BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Course Number: WE102

Wednesday | April 26 | 8:30 am – 12 pm

3.75 LU/GBCI/RIBA

Session Opening

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Questions related to specific products and services may be addressed at the conclusion of this presentation.

Overall Course / Learning Objectives

- Understand owners' needs when working with BIM deliverables and identify solutions to meet these needs.
- Deliver high-value BIM lifecycle data to owners during the design and build phases that owners can immediately use.
- Learn various approaches to integrating lifecycle management into the AEC business model.
- Review case studies from different owner environments that delivered BIM projects that met unique challenges.

Course Outline / Timeline

- **Workshop Welcome & Introduction** / 5 min.
- **Session 1**
  - Chris D'Souza / 45 min.
- **Session 2**
  - Nick Jang / 45 min.
- **Break /** 10 minutes
- **Session 3**
  - Reeves Davis / 45 min.
- **Session 4**
  - Mark Handy / 45 min.
- **Panel Discussion /** 30 min.
- **Closing Thoughts / Thank You /** 5 min.

Speakers List

- Chris D'Souza – Product Marketing Manager, ARCHIBUS, Inc.
- Nick Jiang – President, ARCH Building Data Solutions, LLC.
- Reeves Davis – EVP | Managing Director, JLL, Technology Solutions
- Mark Handy, AIA – Director of Building Data Solutions, TRC Worldwide Engineering

Session Organizer / Bio.

Advisory Group Member / Past Chairman

Role: Session Organizer

AIA Corporate Architects and Facility Management

Robert Dazel, AIA
Marketing Manager for Strategic Accounts
Dryvit Systems, Inc.
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Office Telephone: (734) 243-9301
Cell Phone: (734) 276-0404

Robert Dazel has been a registered Architect since 1992, a long-standing member of AIA, CSI and maintains his LEED GA credentials. He has spent the last twenty years in the Exterior Insulated Wall Cladding Industry holding positions such as architectural services, technical, marketing and sales management. The total of his professional experience has allowed him to become an authority and expert on Exterior Wall Surfacing Materials and Building Envelope Codes, Design, Detailing, Specification and Performance.

Speaker / Bio.

Role: Workshop Presenter

Chris D'Souza
Product Marketing Manager
ARCHIBUS, Inc.
Email: chris_dsouza@archibus.com
Office Telephone: (617) 513-3092

Chris D'Souza leads strategic BIM and IWMS product marketing and development initiatives at ARCHIBUS Inc. He brings over twenty years of experience developing, deploying, and educating global enterprise organizations about technology solutions that relieve operational pain points and promote mission success. Chris has spoken at numerous industry conferences and has introduced innovative, paradigm-shifting workflow methodologies for the built environment through his contributions in leading industry journals. Chris holds a MS in Computer Engineering from Boston University, a BSEE from the University of Pune in India, and an MBA from Babson College.

Speaker / Bio.

Role: Workshop Presenter

Nick Jiang
President
ARCH Building Data Solutions, LLC
Email: njiang@archbds.com
Office Telephone: (314) 445-9529

Nick Jiang is President of ARCH Building Data Solutions. Nick works with public and private sector clients to develop and implement cohesive technology solutions that deliver measurable productivity benefits for infrastructure, workplace, and facilities lifecycle management. Nick has led IWMS design and implementation teams for over 20 major clients, has successfully integrated BIM and GIS into business processes for facilities lifecycle management, and has himself administered and managed millions of square feet of facility space.

Speaker / Bio.

Role: Workshop Presenter

Reeves Davis
EVP, Managing Director
JLL
Email: reeves.davis@am.jll.com
Office Telephone: (980) 365-8970
Cell Phone: (704) 909-8838

Reeves Davis is responsible for the delivery of IWMS solutions to JLL's customers, including setting the vision for technology enablement, design of technical solutions, and overseeing JLL's delivery team across the entire engagement. He provides analytical and technical solutions to JLL's Strategic Workplace Services accounts, focusing on Key Performance Indicators, Industry Benchmarking, Dashboards and Analytical Reporting. Reeves is experienced with a wide variety of industry initiatives including the management of capital projects, space planning, employee moves, assets, risks, fleets, hazardous materials, facility operations, and mobile solutions.

Speaker / Bio.

Role: Workshop Presenter

Mark Handy, AIA
Director of Building Data Solutions
TRC Worldwide Engineering
Email: mhandy@trcww.com
Cell Phone: (317) 509-4043

Mark Handy is Director of Building Data Solutions at TRC Worldwide Engineering. He has over 37 years of experience which have included Healthcare and Higher Education design & facilities management projects. His main focus throughout his career has been on facility life cycle knowledge management. With a technology services orientation - BIM, CAD, Facilities Management, Databases, 3D Laser Scanning - he has worked with over 30 million sf of building spaces and assets for many clients. Products of design and construction can migrate to facility operations for data analysis providing more efiicient processes, higher return on investment, and long term value for clients.

Course Outline / Objective

BIM for Lifecycle Management: Boot Camp for Architects, Contractors, and Engineers

Owners lament: I've been given BIMs from our latest project. What do I do with them?

This workshop helps BIM practitioners provide answers to this and other vexing questions posed by owners.

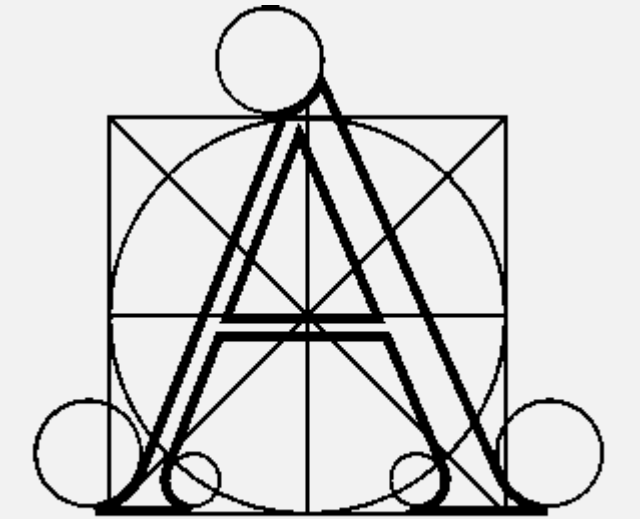
Speakers List

- **Chris D’Souza**
  - **Product Marketing Manager, ARCHIBUS Inc., Boston, Massachusetts**
- Nick Jiang
  - President, ARCH Building Data Solutions, LLC, Chesterfield, Missouri
- Reeves Davis
  - EVP, Managing Director, JLL, IP, Inc., Charlotte, North Carolina
- Mark Handy, AIA
  - Director of Building Data Solutions, TRC Worldwide Engineering, Indianapolis, Indiana

BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Session 1
Foundations In Lifecycle Management with BIM

Chris D'Souza, Product Marketing Manager



A'17 AIA Conference on Architecture 2017
April 27–29, Orlando

Learning Objectives

1) Identify stakeholders, their roles, and their objectives in using lifecycle information that originates from a BIM project and from outside the BIM project.

2) Study three approaches to integrating a lifecycle management practice into the AEC business model.

3) Learn how the latest technologies integrate BIMs with lifecycle management systems, and simplify transfer of BIM lifecycle information to owners.

Learning Modules

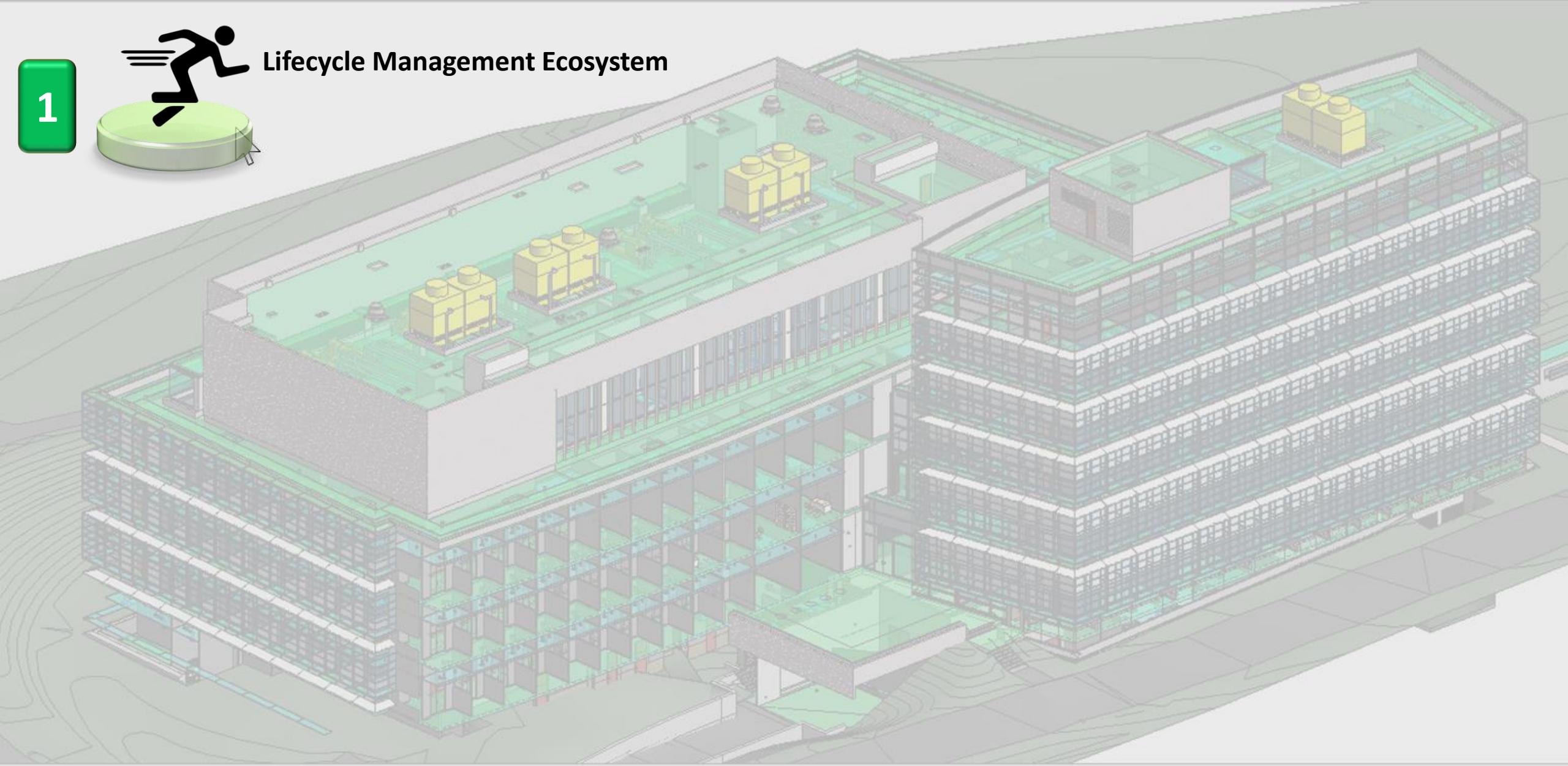
1 Lifecycle Management Ecosystem

2 Business Opportunity for AEC Firms

3 BIM and Lifecycle Technology Integration

1

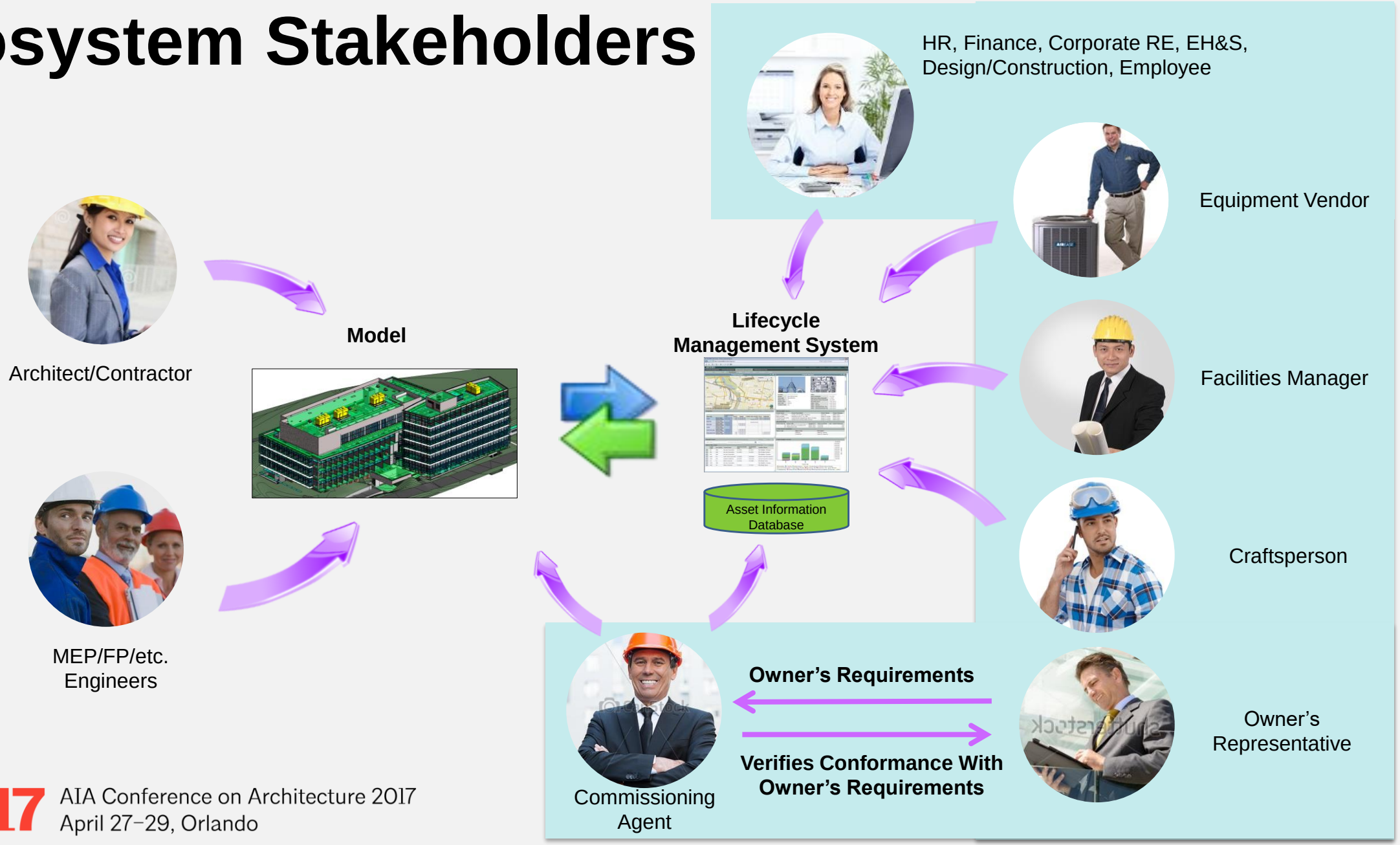
Lifecycle Management Ecosystem



Question to Ponder

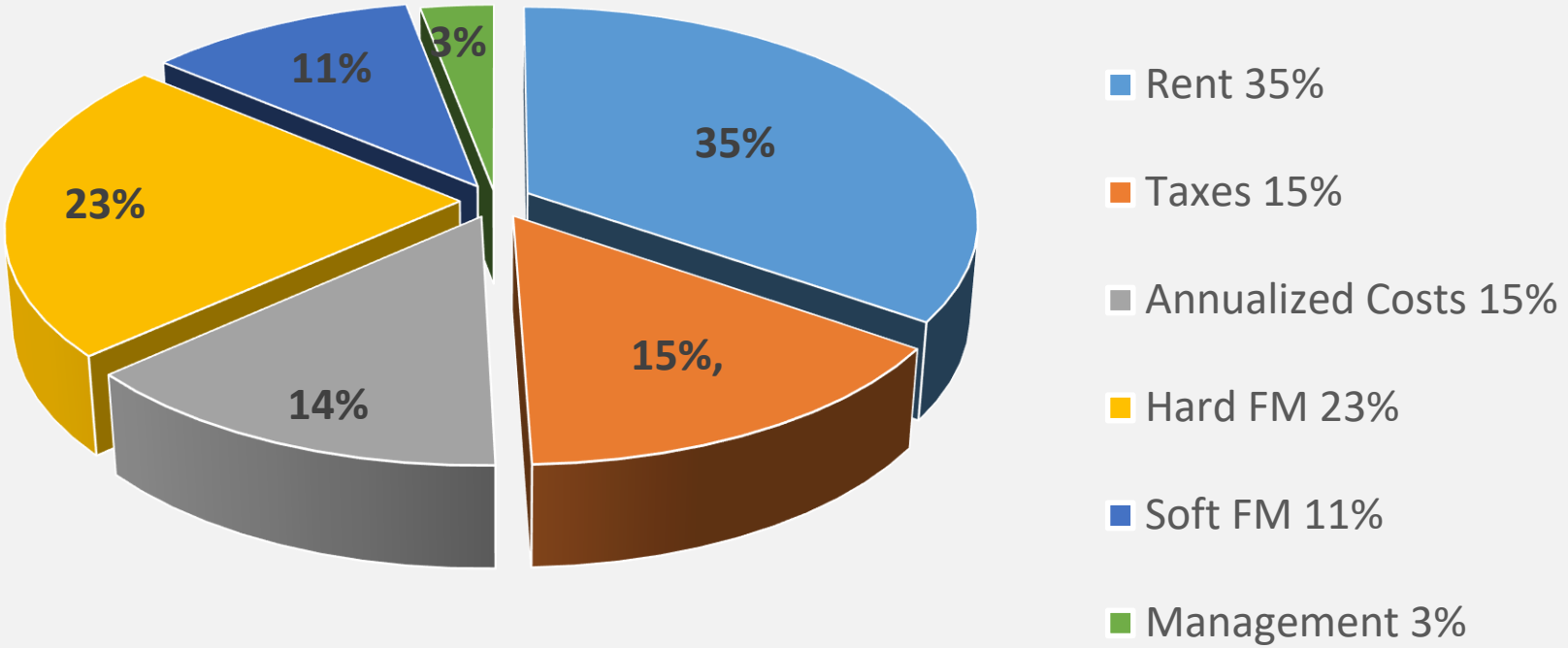
On a BIM project, what do owner's *really* care about?

Ecosystem Stakeholders



Occupancy Costs over Facility Lifecycle

The annual cost split for a new office occupation*



Are there other hidden costs?

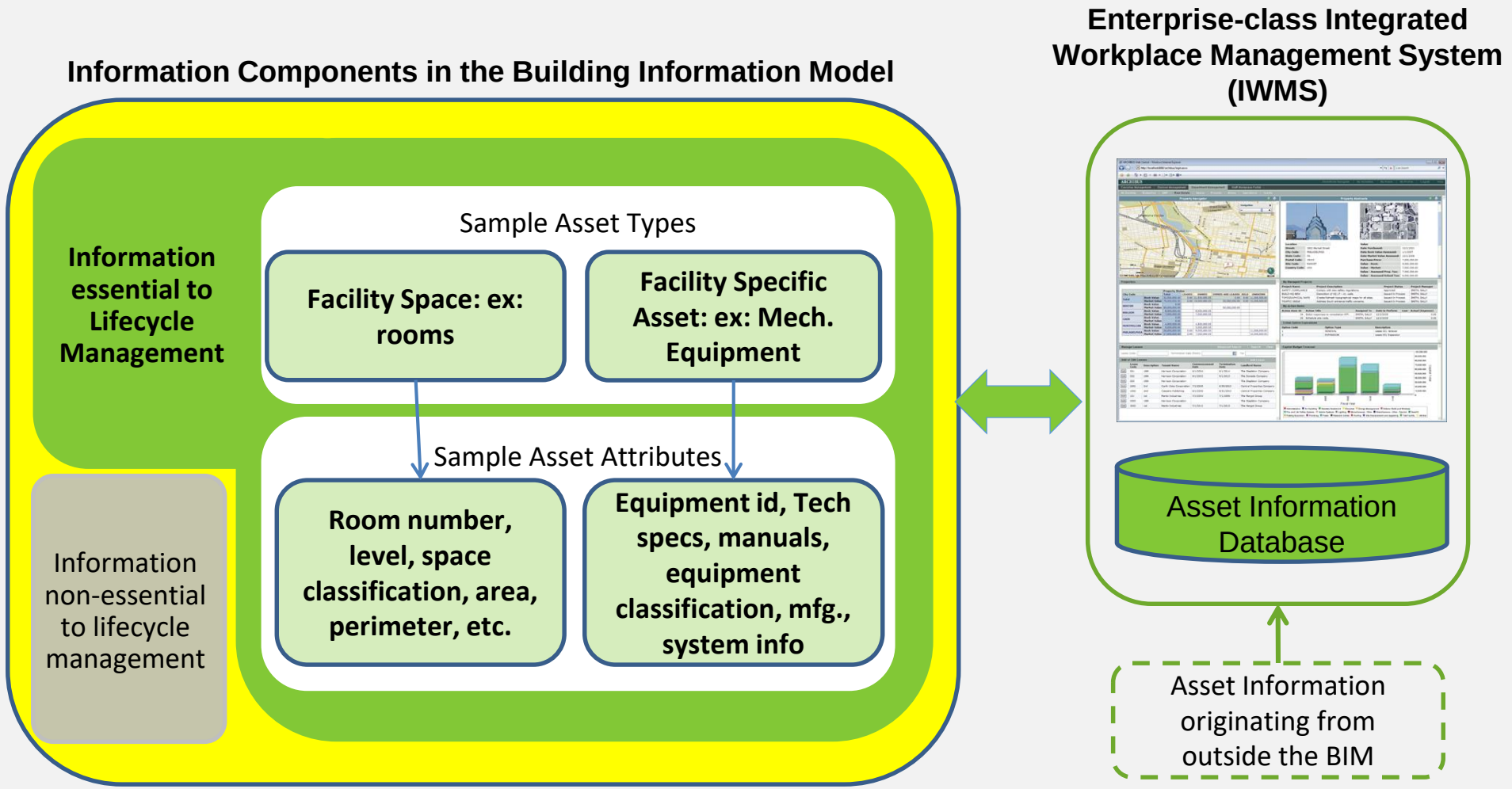
*Source: The Total Office Cost Survey 2013 edition (Actium Consulting)

From Model to Lifecycle Management

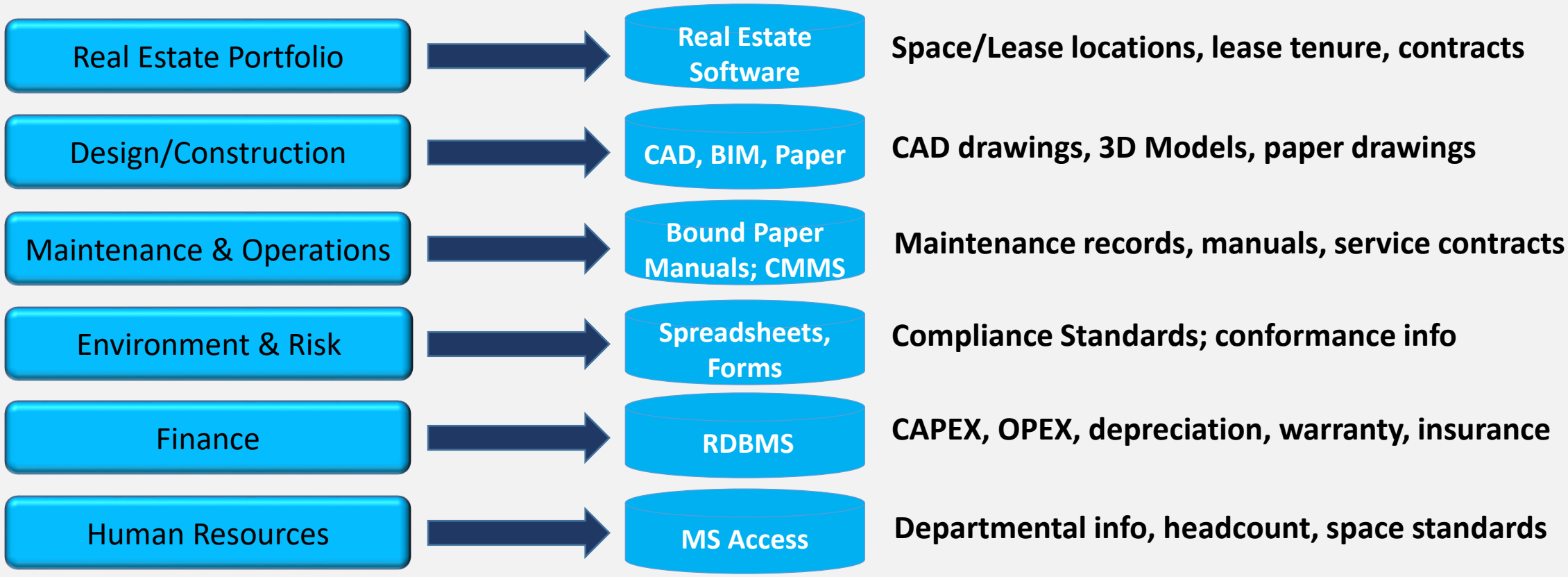
“One item that the Level of Development does not specify is the facility data needed about each facility element. The facility data, attributes, and properties should be specified about each element and even elements not modeled may require facility data to be documented.”

Planning Guide For Facility Owners, Version 2.0, June 2013, Penn State University

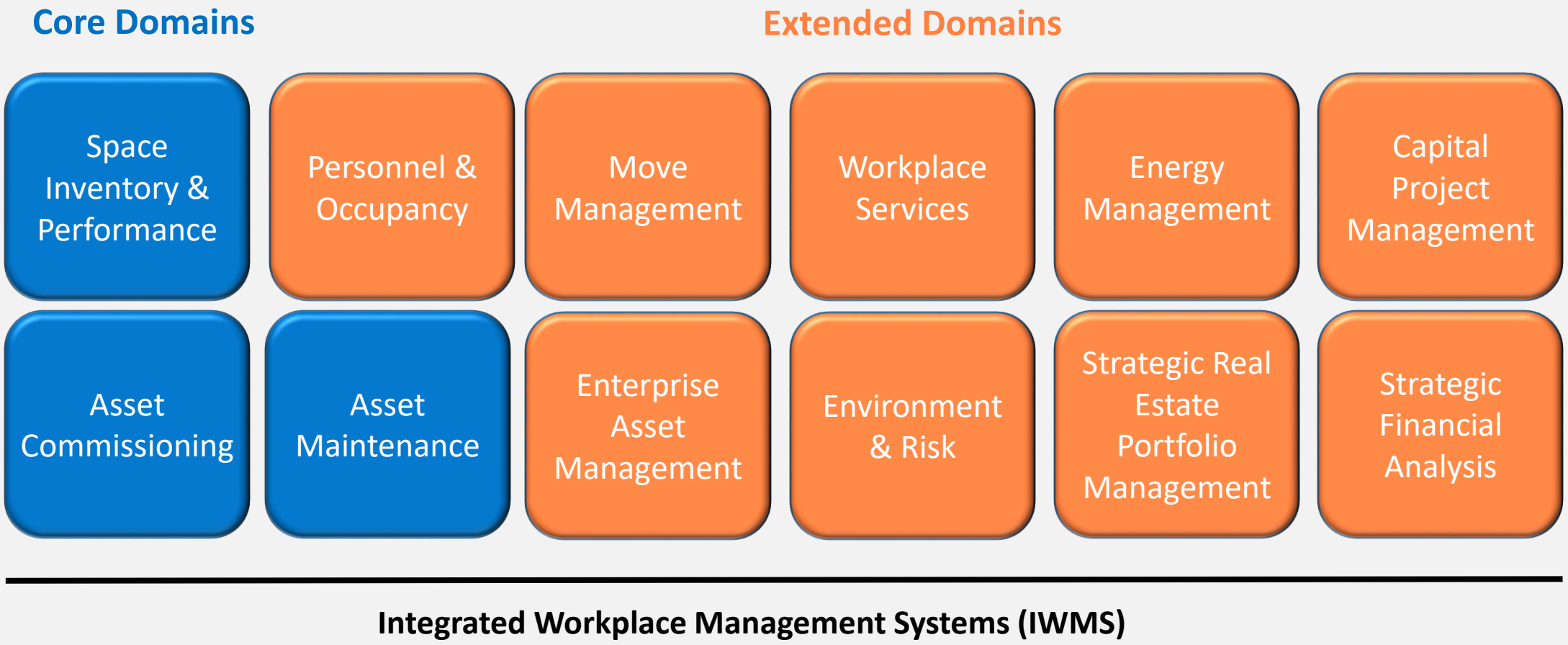
From Model to Lifecycle Management



Lifecycle Management: People, Data, Standards



BIMs as Foundation for Lifecycle Management



Questions from Owners

We have the models. How do we use them

Does the model have what I need for lifecycle management

Who will help my organization get started with the model

Do I have to invest in new technologies to use the models

Can I receive useful lifecycle data before project completion

How do I specify the model data I'd like to have before project completion

What Determines Successful Model Handoff

- Scope
- Value
- Scalability
- Usability (of Technology Solution)

2

Business Opportunity for AEC Firms

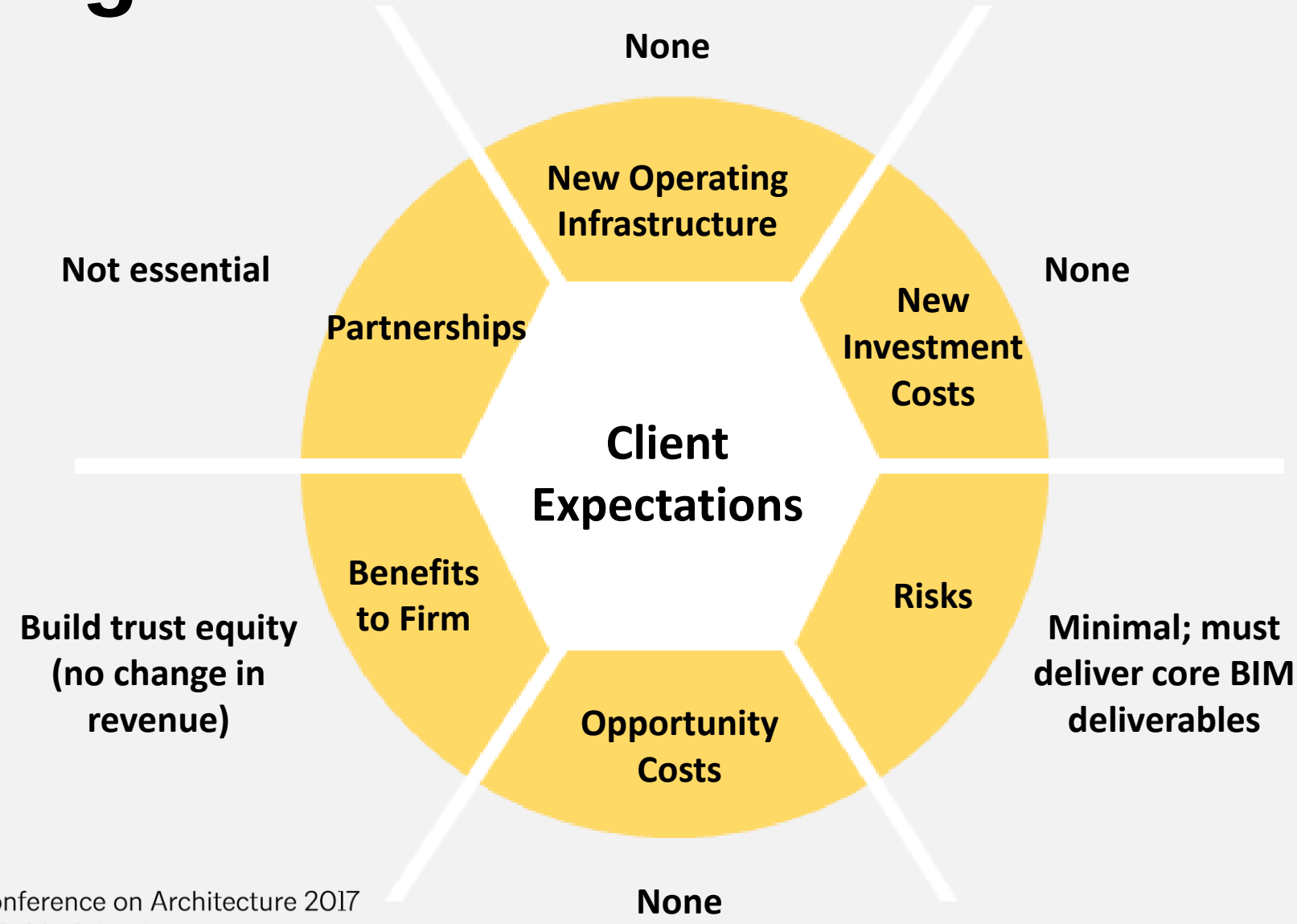
“OK, but what’s in it for me?”

AEC Firm Objective:	Benefit:
Gain intimate knowledge of client infrastructure	Build long term relationship and trust
Facility infrastructure knowledge repository for client	Maintain contact with client after handoff
Shorter learning curve on new projects	Useful on fast-track and negotiated contract projects
FM is a value-added offering to existing services	Competitive differentiator on new bids
Revenue diversification	Useful during slow growth periods

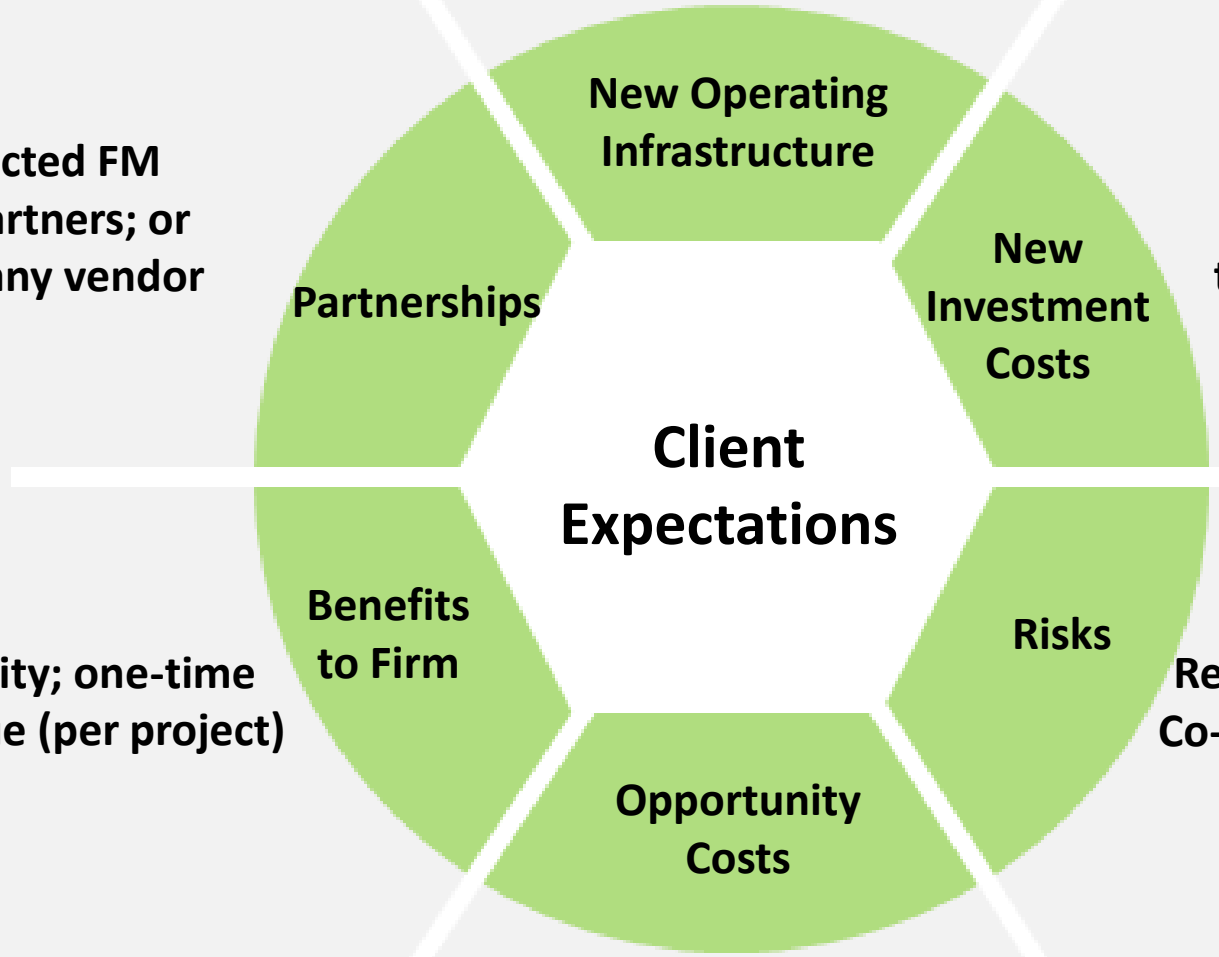
Lifecycle Management Practice

- Business Models for A/E/C Firms
  - Consulting Model
  - Execution Model
  - Post-Handoff Management Model

Consulting Model



Execution Model



FM specialist/co-ordination resource; BIM-FM technology integration resource

Staffing costs for new resources; BIM-FM technology investment

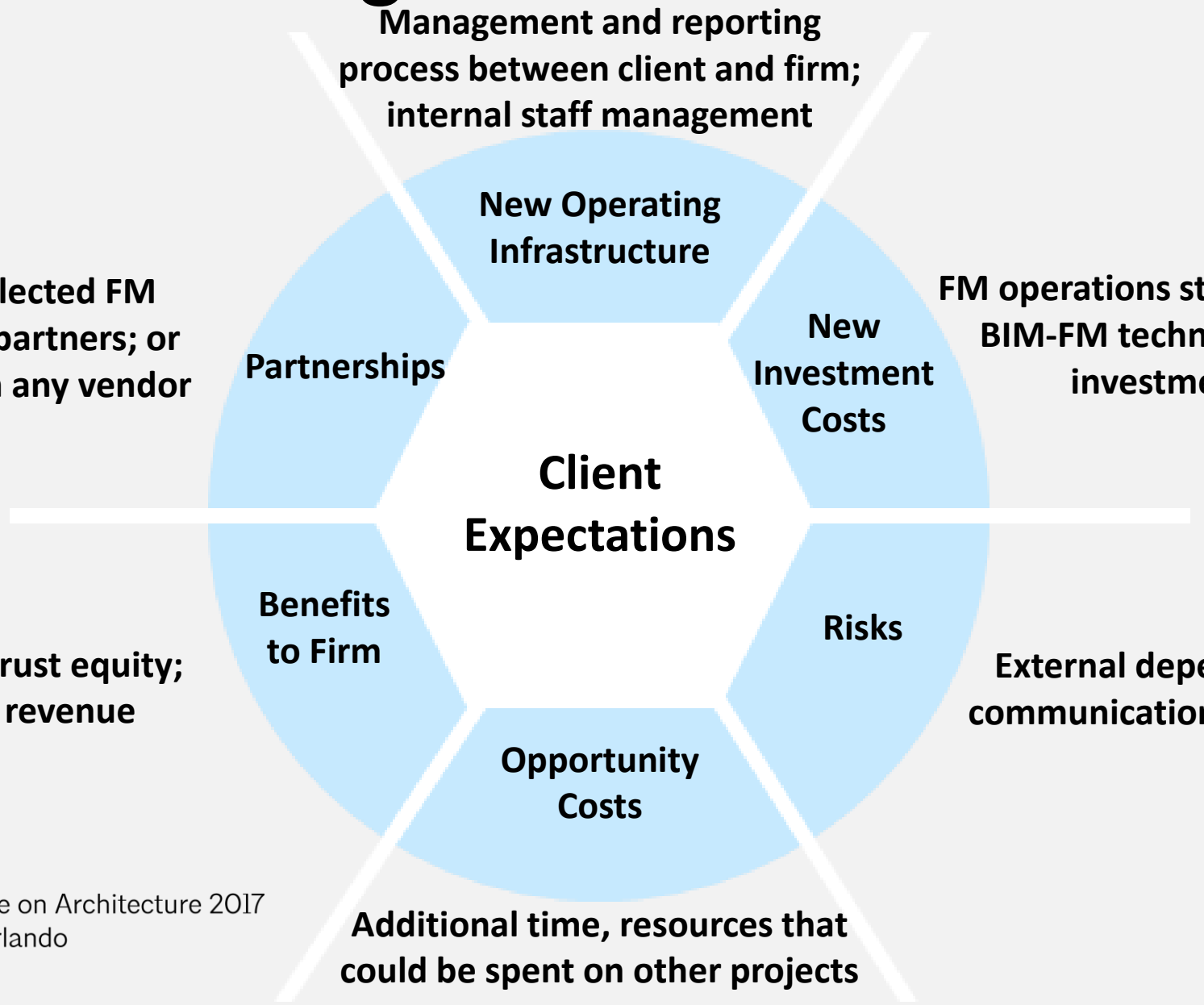
Resource/skill set gaps; Co-ordination challenges

Additional time, resources that could be spent on other projects

Build trust equity; one-time accretive revenue (per project)

With selected FM solution partners; or work with any vendor

Post handoff Management Model

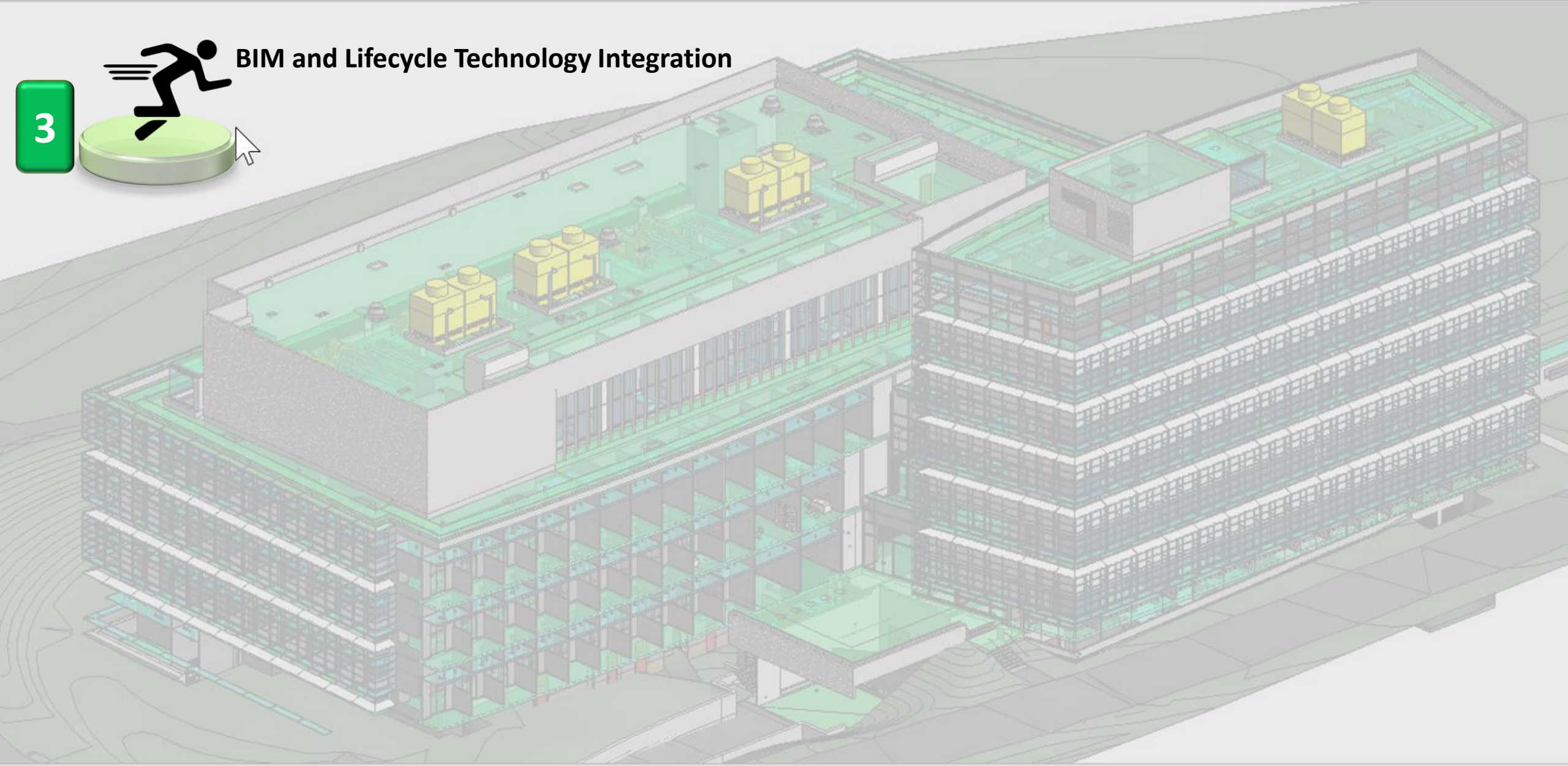


Embracing Lifecycle Management: Best Practices

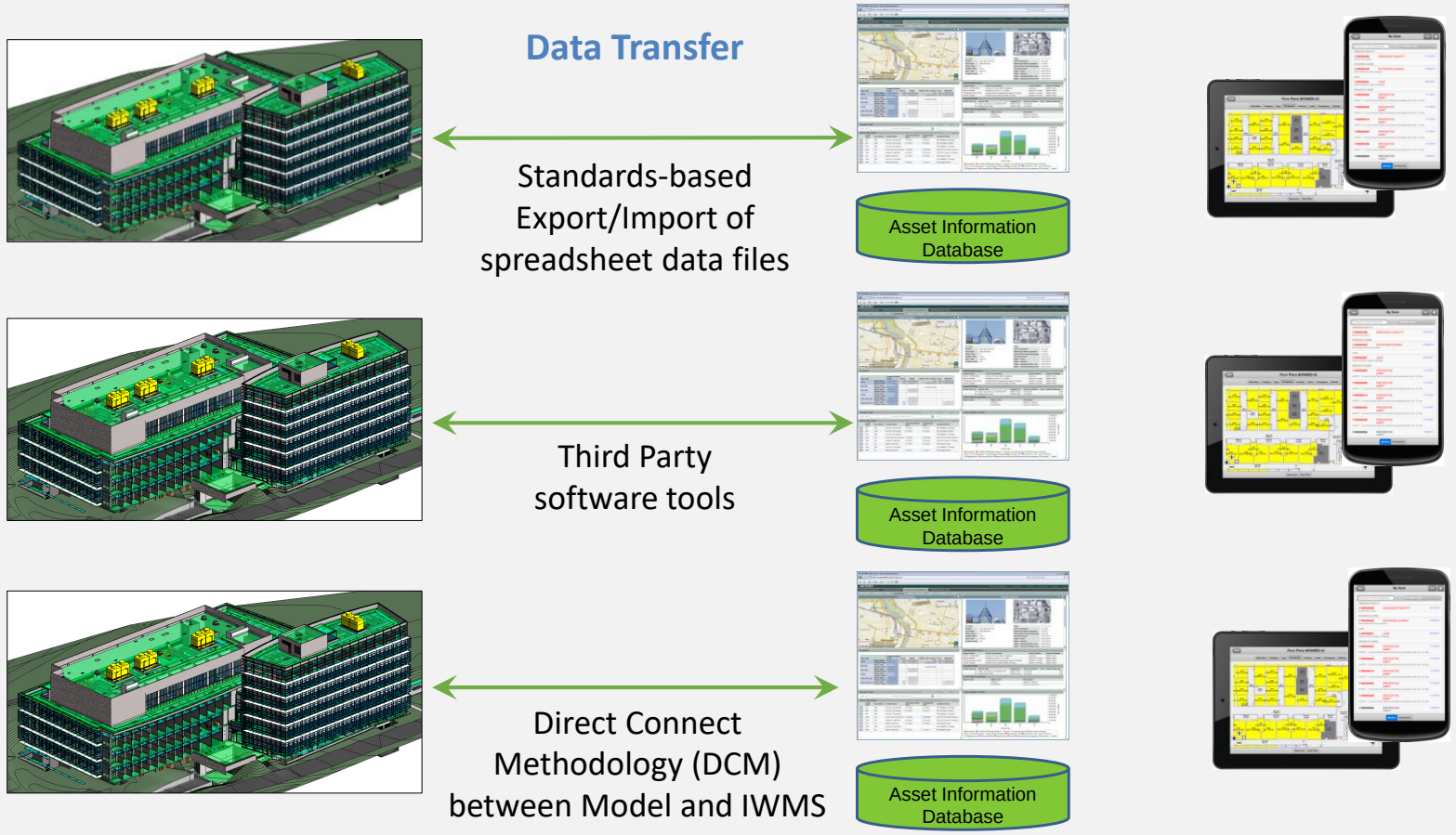
- Select FM model based on firm's strategic objective
- Begin with sectors you have experience with
- Use expected client deliverables to identify firm's gaps
- Clearly articulate value proposition to target clients
- Align pricing with FM value proposition
- Start small and build practice incrementally

BIM and Lifecycle Technology Integration

3



Technology Integration Options



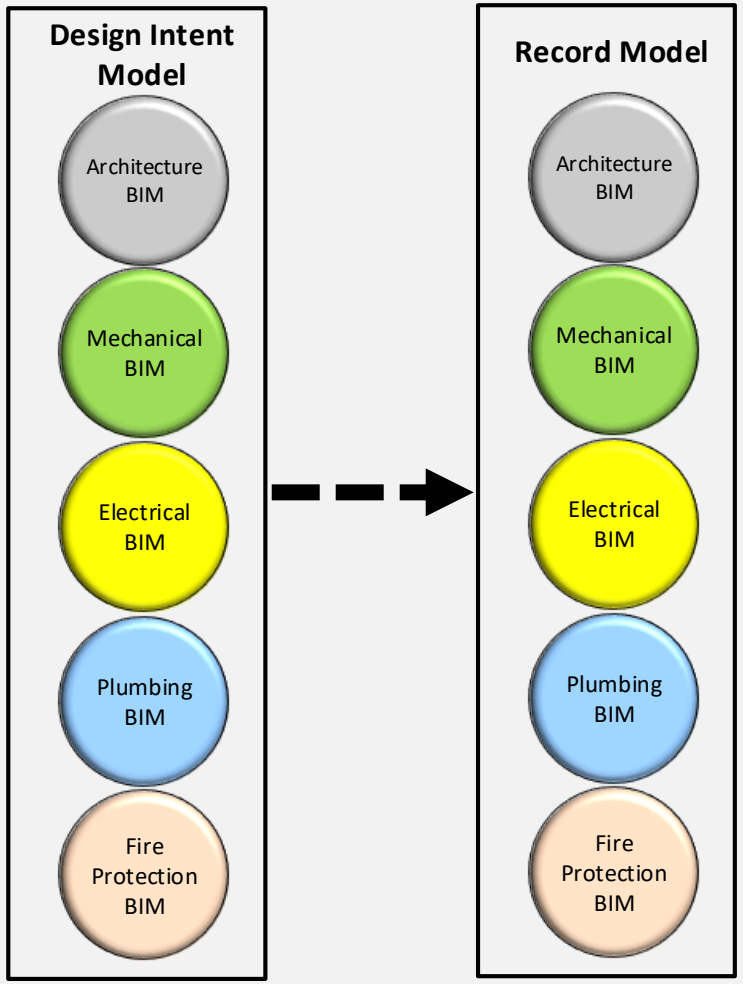
Record model

Desktop and Mobile CMMS/IWMS Access

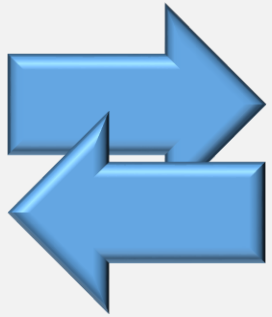
Visualization

- 2D: Published to IWMS
- 3D: IWMS with third party 3D Viewer
- 3D: IWMS with integrated 3D Viewer

Direct Connect Methodology (DCM)



DCM Connects Model to IWMS Using Web Services

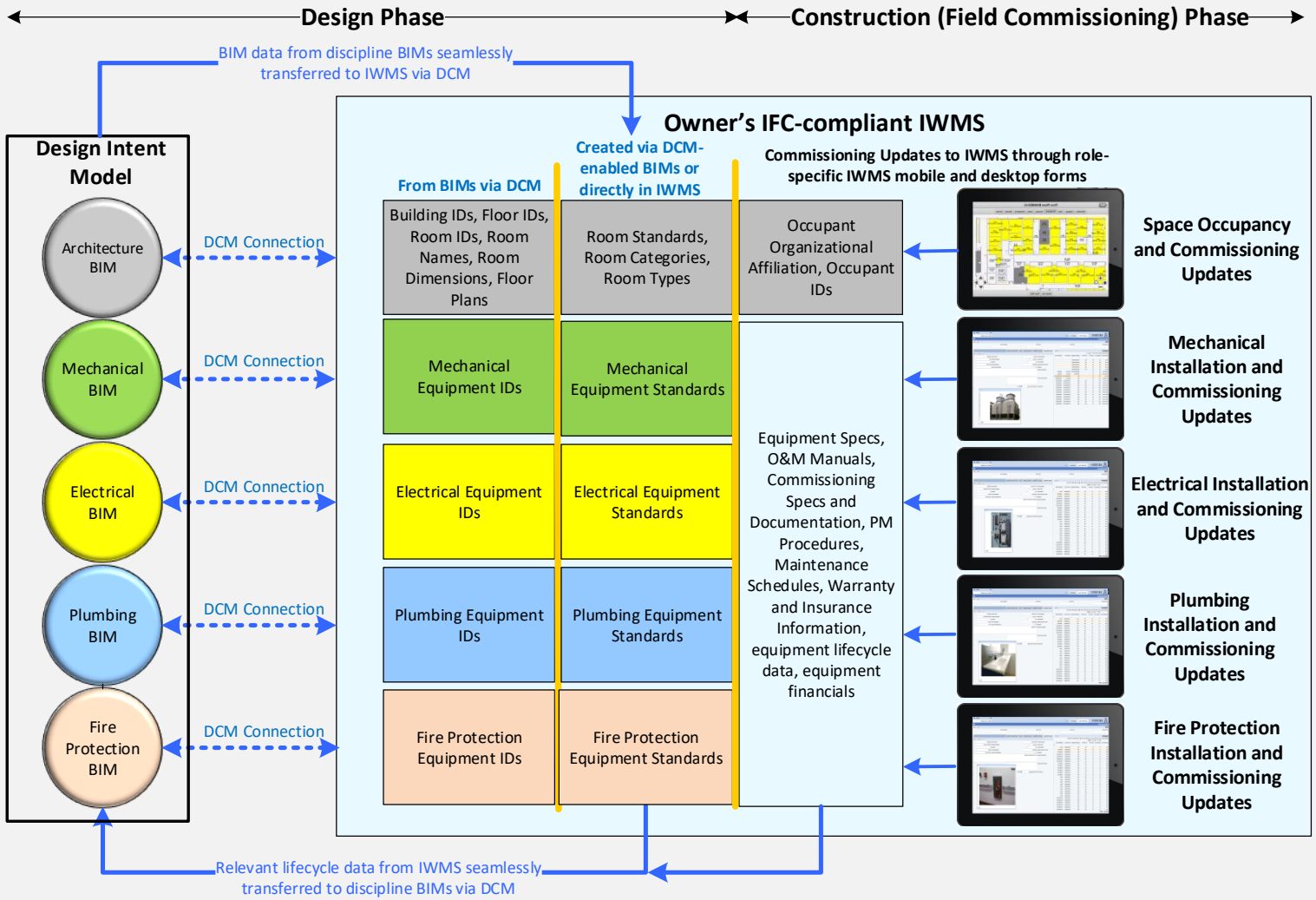


Seamless

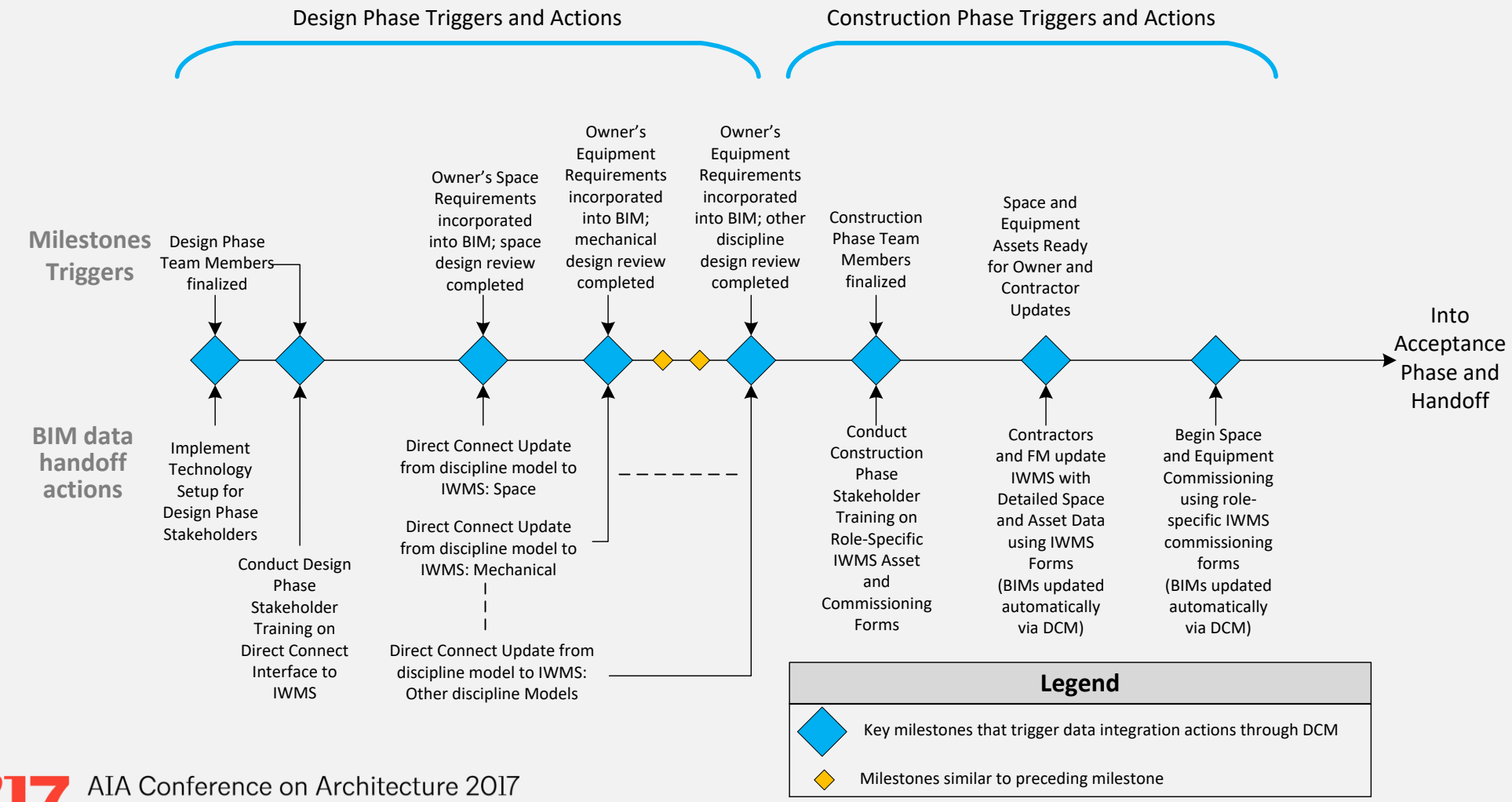
Instantaneous

Bi-directional

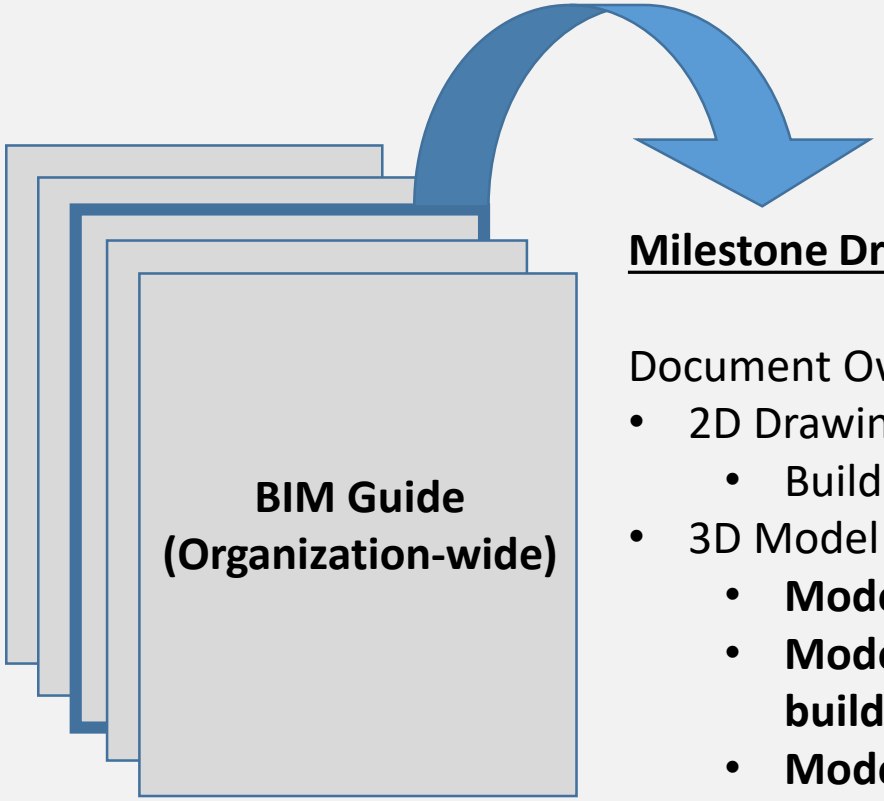
Model Data Exchanges



Model Data Exchange Milestones



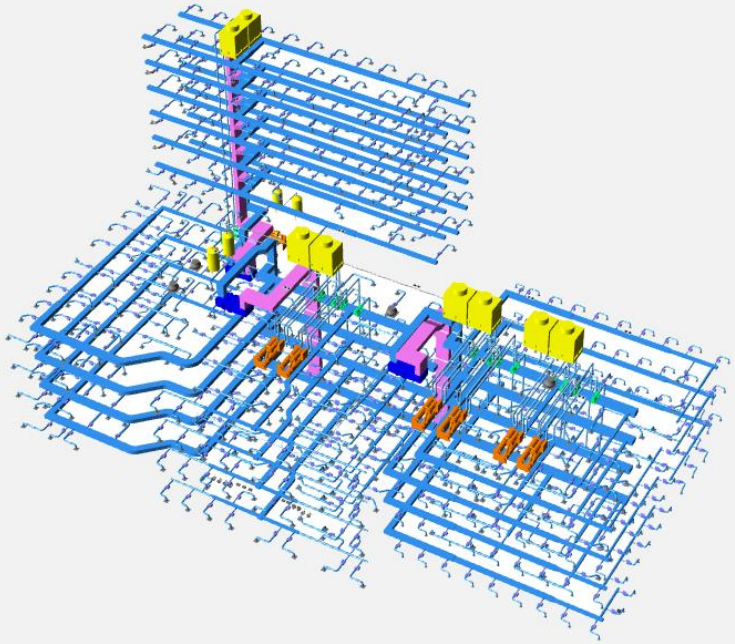
DCM Owner Requirements: Visualization



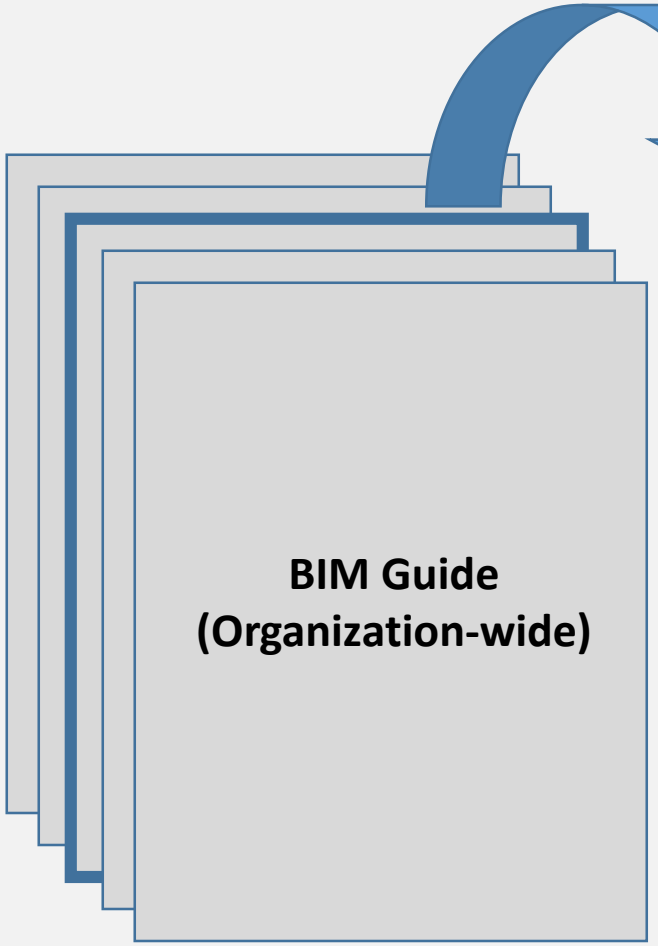
Milestone Driven Geometry Deliverables

Document Owner Requirements:

- 2D Drawings (Floor Plans)
  - Buildings, Floors, Rooms
- 3D Model
  - **Model categories published by floor**
  - **Model categories published per building**
  - **Model categories published by system**
    - **Ex: All HVAC equipment grouped**



DCM Owner Requirements: Lifecycle Data



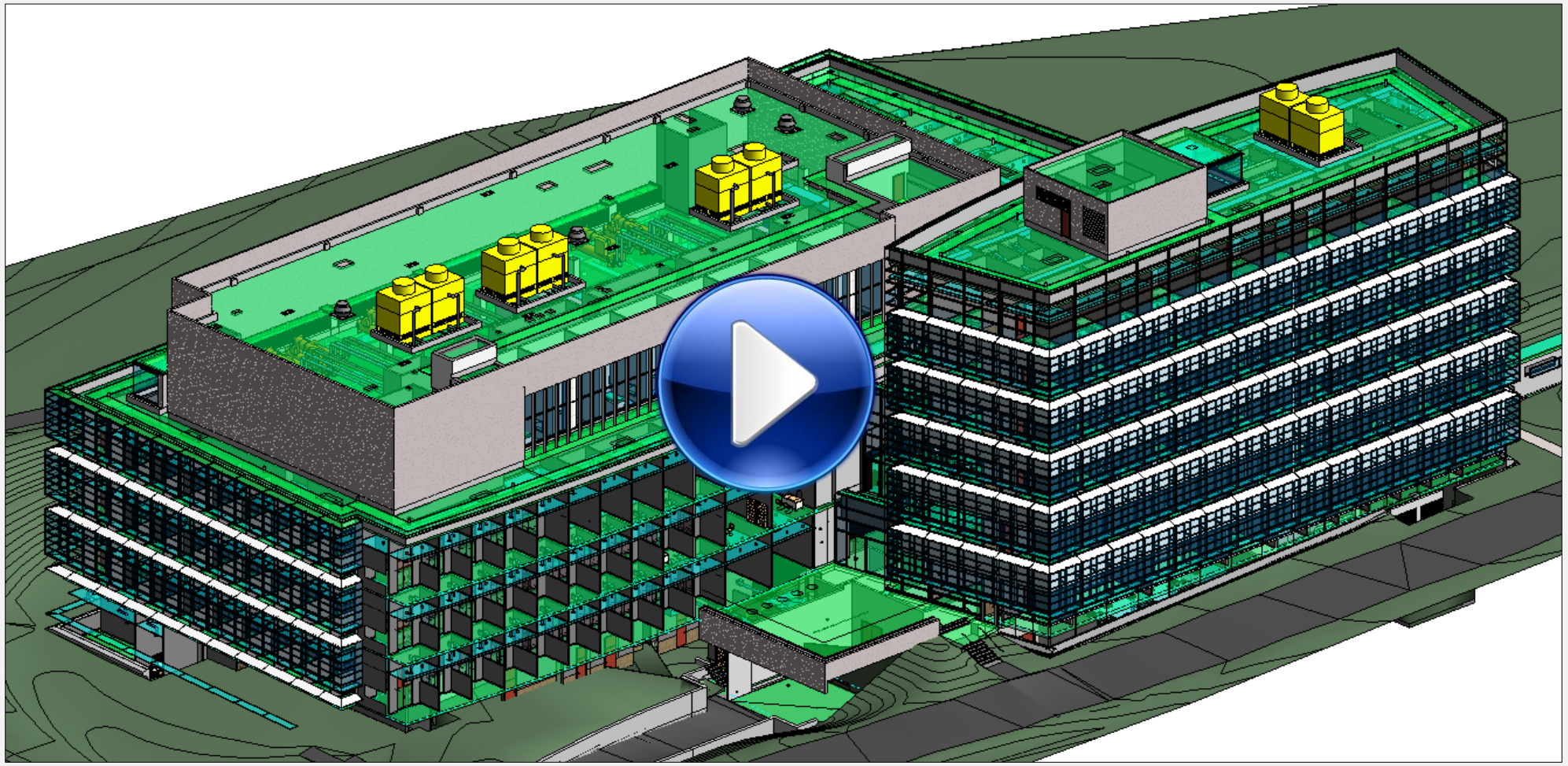
Milestone Driven Data Deliverables

- **Discipline-based**
  - Architectural Model
  - **Mechanical Model**
  - Electrical Model
  - Plumbing Model
  - Fire Protection Model
- **Relate LOD to Asset Standards**
  - Space Standards
  - Equipment Standards
  - Other Standards

MECHANICAL EQUIPMENT

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Panel		*	*	*
Circuit Number		*	*	*
Air Flow				*
Drain Flow		*	*	*
Air Pressure Drop			*	*
System Classification	N/A		*	*
System Name	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

BIM for Lifecycle Management In Action (video)



Key Takeaways

Business Takeaways

- Decide on the business model that best works for your firm
- Evaluate opportunities within your vertical specialties
- Start small and grow FM practice incrementally

Managerial Takeaways

- Establish clear distinction between deliverables of each team member
- Dedicate a facilities liaison to manage FM deliverables
- Invest prudently in resources only after clearly identifying role of the new resource

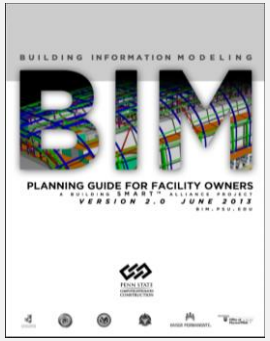
Technology Takeaways

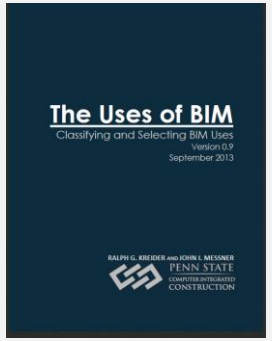
- Get familiar with BIM-FM ecosystem and technologies
- Let technology do the heavy lifting
- Technology is only an enabler. How its harnessed will determine success

Reading Material

- Journal of the National Institute of Building Sciences, Dec. 2016
  - Chris D'Souza – Lifecycle Data Handoff: Guidelines for BIM Project Managers

- Penn State University
  - BIM Project Execution Planning Guide
  - BIM Planning Guide for Facility Owners
  - The Uses of BIM





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BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

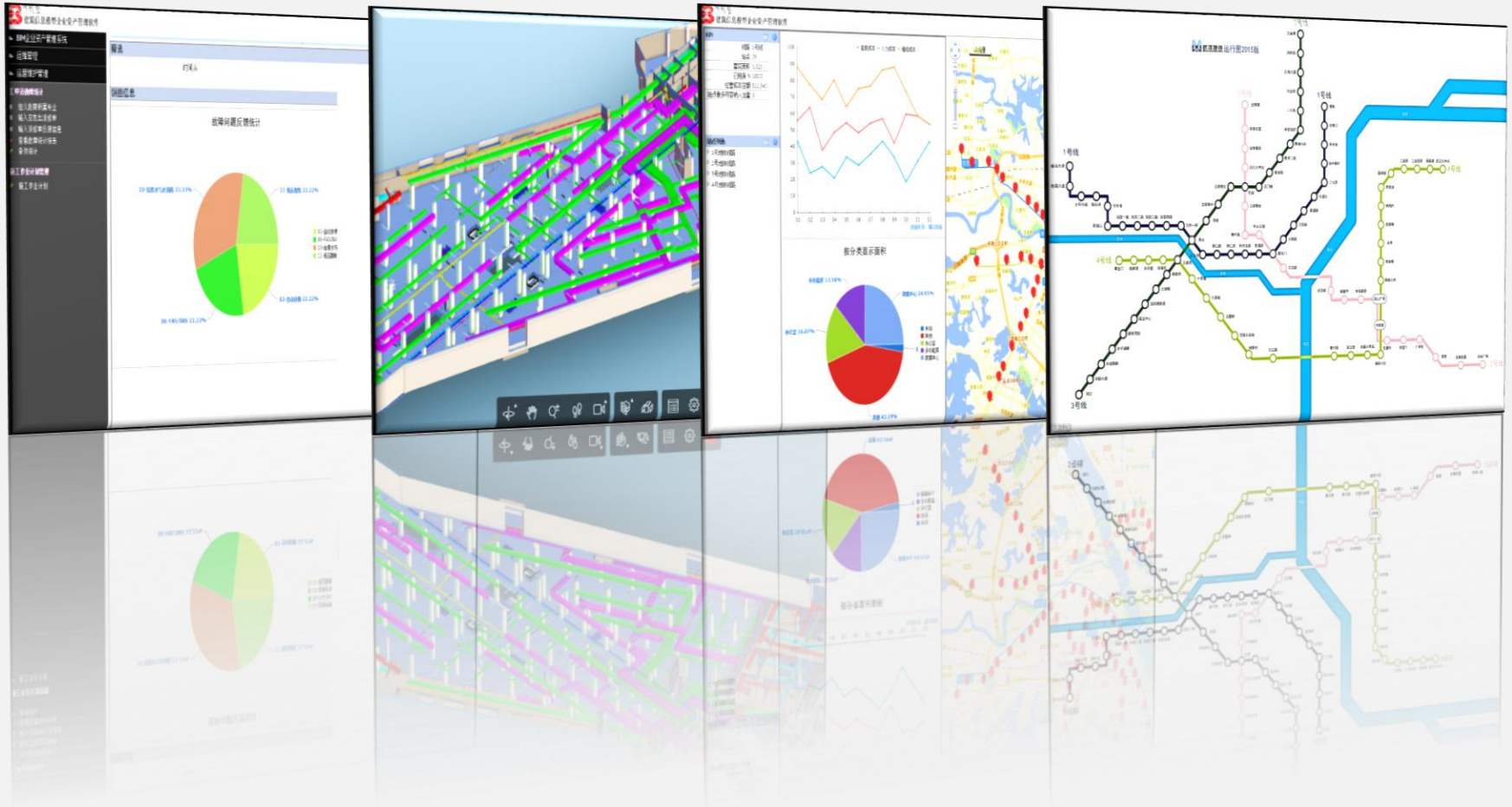
Session 2
Case Study: Enterprise Information Modeling (EIM) Deployment for Wuhan Metro, China

Nick Jang – President

A'17 AIA Conference on Architecture 2017
April 27–29, Orlando

ARCH BUILDING DATA SOLUTIONS
Implement. Integrate. Innovate.

Case Study: Enterprise Information Modeling (EIM) Deployment for Wuhan Metro, China



Course / Learning Objectives

- Creating Enterprise Information Modeling Framework from various data sources
- Use of BIM data for daily operations and asset management
- Unobtrusive change of workflow with mobile and Web technologies
- Central data repository for ease of knowledge transfer

Project Background

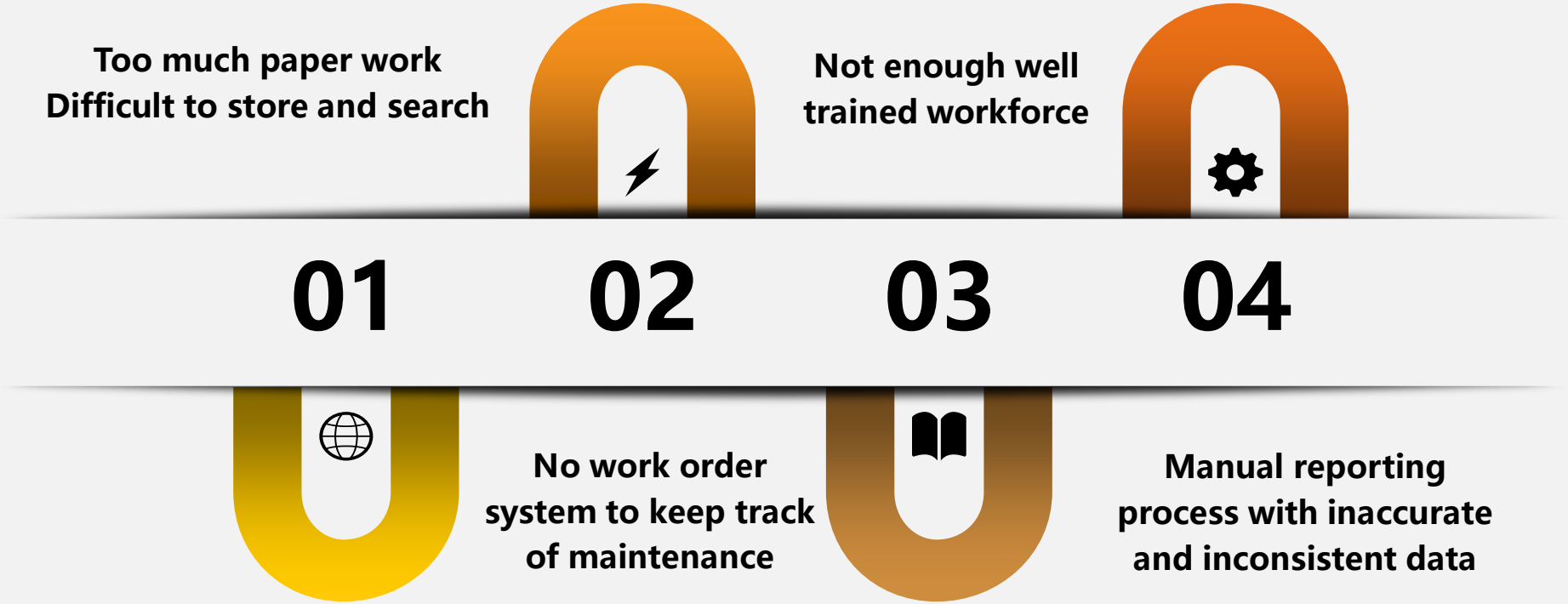
- **Wuhan**: Largest city in Central China with a population of 10.6 million in 2015
- **Phase 1**: 4 lines, 102 stations, 80 miles, 400 million annual ridership
- **By 2017**: 9 lines, 169.7 miles
- **By 2025**: 25 lines, 649 miles
- **Project Goal**: Leverage BIM technologies for asset lifecycle management throughout all phases including – planning, designing, construction, commissioning and operation.
- **Keywords**: Intuitive Business Transformation

2004

Enterprise Information Modeling Framework for Intelligent Rail Transportation Operation

- Four Key Components
  1. CAFM as the backbone for central data repository and daily operations
  2. GIS to visually manage lines/stations and other linear assets
  3. BIM as the platform to collaborate and serve as the source of asset data
  4. QR Code and RFID for asset tagging
- Integration with other Enterprise Data Sources

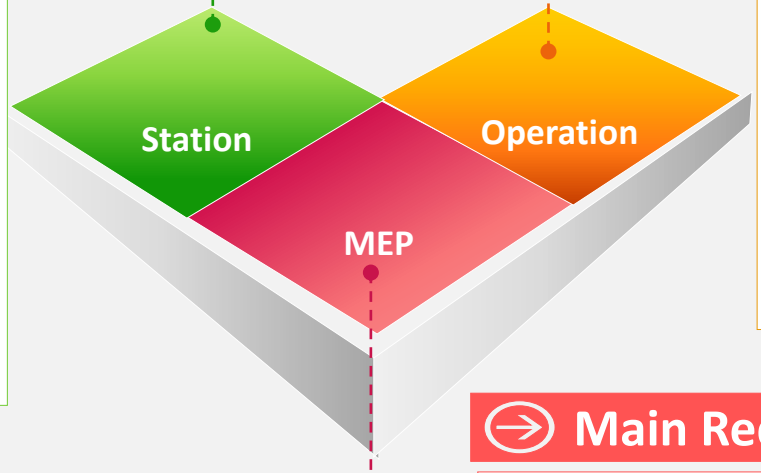
Problems Prior to EIM Implementation



Internal and External Business Needs

Main Requirements

1. Online Work Requests Reporting
2. Dynamic Reporting
3. Craftsperson Scheduling
4. Craftsperson Mgmt
5. Document Mgmt



Main Requirements

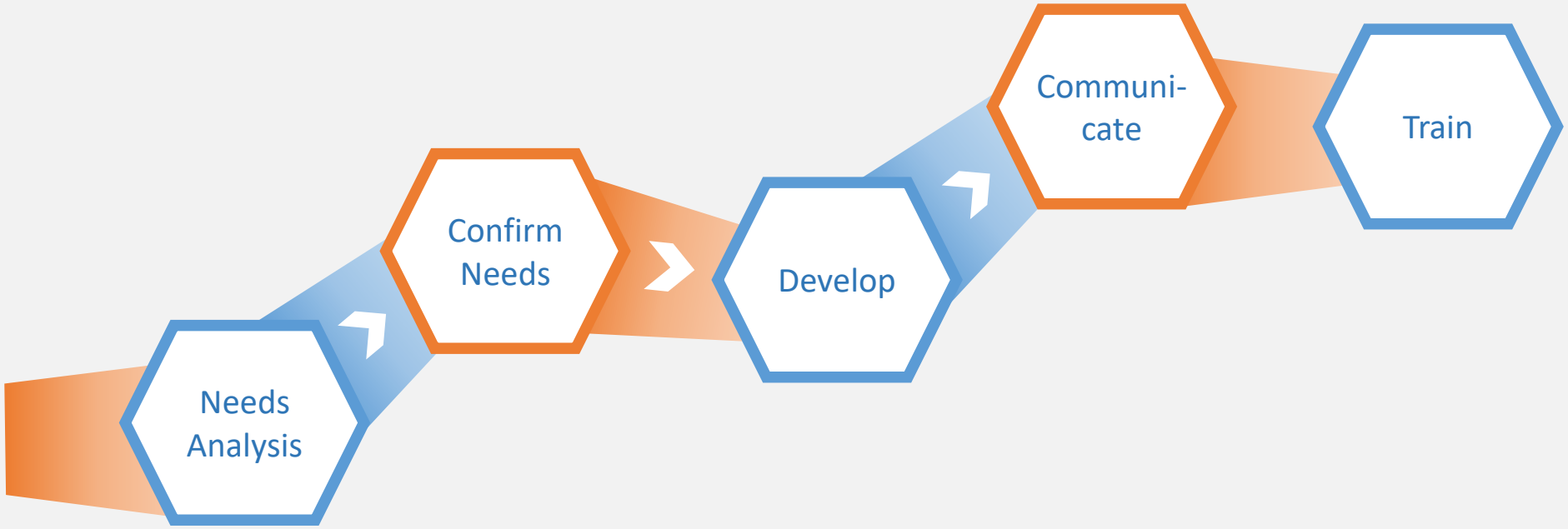
1.Proper Maintenance Procedures
2.Maintenance Process Tracking
3.Historical Data Tracking
4.Problems Analysis
5.Equipments Tracking

Main Requirements

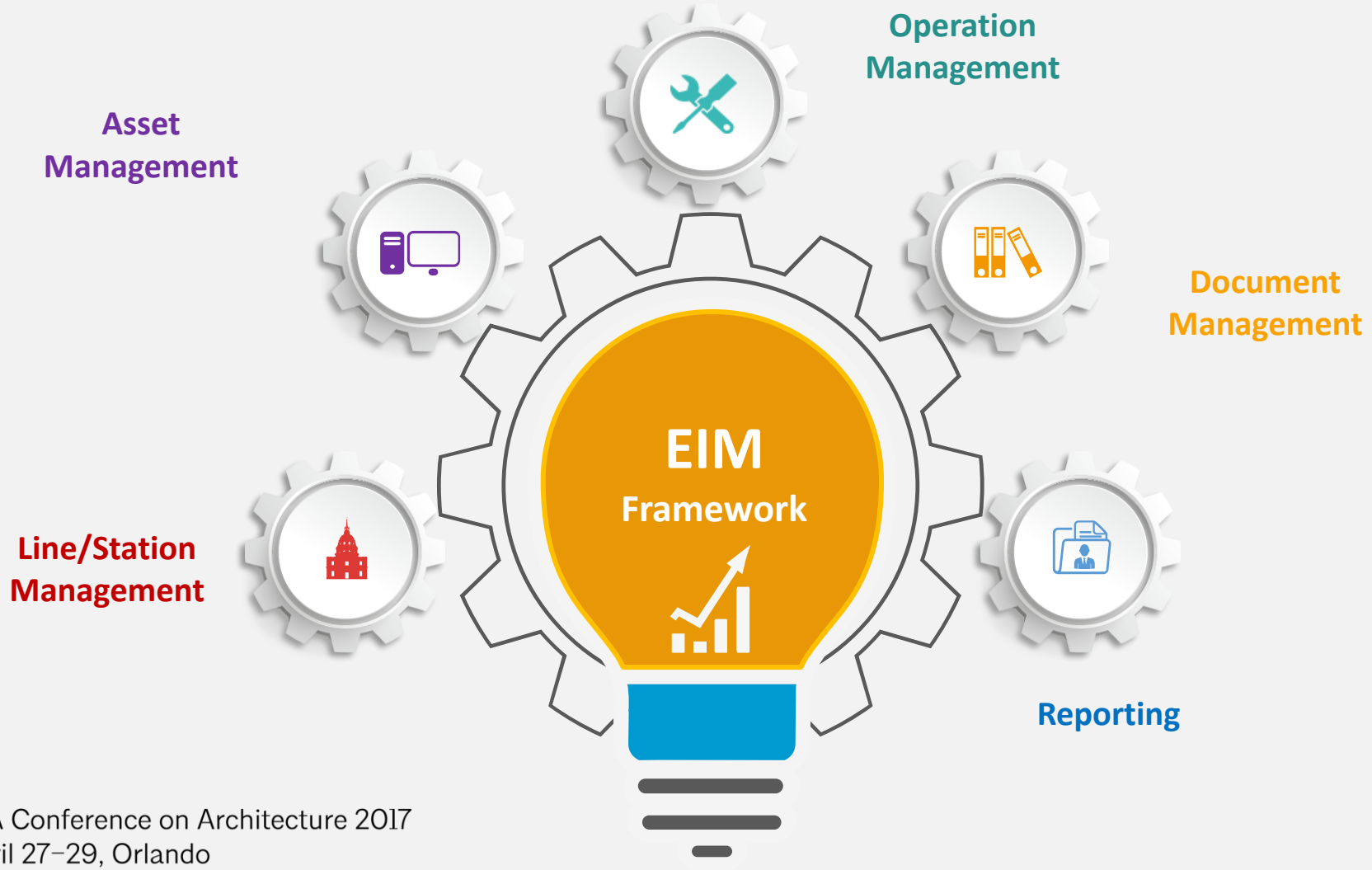
1.Historical Maint. Data
2.Mobile Deployment
3.MEP Problem Analysis
4.MEP Equipment Tracking
5.Retrieval of BIM drawings
6.Business Intelligence

Implementation Process

1. Needs Assessment
2. Align technical requirements with business needs
3. Data normalization and application customization
4. Agile development
5. Training and ongoing support

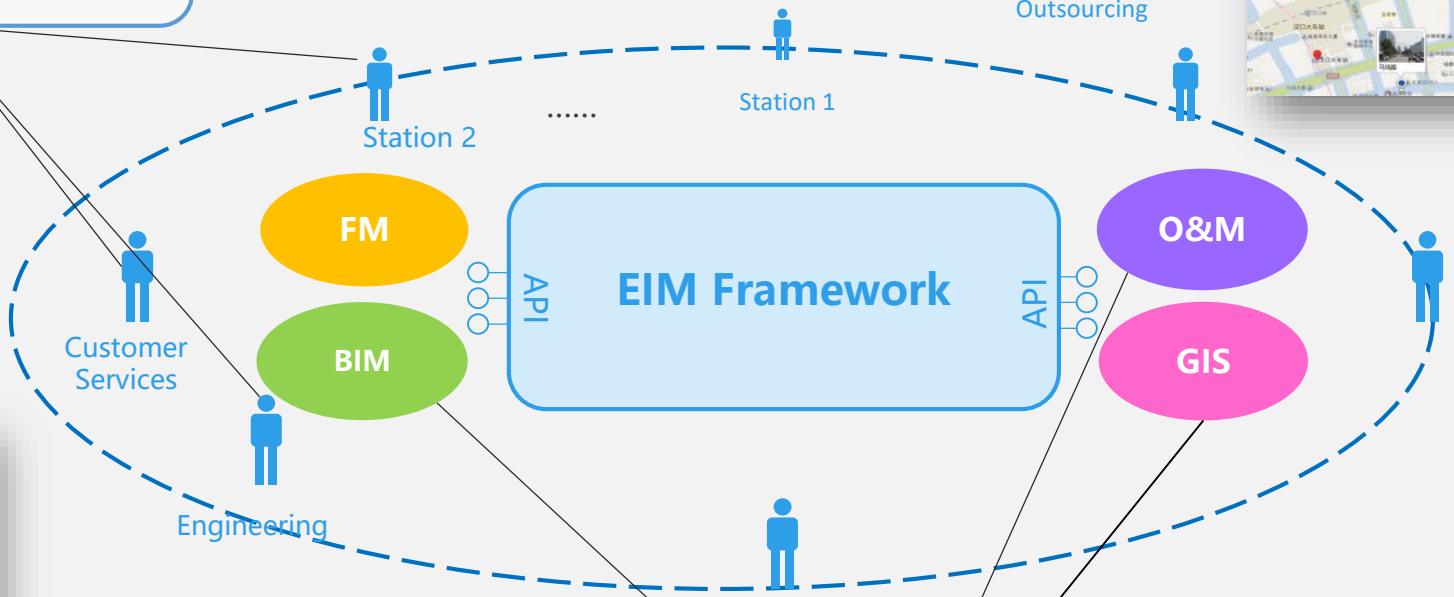


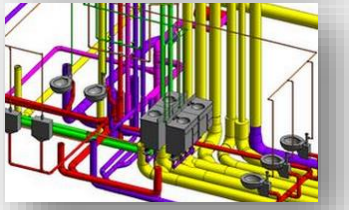
Five Major Functions



Better Collaboration and Integration

Collaborate among various departments





Inter-operable between various systems

A Video Is Worth A Million Words…

1.1 Line/Station Management Summary

Personnel Mgmt

1

- Organization
- Team
- Personnel
- Division./Dept

Space Mgmt

2

- GIS+BIM
- Room Layout
- Zone Layout
- Egress
- 360 Degree View

Space Analysis

3

- Space Assignment
- Space Occupancy
- Space Chargeback

- Improve Space Utilization Efficiency
- Automate Space Classification and Reporting
- Transparent Space Chargeback Process
- Support Space Strategic Planning

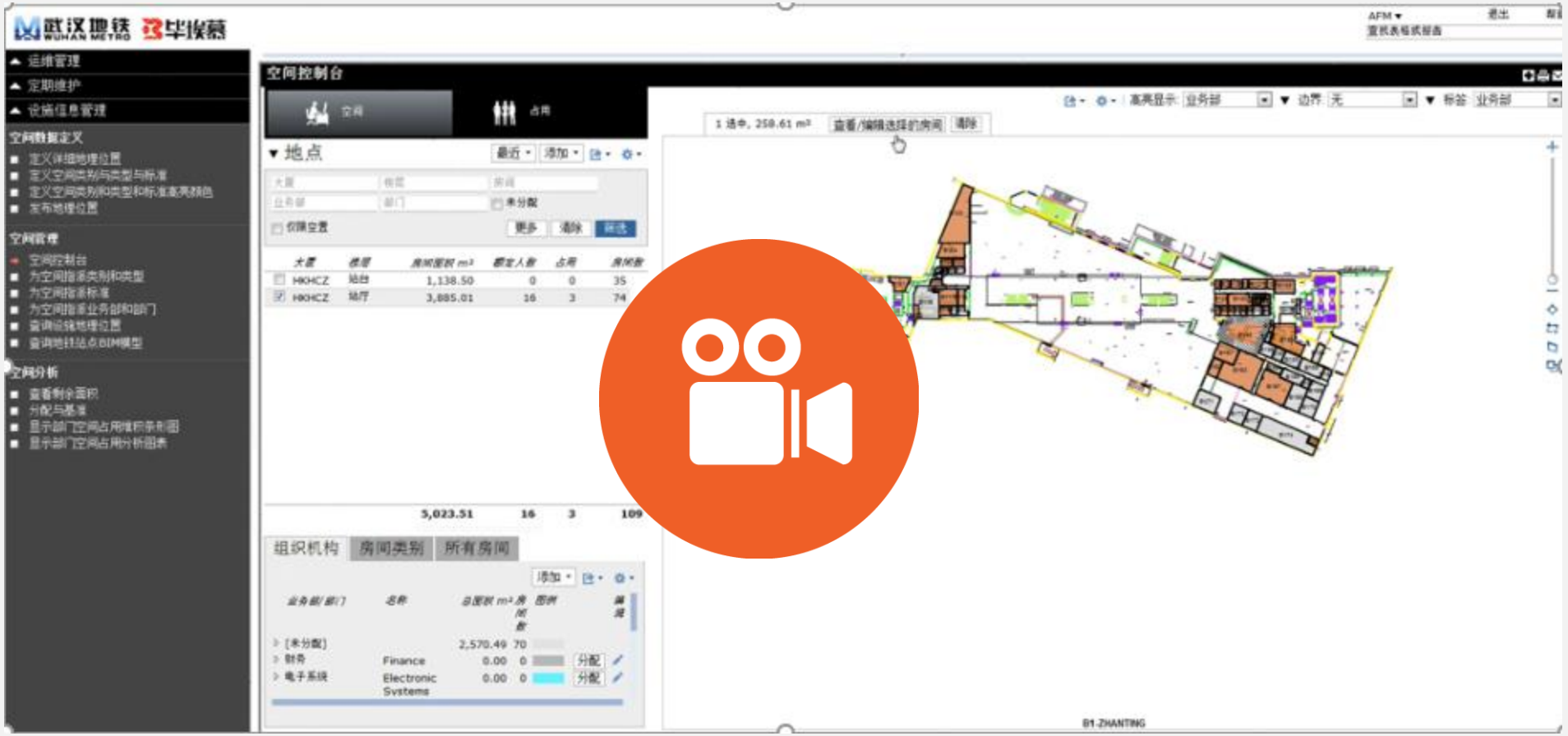
1.2 Line Station management – Personnel

- ✓ **Check personnel name, department, position and attaching team etc.**
- ✓ **Currently 3,000 employees, 20,000+ in the near future**

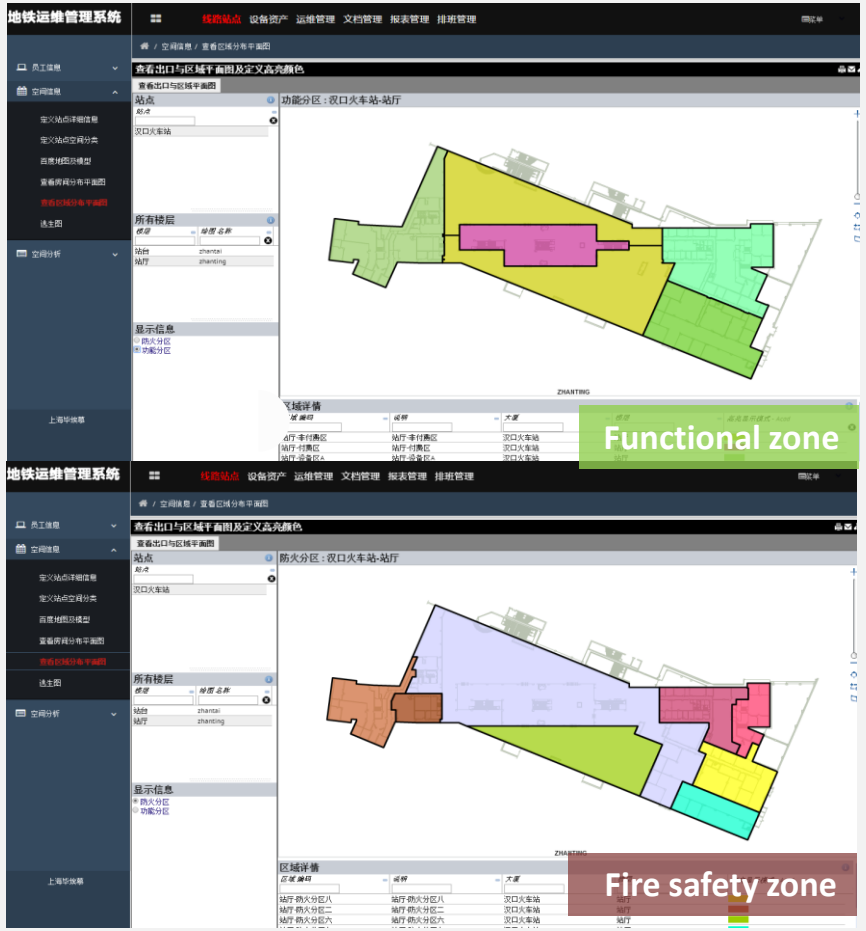
1.4 Line Station Management – Room Management

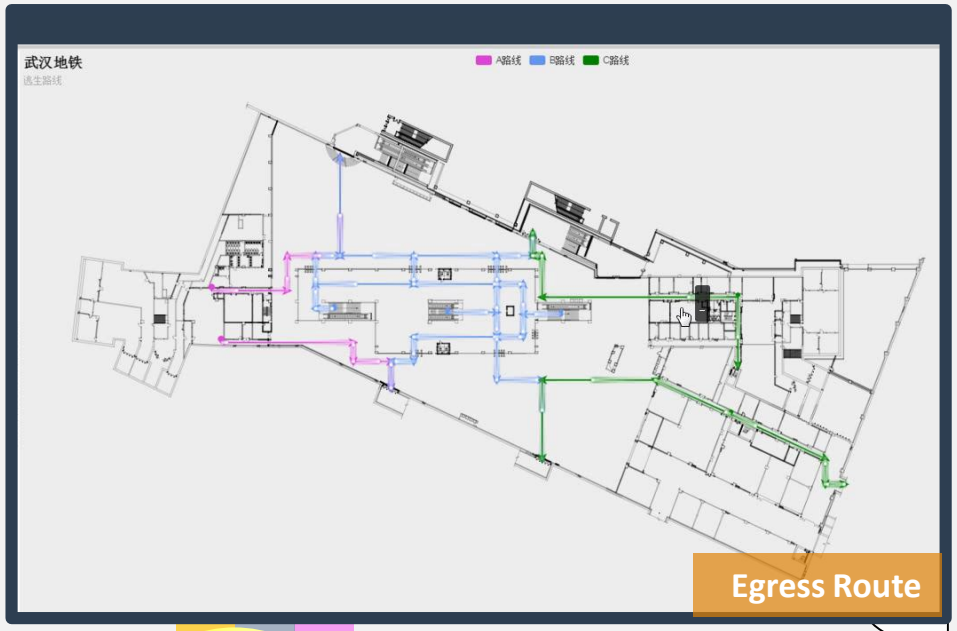
✓ **Room Layout with 360 degree view**

1.5 Line Station Management – 360 Degree View



1.6 Line Station Management – Space Management

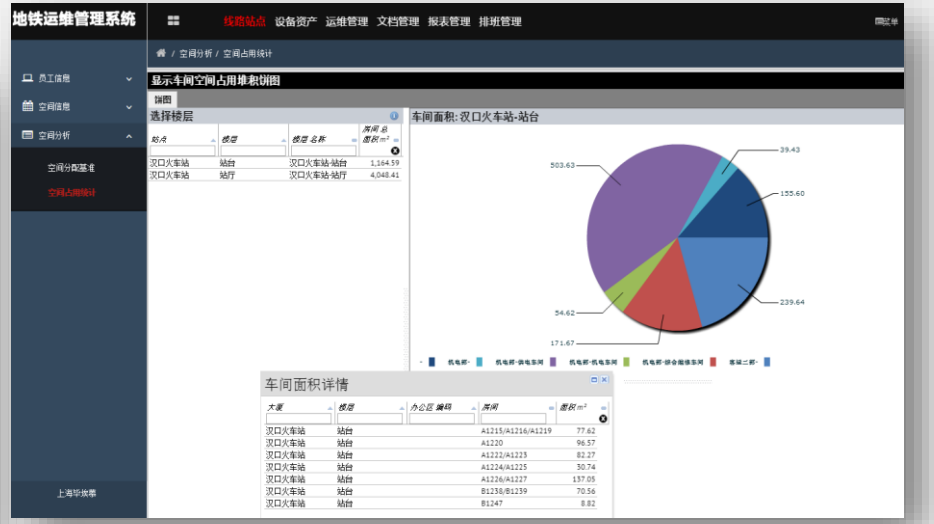




Space Mgmt

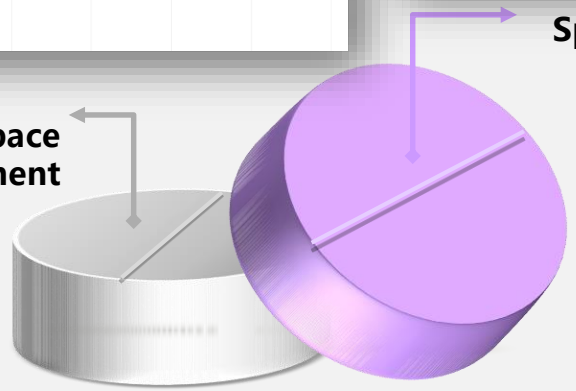
- ✓ Fire safety zone
- ✓ Functional zone
- ✓ Egress route

1.7 Line Station Management – Space Assignment and Analysis



Space Analysis

Space Assignment



Better Space utilization calculation to improve space occupancy

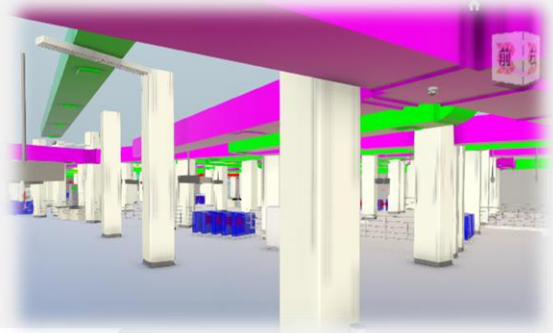
2.1 Asset Management Summary

- Better Data Capture
- Faster WR reporting

RFID Integration

- 3D VR functionality
- 3D Virtual Tour

3D Display



BIM Integration

- 3D Display
- BIM Model in operation
- EIM Framework

Asset List

- Asset Tracking
- Asset BIM Model

Service Provider & Supplier Mgmt

- Performance Assessment
- Service Providers Tracking

2.2 Asset Management – Use of RFID

Sensing

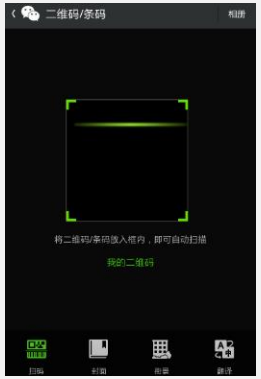
Mobile Scanner

RFID

Retrieve Maintenance Historical Records

Quick Response to Work request

2.3 Asset Management – Use of QR Code

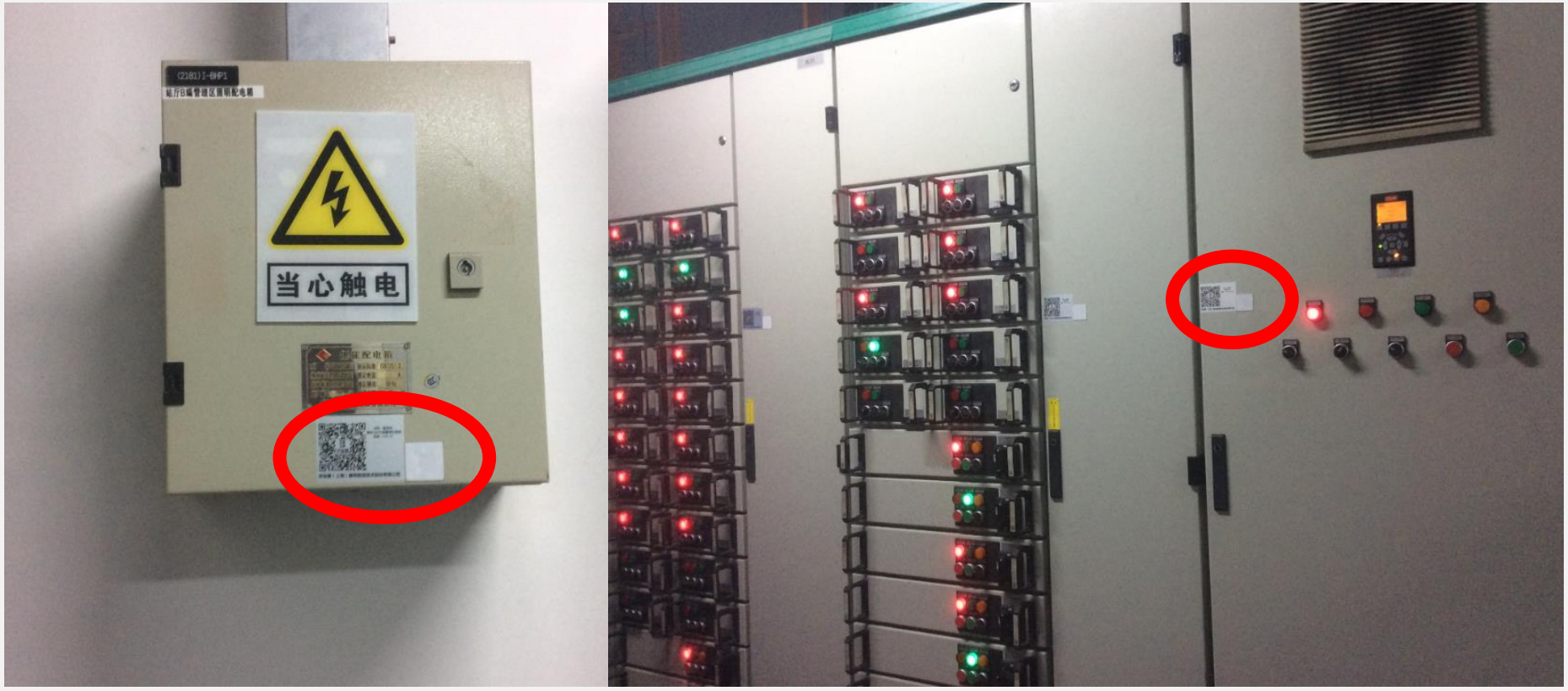


Scan via QQ or WeChat

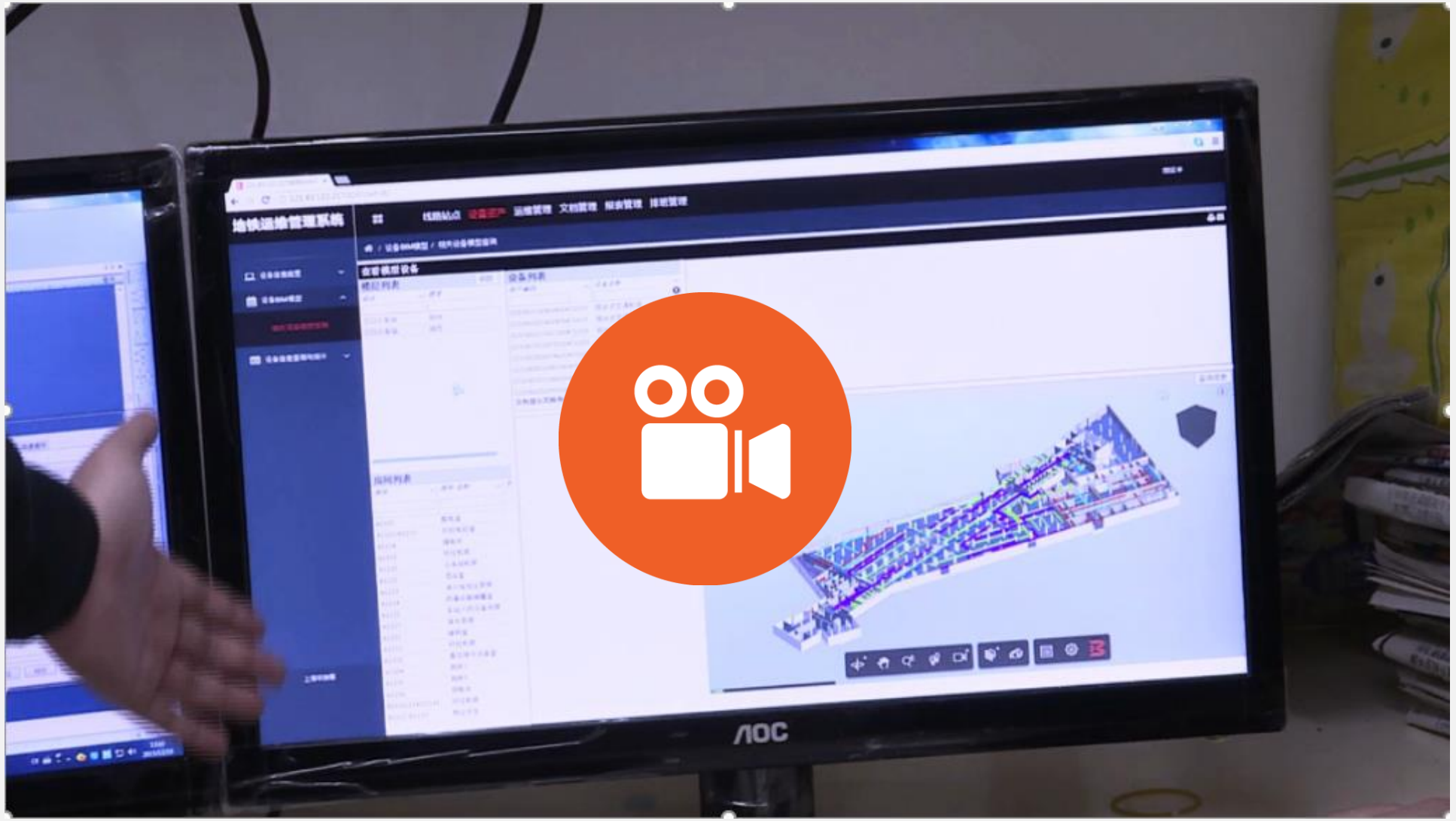
QR Codes

- **Retrieve Maintenance Historical Records**
- **Prompt Response to Work Request**

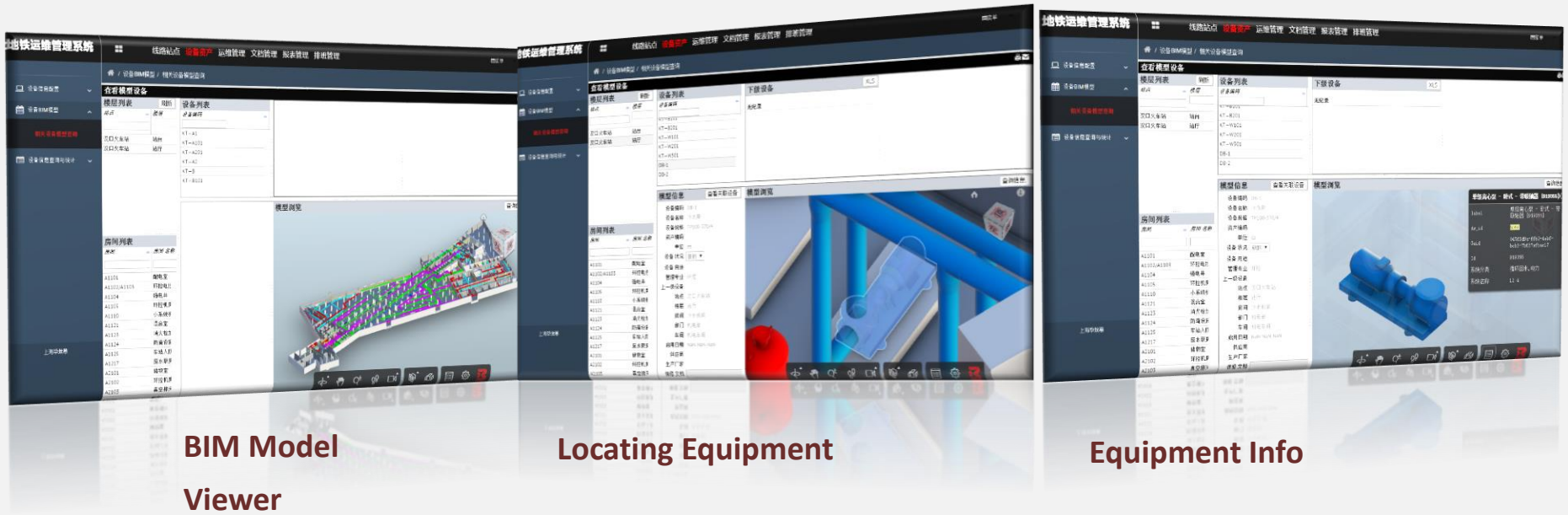
2.4 Asset Management – Both RFID and QR Codes



2.5 Asset Management – Creation of RFID/QR Code



2.6 Asset Management – Equipment Tracking



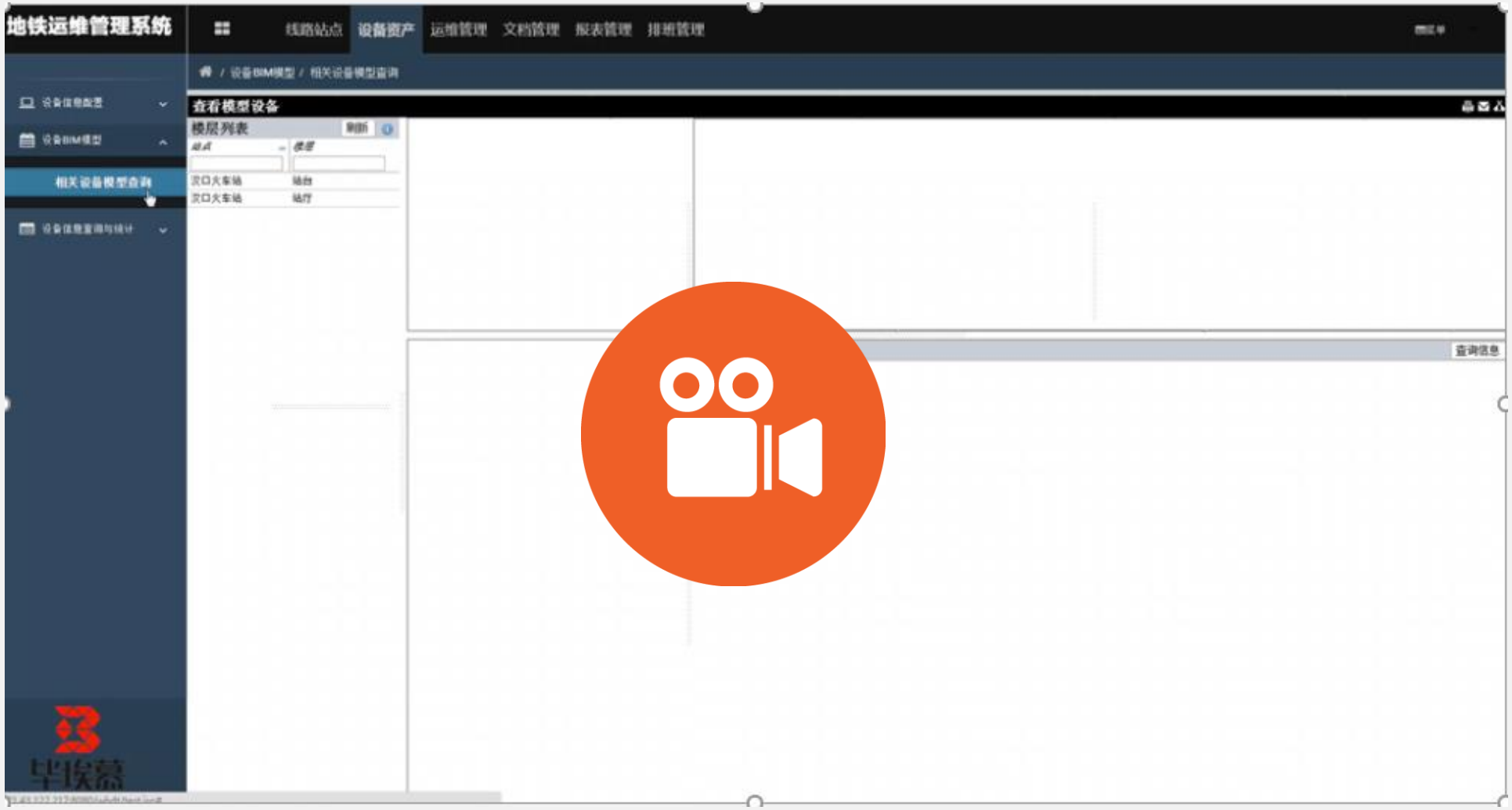
BIM Model Viewer

Locating Equipment

Equipment Info

- ✓ Model Browsing with virtual tour
- ✓ Equipment Info Retrieval via BIM model
- ✓ Equipment Location with Document Management
- ✓ Equipment Isolation from others for better analysis

2.7 Asset Management – Yet Another Video



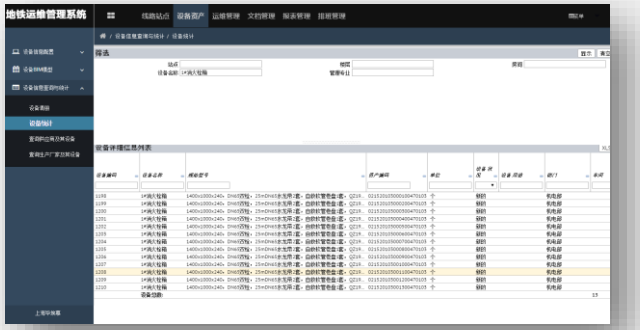
2.8 Asset Management – Query and Statistics

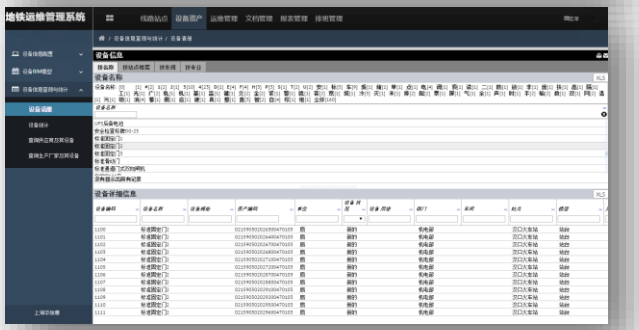
01 **Asset List**
By Asset ID, Category, Floor etc

02 **Asset Statistics**
Standard statistical reporting format

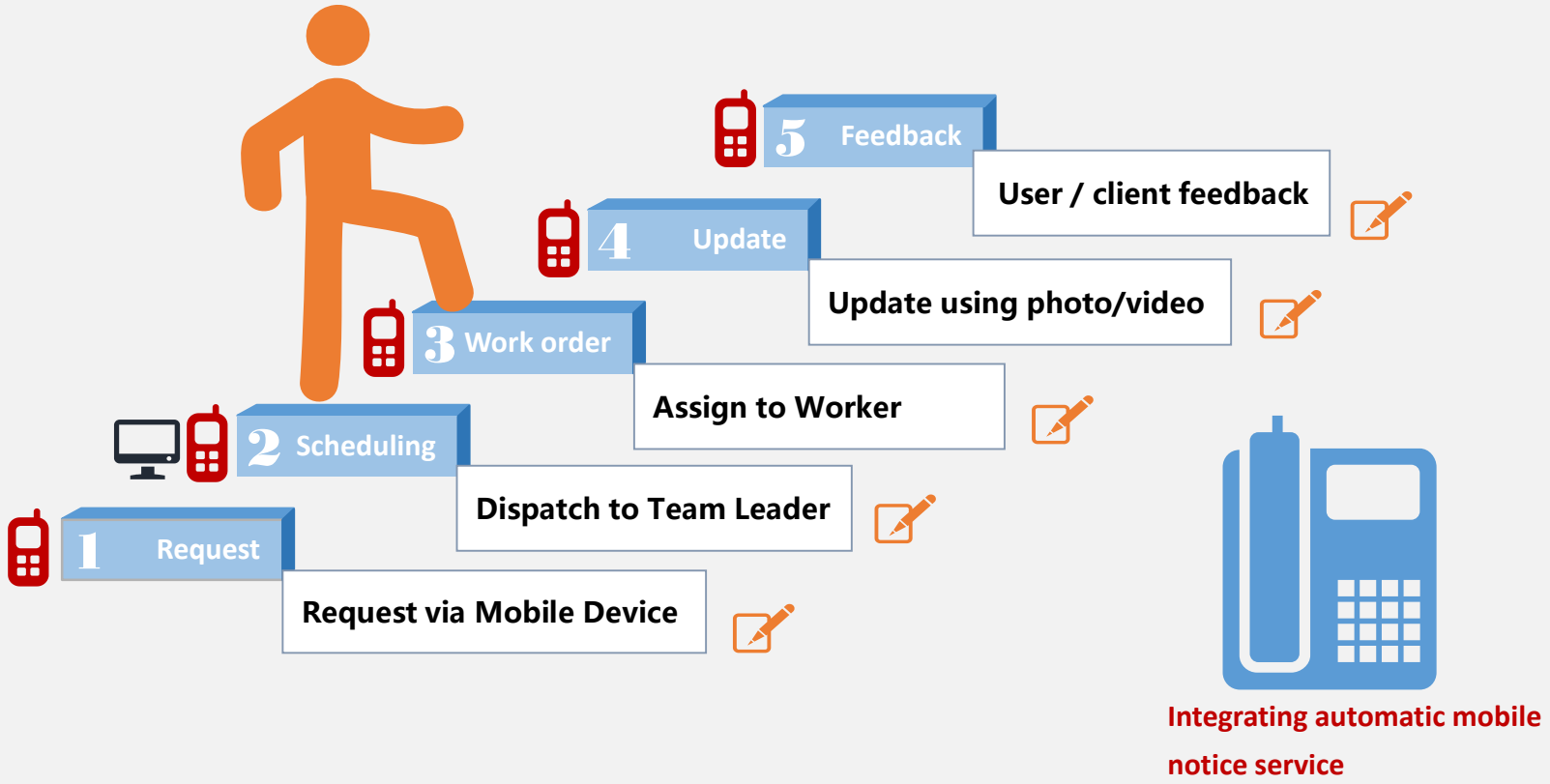
04 **Service Provider Management**
By Service providers with associated assets for performance assessment

03 **Vendor Management**
By vendor with associated assets for performance assessment

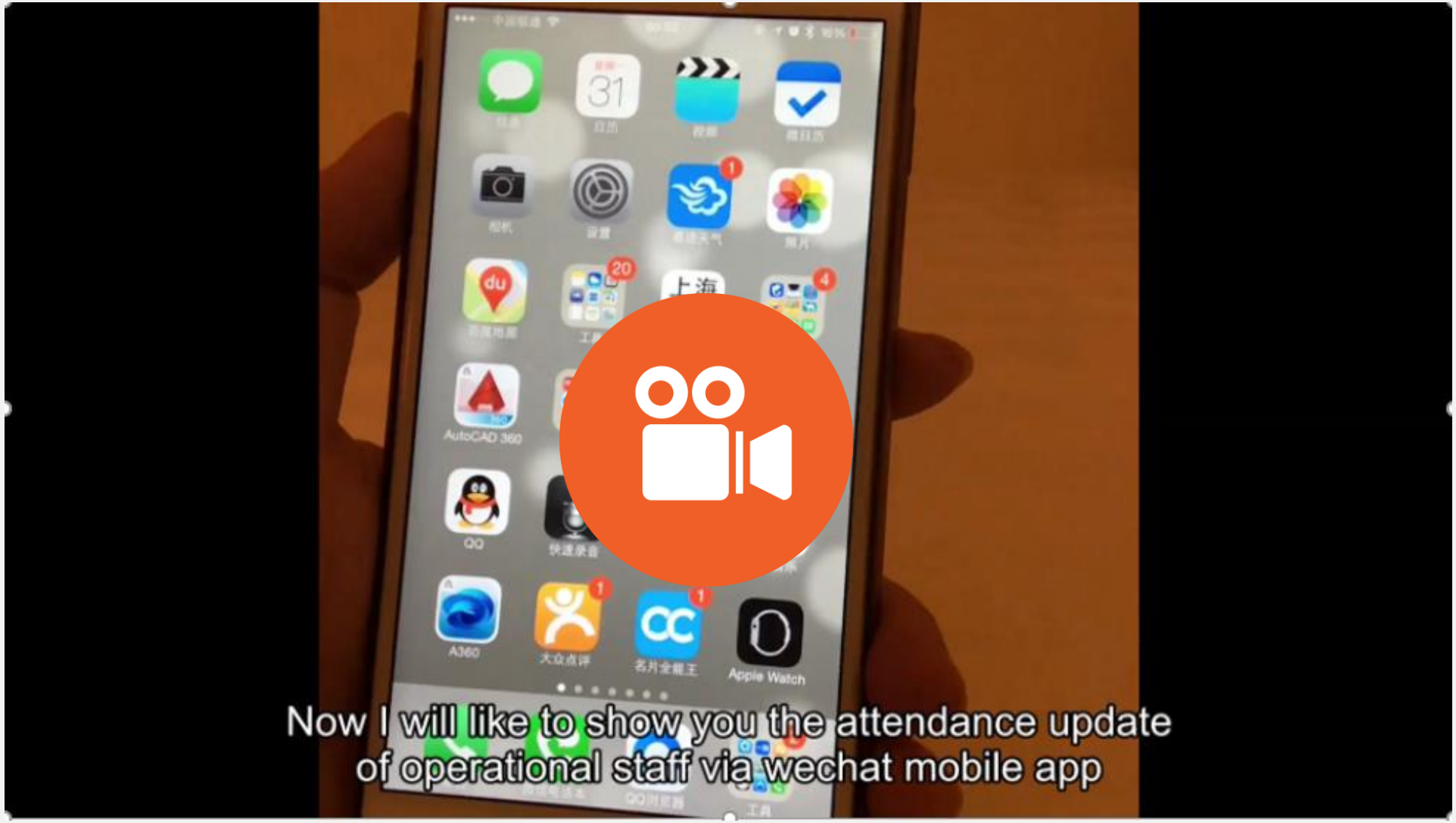




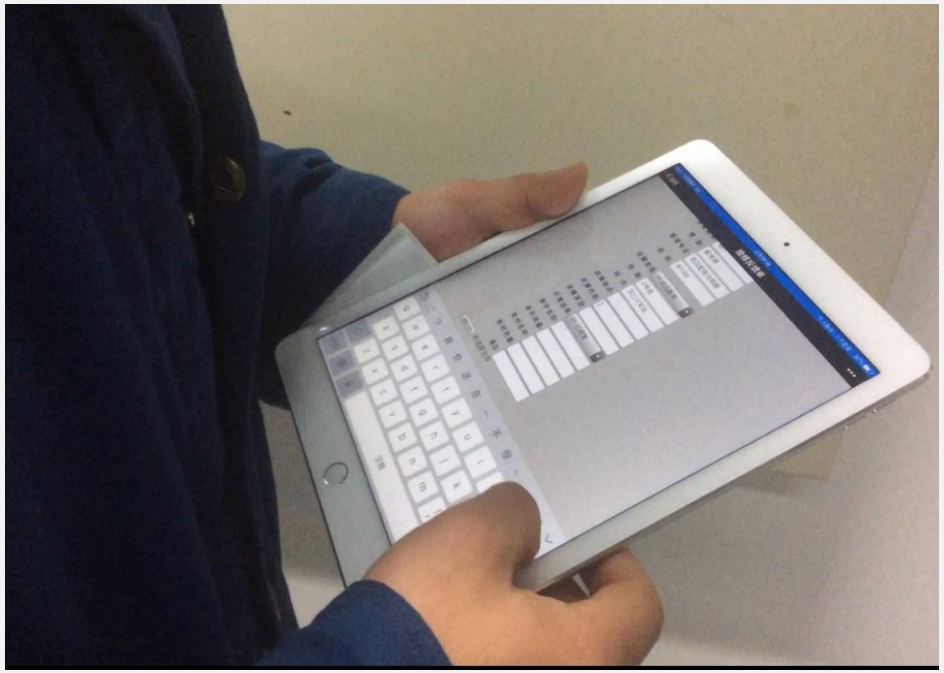
3.1 Operation Management – Workflow Summary



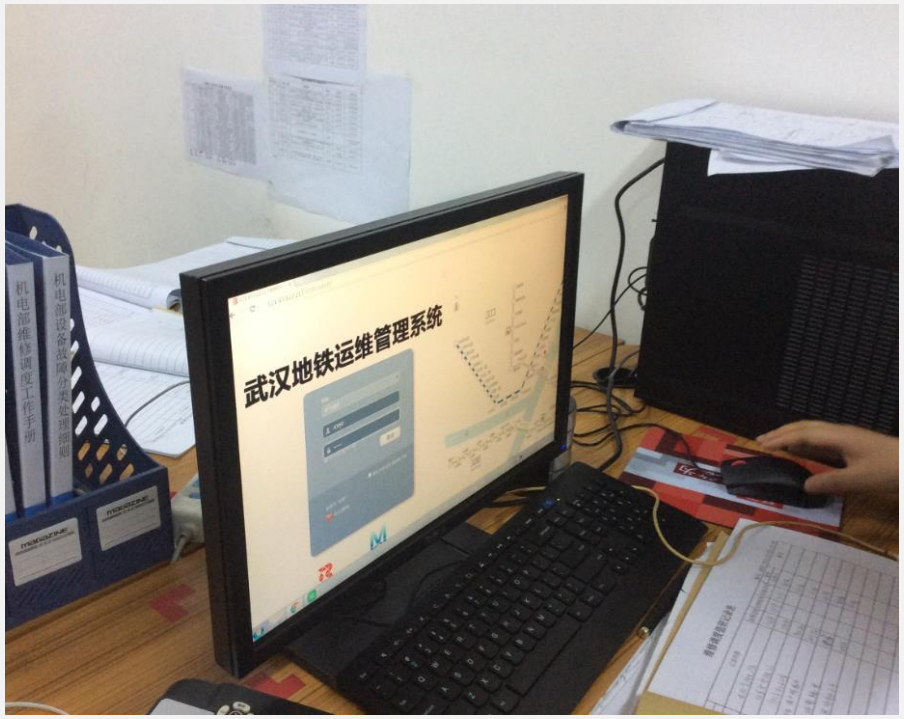
3.2 Operation Management – Demo on Cellphone

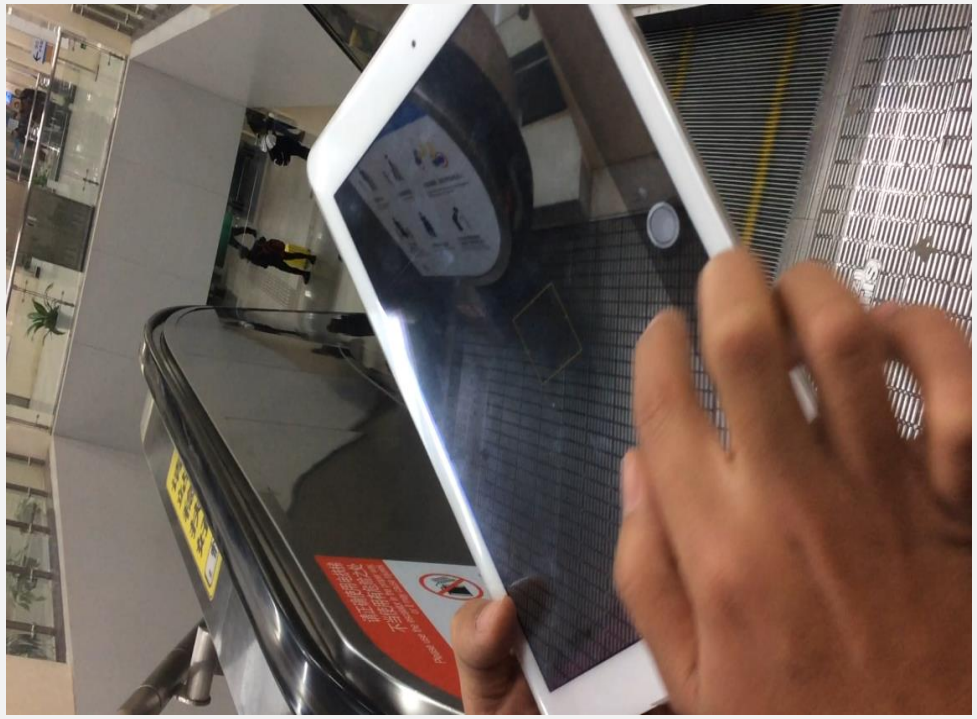


3.3 Operation Management – Submit Work Orders

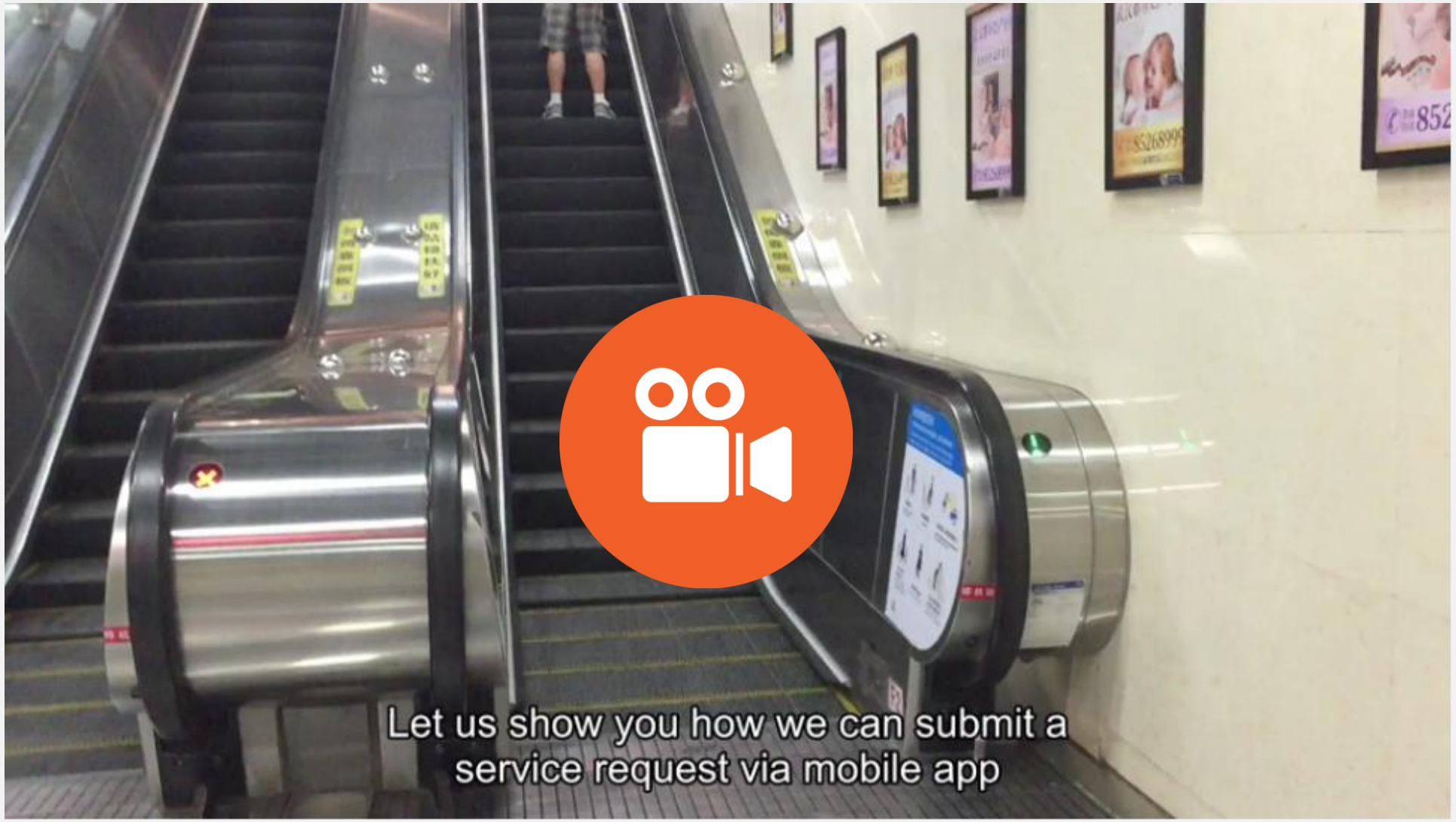


3.4 Operation Management – Instant Syncing

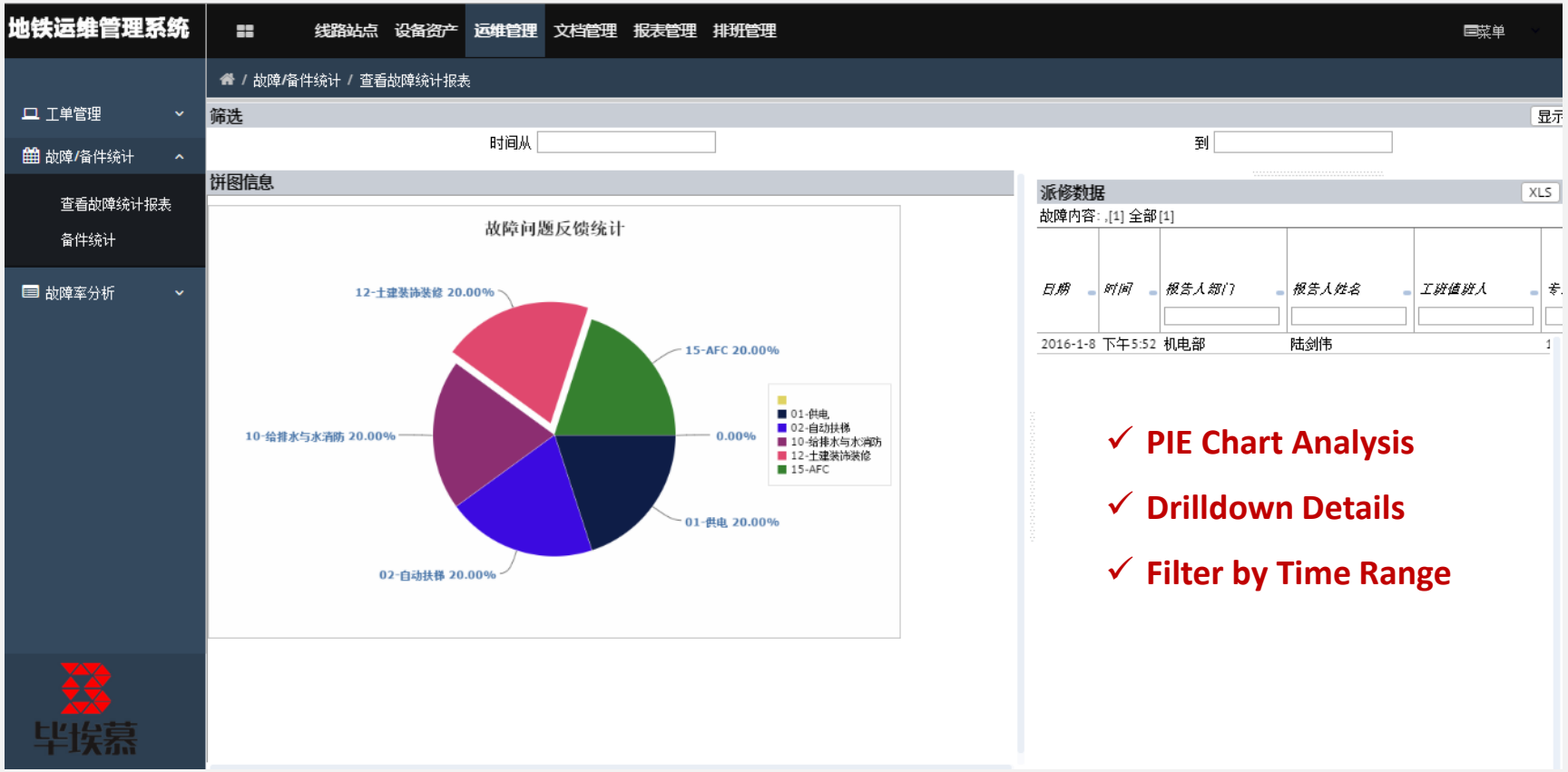




3.5 Operation Management – Quick Demo Video



3.6 Operation Management – Analytics



- ✓ PIE Chart Analysis
- ✓ Drilldown Details
- ✓ Filter by Time Range

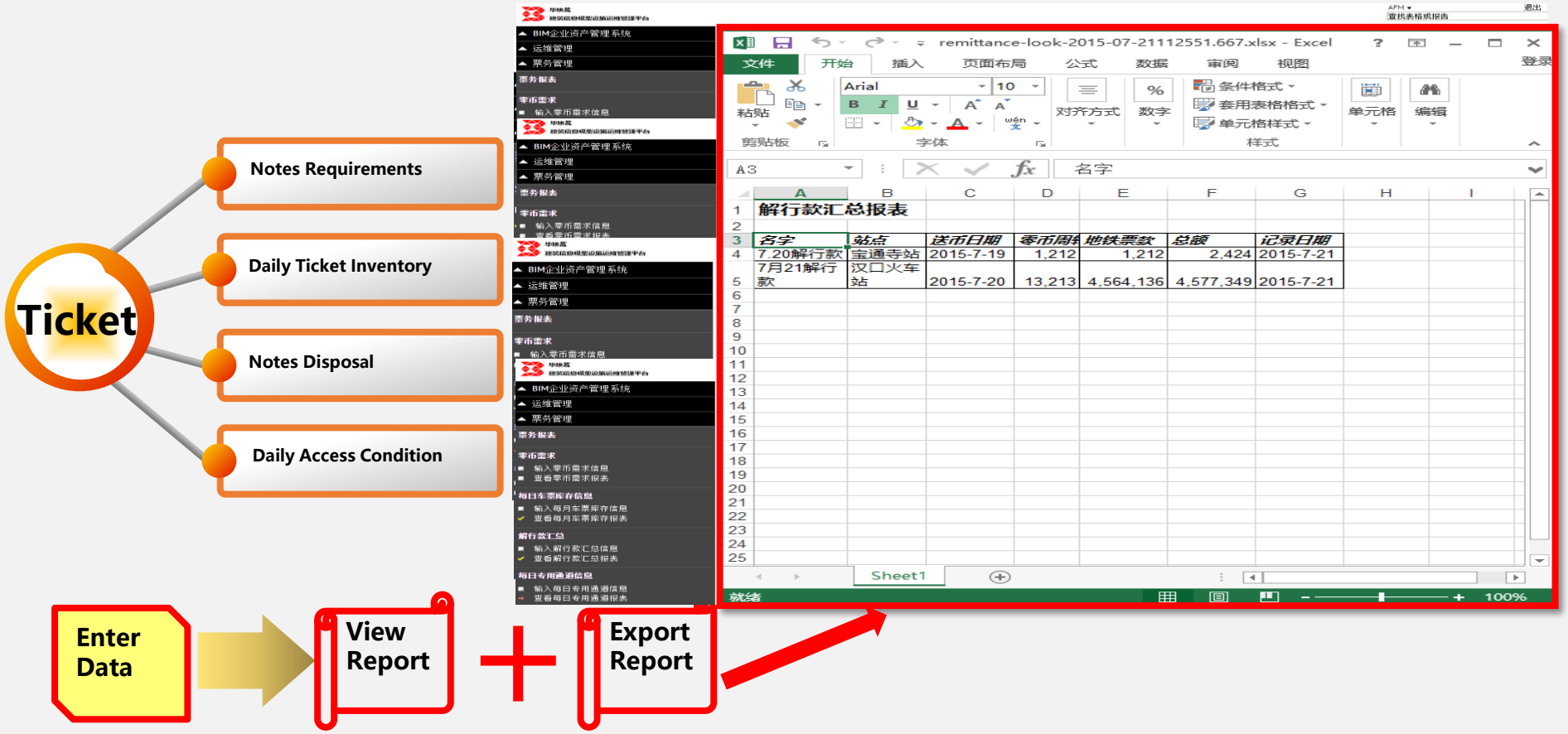
3.7 Operation Management – Response Time Measurement

- Automated Response Time Calculation
- Dynamic and Efficient

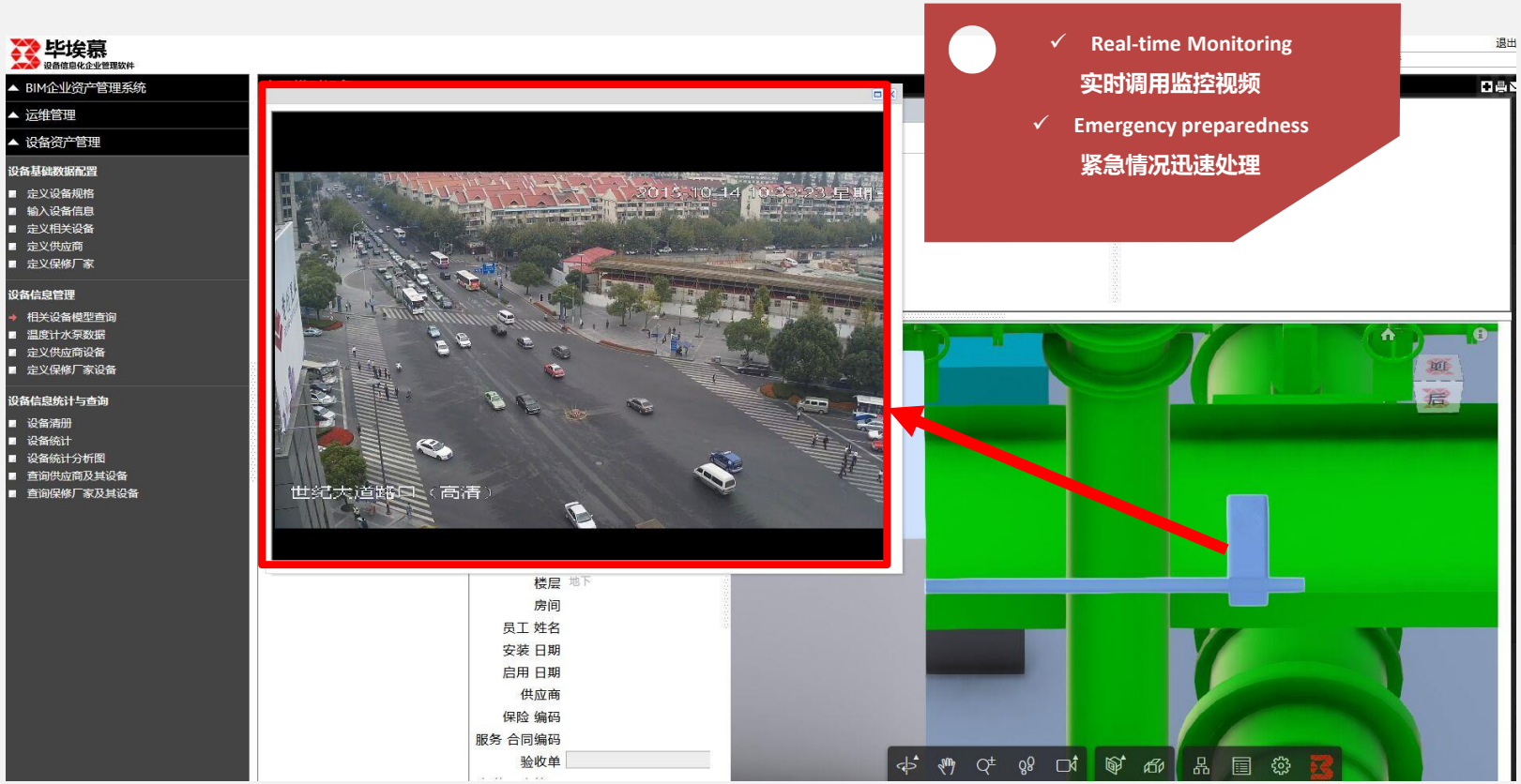
- Analyse by Month
- Good for Analytical Statistics

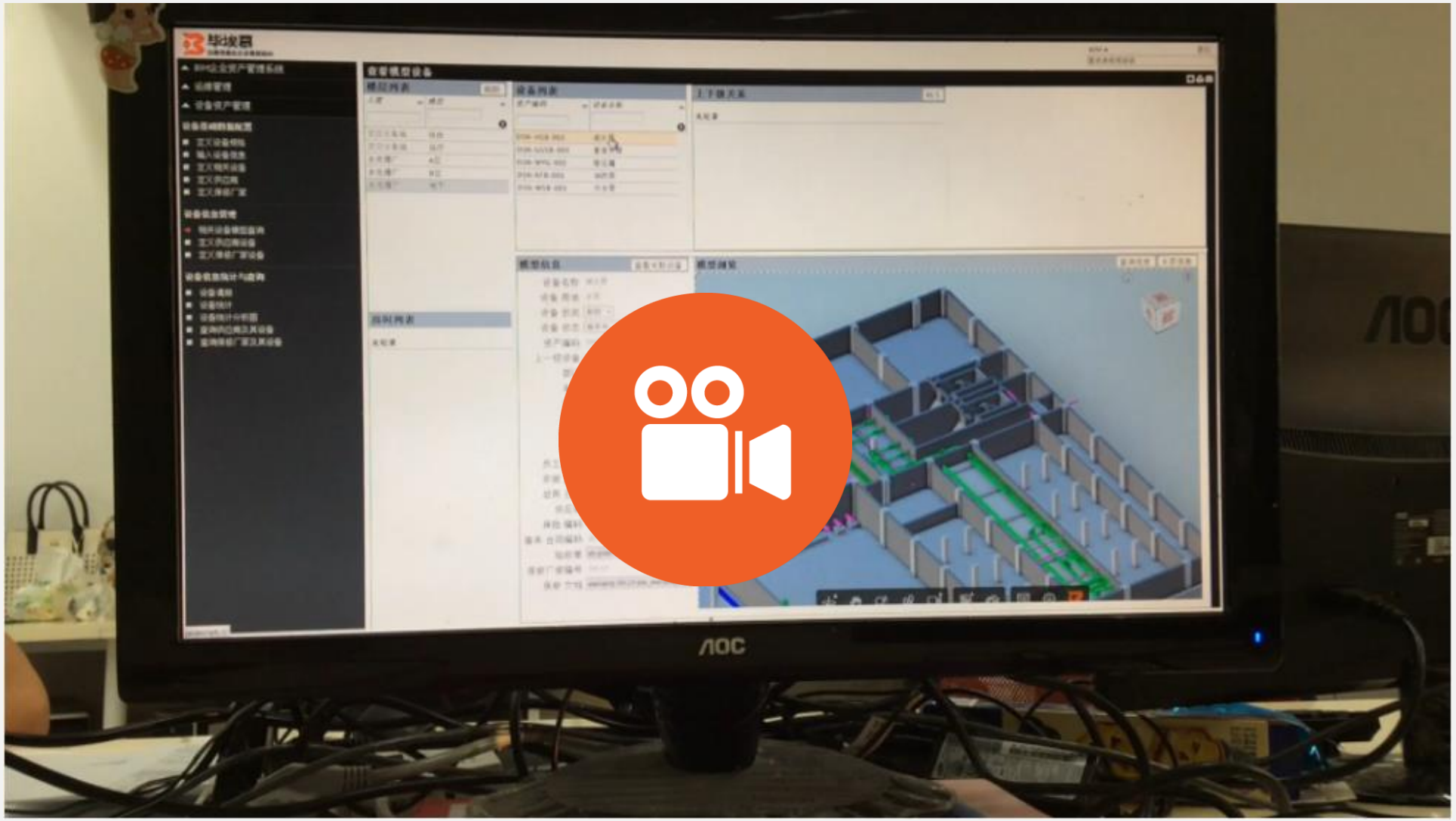
4.1 Other Features – Document Management

4.2 Other Features – Integration with Ticket Sales Mgmt



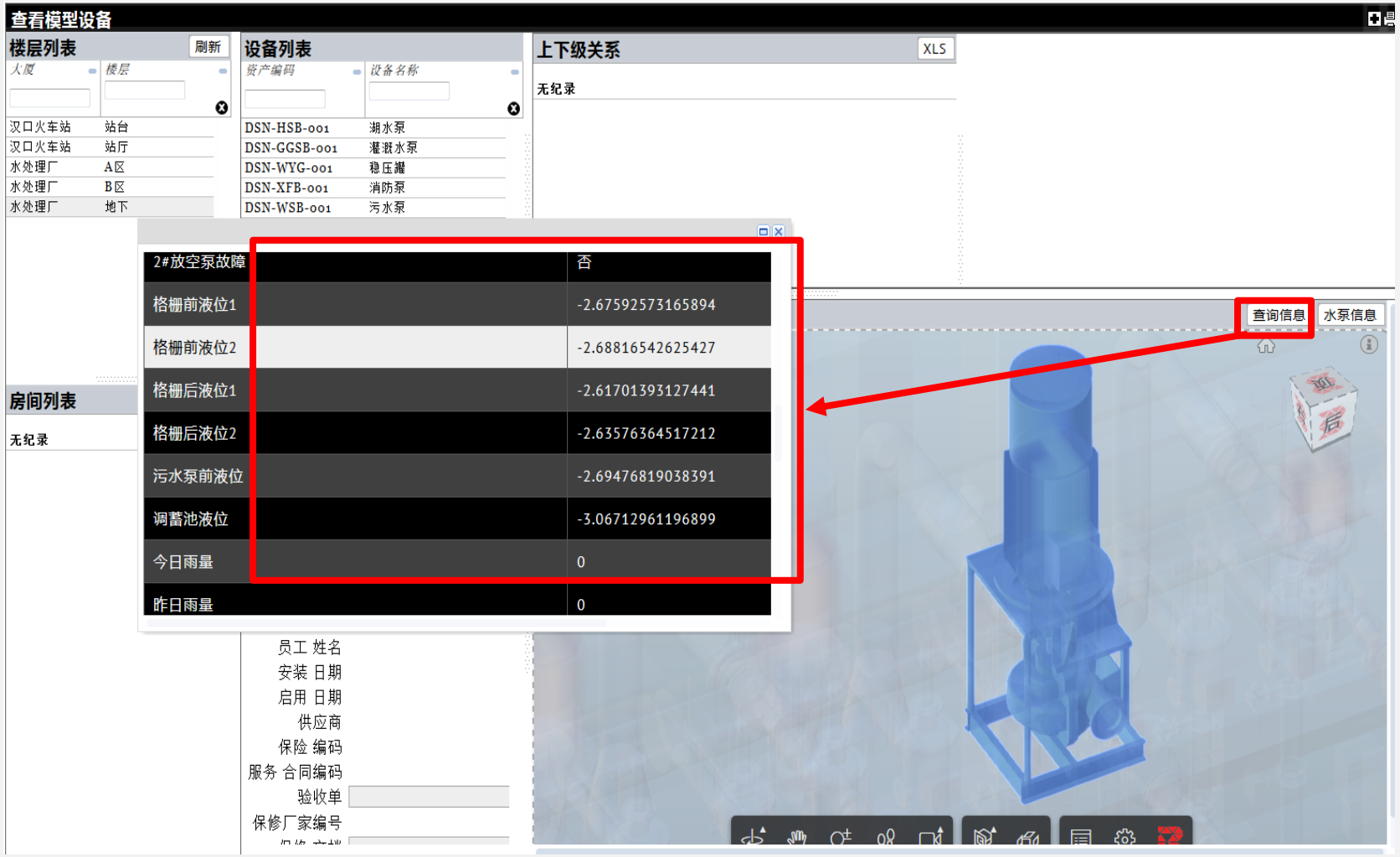
4.3 Other Features – Surveillance Camera Streaming



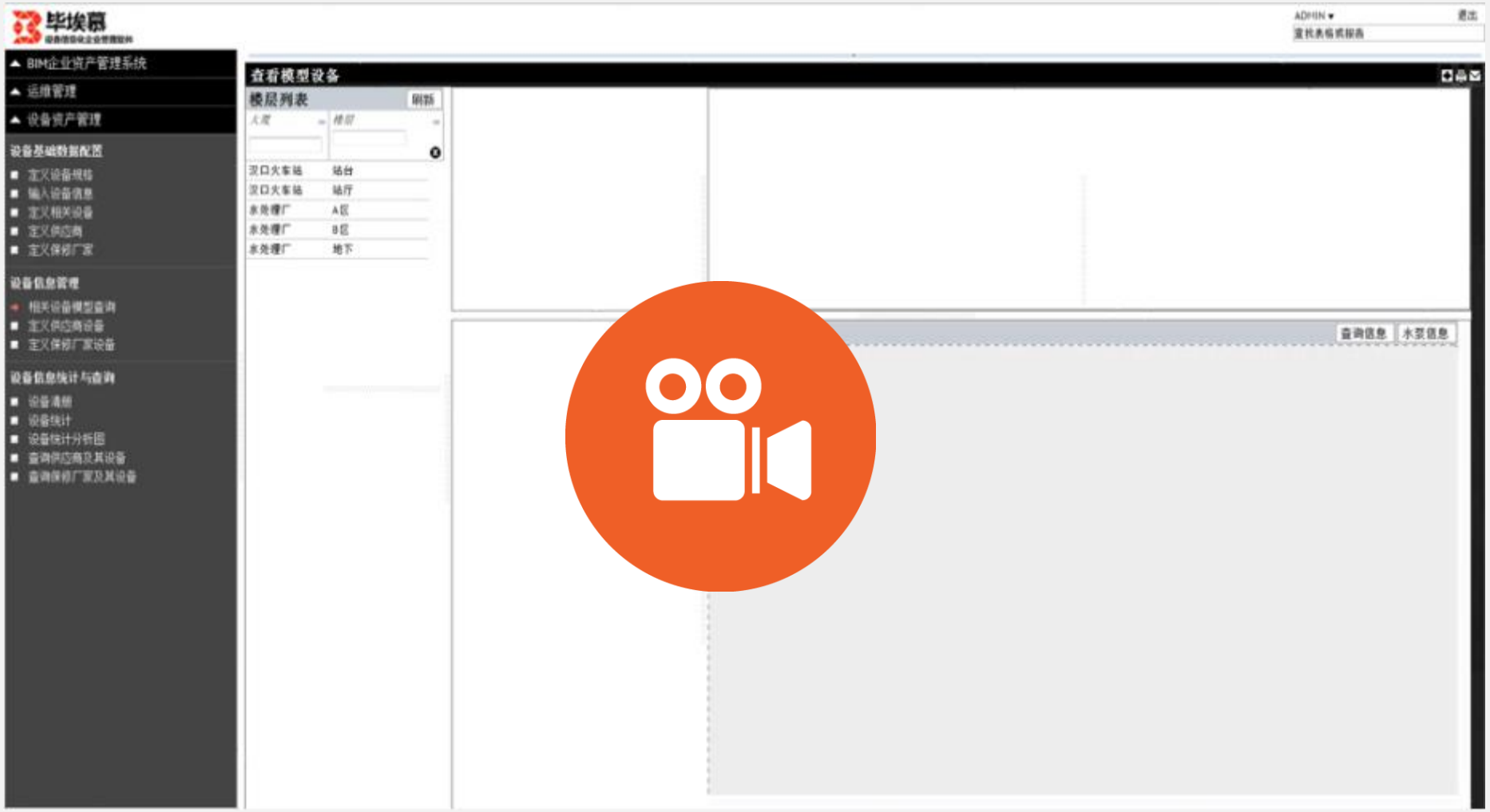

AOC

4.4 Other Features – IoT Integration for Air Quality Monitoring

4.5 Other Features – BAS Integration

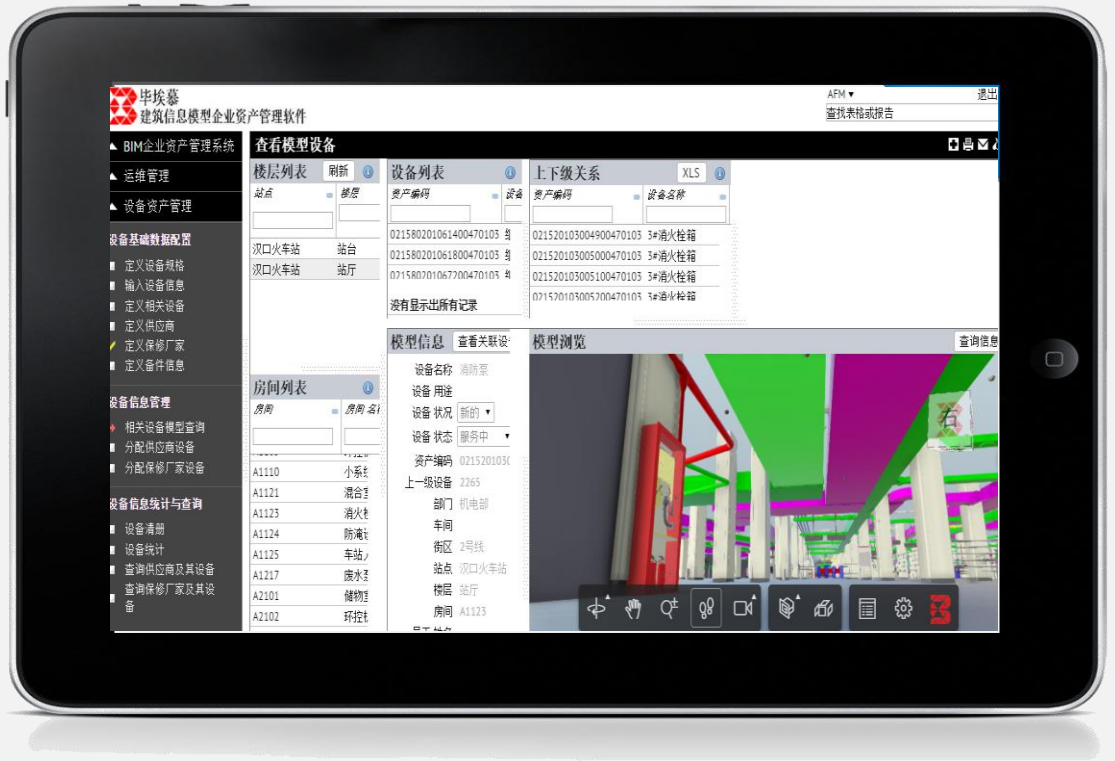


4.6 Other Features – Centralized Web Portal



4.7 Other Features – Powerful Mobile Model Viewer

- **Access by iPad，iPhone，Android Phone, Notebook/Laptop Anytime Anywhere**
- **3D visualization via touch screen**
- **Instantaneous Data at your finger tip**
- **Clearly defined roles & responsibilities of each personnel**




毕埃慕
建筑信息模型企业资产管理软件
ADMIN
退出
查找表格或报告
Show
线路
KPI
站点列表
站点
Model
Model
100
90
80
70
60
50
40
30
20
10
未知
其他
办公室
多功能房
数据中心
地图
卫星
三维
全景

4.7 Other Features – Mobile App Suite

e-mobile

APP

Work Request

Work Order

Repair Update

Self Repair

Online Training

Smart Robot

Monitoring

Construction Planning & Process

Challenges We Encountered

- Change Management

  Strategy : TOP-DOWN Pushing

- Existing Management Problem

  Strategy : Help to suggest to establish standards and best practices with solution

- Redundant and Inconsistent Processes

  Strategy : Reconcile Processes and Establish Unified Workflow

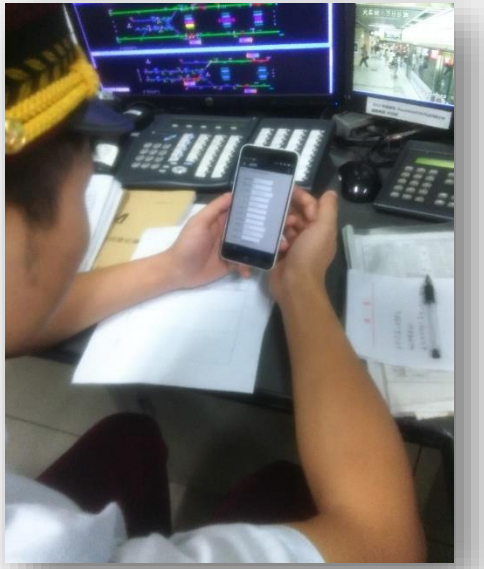
- Hardware & Software are operating as islands with little

  Strategy : Automate and integrate hardware & Software in meeting operational requirements

Before And After – Work Request

Before

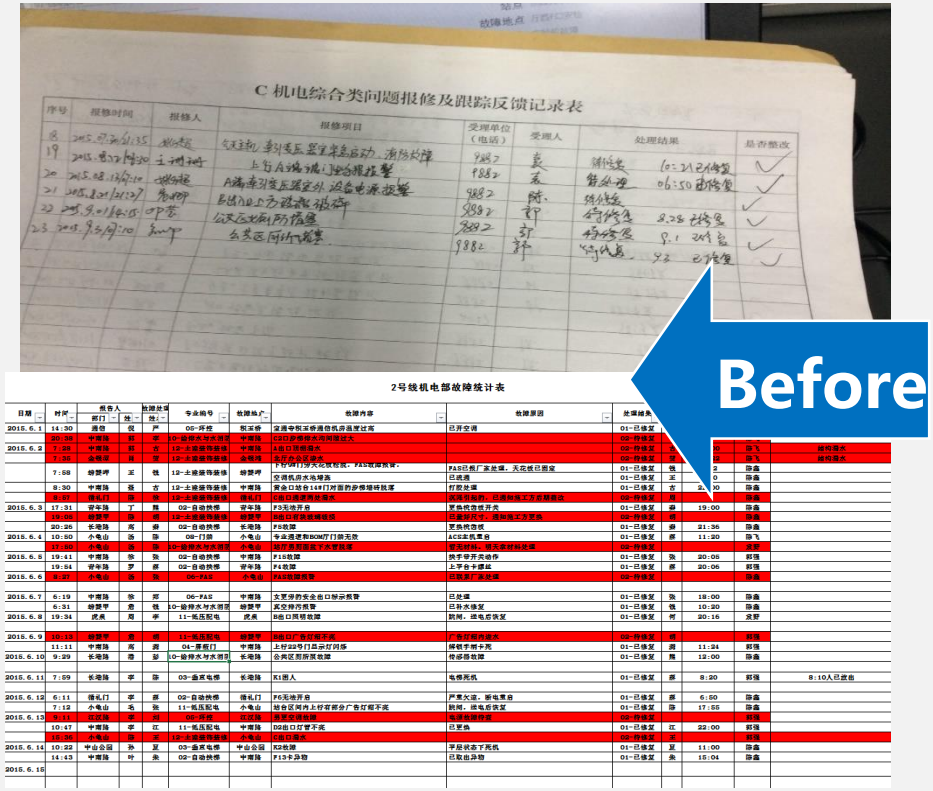
EIM Framework

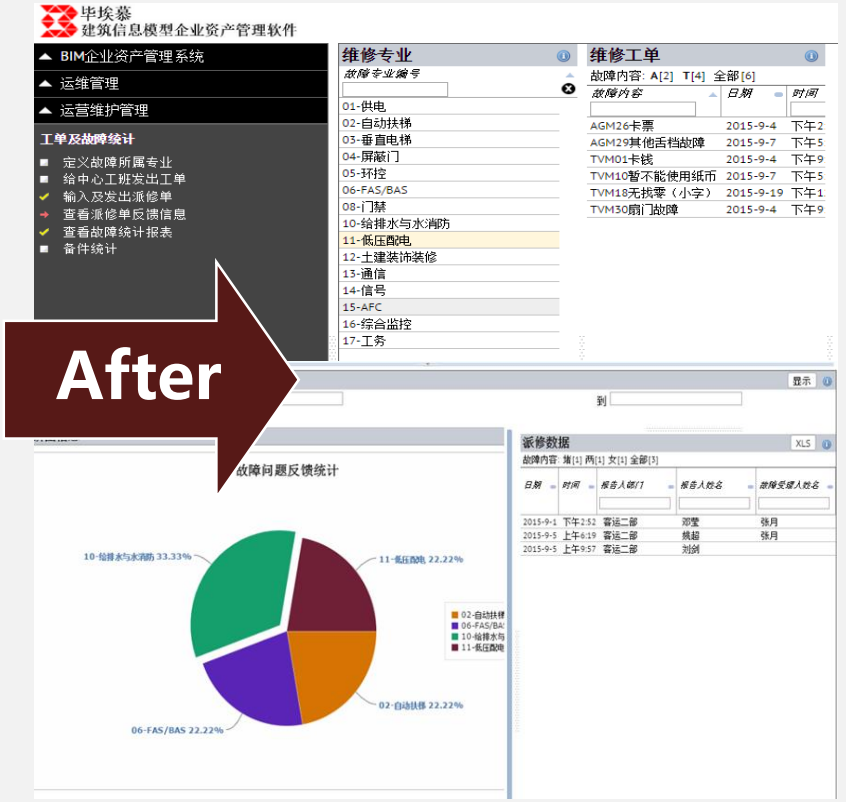


After

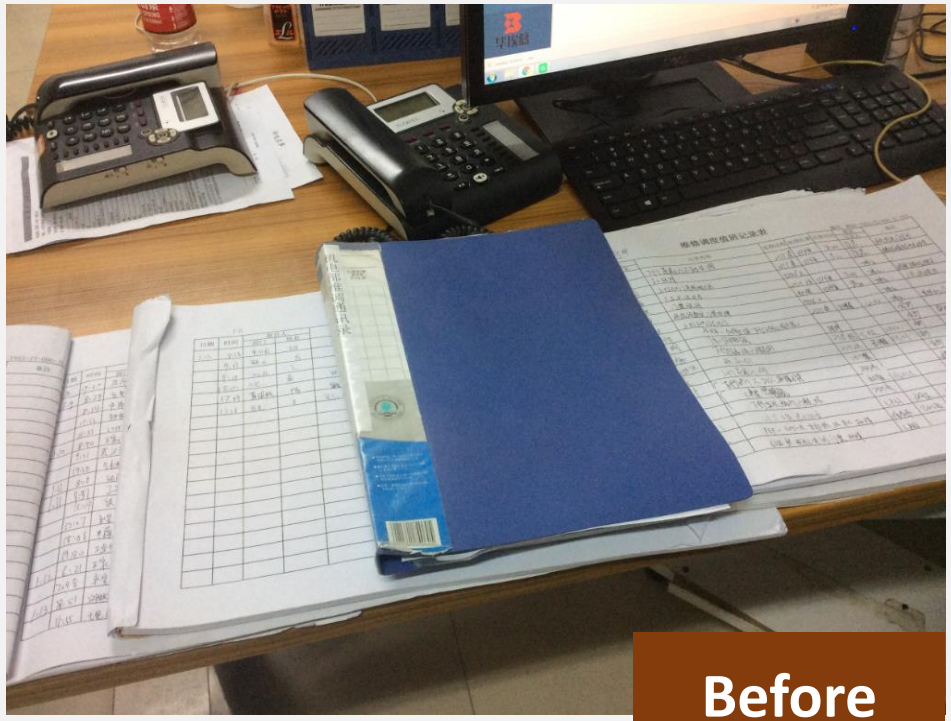
Deployment of Technology is a "MUST" for Facilities Management

Before And After – Record Tracking





Before And After – Document Management



Before

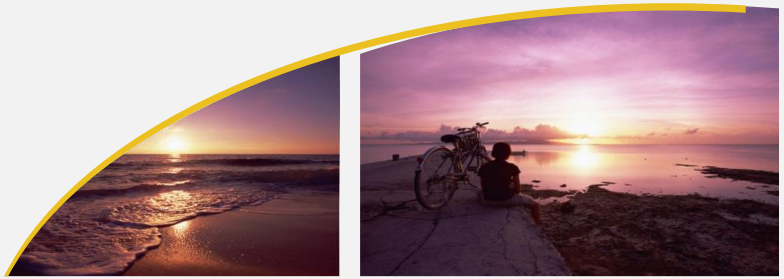
After

SUMMARY

EIM Framework

EIM

- ✓ 70% of BIM value is realized in operation management using EIM
- ✓ EIM framework enabled operation to be part of BIM data collaboration during Design and Construction stages
- ✓ Expanded visibility of FM and established standards & best practices
- ✓ Automated real-time property and asset management which has helped to optimize resources utilization
- ✓ Non-disruptive change to the existing workflow



Contact Information

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314-445-9529

Speakers List

- Chris D’Souza
  - Product Marketing Manager, ARCHIBUS Inc., Boston, Massachusetts
- Nick Jiang
  - President, ARCH Building Data Solutions, LLC, Chesterfield, Missouri
- **Reeves Davis**
  - **EVP, Managing Director, JLL, IP, Inc., Charlotte, North Carolina**
- Mark Handy, AIA
  - Director of Building Data Solutions, TRC Worldwide Engineering, Indianapolis, Indiana

BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Session 3

Reeves Davis – EVP, Managing Director

JLL

A'17 AIA Conference on Architecture 2017
April 27–29, Orlando

Learning Objectives

- Identifying Gaps in BIM to Lifecycle Transition
- Planning for Data Management Beyond Transition
- Avoiding Knowledge Loss Post Construction
- How Communication Strategy Supports Integrated Lifecycle Management

Agenda

- Section 1: What perspective can we add?
- Section 2: Technology Landscape
- Section 3: Integrated Lifecycle Management
- Section 4: Client Specific Case Study
- Section 5: Questions

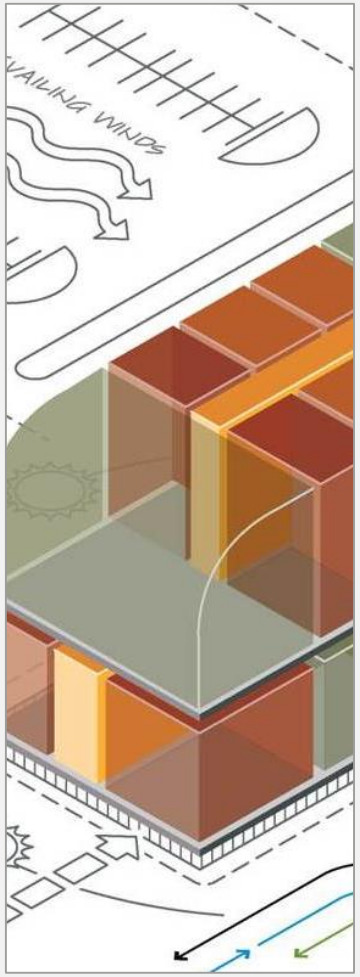
Silo Approach of Information Transfer

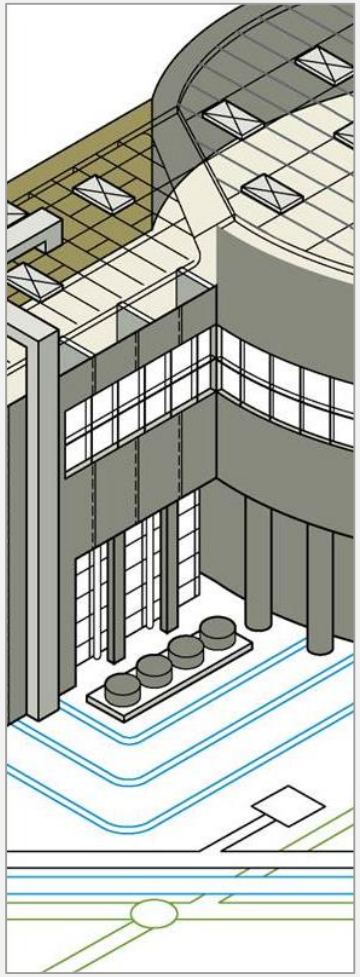
- Information is delivered long after facility is in operation and is time consuming
- Information may not be accurately structured for an IWMS
- Information is Electronic but on DVD's
- Operator has to re-gather information now that building and data has been HANDED OVER
- Typically does not have good warranty information

- Thousand+ page PDF to cycle through
- Typically assigned to low level personnel and is not high priority or quality product
- Data transfer issues are mostly manual
- Lack of shared project knowledge between teams

Owner-Driven Exchange Process

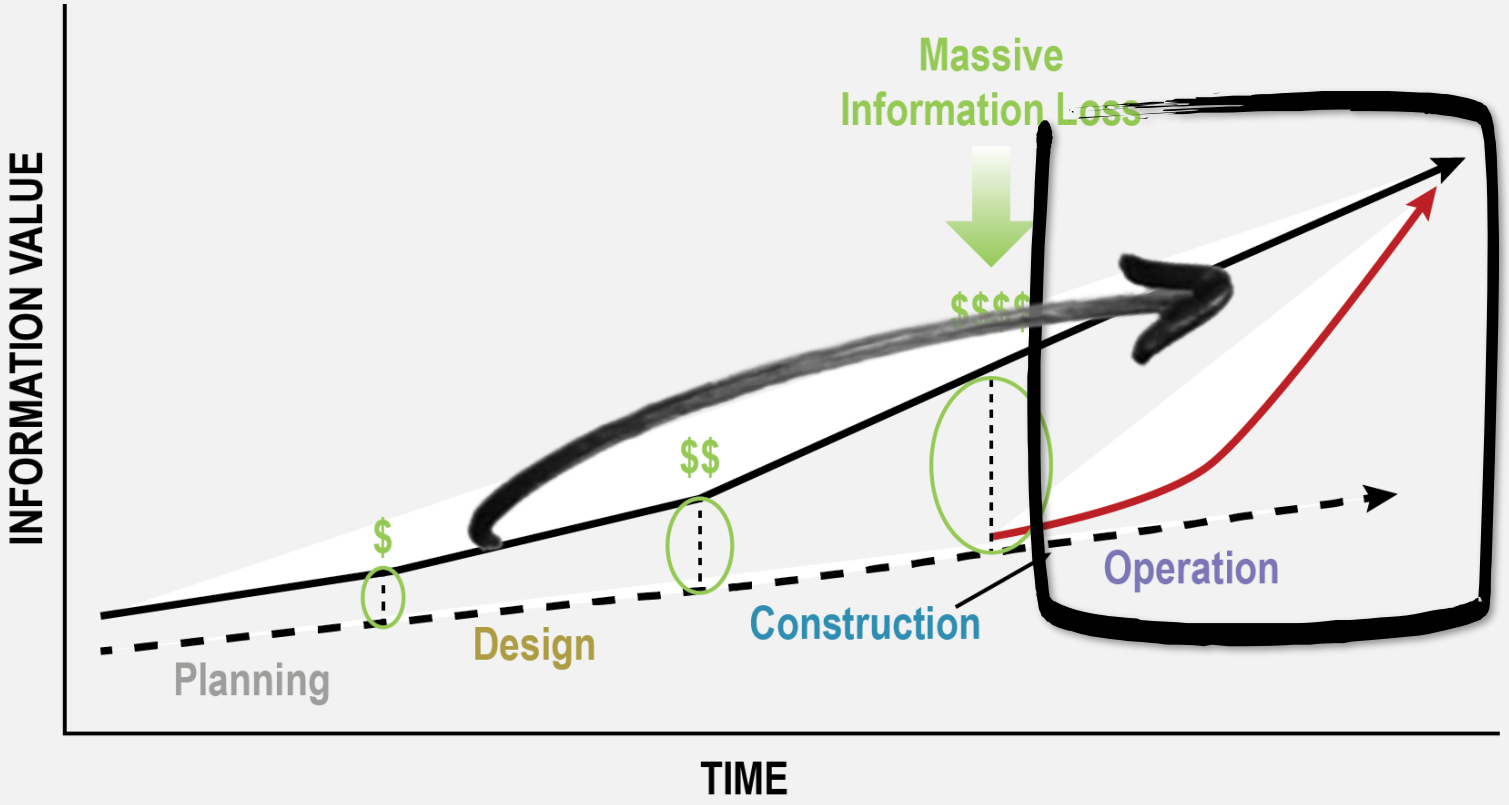
Business As Usual Workflow





Facilities Management

Traditional Development & Handover Process



- 71% of Facility Records are paper based & inaccessible
- Facility Managers spend 10-30% of their time looking for info
- $.23/sf related to inadequate data in Operational Costs
- Equipment data takes 18-24 months to reach the CMMS

Total Cost of Ownership Questions

1. How often do you get handed the actual FM data needed for your IWMS/CMMS or to create your PMs?
2. How many hours does it take your team to find and populate the FM data from your last building project?
3. Where is the data you received from your last BIM Project?...or built project!

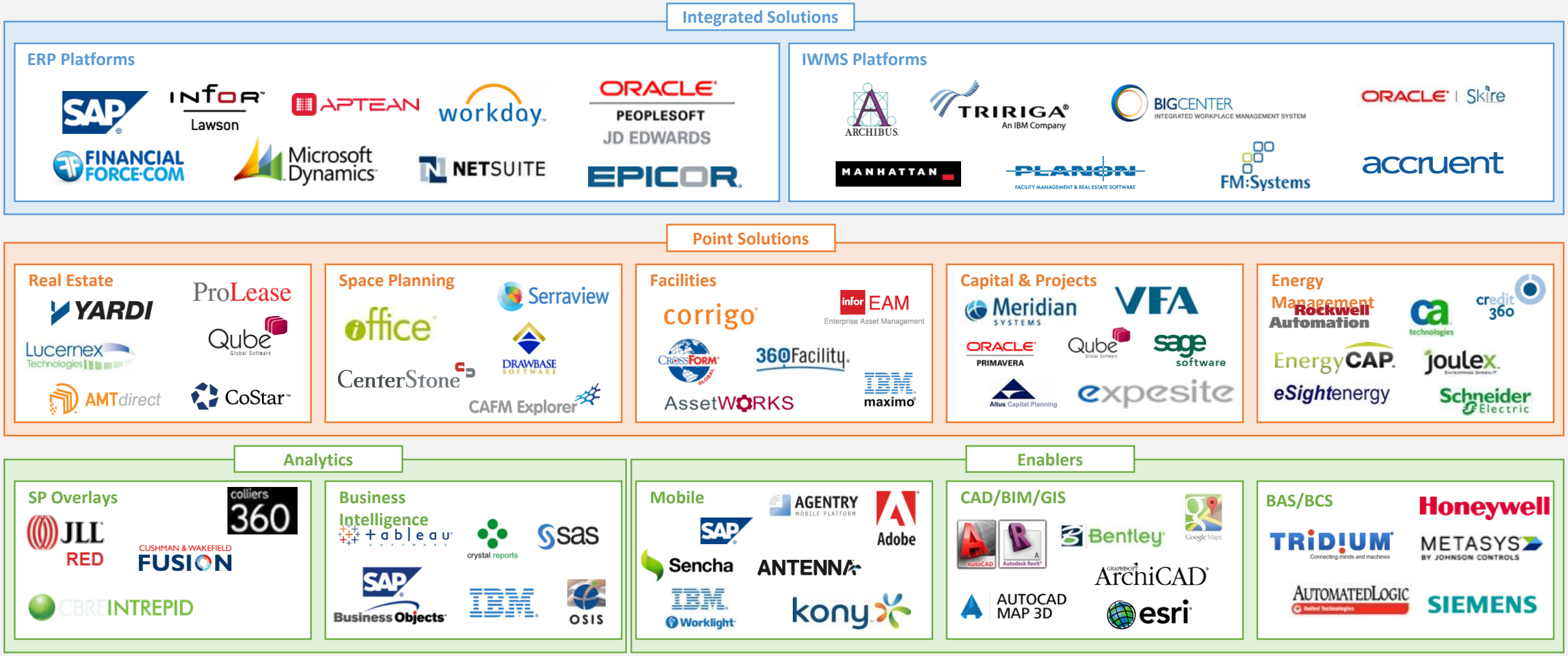
Our NEW Norm!

Buildings

=

Data

CRE Technology Landscape



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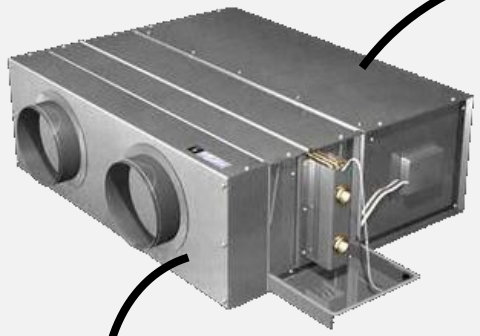
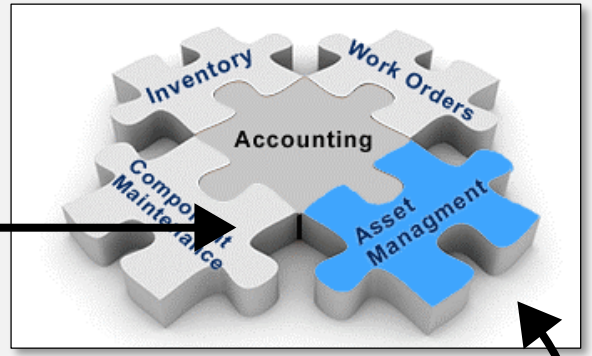
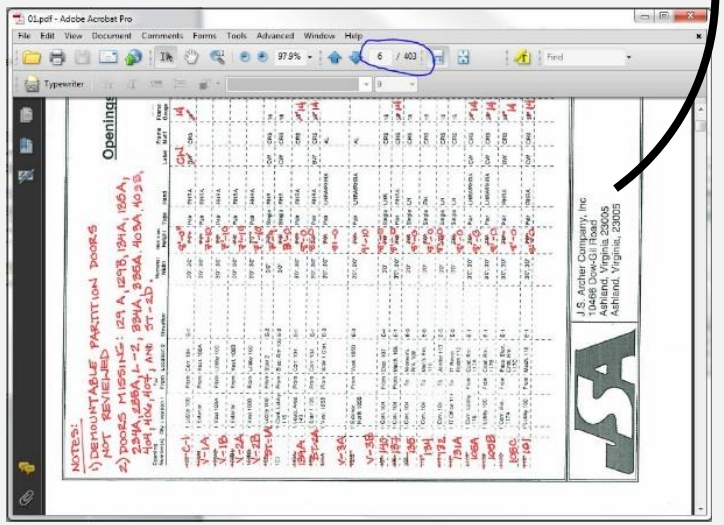
Inconsistent Data Structuring and Naming



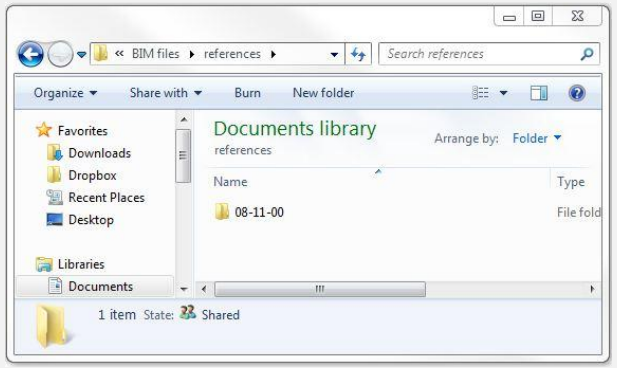
Name	Model	Manufacturer
Fan Coil Unit	????	Airstream
FCU	LWH-45s	???
Fan Unit	????	????
Terminal Box	????	Airstream



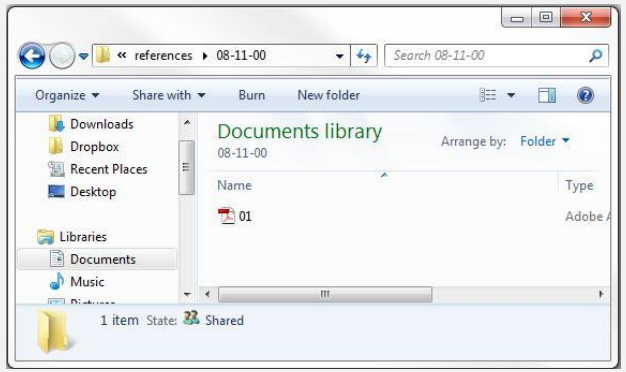
PDF file contains 403 pages that are not searchable, bookmarked nor organized.



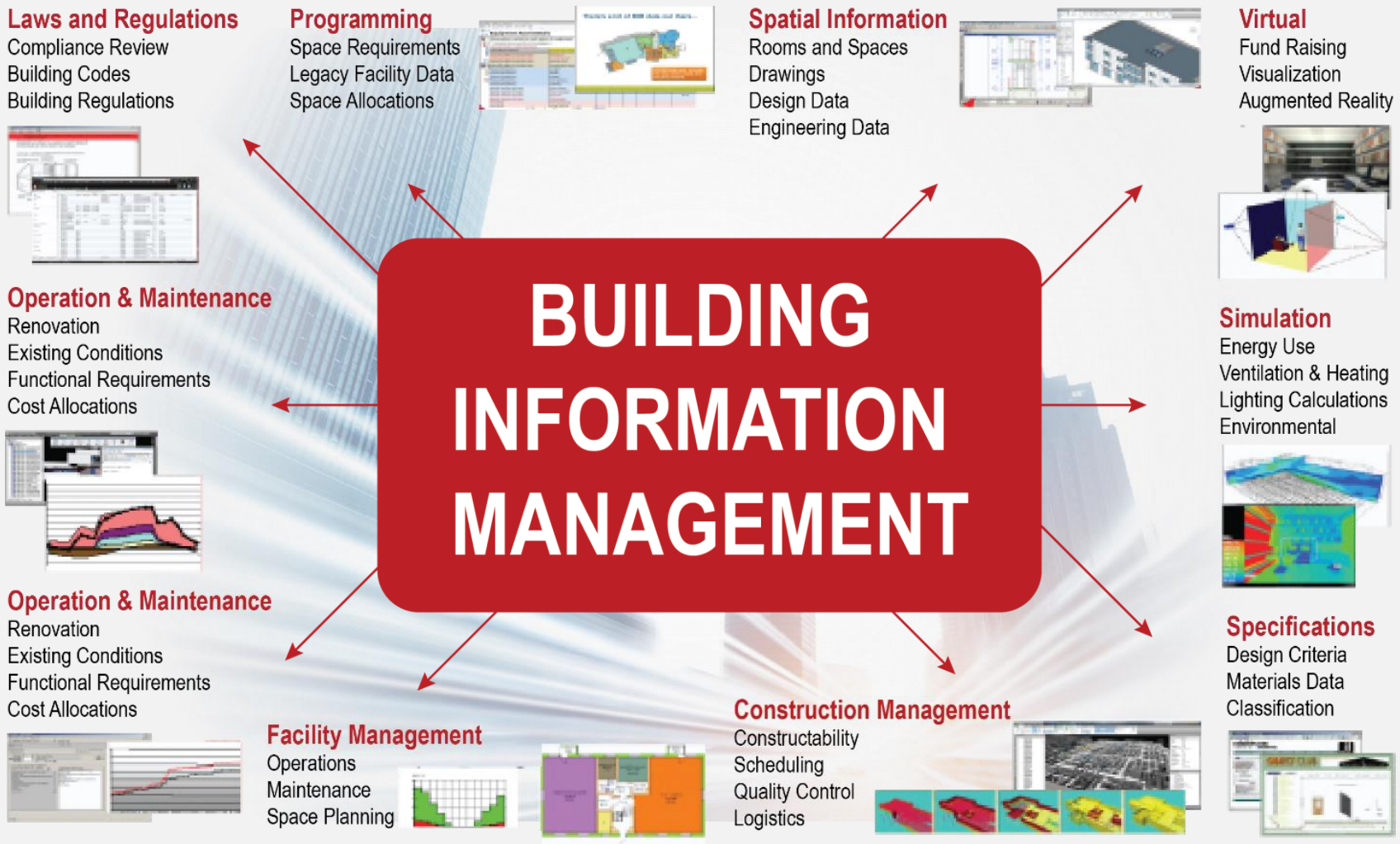
Folders are organized and labeled differently by each team. Handover folder contains a folder called “08-11-00”???



No Standards or Reference for document naming. Document’s name – 01.pdf?



Single Source Integration



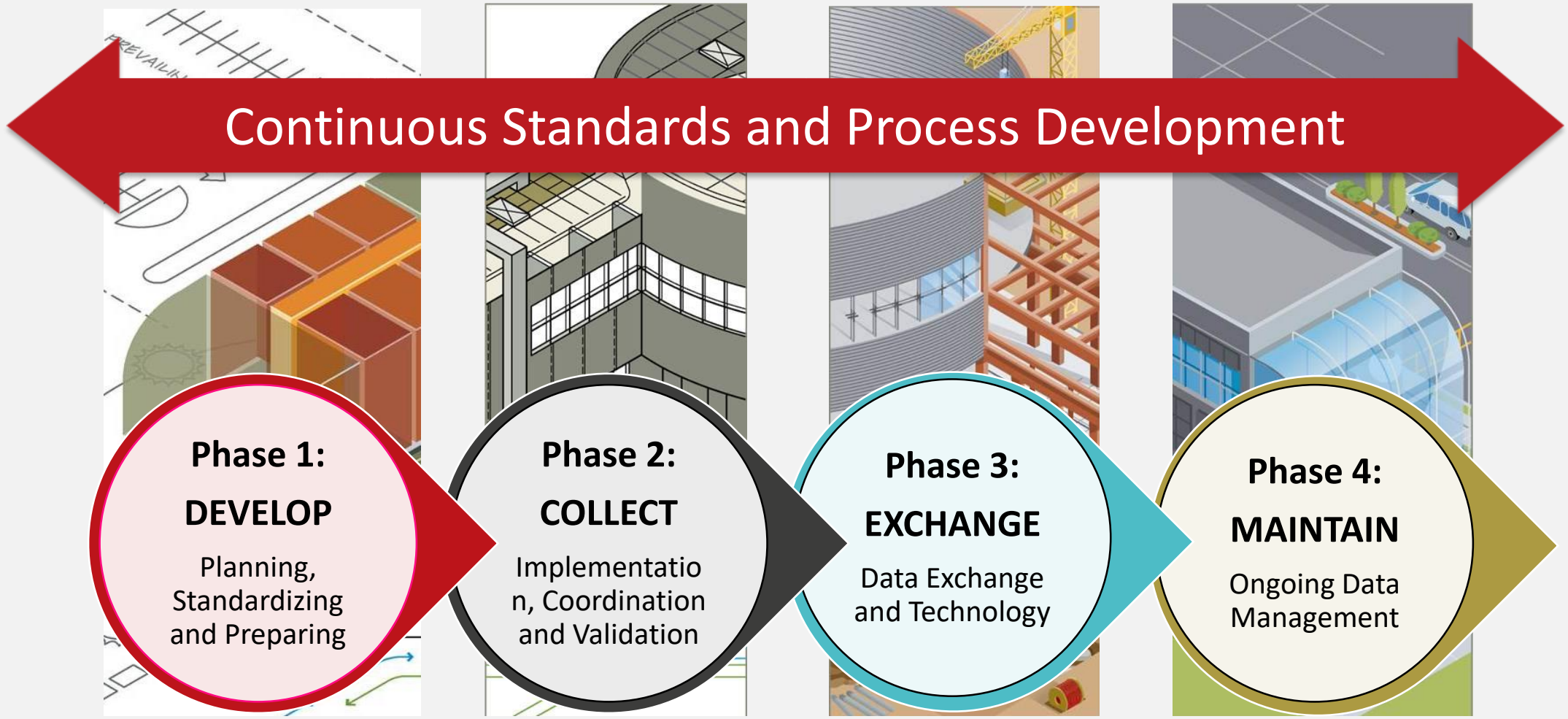
What is Integrated Lifecycle Management?

ILM is a management process that improves collaboration and optimizes efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimizes efficiency through all phases of design, fabrication, construction and lifecycle management.

Integrated Lifecycle Management

Data Exchange

Changing Business As Usual Workflow

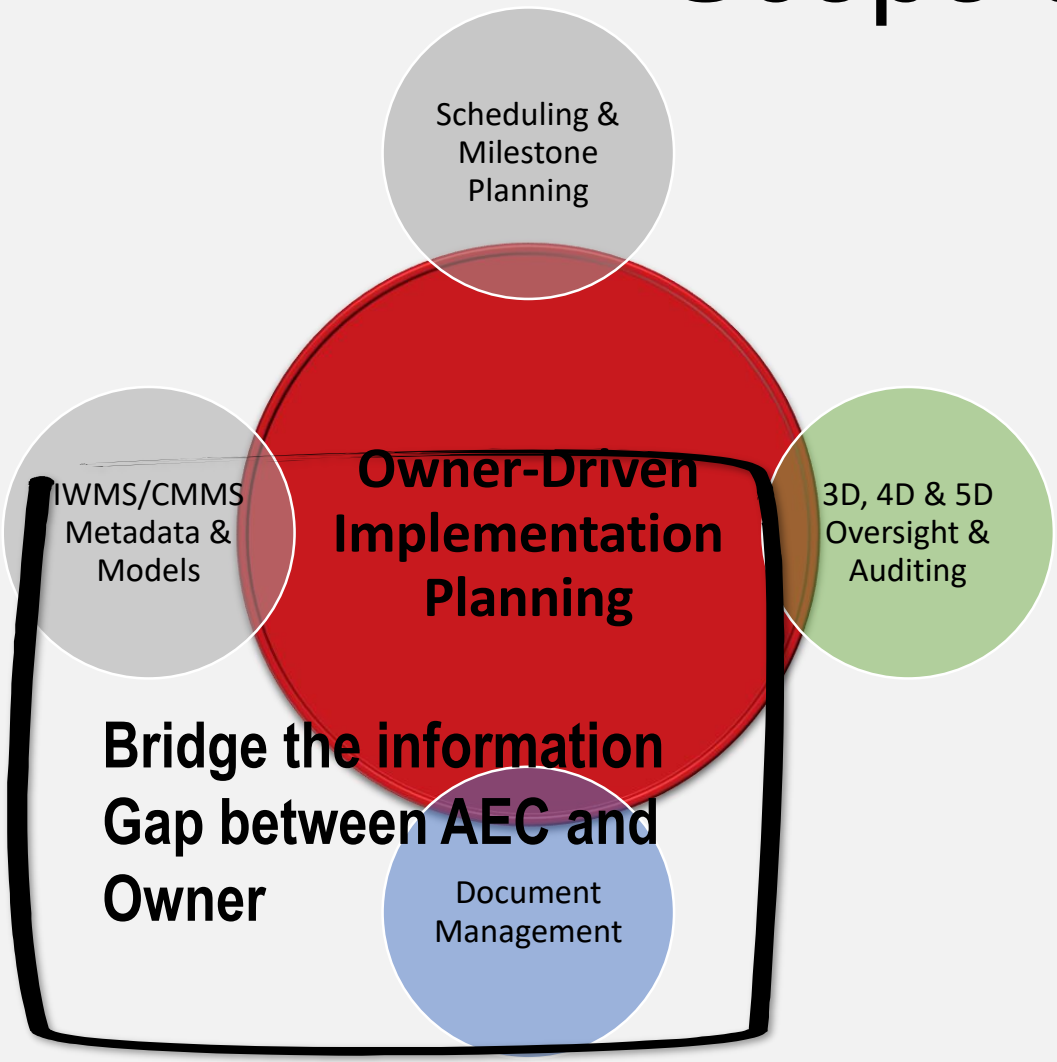


Leveraging the Process

The **ILM Project Strategy** is the development and planning service for creating a BIM for FM vision; and to assist the organization during new construction and renovation projects through all 5 phases of a project's Lifecycle to achieve that BIM for FM workflow vision.

1. Planning & Programming
2. Design
3. Construction
4. Project Closeout/Commissioning
5. Operations and Maintenance

Scope of Services



- Industry is focused on design & construction costs
- Lower the total cost of building ownership through VDC
- Recognize the importance of ‘tribal knowledge’
- Goals are only met through collaborations & relationship building

Creating a Lifecycle Vision

[develop]

Equipment Standard

Category +	Manufacturer +	Model Number +

Equipment Labeling Standards

Use the ***Category*** and ***Abbrevation*** for each piece of equiptment

(* indicates items currently in the database)

Category / Asset	Life/Safety	Abbr	HVAC	Abbr
1	Smoke Detector*	SD	Filter	FLTR
2	Heat Detector*	HD	Motor	MTR
3	Exit Sign	EXITS	Roof Top Unit*	RTU
4	Emergency Light	EL	Steam Trap*	STRAP
5	Fire Control Panel*	FCP	Heat Exchanger*	HX
6	Duct Detector	DD	Heat Pump*	HP

Equipment Asset Details

Information tracked on each piece of equiptment

(* indicates items currently in the database)

indicates fields in COBie Standards

Information Catetory	Equiptment Details	Archibus	Trac Re
Building Program & Project Data	Facility ID*		
Building Program & Project Data	Facility Name*		
Building Program & Project Data	Facility Zone		
Building Program & Project Data	Equiptment Standard*		
Physical Properties	Length*		
Physical Properties	Width*		
Physical Properties	Height*		
Physical Properties	Connections		
Physical Properties	Capacity		
Spacial Location of Asset	Room Name		
Spacial Location of Asset	Room Number		
Spacial Location of Asset	Floor ID*		
Spacial Location of Asset	Floor Name		
Life Safety	Fire Resistance		
Life Safety	Hourly Rating		

2013

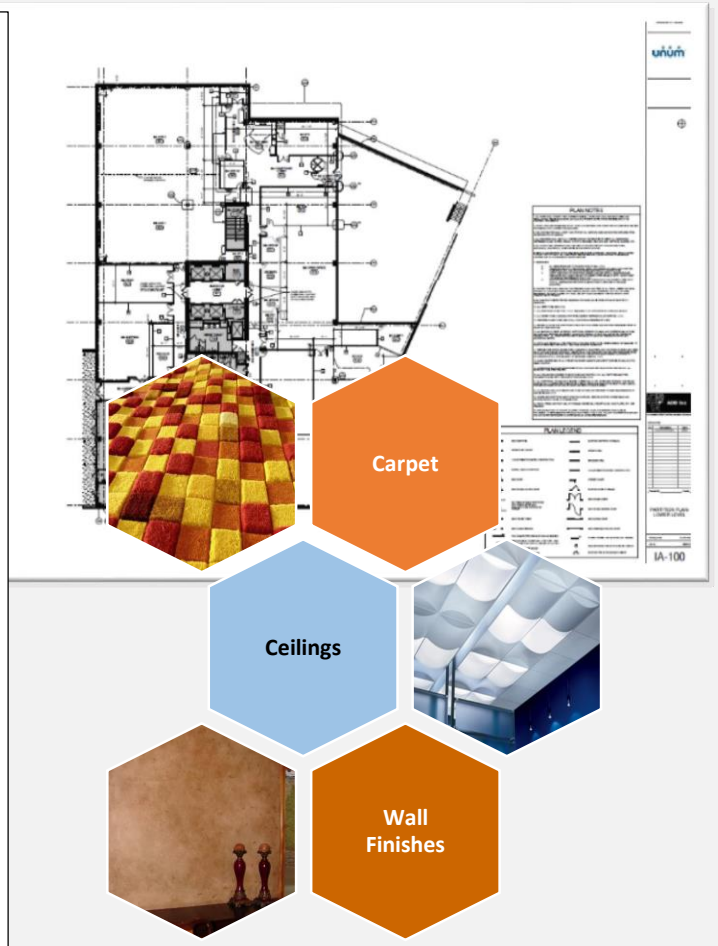
Exhibit 3-Equipment Mapping Matrix

The following Parameter should be tracked for each Equipment Asset and will be mapped to the Equipment Table in the IWMS. The associated mapping along with the Author and Authoring Software is listed below. See ***Exhibit 7-Revit Shared Parameters File*** on how to use the Revit .rte file to transfer Project Standards from the Template File to the Design Model.

Information Category	Equipment Details	IWMS	Model	Who Enters Data	Data Authoring Software	ARCHIBUS Field	Revit Field
Spatial Location	Room Code	X	X	Designer or Contractor	Revit or 360 Field	rm_id	Space Number†
Asset Properties	Mark (Revit Unique Identifier)*	X	X	Designer	Revit	mep_code	Mark†/Name
Asset Properties	Equipment Code (IW Unique Identifier)	X	X	Designer	Revit	eq_id	Equipment Code‡
Asset Properties	CSI ID (CSI MasterFormat Number)	X	X	Designer	Revit	csi_id	CSI Number‡
Asset Properties	Asset ID (Asset Barcode Tag)	X	X	Contractor	360 Field	asset_id	Barcode‡
Asset Properties	Equipment Category	X	X	Based on Type	360 Field	N/A	N/A
Asset Properties	Equipment Type	X	X	Contractor	360 Field	eq_type	Equipment Type‡
Manufacture Information	Manufacturer	X	X	Contractor	360 Field	model_name	Manufacturer‡
Manufacture Information	Model Number	X	X	Contractor	360 Field	model_num	Model Number‡
Manufacture Information	Serial Number	X	X	Contractor	360 Field	num_serial	Serial Number‡
Cost Requirements	Purchase Cost	X		Contractor	360 Field	cost_purchase	N/A
Cost Requirements	Cost of Replacement	X		Contractor	360 Field	cost_replace	N/A
Facility Management	Date Purchased	X		Contractor	360 Field	date_purchased	N/A
Facility Management	Install Date	X	X	Contractor	360 Field	date_installed	Install Date‡
Facility Management	Date In Service	X	X	Contractor	360 Field	date_in_service	In Service Date‡
Facility Management	Life Expectancy	X	X	Contractor	360 Field	eq_life_expct	Life Expectancy‡
Facility Management	Warranty Start Date (Manufacturer)	X		Contractor	360 Field	warranty_start_date	N/A
Facility Management	Warranty Length (Manufacturer)	X		Contractor	360 Field	warranty_length	N/A
Facility Management	Warranty End Date (Manufacturer)	X	X	Contractor	360 Field	warranty_end_date	Warranty End Date
Facility Management	Parent Code (Child to Parent)	X	X	Contractor	360 Field	parent_id	Parent ID‡
Facility Management	Condition‡	X	X	Owner	ARCHIBUS	condition	Condition‡

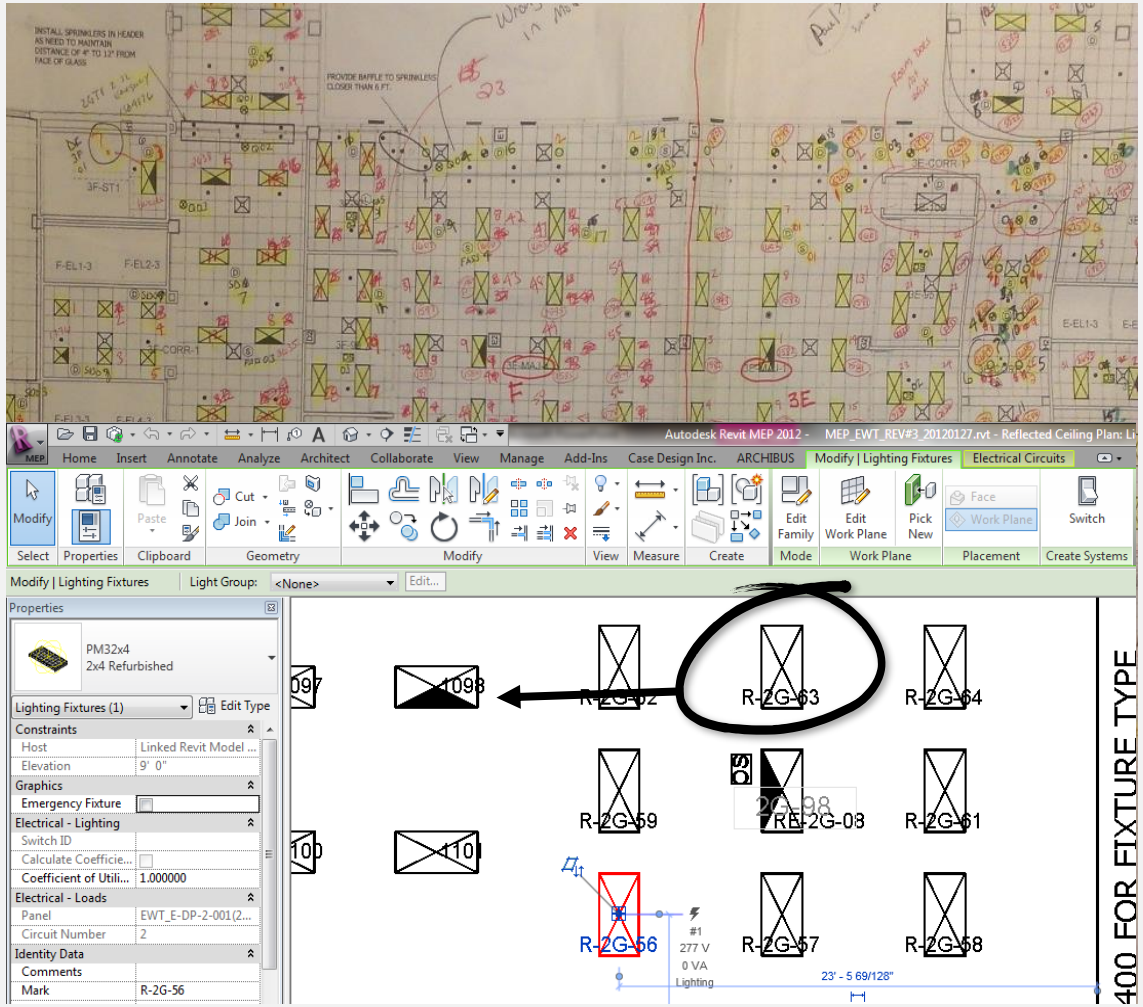
†Existing Revit Field
*Parameter Created by ARCHIBUS
‡Shared Parameter File

Exhibit 1-Equipment Mapping Matrix - Page 1 of 1



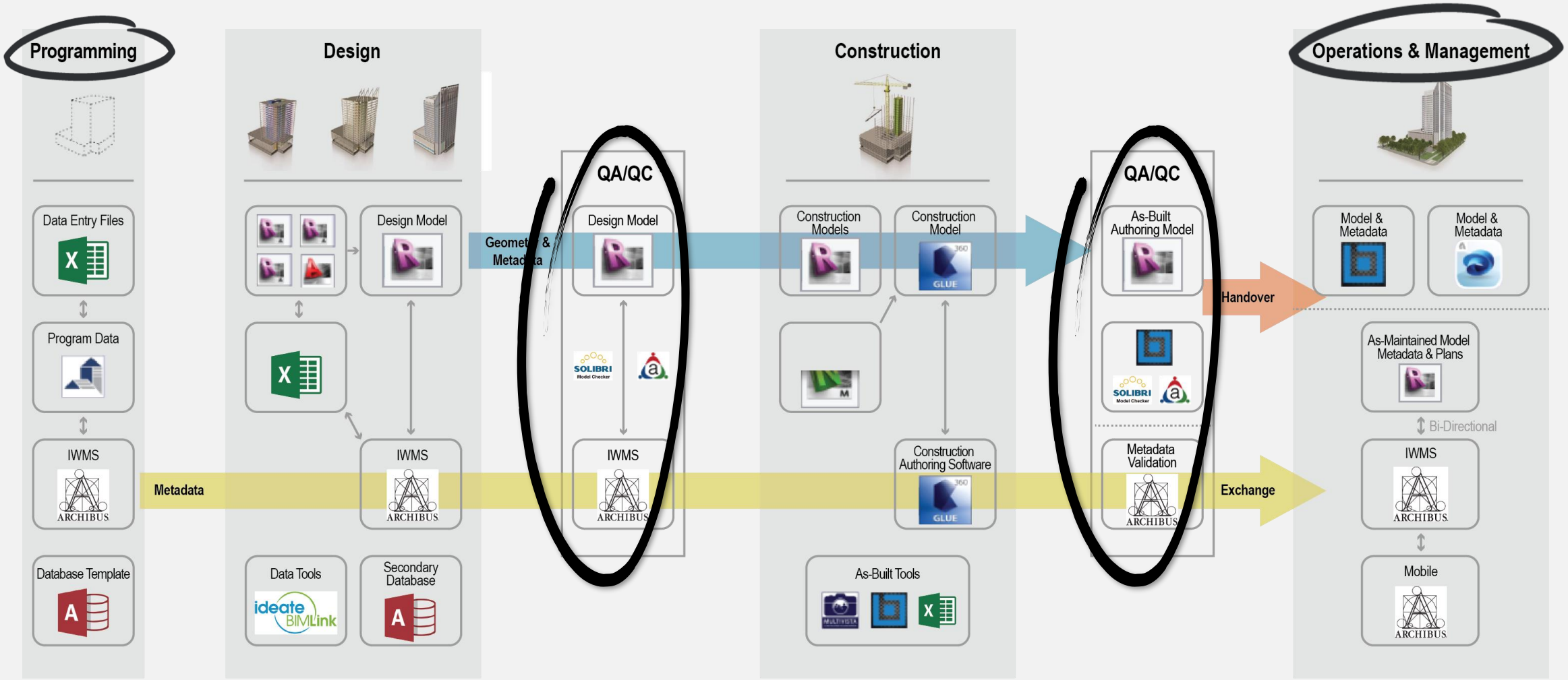
Critical FM Data Standards

HVAC Assets and Asset Parameter Details			
The following Asset Parameters should be tracked on all Equipment Assets:			
Name or Equipment ID			
Equipment Category			
Equipment Type			
Location			
Manufacture	Chiller	Chilled Water EWT	Degree F
Serial Number		Chilled Water Flow	GPM
Model Number		Chilled Water LWT	Degree F
Warranty Start		Condenser Water EWT	Degree F
Warranty End		Condenser Water Flow	GPM
Date Installed		Condenser Water LWT	Degree F
Date Serviced		Nominal Tons	Ton
Barcode		Refrigerant Type	
		[illegible]mber(s)	#
The following Attachments		Source Power Panel Name	Panel Name
Exchange Guidelines.		Service Type	
Product Date		System Type	
O&M manuals	Closed Loop	Percent/Type Glycol	
Installation Guide		System Volume	GAL
Submittal Information		System Type	
Warranty Information		Water Loop Number	
Commissioning Report			
Start-Up and Shut Down Pro	Cooling Tower	Design Wet Bulb Temperature	Degree F
Additional Equipment Testin		Chilled Water EWT	Degree F
		Chilled Water LWT	Degree F
Asset Parameters shown be		Entering Water Temperature	Degree F
listed.		Leaving Water Temperature	Degree F
		Process Fluid Flowrate	GPM
		Process Fluid Inlet Temp.	Degree F
		Process Fluid Outlet Temp.	Degree F
		Source Breaker Number(s)	#
		Source Power Panel Name	Panel Name
		Space Served	Room #
		Service Type	
		System Type	



Technology Metadata Flow Diagram

[develop]



BIM to IWMS/CMMS Data Exchange Planning

[collect]

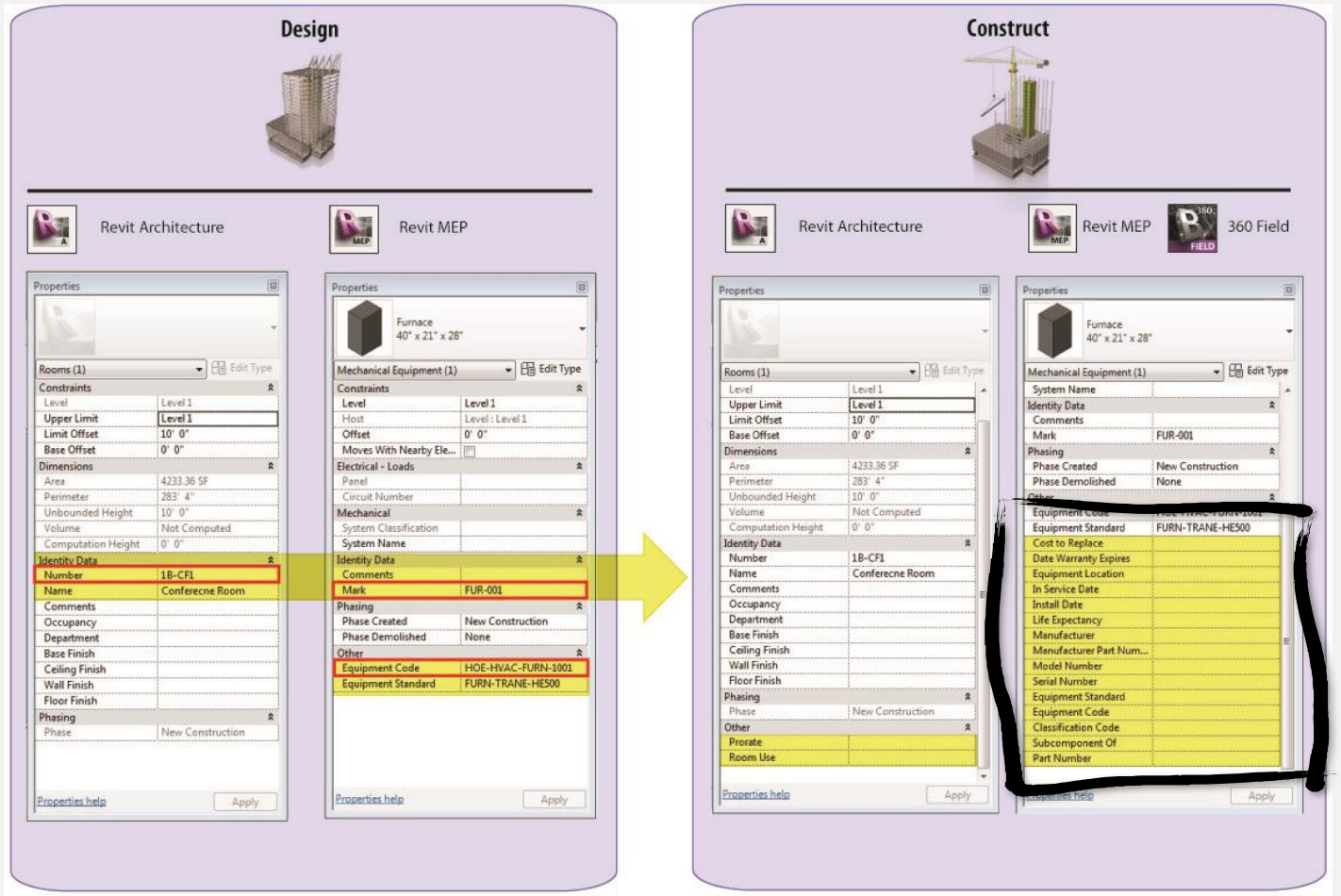
Design Team:

Room Name
Room Code

Equipment Mark
Equipment Code

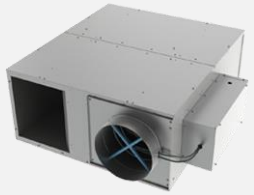
Construction Team:

Further Development
w/ As-Built Data



Coordinated Facilities Maintenance Data

[collect]

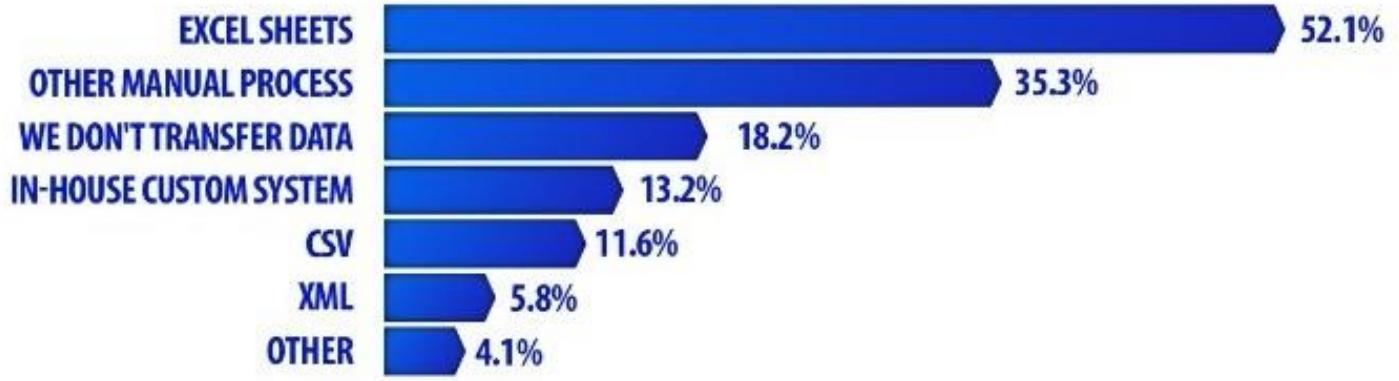


Unique to Project	Unique Standard to Organization	Unique Equipment to Project & Organization	Asset Details		
Name	**Equipment Standard**	**Equipment ID**	**Manufacturer**	**Model**	**Serial**
VAV1-301	HVAC-Price-FDV54012	EWT-HVAC-VAV1-301	Price	FDV5-4012	795272-014-001
HWP3-205	PLBG-Armstrong-43602D	EWT-HVAC-HWP3-205	Armstrong	4360 2D	713111
AHU2-601	044-245-MMD18E	124010440003	Liebert	MMD18E	Y11MBI5748
CU2-R03	057-109-FFCB0601F	1240R0570010	Trane	FFCB0601F	T12J44193

BIM for FM Integration

[exchange]

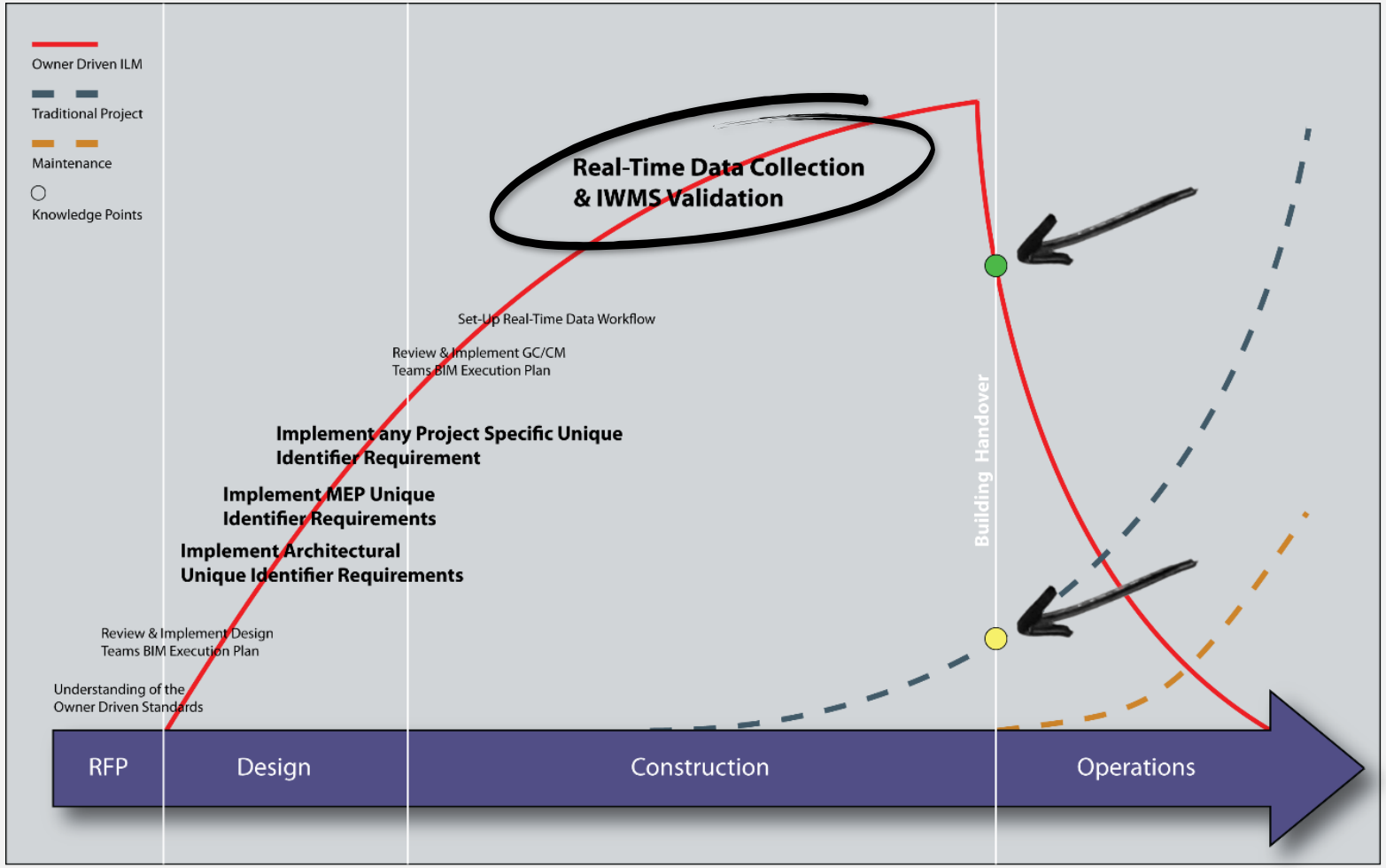
52.1% of applications don't offer data integration and data is transferred via Excel spreadsheets. For a total of 87.4% of all data transfer being done manually.



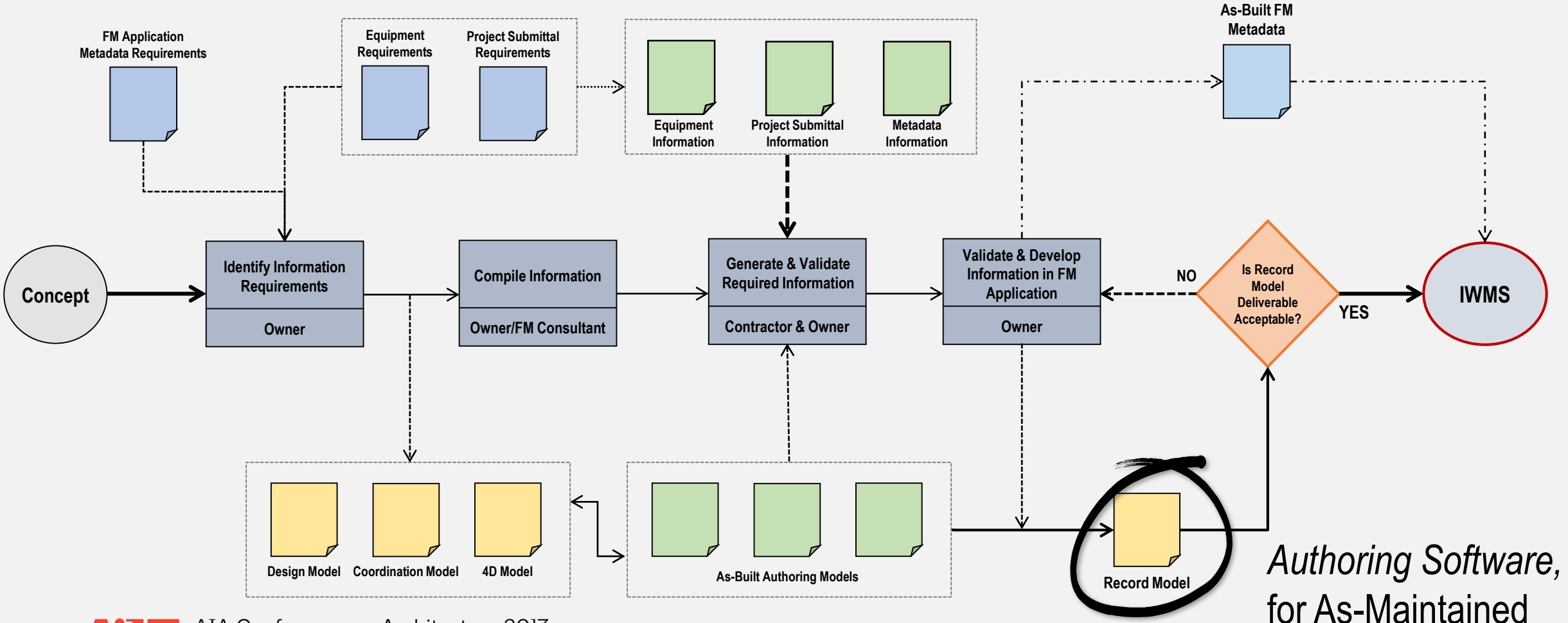
BIM authoring applications do not natively support facilities management, but AEC tools can be integrated to support BIM and populate Facilities Management Systems Real-Time. So our approach to Lifecycle Management is about **cross platform integration**.

Positioning Yourself for Building Handover

[exchange]



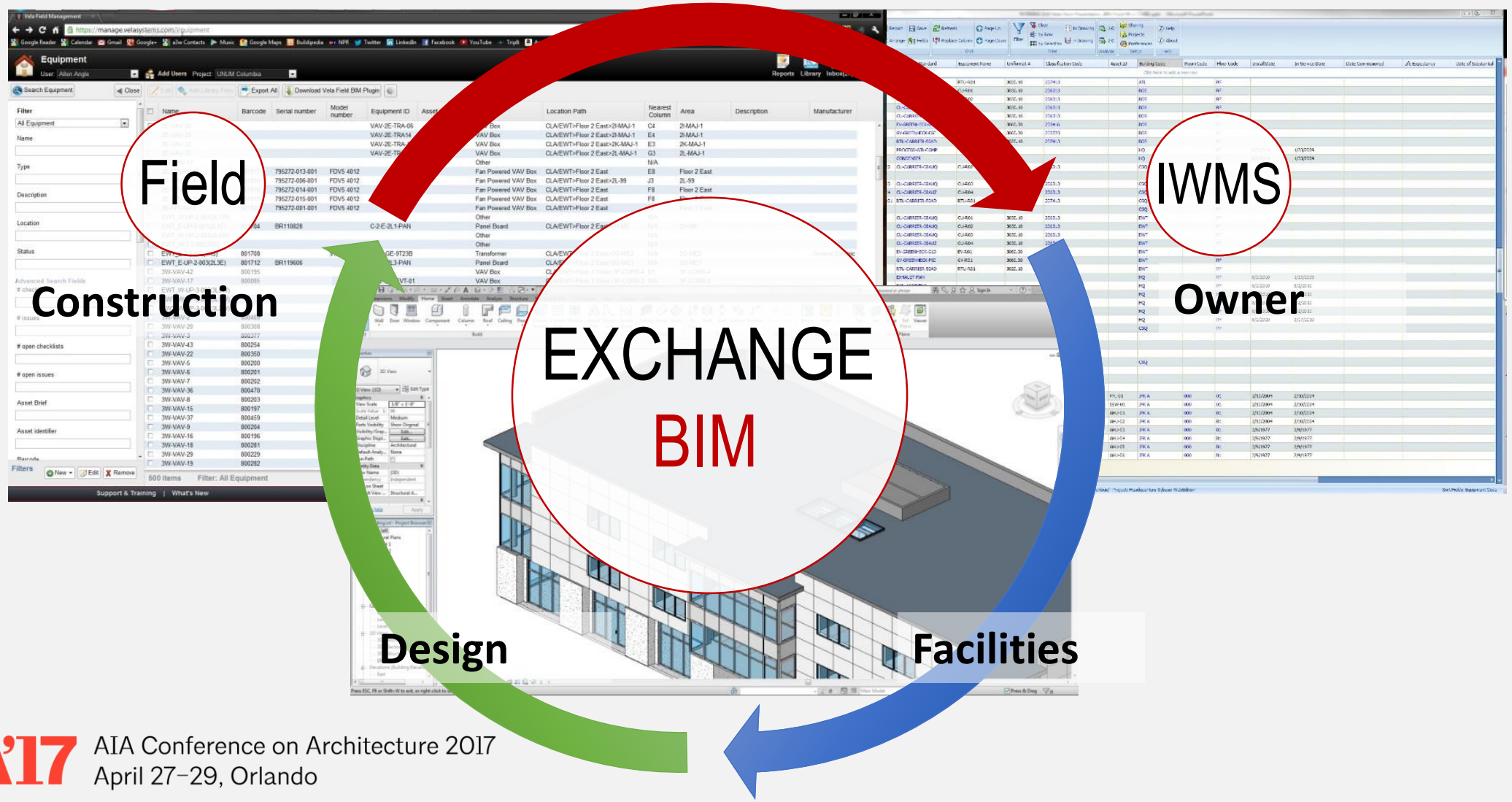
Record Model for As-Maintained Use



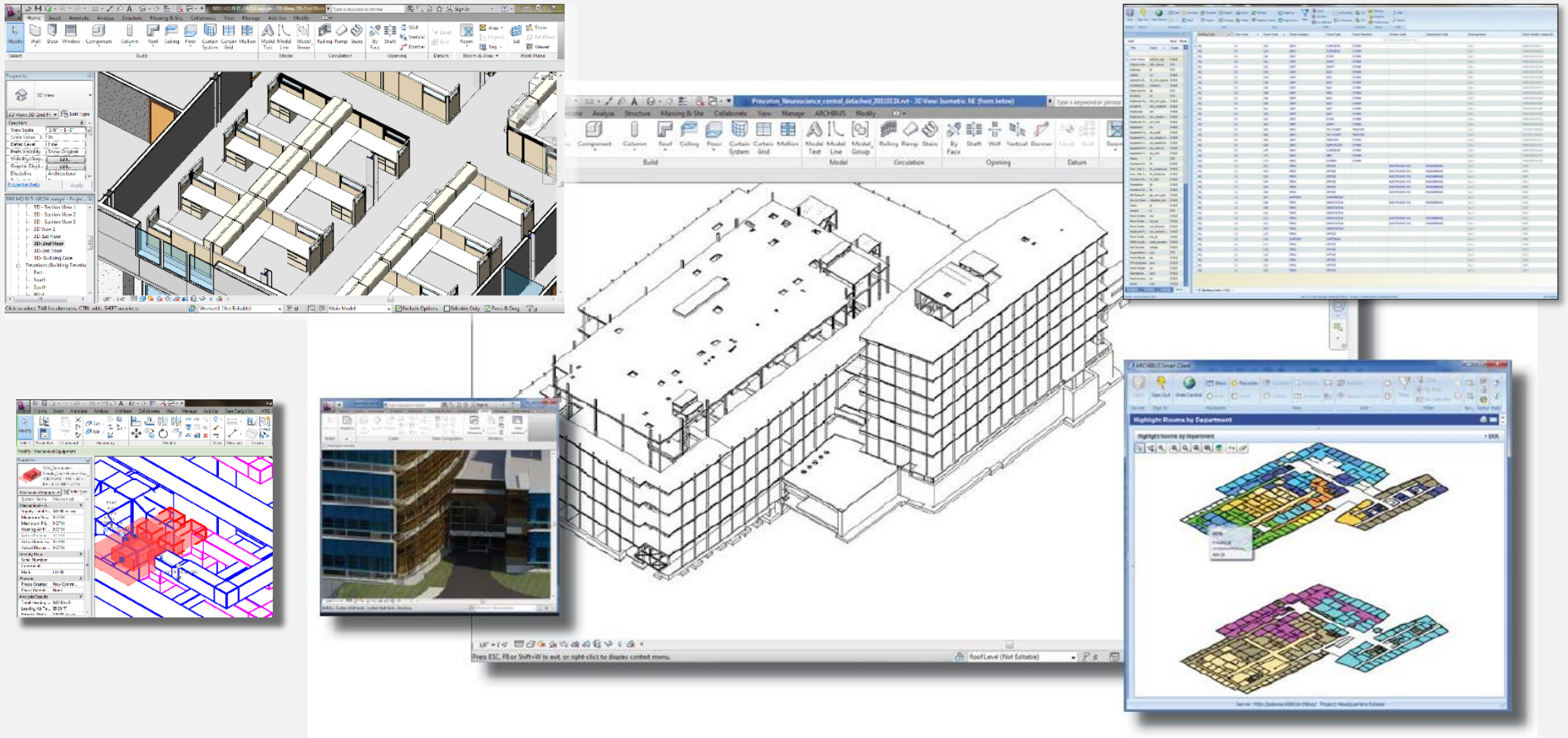
Authoring Software, for As-Maintained Model

Full Lifecycle Data Integration

[exchange]



Integrated Data & Management – As-Maintained Model



Generation Park

- 72 acre site
- 7 buildings
  - Office
  - Manufacturing
  - Parking
- 1.7 million square feet

What Did the Owner Want?

- Build an in-house FM team
- Obtain Space and Equipment Data before occupancy
- Avoid lock-in to proprietary system or data format
  - Concurrent procurement process for IWMS system
  - Selected COBie format

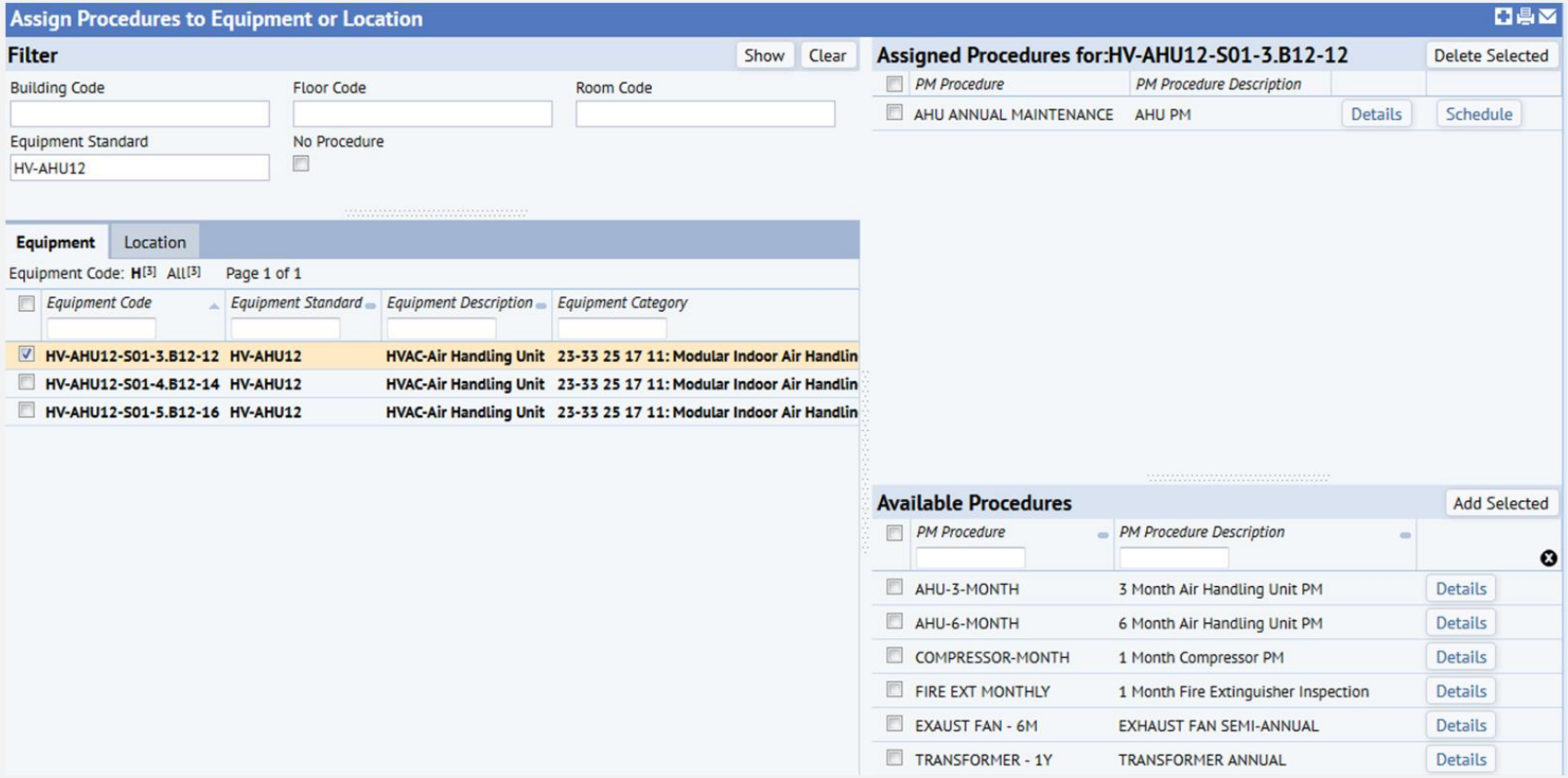
Name	CreatedBy	CreatedOn	Category	Status	TypeName	Description	Duration	DurationUnit	Start	TaskStartUnit	Frequency	FrequencyUnit	TaskNumber	Priors	
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	AHU PM	180	minute	2015-12-12T15:21:28	year	1	year	0	0	Tachometer, Grease
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	1. Check fan blades for dust	10	minute	2015-12-12T15:21:29	year	n/a	n/a	1	0	n/a
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	2. Check fan blades and moving	5	minute	2015-12-12T15:21:30	year	n/a	n/a	2	1	n/a
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	3. Check fan RPM against design	5	minute	2015-12-12T15:21:31	year	n/a	n/a	3	2	n/a
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	4. Check bearing collar set screws	10	minute	2015-12-12T15:21:32	year	n/a	n/a	4	3	n/a
AHU Annual Maintenanc	Ian.Mc	2015-0	PM	Not Yet Started	HV-AHU12	5. Check dampers for dirt	15	minute	2015-12-12T15:21:33	year	n/a	n/a	5	4	n/a

Owner Goal: Load facility data into integrated workspace management system (IWMS) before occupancy using COBie Standard.

Results:

By Substantial Completion:

- 8 Data Sets
  - 7 buildings
  - Site
- 1,603 Rooms
- 14,177 pieces of equipment
- Maintenance Procedures
- 28,000 Spare Parts
- 8,700 O&M Documents



Owner Goal: Load facility data into integrated workspace management system (IWMS) before occupancy using COBie Standard.

Construction Benefits:

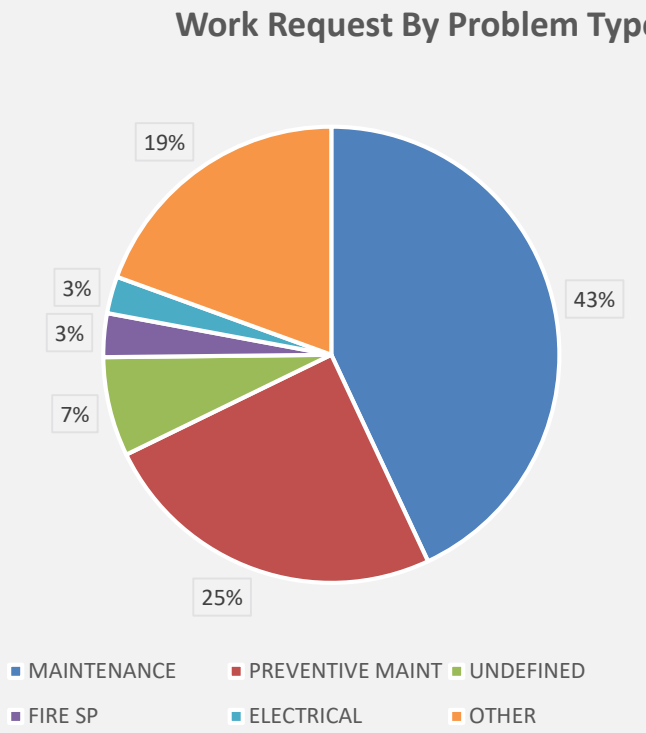
Construction Phase BIM coordinators found fewer problems and submitted fewer RFIs once models were fully populated with COBie data.

Ability to search, export and report on building data:

- Allowed quick reaction to problems and requests for changes due to easy and rapid quantification and location of every equipment type
- Revealed missing safety equipment through COBie “Punchlist” reports
- Permitted loading of COBie equipment inventories and spare parts into 8 additional systems, saving data entry time and creating common naming
- **Common naming** allows these systems to communicate and, e.g., automatically produce work orders in the IWMS when a problem occurs

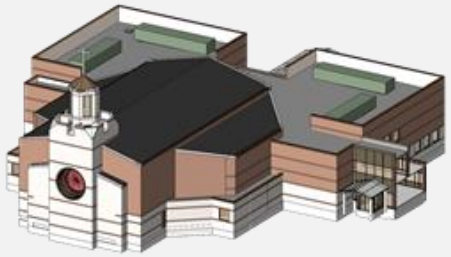
Operations Benefits:

- Equipment history tracking
- Preventative Maintenance scheduling
- Knowing equipment location
- Reporting metrics on:
  - Cost
  - Downtime
  - Labor



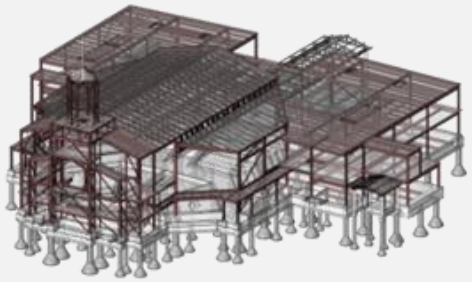
Generation Park Project Phase COBie Participants

- **Client:** FMC Technologies Inc. (now TechnipFMC)
- **Development Manager:** Trammell Crow Houston Industrial Development Inc.
- **BIM & COBie Consultant:**
  Kristine Fallon Associates Inc.
- **Architect:** Gensler
- **Civil Engineer :**
  Cobb-Fendley & Associates
- **MEP Engineer:**
  Wylie Consulting Engineers
- **General Contractor:**
  D.E. Harvey Builders & Inc.
- **COBie Coordinator & Preventive Maintenance Data Integrator:**
  ENGworks
- **IWMS Implementation and Data Loading:** BRG (now JLL)



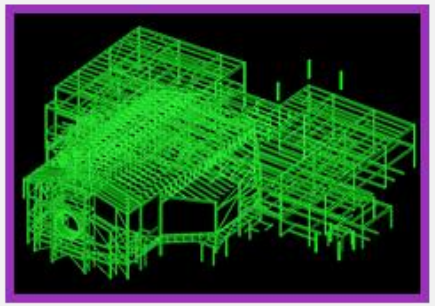
Architectural Model:
Spaces & Product Specifications

+



Consultant Model:
Equipment Specifications

+



Construction Data:
Product Data, Spare Parts, Procedures, Tools, O&M Documents

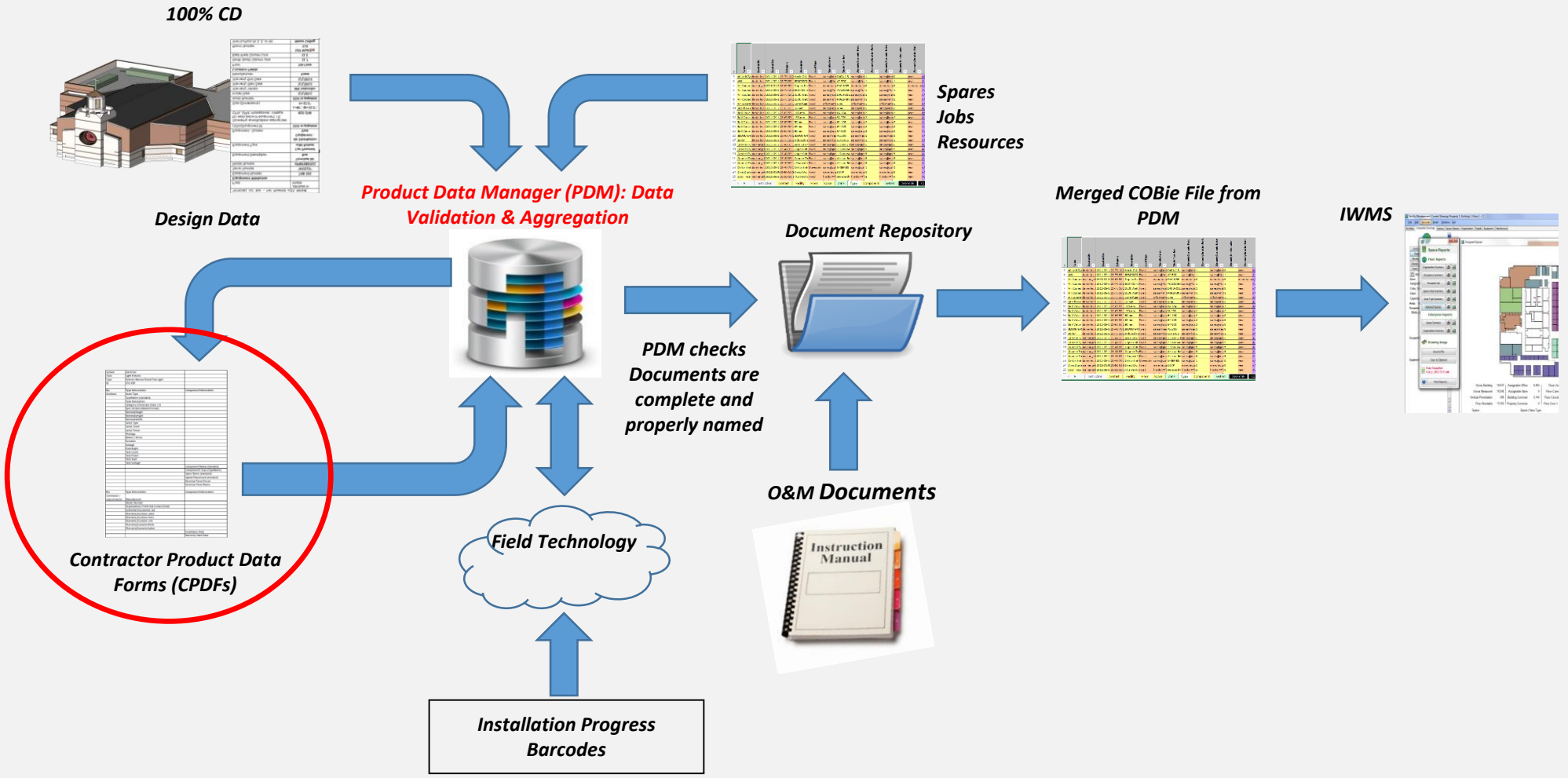
>

IWMS:
Space/Equipment Inventory, Parts, Procedures, Tools,

COBie: Construction to Operations Building information exchange

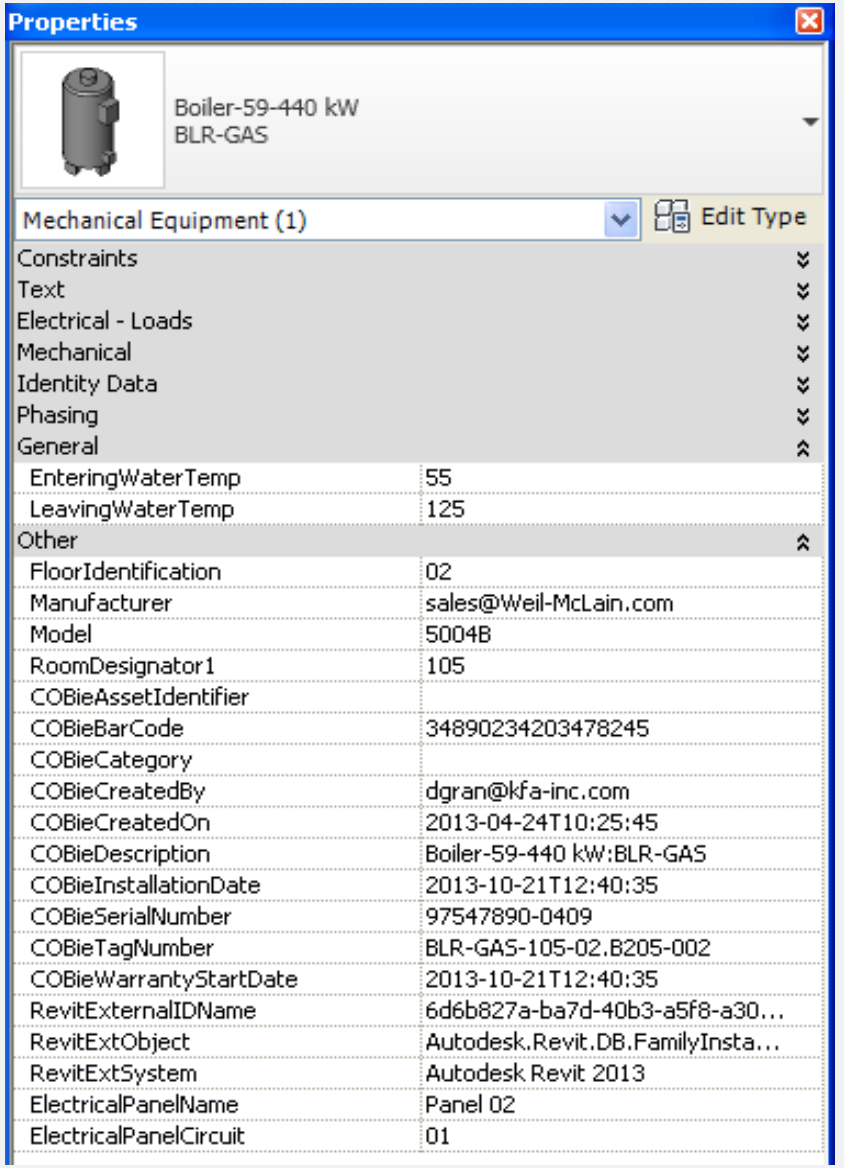
- A subset of international standard ISO 16739 - IFC information model
- Incorporated in the National BIM Standard-US
- Focused on **electronic** delivery of **data** about Spaces and Equipment, not on geometric modeling

COBie Workflow / Data Validation



The Challenge

- BIM is a **Cross-Organizational, Data-Centric** approach to design and construction
- Much attention has been given to the Cross-Organizational aspects
- Little attention has been paid to the Importance or Quality of the Data



Process Challenges

- Timing
  - COBie Execution Plan was approved at the CD stage
  - Contractor Product Data Forms were not submitted as part of the regular submittal process
  - Facility Management team had not been assembled when the COBie Execution Plan was developed
    - Post-construction uses of the data were not developed
    - IWMS had not been selected
    - Naming standards needed adjustment
    - Needed to cull vendor-directed maintenance

Addressing Process Challenges

- Project team was able to catch up and deliver data by Substantial Completion
- **In the future**
  - Facility Management team input is crucial to defining the right amount of data
  - FM team needs to decide what preventive maintenance orders should be scheduled
  - COBie naming standards should be informed by the IWMS data structure
  - COBie Standards and Execution Plan should be developed before modeling begins, based on FM input
  - Design data should be complete and validated at the end of CDs

Technology Gaps and Technology Management Challenges

- COBie process and tools were new to everyone and therefore hard to manage
- Although COBie is based on the idea of capturing data throughout the project, the COBie format only supports a one-time turnover of all data
- COBie tools provided by major technology vendors are immature
  - Technology users are not familiar with these tools
- There is a lack of technology tools that support collaboration on and validation of data

Addressing Technology Gaps and Technology Management Challenges

- BIM & COBie Consultant provided tools to fill the technology gaps
  - Product Data Manager (PDM) to validate and aggregate data
    - Accepts data from multiple applications
  - Contractor Product Data Forms, generated from PDM, that allowed the Contractor to:
    - Know what product data was required
    - Know what the design intent was for that product
    - Easily provide required data in an electronic format
  - Two-way data passing with field technology
  - Tools for checking that all documents were submitted and named correctly
  - COBie punch lists

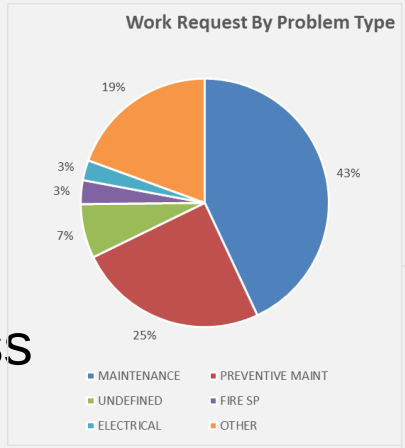
	Designer Provided		
	Value	Units	Override Designer Specification
System	HVAC	N/A	
Class	Variable Air Volume Devices	N/A	
Type	VAV	N/A	
TypeName (Standard)	HV-VAV2	N/A	
Type Description	HVAC-Variable Air Volume Terminal Units	N/A	
Category (OmniClass Table 23)	23-33 41 17 13 13: Single Duct Variable Air Volume Terminal Units	N/A	
Spec Section (MasterFormat)	23 36 00	N/A	
Asset Type	Fixed	N/A	
Contractor Provided			
Inlet Size	10	Inches	
Manufacturer	MFlynn@hdgrant.com	N/A	
Maximum Depth (In)	14	Inches	
Model Number	SDV5000	N/A	
NominalHeight	16	Inches	
NominalLength	20	Inches	
NominalWidth	16	Inches	
Organizations Preferred Contact Email	Bsellers@letsos.com	N/A	
Pressure Drop	0.25	N/A	
Submittal Documents List	Variable Air Volume Devices	N/A	
Warranty Duration Labor	12	N/A	
Warranty Duration Parts	12	N/A	
Warranty Duration Unit	Month	N/A	
WarrantyGuarantorLabor	MFlynn@hdgrant.com	Email	
WarrantyGuarantorParts	MFlynn@hdgrant.com	Email	

Human Factors Challenges

- Reluctance to change established organizational methods
  - Modeling typicals versus complete models
  - Drawing annotation versus COBie naming
  - Primacy of drawings versus model or data
- Need to climb the learning curve
  - New processes
  - New tools
  - Information-centric versus drawing-centric approach
  - Rigor of standard structured data
- Because processes and tools were not refined before each phase (D,C,O&M), users became skeptical of the technology

Addressing Human Factors Challenges

- Be ready
  - Get input from all stakeholders
- Provide user-friendly training in processes and standards
- Provide tools to help team members gauge progress
  - Performance metrics create ownership
- Communication, Communication, Communication
  - Bi-weekly COBie Progress Meetings
  - Provide advice and support
  - Provide feedback: what is the data doing for us; how will it save Owner money?
- Strong contract terms provide motivation to perform
  - Detail BIM and COBie data delivery requirements in Division 1
  - Six-figure retainage “if delivery of COBie data, documents and photographs is not up-to-date or if the deliverables do not conform to the requirements and standards in the COBie Execution Plan and meet the quality standards…”



510 Work Requests w/ Problem Type “Undefined”

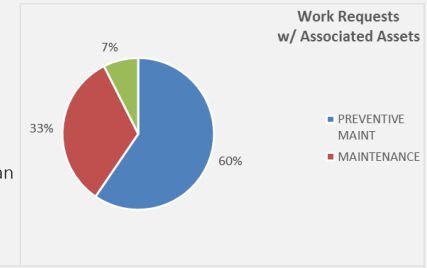
280 Re-routed to other Work Teams (55%)

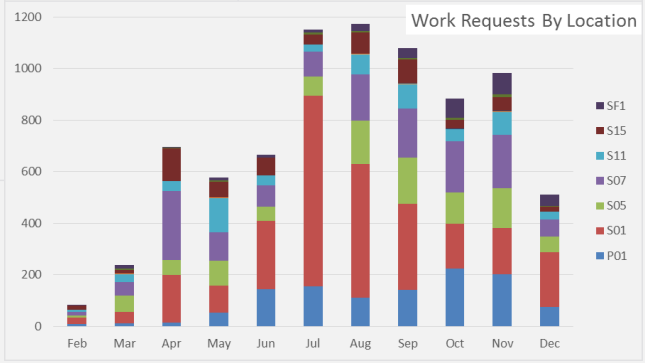
7,367 Work Requests Completed / Closed

2,481 have an associated asset (34%)

---

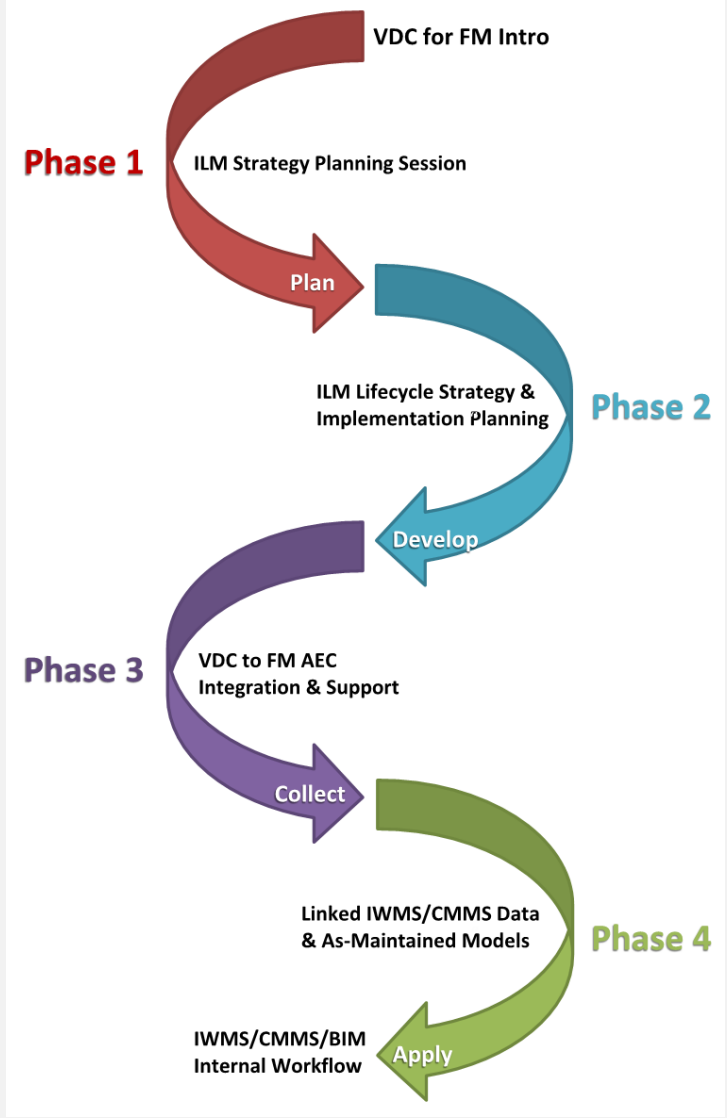
330 Work Request have an incorrect locations (like S06) -_-





Recap and Questions?

- Process oriented not technology dependent
- Success and efficiency is dependent on the Quality of Standards and Process Workflow.
- Educated Owner's can drive an Owner-Driven Process!
- Coordinate and Leverage processes and applications from the AEC Team for workflow integrations
- BIM doesn't fix, correct or resolve any lack of standards, controls or integrity of your current facility data



Contact Information

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704-909-8838

Speakers List

- Chris D’Souza
  - Product Marketing Manager, ARCHIBUS Inc., Boston, Massachusetts
- Nick Jiang
  - President, ARCH Building Data Solutions, LLC, Chesterfield, Missouri
- Reeves Davis
  - EVP, Managing Director, JLL, IP, Inc., Charlotte, North Carolina
- **Mark Handy, AIA**
  - **Director of Building Data Solutions, TRC Worldwide Engineering, Indianapolis, Indiana**

BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Session 1
Case Studies in BIM for Lifecycle Management
Mark Handy – Case Studies in BIM for Lifecycle Management

A'17 AIA Conference on Architecture 2017
April 27–29, Orlando

TRC WORLDWIDE ENGINEERING BDS

Acknowledgements/Credits

- Precision Point, Inc. – Mark Hanna
- TEG Architects – Wayne Estopinal
- Bob Hartig AIA

Course / Learning Objectives

- Learn about benefits obtained through the use of BIM in facility lifecycle management
- Gain insights regarding 3D point cloud scanning related to BIM development
- Study specific instances of BIM documentation used for existing buildings, during design of new projects, during construction and for continuing maintenance and management

BIM perspectives → Points of view

- ***Designer –*** visualization, functional relationships, systems coordination, clash detection, room data, schedules, life safety

- ***Contractor –*** augmented reality, quantity take offs, scheduling, coordination models, as-built documentation, product data, maintenance & warrantees

- ***Owner –*** record documents, facility drawings, space management, asset management, data analytics

Getting Started…

The process still is about…

Timing, Collaboration & Innovation

- What do you (or your client) really want and need?
- What can you (or your client) afford?
- What do you have to begin the project?

Case Study: University Student Union

- Design Criteria and Layout
  - Locations shown on floor plans and visualized spaces
  - Solution Visualization
  - Reporting from connected and embedded data
- Master Facility Drawings & Performance Analytics
  - Development of construction phasing
  - Operations & Maintenance
- University BIM Standard
  - Deliverables
  - Timeline

Exterior Image

Plans with programmed areas

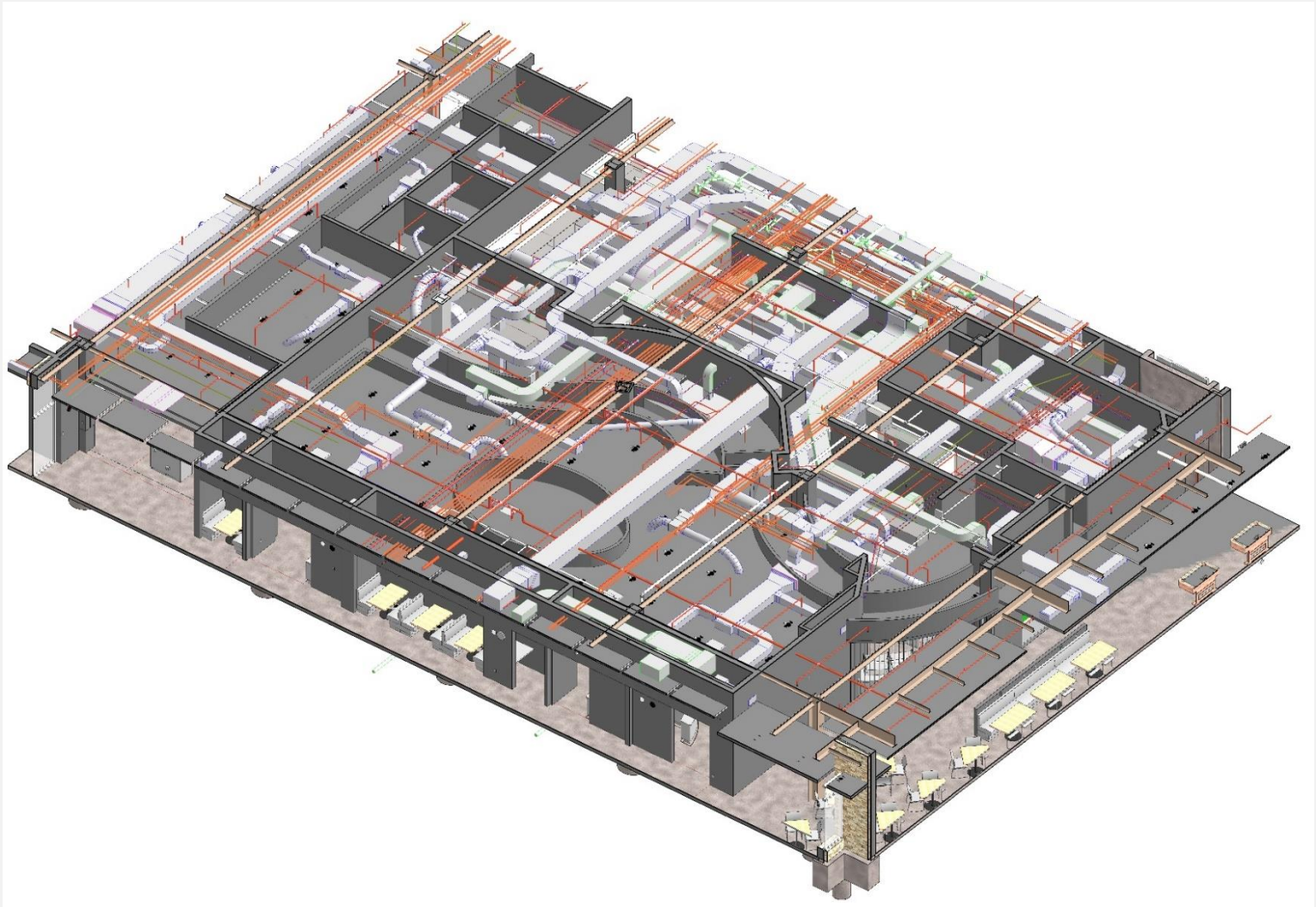
First Floor

Second Floor

Third Floor

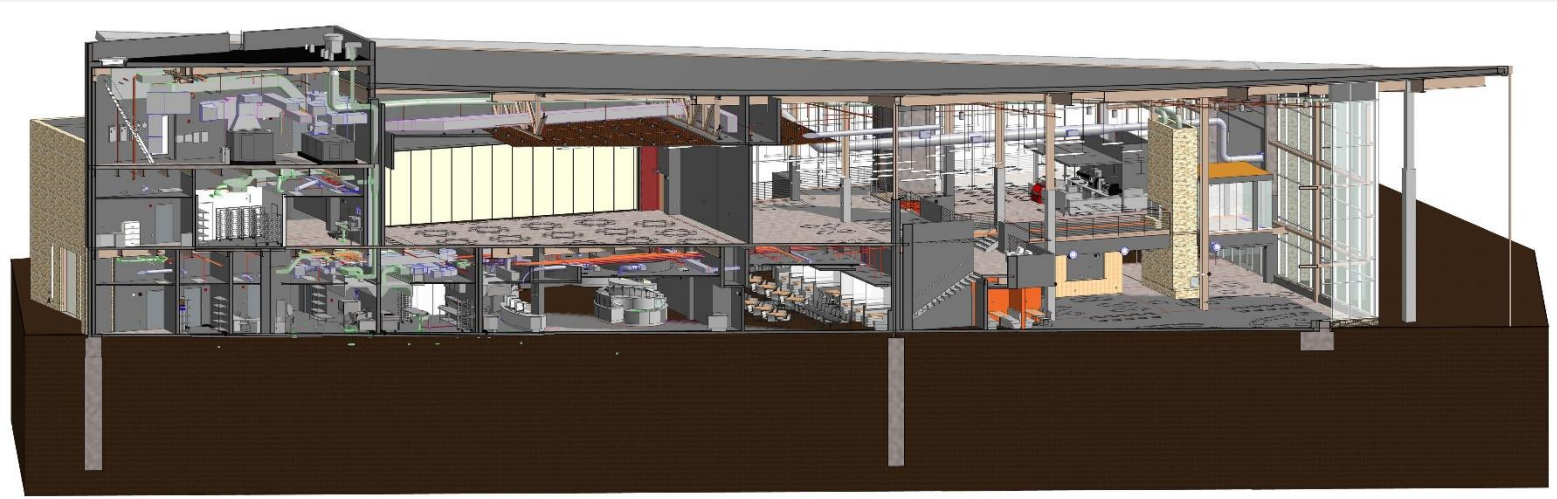
Isometric

- Illustrate systems layout and function
- 3 Dimensional color highlighted image is easier to understand



Sections

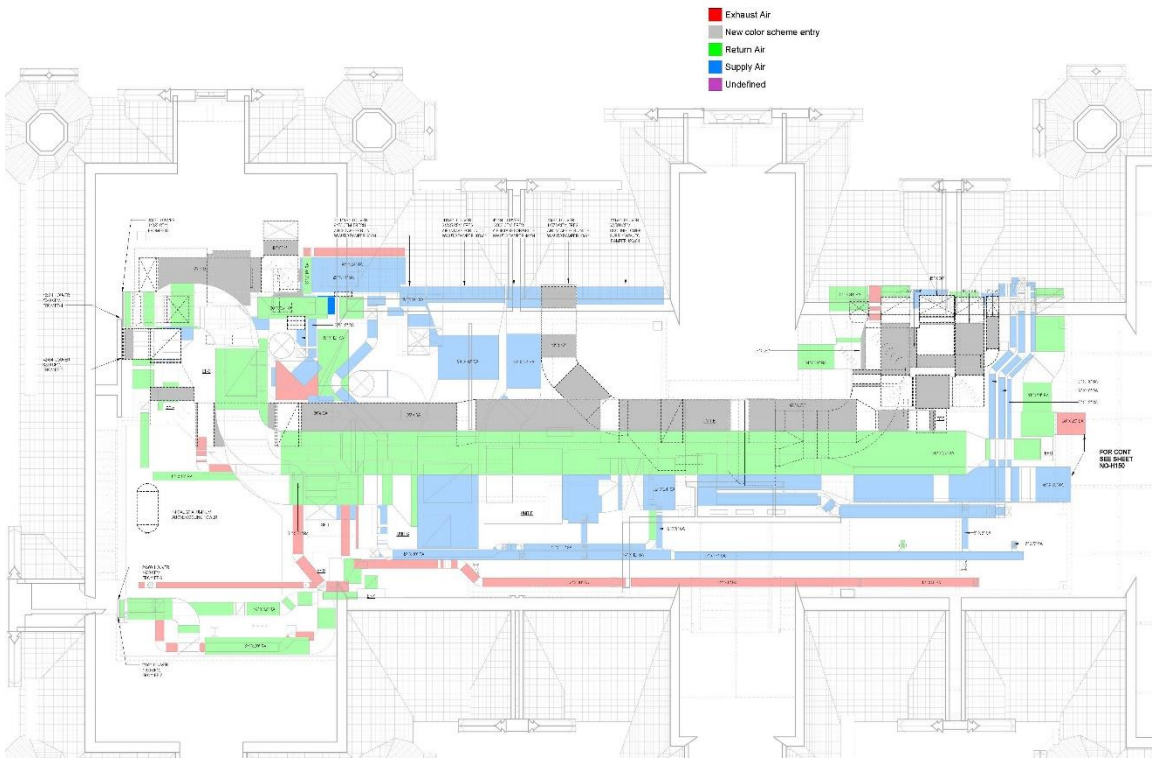
- The fitting…
- Multiple levels
- Spaces with a variety of proportions

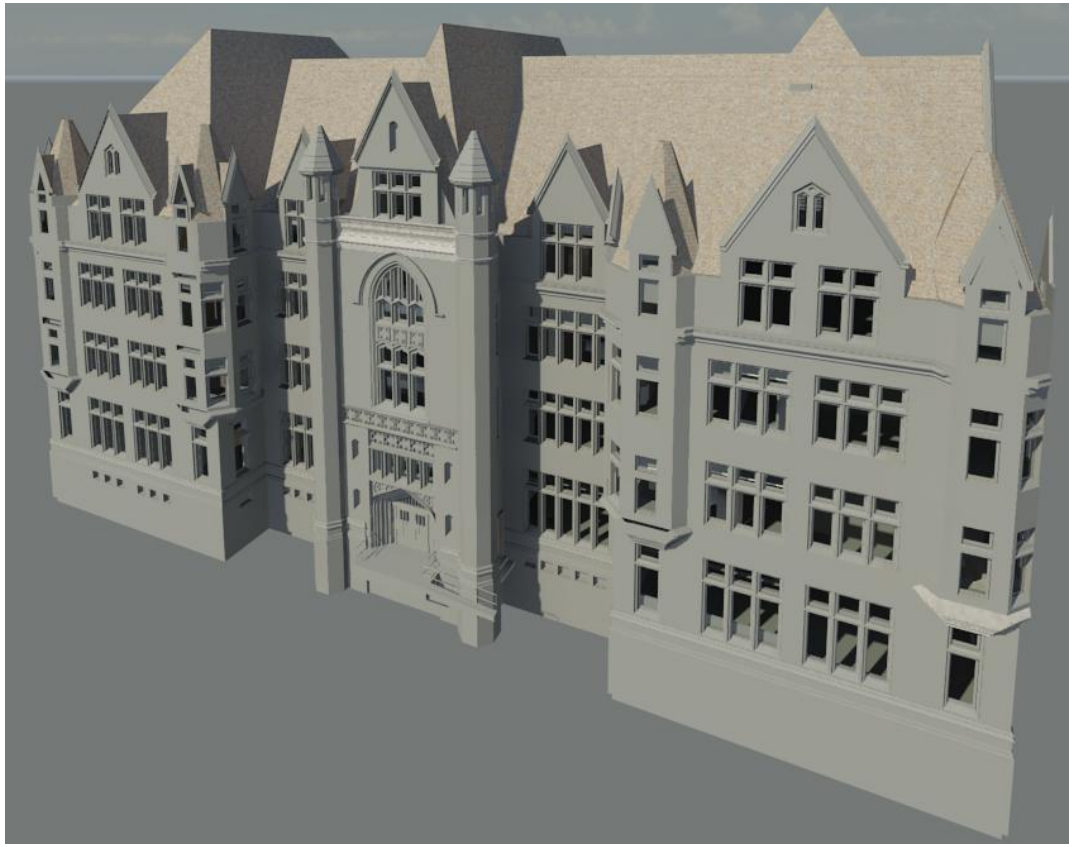


Case Study: Academic Building Renovation

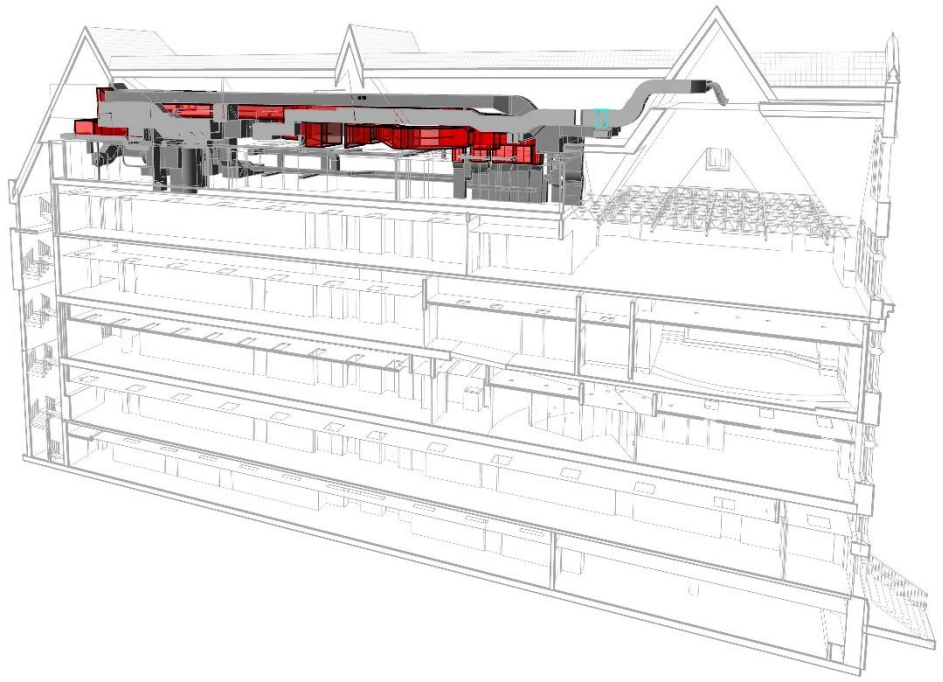
- Existing historic building modeled for engineering retrofit
- Design Criteria and Layout
  - Locations shown on floor plans and visualized spaces
  - Solution Visualization
  - Reporting from connected and embedded data
- Logistics documentation – allowed development of construction phasing including a tenant buildout

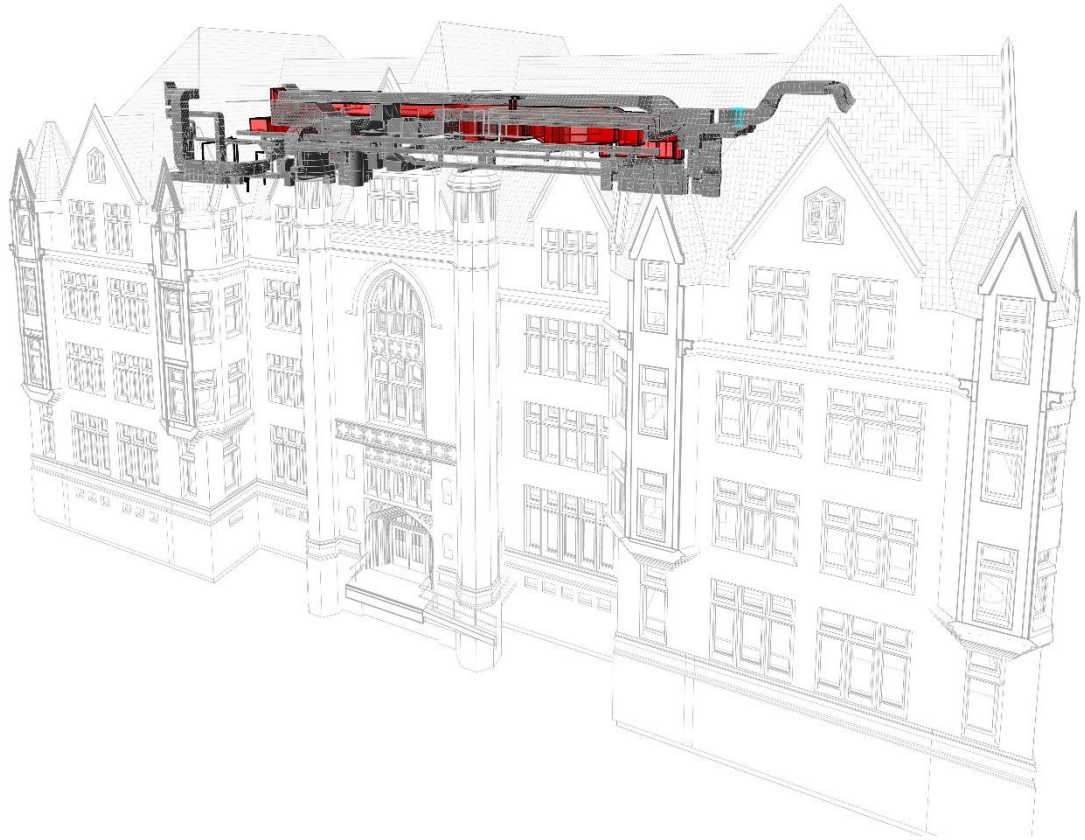
Coordinated Engineering Retrofit





Coordinated Engineering Retrofit



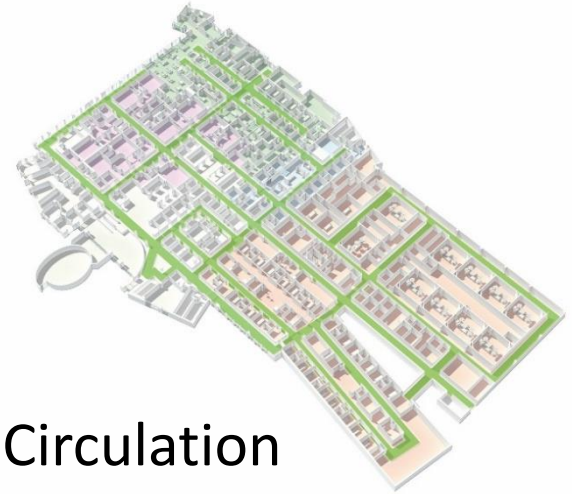


Case Study: Hospital

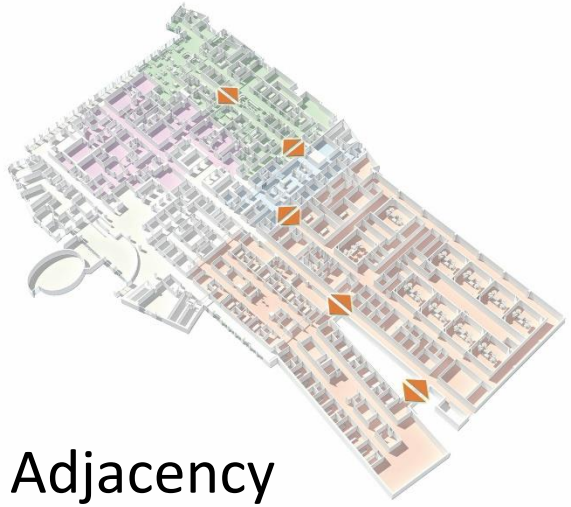
- New hospital modeled during design
- Functional documentation – allowed development of building performance analytics
  - Space allocations
  - Room data sheets
  - Travel distance
- Asset & Maintenance Management
  - Locations shown on floor plans and visualized spaces
  - Reporting from connected and embedded data

Design graphics

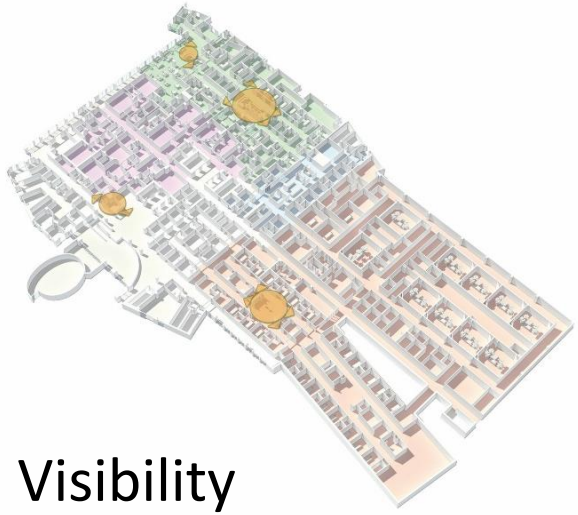
Expandability



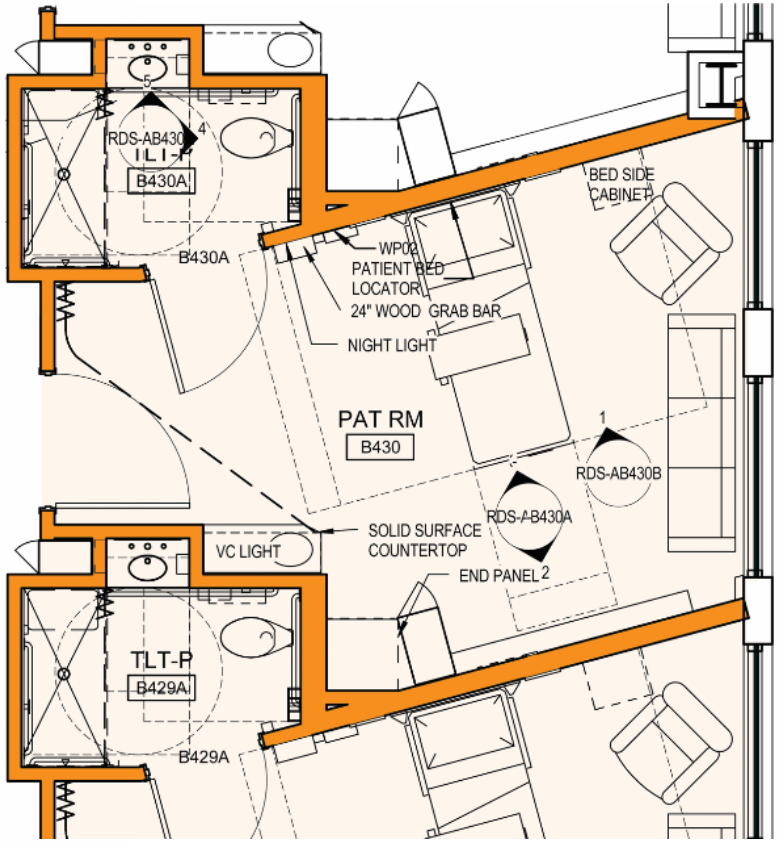
Circulation



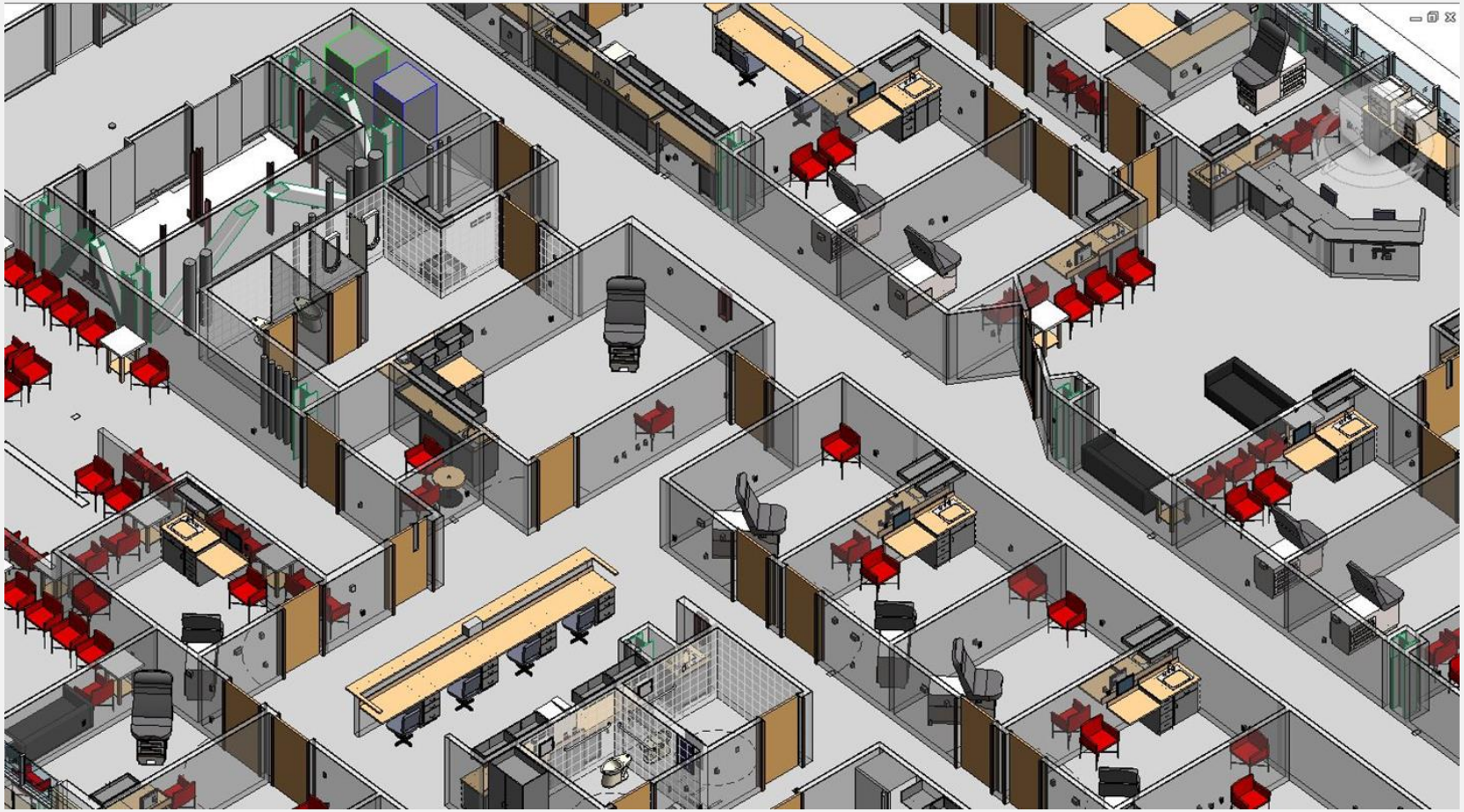
Adjacency



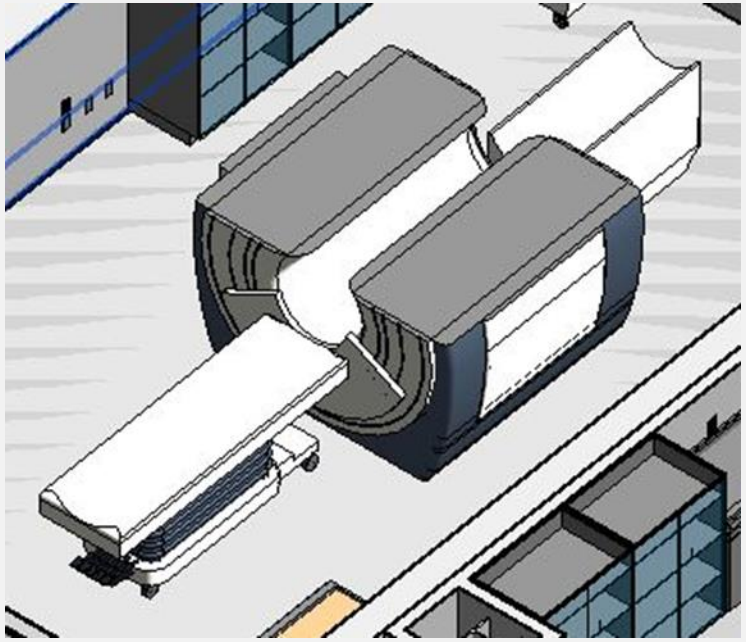
Visibility

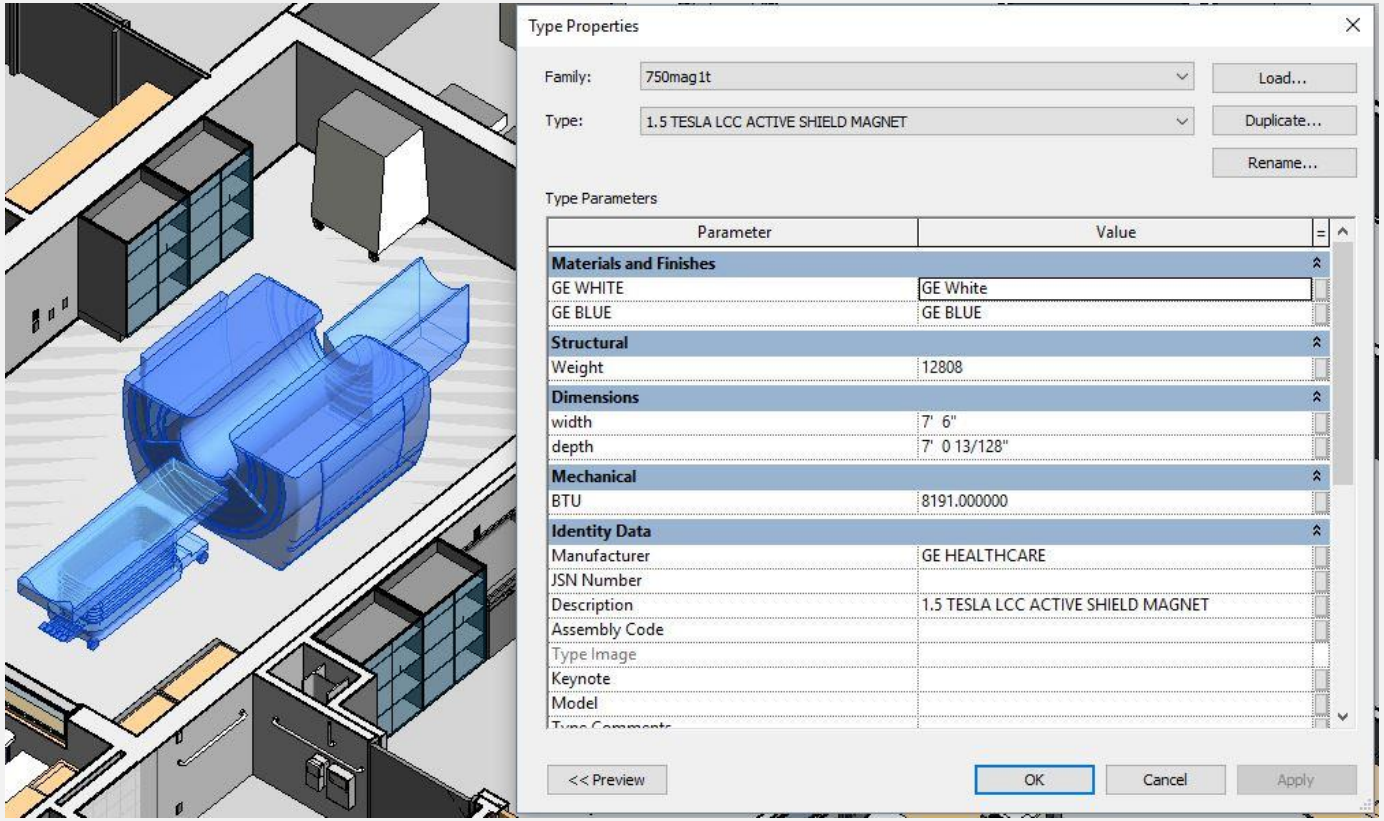


Design visualization: Asset Management

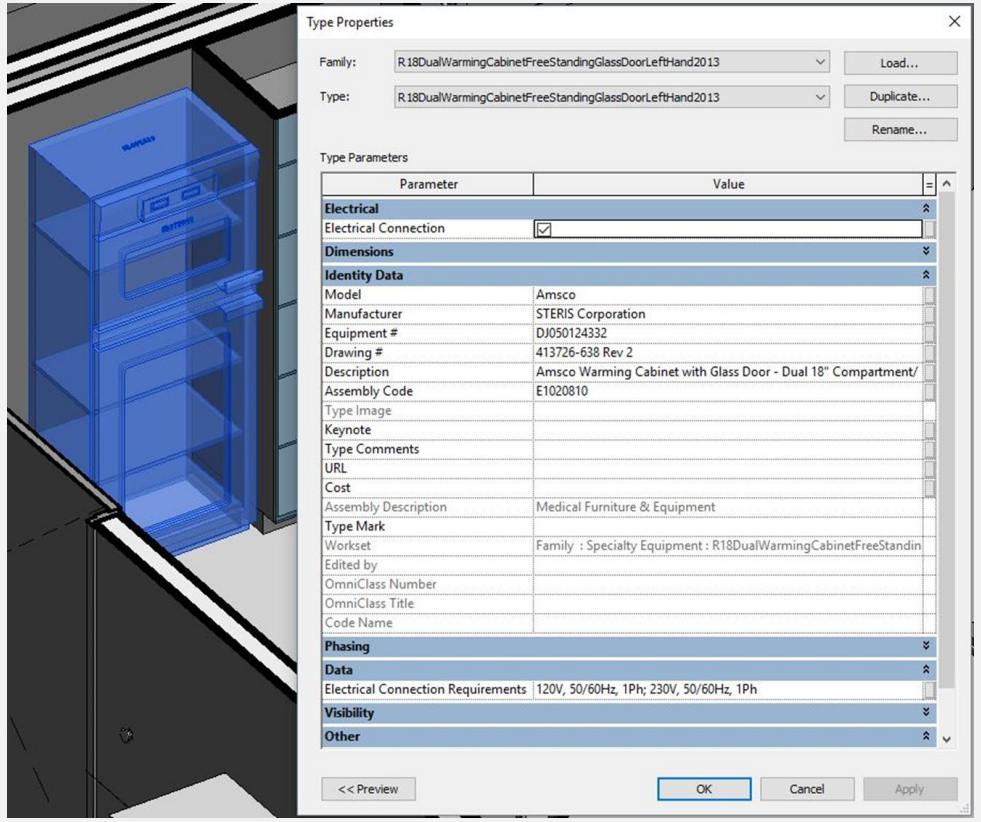


Equipment: MRI and associated data

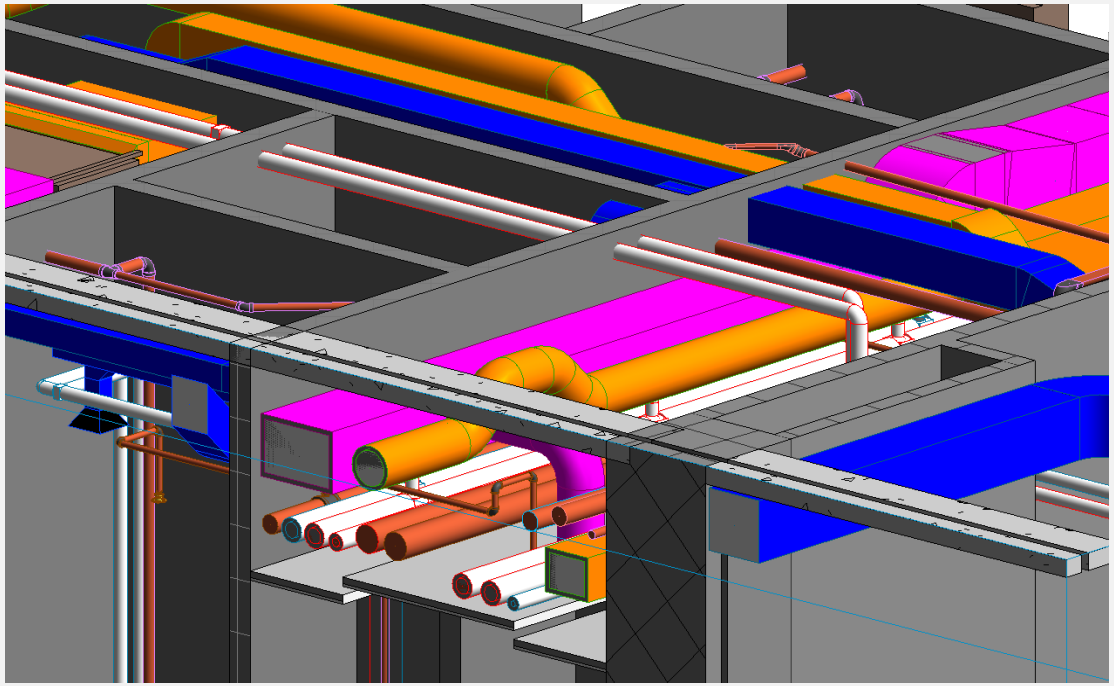


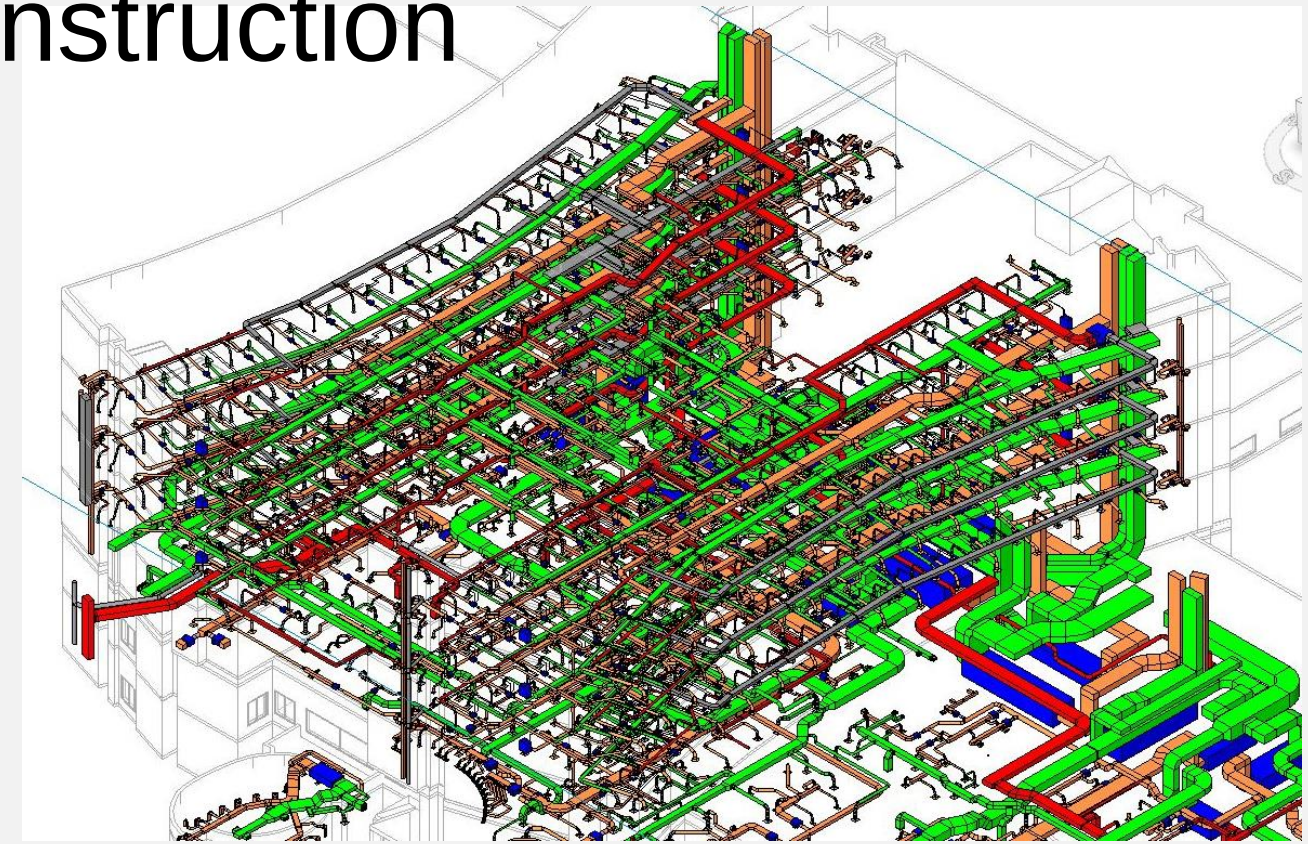


Equipment: Warming cabinet and associated data



HVAC Engineering modeling used for design and construction

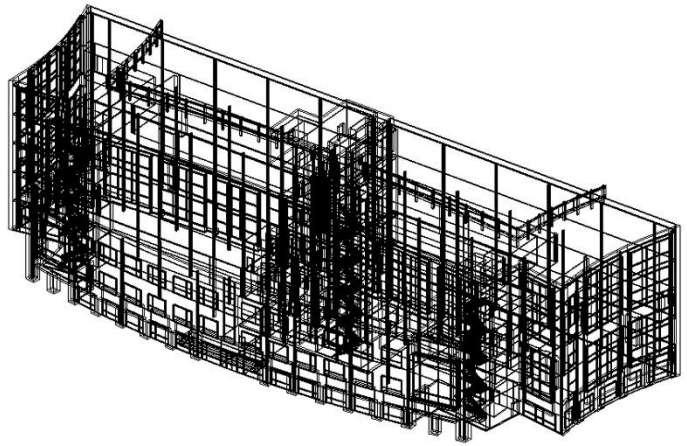


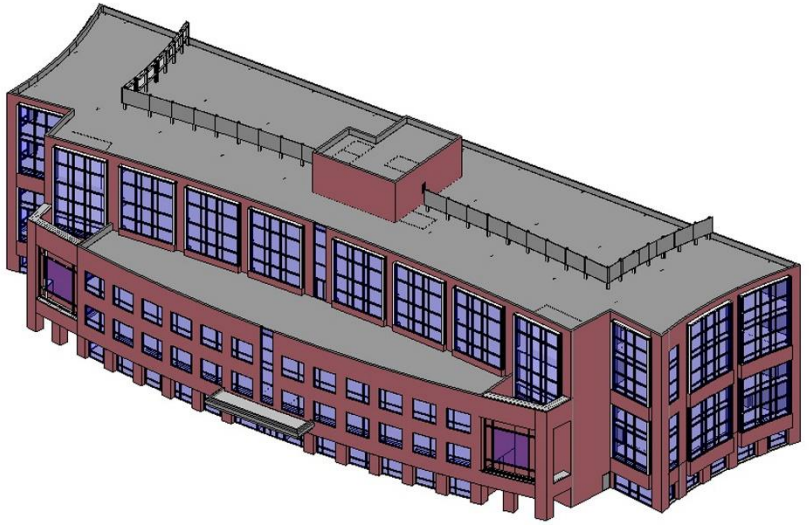


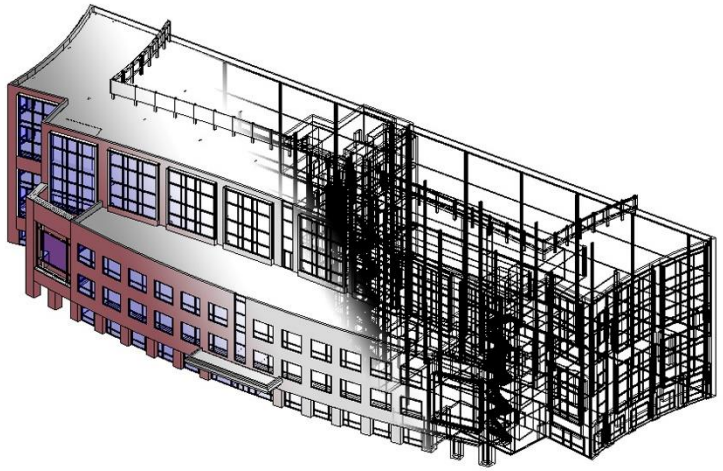
Case Study: Medical Office Building

- Existing medical office building modeled from CAD base plans and field verification
- Shared with designers for ongoing tenant build out projects
- Space management
  - Highlighted drawings
  - Reporting
- Locate assets to be maintained

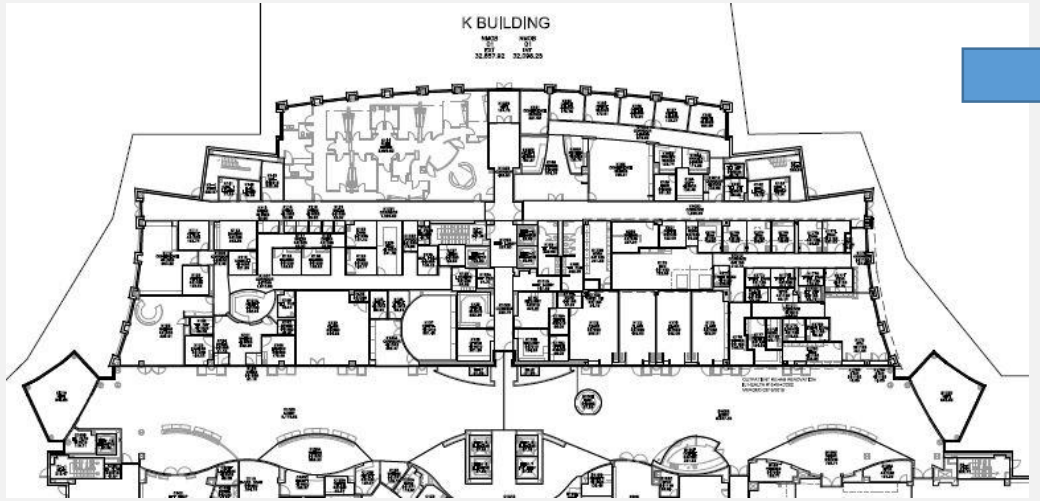
Built virtually after construction

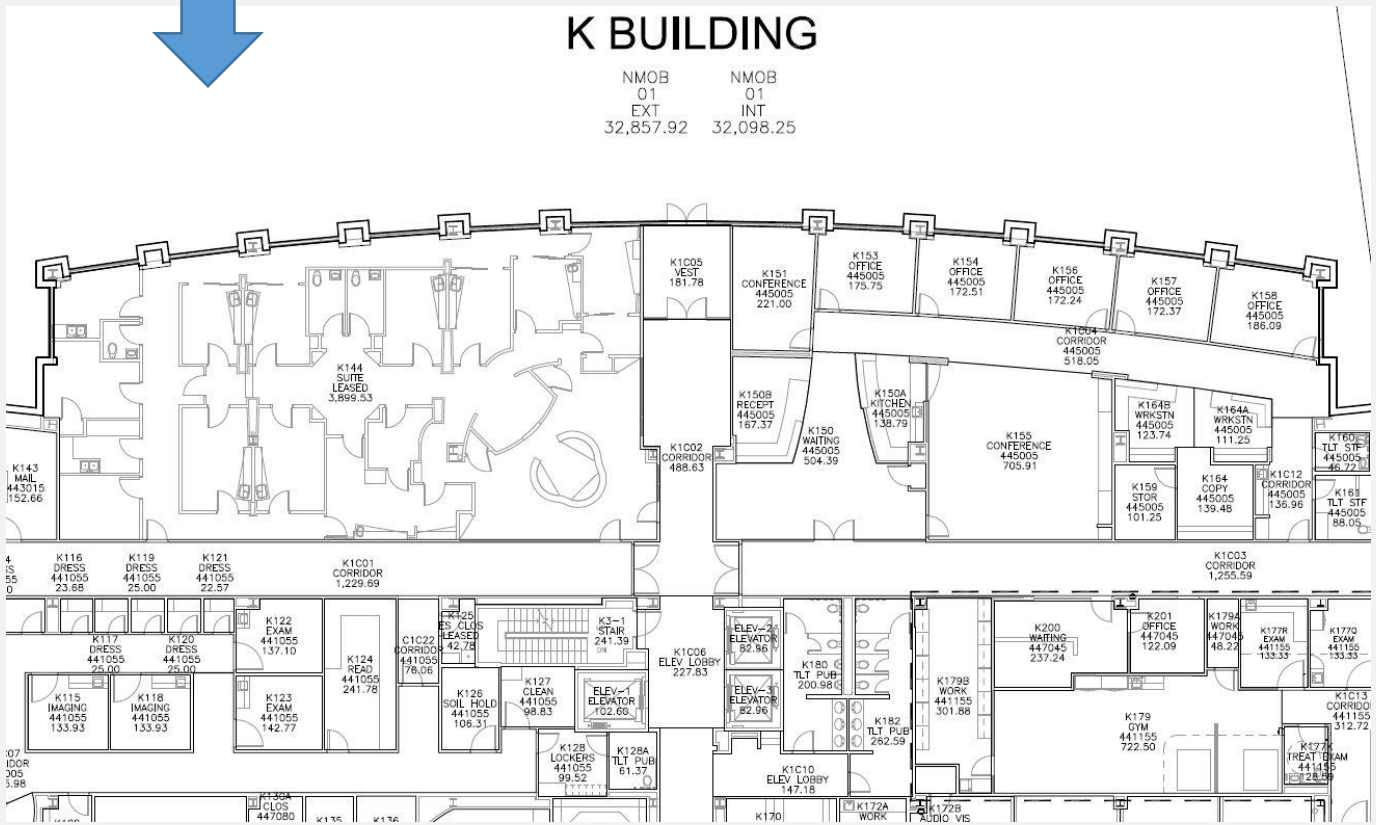






Plans exported from the model & published



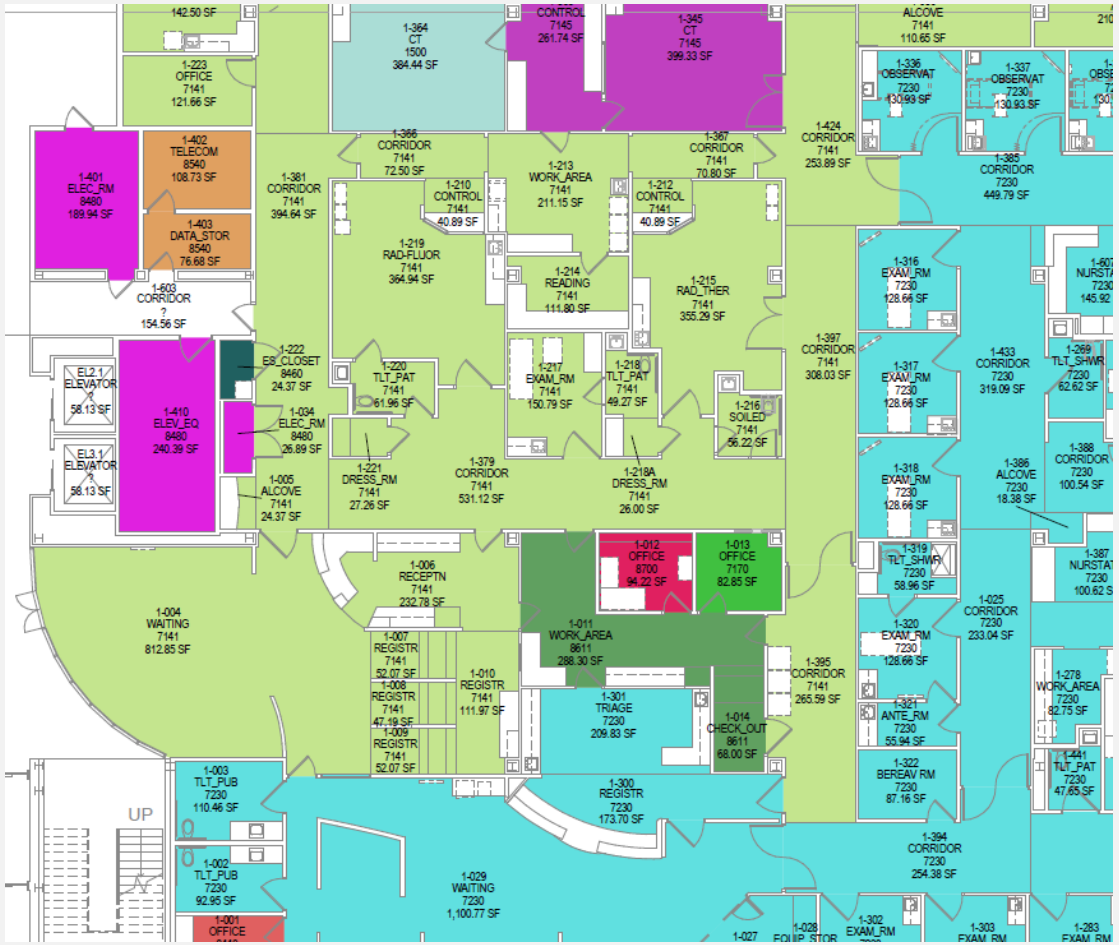


A'17 AIA Conference on Architecture 2017
April 27–29, Orlando

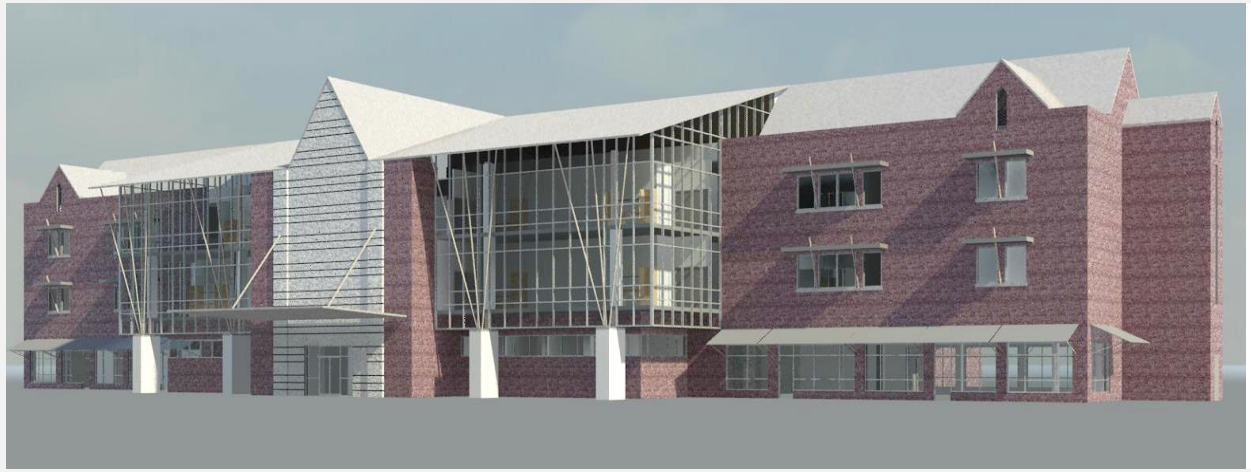
BIM used to show space allocations

Department Legend

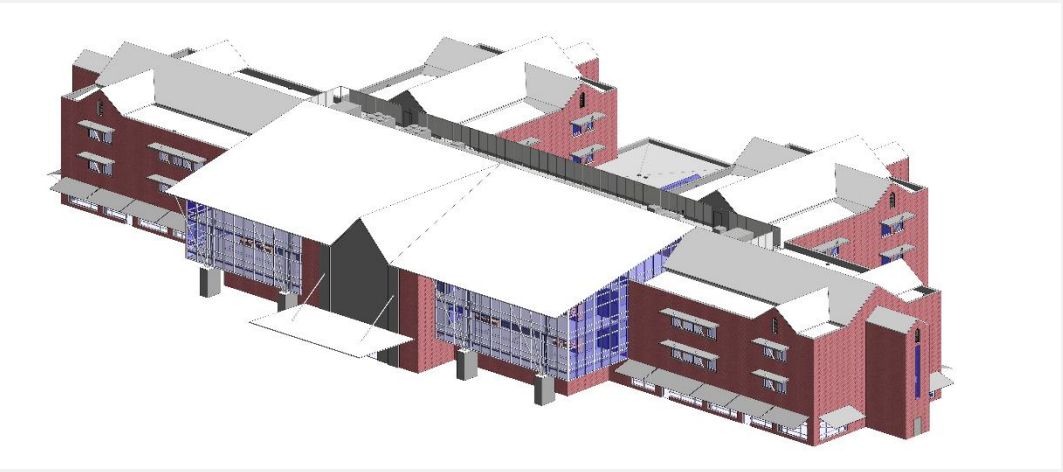
1010	General Stores
1500	Vacant
7065	Laboratory
7125	MRI
7141	Radiology
7145	Cat Scan
7149	Diagnostic Breast Center
7170	Pharmacy
7230	Emergency Services
7522	OB GYN Physician Office
8440	Security
8460	Housekeeping
8472	Utilities
8480	Plant Maintenance
8540	Information Services
8611	Administration
8700	HIM Administrative
TENANT-1	Tenant 1 (1st Floor)



Case Study: Healthcare Clinic Building

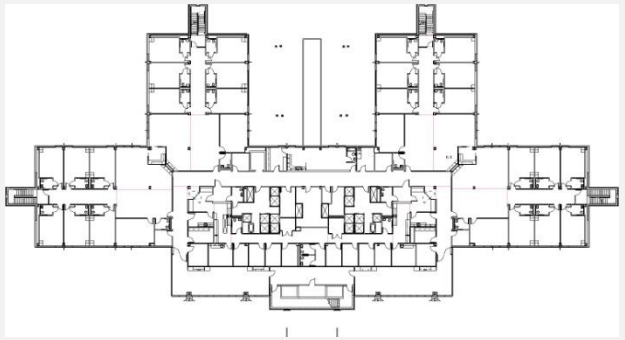


Rendering

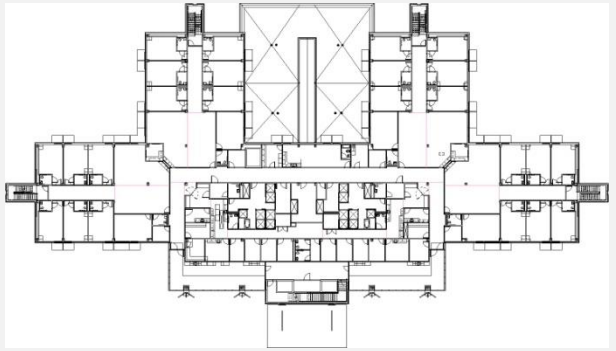


Model

Ground Floor



First Floor



Second Floor

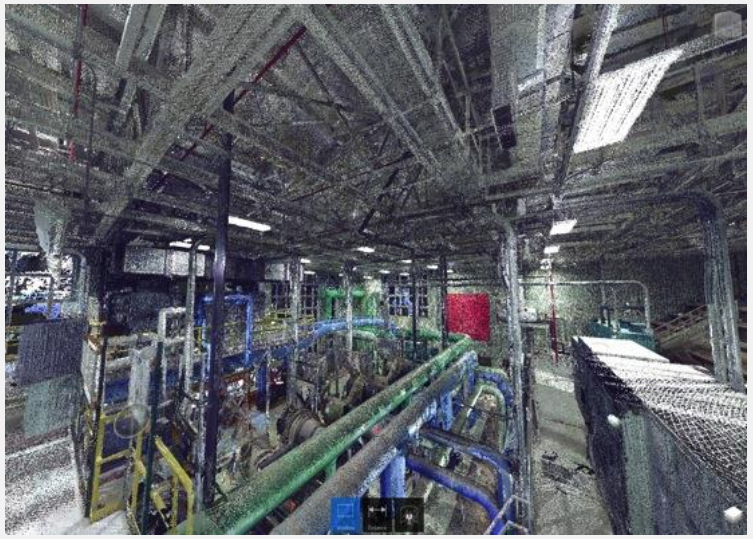
Case Study: Hospital Mechanical Room

- 3D point cloud created
- Scanned data visualization – navigating & labeling
- Asset & Maintenance Management
  - Locations shown on floor plans and visualized spaces
  - Reporting from connected data

Point Clouds: Real World to Digital 3D…

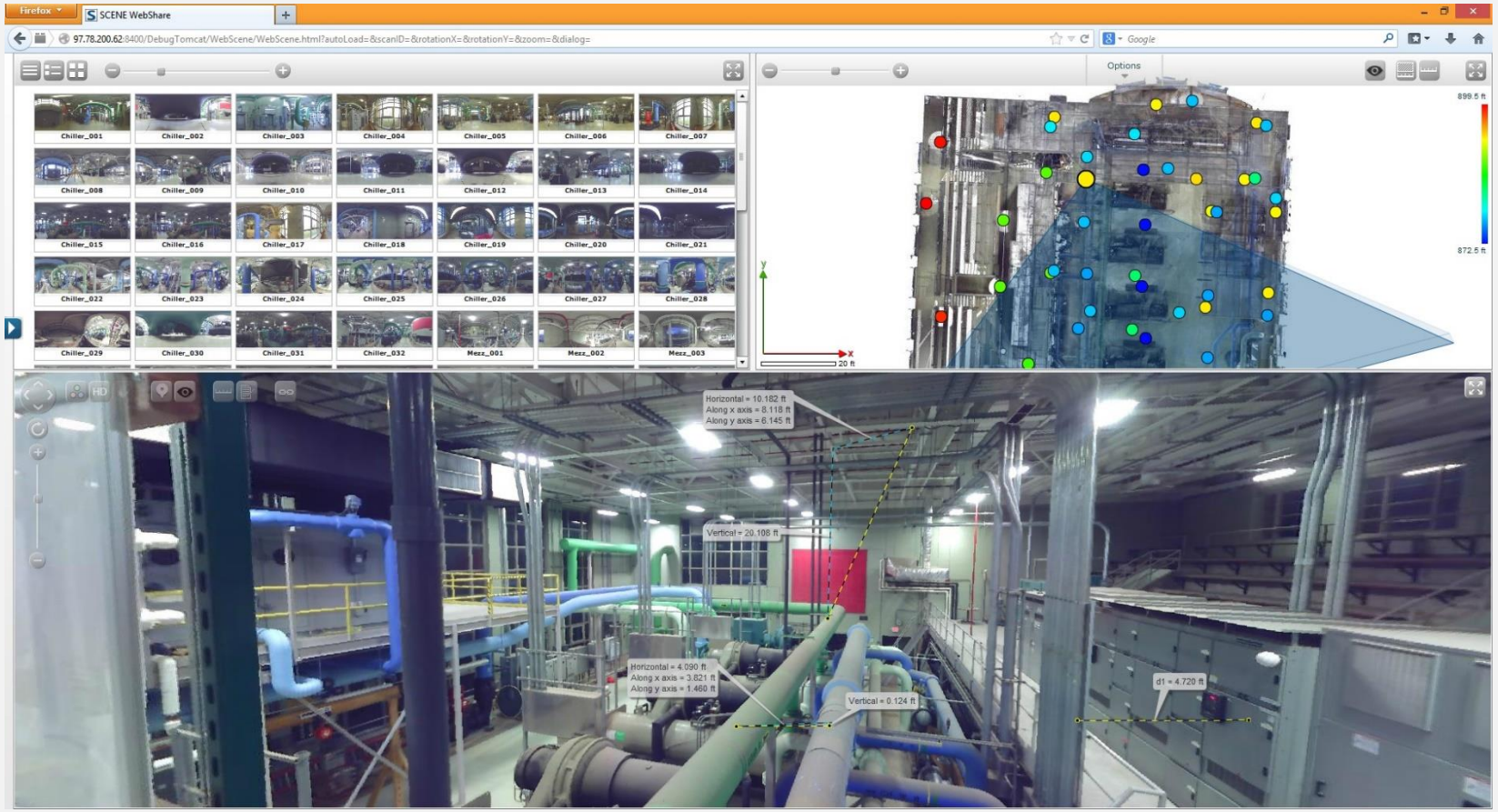
Photograph

3D Reality Capture Scan



Real World → 3D Laser Scanning → Digital 3D

Project Virtualization: As-Built Data in the “Cloud”



3D as-built project data & documentation readily available to project stakeholders from any device.

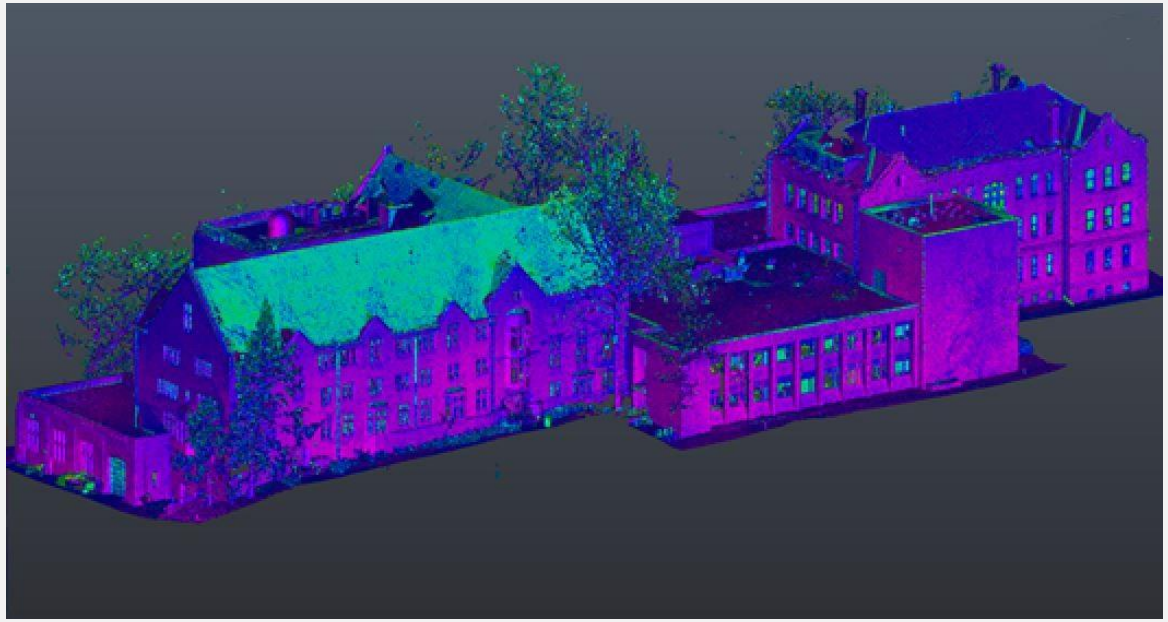
Case Study: Retail & Higher Education

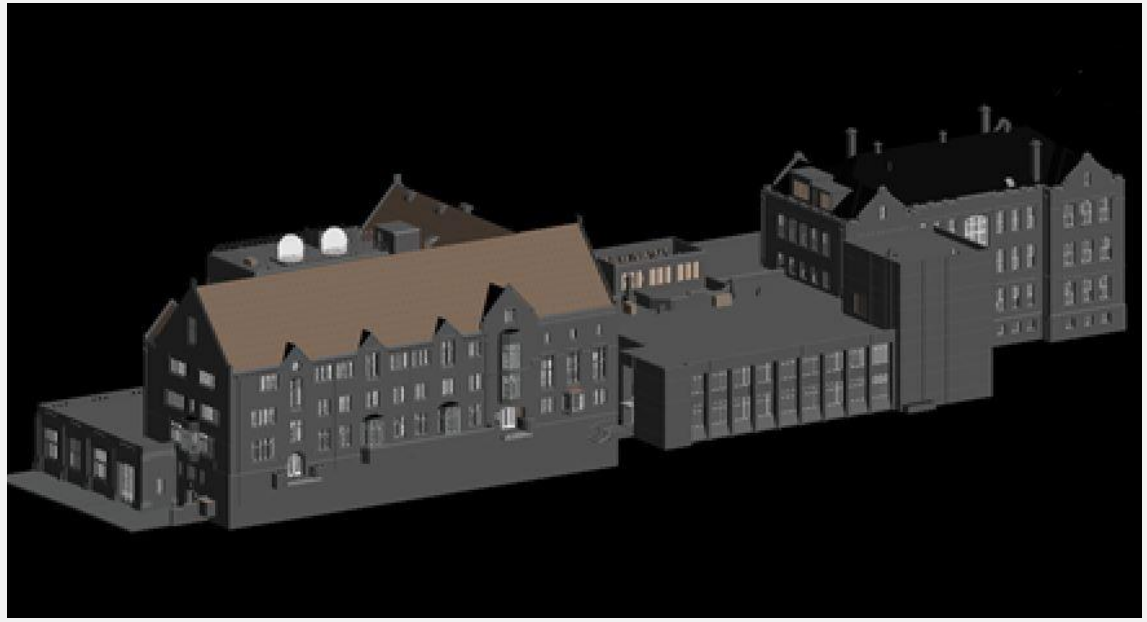
- Building Exteriors modeled from 3D point cloud scanning
- Scan data visualization
- Conversion to BIM
- Existing building documentation to begin new design projects
- Process to document multiple building campuses and shopping centers

Interoperability: Point Cloud to BIM

Conversion
Application

Scan-to-BIM Workflow



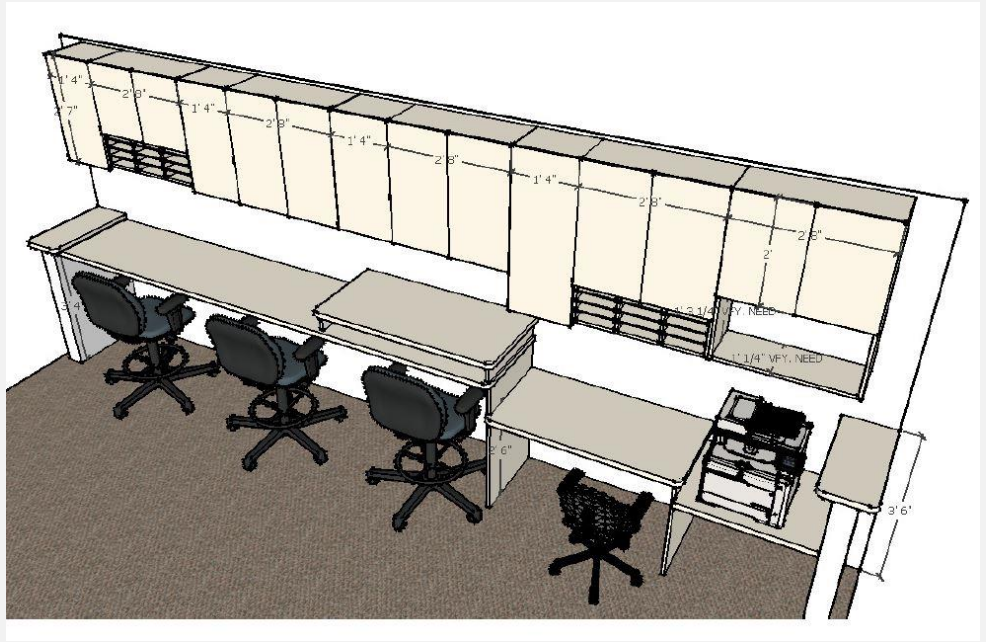


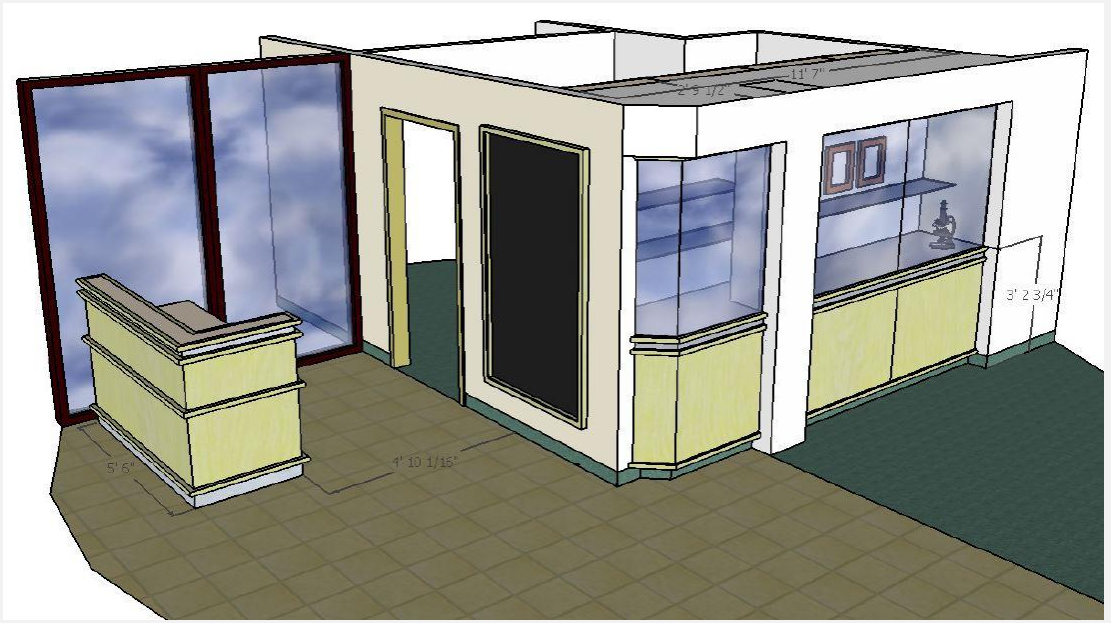
Analyze and access as-is project conditions prior to commencing the design process

Case Study: Medical Office Building

- Existing medical office building project updates
  - Visualized in 3D
  - Drawn to scale – dimensions may be displayed
  - Created from library of components
- Shared with contractors and trades for ongoing projects

In-house project views





The Future – ???

- Process improvements needed?
- Lessons Learned - Tips and Tricks
- Standardizing project updates
- Using the data during the entire building life cycle means it is best to start the process early
- Lifecycle facilities and asset management can truly improved through BIM

BIM stands for…

Building Information Modeling

and

Better Information Management

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www.trcww.com

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317-509-4043

BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Course Number: WE102

Wednesday | April 26 | 8:30 am – 12 pm

3.75 LU/GBCI/RIBA

Panel Discussion

Panel Discussion

Role: Workshop Presenter

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A Final Thank You