



Innovation & Integration in Project Delivery

NWCCC Annual Conference

November 17, 2010

Innovation & Integration

- Ø Learning through partnerships
- Ø Project examples
- Ø Our Shared Future

Thank you to our project partners!



Process

- Design-Build
- DBOM
- GC/CM
- IPD-ish
- Early Subs
- Design Assist
- Target Value Design

Innovation Integration

Technology

- BIM
- Laser Scan
- Tablet Computers

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

Idea in 2003 became a reality in 2006.

- Ø 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

- Ø Started with Design-Build integrated Design & Construction.
- Ø Expand to O&M – Responsibility & accountability for design, quality, life cycle, etc.

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

Technology: BIM 3D & 4D

- Ø BIM proved design assumptions to skeptical owner.

Enabled by DBOM process

- Ø BIM during construction.

Underground As-Builts eased utility agency concerns

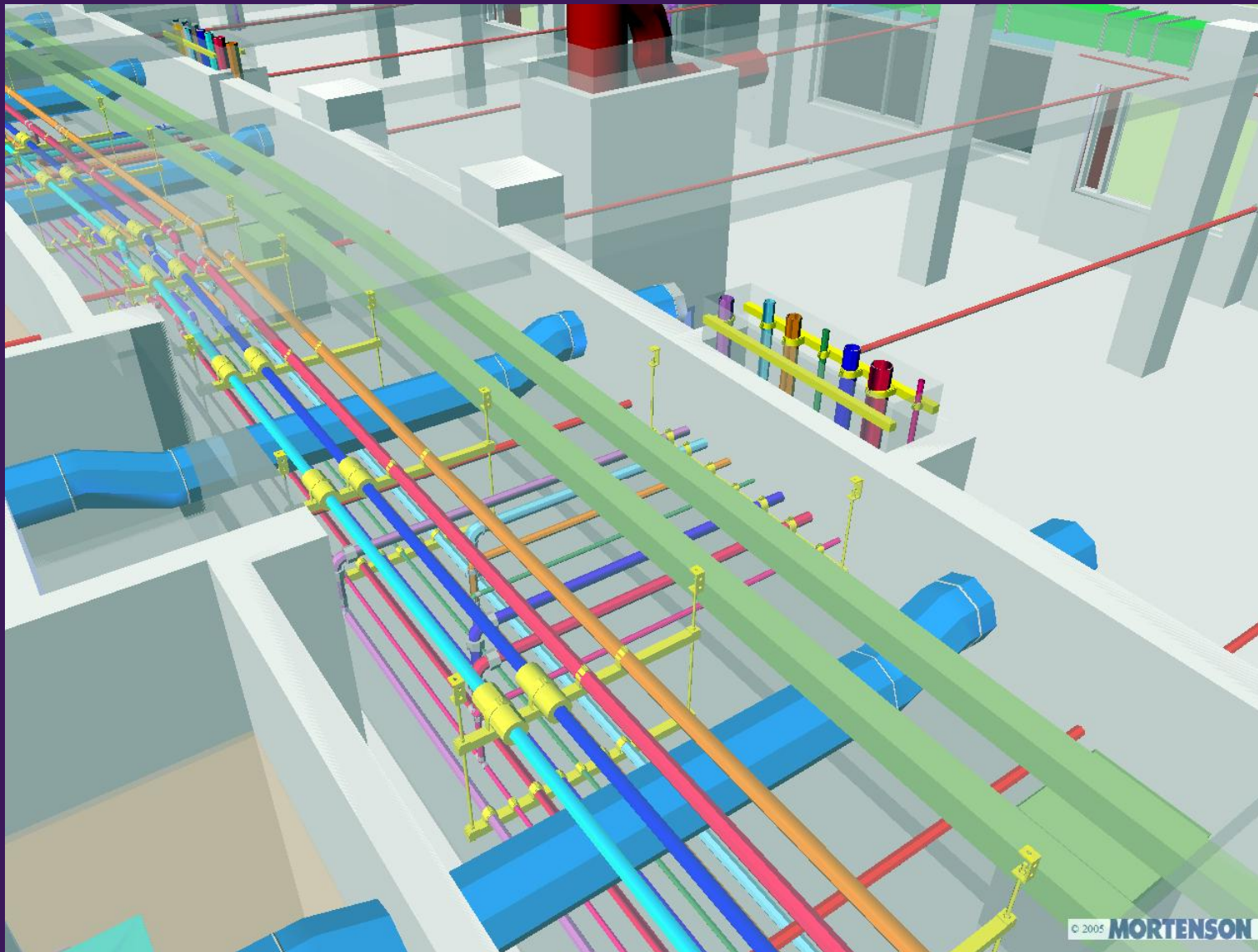
4D improved planning and coordination

Logistics

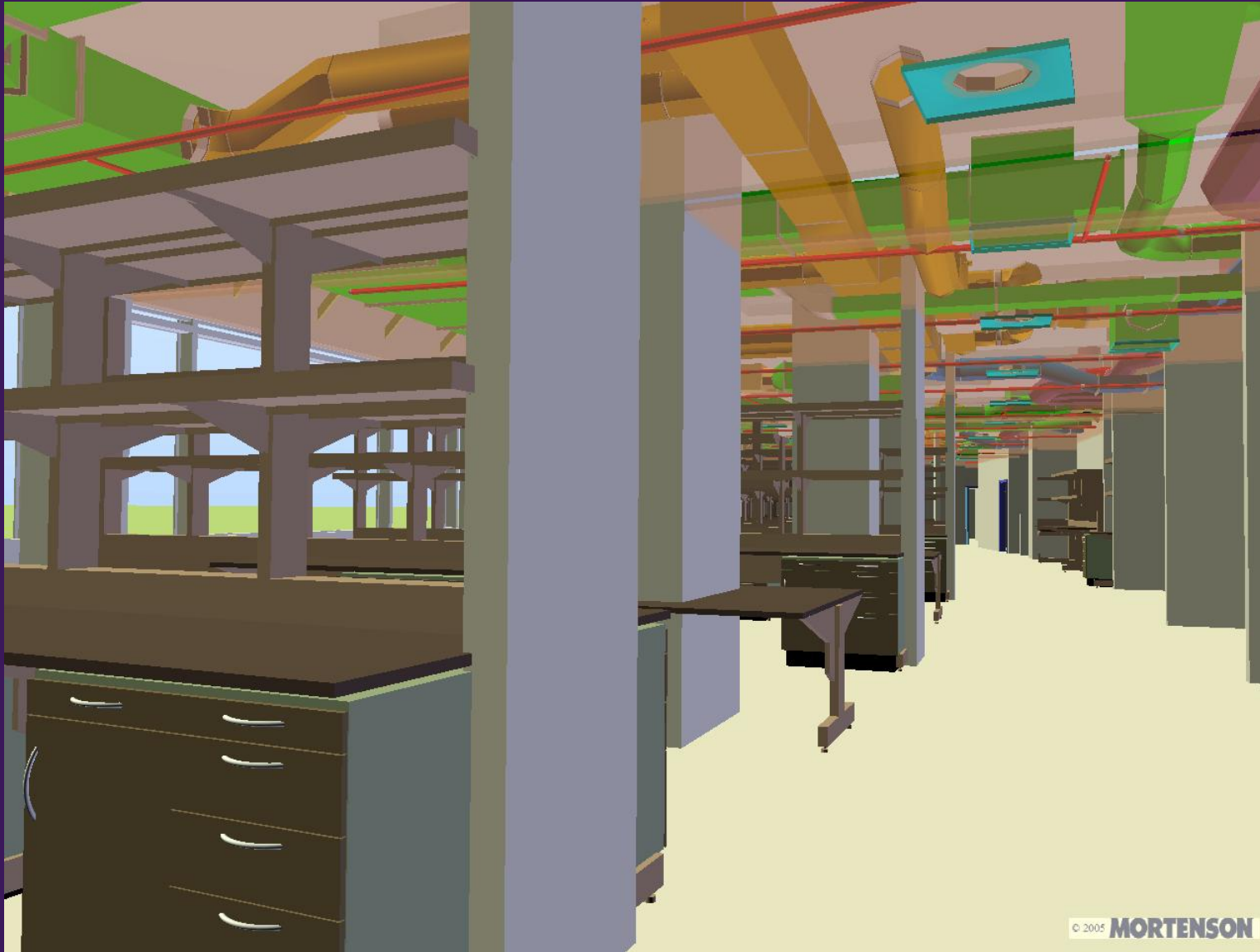
Subcontractors

Safety

Ben Hall Images

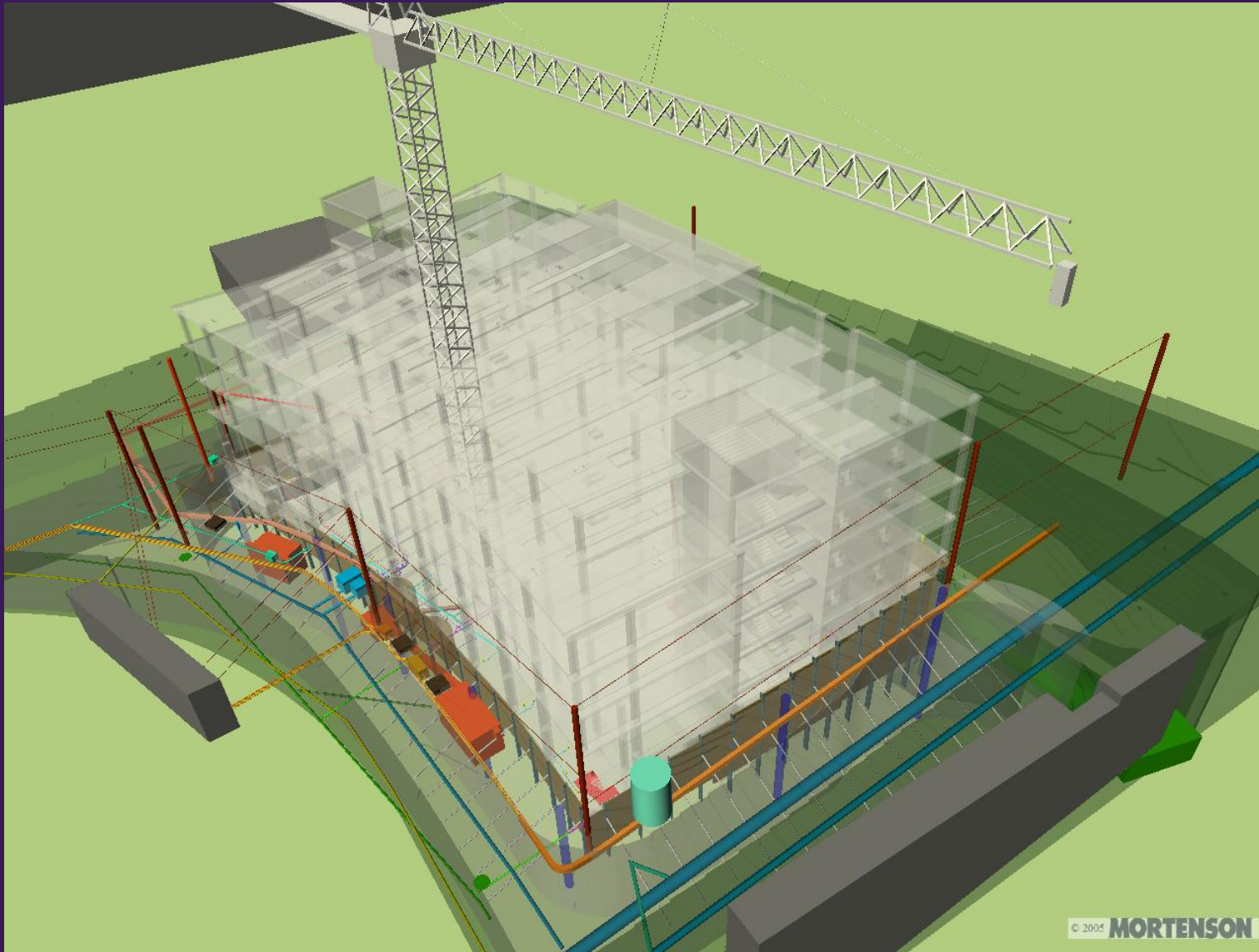


Ben Hall Images

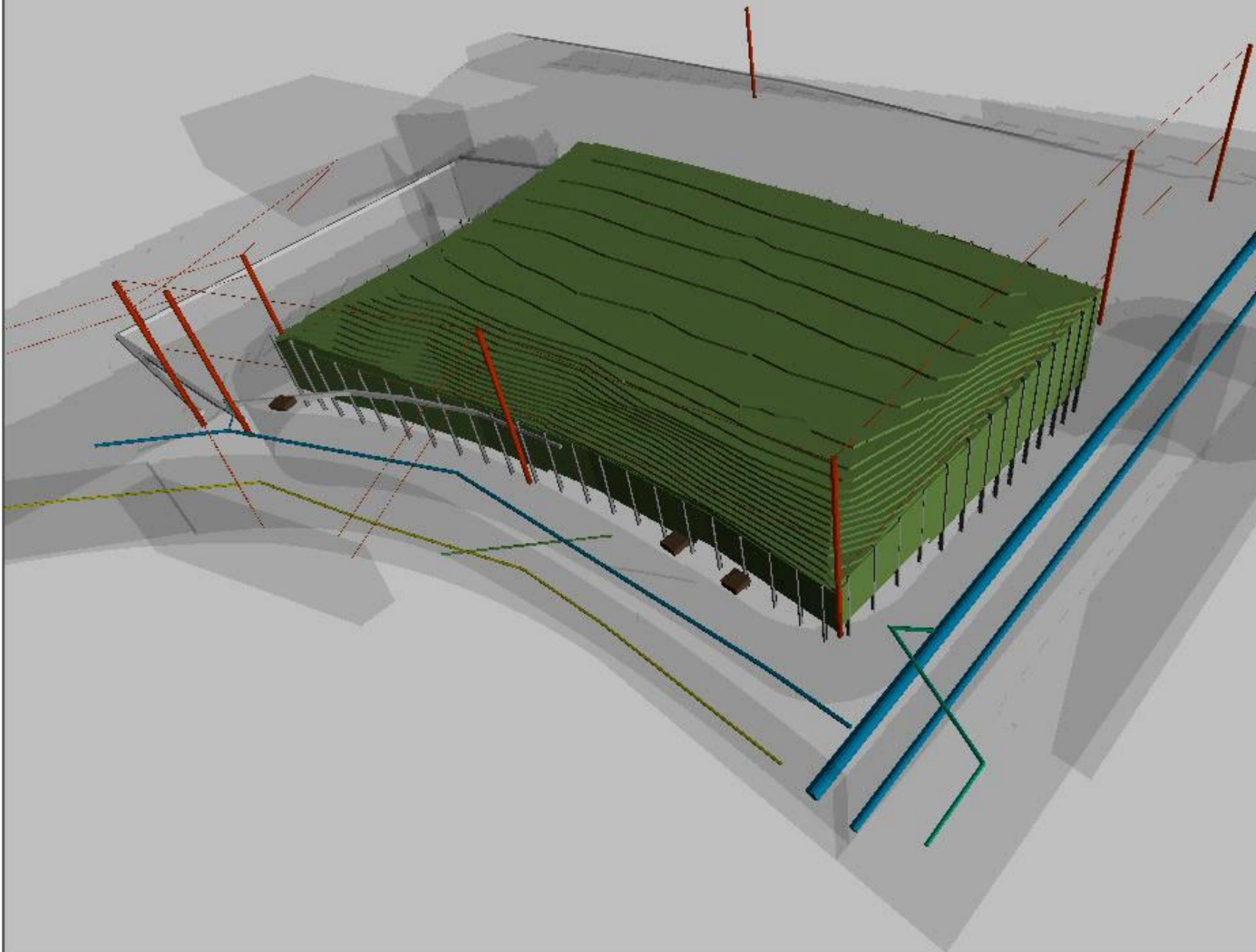


© 2005 **MORTENSON**

Ben Hall Images



02/06/2005
Unregistered



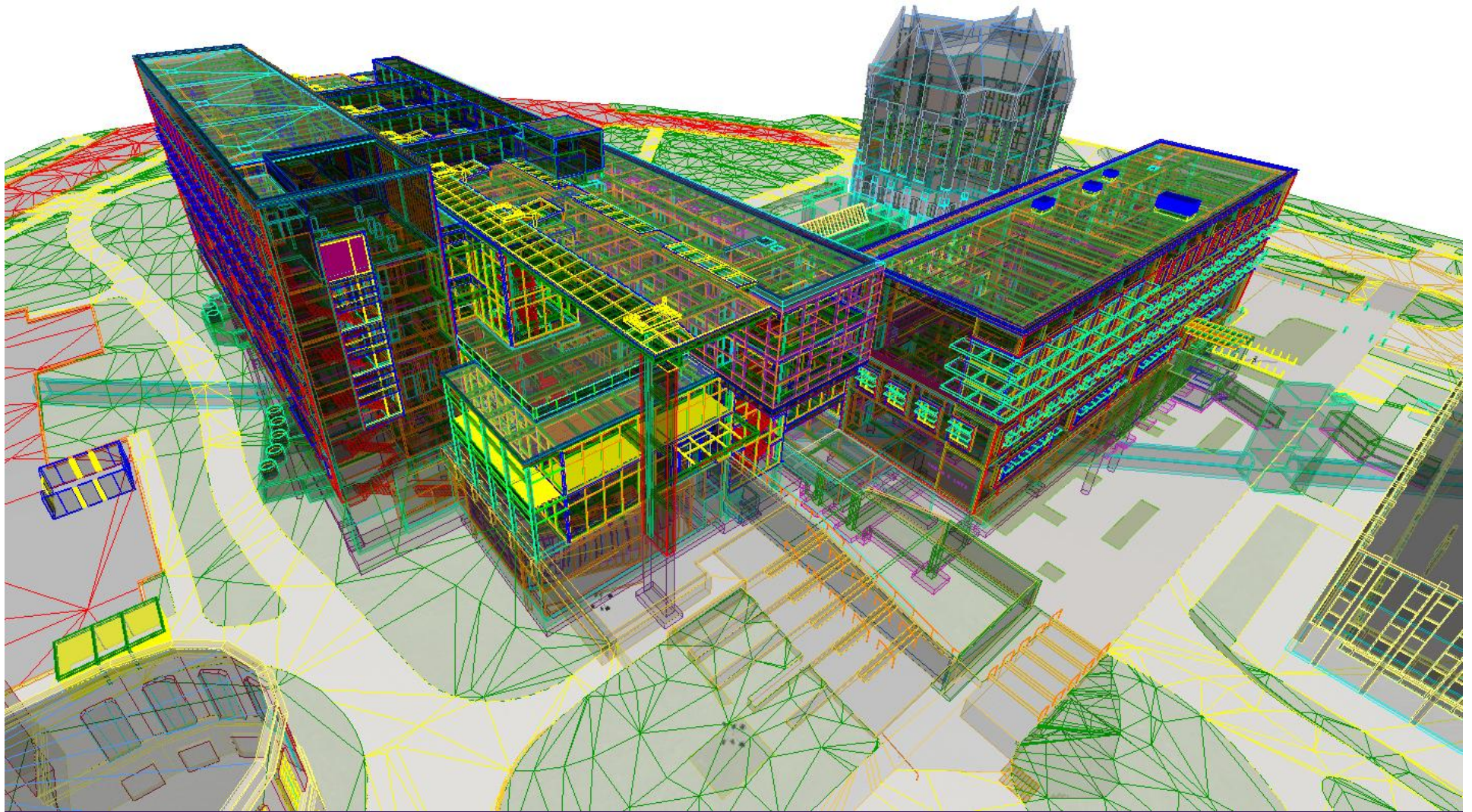
STRIP
FORM
SCORE, RESCORE
CURE
SEAL, PAINT, CLEAN, FINISH
STARTUP, TEST
SET, CONNECT
OFFICE
GRADE, BACKFILL, SITE
REIN, EMBED, WELD
CONSTRUCT, RI, INSTALL
DEMOLISH, EXCAVATE
TEMPORARY
UNSPECIFIED
MILESTONE

Applying Technology to GC/CM

- Ø GC/CM is UW primary method on major projects
- Ø Trade coordination: First BIM use; now standard
- Ø Other technologies
 - Laser scanning
 - Tablet Computers
- Ø On-site document posting and access

BIM in Trade Coordination

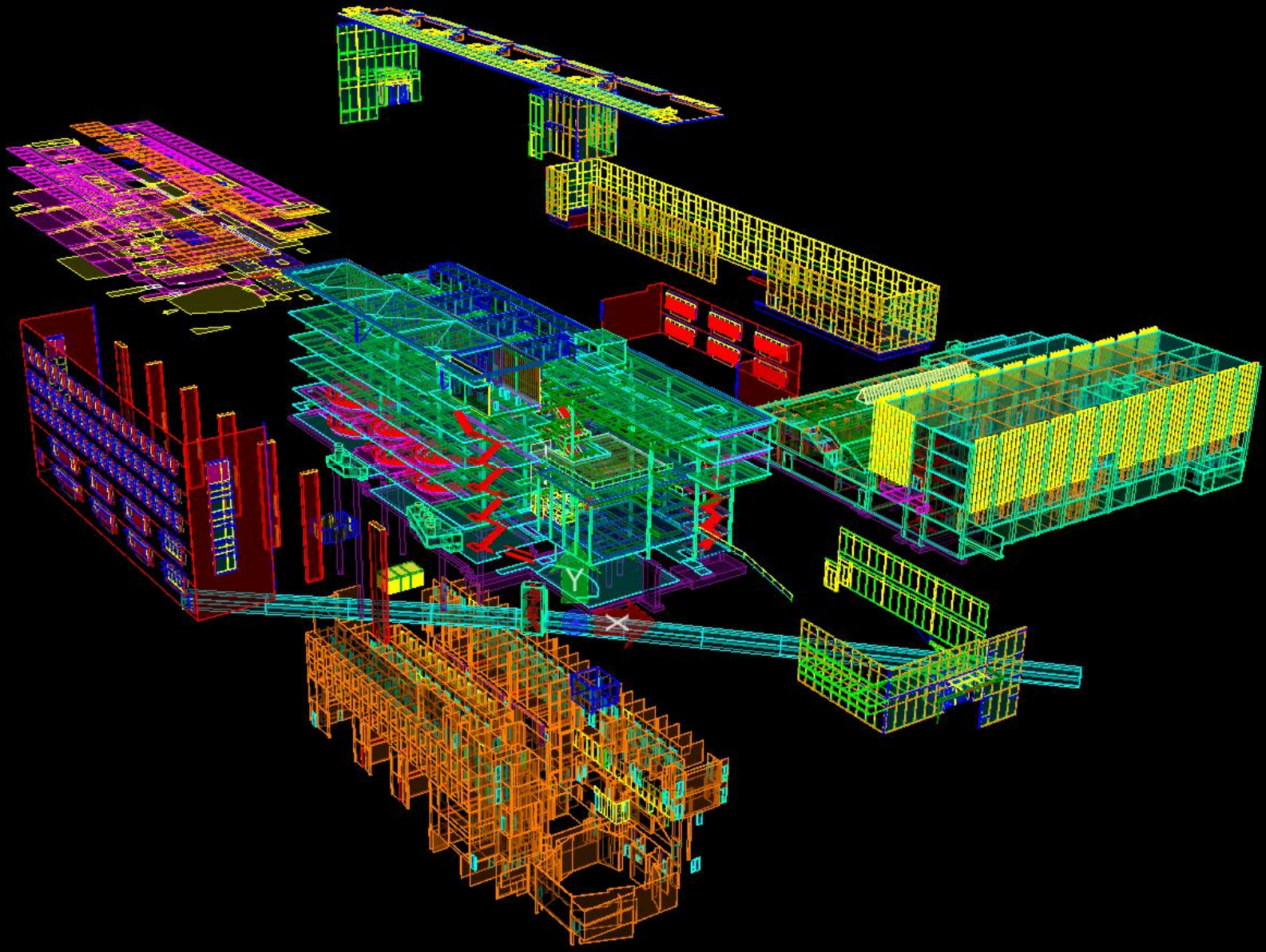
- Ø William H. Foege Building
- Ø Harborview Bond Program
- Ø Health Sciences H-Wing
- Ø Washington Dental Services Center for Early Childhood Oral Health
- Ø UW Tacoma Joy and Tioga Library Buildings
- Ø Clark Hall
- Ø Denny Hall
- Ø Johnson Hall
- Ø Guggenheim Hall
- Ø UW Tower Data Center
- Ø PACCAR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



Combined view of Design Models

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

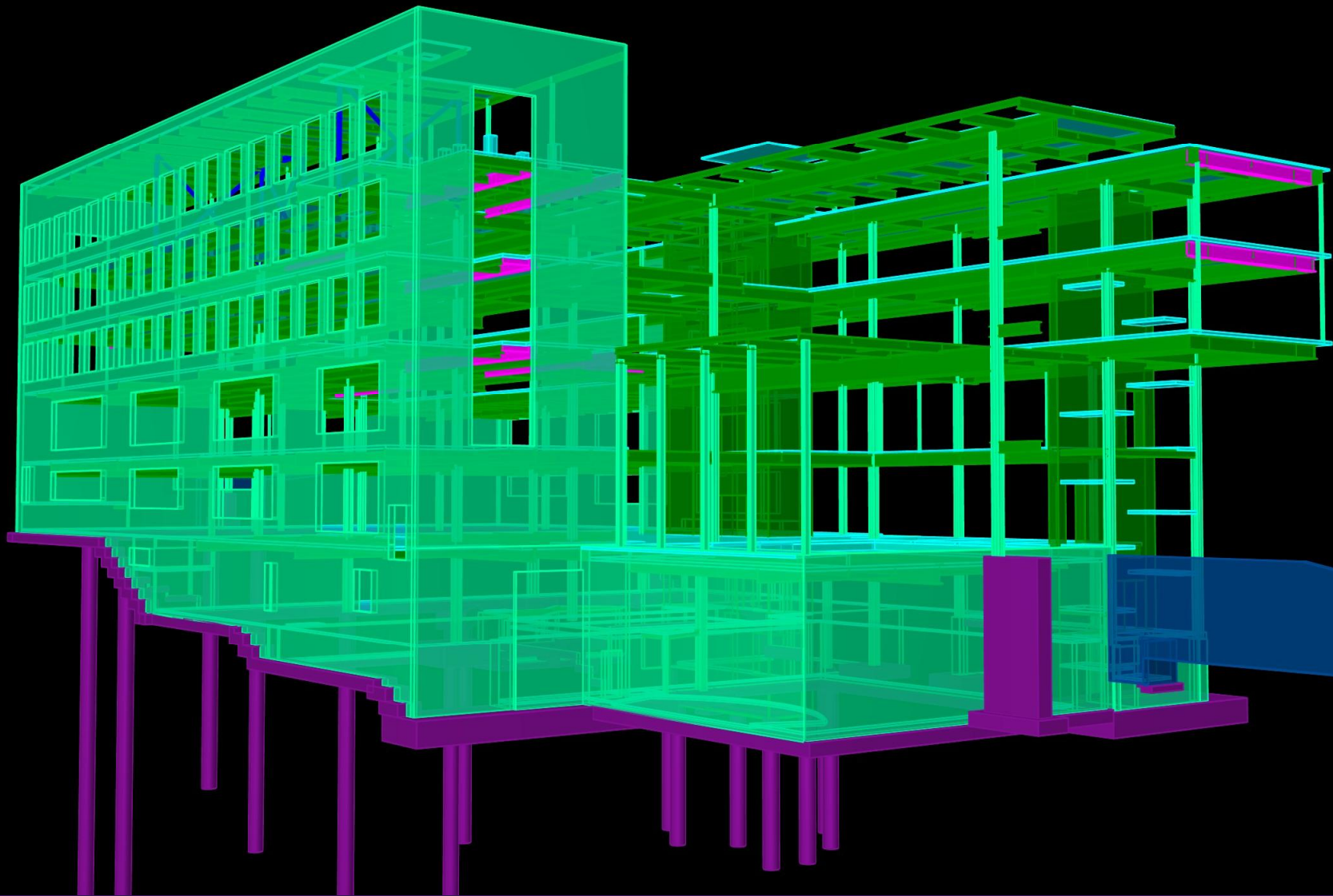
NWCCC Annual Conference
November 17, 2010

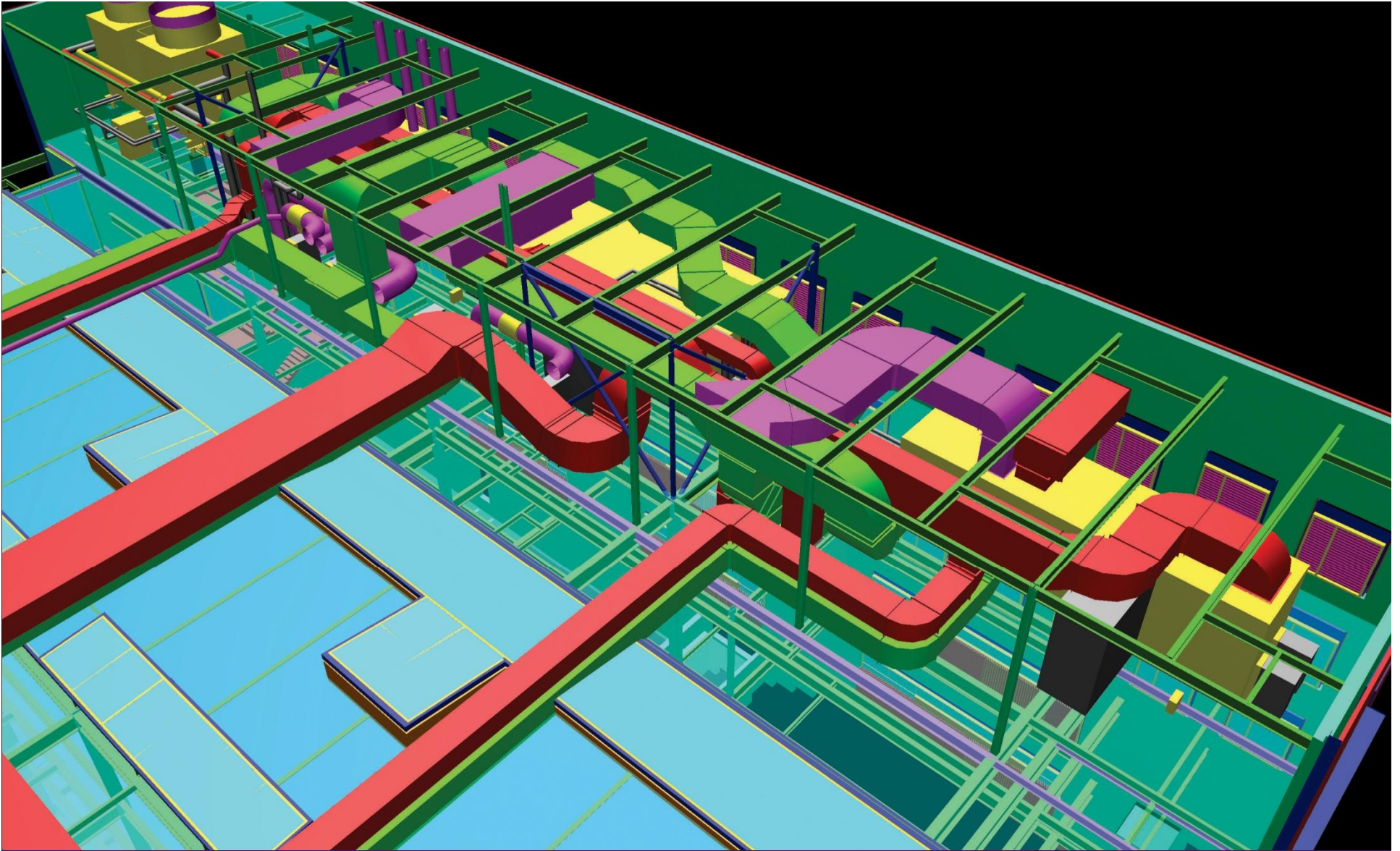


Exploded view of Design Models

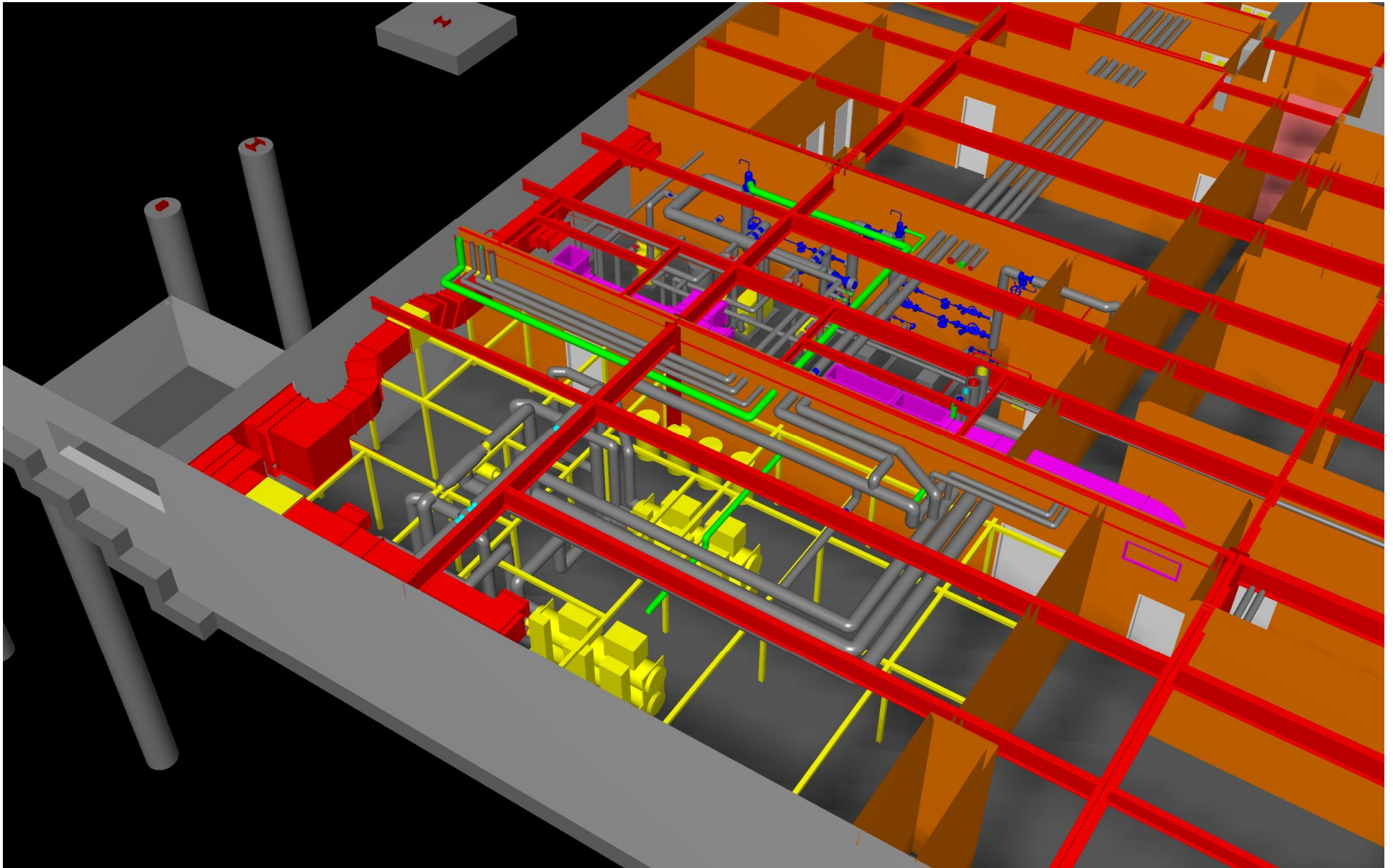
UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010





Design Model used for mechanical coordination - Penthouse



Design Model used for mechanical coordination – Mechanical Room

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010



Design Model used for building sectional studies – North Section

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010

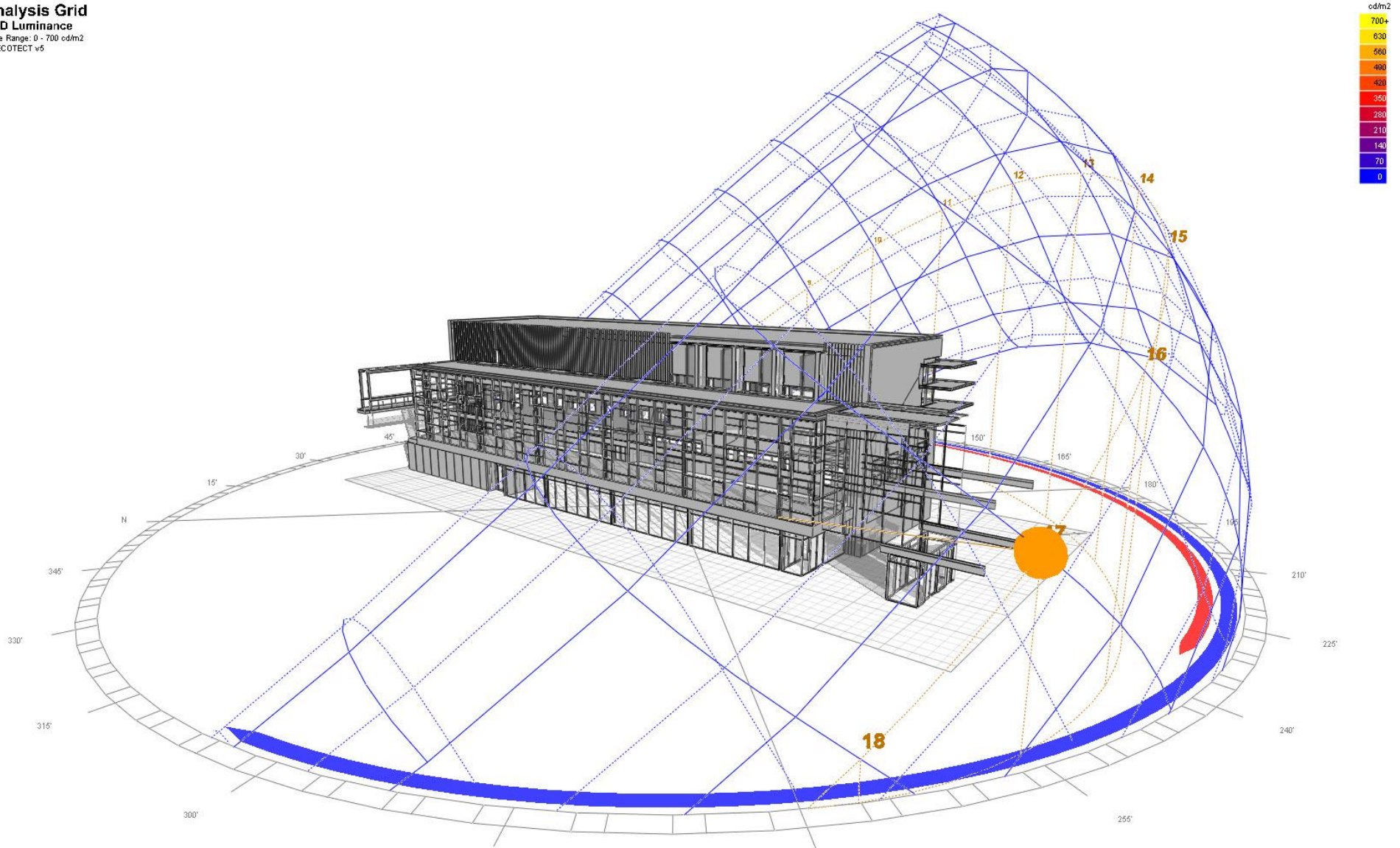


Design Model used for classroom layout and design studies

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010

Analysis Grid
RAD Luminance
Value Range: 0 - 700 cd/m²
(c) ECOTECT v5



Design Model used for sun studies – Sun Path Analysis

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010



Design Model used for sun studies – Solar Shading Study

UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NWCCC Annual Conference
November 17, 2010

MEP 3D Coordination at PACCAR

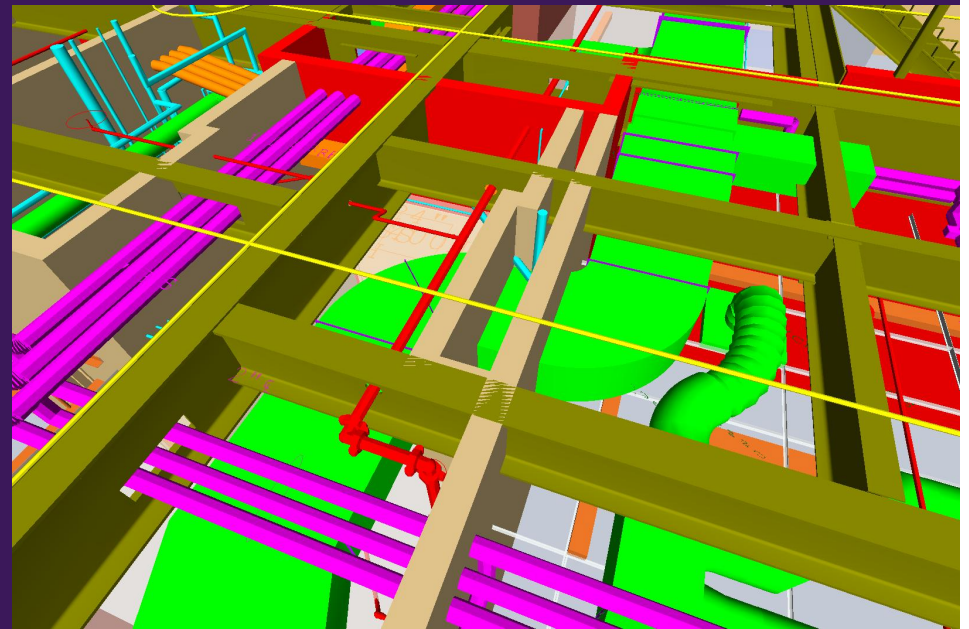
Ø 99% of beam penetrations were shop fabricated as a result of early coordination.

§ Estimated savings = \$120,000

§ 242 penetrations added

§ 127 modified size or location

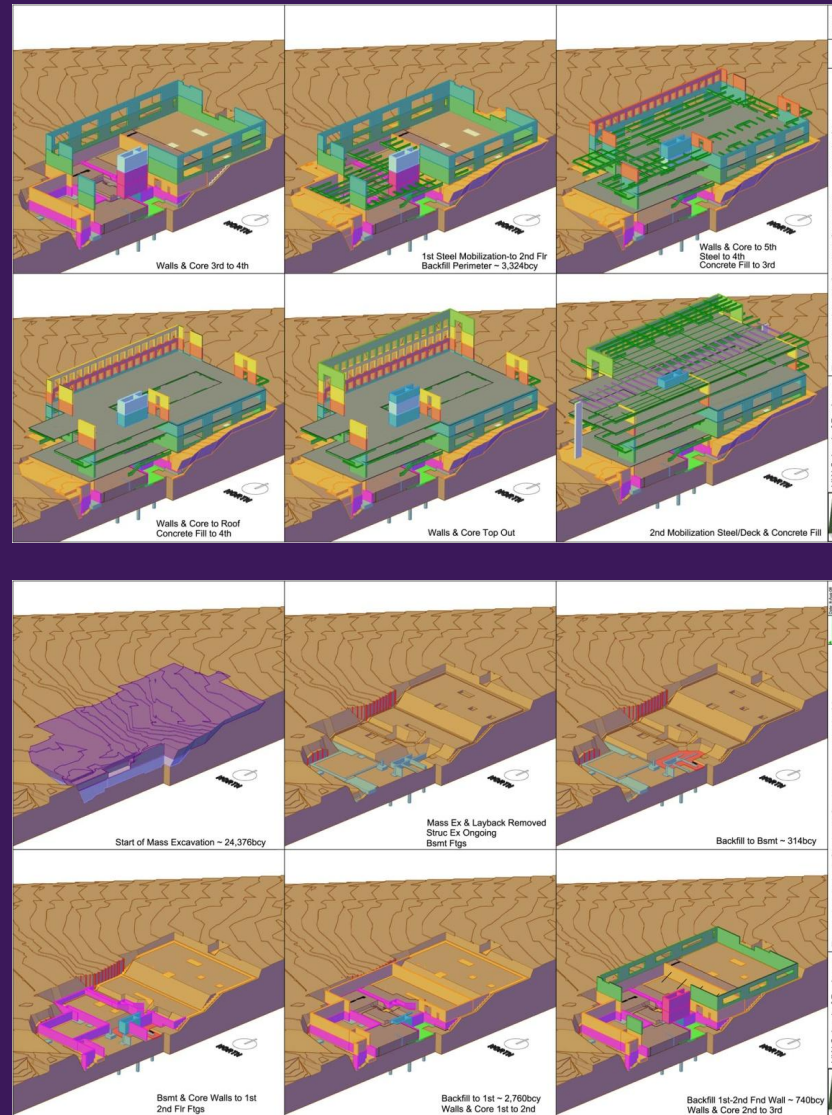
Ø Building architecture preserved by maintaining ceiling heights and keeping MEP hidden despite a great deal of open structure. LMN Architects, structural teams, and the M/E design team attended meetings as needed and collaborated with Sellen to resolve issues early and avoid costly changes later in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



Paccar Hall 4D Modeling

Ø Drawings of the site conditions and excavation were utilized to reveal conflicts that enabled LMN Architects to design supplemental shoring prior to bidding the work.

Ø 4D modeling was a tool used to communicate the complexity and phasing of the work. This resulted in minimal change orders on complex excavation and structural scopes of work.

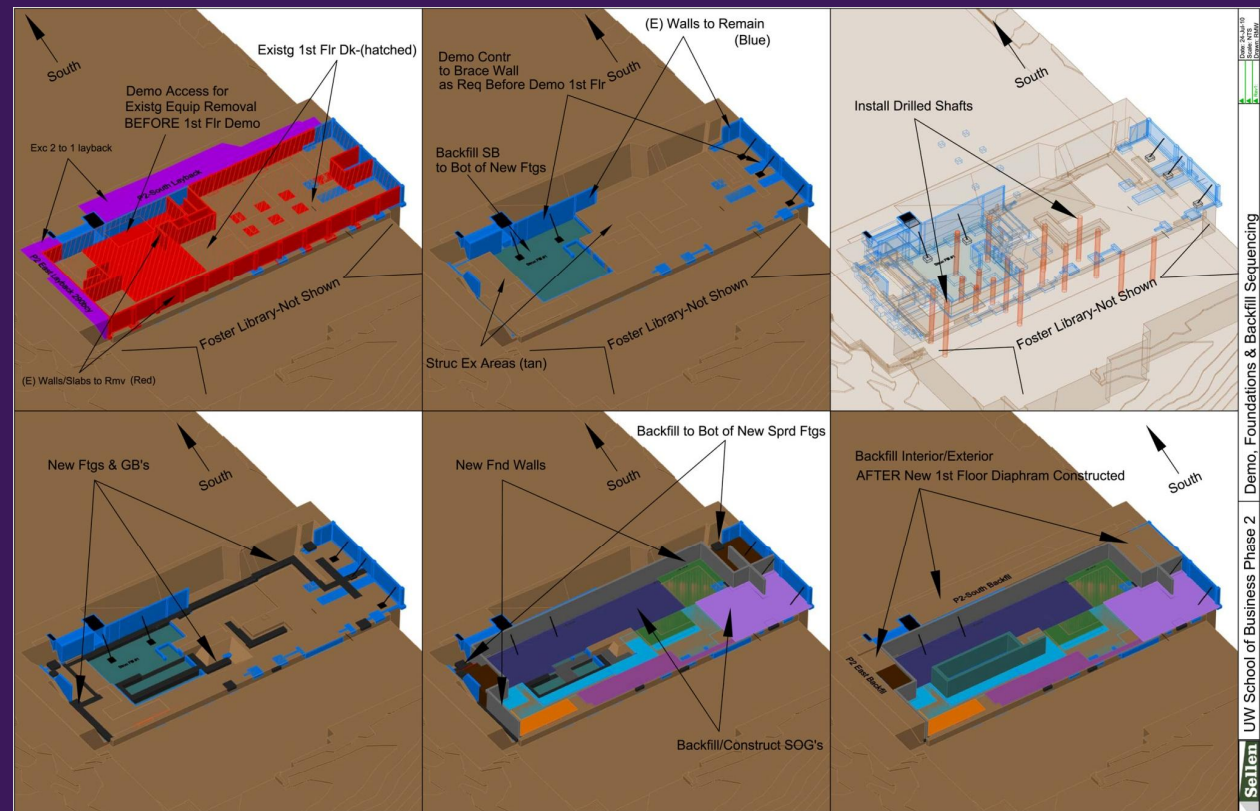


Balmer Hall 4D Modeling

Ø 4D Modeling was used to communicate which walls would remain and to illustrate excavation to the design team.

Ø 4D Modeling resulted in shoring being incorporated into the design prior to bidding.

Ø 4D modeling was used to identify conflicts between drilled piers and existing foundations and were incorporated into our bid instructions so that these issues did not become change orders.



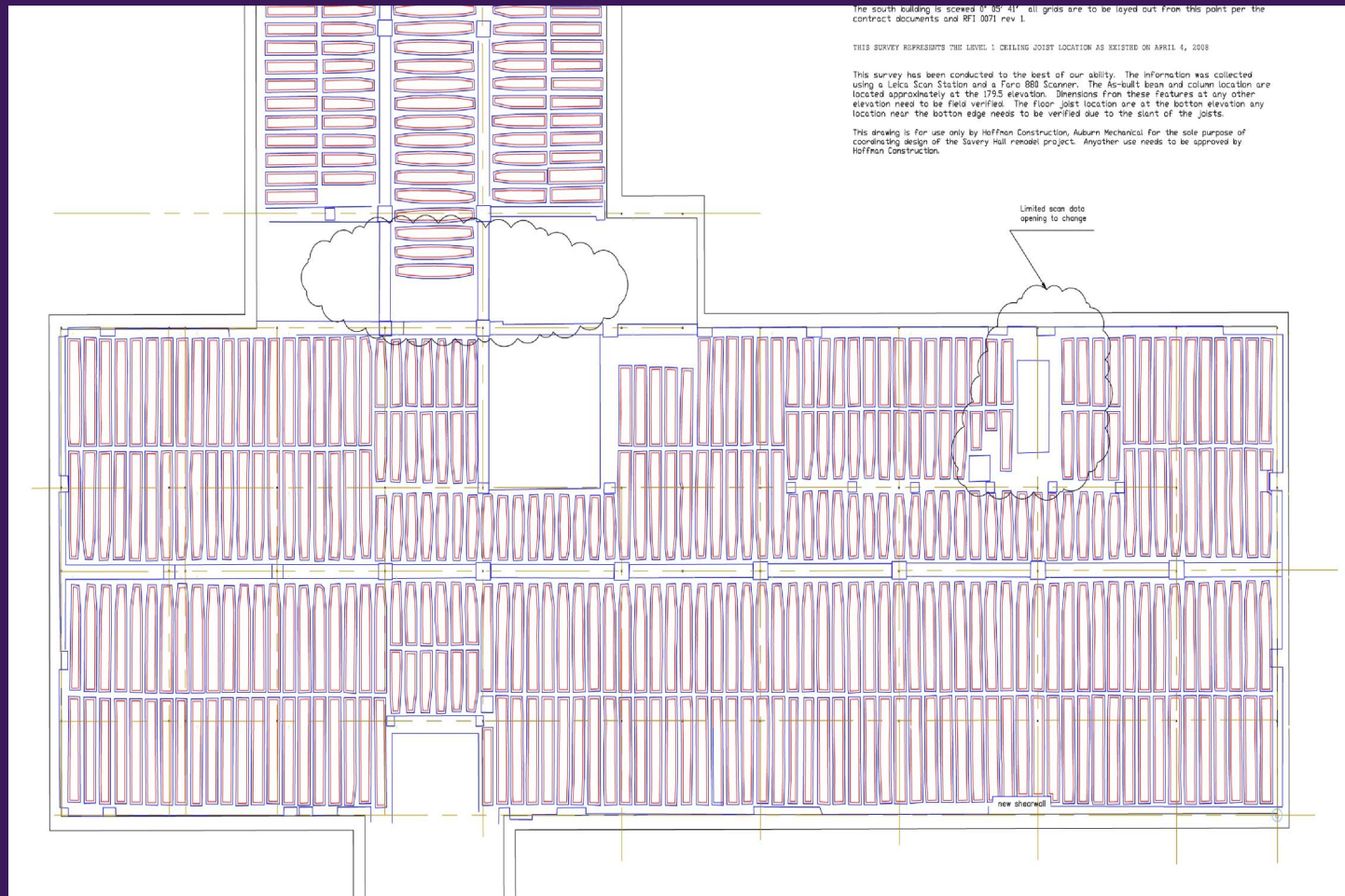
Savery Hall As-Built



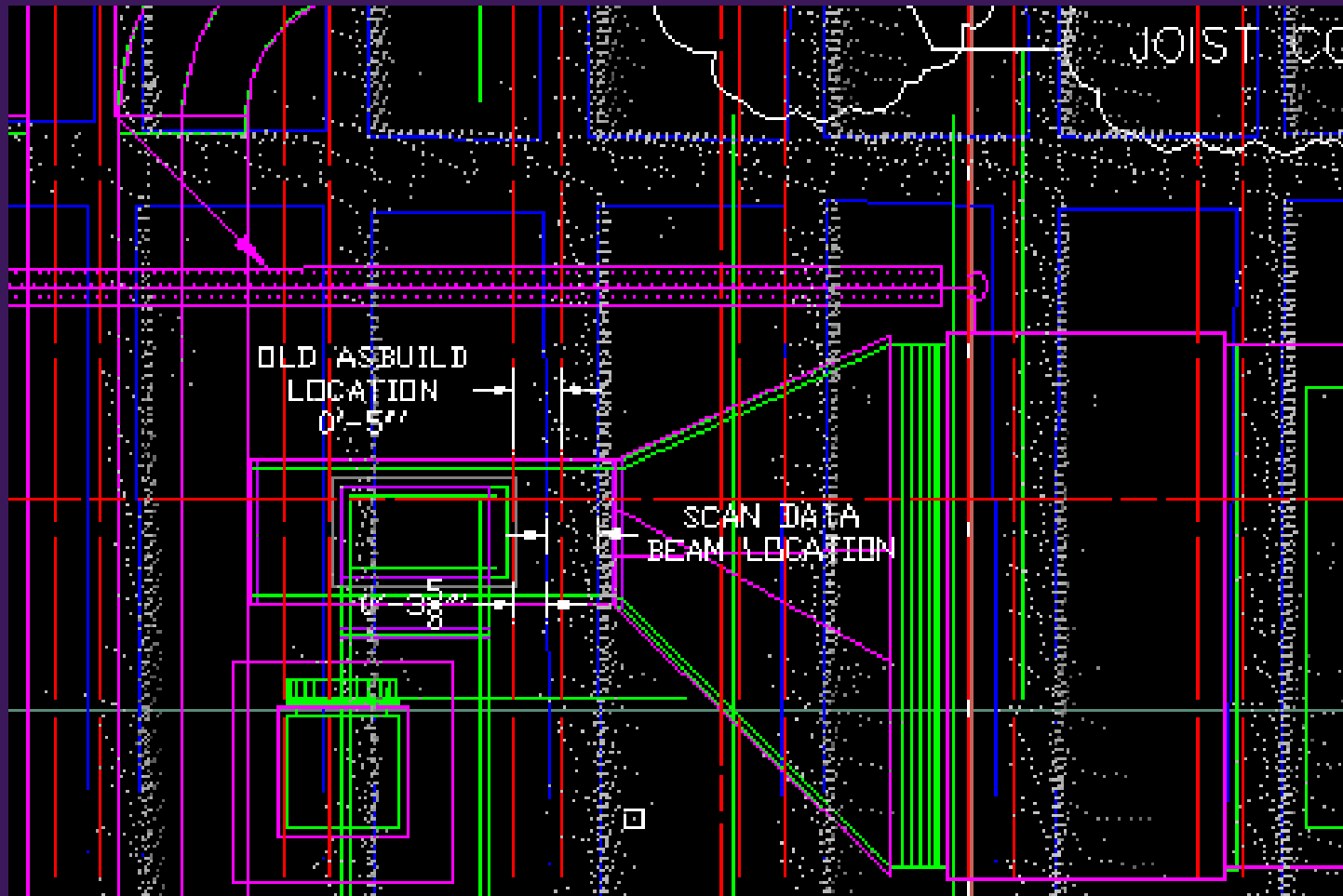
Savery Hall - Structural As-Built



Savery Hall - Structural As-Built



Savery Hall - Structural As-Built

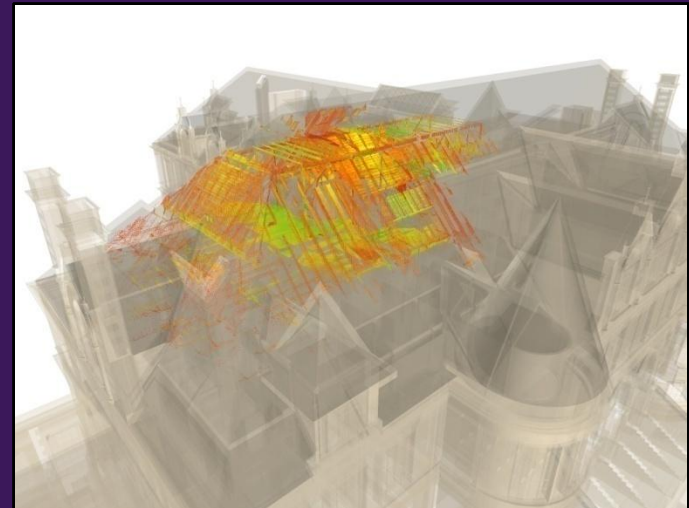
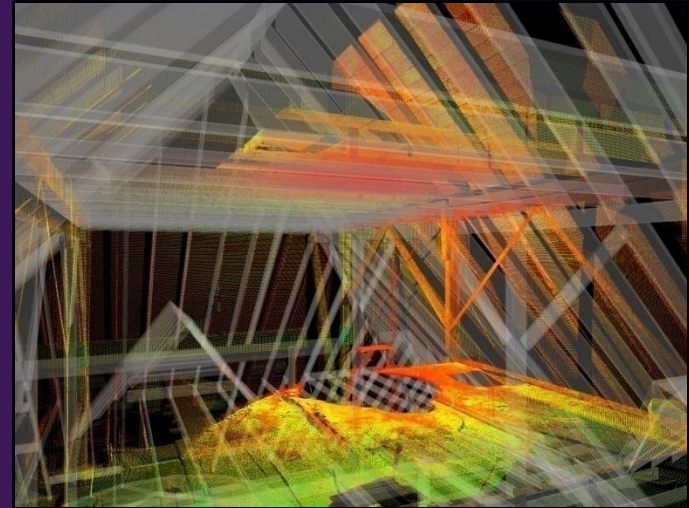


UW Denny Hall Laser-Scan Surveying

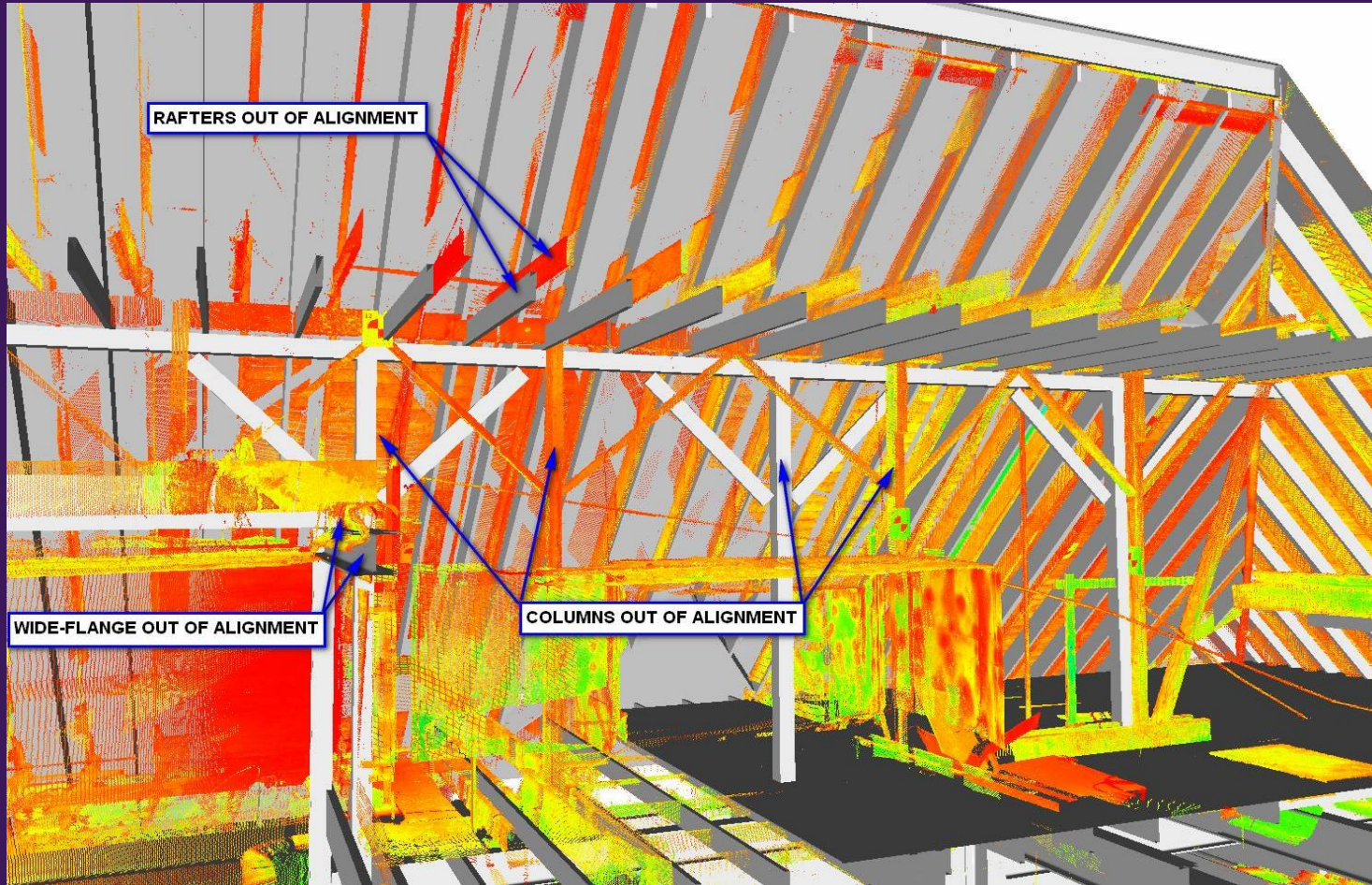
- Ø 3D “Laser Scanning”
 - § Millions of points
 - § Sub-millimeter accuracy
 - § Capture photos and reflectance

- Ø Preconstruction – Verification of existing conditions/as-built

- Ø Construction – Utilize for BIM coordination in the field and O&M

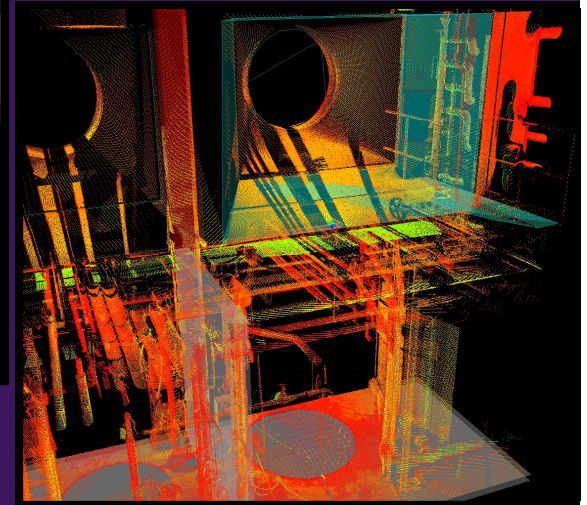
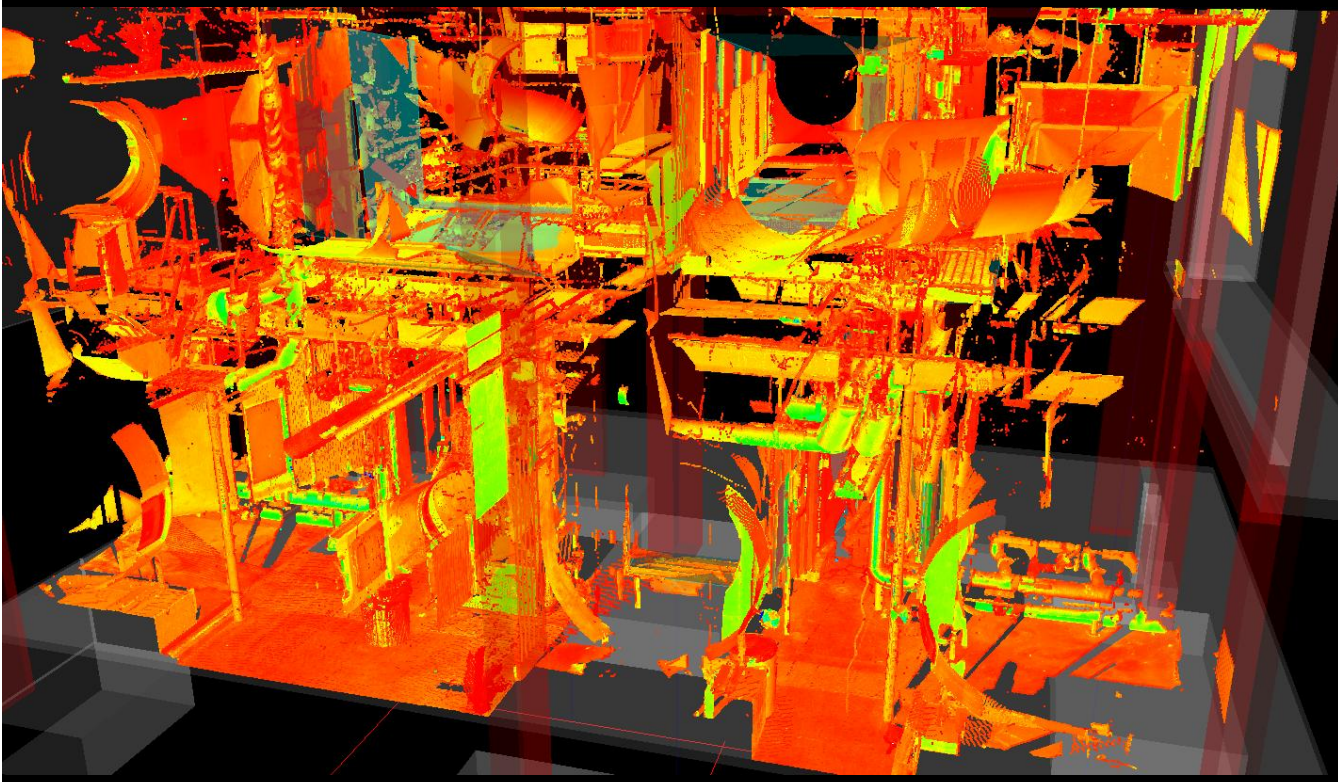


UW Denny Hall Laser-Scan Surveying



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

HSC J1/J2 Microbiology Renovation Laser-Scanning



Laser Scanning at HSC J1/J2 Microbiology Renovation:

Ø Preconstruction – Verification of existing conditions

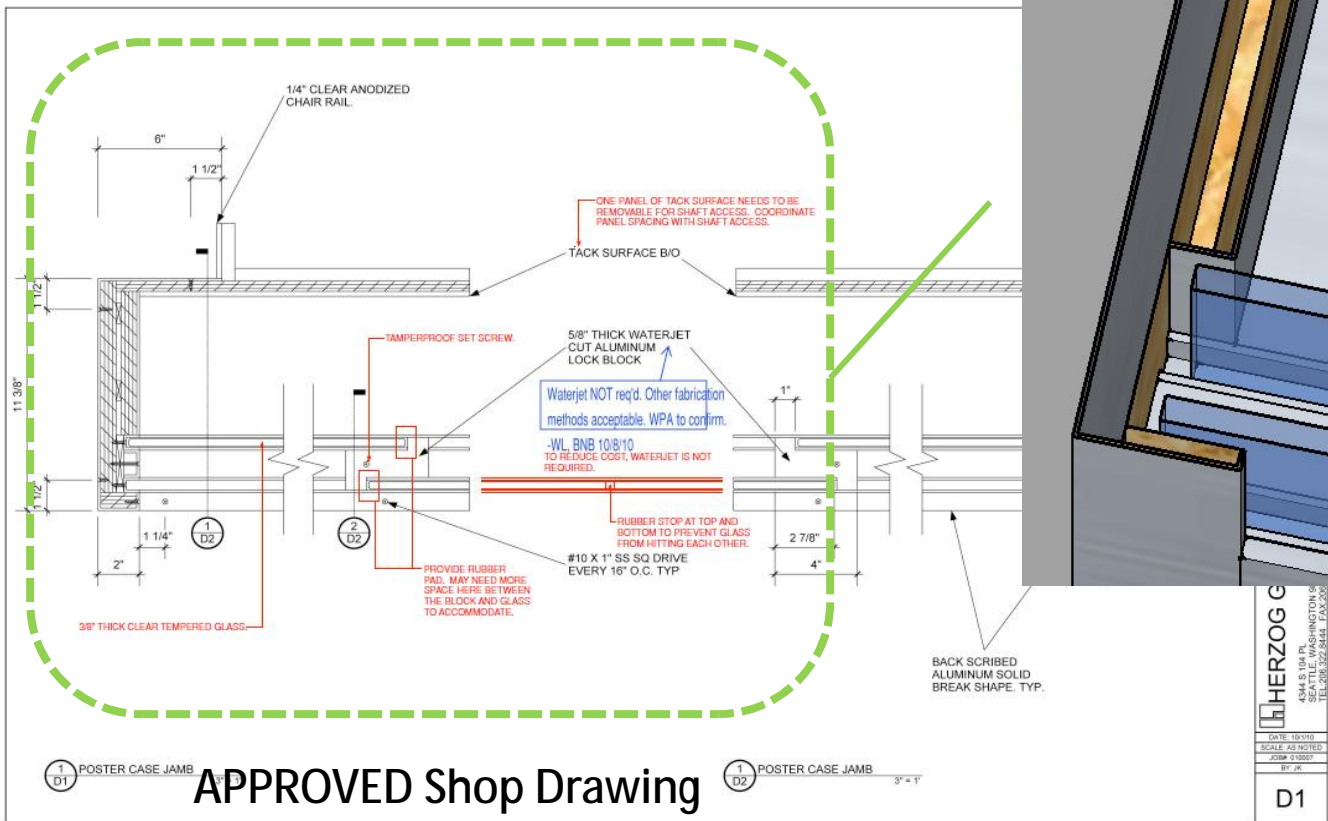
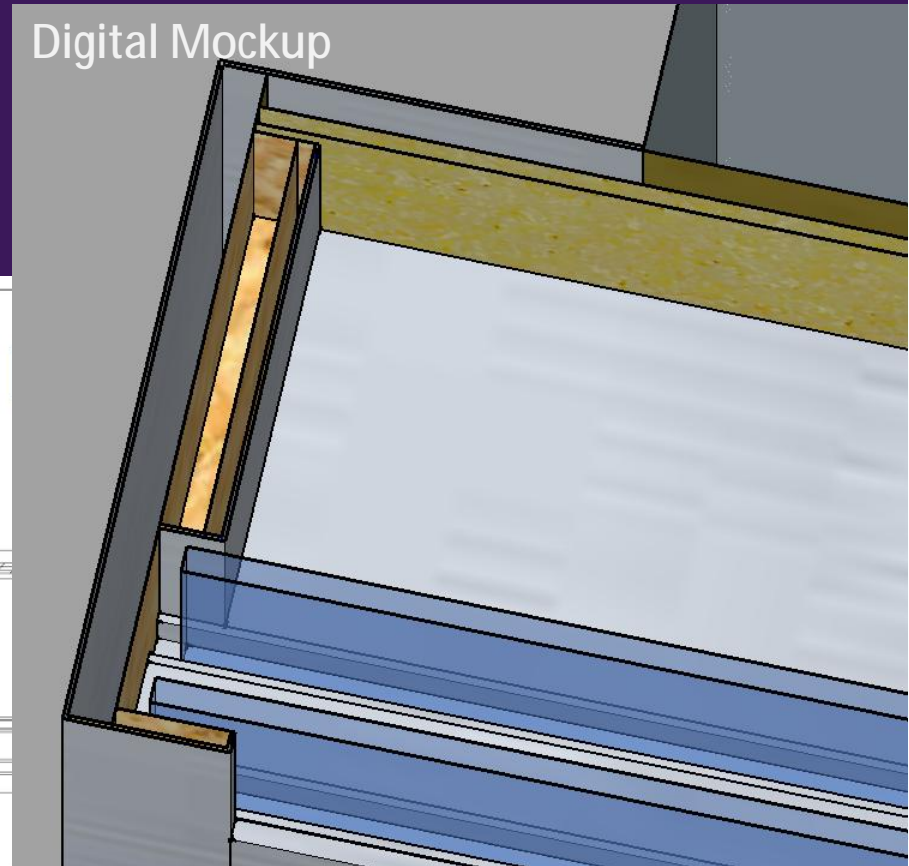
§ Included with bid documents to enhance detail for the demo/installation of new cooling coils beyond 2D prints.

§ Improved accuracy of bid pricing.

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.

Digital Mockup



HSC J1/J2 Microbiology Renovation Digital Mock-up

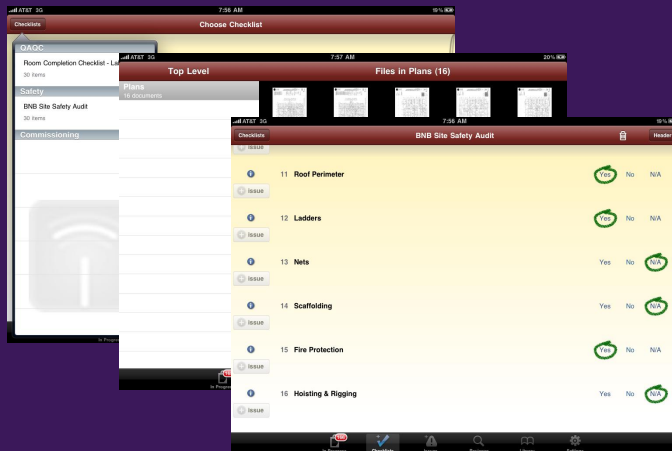


Ruggedized Tablets in the Field:

- Ø SAFETY
- Ø QUALITY CONTROL
- Ø PUNCHLIST
- Ø FUTURE – BIM INTEGRATION

HSC J1/J2 Microbiology Renovation Field Innovations

Input in the Field



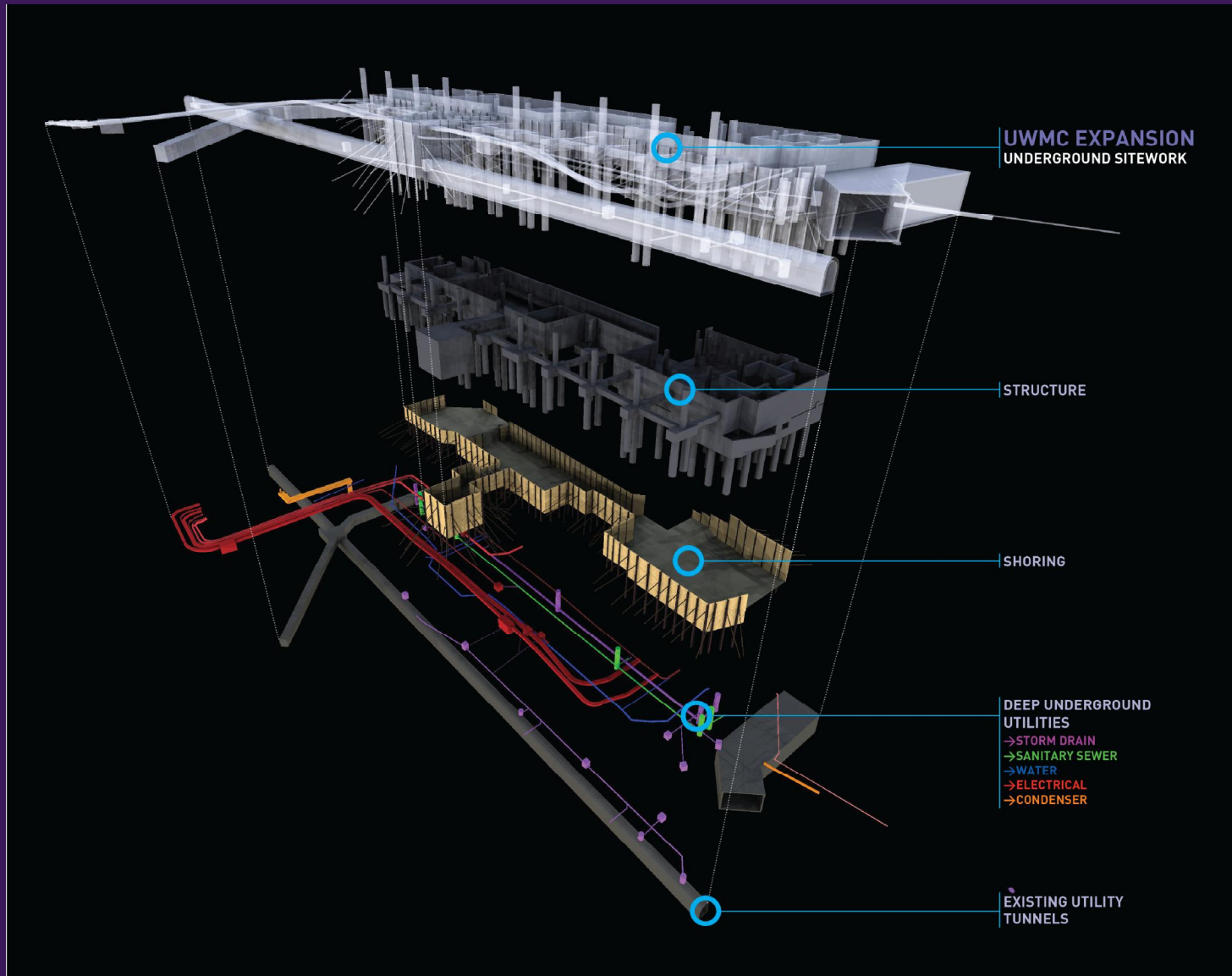
Issue Report

Issue ID	Description	Location Detail	Status	Type	Date Created	Due Date
301 Open Office (1 issues)						
m-00032	Power receptacle and data missing at GL E and 7		Open	Wall Cover Inspection	29 Oct 2010	03 Nov 2010
309 Office (1 issues)						
JC-00003	existing data flex in and out of wall at SW corner		Open	Wall Cover Inspection	29 Oct 2010	01 Nov 2010
340 Open Office (3 issues)						
m-00041	Extra data outlet appears to be rough-in south of door to stair 3S1-N. Please confirm purpose		Open	Wall Cover Inspection	29 Oct 2010	03 Nov 2010
m-00042	Extra power receptacle installed on east wall rear concrete shear wall		Open	Wall Cover Inspection	29 Oct 2010	03 Nov 2010
m-00043	Extra data outlet appears to be installed on west wall at south end rear lobby		Open	Wall Cover Inspection	29 Oct 2010	03 Nov 2010
383 (E) Cylinder Storage (1 issues)						
JC-00015	missing SMRT on south existing wall		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
384 Equipment/Stockroom (2 issues)						
JC-00017	all SMR power in this room is incomplete. 3 of the 4 walls get it.		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
JC-00016	power missing on east wall		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
396 Tech Desk (5 issues)						
JC-00009	outlet missing on north east wall		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
JC-00010	three power outlets Missing on north wall@outertop height		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
JC-00011	three power outlets missing on west wall at columns		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
JC-00013	two wall light switches missing on east wall		Open	Wall Cover Inspection	29 Oct 2010	02 Nov 2010
JC-00012	One power outlet missing on east wall		Open	Wall Cover Inspection	29 Oct 2010	03 Nov 2010

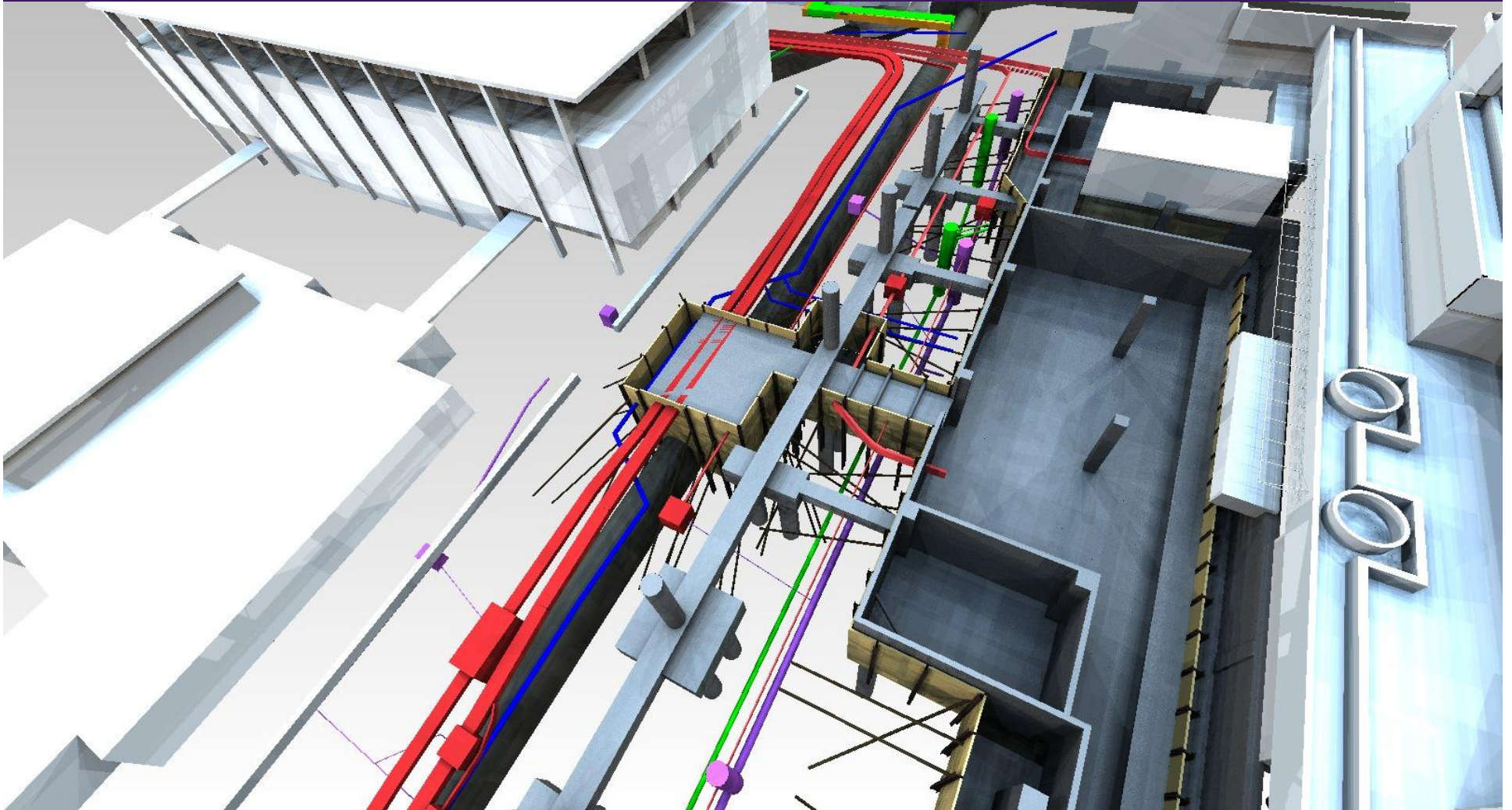
Integration of QC & Safety in the Field with the use of Tablets:

- Ø Use of Web-Enabled Project Management Software with iPad, tablet PC, or smart phone
 - § Increases Efficiency of recording and tracking issues by eliminating redundancy
 - § Software Integrates the entire team into one database – GC, Owner, Subs, Designers
 - § Construction Document/Specification at your fingertips
- Ø Current Use at HSC J1/J2 Microbiology Renovation
 - § Safety – Complete Daily Safety Audits and Share any Issues with the Entire Team
 - § QC – Checklists created in the field to track compliance with the documents and University standards
 - § Punch List – Created in the field, shared via email, back punch in the field
- Ø Future – Integration of BIM in the field to facilitate procurement and quality control

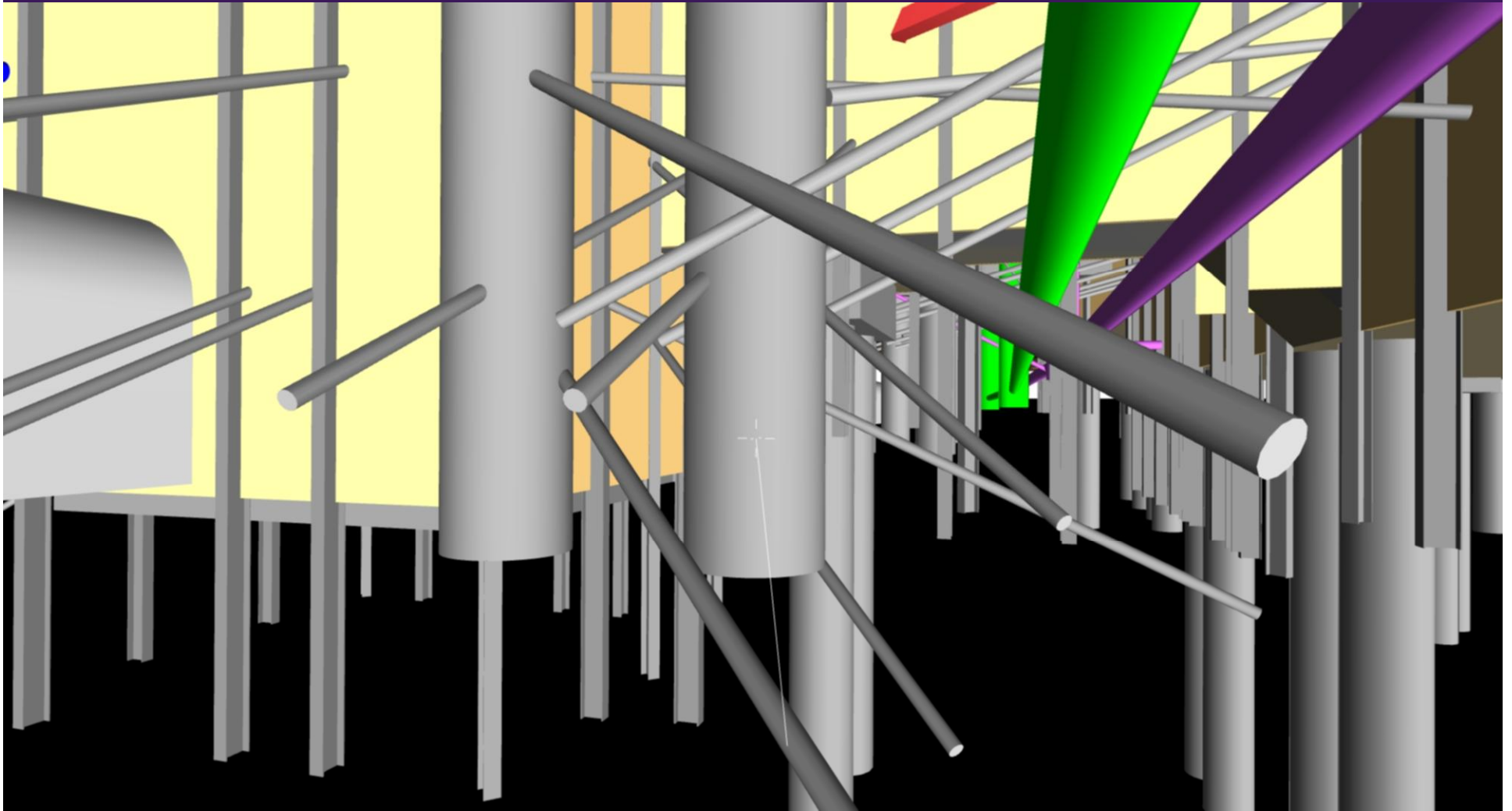
UWMC Expansion Project



UWMC Expansion Project

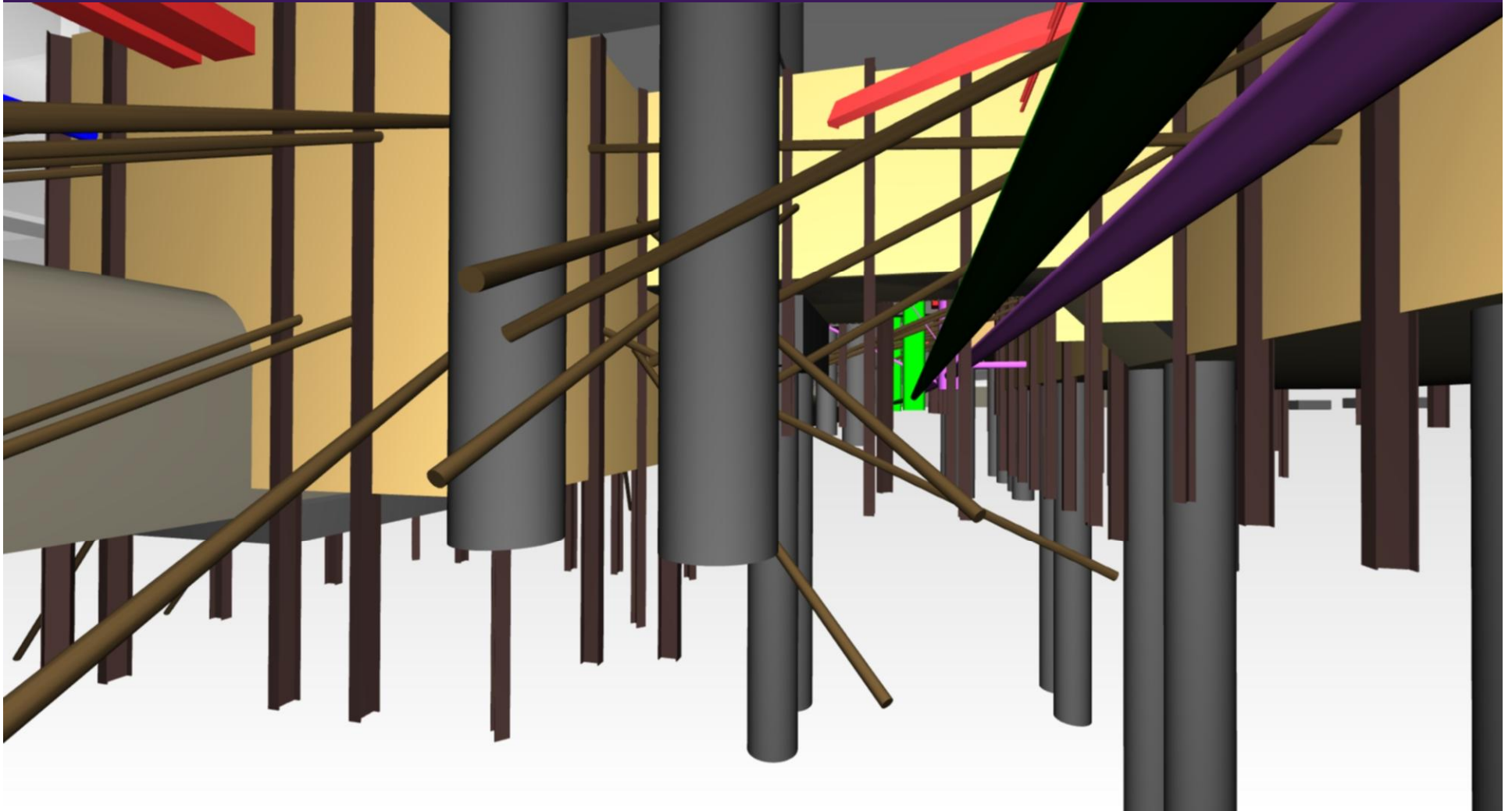


UWMC Expansion Project



3D of the UWMC Expansion foundations "before"

UWMC Expansion Project



3D of the UWMC Expansion foundations "after"

Electronic Plan Table

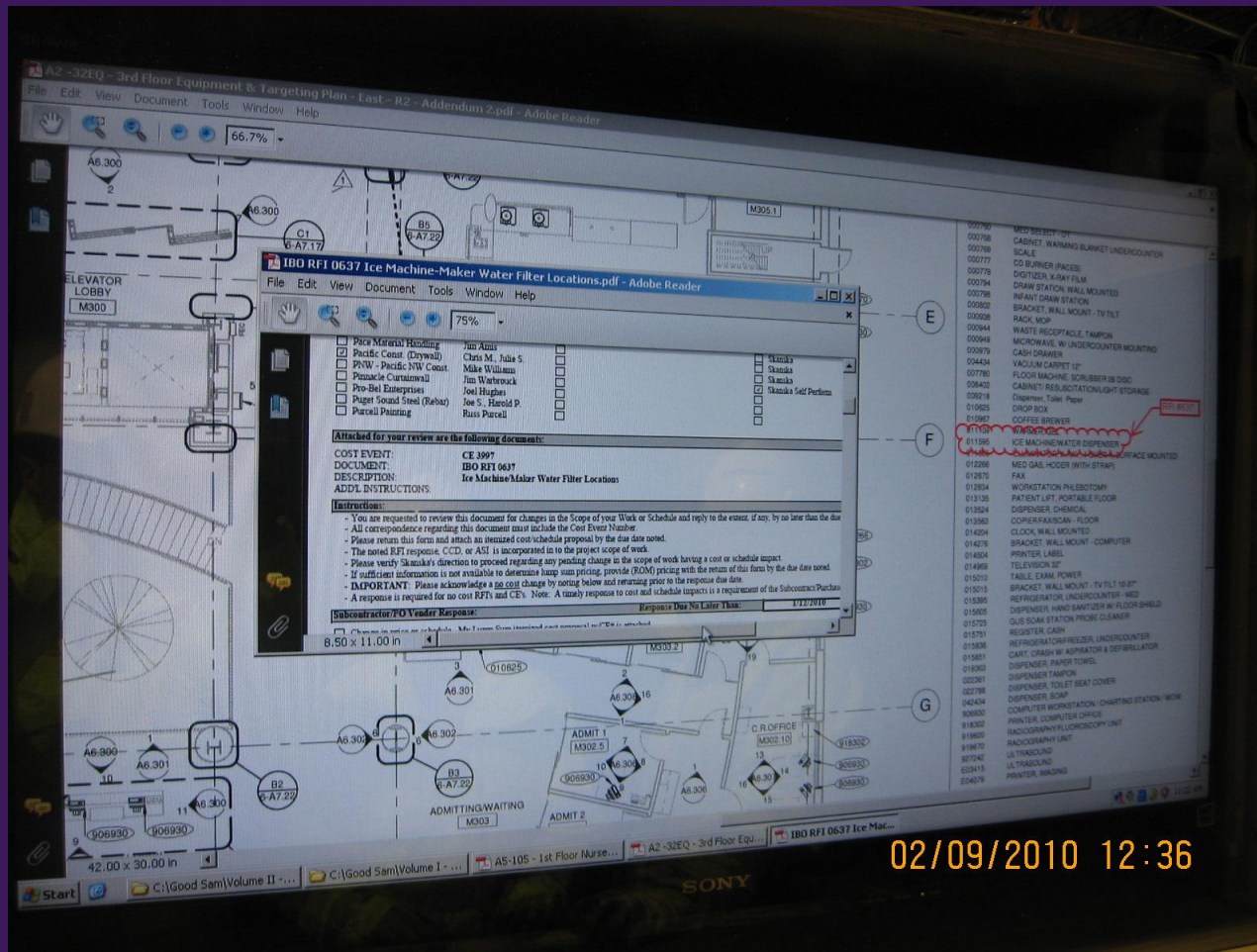
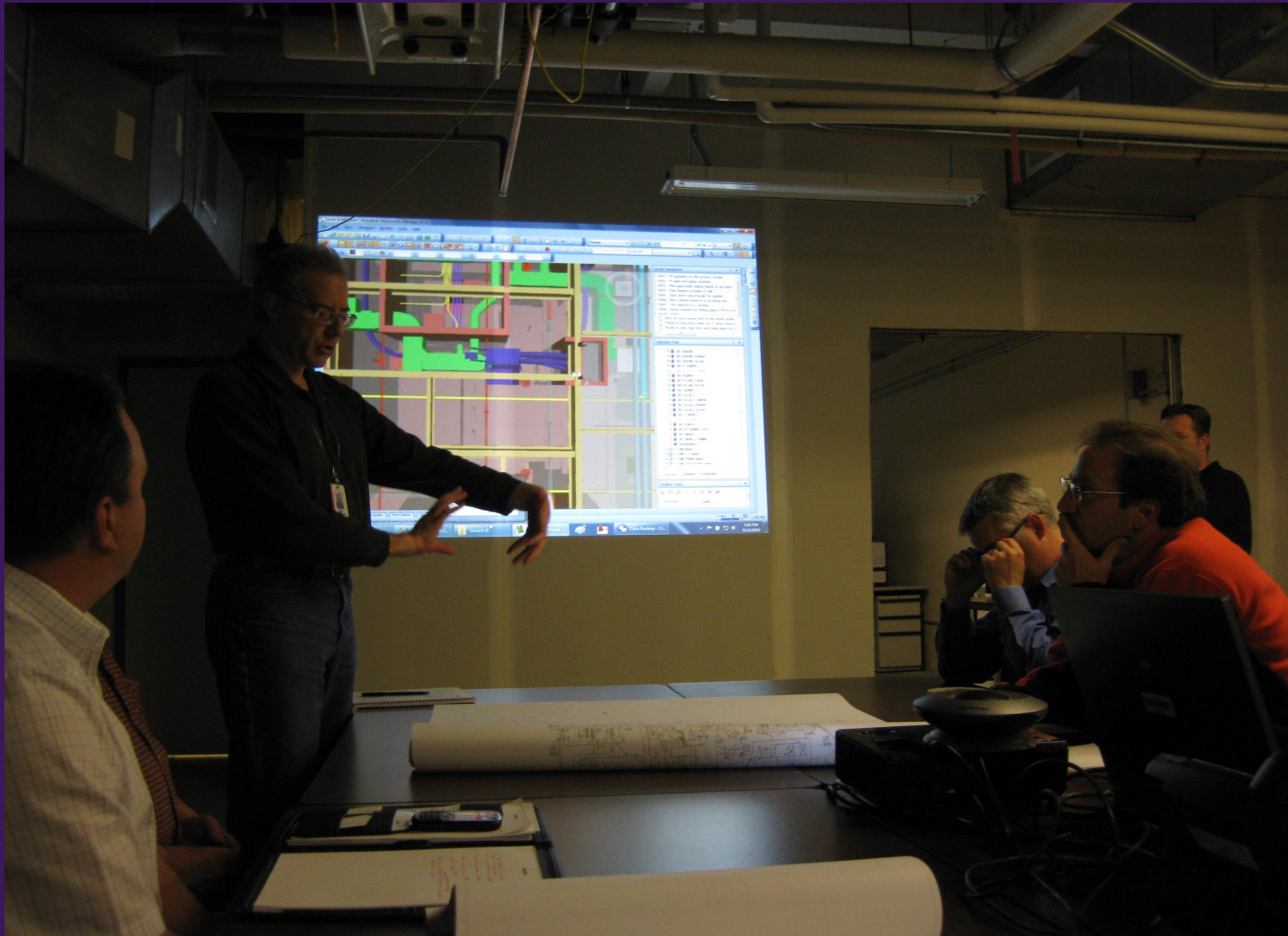


Photo shows the plan in the background, and a Window opened with an RFI that is linked via the plan view.

Electronic Posting in the Field



Design Assist/BIM Charrette – UWMC Expansion Project



UW Bothell Phase 3: *Pulling it all together*

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

UW Bothell Images

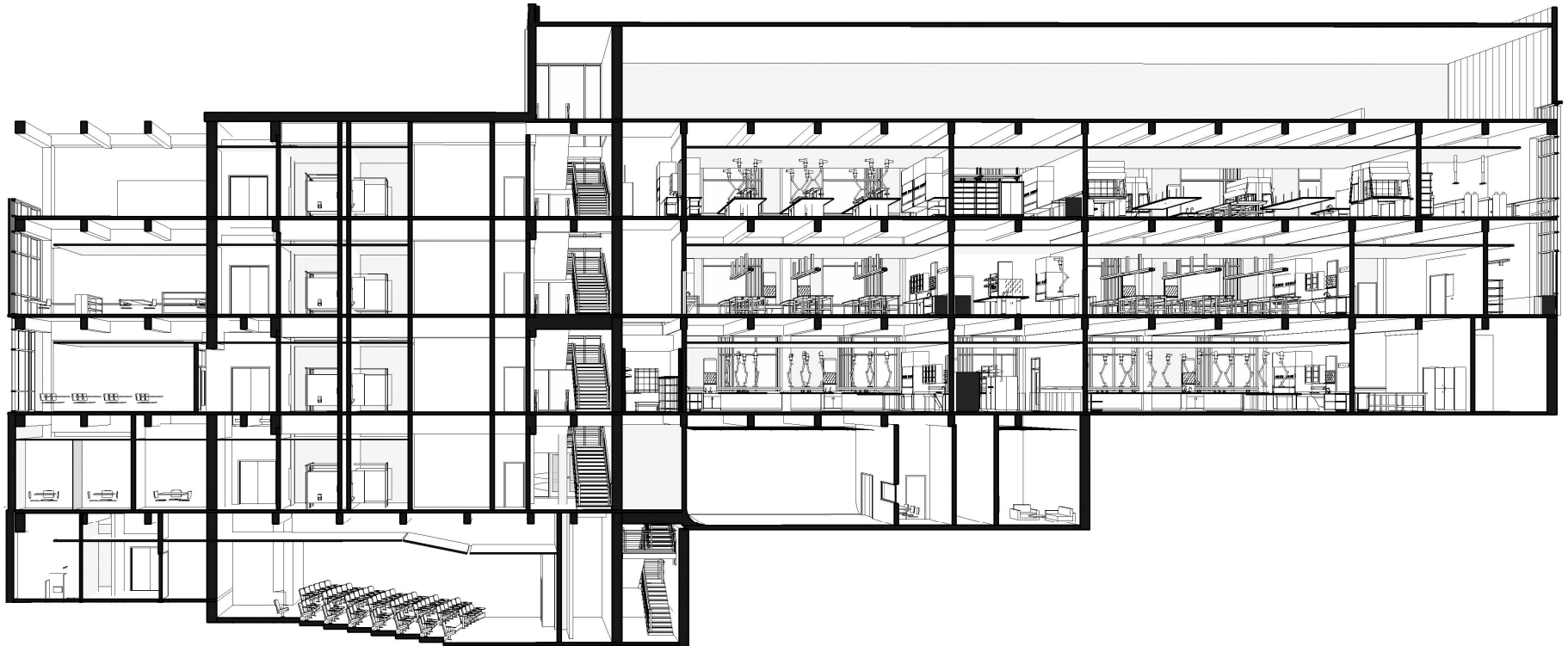


UNIVERSITY OF WASHINGTON
FINANCE & FACILITIES
Capital Projects Office

NE Exterior Perspective

NWCCC Annual Conference
November 17, 2010

UW Bothell Images

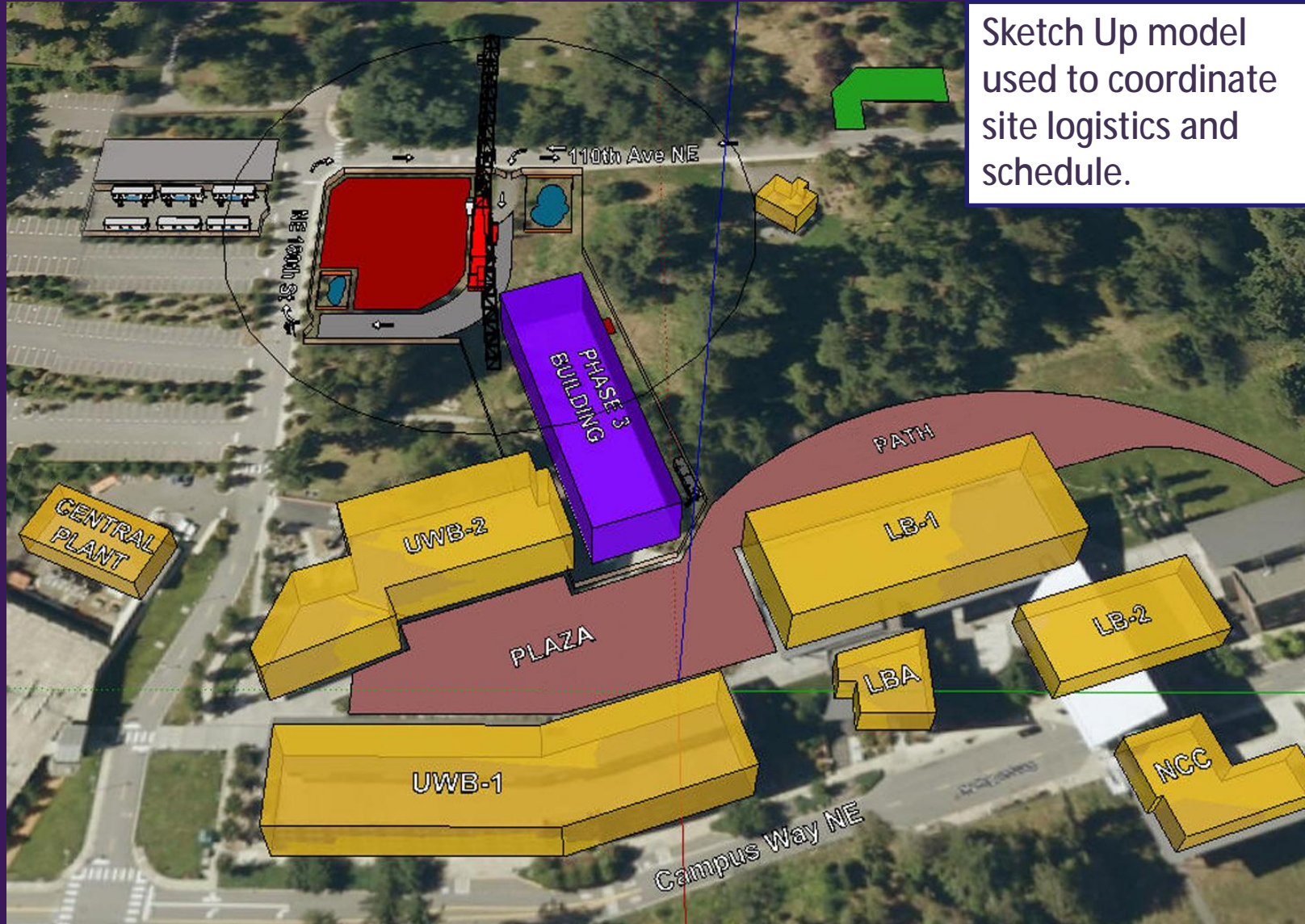


Long Section - Perspective

UW Bothell Images



Injury Free Construction: Site Logistics

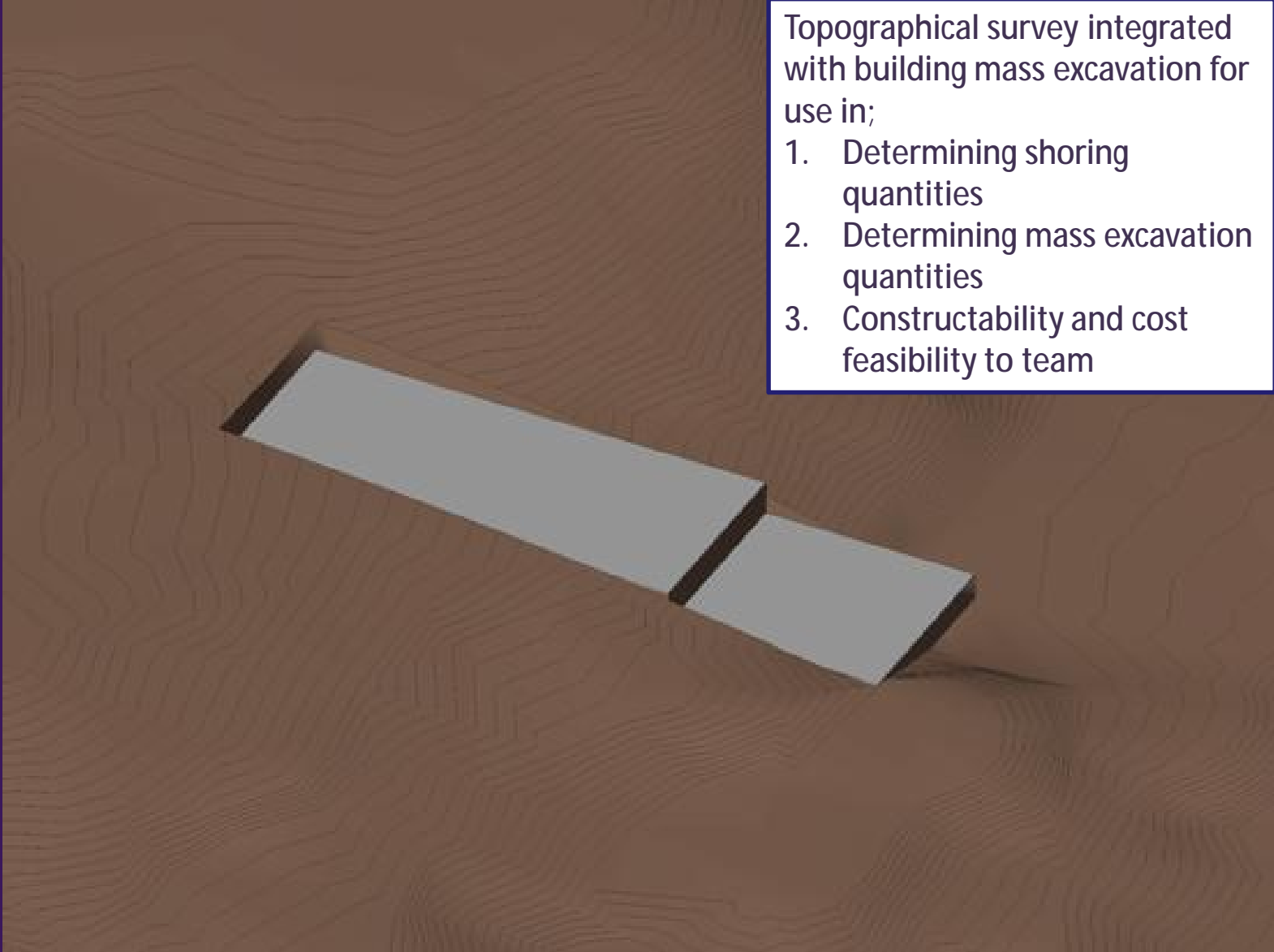


Sketch Up model used to coordinate site logistics and schedule.

Mass Excavation & Shoring

Topographical survey integrated with building mass excavation for use in;

1. Determining shoring quantities
2. Determining mass excavation quantities
3. Constructability and cost feasibility to team



Quantity Take-offs: Revit through Innovaya into Timberline

Start >> Communication >> Quantities >> MC2-ICE >> Help >>

Building Sections

- Default (657)
- Existing (0)
- New Construction (657)
- zzzUnassigned (0)

Component Types

- ARCHITECTURAL
 - Walls (51)
 - Wall Sweeps (0)
 - Curtain Walls (90)
 - Curtain Wall Mullions (0)
 - Doors (0)
 - Windows (0)
 - Window Door Assemblies (0)
 - Ceilings (0)
 - Floors (20)
 - Roofs (0)
 - Fascias (0)
 - Gutters (0)
 - Stairs (0)
 - Railing (0)
 - Architectural Columns (8)
 - STRUCTURAL
 - Beams (376)
 - Braces (50)
 - Columns (62)
 - Slabs (0)
 - Slab Edges (0)
 - Foundations (0)
 - Wall Foundations (0)
 - HVAC & MECHANICAL
 - Mechanical Equipment (0)
 - Plumbing Fixtures (0)
 - Straight Ducts (0)
 - Flexible Ducts (0)
 - Duct Fittings (0)
 - Straight Pipes (0)
 - Flexible Pipes (0)
 - Pipe Fittings (0)
 - ELECTRICAL
 - Electrical Equipment (0)
 - Electrical Fixtures (0)
 - Cable Trays (0)
 - Cable Tray Fittings (0)
 - Conduits (0)

Managed Quantities

Sort by Building Sections

Sort by Component Types

- Concrete - 18" (1)
- Concrete - 18" (1)
- Concrete - 18" (2)
- Concrete - 18" (3)
- Concrete - 18" (3)
- Concrete - 18" (3)
- Concrete - 18" (3)
- Concrete - 18" (5)
- Concrete - 18" (6)
- Exterior - Terra Cotta Screening (1)
- Generic - 12" (2)
- Site Concrete - 5" (1)

All MQs MQs w/ Costs MQs w/o Costs

Quantities > Estimate >

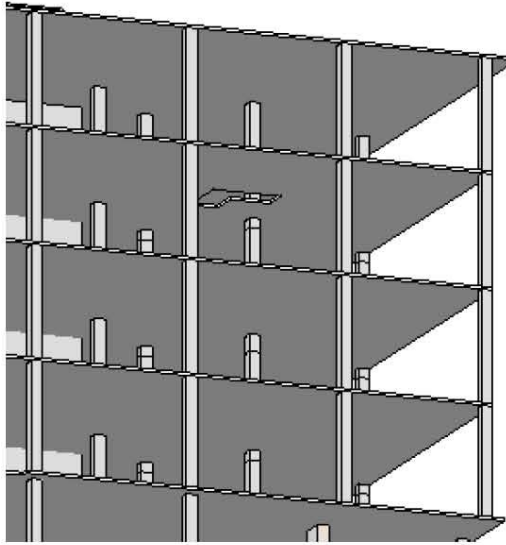
TypeName	UnconnectedHeight (ft)	Width (ft)	AssemblyCode	AssemblyDescription	Length (ft)	Area (sq ft)	Volume (cu yd)	GrossArea (sq ft)
Concrete - 18"	3	1.5			1,061	8,614	0,354	8,614
Concrete - 18"	18	1.5			88,000	1,581,750	87,125	1,581,750
Concrete - 18"	63.167	1.5			21,000	1,279,031	71,057	1,279,031
Concrete - 18"	76	1.5			29,443	2,171,222	120,623	2,213,222
Concrete - 18"	32.5	1.5			21,000	663,305	36,850	663,305
Concrete - 18"	45.333	1.5			0,750	68,000	3,532	68,000
Concrete - 18"	19.833	1.5			67,750	1,008,630	54,665	1,029,630
Concrete - 18"	81.167	1.5			21,896	1,826,250	98,076	1,826,250
Concrete - 18"	20.5	1.5			84,750	1,734,875	96,382	1,734,875
Concrete - 18"	16.833	1.5			63,000	940,375	52,243	961,375
Concrete - 18"	60.667	1.5			51,343	2,899,722	158,622	2,941,722

Use MQ Color Auto-Reset

Auto-Highlight

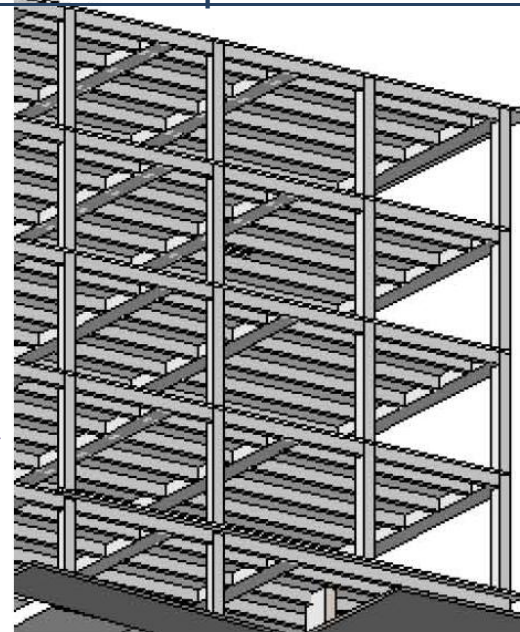
50% SD Estimate: Structures

50% SD Revit model



- Ø Highly accurate quantity take-off
- Ø Format allows expedited A/E review & reduces duplication

Model development for SD Estimates



University of Washington Bothell
Phase 3 Science and Academic Building

Schematic Design
Outline Specifications

B10 SUPERSTRUCTURE

B1010 FLOOR CONSTRUCTION

To provide maximum resistance to vibration effects, the floor system will be framed with concrete beams, joists, and slabs, supported by concrete columns.

All laboratory floors will be designed to support a live load of 100 psf, in addition to a 30 psf equipment load and 20 psf movable partitions. Live load reduction will not be used for any floor slab. A system of wide-shallow beams, spaced at 21'-4" o.c., in the future, will be reviewed with the Owner during design. The framing above the large tiered classroom is adjusted to clear span the space as much as possible.

SD Outline Specifications

The framing will be laid out on a repetitive system, with 12"x27" joists and 18"x27" girders, typical. The typical column size is 18"x18", except at the lowest level where 24"x24" columns will be required due to the increased loading and taller floor to floor height. The floor slab will be 5" deep, with beams spaced at 10'-8" o.c. Typical beams spans at classrooms, labs and offices are 30 feet, with girders spanning 21'-4". The framing above the large tiered classroom is adjusted to clear span the space as much as possible.

Transfer girders are provided above the tiered classroom, and large classroom so as to provide larger spaces without columns. The girders will be reinforced with mild reinforcing and post-tensioned cable to reduce depths and limit deflections. Post tensioning will not be placed in the slab.

An alternate system of wide-shallow beams, spaced at 21'-4" o.c. supporting an 8 inch structural slab was also reviewed. The characteristics of this system far exceed the vibration criteria outlined below. This system was also considered for the east half of the complex that will not be contain labs, however

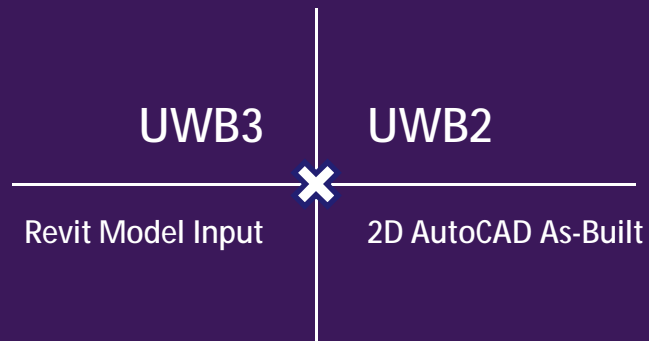
- Ø Rather than manually completing the quantity take-off for the SD 50% estimate, Lewis added the structural design elements so the model could be utilized for estimating.

Field Investigation During Preconstruction

UWB3/UWB2 As-built confirmation study of existing UWB2 building footings

Ø Used to locate control points for UWB3

Ø Confirm new UWB3 footings are coordinated with UWB2 existing footings



Communication Tools

Ø Digital Submittals: Bluebeam

Ø Collaborative Team Site: SharePoint

§ Shared Document Posting

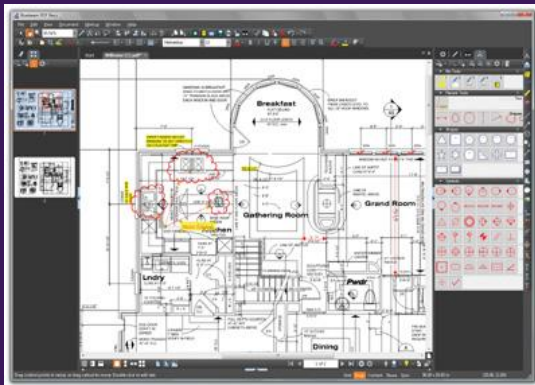
§ Meeting Notices

§ Submittals

§ Progress Photos

§ Site Delivery Coordination

Ø Remote Meeting Collaboration: GoToMeeting



Bluebeam

GoToMeeting
Now Featuring VoIP
And Support For
Both Mac And PC!

Easy Online Meetings – Anytime, Anywhere
Use GoToMeeting to present, demonstrate and meet all you want – for one low flat fee. Discover how you can use Web conferencing to:

- Give sales presentations from your Mac® or PC
- Meet and collaborate across the globe
- Deliver online training

GoToMeeting

UW Bothell

Announcements
Lease Crutcher Levels Selected as GC/CM @ 3/15/2010 7:17 AM
by SEALCJathrys.emtran

Location	Start Time	End Time
UW-Bothell Room 040	3/15/2010 1:00 PM	3/15/2010 2:30 PM
Design Coordination Meeting	3/23/2010 9:00 AM	3/23/2010 11:00 AM
Design Coordination Meeting	3/30/2010 9:00 AM	3/30/2010 11:00 AM
Design Coordination Meeting	4/6/2010 9:00 AM	4/6/2010 11:00 AM

Design Issues Log

Title	Description	Resolution Date
Determine Site Orientation for Phase III	New	4/30/2010

SharePoint

MK1

Show demo

Mark King, 9/9/2010

Innovation and Future Work

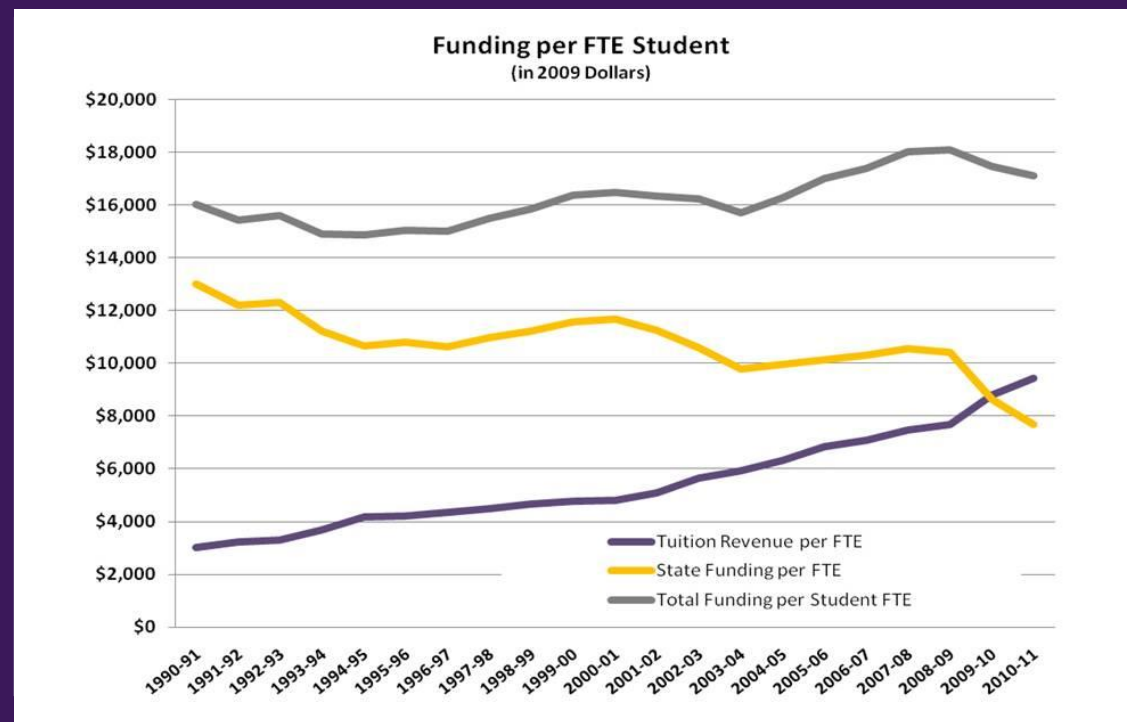
- ∅ Husky Stadium Renovation: Developer Model
- ∅ Husky Baseball Park: Design-Build
- ∅ Harborview Hall Demolition: Design – Demolish
- ∅ West Campus Housing: GC/CM

It's all about *our* *shared* future

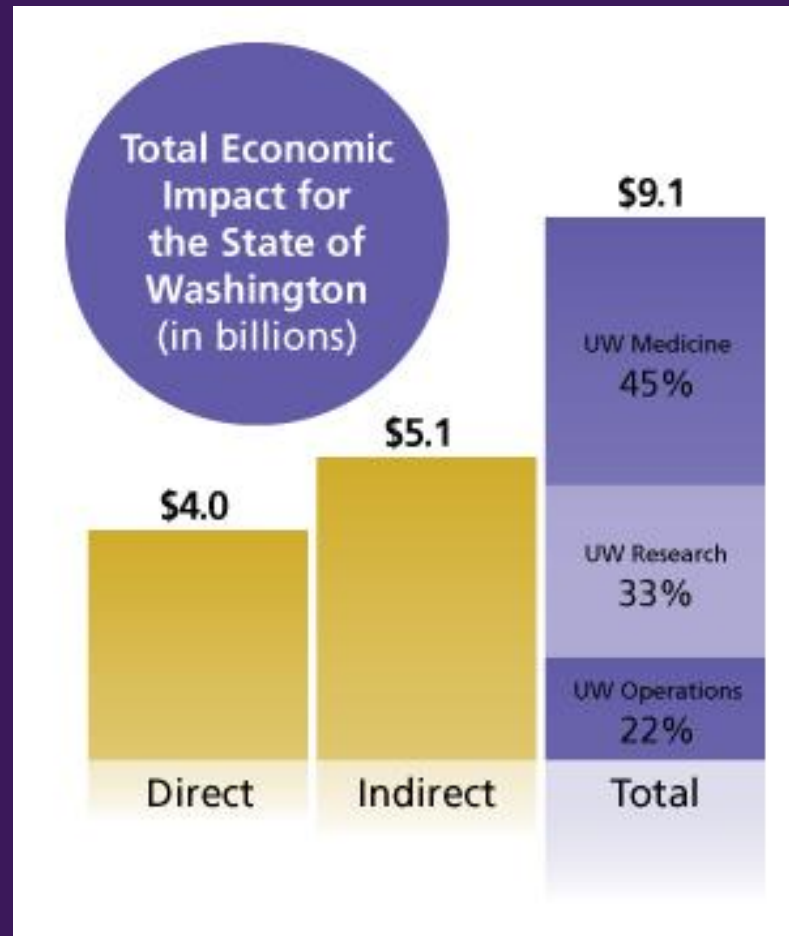
A defining moment for the state of Washington

UNPRECEDENTED decline in state funding

- ▶ The UW lost 30% of state funding
- ▶ Per student funding has been cut to 1990 levels
- ▶ Tuition now surpasses state support for the first time



UW is a major part of Washington's economy



UW creates jobs

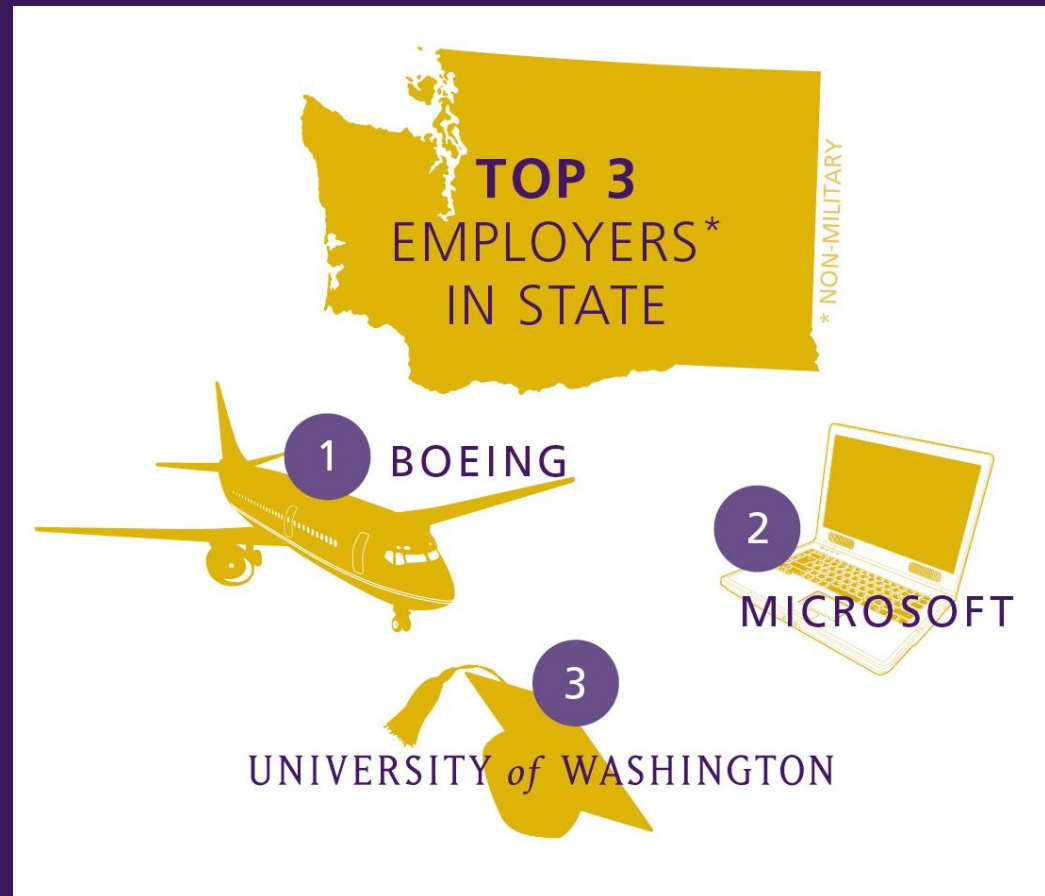
69,803 jobs are supported by the UW

- ▶ 27,921 direct jobs
- ▶ 41,882 indirect jobs

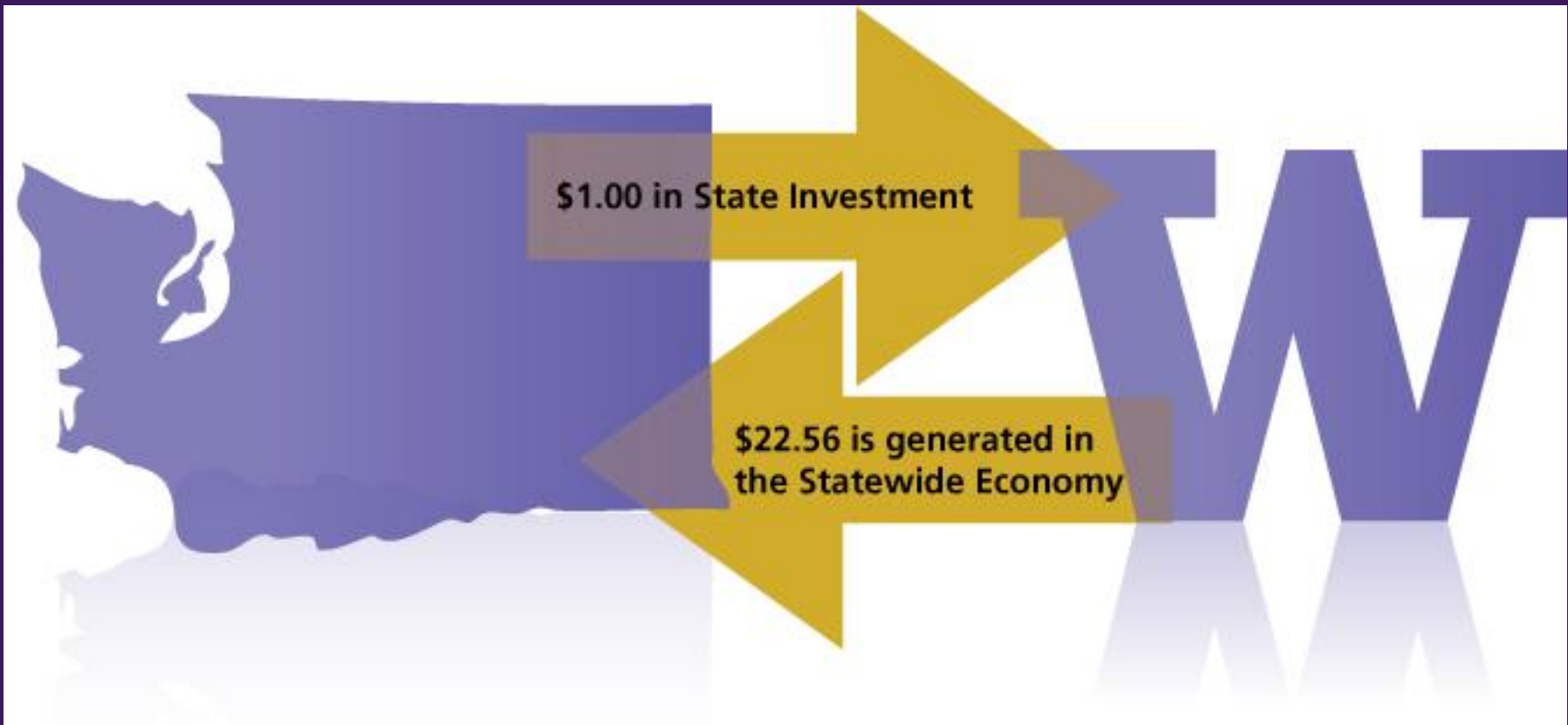
3rd largest employer in state

- ▶ Boeing
- ▶ Microsoft
- ▶ UW

6.1% of the total labor force in Seattle



UW is the state's best investment



EDUCATION matters.

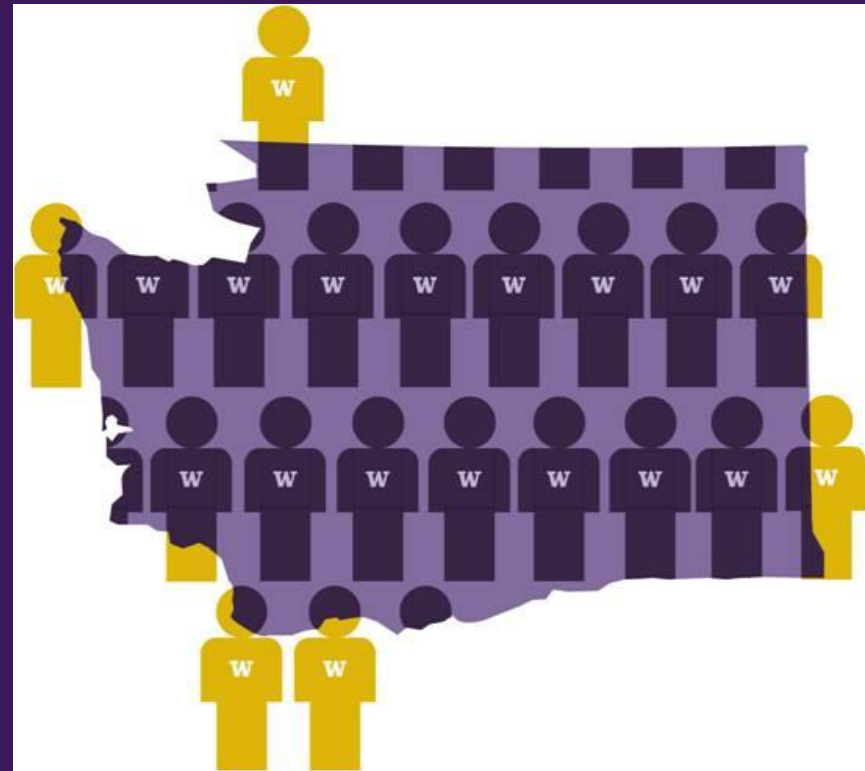
Higher education means opportunity and economic security.

College-educated citizens:

- ▶ Get jobs
- ▶ Stay out of jail
- ▶ Don't rely on social services
- ▶ Vote
- ▶ Give back to their communities
- ▶ Create jobs

UW alumni stay here

- ▶ **75% of UW alumni stay in Washington** to live, work, and raise families
- ▶ **Over 213,000 alumni live in Washington** — more than the population of Spokane or Tacoma
- ▶ **#1 “Best state for keeping college grads”** —
Forbes Magazine, March 2009



We must act. **NOW.**

Now is the time renew our commitment to solving our toughest challenge in higher education. Our children are worth it, and our economic future depends on it.

UW's proposal

- ▶ **Protect state investment** in public higher education.
- ▶ Allow the University **greater capacity to manage** its revenues and operations.

You can help by educating others.

- ▶ **Make higher education a priority.** We all have a stake in the UW. Our kids are worth it, and our economy depends on it.
- ▶ **Protect public funding for higher education.** It's not about the UW, it's about a better future for our kids and the state.
- ▶ **Allow the UW greater ability** to manage its resources and operations. We are a part of the solution— help us help you.

Working together, we can
secure the future of our
children and the future of
Washington.

Innovation & Integration

Open for Questions/Discussion

Thank you!