Change or Perish

Complexity + Collaboration in Construction

CCA OAEC Workshop • 20150225
Markku Allison AIA
collaboration
what is collaboration?
why collaborate?
context
intent

means and methods

design

construction
design

intent

means and methods

construction
despite our best laid plans, projects don’t always flow smoothly
“…but they said…”
“…but they said…”
“…wasn’t that your job?”
“…but they said…”
“…wasn’t that your job?”
“…and then we found out…”
“...but they said...”
“...wasn’t that your job?”
“...and then we found out...”
“...we thought that meant...”
“...but they said...”
“...wasn’t that your job?”
“...and then we found out...”
“...we thought that meant...”
“...you want it when?!?”
business as usual
integrated design
ipd
lean
complexity
source: Dave Snowden, Cognitive Edge
connections = 6

source: Dave Snowden, Cognitive Edge
patterns = 64

source: Dave Snowden, Cognitive Edge
connections = 45
patterns = 3,500,000,000,000
buildings are decisions
context
form
material
structure
context
form
material
structure
heating
cooling
context
form
material
structure
heating
cooling
plumbing
electrical
fire protection
telephone
<table>
<thead>
<tr>
<th>context</th>
<th>form</th>
<th>material</th>
<th>structure</th>
<th>heating</th>
<th>cooling</th>
<th>plumbing</th>
<th>electrical</th>
<th>fire protection</th>
<th>telephone</th>
<th>data</th>
<th>security</th>
</tr>
</thead>
</table>
patterns = 3,500,000,000,000
design and construction is decision making in a complex environment
Elevator
Elevator

- Drywall
- Elevator supplier
- Mechanical sub
- Fire protection
- Mason
- Electrical sub
- GC
- Steel erector
- Steel fabricator
- Finishes subs
connections = 45
patterns = 3,500,000,000,000
complexity

problems are connected
ripples cause unanticipated outcomes
what we think is the problem is perhaps not the problem
ripples from decisions cross contractual boundaries
leaks occur at the intersection of contracts
how do we navigate?
how do we manage?
context  form  material  structure  heating  cooling  plumbing  electrical  fire protection  telephone  data  security  sustainability
teams and projects are living networks
culture
not
contracts
collaboration
what is collaboration?
What IS effective collaboration?
What IS effective collaboration?

- Communicate carefully
- Listen attentively
- Demonstrate understanding
- Be flexible
- Right attitudes
What IS effective collaboration?

- Communicate carefully
- Listen attentively
- Demonstrate understanding
- Be flexible
- Right attitudes

- Listen
- Open mind
- Humility
- Respect
- Consensus
What IS effective collaboration?

• Communicate carefully
• Listen attentively
• Demonstrate understanding
• Be flexible
• Right attitudes

• Listen
• Open mind
• Humility
• Respect
• Consensus

• Common goal
• Effective communication
  Attentive listening
  Respect
  Understanding

• Trust
  Honesty
  Transparency

• Diversity
• Teamwork
• Open mindedness
Effective attitudes
Effective communications
Build an effective team
Know one another
collaboration

projects are networks
people are connected by purpose
companies are abstractions
language
Human Beings

We are biological and historical, and we live in language.

We are creatures of habit – habits of mood, thought, and action.

Source: Chauncey Bell + Associates, Inc.
Biggest Waste in AEC Is Mis-coordination

• Failing to listen well to each others’ concerns, and failing to perform language actions competently and sincerely produces mistrust and a profusion of otherwise unnecessary, wasteful actions.

• Poor management of networks of commitments is the source of an enormous amount of waste in modern organizations, much of which does not appear in our financial reports.

Source: Chauncey Bell + Associates, Inc.
Moods and Emotions

• Embodied assessments
  • Very infectious

• Emotions come from events and sweep us away
  • Moods are always in the background
  • They shape our listening, and shape how we are listened to

Source: Chauncey Bell + Associates, Inc.
Unless we are trained to watch our moods, and we learn to talk with each other about them, we are largely oblivious to them and their effects on our relationships.

Source: Chauncey Bell + Associates, Inc.
Language can help and harm. It can encourage and empower or discourage and undermine ideas and actions.
Building operators, architects, engineers and contractors speak different dialects, which sometimes vary within the same organization and often within the same discipline or trade.
You need the “right” people in the room. Language has no power without people to hear the words. Those are project participants and stakeholders who can speak to value.
Face-to-face conversations in workshops, as opposed to meetings for reporting progress, are the most effective. The telephone game is true. Reported conversations, especially by people outside the team, often lead to misunderstanding.
People use language to organize themselves for action. This is an essential first step.
Language is progressive. Understanding comes in layers, rarely all at once. Conversations should be structured to work from big and simple to small and detailed, based on understanding and agreements made at each step.
common understanding
Don’t tell me about your values. Show me your behavior and I will form an opinion about your values.
Accountable
Accountable
Punctuality

Accountable
Reliability

Punctuality

Accountable

Reliability
Do what we say we are going to do

Punctuality

Reliability

Responsibility for actions

Accountable
Do what we say we are going to do

Punctuality

Reliability

Responsibility for actions
Do what we say we are going to do
Responsibility for actions
Reliability
Punctuality

Accountable.
We are accountable.
We are punctual and reliable.
We take responsibility for our actions and do what we say we’re going to do.
We are committed. We want to succeed. Our heart is in our work and we do whatever it takes to get the job done, and done right.

We are accountable. We take responsibility for our actions and actions of others for whom we are responsible. We know our limits and others can count on us.

We are communicative. We use the most direct and efficient form of communication available. We acknowledge that we’ve heard, listened, and understood. We are clear, concise, direct, honest, and polite.

We are timely. We are punctual, on schedule, and meet deadlines. We prioritize hot items accordingly, acknowledge receipt of handoffs and deliver responses without people having to ask twice.

We are engaged. We respond with attentive, focused willingness and enthusiasm.

We are collaborative. We anticipate the needs and questions of others. We acknowledge others and others’ roles. We include everybody in the loop who needs to be in the loop.

We are prepared. We have thought the project through and have attempted to identify the unknowns. We are knowledgeable about the task at hand and have the necessary back-up material to address questions others may have. We are prepared with options and a recommended solution.

We are accessible. People know where and how to find us and we are there when needed. We are also there when we’re not needed.

We are consistent. We know the level of quality expected in the situation, and the quality of our work is at that level or better. We are always doing our best.
language
we live in language
what we say might not be what is heard
what we say might not be what we mean
complexity
collaboration
language
meanwhile...
theory / practice
AIA
AGC
CURT | 3xPT
LCI
COAA
ABC
NASFA
AISC
Owner Leadership
Integrated Project Teams and Structure
Open Information Sharing
Virtual Building Models

Change organization of projects and teams
Change ineffective behaviors
Utilize technology
Opportunity: Owners driving full collaboration through information sharing early in the project process are most likely to achieve the desired outcomes: fast, efficient, effective, and cost-bound buildings. Such collaboration shifts the bulk of analysis, design, and decision-making earlier in the design process, giving the collaborators maximum opportunity for good decisions. This concept is shown in the following diagram.

Owners driving full collaboration through information sharing early in the project process are most likely to achieve the desired outcomes: fast, efficient, effective, and cost-bound buildings.
Integrated Project Delivery:
First Principles for Owners and Teams

Outcomes of the 3xPT Strategy Group
Integrated Project Delivery Workshop, July 2007
1. **Process and Organization**
   1.1 Owners should lead by example, with a strong commitment to integration and accountability
   1.2 Assemble the right team early, based on qualifications, and identify resulting knowledge gaps
   1.3 Strive for collaboration to drive all processes, whereby interests are aligned with skills best suited to the objectives
   1.4 Quantify and allocate risks and rewards through careful planning and fair principles of distribution
   1.5 Restructure project phases to optimize design/construct processes
   1.6 Maximize the use of digital technology with well-defined building information modeling and digital information management
   1.7 Integrate project thinking through innovative processes like scenario-based planning, 4D modeling, and just-in-time delivery

2. **Scope**
   (Project Scope, Scope of Work, Service Offerings)
   2.1 Develop a clear, mutual definition of project scope and project goals
   2.2 Identify project-critical specialty contractors and subcontractors; get them involved early
   2.3 Identify a process and model coordinator

3. **Performance Metrics**
   3.1 Define performance framework and identify specific performance measures based on owner/project goals
   3.2 Identify the specific team member accountable for each activity; consider collective vs. individual responsibility for appropriate metrics

4. **Tools and Methods**
   4.1 Leverage technology.
   4.2 Optimize use of tools to minimize risks
   4.3 Ensure technological competency of team members, develop a shared understanding of base platforms
   4.4 Define a digital information protocol charter at the project’s inception
   4.5 Require open information sharing

5. **Contractual Agreements**
   5.1 Use contractual terms that drive collaboration to the maximum extent possible, thereby appropriately allocating risk and reward
   5.2 Consider value-based compensation with outcome-based incentives and disincentives aligned across the team
   5.3 Consider collaborative management of project contingencies
   5.4 Work with insurance companies and agencies to develop new risk management approaches and insurance products
Integrated Project Delivery
For Public and Private Owners
BIM Implementation: An Owner’s Guide to Getting Started

UP-1203
April 2010
Integrated Project Delivery: A Guide
contractual principles

Key Participants Bound Together as Equals
Shared Financial Risk and Reward Based on Project Outcome
Liability Waivers between Key Participants
Fiscal Transparency between Key Participants
Early Involvement of Key Participants
Intensified Design
Jointly Developed Project Target Criteria
Collaborative Decision Making
behavioral principles

Mutual Respect and Trust
Willingness to Collaborate
Open Communication
catalysts for IPD

Multi Party Agreement
Building Information Modeling
Lean Design and Construction
A295 Transitional IPD Forms
1. SPE Agreement
2. SPE Member Services Agreement
3. SPE Owner Agreement
4. Non-Member Agreement
AIA C191 | ConsensusDOCS 300
Multi-Party Agreements

- Owner, Design Professional and Constructor, at minimum
- Bound together as equals
AIA E202 BIM Protocol Exhibit
ConsensusDOCS BIM Addendum
2012 AIA SURVEY REPORT ON FIRM CHARACTERISTICS

THE BUSINESS OF ARCHITECTURE

2011 INTEGRATED PROJECT DELIVERY
AWARENESS SURVEY

The AIA Center for Integrated Practice developed a brief survey to gauge AIA member understanding and attitudes towards Integrated Project Delivery, a collaborative alternative delivery method.

In November 2011, the survey was distributed electronically to two separate sets of AIA-member firms containing approximately 1000 names each. The American Institute of Architects developed a brief survey to gauge members' understanding and attitudes towards Integrated Project Delivery contract methodology.

A total of 319 respondents participated in the survey. Respondents run the gamut of AIA membership by experience, age, firm size and project types.

The confidence interval for the survey is ±5% with a 95% design of error for the survey. Questions and responses are written in the form of a survey. Survey questions and comments are included in the terms of this document.

AIA
The results of McGraw-Hill Construction research on BIM from 2007, 2009, and 2012 clearly show the dramatic expansion of BIM adoption in North America over that period.

- Adoption between 2007 and 2009 expanded by 75%.
- Despite the severe economic downturn between 2009 and 2012, the number of firms reporting engagement with BIM grew by 45%.

This trend tangibly demonstrates the powerful value proposition of BIM to a broad range of companies across the construction industry. Counteracting the instinct to cut back during a recession, a quarter of the industry invested in a more efficient and productive future by embracing the technologies and processes of BIM.

Variation by Region

The differences between major regions found in 2009 research have lessened dramatically in 2012.

- The West still leads all regions with an overall BIM adoption rate of 77%, up from 56% in 2009 and well above the national average.
- 2009 Northeast regional adoption (38%) was significantly lower than the national average of 49%. Though still lagging in 2012, at 66%, the region grew the most from 2009 to 2012.
- The Midwest and South are still slightly above and slightly below average respectively, and Canada remains essentially at average.

The range between the highest and lowest adopting regions dropped from a gap of eighteen percentage points in 2009 to only a differential of eleven in 2012, and it is likely to continue to reduce in the future. However, this difference may be affected by regional dynamics of economic recovery. Overall, this narrowing demonstrates that BIM adoption is becoming more widespread industry-wide.

Much of the growth across regions is likely spurred by the relatively large amount of health care work going on nationally, a project type particularly well suited to BIM because of its benefits of collaboration; spatial coordination; mechanical, electrical, and plumbing (MEP) prefabrication; constructability review; and visualization that more effectively engage a wide variety of stakeholders. (For an example, refer to the case study on Sutter Medical Center on page 34).

2012 MHC SmartMarket Report

BIM Use in North America


<table>
<thead>
<tr>
<th>Region</th>
<th>2009</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>49%</td>
<td>72%</td>
</tr>
<tr>
<td>West</td>
<td>56%</td>
<td>77%</td>
</tr>
<tr>
<td>Midwest</td>
<td>52%</td>
<td>73%</td>
</tr>
<tr>
<td>Northeast</td>
<td>38%</td>
<td>66%</td>
</tr>
<tr>
<td>South</td>
<td>45%</td>
<td>68%</td>
</tr>
</tbody>
</table>
## BIM Adoption by Type and Size of Firm (2009 and 2012)


<table>
<thead>
<tr>
<th>Firm Type</th>
<th>2009 Average</th>
<th>2012 Average</th>
<th>2009 Average</th>
<th>2012 Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architects</td>
<td>58%</td>
<td>70%</td>
<td>42%</td>
<td>67%</td>
</tr>
<tr>
<td>Engineers</td>
<td>42%</td>
<td>67%</td>
<td>50%</td>
<td>74%</td>
</tr>
<tr>
<td>Contractors</td>
<td>25%</td>
<td>49%</td>
<td>41%</td>
<td>74%</td>
</tr>
<tr>
<td>Small</td>
<td>25%</td>
<td>49%</td>
<td>41%</td>
<td>74%</td>
</tr>
<tr>
<td>Small to Medium</td>
<td>41%</td>
<td>65%</td>
<td>41%</td>
<td>74%</td>
</tr>
<tr>
<td>Medium to Large</td>
<td>65%</td>
<td>86%</td>
<td>65%</td>
<td>91%</td>
</tr>
<tr>
<td>Large</td>
<td>74%</td>
<td>86%</td>
<td>74%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Variation by Firm Size

- The size of an organization has the biggest influence on the likelihood that it has adopted BIM.
  - 91% of large companies are engaged with BIM in 2012, up from 74% in 2009. In both years, this group was significantly higher than average.
  - Medium-to-large firms, also consistent above-average adopters, grew from 65% in 2009 to 86% in 2012.
  - The small-to-medium group soared from a below-average of 41% in 2009 to 74% in 2012.
  - Only 49% of small organizations report 2012 BIM involvement, in spite of doubling their adoption since 2009. This puts smaller organizations at a competitive disadvantage in serving the needs of increasingly BIM-aware clients.

Larger organizations generally benefit from greater resources and experience in implementing new technologies and standardizing business processes to optimize them. As a result, they are better positioned to be proactive about adopting BIM, evaluating its effectiveness, and rolling it out across their organizations in a managed program.
Given the potential investments and cultural shifts associated with BIM adoption, users have leaned on metrics to help them identify the technology's value. Initially, metrics were hard to come by, as users could only work from limited data. But over time, users have gained a wealth of information about the costs and benefits associated with BIM, helping users expand and refine the use of metrics.

Collaboration

As an earlier adopter of BIM, executives at J.C. Cannistraro, an MEP contractor based in Watertown, Mass., could sense that greater collaboration yielded better results but couldn't quantify it, says Michael Cannistraro, vice president of service metrics.

Metrics Measure the Value Gained from BIM

As they get more BIM projects completed, companies are now developing their own metrics to understand the benefits gained from BIM. Also, researchers are working on a BIMSCORE to be applied industry-wide.

A study by J.C. Cannistraro of 408 projects Valued at $559 million shows how, in the big picture, BIM saves money as the team gets more collaborative.
CONTRACTOR-LED DESIGN-BUILD, CM AT RISK INCREASE IN POPULARITY

Percent construction contract value for projects begun in 2011

<table>
<thead>
<tr>
<th>Project delivery method</th>
<th>2011</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional design-bid-build</td>
<td>55%</td>
<td>61%</td>
</tr>
<tr>
<td>Design-build: contractor-led</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>Design-build: architect-led</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Construction management as agent (agency CM)</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td>Construction manager as constructor (CM at risk)</td>
<td>18%</td>
<td>12%</td>
</tr>
<tr>
<td>Integrated project delivery (IPD)</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>2%</td>
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</table>

2012 AIA Firm Survey
CONTRACTOR-LED DESIGN-BUILD, CM AT RISK INCREASE IN POPULARITY

Percent construction contract value for projects begun in 2011

Project delivery method

- Construction management as agent (agency CM): 5% (2011), 9% (2008)
- Construction manager as constructor (CM at risk): 18% (2011), 12% (2008)
- Other: 4% (2011), 2% (2008)

2012 AIA Firm Survey
CONTRACTOR-LED DESIGN-BUILD, CM AT RISK INCREASE IN POPULARITY

Percent construction contract value for projects begun in 2011

2012 AIA Firm Survey

Figure 5.6

2011 vs. 2008 Project Delivery Methods

Traditional design-bid-build: 55% (2011) vs. 61% (2008)
Design-build: contractor-led: 13% (2011) vs. 9% (2008)
Design-build: architect-led: 2% (2011) vs. 4% (2008)
Construction management as agent (agency CM): 5% (2011) vs. 9% (2008)
Construction manager as constructor (CM at risk): 18% (2011) vs. 12% (2008)
Integrated project delivery (IPD): 2% (2011) vs. 2% (2008)
Other: 4% (2011) vs. 2% (2008)
CONTRACTOR-LED DESIGN-BUILD, CM AT RISK INCREASE IN POPULARITY

Percent construction contract value for projects begun in 2011

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</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>2%</td>
</tr>
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</table>
84% of AIA members are aware of IPD
Member Comprehension of IPD, n=313

41% Never heard of it
22% Heard of it / read some
18% Actively research / confident
16% Engaged in projects with some / all characteristics
18% Engaged in "IPD-ish" project with no characteristics

40% member "understanding" of IPD
Characterized by the ability to explain IPD, especially as distinct from DB or CMs

84% member "awareness" of IPD
2011 AIA IPD Awareness Survey

AIA members using IPD engaged in spectrum of projects
Project type, completed IPD project, n=42

- Industrial: 24%
- Multi-Family Residential: 14%
- Religious: 12%
- Other: 12%
- Recreational: 10%
- Retail, Food Service, Warehouse: 7%
- Education (K-12): 5%
- Office: 5%
- Education (college/university): 5%
- Government/Civic: 5%
- Single Family Residential: 2%
- Health Care: 2%

NOTE: “Completed IPD Project,” n=42 (note small sample base), refers to respondents reporting one or more project underway and/or completed within the last two years using a contractual IPD Model.
AIA members cite lack of owner education, precedent as barriers to IPD

Most significant barriers to adopting IPD, all respondents, n=313
2011 AIA IPD Awareness Survey

Perception of barriers decreases significantly with experience
Most significant barriers to adopting IPD by experience

- General lack of precedent
- My firm lacks the necessary skills/knowledge
- Licensing and liability concerns
- Uncertain about risk management in IPD
- General lack of available information about the process
- Projects I work on are too small
- Projects I work on are not complex enough
- My firm lacks appropriate technology
- General lack of industry support
- Owner does not see advantages
- Uncertain about compensation structure
- Owner resistant to change
- General lack of available, appropriate insurance
- Procurement method constraints/limitations
- Preventative statutes
- My firm lacks trust in industry partners

% change from 'Not Completed IPD' to 'Completed IPD' - Have Not Completed IPD Projects, n=271 - Completed IPD Projects, n=42

NOTE: “Completed IPD Project,” n=42 (“note small sample base), refers to respondents reporting one or more project underway and/or completed within the last two years using a contractual IPD Model.
2011 AIA IPD Awareness Survey

Owner-related barriers persist even with experience
Most significant barriers to adopting IPD by experience

NOTE: "Completed IPD Project," n=42 (note small sample base), refers to respondents reporting one or more project underway and/or completed within the last two years using a contractual IPD Model.
86% of AIA members using IPD have been in practice 15+ years

Years in Practice, completed IPD project, n=42

- 33%: 15 to less than 20 years
- 24%: 20 to less than 25 years
- 29%: 25 or more years
- 5%: 10 to less than 15 years
- 7%: 5 to less than 10 years
- 2%: 1 to less than 5 years
- 0%: Less than 1 year

NOTE: "Completed IPD Project," n=42 (note small sample size), refers to respondents reporting one or more project underway and/or completed within the last two years using a contractual IPD Model.
benefits
IPD Case Studies
AIA, AIA Minnesota, School of Architecture University of Minnesota
March 2012

This document incorporates case studies originally documented in the 2010 publication, “Integrated Project Delivery: Case Studies” by the AIA / AIA California Council
Case study information is presented in a matrix view, encouraging the reader to navigate in a variety of ways. Users can compare projects by looking at the holistic flow of narrative or look across projects at particular strategies. By intention, this study focused on the activities that lay the foundation for IPD, including hard-to-quantify aspects of building trust, transparency and creating a collaborative culture. Even in these early stages, it’s clear that management and social strategies become inextricably linked to the legal/commercial strategies, which then are carried through in the environmental and technical strategies. Over the course of developing the study, it became apparent that lean practices are enormously influential in many areas, crossing several matrix categories. While the matrix may appear to compartmentalize issues that should be interwoven, we hope that the embedded cross linkages can serve to tie the narrative together while keeping the clarity of comparing like information.
<table>
<thead>
<tr>
<th>At a Glance</th>
<th>Overview</th>
<th>Legal and Commercial Strategies</th>
<th>Management Strategies</th>
<th>Social Strategies</th>
<th>Environmental and Technological Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Description</td>
<td>IPD Profile</td>
<td>Survey Data</td>
<td>Contract</td>
<td>Goals</td>
<td>Risk/Reward</td>
</tr>
</tbody>
</table>

**Overview**

- Project Description
- Contract
- Goals
- Risk/Reward
- Liability
- Insurance
- Leadership
- Firm Selection
- Team Selection
- Early Planning
- Implementation
- Early Involvement
- Transparency
- Decision Making
- Culture
- Workplace
- Information Sharing
- BIM

**Environmental and Technological Strategies**

- Workplace
- Information Sharing
- BIM
SEPTEMBER 2010 AIA SURVEY OF PROJECTS NOW USING OR PLANNING TO USE AND IPD AGREEMENT

Survey done for the AIA/AIA-MN/UMN 2011 IPD Case Studies
aia.org/ipdcasestudies2011.
Map drawn by Kai Salmela under the direction of Renee Cheng, University of Minnesota.
### Project Description

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>Cathedral Hill Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>San Francisco, CA</td>
</tr>
<tr>
<td>BUILDING TYPE</td>
<td>Healthcare</td>
</tr>
<tr>
<td>CONTRACT</td>
<td>Single Multi-party Contract – (IFOA)</td>
</tr>
<tr>
<td>OWNER</td>
<td>California Pacific Medical Center, A Sutter Health Affiliate</td>
</tr>
<tr>
<td>ARCHITECT</td>
<td>SmithGroup, Inc</td>
</tr>
<tr>
<td>CONTRACTOR</td>
<td>HerreraBoldt – A Joint Venture</td>
</tr>
</tbody>
</table>

### Project Characteristics

<table>
<thead>
<tr>
<th>PRIVATE</th>
<th>PUBLIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIT</td>
<td>NON-PROFIT</td>
</tr>
<tr>
<td>OWNER OCCUPIED</td>
<td>SPECULATIVE</td>
</tr>
<tr>
<td>NEW CONSTRUCTION</td>
<td>RENOVATION</td>
</tr>
<tr>
<td>RURAL</td>
<td>URBAN</td>
</tr>
</tbody>
</table>

### Team Size

123 individuals

- OWNER
- IPO COORDINATOR
- ARCHITECT
- DESIGN CONSULTANTS
- PRIME CONSTRUCTOR
- TRADE CONTRACTORS
- SUPPLIERS
- AGENCIES

### Building Size

858,000 sq. ft.

### Project Cost

$1,028,533,446

### Schedule

55 months design  
48 months construction
Market Position was not a motivator for the owner. However, Sutter created a market by making IPD a requirement for the commission. For the architect, this project allowed them to enter the IPD arena. For the constructor, a new joint venture was formed specifically for this project.

Cost Predictability was Sutter’s primary driver for using IPD as a company. Enterprise-wide they were highly motivated to keep project costs reasonable.

Schedule Predictability was an important driver of using IPD because of several critical variables bearing on the project. California instated a 2013 deadline for meeting seismic and seismic retrofit requirements (California State Senate Bill 1953 and 1661). The complexity of the building and permitting process in San Francisco will make that deadline difficult to meet. Aging current facilities for CPMC demand investment to keep them functional, creating additional financial incentives to complete the new facility quickly.

Reduced Risk was a major motivator for the owner to shift to IPD. Sutter realized that their capital investments in construction could be better protected from risk with IPD.

Design Complexity was not a primary motivator for the owner to pursue IPD. Although a hospital is a complex building type, the owner has experience achieving complex projects with traditional delivery.
Contract

Single Multi-party Contract
- Integrated Agreement for Lean Project Delivery Between Owner, Architect & CM/IC - also referred as Integrated Form of Agreement (IFOA)

Contract Issued
- August 1, 2007

In 2007, California Pacific Medical Center (CPMC) and Sutter Health made the decision to use an Integrated Form of Agreement (IFOA) to deliver the Cathedral Hill Hospital in San Francisco. By then, Sutter was fairly experienced with IPD and Lean Construction having completed the Fairfield Medical Office two years before. On Fairfield, Sutter used an innovative IFOA agreement created for them by attorney William A. Lichtig. (Find more on this project in: Cohen, Jonathan. 2010. Integrated Project Delivery: Case Studies. Sacramento: AIA California Council.) The IFOA used on this project, Cathedral Hill Hospital, evolved compared to the Fairfield agreement, particularly refining the definition of shared risk/reward terms.

The IFOA addressed collaborative commercial terms, relational expectations, and the use of specific implementation processes, such as Lean Project Delivery tools, to support the relational expectations.

Commercial Terms
The Sutter IFOA requires well-known collaborative commercial terms such as: shared risk, performance incentives, compensation incentives, waiver of liability, and allowance for an Owner Controlled Insurance Program (OCIP) or project specific insurance.

Relational Expectations
The agreement includes some soft language defining the relational and behavioral expectations, for example Article 3.3 Trust states, "Parties shall work together in the spirit of cooperation, collaboration, and mutual respect for the benefit of the Project."

Social Strategies
A large proportion of the IFOA defines tools and tactics to achieve relational expectations and processes to perform the design and preconstruction work. Many of the tools implemented on this project were based on Lean Construction practices, such as reliable promising, pull-based design production, Target Value Design, and the Last Planner System. Meeting frequency requirements are clearly defined for the Core Group, the executive level leadership, as well as their responsibilities in terms of developing work procedures for leading the Integrated Project Delivery Team.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
<th>BUILDING TYPE</th>
<th>CONTRACT</th>
<th>OWNER</th>
<th>ARCHITECT</th>
<th>CONTRACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathedral Hill Hospital</td>
<td>San Francisco, California</td>
<td>Healthcare</td>
<td>Single Multi-party Contract-Integrated Form of Agreement (IFOA)</td>
<td>California Pacific Medical Center, A Sutter Health Affiliate</td>
<td>SmithGroup, Inc</td>
<td>HerreroBoldt – A Joint Venture</td>
</tr>
</tbody>
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Early Involvement

CM/GC Validation (Feasibility/Programming)
Trade Contractors Validation (Feasibility/Programming)

The contract required the CM/GC, trade partners and suppliers to provide input early, during the validation and preconstruction phases of the project.

The owner, California Pacific Medical Center (CPMC) and Sutter Health paid a premium for the early involvement of many members to supplement the A/E team. Involving the contractor and trade partners from the very beginning of the project was a significant investment, but at the time this study was conducted, had yielded measurable savings. According to the contractor’s project executive, the owner had already achieved a 200% return on investment (ROI) for the additional cost of IPD pre-construction services. The return comes from savings in project costs. The initial target cost developed by the team for the project was approximately 14% or $80 million below market average. At the time of this report, the team estimates an additional $22 million dollars will be saved below the market average. The team is continuing to track this ROI throughout the process.

These significant savings have been primarily attributed to the Target Value Design (TVD) process. This process held all team members accountable for designing the most value within the target cost. Cost information was collaboratively developed before the design was fixed, allowing cost to influence design instead of applying value engineering to revise a completed design.

Early involvement was essential to the Target Value Design process. For example, each Cluster Group had an estimator who provided cost feedback to designers on an ongoing basis. By feeding information into an iterative design process, design ideas can be tested against costs. Besides controlling costs, the TVD provided an important benefit by placing control of design and its cost with the architect; this ensured design ideas were not unreasonably diluted or compromised.

Complementary to the Cluster Group estimators, trades involved in early decisions brought detail and accuracy to the design. Additionally, as trade partners became more familiar with the project, they gained greater confidence in their ability to estimate costs, helping to eliminate inflation of prices and costly contingencies.

The team primarily focused on maximizing the value of the design, however information gained through the involvement of the trade partners brought a level of detail to the BIM model that the team believes will reduce material waste and construction time. The team cites a $400,000 savings gained by eliminating continuous backing for handrails. The BIM model accurately located each metal stud, so that backing was made redundant. Team members noted that in a traditional delivery method, the BIM model is rarely used to control construction costs at this level of detail.

It’s important to note that while early involvement contributed expertise, the structure of the risk pool reward provided incentive for the IPD Team to reduce costs.

Budgeting for Early Involvement

Accurately budgeting for effort proved to be difficult for the architect. SmithGroup anticipated additional effort, but assumed, while it would be more than traditional delivery, it might be similar to design-build. They expected most of their effort to be expended during schematic design and design development before handing off much of the work during construction documents. With this IPD project, effort required in the early phases was as expected, but the biggest surprise was the sustained high level of effort required during detail design. The level of design detail required was higher than expected, as the architect stated, “we are designing how we are going to build the building.”

Additional time during preconstruction was compensated based on time and materials, consistent with the terms of the IFOA. Team members observed that early and continued involvement by consistent team members reduces the number of handoff points, thereby maintaining project knowledge and reducing disconnects between designers and contractors. It is expected that the architect’s involvement in the construction phase will be less demanding than in early phases. The architect also anticipates that the increased involvement will lead to additional efficiency, reduced waste and a return to the risk pool.
...the owner had already achieved a **200% return on investment** (ROI) for the additional cost of IPD pre-construction services...

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...early involvement helped build trusting and respectful relationships between the designers, engineers and builders. The sub-contractors expressed that they gained a much broader perspective of the process by witnessing the challenges the architects, engineers and prime contractor had to face in the development of scope of work, schedule and budget. Sub-contractors reported that they avoided getting wrapped up in their own isolated issues because, by working closely with other team members early on in the process, they were able to see how each discipline was inter-dependent. This built respect and helped motivate the team to be more responsive and better support other disciplines...

...and third, because the subs, who will be executing the construction, more fully understand the project, they expect to reduce construction time by 20%...

...they estimated that by bringing on the subcontractors early, over 60% of the owners cost exposure was known before construction started...
…one of the major benefits of early and integrated partnering was the flexibility it provided the owner. Scope changes, totaling about 30% of the original budget, were added by the owner over the course of the project, like "wanted to create a dramatic gesture by cutting a three-story atrium through the space." Within a week the team presented three options with associated cost and schedule impact, allowing the owner to decide business objectives were better served with the atrium and the team was instructed to proceed….

…live group modeling sessions around a projector were held every other week. Steel structure was modeled along with duct runs, cable trays, plumbing lines and sprinkler system. These sessions enabled the IPD team to identify over 400 systems clashes that, because they were discovered early, "provided significant cost savings due to increased field productivity, tighter schedule, more prefabricated work, and less redesign…"

…the architect’s project manager said, "We drew 30% fewer window details, for example, because the curtain wall subcontractor was involved from the get-go and their input was incorporated in the design drawings…"
Trade detailers worked in one large room onsite

Shared sources such as server, plotter, printer, copier, etc.

Coordinated while modeling

Shared server allows for real-time shared drawings

Working in the Big Room
Camino Medical Group Mountain View
HPS • DPR • Southland • McClenahan

Increased Productivity
82% field workplan reliability
Southland experienced 20% to 37% increased productivity rates over HVAC industry standard
Only 43 hours of rework out of 25,000
ZERO M/E/FP field conflict RFIs
$9M / 6mo overall savings

Working in the Big Room
Camino Medical Group Mountain View
HPS • DPR • Southland • McClenahan

Increased Productivity
Full Struct & MEP Model by Trade Contractor

Used by Full Team for Visualization / Coordination / Collision Detection

**ZERO** MEP Change Orders on $40M Lab Building

Systems Coordination | Collision Detection | Cost Avoidance
Original 2D Fax From Structural Engineer Showed Only 1 Condition;
Scope, Constructability Unclear

Miscellaneous Metals
$250,000 Over Budget
Parametric Constructability Model Showed All Conditions. Immediate Visualization / Full Team Approval

Resolved $250,000 Budget Overage

Model Cost: $5,000. Elapsed Time: 2 Weeks

Design Assist / Value Analysis | Constructability Analysis
Holder Archicad & NavisWorks Model

Collision Detection Savings: $800,000

Model Cost: $80,000

Visualization, Coordination, Cost Avoidance
Alignment of design and budget
Decrease latency significantly
Prefabrication

Trade Contractor Model Used for Prefabbing Pipe

Model Direct to CNC Cutting Machine

Waste Minimization
Why this is Good for Us

Increased productivity / Less time in documentation
Fewer RFI’s and conflicts
More informed decision making
Better project cost control / Improved budget management
Minimization of Waste
Better use of resources
Greater understanding and control over the construction process and long term project outcomes
culture
not
technology
culture
not
contracts
Do what we say we are going to do

Responsibility for actions

Punctuality

Reliability

Accountable.
change.
collaboration is inevitable
change!