Developing a 3D Building Information Management Practice

Smithsonian Facilities

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Google search: “Smithsonian AE Center”

Full url: http://www.sifacilities.si.edu/opdc/index.html

BIM Standards and Templates
Smithsonian around the Globe
19 Museums, 9 Research Centers, plus the National Zoo

Smithsonian Facilities
- Museums
- Research
- Admin/Support/Storage

600+ Buildings, 12.5 million Sq Ft
Challenges of Stewardship

- 6,500+ employees and 6,300 volunteers
- Collection care for 138 M+ artifacts
Challenges of Stewardship

• 600+ buildings; ~12.5 million sq. ft.
• Museums, laboratories, field stations, telescopes
• Monumental and historic icons
• Living Collections
Smithsonian Facilities

- 1,100+ facilities staff
- Open 364 days per year
- High rate of visitation: 29.3 million per year (FY16)
Smithsonian Facilities Goals for BIM

- Modernize our information requirements
- Improve facilities information management
- Ensure consistent data deliverables
- Align BIM requirements with project work processes and staff capabilities

*Not interfere with creative process in new design projects*
Basic BIM Requirements for A-Es

Framework BIM Standards and Guidelines to Support Project Development and Development:

1. SI Revit Templates and User’s Guide
2. SI BIM Standards Guidance Document
3. SI BIM Project Execution Plan (PxP)
4. SI BIM Level Of Development Matrix
5. BIM Contract Language Guidance

- Training Seminars for SI Staff and AECs
3.22. Building Information Modeling: The A/E, in consultation with SI, shall select Building Information Model (BIM) application(s) and software(s) to produce accurate 3D and 2D graphic object models, data tables and text-based documents; and to derive 2D Construction Documents. As part of the basic services, the A/E shall:

3.22.1. Provide BIM models for architecture, structure and MEP/FP as applicable for the disciplines required for this scope of work ….

3.22.2. Provide “soft metric” measurements in 2D documents …

3.22.3. Present a BIM execution plan for SI review and comment, during the first progress meeting of the Schematic Design phase …

3.22.4. The bid documents for construction will be two-dimensional views … however, the SI will give the BIM model to the successful contractor for use …

3.22.5. The BIM models shall be developed in a manner that will support on-going operations and management of the building and its systems ….

3.22.6. Provide asset information for all equipment in SI provided format ….
SI BIM Guidelines and Templates

*Customized floor and area plan views* formatted for use by existing SI Systems

- Site plans
- Floor plans
- Area plans
- Structural
- Life safety plans
- Reflected ceiling plans
- Roof plans

- Mechanical and Electrical Assets -- ready for export to SF CAFM system
- GIS requirements – ready for export to SF Geodatabase
- 3D views, walkthroughs, elevations,
- SI title blocks and sheet layouts with agency logo, smart labels and graphic scale symbols
- Includes disciplines, standard layer names

**SI Revit Templates**

- Architectural Template
- Electrical Template
- Mechanical Template
- Structural Template

Revit “.rte” Template File – Space Plan
Prototyping Data Development

Spatial and ACM (Asbestos Containing Material) Data

**SI Room Parameters**
- Level
- Number
- SI_RoomLinkID
- Name
- Area
- Area-MM2
- Perimeter
- Perimeter-MM
- Volume
- Limit Offset
- Department
- Occupancy
- Occupant
- Comments
- ACM_HAZ_ID
- ACM_MAT_TYPE
- ACM_CHANGE
- ACM_MAT_COND
- ACM_COMMENTS
- ACM_STATUS

**Asset Data**

- Asset ID
- Asset Name
- Specification ID
- Specification Name
- Serial Number
- Brand
- Model Number
- Description
- Amps
- Voltage
- KVA
- GPM
- Belt Size
- RPM
- MaxP
- Filter Size
- Ton
- HP
- Gal
- CFM
- BtuH
- Floor
- Room Number

- Include a manageable set of SI parameters in BIM templates - data fields used in CAFM
- Vet the information in standard project reviews (Revit schedule export to a spreadsheet)
- As-built BIM deliverable for FM will have the final data for intake into Tririga FC, GIS
Other Guidance for BIM Deliverables

Level of Development Guide

• SI has developed a guidance framework for the level development required for BIM deliverables

• BIM LOD will be identified early in the project (passed on to the team to detail in the project BIM PxP)

• The **Scope of Work** of the project ultimately defines the BIM requirements
A living document populated and updated by the project team that clarifies and maintains the project BIM development process for the owner, and the team.

**SI BIM Project Execution Plan (PxP)**

- **BIM Project Information**
- **BIM Content & Goals**
- **Technologies**
- **Project Timeline**
- **Submittals & Deliverables**
- **Reviews & Quality Control**

- **Project data.** Project reference information - contacts, roles/staffing
- **Goal and objectives.** Geometry and data requirements for the BIM
- **Software applications, hardware, networking** used in developing the BIM by the project team
- **Schedule** of project BIM milestones
- **Quality control and review processes** for the project BIM
- **Submittal requirements** for project BIM data, throughout the project and at final turnover
Model Checker

- Provides an automated means to check a BIM against a customized rule set
- Useful by SI and by their project consultants
National Air and Space Museum Revitalization Project
Introducing BIM to Project Design Reviews

National Air and Space Museum (NASM) Revitalization – *BIM Pilot Project*

- First SI contract with BIM deliverables – architectural and engineering disciplines
- Will “road test” the SI standards:
- BIM data will be setup, stored in the SI’s archive system (Document Locator), accessed through SI BIM Wiki web site
Current Design Review Process

**iManage**
- iM project created
- iM review session open
- Review Session
- All comments uploaded to iManage (by discipline)
- iM review session closed

**Design Review Process**
- 2D PDFs Drawings
- AE compiles, transmits milestone submission to SI
- DM distributes submission to multiple SI reviewers
- Reviewers independently markup and comment
- Reviewers meet to discuss interdependent issues
- All comments uploaded to iManage (by discipline)
SI Project Review Processes

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**Bluebeam**
- BB project created
- SI BIM lead sets up PDFs; review session
- Project reviewers view PDFs, comment to iManage (screen capture)
- Collaborative session for reviewers*
- BB review session closed

Yellow outlined box = new process requirements. Red outline box = available while prototyping.
New introductory pages will simplify access to new 3D files
Proposed 3D Visualization Tools

**Revizto for Visualization and Walk-through**

- Collaborative review
  - Using Revizto (visualization and walk-through)

**BlueBeam for Detailed Review 3D**

- Individual reviewer, at workstation
- Uses PDF
- Incorporates review of 2D drawings with the 3D views
3D PDF: Collision Detection

- Toggle on/off (discipline links)
- Markups and Screenshot Capture
3D PDF: 2D and 3D Workflow

- Detailed data can be displayed by clicking the 3D component
- Links are provided to access components for different disciplines
- Measuring tools are provided for 2D drawings and 3D models
3D PDF: Section Box

- Sections through 3D models can be cut by the reviewer and saved
- The viewer can isolate object data and apply transparency to help the visualization
3D PDF: Comparing Changes

- Separate drawings can be compared with “overlays” feature
- Components also can be compared in a side by side view
3D PDF: Quantities

- Bluebeam Visual Search Feature can return quantities of components in the model

Select a component graphically - and return a list of like components
Revizto Features

- A plug-in application to Autodesk Revit exports the BIM as a single file (.exe) - a user will click on it to run (no viewing application needed by the reviewer)
- The 3D model is presented in an easy, intuitive video game-like interface
Virtual Reality Demo
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