UNIVERSITY of WASHINGTON

Northwest Construction Consumer Council

The UW Capital Projects Office and NW Construction Consumer Council

Present:

"Changing Project Delivery at the UW through Innovation, Integration, and Adoption of MC/CM and EC/CM"

PACCAR Hall, the Gordon Kloft Classroom

June 22, 2011

GLUMAC engineers for a sustainable future™ Hermanson LEASE CRUTCHER LEWIS NELSON ELECTRIC THA ARCHITECTURE INC

Program Outline

Implementing COBie & Project Delivery Innovations - Part 1

- Eric Smith, Director of Major Projects, UW CPO

Integration of the Project Team – Part 2

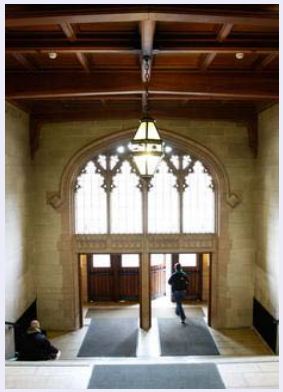
- Will Dann, THA Architects
- Troy Bloedel, Lease Crutcher Lewis
- Steve Tatge, UW CPO

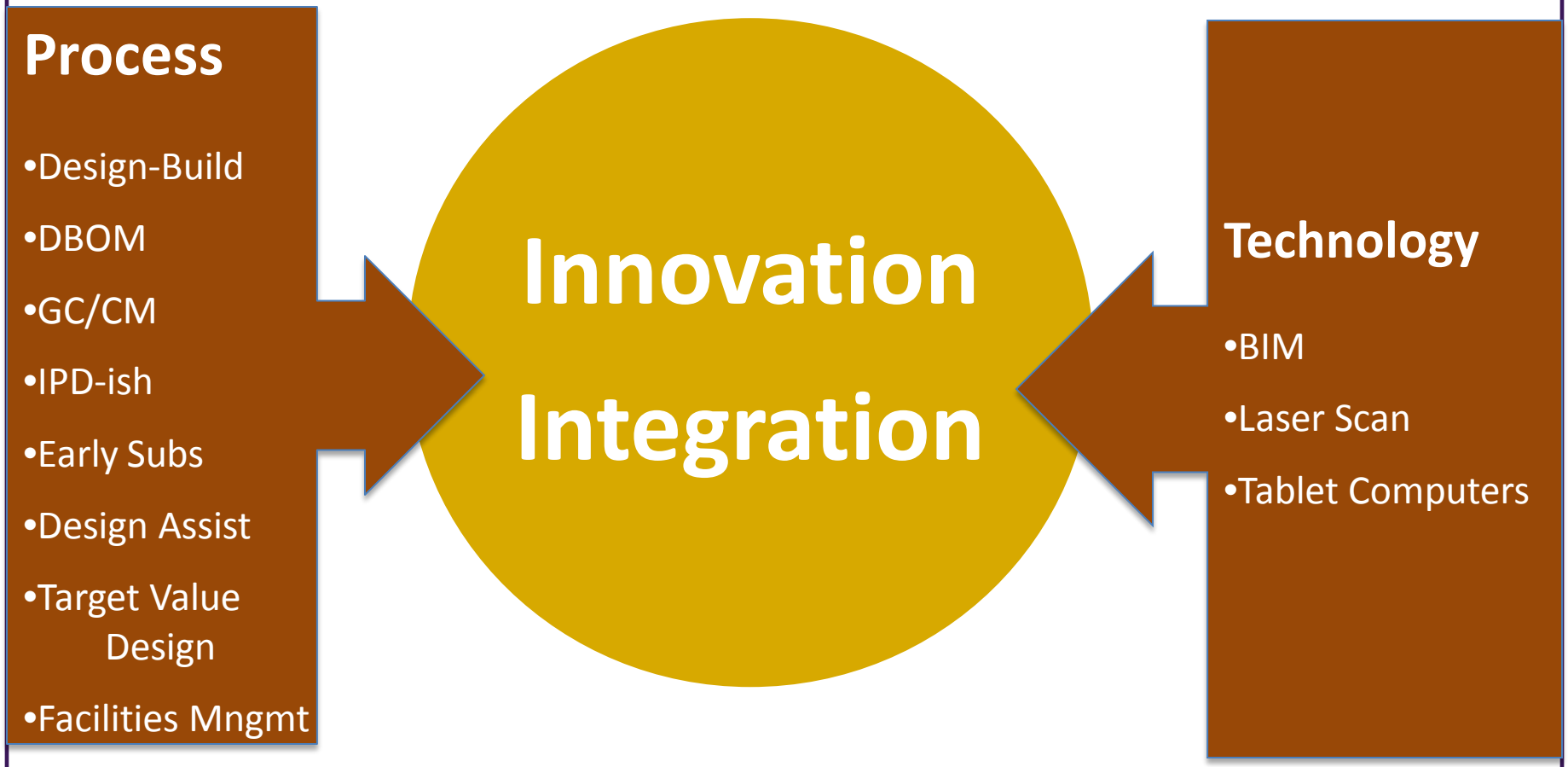
Case Study and Panel Discussion: MC/CM & EC/CM – Part 3

- James Thomas, GLUMAC
- Judi Ebmeyer, GLUMAC
- Len Klein, GLUMAC
- Dave Nehren, Hermanson
- Tim Nelson, Nelson Electric
- Brett Magnuson, UW CPO

Implementing COBie & Project Delivery Innovations - Part 1

- Eric Smith, UW CPO, Director, Major Projects Group


Process
•Design-Build
•DBOM
•GC/CM
•IPD-ish
•Early Subs
•Design Assist
•Target Value Design
•Facilities Mngmt
Innovation
Integration
Technology
•BIM
•Laser Scan
•Tablet Computers

Thank you to our project partners!

Ben Hall/R & T: *Inspirational Learning Moment*

- Idea in 2003 became a reality in 2006

  Genesis to build a lab building competitive with the private market.

  Became an inspiration and example of how process & technology can enable Innovation & Integration.

- Process: DBOM

  Started with Design-Build integrated Design & Construction.

  Expand to O&M – Responsibility & accountability for design, quality, life cycle, etc.

Ben Hall/R & T: *Inspirational Learning Moment*

- Technology: BIM 3D & 4D

  BIM proved design assumptions to skeptical owner.

  - *Enabled by DBOM process*

  BIM during construction.

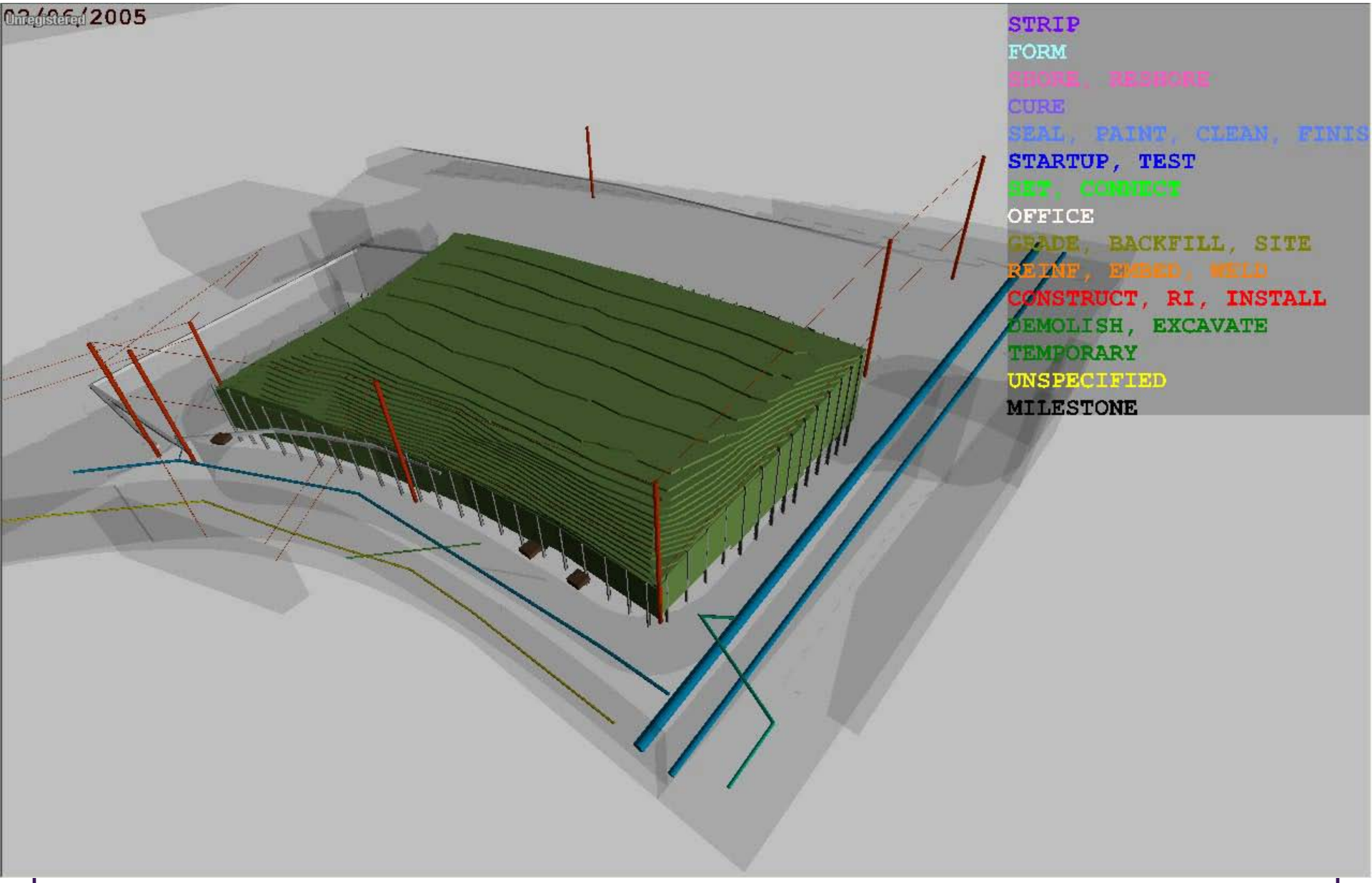
  - *Underground As-Builts eased utility agency concerns*
  - *4D improved planning and coordination*

    Logistics

    Subcontractors

    Safety

Ben Hall Images


Unregistered
2005
STRIP
FORM
SHORE, RESHORE
CURE
SEAL, PAINT, CLEAN, FINIS
STARTUP, TEST
SET, CONNECT
OFFICE
GRADE, BACKFILL, SITE
REINF, EMBED, WELD
CONSTRUCT, RI, INSTALL
DEMOLISH, EXCAVATE
TEMPORARY
UNSPECIFIED
MILESTONE

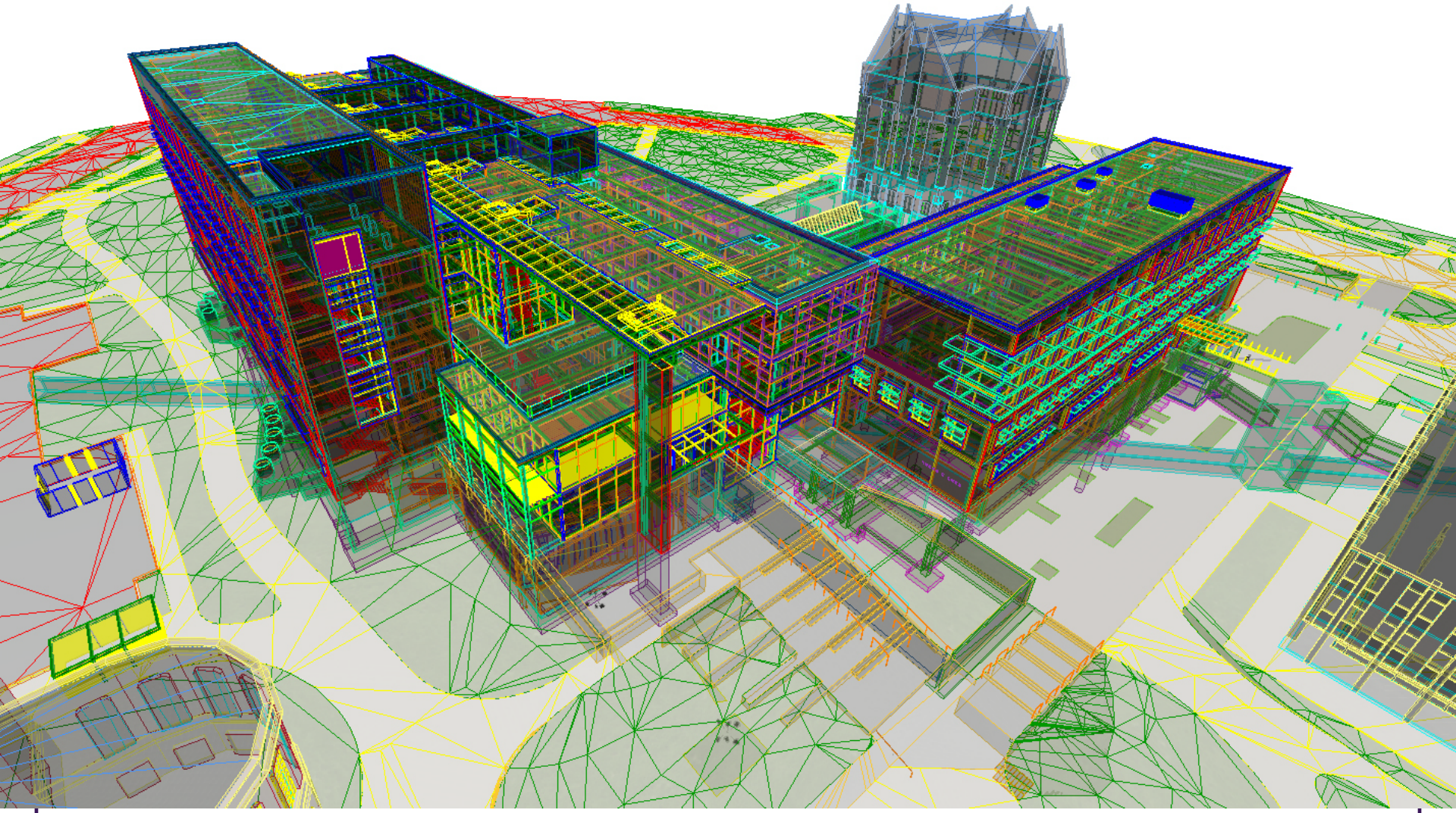
Applying Technology to GC/CM

- GC/CM is UW primary method on major projects
- Trade coordination: First BIM use; now standard
- Other technologies

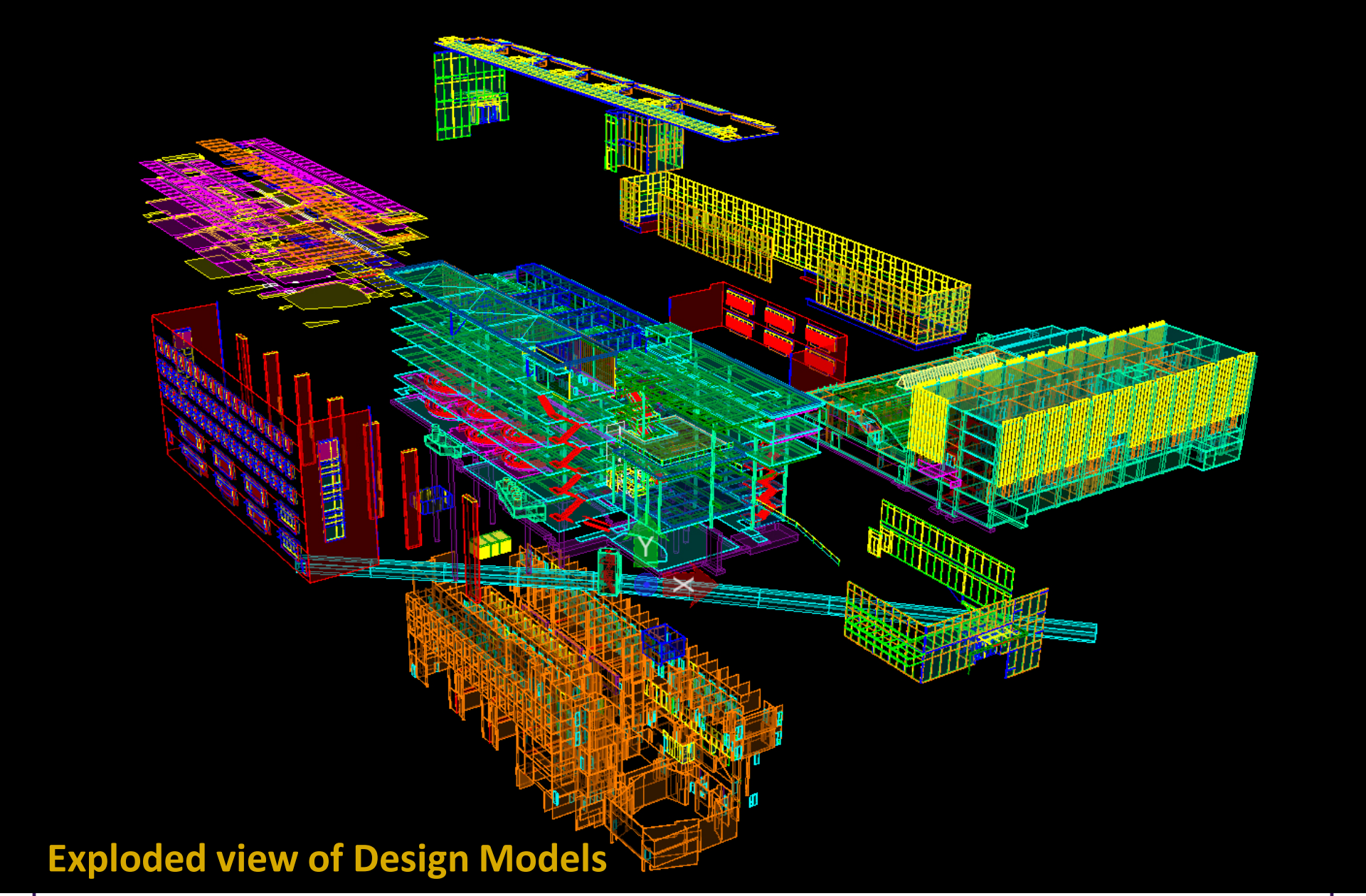
  Laser scanning
  Tablet Computers
- On-site document posting and access

BIM in Trade Coordination

- William H. Foege Building
- Harborview Bond Program
- Health Sciences H-Wing
- Washington Dental Services Center for
- Early Childhood Oral Health
- UW Tacoma Joy and Tioga Library Buildings
- Clark Hall
- Denny Hall
- Johnson Hall
- Guggenheim Hall
- UW Tower Data Center
- PACCAR Hall
- Molecular Engineering
- Student Housing
- Health Sciences J-Wing
- UWMC Expansion

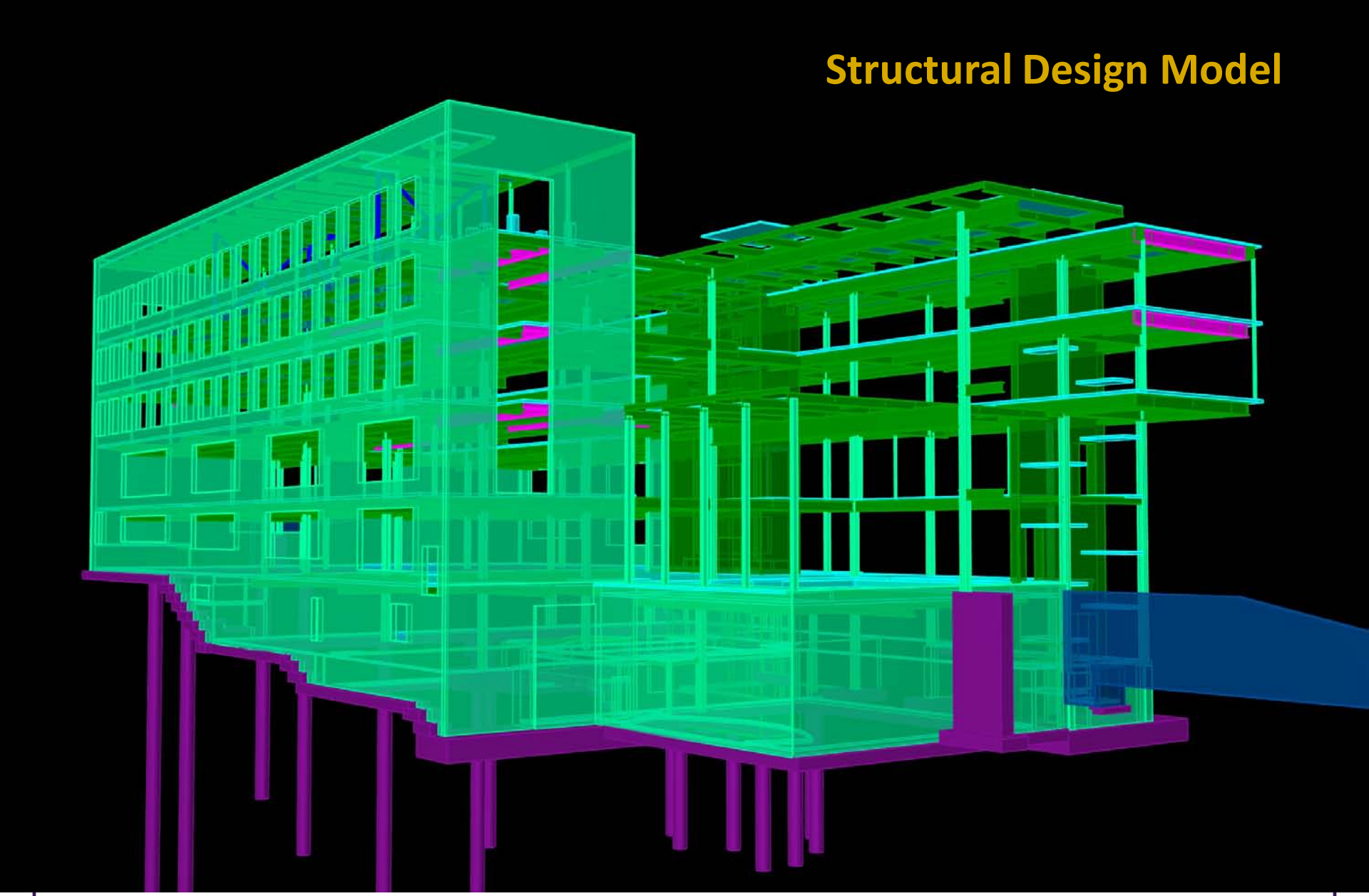


Combined view of Design Models

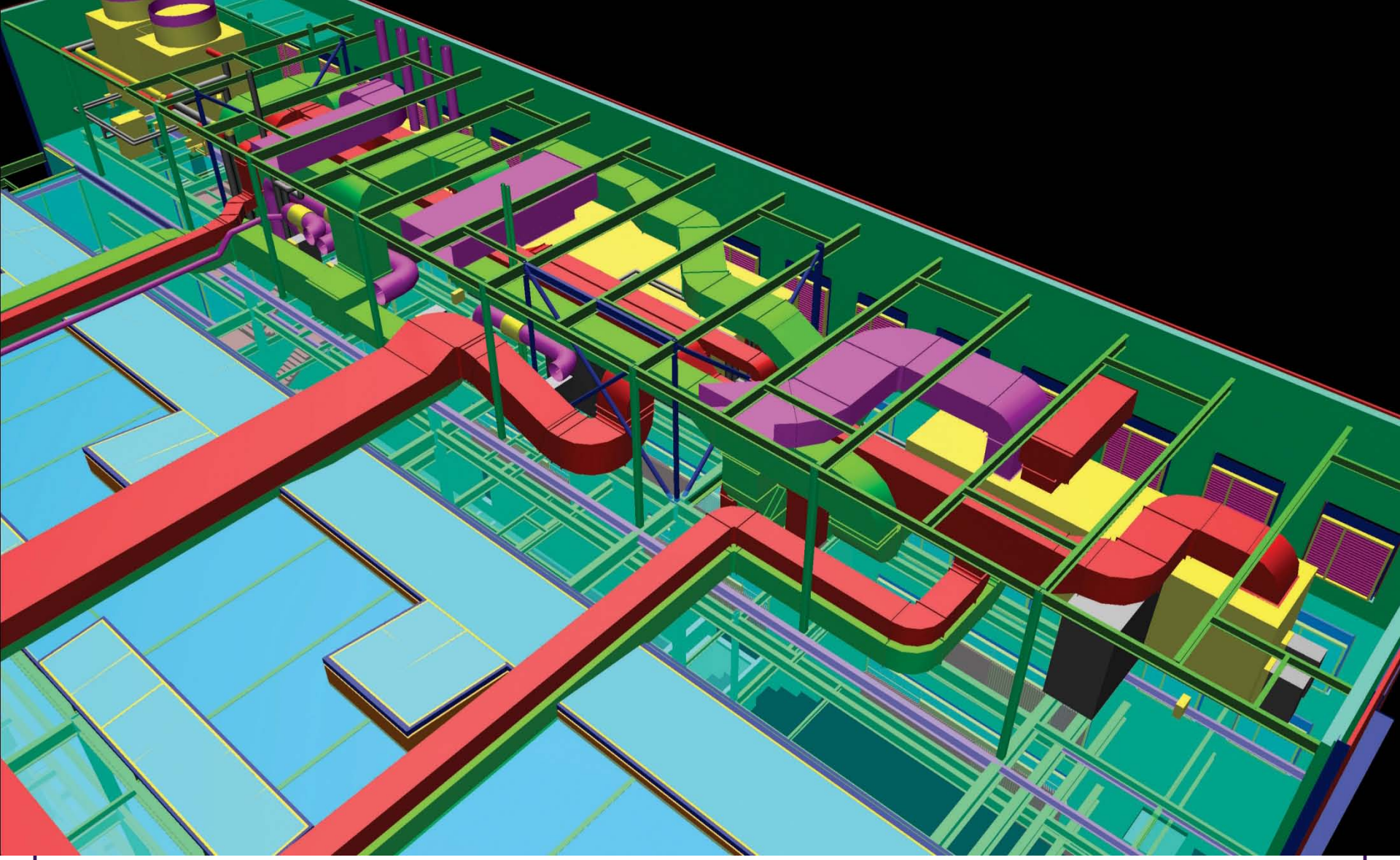


Exploded view of Design Models

Structural Design Model



Design Model used for building sectional studies – North Section

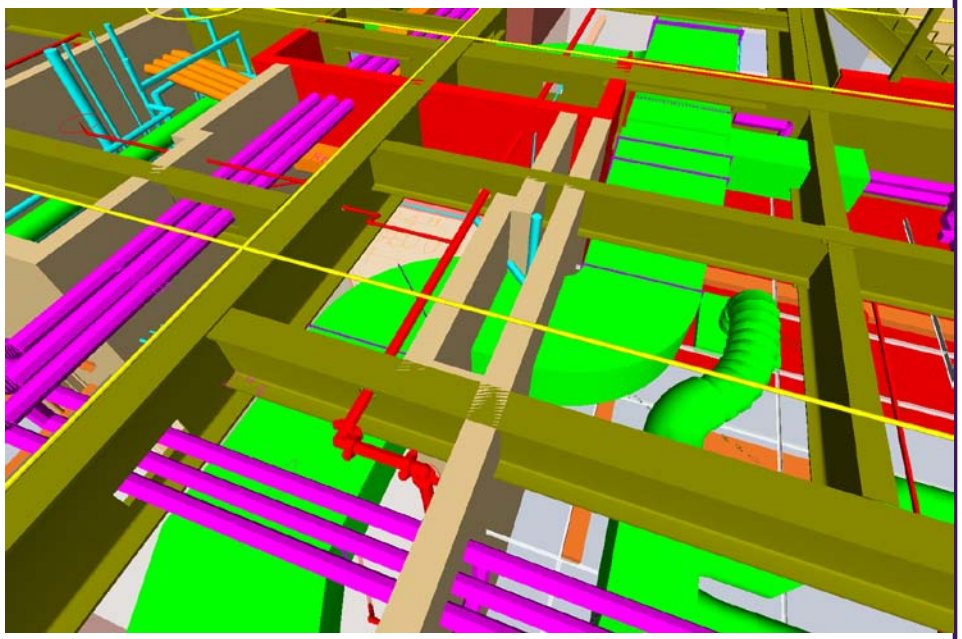


Design Model used for mechanical coordination - Penthouse

MEP 3D Coordination at PACCAR

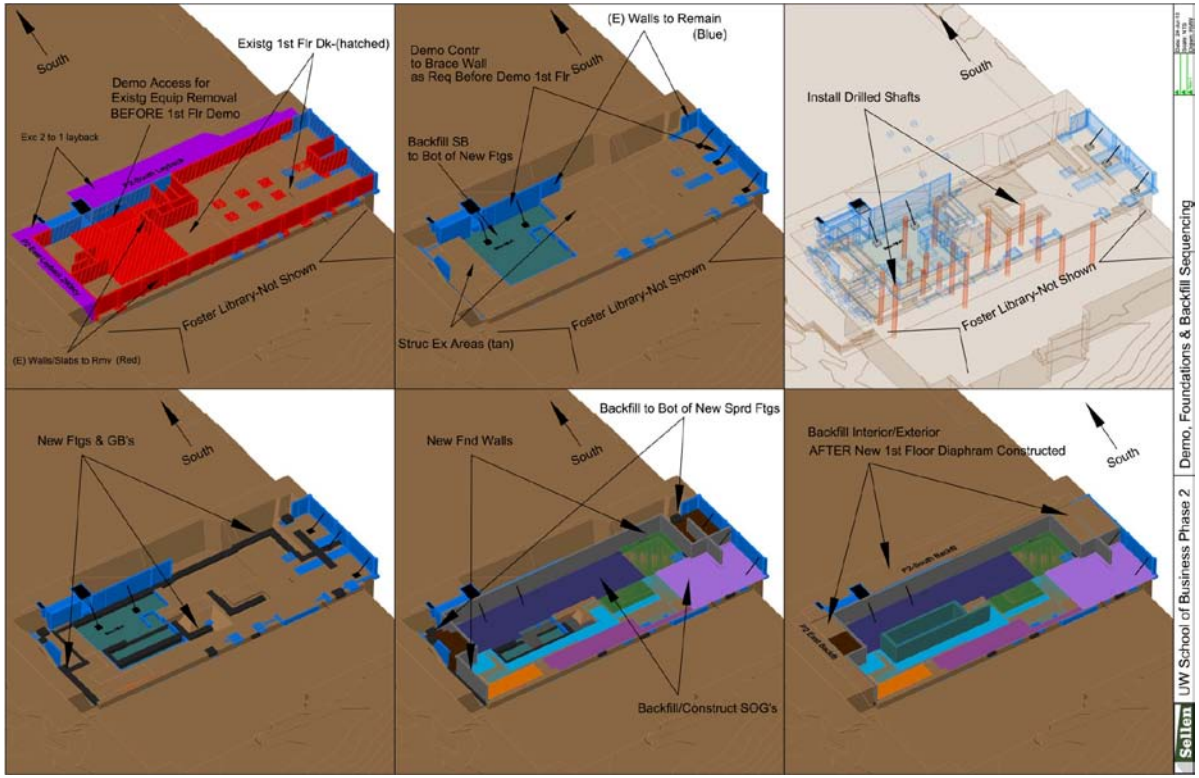
- 99% of beam penetrations were shop fabricated as a result of early coordination.
  - Estimated savings = $120,000
  - 242 penetrations added
  - 127 modified size or location

- Building architecture preserved by maintaining ceiling heights and keeping MEP hidden despite a great deal of open structure. LMN Architects, structural teams, and the M/E design team attended meetings as needed and collaborated with Sellen to resolve issues early and avoid costly changes later in construction.

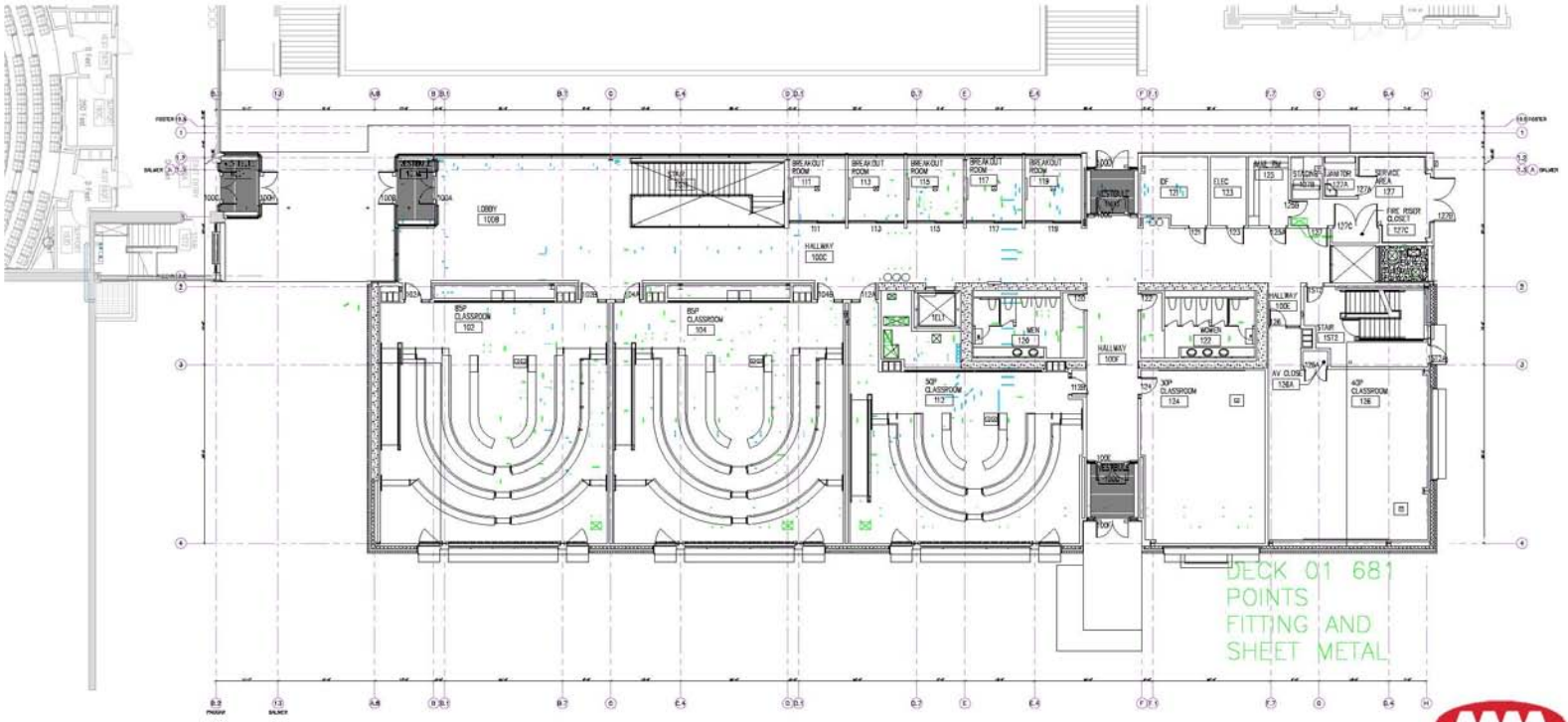


Balmer Hall 4D Modeling

- 4D Modeling was used to communicate which walls would remain and to illustrate excavation to the design team.
- 4D Modeling resulted in shoring being incorporated into the design prior to bidding.
- 4D modeling was used to identify conflicts between drilled piers and existing foundations and were incorporated into our bid instructions so that these



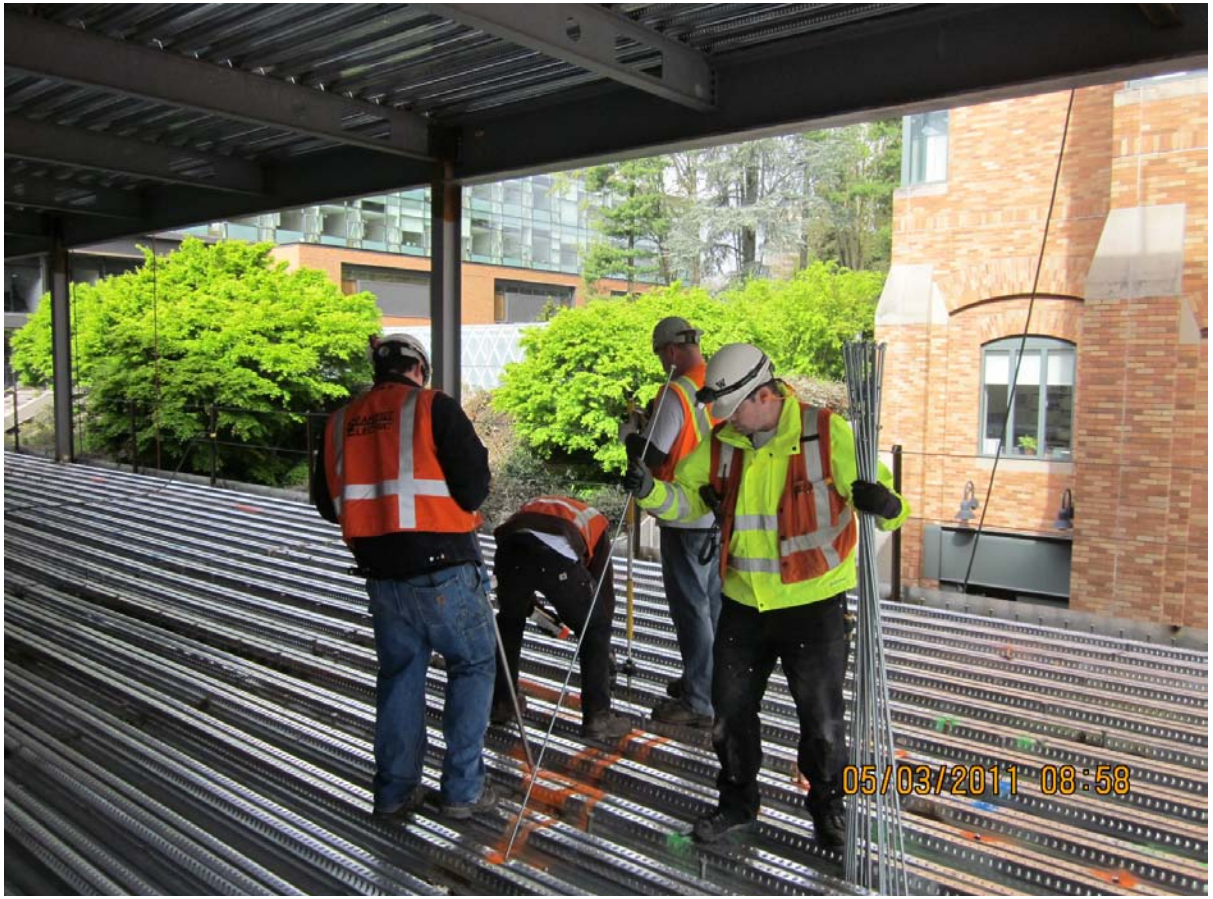
Trimble Plan



MacDonald-Miller
FACILITY SOLUTIONS

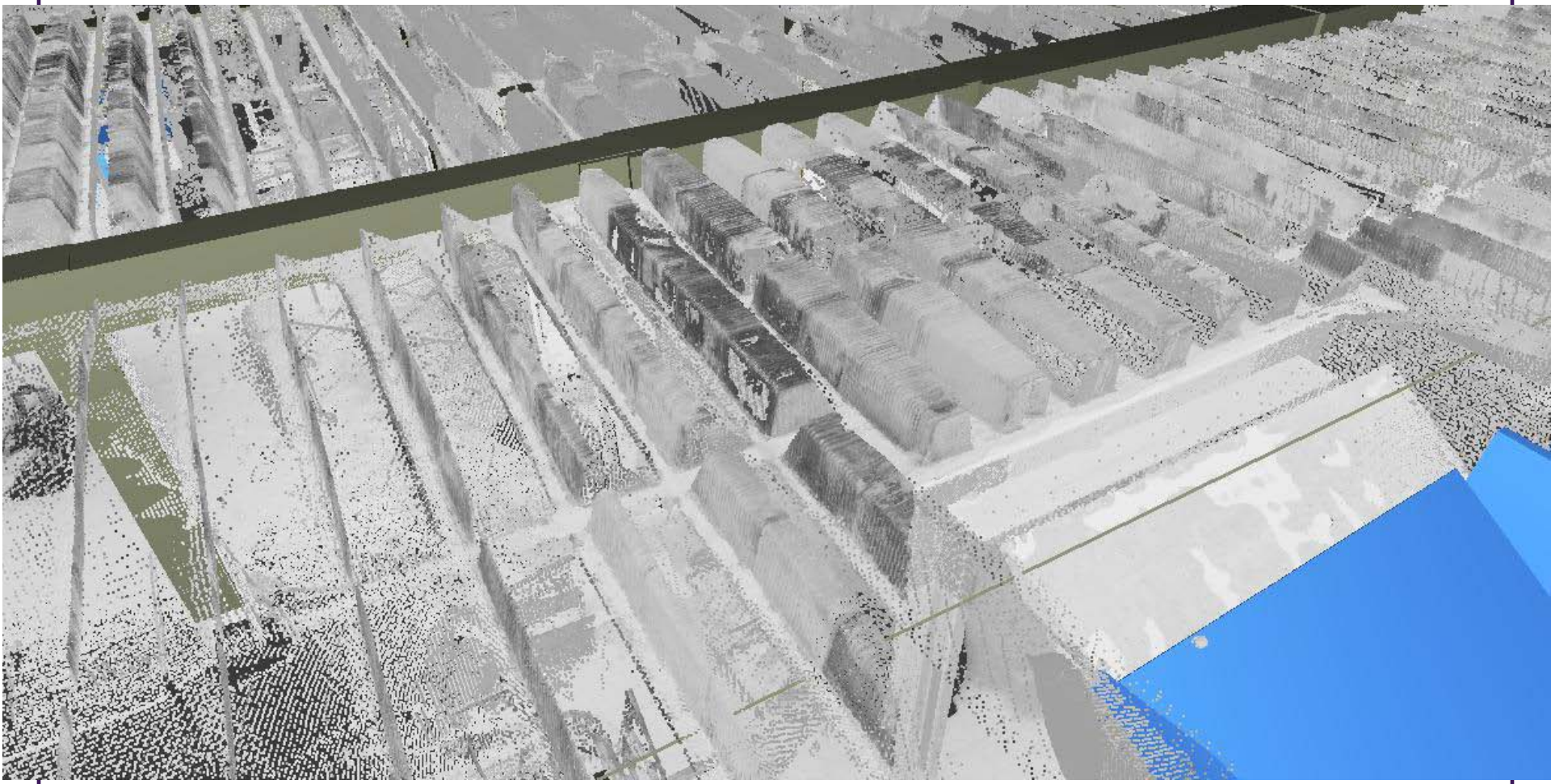
Trimble Unit

Trimble*r's*

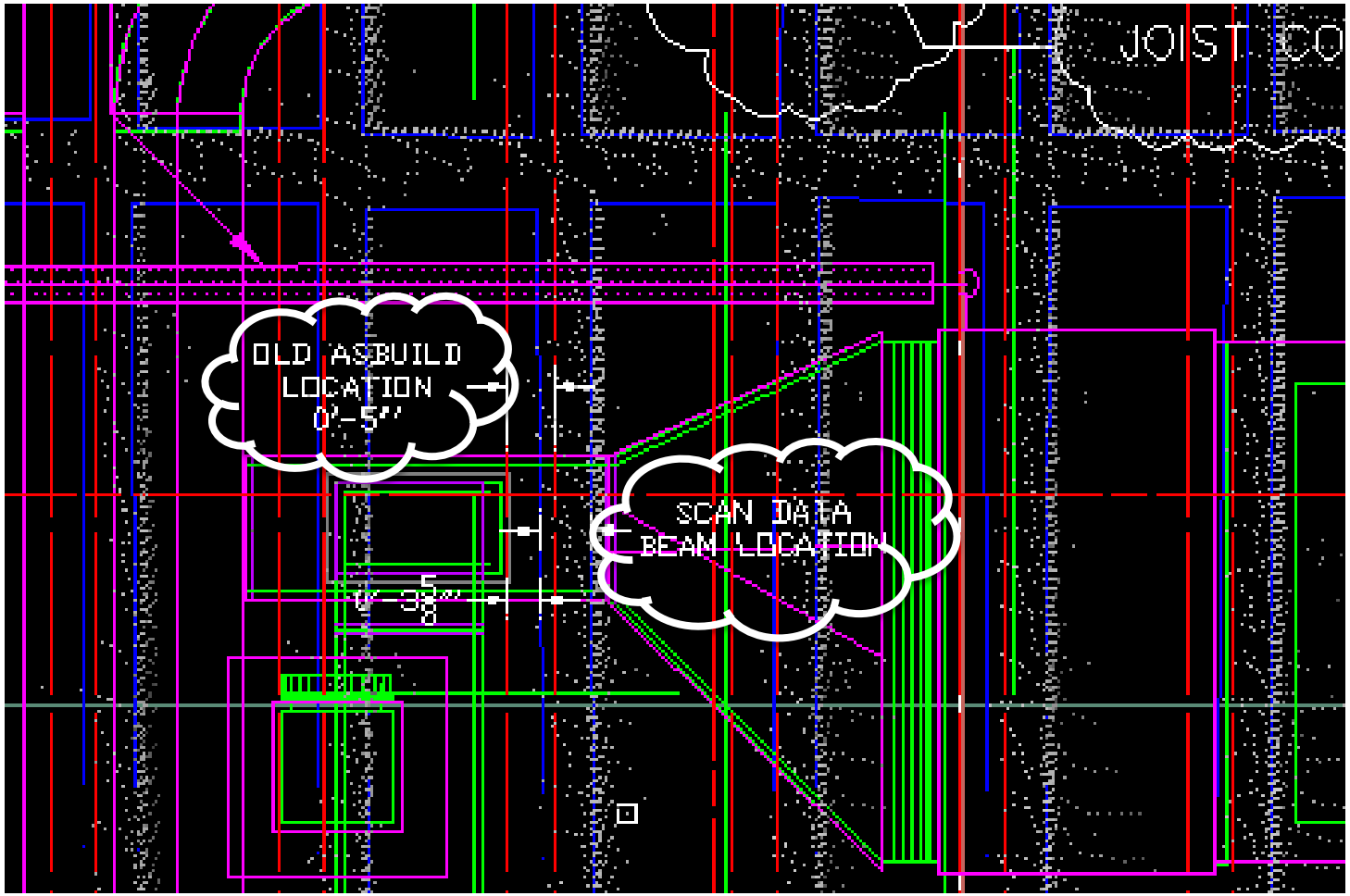


Savery Hall As-Built

Savery Hall - Structural As-Built

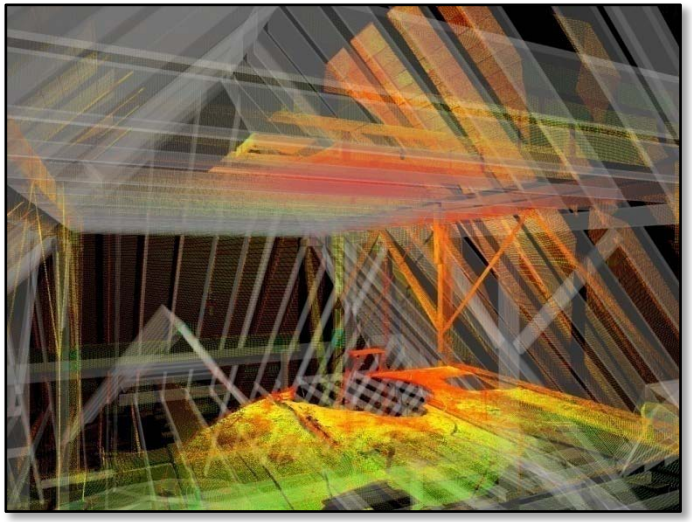


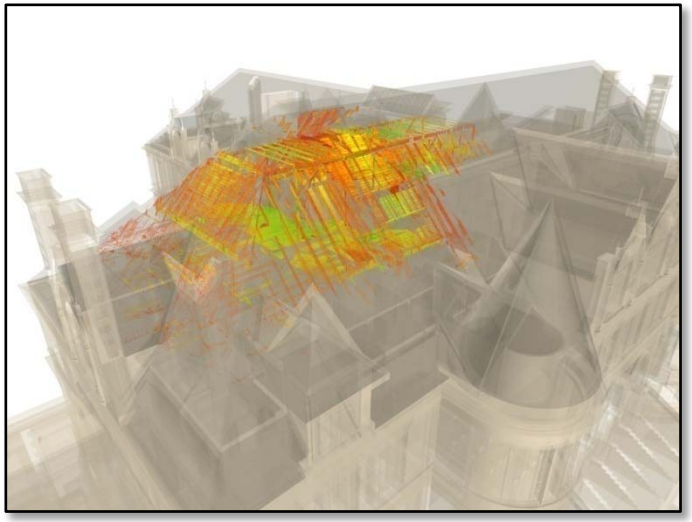
Savery Hall - Structural As-Built



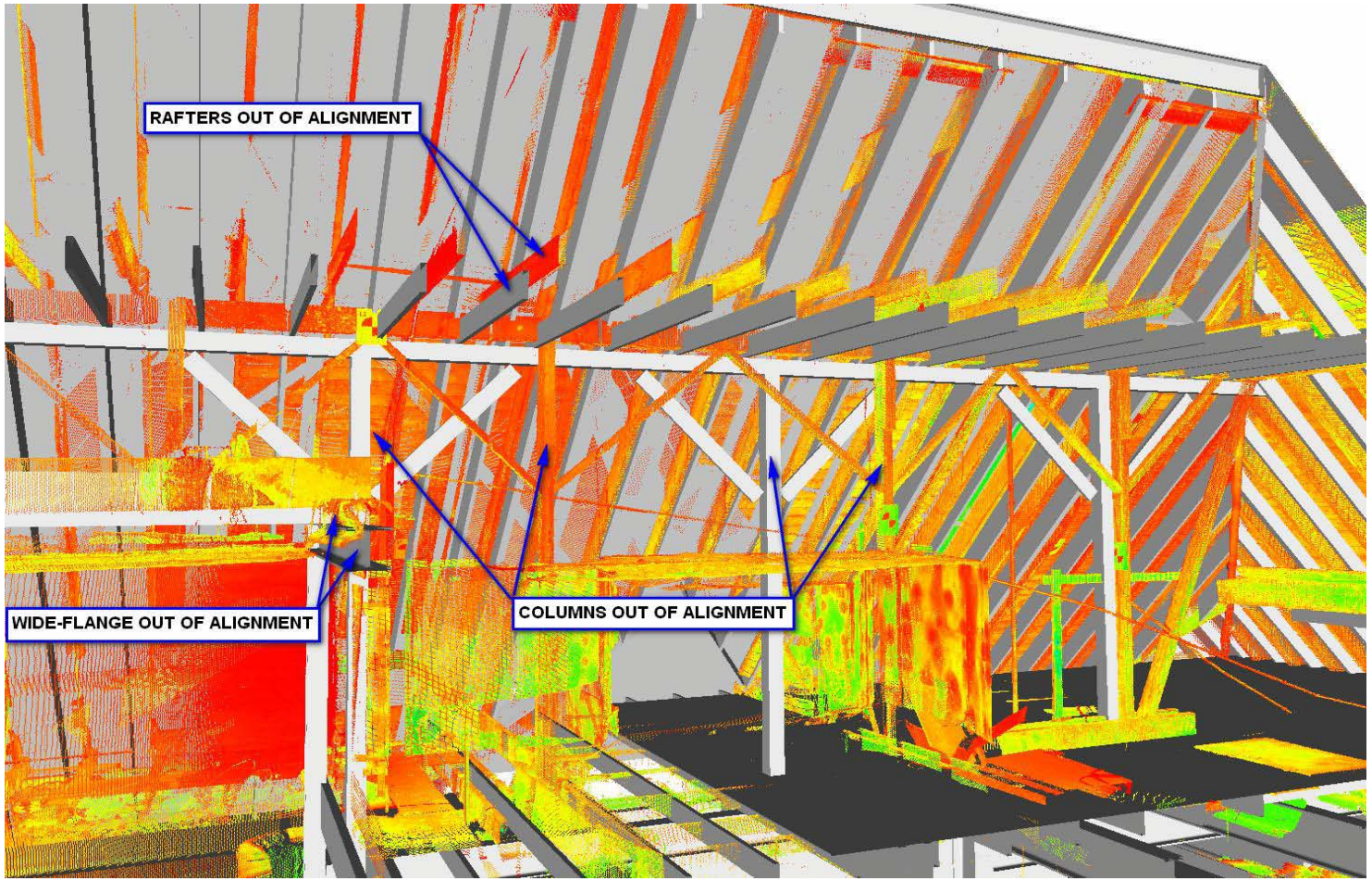
UW Denny Hall Laser-Scan Surveying

- 3D "Laser Scanning"
  Millions of points
  Sub-millimeter accuracy
  Capture photos and reflectance
- Preconstruction – Verification of existing conditions/as-built
- Construction – Utilize for BIM coordination in the field and O&M



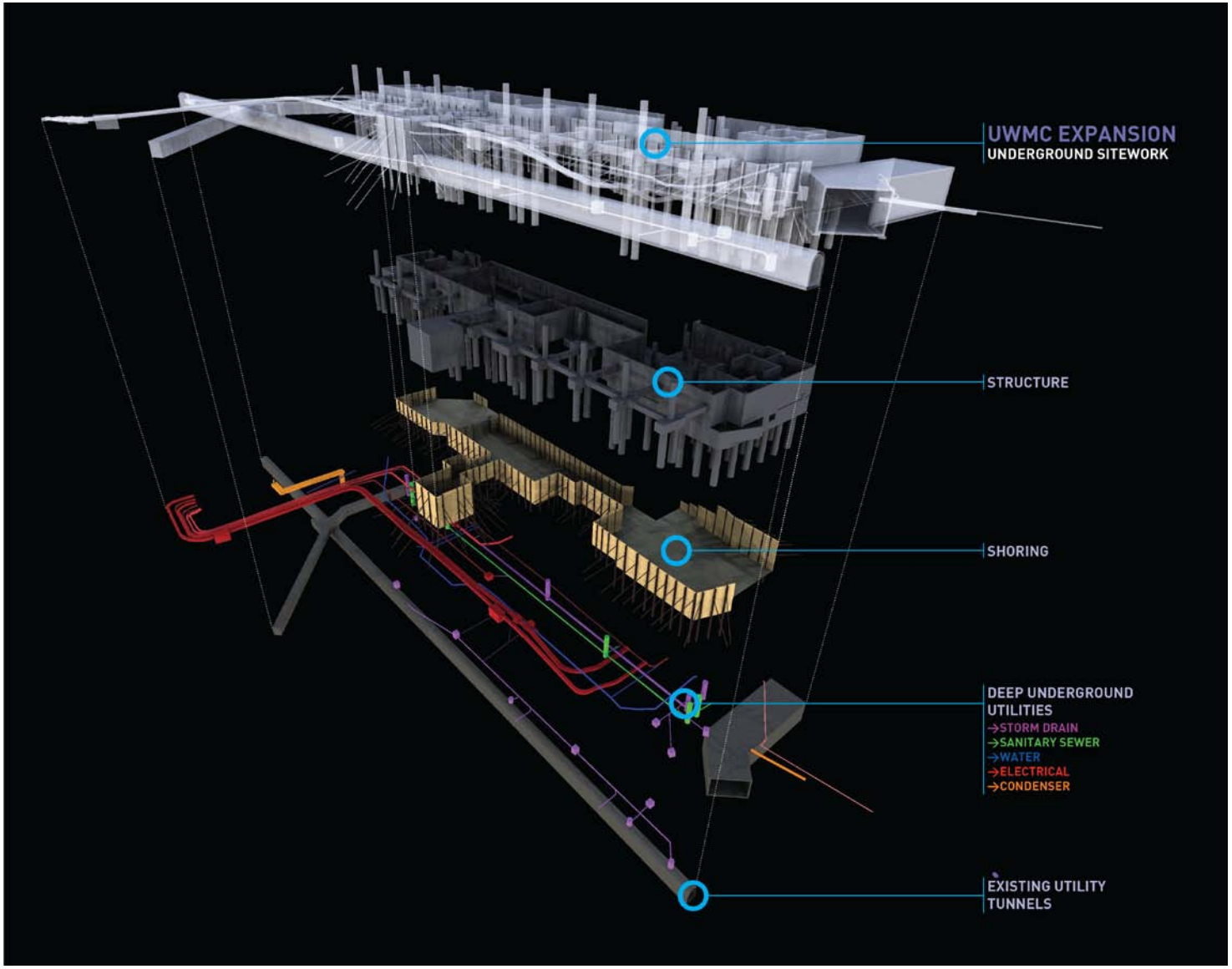


UW Denny Hall Laser-Scan Surveying

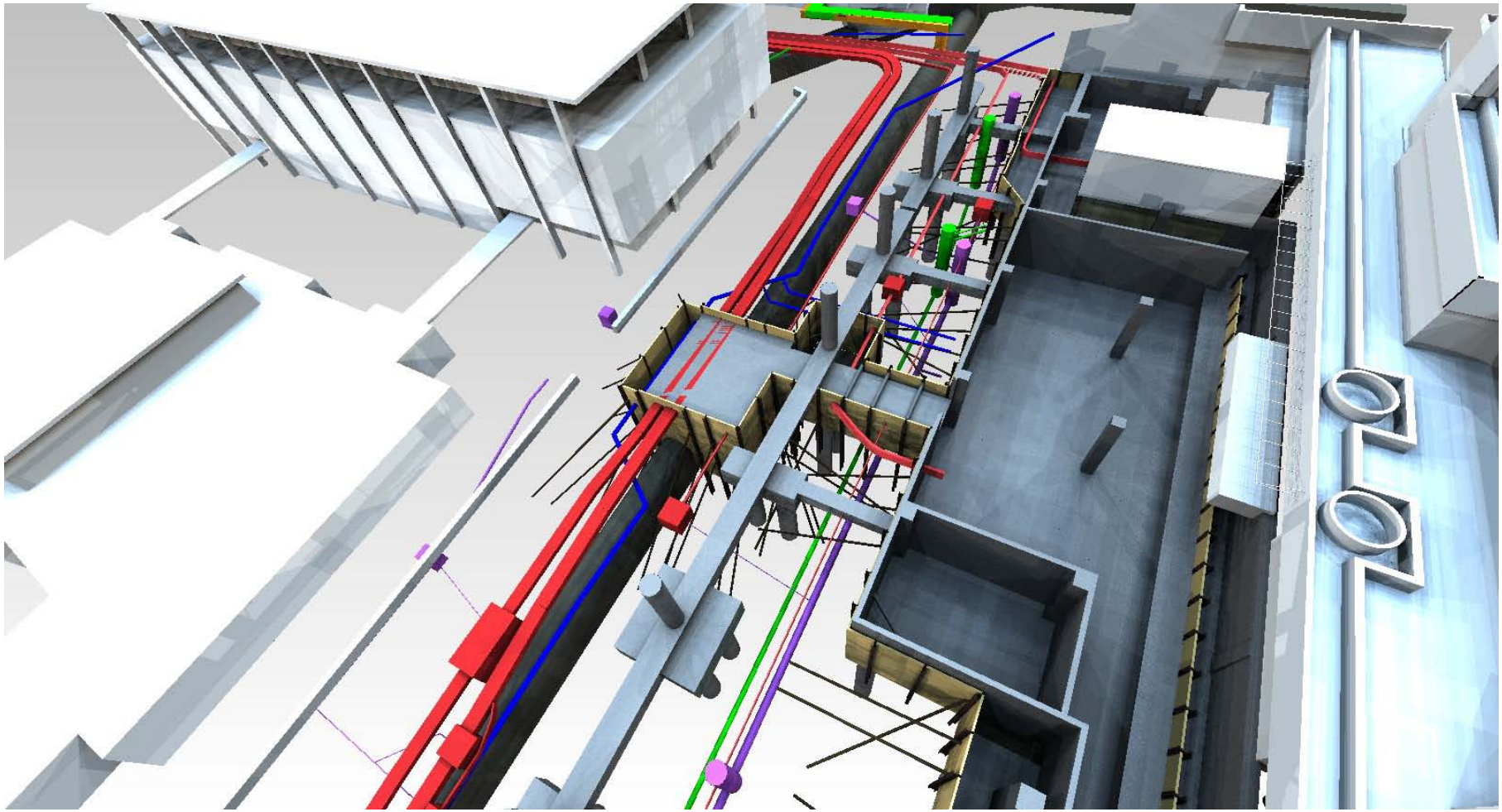


UW Denny Hall Laser Scan revealed a number of discrepancies with as-built documentation.

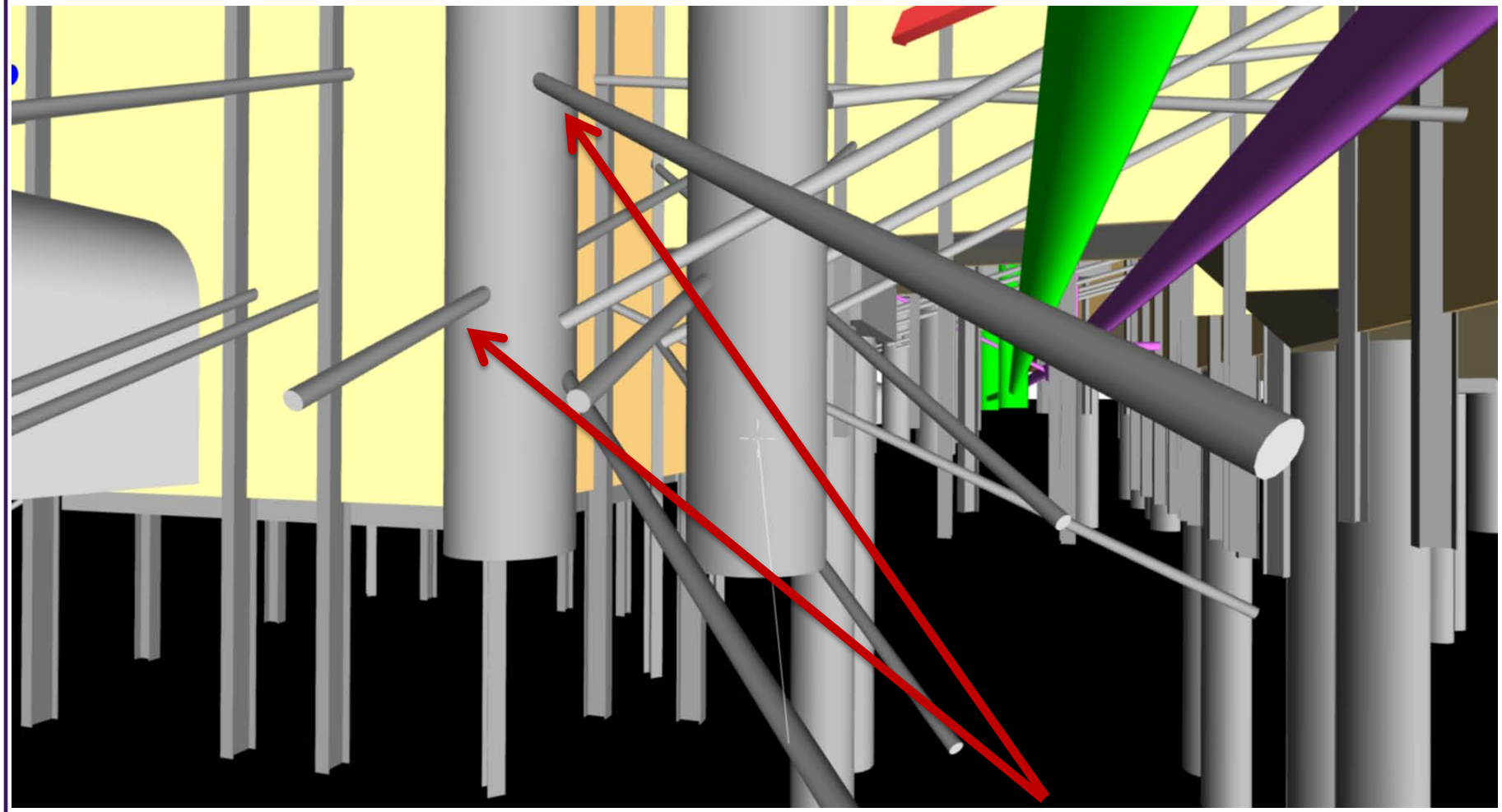
UWMC Expansion Project



UWMC Expansion Project

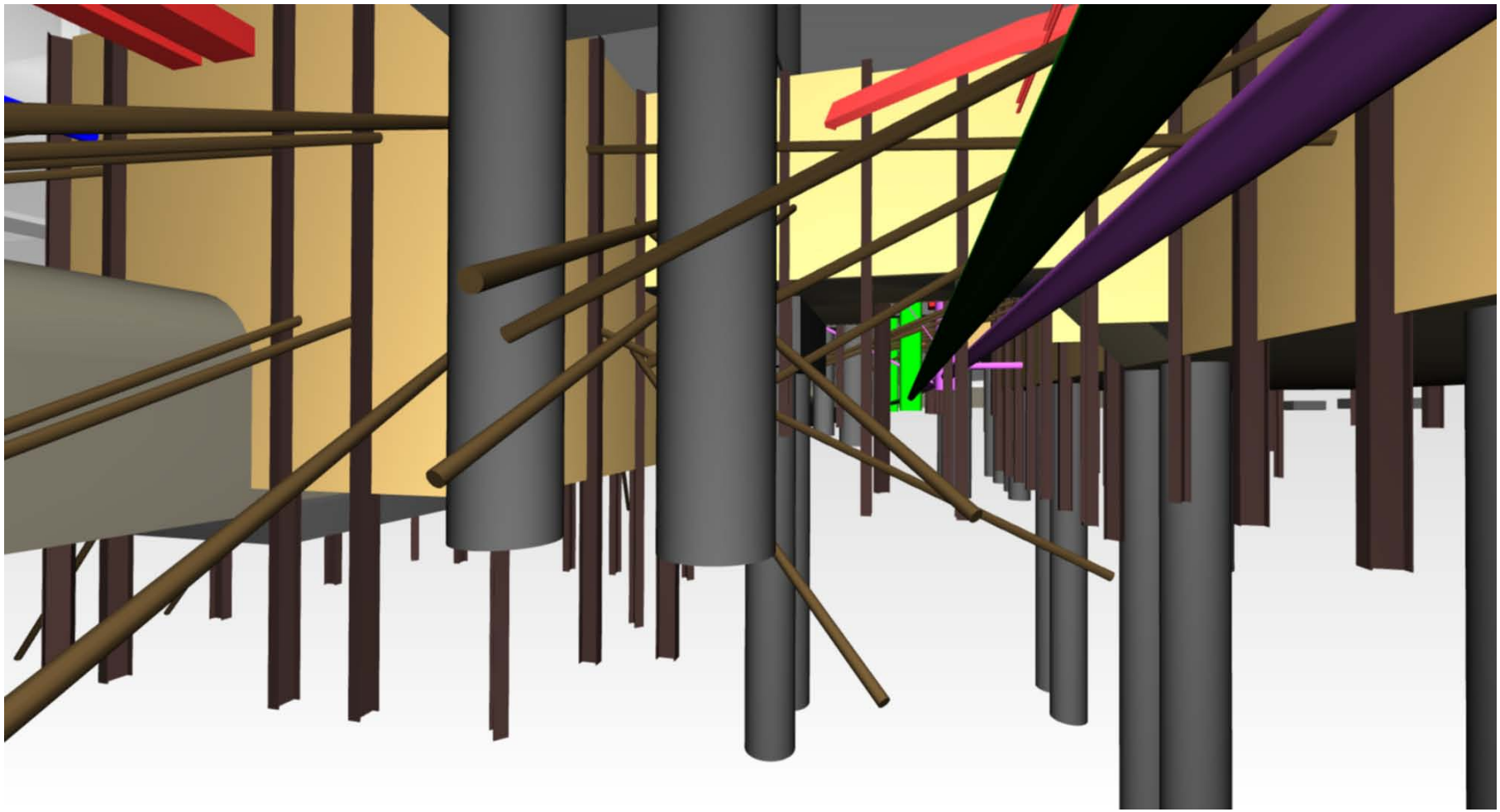


UWMC Expansion Project



3D of the UWMC Expansion foundations *"before"*

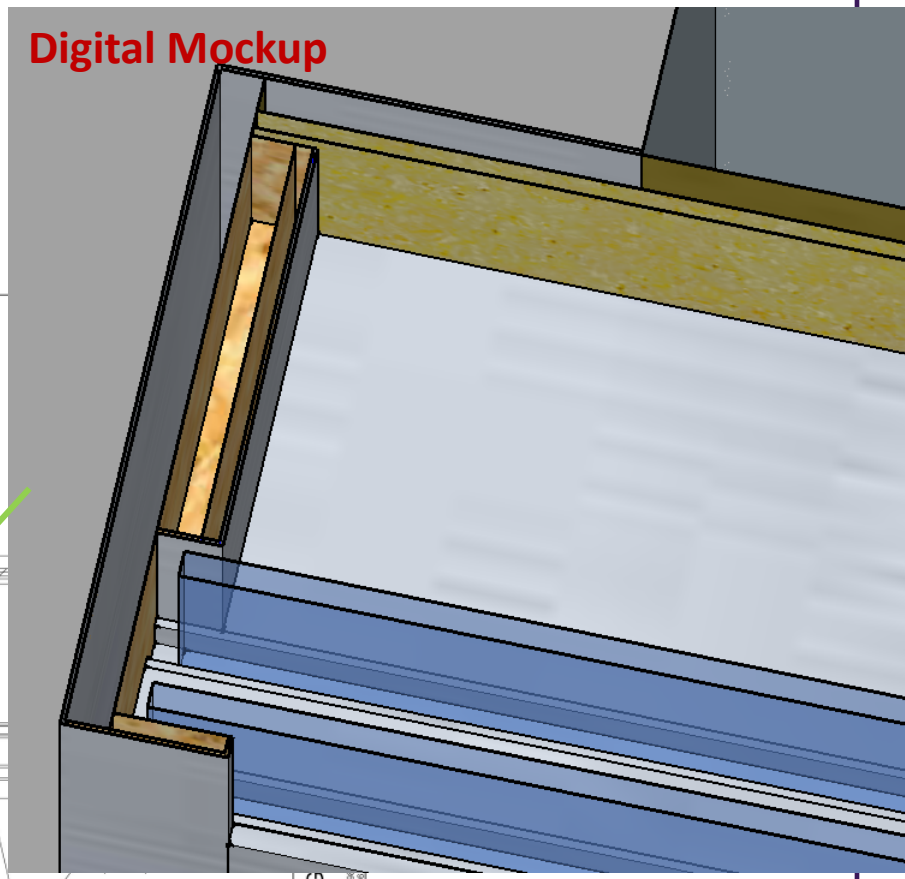
UWMC Expansion Project

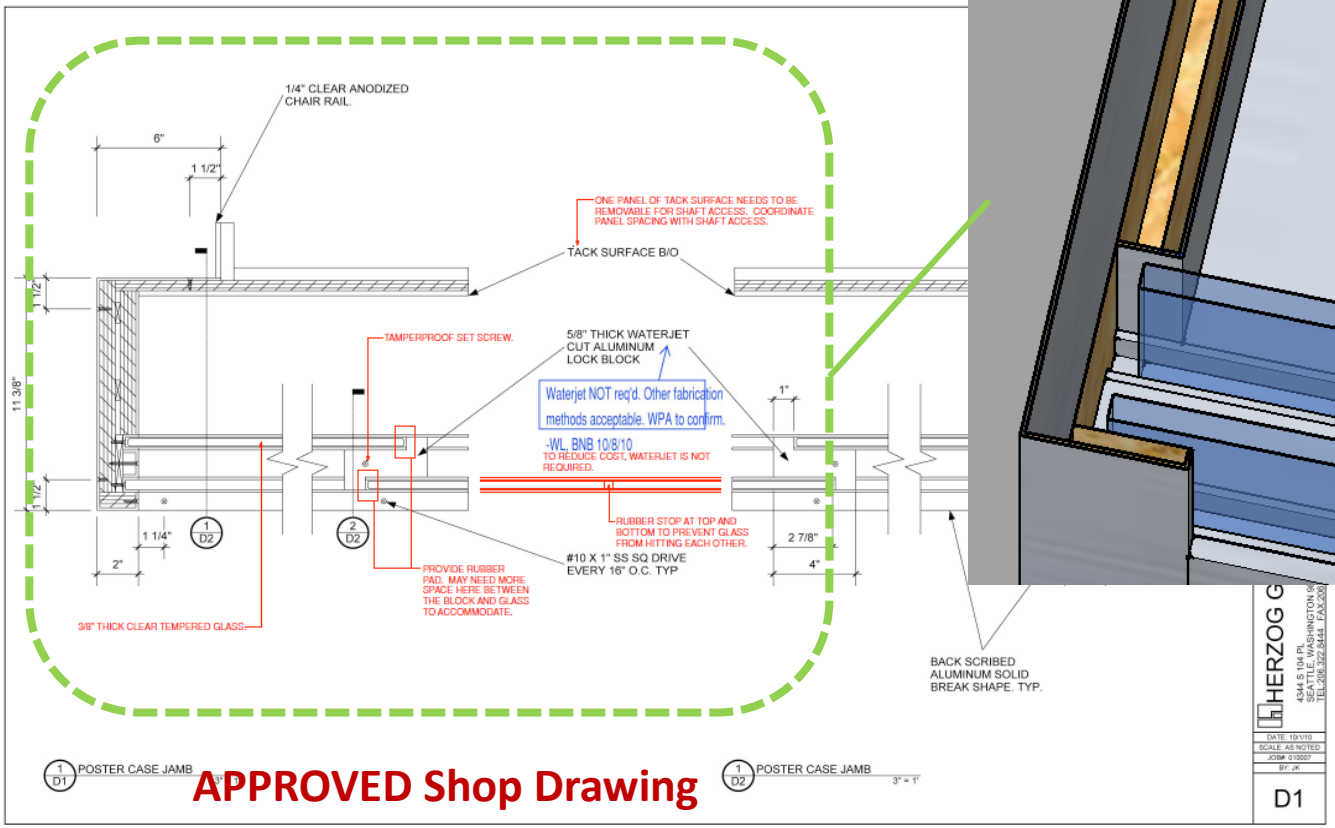


3D of the UWMC Expansion foundations *"after"*

HSC J1/J2 Microbiology Renovation Digital Mockup

3D model resolved many constructability issues only possible through an iterative, digital process. The model turned into the fabrication drawings.





HSC J1/J2 Microbiology Renovation Digital Mock-up

Ruggedized Tablets in the Field:

- Safety
- Quality Control
- Punchlist
- Future – BIM Integration

Electronic Plan Table

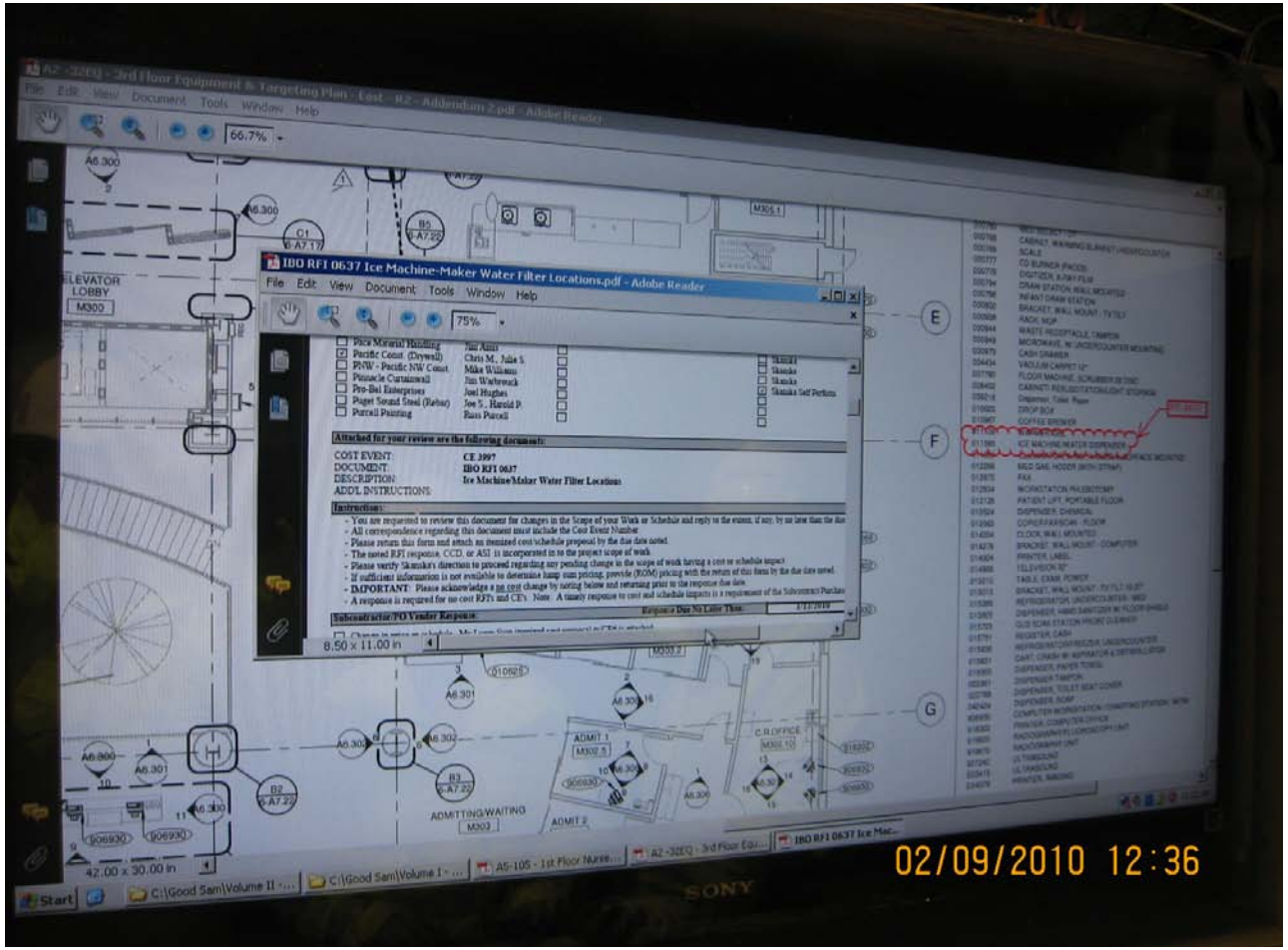
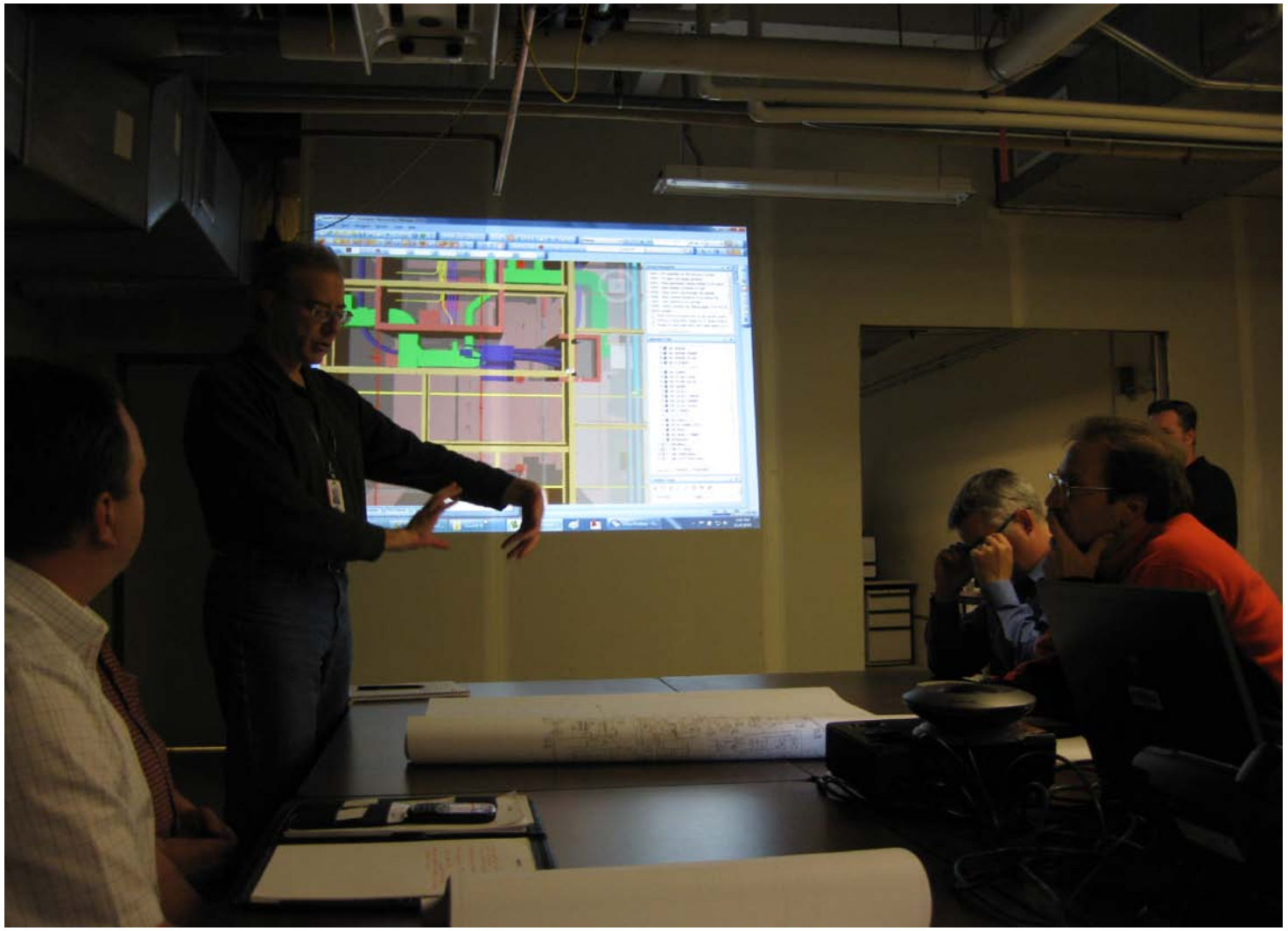


Photo shows the plan in the background, and a Window opened with an RFI that is linked via the plan view.

Electronic Posting in the Field

Design Assist/BIM Charrette – UWMC Expansion Project



UWMC Expansion Design Assist

Investment

▪ Net fee to Mechanical/Electrical Subs	$ 190,000

Return

▪ Finish 10 weeks early – direct construction savings	$ 1,900,000
▪ Start revenue 10 weeks early – added UWMC Margin	$ 3,500,000
▪ Change Orders avoided	$ 300,000
TOTAL RETURN	$5,700,000
Return on investment	**$ 30/$1**

UW Bothell Phase 3: *Pulling it all together*

- Embracing IPD principles
- Form team early
  - GC/CM at design start
  - Early subcontractors – MC/CM and EC/CM
- Target Value Design
- Plan, design and build in 3D model
- Design assist
- Streamline process

BIM for Facility Management

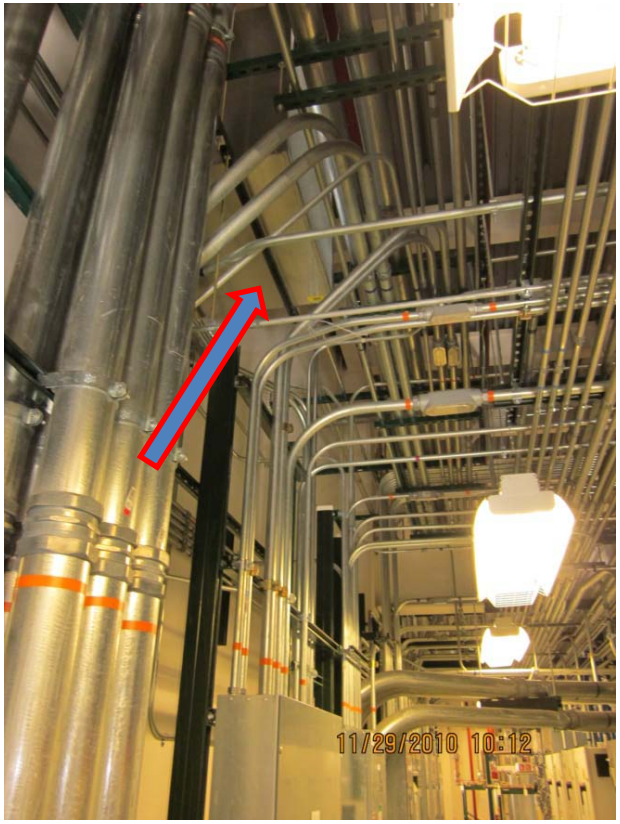
"Design for Maintenance"

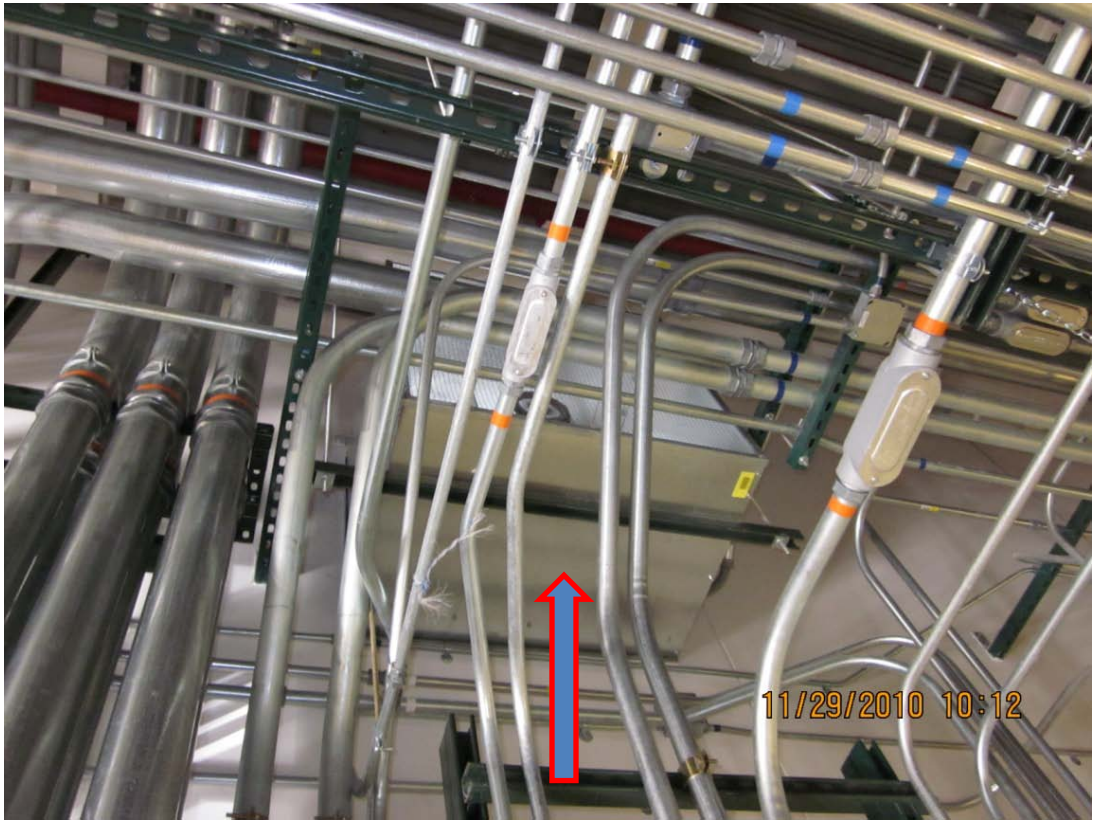
Courtesy of Birgitta Foster

ecobuild® america
Sustainable, High Performance & Technology Solutions for the Built Environment

Latest example…Relief Fan

"I have put in service request…to find a solution to meeting the relief needs of the building, perhaps another exhaust fan can be used….Please discontinue any Preventative Maintenance to this exhaust fan."





Levels of FM Engagement

Bridge to BMS (Building Management System)

- Link the BMS to the BIM models/O&M information
- Critical for post occupancy performance

Link O&M Information To BIM Model

- Software or method to link BIM models to O&M information
- Process to update as necessary

Information Management

- Electronic project information (O&M, Warranties, CAD/BIM files, etc)
- Well thought out structure
- “Foundation” of FIM

COBie case study

Foster School of Business Phase II

$41.8M project cost; 63,000 GSF classroom/admin.

CAPITAL PROJECTS OFFICE
UNIVERSITY of WASHINGTON

COAA
Building Success for Construction Project Owners

FACILITIES SERVICES

buildingSMARTalliance
a council of the National Institute of Building Sciences

Sellen

McKinstry
For The Life Of Your Building

UNIVERSITY of WASHINGTON
Construction Management

MacDonald-Miller
FACILITY SOLUTIONS

jp francis
& associates, inc.
contractors

SEAHURST ELECTRIC
Providing TEGG Electrical Services

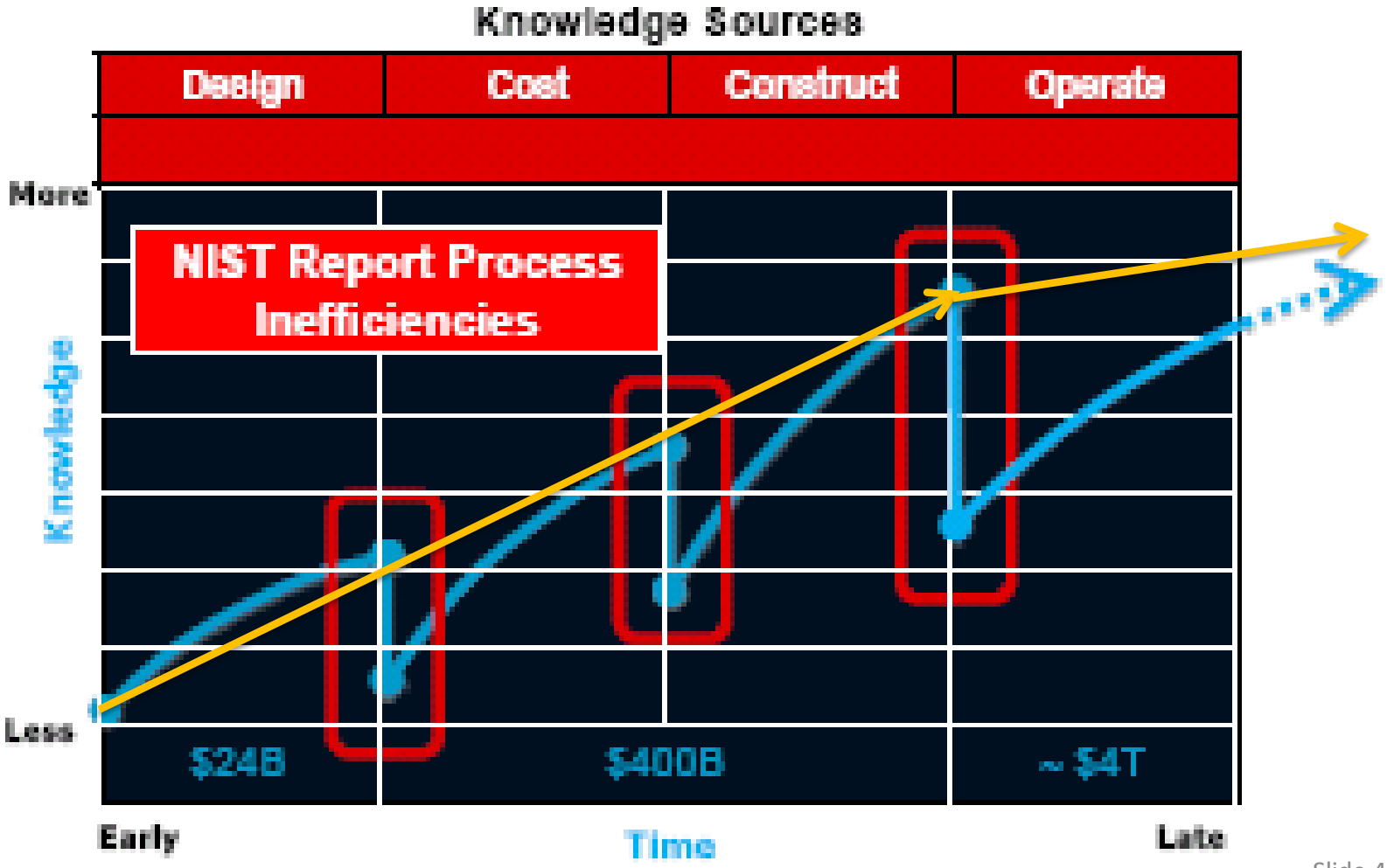
NELSON ELECTRIC

THA
ARCHITECTURE INC

Our current O&M data transfer…

"Here's your building - good luck!"

Data is lost with each phase…



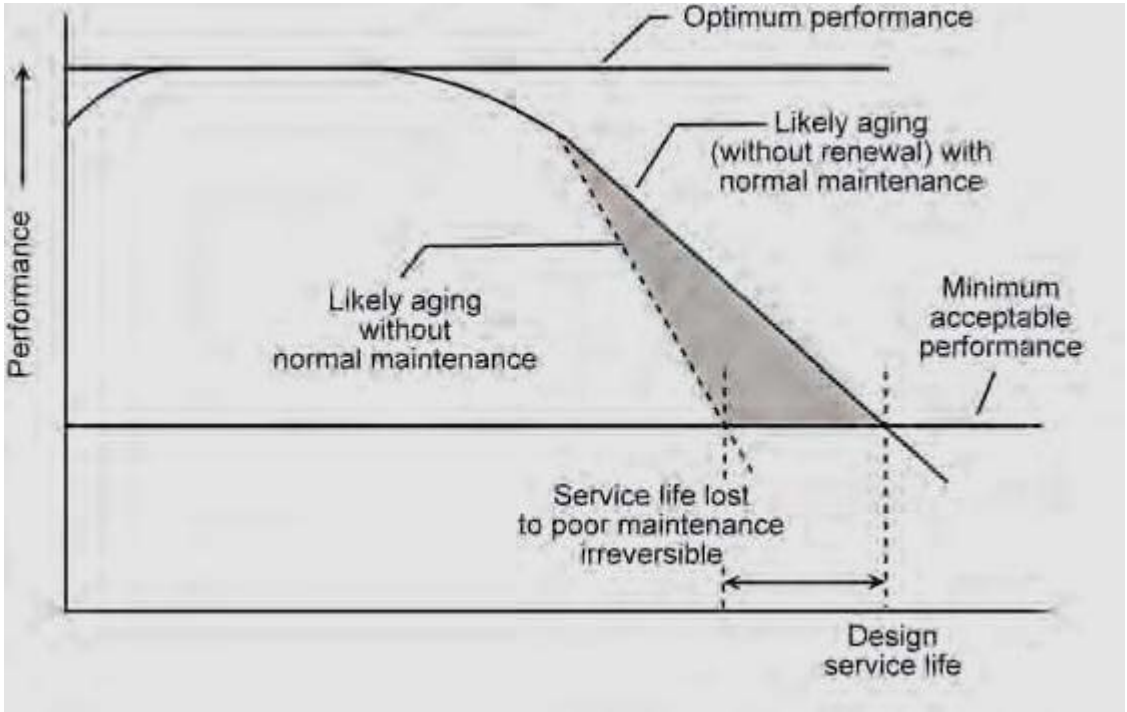
Graphics credit: Brigitta Foster

Less hunting for info, more wrench time

Studies have estimated waste due to O&M management at $0.23/GSF/Year

UW has about 20M GSF…$4.6M/year

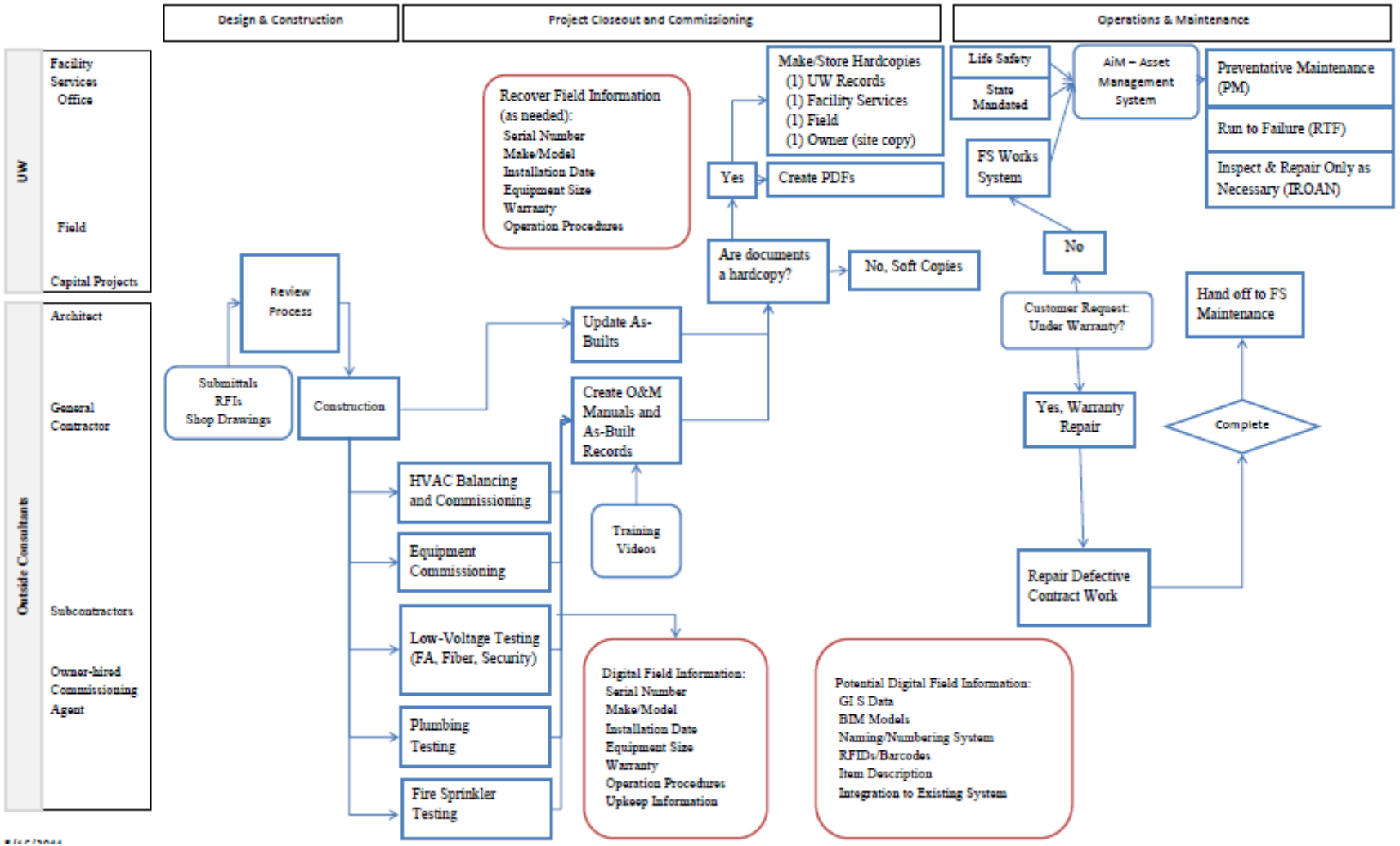
Other studies indicate the cost may be higher still



The UW COBie Pilot

Project Phase	Contracting Phase	Information Captured	Case Study Scope
Requirement	Programming	Space Program	
		Product Program	
Design	Documents	Early Design	
		Schematic Design	
		Coordinated Design	
		Design Reviews	
	Specification	Product Specifications	
		Product Discovery	
Construction	Bidding	Bid Inquiries	
	Selection	Preparation and Submittal Review	
		Shop Drawings	
	Installation	Install Products	
		Inspect Products	☑
		Punch List	
	Commissioning	Capture Parts Data	☑
		Capture Warranty Data	☑
		Capture Maintenance Data	☑
		Capture Systems Data	☑

O&M Data Swim Lane Diagram- current state



The COBie Template

	A	B	C	D	E	F	G	H	I	J	K
1	ComponentID	SpaceID	RegisterID	ExternalSystemName	ExternalNameID	ComponentName	ComponentDescription	CreatedBy	CreatedDate	CreatedTime	ReplacesID
39	38	1,100	54,HVAC System Components and Equipment			RH-21	Radiant Heater	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
40	39	9,0	54,HVAC System Components and Equipment			EF-1	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
41	40	9,0	54,HVAC System Components and Equipment			EF-2	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
42	41	5,103	54,HVAC System Components and Equipment			EF-3	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
43	42	3,101	54,HVAC System Components and Equipment			EF-4	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
44	43	1,100	54,HVAC System Components and Equipment			EF-5	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
45	44	1,100	54,HVAC System Components and Equipment			EF-6	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
46	45	3,101	54,HVAC System Components and Equipment			EF-7	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
47	46	9,0	54,HVAC System Components and Equipment			EF-8	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
48	47	6,104	54,HVAC System Components and Equipment			EF-9	Exhaust Fan	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
49	48	1,100	54,HVAC System Components and Equipment			AH-1	Air Handling Unit	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
50	49	10,0	35,Plumbing Fixtures,pumps, Backflow preventors, Vibration abso			OWS-1	Oil Water Seprator	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
51	50	3,101	35,Plumbing Fixtures,pumps, Backflow preventors, Vibration abso			WH-1	Water Heater	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
52	51	1,100	45,compressed air system components			AC-1	Air Compressor	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
53	52	1,100	35,Plumbing Fixtures,pumps, Backflow preventors, Vibration abso			EEW-1	Emergency Eye Wash	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
54	53	1,100	94,Fuel Oil System and pumps			P-1	Oil Supply Pumps	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
55	54	1,100	94,Fuel Oil System and pumps			P-2	Oil Supply Pumps	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
56	55	1,100	94,Fuel Oil System and pumps			P-3	Oil Supply Pumps	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
57	56	1,100	35,Plumbing Fixtures,pumps, Backflow preventors, Vibration abso			DF-1	Drinking Fountain	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
58	57	7,105	35,Plumbing Fixtures,pumps, Backflow preventors, Vibration abso			SH-1	Shower	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			es,pumps, Backflow preventors, Vibration abso			SS-1	Service Sink	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			es,pumps, Backflow preventors, Vibration abso			S-1	Sink	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			es,pumps, Backflow preventors, Vibration abso			L-1	Lavatory	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			es,pumps, Backflow preventors, Vibration abso			L-1	Lavatory	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			es,pumps, Backflow preventors, Vibration abso			WC-1	Water Closet	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			ters, and grilles			SD-1	Supply Diffuser	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			ters, and grilles			SD-1	Supply Diffuser	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen
			ters, and grilles			R-1	Return	3,Reynolds,Tim,CB Engineers	16-Apr-2008	14:16	Componen

02-Facility | 03-Floor | 04-Space | 05-System | 06-Register | **07-Component** | 08-Attribute | 09-Coordinate | 10-Schedu

NUM

EXHAUST FANS

TAG	AREA SERVED	BASIS OF DESIGN MAKE	BASIS OF DESIGN MODEL	QTY	CFM	S.P. IN.W.G.	WATTS / HP	VOLTAGE	WEIGHT LBS	
EF-1	HIGH BAY	GREENHECK	SB-2L30-7	1	8000	0.125	3/4 HP	208/3/60*	125	2,3,5
EF-2	HIGH BAY.	GREENHECK	SB-2L30-7	1	8000	0.125	3/4 HP	208/3/60*	125	2,3,5
EF-3	ELECTRICAL ROOM	GREENHECK	CSP-A510	1	350	0.25	217 W	115/1/60	36	5
EF-4	RECESSED MAINT AREA	GREENHECK	CSP-A710	1	250	0.625	325 W	115/1/60	36	2
EF-5	PARTS WASHER	NEDERMAN	N16	1	500	3.75	1/2 HP	115/1/60	XX	1
EF-6	WELDING BENCH	NEDERMAN	N16	1	500	3.75	1/2 HP	115/1/60	XX	1
EF-7	TOILET,JAN.,COMM	GREENHECK	CSP-A710	1	210	0.625	325 W	115/1/60	36	
EF-8	HIGH BAY	GREENHECK	SB-2L30-7	1	8000	0.125	3/4 HP	208/3/60*	125	2,3,5
EF-9	OFFICE / KITCHEN	GREENHECK	SP-B150	1	150	0.125	129 W	115/1/60	10	3,6

* ALL 208 VOLT MOTORS SHALL BE 200 VOLT NAMEPLATE.

Fan Schedule

Implementation Plan

- Needs assessment: What types of information does FS need and in what format?
- Analyze current processes for data capture (capital projects), data exchange and data processes (facilities services)
- Design and test COBie processes for data capture (capital projects), data exchange and data processes (facilities services)

Integrating BIM and COBie

"Keep the model alive"

- Training
- Maintenance scheduling and checklists
- Product Data
- Design for Maintenance
- Integration with Facilities Mgmt. software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