

Building Information Modeling Requirements (BIM)

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ATTACHMENT F

BUILDING INFORMATION MODELING REQUIREMENTS

Version 12-21-07

Section 1 - Submittal Format

1.1 Design Deliverables. Develop all designs using Building Information Modeling (BIM) and Computer Aided Design (CAD) software. Design submittal drawings shall be [not supplied] size, suitable for half-size (11"x17") scaled reproduction.

Section 2 – Design Requirements

2.1 Drawings. Deliver CAD files used for the creation of the Construction Documents Drawings per requirements in Section 00 33 16, the criteria of the USACE [not supplied] District, and as noted herein. Specification of a CAD file format for these Drawings does not limit which BIM application(s) or software(s) may be used for project development and execution.

2.2 BIM Model and Facility Data. Contractor shall select BIM application(s) and software(s) and develop project designs using BIM software. Use 3D graphic model(s) (the "Model") and associated intelligent attribute data ("Facility Data") created by this software to produce accurate Construction Documents. The Contractor will be provided with the Corps of Engineers BIM Workspace CD based on the Bentley System BIM to be utilized for submittals. The Contractor may be provided a baseline multi-discipline BIM Project Workspace for a CoS Facility Standard Design in the Bentley BIM v8 format for the purpose of site adaptation. The Workspace is dependent on specific versions of the Bentley BIM suite of products and only the versions of the software that are listed in the Contractor instructions included on the USACE BIM Workspace CD are permitted to be used.

2.2.1 IFC Coordination View. The Contractor's selected BIM application(s) and software(s) must be certified in the IFC Coordination View (2x3 or better. See www.iai-na.org). Submit any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment for Government approval.

2.2.2 Submittal Requirements. BIM submittals shall be fully compatible with the Bentley BIM format version 8.0 and conform to the requirements of Section 3 and 4 below.

2.2.3 Implementation Plan.

2.2.3.1 Prior to the Initial Design Conference, submit an Implementation Plan, documenting viability of the BIM design and analysis technologies selected for the Project Model (integrated with the AEC CAD Standard) from concept development through As-Builts as a design, production, coordination, construction, and documentation tool and the collaborative process by which it shall be implemented.

2.2.3.2 The Implementation Plan shall describe uses of BIM during design and construction phases to include value management, interference management, and design-change tracking, or such other uses as the Contractor proposes. Refer to ERDC TR06-10, "Building Information Modeling (BIM) A Road Map for Implementation To Support MILCON Transformation and Civil Works Projects within the U.S. Army Corps of Engineers" for more information at <https://cadbim.usace.army.mil/default.aspx?p=s&t=19&i=1>.

2.2.3.3 The Implementation Plan shall identify how the BIM data shall be managed and interoperate (data storage, sharing, viewing, quality control parameters in Section 2.3 Quality Control, and updating, as necessary) among all Contractor team members.

2.2.3.4 Conduct an Implementation Plan demonstration at the Initial Design Conference to review the Implementation Plan for clarification, and to verify the functionality of Model technology workflow and processes. The Government shall confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the Plan. If modifications are required, the Contractor shall execute the modifications and resubmit the final Implementation Plan for Government acceptance. There will be no payment for design or construction until the Plan is acceptable to the Government. The Government may also withhold payment for design and construction for unacceptable performance in executing the Implementation Plan.

2.2.4 Model Components. The Model shall include the following, subject to Government concurrence:

2.2.4.1 Project Specific BIM Facility Data. Develop the Facility Data, consisting of a set of intelligent elements for the Model (e.g., doors, air handlers, electrical panels). This Facility Data shall include all material definitions, qualities, and attributes that are necessary for the Project facility design.

2.2.4.2 Project Specific Minimum Requirements. The Contractor's Model shall include, at a minimum, the requirements of Section 4 below. The Government must agree with any proposed modifications to minimum requirements before incorporation into the Model.

2.2.4.3 Facility Data Output. Each submittal under Section 3 shall include a list of Construction Documents (e.g., drawings, elevations, design sections and schedules, details) that shall be produced from the Facility Data and updated as necessary.

2.2.4.4 Model Granularity. Models may vary in level of detail for individual elements within a 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 appropriately scaled civil drawings.

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

2.3.1 Standards Checks. QC checking performed to ensure that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per the A/E/C CADD Standard.

2.3.2 Model Integrity Checks. QC validation used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Report non-compliant elements and provide justification acceptable to the Government if allowed to remain within the Model.

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

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

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

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

2.4.3 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.

2.4.4 Other Parameters. Develop such other Review parameters as the Contractor deems appropriate for the Project and provide to the Government for concurrence..

Section 3 – Design Stage Submittal Requirements

3.1 Submittal Requirements.

3.1.1 Provide submittals in compliance with Implementation Plan deliverables at stages as described hereinafter.

3.1.2 Provide a Contractor-certified written report with each design submittal, confirming that consistency checks as identified in Paragraphs 2.3 and 2.4 have been completed for the design submittal. This report shall be discussed as part of the design review conference and shall address cross-discipline interferences, if any.

3.1.3 Following Government review and concurrence at each Stage in Paragraphs 3.3 through 3.5, provide the Government a 3-D interactive visualization from the Model in Bentley Navigator, Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or equivalent format. The Government may request other formats if needed to address Project-specific requirements.

3.2 Preliminary Implementation Review. Prior to the first Interim Design Submittal or Over-the-Shoulder Progress Review, demonstrate preliminary development of Model components and Facility Data identified in Paragraph 'Model Components'. Review the Model with the Government for conformity to program, massing, circulation, fire protection, security and sustainability Project requirements consistent with the Implementation Plan.

3.3 Interim Design Submittals.

3.3.1 BIM and CAD Data. The Model shall include architectural, interior design, structural, mechanical, electrical, plumbing and fire protection systems and Facility Data, as applicable to the Interim Design package(s). Provide the Model, Facility, Workspace and CAD Data files in native Bentley BIM/CAD and interoperable formats per Implementation Plan requirements, and any rendering files, on DVD/CD-ROM.

3.4 Final Design Submissions and Design Complete Submittals.

3.4.1 BIM and CAD Data. The Model shall include all design elements identified in Section 4, unless otherwise agreed by the Government. Secure Government acceptance of the Model from the Government before proceeding with commencement of construction, as described in paragraph 3.7.6 of Section 01 33 16. Provide the updated Model, Facility, Workspace and CAD Data and rendering files on DVD/CD-ROM.

3.5 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, including interference management and design change tracking information.

3.6 Final As-Builts BIM and CAD Data. Submit the final Model, Facility Data, and CAD files reflecting as-built conditions for Government Approval, as specified in Section 01 78 02.00 10, PROJECT CLOSEOUT.

Section 4 – BIM Model Minimum Requirements and Output

4.1 General Provisions. The deliverable Model shall be developed to include the systems described below as they would be built and the processes of installing them, and to reflect final as-built conditions. The deliverable model at the interim design stage and at the final design stage (“released for construction”) shall be developed to include as many of the systems described below as are necessary and appropriate at that design stage.

4.2 Architectural/Interior Design. The Architectural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.2.1 Spaces. The Model shall include spaces defining accurate net square footage and net volume, and holding data for the room finish schedule for including room names and numbers. Include Programmatic Information provided by the Government or validated program to verify design space against programmed space, using this information to validate area quantities.

4.2.2. Walls and Curtain Walls. Each wall shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect wall types. The Model shall include all walls, both interior and exterior, and the necessary intelligence to produce accurate plans, sections and elevations depicting these design elements

4.2.3 Doors, Windows and Louvers. Doors, windows and louvers shall be depicted to represent their actual size, type and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules.

4.2.4 Roof. The Model shall include the roof configuration, drainage system, major penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections and generic wall sections where roof design elements are depicted.

4.2.5 Floors. The floor slab shall be developed in the structural Model and then referenced by the architectural Model for each floor of the Project building.

4.2.6 Ceilings. All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions shall be depicted in the Model with the necessary intelligence to produce accurate plans, building sections and generic wall sections where ceiling design elements are depicted.

4.2.7 Vertical Circulation. All continuous vertical components (i.e., non-structural shafts, architectural stairs, handrails and guardrails) shall be accurately depicted and shall include the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.8 Architectural Specialties and Woodwork. All architectural specialties (i.e., toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and woodwork (i.e., cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.9 Signage. The Model shall include all signage and the necessary intelligence to produce accurate plans and schedules.

4.2.10 Schedules. Provide door, window, hardware, sets using BHMA designations, flooring, and wall finish, and signage schedules from the Model, indicating the type, materials and finishes used in the design.

4.3 Furniture/Fixtures/Equipment. 3D representation of FFE elements is preferred. For projects with an extensive systems furniture layout that may impact BIM system performance the Contractor will contact the Government for consideration of 2D representation. The FFE systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.3.1 Furniture. The furniture systems Model may vary in level of detail for individual elements within a Model, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing, and shall include all relevant office equipment and furniture system layouts, with necessary intelligence to produce accurate plans, sections, perspectives and elevations necessary to completely depict furniture systems locations and sizes.

4.3.1.1 System Coordination. Furniture that makes use of electrical, data, plumbing or other features shall include the necessary intelligence to produce coordinated documents and data.

4.3.2 Fixtures and Equipment. Fixtures and equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans, elevations, sections and schedules depicting their configuration

4.3.3 Schedules. Provide furniture and equipment schedules from the model indicating the materials, finishes, mechanical, and electrical requirements.

4.4 Structural. The structural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.4.1 Foundations. All necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations.

4.4.2 Floor Slabs. Structural floor slabs shall be depicted, including all necessary recesses, curbs, pads, closure pours, and major penetrations accurately depicted.

4.4.3 Structural Steel. All steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans and related building/wall sections.

4.4.4 Cast-in-Place Concrete. All walls, columns, and beams, including necessary intelligence to produce accurate plans and building/wall sections depicting cast-in-place concrete elements.

4.4.5 Expansion/Contraction Joints. Joints shall be accurately depicted.

4.4.6 Stairs. The structural Model shall include all necessary openings and framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.

4.4.7 Shafts and Pits. The structural Model shall include all necessary shafts, pits, and openings, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements.

4.5 Mechanical. The mechanical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.5.1 HVAC. All necessary heating, ventilating, air-conditioning and specialty equipment, including air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills and hydronic baseboards with necessary intelligence to produce accurate plans, elevations, building/wall sections and schedules. All piping larger than 1.5" diameter shall be modeled.

4.5.1.1 Mechanical Piping. All necessary piping and fixture layouts, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules. All piping larger than 1.5" diameter shall be modeled.

4.5.2 Plumbing. All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All piping larger than 1.5" diameter shall be modeled.

4.5.3 Equipment Clearances. All HVAC and Plumbing equipment clearances shall be modeled for use in interference management and maintenance access requirements.

4.5.4 Elevator Equipment. The Model shall include the necessary equipment and control system, including necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.6 Electrical/Telecommunications. The electrical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.6.1 Interior Electrical Power and Lighting. All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, panelboards and control systems), including necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents. Lighting and power built into furniture/equipment shall be modeled.

4.6.2 Special Electrical Systems. All necessary special electrical components (i.e., security, Mass Notification, Public Address, nurse call and other special occupancies, and control systems), including necessary intelligence to produce accurate plans, details and schedules.

4.6.3 Grounding Systems. All necessary grounding components (i.e., lightning protection systems, static grounding systems, communications grounding systems, bonding), including necessary intelligence to produce accurate plans, details and schedules.

4.6.4 Communications. All existing and new communications service controls and connections, both above ground and underground with necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents. Communications conduit larger than 1.5" shall be modeled.

4.6.5 Exterior Building Lighting. All necessary exterior lighting with necessary intelligence to produce accurate plans, elevations and schedules. The exterior building lighting Model shall include all necessary lighting, relevant existing and proposed support utility lines and equipment required with necessary intelligence to produce accurate plans, details and schedules.

4.6.6 Equipment Clearances. All lighting and communications equipment clearances and no-fly zones shall be modeled for use in interference management and maintenance access requirements.

4.7 Fire Protection. The fire protection system Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.7.1 Fire Protection System. All relevant fire protection components (i.e., branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, control panels) with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled.

4.7.2 Fire Alarms. Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

4.8 Civil. The civil Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a one inch (1"=100') scaled drawing. Additional minimum Model requirements include:

4.8.1 Terrain (DTM). All relevant site conditions and proposed grading, including necessary intelligence to produce accurate Project site topographical plans and cross sections.

4.8.2 Drainage. All existing and new drainage piping, including upgrades thereto, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.8.3 Storm Water and Sanitary Sewers. All existing and new sewer structures and piping, including upgrades thereto, on the Project site with necessary connections to mains or other distribution points as appropriate, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.8.4 Utilities. All necessary new utilities connections from the Project building(s) to the existing or newly-created utilities, and all existing above ground and underground utility conduits, including necessary intelligence to produce accurate plans and site-sections.

4.8.5 Roads and Parking. All necessary roadways and parking lots or parking structures, including necessary intelligence to produce accurate plans, profiles and cross-sections.

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 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.

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 during the source selection, as described in the proposal submission requirements and evaluation criteria, the following criteria are requirements, as applicable to those elective feature(s).

6.2 COBIE Compliance. The Model and Facility Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements, including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate file formats that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.2.1 Electronic Exchange. The National Building Information Model Standard (NBIMS) COBIE format shall be used for electronic exchange on this Project. Compile a COBIE index on the Microsoft Excel spreadsheet provided by NBIMS at www.nbims.org. Unless otherwise noted, also provide information identified in the COBIE Pilot Implementation Standard worksheets.

6.3 Project Scheduling using the Model. In the Implementation Plan and during the Preliminary Implementation Review, 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 Submittal stages, the Contractor shall deliver the construction schedule with information derived from the Model.

6.3.1.2 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 Implementation Plan and during the Preliminary Implementation Review, provide an overview of the use of BIM in the development and support of cost estimating requirements, or other applications such as cost analysis and estimate validation.

6.4.1 Submittal Requirements. During the Submittal stages, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2 Project completion. At project completion, the Contractor shall provide an MII (Micro Computer Aided Cost Estimating System Generation II) Cost Estimate which follows the USACE Cost Engineering Military Work Breakdown System (WBS), a modified unformat, to at least the sub-systems level and uses quantity information supplied directly from BIM output to the maximum extent possible, though other "Gap" quantity information will be included as necessary for a complete and accurate cost estimate.

6.4.2.1 Sub system level extracted quantities from the BIM for use within the estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. Therefore, when developing a BIM, the designer shall be cognizant of what tasks need to be separated appropriately at the beginning stages of model development, such as tasks done on the first floor versus the same task on higher floors that will be more labor intensive and therefore need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the BIM shall be broken down by their location (proximity in the structure) as well as the complexity of its installation.

6.4.2.2 At all design stages it shall be understood that BIM output as described in this document will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the project based on the design. An example of this would be plumbing that is less than 1.5" diameter and therefore not expected to be modeled due to granularity; this information is commonly referred to as The Gap. Quantities from The Gap and their associated costs shall be included in the final project actual cost estimates as well.