BROWARD COUNTY FLORIDA

Aviation Department

Building Information Modeling (BIM) Standard
Version 1

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Prepared by:

ACAI

Contents

1. **Introduction**

    A. **Broward County Aviation Department's (BCAD) BIM Vision**

    With thousands of years of construction history, endless computing power and relentless advances in technology, the act of building in the twenty-first century ought to be done with optimum efficiency and the built environment operated and maintained with the same rigor.

    The arrival of Building Information Modeling (BIM) in the built environment has enabled Designers and Constructors to not only virtualize their design solutions, but also simulate the act of building virtually, before a shovel is ever put in the ground. The term Virtual Design and Construction (VDC) was coined to help explain how designers and builders are now better able to more accurately predict the results of their work. Owners recognize the benefit of BIM and VDC as a risk mitigator and the industry is embracing and advancing BIM services as part of their standard practices.

    BCAD believes in the BIM process and intends to make that process flexible for any and all parties tasked with designing and building its facilities by having clearly defined BIM deliverables. To that end BCAD has commissioned the development of this standard to plot the general requirements for BIM, while clearly stating BCAD's BIM goals and objectives. Where applicable, BCAD will be aligning this Standard with the National Building Information Modeling Standard- United States, Version 2 (NBIMS-US v2).

    B. **BCAD's BIM Goals and Objectives**

    At a minimum BCAD wants to achieve the following goals and objectives:
    - ✓ BIM as a planning tool;
    - ✓ BIM as a visualization and communication tool during design, construction and operations;
    - ✓ BIM as a program validation tool;
    - ✓ BIM to generate construction documentation;
    - ✓ BIM for constructability and maintainability review;
    - ✓ BIM for coordination to minimize change orders due to field coordination;
    - ✓ BIM for "As Constructed" validation for Operations;
    - ✓ BIM and the use of the Construction Operations Building information exchange (COBie) from design through construction to operations.

    BCAD understands that the benefits of BIM do not stop there and will be updating this Standard as new technology evolves. Additional goals and uses of BIM exist, and if so required, will be detailed in the RFP, RFQ, Contract and /or BIM Execution plan (BIMPxP).

    BCAD understands that owners can efficiently repurpose the virtual information accumulated throughout the phases of design and construction in order to operate and maintain their buildings more efficiently throughout their lifecycle. The term Virtual Design Construction and Operation (VDCO) refers to the fact that Facility Managers are now able to use BIM to run their buildings at lower costs and for longer periods of time. BCAD's goal is to leverage the benefits of BIM at the operation and maintenance levels by enabling its staff to quickly access the most relevant and accurate information

about their buildings in order to perform their tasks and make better decisions efficiently. This standard is written to help achieve this goal.

C. Project Delivery & BIM

BIM deliverables and VDCO 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 BIM Project Execution Plan be created for each project. The BIMPxP shall be adapted to support the contract delivery method and specifically outline the BIM protocols, workflow, roles and responsibilities of each party.

D.   BCAD BIM Expectation and Uses of BIM by Department

BCAD has various departments/stakeholders throughout the organization that will need to access and use the BIM information during design, construction, project closeout and throughout occupancy. These stakeholders will need different sets of information and will use the information differently. Because of the various needs and uses, one of the objectives of this standard is to clarify what each group's expectations are, what their use will be, and in what format they will need that information. By defining these uses, this allows the Design & Construction Teams and all BIM participants to plan for and prepare, accumulate, organize and deliver the information in a usable format to BCAD's end users. Currently, the departments will be using the BIMs for viewing only.

The following is a list of BCAD's BIM Expectations by Department:
o   Planning Department
     The BIMs may be used for:
        ✓   Space Planning & Analysis
        ✓   Way finding
        ✓   Feasibility studies
        ✓   Gate parking and airspace studies
        ✓   GIS data input management

o   Business and Property Management Division
        ✓   Tenant / Leasing contracts exhibits

o   Facilities Management Department
     The BIMs may be used for:
        ✓   BIM data will be integrated into BCAD's Facilities Computerized Maintenance Management System (CMMS) through a COBie deliverables for use in the following:
             o   Preventative Maintenance
             o   Corrective Maintenance
             o   Scheduled Inspections
             o   Asset Management

- o Finance & Procurement

  The BIMs may be used for:
  - ✓ Pay application justification
  - ✓ Change Order clarification

- o Security

  The BIMs may be used for:
  - ✓ Spatial location and "views" of all cameras and security access readers
  - ✓ Inventory and mapping of security equipment

- o GIS

  The BIMs may be used for:
  - ✓ Spatial location and information of all infrastructure utilities

2. **General Overview of Deliverables**

At regular predetermined intervals throughout the design and construction phases BCAD will require the Design & Construction Teams to submit individual BIMs, Federated BIMs, drawings, documents and COBie files as contract deliverables. These deliverables are complements to the typical 2D deliverable usually expected from the Design & Construction Teams at each regular project milestone or phase. What to model, when to model and how much information is expected at each phase will be covered in detail under Sections 7 and 9. Which party will model within the Design & Construction Teams will be detailed in the project-specific BIM Project Execution Plans (BIMPxP).

Schedule of Deliverables to BCAD					
Design Team					
Phase	**Deliverable**	**Std Section**	**Due**	**File Type**	
Contract Award	BIMPxP	2.0	within 30 days	Native & PDF	
Planning	Design Models - LOD 100	3.0	Per BIMPxP	Native & IFC (2x3) files	
SD	Design Models - LOD 100	3.0	Per BIMPxP	Native & IFC (2x3) files	
DD	Design Models - LOD 200	3.0	Per BIMPxP	Native & IFC (2x3) files	
CD	Design Models - LOD 300	3.0	Per BIMPxP	Native & IFC (2x3) files	
CD	2D documents	7.0	Per BIMPxP	PDF	
CD	COBie Data Set - Del 1	10.0	Per BIMPxP	COBie2 2.40	
Permitting / Conformance	Federated Design Model - LOD 300	7.0	Per BIMPxP	Native files	
Permitting / Conformance	2D documents	7.0	Per BIMPxP	PDF	
Construction -Approved Submittals	COBie Data Set - Del 2	10.0	Per BIMPxP	Native & IFC (2x3) files	
Construction-	COBie Data Set - Del 3	10.0	Per BIMPxP	COBie2 2.40	

Schedule of Deliverables to BCAD					
Design Team					
Phase	Deliverable	Std Section	Due	File Type	
Installation					
Project Close out	COBie Data Set - FINAL	10.0	Per BIMPxP	COBie2 2.40	
Project Close out	Record Floor Plans	7.0	Per BIMPxP	DWG	
Project Close out	Record BIMs	7.0	Per BIMPxP	Native & IFC (2x3) files	
Project Close out	Federated Record BIM	7.0	Per BIMPxP	Native files	
Construction Team					
Phase	Deliverable	Std Section	Due	File Type	
Contract Award	BIMPxP	2.0	Within 30 days	Native	
Pre-Construction	Coordination BIMs	9.0	Per BIMPxP	Native & IFC (2x3) files	
Project Close out	As-Constructed BIMs	9.0	Per BIMPxP	Native & IFC (2x3) files	
Project Close out	Federated As-Constructed BIM	9.0	Per BIMPxP	Native files	

Deliverable Quality Control (DQC)

To promote achieving the highest quality and integrity of the BIMs throughout Design and Construction BCAD may use the following methods of review:

- ✓ Visual Checks
- ✓ Interference Checks
- ✓ 3D Solids Check – No wireframe or lines are accepted. Surface modeling shall be reserved for Topography modeling only. Other use of surface modeling shall require prior approval by BCAD
- ✓ Information Exchange validations
- ✓ Errors or Warnings - check that are generated inside the BIM Authoring software. It is the Design & Construction Teams' responsibility to ensure BIM quality and data integrity. BCAD will not accept BIM files that have become un-useable, or too heavy for normal use. Proper care shall be taken to strip all BIMs of any and all miscellaneous files that are not directly a part of the BIMs.

Model Accuracy & Tolerances: The following tolerances apply to elements that require LOD 300 or higher.

PHASE	DISCIPLINE	TOLERANCE
EXISTING CONDITIONS MODEL	CIVIL (UNDERGROUND)	ACCURATE TO +/- (6") OF ACTUAL SIZE ACCURATE TO +/- (12") OF ACTUAL LOCATION
EXISTING CONDITIONS MODEL (ACCESSIBLE ITEMS)	ARCHITECTURAL STRUCTURAL MEPFP	ACCURATE TO +/- (1/8") OF DESIGN INTENT SIZE ACCURATE TO +/- (2") OF DESIGN INTENT LOCATION
DESIGN DOCUMENT MODELS	CIVIL ARCHITECTURAL	ACCURATE TO +/- (1/8") OF DESIGN INTENT SIZE ACCURATE TO +/- (2") OF DESIGN INTENT LOCATION

PHASE	DISCIPLINE	TOLERANCE
	STRUCTURAL MEPFP	
SHOP DRAWINGS MODELS	CIVIL INTERIORS ENVELOPE STRUCTURAL MEPFP	ACCURATE TO +/- (1/16") OF ACTUAL SIZE ACCURATE TO +/- (1") OF ACTUAL LOCATION
AS-BUILT MODELS	INTERIORS NOT RELATED TO CODE	ACCURATE TO +/- (1/8") OF ACTUAL SIZE ACCURATE TO +/- (2") OF ACTUAL LOCATION
AS-BUILT MODELS	INTERIORS RELATED TO CODE	ACCURATE TO +/- (1/8") OF ACTUAL SIZE ACCURATE TO +/- (1/4") OF ACTUAL LOCATION
AS-BUILT MODELS	CIVIL INTERIORS ENVELOPE STRUCTURAL MEPFP	ACCURATE TO +/- (1/16") OF ACTUAL SIZE ACCURATE TO +/- (1") OF ACTUAL LOCATION

A. BIM Project Execution Plan (BIMPxP)

The *National Building Information Modeling Standard- United States, Version 2* (NBIMS-US v2) shall be used as the basis of the BIMPxP. The BIM protocols, roles and responsibilities customized for the needs of each project requiring BIM will be addressed in the BIMPxP of the Design & Construction Teams. No more than thirty days after the contract is awarded, a project-specific BIMPxP shall be developed. BCAD will review the BIMPxP and make comments and suggestions. The Design & Construction Teams will then have two (2) weeks to incorporate and adopt said changes.

All project participants need to be committed to the BIMPxP to minimize data recreation downstream. Except for Design Build (DB) projects where only one BIMPxP addressing the protocols and workflows for both Design and Construction will be developed by the DB Team, at a minimum there will always be two (2) BIMPxPs: The Design BIMPxP prepared by the prime Designer and the Construction BIMPxP prepared by the builder. In all cases the BIMPxPs shall be developed in concert with BCAD's Design & Construction Teams.

At a minimum the BIMPxP should address the following:
- ✓ BIM Project Execution Plan Overview
- ✓ Project Information
- ✓ Key Project Contact
- ✓ Project Goals / BIM Uses
- ✓ Organizational Roles / Staffing
- ✓ BIM Process Design
- ✓ BIM Information Exchanges
- ✓ BIM and Facility Data Requirements
- ✓ Collaboration Procedures
- ✓ Quality Control
- ✓ Technological Infrastructure Needs

- ✓ Model Structure
- ✓ Project Deliverables
- ✓ Delivery Strategy / Contract

A sample BIMPxP is included in Appendix A of this document. The *National Building Information Modeling Standard- United States, Version 2* (NBIMS-US v2) has a guide that outlines four (4) necessary steps to create a BIMPxP. These must be met at a minimum. They are as follows:

1.) Confirm goals and high value BIM uses during each project phase
2.) Design the BIM execution process
3.) Define the BIM deliverables in the form of information exchanges
4.) Develop the infrastructure to support the implementation, such as contracts, communication procedures, technology and quality control

B. Model Progression Schedule (MPS)

A Model Progression Schedule shall be used as a tool to help Model Contributors throughout the Design, Construction and Operation phases understand what should be included in the BIMs when at each project milestone. The MPS shall be based on the CSI's OmniClass Table 22 Work Results, formerly known as MasterFormat,   the version currently in the NIBMS-US Standard. It shall be the responsibility of the Design & Construction Teams to tailor the MPS to meet the requirements of this standard and their project-specific needs. An MPS shall be submitted along with the BIMPxP for review by BCAD. You will find a sample MPS in Appendix B of this document.

C. 2D Contract Documents

To promote efficiency and continuity, the 2D construction documents must be extracted directly from the Design BIMs and both the BIMs and the 2D Deliverables will be integral parts of the contract documents.   Two dimensional (2D) details, enlargements, General Notes, externally-generated Schedules, and specifications will take precedence over the Design BIMs.

BCAD expects 2D Deliverables, namely Site Plans, Plans, Sections, Elevations and the Schedules typically found in construction documents to be extracted directly from the BIMs. The BIMs shall include all elements and information needed to produce Permit Documents for Design Intent, Shop Drawings for Construction installation, Record BIM As-Built, and COBie data sets.

D. Building Information Models - BIMs

Overview of BIM Deliverables: This Standard will strive to clarify what BCAD expects from the BIMs in terms of the Level of Detail, Level of Development, Model Content Requirements and Level of Coordination at each phase. At a minimum, three (3) types of BIM deliverables will be produced by the BIM process:

1. Design BIMs
2. Construction BIMs
3. Federated BIMs

The Design and Construction BIM deliverables are expected to be both in their approved native file formats and in IFC (2x3). The Federated BIMs shall be in an approved aggregator format – refer to Section Five for more information on BCAD's Open Standards policies. 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 in BCAD's Document Control System. (See Section 4 for Owner responsibility.)

E.   Construction Operations Building Information Exchange (COBie)

The COBie deliverable will be provided in a file format that is detailed in Section Ten.   The members of the Design & Construction Teams are required to deliver specific facility information throughout the design and construction phases. The responsibility of each team member should be included in the approved Project BIMPxP.

COBie to CMMS workflow

3. **Level of Development (LOD) vs. Level of Detail**

   A. **LOD vs. Level of Detail**
   When talking about *Level of Detail* one generally refers to an object, while *Level of Development* is generally referred to when evaluating the reliability of the information contained in a building system or a discipline as relevant to a specific BIM Use Case. For example, a low level of detail object can be part of an LOD 500 BIM.

   B. **Level of Detail - Definition**
   Level of Detail refers to the amount of aggregated parts included in the modeling of an individual component, assembly or object. BCAD will recognize two Levels of Detail: High and Low. The Level of Detail of components within the BIMs will be discussed in Section Seven & Nine. To avoid confusion when discussing Level of Detail no abbreviations will be used.

   For the purposes set forth in this standard LOD will always mean Level of Development. BCAD will adopt the definitions established by the BIMForum's 2013 Draft LOD Specification.

   C. **LOD Definition**
   The AIA describes the concept of LOD as an identification of the *"…specific minimum content requirements and associated Authorized Uses for each Model Element at [six] progressively detailed levels of completeness."*

   Following are the Fundamental LOD Definitions:

   o LOD 100 – Conceptual
   "The Model Element may be graphically represented in the Model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements."

   o LOD 200 – Generic Placeholders
   "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."

   o LOD 300 – Specific Assemblies
   "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."

   o LOD 350 – Hybrid of Specific & Detailed Assemblies
   "The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, orientation and interfaces with

other building systems. Non-graphic information may also be attached to the Model Element."

o LOD 400 – Detailed Assemblies

"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."

o LOD 500 – As-Built

"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."

BCAD acknowledges that there isn't a strict equivalence between a BIM's LOD and its project phase; however BCAD intends to clearly define what the **minimum modeling content** expectation is at each project phase. See Sections Seven & Nine for expected LOD at each project phase.

4. Roles & Responsibilities

A. The Owner: BCAD

BCAD will assume the roles reserved for owners under the terms and conditions of the governing contract for each project. This Standard does not supersede or circumvent in any way those obligations. The intent of this section is to inform the Design and Constructions Teams of BCAD's means of distributing, collecting and verifying the BIM information for each project. BCAD's roles and responsibilities as related to BIM include, and are not limited to, the following:

BCAD's Information Manager (IM)

BCAD's IM works with BCAD's Information Technology (IT) officers to grant controlled access to the BIMs to BCAD's Project Managers for the duration of their projects. It is also the IM's responsibility to manage and grant access to all BCAD's Departments and Staff.

BCAD's Project Manager (PM)

BCAD's PMs will receive from the IM the procedure on how to access and view models. The Design & Construction Teams are responsible for managing their own secured information exchange systems for the duration of the project or until their BIMs have been accepted as complete by the owner. BCAD shall be given access to such system as part of the Design & Construction Teams participants.

BCAD's BIM Controller

The BIM Controller's role is to ensure that BCAD's BIM Standards are being implemented through all the Capital Improvement Projects (CIP) and may be an internal position or a third-party provider. The BIM Controller gets access to the BIMs from the IM. The BIM Controller is not responsible for managing and maintaining the Federated Design or Construction BIMs; that responsibility lies with the Design Team on the project during the Design phases and the Construction Team during Construction. It is up to the Design & Construction Team to comply and deliver the BIMs to BCAD.

BCAD's responsibilities as it relates to BIM include, but are not limited to, the following:

BCAD's Document Control System

BCAD's Document Control Team manages construction related information for both paper and electronic documents. At the request of BCAD, the Information System Team (IST) creates project folders within BCAD's Information System for the purpose of sharing electronic information while the project is 'active', i.e. during the Design or Construction Phases. BCAD's Information Manager (IM) also uses Microsoft SharePoint to manage non-active electronic files where no bidirectional sharing is required. SharePoint is mostly used for static record documents.

Request For Proposals (RFP) & Request for Qualifications (RFQ)

BCAD will use this BIM Standard as an addendum in all of its RFPs / RFQs. Higher consideration will be given to Design & Construction Teams with prior BIM project experience. The lack of BIM experience on Design & Construction Teams will not be a disqualifier. A thorough understanding of the BIM process,

as it applies to BCAD and this Standard, is a minimum qualifier and must be demonstrated in order to meet BCAD's BIM prequalification standards.

BIMs Ownership and Data Reuse

BCAD and the project BIM contributors have ownership of all BIMs, CAD Files, COBie Data and their associated 2D Deliverables which will be defined in the governing contract for each project. Reuse of the BIMs will also be defined in the governing contract.

BCAD recognizes the need for downstream users of the electronic media hold harmless the authors of the media against any and all harm and liability caused by the use of such media being either corrupt, or used in a manner not intended by the author.

Legacy Information

BCAD will make available through their Document Control System any and all project-related information to the Design & Construction Teams in whatever medium that is readily available. Such information may include, and is not limited to:

1) 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.

2) GIS Utility Atlas. The utility Atlas and BCAD's GIS Standards will be made available to the Civil Engineering team when applicable.

3) Laser Scans in raw formats will be provided should they exist. If needed, the 3D byproduct model of the Point Clouds is the responsibility of the Design & 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.

4) Master Site BIM
Depending on the project a Master Site BIM may be available. When that is the 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 & Construction Teams throughout Design and Construction match their corresponding coordinates inside the Master Site BIM.

B. Design Team

Design Project Manager (PM)

The Project Manager is the ultimate point of contact for the overall project. The individual can serve as the BIM Manager if he/she has the relevant BIM experience depending on the size and complexity of the project.

Design BIM PM (BPM)

The design team shall have a dedicated Project BIM Manager that has sufficient experience for the size and complexity of the project and shall be proficient in the authoring and coordination of BIMs. This individual will serve as the main point of contact for project-related BIM & VDC information.

This Design BIM PM shall be qualified enough to implement the Design BIMPxP and interface with outside BIM stakeholders including using BCAD's Document Control System. Those stakeholders will include, at a minimum, BCAD's PM and BIM Controller, but may also include various BCAD's end user groups, and the Contractor and its subcontractors when they are already known and are a part of the Design & Construction Teams.

COBie Coordinator

The COBie Coordinator will be responsible for the COBie process including assigning room information in the Architectural model. All other project models using room information must reference the room information assigned in the Architectural model. This will ensure the proper location information is provided in the COBie deliverable. If the case where room-naming conventions are provided by BCAD, the room names must be strictly enforced in the COBie deliverables.

C. Construction Team

Construction PM (PM)

The Project Manager is the ultimate point of contact for the overall project. This individual can also serve as the BIM Manager for the project if he/she has the relevant BIM experience with the size and complexity of the project.

Construction BIM PM (BPM)

The Construction team shall have a dedicated BIM PM to the project that has sufficient experience for the size and complexity of the project and shall be proficient in the management of project BIMs. This individual will serve as the main point of contact for BIM & VDCO. The Construction BIM PM shall be qualified to implement the Construction BIMPxP and interface with outside BIM stakeholders including using BCAD's Document Control System.

COBie Coordinator

The COBie Constructor Coordinator will be responsible for coordinating the COBie process with the design team's COBie Coordinator and for completing his/her assigned portion of the COBie deliverable including serial number and installation date.

5. **Formats and Approved Software**

A. **Interoperability and Open Standards**

The Design & Construction Teams are required to use parametric BIM Authoring software on all new construction and renovation projects unless otherwise specified. BCAD requires Industry Foundation Class (IFC 2x3) compliant BIM Authoring software. For a complete list of IFC (2x3) compliant Software please visit:

http://www.buildingsmart-tech.org

Interoperability allows team members from different disciplines to work in different BIM authoring platforms through IFC (2x3), or direct native imports. When more than one software is being used to produce CD's, the Design Team shall take proper care to keep consistency in drafting standards, measurements etc., throughout the Construction Document set. Additionally, all BIM's regardless of authoring platform shall share coordinates to ensure proper placement both relative to each other, but also in relation to the Master Site BIM when one exists. All BIMs regardless of platform shall be the same scale and unless other requirements govern, in Imperial units. In every phase, the BIMs shall be managed, aggregated and coordinated in a single, centralized database resulting in an accurate Federated BIM.

The files must be delivered in these formats:

3D - Formats: Native Formats & IFC (2x3)

2D - Formats: Native Format where applicable and vector PDFs.

Examples of acceptable IFC compliant software and formats are as follows:

BIM Authoring For Design: Allplan Architecture/ Engineering, ArchiCAD, AutoCAD Civil 3D, AutoCAD Architecture / MEP, Bentley Architecture V8i, Bentley Building Electrical / Mechanical / Structural Systems V8i, Digital Project, Revit, Tekla Structures, Vectorworks

In addition to the software listed above, additional BIM Authoring tools for Construction:
CAD-Duct, SDS/2

BIM Managing Software for Design and Construction: Bentley Navigator, BIM 360 Glue, Navisworks, Solibri Model Checker, Tekla BIMSight, Vico

Software that is not listed above will need to be submitted to BCAD for approval prior to use.

6. **BIM Use Cases**

The RFP, BIMPxP and other contract document may request the following BIM Use Cases:

a) **Marketing & Presentation**

While accepted BIM Authoring software shall be used to create the BIMs, it is understood that further development of the models may need to occur outside of the BIM Authoring software in order to create marketing material.

b) **Space and Program Validation**

The Design Team shall implement an iterative BIM-enabled process to validate their adherence to the Program in terms of Space and Equipment. That process can be established using the BIM authoring software being used to produce the design, or it can be done using specialized Program Validation software that utilizes the Design BIMs to validate adherence to the program. The Design Team shall disclose the specifics of what software and format(s) will be used to perform Program Validation when putting together the Design BIMPxP.

c) **Energy Validation Analysis**

The Designer and Construction Teams shall extract relevant data directly from the BIMs to perform energy simulation and life cycle cost calculations to validate their energy modeling. Proper modeling techniques shall be used with environmental parameters. The Design and Construction Teams shall disclose the specifics of what software format(s) will be used to perform the Energy Validation Analysis when putting together the BIMPxP.

d) **Design Review**

The BIMs shall be used to communicate the intent and workability of the proposed design solutions in various ways and through various means to project stakeholders including BCAD, end users, maintenance officials and financial stakeholders. BCAD encourages the Design & Construction Teams to find efficient and effective ways to communicate their intent using BIM. At a minimum, the BIMs shall be used for design reviews, submittals, and construction documents.

The Design and Construction Teams shall identify what specific means of visualization will be used for design review and review submittals when putting together the BIMPxP. Those means may include, but would not be limited to, the following:

- ✓ Images (Screen Shots, Renderings)
- ✓ Animations (Fly-through, Panoramic immersion)
- ✓ Federated BIMs in a Read-only format. It is the Design & Construction Team's responsibility to make a free viewer available to the user.

Special consideration shall be given to security, safety and maintenance issues. At a minimum visualization strategies shall be used to help analyze the following areas and needs:

- ✓ Egress and other life safety related circulation

        ✓   Location of Exit Signs and Strobe Lights
        ✓   Security Check Points
        ✓   Kiosk Design

e)   **Design for Maintenance (D4M) Review**

Using a Federated BIM, the Designer and Construction teams shall demonstrate there is sufficient access to perform proper maintenance activities on building systems and their associated components. D4M reviews differ from constructability reviews as they seek to ensure that elements surrounding these components do not hinder accessibility to safely perform scheduled or corrective maintenance activities.

The schedule of when these reviews take place will be defined in the BIMPxP, but at a minimum the Design and Construction Teams will incorporate them into constructability reviews. Reviews should address access at a minimum: all asset types requiring COBie data set deliverables. Although some elements may be closely located to components, BCAD may deem the restricted clearance allowable. This shall not be in conflict with any code required clearances. Review meetings where the Design & Construction Teams invite BCAD are expected at least once during DD and CD phases and at least once during construction.

f)   **Spatial Coordination & Constructability Review**

Spatial coordination means coordination between systems and components in the Design & Construction BIMs appropriate to the design and construction phases. This process differs from Clash Detection in that clashes may be deemed allowable by the Design Team depending on what systems are conflicting. Clashes are not acceptable during Construction. The Design and Construction Teams shall assure constructability by using a Federated Design BIM. A constructability review meeting where the Design & Construction Teams invite BCAD to participate is expected at least once during DD and CD phases and throughout construction.

g)   **4D Scheduling and Phasing**

When continuous operations must be maintained in areas where construction is occurring, a clear phasing plan is often required. 4D scheduling and phasing is a tool to visually to show how construction of the proposed project will not disrupt current processes and operations. BCAD may request this service should they feel it necessary in complex project phasing.

The video clip of the 4D shall be produced in a 4D specialized software by combining a schedule with the BIMs and in a format viewable over the web such as MP4 or WMV; other formats can be suggested. The Design & Construction Teams will share the 4D model in a read-only, view-only format. It is the Design and Construction Team's responsibility when sharing the 4D Model to ensure that it is in a format that can be opened by a free viewer.

If required by BCAD, the scope and LOD of the 4D shall be clearly defined in the Design or Construction BIMPxP.

Potential use per design phase

a) Planning – Feasibility study.
b) SD – Major Project Milestone and staging.
c) DD – Building Structure and Systems.
d) CD – Building complete with all systems and components.

Potential 4D uses during Construction are as follows:

a) Full Project Schedule
b) Look ahead Schedule
c) As-Planned vs. As Built Schedule
d) Procurement Tracking
e) Construction Sequence Analysis
f) Safety Management
g) Operational Impact

h) 5D Quantities and Cost Estimate Validation

If required by BCAD, at the Schematic Design (SD) phase given the low level of development of the BIMs, it is understood that any 5D use shall be at a macro level and used as a validator for Probable Cost Estimates. As the BIMs LOD progress through the design phases, the Design Team shall use the quantities in the BIMs as a validator for their Estimates. It will be the responsibility of the Design Team to specify when they are writing the BIMPxP what method and software they will use to perform this task.

a) Planning – Probable Cost
b) SD – Probable Cost & quantity Takeoff based on Square Footage
c) DD – Probable Cost & quantity Takeoff based on available BIMs at LOD 200
d) CD – Probable Cost & quantity Takeoff based on available BIMs at LOD 300

i) Clash Detection and Coordination before Installation

It is the Construction Teams responsibility to ensure that Clash Detection and Coordination is used to the fullest extent in order to avoid any problems during installation. BCAD will not accept change orders due to failed construction BIM coordination. Coordination shall be complete and the Construction Federated BIM shall show zero non-justified clashes between the Building components.

j) Shop Drawings, Sleeve Drawings and Fabrication

a) Shop drawings
   Shop Drawings shall be produced directly from the construction BIMs. No parallel 2D process will be accepted
b) Sleeve Drawings
   Sleeve drawings for cast-in-place or precast systems shall be produced after BIM Coordination is completed for the area of construction requiring the sleeve drawings.
c) Fabrication & Preassembly
   Whenever possible the Construction Team shall use the Construction BIMs to fabricate or preassemble their systems.

k) **BIM in the field for Installation**

The GC shall take measures to assure that what is being installed at the field is what was agreed upon on the Coordinated Federated Construction BIM. Any deviations must be documented as updates to the BIMs and the party responsible for resulting conflicts will be liable for costs associated with such deviations.

l) **BIM for GIS**

BCAD is currently developing a utility Atlas in GIS. Where applicable in new construction and renovation projects the Civil Engineer should produce their utility scope in BIM and deliver a GIS compliant model to BCAD. The model shall carry all attributes and/or object data necessary for GIS integration. It is the responsibility of the Architect, Civil engineer or General Contractor to request the GIS Standard from BCAD.

7. **BIM Workflows and Deliverables During Design**

A. **BIM Scope & Modeling Extent**

The Design Team is expected to create a Design Intent model that is accurate and detailed to an LOD of 300. The Construction Document set must be produced directly from the Design BIMs.

The expectation from BCAD is that designers use BIM whenever possible and as applicable. The modeling scope will typically include Civil, Site work, Architectural, Structural, Mechanical, Electrical, Plumbing, Fire Suppression, Signage, Baggage Handling and Passenger Loading bridges as applicable to the project.

In addressing, adjacent boundaries all relevant contextual structures adjacent to, or in the vicinity of the scope of work shall be massed. The BIMPxP shall address the extent of modeling on existing conditions.

B. **Timing of Delivery**

It will be up to BCAD and the Design Team to tailor their BIMPxP to accommodate the timing of the deliverables needed for their particular type of contract.

BCAD expects, regardless of the LOD, that the content of the BIMs inside the Federated BIM, regardless of LOD be exclusionary and unique, i.e. no redundant elements shall exist across BIM contribution inside the Federated BIM.

C. **Model Content Requirements**

Minimum LOD per Phase: A common practice to help designers know what to include in their models at each phase is that when the model is cut in plan or section the BIM should have as much information as traditionally seen in plan and section on 2D documents for that phase.

When generating 2D details, it is acceptable to overlay 2D graphics on BIM-generated views. This practice is only acceptable on enlarged plans, sections and details at scales of ½" or greater. Typical Detail can be 2D-drafted elements, but shall be created in the native BIM Authoring software and properly referenced to the model region it represents.

BCAD acknowledges that there is not a strict equivalence between a BIM's LOD and its project phases, however in general the model progression through the design phases shall be as follows:

Planning –	Min. LOD 100
SD –	Min. LOD 100
DD –	Min. LOD 200
CD –	Min. LOD 300

BCAD will define the minimum BIM content expectation for CD's at an LOD 300. It is the responsibility of the Design Team to use the MPS as part of the Design BIMPxP to establish how they progressively reach BCAD's expectation of the Level of Detail at LOD 300. Any model contribution that is not included

within a specific discipline's scope shall be the responsibility of the prime contract holder to take measures to assure the Design BIMs are complete. Section Three addresses this minimum requirement. The Design Team will update the models with all changes that may occur due to requests an comments from Authorities Having Jurisdiction (AHJ).

D. <u>Level of Detail per Discipline</u>

The following Level of Detail defined below are the minimum requirements at the end of the Design phase. Design team members shall refer to the MPS to determine their exact model content and level of detail for each phase.

<u>Site / Civil</u>

A 3D Topography including retaining walls shall be modeled to include the site and surrounding areas.

<u>Architecture</u>

Model the architectural elements to a level that defines the design intent and accurately represents the design solution. The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS.

<u>Structure</u>

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Floor Slabs model shall detail all edges of slab conditions. Slab opening and penetration larger than 2 square feet shall be accurately located in the model.

<u>Mechanical</u>

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Pipes sized at and over ¾" diameter, shall include insulation where required. Clearance zones for access, door swings, service space requirements, gauge reader and other operational clearances must be modeled as part of the HVAC equipment and checked for conflicts with other elements. These clearance zones should be modeled as transparent solids within objects. The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS.

<u>Electrical</u>

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Switches and Outlets as necessary to coordinate critical areas including, but not limited to, Architectural FF&E shall be modeled. Gang Conduit runs regardless of diameter size shall be modeled as an extrusion.

<u>Plumbing</u>

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Gang piping runs regardless of diameter size shall be modeled as an extrusion.   Access zones shall be modeled as transparent solids when required. All required pipe slopes and insulation shall be accurately depicted in the BIMs.

Fire Protection

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Gang piping runs regardless of diameter size shall be modeled as an extrusion.   Access zones shall be modeled as transparent solids when required.

Security

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. Devices shall be place and located in the BIMs. Security devices as necessary to coordinate critical areas shall be modeled. Gang Conduit runs regardless of diameter size shall be modeled as an extrusion.

Baggage Handling Systems (BHS)

The detail and responsibility to fulfill these modeling requirements should be addressed fully within the MPS. The BHS shall be in BIM. All associated spaces, clearances, supporting structures, equipment, and access zones shall be modeled. The BHS BIMs shall be used in constructability reviews in conjunction with the Architecture and Structural BIMs to verify feasibility.

E. BIM Workflows During Design

Model Contributors Role & Responsibilities: At the inception of the project the Model Contributors shall use state plane coordinates to ensure that all BIMs will be properly positioned and aligned. It is the Architects and Civil Engineers responsibility to coordinate with both the Master Site BIM, when one is available and the GIS utility Atlas to geo-reference their projects. The Design BIMPxP will detail the BIM contributors, their role and their BIM scopes of work.

A sample of BIM Contributors by phase and progression is listed below:

a) Planning
1. Architect
2. Civil Engineers
3. Specialty Equipment Engineer
b) SD
1. Architect
2. Civil Engineer
3. Landscape Architect
4. Structural Engineer
5. Specialty Equipment Engineer
6. Mechanical Engineers
c) DD
1. Architect
2. Civil Engineer
3. Landscape Architect

4. Structural Engineer
5. Specialty Equipment Engineer
6. MEPF Engineers
7. Security & IT Engineers

d) CD
1. Architect
2. Civil Engineer
3. Structural Engineer
4. Specialty Equipment Engineer
5. MEPF Engineers
6. Security & IT Engineers
7. Owner Supplied Vendor and Equipment

Each discipline shall identify a single point of contact as Model Manager for their contribution. The Model Manager shall be responsible for any and all the content found inside their models. The Federated BIMs shall not carry redundant content belonging to another discipline. Proper care shall be taken by each Model Contributor to reference other BIMs as linked files inside their BIMs in order to create their deliverables. Any exceptions to this rule shall be clearly defined in the Design BIMPxP and is subject to BCAD approval.

F. BIM Collaboration and Model Sharing During Design

BIM Collaboration: The Design Team shall establish regular meetings to assure constructability of the Federated Design BIM at least once during the SD, DD and CD Phases. The Design team is expected to invite BCAD and others BCAD deems necessary. These meetings can be held online.

The Design Team is responsible for the regular upload of Design Submittals to BCAD's Document Control System. BCADs Project folder structure and naming conventions will be made available to the Design BIM Team prior to the time of writing the Design BIMPxP.

Model Sharing: The Design Team is expected to follow BCAD's model sharing standards for information exchange with Owner and must also have their own protocols for exchanging working BIMs among the Design Team members. These protocols shall be specifically and clearly addressed in the Design BIMPxP in terms of what sharing method will be used, i.e. web-based exchange servers or FTP's and their folder structure.

Fully Coordinated Design Intent BIM does not mean Clash Free but rather that the Design Team will design, to the best of their ability, building systems which will fit and are constructible as intended. The Design Team shall demonstrate that any clashes that exist in their Design Intent Federated BIM can be addressed in the Construction BIMs through means and methods.

G. Design Deliverables

2D Contract Documents: At the end of Design the Design Team shall submit a set of Construction Documents which will include a Specification Manual. The requirements for delivering the 2D contract

document set representing the design efforts at each phase of design does not change. The Design Team shall refer to BCAD's Standard contract deliverables for the project and meet them at a minimum.

Design BIMPxP: The Design BIMPxP is due prior to the start of Design and 30 days after authorization to proceed.

Design BIMs:
Design BIMs are expected as deliverables at the end of each design phase in their native file formats and in IFC (2x3). These deliverables shall meet the minimum BIM Content Requirements defined in this Standard and the BIMPxP / MPS.

Federated Design BIM:
A Federated Design BIM is expected as deliverable at the end of each design phase in an approved format. (See Section Five). All associated and linked data shall be organized in the BCAD's Document Control System and all links shall be maintained in the Federated BIM.

COBie Deliverable During Design:
The first COBie deliverable is provided using the 100% Design BIMs. The second COBie deliverable will be after product approval by the design team from the construction submittals. Refer to Section Ten.

8. BIM Workflows During the Bidding Phase

Regardless of the delivery method, sometimes a project will require bidding by contractors. The Design BIMs shall be made available for reference to potential Bidders in the latest IFC (2x3) format as individual files. The Federated Design BIM shall be made available in an approved BIM Managing Software native file format. The Design BIMPxP shall also be made available. These files are provided in conjunction with the 2D contract documents as read-only and for reference. Whether they can be used for quantity takeoff shall be explicitly disclosed by the Design Team at the time of handover, or in the Design BIMPxP. When applicable, the COBie file will be made available to Bidders.

Use & Responsibilities During Bidding

1) Design Team

The Design & Construction Teams shall update the BIMs as appropriate during this bidding for any applicable addendum or Request for Information (RFIs) or Model Information Requests (MIRs).

2) Bidders

The Bidders receiving access to these files shall receive proper clearance to the files after signing BCAD's electronic document releases for confidential information. It is the Bidder's responsibility to obtain proper clearance and distribute as deemed necessary the BID and BIM deliverables to their Subcontractors. Bidders and their subs shall review BCAD's BIM Standards prior to submitting their Bids. The Bidders and its Subcontractors shall only use the BIMs as defined by Use Case in the Design BIMPxP and MPS.

9. **BIM Workflows and Deliveries During Construction**

The Construction process or phase begins with the issuance of the Notice to Proceed from the Owner and a full handover of the BIM deliverables to the GC shall occur. The GC shall accept and take control of the Management of the latest project BIM files. As stated earlier, one of BCADs goals during Construction is to minimize Change Orders due to field coordination.

A. **Model Content Requirement**

LOD for Construction: BCAD acknowledges that there isn't a strict equivalence between a BIM's LOD and its project phase; however, in general the model progression through the Construction phases shall be as follows:

   a) Trade Coordination – Min. LOD 350
   b) Coordinated Construction BIMs – LOD 400
   c) BIM As Built – LOD 500

The Level of Detail required per Trade shall be established in the MPS. As a general expectation, the Construction BIMs shall use the Design BIMs Level of Detail as a starting point and augment the information in terms of quantity, size, location, orientation, completeness, final routing, with precise fittings and hanger supports.

The following is the minimum expectation:
   a) All Equipment as listed in the Equipment Schedules in the CD set shall be modeled as custom and specific per the manufacturer specification of the object.
   b) Information associated with the Equipment listed in the Equipment Schedules in the CD set, such as but not limited to, Manufacturer Spec. Sheets, Warranty Information, and O&M manuals, etc., linked to the equipment in the Federated Construction BIM at a location to be determined by BCAD.

B. **BIM Workflows During Construction**

Model Contributors Roles & Responsibilities: The GC is responsible for BIM Management, Coordination and adherence to the Coordinated BIMs during installation. It is the GC's responsibility to assure that a Complete Federated BIM is represented in the Construction BIMs. When a model contribution is required by the MPS and not modeled by any trade, it is the GC's responsibility to assure that the Federated Construction BIM is complete and that the Trade BIM in question is virtually represented. It is the GC's responsibility to make the BIMs available to the Trade Contractors in the BCAD-approved format required for them.

The Design Team shall submit updated BIMs to the Construction Team during Construction only in case of a Design or Scope Change requiring Building Department approval.

It is up to the GC to determine who the model contributor will be at the time of writing the Construction BIMPxP. The following trades are expected as applicable and at a minimum per the MPS and BIMPxP:

1. Utilities
2. Site works
3. Shell & Core
4. Exterior Glazing & Curtain walls
5. Structural Steel
6. Interior Walls, Ceilings, Doors & Windows
7. Specialty Components through Owner Contracted Vendors
8. HVAC
9. Electrical including High and Low voltage
10. Plumbing
11. Fire Protection
12. Security and Building Automated Systems (BAS)

BIM Collaboration During Construction: The GC is expected to know how to run BIM Coordination and is expected to delineate his/her protocols and quality controls in the Construction BIMPxP. It is up to the Construction Team to hold a Construction BIM Kickoff Meeting where the MPS and BIMPxP will be reviewed. The GC team is expected to invite BCAD and the Design Team during scheduled Trade coordination. These meetings can be held online or otherwise and BCAD and the Design Team are expected to attend.

The Construction Team is responsible for the regular upload of Construction Submittals to BCAD. These uploads are expected monthly. BCADs Project folder structure and naming conventions will be made available to the Design & Construction Team at the time of writing the BIMPxP.

Model Sharing During Construction: The Construction Team is expected to have its own protocols for exchanging working BIMs amongst team members. These protocols shall be specifically and clearly addressed in the Construction BIMPxP in terms of what sharing method will be used, i.e. web-based exchange servers or FTP's and their folder structure.

Model sharing and BIM collaboration is critical to assure a Clash Free Construction BIM before installation.

Clash Detection and Spatial Coordination: At a minimum, Clash detection between any, and all of the following elements, should occur:

a. Architecture
b. Structure
c. Mechanical
d. Fire
e. Electrical
f. Plumbing
g. Life Safety
h. Equipment

Federated models shall follow the trade colors listed below:

    a. Architecture: White
    b. Structural Steel: Maroon
    c. Concrete: Gray
    d. HVAC Equipment: Gold
    e. HVAC Supply Duct/Diffuser: Blue
    f. HVAC Return Duct/Diffuser: Magenta
    g. HVAC Pipe: Gold
    h. Electrical Equipment: Dark Yellow
    i. Electrical Conduits: Light Yellow
    j. Communication Conduit: Light Blue
    k. Electrical Cable Tray: Dark Orange
    l. Electrical Lighting: Yellow
    m. Plumbing Water: Cyan
    n. Plumbing Sewer: Magenta
    o. Plumbing Storm Drain: Green
    p. Fire Protection: Red
    q. Pneumatic Tube: Dark Green
    r. Equipment: Light Green
    s. Specialty Gas: Light Green
    t. Security Systems: Orange
    u. Fire Alarm: Fuchsia

C. Construction Deliverables:

2D Installation Drawings: The Installation Drawings are due during Construction. The Construction Team shall refer to BCAD's Standard contract and Project Specifications manual for defined deliverables.

Construction BIMPxP: The Construction BIMPxP is due prior to the start of Construction and 30 days after authorization to proceed.

Construction BIMs: Construction BIMs are expected as deliverables at the end of construction in their native file formats and in IFC (2x3). These deliverables shall meet the minimum BIM Content Requirements defined in this Standard and the BIMPxP / MPS. BIMs that are required:

    i. Trade BIMs
    ii. Federated BIM
    iii. Clash Reports
    iv. As Constructed BIMs

Federated Construction BIM:

A Federated Construction BIM is expected as deliverable at the end of construction in an approved format. (See Section Five). All associated and linked data shall be organized in the BCAD's Document Control System and all links shall be maintained in the Federated BIM.

COBie Deliverable During Construction:

The COBie deliverables are defined in the Design Teams BIMPxP and the Construction BIMPxP. Best Practices and workflow are detailed in Section Ten.

10. **Construction Operations Building Information Exchange (COBie) Workflow, Roles and Responsibilities and Deliverables**

Construction Operations Building information exchange (COBie) was created to standardize the exchange of information between construction and Facilities Mangers at handover in a consistent format. Standardizing information exchanges eliminates the need for repeated or custom mapping. Once a standard is adopted, the software vendors can incorporate the Standard into their applications and users do not have to worry about connecting databases as they can be pre-mapped.

Although the COBie deliverable format has been in practice for several years, it had not been incorporated into software development plans as it was not considered a "standard". In 2011, COBie Standard was adopted into the National Building Information Modeling Standard- United States, Version 2 (NBIMS-US v2). Now as a recognized standard, COBie has been implemented by BIM authoring tool software vendors as well CMMS providers. For a complete list of COBie capable software can be found on the buildingSMARTalliance website at http://www.nibs.org/?page=bsa_cobiemm

Information on how to use COBie may be found at http://www.wbdg.org/resources/cobie.p

This section is intended to:

- ✓ Describe the **List of Assets** requiring COBie Data Set
- ✓ Define the **Roles and Responsibilities** of Design & Construction Team members for COBie deliverables
- ✓ Identify both the COBie and BCAD **specified data sets** (attributes) to meet the required deliverable,
- ✓ Recommend **best practices**
- ✓ Discuss data **validation processes** for quality control
- ✓ Provide a COBie **Deliverable Progression Schedule**

A. List of Assets requiring COBie Data Set

At a minimum and not limited to, BCAD will require COBie data sets for all components on the Equipment List per the Construction Documents that require any of the following:

- ✓ Scheduled preventative maintenance i.e. Mechanical, Electrical,
- ✓ Routine maintenance/inspections : i.e. Plumbing
- ✓ Regulatory inspections i.e. life safety related: fire extinguisher, fire dampers, backflow preventers

B. Roles & Responsibilities

All COBie deliverables will be provided in the COBie Standard file format conforming to version 2, release 4, (COBie2 2.40). A sample COBie deliverable format file containing BCAD additional data sets may be provided upon request from BCAD.

The chart below identifies the minimum COBie data set required BCAD. The first available collection point of each attribute has been identify as either at 100% Design (D_{100}), after Contractor approved submittals (C_{SA}), or after Contractor installations (C_I). The responsible party for providing and collecting the COBie data

set will be either assigned to the Design Team (Architect or Engineer (A/E) or Construction Team (Contractor) as part of the BIMPxP.

In the case where BCAD may request additional sets of data to be provided, it will then be the responsibility of the Design & Construction Teams to add those attribute names to the chart, and identify when first available and who is responsible for collection. A revised chart should become part of the approved BIMPxP plan.

	Required Data set	A/E D100	A/E CSA	Contractor CI
Project Parameters	Facility Name	✓✓		
	Facility Type	✓✓		
	Project Name	✓✓		
	Site Name	✓✓		
	Linear Units	✓✓		
	Area Units	✓✓		
	Volume Units	✓✓		
	Currency Unit	✓✓		
	Area Measurement	✓✓		
Type/Instance Parameters	Floor Name	✓✓		
	Floor Classification	✓✓		
	Room Name	✓✓		
	Space Classifaction	✓✓		
	Floor Name	✓✓		
	Space Description	✓✓		
	Type Name	✓✓		
	Type Classification	✓✓		
	Type Description	✓✓		
	Asset Type	✓✓		
	Manufacturer		✓✓	
	Model Number		✓✓	
	Warranty Guarantor- Parts		✓✓	
	Warranty Duration- Parts		✓✓	
	Warranty Guarantor- Labor		✓✓	
	Warranty Duration- Labor		✓✓	
	Warranty Duration- Units		✓✓	
	Vendor		✓✓	
	Component Name	✓✓		
	Type Name	✓✓		
	Location	✓✓		
	Component Description	✓✓		
	BCAD Asset #	✓✓		
	Serial #			✓✓
	Installation Date			✓✓
	Purchase Price		✓✓	
	Replacement Cost		✓✓	
	Zone Name	✓✓		
	Zone Classification	✓✓		
	Space Name	✓✓		
	System name	✓✓		
	System Classification	✓✓		
	Component names	✓✓		
	Email		✓✓	
	Classification		✓✓	
	Company		✓✓	
	Phone		✓✓	
	Contact Name		✓✓	
	Address		✓✓	
	City		✓✓	
	State		✓✓	
	ZIP Code		✓✓	
	51	30	19	2
		59%	37%	4%

A/E	Holds the Design Team Prime Contract
Contractor	Holds the Construction Team Prime Contract
D100	100% design stage/CD
CSA	Contractor Approved submittals
CI	Contractor Installation

COBie tabs required BCAD:

At this time, BCAD is only requiring the following tabs in the COBie2 2.40 file to be provided:

- ✓ Facility
- ✓ Floor
- ✓ Space
- ✓ Type
- ✓ Component
- ✓ System
- ✓ Zone
- ✓ Contact

Facility	Floor	Space	Type	Component	System	Zone	Contact

C. Classification tables

Unless otherwise provided, the use of OmniClass tables for classification designations is required. These tables may be found at http://www.omniclass.org/

Use the following the OmniClass Classification tables for:

       Facility Classification
       OmniClass Table 11 - Construction Entities by Function

       Space Classification
       OmniClass Table 13 Spaces by Function*****

       Type Classification
       OmniClass Table 23 – Products *****

       System Classification
       OmniClass Table 21 – Elements***** (previously Uniformat)

       Contact Classification
       OmniClass Table 34 – Organizational Roles

       *OmniClass tables adopted by the National BIM Standard- US v2

For the following classifications use the tables below:

       Floor Classification
       Ground

Level
Roof

Zone Classification
Circulation Zone
Lighting Zone
Fire Alarm Zone
Occupancy Zone
Ventilation Zone
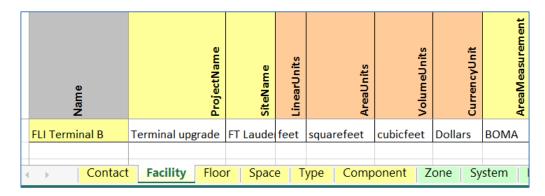
System Classification
As determined by BCAD

D. COBie Standard and BCAD specified data set

The chart below is the information that you are required to have and is intended to clarify where the data should reside in a COBie formatted file deliverable (spreadsheet).

Required Data set	Required by	Appears in COBie Tab	Under Column
Facility Name	COBie- Std	Facility	Name
Facility Type	COBie- Std	Facility	Category
Project Name	COBie- Std	Facility	Project name
Site Name	COBie- Std	Facility	Site name
Linear Units	COBie- Std	Facility	Linear Units
Area Units	COBie- Std	Facility	Area Units
Volume Units	COBie- Std	Facility	Volume Units
Currency Unit	COBie- Std	Facility	Currency Unit
Area Measurement	COBie- Std	Facility	Area Measurement
For each Level			
Floor Name	COBie- Std	Floor	Name
Floor Classification	COBie- Std	Floor	Category
For each Room			
Room Name	COBie- Std	Space	Name
Space Classification	COBie- Std	Space	Category
Floor Name	COBie- Std	Space	Floor Name
Space Description	COBie- Std	Space	Description
For each Asset Type			
Asset Type Name	COBie- Std	Type	Name
Asset Type Classification	COBie- Std	Type	Category
Asset Type Description	COBie- Std	Type	Description
Asset Type	COBie- Std	Type	Asset Type
Manufacturer	COBie- Std	Type	Manufacturer
Model Number	COBie- Std	Type	Model Number
Warranty Guarantor- Parts	COBie- Std	Type	Warranty Guarantor- Parts
Warranty Duration- Parts	COBie- Std	Type	Warranty Duration- Parts
Warranty Guarantor- Labor	COBie- Std	Type	Warranty Guarantor- Labor
Warranty Duration- Labor	COBie- Std	Type	Warranty Duration- Labor
Warranty Duration- Units	COBie- Std	Type	Warranty Duration- Units
Vendor	BCAD	Type	Vendor
For each Asset			
Asset Name	COBie- Std	Component	Name
Asset Type Name	COBie- Std	Component	Type Name
Asset Location	COBie- Std	Component	Space
Asset Description	COBie- Std	Component	Description
BCAD Asset #	BCAD	Component	BCAD Asset #
Serial #	BCAD	Component	Serial Number
Installation Date	BCAD	Component	Installation Date
Purchase Price	BCAD	Component	Purchase Price
Replacement Cost	BCAD	Component	Replacement Cost
For each Zone			
Zone Name	COBie- Std	Zone	Name
Zone Classification	COBie- Std	Zone	Category
Space Names	COBie- Std	Zone	Space names
For each System			
System name	COBie- Std	System	Name
System Classification	COBie- Std	System	Category
Asset Names	COBie- Std	System	Component names
For each Contact			
Email	COBie- Std	Contacts	Email
Classification	COBie- Std	Contacts	Category
Company	COBie- Std	Contacts	Company
Phone	COBie- Std	Contacts	Phone
Contact Name	BCAD	Contacts	First Name
Address	BCAD	Contacts	Address
City	BCAD	Contacts	City
State	BCAD	Contacts	State
ZIP Code	BCAD	Contacts	ZIP Code

Example of a COBie2 2.40 formatted file with required Facility information

Name	ProjectName	SiteName	LinearUnits	AreaUnits	VolumeUnits	CurrencyUnit	AreaMeasurement
FLI Terminal B	Terminal upgrade	FT Laude	feet	squarefeet	cubicfeet	Dollars	BOMA

Contact **Facility** Floor Space Type Component Zone System

E. Best Practices

Entering data in the COBie standard formatted file: One option for providing COBie deliverables is to manually enter the required information into a COBie formatted file. On projects with limited amount of assets or no model was provide, manual entry may be reasonable choice. However on projects with large amounts of new assets, manual entry may not be the most cost effective method for collection.

In cases where a model is provided, the most efficient method is to extract information directly from data embedded in the BIMs. Several options are available for extracting data. It is becoming more common that the BIM authoring software's to have COBie data export capabilities but there are also open source BIM servers available with COBie data extraction features. Another method is to copy and paste from COBie formatted Schedules as described next.

Use of COBie Schedules in the BIM file

It is recommended to create COBie schedules in the BIM file with headings that match the required tabs in the COBie deliverable file. These schedules can also be used to efficiently visual check that all required information is been provided. Also allows for quick corrections before extracting into COBie formatted file for submissions. Shown below is an example of a COBie schedule created in a BIM matching the required data set headings of a tab in the COBie deliverable format.

COBie Types Schedule									
Type Name	Type Classification	Type Description	Asset Type	Manufacture	ModelNumber	WarrantyGuarantorParts	WarrantyDurationParts	WarrantyGuarantorLabor	WarrantyDurationLabor
1 D	Air Ductwork		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor
1.5 D	Air Ductwork		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor
1.5 W	Air Ductwork		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor
2 D	Air Ductwork		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor
3.9 LPS - 0.8 Meter Head	Pumps		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor
15 mm Pendent	Fire Fighting Sprinkler Heads		FIXED	Manufact		WarrantyGuarantorParts	WarrantyDurationPart	WarrantyGuarantorLabor	WarrantyDurationLabor

Data Validation

Name	CreatedBy	CreatedOn	Category Table 23	Description	AssetType	Manufacturer	ModelNumber	WarrantyGuarantorParts	WarrantyDurationParts	WarrantyGuarantorLabor	WarrantyDurationLabor	WarrantyDurationUnit

Instruction Contact Facility Floor Space **Type** Component Zone System Attribute PickLists (2)

Providing the completed COBie deliverable in the correct format is essential. Each responsible party is required to validate and ensure that all the COBie data sets are provided with correct information for each asset listed in the contract prior to submittal to BCAD.

Upon delivery of the COBie formatted file (s), BCAD will run a data validation report which will identify any errors/warnings due to missing, invalid entry, or corrupt data. The report will be reviewed with responsible parties to identify corrective measure or agree to accept data as received.

The responsible party, at no additional cost to BCAD, will have five (5) working days to correct all identified errors and resubmit an updated COBie formatted file to BCAD to rerun validation report. If a second validation report shows new errors or any unresolved previous errors on the revised deliverable, the submittal will be rejected until all errors have been addressed.

F. COBie Progression Schedule (CPS)

BCAD will implement a Transition to Operations approach to allow the facility management team time to prepare for the new assets by requiring progressive delivery of COBie data sets based on Project Phases. In some cases, there could be multiple deliverables within one project phase. The complete schedule of deliverables is to be stated in the BIMPxP.

The **first COBie file deliverable** will be from the Design Team with a data set using the 100% design model provided in the contract documents or created from 2D contract documents. This first deliverable will be due with 30 days of Construction Documents submittal.

For the assets listed in the contract as requiring COBie data sets, the following information is to be delivered in a COBie2 2.40 formatted file :

Deliverable Stages	Proj Phase	Required Data set	A/E D₁₀₀	Required by	Appears in COBie Tab	Under Column
Deliverable 1	100% Design	Facility Name	✓✓	COBie-Std	Facility	Name
		Facility Type	✓✓	COBie-Std	Facility	Category
		Project Name	✓✓	COBie-Std	Facility	Project name
		Site Name	✓✓	COBie-Std	Facility	Site name
		Linear Units	✓✓	COBie-Std	Facility	Linear Units
		Area Units	✓✓	COBie-Std	Facility	Area Units
		Volume Units	✓✓	COBie-Std	Facility	Volume Units
		Currency Unit	✓✓	COBie-Std	Facility	Currency Unit
		Area Measurement	✓✓	COBie-Std	Facility	Area Measurement
		For each Level				
		Floor Name	✓✓	COBie-Std	Floor	Name
		Floor Classification	✓✓	COBie-Std	Floor	Category
		For each Room				
		Room Name	✓✓	COBie-Std	Space	Name
		Space Classification	✓✓	COBie-Std	Space	Category
		Floor Name	✓✓	COBie-Std	Space	Floor Name
		Space Description	✓✓	COBie-Std	Space	Description
		For each Asset Type				
		Asset Type Name	✓✓	COBie-Std	Type	Name
		Asset Type Classification	✓✓	COBie-Std	Type	Category
		Asset Type Description	✓✓	COBie-Std	Type	Description
		Asset Type	✓✓	COBie-Std	Type	Asset Type
		For each Asset				
		Asset Name	✓✓	COBie-Std	Component	Name
		Asset Type Name	✓✓	COBie-Std	Component	Type Name
		Asset Location	✓✓	COBie-Std	Component	Space
		Asset Description	✓✓	COBie-Std	Component	Description
		BCAD Asset #	✓✓	BCAD Maximo	Component	BCAD Asset #
		For each Zone				
		Zone Name	✓✓	COBie-Std	Zone	Name
		Zone Classification	✓✓	COBie-Std	Zone	Category
		Space Names	✓✓	COBie-Std	Zone	Space names
		For each System				
		System name	✓✓	COBie-Std	System	Name
		System Classification	✓✓	COBie-Std	System	Category
		Asset Names	✓✓	COBie-Std	System	Component names

The **second COBie file deliverable** will be during submittal approval (Csa) phase, also provided by design team. This deliverable should be stated in the BIMPxP as it may be done incrementally or at one time after all approvals have been completed and models have been updated with approved assets. For the assets listed in the contract as requiring COBie data sets, the following information is to be delivered in a COBie formatted file:

Deliverable Stages	Proj Phase	Required Data set	D₁₀₀ (A/E)	Cₛₐ (A/E)	Required by	Appears in COBie Tab	Under Column
Delieverable 2	Approved Submittals	Facility Name	✓✓		COBie- Std	Facility	Name
		Facility Type	✓✓		COBie- Std	Facility	Category
		Project Name	✓✓		COBie- Std	Facility	Project name
		Site Name	✓✓		COBie- Std	Facility	Site name
		Linear Units	✓✓		COBie- Std	Facility	Linear Units
		Area Units	✓✓		COBie- Std	Facility	Area Units
		Volume Units	✓✓		COBie- Std	Facility	Volume Units
		Currency Unit	✓✓		COBie- Std	Facility	Currency Unit
		Area Measurement	✓✓		COBie- Std	Facility	Area Measurement
		For each Level					
		Floor Name	✓✓		COBie- Std	Floor	Name
		Floor Classification	✓✓		COBie- Std	Floor	Category
		For each Room					
		Room Name	✓✓		COBie- Std	Space	Name
		Space Classification	✓✓		COBie- Std	Space	Category
		Floor Name	✓✓		COBie- Std	Space	Floor Name
		Space Description	✓✓		COBie- Std	Space	Description
		For each Asset Type					
		Asset Type Name	✓✓		COBie- Std	Type	Name
		Asset Type Classification	✓✓		COBie- Std	Type	Category
		Asset Type Description	✓✓		COBie- Std	Type	Description
		Asset Type	✓✓		COBie- Std	Type	Asset Type
		Manufacturer		✓✓	COBie- Std	Type	Manufacturer
		Model Number		✓✓	COBie- Std	Type	Model Number
		Warranty Guarantor- Parts		✓✓	COBie- Std	Type	Warranty Guarantor- Parts
		Warranty Duration- Parts		✓✓	COBie- Std	Type	Warranty Duration- Parts
		Warranty Guarantor- Labor		✓✓	COBie- Std	Type	Warranty Guarantor- Labor
		Warranty Duration- Labor		✓✓	COBie- Std	Type	Warranty Duration- Labor
		Warranty Duration- Units		✓✓	COBie- Std	Type	Warranty Duration- Units
		Vendor		✓✓	BCAD Maximo	Type	Vendor
		For each Asset					
		Asset Name	✓✓		COBie- Std	Component	Name
		Asset Type Name	✓✓		COBie- Std	Component	Type Name
		Asset Location	✓✓		COBie- Std	Component	Space
		Asset Description	✓✓		COBie- Std	Component	Description
		BCAD Asset #	✓✓		BCAD Maximo	Component	BCAD Asset #
		Purchase Price		✓✓	BCAD Maximo	Component	Purchase Price
		Replacement Cost		✓✓	BCAD Maximo	Component	Replacement Cost
		For each Zone					
		Zone Name	✓✓		COBie- Std	Zone	Name
		Zone Classification	✓✓		COBie- Std	Zone	Category
		Space Names	✓✓		COBie- Std	Zone	Space names
		For each System					
		System name	✓✓		COBie- Std	System	Name
		System Classification	✓✓		COBie- Std	System	Category
		Asset Names	✓✓		COBie- Std	System	Component names
		For each Contact					
		Email		✓✓	COBie- Std	Contacts	Email
		Classification		✓✓	COBie- Std	Contacts	Category
		Company		✓✓	COBie- Std	Contacts	Company
		Phone		✓✓	COBie- Std	Contacts	Phone
		Contact Name		✓✓	BCAD Maximo	Contacts	First Name
		Address		✓✓	BCAD Maximo	Contacts	Address
		City		✓✓	BCAD Maximo	Contacts	City
		State		✓✓	BCAD Maximo	Contacts	State
		ZIP Code		✓✓	BCAD Maximo	Contacts	ZIP Code

The **third COBie file deliverable** will be from either the Design Team or Construction Team and will be defined in the BIMPxP. COBie data set for all assets listed in the contract and due once all assets have been installed. This too may be done incrementally or at one time after all installations have been completed and models have been updated.

Deliverable Stages	Proj Phase	Required Data set	D100 (A/E)	CSA (A/E)	CI (Contractor)	Required by	Appears in COBie Tab	Under Column
Delieverable 3	Installation	Facility Name	✓✓			COBie- Std	Facility	Name
		Facility Type	✓✓			COBie- Std	Facility	Category
		Project Name	✓✓			COBie- Std	Facility	Project name
		Site Name	✓✓			COBie- Std	Facility	Site name
		Linear Units	✓✓			COBie- Std	Facility	Linear Units
		Area Units	✓✓			COBie- Std	Facility	Area Units
		Volume Units	✓✓			COBie- Std	Facility	Volume Units
		Currency Unit	✓✓			COBie- Std	Facility	Currency Unit
		Area Measurement	✓✓			COBie- Std	Facility	Area Measurement
		For each Level						
		Floor Name	✓✓			COBie- Std	Floor	Name
		Floor Classification	✓✓			COBie- Std	Floor	Category
		For each Room						
		Room Name	✓✓			COBie- Std	Space	Name
		Space Classification	✓✓			COBie- Std	Space	Category
		Floor Name	✓✓			COBie- Std	Space	Floor Name
		Space Description	✓✓			COBie- Std	Space	Description
		For each Asset Type						
		Asset Type Name	✓✓			COBie- Std	Type	Name
		Asset Type Classification	✓✓			COBie- Std	Type	Category
		Asset Type Description	✓✓			COBie- Std	Type	Description
		Asset Type	✓✓			COBie- Std	Type	Asset Type
		Manufacturer		✓✓		COBie- Std	Type	Manufacturer
		Model Number		✓✓		COBie- Std	Type	Model Number
		Warranty Guarantor- Parts		✓✓		COBie- Std	Type	Warranty Guarantor- Parts
		Warranty Duration- Parts		✓✓		COBie- Std	Type	Warranty Duration- Parts
		Warranty Guarantor- Labor		✓✓		COBie- Std	Type	Warranty Guarantor- Labor
		Warranty Duration- Labor		✓✓		COBie- Std	Type	Warranty Duration- Labor
		Warranty Duration- Units		✓✓		COBie- Std	Type	Warranty Duration- Units
		Vendor		✓✓		BCAD Maximo	Type	Vendor
		For each Asset						
		Asset Name	✓✓			COBie- Std	Component	Name
		Asset Type Name	✓✓			COBie- Std	Component	Type Name
		Asset Location	✓✓			COBie- Std	Component	Space
		Asset Description	✓✓			COBie- Std	Component	Description
		BCAD Asset #	✓✓			BCAD Maximo	Component	BCAD Asset #
		Serial #			✓✓	BCAD Maximo	Component	Serial Number
		Installation Date			✓✓	BCAD Maximo	Component	Installation Date
		Purchase Price		✓✓		BCAD Maximo	Component	Purchase Price
		Replacement Cost		✓✓		BCAD Maximo	Component	Replacement Cost
		For each Zone						
		Zone Name	✓✓			COBie- Std	Zone	Name
		Zone Classification	✓✓			COBie- Std	Zone	Category
		Space Names	✓✓			COBie- Std	Zone	Space names
		For each System						
		System name	✓✓			COBie- Std	System	Name
		System Classification	✓✓			COBie- Std	System	Category
		Asset Names	✓✓			COBie- Std	System	Component names
		For each Contact						
		Email		✓✓		COBie- Std	Contacts	Email
		Classification		✓✓		COBie- Std	Contacts	Category
		Company		✓✓		COBie- Std	Contacts	Company
		Phone		✓✓		COBie- Std	Contacts	Phone
		Contact Name		✓✓		BCAD Maximo	Contacts	First Name
		Address		✓✓		BCAD Maximo	Contacts	Address
		City		✓✓		BCAD Maximo	Contacts	City
		State		✓✓		BCAD Maximo	Contacts	State
		ZIP Code		✓✓		BCAD Maximo	Contacts	ZIP Code

The **final COBie file deliverable** will be from Design Team or Construction Team as defined in the BIMPxP that represents the As-Built models and will be a complete COBie data set for all assets listed in the contract, and due same time as As-Built models.

Deliverable Stages	Proj Phase	Required Data set	A/E As-Built	Required by	Appears in COBie Tab	Under Column
FINAL Deliverable	As Built	Facility Name	✓✓	COBie- Std	Facility	Name
		Facility Type	✓✓	COBie- Std	Facility	Category
		Project Name	✓✓	COBie- Std	Facility	Project name
		Site Name	✓✓	COBie- Std	Facility	Site name
		Linear Units	✓✓	COBie- Std	Facility	Linear Units
		Area Units	✓✓	COBie- Std	Facility	Area Units
		Volume Units	✓✓	COBie- Std	Facility	Volume Units
		Currency Unit	✓✓	COBie- Std	Facility	Currency Unit
		Area Measurement	✓✓	COBie- Std	Facility	Area Measurement
		For each Level				
		Floor Name	✓✓	COBie- Std	Floor	Name
		Floor Classification	✓✓	COBie- Std	Floor	Category
		For each Room				
		Room Name	✓✓	COBie- Std	Space	Name
		Space Classification	✓✓	COBie- Std	Space	Category
		Floor Name	✓✓	COBie- Std	Space	Floor Name
		Space Description	✓✓	COBie- Std	Space	Description
		For each Asset Type				
		Asset Type Name	✓✓	COBie- Std	Type	Name
		Asset Type Classification	✓✓	COBie- Std	Type	Category
		Asset Type Description	✓✓	COBie- Std	Type	Description
		Asset Type	✓✓	COBie- Std	Type	Asset Type
		For each Asset Type				
		Manufacturer	✓✓	COBie- Std	Type	Manufacturer
		Model Number	✓✓	COBie- Std	Type	Model Number
		Warranty Guarantor- Parts	✓✓	COBie- Std	Type	Warranty Guarantor- Parts
		Warranty Duration- Parts	✓✓	COBie- Std	Type	Warranty Duration- Parts
		Warranty Guarantor- Labor	✓✓	COBie- Std	Type	Warranty Guarantor- Labor
		Warranty Duration- Labor	✓✓	COBie- Std	Type	Warranty Duration- Labor
		Warranty Duration- Units	✓✓	COBie- Std	Type	Warranty Duration- Units
		Vendor	✓✓	BCAD Maximo	Type	Vendor
		For each Asset				
		Asset Name	✓✓	COBie- Std	Component	Name
		Asset Type Name	✓✓	COBie- Std	Component	Type Name
		Asset Location	✓✓	COBie- Std	Component	Space
		Asset Description	✓✓	COBie- Std	Component	Description
		BCAD Asset #	✓✓	BCAD Maximo	Component	BCAD Asset #
		Serial #	✓✓	BCAD Maximo	Component	Serial Number
		Installation Date	✓✓	BCAD Maximo	Component	Installation Date
		Purchase Price	✓✓	BCAD Maximo	Component	Purchase Price
		Replacement Cost	✓✓	BCAD Maximo	Component	Replacement Cost
		For each Zone				
		Zone Name	✓✓	COBie- Std	Zone	Name
		Zone Classification	✓✓	COBie- Std	Zone	Category
		Space Names	✓✓	COBie- Std	Zone	Space names
		For each System				
		System name	✓✓	COBie- Std	System	Name
		System Classification	✓✓	COBie- Std	System	Category
		Asset Names	✓✓	COBie- Std	System	Component names
		For each Contact				
		Email	✓✓	COBie- Std	Contacts	Email
		Classification	✓✓	COBie- Std	Contacts	Category
		Company	✓✓	COBie- Std	Contacts	Company
		Phone	✓✓	COBie- Std	Contacts	Phone
		Contact Name	✓✓	BCAD Maximo	Contacts	First Name
		Address	✓✓	BCAD Maximo	Contacts	Address
		City	✓✓	BCAD Maximo	Contacts	City
		State	✓✓	BCAD Maximo	Contacts	State
		ZIP Code	✓✓	BCAD Maximo	Contacts	ZIP Code

BIM Project Execution Plan

For:
PROJECT NAME
Project Street Address
Project City, State

Project Image

Developed By:

BUILDING INFORMATION MODELING

BIM EXECUTION PLAN
FOR

TABLE OF CONTENTS

1 INTRODUCTION

This project will utilize Building Information Modeling (BIM) on this project. The Design & Construction Teams will work together to create BIMs and a Federated BIM to manage the coordination effort.

2 EXECUTION PLAN OVERVIEW

To successfully implement Building Information Modeling (BIM) on this project, the project team has developed a detailed BIM Project Execution Plan. The purpose of the BIM Project Execution Plan (BIMPxP) is to detail the strategy for the use of BIM technologies and the results thereof.

- Conduct information exchanges and handoffs

- Define how models and model data will be compiled, reviewed, and managed

- Review the Contract Documents and other trades' 3D / BIM shop drawings

3 PROJECT INFORMATION

Project Information

1. Project Owner:
2. Project Name:
3. Project Location/ Address:
4. Contract type:
5. Brief Project Description:
6. Project Numbers:

4 TERMINOLOGY AND LOD DEFINITION

Terminology

BIM (Building Information Modeling): A process involving the generation and management of digital representations of physical and functional characteristics of a facility. The resulting Building Information Models become shared knowledge resources to support decision-making about a facility from earliest conceptual stages, through design and construction, through its operational life and eventual demolition.

BIM Project Execution Plan (BIMPxP): This document lays out how BIM will be implemented on the project as a result of the decision of the group.

5 BIM / VDCO Goals & Uses

Major VDCO / Objectives:

GOAL DESCRIPTION	POTENTIAL VDC USES

BIM Uses:

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		DESIGN AUTHORING	X	SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS		DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
			3D COORDINATION	X	3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS	X	3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
			MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

6 BIM PLANNING & PREPARATION

This section outlines the various resources that need to be brought together in order to successfully initiate, manage, and complete the processes defined above:

6.1 CONTACTS

ROLE	CONTACT	COMPANY	PHONE	EMAIL

6.2 ROLES AND RESPONSIBILITIES:

Design/ Construction Project Manager:
Provides guidance to BIM process relative to contract and field implementation

Design/ Construction BIM Project Manager:
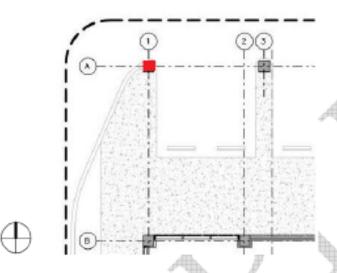Oversees, detects clashes and coordinates the BIM process with all trades, manages coordination and record models.

Model Manager:
Model Managers are assigned to a specific discipline/trade and are responsible for BIM content creation.

6.3 PROCESS MAP

7 MODELING

7.1 ORIGIN MONUMENT, LOCATION, AND BASE

7.2 SCOPE OF WORK & LEVEL OF DEVELOPMENT

Scope of Work

Discipline Model	LOD	Modeler	Responsible Party for QA/QC
Civil			
Architecture			
Structural			
Mechanical			
Electrical			
Plumbing			
Fire Protection			

7.3 SOFTWARE AND/OR HARDWARE REQUIREMENTS

BIM USE	Discipline/ Trade	SOFTWARE	VERSION
	SITE		

	ARC		
	STRUCT		
	MDUCT		
	MPIPE		
	PLUMB		
	FP		
	ELECT		

7.4 FILE FORMATS

7.5 MODEL REQUIREMENTS

Solid 3D Modeling: All objects must be modeled as 3D Solid Objects. Wireframe models and 2D line work will not be accepted

Elevation/Levels: All elements must be modeled at their correct elevation/level so that when brought into the coordination model, all aspects of the model align and all components are in their correct place.

"Clean" Models – No XREFS: Any 3D DWG model submitted should contain only relevant 3D data and no extraneous 2D data, nor should it contain any x-referenced files.

Trade Colors: Each building system will be identifiable by a single color with as follows:

I. Architecture : White
II. Structural Steel : Maroon
III. Concrete : Gray
IV. HVAC Equipment : Gold
V. HVAC Supply/Diffuser : Blue
VI. HVAC Return/Diffuser : Magenta
VII. HVAC Pipe : Gold
VIII. Plumbing Water : Cyan
IX. Plumbing Sanitary : Magenta
X. Plumbing Storm Drain : Green
XI. Fire Protection: Bright Red
XII. Fire Alarm System : Fuchia
XIII. Security Systems: Orange
XIV. Specialty Gasses : Light Green
XV. Domestic Water CW : Light Blue
XVI. Domestic Water HW :Light Red
XVII. Condensate : Light Purple
XVIII. Electrical Equipment : Dark Yellow
XIX. Electrical Conduit : Light Yellow

Discipline	Rounding Tolerance for Modeling	Installation Accuracy
Architecture	*Accurate to +/- [1/256"] of Actual Size and Location*	
Structural	*Accurate to +/- [1/256"] of Actual Size and Location*	
Mechanical	*Accurate to +/- [1/8"] of Actual Size and Location*	
Electrical	*Accurate to +/- [1/8"] of Actual Size and Location*	
Plumbing	*Accurate to +/- [1/8"] of Actual Size and Location*	
Fire Protection	*Accurate to +/- [1/8"] of Actual Size and Location*	

8 COORDINATION AND BIM MANAGEMENT

8.1 COORDINATION PROCEDURES

Coordination Strategy:

Meeting Type	Project Stage	Frequency	Participants	Location
BIM Kick-Off	*00/00/20xx*	*Once*		
BIM Coordination Meeting	*Construction*	*Weekly*		

8.2 FILE EXCHANGE METHODS & PROCEDURES

File exchange will be conducted via _____

Each party will be required to notify all affected trades on the contact list when a new file is uploaded.

8.3 FILE NAMING STRUCTURE

For Static (archival) Files: YYMMDD – PRJ-BD – D13 – Description.xxx
or Dynamic (working) Files: PRJ-BD – D13.xxx

PRJ	=	Project Acronym
BD	=	Building Acronym
D	=	Discipline
13	=	Revit/ACAD/Navis Version
Description	=	concise identification
xxx	=	file extension

8.4 BIM HIERARCHY PROTOCOLS

The project team will decide the construction order and location. Precedence and priority will also be defined for critical areas.

Coordination will be expected to start as soon as contracts are awarded and follow the typical sequence:

1: Item shows on the architectural (including all fixtures and devices shown on the reflected ceiling plans) and structural plan.

2: Equipment shown on the mechanical or electrical plans which cannot be relocated.

3: Equipment or devices requiring access for maintenance.

4: Fire sprinkler mains, existing

5: Plumbing and HVAC gravity lines

6: Ductwork, rigid

7: Plumbing and HVAC piping 3" or larger

8: Fire sprinkler mains, new

9: Electrical conduit 2-1/2" or larger

10: Plumbing and HVAC piping 2-1/2"and smaller

11: Fire sprinkler piping other than remains

12: Electrical conduit 2" or smaller

13: Low voltage systems, i.e. Telecomm, Data, Fire Alarm, etc.

14: Ductwork, Flex

8.5 CHANGE MANAGEMENT

The process of BIM Coordination is the process of continually updating and managing changes to Models. Those changes result from 'clashing' models against each other and deciding which model element needs to move in order to 'clear' a clash or conflict.

8.6 TIMELINE SCHEDULE OF DELIVERY

Timeline: The modeling and BIM Coordination Process is expected to last from _____ to _____.

Delivery Schedule will be per areas.

Project Phase	Modeling Start Date	Modeling End Date	Coordination Start Date	Coordination End Date	Project Stake Holders Involved
Structural					
Architectural					
Mechanical					
Plumbing					

Electrical				
Fire Protection				

9 SHOP & FIELD IMPLEMENTATION & EXECUTION

The Design or Construction Teams will prepare layouts

10 FINAL SUBMISSION

BIM Execution Plan

Project

By signing below, this BIM Execution Plan is herewith adopted and agreed upon between the signed companies.

_____   _____   Date
"Client"

_____   _____   Date
Design/ Construction Team BIM Manager

_____   _____   Date
- Mechanical Engineer / Subcontractor

_____   _____   Date
- Electrical Engineer / Subcontractor

_____   _____   Date
 - Plumbing Engineer / Subcontractor

_____   _____   Date
- Fire Protection Engineer / Subcontractor

12. Appendix B – Model Progression Schedule (MPS)- Available upon request in Excel Format.

RP = RESPONSIBLE PARTY	MODEL PROGRESSION STAGES													
	PROGRAMMING		SCHEMATIC		DD		CD		PRECON		CONSTRUCTION		RECORD	
PROJECT CONTROL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
References														
Grid														
Levels					INCLUDED									
Location														
Origin														
Spatial														
Occupancy														
Regions														
Rooms														
Spaces														
Project Information														
Splash Page					INCLUDED									
SITE	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Hardscape														
Existing Conditions														
Curbs & Gutters														
Flag post														
Fencing														
Freestanding Garages														
Paved Areas														
Pergolas & Canopies														
Ramps														
Retaining Walls														
Roads														
Services Structures														
Sidewalks														
Site Element Demolition														
Site Element Relocation														
Site Element Remediation														
Special Features														
Softscape														
Existing Conditions														
Planting														
Topography														
Trees														
Water Features														
Markings & Signage														
Existing Conditions														
Monument Signs														
Parking Signage														
Parking Spaces														
Paving Markings														
Road Signage														
Temporary Signage														
CIVIL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Features														
Existing Conditions														
Airfields														
Earthwork														
Recreation Areas														
Site Clearing														
Site Development														
Site Preparation														
Tunnels														
Services														
Existing Conditions														
Communication Systems														
Electrical														
Fire Protection														
Fuel														
Gas														
Sewer														
Site Lighting														
Specialty														
Storm														
Water														

RP = RESPONSIBLE PARTY	MODEL PROGRESSION STAGES													
	PROGRAMMING		SCHEMATIC		DD		CD		PRECON		CONSTRUCTION		RECORD	
ARCHITECTURAL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Interior														
Existing Conditions														
Drop Ceilings														
Flooring														
Furring and Build-outs														
Glazing														
Interior Doors														
Interior Walls														
Non-Bearing Columns														
Pilasters														
Railings														
Soffits														
Toilet Accessories														
Toilet Partitions														
Trim Elements														
Exterior														
Existing Conditions														
Canopies & Awnings														
Curtain Walls														
Doors														
Existing Conditions														
Gutters and Spouts														
Non-Bearing Walls														
Reveals														
Specialty Features														
Sun Control Elements														
Trim Elements														
Windows														
Placeholder Elements														
Existing Conditions														
Electrical Accessories														
Electrical Equipment														
Floor Systems														
Lighting Fixtures														
Louvers & Grills														
Mechanical Accessories														
Mechanical Equipment														
Openings														
Plumbing Fixtures														
Specialty Systems or Elements														
Stair Systems														
Structural Roofs														
Structural Walls														
Roofs														
Existing Conditions														
Copings														
Coverings														
Curbs & Accessories														
Equipment Screening														
Lightning Protection														
Parapets														
Soffit & Facia														
Specialty Features														
Substrates														
Furnishings														
Existing Conditions														
Appliances														
Casework / Cabinetry														
Fixed Furnishings														
Furniture Systems														
Movable Furnishings														
STRUCTURAL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Substructure														
Existing Conditions														
Foundations & Footings														
Grade Beams														

RP = RESPONSIBLE PARTY	MODEL PROGRESSION STAGES													
	PROGRAMMING		SCHEMATIC		DD		CD		PRECON		CONSTRUCTION		RECORD	
Piles & Pile Caps														
Slabs on Grade														
Specialty Foundations														
Stem Walls														
Superstructure														
Existing Conditions														
Beams & Joists														
Bridging														
CMU Walls														
Columns														
Conveying Pits and Sumps														
Curbs														
Equipment Support Framing														
Expansion Joints														
Floor Deck Structures														
Lintels & Tie Beams														
Ramps														
Retention Walls														
Shear Walls														
Specialty Structures														
Stairs														
Stiffeners & Bracing														
Tie Columns														
Trusses														
MECHANICAL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Existing Conditions														
Heating System Equipment														
Access panels														
Controls & Instrumentation														
Cooling System Equipment														
Diffusers & Dampers														
Distribution Equipment														
Duct Fittings & Accessories														
Flexible Ductwork														
Hangers														
Louvers														
Mechanical Piping														
Pipes Fittings & Accessories														
Registers & Grills														
Rigid Ductwork														
Risers														
Servicing / Maintenance Areas														
Sleeves														
Specialty HVAC Systems & Equipment														
System Clearances														
Terminal & Package Units														
ELECTRICAL	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Existing Conditions														
Risers														
Access panels														
Cable Trays														
Data Racks														
Distribution Conduit < 1-1/2"														
Distribution Conduit > 1-1/2"														
Electrical Equipment														
Hangers														
Junction Boxes														
Lighting Fixtures														
Panels														
Power Devices														
Receptacles & Switches														
Sleeves														
Specialty Electrical Systems														
Switchgear														
System Clearances														
Transformers														

RP = RESPONSIBLE PARTY	MODEL PROGRESSION STAGES													
	PROGRAMMING		SCHEMATIC		DD		CD		PRECON		CONSTRUCTION		RECORD	
	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
PLUMBING														
Existing Conditions														
Plumbing Fixtures														
"Flexible" Pipe & Fittings < 1"														
Access panels														
Hangers														
Plumbing Accessories														
Plumbing Equipment														
Rain Water Drainage														
Rigid Piping & Fittings														
Risers														
Sleeves														
Specialty Plumbing Systems														
System Clearances														
FIRE PROTECTION	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Existing Conditions														
Risers														
Sprinklers & Drops														
Rigid Piping & Fittings														
Fire Protection Equipment														
Accessories														
Drain Valves														
Standpipes														
Access panels														
System Clearances														
Sleeves														
Hangers														
Specialty Fire Protection Systems														
Specialty Fire Protection Accessories														
SECURITY	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Existing Conditions														
Cameras														
Alarms														
Card Readers														
Sensors														
Control Systems														
Screening Checkpoints														
SPECIALIZED SYSTEMS	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP	LOD	RP
Specialty Construction														
Existing Conditions														
Specialty Building Features														
Specialty Facilities														
Specialty Instrumentation														
Conveying Systems														
Existing Conditions														
Baggage Handling System														
Elevators & Lifts														
Escalators & Moving Walks														
Other Conveying Systems														
Equipment														
Existing Conditions														
Access Zones														
Clearance Zones														
Commercial Equipment														
Institutional Equipment														
Laboratory Equipment														
Other Specialty Equipment														
Vehicular Equipment														

13. Glossary

2D   Two dimensional

3D   Three dimensional

4D   BIM + Schedule (Time) = 4D

5D   BIM + Cost = 5D

A/E   Architect and Engineer

AHJ   Authorities Having Jurisdiction (AHJ)

As-Constructed BIM The updated Contractor BIMs which represent what was installed in the field.

BCAD   Broward County Aviation Department

BHS   Baggage Handling Systems

BIM   Building Information Model or Building Information Modeling

BIMPxP   Building Information Modeling Project Execution Plan

BPM   BIM Project Manager

CAD   Computer-Aided Design

CAFM   Computer- Aided Facility Management

CD   Construction Documents

CMMS   Computerized Maintenance Management System: A type of management software that performs functions in support of operations and maintenance (O&M) programs.

COBie   Construction Operation Building Information Exchange. An information standard that captures facility data generated during the facility's design, construction and commissioning phases. It is a data Specification.

CPS   COBie Progression Schedule

Construction BIM Building Information Model typically representing a single building system created for purposes of planning, scheduling, coordinating, fabricating, installing during construction. Model elements are accurate in terms of size, shape, location, quantity and orientation and may include fabrication, assembly, detailing and non-geometric information. MEPF System models include COBie data. Construction BIMs are maintained in the native format of the authoring software.

Coordination BIM Composite model that includes multiple Design or Construction BIMs, registered spatially, used for the purpose of interference checking (clash detection), visualization and 4D applications during construction. Coordination BIMs are maintained in the native format of the coordination software.

CI Contractor Installation

Csa Contractor Submittal Approval

D100 100% Design Stage / Construction Document

DB Design Build

DD Design Development

DQC Deliverable Quality Control

DWG DWG is a binary file format used for storing two and three dimensional design data and metadata. It is the native format for several CAD packages.

Federated Model An aggregation of Models in a single database.

FLCM Facility Life Cycle Management

FM Facility Management or Facility Manager

IFC (2X3) Industry Foundation Classes: an object oriented neutral file format with a data model developed by the buildingSMART (International Alliance of Interoperability, IAI) to describe, exchange and share information typically used with the building and facility management industry sector. IFC (2X3) is an International Standard. (ISO 16739)

IST BCAD's Information System Team

Level of Detail The amount of parts modeled inside an object or system.

LOD Level of Development. The specific minimum content requirements and associated Authorized Uses or each Model Element at six progressively detailed levels of completeness.

MasterFormat MasterFormat, a publication of CSI and CSC, is a master list of numbers and titles classified by work results. It primarily used to organize project manuals and detailed cost information, and to relate drawings notations to specifications.

MEPF Mechanical, Electrical, Plumbing, Fire Protection

MIR Model Information Request

MPS	Model Progression Schedule (MPS) also known as the Model Element Table as referenced in the AIA G202 document and is a matrix that defines specific model elements by Uniformat classification.
NBIMS	National Building Information Modeling Standard- United States, Version 2 (NBIMS-US v2)
OmniClass	OmniClass Construction Classification System – Open Source- is a classification system for the construction industry. It incorporates other extant systems currently in use as the basis of many of its Tables – MasterFormat for work results and UniFormat for elements.
PxP	Project Execution Plan
Record BIM	The updated BIMS that come from the architect that includes the contractors AS Constructed BIMS.
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Qualifications
RP	Responsible Party
SD	Schematic Design
VDC	Virtual Design and Construction
VDCO	Virtual Design Construction and Operation (VDCO)

14. Credits

Primary References:
National Building Information Modeling Standard- United States, Version 2 (NBIMS-US v2)
Department of Veterans Affairs – The VA BIM Guide, v. 1.0 April 2010

Additional Reference:
BIMForum's 2013 Draft LOD Specification
Broward Health BIM Standard BIM Standards Version 1, December 26, 2012
Construction Specification Institute (CSI) 2011 OmniClass Tables

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