BIM Execution Plan

A guide to using industry standards, best practices and data exchange procedures in order to successfully coordinate and collaborate with other cross disciplines using BIM.

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Contents

Overview of the BIM Execution Plan

Introduction

A detailed BIM Execution Plan (BEP) for this Project has been developed to implement and execute the use of ARCHICAD - as Building Information Modeling (BIM) - using industry standards, best practices and data exchange procedures that will be outlined in this BIM Execution Plan, to successfully coordinate, communicate and collaborate with other Cross-Disciplines/trades using BIM.

The BIM Execution Plan is a protocol. A protocol negotiated with other Cross-Disciplines and trades based on their respective capacity and capability to deliver BIM in context to the requirements of the BIM Execution Plan - which helps to define the uses for BIM - from design, to construction, to facility and asset management - along the entire life cycle of the project. The BIM Execution Plan details the process for executing BIM throughout the project lifecycle.

Consider the BIM Execution Plan as living document; flexible and adaptive to the specific Cross-Disciplines and Trades experience, expertise, needs and use of BIM, as well as the final deliverable requirements for the Project.

The BIM Execution Plan will provide the basis of establishing many of the protocols for the development, use, coordination, and exchange of both the geometry and the meta data contained in the BIM; as well as defining the Level of Development (LOD) for building assemblies and components described in the building information model (BIM) at certain phases of design and milestones of the project. And finally at the project closeout, the BEP adequately ensures that the data developed in the BIM throughout the design and construction process, in coordination with all Cross-Disciplines/trades, fulfill the requirements of the BIM deliverables at handover for facility management and operations.

Building Information Modeling - using ARCHICAD and other BIM authoring solutions and applications - represents significant process change for the entire Architecture, Engineering, Construction, and Facilities Management (AECOO) industry to streamline and ensure qualitatively better communication, coordination and collaboration on the project.

Committing all sectors and organizations of the entire AECOO industry to the utilization of BIM technology on all projects implementing and executing BIM processes - as effectively and efficiently as possible outlined in a thorough and coordinated BEP, as well as Integrated Project Delivery (IPD) methodologies using BIM - should assist all stakeholders in the AECOO industry realize significant optimization and benefits throughput the entire design, procurement, construction and operation life cycle of the project.

Instructions

The intent of providing a BIM Execution Plan for a project, creates a template or framework that will allow all members of the Project Team - Architects, Engineers and other Cross Cross-Disciplines, Contractors, Facility Mangers, etc. - to successfully implement Building Information Modeling (BIM) and utilize best practices on this project for improved communication, better coordination, and more effective collaboration.

The use of this BEP template is required for BIM implementation and utilization on this project by all members of the Project Team using BIM, and required to provide BIM deliverables. The Project Team shall complete this BEP template in cooperation and coordination with other Project Team members to work together and exchange BIM data more efficiently and effectively; adding or deleting, revising as needed to provide a project specific BEP. Each Project Team shall review and approve this BIM Execution Plan (BEP).

Responsibilities

BIM applications used for authoring, data integration, collision detection, coordination and collaborative team workflows will be used to develop and produce project-specific information and documentation as required for submittals and deliverables. The use of BIM on this project will be implemented and leveraged for communication and coordination for all project deliverables, reviews, design analysis, decisions and approvals, as well as QA/QC during all phases of the project.

All Project Team members are responsible to acquire the necessary application(s), staff, experience/expertise, equipment, etc. needed to successfully use and deliver BIM for the project, Equipment used by the subcontractors during the on-site coordination meetings must meet the requirements of the software being implemented so as not to cause delays in modeling and redrawing.

All Project Team members will be responsible for specific modeling, data input, documentation, coordination and reliability of each BIM deliverables throughout the phases and milestones of the project.

Ownership and Utilization

The importance of accurate modeling, data input, coordination, management, and stewardship of the BIM during the design, documentation, procurement, construction and facility management workflows and processes cannot be overstated.

It is recommended that each Project Team member utilize recognized BIM standards and best practices to properly implement, integrate and manage BIM data throughout the facility lifecycle for ownership and reuse.

The Owner may make use of the BIM and CAD data following any deliverable. Ownership of the BIM, CAD files, documentation and facility data developed for the project will remain with the project throughout the lifecycle of the facility.

Therefore, it is also recommended that the design process shall allow refinements to the BIM during and after the procurement and construction process, with the goal of neutral, non-proprietary, version agnostic project data in the BIM deliverable; supporting the owner the continued utilization of the BIM for facility and asset management throughout the lifecycle of the project.

Usage

The usage of the BIM will be comprehensive and progressive throughout the Project and lifecycle of the facility. This BEP template is intended to be used on all project types, including; new construction, renovation, remodeling, adaptive re-use, etc.

The implementation of BIM on this project will adhere to the guidelines and requirements of this BEP; including other documents and sources for the proper guidance and usage of BIM.

Project Team

The Project Team may include, but not necessarily be limited to design, procurement, construction, facility managers, owner's representatives, etc. and the term "teams" have been used in this BEP to assist in defining which Cross-Discipline or group the requirements the BEP applies to on context to the phases and milestones of the Project.

However, because the standard of care and project delivery requirements can define risk differently for some projects, the responsibility for coordinated BIM will shift to either the Design Team or Construction Team, or both throughout the project.

Project Information

Project

Project Name:

Project Owner:

Project Location and Address:

Contract Type/Delivery Method: [CM, DB, BID]

Project Description:

Additional Project Information:

Project Numbers:

Design Phases and Milestones

Include all phases, milestones, coordination activities, major design reviews, stakeholder reviews, and any other major events which occur during the project lifecycle o this BEP.

PROJECT PHASE / MILESTONE	ESTIMATED START DATE	ESTIMATED COMPLETION DATE	PROJECT STAKEHOLDERS INVOLVED
Programming			
Preliminary/Concept			
Schematic			
Design Development			
Construction Documentation			
Bidding/Negeotiation			
Construction			

BEP Signatures

(Add additional signatures lines as necessary for the Project)

	/ /
Lead BIM Coordinator	Date

	/ /
Design Team BIM Manager	Date

	/ /
Construction Team BIM Manager	Date

	/ /
Project Manager	Date

	/ /
Facility Manager	Date

	/ /
Owner's Agent	Date

Contact Information

Project Team

Include BIM Mangers and lead contacts and/or BIM coordinators for each organization on the Project.

Additional contacts can be included later in the document.

ROLE	ORGANIZATION	CONTACT NAME	E-MAIL	PHONE
Owner				
Architect				
Construction Manager				
Civil Engineer				
Structural Engineer				
Mechanical Engineer				
Plumbing Engineer				
Project manager				
Design Team BIM Manager				
Lead BIM Coordinator				
Construction BIM Manager				
Facility Manager				
Other Project Role				

Goals and BIM Use

Goals/Objectives

Include all major BIM Goals and Objectives for this Project. To be determined by project team and owner.

The priorities shown here are suggested. Indicate "H, M, L" in the chart below.

PRIORITY (HIGH/MED/LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES
	Accurate documentation of building systems geometry and data to facilitate and automate O&M operations.	RECORD MODELING
	Reduce and eliminate building system construction errors by digital modeling of building system geometries to detect conflicts or collisions.	3D COORDINATION
	Provision of standardized 3D digital construction document models which facilitate audit, analysis, construction and renovation.	DESIGN AUTHORING
	Utilize intelligent modeling software to achieve optimum, cost-efficient design solutions for building systems such as mechanical, electrical and structural.	ENGINEERING ANALYSIS
	Improved communication and cooperation between project participants to achieve LEED credits and obtain sustainability goals.	SUSTAINABILITY (LEED) EVALUATION
	Improved visualization and presentation of virtual designs to validate design goals such as aesthetics, layout, sightlines, security, etc.	DESIGN REVIEWS
	Efficient and accurate assessment of design performance parameters in regard to spatial requirements.	PROGRAMMING
	Precise estimate of building systems costs and alternative schemes during the life-cycle of a project.	COST ESTIMATION
	Enhanced efficiency and accuracy of existing conditions documentation by use of current software to create 3D models that can be queried for information	EXISTING CONDITIONS MODELING
	Utilization of digital information to automate building component fabrication and field construction.	DIGITAL FABRICATION
	Utilization of the information model to provide detailed control points in assembly fabrication and field construction.	3D CONTROL AND PLANNING

Increased efficiency in building maintenance staff by use of information model data links to the Owner's computerized maintenance management system (CMMS).	BUILDING MAINTENANCE SCHEDULING
Automated access to building asset information by linking the record information model to the owner's computerized maintenance management system (CMMS). This would include linked access to building system operation routines, maintenance manuals, equipment specifications and fabrication documents.	ASSET MANAGEMENT
Use of the information model to track, analyze and report proposed and current use of space and related resources within facility.	SPACE MANAGEMENT / TRACKING

Use

Highlight and place an X next to the additional BIM Uses to be developed in the BIM as selected by the Project Team.

Additional items can be added and may be needed on the project.

PROGRAMMING	DESIGN	CONSTRUCTION	OPERATE
Existing Conditions Modeling	Existing Conditions Modeling	Existing Conditions Modeling	Existing Conditions Modeling
Cost Estimation	Cost Estimation	Cost Estimation	Cost Estimation
Phase Planning (4d Modeling)	Phase Planning (4d Modeling)	Phase Planning (4d Modeling)	Existing Conditions Modeling
Programming	Design Authoring	3D Coordination	Cost Estimation
Site Analysis	Other Eng. Analysis	Site Utilization Planning	Existing Conditions Modeling
Code Validation	3d Coordination	3D Coordination	Cost Estimation
Project Site Survey	Design Reviews	Site Utilization Planning	Existing Conditions Modeling
Sustainability (LEED) Evaluation	Code Validation	3D Coordination	Cost Estimation
Existing Conditions Modeling	ADA Verification	Site Utilization Planning	Existing Conditions Modeling
Cost Estimation	Sustainability (LEED) Evaluation	3D Coordination	Cost Estimation

PROGRAMMING	DESIGN	CONSTRUCTION	OPERATE
Phase Planning (4d Modeling)	Energy Analysis	Site Utilization Planning	Existing Conditions Modeling
Programming	Structural Analysis	3D Coordination	Cost Estimation
Site Analysis	Lighting Analysis	Site Utilization Planning	Existing Conditions Modeling
Code Validation	Mechanical Analysis	3D Coordination	Cost Estimation
Project Site Survey	Other Eng. Analysis	Site Utilization Planning	Existing Conditions Modeling
	3d Coordination	3D Coordination	Building Maintenance Scheduling
		Site Utilization Planning	Building System Analysis (Commissioning)
		Construction System Design	Asset Management
		Digital Fabrication	Space Management / Tracking
		3D Control And Planning	Disaster Planning
		Record Modeling	Record Modeling
		3D Coordination	2d (As-Built) Drawings
		Site Utilization Planning	COBie DELIVERABLES
		Construction System Design	Building Maintenance Scheduling
		Digital Fabrication	Building System Analysis (Commissioning)
		3D Control And Planning	Asset Management
		Record Modeling	Space Management / Tracking
		3D Coordination	Disaster Planning

BIM Coordinator and Manager Roles

BIM Coordinators

An individual will be assigned to the role of lead BIM Coordinator for all major design, cross-Cross-Disciplines, trades, (Architecture, Structural, MEP, Interior design, etc.) to coordinate their respective work, exchanges and deliverables with the entire Design/Construction Team.

These individuals will have the necessary BIM and application experience required to support this BEP for the project, and will have, but not necessarily limited to, the following responsibilities for their Cross-Discipline:

- Coordinate the BIM development of each respective Cross-Discipline/trade, BIM standards, best practices, level of development (LOD), data input and exchange requirements, etc. as required by this BEP and with the Design Team BIM Manager.

- Lead all the appropriate technical requirements needed for BIM development. documentation and analysis for their respective Cross-Discipline/trade.

- Coordinate collision detection and resolution activities required by this BEP.

- Coordinate internal and external BIM training as required by this BEP.

- Coordinate trade items into the respective BIM as required by this BEP.

BIM Managers - Design Team

An individual assigned by the Design Team will serve as the main point of contact between the Design Team, Construction Team, and al other Cross-Disciplines/trades for all BIM related issues and exchange requirements outlined in this BEP.

This individual will have the necessary BIM and application experience - including relevant proficiency in the BIM authoring and coordination software to be used - required to support this BEP for the project, and will have, but not necessarily limited to, the following responsibilities for their Cross-Discipline:

- Authors and aligns the BEP requirements with the BIM Managers and BIM Coordinators of all the Cross-Disciplines/trades.

- Ensures development and compliance with the guidelines and requirements of this BEP.

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- Validates each Cross-Discipline/trade respective BIM to ensure compliance with the program data and design criteria for the proposed functional requirements for occupancy and operations.

- Determines and establishes the appropriate classification/reference system to be used by the Design Team and Construction Team and other Cross-Disciplines/trades throughout the design and construction process.

- Determines and establishes the project datum, geo-location/origin/survey points, stories/levels of the BIM for all exchange protocols required by the BEP, and assures the technical aspects of each Cross-Discipline/trade BIM are properly referenced and maintained. throughout the design and construction process.

- Determines the software training and learning to fulfill the requirements of the BEP.

- Assumes responsibility for and ensures the proper classification of all functional spaces, building assemblies, components and equipment contained in all the Cross-Disciplines/trades BIM to ensure compliance with the program data and design criteria for the proposed functional requirements for occupancy and operations to be used for facility and asset management throughout the design and construction process.

- Develops, coordinates, publishes, and verifies that all required domains of the Cross-Disciplines/trades BIM configurations meet the standards and requirements of this BEP, for seamless exchanges and integration of design and construction modeling and data throughout the entire process of design, construction and closeout of the project.

- Coordinates the setup of the BIM Server/BIMcloud and Teamwork with access, passwords. roles and permissions, etc. of any Cross-Disciplines/trades participating in the BIM development using ARCHICAD.

- Coordinates the setup of a file server with a web portal, security, access, permission, etc. for non-ARCHICAD BIM development and CAD file exchanges.

- Coordinates and assembles the composite BIM (reference models) for coordination meetings.

- Coordinates the composite BIM (reference models) for all design coordination and collision detection between the Cross-Disciplines/trades.

- Facilitates coordination meetings between the Cross-Disciplines/trades and provides BIM collaboration Format (BCF) exchanges by the identification, tracking and resolution of all collisions contained in the reports.

- Schedules, coordinates, and facilitates BIM coordination meetings between the Design Team and Construction Team and all other appropriate Cross-Disciplines/trades.

- Coordinates the schedule and frequency of all BIM data exchanges between the Design Team and Construction Team and each Cross-Discipline/trade as required at each design phase or milestone established in the BEP.

- Coordinates with the Construction Team BIM Manager to ensure that the BIM final deliverables meet the requirements of the BEP at project closeout for all Cross-Disciplines/trades.

- Monitors each Cross-Discipline/trade complies with requirements the BEP and related BIM Level of Detail (LOD) requirements at each phase and milestone submittal throughout the design and construction process.

- Assures that the BIM deliverables specified and/or required by the contract and the BEP are provided in accordance with the formats specified.

- Assures COBie information is provided to the Construction Team for milestone submittals and final deliverables at the project closeout for facility and asset management.

- Assures BIM-derived 2D documentation conforms to the CAD Standards and for paper printing as required in the BEP.

BIM Managers - Construction Team

An individual, assigned by the Construction Team, will serve as the main point of contact between the Construction Team, the Design Team, and all other Cross-Disciplines/trades for all BIM related issues and exchange requirements outlined in this BEP.

This individual will have the necessary BIM and application experience - including relevant proficiency in the BIM authoring application and coordination software to be used and required to support this BEP for the project, and will have, but not necessarily limited to, the following responsibilities for their Cross-Discipline:

- Ensures development and compliance with the guidelines and requirements of this BEP for the Construction Team BIM, creating and coordinating data developed during construction process.

- Determines the software training and learning to fulfill the requirements of the BEP.

- Coordinates the exchange protocol for Construction Team with the Design Team BIM Manger for efficient delivery of project.

- Acts as the main point-of-contact for BIM and BIM-related issues between the Construction Team, subcontractors, Cross-Disciplines/trades and the Design Team and others as required by the BEP.

- Coordinates construction sequencing and scheduling activities, and assures they are integrated with the Construction Team BIM

- Coordinates and facilitates use of composite BIM developed by the trades in construction-related collision detection processes and coordination meetings and provides BIM collaboration Format (BCF) exchanges by the identification, tracking and resolution of all collisions contained in the reports.

- Communicates with the Design Team, coordinates the required BIM data extraction sets required by the construction trades, and ensures that these requests are met to facilitate the BIM deliverables and exchanges required by this BEP.

- Coordinates with the Design Team to facilitate design changes occurring in the field have been documented and are updated in the respective Cross-Discipline/trade BIM in a timely manner to ensure compliance with design intent.

- Coordinates with Fabrication Modelers to integrate 3D fabrication models with the updated design BIM (including other Cross-Discipline/trade BIM) to coordinate and ensure compliance with design intent, prior to approval and installation.

- Coordinates update of as-constructed field conditions and installations in the Record (As-Built) BIM deliverable and record drawings and CAD files.

- Coordinates with Design Team and Owner/Commissioning Agent to assure COBie information is complete and accurate for the FM Handover exchange for operations.

BIM Elements (domain of each Cross-Discipline)

Undefined

Responsibilities

Design

The Design Team will coordinate exchanges; managing, and updating the BIM(s) through the end of the construction phase, aggregating and referencing all design revisions and/or updates to the BIM(s) recording any design changes initiated by any RFI, Change Order, or coordination with existing and or modified conditions, etc.

Before substantial completion, the respective Cross-Discipline/Trades BIM(s) will be updated by the Design Team and will be transmitted to the Construction Team, who will be responsible for the construction-related revisions and updates to the BIM(s).

After final completion - commissioning/occupancy - the Construction Team will transmit the Record BIM(s) back to the Design Team who will then be responsible for the final preparations and delivery of the Record (As-Built) BIM and FM Handover (COBie) to the Owner for facility and asset management.

Construction

Throughout the Construction Phase, the Construction Team will record and maintain the As-Built/Field drawings and BIM metadata. The As-Built/Field drawings and BIM metadata will be used by both the Design and Construction Teams to review and coordinate all revisions, deviations, additions, changes, or corrections to the BIM(s) specified, procured, constructed and/or installed, etc. during the construction process.

Before substantial completion, the respective Cross-Discipline/Trades BIM(s) will be updated by the Design Team and will be transmitted to the Construction Team, who will be responsible for the construction-related revisions and updates to the BIM(s).

The Construction Team will assure that all updates and revisions to the BIM(s) as implemented will record the As-Built/Field conditions, information and metadata obtained and coordinated from the "red-line" As-Built/Field drawings

The Construction Team will incorporate all final updates to material/equipment data and properties *metadata) where installations differ from the original design included in all the plans and specifications, including the Design Teams BIM(s).

The Construction Team will embed and or link required close-out documentation to the BIM(s) (shop drawings, submittal information, O&M manuals, testing and balancing documentation, commissioning information, point cloud surveys, photos, etc.)

The Construction Team will update the BIM(s) after final completion -
commissioning/occupancy - the Construction Team will transmit the Record BIM(s) back to the
Design Team who will then be responsible for the final preparations and delivery of the Record
(As-Built) BIM and FM Handover (COBie) to the Owner for facility and asset management.

Facility/Asset Management

Undefined

Team

ROLE	DESCRIPTION MANAGEMENT PLAN AND DEVELOPMENT	BIM RESPONSIBILITY
The Owner Project Manager	Manages and coordinates project execution and BIM to meet project delivery and cost containment	Oversight
Design Team Project Manager	Team manager and coordinator, BMP	Coordination & review
BIM Manager	Coordinate BIM use on project, determine schedule of use, sharing activities, quality control, modeling responsibilities and document in bmp	Oversight, management execution, and model exchange
Architecture	Design execution –formulate with BIM mgr. Map BIM use for architectural design	Modeler and review
Structural	Engineering - formulate with BIM mgr. Map BIM use for structural design – determine BIM use for structural simulations, analysis, and documentation. Identify tools	Modeler & review, and model exchange
MEP	Engineering - formulate with BIM mgr. Map BIM use for MEP design – determine BIM use for simulations, analysis, and documentation. Identify tools	Data development modeler, and model exchange
Interior Design	Interior design execution –formulate with BIM mgr. And architect - map BIM use for architectural design	Data development modeler and model exchange
Sustainability and Energy	Engineering - formulate with BIM mgr. Map BIM use for sustainability, 3rd party rating systems. – determine BIM use for simulations, analysis, and documentation. Identify tools	Data development review & user
Medical Center Users	Determine facility functionally issues to be modeled and tested	Development of critical medical issues, review and input of testing

ROLE	DESCRIPTION MANAGEMENT PLAN AND DEVELOPMENT	BIM RESPONSIBILITY
Commissioning	Support. Provides architectural, engineering, equipment compliance reports produced in COBie format	Data development review & user
BIM Modeling Expertise by Software Application	Supports BIM manager on application specific content, issues	Modeler and data integrator
Project Estimator	Supports alignment of project delivery to BIM development & cost containment strategies	Oversight
Contractor	Receives or helps create BIM for constructability and handover for field use. Determine interference checking responsibility	Model user and review, and model exchange
Sub-Contractor and/or Fabricator (as appropriate)	Off-site fabrication - formulate with BIM mgr. And designer. Map BIM use for fabrication and shop drawing design. Determine BIM use for simulations of maintenance space analysis, and documentation. Identify tools	Model user, modeler, integrator

BIM Deliverables - Objectives, Roles and Responsibilities (by Phases)

Pre-Design - Program of Requirements/Conceptualization

Objectives:

- Provide initial design intent based on program requirements and conceptual design parameters established by the Owner.

- Ensure that planning/zoning and building code/life-safety requirements meet the Project objectives.

- Establish a 3D reference point for BIM coordination.

- Provide room data sheets and all space considerations for reference in the BIM.

- Provide all surveys, existing conditions, point-cloud scans, etc. in an digital file format.

- Establish a preliminary Building Energy Model (BEM) will be used to narrow down design strategies to those that are in line with and will achieve the projects energy goals and targets.

- Provide comparative design simulations will be used to inform deign decisions with reference to building envelope, lighting, domestic water, and HVAC systems.

BIM Roles:

- A BIM may or may not take shape during the Pre-Design (Program)/Conceptualization phase.

- If a BIM is created, its role will be to depict the visual concept of the design intent and general layout of the project along with program and space requirements.

- The Design Team will model all existing conditions needed to explain the design intent and the extent of the construction work for alterations and additions surrounding the Project.

- The BIM Level of Development (LOD) will be 0-100.

Responsibilities:

- The Design Team BIM Manager will establish a baseline BIM to be used as the basis for other BIMs.

- During the Pre-Design (Program)/Conceptualization phase, the BIM Managers from all Cross-Disciplines/Trades will establish modeling standards and guidelines as required by this BEP.

Schematic/Criteria Design

Objectives:

- Provide spatial design based on input from the Pre-Design (Program)/Conceptualization phase.

- Provide initial design intent for building systems, assemblies, components and/or attributes including; architectural, structural, and MEP.

- Identify initial coordination issues between building systems, assemblies and components.

- Receive and coordinate input from suppliers and fabricators regarding system cost, placement, fabrication and scheduling.

- The Design Team will extract quantity take-off information to support comparative analysis.

- The Design Team shall submit data in COBie format, if applicable.

BIM Roles:

- The Design Team BIM will show the general design and layout of the building envelope and superstructure.

- The Design Team BIM will be the baseline BIM for all other building systems, assemblies and component designs, including the MEP and the Structural BIM.

- Each Cross-Discipline/Trade design BIM(s) will be used to show the initial selection and layout of building systems. assemblies and components.

- The Design Team BIM will be used to inform and develop the Building Energy Model (BEM).

- The Building Energy Model (BEM) will define and refine design strategies and to calibrate the building's energy performance.

- The BIM Level of Development (LOD) will be 100-200.

Responsibilities:

- The Design Teams BIM Manager will exchange the BIM with the Cross-Disciplines/Trades.

- The Cross-Discipline/Trade BIM Managers will audit and deliver the completed BIM(s) to the Design Teams BIM Manager.

- The Design Teams BIM Manager will review the Cross-Discipline/Trade BIM(s) to ensure compliance with the design intent and phase requirements.

- The Design Teams BIM Manager will link or reference each Cross-Discipline/Trade BIM.

- The Design Teams BIM Manager will coordinate with the Cross-Discipline/Trade BIM Managers to eliminate duplicate or redundant objects.

Design Development/Detail Design

Objectives:

- Provide final design of building and all building systems, assemblies and components to be specified.

- Resolve coordination issues between all building systems, assemblies and components.

- Provide a BIM to the Construction Team capable of constructibility, including analyzing scheduling, costing, shop drawings, fabrication.

- The Design Team will submit a COBie deliverable that is updated from the Schematic Design Phase.

BIM Roles:

- The Design Team BIM will be the baseline for all other Cross-Discipline/Trade designs.

- The Cross-Discipline/Trade designs and BIM(s) will be modified accordingly to represent the enhanced design.

- The BIM Level of Development (LOD) will be 200-350.

Responsibilities:

- The Cross-Discipline/Trade BIM Managers will use the Design Team BIM to revise and complete their designs.

- Once each Cross-Discipline/Trade BIM(s) are complete, the Cross-Discipline/Trade BIM Managers will deliver their BIM to the Design Teams BIM Manager.

- The Design Teams BIM Manager will review the Cross-Discipline/Trade BIM(s) to ensure compliance with the phase requirements.

- The Design Teams BIM Manager will provide the Construction Teams BIM Manager with the Design Teams BIM and the Cross-Discipline/Trade BIM(s).

Construction/Implementation Documents

Objectives:

- Finalize design of the building and all building systems, assemblies and components.

- Prepare construction documentation and specifications (contract documents).

- Provide a Construction BIM that highlights constructibility, trade coordination, shop drawings and fabrication workflow and processes.

- The Design Team shall submit quantity take-off information. The COBie Construction Document set shall be an update to the Design Development COBie data set.

BIM Roles:

- All BIM(s) will be used to reflect the design.

- Each BIM(s) will then be used to generate the contract documents.

- The Construction BIM(s) will be used for constructibility, analysis, estimating, scheduling, shop drawings and fabrication workflows and processes.

Responsibilities:

- The Design Team and the Cross-Discipline/Trade BIM Managers will prepare contract documents.

- The BIM Level of Development (LOD) will be 250-400.

Agency

Undefined

Buyout

Undefined

Construction

Objectives:

- Update Design Team and Cross-Discipline/Trade BIM(s) based on all submittals, RFIs, or owner-directed changes.

- Maintain the Construction BIM based on construction activities.

- The Construction Team will submit RFIs and submittals through the collaborative project management system.

- Project Management files shall be created for all critical milestones. A full collision report shall be submitted.

BIM Roles:

- The Design Team and Cross-Discipline/Trade BIM(s) will be revised throughout construction.

- Based on any Owner directives/changes and As-Built/Field conditions, all BIMs will be fully coordinated and always reflect the status of revised contract documents.

- The Construction BIM(s) will be used for constructibility, analysis, estimating, scheduling, sequencing, shop drawings, fabrication and trade coordination.

Responsibilities:

- The Design Team BIM Manager will work with the Cross-Discipline/Trade BIM Managers to answer the RFIs and submittals and revise the BIM(s) accordingly.

- The Construction Teams BIM Manager will update the Construction BIM(s) and will work with the Design Team to update the Design Team and Cross-Discipline/Trade BIM(s).

- The BIM Level of Development (LOD) will be 400-500.

Close-Out/Record

Objective:

- The Design, Cross-Discipline/Trade and Construction Teams will collaborate and coordinate all BIM(s) to deliver the final Close-Out/Record (As-Built conditions) BIM(s).

- Throughout the construction process, the Design Team will incorporate all changes from requests for information (RFIs), architect's supplemental instructions (ASIs) and change orders in into the Design and Cross-Discipline/Trade BIM(s).

- At specified dates during the construction process, the Construction Team will provide the Design Team with changes and/or revisions due to shop drawings, coordination drawings and change orders processes.

- The Design Team will then incorporate the changes reported by the Construction Team into Design Team and Cross-Discipline/Trade BIM(s).

BIM Roles:

- The Design Team BIM(s) will be used as the coordinated Record (As-Built/Field) BIM representing the actual conditions as constructed.

- This Record (As-Built) BIM will be used by Owner for facility and asset management, scheduling and maintenance, etc.

Responsibilities:

- The Design Team BIM Manager will deliver the Record (As-Built/Field) BIM, including as-constructed information and metadata and all other supporting BIM(s) to The Owner,

- The Owner-BIM and the The Owner-CAD documents will be unlocked and available for updates.

- The BIM Level of Development (LOD) will be 500.

Owner - Facility/Asset Management (COBie)

Objective:

- The Design Team Close-Out/Record BIM(s) will be used for facility management, with the possibility of use in ongoing operations and life-cycle analysis as well as computerized maintenance management systems (CMMS) applications or solutions.

- The Facility Management (FM) Team will use data from the Close-Out/Record BIM(s) to populate FM and CMMS databases.

- All elements, objects/families, etc. in the BIM will have COBie attributes for appropriate data tracking.

BIM Roles:

- The Design Team BIM(s) will be used as the coordinated Record (As-Built/Field) BIM representing the actual conditions as constructed.

- This Record (As-Built) BIM will be used by Owner for facility and asset management, scheduling and maintenance, etc.

Responsibilities:

- The Design Team shall update the Design Team's BIM Model on a continual basis during the Construction Phase.

- The BEP shall be coordinated with the Design Team/Construction Team to allow for bi-weekly updates to track equipment specifications and as-built changes.

- The updates may be delivered from the Construction Team to the Design Team through shop drawings, product data, or by electronic data collection methods, etc.

- The BEP schedule will have a milestone date established 4 months before the Substantial/FinalCompletion date at which the updated Design Team's BIM COBie data (in spreadsheet form) will be delivered to the Owner.

Level of Development (BIM)

Level of Development Specification

The latest Specification for the LOD framework and standardization can be found here:

http://bimforum.org/lod/

The Level of Development (LOD) Specification is a reference that enables practitioners in the AEC Industry to specify and articulate with a high level of clarity the content and reliability of Building Information Models (BIMs) at various stages in the design and construction process.

Level of Development (LOD) Descriptions

The LOD descriptions outline the specific uses and requirements. The associated LOD at each phase described will be used to establish the required level of development for each element/object of the BIM at each phase of the Project.

The LOD for each phase provides guidance for the progressive development (completeness) of the BIM. Each subsequent LOD builds on the previous level of development and includes all the characteristics of previous LOD.

Design (100-300)

100   Conceptual:

Building massing representative of the overall area, height, volume, location, and orientation. May be modeled in three-dimensions or represented by other program andor room data.

Analysis based on the volume, area and orientation of the general representation of the Modeled elements/objects may occur.

200   Approximate:

Elements/objects are modeled as general building systems, assemblies and or components with approximate quantities, size, shape, location, and orientation. Any additional metadata may also be attached to each element/object.

Analysis based on the quantities, size, shape, location and orientation of the general representation of the elements/objects may occur.

300   Precise:

Elements/objects are modeled as detailed building assemblies and components that are accurately representative of quantity, size, shape, location, and orientation.

Additional metadata may also be attached to elements/objects.

Analysis based on the performance of selected systems of the specific representation of the element/objects may occur.

Assemblies for Coordination (350)

Elements/objects are modeled to accurately represent detailed building systems, assemblies and components in terms of specification, quantity, size, shape, orientation necessary for cross-discipline/trade coordination and construction layout.

Additional metadata may also be attached to elements/objects.

Construction

The Construction BIM is considered a composite of multiple BIMs developed with an LOD of 100-400. The Construction BIM will be further developed and submitted as the Record BIM including (As-Built) conditions.

During construction, changes shall be included as accurate representation of BIM elements/objects, including fabrication, RFI's, change orders, installations, etc. The Record BIM shall include (As-Built) information and be developed with an LOD of 500.

Fabrication (400)

Elements/objects are modeled to accurately represent detailed building systems, assemblies and components in terms of specification, quantity, size, shape, orientation with complete fabrication, assembly, and detailing information.

Additional metadata may also be attached to elements/objects.

Analysis based on the performance of selected systems of the specific representation of the element/objects may occur.

Record (As-Built) - FM/Asset (500)

Elements/objects are modeled of actual building systems, assemblies and components as constructed, and precisely representing size, shape, location, quantity, and orientation, including (As-Built) conditions.

The Design, Cross-Discipline/Trade and Construction Teams will collaborate and coordinate all BIM(s) to deliver the final Close-Out/Record (As-Built conditions) BIM(s).

All elements, objects/families, etc. in the Record BIM will have COBie attributes for appropriate data tracking.

The Facility Management (FM) Team will use data from the Close-Out/Record BIM(s) to populate FM and CMMS databases.

Exchanges (Design and Construction)

Collaboration and Coordination

Submission

Undefined - By Project Team

Schedule

Undefined - By Project Team

Sharing

Undefined - By Project Team

Workflow

Undefined - By Project Team

File Naming

Undefined - By Project Team

Software

Applications

Undefined - By Project Team

Exchange Requirements

Undefined - By Project Team

IFC (Model Exchange)

Reference Model Workflow

Undefined - By Project Team

Geo-Location

Undefined - By Project Team

Project Location (0,0,0)

Undefined - By Project Team

Stories

Undefined - By Project Team

Documentation

DWG

Undefined - By Project Team

PDF

Undefined - By Project Team

QA/QC

Coordination Meeting Procedures

Undefined - By Project Team

Submission

Undefined - By Project Team

Schedule

Undefined - By Project Team

Review and Approval

Undefined - By Project Team

Accuracy and Tolerances

Undefined - By Project Team

Collision Detection

Undefined - By Project Team

BIM Execution Plan Resources

Acknowledgements

- buildingSMART Alliance

    http://www.nibs.org

- General Services Administration (GSA) – 2003 National 3D-4D BIM Program

    http://www.gsa.gov

- NBIMS National BIM Standard

    https://www.nationalbimstandard.org

- U.S. Department of Veterans Affairs - VA BIM Guide

    http://www.cfm.va.gov/til/bim/BIMGuide

- Pennsylvania State University, Computer Integrated Construction (CIC) Research

    Program http://bim.psu.edu/Project/resources

- Indiana University, University Architect's Office

    http://www.iu.edu/~vpcpf/consultant-contractor/standards/bim-standards.shtml

- Georgia Tech

    https://facilities.gatech.edu

- BIM Smart Foundation

    http://www.bimsmartfoundation.org

- Construction Operations Building Information Exchange (COBie)

    http://www.wbdg.org

- BIMForum - US Chapter of buildingSMART International

    http://bimforum.org

Glossary of Acronyms and Terms

Acronym/Term	Definition
2D/3D/4D/5D	Documentation / Model / Simulation / Estimation
A/E	Architect/Engineer
AEC	Architecture/Engineering/Construction
AECOO	Architecture/Engineering/Construction/Owner/Operator
ASI	Architect's Supplemental Instruction **--** The process used to resolve minor issues in the construction documents so long as they do not affect contract time or money.
BEP	BIM Execution Plan **--** Written plan to integrate the BIM tasks and information with all stakeholders and processes.
BIMs	Building Information Model(s) - Product **--** An object-based digital representation of the physical and functional characteristics of a building or facility. The Building Information Model(s) or Models serve as a shared knowledge resource (database) for information (metadata) about a building or facility, forming a reliable basis for analysis during the functional lifecycle.
BIM	Building Information Modelling - Process **--** A collection of defined model uses, workflows, and modeling methodology used to achieve specific, repeatable, and reliable information results derived from the Model(s) for coordination, communication and collaborations through specific exchanges. Modeling methods affect the quality of the information generated from the BIM(s).
BMP	Best Management Practice **--** **M**ethodology that consistently achieves reliable results, superior to those achieved with other means, and that is used as a benchmark. In addition, a "best" practice can evolve to become better as improvements are discovered.
CAD	Computer Aided Design **--** (Also known as 2D Drawings) A geometric/symbol based computer drawing system that replicated hand drawing techniques. The production of CAD documents are to be completely derived from the BIM model(s).
CAFM	Computer-Aided Facilities Management **--** Includes the creation and utilization of Information Technology (IT)-based systems in the built environment. A typical CAFM system is defined as a combination of Computer-Aided Design (CAD) and/or relational database software with specific abilities for Facilities Management.

Acronym/Term	Definition
CMMS	Computerized Maintenance Management Systems **--** A software package that maintains a computer database of information about an organization's maintenance operations, enabling the facility manager to track the status of maintenance work on their assets and the associated costs and manpower related to that work.
COBie	Construction Operations Building Information Exchange (FM Handover MVD) **--** Information exchange standard/protocol for BIM projects - generally spreadsheet based progressively developed through construction process passed to building operator. The model and facility data for the commission, operations, and maintenance of the project expected from BIM for facility handover in formats suitable for integration into current and future CAFM systems.
Construction Team	A group of professionals working together for a common goal in utilizing techniques and industry involved in the assembly and erection of structures.
Contracting Entity	Is the party or company who enters into a binding agreement with the owner as the primary responsible entity that is awarded the contract.
Cross-Discipline/Trade	Involving two or more different domains of expertise or skills; such as, architects/consulting engineer or fabrication/product design, etc.
Design Team	A group of design professionals working together for a common goal or purpose. It is made up of different individuals with different skills or talents. It may consist of architects, engineers, artists etc.
Design/Construction Team	The term use when both the Design Team and Construction Team is referenced. (See Design Team, Construction Team)
Fabrication	The act or process of manufacturing, to make, build, or construct in reference to building systems or components. Usually means off site fabrication done within a controlled environment resulting in improved accuracy and efficiencies.
GIS	Geographic Information System
GSF	Gross Area Square Feet **--** The sum of all areas on all floors of a building included within the outside faces of its exterior walls. Includes: exterior covered areas, and all vertical penetration areas, for circulation and shaft areas that connect one floor to another. Note: GSF calculations do not include space that is open to below.
HVAC	Heating, Ventilation, Air Conditioning **--** The system used to provide heating and cooling services to building
IPD	Integrated Project Delivery **--** Contractual form relevant to the BIM design and construction process. Not widely used outside of the USA at present.

Acronym/Term	Definition
LEED	Leadership in Energy and Environmental Design **--** Is a green building certification program that recognizes best-in-class building strategies and practices. To receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification.
LOD	Level of Development **--** Scales applied to provide a common understanding of information requirements at different stages of a project (A scale developed by the American Institute of Architects).
MEP	Mechanical, Electrical and Plumbing **--** The professional engineers designing the building systems for Mechanical, Electrical and Plumbing disciplines.
Model	General term used to refer to the computer file or files that may contain BIM data.
NSF	Net Square Feet -- The total square footage of all the rooms/areas on a floor. This includes assignable and non-assignable rooms. Note: NSF calculations do not include wall thickness or space that is open to below. Also referred to as **Net Usable Area (Net Usable Square Feet) NUSF**
O&M	Operations & Maintenance **--** Encompasses a broad spectrum of services required to assure that the built environment will perform the functions for which a facility was designed and constructed.
PFD	Program for Design **--** The development of a comprehensive and purposeful system or plan to achieve a specific goal.
RFI	Request for Information **--** The process of requesting additional information, directive or clarification from the architect or client.

Appendix

BIM Execution Checklists

Not Used