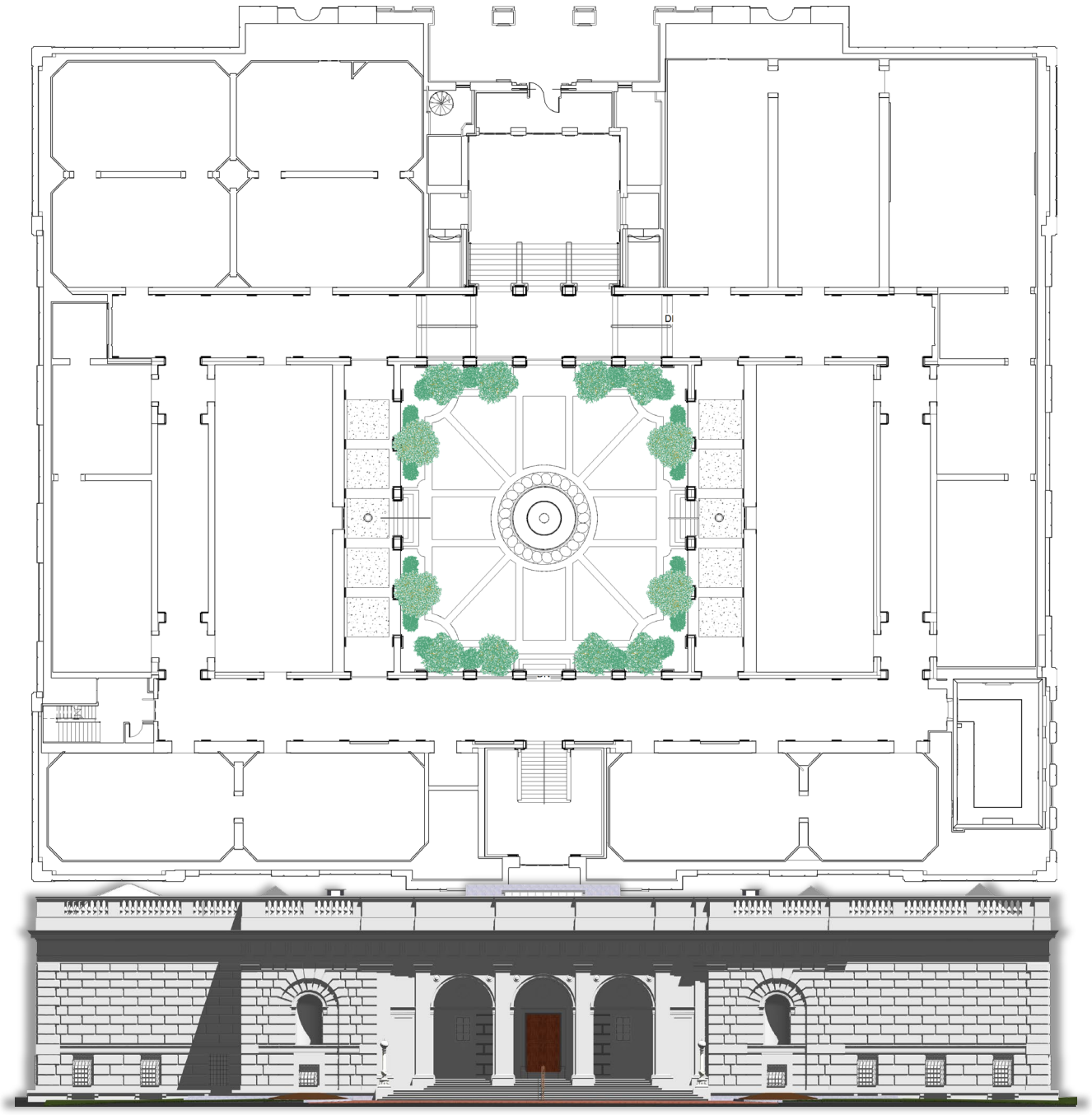
Smithsonian

Office of Planning, Design, and Construction

BIM Guidelines



November 2024

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Document Revision List

Task	Details	Revision Date
Layering Standards	Revised Layering Standards	September 2018
Asset Management	Revised Asset Management to align with new requirements	September 2018
SI Space Naming Guidelines	Added Space Naming Guidelines	September 2018
LOA Requirements	Added LOA Requirements for Modeling	September 2018
Construction / Bid Set	Added documents that may be available	April 2021
Electronic File Storage	Added OneDrive	April 2021
Remove Model Review	Removed SI “Model Review” Tool	March 2024
Remove Smithsonian Facilities (SF)	Change Smithsonian Facilities to New Department	November 2024
Modeling Parameters	Clarified Modeling minimal elements	November 2024

1. INTRODUCTION

Building Information Modeling, or BIM, is utilized throughout the building industry for developing and documenting building projects, from early in the conceptual design phase through to project delivery.

> *"Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. BIM is used for the purpose of visualization, engineering analysis, conflict, analysis, code criteria checking, cost engineering, as-built product, budgeting and many other purposes…" -- National BIM Standard - United States (NBIMS)*

The Smithsonian Institution (SI) encompasses over 12 million square feet of space in over 640 buildings in the US, Panama, and other international locations. Management of Building Information Models (BIM) at the SI is the responsibility of the Smithsonian OPDC, the organization that is responsible for both in-house design efforts and administration of repair, renovation and new construction projects for the museums and other facilities.

The purpose of this manual is to convey the key processes, responsibilities and details for BIM development for OPDC projects by architecture, engineering and construction (AEC) consultants. The goal of the standards documents is to assure accurate and consistent project deliverables.

This document includes guidance for drawing appearance, BIM element standards and symbols, and deliverable requirements. The *OPDC BIM Standards* is one of several interrelated documents that assist project teams to fulfill the SI's project requirements. Additional OPDC BIM-related guidance includes:

- OPDC BIM Integration Flowchart
- OPDCCAD Guidelines
- OPDC BIM Execution Plan Framework Document
- OPDC BIM Content LOD Matrix
- OPDC Revit Template User's Guide
- OPDC Revit Templates (Architectural, Mechanical/Plumbing, Electrical, Structural, & Fire Alarm / Security BIM files)
- Specification Section – 01 3250 BIM Requirements
- Specification Section – 01 7823 O&M Data Requirements
- SI Facility Asset Data Spreadsheet
- SI Space Naming Guidelines

2. BIM PROJECT EXECUTION PLAN (PXP) REQUIREMENTS

Smithsonian OPDC requires that a BIM Project Execution Plan (PxP) be developed for project employing BIM. The "*OPDC BIM Execution Plan - Framework Document"* has been developed as a template by Smithsonian OPDC to assist project teams developing BIM execution plans, consistently across all OPDC BIM projects.

2.1 BIM Execution Plan Overview

BIM Project Execution Plans will be living documents, updated by the consultant team throughout project development and delivery then transferred to the Contractor for updating throughout the construction. The BIM PxP works in concert with the other OPDC BIM guidance documents noted in Section One.

Any changes made to the BIM PxP during the course of a project must be approved by the authoring party, and reviewed and approved by the SI's COTR (Contracting Officer's Technical Representative) for the project.

2.2 Procurement Strategy and the PxP

The BIM Execution Plan (PxP) will be tailored to align with the project's procurement method (such as Design-Bid-Build (DBB), CM at Risk, Design-Build (DB), etc.

Procurement strategies will influence whether there are separate design and construction BIMs and who will be the responsible party for the final project BIM deliverable. Separate contracts will require a separate BIM PxP, but should align with each other to ensure a collaborative process.

When a project BIM is to be developed collaboratively for both design/documentation and construction, the BIM Execution Plan (PxP) should address how the model(s) can be handed-off between stages effectively.

2.3 BIM Sharing

Project development is an intrinsically collaborative process. The PxP will detail BIM authoring tools, data integration, and collaborative team workflow environments that will be employed throughout the project BIM development process.

Listed below are the *possible* BIM information products that will be delivered during different stages of the project lifecycle.

2.3.1 Design

The A/E design consultants for a project shall be responsible for providing Design Intent Model(s) as part of project deliverables, as described in the project scope of work. The design phase PxP will describe the details of the project model, including file formats, coordination/federation of the model(s), and format for deliverables.

2.3.2 Construction Documents/Bid Set

For projects having a bid phase, BIM requirements will be defined and reviewed with potential bidders. The design phase PxP will be provided as part of the overall OPDC BIM guidance for the project.

Prior to the start of construction, the following building information, obtained and developed by the Architect and/or Engineer during the design phase, may be available to the Contractor for the development and use by the contractor during the construction process:

1. Design Intent Model(s) (.rvt, .ifc, .nwc, .nwd, .dwg)
2. Contract Documents (.pdf, .dwg)
3. Point Clouds (.rcs)
4. Scans of the original building design drawings (.pdf)
5. BIM PxP (.docx, .pdf)
6. LOD Matrix (.xlsx, .pdf)
7. SI Facility Asset Data Spreadsheet (.xlsx)

The Contract Documents are the binding document(s), the Design Intent Model(s) are provided for reference only.

2.3.3 Construction Phase

- It is the contractor's responsibility to assure that all major trades are modeled as per the contract and used for clash detection, construction phasing, and installation coordination and noted in the PxP.
- Subcontractor's fabrication model(s) shall be coordinated within the Coordination model(s)and noted in the PxP.
- Clash analyses and reports for the project will be detailed in the project PxP.

2.4 BIM Responsibilities

The PxP will detail all parties' responsibilities in the project BIM development process.

2.5 BIM Software

The Smithsonian BIM practice employs Autodesk Revit as their primary BIM authoring application. The software version that is used for project BIM development will be noted in the BIM PxP.

Smithsonian OPDC will advise project consultants on the preferred version of any software to be used before project execution. Any deviation from that version must be approved by the SI project COTR prior to commencement of work. OPDC will approve version updates, if necessary, for multi-year projects during the course of project development.

The following table shows a list of current acceptable BIM and CAD applications for OPDC projects. This list does not preclude the utilization of other software for the prescribed uses. Software other than listed below may be used but are subject to SI project COTR's approval due to interoperability requirements.

Table 2-1: BIM Software by Discipline/Use for Project Development			
BIM Use	**Discipline**	**Software**	**Version**
Architecture Design	Architecture	AutoCAD and Revit	As agreed by OPDC and project consultant at project initiation
Structure Design	Structure	AutoCAD (Add-on) and Revit	
HVAC Design	HVAC	Revit / AutoCAD (Add-on) CADduct and CADmech	
Plumbing Design	Plumbing	Revit / AutoCAD (Add-on) CADduct and CADmech	
Electrical Design	Electrical	Revit / AutoCAD (Add-on) CADelec	
Civil Design	Civil	AutoCAD Civil 3D	
Fire Protection Design	Fire Protection	MEP CAD AutoSprink	
HVAC Fabrication	HVAC	Revit / AutoCAD (Add-on) CADduct and CADmech	
Plumbing Fabrication	Plumbing	Revit / AutoCAD (Add-on) CADduct and CADmech	
Electrical Fabrication	Electrical	Revit / AutoCAD (Add-on) CADelec	
Fire Protection Fabrication	Fire Protection	MEP CAD AutoSprink	
Structure Detailing	Structure	Revit / AutoCAD (Add-on)	
Coordination	CM Coordination	Navisworks Manage, Revizto	
Design Review	All disciplines	Bluebeam, Revizto	

2.6 BIM Goals and BIM Uses in the PxP

BIM goals are included within the Project Execution Plan to summarize the scope of the project BIM development effort. BIM utilization for AEC project development may include existing conditions modeling; design visualization; design reviews; clash detection and constructability exercises; asset and space data development; and as-built documentation.

2.6.1 Existing Conditions Modeling

Description: *A process in which a project team develops a 3D model of the existing conditions for a site, facilities on a site, or a specific area within a facility. This model can be developed in multiple ways, including laser scanning and conventional surveying techniques.*

An existing condition model may be used as a basis for design studies, sight line studies, move management and logistics, day lighting, area calculations, space allocation studies, volume calculations for HVAC, planning standards, phasing studies, testing locations, and other studies relevant to the project Scope of Work (SOW). The project SOW will define the approximate area, relevant building systems, and associated equipment to be modeled. The BIM PxP will define the agreed upon modeling effort.

The SI COTR will provide access to master drawings, any partial models for preliminary modeling and current exports from SI's Facility Center (Tririga) of space and asset data. Field verification is part of this process unless otherwise specified by SI. All applicable OPDC BIM and CAD standards and requirements apply.

At a minimum, an existing conditions model will contain:

- The visible architecture elements walls, floors, ceilings, columns, and roof. These elements are to be modeled to LOD 300 with an LOA of 12mm (½") unless noted otherwise in SOW.
- Assembly and product information must be added to the model as required by the SOW.
- Space volumes and data (numbers, functional use, space ownership)
- Date attribute field noting as to when the existing conditions were verified, indicating the currency of the model and its associated data.

Optional:

- Element(s) may be modeled to a greater LOD and/or LOA in accordance with the SOW.
- MEP equipment and routing may be modeled in accordance with the SOW.
- Assets, furniture and fixtures may be modeled in accordance with the SOW.
- Extend the modeling beyond the immediate SOW areas to show context and additional information based on project needs.

Laser Scanning for Existing Conditions

Laser scanning is a technology-based process for capturing 3D environments, including distances, in a 3D digital model called a *point cloud*, which is comprised of millions of measured points.

The SI COTR will evaluate the cost and efficiency benefits of laser scanning to capture existing conditions, as well as the optional conversion of the point cloud data to BIM, based upon the size and complexity of the project. The scope and procedure for the laser scanning, and conversion to BIM, if specified, will be clearly stated in the project BIM PxP.

The required object surface density shall be a minimum of 6mm (¼"). RGB color shall be mapped to both the exterior and interior scans. Selected areas or objects may require a greater object surface density as directed by COTR and/or SOW.

2.6.2 Design Authoring

Description: *A key process in which 3D software applications are used to develop a Building Information Model (BIM) that illustrates the design intent.*

The first step in design authoring for an OPDC project is to incorporate *OPDC Revit template(s)* as a part of the project BIM. A project BIM may include multiple component models including the architectural, HVAC, electrical, plumbing, structural, fire protection, life safety and security disciplines. Typically, multiple engineering models may be linked to or federated with, the architectural model, as required by the project scope.

BIM authoring software shall be used to model parametric components and objects. Modeled objects shall contain parameters and associated data applicable to the building system. The level of development in a project model will accumulate as the project matures. This is noted within the OPDC BIM Content LOD Matrix. At minimum, project LOD must include all features that will accurately describe the design solution.

1. At a minimum, all required models shall be detailed to the Level of Detail required by each design phase and/or sub-phase.
2. BIMs should include all geometry, physical characteristics, information and data necessary so to describe and facilitate the design, intended construction, and cost estimating of a project, meeting the requirements noted in project's BIM Content LOD Matrix, for each design phase and/or sub-phase of a project.
3. All drawings, simulations, and services required for analysis and review shall be extractions from the project BIM(s).
4. Modeled elements in the project BIM need not illustrate the individual parts required for the assembly and/or the manufacture of the component. The intent of the project model is to provide a level of detail to describe the overall size, shape, clearances, information, data for building components and coordination with other components and work.
    - At a minimum, model will contain:
        - All elements are to be modeled to LOD 300 with an LOA of 12mm (½") unless noted otherwise in specification.
        - Model all elements larger than 38mm (1-1/2 inch) in diameter for any trade. When equal or smaller element are grouped or run in a uniform path. That group of elements shall be modeled when larger than 152mm (6 inches).

2.6.3 3D Model Coordination / Clash Detection ("Interference Checking")

Description: *A process during the coordination process that employs clash detection software to identify conflicts between building systems by analyzing a combined or federated model. The goal of the clash detection is to reduce the number of changes during construction due to major building interferences to zero.*

Clash Detection - Design:
OPDC requires Clash Detection Reports (CDRs) from the design team at each design milestone starting at the 35% design deliverable. CDRs must include the results from an automated model checking software to indicate level of model coordination and other applicable codes. Both hard and soft clashes should be included in the model checking process.

OPDC classifies clashes in two categories described below:

Category 1 - Clashes that can be internally resolved by a single entity (consultant or subcontractor). The goal is to reduce error propagation in the design and to ensure compliance with good design practices and applicable codes and regulations.

These clashes should be resolved prior to submission of a design deliverable.

Category 2 – Clashes that require coordination between multiple entities. For example, this could be a clash between the structural and mechanical designs. The goal is to reduce the number and impact of field changes during the construction phase of the project. As a best practice, clashes should be resolved prior to submission of a design deliverable.

These clashes should be resolved prior to submission of a design deliverable.

At final submission models shall be free of conflicts among major systems, their subsystems and elements that would cause coordination issues during construction.

For any unresolved clashes indicated in the final CDR at Final Submission, the design team must provide a separate narrative explaining why the clash could not or need not be resolved.

Clash Detection - Construction:
Clash detection during construction is primarily a coordination tool. As in design, both hard and soft clashes should be considered during the coordination process. During the construction phase, the accuracy of fabrication models shall be verified. Prior to each fabrication or shop drawing submittal for approval, fabrication contractors shall submit their models to the Contractor's BIM Manager for integration into the federated model for clash detection / coordination and resolution.

CDRs shall be provided with fabrication or shop drawing submittals.

2.6.4 SI Asset Management

Description: SI has created the SI Facility Asset Data Spreadsheet, it is way to capture information regarding assets outside of the BIM for use by SI to import into their facilities management system. SI will

provide A/E current export from SI's Facility Management system at start of the project and will be a living document that is updated through the entire life of the project. In addition to the spreadsheet, customized data fields (parameters) have been incorporated and applied to components in the project BIM by use of the *OPDC Revit Templates* (Mechanical/Plumbing and Electrical).

Data populated in the required fields will be used for incorporation into the SI Facility Center (Tririga) application for asset management.

The scope and procedures for asset management will be detailed in the project BIM PxP by the AEC consulting teams, with the SI COTR's review/approval. Please refer to the SI Facility Asset Data Spreadsheet for data fields (parameters) and requirements and OPDC Revit Template User's Guide for required data fields (parameters) within the project BIM.

Refer to the project-specific document "*01 7823_O&M Data Reqs*" for more specificity about construction phase and asset requirements

2.6.5 As-Built / Record Modeling

Description: *Record modeling is the process used to create a model having an accurate representation of the physical conditions, environment and assets of a facility.*

The record model should, at a minimum, contain component information relating to the main architectural, structural, and MEP elements. Additional information such as custom parameters for equipment and spaces may be required.

The project team will update the project BIM PxP to reflect the specific scope, parties responsible, guidelines and modeling requirements that will be undertaken to deliver a final as-built BIM and reflect all changes from the design BIM that have been incorporated in the final building at project delivery. Using the table from the OPDC BIM PxP (Table 2 below), project teams can identify which BIM uses will be implemented in a specific project.

At a minimum, model will contain:

- As-Built Model(s) shall be field verified for accuracy and updated as required. The Level of Development (LOD) shall be LOD 500
- The Level of Accuracy (LOA) of the model(s) shall be minimal 12mm (1/2") for existing and align with construction tolerances for all new construction (minimal 24mm (1")).
- Model all elements larger than 38mm (1-1/2 inch) in diameter for any trade. When equal or smaller element are grouped or run in a uniform path. That group of elements shall be modeled when larger than 152mm (6 inches).
- Assembly and product information must be added to the model as required by specification.
- Element(s) may be modeled to a greater LOD and/or LOA in accordance with specification.
- MEP equipment and routing may be modeled in accordance with specification.
- Assets, furniture, and fixtures may be modeled in accordance with specification.

Note: Description, scope, and requirements for additional BIM Uses that may be applicable to the project will be included in the project BIM PxP.

Table 2-2: BIM Uses							
X	Plan	X	Design	X	Construct	X	Operate
	Programming		Design Authoring		Site Utilization Planning		Building Maintenance Scheduling
	Site Analysis (3D Field Positioning And QC)		Design Reviews / Model Reviews		Construction System Design		Building System Analysis
	3D Safety and Logistics Planning		Asset Management		Asset Management		Asset Management
			3D Coordination / Clash Detection		3D Coordination / Clash Detection		Space Management / Tracking
			Structural Analysis		Digital Fabrication		Disaster Planning
			Lighting Analysis		3D Control and Planning		
			Energy Analysis		Record Modeling		Record Modeling
			Mechanical Analysis				
			Other Engineering Analysis				
			Sustainability (LEED) Evaluation				
			Code Validation				
	Phase Planning (4D Modeling)		Phase Planning (4D Modeling)		Phase Planning (4D Modeling)		Phase Planning (4D Modeling)
	5D Cost Estimation		5D Cost Estimation		5D Cost Estimation		5D Cost Estimation
	Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling
Legend: X = Confirmed Use; O = Potential Use							

2.7 BIM LOD Requirements

BIMForum (the U.S. Chapter of buildingSMART International) presents a standard document - *Level of Development (LOD) Specification,* which underlay's SI guidance for LOD. The LOD for OPDC project BIMs will be detailed in the *BIM Project Execution Plan (PxP)* for every project. SI requires a minimum of LOD 300 for design model(s), LOD 350-400 for coordination, and LOD 500 for As-Built Model(s).

The AIA in its *Document G202 TM – 2013 Project Building Information Modeling Protocol Form* provides another industry-recognized framework as a means of defining the detailed modeling requirements for a project. The LOD definitions within the BIMForum specification are identical to those published in the AIA's updated Digital Practice Documents, with an exception of addition of LOD 350.

The table below summarizes those levels of development as defined by the BIMForum.

Table 2-3: Summary of the BIM Forum Level of Development (LOD) Definitions

LOD	Description
LOD 100	The model element may be graphically represented in the model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200. Information related to the model element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other model elements.
LOD 200	The model element is graphically represented within the model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the model element.
LOD 300	The model element is graphically represented within the model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the model element.
LOD 350	The model element is graphically represented within the model as a specific system, object, or assembly in terms of quantity, size, shape, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the model element.
LOD 400	The model element is graphically represented within the model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the model element.
LOD 500	The model element is a field verified representation in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the model elements.

Table Source: BIM Forum's Level of Development Specification

OPDC projects employing BIM require a BIM Content LOD matrix to be filled out and submitted, utilizing the template provided by the OPDC BIM PxP's *Appendix B* (a Microsoft Excel format file).

3. OPDC REVIT TEMPLATES AND REVIT TEMPLATE USER GUIDE

3.1 Overview of the Templates

The *OPDC Revit Template* files provide a pre-configured Revit file to serve as a starting point a new project BIMs. The OPDC template file contains commonly-used drawing objects and SI conventions to assist Revit users in setting up a new model for an OPDC project.

OPDC Revit templates have been configured with custom sheet title blocks with related graphic content and settings, defined Revit settings for units, fill patterns, line styles, line weights, view scales, and standards for Revit views and families, and more. It supports compliance with SI standards by containing customized objects and views, including:

- Floor and area plan views customized for exporting data to SI's Facility Center applications.
- Basic schedule views for listing component data
- Title blocks and sheet layouts with SI logo with smart labels and selection of graphic scale symbols
- Pre-configured SI drawing sheets
- Customized annotation families aligning with SI standards

The template is a modified Autodesk Revit imperial default template. (See the *OPDC Revit Template User's Guide* for information on using metric units with OPDC project BIMs).

The *OPDC Revit Template User's Guide* identifies the features customized for the OPDC architectural template, and describes how to use them in a Revit project. Additional templates have been developed for the Mechanical, Plumbing, Electrical, Structural, Fire Protection, Telecommunication, and Security disciplines.

The templates can be modified to suit the project requirements except for the features that contain "SI" prefix/suffix including SI asset parameters. These discipline templates are discussed in the *OPDC Revit Template User Guide's* appendices.

3.2 SI-GIS and Space Naming

One of the core objectives for BIM at the SI is to develop and deliver spatial information in the project BIM, and at project completion, export the geometry and data to the SI's Facility Center applications. The *OPDC Revit Templates* have been configured with floor and area plans views and schedules that align with SI spatial requirements.

Refer to the *OPDC Revit Template User's Guide* for detail instructions to create and export these views as part of the design deliverables. For SI-GIS space requirements please refer to SI Space Naming Guidelines.

3.3 Model Ownership and After-Project Use

The design intent model(s) (final project master model) deliverable, the as-built model(s), conformed model(s), all sub-model(s), model objects and elements, the associated and embedded data, BIM reports, and all views within the construction set or used as presentation are part of the instrument of service and considered a component of the design and construction documents which SI owns. These items may be used and re-used at the SI's discretion for additional facility lifecycle and new project needs beyond the original project execution and project information turnover.

No parties involved in creating the model(s) shall be held responsible for costs, expenses, liabilities, or damages which may result from the use of the model after project completion or beyond the uses described and agreed to in the original project SOW and documented in the BIM PxP.

4. FILE ADMINISTRATION

4.1 Model, View and Sheet File Naming

4.1.1 OPDC Model File Naming

The BIM developer shall define the naming conventions for models in accordance with the following format:

Format	[Smithsonian OPDC Project Number][-][Discipline Code][-][Software Version Designator][.][FileType]
Example	1234567-A-R24.RVT

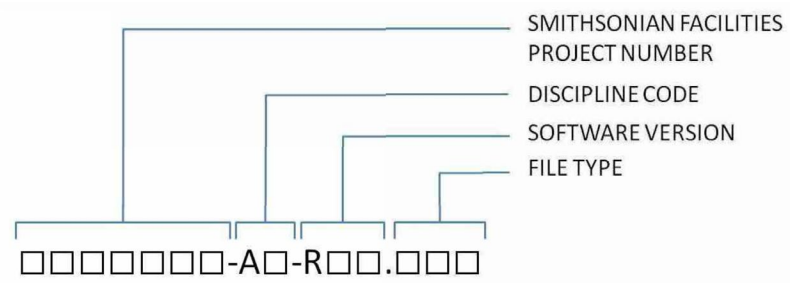


Figure 4-1: File Naming Structure

Table 4-1: Components of the BIM file name(s)	
File name component	**Description**
Project number	The consultant team shall confirm the official project number with OPDC to establish project naming conventions.
Discipline codes	As listed in the Table 4: Discipline Code Tables of this document.
Software version	Follow the format: R## ## is the last 2 digits of the year released *Example:* *R24 Autodesk Revit 2024*
File type	Revit (.rvt) Navisworks (.ncs, .nwd) AutoCAD (.dwg)

4.1.2 OPDC View Naming

Additional views created in the model must follow the naming standards used in the example views included in the template. The view name is created on:

Floor Level_View Type_Region *(use all if building not divided)*_Function (depends on view purpose)_View Purpose

Examples:

02_Floor Plan_East_Dimensions_Doc
00_North and South Elevations_All_Framing_Work
03_Mechanical Plan_West_HW Piping_Coor

Note: Abbreviations can be used to keep the length of the view name short as long as the abbreviations are listed in the general notes and abbreviations list. For example, "FP" can be used instead of "Floor Plan".

4.1.3 OPDC Sheet Naming

The *OPDC Revit Templates* contain a number of pre-configured sheets which serves as a starting point for CD sheet generation.

The naming conventions for Revit sheet views and CAD Sheets exported from Revit shall be in accordance with the following format:

For within Revit Sheet Views

Format	[Discipline Code][Sheet Type][Sheet Sequence][Drawing Type Code]
Example	A-101FP

For Sheet Views exported to CAD

Format	[Smithsonian OPDC Project Number][-][Discipline Code][Sheet Type][Sheet Sequence][Drawing Type Code][.][File Type]
Example	123456-A-101FP.DWG

NUMBERING SYSTEM:

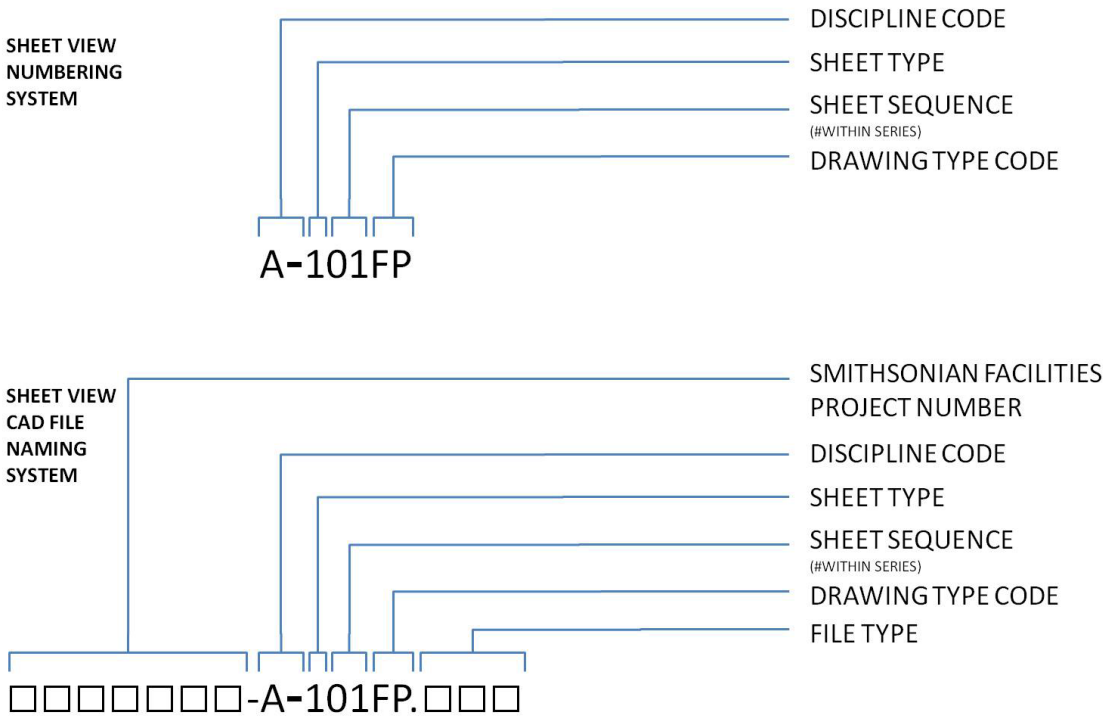


Figure 4-2: Sheet Numbering System and Sheet File Naming System

The Discipline Code shall consist of up to two alphabetical characters utilizing the list in the discipline code tables below. Note that the hyphen in the discipline code is a required place holder in the absence of the second character. The hyphen is preferred rather than a decimal point due to the use of the "dot" in electronic file names. Alternatively, an underscore may be used to replace the hyphen when a particular operating system does not accept hyphens in file names.

Refer to *Table 4-2* below for OPDC approved discipline codes.

4.1.4 Sketches and Supplemental Drawing File Names

Sketches and supplemental drawings shall be named in a similar manner.

- Sketch files created during design should be named with the two-letter designation SK first, discipline code next, then the next consecutive number of a series:
  - 0403110-SKI014.pdf (Fourteenth in a series of interiors sketches)
- Drawings created as part of an addendum, or supplemental drawings, should be named with the two-letter designation SD first, discipline code next, then the sheet number that is referred to, and the revision number:
  - 0403110-SDM102.3.pdf (Supplemental drawing for mechanical sheet 102, revision number 3)

Table 4-2: Discipline Codes

Discipline Codes					
Discipline	**Designator**	**Description**	**Discipline**	**Designator**	**Description**
General	**G-**	**All General**	**Landscape**	LI	Landscape Irrigation
	GI	General Information		LL	Landscape Lighting
	GC	General Contract		LP	Landscape Planting
	GR	General Resource		LR	Landscape Relocation
Survey / Mapping	**V-**	**All Survey/Mapping**		LS	Landscape Site
	VA	Aerial Survey	**Structural**	**S-**	**All Structural**
	VF	Field Survey		SD	Structural Demolition
	VH*	Hydrographic Survey		SS	Structural Site
	VI	Digital Survey		SB	Structural Substructure
	VU	Combined Utilities		SF	Structural Framing
Civil	**C-**	**All Civil**		SR*	Structural Reinforcement
	CB*	Civil Beach Re-nourishment		ST*	Superstructure
	CD	Civil Demolition		SC*	Structural Components
	CE*	Civil Ecosystem Restoration	**Architectural**	**A-**	**All Architectural**
	CF*	Civil Flood Control		AS	Architectural Site
	CG	Civil Grading		AD	Architectural Demolition
	CI	Civil Improvements		AE	Architectural Elements
	CN*	Civil Navigation		AI	Architectural Interiors
	CO*	Civil Operation and Maintenance		AF	Architectural Finishes
	CP	Civil Paving		AG	Architectural Graphics
	CH*	Civil Shore Protection		AL**	Life Safety
	CR*	Civil Recreation	**Interiors**	**I-**	**All Interiors**
	CS	Civil Site		ID	Interior Demolition
	CX*	Civil Security		IN	Interior Design
	CT	Civil Transportation		IF	Interior Furnishings
	CU	Civil Utilities		IG	Interior Graphics
Civil Works	**W-****	**Civil Works**	**SI Custom**	**EX****	**Exhibits**
Utilities	**U-**	**All Other Utilities**		AA**	Accessibility
Geotechnical	**B-**	**All Geotechnical**		EV**	Elevator
Landscape	**L-**	**All Landscape**		GS**	Graphics
	LD	Landscape Demolition		SS**	Special – Systems
	LG	Landscape Grading	**Historic Preservation**	**PH****	**Historic Preservation**
Note: * = Not in NCS 5.0; **=SI Only Discipline Code			**Source: USACE A/E/C CAD Standard Release 5.0**		

Discipline Code Table, continued					
Discipline	**Designator**	**Description**	**Discipline**	**Designator**	**Description**
Equipment	**Q-**	**All Equipment**	**Fire Protection**	FD**	Fire Protection Demolition
	QA	Athletic Equipment	**Electrical**	**E-**	**All Electrical**
	QB	Bank Equipment		EA*	Elec. Airfield Lighting & Nav-aids
	QC	Dry Cleaning Equipment		ES	Electrical Site
	QD	Detention Equipment		EC*	Electrical Cathodic Protection
	QE	Educational Equipment		EG*	Electrical Grounding
	QF	Food Service Equipment		ED	Electrical Demolition
	QH	Hospital Equipment		EP	Electrical Interior Power
	QL	Laboratory Equipment		EL	Electrical Interior Lighting
	QM	Maintenance Equipment		EI	Electrical Instrumentation
	QP	Parking Lot Equipment		EY	Elec. Interior Auxiliary Systems
	QR	Retail Equipment		ET	Electrical Telecommunications
	QS	Site Equipment	**Tele-communi-cations**	**T-**	**All Telecommunications**
	QT	Theatrical Equipment		TD*	Telecom. Demolition
	QV	Video/Photographic Equip.		TA	Audio Visual
	QY	Security Equipment		TC	Clock and Program
Mechanical	**M-**	**All Mechanical**		TI	Intercom
	MS	Mechanical Site		TM	Monitoring
	MD	Mechanical Demolition		TN	Data Networks
	MH	Mechanical HVAC		TS*	Supervisory Control & Data Acquisition (SCADA) systems & equipment
	MP	Mechanical Piping		TT	Telephone
	MI	Mechanical Instrumentation		TY	Security (Access control& Alarms)
	MY*	Mechanical Hydraulic Sys.	**Hazardous Materials**	**H-**	**Hazardous Materials**
Plumbing	**P-**	**All Plumbing**		HA	Asbestos
	PS	Plumbing Site		HC	Chemicals
	PD	Plumbing Demolition		HL	Lead
	PP	Plumbing Piping		HP	PCB
	PQ	Plumbing Equipment		HR	Refrigerants
	PL	Plumbing	**Shop Drawings**	**Z-**	**Contractor/Shop Dwgs.**
Fire Protection	**F-**	**All Fire Protection**	**Operations**	**O-**	**Operations**
	FA	Fire Detection and Alarm	**Others**	**X-**	**Other Disciplines**
	FX	Fire Suppression			
Note: * = Not in NCS 5.0; **=SI Only Discipline Code			**Source: USACE A/E/C CAD Standard Release 5.0**		

Discipline Code Table, continued					
Discipline	**Designator**	**Description**	**Discipline**	**Designator**	**Description**
Process	**D-**	**All Process**	**Resource**	**R-**	**All Resource**
	DS	Process Site		RC	Resource Civil
	DD	Process Demolition		RS	Resource Structural
	DL	Process Liquids		RA	Resource Architectural
	DG	Process Gases		RM	Resource Mechanical
	DP	Process Piping		RE	Resource Electrical
	DQ	Process Equipment			
	DE	Process Electrical			
	DI	Process Instrumentation			
Note: * = Not in NCS 5.0; **=SI Only Discipline Code			**Source: USACE A/E/C CAD Standard Release 5.0**		

The **Drawing Type Code** shall consist of up to two alphabetical characters utilizing the list in the Drawing Type Code tables below.

Table 4-3: Drawing Type Codes					
	Designator	**Description**		**Designator**	**Description**
All Disciplines	FP	Floor Plan	**Discipline Specific**	**Structural**	
	DP	Demolition Plan		MP	Framing Plan
	SP	Site Plan		NP	Foundation Plan
	QP	Equipment Plan		**Architectural/Interiors**	
	XP	Existing Plan		EP	Enlarged Plan
	RO	Roof Plan		CP	Ceiling Plan
	EL	Elevation		RP	Furniture Plan
	SC	Section		NP	Finish Plans
	DT	Detail		VP	Evacuation Plan
	SH	Schedule		**Mechanical**	
	3D	Isometric/3D		CP	Control Plan
	DG	Diagrams		HP	HVAC - Ductwork Plan
Discipline Specific	**General**			PP	Piping Plan
	BS	Border Sheet		**Electrical**	
	KP	Key Plan		CP	Communication
	CS	Cover Sheet		GP	Grounding
	Civil			LP	Lighting
	EP	Environmental Plan		PP	Power
	GP	Grading Plan		**Plumbing**	
	RP	Road/Topographic Plan		PP	Plumbing Plan
	SV	Survey		**Fire – Protection**	
	UP	Utility Plan		KP	Sprinkler Plan
				Telecommunications	
				DP	Data
				TP	Telephone

It is important that files are named in this exact format to avoid system conflicts when drawings are transferred to the SI's archival system. The sheet sequence number shall consist of three numerical characters from the following table:

Table 4-4: Sheet Sequence Numbers			
000	General (Symbols, Legends, Notes)	500	Details
100	Plans (including Reflected Ceiling Plans)	600	Schedules and Diagrams
200	Elevations	700	User Defined (Elevators and Stair plans, details, sections)
300	Sections	800	User Defined (non-architecture)
400	Enlarged Views (plans, sections, elevations)	900	3D Views, Interior Details, Partition Types, Window Types

4.1.5 OPDC Combined PDF Naming

The A/E lead shall define the naming conventions for combined PDF volumes in accordance with the following format:

Format	[File Name]- [-][Reference Date or Submission Type][-][Smithsonian OPDC Project Number][.][FileType]
Example	Vol#_Report-65DD-1234567.PDF / Vol#_Drawing-140627-1234567.PDF

Table 4-5: Components of the Combined PDF file name	
File name component	**Description**
File name	Volume number description
Reference date	YYMMDD
Submission type	35DD, 65DD, 100CD
Project number	The consultant team shall confirm the official project number with OPDC to establish project naming conventions.
File type	Portable Document Format (.PDF)

Note: The BIM PxP should outline naming conventions for all the submittals pertaining to the project. Any deviations from the OPDC BIM Guidelines should be approved by the SI project COTR.

4.2 Federated Model File Coordination

The files that are generated by the consulting construction manager and trade contractors during the coordination process should follow the same naming conventions as described in the model file naming and sheet file naming sections.

The contractor shall require subcontractors, fabricators, suppliers, and manufactures to submit all models to the contractor utilizing 3D modeling software in order to facilitate seamless coordination with BIM workflows and file integration. All design elements should be produced three-dimensionally in programs that can output file formats supported by Autodesk Navisworks. Models should be updated after each project coordination meeting or as changes occur in the field during construction and delivered to SI at each project BIM milestone.

4.3 Electronic File Storage

Refer to the project Scope of Work (SOW) to determine which type of transmission method is required for each project submission.

FTP Site: Due to the constraints of sending large files via e-mail, OCIO has established an FTP site to use for transferring electronic documents between Smithsonian OPDC and outside consultants. The FTP site acts like any other folder in Windows Explorer. To access the site please obtain instructions from the project design manager.

Note: To prevent unauthorized use of SI files, any files left on the FTP site for more than 48 hours will be deleted. This should give everyone ample time to send and receive daily work. Please make sure you have copies of your files stored on your personal computer or on the secure internal network.

E-mail: The size of attachments to e-mails on the Smithsonian network is limited to 3.5 megabytes, total. Use of the FTP site is recommended for larger transmissions.

Dropbox: SI utilizes Dropbox for the transfer of large files. Please discuss with the Project Design Manager to obtain shared folder access.

OneDrive: SI utilizes OneDrive for the transfer of large files. Please discuss with the Project Design Manager to obtain shared folder access.

Documentation:

The Smithsonian OPDC *Project Documentation Form* and *Deliverables Matrix*. These forms are similar in nature to the GSA's deliverable requirements. The *Project Documentation Form* identifies the personnel responsible for the project, versions of software used in its preparation, and any script files, non-AutoCAD entities (fonts, line types, blocks, etc.) used in drawing preparation. The *Deliverables Matrix* identifies each drawing submitted by name, all external references by name, and the plot scale for each drawing. Refer to *Appendix A* in this document for examples of the forms.

5. PROJECT DELIVERABLE STANDARDS

Maintaining consistent file naming and structure is critical for referenced (linked) files to function properly across design teams and for end users such as facilities managers to retrieve files quickly once the project is complete. For this reason, the design and construction teams shall follow the folder structure recommended below.

5.1 Project Folder Structure

OPDC recommends the folder structure illustrated with the blue highlight in Figure 5-1. Following a project folder structure, will facilitate in delivering the Revit project files while maintaining the links to all the external linked files as long as the linked files are defined using relative path within Revit model.

A relative path defines the position of a linked file in a working directory such as a project folder. Its position is defined by its relative location. If a relative path is used for links and when the project and the linked files are moved together to a new directory, the link is maintained. Revit locates the linked model by its relative position to the working directory.

Any deviations to the recommended folder structure should be discussed and approved by the SI project COTR. Additional files and folders can be added to this structure as long as the level 3 hierarchy and contents are maintained.

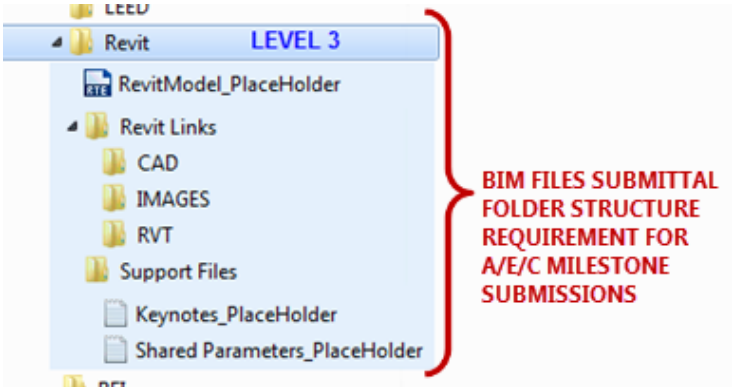


Figure 5-1: Project Folder Structure

5.2 Project Collaboration and Data Security

The project consultant responsible for the project collaboration environment shall establish protocols for model and data security, permissions, and access rights to the stakeholders. Both the design and construction consultants shall establish adequate user access rights to prevent data loss or damage during file exchange, maintenance, and archiving. These access controls shall be established as per the instructions in the project BIM PxP, and will be detailed in a user access matrix as part of the BIM PxP. This environment will establish a single point to upload, share, and exchange models and project data. The same server shall be used to assemble project deliverables at pre-defined milestones across the project phases. SI project COTR and SI Facilities personnel shall have access to this collaboration site.

5.3 BIM Deliverables

Project BIM requirements are defined within a project's scope of work (SOW) and will vary between projects. A suggested framework for BIM deliverables is provided below, organized by standard SI project milestones.

The level of development (LOD) and level of accuracy (LOA) for each BIM deliverable should be listed in the project's OPDC BIM content matrix and BIM PxP. LOD and LOA should be sufficient to produce traditional two-dimensional deliverables required for each stage.

The specific BIM deliverable requirements for a project along with and responsible parties will be listed by model category, and be described in the project BIM PxP.

5.3.1 Design

Pre-Design

- BIM Project Execution Plan (within 30 days after contract execution)
- Feasibility Models*
- Database of Programs/Spaces
- Massing/Volume/Area
- Relationships/Functions
- Responsibility Matrix
- Data Organization Outline
- Restatement of Owner Requirements
- AIA E202 Refinements
- Laser Scan Files* (Point Clouds)
- Existing Conditions Model(s)*
- SI Facility Asset Data Spreadsheet

Schematic Design (35% Submission)

- BIM Execution Plan Update
- Preliminary Energy Model Values* [1]
- Concept Model
- Architectural Model - Based on approved concept model in the native BIM format
- Preliminary Systems Model - Structural, MEP, Civil or other systems required by the project in the native BIM format
- Clash Detection Report
- IFC models for all the required disciplines
- Navisworks files (If used for Clash Detection)
- SI Facility Asset Data Spreadsheet

Design Development (65% Submission)

- BIM Project Execution Plan
- Energy Model Values*[1]
- Architectural Model in the native BIM format
- Structural Model in the native BIM format
- MEP Model in the native BIM format
- Fire Protection Model in the native BIM format
- Life safety and security model in the native BIM format
- Site/civil model in the native CAD format
- Other systems models* in the native BIM format
- Detailed clash/collision report
- IFC models for all the required disciplines
- Navisworks files (If used for Clash Detection)
- SI-GIS Exports (CAD and Excel Format)
- SI Facility Asset Data Spreadsheet

Construction Documents (100% and Final Submission)

- BIM Project Execution Plan
- Energy model values*[1]
- Architectural model in the native BIM format
- Structural model in the native BIM format
- MEP model in the native BIM format
- Fire protection model in the native BIM format
- Life safety and security model in the native BIM format
- Site/civil model in the native CAD format
- Other systems models* in the native BIM format
- Detailed clash/collision report - showing issues and resolutions
- Quantity reports*
- IFC models for all the required disciplines
- Navisworks files (If used for Clash Detection)
- SI-GIS Exports (CAD and Excel Format)
- SI Facility Asset Data Spreadsheet

At the 100% Construction Documents submission, the design team shall be responsible for providing:

- A federated BIM fully coordinated and assembled into one Revit Black Box View.
- Separate copies of each technical discipline model in the original software authoring tool and IFC format.
- A 2D plan set, derived from the assembled BIM, for contract bidding in the CAD and PDF formats.

** If applicable/available/required*

[1] *Energy models may be executed within applications existing BIM software and applications.*

The table below lists a project's electronic deliverables for design phase.

Table 5-1: Design Deliverables

Phase	Submission Requirements	Format
Programming	Narrative Project Execution Plan Existing Condition Model(s) SI Facility Asset Data Spreadsheet	.pdf .pdf, .docx .rvt, .dwg, .ifc, point cloud formats .rcs/.rcp/.pcg/.pts/.ptx/.dp/.las, .laz,.xyz, etc. .xlsx
Schematic Design (35% Submission)	Narrative Project Execution Plan Drawings Design Intent Model(s) SI Facility Asset Data Spreadsheet	.pdf .pdf, .docx .pdf .rvt, .ifc, .nwc, .nwd, .dwg .xlsx
Design Development (65% Submission)	Project Execution Plan LOD Matirx Specifications Drawings Design Intent Model SI-GIS Exports SI Facility Asset Data Spreadsheet	.pdf, docx .pdf .pdf, .docx .pdf .rvt, .ifc, .nwc, .nwd, .dwg .dwg, .xlsx .xlsx
Construction Documents (100% Submission)	Project Execution Plan LOD Matrix Drawings Specifications Design Intent Model SI-GIS Exports SI Facility Asset Data Spreadsheet	.pdf, .docx .pdf, xlsx .pdf, .dwg .pdf, .docx .rvt, .ifc, .nwc, .nwd, .dwg .dwg, .xlsx .xlsx
100% Construction Documents (Back Check Submission)	Project Execution Plan LOD Matrix Drawings Specifications Design Intent Model SI-GIS Exports	.pdf, .docx .pdf, .xlsx .pdf, .dwg .pdf, .docx .rvt, .ifc, , .nwc, .nwd, .dwg .dwg, .xlsx

Table 5-1: Design Deliverables		
Phase	**Submission Requirements**	**Format**
	SI Facility Asset Data Spreadsheet	.xlsx
Bid Process	Addenda	.pdf, .rvt, .dwg, .ifc
Construction	Bulletins	.pdf, .rvt, .ifc, .nwc, .nwd, .dwg
Record Documents	Project Execution Plan LOD Matirx Specifications Conformed Model(s) SI-GIS Exports Drawings	.pdf, .docx .pdf, .xlsx .pdf, .docx .rvt, .ifc, .nwc, .nwd, .dwg .dwg, .xlsx .pdf, .dwg

5.3.2 Construction

The construction model(s), coordination model(s), coordination reports, and facility data for the project will be submitted by the contractor to the SI during the construction phase according to the project scope of work.

Refer to the project-specific document "*01 3250_BIM Reqs*" for more specificity about construction phase and as-built BIM requirements.

Table 5-3 Construction Deliverables		
Phase	**Submission Requirements**	**Format**
Construction (Monthly)	Coordination Model(s) SI Facility Asset Data Spreadsheet	.rvt, .ifc,. nwc, .nwd, .dwg .xlsx
Construction (Quarterly)	Construction Model(s) SI Facility Asset Data Spreadsheet	.rvt, .ifc, .nwc, .nwd, .dwg .xlsx
At project completion – with submittals, O&M's and warranties attached	As-Built Model – Final Project Execution Plan LOD Matrix O&M and Warranty Documents SI-GIS Exports SI Facility Asset Data Spreadsheet	.rvt, .dwg, .ifc, .nwc, .nwd .pdf, .docx .pdf, .xlsx .pdf, .docx .dwg, .xlsx .xlsx

5.3.3 Final Deliverables/As-Built Documentation

At project completion, the project consultant, typically the Contractor, will update and submit As-Built Model(s) to document the condition of the facility upon completion of construction. As-Built Model(s) are to be submitted with all Model(s) link into one central model using Autodesk Revit. In addition the contractor shall submit final SI Facility Asset Data Spreadsheet, LOD Matrix, BIM PxP, O&M manuals CAD exports, SI-GIS exports and warranty documents with final model.

5.4 Autodesk Revit BIM Deliverables Checklist

Table 5-2: BIM Deliverable Checklist

Description	☑/☒
Model file name conforms to OPDC standards	☐
All annotations and title blocks are as per the OPDc standards	☐
All SI floor plans and area plan views required by the OPDC have been created for all floors in the project	☐
All the custom SI schedules are populated with all the required data for the project	☐
The model is correctly assembled as per visual inspection	☐
All the model contents are correctly placed per their element categorization in the correct workset, and conform to standards	☐
All non-transmittal linked-in files (CAD/Revit) have been removed from the model	☐
All non-required views / legends / schedules / sheets / images have been removed from the model	☐
Unwanted **Design Options** have been removed from the model	☐
All unnecessary groups have been removed from the model. All groups used to model the building have been ungrouped and purged from the deliverables to reduce the file size of the model	☐
As a last step, the model has been purged (repeat the process three times -- materials are only removed after the parent object has been removed). This will reduce the file size.	☐
Update **Save to Central** view with any relevant model notes	☐

5.5 CAD Deliverables from BIM

5.5.1 Sheet Drawing Submission Standards

Introduction

CAD files exported from the project BIM represent one, and only one, plotted drawing sheet. There must be a one-to-one relationship between files and floors.

Areas of a floor that occur at different elevations relative to each other, without overlapping, should be in the same drawing. Areas that occur as mezzanines, no matter how small, should be relegated to a separate drawing, with the full building column grid included to help with spatial reference.

File Format

All drawing sheets shall be submitted in both Adobe Acrobat PDF file format (.pdf) and in AutoCAD (.dwg) format.

PDF Files

All graphics in PDF files must be measurable/snap-able using software markup tools such as Adobe Acrobat Professional or Bluebeam. All drawing text in PDF files must be searchable. There shall be one PDF file per printed sheet in the drawing set.

Recent versions of the Adobe Acrobat application allow for the inclusion of layers from AutoCAD files in the PDF document. Use of this feature will NOT be accepted.

AutoCAD

Drawing files shall be in the AutoCAD (.dwg) format. The version of the software will be as noted in the project BIM PxP.

There shall be one AutoCAD (.dwg) file per printed sheet in the set, and X-refs shall be bound.

CAD Page Setup

Pages must be oriented, when displayed on-screen, in the same direction as the hard copy would be read.

Scale

All 2D PDF files must be created on the paper size used for the contract documents. When printed on the appropriately sized paper, all drawing scales shown in the drawing should be accurate when measured with mechanical drafting tools.

Line Weights

Acceptable line weights on drawing deliverables will be in a range from about 0.18 mm to 1.0 mm when plotted full-size.

Only use the highest range of line weights to indicate major dividing lines such as section-cuts and match lines.

The narrowest line weights should be used for highly detailed items and column grids.

Within the middle-range, be sure to giving greater weight to new construction when occupying the same plan as existing construction. Give even greater weight to annotations.

On engineering drawings referencing the partitions, ceiling grids, and other components on the architectural plans, a 50% to 75% shading should be used on the architectural elements to increase the readability of the engineering elements.

Layers

Layer names must adhere to the most recent version of the AIA Layer Guidelines, as included in the National CAD Standard.

Building elements must be placed on the correct layers. Do not repeat similar information among different layers.

Do not store information on Layer "0".

The following charts list the layers for site plans and floor plans that are considered the Standard Base Plans. Only these layers are required to meet the specifications of this section.

Table 5-3: Layer Standards for Standard Base Plans – Site Plan

Site Plan Layers	Description	Line Type	Color
C-BLDG-OTLN	Building Footprints	Continuous	W/7
C-PKNG-OTLN	Parking Lots	Continuous	C/4
C-PKNG-CURB	Parking Curbs and Gutters	Continuous	G/3
C-PROP-LINE	Property Lines (check Benchmarks)	Continuous	Y/2
C-ROAD-OTLN	Roads	Continuous	C/4
C-ROAD-CURB	Curbs	Continuous	M/6
L-PLNT-TREE	Trees	Continuous	83
L-PLNT-GRND	Ground Covers and Vines	Continuous	82
L-PLNT-BEDS	Landscaping Beds	Continuous	M/6
L-PLNT-BUSH	Bushes and Shrubs	Continuous	83
L-PLNT-TURF	Lawn Areas	Continuous	23
L-SITE-BRDG	Bridges	Continuous	22
L-SITE-EWAT	Water features	Continuous	162
L-SITE-FENC	Fencing	Continuous	Y/2
L-SITE-DECK	Decks	Continuous	232
L-SITE-POOL	Pools and Spas	Continuous	162
L-SITE-ROCK	Boulders and cobble	Continuous	R/1
L-SITE-RTWL	Retaining Walls	Continuous	C/4
L-SITE-SPRT	Sports Fields	Continuous	Y/2

Table 5-3: Layer Standards for Standard Base Plans – Site Plan			
Site Plan Layers	**Description**	**Line Type**	**Color**
L-SITE-WALK	Walks and Steps	Continuous	R/1

Table 5-4: Layer Standards for Standard Base Plans – Floor Plan			
Base Plan Layers	**Description**	**Line Type**	**Color**
A-AREA-IDEN	Room numbers	Continuous	W/7
A-DOOR-FRAM	Door Frame	Continuous	M/6
A-DOOR-FULL	Full-height doors	Continuous	G/3
A-DOOR-GLAZ	Door Glazing	Continuous	B/5
A-DOOR-PRHT	Partial-height doors	Continuous	M/6
A-EXBT	Exhibit	Continuous	R/1
A-EXBT-WALL	Exhibit Wall	Continuous	40
A-FLOR-EVTR	Elevators, wheelchair lifts	Continuous	Y/2
A-FLOR-LEVL	Floor level changes, shafts, ramps	Continuous	M/6
A-FLOR-OTLN	Building / Gross Area Polyline	Continuous	40
A-FLOR-OTLN-RPRM	Room / Space Area Polyline	Continuous	M/6
A-FLOR-OVHD	Overhead items	ACAD_ISO02W100	Gr/8
A-FLOR-SPCL	Architectural specialties (e.g. toilet room accessories, display cases)	Continuous	G/3
A-FLOR-STRS	Stairs, escalators	Continuous	Y/2
A-FLOR-TPTN	Toilet room partitions	Continuous	R/1
A-GLAZ-CURT	Curtain Wall Panels and System	Continuous	B/5
A-GLAZ-PRHT	Window glazing	Continuous	R/1
A-GLAZ-SILL	Window sills	Continuous	B/5
A-ROOF	Parapet walls (for reference on partial floors)	Continuous	Gr/8
A-WALL-CWMG	Curtain wall mullions	Continuous	R/1
A-WALL-FENC	Fence	Continuous	R/1
A-WALL-FULL-EXTR	Exterior Walls	Continuous	Y/2
A-WALL-FNDN	Foundation Walls	Continuous	G/3
A-WALL-FULL-INTR	Full-height Interior Walls	Continuous	G/3
A-WALL-MOVE	Movable partitions	Continuous	B/5
A-WALL-PRHT	Partial-height walls	Continuous	R/1

Table 5-4: Layer Standards for Standard Base Plans – Floor Plan			
Base Plan Layers	**Description**	**Line Type**	**Color**
S-COLS-PRIM	Primary columns	Continuous	M/6
S-COLS-SCND	Secondary columns	Continuous	Y/2
A-AREA-LINE	Lines defining room areas that are not walls	Continuous	C/4
P-SANR-FIXT	Plumbing Fixtures	Continuous	M/6
A-FLOR-HRAL	Handrails	Continuous	R/1
A-FLOR-WDWK	Built-in cabinets and counters	Continuous	G/3
A-WALL-HEAD	Door headers	Continuous	R/1
I-FURN	Furniture	Continuous	B/5
I-FURN-PNLS	Systems Furniture	Continuous	B/5
S-GRID-HORZ	Horizontal column grid lines	ACAD_ISO08W100	B/5
S-GRID-IDEN	Column identifiers	Continuous	R/1
S-GRID-VERT	Vertical column grid lines	ACAD_ISO08W100	B/5

5.5.2 Standard Title Block and Cover Sheet

The standard Smithsonian title block shall be used on every sheet. The first sheet in any set of drawings (cover sheet) shall be designated the Title / Cover Sheet, and will be numbered according to the process outlined in the previous section. It shall contain the OFEO approval block directly above the title block.

CAD Project Title Block

All of the title block parameters are block attributes. To edit the attributes, use AutoCAD's DDATTE or AT command. Do not change the text size in the drawing provided (except for the A/E logo and information pertinent to consultants).

Please refer to the *Special Conditions for A/E Services* document for logo location and size, as well as the identification code.

All Smithsonian title blocks are available for download at the OFEO website, A/E Center, in DWG format.

Revit Project Title Block

The Smithsonian Institution's Revit project title block contains parameters for project information compliant with the OPDC CAD guidelines. There are two sizes of SI title blocks within the *OPDC Revit Templates*: SI-24x36In and SI-36x48In.

See Revit Template User Guide for additional Information.

5.5.3 SI Sheet Sizes

The following table lists sheet sizes to be used for all OPDC projects. The preferred standard is Arch D (24 x 36 in). This sheet size (Revit title block family) is provided in the *OPDC Revit Templates,* along with Arch E (36 x 48 in.). If a project requires an alternate size, approval must be obtained from the SI project COTR. Revit title blocks and cover sheet families should be created by A/E for the sizes that are not provided in the *OPDC Revit Template,* as per the respective size sheet and coversheet files in "dwg" format.

To create the new title block and cover sheet families, the A/E shall use the Revit parameters and symbols from the Revit title block and cover sheet families provided within the *OPDC Revit Templates*. All title blocks and cover sheets are provided in metric and imperial versions, and are available for download at the *SI A/E Center* web site in "dwg" format. All drawings in a project submission shall be produced in a consistent format and drawing size. Submitted sketches should utilize either the letter or tabloid format.

Table 5-5: SI Sheet Sizes

Paper Size	Dimensions	File Name
Arch D (Standard)	24 by 36 inches 610 by 914 mm	Cover: ST-CVR_in.dwg Sheet: ST-TTL_in.dwg Cover: ST-CVR_mm.dwg Sheet: ST-
Arch E	36 by 48 inches 914 by 1219 mm	Cover: E-CVR_in.dwg Sheet: E-TTL_in.dwg Cover: E-CVR_mm.dwg Sheet: E-
Arch F (Arch 30)	30 by 42 inches 762 by 1067 mm	Cover: F-CVR_in.dwg Sheet: F-TTL_in.dwg Cover: F-CVR_mm.dwg Sheet: F-
Tabloid	11 by 17 inches 279 by 432 mm	Vertical: 11x17-V_in.dwg Horizontal: 11x17-H_in.dwg Vertical: 11x17-V_mm.dwg
Letter	8-1/2 by 11 inches 216 by 279 mm	Portrait: 8x11-P_in.dwg Landscape: 8x11-L_in.dwg Portrait: 8x11-P_mm.dwg

5.5.4 OPDC Project Units, Fonts and Dimensions

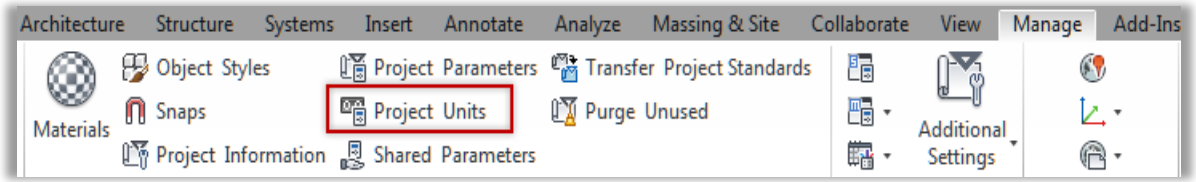
Project Units

Project units and design units must be configured during the initial stages of the project. The *project units'* parameter within the *OPDC Revit Template* files is set to imperial units (feet/inches), however OPDC projects may require metric deliverables.

Metric Units

To change from imperial to metric units in Revit:

- Create a new Revit project file (.rvt) by loading the template file into a Revit work session, and save it with the appropriate file name for your project/facility
- On the Revit menu's **Manage** tab -> **Settings** panel, select the **Project Units** option



- The **Project Units** dialog box pops-up. Click the button under the **Format** column for each unit type to display the Format settings dialog box
- In the **Format** dialog box, select the correct unit from the **Units** drop down list.

For additional notes and instructions on units' conversion, refer to the Autodesk Revit Help web site.

Text Sizes and Fonts

The *OPDC Revit Template* includes SI standard fonts based upon the National CAD Standard v5 (NCS). **Arial** font is the standard for all SI text annotations (OPDC does accepts AutoCAD text or true-type fonts). **RomanS, Swis721 Blk BT** and **Minion** fonts are also used in the title blocks and headings.

Minion Open-type fonts are available for download at https://logo.si.edu/visual-styles/typography/

The text size for typical notes within SI architectural drawings is 3mm (1/8") with a 1.0 width factor. Any deviations must be approved by OPDC.

Upper-case lettering shall be used on drawings unless lower-case letters are required to conform to other established standards, equipment nomenclature, or marking.

Dimensions

The *OPDC Revit Template* includes the SI "soft metrics" dimensioning standard, which calls for dimensional representation of metric units followed by imperial units in the parenthesis. For additional information, see *soft or hard metrics* as described within *DoD Publication SD-10 Guide for Identification and Development of Metric Standards*.

Two types of OPDC standard tic-mark types are included in the *OPDC Revit Templates*: **SI_Arrow** and **SI_Slash**. Confirm the required dimensioning standard for the project with the SI, and modify if necessary.

5.5.5 Symbols

OPDC BIM and CAD Annotation Symbols

Symbols included in the OPDC *Revit Templates* have been set up to comply with the *OPDC CAD Standards*. No substitutions will be permitted. (Images shown are not to scale).

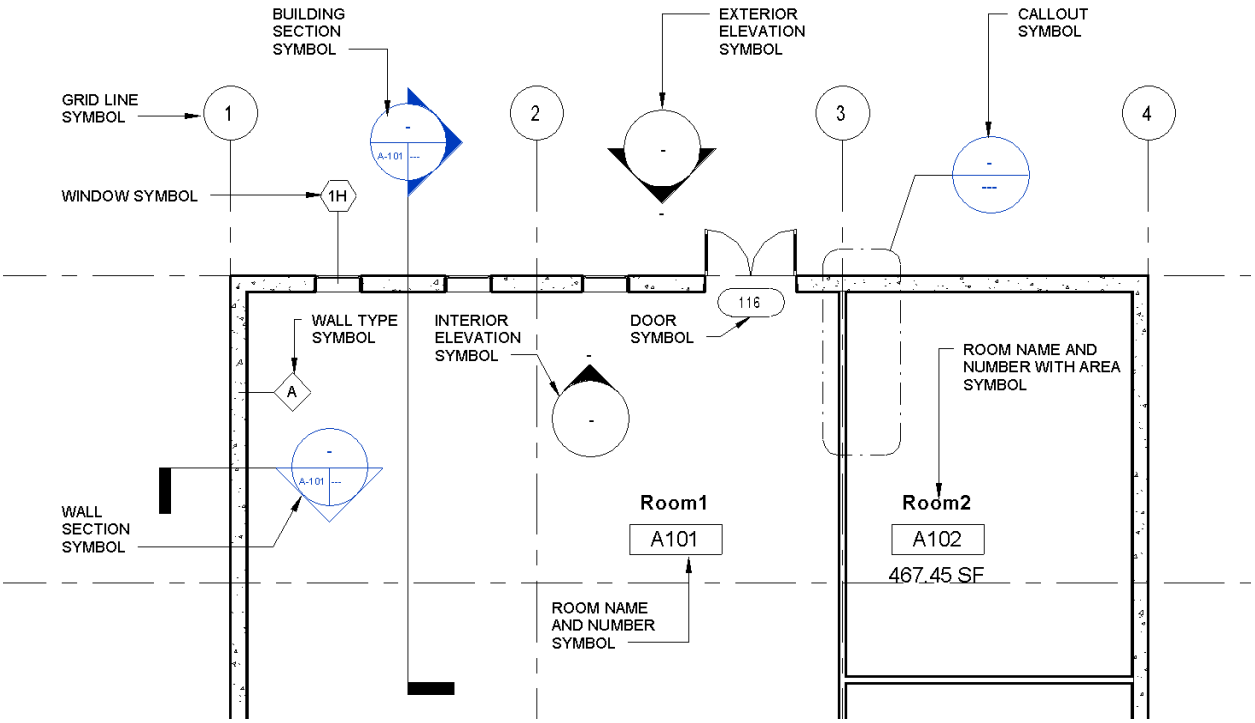


Figure 5-2: Custom OPDC annotation symbols

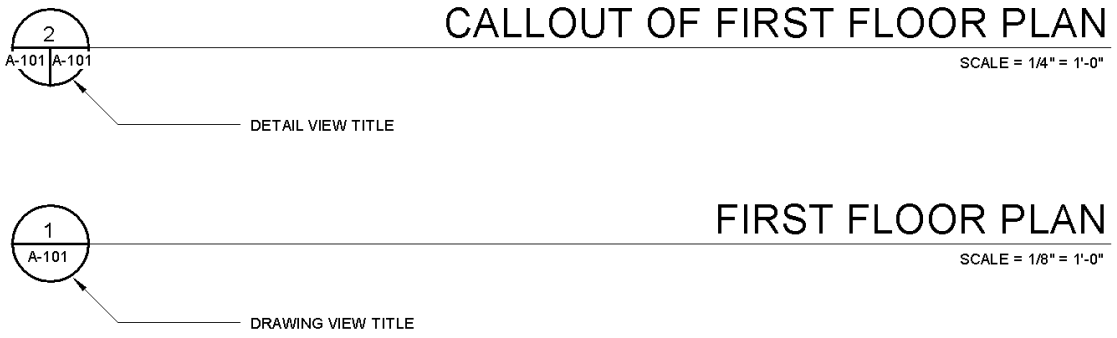


Figure 5-3: Custom OPDC view title symbols

Smithsonian OPDC CAD Standard Symbols

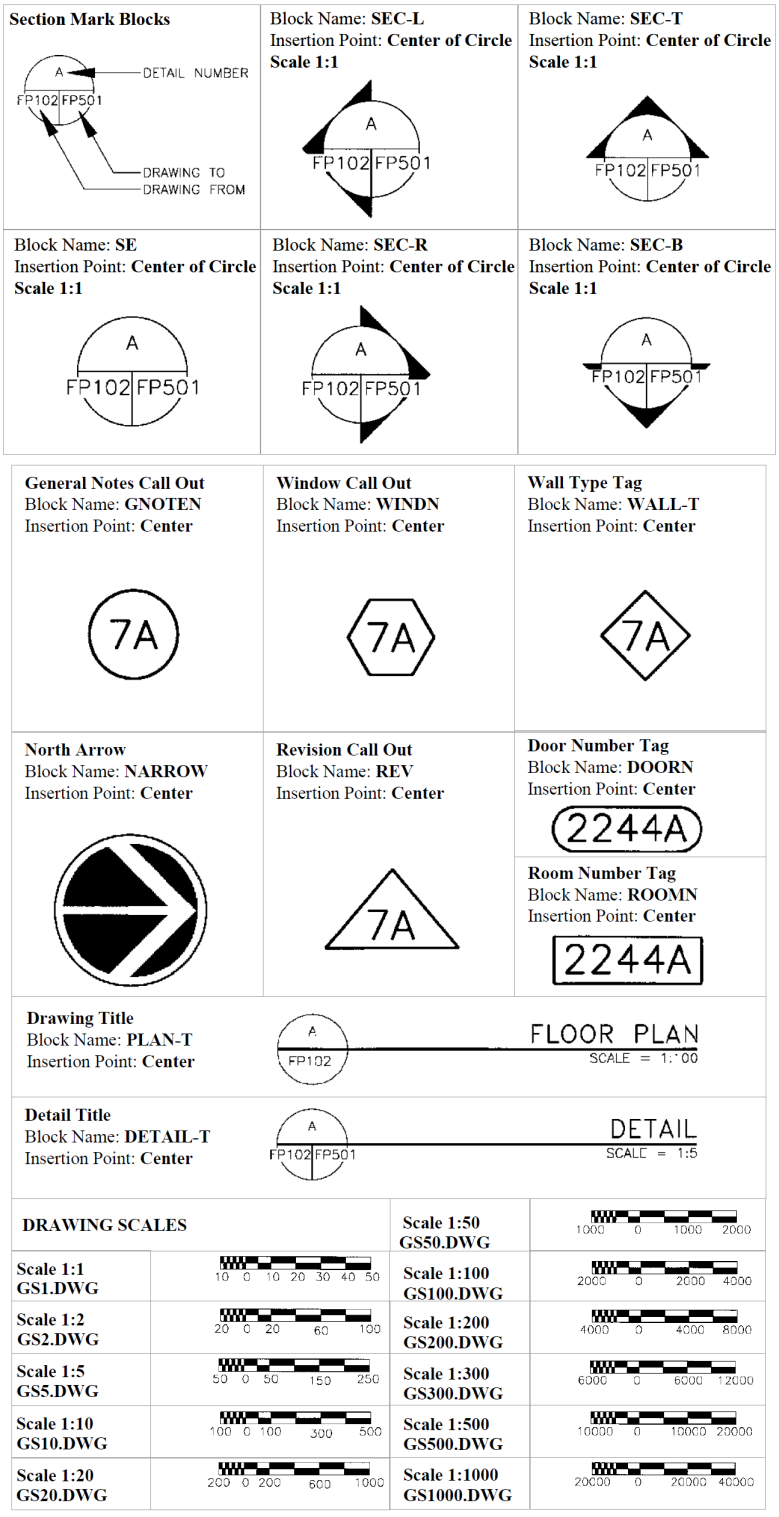
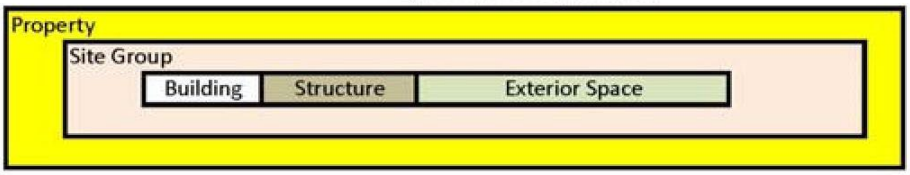


Figure 5-4: OPDC CAD symbols available from the Smithsonian A/E Information Center website

5.5.6 SI Space Class Determination for GIS and TRIRIGA Facilities Center

GIS and Tririga
Space Class Determination



1 For the purposes of the Smithsonian Institution, Geospatial data is associated by a property.
"***Property***" may be a site composed of any combination of the following:

- **A.** Land Acreage
- **B.** Site Groupings
- **C.** Buildings
- **D.** Structures
- **E.** Exterior Spaces
- **F.** Interior Spaces
- **G.** Leases
- **H.** Easements
- **I.** Rights of Way
- **J.** Use Agreements
- **K.** bodies of Water

000 **999** The identifier code for a property is a 3 number combination between 000 and 999

2 A "***Site Group***" may contain any combination of the following:

- **A.** Land Acreage
- **C.** Buildings
- **D.** Structures
- **E.** Exterior Spaces

A000 **999Z** The identifier code for a site group is a 4 character alphanumeric combination.

3 A "***Building***" is comprised of:

		note: EGA is not necessarily the building footprint.	EGA - IGA	=	GWA
EGA	Exterior Gross Area		3689		
IGA	Interior Gross Area		3210		
GWA	Gross Wall Area	i.e. this is the shell of the building	479		

Exterior Gross Area

A000 **999Z** The identifier code for a building is a 4 character alphanumeric combination.

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GIS and Tririga
Space Class Determination

3a **Exterior Gross Area** **EGA**

All area on a single horizontal plane within the outermost enclosed walls

this does not include:

Balconies	Exterior Spaces	Lean-tos
Patios	Covered Walkways	Roofs
Terraces	Loading Docks	Gardens
Structures	Trash Compactors	Green Roofs

3b **Interior Gross Area** **IGA**

The portion of a floor that is totally enclosed within the dominant portion. IFMA

Derived from "Gross Measured Area" BOMA

includes:

Voids	Vertical Penetration areas	
Amenities	Circulation areas	Service areas

this does not include:

Exclusions	Perimeter Encroachments	Interior Parking
Interstitial	Interior Encroachments	Restricted Headroom

The Interior Gross Area is subdivided into "**Support Areas**" and "**Useable Areas**".

3b.1 **Useable Area**

portions of a building that can be classified as tenant area or amenity area. IFMA

The remainder of the Interior Gross Area after the Support Areas have been subtracted.

example:		Interior Gross Area	3210	IGA
	support areas	Service areas	422	
		Voids	56	
		Vertical Penetrations	135	
		Circulation areas	311	
		Useable Area	2286	

3c **Gross Wall Area** **GWA**

The remainder area of a building after the Interior Gross Area has been subtracted from the Exterior Gross Area.

includes:

Walls	Retaining Walls	Inaccessible
Columns	Unexcavated	Unusable

may include:

Exclusions	Perimeter Encroachments	Interior Parking
Interstitial	Interior Encroachments	Restricted Headroom

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4 A "***Structure***" is comprised of:

Boundary Footprint	note: a structure may exist without bounded or interior space
Bounded Space	i.e. a bridge tenders control room

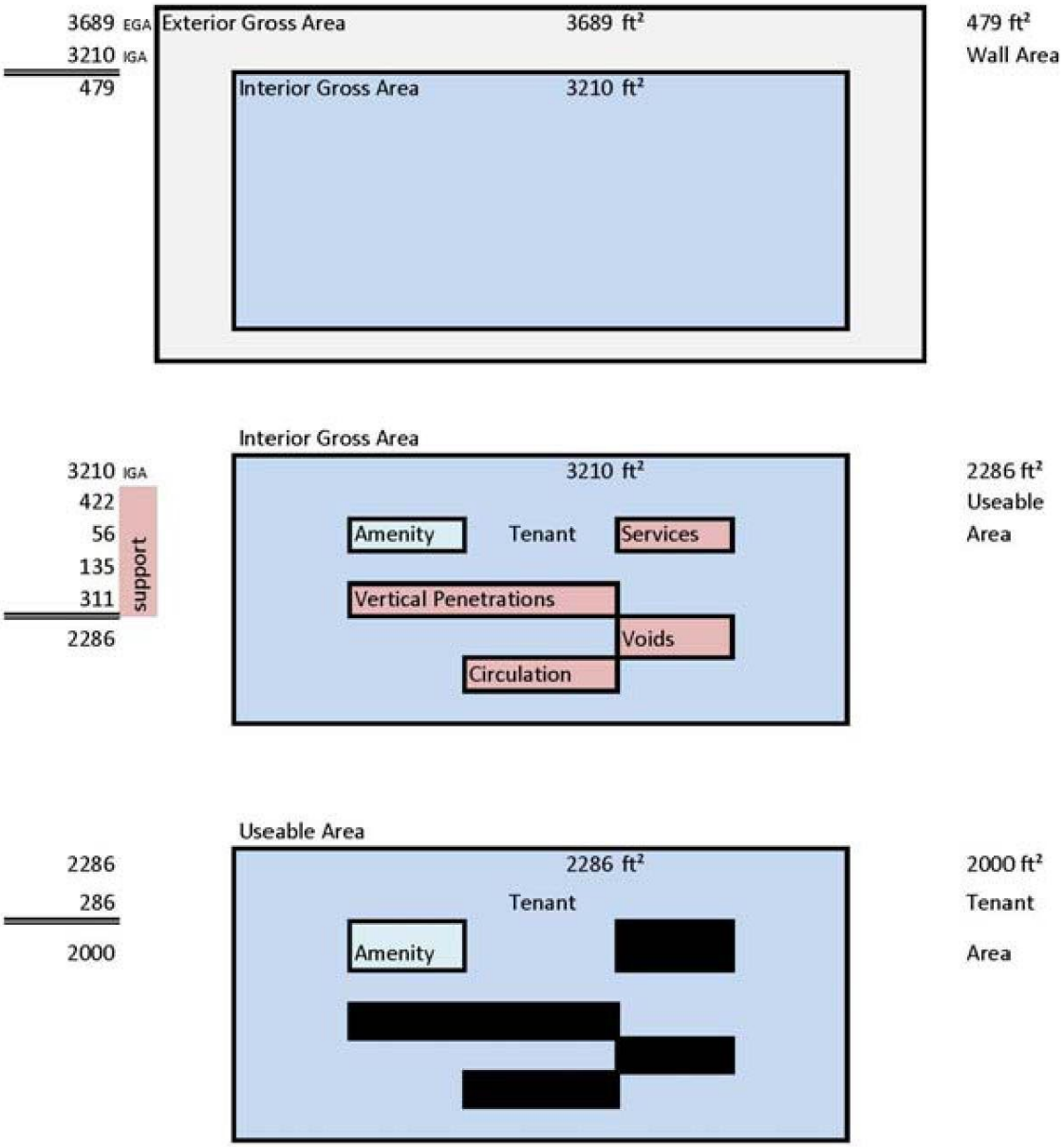
A000 **999Z** The identifier code for a structure is a 4 character alphanumeric combination.

5 An "***Exterior Space***" is comprised of:

Major Boundary Outline	i.e. a garden
Minor Boundary	i.e. a planting bed within a garden

A000 **999Z** The identifier code for an exterior space is a 4 character alphanumeric combination.

GIS and Tririga
Space Class Determination
IFMA Building Model



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