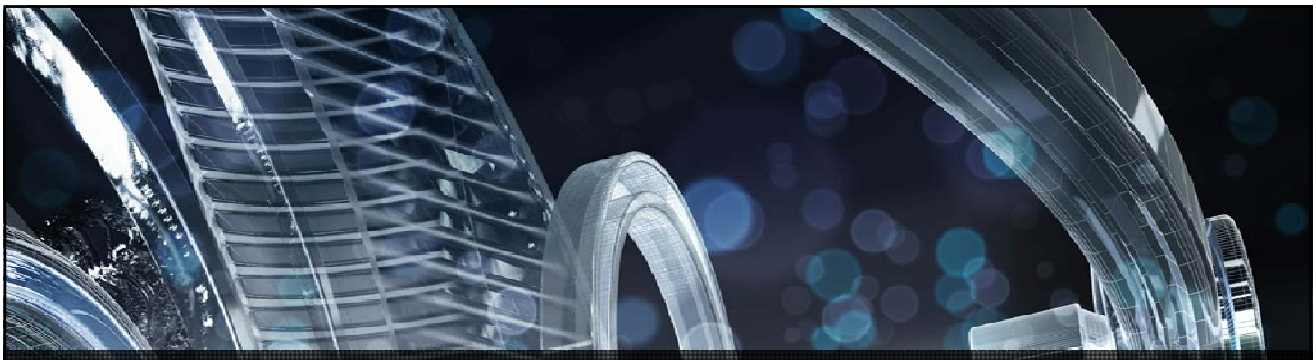

AB3200 - A Dissection of the U.S. Army Corps of Engineers BIM Requirements

Steve Hutsell
Chief, Geospatial Section
USACE, Seattle District

Shawn Foster
Technology Manager, Energy Division
Black & Veatch

Autodesk University

Class Summary

Panel Discussion

- *Since 2006, the U.S. Army Corps of Engineers (USACE) has partnered with BIM-aggressive, private-sector individuals, firms, and academia in conducting discussions and workshops on mutually beneficial BIM issues, such as best practices, standards, and contract language. Our goal is to strengthen public and private sector BIM initiatives. This panel will discuss the collaborative development of the USACE BIM Contract Requirements which currently include BIM Contract Language, the BIM Project Execution Plan (PxP) template and the Minimum Modeling Matrix (M3).*

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Learning Objectives

At the end of this class, you will be able to:

- Explain the history of USACE BIM Contract Requirements
- Explain the intent of the USACE BIM Contract Requirements, including the Minimum Modeling Matrix (M3)
- Explain the USACE efforts to integrate the Autodesk platform in the Centers of Standardizations (CoS) program
- Correctly implement USACE BIM Contract Requirements

Panel Members

"The views expressed in this presentation are those of the author(s) and do not reflect the official policy or position of the United States Army, Department of Defense, or the U.S. Government."

- Eric Baker
  Mason & Hanger – BIM Coordinator
- Lauren Collier
  SSOE, Inc – BIM Technical Leader
- Connor Christian
  McCarthy Construction – BIM Manager
- Shawn Foster
  Black & Veatch – Technology Manager, Energy Division
- Steve Hutsell
  USACE, Seattle District – Chief, Geospatial Section
  USACE BIM Contract Language Lead
- Rachel Riopel Wiley, AIA
  HDR Architecture – Project Architect
- Van Woods
  USACE, Seattle District – BIM Program Manager
  Northwestern Division Regional BIM Coordinator
  CoS BIM Technical Coordinator

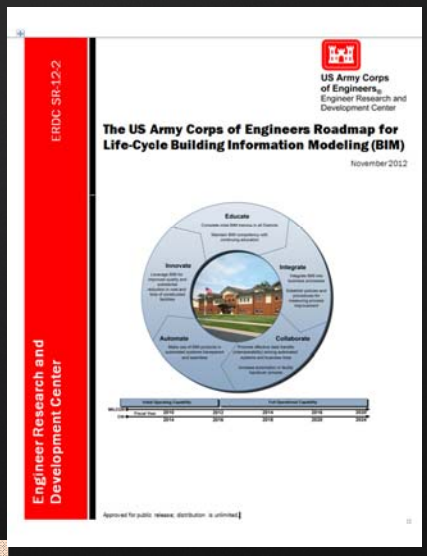
Outline

Introduction – Steve Hutsell
USACE BIM Roadmap – Steve Hutsell
Development of BIM Contract Language (previously Attachment "F") – Steve Hutsell
- *Section 1, 2 and 7 – Shawn Foster*
- *Section 3 – Connor Christian*
- *Sections 4, 5, and 6– Eric Baker*

Project Execution Plan (PxP) and Checklists – Lauren Collier
Minimum Model Matrix (M3) – Rachel Riopel Wiley
CoS Revit/Civil3D implementation initiatives – Van Woods
SIM and KnowledgeSmart - Steve Hutsell
Questions & Answers

USACE BIM Road Map

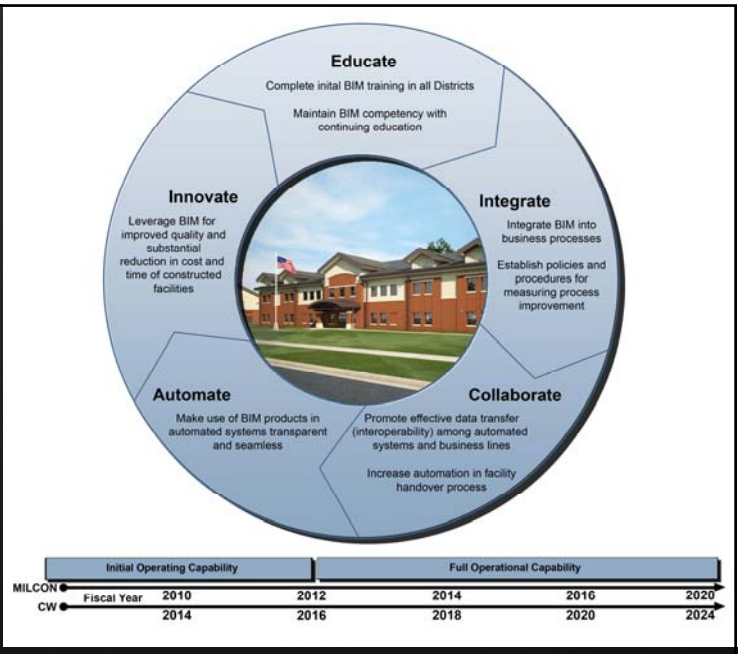
- Communicates Intentions
- Phased Approach
- Enumerates goals, objectives, and metrics
- Provide advice and lessons-learned
- Anticipates Technology
- Seeks Input and Review
- Living Document – Oct 2006, Nov 2012



USACE BIM Road Map

Achieve a coordinated move towards BIM while managing technology and business process risks

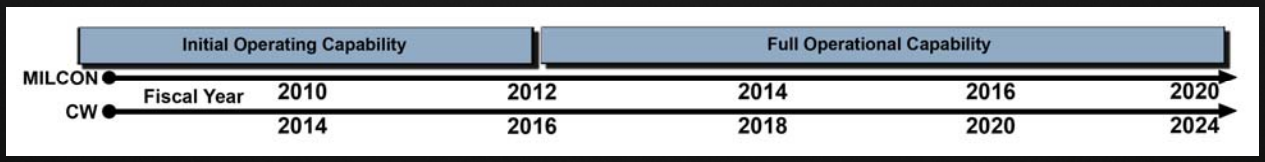
• Transform the USACE BIM implementation to go beyond a labor and time saving device associated with reduced cost of producing coordinated drawings to a set of information upon which to realize business process transformation.



USACE BIM Road Map

Strategic Goals for MILCON and Civil Works

1. Educate – Achieve and maintain competency in BIM
2. Integrate - Establish policies and procedures for measuring process improvement
3. Collaborate – Effective data transfer among automated systems and business lines
4. Automate – Achieve Full Operational Capability using BIM
5. Innovate – Identify downstream technologies and processes to leverage investment in BIM



USACE/Industry BIM Advisory Committee

- In Fall of 2006 USACE established a dialog with BIM-aggressive AE's, GC's, Academia, and Legal firms in conducting discussions and workshops on mutually beneficial BIM issues
- Mixture of Bentley BIM, Revit and ArchiCAD users
- Collaboration provided a tremendous opportunity to partner in strengthening federal and private sector BIM initiatives.
  - Best practices
  - Contract language
  - Standards

USACE/Industry BIM Advisory Committee

- Mission Statement: Push for innovation within a BIM application-neutral context, yet ensure that the requirements are practical, fair and reasonable within the existing state of the technology and standards.
- Membership
  - Participation is strictly voluntary
  - All costs incurred to participate are the responsibility of the firms
  - Monthly on-site/webmeeting workshops and bi-weekly conference calls

Introduction – USACE BIM Roadmap – Development Team -- BIM Contract Language

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USACE/Industry BIM Advisory Committee

- USACE BIM Contract Requirements
  - BIM Contract Language
  - BIM Project Execution Plan (PxP) Template
  - Minimum Modeling Matrix (M3)
  - BIM Submittal Checklist (in development)

USACE/Industry BIM Advisory Committee

- Current Members

USACE

Seattle District	Steve Hutsell Van Woods
Fort Worth District	Greg Hall
CAD/BIM Technology Center	Edward Huell Steve Spangler
HQ	Jason Fairchild

USACE/Industry BIM Advisory Committee

AE's

▪ Black and Veatch	Shawn Foster
▪ Burgess & Niple	Jason Kornaker
▪ CH2M Hill	Dave Fouché Rob Cowan Will Love
▪ HDR, Inc.	John Bowen Rachel Riopel Wiley Ron Croke
▪ Jacobs Global Buildings	Charles Wood Dawn Bridges
▪ Mason & Hanger	Eric Baker Mark Mates
▪ SSOE	John Eddy Lauren Collier Mark LaBell, Jr.

USACE/Industry BIM Advisory Committee

GC's

▪ Balfour Beatty	Kurt Maldovan
▪ M.A. Mortenson Co.	Luke Koch Mitch Cornelius Steve Knighton
▪ McCarthy Building	Connor Christian John Grady
▪ SenovvA	Adam Lega
▪ Sundt Construction	Dan Russell
▪ The Walsh Group	Michael Baird Weston Tanner

USACE/Industry BIM Advisory Committee

AGC and Associates

- AGC — Dmitri Alferieff
- Hurtado, S.C., Counselors at Law — Kim Hurtado

Academia

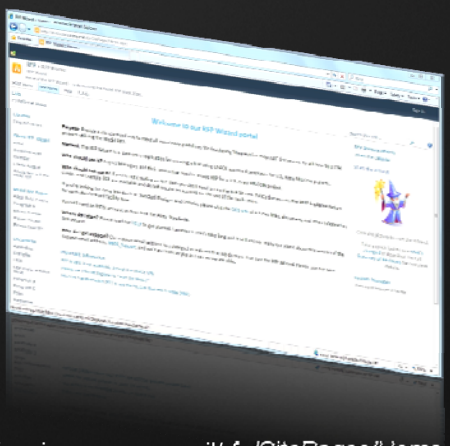
- The Pennsylvania State University
  - John Messner
    - Director, CIC Research Program
    - Leads the BIM Project Execution Planning Guide project.
  - Ralph Kreider – Graduate Student

USACE BIM Contract Language

- The contract language is a work in progress
  - Fine-tuned to reflect developments in the industry
  - Incorporate lessons learned as projects are awarded and executed.
- In coordination with the BIM COP
  - Continue to develop language in support of other contract requirements
    - MILCON Design Phase
    - MILCON Construction Contracts
    - Civil Works
- Support for other Agencies
  - Adoption or Adaption of USACE Contract Language and tools

USACE BIM Contract Language

- USACE Model RFP Wizard
  - On-line tool for standard development of Requests for Proposals
  - Mandated for the Centers of Standardization (CoS) program
- BIM contract requirements implemented in Wizard in early January 08
- DB contracts with firm fixed price



http://mrsi.usace.army.mil/rfp/SitePages/Home.aspx

USACE BIM Contract Language

- CoS Projects
  - Standard Designs for common Army Installation facilities
    - i.e. Barracks, Company Operations, Dining Facility
  - Standard designs developed and maintained by designated CoS Districts
    - Initial development in Bentley Systems BIM with USACE Bentley BIM workspace.
    - Revit templates available now
  - USACE in-house design teams and Contractors are provided baseline BIM facility designs for adapt-build projects.

Introduction – USACE BIM Roadmap – Development Team -- BIM Contract Language

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USACE BIM Contract Language

- Covers the following scenarios
  - CoS Projects: Effective 4/7/2011, on a 'project-specific' basis, Project Delivery Teams (Installation, Geographic District and CoS District) can specify
    - BIM application-specific format submittals
      - Autodesk Revit or Bentley BIM
    - BIM application-neutral submittals
      - Contractor submits in platform of choice – Revit or Bentley BIM
  - Non-CoS Projects:
    - BIM application-specific submittals
      - Bentley BIM, Revit, ArchiCAD
    - BIM application-neutral submittals
      - Contractor submits in BIM platform format of choice.

USACE BIM Contract Language

Section 1 – General

Section 2 – Design Requirements

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

Section 5 – Ownership Rights in Data

Section 6 – Contractor Electives

Section 7 – Definitions

7.3. "Model Element": A self-contained element with a unique identification, whose behavior and properties are defined by Facility/Site Data and software processes. Model Elements can represent a physical entity, such as a pump or a concrete wall, and range from the simple to the complex.

7.4. "Facility/Site Data": The non-graphical information attached to objects in the Model that defines various characteristics of the object. Facility/Site Data can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), and project identification numbers. Facility/Site Data can also define supplementary physical entities that are not shown graphically in the Model, such as insulation around a duct, hardware on a door, content of conduit, or transformer properties.

7.5. "Workspace": A collection of content libraries and supporting files that define and embody a BIM standard. A workspace includes BIM libraries such as wall types, standard steel shapes, furniture, HVAC fittings, and sprinkler heads. It also contains sheet libraries such as print/plot configurations, font and text style libraries, and sheet borders and title blocks. The USACE has developed Workspaces specific to USACE BIM standards; these workspaces are dependent on specific versions of the BIM applications they serve. All USACE BIM Workspaces can be downloaded from the CAD/BIM Technology Center (https://cadbim.usace.army.mil). In some cases, there is a specific Workspace for a given CoS Facility Standard Design.

USACE BIM Contract Language

7.2. "Model": A digital representation of physical and functional characteristics of a facility or a part thereof, comprised of "Model Elements" with "Facility/Site Data".

7.3. "Model Element": A self-contained element with a unique identification, whose behavior and properties are defined by Facility/Site Data and software processes. Model Elements can represent a physical entity, such as a pump or a concrete wall, and range from the simple to the complex.

7.4. "Facility/Site Data": The non-graphical information attached to objects in the Model that defines various characteristics of the object. Facility/Site Data can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), and project identification numbers. Facility/Site Data can also define supplementary physical entities that are not shown graphically in the Model, such as insulation around a duct, hardware on a door, content of conduit, or transformer properties.

Takeaway - Understand the definitions for 'Model' and 'Facility/Site Data'

Model Element = 3D Geometry, Facility/Site Data = non-graphical info attached to Model objects, Model = Geometry + Data

USACE BIM Contract Language

Section 1 – General

Section 2 – Design Requirements

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

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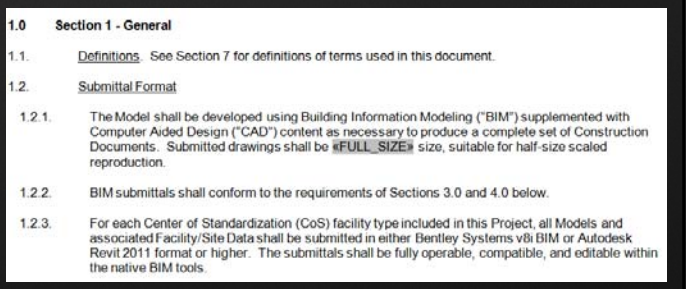
Section 7 – Definitions



1.0 Section 1 - General

1.1. Definitions. See Section 7 for definitions of terms used in this document.

1.2. Submittal Format

1.2.1. The Model shall be developed using Building Information Modeling ("BIM") supplemented with Computer Aided Design ("CAD") content as necessary to produce a complete set of Construction Documents. Submitted drawings shall be «FULL_SIZE» size, suitable for half-size scaled reproduction.

1.2.2. BIM submittals shall conform to the requirements of Sections 3.0 and 4.0 below.

1.2.3. For each Center of Standardization (CoS) facility type included in this Project, all Models and associated Facility/Site Data shall be submitted in either Bentley Systems v8i BIM or Autodesk Revit 2011 format or higher. The submittals shall be fully operable, compatible, and editable within the native BIM tools.

USACE BIM Contract Language

1.2.3. For each Center of Standardization (CoS) facility type included in this Project, all Models and associated Facility/Site Data shall be submitted in either Bentley Systems v8i BIM or Autodesk Revit 2011 format or higher. The submittals shall be fully operable, compatible, and editable within the native BIM tools.

Takeaway - USACE expects you to use BIM

You must submit Model in format requested…AND be

"… fully operable, compatible, and editable within the native BIM tools."

No translations!

Section 1-General -- Section 2 – Design Requirements -- Section 3 – Submittal Requirements -- Section 4 – Minimum Modeling and Data Requirements -- Section 5 – Ownership Rights in Data -- Section 6 – Contractor Electives

USACE BIM Contract Language

Section 1 – General

~~Section 2 – Design Requirements~~

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

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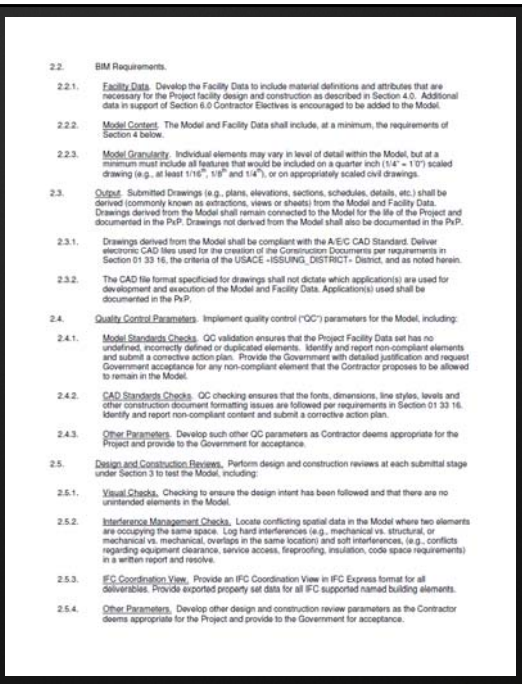
Section 6 – Contractor Electives

Section 7 – Definitions



2.2. BIM Requirements.

2.2.1. Facility Data. Develop the Facility Data to include material definitions and attributes that are necessary for the Project facility design and construction as described in Section 4.0. Additional data in support of Section 6.0 Contractor Electives is encouraged to be added to the Model.

2.2.2. Model Content. The Model and Facility Data shall include, at a minimum, the requirements of Section 4 below.

2.2.3. Model Granularity. Individual elements may vary in level of detail within the Model, but at a minimum must include all features that would be included on a quarter inch (1/4" = 1'0") scaled drawing (e.g., at least 1/16th, 1/8th and 1/4th), or on appropriately scaled civil drawings.

2.3. Output. Submitted Drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) from the Model and Facility Data. Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP. Drawings not derived from the Model shall also be documented in the PxP.

2.3.1. Drawings derived from the Model shall be compliant with the A/E/C CAD Standard. Deliver electronic CAD files used for the creation of the Construction Documents per requirements in Section 01 33 16, the criteria of the USACE -ISSUING_DISTRICT- District, and as noted herein.

2.3.2. The CAD file format specificied for drawings shall not dictate which application(s) are used for development and execution of the Model and Facility Data. Application(s) used shall be documented in the PxP.

2.4. Quality Control Parameters. Implement quality control ("QC") parameters for the Model, including:

2.4.1. Model Standards Checks. QC validation ensures that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant element that the Contractor proposes to be allowed to remain in the Model.

2.4.2. CAD Standards Checks. QC checking ensures that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per requirements in Section 01 33 16. Identify and report non-compliant content and submit a corrective action plan.

2.4.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for acceptance.

2.5. Design and Construction Reviews. Perform design and construction reviews at each submittal stage under Section 3 to test the Model, including:

2.5.1. Visual Checks. Checking to ensure the design intent has been followed and that there are no unintended elements in the Model.

2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.

2.5.3. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

2.5.4. Other Parameters. Develop other design and construction review parameters as the Contractor deems appropriate for the Project and provide to the Government for acceptance.

USACE BIM Contract Language

2.1. Use of BIM. Contractor shall use BIM application(s) and software(s) to develop Projects consistent with the following requirements.

Takeaway -

- USACE expects you to use BIM
- USACE doesn't want you building a separate BIM off to the side as a parallel effort
- USACE doesn't want you to perform a last-minute effort to fulfill a requirement.

USACE BIM Contract Language

2.1.2. BIM Program Configuration Standards. If Contractor selects Bentley Systems BIM as the BIM platform of choice, the latest version of the Bentley TriServices Workspace must be used and can be downloaded from the CAD/BIM Technology Center website, currently https://cadbim.usace.army.mil. For Revit Versions 2011 or earlier, a USACE Revit Standard will not be provided; Contractor can select which Revit templates and resources to use. For Revit 2012, the USACE Revit 2012 Templates must be used and can be downloaded from the CAD/BIM Technology Center website, currently https://cadbim.usace.army.mil.

Takeaway -

- Use the USACE BIM Standards
- Use the USACE vendor-specific BIM Workspace, Resources, or Templates IF required for the type of project you are working on
- Definitely for Center of Standardization projects
- As needed or as specified on a project-by-project basis

USACE BIM Contract Language

2.1.5. BIM Project Execution Plan.

2.1.5.1. Develop a BIM Project Execution Plan ("Plan" or "PxP") documenting mandatory and Contractor-elected BIM Uses, analysis technologies and workflows.

2.1.5.2. Contractors shall use the USACE BIM PROJECT EXECUTION PLAN (PxP) Template located at https://cadbim.usace.army.mil to develop an acceptable Plan.

Takeaway - USACE expects you to develop a BIM Execution Plan (PxP)

USACE wants to know how you intend to use BIM, and how you expect to fulfill the Attachment F BIM Requirements

They've had many private sector partners say they can do BIM but in the end truly can't

More about PxP later

USACE BIM Contract Language

2.2. BIM Content.

2.2.1. Facility/Site Data. Develop the Facility/Site Data to include material definitions and attributes that are necessary for the Project facility design and construction as described in Section 4.0. Additional data in support of Section 6.0 Contractor Electives is encouraged to be added to the Model.

2.2.2. Model Content. The Model and Facility/Site Data shall include, at a minimum, the requirements of Section 4.0 below.

Takeaway - Geometry AND Data

More info on Geometry and Data requirements in Section 4.0

USACE BIM Contract Language

2.3. Output. Submitted Drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) from the Model and Facility/Site Data. Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP. Drawings not derived from the Model shall also be documented in the PxP.

Takeaway - USACE requires that the drawings submitted as construction documents be a direct output from the model (views/sheets/extractions)

USACE does not want you to produce all your drawings in CAD and build the BIM independently

Don't try to "fake it" by doing it the "old way" then building a model

USACE BIM Contract Language

2.3.2. The CAD file format specified for drawings shall not dictate which application(s) are used for development and execution of the Model and Facility/Site Data. Application(s) used shall be documented in the PxP.

Takeaway - The CAD submittal can be a different format than the BIM submittal

example: USACE can ask for a Revit project with MicroStation drawings

Why?

USACE is the owner's agent: they are acting on behalf of their 'client'

USACE is the owner's voice, who may have specific requirements

USACE BIM Contract Language

2.4. Quality Control Parameters. Implement quality control ("QC") parameters for the Model, including:

2.4.1. Model Standards Checks. Provide QC checks demonstrating that the Project Facility/Site Data set has no undefined, incorrectly defined or duplicated elements. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant element that the Contractor proposes to be allowed to remain in the Model.

2.4.2. CAD Standards Checks. Provide QC checks demonstrating that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per requirements in Section 01 33 16. Identify and report non-compliant content and submit a corrective action plan.

Takeaway - You must perform good QC of the model

USACE outlines what kinds of things they want you to check

USACE also wants CAD Standards check (AEC x.0 per contract)

You must submit documentation of your checks

USACE BIM Contract Language

2.5. Design and Construction Reviews. The Model and Facility/Site Data will be used to perform reviews at each submittal stage under Section 3.0 to test the Model, including Over-The-Shoulder Progress Reviews:

2.5.1. Visual Checks. Checking to demonstrate the design intent has been followed and that there are no unintended elements in the Model.

2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.

2.5.3. Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

Takeaway - Perform formal Interference Management ("clash") checks

Tell USACE how you will do this in the PxP

Over the Shoulder Reviews will happen

USACE BIM Contract Language

2.5. Design and Construction Reviews. The Model and Facility/Site Data will be used to perform reviews at each submittal stage under Section 3.0 to test the Model, including Over-The-Shoulder Progress Reviews:

2.5.1. Visual Checks. Checking to demonstrate the design intent has been followed and that there are no unintended elements in the Model.

2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.

2.5.3. Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

Takeaway - USACE wants you to USE the Model, not just build it

….not just use it to produce drawings

Get in the model and review the design – with the client

USACE BIM Contract Language

SUMMARY OF CHANGES FOR SECTION 2.0

- Removed “For Design” in Requirements
- Clarified Technology Platform Choices and Resources
- Addition and Definition of Over the Shoulder Submittal

Section 1-General -- Section 2 – Design Requirements -- Section 3 – Submittal Requirements -- Section 4 – Minimum Modeling and Data Requirements -- Section 5 – Ownership Rights in Data -- Section 6 – Contractor Electives

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USACE BIM Contract Language

Section 1 – General

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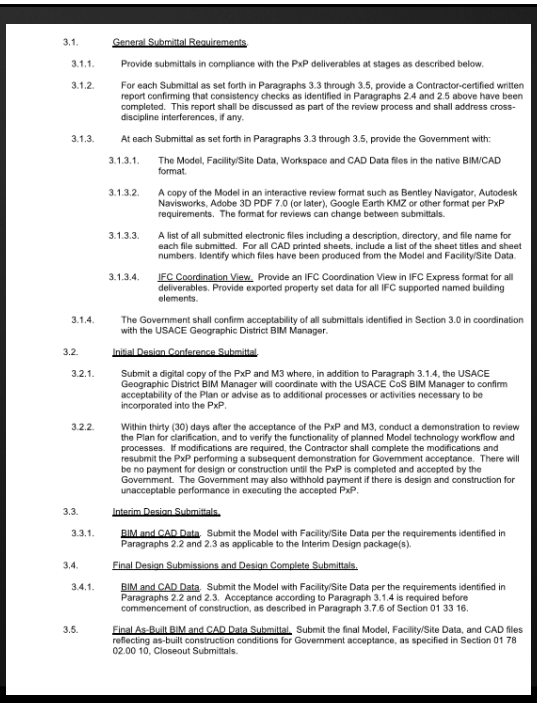


3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with the PxP deliverables at stages as described below.

3.1.2. For each Submittal as set forth in Paragraphs 3.3 through 3.5, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.4 and 2.5 above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Submittal as set forth in Paragraphs 3.3 through 3.5, provide the Government with:

3.1.3.1. The Model, Facility/Site Data, Workspace and CAD Data files in the native BIM/CAD format.

3.1.3.2. A copy of the Model in an interactive review format such as Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per PxP requirements. The format for reviews can change between submittals.

3.1.3.3. A list of all submitted electronic files including a description, directory, and file name for each file submitted. For all CAD printed sheets, include a list of the sheet titles and sheet numbers. Identify which files have been produced from the Model and Facility/Site Data.

3.1.3.4. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

3.1.4. The Government shall confirm acceptability of all submittals identified in Section 3.0 in coordination with the USACE Geographic District BIM Manager.

3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the PxP and M3 where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the PxP.

3.2.2. Within thirty (30) days after the acceptance of the PxP and M3, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance. There will be no payment for design or construction until the PxP is completed and accepted by the Government. The Government may also withhold payment if there is design and construction for unacceptable performance in executing the accepted PxP.

3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3 as applicable to the Interim Design package(s).

3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

3.5. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility/Site Data, and CAD files reflecting as-built construction conditions for Government acceptance, as specified in Section 01 78 02.00 10, Closeout Submittals.

USACE BIM Contract Language

3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with the PxP deliverables at stages as described below.

3.1.2. For each Submittal as set forth in Paragraphs 3.3 through 3.5, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.4 and 2.5 above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

Takeaway - Submittals must comply with PxP and delivered at the stages defined in Section 3.

Contractor shall check compliance of sections 2.4 (QA/QC) and 2.5 (Design and Construction Reviews) before submitting and provide written report confirming consistency

USACE BIM Contract Language

3.1.3. At each Submittal as set forth in Paragraphs 3.3 through 3.5, provide the Government with:

3.1.3.1. The Model, Facility/Site Data, Workspace and CAD Data files in the native BIM/CAD format.

3.1.3.2. A copy of the Model in an interactive review format such as Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per PxP requirements. The format for reviews can change between submittals.

3.1.3.3. A list of all submitted electronic files including a description, directory, and file name for each file submitted. For all CAD printed sheets, include a list of the sheet titles and sheet numbers. Identify which files have been produced from the Model and Facility/Site Data.

3.1.3.4. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

Takeaway - Native format (e.g. Revit) and review format (e.g. Navisworks) must be submitted at each interim submittal

Include all associated files and a directory of where each file is located.

Include IFC Coordination View and property set

USACE BIM Contract Language

3.1.4. The Government shall confirm acceptability of all submittals identified in Section 3.0 in coordination with the USACE Geographic District BIM Manager.

Takeaway - The Geographic District BIM Manager must review for acceptance the BIM submittals

Approval by the Contracting Officer does not meet requirements

USACE BIM Contract Language

3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the PxP and M3 where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the PxP.

Takeaway -

- Items in Section 3.2 are one time submittals (unless modified)
- PxP must be approved by the Geographic District and CoS District BIM Managers (more on PxP later)
- PxP must show intent to meet USACE BIM Contract Language requirements

USACE BIM Contract Language

3.2.2. Within thirty (30) days after the acceptance of the PxP and M3, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance. There will be no payment for design or construction until the PxP is completed and accepted by the Government. The Government may also withhold payment if there is design and construction for unacceptable performance in executing the accepted PxP.

Takeaway -

- Prove you can perform the tasks and procedures outlined in your PxP and M3
- Get it right early in the process
- Payment can be withheld for non-compliance to PXP and M3

USACE BIM Contract Language

3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3 as applicable to the Interim Design package(s).

3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. Submit the Model with Facility/Site Data per the requirements identified in Paragraphs 2.2 and 2.3. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

Takeaway - Every submittal needs to meet the requirements of 2.2 (BIM Content) and 2.3 (Output)

Construction cannot start until Final Design Submission is approved

USACE BIM Contract Language

3.5. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility/Site Data, and CAD files reflecting as-built construction conditions for Government acceptance, as specified in Section 01 78 02.00 10, Closeout Submittals.

Takeaway - Obviously, the most important submittal.

Manage the interim submittals properly to ensure that the final submittal is accepted and approved.

Don't forget section 3.2.2 allows for Government to withhold payment.

USACE BIM Contract Language

SUMMARY OF CHANGES IN SECTION 3.0

- The M3 and Site Data
- Moved IFC Coordination View from 2.0 to 3.0
- Moved Over the Shoulder Submittal from 3.0 to 2.0

USACE BIM Contract Language

Section 1 – General

Section 2 – Design Requirements

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

Section 5 – Ownership Rights in Data

Section 6 – Contractor Electives

Section 7 – Definitions

4.0 Section 4 – Minimum Modeling and Data Requirements

4.1. Minimum Modeling Matrix (M3)

4.1.1. Develop an M3 documenting elements included in the facility and site. The M3 describes the minimum modeling and data requirements by defining the Level of Development ("LOD") and Element Grade.

4.1.2. Contractors shall use the USACE Minimum Modeling Matrix (M3) Template located at https://cadbim.usace.army.mil and submitted as part of the PxP.

4.2. Additional Requirements.

4.2.1. Classification. All modeled elements shall include Facility/Site Data referencing one or more classification system(s).

4.2.2. Spatial Data. The Model shall include spatial data defining actual net square footage and net volume, and holding data to develop the room finish schedule including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

4.2.3. Schedules. Schedules shall be produced from the Facility/Site Data within the Model. Any exceptions should be documented in the PxP and submitted to the USACE for review.

4.2.4. Details and Enlarged Sections. All details and enlarged sections necessary for construction shall be derived from the Model when possible. For those details and enlarged sections not derived directly from the Model, Contractor must verify that geometry and data depicting the details and enlarged sections are consistent with Model elements. Details with significant drafted content such as 'standard' and 'typical' details shall not contradict the model and shall utilize the model as an underlay when possible for the purposes of verification and coordination. Three dimensional, isometric, and section isometric details derived from the model are preferred.

4.2.5. Legends. Model Elements shall be used to produce representations shown in the legends and shall match graphical representations shown in plans, sections, and elevations.

4.2.6. Drawing Indices. Where BIM authoring platform supports it, drawing indexes should be derived from a model-driven schedule.

USACE BIM Contract Language

4.0 Section 4 – Minimum Modeling and Data Requirements

4.1. Minimum Modeling Matrix (M3)

4.1.1. Develop an M3 documenting elements included in the facility and site. The M3 describes the minimum modeling and data requirements by defining the Level of Development ("LOD") and Element Grade.

4.1.2. Contractors shall use the USACE Minimum Modeling Matrix (M3) Template located at https://cadbim.usace.army.mil and submitted as part of the PxP.

Takeaway - The M3 defines the minimum modeling and data requirements for the project.

You are required to use the USACE M3.

USACE BIM Contract Language

4.2. Additional Requirements.

4.2.1. Classification. All modeled elements shall include Facility/Site Data referencing one or more classification system(s).

Takeaway - All elements will reference at least one of the following classifications systems:

- OmniClass
- UniFormat
- MasterFormat

USACE BIM Contract Language

4.2.2. Spatial Data. The Model shall include spatial data defining actual net square footage and net volume, and holding data to develop the room finish schedule including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

Takeaway - Spatial data is the repository for the room Information used for schedules and analysis.

4.2.3. Schedules. Schedules shall be produced from the Facility/Site Data within the Model. Any exceptions should be documented in the PxP and submitted to the USACE for review.

Takeaway - All schedules shall be derived from the model, unless documented in the PxP that is reviewed and accepted by USACE.

USACE BIM Contract Language

4.2.4. Details and Enlarged Sections. All details and enlarged sections necessary for construction shall be derived from the Model when possible. For those details and enlarged sections not derived directly from the Model, Contractor must verify that geometry and data depicting the details and enlarged sections are consistent with Model elements. Details with significant drafted content such as 'standard' and 'typical' details shall not contradict the model and shall utilize the model as an underlay when possible for the purposes of verification and coordination. Three dimensional, isometric, and section isometric details derived from the model are preferred.

Takeaway - The model must be fully integrated into your design and drafting process.

USACE BIM Contract Language

Section 1 – General

Section 2 – Design Requirements

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

Section 5 – Ownership Rights in Data

Section 6 – Contractor Electives

Section 7 – Definitions

5.0 Section 5 - Ownership and Rights in Data

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility/Site Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

USACE BIM Contract Language

5.0 Section 5 - Ownership and Rights in Data

5.1. Ownership. The **Government has ownership of and rights at the date of Closeout** Submittal to all CAD files, BIM Model, and Facility/Site Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). **The Government may make use of this data following any deliverable.**

Takeaway - USACE owns the Model, all content, the Facility/Site Data, drawings, parts, rules, schedule templates, etc. as submitted in the project.

This does not preclude the submitting company from using the data on other projects.

USACE BIM Contract Language

Section 1 – General

Section 2 – Design Requirements

Section 3 – Submittal Requirements

Section 4 – Minimum Modeling and Data Requirements

Section 5 – Ownership Rights in Data

Section 6 – Contractor Electives

Section 7 – Definitions

6.0 Section 6 – Contractor Electives

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit, as described in the proposal submission requirements and evaluation criteria, the requirements of paragraphs 6.2 through 6.5 are as applicable for those elective feature(s) that will be included in the project.

6.2. COBIE Compliance. The Model and Facility/Site Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements on the Whole Building Design Guide website (www.wbdg.org) , including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate records that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of the Project construction schedule.

6.3.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.4, the Contractor shall deliver the construction schedule linked to the Model.

6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for Project scheduling.

6.4. Cost Estimating. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of cost estimating, or other costing applications such as comparative cost analysis for proposed changes and estimate validation.

6.4.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.5, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project Completion. At Project completion, the Contractor shall provide an Micro Computer Aided Cost Estimating System Generation II ("MII") Cost Estimate that follows the USACE Cost Engineering Military Work Breakdown System ("WBS"), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from Model output to the maximum extent possible, though other "gap" quantity information will be included by the contractor as necessary for a complete and accurate Cost Estimate. (See Paragraph 6.4.2.2).

USACE BIM Contract Language

6.0 Section 6 – Contractor Electives

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit, as described in the proposal submission requirements and evaluation criteria, the requirements of paragraphs 6.2 through 6.5 are as applicable for those elective feature(s) that will be included in the project.

6.2. COBIE Compliance. The Model and Facility/Site Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements on the Whole Building Design Guide website (www.wbdg.org) , including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate records that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

Takeaway - Document the electives chosen in the PxP (Any Elective selected in the PxP becomes contractual.)

Electives are previews of requirements to come

Will potentially become factored into future contractor selection criteria

USACE BIM Contract Language

6.3. Project Scheduling using the Model. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of the Project construction schedule.

6.4. Cost Estimating. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of cost estimating, or other costing applications such as comparative cost analysis for proposed changes and estimate validation.

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing and other analyses that may be generated from the Model or reports summarizing the data compiled from these analyses shall be submitted in the form established by contractor in its accepted PxP.

Takeaway - Document the electives chosen in the PxP (Any Elective selected in the PxP becomes contractual.)

Electives are previews of requirements to come

Will potentially become factored into future contractor selection criteria

Section 1-General -- Section 2 – Design Requirements -- Section 3 – Submittal Requirements -- Section 4 – Minimum Modeling and Data Requirements -- Section 5 – Ownership Rights in Data -- Section 6 – Contractor Electives

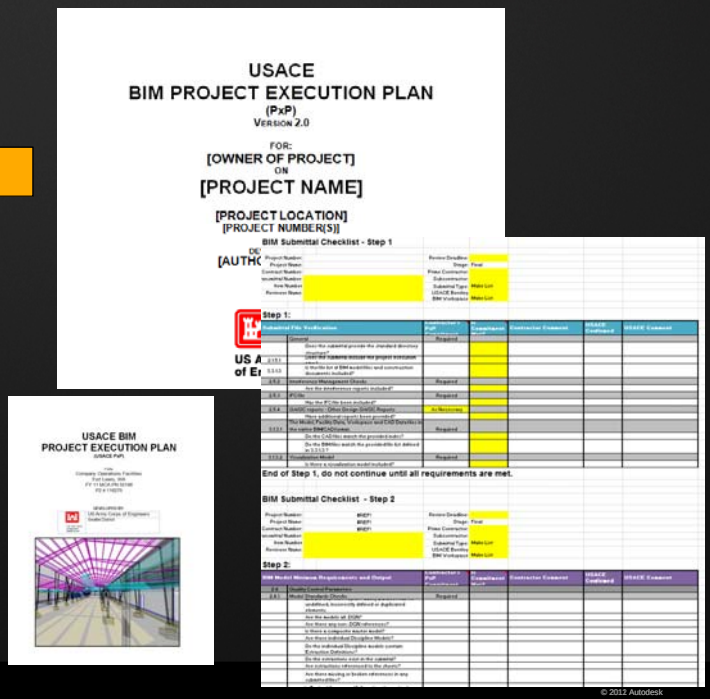
Project Execution Plan and Checklist

Minimum Modeling Matrix (M3)

CoS and Autodesk Initiatives

SIM

KnowledgeSmart

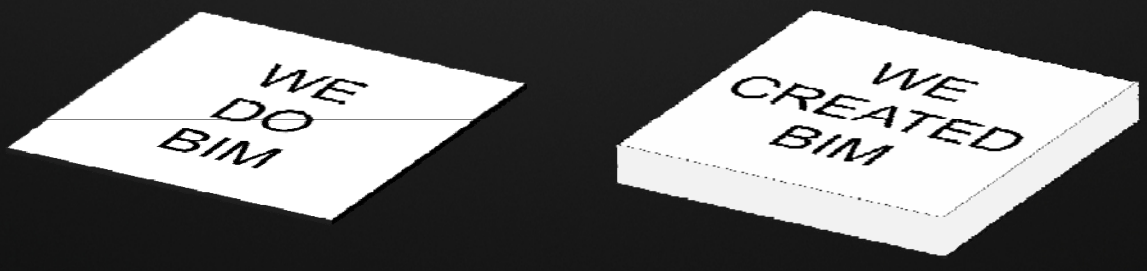


Submit a Plan

- Establish the organizations' general Means and Methods of meeting the Scope and Deliverable requirements of USACE BIM Contract Language
- There will be no payment for design or construction until the Plan is acceptable to the Government.
- The Government may also withhold payment for unacceptable performance in executing the Plan

The PROBLEM

- Past Plans format and content varied
  - 1-page "We will do BIM on this project"
  - 50+ pages on the history of BIM, benefits of BIM, why USACE should be using BIM, how the firm invented BIM in 1987…
- Very difficult and time consuming to review



Solution
Project Execution Plan (PxP)

- What are the benefits?
  - Assists organizations in planning their BIM process
  - Provides a standard format that streamlines the development of the Plan
  - Quality of Plans has improved dramatically
  - Review and acceptance process is accelerated

Project Execution Plan (PxP)

Defines BIM Uses *for Project*

Template available from CAD / BIM Technology Center

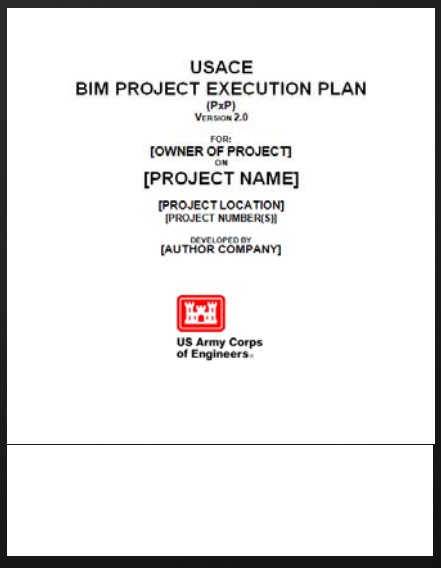
Version 2.0

https://cadbim.usace.army.mil/BIM_Contract_Requirements

Completed by Contractor *prior to Start of Project*

Must be accepted by Geographic District BIM Manager

Payment can be withheld *for failure to perform*


USACE
BIM PROJECT EXECUTION PLAN
(PxP)
VERSION 2.0
FOR:
[OWNER OF PROJECT]
ON
[PROJECT NAME]
[PROJECT LOCATION]
[PROJECT NUMBER(S)]
DEVELOPED BY
[AUTHOR COMPANY]
US Army Corps of Engineers

Project Execution Plan (PxP)

Differences between versions

CHANGES to PXP

NEW VERSION 2.0

TABLE OF CONTENTS

OLD VERSION 1.0

TABLE OF CONTENTS

PxP Version 2.0

Section C: Project Goals/ BIM Objectives

- *Reorganization of BIM Use Chart*
  - *Red & X's are Required*
- *COBIE- is potential BIM Use*

SECTION C: PROJECT GOALS / BIM OBJECTIVES

Describe how the BIM Model and Facility Data are utilized to maximize project value (e.g. design alternatives, life-cycle analysis, energy analysis, sustainability analysis scheduling, estimating, material selection, pre-fabrication opportunities, site placement, etc.) Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet.

1. **MAJOR BIM GOALS / OBJECTIVES:**
   State BIM Goals / Objectives

BIM GOAL	DESCRIPTION

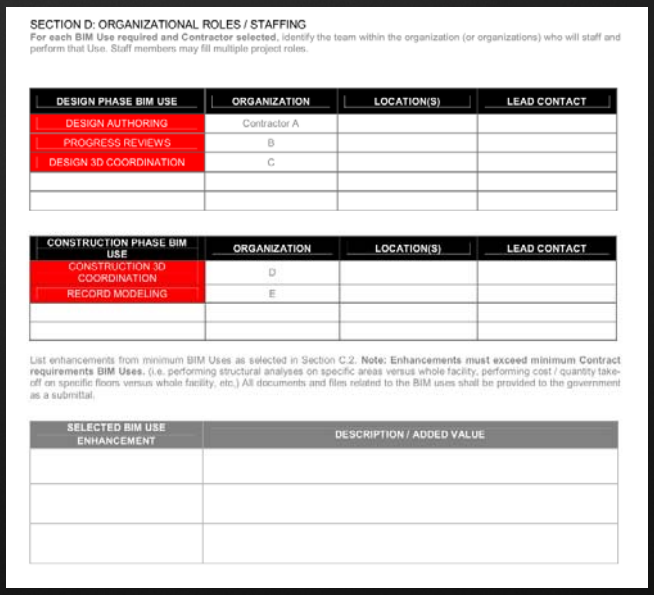
2. **BIM USES:**
   The BIM Uses currently highlighted/shaded and checked with an (X) are required by USACE. Contractor to identify with a (C) additional BIM Uses for the project selected as Contractor Electives. Reference BIM Project Execution Planning Guide at www.engr.psu.edu/BIM/BIM_Uses for Use descriptions. Include additional BIM Uses as applicable in empty cells of Design and Construct columns. Do not complete Plan and Operate Columns.

PLAN (NIC)		DESIGN		CONSTRUCT	OPERATE (NIC)
PROGRAMMING	X	DESIGN AUTHORING		SITE UTILIZATION PLANNING	BUILDING SYSTEM ANALYSIS
SITE ANALYSIS	X	PROGRESS REVIEWS		CONSTRUCTION SYSTEM DESIGN	ASSET MANAGEMENT
	X	INTERFERENCE MANAGEMENT (3D COORDINATION)	X	INTERFERENCE MANAGEMENT (3D COORDINATION)	SPACE MANAGEMENT / TRACKING
		STRUCTURAL ANALYSIS		DIGITAL FABRICATION	DISASTER PLANNING
		LIGHTING ANALYSIS		3D CONTROL AND PLANNING	
		ENERGY ANALYSIS	X	RECORD MODELING	OPERATION & MAINTENANCE RECORD MODELING
		PROGRAM VALIDATION		FIELD / MATERIAL TRACKING	
		MECHANICAL ANALYSIS		DIGITAL LAYOUT	
		OTHER ENG. ANALYSIS			
		SUSTAINABILITY (LEED) EVALUATION			
		CODE VALIDATION			
PHASE PLANNING (4D)		PRELIMINARY CONSTRUCTION SCHEDULING (4D)		CONSTRUCTION SCHEDULING (4D)	BUILDING MAINTENANCE SCHEDULING (4D)
COST ESTIMATION (5D)		COST ESTIMATION (5D)		COST ESTIMATION (5D)	COST ESTIMATION (5D)
EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING	EXISTING CONDITIONS MODELING
CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)	CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)

PxP Version 2.0

Section D: Organizational Roles and Staffing

- *Original Table is now Separated*
  - *Design and Construction Roles*
- *REMOVED-*
  - *Total Staffing requirements*
- *ADDED-*
  - *Separate Table for BIM Use Enhancements*



SECTION D: ORGANIZATIONAL ROLES / STAFFING

For each BIM Use required and Contractor selected, identify the team within the organization (or organizations) who will staff and perform that Use. Staff members may fill multiple project roles.

DESIGN PHASE BIM USE	ORGANIZATION	LOCATION(S)	LEAD CONTACT
DESIGN AUTHORING	Contractor A		
PROGRESS REVIEWS	B		
DESIGN 3D COORDINATION	C		

CONSTRUCTION PHASE BIM USE	ORGANIZATION	LOCATION(S)	LEAD CONTACT
CONSTRUCTION 3D COORDINATION	D		
RECORD MODELING	E		

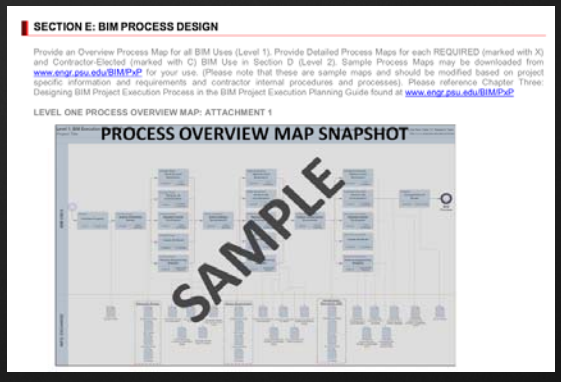
List enhancements from minimum BIM Uses as selected in Section C.2. **Note: Enhancements must exceed minimum Contract requirements BIM Uses.** (i.e. performing structural analyses on specific areas versus whole facility, performing cost / quantity take-off on specific floors versus whole facility, etc.) All documents and files related to the BIM uses shall be provided to the government as a submittal.

SELECTED BIM USE ENHANCEMENT	DESCRIPTION / ADDED VALUE

PxP Version 2.0

Section E: BIM Process Design

- *Process map for all Required BIM Uses (marked with X)*
- *Example Maps can be downloaded from http://www.engr.psu.edu/BIM/PxP*



SECTION E: BIM PROCESS DESIGN

Provide an Overview Process Map for all BIM Uses (Level 1). Provide Detailed Process Maps for each REQUIRED (marked with X) and Contractor-Elected (marked with C) BIM Use in Section D (Level 2). Sample Process Maps may be downloaded from www.engr.psu.edu/BIM/PxP for your use. (Please note that these are sample maps and should be modified based on project specific information and requirements and contractor internal procedures and processes). Please reference Chapter Three: Designing BIM Project Execution Process in the BIM Project Execution Planning Guide found at www.engr.psu.edu/BIM/PxP

LEVEL ONE PROCESS OVERVIEW MAP: ATTACHMENT 1

PROCESS OVERVIEW MAP SNAPSHOT

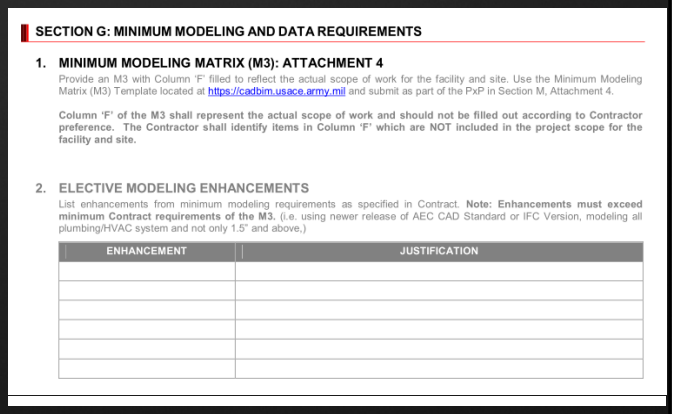
SAMPLE

PxP Version 2.0

Section G: Minimum Modeling Matrix (M3)

- Download-

  https://cadbim.usace.army.mil
- Submit as Attachment 4 in PXP
- Contractor shall Identify in Column F of M3 what is NOT included in project
- Elective Modeling Enhancements are not longer pre-populated
- Variances Table was Removed



SECTION G: MINIMUM MODELING AND DATA REQUIREMENTS

1. **MINIMUM MODELING MATRIX (M3): ATTACHMENT 4**

Provide an M3 with Column 'F' filled to reflect the actual scope of work for the facility and site. Use the Minimum Modeling Matrix (M3) Template located at https://cadbim.usace.army.mil and submit as part of the PxP in Section M, Attachment 4.

Column 'F' of the M3 shall represent the actual scope of work and should not be filled out according to Contractor preference. The Contractor shall identify items in Column 'F' which are NOT included in the project scope for the facility and site.

2. ELECTIVE MODELING ENHANCEMENTS

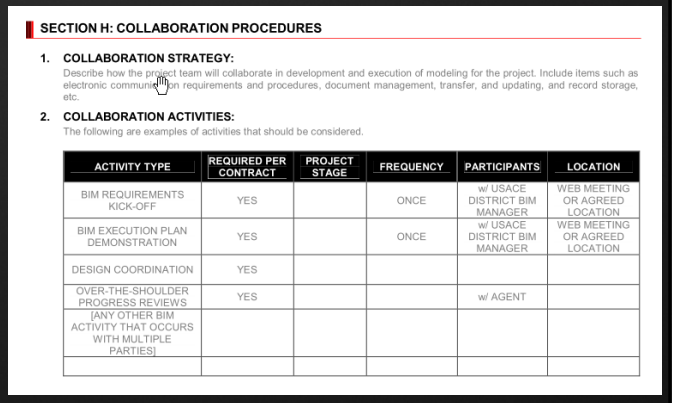
List enhancements from minimum modeling requirements as specified in Contract. **Note: Enhancements must exceed minimum Contract requirements of the M3.** (i.e. using newer release of AEC CAD Standard or IFC Version, modeling all plumbing/HVAC system and not only 1.5" and above,)

ENHANCEMENT	JUSTIFICATION

PxP Version 2.0

Section H: Collaboration Procedures

- Identification of Participants is added
- Pre-populated "Collaboration Activities" Table to reflect Model RFP, Section 01 33 16, USACE BIM Contract Language Requirements



SECTION H: COLLABORATION PROCEDURES

1. **COLLABORATION STRATEGY:**

Describe how the project team will collaborate in development and execution of modeling for the project. Include items such as electronic communication requirements and procedures, document management, transfer, and updating, and record storage, etc.

2. **COLLABORATION ACTIVITIES:**

The following are examples of activities that should be considered.

ACTIVITY TYPE	REQUIRED PER CONTRACT	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
BIM REQUIREMENTS KICK-OFF	YES		ONCE	w/ USACE DISTRICT BIM MANAGER	WEB MEETING OR AGREED LOCATION
BIM EXECUTION PLAN DEMONSTRATION	YES		ONCE	w/ USACE DISTRICT BIM MANAGER	WEB MEETING OR AGREED LOCATION
DESIGN COORDINATION	YES				
OVER-THE-SHOULDER PROGRESS REVIEWS	YES			w/ AGENT	
[ANY OTHER BIM ACTIVITY THAT OCCURS WITH MULTIPLE PARTIES]					

PxP Version 2.0

Section I: Quality Control

- Visual Strategy for model Quality
- Added “Version Updating Check”
- Added “Revision Authority Check”

SECTION I: QUALITY CONTROL

1. **OVERALL STRATEGY FOR QUALITY CONTROL**
   Describe the strategy to control the quality of the model.
2. **QUALITY CONTROL CHECKS**
   The following checks should be performed to assure quality.

CHECKS	DEFINITION	RESPONSIBLE PARTY	SOFTWARE PROGRAM(S)	FREQUENCY
VISUAL CHECK	Ensure there are no unintended model components and the design intent has been followed			AT EVERY SUBMITTAL
INTERFERENCE CHECK	Detect problems in the model where two building components are clashing including soft and hard			AT EVERY SUBMITTAL
STANDARDS CHECK	Ensure that the BIM and AEC CADD Standard have been followed (fonts, dimensions, line styles, levels/layers, etc)			AT EVERY SUBMITTAL
MODEL INTEGRITY CHECKS	Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the reporting process on non-compliant elements and corrective action plans			AT EVERY SUBMITTAL
VERSION UPDATING CHECK	Ensuring that all users are using the agreed upon version of the software and the method by which changing software version is completed			AT EVERY SUBMITTAL
REVISION AUTHORITY CHECK	Describe the method by which all users will be given access and extent of revision authority to versions of the model as updated.			AT EVERY SUBMITTAL

PxP Checklist (in development)

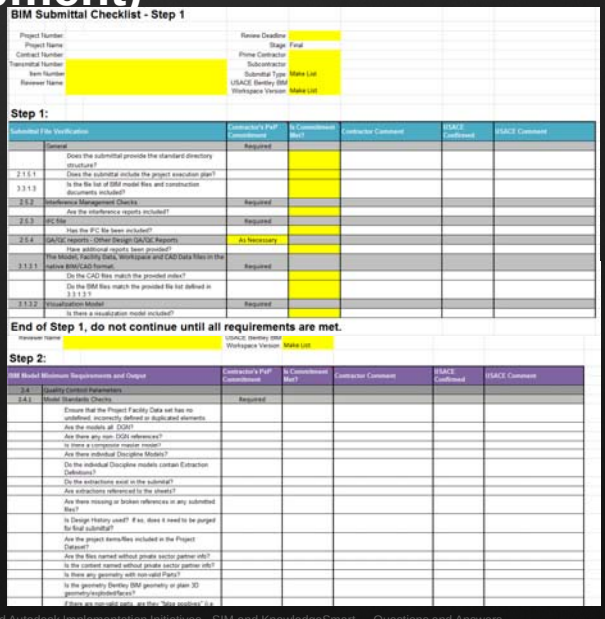
Provides consistency in checking

- Contract *Requirements*
- USACE BIM Contract Language *Requirements*
- M3 *Requirements*
- PxP *Commitments*

Included *with each BIM submittal*

Review of BIM Requirements *only*

Is Not Part of the *Independent Technical Review (Design Review)*


BIM Submittal Checklist - Step 1

Step 1:

End of Step 1, do not continue until all requirements are met.

Step 2:

PxP Checklist

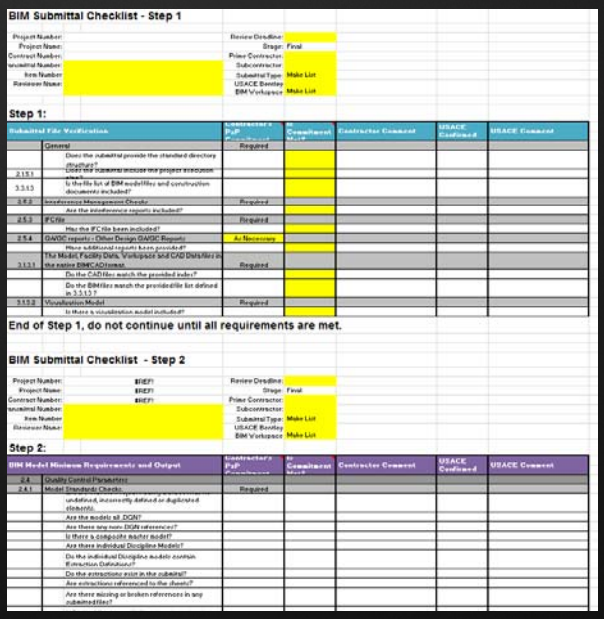
Completed *by Contractor*

Step 1 *Submittal File Verification (Is everything included and in the correct format)*

Verified by USACE Area Office Submittal Quality Control Review

Step 2 *Actual Checklist (Checking against Min. Modeling Requirements M3 and PxP)*

Verified by Geographic District BIM Manager


BIM Submittal Checklist - Step 1

Step 1:

End of Step 1, do not continue until all requirements are met.

BIM Submittal Checklist - Step 2

Step 2:

PxP and Checklist Conclusions

- Provides Execution Plan Consistency
  - District to District
  - Project to Project
  - Contractor to Contractor
- Applicable for Internal Use
  - USACE, other Federal Agencies
  - Private-sector
- Other Agency Partners Adapted or are Considering Adoption
  - DoD Military Health System
  - United States Air Force (USAF)
  - Federal Aviation Administration (FAA)

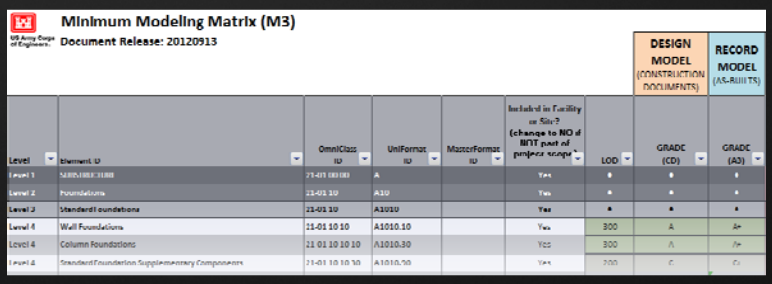
Project Execution Plan and Checklist

Minimum Modeling Matrix (M3)

CoS and Autodesk Initiatives

SIM

KnowledgeSmart



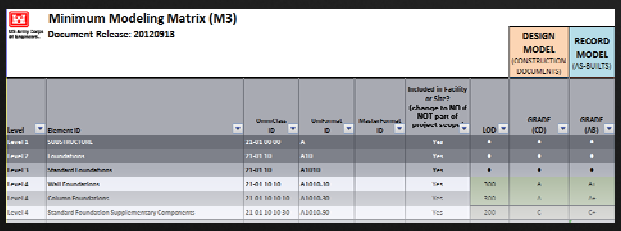
Minimum Modeling Matrix (M3)

Document Release: 20120913

Level	Element ID	OmniClass ID	UniFormat ID	MasterFormat ID	Included in Facility or Site? (change to NO if NOT part of project scope	LOD	DESIGN MODEL (CONSTRUCTION DOCUMENTS) GRADE (CD)	RECORD MODEL (AS-BUILTS) GRADE (AS)
Level 1	SUBSTRUCTURE	21-01 00 00	A		Yes			
Level 2	Foundations	21-01 10	A10		Yes			
Level 3	Standard Foundations	21-01 10	A1010		Yes			
Level 4	Wall Foundations	21-01 10 10	A1010.10		Yes	300	A	A+
Level 4	Column Foundations	21 01 10 10 10	A1010.30		Yes	300	A	A+
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.50		Yes	200	C	C+

Minimum Modeling Matrix "M3"

- 01.Instructions
- 02. Modeling Requirements
- 03. Scope-LOD-Grade

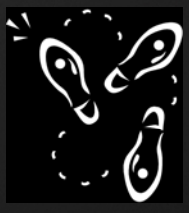


Minimum Modeling Matrix (M3)

Document Release: 20120913

Level	Element ID	OmniClass ID	UniFormat ID	MasterFormat ID	Included in Facility or Site? (change to NO if NOT part of project scope	LOD	DESIGN MODEL (CONSTRUCTION DOCUMENTS) GRADE (CD)	RECORD MODEL (AS-BUILTS) GRADE (AS)
Level 1	SUBSTRUCTURE	21-01 00 00	A		Yes			
Level 2	Foundations	21-01 10	A10		Yes			
Level 3	Standard Foundations	21-01 10	A1010		Yes			
Level 4	Wall Foundations	21-01 10 10	A1010.10		Yes	300	A	A+
Level 4	Column Foundations	21 01 10 10 10	A1010.30		Yes	300	A	A+
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.50		Yes	200	C	C+

01. Instructions

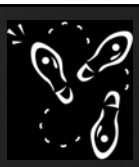


02. Modeling Requirements

03. Scope-LOD-Grade

Project Execution Plan and Checklists – Minimum Modeling Matrix (M3) - CoS and Autodesk Implementation Initiatives - SIM and KnowledgeSmart -- Questions and Answers

01.Instructions

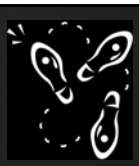


- Basic Functionality/ Features

GENERAL INSTRUCTIONS

1. Modify Column F on Tab "03. Scope-LOD-Grade" to indicate the Elements included in the Project scope.
2. Filters are available to sort and limit column data in the table.
3. Discipline and Notes columns available as a convenience and are not a contractual requirement.
4. Bi-directional hyperlinks are available in column headers, Element IDs and Modeling Requirements.

Understanding the Organization

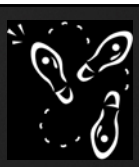


- Classification structure

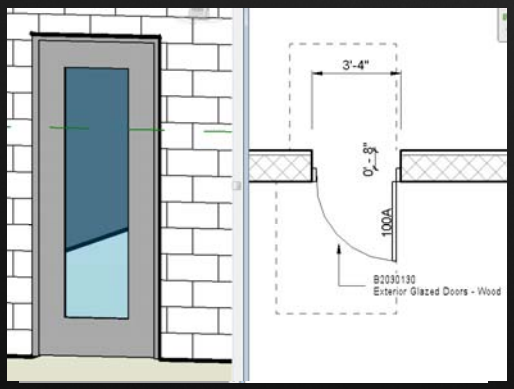
"Parent"
"Parent"
"Child"

Level	Element ID	OmniClass ID	UniFormat ID	MasterFormat ID
Level 1	SUBSTRUCTURE	21-01 00 00	A	
Level 2	Foundations	21-01 10	A10	
Level 3	Standard Foundations	21-01 10	A1010	
Level 4	Wall Foundations	21-01 10 10	A1010.10	
Level 4	Column Foundations	21-01 10 10 10	A1010.30	
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.90	
Level 3	Special Foundations	21-01 10 20	A1020	31 60 00
Level 4	Driven Piles	21-01 10 20 10	A1020.10	31 62 00
Level 4	Bored Piles	21-01 10 20 15	A1020.15	31 63 00
Level 4	Caissons	21-01 10 20 20	A1020.20	31 64 00
Level 4	Special Foundation Walls	21-01 10 20 30	A1020.30	31 66 16
Level 4	Foundation Anchors	21-01 10 20 40	A1020.40	31 68 00

Definitions: Level of Development



- Unique to the USACE requirements
- To what degree of accuracy is the information being provided?

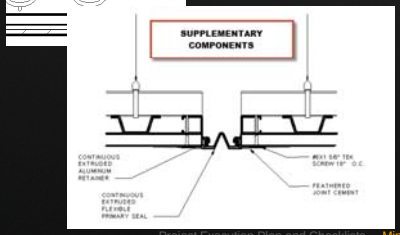


LEVEL OF DEVELOPMENT DEFINITIONS (ACCURACY)

The following LOD descriptions identify the specific element requirements for each Model Element.

LOD	Definition
•	Refer to the specific child element for appropriate LOD. (Used for categories that have multiple sub-elements for which varying LOD apply.)
100	Model Elements indicative of area, height, volume, location, and orientation may be modeled in three dimensions or represented by other data. (ie., a pump would be a cube)
200	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. (ie., a pump would be a generic pump of approximate size.)
300	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. Accurate to the degree dimensioned or indicated on contract documents. (ie., a pump would be a generic pump of accurate size complete with connections and clearances for a complete system.)

Definitions: Element Grade



- What format is the content supposed to be delivered in?

ELEMENT GRADE DEFINITIONS (FORMAT)

Within each Level of Development, there is the potential to represent information in various formats. In practice, it has been proven that there are certain elements for which there is a greater benefit in providing 3-dimensional representation, while in others drafting or representation in the form of narratives is sufficient for a particular deliverable.

Grade	Description
A	3D + Facility Data
B	2D + Facility Data
C	2D Only (Drafting, linework, text, and or part of an assembly)
+	Original Grade (A, B, or C) adjusted for contract changes and field conditions.
-	Not included in or tied to the model (however is still required in the deliverable)
•	Refer to the specific child element for appropriate Grade. (Used for categories that have multiple sub-elements for which varying Grades apply.)

02.Modeling Requirements

- Covers elements at Levels 01 and 02 of classification
  - A-Substructure
  - B-Shell
  - C-Interiors
  - D-Services
  - E-Equipment & Furnishings
  - F-Special Construction & Demolition
  - G-Sitework
- These work IN TANDEM with the LODs prescribed in tab 03.

03.Scope-LOD-Grade

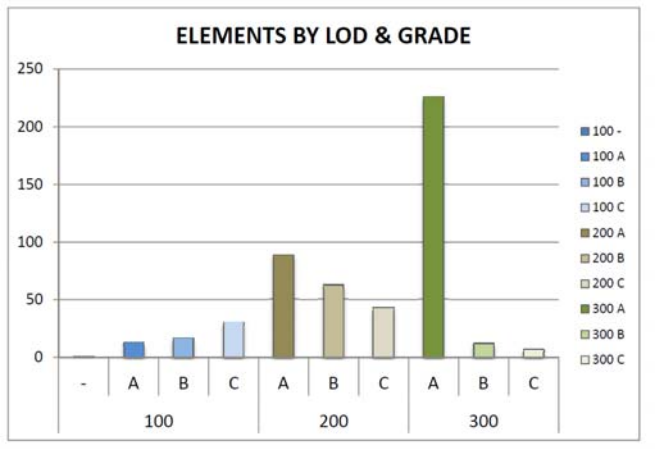
Minimum Modeling Matrix (M3)
US Army Corps of Engineers
Document Release: 20120913

Level	Element ID (4)	OmniClass ID	UniFormat ID	MasterFormat ID	1 Included in Facility or Site? (change to NO if NOT part of project scope)	LOD	DESIGN MODEL (CONSTRUCTION DOCUMENTS) GRADE (CD)	RECORD MODEL (AS-BUILTS) 2 GRADE (AB)	3 FOR AGENCY OR CONTRACTOR INTERNAL USE. NOT A CONTRACTUAL REQUIREMENT. Primary Discipline (This will allow design team to identify discipline specific areas of content)	Notes
Level 1	SUBSTRUCTURE	21-01 00 00	A		Yes	•	•	•	Structural	
Level 2	Foundations	21-01 10	A10		Yes	•	•	•	Structural	
Level 3	Standard Foundations	21-01 10	A1010		Yes	•	•	•	Structural	
Level 4	Wall Foundations	21-01 10 10	A1010.10		Yes	300	A	A+	Structural	
Level 4	Column Foundations	21-01 10 10 10	A1010.30		Yes	300	A	A+	Structural	
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.90		Yes	200	C	C+	Structural	
Level 3	Special Foundations	21-01 10 20	A1020	31 60 00	Yes	•	•	•	Structural	
Level 4	Driven Piles	21-01 10 20 10	A1020.10	31 62 00	Yes	300	A	A+	Structural	
Level 4	Bored Piles	21-01 10 20 15	A1020.15	31 63 00	Yes	300	A	A+	Structural	
Level 4	Caissons	21-01 10 20 20	A1020.20	31 64 00	Yes	300	A	A+	Structural	
Level 4	Special Foundation Walls	21-01 10 20 30	A1020.30	31 66 16	Yes	300	A	A+	Structural	
Level 4	Foundation Anchors	21-01 10 20 40	A1020.40	31 68 00	Yes	100	C	C+	Structural	
Level 4	Underpinning	21-01 10 20 50	A1020.50	31 48 00	Yes	100	C	C+	Structural	
Level 4	Raft Foundations	21-01 10 20 60	A1020.60	03 71 00	Yes	300	A	A+	Structural	
Level 4	Pile Caps	21-01 10 20 70	A1020.70		Yes	300	A	A+	Structural	
Level 4	Grade Beams	21-01 10 20 80	A1020.80		Yes	300	A	A+	Structural	
Level 2	Subgrade Enclosures	21-01 20	A20		Yes	•	•	•	Architectural, Structural	
Level 3	Walls for Subgrade Enclosures	21-01 20 10	A2010		Yes	•	•	•	Architectural, Structural	
Level 4	Subgrade Enclosure Wall Construction	21-01 20 10 10	A2010.10		Yes	300	A	A+	Architectural, Structural	

01. Instructions | 02. Modeling Requirements | 03. Scope-LOD-Grade | PickLists

Breaking Down the M3

REQUIRED LEVEL OF DEVELOPMENT	COUNT
100	62
-	1
A	13
B	17
C	31
200	195
A	89
B	63
C	43
300	245
A	226
B	12
C	7
Grand Total	502



Project Execution Plan and Checklist

Minimum Modeling Matrix (M3)

CoS and Autodesk Initiatives

SIM

KnowledgeSmart

Project Execution Plan and Checklist

Minimum Modeling Matrix (M3)

CoS and Autodesk Initiatives

SIM

KnowledgeSmart

As of November 15, the slides around the CoS initiatives are in approval stage

When we get them, we will update the PPT and Handouts accordingly.

We apologize for any inconvenience.

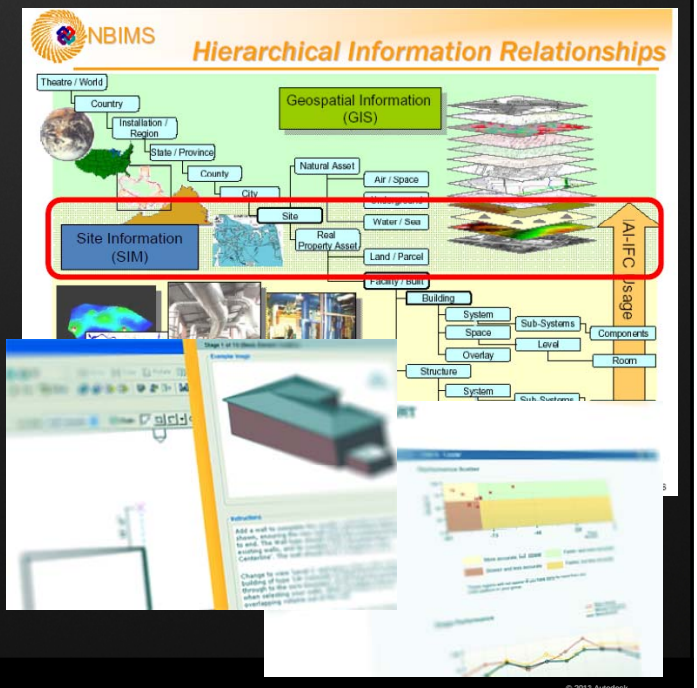
Project Execution Plan and Checklist

Minimum Modeling Matrix (M3)

CoS and Autodesk Initiatives

SIM – Site Information Modeling

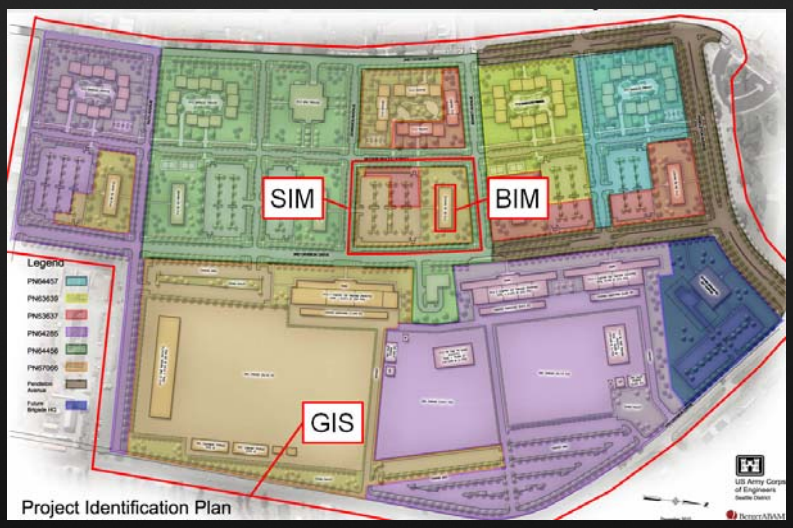
KnowledgeSmart



Site Information Modeling (SIM) Initiative

- Site/Infrastructure Design
- Survey/Mapping/LIDAR/DTM
- Landscape Architecture
- Surface and Subsurface Utilities
- Also known as
  - 'BIM' for Civil Works
  - Civil Works Information Modeling
  - Infrastructure Information Modeling

Site Information Modeling (SIM) Initiative



Project Execution Plan and Checklists – Minimum Modeling Matrix (M3) - CoS and Autodesk Implementation Initiatives -- SIM and KnowledgeSmart -- Questions and Answers

AU Autodesk University

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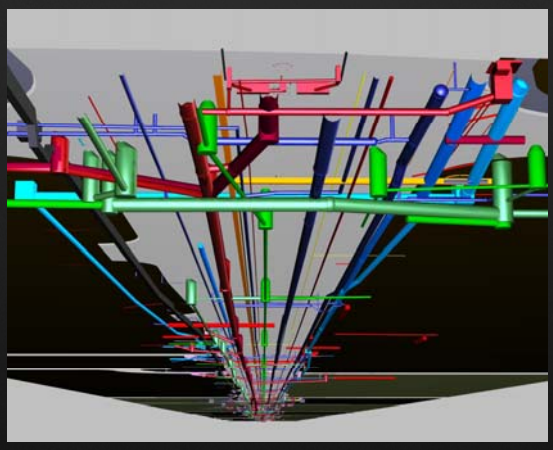
The Power Of SIM

- Infrastructure Coordination / Constructability Review
  - Check for infrastructure conflicts before beginning design/construction.
- Construction Scheduling
  - Collaborated model allows one to see implications and relations to systems and utilities in the area.
- Quantity Take Off
- 3D Review
- 3D Trench Generation
  - Digitally construct trenches at installation sequence and communicate 3D models for automated machine guidance.

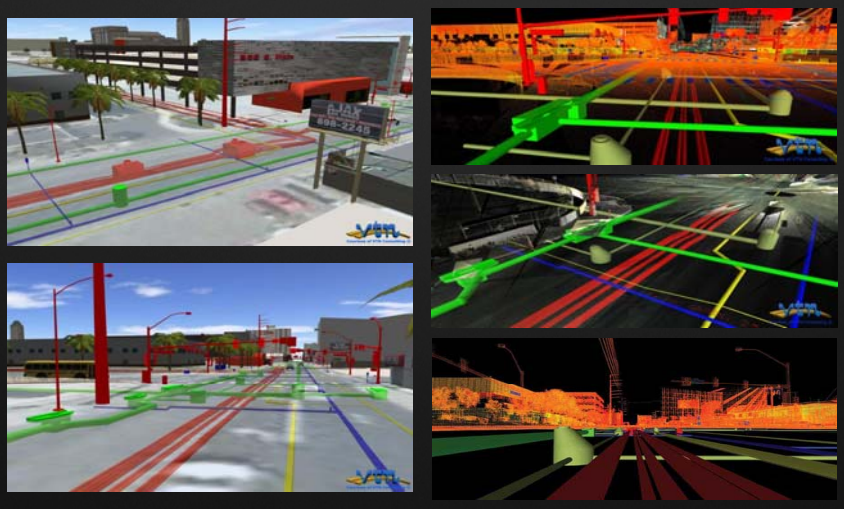
Light Rail Northwest Exchange, Phoenix



Courtesy of Eric Cylwik, Sundt Construction

Article: Virtual Design and Construction in Horizontal Infrastructure Projects

3D Infrastructure Model, Las Vegas



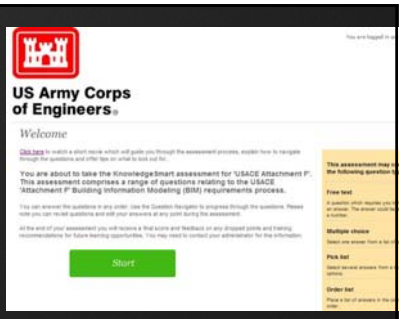
Courtesy of Keith Warren, VTN Consulting

Site Information Modeling (SIM) Initiative

- USACE/Industry SIM Advisory Committee
  - Includes Survey & Mapping, AEC and Legal firms
- 3D modeling emphasis of surface/sub-surface elements and topology
- S-M Products in development
  - Pre-solicitation, Task Order SOW, Technical Requirements Templates
  - USACE SIM Objects Library
  - Integration with the M3
- AEC Products in development
  - Design Phase requirements implementing Survey & Mapping content

KnowledgeSmart Initiative

- 'USACE BIM Contract Requirements' Module
- Assessment comprised of questions relating to Contract Language, the PxP and the M3.
- What USACE wants the industry to know
- Potential use as a differentiator on an RFP response
- Free for public use. **Yes, free**. No charge. Zip. Nil. Gratis. Complimentary. On the house.
- www.knowledgesmart.net
  KS hosting Top DAUG at AUGI Booth



Questions & Answers

Just a quick reminder to please complete the online class survey via your mobile device, laptop, or a survey kiosk after each class you attend.