

**Collaboration, Sustainability, BIM and Integrated Project Delivery**  
Implications for the Future of the Industry

COFPAES  
Oct 14 2008

Markku Allison, AIA



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We'll be speaking today about changes that are moving rapidly through the industry, their causes and implications, evidence of change and industry resources.



 AIA

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Our profession and industry are in the midst of a swiftly accelerating transformation, in response to range of driving forces.



Figure 6. Labor productivity index for US Construction Industry and all non-farm industries from 1964 through 2007.



2007  
**MHC SmartMarket Report**  
*On average, about 3.1% of project costs are related to software non-interoperability*



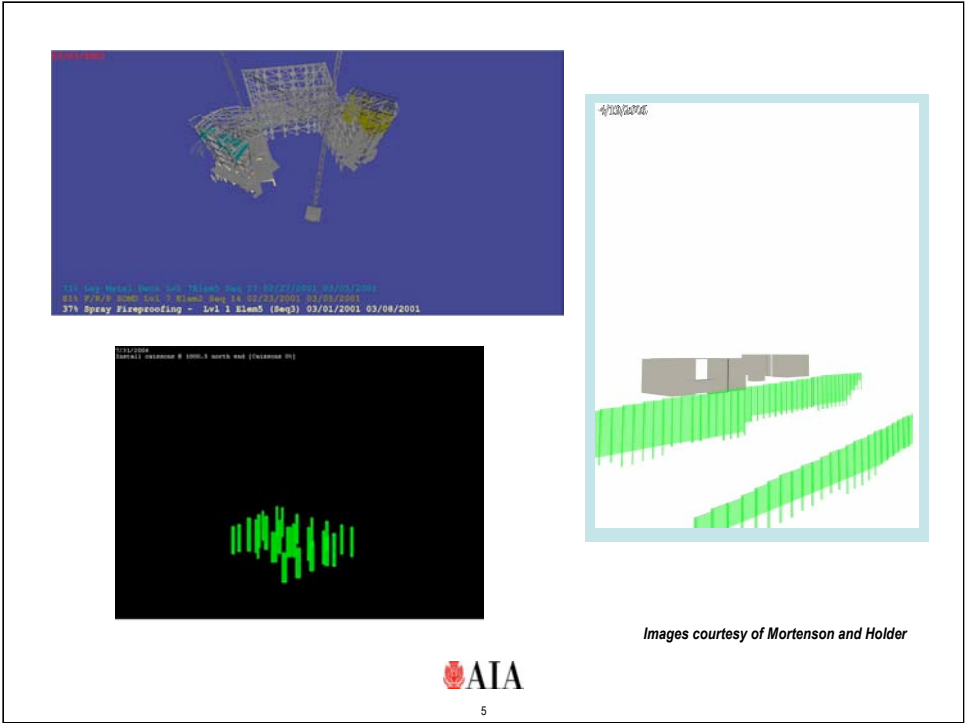
One driver is better understandings and documentation of waste. The newest data important to know about is the MHC SmartMarket Report...you can get this on our website now. In addition to valuable information about the costs of the lack of interoperability, there is great data about BIM adoption.

- Department of Labor: Construction alone out of all non-farm industry has DECREASED in productivity since 1964...all other non-farm industry has increased by over 200%.
- NIST Study 2004: identifies \$15.8M lost in the industry each year due to lack of software interoperability.

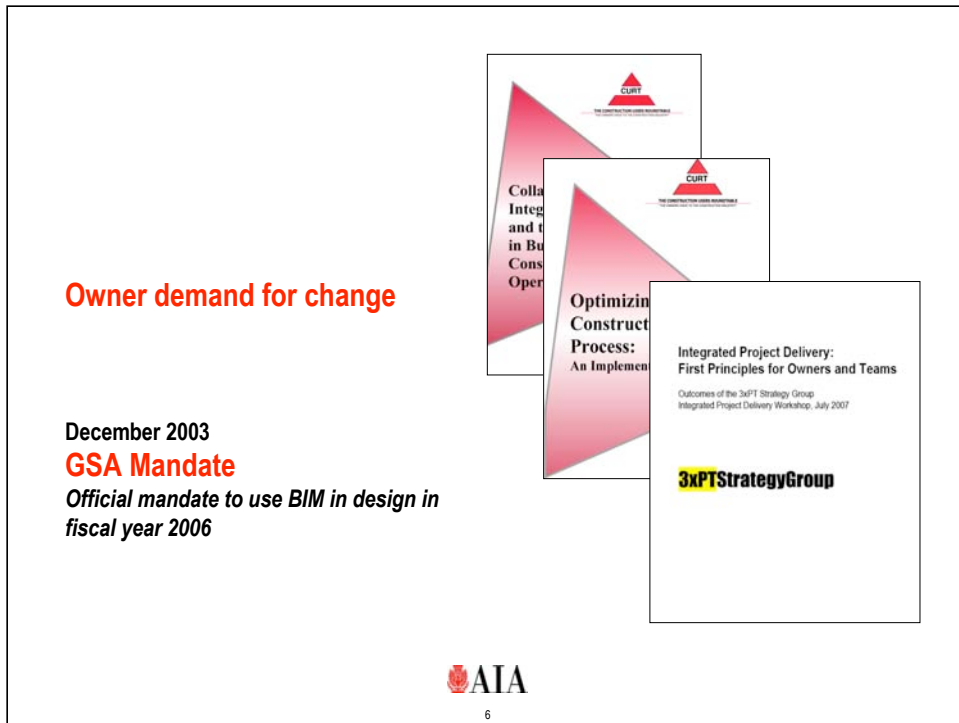


A second driver is technological evolution. 3d, 4d, and 5d BIM is here, and according to a 2007 MHC SmartMarket report is approaching a tipping point leading toward full industry adoption.

BIM is much more than just 3d visualization like these examples...



...4d and 5d BIM is here. Models show scheduling and sequencing of construction.



A very important driving force: owner demand for change. They are aware of the preceding facts and the cost benefit opportunities of overcoming those problems through the use of new technologies and approaches to capital projects.

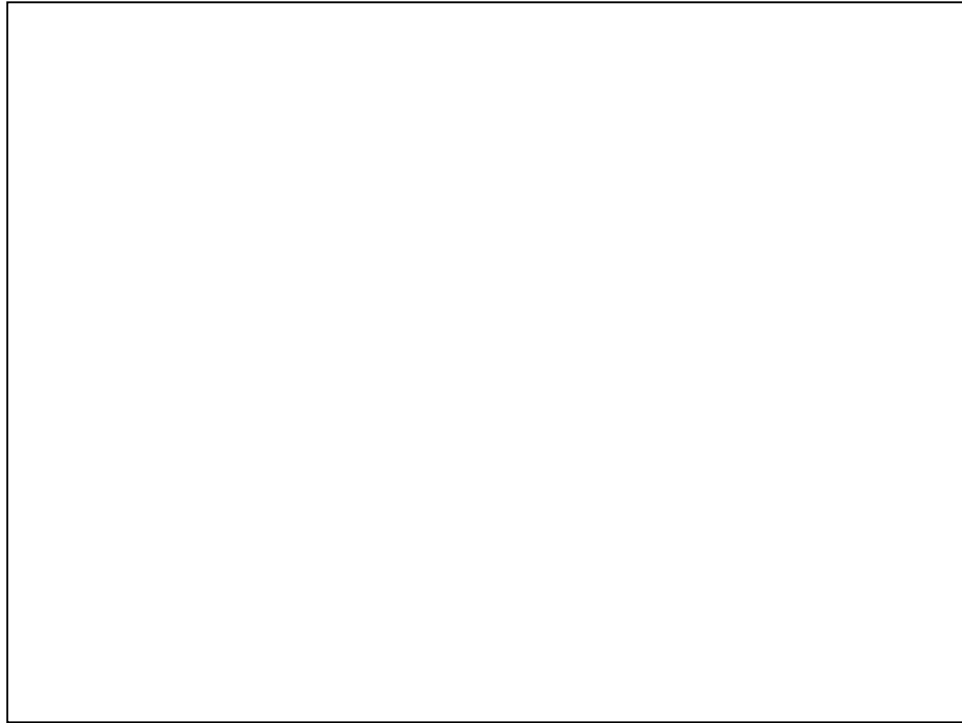
- General Services Administration (GSA) put a significant stake in the ground in 2003, requiring BIM on projects beginning FY 2006--now a requirement.
- Construction Users Roundtable (CURT, a significant owners organization) whitepapers of 2004/2006 form a foundation of owner demand for change, and are collaborative in nature--owners recognize their own behaviors are contributors to industry problems, not just blaming architects / contractors.
- 3xPT Strategy Group (collaboration between AIA, AGC and CURT) issued First Principles paper for owners and teams in July 2008.

one more driver



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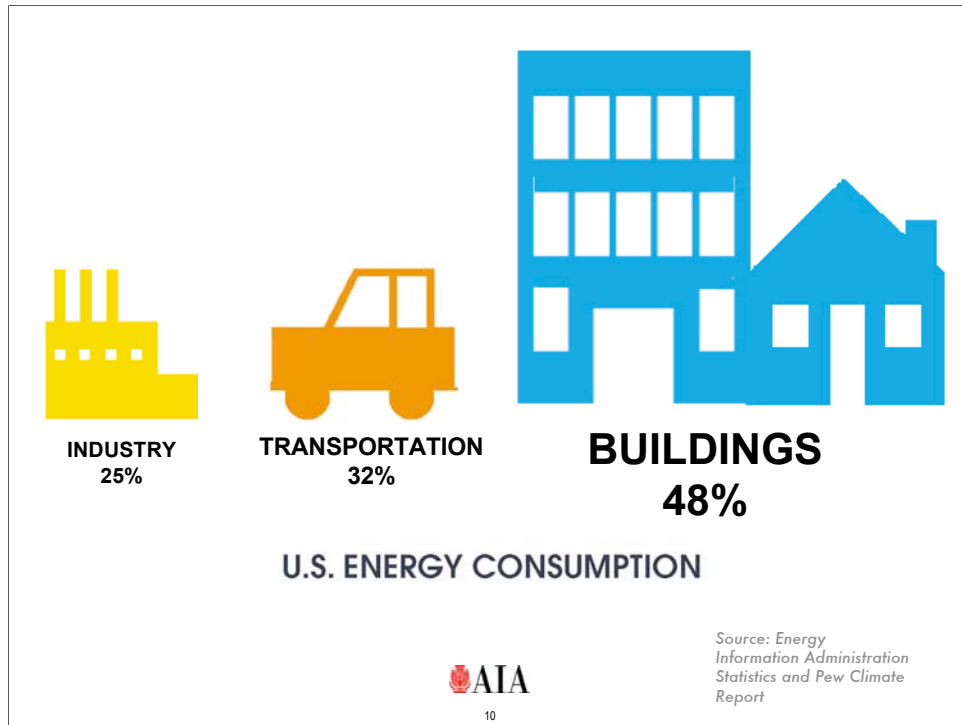
The AIA sees one more substantial reason that transformation is happening



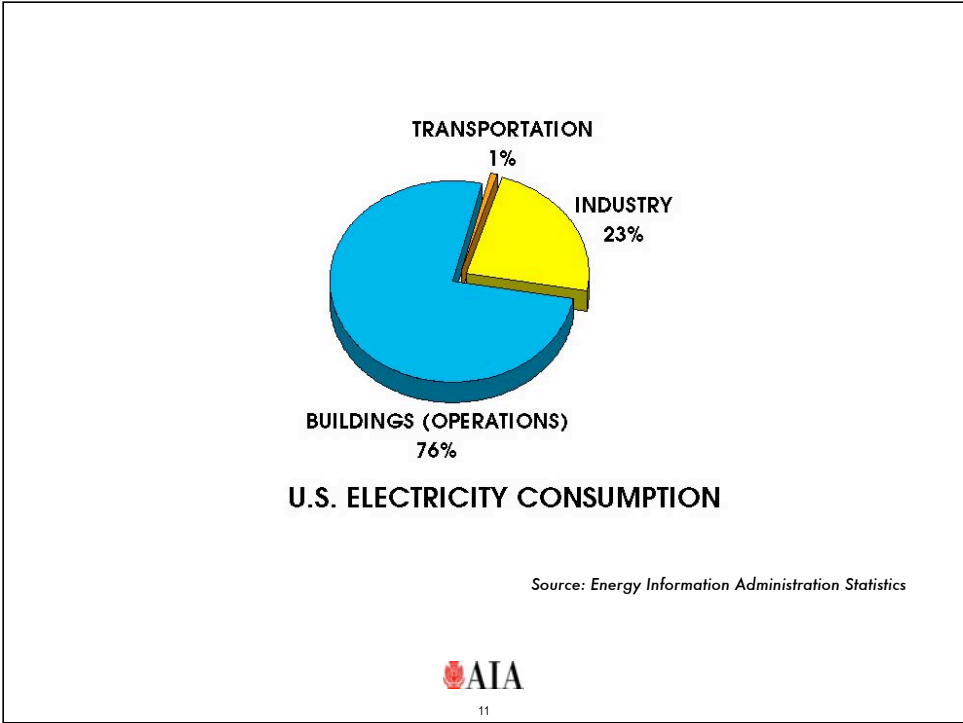
- In two surveys of 1000 randomly selected registered voters about greenhouse gases: in 2007 40% thought that cars and trucks were the leading cause, and actually that number went up to 44% in 2008.



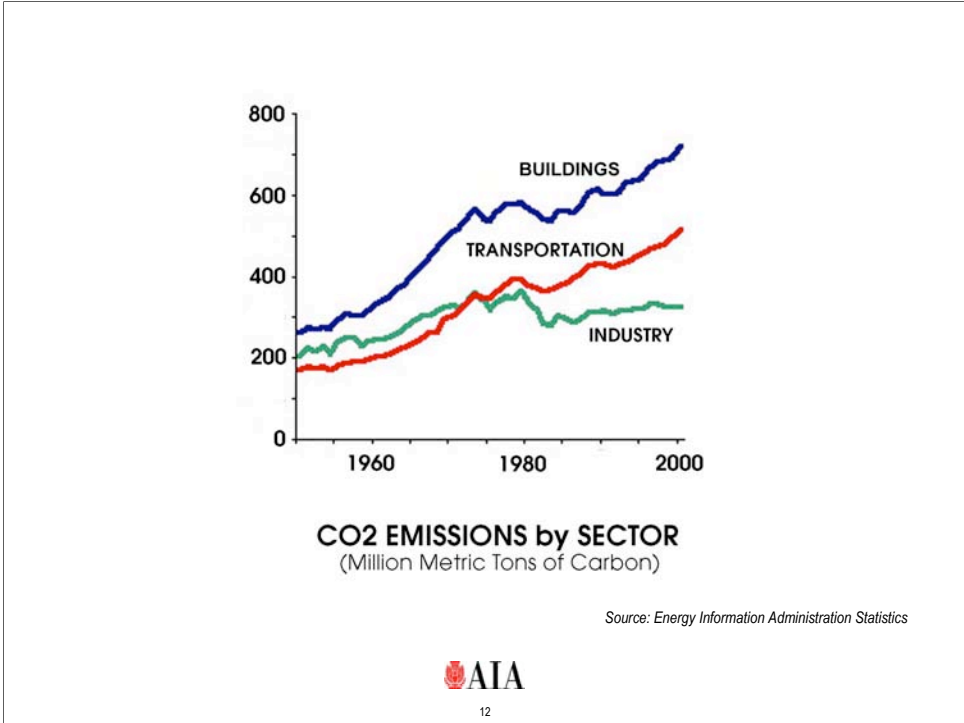
But the truth of the matter is that this equals this...



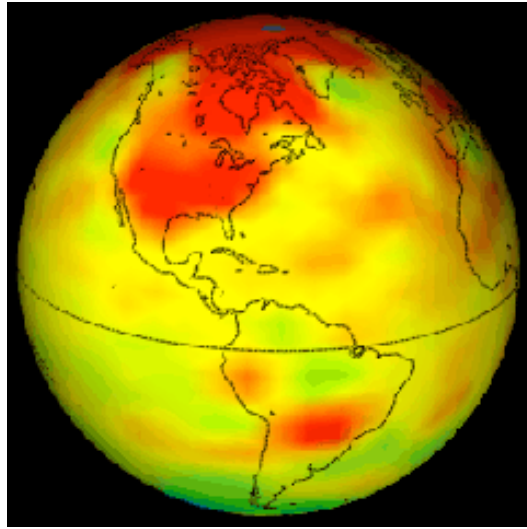
Energy information administration figures tell us that the built environment consumes 48% of US energy...



...is responsible for 76% of annual US electrical energy consumption...



...making buildings the number one contributor of greenhouse gas emissions.



 AIA

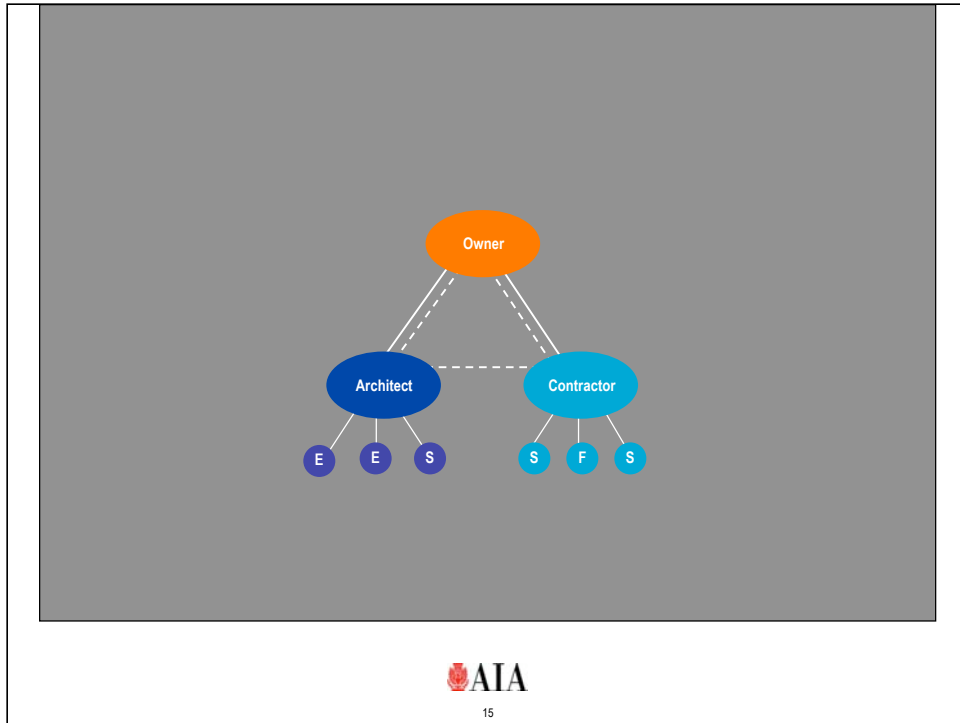
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We're talking of course about climate change. In light of the role of buildings in the real and growing concern of climate change, as architects, this is clearly a responsibility we must acknowledge.

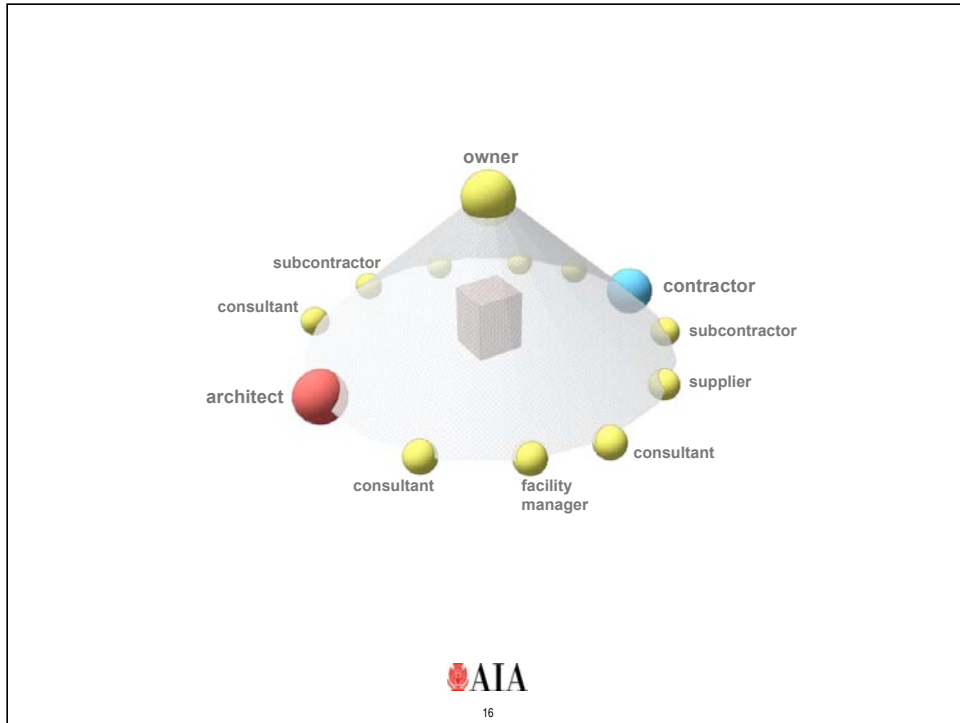
So where are things going?



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With BIM and other industry forces acting as catalysts, the traditional model of delivery is evolving from this...



...to this: in its ultimate form, think about all parties joined together by a single agreement, using technology and coming together around a defined outcome or project.

Implications



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Implications?

This is a good thing!



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Number one thing to know: this transformation is a good thing!

We've found that when we've completed the design-development phase, we're already **close to 60 percent finished with construction documentation**. With the Virtual Building model, we shorten the time required in documentation, resolve design conflicts and, overall, produce better documents.

- *Orcutt-Winslow Partnership*

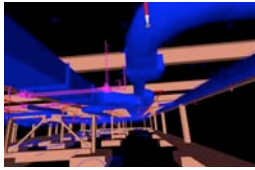
**DD = 60% CD's!**

**Increased Productivity**



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Positive stories are flowing in...from all stakeholders. Where can Orcutt-Winslow invest the time saved here? In design.



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

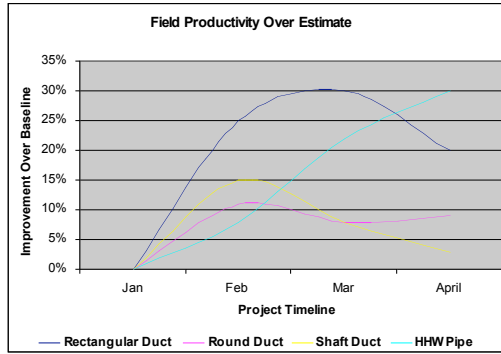
**Working in the Big Room**  
Camino Medical Group Mountain View  
HPS • DPR • Southland • McClenahan

**Increased Productivity**



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In another example, on this Sutter Health 250,000sf medical office building (MOB) project in California, trade detailers, architects and engineers were all co-located in a “big room”, sharing models and answering questions in real time...



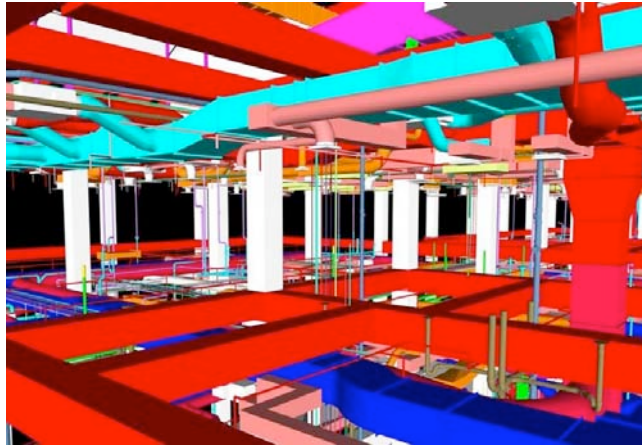
- 82% field workplan reliability
- Southland experienced 20% to 37% increased productivity rates over HVAC industry standard
- Only 43 hours of rework out of 25,000
- **ZERO** M/E/FP field conflict RFIs
- \$9M / 6mo overall savings

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

Increased Productivity



The benefits were significant: these are HUGE savings!



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



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ZERO MEP change orders on a \$40M lab building? Big benefit.

Original 2D Fax From Structural Engineer Showed Only 1 Condition;

Scope, Constructability Unclear

Miscellaneous Metals  
\$250,000 Over Budget

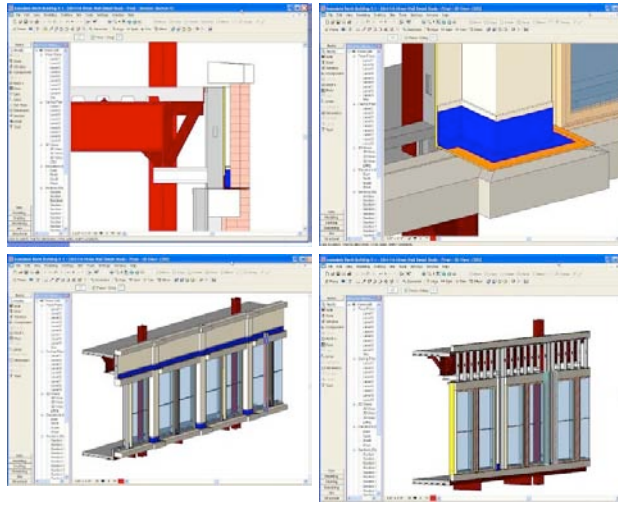
Design Assist / Value Analysis | **Constructability Analysis**

AIA

HOLDER

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Two sketches represent a condition supposed to be the same around the structure...lack of clarity drives miscellaneous metals bid over budget by \$250,000.



Parametric  
Constructability Model  
Showed All Conditions.  
Immediate Visualization /  
Full Team Approval

Resolved \$250,000  
Budget Overage

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

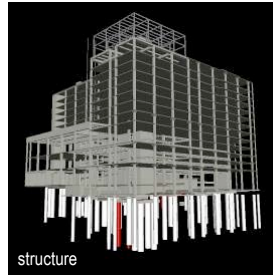
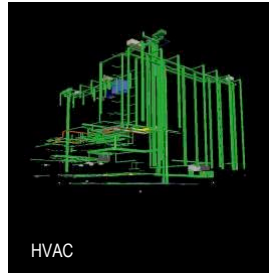
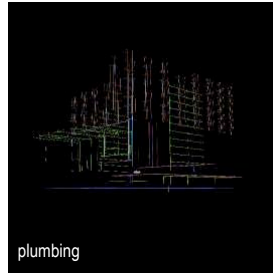
Design Assist / Value Analysis | **Constructability Analysis**



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An investment of \$5K and two weeks clarifies conditions and constructability, eliminating \$250K overage.



Holder Archicad &  
NavisWorks Model

Collision Detection  
Savings: \$800,000

Model Cost:  
\$80,000

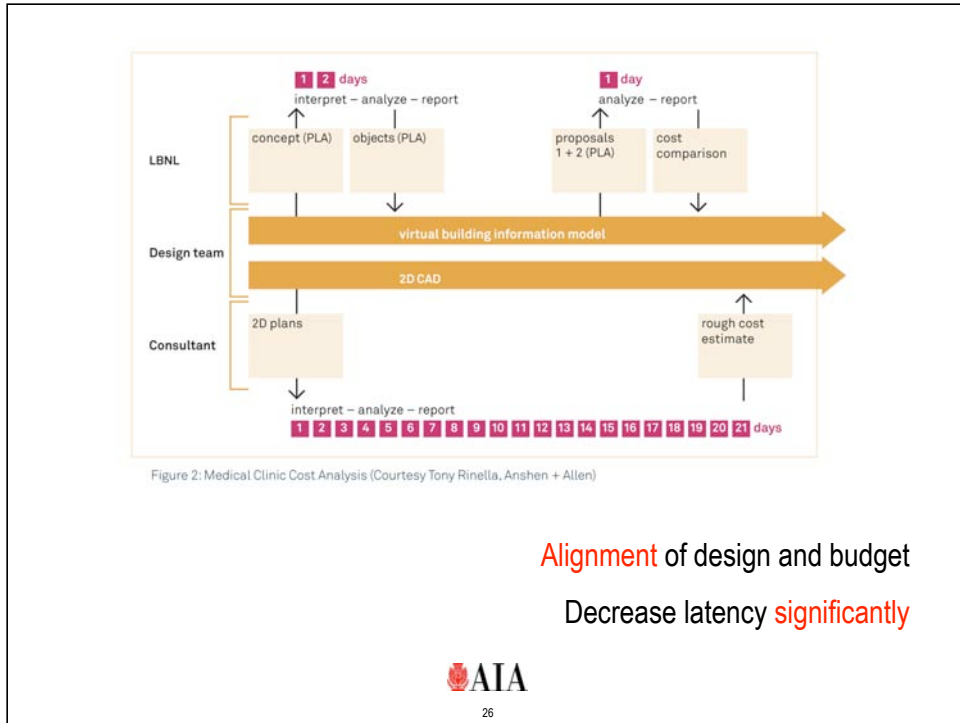
Visualization,  
Coordination,  
Cost Avoidance



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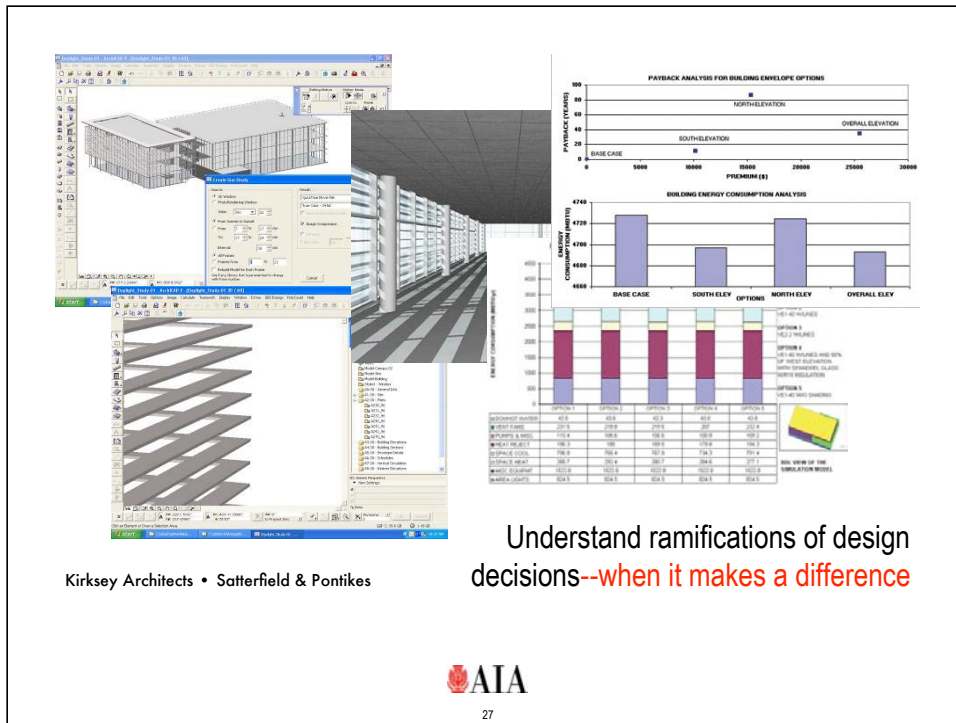
Investment on this project of \$80,000 in a model paid back an estimated ten-fold in avoidance of field change orders and conflicts.



Feedback regarding costs in a collaborative BIM enabled project is delivered when it's needed, not when you've been continuing down an ill informed road.

In a traditional process, you reach a cost checkpoint and package it all up and send it to the estimator...but you don't stop work. You keep designing. And in many--if not most--cases, when the estimate comes back 2 to 3 weeks later you're out of alignment and need to re-design, losing valuable time and effort.

In a BIM-driven process, with a carefully crafted model that period or latency--the time from when a question is asked and an answer is received in a fashion that allows you to move forward in an informed fashion--can be reduced to 2 to 3 days.

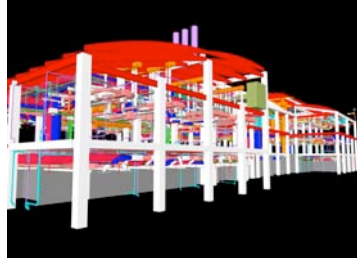


Another significant implication / benefit is the ability of understanding ramifications of design decisions early in the process. In this example from Kirksey Architects and Satterfield / Pontikas contractors, the team was able to study the energy performance and long-term cost of five skin alternatives--during design, when it made a real difference in overall design and budget management.



Trade Contractor  
Model Used for  
Prefabbing Pipe

Model Direct to CNC  
Cutting Machine



Waste Minimization

Prefabrication



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Subtrades can use models to drive straight through to CNC fabrication, minimizing waste and increasing shop and field productivity.

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

Higher predictability of outcomes

Minimization of Waste

Greater understanding and control over the construction process



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Bottom line...these are all reasons why this transformation is good not just for us but for industry at large.

Evidence



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Let's put some weight behind these statements of impact to practice as illustrated by major initiatives of industry in general and the Institute in particular.

What is industry doing



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**New Organizations / Initiatives**

National Building Information Modeling Standard (NBIMS)

buildingSMARTalliance

AECOO Testbed



### What is CURT doing?

- CURT's Process Transformation Committee
  - Broadening industry dialogue
    - Owner implementation
  - GSA, Intel, J&J, Citigroup, and more
  - CURT-CIFE VDC Usage Survey
- Developing Business Metrics around BIM/VDC



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### What CURT is doing...

CURT continues its collaborative work with the Process Transformation Committee, with a research effort in 2007 and a paper on implementation of BIM for Owners in 2008.



### What is the AGC doing?

- "Contractor's Guide to BIM" (C3T Committee)
- Participating in Industry Task Forces with AIA and CURT
- Coordinating Programs with Chapters (Industry Liaison)
- Supporting Standards Development (EIS Committee)
- Industry Forum (PIAC BIMforum)
- Full time staff person focused on BIM/IPD



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## What AGC is doing...

AGC is involved in a range of efforts similar to the AIA. Perhaps the most important of these is the BIMForum, an open community focused on challenges and opportunities of BIM. Check it out at [www.bimforum.org](http://www.bimforum.org).

## What is the 3xPT doing?

Integrated Project Delivery Workshop, July 2007

- Fill a current information void
- Provide clear and rich descriptions of defined project intentions and guidelines for several pre-defined integration / collaboration delivery scenarios.
- Paper Released 7 July 2008



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## What 3xPT is doing...

The 3xPT Strategy Group is a formal collaboration between CURT, AIA and AGC on matters of industry transformation. An important paper on First Principles of IPD for Owners and Teams was released in July 2008; download at the AIA's IPD website.

## AIA Activities and Resources

Informing and Educating Architects  
Advocating Industry Change



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And finally, what is the AIA doing...

Our efforts may be categorized in two main buckets. While we're engaged in a very broad range of activities, I'd like to highlight several that I believe will have most impact for this audience.

AIA Sustainable Architectural Practice Position Statement  
December 2005



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The first is the AIA's position statement on sustainable practice of 2005.

The AIA recognizes a **growing body of evidence** that demonstrates **current** planning, design, construction, and real estate **practices** contribute to patterns of resource consumption that **seriously jeopardize the future of the Earth's population**.

**Architects need to accept responsibility** for their role in creating the built environment and, consequently, believe **we must alter our profession's actions** and encourage our clients and the entire design and construction industry to join with us to change the course of the planet's future.



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The AIA recognizes that architects need to accept responsibility for their role in creating the built environment...

Promote sustainable design including resource conservation to achieve a minimum 50 percent reduction from the current level of consumption of fossil fuels used to construct and operate new and renovated buildings by the year 2010, and promote further reductions of remaining fossil fuel consumption by 10 percent or more in each of the following five years;



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...and goes on to set fossil fuel consumption reduction targets....

AIA's fossil fuel consumption reduction targets

Now, By 2010: New Buildings - 50%

2010 – 60%

2015 – 70%

2020 – 80%

2025 – 90%

2030 - net zero carbon emissions



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...with a goal of carbon neutrality by 2030 for member designed buildings.

**50% of what?**

Commercial Building Energy Consumption Survey 2003  
(CBECS)

Regionalized and type specific  
Measured in kBtu/sf/year

*(new discussions currently under way)*



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What is the baseline?

Progress to the goal will be based on comparison to CBECS 2003, using tools like EPA's Target Finder.

project delivery position statement | december 2007



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**Next: a new public policy position statement was unanimously approved by the AIA Board in December 2007**

### Position No. 26: Project Delivery

The AIA believes that *every project delivery process* must address the quality, cost-effectiveness, and sustainability of our built environment. This can *best be effected* through *industry-wide adoption* of an integrated approach to project delivery methodologies characterized by *early involvement* of owners, designers, constructors, fabricators and end user/operators in an environment of *effective collaboration and open information sharing*. The AIA also believes that an architect is *well qualified to serve as a leader* on integrated project delivery teams. The AIA further believes that evolving project delivery processes require *integration of education and practice in design and construction*, both within and across disciplines.



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The new statement is longer than the old and incorporates many of the values of IPD (touch on a few samples of highlighted text)...

### Ramifications

- Applies to all projects
- Integrated, collaborative models are best
  - Early involvement is important
  - Open information sharing is important
- Design and construction education integration should happen
- Leadership roles may be filled by others than just the architect



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...and the essence of the new statement may be distilled down to these six points. Note especially the last bullet.

sea change for the Institute



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...truly a sea change for the institute.



integrated project delivery guide | 2007.11.05



Moving on. On November 5th of 2007, we launched the IPDG, available at no cost to all interested parties on the AIA website.

Close collaboration

AIACC / AIA TGD / AIA IPDiG

(aggressive timeline!)

ipdg | genesis



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And represents a strong collaboration

**general**  
**specific**

ipdg | structure



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It moves from general to specific

principles  
general  
specifics  
how-to

ipdg | structure



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Going from principles to how-to.

Principles of Integrated Project Delivery

*Mutual Respect and Trust*  
*Mutual Benefit and Reward*  
*Collaborative Innovation and Decision Making*  
*Early Involvement of Key Participants*  
*Early Goal Definition*  
*Intensified Planning*  
*Open Communication*  
*Appropriate Technology*  
*Organization and Leadership*

ipdg | key ideas



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The Guide describes the basic principles of IPD, and outlines important areas of consideration and “how-to” information about setting up and implementing an IPD project.

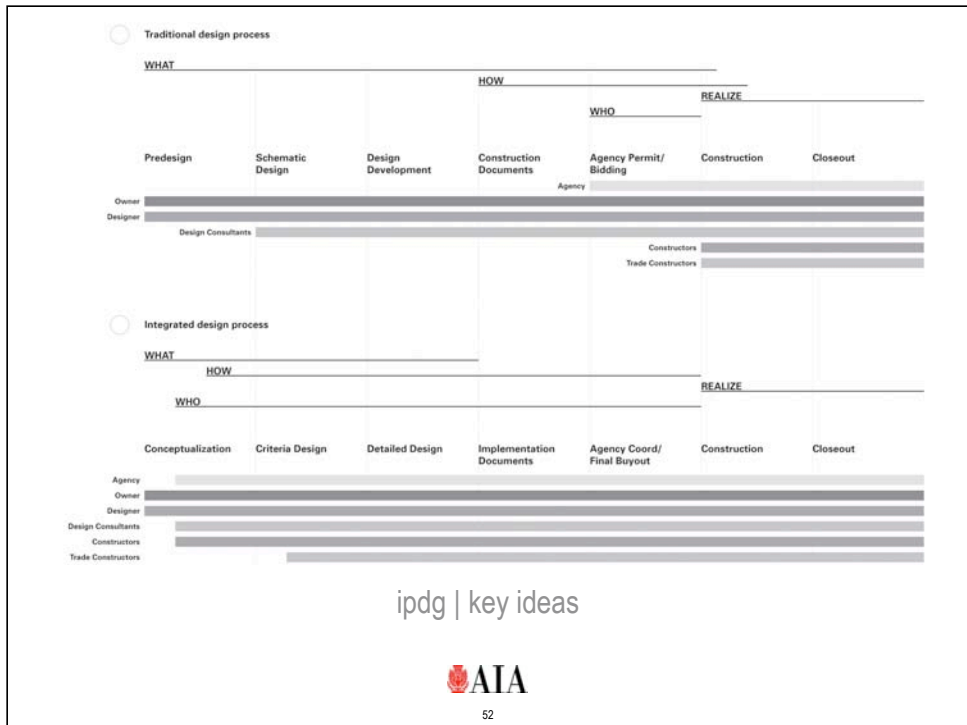
IPD principles can be applied to a variety of contractual arrangements

ipdg | key ideas



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An important underlying idea should be understood: it's not just about project alliances or multi-party agreements.



A very important concept in the guide includes the renaming of phases to support new outcomes, roles and responsibilities. Note early involvement of players.

Owner	1965	13%
Designer	7013	45%
Constructor	1635	10%
Subcontractor	251	2%
Engineer	1270	8%
Systems Supplier	291	2%
Attorney	491	3%
Insurer	105	1%
Student	386	2%
Educator	431	3%
None of the Above	1746	11%
<b>GRAND TOTAL</b>	<b>15107</b>	<b>100%</b>

market interest (2008.10.14)



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As you can see, we've had significant market interest in The Guide since its November release--everyone is interested in IPD. Note that owners constitute the second largest group of those downloading the guide.

(contact markku for up-to-date figures)



50to50 | 2007.12.12



The next major resource you should know about is the 50to50.

50 specific strategies to move toward carbon reduction.  
A how-to resource for practitioners and others.

50to50



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(self explanatory)

Active Solar Systems  
Alternative Energy  
Alternative Transportation  
Appropriate Size and Growth  
Building Form  
Building Monitoring  
Building Orientation  
Carbon Offsets  
Cavity Walls for Insulating Airspace  
Co-Generation  
Conserving Systems and Equipment  
Construction Waste Management  
Cool Roofs  
Deconstruction and Salvage Materials  
Daylighting  
Earth Sheltering  
Efficient Artificial Lighting  
Efficient Site Lighting Systems  
Energy Modeling  
Energy Source Ramifications  
Energy-Saving Appliances and Equipment  
Environmental Education  
Geoexchange  
Green Roof  
High-Efficiency Equipment

Integrated Project Delivery  
Life Cycle Assessment  
Mass Absorption  
Material Selection and Embodied Energy  
Natural Ventilation  
Open, Active, Daylit Spaces  
Passive Solar Collection Opportunities  
Photovoltaics  
Preservation/Reuse of Existing Facilities  
Radiant Heating and Cooling  
Renewable Energy Resources  
Rightsizing Equipment  
Smart Controls  
Space Zoning  
Staff Training  
Sun Shading  
Systems Commissioning  
Systems Tune-Up  
Thermal Bridging  
Total Building Commissioning  
Vegetation for Sun Control  
Walkable Communities  
Waste-Heat Recovery  
Water Conservation  
Windows and Openings

50to50



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The 50 strategies (rattle off a smattering of titles to give flavor)

- What is it?

- How do I do it?

*Established techniques*

*Emerging trends*

- What are relevant resources?

- What are related strategies?

*Use an integrated approach to carbon reduction*

50to50 | strategy structure



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Each strategy follows the same structure, and includes an important section on using integrated approach to carbon reduction.

50to50 | strategy structure

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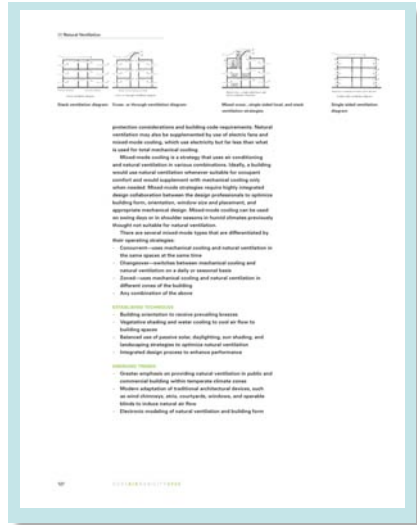
The strategies range from three to six pages, combining text, diagrams, images, links.



50to50 | strategy structure



(same)



(same)



agreements



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We are also working on agreements

- Digital Data Licensing Agreement: C106-2007
- Digital Data Protocol Exhibit: E201-2007

•Two new IPD agreements | Thursday, May 15th, 2008

agreements



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We released two digital info sharing docs last year, and two new IPD docs were released on May 15th at the AIA convention.

IPD Agreements – Two Approaches

Transitional Forms | B195, A195, A295

*More recognizable, familiar*

*Utilizes GMP contract with pre-construction services*

*Immediately familiar and usable within today's environment*

SPE – Full Integration | C195

*More provocative, unique approach*

*Single Purpose Entity (Limited Liability Company)*

*All for one and one for all*



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## Next--agreements.

There are two new forms of agreements issued by the AIA on May 15th. These are available in your documents software.

One is transitional in nature and one is far-reaching and provocative. Both will spur conversation in the industry and both will enable transformed ways of practice.

Agreements

October 2008

SPE Member Service / Owner Funding Agreements  
E202: BIM Protocol Exhibit



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We'll also be releasing two new documents in October 2008.

## Compensation Models

December 2008

### New Compensation Models for a Transformed Industry: A Guide for Teams

#### Outline

- *Compensation Models: The Basics*
- *Patterns in Current Compensation Models*
- *Motivations for Team Members*
- *New Value Propositions*
- *Glossary*
- *Top Ten FAQ's*
- *Case studies?*



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The first and most important IPDiG effort for the year is a guide to compensation models for teams, offering new paradigms for a transformed industry. The guide should be available for download in December 2008.

Case Studies Database

Connecting the Dots

W/ SDiG  
*COTE Top 10*  
*Sustainable Outcomes*  
*Project Delivery Methods*  
*Technology Used*  
*...and more*



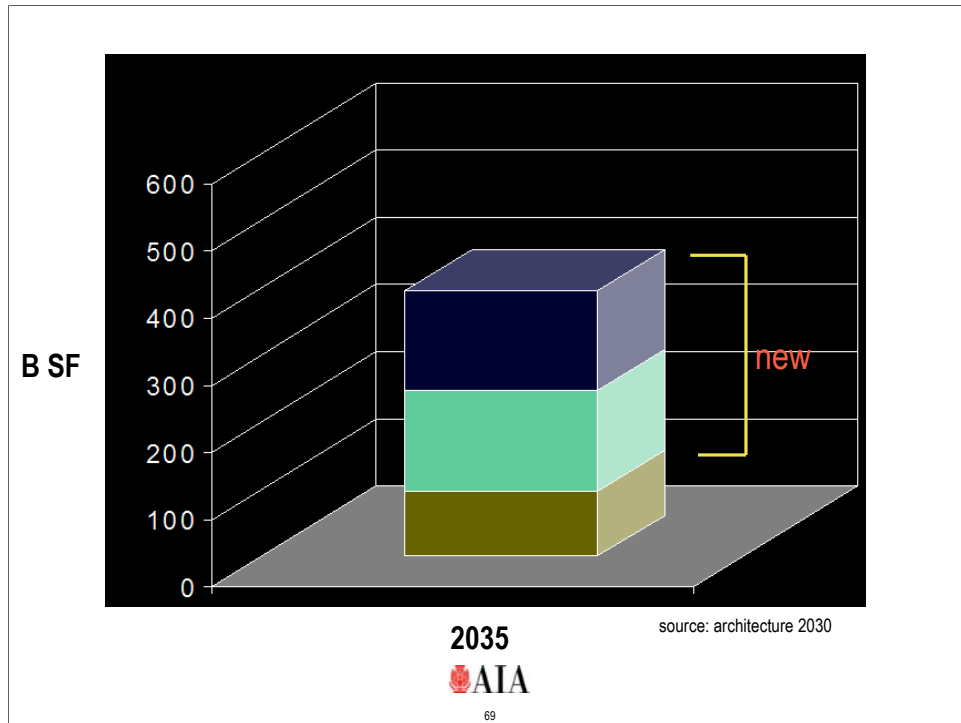
67

Creating a searchable database of case studies is another important project.

What does it all mean?



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- So ..... what does it all mean? One more fact will bring it into context:
- Currently there is roughly 250 billion sf of commercial building stock in the U.S. In the next 30 years...
- (click) 50 bsf will be demolished
- (click) 150 bsf will be significantly renovated
- (click) And 150bsf will be new construction.
- (click, click) meaning that by 2035 we will have the OPPORTUNITY to influence 75% of the existing building stock at that time.



 AIA

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..and with good anecdotal evidence (and we're working on hard data) that highest and best sustainable outcomes--like high performance buildings, low energy use, etc....

- Active Solar Systems
- Alternative Energy
- Alternative Transportation
- Appropriate Size and Growth
  - Building Form
  - Building Monitoring
  - Building Orientation
  - Carbon Offsets
- Cavity Walls for Insulating Airspace
  - Co-Generation
- Conserving Systems and Equipment
- Construction Waste Management
  - Cool Roofs
- Deconstruction and Salvage Materials
  - Daylighting
  - Earth Sheltering
  - Efficient Artificial Lighting
  - Efficient Site Lighting Systems
  - Energy Modeling
  - Energy Source Ramifications
- Energy-Saving Appliances and Equipment
- Environmental Education
  - Geoexchange
  - Green Roof
- High-Efficiency Equipment

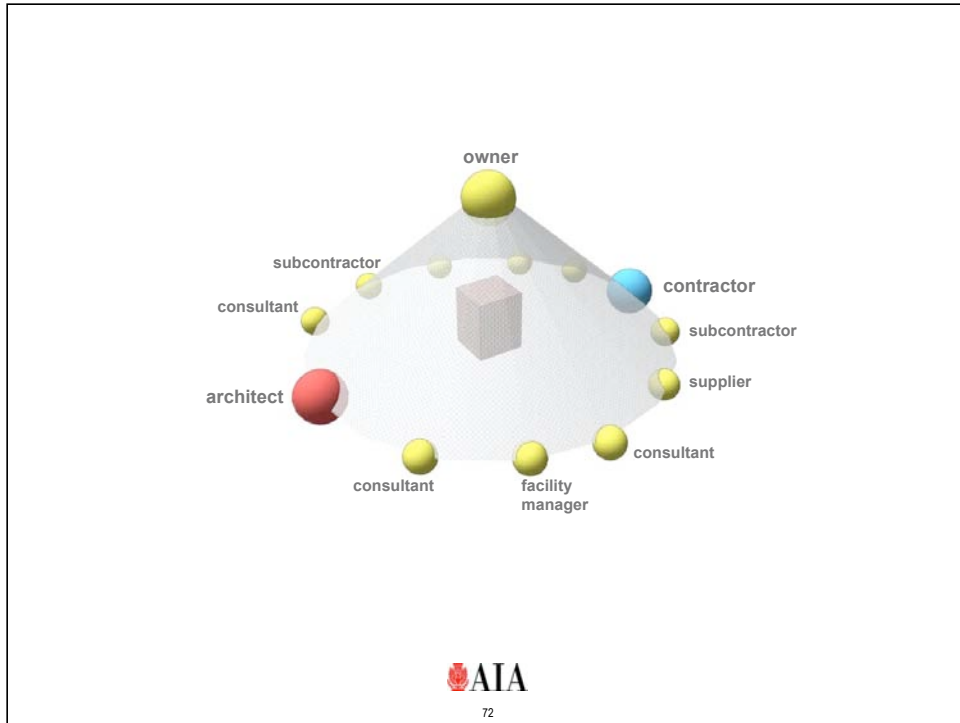
- Integrated Project Delivery
  - Life Cycle Assessment
  - Mass Absorption
- Material Selection and Embodied Energy
  - Natural Ventilation
  - Open, Active, Daylit Spaces
  - Passive Solar Collection Opportunities
    - Photovoltaics
- Preservation/Reuse of Existing Facilities
  - Radiant Heating and Cooling
  - Renewable Energy Resources
  - Rightsizing Equipment
    - Smart Controls
    - Space Zoning
    - Staff Training
    - Sun Shading
  - Systems Commissioning
    - Systems Tune-Up
    - Thermal Bridging
- Total Building Commissioning
  - Vegetation for Sun Control
  - Walkable Communities
  - Waste-Heat Recovery
  - Water Conservation
  - Windows and Openings

50to50



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When we look at the strategies and consider who would need to be involved in their implementation, we can easily see how when several overlap and cross-connect that we need more stakeholders at the table...



...most easily achieved using collaborative delivery models--like integrated project delivery with BIM technologies. The two topics--sustainability and IPD--are intimately connected in a realm of OPPORTUNITY. So what it all means is...

What to expect, and when?

Higher building performance goals  
Increase in required data sharing  
Increased adoption of BIM / VDC  
Increased collaboration



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What it all means is more collaboration, earlier, and earlier. Starting NOW.

While change is never easy, it is achievable.



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Remember...

Talk. Share. Collaborate. Experiment.



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**Just step out and start!**

changeisnow

[www.aia.org/ipd](http://www.aia.org/ipd)

SUSTAINABILITY 2030

[www.aia.org/sustainability](http://www.aia.org/sustainability)



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Check out these resources and more at...

The end.