is not predictable. Therefore, detailed planning only forecasts about six weeks, and should be based on the project teams' ability to accurately plan for that time window.

The LPS is based on negotiated handoffs from one specialist to another. That's why it is essential for each performer to define his or her deliverables and verify concurrence from the next performer about the details and dates. Such conversations may, in the beginning, feel strange to those not used to being included in the discussions. But, that

inclusiveness is one reason those conversations make LPS such a vast improvement over other planning approaches.

LPS is also multi-dimensional. During the build phase, each step tends to be seen as linear, allowing one trade to link its work to that of another. Conversely, during the design phase, the work is far more collaborative and iterative. However, the desired outcomes and purposes are the same. Leaders should discuss the handoff of work, break that work into manageable chunks, check in with each other frequently and hold each other accountable.

LPS is conceptually designed to reduce discrepancies. During the design phase, that means understanding the connection between decision making and the impact of divergence. The *order* of the decisions influences the work that follows. The decisions that significantly impact cost and schedule should be made earlier. A team employing early involvement should discuss that order of decisions and inform them with cost and constructability information. The team should also negotiate an ideal workflow that keeps all parties engaged and focused on the entire value stream.

Numerous training simulations help to express those ideas and dynamics. Most can help to inform and train the team around those critical concepts. All should be considered as the team develops onboarding training materials. Examples include Nuts & Bolts, Block Game Pull Plan Simulation, Airplane Game, and Turn the Tarp.

Meeting Rules of Engagement integrated continuously for the duration of the project. Note the rules listed are common to most project teams with additional rules or terms added specific to that team.

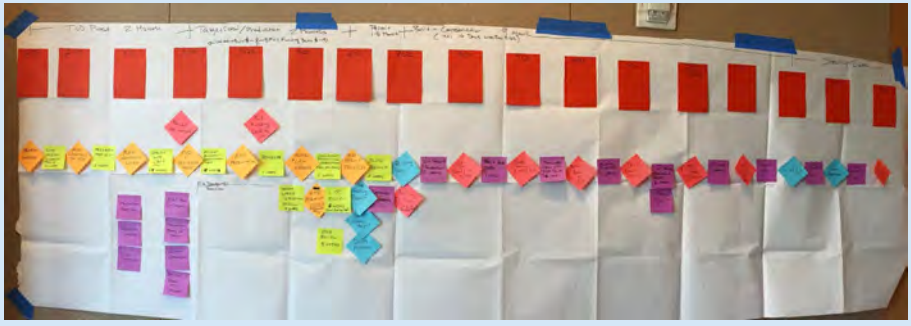
The Implementation of LPS

The integrated team realizes that design and development get accomplished through a network of commitments (Refer to appendix for Last Planner System as a Network of Commitments paper). That requires near constant negotiation and prioritization. That is why it is best if done together in a Big Room which meets frequently.

The implementation of a design and building program involves many people from multiple companies. Because each person's work affects that of many others, integrated teams want to plan as a unit rather than as individuals. That requires an emphasis on team commitments and team accountability. The goal is to integrate and align each plan with that of others until an acceptable approach for the overall plan can be taken.

The primary focus of LPS is to create a smooth and sustainable workflow that everyone understands. Doing so has shown significant improvement in predictability, reliability and stability. From that view, LPS helps to create a solid plan with a good understanding of the timing and placement of work components, including information, equipment, tools and workers. It achieves that benefit because it has been crafted by the ones closest to the work being performed.

As with any change, the ability to show early value is critical to adoption. If the team measures reliability (percent plan complete), the team will rapidly see that commitments don't always endure. When a team sees that 25% of the work they planned to get done actually gets done, they all become suddenly more educated and wise about human nature and planning. It is critically important to improve through objective measurement of variance rather than personal criticism.



Project Milestone Plan for project duration from design to client occupation, laid out graphically and color coded.

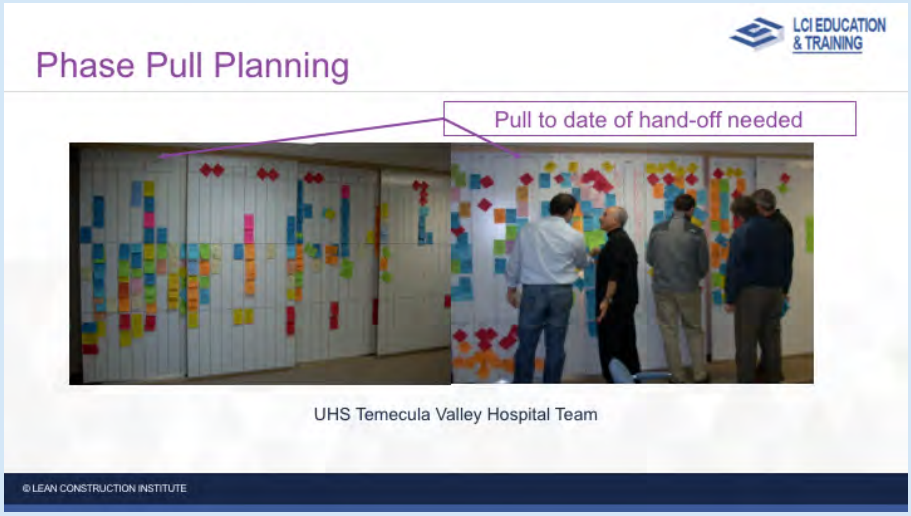
An integrated delivery team will use LPS to work out conflicts early in the process. They will allow consideration of real implementation sequence and methods. For instance, if a crane can't get close to the north side of the building, a team can either design smaller precast panels or rent a more suitable crane. Likewise, if electrical sleeves need to be installed before concrete curbs can be poured, the team can schedule that in the planning session, or even hand the sleeves over to the concrete trade for installation. A Building Information Model (BIM) is extremely helpful in conflict resolution. But, to inform the model with the right information requires material selection and installation details best provided by the builder. The earlier this happens, the less disruption to the project and the less rework for the designers.

Phased implementation of LPS concepts is a standard approach to support a team early in adoption. Phase Pull Planning–planning backward from a milestone based on requests and promises–has become a more prevalent practice in the industry. And, for good reason; it creates a better workflow. It is also very good at identifying missing steps, misalignment of work sequencing or ineffective installation. While only one step in LPS, it is a critical first learning that will show that traditional practice can truly be improved.

In today's design and construction industry, teams tend to rush the work to show progress. But, doing so constricts the planning process. Many assume designers know how to build, but that is just not the case. And, many assume builders understand the design intent, but that's not true either.

The heart and soul of the Last Planner® System considers how the work needs to get done. As one PM explained, "It examines how my work gets done by considering your work." It helps to equip the person doing the work with everything he or she needs to do the work safely, efficiently and effectively. LPS really creates a value-stream look at a multi-specialty process; it optimizes that process around the overall project, not one performer. Experienced teams realize the high value LPS brings to commercial construction. But it remains a vast departure from industry traditions and, therefore, requires a mindset shift.

The key to success of the LPS Phase Pull Plan is not the documented plan or even an improved sequence that saves time, but the transfer of knowledge from one practitioner to another. Each handoff of work is an imprecise transaction between customer and provider. Understanding the condition of the work given to the next phase helps the recipient worker or team to receive and utilize it. Having a clear and predictable understanding of when that work will be handed off allows for better resource planning.



Last Planner® System being adapted to use during design phase by UHS Temecula Valley Hospital team. Right photo shows members "advancing the plan", which was done in the Big Room on a regular basis of about every 3 weeks.

The effort to drive this communication and the commensurate promises is not a simple task. Many will come to the planning wall and state, "I need a week to perform my task." But, what they are really saying is, "We both know you will promise me access Monday but won't give it to me until Tuesday afternoon. I won't have people available until Thursday morning, so I can have it done by Friday." But, through LPS, the desired and expected outcome is to give access the day it is promised and that the provider has resources ready that day. That enables the team to save three days of waste.

When a team uses LPS for look-ahead planning, it often reveals the constraints to performing the work as planned. Constrictions are identified and tracked in a constraint log that identifies and resolves the impediments before they can impact the work. That can also be quite useful as a prioritization tool. The constraint log will identify the responsible person(s), the tasks to be completed and the last responsible date for completion.

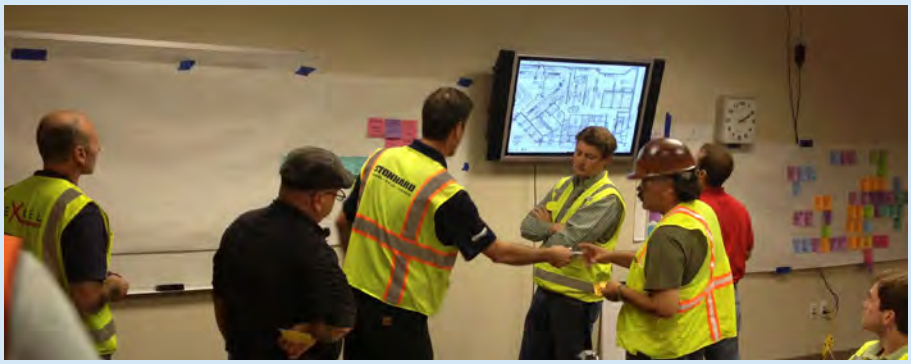
LPS: Making Better Promises

Percent Plan Complete (PPC) leads to continuous improvement by the team. Most leaders think they are good planners, but even a well-run traditional project will usually see that about 50% of the activities get completed on time. Integrated teams find that

Massport Airport team working on a first phase pull during design. Working in a request-promise cycles from the defined milestone for the phase of work.

when they reach about 75% consistently, the project is working well. At 85%, projects become profitable for all participants. New teams often struggle with that concept, as it often appears to be a performance indicator that can be used for coercion or punishment. But, used properly, the primary purpose is to learn how to make better promises to each other and to manage those promises. That means learning and understanding the impact of a missed promise. It is essential for the workflow (not retribution) to document why a promise was missed. As such, it can help to create a countermeasure against that variance. Obviously, this process requires a safe and open environment with a focus on continuous improvement.

Many integrated teams have struggled with how LPS works with Primavera P6 or other schedule software. Successful integrated teams tend to use the P6 schedule to inform their Milestone Plan, which prepares the Phase Pull Planning for deeper engagement. LPS is learned best when done as an immersive exercise involving relevant learning with simulations followed immediately with actual implementation. Simulations present a great way to learn to help reframe the thinking to "pull," "handoff," "clarity of task and ask" and several other learning concepts. However, the real learning happens when the team takes to the pull plan wall. That is best led by an experienced facilitator who can help drive the critical conversations, clarify task and duration, help negotiate the deliverable condition and make sure that the right information exists before a job



JE Dunn Construction project planning session with last planners referencing visuals while planning.

can start. Experienced Lean/IPD leaders can assess how long it will take for a team to become effective implementing LPS and allow sufficient time for planning sessions.

Planning the work during the design phase is more challenging due to the non-linear nature of work. However, the basics of keeping promises, clarifying handoffs, and measuring and understanding variance support better project outcomes. Experience knows that a clear definition of a milestone will help all involved to do a better job at organizing their effort, focusing their activity and defining their needs. Those can then be translated into measurable steps.

When using LPS in its intended form, a team can use it to inform resource needs well in advance as well as when to bring others on board. It can also reduce the urgent calls and missed promises when planning breaks down.

LPS: How Planning Time Saves Work and Rework Time

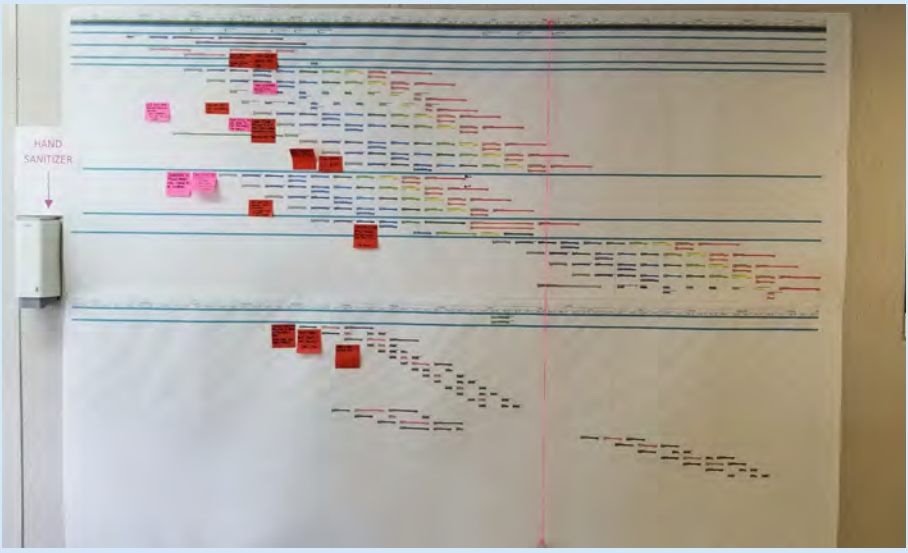
Sometimes the Last Planner System gets referred to as Pull Planning. It may help to understand that Phase Pull Planning is one of five levels of planning in the system which also has five types of associated conversations (should, can, will, did, learn). Planning sequential tasks and having clarifying conversations at the planning wall are essential parts of LPS. But, so are understanding the integration with milestone planning (should), look-ahead planning (can), weekly work planning (will), the assessment of what actually happened (did), and how to make it better going forward (learn). Team training is also vital to help participants understand that LPS is a *system* of planning, not just a task list.

DPR Construction team discussing overall phase approach prior to starting the Phase Pull Plan using visuals to ensure alignment in the conversation and approach.

Engage the planners to consider that each cycle of planning should attempt to improve the last cycle. It is also vital to encourage open discussion about why something didn't go as planned and then seek actions that overcome the reasons.

This planning process is intended to offer a visual plan that is easy to understand, reveals progress and provides clarity about the promises and handoffs. That planning should be prominently displayed in a common area. It is best if the participants can see it daily and update as frequently as possible. A healthy work culture will cheer success, challenge each other through and beyond failuresand always work to improve the previous performance.

The planning process is a continuous improvement effort that needs constant coaching. Good coaches can, for example, help to avoid falling back to traditional silo



DPR Construction "takt" planning for phase of work. The output of conversation creates a graphic visual of the flow and timing for repeated segments of the work.

planning that injects waste into the process. All training and other planning dynamics should always be helpful exercises, done to produce improvement, not disparagement. That's why the process can often be better facilitated by leaders not directly involved in the specific effort.

Adequate and early preparation for a planning session usually leads to more successful outcomes. Whether planning is part of a big room session or another format, it should be highly prioritized and scheduled. It helps to define what will be planned and then make sure all relevant parties are invited to participate. Each participant should know to come prepared with an understanding of his or her deliverable. Seek to have participants arrive with pre-prepared tags for work they know will be needed for that phase. Of course, additional items will always arise during the planning conversation, but pre-work allows for the session to move quicker and more smoothly.

Naturally, in the beginning, the Last Planner System may be slow and awkward. Most designers are not used to the detail considered in LPS. However, as they learn about the connected decisions of each participant, the impact they have on each other and a better way to communicate the need and timing of decisions, they begin to see how to drive value-based choices and reduce the amount of rework and frustration.

based on a real project situation...

Last Planner System Story

A new project team was trying to implement Last Planner® System during the design phase of their project. As they approached the second round of milestone planning, they were frustrated because the owner representatives were not showing up for meetings. So, they talked to Melanie, the facilities director, about the need for owner representation. But, Melanie didn't understand why she needed to be there either. After all, didn't the company hire the best construction manager and architecture firm? And, weren't they both recognized as experts in collaborative work? Couldn't they handle this?

George, the architect, tried to explain, "During milestone planning, we lay out key decision points. Everyone must understand those points and any dependencies between them. Those decision point milestones create our roadmap for design. It is imperative that we understand what everyone is thinking. We must know how decisions are made so that we can work within that structure."

He also explained how the different discipline leads for the project, the systems engineers, need to make promises and requests to ensure that everyone has the information needed to meet those decision points. That would often include needing information from the owner team that might influence the decision. "Look; we need to know what the owner groups need and when they need it. That actually reduces the time we take from their schedules."

Amanda, the construction manager PM, added that using the system, albeit in a little different manner during construction phases, had led to much higher levels of reliability and predictability in their projects. She said that people are encouraged to present possible issues that may keep them from doing their work as needed. Some were surprised to learn that the system works best when everyone openly discusses the risks they face.

Her excitement began to convince the skeptics. She saw nods as she went on to explain how using Last Planner® System during the design phase can have a major impact on a design team's ability to stay on schedule. Everyone began to understand that focusing on key decision points earlier helps to puts the whole team and project on a better path for success.

Leaders should always expect push-back when attempting to introduce new processes. They will always hear variations of, "We don't have time for these new ideas and meetings." But, they should educate the whole team that the new process saves time: "Everyone has to plan the work; we are just going to do it together." Everyone should also understand that even on well-run traditional projects, approximately 50% of the current day planned activities are met, leaving the team a full half-day behind on day 2.

Three key leaders must be fully committed to the change in planning.

1. The architectural project manager must support the design phase. She or he should encourage all design consultants about the value in concepts, like being able just to draw once. Spending a little more time planning will save much time executing.

2. The construction superintendent (CS) should be a leader of LPS during the construction planning phase. The CS needs to convince the last planners that their life will improve through better planning. The prospect of less rework should help motivate the field staff to a better outcome; a well-planned project is much safer for all involved.

3. The owner's project manager is also critical in supporting the change. The PM should encourage the use of LPS from the start, setting the expectation that better results are available.

All the key leaders can and should encourage the team and not lose patience when results seem slow. They should all have confidence that the learning will drive the results. It is also vital that the leaders be willing and ready to get their hands dirty to learn and teach these practices. They need to help train, encourage transparency and integrate people who have not been involved in LPS and make sure the new participants get the respect they deserve.

This kind of change is often better served through the use of a coach. And, an experienced coach could be a member of a key trade partner firm. If the team has no experienced and capable coaches, an outside coach should be considered.

When working through these changes, teams learn quickly that the construction industry has not been very good at making and keeping promises. They should expect PPC compliance of 20% to 30% during the first few cycles. That is actually an excellent motivator to show teams what can happen if they don't put attention to these new concepts.

The industry has a large margin for improvement. LPS can help close that gap.

CHAPTER 10

MANAGING THE TEAM BUDGET

Go and Do:

- Significantly improve value-based decisions through discovery and Set-Based Design solution set analysis.
- Build consolidated team budget (see Value Tracker).
- Develop practice of rapid iterative estimating updates.
- Develop and maintain frequently a burn rate/earned value document and assess it against progress frequently.
- Have design team predict and report on labor and resource prediction and consumption monthly.

Budgeting is one of life's essentials for individuals, families, organizations, institutions and nations. It is certainly a major requirement and focus for large commercial construction projects. The budget is the primary management tool. Every level of leadership uses the budget to measure the distance between the actual expenses and the target cost.

Much of the budget management process requires a clear and coherent grasp of the "burn rate." It may help to remember that many people first encountered the phrase in the various space programs. Burn rate is one of the most critical factors in rocketry. And for very good reasons; it calculates and monitors the rate of fuel consumption relative to its target. For example, to push through the gravitational pull of the Earth

requires a certain amount of fuel. Naturally, the burn rate decreases after the rocket reaches that goal.

In the very same way, a Target Value Delivery must calculate and monitor the cost of the project as it develops. Hitting the TVD goal demands a comprehensive estimate of all costs in order to reach completion for all parties involved. In order to successfully manage multi-party scopes, you must have a clear understanding of everyone's burn rate. That requires close integration between the owner, architect, builder and trade partners to monitor the expenses throughout the construction project.

Each building objective, phase and system impacts all the others. That requires the experience and the expertise of many project leaders to make a reasonable assessment of the impact of each decision. For example, is the structure supported by steel or concrete? Is the skin glass, pre-cast, stuccoor other surfaces? Each of these issues impacts all other matters and should, therefore, be considered within the entire value stream.

How Do You Manage and Track Burn Rate?

Various time-tested processes help to calculate and manage the burn rate. For example, Set-Based Design (SBD) "allows for commitment to a specific solution to be postponed, allowing designers to consider multiple alternatives"[1] for a longer-than-typical time frame. But, of course, they do so with full awareness of the cost to examine the multiple solution sets. An integrated team can carry these options to the right decision point while assessing the project. SBD also permits the project leaders to better update risks and opportunities as the project develops.

"Rapid iterative estimating" helps integrated teams to continuously measure progress against the established target. That can be done using a Value Tracker document (see appendix) that keeps tabs on the current working estimate, program risks, opportunities to study and appropriate risk mitigation funds (based on a stage of development). Rapid iterative estimating also gives a continual understanding of incurred costs during the development phase (burn rate).

These processes and tools require "open book" transparency for all companies and leaders involved in the project. Managing the burn rate requires a true understanding of labor cost, burden, overhead, markups and required profit. Teams must learn to share this information honestly, being respectful of the sensitive nature of the information

1 William R. Seed, Executive Editor, *Transforming Design and Construction* (Arlington, VA: Lean Construction Institute, 2015?)

based on a real project situation...

Budget Management

A project team, fairly new to IPD, was working through their first core team planning meeting when the conversation turned to budget management. The idea of managing the money spent on the project during the design phase was new to most of this team. Brent, the Senior PM from the general contractor, seemed very comfortable with this idea, but the lead architect, Arthur, remained uncomfortable.

Later that day on the drive to the proposed jobsite, Arthur confided in the team coach about his concerns. "You see, Lisa, at an architecture firm like mine, that is not something we typically do." Lisa asked how they develop a fee for their proposed projects.

"Well, we look at our past projects, those about the same size and scope as what we are proposing, and we look at how much we spent on labor and reimbursable expenses. Then we estimate a price that should get us in the ballpark."

"So, how does that work out for your firm?"

Arthur shrugged, "Sometimes we win, and sometimes we lose. If we get a great team to work with, we do well. If we are forced into a lowball fee, then we have to make adjustments, sometimes painful ones, to our team and the service we can provide. And, if we have a low fee and a non-collaborative team; well, we have a hard time making it all work."

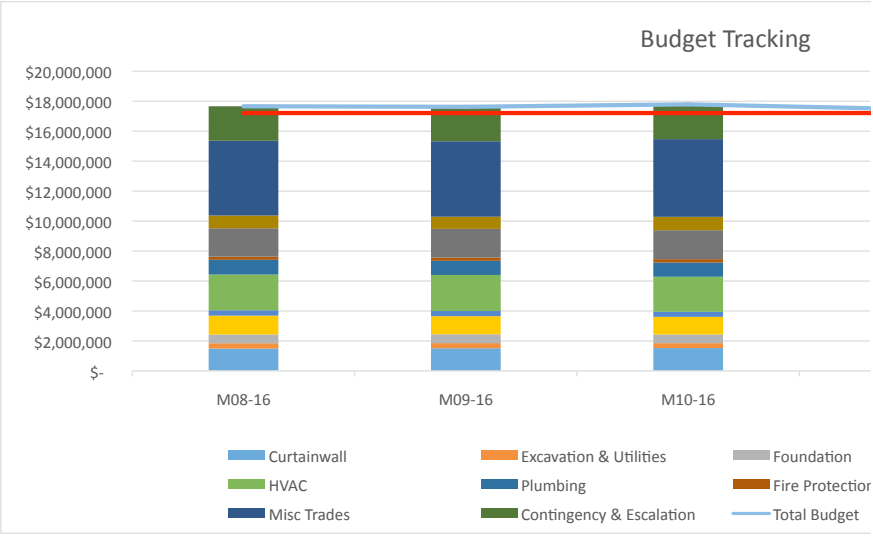
"Wow, Arthur, doesn't that add a lot of stress to the design team?"

When he admitted the stress, Lisa encouraged him to share his concern with the project team. After all, he was officially part of a new organization, created by the IPD Contract. His company's financial health should be a concern of the entire team.

So, when they returned to the Big Room meeting, George shared his concern with the team. The moment he finished talking, the GC jumped in and said, "Oh, George, that's not a big deal. We can help you with that. This is *our* problem, not just yours. Let's get together after this meeting and figure out what we need to do to help."

From that day on, everyone knew they were part of something bigger than themselves, something that transcended not only their companies, but also surpassed an old and broken way of delivering capital projects. Through genuine humility and helpfulness, they were putting the success of the team ahead of their pride and their "traditional role" on a project.

			Expe
Scope	**August-16**	**September-16**	**October-16**
Curtainwall	$ 1,487,586	$ 1,509,900	$ 1,524,999
Excavation & Utilities	$ 358,926	$ 344,569	$ 327,341
Foundation	$ 584,962	$ 590,812	$ 584,904
Structural Steel	$ 1,259,635	$ 1,209,250	$ 1,172,972
Concrete	$ 356,284	$ 342,033	$ 342,033
HVAC	$ 2,384,685	$ 2,408,532	$ 2,336,276
Plumbing	$ 984,236	$ 944,867	$ 944,867
Fire Protection	$ 210,000	$ 218,400	$ 227,136
Electrical	$ 1,895,236	$ 1,914,188	$ 1,933,330
Drywall	$ 854,236	$ 811,524	$ 892,677
Misc Trades	$ 4,986,251	$ 5,036,114	$ 5,187,197
Contingency & Escalation	$ 2,304,306	$ 2,299,528	$ 2,321,059
Total Budget	**$ 17,666,343**	**$ 17,629,715**	**$ 17,794,789**
Target Cost	**$ 17,215,500**	**$ 17,215,500**	**$ 17,215,500**



Project target value budget tracker with monthly updates and color coded visual aligning with Work Cluster portion of the budget.

understand how their cost of work is determined. By learning the vast differences in the pieces of the process, they often see how they might improve by incorporating lessons from others. The budget management process, including the measurement of burn rate, delivers a beneficial and comprehensive learning experience.

Each team member should be prepared to report to every other team member on a frequent basis. As one Construction Project Manager said recently, "Today, all budgets are presented in full-disclosure; all trade partners see everyone's budgets...the glass guy sees what the architect's making in fees; everybody sees it. They all know each other. So now they all realize we're all looking out for each other and they can save some money. There's an impact on their company. They all realize, 'Hey, I'm saving money too.'"

The PM's comments are critical to a general understanding of the nature and benefit of Lean/IPD. They also reveal the power of managing the burn rate through collaboration and transparency. The value is derived through the multiple subject experts. That's a primary reason the project leader must keep a pulse on who is participating and the value they bring. Failure to do so leads to significant misunderstanding and lost value.

Anticipating Problems

As with any procedure, managing the burn rate carries significant risks. The biggest one relates to the reporting cycle. Some project participants tend to run late in their billing cycle. That problem causes the team to lose the essential visibility into the scope of the project and its costs. And, that almost always results in overspending, working on the wrong things or developing work beyond its appropriate level of confidence.

Waiting too long to implement the practice also imposes great risks. If the leadership does not require compliance, a team will procrastinate and thereby fail to effectively control the budget. The primary reason for the late start is that it may take a few months to assemble a team. The originators often want to wait until the team is complete. But, it may take a year to assemble the complete team. Managing the budget must begin immediately.

Unfamiliarity with the budgeting process or waiting for the final team composition should not stop the team from launching the various components of budget management through the use of the value tracker. Because the value tracker tool has many components and was developed to manage each of these pieces, they can make an informed guess, get started, add personnel as the team grows and course correct as necessary. The whole thing is a learning process. Mistakes should be seen as educational, not punitive.

Finally, leaders should know that the idea of integrated team performance is scary to the ones paying the bills. Because they see many people in a room for a day and know they are paying by the hour, they usually want some assurance of progress. As

with many processes, communication and relationships are key. That's another reason that integrated project delivery is superior to the old traditional methods of construction. Regular and respectful conversations will eventually help overcome the concerns about overspending. Clear communication can also reduce the tension in the Big Room and increase vision for what is being gained through the process.

The success of this process can be a significant confidence builder for the team, but more so for the owner. The fluidity and control of the process give the owner confidence to release early work packages without the fear of cost disruption in later development. That can build and increase a fast- track delivery of various project components.

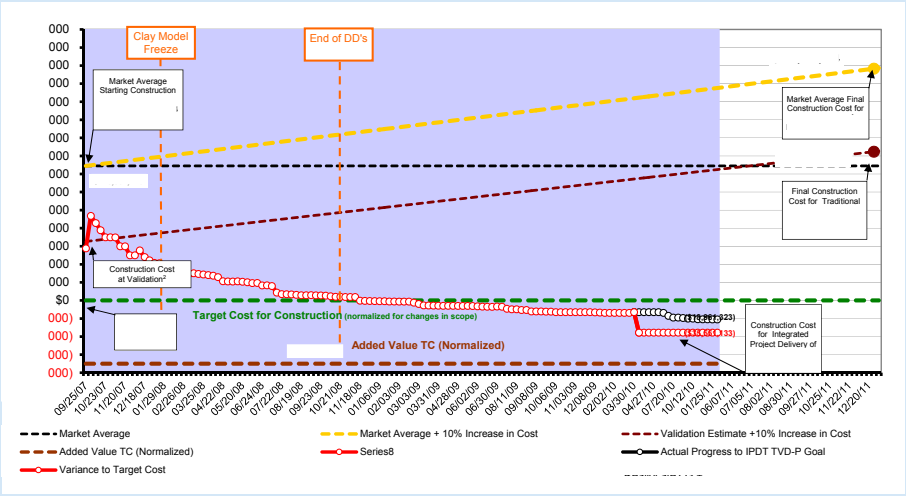
That process should be further supported through frequent, *and accurate*, updates which allow everyone to see real progress. Frequent course correction can also help everyone, especially owners, to manage expectations. Everyone on the team should be free to speak openly, even challenging ideas, processes or decisions.

Successful integrated teams will and must work hard to understand all of the owner's costs and constraints. The more the owner can share openly, the more likely the team will succeed. For example, it helps for the owner to share his or her equipment needs, the impact of operational costs, community concerns and needs, land development improvements and other project issues. It is also sometimes appropriate and essential for the owner to share financial patterns with the team. Even if the team is not directly responsible for a financial area, they should be aware of factors that could impact the resources or time available to the project.

Finally, teams must hold the owner accountable for making decisions in a timely fashion. All parties should clearly communicate what they need and should discuss the reasons that may not be attainable. The team should also share their individual constraints as they relate to other projects or business needs that may impact progress or timing. The more open and honest the team can be, the more it can optimize the results.

Budget Management Is about Managing Change and Leadership

While managing the budget may seem like only a financial challenge, it is really as much about change management and leadership. It is not just an estimating method, but a program-driving effort that requires dedicated and skilled leaders who can keep a team focused and accountable. The leader should have a strong knowledge of the contract structures and scopes of responsibility for the design team, CM and trade partners. That eliminates wasted time in seeking responses from parties who may have



Project team target cost tracking over time including impact of value added to the project.

no power to change the outcome. That leader should integrate everyone in the process and develop high trust and respect throughout every area and phase of the project.

The leader must, by skill and by natural gifting, keep all participants engaged. It is critical that everyone understand the process, the progress and the need to deliver the project on time and on budget. They must also understand risk mitigation and how to capture an opportunity. Each player must contribute to the quality and flow of the project. And, that's why each player should understand burn rate and how it informs decisions and is used to deliver on target. Each team member must be accountable for their burn rate prediction and management.

Because the real issues are leadership and managing change, leaders must help all players in understanding the common team resources that are available: building modeling, collaborative document management, value trackers, consolidated budgeting tools, field viewing and reporting systems and many other tools and concepts.

The broader issues are also why teams must learn to communicate in a common language. For example, standard estimating forms help everyone to understand the details. And, because designers are not usually as experienced in reading detailed estimates, they need to be trained to see how their work impacts the cost. Each team must tailor components of the estimate to be standard for all trade partners and Work Clusters. For example, exterior skin trades estimate differently and have different fee structures from the mechanical, electrical and plumbing (MEP) trades. But, all the players

	Actual						
	May-17	June-17	July-17	August-17	September-17	October-17	November-17
Composite	$7,337	$12,405	$11,721	$35,479	$62,007	$102,152	$66,603
Big Room Meeting	$2,457	$3,843	$6,145	$9,633	$15,378	$18,628	$16,512
Component Team	$375	$524	$524	$1,528	$762	$2,699	$2,893
Design Meetings	$0	$0	$892	$551	$763	$20,375	$7,006
BIM Coordination	$421	$0	$0	$5,213	$35,023	$26,111	$18,561
Estimating	$865	$960	$1,394	$4,354	$6,368	$7,668	$8,308
Travel	$50	$50	$50	$50	$50	$50	$50
Mockups	$3,169	$7,028	$2,715	$14,151	$3,662	$26,621	$13,273

Jackson Health System project team's portion of a Burn Rate Tracker tracking their costs for producing the project to be compared monthly to projected costs.

should understand those differences. Therefore, the leader must set minimum requirements by group and then gain concurrence from both the design team and trade partners.

Strong front-end documents during partner selection will also enhance the success of the process. When selecting trade partners, the leaders should present detailed design narratives (as practical) and thoughtful schedules and site logistics plans, along with safety checks and plans. Organization and thoughtfulness in this phase often foster innovation from the trade partners. As they gain a clear understanding of project limitations within the project, they tend to focus efforts on areas that *can* be innovated.

The team should help individual groups examine and solve problem areas, or at least present options to the larger team. That is often done in Work Clusters. As a key management component, these teams will often accept budget challenges from the Big Room leadership.

This approach also trains the whole team to be comfortable in moving the budget in new ways. Consistent with the foundational philosophy of Lean performance, team members should not be afraid to evaluate the process of budget management and offer improvement options. Everyone should learn to find ways to become more accurate. Good leaders will always bring fresh eyes to the effort when possible to expose any blindness of the team. For example, they will invite team members who are not dealing with the budget on a daily basis to examine a budget issue via a Work Cluster or Big Room meeting.

A key to attaining a target is to have it always visible to the team. Help the team to understand the goal and the time and funding relationship to it. Help the team interpret the goal in their language. Don't assume everybody knows how to read the chart. Take time on a regular basis to review technical aspects of the document and remind the team how to use it to gain predictability in the process and deliver a successful project.

The Real Value of Collaborative Budget Management

Many Lean/IPD management teams create a small group responsible for the collation and distribution of budget and other financial management documents. That group should be multi-disciplined and vested with the authority to require accountability to reporting needs and timely cost data presentation. The group should be willing to review and challenge presented materials. Again, any challenge should be constructive rather than accusatory and intended for team learning. Fairness and contract compliance should be the foundation of each challenge.

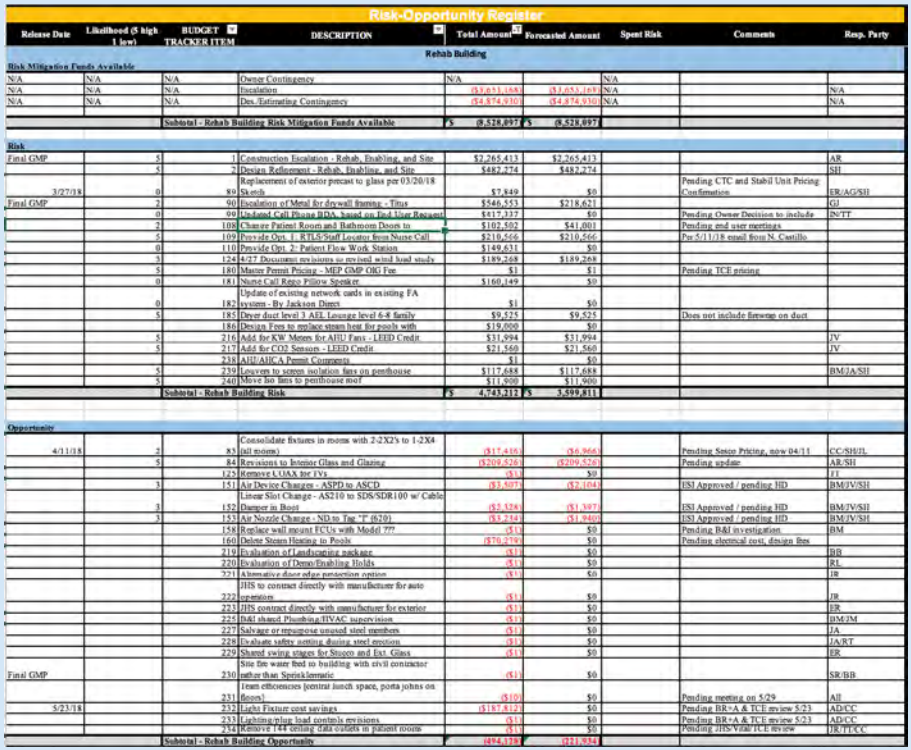
The management team should continue to adjust burn rate projections based on pull planning. A critical portion of the selection and onboarding process is to establish rates, overheads and reimbursable costs. Anyone reviewing invoices should be made aware of those terms. That also reinforces the need for strong up-front documentation when onboarding trade partners. All billing rates, methods, reimbursement procedures and sub-tier procurement methods should be outlined clearly. These should be shared with each partner and managed according to value provision. Before final contract, many of these agreements reflect time and material relationships; certification of time spent and by whom is critical. It is often essential for an auditor to review terms and rates at the beginning of a project. That needs to be done at the earliest possible time.

When updating estimates and looking at actuals, the team should track field productivity (shop, design studio, etc.) against the estimated value. The team must be able to frequently identify variance and provide countermeasures as required.

Cost swings are common in budget management. If the process is running well, each bi-weekly report should show changes in cost estimates. The fluctuations are merely a part of maintaining a near constant understanding of both the current state and the future target. Leaders must know how and when to course correct if trends don't head in the right direction.

At the beginning of the project, as more items are investigated to provide better value decisions, more time gets consumed. However, that time and expense will normally be offset by less design team rework later, less reworking during shop drawing and the approval cycle and more savings during construction administration. That may lead to a reconsideration of compensation, in light of the value derived against the burn rate.

Finally, don't underestimate the value and priority of budget management. Yes, that level of control requires an enormous effort, but its value is significant. Far more than managing the dollars, the management and leadership brought into the mix provide



Risk-Opportunity Register

Release Date	Likelihood (5 high 1 low)	BUDGET TRACKER ITEM	DESCRIPTION	Total Amount	Forecasted Amount	Spent Risk	Comments	Resp. Party
			Rehab Building					
Risk Mitigation Funds Available								
N/A	N/A	N/A	Owner Contingency	N/A		N/A		
N/A	N/A	N/A	Escalation	($3,653,168)	($3,653,168)	N/A		N/A
N/A	N/A	N/A	Des./Estimating Contingency	($4,874,930)	($4,874,930)	N/A		N/A
		Subtotal - Rehab Building Risk Mitigation Funds Available		$ (8,528,097	$ (8,528,097			
Risk								
Final GMP	5	1	Construction Escalation - Rehab, Enabling, and Site	$2,265,413	$2,265,413			AR
	5	2	Design Refinement - Rehab, Enabling, and Site	$482,274	$482,274			SH
3/27/18	0	89	Replacement of exterior precast to glass per 03/20/18 Sketch	$7,849	$0		Pending CTC and Stabil Unit Pricing Confirmation	ER/AG/SH
Final GMP	2	90	Escalation of Metal for drywall framing - Titus	$546,553	$218,621			GJ
	0	99	Undated Cell Phone BDA, based on End User Request	$817,337	$0		Pending Owner Decision to include	JN/TT
	2	108	Change Patient Room and Bathroom Doors to	$102,502	$41,001		Pending end user meetings	
	5	109	Provide Opt. 1: RTLS/Staff Locator from Nurse Call	$210,566	$210,566		Per 5/11/18 email from N. Castillo	
	0	110	Provide Opt. 2: Patient Flow Work Station	$149,631	$0			
	3	124	4/27 Document revisions to revised wind load study	$189,268	$189,268			
	5	180	Master Permit Pricing - MEP GMP OIG Fee	$1	$1		Pending TCE pricing	
	0	181	Nurse Call Rego Pillow Speaker	$160,149	$0			
	0	182	Update of existing network cards in existing FA system - By Jackson Direct	$1	$0			
	5	185	Dryer duct level 3 AEL Lounge level 6-8 family	$9,525	$9,525		Does not include firestop on duct	
		186	Design Fees to replace steam heat for pools with	$19,000	$0			
	5	216	Add for KW Meters for AHU Fans - LEED Credit	$31,994	$31,994			JV
	5	217	Add for CO2 Sensors - LEED Credit	$21,560	$21,560			JV
		238	AHU/AHCA Permit Comments	$1	$0			
	5	239	Louvers to screen isolation fans on penthouse	$117,688	$117,688			BM/JA/SH
	5	240	Move ho fans to penthouse roof	$11,900	$11,900			
		Subtotal - Rehab Building Risk		$ 4,743,212	$ 3,599,811			
Opportunity								
4/11/18	2	83	Consolidate fixtures in rooms with 2-2X2's to 1-2X4 (all rooms)	($17,416)	($6,966)		Pending Senior Pricing, now 04/11	CC/SH/JL
	5	84	Revisions to Interior Glass and Glazing	($209,526)	($209,526)		Pending update	AR/SH
		125	Remove LUAX for IVs	($1)	$0			JJ
	3	151	Air Device Changes - ASPD to ASCD	($3,507)	($2,104)		ISI Approved / pending HD	BM/JV/SH
	3	152	Linear Slot Change - AS210 to SDS/SDR100 w/ Cable Damper in Boot	($2,328)	($1,397)		ISI Approved / pending HD	BM/JV/SH
	3	153	Air Nozzle Change - ND to Tag "I" (620)	($3,234)	($1,940)		ISI Approved / pending HD	BM/JV/SH
		158	Replace wall mount FCUs with Model ???	($1)	$0		Pending B&I investigation	BM
		160	Delete Steam Heating to Pools	($70,279)	$0		Pending electrical cost, design fees	
		219	Evaluation of Landscaping package	($1)	$0			BB
		220	Evaluation of Demo/Enabling Holds	($1)	$0			RL
		221	Alternative floor edge protection option	($1)	$0			IB
		222	JHS to contract directly with manufacturer for auto operators	($1)	$0			JR
		223	JHS contract directly with manufacturer for exterior	($1)	$0			ER
		225	B&I shared Plumbing/HVAC supervision	($1)	$0			BM/JM
		227	Salvage or repurpose unused steel members	($1)	$0			JA
		228	Evaluate safety netting during steel erection	($1)	$0			JA/RT
		229	Shared swing stages for Stucco and Ext. Glass	($1)	$0			ER
Final GMP		230	Site fire water feed to building with civil contractor rather than Sprinklermatic	($1)	$0			SR/BB
		231	Team efficiencies [central lunch space, porta johns on floors]	($10)	$0		Pending meeting on 5/29	All
5/23/18		232	Light Fixture cost savings	($187,812)	$0		Pending BR+A & TCE review 5/23	AD/CC
		233	Lighting/plug load controls revisions	($1)	$0		Pending BR+A & TCE review 5/23	AD/CC
		234	Remove (14) ceiling data outlets in patient rooms	($1)	$0		Pending JHS/VDC/TCE review	JR/TT/CC
		Subtotal - Rehab Building Opportunity		($494,339)	($221,934)			

Jackson Health System project team's portion of a Risk-Opportunity Tracker for areas of risk to the project and areas for possible opportunities.

a wealth of learning for everyone involved in the project. The process gives each participant confidence in the outcome and teaches the advantages of treating every member fairly.

Indeed, it is a cornerstone of the integrated delivery process.

CHAPTER 11

RETROSPECTIVES

Go and Do:

- Build a culture of improvement through retrospection
- Improve meetings through plus/delta discussions
- Stop frequently to examine your process for ways to improve or repair
- Learn to facilitate the process in a way that assures results
- Build team trust through regular and candid retrospectives

As a team begins to consider the pathways to improvement, it is important to look back and reflect. Our culture does not make that easy. Many projects are led by pivotal players who rush from one job to the next. Others manage several projects concurrently. So, taking the time for *retrospection* (as in reviewing and contemplating progress) often requires a struggle against the noise and distractions that pervade everything.

A Lean student or practitioner will strive for continuous improvement. But, that will not happen easily. It takes a focused mind and diligent posture to look back and consider how outcomes compare to expectations or desires.

The Leadership Role in Retrospectives

Effective retrospection means that a team must create a safe environment in which to provide honest and candid feedback. Leaders must permit and maintain room

Bill Seed leading a team in a Retrospective for improving part of a project process.

for various perspectives. They must also know that different people require different timelines for finding the safety and the confidence needed to speak frankly. That means a team must be patient and tolerant. As a "safe place" materializes, everyone must listen in humility, looking for the validity in each person's reflections. Even if they are strained or contentious, every team member should listen beyond the obvious in order to hear what could be a valuable perspective. A proper retrospective is truly a respectful event. In time, the respect, patience and listening will become natural.

Retrospectives (even by another name) should be scheduled events, beginning after a period (perhaps two months) on the project. They should flow naturally when a program changes, major players transition in or out, a breakdown occurs, a significant project milestone has been accomplished and at other significant mile markers. A short-term reflection could be a Plus/Delta[1] immediately following a meeting. Or, perhaps

1 Plus/Delta is "A discussion done at the end of a meeting, project, or event used to evaluate the session or activity. Two questions are asked and discussed: What worked or produced value during the session? What could we do different/better next time to improve the process or outcome?" William R. (Bill) Seed, Editor. *Transforming Design and Construction.* Lean Construction Institute.

a 5-minute group description around a specific event. Retrospectives looking over a longer period of time or a significant deliverable should be planned and facilitated, perhaps even with specific questions prepared for the event.

based on a real project situation...

Retrospective Story

A recent $220 million project was about half-way finished when the project team had to face numerous challenges, including some large dysfunctions among the various project teams. Because of the resulting turmoil, six project leaders had left over the previous months. Therefore, the team was also very short staffed.

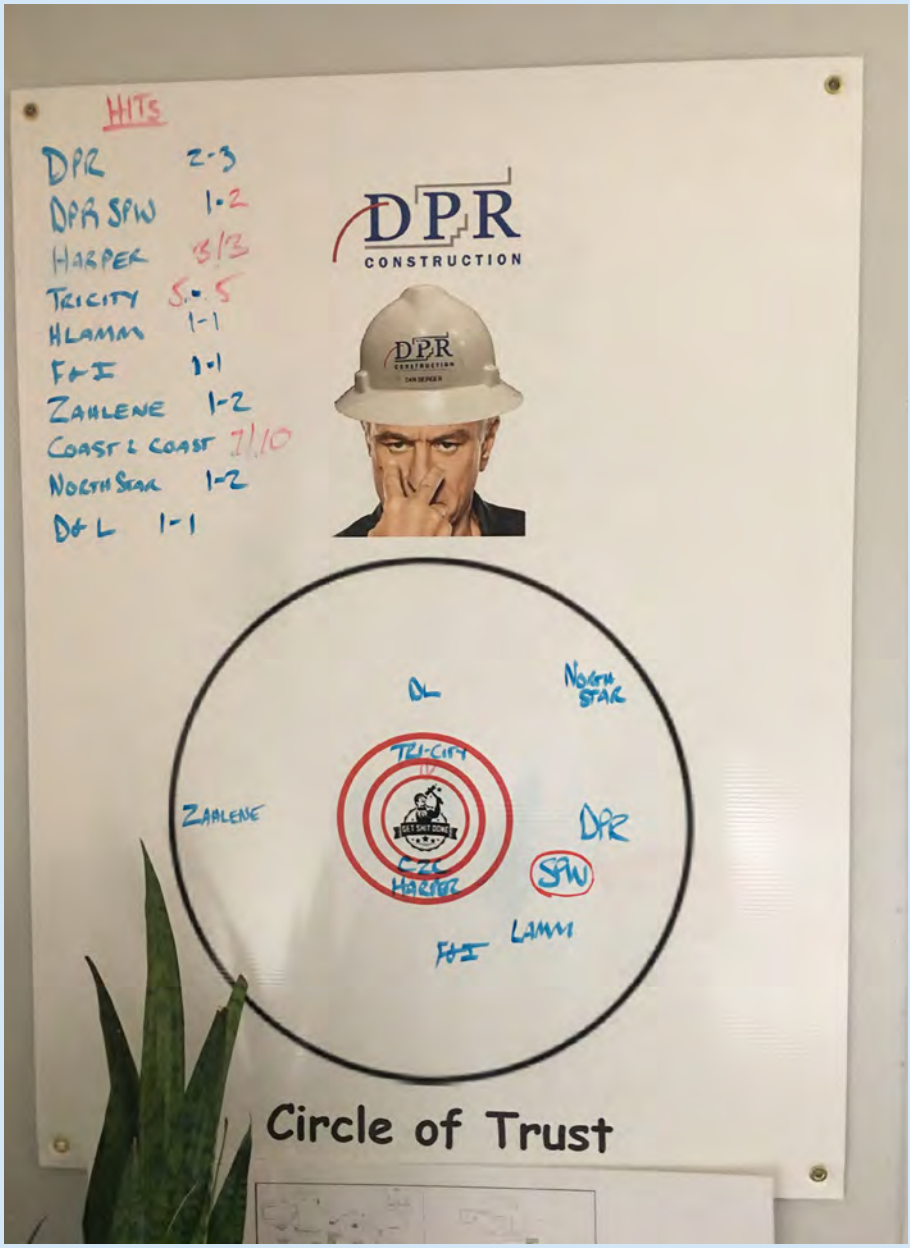
The General Superintendent and the Project Executive decided to take the time to stop, learn and focus on making things better.

The Senior PM set up two 4-hour Retrospective meetings with all of the GC's staff on site. The first one invited and considered everyone's thoughts on what the team needed to start doing, stop doing, keep doing or do differently. The Retrospective was friendly, professional and focused on issues, not on individuals. They identified the overarching topics that needed improvement. Then they selected four of those topics that needed to be addressed first: planning, self-performance, accountability and communication. Then the room selected who would work with each topic.

Over the following week, preceding the next Retrospective, the four groups met several times to discuss how to improve in their categories. The following Friday, the team convened the second Retrospective, where they continued to develop action plans. They ended the meeting with commitments to actions, as well as scheduling weekly check-in calls to update everyone on progress and status.

The most outstanding result of the Retrospectives was watching people showing true leadership in making sure their groups completed the work as committed. A Project Engineer volunteered to monitor the check-in calls, a Project Administrator kept her group moving and focused on accomplishing their assignments and a Quality Specialist took the lead with his sub group. After a couple of months, they had implemented more improvements and made significant progress in all four areas.

But, perhaps the most lasting result was that they all saw and understood that none of the change would have happened without the honest Retrospectives and the new dynamics of leadership they produced.



DPR Construction transparent and visual representation of team members circle of trust in "getting stuff done" as the bulls eye.

The primary purpose of any retrospection is to consider opportunities for improvement, identify any wasteful practice and improve the value proposition for all involved. So, naturally, they ask important (and sometimes painful) questions: Are these meetings valuable? Is the frequency adequate? How can we do this better? Do we need an unbiased facilitator?

Simply stated, a retrospective should be used to check alignment around the larger purpose of a program or the Conditions of Satisfaction. That is helpful when new members join the team. Reflection around an individual practice can be useful if that practice is repeatable. Did our interview find the right partner? Why or why not? Did our concrete pour work out as planned? Are our control systems catching errors? How can we continue to improve?

Sometimes reflection helps to integrate partners into a team or even a long-term relationship with other businesses. Individual growth can also be advanced through retrospectives. High-performing teams have learned to extend the practice to the supply chain for improvement as well. A facilitator should consider and describe the nature of a retrospective at the beginning, explain the purpose and desired outcome. Leaders should never permit them to become rote. The facilitator should help drive fully engaged participation. The leader should encourage open sharing and prevent the meeting from becoming negative. Make sure the group focuses on issues, not people.

Don't ignore any question, concern or suggestion. Even if a proposal seems too expensive, discuss it openly with everyone. Wisdom and insight often flow from those least expected to contribute. Assign a champion to gather the resources necessary to solve the problem. If the resources are too expensive, tell the group; someone might know a different path to the solution. In other words, treat everyone as a partner in the process.

A Healthy Culture Includes Retrospection

Healthy people and practices produce healthy cultures. And, that necessarily includes the practice of thoughtfully considering the path that led to the present moment as well as the one that points forward.

Retrospectives should lean more toward intentional contemplation than utilitarian objectives. In other words, they should encourage deep thought. Silence produces more innovation than noise ever will. That's why some businesses practice periods of silence, including no email. Give the room to breathe deeply, to consider the reasons and rhythms behind what we do together.

DPR Construction team's "Come on Man Board" for visual depiction of Plus/Delta by placing with a thumbs up (Plus) or thumbs down (Delta) as a fun way to implement improvements.

For example, relational strains and challenges are inevitable in any social group. That certainly includes vocational groups. Exposing and resolving those kinds of struggles can lead to greater cohesion and collaboration. But how? Leaders know that sometimes an open airing of problems represents the best path to harmony. But, very often, group conflicts are best resolved by granting more private, even anonymous, channels (as through a suggestion box). In other words, leadership must be ready to provide alternative methods that will help all personality types to find comfort and safety in resolving grievances and making other adjustment issues in the group. Some people need open forums of engagement. Others need a confessional booth.

A healthy culture knows that not all retrospectives are the same. Some bring out valuable knowledge and the opportunity to improve, while others uncover cultural or behavioral problems. Sometimes the facilitator may need to help a team navigate through complaints to find effective improvements or solutions. Properly facilitated, conflict can bring resolution or innovation. Teams will inevitably encounter problems of communication or expectation or even experience a "breakdown," but those dynamics often become the path to better alignment and deeper resolution. Sometimes a neutral facilitator can help the group to deal with challenging issues in positive terms. They do not need to be industry experts, and sometimes it can even be an advantage if they are not. That can allow them to interact with the group with a very fresh and different perspective.

Addition Learning and Resources

Lean Construction Institute Books:

- Transforming Design and Construction; A Framework for Change
- Target Value Delivery; Practitioner Guidebook to Implementation
- Lean Construction Education Courses:
- Introduction to Lean Project Delivery
- Introduction to Last Planner® System
- Introduction to Lean in Design Phase
- Introduction to Last Planner® System in Design
- Lean in Design - Build
- Mindset of an Effective Big Room
- Target Value Delivery
- Gemba

Lean Construction E-Learning Courses:

- Introduction to Last Planner® System
- Introduction to Lean Project Delivery
- More to be available soon

Recommended White Papers:

- Negotiating an Integrated Project Delivery Agreement
  Howard W. Ashcraft, Jr.
- Another Approach to Transforming Project Delivery: Creating a Shared Mind
  Kristin Hill, Christine Slivon, and John Draper
- Study-Action Teams: Opening Minds for Organizational Change
  Christine Slivon and Hal Macomber
- Collaborative Team Procurement for Integrated Project Delivery: A Case Study
  Robert Leicht, Allison Townes, Bryan Franz
- Cross-Functional Project Teams in Construction: A Longitudinal Case Study
  Jean E. Laurent, Robert Leicht
- The Last Planner System: Conversations that Design and Activate The Network of Commitments
  Gregory Howell and Hal Macomber
- Retrospectives
- Rebecca Bettler (Snelling)

GLOSSARY

A3

A one-page report prepared on a single 11-by-17-inch sheet of paper that adheres to the discipline of PDCA thinking as applied to problem solving—or A3 Thinking. The A3 includes the background, problem statement, analysis, proposed corrective actions (and the action plan), and the expected results, often with graphics. A3 reports can be used as a standard method for summarizing problem-solving efforts (including analysis of Target Value Design options), status reports and planning exercises.

3P

Production Preparation Process (3P) is preparing an area physically and process-wise for a new or expanded service line. It involves simulation, usually using cardboard cutouts to look at the layout for staff to design or redesign space.

5S

A disciplined approach to maintaining order in the workplace that uses visual controls to eliminate waste. Typically the English translations of the 5S words are Sort, Set in Order, Shine/Sweep, Standardize and Self-Discipline/Sustain.

5 Why Analysis

The problem-solving technique used to dig for the root cause of a condition by asking why successively (at least five times) whenever a problem exists in order to get beyond the apparent symptoms. As each answer to the why question is documented, an additional inquiry is made concerning that response.

Actual Cost

In Target Value Design, the documented costs of actually performing a portion of work or an entire project based upon agreed definitions of cost, overhead and profit.

Allowable Cost

The maximum amount the Owner is willing and able to spend for a facility asset.

Batch

An accumulation of work produced by a trade, discipline or other specialist that moves as a unit. The goal of lean is to produce a batch size of one to achieve "single piece flow." Leading to the mantra: "Flow where you can. Pull where you can't. Push where you must."

Black Belt

Individual certification of full-time facilitators for long-term projects (four to nine months) or Kaizens (two to five days) using Lean Six Sigma methodology. Black Belts also can coach Green Belts and the A3 process.

Choosing by Advantage (CBA)

Choosing by Advantage is a tested and effective decision-making system developed by Jim Suhr for determining the best decision by looking at the advantages of each option. CBA's five phases of decision-making: 1. Stage-setting: establish the purpose and context for the decision; 2.Innovation: formulate an adequate set of alternatives; 3. Decision-making: choose the alternative with the greatest total importance of advantages; 4.Reconsideration: change the decision if it should be changed or improved on; and 5. Implementation: make the decision happen, adjust as needed, and evaluate the process and results.

Commitment-Based Planning

A planning system that is based on making and securing reliable promises in a public setting.

Conditions of Satisfaction

A directive or set of criteria that specifies how the success of the outcome will be gauged.

Conceptual Design

The phase of the project that determines WHAT is being built. Deliverables include: program, technology plan, target cost budget, performance metrics, conditions of satisfaction and milestone schedule.

Constraint

Something that stands in the way of a task being executed.

Continuous Flow

Work that proceeds without interruption or waste.

Criteria Design

This term is from the AIA IPD terms: The project phase where the project begins to take shape. Deliverables include: set-based design studies evaluated and studied by IPD team; real-time estimating; defined scope/ target cost approval; more developed schedule; and, quality review of constructability of design.

Customer

The primary recipient of the output from processes. In Lean Six Sigma, the terms "customer," "external customer" or "end user" describes individuals and organizations that pay for and receive products and services. The terms "customer," "internal customer" or "process partner" often are used at the project level to describe those parts of the organization that internally receive the output from process being improved.

Cycle Time

The time it takes a product or unit of work (i.e., a room, building, quadrant) to go from beginning to completion of a production process.

Detailed Design

This term is from the AIA IPD terms: This project phase concludes the WHAT phase of the project. Deliverables include: approved documents with decisions defined; definition of all major building systems including furniture, fixtures and equipment; and, coordination and full engineering of all building elements. Also: Sub trades are ready to start shop drawings; construction quality review and outline; and products are established and vetted for specifications.

DMAIC

(Pronounced Duh-MAY-ic) A sequential, five-step improvement process for improving existing products and services. DMAIC is the abbreviation for Define, Measure, Analyze, Improve and Control.

- Define describes the performance gap to be closed.
- Measure describes the method of measurement and collection of data to describe the baseline performance.

- Analyze identifies the root cause of the performance gap.
- Improve develops, selects, and implements improvements to the process.
- Control validates that the performance gap has been closed and establishes management controls and ongoing metrics to ensure that project gains can be sustained over time.

Enabling Projects

The many and multiple secondary projects required to be accomplished before the primary project can be undertaken.

Error Proofing

Describes when it is near impossible for an error to occur. Examples in healthcare are dialysis machines that allow only flow out of the patient; Leur locks that allow only certain syringes to attach to be attached; and enteral feeding tubes that will not attach to IV machines.

Expected Cost

An expression of the team's best estimate at the conclusion of the Validation Phase of what current best practice would produce as a price for the facility reflected in the accompanying basis of design documents. Typically, the Expected Cost will also be supported by benchmarking or other market data to calibrate the Expected Cost in light of the market context.

Evidence-Based Design

Evidence-Based Design represents a model of design practice characterized by the use and generation of scientific evidence to support decision-making.

First-Run Study

Trial execution of a process in order to determine the best means, methods, sequencing, etc., to perform it. First-run studies are done at least a few weeks ahead of the scheduled execution of the process, while there is time to acquire different or additional prerequisites and resources. They may also be performed during design as a basis for evaluating options or designing the portion of the work.

Five Big Ideas

A set of organizing concepts that support Lean Project Delivery. They were developed to explain and organize the Sutter Health Lean Construction Initiative: Optimize the project not the piece; Collaborate, Really Collaborate (originally implied "specialty contractors involved at schematic design"); Projects as Networks of Commitment; Increase Relatedness; and Tightly Couple Action and Learning.

Fishbone Diagram

A tool used to identify and organize possible causes of a problem in a structured format. It looks like the skeleton of a fish, with the head of the fish used as the main problem in question and the body to signify the causes. It also can be used as tool for capturing the ideas of a team.

Future State Value Stream Map

Taking the Current State value stream map and seeing how it should look in an ideal world, eliminating steps and getting rid of waste.

Gemba

The Japanese term for workplace, i.e., where the work is actually getting done. Lean experts encourage "going to the gemba" to see how things are really done and where there is opportunity to eliminate or reduce waste.

Green Belts

Individual certification of part-time facilitators of long-term projects (four to nine months) or Kaizens (two to five days) that are of strategic importance to the organization using Lean Six Sigma methodology. These staff members can also coach on A3 development and help with Black Belt project initiatives.

Hand-off

The act of releasing an item or activity to the person or group performing the next step or operation on that item or activity, e.g., a structural steel design is "handed off" to the steel detailer to complete shop drawings; a room (or portion) that has been framed is "handed off" to the drywall installer; or all construction on a floor of a hospital is completed and it is "handed off" to the hospital personnel to begin staff-and-stock activities.

Implementation Documents

This term is from the AIA IPD terms. During this phase, focus shifts from WHAT is being created to documenting HOW it will be implemented. Deliverables include: Coordinated BIM model; shop drawings for some trades; specifications; and the drawings required to define: procurement, assembly, layout, schedule, procedural information and legal requirements.

Integrated Project Delivery (IPD)

A project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of the project, from early design through project handover.

Inventory

Stock on hand–often divided between raw materials inventory, work-in-process and finished goods inventory.

Kaizen

Japanese term for the philosophy of incremental, continuous improvement.

Kanban

A signal that usually is visual. Generally, it signals that it is time to do work, or that the next step in the process needs to be done. Examples include tape on the counters signaling that a specimen or prescription is done or flags on the doors to exam rooms that a patient is ready to be seen. A kanban also can be a signal to trigger replenishment in an inventory control system.

Last Planner®

The person or group that makes assignments to direct workers. "Squad boss" and "discipline lead" are common names for last planners in design processes. "Superintendent" (if a job is small) or "foreman" are common names for last planners in construction processes.

Last Planner® System (LPS)

The collaborative, commitment-based planning system that integrates should-can-will-did planning (pull planning, make-ready look-ahead planning with constraint analysis, weekly work planning based upon reliable promises, and learning based upon analysis of PPC and Reasons for Variance.

Last Responsible Moment

Delaying commitment until the last responsible moment, that is, the moment at which failing to make a decision eliminates an important alternative. If commitments are delayed beyond the last responsible moment, then decisions are made by default, which is generally not a good approach to making decisions.

Lean

Culture of respect and continuous improvement aimed at creating value for the customer by identifying and eliminating waste.

Lean Project Delivery System (LPDS)

LPDS represents the development and delivery of a project from determining that which helps clients better achieve their business purposes through final use. Positive iterations are encouraged within each phase so as to prevent negative iteration between the phases. Production control, work structuring and learning are continuing functions.

Load

The utilization of a resource. The amount of output expected from a production unit or individual worker within a given time. Within a weekly work plan, what is to be accomplished by a design squad or individual designer, engineer, draftsperson, construction craft worker, crew, etc. A quality assignment "loads" a resource within its capacity.

Look Ahead Planning

A short interval plan (usually based on the pull/phase plan) that identifies all the activities to be performed in the next six weeks. The 6W Lookahead Schedule (LAS) is updated each week and always identifies new activities coming six weeks out so that the project management team can make appropriate arrangements to assure that the work will be ready to be performed in the week indicated.

When an activity cannot be advanced, the reason why is identified and listed as a constraint. The 6W LAS typically has been prepared as an Excel spreadsheet, but it may also be captured using one of the scheduling software packages.

The output of look-ahead planning is a list of constraints and individual commitments to remove those constraints meeting the follow-on trade's Conditions of Satisfaction.

Look Ahead Window

The duration associated with Look Ahead Planning. Typically look-ahead windows extend from three to 12 weeks into the future, with six weeks preferred on most projects. Reducing the look ahead period normally will increase inventory pushed to site organization.

Master Schedule

A schedule that identifies major events in a project (start-up, turn-over to client, order long delivery components, mobilize in field, complete design, government reviews, etc.) and their timing. It is the basis for contractual agreements between the Owner and other team members. It is seen as a way to identify long lead items, the feasibility of completing the project as currently required, the basis for defining milestones and phases–but not as a way to "control" the project.

Milestone

An item on the Master Schedule that defines the end or beginning of a phase or a contractually required event.

Muda

Japanese word for "non-value-added" or Ohno's 7 Wastes +1.

Mura

Japanese word for "unevenness"–fluctuation in demand that causes the workflow to be uneven.

Muri

Japanese word for "overburdening"–excessive demand on a system that causes the system to produce beyond its reasonable capacity. Pushing a machine or person beyond natural limits. Overburdening people results in safety and quality problems. Overburdening equipment causes breakdowns and defects.

Network of Commitments

The web of promises necessary to deliver any project. The role of management is to articulate and activate the unique network of commitments required to deliver each project.

Non-value added

Tasks or activities that the organization performs that the customer does not value and (if given the choice) is not willing to pay for.

PDCA Cycle

Stands for Plan – Do – Check - Act. The cycle introduced by Walter A. Shewhart and popularized by Dr. W. E. Deming as a method of continuous improvement.

PICK Chart

An Ease/Impact chart that segregates ideas into Possible, Implement, Challenge and Kibosh categories.

Plan Reliability

The extent to which a plan is an accurate forecast of future events, measured by PPC. Example: If your weekly work plans have a 60% PPC, they accurately predict completion/release of 60% of the tasks represented as weekly assignments.

Plus/Delta Review

A discussion done at the end of a meeting, project or event used to evaluate the session or activity. Two questions are asked and discussed: What worked or produced value during the session? What could we do different/better next time to improve the process or outcome?

Poke yoke

A mistake-proofing method or device developed by Shigeo Shingo that is used to prevent an error or defect from happening or being passed on to the next operation.

PPC (Plan Percent Complete)

A basic measure of how well the planning system is working–calculated as the number of assignments completed on the day stated divided by the total number of assignments made for the week. In many cases the PPC will be less than 50% when a project starts to monitor the PPC and will rise to 80% or 90% as the team becomes conscious of the need to actually perform work as planned. PPC is not a form of Earned Value that measures the percentage of completion achieved for an activity; rather it measures the percentage of assignments that are 100% complete.

Process

A sequential series of tasks, activities, decisions and events that generate a product or service.

Process Map

A flowchart identifying all the activities, operations, steps and work times for a process.

Process Owner

The individual(s) ultimately responsible for the process; the Director, Manager or Supervisor of the department.

Promise

The action taken by a speaker (Performer) to commit to a listener (Customer) to take some action to produce a mutually understood result (Conditions of Satisfaction) by a definite time in the future. (See Reliable Promise).

Pull

A method of advancing the wherewithal necessary for work when the next-in-line customer is ready to use it. A request from the customer signals that the work is needed and is pulled from the performer. Pull releases work when the system is ready to use it.

Push

An order from a central authority based on a schedule; advancing work based on central schedule. Releasing materials, information or directives, possibly according to a plan but irrespective of whether or not the downstream process is ready to process them.

Pull Plan

A plan for executing a specific phase of a project using a pull technique to determine hand-offs. Typically it is prepared by the team actually responsible for doing the work–engineers, architects, owners, designers for a design phase", designers, specialty contractors, GC for a "construction phase." The team members start at the conclusion of the phase and work backwards, at each step identifying the requirements to declare a chunk of work complete and their needs to start that chunk. Many times it is performed by pasting descriptions of the chunks of work on a wall, establishing durations and efficient work flow pattern and then capturing the final solution in Visio or project management software.

Quality

Conformance to a customer's valid and agreed upon Conditions of Satisfaction.

Request

The action taken by a speaker (Customer) to ask a listener (Performer) to take some action to produce a mutually understood result (Conditions of Satisfaction) by a definite time in the future.

Reliable Promise

A promise made by a Performer only after self-assuring that the promisor (1) is competent or has access to the competence (both skill and wherewithal); (2) has estimated the amount of time the task will take; (3) has blocked all time needed to perform; (4) is freely committing and is not privately doubting ability to achieve the outcome; and (5) is prepared to accept any upset that may result from failure to deliver as promised.

Root Cause Analysis

A systematic method of analyzing possible causes to determine the root cause of a problem. (Also see 5 Whys).

Set-Based Design

Once bubble diagrams are defined, set-based design begins. Drawings begin to show room shapes, door locations, and defined people and material flow. Drawing options for room and flow are provided so the client can choose the best of each option as they are developed by the architect.

Set-based design allows for commitment to a specific solution to be postponed, allowing designers to consider multiple alternatives for longer than is typical. A design team can review sets of design alternatives available to each team participant, integrate these sets to find compatible combinations for the project as a whole, and weigh inputs from several project participants at the same time.

Spaghetti diagram (or spaghetti chart)

A map that shows the current layout of operations and the path taken by people, the product, or the service as it moves through the process or processes, often resembling a plate of spaghetti.

Standard Work Instructions (SWI)

One of the most important Lean tools. It establishes the best current sequence for each process. It should be routinely evaluated, updated and improved. Standard work reduces chaos, achieves consensus, supports creativity, enables job rotation, stabilizes the process, incorporates visual management, and provides a baseline for improvement. It is the best way that we know how a process should work currently.

Storm Clouds

Problems associated with the current condition. Any reasons for delay or failure to move onto the next step in the process could be considered storm clouds.

Target Cost

The cost goal established by the delivery team as the "target" for its design and delivery efforts. The Target Cost should be set at less than best-in-class past performance. The goal is to create a sense of necessity to drive innovation and waste reduction into the design and construction process.

Target Value Design

A disciplined management practice to be used throughout project definition, design, detailing and construction to assure that the facility meets the operational needs and values of the users; is delivered within the allowable budget; and promotes innovation throughout the process to increase value and eliminate waste (time, money, human effort).

Total Productive Maintenance (TPM)

A consistent system established for maintaining and servicing equipment that minimizes downtime (i.e., establishing a regular preventative schedule before there are equipment breakdowns).

Value (or value-added time or tasks)

Tasks or activities that the organization performs that the customer is willing to pay for. It is a step required to make the product or service function properly when used or experienced by the customer or patient.

Value Stream Map

A picture (map) of the entire process being studied; includes both material (product/service) and information flows and includes both value-added and non-value added activities. It is a tool used to identify waste within the process and identify areas of improvement. It shows values (information like timing of steps) and numbers to show objectively where improvements can be made.

Variance

When an assignment is not completed as stated, it is considered a variance from the weekly work plan.

Variability

The range of work completed each day or week.

Visual Management

Using visual cues to assist with Standard Work instructions; a visual workplace is a (non-verbal) method of sharing information. Everyone is made aware of the status of the work and is easily able to spot abnormal conditions. Could be signage for patients or tape on the counters to signal that the next step in the process needs to be done.

Voice of the Customer

Voice of the Customer is a term used to describe customers' needs and perceptions of a product or service. This is necessity for understanding the best way to meet customer or patient's needs.

Waste

Defined in the eyes of the patient/customer; anything that doesn't add value to the final product or service (i.e., unnecessary movement of people, items, or information). The 8 Types of Waste are: defects/corrections; overproduction; waiting; not using employee skills (underutilization); transportation/movement; inventory; motion; and excessive processing.

Weekly Work Plan (WWP)

The commitment-level planning document of LPS: A list promised task completions agreed upon by the Performers. The WWP is used to determine the success of the planning effort and to determine what factors limit performance. All the activities shown on the 6W LAS for the current week are included on the WWP. In most cases they are expanded to include more detailed assignments that allow coordination between the different Performers to occur at a Weekly Work Planning Meeting.

Weekly Work Planning

The process by which the Last Planner® establishes the plan for the coming period.

Work Flow

The movement of information and materials through networks of interdependent specialists.

Workable Backlog

An activity or assignment that is ready to be performed, but is not assigned to be performed during the active week in the WWP. If the team agrees that performance of this activity will not hinder other work, then it can be placed on the list of Workable Backlog as part of the WWP. Completion or non-completion of these activities are not recorded or counted in calculation of PPC. A reasonable amount of Workable Backlog allows Performers who are stopped from doing their assignments on the WWP or finish them early to continue work without causing harm to others; thus maintaining a reliable work flow. An example could be assignments that have met all quality criteria, except that some must yet satisfy the sequence criterion by prior execution of prerequisite work already scheduled. Other backlog assignments may be performed within a range of time without interfering with other tasks. Example: Those spare parts lists don't have to be completed for three months, but it won't harm anything if they are produced earlier, so use them as fallback or fill-in work when needed.

Work Balancing (Level Loading)

Creating a more continuous workflow by ensuring that one step in a process is not causing a delay. This is about ensuring that each step in the overall process contains similar amounts of work so that no one is overburdened and no one is waiting. Everyone is working together in a BALANCED fashion.

CONTRIBUTORS

Bernita Beikmann

HKS, Inc.

After earning her Bachelor of Architecture at Kansas State University, for the past 22 years Bernita has served as a project architect, project manager and a coach and facilitator for project teams at HKS. As a Lean Six Sigma Black Belt, she works with all departments at HKS to improve internal processes.

She is also a Lean Six Sigma Green Belt, is certified by the National Council of Architectural Registration Boards and carries Evidence-Based Design accreditation and certification.

Bernita has built a reputation as a Lean design advocate. Her passion for these principles, coupled with furthering her education, has placed her in a position to encourage many organizations and companies to implement Lean design.

She currently serves on the Joint Committee for the AIA and AGC. She also serves on the Lean Construction Institute board.

Chris Dierks

DPR Construction

Chris Dierks is the East Coast Leader of Lean and Integrated Project Delivery (IPD) for DPR Construction. After earning a Bachelor of Science degree in Construction Science and Management from Kansas State University in 1998, Chris has worked in the construction industry for over 20 years on a wide range of technically challenging projects in a variety of leadership roles.

Chris started his Lean journey back in 2006. Today, Lean and IPD drive his work to develop processes to help build collaboration, create better decision making and bring more value to project delivery.

On a nationwide basis for both internal and external partners, Chris facilitates workshops to help transfer knowledge among leaders who are transforming the way projects are designed and built.

Chris is very active with the Lean Construction Institute (LCI) and regularly speaks at various industry events and universities on the topics of Lean and IPD.

Henry Nutt III

Southland Industries

Henry is responsible for all sheet metal labor for Southland's Northern California Division. He also assists with project scheduling, personnel assignments and training, tools and equipment management, project safety and interfacing with labor unions. As a Sheet Metal General Superintendent, Henry has managed over 200 shop and field employees.

Henry is directly involved with Southland's Lean construction delivery method, which includes division-wide alignment processes, and training for project management, shop personnel and field staff. He is an instructor and frequent participant at the Lean Construction Institute's monthly Communities of Practice in the NorCal chapter and a regular attendee at the annual LCI Congress.

He has taught "Intro to Lean Construction" and "Last Planner® System" classes with the Lean Construction Institute. In addition, Henry recently developed a six-week Lean Construction class explicitly designed for all levels of tradespersons in Northern California.

Kristin Hill

Lean Construction Institute

Kristin brings 12+ years of Lean experience to her role as the Director of Education Programs for the Lean Construction Institute. Before joining the LCI staff, Kristin was the founder and president of InsideOut Consulting. As a Lean Consultant, she drew heavily from her experience as an architect, having founded, grown and sold an architectural firm.

Over the years, Kristin has supported the efforts of LCI in numerous roles, including volunteer and leadership functions. She was one of three executive editors for LCI's most recent publication, *Target Value Delivery: Practitioner Guidebook to Implementation – Current State 2016*. Kristin was part of the team of collaborators who produced LCI's hallmark publication, *Transforming Design and Construction: A Framework for Change*. Kristin also has taught extensively at LCI training and networking events, including the annual Congress and June Design Forum programs.

Mark Konchar,
Balfour Beatty, US

As Balfour Beatty's Chief of Innovation, Mark develops ideas and approaches to industry innovation. In addition, through research and development, Mark finds new ways for Balfour Beatty to streamline processes, reduce redundancy and increase expertise in the company's strategic procurement and business acquisition efforts.

Mark earned his BAE and Ph.D. in architectural engineering from Penn State University. In 2010, he was named a Centennial Fellow by Penn State University's Department of Architectural Engineering for his exceptional contributions during the department's first 100 years, and potential to make significant contributions during the second century. And, Mark was one of *Building Design + Construction's* 40 under 40 (2009).

He is immediate past chairman of the board of directors for the Lean Construction Institute and is a Certified Core Clarity instructor. He is also a Designated Design-Build Professional (DBIA) and a LEED Accredited Professional.

Tara Laski
Southland Industries

With a BS in Construction Engineering, Tara has spent 18 years supporting a blend of construction projects. For the last 10 years, her focus has been on supporting IPD teams, where she has developed, led and mentored individuals to create high-functioning teams.

Tara started her career working for a general contractor, focusing on the management of healthcare projects. That management experience still helps her to anticipate and accurately forecast potential issues, prioritize problem resolutions and positively impact project delivery.

At Southland Industries, Tara works to develop the project management and design staff and to support Lean leadership throughout the company.

Tara is passionate about open collaboration among team members and the atmosphere of innovation that it promotes. She continues to look for ways to improve her own Lean skills and speaks publicly to encourage others along their ILPD journey.

Robert Leicht

Penn State University

Robert M. Leicht, an associate professor and graduate of the Department of Architectural Engineering at Pennsylvania State University, is the university's Director of the Partnership for Achieving Construction Excellence (PACE). Dr. Leicht is the lead faculty for the construction capstone course; he leads the construction-engineering course dedicated to mechanical and electrical system construction. He also teaches graduate-level courses in project delivery systems and Lean production management.

To support his research into assembling integrated teams, Dr. Leicht uses theories from organizational science, communication and information modeling in addition to Lean. He was a project lead in developing the Owner's Guide to Maximizing Success in Integrated Projects. He was also a co-investigator for the BIM Guide for Owners, which builds upon the widely adopted CIC BIM Execution Planning Guide. Dr. Leicht is currently involved in an ongoing project for better planning integrated design and construction tasks, as well as new methods to organize and assess interdisciplinary teams to support integrated design and construction.

Will Lichtig

The Boldt Company

Will Lichtig, the Executive Vice President of Performance and Innovation Resources for The Boldt Company, is a frequent speaker at industry events and a nationally recognized leader in the Lean and integrated project delivery movements. He has been at the forefront in the development of Integrated Lean Project Delivery® (ILPD) process.

In his role at The Boldt Company, Will works with teams to develop and implement Lean process for target value design, Lean production planning and control, Built in Quality, Lean problem solving and other vital processes that provide innovative approaches to project delivery. He also provides leadership coaching to project teams as they deliver projects using Lean methods.

Awards | Achievements for Innovation

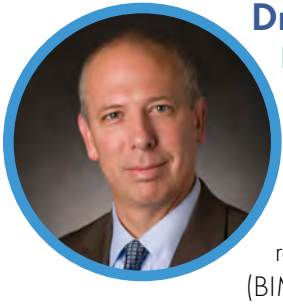
2012: Recognized by the Lean Construction Institute in 2012 with its Pioneer award.
2007: Recognized by ENR Magazine, which honored him as an "ENR Newsmaker" for 2007.

Nick Loughrin
The Boldt Company

Throughout his 20-year career in construction, Nick has learned that a commitment to accountability, collaboration and innovation is the foundation for a successful project. In his current role as Director of Business and Project Development for The Boldt Company, Nick's embrace of Lean and his history as a project manager have given him the tools and credibility to shape diverse groups into effective teams.

Before his current role, Nick served as a Continuous Improvement Manager, facilitating and coaching teams in the application of Lean thinking to project delivery. He also worked with the ACH ILPD® team through the Target Value Design and construction process.

Nick holds a BS in Civil and Environmental Engineering from Marquette University. He is an active member in his community. He also serves on the board of the Bryon Riesch Paralysis Foundation and the Lean Construction Institute Chicago Community of Practice.



Dr. John Messner
Penn State University

Dr. John Messner is the Director of the Computer Integrated Construction (CIC) research program at Penn State and the Charles and Elinor Matts Professor of Architectural Engineering. He specializes in research related to Lean construction, Building Information Modeling (BIM) and virtual prototyping, along with globalization issues in construction. The CIC research group developed the BIM Planning Guide for Facility Owners and the BIM Project Execution Planning Guide.

Dr. Messner is currently leading the Lean Deployment Planning Guide project for the Lean Construction Institute, which is focused on providing a structured approach to planning for the implementation of Lean methods on a project level. He is the chair of the LCI Research Committee, chair of the building SMART alliance (a council of the National Institute of Building Sciences), and past chair of the Computing Division of ASCE. At Penn State, he has taught courses in virtual prototyping, BIM, strategic management in construction, international construction and production management.

Scott Nelson

Advocate Aurora Health

Scott Nelson is the Vice President of Planning, Design and Construction for Advocate Aurora Health. In that capacity, he is responsible for approximately $2.5 billion in active construction projects, leading the planning, design and construction activities at the system level. Additionally, he provides financial oversight in the planning and implementation of all capital construction projects and develops system-wide, facility-related standards to improve patient care and efficiencies.

He led the system-wide master facility planning process for 10 hospital campuses and the Advocate Medical Group ambulatory strategy. Scott was also instrumental in the development of the organization's Integrated Lean Project Delivery (ILPD) strategy and development of the first master contract using an Integrated Form of Agreement. In addition, he has championed the development and implementation of Advocate's modular construction/prefabrication strategy and the commitment towards environmentally friendly design and construction which has resulted in over $1 billion in projects that have received LEED Silver or LEED Gold certification.

Angela Ramer

HKS, Inc.

Angela is a design anthropologist, integrating research, design and strategy for both HKS client and CADRE projects. Her training as an anthropologist provides a holistic, ethnographic approach to triangulating data: immersive, on-site collection, online surveys, analytics and visualization to directly inform design decisions.

She received her MSc of Applied Anthropology from the University of North Texas, with a concentration in the fields of business, technology and design. Her current work at HKS spans industries to include business and program performance strategy, corporate office and headquarters design, campus planning, quantitative workflow evaluation and qualitative assessment of educational environments, as well as experience-based design planning for community spaces.

Angela is an active member of the American Anthropological Association, as well as several applied/practicing anthropology organizations that publish and present insights from her work annually. Her previous work includes research positions at Gensler and the National Institutes of Health.

William R. (Bill) Seed

Jackson Health System

After earning his Bachelor of Science in Mechanical Engineering from the University of Akron in 1990, Bill has spent his career in the commercial construction industry, 25 years specifically dedicated to health care.

Bill currently leads the $1.5 billion Jackson Miracle-Building Bond Program in Dade County, Florida.

He spent two years helping Walt Disney Imagineering convert to Integrated Lean Project Delivery. While new to the entertainment industry, he used the skills developed in his prior roles to effect this change.

Prior to Disney, Bill and his various teams developed over 2000 new behavioral health beds, including four green field campuses, five new medical acute care hospitals and numerous large and smaller facility enhancements. Most of these projects utilized ILPD methods and contracts.

Bill serves as a member of the National Academy of Constructors and the board of directors of the Lean Construction Institute. He won the 2012 LCI Pioneer award and is an active owner advocate for the implementation of Integrated Lean Project Delivery.

Rebecca Snelling

JE Dunn Construction

Rebecca Snelling is Vice President and National Lean Director for JE Dunn Construction. After earning her degree in Business Management from the University of Phoenix, Rebecca started in the construction industry in 1996. She began her Lean journey in 2006.

Rebecca is currently developing and leading a group of coaches and trainers for all JE Dunn employees and project teams, implementing Last Planner System in Design and Construction, Target Value Delivery, Integrated Project Delivery, Choosing by Advantages and other Lean practices and behaviors. Additionally, she coaches leadership on Lean and works to standardize and improve processes across the organization.

Rebecca has been actively involved with the Lean Construction Institute (LCI) and is a contributing author of both LCI books. Rebecca is an LCI instructor, served as chair of the LCI Education Committee and also functions as a Master Trainer of the Choosing by Advantages Decision-making System.

Andrea Sponsel
HKS, Inc.

Andrea Sponsel, a graduate of Miami University, is a Vice President and Senior Interior Designer at HKS. After beginning her Lean journey eight years ago, she was immediately immersed in the philosophy of continuous improvement, standardization of work and eliminating waste to create value.

She quickly and easily identified with the process. Since then, she has found her passion in teaching the technical and people sides of change to others in HKS. She is also part of the core group for the Central Indiana Community of Practice.

At HKS, Andrea is known as a Lean champion, specializing in healthcare and higher education facilities. Introduced to Lean design philosophies in 2010, Andrea loves to promote more efficient delivery of design. She is also a Lean Six Sigma Green Belt and a Prosci Certified Change Practitioner.

Michael Murray
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Boulder Associates

Michael Sullivan
Google

ABOUT THE LEAN CONSTRUCTION INSTITUTE AND LEAN PROJECT MANAGEMENT

Lean Construction Institute (LCI) is a non-profit organization founded in 1997. The Institute operates as a catalyst to transform the industry through Lean, using an operating system centered on a common language, fundamental principles and basic practices. The Lean operating system provides the foundation for a different, more collaborative and more effective form of project management. Use of Lean techniques produces a transformational way of designing and building capital facilities and generating major improvements in owner satisfaction while dramatically improving schedule and waste reduction, particularly on complex, uncertain and quick projects.

With over 200 corporate members, representing the owner, designer, general contractor and trade partner communities, LCI is a voice for industry as it relates to project work. LCI sponsors programs in education, networking and research to assist members on all stages of their Lean journey.

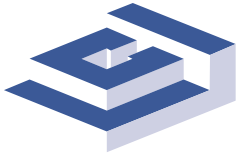
LCI Vision:

Transformational improvement in: the delivery of value to stakeholders, and the quality of the work environment for all participants, achieved by re-integrating a siloed industry through Lean.

Strategy:

LCI seeks to increase owner and construction supply chain satisfaction with design and construction delivery by creating demand for transformation in the owner community and developing the capacity in the supply chain necessary to meet this demand.

For more information on Lean Construction Institute, visit **www.leanconstruction.org.**



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We Invite You to Join LCI

We cordially invite your firm to join us in the movement to transform design and construction through the concepts, tools and techniques of Lean project design and delivery. Lean can benefit your organization and personnel whether you are an owner organization, a contractor, a design firm, or one of the skilled trades. Through our regional Communities of Practice, events, the website, and other benefits such as all-expense paid training for new corporate members, we are working to transform our industry by making a difference. In short, supporting and participating in LCI provides corporate member companies with the foundation for a sustainable competitive advantage.

For more information on LCI membership, please contact Ilene Goldberg, LCI Manager of Membership and CoP Relations: **igoldberg@leanconstruction.org** or **703-387-3049**.

For more information on Lean Construction Institute, visit **www.leanconstruction.org**

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A Guide to Better Project Outcomes

Narrated by a Pioneering Leader

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If you are a leader who is looking to improve the process and outcomes of commercial construction projects, we wrote this book for you.

The following pages describe a "Lean" approach, a much better pathway for delivering capital projects. We present a framework that will clarify an IPD (integrated project delivery) system.

You will discover eleven Lean practices developed and utilized by experienced practitioners to transform projects. We advise those stepping into the Lean/IPD approach to start with some basics described in the book as "Go and Do." Travel at your own speed. Then, build upon what works for you.

This book catches the voices of Lean/IPD leaders, the real world wisdom and experience of those who have mastered the philosophy and value of each practice described.

Finally, we include an appendix of resources and opportunities for deeper dives into the practices, attitudes and values that bring transformation.

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