W15: Introduction to BIM: People, Processes and Tools

Presented by National Institute of Building Sciences, National BIM Standard Committee

3 AIA CONTINUING EDUCATION LEARNING UNITS

AEC technology is unalterably moving to the integration of the BIM (Building Information Model) in all phases of Design, Engineering, Construction, and Facility Management. If you want to understand this digital technology and what effect it will have on the industry; this presentation will explain the history, the present state, and future of the BIM.

Alan Edgar, Assoc. AIA
OSCRE Workgroup Program Manager
Chair, National BIM Standard Committee
December 11, 2007

Agenda Alert

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Facilities Information Council
National BIM Standard

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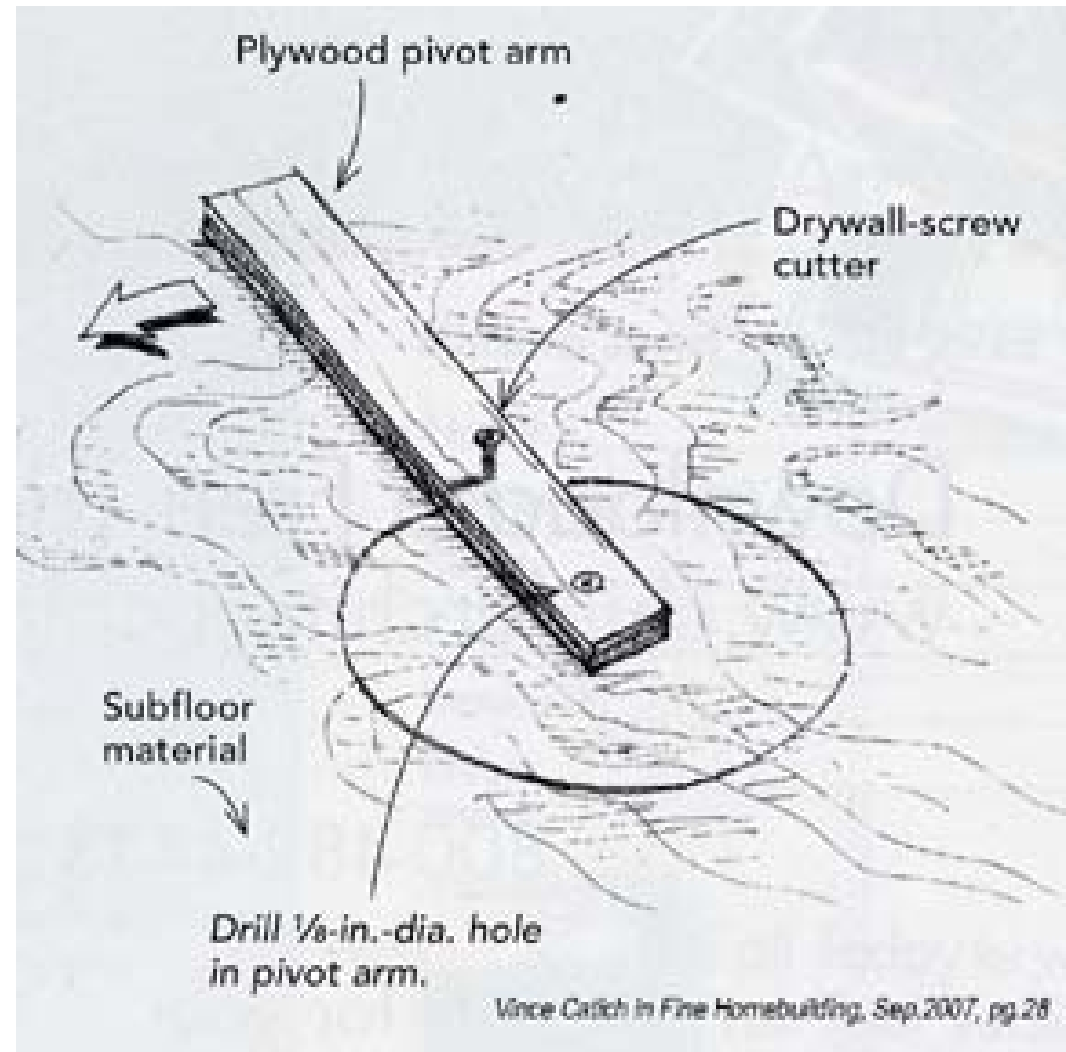
What is the Problem to be Solved?

A Utopian View

Introduction to BIM

Getting There From Here

Immediate Next Steps

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Plywood pivot arm

Drywall-screw cutter

Subfloor material

Drill ⅛-in.-dia. hole in pivot arm.

Vince Catch in Fine Homebuilding, Sep.2007, pg.28

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Owner	Designer	Builder

Owner

- CFO, CTO, CIO
- Architect
- Design Engineer
- Builder
- Commercial Real Estate Professionals (lease, buy/sell)
- Corporate Real Property Professionals (own/operate)
- CAD/BIM Manager
- Maintenance Engineer

Builder

- Facility Manager
- Software Vendors
- Planners
- Mapmakers
- Building Product Manufacturers
- Fireman/Law Enforcement
- Developer
- Specifier
- Estimator
- Material Scientist

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- What is level of knowledge

- What is level of experience

- Beliefs concerning transition effort and timing.

- Rate importance of several issues: (contracting, cost, skills/training, availability of information, availability of technology)

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What is the Problem to be Solved?

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Introduction to BIM

Getting From Here to There

Immediate Next Steps

Introduction to buildingSMARTalliance®,
Tr. 8:00-9:00a

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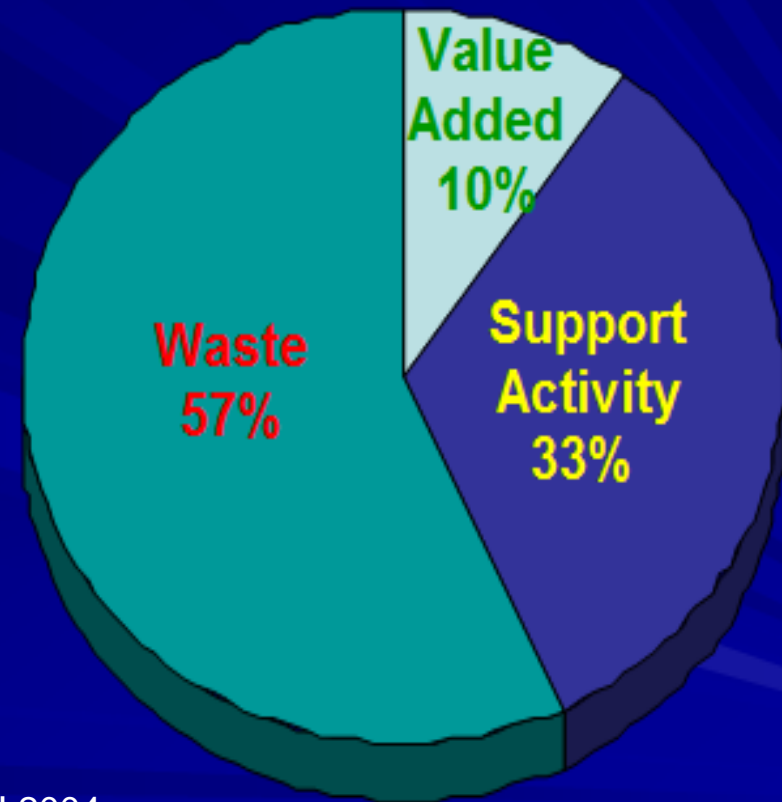**National BIM Standard**

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- NIST in 2004 identified $15.8B lost to lack of inter **$4.8 trillion 2008**
- ~~$~~3 trillion industry with possible 30% waste
- 40% of global raw materials are consumed by buildings
- Facilities consume 40% of the energy
- 65.2% of total U.S. electricity consumption
- Facilities contribute 40% of the emissions
- Facilities contribute 20% of land fills
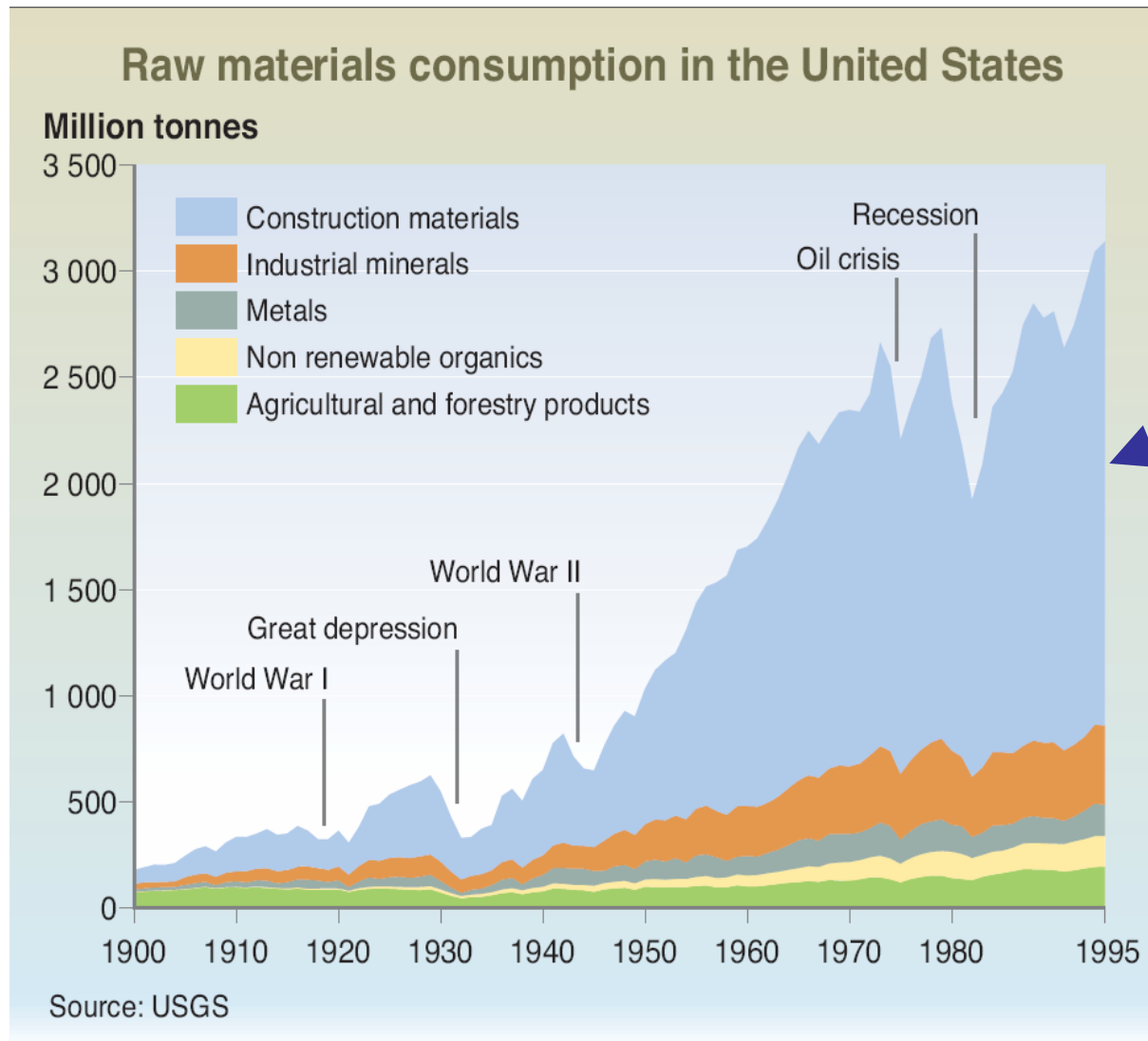- U.S. is no longer the worlds largest consumer…but we did not slow down
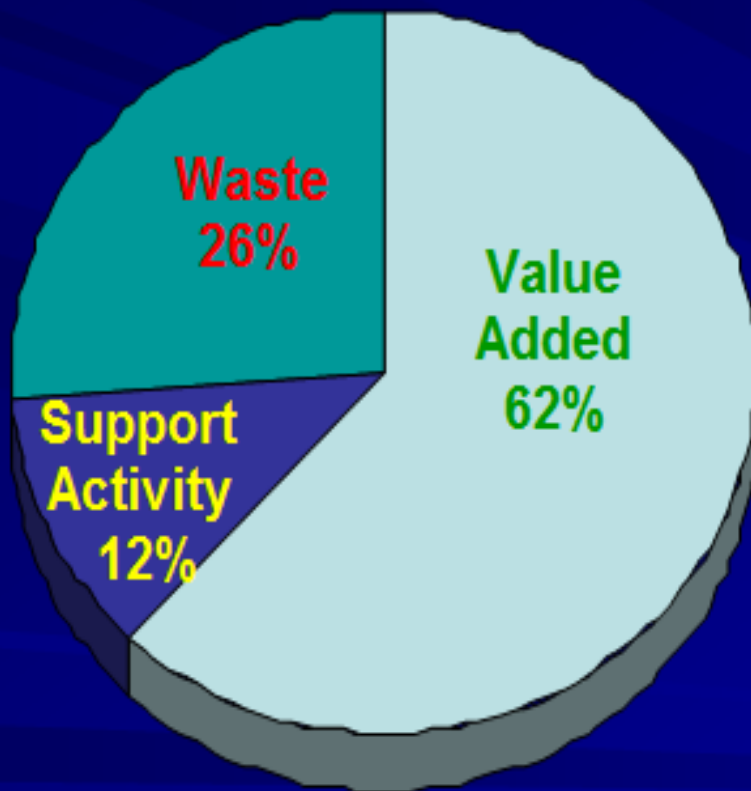
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Source: CII & LCI 2004

Raw materials consumption in the United States

Million tonnes

Legend:
- Construction materials
- Industrial minerals
- Metals
- Non renewable organics
- Agricultural and forestry products

Annotations on chart: World War I, Great depression, World War II, Oil crisis, Recession

Y-axis: 0, 500, 1 000, 1 500, 2 000, 2 500, 3 000, 3 500

X-axis: 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1995

Source: USGS

Need to reduce waste here also!!

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AEC/O costs of non-interoperabilty

Average = 3.1%

- Build team members:
  - 50% say it adds < 2%,
  - 31% say 2-4%.
  - 13% say 5 to 10%
  - 2% say > 10%

- Engineers say 4%
- Owners say 2.5%

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 5.
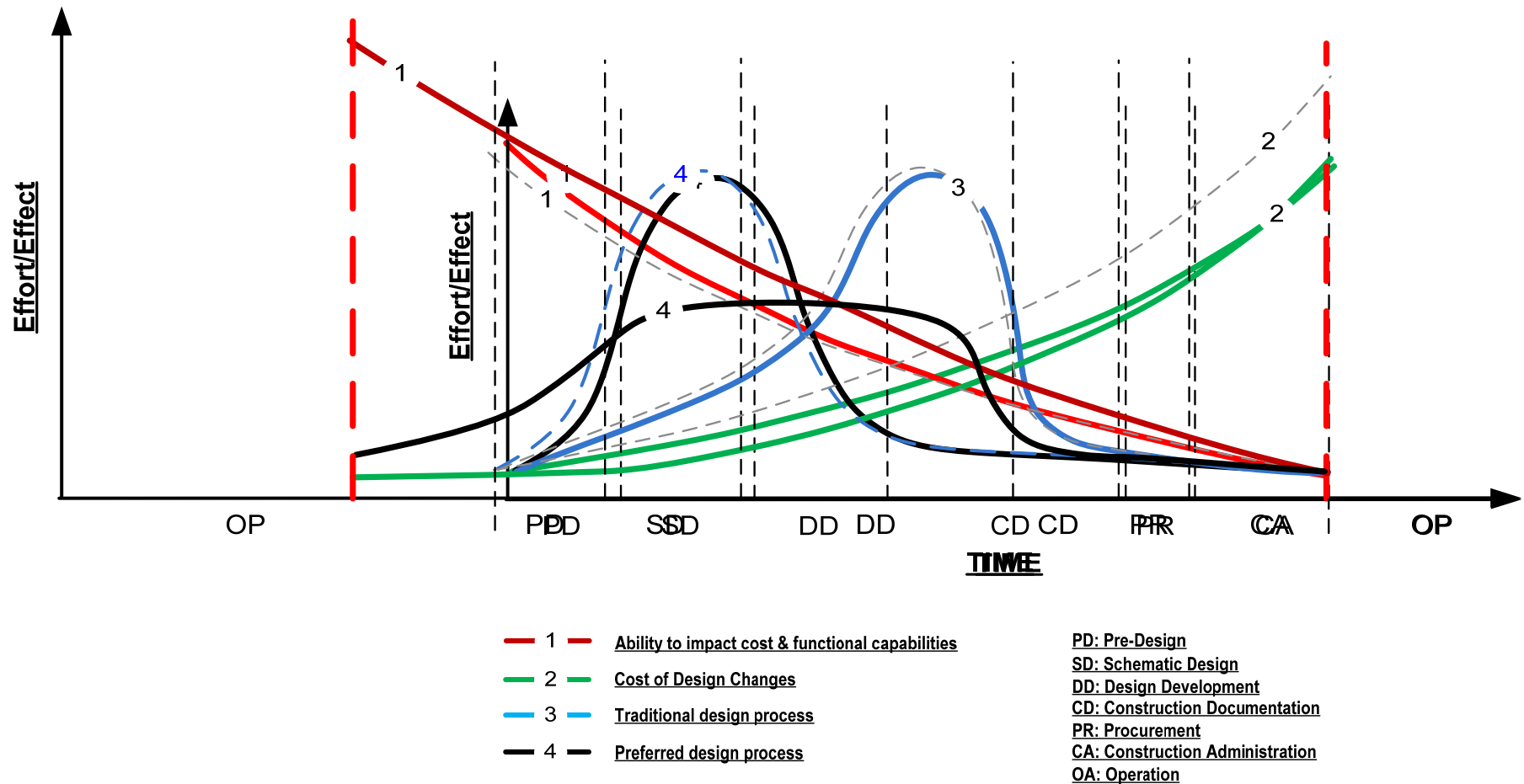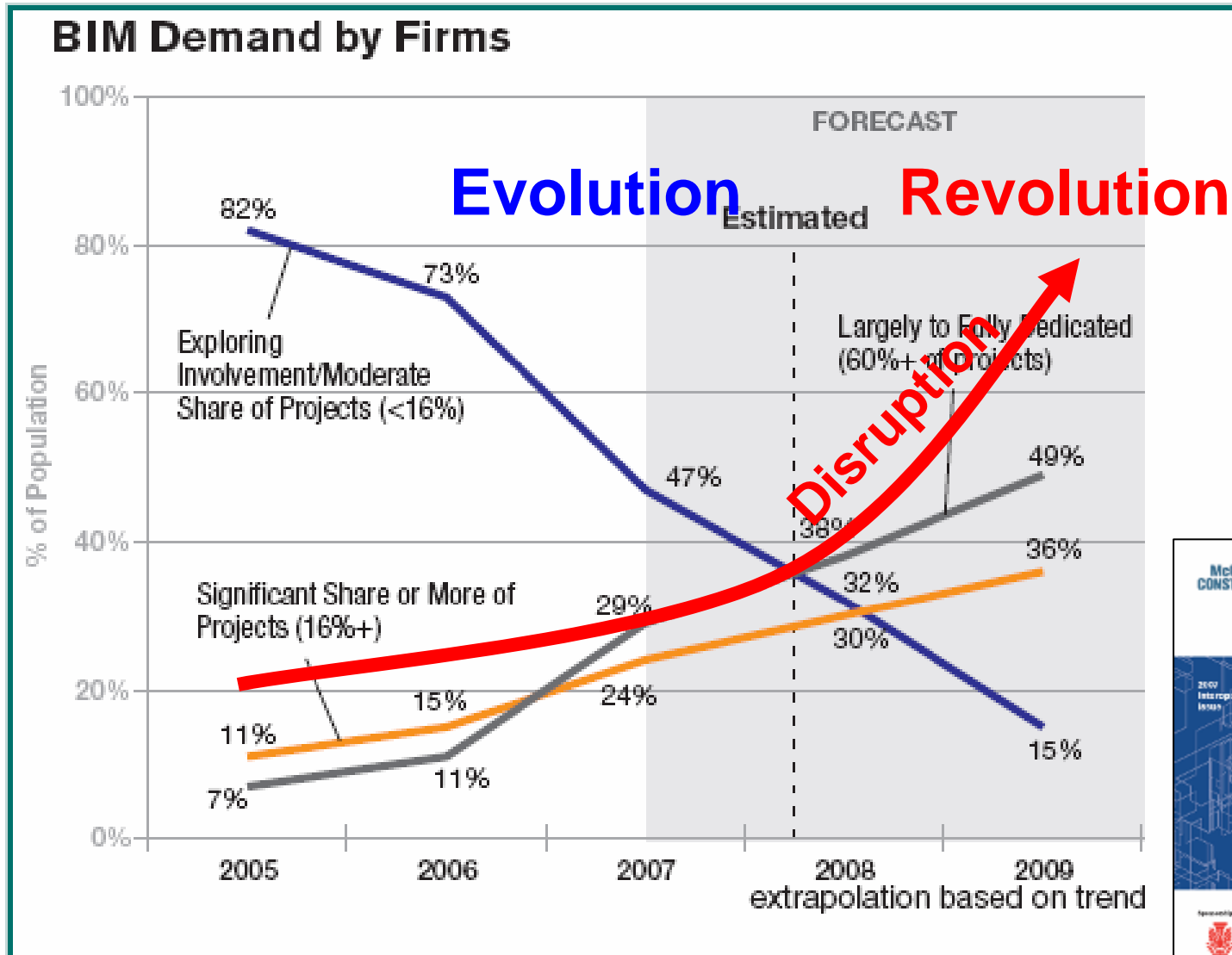
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Problems Related to Lack of Interoperability

What is driving costs due to lack of interoperability?

- Manually re-entering data (69%)

- Time using duplicate software (56%)

- Document version checking (46%)

- RFI processing (40%)

- Cost of data translations (31%)

- Most industry participants would benefit from industry interoperability:

  – 8 in 10 report sharing Medium (41%) or High (31%) quantity of data.

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Effort, Affect, Timing & Value

"Collaboration, Integrated Information and the Project Lifecycle in Building Design, Construction and Operation", The Construction Users Roundtable, August 2004, p4.
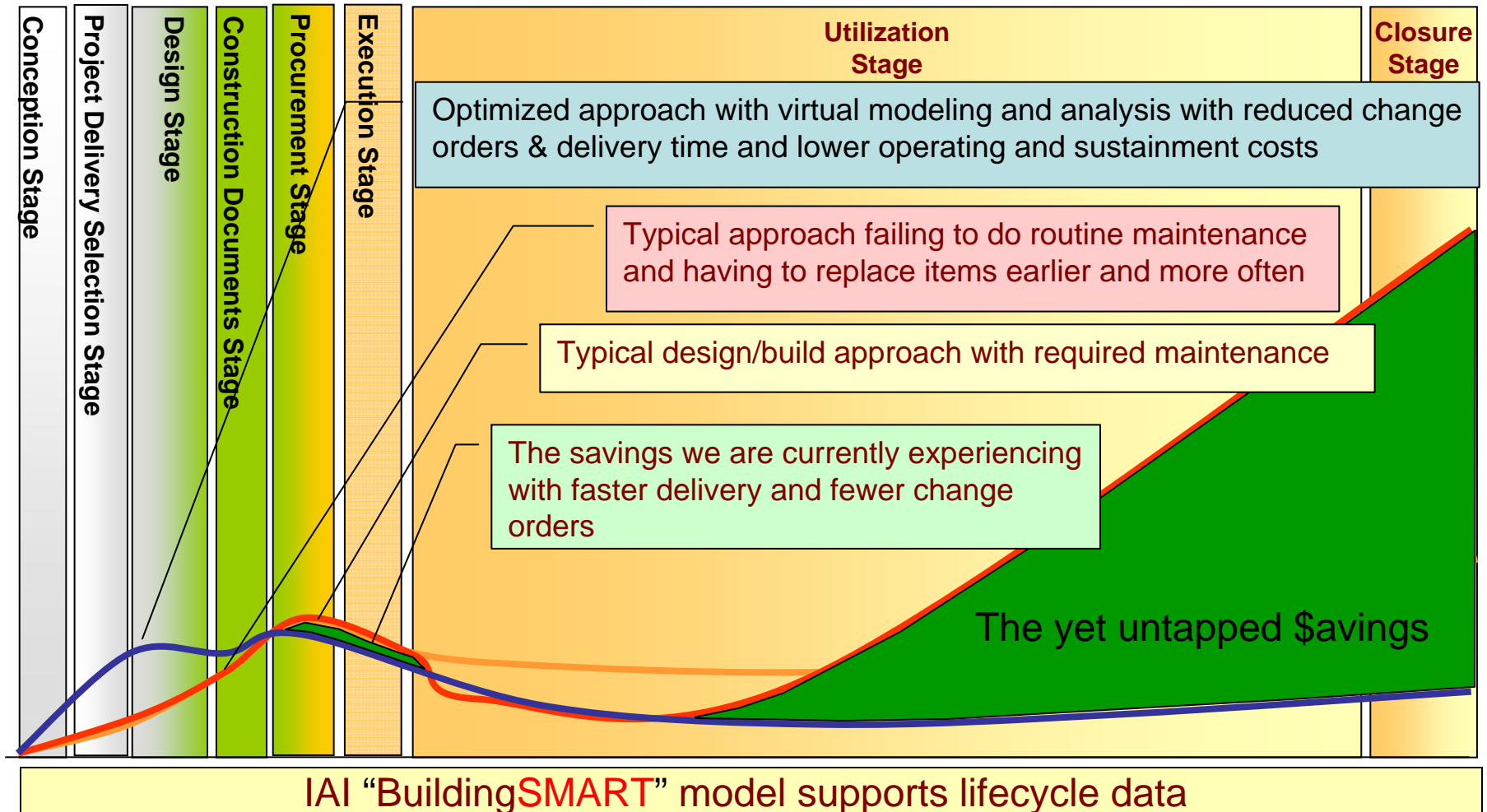
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Time is of the essence

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Savings Opportunities

| Conception Stage | Project Delivery Selection Stage | Design Stage | Construction Documents Stage | Procurement Stage | Execution Stage | Utilization Stage | Closure Stage |

Utilization Stage

Closure Stage

Optimized approach with virtual modeling and analysis with reduced change orders & delivery time and lower operating and sustainment costs

Typical approach failing to do routine maintenance and having to replace items earlier and more often

Typical design/build approach with required maintenance

The savings we are currently experiencing with faster delivery and fewer change orders

The yet untapped $avings

IAI "BuildingSMART" model supports lifecycle data

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The opportunity now exists…

- to virtually design new or to modify existing facilities
- to coordinate design documentation
- to simulate construction and operation prior to physical implementation
- to drive out problems and predict performance
- to coordinate the construction to reduce construction time and eliminate change orders
- to enter data once as part of the business process then re-use it throughout the business; throughout the lifecycle and beyond.

The Opportunity Also Exists:

– To harvest business intelligence and operational information to inform strategic planning.

– To harvest building information for use in programming and design.

– To aggregate data from Building Automation Systems with facilities operations to create unique customer experiences, provide analytics and enable high performance buildings.

– To design with computers then provide parameters and constraints to BIM-based rationalization processes.

– To merge geospatial and building information for planning, development and emergency response.

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In many cases Capital Facilities projects create the 'seed' data that make these capabilities possible.

Intelligent Building PBIM and Facilities Management

Wed. 4:00 – 5:00

Lean Principles – Waste in Construction

Correction: Rework, re-doing some tasks because of errors in the design process discovered after work was started

Over Production: Performing work ahead of schedule, causing interferences with other planned work. Additional material ordered due to inability of suppliers to provide quality

Motion: Construction teams returning back to "office" to pick up plans, tools or materials not available at the site.

Material Movement: Moving materials from one staging to another, handing off work between crews.

Waiting: People waiting for equipment, plans, or instructions on how to proceed. Waiting for material because of ineffective supply chains.

Inventory: Material staged on site too far in advance of when needed.

Processing: Redundant or unnecessary reporting, expediting material orders, or excessive coordination between suppliers.

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Source: GHAFARI Associates, Inc

- Building Information Modeling

- Building Information Models

- Building Information Management

- Interoperability

- A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle from inception onward.

- A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on open standards for interoperability.
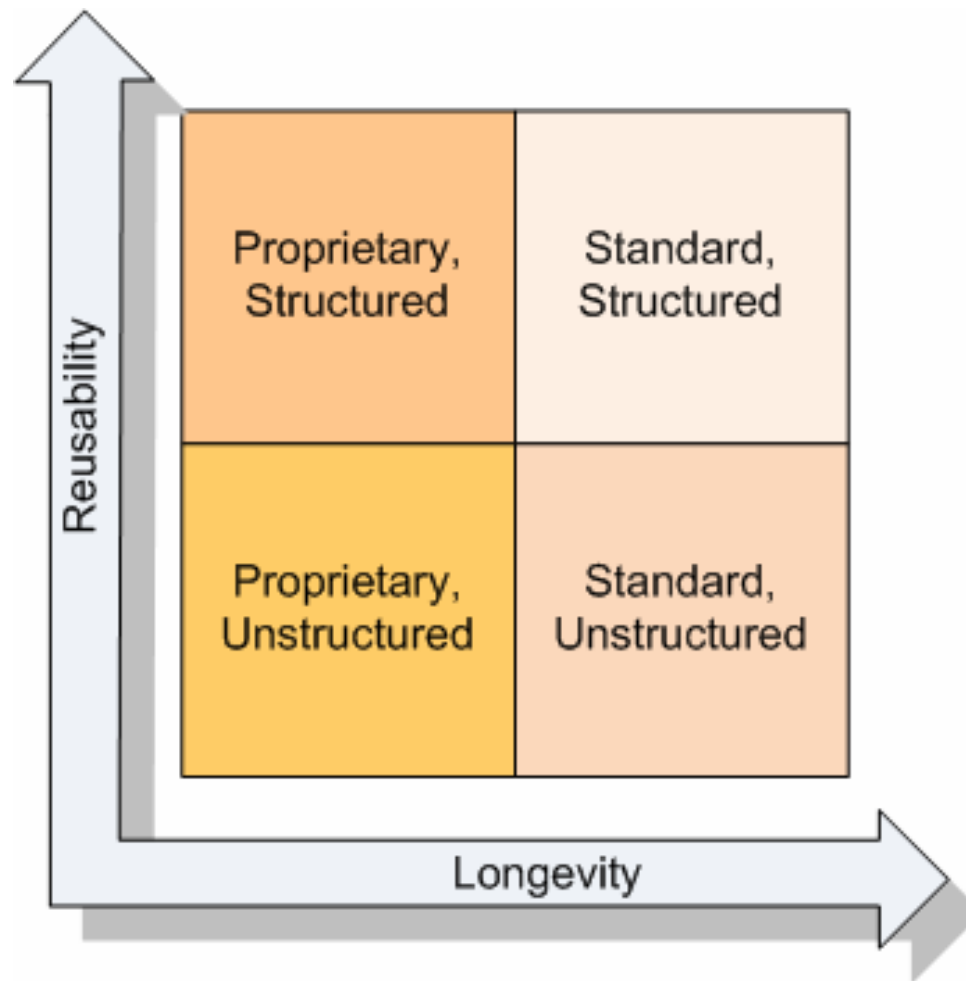
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- Technical – the ability to manage and communicate electronic product and project data among collaborating firms.

- Cultural – ability to implement and manage collaborative relationships among members of cross-disciplinary build-teams that enables project execution.

- Not necessarily 'everything to everything'.

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 4.

- Unstructured – drawings, e-mails, memos, most reports, forms, etc.

- Structured – based on a data schema.

- Proprietary – defined and owned by a specific company. Format is often referred to as 'native' to a software application.

- Standard

  – Defacto – may have originated with a single vendor but now publicly available and widely supported.

 – De jure – maintained by a standards development organization; e.g.: International Organization for Standardization (ISO).

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CRANIUM
CERVICAL VERTEBRAE
MANDIBLE
CLAVICLE
SCAPULA
HUMERUS
STERNUM
RIBS (THORACIC VERTEBRAE ARE HIDDEN BEHIND)
RADIUS
ULNA
CARPALS
METACAR
PHALANG
LUMBAR VERTEBRAE
PELVIC GIRDLE
SACRUM
FEMUR
PATELLA
TIBIA
TARSALS
FIBULA
METATARSLS
PHALANGES

The left hand   OUM

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Longevity and Reusability of Forms and Formats

General Buildings Information Handover Guide, Principles Methodology and Case Studies, National Institute of Standards and Technology, Fallon, Palmer, Aug. 2007, p. 57.

Foundation Elements – 3D / VDC

Courtesy: Kling
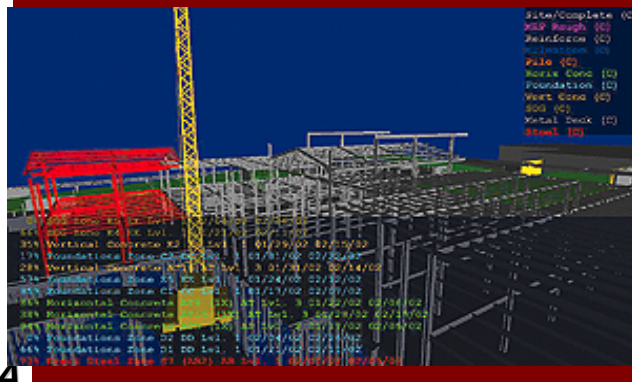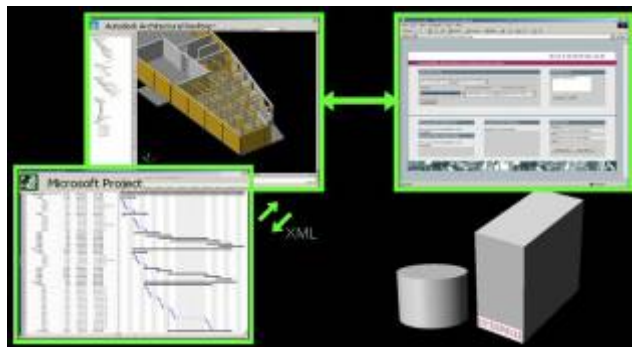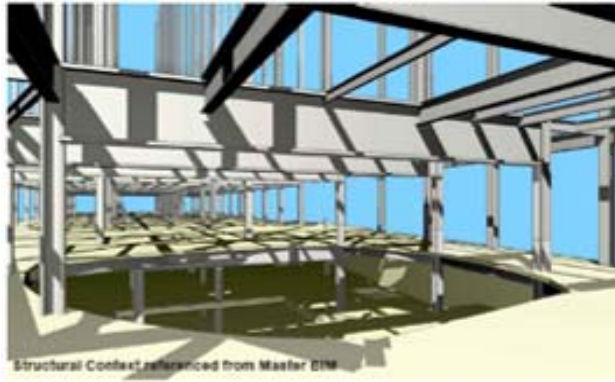
For Example…

Accurate steel members
  - Size, weight, performance, cost.
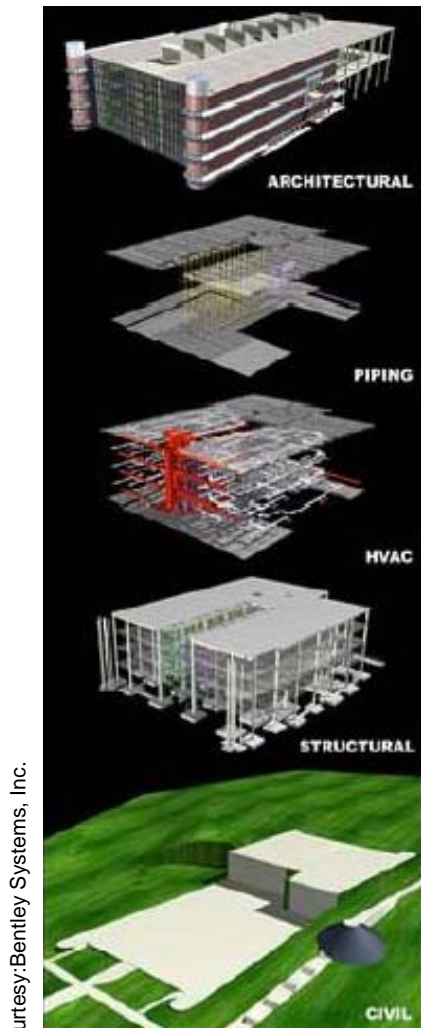
Accurate connections

Accurate 3D position

Simulation of
  - Installation process & equipment requirements
  - lighting
  - structural performance
  - etc.

Overlap with other 3D elements to identify collisions.
  - Mech, elec, plbg,
  - Walls, ceilings, FF&E
  - Access for maint. & repair

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Foundation Elements – Data Commissioning

Data Commissioning for Facilities Operations & Management

Courtesy:Bentley Systems, Inc.

COBIE

DATA SETS	FUNCTION
• 3D Geometry	• Legal
• Real Property	• Fiduciary
• Space Inv.	• Store Ops
• Equipment	• Bldg. Ops
• Warranty	• Fac. Mgmt
• Maint. Tasks	• Asset Mgmt
• Instructions	
• Schedules	
• Cost	

[Construction to Operations Building Information Exchange]

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AECbytes

Analysis, Research, and Reviews of AEC Technology
Lachmi Khemlani,Ph.D.

AECbytes Special Report (October 10, 2007)

Top Criteria for BIM Solutions: AECbytes Survey Results

■ Contrasting choices/approaches to BIM

– Slight preference for scalable solution supporting collaboration vs. single database (although easier to set up)

– Large preference for BIM-integrated CAD vs. BIM-only with more efficient modeling.

– Large preference for fully automated coordination vs. more flexible modeling

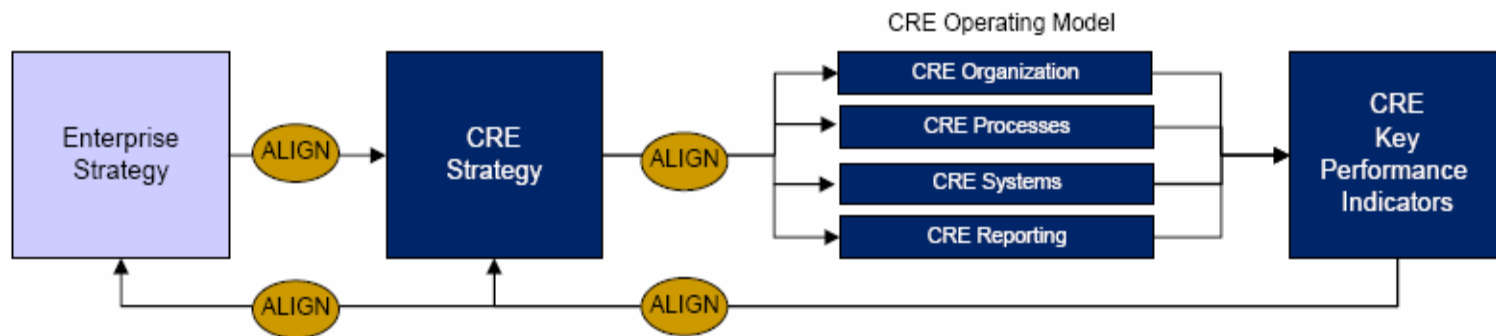– Intuitiveness and easy to use beats ability to model more complex forms.

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AECbytes

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Top Criteria for BIM Solutions: AECbytes Survey Results

■ Contrasting choices/approaches to BIM

– Additional important critieria:

- Ability to be localized—to capture local building codes and standards
- Integration with facilities management
- Integration with space programming and planning tools
- Integration with related disciplines such as urban design, landscape design, civil engineering, and GIS
- Compatibility with other BIM applications
- Improved link from design to fabrication
- Support for rapid prototyping/3D printing
- Ability for specification data development and management within the application
- Support for LEED

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Other Stakeholder Interests..

- Open Standards for Real Estate (OSCRE)

Real Property Marketplace

"No longer is Real Estate a passive back-office function. The transition, in many respects, mirrors the shift experienced a decade ago in IT, which evolved from a tactical delivery system, to a strategic competitive advantage. Companies are recognizing that real estate and facilities can be a key business enabler. Its no longer about the real estate asset itself; its about optimally managing the portfolio of assets in a way that best supports the enterprise."

Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005

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Real Estate Information Opportunities

"Of the 25 participating firms, 80% indicated that CRE had strategic objectives but noted that these were not always formally documented. Of those that had a CRE strategy, roughly one-third could tie the strategy directly back to the enterprise strategy."

"Constantly asked to do 'more with less', CREs are looking at how organizations, processes, reporting and systems… CREs ranked their organizations as most mature followed by processes, reporting and systems."

- Aligned by Function – CRE has no FM responsibility
- Aligned by Activity – Central acquistion, decentralized O&M.
- Particularly with 'execution functions' - 92% outsource but very few single-source.
- Corporates call upon service providers for advice but typically hold strategy in-house. Portfolio administration, lease administration and space planning can go either way.

Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005

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Real Estate Information Opportunities

- CRE professionals need timely, accurate, secure data.
- Today's available technologies are good, but challenge is lack of standards around industry metrics.
- ROI difficult to measure:
- 76% use KPIs; most within Financial and Internal Operations.
- Occupancy Cost/SF, Cost/Employee, Vacancy & Utilization typical.
- But lack of standards makes it difficult to compare across portfolios & industries.

  Biggest Issues:
  - Portfolio Rationalization
  - Demonstrating Value
  - Increased Efficiencies and Productivity in the Workplace
  - Leveraging Technology

Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005

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Corporate Building Information

CISCO

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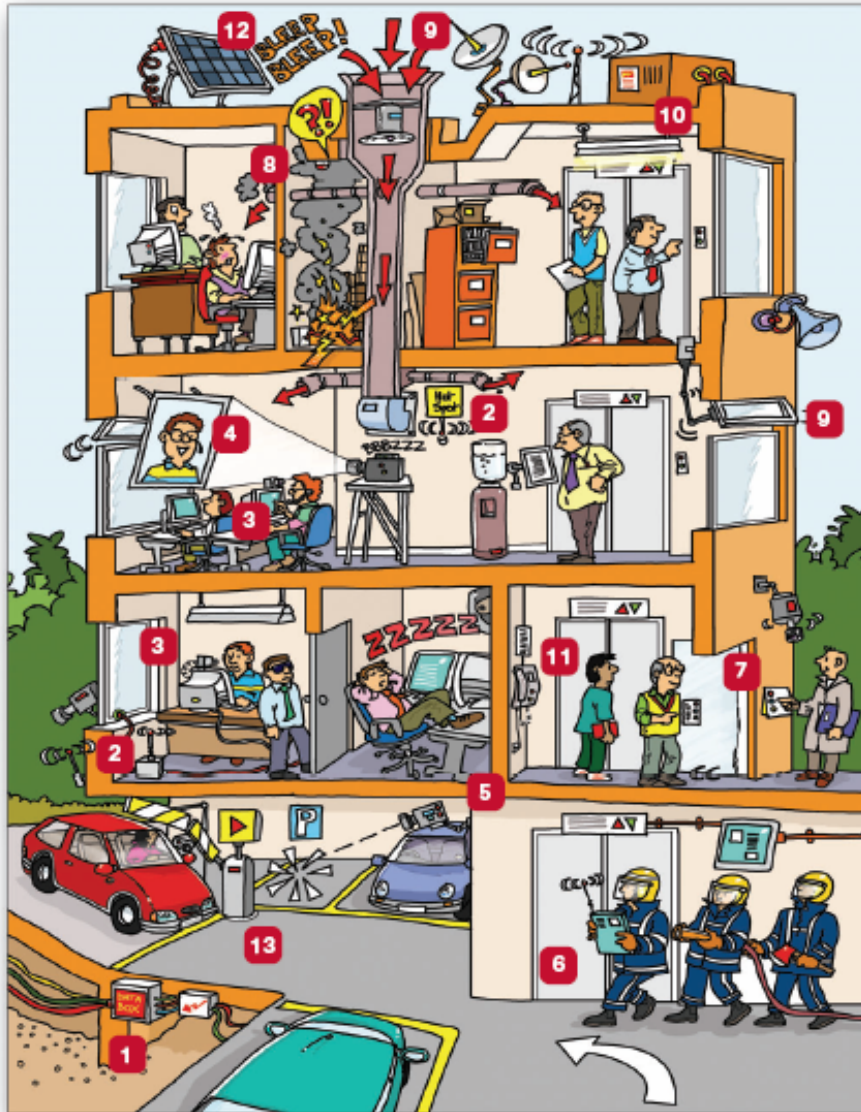
- Personnel
- Real Property Asset Management
- Personal Asset Management
- Facilities Operations Management
- Maintenance and Repair Management
- Building Automation Systems
- Building Intelligence Integration and Network Convergence (data, telcom, display/notice, tenant services).
- Geospatial Context

Corporate *Business* Information
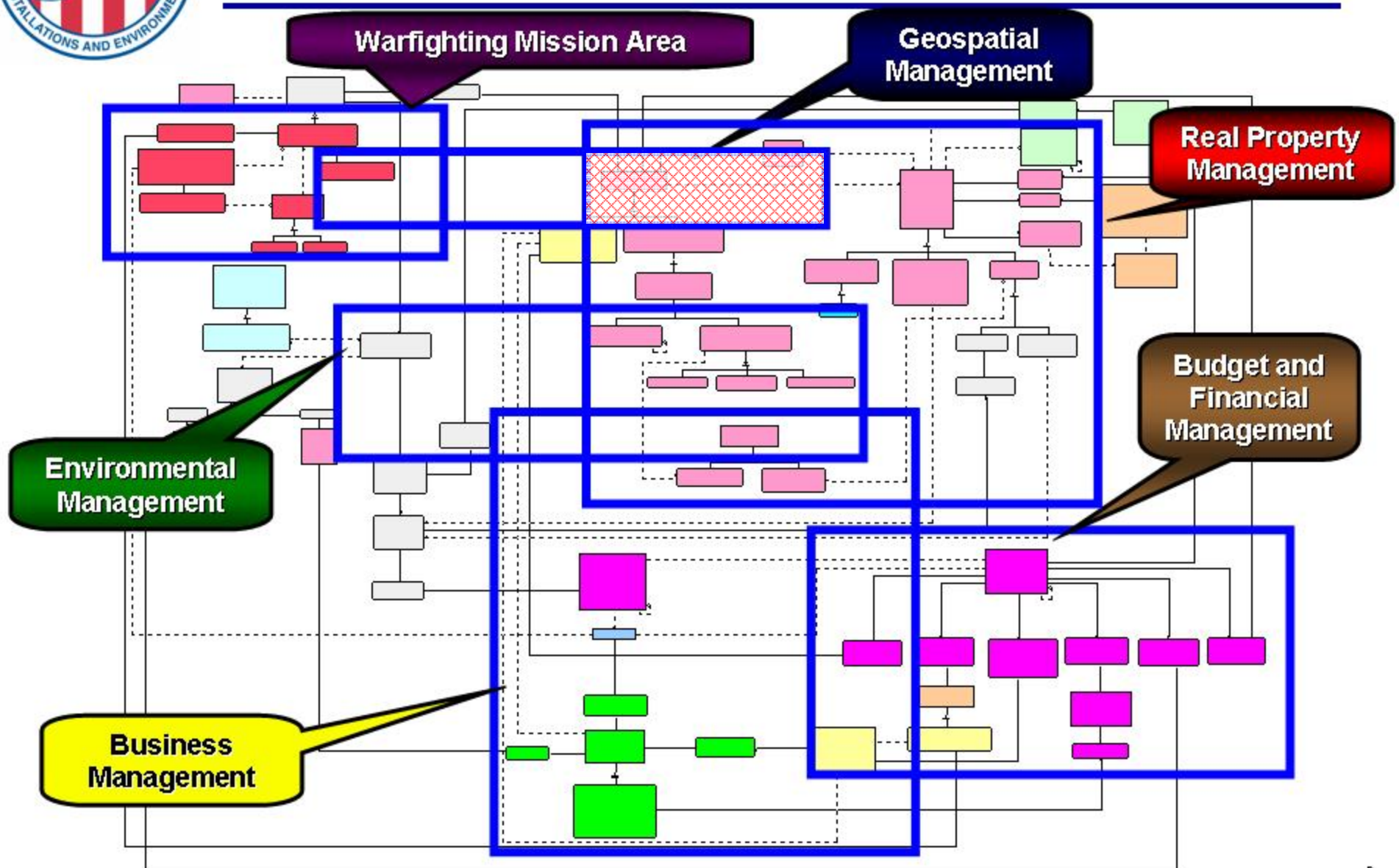
Real Estate Landscape

Use Real Estate as a Resource

- Corporates
- Education
- Health Care
- Commercial
- Industrial
- Government
- Residential

- **Manage Occupant Workforce**
- **Concerned about worker productivity**
- **Concerned about how building supports 'Brand'.**
- **Building supports service model.**

Use Real Estate as Their Business

- Investors
- Owners
- Multi-Family Housing
  - Multi-Unit
  - Apartments
  - Condo
- Service Providers
  - Brokers
  - Listing Exchanges
  - Mortgage Banking
  - Appraisal
  - Lawyers
  - Insurance/ Title
  - Operators
    - JLL, TCC, JCI, CBRE, C&W
  - Construction Industry (AEC)
- Vendors

- **Manage Property & Portfolio**
- **Concerned about Investment Performance**

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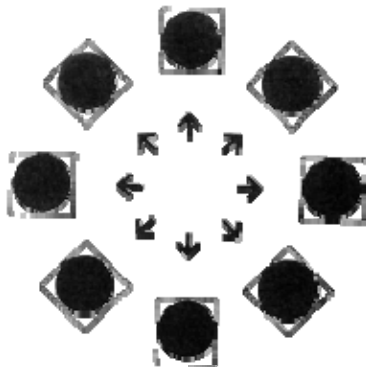**National BIM Standard**   *A* buildingSMARTalliance™ *Member*

How 72% Work Now..
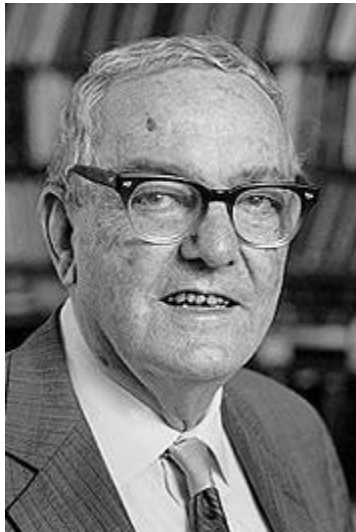
- "..all of us who use computers in complex ways are using computers to design or to participate in the processes of design. Consequently we as designers, or as designers of design processes, have had to be explicit as never before about what is involved in creating a design and what takes place while the creation is going on."

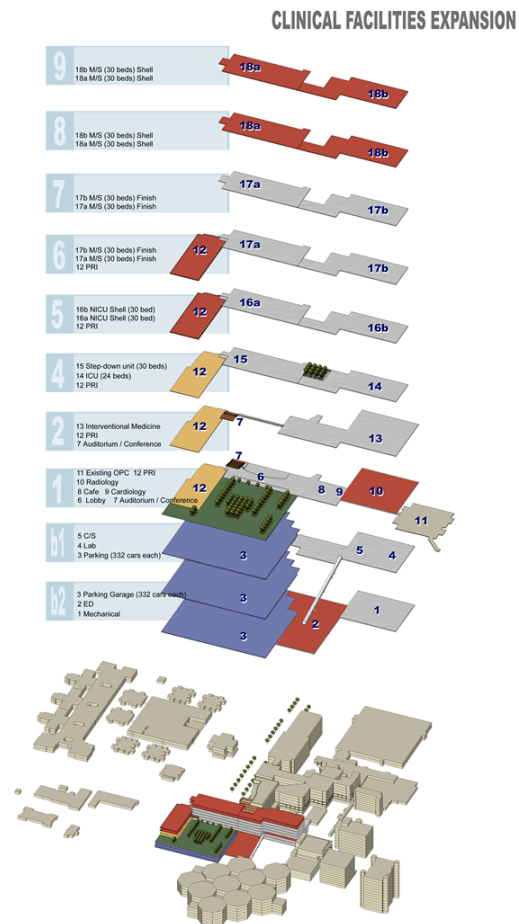- Herbert A. Simon: "The Science of Design", *The Sciences of the Artificial - 3rd Edition.*

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Being Specific is Important for BIM

Conceptual

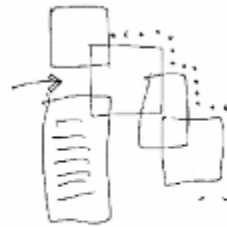[Analysis]

Schematic

CLINICAL FACILITIES EXPANSION

Physical

Modeled

Actual

STORYBOARD MODEL #1: NEED ADDITIONAL WORK (COMMERCIAL) OR LIVING (RESIDENTIAL) AREA

PLANNING	REAL ESTATE	LEGAL	FINANCIAL	PROGRAM & PROJECT MANAGEMENT	FACILITIES MANAGEMENT	PERFORMANCE MANAGEMENT

Step 1

ANALYSIS
FORECAST INDICATES ADDITIONAL SPACE REQUIRED IN 'X' MONTHS

SP&M-WG
DEVELOP SPACE ANALYSIS WORKFLOW & SCHEMA

CPM & LEASE-WG's
Lease Abstract

FM-WG
DEVELOP MOVE REQUEST PACKAGE WORKFLOW & SCHEMA

STRATEGY & PLANNING METRICS-WG
DEVELOP PERFORMANCE BENCHMARK

ANALYSIS
SITE, BUILDING, SPACE REQUIREMENTS

Step 2

Step 3   **Step 3**   **Step 3**

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

Step 4

ANALYSIS
PURCHASE, LEASE OR REMODEL

ANALYSIS
LEASE OR PURCHASE PARAMETERS

VIRTUAL DESIGN & CONSTRUCTION
3D/4D/5D BUILDING INFORMATION MODEL

ANALYSIS
ESTABLISH PROGRAM & PROJECT BUDGETS AND TIMELINES

ANALYSIS
ESTABLISH OPERATING REQUIREMENTS AND BUDGETS

ANALYSIS
ESTABLISH BASELINE PERFORMANCE METRICS AND OPERATING COSTS

ANALYSIS
COMPILE AND REVIEW DATA

Step 5

APPROVAL   NO   NO

RPUID-WG
Real Property Unique Id

REMODEL

COMMERCIAL & RESIDENTIAL PROPERTY LISTINGS EXCHANGE – WG's

ASSUME LEASED PROPERTY FOR THIS SCENARIO

ASSUMPTIONS (ONE OR MANY)
1- BASIC MOVE IN REQUREMENTS (TELECOM, SECURITY, FURNITURE)
2- CONSTRUCTION RETROFIT
3- VENDORS, CONTRACTORS REQ'D
4- CONTRACTS ASSIGNED
5- PURCHASE ORDERS

YES

PURCHASE

Step 6 & 7

APPRAISAL-WG

LEASE

CPM & LEASE ABSTRACT – WG's
Tenants, Recurring Charges, M&A, Lease Abstracts

Step 8   **PROJECTS**

ANALYSIS
CONTINUOUS MONITORING

ANDY FUHRMAN DECEMBER 3, 2003

Conceptual   Schematic

10. **Communications**

A goal to promote the effective exchange of information or ideas in an organization may call for **networks or patterns** of communication: Who communicates with whom? How? How often?

ADMINISTRATION   4,225

GUIDANCE/CLINIC

FOOD SERVICE

BUILDING SERVICES   1,570

STUDENT LOCKERS   1,624

GRAND TOT

GRAND TOT   142,080

Building Types

The following building efficiency ratios are reasonable for the building types listed, until they can be modified by the specific conditions of a particular project.

Home Office Buildings	50/50%
University Administration	55/45%
Corporate R + D	50/50%
University R + D	60/40%
Science	60/40%
Dormitory	60/40%

shape derived from flower

[a]

shape derived from
other design projects

[b]

modified design floor plan

[c]

MAIN HOSPITAL   THE CRITICAL CARE HOSPITAL
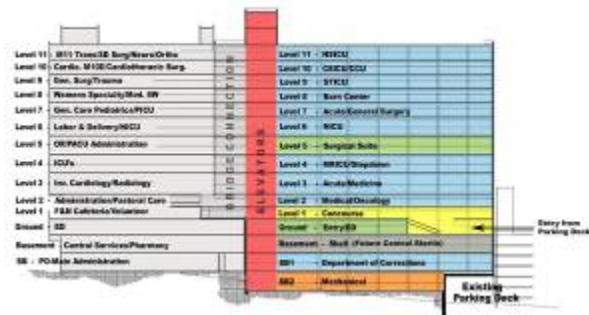
- Volumes of Unstructured Information:

  – SD/early DD drawings (pictures)

  – Outline specifications (text)

  – Study models (physical)

  – Conceptual engineering calculations (spreadsheets, reports w/charts & diagrams)

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Is BIM the Answer?   BIM Without Makeup

oscre.org/ns/cie/SendImportTestData/standard

ode

Code

ModifiedDate

rence

ocatedBy

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Facilities Infor
National BI

2007

Is BIM the Answer?

Daniel Libeskind's Denver Art Museum

3D
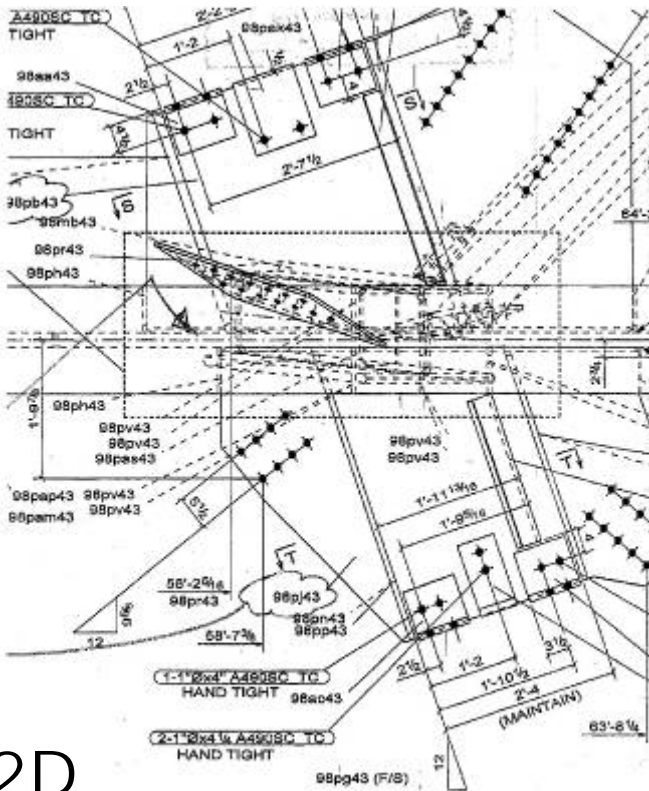
2D

Visualization

with Conflict
Analysis
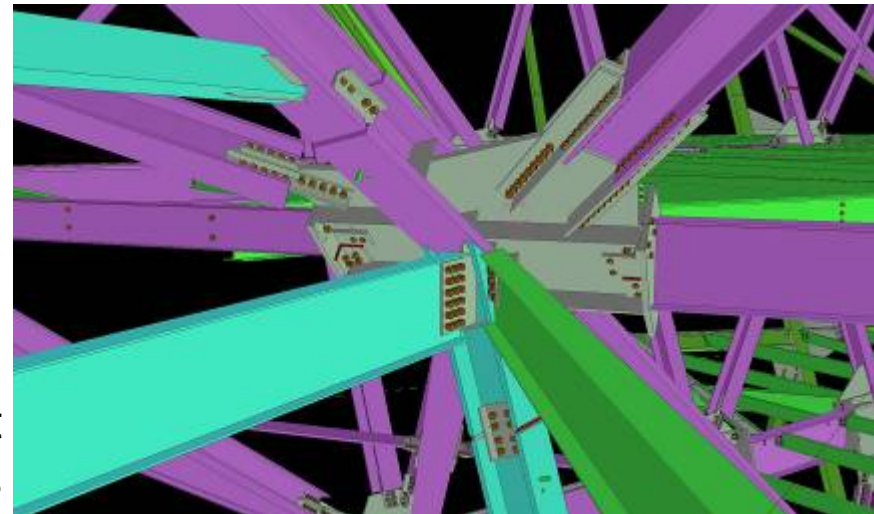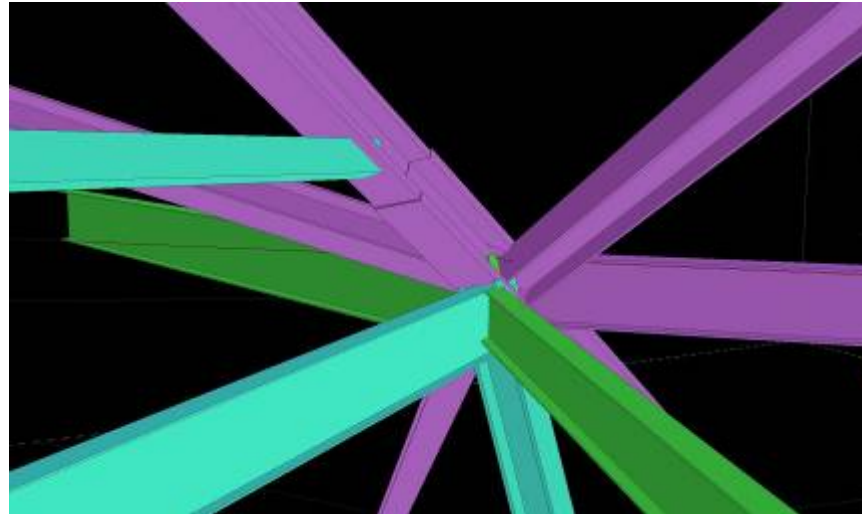
Slide courtesy of C. Eastman

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CAD
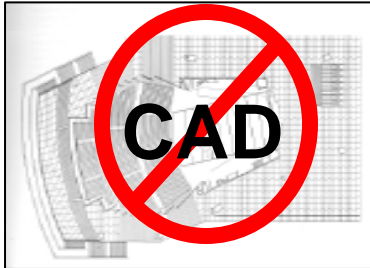
Geospatially Located

Building Information Model
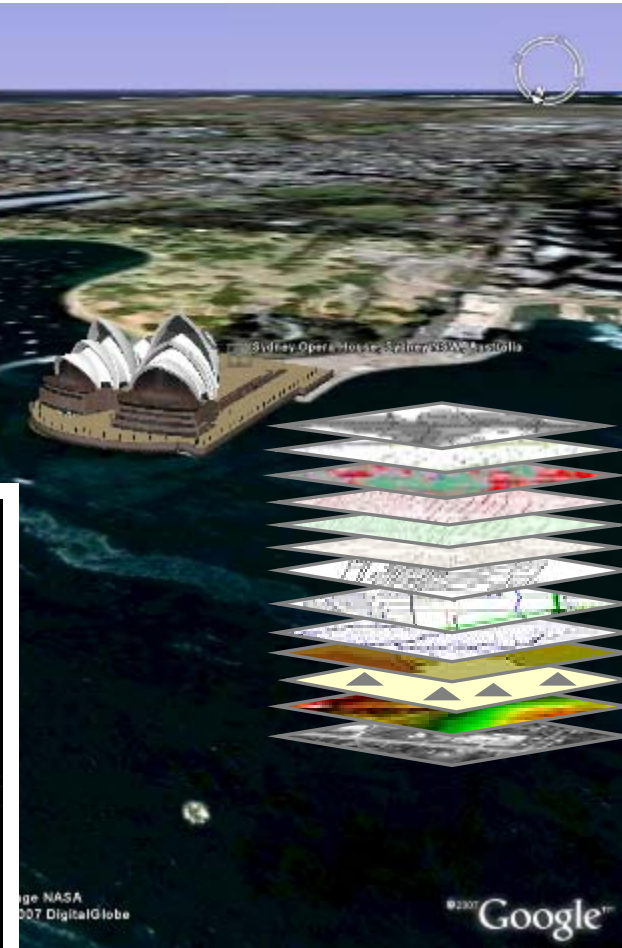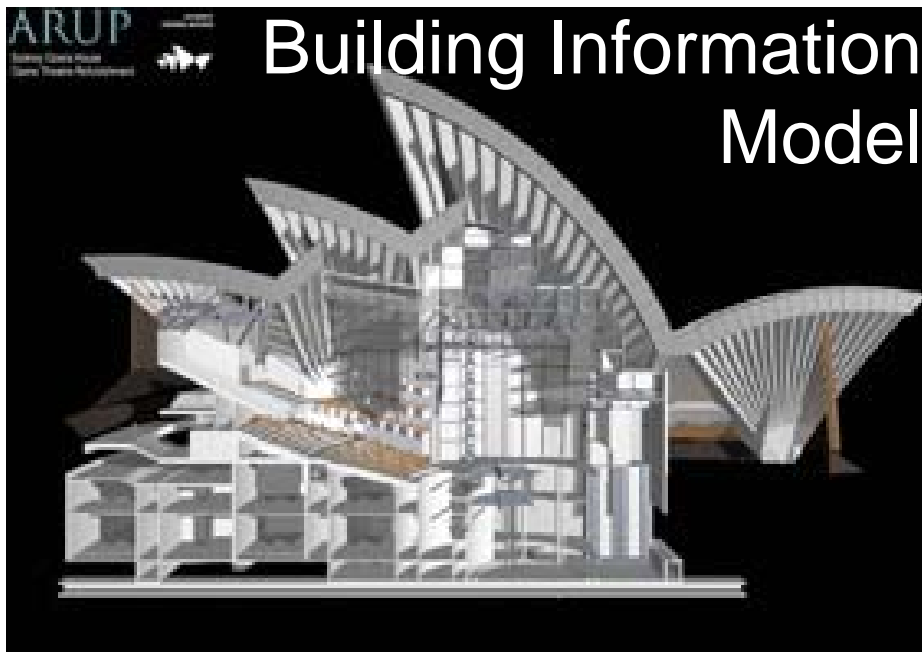
ARUP

Copyright Sydney Opera House.
Courtesy Utzon Architects/Johnson
Pilton Walker (Architects in
collaboration), ARUP, with permission

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- *2006 AIA Firm Survey -* 16 percent of AIA member-owned architecture firms have BIM software, and 64 percent of these use BIM for billable work (ie: 10.2% use BIM software)
  - 86% SD, 90% DD, 81% CD.
  - Large firms, international scope, institutional specialization.

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- 57% - 2D CAD most frequently used by A/E. (33% of contrs.)

- 50% - PM software by contrs.

- 39% - Scheduling software; esp. contractors & owners.

- 28% - Build team frequent-users of BIM. (2006 AIA – 10% use BIM software for billable work)

- ca.10% - Collaboration, engineering analysis, bidding

Why Do Build Team Member Want Interoperability?

- Factors influencing use of BIM:
  - Less time drafting, more time designing (69%)
  - Owners demanding it (49%)
  - BIM ability to improve communication with Client/Others. (47%)
  - Parametric Modifications of Designs (43%)
  - Improved interoperability (41%)
  - Reduced RFI, document version control, improved budget/cost estimating. (38%)
  - Clash detection, reduced insurance claims (32%)
  - Scheduling, Code Compliance checking (25%)
  - Safer worksites and lean construction (ca. 17%)

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 4.

AECbytes

Analysis, Research, and Reviews of AEC Technology
Lachmi Khemlani, Ph.D.

AECbytes Special Report (October 10, 2007)

Top Criteria for BIM Solutions: AECbytes Survey Results

- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.

- http://www.aecbytes.com/feature/2007/BIMSurvey Report.html

- June 20 – July 9, 2007. Published October 10, 2007

- Compare Revit® to Bentley BIM solutions (BIM authoring bias)

- Most important use – drawing production

- low interest in analysis, performance simulations & rendering/animation, interoperability.

- Participants mostly Architects and allied professionals, smaller sized (1-99) firms with 1-4 offices

- BIM solutions used or being evaluated. Revit 67%, Archicad 32%, Bentley BIM 15%, all others 4 to 20%.

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AECbytes

Analysis, Research, and Reviews of AEC Technology
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- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.

- http://www.aecbytes.com/feature/2007/BIMSurvey Report.html

- Top wish list:
  - Full support for CDs – no other drafting application needed (8.8)
  - Coordinated objects (8.0)
  - Availability of Object libraries (8.3)
  - Large project capability (8.0)
  - Multi-disciplinary capability; architecture, structure, M/E/P (7.8)
  - Direct integration with structural (7.1)
  - Cost estimating, construction scheduling, integration with analysis, integration with PM (6.98)
  - IFC compatibility (6.7)
  - Market leadership (4.9)

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Getting There From Here

How to get everything we want…

One step at a time.

- Lifecycle Information Helix
- Focus on Information Exchanges
- Single Providers Mythology
- Collaboration
- Information Security – Digital Rights Mgmt.
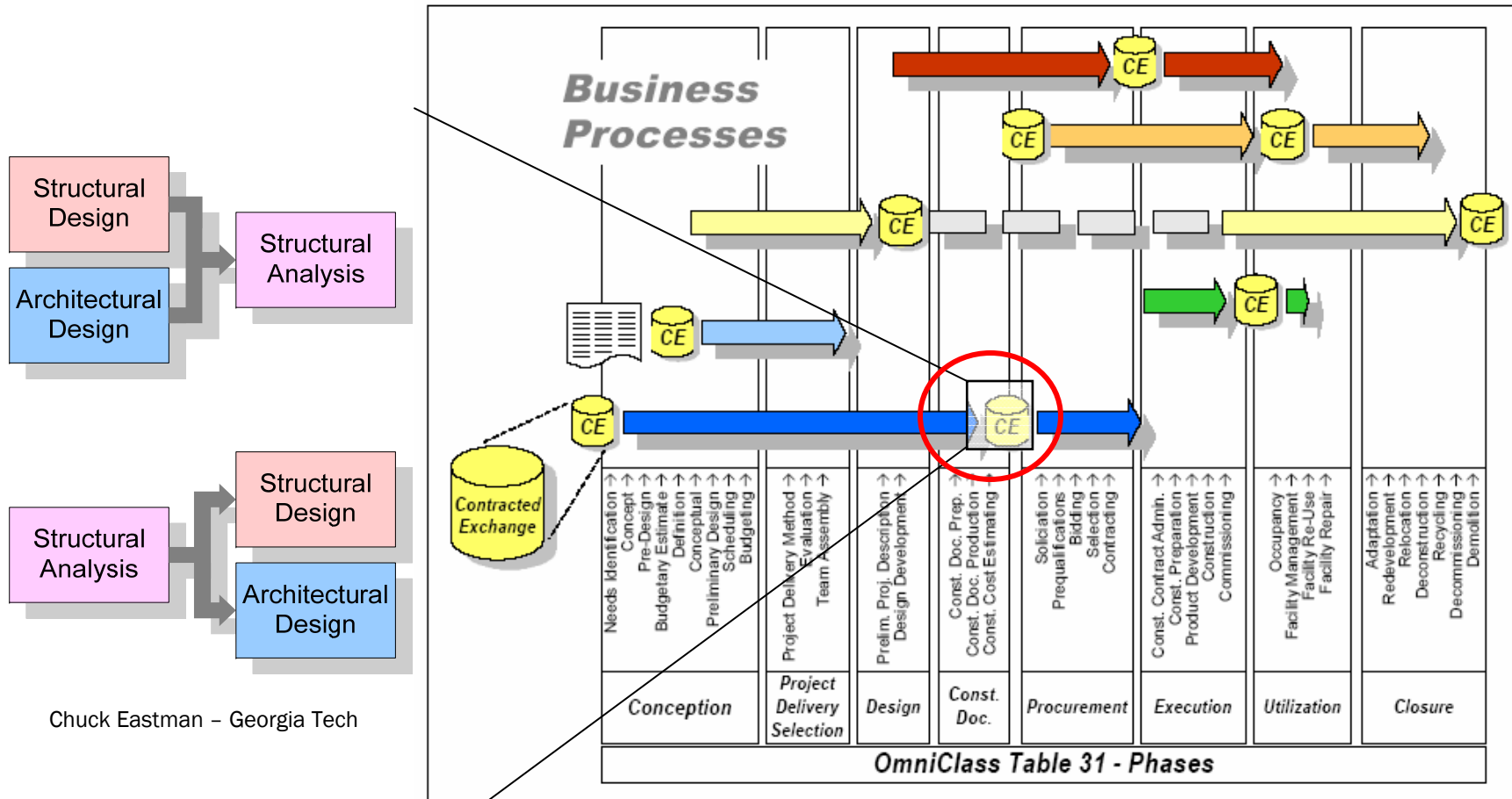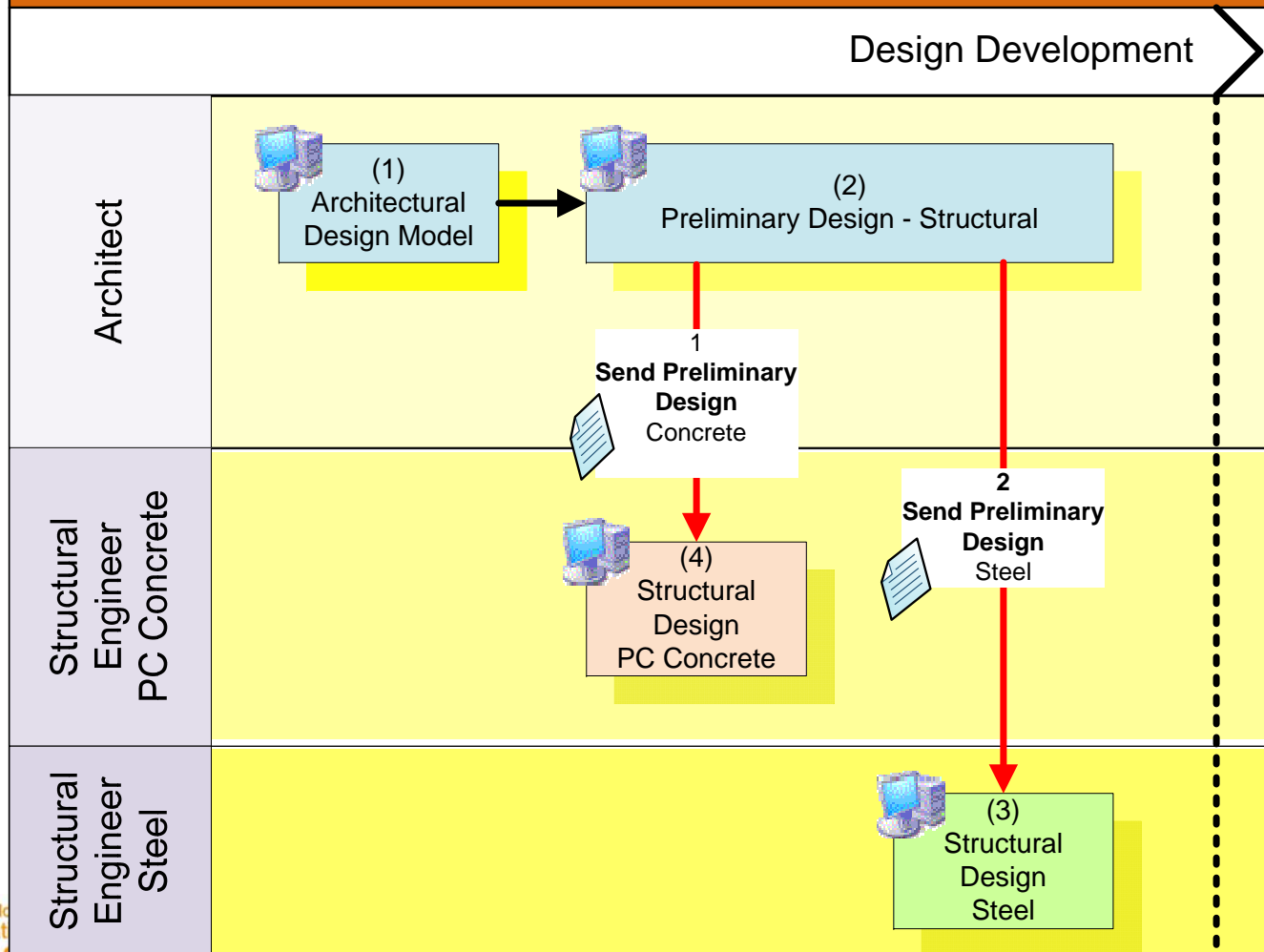- Terminology – 3D, VDC, Lifecycle BIM
- Delivering Buildings + Value

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Facilities Information Council
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Building is a Verb

National Building Information Modeling Standard
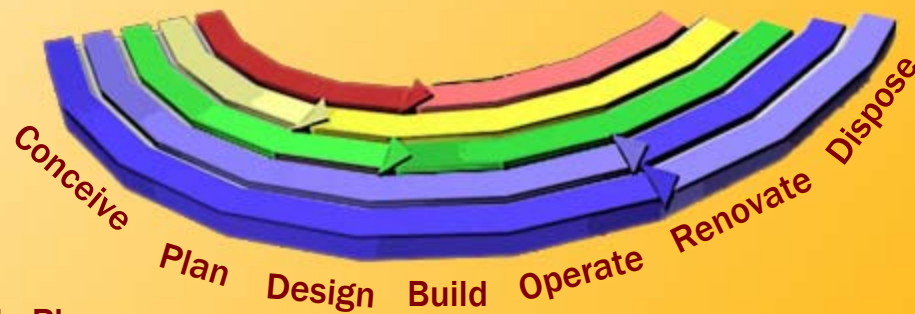
Conceive
Plan
Design
Build
Operate
Renovate
Dispose

Lifecycle Phases

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Facilities Informat
National BIM

Learn and Improve

National Building Information Modeling Standard

Knowledge over time

Information Exchanges

Conceive

Plan   Design   Build   Operate   Renovate   Dispose

Lifecycle Phases

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Facilities Informat
National BIM

© AEdgar 2006
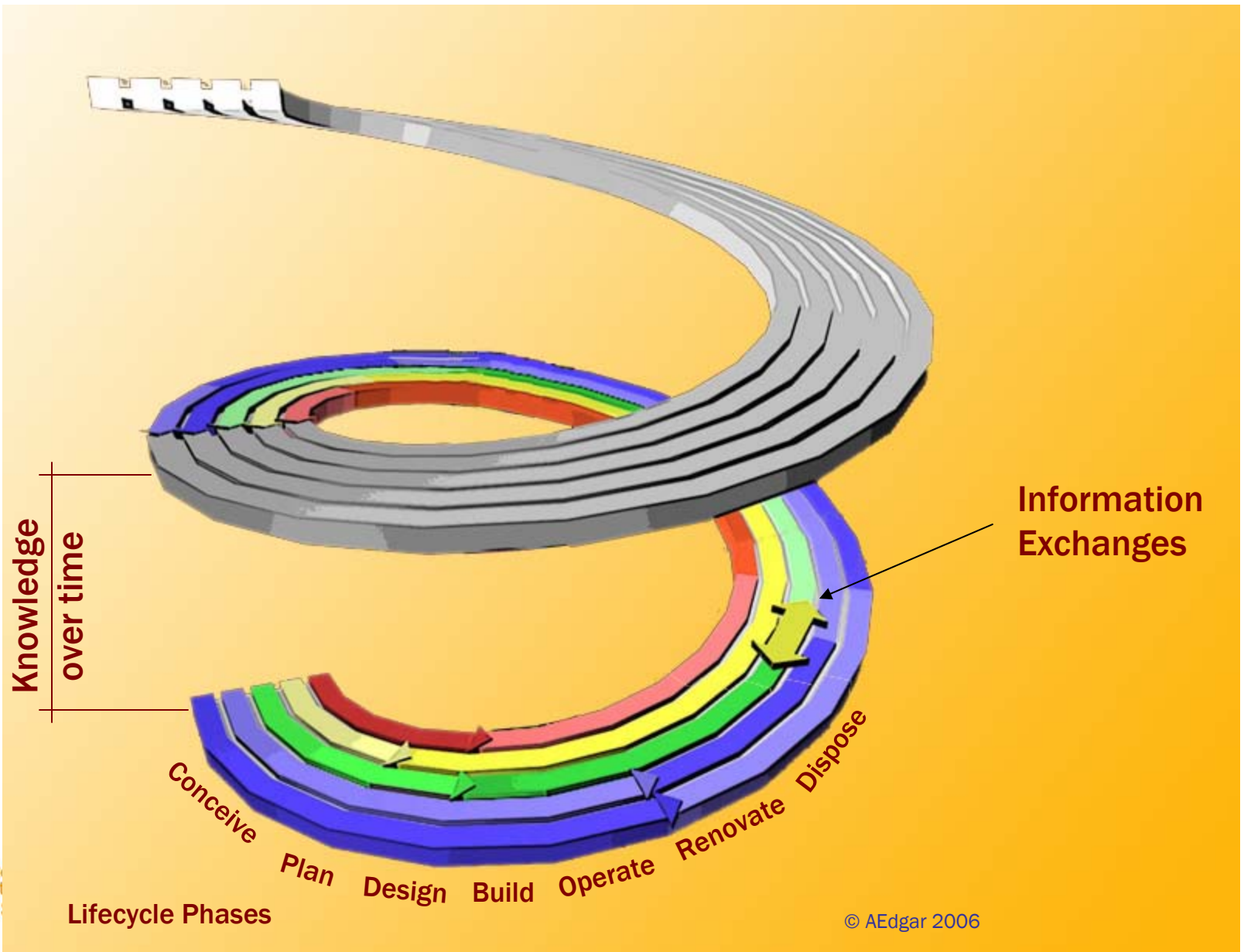
Share and re-use information easily

Interoperability

National Building Information Modeling Standard

Information Backbone

Information Exchanges

Knowledge over time

Conceive Plan Design Build Operate Renovate Dispose

Lifecycle Phases

National Institute of Buil...
Facilities Informat...
National BIM ...

© AEdgar 2006
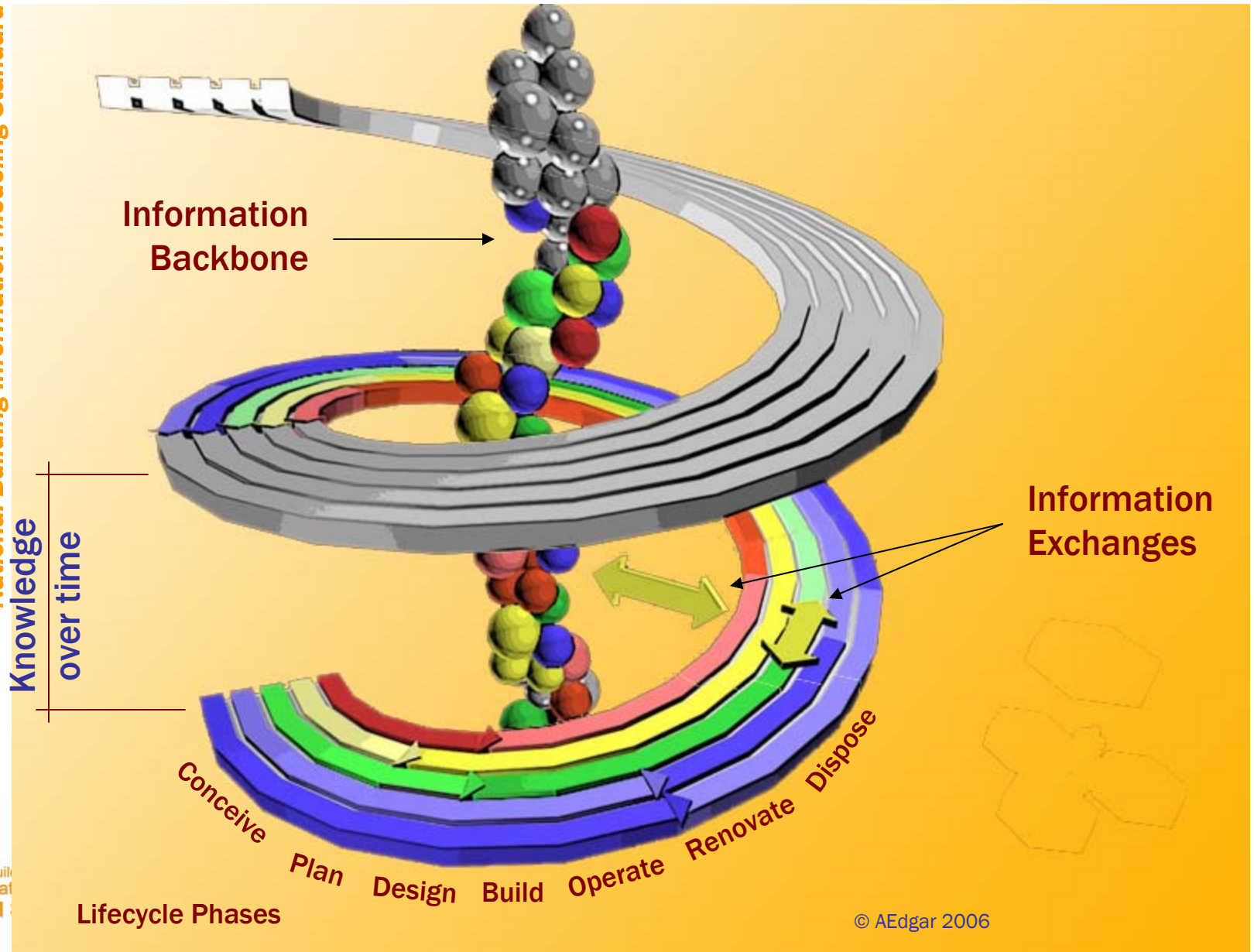
Projects create buildings + lots of information

Lifecycle Information

National Building Information Modeling Standard
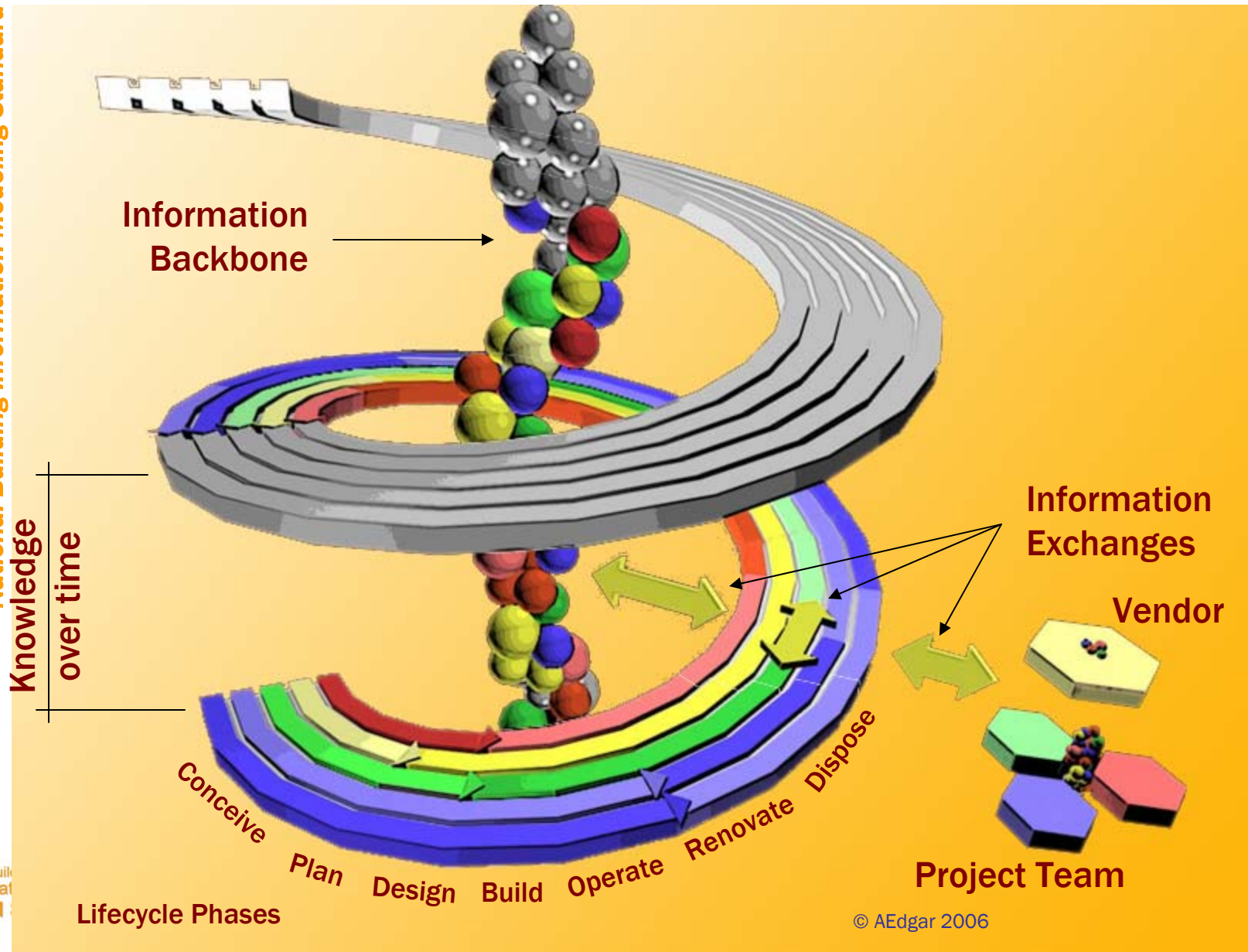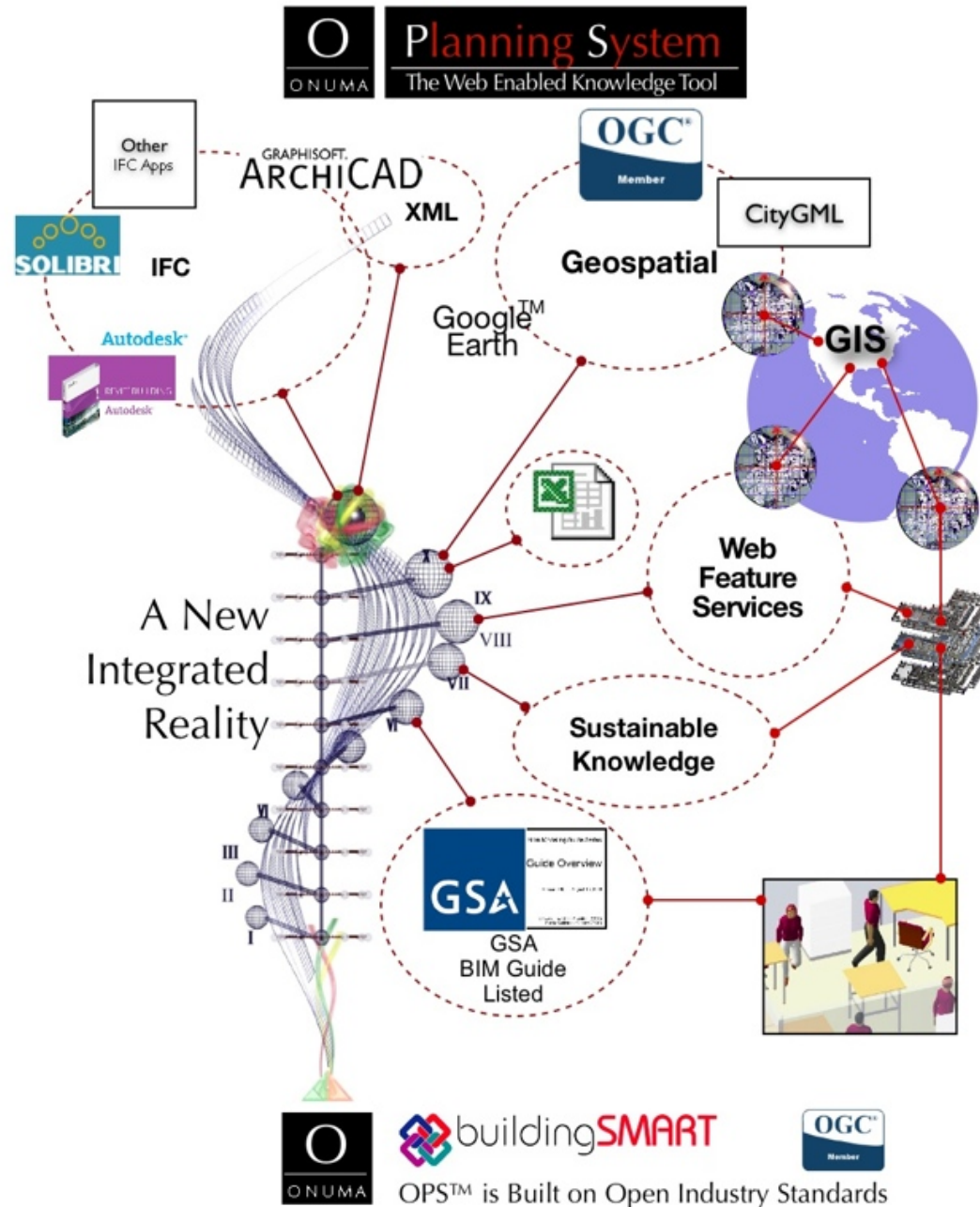
Knowledge over time

Information Backbone

Information Exchanges

Vendor

Conceive Plan Design Build Operate Renovate Dispose

Lifecycle Phases

Project Team

National Institute of Buil...
Facilities Informat...
National BIM S...

© AEdgar 2006
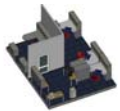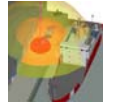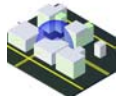
Strategy:
Focus on the Information Exchanges

Information Exchange Requirement

Structural Design

Architectural Design

Structural Analysis

Structural Analysis

Structural Design

Architectural Design

Chuck Eastman – Georgia Tech

Business Processes

CE

CE

CE

CE

CE

CE

CE

CE

CE

Contracted Exchange

Needs Identification
Concept
Pre-Design
Budgetary Estimate
Definition
Conceptual
Preliminary Design
Scheduling
Budgeting

Project Delivery Method
Evaluation
Team Assembly

Prelim. Proj. Description
Design Development

Const. Doc. Prep.
Const. Doc. Production
Const. Cost Estimating

Solicitation
Prequalifications
Bidding
Selection
Contracting

Const. Contract Admin.
Const. Preparation
Product Development
Construction
Commissioning

Occupancy
Facility Management
Facility Re-Use
Facility Repair

Adaptation
Redevelopment
Relocation
Deconstruction
Recycling
Decommissioning
Demolition

Conception

Project Delivery Selection

Design

Const. Doc.

Procurement

Execution

Utilization

Closure

OmniClass Table 31 - Phases

Alan Edgar – FacilityGenetics, L.L.C.

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Facilities Information Council
National BIM Standard

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Architect to Structural Design Engineer
(Multiple Applications)

Workgroup: Architectural Design to Structural Design (Sample)
Business Process Map: Design Development - Structural

Design Development

Architect

(1)
Architectural Design Model

(2)
Preliminary Design - Structural

1
Send Preliminary Design
Concrete

2
Send Preliminary Design
Steel

Structural Engineer PC Concrete

(4)
Structural Design PC Concrete

Structural Engineer Steel

(3)
Structural Design Steel

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Facilities Informat
National BIM Standard

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Economic Value of Exchange Standards
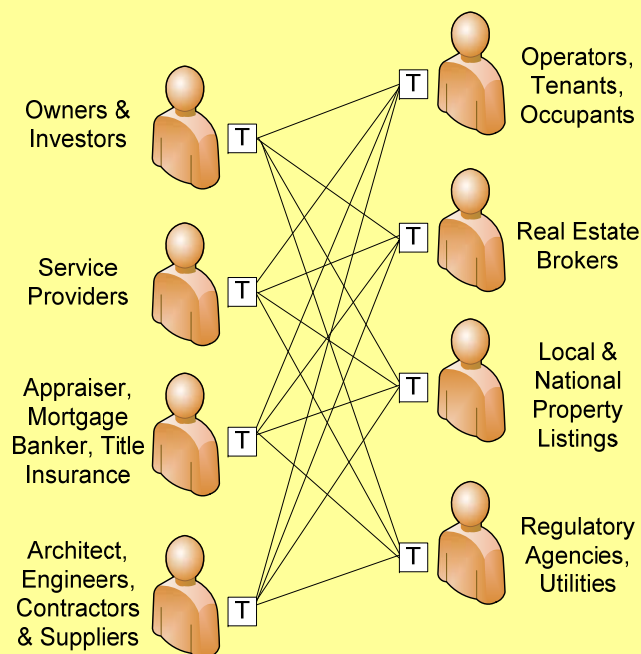
Typical Systems Integration Without Data Standards
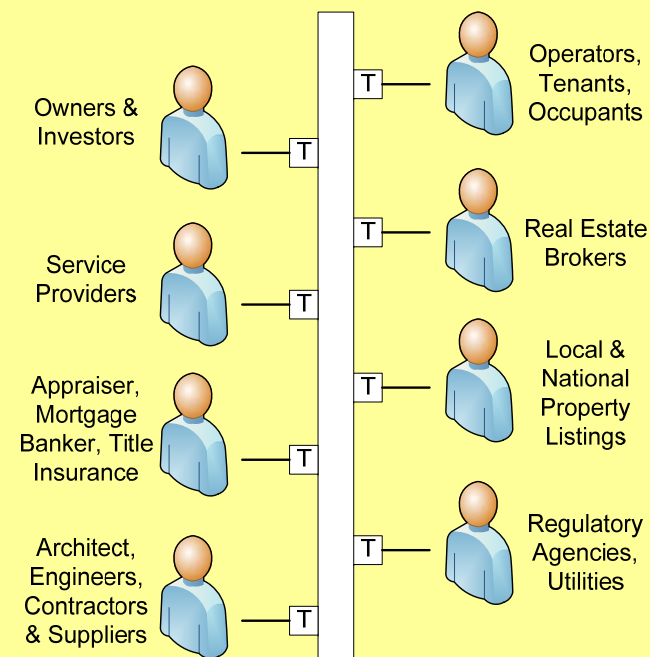
Frictionless Systems Integration Using OSCRE's Common Data Exchange Standards With Translators

Copyright 2005 © OSCRE America

Number of Components to Integrate	Formula/Calculation (See Last Slide for Calculation Details)	Cost of Integration (FTE's)	Labor Cost ($50,000/FTE)
20	N(N-1) 20(19)=380	38	$1,900,000
20	N=2.0 20(2.0)=40	4	$ 200,000
NET SAVINGS	340 CONNECTIONS	34 FTE's	$1,700,000
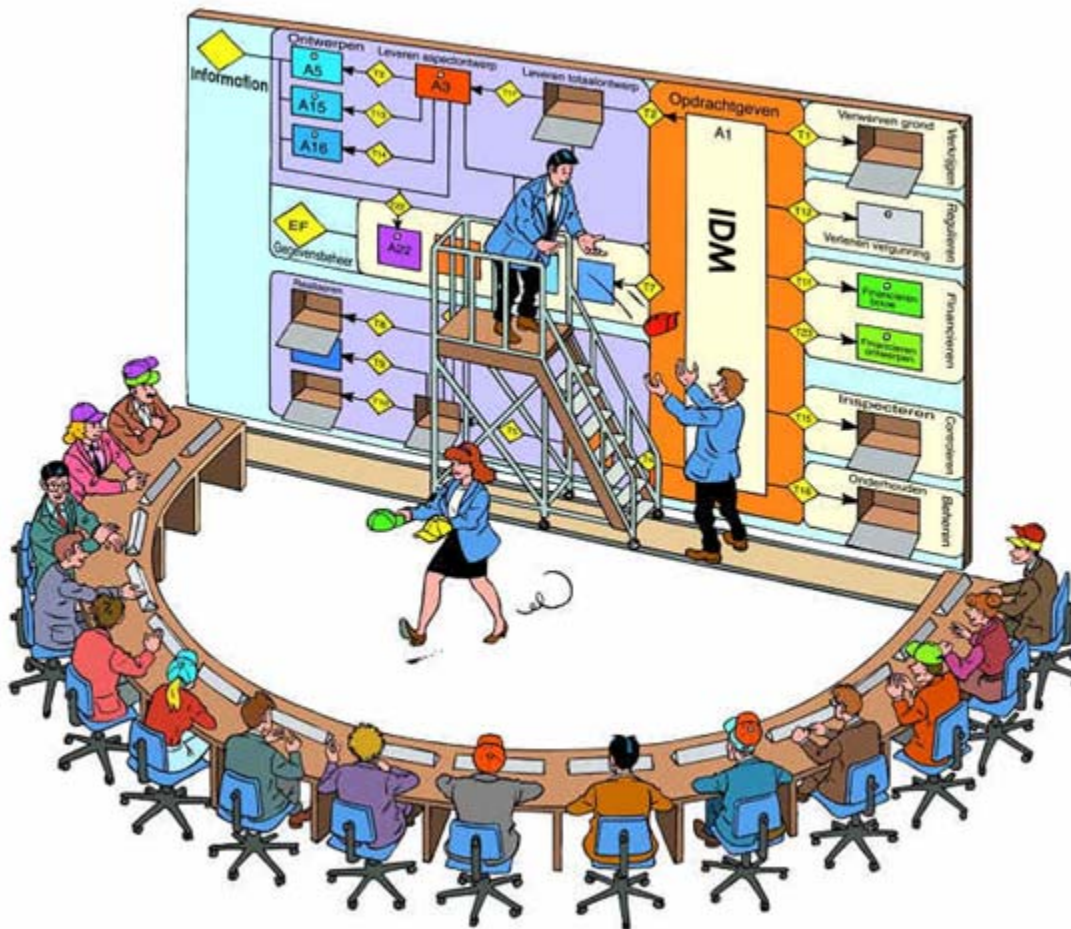
Teaming around project or task.

Co-location or remote reviews from Shared BIM model.

Persistent data & standard exchanges.

Brings integrated view to issue – facilitating resolution.

- Key to shared data resource

- Manage access to provide and retrieve data.

- Based on contracted relationships.
  - New AIA C106™-2007 Digital Data Licensing Agreement
  - New AIA E201 ™ -2007 Digital Data Protocols.

Who Benefits from Lifecycle BIM?

Building Information Model (BIM)
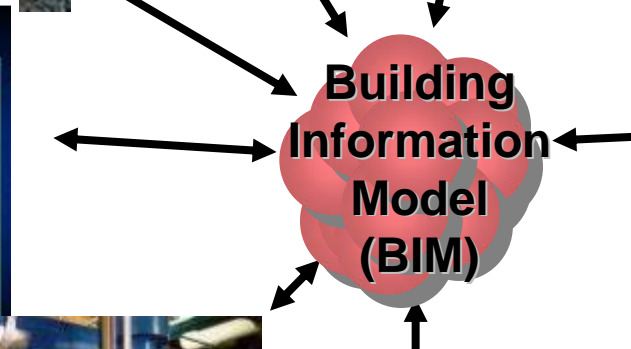
Facility Information Views

- Owners
- Planners
- Realtors
- Appraisers
- Mortgage Bankers
- Designers
- Engineers
- Cost & Quantity Estimators
- Specifiers
- Contracts & Lawyers
- Construction Contractors
- Sub-Contractors
- Fabricators
- Code Officials
- Zoning
- Facility Managers
- Maintenance & Sustainment
- Renovation & Restoration
- Disposal & Recycling
- Scoping, Testing, Simulation
- Safety & Occupational Health
- Environmental & NEPA
- Plant Operations
- Energy, LEED
- Space & Security
- Network Managers
- CIO's
- Risk Management
- Occupant Support
- First Responders
- Disaster Recovery
- Continuation of Operations Plans

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- **Data Richness** – How complete is the model?
- **Life-cycle Views** – How many phases are included?
- **Roles Or Disciplines** – How many players?
- **Business process** – Business processes defined?
- **Change Management** – Change management process in place?
- **Timeliness/ Response** – How long does it take to respond to RFI's or Change Orders?
- **Delivery Method** – Single platform or SOA and web?
- **Graphical Information** – Using 3D models?
- **Spatial Capability** – Tie to geospatial or spatially aware?
- **Information Accuracy** – Information assurance for input and output?
- **Interoperability/ IFC Support** – Do you use IFC's as a primary tool?
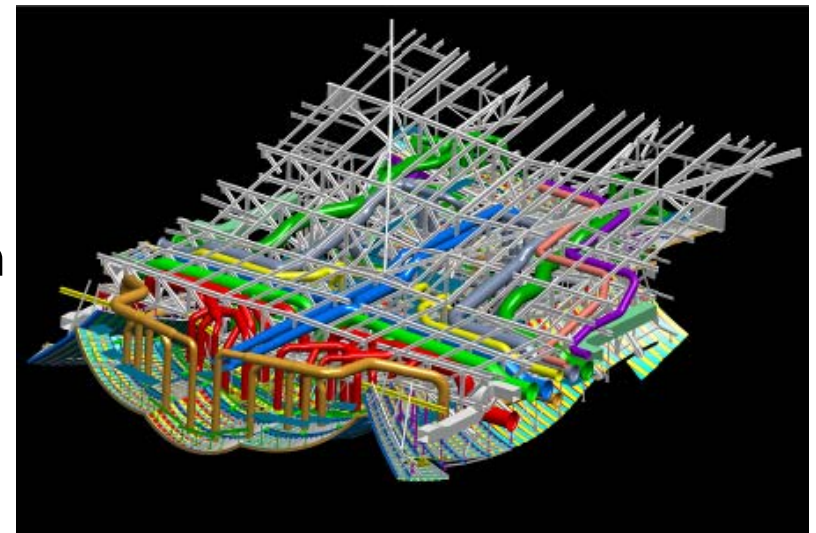
BIM Capability Maturity Model
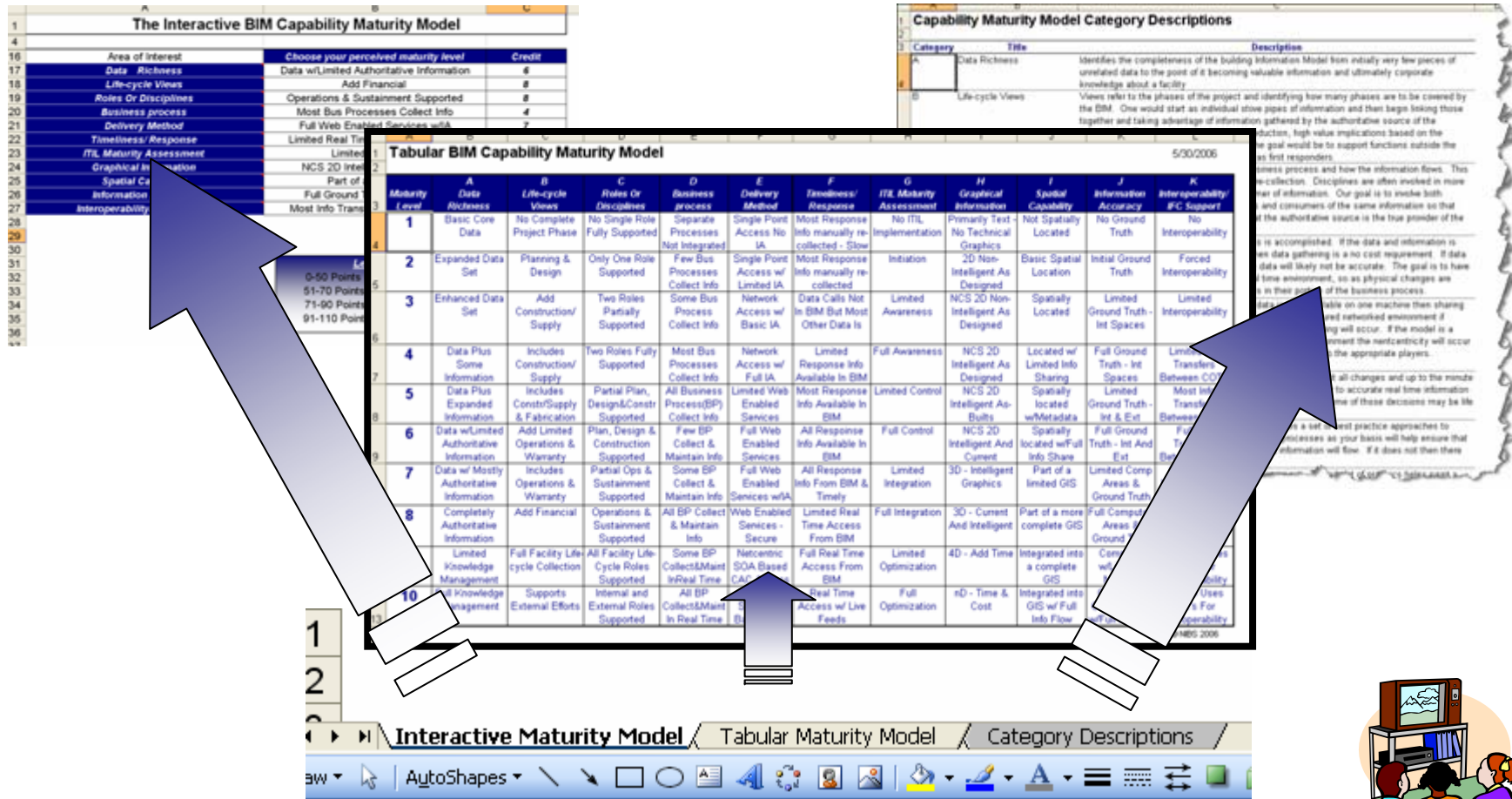
Article: http://www.aecbytes.com/viewpoint/2007/issue_33.html

Download: http://www.facilityinformationcouncil.org/bim/pdfs/BIM_CMM_v1.8.xls

Organization – North America

National Institute of Building Sciences

Board of Directors

buildingSMARTalliance™

IAI-International

Product Development Team
Bjørn K Stangeland
Lars C. Christensen

President

Board of Direction

buildingSMART Staff

Business Practice Integration

Real Property Community

Energy And Environment

Economy & Sustainability

Alliances And Standards

Technical Committee (IAI – North America)
Coordinator – Deke Smith
IFC – Kimon Onuma
IDM – Dianne Davis
MVD – Richard See
IFD – Roger Grant

Visualization, Simulation & Analysis

Quality of Life

Research And Development

User Groups

Education

Facility Information Council
David Jordani

Project listing and coordination
NBIMS Charter
Coordinated w/NBIMS

National Institute of Building Sciences
Facilities Information Council
National BIM Standard

A buildingSMART

Pankow Projects
Precast Concrete
Structural Steel
Execution Planning

National BIM Standard
Alan Edgar

National CAD Standard
Mark Butler

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IFC-based
Product Library

Object placed
in BIM model
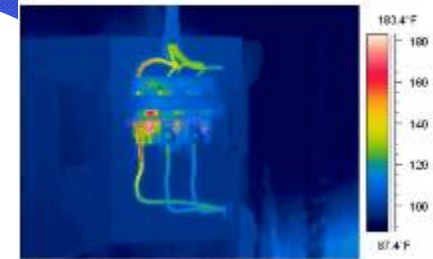
Automated model
analysis

Maintaining, Repair,
Replacement
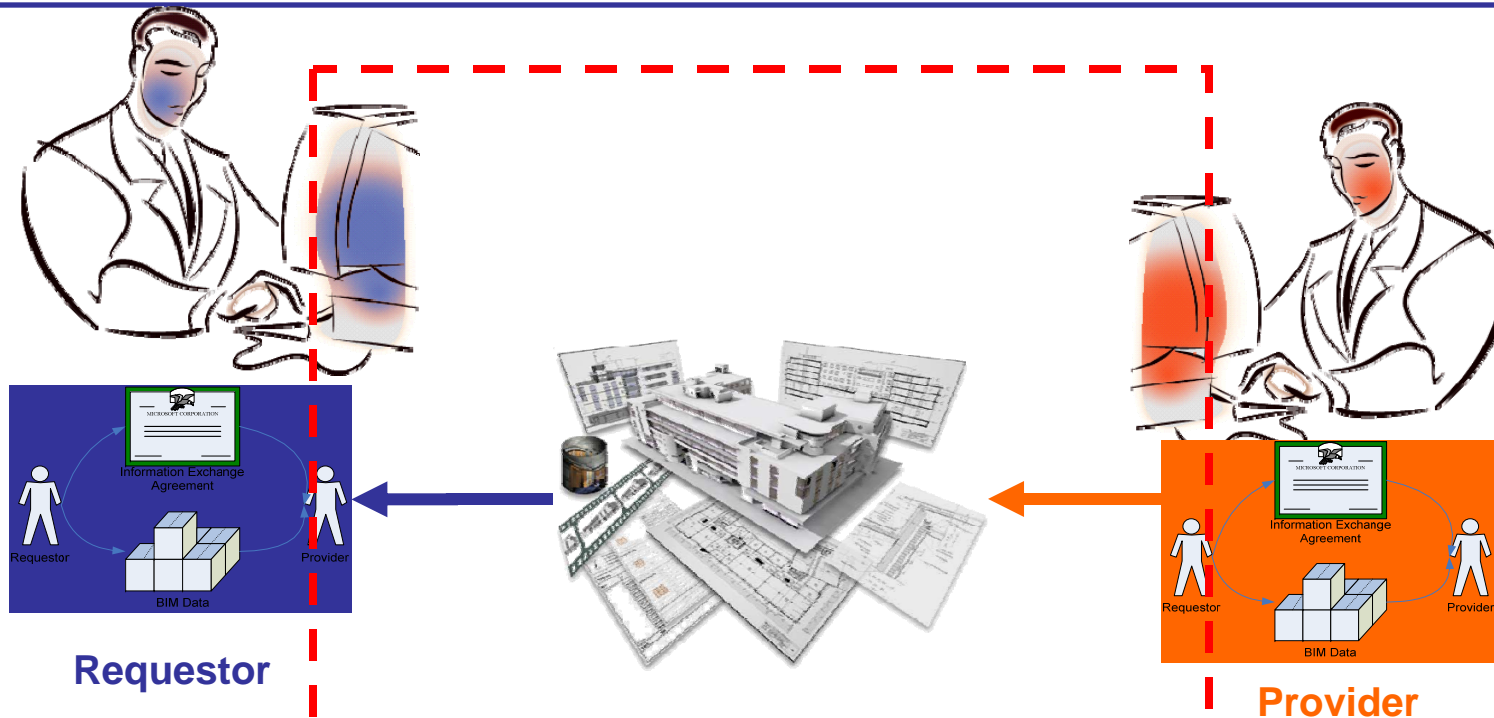
BIM for NEMA

Commissioning &
Operating

Construction &
Installation

Procurement

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Facilities Information Council
National BIM Standard

A buildingSMARTal

© NIBS 2007
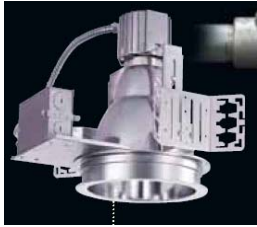
Electrical Manufacturing Lifecycle Value Chain

PHASE	VALUE ADD
Standards and Manufacturing Specifications	Basic physical & performance characteristics
Virtual Design/Engineering	Design requirements Product Selection Planned cost, quantity Geometry placed into model Systems integration Conflict resolution Performance Analysis
Procurement & Installation Planning	Nameplate info Actual cost Inventory management
Contractor Installation	Validate installed components Commissioning data
Operations Engineering	Maintenance and repair specs & data Renewal and replacement specs & data

National
Building Information Modeling
Standard

Version 1.0 - Part 1:
Overview, Principles, and Methodologies

Transforming the Building Supply Chain
Through Open and Interoperable Information Exchanges

Copyright © 2007 National Institute of Building Sciences. All rights reserved.
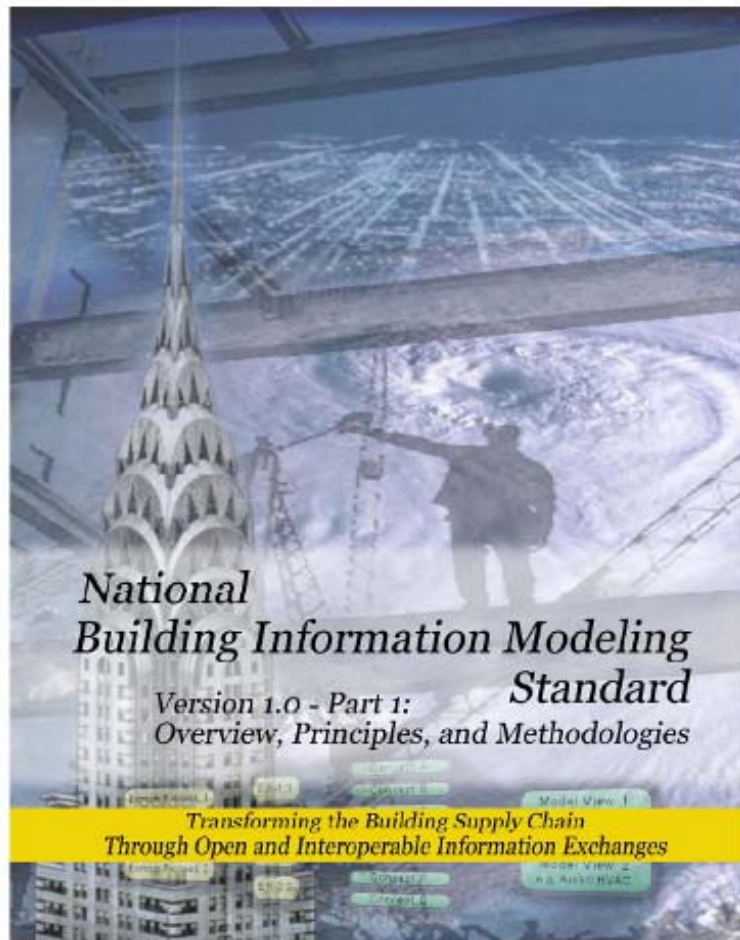
- First draft released March 07

- Two month review period

- Revision period extended

- Revisions complete
  - Initiative
  - Info Exchange Concepts
  - Dev/Use Process
  - References (guides)
  - Appendix (normative)

- V1-P2 in planning

- The National BIM Standard will consist of specifications and encodings to define the requirements for exchanges of data between parties using building information modeling processes and tools.

- NBIMS will

  a.) Organize groups of industry professionals to **define requirements**, then **publish exchange specifications** for use in specific business contexts within a holistic facility lifecycle framework

  b.) Publish **encodings** for the exchange specifications employing internationally acceptable open standards as normative references

  c.) **Facilitate implementation** by software developers of encodings in software

  d.) **Facilitate use** of certified software by end-users to create and use interoperable building information model exchanges.
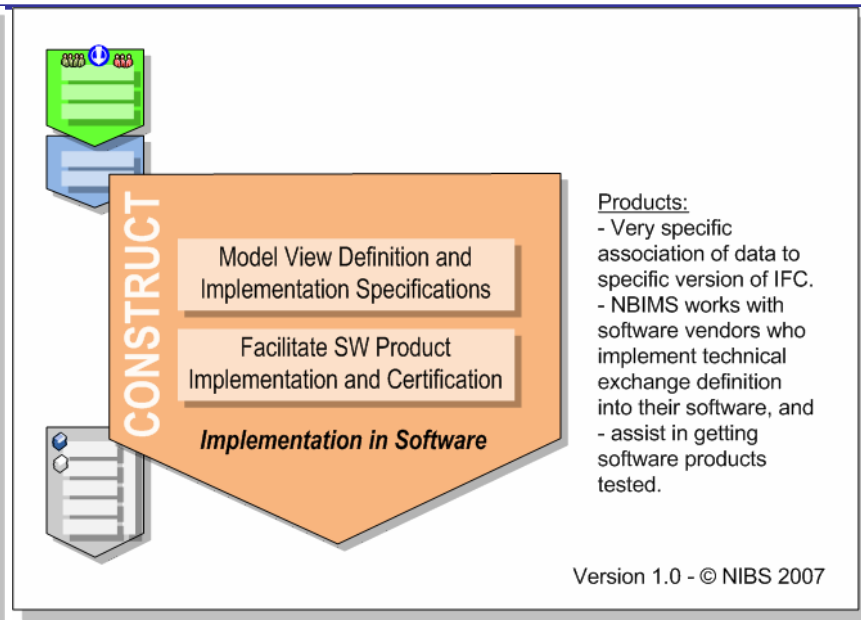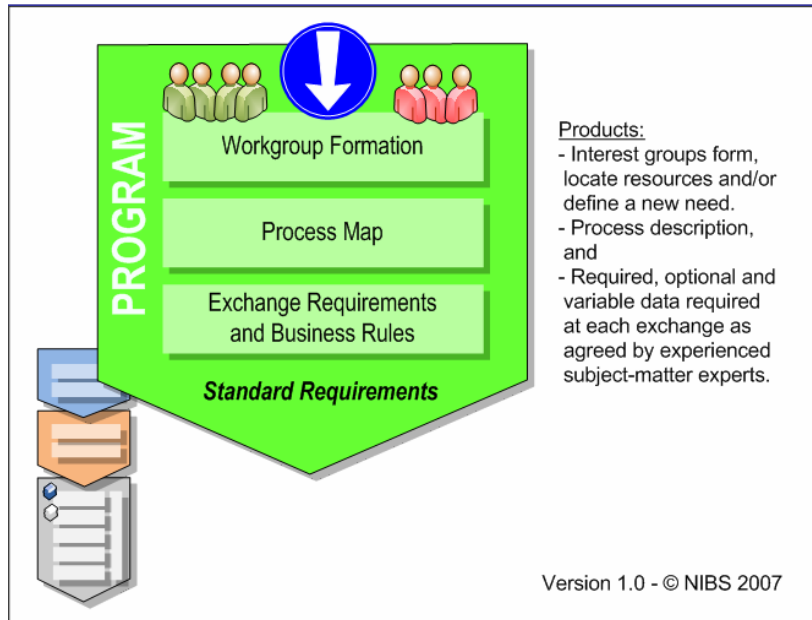
National Institute of Building Sciences
Facilities Information Council
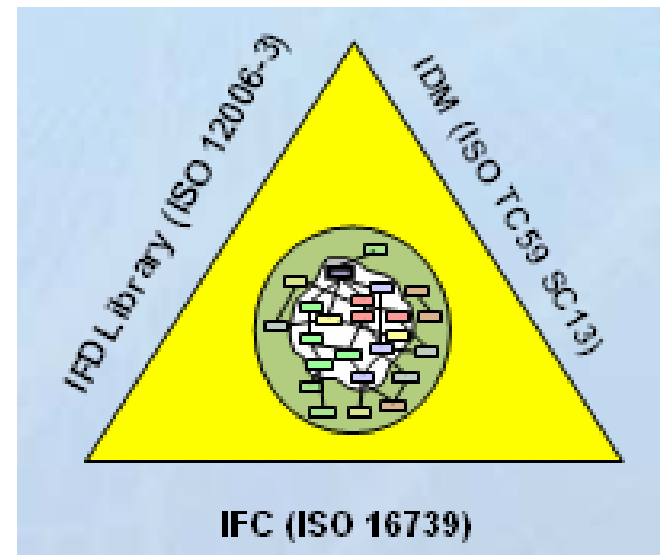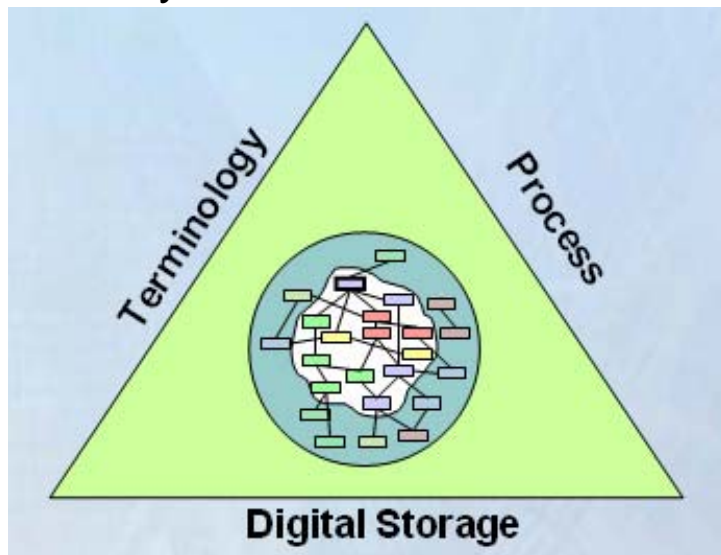**National BIM Standard** *A* buildingSMARTalliance™ *Member*

Nikon School®

Sometimes technology can seem overpowering

NBIMS Scope

Requestor

Provider

Request & Delivery of BIM Data

North American Data Standards
Used in the exchange of Information
between team members

OmniClass™, IFDLibrary™, IFC

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Facilities Information Council
National BIM Standard

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PROGRAM
- Workgroup Formation
- Process Map
- Exchange Requirements and Business Rules

Standard Requirements

DESIGN
- Exchange Requirement Models
- Generic Model View Definition

Standard Design

CONSTRUCT
- Model View Definition and Implementation Specifications
- Facilitate SW Product Implementation and Certification

Implementation in Software

DEPLOY
- Generic BIM Guide
- Product-Specific BIM Guides
- BIM Creation
- BIM Exchange and Data Validation
- BIM Data Reuse and Extension

Project Agreement Requirements

Use in Industry

PROGRAM
- Workgroup Formation
- Process Map
- Exchange Requirements and Business Rules

Standard Requirements

Products:
- Interest groups form, locate resources and/or define a new need.
- Process description, and
- Required, optional and variable data required at each exchange as agreed by experienced subject-matter experts.

Version 1.0 - © NIBS 2007

BIM Data Reuse and Extension

many purposes by certified software.

Use in Industry

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PROGRAM

Workgroup Formation

Process Map

Exchange Requirements and Business Rules

Standard Requirements

Products:
- Interest groups form, locate resources and/or define a new need.
- Process description, and
- Required, optional and variable data required at each exchange as agreed by experienced subject-matter experts.

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CONSTRUCT

Model View Definition and Implementation Specifications

Facilitate SW Product Implementation and Certification

Implementation in Software

Products:
- Very specific association of data to specific version of IFC.
- NBIMS works with software vendors who implement technical exchange definition into their software, and
- assist in getting software products tested.

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DESIGN

Exchange Requirement Models

Generic Model View Definition

Standard Design

Products:
- Common groupings of data.
- Non-software-specific description of how data groupings to be managed by applications..

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DEPLOY

Generic BIM Guide

Product-Specific BIM Guides

BIM Creation

BIM Exchange and Data Validation

BIM Data Reuse and Extension

Project Agreement Requirements

Use in Industry

Products:
- Individual parties to contracts agree on BIM function to be provided using BIM Guides that are not product-specific.
- Project parties create BIMs using Certified software & product-specific BIM Guides.
- BIM construction and data content are checked using validation software.
- BIMs are used for many purposes by certified software.

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In order for a real free flow of information to occur, three factors need to be in place:

1. The format for information exchange,
2. A specification of which information to exchange and when to exchange the information, and
3. A standardized understanding of what the information you exchange actually is

Interoperability through Standards,
courtesy Janne Aas-Jakobsen, Jotne EPM Technology AS

Excerpted from NBIMS V1-P1, Appendix C – IFDLibrary, Roger Grant, CSI

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Architect   **Engineer**

Tell me and I'll forget.
Show me and I'll remember. Involve me and I'll understand.
Confucius

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Business Case Development –
Aligning OmniClass™ to BIM Process

IDM Business Case Development

1 WHO (is requesting)
Actor requesting information to support a process or decision
(Authoritative Reference OMNI CLASS – Table 33 & 34)

2 WHY (project/process use or benefit)
Why is this information important for a project activity
(Authoritative Reference OMNI CLASS- Table 32)

3 WHEN (stage in project)
(Authoritative Reference OMNI-CLASS-Table 31) Table 31 is tied to IFC
Phases (Project Lifecycle)

4 WHAT
Dataset in BIM that supports the request and benefit)
Because BIM use aggregates information several tables support this activity .
Authoritative Reference OMNI-CLASS Tables 11, 12,14, 21, 23, 41, 49

5 To WHOM
Group/Actor that provides/fullfills the information need OMNI-Class 33 34

6 HOW
Tools/formats/results Table 35 & 22

7 INPUTS & OUTCOME
Information, Product or Service Delivered Omniclass 36

For Example:

1. (Table 34) Architect aka: 34-25 21 00

2. (Table 32) Conception services, Designing, Prelininary Designing aka: 32-11 14 13

3. (Table 31) Conception Stage aka: 31-10 00 00

4. (Table 12) Building 12-11 00 00; (Table 21) Superstructure, Enclosure aka: 21-41 31 00; (Table 23) Electrical Power and Lighting 23-80 00 00

5. (Table 34) Engineer 34-25 31 00

6. (Table 36) Design Tools (OmniClass NA for IFC)

7. (Table 36) Building Envelope Design Information:36-21 17 21
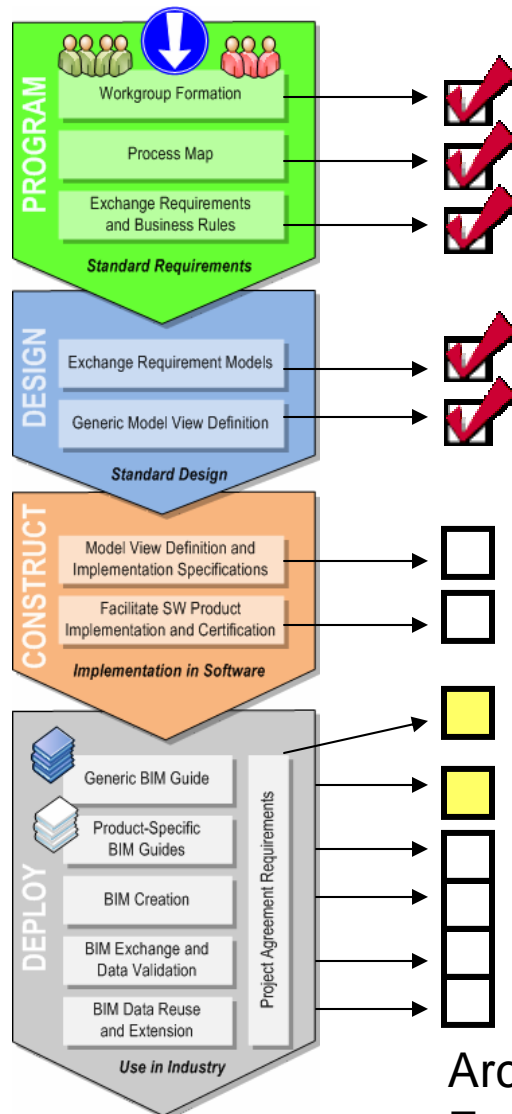
- Precast Design (MVD)
- GSA Spatial Validation
- COBIE
- ICC Automated Code Checking
- Specifiers' Property Information Exchange
- Sheet Metal
- Owner's Deliverable
- Structural Steel
- Early Design

Architectural Precast Concrete - Architect to Detailer
Funded by Charles Pankow Foundation
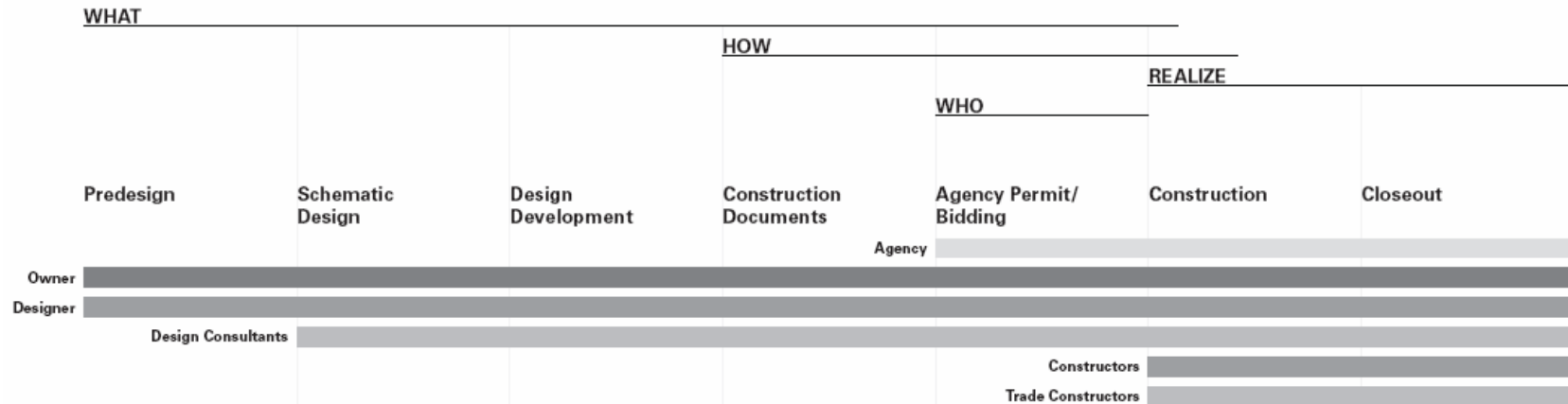
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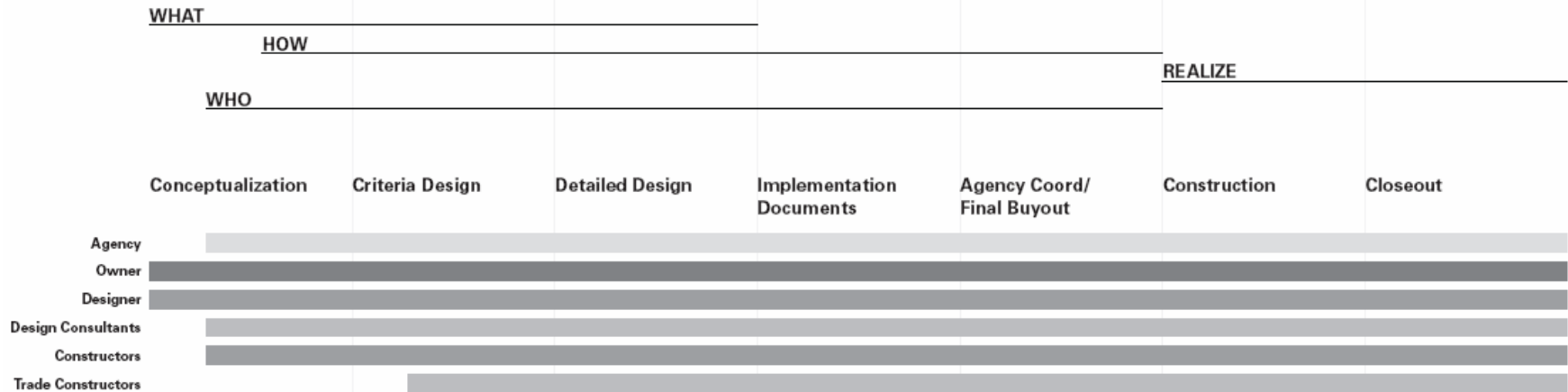- **Business Process Roadmaps** – Provide the business relationships of the various activities of the real property industry. May be basis for organizing the business processes - help organize the NBIMS and the procedures defined in the Information Delivery Manuals (IDM's). (FIATECH Capital Projects, USACE BIM Roadmap)

- **Candidate Standard** – Candidates to go through the NBIMS development/consensus process in the future. (COBIE, Early Design).

- **Guidelines** – Available from several organizations and some items should be considered for inclusion in NBIMS.(AIA-IP, AGC BIM Guide, Coast Guard Model Guidelines, General Buildings Information Handover Guide, GSA 3D-4D-BIM Program)

- **Other Key References** – Parallel efforts being developed in concert with the NBIMS however are not part of the NBIMS and in fact, may be standards in their own right. (ICC SmartCodes, OGC© OWS-4, OGC© AECOO Interoperability, OSCRE Real Property Exchange Standards, Pankow/NIBS/FIATECH Architectural Precast Concrete, US National CAD Std., ISO 15926).

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Related Industry Activities

- gbXML - Green Building XML schema, BIM to engineering analysis. (USGBC)
- agcXML - XML schema for electronic interchange of common construction data and document. (NIBS & AGC)
- ifcXML – XML representation of IFC Express model (IAI)
- CIS/2 – ISO STEP modeling. Building structural steel lifecycle. (American Institute of Steel Construction)
- OSCRE – XML-based exchange document definitions supporting real property industry.
- IFC2x3G - Prototype for linking BIM to geographical & geospatial information
- GML/CityGML - an open data model and XML-based format for the storage and exchange of virtual 3D city models (Open Geospatial Consortium)

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- NIBS publication
- Issue #1 on the street
- Issue #2 in production
- Semi-annual for now.

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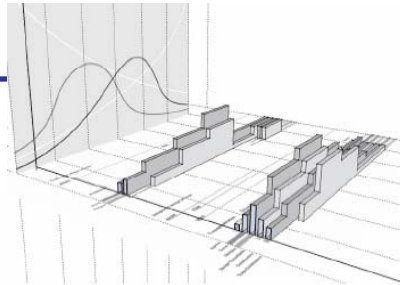
AIA Integrated Project Delivery

AIA National | AIA California Council
The American Institute of Architects

2007
version 1

Integrated
Project Delivery:
A Guide

http://www.aia.org/ipdg

- Change is now
- Collaborative, Productive and Integrated Teams
- Early involvement of key participants.
- Trust, transparent processes, information sharing, team success tied to project success, value-based decision making, use available technology and support.
- Open and interoperable data exchanges, open standards technology, disciplined and transparent data structures.

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Traditional design process

WHAT

HOW

REALIZE

WHO

| Predesign | Schematic Design | Design Development | Construction Documents | Agency Permit/ Bidding | Construction | Closeout |

Agency

Owner

Designer

Design Consultants

Constructors

Trade Constructors

Integrated design process

WHAT

HOW

REALIZE

WHO

| Conceptualization | Criteria Design | Detailed Design | Implementation Documents | Agency Coord/ Final Buyout | Construction | Closeout |

Agency

Owner

Designer

Design Consultants

Constructors

Trade Constructors

*AIA California Council's "Integrated Project Delivery: Working Definition",
See http://www.aia.org/ip_default*

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- April 2007 AIA published two new standard form documents addressing transmitting data in a digital working environment and maintaining control over its future use.

- AIA's new documents C106™-2007, Digital Data Licensing Agreement, and E201 ™ -2007, Digital Data Protocol Exhibit, allow contracting parties to share digital data in accordance with agreed-upon protocols for transmission, format, and use of the data.

- Standardizes ad-hoc agreements.
- Protection from infringement
- Misuse
- Reduce risk of data degradation & downstream software incompatibility.
- Reduce unintended reliance on accuracy of information.
- Impediments caused by broad disclaimers
- 'Chain of licenses' and intellectual property.

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ARTICLE 3 PROJECT PROTOCOL TABLE

§ 3.1 The parties agree to comply with the data formats, transmission methods and permitted uses set forth in the Project Protocol Table below when transmitting or using Digital Data on the Project.
(Complete the Project Protocol Table by entering information in the spaces below. Adapt the table to the needs of the Project by adding, deleting or modifying the listed Digital Data as necessary. Use Section 3.2 Project Protocol Table Definitions to define abbreviations placed, and to record notes indicated, in the Project Protocol Table.)

Digital Data	Data Format	Transmitting Party	Transmission Method	Receiving Party	Permitted Uses	Notes *(Enter #)*
3.1.1 Project Agreements and Modifications						
3.1.2 Project communications						
General communications						
Meeting notices						
Agendas						
Minutes						
Requests for information						
Other:						

§3.2 PROJECT PROTOCOL TABLE DEFINITIONS
(Below are suggested abbreviations and definitions. Delete, modify or add as necessary.)

Data Format:
(Provide required data format, including software version.)
W   .doc, Microsoft® Word 2002

Transmitting Party:
O   Owner
A   Architect
C   Contractor

docinfo@aia.org

Transmission Method:
EM   Via e-mail
EMA   As an attachment to an e-mail transmission
CD   Delivered via Compact Disk
PS   Posted to Project Web site
FTP   FTP transfer to receiving FTP server

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- Risk has always existed – no shortage of litigation
- Collaborative view, broad participation can only reduce E & O.
- Clash detection has demonstrated results
- Blurred responsibilities create liability?
  - Design, construction coordination, shop drawings, etc.
  - Maintain 'responsibility swimlanes' with protocols and technology.
- 'Owner' of master model?
  - Use 'Federation' model
  - Contracts define responsibilities for specific elements.
- Diminished liability protection. Same for 2D & 3D.
- Software induced error? Owner accepts both increased efficiency and promise of reduced errors as well as potential for software glitches or errors in using software.

Commentary by Richard H. Lowe 'Buckling Up Risks', AGC Constructor Magazine, Jan/Feb 2007.

OSCRE

Theatre / World
Country
Installation / Region
State / Province
County
City
Site
Natural Asset
Real Property Asset

Air / Space
Underground
Water / Sea
Land / Parcel
Facility / Built

Geospatial Information (GIS)

IAI-IFC Usage

Building
System
Space
Overlay
Sub-Systems
Level
Components
Room

Structure
System
Space
Overlay
Sub-Systems
Level
Components
Room

Linear Structure
Node
Segment

Building information Modeling (BIM)

- Standards-based Web Service architecture and technologies tested against GSA and DOD business cases:
  - Provide feedback to IAI International IFC work
  - Compliment National BIM Standard development activity

- December 2006 Demonstration – Location of Field Hospital as part of regional emergency event
  - BIM, Geospatial, and real time (sensor) integration / fusion
  - Newark Airport
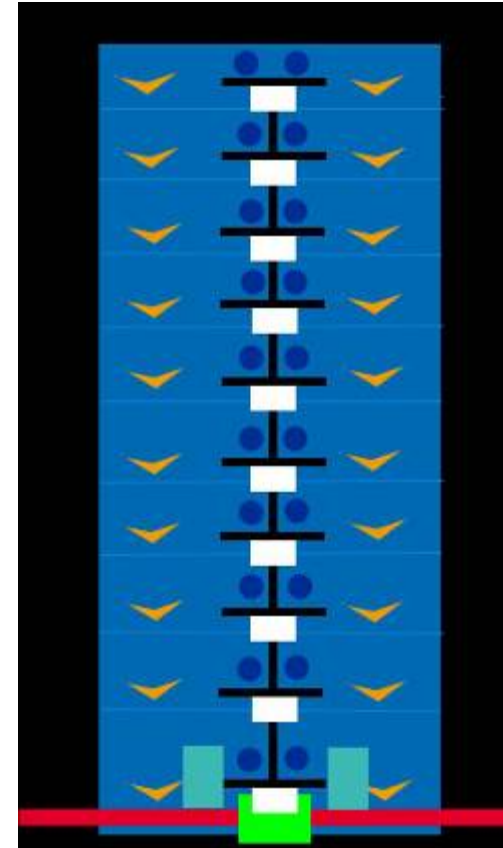 - Port Authority of NY / NJ hosting

Linking CAD-GIS-BIM

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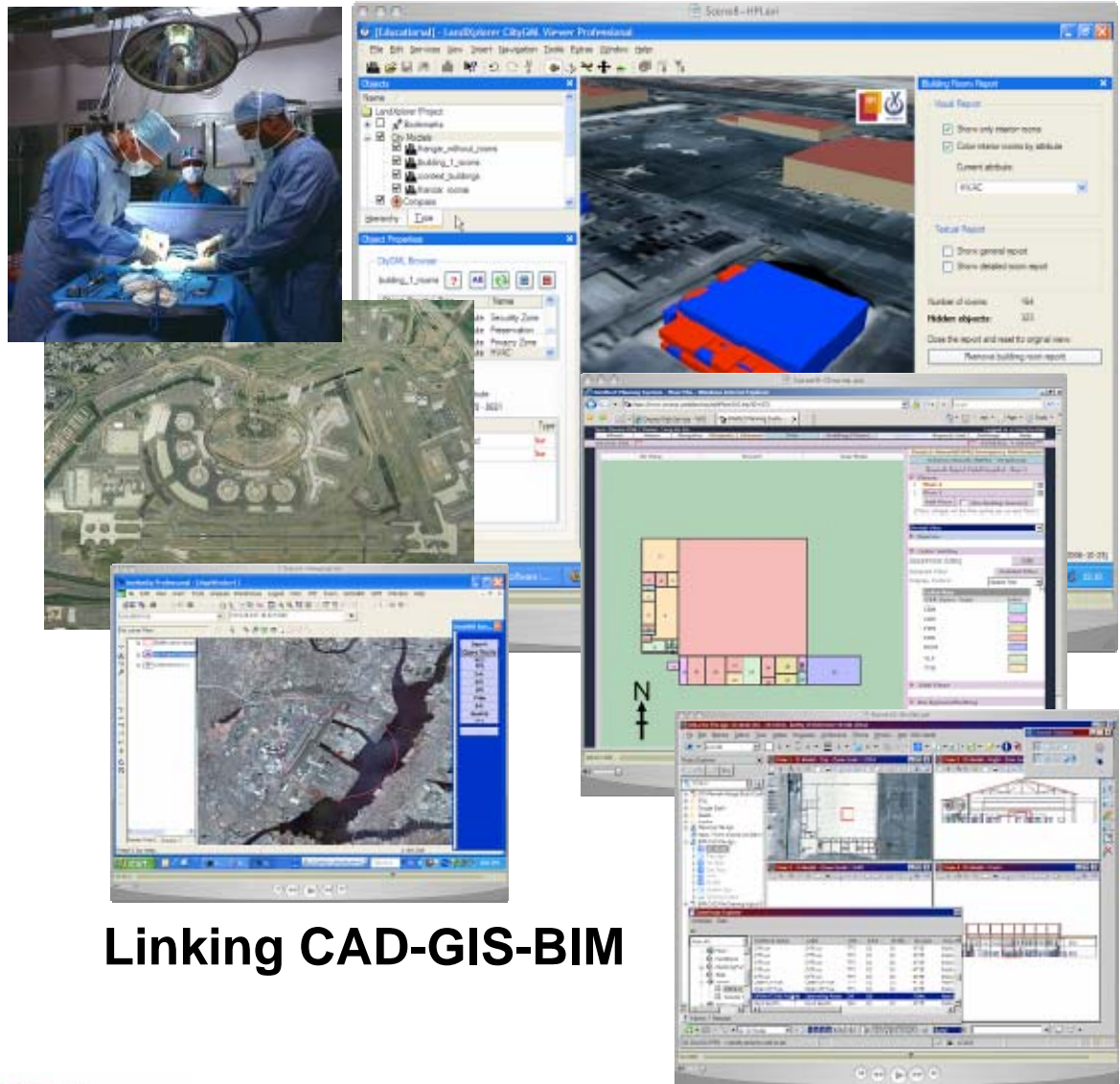
Energy Code Compliance Checking
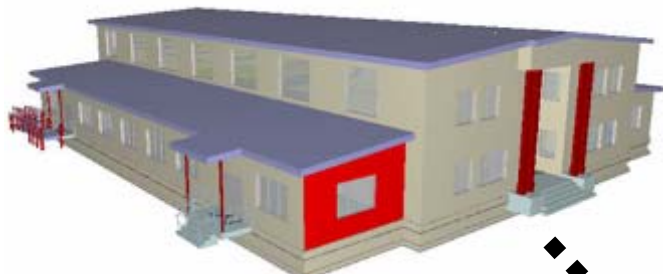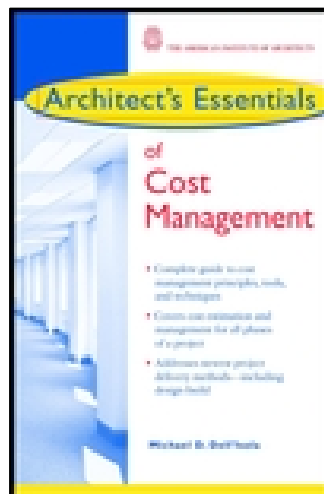
Energy Analysis

Costing

AECOO Testbed

Green Buildings

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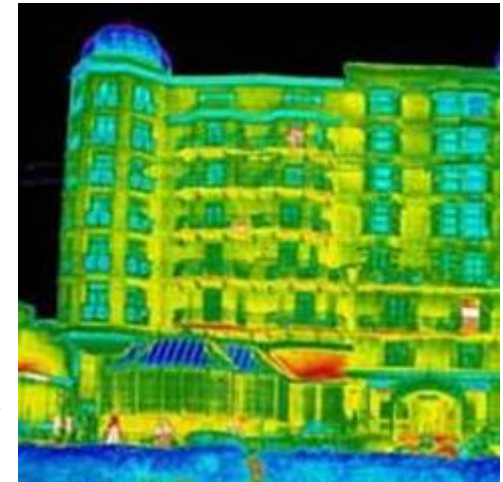
ISO/PAS 16739
(Industry Foundation Class)

ISO 15926
(Process Industry)

OSCRE Space Classification Code List

IFMA / BOMA Designations																							Non-measured portfolio
Exterior Gross																							
		Interior Gross																					
				Rentable per Contract (for information only)																			
					Building Rentable (measurable)																		
						Usable Area																	
								Interior Planning Area															
									Assignable Area														

Level 1 Space Classification

Exterior Wall	Excluded	Interior Parking	Vertical Penetration	Void	Lease Legal Area Reconciliation	Core Building Service	Primary Circulation	Encroachment	Expansion	Secondary Circulation	Business Support	Personnel Service	Training	Public Space	Office	Environmentally Controlled	Medical Practice	Laboratory	Commercial	Production	Warehouse	Residential	Alternative Workplace	Non-enclosed Roof
1100	1200	1300	1400	1500	2000	2100	2200	3100	3200	3300	4100	4200	4300	4400	5100	5200	5300	5500	6100	7100	7200	8200	9100	9200

OSCRE

OSCRE Space Classification

©2007 OSCRE Americas, Inc.

Comparison of Space Use Classifications to IFMA/BOMA Unified Space Measurement Standard

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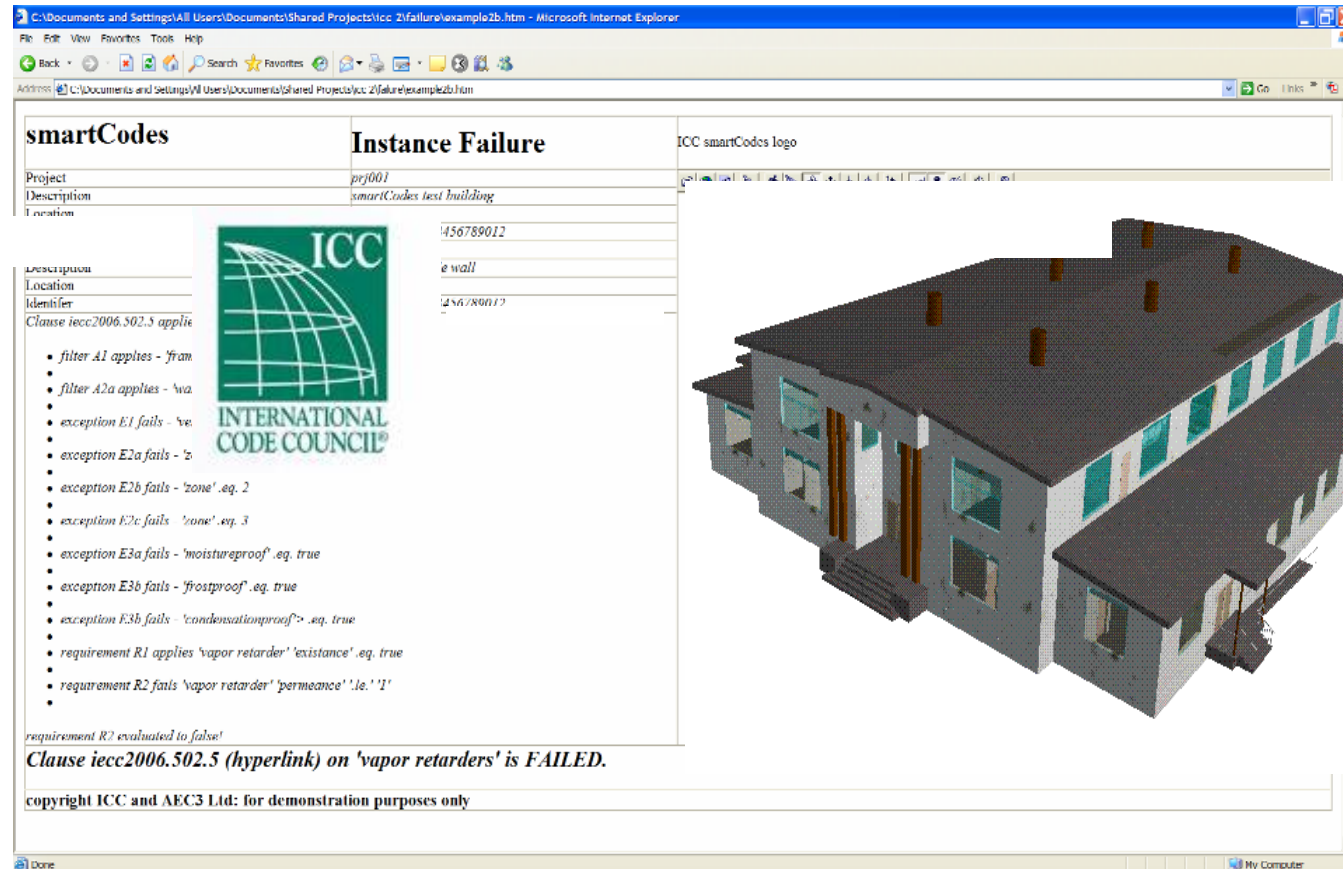
2006 Released *GSA BIM Guide for Spatial Program Validation*.

- 340MSF in 8700 owned and leased buildings
- Prospectus level projects receiving design funding in FY2007+, require spatial program BIMs for final concept approval. Handovers from Preliminary Concept Design and Final Concept Design.
- Contains Floor Calc, Tenant Stack Plan, ANSI/BOMA Stack Plan.
- First in a planned series of exchange standards.
- 60 projects to date, 20 underway.
- Vendor neutral- Support the GSA Spatial Validation IFC Model View.
- Assessing industry readiness and technology maturity
- 11 Regions & home office; 36 BIM Champions, 1 3D-4D Program Manager
- Also 4D sequencing, laser scanning, & energy modeling.

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Model Checking

2006 International Energy Conservation Code®

SmartCodes demo: http://www2.iccsafe.org/io/smartcodes/

"Use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners."

Courtesy of Paul Ehrlich:

BUILDING INTELLIGENCE
GROUP
LLC

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What Integrated Building Systems Features?

- ## Networking / Telecom
  - Common network infrastructure
  - Structured – maintainable cabling
  - Wifi, VOIP

- ## Security / Life Safety
  - Digital video monitoring
  - Access control and monitoring
  - Automatic fire detection, suppression and egress support
  - Contaminant monitoring and containment
  - Physical security / guard services

- ## A/V
  - Digital signage
  - Paging
  - Entertainment
  - Presentation support

Courtesy of Paul Ehrlich:

- ## Mechanical
  - Personal comfort control
  - Energy efficient equipment
  - Thermal storage
  - Combined heat and power
  - Controls optimization

- ## Electrical
  - Energy efficient lighting
  - Lighting control
  - Distributed generation
  - Dual power feeds / emergency power
  - Power quality monitoring
  - Sub-metering / billing

Courtesy of Paul Ehrlich:

- # BIM = Intelligent Design
- # IBMS = Intelligent Building Operations
- # Looking for:
  - One tool for design, construction and operations
  - System and equipment information becomes operating procedures and input for maintenance management
  - Ability to run energy models on operating buildings
  - Real time validation of design
  - Integrated facility information management
- # BIM is largely an Architectural tool today – Engineers are still learning about it
- # Could expose the gap between design and construction

Courtesy of Paul Ehrlich:

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- Need for real systems integrators (not just ATC contractors)
- Need to know:
  - HVAC, Security, Fire Alarm, Business Systems and IT, Lighting Control, Energy Management
- What's ready today?
  - Technologies are fairly mature
  - Standards exist and are widely available
  - Products are largely available
- What's missing?
  - Good financial justification tools
  - Trained consultants
  - Contractors
  - Operations staff

Courtesy of Paul Ehrlich:

Planning System
The Web Enabled Knowledge Tool

ONUMA

Other IFC Apps

GRAPHISOFT. ARCHICAD

XML

OGC Member

CityGML

SOLIBRI   IFC

Geospatial

Google™ Earth

GIS

Autodesk

A New Integrated Reality

Web Feature Services

Sustainable Knowledge

GSA

GSA BIM Guide Listed

ONUMA   buildingSMART   OGC Member

OPS™ is Built on Open Industry Standards

Chair 06
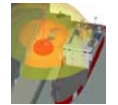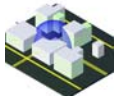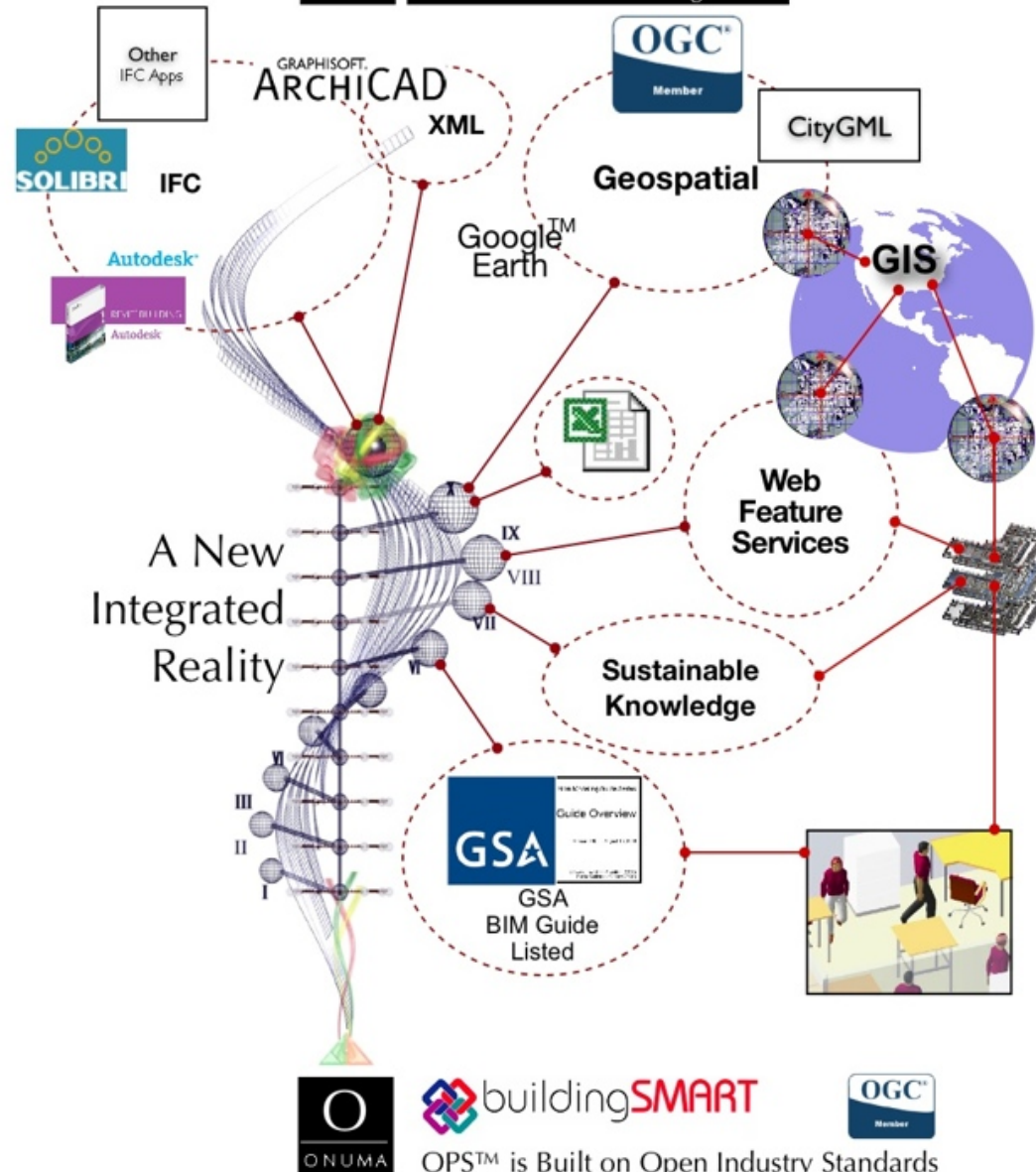
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Missions • Scenarios • Assets • Portfolios, Facilities, and Life Cycles

GIS

Multiple Locations

Missions

US COASTGUARD

Buildings and Floors

USCG ISC Alameda BIM

WFS

Query Bounding Area of Geospatial Coordinates

Scenario Based Planning

Spaces

People, Furniture, Equipment

Sites, Features, and Multiple Buildings

Data

USCG BIM All Sites

buildingSMART

BIM

IFC
CityGML
Google Earth
XML
Excel

USC

OGC Member

GSA

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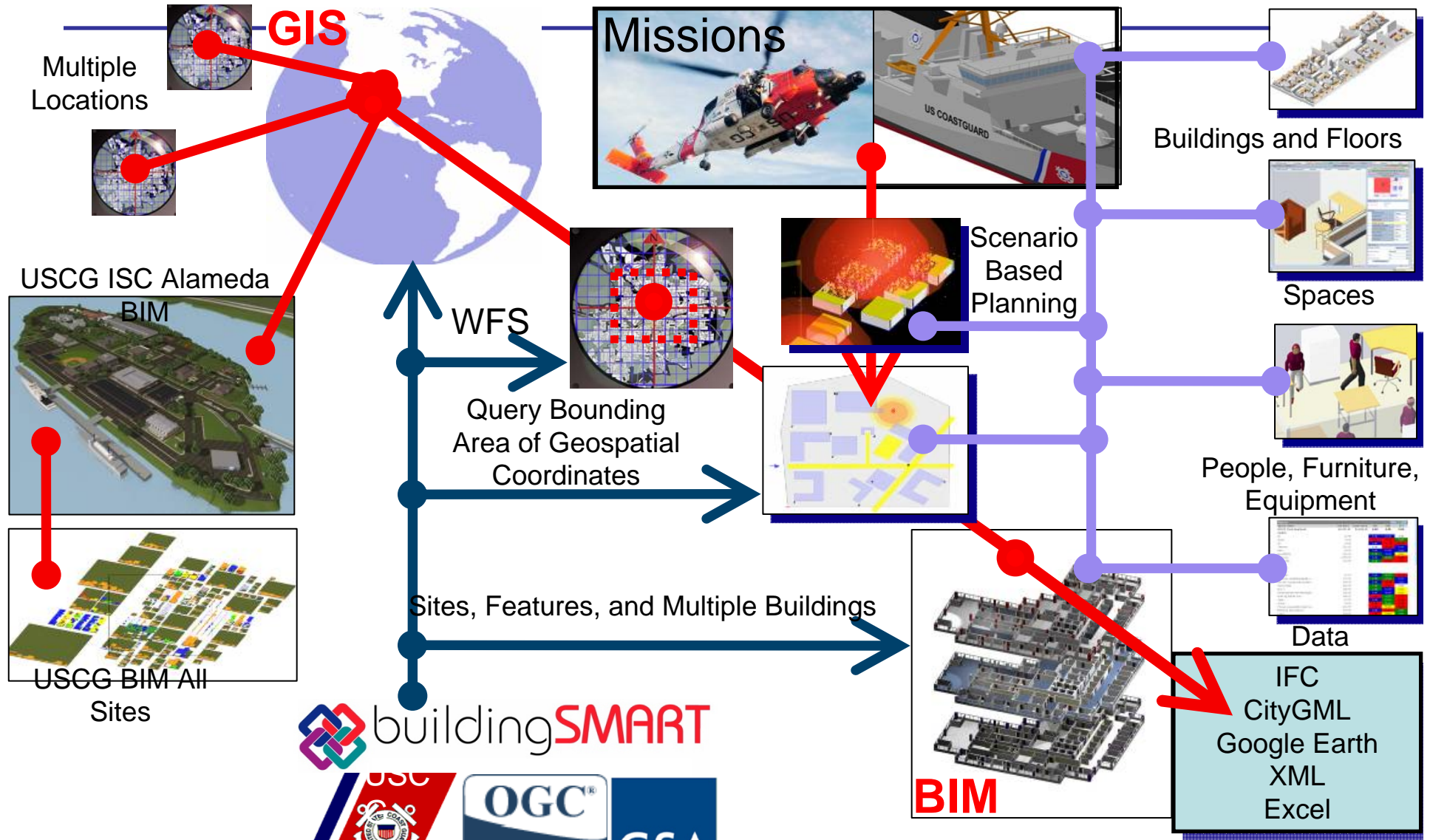
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United States Coast Guard

ONUMA Planning System

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Schematic Diagramming & Provisioning

Mission Dependency Analysis

- Metric Data
- MDI / SUI / FCI / Security / Other

buildingSMARTalliance™ Conference
Tr. 8:00-5:30

- # <u>Vision</u>
  - A global environment where all participants can readily and transparently share, apply and maintain information about facilities and infrastructure

- # <u>Mission</u>
  - Improve all aspects of the facility and infrastructure lifecycle by promoting collaboration, technology, integrated practices and open standards

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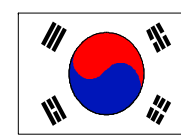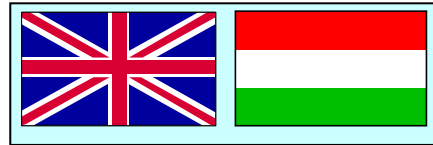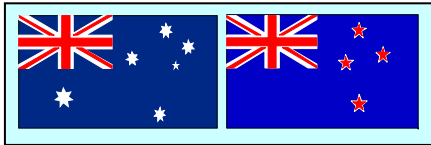**National BIM Standard**

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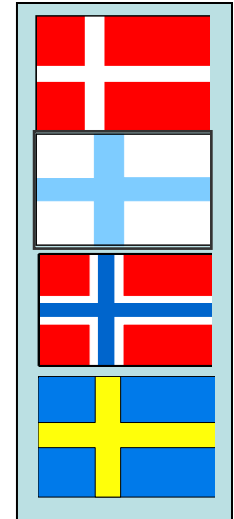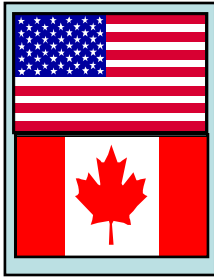
- **13 chapters - 26 countries - 542 organizations**

Membership

- **Owners**
- **Architects**
- **Engineers**
- **Facility managers**
- **Builders**
- **Manufacturers**
- **Software vendors**
- **Universities**
- **Research laboratories**
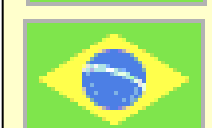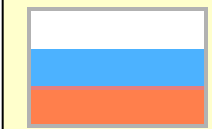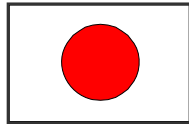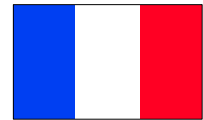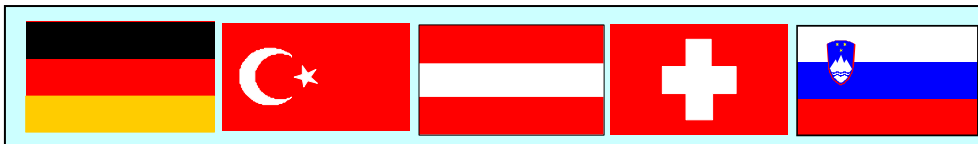
28   16   72   20   ?   30

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Entities With Known BIM Efforts

- 3XPT Strategy Group
- 7group
- American Institute of Architects (AIA) - Building Connections
- AIA - Integrated Project Delivery
- American Institute of Steel Construction (AISC)
- American Society for Quality (ASQ)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- American Society of Civil Engineers (ASCE)
- American Society of Interior Designers (ASID)
- Association of General Contractors of America (AGC) - BIMForum
- Building Owners and Managers Association (BOMA)
- buildingSMART alliance
- Continental Automated Buildings Association (CABA)
- Canadian Green Building Council (CaGBC)
- Center for Facilities and Environment (CIFE)
- Construction Industry Institute (CII)
- Construction Managers Association of America (CMAA)
- Construction Owners Association of America (COAA)
- Construction Specifications Institute (CSI)
- Construction Users Round Table (CURT)
- Design Build Institute of America (DBIA)
- FIATECH
- General Services Administration (GSA)
- International Alliance for Interoperability (IAI)—International Institute for Market Transformation to Sustainability (MTS)
- International Center for Facilities (ICF) Ottawa

- International Code Council (ICC) - SMARTcodes™
- International Facilities Managers Association (IFMA)
- Lean Construction Institute (LCI)
- National Academy of Sciences Federal Facilities Council (FFC)
- National Association of Home Builders (NAHB)
- National Institute for Standards and Testing (NIST)
- NIBS - Building Enclosure Technology and Environment Council (BETEC)
- NIBS - Building Seismic Safety Council (BSSC)
- NIBS - Facility Information Council (FIC)
- NIBS - Facility Maintenance and Operations Committee (FMOC)
- NIBS - High Performance Building Council (HPB)
- NIBS - International Alliance for Interoperability of North America (IAI-NA)
- NIBS - Multihazard Mitigation Council (MMC)
- NIBS - National BIM Standard (NBIMS)
- NIBS - National CAD Standard (NCS)
- NIBS - Whole Building Design Guide (WBDG)
- Open Geospatial Consortium (OGC)
- Open Standards Consortium for Real Estate (OSCRE)
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- Sustainable Buildings Industry Council (SBIC)
- US Army - Civil Engineering Research Laboratory (CERL)
- U.S. Green Building Council (USGBC)

Who is Coordinating?

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- Provide visibility to ongoing efforts to develop buildingSMART® practices.
- Identify the interfaces, gaps, overlaps and collaboration opportunities among groups addressing buildingSMART® practices.
- Provide buildingSMART® products, such as the U.S. National Building Information Model Standard (NBIMS).
- Support ongoing buildingSMART® projects.
- Reduce wasted industry time, effort and cost.
- Demonstrate the benefits to industry of moving toward a common vision of buildingSMART®.

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Immediate Next Steps

- Invest in education & re-training
- Manage across or eliminate stove-piped business functions
- Integrate IT applications focused on business alignment and services.
- Support more integrated design/delivery teams
- Create project information manager role.
- Support value-enhanced services
- Require & support higher functioning facilities
- Measure results – standardize metrics
- Adopt available standards:
  - OSCRE, IFMA/BOMA, OGC, NBIMS
- Invest in Transformation

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- Involve senior management – build business case
- Software is typically 20% of the investment.
- Invest in education & re-training
- Create project information manager role.
- De-layer design & production activities/staffing
- Seek contracts that reward value enhancement
- Sell value-enhanced services. Optimize 'project' outcomes.
- Adopt available standards
  - NCS, MasterFormat®, UniFormat®, Structural & Systems Design, BAS technology

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- Implement and report metrics
- Profile model content, consider outsourcing library development
- Maximize collaboration with owners, consultants, contractors early in process and often throughout.
- Use authoring & analysis tools that support open exchanges & interoperability.
- Participate in product library development based on standards.
- Re-Invest short-term gains in long-term transformation.

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- Invest in education & re-training
- Create project information manager role.
- Drive lean construction methods
- Seek projects and contracting methods that reward value enhancement
- Sell value-enhanced products & services
- Adopt and implement advanced IT
- Implement BIM 4D (Scheduling) & 5D (Cost)
- Build to the Model
- Use authoring & analysis tools that support open exchanges & interoperability.
- Participate in Standard development.
- Re-invest short-term gains in long-term transformation.

- See what stake you have – where you have the most to gain.
  - Read the literature.
  - Implement lean methods.
  - Enhancing value services and products
  - Reduced cycle time
  - <4% change orders for projects. Data becoming available.
  - Better coordination between design, construction & operations.
- Find out what its costing not to operate this way.
- Find out what the competition are doing.
- Leverage innovations – the bar is being raised.
- Leverage open standard innovators.
  - Industry organizations.
  - Professional associations.
  - Standards developers.
- Be a leader – not a follower.

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- Its not about tomorrow. It is in your hands today.

- Its not about technology. It is about how you do business.

- Benefits are very big.

- Not just commercial, it is residential and more.

- Break down barriers or lose competitive ground.

- Leverage innovations and implement them.

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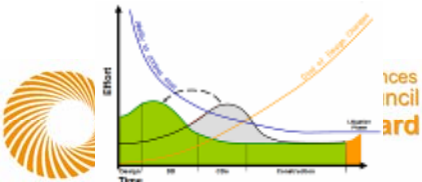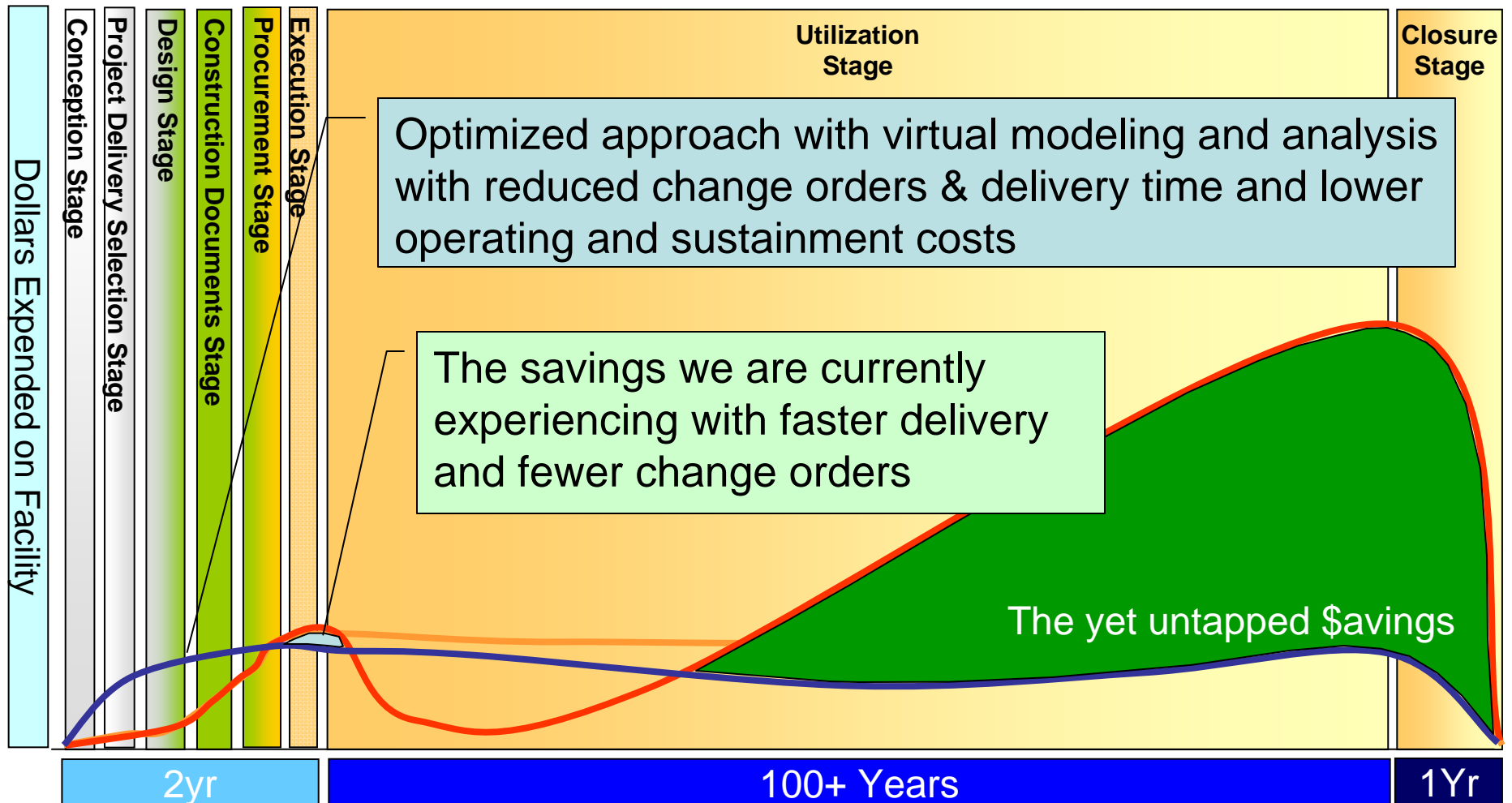**National BIM Standard** *A* buildingSMARTalliance™ *Member*

Funding Transformation

- Today: Delivering buildings – creating value for design & construction participants.

- Soon: Delivering buildings + lifecycle information to create value and opportunities throughout the supply chain.

- Leverage 'local efficiencies' to pay for collaboration and interoperability.

Business Model – Future Values

Utilization Stage

Closure Stage

Dollars Expended on Facility

Conception Stage

Project Delivery Selection Stage

Design Stage

Construction Documents Stage

Procurement Stage

Execution Stage

Optimized approach with virtual modeling and analysis with reduced change orders & delivery time and lower operating and sustainment costs

The savings we are currently experiencing with faster delivery and fewer change orders

The yet untapped $avings

2yr

100+ Years

1Yr

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Value Opportunities – Reduce Cycle Time

2005 All Stores	
Store Count	**1,234**
Gross Sales	**$43,200,000,000**
Net Income	**$2,771,000,000**
2005 Avg. Per Store	
# New Stores	**150**
Net Income	**$2,245,543**
Net Income per Week	**$43,184**
Net Income Potential per Week - 150 stores	**$6,477,528**
2006 Est. New Stores	**150**

Data Commissioning Cost Reduction

$50K per building

x

150 buildings per year

= $7,500,000

Store Count	150
Store SF	50,000
Gross cost per SF	$120
Gross Base Building	$6,000,000
8% Change Orders	$480,000
.5% Change Orders	$300,000
Net savings per store	**$180,000**
Net savings all stores	**$27,000,000**

Data Commissioning

■ Nearly automatic data commissioning

(**Source: NASA-USACE/CERL COBIE Project**)

Change Orders

■ Change orders reduced from 8-10% to .05%

(Source: *BIM Best Practices, Best Results*, GM Virtual Factory Initiative, Fallon, AIA Convention Presentation May 3, 2007, http://www.aia.org/SiteObjects/files/convention_ces/TH1807.pdf)

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Case Study – Letterman Digital Arts Center

- "Despite numerous design layout changes that were required by Lucas Film Ltd. due to company restructuring, the LDAC project was completed on time and below the estimated budget….over two hundred design and construction conflicts were identified, most of which were corrected before construction, resulting in an estimated savings of over $10 million on this $350 million project."

as shown on arch.

as shown on struct.

intrudes into lobby

resolved steel frame

National BIM Standard
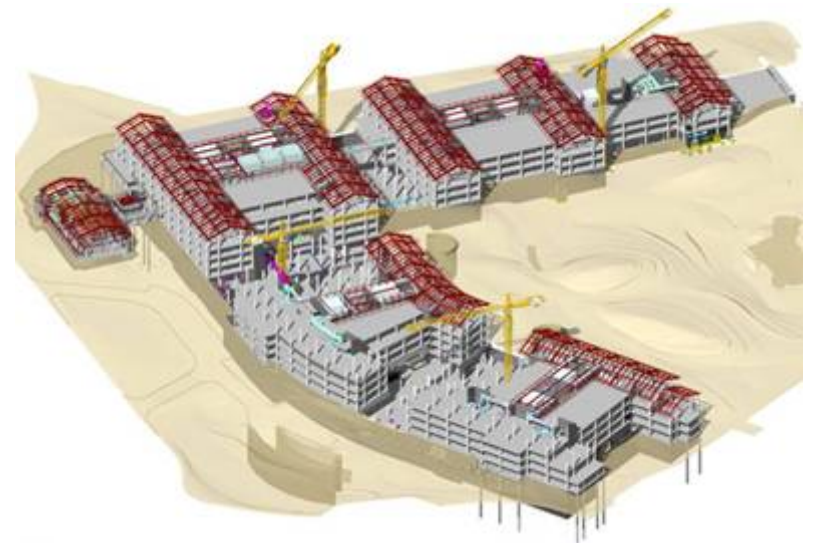
Courtesy of AECbytes "Building the Future" Article (September 30, 2006)

Building Owners Driving BIM: The "Letterman Digital Arts Center" StoryMieczyslaw (Mitch) Boryslawski, Associate AIA

Founder, View By View, Inc.
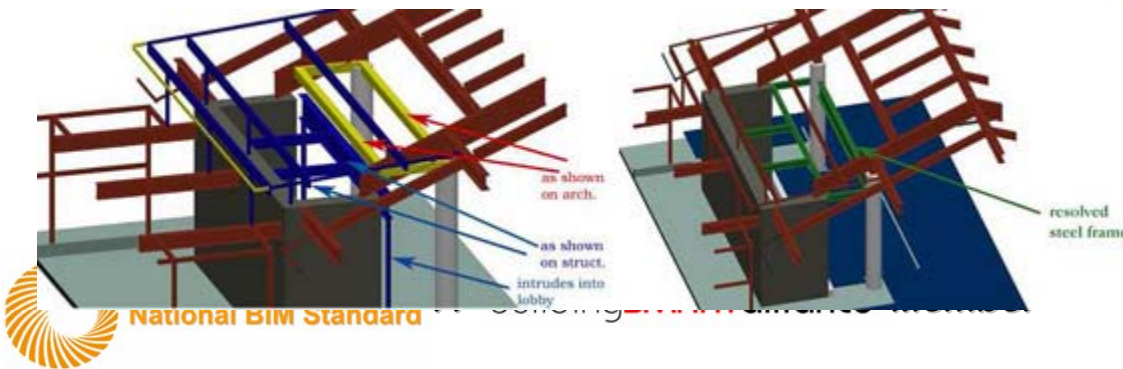
1. Implementing integration in homogenous, proprietary teams with 'lean' aims. Gaining benefits from BIM tools and methods used in project-specific scope. Pocket benefits.

2. Same as #1 but pocket most benefits and use some to fund interoperability development and industry adoption.

3. Implement interoperability across greater scope of lifecycle in heterogenous, project-specific and 'loose' federations. Gain greater benefits from higher use of BIM tools and methods. Pocket greater benefits and continue to use a percentage of gains to fund more transformation.

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Alan R. Edgar

OSCRE Workgroup Program Manager

Chair, National BIM Standard Committee

765-215-8251

www.oscre.org

www.facilityinformationcouncil.org/bim/

- For more information:

www.nibs.org

www.buildingsmartalliance.org/

Thank You

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