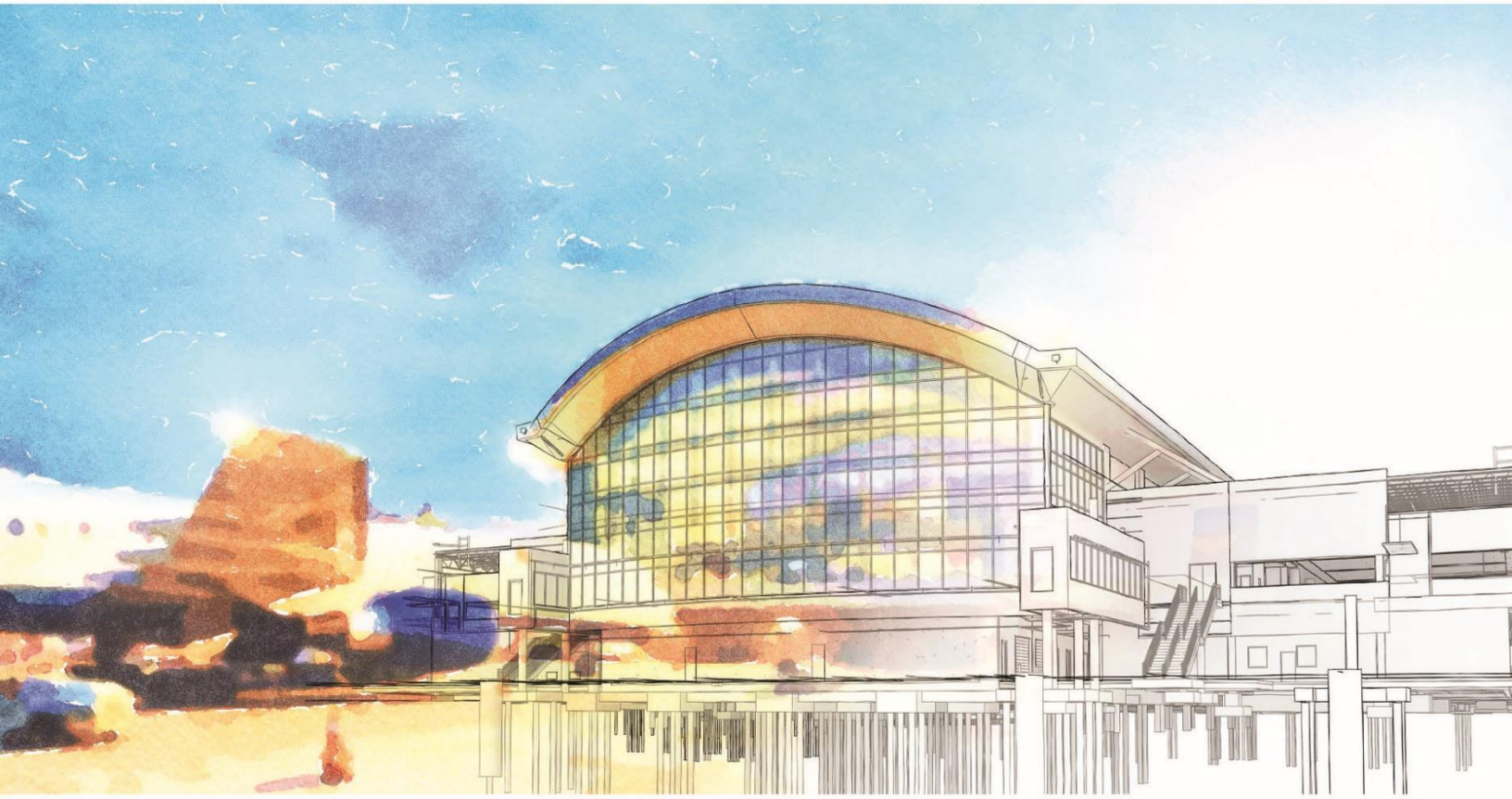
Building Information Model (BIM)

Standard Manual



Fort Lauderdale-Hollywood International Airport
North Perry Airport

Broward County, Florida

Broward County Aviation Department
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Revisions

Change Record			
Date	Author	Version	Change Reference
09/30/2022	Woolpert	1.0	Initial Draft
11/03/2022	Woolpert	1.0	Second Draft
01/20/2023	Woolpert	1.0	Final
06/12/2023	Woolpert	1.1	Updates to 5.4 Facilities Management Data
01/20/2024	Woolpert	1.2	Updated templates and reference to v2023
08/13/2024	Woolpert	1.3	Updated templates and reference to v2024

1. General Information

1.1 Foreword

This Building Information Model (BIM) Standard Manual provides guidance to Broward County Aviation Department (BCAD) staff and consultants who are developing BIM deliverables to be submitted to, maintained by, or used by BCAD staff. It is intended to help BCAD achieve a standardized approach to facility data and record drawing management.

The BIM Standard Manual is one of several interrelated documents that assist project teams in fulfilling BCAD project requirements. This standard has been developed in conjunction, and is compatible with:

- BCAD's geographic information systems (GIS) standards
- Computer-aided design (CAD) standards
- Electronic media submittal (EMS) requirements

This document will be updated regularly and all professionals working on BIM projects for BCAD should verify that they are using the latest version of this document. This document supersedes the BCAD Building Information Modeling (BIM) Standard, Version 1, dated September 2013 and CAD Building Information Modeling (BIM) Standard, Version 2, dated September 2018.

1.2 Purpose

BIM data created for BCAD must be developed and submitted according to the specifications documented in this standard. This document represents the minimum BIM requirements for BCAD projects. Additional BIM requirements may be incorporated on appropriate projects in support of defined objectives. This includes data prepared internally by BCAD staff as well as by outside organizations for work performed on behalf of airport tenants and consultants to BCAD.

BCAD uses Autodesk Revit® software as the BIM solution for building and facility design and documentation. This information is for anyone authoring Revit® models for BCAD, including BCAD staff and external service providers. The reader is assumed to have a basic knowledge of Revit and the workflows and terms common to the industry. This document presents baseline BIM requirements for all new facilities and facility renovation projects at BCAD.

Each submitted Revit file and CAD drawing file will become part of the permanent archive. The data used to produce the drawings will serve as a critical source for updating information within BCAD's BIM and CAD data storage system.

All consultants and subconsultants (architecture, structure, MEP, fire protection, BHS, etc.) will create BIM models and produce 2D construction documents natively using the current, approved version of Revit. The Revit design files shall be 100 percent Revit and include all designed equipment and systems to be modeled. The Revit file shall not contain any imported or linked AutoCAD, Bentley or other CAD or graphic files used as design data. For example, a CAD site plan may be used as an underlay, but a terminal floor plan must be completely modeled in Revit. Similarly, a graphic file may be used for a company logo on a titleblock, but a room schedule must be created using Revit. All Revit files shall include the models, families, and 2D documentation.

The content of this manual supersedes all previously published BCAD site/civil CAD standards versions and is subject to change without notice. The latest version of this document and all supporting documentation can be found at BCAD's website:

https://www.broward.org/Airport/Business/pages/bimstandard.aspx. BCAD shall not be liable for errors and omissions in this standards manual.

1.3 Design And Construction Agent Responsibilities

Design and construction agents shall ensure proper synchronization of the BIM requirements with the project acquisition strategy (delivery, contracting, and procurement methods). As an example, for traditional project delivery methods, requirements for data synchronization during construction may be established during the design contract execution and must be coordinated with the construction contract.

Design and construction agents shall ensure contracts are coordinated to align responsibility with the chosen acquisition strategy.

Design and construction agents shall ensure the BIM execution plan is in support of the BCAD BIM objectives prior to approval of the BIM execution plan.

It is preferable for BCAD to have bidding firms (AE or Contractor) accomplish a draft implementation plan to be used as a discriminator for possible award to the firms who propose maximum BIM use throughout the facility life cycle. Whether the BIM project execution plan (BIMPxP) is accomplished before or after award, the plan shall include using the BIM data for the minimum requirements delineated in Section 3: BIM Requirements.

Design and construction agents shall coordinate contract requirements to ensure appropriate contractual controls exist to ensure timely and effective implementation of the BIM execution plan. Such controls may include withholding of payment for unacceptable design and construction performance as part of plan execution.

1.3.1 BIM Manager Responsibilities

One individual must be designated as the architect/engineer (AE) BIM manager to be accountable to BCAD for BIM; this responsibility includes data creation and model management coordination between team members for the project. If the project is being procured by design-bid-build, then there will be a separate BIM manager for the AE and the general contractor (GC) who each must coordinate their respective work.

If design-build (or other similar joint design-construction entity) procurement is used, there may be just one model manager for the entire project.

Each model manager is accountable to BCAD for the following activities, including but not limited to:

- Ensuring compliance with BCAD's BIM standard and required deliverables
- Developing, maintaining, updating, distributing, and providing clarifications to/for the BIM project execution plan (BIMPxP)
- Structuring, defining, coordinating, and managing model creation and model and data quality control across all firms, disciplines, or trades under its contractual umbrella
- Leading and facilitating the BIM management project kick-off meeting with project team member modelers to explain the BIM project objectives and management protocols
- Verifying that the georeferences in the associated technical discipline models are properly referenced to the identified project's permanent survey monument as well as with each other
- Ensuring regularly scheduled design and/or construction coordination review meetings
- Coordinating updates of the design-intent model(s) to create the record model and delivery of BIM-derived 2D drawings and other information as required to support the project delivery process
- Instituting quality control (QC) for proper modeling, standards adherence, and classification of all spaces and equipment as required
- Providing proper delivery and data and model QC and coordination

2. Legal Considerations

2.1 Ownership and Use of BIM

The ability to own, reuse, and manage building data properly throughout the facility life cycle accrues significant advantages for an owner. Consequently, BCAD places significant importance on the accurate creation, management, and stewardship of all digital information (including but not limited to models, 2D drawings, specifications, visualizations, and data) created during project development and execution. BCAD intends that this information will be used for planning, design, construction, equipment selection, and facility management, as well as other purposes (including but not limited to commissioning, management of project activities, and real property reporting) and by other software as needed.

2.2 Contract Documents

The design-intent model is the AE's primary design deliverable to BCAD. The 2D drawings are derived from the design-intent model, but only reflect specific extracted views and do not contain as much information as is in the model, itself. The GC is required to construct in accordance with the model, as amended through contract-approved processes. At BCAD's discretion, the contract documents may state specifically that 2D drawings or other information takes precedence over the design-intent model, but in all other cases, the design-intent model takes precedence over the 2D drawings. The non-editable federated design-intent model will be the instrument of the contract used for construction award. Regardless, all revisions to the contract documents after construction award must be made in the design-intent model and the subsequent updated 2D drawings must be derived from the updated model. All models must be shared with project stakeholders as needed.

2.3 Reviews, Approvals, Issue Resolution, and Waivers

Situations may arise where adherence to this standard is not in the best interest of BCAD. If such a situation arises, the party creating the information must request and obtain a waiver from BCAD before deviating from BCAD BIM standard. If a construction agent is used, the construction agent must submit the waiver request to BCAD for a decision. The construction agent is not authorized to waive the BCAD BIM standard. BCAD is not opposed to waiver requests, but the request must identify the specific standard section(s) for which the waiver is requested, the reason for the waiver, the resulting impacts on the purposes BCAD intends, and any alternative approaches that should be considered. The AE and the GC must update their respective BIMPxP with any approved waivers.

See the attached "BCAD BIM Request for Variance.docx" for the template.

2.4 Referenced Standards & Documents

BCAD's BIM standard is part of BCAD's overall guidelines and standards with which consultants and BCAD staff must comply. Additional documents, which may be beneficial, can be provided by BCAD and include:

- BIM standards manual and appendices
- BCAD's CAD standards
- BCAD's GIS standards
- BIMForum Level of Development Specification 2023
- Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-18B "General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standards", which can be found at https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-18B-chg1-consolidated.pdf

This BIM standard is based heavily on the National BIM Standard-United States™ (NBIMS-US™) – V3, which can be found at https://www.nationalbimstandard.org.

It is the responsibility of the consultant to obtain the latest set of standards referenced in this document. The consultant is encouraged to contact the BCAD PM to facilitate obtaining these documents. The consultant is also encouraged to obtain the BCAD Revit template file that matches this BIM standard as well as any existing as-built electronic data which may be applicable.

For each project, the BIM manager shall notify the consultant of what data model will be maintained in the future and a conformed model should be provided upon project completion.

2.5 Legacy Information

BCAD will make available any and all project-related information to the design and construction teams in whatever medium that is readily available. Such information may include, but is not limited to:

- Record drawings and as-built files: Record drawings and as-built files will be made available whenever possible. Such files may be found in any formats, including but not limited to PDF, TIFF, CAD, or BIM.
- Utility data: Utility data in CAD or GIS format, as well as BCAD's GIS standards, will be made available to the civil engineering team when and where applicable. Both the BCAD Utility Work Program and the BCAD GIS manager are to be consulted to ensure the most accurate, updated data is provided.
- Laser scans in raw formats: If needed, the 3D by-product model of point clouds is the responsibility of the design and construction teams. If a valid 3D by-product

model already exists, BCAD will make it available. The placement and use, when available, of such information will be established by the project BIMPxP.

- Master site BIM. Depending on the project, a master site BIM may be available. In this case, BCAD will share the model and project-shared coordinates so that any and all new project BIMs will be properly placed and located within the master site BIM. It is critical that all BIMs created by the design and construction teams throughout design and construction match their corresponding coordinates inside the master site BIM.

2.6 Contact Information

Questions pertaining to this document should be directed to the BCAD BIM management team at BCADPlanning@Broward.org.

3. BIM Requirements

3.1 Introduction

The **BCAD BIM standards** is a suite of documents (including this BIM manual) that apply to the physical asset documentation of **existing and new** facilities **owned** by BCAD at both Fort Lauderdale-Hollywood International Airport (FLL) and North Perry Airport (HWO). These standards apply to design and construction projects where the services of a professional licensed AE are required to sign the construction documents and other work if the final deliverable is ultimately to be used to document the physical asset, even in cases where a licensed professional is not required. The BCAD BIM standards apply to the work of the AE and the construction team managed by the GC. The use of BIM on non-recurring maintenance (NRM) projects is strongly encouraged but is at the discretion of the local BCAD facility.

3.2 BIM Uses

The table below lists the functional capabilities of BIM and when they are used during each major project stage. The BIM uses shaded in red and checked with an (X) are required BCAD BIM requirements. Additional BIM uses may be identified on a project as applicable. Contractors may identify additional BIM uses for the project as contractor electives. Reference the BIM project execution planning guide at www.nationalbimstandard.org for BIM use descriptions.

Table 1 – BIM Uses

Plan (NIC)	Design	Construct	Operate (NIC)
Programming	Design Authoring	Site Utilization Planning	Building System Analysis
Site Analysis	Design Reviews	Construction System Design	Asset Management
	3d Coordination - Interference Management	3d Coordination - Interference Management	Space Management / Tracking
	Engineering Analysis - Structural	Digital Fabrication	Disaster Planning
	Engineering Analysis - Lighting	3d Control And Planning / Digital Layout	
	Engineering Analysis - Energy	Record Modeling	Record Modeling
	Program Validation	Field / Material Tracking	
	Engineering Analysis - Mechanical		
	3d Control And Planning (Digital Layout) - Geolocating The Project		
	Sustainability (Leed) Evaluation		
	Engineering Analysis – Other (Per Contract Requirements)		
	Code Validation		
Phase Planning (4d)	Preliminary Construction Scheduling (4d)	Construction Scheduling (4d)	Building (Preventive) Maintenance Scheduling (4d)
Cost Estimation (5d)	Cost Estimation (5d)	Cost Estimation (5d)	Cost Estimation (5d)
Existing Conditions Modeling	Existing Conditions Modeling	Existing Conditions Modeling	Existing Conditions Modeling
Construction Operations Building Information Exchange (Cobie)	Construction Operations Building Information Exchange (Cobie)	Construction Operations Building Information Exchange (Cobie) Builder And Omniclass As Required	Construction Operations Building Information Exchange (Cobie) Builder And Omniclass As Required

3.3 BIM Project Execution Plan

The BIMPxP is a process management document executed between the AE prime and its consultants and between the GC and its subcontractors to define how those teams will use BIM to meet BCAD requirements. The BIMPxP must include the standards, responsibilities, and protocols for modeling and file transfer (such as setting up collaboration servers). The AE's and GC's BIMPxP(s) will be used to track progress towards meeting BCAD BIM requirements.

The AE, with the assistance from BCAD, will assist in the transition between the design and construction BIMPxP in design-bid-build (DBB) procurements. The AE BIMPxP must be used as the basis for the GC BIMPxP and will be updated as required by the GC.

The protocol for sharing the models between the AE and GC and the method of coordination during construction period services for the handoff of information, including scheduling handoff dates, formatting, responsibilities, data validation, etc., must be coordinated between the AE and GC and documented in their respective BIMPxP plans.

The BIMPxP(s) must provide the information as required in the BCAD BIMPxP template, attached as "BCAD BIM Project Execution Plan (BIMPxP).docx."

3.4 Template Files

All projects must use the most current BCAD BIM templates. The current Revit template version is **2024**. These are Revit project files (not Revit template files) for architecture, MEP, and Structural files. These are available in the standard content, 03 Project Library\02_Templates\. Inherent in the Revit project template files are graphic standards and organization of the views, legends, schedules, and sheets.

Consistency in worksets, phases, design options, and other built-in characteristics of organization and use has a great impact on the ability of diverse teams to effectively utilize the model.

Because the models will become part of the facilities, maintenance, and operations tools, it is essential that the base set of standards established by the BCAD templates be maintained through the design and construction process.

3.5 Folder and File Structure

BCAD uses BIM360 in the Autodesk Construction Cloud environment to host and manage model information from concept through construction. All projects utilizing Revit shall be hosted by the lead AE firm or General Contractor on BIM360 account as live, work-shared, collaborated Revit documents. The Revit models shall be scheduled for automatic publishing on a weekly basis. The published models shall include a 3D view for each phase of the project that includes all linked models, as well as a complete set of drawing sheets from the most recent package submittal. After each deliverable has been submitted, all models shall be published and should include all sheets in the submittal along with clouded revisions.

Special consideration must be made for security sensitivity levels. Because spatial data can be used for nefarious purposes, it is important to protect it from unauthorized users. Title 49, Code of Federal Regulations, Part 1520, defines Sensitive Security Information (SSI) and how it should be protected. Based on this definition, many forms of spatial data are considered SSI. Protecting sensitive spatial data is therefore not just good practice - it is the law. However, being too protective of data can unnecessarily limit its usefulness. The challenge is to restrict data to users having an operational need to know and whose credentials the data provider has qualified. With spatial data this challenge is particularly complex because there is such a wide variety of data users and ways in which they need to

use the data. One of the more efficient ways of restricting access to spatial data is to apply specific restrictions at the directory level that contain only SSI information. This standard applies one of the following sensitivity levels to each feature type. These are based on classifications listed in the MD_ClassificationCode list in ISO 19115.

• Unclassified data is available for general disclosure.

• Restricted data is not available for general disclosure.

• Confidential data is available to persons who can be entrusted with the information.

• Secret data is to be kept private, unknown, or hidden from all but a select group of people.

• Top Secret data is of the highest secrecy restricting access to only those requiring access to perform their jobs.

The AE or GC will create the project in Autodesk Construction Cloud and give access permissions to all users based on their role and security authorization. BCAD shall be given permission to view and download all project files. The AE or GC is also responsible for automated publishing and maintaining the overall BIM360 project hub. A third-party consultant may also be utilized for BIM management. In this instance, the consultant will be responsible for these items.

3.5.1 BIM Folder Structure for Deliverables

The following folder structure is the standard folder structure for BIM-related files that will be used on BCAD projects. No deviations from this folder structure will be permitted without a proposed variance request. If desired, however, each project team may add subfolders as defined in the BIMPxP and approved by BCAD.

Project Documents for Design BIMs

- Design BIM execution plan (owner, AE)
- Design BIM analysis reports (owner, AE)
- Coordination logs and reports
- Design model deliverables (public)
  - SD deliverables
  - DD deliverables
  - CD deliverables
  - Government agency submittals
  - Approved construction documents
  - Models for construction manager
- COBie data deliverables

- BIM project close-out
  - Record CAD floor plans
  - Record BIMs
  - Federated record BIM
  - COBie data final deliverable
- Navis Works
- Other formats that allow the model to be viewed without paid access.

Project Documents for Construction BIMs

- Owner BIM execution plan (owner, CM, BIM subs)
- Construction BIM analysis reports (owner, GC)
- Coordination logs and reports
- Coordination models
- Trade models
  - Models used to produce final shop drawings
  - Models used to produce 4D
    - Schedule data used to produce 4D
  - Models used to produce 5D
    - Model quantities used to produce 5D
- COBie data deliverables
- BIM project close-out
  - As-built models (each discipline separate)
  - Federated as-built models
  - Record models (each discipline separate)
  - Federated record models
  - COBie data final deliverable
- Other

3.6 Revit Project Files: Naming Convention

This section outlines the BCAD naming conventions for Revit model (.RVT) files. Files are divided and group-formatted into the following three sections as follows:

FLL/HWO_<*Building Identifier-**>_<BIM team-discipline identifier>_<BCAD Project Number>_<Revit Version>.rvt

FLL/HWO_Building Identifier-ZoneA_Level#_W-A_20110930_R24.rvt

Fields within the general categories are delimited with a hyphen if needed.

*Building identifier to be provided by BCAD project manager.

**For tenant fit-outs, use level and zone designation.

3.6.1 BIM Team and Discipline Identifier

<Office of Origin>< dash ><Discipline>, e.g., WLP-A (Woolpert, Architecture)

Table 2 – Discipline Identifiers

Discipline Legend	
A	Architectural
C	Civil
E	Electrical
F	Fire Protection
I	Interiors
L	Landscape
M	Mechanical
P	Plumbing
S	Structural
Q	Equipment

3.7 Project Information

Project information must be completed as it becomes available. This information includes consultant name and address, design contract number, project issue date, package submittal, project address, and project name.

3.8 Worksets

Worksets are Revit's way of enabling multiple people to work on the same project. All BCAD project files must have work-sharing enabled. All workset-enabled projects shall have at least the default workset, "Workset 1," which shall be renamed to the model discipline (Architecture, Mechanical, Structural, etc.) corresponding with the primary UNIFORMAT 2010 Level 2 group below. As project complexity increases, worksets should be added from the following list. Subdisciplines will remain under the main designation with sequential numbers (see Secondary List below). This list is not exclusive. Projects may have other worksets, but at the end of the project, the models must be submitted using the workset names and guidelines below. Worksets unique to the model that should not appear in other models should have a letter "Z" prefix in front of the workset and 'closed'/not visible in other models. An example of this case would be Lighting Photometrics.

PRIMARY LIST A10 Foundations

B10 Superstructure

B20 Exterior Closure

C10 Interior Construction

C30 Interior Finishes

D10 Conveying systems

D20 Plumbing

D30 HVAC

D40 Fire Protection

D50 Electrical

E10 Equipment

E20 Furnishings

F10 Special Constructions

G10 Site

L10 Airport Equipment

SECONDARY LIST (examples)

D21 Domestic Water

D22 Sanitary Sewer

D23 Natural Gas

D31 Hydronic Systems

D32 HVAC Controls

D41 Fire Alarm

D51 Electrical Lighting

D52 Electrical Power

D53 Electrical Grounding

Z59 Lighting Photometrics

Z39 HVAC Internal Markups

Z39 HVAC Load Calculations

_LINKED CAD

This workset will be created in the OFF position by default in all views; it is never to be set as the active workset. Link a DWG to all views and then change its property to assign it to this workset. Use Visibility Graphics as needed per view to turn this workset on, then isolate the individual drawing using the Imported Categories tab.

_COORD-[DISCIPLINE]

This workset contains elements that are used in the model solely for spatial coordination, system connectivity, or copy monitoring. For example, Mechanical equipment is copy monitored to an electrical model for system connectivity purposes, or light families may exist in Architecture for coordination. These worksets may only be added with BCAD approval.

_LR<DISCIPLINE INITIAL>- For linked Revit files

Create one workset per linked Revit model discipline. These worksets will appear in ALL workset files where another Revit file is linked. This allows users to use Visibility Graphics to turn off linked Revit models or use the worksets dialog box to select Opened=No. An example is _LR<DISCIPLINE>, such as _LRA for Architecture or _LRS for Structure.

3.9 Phasing

Phases shall be set up in coordination with the BCAD BIM and must be uniform across all models within the project. Most projects will have an existing phase and a single new phase for design work. Any phases other than existing shall be named based on the expected construction completion calendar date.

For example, a project phase completing in September 2026 would be named 2026.

If the project has multiple phases or packages, the model shall accurately reflect those phases or packages in phase naming and phased model content in coordination with the BCAD PM. In such cases, the phases shall be named using the date format above and followed by a hyphen and the name of the phase. See examples:

Existing

2026-Phase 1

2026-Phase 2

2027-Phase 3

3.10 Views

3.10.1 Model Views

The following conventions apply to all views in the project regardless of the view type, plan section, legend, or schedule.

3.10.2 Original Views

Once section and elevation marks have been placed in the project, do not delete the original Level plan views. This is important as BCAD uses the Referenced From parameter. Deleting the original views will create problems with this system.

3.10.3 Creating New Views

When creating a new view or sheet by duplication or from scratch, always open the view properties and fill in the element properties used for view sorting and organization.

3.10.4 Level Names

Level names, once set by the project BIM manager, may not be changed. This applies to the names that appear in elevations and sections.

3.10.5 Duplication of Section Mark Types

Section detail types may not be duplicated.

3.10.6 Duplication of Drafting View Types

Drafting view types may be duplicated to help organize 2D details in projects. In large projects, the view's browser driving parameters shall be used.

3.10.7 View Organization Parameters

Most view types (Plans, Sections, Elevations, Detail, and Drafting) have two custom parameters: 'Category' and 'Sub-Discipline', which are used with two default Revit view parameters: 'Discipline' and 'Associated Level', to sort and organize the default views provided in any template.

'Discipline' refers to the design discipline for the documents being generated, such as Architectural, Structural, etc.

'Category' is used per the National CAD Standard sheet ordering system to group similar view types together, e.g., 100-PLANS, 150-RCP, 200-ELEVATIONS, 300-SECTIONS, 500-DETAILS, 900-3D, etc.

Plans and RCP: Floor plans and reflected ceiling plans are associated to levels.

Elevations: Design elevations should be used for color presentations. Sheet elevations should be used for construction documents.

Sections and detail views: Created with the section tool, the type determines the look of the mark as well as where the view appears in the project browser.

Drafting views: Generate standard 2D details that can be imported across projects.

Subdiscipline: The project browser uses subdisciplines to organize the plan views into different categories based on how the view will be used in the project. Additional subdisciplines may be added for specific project needs.

Design views: Used for presentation views, design views may include color, shading/shadow, and other conceptual and/or schematic design information.

Export views: Export to other formats.

Sheet views: The construction document set that contains final annotations and dimensions.

Working views: Used in day-to-day modeling, these views are never placed on sheets.

Temporary working views: Create views at a different scale or with differing Visibility Graphic settings when a working view is in use by another member of the team. If you create one of these views, it is your responsibility to delete it when you are finished using it.

3.10.8 View Counts

Keep the number of views to a minimum. Delete old and unused views.

3.10.9 View Naming

All views, schedules, and legends shall be named in ALL CAPS if being used on sheets. Informational or working legends, which are not placed on sheets, are named in all lowercase letters.

3.10.10 Legends

Legends are broken into two general categories.

Notes legends: Include General Notes and Code Analysis views.

Symbol legends: Includes the list of BCAD-approved default Fill Patterns and the BCAD symbols reference.

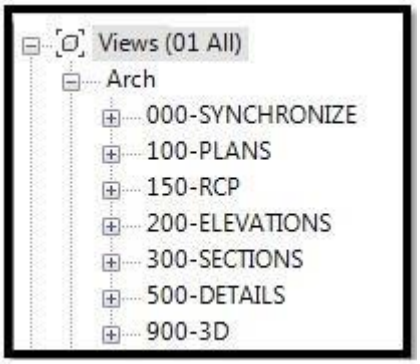
3.10.11 Schedules

The key in a schedule name indicates the scheduling of Revit keys rather than building components.

3.10.12 Browser Organizations for Views

The BCAD templates have six standard view organizations. Each organization definition sorts and/or filters views in the project browser. For example, in the 01 ALL organization, views are sorted first by discipline, then category and subdiscipline, and finally by their associated level.

Figure 1 – Browser Organization for Views



All views will be listed and groups of view types are packaged together. A consultant could create a subdiscipline called Schematic Presentation and place all the Schematic Design views into that package. Those views will remain with the project but will be separate from the rest of the DD and CD views.

3.10.13 Template Browser Organizations: BCAD Standards (Numbered)

These standard BCAD browser organizations shall not be modified or deleted.

01 All: Views are ordered in a structure similar to the National CAD Standard.

Order: Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: None Applied

02 Design Views:

Order: Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: Subdiscipline = Design

03 Sheet Views: Only sheet views are shown in the project browser.

Order: Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: Subdiscipline = Sheet

04 Working Views: Only working views are shown in the project browser.

Order: Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: Subdiscipline = Working

05 Export Views: Only export views are shown in the project browser.

Order: Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: Subdiscipline = Export

06 Details Order: Only detail views are shown in the project browser.

Terminal Number>Discipline > Category > Subdiscipline > Associated Level

Filter: Category = 500-Details

3.10.14 Schedules

3.10.15 Schedule Creation

Schedules must be created using Revit's built-in scheduling tools. Use of drafting views, CAD, text tools, drafting lines, or other workarounds is not permitted.

3.10.16 Template Schedules

The BCAD template contains many customized schedules. They are created to facilitate project data entry and documentation in a manner that is consistent with the needs of BCAD's stakeholders both during and after the project.

Whenever possible and appropriate, BCAD template schedules shall be used for documentation. This section outlines the custom schedules available in the BCAD templates and container files.

3.10.17 Schedules: Mechanical Schedules

Use of BCAD's mechanical schedules is required for all applicable mechanical equipment. No substitutions or modifications are permitted without authorization from the BCAD systems group and BCAD PM.

Existing BCAD mechanical schedules may be renamed to remove the M- prefix. The BCAD standard mechanical schedules are listed below.

M-ABBREVIATIONS

M-AHU SCHEDULE (1/2)

M-AHU SCHEDULE (2/2)

M-AIR SOLID SEPARATOR SCHEDULE

M-CABINET UNIT HEATER SCHEDULE

M-CRAH SCHEDULE

M-DAMPER SCHEDULE

M-DEDICATED OUTDOOR AIR UNIT SCHEDULE (1/2)

M-DEDICATED OUTDOOR AIR UNIT SCHEDULE (2/2)

M-DEDICATED OUTDOOR AIR UNIT SCHEDULE COMPLETE

M-DIFFUSER, REGISTER and GRILLE SCHEDULE

M-EQUIPMENT SOUND SCHEDULE

M-EXPANSION TANK SCHEDULE

M-FAN COIL UNIT SCHEDULE

M-FAN SCHEDULE

M-HEAT EXCHANGER SCHEDULE

M-INFRARED RADIANT HEATER (NATURAL GAS) SCHEDULE

M-LOUVER SCHEDULE

M-MAKEUP AIR UNIT SCHEDULE

M-PLENUM BOX SCHEDULE

M-RADIANT MANIFOLD SCHEDULE

M-UNIT HEATER SCHEDULE

M-VAV SCHEDULE

3.10.18 Schedules: Door and Frame Schedules

The BCAD template contains a series of door schedules for easy reference. Use of these schedules is currently optional.

Table 3 – Door and Frame Schedules

Door and Frame Schedule	Schedule intended for plotted set of drawings
Door and Frame Schedule 01 Materials Key	Key schedule. Holds full information for the materials and finishes assigned to the frame and panel in the DOOR AND FRAME SCHEDULE
Door and Frame Schedule 02 Detail Key	Key schedule. Holds head, Jamb and Sill detail references for specific typical wall conditions to populate DOOR AND FRAME SCHEDULE.
Door and Frame Schedule 03 Hardware Key	Hardware Sets are described in the specifications; edit this Key Schedule to correspond to the specifications to populate DOOR AND FRAME SCHEDULE.

Customized schedules shall be used to record or plot the standard abbreviations for the project. This schedule is a key schedule that holds values in the Revit Internal Point Loads parameters.

3.11 Sheets

3.11.1 Sheets

Sheets, like views, have their own parameters for sorting and organizing within the project browser. These same parameters are used to organize the sheets in the Drawing Index schedules. For general sheet naming, numbering, and layout standards, refer to the National CAD Standards v6.0.

3.11.2 Title Blocks

Standard title blocks are provided in BCAD Revit project template. BCAD's standard title block is 24x36. The title block family shall not be modified without approval from the BCAD PM. All consultants and subconsultants on a project shall use the same title block.

3.11.3 Sheet Parameters

Sheet parameters are used to organize the project browser and drawing lists for document sets. The following section documents the elements to which each parameter is assigned. Similar to the view browser organizations, these are set in the template as a base set of schedules and browser organizations. This base set may be added to for any project.

Volume Number: Used for Drawing Index schedule to sort construction document sheets by volume if needed. Volume is also used in the browser organization: 02 Architectural Set by Volume.

Sheet Sort Order: Enables the Drawing Index schedules and browser organizations to be organized in a non-alphabetical manner. The sheet sort order number is organized by the National CAD Standard Discipline Designator with a two-digit numerical prefix, for example, 00-GENERAL or 07-ARCHITECTURAL.

Category: Used for browser organization, this is the sheet type designator as defined by NCS, for example, 100-PLANS or 200-ELEVATIONS.

Table 4 – Sheet Parameters

Abbreviation	NCS	Sheet Discipline Order
G	General	00
H	Hazardous Materials	10
V	Survey/Mapping	20
B	Geotechnical	30
C	Civil	40
L	Landscape	50
S	Structural	60
A	Architectural	70
I	Interiors	80
Q	Equipment	90
F	Fire Protection	100
P	Plumbing	110
D	Process	120
M	Mechanical	130
E	Electrical	140
T	Telecommunications	150
R	Resource	160
X	Other Disciplines	170
Z	Contractor/Shop Drawings	180
O	Operations	190

Table 5 – Sheet Type Designators

Abbreviation	NCS
000	General (Symbols, legends, notes, etc.
100	Plans (Horizontal Views)
200	Elevations (vertical views)
300	Sections (sectional views, wall sections)
400	Large-Scale Views (Enlarged plans, elevations, stair sections or sections that are not details)
500	Details
600	Schedules and Diagrams
700	Assets (user Defined by BCAD)
800	User Defined
900	3D Representations (Isometrics, perspectives, photographs)

3.11.4 Sheet Browser Organization

Like the views, the project browser enables for the organization of sheets. These organization definitions only affect the project browser and not the drawing list schedules. However, the same parameters are used to drive the browser organization as well as the drawing list schedules.

3.11.5 Template Browser Organizations: BCAD Standards (Numbered)

BCAD templates have three built-in, customized browser organizations. These standard BCAD browser organizations shall not be deleted or changed. Any project may add to this set for project specific organizations. If possible, use parameters already in use by the other browser organizations.

01 By NCS: All sheet views are shown.

Group by: Volume Number > Sheet Sort Order > Category

Sort by: Sheet Number

Filter: No filter applied

02 Architectural Set by Volume: All printed views are shown. Any sheet that is a placeholder (for drawing index) is not shown.

Group by: Volume Number

Sort by: Sheet Number

Filter: Category not equal to 999-PLACE HOLDERS

03 Architectural Set: All printed views are shown. Placeholder sheets for drawing index are not shown.

Group by: Category

Sort by: Sheet Number

Filter: Category not equal to 999-PLACE HOLDERS

3.12 Annotation

3.12.1 Text Styles

BCAD has selected **Verdana** as the default annotation font as it is typically installed on most computers as a default Windows True Type font. Arial has been selected as the default border sheet font for contrast.

Verdana was designed to be readable at small sizes. Additionally, the lack of serifs, large x-height, wide proportions, loose letter spacing, and emphasized distinctions between similarly shaped characters increase legibility.

Contrasting text styles are used within a drawing to delineate information types.

In BCAD deliverable CAD drawings, only the Verdana font shall be used. However, the Verdana font may be modified in size, color, or style (bold, italics, underline, outline) as needed by the data provider for additional emphasis. Only Verdana True Type Font available through a standard MS Windows program is permitted. No special Verdana font downloads are permitted as they will not be universal on every PC. The BCAD standard text types are provided in the BCAD Revit templates:

Headings: 5/32 inch, used for headings (such as on legends, notes, etc.)

Subheadings: 1/8 inch, used hierarchically beneath headings (such as schedule headings)

Notes: 3/32 inch, used by default in when a project is not covered specifically by the preceding types

Notes transparent: 3/32 inch, used when a transparent background may be necessary for notes

3.12.2 Standard Dimensions

BCAD templates have one linear dimension type; any additional types must be removed prior to each submittal:

Standard: Standard dimension type is to be used for all construction document purposes.

3.12.3 Sheet Notation

Annotations shall follow the National CAD Standards current version (6.0), Uniform Drawing System Module 7 Notations. Please refer to that document for complete text on any of the topics in this section.

There are five types of notes: general notes, general [discipline] notes, general sheet notes, reference keynotes, and sheet keynotes. General notes, general [discipline] notes, and general sheet notes do not directly correspond to graphic representations and are not directly linked by symbol or other identifier to drawings or specifications. Should these three types of notes appear on the same sheet, they are listed in the following hierarchical order:

General notes

General [discipline] notes (such as general architectural notes)

General sheet notes

3.12.4 General Notes

General notes are located within the G-series, general drawing sheet types.

General [Discipline] Notes

General [discipline] notes appear on the first (0-series) sheets within a particular design discipline and apply to all subsequent sheets within that discipline. For example, general architecture notes appear on sheet A-001 and apply to all architecture sheets within the drawing set.

Sheet Notes

General sheet notes are used to communicate sheet-specific information or instructions. General sheet notes are tabulated sequentially within the note block. General sheet notes follow the other types of general notes (general notes or general [discipline] notes) and precede any reference keynotes that may appear in the note block. Refer to the following illustrations.

Figure 2 – Sheet Notes: Dimension Examples

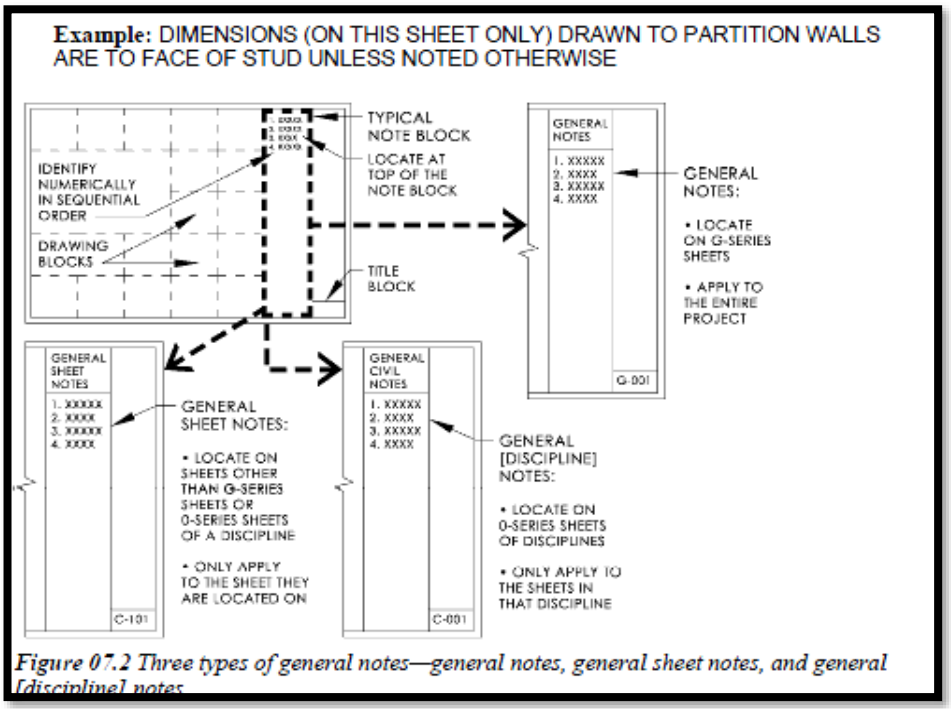


Figure 07.2 Three types of general notes—general notes, general sheet notes, and general [discipline] notes

Figure 3 – Sheet Notes: General Note Examples

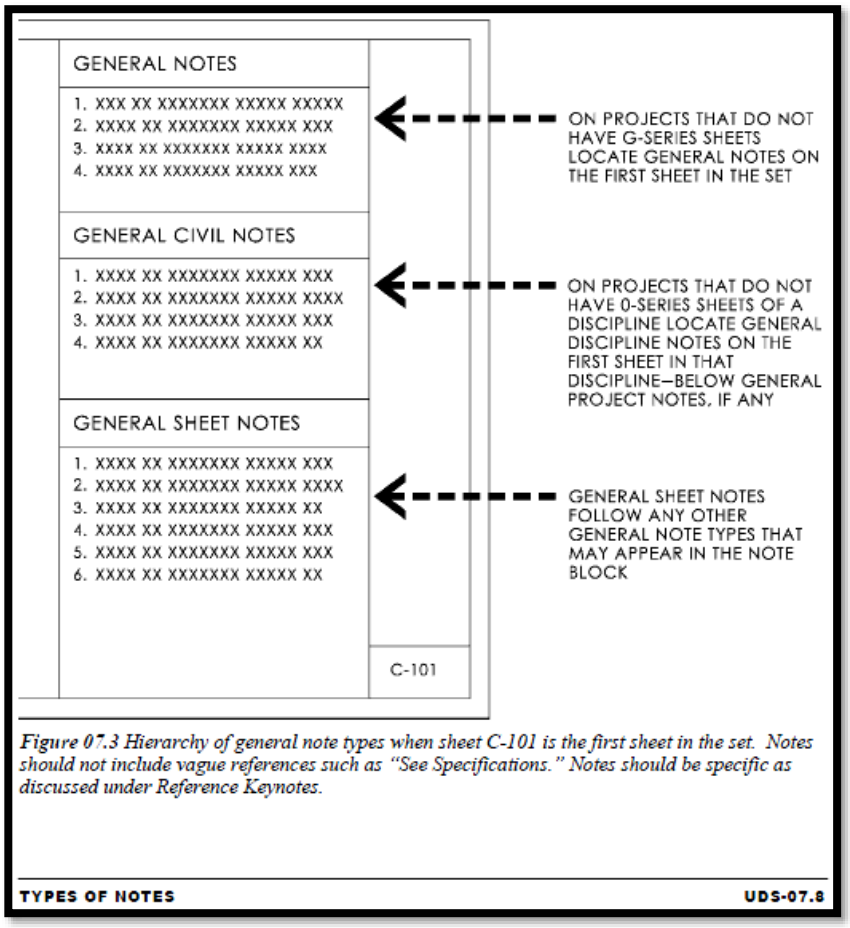


Figure 07.3 Hierarchy of general note types when sheet C-101 is the first sheet in the set. Notes should not include vague references such as "See Specifications." Notes should be specific as discussed under Reference Keynotes.

Sheet Notation General Rules

When placing notes on the drawing, place the note directly next to the noted object, using complete text within the drawing area. Revit keynote functionality may also be used for sheet notation where possible and appropriate.

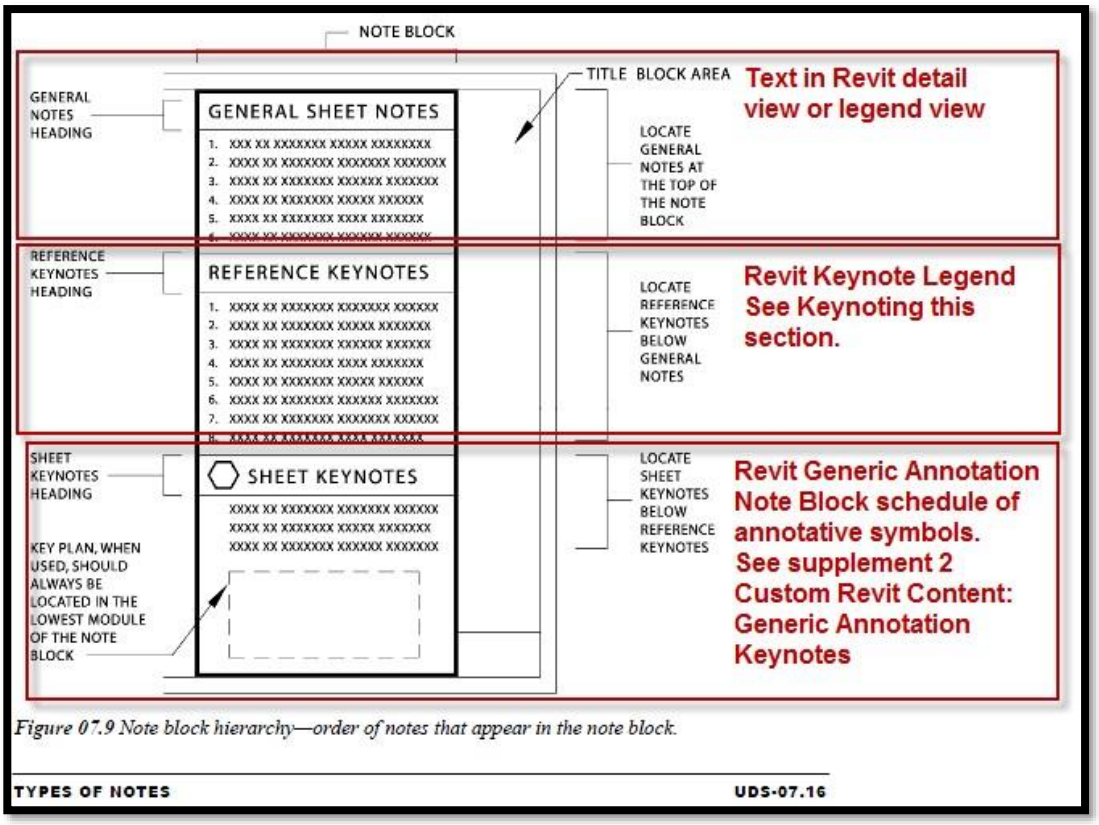
If the full text of the note cannot be placed within the drawing area, it will become either a reference keynote or a sheet keynote.

To promote most flexibility for all firms and disciplines working with BCAD, the following Revit components have been identified to fill the roles established by the National CAD Standard for reference keynotes and sheet keynotes:

Sheet keynotes are more generic and may use the Revit keynote tools or generic annotations and note block schedules.

Reference keynotes refer to designated specification sections within the project and utilize the Revit keynote tools.

Figure 4 – Reference Keynotes



3.12.5 Keynotes

The Revit keynoting feature links data in a text file to the elements and/or materials within the Revit model. If one material or element type is linked to a keynote, all future keynotes placed on that same material or element within other views will display the same value.

BCAD maintains a single master keynote file; BCAD_RevitKeynotes_Imperial.txt. It is located in the 04_Support>03_Keynoting folder.

Sheet Notes

Family: Annotation: 000000 <Use> SheetNote-GA

Each family is separated by use. Alt, demo, plan, and elev notes are provided in the base template. If needed, save this family from the template for different uses.

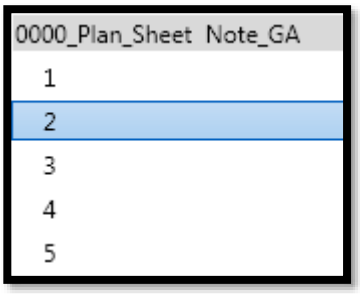
000000-PLAN-Sheet Note-GA

000000-ELEV-Sheet Note-GA

Types

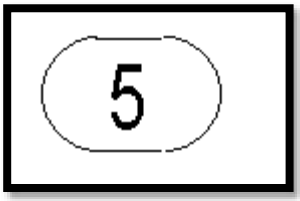
Types are used to designate the number of the sheet note. For example, note 2 on floor plan A would use 000000-PLAN- Sheet Note-GA:2.

Figure 5 – Sheet Note Types



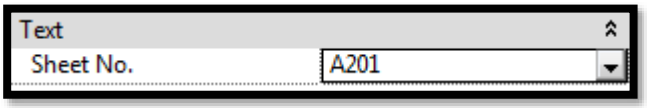
Symbol

Figure 6 – Sheet Note Symbol



Parameters

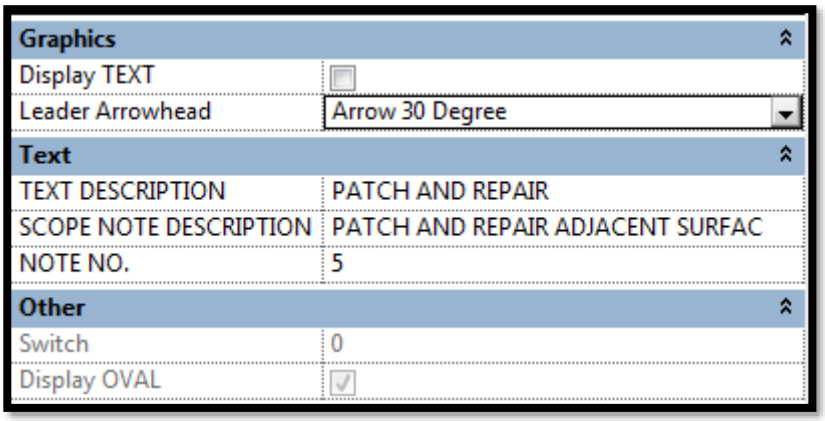
Figure 7 – Sheet Note: Instance Parameters



Sheet No. is used to filter the note block schedules for placing on individual sheets

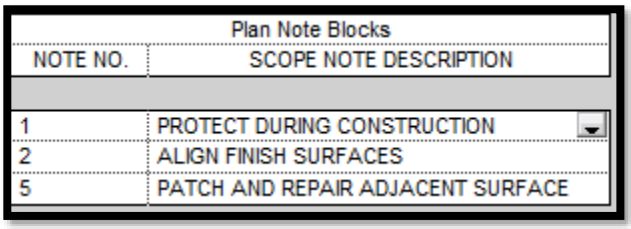
Type Parameters

Figure 8 – Sheet Note: Type Parameters



Scope Note Description: Long text that appears in a note block schedule placed on the sheet (sheet notes)

Figure 9 – Scope Note Description



The text associated with any number will match the same number used on other sheets.

Note No.: Used for note block schedule and duplicates type name

3.12.6 Line Patterns and Styles

Line styles and patterns approved by BCAD will be available in all templates and can be found in the legend: Line Types.

Medium, wide, and thin lines shall not be used. However, they cannot be purged from the templates.

BCAD line styles shall be named according to thickness, color, and line pattern (if not solid black).

Table 6 – Line Pattern and Style Examples

02	A solid black line with thickness 2
02 Red	A solid red line style with thickness 2
02 Hidden Red	A red line, thickness 2 with the Hidden line pattern

Line Patterns

Line patterns are documented in the templates in the schedule: Line Patterns for Drafting.

Line Weights

Line weights approved by BCAD will be available in all templates: Line Weights.

Table 7 – Line Weights

Line Weights						
Weight	1” = 1’-0”	1/2” = 1’-0”	1/4” = 1’-0”	1/8” = 1’-0”	1/16” = 1’-0”	1/32” = 1’-0”
1	0.0030”	0.0030”	0.0030”	0.0030”	0.0030”	0.0030”
2	0.0042”	0.0040”	0.0040”	0.0040”	0.0035”	0.0033”
3	0.0062”	0.0057”	0.0054”	0.0050”	0.0037”	0.0036”
4	0.0090”	0.0082”	0.0076”	0.0070”	0.0049”	0.0038”
5	0.0109”	0.0098”	0.0091”	0.0085”	0.0057”	0.0043”
6	0.0131”	0.0118”	0.0109”	0.0100”	0.0066”	0.0049”
7	0.0159”	0.0142”	0.0130”	0.0119”	0.0076”	0.0056”
8	0.0192”	0.0170”	0.0155”	0.0140”	0.0088”	0.0063”
9	0.0232”	0.0204”	0.0185”	0.0168”	0.0102”	0.0072”
10	0.0280”	0.0245”	0.0221”	0.0200”	0.0118”	0.0082”
11	0.0338”	0.0294”	0.0264”	0.0238”	0.0137”	0.0093”
12	0.0409”	0.0353”	0.0316”	0.0280”	0.0159”	0.0106”
13	0.0508”	0.0508”	0.0450”	0.0390”	0.0213”	0.0138”
14	0.0641”	0.0641”	0.0641”	0.0550”	0.0285”	0.0178”
15	0.0790”	0.0790”	0.0790”	0.0790”	0.0382”	0.0231”
16	0.1100”	0.1100”	0.1100”	0.1100”	0.0511”	0.0298”

3.12.7 Linked Revit and CAD Files

Linked Revit files must be linked and located using shared coordinates, pinned in place, and placed on the corresponding worksets. Linked Revit files shall be linked as overlays using relative pathing.

If CAD files are needed, approval must be received from the BCAD BIM manager. When approved, CAD files must be linked and placed on the correct workset _LINKED CAD.

CAD files must never be imported or exploded.

3.12.8 Design Options

Design options enable the creation of studies of multiple alternates within the Revit file.

Unless specifically approved by BCAD, design options shall be eliminated from the model file prior to submission at 90 percent submittals or later.

3.12.9 Geospatial Coordinates

The geographic location in the Revit template model has been set to the following:

Florida State Plane Coordinate System East Zone (FIPS 0901), NAD 83, HARN, 2011 Adjustment (FIPS: 0901, Esri WKID: 6438)

Latitude: 26°04'24.7660"

Longitude: -080°08'58.8344"

Easting: 935287.890076

Northing: 633331.811096

The project base point in the Revit template model is aligned with this survey point as a placeholder position. The project base point must be adjusted in relation to this survey point at the beginning of each project and aligned to a specific building feature or structural grid intersection chosen by the BCAD PM. All Revit models for a particular project or building that are linked together shall have the same survey point and project base point.

3.12.10 Model Levels

Levels are to be restricted to occupiable floor levels and shall be labeled numerically and in ALL CAPS, such as LEVEL 01, LEVEL 02 or LEVEL 03.

When using levels that exist in provided BCAD models, match the naming of those levels.

If surveyed elevations do not match the elevations of existing levels in the model, contact BCAD for direction.

Levels shall not be created for intermediate spaces (such as landings) or upper limit delineations (such as parapet tops). Reference plane and elevation annotations may be used for such conditions. New levels must be approved by BCAD.

3.12.11 Model Delivery

Models must be delivered at each submittal at the same time as the rest of the contract deliverables for that package.

3.12.12 Modeling Standards

The project BIM team shall continue development of the BIM. Parametric links shall be maintained within the models to enable automatic generation of all plans, sections, elevations, custom details, and schedules as well as 3D views. Except for specifications, all information needed to describe the detailed design shall be graphically or alphanumerically included in and derived from these models only. Documentation of the models or design documents shall not happen outside of the BIM authoring software.

At a minimum, all elements within the scope of work, within the limits of the construction site, or that may be affected by construction must be modeled. These elements include but are not limited to:

- All building structures, equipment, and systems
- Utilities above or below ground, inside and outside of project boundaries to service connection points
- Construction details
- All major vegetation to be preserved
- Any areas to be protected during construction
- Project site conditions
- Equipment needed for room test fits and building service equipment

3.12.13 Discipline Models

AE design models must be subdivided by discipline and by non-building equipment as required in the BCAD BIM standard. All discipline model divisions are to be documented in the BIMPxP.

In general, each discipline model, with the exceptions noted herein, must contain the objects that relate to its discipline design.

Each project will require different discipline models depending on the scope of work. It is the responsibility of the AE and GC to appropriately structure their modeling to provide adequate information as needed for the project. However, BCAD has the following requirements for these discipline models, which must be included in the record model:

Provide project-specific BIM facility data consisting of a set of intelligent elements for the model (e.g., doors, air handlers, electrical panels). This facility data shall include all material definitions, qualities, and attributes that are necessary for the project facility design. The data format must be compatible with the facility management software (BUILDER and Tririga) for subsequent database searches.

Models may vary in level of detail for individual elements within a model, but at a minimum must include all features that would be included on a quarter-inch (1/4" = 1'0") scaled drawing (at least 1/16th, 1/8th, and 1/4th) or appropriately scaled civil drawings.

Civil

All features and information typically provided in site plans must be provided using civil information modeling (CIM) software and comply with the BCAD BIM standard. This includes roadways, walks, physical features, topography (contours), locations of rims and invert elevations of underground utilities, soil/geotechnical conditions, etc. AE modeling of subsurface utilities and conditions must be labeled as FOR INFORMATION ONLY. Buildings must be minimally modeled for site/civil work but must reflect the accurate location of outside proposed building walls and any utility penetrations through floor slabs and walls below ground. Site elements requiring maintenance must include FM data as noted and included in the COBie deliverable.

Underground site utilities: Objects must be modeled in 3D for civil underground utilities and site work, both existing and proposed, and be classified using OmniClass Table 21 to identify the system each asset is a part of, Table 22 to align with specification sections, and Table 23 to identify asset types. Include all utility properties. Modeling will extend five feet beyond the project construction boundaries and connect with the site and building utility services.

Digital terrain model (DTM): Model all relevant site conditions and proposed grading, including necessary intelligence, to produce accurate project site topographical plans and cross sections.

Drainage: Model all existing and new drainage piping, including upgrades thereto. Include necessary intelligence to produce accurate plans and profiles for the project site.

Stormwater and sanitary sewers: Model all existing and new sewer structures and piping, including upgrades thereto, on the project site with necessary connections to

mains or other distribution points as appropriate. Include necessary intelligence to produce accurate plans and profiles for the project site.

Utilities: Model all necessary new utilities connections from the project building(s) to the existing or newly created utilities, and all existing above-ground and underground utility conduits, including necessary intelligence to produce accurate plans and site sections.

Roads and parking: Model all necessary roadways and parking lots or parking structures, including necessary intelligence to produce accurate plans, profiles, and cross-sections.

Structure

Structural models must be the basis of evaluating and analyzing the building structure and include all the objects, elements, and components to do so. All material and material properties must be included for each object and the building structure and geometry must be accurately defined and labeled for foundations, subgrade enclosures, slab-on-grade, superstructure, and exterior vertical enclosures and roofs.

Foundations: Include all necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations.

Floor slabs: Structural floor slabs shall be depicted, including all necessary recesses, curbs, pads, closure pours, and major penetrations (accurately depicted).

Structural steel: Depict all steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans and related building/wall sections.

Cast-in-place concrete: Include all walls, columns, and beams, including necessary intelligence to produce accurate plans and building/wall sections depicting cast-in-place concrete elements.

Expansion/contraction joints: Joints shall be accurately depicted.

Stairs: The structural model shall include all necessary openings and framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.

Shafts and pits: The structural model shall include all necessary shafts, pits and openings, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements

Architecture

Architectural models must include the BIM objects relative to floors, exterior and interior walls and partitions, roofs, vertical transportation, windows, doors, stairs, ramps, railings, ceilings, grilles and gates, and interior specialties. Required structural blocking, such as for televisions or monitors, must be modeled for quantities, size, shape, and location. Reference major structural components from the structural model (including but not limited to structural walls, floors, roof structure, columns, and foundations). Reference the interiors model, PRC equipment models, appropriate building equipment and systems models (including mechanical for louvers), and others as needed to coordinate the work.

Floors: The floor slab shall be developed in the structural model and then referenced by the architectural model for each floor of the project building.

Interior partitions, fire-rated partitions, and smoke barriers: The model must include fire resistance ratings in the wall object properties and must graphically be depicted in 2D plan sets. Patient safety is paramount in medical care facilities and protecting against fire and smoke is critical to that safety. Consequently, the use of wall fill patterns in models and drawings that depict the appropriate construction is important to understanding which spaces are protected. This information is also required for Joint Commission inspections.

Doors, windows, and louvers: Doors, windows, and louvers shall be depicted to represent their actual size, rating, types and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules. Properties of door objects must include finish information, door swing, vision panels, seals, acoustical properties, hardware, locks and keying, electrical requirements, and applicable fire resistance ratings.

Ceilings: All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions, shall be depicted in the model with the necessary intelligence to produce accurate plans, building sections, and generic wall sections where ceiling design elements are depicted. Properties of ceilings must include fire ratings and sound transmission coefficients. All ceiling materials other than paint must be modeled and included as part of the overall room finish tag.

Raised Floors: Access/raised Floors are modeled EXCLUDING supports.

Architectural specialties and casework: All architectural specialties (such as toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and casework (such as cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations, and sections in which such design elements are referenced. Casework materials will generally consist of a

horizontal and/or vertical element. Casework and countertops must be modeled to correct dimensions (length/width, depth, and height).

Walls and curtain walls: Each wall shall be depicted to the exact height, length, width, and ratings (thermal, acoustic, fire) to properly reflect wall types. The model shall include all interior and exterior walls and the necessary intelligence to produce accurate plans, sections, and elevations depicting these design elements. Wall bases must be modeled based on dimension and type where elevated. Wall finishes greater than 1/4-inch thickness must be modeled for coordination and clearance. Non-geometric data, such as actual material specified, will be included as part of the room finish tag on the architectural finish plans.

Roof: The model shall include the roof configuration, drainage system, major penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections, and generic wall sections where roof design elements are depicted.

Stairs/vertical circulation: All continuous vertical components such as non-structural shafts, architectural stairs, handrails, and guardrails shall be accurately depicted and include the necessary intelligence to produce accurate plans, elevations, and sections in which such design elements are referenced. All stairs and their finishes will be scheduled in the model.

Interiors and FFE

A separate FFE model, referenced to the architectural model and medical equipment, food service, and other equipment models (as needed in the project), must be created for FFE items that are purchased and installed by BCAD (acquisition code OFOI). Do not attach FFE to a surface.

Interior finishes: Interior finish plans, ceiling plans, elevations, and intelligent scheduling of objects/elements must be used to convey materials and finishes in a separate interiors model associated with the architectural model (and others as required). Interior finishes must be included as a part of the room properties. All materials that are representative of a system greater than ¼-inch thickness must be included in the model as 3D geometry. Examples include wall protection or interior cladding such as stone, masonry, glass, metal, or wood paneling.

Modular furniture: Manufactured modular furniture selected for the design-intent documents which will be purchased by BCAD and installed by the GC (acquisition code OFCI) must be modeled to correct dimensions (length/width, depth, and height) and linked to the basis-of-design cut sheet for the item.

Signage: The model shall include all signage and the necessary intelligence to produce accurate plans and schedules.

Schedules: Provide door, window, hardware, sets using BHMA designations, flooring, wall finish, and signage schedules from the model, indicating the type, materials, and finishes used in the design.

Furniture/fixtures/equipment (FFE): Three-dimensional representations of FFE elements are preferred. For projects with an extensive systems furniture layout that may impact BIM system performance, the contractor will consult with BCAD for consideration of 2D representation. The FFE systems model may vary in level of detail for individual elements, but at a minimum, it must include all features that would be included on a 1/4”=1’0” scaled drawing. Additional minimum model requirements include:

Furniture (INCLUDE AS REQUIRED): The furniture systems model may vary in level of detail for individual elements within a model, but at a minimum, it must include all features that would be included on a 1/4”=1’0” scaled drawing and shall include all relevant office equipment and furniture system layouts, with necessary intelligence to produce accurate plans, sections, perspectives, and elevations necessary to completely depict furniture systems locations and sizes.

Systems coordination: Furniture that makes use of electrical, data, plumbing, or other features shall include the necessary intelligence to produce coordinated documents and data.

Fixtures, equipment fixtures, and equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans, elevations, sections, and schedules depicting their configuration.

Schedules provide furniture and equipment schedules from the model indicating the materials, finishes, and mechanical and electrical requirements.

Food Service

Food service and laboratory equipment must each be placed in a separate model and referenced to the architectural and appropriate engineering models for the utility hookups or structural support required for the equipment. Food service and laboratory equipment that is ASE will be so designated in its respective models.

Mechanical, Electrical, Plumbing, Fire Protection, and Medical Technology

Mechanical, electrical, plumbing, fire protection, and technology (MEPFT) systems must be in their own discipline models, referenced to the architectural model and other discipline models as needed. All system models must include all equipment necessary for operations,

including but not limited to boilers, chillers, geothermal and solar energy systems, pumps and piping distribution systems (including modeling for pipe slope and insulation), water-side terminal units, fans, air handlers, air distribution and evacuation systems (including modeling for duct and equipment insulation), air-side terminal units, VAV boxes, electrical feed and distribution systems transformers, electrical panels and switchgear, lighting, emergency circuitry, emergency generators, all public utility systems from tap, all control systems, data and phone wiring and terminal devices, data switches, and data rooms. Fire protection models must include fire ratings, sprinkler medium, pressure, and flow volume. Include all properties and data as noted in FM Data Spreadsheet.

Use OmniClass Table 21 to identify the system each asset is a part of, Table 22 to align with specification sections, and Table 23 to identify the asset type. Include all utility properties. Modeling will extend five feet beyond the project construction boundaries and will connect with the site and building utility services.

All system elements 1.0 inch in diameter and larger (such as general plumbing and fire protection, but not individual electrical cables unless in patient headwalls) and other elements (ducts, cable trays, etc.) with a dimension over 4 inches must be modeled. Conduit that will be consolidated into cable trays need not be modeled individually; only the tray needs to be modeled.

All riser diagrams must be model based.

Mechanical: All components of the mechanical systems must be modeled accurately and include the necessary space reservations for appropriate access during maintenance and replacement. Louvers should be modeled as a part of mechanical.

HVAC: All necessary heating, ventilating, air-conditioning, and specialty equipment, including air distribution ducts for supply, return and ventilation; exhaust ducts; control system; registers; diffusers; grills; and hydronic baseboards must be modeled with with necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules. All piping larger than 1.5” diameter shall be modeled.

Mechanical piping: All necessary piping and fixture layouts and related equipment must be modeled and include necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules. All piping larger than 1.5” diameter shall be modeled.

Plumbing: All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment must be modeled with the necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All piping larger than ½” diameter shall be modeled.

Equipment clearances: All HVAC and plumbing equipment clearances shall be modeled for use in interference management and maintenance access requirements.

Elevator equipment: The model shall include the necessary equipment and control system, including necessary intelligence to produce accurate plans, sections, and elevations depicting these design elements.

Electrical: Ceilings, diffusers, light fixtures, etc., are cosmetically arranged by the architect but the systems are designed by the electrical engineer. The architectural, mechanical, and electrical models must reference each other and be a part of the design coordination to eliminate any mismatches between the models.

Interior electrical power and lighting: All necessary interior electrical components (such as lighting, receptacles, special and general-purpose power receptacles, lighting fixtures, panel boards, and control systems) must be modeled with the necessary intelligence to produce accurate plans, details. and schedules. Cable tray routing shall be modeled without detail of cable contents. Lighting and power built into furniture/equipment shall be modeled.

Special electrical systems: The model shall include all necessary special electrical components, such as security, mass notification, public address, nurse call, and other special occupancies and control systems. Include the necessary intelligence to produce accurate plans, details, and schedules.

Grounding systems: All necessary grounding components (such as lightning protection systems, static grounding systems, communications, grounding systems, and bonding) shall be modeled and include necessary intelligence to produce accurate plans, details, and schedules.

Communications: The model shall include all existing and new communications service controls and connections, both above-ground and underground, with necessary intelligence to produce accurate plans, details, and schedules. Cable tray routing shall be modeled without detail of cable contents. Communications conduit larger than 1.5” shall be modeled.

Exterior building lighting: All necessary exterior lighting will be modeled with necessary intelligence to produce accurate plans, elevations, and schedules. The exterior building lighting model shall include all necessary lighting, relevant existing and proposed support utility lines, and equipment required with necessary intelligence to produce accurate plans, details, and schedules.

Equipment clearances: All lighting and communications equipment clearances and no-fly zones shall be modeled for use in interference management and maintenance

access requirements. Include the original model-based schedules for all equipment. No fabricated or extraneously produced schedules will be accepted.

Schedules: The construction drawings shall include equipment schedules that are of the BIM native schedules. Equipment shall not be generated in third-party software and inserted on the drawings as raster images, detail lines and text, AutoCAD line work and text, or other non-BIM formats for aesthetic reasons. The data in the schedules as printed on the contract drawings shall be the exact same data as in the model.

Plumbing for domestic (potable) water: Because of the need to manage healthcare environments to prevent legionella and other water-borne pathogens, all supply and return elements, components, and distribution systems of the domestic water system must be modeled regardless of size, with properties for the name of the system, pipe material, pipe diameter, direction of water flow, design temperature ranges, filter locations, and type, all color-coded for supply and return. Include any other identification necessary to view the domestic water system independently from other plumbing so the system can be managed for patient safety during facility management operations.

Other plumbing components may be in the plumbing model and identified by system and component if not a part of the domestic water system.

Fire protection: The fire protection system model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a 1/4”=1’0” scaled drawing. Additional minimum model requirements include:

All relevant fire protection components (such as branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, and control panels) shall be indicated with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled. In a design-bid-build project where the suppression system is specified through a performance specification and designed by the construction contractor, the AE will provide the design model with associated fire protection system components appropriate to the level of design and provide specifications for the construction contractor to the final installed fire protection system in the record model.

Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

Baggage Handling System

Baggage handling systems (BHS) shall be modeled in 3D and provide the clear area and dimensions of equipment. Model equipment to a level of detail suitable to ensure the required clear space for the baggage envelope, egress, and other rights-of-way are maintained throughout the system.

Equipment: Equipment, including motors, will be modeled to its overall height, width, and depth.

Equipment clearances: Model the required clear space for the baggage envelope as solid above the bag line surface. Any access zone (work areas for pulling motors) requirements will be modeled as solids (clearances in front of motor control centers).

Supports: Model the preliminary support structure for the BHS to include floor-, wall-, or ceiling-mounted supports.

Catwalks: Model any catwalks necessary for the BHS.

Egress: Coordinate clear width and height egress paths.

Schedules and circuiting: All equipment and fixtures shall be properly circuited and scheduled within the model itself.

Tags: All equipment shall utilize dynamic tags and no “dumb” text tags are permitted.

Openings: Coordinate all floor and wall openings, concrete curbs, and security/fire doors required for the BHS.

No-fly zones: No-fly zones above control panels shall be modeled as solids.

3.13 Security and IT Systems

Electrical/wiring associated with security and IT systems shall be modeled per the electrical modeling requirements as outlined in this standard.

Location: At a minimum, device locations are to be designated by installation points in 3D space.

Schedules and circuiting: All equipment and fixtures shall be properly circuited and scheduled within the model itself.

Tags: All equipment shall utilize dynamic tags and no “dumb” text tags are permitted.

Equipment: Equipment and server racks are to be modeled as solid objects relative to their overall height, width, and depth. Include, at a minimum, the following equipment/devices: FIDS, PA, CCTV, access control, and smoke evacuation systems.

No-fly zones: No-fly zones above control panels shall be modeled as solids.

3.13.1 Acquisition Codes

The responsibilities for equipment purchasing and installation are defined by an acquisition code designated for each piece of equipment. All equipment must have acquisition codes associated with the equipment object.

The codes are:

OFOI = Owner-furnished/owner-installed

OFCI = Owner-furnished/contractor-installed

CFCI = Contractor-furnished/contractor-installed

ROI = Reused existing equipment/owner-installed

RCI = Reused existing equipment/contractor-installed

3.13.2 Construction Documents Phase

The project BIM team shall continue development of the models created in the design development phase. Maintain parametric links within the respective models to enable automatic generation of all plans, sections, elevations, custom details, schedules, and 3D views. All information needed to describe the execution documents shall be graphically or alphanumerically included in and derived from these models only. Specifications are not required to be linked within the models.

Revit and Civil 3D models are to be submitted as 30, 60, 90, and 100 percent construction documents with LoD matching those laid out in the LoD matrix. Include families in use that were not part of BCAD library for review. BCAD will review models and families within 14 days and schedule meetings with the project team to discuss.

See attached “BCAD LOD Matrix Template.xlsx” for the LOD matrix template.

Data

Programmatic spaces: All rooms in the architectural and/or MEP BIM model shall conform to BCAD naming, numbering, and categorization requirements.

Sustainability

Energy: As called for by BIMPXP, preliminary energy modeling data included:

- Detailed electric and fuel rates as defined by the local service provider
- Building function and occupancy
- Building operating schedules
- Building construction types

Equipment (data): All equipment in the model will be registered in the project equipment library.

3.13.3 Concurrent Record Model (Design Team)

The project BIM team shall submit a plan to the owner for review prior to the start of construction that outlines the process for concurrent record documentation. The design team will incorporate changes from requests for information (RFI), change orders, addenda, and other CA revisions into their models as they are issued.

Concurrency is mandated. Methods for recording and communicating construction information are left to the discretion of the contractor.

Potential options for concurrency include:

Traditional methods

Periodic laser scanning of completed or partially completed primary systems coordinated with the sequence of construction

Integration of model changes in RFI-change order approval processes; responsibility of the modeling updates is determined by the BIMPXP

Primary systems include, but may not be limited to structural framing, primary HVAC duct runs, primary fire protection main runs, primary electrical conduits (2 inches plus tolerance), ceiling grids layouts, or any elements or systems indicated as assets in the LoD matrix.

See attached “BCAD LOD Matrix Template.xlsx” for the LOD matrix template.

Once the contractor model is completely coordinated, the design team shall reconcile any differences between the contractor and design models.

3.13.4 Commissioning Requirements

Commissioning data including but not limited to design intent, performance criteria, and operations data shall be recorded and/or linked to the REVIT or Civil 3D model as commissioning occurs throughout the project. It shall be the project team's responsibility to coordinate the information sources and integrate this information into the REVIT or Civil 3D model for transfer at the completion of the project.

3.13.5 Project Close-out

The project BIM team shall update their respective models with contractor-recorded changes (record documents). Republish record documents in paper, CAD and PDF formats.

In addition to any submissions required per BCAD professional services contract (deliverables sections) and the BCAD as-built requirement documents, the project BIM team will submit a record model prior to close-out.

3.13.6 Record Models

Record models shall be submitted in .rvt and Civil 3D .dwg format and shall be cleaned of extraneous scrap or working views, stories, abandoned designs, object creation and testing places, and other content typically produced in BIM production.

Record models shall be modeled to the LoD noted in the LoD matrix with any assets updated to reflect actual location, size, shape, and orientation of installed assets.

See attached "BCAD LOD Matrix Template.xlsx" for the LOD matrix template.

3.14 Level of Development

Level of design/development/detail (LOD) is the overall state of information model at a particular point in the design process. This includes not only graphical objects, but also the data associated with the objects. The model should develop over time from a very coarse design to the record drawings and as-builts. This process has been distilled down into five distinct categories as formalized in the AIA E202 contract document.

Specific disciplines will also progress through the process at different rates. It is very common to have structural steel reach 400 level before all mechanical has reached 300 level. The entire team must recognize this and plan accordingly, making sure objects do not make it to the field if their final design will be influenced by objects not yet defined in the model. For example, steel must not be released from the 300 level before mechanical loads are known. This is not to say that mechanical must be complete to the same level, only that the loads needed to calculate the steel are true. As the model progresses from conceptual through as-built, ownership of graphical objects and their associated data may pass from

one group to another. This may also involve the transition from one data format to another. It is critical that data fidelity be maintained through this process.

It is critical to have a clear definition of what is included in the information model at different points in a project's life cycle. Understanding expectations, roles and responsibilities is one of the most important aspects of a successful BIM-based project. To assist in this, GSA has developed several resources:

Basic definitions of level of detail (listed below)

Detailed object definitions

The LOD is based off the BIMForum LOD Specification 2023 that uses ASTM E1157 09 Uniformat II Active Standard. The description excerpt below is according to the LOD Specification 2023:

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 (such as cost per square foot, tonnage of HVAC, etc.) can be derived from other model elements.

BlMForum Interpretation: LOD 100 elements are not geometric representations. Examples are information attached to other model elements or symbols showing the existence of a component but not its shape, size, or precise location. Any information derived from LOD 100 elements must be considered approximate.

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.

BlMForum interpretation: At this LOD elements are generic placeholders. They may be recognizable as the components they represent or they may be volumes for space reservation. Any information derived from LOD 200 elements must be considered approximate.

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.

BIMForum interpretation: The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs. The project origin is defined and the element is located accurately with respect to the project origin.

LOD 350

The model element is graphically represented within the model as a specific system, object, or assembly in terms of quantity, size, shape, location, 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.

BIMForum interpretation. An LOD 400 element is modeled at sufficient detail and accuracy for fabrication of the represented component. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.

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.

See attached “BCAD LOD Matrix Template.xlsx” for the LOD matrix template.

4. BIM Deliverables

4.1 General

BIM deliverables and BCAD workflow will change depending on the contracted project delivery method. It is not the standard's intent to define processes for each delivery method, but instead to define the minimum BIM deliverables that will be required. The standard will define how BCAD plans to use the deliverables and will require that a BIMPxP be created for each project. The BIMPxP shall be adapted to support the contract delivery method and specifically outline the BIM protocols, workflows, roles, and responsibilities of each party. Develop all designs using BIM and CAD software.

The use of BIM does not negate the need for delivery of CAD files used for the creation of the construction documents drawings. Specification of a CAD file format for these drawings submitted shall not be used to limit which BIM application(s) or software(s) may be used for project development and execution.

The model, CAD files, facility/site data, and workspace should be delivered in the native, DWF, and PDF formats for PM review using viewer software or Adobe Acrobat Reader. The BIM shall be in a native file format with linked performance-based specifications (via e-SPECS for Revit with SpecLink integration or similar), interactive for the user.

Electronic submittals shall be on digital media acceptable to BCAD. The electronic submittals shall be organized and structured supportive of archival and retrieval. The electronic submittals shall have a dashboard-type feature to help viewers navigate through the digital media and associated files. Files not using names which readily identify their content shall have appropriate metadata including searchable short descriptions of the file's content or relevance.

4.2 Deliverables

During the planning and development phase, BIM provides owners with information about the current and potential future states of a project and generated information for analysis. During design and construction, BIM supports information capture, communication, coordination, design, and construction. At regular predetermined intervals throughout these phases, BCAD will require the design and construction teams to submit individual BIMs, federated BIMs, drawings, documents, and COBie files as contract deliverables. These deliverables are complements to the typical 2D deliverables expected from the design and construction teams at each regular project milestone or phase. BIM authoring tools, data

integration, and collaborative team workflows will be used to develop and produce project information and documentation as required for all submittals.

The design and construction BIM deliverables are expected to be both in their approved native file formats and in IFC (2x3). Any associated data linked to the BIM deliverables are considered part of the deliverable to BCAD and shall be stored and organized according to BCAD's standards.

5. Final Record Model and CAD Data

The following shall be required of the construction contractor.

Submit the final record model, facility, and CAD data files reflecting as-built conditions for BCAD approval prior to project closeout.

Record models shall contain updated and accurate parameter data at the time of submittal.

The record model shall update the final design model, facility, and CAD data files reflecting as-built conditions for BCAD approval. Update the design model assemblies with actual manufacturer BIMs (when available) as part of the record model. Provide operations and maintenance, product, and warranty data within the as-built model.

Include updates from all field changes and contract modifications.

It is the intent of BCAD to reduce the amount of paper waste in our landfills and to adopt the use of digital formats. Consequently, project deliverables will be digital files (including but not limited to model files, plans, and specifications) except as separately identified in AE deliverables document (PG 18-15). The format of all digital files must be documented in the AE and GC's individual BIMPxP.

BIM files must be cleaned of extraneous scrap or working space layers, stories, abandoned design, object creation and test places, empty layers, and other content which is typically produced in BIM production.

5.1 Drawing Deliverables Requirements

The drawing deliverables requirements (DDR) governs the graphical appearance of 2D and sheet-centric output, whether created from BIM or CAD. All .dwg and electronic 2D and 3D PDF drawings and formats must comply with the DDR standards, which can be found in the Broward County CAD Standards document.

5.2 Design-Intent Model - Bidding

The AE must provide to the BCAD contracting officer for potential bidders the following:

1. The fully assembled and coordinated non-editable design-intent model in a NWD format (or equal) or a digital 3D PDF format
2. The native BIM files
3. Design-intent 2D drawings (as noted in the DDR) derived from the design-intent model

5.3 Construction Award

Once a contract for construction has been awarded, the AE will provide BCAD with an editable copy of the fully coordinated and assembled design-intent model (NWD format or equal), copies of the editable authoring BIMs for each discipline and digital 2D PDF drawing files, which BCAD will provide to the GC. To assist in the sharing of information during construction, the AE and GC will establish a protocol for digital data exchange that addresses interoperability, model divisions, and user access requirements prior to providing these files, which must be documented in their respective BIMPxPs.

5.4 Facility Management Data

BCAD requires data from the design and construction process to be reused for facility management (FM) purposes. BCAD will use the information in a computerized maintenance management system (CMMS) and computer-aided facility management (CAFM). To assure that data for FM can be adequately transferred into BCAD's CMMS to operate the building, the data described in BCAD data requirements for FM data must be compiled during project delivery and provided in a COBie or similar database format. Both the AE and the GC must collaborate with BCAD to assure this information is available to the facility.

When the information is complete and ready for transfer to CMMS, an FME workbench will extract the data directly from Revit and convert the 3D geometry and attributes to GIS for use in the CMMS.

To prepare the Revit model for conversion to GIS, the following steps must be followed.

- Create a 3D view called "FM - OVERALL 3D".
- Create 2D views for each major floor plan – Naming should be "FM - LEVEL 1 OVERALL FLOOR PLAN", "FM - LEVEL 2 OVERALL FLOOR PLAN", etc. Do not create reflected ceiling plans. Ceilings and overhead equipment will be generated in GIS from the 3D view. Use the plan region tool to generate graphics for elements that are above the visible view.
- Create 2D floor plan showing all levels from the top of the building to the lowest level, called 'FM – COMBINED OVERALL FLOOR PLAN" and set the view to wireframe.
- Turn on all Worksets and set all categories to visible in Visibility Graphics for all the new views.

- Combine all phases into the latest as-built scenario. For example, if there is an existing phase with demolished items, combine it into the new phase so all that is left in the model are existing and new elements.
- Eliminate all design options.
- Fill out all COBie fields with required information as laid out in the BIMPxP.
- Add the associated floor name to parameter called “FME REFERENCE LEVEL”. For example, Level 1, Level 2, etc. For items that span multiple floors such as exterior walls, assign the lowest floor that the item is visible in.
- Add the category and asset type to the “COBie.Type.Category” and “COBie.Type.AssetType” parameter fields for all elements in the model. An example template is shown in the first 2 columns of Table 8 below. This list may be modified or amended during the project kickoff phase and should be documented in the BIMPxP. The third column of the table lists the GIS Feature Class that the Revit elements will be mapped to. These fields are not editable because they follow BCAD’s standard GIS Schema. If changes are made to the COBie fields in this template, the FME workbench must be updated so the mappings are directed to the appropriate feature class in GIS.

Table 8 – Revit Attributes (Example)

COBie.Type.Category	***COBie.Type.AssetType***	***BCAD GIS Feature Class (BCAD use only)***
Exterior Vertical Enclosure		
Exterior Windows	Window	#Window
Exterior Doors	Door	#Door
Exterior Grilles	Grille	OtherLine
Exterior Louvers	Louver	OtherLine
Exterior Vents	Vent	OtherLine
Interior Construction		
Interior Windows	Window	#Window
Interior Doors	Door	#Door
Interior Finishes		
Flooring	Flooring	#Floor
Ceiling Finishes	Ceiling Tile	OtherPolygon
Conveying		
Vertical Conveying Systems	Elevator	#Elevator
	Escalator	#Escalator
Horizontal Conveying	Moving Sidewalk	#MovingSidewalk
Material Handling	Material Handling	OtherLine

Operable Access Systems	Operable Access System	OtherLine
Baggage Handling	Baggage Conveyor	#BaggageConveyor
	Baggage Carousel	#BaggageCarousel
Plumbing		
Domestic Water Distribution	Water Heater	pwStructure
	Water Closet	pwStructure
	Urinal	pwStructure
	Lavatory	pwStructure
	Drinking Fountain	pwStructure
	Pump	pwStructure
	Valve	pwSystemValve
	Valve Actuator	pwStructure
	Control	pwStructure
Sanitary Waste	Backwater Valve	ssSystemValve
	Valve	ssSystemValve
	Instrumentation	ssStructure
	Control	ssStructure
Heating, Ventilation, and Air Conditioning (HVAC)		
Heating Systems	Boiler	UtilityPoint
Cooling Systems	Compressor	UtilityPoint
	Condenser	UtilityPoint
	Condensing Unit	UtilityPoint
	Water Chiller	UtilityPoint
	Cooling Tower	UtilityPoint
	Air Conditioner	UtilityPoint
	Variable Speed Drive	UtilityPoint
	Heat Pump	UtilityPoint
	Cooling Unit	UtilityPoint
Facility HVAC Distribution Systems	Air Handling Unit	UtilityPoint
	Air Distribution Fan	UtilityPoint
	Air Distribution Fan Coil Unit	UtilityPoint
	Air Distribution Ductwork	UtilityLine
	Diffuser	UtilityPoint
	Damper	UtilityPoint
	Fire Damper	UtilityPoint
	Air Humidity Control	UtilityPoint
	Valve	UtilityPoint
	Control	UtilityPoint

Ventilation	Exhaust Hood	UtilityPoint
	Ductwork	UtilityLine
	Fan	UtilityPoint
Fire Protection		
Fire Suppression	Pump	UtilityPoint
	Standpipe	UtilityPoint
	Sprinkler Head	UtilityPoint
Fire Protection Specialties	Fire Extinguisher	FireExtinguisher
Electrical		
Facility Power Generation	Generator	eDevice
	Electric Motor	eDevice
Electrical Service and Distribution	Transformer	eDevice
	Switchgear	eDevice
	Switchboard	eDevice
	Switch	eDevice
	Circuit Breaker	eDevice
	Protection Device	eDevice
	Raceway	UtilityLine
	Wiring	UtilityLine
	Control	eDevice
Lighting	Light Fixture	eDevice
	Control	eDevice
Communications		
Data Communications	Wireless Access Point	Amenities
Access Control and Intrusion Detection	Access Control	AccessControlLock
	Intrusion Detection	AlarmDevice
Electronic Surveillance	Camera	SurveillanceCamera
Detection and Alarm	Fire Alarm	FireAlarm
	Control Panel	FireControlPanel
	Pull Station	AlarmDevice
	Fire Matrix	AlarmDevice
Furnishings		
Selective Furnishings	Furnishing	#Furnishing

5.5 Record Model

The AE is responsible for conforming the design-intent model to the actual constructed building (the as- built), which is the record model. After construction is complete, the record

model will be the engineering record of construction used for ongoing FM. The record model will be updated on a regular basis to keep current with construction changes and include any associated plans, elevations, details, shop drawings, or other information pertinent for FM.

Construction details or construction information that is not useful for managing and maintaining the facility (such as concrete pour sections, construction sequencing, etc.), will not be included in the record model. The final locations and sizes of the MEPFT equipment and distribution systems, utilities servicing patient headwalls, distribution systems, fire walls and smoke partitions, magnetic shielding for medical equipment, structural support for mounting overhead equipment (medical equipment, lights, etc.), and location of interior partitions (at a minimum) must reflect as-built conditions in the record model.

The record model must be fully assembled and coordinated in the original design-intent native BIM authoring file formats. The AE must develop a 3D grid to be included as a point of reference and provide any necessary instructions for navigating through the model. As the model contains linked riles, a full description of how to reassemble the model and how to extract 2D documentation, including software names and version numbers, must be provided in the digital project files. See the DDR for file structures and naming.

5.6 Construction Models

The construction models (used for construction and reflecting the actual constructed facility at the end of the project) will be comprised of construction models and field changes, including, (but not limited to) RFIs, fabrication information, revision addenda and construction change directives (CCD). The GC is responsible for delivering construction BIMs to BCAD.

5.7 As-Built Drawings

The record model must be used by the AE to derive the 2D **as-built Drawings**. The drawings must follow the requirements in the DDR.

6. Quality Control

The AE and the GC are responsible for assuring their models and data submittals have been thoroughly checked and meet BCAD BIM standard and contract requirements for the project. Models and data must be submitted as noted in Section 4.2 – Deliverable Summary, for compliance evaluation by BCAD.

At each stage, provide a contractor-certified written report with each design submittal, confirming that consistency checks as identified in this section have been completed for the design submittal. This report shall be discussed as part of the design review conference and shall address cross-discipline interferences, if any.

Visual check: Ensure there are no unintended model components, and the design intent has been followed.

Interference check: Locate conflicting spatial data in the model where two elements are occupying the same physical space. Log hard interferences (such as mechanical versus structural or mechanical versus mechanical overlaps in the same location) and soft interferences (conflicts regarding service access, fireproofing, or insulation) in a written report and document disposition.

Standards check: Ensure that the BIM and A/E/C CADD standard have been followed (fonts, dimensions, line styles, levels/layers, and other contract document formatting issues).

Model integrity checks: Conduct QC validation processes to ensure that the project facility dataset has no undefined, incorrectly defined, or duplicated elements and includes the report on non-compliant elements and corrective action. Provide justification acceptable to BCAD of non-compliant elements if they are permitted to remain within the model.

Version updating check: Ensure that all users are using the agreed-upon version of the software and the method by which changing software version is completed.

Revision authority check: Describe the method by which all users will be given access and extent of revision authority to versions of the model as updated.

Other QC parameters: Develop other QC parameters as the contractor deems appropriate for the project and provide to BCAD for concurrence.

Over-the-shoulder progress reviews: Periodic QC meetings or construction progress review meetings shall include QC reviews on the implementation and use of the model, including interference management and design change tracking information.

7. Design And Construction Reviews

Design submittal drawings shall be sized per contract requirements and suitable for A3 (11”x17”) legible scaled reproduction.

Provide models and CADD files for design and construction review submittals in DWG, DWF, and PDF format for PM review using viewer software or Adobe Acrobat Reader.

Provide a list of construction documents (drawings, elevations, design sections and schedules, details) produced from the facility data and updated as necessary for each submittal.

Perform design and construction reviews at each submittal stage to test the model. This model review shall correlate to the actual submittal provided to BCAD. Minimum model reviews include:

Visual checks: Ensure the design intent has been followed and that there are no unintended elements in the model.

Interference management checks: Locate conflicting spatial data in the model where two elements are occupying the same space. Log hard interferences (such as mechanical versus structural or mechanical versus mechanical overlaps in the same location) and soft interferences (including conflicts regarding equipment clearance, service access, fireproofing, or insulation) in a written report and resolve.

IFC coordination view: Provide an IFC coordination view in IFC Express format for all deliverables. Provide exported property set data for all IFC-supported and named building elements. Provide an IFC export configuration text file illustrating BIM to IFC assignments.

Model standards/CAD standards check reports: Provide a written report documenting that the BIM and AEC CADD standard have been followed (fonts, dimensions, line styles, levels/layers, etc).

Model integrity validation: Provide a written report documenting the QC validation process used to ensure that the project facility dataset has no undefined, incorrectly

defined, or duplicated elements and includes the reporting process on non-compliant elements and corrective action plans.

Project scope validation check: Provide a report comparing the programmed scope (from the project requirements document) to the actual design scope. The comparison shall either be done within the model platform itself or an external project review program approved by BCAD. Actual NSF for the design shall be automatically generated within the model and not manually entered. The project scope validation check shall have a minimum of the following data points listed: room number, department or functional area, space type, room name, target NSF, design actual NSF, calculated delta between target and actual NSF for room, and calculated exceeds critical delta (yes or no). The project team shall establish a target critical delta or allowable variance for rooms at the beginning of the project (for example, 2%). The project scope validation report will indicate rooms that fall outside of these established criteria.

Project room contents (PRC) validation check: Provide a report comparing the approved PRC list by room (from the project requirements document) to the actual design PRC. The comparison shall either be done within the model platform itself or an external project review program approved by BCAD. The report shall provide a list of rooms where the design PRC does not match the approved PRC and the specific items that do not match. The non-matching items list shall include, at a minimum, the PRC equipment items approved and expected and the designed PRC items not matching.

Gross area tabulation calculation: The contractor shall calculate the departmental gross square feet/meters (GSF/GSM) and the building GSF/GSM using the model's automatic calculation attributes in accordance with the gross square footage calculation guidance contained in AFI 32-1084 Facility Requirements. The total building gross area tabulation report shall identify, at a minimum, the total mechanical gross, circulation gross, electrical gross, and overall building gross area factor.

Conduct a 3D interactive review format of the model in Bentley Navigator, Navisworks, Adobe 3D PDF 9.0 (or later), Google Earth KMZ, or other format per execution plan requirements. The file format for reviews can change between submittals.

Change tracking report: The contractor shall provide documentation of changes made to the model at each stage utilizing software tools such as the Revit compare tool.

During the construction submittal stages, the contractor shall deliver the construction schedule with information derived from the model.

8. Definitions

Acquisition codes (OFOI, OFCI, CFCI, R): Codes that identify responsibility for purchasing and installing personal and real property equipment.

OFOI: owner-furnished/owner-installed
OFCI: owner-furnished/contractor-installed
CFCI: contractor-furnished/contractor-installed
R: reused

AE: The architect/engineering firm, along with all the consultants hired by the AE to produce the design-intent model, contract documents, and all other documentation necessary to support bidding and construction.

Airport spatial data: Any data representing manufactured or natural features that have geometry (size, location, elevation/depth, etc.) and have specific attributes associated with them. The coordinates of a point are the most obvious example of spatial data, but spatial data also incorporates projection systems, line and polygon attributes, and other information. The two main classes of spatial data are vector and raster.

Architecturally significant equipment (ASE): Medical and non-medical equipment items that are customarily installed by the manufacturer or vendor that can impact the construction critical path schedule and/or requires connection to/accommodation by building infrastructure. Close coordination between BCAD activations and procurement, equipment planners, GC, installer/vendor, and AE is required.

Assets: Items, things, or entities that have potential or actual value to an organization.

Asset information model (AIM): Information model relating to the operational phase (ISO).

Asset information requirement: Information requirements in relation to the operation of an asset (ISO).

Building information model(ing) (BIM): Various definitions are used within industry. BIM is the process, the model, and the management of creating digital information for design and construction. The context defines the acronym's meaning.

BIM project execution plan (BIMPxP): A internal BIM project management plan which outlines the management roles, division of work between prime/consultants or GC/subcontractors for modeling responsibilities, standards, software versions, etc., used for model creation on a project.

Civil Information Model (CIM)

Construction Operations Building Information Exchange (COBie): Specification relating to managed asset information including space and equipment. It is closely associated with building information modeling (BIM) approaches to design, construction, and management of built assets.

Computer-aided design (CAD)

Computer-aided facility management (CAFM)

Computerized maintenance management system (CMMS)

Common data environment (CDE): Agreed-upon source of information for any given project or asset for collecting, managing, and disseminating each information container through a managed process (ISO).

Construction model: The GC model used for construction purposes on the project.

Design-Bid-Build (DBB)

Delivery phase: Part of the life cycle during which an asset is designed, constructed, and commissioned.

Design-intent model: A complete and coordinated expression of the AE's design. Final equipment and materials choices are based on performance specifications provided by the AE, allowing some variation, but equivalent equipment and materials are to be selected by the GC during construction. Therefore, the design-intent model will be augmented with submittals, shop drawings, and substitution requests provided by the GC. Moreover, the GC is responsible for the means and methods of construction, which are similarly not contained in the design-intent model. The GC is, however, responsible for providing, installing, and constructing a complete and functional project, which includes requirements explicitly contained in the design-intent model and requirements that, using normal industry practices, are reasonably inferable from the design-intent model and necessary to achieve a complete, functional and maintainable project. Design-intent model also refers to individual models such as a particular discipline model or in whole such as a composite or federated model.

Drawing deliverable requirements (DDR): Defines 2D drawing creation derived from either CAD or BIM.

Digital Terrain Model (DTM)

Exchange information requirement (EIR): Information required in relation to the agreed-upon instruction for the provision of information concerning works, goods, or services (ISO).

Facilities Management (FM)

Federated model: An assembly of various discipline or trade models into a composite 3D view.

Federation: Creation of a composite information model from separate information containers (ISO).

Furnishings, fixtures, and equipment (FFE): Movable and fixed furnishings, fixtures, and non-medical equipment.

General contractor (GC): The GC and all subcontractors under contract to the GC who are involved in the construction/fabrication of a specific facility.

Globally unique identifier (GUID): Machine-readable identifying codes that must be preserved through generation and regeneration of digital deliverables so that a given object (space, equipment, etc.) can be tracked properly. GUIDs are automatically assigned by the Space and Equipment Planning System (SEPS), BIM, or other software. BIM software documentation should be consulted to determine how copied equipment object instances are handled in outputted reports and how they are handled internal to the software.

Gross Square Feet (GSF)

Gross Square Meters (GSM)

Industry foundation classes (IFC): An international standard schema for data exchange.

Information: Reinterpretable representation of data in a formalized manner suitable for communication, interpretation, or processing (ISO).

Information model: Set of structured and unstructured, named, persistent sets of information retrievable from within a file, system, or application storage hierarchy (ISO).

Information requirement: Specification for what, when, how, and for whom information is to be produced (ISO).

Level of development (LOD): The degree to which the element's geometry and attached information has been thought through, as well as the degree to which project team members may rely on the information when using the model. This base definition is further defined in the "Level of Development Specification," 2022 by BIM Forum.

Metadata: Information about data, describing the quality (accuracy, last revised originator, etc.) of that data being examined by a user to manage user expectations for proper application of that data. Security-level restrictions for the use of a certain data are also part of metadata.

Mechanical, electrical, plumbing, fire protection, and technology (MEPFT) equipment: Includes medical and low-voltage systems, structured cabling, and equipment such as generators, transformers, electrical fixtures, air handling units, boilers, chillers, VAV boxes, plumbing fixtures, and communication technology cable trays.

MEPFT systems: The distribution systems for piping, conduits or ducting,(including but not limited to MEPFT (including medical, low-voltage systems, structured cabling, communications, etc.).

Model: Refers to an individual model containing various components, a combination of models and/or the process of modeling in general. The most appropriate meaning within the context of use would apply.

Net Square Feet (NSF)

Net Square Meters (NSM)

Non-Recurring Maintenance Project (NRM)

Operational phase: Part of the life cycle during which an asset is used, operated, and maintained

Organizational information requirement (OIR): Information requirements in relation to organizational objectives (ISO).

Project data security plan: The documented protocol that defines how the data will be protected from loss or unauthorized access during creation, exchange, and retention.

Program for design (PFD): The baseline SEPS design program as provided by BCAD that identifies the rooms, net square footage, and other requirements for the project.

Project information: Information produced for or utilized in a specific project,

Project Manager (PM)

Project room contents (PRC): A SEPS export file providing preliminary room contents for each room.

Quality Control (QC)

Record model: The design-intent model updated with actual constructed locations for equipment, systems, walls, etc., which will be used for facility management. This is intended to be a lightweight model with enough detail to enable facilities management operations without overly detailed elements.

Responsibility matrix: Chart that describes the participation by various functions in completing tasks or deliverables.

Workset: Revit's way of enabling multiple people to work on the same project.

9. Attachments

BCAD LOD Matrix Template

BCAD BIM Project Execution Plan (BIMPxP)

BCAD BIM Request for Variance

BCAD BIM Standards

BCAD Shared Parameters

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