1. Welcome
2. Understanding Your Client (UHS)
3. Why Lean?
4. Collaborative Communication
   4.1 Trust
   4.2 Conditions of Satisfaction
5. IPD Agreement
   5.1 Consensus Docs 300
   5.2 Choosing Your Partners /Management Group
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   6.1 Principles
      6.1.1 Fourteen Principles
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   6.2 Tools
      6.2.1 Collaborative/Pull Planning
      6.2.2 Transparency/Big Room
      6.2.3 Innovation/Target Cost Delivery
   6.3 Team Organization
7. Continuous Learning
8. Timeline
9. Appendices
Dear Healthcare Development Team Member,

On behalf of the entire UHS Project Delivery Team, welcome! You have been invited to this project for your unique talents, and you will be challenged to use them fully, as well as to develop them as we work together. This project is very, very different from any other project you have worked on. We expect that you will assist us in “breaking down the silos” and in reducing waste of traditional project delivery.


**Learning:** Ask a lot of questions before starting any task. What are the conditions of satisfaction? What are the expectations of my work? What is the target cost of the system I am working on and can I reduce that? What performance indicator is affected by this task? How might I add value to this project? What innovative concept could help improve the delivery of healthcare, or eliminate injuries during construction and operation? How can I reduce task duration? What can I do to ultimately improve the quality of care or the total cost of ownership? Listen to others for understanding and admit when you need help. If you know everything already, it will be hard to succeed as a part of this team.

**Collaboration:** Collaborate with people from other companies and disciplines. There are many intelligent people that you will have access to everyday. If you are a designer, then work hand-in-hand with a specialty builder. Communicate openly and frequently about how to best solve a problem or develop a system before we draw.

**Innovation:** Be as innovative and creative as possible. You are hereby given permission to think “outside of the box”. Question the norm and challenge everyone on the team, regardless of position, company affiliation, or tenure.

Lean project delivery is about focusing on delivering value while reducing waste throughout the system. Working together to identify and reduce waste enhances everyone’s value proposition. This goes beyond lower cost for the owner to include enhanced profits for partners, more timely delivery, better quality, and more satisfaction for all. We at UHS believe that all partners in the project should make a fair profit and that the team should develop on-going relationships that they enjoy.

As you will read further on, UHS’s mission statement states, “to provide superior quality healthcare services...” We look to our healthcare facility development teams to incorporate this important thought throughout their work as they focus on delivering value to UHS and our extended customers.

We expect our development team to care about the operations of the facility long term; taking into consideration energy consumption, maintenance, the number of employees needed to service patients, the number of nurse steps and other such factors. Operationally, we look to our teams to Value Stream map and implement other lean approaches to improve the efficiency of our facilities while enhancing the quality of experience for the customer.

Taking this into consideration will make for rewarding relationships and positive outcomes for this project and for the people who will deliver and receive care in the future. Thank you for working with us to improve care delivery by enhancing the way a project is designed and built.

**Sincerely,**

UHS Project Development Team
UHS Mission Statement
To provide superior healthcare services that: Patients recommend to families and friends, physicians prefer for their patients, purchasers select for their clients, employees are proud of, and investors seek for long-term results. We will realize this vision through our commitment to the following principles:

Service Excellence
We will provide timely, professional, effective and efficient service to all of our customer groups.

Continuous Improvement in Measurable Ways
We will identify the key needs of our customers; assess how well we meet those needs, continuously improve our services, and measure our progress.

Employee Development
We understand that the professionalism and drive of our people are the most important factors in the quality of the service UHS provides. We will hire talented people, increase their skills through training and experience, and provide opportunities for personal and professional growth within the company.

Ethical and Fair Treatment of All
We are committed to forming relationships of fairness and trust with our patients, the physicians, purchasers of our services, and our employees. We will conduct our business according to the highest ethical standards.

Teamwork
We will work together to provide ever-improving customer service. This team approach to our work will supersede traditional departmental organization and create a true customer focus. People at all levels of the organization will participate in decision-making and process improvement.

Compassion
We will never lose sight of the fact that we provide care and comfort to people in need. The patients and families who rely upon us are fellow human beings, and they will receive respectful and dignified treatment from all of our people at all times.

Innovation in Service Delivery
We will invest in the development of new and better ways of delivering our services.
**UHS Staff Expectations**

UHS staff is committed to creating a “WOW” experience!

**Treat Everyone as a Guest**
I make a positive first impression and continue that positive impression through ongoing efforts.  
I anticipate the needs and expectations of all customer groups.  
I will display service recovery skills.  
I am responsible for resolving customer dissatisfaction without assigning blame.

**Associated Behaviors**
Always say “Please” and “Thank You”
Greet guests with eye contact and a smile

**Demonstrate Professionalism and Excellence in the Things I Do**
I deliver excellence that goes beyond departmental and individual job responsibility.  
I am proud to sign my name to what I do.  
I demonstrate professionalism in how I look, what I do, and what I say.  
I hold myself accountable – I am a positive role model.

**Associated Behaviors**
Always wear your name badge
Use language appropriate to the situation and the guest

**Practice Teamwork**
I participate in decision-making and process improvement, regardless of my level within the organization.  
I communicate effectively within and beyond my assigned team.  
I focus on the problem or issue, not the person.

**Associated Behaviors**
Always end an interaction with the guest by asking, “Is there anything else I can do for you?”
I hold myself accountable for getting the information I need to know to do my job
The American healthcare construction industry is in crisis. The industry is struggling with skyrocketing costs, poor quality, skilled labor shortages and employee dissatisfaction—all symptoms of deeper problems inherent in the system itself.

More and more construction industry professionals are realizing the imperative of improving quality and safety and eliminating waste as strategies for responding to the challenges. Enter Lean Construction, the “how to” of managing change, and creating continuous improvement.

Lean Construction (adapted from the Toyota Production System) is not just another project delivery model: it’s a way to transform your entire organization into a safe and high-quality, high-performing project delivery system.

Lean project delivery entails deep collaboration. It means collaborating with different parties and in different ways than used on more traditional projects.

"Collaboration dramatically improves team performance. Most teams collaborate with varying degrees of success, but by incorporating Collaborative Project Delivery teams can greatly enhance their effectiveness. Collaborative Project Delivery brings principles, structure and tools to enable collaboration to become an integrated system in which all team members are working together. It is a system that keeps teams mindful and purposeful about collaboration resulting in greater successes and more personal reward. Individuals can gain the skills necessary to work effectively in teams." – InsideOut Consulting, Inc.

**Fundamentals of Lean:**
- To understand **value** from the customer’s perspective and to only take **actions** which deliver that value (thus eliminating waste).
- Waste is disrespectful
  - to humanity – squanders scarce resources
  - to individuals – adds work
  - to clients – adds cost/time/aggravation
- Become a learning organization through relentless reflection and continuous improvement as a team. It entails continuously analyzing the work and the team’s processes to improve them. Status quo is never acceptable.
- Lean is about inspiration and empowerment. People are empowered to affect decisions and the work itself which not only delivers better projects, but leads to heightened satisfaction for all.
- Lean is about developing **principles** that are right for your organization & diligently practicing them to achieve high performance. It is not about **imitating the tools** used by Toyota in a particular manufacturing process.
The commercial terms used by UHS teams are per Consensus Docs 300 for Integrated Project Delivery. This is addressed in more detail in Section 5.1.

Lean project teams organize in a flat, collaborative, cross-discipline, responsibility-based manner. This is addressed in more detail in Section 6.3.

Lean operating system consists of lean principles, behaviors and tools. This guide addresses all of these throughout but focuses on lean as a system in all of Section 6.

**Important Note to Reader:**
You are about to embark on a challenging yet fun journey. Shifting to lean delivery is referred to as a journey because it is exactly that! It entails learning step by step how to do things differently. It truly is a shift to new behaviors and thinking to form new habits. It entails change and change is never easy. But it can be fun and the outcome can be rewarding in many ways. The best advice is to relax into the new ways, open up to new ideas and processes, enter into it with an adventurous spirit and have fun. It is important not to become overwhelmed by the changes, especially with being presented with this guide. Back to the concept of the journey – one must learn one step at a time!

**Learning Resources:**
“Toyota Way”, Jeffery Liker
Appendix 1  Why Lean? Presentation by Universal Health Services William Seed
4.1 Trust, Trust, Trust!

Lean/Collaborative project delivery is dependent on building deep trust throughout the team. Trust does not just happen but must be consciously built and begins by understanding how it is connected with 3 assessments that others are making:

1. Sincerity – ethical
2. Competence – operational
3. Reliability – need history

If teams start with an assumption that everyone on the team is sincere in their efforts for the greater project, and that they are part of the team because they are competent in their specialty, or they would not have been chosen to join the team, then the opportunity is to build trust through being reliable. Being reliable means making clear, complete commitments and managing those commitments well.

The following diagram from Steven M. R. Covey’s “The Speed of Trust” indicates the importance of trust:

YouTube – Stephen Covey – Leading at the Speed of Trust
http://www.youtube.com/watch?v=igyxxYSiXYo
4.2 Conditions of Satisfaction

All projects are a network of promises, commitments, or agreements. The promise to deliver the project is a big commitment that is delivered by people in network of commitments. A promise is not a complete promise unless it has clear, agreed-to “Conditions of Satisfaction” (CoS). Project teams must develop written CoS for their project in collaboration with the Owner and Key Stakeholders of the project. CoS are measurable statements that tell the project delivery team what tests a project must pass to be accepted as a success. They should be posted in the Big Room for all to share in understanding.

Conditions of Satisfaction are critical in the way projects are planned. See Section 6.2.1 Collaborative/Pull-planning.

Hand-in-hand with trust is a view that contingency represents a lack of trust. Every person and company that is involved in projects builds in contingency. Why? Because they are uncertain about what is going to happen during the project. Uncertainty is a form of lack of trust. Contingency is waste on a project, yet it is a major part of traditional delivery. It shows up in time, costs and space. Driving out uncertainty is critical to lean delivery. Identifying risks as a team and developing strategies to reduce or eliminate risk is the job of a lean team. But it takes being open with information – ALL information.

Learning Resources:

Appendix 2 Conditions of Satisfaction Examples for other UHS projects
GW Evolution of Conditions of Satisfaction

Appendix 3 Action Workflow Diagram
“The Speed of Trust”, Steven M. R. Covey
“Crucial Conversations”, Kerry Patterson
5
IPD Agreement
(Commercial Terms)

5.1 Consensus Docs 300

UHS implements Consensus Docs 300 as the base document to form the Agreement for Integrated Project Delivery. The agreement is signed jointly by a minimum of the Owner, Architect and Constructor. Other Trade Partners or Key Contributors may be invited to be partner signers of the Agreement. The Agreement requires the team to deliver the project using lean methodologies.

It is quite different than traditional contract agreements in that it is a relational vs. a transactional contract. It is based on building trust, being transparent and open and on the signing parties making decision regarding how they are going to act. It requires collaboration per the agreement:

3.2 COLLABORATIVE PROJECT DELIVERY The Parties agree that the Project objectives can be best achieved through a relational contract that promotes and facilitates strategic planning, design, construction and commissioning of the project, through the principles of collaboration and lean project delivery. This approach recognizes that each Party’s success is tied directly to the success of all other members of the Collaborative Project ConsensusDocs 300 (Standard Form) Page 5 of 47. Team and encourages and requires the Parties to organize and integrate their respective roles, responsibilities and expertise, to identify and align their respective expectations and objectives, to commit to open communications, transparent decision-making, proactive and non-adversarial interaction, problem-solving, the sharing of ideas, to continuously seek to improve the Project planning, design, and construction processes, and to share both the risks and rewards associated with achieving the Project objectives.

The traditional idea of “control” on a project by certain individuals is no longer appropriate. Management and decision-making is by a Management Group:

4.1 MANAGEMENT GROUP The delivery of the Project shall be managed by the Management Group, which shall serve as the decision-making body for the delivery of the Project and shall employ collaborative methods for achieving the highest quality and most efficient and economical delivery of the Project. The Management Group shall be comprised of an authorized representative of the Owner, the Designer and the Constructor. The original Management Group may invite other critical project participants to become members of the Management Group, for purposes of advancing the overall collaborative approach and the best interests of the Project. Any party added as an additional Management Group member shall be entitled to participate in all Management Group functions and shall have a right to vote on Management Group decisions that directly concern that party’s work and area of expertise. The Management Group may also vote to remove non-original Management Group members from the Management Group.

It is recommended that new teams perform a Study Action Team™ to learn about the agreement with a shared understanding. See Appendix 20, Another Approach to Project Delivery: Creating a Shared Mind.
5.2 Choosing Your Partners /Management Group

As stated above, the Integrated Project Delivery (IPD) Agreement is a relational contract. It describes HOW the team members will act, make decisions and manage the project as a collective entity. Therefore choosing partners who will operate in this way is imperative to the success of the team and project. From Consensus Docs 300:

3.4 COLLABORATIVE RELATIONSHIP The Parties each accept the relationship of mutual trust, good faith and fair dealing established by this Agreement and covenants with each other to cooperate and exercise their skill and judgment in furthering the interests of the Project. The Designer and Constructor each represents that it possesses the requisite skill, expertise, and, as applicable, licensing to perform the required services. The Owner, Constructor, Designer and all members of the CPD Team agree to adhere to principles of collaboration based on mutual trust, confidence, good faith and fair dealing. Within the scope of their respective expertise, the Parties shall together actively and continually pursue collaboration in the best interests of the Project. The Parties shall endeavor to promote harmony and collaboration among all Project participants.

Notice the reference to the parties acceptance of a relationship of mutual trust, good faith and fair dealing. This is the basis for choosing partners for the project. The team must be comprised of members who trust each other, are willing and interested in operating by lean approaches, who will contribute to the team through innovating and problem-solving as a whole, and who will focus on optimizing for the good of the project as a whole. This is very different than choosing partners based on a fee structure.

UHS has developed a preliminary questionnaire that can be used during the interview process. It is attached in Appendix 5. It is expected that teams will add to the list for themselves and other teams in order to continually improve the interview process.

IPD projects are managed by the signors of the agreement who form a Management Group. It is important that teams learn to make decisions by consensus, hence the name Consensus Docs. Per the Agreement, a Management Group is the management body or the delivery of the project. It is often also referred to as the Core Group.

4.1 MANAGEMENT GROUP The delivery of the Project shall be managed by the Management Group, which shall serve as the decision-making body for the delivery of the Project and shall employ collaborative methods for achieving the highest quality and most efficient and economical delivery of the Project. The Management Group shall be comprised of an authorized representative of the Owner, the Designer and the Constructor. The original Management Group may invite other critical project participants to become members of the Management Group, for purposes of advancing the overall collaborative approach and the best interests of the Project. Any party added as an additional Management Group member shall be entitled to participate in all Management Group functions and shall have a right to vote on Management Group decisions that directly concern that party’s work and area of expertise. The Management Group may also vote to remove non-original Management Group members from the Management Group.
Frequently Asked Questions about a “Management/Core Group”

These answers are based on and supported by the Integrated Agreement for Project Delivery between Owner, Architect, CM/GC and MEP/FP Engineer (IAPD) prepared for a project team working on a hospital project.

What is a Core Group?
The Core Group includes representatives from the Owner, Architect, CM/GC and MEP/FP Engineer. They provide “governance” for the project – in other words – resolution of cost and schedule questions, resolving personnel conflicts, making sure the goal of collaboration is met and generally setting the strategic direction of the project. The representatives must be close enough to the project to understand the needs of the various parties and senior enough in their own organization to be able to commit resources as required. The Core Group functions in a very open, frank, collaborative way – this requires a certain “chemistry” within the group for it to function effectively. It also implies that there is no “hierarchy” within the group – all are equal in stature and value and all opinions are considered.

Why do we need a Core Group?
The IAPD establishes a fundamentally different way of operating. The parties agree to establish a relationship to jointly deliver the project. The Owner does not buy a design from the Architect and a constructed plant from the CM/GC with all the details, specifications and conflicts inherent in that transaction. The goals of this relationship are: collaborating throughout design and construction with all members of the Integrated Project Delivery (IPD) Team: planning and managing the Project as a network of commitments; optimizing the Project as a whole, rather than any particular piece; and tightly coupling learning with action (promoting continuous improvement throughout the life of the Project). The Core Group provides the leadership and “governance” to see that these goals are met.

What does the Core Group “do”?
The Core Group provides “governance” of the project. This being said, there are some specific responsibilities that they must fulfill:

• They must insure that the IPD Team implements and uses a Production Control System (such as Last Planner System®) The Core Group will encourage all IPD Team members to make “reliable promises,” realistic requests, understand constraints and work to improve the planning system.
• They will closely monitor the team’s schedule and cost performance. Both of these are critical to all team members, especially when incentive programs have been put in place. The Core Group’s responsibility includes review of a preliminary cost model, the SD Cost model, the project estimate and approval of overruns. • The Core Group shall oversee development of design documents, including milestone schedules and the use of CADD techniques. • The Core Group selects the remainder of the project team. They do this in conjunction with the CM/GC and use various methods ranging from “team, qualifications and fee” proposals to lump sum bids. The Core Group may choose to eliminate or add additional contractors as the project proceeds.

How often does a Core Group meet?
The Core Group typically meets bi-weekly. Some Core Groups have found that at certain times during a project weekly meetings are more appropriate. It is suggested that on a quarterly basis, senior staff or management from the parties attend the Core Group meeting to better understand the progress of the project.

How does a Core Group make decisions?
The Core Group will try to make all decisions by consensus.

Can a Core Group change over time?
Yes, new members can be added or removed by the original Core Group. This would typically happen as the project progresses and an organization’s role was begun or completed.

If there is an impasse in the Core Group, how is the issue solved?
In the event of an impasse, the Owner may give directions that it believes are in the best interest of the project.

Can an Owner overrule the Core Group?
There is a detailed “Dispute Resolution” procedure described in Section 41 of the IAPD that provides a means to resolve contentious issues that is similar to that included in more standard contracts. Section 41 also stipulates that subcontractors who are not a party to the IAPD must agree with the resolution procedure.

What is the relationship between the Core Group and Lean Contractors?
Lean Contractors are those brought on to the project as Trade Contractors and later awarded a subcontract for design and/or construction services. These contractors will participate in incentive programs and agree to fully support the goals of an integrated project delivery program. The Lean Contractor staff participates in weekly IPD Team meetings, utilizes the production control system and are considered an integral part of the integrated project delivery model. The Core Group will, on a regular basis, invite the senior leadership of these contractors to participate with them in reviews of the project progress. These reviews will include assessments of the contractor staff performance, the current schedule status and most importantly the financial status of the project as it reflects on the availability of incentive funds to be awarded at project completion.
5.3 Executing the Agreement

Executing the IPD Agreement takes time. It is a VERY different form of agreement and companies should take appropriate time to understand the agreement. It is highly recommended that the signors all read the agreement in sections and come together (phone is fine) to discuss in segments to gain an mutual, shared understanding of what is being signed. It is ideal to have these conversations coached by a facilitator that understands the agreement.

Teams usually work together through a Validation Period (See Section 6.2.3 Target Cost) to determine a Target Cost in which they have confidence that they can deliver. Alignment to a Target Cost is imperative to signing the IPD Agreement. UHS project teams are funded to deliver work through Validation under letters of agreement. Fees for service are determined and tracked openly during this phase. Teams must sign the IPD Agreement prior to submitting for Permitting of the project, unless otherwise agreed to with UHS Management. Initially a pull-plan should be developed to take the team through Validation.

Learning Resources:

Appendix 3  Copy of Consensus Docs 300
Appendix 4  Integrated Project Delivery; An Example of Relational Contracting, Owen Matthews & Gregory A. Howell
Appendix 5  Interview Questions – Wellington
            Sample RFP for Contractors
Operating System
The following mind map diagram is a way to think about lean as an operating system. The principles and tools of lean delivery intertwine to create a system. No one principle or tool can stand on its own. For purposes of this guide, they are given a structure to help the beginning learner ground their thinking and gain a mental picture of the system. In addition, the diagram and this guide focus on the tools and principles that a beginner should start to learn and continue to relentlessly develop. As one shifts in their understanding of lean delivery and their thinking and behaviors will also shift. Then they are ready to start to take lean delivery to higher level.
6.1 Principles

6.1.1 FOURTEEN PRINCIPLES

The following diagram indicates how the principles build upon each other and are needed to complete the full pyramid. Most companies stay focused at the process or tool level on the pyramid below during transformation, thus not realizing long-term success with lean initiatives.

14 Principles as identified in “The Toyota Way” by Jeffery Liker

**Philosophy: Long Term Thinking**
Principle 1: Base management decisions on a long-term philosophy, even at the expense of short-term financial goals

**Process: Eliminate Waste**
Principle 2: Create continuous process flow to bring problems to the surface
Principle 3: Use ‘pull’ systems to avoid over production
Principle 4: Level out the workload (Work like tortoise, not the hare)
Principle 5: Build culture of stopping to fix problems, get right quality first time
Principle 6: Standardize tasks as foundation for continuous improvement & empowerment
Principle 7: Use visual control so problems are not hidden
Principle 8: Use reliable, tested technology that serves your people & processes

**People & Partners: Respect, Grow, Challenge**
Principle 9: Grow leaders who understand work, live philosophy & teach others
Principle 10: Develop exceptional people & teams who follow your philosophy
Principle 11: Respect your extended network of partners by challenging them & helping improve

**Problem Solving: Continuous Improvement & Learning**
Principle 12: Go & see to thoroughly understand the situation
Principle 13: Make decisions slowly by consensus, considering all options, implement rapidly
Principle 14: Become a learning organization through relentless reflection & continuous improvement
6.1 Principles (cont.)

6.1.2 EIGHT WASTES

There are 8 categories of waste identified in “The Toyota Way”, by Jeffery Liker. Most waste in the design and construction industry fall into the same categories. See if you can think of examples of waste in each!

• Overproduction
• Waiting
• Unnecessary transport or conveyance
• Over or incorrect processing
• Excess inventory
• Unnecessary movement
• Defects
• Unused employee creativity

Learning Resources: “The Toyota Way”, Jeffery Liker

6.2 Tools

Many tools exist for teams to deliver on a lean basis. The tools presented herein are just a few and are included in an introductory manner. Much more depth of understanding is needed in order to successfully implement the tools. As you learn about the tools, keep in mind that they are based on the principles, without that understanding the tools become meaningless. Also keep in mind that the tools and principles work together as a system. They are intertwined liked gears, all turning and affecting each other.

6.2.1 COLLABORATIVE/PULL PLANNING

“Collaborative Planning is the foundation by which the team collectively organizes the actions required to meet their goals. It is an approach which profoundly improves the team’s ability to plan, and then deliver, effectively. The focus is on expected outcomes and doing the right work at the right time. Planning and execution are connected through conversations resulting in well-coordinated action and an understanding of the interdependency of the work.” – InsideOut Consulting, Inc.

Collaborative Planning results in: (InsideOut Consulting, Inc.)

• team-wide understanding of value for client
• realistic and achievable plan
• alignment by all performers
• increase in reliability
• diminish or eliminate re-work/unnecessary work
• rapid response to unpredictable circumstances
• capacity being managed
• more simultaneous work
• less problems during execution
• less stress, frustration and overwhelm
• people enjoy their work
6.2.1 COLLABORATIVE/PULL PLANNING (CONT.)

Pull-planning is a method of planning that is based in conversation about requests and promises. Work is planned at the “request” of a downstream “customer”. The “performer” of the work makes a promise with agreed to “Conditions of Satisfaction”. In essence, the work in planned from the “expected outcome or defined milestone” backwards, and becomes more detailed as it is closer to the date of the planning conversation.

“Plans are nothing; Planning is everything.” – Dwight D. Eisenhower

“Planning is the act of conversation that leads to well-coordinated action.” – InsideOut Consulting, Inc.

Planning is linked through conversations; what we SHOULD be able to do, what we CAN do, what we WILL do and what we DID.

The Last Planner System of Production Control

- **Master Scheduling**: Set milestones
- **Phase “Pull” Planning**: Specify handoffs
- **Lookahead Planning**: Make ready & Launch replanning when needed
- **Weekly Work Planning**: Promise
- **Learning**: Measure PPC & Act on reasons for failure to keep promises

*Courtesy of Lean Construction Institute*
6.2.1 COLLABORATIVE/PULL PLANNING (CONT.)

Key aspects of pull-planning are:

- Manage constraints and variances of the project as a team
- Reduce the uncertainty so that the team is better prepared to respond to the unexpected
- Focus on clearly defined outcomes. Note: 50% Design Development is not a clearly defined outcome.
- Planning is done in a pull manner.
- Planning and execution are connected through conversation using requests and promises with clear Conditions of Satisfaction for each agreement.
- Work is made to flow by breaking the work down into smaller increments
- The people performing the work are the ones who plan the work
- Holding regular, short, energetic Check-in Sessions is an important part to keep the team coordinated and to manage the constraints.
- During the design phase at Check-in Session each person answers 4 questions:
  1. What commitments did you complete since the last session?
  2. What commitments will you complete before the next session?
  3. What concerns or constraints do you have regarding your work?
  4. Are you on track to meet the overall work plan?
- During the construction phase the process shifts to using a 6-week look ahead plan for tracking the commitments and constraints
- We track the productivity of the team using Percent Plan Complete or PPC. In the industry on average 55% of what is said will be accomplished by a given time actually is. This is a low percentage and indicative of the problems in the industry. Lean teams strive to reach at least 85% on a regular basis.
- Work is planned using sticky (GM Post-it) notes on a wall (see photos below). The work is then captured in a work register or other format. Often this is an excel spreadsheet that all can easily use.
- There is a continuous learning cycle built-in (Plan-Do-Check Act/Adjust)
6.2.1 COLLABORATIVE/PULL PLANNING (CONT.)

- Promise must have clear CoS
- Next step after making a promise is to manage and keep it

- A request must have clear CoS
- Be sure to negotiate to a promise you can keep

Elements of a Sticky Note – Promise
Action Work Flow

Learning Resources:
Appendix 6  Last Planner System of Production Control
Appendix 7  Intro to Pull Planning GWUH On-boarding Manual Presentation
“Product Development for the Lean Enterprise”, Michael Kennedy
“Joe’s Garage”, William Miller
6.2.2 TRANSPARENCY / BIG ROOM

“Making work ‘transparent’ or accessible and visible to all team members at all times is key to collaboration. The open sharing of work that is still in progress enables others to contribute knowledge that may shape the outcome of the work (refer to Innovation above). Transparency improves predictability by allowing the whole project team, especially the team leaders, to know that quality work is being delivered with a better understanding of its status. Collaborative Delivery tools and methods bring transparency to the work.” – InsideOut Consulting, Inc

Transparency results in: (InsideOut Consulting, Inc.)
- understanding of status of work
- rapid identification of misalignments
- responsiveness to others’ difficulties
- clarity of work product across disciplines
- anticipating and delivering on the needs of other team members
- more coordinated work
- team confidence

An important aspect of lean project delivery is the concept of the “Big Room.” The Big Room is a term to describe a space where all stakeholders in the IPD team can come together and work. As opposed to individuals working in silos in their own offices, this allows for open communication and dialogue, resulting in more efficient and real-time work product, as well as less rework and revision. Teams should plan consistent Big Room days for working together. If teams cannot be physically together, they must look to technological means to implement the concept of working in this manner.

Examples of activities in the Big Room include:
- Collaborative design conversations – set an agenda for the subject of the conversations to ensure the right people are included
- Pull-planning
- Presentations
- Learning opportunities
- Structured Reflections – the team collectively reflects on how they are operating for the purpose of continuously improving their process of working together
- Plus/Delta for rapid improvement
- Collective team sessions and smaller break-out sessions
- Mutually developing working agendas for big room days

Teams should strive to have the space set up in a manner to support their work and be flexible. This may include:
- Smart Boards
- Wireless internet connectivity
- Lots of wall space for posting work, financials, Conditions of Satisfaction
- Dedicated space for the Pull-plan with space around for gathering to plan o Supplies for Pull-planning
- Break out rooms for smaller meetings
- Conference calling set up o Post the call numbers and pass codes on agendas and in the rooms o GoToMeeting or other video conferencing set up o Provide flip chart pads and/or marker boards
- Restrooms and kitchenette area for coffee/water/snacks
6.2.2 TRANSPARENCY / BIG ROOM (CONT.)

Teams should post information on the walls to serve as reminders and guides to the team. This should include things like:

- Conditions of Satisfaction for the project (Appendix 2)
- Rules for Engagement in the Big Room (Appendix 8)
- Pull-plan with Plan Percent Complete (PPC)
- Project data/plans, etc.
- Financial tracking data – keep up to date
- A3’s

**Lean principle 14:** Become a learning organization through relentless reflection and continuous improvement.

Lean thinking and behaving integrates a continuous improvement cycle. This cycle is one of Plan-Do-Check-Act/Adjust known as PDCA. The following is an adaptation of PDCA to a project called the Four P’s and is critical to the successful development of a project. An Owner’s challenge is to predict the cost, make a business case, and decide to proceed, then deliver and operate. Most projects predict a cost, decide to proceed then pay whatever it takes to build and operate. UHS looks to **predict** the cost, **plan** to the prediction, **perform** to the plan while perfecting along the way and **perfecting** from one project to the next. This approach applies to each participant of the project from design parties through the trades. It is applicable to every scope within the project, each day of work and every meeting.

![PDCA Diagram](image)

**The fundamentals of the projects are based on the Four P’s:**

**Predict:** UHS is an investor-owned system. Therefore, our client must accurately predict the cost of a project prior to its start and maintain or reduce that cost as the project moves to completion.

**Plan:** Planning is extensive and constant. The effort should involve a significant amount of innovation.

**Perform:** Everyone is expected to deliver on promises.

**Perfect:** Lean is a method of continuous improvement.

**Learning Resources:**

- Appendix 8 Big Room Rules of Engagement
- Appendix 9 Email Etiquette
- Appendix 10 Examples of Project Big Room Agendas
- “Toyota Culture”, Jeffery Liker
6.2.3 INNOVATION / TARGET COST DELIVERY

Target Cost Delivery is a cornerstone of lean project delivery. It is comprised of Target Value Design (TVD) and Target Value Production (TVP). The Agreement requires that the team align around a Target Cost for delivering the project early in the project, during the business case development and then validate the Target Cost through a validation period. The graphic below indicates how Target Cost Delivery is addressed throughout the phases of a project.

Target Delivery is upside down and backwards to traditional project delivery costing. Therefore it is also a hard concept for teams to grasp. It is a very different model from design, estimate in review, cost and value engineer – a traditional process full of waste. Keeping in mind that lean is about identifying value and taking only actions to deliver value, clients do not value the process of rework and loss of quality that comes from “value engineering.”

Target Cost Delivery is a project approach that drives design and production (construction) to deliver to defined Conditions of Satisfaction (value) within project constraints including cost and time. It generates a “creative tension” between driving up quality YET driving cost down.

Teams develop the Target Cost through consensus with each other and the owner. Often teams start with benchmarking similar projects in a similar market on a square foot basis, then deciding on a lower target. Delivering to Target Cost results in savings not only for the client but the entire team.
6.2.3 INNOVATION / TARGET COST DELIVERY (CONT.)

An approach for designing to the Target Cost is outlined in Appendix 11. It involves keeping a “creative tension” throughout decision making. This is often referred to as “no-compromise goals.” For a better understanding of this, refer to Chapter 5 of the “Toyota Way” by Jeffery Liker. Traditionally we describe a 3-legged stool, the legs being quality, price and time. It is said that a project can deliver on 2 but not all 3. Target Cost Delivery proves this to be wrong. Clients can have all 3 and project teams must strive to deliver on all three aspects. Driving out waste in the system and continuously improving on their delivery process are critical ways in which teams reach target cost.

Innovation is equally important for delivering to target cost. Without changing the way they design and produce projects, teams will struggle to meet target cost and likely fall back on traditional actions and behaviors that don’t work. Innovation in this context means doing things that are not traditionally or usually done on projects.

**Eliminating Contingency** is a prime goal of a lean project team. Contingency is waste. When viewed this way, it becomes imperative that project teams actively reduce uncertainty and raise the level of reliability for the project. **Open book management** is required to drive to a target cost. Teams must identify true project direct costs, which means no contingency included. Risk must be managed by identifying possible risks with associated probable costs. Then actively working to address the risk to reduce or manage it as a team. Contingency as related to trust is addressed in Section 4.2.

Project costs are comprised of direct costs, profit/overhead and contingency. When contingency is hidden throughout it represents a huge portion of project costs. Identifying contingency and pooling it together to manage risks becomes the additional shared profit pool for IPD teams to share. Understanding that eliminating the need for hidden contingency results in $$$ for the company via the shared profit pool metrics.

**Following are some means or achieving Target Cost Delivery.**

**Collaborative Conversation** before drawing is a form of innovation during the design process. In the lean context this means including ALL relative stakeholders and perhaps others as provocateurs in designing an aspect of the project IN CONVERSATION prior to drawing. Stakeholders must include constructors and cost estimators to influence the decisions early on. All stakeholders arrive at mutual consensus during the conversations and know what their work consists of upon conclusion. This means that engineers do not have to wait (waste) for the architects to draw everything before they can do some work. Here are pictures of teams in collaborative conversation.
6.2.3 INNOVATION / TARGET COST DELIVERY (CONT.)

Set-based Solutions is a critical aspect of lean design. Traditionally teams make decisions from narrow perspectives of their specialty or discipline – “knowing” what is best. Those decisions become integrated into the design early on and often need to be revisited due to other project constraints resulting in rework, OR the right thing is not actually built. Set-based solutions involve looking at multiple options early on from a broader, collaborative perspective. Options are thoroughly considered from all stakeholders and from the perspective of the whole project. The team narrows the options, choosing the best one for the project at a time that is right. This “right time” is referred to as the “last responsible moment”. When decisions are made too soon, they may not be the best decision and may be influenced by information that emerges at a later time. Last Responsible Moment decisions should be identified on the pull-plan.

A3 Thinking/Decision Making Process is used to analyze, document and lead to alignment on decisions for the sets. A3 refers to an 11x17 piece of paper used for documenting the process. However, the A3 Process is way more. It is a process that tells a clear story and is about the underlying thinking. It is a documented representation of the thinking process behind a decision. It must include all stakeholders at a minimum in order for the process to render a collaborative, decision made by consensus. Appendix 12 is a presentation that describes the A3 Thinking Process.

Choosing by Advantages (CBA) is a powerful tool for sound decision making that supports the A3 decision making process. The A3 process includes an analysis step; conducting a CBA is a way to arrive at a sound decision. From www.decisioninnovations.com

Decisions must be based on the Importance of Advantages!

Compared with the methods in common use today — including such methods as Choosing By Advantages and Disadvantages, the pros and cons methods, the so-called Rational Methods, and others — the CBA methods are simpler and faster, and they produce better decisions. Those who learn and apply the CBA definitions, principles, models, and methods are able to significantly improve the quality of their lives and the lives of others by improving the quality of their decisions. Because CBA helps good decision makers become excellent and excellent decision makers even better, more and more individuals, families, and organizations are learning and using the CBA methods. For example, CBA is being used in several government agencies, including the U.S. Forest Service, the National Park Service, and others. As another example, it was successfully used by an interdisciplinary decision-making team — with representatives from the Sierra Club, the Audubon Society, land developers, government agencies, and others — to select a highway location for the 2002 Winter Olympics.

What is very exciting is that CBA strengthens interpersonal relationships in families, as well as in business organizations and government agencies. CBA is a major breakthrough in the art of decision-making.

See Appendix 13 for examples of CBA decisions.
6.2.3 INNOVATION / TARGET COST DELIVERY (CONT.)

Building Information Modeling (BIM) is a tool that supports lean delivery. It allows teams to fully understand the implications of the design early on by detecting clashes and to sequence work. It provides the opportunity for “drawing once” to become a reality. Re-drawing work in the form of shop or fabrication/detailing drawings is considered waste. When trade partners are included in the design process, they can be the producers of the models/drawings that are not only used for Construction Documents and Permitting, but for the final fabrication and production. Furthermore, the use of BIM allows for pre-fabrication or pre-assembly of portions of work. Producing sections of work off-site enhances the team’s ability to deliver better quality and in reducing the schedule. A project teams using exterior panel systems assembled and hung from the inside of the building cut a production schedule from 11 months to 4 weeks for close in of the building. BIM affords the opportunity to dramatically change a production process from the traditional stick by stick sequence that extends of long periods of time.

Learning Resources

Appendix 11 Target Value Design, Lean Project Consulting
“Managing to Learn” – John Shook
Appendix 12 A3 Thinking Process, InsideOut Consulting
Appendix 13 Examples of CBA Decisions
Appendix 14 Target Cost Delivery Presentation, InsideOut Consulting
“The Toyota Way” – Chapter 5, Jeffery Liker
www.ewenger.com/theory, Community of Practice Informational Website
6.3 Team Organization

(Organization)
During design, lean projects teams organize in a manner conducive to cross-discipline collaboration. The organization is in “clusters” sometimes also referred to as “components”. The clusters are developed to address or design a particular aspect of the facility. The clusters are comprised of team members who are appropriate to the system or aspect design and must include estimating and constructors as part of the group. The clusters are responsible for planning their work and for delivering it to the target cost associated with their portion of the work. This is why real-time-estimating is important in the clusters. The clusters will change with the project as it develops. See Appendix 14 for a PowerPoint presentation of a particular project’s clusters.

Learning Resources:
Appendix 15  Cluster Group PowerPoint (Temecula)
Recall the 4P’s Pyramid from section 6.1 and the top segment of the pyramid:

**Problem Solving:** Continuous Improvement & Learning

Continuous Learning IS what lean is about. It is a major differentiator for lean delivery. Teams must incorporate proactive, planned ways to advance lean and to continuously learn to better their delivery. Teams often feel too busy to take time out for learning and this is a mistake.

Developing a Community of Practice (CoP) is an approach for teams to ensure that they continuously advance their lean learning. See Appendix 16 for an A3 for Advancing the Skills of Lean Teams. This A3 describes how a CoP can be instrumental to a team’s development.

**Learning Resources:**
- Appendix 16  A3 Advancing Skills of Lean Facilitators
- Appendix 17  COAA Project Leadership Awards Nomination for GW
- Appendix 18  GWB Story
- Appendix 19  Links to Informational Videos
- Appendix 20  Another Approach to Project Delivery: Creating a Shared Mind
- Appendix 21  Project Delivery is Broken: If’s it Broke, Fix it
- Appendix 22  Learning Guide for a High Performing Team
Determine Project Target Cost Estimate
Assemble Team Including Major Trade Partners and Engineers
Determine Project Budget

Apply for Permitting
Sign IPD Agreement
Funding Approval
Request Funding for Project
Validate Target Cost

Project Definition
Validation
Design Documentation
Construction
Learning Resources:

Appendix 1  Why Lean? Presentation by Universal Health Services William Seed
Appendix 2  Conditions of Satisfaction Examples GW Evolution of Conditions of Satisfaction
Appendix 3  Consensus Docs 300 Insert Consensus Docs 300
Appendix 4  Integrated Project Delivery; An Example of Relational Contracting by Owen Matthews and Gregory A. Howell
Appendix 5  Interview Questions – Wellington Sample RFP for Contractors
Appendix 6  Last Planner System of Production Control
Appendix 7  Intro to Pull Planning GWUH On-boarding Manual Presentation
Appendix 8  Big Room Rules of Engagement
Appendix 9  Email Etiquette
Appendix 10 Examples of Project Big Room Agendas
Appendix 11  Target Value Design by Lean Project Delivery
Appendix 12  A3 Thinking Process Presentation by InsideOut Consulting
Appendix 13  Examples of CBA decisions
Appendix 14  Target Cost Delivery Presentation, InsideOut Consulting
Appendix 15  Cluster Group PowerPoint (Temecula)
Appendix 16  A3 Advancing Skills of Lean Teams
Appendix 17  COAA Project Leadership Awards Nomination for GW by Bernita Beikmann, HKS Architects
Appendix 18  GWB Lean Story
Appendix 19  Links to Informational Videos
Appendix 20  Another Approach to Project Delivery: Creating a Shared Mind, Kristin Hill, Christine Slivon, John Draper
Appendix 21  Project Delivery is Broken: If’s it Broke, Fix it, Kristin Hill
Appendix 22  Learning Guide for a High Performing Team
Universal Health Services, Inc.

Facilities
236 Hospitals and Ambulatory Care Treatment Facilities:
- 26 Acute Care Hospitals
- 201 Behavioral Health Facilities
- 9 Outpatient Facilities & Surgical Hospitals

UHS operates facilities in 37 states, D.C. and Puerto Rico

Revenue
2010 Net Revenue $5.6 Billion
- Acute Care Services $3.8 billion (67%)
- Behavioral Health Services $1.75 billion (31%)
- Outpatient Treatment Centers $29 million (1%)
- Other $73 million (1%)
Design & Construction
How Can We Help You Grow?

William R. Seed, Staff Vice President

What We Do
- Pre Acquisition Assessment
- Capital Facility Upgrades
- Concept Design/Feasability
- Equipment Planning
- Construction Implementation
- Engineering Support
- Utility Cost Management
- Master Planning

Capital Project Spend
- 2007 $439 million 124 projects
- 2008 $415 million 93 projects
- 2009 $380 million 65 new projects
- 2010 $319 million 35 new projects
- 2011 $400 million 100 new projects

Forget IPD
Let’s Bid, the Market is Great!
Bid Day

DESIGN*BID*BUILD
What did you just Buy?

$10MM Cost = $9MM + $1MM Profit
$9MM Construction Cost

What did you just buy?

1. Contentious partners whose primary focus is to get that profit back.
2. Only what is indicated in the Bid Documents.
3. Arguments, Delays, Change Orders.
4. A Group of Trades who most likely have very little understanding of your needs, that have never worked together.

OPENING DAY...$10MM Cost...$11 MM Cost... ???

What is in Cost?

$9MM = $4.5MM Value + $4.5MM Waste

= $4.5MM Value + $2.25MM Unavoidable Waste + $2.25MM Avoidable Waste

Avoidable Waste

- Incomplete information
- Duplicated effort
- Lack of design knowledge
- Significant Paperwork
- Misunderstanding design intent
- Rework
- Inappropriate scheduling
- Poor Work
- Poor logistics
- Hunting, Gathering
- Insufficient/Incorrect Material
- Mismatched Systems
- Unused Creativity

How about we give the Trades the Profit and Incentivize them to Eliminate Avoidable Waste?

BID DAY

$10MM Cost = $1 MM Profit + $4.5MM Value + $2.25MM Unavoidable Waste + $1.125MM Avoidable Waste

* Coordinated Collaboration Efforts
* Eliminate Changes and Waste
* Do the work right one time
* Empower the work force to decide

OPENING DAY

$8.875MM

Appendix 1
TEXOMA MEDICAL CENTER
Conditions of Satisfaction
Results
• reduce cost by $4 million—overall goal is $94 million
• deliver project in 17 months—November 2009.
• no punch list
• no injuries
• no rfi’s
• no change orders
• no rework
• Final construction cost was $97.9 million
  • $1.7 million in savings pool
  • $7 million in value adds
• project delivered first week in December despite 87 rain days
• no punch list at owner turn over
• Only 4 minor recordable injuries
• 190 rfi’s
  • 40 related to early steel package
  • many were confirming
• $1.4 million in change orders
  • $1.1 million was owner driven
• rework greatly minimized through collaborative efforts

Let’s Back Up!
Ever wonder:
who decided to build Redundant Steam Systems?
Why so many Fancy Doors?
Why Custom Air Handlers?
Why is the Roof System so Expensive?
Who wrote the Duct Cleaning Specification?
Why 6 Band no Hub Connectors?
Why these Recessed Door Pockets?
Why are these Details not Buildable?
Why am I paying a Premium for Window Extrusions?

What if you could pick?

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Better</th>
<th>Best</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chillers</td>
<td>300</td>
<td>325</td>
<td>350</td>
</tr>
<tr>
<td>Generators</td>
<td>200</td>
<td>250</td>
<td>310</td>
</tr>
<tr>
<td>Roof</td>
<td>50</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Wall System</td>
<td>100</td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>Flooring</td>
<td>5</td>
<td>7</td>
<td>9</td>
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<tr>
<td>Glass</td>
<td>10</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Elevators</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>

Real Trade Pricing
Total Impact of Cost
No Value Engineering

...And postpone the decision until the last responsible moment?
...Giving latitude to make the Value Decision while new issues pop up?

HOW?
Form Team from the Start
Establish Target Value Design
Design to a Detailed Budget
Set Based Design with a Conceptual Estimator
Take advantage of Trade Knowledge
Create a learning Innovative Environment
Create B.H.A.G.
Get Involved!!
### Appendix 1

#### Background

In York, 21st Century Schools was assembled to take on the challenge of building a K-12 education center. By leveraging the expertise of Turner LMC, the project was able to work closely with the community to identify and address the needs of the students. The school was designed with a focus on sustainability and energy efficiency, making it a model for future educational facilities.

#### School Site

- **Address:** 123 School Rd, York, NY 11066
- **Size:** 100,000 sq ft
- **Cost:** $45 million
- **Funding:** State and Local Funds

#### Project Team

- **Architect:** Turner LMC
- **Engineer:** Davis Partners
- **General Contractor:** Turner Construction

#### Construction

- **Start Date:** September 2020
- **Completion Date:** December 2023

#### Key Milestones

1. **Site Preparation:** September 2020
2. **Foundation:** October 2020
3. **Structural Frame:** November 2020
4. **Electrical and Plumbing:** December 2020
5. **Interior Finishes:** January 2023
6. **Final Inspections:** February 2023

#### Budget

- **Total Budget:** $50 million
- **Funded by:** State and Local Funds

#### Schedule

- **Pre-Construction:** 6 months
- **Construction:** 36 months
- **Post-Construction:** 6 months

#### Risk Management

- **Insurance:** Comprehensive General Liability
- **Surety:**mux

#### Contractual Agreements

- **Design-Build Agreement:** Turner LMC
- **Construction Contract:** Turner Construction

#### Project Team

- **Principal:** John Doe, AIA
- **Project Manager:** Jane Smith

#### Contact Information

- **Phone:** 555-1234
- **Email:** info@yorkschool.com

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#### Appendix 2

- **Contact:** John Doe, AIA
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#### Appendix 3

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#### Appendix 4

- **Contact:** Mike Brown, CFO
- **Phone:** 555-9876
- **Email:** mike.brown@yorkschool.com
GWUH Radiation Oncology Relocation
Conditions of Satisfaction

**Comprehensive Finish Schedule** that incorporates elegance and quality yet fits within the budget

**Impeccable Coordination** that results in no field conflicts or system compromises

**No Disruptions to Other Building Tenants** yet work is completed without delays or interruptions

**Rapid Mitigation of Existing Condition Discoveries** without cost or schedule impacts

**Smooth Operational Transition** from Warwick to 1250 without disruption to patient care activities

**Integrate Field Staff into Innovation Process** by establishing a Lean Introduction Program

**Reward Field Staff for Innovation** without negatively impacting the budget

**No Submittals for Commodities and Repeat Items** yet satisfy specification and contract requirements

**Define or Develop a Standards Book** that can be used for all GW projects yet customizable for specifics

**All Partners Realize Their Anticipated Profit** without overstating the actual cost of the work

**Zero Defects in Permit Drawings** by...... yet........

**Establish a Lean Savings Pool** to reward innovation and participation yet stay within budget

**Zero Deficiencies During AHJ Inspections** by...... yet........

**Pull Plan Scheduling Throughout the Project** so that at project completion all trades are proficient with this process

**Publish One (1) Whitepaper Per Month** serve as study action for the team
Conditions of Satisfaction

1) Project Delivery Success
• Maintain Conditional Use Permit by securing major modification approval in November 2010
• Maintain or reduce the Target Value Cost of $144M for 140 beds
• Deliver the Owner’s Manual six months prior to opening (approx 3rd quarter 2012)
• Certificate of Occupancy by the 1st quarter of 2013
• Construction safety reflected by ?

2) Project Team Participation and Satisfaction
• Every team member firm finishes this project with a profit
• Secure one new project as a team by the issuance of the Certificate of Occupancy
• Two visitors (owners/industry colleagues/additional team firm employees) in the Corona Big Room per month
• Two or more educational presentations in the Corona Big Room per month
• Every team member an active participant in at least one lean organization
• Predictable outcomes as a result of labor efficiency
• Reliability and trust as shown by measuring promises made versus promises kept

3) Community and Social Responsibility
• Positive press in the local and regional press
• Physician buy-in as reflected by hiring rates
• Neighborhood satisfaction score of 3.5 (out of 4) – survey to be conducted

4) Relationships with Regulatory Agencies
• Maintain promise of UHS being OSHPDs best customer
• Zero defects in all agency submittals
• Drawings in OSHPD possession for a time period 15% lower than the lowest established records
• “No excuses” surrounding OSHPD, City, etc. for not meeting COS, milestones, etc.
• Trade partners considered a business partner of OSHPD at the completion of the project

5) Facility Operational Success
• 30% more operationally efficient than the best performing UHS facility
• Patient Family Centered Care Delivery and Design reflected by HCAHPS scores of ____________.
• Safe Patient Care Environment by improving/reducing ______________.
• Community endorsement by the use of our facilities versus others in the area

Appendix 2
Wellington Bed Tower
Conditions of Satisfaction

- Fully predictable time line by fully understand the time requirements necessary to permit and construct the Bed Tower and Kitchen then predict a completion date by September 1, 2011. We will meet this date by working together across traditional contract boundaries to help remove any hurdles and there will be no time slippage from commitment to completion.

- Fully predictable delivery cost by fully understanding the direct costs and identify cost risks necessary to establish a final project budget by September 1, 2011. We will work across traditional contract boundaries to understand the value and cost of innovated concepts and incorporate innovated ideas from the build partners to obtain the best value. There will be no change orders driven by the documents or scope misunderstandings, the final construction GMP will not exceed the identified value in the final budget and an incentive pool will be created, defined and shared among all team members.

- Fully predictable end product by communicating with the end users and occupants consistently and effectively such that there will be no surprises to the form, fit or function of the final product or the process. We will design the Kitchen one time and we will communicate any and all disruptions to the facility to safely and predictably understand all disruptions to the care and use of the campus. We will meet a 100% ratio of predicted disruptions to actual disruptions throughout the process.

- Exceed UHS’s expectations in an effort to get the next project by innovation, continuous improvement, staying on budget, delivering quality, value and communications up to 24 months after completion.

- No warranty callbacks due to QA, staff training, OM manuals and completing last 10% of work...

- Up to 150% Profit yet still maintain scope, quality, without lowering wages, impacting facility operations, reimbursable expenses or hurting other trade partners and implement a “no OT policy”.

- Improve production & efficiency by maintaining safety, close parking, carefully coordinated staging, economic transportation, JIT delivery, field coordination, flow of work, start times, innovation, risks, clean site, pull planning and schedule to drive design.

- Complete project with ZERO accidents and repeat near misses by employing full time safety inspector, take appropriate action on near misses, careful planning, educations, awards program, obtaining partners corporate support and hold everyone accountable.

- Deliver a lower cost project to increase ROI but still deliver customer expectations, maintain scope, quality, without lowering wages, impacting facility operations, reimbursable expenses or hurting other trade partners.

- No avoidable rework in the field caused by team breakdowns, failure to communicate or failed planning efforts, and conduct End User virtual & actual mockups, walk-thru’s, detailed & accurate BIM, systematic QA, reduce mgmt turn-over, finished product mockups and project team conversations.

- Generate community excitement by ground breaking on 9/14, team up with Marketing, provide public tours, accident free worksite, use local vendors and artists, BIM for Marketing, solicit feedback and use of effective signage.
- Utilize lessons learned from Phase I.
- Provide the minimal amount of disruption to the facility.
- Planned, controlled and properly communicated disruptions to the facility.
- Have the best UHS pull plan.
- Perform proper coordination and planning to eliminate delays and cost overruns.
- Complete project within the target value and schedule.
- Utilize an integrated project team to provide drive a higher level of value to the client and to reduce individual risk.
- Create a safe environment for all team members.
- Zero injuries.
- Break old habits-break down barriers.
- Ask why—spend the money as if it was out of your own pocket.
- Have an open and trusting relationship with OSHPD.
- Each team member will realize a fair and reasonable profit.
- Continued innovation throughout the design and construction process.
Corona Regional Medical Center Upgrades
Conditions of Satisfaction (COS)

1. Utilize an integrated, lean approach to maximize the value to the client and improve reliability in the design, cost, and schedule, using a Target Value (Budget) of $23 million.

2. Prioritize system upgrades and ensure upgrades are functional to 2030 with zero unplanned interruptions to the existing facility, and improving plant conditions and operations in that timeframe.

3. Upgrade existing facility to meet criteria for compliance to 2030 with current regulatory requirements, including the completion of construction by applicable deadlines.

4. The team assures there will be a predictable outcome for all aspects of the project.

5. Stay committed to Lean Learning and Value Education throughout the project and our respective organizations…taking it forward.

6. Keep communications flowing with open dialogue, teamwork, and cooperation allowing us to proactively resolve conflicts within the team.

7. All parties represented on the team will realize a fair and reasonable profit for the successful validation, design, and construction of the upgrades project. Share profit and loss equally as part of the team commitment.

8. Individuals’ enjoyment of the lean process will continue until the project is complete, as a success factor for the project. End as friends.

9. Team collaboration will be utilized to transform – and essentially eliminate - the traditional RFI and submittal processes.

10. The core team and trade partners will commit to pull planning, and will identify resources and flows for the project schedule, in order to provide the most efficient schedule for the project, and to improve trade productivity.
CONSENSUSDOCS 300
STANDARD FORM OF TRI-PARTY AGREEMENT FOR COLLABORATIVE PROJECT DELIVERY

This document was developed through a collaborative effort of entities representing a wide cross-section of the construction industry. The organizations endorsing this document believe it represents a fair and reasonable consensus among the collaborating parties of allocation of risk and responsibilities in an effort to appropriately balance the critical interests and concerns of all project participants.

These endorsing organizations recognize and understand that users of this document must review and adapt this document to meet their particular needs, the specific requirements of the project, and applicable laws. Users are encouraged to consult legal, insurance and surety advisors before modifying or completing this document. Further information on this document and the perspectives of endorsing organizations is available in the ConsensusDOCS Guidebook.

TABLE OF ARTICLES

1. AGREEMENT
2. DEFINITIONS
3. COLLABORATIVE PRINCIPLES
4. MANAGEMENT BY THE MANAGEMENT GROUP
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6. DEVELOPMENT OF DESIGN AND COLLABORATIVE PRECONSTRUCTION SERVICES
7. PROJECT PLANNING AND SCHEDULE
8. PROJECT BUDGET, COST MODELING AND PROJECT TARGET COST ESTIMATE
9. DESIGNER'S COMPENSATION
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17. COST OF WORK
18. PAYMENT
19. RIGHT TO AUDIT
20. CHANGES
21. INDEMNITY, INSURANCE AND BONDS
22. SUSPENSION, NOTICE TO CURE AND TERMINATION OF THE AGREEMENT
23. DISPUTE RESOLUTION
24. MISCELLANEOUS
25. CONTRACT DOCUMENTS

This Agreement has important legal and insurance consequences. Consultation(s) with an attorney and with insurance and surety consultants are encouraged with respect to its completion or modification.
INTEGRATED PROJECT DELIVERY
AN EXAMPLE OF RELATIONAL CONTRACTING
Owen Matthews1 and Gregory A. Howell2

ABSTRACT

Maximizing value and minimizing waste at the project level is difficult when the contractual structure inhibits coordination, stifles cooperation and innovation, and rewards individual contractors for both reserving good ideas, and optimizing their performance at the expense of others. This paper describes an innovative contractual structure that aligns the interests of all contractors with the objectives of the lean delivery system. The approach, requirements for implementation, and results obtained will be described and a brief reflection on theory offered.

Key Words
Contract, Lean Delivery, Project Organization, Primary Team Member, Pact, Relational Contracting, formula, Integrated Project Delivery

Westbrook is a 55-year-old mechanical contractor located in Orlando Florida. Chilled water systems have been the heart of Westbrook’s construction business over the years. Westbrook also offers air-conditioning, plumbing and electrical services to residential and commercial Clients.

Westbrook has participated in a number of design build projects, sometimes as a subcontractor and sometimes as a prime contractor. They could not help but notice that when they worked as a subcontractor, promises of cooperation and teamwork never seemed to reach their potential, and the results often fell short of the team member’s expectations. This happened even when they worked with high-caliber and well-intentioned General Contractors (GCs) and for clients who had bought into, and expected to receive the benefits of a design/build cooperative effort. Even as the prime contractor they were unable to sustain a spirit of teamwork through the end of the project. The instinct among all parties for self interest was too keen especially in instances where individual profit potential might have eroded somewhat throughout the project.

Maximizing value and minimizing waste at the project level is difficult when the contractual structure inhibits coordination, stifles cooperation and innovation, and rewards individual contractors for both reserving good ideas, and optimizing their performance at the expense of others. What was wrong? What was standing in the way of their being able to work as a true team; one able to work together to maximize value while minimizing waste throughout the process?

In pursuit of answers to these questions, they have been working over the past five years with a consortium of design professionals and construction practitioners to determine if there might not be a better way to organize themselves to deliver a project than the models that are common today. For four years now they have been meeting for breakfast twice a month to further this pursuit and in the process have built relationships that form the basis for Relational Contracting.

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Owen Matthews

FOUR MAJOR SYSTEMIC PROBLEMS WITH THE TRADITIONAL CONTRACTUAL APPROACH

Problem 1: Good ideas are held back
The Mechanical, Electrical and Plumbing (MEP) contractors and other major trades were generally brought into the process by the GC once the drawings were at the Design Development (DD) stage in order to establish a competitive price. Even though the trades were frequently consulted through the design process, there was no real commitment to or from them because a number of different companies representing the same trades were involved. As a result, each of the trade contractors saved their best ideas in hopes of gaining a competitive edge during the “bidding process.” Many times these ideas were very good. Time and the opportunity for innovation among the trades were lost as the design team attempted to revamp their designs to accommodate the best of these late arriving ideas.

Problem 2: Contracting limits cooperation and innovation
A systemic, but less obvious problem was the system of subcontracts that link the trades and form the framework for the relationships on the project. The prime contractor held the contract for every consultant and subcontractor. Long and onerous subcontract agreements attempted to spell cut in great detail exactly what each subcontractor was to provide (and by deduction exactly what he was not to provide), rules for compensation, and sometimes useful, if unrealistic, information about when work was to be performed.

The 20 to 30 page subcontracts mostly dealt with remedies and penalties for noncompliance. These contracts made it difficult to innovate across trade boundaries even though the work itself was frequently interdependent. (It is hard to have a wholesome relationship with another when you have a charge of dynamite around your neck and the other holds the detonator.) Of course, horse trading always takes place anyway, but for “equal” horses. Trading a small increase in effort by one contractor for a big reduction for another, a horse for a pony was almost impossible.

Problem 3: Inability to coordinate
While some projects held “partnering” sessions, there was no formal effort to link the planning systems of the various subcontractors, or to form any mutual commitments or expectations amongst them. Project organizations looked like 20 or more rubber balls, representing subcontractors, all referred to a single point by long elastic bands. When the connection point jiggled, the balls jiggled in all random directions colliding with each other in unusual and unexpected ways.

Problem 4: The Pressure for local optimization
Each subcontractor fights to optimize his performance because no one else will take care of him. The subcontract agreement and the inability to coordinate drive subcontractors to defend their turf at the expense of both the client and other subcontractors. Remember that everyone on the project other than the prime contractor is a subcontractor. These subcontractors frequently, in their life outside of the subcontract, may be generous, caring and professional. However, since right or wrong is defined by the subcontract, they, more often than not, take on a very legalistic and litigious stance becoming an army where the rules of engagement are “Every man for himself.”
APPRAISING THE SOLUTION

Could they organize themselves to function as a single company with unified goals and objectives? Could independent design firms and construction companies actually find a way to integrate project delivery? To use the earlier analogy, was there a way to take all of these rubber bands and connect each to the other so that they could all move in the same direction? A new set of questions suggested the new approach:

What if every member of the design build team shared completely the responsibility for the entire project and set about correcting deficiencies or problems wherever they popped up without regard to who caused the problem or who is going to pay for it? What if all of the construction members were friends looking out for the interest of the Client and each other, applauding the successes of each other and sharing the pain of each other's failures? What if all of the design and construction entities on a project could be organized in such a way that they all functioned as if they truly were a single company with a single goal and with no competition amongst themselves for profit or recognition?

They were not naive. They knew that aligning interests, objectives and practices, even in a single business, is not easy or automatic; however, the advantages looked real, and they had powerful ties and long standing relationships with the companies that could make it happen. A new process which they called Integrated Project Delivery (IPD) was taking shape. Primary Team Members would include the Architect, key technical consultants as well as a general contractor and key subcontractors.

There are two types of contracts, transactional and relational:
- transactional where exchanges are made for goods and services,
- relational contracts where the relationship "takes on the properties of a mini-society with a vast array of norms beyond those centered on the exchange and its immediate processes.

Without benefit of these definitions in the beginning, the Team was never the less creating a network of commitment built around relational contracts.

Two Principles Govern Their Team Relationship

With the IPD process, two principles define the relationships between the Team Member that holds the prime contract with the client and between that Team Member and the other Primary Team Members (PTMs).

1. With IPD, all PTMs are responsible for all provisions of the prime contract with the Client.
2. Primary Team Members share the risk and profit for total project performance.

The Prime Contract

A single contract binds the IPD Team to the client. The prime contract may be any one of a number of standard forms that are available. It spells out the commercial terms and defines the scope, schedule and cost of the project. One entity signs the prime contract.

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3 Integrated Project Delivery (IPD) is a registered business mark with the US PTO
don’t cut him loose. They are not involved in a search for the guilty. They are involved in applying all of their talents to getting the job done. They recognize that everyone makes mistakes and are willing to jointly absorb the cost for those honest mistakes. They are comfortable in this because they have chosen team members with integrity, character and competency; Team Members who are trustworthy.

THE IMPACT OF IPD ON PROJECT DELIVERY

On the design process
There is no incentive for team members to hold back ideas. This effect is very powerful in reducing project costs and enhancing the “value engineering” process. Value engineering takes place at the beginning of the project and throughout the project. It is “built in” and not “tacked on” at the last minute as a cost saving or profit enhancement tactic. It is amazing how quickly effective solutions can be devised when there is no concern over the marketing plan for pay. This creativity always benefits the client, however, when the GMP is set too late in the process the IPD Team Members are limited in their participation in the savings brought about through this creativity.

Cooperation, Innovation and Coordination
All of the primary team members wear the same hardhats on the job with the same logo. They all work under one general superintendent who has total authority from the Primary Team Members to direct the project to achieve the most efficient and lowest overall cost delivery. Field problems are quickly resolved based on the lowest perceived overall cost and least impact principle.

The Team decides what positions such as Project Executive, Director of Design Services, Director of Construction Services, Project Manager, Project Superintendent, Project Accountant, Manager of Information Technology, and System Coordinator are filled for the particular project at hand. These positions are filled with the best available person from any of the Primary Team Members. They become direct job cost and the company from which they came is reimbursed for the time they spend on the project.

Each person assigned a project leadership position works for the Team, is paid by the Team, and is responsible to the Team in this way, their allegiance is to the Team and the project and not to their own sponsoring company. All have the traditional authority and responsibilities of the positions that they are filling.

The principals of the companies developing the IPD process meet two mornings a month for breakfast and fellowship. They discuss the IPD concept in order to refine and further develop it. Attendance at these meetings, and the involvement and “buy in” of the key stakeholders is crucial to the success of the process. These meetings underpin the broader network of relationships that hold the projects together.

Each month the PTMs are reimbursed based upon their actual verifiable direct job cost. At the end of the project, gross profits are distributed to each PTM in accordance with their incurred direct cost on the project. A mutually agreed upon formula is used for determining the actual amount of gross to be distributed to each team member. The formula is weighted more highly toward direct labor than subcontracts and more highly toward material purchases than major equipment purchases. The intent is to recognize the varying overhead associated with each type of job cost.

GOVERNING THE RELATIONSHIP

The best governance is self-governance. With IPD self-governance among the PTMs is facilitated and encouraged by the structure of the IPD process. From the Client’s viewpoint the IPD central accounting and monthly review of each of the PTMs billing packages is a form of governance. Since the collective interest of the PTMs is aligned with that of the Client, he can have confidence in this review process. The open book, and shared savings features are both means of governance. Governance of the project execution is vested in the people who perform the traditional roles of Project Executive, Project Manager, Superintendent, Director of Design Services, etc. These people have traditional responsibilities and authority on the project. Dispute resolution would be handled by discussion and agreement between the PTMs. They have found that most project disputes typically are rooted in the financial interests of the disputing parties. Since they have a common financial interest, disputes of the typical type do not seem to be a problem. In any case through the first four projects, there have been no disputes.

EXAMPLES OF SUCCESS

They have completed four successful IPD projects and have been awarded a five-year continuing services contract for design build work for Orlando Utilities Commission, an enthusiastic Client from a prior IPD project. Rather than describe the projects that have been completed, it may be more helpful to offer some examples of the IPD process in action. Some of these examples may seem trivial in size but they are offered as best illustrating the effects IPD. A “Case Study” is also included for the OUC North Chiller Plant which is the most current IPD project.

The Last PlannerSM: An extensive dormitory renovation had to be done over the summer. The Team knew that an exhaustive approach to planning and organizing the work would be required because the renovation of an old building can be very complex, a large number of trades would be involved, and the completion time was short. They committed to an aggressive use of the Last PlannerSM. Their integrated approach to the project enabled the team to optimize implementation of the Last PlannerSM system. Instead of a GC having to herd a group of independent contractors and design professionals, each with their own agendas, toward a project completion date, they were able to develop a coherent approach and work as a unit. No one wanted to let the Team or themselves down. They shared the full responsibility for the overall project and this meant keeping on schedule. Occasionally, despite their best efforts, work fell behind. In other situations it cost more than expected to hold to the schedule. These situations did not present an insurmountable obstacle as they were sharing all cost and the burden of over time, etc. The cost of keeping up did not fall on the party working to catch up, but was shared by the total Team through their shared cost arrangement. The project finished two weeks ahead of schedule while other similar projects on campus ran over their schedules.

Shared Manpower: Their electrical team member made use of workers from other trades as needed to assist in pulling wire and other chores. This availability of ready casual labor enabled him to complete the job with fewer workers assigned to the project than otherwise would have been required. This type of impromptu sharing of manpower occurred throughout the project and between all trades.

Problem Resolution: In the course of construction, a large conduit bank masked a portion of a roof hatch. The IPD superintendent agreed with the Client’s representative to install a second hatch in another section of the plant. This solution gave the Client a full hatch and a second hatch with somewhat restricted access. There was no need to price anything or get any
kind of approval. All trades simply did what was necessary to quickly and efficiently make this change.

Handling Major Changes to the Work: The intention was to match new cooling towers to existing towers. After the towers were released the manufacturer notified them the model had been changed to one that was taller and had a different footprint. The Client opted to go with a different manufacturer. The IPD Team was able to stop the order for the original towers without penalty, select the new towers that were suitable, redesign the support steel and modify the piping and electrical to accommodate the new towers. Because of the flexibility of the IPD process and integrated design team, they were able to make this change without requiring an increase to the GMP or any extension of the project schedule. They believe that the magnitude and timing of this major change would have scuttled the schedule and budget of a traditionally run project.

Work Across Traditional Boundaries: Their electrical Team Member received a favorable quote for variable frequency drives as a part of the equipment package. These drives were originally intended to be provided in the mechanical package. They simply agreed on the spot for the electrical to buy the drives as a part of its package as that made the best sense for the project. The project cost was reduced and the increased profit shared by all including the Owner.

Recovering From Oversights: When they discovered a missing elevation for an exterior light, the superintendent called the architect and explained the problem. Within 30 minutes a sketch was faxed showing the mounting elevation. No RFI was required and there was no impact on the project because of this omission. It was their integrated approach that made it possible for the field superintendent to call the project architect direct and effect this fast resolution.

Avoiding Redundant Effort and Expense: Multiple trades required core drilling, fire protection, electrical and pipe chases, and clean up. The trade that had the most in each category, or for whom the work was most convenient, provided this service for all trades. There was no need to record or charge back any cost. This resulted in efficiency and lowered overall project cost.

Enhancements to Job Site Safety: The IPD Team determined to run accident free projects. The superintendent has the authority to direct the activities of all workers on the projects. This ensures uniform compliance with safety procedures. The cost of safety compliance falls to the entire team and not just to the involved subcontractor, so there has been no resistance to following these sometimes costly safety procedures. There has not been a single accident on any of the four IPD projects completed to date. All shared the costs and the benefits of this achievement.

Spending More to Save More: Normally, the Design Engineer prepares design drawings from which the contractor prepares shop drawings for fabrication. Major changes in the layout can arise during this translation. In the case of the OUC South project, the engineer sent his designer to the mechanical contractor's office. The designer worked there with an experienced mechanical piping expert to lay out the equipment room in detail using object based 3-D. This increased engineering cost at first, but saved money downstream. The mechanical contractor did not have to produce shop drawings because the engineering drawings were sufficient for the fabrication shop. The pipe was fabricated and installed exactly as designed.

Sharing Rental Equipment: Rental equipment and other resources were shared by the Team. This resulted in optimum usage of the equipment. There was no need to track who used the equipment or for how long. The Team Members shared all cost.

OUC NORTH PLANT – A CASE STUDY

Westbrook and the IPD Team was awarded a contract for the design and construction of a central chilled water plant in downtown Orlando that would have the utility infrastructure to support the ability to deliver 12,000 tons of chilled water to the chilled water customers of Orlando Utilities Commission in the downtown area. Initially the plant would have an installed capacity of 3,000 tons that could be easily and quickly expanded as needed to the ultimate build out of 12,000 tons.

This contract was awarded to the Westbrook/IPD team pursuant to their having been selected as one of two design-build firms that would deliver chilled water plants such as this to OUC over a five year period.

The plant stands today as a testament to the benefits of Relational Contracting as employed by the Westbrook/IPD Team.

Schedule Performance

- Contract Date: 12/30/03
- DD Complete: 1/26/04
- Demolition Complete: 1/7/04
- Permit Issued: 4/14/04
- Work Begins on Site: 5/4/04
- Plant Ready to Operate: 7/28/04

This performance would not have been possible without the Team commitment and the heavy reliance on the relationships amongst the Team Members to ensure that commitments were kept. Once everyone got in the spirit of accelerating the project, it seemed that anything was possible.

Budget Performance

- GMP: $6,000,000
- Final Price: $5,400,000
- IPD savings against GMP: $600,000

The GMP was set after the DD documents were complete and reflected the Team’s best value engineering which was applied from the first day. These savings of approximately 10% were realized in the construction phase of the project. No one ever dreamed such savings were possible in the actual construction phase. The IPD advantages mentioned above contributed to these savings. Beyond that, they have discussed below some of the jobs specific events that contributed to these extraordinary savings in both time and direct job cost.

Coordinate Design With Schedule: Many different column cross sections will satisfy a design requirement. By involving the steel erector, they were able to use the mill schedule to inform the selection of columns that would be available when needed. This type of coordination would have been next to impossible under traditional delivery systems.

Function Over Form in Design: The placement of the columns can be arbitrary to some degree. The mechanical contractor modeled the equipment room using the 3D objects for the actual equipment and suggested a column spacing that worked best even to the point of offsetting one of the columns 18" from its predicted location. From a structural viewpoint this worked as well as
any other layout and it was adopted. The structural engineer verified the adequacy of the design to accommodate this change. Rarely, if ever, would a mechanical contractor be involved in the determination of the column grid and certainly no other system would afford the opportunity to offset a main column to accommodate the mechanical work.

Early Fundamental Design Decisions Support Construction Details: When the Team began to seriously consider placing all utilities under the slab the design of the column footers was the subject of a rigorous Team meeting which considered how high the tops of the pads could be and still allow utilities that had to pass over them to turn up properly to the finished floor. Several vertical offsets were planned in the perimeter foundation wall to allow passage of utilities without sleeving or cuttag that wall.

GC Goes the Extra Mile: The general contractor backfilled and compacted to an elevation 30" below grade and the site was turned over to the Team Member responsible for the electrical construction who laid 1 mile of conduit without the need for any excavation. Seeing the entire grid laid out "above ground," as it was, afforded the opportunity for accurate layout and verification. The GC then came back in and backfilled to grade using fire hoses to wash fine aggregate in and around the conduits. This innovation saved more than three weeks off of the schedule and many thousands of dollars. Consider that the conduit was originally intended to be run overhead in galvanized pipe. This implied extensive hangers and considerably increased lengths as the pipe would have had to run parallel to column lines and would have required 20' drops at each end of each run.

The top of the column footers was set 30" below top of grade to allow room for all utilities to turn up and penetrate the finished floor vertically. Setting the elevation for the top of the footers was a Team decision determined in a weekly Team design meeting.

An initial perceived obstacle to laying out all of the utilities exposed was how backfill could be done without crushing and moving the conduits. The Team solution was to begin backfill at one point using fine sand, washing it in with fire hoses, compacting and testing as they fanned the backfill operation over the entire building. It worked flawlessly. Here you can see the backfill process beginning at the top of the picture. An added benefit was that each run was totally visible and could be easily checked for correctness.
Appendix 4

On this object based CADD drawing prepared by Westbrook we can see each hanger assembly. The main headers are 30" and 24" pipe. Everything shown was prefabricated off site and delivered "just in time".

The steel has arrived and is being erected. Note the weldments to receive the pipe hanger assemblies. This steel with the weldments was prefabricated in another state. Note the date on the picture.

The mechanical design determined the column grid and the structural engineer designed to suit. Here we see that one column near the center was offset to accommodate connections to one chiller. The points represent pipe hanger locations placed by mechanical contractor/design team. Where no steel existed, the structural engineer added beams to carry the pipe hangers.

By the end of the next day, 5/19/04, every hanger assembly was installed and still no pipe had been delivered to the site. The hanger assemblies were prefabricated to exact lengths. No measuring or layout was required to install them. All that was required was putting assembly A on point A and installing a bolt.
PROBLEMS ENCOUNTERED

IPD has encountered and resolved a number of challenges concerning such issues as insurance, bonding, job costing, job accounting, the formula for distributing gross, the form of the internal "peel", project leadership, consolidated budgeting, warranty, communications, etc. These have all been, for the most part, expected issues that simply needed to be addressed and solved. Even so, over the past four years there have been other problems worth noting.

The Uncommitted Member: IPD team members were carefully selected and had significant history working together on design-build projects and design-bid-build projects. Nonetheless, they still had a team member who wasn’t suitable for the IPD process. The managing partner and majority shareholder of that member of the Team had very little personal involvement with IPD. As a result, the representative of that company experienced significant internal pressure to revert to the old self-preservation concepts. At the conclusion of the project, the member withdrew from the IPD Team through mutual consent.

Old Habits Die Hard: On an early IPD project the General Contractor assigned a skilled and respected project manager who had been working in the industry for more than 20 years. While the Project Manager and Executive Vice President of the GC partner were both on board with IPD and attended the bi-monthly meetings, the assigned project manager just could not get his mind around the concept. He often seemed offended that he was not being asked or allowed to function in his typical role as PM. This was a man that the Team Members had enjoyed working with successfully on other more traditionally run projects, but he could not work effectively in the IPD environment.

These cases show that not everyone is suited to work in this environment. Those assigned to work on IPD projects must be carefully selected and prepared for the new rules.

CONTINUING CONCERNS - AREAS FOR DEVELOPMENT

Setting the price: With IPD, the value engineering process is so strong and effective that by the time they reach the design-development stage, everyone’s best ideas are incorporated. The budget produced at that time, therefore, reflects all of the Team’s creativity and experience. Value engineering, experienced as cost saving ideas submitted late in the design process, does not occur as the construction practitioners and design professionals work together from the start to ensure a cost efficient design. The Client receives the full benefit of this process and the likelihood of contractor initiated change orders is greatly reduced. It seems clear that this offers powerful benefits for the Client but the IPD Team is uncertain at this point how these benefits can be quantified and how they can be compensated for the true value that the IPD process adds to the project. As it stands today, IPD members benefit only from cost savings after the budget is developed. These result from the considerable field efficiencies inherent in the IPD process and the application of Lean Construction Principles.

Managing Risk: Depending on the size or complexity of the project, a joint risk assessment committee could review the project monthly focusing on such areas as the teams performance, any indications of a team member problem, change orders and claims initiatives, payment history of the Client and any trends that may need correcting.
WORKING WITH NON IPD MEMBERS, EXPANDING THE TEAM

It is fairly easy to introduce a specialty contractor into a project as a member of the team either by bringing him in early and negotiating a price at the appropriate time or by actually inviting them to become a full member of the team for a particular project sharing cost with the rest of the team. Circumstances would determine which method might be employed.

They pursued a major project where their usual engineering partner was unable to participate. They agreed to invite another engineering firm to participate with them as a full Team Member for that particular project. The substitute firm readily understood the IPD process and was an eager and capable participant in the preliminary design and pricing. IPD was not the successful bidder for this design-build project, but the experience with the "plug in" Team Member was successful.

REFLECTION ON THEORY (Greg Howell)

IPD developed as the participants applied common sense drawn from their experiences: No particular theoretical consideration shaped the effort. Even so, reflection on organizational theory, particularly those rooted in transactional cost analysis, helps explain why the approach is so effective and may offer guidance for future development. This note proceeds by first considering two types of costs that arise in the course of doing work in an organization. This is followed by a discussion of the way managing these types of cost shape organizations and contracts. IPD is located in the resulting framework and suggestions offered.

Types of costs

The cost associated with doing work in organizations can be divided between the cost expended producing goods and services - the production cost, and transactional costs - the cost of "doing the deal", associated with the movement of those goods and services across organizational or market boundaries (Williamson 1976). In construction, transaction costs include among others, the cost of preparing and negotiating contracts, insuring performance and settling disputes. Efforts such as partnering are aimed at reducing the transaction costs associated with disputes. Constructability and value engineering efforts are mostly aimed at reducing production costs. Examples of efforts that reduce both costs can be found in this paper under the heading "Examples of Success." For example, IPD demonstrates how they reduced transaction costs in "Recovering from Oversights". An example of reduced production costs is found in "Sharing Rental Equipment". (Interested readers are advised to read closely the works of Williamson, Gough, Gunnarson & Levitt, and Macneil included in the references section of this paper.)

Types of contracts

Williamson and Macneil discuss two broad classes of contracts transactional where exchanges are made for goods and services, and relational contracts where the relationship "takes on the properties of a mini-society with a vast array of norms beyond those centered on the exchange and its immediate processes." (Williamson 1979, pg 238) Relational contracts arise as transactions become less discrete, and the transaction costs increase due to the duration, uncertainty and complexity of the matter at hand.

Transactional contracts foresees a single outcome; the value of a single future outcome is made present and both parties agree to the exchange - money for the project (Williamson 1979). The dispute record of the construction industry proves that drafting transactional contracts for the delivery of complex and uncertain construction that foresee all contingencies, allocate all risks, limit opportunistic behavior and still motivate highest global efficiency is impossible.

Macneil, cited extensively by Williamson, proposes relational contracts to manage in this situation (Macneil 1974). Relational contracts foresee many possible outcomes - for richer, for poorer, in sickness and health, now and forever - and bind the parties to maintain their relationship even as they pursue other objectives.[1]

IPD Contract and Organization

IPD employs both transactional and relational contracts. Externally, they enter a classic transactional contract with the client and some suppliers. Internally, members are bound by a relational contract described in the "pay" in their own pay. The "pay" minimizes transactional cost by binding the parties together in a partnership for the duration of the project. Records are not kept to allocate costs or determine blame. They have yet to have a dispute internally or with a client.

Production costs have been reduced by sharing resources and finding innovative ways to reduce project cost, trading ponies for horses. All this is accomplished because the contractual incentives and operating rules reward cooperation and still stimulate innovative approaches to managing work. (It could be argued that sub contractor transaction costs may be increased if they could have made more money pursuing their own short term interest or by the requirement for a larger insurance policy, but we hear no complaints from IPD participants.)

IPD is a clever solution to the tough organizational and contracting problems faced in today's market. It relies on careful participant selection, transparency and continuing dialog. They have not set in place alternative dispute resolution methods or taken other steps to insulate they can solve problems and retain their organizational structure. Perhaps they will never face such problems.

CONCLUSION

IPD is a Relational Contracting approach that aligns project objectives with the interests of key participants. It creates an organization able to apply the principles and practices of the Lean Project Delivery System.

REFERENCES

Gunnarson, Sven, and Levitt, Raymond, E., 1982, "Is a building a hierarchy or a market?" Proceedings of the 7th Internet Congress. Copenhagen, 1982.


[1] CEO, Westbrook Air Conditioning & Plumbing, Box

END
Wellington BedTower
Project Management Questionnaire

Innovation is a unique solution to a need or process that offers improvement over the traditional methods. With that in mind, how often do you innovate? How important is it to your role on a project? Have you either been rewarded or offered to others a reward for innovation?

Innovation is critical to continuous improvement. As such I always look to ways to innovate and encourage others to do so. As a PM or Superintendent it is not only my job to innovate but critical that I empower and require others to do so daily as well.

What do you think about “lean Construction”? Is it new and improved? Or is it just another fad? Is it something you have been doing but now it has a name? Do you have no idea?

Lean construction is the new application of concepts brought forward in other industries now being applied to our industry. The applications are different but the concepts are the same. 1) drive customer value, 2) eliminate waste, 3) continuous improvement. The essence of Lean construction is to involve the builders in the design process to garner all of the best ideas and solutions prior to drawing plans. This eliminates inconsistencies in the field while in the field collaboration between trades rather than silo mentality drive improvement to all parties. The concept of optimizing the entire value stream rather than pieces changes the perspective of how and where value is created.

Define the best way to solve a problem. Who was involved in problem solving on your most successful jobs? In a perfect world, who and how often would this problem solving group get together?

All stake holders should be present and all possible options should be given an opportunity to be discussed. Time should be spent researching any promising opportunity as the best decision can’t be made if it is not considered. A multiple disciplinary approach should be taken, not a one person perspective. The designers should walk the site regularly and tradesmen should be given direct access to the designers.

It is critical that all parties be offered respect and all comments are given equal value regardless of who brought them to the table.

Please answer true or false to the below statements:

Trust is soft    False
Trust is slow    False
Trust is built solely on integrity    False
You either have trust or you don’t    False
Once lost, trust cannot be restored    False
You can’t teach trust    False
Trusting people is too risky    False
Trust is established one person at a time    False

How do you make (or enhance) profit on your projects?
Work smart. Plan, Plan, then plan some more. Do it right the first time. Eliminate waste as much as possible. Listen to the guys in the trenches. Ask questions when not sure. Admit your ignorance.

How do your partners (subcontractors) make their profit?
Ask them. Less labor? Work being ready when they deploy troops? Better ability to schedule materials. Have confidence that when asked to provide 6 tradesmen all 6 will be productive. Proper coordination with others. Understanding expectations by performing first work studies.

What do you think is a fair profit?
Fair is what is agreed upon. More is unfair if at the expense of others. Less is unfair provided all agreements are lived up to.

How does the architect make profit?
Draw less. Full code understanding. Collaborating with Authorities having jurisdiction. Understanding how you plan to build something and helping to make sure it fits.

How does the owner make profit (during the job not after)?
By receiving more value. Value can take many forms. Early delivery. Better quality. Better access to maintain. The ability to chose between systems with an actual cost to make fully informed decisions. Knowing when critical decisions need to be made. Having flexibility to make decision without impacting others.

If you had the opportunity, would you be willing or do you think it is your role to help others make or enhance their profit?
It is imperative we all have the same goals to win.
Sample RFP for Contractors

Date
Contractor Address
Re: Request for Proposal
   UHS hospital at location

Dear Mr. Contractor,

On behalf of the UHS project team, we are pleased to invite your firm to submit a proposal for preconstruction and construction services for the referenced project. The current team performing design, preconstruction and construction services for previous “Pre-phase” packages and this referenced work is the Owner (name), Architect (name), GC (name), etc.

The project is a new tower ............. The interior fit-out includes surgery with .......... There is an amount of shell space that will remain for future development that is outside the scope of this project. Also included are some renovations to existing spaces that are primarily at connection points between the existing and new building. Refer to the design documents that have been completed to date for more specific information regarding the scope of the project. Documents are being forwarded to your attention from (drawing service) under separate cover.

A key element of the delivery of this project through the preconstruction and construction phases is the implementation of “Lean Construction” principles. The project team strongly feels that to successfully implement these principles the major stakeholders of the project should be involved during the preconstruction and planning of the project. We encourage you to research and learn about the concepts of “Lean Construction” and incorporate these within your proposal. There are many resources available to learn about “Lean Construction”. We have found the following website (www.leanconstruction.org) to be very informative.

UHS has expressed a commitment to the partnering concepts of Lean Construction and intends to enter into mutually beneficial relationships with qualified, reputable firms for the project.

It is desired that the preconstruction and construction services be performed on an “open book” format with the establishment of a guaranteed maximum price at a mutually agreeable time frame.

It is our intent to select firms to work with in each trade category following our review of the proposals received and interviews/presentations with short-listed firms. The proposals shall be delivered on or before (date) to:

Whoever will read them

We are currently anticipating that these interviews/presentations will be scheduled sometime during the week of (date) with selection of the successful firms following very shortly. Upon selection the preconstruction and planning efforts will begin immediately with construction in late summer.

Sincerely,
UHS
Project Director

Cc:
Last Planner™ System of Production Control

The use of an Integrated Project Delivery (IPD) system to plan, design, fabricate and erect this project is essential to meeting the Owner’s “Conditions of Satisfaction”, specifically those regarding cost and schedule. There are many components of IPD; however, one of the most important is the use of the Last Planner™ System (LPS) by the construction forces in the field. The LPS was developed to produce predictable workflow and rapid learning. This produces maximum value to the Owner by eliminating waste caused by unpredictable workflow. Its use has enabled contractors to reduce the delivery time of the project and at the same time allowed specialty contractors to improve utilization of their resources.

The LPS requires team members to make and keep commitments based on their confidence that prerequisite work, design information, materials, labor and equipment will be ready so they can start and complete installations to meet Master Schedule milestones. Specialty contractor supervisors are expected to plan together with other trades in building a “Phase Schedule” for each major phase of work on the project in which they will be participating. In the Phase Planning Meeting, specialty subcontractor supervisors structure the flow of work and design the network of commitments by identifying hand-offs between trades. Each onsite supervisor is considered a “Last Planner” in the LPS, and has the responsibility to plan their activities six weeks ahead in a “Lookahead Schedule” and to identify crew assignments for the current and next week in a “Weekly Work Plan”. Last Planners are asked to commit to performing work that they know can be made ready for their crews and to refuse to assign work they are not confident can be started and/or completed because it is not ready. It is this cycle of planning and commitment coupled with learning from seeing the results which creates reliable workflow.

In schematic fashion, LPS can be represented as shown below:
What is Pull Planning?

Working from a target completion date (milestone) backward, tasks are defined and sequenced so that their completion releases work.

How does Pull Planning Work?

- Work tasks, information flow, and material deliveries are planned based on the request (or “pull”) of downstream customers.
- Pull scheduling will often expose the need for smaller batches, just in time delivery, improved leveling of resources, and reduced lead times.
- Workflow becomes more reliable and efficient as the waste of waiting, redundancy, and over-processing are eliminated.
Pull Planning Step

1. Define the phasing of the work
2. Determine completion dates for the phases (or milestones)
3. Using team scheduling and sticky’s on a wall, develop the network of activities required to complete the phase working backward from the completion date
4. Apply durations to each activity with no contingency or float in the estimates
5. Re-examine logic to try to shorten the duration
6. Determine the earliest practical start date

Pull Planning Step continued

7. Decide what activities to buffer or pad with time contingency
   - Which activity durations are most fragile?
   - What are the risks?
   - Rank order by degree of uncertainty
   - Allocate available time to the fragile activities in rank order
8. Is the team comfortable that the available buffers are sufficient to assure completion within the milestone? If not, either re-plan or shift milestone as needed and possible

Milestone or Phases

Sticky Format
Sticky Wall

Pull Planning Rules

- All work shall be clear as to content, sequence, timing and outcome
- Every connection (hand off of work) in the work stream must be direct and there must be a clear way to request action and receive a response
- The pathway for production must be simple and direct
- Tasks and completion dates must be negotiated with “performer” and “receiver”
- No one can assign or move another persons sticky

Now What?

- Transfer sticky’s and commitment dates to:
  - Work Register (design phase)
  - Last Planner System (construction phase)
  - Other specialized software available
- Monitor progress and task completion through Check-In sessions or Daily/Weekly meetings
- Adjust commitments or tasks as needed by Re-Pulling if needed

Work Register

<table>
<thead>
<tr>
<th>Task</th>
<th>Start Date</th>
<th>End Date</th>
<th>Task Owner</th>
<th>Task Description</th>
<th>Task Status</th>
<th>Work Required</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>1/1/2023</td>
<td>1/31/2023</td>
<td>John Doe</td>
<td>Task A</td>
<td>Complete</td>
<td>Yes</td>
<td>Notes 1</td>
</tr>
<tr>
<td>Task 2</td>
<td>2/1/2023</td>
<td>2/28/2023</td>
<td>Jane Smith</td>
<td>Task B</td>
<td>In Progress</td>
<td>No</td>
<td>Notes 2</td>
</tr>
<tr>
<td>Task 3</td>
<td>3/1/2023</td>
<td>3/31/2023</td>
<td>John Doe</td>
<td>Task C</td>
<td>Complete</td>
<td>Yes</td>
<td>Notes 3</td>
</tr>
<tr>
<td>Task 4</td>
<td>4/1/2023</td>
<td>4/30/2023</td>
<td>Jane Smith</td>
<td>Task D</td>
<td>In Progress</td>
<td>No</td>
<td>Notes 4</td>
</tr>
<tr>
<td>Task 5</td>
<td>5/1/2023</td>
<td>5/31/2023</td>
<td>John Doe</td>
<td>Task E</td>
<td>Complete</td>
<td>Yes</td>
<td>Notes 5</td>
</tr>
</tbody>
</table>

*Figure 1: Work Register Example*
## WEEKLY WORK PLAN

<table>
<thead>
<tr>
<th>Date</th>
<th>Task Description</th>
<th>Type</th>
<th>Learning</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 10</td>
<td>Task 1</td>
<td>Training</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Dec 11</td>
<td>Task 2</td>
<td>Meeting</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Dec 12</td>
<td>Task 3</td>
<td>Workshop</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

### Learning Needs

- [X] Reading
- [X] Writing
- [X] Speaking
- [X] Listening

### Appendices

- Appendix 7

---

Questions?

![Post-it notes on a whiteboard with notes scrawled on them. The notes are various colors and cover the entire visible area.]

Appendix 7
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.

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 PDA’s.

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

• Is this email needed, or is this issue better addressed via phone call or meeting?

• Does this person really need another email?

• Share your appreciation in regular meetings and calls.

• Place “UHST” and the request/action needed in the subject line

• Use agreed-upon acronyms (EOM: end of message) in subject line

• Summarize background information below the action item(s)

• Set clear due date and time if applicable

• “To” recipient is the only person needed to take action

• “CC” recipients are stakeholders receiving information only

• Restrict the use of “Reply All”
**UHS Temecula Medical Center - Big Room Agenda**

**Date:** Tuesday, July 12  
**Facilitator:** Jeff H.  
**UHS Onsite:** Tara  
**Visitors:**

<table>
<thead>
<tr>
<th>Big Room</th>
<th>Temecula</th>
<th>Corona</th>
</tr>
</thead>
</table>
| **7:30** | HOSPITALITY AND SET UP (GoTo) | **7:00** | BREAKOUT: Budget Cluster  
Attendees: MegaYots, DA, DS, TM, TS, KL, ES, SD, SW, TL, BK |
| **8:00** | INTRODUCTIONS  
AH HA MOMENTS  
CHECK-IN  
CLUSTER LEADER REPORT OUT | **7:00** to **8:00** | |
| **8:15** to **9:00** | HOT TOPICS  
1. ESA Extension Action Plan  
Sharing Reflection COP  
Scott D (L) - ALL | **8:15** to **9:00** | **8:30** to **12:00** | CORONA TEAM  
| **9:00** to **11:00** | Pull Planning: Itemize time slots before start  
1. Construction Milestone – Steve Y  
2. Inc 3 & 4 QA/QC  
3. Procurement – Details for next 2-3 mos  
a. Balance of trade partners  
b. Agree on target date/updates for all trades  
4. Site grading - Status Updates/Pull Plan  
a. Permit status, bid status, award of trades.  
5. Increment 5, 6 Pull Plan  
ATTENDEES: Saiful/M, Steve, H,  
6. BIM Update Pull Plan – Dustin/Jason K.  
7. Structural Pull Plan – Schuff/YK REQUIRED | **9:00** to **11:00** | **10:30** to **11:30** | Constructability Review  
Steve Y (L), Bob, Dean, Ken, Marius, Ward, Ed, Scott D, Steve H, |
| **11:00** to **11:30** | NEXT WEEK’S AGENDA | **11:30** to **11:45** | FLEX TIME | |
| **11:45** to **12:00** | FLEX TIME | **12:00** to **12:30** | LUNCH – ??? HEAD COUNT | **12:00** to **12:30** | Core Team  
Attendees: Dave S (L), Steve W, GZ, Tara, Rebecca, Ken, Scott, Bob, Ed, Tom M., Steve Y., Kelley, Cynthia (GoTo) |
| **12:30** to **12:45** | Core Team  
Attendees: Dave S (L), Steve W, GZ, Tara, Rebecca, Ken, Scott, Bob, Ed, Tom M., Steve Y., Kelley, Cynthia (GoTo) | **12:30** to **12:45** | | |
| **1:30** to **2:30** | Inc. 5 Page Turn  
- Bring Drawing Sheet index & Half size set  
Attendees: Ward (L), Ken, Sun, Dan, Steve H., Imelda, Scott D., Carlos, David S., Corey, Rahim, Jason N., Marius, Natasha | **1:30** to **2:30** | **2:30** to **4:00** | COMMUNITY OF PRACTICE  
- Debrief Conversation  
- Onboarding Review  
- Study Action Team  
- Next week's Agenda  
- Plus Delta  
Attendees: Steve Y, Dean, Dan, Corey, Chris. |
| **2:30** to **3:00** | Hazardous Materials Inv  
- Develop a plan that leads to completion in 2 weeks  
Attendees: Marius (U), Ward (L), Steve W (L), Ken, Rebecca, Tara, Dave Smith, Electrical |
| **3:00** to **3:45** | Hazardous Materials Inv  
- Develop a plan that leads to completion in 2 weeks  
Attendees: Marius (U), Ward (L), Steve W (L), Ken, Rebecca, Tara, Dave Smith, Electrical |
| **3:45** to **4:00** | FLEX TIME | **3:45** to **4:00** | | |
| **4:00** to **4:15** | FLEX TIME | **4:00** to **4:15** | Plus/Deltas (Save smart boards) | **4:00** to **4:15** | Plus/Deltas (Save smart boards) |

**Big Room:**  
https://www2.gotomeeting.com/join/168532106  
Meeting Password: bigroom2010  
Organizer Email: william.seed@uhsinc.com  

**Temecula Room:**  
https://www2.gotomeeting.com/join/282780482  
Meeting Password: temecula2010  
Organizer Email: kathy.duffy@uhsinc.com  
Organizer Password: temecula2010  
Call-in #: 646-558-2103 Access Code: 282-780-482

**Corona Room:**  
https://www2.gotomeeting.com/join/277828538  
Meeting Password: corona2010  
Organizer Email: nancy.squartino@uhsinc.com  
Organizer Password: corona2010  
Call-in #: 630-869-1012 Access Code: 277-828-538

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**HOSPITALITY AND SET UP (GoTo)**

- **INTRODUCTIONS**
- **AH HA MOMENTS**
- **CHECK-IN**
- **CLUSTER LEADER REPORT OUT**

- **INTRODUCTIONS**
- **AH HA MOMENTS**
- **CHECK-IN**
- **CLUSTER LEADER REPORT OUT**

**Hot Topics**

1. ESA Extension Action Plan
2. Construction Milestone
3. Procurement – Details for next 2-3 mos
   - Balance of trade partners
   - Agree on target date/updates for all trades
4. Site grading Status Updates/Pull Plan
   - Permit status, bid status, award of trades
5. Increment 5, 6 Pull Plan
   - Attendees: Saiful/M, Steve, H
6. BIM Update Pull Plan – Dustin/Jason K
7. Structural Pull Plan – Schuff/YK REQUIRED

**Constructability Review**

- Attendees: Steve Y, Dean, Dan, Corey, Chris.

**Next Week’s Agenda**

- Core Team
  - Attendees: Dave S (L), Steve W, GZ, Tara, Rebecca, Ken, Scott, Bob, Ed, Tom M., Steve Y., Kelley, Cynthia (GoTo)
UHS Temecula Medical Center - Big Room Agenda

**Predict, Plan, Perform, Perfect**
**Intent, Capability, Results, Integrity**

**Date:** Wednesday, July 13

**Facilitator**

**UHS Onsite:**

**Visitors:**

| 7:30 | HOSPITALITY AND SET UP (GoTo) |
| 8:00 | INTRODUCTIONS AND AGENDA |
| 8:30 to 9:30 | Headwall Sound Proofing Discussion |
| | - Posttest debrief |
| | Attendees: Chris (L), Dean, Marius, Ward, Ian (GoTo), James, Trade foremen |
| 8:00 to 10:00 | ONSITE Underground Utilities Pull Plan |
| | Attendees: Tom M (L), Berg, Ball, Earth Tek, Landscape, Granite |
| 1:00 to 2:30 | DPR/TURNER ops / staff |
| | - Site Submittals Log |
| | - Budget, contract, safety |
| | Attendees: Danny (L), George, Chris, Steve Y, Ed, Tom M, Doug, Richard, Kelley |
| | Job Site Office |
| 2:30 to 4:00 | Document Management During Construction |
| | - Determine Software |
| | - Procedures |
| | - Owner of Process |
| | Attendees: Dan (goto), (L), Danny (goto), Steve H, Margie(goto) Dean, Ken, Emily(goto), Frank (goto) |
| 4:00 to 4:15 | Plus/Delta (Save smart boards) |

**Big Room**

https://www2.gotomeeting.com/join/268512106
Meeting Password: bigroom2010
Organizer Email: william.seed@uhsinc.com
Organizer Password: bigroom2010
Call in #: 215-383-3305 Access Code: 368-532-106

**Temecula Room**

https://www2.gotomeeting.com/join/238780482
Meeting Password: temecula2010
Organizer Email: kathy.duffy@uhsinc.com
Organizer Password: temecula2010
Call in #: 646-558-2102 Access Code: 282-780-482

**Corona Room**

https://www2.gotomeeting.com/join/277828538
Meeting Password: corona2010
Organizer Email: nancy.squartino@uhsinc.com
Organizer Password: corona2010
Call in #: 630-869-3012 Access Code: 277-828-538
Target-Value Design: Nine Foundational Practices for Delivering Surprising Client Value

Hal Macomber and John Barberio

Throw-it-over-the-wall design performed by specialists and sub-specialists working in isolation from others interacting with the design results in projects that are unaffordable, unconstructable, off-target and late. Rework, repricing, change orders, and de-value engineering are all symptoms of a process that ignores the nature of design and the systems nature of the built environment.

Target-Value Design (TVD) turns the current design practice upside-down:

- Rather than estimate based on a detailed design, design based on a detailed estimate.
- Rather than evaluate the constructibility of a design, design for what is constructible.
- Rather than design alone and then come together for group reviews and decisions, work together to define the issues and produce decisions then design to those decisions.
- Rather than narrow choices to proceed with design, carry solution sets far into the design process.
- Rather than work alone in separate rooms, work in pairs or a larger group face-to-face.

TVD offers designers an opportunity to engage in the design conversation concurrently with those people who will procure services and execute the design.

A Little Background

What do we mean by design conversation? We hold design as principally a social activity. The notion that some one person sits alone and is inspired to design misses both the nature of design and the countless contributions from others. The point of design is to bring forth new value in line with the client's interests.

What is value? Value is an assessment made relative to a set of concerns that someone wants addressed. There is nothing of value independent of a person saying (assessing) it is valued. Client concerns – interests, not worries – must be

1 Hal is a Principal with Lean Project Consulting. Previously, he was the COO for the Neenan Company, an integrated design-build firm.
2 John is a business consultant to the design and construction industry, JB Consulting Services, LLC.

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kept in the foreground of the design conversation. Doing so allows designers to engage in a conversation for exploring various ways to take care of the concerns of that client. Those concerns inevitably change over the life of the project. As design proceeds new concerns arise while others fade away. Locking down requirements early in the process cuts short the exploration and development of the clients' concerns. Consequently, design suffers as does the value delivered to the client.

What roles do clients play? Clients are key performers during design, not just customers. As performers they express their concerns, make value assessments, and eventually make choices. When clients fail to take those actions in a timely way it leads to immeasurable waste for the project team. The team cannot let their fear of the client get in their way of holding all performers, including the client, to act responsibly.

**TVD Foundational Practices**

Here we are introducing nine practices for creating the conditions for delivering the target-value from the design process.

1. **Engage deeply with the client to establish the target-value.** Both designers and clients share the responsibility for revealing and refining concerns, for making new assessments of what is value, and for selecting how that value is produced. Continue engaging with the client throughout the design process continue to uncover client concerns.

2. **Lead the design effort for learning and innovation.** Expect the team will learn and produce something surprising. Establish routines to reveal what is learned and innovated real-time. Also expect surprise will upset the current plan and require more re-planning.

3. **Design to a detailed estimate.** Use a mechanism for evaluating design against the budget and the target values of the client. Review how well you are achieving the targets in the midst of design. When budget matters, stick to the budget.

4. **Collaboratively plan and re-plan the project.** Use planning to refine practices of coordinating action. This will avoid delay, rework, and out-of-sequence design.

5. **Concurrently design the product and the process in design sets.** Develop details in small batches (lot size of one) in tandem with the customers (engineer, builders, owner, users, architect) of the design detail. Adopt a practice of accepting (approving) completed work as you design.
6. **Design and detail in the sequence of the customer who will use it.** This maintains attention to what is valued by the customer. Rather than doing what you can do at this time, do what others need you to do next. This leads to a reduction in negative iterations.

7. **Work in small and diverse groups.** Learning and innovation arises socially. The group dynamics of small groups – 8 people or less – is more conducive to learning and innovating: trust and care for one another establish faster; and communication and coordination are easier.

8. **Work in a Big Room.** Co-locating design team members is usually the best option. Design is messy. Impromptu sessions among design team members are a necessary part of the process. So are regular short co-design sessions among various specialists working in pairs.

9. **Conduct Retrospectives throughout the process.** Make a habit of finishing each design cycle with a conversation for reflection and learning. Err on the side of having more retrospectives not less. Use plus|deltas at the end of meetings. Use more formal retrospectives that include the client at the end of integration events. Instruct all team members to ask for a retrospective at any time even if they just have a hunch that it might uncover an opportunity for improvement.

**How to Proceed**

Be careful not to pick and choose from the above nine practices. We call them foundational practices indicating that taken together they establish a base for adopting other lean design practices. Both **Responsibility-based Project Delivery™** and **Knowledge-based Design** build on TVD.

Also, be careful not to think “We already do this.” While we have taken care to describe what we see as different, we recognize that it might sound like something very familiar. Consider how what we are describing here is different from what you are doing.

Take an experimental approach to adoption – PDCA (plan-do-confirm-adjust) – based on the scientific method. While the nine foundational practices work, exactly how they work for your organization and specific projects might vary. Use your team leaders to bring about TVD practices on a project-by-project basis by considering both what is being designed and who will be doing the work. Stay close to these early experiments standing ready to offer whatever help the project team needs to succeed both on their project and with these new practices.
Collaborative Thinking Process/A3

Kristin Hill, AIA
InsideOut Consulting, Inc.
June 19, 2010

Resource

“Managing to Learn”
Using the A3 management process to solve problems, gain agreement, mentor and lead

by John Shook

Collaborative Thinking Process A3

- Process for producing consensus & alignment
  - Status reports
  - Proposals/recommendations
  - Problem solving

- A3 format for documenting the process

What is an A3?

- “A3” refers paper size 11x17 (approx)
- Every organization issue - 1 page
- Follows a common logic
Effective A3 Process

- Effective Use of A3 Process
  - Can facilitate shift from *debate* about who *owns what* (authority-focused)
  - To *dialogue* around *what is the right thing to do* (responsibility-based)

- Creates a “pull-based” authority

Radical impact on the way decisions made
- Individuals *earn* authority to take action
- Leaders do not take a laissez-faire disengagement

Incorporate A3 into team activities:
- Learn to stop avoiding problems
- Recognize problems as powerful opportunities for learning and improvement
- Places *responsibility* on the author-owner
  - Not necessarily having authority over all aspects
  - Accepts responsibility to *get decisions made and implemented*

A3 – Storyboard

- The *underlying thinking* matters - not the *format*

- Visual manifestation of problem-solving thought process involving *continual dialogue* between owner of issue & other stakeholders

Story

- Should tell a *story* from the upper left to lower right

- Traces a journey from context/definition, to resolution & sequel
The Process

- A3 Process follows PDCA
- Plan – Do – Check – Act (Adjust)
- Fundamental approach to ALL work in collaborative/lean approaches

Elements

- Title
- Owner/Date
- Background
- Current Condition
- Target Condition
- Analysis
- Proposed Countermeasures
- Plan
- Follow-up
Owner & Date: Who “owns” the issue & date of current version

Background: Describe the business context & importance of the issue

Current Condition: Describe what is currently known about the issue

Target Condition: Identify desired outcome

Analysis: Analyze the current situation & underlying “root” cause creating the gap between Current Condition & Target Condition

Identify the “real issue”
Getting to the Real Issue

- Go to **Gemba** to fully understand the issue
  - The value-creating place the work actually happens to discover the “truth”

- **“Root Cause”** investigation
  - Perform “5 Whys” to get beyond the obvious symptoms

Propose Countermeasures: Propose corrective action or countermeasure

Gain consensus - *Nemawashi*

Nemawashi

- Refers to the consensus process of aligning organization around the countermeasure
- Approval at end of the process – formality
- Heart of Pull-based authority

Consensus/Agreement

- Does NOT mean giving up on one’s ideas or beliefs
- DOES mean that one will support the decision of the group
- Requires listening to other’s point of view
Set-based Decision-Making

- One of most important aspects of lean decision-making
  - Assessment of a *set* of countermeasures
  - “Just-in-Time” Decision-Making

**Caution!**

- A3 Pitfalls
  - Making it about the “report”
  - Not working until reaching consensus with key stakeholders – not collaborating
  - Not identifying all/correct stakeholders
  - “Jumping” to a solution or attaching to one course of action
  - Arduous process – frustration
  - Operating in-between “authority & responsibility based” approach
Learning to Learn

- Develop perpetual PDCA Thinkers
- Use A3 Thinking to document the process
- Become a continuous learning & improving organization – be lean

Let’s Try

- Break into groups of 5-6 people each
- Pick an “owner”
- Owner to pick from the following (no discussion – it is the owner’s choice)
A3 Topics

Propose: Going from sick/holiday/vacation structure to Paid Time Off (PTO)
Propose: Going to a 4 day work week in summer
Problem: People arrive late to meetings
Problem: People (mostly management) are not turning time sheets in on time
Propose: Free yoga classes at lunch

Start A3 Process

- Identify stakeholders – someone play the role
- Develop the title – remember it should state the real problem & not be offering the solution

Elements

- Title
- Owner/Date
- Background
- Current Condition
- Target Condition
- Analysis
- Proposed Countermeasures
- Plan
- Follow-up
### Choosing by Advantages Study: George Washington University Hospital Rad Onc Space

<table>
<thead>
<tr>
<th>Factor: Location relative to GWUH</th>
<th><strong>Alternative 1</strong> 1255 23rd Street</th>
<th><strong>Alternative 2</strong> 1250 23rd Street Basement using Lin Ac courtyard for Lin Ac</th>
<th><strong>Alternative 3</strong> 1250 23rd Street Basement using lease space above for shielding</th>
<th><strong>Alternative 3</strong> 2101 L Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria: Distance from GWUH to Lease Space</td>
<td>Attribute: Advantage: 3.5 Blocks</td>
<td>Attribute: Advantage: 3.5 Blocks</td>
<td>Attribute: Advantage: 3.5 Blocks</td>
<td>Attribute: Advantage: 4 blocks</td>
</tr>
<tr>
<td>Criteria: Leasable Square Footage is attached will be less advantageous for staff and patients to be split.</td>
<td>Attribute: Advantage: Contiguous</td>
<td>Attribute: Advantage: Is contiguous</td>
<td>Attribute: Advantage: Must be split if 2 Lin AC's are required</td>
<td></td>
</tr>
<tr>
<td>Factor: Requires special zoning provisions</td>
<td>Attribute: Advantage: No special zoning, cannot block fire pump below</td>
<td>Attribute: Advantage: No special provisions</td>
<td>Attribute: Advantage: Must verify retail rules if using Level 1 space</td>
<td></td>
</tr>
<tr>
<td>Factor: Square footage meets original program square footage.</td>
<td>Attribute: Advantage: 4000 square feet short of program</td>
<td>Attribute: Advantage: At program</td>
<td>Attribute: Advantage: at program with unusable square footage</td>
<td>Attribute: Advantage: 1000sf may be available 20 upgrades below courtyard</td>
</tr>
<tr>
<td>Factor: Ceiling Height of space</td>
<td>Attribute: Advantage: Most generous ceiling</td>
<td>Attribute: Advantage: Ceiling height adequate if space is leased above for shielding</td>
<td>Attribute: Advantage: 14’-0” in garage Lease has 9’-6”</td>
<td>Attribute: Advantage: 50</td>
</tr>
<tr>
<td>Criteria: Minimum 12’-0” ceiling height to accommodate Linear Accelerator with 12’-0” ceiling heights</td>
<td>Attribute: Advantage: Will accommodate Lin Ac’s</td>
<td>Attribute: Advantage: Will accommodate LIN Ac’s in Courtyard</td>
<td>Attribute: Advantage: Must accommodate Lin Ac’s in space is purchased above</td>
<td>Attribute: Advantage: 90</td>
</tr>
<tr>
<td>Factor: Can accommodate 2 Linear Accelerators</td>
<td>Attribute: Advantage: Floor plan will accommodate for Lin Ac will be required</td>
<td>Attribute: Advantage: Floor plan will accommodate for Lin Ac</td>
<td>Attribute: Advantage: 2.3 levels of parking below courtyard upgrades required</td>
<td>Attribute: Advantage: No foundation upgrades for basement only.</td>
</tr>
<tr>
<td>Criteria: Requires structural upgrade to foundation.</td>
<td>Attribute: Advantage: Add 3 floors</td>
<td>Attribute: Advantage: Will have to upgrade structure for this location</td>
<td>Attribute: Advantage: Will have to upgrade structure for this location</td>
<td>Attribute: Advantage: Add elevator/strip structural upgrades required</td>
</tr>
<tr>
<td>Factor: Access to power</td>
<td>Attribute: Advantage: Easy access and space for new breakers 480V service 2 400A switchboards</td>
<td>Attribute: Advantage: Limited space for new breakers/Long distance for switchgear/1’ cloth not adequate for space</td>
<td>Attribute: Advantage: Limited space for new breakers/Long distance for switchgear/1’ cloth not adequate for space</td>
<td>Attribute: Advantage: Available space for new breakers 480 V, 400A switch board</td>
</tr>
<tr>
<td>Factor: Additional requirements</td>
<td>Attribute: Advantage: 2nd floor space is required, may need to add stair/elev</td>
<td>Attribute: Advantage: Not sure if building in courtyard is allowed</td>
<td>Attribute: Advantage: Must transfer patient from Level 2 to Level 1</td>
<td>Attribute: Advantage: Restrictions on Lease space on 1/ only 1000sf may be available 8 upgrades below courtyard</td>
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<tr>
<td><strong>COST RANKING</strong></td>
<td><strong>420</strong></td>
<td><strong>310</strong></td>
<td><strong>490</strong></td>
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### Appendix 13
Choosing by Advantages Study: George Washington University Hospital Helipad Elevator Analysis

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<tr>
<td>Criteria:</td>
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<table>
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<tr>
<th>Factor: Length of Path from Helped Loop to Elevator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
<th>Alternative 5</th>
<th>Alternative 6</th>
<th>Alternative 7</th>
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<tbody>
<tr>
<td>Criteria:</td>
<td>120' of Path to Elevator</td>
<td>120' of Path to Elevator</td>
<td>120' of Path to Elevator</td>
<td>120' of Path to Elevator</td>
<td>120' of Path to Elevator</td>
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<tr>
<th>Factor: Amount of Space Affected on the 5th Floor</th>
<th>Alternative 1</th>
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<table>
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<tr>
<th>Factor: Amount of MEP Revisions and Ductwork and Fans</th>
<th>Alternative 1</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Factor: Amount of Exterior Wall Required</th>
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Appendix 13
<table>
<thead>
<tr>
<th>Choosing by Advantages: Helipad Analysis</th>
<th>Alternatives 1</th>
<th>Alternatives 2</th>
<th>Alternatives 3</th>
<th>Alternatives 4</th>
<th>Alternatives 5</th>
<th>Alternatives 6</th>
<th>Alternatives 7</th>
<th>Alternatives 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor:</strong> Amount of Structural Modifications Required</td>
<td>Hold in void, New Shear Wall, New Floor into new shear wall</td>
<td>Cut Roof create sump pit</td>
<td>Cut roof, new column rings</td>
<td>Extend parapet roof, Remove portion of Existing parapet roof</td>
<td>Construct area for equipment, Remove portion of roof, new roof</td>
<td>Construct area for equipment</td>
<td>New sump pit</td>
<td>New structure required to support elevator</td>
</tr>
<tr>
<td><strong>Criteria:</strong> Advantage</td>
<td>Attribute</td>
<td>Advantage</td>
<td>Advantage</td>
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<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
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<tr>
<td><strong>Factor:</strong> Amount of Steps Elevations will be Down</td>
<td>3 days</td>
<td>9 days</td>
<td>9 days</td>
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<td>9 days</td>
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<tr>
<td><strong>Criteria:</strong> Days for preparing/days for elevator installation</td>
<td>Attribute</td>
<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
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<td>Advantage</td>
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<tr>
<td><strong>Factor:</strong> Length of access path required to elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
<td>30' of Path to Elevator</td>
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<tr>
<td><strong>Criteria:</strong> Length of travel from Helipad Stop to Elevator</td>
<td>Attribute</td>
<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
<td>Advantage</td>
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<tr>
<td><strong>Factor:</strong> Amount of space affected on 5th Floor</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
<td>50' of Path to Elevator, May fit above ceiling</td>
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<tr>
<td><strong>Criteria:</strong> Square footage of space affected</td>
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<tr>
<td><strong>Factor:</strong> Amount of Revisions to existing roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
<td>Relocate mechanical exhaust to roof, add mechanical equipment on new roof</td>
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<td><strong>Criteria:</strong> Amount of MEP revisions and ductwork</td>
<td>Attribute</td>
<td>Advantage</td>
<td>Advantage</td>
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<tr>
<td><strong>Factor:</strong> Amount of Space in Leased Space affected</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
<td>Does not require variance</td>
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<tr>
<td><strong>Criteria:</strong> Cannot be over 18'-6&quot; above roof</td>
<td>Attribute</td>
<td>Advantage</td>
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<td>Advantage</td>
<td>Advantage</td>
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<tr>
<td><strong>Factor:</strong> Amount of Space in Existing Space affected</td>
<td>2 rooms existing elevator lobby</td>
<td>2 rooms existing elevator lobby</td>
<td>2 rooms existing elevator lobby</td>
<td>2 rooms existing elevator lobby</td>
<td>2 rooms existing elevator lobby</td>
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<td><strong>Criteria:</strong></td>
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<td><strong>Factor:</strong> Structural Analysis Required</td>
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<td><strong>Factor:</strong> Maximum 6' 0&quot; Path to Elevators</td>
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<td><strong>Criteria:</strong></td>
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<td><strong>Factor:</strong> Length of Path at 6' 0&quot;</td>
<td>Can maintain</td>
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<td><strong>Criteria:</strong></td>
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<td>Advantage</td>
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<td><strong>Factor:</strong> Amount of Abobe Ceiling Modifications on Level 6</td>
<td>Large amount of HVAC, above ceiling to serve adjacent rooms</td>
<td>Small amount of HVAC, above ceiling to serve adjacent rooms</td>
<td>None</td>
<td>None</td>
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<td>None</td>
<td>Outside air intake at end of patient room to be modified</td>
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<td><strong>Criteria:</strong></td>
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<td>Factor:cost &amp; time</td>
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<td>Criteria:less LP of perimeter is better</td>
<td>Attribute:3,565</td>
<td>Advantage:2,037</td>
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<td>Factor:Parking Relationship</td>
<td>Criteria:less distance in LP is better</td>
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<td>Factor:Additional Abatement Requirement</td>
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<td>Factor:West Side Utilities</td>
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<td>Factor:Structural Concrete</td>
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<td>Attribute:max max max</td>
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<td>Factor:Site Concrete</td>
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<td>Factor:Finish</td>
<td>Criteria:less is better</td>
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<td>Factor:Speed of Const.</td>
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<td>Factor:MEP Systems</td>
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<td>Factor:Exterior Material Options</td>
<td>Criteria:no restriction of material selection is better</td>
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<td>Factor:Kitchen Distance From Building Entrance</td>
<td>Criteria:less footage distance and inside is better</td>
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<tr>
<td>Factor:FerTile Transport</td>
<td>Criteria:no elevator is best</td>
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<td>Advantage:18</td>
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<td>0</td>
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<td>Factor:Construction Type</td>
<td>Criteria:2B (less than 55000 sf) is better</td>
<td>Attribute:18</td>
<td>Advantage:18</td>
<td>18</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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<td><strong>SCORE</strong></td>
<td></td>
<td>375</td>
<td>346</td>
<td>304</td>
<td>271</td>
<td>440</td>
<td>490</td>
<td>800</td>
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<tr>
<td><strong>RANKING</strong></td>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
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Appendix 13
BASIC PRINCIPLES OF SOUND DECISIONMAKING

Jim Suhr
The Institute for Decision Innovations, Inc.
2877 N. 1050 E., North Ogden, Utah 84414-1770, USA
801-782-6168

ABSTRACT
Choosing By Advantages (CBA) is a decisionmaking system. One of its applications is in Value Analysis (VA). The CBA System includes definitions, principles, models, and methods for practically all types of decisions. The principles are central. The definitions and models explain the principles, and the methods apply the principles. Following are four of the sound–decisionmaking principles upon which the CBA System is based:

1. Sound methods base decisions on the importance of prospective differences among the alternatives—not factors, criteria, goals, roles, categories, objectives, attributes, pros and cons, and so forth. (This principle was recognized and validated at least three centuries ago.)
2. Sound methods base decisions on the importance of advantages—not advantages and disadvantages. (An advantage is a difference between the attributes of two alternatives.)
3. Sound methods base decisions on the relevant facts. (In the CBA vocabulary, methods that do not base decisions on the relevant facts are called unsound methods.)
4. Engineers, architects, leaders in organizations, and so forth are professional decisionmakers. They need to learn and skillfully use sound methods of decisionmaking.
Understanding Target Cost Delivery

InsideOut Consulting
Kristin Hill
September 13, 2011

Operating System: Principles + Tools

- Transparency
- Collaborative Planning
- Principles Lean Thinking Behaviors
- Collaborative Communication
- Collaborative Innovation

Target Cost

A management approach that drives design to deliver to defined customer values within project constraints.
Guideline 1

Develop clear Conditions of Satisfaction (CoS) – what is of value to the client

Economics of Trust
From "The Speed of Trust"

Trust = Speed + Cost

Trust = Speed + Cost

Traditional Risk Management

Open-Face Risk Management
Guideline 2

- Develop a detailed estimate and design to it – any cost over run is a team wide problem
  - Estimate real-time through-out the design to keep the design on “target”
  - Embed estimation with all components/clusters - estimators become part of the design team
  - Traditional – estimate after the fact and value engineer

Component-Based Design

Target Cost Components

Design/Budget/Schedule/Constructor

Appendix 14
Guideline 3

- Spend time together – work in with a "big room" concept
  - Set detailed agendas about the day(s) together – set expected outcomes/ required participants
  - Traditional – work in isolation and throw work over the wall
Guideline 4

- Constantly **plan together** – how are you going to meet the schedule
  - Pull plan weekly in the big room – re-plan constantly
  - Traditional – Schedules are done in isolation and are not a “plan” (but a hope and a prayer)

Guideline 5

- Design in conversation **prior to drawing**
  - Determine the issues from multiple perspectives and form decision together – **design to the decisions**
  - Traditional - is to design then discuss and revise
Guideline 6

- Collaborate with the Constructors for constructability of the design
  - Include constructors in the conversations and development of the design at a detailed level – constructors are designers
  - Traditional - is to “review, comment and revise”

Guideline 7

- Design in “sets of solutions” and hold off converging on a solution until right time
  - Gain input from all stakeholder perspectives – use A3 process to gain alignment and document
  - Make decisions based on optimizing the whole
  - Traditional - is to make decisions from narrow perspectives and revise – value engineer
Set-Based Solutions
From CPR Program

Set-based Design is
A simple, repetitive development cycle that achieves high innovation in products and manufacturing systems without risk through redundancy, robustness, and knowledge capture.

Point-based Concurrent Engineering
- Iterate if required

Set-based Concurrent Engineering
- Evaluate against threats and each other
- Eliminate weak
- Add knowledge
- Combine in different ways

Figures 5b

“Product Development for the Lean Enterprise”, Michael Kennedy
Guideline 8

➢ Set “no-compromise” goals – creative tension

- The 3-legged stool
- Traditional – one leg must be compromised
Creative Tension CoS

Maintain a construction budget of $25 million yet implement new features to improve employee efficiency and safety.

Provide infrastructure to allow growth of services & or building yet minimize construction budget impact.

Design a facility that allows for a Phase II expansion yet minimizes construction impact on site, patients and staff.

Foster staff involvement to solicit, understand, receive and respond to any needs, real or perceived yet not grow the building or build the target value.

Learn through an improving process and outcome yet reduce rework and wasted energy.

Guideline 9

- Eliminate waste and innovate
  - Learn to “see” waste and become creative in eliminating
  - Drive cross-team innovative ideas – create a focus
  - Traditional – waste, waste, waste and fear of innovation
Coordinated Design to Fabrication

Field Installation

3D Model

Pre-fab

The 40% Dividend (World-class Trust)
from “The Speed of Trust”

• High collaboration & partnering
• Effortless communication
• Positive, transparent relationships
• Fully aligned systems & structures
• Strong innovation, engagement, confidence & loyalty
**CLUSTER ADJUSTMENT**

- Propose Cluster/IPD Relationship
- Review Check-in Call Structure
- Agree on Appropriate Clusters
- Determine Cluster Leaders & Members

---

**UHS Temecula – Cluster Integration**

Flow of Requests

- **INTEGRATED TEAM**
  - **CLUSTER**
  - **CLUSTER**
  - **CLUSTER**

- **INTEGRATED TEAM** (Cluster Leaders)
- **CLUSTERS**
  - Macro
  - Micro

<table>
<thead>
<tr>
<th>Pull Plan Level</th>
<th>Macro</th>
<th>Micro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-ins Occur</td>
<td>2x per week</td>
<td>Daily or As-Needed</td>
</tr>
<tr>
<td>Milestones Come From</td>
<td>Master Schedule</td>
<td>Macro Pull Plan Commitments</td>
</tr>
<tr>
<td>Hand-offs Between</td>
<td>Cluster Leaders</td>
<td>Cluster Members</td>
</tr>
<tr>
<td>Break Down Work</td>
<td>1 week max</td>
<td>2 day max</td>
</tr>
<tr>
<td>Reflections</td>
<td>Every 3 weeks</td>
<td>Every 3 weeks</td>
</tr>
</tbody>
</table>

---

**UHS Temecula – Daily Check-in/Pull Plan Schedule**

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLUSTER Check-in</td>
<td>IPD Check-in</td>
<td>CLUSTER Check-in</td>
<td>CLUSTER Check-in</td>
<td>IPD Check-in</td>
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<tr>
<td>• Cluster leaders to establish structure of daily check-ins</td>
<td>• Cluster leaders only • Focus Check-ins on macro hand-offs between clusters</td>
<td>• Cluster leaders to establish structure of daily check-ins</td>
<td>• Cluster leaders only • Focus Check-ins on macro hand-offs between clusters</td>
<td></td>
</tr>
</tbody>
</table>

**Macro Pull Plan**
- • Milestones 2 ahead
- • Intervals 2 ahead
- • Weeks 2 ahead
- • Status Work
- • Update Work Register
- • Measure PFC

**Micro Pull Plan**
- • Pull to Milestones
- • Established from Macro Pull Plan Commitments

**PDCA Process – Regularly Conduct Structured Reflections (3 wks)**

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**UHS Temecula – Design/Budget/Schedule/Constructor**

Each cluster should integrate estimating, schedule, and constructor with design

- **INTEGRATED TEAM**
  - **CLUSTER**
  - **CLUSTER**
  - **CLUSTER**

**Clusters**
- **Design**
  - **Schedule**
  - **Budget**
  - **Constructor**

Leads to break-downs/miscommunication

- **CLUSTER**
  - **Design/Estimate/Schedule/Constructor**

- **CLUSTER**
  - **Design/Estimate/Macro Schedule**

- **CLUSTER**
  - **Design/Estimate/Schedule/Constructor**

**Appendix 15**
CLUSTER MEMBERSHIP/REPRESENTATIVES

- Same cluster members thru the life of the project – IPD Continuity
- Cluster leader may change depending on the phase of project
- Individual members’ time commitments may vary over time

UHS Temecula - Cluster Details

**Healthcare User Operations**
- UHS Dept. Heads
- UHS Subject Matter Experts
- HMC H/C Planners

**Community Public Relations**
- UHS Regional Mgr.
- UHS P/R
- Local P/R

**Medical Equipment**
- UHS Planner
- UHS IS/IT
- HMC
- DPR/Turner Vendors

**UHS Temecula - Cluster Details**

**Rebecca Hathaway-Leader**
Frank L., Tara L., Chuck D.,
George V., Seena H.,
Nancy S., Kathy D.,
Barbara C., Terry M.,
Dave Smith

**Frank Lopez to determine Leader**
Rebecca H., Tara L., Steve W.

**Nancy Squartino - Leader**
Marius Nimitz, Seena H.
Dave Smith, Kathy Duffy
Imelda Flores
Tara Laski

**UHS Temecula - Cluster Details**

**Project Operations**
- Master Schedule
- Production Planning
- Purchasing
- Budget - Estimating
- Safety
- Quality – BIM Coord.
- Cost Accounting
- Framing / Drywall (DPR)
- Kitchen
- Casework
- Lab Casework
- Doors Frames Hardware
- T-Grid Ceiling, Flooring, Paint

**Interiors Build-Out**
- Plumbing
- HVAC
- Electrical
- Fire Prot./Alarm
- IS/IT, PTS

**MEP / FP / IS-IT**
- Steve Yots - Leader
  Tom M., Ed S., Jim R.,
  Frank V. (IOR), Danny P.
  Chris O., Vanessa V.
  Kelley R., Richard S., Doug A.
  Lee T., Tom S., Raul R.

**Ward Thompson – Leader**
Marius N., Steve W.,
Steve H., Eric S.
Mike B. (Mission Bell)
Jenna S., Sheldon V.
Joseph M.,

**Ken Lindsey - Leader**
Dean S., Corey L.,
Bob K., Dave Smith,
Nate
Kathy D., Price B., Mark O.
**UHS Temecula - Cluster Details**

- **Core and Shell**
  - HMC
  - DPR Framing
  - Kone Elevator
  - PCI
  - Vision Systems
  - Roofing
  - Saiful Bouquet
  - HMC
  - DPR Concrete
  - Schuff Steel
  - Drillers (TBN)

- **Structural**
  - URS
  - HMC
  - Site Work
  - Geotech Soil Report
  - Soil Testing
  - Surveyor

- **Site**
  - Dan Munch - Leader
  - Steve H., Tom M.
  - Manish S. (Kone)
  - Gordon S. (PCI)
  - Gary C. (Vision sys)
  - Tom S.,

- **Ed Straub – Leader**
  - YK, Dan M., Steve W., Steve H.
  - Mike P. (Schuff), Marc L. (Schuff)
  - Bryan Fiehler (DPR/C Supt)
  - Tyler Boland (DPR/C PM)
  - Tom S.

- **Tom M. - Leader**
  - Dan M., Steve W.
  - Margie D., Cynthia G.
  - Emily H., Tom W., Dean S.
  - Doug A.

**UHS Temecula – Support Teams**

- **Core Team**
  - Coordination and overall day-to-day management and administration of the Project consistent with Integrated Project Delivery principles
  - Bill S., Tara L.,
  - Steve W., Rebecca H.,
  - George Z., Dave S.,
  - Ken L., Scott D., Bob K

- **Community of Practice**
  - Advance the teams application of lean behaviors, skills, processes and tools
  - George Z., Dean S., Steve Y,
  - Corey L., Dan M., Chris O.,
  - Tara L., Kristin H (Coach)

**Cluster Member/Leader Responsibilities**

- **CLUSTER LEADER**
  - Role Model / Motivate
  - Use pull planning to organize work of cluster
  - Ensure that cluster’s commitments are being met
  - Verify cluster member commitments are being removed
  - Verify that cluster topics make their way on to agenda
  - Represent the cluster in integrated team meetings
  - Organize daily cluster check-in structure as appropriate
  - Assist with On-Boarding process
  - Foster A3 process in decision making
  - Foster lean learning and principles

- **CLUSTER MEMBER**
  - Make reliable commitments
  - Manage commitments to completion
  - Make cluster leader aware of any and all commitments
  - Actively participate in pull planning
  - Actively participate in development of A3’s
  - Fill in for cluster leader as needed
  - Actively pursue lean principles and learning

**UHS Temecula – Implementation Strategy**

- By May 31st:
  - Cluster Leaders to meet with anticipated cluster members
  - Cluster Leaders to agree with cluster members which days & times to use for check-in
  - Cluster Leaders to reinforce/clarify responsibilities of cluster members
  - Report-out required on 31st by each cluster leader discussing cluster membership, daily check-in structure, etc
Plus / Delta
Learning Resources only available online at UHSPOM.COM

Appendix 16  A3 Advancing Skills of Lean Teams
Appendix 17  COAA Project Leadership Awards Nomination for GW by Bernita Beikmann, HKS Architects
Appendix 18  GWB Lean Story
Appendix 19  Links to Informational Videos
Appendix 20  Another Approach to Project Delivery: Creating a Shared Mind, Kristin Hill, Christine Slivon, John Draper
Appendix 21  Project Delivery is Broken: If it Broke, Fix it, Kristin Hill
Appendix 22  Learning Guide for a High Performing Team