Documenting Building Information Requirements

Digital Architecture, Design & Engineering Assets

2017-11-16

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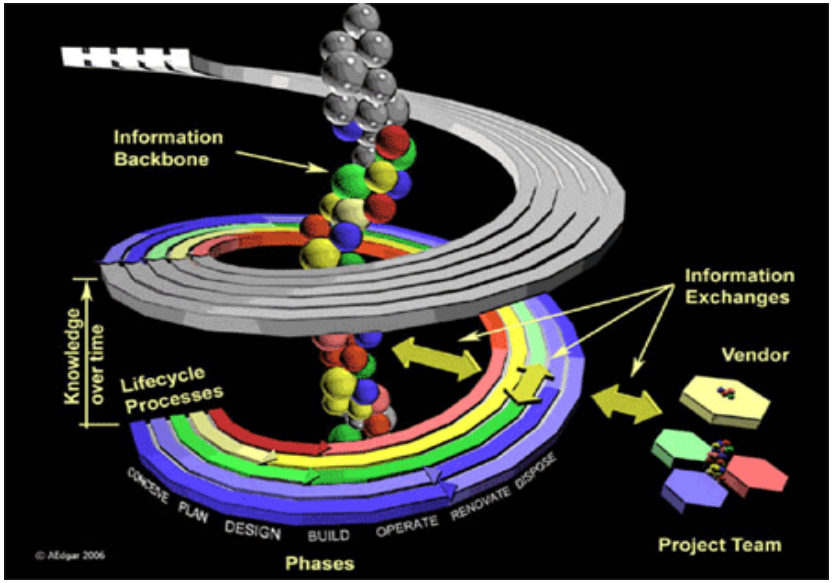
Product Room Leader, buildingSMART International

Shared Information

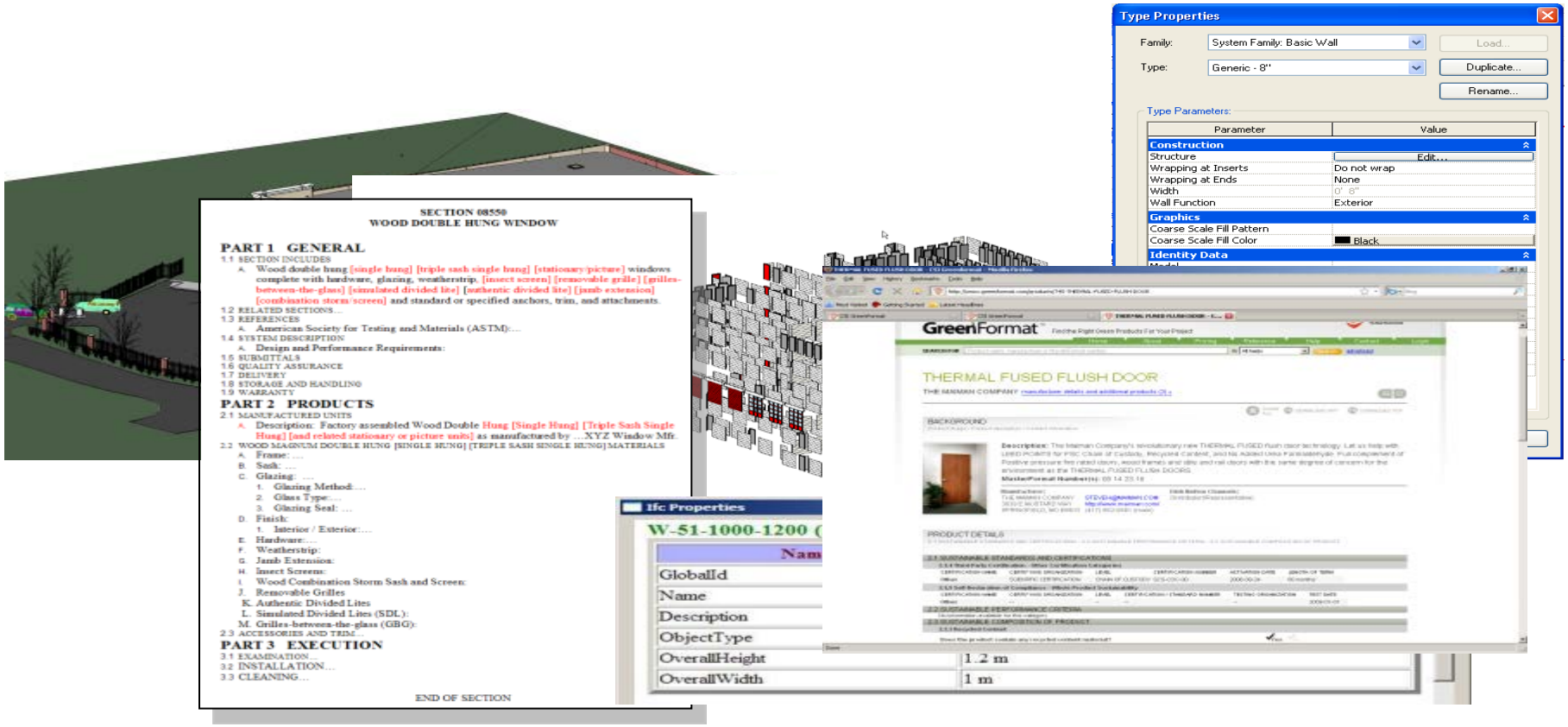
A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward.



United States National BIM Standard

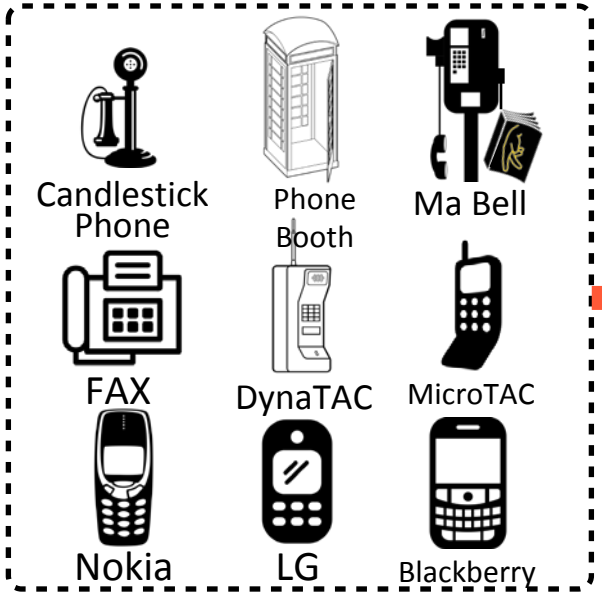
National Institute of BUILDING SCIENCES

BIM – Information Modeling and Management

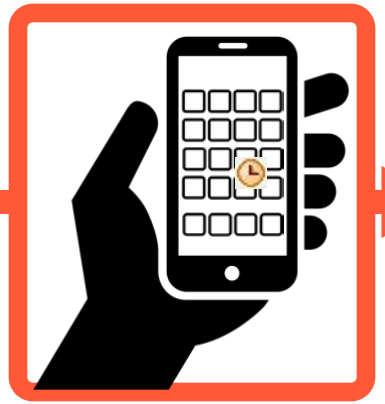


Standalone Devices

Pre-2007



Post 2008



Platforms

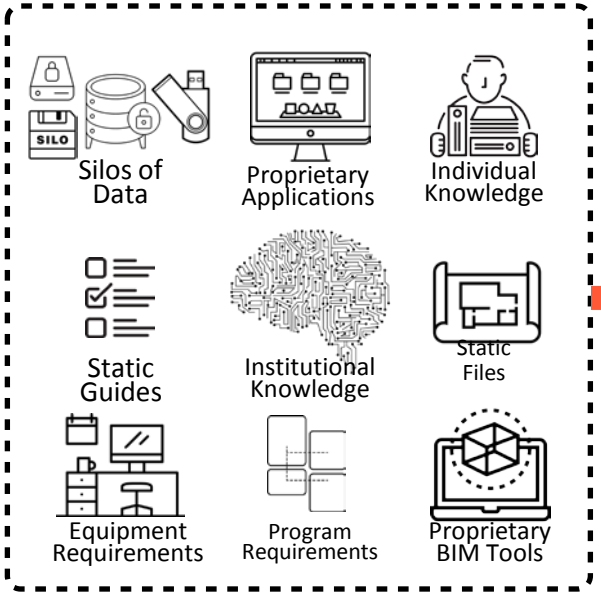
Easy to Use Apps

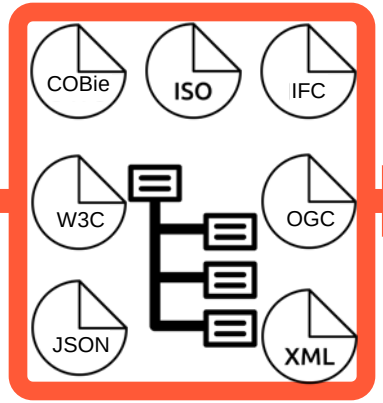
AEC GAME CHANGERS

National Institute of BUILDING SCIENCES

Courtesy Kimon Onuma, Onuma, Inc.

Institutional Knowledge & Data





Standards

Easy to Use Apps

Courtesy Kimon Onuma, Onuma, Inc.

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

Digital Built Britain

Lower costs

33%

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

Faster delivery

50%

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

Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

Improvement in exports

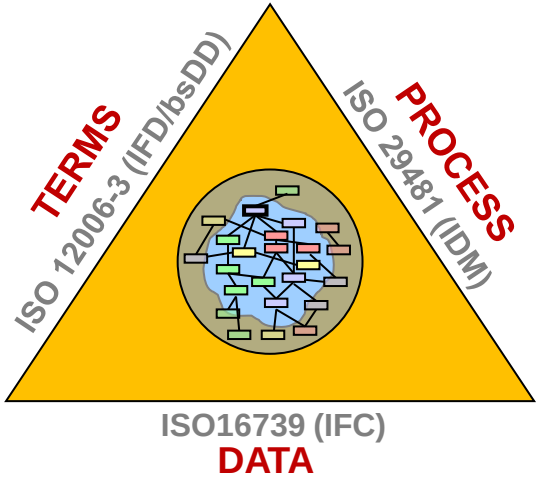
50%

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

Source: Opening Plenary, buildingSMART London Standards Summit, prepared by Mark Bew

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**

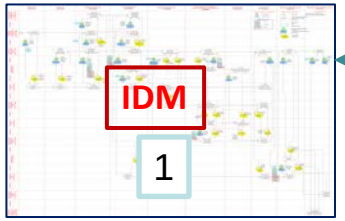
Terminology - bSDD

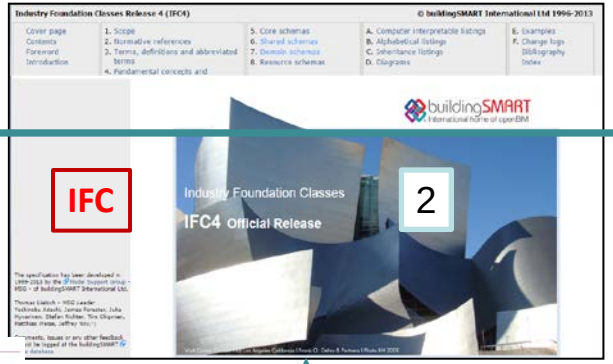
- **Uniquely identify properties and objects**
- **Multilingual support**
- **Dynamically extend the IFC model**
- **Tools: buildingSMART Data Dictionary (bSDD)**

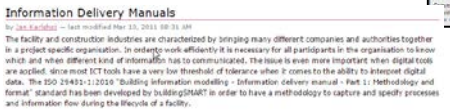
Collaboration - BCF

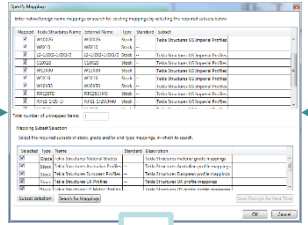
- **Electronic messages when using models (RFI, RFC)**
- **Tools: http://www.buildingsmart-tech.org/specifications/bcf-releases**

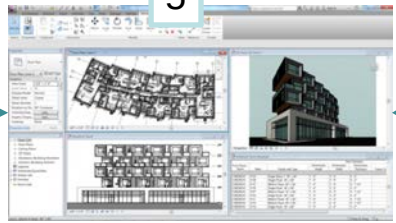
Using bSI Standards for Information Identification and Exchange







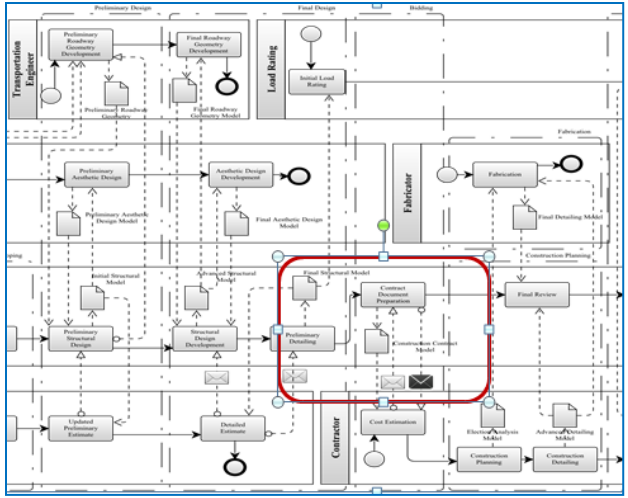




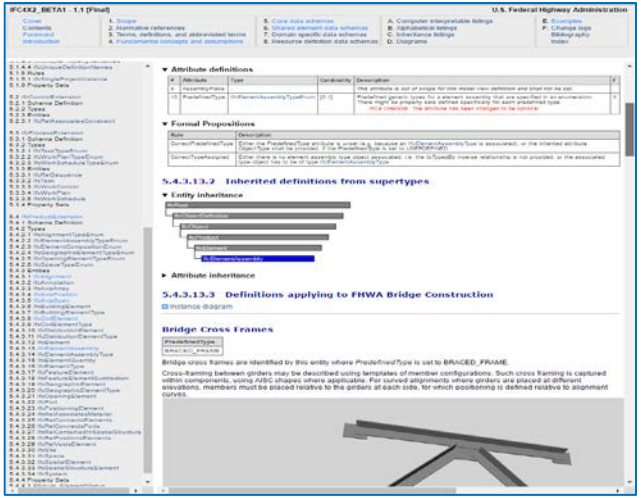
1. **IDM to document work flows and exchanges**
2. **IFC defines universe of modeling requirements**
3. **MVD for Exchange Specification using IFC.DOC**
4. **bSDD repository for model and non-model Entities/Types/Properties/References with GUID and Context for specific use**
5. **Requirements expressed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

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

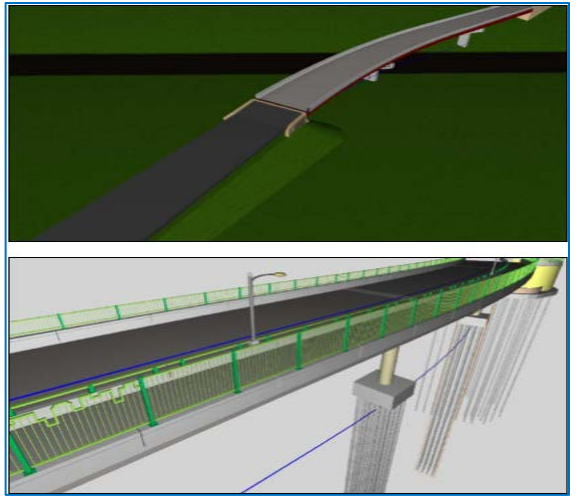
Process Map - IDM



Exchange Specification - MVD



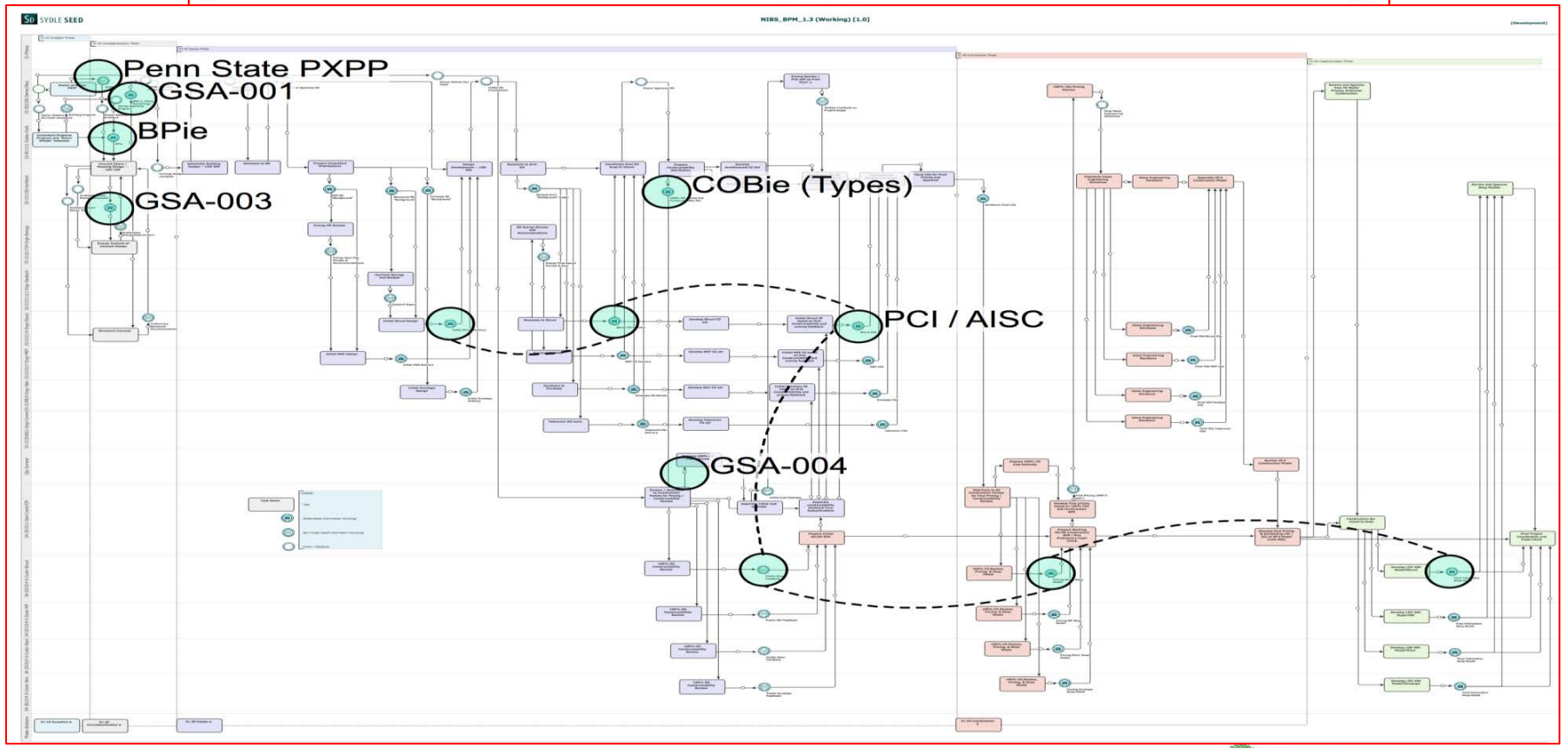
Examples



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

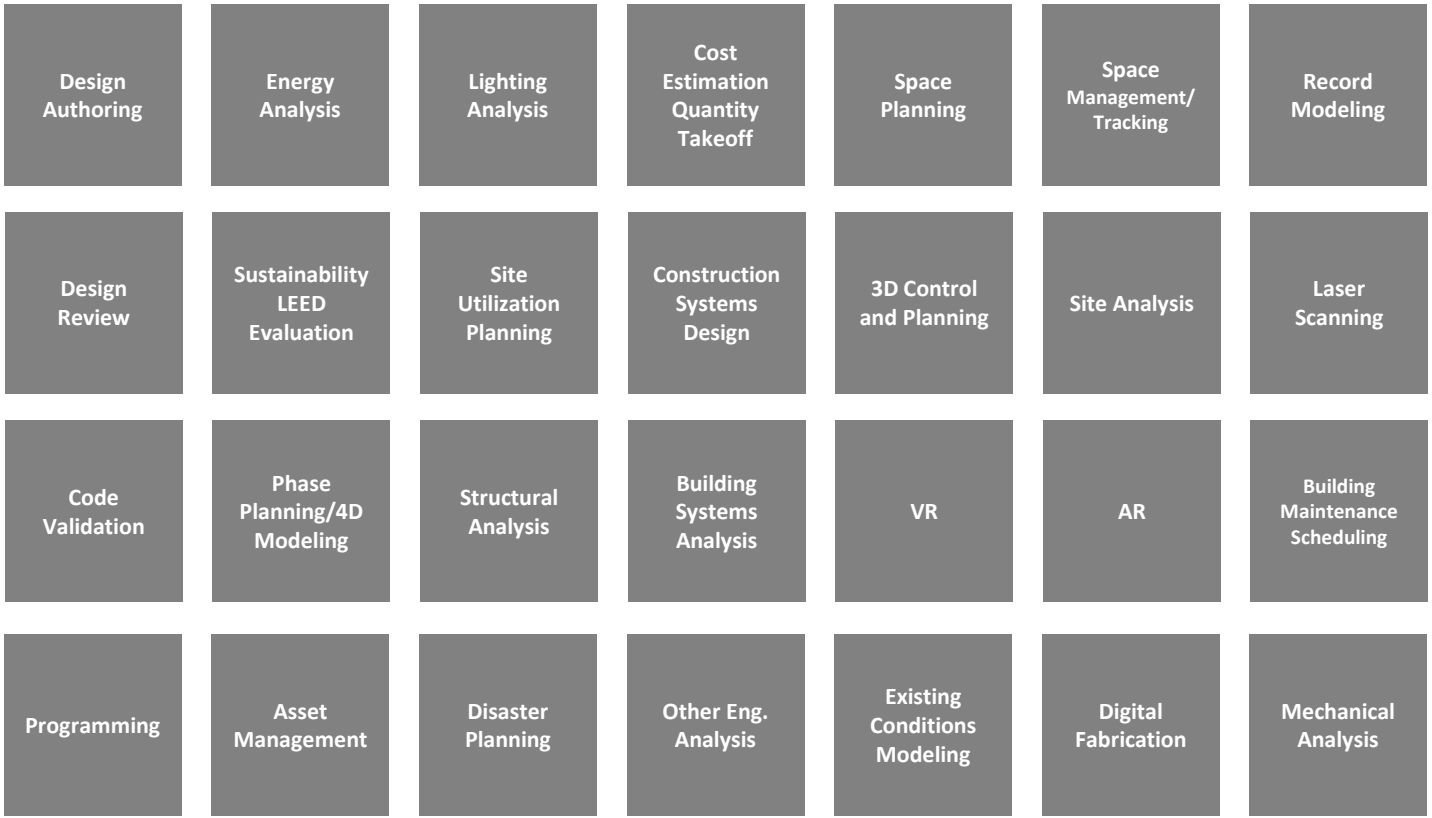
http://www.nibs.org/?page=bsa_bridge
https://www.fhwa.dot.gov/bridge/pubs/hif16011/

Process Map – IDM for Buildings



Courtesy Robert Anderson, buildingSMART alliance

BIM Use Cases



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

Courtesy Alyssa Lapan, Department of State Bureau of Overseas Building Operations.

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DHA/VA Use Case: Space and Equipment Planning

Space

Equipment

Department of Defense
Defense Health Agency

Courtesy Kimon Onuma, Onuma, Inc.

DHA/VA Use Case: Space and Equipment Planning

SEPS2BIM.org

Available Online

Courtesy Kimon Onuma, Onuma, Inc.

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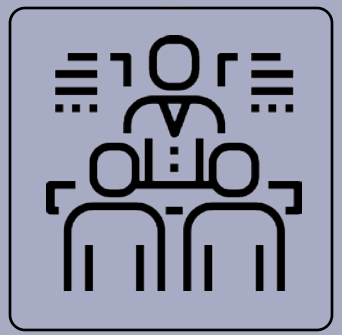
U.S. Department of State
Bureau of Overseas Buildings Operations



Improved Coordination

Shared Data For Lifecycle

Improved Efficiencies

Supporting Projects & Portfolio

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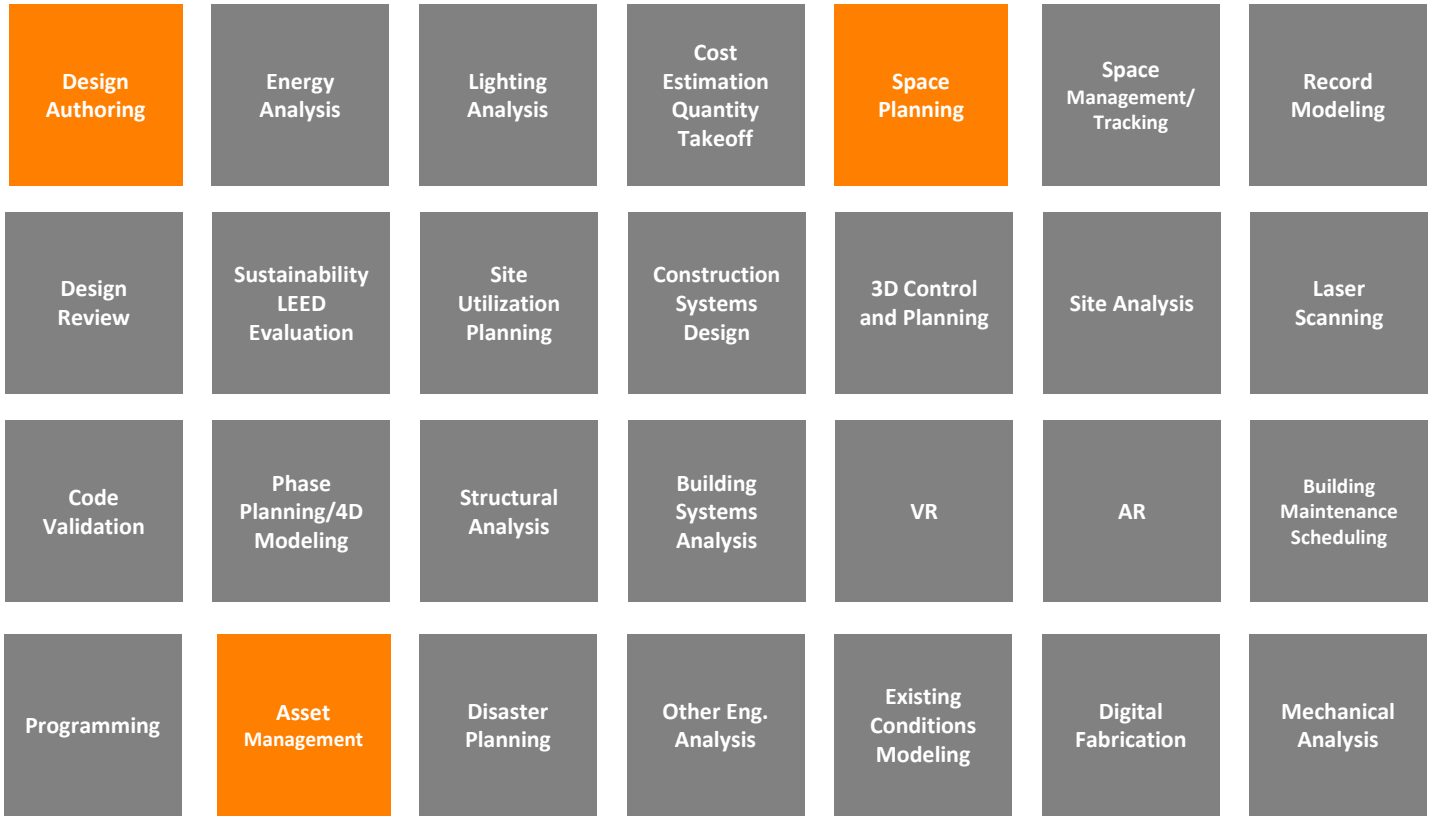
AEC GAME CHANGERS

BIM Use Cases



Decide where to start.

Courtesy Alyssa Lapan, Department of State Bureau of Overseas Building Operations.

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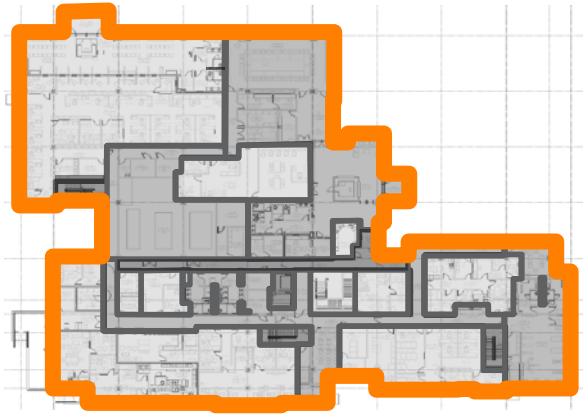
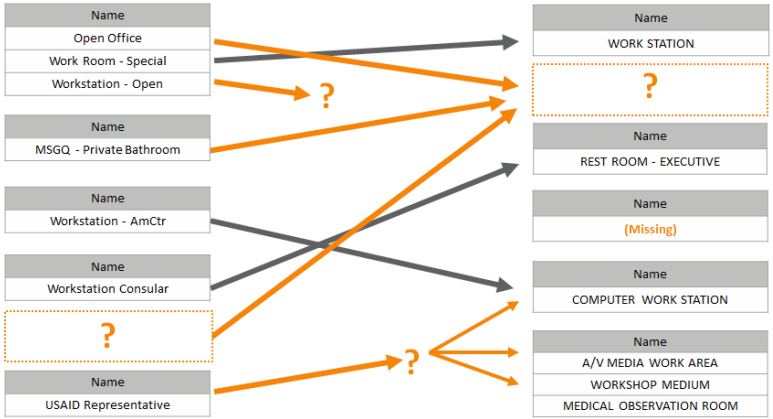
DoS OBO Use Case: Space Planning





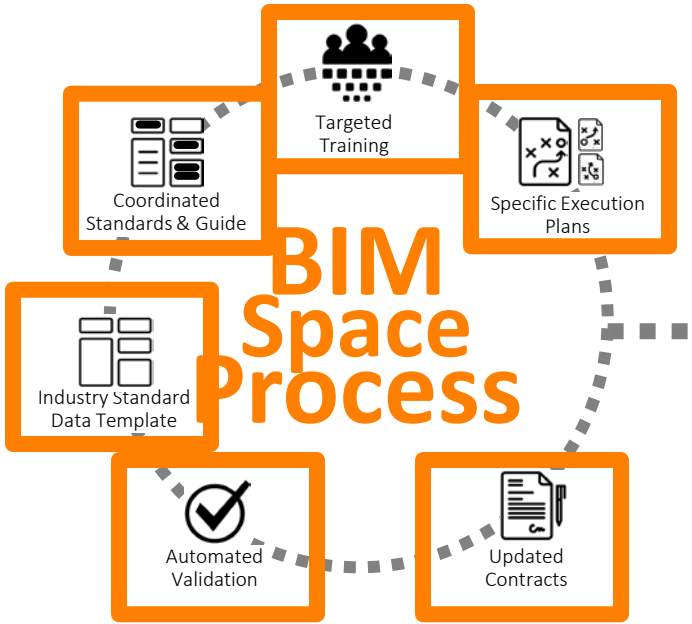
Measured ~8,800 GSM

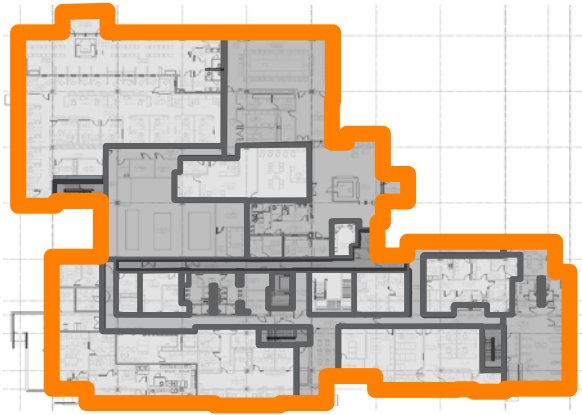
Range in Systems:
~ 8,000 GSM - ~ 4,000 GSM

6,000 Space Types in Various Systems

900 Space Types in OmniClass

DoS OBO Use Case: Space Planning

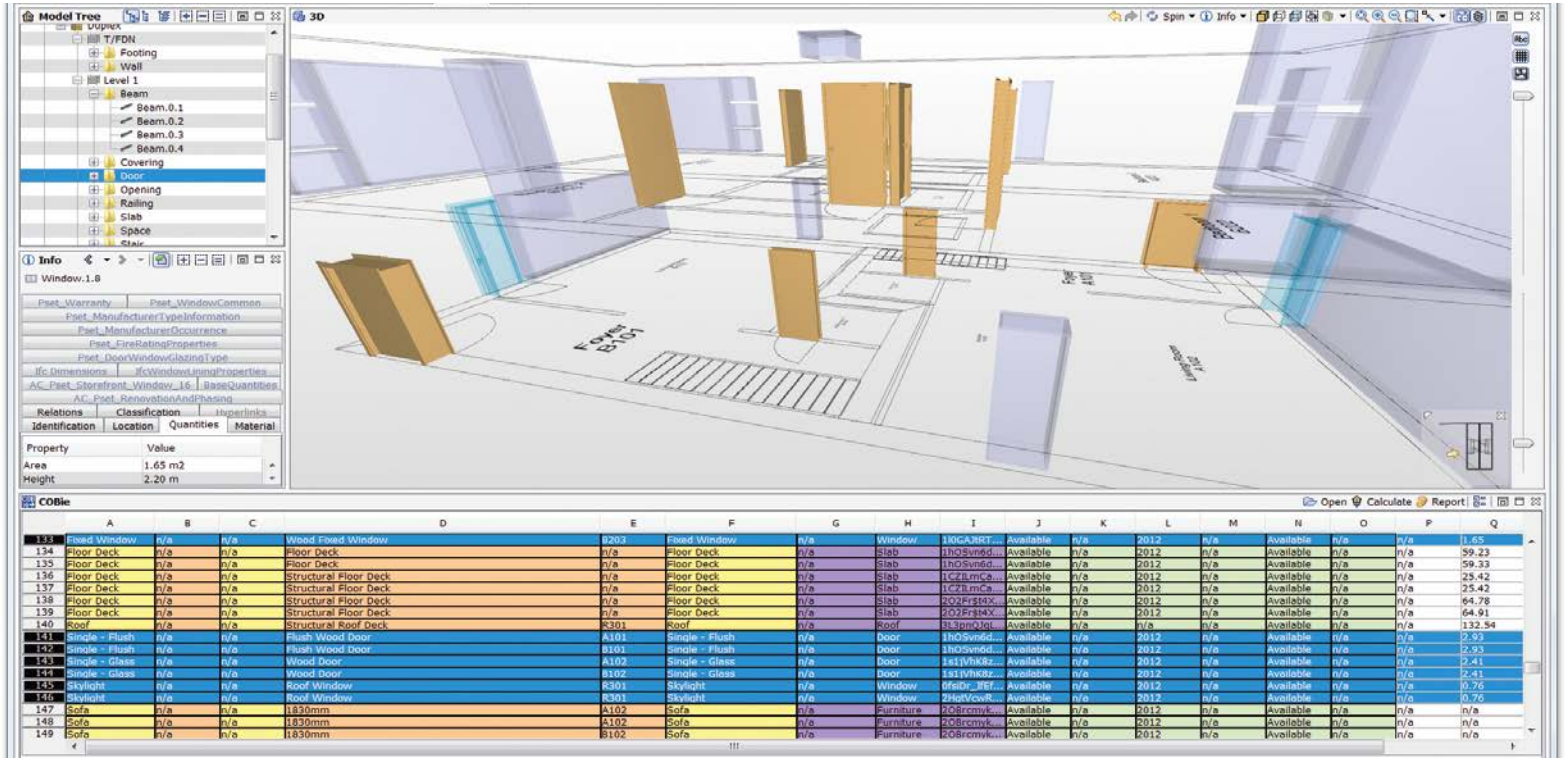




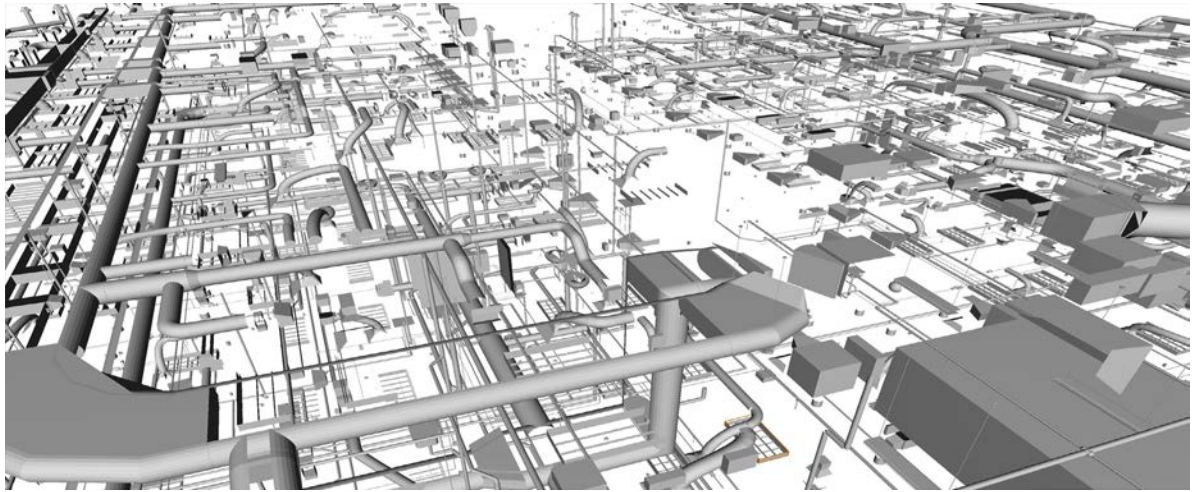
Measured 8,800 GSM

All Systems 8,800 GSM
Common Space Names
Requirements Communicated

Use Case: Asset Management (COBie)



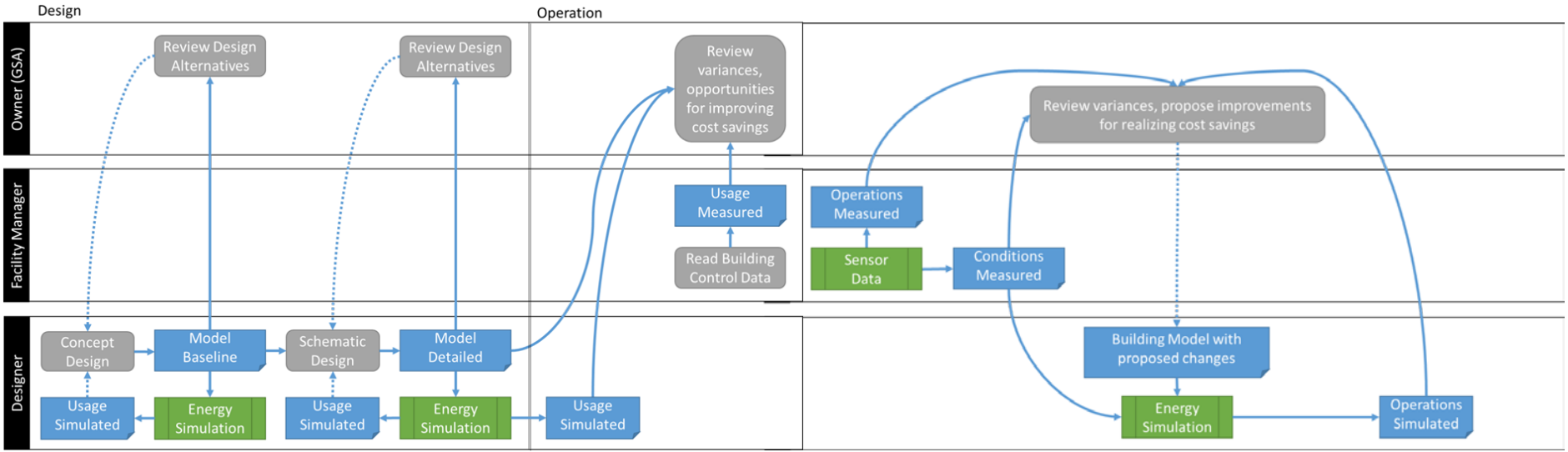
GSA Use Case: Energy Analysis



- 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).

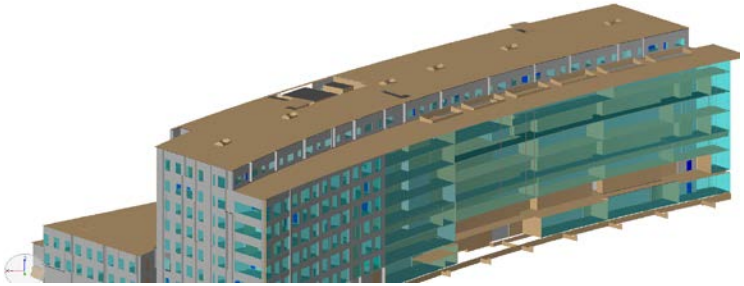
GSA Use Case: Energy Analysis

Energy Analysis Process Model (IDM)

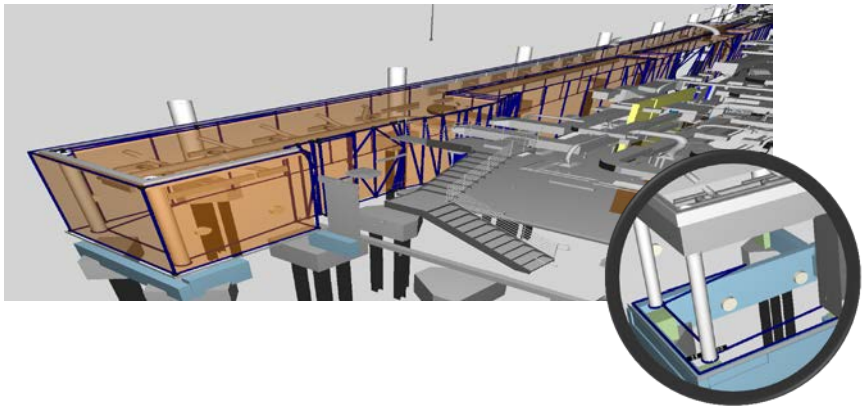


GSA Use Case: Energy Analysis

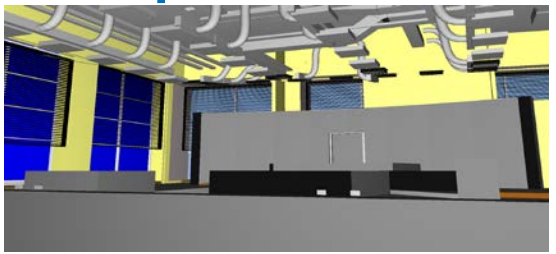
Example building envelope



Example space boundaries

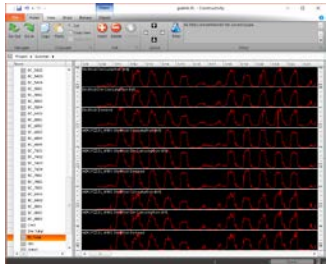


Example ductwork



Example equipment

Example meter data



GSA Use Case: Energy Analysis

Based on Industry Standards for Energy Analysis and Modeling

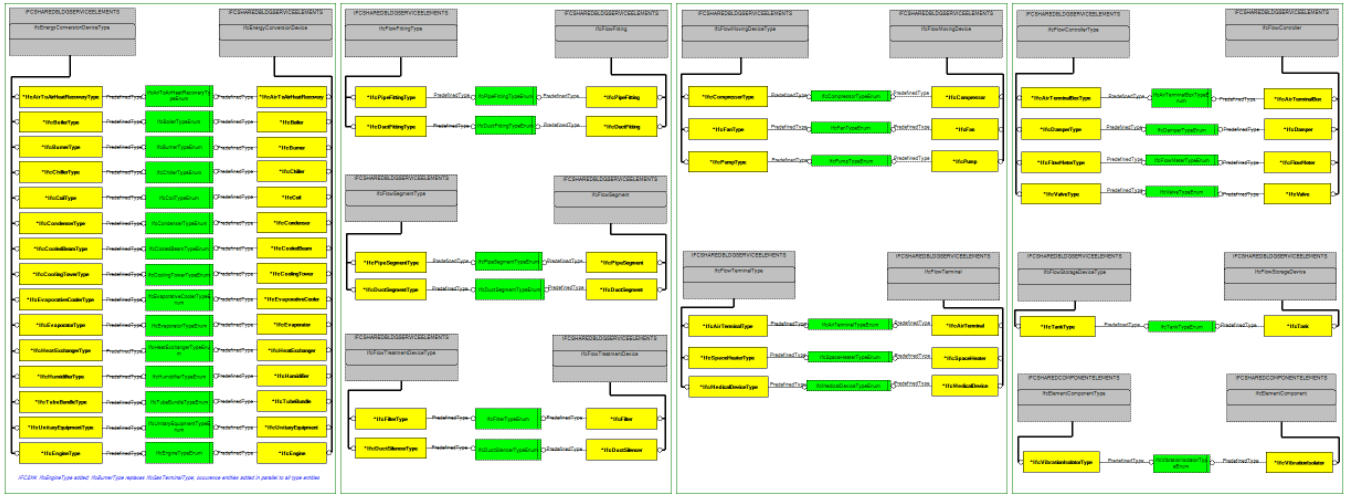
1. ASHRAE 90.1 for Baseline Building Performance
   - Given a particular building configuration, climate region, and usage, calculate what should be reasonably expected for energy usage
2. EnergyPlus for Building Energy Analysis
   - Simulation of building components to conduct thermal analysis of spaces, 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

Energy Exchange Specification

GSA-Energy

D.1.3.5 IfcHvacDomain



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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

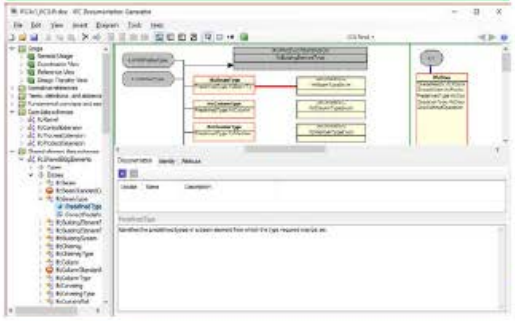
IFC interoperability tools overview

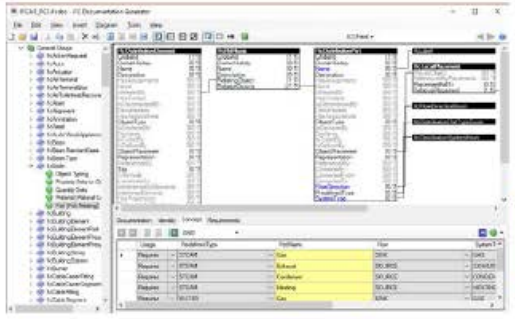
Define Data Requirements
data models, exchanges

Publish
specs, APIs, contracts

Implement
application software

IfcDoc





bSI Tech Website

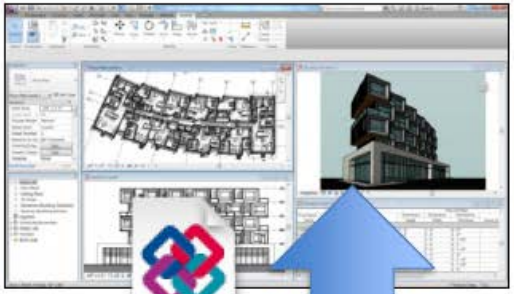
Extend
product templates

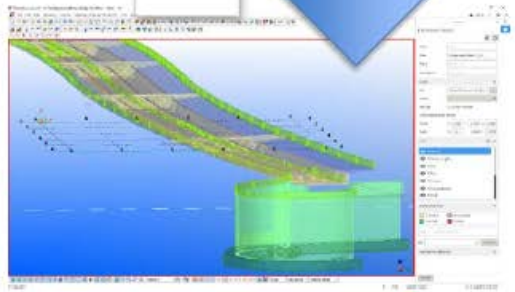
bSI Data Dictionary

Validate
verify conformance

bSI Test Server

BIM Software



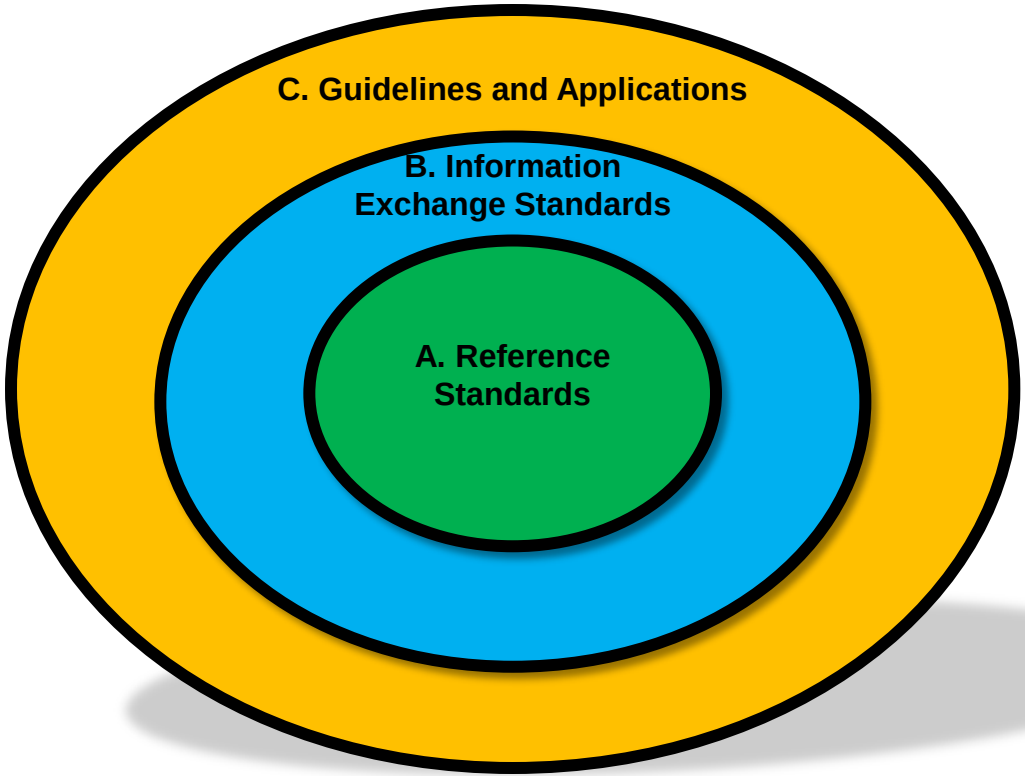


Source: IFC Strategy Session, buildingSMART Barcelona Standards Summit, prepared by Tim Chipman

National Institute of BUILDING SCIENCES

National Standards Model

National BIM Standard - United States™
an initiative of the National Institute of Building Sciences buildingSMARTalliance™



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

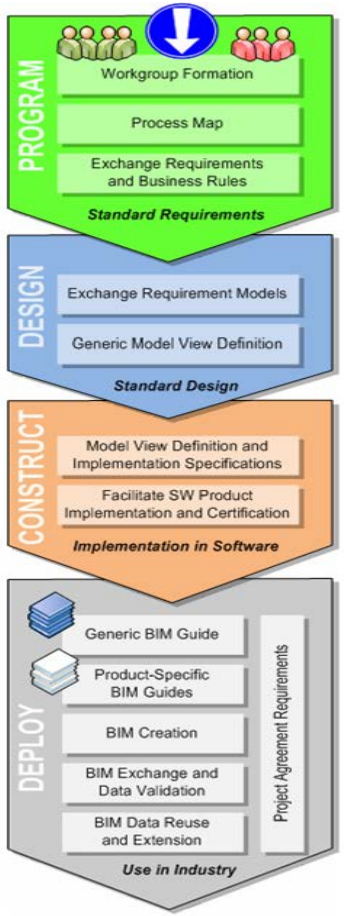
BIM Standard Development Process per U.S. National BIM Standard

1. Program -> *Standard Requirements*
   - Process Map
   - Exchange Requirements and Business Rules

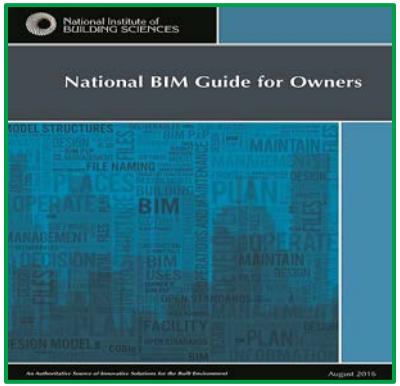
2. Design -> *Standard Design*
   - Exchange Requirements Model
   - Generic Model View Definition

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



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

buildingSMART®
International home of openBIM®

Questions/Discussion

Roger Grant, CSI
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www.nibs.org