Design Management – A Lean Approach

Faster Forward – Technology in Architectural Practice November 17, 2011
Bruce Cousins, AIA

• 30 + yrs. Architect & Technology Consultant, M Arch. UC Berkeley

• 2.5 Years Sr. Mgr. Virtual Design and Construction, Top 300 General Contractor

• $0.75B in Virtual Design and Construction (VDC)

• 41 construction professionals managing projects using virtual building models

• Used VDC at all operational levels as extension of employee skill set
Learning Objectives

1. 3D Building Information Modeling technology is changing the way Architects design and deliver a project.
2. Combining the “Lean” Process with BIM technology works to facilitate a collaborative design process.
3. New Roles and Responsibilities are evolving for Architects to lead and or collaborate with all project stakeholders throughout design and construction process.
4. The fundamental building blocks of the Lean Process that can be applied to managing the design process?
   Design Management, Target Value Design, Set Based Design, Rapid Prototyping, Co-Location, Shared risk & reward.
5. Path Forward for Lean, BIM and IPD projects?
Resetting the Operating System

INTRODUCTION
What is Not Working?

Calatrava has prepared a reduced design for South Terminal to save money, Day said. "He said 'Don't tell me what to cut. Tell me your budget.'"

The result is a new design for the hotel-train-station-plaza complex that is 25 percent reduced in area, and 30 percent reduced in volume, from the original design, she said.

Financial Constraints, unnecessary time delays, deep divisions between the design team and the Program Managers.

Robertina Calatrava - Letter

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What is Not Working?

✓ Unrealistic design & production schedules
✓ Incomplete documents push decisions downstream
✓ Lack of management discipline overwhelms even the most dedicated project team
✓ Lack of Accountability within the Team
✓ Quality suffers, employees work long hours to meet impossible deadlines
✓ Silos of work do not allow transparency & teamwork
✓ Lack of Coordinated Documents
✓ Frequent Rework to meet project goals
Master Builder Era

HH Richardson  Le Corbusier  FLW
The Virtual Building Era

Morphosis

Gehry Technologies

Ghafari Associates

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The Virtual Building Era

VDC-BIM Technology encourages & enhances collaborative design relationships... signaling the end of an era of America’s construction industry that has been risk averse, conservative and confrontational...

NO ONE KNOWS AS MUCH AS EVERYONE
Tradition Yields to Collaboration...

✓ Team agrees change is desired to the conventional design process
✓ Team members promise each other that they will work cooperatively to provide the most value to the Client
✓ They will commit to redesign the design process
✓ Share risk & reward – put profits at risk
✓ The Project Team become its own “company”
✓ Create a learning environment
✓ Everyone feels Vulnerable
Response to Traditional OS Breakdowns

Partnering

Design/Build

ITUNES NEW OPERATING SYSTEM

IPD – Integrated Project Delivery

New OS
Virtual Design & Construction
the Dashboard for LEAN Processes
The “New” Operating System

MANAGING DESIGN IN A COLLABORATIVE PROJECT ENVIRONMENT
Beginning the Lean Journey…
In Sutter’s brave new world of lean construction, the traditional “command and control” mentality of project management is gone. Gone are most lump sum, low-bid contracts. Gone are guaranteed maximum prices. Gone are inflated bids to cover risk. Gone are the adversaries. Gone are most requests for information. And, so far, gone are costly claims.” — Nadine Post, Engineering News
Meet or Exceed the Clients Expectations?

• Ideas - Fresh Thinking
• Iconic Imageable Forms
• Predictable Outcomes
• Meet the Project End Users Needs

Value is what a Client wants.
Design is Messy & Not Sequential

A new design management paradigm must acknowledge this fundamental essence of design thinking. A Lean management approach acknowledges the essence design thinking is fuzzy, iterative, non sequential …
Purposes

Design Criteria

Design Concepts

Process Design

Product Design

Detailed Engineering

Fabrication & Logistics

Installation

Commissioning

Operations & Maintenance

Alteration & Decommissioning

Project Definition

Lean Design

Lean Supply

Lean Assembly

Use

Production Control

Work Structuring

Learning Loops

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TAP Faster Forward 2011
Lean Management
The OS for Successful Project Delivery

“Anything that does not add value is waste.”
Waste…In Planning & Design

• Lack of Accurate Owner Program
• Early Starts without complete info
• Discovery of the unknown – Lack of Sequence
• Waiting – Owner and other Review
• Predetermined design solutions that need rework to fit
• Lack of Direct Access to Supply Chain – Means & Methods

Source: The Toyota Product Development System
Waste…In Construction

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

Source: The Toyota Way
BIM Technology’s Contribution to Design Management

• A 3D Picture is worth a Thousand Words or 2D Drawings
• Transforms ego-based conflict into fact-based conversations
• Increases the Speed of the Design Process Work Flow with less risk of missing key design issues
• Enables effective low cost Rapid Prototyping & Simulation of building performance

Levit, Raymond & John Kunz, Design Your Project Organization as Engineers Design Bridges – CIFE Working Paper #73

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Integrated VDC-BIM & Lean

FIVE BIG IDEAS OF LEAN PROJECT DELIVERY

- Collaborate; Really Collaborate
- Increase Relatedness
- Networks of Commitment
- Optimize The Whole
- Tightly Couple Learning with Action

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Key Concepts

COLLABORATIVE WORKFLOW & DESIGN MANAGEMENT
Design Management

CURRENT STATE

- Conventional Views – Design cannot be measured & understood
- Scope Budgets are a moving target
- Lack of design process transparency is expected
- Rework and back tracking are inevitable
- Direct participation in supply chain will be done later
- Undisciplined & non existent design management
- 3D Models used primarily for presentations
- Lack of Timely Owner Decisions
Continuum of Design Management

Design projects are unique & therefore cannot be planned or managed

Design is understandable and measurable...therefore can be managed
Translations from Model to Building
Michael Kilkelly, Gehry Partners

KA Connect podcast 5/30/11

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“Anything that does not add value is waste”

KEY CONCEPTS OF LEAN PROCESS IN DESIGN MANAGEMENT
The Objectives of a Collaborative OS

✓ Work together to define the issues and produce decisions then design to those decisions vs. Design alone and then come together for group reviews and decisions

✓ Work in pairs or a larger group, face to face vs. Work separately

✓ Design based on a detailed estimate vs. Estimate based on a detailed design.

✓ Carry design sets far into the design process vs. Narrow choices to proceed with one design

✓ Design for what is constructible vs. Evaluate the constructability of a design after it is designed
Lean Project Work Flow

- Pre Project Planning
  - Business Planning
  - Plan Validation & Feasibility
  - Go/No Go

- Project Definition
  - Design
    - Develop Design
      - Detailed Engineering
    - Go/No Go
  - Permit
    - Go/No Go

- Construct
  - Commission / Turnover
    - Go/No Go

- Set Targets
  - Design to Targets
  - Build to Targets

“Target Costing” Lean Construction Institute

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Establish “Client First” Spirit

Hold kickoff & alignment workshops

The Owner, Architect, Builder work as a team to solve the Client’s Problem

Define Perceived Risks and Constraints

Launch meeting schedule

Establish the BIG room and Co-located teams
“Design is principally a social activity.”

--Gregory Howell – Lean Construction Institute
Align Interests & Establish Trust

Expected Outcomes:

1. Agreement by the companies and individuals present concerning their collective appetite for delivering the project under an integrated agreement and using Lean project delivery principles.

2. Agreement on the path forward for developing the team’s capabilities to deliver the project on a Lean, integrated basis and for negotiating an operating agreement to govern the team.

Set Goals & Objectives  Team Building
WORK TOGETHER FACE TO FACE

Eat Together & Give Prizes
Last Planner

- People doing the work are best qualified to schedule their Work
- Design and construction projects are a network of commitments.
- Teams must collaborate and make reliable promises to complete the project
WORK TOGETHER FACE TO FACE

Make Team Communication Visual

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TAP Faster Forward 2011
Target Value Design - TVD

1. Set Target Cost – Typically lower than the budget that assumed current best practice
2. Form Target Value Design Teams by system and allocate the target cost to each team
3. Provide cost and performance standards for the Core Building Elements
Target Value Design - TVD

1. Entitlements & Permit
2. Site / Civil / Foundations
3. Structure
4. Enclosure
5. MEP Fire Low Voltage
6. Interiors
7. Amenities
Determine the initial expected cost of the facility based on Cost for a Similar Project.

Builder provides frequent estimates based on Design Sets – Balance Project Sets.

Project Team agrees on Target Budget - Design Team & Production Team Share Responsibility in proportion to Risk & Reward.
“Real Time” Budget Reviews

DESIGN BASED ON A DETAILED ESTIMATE
SET BASED DESIGN

Use a “Set” based Design approach, evaluating Design ALTERNATIVES against target values

1. Embrace & Engage the Supply Chain
2. Design Build 3D prototypes of Concepts
3. Evaluate Sets including Target Budgets
4. Production Team must use & Understand BIM
5. Use A3 Documentation to generate Sets
6. Frequent Review of Sets with key production team members
## Set Based Design

**Stanford Green Dorm**

### Building System Matrix

<table>
<thead>
<tr>
<th>Dorms / Common Lab Space</th>
<th>CO₂ Impact</th>
<th>Life Cycle Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wood Bearing Wall</td>
<td>12, 8, 4</td>
<td>69</td>
</tr>
<tr>
<td>2. Steel Frame / Mti Deck/Concrete Topping</td>
<td>7, 8, 9</td>
<td>83</td>
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<tr>
<td>3. Wood Post and Beam</td>
<td>12, 8, 9</td>
<td>15</td>
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<tr>
<td>4. Metal Stud Bearing Wall</td>
<td>3, 9, 10</td>
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<tr>
<td>5. Concrete Slab and Walls</td>
<td>3, 9, 10</td>
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<tr>
<td>6. CMU Bearing Wall/Wood Floor</td>
<td>12, 3, 10, 11</td>
<td>58</td>
</tr>
<tr>
<td>7. Straw-Bale / Wood Frame</td>
<td>12, 3, 4, 18</td>
<td>58</td>
</tr>
</tbody>
</table>

### Notes
- 1. FSC Certified Wood
- 2. Resource Efficient Framing
- 3. Plywood Shearwalls
- 4. 15" Concrete or Gypsum Topping
- 5. Steel Under Discontinuous Walls
- 6. Low Cement Concrete (70% Slag, 30% Cement)
- 7. Rocking & Restoring Systems w. Replaceable Fuses (FT Cable, Steel Fuses, ECC Fuses)
- 8. Moment Frames w. Dampers
- 9. Structural Insulated Panel (SIP) Skins
- 10. Plywood Flex Diaphragm
- 11. Rigid Insulation (FG) on Exterior Walls
- 12. Rocking and Restoring Systems w. PT Cable Reinforcement
- 13. Lime Plaster Skins

### Architects
- EHDD
- Contractor: Pankow
- Mechanical Engineer: Taylor

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Who “Drives” Design Management?

Design Integrator

Architect

Engineer

Builder

DI
Design Integrator is a person whose primary task is to focus on facilitating the Design Management workflow based both on social coordination and technical integration.
Characteristics of a Good Design Manager

- Empathy with and enthusiasm for the project goals and objectives
- Have a natural ability to direct creative professionals (both designers and builders) toward the project’s objectives.
- Ability to make difficult choices – often at odds with some stakeholders
- Integrity, ethics, and a reputation for fair dealing
- Disciplined in maintaining project flow
- Level temperament and patience in working with others
- Willingness to give credit to co-workers when due
- Familiarity with project delivery methods
- Training and broad understanding in both design and construction
- Ability to gain & maintain respect of the Project Team

http://www.dbiabooks.com/shopexd.asp?id=8395
Design Manager or Design Integrator

“Responsibility without Authority”
Leveraging Lean Project Planning in Design Management

- Define Design Work Flow – Identify Risks
- Manage the Design – Use TVD to find the right solutions quickly – from months to days
- Structure the Work - Not the same old way
- Manage the Supply Chain – establish new strategic vendor relationships
- Simulate Construction – 3D, 4D & 5D technology schedule, materials & methods
  - Rapid Prototyping – What If’s?
  - Really Collaborate – Redefine Risk Reward

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Lean Design Management

THE PATH FORWARD
Design Management

FUTURE STATE

- Design Team understands that design is manageable
- Rework and back tracking are inevitable – Built into Design Schedule and Process
- A collaborative environment is established & supports an integrated and transparent decision-making process
- Shared obligations, risks and rewards are agreed upon
- A “Learning Environment” for best practices is in place
- VDC-BIM is used to plan by simulations and rapid prototyping
- Project is designed to budget (TVD & cluster estimates)
- Easily understood metrics Planned Percent Complete (PPC) used to track Design teams progress and Project Budget
- Project teams practice continuous improvement with process change and technological innovation

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LEAN Design .......
“Shared Obligations, Risks and Rewards”

✓ Mutual Respect & Trust
✓ Intensive Planning Early
✓ Shared Compensation
✓ Shared Risk & Reward
✓ Early Participation
✓ Co Located Design
✓ Not Design/Build!!
Adopting Innovative ways of Project Mgt …

• Create a Learning Environment
• Devote Time and Resources
• Carefully Plan, Manage & Measure
• Invest in Training
• Use Social Media to Communicate
• Allow for Failure – “Failure is not the end of a conversation but the beginning of another one.”
# PLAN YOUR LEAN JOURNEY – START SMALL

**Focus:** Lean Transformation

## Performance, gaps, and targets

<table>
<thead>
<tr>
<th>Goal</th>
<th>Possible metrics</th>
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<tbody>
<tr>
<td>Become a learning organization</td>
<td># of accepted improvements</td>
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<tr>
<td>Do projects in a lean way</td>
<td># of projects on LPS PPC - by business unit, region, project</td>
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### Reflection on last 12 month’s activities

<table>
<thead>
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<th>Activity</th>
<th>Rating</th>
<th>Key results / Issues</th>
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<td>Implement LPS on Beattitudes</td>
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<td>Implement LPS on Sagewood</td>
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<td>SAT with leadership group</td>
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### Rationale for next 12 month’s activities

- Start Portico Place project

## This year’s action plan (milestone chart)

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<td>Do projects in a lean way</td>
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<td>Project #6</td>
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## Followup / Unresolved Issues

**Signatures**

**Author:**

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Lean Resources & References
VDC-BIM Resources & References
Design Mgt. Resources & References

The ADePT Design software suite lets you plan and control complex, iterative, and information driven project processes.

KA Connect 2011 Podcast
Romano Nickerson, Boulder Associates
“Learning How to be Lean”

www.leanconstruction.org
Lean Design Forum

http://www.dbiabooks.com/shopexd.asp?id=8395
Thoughts to change by

“Don’t let great be the enemy of good.”

“Keep everything simple, make it visible, trust your people to do the right thing.”

To accomplish great things we must not only act, but also dream; not only plan, but also believe.
“Design Management – A Lean Approach”
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Bruce C. Cousins AIA
700 Colorado Blvd. #249
Denver, Colorado 80206
(303) 888-6304
www.studiovltd.com

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