

**[Project Title]**

**BIM Project Execution Plan (PxP)**

Date

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# BIM Project Execution Plan Overview

As the world’s largest museum and research complex, the Smithsonian Institution (SI), through the Office of Planning, Design and Construction (OPDC) is responsible for the planning, design, construction, and revitalization of all Smithsonian facilities, across eight states, the District of Columbia, and in Panama.

The purpose of this manual is to provide a standardized document template, with which, AEC consultant teams can outline the information, procedures, and responsibilities relevant to a Building Information Model (.rvt, .dwg, .xlsx, etc.) development effort for Smithsonian projects. The goal of the OPDC BIM PxP framework is to assure accurate and consistent work within, and across SI projects.

The *OPDC BIM Project Execution Plan (PxP)* works in concert with the OPDC BIM Guidelines, *SI Revit Template Users Guide, SI Space Naming Guidelines and SI Facility Asset Data Spreadsheet*. Those documents describes the type and level of information required by the OPDC for BIM deliverables.

Each project’s BIM PxP will be a living document, revised and updated as necessary by the project team to reflect changes in BIM development that occur during project execution.

The BIM PxP will clearly detail the responsibilities for developing all components in the project BIM, and their level of detail. Any changes made in the approach to BIM development during project execution should be reflected in the BIM PxP, approved by the project team, and reviewed by the SI’s COTR (Contracting Officer's Technical Representative).

SI BIM MISSION STATEMENT

The Smithsonian Institution (SI) BIM mission statement is to obtain a well-documented BIM deliverable that not only provides required design submittals but also caters easy transition from BIM to SI’s Facility Center applications.

*Please note: Instructions (italicized) and* examples (not-italicized) *to assist with the completion of this guide are shown in grey. The instructions should be deleted and the example text should be modified to suit the needs of the organization filling out the template. If modified, the format of the text should be changed to match the rest of the document.*

## Document Revision History

*At a minimum, updates in the BIM PxP are required at the beginning of the project, start of SD, start of DD, and hiring of Construction Manager.*

| Rev | Date | Section | Description of Updates |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# Project Information

## Basic Project Information

*Confirm official SI project name and project number*

| Project Name |  |
| --- | --- |
| Project Numbers | Contract number, task order, Smithsonian OPDC project number, etc. |
| Project Owner |  |
| Project Location and Address |  |
| Contract Type / Delivery Method |  |
| Brief Project Description | Number of facilities, general size, etc. |
| Additional Project Information | Unique BIM project characteristics and requirements |

## Project Schedule

*Include BIM milestones, design activities, and any other major activities during the project.*

| Project Phase / Milestone | Estimated Start Date | Estimated Completion Date | Revise BIM Plan | Project Stakeholders Involved |
| --- | --- | --- | --- | --- |
| Preliminary Planning | Date TBD | Date TBD | YES/NO |  |
| Schematic Design | Date TBD | Date TBD | YES/NO |  |
| Design Development | Date TBD | Date TBD | YES/NO |  |
| Bidding Documents | Date TBD | Date TBD | YES/NO |  |
|  | Date TBD | Date TBD | YES/NO |  |
| Construction Documents | Date TBD | Date TBD | YES/NO |  |
| 35% Construction | Date TBD | Date TBD | YES/NO |  |
| Project Closeout | Date TBD | Date TBD | N/A |  |

## BIM Execution Plan Timeline

The timeline for implementation of BIM over the life cycle of the project.

This table is pre-populated with recommendations on which phase each activity will take place. *Adjust as needed specific to project needs.*

| BIM Activity | Schematic Design | Design Development | Construction Documents  | Construction | Facility Turnover |
| --- | --- | --- | --- | --- | --- |
| Division 1 BIM & O&M Spec Creation |  |  | X |  |  |
| BIM / GIS Kickoff Meeting | X |  |  | X |  |
| Revit standards and templates | X | X |  | X |  |
| BIM Execution Plan updates | X | X | X | X | X |
| BIM collaboration meetings | X | X | X | X | X |
| Model progression table (LOD Matrix) | X | X | X | X |  |
| SI GIS Exports |  | X | X |  | X |
| SI Facility Asset Data Spreadsheet | X | X | X | X | X |
| Record Model(s) |  |  | X | X | X |

## Key Project Contacts

List of lead BIM contacts for each organization on the project team.

|  Role | Organization | Contact Name | Location | E-Mail | Phone |
| --- | --- | --- | --- | --- | --- |
| Project Manager(s) |  |  |  |  |  |
| BIM Manager(s) |  |  |  |  |  |
| Discipline Leads |  |  |  |  |  |
| Other Project Roles |  |  |  |  |  |
|  |  |  |  |  |  |

## BIM Roles and Responsibilities

*Describe BIM roles and responsibilities such as BIM Managers, Project Managers, Drafts persons, etc.*

## BIM Use Staffing

*For each BIM Use noted, identify the team within the organization (or organizations) who will staff and perform that Use, and estimate the personal time required. (Optional)*

| BIM Use | Organization | Number of Total Staff for BIM Use | Estimated Worker Hours | Location(s) | Lead Contact |
| --- | --- | --- | --- | --- | --- |
| 3D coordination | Contractor A |  |  |  |  |
|  | Contractor B |  |  |  |  |
|  | Contractor C |  |  |  |  |
| BIM creation | Architect |  |  |  |  |
|  | Civil Engineer |  |  |  |  |
|  | Structural Engineer |  |  |  |  |
|  | MEPF Engineer |  |  |  |  |

# Project Specific Deliverables

## BIM Goals

*The project team will document BIM goals for each project phase in order to assist in populating the table in Section 3.2. Examples have been provided in gray below. These should be edited/replaced with project specific information.*

| Project Phase | Priority (High/ Med/ Low/ Not Pursued) | Goal Description | Potential BIM Uses |
| --- | --- | --- | --- |
| Schematic Design |  | Location, solar, wind, preliminary energy analyses | Efficient design decision making |
| Design |  | Address conflicts in design | 3D Design coordination |
| Construction |  | Identify concerns with construction sequences | 4D modeling |
| Turnover |  | As-built model | Turnover to model |

## BIM Uses

*Note BIM uses that will be implemented on this project by placing a mark next to the* ***BIM Use*** *item (Reference the BIM Goals identified previously in the Section 3.1). Insert any additional uses, as applicable, in the empty cells in the table below.*

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

*BIM Uses that are specific to the project should be noted in this table. Include ranking values - High (Mandatory), Medium (Significant), Low (Minimal). Examples are shown in the table below.*

| BIM Use | Value to Project | Responsible Party | Value to Resp. Party | Additional Resources/ Skills Req’d to Implement | Notes | Proceed with Use |
| --- | --- | --- | --- | --- | --- | --- |
|
|    | High/ Med/ Low  |    | High/ Med/ Low  |    |    | Yes/No/Maybe  |
|
| Record Modeling | HIGH | Contractor | MED | Req. training and software |   | **YES** |
|   |   | Facility Manager | HIGH | Req. training and software |   |  |
|   |   | Designer | MED |   |   |  |
|  |  |  |  |  |  |  |
| Cost Estimation | MED | Contractor | HIGH |   |   | **NO** |
|  |  |  |  |  |  |  |
| 4D Modeling | HIGH | Contractor | HIGH | Need training on latest software  | High value to owner due to phasing issues | **YES** |
|   |   |   |   | Infrastructure needs | Use for Phasing & Construction |  |
|  |  |  |  |  |  |  |
| 3D Coordination (Construction) | HIGH | Contractor | HIGH |   |   | **YES** |
|   |   | Sub-contractors | HIGH | Conversion to Digital Fab. Required | Modeling learning curve possible |  |
|   |   | Designer | MED |   |   |  |
|  |  |  |  |  |  |  |
| Engineering Analysis | HIGH | MEP Engineer | HIGH |   |   | **MAYBE** |
|   |   | Architect | MED |   |   |  |
|  |  |  |  |  |  |  |
| Design Reviews | MED | Arch | LOW | Federated model views in the native design model | Reviews from design model no additional detail req. | **YES** |
|  |  |  |  |  |  |  |
| 3D Coordination (Design) | HIGH | Architect | HIGH | Coordination software req. | Contractor to facilitate coordination | **YES** |
|   |   | MEP Engineer | MED |   |   |  |
|   |   | Structural Engineer | HIGH |   |   |  |
|  |  |  |  |  |  |  |
| Design Authoring | HIGH | Architect | HIGH |   |   | **YES** |
|   |   | MEP Engineer | MED |   |   |  |
|   |   | Structural Engineer | HIGH |   |   |  |
|   |   | Civil Engineer | LOW | Large learning curve | Civil not required |  |
|  |  |  |  |  |  |  |
| Programming | MED |   |   |   | Planning phase Complete | **NO** |
|  |  |  |  |  |  |  |
| Code Evaluation | LOW | Contractor | MED | Software req. | Streamline code review | **NO** |
|  |  | Architect | LOW | Software req. |  |  |

### Detailed BIM Use Requirements

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 and may include laser scanning and/or conventional surveying techniques, depending on project goals and efficiencies.

*Smithsonian building projects often involve renovation and modernization (revitalization), therefore project teams are often required to perform existing conditions modeling as part of the scope of work. The scope and extent of this task should be discussed and finalized with the SI’s Project COTR in the project initiation stage.*

*The PxP should detail the specific scope, responsible parties, and specific plan/process/requirements associated with laser scanning or other reality capture methods that will be utilized for modeling existing structures or below grade utilities (if applicable).*

1. **Site Analysis**

*Description*: A process in which BIM/GIS tools are used to evaluate properties in a given area to determine the most optimal site location for a future project. The site data collected is used to first select the site and then position the building based on other criteria.

*Detail specific scope, parties responsible, specific plan/process/requirements associated with utilizing BIM data to drive field positioning/ layout via laser technology of work on the project site as well as any use of laser scanning to validate installation of work per the approved models if applicable.*

1. **Design Authoring**

*Description*: A process in which 3D software is used to develop a Building Information Model based on criteria that is important to the translation of the building's design. Design authoring is the first step towards BIM and the key is connecting the 3D model with a powerful database of properties, quantities, means and methods, costs and schedules. The design authoring tools creates building information model and construction documents. It helps monitor quality control of design, cost and schedule. As a powerful visualization tool, it helps document and present the design intent to the client, consultants and other stakeholders. And most importantly, it helps coordination between various disciplines facilitated through interference detection.

*For SI projects the design authoring step should include scope and requirements to develop life safety and security model and drawings along with other discipline scopes and requirements.*

*Detail specific scope, parties responsible, specific guidelines and modeling requirements associated with utilizing Design Authoring tools to generate efficient project BIM.*

1. **Design / Model Review**

*Description*: A review process in which the project BIM is evaluated based on a set of criteria, which can include: alignment with the project program, compliance with project standards, visual review of space aesthetics and layout in a virtual environment, and specific requirements such as layout, sightlines, lighting, security, ergonomics, acoustics, textures and colors, among many others. This BIM Use Requirement may be executed via computer software, such as virtual reality applications. Virtual mock-ups can be performed at various levels of detail depending on project needs.

*The PxP should detail the scope, parties responsible, specific guidelines, report delivery requirements for project Design Reviews.*

1. **3D Coordination / Clash Detection**

*Description*: A process in which Clash Detection software is used during the coordination process to determine field conflicts by comparing 3D models of building systems. The goal of clash detection is to eliminate the major system conflicts prior to installation.

*Detail specific scope, parties responsible, specific guidelines, report delivery requirements for 3D coordination and clash detection.*

1. **4D Scheduling**

*Description*: A BIM-based process in which a 4D model (3D models with the added dimension of time) is utilized to effectively plan the phased occupancy in renovation or retrofit projects, or to show the construction sequence and space requirements on a building site. 4D modeling is a visualization and communication BIM tool that can provide the project team and owner with a better understanding of project sequencing through visualization.

*For Smithsonian renovation and revitalization projects, views and schedules should be configured to group phases of the project, such as existing, demolished, new construction and other phase for future works, separately within the construction documents set.*

*The PxP should detail the specific scope, parties responsible, specific modeling and coding requirements associated with utilizing BIM to support 4D project phasing, detailed installation simulations, or Location Based Scheduling (LBS).*

1. **5D Cost Estimation**

*Description*: A process in which BIM can be used to assist in the generation of accurate quantity take-offs and cost estimates throughout the lifecycle of a project. This process allows the project team to see the cost effects of their changes, during all phases of the project, which can help curb excessive budget overruns due to project modifications.

*The PxP should detail the specific scope, parties responsible, specific modeling and coding requirements associated with utilizing BIM to support quantity extraction objectives, if any.*

1. **Sustainability Analysis**

*Description*: A process in which a BIM project is evaluated based on LEED or other sustainable criteria. This process should occur during all stages of a facilities life including planning, design, construction, and operation. Applying sustainable features to a project in the planning and early design phases is more effective (ability to impact design) and efficient (cost and schedule of decisions). This comprehensive process requires more disciplines to interact earlier by providing valuable insights. This integration may require contractual integration in planning phase.

*The PxP should detail the specific scope, parties responsible, specific modeling and coding requirements associated with utilizing BIM to support LEED tracking, if any.*

1. **Energy Analysis**

*Description*: The BIM Use of Energy Analysis is a process in the design phase which one or more building energy simulation programs use a properly adjusted BIM to conduct energy assessments for the current building design. The core goal of this BIM use is to inspect building energy standard compatibility and seek opportunities to optimize proposed design to reduce structure's life-cycle costs.

*The PxP should detail the specific scope, parties responsible, specific modeling and coding requirements associated with utilizing BIM to support Energy Modeling objectives, if any.*

1. **Record Modeling**

*Description*: Record Modeling is the process used to depict an accurate representation of the physical conditions, environment, and assets of a facility. The record model should, at a minimum, contain information relating to the main architectural, structural, and MEP elements. Additional information including equipment and space planning systems may be necessary if the owner intends to utilize the information for maintenance and operations. The record model also contains information linking pre-build specification to as-built specifications. This allows the owner to monitor the project relative to the specifications provided.

*The PxP should detail the specific scope, parties responsible, guidelines and modeling requirements to update the final design BIM as per the changes that occur on site due to conflicts and/or changes on scope. This way at the completion of the project the BIM becomes the “as built” and can be leveraged beyond construction for maintenance and operations tasks.*

1. **Asset Management**

*Description*: A process in which an organized management system is linked to a record model to efficiently aid in the maintenance and operation of a facility and its assets. Asset Management utilizes the SI Facility Asset Data Spreadsheet to populate an asset management system which is then used to determine cost implications of changing or upgrading building assets, segregate costs of assets for financial tax purposes, and maintain a current comprehensive database that can produce the value of a company's assets. Asset Data is then input into the As-Built Model(s) to allow users to visualize the asset in the model before servicing it potentially reducing service time.

*The PxP should detail the specific scope, parties responsible, guidelines and modeling requirements for asset management tasks.*

*Note: Add description, scope and requirements for additional BIM Uses that may be applicable to the project.*

## Project Deliverables

At each phase of the Design and Construction process, OPDC requires the delivery of the model, along with electronic versions of hardcopy submissions and other files that support the intent of the project.

As a guide, the table below lists typical file types for electronic deliverables.

*The list of Design Deliverables in the PxP must include those that are contractually required by the SI at each submission (reference the project SOW). The list may also include non-contractually required documents that are being utilized within the consulting team.*

### Design Deliverables

| Phase | Submission Requirements | Format |
| --- | --- | --- |
| Programming | NarrativeProject Execution PlanExisting 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) | NarrativeProject Execution PlanDrawingsDesign Intent Model(s)SI Facility Asset Data Spreadsheet | .pdf.pdf.pdf.rvt, .ifc, .nwc, .nwd, .dwg.xlsx |
| Design Development(65% Submission) | Project Execution PlanLOD MatrixSpecificationsDrawingsDesign Intent Model(s)SI GIS ExportsSI Facility Asset Data Spreadsheet | .pdf, .docx.pdf.pdf, .docx.pdf.rvt, .ifc, .nwd, .nwd, .dwg.dwg, .xlsx.xlsx |
| Construction Documents(100% Submission) | Project Execution PlanLOD MatrixDrawingsSpecificationsDesign Intent Model(s)SI-GIS ExportsSI Facility Asset Data Spreadsheet | .pdf, .docx.pdf.pdf, .dwg.pdf, .docx.rvt, .ifc, .nwc, .nwd, .dwg.dwg, xlsx.xlsx |
| 100% Construction Documents (Back Check Submission) | Project Execution PlanLOD MatrixDrawingsSpecificationsDesign Intent Model(s)SI-GIS ExportsSI Facility Asset Data Spreadsheet | .pdf, .docx.pdf, .xlsx.pdf, .dwg.pdf, .docx.rvt, .ifc, .nwc, .nwd, .dwg.dwg, xlsx.xlxs |
| Bid Process | Addenda | .pdf, .rvt, .dwg, .ifc |
| Construction | Bulletins | .pdf, .rvt, .ifc, .nwc, .nwd, .dwg |
| Record Documents | Project Execution PlanLOD MatrixSpecificationsConformed Model(s)SI-GIS ExportsDrawings | .pdf, .docx.pdf, .xlsx.pdf, .docx.rvt, .ifc, nwc, .nwd, .dwg.dwg, .xlsx.pdf, .dwg |

### 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(s) – FinalProject Execution PlanLOD MatrixO&M and Warranty DocumentsSI-GIS ExportsSI Facility Asset Data Spreadsheet | .rvt, .dwg, .ifc, .nwc, .nwd.pdf, .docs.pdf, .xlsx.pdf, .docx.dwg, .xlsx |

### SI Deliverables for Design and Construction

All BIM deliverables to follow the schedule and requirement as indicated in the A/E Scope of Work / Construction Contract, OPDC BIM Guidelines and OPDC Revit Template User Guide.

# Electronic Communications

## Software Requirements

This table will detail the software applications employed on SI projects. If a team member has any deviations, this needs to be discussed with SI to understand potential impact to final deliverables.

| BIM Use | Discipline | Software | Version |
| --- | --- | --- | --- |
| Architecture Design | Architecture | AutoCAD and Revit  | Agreed upon by SI and Contractor at the PI (Project Initiation) |
| Structure Design | Structure | AutoCAD (Add-on) and Revit  | Agreed upon by SI and Contractor at the PI |
| HVAC Design | HVAC | Revit / AutoCAD (Add-on) CADduct and CADmech | Agreed upon by SI and Contractor at the PI |
| Plumbing Design | Plumbing | Revit / AutoCAD (Add-on) CADduct and CADmech | Agreed upon by SI and Contractor at the PI |
| Electrical Design | Electrical | Revit / AutoCAD (Add-on) CADelec | Agreed upon by SI and Contractor at the PI  |
| Civil Design | Civil | AutoCAD Civil 3D | Agreed upon by SI and Contractor at the PI  |
| Fire Protection Design | Fire Protection | MEP CAD AutoSprink | Agreed upon by SI and Contractor at the PI  |
| HVAC Fabrication | HVAC | Revit MEP / AutoCAD (Add-on) CADduct and CADmech | Agreed upon by SI and Contractor at the PI  |
| Plumbing Fabrication | Plumbing | Revit / AutoCAD(Add-on) CADduct and CADmech | Agreed upon by SI and Contractor at the PI  |
| Electrical Fabrication | Electrical | Revit / AutoCAD (Add-on) CADelec | Agreed upon by SI and Contractor at the PI  |
| Fire Protection Fabrication | Fire Protection | MEP CAD AutoSprink | Agreed upon by SI and Contractor at the PI  |
| Structure Detailing | Structure | Revit / AutoCAD (Add-on) | Agreed upon by SI and Contractor at the PI  |
| Coordination | CM Coordination | Navisworks Manage, Revizto | Agreed upon by SI and Contractor at the PI |
| Design Review | All disciplines | Bluebeam, Revizto | Agreed upon by SI and Contractor at the PI |

## Electronic File Storage

Any electronic storage location (such an FTP site, Drop Box, etc.) used for the regular exchange of files from project consultants and the SI will be identified in the following table.

| File Location | File Path /Directory | File Type | Password Protect | File Maintainer | Updated |
| --- | --- | --- | --- | --- | --- |
| FTP siteftp://ftp.\*\*\*.\*\*\*/\*\*\* | Root Project Folder /Arch /Mech | .rvt | Yes\*\*\*\*\*\*\*\* | Joe Smith | Weekly |
|  |  |  |  |  |  |

\* Refer to Model File Naming Section for filing naming conventions

## Project Folder Structure

OPDC recommends the folder structure illustrated with the blue highlight in the Figure 5.1. This taxonomy will facilitate the delivery of federated Revit project files while maintaining links to external files (the linked files must be defined using “relative path” within the Revit model).

Using relative paths for links assures that when those files are moved together to a new directory (such as at the SI), links will be maintained. Revit locates the linked files by their 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 1, 2 and 3 hierarchy and contents are maintained.

`

Figure 4‑1: Project Folder Structure

## Information Exchange Schedule

| Information Exchange | File Sender | File Receiver | One-Time or Frequency | Due Date or Start Date |
| --- | --- | --- | --- | --- |
| Authoring – 3D Coordination | Architectural / Structural | FTP Post – Coordination Lead | Weekly | [Date] |
| As-built model updating check | Contractor |  | Monthly |  |
|  |  |  |  |  |
|  |  |  |  |  |

Use this table to describe standard information exchanges and file transfers that will occur on the project. Project files will be transferred at regular intervals to the locations identified above (Electronic File Storage). Files shall be transferred according to the frequency listed below by the project BIM team’s individuals responsible for coordination and data exchange (often identified as Discipline Model Managers or Trade Model Managers). Additional uploads may be required as requested by the A/E or CM BIM Manager.

Describe the as-built model checking process employed by the consulting team.

|  |
| --- |

Describe the BIM update process. Describe the handover procedures from the consultant team to the owner.

|  |
| --- |

## SI Asset Management

Refer to SI Asset Management section in the Smithsonian OPDC BIM Guidelines for requirements.

*Add detail specific plan/process/requirements associated with utilizing and updating the spreadsheet.*

## Space Naming

Refer to SI Space Naming Guidelines for naming and space requirements.

*Add details to this section in case of any deviations from the Smithsonian Institution standards* *with the approval of SI’s Project COTR.*

## Model File Naming

Refer model file naming sections in the *Smithsonian OPDC BIM Guidelines* for naming conventions.

*Add details to this section in case of any deviations from the Smithsonian OPDC standards* *with the approval of SI’s Project COTR.*

## Sheet View Naming

Refer sheet view naming sections in the *Smithsonian OPDC BIM Guidelines* for naming conventions.

*Add details to this section in case of any deviations from the Smithsonian OPDC standards with the approval of SI’s Project COTR.*

## Trade Contractor Coordination File Naming

Files generated during the coordination process should follow the same naming conventions as described in the model file naming and sheet file naming sections in the *Smithsonian OPDC BIM Guidelines*.

## Reference Points

Refer to reference points sections in the *Smithsonian OPDC BIM Guidelines* for project origin locations.

*Add details to this section in case of any deviations from the Smithsonian OPDC standards with the approval of SI’s Project COTR.*

# Collaboration Procedures

## Meetings

### Project Meetings

In the table below, define the type of meetings held during the project, including coordination meetings, owner updates, progress meetings, etc. Indicate the required attendees and scope of the meeting.

| Meeting Type | Phase | Frequency | Participants | Location |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

### BIM Coordination Meetings

In the table below, define the type and frequency of meetings related to BIM Coordination. Indicate the required attendees and scope of the meetings.

| Meeting Type | Phase | Frequency | Participants | Location |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

## Coordination Schedules

Outline the deliverables required and the anticipated date for completion.

### Design

| Deliverable | Date |
| --- | --- |
|  |  |
|  |  |
|  |  |

### Construction

| Deliverable | Date |
| --- | --- |
|  |  |
|  |  |
|  |  |

## BIM Coordination

### Model Element Color Coding

All engineering consultant BIMs will contain a 3D view titled ‘Arch Coordination’. This view will have filters applied to color code systems for coordination through the BIM links. The following colors, or an alternative color scheme as agreed to by the architect and consultants, will be applied to differentiate systems:

|  |  |  |
| --- | --- | --- |
| **System** | **Color** | **RGB Color Index** |
| Outside Air (Pressurization) |  | 128,255,255 |
| Supply Air |  | 0,128,192 |
| Return Air |  | 0,64,128 |
| Exhaust Air |  | 128,0,128 |
| Mechanical Equipment |  | 220,220,220 |
| Mechanical Piping (Wet) |  | 224,196,95 |
| Mechanical Piping (Dry) Vent |  | 255,128,64 |
| Kitchen Exhaust |  | 255,128,128 |
| Plumbing Equipment |  | 118,146,60 |
| Plumbing (Domestic) |  | 0,128,0 |
| Plumbing (Sanitary Storm) |  | 200,140,255 |
| Plumbing (Sanitary Waste) |  | 64,0,128 |
| Lighting |  | 254,159,106 |
| Electrical |  | 255,255,0 |
| Telecommunications |  | 128,128,64 |
| Fire Protection |  | 255,0,0 |
| Fuel Supply |  | 0,0,0 |
| Irrigation |  | 182,205,189 |
| Structural |  | 146,205,220 |

Integrated (Federated) Model/ Integration Processing accordance with the Project Schedule the Project BIM Manager will be responsible for performing clash detection with the design and/ or trade models. The clashes will be organized for review by the Project Team. Once clashes have been reviewed, a potential resolution has been assigned to a specific team member it is expected that the clash be resolved in a timely manner, preferably prior to the next scheduled meeting time.

### Hierarchy of Systems Coordination

In the event that any system has interference or clash with a differing system, A/E will agree upon following a discipline hierarchy for resolutions based on the consensus of the project team.

*An example is listed below.* Indicate the required *hierarchy* specific to the project.

1. Structure
2. Architecture (must follow RFI process for changes as required)
3. Equipment location and Access (must follow RFI process for changes as required)
4. Sloped Piping – vent, storm, sanitary
5. High and Medium pressure ductwork and devices
6. Large diameter pressurized pipe mains, valves and devices (50mm (2”) and larger), fire protection mains
7. Plumbing (other than systems utilizing gravity)
8. Conduit 50mm (2”) and greater, power feeds to equipment and all switch gear
9. HVAC Piping (other than systems utilizing gravity)
10. Fire Protection Distribution (Branch lines)
11. Low pressure ductwork, grilles, registers, diffusers and associated equipment (location changes must be approved by designers)
12. Electrical Distribution Equipment
13. Sleeves through rated partitions
14. Access panels

## Quality Control

The following checks should be performed in the models to assure quality:

| Check | Definition | Responsible Party | Software Program(s) | Frequency |
| --- | --- | --- | --- | --- |
| Visual Check | Ensure there are no unintended model components and the design intent has been followed | All ModelAuthor(s) | Navisworks, Revit | Each milestonedeliverable |
| Interference Check | Detect programs in the model where any building components are clashing including hard and soft | All ModelAuthor(s) | Navisworks, Revitotherprogram(s)TBD | 65% DD,100% DD,65% CD, 100% CD |
| Standards Check | Ensure that the BIM standards have been followed (Refer to the OPDC *Revit Template Users Guide*) | All ModelAuthor(s) | Navisworks, Revit | Continuous |
| Model Integrity Checks | Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined, or duplicated elements and the reporting process on non-compliant elements and corrective action plans | All ModelAuthor(s) | Navisworks, Revit | Weekly |

## Model Accuracy and Tolerances

Models should include dimensioning as needed for design intent, analysis, and construction. Level of Accuracy (LOA) of the model shall be minimal 12mm (½”) for existing and align with construction tolerances for all new construction (minimal 24mm (1”).

*Complete the table below to fill the modeling accuracy and tolerances.*

| Phase | Discipline | Tolerance |
| --- | --- | --- |
| Design documents | Arch | Accurate to +/- [ # ] of actual size and location |
| Shop drawings | Mech contractor | Accurate to +/- [ # ] of actual size and location |
| As-builts |  |  |

# Model Content Requirements

## Model Content LOD

Refer to *OPDC Revit Template Users Guide* for minimum model element requirement standards, under *Revit Modeling Requirements* section. This guidance describes the minimum standards required for project deliverables along with *Modeling Level of Development* definitions.

The project team shall develop a BIM Content LOD matrix utilizing the template illustrated below and provided as a Microsoft Excel attachment.

*BIM Content LOD Matrix has also been provided in a Microsoft Excel format for editing in Appendix B. Attach a version of this spreadsheet to the BIM Project Execution Plan.*



## Revit Worksets

Revit Worksets are a way to separate a set of elements in the Revit project model into subsets for “worksharing”. The Revit model contains a *Workset Table* which lists references to all worksets contained in that project model.

During project BIM development, Revit users should be aware of the active workset. There may be one or many worksets in a project. Each new model element added to the project will be placed in the active workset. For OPDC BIM development purposes, the following will be the essential worksets in a work shared project for architectural models:

For large projects where disciplines are modeled in separate Revit models:

| Workset Name | Purpose |
| --- | --- |
| Exterior Shell | Include all exterior shell elements of the building(s) |
| Interior | Include all interior elements of the building(s) except furniture and equipment |
| Core | Include core structure and core elements of the building(s) |
| Furniture | Include all interior furniture and equipment elements of the building(s) |
| Exhibits Walls | Include exhibit walls/partitions different from interior walls and exhibits |
| Exhibits | Include exhibits |
| Grid and Levels | Include grids and levels |
| Links | Include linked discipline Revit models |
| Architectural Lighting | Include light locations as per the architect so that they can be turned off or removed easily when lighting from MEP is finalized |
| Signage | Include interior and exterior signs  |
| Security/Surveillance and Access | Include locations for CCTVs, motion detectors, screening devices, push button mounts, etc. |

For small projects where disciplines are included within the Architectural Revit model:

| Workset Name | Purpose |
| --- | --- |
| Exterior Shell | Include all exterior shell elements of the building(s) |
| Interior | Include all interior elements of the building(s) except furniture and equipment |
| Core | Include core structure and core elements of the building(s) |
| Furniture | Include all interior furniture and equipment elements of the building(s) |
| Exhibits Walls | Include exhibit walls/partitions different from interior walls and exhibits |
| Exhibits | Include exhibits |
| Grid and Levels | Include grids and levels |
| Separate discipline worksets | Include separate discipline worksets for Mechanical, Electrical, Plumbing, Fire Protection, Structural and Life Safety  |
| Signage | Include interior and exterior signs  |
| Security/Surveillance and Access | Include locations for CCTVs, motion detectors, screening devices, push button mounts, etc. |

*If additional worksets are included in the project BIM, please indicate them in the table below.*

These worksets are mandated for project BIMs to structure consistent models for the SI BIM inventory, and follow on use by the Smithsonian Institution.

*Please note: For the PxP - delete the non-applicable table above.*

Detail specific plan/process/requirements associated with utilizing embedding FM related data into the As-Building models. Include data requirements, data storage location, linkage requirements, etc.

# Appendices

## Appendix A - Definitions

|  |  |
| --- | --- |
| **As-Built Drawings** | Physical mark-up of a printed set of Construction Documents that captures changes and updates throughout the construction process, including RFIs, bulletins, and field conditions. This does not involve the updating of any models. |
| **As-Built Record Model** | Design Model that has incorporated changes and updates throughout the construction process, including RFIs, bulletins, and field conditions. |
| **Asset** | Individual items incorporated into the construction of a project. For the SI, information is collected by this for use as facility data. |
| **BIM Project Execution Plan (PxP)** | A document created utilizing the OPDC’s provided template to define procedures and roles for the preparation of electronic media during the project. |
| **Closeout Documents** | Consist of approved submittals, operating and maintenance manuals, as-builts, warranties, and other documentation and paperwork that is prepared by either the Contractor or Architect for the Owner’s information and use, and is provided as a condition precedent to Final Payment. |
|  |  |
| **Conformed Model** | Updates the Design Intent Model for those aspects maintained by the designer to record authorized design changes during construction. |
| **Contractor** | The firm serving as lead builder for the project, working in the capacity of either General Contractor or Contractor. |
| **Construction Model** | BIM that demonstrates and communicates the facility data necessary to procure, fabricate, schedule or construct the Project. |
| **Coordination Model** | BIM prepared by Contractors to further develop the Design Model for use in system fabrication or field construction. |
| **Design Intent Model** | BIM prepared by the design team to communicate aspects of the design. It may consist of sub-models prepared by each of the discipline designers, such as Architecture, Mechanical, Electrical, and Structural. |
| **Designer** | The firm serving as developer of the project documents, working in the capacity of Architect, Engineer, or Consultant. |
| **.DWG** | File type associated with a native AutoCAD file. |
| **Facility Center** | SI wide database used to manage and maintain facilities data information for work orders and asset management. |
| **GIS** | Geographic Information Systems |
| **Level of Development (LOD)** | A way to define the level of detail of elements within a BIM.  |
| **Level of Accuracy (LOA)** | A way to define the level of accuracy of elements within a BIM. |
| **Master Format** | A numbering system developed by CSI to organize specifications. Additional information may be found at: <http://www.csinet.org/Home-Page-Category/Formats/MasterFormat/MF-use.aspx> |
| **.NWC, .NWD** | File type associated with a native Navisworks file. |
| **OmniClass** | A numbering system developed by International Organization for Standardization (ISO) to provide structure for electronic databases. It is helpful for categorizing assets in a BIM or facilities management system.  |
| **OmniClass Table 23** | Spreadsheet that contains the corresponding codes utilized in the BIM to categorize assets within the facility management system.  |
| **Project Closeout** | The managed and orderly transition of the work from Substantial Completion to Final Payment, including the finalization of final paperwork. |
| **Project Team** | The collective group of representatives from the SI, the Designer, and Contractor. |
| **.RVT** | File type associated with a native Autodesk Revit file. It is the deliverable file format for all projects. |
| **SI Explorer** | The SI’s geospatial information system (GIS). Web viewer of joined ArcGIS and Facility Center data. |
| **Substantial Completion** | Establishes a date that the Work can be used for the purpose intended, and involves the formal transition of property management from the Contractor to the SI |

## Appendix B - References

Autodesk Model Performance Technical Note White Paper <http://images.autodesk.com/adsk/files/autodesk_revit_2014_model_performance_technical_note.pdf>

Autodesk Revit 2016 Help Wiki <http://help.autodesk.com/view/RVT/2016/ENU/>

Construction Industry Institute <https://www.construction-institute.org/scriptcontent/more/res_cpf_2010_2_v2_more.cfm>

National CAD Standard Version 5.0 <http://www.nationalcadstandard.org/ncs5/>

National BIM Standard-US Version 2 <http://www.nationalbimstandard.org/references.php>

Penn State Computer Integrated Construction <http://bim.psu.edu/>

USACE CAD and BIM Drawing Standards <https://cadbim.usace.army.mil/BIM>