BIM for Facility Managers

Michael Schley, IFMA Fellow
CEO and Founder, FM:Systems

Paul Teicholz, Ph.D.
Founder and former Director, Center for Integrated Facility Engineering at Stanford University

Angela Lewis, Ph.D. P.E., LEED AP
Project Manager,
Facility Engineering Associates
Evaluate Sessions

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Visit the registration kiosks
or go online at

http://ceu.experient-inc.com/FFN131
Meet Our Presenters:

Michael Schley, IFMA Fellow

- CEO and Founder, FM:Systems
- Trustee, IFMA Foundation
- Chair, IFMA Foundation Knowledge Management Committee
- Chair, AIA CAD Layer Guidelines Task Force
Meet Our Presenters:

Paul Teicholz, Ph.D.

- Professor Emeritus at Stanford University
- Founding Director of the Center for Integrated Facility Engineering at Stanford
Meet Our Presenters:

Angela Lewis, Ph.D., P.E., LEED AP

- Project Manager with Facility Engineering Associates
- Contributor to “BIM for Facility Managers” book
- Organized 2013 COBie Challenge for FM
- Past Technical Editor of IFMA Foundation Sustainability How-to Guides
Introduction

BIM and Facility Management

• The IFMA Foundation
  – Education, Scholarships, and Research

• Significance of BIM to Facility Management
  – 90% of the costs of a building occur during operations.
  – BIM can play a significant role in managing these costs.

• Early Discussions in 2011

Paul Teicholz  Chuck Eastman  Eric Teicholz  Mike Schley
Introduction

The Need for a Book

• Information on BIM Standards
• Information on BIM Practices
• Case Studies from Early Adapters

• IFMA/John Wiley partnership
Introduction

Contents
1. Introduction
2. BIM Technology for FM
3. Owner BIM for FM Guidelines
4. Legal Issues When Considering BIM for FM
5. Using COBie
6. Case Studies
Agenda- Highlights from the Book

• Benefits and Costs of BIM for FM
• BIM Standards
• Legal and Contractual Issues
• Case Studies
  – University of Chicago Administration Building
  – USC School of Cinematic Arts
  – Xavier University
• Questions
Problems with Current FM Practice

Use of paper-based files for building and equipment information (hard to file & access), quickly outdated often inaccurate
Problems with Current Practice - continued

• Cost and time needed to develop input for CMMS and CAFM files (normally around $1-$3 per gross SF, takes significant time after startup)

• Cost and time needed to refer to paper files when FM problems occur

• Poorer building and equipment performance (lack of adequate data for preventive maintenance)
Benefits of BIM FM Integration

- Reduces Costs
  - Accurate and complete data ready for use when building completed, lowers data capture and O & M costs

- Integrates Systems
  - Data from BIM integrates with CMMS/CAFM/BAS, updated over life of building

- Improves Performance
  - More complete and accessible FM data allows faster analysis and correction of problems and fewer breakdowns. Supports happier and more productive users
Benefits of BIM FM Integration

- Reduced cost and time needed to collect and build CMMS, CAFM and BAS systems
- Improved data quality in FM systems so that paper files not required
- Reduced cost and time needed to address equipment problems
- Better building and equipment performance (reliability, energy use)
- Use of integrated system to plan building modifications
Costs of BIM FM Integration
it doesn’t come free!

• Front-end costs during design, construction and turnover to enter data into BIM model that will be needed by FM systems (associated with COBie data) note: There are alternative processes available to define/collection/transfer this data – see book

• On-going cost to update BIM and FM systems to reflect changes to building and systems (files need to reflect reality, not as-designed or as-built)
ROI Analysis of BIM FM Integration-1

Based on 2009 IFMA Maintenance cost survey data:
400,000 GSF office HQ with useful life of 25 years

• Initial costs to create integrated system
  Investment in systems, data collection & verification, training of project team $100,000

• Ongoing costs to maintain integrated system to reflect changes to building and equipment
  25% time for 1 FTE at $125,000/yr (fully burdened), $31,250/yr
ROI Analysis of BIM FM Integration-2

- Initial Savings
  - from less labor and time needed to collect data regarding building and equipment: avoid cost of minimum of 2 months for 2 FM gathering initial data: $41,667
ROI Analysis of BIM FM Integration-3

- Ongoing Savings
  - O&M savings of faster access to better information, 0.5 hrs per work order, 1600 work orders per year, $50/hr fully burdened = $40,000/yr
  - Utility cost savings from better equipment performance, reduced energy use, 3% of $2.39/GSF/yr = $28,680/yr
  - Total savings = $68,680/yr or $0.17/GSF/yr
ROI Analysis of BIM FM Integration-4

• Initial costs
  – $100,000 - $41,667 = $58,333

• Present Value of ongoing savings
  • Annual savings = 68,680 - $31,250 = $37,430/yr
  • Present value over 25 years at 6% interest rate = $478,481

• Net Present Value
  • $478,481 - $58,333 = $420,148

• Internal ROI = 64%

• Payback period: $58,333 / $37,430 = 1.57 years
ROI Analysis of BIM FM Integration-5

• These are extraordinary results and they exclude the following “soft” benefits:
  – Better building performance for users
  – Fewer equipment breakdowns
  – Improved inventory control of spares
  – Longer equipment lives (can be a significant saving)
  – Use of combined BIM FM model for remodeling and upgrades

Conclusion: Many benefits, few downside risks
BIM Standards
National BIM Standard (NBIMS V2)

Examples of Topics
- OmniClass
- Information exchanges
  - Construction operations building information exchange
  - Spatial program validation
  - Design to building energy analysis
- Practice documents
  - BIM Project Execution Planning Guide
  - Spatial coordination information for MEP

To download: www.nationalbimstandard.org
Construction Operations Building Information Exchange (COBie)

What is it?
What COBie is not
What is Included
Value of COBie
How to Get Started
What is COBie?

A standard method of exchanging information that drives down cost (paraphrased statement from Bill Brodt)

http://thelinkbetween.wordpress.com/2011/02/16/bridge-building/
What COBie is NOT

• “Just” a spreadsheet
  – IFC, ifcXML, spreadsheetML
• “Just” a model
• A process
• A specification for naming data
• A product
• A BIM requirement

COBie is MORE than “just” a spreadsheet

PRODUCT
What is Included in COBie

- Asset data
- Spare part information
- Preventive maintenance procedures
- Closeout submittals, O&M manuals, product data

Number and names of floors
Room numbers and names
Occupancy classification
Contact information

- Facility
- Design
- Construction
- Floor
- Type
- Spares
- Zone
- Component
- Jobs
- System
- Resources
- Space
- Contacts
- Documents
- Issues
- Impacts
- Connections
- Coordinates
- Assemblies
Value of COBie

- Prevents loss of data between design and construction to facility management handover
- Minimizes data entry
- Use of industry standards reduces cost of software implementation

Image courtesy Birgitta Foster – buildingSMART alliance
How to Get Started (1)

1. Determine what data is important

Buy in from both sides of the process is critical to success
How to Get Started (2)

2. Determine what level of detail about the data to collect

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How to Get Started (3)

3. Determine who will collect the data and how

<table>
<thead>
<tr>
<th>Who?</th>
<th>How?</th>
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<tbody>
<tr>
<td>Architects?</td>
<td>BIM authoring software?</td>
</tr>
<tr>
<td>Engineers?</td>
<td>COBie capable software?</td>
</tr>
<tr>
<td>Construction contractor?</td>
<td>Spread sheet?</td>
</tr>
<tr>
<td>- Subcontractors?</td>
<td>Other?</td>
</tr>
<tr>
<td>Commissioning agent?</td>
<td></td>
</tr>
<tr>
<td>Facility manager?</td>
<td></td>
</tr>
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</table>
Legal and Contractual Issues
Chapter 4: Legal Issues When Considering BIM for Facilities Management

• What is the BIM Model’s contractual status
• Who owns the model?
• Who owns the intellectual property
• Issues with Interoperability and Data Exchange

Chapter 4 Authors:
Howard Ashcraft and Kymberli Aguilar
HansonBridgett, San Francisco
BIM and Contracts

In standard architectural and engineering practice, the plans and specifications are, by reference, part of the construction contract.

What then is the role of the Building Information Model?

<table>
<thead>
<tr>
<th>Option</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BIM is used to create the plans and specifications but has no contractual status</td>
<td>Straightforward Reflects current typical practice.</td>
</tr>
<tr>
<td>2. BIM is co-equal with the plans and specifications</td>
<td>Requires rules of precedence in case of conflicts.</td>
</tr>
<tr>
<td>3. BIM is the controlling document.</td>
<td></td>
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</table>
Who Owns the Model?

<table>
<thead>
<tr>
<th>Option</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Building owner owns the model.</td>
<td>Issue of designer’s library elements</td>
</tr>
<tr>
<td>2. Designer owns the model.</td>
<td>Owner is licensed to use. Derivative works can be complicated.</td>
</tr>
<tr>
<td>3. Each party owns what they create.</td>
<td>Can be complicated</td>
</tr>
</tbody>
</table>

Licensing can be used instead of ownership.

Indemnification- Managing risk.
The Power of Licensing

“Typically, parties will agree to provide a license, which allows limited use to another party while maintaining copyright and ultimate control. A license is permission to do something with another’s property that, absent the license, would be legally actionable.”

“From an FM perspective, it is important that the owner either own the design or have a broad license to use the design information to operate, maintain, and upgrade the project facilities.”

- Ashcraft and Aguilar, BIM for Facility Managers
## AIA E202 – BIM Protocol Exhibit

### LOD- Level of Detail
- 100 Conceptual Design
- 200 Schematic Design
- 300 Construction Documents
- 400 Assembly and Fabrication
- 500 As Constructed

### Model Elements
- A SUBSTRUCTURE
  - A10 Foundations
    - A1010 Standard Foundations
    - A1020 Special Foundations
    - A1030 Slab on Grade
  - A20 Basement Construction
    - A2010 Basement Excavation
    - A2020 Basement Walls
- B SHELL
  - B10 Superstructure
    - B1010 Floor Construction
    - B1020 Roof Construction
    - B20 Exterior Enclosure
      - B2010 Exterior Walls
      - B2020 Exterior Windows
      - B2030 Exterior Doors
    - B30 Roofing
      - B3010 Roof Coverings
      - B3020 Roof Openings
- C INTERIORS
  - C10 Interior Construction
    - C1010 Partitions
    - C1020 Interior Doors
    - C1030 Fittings

### Model Element Author
- American Institute of Architects
  - [www.aia.org](http://www.aia.org)
Case Studies

University of Chicago
USC School of Cinematic Arts
Xavier University
University of Chicago Administration Building Renovation: Project Overview

15,000 SF building built in 1949

Renovation and modernization of restrooms and HVAC

Tight spaces for rerouting ductwork

Creation of Accurate As-Built Drawings

Translational Tool using the “Spirit of” COBie as the Foundation

Results of Translational Tool: Asset Tab

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<tr>
<th>Name</th>
<th>Design Manufacturer</th>
<th>Design Model Number</th>
<th>Installed Manufacturer</th>
<th>Applicable Vendor</th>
<th>Warranty Duration</th>
<th>Expected Life</th>
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<td>M000001</td>
<td>2</td>
<td>10 Years</td>
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<td>Air Handler Unit</td>
<td>McQuay</td>
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<tr>
<td>Split A/C Unit</td>
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University of Chicago: Lessons Learned

- No “out of the box” solutions
- New processes are needed
- Existing systems are both a restraint and a decision driver
- Team member skills
- Communication between disciplines
University of Chicago: Challenges

- How much data?.... and how detailed?
- Should the 3D model be used for FM?
University of Southern California (USC): Overview

- School of Cinematic Arts
- 3 Phase, 6 building $165 million complex
- BIM FM further defined through each phase

USC FM Portal

Phase 1 Portal: Using Navisworks

Phase 3 Portal: Using EcoDomus (middleware)

USC BIM Guidelines

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<th>Milestone</th>
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<td>COBie Design Data</td>
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<tr>
<td></td>
<td>• Contact</td>
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<tr>
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<td>• Facility</td>
</tr>
<tr>
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<td>• Zone</td>
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<td>Design Development</td>
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<td>• Component</td>
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Link to access
USC: Lessons Learned

**New processes ≠ New tools**

- Develop a BIM Guideline early, and use it
- Use industry standards, such as COBie
- Importance of top level support for BIM FM

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USC: Challenges

• Management of after construction BIM
  – Data validation
  – Who will manage?
  – With what funds?
• What is the business case?
Case Study- Xavier University

• A Jesuit, Catholic university in Cincinnati
• Founded 1831
• 7,019 total students
• 70 buildings – over 2 million GSF
Xavier’s Hoff Academic Quad and Residence Hall Project

- $117 M, Largest capital projects in schools history
- Added 25% to campus
- 4 new buildings
- BIM used to facilitate design and construction
Xavier’s Challenges

- Produce 10 Year Comprehensive Facilities Plan for entire campus
- Forecast facilities capital costs and obtain proper funding to reduce deferred maintenance
Room finish information from design and construction phases....
Is linked to lifecycle data (expected life, replacement cost) in the facility management system
Xavier’s Results

- Integration of BIM and FM data avoided 12 person months of data gathering and entry
- Used FM data to document extensive deferred maintenance and increase O&M funding from $750K to $12M per year
Xavier Results and Lessons Learned

- Project started in 2009
- Modeled for design and construction not FM
- Subcontractor’s models developed in various CAD-based tools
  - Costly to redo sub’s models to meet Xavier’s needs
- The earlier you plan your BIM data efforts, the better.
Questions?
Thank You!

For attending this educational offering at IFMA’s Facility Fusion.

Please evaluate this session at the registration kiosk or online at http://ceu.experient-inc.com/FFN131