



BIM GUIDE

Developed for



BIM GUIDE

Protocols and Project Execution Plan

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BIM GUIDE

Protocols and Project Execution Plan

■ OBJECTIVE

The College of the Desert is committed to using Building Information Modeling for the design, construction, and management of all its future projects. This guide will cover the overall process of developing a BIM project workflow and the basic understanding of College of the Desert's standard. Please be aware that this document does not cover all project types and is College of the Desert's template for developing project specific execution plans.

By implementing BIM and providing a collaborative environment, College of the Desert will achieve improved design and management of campus building efforts, easy access to standardized building data, and improved coordination efforts.

Building Information Modeling is the development and use of a multi-faceted computer software data model to not only document a building design, but to simulate the construction and operation of a new capital facility or a recapitalized (modernized) facility. The resulting Building Information Model is a data-rich, object-based, intelligent and parametric digital representation of the facility, from which views appropriate to various users' needs can be extracted and analyzed to generate feedback and improvement of the facility design. (U.S. General Services Administration)

■ ROLES & RESPONSIBILITIES

There will be at least one member from each stakeholder involved in the project. Each organization has specific responsibilities during the project life which will be reviewed and agreed upon at the beginning of the project. All major design technical disciplines/trades (architecture, structural, MEP, interior design, etc.) shall assign an individual to the role of BIM Lead to coordinate their work with the entire Design/Construction Team. Below is a brief outline of the responsibilities of each stakeholder.

Define Role		Determine Responsibility in BIM Project Execution Plan	BIM Responsibility
OWNER			
College Project Manager		Participant in the design process	Participant
Owners Representative		Quality assurance, point person to manage and coordinate project	Oversight
A&E TEAM			
Design Team Project Manager		Team manager and coordinator	Coordination & Review
BIM Manager		Coordinate BIM use on project, determine schedule of use, sharing activities, quality control, modeling responsibilities and document	Oversight, Management, Execution, & Model Exchange
Architecture		Design Execution – Formulate with BIM Mgr. Map BIM use for architectural design	Modeler, Review, and Model Exchange
Structure		Engineering – Formulate with BIM Mgr. Map BIM use for structural design – Determine 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, 3 rd Party Rating Systems – Determine BIM use for simulations, analysis, and documentation. Identify tools	Data Development Review & User
Landscape Architect		Formulate with BIM Mgr. Map BIM use for Landscape design	Modeler, Review, and Model Exchange
Civil Engineer		Formulate with BIM Mgr. Map BIM use for Civil design	Modeler, Review, and Model Exchange
BUILD TEAM			
Pick Either 1 or 2	1. Construction Manager	Team manager and coordinator (Owner Rep) Multiple-Prime Contracts	Coordination & Review
	2. Contractor Team Project Manager	Team manager and coordinator	Coordination & Review
BIM Manager		Coordinate BIM use on project	Oversight, Management, Execution, & Model Exchange
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

Figure 1

- **OWNER**

- **College Project Manager**

- Participant in the design process, works with the Design Team and Owner Representative

- **Owner Representative**

- Point person to manage and coordinate the project

- **A&E TEAM**

- **Design Team Project Manager**

- Team manager and coordinator

- **Design Team BIM Manager**

- As part of the execution of the Design BIM Project Execution Plan (refer to appendix), the Design Team shall assign an individual to the role of Design Team BIM Manager. This individual shall have sufficient BIM experience for the size and complexity of the project and shall have relevant proficiency in the proposed BIM authoring and coordination software. The individual shall serve as the main point of contact with the College and the Design Team for BIM related issues.

- **Architecture**

- a. Plan and execute project to achieve BIM goals.
 - b. Coordinate technical discipline BIM development, standards, data requirements, etc. as required with the Design Team BIM Manager
 - c. Lead the technical discipline team in its documentation and analysis efforts
 - d. Coordinate clash detection and resolution activities
 - e. Coordinate internal and external BIM training as required
 - f. Coordinate trade items into the Design BIM (depending on contract strategy)

- **Structure, MEP, Sustainability & Energy**

- a. Determine BIM use for simulations, analysis, and documentation, Identify tools necessary.
 - b. Coordinate technical discipline BIM development, standards, data requirements, etc. as required with the Design Team BIM Manager
 - c. Lead the technical discipline team in its documentation and analysis efforts
 - d. Coordinate clash detection and resolution activities
 - e. Coordinate internal and external BIM training as required
 - f. Coordinate trade items into the Design BIM (depending on contract strategy)

- **Interior Design, Landscape Architect, Civil Engineer**

- a. Work with BIM Manager and Architect to determine discipline goals for BIM.
 - b. Coordinate technical discipline BIM development, standards, data requirements, etc. as required with the Design Team BIM Manager
 - c. Lead the technical discipline team in its documentation and analysis efforts
 - d. Coordinate clash detection and resolution activities
 - e. Coordinate internal and external BIM training as required
 - f. Coordinate trade items into the Design BIM (depending on contract strategy)

- **BUILD TEAM**

Depending on the Project's contract strategy there could be two choices for the structure of the Build Team.

For Multiple Prime Contracts the primary is:

- **Construction Manager**
Team manager and coordinator

For all other Contracts the primary is:

- **Contractor Team Project Manager**
Team manager and coordinator

The remainder of the Build Team will be structured as follows:

- **Construction Team BIM Manager**
The Construction Team Project Manager shall identify the individual assigned to be the Construction BIM Manager. This individual shall have the appropriate level of relevant BIM experience required for the project complexity and contract delivery strategy.
- **Contractor**
Receives or helps create BIM for Constructability and handover for Field Use. Determine Interference checking responsibility
- **Subcontractor**
BIM used for fabrication and shop drawing design. Determine BIM use for simulations of maintenance space analysis, and documentation. Identify tools.
The following construction trades shall provide 3D fabrication models with parametric model objects:
Structural Steel
Mechanical System Duct MEP subcontractors (vendor models if available)
Curtain Wall
Building Envelope Systems (rain screens, pre-cast panels, glazing systems)
Casework and furniture systems
Any additional fabrication models generated by subcontractor

■ CONTRACT STRATEGIES

When beginning a project it is important to define what kind of contract strategy the project team will be following.

If using a delivery structure, other than IPD, with BIM, it is important to include the ideals of IPD within that structure where possible. These ideals include collaborative, integrated and productive teams comprised of key project participants, building upon early contributions of individual expertise; these teams are guided by principles of trust, transparent process, shared risk and reward, value-based decision making, and utilization of full technological capabilities and support.

Three common strategies are the following:

- i. Design Bid Build (Traditional): When the owner's project is divided into separate contracts for design (with the architect) and construction (with one or more contractors)
 - No collaboration between designer and GC.
 - GC to meet BIM requirements based on model(s) created by others.
 - Liability concerns
- ii. IPD Integrated project delivery: is a collaborative project delivery approach that utilizes the talents and insights of all project participants through all phases of design and construction.
- iii. Design Build: In design-build project delivery, the owner enters into a contract with a design-builder who is obligated to design and construct the project. The design-builder then enters into contracts with architects and construction contractors, as needed.
 - Establishes a collaborative effort between owner, designer and constructor.
 - Input by General Contractor early on in process.
 - Similar advantages in CM-at-Risk and Integrated Project Delivery
- iv. Multiple Prime Contracts: Instead of contracting with a single contractor who then subcontracts out some or all of the work, the owner contracts directly with various trade contractors for the performance of their segment of the work. The owner may contract directly with a few trade contractors or with many contractors depending upon the owner's ability to effectively manage the contractors.
Because of the scheduling, coordination, and cost control problems inherent in the multiple-prime method, many owners will engage a construction manager or other advisors to assist with the process. Other owners may have their own in-house project management team that will assume responsibility for coordination, scheduling, and cost control.

■ LEVEL OF DEVELOPMENT

AIA Document E202 has established a protocol for the expected levels of development, and authorized uses of Building Information Models on the Project and assigns specific responsibility for the development of each Model Element to a defined Level of Development at each Project phase. The level of development will be project specific and determined by College of the Desert and the A/E team. Please see Appendix B for a sample of the AIA Model Element Table that gives the minimum requirements for College of the Desert Building Information Models. This sample is describing the model only and does not suggest that this is the minimum level of detail for the contract documents. Each project team will need to revisit and update the AIA Model Element Table as necessary at the beginning of the project.

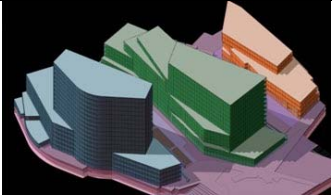
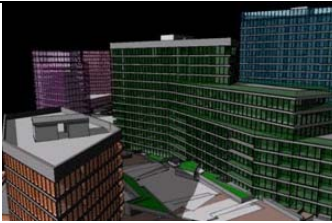
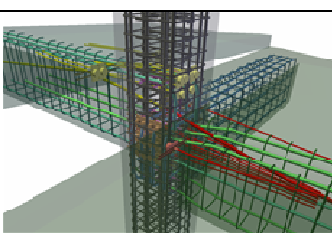
	LOD 100 – Essentially the equivalent of conceptual design, the model would consist of overall building massing and the downstream users are authorized to perform whole building types of analysis (volume, building orientation, cost per square foot, etc.)
	LOD 200 - Similar to schematic design or design development, the model would consist of "generalized systems or assemblies with approximate quantities, size, shape, location and orientation." Authorized uses would include "analysis of selected systems by application of generalized performance criteria."
	LOD 300 - Model elements are suitable for the generation of traditional construction documents and shop drawings. As such, analysis and simulation is authorized for detailed elements and systems.
 Image courtesy of Mortenson Construction	LOD 400 - This level of development is considered to be suitable for fabrication and assembly. The MEA for this LOD is most likely to be the trade contractor or fabricator as it is usually outside the scope of the architect's or engineer's services or would constitute severe risk exposure if such parties are not adequately insured.
	LOD 500 - The final level of development represents the project as it has been constructed - the as-built conditions. The model is suitable for maintenance and operations of the facility.

Figure 2
(<http://allthingsbim.blogspot.com/2008/12/aia-bim-protocol-e202.html>)

The following is the AIA E202 explanation of each Level of Development:

LOD100

Model Content Requirements. Overall building massing indicative of area, height, volume, location, and orientation may be modeled in three dimensions or represented by other data.

Authorized Uses

Analysis. The Model may be analyzed based on volume, area and orientation by application of generalized performance criteria assigned to the representative Model Elements.

Cost Estimating. The Model may be used to develop a cost estimate based on current area, volume or similar conceptual estimating techniques (e.g., square feet of floor area, condominium unit, hospital bed, etc.)

Schedule. The Model may be used for project phasing and overall duration.

LOD 200

Model Content Requirements. Model Elements are modeled as generalized systems or assemblies with approximate quantities, size, shape, location, and orientation. Non-geometric information may also be attached to Model Elements.

Authorized Uses

Analysis. The Model may be analyzed for performance of selected systems by application of generalized performance criteria assigned to the representative Model Elements.

Cost Estimating. The Model may be used to develop cost estimates based on the approximate data provided and conceptual estimating techniques (e.g., volume and quantity of elements or type of system selected).

Schedule. The Model may be used to show ordered, time-scaled appearance of major elements and systems.

LOD 300

Model Content Requirements. Model Elements are modeled as specific assemblies accurate in terms of quantity, size, shape, location, and orientation. Non-geometric information may also be attached to Model Elements.

Authorized Uses

Construction. Suitable for the generation of traditional construction documents and shop drawings.

Analysis. The Model may be analyzed for performance of selected systems by application of specific performance criteria assigned to the representative Model Elements.

Cost Estimating. The Model may be used to develop cost estimates based on the specific data provided and conceptual estimating techniques.

Schedule. The Model may be used to show ordered, time-scaled appearance of detailed elements and systems.

LOD 400

Model Content Requirements. Model Elements are modeled as specific assemblies that are accurate in terms of size, shape, location, quantity, and orientation with complete fabrication, assembly, and detailing information. Non-geometric information may also be attached to Model Elements.

Authorized Uses

Construction. Model Elements are virtual representations of the proposed element and are suitable for construction.

Analysis. The Model may be analyzed for performance of approved selected systems based on specific Model Elements.

Cost Estimating. Costs are based on the actual cost of specific elements at buyout.

Schedule. The Model may be used to show ordered, time-scaled appearance of detailed specific elements and systems including construction means and methods.

LOD 500

Model Content Requirements. Model Elements are modeled as constructed assemblies actual and accurate in terms of size, shape, location, quantity, and orientation. Non-geometric information may also be attached to modeled elements.

Authorized Uses

General Usage. The Model may be utilized for maintaining, altering, and adding to the Project, but only to the extent consistent with any licenses granted in the Agreement or in a separate licensing agreement.

■ BIM PROJECT EXECUTION PLAN

Below are outlines of the Project Execution Plans for the Design and Construction Teams. The BIM Project Execution Plan will organize and steer the project participants through a structured process to develop a detailed and consistent plan for the lifecycle of the project. The template provided in Appendix A will assist the A/E team with achieving College of the Desert BIM requirements.

Design Project Execution Plan

The Design Team shall submit the Project Execution Plan for review and approval before the start of schematic design. At a minimum, the Project Execution Plan shall contain the following:

- a. The project contract strategy (DBB, DB, IDC Multiple Prime) and how the Design BIM will support the project delivery activity
- b. Legal status that the Design Model will have for construction (Binding, Informational, Reference, Reuse)
- c. BIM qualifications, experience, and contract for all major disciplines (Architect, Civil, MEP, Structural, etc.)
- d. Proposed project goals and objectives to be achieved in the project.
- e. Energy modeling strategies
- f. Project schedule aligned to BIM development and progress submittals per Submission Standards. Schedule to include:
 1. Software compatibility testing schedule (if required)
 2. Proposed BIM workshops and training as needed
 3. Progress BIMs per Design Document Submission
- g. Proposed BIM software to be used by each technical discipline team member
- h. File formats used for project submittal and file sharing
- i. Strategy for updating and coordinating changes during construction into the final BIM model deliverable files
- j. Strategy for hosting, transfer, locations, support, and access of data between technical disciplines (use of model server, FTP, extranet, access, security, etc.) A technical evaluation of the options to match the IT technical needs of the size and complexity of the project, and to provide access by the Design/Construction Team and, peer reviewers, etc.
- k. Documentation of any proposed deviation from College BIM Standards for approval

Construction Project Execution Plan

After bid award, the Contractor shall submit a Construction BIM Project Execution Plan, outlining the strategy and schedule for utilizing BIM Technology to execute construction related activities and project coordination. Following this outline will assist the Construction Team with achieving College of the Desert BIM requirements. The Construction Project Execution Plan shall address the following:

- a. The project contract strategy (DBB, DB, IDC, Multiple Prime) and how the Construction BIM will support the project delivery activity. When a DBB execution strategy is used, the Construction Project Execution Plan shall address the specific strategy for the Design BIM reuse.
- b. Identification of the legal status of the Design Model to construction (Binding, Informational, Reference, Reuse)
- c. BIM qualifications, experience, and contact information for all trades.
- d. Constructability analysis with BIM
- e. Proposed trade coordination strategy (clash detection)
- f. Proposed use of digital fabrication
- g. Utilization of 4D scheduling and construction sequencing technology (as specified in contract)
- h. List of sub-contractors using digital fabrication
- i. Proposed BIM Software to be used by the builder and fabrication modelers
- j. Strategy to assure all trade information is modeled and coordinated
- k. Proposed sub-contractor BIM workshops and training integrated into project schedule
- l. Integration of construction changes and commissioning data into BIM
- m. Strategy for COBIE integration and submittals (as specified in contract)
- n. Strategy for updating and coordinating changes during construction into the final BIM deliverable
- o. Updating as-built conditions in As-built/Record BIM
- p. Strategy for software compatibility, file formats, hosting, transfer, locations, support, and access of data between trades (use of model server, FTP, extranet, access security, etc.) A technical evaluation of the options to match the IT technical needs of the size and complexity of the project, and to provide access by the Design/Construction Team and, fabricators, etc.
- q. Documentation of any proposed deviation from College BIM Standards for approval

■ APPROVED SOFTWARE

The table below describes the lists the approved BIM software. All software used should be the most recently released version unless determined otherwise by the College of the Desert.

Software	Available
Authoring – Design (Architecture, Structural)	Revit Architecture, Bentley BIM, ArchiCAD, Tekla or equal
Authoring - MEPF (design & construction)	Revit MEP, AutoCAD MEP, Bentley BIM, CAD-Duct, CAD-Pipe, AutoSprink, PipeDesigner 3D or equal
Authoring - Civil	Bentley Inroads and Geopak, Autodesk Civil 3D
Coordination (spatial conflict, clash detection)	NavisWorks Manage or Bentley Navigator
4D Scheduling	Synchro, Vico, NavisWorks Simulate, Primavera, MS Project , Bentley Navigator
Cost Estimate	Innovaya, Vico or equal
Energy Analysis	Green Building Studio, IES, Ecotect, Hevacomp, TAS, or equal
Specifications	E-Specs or equal
Model Checking Validation, IFC File Optimizer	Solibri or equal
Water Management	Bentley WaterGem

Figure 3

■ FILE STRUCTURE

The organization and naming convention for files is critical so that the linked files function properly. It is important to set up a protocol for the team when the Project Execution Plan is developed.

Sample Naming Convention:

ARCH-Project-Project #
STRUCT-Project-Project #
MECH-Project-Project #
ELEC-Project-Project #
PLUMB-Project-Project #
CIVIL- Project-Project #

Model Folders:

There should be a model folder for each discipline. The files should have a relative path to models.

Archive Folder:

Milestone Submittals – Model & PDF set

Family Folder:

Any project specific families created or modified

Support Folder:

Any logos, graphics, applications such as script, etc needed for the project

Coordination Folder:

Files for Construction coordination in format for clash detection software and organized by date.

Renderings, LEED, Specifications, Analysis, and other information will have their own folders as the project team sees fit.

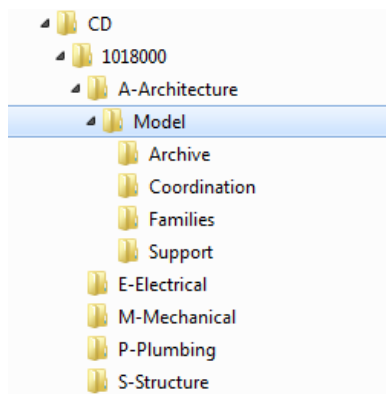


Figure 4

■ DATA SECURITY PROTOCOL

A protocol should be established by design teams to prevent any possible data corruption. Both the Design and Construction Teams shall establish adequate user access rights to prevent data loss or damage during file exchange, maintenance, and archiving.

■ DELIVERABLES

The model should be audited, cleaned of all extraneous materials/design work, and compressed.

Unless otherwise noted in the Contract Strategy or the BIM Project Execution Plan the following should be included in the final deliverables:

DESIGN TEAM:

1. Native file format of the Design Intent Model in the appropriate version as agreed upon in the Project Execution Plan
2. IFC file format in the version agreed upon by the Project Execution Plan
3. One printed full size set of drawings of the final documents produced from the Design Intent Model
4. One set of drawings in PDF file format of the final documents produced from the Design Intent Model
5. All digital files should be submitted to the College of the Desert on a CD/DVD. All data should be organized with the appropriate date and labels.

CONTRACTOR:

1. Native file format of the final As-Built Model for building systems in the approved version as agreed upon in the Project Execution Plan
2. IFC file format of the As-Built Model in the version agreed upon by the Project Execution Plan
3. One set of drawings in PDF file format of the final documents produced from the As-Built Model
4. All digital files should be submitted to the College of the Desert on a CD/DVD. All data should be organized with the appropriate date and labels.

■ COLLABORATION

The success of using BIM is completely dependent upon how well the project team communicates and collaborates during the life of the project. The following are examples of the collaboration process:

Project Kickoff Meeting

Upon award of the project, College of the Desert will facilitate a project kickoff meeting. College of the Desert will review the project requirements and answer questions from the project team.

BIM Coordination Meetings

During design and construction, teams will meet to facilitate BIM design review and clash detection/coordination. All team members will discuss technical discipline coordination issues using the BIM models. Regular meetings will be needed; the occurrence of these meetings will depend on the contract strategy. Alternatively, collaboration meetings using web conferencing (webinar) is acceptable for facilitating these meetings. Appropriate equipment and tools shall be provided. Smart boards may be used to view documentation (2D & 3D) and create mark ups interactively.

During construction, meetings will take place at the construction site.

Subcontractor Coordination

Prior to installation, the Contractor shall hold trade coordination meetings with subcontractors. The coordinated model will be used to review and optimize scheduling and field installation. Subcontractors will be expected to have individuals attend who can actively engage in the subcontractor coordination process and make schedule commitments.

Email

Notification of file uploads or any other email correspondence pertaining to the project shall include the acronym for the project name included in the subject line.

■ MODEL FORMAT

The models shall contain objects and elements that represent the actual dimensions of the building elements and the building equipment that will be installed on the project. BIM Managers will work with the design teams to develop the model and model views for coordination.

Models shall include representations of required clearances. The clearances should be shown and labeled in a separate view.

The granularity of elements in the model shall correspond with the proposed sequence of the installation at the site. For example, do not use one wall element for the entire floor.

Models submitted for clash detection shall be “clean” of all extraneous 2D references and/or 3D elements.

For coordination with subcontractors a 3D marker is placed at the model origin.

■ MODELING REQUIREMENTS

General

The Building Information Model will be used for all building system design, development, and analysis, including but not limited to architectural, structural, mechanical, electrical, plumbing, and fire suppression.

During Conceptual Design, Schematic Design, and Design Development BIM technology shall be used to develop and establish building performance and the basis of design in accordance with College of the Desert Standards. The model shall be interoperable with analytic tools including but not limited to building envelope, orientation, daylighting, energy consumption, building management system (BMS), renewable energy strategies, life cycle cost analysis, and spatial requirements.

Use appropriate element libraries when creating model object. Model objects shall contain parts and components as opposed to simple 3D geometry (e.g., walls, doors, windows, railings, stairs, and furniture).

Model objects shall contain IFC parameters and associated data applicable to building system requirements.

The Contractor shall utilize model geometry and extract graphical information for generating construction administration documents from the project model (e.g., RFI's, Directives, Bulletins, and Change Orders). The Contractor shall record as-built conditions in BIM as part of final delivery.

Submittal drawings, calculations and analysis shall be extracted from the coordinated model.

Elements, objects and equipment shall be uniquely tagged.

Types of Elements

Model elements shall be derived from the following sources only:

1. Manufacturer's Model Elements: elements created by and acquired from manufacturers often have more information than is necessary to keep in the BIM model. The appropriate level of detail should be retained for the design element. However, embedded performance data shall remain for analysis and specification purposes.
2. Custom Created Model Elements: custom model elements that are created must utilize appropriate BIM Authoring tool templates to create custom elements. Custom model components need to be assigned as a part and a part of a family or group.

Origin

At the beginning of a project, a reference origin must be established by the project team. The College of the Desert would like to use the established campus monument as the reference origin for all projects. This information will be given to the project team at the start of the project.

Once the location of the building has been tied to campus monument and verified in the civil site plan, the location of the building in the architectural model shall take precedence over all other trades, and the defined origin shall not be moved. In the event that the lower left corner of the building changes location or shape, reference lines (or planes) should be drawn and noted at the original project origin to maintain a visual recognition of this origin.

Grids

The architecture BIM Lead shall provide a 3D grid for incorporation into the model.

Space Information

Areas of four square feet or greater shall be tracked in the model. Spatial data will be generated and is associated with bounding elements such as walls, doors, floors, ceilings, etc. Space/area schedules and diagrams must be dynamically updated from the model geometry. All College of the Desert spatial requirements must be validated through reports generated from the model.

Space Naming

Each space shall include the following parameters in its properties dialogue:

- Room Name
- Room Number
- Occupancy
- Department
- Occupant
- Area

Furniture, Fixtures, and Equipment Coding

Each piece of furniture, fixture, and equipment in the project scope will have the necessary parameters included. Information will vary depending on the LOD for the submission phase. The following parameters will be included at minimum:

- Item Name
- Model
- Manufacturer
- Assembly Code – (based on hierarchal list of UniFormat Codes assigned by R.S. Means)

■ DRAWING REQUIREMENTS

General

All 2D information for the purposes of assembling a printed set of documents shall be derived from the BIM model(s) to the fullest extent possible. All BIM information shall be fully parametric so that all applicable information regarding fixtures and/or elements can be generated for schedules.

Font

Arial font typeface shall be used. The font size shall be at a minimum of 3/32".

Line Styles & Line Weights

The default line styles of the BIM software shall be used. The A/E has the discretion and responsibility to edit the default line weights as necessary to reflect the graphic intent of the National CAD Standards.

Interior Partitions

Each type of wall used in the project is created in model form. It is important for project teams to establish a naming convention to manage the partition types within the BIM model. At minimum the following parameters for walls shall be tracked:

- Partition Type
- Partition Tag
- Fire Rating
- Construction Type – Metal Stud, Wood Stud, Concrete, Masonry
- Structural Usage
- Assembly Code – (based on hierarchal list of UniFormat Codes assigned by R.S. Means)
- Size
- UL listing

Doors

Door types should be created to accurately reflect each kind of door in regards to type, size and information. At minimum the following parameters for doors shall be tracked:

- Frame Material
- Door Panel Material
- Width
- Height
- Fire Rating

Casework

Each component of casework in the project should be modeled to the appropriate LOD for the project phase. At minimum, the following parameters should be tracked:

- Counter Material
- Counter Type
- Base Surfaces Material
- Base Surfaces Type

Finishes

At minimum the following parameters for finishes shall be tracked:

- Floor Finish/Type
- Base Material/Finish
- North Wall Material/Finish
- East Wall Material/Finish
- South Wall Material/Finish
- West Wall Material/Finish
- Ceiling Material/Finish
- Multiple Finishes in the same room
- Comments/Footnotes

Model Text

It is important to keep all annotation elements organized in the model. There are two important types of text, General Notes which are in every project, and Sheet Notes (keynotes) that reference specific geometry. Any notation that will populate multiple sheets shall be put on views that allow duplication of the notations. Rather than using loose text (which is meaningless to the model), BIM software allows model objects to be linked from the object's parameters to the tag or notation. Use either the specification number or the object description when tagging.

■ APPENDIX A

BIM Project Execution Plan Template

- A. Overview & Mission Statement
- B. Project Description
- C. Core Collaboration Team
- D. Project Team per Discipline
- E. BIM Lead
- F. Project Goals & Objectives
- G. BIM Uses
- H. Project Phases/Milestones
- I. Modeling Plan
- J. File Sharing Protocol
- K. Deviation from Standards

A. Overview

To successfully implement Building Information Modeling (BIM) on a project, the project team will need to complete this detailed BIM Project Execution Plan. The BIM Project Execution Plan defines uses of BIM on the project (e.g. design authoring, cost estimating, and design coordination), along with a detailed design of the process for executing BIM throughout the project cycle.

BIM Mission Statement:

B. Project Description

Enter key information about the project below. Include the project name, the owner's project number, the address, and the project description.

Project Name	
Owner's Project Number	
Contract Type/Delivery Method	
Project Address	
Project Description	
Legal Status of Design Model (in Construction)	

C. Core Collaboration Team

Your project's Core Collaboration Team ideally includes at least one person from each stakeholder involved in the project, such as the owner, architect, contractor, sub-consultants, suppliers, and trade contractors. This team is responsible for:

- Completing this BIM Project Execution Plan
- Creating the document management file folder structure and permission levels in the collaborative project management system
- Enforcing the action plan set out in this document throughout the design and construction of the project. To complete this BIM Project Execution Plan, the Core Collaboration Team on your project will:
- List the goals and objectives of using BIM and collaborative project management technologies on your project
- Specify the project's phases/milestones
- Map out the communication among project team members for the different project phases

List the Core Collaboration Team members for your project below.

Contact Name	Role / Title	Company	Email	Phone

D. Project Team per Discipline

Your Project Team includes all of the people that you have working on the project in-house. Each discipline, such as the architect, structural, mechanical, electrical, and plumbing engineers shall have a project team.

List the in-house Project Team members for your project below.

Project Manager	
Project Architect	
BIM Lead	
BIM Technician	

E. BIM Lead

Each party – such as the owner, architect, contractor, or sub-consultants – that is responsible for contributing modeling content should assign a BIM Lead to the project. The BIM Lead from each party has a number of responsibilities. They include, but are not limited to:

- Transferring modeling content from one party to another
- Validating the level of detail and controls as defined for each project phase
- Validating modeling content during each phase
- Combining or linking multiple models
- Participating in design review and model coordination sessions
- Communicating issues back to the internal and cross-company teams
- Keeping file naming accurate
- Managing version control
- Properly storing the models in the collaborative project management system

List each party's BIM Lead for the project in the table below.

Stakeholder Company Name	BIM Lead Name	Email	Phone

F. Project Goals and Objectives

Using collaborative project management and BIM Technologies on projects can offer tangible as well as intangible benefits. List your objectives for using BIM and collaborative project management technology and processes on this project below. Also list how you will measure the achievement of these objectives and their targeted timeframes. The first line shows an example.

Project Goal	Objective	Archived if	Projected Timeframe
<i>Streamline structural steel procurement</i>	<i>Include the steel supplier in the modeling process in order to start fabrication earlier</i>	<i>Steel is ready and delivered to site when needed</i>	<i>April 2011</i>

G. BIM Uses:

Highlight and place an X next to the additional BIM Uses as selected by the project team using the BIM Goal & Use Analysis Worksheet. See BIM Project Execution Planning Guide at www.engr.psu.edu/BIM/BIM_uses for Use descriptions. Include additional BIM Uses as applicable in empty cells.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		Design Authoring		Site Utilization Planning		Building Maintenance Scheduling
	SITE ANALYSIS		Design Reviews		Construction System Design		Building System Analysis
			3D Coordination		3D Coordination		Asset Management
			Structural Analysis		Digital Fabrication		Space Management / Tracking
			Lighting Analysis		3D Control And Planning		Disaster Planning
			Energy Analysis		Record Modeling		Record Modeling
			Mechanical Analysis				
			Other Eng. Analysis				
			Sustainability (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

H. Project Phases/Milestones

Traditional project delivery includes the phases of schematic design, design development, construction documents, construction operations, etc. Integrated project delivery (IPD) phases may include conceptualization, criteria design, detailed design, implementation documents, and others. For more information on IPD project phases, see the American Institute of Architects publication, *Integrated Project Delivery: A Guide*, 2007 (available at www.aia.org/jpdg).

In the table below, outline the phases of your project, their estimated start dates, and the stakeholders involved. The first line shows an example.

Project Phase / Milestone	Estimated Start Date	Estimated Completion Date	Project Stakeholders Involved
<i>Conceptualization</i>	<i>2/1/2012</i>	<i>4/1/2014</i>	<i>Owner, A/E, Sub-consultants, CM</i>

I. Modeling Plan

Advance planning around which models will need to be created during the different phases of the project, who will be responsible for updating models and distributing them, and predetermining the content and format of models as much as possible, will help your project run more efficiently and cost-effectively during every phase.

1. Planned Models

During the course of your project, the project team may generate multiple models. Typically the architect and their sub-consultants generate a Design Intent Model to depict the design intent of the building, and the contractor and their subcontractors generate a Construction model to simulate construction and analyze the constructability of the building. The construction team should provide input for the Design Intent model, while the design team should provide input for the Construction model.

Even when the team is committed to using integrated project delivery (IPD) methods, creating separate models is sometimes necessary based on contractual obligations, risk factors, and the functional intent of each model. For example, the Design Intent model – used to depict the design intent – may not include information on the means and method of sequencing of construction. Other models may be created specifically for certain types of analysis, such as energy consumption or safety. These Analysis models are usually spin-offs of either the Design Intent model or the Construction model.

In the table below, outline the models that will be created for the project. List the model name, model content, project phase when the model will be delivered, the model's authoring company, and the model authoring tool that will be used. For models that will not be used or created in your project, just leave the row blank, and add rows for model types you anticipate needing that are not already listed. The first line offers an example.

Model Name	Model Content	Project Phase	Authoring Company	Authoring Tool
<i>Coordination Model</i>	<i>Architectural, Structural, and MEP components of main building and parking garage structure</i>	<i>Design Development and Construction Documents</i>	<i>ABC Designers</i>	<i>Revit Architecture by Autodesk</i>
Civil Model				
Architectural Model				
Structural Model				
MEP Model				
Construction Model				
Coordination Model				
As-Built Model				
Energy Analysis Model				

2. Model Components

As an aid to usability during later phases of your project, specify what the content, level of detail, and file naming structure of your models should look like.

- **File Naming Structure**

Determine and list the structure for model file names. The first line offers an example.

File Names for Models Should Be Formatted As
model type, hyphen, date, e.g.: DESIGN-011208

- **Precision and Dimensioning**

Models should include all appropriate dimensioning as needed for design intent, analysis, and construction. With the exception of the exclusions listed below, the model will be considered accurate and complete. In the table below, enter which items' placement will not be considered entirely accurate and should not be relied on for placement or assembly.

Items that Will Not Be Considered Accurate for Dimensioning or Placement

- **Modeling Object Properties**

The level of property information in the modeling objects and assemblies depends on the types of analysis that will be performed on the model.

- **Modeling Level of Detail**

Specify the level of detail in your models below. The level of detail can be defined by exclusions and/or by object size.

1. Exclusions: List the objects that will be excluded from the model in the table below. The first line offers an example.

Items that Will Be Excluded from the Model
Door hardware

2. Size: Any object smaller than (_____) (Fill in item size, for example, 6"x6"x6") will not be included in the model.

- **Model Reference Coordination**

Models may be linked or combined. In order for the referencing to work properly, a (0,0,0) reference point must be established. Fill in the (0,0,0) reference point for this project in the table below.

Project's (0,0,0) Reference Point	
--	--

3. Contract Documents

Two-dimensional paper drawings or documents may be generated from certain models to fulfill contract document deliverable requirements. Certain models will be used for analysis purposes only and will not be included as part of the contract documents. List the models that will be considered part of the contract documents in the table below.

Models to Be Considered Part of Project Contract Documents

J. File Sharing Protocol

The following document management issues should be resolved and a procedure should be defined for each:

- A. Permissions/Access (Who is granted access to FTP Server/Host Server/Model)
- B. Server Locations (For BIM Servers)
- C. FTP Site Location(s)
- D. File Transfer Protocol
- E. Support (Ensure files and models shared are current.)

K. Deviations from Standards

Any deviations from the College of the Desert Standards must be documented below for approval by the College.

Deviations from Standards

■ APPENDIX B
AIA Document E202 – 2008
Article 4
(Sample Only)

DRAFT AIA® Document E202™ – 2008

Building Information Modeling Protocol Exhibit

10-10

ARTICLE 4 MODEL ELEMENTS

§ 4.1 Reliance on Model Elements

§ 4.1.1 The Model Element Table at Section 4.3 identifies (1) the LOD required for each Model Element at the end of each Project phase, and (2) the Model Element Author responsible for developing the Model Element to the LOD identified. Each Model Element Author's content is intended to be shared with subsequent Model Element Authors and Model Users throughout the course of the Project.

§ 4.1.2 It is understood that while the content of a specific Model Element may include data that exceeds the required LOD identified in Section 4.3 for a particular phase, Model Users and subsequent Model Element Authors may rely on the accuracy and completeness of a Model Element consistent only with the content required for a LOD identified in Section 4.3.

§ 4.1.3 Any use of, or reliance on, a Model Element inconsistent with the LOD indicated in Section 4.3 by subsequent Model Element Authors or Model Users shall be at their sole risk and without liability to the Model Element Author. To the fullest extent permitted by law, subsequent Model Element Authors and Model Users shall indemnify and defend the Model Element Author from and against all claims arising from or related to the subsequent Model Element Author's or Model User's modification to, or unauthorized use of, the Model Element Author's content.

§ 4.2 Table Instructions

§ 4.2.1 The table in Section 4.3 indicates the LOD to which each Model Element Author (MEA) is required to develop the content of the Model Element at the conclusion of each phase of the Project.

§ 4.2.2 Abbreviations for each MEA to be used in the Model Element Table are as follows:

(Provide abbreviations such as "A – Architect," or "C – Contractor.")

Abbreviation	Model Element Author (MEA)
A	Architect
S	Structural Engineer
M	Mechanical Engineer
E	Electrical Engineer
P	Plumbing Engineer
C	Civil
GC	General Contractor
L	Landscape Architect

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA Standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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1

§ 4.3 Model Element Table						Minimum Model LOD Required of Design Team												Note Number (See 4.4)	
Identify (1) the LOD required for each Model Element at the end of each phase, and (2) the Model Element Author (MEA) responsible for developing the Model Element to the LOD identified.																			
Insert abbreviations for each MEA identified in the table below, such as "A – Architect," or "C – Contractor."																			
NOTE: LODs must be adapted for the unique characteristics of each Project.																			
Model Elements Utilizing CSI UniFormat™						LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA		
A	SUBSTRUCTURE	A10	Foundations	A1010	Standard Foundations	200	S												
				A1020	Special Foundations	200	S												
				A1030	Slab on Grade	200	S												
	A20	Basement Construction	A2010	Basement Excavation	200	S													
			A2020	Basement Walls	200	S													
B	SHELL	B10	Superstructure	B1010	Floor Construction	200	S												
				B1020	Roof Construction	200	S												
				B2010	Exterior Walls	200	A/S												
		B20	Exterior Enclosure	B2020	Exterior Windows	200	A												
				B2030	Exterior Doors	200	A												
				B3010	Roof Coverings	200	A												
	B30			Roofing	B3020	Roof Openings	200	A/S											
C	INTERIORS	C10	Interior Construction	C1010	Partitions	200	A												
				C1020	Interior Doors	200	A												
				C1030	Fittings	200	A												
		C20	Stairs	C2010	Stair Construction	200	A												
				C2020	Stair Finishes	200	A												
		C30	Interior Finishes	C3010	Wall Finishes	200	A												
				C3020	Floor Finishes	200	A												
				C3030	Ceiling Finishes	200	A												
D	SERVICES	D10	Conveying	D1010	Elevators & Lifts	200	A												
				D1020	Escalators & Moving Walks	200	A												
				D1030	Other Conveying Systems	200	A												
		D20	Plumbing	D2010	Plumbing Fixtures	200	M												
				D2020	Domestic Water Distribution	200	M												
				D2030	Sanitary Waste	200	M												
				D2040	Rain Water Drainage	200	M												
				D2090	Other Plumbing Systems	200	M												
		D30	HVAC	D3010	Energy Supply	200	M												
				D3020	Heat Generating Systems	200	M												
				D3030	Cooling Generating Systems	200	M												
				D3040	Distribution Systems	200	M												
				D3050	Terminal & Package Units	200	M												
				D3060	Controls & Instrumentation	200	M												
				D3070	Systems Testing & Balancing	200	M												
				D3080	Other HVAC Systems & Equipment	200	M												
				D3090	Other HVAC Systems & Equipment	200	M												
				D3100	Other HVAC Systems & Equipment	200	M												
		D40	Fire Protection	D4010	Sprinklers	200	M												
				D4020	Standpipes	200	M												
				D4030	Fire Protection Specialties	200	M												

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■ APPENDIX C

Glossary

A

AIA E202 – AIA Document E202™ 2008 is a practical tool for managing the use of building information modeling (BIM) across a project. It establishes the requirements for model content at five progressive levels of development, and the authorized uses of the model content at each level of development. Through a table the parties complete for each project, AIA Document E202–2008 assigns authorship of each model element by project phase. E202 defines the extent to which model users may rely on model content, clarifies model ownership, sets forth BIM standards and file formats, and provides the scope of responsibility for model management from the beginning to the end of the project. Though written primarily to support a project using integrated project delivery (IPD), E202 may also be used on projects delivered by more traditional methods. E202 is not a stand-alone document, but must be attached as an exhibit to an existing agreement for design services, construction or material. NOTE: E202–2008 is available in AIA Contract Documents software, but is not available in print. (AIA website)

As-Built Documents – As-built documents are the collection of paper drawings or electronic drawings that typically reside in the contractor’s onsite trailer that contain mark-ups, annotations, and comments about changes that have been made to the contract documents during the construction phase. (Indiana University)

As-Built Model – Design Intent Models that have been updated throughout the construction process. These changes and updates have either been made by the Construction Team or they have been communicated from the Contractor to the Design Team through the comments, annotations, and mark-ups from the As-Built Documents. These are typically, but not always, discipline specific models. (Indiana University)

B

BIM – (Building Information Model) a digital representation of the physical and functional characteristics of the Project. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder.

BIM – (Building Information Modeling) a process focused on the development, use, and transfer of a digital information model of a building project to improve the design, construction and operations of a project or portfolio of facilities.

BIM Goals – Objectives used to define the potential value of BIM for a project and for project team members. BIM Goals help to define how and why BIM will be used on a project or in an organization. (Pennsylvania State University)

BIM Process – A generic name for the practice of performing Building Information Modeling. This process can be planned or unplanned. The BIM Process may also be referred to as the BIM Execution Process or the BIM Project Execution Process. (Pennsylvania State University)

BIM Process Maps – A diagram of how BIM will be applied on a project. (Pennsylvania State University)

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

BIM Tool – A software application used to generate and manipulate building information models. The term can be further qualified to denote specific application areas. For example, “BIM Design Tool” is often used to refer to tools used primarily for architectural design, such as Revit Building, Bentley Architecture, Digital Project, and ArchiCAD.

Building Management System (BMS) - is a computer-based control system installed in buildings that controls and monitors the building’s mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.

BuildingSMART Alliance – Created to spearhead technical, political, and financial support for advanced digital technology in the real property industry—from concept, design and construction through operations and management—the buildingSMART alliance operates within the independent nonprofit National Institute of Building Sciences (NIBS). (BuildingSMART Alliance website)

C

CAD – Computer Aided Design. A geometric/symbol based computer drawing system used in art, architecture, engineering, and manufacturing to assist in precision drawing.

COBIE – The model and facility data for the commission, operations, and maintenance of the project shall satisfy the Construction Operations Building Information Exchange (COBIE) requirements, and be submitted in compliance with the commissioning requirements.

Clash Detection - is a process of discovering the building system conflicts and issues by collaborating in 3D during the coordination process. Sometimes referred to as interference checking and/or interference avoidance.

CM at Risk - is a delivery method which entails a commitment by the construction manager to deliver the project within a Guaranteed Maximum Price (GMP), in most cases.

D

Design Build – In design-build project delivery, the owner enters into a contract with a design-builder who is obligated to design and construct the project. The design-builder then enters into contracts with architects and construction contractors, as needed.

Design Bid Build – When the owner's project is divided into separate contracts for design (with the architect) and construction (with one or more contractors)

Design Intent Model – is a BIM model developed by an architect from which the automated construction documents are derived, along with automated schedules, details, and client presentations.

E

Energy Analysis/Simulation – Energy simulation software tools for evaluation of energy efficiency, renewable energy, and sustainability in buildings.

F

File Sharing Protocol – Establishing a single shared project server (FTP site) for the upload and exchange of digital models, and the collection of project deliverables at pre-determined milestones. The same shared server shall continue to be used for the same purposes during Construction. Models on this shared server will be fully accessible web based to all team members via assigned site user names and passwords.

I

IPD – (Integrated Project Delivery) leverages early contributions of knowledge and expertise through the utilization of new technologies, allowing all team members to better realize their highest potentials while expanding the value they provide throughout the project lifecycle. (AIA)

IFC – Industry Foundation Class. IFCs are data elements that represent the parts of buildings, or elements of the process, and contain the relevant information about those parts. IFCs are used by computer applications to assemble a computer-readable model of the facility that contains all the information of the parts and their relationships to be shared among project participants. The project model constitutes an object-oriented database of the information shared among project participants and continues to grow as the project goes through design, construction, and operation. The International Alliance for Interoperability (IAI) has created this IFC data exchange format. (LACCD)

Information Exchange (IE) – The information passed from one party to another in the BIM process. The parties involved should agree upon and understand what information will be exchanged. These are often in the form of deliverables from a process that will be required as a resource for future processes. (Pennsylvania State University)

Interoperability – Refers to the exchange of information among project participants throughout the lifecycle of a facility by direct communication between software applications.

L

Level of Development (LOD) – Also called Level of Detail, describes the level of completeness to which a Model Element is developed.

M

Model Element – A Model Element is a portion of the Building Information Model representing a component, system or assembly within a building or building site.

Model Element Author (MEA) – The Model Element Author is the party responsible for developing the content of a specific Model Element to the LOD required for a particular phase of the project.

Model User – The Model User refers to any individual or entity authorized to use the Model on the Project, such as for analysis, estimating, or scheduling.

O

OmniClass – is a classification system for the construction industry. OmniClass is useful for many applications, from organizing library materials, product literature, and project information, to providing a classification structure for electronic databases. It incorporates other extant systems currently in use as the basis of many of its Tables – MasterFormat™ for work results, UniFormat for elements, and EPIC (Electronic Product Information Cooperation) for structuring products. (<http://www.omniclass.org/>)

P

Parameter – Any set of physical properties whose values determine the characteristics or behavior of something (Merriam-Webster Online Dictionary)

S

Stakeholder - Stakeholders are the specific people or groups who have a stake, or an interest, in the outcome of the project. Normally stakeholders are from within the company, and could include internal clients, management, employees, administrators... etc (Visitask.com)

U

UniFormat – UniFormat, a publication of CSI and CSC, is a method of arranging construction information based on functional elements, or parts of a facility characterized by their functions, without regard to the materials and methods used to accomplish them. These elements are often referred to as systems or assemblies. (<http://www.csinet.org/uniformat>)

■ APPENDIX D

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■ APPENDIX E

Credits

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