

MP2721-R: Volumetric Modeling for Your BIM Workflow

Ryan Baker Cameron, AIA, LEED AP, EDAC, NCARB
Architect

Birgitta Foster
Director of Facilities Integration, ACAI Technologies
(Former Assisting Director, buildingSMART alliance)

Class summary

- In this roundtable session, you learn about generating a powerful data-oriented volume model for **Building Information Modeling (BIM) guidelines**. The session will follow a portion of a well-known national **BIM guideline** and discuss with the group the steps to develop a model. As the model evolves, the design authoring/volumetric model grows to include building function and occupancy; building location and envelope construction components, including R-values, SHG coefficient, color and other information.
- In this roundtable, we will discuss uses for the beginning stages of the **volumetric model** to support early decision making for a building's position and orientation to gauge the overall look. Attendees are asked to come prepared with basic knowledge of **COBie, NBIMS, BIM Execution Plans** and advanced knowledge of **Revit**. Including this portion of BIM into your current workflow is necessary to ensure **National Standards compliance** for projects of all types.

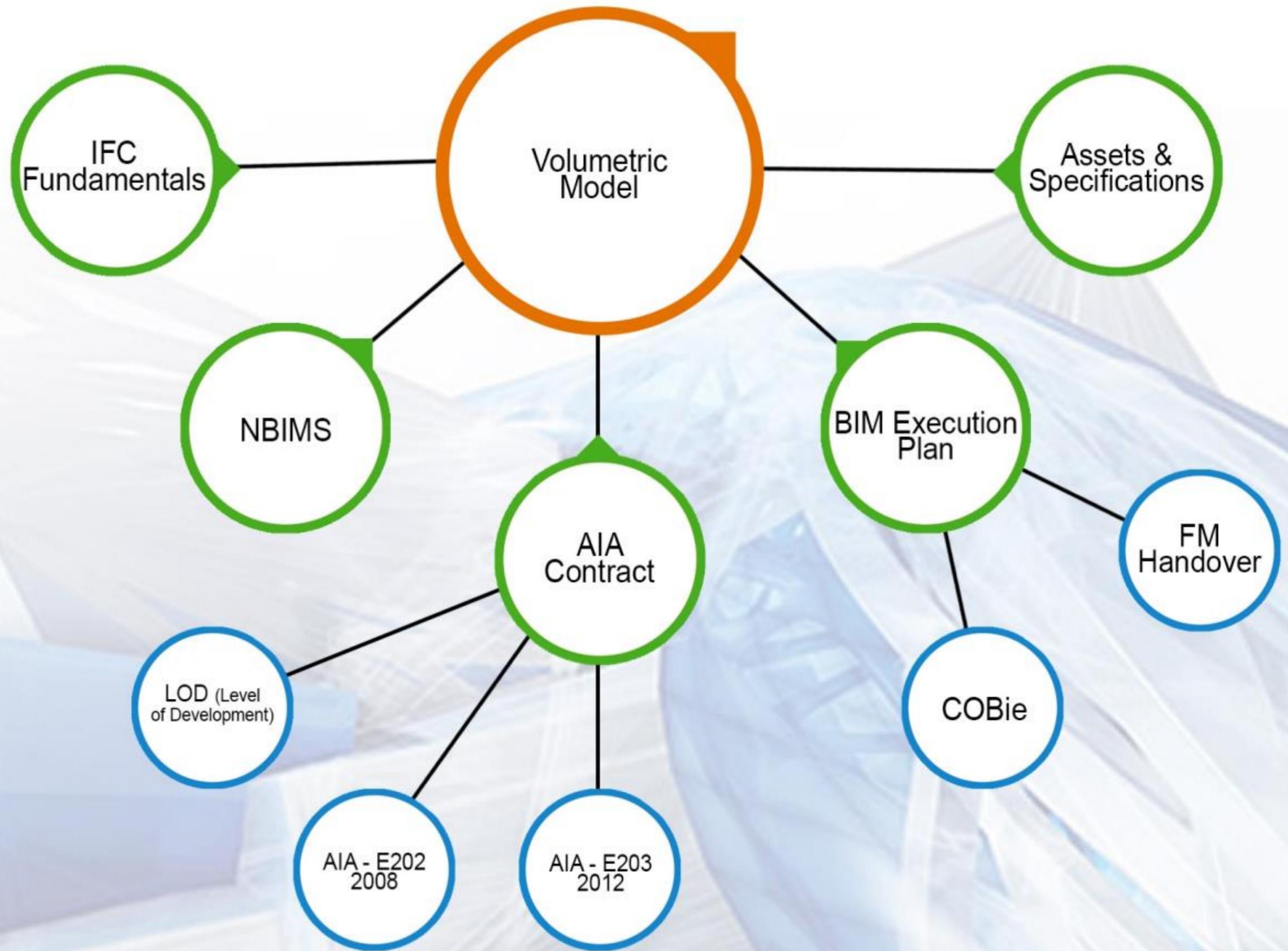
Opening Statements

- I originally submitted this roundtable, not because of expertise on the subject, but because it appears that there are still a lot of unknowns as far as BEP, COBie, NBIMS, AIA E202/203 and FM handover. It is hard for one individual (BIM manager, Project Architect, etc...) to know everything about everything. I will be demonstrating the key learning objectives described as well as issues mentioned in the class description as well.
- **This roundtable was really built for YOU, the attendees. My team can prepare all we want, but in the end it solely depends on the people around the table to participate and share ideas. So please feel free to independently share questions and concerns.**
- If you are looking for an actual application of Volumetric Modeling using IFC, COBie or LOD, we recommend attending **AB2947 – Applying Open Standards and LOD to BIM by James Vandezande on Wednesday, Dec. 4th, 2:30-3:30PM.**

Key learning objectives

At the end of this class, you will be able to:

- Learn new skills in developing pre-proposal solutions that adapt to constantly changing BIM Guidelines
- Create volumetric Revit models to assess design data that drives critical functions in a building
- Enhance your company's workflow to include volumetric modeling in the process
- Learn why volumetric modeling will help create a better BIM project



Section 1: Covering the basics

Learning new skills and adapting to guidelines

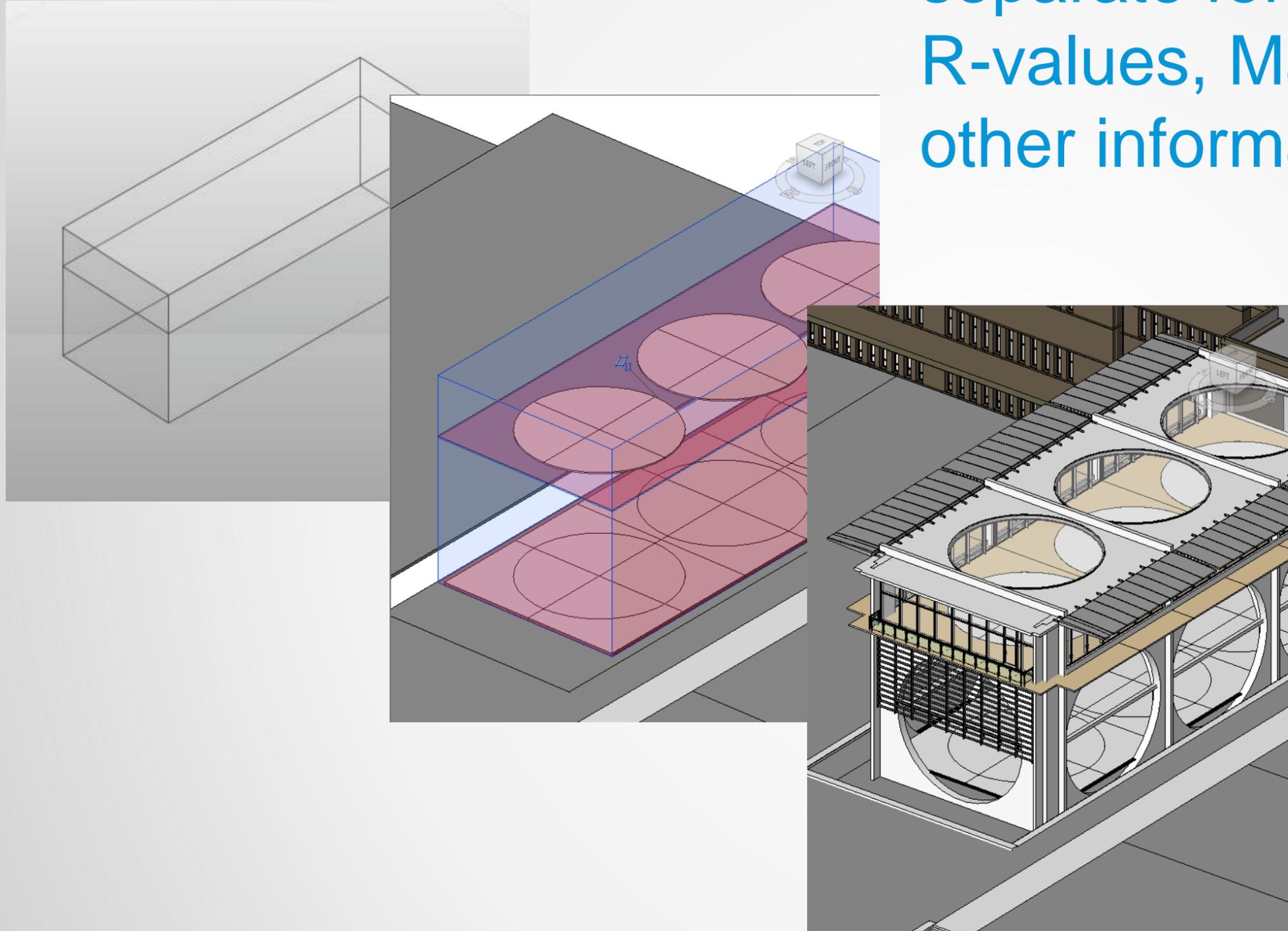
Review of a project to show steps taken to adapt to guidelines.
What is the immediate information we could utilize to help contribute to the project down the road?

- Sq. Ft. Takeoff (Schematic)
- Thermal properties (to identify performance requirements by energy code for example)
- Volume

So before you get to this amount of detail,
we have to start at this low detail model.



Keeping a mass model family separate for quick extraction of SF, R-values, Material information and other information

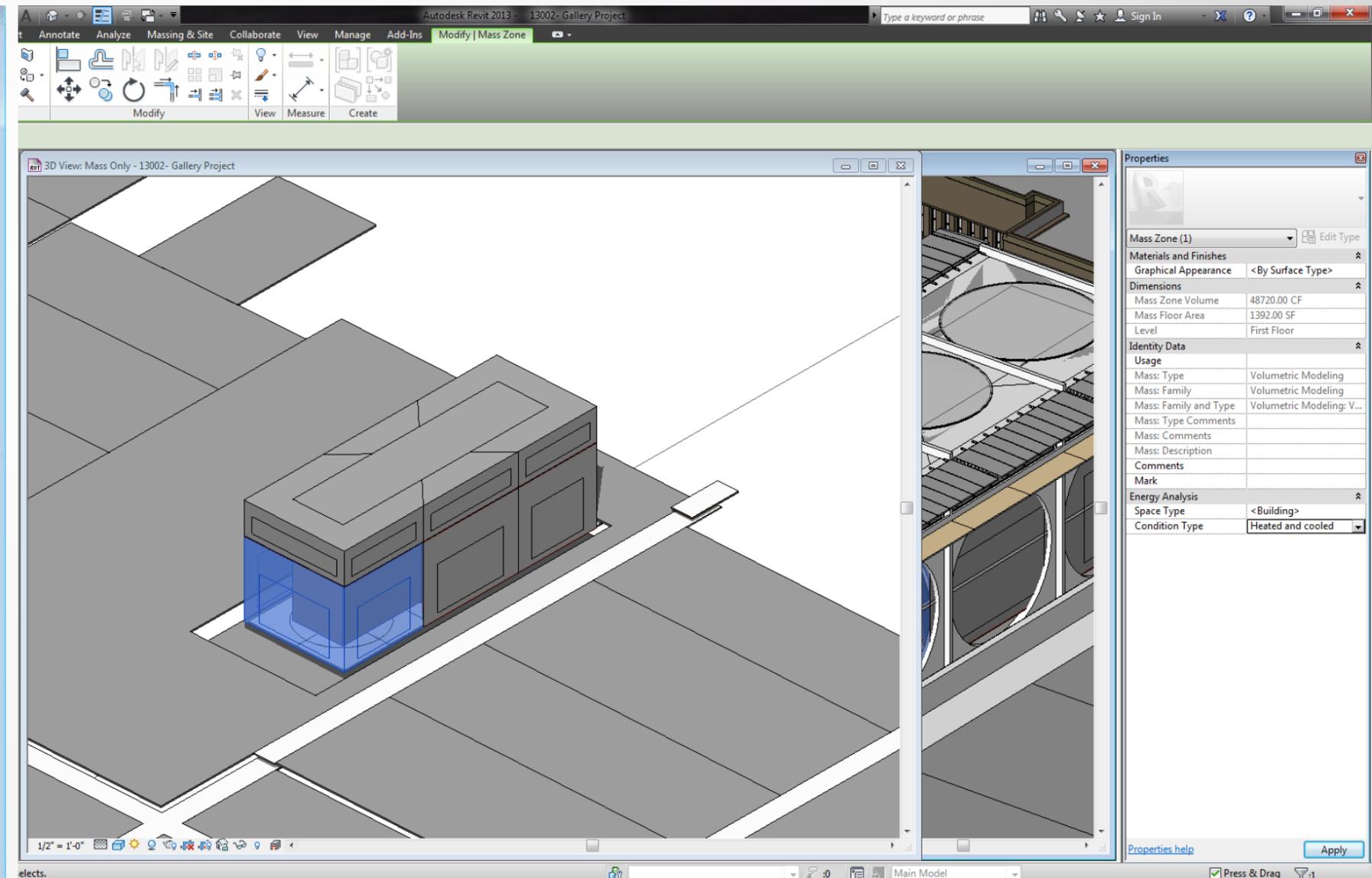
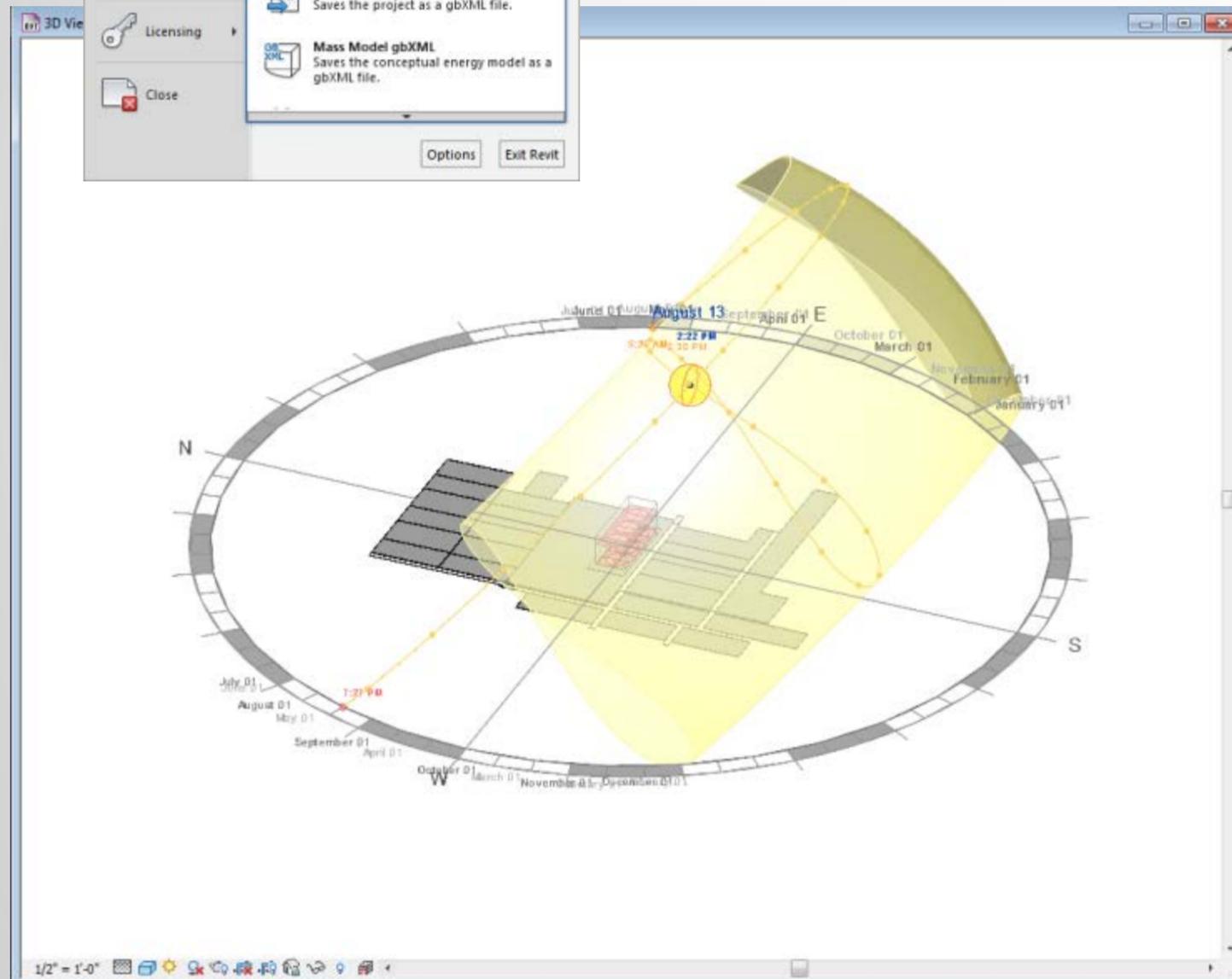
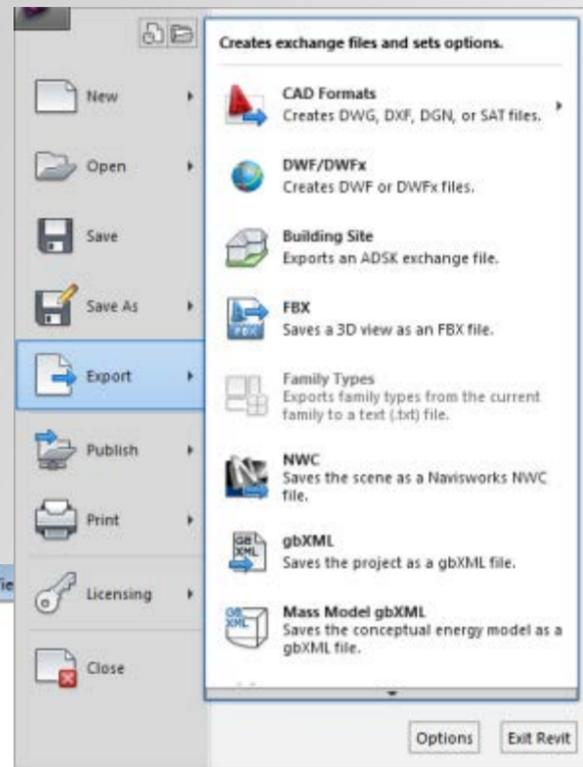


Arch & Owner

MEP

Volumetric Modeling	
Mass (1)	Edit Type
Constraints	
Offset	0' 0"
Work Plane	Level : First Floor
Dimensions	
Mass Floors	Edit...
Gross Floor Area	12288.00 SF
Gross Surface Area	29888.00 SF
Gross Volume	307200.00 CF
Identity Data	
Comments	
Mark	
Phasing	
Phase Created	New Construction
Phase Demolished	None
Other	
Schedule Level	First Floor

Now that we have our basic model, we can orient the building by site or by solar angle and export a gbXML file which creates our volumetric model with zones.



Material Editor



Name	Aspect
Glass	Graphics
Reflective - Coated	Appearance
Glass - Low E Coated	Thermal

Thermal Properties

▼ Information

Name: Glass - Low E Coated
 Description: Low E coated glass
 Keywords: clear,thermal,solid
 Type: Solid
 Subclass: Glass
 Source:
 Source URL:

▼ Properties

Transmits Light

Behavior: Isotropic

Thermal Conductivity: 0.5778 btu/(hr-ft.°F)

Specific Heat: 0.1799 btu/(lb.°F)

Density: 143.58 pound per cubic foot

Emissivity: 0.84

Permeability: 0.0000 grain/(ft²·hr-inHg)

Porosity: 0.00

Reflectivity: 0.00

Electrical Resistivity: 1.0000E+10 Ω·m

Custom Parameters Done

Asset Browser

coa

Autodesk Physical Assets

Search results for "coa"

Autodesk Ph...	Asset Name	Aspect
► Solid		
	Glass - Low E Bronze	Thermal
	Glass - Low E Coated	Thermal



REScheck-Web - 2009 IECC - Google Chrome

https://energycode.pnl.gov/REScheckWeb/index.html

REScheck-Web™

Project title: 2009 IECC

Email Address: Password: Log In

Register | Forgotten Password?

New Project

PROJECT ENVELOPE MECHANICAL REQUIREMENTS

Reports

Row: Edit Duplicate Move Up Move Down Delete

Orientation - Front Faces: West

Glazing Requirements

Add: Ceiling Skylight Wall Window Door Basement Floor Crawl

	Component	Assembly	Gross Area	Orientation	Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC
1	Wall	Wood Frame, 16in. o.c.	9000 ft ²	Right Side	19	19	0.027	
2	Window	Wood Frame, 2 Pane w/ Low-E	200 ft ²	Right Side			0.48	0.4
3	Wall	Solid Concrete or Masonry w/ Interior Insul	9000 ft ²	Front	19	19	0.028	
4	Wall	Wood Frame, 16in. o.c.	9000 ft ²	Left Side	19	19	0.027	
5	Wall	Wood Frame, 16in. o.c.	9000 ft ²	Back	19	19	0.027	
6	Floor	All-Wood Joist/Truss Over Uncond. Space	2800 ft ²		0	0	0.249	
7	Ceiling	Flat or Scissor Truss	2800 ft ²		30	30	0.017	

Passes: Compliance based on performance alternative 34.1%

Compliance Method: Performance Alternative +34.1% Explanation of results...

Has anyone used this process before and is it helpful?

How are other disciplines (including architecture) capturing exterior square footages for examining walls to input into the web-based software?

DIAGRAM

BEP (BIM Exec. Plan) How are we organized to take on this level of responsibility?

How are we organized to take on this level of responsibility?

DIAGRAM

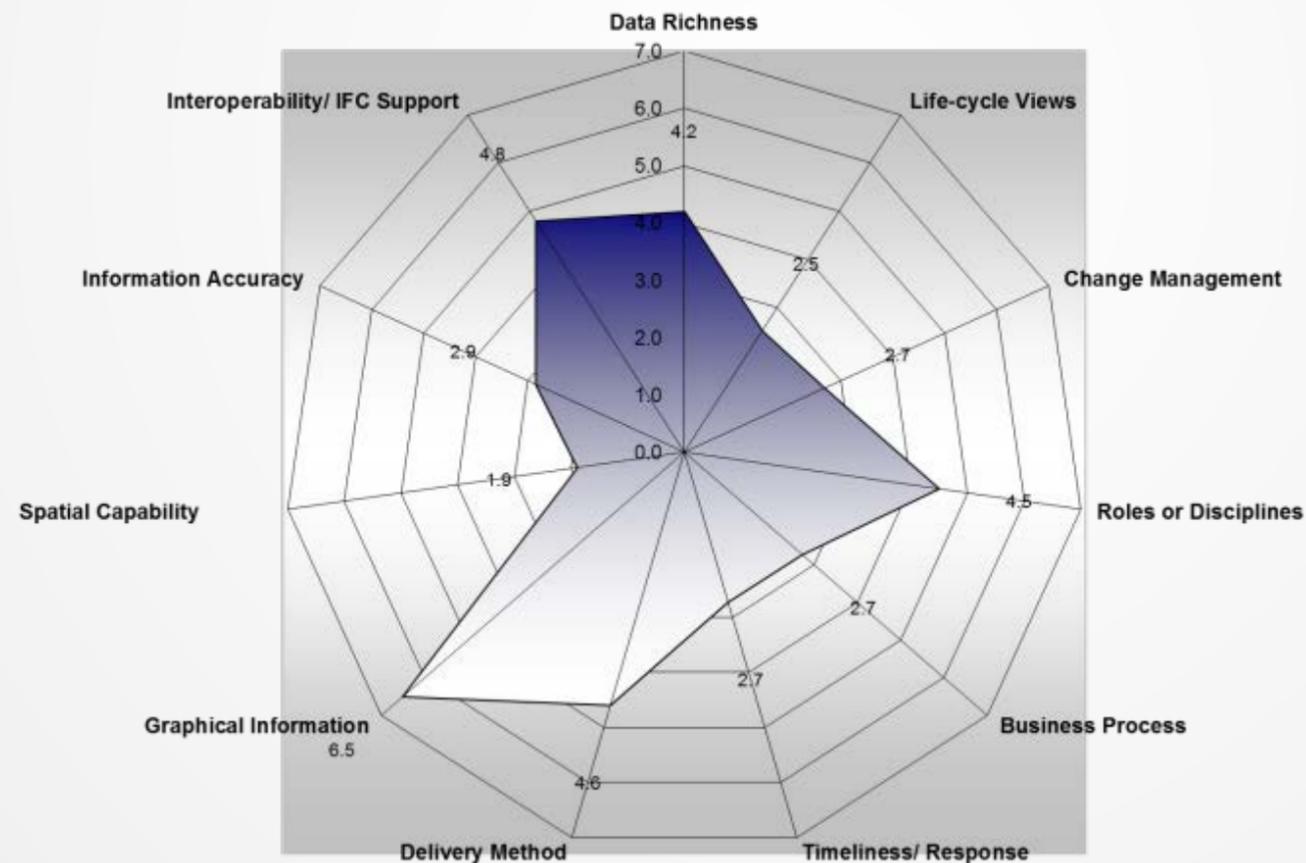
Where is everyone at on completing and following through on an AIA E202/208 agreement?

Are there any tips your team learned to avoid when signing that agreement?

DIAGRAM

Are there any special processes, charts or workflows that people are using to help aid in the delivery of their models?

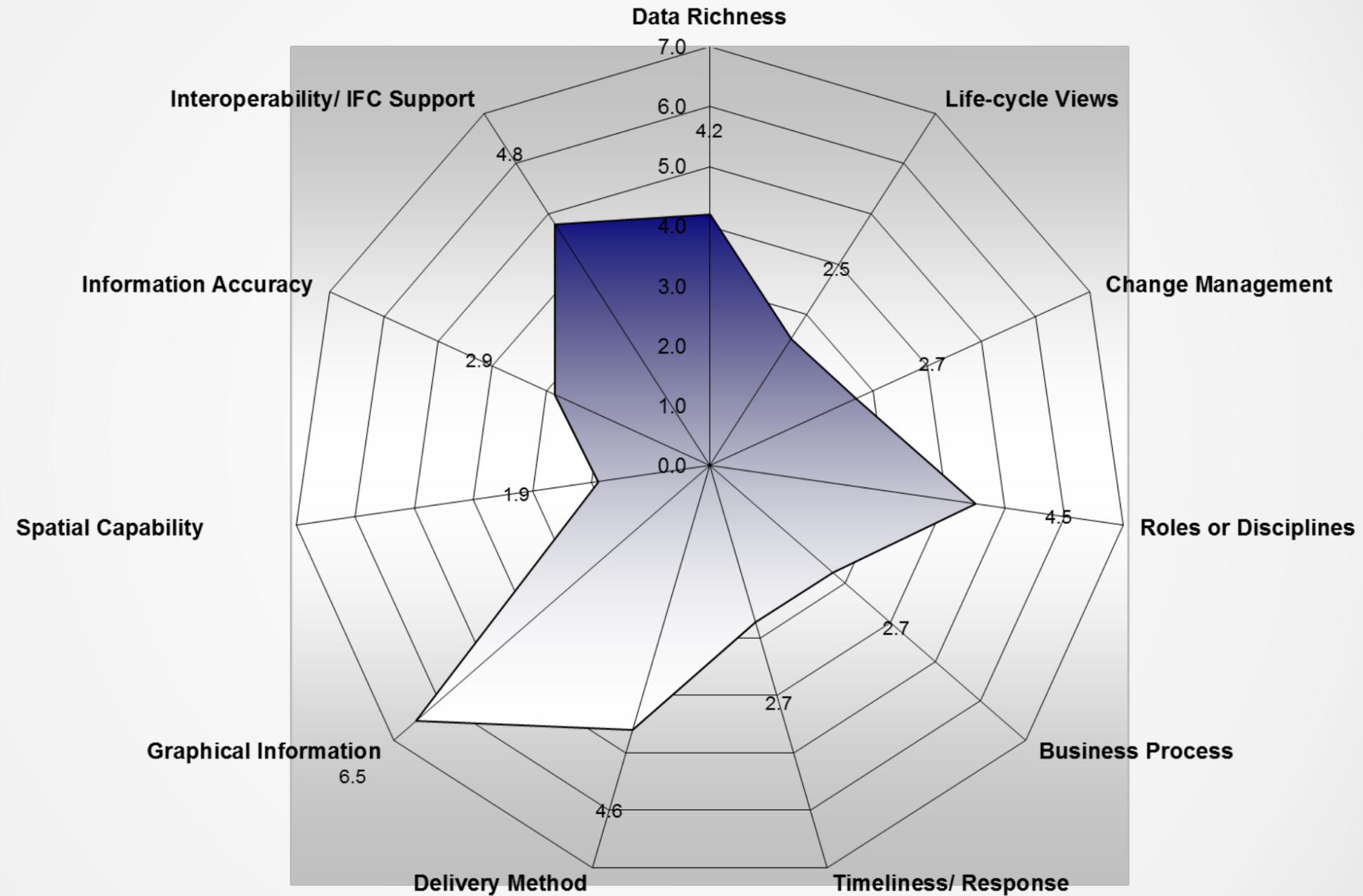
Areas of Interest and their Respective Credits



DIAGRAM

Examples:

Areas of Interest and their Respective Credits

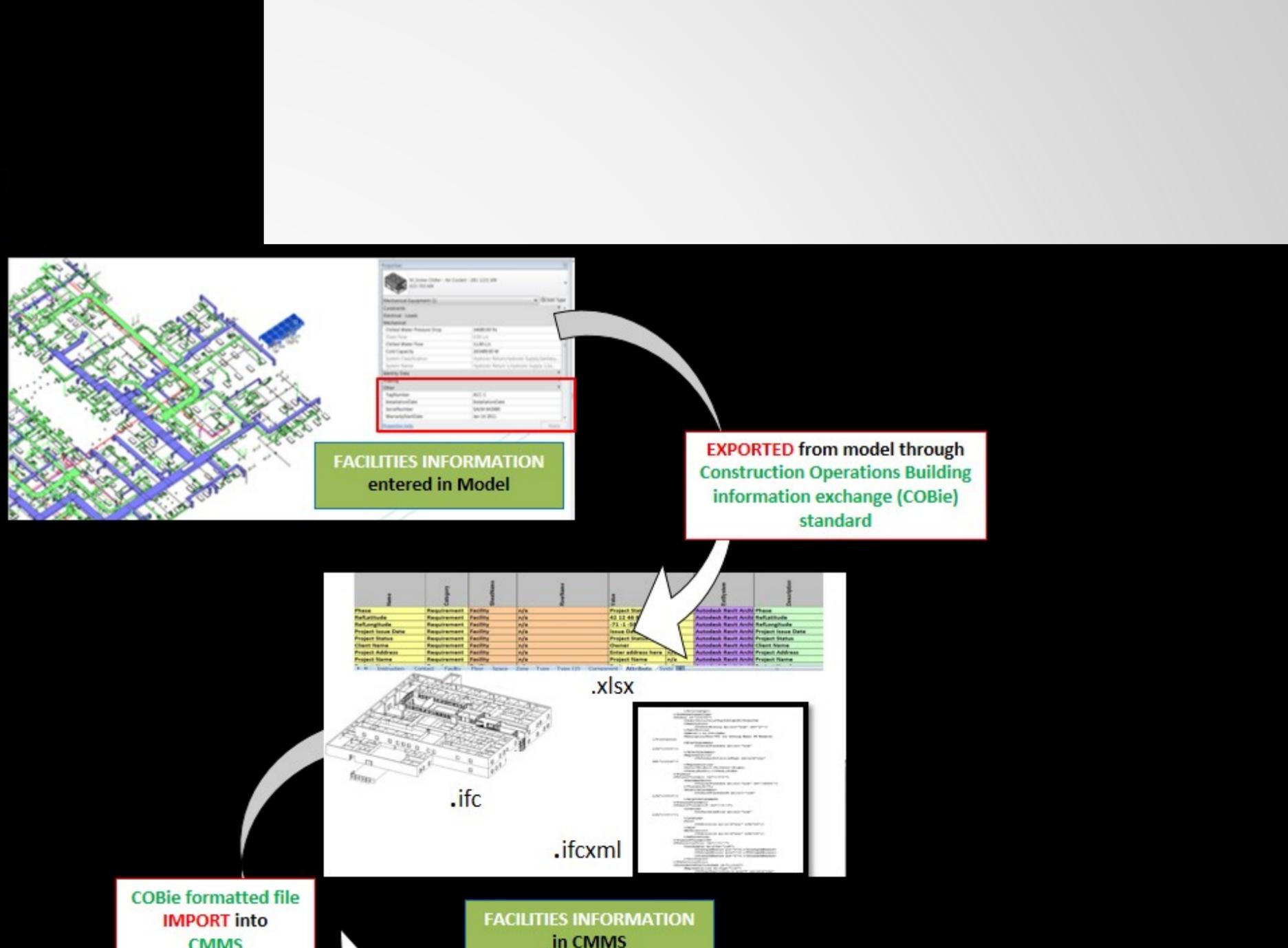
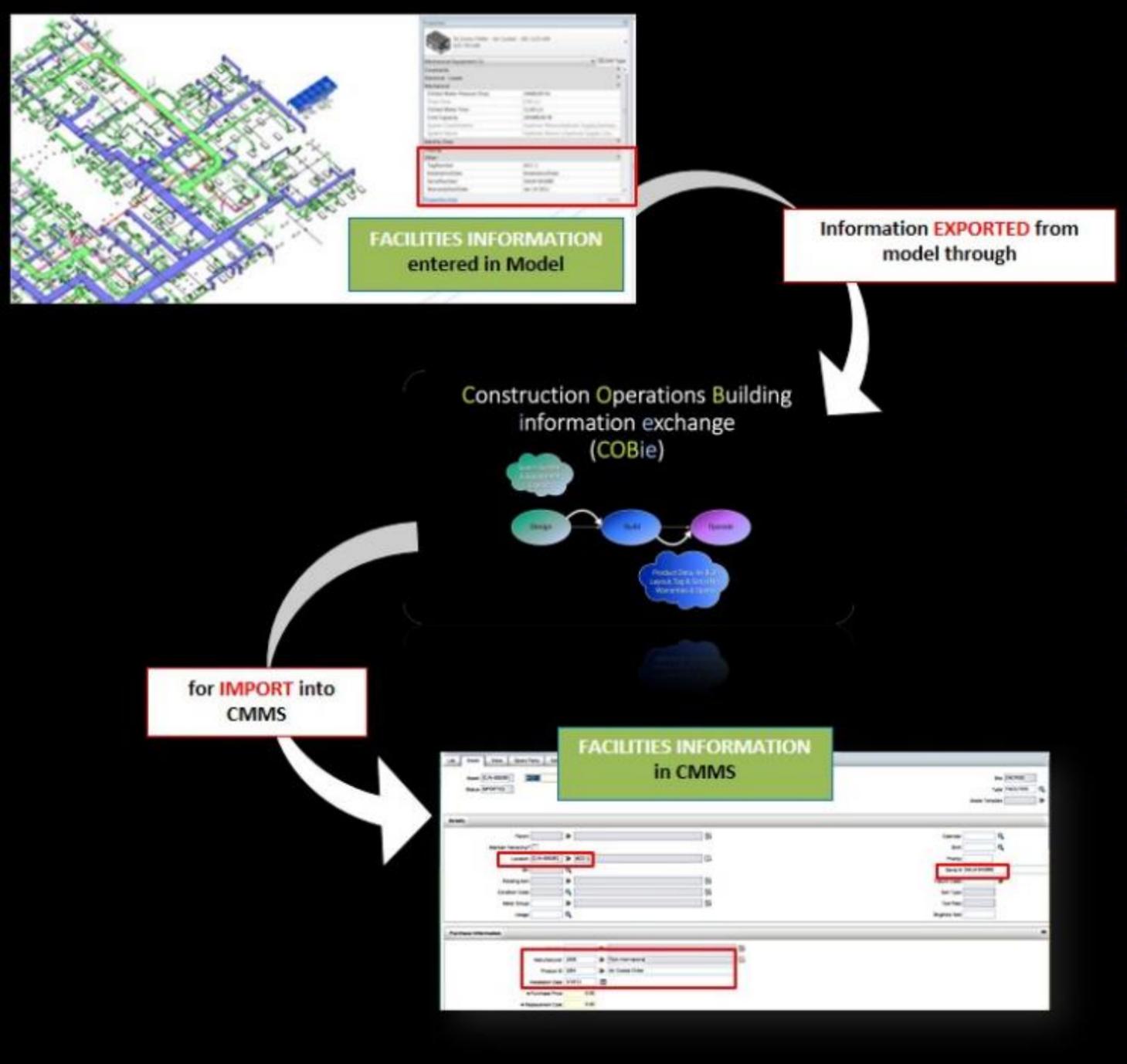


DIAGRAM

Section 2: Going to the bank of COBie

COBie is not just going to fall out of your BIM model. It will take time to set it up, test it, and then do the export and validate it. Keep in mind it will take a lot less time if you use some-one who knows what they are doing.

DIAGRAM



DIAGRAM

Birgitta Foster, 2013

Remember.....



Well Defined COBie data set

COBie Import Tool - TMA Systems

COBie Import Tool

Facility Name:

Repair Center:

COBie File Name:

Database:

100%

All COBie Data has been imported successfully

Required Data set	Required by	Appears in COBie Tab	Under Column
Facility Name	COBie- Std	Facility	Name
Facility Type	COBie- Std	Facility	Category
Project Name	COBie- Std	Facility	Project name
Site Name	COBie- Std	Facility	Site name
Linear Units	COBie- Std	Facility	Linear Units
Area Units	COBie- Std	Facility	Area Units
Volume Units	COBie- Std	Facility	Volume Units
Currency Unit	COBie- Std	Facility	Currency Unit
Area Measurement	COBie- Std	Facility	Area Measurement
For each Level			
Floor Name	COBie- Std	Floor	Name
Floor Classification	COBie- Std	Floor	Category
For each Room			
Room Name	COBie- Std	Space	Name
Space Classification	COBie- Std	Space	Category
Floor Name	COBie- Std	Space	Floor Name
Space Description	COBie- Std	Space	Description
For each Asset Type			
Asset Type Name	COBie- Std	Type	Name
Asset Type Classification	COBie- Std	Type	Category
Asset Type Description	COBie- Std	Type	Description
Asset Type	COBie- Std	Type	Asset Type
Manufacturer	COBie- Std	Type	Manufacturer
Model Number	COBie- Std	Type	Model Number
Warranty Guarantor- Parts	COBie- Std	Type	Warranty Guarantor- Parts
Warranty Duration- Parts	COBie- Std	Type	Warranty Duration- Parts
Warranty Guarantor- Labor	COBie- Std	Type	Warranty Guarantor- Labor
Warranty Duration- Labor	COBie- Std	Type	Warranty Duration- Labor
Warranty Duration- Units	COBie- Std	Type	Warranty Duration- Units
Vendor	Owner Specified	Type	Vendor
For each Asset			
Asset Name	COBie- Std	Component	Name
Asset Type Name	COBie- Std	Component	Type Name
Asset Location	COBie- Std	Component	Space
Asset Description	COBie- Std	Component	Description
Asset #	Owner Specified	Component	Asset #
Serial #	Owner Specified	Component	Serial Number
Installation Date	Owner Specified	Component	Installation Date
Purchase Price	Owner Specified	Component	Purchase Price
Replacement Cost	Owner Specified	Component	Replacement Cost
For each Contact			
Email	COBie- Std	Contacts	Email
Classification	COBie- Std	Contacts	Category
Company	COBie- Std	Contacts	Company
Phone	COBie- Std	Contacts	Phone
Contact Name	Owner Specified	Contacts	First Name
Address	Owner Specified	Contacts	Address
City	Owner Specified	Contacts	City
State	Owner Specified	Contacts	State
ZIP Code	Owner Specified	Contacts	ZIP Code

EXAMPLE

Required Data set	Required by
Facility Name	COBie- Std
Facility Type	COBie- Std
Project Name	COBie- Std
Site Name	COBie- Std
Linear Units	COBie- Std
Area Units	COBie- Std
Volume Units	COBie- Std
Currency Unit	COBie- Std
Area Measurement	COBie- Std
For each Level	
Floor Name	COBie- Std
Floor Classification	COBie- Std
For each Room	
Room Name	COBie- Std
Space Classification	COBie- Std
Floor Name	COBie- Std
Space Description	COBie- Std
For each Asset Type	
Asset Type Name	COBie- Std
Asset Type Classification	COBie- Std
Asset Type Description	COBie- Std
Asset Type	COBie- Std
Manufacturer	COBie- Std
Model Number	COBie- Std
Warranty Guarantor- Parts	COBie- Std
Warranty Duration- Parts	COBie- Std
Warranty Guarantor- Labor	COBie- Std
Warranty Duration- Labor	COBie- Std
Warranty Duration- Units	COBie- Std
Vendor	Owner Specified
For each Asset	
Asset Name	COBie- Std
Asset Type Name	COBie- Std
Asset Location	COBie- Std
Asset Description	COBie- Std
Serial #	Owner Specified
Installation Date	Owner Specified
Purchase Price	Owner Specified
Replacement Cost	Owner Specified
For each Contact	
Email	COBie- Std
Classification	COBie- Std
Company	COBie- Std
Phone	COBie- Std
Contact Name	Owner Specified
Address	Owner Specified
City	Owner Specified
State	Owner Specified
ZIP Code	Owner Specified

DIAGRAM

Leverage BIM authoring software tools for COBie data

COBie Tool Kit

Software for Design

Software used by designers and consultants to produce construction contract documents is listed in this category. COBie Challenge events starting in 2013 checked software to determine (1) if the format of the COBie file is correct, and (2) if the content of the COBie file matches the content of the standard drawings. To see the specific results and criteria for the Challenge events, click through for a given product.

Company	Product (click for demo)	Event (click for results)
AutoDesk	Revit 2013	2013 COBie Coordinated Design Challenge
Bentley Systems	AECOSim Building Designer (beta) PDF	2013 COBie Coordinated Design Challenge
DDS	DDS-CADD (PPT)	2009 BIM Information Exchange Demo
GraphiSoft	ArchiCAD 17 (beta) (PDF)	2013 COBie Architectural Design Challenge
Nametscheck	Vectorworks	2008 BIM Information Exchange Demo

DIAGRAM

The image shows a screenshot of Autodesk Revit software. The top portion displays a 'COBie2-Component' table with columns for Name, Level, CreatedBy, TypeName, Space, SerialNumber, Description, ExtIdentifier, InstallationDate, and WarrantyStartDate. The bottom portion shows a 'COBie Spaces Schedule' table with columns for Name, CreatedBy, Category, FloorName, Description, System, ExtIdentifier, Room Tag, UsableHeight, GrossArea, and NetArea. A 3D model of a building is visible in the background, with a 'Properties' window open for a selected room.

Name	Level	CreatedBy	TypeName	Space	SerialNumber	Description	ExtIdentifier	InstallationDate	WarrantyStartDate	TagNumber
66	PARKING GARAGE LEVEL 1	cobie@acaiworld.com	Transformer-Wet_Type-12000-480V277: 500 KVA	1		WET-TYPE 480-20	3167683			
75	MAINTENANCE LEVEL 1	cobie@acaiworld.com	Pull_Box-Generac: Pull_Box-Generac			PULL BOX	3187896			
AHU-2-1	PARKING GARAGE LEVEL 1	cobie@acaiworld.com	AHU-3_Modular-McQuay-Indoor-Vision-2_Decks: AHU-2-1			AHU-3_Modular-M	3251658			
77	PARKING GARAGE LEVEL 1	cobie@acaiworld.com	Panelboard-480V_MLO-Surface: 250 A			Panelboard-480V_	3256388			
78	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Panelboard-Siemens-PS: MDP1			DISTRIBUTION PAN	3256732			
79	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Controller_with_Transfer_Switch-Fire_Pump-Firetrol-FTA1			AUTOTRANSFORM	3256819			
80	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Switch-Automatic_Transfer: 400-1000 A			Switch-Automatic_	3256920			
81	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Switch-Automatic_Transfer: 400-1000 A			Switch-Automatic_	3257145			
82	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Switch-Automatic_Transfer: 400-1000 A			Switch-Automatic_	3257153			
78	MAINTENANCE LEVEL 1	bim@aecmworld.com	Switch-Disconnect: VL710F			Switch-Disconnect	3257179			
79	MAINTENANCE LEVEL 1	bim@aecmworld.com	Switch-Disconnect: VL850			Switch-Disconnect	3257181			
80	MAINTENANCE LEVEL 1	bim@aecmworld.com	Switch-Disconnect: VL850			Switch-Disconnect	3257183			
81	MAINTENANCE LEVEL 1	bim@aecmworld.com	Switch-Disconnect: VL850			Switch-Disconnect	3257186			
635	MAINTENANCE LEVEL 1	bim@aecmworld.com	Receptacle-Duplex-Wall: GFCI			GFCI RECEPTACLE	3257192			
637	MAINTENANCE LEVEL 1	bim@aecmworld.com	Receptacle-Duplex-Wall: GFCI			GFCI RECEPTACLE	3257196			
84	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Panelboard-208V_MCB-Surface: RP1			Panelboard-208V_	3257692			
85	PARKING GARAGE LEVEL 1	bim@aecmworld.com	Generator-Emergency_Power-Diesel: 500 KW			200 KW DIESEL ST	3257874			

Name	CreatedBy	Category	FloorName	Description	System	ExtIdentifier	Room Tag	UsableHeight	GrossArea	NetArea
1E29	dal	13-15 11 34 11: Office	First Floor	HK, SUPV. OFFICE	AutocadSpace	Office	n/a	n/a	11.03	11.03

Basic Does and Don'ts

Can **not** change

- ❌ order and naming of the worksheets.
- ❌ order and naming of column headings within each spreadsheet

Name	CreatedBy	CreatedOn	TypeName	Space	Description	ExtSystem	ExtObject	ExtIdentifier	SerialNumber	InstallationDate	WarrantyStartDate	TagNumber	BarCode	AssetIdentifier

Instruction Contact Facility Floor Space Zone Type Component System Assembly Connection Spare Resource Job Impact Document At

Permitted

- ✓ Required data that is **not available** at the time when the file is submitted should be **left blank**
- ✓ User defined information columns shall be **placed right** of all COBIE data columns to **track additional information**

DIAGRAM

Who needs to know how to use COBie ?

The COBie Responsibility Matrix

legend	Company	PDC Name	PDC Email	PDC Phone	Color Code								
	owner				paint color to use								
	designer				paint color to use								
	consultant				paint color to use								
	prime contractor				paint color to use								
	Owner O&M Champion				paint color to use								
	Data Integrator				paint color to use								
	sub contractor A				paint color to use								
	sub contractor B				paint color to use								
	commissioning				paint color to use								
	not used or n/a	-	-	-	paint color to use								

Worksheet ->	Contact	Facility	Floor	Space	Zone	Type	Component	System	Assembly	Connection	Spare	Resource	J
Column													
1	Email	Name	Name	Name	Name	Name	Name	Name	Name	Name	Name	Name	Name
2	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy	CreatedBy
3	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn	CreatedOn
4	Category	Category	Category	Category	Category	Category	TypeName	Category	SheetName	ConnectionType	Category	Category	Category
5	Company	ProjectName	ExtSystem	FloorName	SpaceNames	Description	Space	ComponentNames	ParentName	SheetName	TypeName	ExtSystem	Status
6	Phone	SiteName	ExtObject	Description	ExtSystem	AssetType	Description	ExtSystem	ChildNames	RowName1	Suppliers	ExtObject	TypeName
7	ExtSystem	LinearUnits	ExtIdentifier	ExtSystem	ExtObject	Manufacturer	ExtSystem	ExtObject	AssemblyType	RowName2	ExtSystem	ExtIdentifier	Description
8	ExtObject	AreaUnits	Description	ExtObject	ExtIdentifier	ModelNumber	ExtObject	ExtIdentifier	ExtSystem	RealizingElement	ExtObject	Description	Duration
9	ExtIdentifier	VolumeUnits	Elevation	ExtIdentifier	Description	WarrantyGuarantorParts	ExtIdentifier	Description	ExtObject	PortName1	ExtIdentifier		Duration
10	Department	CurrencyUnit	Height	RoomTag		WarrantyDurationParts	SerialNumber		ExtIdentifier	PortName2	Description		Start
11	OrganizationCode	AreaMeasurement		UsableHeight		WarrantyGuarantorLabor	InstallationDate			ExtSystem	SetNumber		TaskSta
12	GivenName	ExternalSystem		GrossArea		WarrantyDurationLabor	WarrantyStartDate			ExtObject	PartNumber		Frequen
13	FamilyName	ExternalProjectObject		NetArea		WarrantyDurationUnit	TagNumber			ExtIdentifier			Frequen
14	Street	ExternalProjectIdentifier				ExtSystem	BarCode			Description			ExtSyste
15	PostalBox	ExternalSiteObject				ExtObject	AssetIdentifier						ExtObje
16	Town	ExternalSiteIdentifier				ExtIdentifier							Extident
17	StateRegion	ExternalFacilityObject				ReplacementCost							TaskNum
18	PostalCode	ExternalFacilityIdentifier				ExpectedLife							Priors
19	Country	Description				DurationUnit							Resourc

<http://www.buildingsmartalliance.org/index.php/projects/cobie>

DIAGRAM

We got your **COBie** covered.



COBie



bSa COBie Classes Coming Soon.

sponsored by

ACAI

visit www.buildingsmartalliance.org for details

DIAGRAM



Introduction to Construction Operations Building information exchange (COBie)

Historically information transmittals for a building under construction have been done on paper and therefore a significant portion of the information is lost once the building is completed. The Construction Operations Building information exchange (COBie) keeps this information in a usable format for everyone to access throughout the building's lifecycle.

The primary benefit of COBie is that it enables information to flow from the design phase, allows information to be added during construction and is available to deliver the information to the facility manager upon completion. Many organizations are now requiring COBie for their projects and more will be doing so in the future. COBie is the information base for the United Kingdom's building information modeling (BIM) implementation. COBie adds the "I" to BIM.

This course provides the basis for implementing a strong COBie strategy for any organization.

Who should take the course? Architects, Engineers, Contractors, Owners, Facility Managers, Maintenance Engineers, essentially anyone involved with implementing BIM in the facility life cycle. It is a fundamentals course necessary for all users to understand the opportunities BIM provides.

Course ID: COBIEINTRO

Duration: 2 hours

Learning Units: 2.0 LU

Prerequisites: None

HSW: Yes



Produced by:

buildingSMARTalliance[™]
a council of the National Institute of Building Sciences

LEARNING OBJECTIVES

By completing this course you will learn and be able to:

- Explain the value and benefits of using information exchanges, specifically the construction to operations building information exchange between architecture, engineering, construction and facility management professionals;
- Define what the construction operations building information exchange is and well as what it is not; and
- Describe the relationships between the COBie standard, facility management software and BIM authoring software.

1. View the Course Modules.

All materials are contained within the modules below. Each should be viewed in its entirety. There is no time limit and you can return to any module to review.

- **Module 1: Introduction to COBie** – course introduction by Deke Smith Executive Director, bSa and Birgitta Foster, Assisting Director, bSa with additional comments by Paul Teicholz, author and professor emeritus Stanford university.
- **Module 2: COBie from an Industry Perspective** – interviews with seven (7) industry professionals on the value and benefits of COBie as facilities managers, designers, contractors, FM software providers, and public and institutional owners.
- **Module 3: What COBie is, What COBie is not** – an informative discussion on what COBie is but more importantly what it is not, in an effort to dispel common misconceptions of the information exchange standard. Featuring statements by Bill Brodt and Bill East, the founders of COBie.
- **Module 4: COBie Standard Deliverable Formats** – an in-depth discussion on COBie deliverable formats with examples.
- **Module 5: The Role of the Stakeholder (Part A)** – describes the relationships between the BIM authoring tools, the COBie standard and FM applications with practical examples with facility managers, architects and engineers.
- **Module 6: The Role of the Stakeholder (Part B)** – continues with more examples of the role of the construction contractors and commissioning agents with the COBie standard.
- **Module 7: COBie: Linking It All Together** – describes the role of the BIM authoring and FM software applications in transferring information from design and construction to operations using an open information exchange standard, COBie.

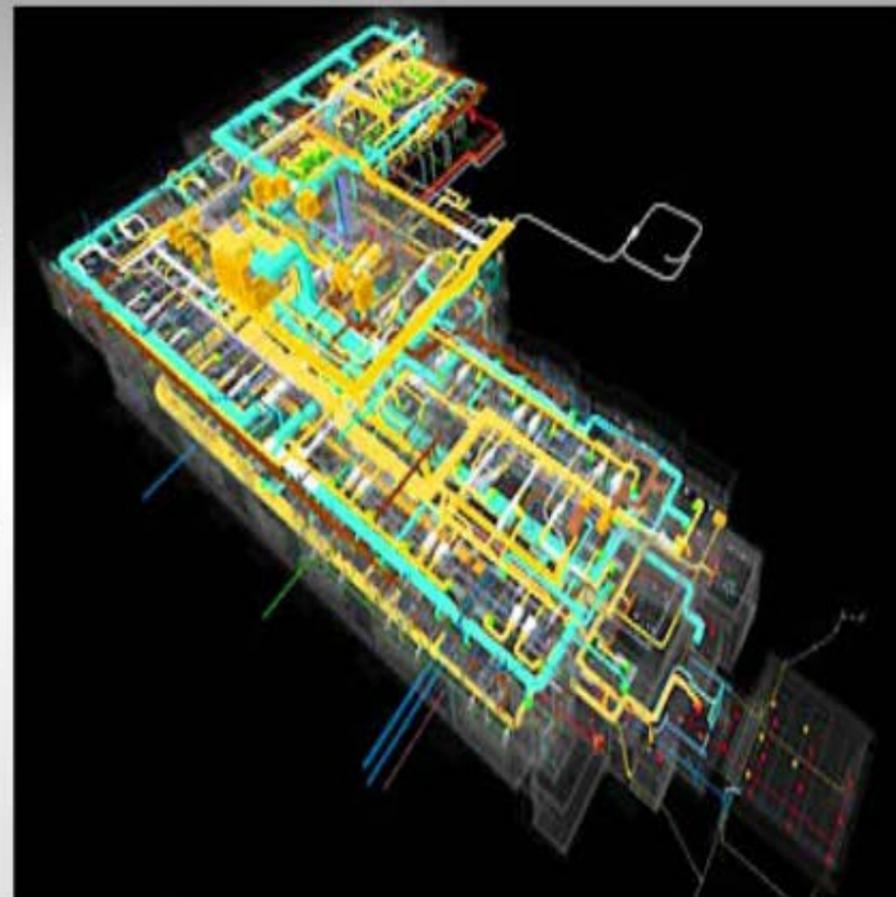
DIAGRAM



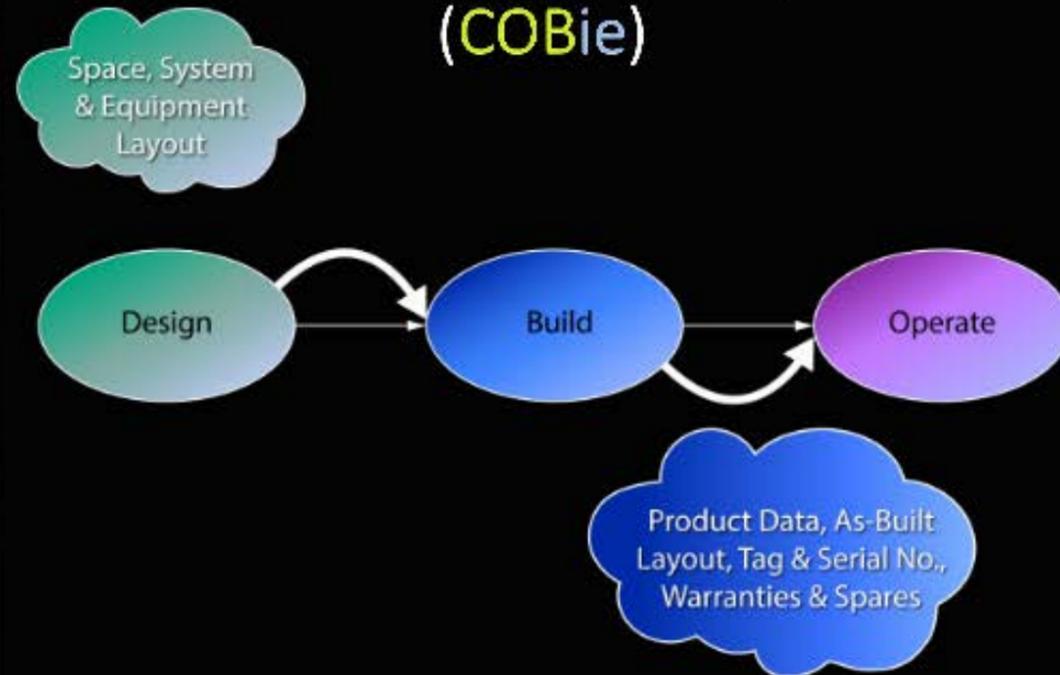
Introduction to Construction Operations Building information exchange (COBie)



Introduction to COBie



Construction Operations Building information exchange (COBie)



MENU

Sponsored by



Building SMART alliance
online course

Interactive interface

DIAGRAM

NBIM-US^T Version 2

Guidelines and Applications

Minimum BIM

BIM Project Execution Guide / Content

MEP Coordination

Planning, Executing and Managing Information Handover

Information Exchange (ie) Standards

Construction Operations Building (COBie)

Design to Spatial Programming

Design to Energy Analysis

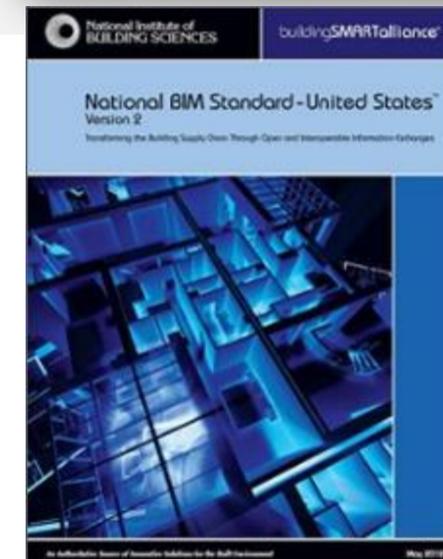
Design to Quantity Take-off

Reference Standards

Industry Foundation Class (IFC 2x3 / ISO PAS 16739)

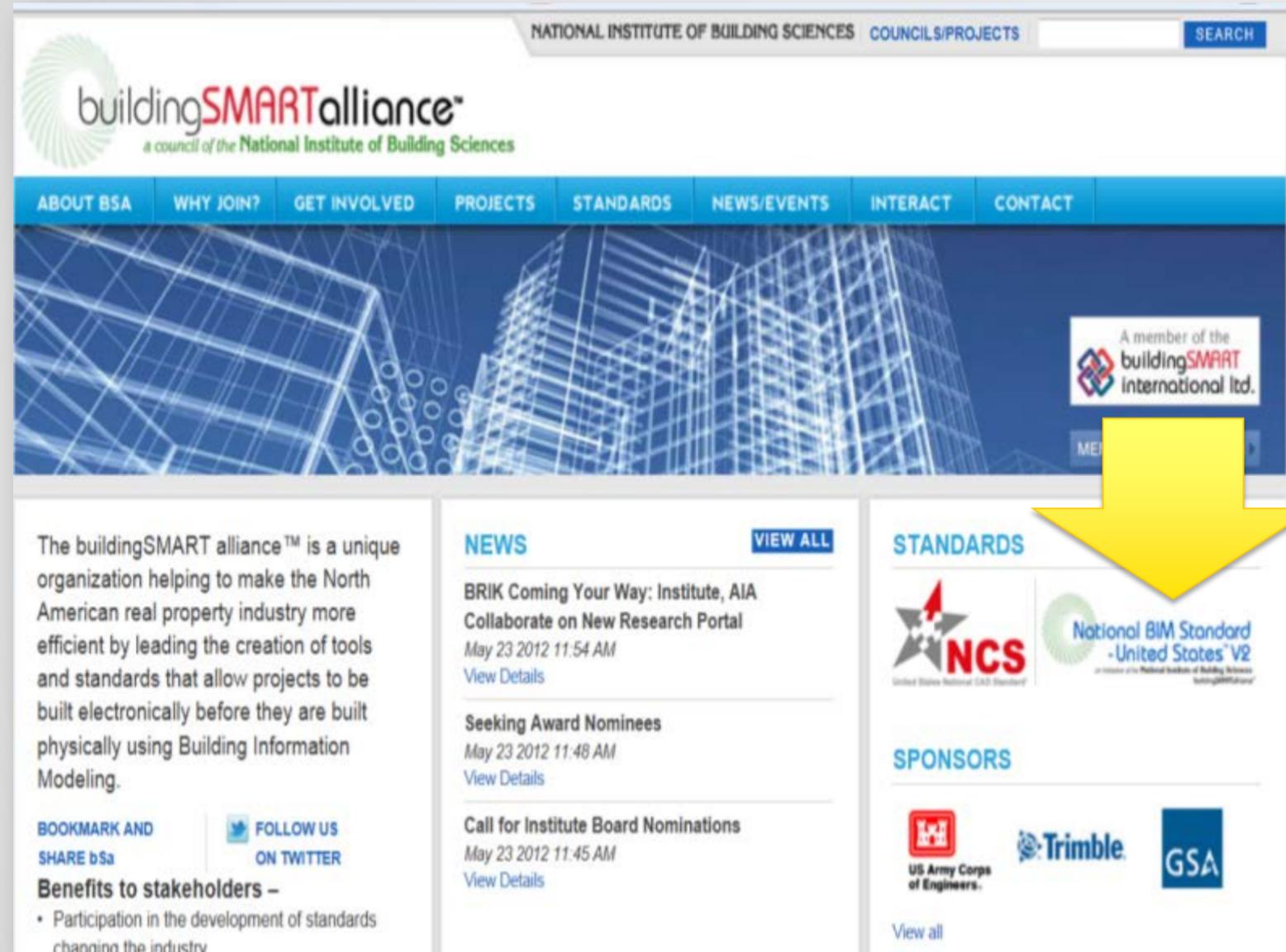
OmniClass Tables (13, 21, 22, 23, 32, 36)

IFD Library Update



DIAGRAM

buildingsmartalliance.org



Available

- free from Website as PDF downloads
- eBook version Available

DIAGRAM

What are some tips/tricks on how to organize your model, schedules and personnel to efficiently utilize a volumetric model?

DIAGRAM

Resources:

COBie Website

http://www.nibs.org/?page=bsa_cobie

bSa : Means and Methods

http://www.nibs.org/?page=bsa_cobiemm

Linkedin discussion Group – Bill East

<http://www.linkedin.com/groups?gid=2638637>

COBie software and toolkit

<http://usa.autodesk.com/adsk/servlet/oc/offer/form?siteID=123112&id=18070390>

DIAGRAM

