

Documenting Building Information Requirements

Digital Architecture, Design & Engineering Assets

2017-11-16

Roger J. Grant, CSI

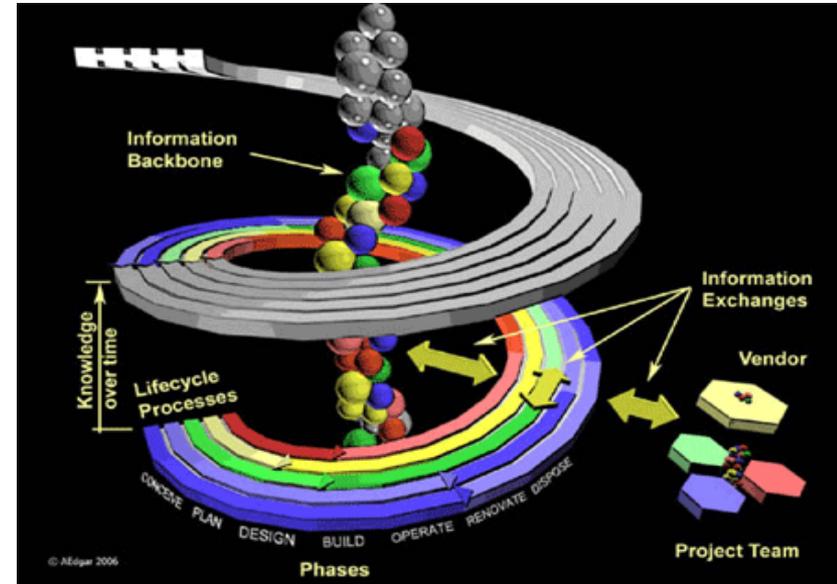
Program Director, National Institute of Building Sciences

Product Room Leader, buildingSMART International

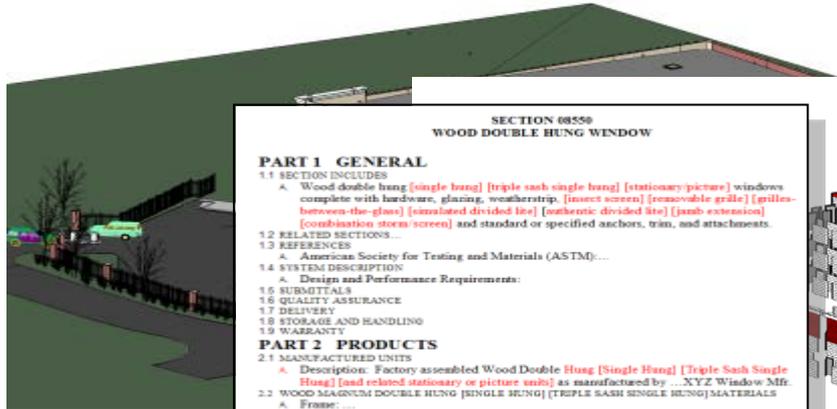


Shared Information

A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward.



BIM – Information Modeling and Management



**SECTION 08550
WOOD DOUBLE HUNG WINDOW**

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wood double hung [single hung] [triple sash single hung] [stationary/picture] windows complete with hardware, glazing, weatherstrip, [insect screen] [removable grille] [grilles-between-the-glass] [simulated divided lite] [authentic divided lite] [jamb extension] [combination storm screen] and standard or specified anchors, trim, and attachments.

1.2 RELATED SECTIONS

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):...

1.4 SYSTEM DESCRIPTION

A. Design and Performance Requirements:

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 DELIVERY

1.8 STORAGE AND HANDLING

1.9 WARRANTY

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Factory assembled Wood Double Hung [Single Hung] [Triple Sash Single Hung] [lead related stationary or picture units] as manufactured by ...XYZ Window Mfg.

2.2 WOOD MAGNUM DOUBLE HUNG [SINGLE HUNG] [TRIPLE SASH SINGLE HUNG]/MATERIALS

A. Frame: ...

B. Sash: ...

C. Glazing: ...

1. Glazing Method: ...

2. Glass Type: ...

3. Glazing Seal: ...

D. Finish: ...

1. Interior / Exterior: ...

E. Hardware: ...

F. Weatherstrip: ...

G. Jamb Extension:

H. Insect Screen:

1. Wood Combination Storm Sash and Screen

2. Removable Grilles

K. Authentic Divided Lites

L. Simulated Divided Lites (SDL):

M. Grilles-between-the-glass (GBG):

2.3 ACCESSORIES AND TRIM...

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION

3.3 CLEANING...

END OF SECTION



Ifc Properties

W-51-1000-1200 (

GlobalId

Name

Description

ObjectType

OverallHeight 1.2 m

OverallWidth 1 m

GreenFormat Find the Right Green Products for Your Project

THE MANAM COMPANY [View the full details and additional products](#)

BACKGROUND

DESCRIPTION: The Manam Company's revolutionary new THERMAL FUSED FLUSH door technology. Let us help with LEED credits for 100% reuse of content, recycled content, and low VOC's. Plus, complete the environment as the THERMAL FUSED FLUSH DOORS.

MANUFACTURING NUMBER: 09-14-23-19

CONTACT: THE MANAM COMPANY info@manam.com <http://www.manam.com>

PRODUCT DETAILS

1.1 SUSTAINABLE STANDARDS AND CERTIFICATIONS

S.E.A. Green Building Certification - Green Building Solutions

CERTIFICATION NAME	CERTIFYING ORGANIZATION	LEVEL	CERTIFICATION NUMBER	ACTUATED DATE	START OF YEAR
Green Building Solutions					

1.2 SUSTAINABLE PERFORMANCE CRITERIA

S.E.A. Green Building Certification - Green Building Solutions

CERTIFICATION NAME	CERTIFYING ORGANIZATION	LEVEL	CERTIFICATION NUMBER	ACTUATED DATE	START OF YEAR
Green Building Solutions					

Type Properties

Family: System Family: Basic Wall

Type: Generic - 8"

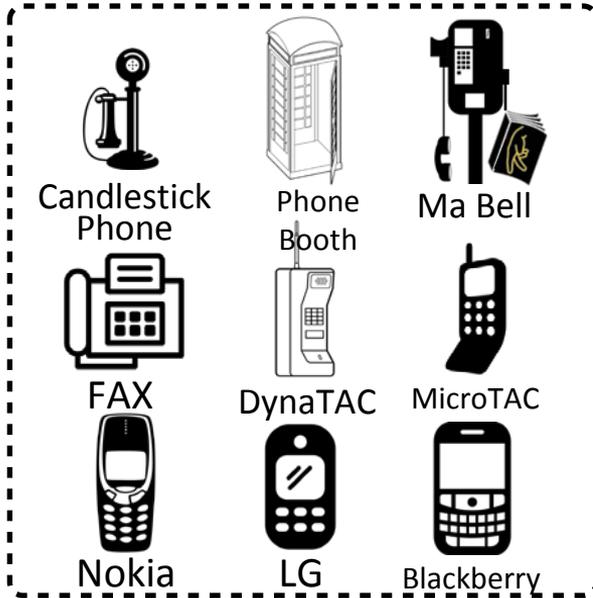
Type Parameters:

Parameter	Value
Construction	
Structure	Edit...
Wrapping at Inserts	Do not wrap
Wrapping at Ends	None
Width	8"
Wall Function	Exterior
Graphics	
Coarse Scale Fill Pattern	
Coarse Scale Fill Color	Black
Identity Data	

Standalone Devices

Easy to Use Apps

Pre-2007



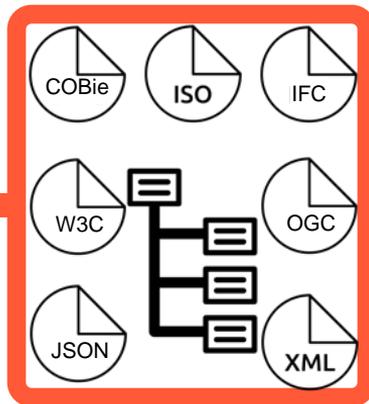
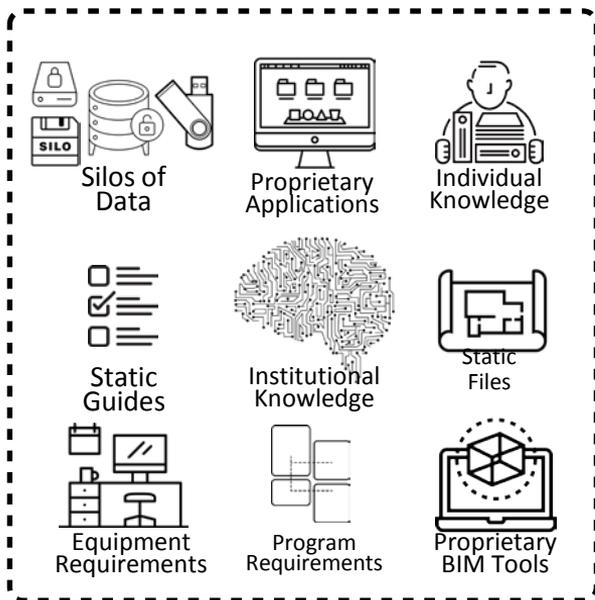
Post 2008



Platforms



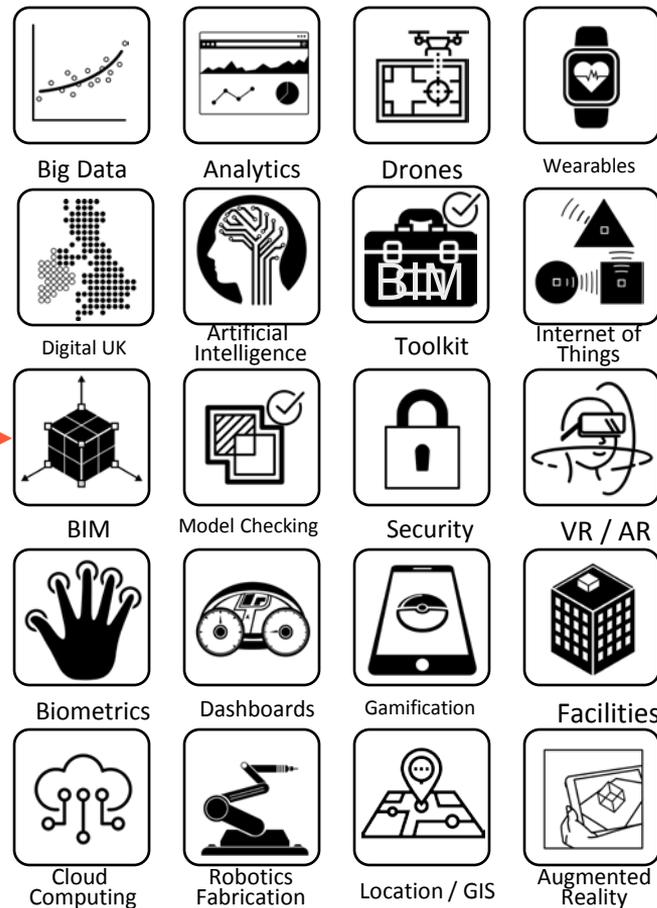
Institutional Knowledge & Data



Standards



Easy to Use Apps



The Importance of Standards

Requirements

Open Shareable Machine
Readable Data

Good data is essential: What
is good data?

Living with legacy

Benefits

Save time and money on
design, construction and
operations

Make better, more informed
decisions

Deliver better results for
customers

Preserve information for future

Good data requires open standards

What are we trying to solve?

- Capture data in digital form that is **usable**
- Automate tasks that depend on this data
- Make better decisions with better data
- Spend less time on non-value-added tasks
- Future-proof information for archiving and reuse



Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

buildingSMART Standards and Tools

Set the open standard for object-based data exchange and sharing for virtual buildings:

Data Model - IFC

- Schema for structured information
- Syntax for exchange (SPF, XML, JSON,....)
- Comprehensive information specification
- Tools: <http://www.buildingsmart-tech.org/specifications/ifc-releases>

Processes – IDM/MVD/ER

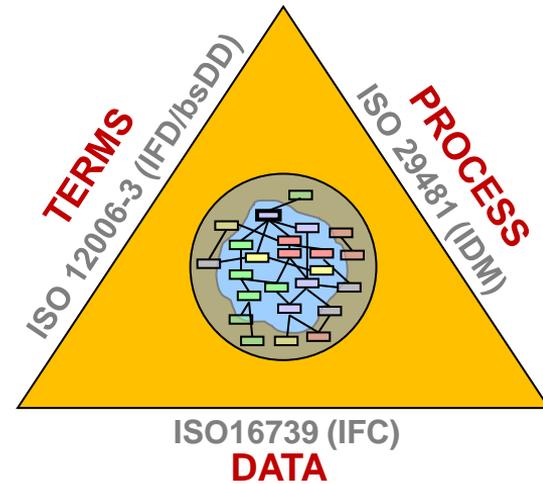
- Identify exchange requirements and rules for particular business processes
- Map requirements to IFC
- Scope for software implementation
- Tools: ifc.Doc

Terminology - bSDD

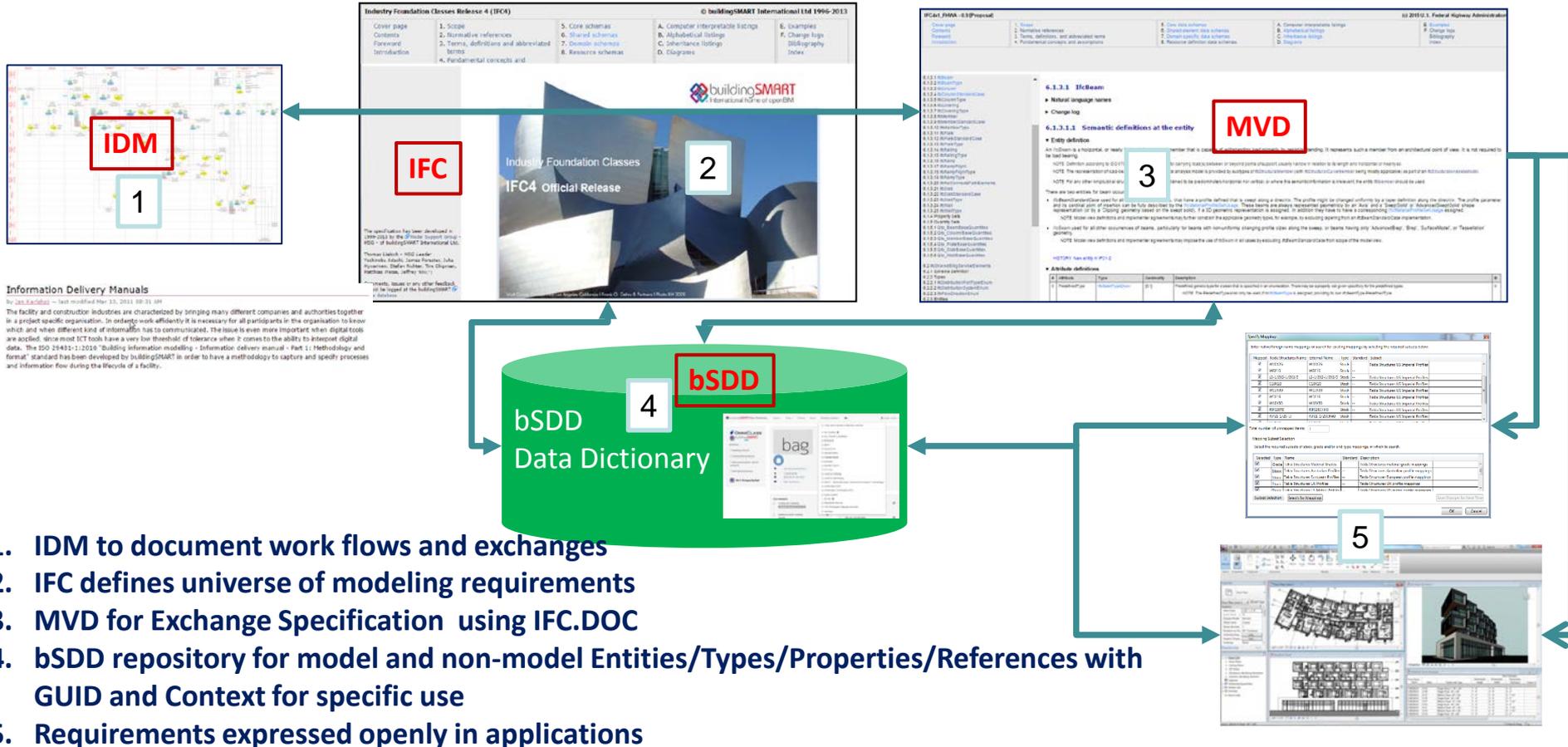
- Uniquely identify properties and objects
- Multilingual support
- Dynamically extend the IFC model
- Tools: buildingSMART Data Dictionary (bSDD)

Collaboration - BCF

- Electronic messages when using models (RFI, RFC)
- Tools: <http://www.buildingsmart-tech.org/specifications/bcf-releases>



Using bSI Standards for Information Identification and Exchange

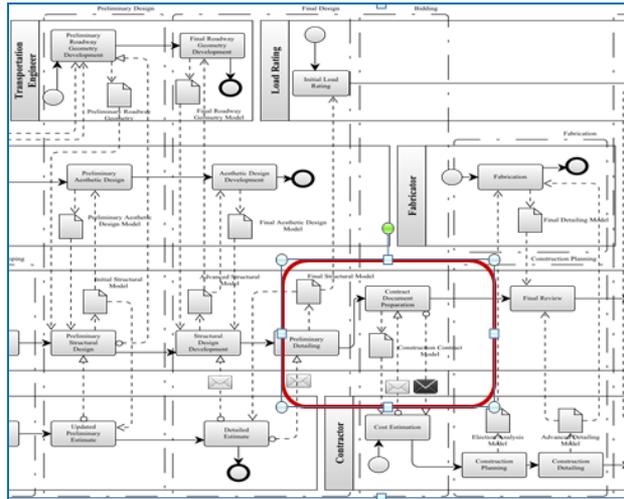


Information Delivery Manuals
by Jan Laedke - last modified Mar 15, 2011 09:31 AM
The facility and constructor industries are characterized by bringing many different companies and authorities together in a project specific organization. In order to work efficiently it is necessary for all participants in the organization to know which and when different kind of information has to be communicated. The issue is even more important when digital tools are applied, since most ICT tools have a very low threshold of tolerance when it comes to the ability to interpret digital data. The ISO 15442-1:2010 "Building information modelling - Information delivery manual - Part 1: Methodology and format" standard has been developed by buildingSMART in order to have a methodology to capture and specify processes and information flow during the lifecycle of a facility.

1. IDM to document work flows and exchanges
2. IFC defines universe of modeling requirements
3. MVD for Exchange Specification using IFC.DOC
4. bSDD repository for model and non-model Entities/Types/Properties/References with GUID and Context for specific use
5. Requirements expressed openly in applications

FHWA Use Case: Bridge Design to Construction Contract Exchange Requirements U.S.

Process Map - IDM



Exchange Specification - MVD

U.S. Federal Highway Administration

▼ Attribute definitions

Attribute	Type	Operational	Description
bridgeCrossFrame	Entity	Yes	Any attribute is a set of bridge for this member type definition and shall not be set.

▼ Formal Propositions

5.4.3.13.2 Inherited definitions from supertypes

▼ Entity inheritance

▼ Attribute inheritance

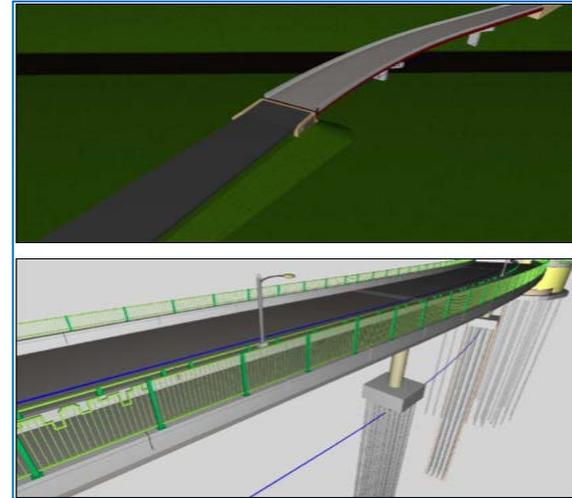
5.4.3.13.3 Definitions applying to FHWA Bridge Construction

Bridge Cross Frames

Bridge cross frames are identified by this entity where ProductType is set to BRACED_FRAME.

Cross framing behavior defines may be described using templates of member configurations. Such cross framing is captured within components, using ABC shapers where appropriate. For curved alignments where shapers are placed at different positions, members must be placed relative to the girder at each side, for which positioning is defined relative to alignment curves.

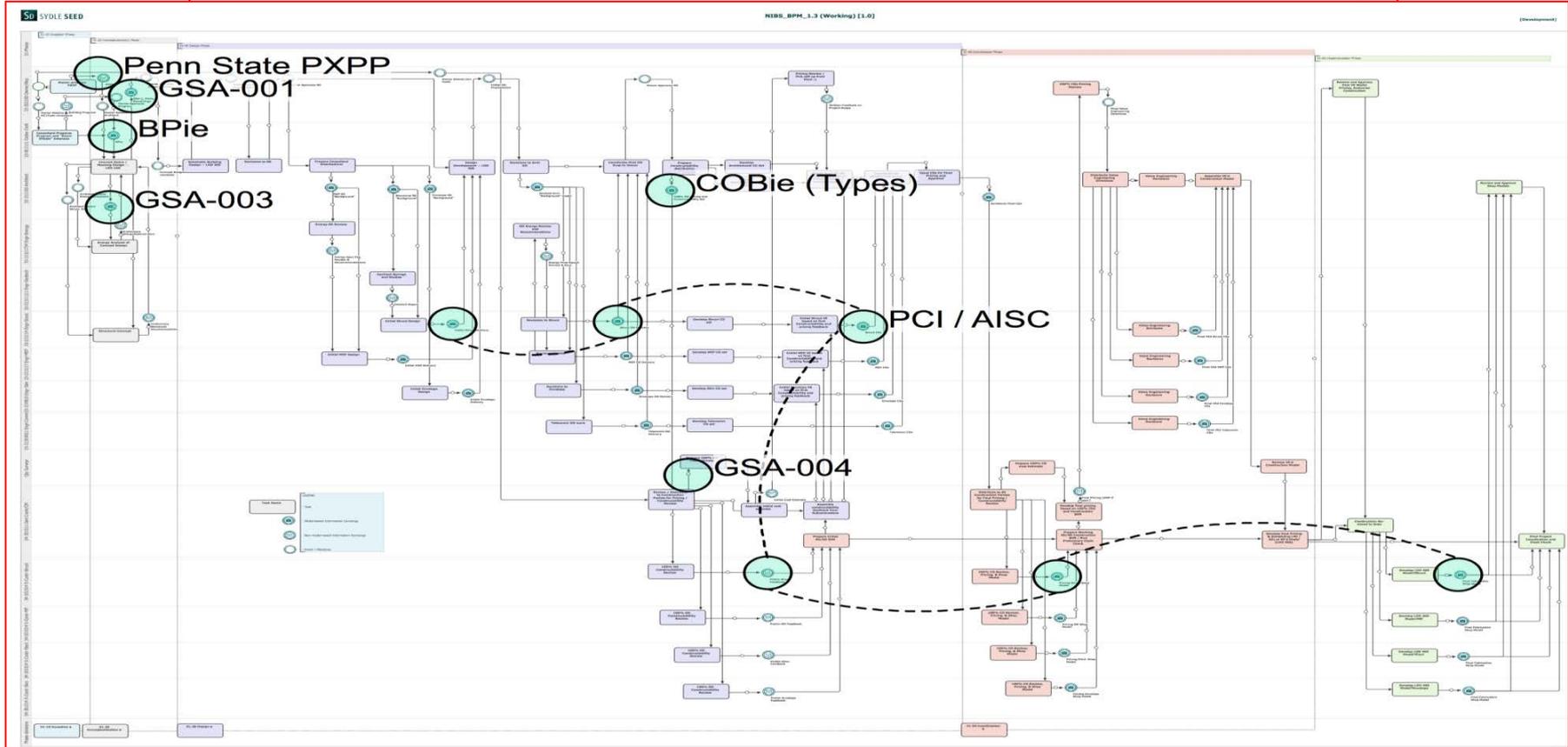
Examples



- With IFCBridge developing Terminology Library
- AASHTO and FHWA moving to implementation phase

http://www.nibs.org/?page=bsa_bridge
<https://www.fhwa.dot.gov/bridge/pubs/hif16011/>

Process Map – IDM for Buildings



BIM Use Cases

Design Authoring	Energy Analysis	Lighting Analysis	Cost Estimation Quantity Takeoff	Space Planning	Space Management/ Tracking	Record Modeling
Design Review	Sustainability LEED Evaluation	Site Utilization Planning	Construction Systems Design	3D Control and Planning	Site Analysis	Laser Scanning
Code Validation	Phase Planning/4D Modeling	Structural Analysis	Building Systems Analysis	VR	AR	Building Maintenance Scheduling
Programming	Asset Management	Disaster Planning	Other Eng. Analysis	Existing Conditions Modeling	Digital Fabrication	Mechanical Analysis

Penn State has identified **25 BIM Uses.**

DHA/VA Use Case: Space and Equipment Planning



VA



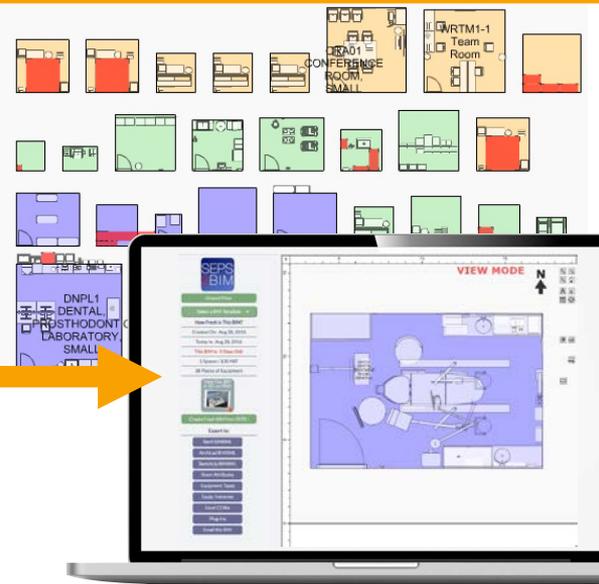
Department of Defense
Defense Health Agency



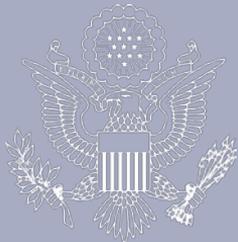
Space

Equipment

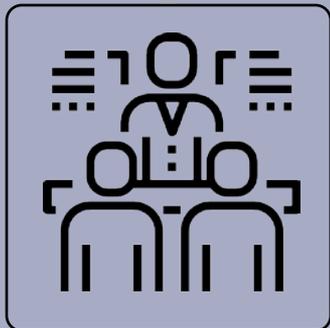
DHA/VA Use Case: Space and Equipment Planning



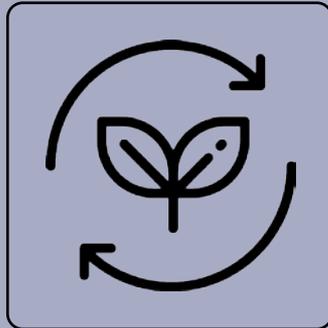
SEPS2BIM.org
Available Online



U.S. Department of State Bureau of Overseas Buildings Operations



**Improved
Coordination**



**Shared Data
For Lifecycle**



**Improved
Efficiencies**



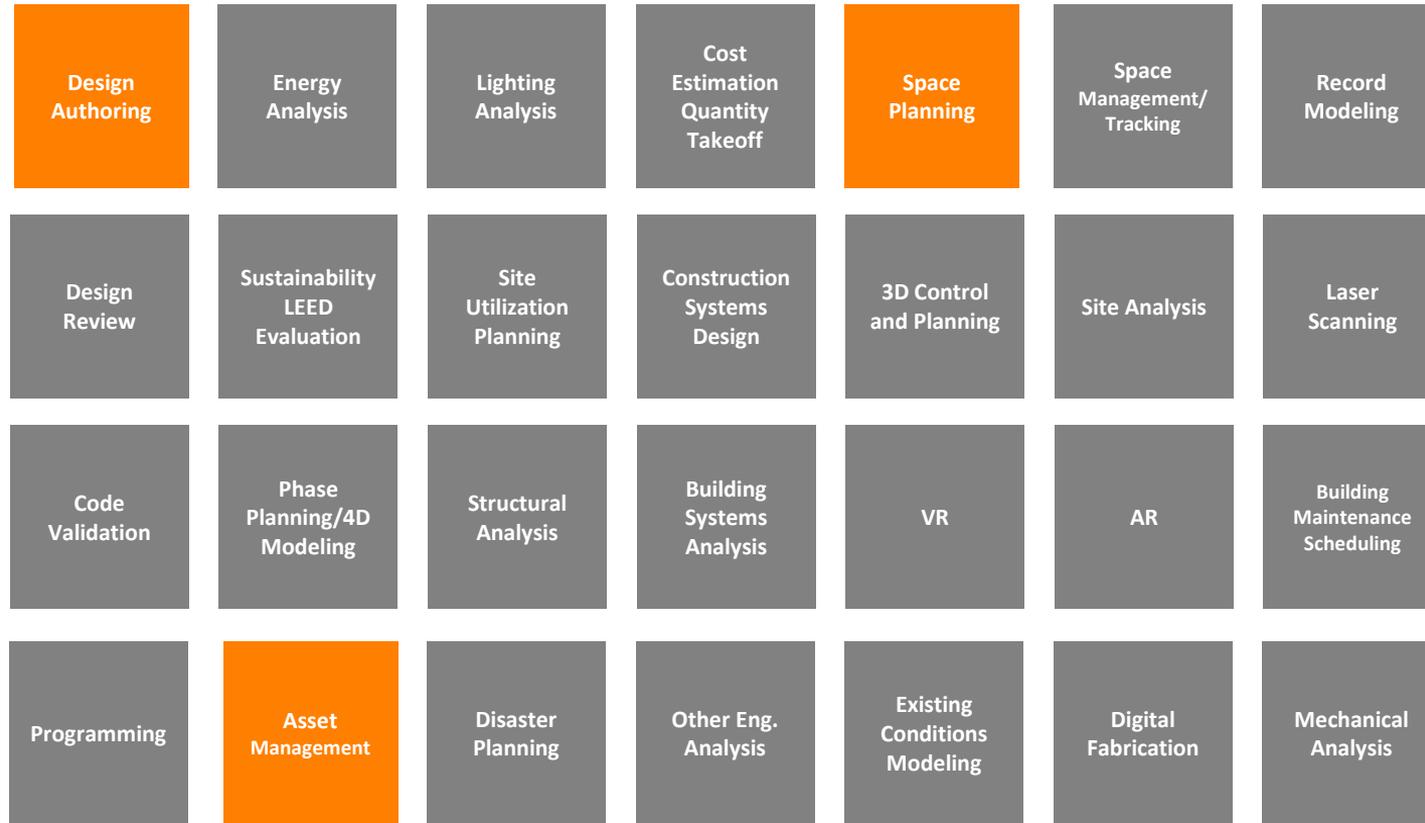
**Supporting Projects
& Portfolio**



**National Institute of
BUILDING SCIENCES**
*An Authoritative Source of Innovative Solutions
for the Built Environment*

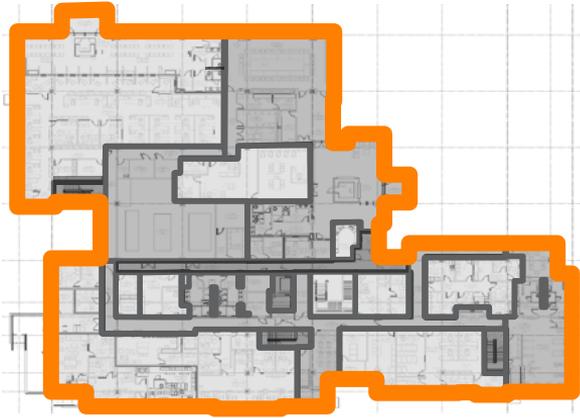


BIM Use Cases



Decide where to start.

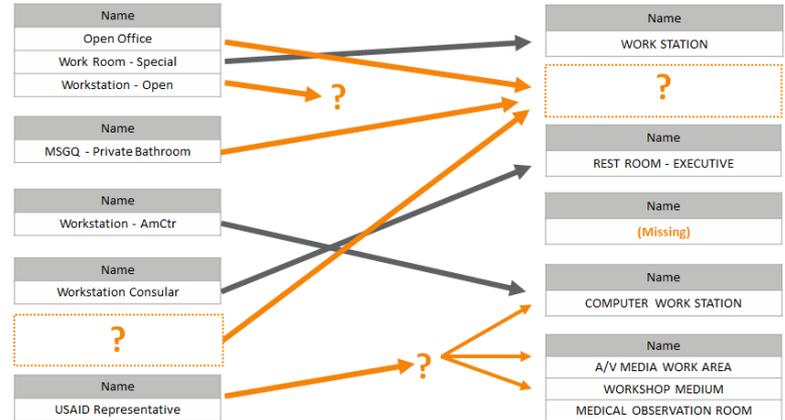
DoS OBO Use Case: Space Planning



Measured ~8,800 GSM

Range in Systems:

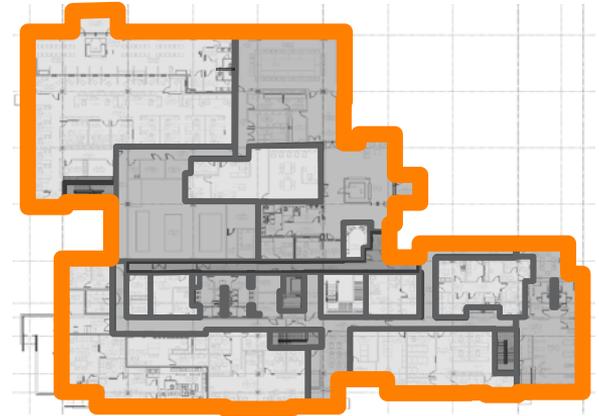
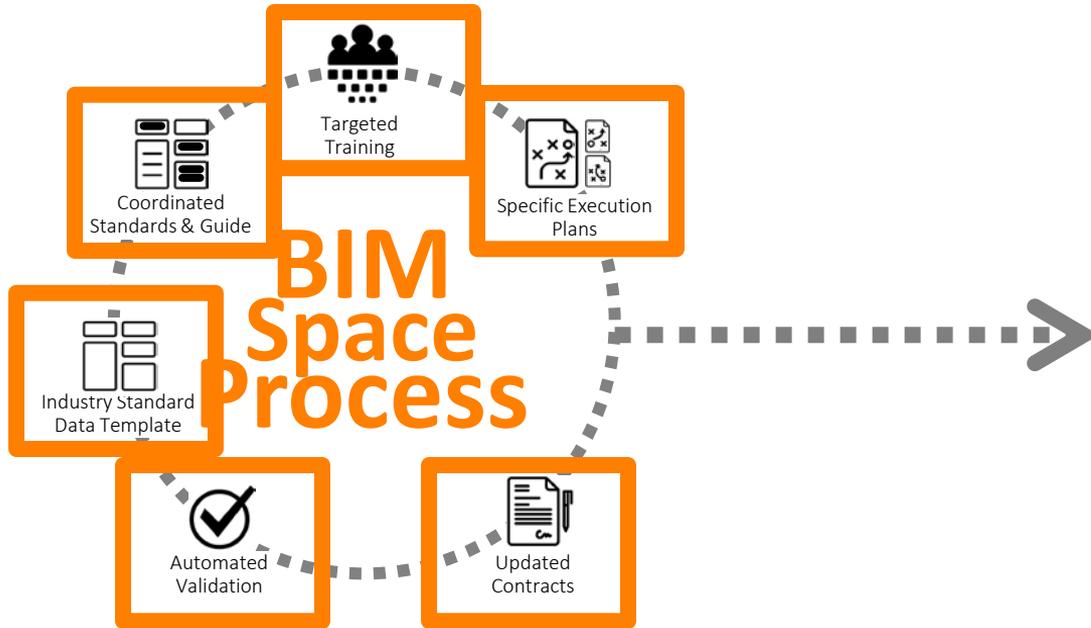
~ 8,000 GSM - ~ 4,000 GSM



6,000 Space Types in Various Systems

900 Space Types in OmniClass

DoS OBO Use Case: Space Planning



Measured 8,800 GSM

All Systems 8,800 GSM

Common Space Names

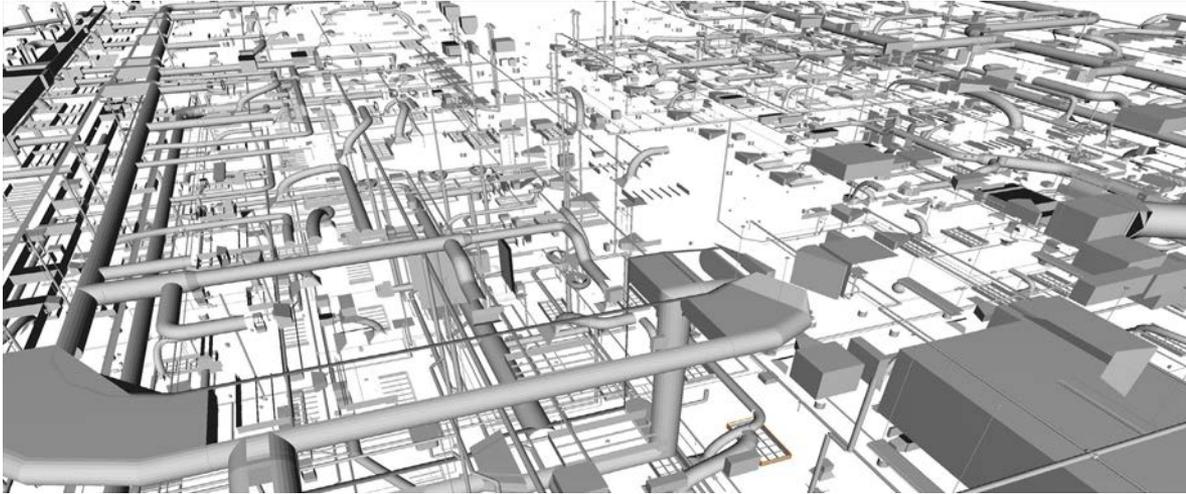
Requirements Communicated

Use Case: Asset Management (COBie)

The screenshot displays a BIM software interface with a 3D model of a building interior and a COBie data table. The 3D model shows a room with various elements like beams, doors, and windows. The COBie table below provides detailed information for each element, including its name, location, and material.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
133	Fixed Window	n/a	n/a	Wood Fixed Window	R203	Fixed Window	n/a	Window	110CAJRCT	Available	n/a	2012	n/a	Available	n/a	n/a	1.65
134	Floor Deck	n/a	n/a	Floor Deck	n/a	Floor Deck	n/a	Slab	110S5vnd6	Available	n/a	2012	n/a	Available	n/a	n/a	59.23
135	Floor Deck	n/a	n/a	Floor Deck	n/a	Floor Deck	n/a	Slab	110S5vnd6	Available	n/a	2012	n/a	Available	n/a	n/a	59.33
136	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	11C2LmCa	Available	n/a	2012	n/a	Available	n/a	n/a	25.42
137	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	11C2LmCa	Available	n/a	2012	n/a	Available	n/a	n/a	25.42
138	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	202FRM4X	Available	n/a	2012	n/a	Available	n/a	n/a	64.78
139	Floor Deck	n/a	n/a	Structural Floor Deck	n/a	Floor Deck	n/a	Slab	202FRM4X	Available	n/a	2012	n/a	Available	n/a	n/a	64.91
140	Roof	n/a	n/a	Structural Roof Deck	R301	Roof	n/a	Roof	1133m201	Available	n/a	n/a	n/a	Available	n/a	n/a	132.34
141	Single - Flush	n/a	n/a	Flush Wood Door	A101	Single - Flush	n/a	Door	110S5vnd6	Available	n/a	2012	n/a	Available	n/a	n/a	2.93
142	Single - Flush	n/a	n/a	Flush Wood Door	B101	Single - Flush	n/a	Door	110S5vnd6	Available	n/a	2012	n/a	Available	n/a	n/a	2.93
143	Single - Glass	n/a	n/a	Wood Door	A102	Single - Glass	n/a	Door	111VhK2	Available	n/a	2012	n/a	Available	n/a	n/a	2.41
144	Single - Glass	n/a	n/a	Wood Door	B102	Single - Glass	n/a	Door	111VhK2	Available	n/a	2012	n/a	Available	n/a	n/a	2.41
145	Skylight	n/a	n/a	Roof Window	R301	Skylight	n/a	Window	116fstr_JEY	Available	n/a	2012	n/a	Available	n/a	n/a	0.76
146	Skylight	n/a	n/a	Roof Window	R301	Skylight	n/a	Window	2191Vcovr	Available	n/a	2012	n/a	Available	n/a	n/a	0.76
147	Sofa	n/a	n/a	1830mm	A102	Sofa	n/a	Furniture	106ircmky	Available	n/a	2012	n/a	Available	n/a	n/a	n/a
148	Sofa	n/a	n/a	1830mm	A102	Sofa	n/a	Furniture	106ircmky	Available	n/a	2012	n/a	Available	n/a	n/a	n/a
149	Sofa	n/a	n/a	1830mm	B102	Sofa	n/a	Furniture	106ircmky	Available	n/a	2012	n/a	Available	n/a	n/a	n/a

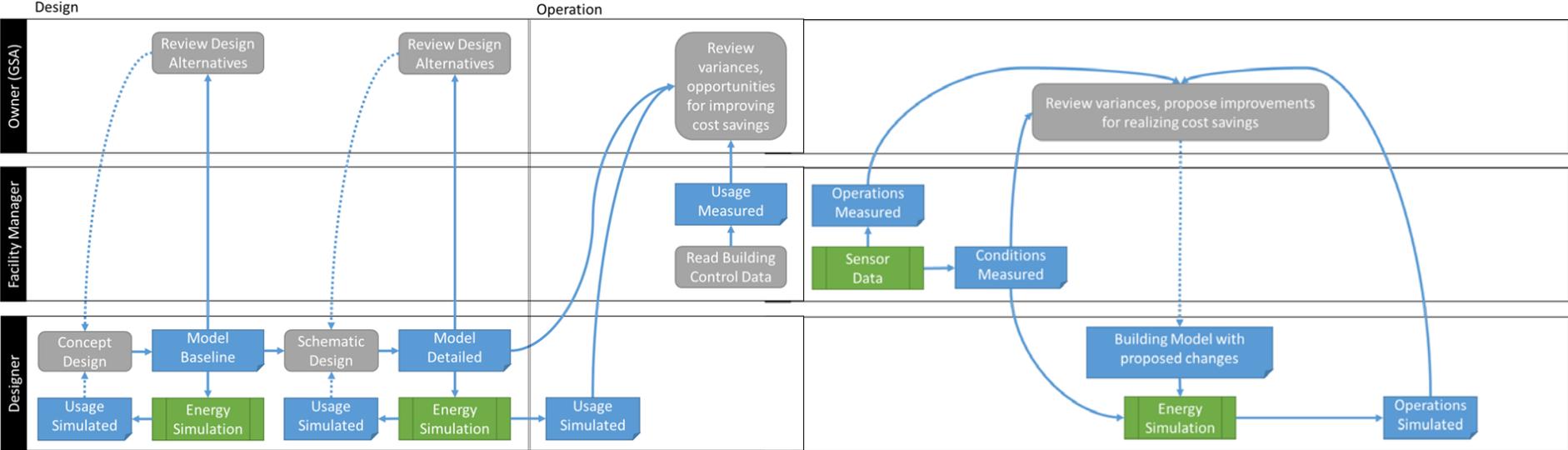
GSA Use Case: Energy Analysis



- This presentation references ongoing work performed by NIBS for GSA related to energy analysis.
- This work has been specifically prepared for GSA Office of the Public Buildings IT Services.
- Much of this work, when completed, will be posted on the GSA external website (www.gsa.gov) and NIBS will share an abbreviated courtesy copy, that references the study commissioned by GSA at (www.nibs.org).

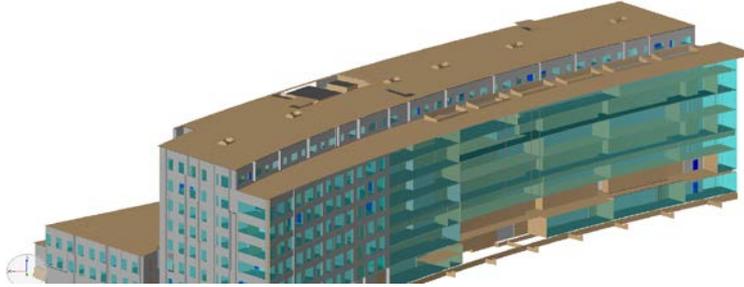
GSA Use Case: Energy Analysis

Energy Analysis Process Model (IDM)

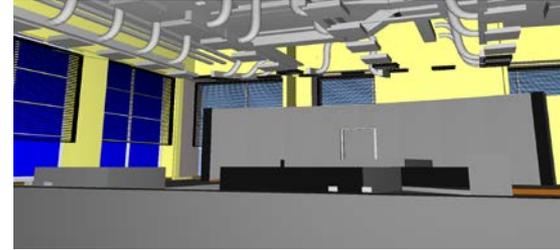


GSA Use Case: Energy Analysis

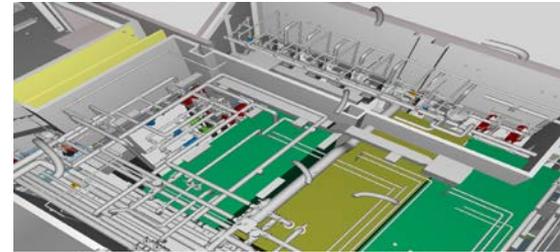
Example building envelope



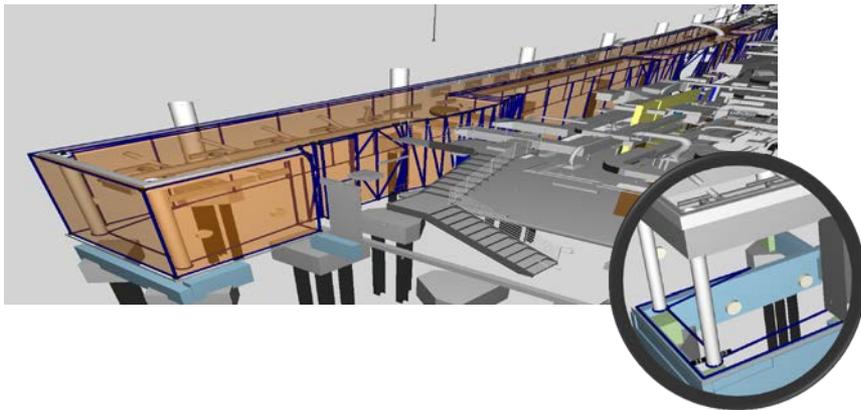
Example ductwork



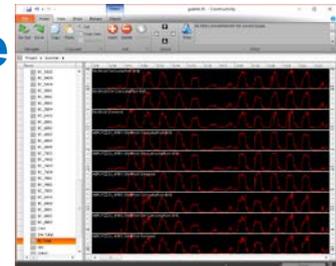
Example equipment



Example space boundaries



Example meter data



GSA Use Case: Energy Analysis

Based on Industry Standards for Energy Analysis and Modeling

1. ASHRAE 90.1 for Baseline Building Performance
 - Given a particular building configuration, climate region, and usage, calculate what should be reasonably expected for energy usage
2. EnergyPlus for Building Energy Analysis
 - Simulation of building components to conduct thermal analysis of spaces, envelope, materials, systems and connections
3. Project Haystack for Building Operations Data
 - Track and collect energy usage from building systems
4. buildingSMART IFC for building representation
 - Performance specification, simulation and operations tracking mapped to BIM through IFC

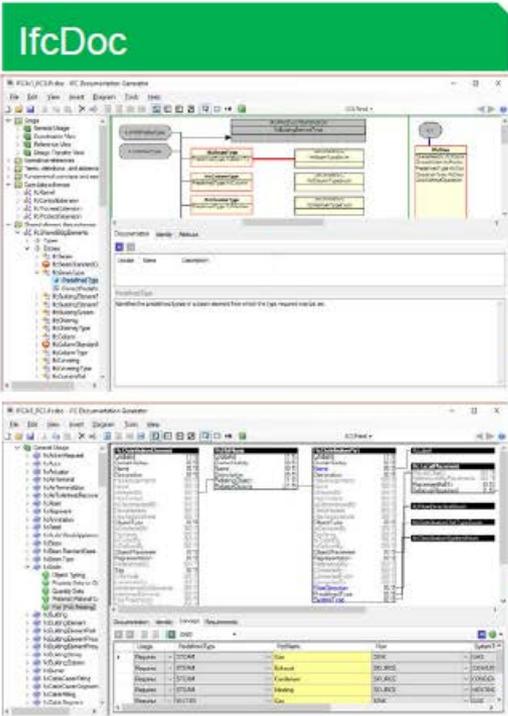
GSA Use Case: Energy Analysis

Data Exchange Scenarios

- Capture space occupancy and equipment scheduling
- Capture performance data
 - Baseline (ASHRAE 90.1) simulation results
 - Design (EnergyPlus) simulation results
- Actual building performance
- Relate baseline, design, and actual performance data with specific objects

IFC interoperability tools overview

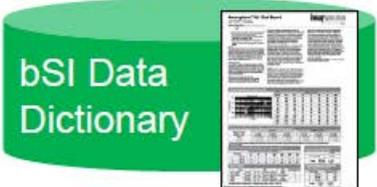
Define Data Requirements
data models, exchanges



Publish
specs, APIs, contracts



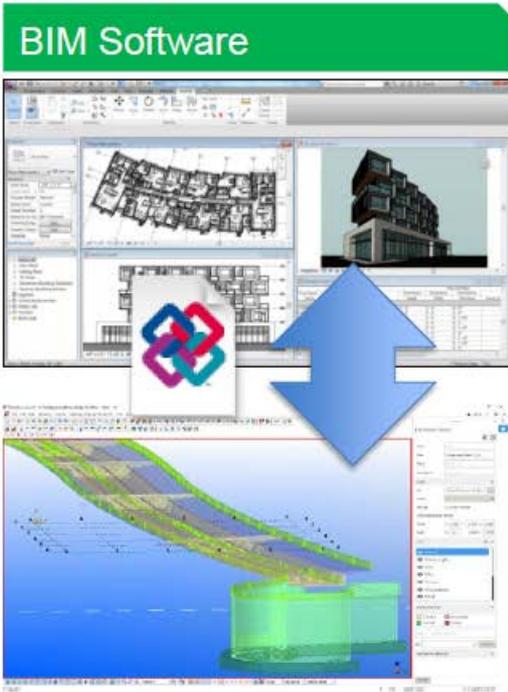
Extend
product templates



Validate
verify conformance

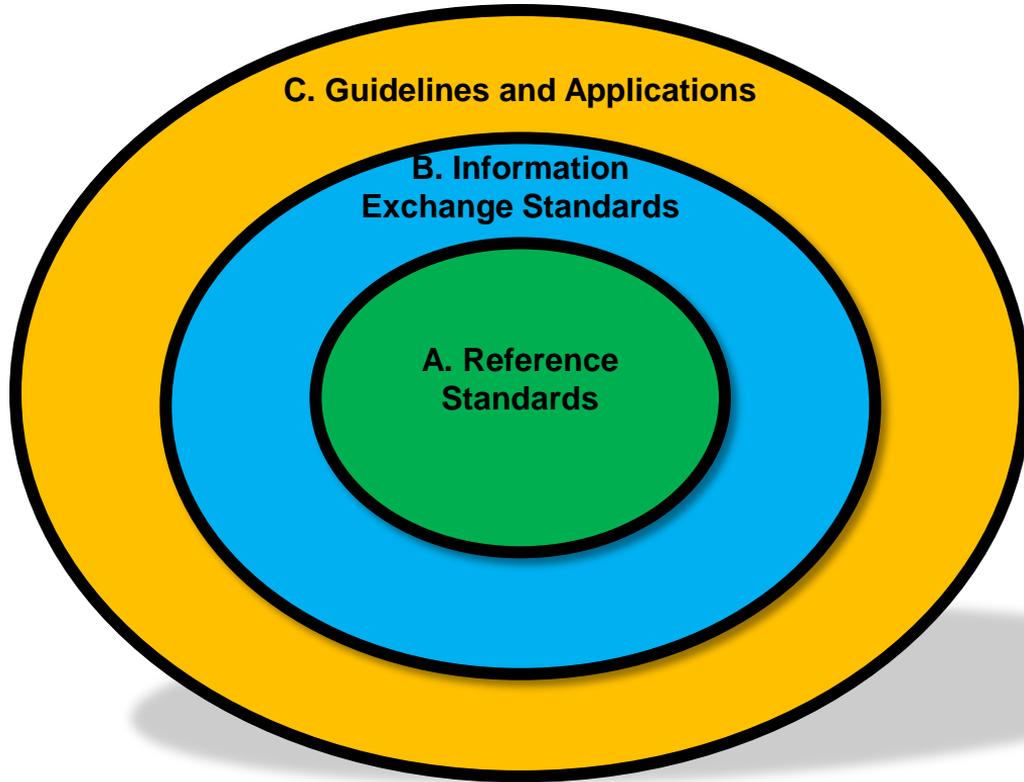


Implement
application software



Source: IFC Strategy Session, buildingSMART Barcelona Standards Summit, prepared by Tim Chipman

National Standards Model



A. Reference Standards

A.1. ISO Standards

A.2. Normative Standards - bSI

A.3. Conformance Specifications

A.4. Test Suite

B. Information Exchange Standards

B.1. Information Exchanges

B.2. Reference Processes

B.3. Reference Specifications

B.4. Reference Examples

C. Guidelines and Applications

C.1. Contract Specifications

C.2. Best Practice Guides

C.3. Open Standards based Applications

BIM Standard Development Process per U.S. National BIM Standard

1. Program -> *Standard Requirements*

- ❖ Process Map
- ❖ Exchange Requirements and Business Rules

2. Design -> *Standard Design*

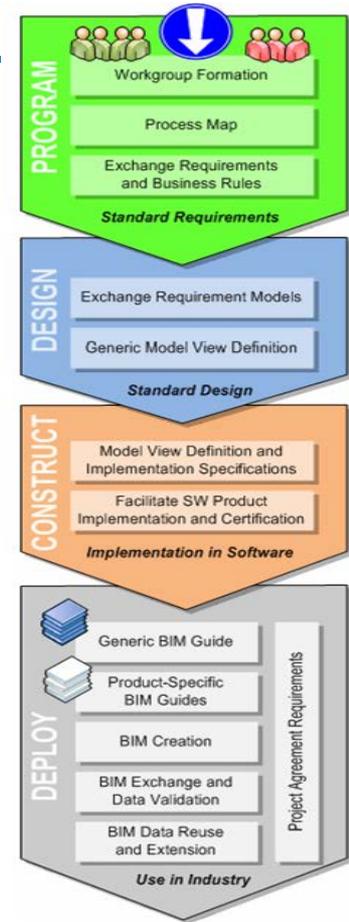
- ❖ Exchange Requirements Model
- ❖ Generic Model View Definition

3. Construction -> *Implementation in Software*

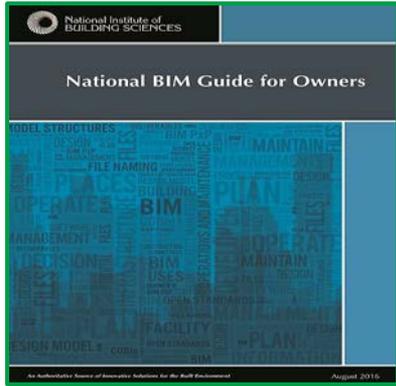
- ❖ Model view definition and Implementation Specifications
- ❖ Facilitate S/W Product Implementation and Certification

4. Deployment -> *Use in Industry*

- ❖ Generic BIM Guide
- ❖ Product specific BIM Guides
- ❖ BIM Creation
- ❖ BIM Exchange and Data Validation
- ❖ BIM Data Reuse and Extension
- ❖ Project Acquisition Requirements



National BIM Guide for Owners



1. INTRODUCTION

FOREWORD

- 1.1 PURPOSE
- 1.2 SCOPE
- 1.3 USE

2. PROCESS

- 2.1 DEFINE BIM REQUIREMENTS
- 2.2 TEAM ROLES AND RESPONSIBILITIES
- 2.3 BIM PROJECT EXECUTION PLANNING
- 2.4 MANAGING PROJECT REQUIREMENTS AND DELIVERABLES

3. INFRASTRUCTURE AND STANDARDS

- 3.1 TECHNOLOGY
INFRASTRUCTURE
- 3.2 STANDARDS
- 3.3 SPACE AND DRAWING STANDARDS
- 3.4 FILE STRUCTURE
- 3.5 MODEL STRUCTURES
- 3.6 MODELING REQUIREMENTS

4. EXECUTION

- 4.1 BIM EXECUTION PLAN (PXP)
- 4.2 BIM USES
- 4.3 MODEL DELIVERABLES

Takeaway

- Useful data already exists
- Useful technology already exists
- The real work: bringing data and technology together – It's a Journey, Get Started!

Get Involved:

<http://www.nibs.org/bsa>

<http://www.buildingsmart.org>



Questions/Discussion

Roger Grant, CSI

rgrant@nibs.org

www.nibs.org