BIM PROJECT EXECUTION PLAN DOCUMENT TEMPLATE

The categories required for a BIM Execution Plan were developed by referencing current BIM implementation documents. These documents include the AIA BIM Protocol Exhibit, the Autodesk Communication Specifications[1], the AGC Consensus Docs BIM Addendum and the United States Army Corps of Engineers (USACE) BIM Roadmap[2]. Each of these documents attempts to define the processes, standards and/or contract language necessary to execute BIM on a project, while each document focuses on different key aspects of BIM implementation. The contents of these documents were compiled and organized in order to determine the key aspects of BIM use on a project and within organizations. The categories are as follows:

- Project Goals/BIM Objectives
- BIM Process Design
- BIM Scope Definitions
- Delivery Strategy/Contract
- Organizational Roles and Responsibilities
- Communication Procedures
- Technology Infrastructure Needs
- Model Quality Control Procedures
- Project Reference Information

1.1 Project Goals/BIM Objectives

This section of the plan should include a clear list of the BIM Goals, along with specific information on the selected BIM uses identified through the procedure defined in Step 1 (Identifying BIM Uses).

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[1] Autodesk Communication Specifications

[2] USACE BIM Road Map

1.2 BIM Process Design

This section of the plan should include the process developed through the procedure defined in Step 2 (Designing the BIM Execution Process). The process should include the overview map of the BIM Uses, a more detailed map of each of the BIM Uses, a description of any elements on each map, and documentation of the Information Exchange Requirements.

1.3 BIM Scope Definitions

This section of the plan should clearly define the requirements and responsible parties of selected BIM deliverables, while also defining where the BIM deliverables fall into the project schedule, through the procedure defined in Step 3 (Defining BIM Deliverables). The process should include the completed Information Exchange Requirements Worksheet.

1.4 Delivery Strategy/Contract

BIM can be implemented on all delivery approaches, but core concepts are easier to implement with higher levels of integrated project delivery. BIM contract requirements can be added to any delivery method or contract structure, but more viable options are Design-Build and Integrated Project Delivery (IPD) approach.

Several AIA and AGC documents were recently released to address BIM, delivery structure and contracting. More information and samples of the AIA and AGC documents can be found at **www.aiacontractdocuments.org** and **www.consensusdocs.org**.

1.4.1 Definition of delivery structure

If it is not a goal to utilize IPD or Design-Build on a project, BIM can still be implemented with other delivery structures. When 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. Please refer to the following documents for more information on IPD and Design-Build:

- AIA IPD Agreements: C196-2008 and C197-2008
- AIA Integrated Project Delivery Guide (IPDG). This document is a guide to implementing IPD on a project.
- AIA Design Build (DB) Agreements: A441-2008 and C441-2008

1.4.2 BIM Contractual Requirements

The integration of BIM on a project not only improves particular processes, but if used on a project wide level, can increase the degree of collaboration on a project. Collaboration is of particular importance in the contract language, because it affects the degree of change in the project delivery process, and therefore the range of potential legal issues in the project agreements. [3] Careful attention should be paid upfront to the drafting of BIM contractual requirements as these requirements will guide a project's delivery.

The following areas of BIM implementation should be considered and included in contracts where applicable.[5]

- Model Development and Responsibilities of Parties Involved (Step 3)
- Model Sharing and Reliance
- Interoperability
- Model Management
- Intellectual Property Rights

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[3] Larson, D. A., and Golden, K. A. (2008). Entering the Brave New World: An Introduction to Contracting for BIM. William Mitchell Law Review, Volume 34.

Typical contracts can be used on BIM projects, but should be edited to include the items mentioned above as necessary. Please refer to the following contract attachments addressing BIM implementation on a project:

- AIA On-Site Project Representation scope of services document: B207-2008
- AIA E202-2008: BIM Protocol Exhibit. This document addresses the development of a model throughout a project.
- AIA Document E201-2007: Digital Data Protocol Exhibit
- ConsensusDOCS 301 BIM Addendum. This document addresses the risk management of a BIM design process.
- ConsensusDOCS 200.2: Electronic Communications Protocol Addendum

1.5 Organizational Roles and Responsibilities

1.5.1 Define the roles of each organization along with responsibilities

At a minimum, the core BIM collaboration team should consist of:

- Designer/Architect
- Structural Engineer
- Mechanical Engineer
- Electrical Engineer
- Civil Engineer
- Others/Consultants
- General Contractor
- Subcontractors
- Fabricators/Suppliers

This core BIM team has the following responsibilities:

- Communicate the BIM vision to the entire project team

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- Assign BIM tasks to the team members

- Set expectations and metrics (RM)

- Arrange weekly or bi-weekly meetings

- Define agenda and progress reports

- Agree on the BIM implementation process

- Set up the schedule and milestones

- Agree on the quality control and assurance of the model

After the core BIM collaboration team is assigned, based on experience of team members, a BIM Manager for the project is chosen; which is usually the designer, general contractor or main subcontractor i.e. mechanical.

BIM Manager has the following responsibilities:

- Communicate the BIM vision to the core BIM team
- Organize training for internal staff
- Main point of contact for BIM troubleshooting and addressing issues
- Manage the BIM implementation process
- Schedule the weekly meetings
- Facilitate the information/data exchange
- Generate conflict resolution reports
- Manage and maintain the BIM model
- Quality control of the model or engage 3rd independent party (RM)

1.6 Communication Procedures

1.6.1 Electronic Communication procedures

Communication protocol should be established between all project team members to ensure smooth collaboration. Electronic communication between stakeholders can be created, uploaded, sent out and archived through the project management system software. Copies of all the project

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related communication should be saved for safekeeping and future reference. Document management (file folder structure, permissions and access, folder maintenance, folder notifications, file naming convention, etc.) should also be resolved and set up at the earliest possible time (ACS).

Please refer to AIA Document E201-2007: Digital Data Protocol Exhibit and ConsensusDOCS 200.2: Electronic Communications Protocol Addendum for more information on this topic.

1.6.2 Meeting Communication Procedures

After the electronic communication procedures have been established it is also important to define the specific meeting communication procedures, which should include:[4]

- A schedule for initial delivery of each model to the BIM Manager, and a schedule for updating each model after the coordination session.
- Procedure and protocol for the submission and approval of the model including electronic stamping.
- IT-related issues: file format to be used, file-naming and object-naming conventions, file structure, software used, and interoperability of applications.
- Coordination and scheduling of conflict detection and resolution procedure.

1.7 Technology Infrastructure Needs

All project team members who use BIM tools should have access to the appropriate hardware and software on which they were trained previously. Specific vendor's system requirements should be referred to for more details (ACS). To remedy interoperability issues all parties involved need to agree on what software will be used by architect/engineers/consultants, general contractor/construction manager and subcontractors for coordination purposes; and in what format the files will be saved.

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[4] Lowe, R. H. and Muncey J. M. (2008). The ConsensusDOCS 301 BIM Addendum. American Bar Association: Forum on the Construction Industry.

When making software selections for some of the high priority/frequency BIM uses, it is good to keep in mind the following types of BIM software (ACS):

- Design Authoring: BIM authoring tool should be selected based on ability to create parametric models that can be automatically updated, linked to other models, shared with consultants or subcontractors or referenced if needed. Also BIM authoring software must be able of producing 2D drawings to satisfy contract requirements and possibly create an output file in IFC format developed by the IAI and accepted as database standard.

- 3D Design Coordination: Software being able to combine multiple BIM files from consultants or subcontractors would need to be selected. The following file types may be used as a reference: .dwg, .dwf, .dxf, .sat, .ifc, .dgn, .prp, .prw, .ipt, .iam, and .ipf.

- Virtual Mockups: Software that can allow the owner or end users to walk through the model, look around, zoom, pan, orbit, examine, or fly through for the design review and feedback purposes.

- 3D MEP Coordination: Software most suitable for this BIM use would be the one being able to perform interference checking/clash detection between various trades' models and produce conflicts' report exported either in .xls, .cvs, or.xml format. The report usually contains visual snapshot of the conflict along with additional information of clashed building components.

- Cost Estimating: Software must be able to extract quantities from the model for cost estimating purposes or integrate with estimating programs or cost databases. Also the quantity takeoff data needs to be exported to .xls, .csc, or .xml file format.

- 4D Phasing or Modeling: 4D software needs to enable adding of the construction or phasing schedule to the model and provide visual progression of construction for the purpose of review and feedback.

1.8 Model Set-up and Quality Control

1.8.1 Model Set-up

After agreeing on electronic communication procedures and technology infrastructure needs, the BIM core team also needs to reach consensus on how the model is set-up, organized, communicated and controlled. The following topics are of utmost importance:

- Origin and reference points: control point location 0, 0, 0
- Project zoning: standard floor plan sectioned up into zones or areas
- File naming structure: naming convention for all subcontractors/trades
- FTP site or alike: all electronic files hosted on this site
- File scale: scale used throughout the project
- Accuracy: agree on the accuracy and tolerances before start of the modeling
- Layering: agree on the layering naming system to be same for all trades involved
- Changes to electronic files: all changes should be noted and marked with a cloud/bubble
- Hardcopies and signoff: agree on layouts, fonts, etc and require signoff by designers/trades

It is good to keep in mind that BIM models might not be easily interchangeable between BIM software packages at this point in time. The vendors are currently working on remedying this interoperability issue between different BIM software (RM). For this purpose, Industry Foundation Class (IFC) file format was created by the International Alliance for Interoperability (IAI). For more information on this and other file formats, please refer to NIST General Buildings Information Handover Guide (Fallon and Palmer, 2007).

Lately, some governmental agencies are requiring Industry Foundation Class (IFC) file format for their submittals. The General Services Administration (GSA) is specifically asking for IFC deliverables for spatial program validation for all projects since year 2007 (RM).

1.8.2 Model Quality Control

In order to assure model quality in every project phase, control procedures need to be set in place. Each of the models created during project progression and development needs to be pre-planned considering model content, level of detail, format and responsible party for updates, quality and distribution of the model to all the parties involved in the coordination efforts. Each of the parties contributing to the BIM model should have a responsible person or Model Manager to handle the

model. Model Managers, as part of the core BIM team, are in charge of participating in design reviews and coordination sessions along with taking care of all the issues that might arise with keeping the model updated, accurate and comprehensive (ACS).

Quality control and assurance of deliverables need to be accomplished at each design review, coordination meeting or milestone. The AEC CADD and the National Building Information Model Standards can be used as reference for appropriate quality control and assurance. Corrupt information or corrupt files need to be further investigated and prevented in the future (RM).

The BIM Manager is in charge of checking all the electronic files against drawing library files using the standard checker utility within BIM authoring software or 3rd party software. The deliverable needs to comply with AEC CADD standards considering proper family, parts, dimension style, line style, text style, levels and other standards. Design or model interferences must also be checked within each discipline and between various disciplines in coordination models. Navigator along with Conflict Detection software should be very valuable at this instance (RM).

Designers and consultants both are in charge of performing quality control checks of their design, dataset and model properties before submitting their deliverables. Documentation confirming that quality check was performed can be part of each submittal or BIM report. BIM Manager should be the final instance to confirm quality of the model after the revisions were made (RM).

There are a few types of checks that should be performed to assure model quality (RM):

- Visual Check: ensure there are no unintended model components and the design intent has been followed by using navigation software.
- Interference Check: detect problems in the model where two building components are clashing by using Navigator along with Conflict Detection software.
- Standards Check: ensure the BIM and AEC CADD Standard have been followed (fonts, dimensions, line styles, levels, etc) by using standards checker tool with BIM authoring software or 3rd party software.

- Element Validation: ensure that the dataset has no undefined or incorrectly defined elements by using the validation tool within the BIM authoring software or 3rd party software.

The BIM Manager should make sure that the proper protocol for quality control/assurance of the BIM models has been followed before accepting submittals and model revisions (RM).

1.9 Project Reference Information

1.9.1   Critical Project Overview Information

Critical project overview information should be defined early in the BIM Execution Planning for all the key team members to better organize the process. The suggested critical project overview information to be collected is the following:

	Critical Project Overview Information
1.	Project Name, Number and Address
2.	Brief Project Description
3.	Project Phases and Milestones
4.	Contract Type: Design Build, IPD, Negotiated Work, Others
5.	Contract Status: Awarded, In Pursuit, Others
6.	Funding Status:
7.	Parties Involved or on Board with BIM: Owner, Architect, Designers/Consultants, Contractor/CM, Subcontractors, Fabricators, Others
8.	Parties Experienced with BIM: Owner, Architect, Designers/Consultants, Contractor/CM, Subcontractors, Fabricators, Others
9.	Communication Plan for Stakeholders
10.	BIM Schedule/Timeframe

1.9.2 Key Project Contacts

The core project BIM team will be defined at this point. At least one BIM representative from each involved party should be identified: owner, designer, consultants, contractor, subcontractors, manufacturers, suppliers, etc. All stakeholders contact information will be collected, exchanged, and if possible posted on a shared collaborative project management web-portal in the following categories (ACS):

Key Project Contacts		
1.	Name	
2.	Role/Title	
3.	Company	
4.	Phone	
5.	E-mail	