Walk-in Slide: AU 2014 Social Media Feed

1. Click on the link below, this will open your web browser

http://aucache.autodesk.com/social/visualization.html

2. Use “Extended Display” to project the website on screen if you plan to work on your computer. Use “Duplicate” to display same image on screen and computer.

Extending Virtual Design and Construction to Support Total Cost of Ownership

Andrew Arnold, Ph.D.
Director, DPR Consulting, DPR Construction
@JAndrewArnold

Bruce Mace
Director UCSF Medical Center Facilities Management

Class summary

- Overview
- UCSF Medical Center Healthcare System
- BIM for FM at Mission Bay
- Lessons learned and vision for future

Key learning objectives

- At the end of this class, you will be able to:
  - Understand how O&M can evolve the practice for enterprises
  - Understand the business case for BIM in lowering total cost of ownership
  - Understand virtual design and construction principles, and their extension for O&M
  - Understand the importance of early involvement by the owner's operations and maintenance team in capital projects

DPR OFFICES

18

LOCATIONS

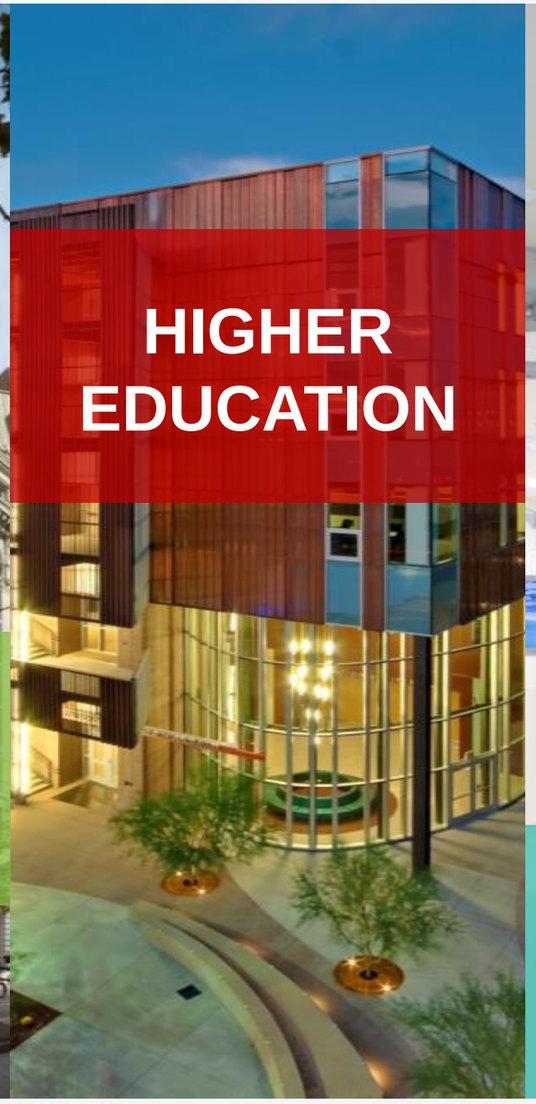
1,500

FULL-TIME STAFF

1,400

CRAFT EMPLOYEES

Overview, DPR Core Markets

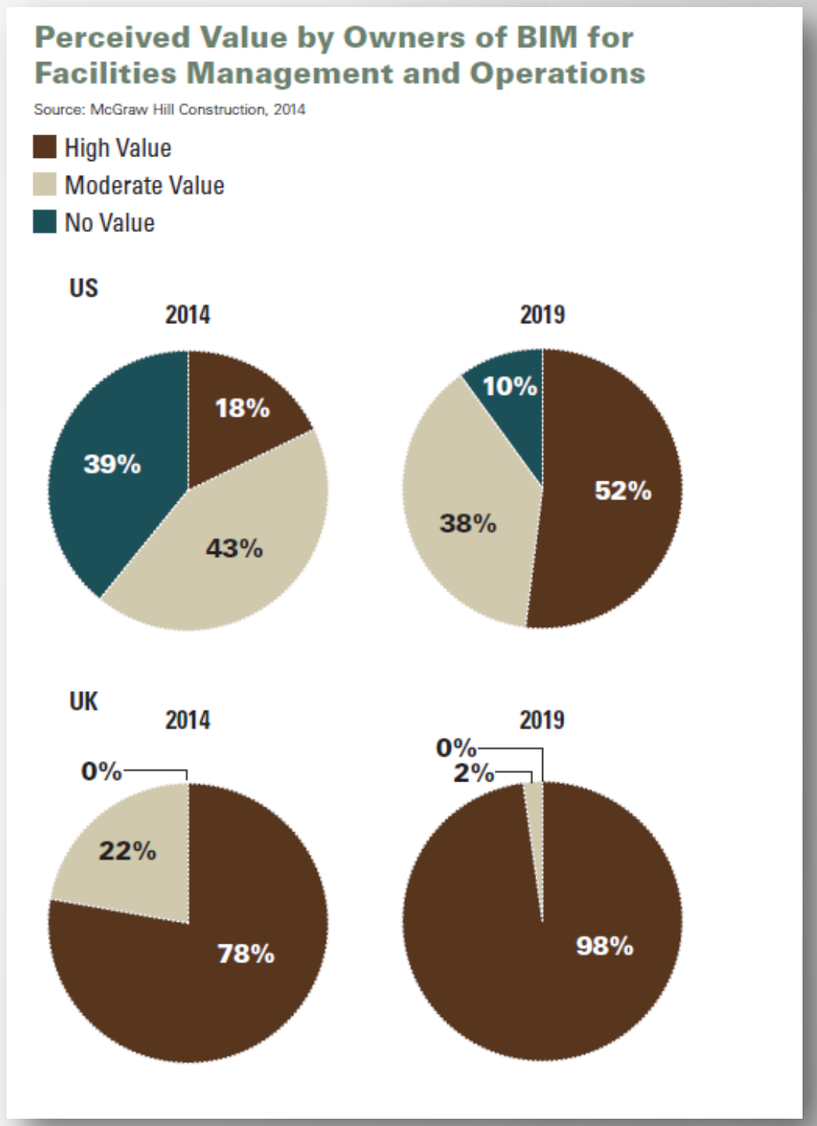


Where BIM for FM is headed in the near and long term

PERCEIVED VALUE BY OWNERS

BIM for facility management and operations

- Complete and accurate data, linked to graphics
- Eliminate double entry of information
- Capture real time performance data in model
- Scheduled maintenance integrated with model and work order systems
- Space management
- More accurate planning, scoping, and budgeting for alterations

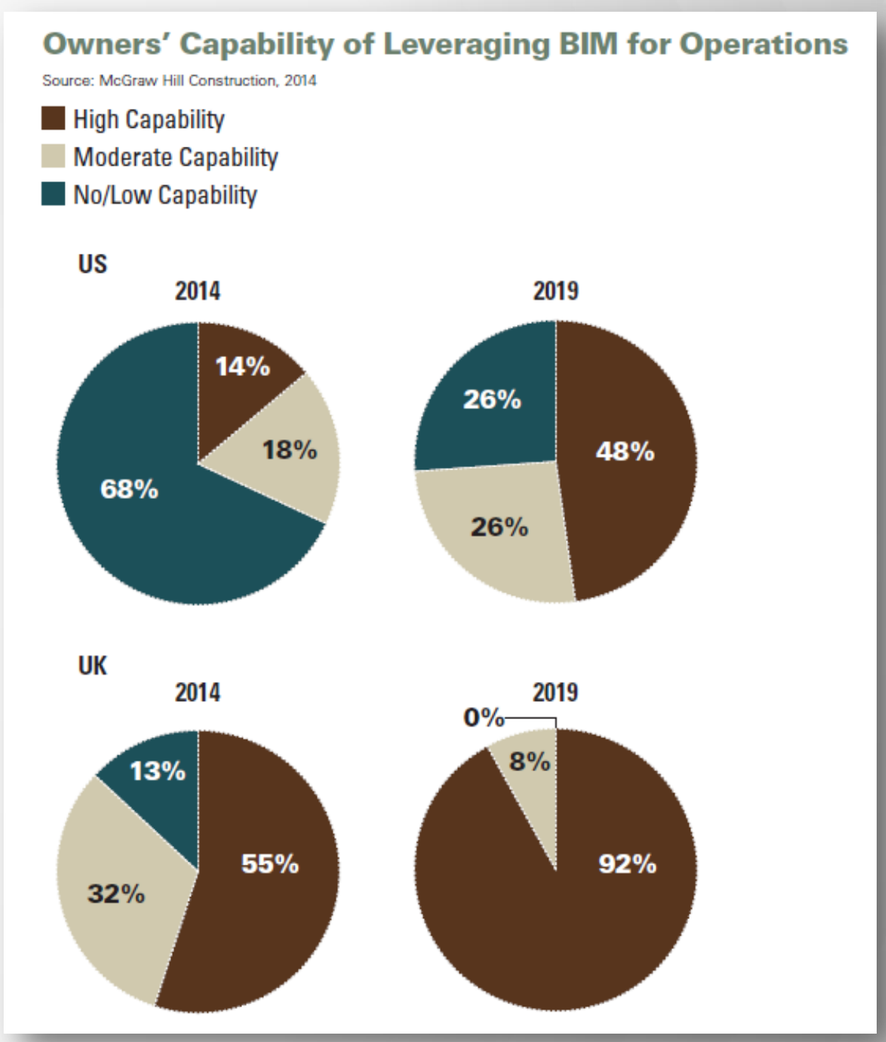


McGraw Hill Construction, 2014

OWNERS CAPABILITY OF LEVERAGING BIM

BIM for facility management and operations

- 14% of US owners believe they have high capabilities now,
  - Growing to 48% within 5 years
- Large owners well positioned
- BIM-active owners are aware of the data that can be represented in models
- Government Initiatives e.g., Integrated Facilities Management Agencies (FED iFM) are driving interest

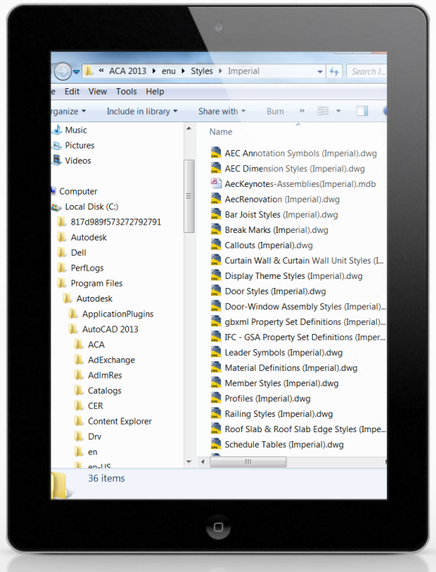


McGraw Hill Construction, 2014

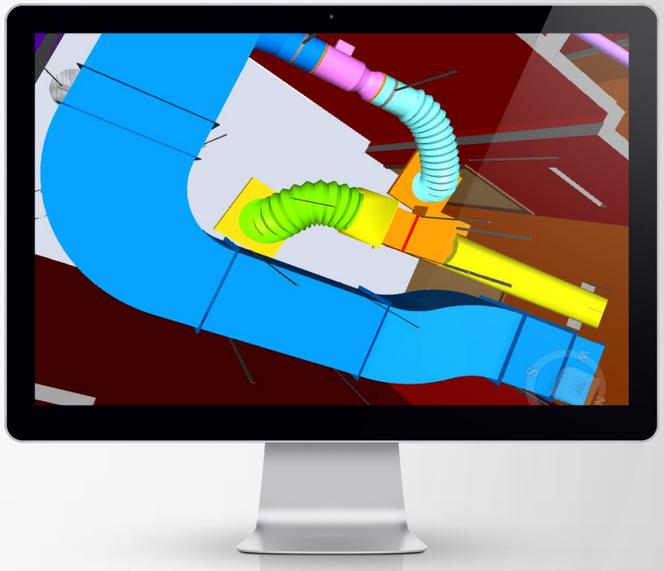
INFORMATION MANAGEMENT

Increasing value and complexity

PAPER



DIGITAL FILES



ELEMENTS WITH DATA

WHOLE LIFE MANAGEMENT

Comparative costs

Energy
+- $2/SQ FT

Facility
Finance
10x

People
15x

Steve Selkowitz, Windows and Envelope Materials Group
Lawrence Berkeley National Laboratory

ENERGY IS STILL A BIG NUMBER!

- $898.4 billion construction value, North America, 2013
  - US Census Bureau
- Energy is 50% to 100% of construction cost
- Invest savings in occupant satisfaction

Steve Selkowitz, Windows and Envelope Materials Group
Lawrence Berkeley National Laboratory

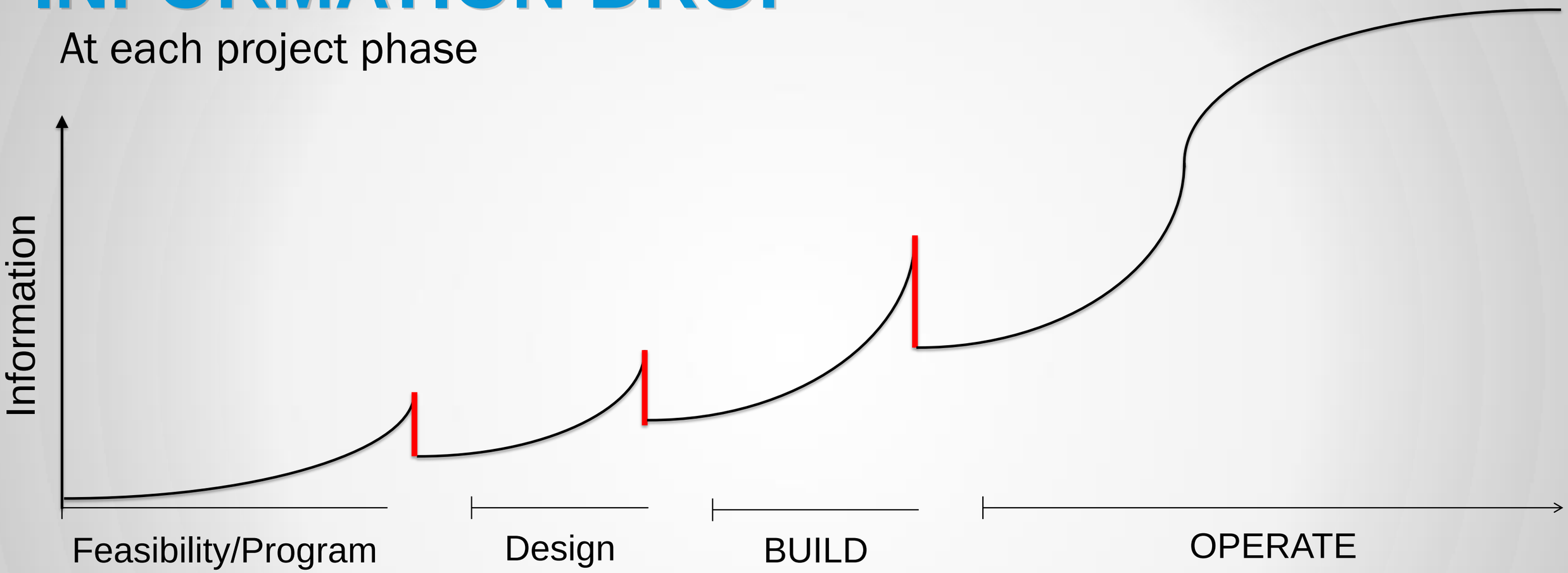
MOVING TOWARD HIGH PERFORMANCE

Gaps between Design Intent and Performance

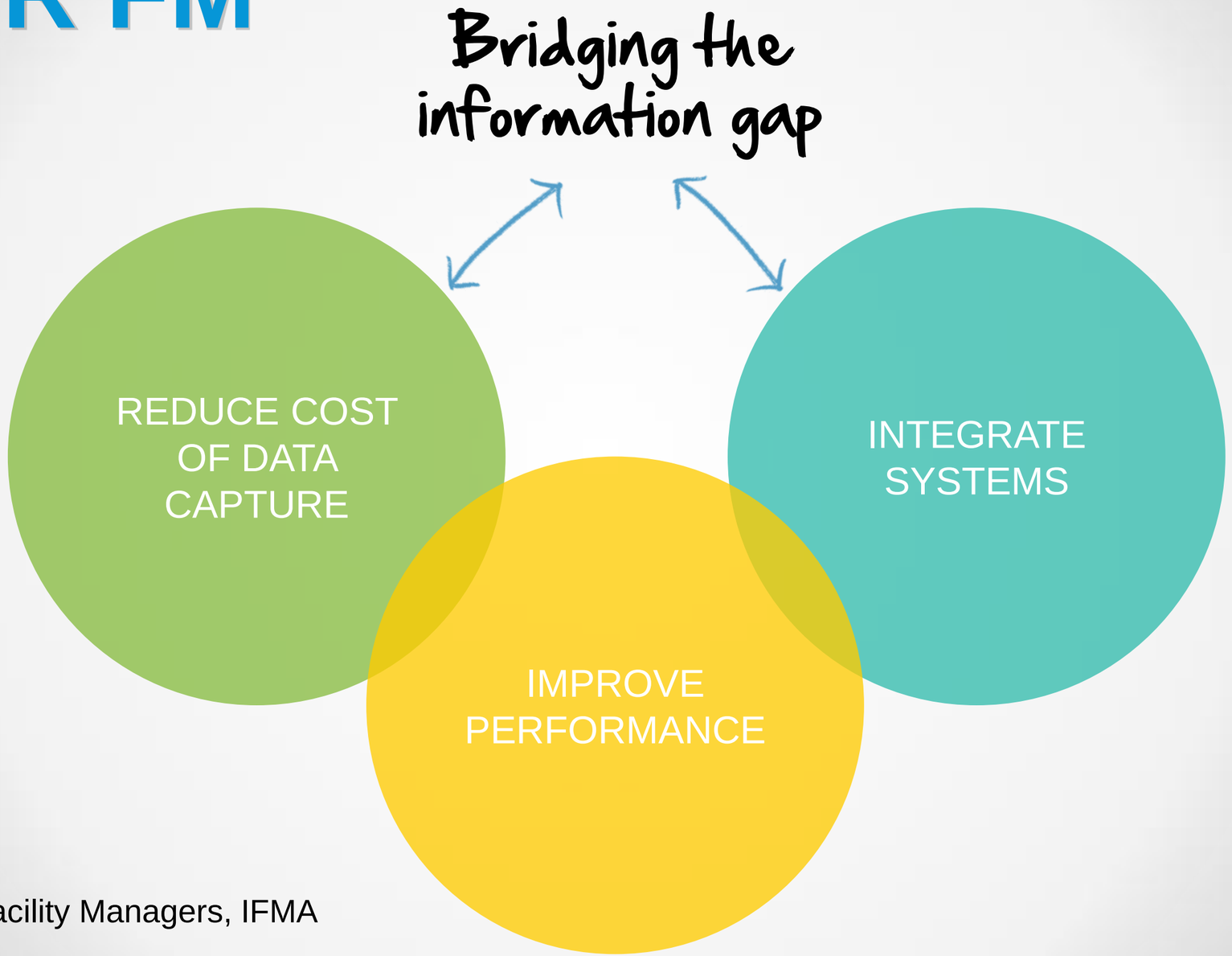
Steve Selkowitz, Windows and Envelope Materials Group
Lawrence Berkeley National Laboratory

INFORMATION DROP

At each project phase



BIM FOR FM



Adapted from BIM for Facility Managers, IFMA
Paul Teicholz, Editor

GUIDELINES

Organization, Processes, Data

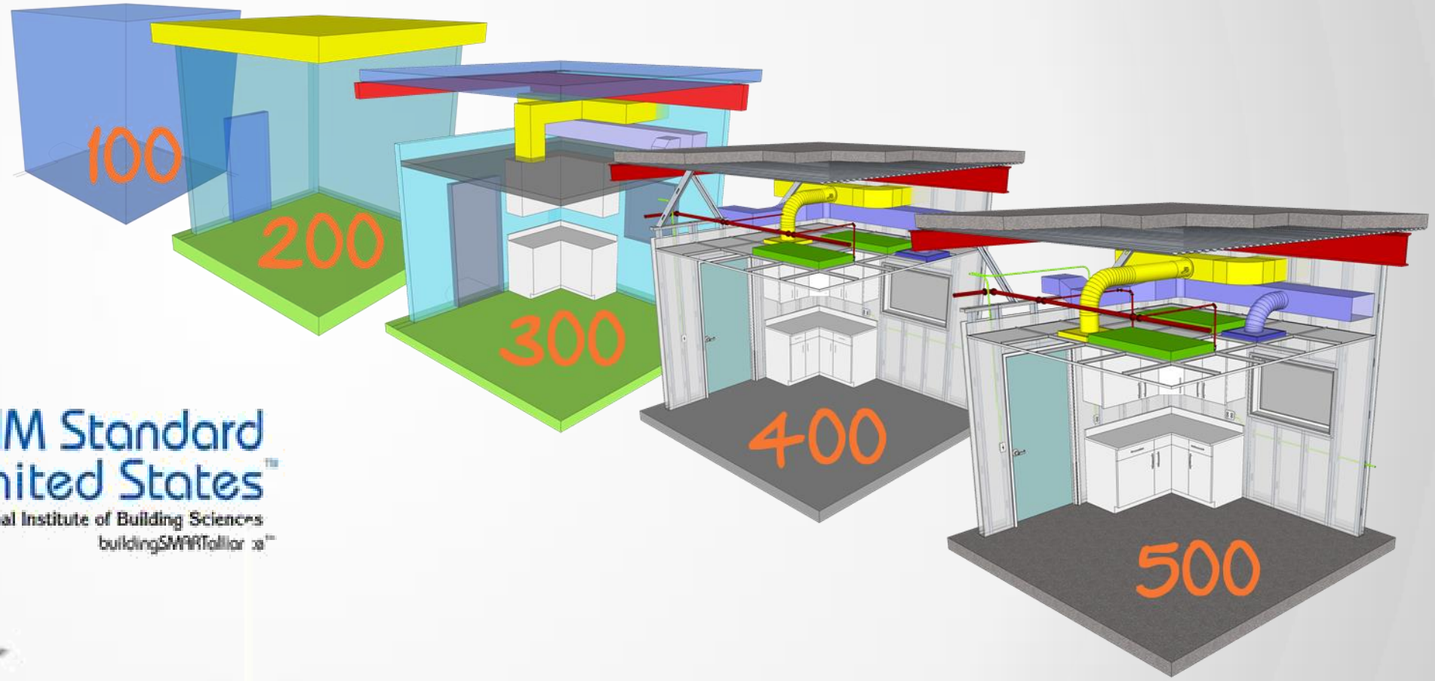
National BIM Standard - United States™

an initiative of the National Institute of Building Sciences

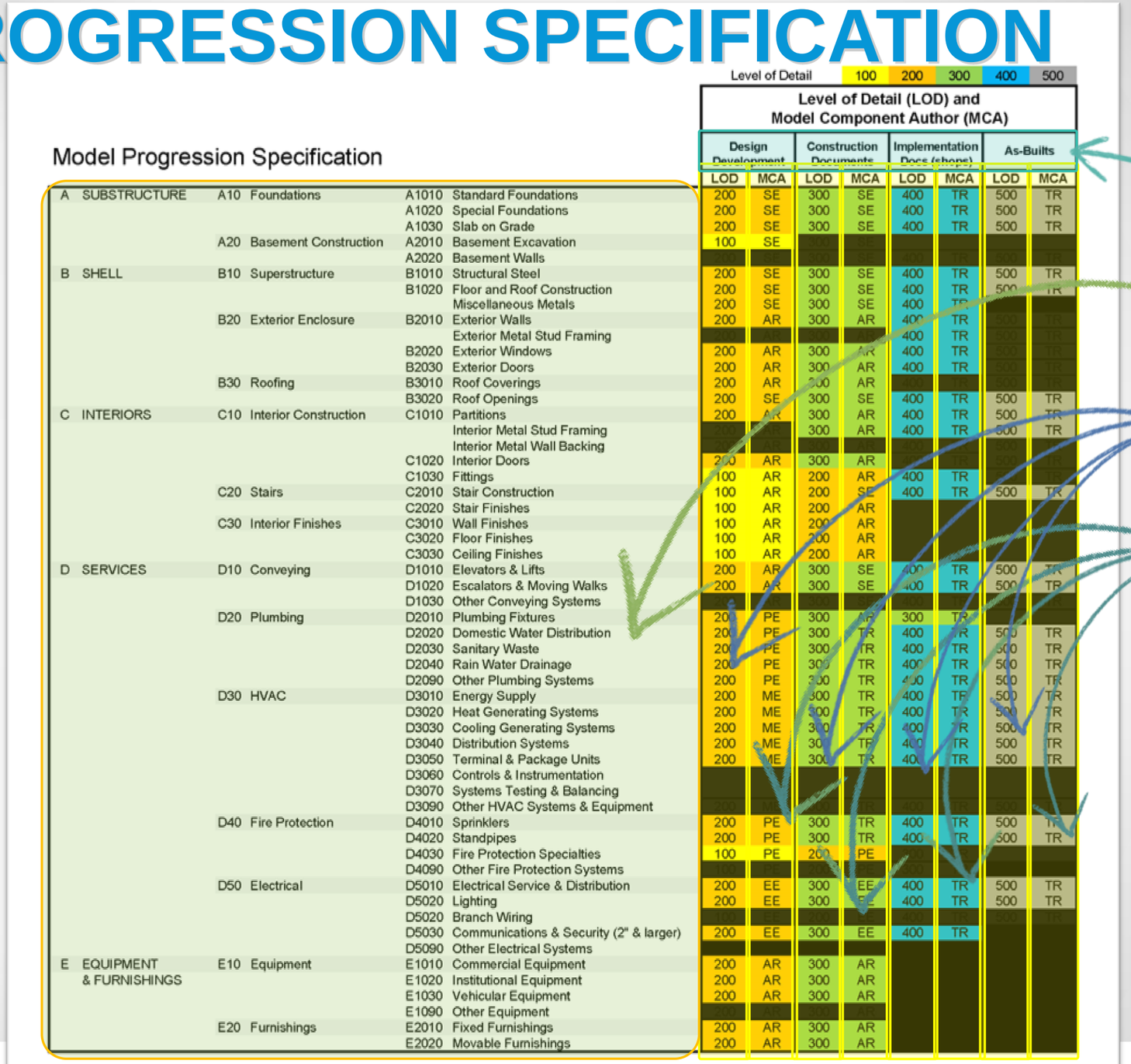
buildingSMARTalliance™

NCS

United States National CAD Standard®



MODEL PROGRESSION SPECIFICATION



Model Progression Specification

Level of Detail 100 200 300 400 500

Level of Detail (LOD) and Model Component Author (MCA)

					Design Development		Construction Documents		Implementation Docs (shops)		As-Builts	
					LOD	MCA	LOD	MCA	LOD	MCA	LOD	MCA
A	SUBSTRUCTURE	A10	Foundations	A1010 Standard Foundations	200	SE	300	SE	400	TR	500	TR
				A1020 Special Foundations	200	SE	300	SE	400	TR	500	TR
				A1030 Slab on Grade	200	SE	300	SE	400	TR	500	TR
		A20	Basement Construction	A2010 Basement Excavation	100	SE						
				A2020 Basement Walls								
B	SHELL	B10	Superstructure	B1010 Structural Steel	200	SE	300	SE	400	TR	500	TR
				B1020 Floor and Roof Construction	200	SE	300	SE	400	TR		
				Miscellaneous Metals	200	SE	300	SE	400			
		B20	Exterior Enclosure	B2010 Exterior Walls	200	AR	300	AR	400	TR		
				Exterior Metal Stud Framing					400	TR		
				B2020 Exterior Windows	200	AR	300	AR	400	TR		
				B2030 Exterior Doors	200	AR	300	AR	400	TR		
		B30	Roofing	B3010 Roof Coverings	200	AR	300	AR				
				B3020 Roof Openings	200	SE	300	SE	400	TR	500	TR
C	INTERIORS	C10	Interior Construction	C1010 Partitions	200	AR	300	AR	400	TR	500	TR
				Interior Metal Stud Framing			300	AR	400	TR	500	TR
				Interior Metal Wall Backing								
				C1020 Interior Doors	200	AR	300	AR				
				C1030 Fittings	100	AR	200	AR	400	TR		
		C20	Stairs	C2010 Stair Construction	100	AR	200	SE	400	TR	500	TR
				C2020 Stair Finishes	100	AR	200	AR				
		C30	Interior Finishes	C3010 Wall Finishes	100	AR	200	AR				
				C3020 Floor Finishes	100	AR	200	AR				
				C3030 Ceiling Finishes	100	AR	200	AR				
D	SERVICES	D10	Conveying	D1010 Elevators & Lifts	200	AR	300	SE	400	TR	500	TR
				D1020 Escalators & Moving Walks	200	AR	300	SE	400	TR	500	TR
				D1030 Other Conveying Systems								
		D20	Plumbing	D2010 Plumbing Fixtures	200	PE	300	AR	300	TR		
				D2020 Domestic Water Distribution	200	PE	300	TR	400	TR	500	TR
				D2030 Sanitary Waste	200	PE	300	TR	400	TR	500	TR
				D2040 Rain Water Drainage	200	PE	300	TR	400	TR	500	TR
				D2090 Other Plumbing Systems	200	PE	300	TR	400	TR	500	TR
		D30	HVAC	D3010 Energy Supply	200	ME	300	TR	400	TR	500	TR
				D3020 Heat Generating Systems	200	ME	300	TR	400	TR	500	TR
				D3030 Cooling Generating Systems	200	ME	300	TR	400	TR	500	TR
				D3040 Distribution Systems	200	ME	300	TR	400	TR	500	TR
				D3050 Terminal & Package Units	200	ME	300	TR	400	TR	500	TR
				D3060 Controls & Instrumentation								
				D3070 Systems Testing & Balancing								
				D3090 Other HVAC Systems & Equipment								
		D40	Fire Protection	D4010 Sprinklers	200	PE	300	TR	400	TR	500	TR
				D4020 Standpipes	200	PE	300	TR	400	TR	500	TR
				D4030 Fire Protection Specialties	100	PE	200	PE				
				D4090 Other Fire Protection Systems								
		D50	Electrical	D5010 Electrical Service & Distribution	200	EE	300	EE	400	TR	500	TR
				D5020 Lighting	200	EE	300	EE	400	TR	500	TR
				D5020 Branch Wiring								
				D5030 Communications & Security (2" & larger)	200	EE	300	EE	400	TR		
				D5090 Other Electrical Systems								
E	EQUIPMENT & FURNISHINGS	E10	Equipment	E1010 Commercial Equipment	200	AR	300	AR				
				E1020 Institutional Equipment	200	AR	300	AR				
				E1030 Vehicular Equipment	200	AR	300	AR				
				E1090 Other Equipment								
		E20	Furnishings	E2010 Fixed Furnishings	200	AR	300	AR				
				E2020 Movable Furnishings	200	AR	300	AR				

LEVEL OF DETAIL (LOD)

100 Overall building massing indicative of area, height, volume, location and orientation may be modeled in three

Model Component Author (MCA)

AR Architect

When

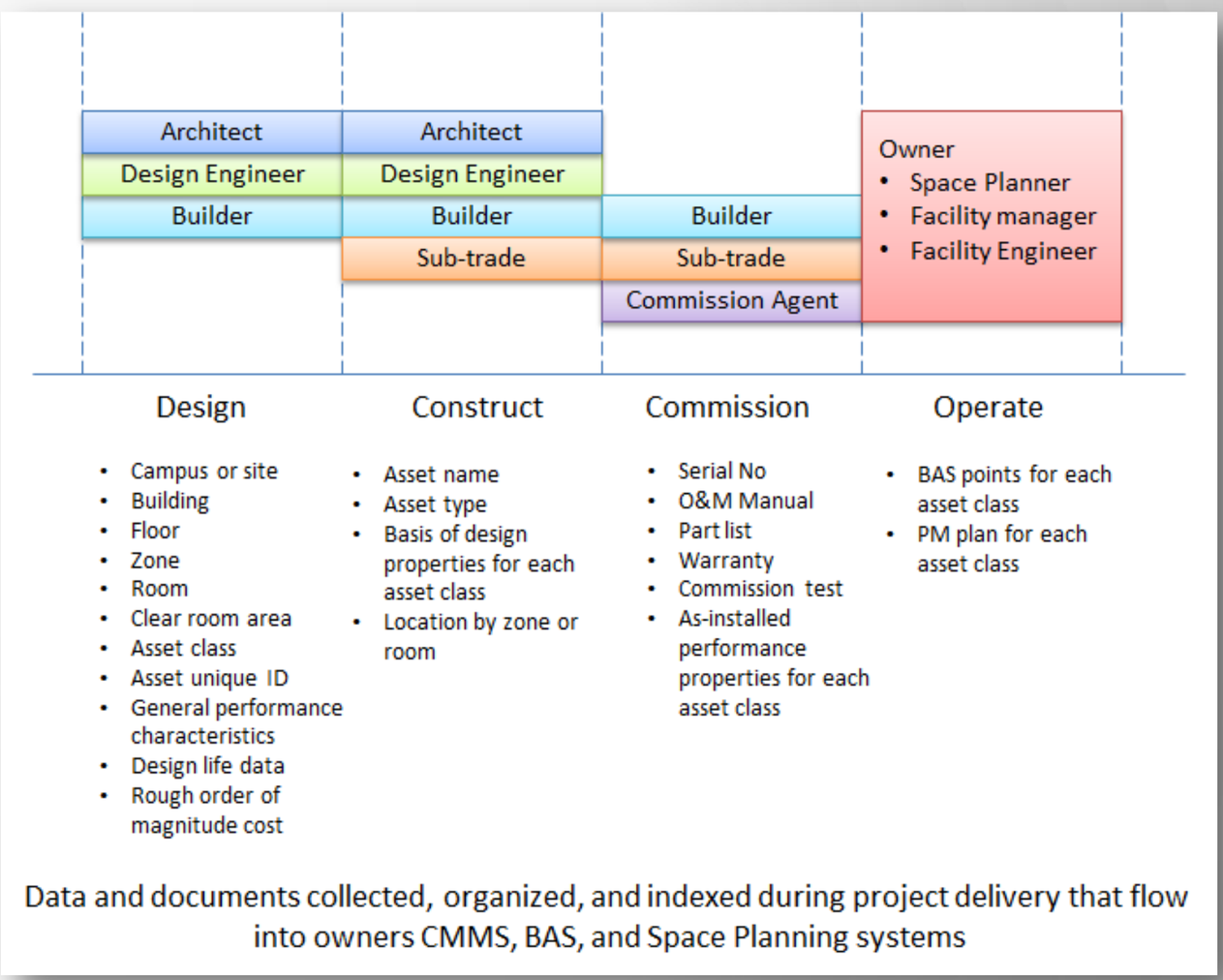
What

What LOD

Who

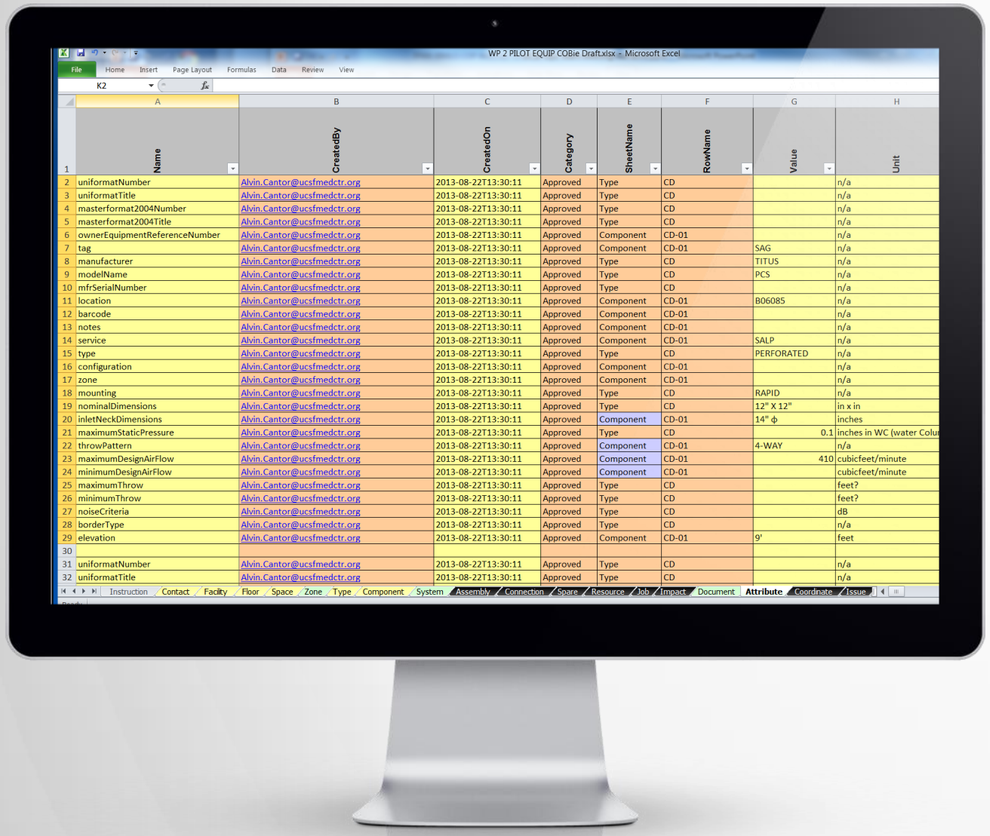
INCLUDE FM REQUIREMENTS

- Engage all stakeholders
- Pull FM requirements into project buyout
  - Define lifecycle information needs
  - Determine level of fidelity required
  - Set standards
- Capture data at appropriate milestones
- Integrate systems
  - Design
  - Estimating
  - Commissioning
  - Optimization



DATA EXCHANGE

COBie is useful, but don’t boil the ocean…



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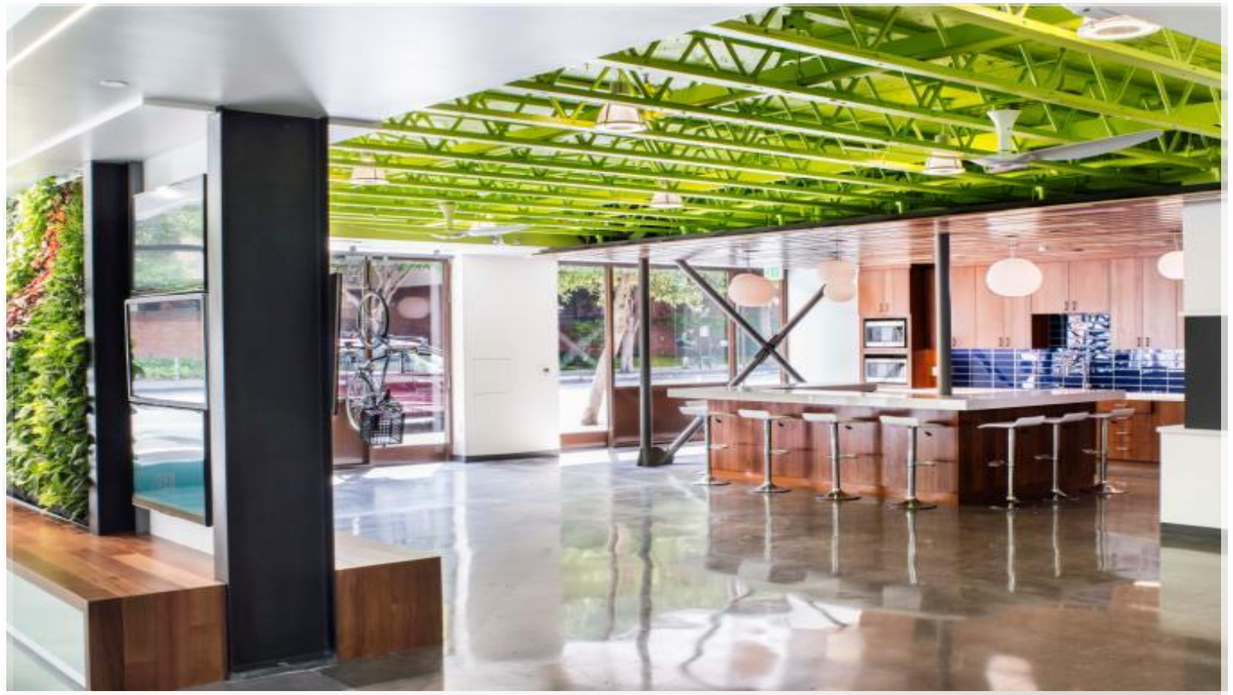
WHOLE LIFE MANAGEMENT

945 Front Street, San Francisco CA

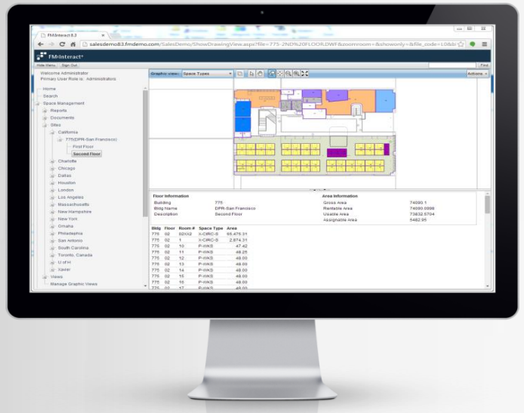
- Targeting LEED NC v4 Platinum
- 118kw photovoltaic (PV) system
- Rooftop solar thermal water heating
- Solatube750 DS Daylighting System
- Velux Solar-powered, automated operable skylights
- Eight-foot Essence and Four Haiku® Big Ass® Fans
- Three living walls
- Reclaimed wood panels and floors
- Living Laboratory



NET ZERO

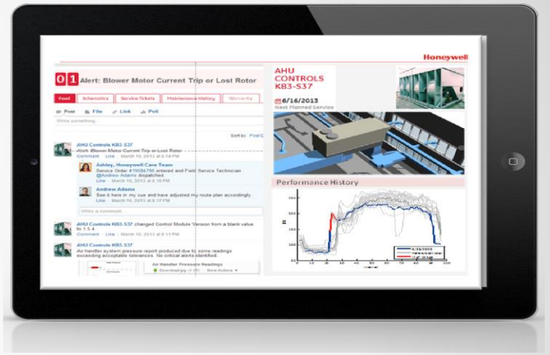
DPR OFFICE DEMONSTRATIONS

945 Front Street, San Francisco CA

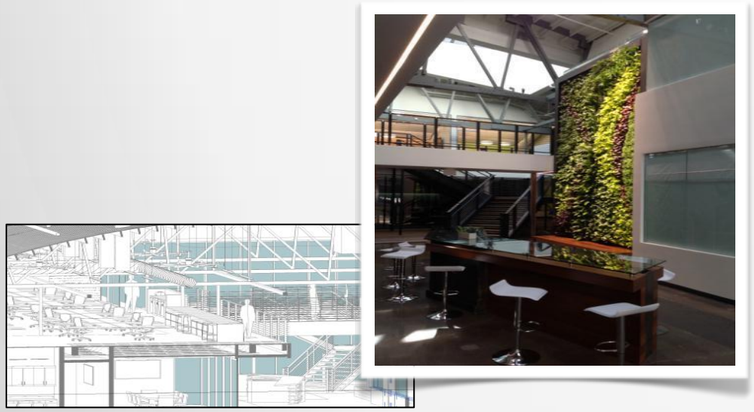


- Space management
- Asset management

Honeywell Enterprise Building Integrator



Building Engineer's Dashboard

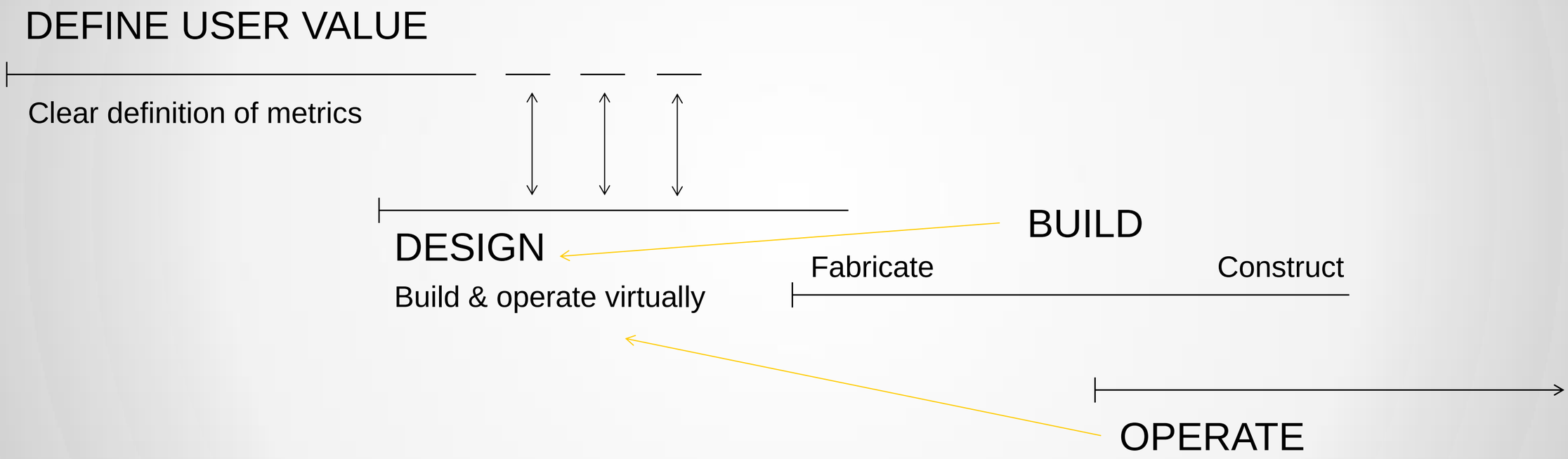


Honeywell Analytics

Plant & Distribution Options	TOTAL COST OF OWNERSHIP (50 yr NPV)	IRR (50 yr)	DISCOUNTED PAYBACK (includes maintenance, repair, depreciation, replacement, taxes and escalation)
GOOD (VRF w/DOAS)	$$	Base Case	Base Case
BETTER (CW Loop w/Chilled Beams)	$$$	17%	11.1 years
BEST (CHW Plant w/Chilled Ceiling)	$$$$	20%	9.3 years
BEST ALTERNATIVE (CHW Plant w/Chilled Slab)	$	N/A	Less Expensive than VRF

Metrics

FUTURE VISION



UCSF Medical Center

Growth as a Regional Health System

- Benioff Children’s Hospital San Francisco
- Benioff Children's Hospital Oakland
- UCSF Medical Center Parnassus Heights
- UCSF Medical Center Mount Zion
- Alliance Partners
- Strategic Growth – anticipate change

Medical Center Facilities Management

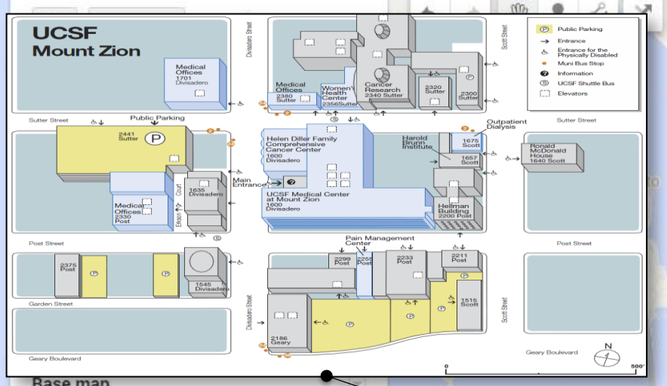
Bruce Mace, Director

Jhoric De Guzman, Associate Director

Edmon Obiniana, Associate Director

December 2014

UCSF Medical Center



6

Focused on leading BIM integration…

Benioff Children's Hospital

Ucsf-Mount Zion

UCSF/Mission Bay

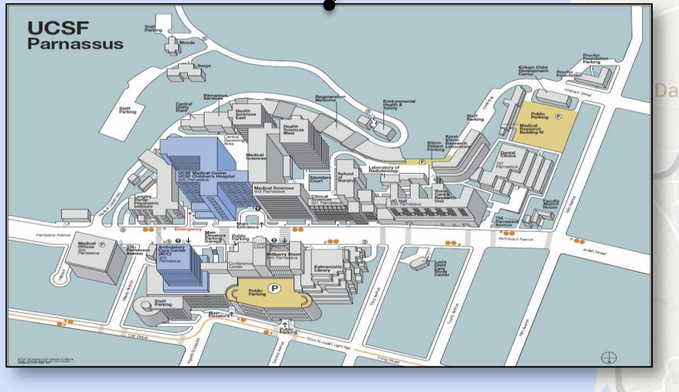
UCSF Parnassus

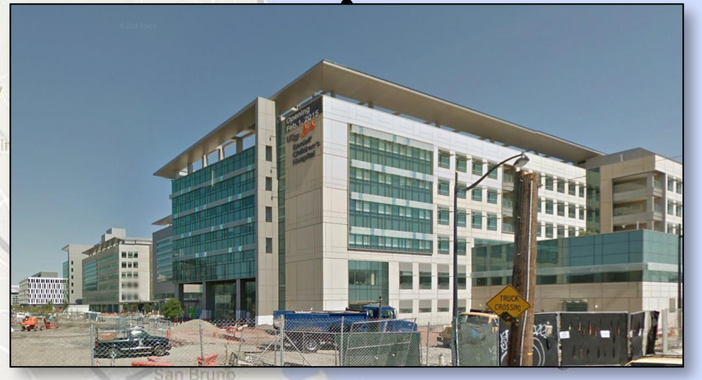
4

LOCATIONS

125

FULL-TIME STAFF





UCSF Medical Center Healthcare System

Changes in Healthcare

- National Standard of Care
- HCAHP *(Hospital Consumer Assessment of Healthcare Providers and Systems)* **$$$**
- *“core questions about critical aspects of patients' hospital experiences”*
- Facilities Management and the direct support of the Patient Care Environment and occupant satisfaction.

UCSF Medical Center

Synergy

- DPR, Autodesk, IBM, ecoDomus
  - Addressing Information Gaps by bridging the “delivery drops” through BIM
- UCSF
  - Addressing Project Delivery issues through the development of Milestones Matrix and the utilization of BIM – “merging onto the highway…”
- Collaboration
  - Shared Goals
  - Data exchange
  - Continued Partnership

UCSF Medical Center

Milestones Matrix

Milestone	BASIS OF DESIGN RESEARCH & FIELD INVESTIGATION	CONSTRUCTION DOCUMENTS / BID	CONSTRUCTION ADMINISTRATION	Submittals	INITIATE "LIVING PUNCH LIST"	Demolition * Partition Ceiling	Major Equipment, O&M Commissioning, Testing	PROJECT CLOSE-OUT Punch List	Substantial / Final Completion	WARRANTY Guarantee Repair	12-month REVIEW & WARRANTY CLOSEOUT
Project Delivery Process	BOD & Design Criteria		RFI, CO, ASI, etc.				Infrastructure Approval	Manuals, O&M, BMS, SOO, Program Templates, Support Documentation		PM to meld Punch Lists - create master "close-out" document	Project Manager close-out project
	Design Assumption / Existing Infrastructure		Project schedule - 3-week and completion timelines		Create Living Punch List	PM and Construction Coordinator Issue Resolve	Commissioning	As Builts to Date		Lessons Learned Documentation	Sign off 11-month Punch List
	Design Team / Facilities		Shutdown Research Schedule	Value Engineering Review		Demo Partition Ceiling	O&M Materials, Spare Parts, etc.		Occupancy		
	Design Criteria	90% DD	Project Team Support	Asset Inventory		Modify Living Punch List	Warranty Response				
	Design Guidelines	50% CD	Field Issue Log	Submittals by Exception			Activate Submittals				

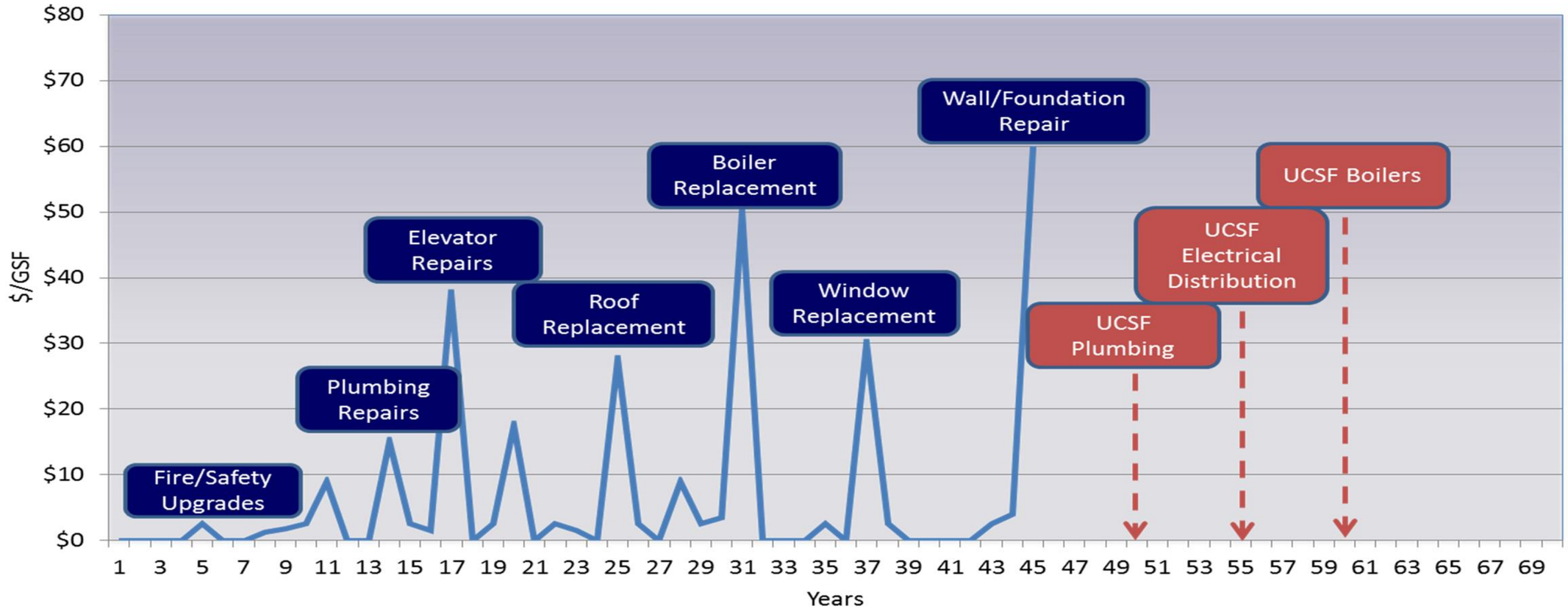
Milestone	BASIS OF DESIGN RESEARCH & FIELD INVESTIGATION	CONSTRUCTION DOCUMENTS / BID	CONSTRUCTION ADMINISTRATION	Submittals	INITIATE "LIVING PUNCH LIST"	Demolition * Partition Ceiling	Major Equipment, O&M Commissioning, Testing	PROJECT CLOSE-OUT Punch List	Substantial / Final Completion	WARRANTY Guarantee Repair	12-month REVIEW & WARRANTY CLOSEOUT

PROJECT DELIVERY CONTINUUM PERFORMANCE

Milestone	BASIS OF DESIGN RESEARCH & FIELD INVESTIGATION	CONSTRUCTION DOCUMENTS / BID	CONSTRUCTION ADMINISTRATION	Submittals	INITIATE "LIVING PUNCH LIST"	Demolition * Partition Ceiling	Major Equipment, O&M Commissioning, Testing	PROJECT CLOSE-OUT Punch List	Substantial / Final Completi	WARRANTY	12-month REVIEW & WARRANTY

UCSF Medical Center

AGING INFRASTRUCTURE



Many system components >25 yrs old

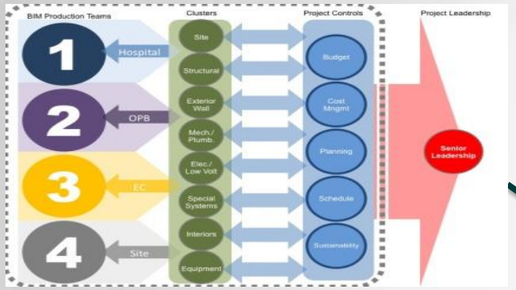
UCSF Medical Center

University of California at San Francisco
Mission Bay Medical Center

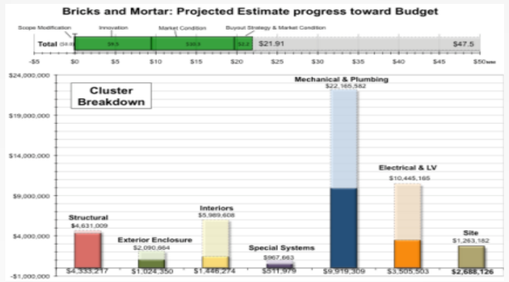
Customer value in construction

VIRTUAL DESIGN AND CONSTRUCTION

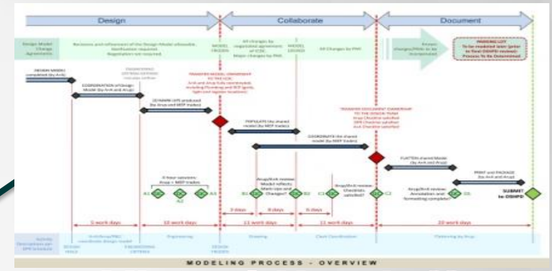
THE INTEGRATION PLAN



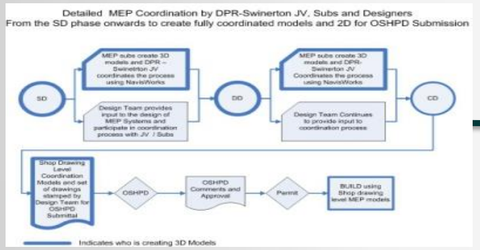
Virtual Company



Target Costing

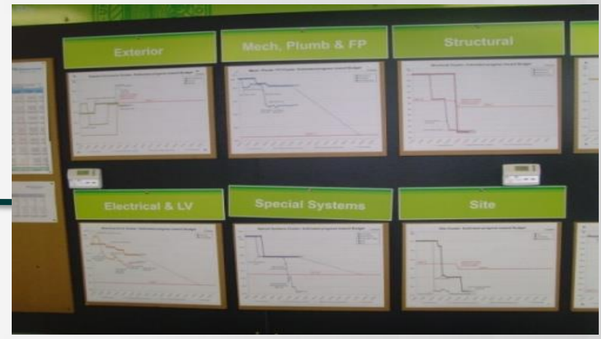


Virtual Handoffs



Virtual Building Process

UCSF Medical Center at Mission Bay



Process Metrics

Virtual Building Tools

Collaborative Planning Workshop

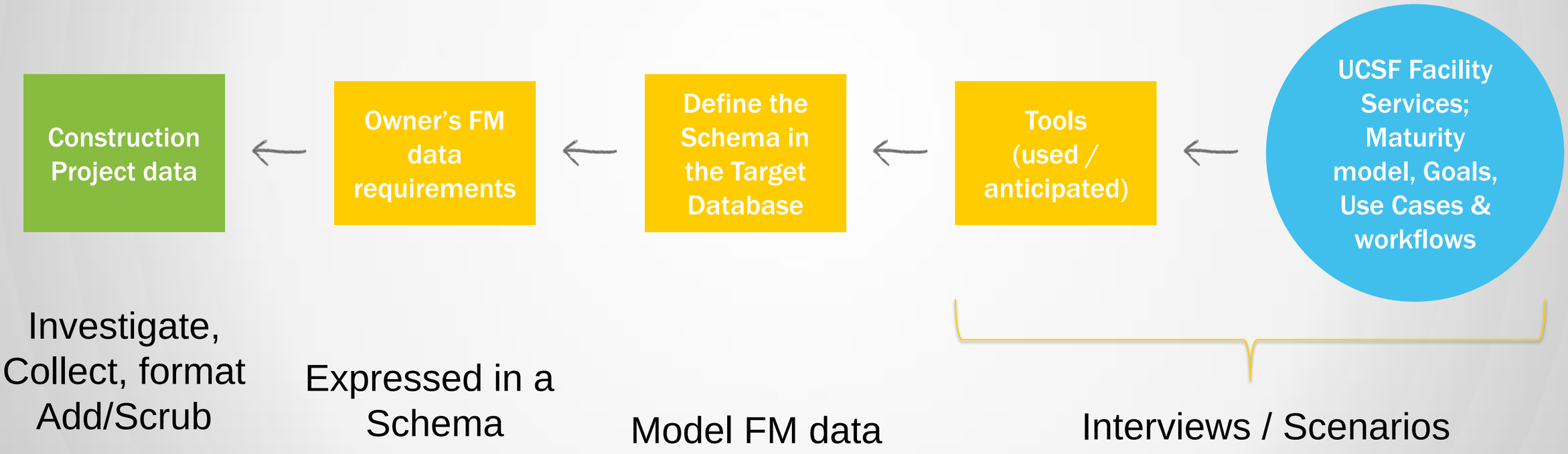
Integrated Center for Design and Construction

Customer value in operations and maintenance

EXTENDING VDC FOR FACILITIES MANAGEMENT

ASSESSMENT

Pull project data for Facilities Management

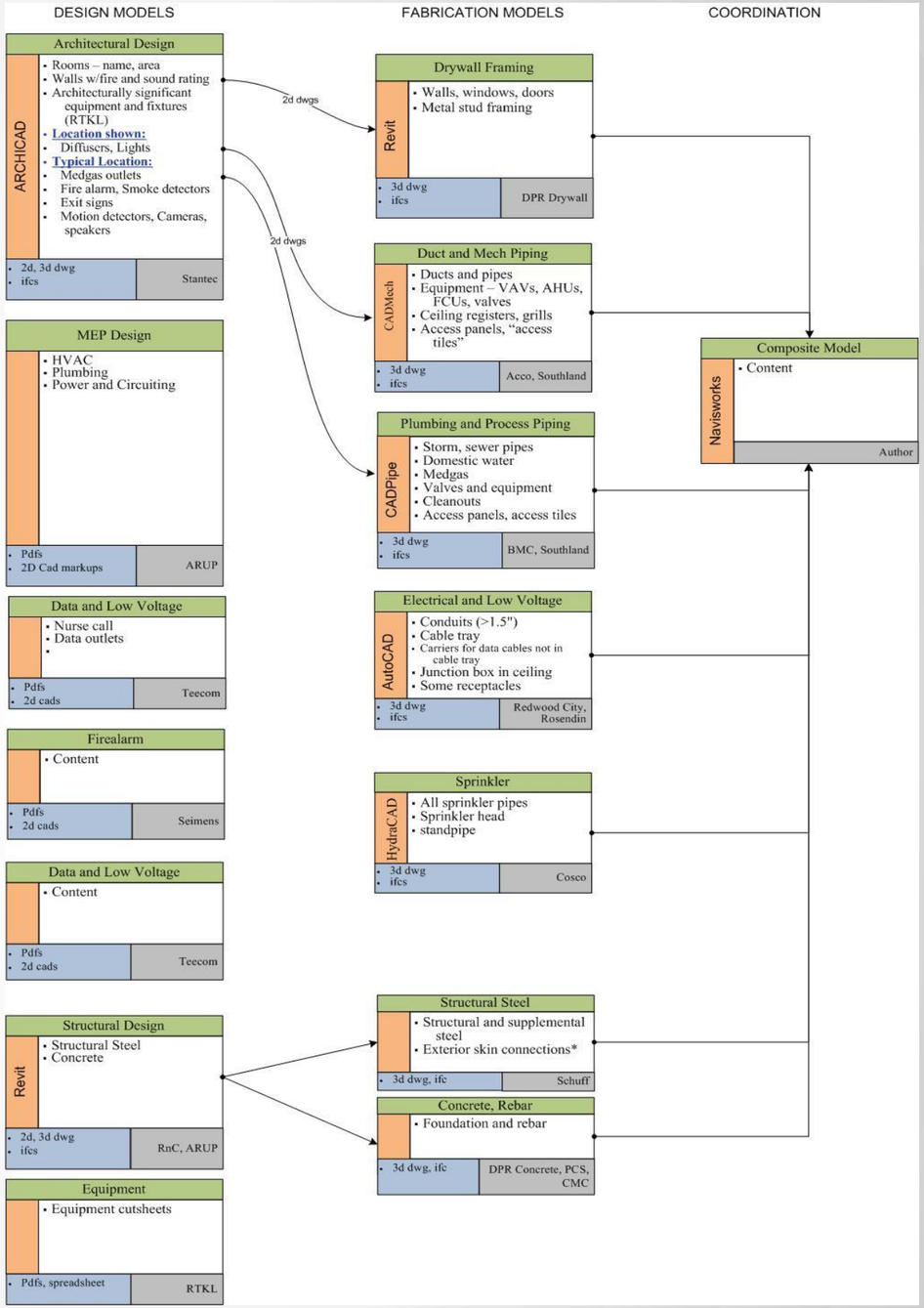


UCSF MISSION BAY

Project models

MULTIPLE SYSTEMS

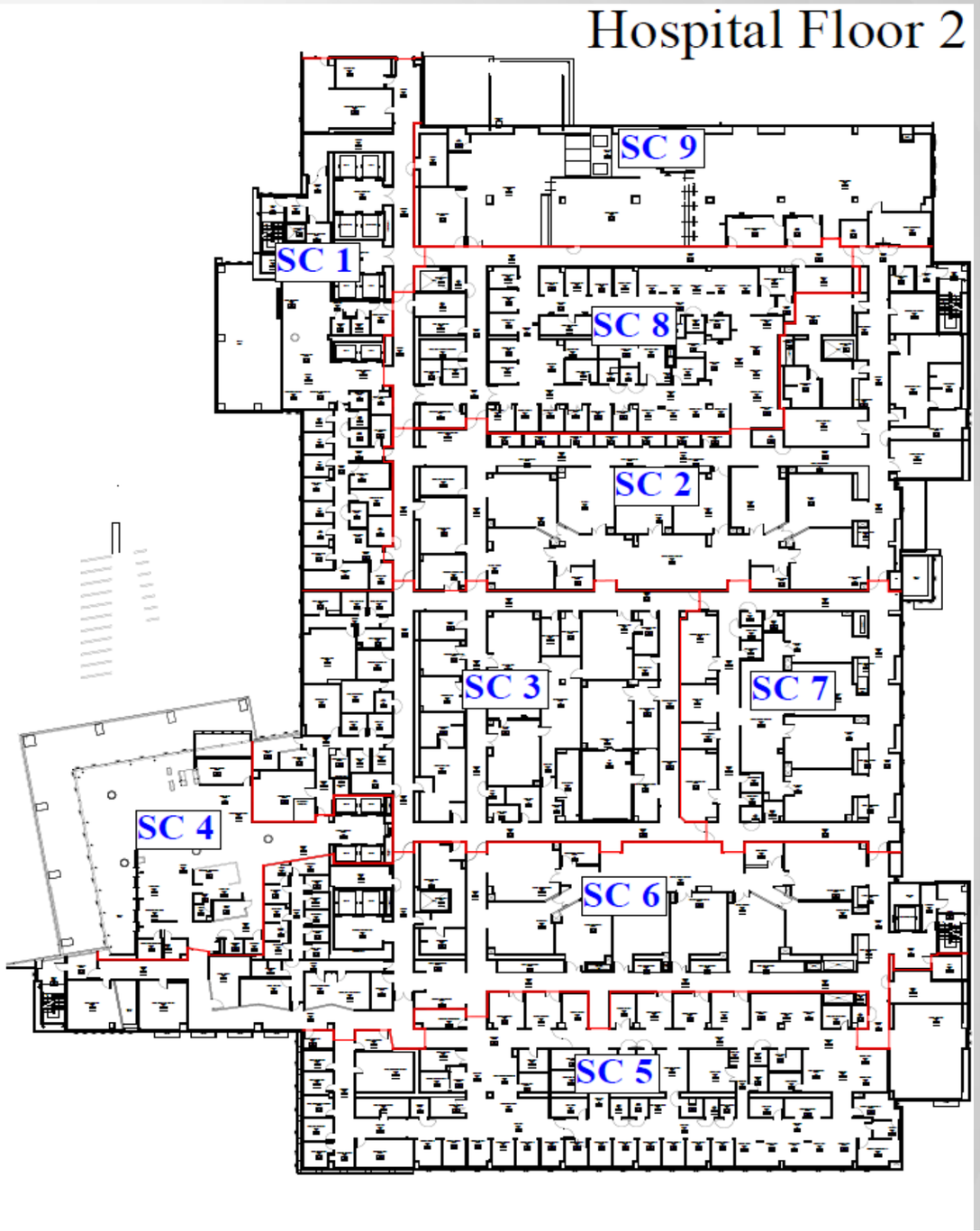
- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
  - M: CAD Duct,
  - E: CAD MEP
  - P: CAD Pipe



UCSF MISSION BAY

Chunking Project models

- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
  - M: CAD Duct,
  - E: CAD MEP
  - P: CAD Pipe



SEPARATE WORKFLOWS FOR MODELS AND DOCUMENTS

- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
  - M: CAD Duct,
  - E: CAD MEP
  - P: CAD Pipe

SOURCES FOR DATA

Schedules, specs, Submittals, Commission & test reports, etc.

Data UCSF seeks

		ATTRIBUTE	ATTRIBUTE_VALUE	SOURCE
CeilingDiffuser	Class	uniformatNumber		
		uniformatTitle		
		masterformat2004Number		
		masterformat2004Title		
		ownerEquipmentReferenceNumber		
		tag	SAG	
		manufacturer	TITUS	B-M0.16
		modelName	PCS	B-M0.17
		mfrSerialNumber		
		location	B060805	MODEL
		barcode		
		notes		
		service	SALP	
		type		
		configuration		
		zone		
		mounting	RAPID	B-M0.17
		nominalDimensions	12" X 12"	MODEL
		inletNeckDimensions	14" ϕ	MODEL
		maximumStaticPressure	0.1	
		throwPattern	4-WAY	B-M0.17
		maximumDesignAirFlow	410	
		minimumDesignAirFlow		
		maximumThrow		
		minimumThrow		
		noiseCriteria		
		borderType		
		elevation	9'	
		eqptID		

Identification System Product

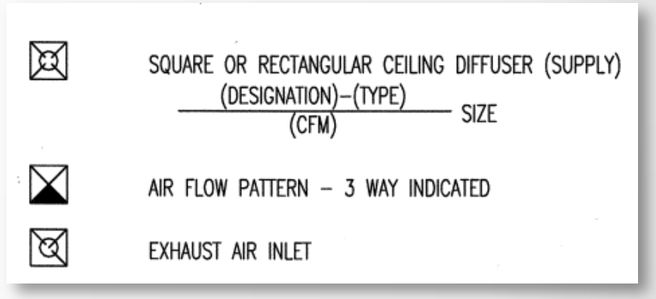
Example Sources

Schedule

SUPPLY AIR OUTLET SCHEDULE

ITEM	MANUFACTURER & MODEL NO.	TYPE	NECK SIZE IN. x IN.	OVERALL DIMENSION IN. x IN.	MAX. S.P. IN. WG	MAX. N.C.	NOTES	SERVICE
SAG	TITUS PCS	PERFORATED SUPPLY AIR GRILLE	SEE PLAN	SEE PLAN	0.1	25	4, 7	

Drawing legend



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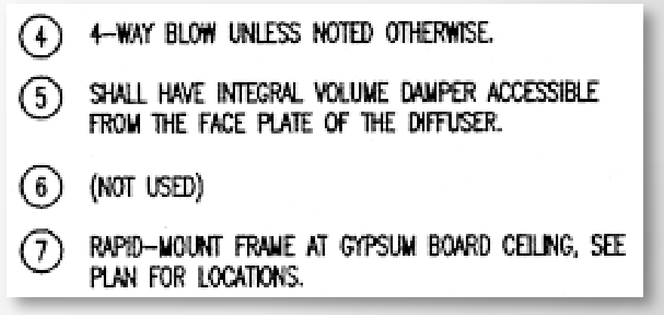
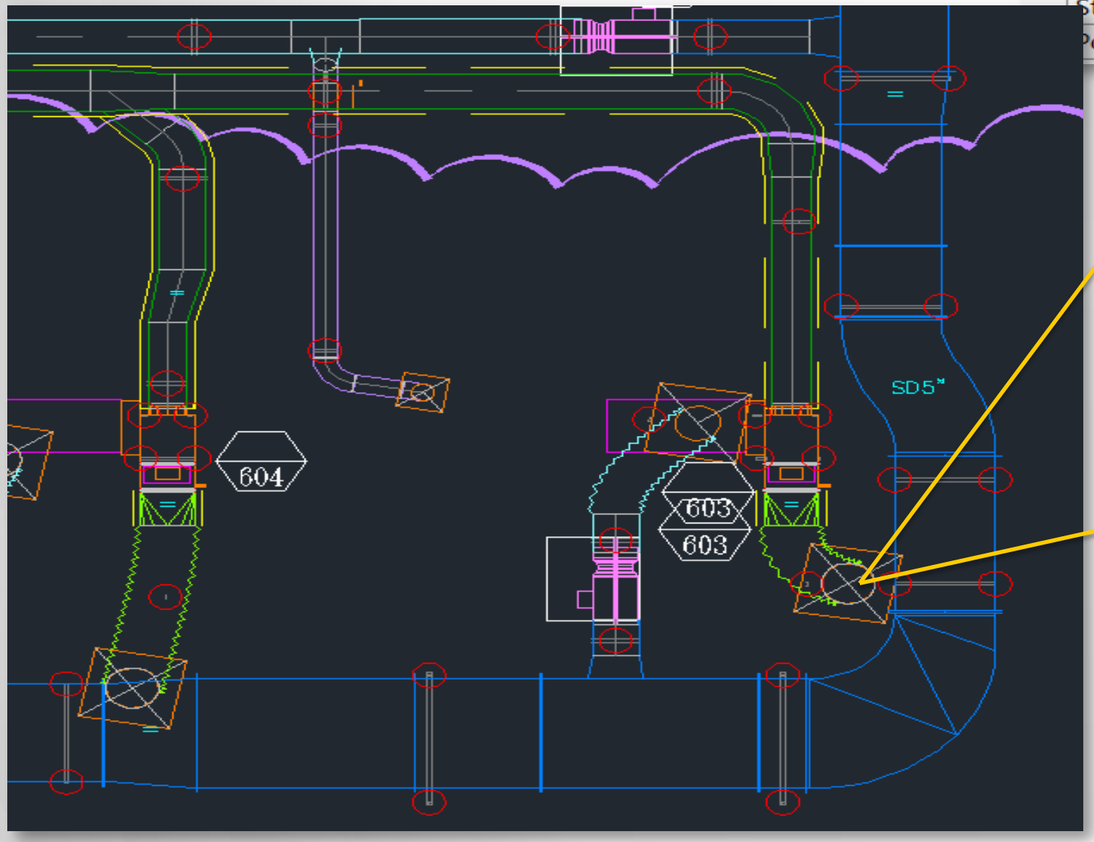


ADD DATA

CADmep+	
Item Number	CD
Description	CD
End Size(s)	24x24, Vav collar 14,
Length/Angle	2"
Service	SUPPLY - LP - GV
Section	Level 6
Elevation	TOD9'-0", BOD9'-0"
Area	0"
Weight	0"
Notes	
CustomData	EquipmentTag# = equip,...
Status	1: Draw Rev 1
Points	ENDPOINTS: -108.47,-950...

Existing BIM Data



Source BIM file

PROPERTY SETS	
UCSF FM Common	
EQUIPMENTTAG	SAG
MANUFACTURER	TITUS
MASTERFORMATTITLE	
MODEL	PCS
ROOMLOCATION	C6851
SERIALNO	
UCSFEQPTTAG	
UCSF FM Diffusers	
ELEVATION	9'
INLETNECKDIMENSIO...	14"DIA
MAXIMUMDESIGNAIR...	410
MAXIMUMSTATICPRE...	0.1
MOUNTING	RAPID
NOMINALDIMENSIONS	12"X12"
THROWPATTERN	4-WAY
UCSF FM HVAC System	
Layer	M-SALP-GVDU-GRIL
SERVICE	SUPPLY - LP - GV

Additional BIM Data

Identification

System

Product

Customer value in Operations and Management

ACTIONS

DATA AND OWNER RESPONSIBILITY

- Requirements
  - 5% model – be real!
- Standards of delivery
  - COBie/Revit, evolution of our future
- Change Management of Data
  - Content Management System “Sole Source” Data Management
- Leadership Change
  - Operational Intent – commit development of a “Business Application Team”
- Partnerships: IBM/Autodesk/Ecodomus/DPR/UCSF & BIM
  - Integration through the POC

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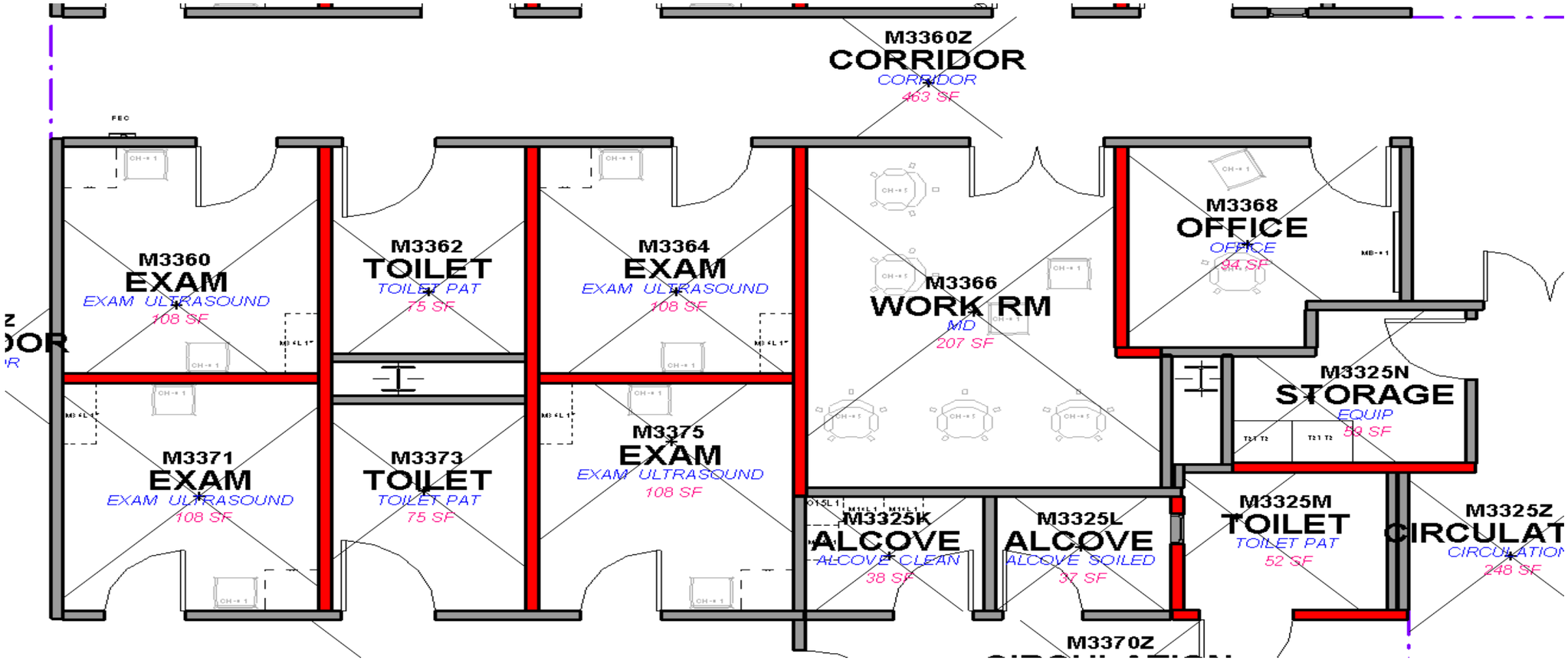
SPACES

Assets findable by location



Create Rooms in Revit. Add Space Planning Data – Room Category, Room Desc., Area

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UCSF Facilities
5% “Bread & Butter”

Sample Size of 166 Asset Types

- Architectural
- Mechanical
- Electrical
- Plumbing
- Medical
- Fire Protection
- Regulatory

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UCSF Benioff Children’s Hospital

INFORMATION WE'D LIKE TO SEE IN A PERFECT WORLD...

	FACILITIES 5% ITEM DESCRIPTION	Infrastructure System	Process	Downstream Service Area	Upstream Isolation	Regulatory Requirement	BIM (3D)	2D	DENSITY	# OF ATTRIBUTES	Warranty
2	AIR COMPRESSOR	MECH					!				
3	AIR CONDITION/WINDOW	MECH					!				
4	AIR CONDITIONING UNIT	MECH					!				
6	AIR HANDLING UNIT	MECH					✓		◔		
7	AREA DRAIN INTERIOR	PLMB					✓		●		
8	AREA DRAINS, EXTERIOR OF BLDGS	PLMB					!		●		
9	BACKFLOW PREVENTION DEVICES	PLMB					!		◑		
11	BOILER	MECH					✓		◑		
12	BOOSTER FAN	MECH					!				
14	BRANCH HEAT PUMP	MECH					!		●		
15	CARBON DIOXIDE SYSTEM	PLMB					✓				
18	ABSORPTION CHILLER UNITS	MECH					!		●		
21	CHILL WATER COILS	MECH					!		●		
22	CHILL WATER PUMP	MECH					!		◑		
23	CHILL WATER SYSTEM	MECH					!				
24	CHILLER ABSORBTION	MECH					!		◑		
25	CHILLER CENTRIFIGAL	MECH					!		◑		
27	COMPRESSOR	MECH					✓		◑		
28	CONDENSATE RETURN BOOSTER PUMP	MECH					✓		◑		
30	CONDENSATE RETURN LIFT PUMP	MECH					✓		◑		

LEADERSHIP CHANGE

- Development of a tool - BIM
  - **Old vs. New**
  - “As Built” Drawings vs. Mobile 3D field view
- Benefits to Facilities Operations
  - Time Savings to repair and maintain facility
  - Access to valves, etc.
  - Real Time Accuracy of Data
  - Living Model vs. Historical “layered sticks”
  - Accessibility, transparency and improved
- Foundation for Future Growth
  - “Electronification of Facilities Management”
  - Call Center, U-Scan, Regulatory Model, etc.

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POC MAXIMO/ BIM UCSF FACILITIES

- Hey! You get a new hospital to bring online… BTW.
- December 2010 mandated CMMS change…
- Status quo or chance for potential results?
- “Opening doors, cracking others” or, the reality management program for clearing thresholds.
- Create your future in vision, pay as you go and scale the process to provide business metrics to support the path as it unfolds.
- Collaborate, trust pockets of expertise…
- Build your team.

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Bridge project and asset systems

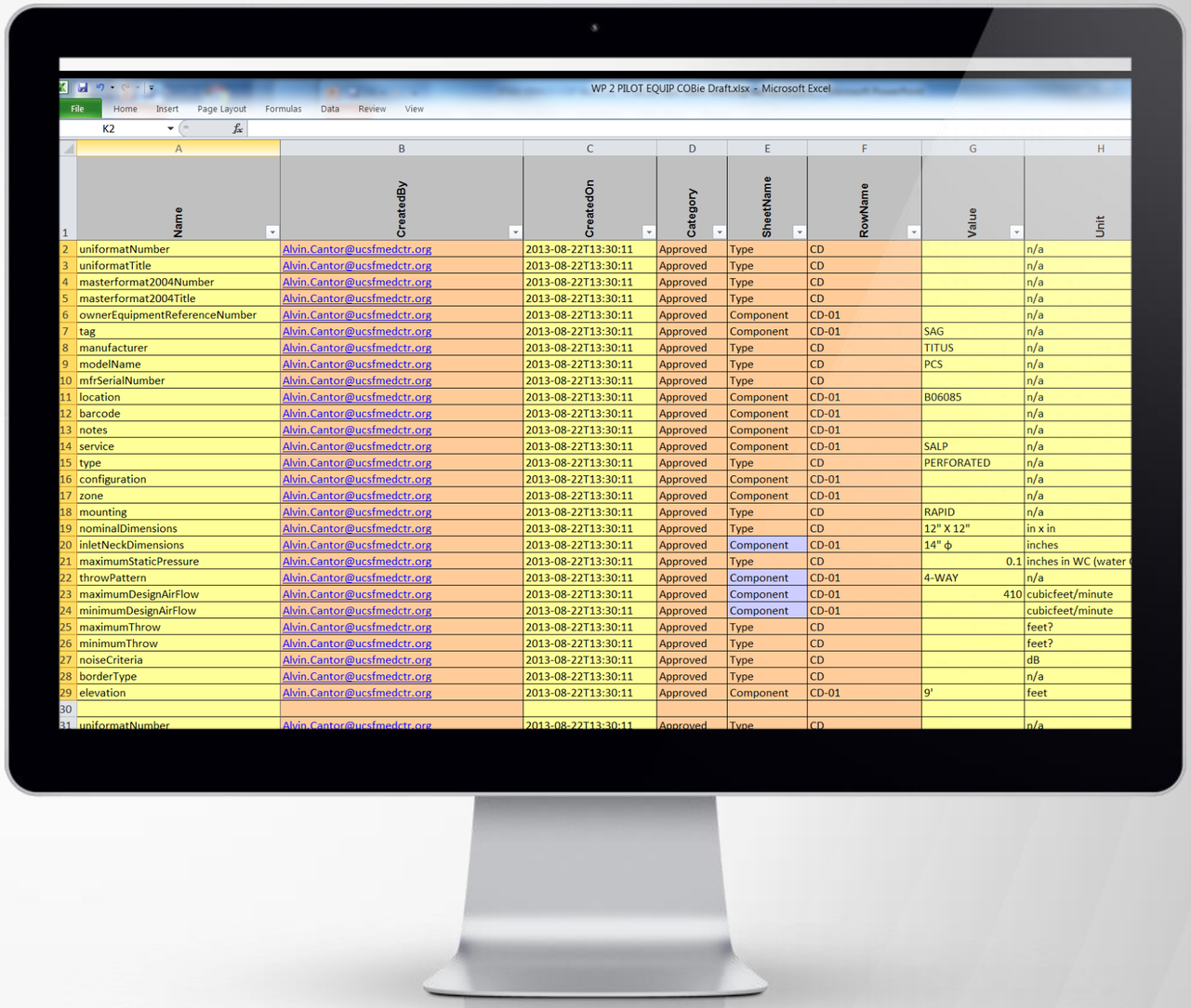
RESULTS

DATA EXCHANGE

UCSF Mission Bay project

40,000 ASSETS

Flow from as-builts into space planning and CMMS systems



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18	mounting	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	RAPID	n/a
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20	inletNeckDimensions	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	14" ϕ	inches
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23	maximumDesignAirFlow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	410	cubicfeet/minute
24	minimumDesignAirFlow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		cubicfeet/minute
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30								
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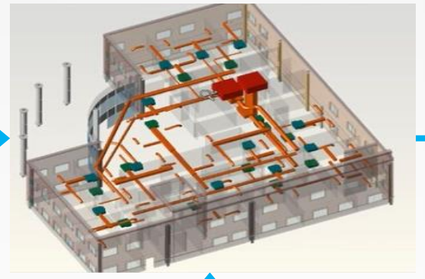
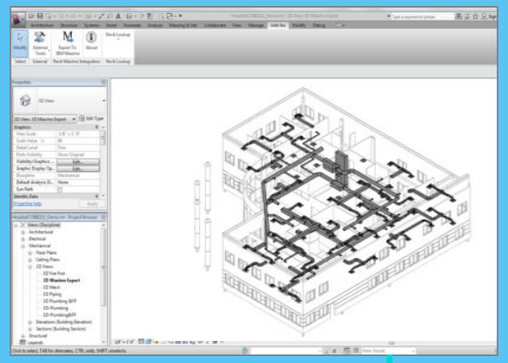
COBie format

IBM MAXIMO©, AUTODESK REVIT© & NAVISWORKS© INTEGRATION



REVIT



NAVISWORKS

CAD MEP | AutoCAD | BIM 360 | Other...

IBM maximo®

COBie Export

COBie Excel

COBie Import

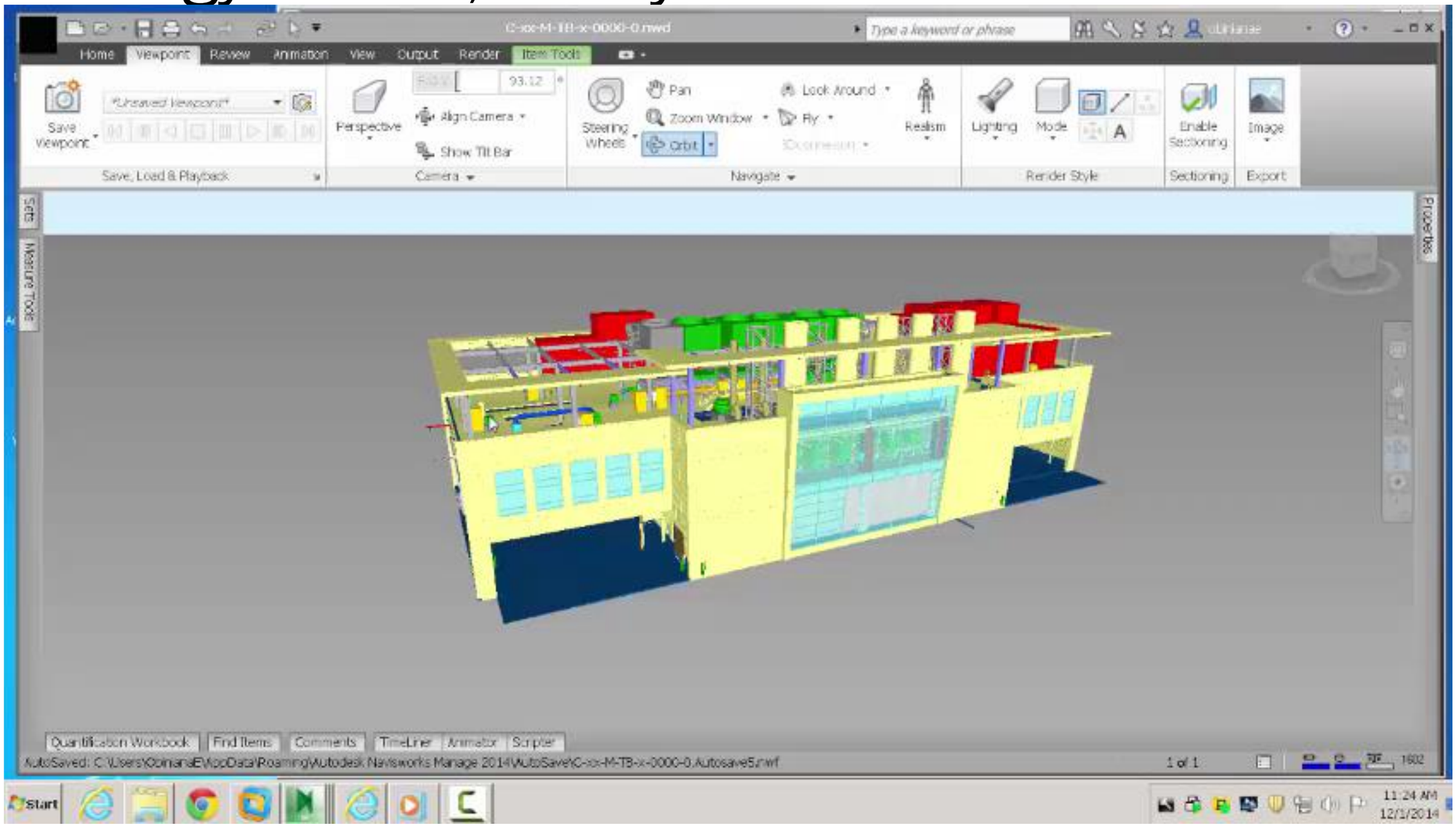
BIM Software

BIM Data Format & Geometry

FM Software

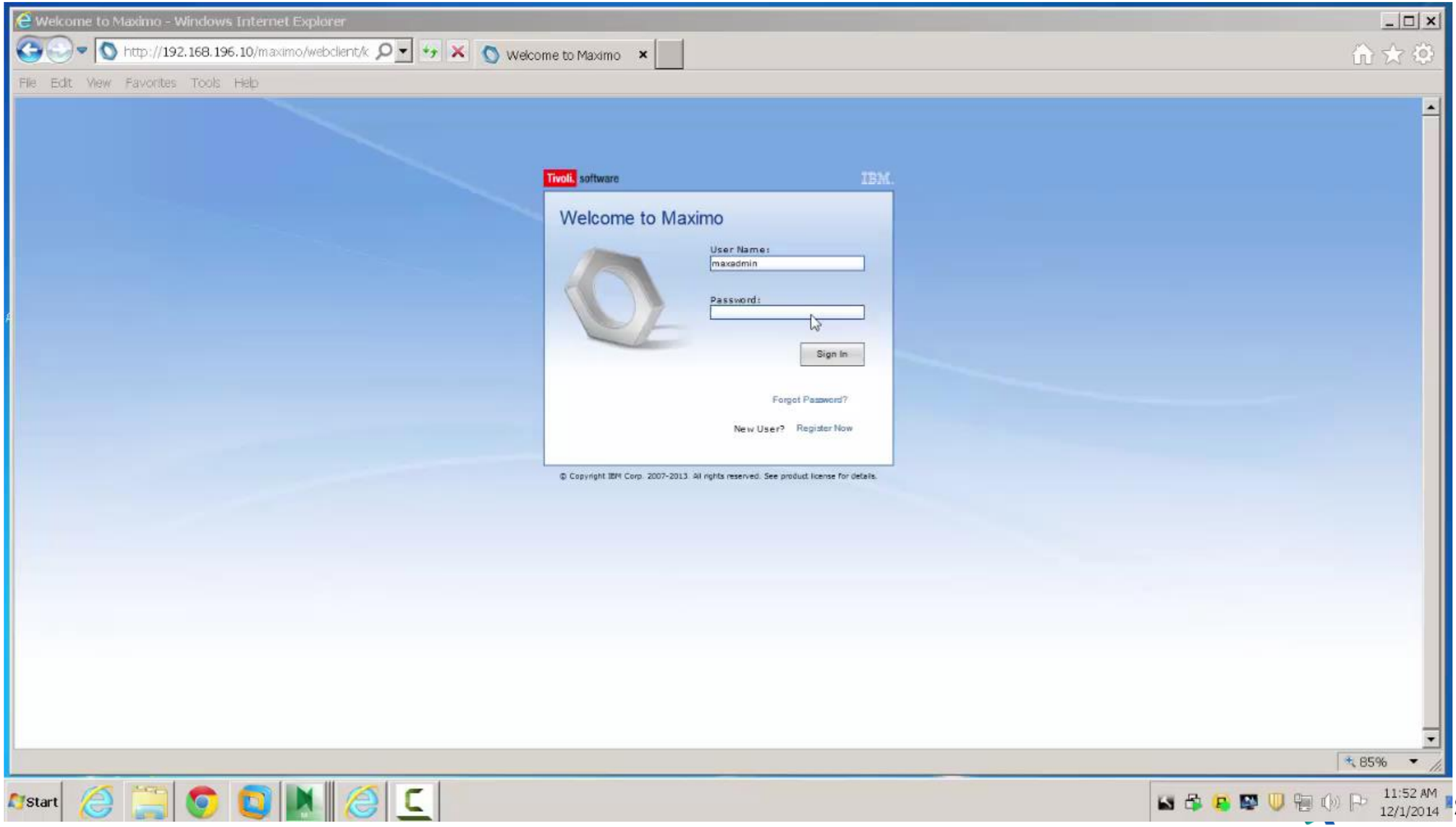
POC MAXIMO/ BIM UCSF FACILITIES

Energy Center, 3D flyover



POC MAXIMO/ BIM UCSF FACILITIES

Integration



Customer value in Operations and Management

LESSONS LEARNED

EXTEND VIRTUAL DESIGN AND CONSTRUCTION

DPR View

- Pull facility management requirements into project;
- Transition from digital files to object data;
- Coordinate design, construction, and operations data;
- Support knowledge transfer
- Develop capacity and tools to condition data
- Manage files, data, tools
- Partner to support owner's Whole Life Management Goals

LEADERSHIP BY OWNER O&M ORGANIZATION

UCSF View

- Leadership for innovation/process change
- Identify scope of use for the near, mid and long-term
- Merging onto the highway is a challenge – start early
- What will be AEC standard of care when delivering databases as well as drawings
- Early and continuous involvement
- Change management
  - Authoring and data management tools
  - File maintenance/versioning
  - Maintain as-managed CAD/BIM and synchronizer w/CMMS

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Session Feedback

- Via the Survey Stations, email or mobile device
- AU 2014 passes given out each day!
- Best to do it right after the session
- Instructors see results in real-time

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