



BUILDING INNOVATION

Conference

The Long Journey of Making Models as Contract Documents a Reality



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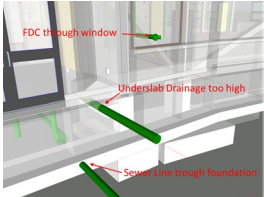
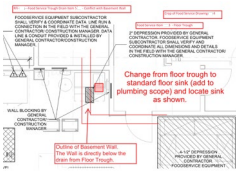
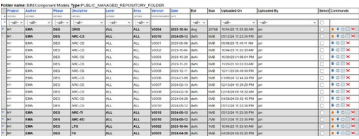
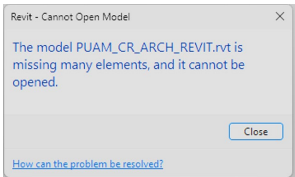

The Long Journey of Making Models as Contract Documents a Reality

- Presenters:
 - Carrie Sturts Dossick,
 - Jan Reinhardt,
 - Jim Bedrick,
 - Roger Grant

The Long Journey of Making Models as Contract Documents a Reality

- Context
 - BIM has been used in our industry for more than 15 years now
 - Accepted practices, services, skill sets, pricing
 - Models are routinely shared and used
- And yet...
 - The quality of models created and shared is inconsistent
 - The confidence relative to created and shared models is low
 - We rely on paper and PDF
 - We are underutilizing automation

Catalog of Challenges

<p>Challenge</p>		
<p>Intended Content Not everything in a model should be considered reliable What to model, how much to model and when to model is not clear</p>		
<p>Competition of Sources Competition between Model and PDF</p>		
<p>Moving Targets Which model version should I use? Navigating Work in Progress vs Milestone Models</p>		
<p>In-transparent Transfers</p> <ul style="list-style-type: none"> - Configuration issues - Technical issues - Auditability 		
<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose?</p>		

Where we are

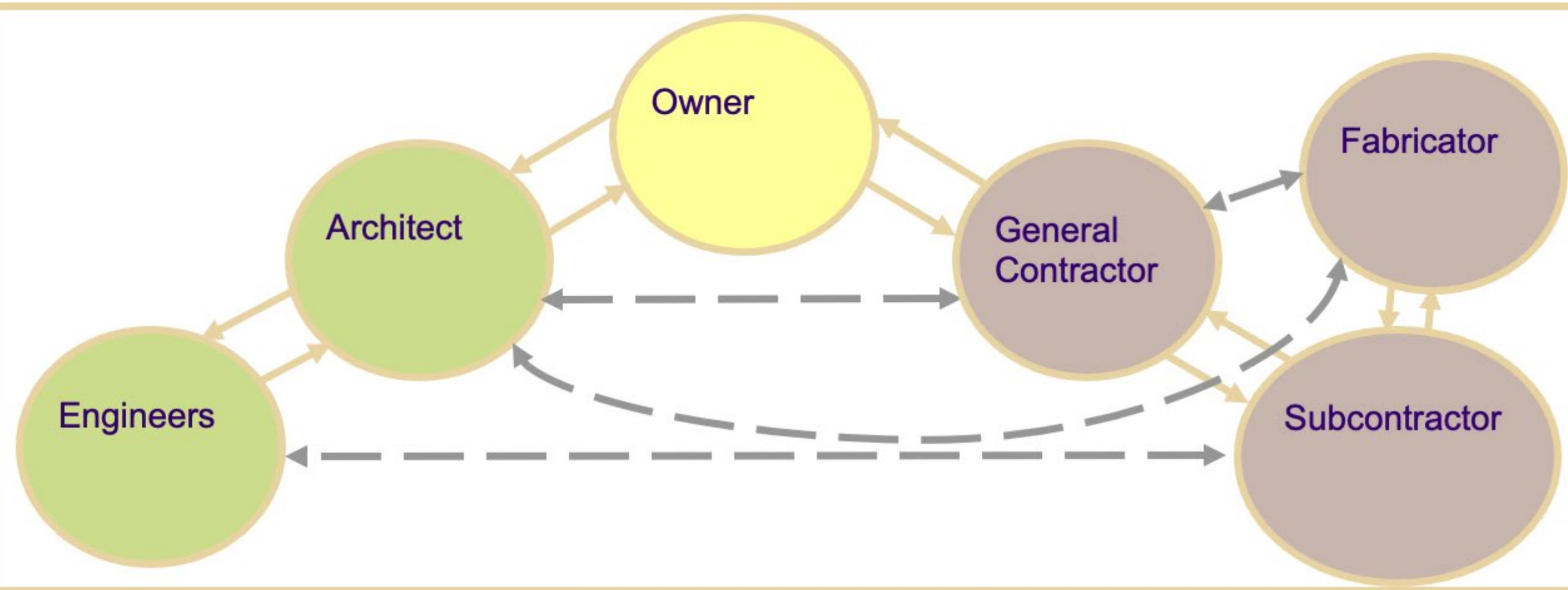
The Vision: Models as contracts

Single source of Truth: Information is trusted & available

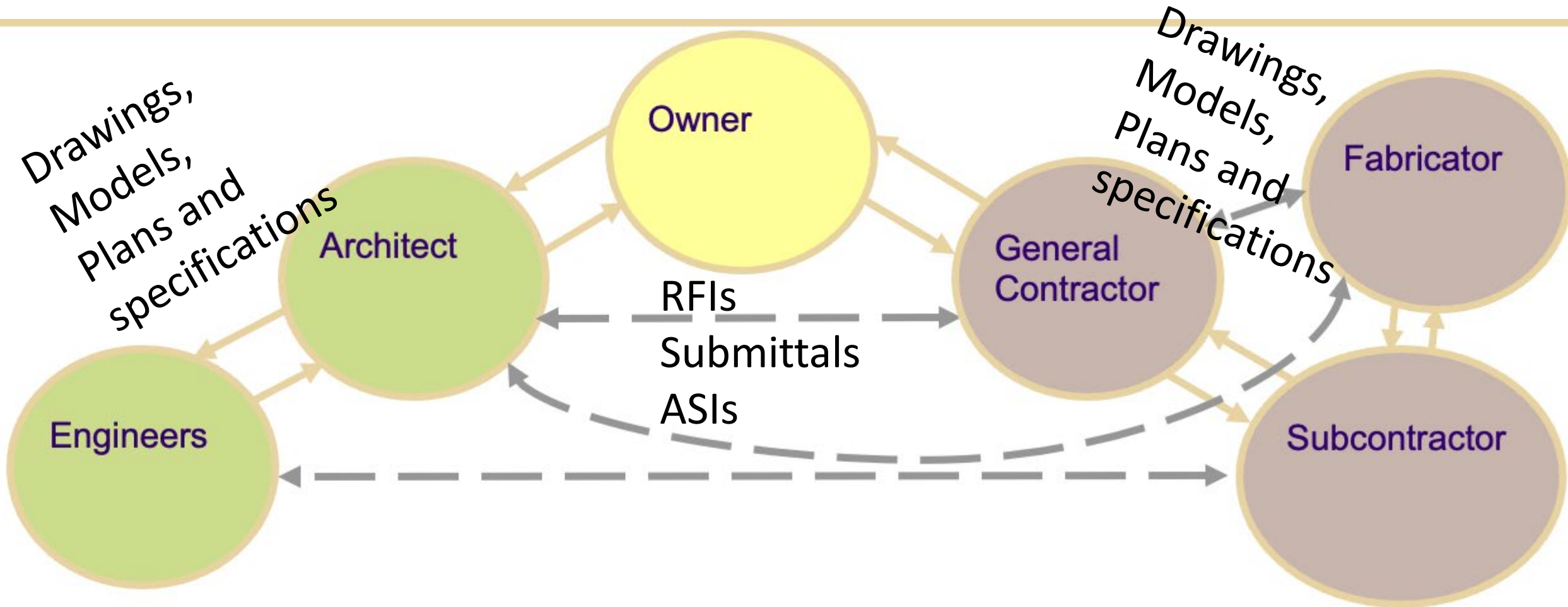


<https://www.weforum.org/agenda/2020/06/17-predictions-for-our-world-in-2025/>

We work in teams across industry networks



Many of our documents are contracts



From Then....



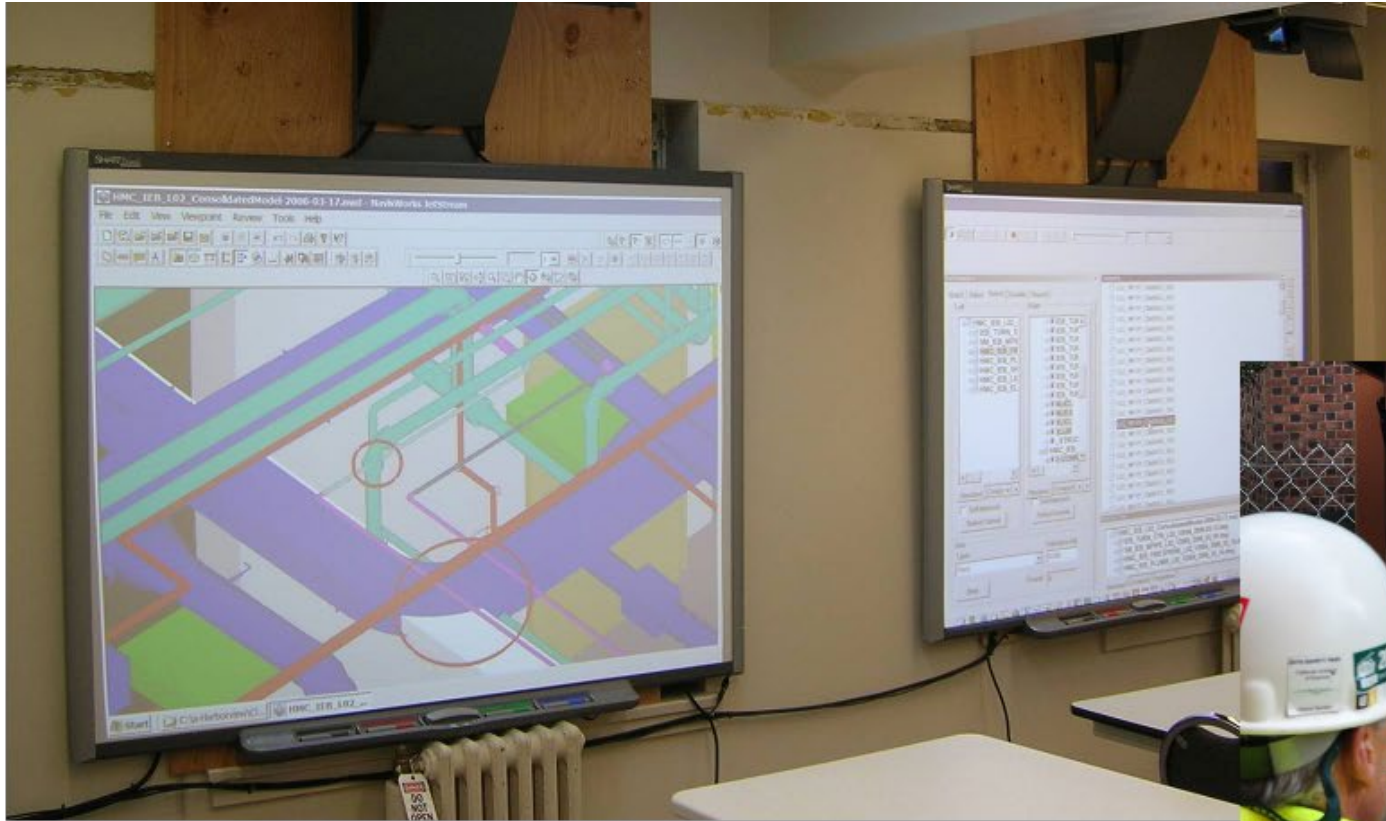
Provided by Dan Gramer, Turner Construction



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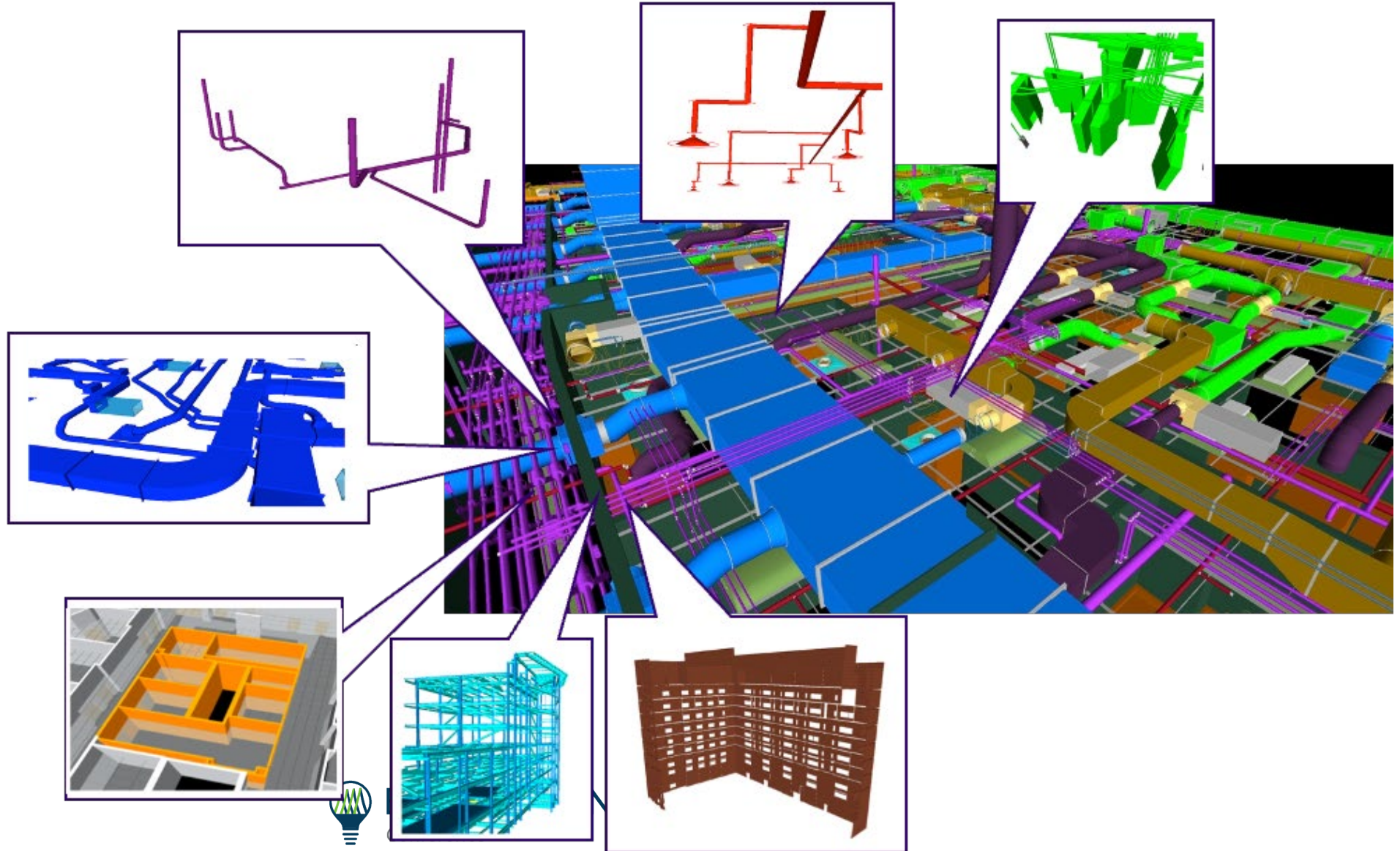
Khanzode, Atul & Fischer, Martin & Reed, Dean. (2007). Challenges and benefits of implementing virtual design and construction technologies for coordination of mechanical, electrical, and plumbing systems on large healthcare project. CIB 24th W78 Conference.

To now... ..



BIM Execution Plans & Model Deliverables

Federated
Models



Documents do several things:

Cognitive resources for creators

Sites for conversation

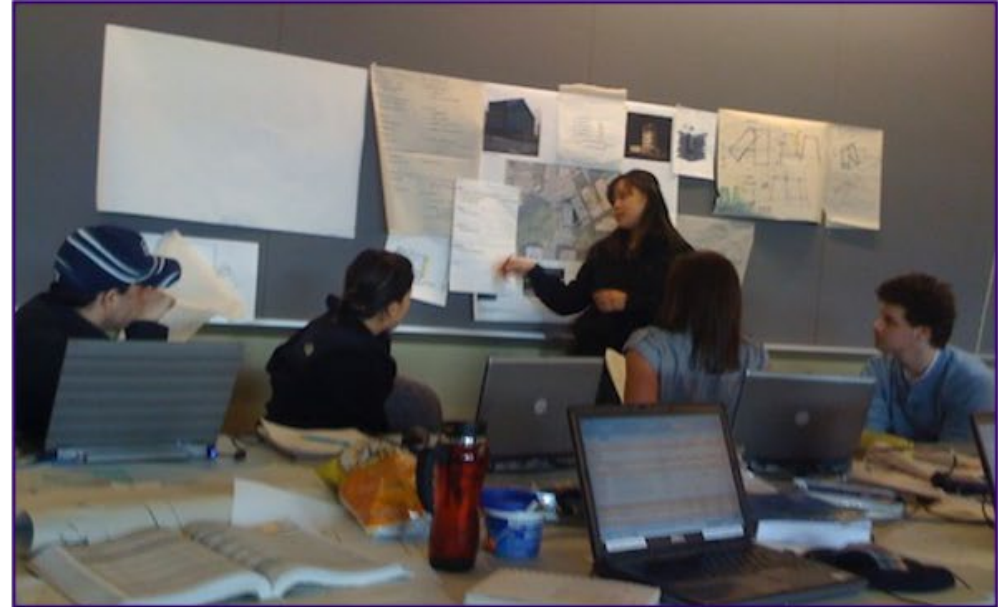
Documentation

(Ewenstein and Whyte 2007; Neff et. al. 2010;
Suwa et al. 2000; Whyte et al. 2008)

Clean Tech vs Messy Talk



≠



Clean Technology

“documentation,
data exchange
and management”

(Ku, et al. 2008)

Messy Talk

“unexpected discoveries”

(Suwa, et al. 2000)

“emergent”

(Whyte, et al. 2008)

Formal
Documentation

Procedural and legal
documentation

Informal Dialog

Talk and
brainstorming

Documentation

Annotation
And note taking

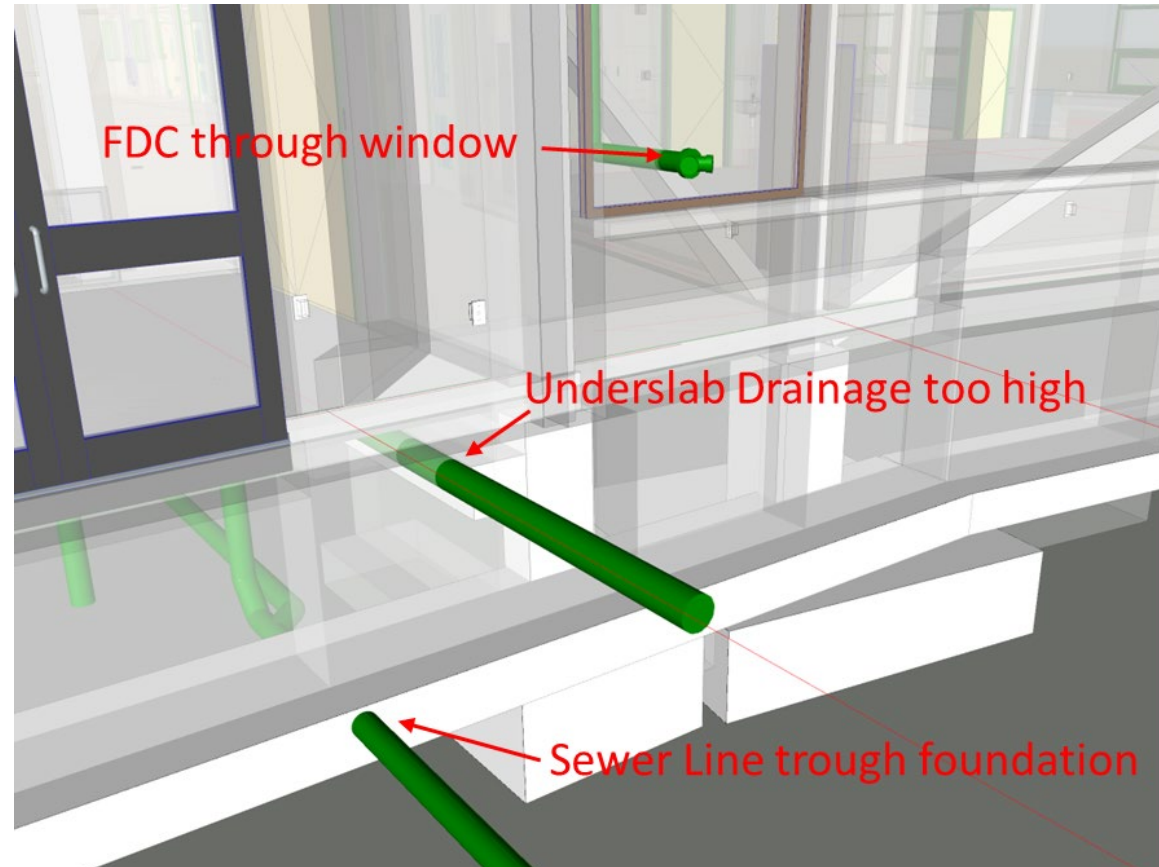
**“For the meeting
minutes, I need dialog.”** – Asst. Superintendent,
MEP Coordination



Challenges in Practice

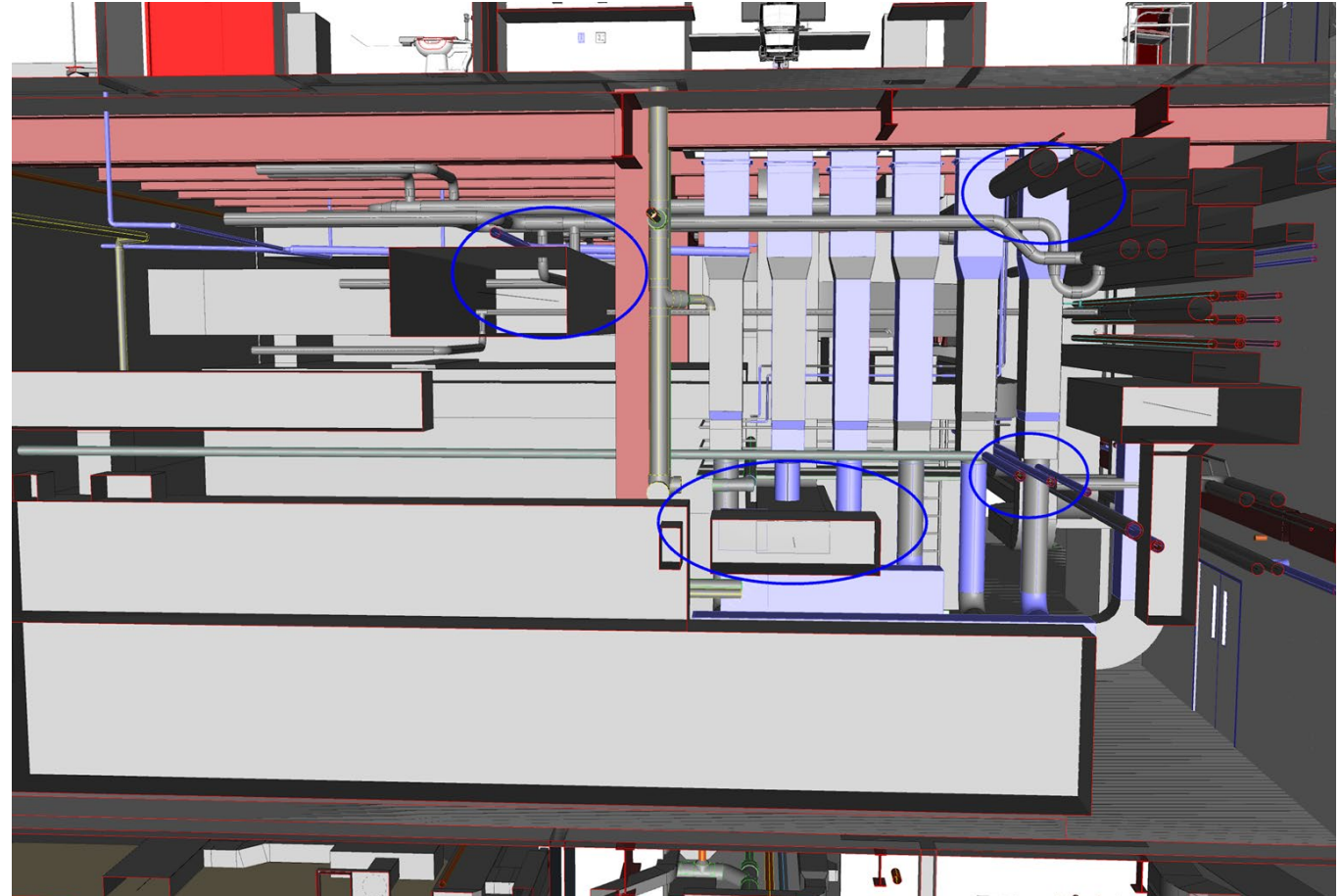
Some examples

- Typical BIM Project
 - School Project
 - Design Team shares initial model;
 - Sporadic updates to design model



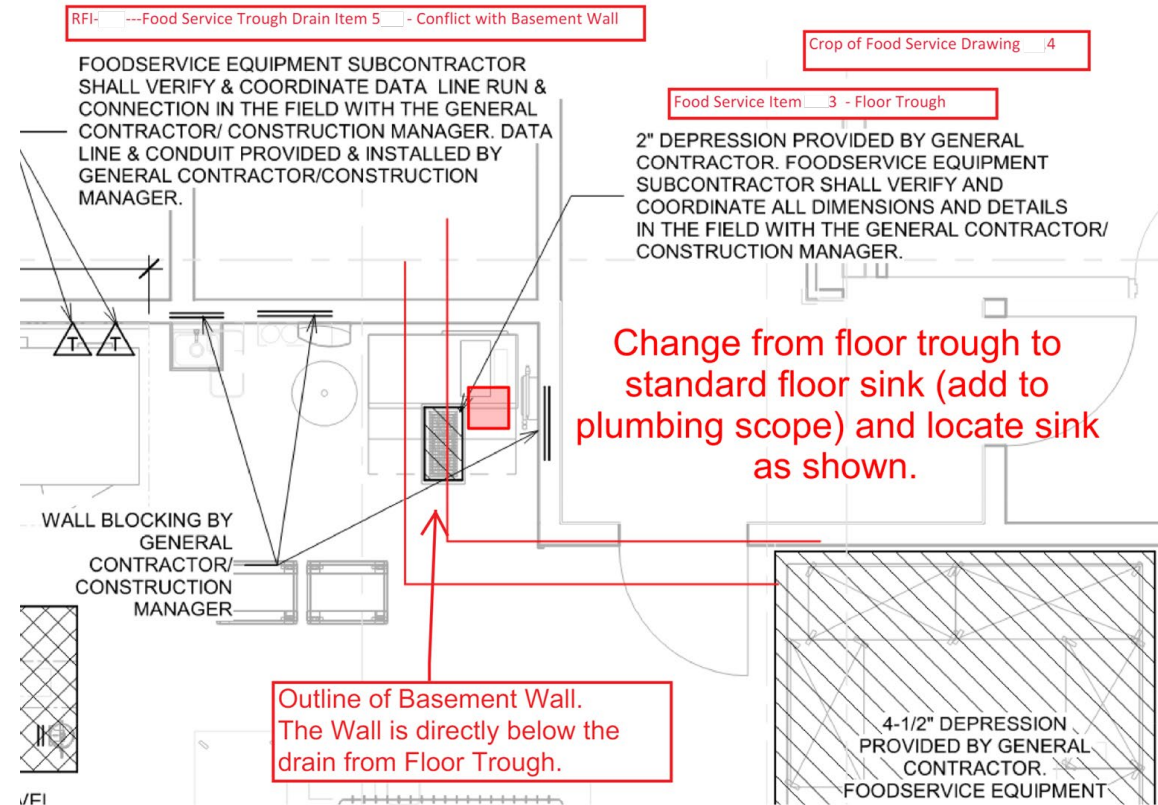
Some examples

- Typical BIM Project
 - Hospital Project
 - Design Team shares initial model;
 - Sporadic updates to design model



Some examples

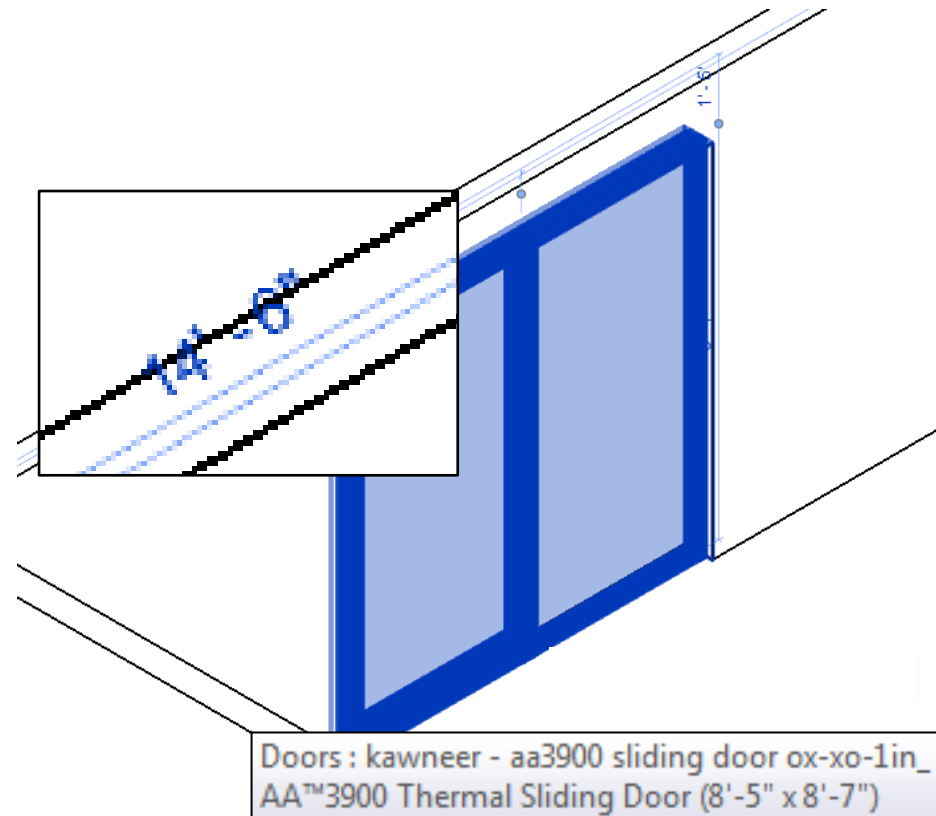
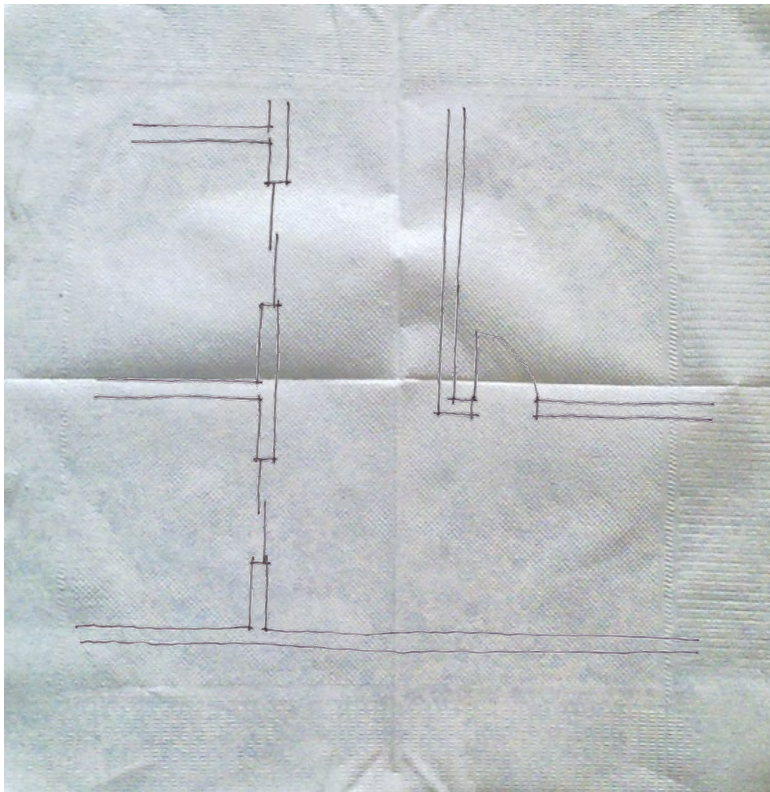
- Typical BIM Project
 - Hospital Project
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 - Sporadic updates to design model



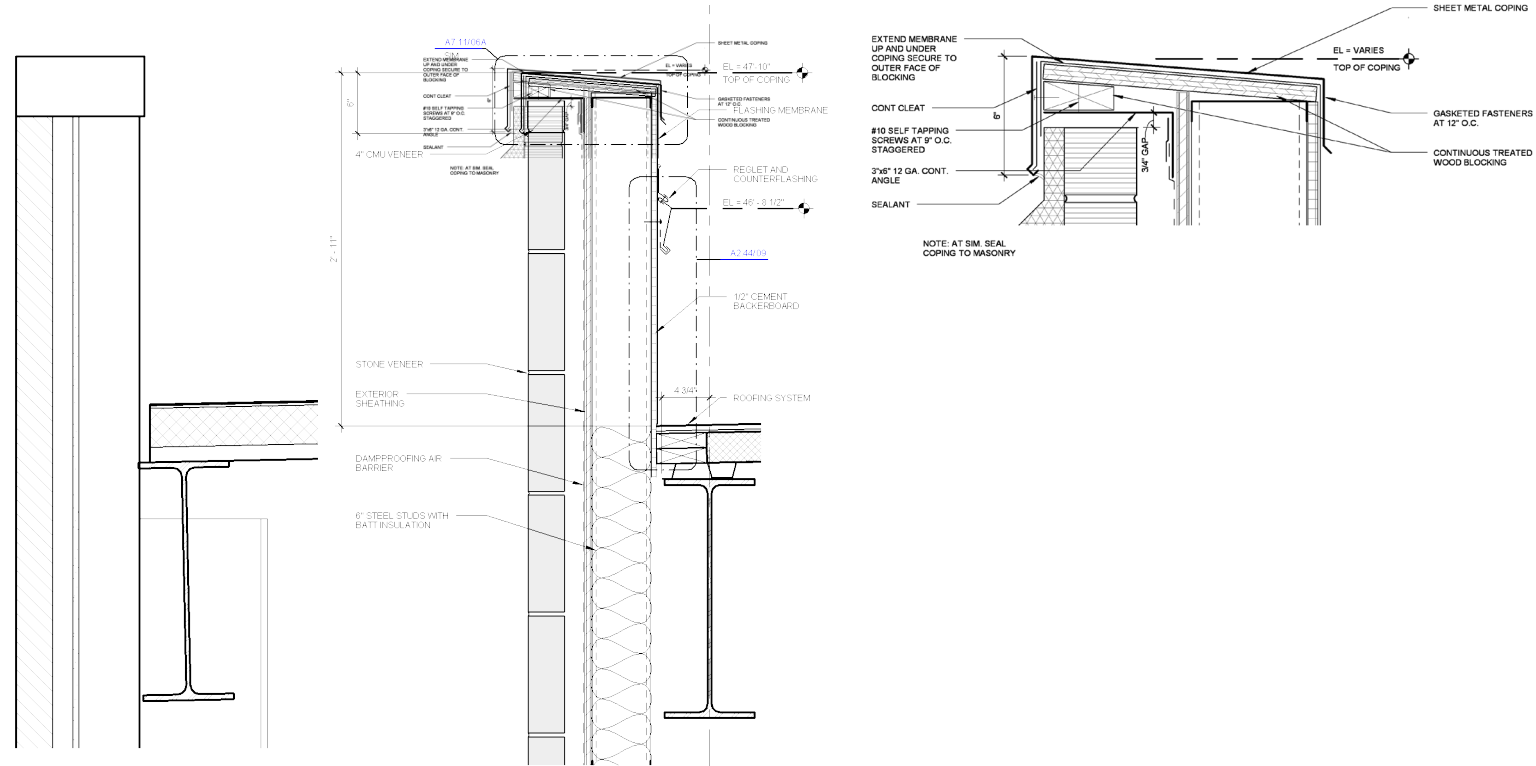
Model vs Drawing

Visual cues about state of development

BIMs often carry unintended information



Model vs Drawing



Model



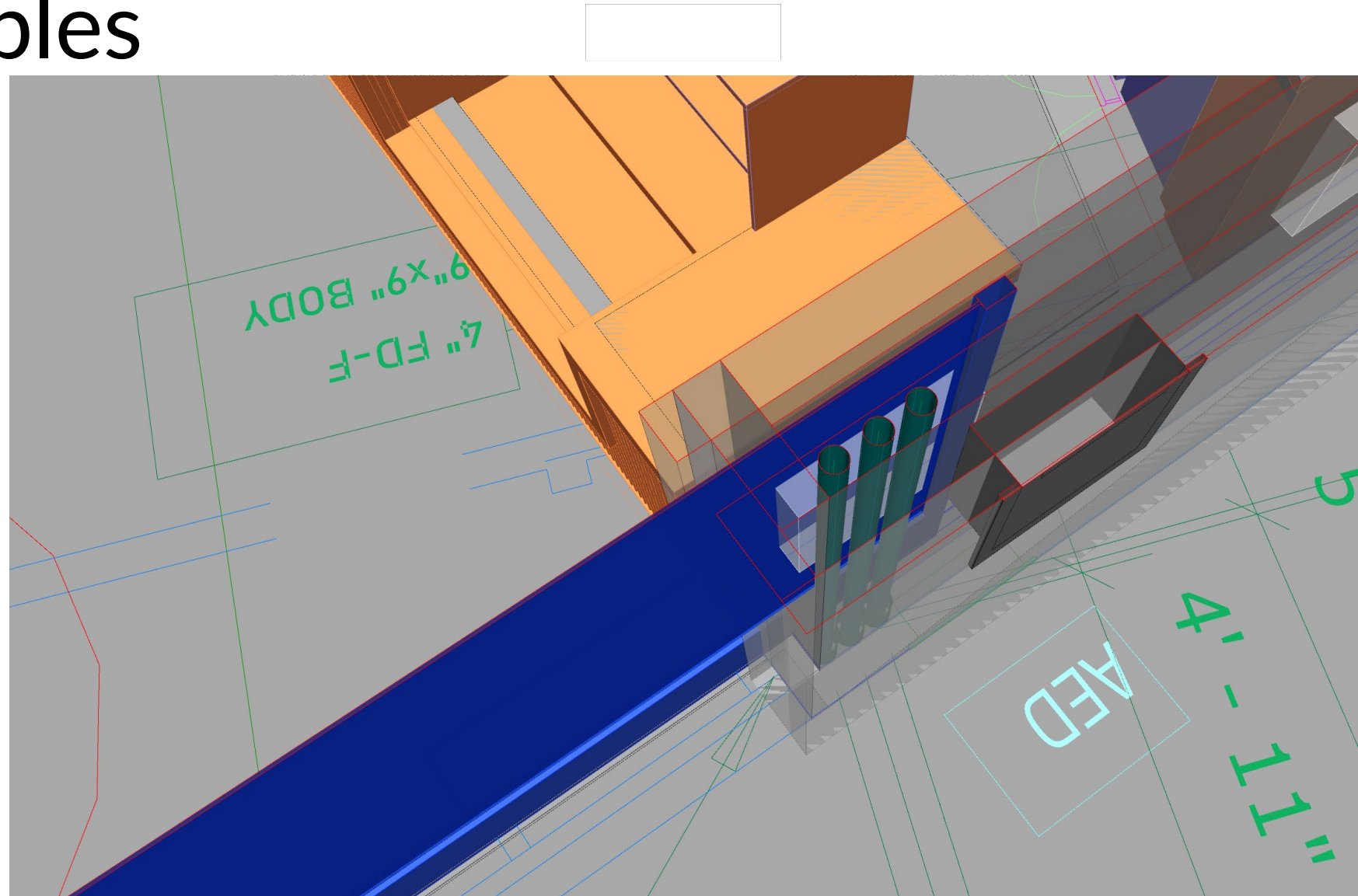
Composite
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Annotations

Credits for Slide: Davis Chauviere, HKS

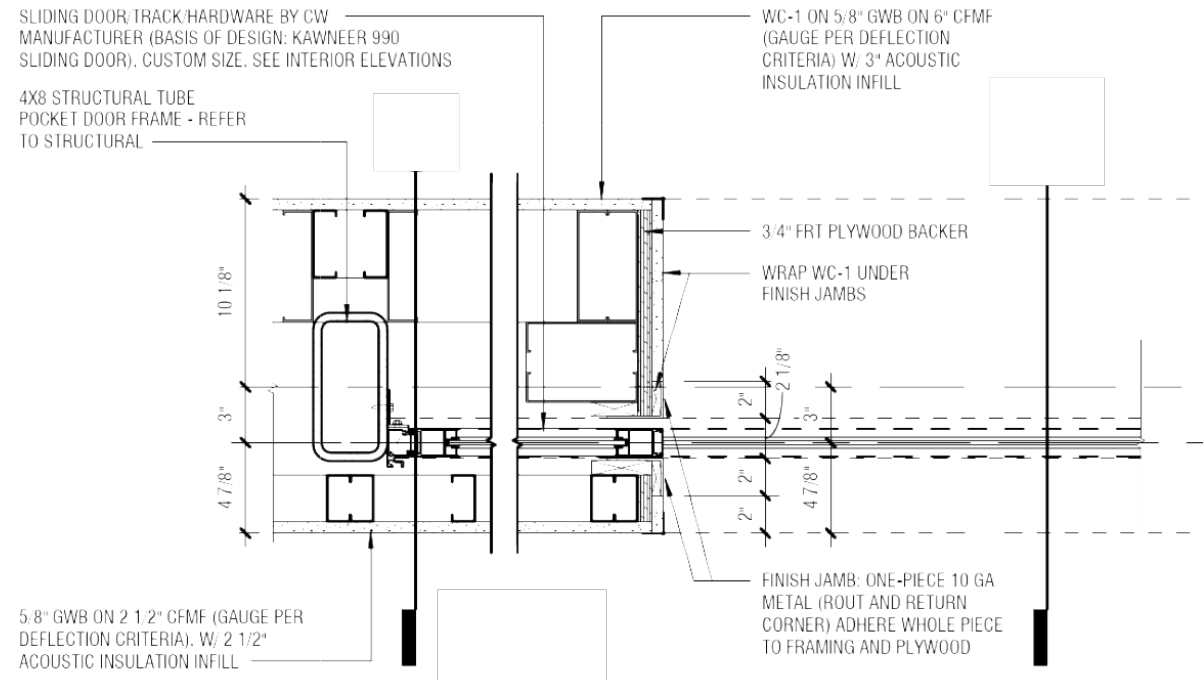
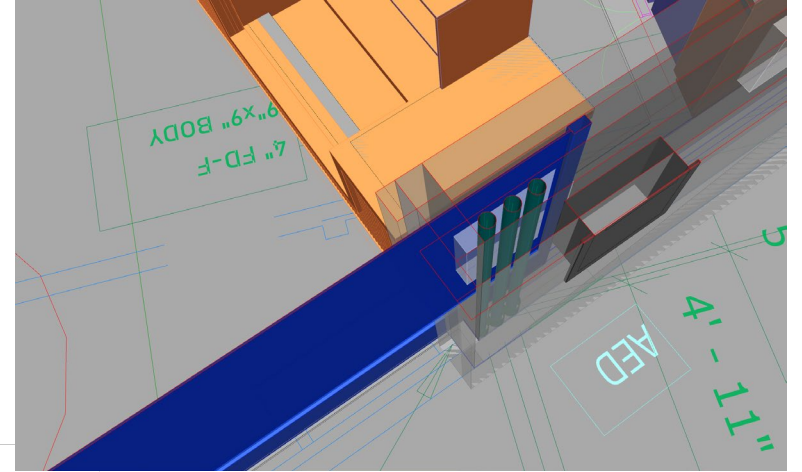
Some examples

- Pocket Door and pipes
- Clear in the model



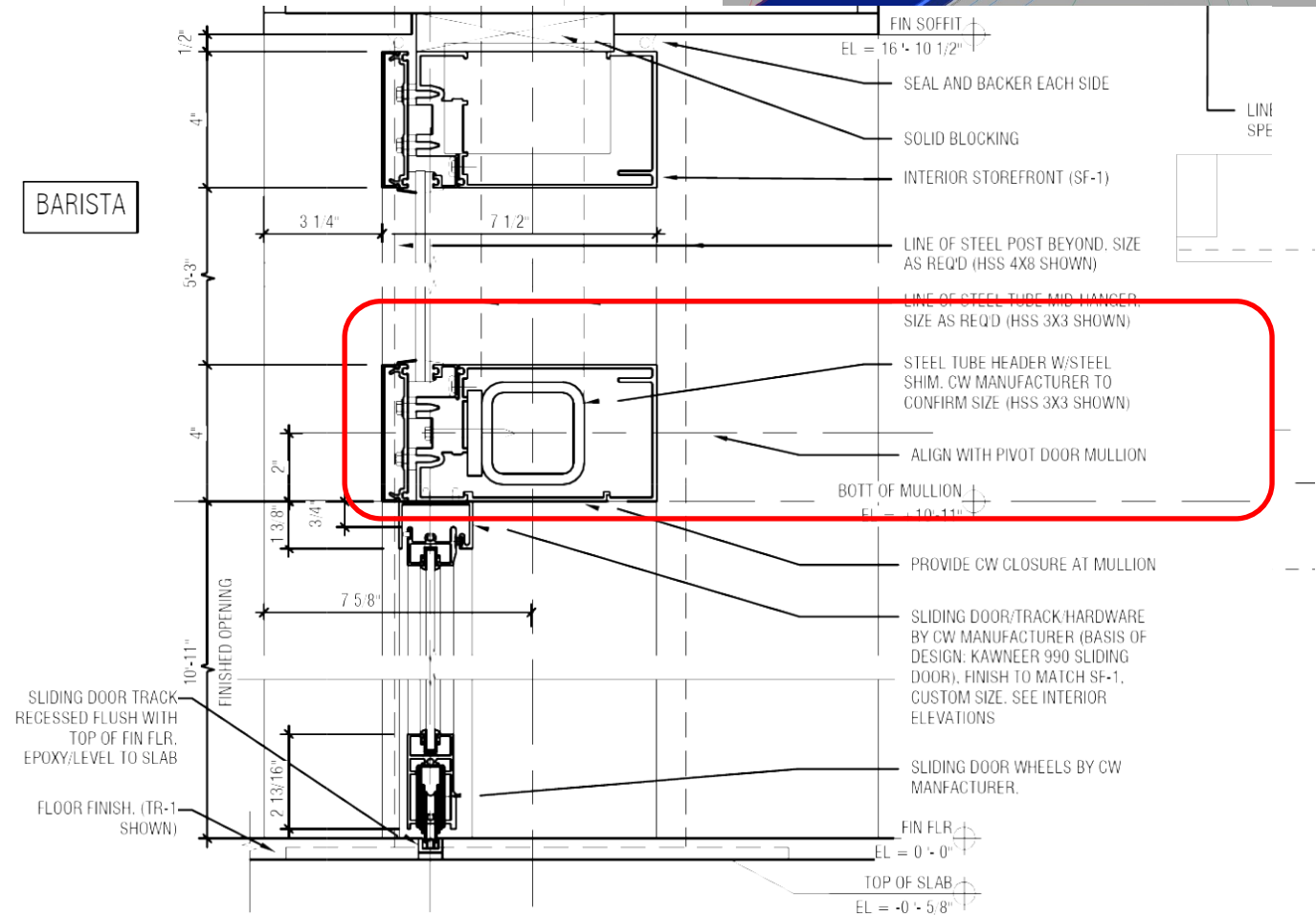
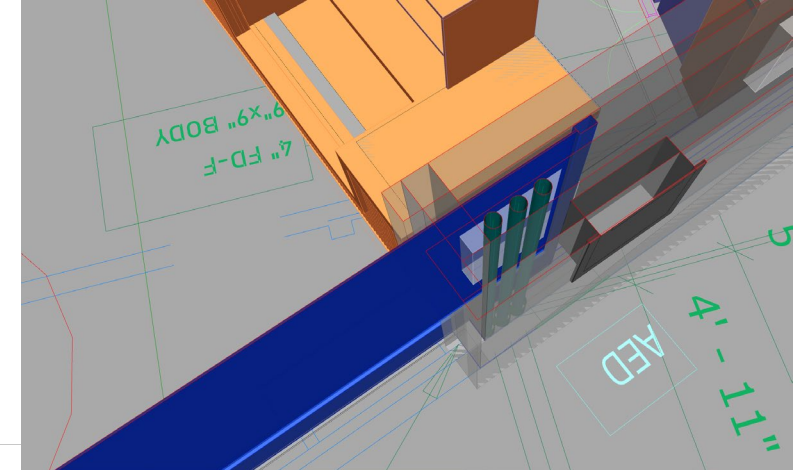
Some examples

- Pocket Door and pipes
- Clear in the model
- Detail provided in PDF



Some examples

- Pocket Door and pipes
- Clear in the model
- Conflict according to elevation detail



Some examples

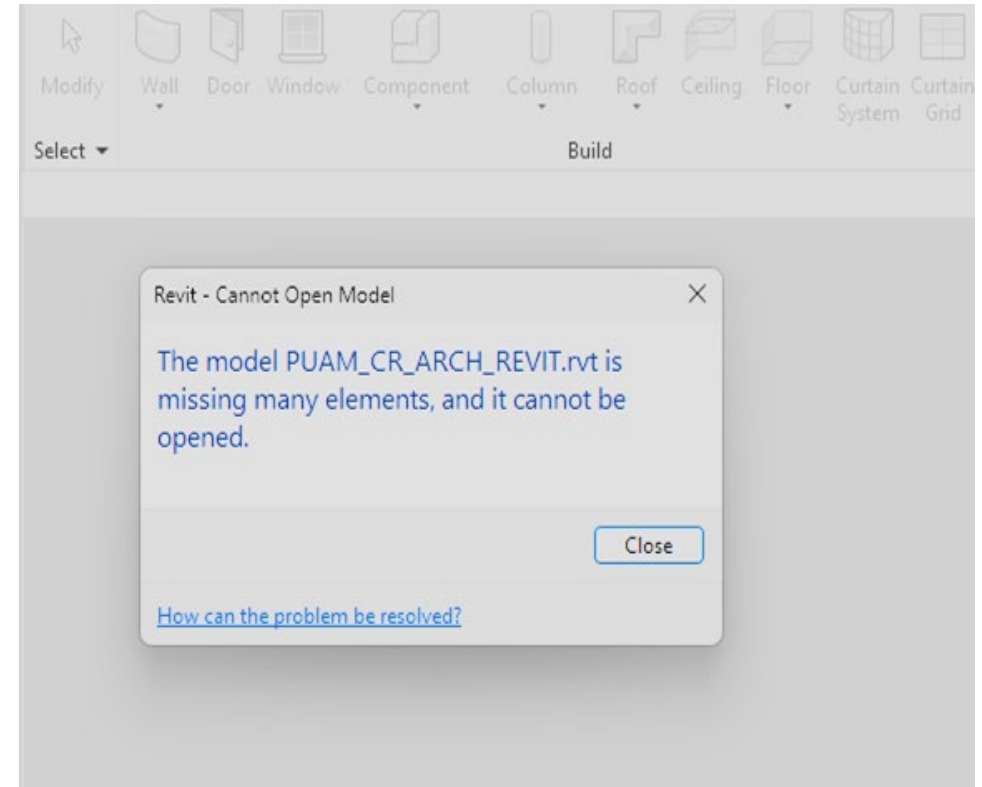
- Model versioning
 - Models have no title blocks
 - How do we deal with fast iterations?
 - If I am unsure if I have the latest background I will wait to do my detailing

Folder name: BIM/Component Models Type:PUBLIC_MANAGED_REPOSITORY_FOLDER

	Project	Author	Phase	Discipline	Level	Area	Version	Date	Ext	Size	Uploaded On	Uploaded By	Select	Commands
+ DEFINED	DEFINED	DEFINED	DEFINED	DEFINED	DEFINED	DEFINED	VERSIONNUMBER	DATE						
+ ~all~	~all~	~all~	~all~	~all~	~all~	~all~			~all~		~all~	~all~	<input type="checkbox"/>	
+ H1	EMA	DES	GRID	ALL	ALL	V0004	2023-10-04	dwg	207kB	10/04/23 11:33:38 AM	jan	<input type="checkbox"/>		
- H1	EMA	DES	ARC-CS	ALL	ALL	V0010	2024-05-12	dwx	6MB	05/12/24 11:23:04 PM	jan	<input type="checkbox"/>		
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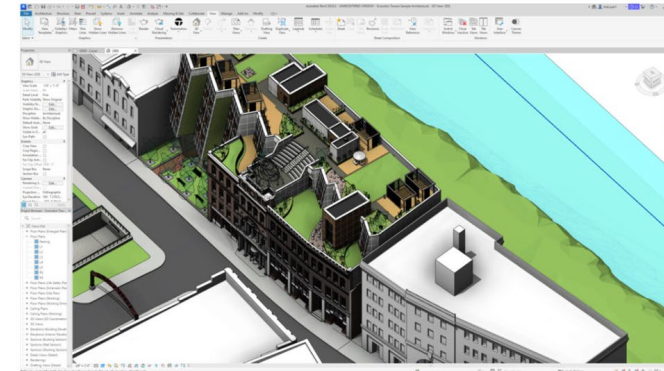
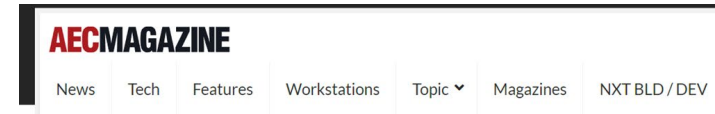
Some examples

- Technology
- Can we trust the model?
 - Authoring tool
 - Transmission tool
 - File formats
 - Model review tool



State of affairs – technical side

- Ambiguity:
 - Software versions and version upgrades of models
 - Design Options
 - Project Phases
 - Coordinate systems
 - Object enablers; missing pieces



BIM NEWS

Schema conflicts hit Revit 2024

AEC Posted on February 5, 2024 by AEC Magazine

0



Schema conflict issues in the migration of RVT files from Revit 2023 to Revit 2024 force some firms to opt out of current release

With each new release of Revit, the core .RVT file format changes as new features and functionality are added. In this respect, last year's release of Revit 2024 was no different. Before deploying at scale, a process that involves a one-way conversion of the previous version of .RVT, most firms carry out some due diligence, to verify that introducing the new version won't cause any issues for current projects.

Some examples

- In-transparent proprietary solutions
 - Inability to check with alternative solutions
 - Inability to audit; inability to get to the ground truth

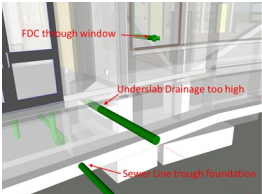
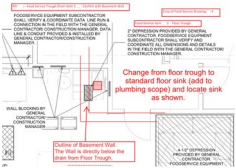
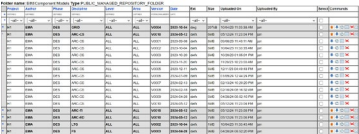
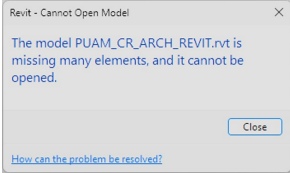

- This is a problem for the author and the recipient of a model

BIM Literacy

- Drawings are reviewed, checked, signed and sealed
- Can we review models with the same confidence?



Catalog of Challenges

<p>Challenge</p>		
<p>Intended Content Not everything in a model should be considered reliable What to model, how much to model and when to model is not clear</p>		
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<p>Moving Targets Which model version should I use? Navigating Work in Progress vs Milestone Models</p>		
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<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose?</p>		

What is the opportunity?

- We can do targeted coordination
- We don't delay decisions because we are unsure which source to trust
- We understand the sources of problems
- We can automate:
 - Quantity take off
 - Procurement
 - Field Layout
 - Close out deliverables, record deliverables

Solutions

“It all boils down to trust in the model”

Jim Bedrick

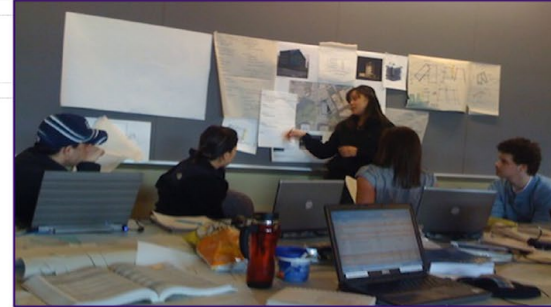
“



Clean Technology

“documentation,
data exchange
and management”
(Ku, et al. 2008)

≠



Messy Talk

“unexpected discoveries”
(Suwa, et al. 2000)
“emergent”
(Whyte, et al. 2008)

”

Carrie Dossick

“Trust but verify”

Ronald Reagan



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Making the Model (and Data) a Trusted Document

1. Use Open Standards

- ❑ Process Management
- ❑ Information Exchange

2. Establish Rules of Engagement

- ❑ Model Contract BIM Addendums
- ❑ In-house BIM Requirements and Standards

3. Set Clear Requirements

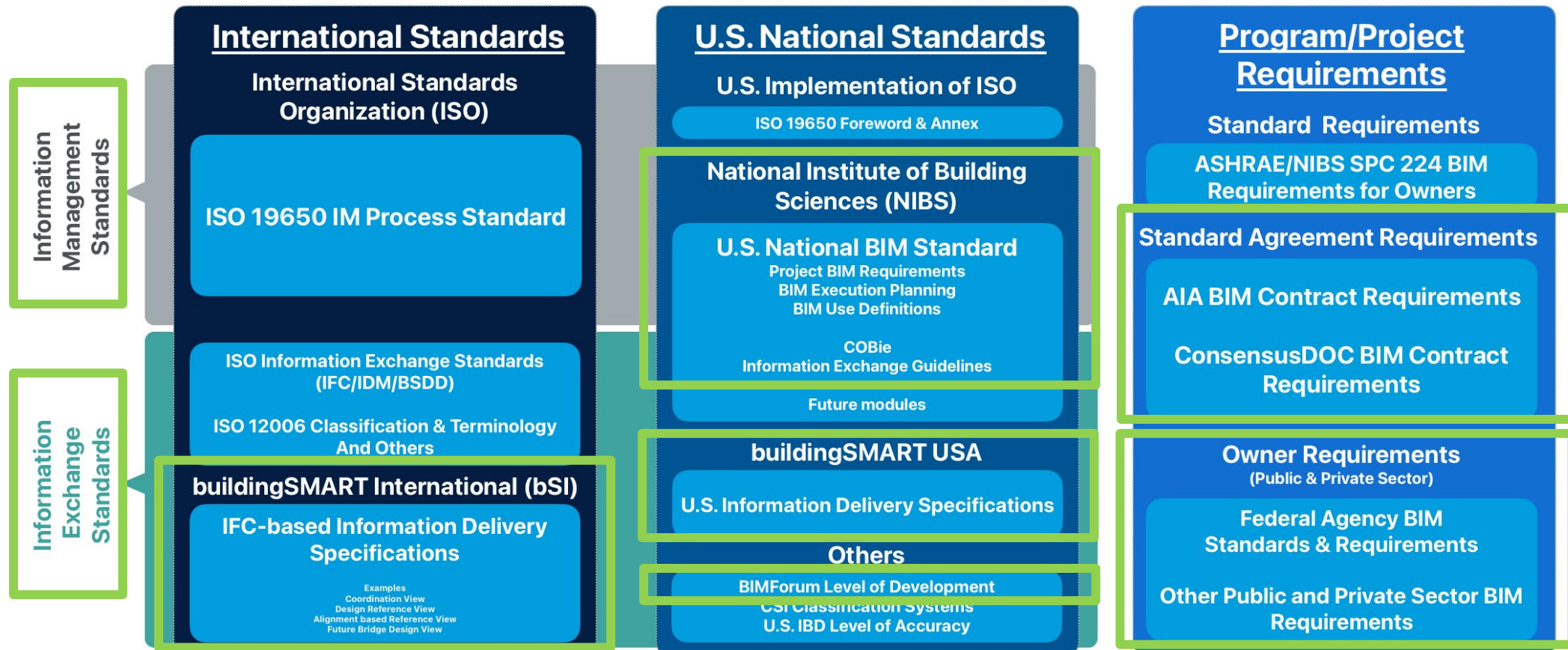
- ❑ Execution Plans and Model Element Specifications
- ❑ Exchange Specifications

4. Validate Deliverables

- ❑ Submittal Review Processes and Procedures based on Standards

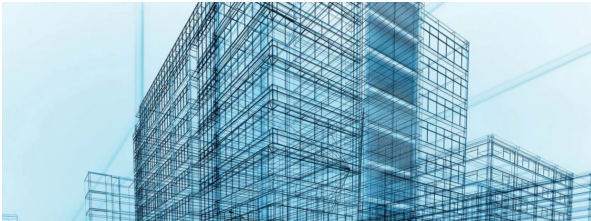
Open Standards for Models and Data

U.S. BIM Standards and Guidelines Framework



U.S. National Process Management Standards to Establish Requirements and Set Expectations

NATIONAL BIM STANDARD- UNITED STATES® VERSION 4



NBIMS-US Overview

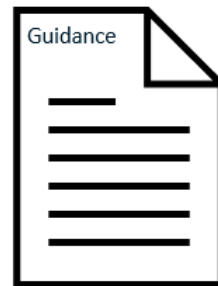
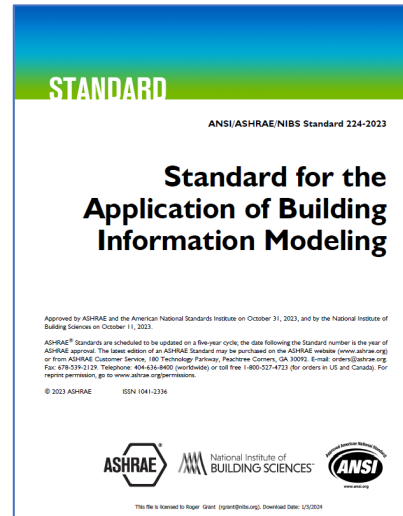
Project BIM Requirements

BIM Execution Planning

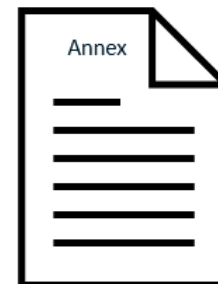
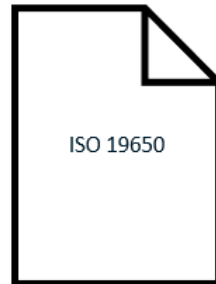
BIM Use Definitions

Information Exchange Guidelines

COBie Version 3.0



Application of NBIMS V4



Terminology Mapping

National BIM Standard U.S. Version 4

- Focus: Asset Owner & Project Team
- Whole Life Cycle

ANSI ASHRAE NIBS Standard 224 BIM for Owners

- Focus: Asset Owner
- Project Delivery

AIA and ConsensusDocs BIM Requirements

- Focus: Project Teams
- Open Model and Data Exchange

ISO 19650 U.S. Forward and Annex (In Process)

- Focus: Asset Owner & Project Team
- Whole Life Cycle

Government Agency Standards

- Focus: Asset Owners & Project Team
- Project Delivery and Handover



NBIMS v4: Project BIM Requirements

Goal

To define the elements of BIM requirements that the owner should include in the Owner's Project Requirements (OPR), along with examples and resources to support owner adoption.

Core Content

- Standard for Project BIM Requirements
- Template language for Project BIM Requirements
- Guideline for Project BIM Requirements
- Including how this standard relates to ISO 19650

Audience and Value

Owner:

- To support the owner's development of their Project BIM Requirements.
- To provide a comprehensive guide as to what should be included in Project BIM Requirements.

Proposer:

- To understand what to expect from an owner's project BIM Requirements.

Project Team:

- To create greater consistency across the industry.

NBIMS V4: PBR Standard and Example Language

5 PROJECT BIM REQUIREMENTS

Each section of this standard for Project BIM Requirements contains: 1) Title of the requirement, and 2) Definition of the requirement. The standard is divided into three sections: Executive, Management, and Working/Technical.

5.1 EXECUTIVE

5.1.1 Deliverables

5.1.1.1 Required Deliverables

The Owner Project Requirements (OPR) shall identify all deliverables required by the Standard for Project BIM Requirements.

5.1.1.2 BIM Quality Plan

A BIM Quality Plan shall be documented in the Project BEP and could be incorporated or referenced in a Project Quality Plan. The OPR shall define when the BIM Quality Plan should be delivered and by which delivery team member(s). See: BIM Quality Plan

5.1.1.3 Security Plan Deliverable

If a Security Plan is not being provided to the delivery team member, then the OPR shall define when the Security Plan should be delivered and by which delivery team member(s) it should be delivered. See: Security

5.1.1.4 BIM Execution Plan (BEP) Deliverables

The OPR shall define when a Project BEP should be delivered and which delivery team member(s) should be involved in the development and delivery of the BEP (see BIM Execution Plan Module for details).

5.1.1.5 Model Deliverable(s)

The OPR shall specify the deliverable format for each BIM Use. For each Model Deliverable, the owner shall provide a Model Requirement (See: Model Requirements) expectation.

5.1.1.6 Data Deliverable(s)

The OPR shall specify the delivery format for any required data deliverable. Each data deliverable shall be delivered using either an industry standard format (e.g., COBie) or a format defined by the owner. (See: Data Requirements)

1 Project BIM Requirements

Each section of this Standard for Project BIM Requirements standard contains: 1) Title of the requirement, and 2) example language (*Italics*). The template is divided into three sections: Executive, Management, and Working/Technical.

1.1 Executive

1.1.1 Deliverables

1.1.1.1 *Required Deliverables*

The [Appointed Party] is required to deliver the following deliverables:

- o Quality Plan*
- o Security Plan*
- o BIM Execution Plan*
- o Model Deliverable*
- o Data Deliverable*

The procedures and milestones for delivery of each required deliverable shall be specified in the BEP.

1.1.1.2 *Quality Plan*

The Quality Plan must be submitted by [X]. The Quality Plan shall be resubmitted for approval of any changes made, and shall be included with each major project milestone package.

1.1.1.3 *Security Plan Deliverable*

The Security Plan must be submitted by [X]. The Security Plan shall be resubmitted for approval of any changes made, and shall be included with each major project milestone package.

1.1.1.4 *BIM Execution Plan (BEP) Deliverable*

The BEP must be submitted by [X]. The BEP shall be resubmitted for approval of any changes made, and shall be included with each major project milestone package.




BIM Execution Planning (BEP)

Updated Section

Goal

To develop a comprehensive BEP Content Standard, Guide and Templates that can be used as a standard deliverable, with structured extensions or customizations by owners and delivery team members as needed.

Core Content

-  Overview of BEP Module
-  Standard BEP Content
-  BEP Template
-  Process Map Templates
-  BEP Information Exchange



INTRODUCTION

The *NBIMS BIM Execution Plan (BEP) Template* may be used to create project-specific BEPs adhering to the National BIM Standard. The content may be used to make an organization's BEP template or to review content from online commercially available BEP applications. A BEP has become a recognized contract deliverable. The BEP process and this documentation will help all project members achieve an efficient and effective BIM process for project delivery.

UPDATES to the BEP Process

The NBIMS BEP is aligned to ISO 19650 and US project delivery. Various groups develop the BEP information. The **Owner** provides information on BIM projects in the Request for Proposal (RFP) phase. Owners providing this information in an RFP will better understand a team's capability to perform on a BIM project.

Proposers respond with a *Project Proposal BEP*, and the selected *Project Team* develops the *Project-Specific BEP*. The *Project Specific BEP* is updated as new team members begin work on the project. It is used throughout a project to review BIM performance.

Template Sections

Below are the information categories in the BEP Template. The tabs in this file are by category

Cover Page (Cover)	BIM Uses (Uses)
Project & BEP Summary (Summary)	Technological Infrastructure Needs (Software) (Info Sharing)
Reference Information (Ref Info)	Quality Management (Quality) (QM Strat)
BIM Contacts	IM Risk Register (Risk Reg)
Organizational Roles & Responsibilities (Roles)	Model Federation and Standards (Federation Strat)
Project Phases & Milestones (Schedule)	Information Exchanges (IE)
Project Goals (Goals)	Model Element Table (MET Buildings) (MET Infrastructure)
Team Collaboration (Collab)	Picklist

References

National BIM Standard - United States	
NBIMS BIM Use Reference	
NBIMS BIM Execution Plan Standard Content Document	
BIMForum LOD Specification	https://bimforum.org/resource
Construction Specification Institute (CSI) https://www.csiresources.org	

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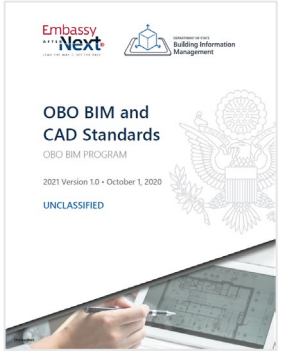


Example: BIM Requirements at Department of State Overseas Buildings Operations



PROJECT | SRP | FINAL
Chancery

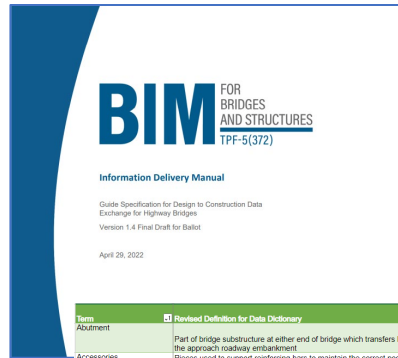
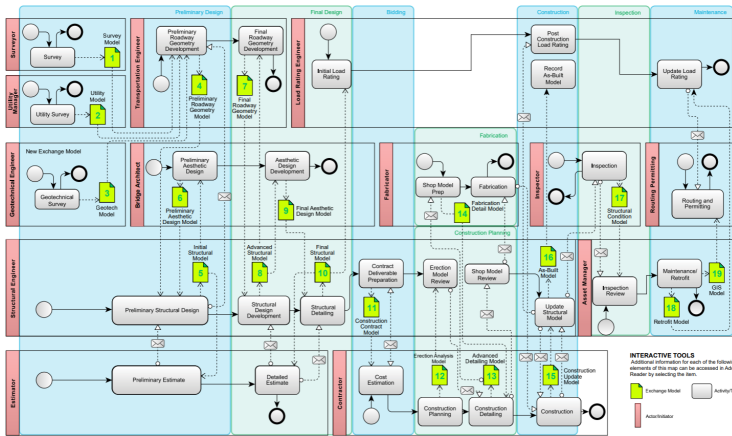
SRP TAG	AA	SRP-M	SPACE NAME	POSITION	US	POS	QTY	NUM	USM	COMMENTS	WCD	
Commercial Bank												
Z03-01-012	00A	00003	Subprocessor Machinery Room - 1001				3.0					
Z03-01-013	00A	00003	Reception Lobby - 1001				39.7					
Summary for Commercial Bank							4	233.2	233.2			
Non-Desk Position							0.0	0.0	0.0	0.0		
Non-Desk Position							0.0	0.0	0.0	0.0		
Non-Desk Position							0.0	0.0	0.0	0.0		
TOTAL DESK POSITIONS							4	233.2	233.2			
TOTAL NON-DESK POSITIONS							0	0.0	0.0			
TOTAL POSITIONS							4	233.2	233.2			
Commercial Bank												
Z03-01-003	00A	00003	ATM				3.2			Load with Cashier Booths		
Summary for Commercial Bank							0	3.2	3.2			
TOTAL DESK POSITIONS							0	0.0	0.0			
TOTAL NON-DESK POSITIONS							0	0.0	0.0			
TOTAL POSITIONS							0	0.0	0.0			
Commercial Travel Office												
Z03-04-001	00A	00006	Office, Commercial				14.4					
Z03-04-002	00A	00006	Storage, General - Entry				4.0					
Summary for Commercial Travel Office							0	18.4	18.4			
TOTAL DESK POSITIONS							0	0.0	0.0			
TOTAL NON-DESK POSITIONS							0	0.0	0.0			
TOTAL POSITIONS							0	0.0	0.0			
Summary for Chancery - US DESK POS							4	233.2	233.2			
Summary for Chancery - US NON-DESK POS							0	0.0	0.0			
TOTAL POSITIONS							4	233.2	233.2			



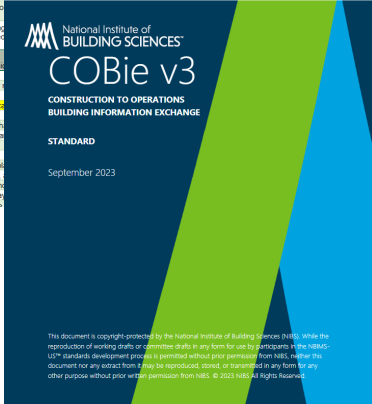
Note: data and imagery shown are for example only
Courtesy Department of State Overseas Buildings Operations

U.S. National Information Exchange Standards

Bridge Lifecycle Management Overview Map



Term	Revised Definition for Data Dictionary	Revised Reference
Abutment	Part of bridge substructure at either end of bridge which transfers loads from superstructure to foundation and provides lateral support for the approach roadway embankment.	FHWA (2012) Bridge Inspector's Reference Manual (BIRM)
Accessories	Pieces used to support reinforcing bars to maintain the correct position of the bars prior to and during concrete placement.	TPF-5(372) Defined
Anchor Bolt	Steel element either cast into concrete or post-installed into a hardened concrete member and used to transmit applied loads to the concrete. Anchor bolts are also referred to as anchors or anchor rods.	AASHTO (2020) LRFD Bridge Design Specifications (9th ed.)
Approach Slab	A reinforced concrete slab placed on the approach embankment adjacent to and usually resting upon the abutment back wall, the function of the approach slab is to carry wheel loads on the approaches directly to the abutment, thereby transferring any approach roadway misalignment due to approach embankment settlement.	FHWA (2012) Bridge Inspector's Reference Manual (BIRM)
Approach Structure	A structure between the roadway pavement and a bridge. It is used to provide a smooth transition between these two elements.	FHWA (2012) Bridge Inspector's Reference Manual (BIRM)
Appearance	Curbs, parapets, railings, barriers, fences, and sign and lighting posts attached to the bridge or approach slab.	TPF-5(372) Defined
Arch Type Buried Structure	A type of buried structure that consists of a rounded or elliptical shape being concrete.	
Barrier	A bridge appearance built to protect pedestrians and vehicles from falling synchronous with parapet and traffic railing, barrier is most commonly used shape.	
Battered Pile	A pile or micropile installed at an angle inclined to the vertical to provide h	
Beam	See "Girder"	
Bearing	A structural device that transmits loads while facilitating translation and/or	
Bearing Stiffener	A vertical web stiffener at the bearing location.	
Bent	A type of pier consisting of multiple columns or piles supporting a single or	
Bent Cap	See "Pier Cap"	
Bent Plate	A single steel plate that has been shaped during the fabrication phase to h	
Bolt	A mechanical fastener with machine threads at one end to receive a nut, a	
Bolt Assembly	The bolt, nut(s), and washer(s).	
Box Culvert	Culvert of rectangular or square cross-section.	
Bracing	Member or system that provides stiffness and strength to limit the out-of-pl	
Bracing Member	A member intended to provide stability to another member or part thereof,	
Bridge	provides a different definition of "bridge" which is based on span length and	
Cable-Stayed Bridge	A bridge in which the superstructure is directly supported by cables, or sta	
Cambar	The abutment or pier or tower or wall provided in beams for connections	



U.S. Bridge Lifecycle Process Map

- Focus: Asset Owner & Project Team
- Whole Life Cycle

U.S. Bridge Design to Construction IDM

- Focus: Asset Owner & Project Team
- Project Delivery

U.S. Bridge Design to Construction MVD / IDS

- Focus: Technology Providers
- Open Model and Data Exchange

U.S Bridge Data Dictionary

- Focus: Project Team & Technology Providers
- Project Delivery and Open Model and Data Exchange

COBie Information Exchange Specification

- Focus: Project Team & Technology Providers
- Project Delivery and Handover

Industry Foundation Classes IFC Bridge Design to Construction Information Exchange (U.S.) IFC4.1 Model View Definition

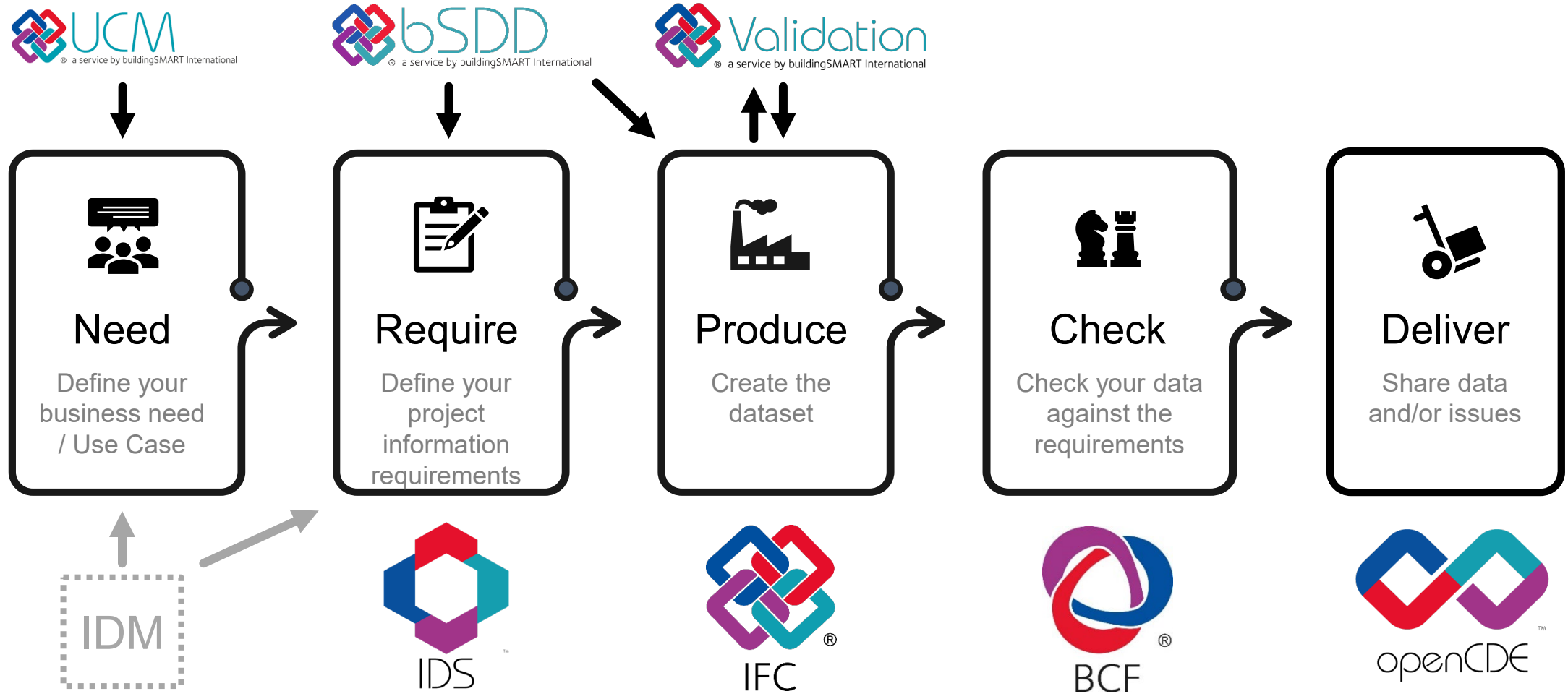


This work incorporates parts of the Industry Foundation Classes (IFC) model by buildingSMART International subject to the following copyright notice: copyright © 2016 IFC Bridge Design to Construction Information Exchange (U.S.) was developed under contract to the U.S. Federal Highway Administration by the National Institute of Building Sciences. Extensions to the IFC model developed under this contract are copyrighted by National Institute of Building Sciences and are licensed for use under a Creative Commons Attribution-NonCommercial-ShareAlike license. References to this work should be in the form of: National Institute of Building Sciences (2016) "IFC Bridge Design to Construction Information Exchange (U.S.)", National Institute of Building Sciences, Washington, DC. <http://www.nibs.org/?page=bsa-bridge> (cited DD-MMM-YYYY)

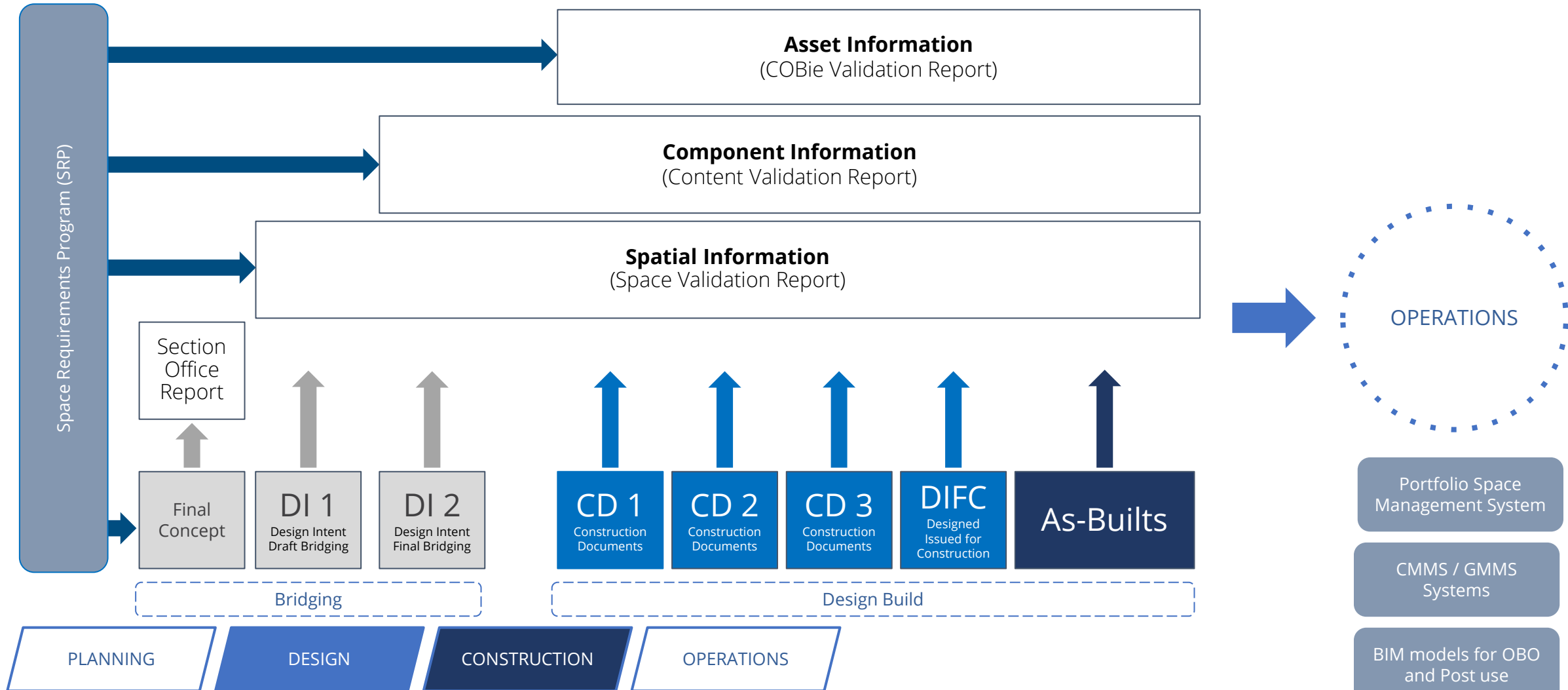
October 5, 2023

openBIM® Workflows for Requirements and Verification

buildingSMART Standards & Services



Example: Exchange Requirements and Validation at Department of State OBO



Example: Bridge Information Exchange Specification

BIM FOR BRIDGES AND STRUCTURES
TPF-5(372)

ROADMAP

BACKGROUND

The desired outcome of the work under the TPF-5(372) Project is to establish a standard for bridge semantic and geometric information that is common in the United States, which is a continuation of a previous effort known as the IFC Bridge project to create international standards. The resulting products from the TPF-5(372) may be used by States as a baseline for future projects to further refine standards at the local level. The work under this project will be conducted in a series of activities in a five-year timeline to accomplish four major goals:

- OUTCOME 1:** Development of Information Delivery Manual (IDM)
- OUTCOME 2:** Creation of Model View Definition (MVD)
- OUTCOME 3:** Development of Software Certification Materials
- OUTCOME 4:** Deployment of Stakeholder Training

PROJECT SPONSORS

Total Commitments Received: \$2,545,000.00*

*As of January 2023

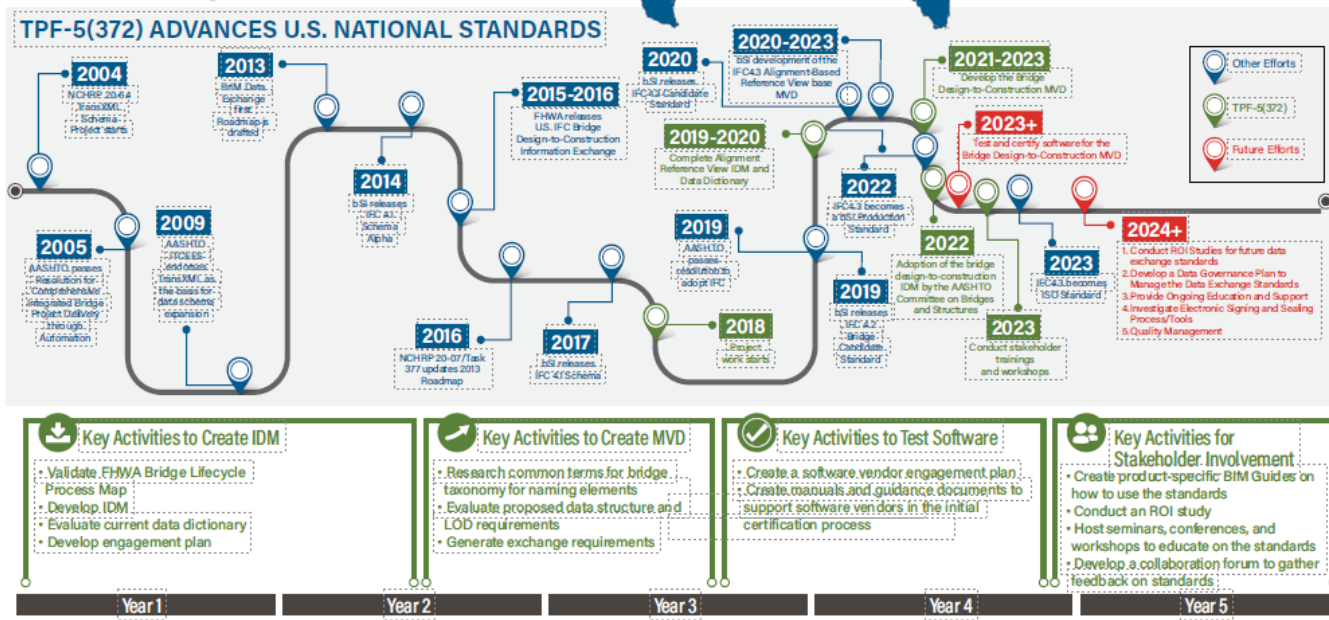
<https://www.pooledfund.org/Details/Study/624>
<https://www.bimforbridgesus.com>



24 PARTICIPATING STATES PLUS FHWA*

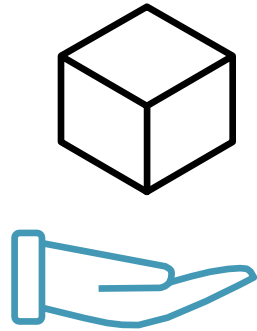
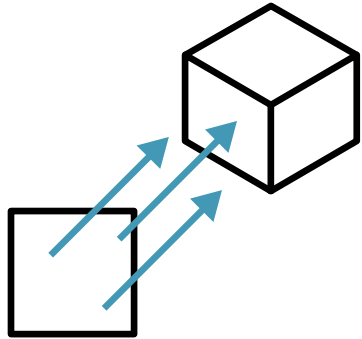
Potential AASHTO Publications

- BIM for Bridges IDM
- BIM for Bridges MVD
- BIM Guide for MVD certification

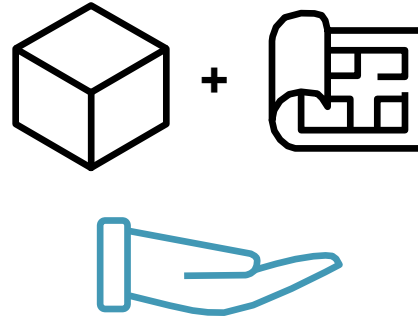


Year 1	Year 2	Year 3	Year 4	Year 5
<p>Key Activities to Create IDM</p> <ul style="list-style-type: none"> • Validate FHWA Bridge Lifecycle Process Map • Develop IDM • Evaluate current data dictionary • Develop engagement plan 	<p>Key Activities to Create MVD</p> <ul style="list-style-type: none"> • Research common terms for bridge taxonomy for naming elements • Evaluate proposed data structure and LOD requirements • Generate exchange requirements 	<p>Key Activities to Test Software</p> <ul style="list-style-type: none"> • Create a software vendor engagement plan • Create manuals and guidance documents to support software vendors in the initial certification process 	<p>Key Activities for Stakeholder Involvement</p> <ul style="list-style-type: none"> • Create product-specific BIM Guides on how to use the standards • Conduct an ROI study • Host seminars, conferences, and workshops to educate on the standards • Develop a collaboration forum to gather feedback on standards 	

Moving to Planless Digital Delivery in Infrastructure

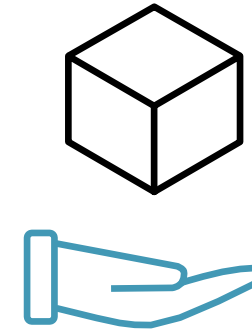


For Information Only



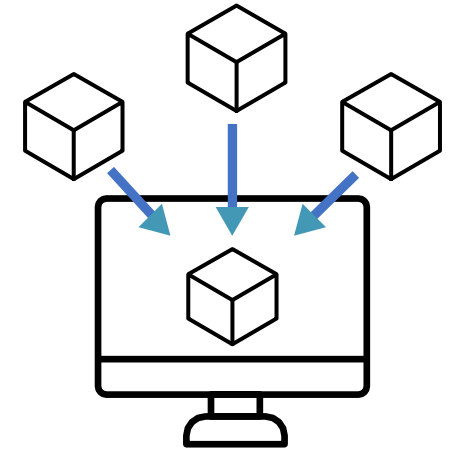
LEVEL 3

Deliver 3D model contractually with conventional plans



LEVEL 4

Deliver 3D model contractually without plans



As-Built

LEVEL 5

Collect digital as-builts

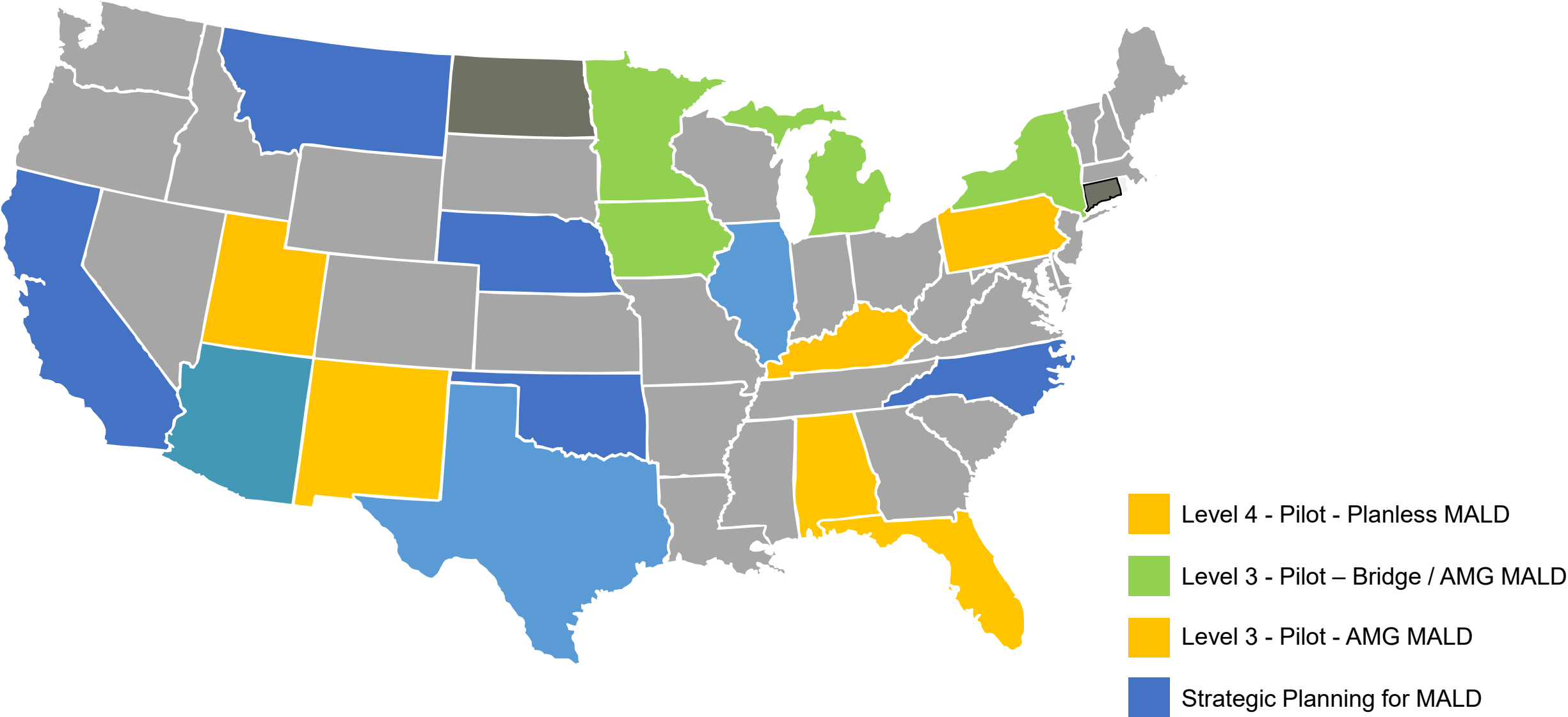
LEVEL 1

Transition from 2D to 3D for plan production

LEVEL 2

Deliver 3D model for information only

Model Based Digital Delivery with Model as the Legal Document

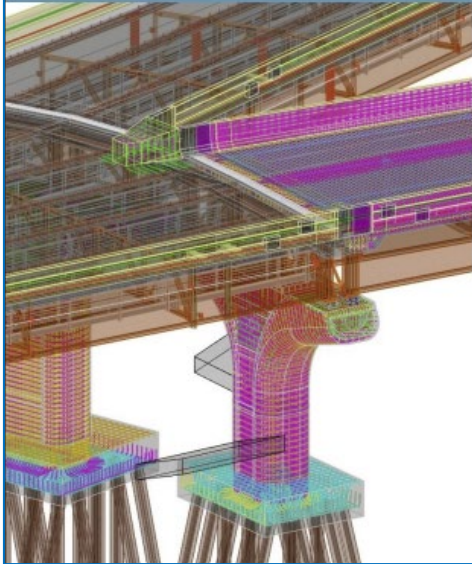


Source: HDR – March 2024

Examples: Bridge Models as Legal Documents

Iowa DOT, I-80/I-380 BIM Pilot

JOHNSON COUNTY, IA



SCOPE OF WORK

- 5 span diverging gore (FIO)
- 13 span curved ramp carrying the NB movement (FIO)
- 3 span curved ramp carrying the SB movement (MALD)
- Develop BIM for the bridges as complete as possible,
- Evaluate the BIM software and assess the model use during construction



**BLUEBEAM
BENTLEY**

- OpenBridge SS4
- ProStructures SS4
- MicroStation
- View
- Navigator



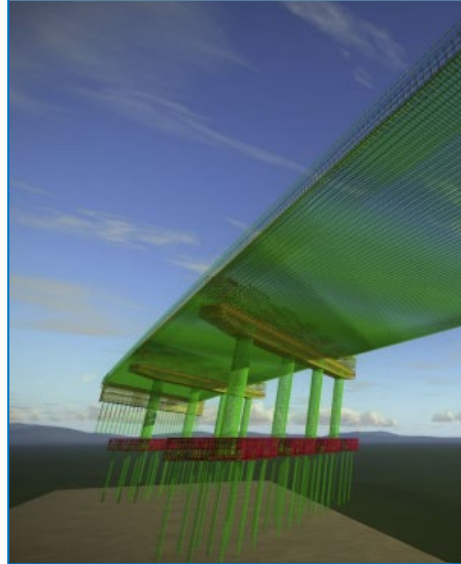
DELIVERY TYPE
D-B-B



**MODEL AS THE
LEGAL DOCUMENT**

UDOT, I-80 Blackrock Bridge Replacements

SALT LAKE AND TOOELE COUNTY, UT



SCOPE OF WORK

- SR-36 Bridge over I-80
- I-80 over UPRR (EB & WB)
- Develop an integrated 3D model which includes the geometrics, structures design and construction planning
- Deliver the project contract documents electronically in conjunction with plan sheets as needed



**BLUEBEAM
BENTLEY**

- OpenBridge SS4
- ProStructures SS4
- MicroStation
- View
- Navigator



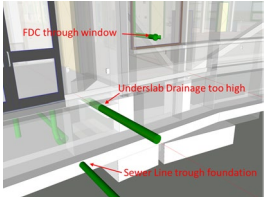
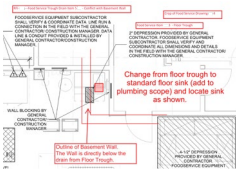
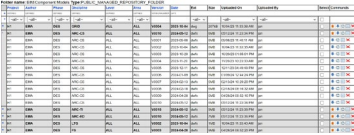
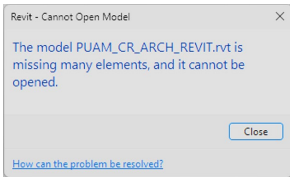

DELIVERY TYPE
CMGC



**MODEL AS THE
LEGAL DOCUMENT**



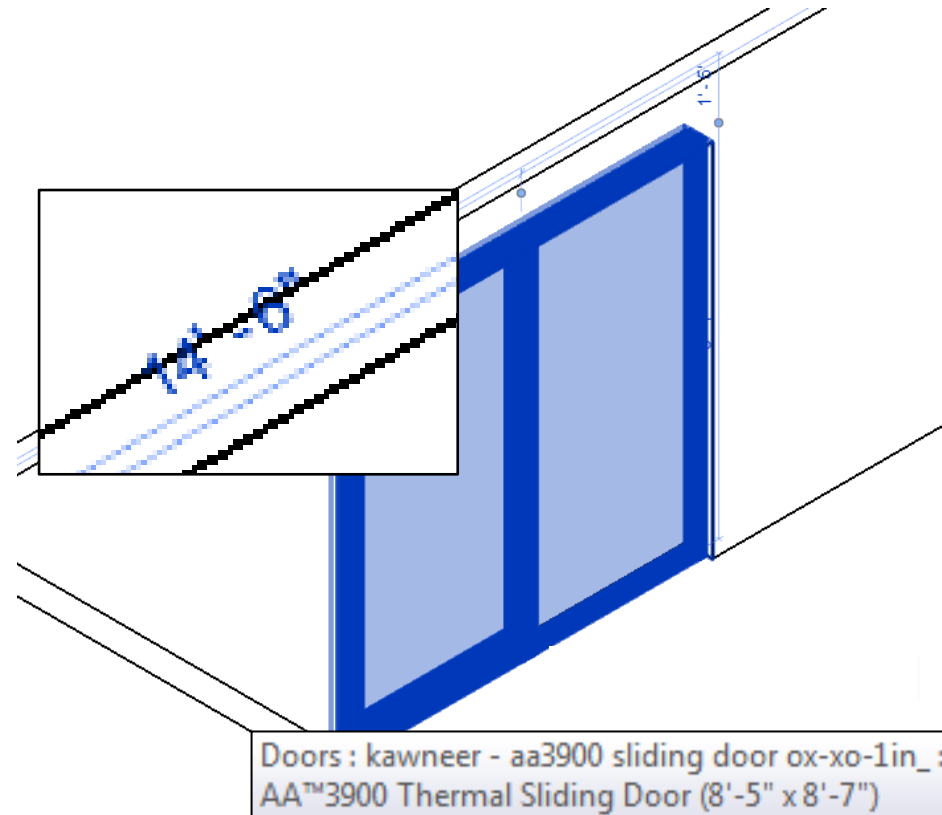
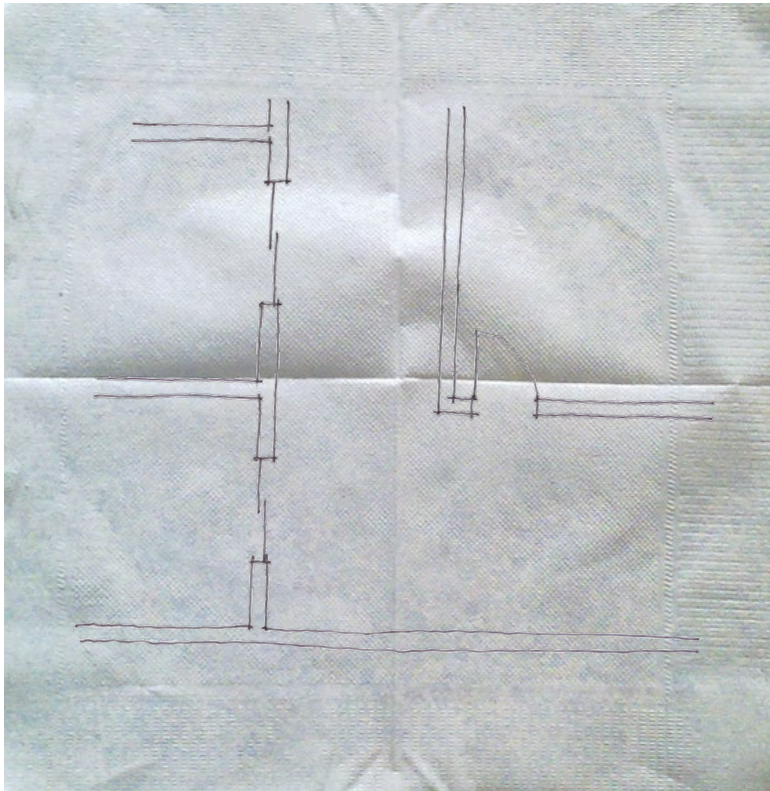
Catalog of Challenges

<p>Challenge</p>		
<p>Intended Content Not everything in a model should be considered reliable What to model, how much to model and when to model is not clear</p>		
<p>Competition of Sources Competition between Model and PDF</p>		
<p>Moving Targets Which model version should I use? Navigating Work in Progress vs Milestone Models</p>		
<p>In-transparent Transfers</p> <ul style="list-style-type: none"> - Configuration issues - Technical issues - Auditability 		
<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose?</p>		

Model vs Drawing

Visual cues about state of development

BIMs often carry unintended information



Response?

The Disclaimer:

This model looks great so you can look at it but you can't use it for anything or rely on it for anything which includes, but is not limited to, everything.

If you use it for anything anyway then you have to pay my lawyers anything they want if I get sued for anything related to your use of the model for anything.

Have a nice day.

Response?

Disclaimer Approach:

Some of the information is not reliable *so don't rely on any of it.*

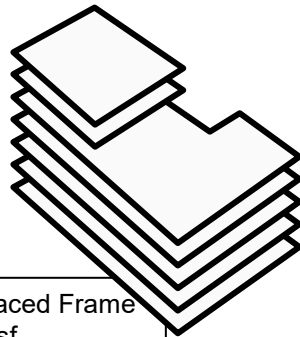
Specified-Use Approach:

Some of the information is not reliable *so only rely on*

- *what I say you can,*
- *for the purposes I say you can,*
- *to the degree of precision I say you can.*

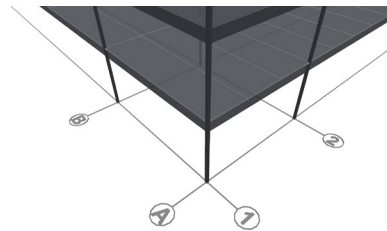
LOD Schema

Conceptual



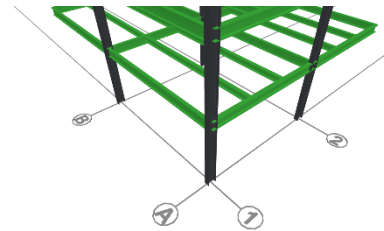
LOD 100

Generic
Placeholders



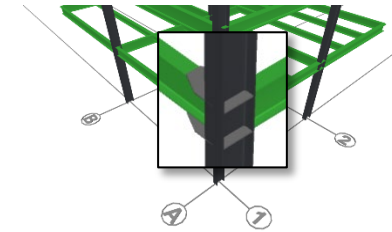
LOD 200

Measurable
Assemblies



LOD 300

Details



LOD 400



Level of *Development* vs. Level of *Detail*

Level of Detail – **Quantity** of detail

Level of Development – **Reliability** of detail

Level of **Detail**

- Looks like specific steel shapes
- Location can be measured precisely

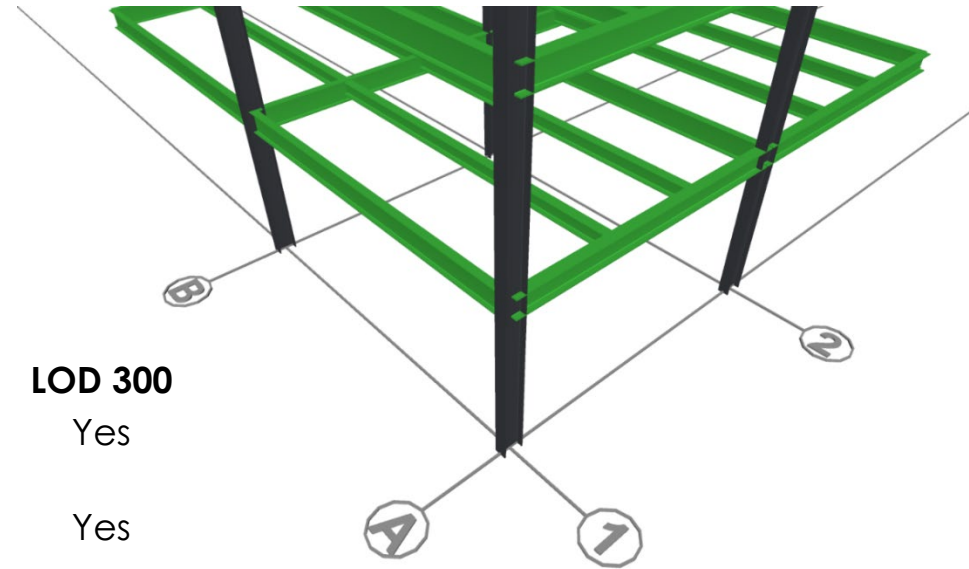
Level of **Development**

- Have the shapes been engineered?
- Are they in the final locations?

	LOD 200	LOD 300
--	---------	---------

• Have the shapes been engineered?	No	Yes
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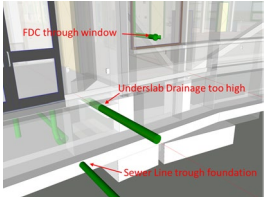
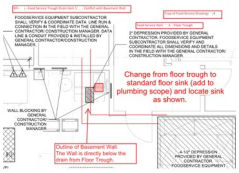
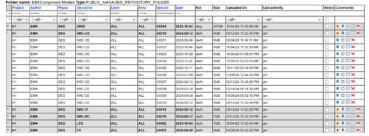
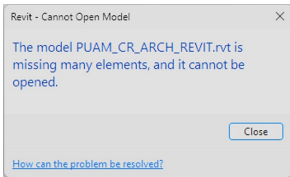

• Are they in the final locations?	No	Yes
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Model Development Spec

Milestones/Deliverables																																	
Building Systems																																	
Level of Development																																	
Model Element																																	
Author																																	
Uniformat Level	Date									Date		Date		Date		Date		Date		Date		Date		Date		Date		Date		Date			
	Conceptual									SD						DD						CD											
	1	2								50%	100%	100%	50%	100%	100%	50%	100%	100%	50%	100%	100%	50%	100%	100%	50%	100%	100%	50%	100%	100%			
	Level	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes		
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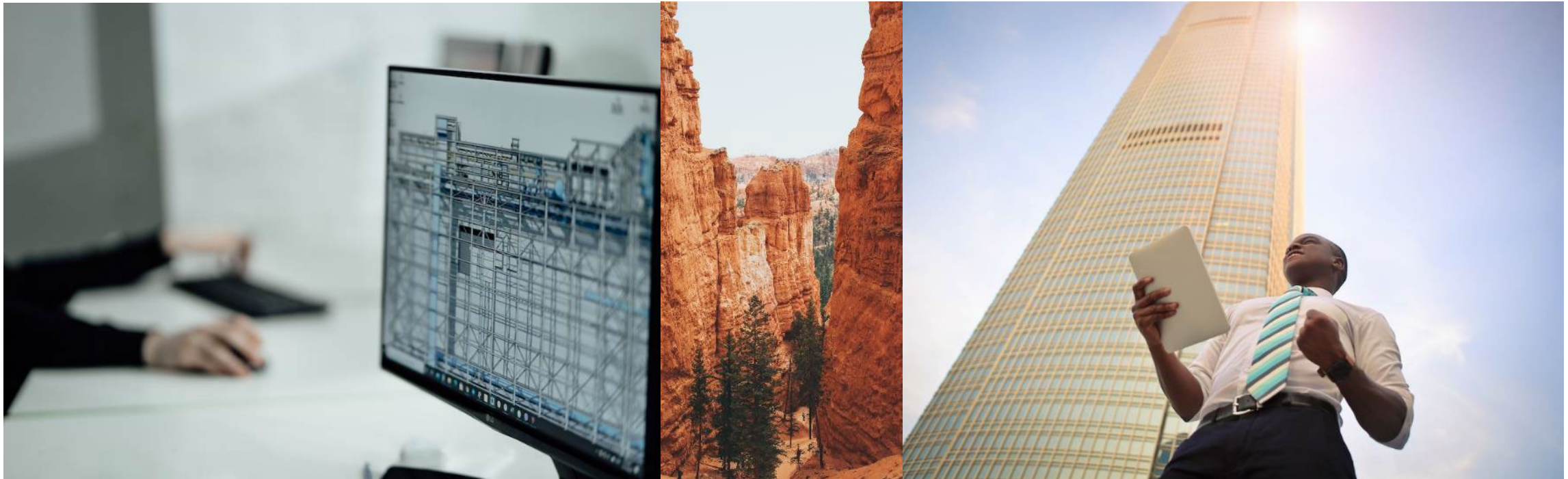
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<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose?</p>		

Knowledge divide

Practitioners
understand modeling

Decision-makers
understand business issues



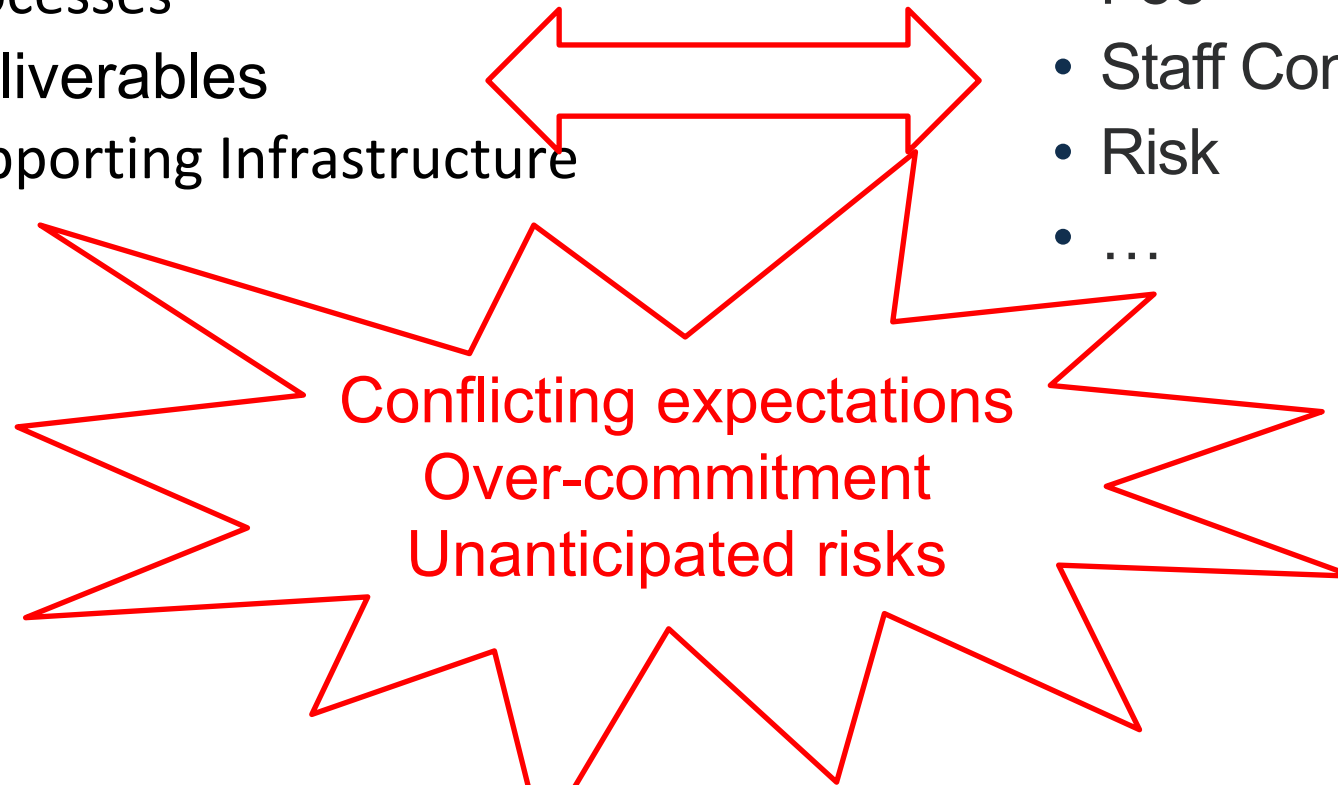
Knowledge divide

Practitioners
understand modeling

- Processes
- Deliverables
- Supporting Infrastructure
- ...

Decision-makers
understand business issues

- Fee
- Staff Commitment
- Risk
- ...



BIM Exhibits

ConsensusDocs® 301
BUILDING INFORMATION MODELING (BIM) ADDENDUM
 TABLE OF ARTICLES

1. GENERAL PRINCIPLES
2. DEFINITIONS
3. BIM MANAGER
4. BIM EXECUTION PLAN
5. RISK ALLOCATION
6. MODEL INTELLECTUAL PROPERTY RIGHTS

ARTICLE 1 GENERAL PRINCIPLES

1.1 This Addendum identifies rights and responsibilities of Project Participants related to the use of BIM on this Project. It is not intended to create privity of contract among any Project Participants beyond that which otherwise exists at law or by the terms of the Governing Contracts or Affiliated Contracts.

1.2 This Addendum and its Exhibits shall be appended to or incorporated by reference in the Governing Contracts and all Affiliated Contracts of Contributors, as well as any contracts of others having rights or obligations under this Addendum, as needed.

1.3 Nothing in this Addendum shall relieve the Design Professional from any design obligations under its Governing Contract, including responsibility for its Contributions to comply with applicable codes, regulations, or laws. No Contributor may require the Design Professional to provide designs inconsistent with these obligations or may modify another Contributor's Contribution without that Contributor's consent.

1.4 Nothing in this Addendum shall diminish or expand the extent to which, under applicable law, Owner confirms or warrants the adequacy, sufficiency, or both of any Model.

1.5 Except to the extent required under the Constructor's Governing Contract, Constructor's and its Subcontractors' and Suppliers' Contributions or participation in modeling activities shall not constitute the performance of design services.

1.6 If any Project Participant becomes aware of a discrepancy between a Model and another Model or Contract Document, that Project Participant shall promptly notify the other affected Model Contributors and the BIM Manager.

1.7 Except as expressly provided in this Addendum, this Addendum shall take precedence over any conflicting or inconsistent Governing Contract or Affiliated Contract terms.

ARTICLE 2 DEFINITIONS

2.1 Capitalized terms not otherwise defined in this Addendum shall have definitions as set forth in the most current edition at the time of execution to the Governing Contract of the ConsensusDocs 200 Standard Agreement and General Conditions between Owner and Constructor.

2.2 "4D" means integrating time or schedule information, including phase planning modeling into a Model.

1

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ConsensusDocs 301

DBIA Contract Document #E-BIMWD

Building Information Modeling Exhibit

SAMPLE

Document No. E-BIMWD
 Second Edition, 2010
 © Design-Build Institute of America
 Washington, D.C.



DBIA E-BIMWD

DRAFT AIA® Document E201® - 2022
BIM Exhibit for Sharing Models with Project Participants, where Model Versions may be Enumerated as a Contract Document

This Exhibit dated the day of in the year is incorporated into the agreement (the "Agreement") between the Parties for the following Project:
(Name and location or address of the Project)

 2022 BIM Docs

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. MODEL USES, SHARING, AND RELIANCE
3. BIM EXECUTION PLAN
4. LEVELS OF DEVELOPMENT
5. NON-BIM DIGITAL DATA
6. OWNERSHIP, SHARING, AND SECURITY OF DIGITAL DATA
7. INSURANCE FOR BIM AND DIGITAL DATA RISKS
8. OTHER TERMS AND CONDITIONS

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 This Exhibit establishes the terms and protocols governing reliance upon, and the ownership, development, uses, transmission, and sharing of, Building Information Models and other Digital Data for the Project.

§ 1.2 Definitions

§ 1.2.1 Agreement. Agreement is the agreement into which this Exhibit is incorporated.

§ 1.2.2 BIM Execution Plan. A BIM Execution Plan is a written plan detailing the development and use of, and protocols related to, Project Models and setting forth each of the Project Participants' responsibilities related thereto.

§ 1.2.3 Building Information Model or Model. A Building Information Model (BIM), or Model is a digital representation of the Project or a subset of the Project. A Model is a collection of one or more Model Portions, each of which is an assemblage of Model Elements.

§ 1.2.3.1 Model Portion or Portion. A Model Portion, or Portion, is a subset of a Model as designated in Table 2.4 of this Exhibit. The Parties may designate a Model Portion by discipline, trade, area, location, phase, or other mutually agreeable distinction.

§ 1.2.3.2 Model Author or Author. A Model Author, or Author, is the Project Participant responsible for developing a Model Portion.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA Standard Form. An Additions and Deletions Report that notes added information as well as revisions to the Standard Form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

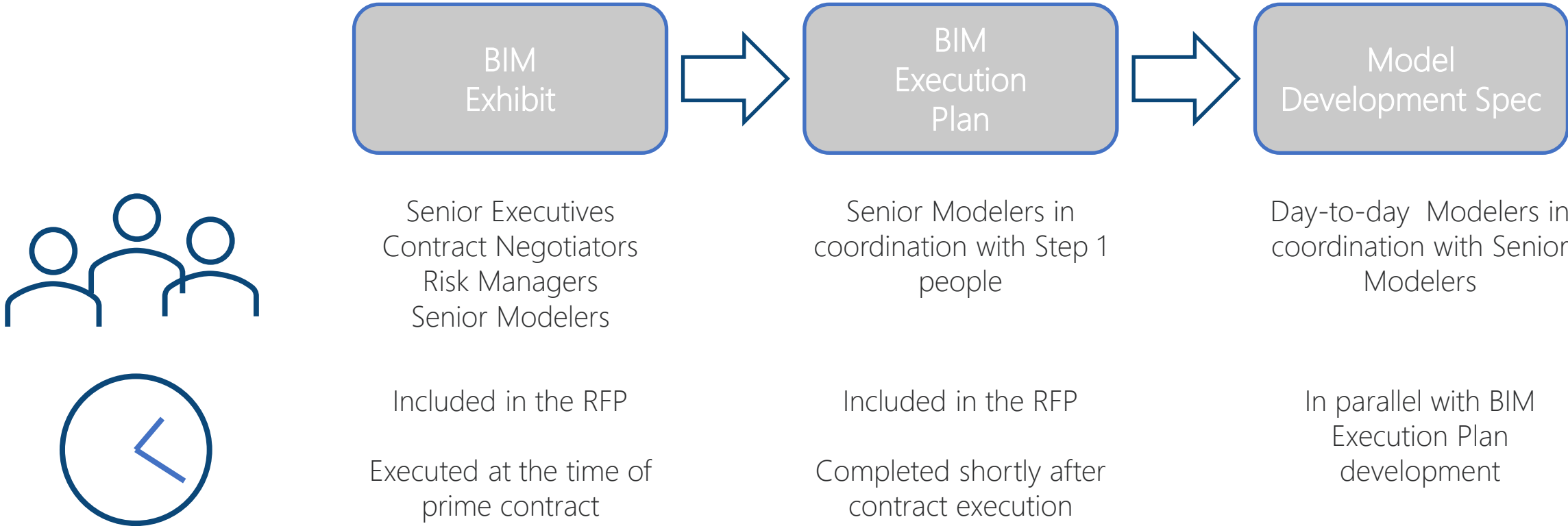
This document is intended to be incorporated into an agreement between the Parties.

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AIA E201 – 2022

Developing the BIM Contract



ConsensusDocs 301

ConsensusDocs® 301

BUILDING INFORMATION MODELING (BIM) ADDENDUM

TABLE OF ARTICLES

1. GENERAL PRINCIPLES
2. DEFINITIONS
3. BIM MANAGER
4. BIM EXECUTION PLAN
5. RISK ALLOCATION
6. MODEL INTELLECTUAL PROPERTY RIGHTS

ARTICLE 1 GENERAL PRINCIPLES

1.1 This Addendum identifies rights and responsibilities of Project Participants related to the use of BIM on this Project. It is not intended to create privity of contract among any Project Participants beyond that which otherwise exists at law or by the terms of the Governing Contracts or Affiliated Contracts.

1.2 This Addendum and its Exhibits shall be appended to or incorporated by reference in the Governing Contracts and all Affiliated Contracts of Contributors, as well as any contracts of others having rights or obligations under this Addendum, as needed.

1.3 Nothing in this Addendum shall relieve the Design Professional from any design obligations under its Governing Contract, including responsibility for its Contributions to comply with applicable codes, regulations, or laws. No Contributor may require the Design Professional to provide designs inconsistent with these obligations or may modify another Contributor's Contribution without that Contributor's consent.

1.4 Nothing in this Addendum shall diminish or expand the extent to which, under applicable law, Owner confirms or warrants the adequacy, sufficiency, or both of any Model.

1.5 Except to the extent required under the Constructor's Governing Contract, Constructor's and its Subcontractors' and Suppliers' Contributions or participation in modeling activities shall not constitute the performance of design services.

1.6 If any Project Participant becomes aware of a discrepancy between a Model and another Model or Contract Document, that Project Participant shall promptly notify the other affected Model Contributors and the BIM Manager.

1.7 Except as expressly provided in this Addendum, this Addendum shall take precedence over any conflicting or inconsistent Governing Contract or Affiliated Contract terms.

ARTICLE 2 DEFINITIONS

2.1 Capitalized terms not otherwise defined in this Addendum shall have definitions as set forth in the most current edition at the time of execution to the Governing Contract of the ConsensusDocs 200 Standard Agreement and General Conditions between Owner and Constructor.

2.2 "4D" means integrating time or schedule information, including phase planning modeling into a Model.



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1.7 Except as expressly provided in this Addendum, this Addendum shall take precedence over any conflicting or inconsistent Governing Contract or Affiliated Contract terms.

2.12 "Contract Documents" is as defined in a Governing Contract, but is hereby modified to include the Full Design Model, this Addendum, as modified and agreed to by the parties, and the BIM Execution Plan adopted by the parties pursuant to this Agreement.

4.3 MODEL USES AND DELIVERABLES The BIM Execution Plan shall address, at a minimum, the following Model Uses and deliverables:

4.3.1 Identify and prioritize desired goals and objectives for BIM;

4.3.2 Maximize structure lifecycle best value and develop a list of Model Uses; and

4.3.3 Determine required Geometric modeling, related deliverables, process and Model deliverable requirements, including:

4.3.3.1 Identify by Model Phase the Models needed to achieve each Model Use;

4.3.3.2 Identify the parties responsible for each Model deliverable;

4.3.3.3 Determine which Models will be Contract Documents;

4.3.3.4 Create a schedule for Model deliverables, including dates for completion of Model Phases and interim coordination milestones within Model Phases, as necessary; and

4.3.3.5 Determine a process to preserve versions of each Federated Model and its constituent Models, and scheduling for such process.



ConsensusDocs 301

ConsensusDocs® 301

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5.5 To the extent that any Design Models are included as Contract Documents under the BIM Execution Plan adopted for the Project or otherwise in this Addendum, Project Participants may rely upon the accuracy of information in those Design Models; provided, however, the selection in § 4.6.9 shall control a Project Participant's right to rely on the Dimensional Accuracy of a Contribution, Model, or Model Elements.

4.6.9 DIMENSIONAL ACCURACY A Contribution of or to a Model shall be:

- dimensionally accurate and take precedence over the dimensions called out in the Drawings or inferred from the Drawings; details and components that are not represented in a Contribution to a Model must be retrieved from the Drawings; or
- accurate to the extent the LOD specified in the BIM Execution Plan requires dimensions to be accurate, and all other dimensions must be retrieved from the Drawings; or
- not dimensionally accurate; the Model can be used for reference only and all dimensions must be retrieved from the Drawings; or
- Other (*specify*): []



AIA E201 – 2022

DRAFT AIA® Document E201 – 2022
BIM Exhibit for Sharing Models with Project Participants, where Model Versions may be enumerated as a Contract Document

This Exhibit dated the **« »** day of **« »** in the year **« »** is incorporated into the agreement (the "Agreement") between the Parties for the following Project:
(Name and location or address of the Project)

«2022 BIM Docs»
« »

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§ 1.2.3.2 Model Author or Author. A Model Author, or Author, is the Project Participant responsible for developing a Model Portion.

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BIM Exhibit for Sharing Models with Project Participants, where Model Versions may be enumerated as a Contract Document

Important Concepts

- Model Version
- Model Portion
- Model Uses
- Model Sharing



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Model Version

Model Version. A Model Version is a specific edition of a Model or Model Portion that is sufficiently identifiable as unique and unchanged as of the time it is saved by its Author.

TPTL157_ARC_OOO_T17_2022-12-08-1238

REVISION	DATE	DESCRIPTION
06.05.17	BUILDING PERMIT SUBMITTAL	
1	10.20.17	PLAN CHECK #1
2	12.15.17	PLAN CHECK #2
3	02.23.18	PLAN CHECK #3
4	04.05.18	PLAN CHECK #4
5	09.26.18	REVISION #5
	10.15.18	CONSTRUCTION SET
7	11.20.20	REVISION#7
	ASI 046 - 08.18.2022	

Name	Date modified	Size
TPTL157_ARC_OOO_T17_TYP.rvt	8/12/2022 12:38 AM	23,256 KB
TPTL157_ARC_OOO_SITE-B_T17_10_TYP.rvt	1/3/2022 8:52 PM	24,688 KB
schema	1/3/2022 8:32 PM	1 KB
TPTL157_MEP_JRP_SITE-B_T17_TYP_SBI_Edite...	1/3/2022 8:27 PM	52,576 KB
TPTL157_MEP_JRP_SITE-B_T17_TYP.rvt	1/3/2022 8:17 PM	54,472 KB
TPTL157_MEP_JRP_SITE-B_T18_TYP.rvt	1/3/2022 8:15 PM	72,312 KB
TPTL157_STR_SHK_SITE-B_T17.rvt	12/14/2021 9:04 PM	13,816 KB
TPTL157_MEP_JRP_SITE-B_T17_TYP_SBI_Edite...	1/3/2022 8:33 PM	
Revit_temp	1/3/2022 8:30 PM	
TPTL157_MEP_JRP_SITE-B_T17_TYP_backup	1/3/2022 8:18 PM	
TPTL157_MEP_JRP_SITE-B_T18_TYP_backup	1/3/2022 8:15 PM	

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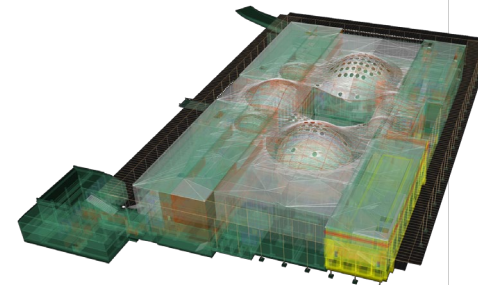
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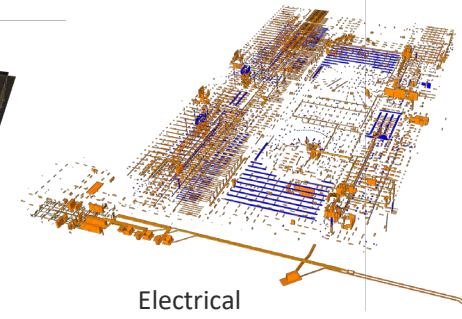
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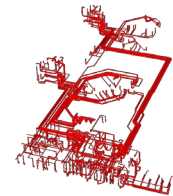
Model Portion



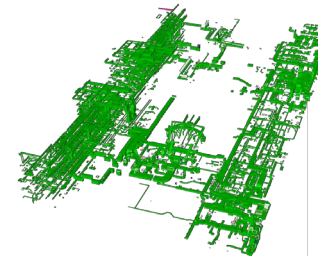
Architectural/Structural



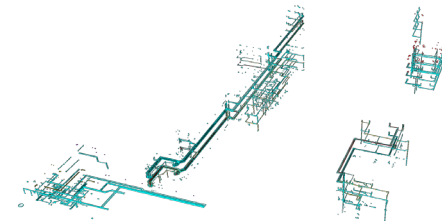
Electrical



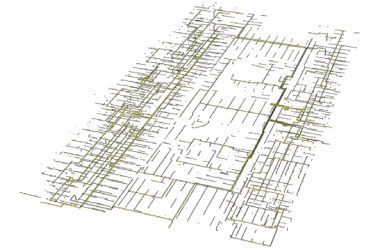
Life Support



Mechanical



Plumbing



Fire Protection



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Model Uses

§ 2.2 Model Uses

§ 2.2.1 The Project Participants shall develop Models on the Project for the following uses:
(Check all of the boxes for Model Uses that may apply on the Project and describe the selected uses.)

[« »] § 2.2.1.1 **Planning** (Examples include programming, site analysis, energy analysis, scheduling, cost and quantity estimating, and documentation of existing conditions):

[« »] § 2.2.1.2 **Design** (Examples include design authoring, design review, 3D coordination, structural analysis, lighting analysis, energy analysis, site utilization, and engineering analysis):

[« »] § 2.2.1.3 **Construction Management** (Examples include preconstruction activities, scheduling, cost estimating, value engineering, and constructability):

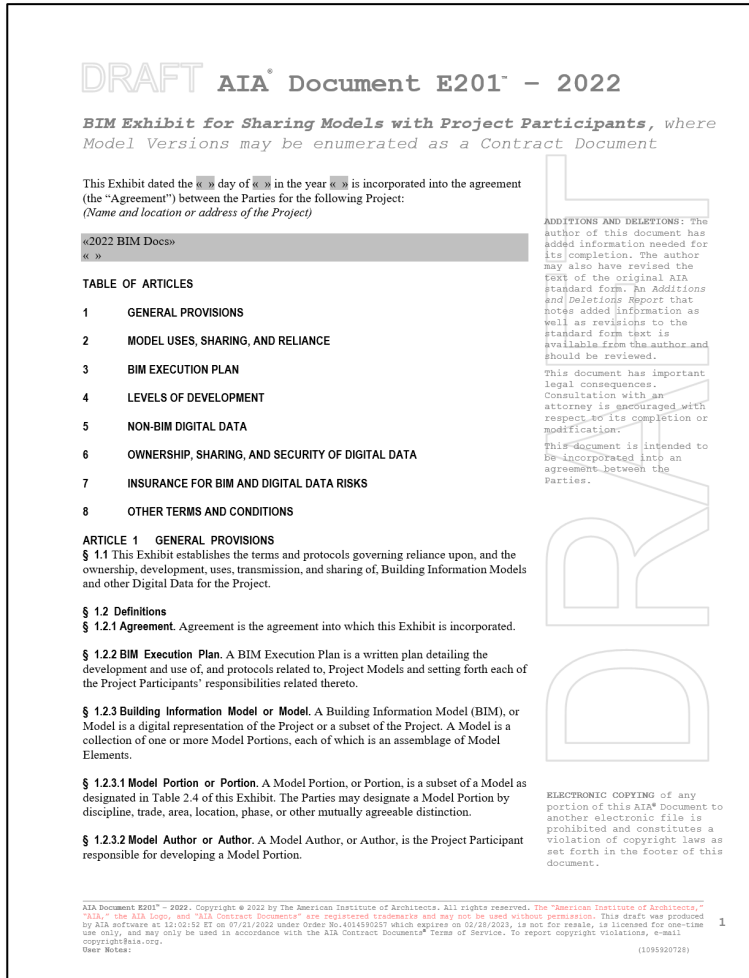
[« »] § 2.2.1.4 **Construction** (Examples include construction system design, procurement, fabrication, 3D control and planning, and record modeling):

[« »] § 2.2.1.5 **Post Construction** (Examples include building system maintenance, building system analysis, asset management, space management and tracking, disaster planning, and record modeling):

[« »] § 2.2.1.6 **Other:**



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Model Sharing

- **Tier 1:** No authorized sharing – any reliance is at the user’s sole risk.
- **Tier 2:** May be shared among all project participants subject to specified authorization and reliance provisions but may **not** be enumerated as a contract document.
- **Tier 3:** May be shared among all project participants subject to specified authorization and reliance provisions and **may be enumerated as a contract document.**

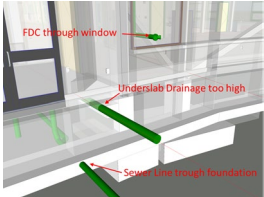
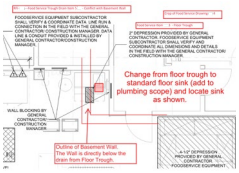
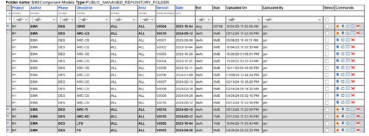
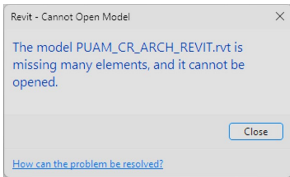

Model Portion	Model Author	Sharing Tier		
		Tier One	Tier Two	Tier Three
<i>(List each Model Portion, designated by discipline, trade, area, location, phase, or other description)</i>	<i>(List the Model Author for each Model Portion)</i>	<i>(Designate a single Sharing Tier for each Model Portion)</i>		

§ 2.4.1 Default Sharing Protocols

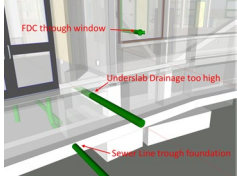

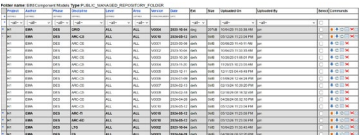
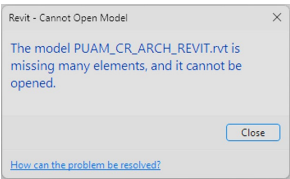

§ 2.4.1.1 The Parties agree that any portion of a Model not included in Table 2.4, or any Model Portion that is not designated with a Sharing Tier, shall be Tier One.

§ 2.4.1.2 The Parties agree that there shall be no reliance on a Portion until a Version is issued pursuant to Section 2.5. The Parties further agree that, prior to the development of a BIM Execution Plan, the Sharing Tier for any Model Portion shall be Tier One.

Catalog of Challenges

<p>Challenge</p>		
<p>Intended Content Not everything in a model should be considered reliable What to model, how much to model and when to model is not clear</p>		
<p>Competition of Sources Competition between Model and PDF</p>		
<p>Moving Targets Which model version should I use? Navigating Work in Progress vs Milestone Models</p>		
<p>In-transparent Transfers</p> <ul style="list-style-type: none"> - Configuration issues - Technical issues - Auditability 		
<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose?</p>		

Catalog of Challenges and Solutions

Challenge	Solutions	
<p>Intended Content Not everything in a model should be considered reliable What to model, how much to model and when to model is not clear</p>	<ul style="list-style-type: none"> - Project BIM Requirements - BIM Execution Plan and Model Element Table - LOD Specification 	
<p>Competition of Sources Competition between Model and PDF Between requirements and deliverables</p>	<ul style="list-style-type: none"> - Contract Language and Standards - BIM Execution Plan 	
<p>Moving Targets Which model version should I use? Navigating Work in Progress vs Milestone Models</p>	<ul style="list-style-type: none"> - ISO 19650, NBIMS, In-house Standards - BIM Execution Plan - Common Data Environment CDE 	
<p>In-transparent Transfers</p> <ul style="list-style-type: none"> - Configuration issues - Technical issues - Auditability 	<ul style="list-style-type: none"> - Open standards - IFC+ - COBie - Joint model reviews - Validate deliverables - Use of proven, tested software 	
<p>BIM Literacy Do I understand what I am sending and receiving? Do I know what is required for what purpose</p>	<ul style="list-style-type: none"> - Get started - Exposure - Training - Follow consistent approach 	

Call to Action

- Check out and use Open Standards and Model Contracts
- Join NIBS Digital Technology Council
 - MALD Interest Group?
 - Future Workshop?
 - Project Needs Statement
 - Email – rgrant@nibs.org