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Project Automation Requirements & Deliverables Guideline



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Project Automation Requirements & Deliverables Guideline

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Project Automation Requirements & Deliverables Guideline

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1.0 PURPOSE

This document outlines the Automation requirements and deliverables for the A/E and will act as a guideline for the A/E to develop a Project Automation Plan (PAP) and BIM Execution Plan (BEP) plan. Projects that may not require BIM (Building Information Modeling) due to the type or small size of the project will not be required to develop a BEP however other aspects of Automation such as Computer Aided Design (CAD), GIS (Geographical Information System), or Information Management (IM) may be employed. The intent of this document is to promote the maximum utilization of CAD, BIM, GIS, and IM by the A/E and other project participants.

This document should be modified to suit the project and any relevant additional information added as appropriate.

2.0 DEFINITIONS

Definitions	Description
A/E	Architectural/Engineering
Automation	Field of specialized software tools and associated work processes involved with the creation of A/E project deliverables. Focus is on CAD/BIM/GIS and IM
BEP	BIM Execution Plan
BIM	Building Information Model(ing) VERB: A cross-functional collaborative process of creating, collecting & managing information to virtually design, procure, schedule, construct, commission, start-up and operate a facility. BIM therefore develops a digital representation of the physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward NOUN: The collection of files and databases used in building the information model of the facility
CAD	Computer Aided Design
CMMS	Computerized Maintenance Management System
COBie	Construction Operations Building Information Exchange (COBie) is a non-proprietary data format for the publication of a subset of Building Information Models (BIM) focused on delivering asset data as distinct from geometric information
ER	Exchange Requirements: Defines the information that will be required by the Entity from the A/E, suppliers, and consultants for the operation and maintenance of the completed built asset.
FCD	Field Change Directive
GIS	Geographic Information System
IM	Information Management
ICT	Information & Communications Technology
LOD	Level of Development
PAP	Project Automation Plan
RFI	Request for Information
SME	Subject Matter Expert
Super User	Subject matter expert who will define how the software will be used, support software implementation, and drive its implementation on the project
UOM	Unit of Measure
WBS	Work Breakdown Structure

3.0 REFERENCES

Reference	Description
EPM-KE0-PR-000008	CAD Standards Procedure
EPM-KE0-RG-000009	List of Commonly Used Design and Engineering Software
EPM-KE0-TP-000025	Project BIM Execution Plan (BEP) Template
EPM-KE0-RG-000014	BIM Level of Development Matrices
EPM-KE0-TP-000012	Tagging Procedure Template



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EPM-ID0-PR-000002	Project Standard Document Numbering Procedure
EPM-KE0-GL-000018	Standard Drawing Template Guide
EPM-KCE-PR-000007	Project Construction As-Built Drawings Procedure
NBIMS https://www.nationalbimstandard.org/	National BIM Standard – United States website

4.0 ENGINEERING ROLES AND RESPONSIBILITIES

4.1 Automation Manager

The A/E shall designate a trained Automation Manager to act as Automation representative to coordinate with the Entity's Project Automation team. The A/E Automation representative will be responsible for, but not limited to, the following items:

- Understanding the scope of the project as it pertains to Automation for all phases of the project
- Creating staffing plans for the A/E Project Automation group
- Initiate and chair the Project Automation Kickoff meeting
- Set project models and drawings with the correct coordinate systems
- Incorporate project specific requirements and project files supplied by the Entity into the applications
- Develop and/or customize reference databases, libraries, and project files to aid in the production of the required deliverables
- Ensures that all model elements, regardless of authoring software, are assigned the Entity approved Industry Classification codes. Unless otherwise stated by the Entity, Unifomat II shall be the Industry Classification Code assigned
- Ensures all model data complies with the Entity Exchange Requirements (ER)
- Is responsible for issuing the Project BIM Execution Plan (BEP)
- Ensures accuracy of the model data used for material take-off and handover
- CAD standards documentation shall follow CAD Standards Procedure - EPM-KE0-PR-000008 and the US National CAD Standards v6
- Maintain CAD and 3D model functionality and quality through regular health checks and audits – includes file size management and addressing system generated warnings and errors
- Verify drawing indexes and ensure applicable naming and numbering conventions are being followed
- Conducting internal model reviews and quality checks prior to milestone submissions in the agreed timeframe per Entity requirements
- Ensuring relevant clashes are delegated and resolved within 10 business days
- Maintaining and providing concurrent Record and As-Built models based on RFI's, submittals, other changes, and on-site verification per project agreement
- Ensure key decision makers are present at all meetings
- Is the principal point of contact for sub-contractors, suppliers

4.2 BIM Manager

For large projects that have a significant BIM component, a separate A/E BIM Manager shall be assigned who is responsible for BIM scope and will be responsible for developing, administering, and supporting the BIM and associated documentation required.

4.3 Discipline Automation or BIM Specialist

Each discipline shall assign a specialist or Super user and made responsible for the administration, support and coordination of respective discipline work processes and software support in their discipline and work closely with the Automation and/or BIM Manager as appropriate.

4.4 Supplier and Subcontractor BIM representatives

Supplier and Subcontractor BIM representatives are responsible for providing input to the A/E. This will be based on the A/E input requirements relative to document, files and data etc. that the A/E requires.



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5.0 AUTOMATION KICK-OFF MEETING

An Automation Kickoff Meeting will be conducted at the beginning of the project. The Project Automation Plan document will be distributed at this time, and it is required that external Automation representatives be in attendance. Topics that may be discussed at the Automation Kickoff Meeting include the following:

1. Identify scope of Automation
 - a) CAD, BIM, GIS, Information Management (per Exchange Requirements (ER)). See section 4 of the BIM Execution Plan (BEP) - EPM-KE0-TP-000025.
 - b) Confirm software to be used on the project taking into account all Entity requirements
 - c) Identify sub-contractor and supplier scope and flow-down of Automation requirements including data ER.
2. Identify roles:
 - a) Discipline and automation roles: BIM Manager, CAD specialists, super users, SME's etc.
 - b) Identify discipline-specific decision makers: design managers, leads, and coordinators
 - c) Identify internal, client and sub-contractor ICT and automation/BIM contacts and responsibilities
 - d) Identify Entity contacts for Automation and ICT.
3. Project Overview
 - a. Project Information security requirements and compliance
 - b. Automation Role Introductions
 - c. Key Milestones and Target Dates
 - d. Milestone Deliverables, including Level of Development (see Attachment 3 - LOD matrix – EPM-KE0-RG-000014) and the Exchange Requirements (ER)
 - e. Phasing/sequencing for Project delivery
 - f. Project-specific collaboration requirements
 - g. Alignment with Client ER
 - h. Discuss with the design partner (if any) BIM Execution Plans (BEP) and processes
 - i. Identify design reference drawings [owner or client provided]
4. Project Set-up Documents
 - a. Confirm software suite and software versions
 - b. Model and drawing file structure and breakdown (based on Work Breakdown Structure (WBS) – refer to EPM-KPP-PR-000001 -Project Planning and Scheduling Definitions and Concepts Procedure)
 - c. Confirm standards, Units of measure (UOM)
 - d. Work share requirements (Revit work sets or other)
 - e. Add Civil 3D, Inroads and OpenRoads specific items if applicable
 - f. Define GIS scope, map scales and sources of maps for the project
 - g. Documents required e.g. BEP (sample attached), CAD Standards, Revit users guide, work process diagrams etc.
5. Coordinates
 - a. Project and Survey Base Points
 - b. Elevation and Angle to True North
 - c. Project North Orientation
 - d. Host model for Shared Coordinates
 - e. Address multiple coordinate systems and assure that all agree on the project coordinates
 - f. LiDAR and GIS Requirements
6. Project-Specific Modeling Requirements
 - a. Work sharing setup and conventions; use of work sets (Revit only)
 - b. Use of external reference files (naming conventions, file locations and tracking status)
 - c. Management of families/generic objects, stand-off distances and clearances
7. Collaboration
 - a. Platforms / cloud solutions to be used
 - b. Model sharing schedules
 - c. Model Review requirements and update frequencies
8. Coordination



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- a. Analysis methodology (piping, lighting, structural, etc.)
- b. Managing alternate designs (design options, work sets, separate files)
- c. Coordinate meeting schedules
- d. Interoperability requirements

Meetings shall be recorded and minutes distributed. Assigned tasks shall be assigned to responsible persons with a required completion date.

6.0 COLLABORATION

Unless otherwise directed by project leadership, weekly coordination and work plan meetings shall be held. It is required that A/E Automation representatives (or designees authorized to make decisions) participate in these meetings. During this meeting, the Action Items List will be reviewed.

6.1 Interoperability Requirements

For interoperability, both internally and with the client, standardization of the following elements must be maximized between project participants.

6.1.1 Authoring and Model Review Software

Review Entity mandatory and recommended design software requirements and combine with company software list to form the project software solutions list. Refer to EPM-KE0-RG-000009 – List of Commonly Used Design and Engineering Software.

6.1.2 Collaboration Platforms

Determine Entity collaboration platform such as BIM 360 Docs, Project Wise, SharePoint, Navisworks, etc. if working in a shared working environment. If not a shared working environment, agree with the Entity how files will be delivered. e.g. OneDrive, Dropbox etc.

6.1.3 Files provided by Entity

The Entity should provide the following standard file requirements to the A/E to use during the design phase to provide consistency across projects.

- AutoCAD templates (use EXPRO templates) or other CAD format templates
- Border file
- Note and Legend formatting
- Font sizes and styles
- Parameters or .ini files of various software
- Exchange Requirements.

7.0 MODEL DEVELOPMENT AND DELIVERABLES

All project data and drawings related to the design of a facility shall be generated from 3D models. The following drawings and diagrams may be authored in 2D:

- standard details and legends
- Flow diagrams and Process and Instrumentation Diagrams (P&IDs)**
- Electrical one-line and schematic drawings

** The Entity preference is for P&IDs to be authored using Intelligent P&ID software linked to the 3D model and where lists such as line lists, mechanical, electrical, and instrument equipment lists can be extracted from the software.

For projects utilizing BIM – refer to attachment 1 for a sample Project BIM Execution Plan (BEP) template. This template should be customized for the specific project and issued to the A/E to be used as a basis for the A/E to develop their Project BIM Execution Plan (BEP).



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7.1 Concurrent Record and As-Built Modeling [as required by project]

When part of the contract, maintaining up-to-date Record and As-Built models is an ongoing process throughout the construction phase. Record and As-Built models must incorporate all field changes - including, but not limited to: RFIs, Fabrication models, Revision Addenda, and Field Change Documents (FCDs) for creation of the Record As-Built Model.

Completed construction will be verified, with any additional changes reported by the team to be updated in As-Built Models and drawings to be used for Facility Management. Record and As-Built Models and drawings will be at the same level of detail as the original deliverables were generated from.

For more information regarding the As-Built drawing and models refer to EPM-KCE-PR-000007 - Project Construction As-Built Drawings Procedure.

8.0 AUTOMATION CLOSEOUT MEETINGS

Automation or BIM Closeout meetings will be scheduled with individual partners, subcontractors, and consultants. In addition to the follow agenda items, the Entity team will also be capturing external feedback.

8.1 Sample Automation Closeout Agenda

Lessons Learned:

- Major project successes and how to replicate them for future projects
- Major project challenges and how to manage them for future projects
- Process and collateral recommendations for future projects
- Change management successes and challenges
- Address any training or resource requirements
- Additional project team feedback

Comparisons:

- Budget – over or under, and reasoning
- Scheduling – dates, deliverables, activities and tasks (planned vs. actual)
- How can these help future projects
- Risks – anticipated vs. actual, and how to mitigate these in the future
- Additional (unintended) work or requirements

Content Created:

- Revit families (if Revit used) and data
- Standard details
- Content needed for future projects

Next Steps:

- Documentation for future projects

9.0 NAMING AND NUMBERING CONVENTIONS

Unless alternative naming conventions are specified, the following will apply.

9.1 Drawing and Model File Naming

File naming formats by the A/E and sub-contractors shall follow the format defined for document numbering in the procedure called Project Document Numbering System – EPM-ID0-PR-000002

9.2 Document Numbering System

Drawings and Documents produced from the model shall contain the project document number in the title block.

Refer to the document: Project Standard Document Numbering Procedure – EPM-ID0-PR-000002

9.3 Asset and Component Tagging Requirements



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9.3.1 Exchange Requirements (ER)

The Entity Exchange Requirements (ER) defines the information that will be required by the Entity from both their own internal team and from A/Es and suppliers for the development of the project and for the operation of the completed facility.

When required by the Entity, the Entity will define tagging and attribution requirements as part of the Exchange Requirements (ER) and issue this to the A/E to include these requirements in their Project Automation Plan. The Entity typically lists the asset types by Masterformat number (for equipment number, line number, instrument number etc.), that require tagging. The Entity Tagging Procedure states how these tags are defined and how the tags will be used (e.g., on design documents, for material receipt at a project site, for asset management throughout the life off the building or facility, etc.). Refer to the Tagging Procedure Template - EPM-KE0-TP-000012.

Data should be exchanged in COBie data format using the Industry Foundation Class (IFC) file format.

Typical assets that require tagging are listed below based on Masterformat division. On projects using BIM, these assets must be tagged in the model. If assets are shown on 2D drawings only, then a register must be maintained that lists the items tagged on the drawings with the required attribute data together including the drawing number reference.

MasterFormat Division	Asset Types
Division 14 - Conveying Equipment	
	Elevators
Division 21 - Fire Suppression	
	Fire Pumps
Division 22 - Plumbing	
	Domestic Water Pumps
	Backwater Valves
	Sanitary Sewerage Pumps
	Facility Packaged Sewage Pumping Stations
	Sump
	General Service Packaged Air Compressors and Receivers
	Electric Domestic Water Heaters
	Fuel-Fired Domestic Water Heaters
	Domestic Water Heat Exchangers
Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC)	
	Facility Fuel Pumps
	Fire Dampers
	Smoke-Control Dampers
	HVAC
	Constant-Air-Volume Units
	Variable-Air-Volume Units
	Ventilation Hoods
	Heating Boilers
	Boiler Feed water Pumps
	Furnaces
	Fuel-Fired Heaters
	Heat Exchangers for HVAC



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	Refrigerant Compressors
	Refrigerant Condensers
	Packaged Water Chillers
	Cooling Towers
	Indoor Central-Station Air-Handling Units
	Packaged Outdoor HVAC Equipment
	Custom-Packaged Outdoor HVAC Equipment
	Evaporative Air-Cooling Equipment
	Decentralized Unitary HVAC Equipment
	Convection Heating and Cooling Units
	Radiant Heating Units
Division 26 - Electrical	
	Medium-Voltage Transformers
	Medium-Voltage Switchgear
	Medium-Voltage Metering
	Low-Voltage Transformers
	Low-Voltage Switchgear
	Switchboards and Panel boards
	Static Uninterruptible Power Supply
Division 28 - Electronic Safety and Security	
	Fire Detection and Alarm Annunciation Panels and Fire Stations
Division 33 - Utilities	
	Water Utility Pumping Stations
	Water Supply Wells
	Packaged Utility Lift Stations
	Packaged Utility Wastewater Pumping Stations
	Fuel-Oil Pumps
	Gasoline Pumps
	Diesel Fuel Pumps
	Utility Transformers
	High-Voltage Switchgear and Protection Devices
	Medium-Voltage Utility Switchgear and Protection Devices

For the above listed assets, the following typical data will need to be collected by design and construction teams to support Computerized Maintenance Management System (CMMS) and Computer-aided facility management (CAFM):

Tag/ attribute

- Asset tag (parent)
- Asset description
- Location Code
- Spec Reference
- Manufacturer
- Manufacturer Model Number
- Serial Number
- Installation Date
- Warranty Start Date



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- Warranty Duration
- Warranty Description

9.3.2 Asset and Component tagging format

Refer to EXPRO Tagging Procedure Template – EPM-KE0-TP-000012 for a sample of a tagging procedure.

9.3.3 Industry Classification Code

All elements in the model must be assigned a Unifomat II Industry Classification Code unless noted otherwise.

9.4 Data Quality

Consistent attribute or data definitions throughout the lifecycle of the project development is fundamental to the success of the project's ability to handover data to the Entity. Whether BIM is used on the project or if data is collected manually on spreadsheets, the project must employ data quality practices to ensure that the data handover to the Entity is accurate and complete, formatting is correct, range of values is allowable, and UOM is correct.

10.0 SUBMITTAL REQUIREMENTS

Deliverable Type	With Proposal	Official Submittals 30%, 60%, 100% and handover	Regular Submittal as Agreed During Execution Phase
BIM Questionnaire (see attachment 2 EPM-KE0-TP-000024)	x	x	
Contractor and Sub-Contractor BIM Execution Plan	x	x	x
Model Data Quality Check Reports		x	
Clash Report		x	
Model handover		x	x
List of BIM Open Issues		x	x
Quantity Reports		x	x
Deviation Request to the BIM Automation Requirements	x		x

11.0 ATTACHMENTS

1. EPM-KE0-TP-000025 - Project BIM Execution Plan Template
2. EPM-KE0-TP-000024 - BIM Authoring Tool Questionnaire Template
3. EPM-KE0-RG-000014 – BIM Level of Development Matrices



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Attachment 1: EPM-KE0-TP-000025 - Project BIM Execution Plan Template

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1.0 INTRODUCTION

[This document must be tailored by the Entity for each project. The Entity should then give this document to the A/E as a template or basis for the A/E to prepare their own BIM Execution Plan (BEP). There are examples of BIM documentation on the internet that could be useful to the Entity or their consultants in preparing a BEP. For example, the Denver International Airport (DIA) and the VA BIM Standard from the US Department of Veteran Affairs.]
[remove this note]

1.1 Purpose

This BIM execution plan is to provide the project team with clear guidance as to the staffing, tools, processes, procedures and systems required to facilitate the flow of information to support the design, procurement and construction of the [Project name] Project.

1.2 Scope

- This plan applies to all parties and all work performed on the [Project name] Project where Building Information Modeling (BIM) is utilized.

1.3 Definitions

Definitions	Description
A/E	Architectural/Engineering
AR	Augmented Reality
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CAD	Computer Aided Design
CDE/ Data Warehouse	Common Data Environment: Large store of linked Data and trusted source of truth of the assets
CMMS	Computerized Maintenance Management System
COBie	Construction Operations Building Information Exchange (COBie) is a non-proprietary data format for the publication of a subset of BIM focused on delivering asset data as distinct from geometric information
ER	Defines the information that will be required by the Entity from the A/E, suppliers, and consultants for the operation and maintenance of the completed built asset
GIS	Geographic Information System
IM	Information Management
ICT	Information & Communications Technology
LOD	Level of Development
MEP/FP	Mechanical, Electrical, Plumbing/Fire Protection
SME	Subject Matter Expert
Super User	Subject matter expert who will define how the software will be used, support software implementation, and drive its implementation on the project
WBS	Work Breakdown Structure



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1.4 References

- EPM-KE0-GL-000020 – Project Automation Requirements and Deliverables Guideline
- EPM-KE0-PR-000008 – CAD Standards Procedure
- EPM-KE0-TP-000012 – Tagging Procedure Template
- EPM-ID0-PR-000002 – Project Standard Document Numbering Procedure
- EPM-KE0-TP-000024 – BIM Questionnaire Template
- EPM-KE0-RG-000014 – BIM Level of Development Matrices

EPM-KE0-RG-000009 – Project Automation Requirements & Deliverables Guideline

EPM-KE0-PR-000010– 3D Model Review Procedure

- *Edit above for project specific document references and add additional references as required*

1.5 Project Overview

1.3.1 Project Owner

1.3.2 Contract Type

[Engineering services, lump sum etc.]

1.3.3 Project Description

1.6 Design Execution

Describe the strategy of the design execution, that is, if the A/E is hiring outside firms to perform specialty work (structural design, HVAC, etc.) describe who is performing the work and how/when the data will be updated into the design effort

1.7 Project Schedule

Describe the overall project timeline and milestones including when consultants or various internal disciplines (structural, electrical, HVAC, piping, etc.) will complete portions of the work to prepare the final complete 3D design.

2.0 BIM EXECUTION

2.1 Responsibilities

- Define the BIM organization and include a diagram.
- Describe the various roles and contacts, depending on the size and complexity of the project, this will include the Automation Manager, BIM Manager, Discipline BIM Leads, Subcontractor BIM Coordinators, Subject Matter Experts (SME or Super Users), ICT support

Automation Manager: leads all aspects of project automation related to design. Covers CAD/BIM/GIS/IM and related software; main contact with client and subcontractors. Is the main contact when interfacing with the client and subcontractors on Automation related matters. Responsible for all Automation related documentation

BIM Manager: On large projects a BIM Manager will be responsible for the development of and administration of the BIM and the coordination of the BIM stakeholders working through the discipline BIM Leads.



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SMEs/Super Users: understand the technical and work process aspects for their disciplines together with a high understanding of the software. On large projects may be full-time in this role but otherwise mainly doing production work

SubContractor BIM Coordinators: Subcontractor (if any) main point of contact for BIM related deliverables to the A/E

ICT Support: ICT infrastructure and desktop hardware and software support

2.2 Strategy

The BIM strategy for the project is to -

CREATE the design information in a 3D model format using discipline-based tools that support design coordination, analysis, and interoperability of data for use through manufacture and construction then into operations.

COLLABORATE at all stages of the project using the BIM model as the basis for review, evaluation and comment.

CONTROL the management of the works using the BIM model to support estimating, scheduling, logistics, and commissioning.

CONSUME the BIM model and the associated project information across all functions and disciplines by allowing access to data to all parties via a Common Data Environment (CDE).

CONTRIBUTE additional information to the model throughout the project lifecycle by all teams to build a complete project information resource to optimize handover for operations.

This BIM Execution Plan (BEP) outlines the tools, systems, processes and protocols required to successfully deliver the strategy. The illustration below [A/E to insert diagram] illustrates the cross-functional interactions needed to achieve this strategy.

2.3 Engineering and Construction Automation Tools & Systems

Include a listing of software used and for what purpose. Use EPM-KE0-RG-000009 - List of Commonly Used Design & Engineering Software to help develop this list

Create a high level diagram showing the flow of information between the contractor and sub-contractors and the Entity

2.4 Engineering Design Sub-Contractor BIM Planning

Each sub-contractor is required to prepare their own BIM Execution Plan, which sets out how the sub-contractor will deliver the required BIM information to the A/E for their scope of work. This is to be submitted to the A/E BIM Manager for review and approval within 30 days of contract award.

Sub-Contractor's BEP is to cover the following topics –

BIM Uses

CAD Standards

BIM & CAD Software Tools and Applications to be used

Model Schedule. A complete list of all BIM and CAD Models to be prepared by the Designer



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BIM Contacts and Roles & Responsibilities. A list of BIM and CAD Coordinators with responsibility for delivering the BIM requirements

BIM File Management. Detailed description of the locations for storage and control of the designer's electronic design files

Quality Control of Models, Drawings & Data. Methods and procedures for standards compliance checking

Model Development Plan. A plan defining how the BIM will be developed to meet the Project Milestones BIM information exchange methods and formats

BIM Deliverables, including CAD files and model deliverables together with file types. Include data requirements of the Entity and A/E with submission schedule

Interfaces - BIM Coordination includes the facility interfacing process. A Package Interface Lead is assigned. The BIM Coordinator will work with the Package Interface Lead and the BIM Coordinators of interfacing Packages to develop a common approach to the modeling of the interfacing objects such that the interfacing elements are coordinated by geo-location, construction sequence, and by discipline-to-discipline services. The Sub-Contractor BEP should outline that interfacing approach.

Add project specific requirements here also.

2.5 Modeling Scope & Detail

Discuss what will and will not be modeled, the level of detail shown for existing facilities if applicable and scope of others.

All project data and drawings related to the design of a facility shall be generated from 3D models with the following exceptions:

- standard 2D details and legend views
- Flow diagrams and Process and Instrumentation Diagrams (P&IDs)
- Electrical one-line and schematic drawings

If required by the Entity, add this requirement:

Note that all schedules and quantities shall be generated from the project 3D models.

2.5.1 Level of Development

The Level of Development (LOD) Specification is a reference that specifies and articulates the content and reliability of Building Information Models (BIMs) at various stages in the design and construction process. The Level of Development (LOD) is defined in section 6.7.1. The LOD Matrix, which describes the LOD for each project phase, is described in Attachment 2. Alternatively the AIA G202: AIA G202-2013 Building Information Modeling Protocol Form outlines other non-data project modeling requirements for each project phase. Additionally, the following items are to be considered standard:

Edit to suit:

- Floor Slabs: Owned by Structural. Include slab depressions and model any penetrations above 600mm X 600mm
- Thin Floor Elements (Carpet, Tile, etc.): Owned by Architectural. To be modeled as non-room bounding
- Structural Walls: Owned by Structural. Full height, no stud framing, no bracing, model any penetrations above 600mm X 600mm
- Structural Framing: Owned by Structural. Model actual beam column, base plate, bracing, joist, and girder sizes. Excludes connections
- Structural Concrete: Owned by Structural. Rebar is normally excluded.
- Nonstructural Walls: Owned by Architectural. True height, no stud framing, no bracing, no MEP/FP connections



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- Doors: Owned by Architectural. Model clearances with symbol lines in plan, and with transparent solid in 3D. Exclude hardware.
- Areas and Rooms: Owned by Architectural. Model as fully enclosed or defined.
- Stairs and Railings: Structural supports owned by Structural. Other elements owned by Architectural. Model risers, treads, intermediate landings, and railings per building code requirements.
- Elevators: Shaft clear width and depth owned by Architectural. Cab width and depth owned by Mechanical. Supplemental framing for elevator hoist beams and rail supports owned by Structural.
- Casework: Owned by Architectural. Excludes hardware.
- Ceilings: Owned by Architectural. Model as non-room bounding, do not use "Basic" ceiling type.
- Mechanical Equipment: Owned by Mechanical. Model accurate size to match basis of design and accurate placement. Include service, replacement, and access clearances, as well as coil or tube pull zones, using symbol lines in plan, and transparent solid in 3D.
- Ducts / Diffusers: Owned by Mechanical. Model accurate size and placement, with worst-case scenario thickness. Model diffusers with proper category. Exclude flanges.
- Piping: Owned by Mechanical and Plumbing. Model accurate size and routing. Insulation, while an attribute of the piping, is not normally displayed or may be displayed semi-transparently.
- Fire Protection: Owned by Mechanical and Electrical. Model pumps, risers, mains, and fire alarms. Exclude branch lines, sprinkler heads, and fireproofing.
- Electrical Equipment: Owned by Electrical. Sized to match basis of design. Model required clearances, including cable tray access, with transparent solid in 3D. Model cable trays and all conduit 1-1/2" or greater.
- Quantity Takeoff Analysis: I should be assumed that the Entity will use the 3D model quantity takeoff capabilities for estimating and sequencing purposes. Accuracy and currency of quantities shall be maintained in all models at scheduled deliverable dates.

2.6 BIM Uses

BIM (both graphical models and non-graphical data) is normally started in engineering but built upon and in collaboration with other departments, suppliers and sub-contractors during the design phase of the project. This information will be consumed by later functions where that data is input into their work processes. Typical uses are summarized in the table below against each function.

A/E to list the BIM Uses to be employed on this project as agreed with the Entity and include a description. E.g.:

2.6.1 Design Authoring

The process by which the 3D software is used to digitally develop the building or facility design. The disciplines work collaboratively by working in a common environment where each contributor to the model can view the input of the others and develop their model for each project milestone according to the LOD required. This is a key part of BIM where 3D objects can be linked to database properties to define these objects and further include them in other uses below and more.

2.6.2 Engineering Analysis

The geometric BIM models produced from the BIM authoring tools will be linked to, or exported to, analysis software for structural design analysis and calculation as required.

2.6.3 Drawing & Schedule Generation

General arrangement drawings, coordination drawings, location drawings and schedules of components and materials for all work scope that is modelled will be generated from the BIM model as sheet sets that are contained in the BIM project model for that discipline. Typical details, assembly and component details, and shop drawings may be created separately from the BIM model. The details of drawings generated separately from BIM Models are to be stated in each sub-contractor's BIM Execution Plan.



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2.6.4 Interference Management (Clash Checking)

The A/E is responsible for Design coordination between disciplines and will run clash checks in either the authoring or reviewing software to identify spatial interferences between modeled elements. A clash register will be maintained for review and action during design reviews. Lead Engineers will not be permitted to approve an element as LOD 350 unless it is confirmed as being clash free against all related models for that work area.

2.6.5 Engineering Progress Tracking

Describe the method to be used for tracking the progress of the model and the relation of LOD to model progress.

2.6.6 Interactive Design Reviews

The BIM model will be viewed live during interactive design reviews for all work scope and disciplines. Various formats of the model and viewing applications may be used. Actions arising will be recorded against specific objects, zones or models and issued as comments to the model authors either through meeting minutes, comment sheets or reports.

2.6.7 Shop Detailing

Detail or fabrication drawings such as steel detailing drawings and fabrication piping isometrics will be extracted from the model

2.6.8 Visualization

The BIM model will be used to create graphic visualizations and animations to assist communication of the works to Sub-Contractors, Suppliers, the Owner and other Stakeholders. This will also include demonstrating and illustrating safe methods of working, both to enhance graphics and posters for craft labor and through animations and toolbox talks, (e.g. showing the safe work method on an iPad on site, an example being excavation support).

2.6.9 Phasing and Construction Sequencing Simulations (4D)

Discuss how 4D planning and visualization will be employed on the project.

2.6.10 Quantity Take-Off

Quantity take-offs (QTO) will be extracted from the BIM model and made available in a location and format to be confirmed between Project Controls, Procurement and Engineering, but which will, as a minimum align with the Work Breakdown Structure (WBS).

2.6.11 Vendor Equipment Submittals

Discuss the provision of equipment, materials, systems or assemblies from suppliers and will include the supply of BIM models of that work scope in compliance with project information requirements and LOD.

2.6.12 Field Progress Tracking

Discuss how the BIM will be used to track progress in the field.

2.6.13 Augmented Reality

The BIM model will be made available on site using mobile devices and will be viewable using AR technology to visualize accurately on site both hidden elements and yet to be constructed elements of the works. This may include temporary works.

2.6.14 Digital Fabrication

The BIM model will be made available to manufacturers for the automatic fabrication of building components using CNC machines to minimize tolerances and waste and maximize productivity. In particular for structural steelwork, rebar and metalwork (ductwork) production.



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2.6.15 Record Modelling (As-Built)

The BIM model will be revised as work packages are completed to record the as-built status of the works. The LOD for completed objects recorded as constructed by Field staff will be updated to LOD 500 (see section 6.7.1).

2.6.16 Operations & Maintenance Information and Handover

The BIM model and database will store operational and maintenance information progressively and will be used to both visualize and report the collation of work packages ready for handover to the Owner for Operations and Maintenance.

2.6.17 Reality Capture

Existing conditions and As-Constructed works will be rapidly captured for incorporation into the BIM Model using laser-scanning equipment to generate point cloud data sets. This data can be used directly in the BIM authoring tools and visualization tools. Clash Checks between point cloud data and designed models can be carried out to validate early works prior to later trades and sub-contractors works on site.

2.6.18 Other

Describe other BIM Uses here that the Entity has planned to use.

3.0 WORK PROCESSES

3.1 BIM Model Engineering to Construction

Describe the work processes involved with the development of the BIM – include diagrams of the work flow from developing conceptual models through detail design and as-built. Describe how model reviews are conducted and how models are checked, how quantities and drawings are extracted from the model.

3.2 Model Review Procedure

Typical Model Review activities include:

- Design Review
- LOD Matrix compliance check
- Model data checks
- Checking model against project requirements
- Compliant component tagging
- Checking index sheet/drawing lists
- Check of package for text, symbol, sheet layout and plotting inconsistencies
- Spelling or grammatical errors
- Drawing formatting
- Minutes and record keeping

Develop this section in detail or create a separate procedure document. Refer to EPM-KE0-PR-000010– 3D Model Review Procedure

3.3 REVIT Procedures (where Revit used)

Remove this section and replace with procedures for other software.



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If Revit is used as the model authoring software, in addition to the A/E's Revit guides and instructions, the following guidelines are recommended good practice.

3.3.1 Revit Model Management

To maintain smaller Revit file size and optimal model functionality, the following items should be completed on a regular schedule (ideally weekly):

- Copy the Central File into a backup folder.
- Open the Central File with the "Audit" checkbox selected, detach from Central and keep Work sets when prompted, then "Save As Compact Model" in the original location under the original filename.
- Check model file size and verify that it does not exceed the Entity standard "Not to exceed" number.
- Check number of Detail and Model groups – this number should be kept to a minimum necessary.
- Verify that any links present are still in use, remove if no longer required. Remove any missing links. Any required external references should be placed on their own dedicated Work set.

Monitor Work sets through dedicated single-Work set views to ensure items are being placed on correct Work set.

- Note any improper or excessive use of in-place families or generic models. These types of elements can be a drain on resources, and if repeated across the project, can impact model performance.
- Note any seemingly unused or temporary views, and verify with the project team that they can be deleted.
- Check Errors and Warnings – this number should ideally be kept to a minimum, as too many warnings will impact model performance, and certain design activities can cause these to multiply quickly. Generate a Warning Report in Excel and delegate to the project team, tracking unresolvable warnings to avoid duplicate efforts.

3.3.2 Revit Revision Standards

Revisions shall be per project and across disciplines, not per sheet.

3.3.3 Drawing Sheet Naming and Numbering

Drawing [Sheet] Naming

- 1ST FLOOR shall be used in place of FIRST FLOOR or LEVEL 1
- Area X shall be used to designate a portion of the Key Plan and shall correlate to the sequence modifier in the sequence number e.g. 12X
- Drawing Titles to be placed on sheets shall be given unique titles

Drawing Sheet Numbering

Sheets shall be numbered to follow the last 4 elements of the document number (set this as a sheet number prefix parameter if using Revit software) so as to be able to match with the model number per 9.1 above:

Location Code	Discipline Code	Document Type Code	Sequence Number
Element 4	Element 5	Element 6	Element 7
6 Characters	3 Characters	2 Characters	6 Characters

Refer to EPM-ID0-PR-000002 - Project Standard Document Numbering Procedure for more information about the elements making up the document number.

3.4 Clash Detection

Internal clash detection should be conducted after 30% model completion but early enough to achieve a clash free model by the 60% model complete milestone. Once started, the formal clash detection process should be repeated at least every 2 weeks. For CAD systems that support "live" or interactive clash detection, this functionality should be turned on at the beginning of the project.

The following considerations must be taken into account:

- File names and locations must remain the same. For this reason, archiving at project milestones should consist of saving copies of the models in another network folder, and continuing to work within the original.



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- Ensure software settings include all valid objects that will be included in the clash
- At a minimum Project BIM Leads will host interdisciplinary clash meetings at project milestones, and delegate clashes to be resolved within 5 business days – in time for the process to clash detection cycle to begin again. System settings must reflect the ownership of clashes between disciplines established on the project. Eg. A clash between a pipe and a structural member should be assigned to the Plumbing discipline
-

3.5 Shop Drawing & Modeling

Describe the LOD required for the issuance of shop drawings.

3.6 As-Built Modeling

The BIM will be revised as work packages are completed to record the as-built status of the works. The LOD for completed objects recorded as constructed by field staff will be updated to LOD 500 (see section 6.7.1).

4.0 STANDARDS AND PROCEDURES

Building Information Management shall be setup so that deliverables are in line with the CAD Standards Procedure EPM-KE0-PR-000008

4.1 International Standards and Guidance Documents

The below list of standards are included for reference, and have been used in the preparation of this BIM Execution Plan.

1. Level of Development Specification: Version 2013. (Reference provided for guidance only)
www.bimforum.org/lof
2. US Army Corp of Engineers (USACE) Minimum Modelling Matrix (M3), Version 1.2, dated 03 Oct 2013 (USACE_M3_v1.2_20131016.xlsx)
<https://cadbim.usace.army.mil/default.aspx?p=a&t=1&=14>
3. AIA Document G202 – 2013 – Project Building Information Modelling Protocol Form
4. Uniformat II - Elemental Classification for Building Specifications, Cost Estimating and Cost Analysis

5.0 COLLABORATION

Collaboration is vital to the success of a BIM Project. There are two aspects to collaboration; communication between people, and the control and sharing of the project information and data.

5.1 Meetings & communication

Set the meeting schedules for BIM support personnel, attendance at design coordination meetings, constructability review and model review sessions.

5.2 Model collaboration

As part of the BIM, the design shall be authored using the BIM software collaboratively and in real time. Where work is performed in multiple offices or where subcontractors and suppliers are major participants in the BIM, the A/E will facilitate the maximize "live" collaboration practicably possible and minimize the frequency and time



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lag of BIM updates to the A/E's master BIM from external participants. The BIM shall not be created at the end of the project only to meet project deliverables.

6.0 DATA MANAGEMENT & EXCHANGE

6.1 Common Data Environment (CDE)

The Common Data Environment is the engineering working environment where all current, controlled project design information is stored and made available by controlled access. It is normally an application or group of applications that form the "single source of truth" for the building information. If the concept of the CDE is utilized it should be defined here and shown diagrammatically.

6.2 Data Control

Describe access to "Work in Progress" and permissions to the applications.

6.3 Data Structure

Show the data hierarchy data. Normally this follows the WBS in the applications as appropriate and folder structures in file shares.

6.4 Asset and Component Tagging Requirement

Typical assets that require tagging are listed below per the project tagging procedure EPM-KE0-TP-000012:

Master Format Division	Asset Types
Division 14 - Conveying Equipment	
	Elevators
Division 21 - Fire Suppression	
	Fire Pumps
Division 22 - Plumbing	
	Domestic Water Pumps
	Backwater Valves
	Sanitary Sewerage Pumps
	Facility Packaged Sewage Pumping Stations
	Sump
	General Service Packaged Air Compressors and Receivers
	Electric Domestic Water Heaters
	Fuel-Fired Domestic Water Heaters
	Domestic Water Heat Exchangers
Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC)	
	Facility Fuel Pumps
	Fire Dampers
	Smoke-Control Dampers
	HVAC
	Constant-Air-Volume Units



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	Variable-Air-Volume Units
	Ventilation Hoods
	Heating Boilers
	Boiler Feed water Pumps
	Furnaces
	Fuel-Fired Heaters
	Heat Exchangers for HVAC
	Refrigerant Compressors
	Refrigerant Condensers
	Packaged Water Chillers
	Cooling Towers
	Indoor Central-Station Air-Handling Units
	Packaged Outdoor HVAC Equipment
	Custom-Packaged Outdoor HVAC Equipment
	Evaporative Air-Cooling Equipment
	Decentralized Unitary HVAC Equipment
	Convection Heating and Cooling Units
	Radiant Heating Units
Division 26 - Electrical	
	Medium-Voltage Transformers
	Medium-Voltage Switchgear
	Medium-Voltage Metering
	Low-Voltage Transformers
	Low-Voltage Switchgear
	Switchboards and Panel boards
	Static Uninterruptible Power Supply
Division 28 - Electronic Safety and Security	
	Fire Detection and Alarm Annunciation Panels and Fire Stations
Division 33 - Utilities	
	Water Utility Pumping Stations
	Water Supply Wells
	Packaged Utility Lift Stations
	Packaged Utility Wastewater Pumping Stations
	Fuel-Oil Pumps
	Gasoline Pumps
	Diesel Fuel Pumps
	Utility Transformers
	High-Voltage Switchgear and Protection Devices
	Medium-Voltage Utility Switchgear and Protection Devices



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6.5 Component Attributes

Attributes are the non-graphical information attached to objects in the 3D Model that defines various characteristics of the object. Attributes can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, and industry classification codes. Attributes can also define supplementary physical entities that are not necessarily shown graphically in the Model, such as insulation around a duct, hardware on a door, content of conduit, or transformer properties.

Where Exchange Requirements have been defined by the Entity, data must be delivered to the Entity per the Exchange Requirements definition and schedule in Construction Operations Building Information Exchange (COBie) format unless noted otherwise. The A/E shall add attributes for internal purposes however, for the above listed assets, the following typical data will need to be collected by design and construction teams to support Computerized Maintenance Management System (CMMS) and Computer-aided Facility Management (CAFM) systems requirements:

Tag/ attribute

- Asset tag
- Asset description
- Location Code
- Spec Reference
- Manufacturer

- Manufacturer Model Number
- Serial Number
- Installation Date
- Warranty Start Date
- Warranty Duration
- Warranty Description

Model objects shall also have an attribute assigned for the current LOD for discrete model objects.

6.6 Data Interoperability

A/E to complete as per internal and Entity requirements

6.6.1 Engineering Data Formats

List the file extensions used on the projects together with their parent applications and version.

6.6.2 Electronic Data Interchange

List file types to be used between applications e.g. Revit to Aconex = IFC format.

6.7 BIM Model Definition

6.7.1 Level of Development

The LOD values defined below are based upon the BIMForum interpretation of AIA G202-2013 Building Information Modeling protocol.

LOD 100 - elements are not geometric presentations. They may be symbols or other generic representations of information that can be derived from other model elements. Any information derived from LOD 100 elements must be considered approximate.



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LOD 200 - elements are represented graphically but are generic placeholders, e.g., volume, quantity, location, or orientation. Any information derived from LOD 200 elements must be considered approximate

LOD 300 - elements are graphically represented as specific systems, objects, or assemblies from which quantity, shape, size, location, and orientation can be measured directly, without having to refer to non-modeled information such as notes or dimension call-outs

LOD 350 - elements are enhanced beyond LOD 300 by the addition of information regarding interfaces with other building systems. For example, an LOD 350 masonry wall element would include jamb conditions, bond beams, grouted cells, dowel locations, and joints – information that enables the model user to coordinate the wall element with other systems in the structure

LOD 400 - elements are modeled at sufficient detail and accuracy for fabrication of the represented component.

LOD 500 - facilities management - This level will have suitable geometry and information to support operations and maintenance. Geometry and data should be as-built and field verified.

An LOD matrix per element Uniformat II Industry Classification code is described in Attachment B of this document.

6.7.2 Geo-Referencing Models

The project coordinate system is: [enter coordinate system]

Refer to the BIM and CAD Standards for the method of registration between BIM models and the coordinate system to ensure correct geo-referencing of the project model.

6.8 Quality Control

6.8.1 Data Quality and completeness

Quality Control and Assurance of the BIM Data will be done through the following processes of design coordination, checking, review and audit.

1. Coordination of the BIM Data through Design Reviews, Clash checks etc.
2. Checking of the deliverables created from the BIM Model prior to approval. (Including checks that the drawings and model are consistent)
3. Regular audits of the BIM by each respective discipline to check for data quality and completeness
4. A/E Automation check of the BIM supplied by sub-contractors prior to incorporation of the A/E master BIM
5. Regular A/E Internal audits of the BIM by the A/E Automation team.

6.8.2 Model Coordination

Model (or Design) Coordination is a continuous process undertaken by the design teams. Each Design Package team is required to formally record (through meeting minutes or reports) the completion and actions arising from these practices.



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1. Interactive Design Reviews
2. Interference Management (Clash Checking)
3. Phasing and Construction Sequencing Simulations (4D BIM if utilized)

6.8.3 Model and Sheet Checking and Approval

BIM Models and Sheets (Drawings) will be checked by the Design Contractor Design Team and approved by the Design Manager, prior to submission to the Entity for acceptance. A QC checklist will be used for each type.

6.8.3.1 Model QC Checklist

Each model must have an associated checklist used during the checking and approval process that contains the following checks:

Model Integrity Checks

- Content (objects and data) integrity and inclusions/exclusions
- LOD
- Areas inclusions/exclusions
- Spaces and zones inclusions/exclusions
- Schedules including schedule summations
- Tags and tag agreement with schedule data
- Sizes and types
- General notes

Standards Check

- Adherence to CAD or BIM standards
- Delivery format – scale, orientation, view types on sheets
- Detailing – information and section cuts, detail references
- Annotations and Tags
- Dimensioning
- Title block and title text including naming and numbering
- Line work
- Layering in CAD

Coordination Checks

- Linked Files
- Geo-Referencing location, conformance with alignment
- Clash Reports
- Visual Checks

The Model QC Checklists must be submitted with the design submissions to the Entity. One checklist per model.

6.8.3.2 Sheet QC Checklist

Each set of drawings within a design package must have an associated checklist used during the checking and approval process that contains checks against the following:

- CAD Standards Check
- Dimensioning
- Title block and title text including naming and numbering
- Cross-References
- Specification and Material References
- Annotation and Tagging
- Survey Grid References
- Check and Approval Names
- Reference (XRef) Files are current



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The Sheet QC Checklists must be submitted with the Design Submissions, one checklist per package.

6.8.4 BIM Audits

Audits of the BIM Management Process will be undertaken regularly in conjunction with the Entity Quality Team. The BIM Audits will cover any aspects of this BEP, and for BIM and CAD Standards compliance. The audit schedule will be issued in advance by the Entity and will detail the areas to be audited in each case.

6.9 Deliverables

6.9.1 Deliverables to the Entity

List the deliverables per the Prime Contract.

6.9.2 Sub-Contractor Model & Data Submittals to A/E

Sub-contractor BIM deliverables must be captured contractually and managed by the A/E Automation group. The Entity requirements must be flowed down to the sub-contractors.

6.10 Training/Induction

It is the responsibility of all parties and each Design Sub-Contractor to supply competent staff trained in the applications and tools they will be required to use on the Project.

A/E is responsible for providing guidance on the particular requirements applicable to the Project.

6.11 BIM IS&T Requirements

6.11.1 Software

Refer to the Project Automation Plan for the software to be used on the project. Check if the Entity mandates the use of any software.

6.11.2 Hardware

Refer to the A/E ICT department for workstation and hardware information.

7.0 BIM MODEL QUALITY

Consistent tag data and attribute definitions throughout the lifecycle of the project development are fundamental to the success of the project models ability to deliver many BIM deliverables such as drawings, quantity reports, and asset management data deliverables. Describe the quality processes and tools in this section.

8.0 SUBMITTAL REQUIREMENTS

The following BIM related documents must be included as part of the submittal requirements from the A/E to the Entity. Similarly these documents need to be submitted from subcontractors and suppliers to the A/E where applicable.



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Deliverable Type	With Proposal	Official Milestone Submittals 30%, 60%, 100% and handover	Regular Submittal as Agreed During Execution Phase
<i>BIM Authoring Tool Questionnaire</i>	x	x	
<i>Contractor and Sub-Contractor BIM Execution Plan</i>	x	x	
<i>Model Data Quality Check Reports</i>		x	x
<i>Clash Report</i>		x	
<i>Model handover</i>		x	x
<i>List of BIM Open Issues</i>		x	x
<i>Quantity Reports</i>		x	x
<i>Deviation Request to the BIM Automation Requirements</i>	x	x	x

[Edit to suit project requirements]



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Attachment 2: EPM-KE0-TP-0000

Project/Proposal Name:			
Partner/Subcontractor:			
This form is to be completed by the A/E and any subcontractors who will be working on the design for the Entity. This form is to identify the BIM/3D capabilities of the A/E and subcontractors in providing electronic deliverables.			
How is the 3D/BIM Model used?	3D Model tool & version used to generate deliverables:	Model exports to the following formats:	Model Review Tool
☐ Design Intent & Drawing Generation ☐ Visualization/Rendering ☐ Clash Checks ☐ QA/QC Checking of Data ☐ Quantity/Material Takeoff ☐ Spec driven modeling, CSI Division/Section, Uniformat II ☐ Generating Fabrication Data ☐ Work-Packaging ☐ 4D sequence w/schedule ☐ Progress tracking/Statusing	☐ Autodesk REVIT ver: 00000000 ☐ Autodesk InfraWorks ver: 00000000 ☐ Autodesk Civil 3D ver: 00000000 ☐ AutoCAD ver: 00000000 ☐ Bentley (InRoads/OpenRoads) ver: 00000000 ☐ Bentley Building (AECOsim) ver: 00000000 ☐ Bentley Civil (GEOPAK) ver: 00000000 ☐ Bentley MicroStation ver: 00000000 ☐ Tekla ver: 00000000 ☐ Other: _____ ☐ Other: _____	☐ IFC (geometry & data) ☐ .DGN ☐ .DWG / .DXF ☐ .RVT (Revit Files) ☐ .MOD (LDM) ☐ Other: _____	☐ NavisWorks ver: 00000000 ☐ Navigator ☐ Other: _____ Remarks: _____
Commodities Modeled in 3D*			
Architectural Families	MEP	Structural	Civil
☐ Doors/ Windows/ Louvers ☐ Walls/ Roofs/ Floors ☐ Flooring / Finishes ☐ Stairs/handrail/Elevators/Conveyor ☐ Ceiling ☐ Furniture/Equipment ☐ Interior specialties ☐ Other: _____	☐ Piping & in-line components ☐ Duct and fixtures ☐ Elec. Cableway/Ductbank ☐ Mechanical/Elec. Equipment ☐ Spools and Shop/Field welds ☐ Supports: piping, raceway ☐ Electrical / Communication Fixtures ☐ Others: (i.e., Conduit > 1.5", etc)	☐ Concrete ☐ Embeds ☐ Piles ☐ Rebar ☐ Steel ☐ Steel Bridges, tunnels ☐ Misc. Steel: stairs, gusset plates, handrail ☐ Other: _____	☐ Earthworks ☐ Roads/Alignment ☐ Soil stabilization ☐ UG utility (i.e. piping, drains, duct-banks) ☐ Trenches ☐ Track ☐ UG Utilities within 15m of buildings ☐ Other: _____
☐ *3D model includes: maintenance/pull space volumes, access spaces, exclusion areas, hazardous zones			
Data Capabilities – Components are uniquely tagged/classified: Eng., Proc/Fabrication, Installation			
☐ All objects in the BIM/3D Model tagged with an Industry classification Code (e.g. Uniformat II, or other: _____)			
☐ All objects in the BIM/3D Model tagged with LOD Level			
Commodity Types	Commodities Uniquely Tagged in the BIM/3D Model (Y/N)	Commodity Material Takeoff Extracted from 3D Model (Y/N)	Commodity design deliverable generated from 3D Model (Y/N)
Structural (Foundations)			
Civil/Site/Drainage			
Bridges/Tunnels			
Roads/Highways			
Structural Steel			
Equipment/Specialty			
Utilities/Manholes			
HVAC Duct and fixtures			
Rooms/spaces/volumes			
Arch. Components			
Others:			
Others:			
Experience with 3D Model Collaboration Tools			
☐ ProjectWise ver: 00000000		☐ Accosim ver: 00000000	
☐ BIM 360 Docs		☐ other	
☐ C4R – Collaboration for Revit			
Prepared by (Title)			
Email		Phone	
Other Remarks			

24 - BIM Authoring Tool Questionnaire Template

Attachment 3: EPM-KE0-RG-000014 – BIM Level of Development Matrices

[illegible]



Project Automation Requirements & Deliverables Guideline

Model Object Category	Uniformat [Uniformat II]	Use on this project	This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. Project stages defined in Master Design Review Procedure - EPM-KE0-PM-000002	Relevant Attribute Tables	Model Element Author(MEA)	30% Design Review Stage			60% Design Review Stage			90% Design Review Stage			RECORD/ HANDOVER		
						Date:			Date:			Date:			Date:		
						LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes
 EXPLO هيئة كفاءة الأداء واستشرجات الحكومة Expectations Efficiency & Projects Authority	A20		Subgrade Enclosures	A, B Concrete; A, B Wood; A, B Masonry; A, B Precast Concrete													
	A2010		Walls for Subgrade Enclosures	A, B Concrete; A, B Wood; A, B Masonry; A, B Precast Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	A2010.10		Subgrade Enclosure Wall Construction														
	A2010.20		Subgrade Enclosure Wall Interior Skin														
	A2010.90		Subgrade Enclosure Wall Supplementary Components														
	A40		Slabs-on-Grade	A, B - Str. Concrete													
	A4010		Standard Slabs-on-Grade	A, B Concrete													
	A4020		Structural Slabs-on-Grade	A, B Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	A4030		Slab Trenches														
	A4040		Pits and Bases														
	A4090		SlabOn-Grade Supplementary Components														
	A4090.10		Perimeter Insulation														
	A4090.20		Vapor Retarder														
	A4090.30		Waterproofing														
	A4090.40		Mud Slab														
	A4090.50		Subbase Layer														
	A60		Water and Gas Mitigation														
	A6010		Building Subdrainage														
	A6010.10		Foundation Drainage														
	A6010.20		Underslab Drainage														
	A6020		Off-Gassing Mitigation														
	A6020.10		Radon Mitigation														
	A6020.20		Maethane Mitigation														
	A90		Substructure Related Activities														
	A9010		Substructure Excavation														
	A9020		Construction Dewatering														
	A9030		Excavation Support														
	A9030.10		Anchor Tiebacks														
	A9030.20		Cofferdams														
	A9030.40		Cribbing and Walers														
	A9030.60		Ground Freezing														
	A9030.70		Slurry Walls														
	A9040		Soil Treatment														
B. SHELL	B		SHELL														
	B10		Superstructure														
	B1010		Floor Construction	A, B Cold Formed Metal Framing; A, B Masonry; A, B Metal Deck; A, B Precast Concrete; A, B Steel Joist; A, B Structural Steel; A, B Concrete; A, B Wood	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Floor Structural Frame		A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Concrete	A, B Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Precast Structural Inverted T Beam	A, B Precast Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Precast Structural Column	A, B Precast Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Masonry	A, B Masonry	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Steel Framing Columns	A, B Structural Steel	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Steel Framing Beams	A, B Structural Steel	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Steel Framing Bracing Rods	A, B Structural Steel	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Steel Joists	A, B Steel Joist	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Cold-Formed Metal Framing	A, B Cold Formed Metal Framing	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.10		Wood Floor Trusses	A, B Wood	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Floor Decks, Slabs, and Toppings		A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Wood Floor Deck	A, B Wood	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Metal Floor Deck	A, B Metal Deck	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Composite Floor Deck	A, B Structural Steel; A, B Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Concrete	A, B Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.20		Precast Structural Double Tee	A, B Precast Concrete	A/S	200	A/S		200	A/S		300	A/S		300	A/S	
	B1010.30		Balcony Floor Construction														
	B1010.40		Mezzanine Floor Construction														
	B1010.50		Ramps														



Project Automation Requirements & Deliverables Guideline

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						Stage			Stage			Stage			Date:		
						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 هيئة كفاءة الإنفاق والمشتريات الحكومية Expenditure Efficiency & Projects Authority	B1010.90		Floor Construction Supplementary Components														
	B1020		Roof Construction	A, B Cold Formed Metal Framing; A, B Masonry; A, B Metal Deck; A, B Precast Concrete; A,B Steel Joist; A, B Structural Steel; A, B Concrete; A, B Wood	A	200	A		200	A		300	A		300	A	
	B1020.10		Roof Structural Frame	A, B Structural Steel; A, B Concrete; A,B Steel Joist													
	B1020.20		Roof Decks, Slabs, and Sheathing	A,B Steel Joist; A, B Metal Deck													
	B1020.30		Canopy Construction														
	B1020.90		Roof Construction Supplementary Components														
	B1080		Stairs	A, B Cold Formed Metal Framing; A, B Masonry; A, B Metal Deck; A, B Precast Concrete; A, B Structural Steel; A, B Concrete; A, B Wood	A	200	A		200	A		300	A		300	A	
	B1080.10		Stair Construction	A, B Structural Steel; A, B Precast Concrete; A, B Concrete													
	B1080.30		Stair Soffits	A, B Structural Steel; A, B Precast Concrete; A, B Concrete													
	B1080.50		Stair Railings	A, B Structural Steel; A, B Precast Concrete; A, B Concrete													
B1080.60		Fire Escapes	A, B Structural Steel; A, B Precast Concrete; A, B Concrete														
B1080.70		Metal Walkways	A, B Structural Steel; A, B Precast Concrete; A, B Concrete														
B1080.80		Ladders	A, B Structural Steel														
B20		Exterior Vertical Enclosures															
B2010		Exterior Walls	B – Ext. Wall	A	200	A		200	A		300	A		300	A		
B2010.10		Exterior Wall Veneer	A, B Masonry	A	200	A		200	A		300	A		300	A		
B2010.20		Exterior Wall Construction	A, B Cold Formed Metal Framing; A, B Wood	A	200	A		200	A		200	A		300	A		
B2010.20		Exterior Walls - Wood		A	200	A		200	A		200	A		300	A		
B2010.20		Exterior Walls - Cold-Form Metal Framing		A	200	A		200	A		200	A		300	A		
B2010.20		Exterior Walls - Masonry		A	200	A		200	A		200	A		300	A		
B2010.20		Exterior Walls - Precast Concrete		A	200	A		200	A		200	A		300	A		
B2010.30		Exterior Wall Interior Skin															
B2010.40		Fabricated Exterior Wall Assemblies															
B2010.50		Parapets		A	200	A		200	A		300	A		300	A		
B2010.60		Equipment Screens		A	200	A		200	A		200	A		300	A		
B2010.80		Exterior Wall Supplementary Components															
B2010.90		Exterior Wall Opening Supplementary Components															
B2020		Exterior Windows	B – Ext. Openings	A	200	A		200	A		300	A		500	A		
B2020.10		Exterior Operating Windows															
B2020.20		Exterior Fixed Windows															
B2020.30		Exterior Window Wall															
B2020.50		Exterior Special Function Windows															
B2050 [B2030]		Exterior Doors and Grilles	B – Ext. Doors	A	200	A		200	A		300	A		500	A		
B2050.10		Exterior Entrance Doors															
B2050.20		Exterior Utility Doors															
B2050.30		Exterior Oversize Doors															
B2050.40		Exterior Special Function Doors															
B2050.60		Exterior Grilles															
B2050.70		Exterior Gates															
B2050.90		Exterior Door Supplementary Components															
B2070		Exterior Louvers and Vents	B - Ext. Louvers and Vents	A	200	A		200	A		300	A		300	A		
B2070.10		Exterior Louvers															
B2070.50		Exterior Vents															
B2080		Exterior Wall Appurtenances															
B2080.10		Exterior Fixed Grilles and Screens															
B2080.30		Exterior Opening Protection Devices															
B2080.50		Exterior Balcony Walls and Railings															
B2080.70		Exterior Fabrications															
B2080.80		Bird Control Devices															
B2090		Exterior Wall Specialties															
B30		Exterior Horizontal Enclosures															



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						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 EXPRO هيئة كفاءة الإنفاق والمشروعات الحكومية Expenditure Efficiency & Projects Authority	B3010		Roofing	B – Roof	A	200	A			200	A			300	A		
	B3010.10		Steep Slope Roofing														
	B3010.50		Low Slope Roofing														
	B3010.70		Canopy Roofing														
	B3010.90		Roofing Supplementary Components														
	B3020		Roof Appurtenances														
	B3020.10		Roof Accessories														
	B3020.30		Roof Specialties														
	B3020.70		Rainwater Management														
	B3040		Traffic Bearing Horizontal Enclosures	B – Roof	A	200	A			200	A			200	A		
	B3040.10		Traffic Bearing Coatings														
	B3040.30		Horizontal Waterproofing Membrane														
	B3040.50		Wear Surfaces														
	B3040.90		Horizontal Enclosure Supplementary Components														
	B3060 [B3020]		Horizontal Openings	B – Ext. Openings	S	200	S			200	S			200	S		
	B3060.10		Roof Windows and Skylights														
	B3060.50		Vents and Hatches														
	B3060.90		Horizontal Openings Supplementary Components														
	B3080		Overhead Exterior Enclosures	Ceilings (susp. Ceilings)													
	B3080.10		Exterior Ceilings														
	B3080.20		Exterior Soffits		A	200	A			200	A			300	A		
	B3080.30		Exterior Bulkheads														
C. INTERIORS	C		INTERIORS														
	C10		Interior Construction														
	C1010		Partitions	C - Partitions	A	200	A			200	A			300	A		
	C1010.10		Interior Fixed Partitions														
	C1010.10		Masonry	A, B, Masonry													
	C1010.10		Cold-Form Metal Framing	A, B, Cold-Form Metal Framing													
	C1010.10		Wood	A, B, Wood													
	C1010.20		Interior Glazed Partitions		A	200	A			200	A			300	A		
	C1010.40		Interior Demountable Partitions														
	C1010.50		Interior Operable Partitions														
	C1010.70		Interior Screens														
	C1010.90		Interior Partitions Supplementary Components														
	C1020		Interior Windows	C – Int. Windows	A	200	A			200	A			300	A		
	C1020.10		Interior Operating Windows														
	C1020.20		Interior Fixed Windows														
	C1020.50		Interior Special Function Windows		A	200	A			200	A			300	A		
	C1020.90		Interior Window Supplementary Components														
	C1030 [C1020]		Interior Doors	C – Int. Doors	A	200	A			200	A			300	A		
	C1030.10		Interior Swinging Doors														
	C1030.20		Interior Entrance Doors														
	C1030.25		Interior Sliding Doors														
	C1030.30		Interior Folding Doors														
	C1030.40		Interior Colling Doors														
	C1030.50		Interior Panel Doors														
	C1030.70		Interior Special Function Doors														
	C1030.80		Interior Access Doors and Panels		A	200	A			200	A			300	A		
	C1030.90		Interior Door Supplementary Components														
	C1040		Interior Grilles and Gates	C - Int. Doors													
	C1040.10		Interior Grilles		A	200	A			200	A			300	A		
	C1040.50		Interior Gates		A	200	A			200	A			300	A		
	C1060		Raised Floor Construction	C - Raised Floor	A	200	A			200	A			300	A		
	C1060.10		Access Flooring														
	C1060.30		Platform/Stage Floors														
	C1070		Suspended Ceiling Construction	C - Susp. Clg.	A	200	A			200	A			300	A		



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						Date:			Date:			Date:			Date:		
						LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes
 هيئة كفاءة الإنفاق والمشتريات الحكومية Expenditure Efficiency & Projects Authority	C1070.10		Acoustical Suspended Ceilings														
	C1070.20		Suspended Plaster and Gypsum Board Ceilings														
	C1070.50		Specialty Suspended Ceilings														
	C1070.70		Special Function Suspended Ceilings														
	C1070.90		Ceiling Suspension Components														
	C1090		Interior Specialties														
	C1090.10		Interior Railings and Handrails	A, B Miscellaneous Steel	A	200	A		200	A		300	A		300	A	
	C1090.15		Interior Louvers	B,C Louvers and Vents													
	C1090.20		Information Specialties														
	C1090.25		Compartments and Cubicles														
	C1090.30		Service Walls														
	C1090.35		Wall and Door Protection														
	C1090.40		Toilet, Bath and Laundry Accessories														
	C1090.45		Interior Gas Lighting														
	C1090.50		Fireplaces and Stoves														
	C1090.60		Safety Specialties														
	C1090.70		Storage Specialties														
	C1090.90		Other Interior Specialties	A, B Miscellaneous Steel													
	C20		Interior Finishes														
	C2010 [C3010]		Wall Finishes		A	200	A		200	A		300	A		300	A	
C2010.10		Tile Wall Finish															
C2010.20		Wall Paneling															
C2010.30		Wall Coverings															
C2010.35		Wall Carpeting															
C2010.50		Stone Facing															
C2010.60		Special Wall Surfacing															
C2010.70		Wall Painting and Coating															
C2010.80		Acoustical Wall Treatment															
C2010.90		Wall Finish Supplementary Components															
C2020		Interior Fabrications		A	200	A		200	A		200	A		300	A		
C2030 [C3020]		Flooring		A	200	A		200	A		300	A		300	A		
C2030.10		Flooring Treatment															
C2030.20		Tile Flooring															
C2030.30		Specialty Flooring															
C2030.40		Masonry Flooring															
C2030.45		Wood Flooring															
C2030.50		Resilient Flooring															
C2030.60		Terrazzo Flooring															
C2030.70		Fluid-Applied Flooring															
C2030.75		Carpeting															
C2030.80		Athletic Flooring															
C2030.85		Entrance Flooring															
C2030.90		Flooring Supplementary Components															
C2040		Stair Finishes		A	200	A		200	A		300	A		300	A		
C2040.20		Tile Stair Finish															
C2040.40		Masonry Stair Finish															
C2040.45		Wood Stair Finish															
C2040.50		Resilient Stair Finish															
C2040.60		Terrazzo Stair Finish															
C2040.75		Carpeted Stair Finish															
C2050 [C3030]		Ceiling Finishes		A	200	A		200	A		300	A		300	A		
C2050.10		Plaster and Gypsum Board Finish															
C2050.20		Ceiling Paneling															
C2050.70		Ceiling Painting and Coating															
C2050.80		Acoustic Ceiling Treatment															
C2050.90		Ceiling Finish Supplementary Components															
D. SERVICES	D	SERVICES															
	D10	Conveying		A	200	A		200	A		200	A		300	A		



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						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 هيئة كفاءة الإنفاق والمشتريات الحكومية Expenditure Efficiency & Projects Authority	D1010		Vertical Conveying Systems		A		200	A			200	A/M			300	A/M			500	A/M	
	D1010.10		Elevators																		
	D1010.20		Lifts																		
	D1010.30		Escalators																		
	D1010.50		Dumbwaiters																		
	D1010.60		Moving Ramps																		
	D1030 [D1020]		Horizontal Conveying																		
	D1030.10		Moving Walks																		
	D1030.30		Turntables																		
	D1030.50		Passenger Loading Bridges																		
	D1030.70		People Movers																		
	D1050 [D1090]		Material Handling																		
	D1050.10		Cranes																		
	D1050.20		Hoists																		
	D1050.30		Derrieks																		
	D1050.40		Conveyors																		
	D1050.50		Baggage Handling Equipment																		
	D1050.60		Chutes																		
	D1050.70		Pneumatic Tube Systems																		
	D1080		Operable Access Systems																		
	D1080.10		Suspended Scaffolding																		
	D1080.20		Rope Climbers																		
	D1080.30		Elevating Platforms																		
	D1080.40		Powered Scaffolding																		
	D1080.50		Building Envelope Access																		
	D20		Plumbing	D20 - Plumbing; D- Fluid_Gas Distribution; D60 - Electrical	M		200	M			200	M			300	M			300	M	
	D2010 [D2020]		Domestic Water Distribution		M		200	M			200	M			300	M			300	M	
	D2010.10		Facility Potable-Water Storage Tanks		M			M				M				M					
	D2010.20		Domestic Water Equipment		M			M				M				M					
	D2010.40		Domestic Water Piping		M			M				M				M					
	D2010.60		Plumbing Fixtures		M		200	M			200	M			300	M			300	M	
	D2010.90		Domestic Water Distribution Supplementary Components		M			M				M				M					
	D2020 [D2030]		Sanitary Drainage		M		200	M			200	M			300	M			300	M	
	D2020.10		Sanitary Sewerage Equipment		M			M				M				M					
	D2020.30		Sanitary Sewerage Piping		M			M				M				M					
	D2020.90		Sanitary Drainage Supplementary Components		M			M				M				M					
	D2030 [D2040]		Building Support Plumbing Systems		M		200	M			200	M			300	M			300	M	
	D2030.10		Stormwater Drainage Equipment		M			M				M				M					
	D2030.20		Stormwater Drainage Piping		M			M				M				M					
	D2030.30		Facility Stormwater Drains		M			M				M				M					
	D2030.60		Gray Water Systems		M			M				M				M					
	D2030.90		Building Support Plumbing System Supplementary Components		M			M				M				M					
	D2050 [D2090]		General Service Compressed-Air		M			M				M				M					
	D2060 [D2090.99]		Process Support Plumbing Systems		M			M				M				M					
	D2060.10		Compressed-Air Systems		M			M				M				M					
	D2060.20		Vacuum Systems		M			M				M				M					
	D2060.30		Gas Systems		M			M				M				M					
	D2060.40		Chemical-Waste Systems		M			M				M				M					
	D2060.50		Processed Water Systems		M			M				M				M					
	D2060.90		Process Support Plumbing System Supplementary Components		M			M				M				M					
	D30		HVAC	D20 - Plumbing; D30 - HVAC; D- Air Distribution; D40 - Fire Protection; D- Fluid_Gas Distribution; D50 - Electrical; D- Electrical Distribution	M		200	M			200	M			300	M			500	M	
	D3010		Facility Fuel Systems		M		200	M			200	M			300	M			500	M	
	D3010.10		Fuel Piping		M			M				M				M					
	D3010.30		Fuel Pumps		M			M				M				M					
	D3010.50		Fuel Storage Tanks		M			M				M				M					



Project Automation Requirements & Deliverables Guideline

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Model Object Category	Uniformat (Uniformat II)	Use on this project	This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License Project stages redefined to Matchroot Design Review Procedure - EPM-KE0-PR-000002	Relevant Attribute Tables	Model Element Author(MEA)	30% Design Review Stage			60% Design Review Stage			90% Design Review Stage			RECORD/ HANDOVER						
						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 هيئة كفاءة الإنفاق والمشتريات الحكومية Expenditure Efficiency & Projects Authority	D3020		Heating Systems		M	200	M			M			M								
	D3020.10		Heat Generation		M				200	M			300	M			500	M			
	D3020.30		Thermal Heat Storage		M		M			M			M								
	D3020.70		Decentralized Heating Equipment		M		M			M			M								
	D3020.90		Heating System Supplementary Components		M		M			M			M								
	D3030		Cooling Systems		M	200	M		200	M			300	M			500	M			
	D3030.10		Central Cooling		M					M			M								
	D3030.10		Evaporative Air-Cooling		M		M			M			M								
	D3030.40		Thermal Cooling Storage		M		M			M			M								
	D3030.70		Decentralized Cooling		M		M			M			M								
D3030.00		Cooling System Supplementary Components		M		M			M			M									
D3050		Facility HVAC Distribution Systems		M	200	M		200	M			300	M			500	M				
D3050.10		Facility Hydronic Distribution		M		M			M			M									
D3050.30		Facility Steam Distribution		M		M			M			M									
D3050.50		HVAC Air Distribution		M	200	M		200	M			300	M			500	M				
D3050.90		Facility Distribution Systems Supplementary Components		M		M			M			M									
D3060 [D3040]		Ventilation		M	200	M		200	M			300	M			500	M				
D3060.10		Supply Air		M		M			M			M									
D3060.20		Return Air		M		M			M			M									
D3060.30		Exhaust Air		M		M			M			M									
D3060.40		Outside Air		M		M			M			M									
D3060.60		Air-to-Air Energy Recovery		M		M			M			M									
D3060.70		HVAC Air Cleaning		M		M			M			M									
D3060.90		Ventilation Supplementary Components		M		M			M			M									
D3070		Special Purpose HVAC Systems		M		M			M			M									
D3070.10		Snow Melting		M		M			M			M									
D40		Fire Protection	D40 - Fire Protection, D- Fluid, Gas Distribution; D50 - Electrical		M	200	M		200	M			300	M			500	M			
D4010		Fire Suppression			M		M			M			M								
D4010.10		Water-Based Fire-Suppression			M		M			M			M								
D4010.50		Fire-Extinguishing			M		M			M			M								
D4010.90		Fire Suppression Supplementary Components			M		M			M			M								
D4030		Fire Protection Specialties			M	200	M		200	M			300	M			500	M			
D4030.10		Fire Protection Cabinets			M		M			M			M								
D4030.30		Fire Extinguishers			M		M			M			M								
D4030.50		Breathing Air Replenishment Systems			M		M			M			M								
D4030.70		Fire Extinguisher Accessories			M		M			M			M								
D50		Electrical	D50 - Electrical, D- Electrical Distribution		E	200	E		200	E			300	E			500	E			
D5010		Facility Power Generation			E	200	E		200	E			300	E			500	E			
D5010.10		Packaged Generator Assemblies			E		E			E				E							
D5010.20		Battery Equipment			E		E			E				E							
D5010.30		Photovoltaic Collectors			E		E			E				E							
D5010.40		Fuel Cells			E		E			E				E							
D501060		Power Filtering and Conditioning			E		E			E				E							
D5010.70		Transfer Switches			E		E			E				E							
D5010.90		Facility Power Generation Supplementary Components			E		E			E				E							
D5020 [D5010]		Electrical Service and Distribution			E	200	E		200	E			300	E			500	E			
D5020.10		Electrical Service Entrance			E		E			E				E							
D5020.30		Power Distribution			E		E			E				E							
D5020.70		Facility Grounding			E		E			E				E							
D502090		Electrical Service and Distribution Supplementary Components			E		E			E				E							
D5030		General Purpose Electrical Power			E	200	E		200	E			300	E			500	E			
D5030.10		Branch Wiring System			E		E			E				E							
D5030.50		Wiring Devices			E		E			E				E							
D5030.90		General Purpose Electrical Power Supplementary Components			E		E			E				E							



Project Automation Requirements & Deliverables Guideline

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						Stage			Stage			Stage			Date:						
						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 EXPLO هيئة كفاءة الإنفاق والمشتريات الحكومية Expenditure Efficiency & Projects Authority	D5040 [D5020]		Lighting		E		200	E			200	E			300	E			500	E	
	D5040.10		Lighting Control		E			E				E					E				
	D5040.20		Branch Wiring for Lighting		E			E				E					E				
	D5040.50		Lighting Fixtures		E			E				E					E			E	
	D5040.90		Lighting Supplementary Components		E			E				E					E				
	D5080 [D5090]		Miscellaneous Electrical Systems		E		200	E			200	E			300	E			500	E	
	D5080.10		Lightning Protection		E			E				E				E					
	D5080.70		Transient Voltage Suppression		E			E				E				E					
	D60 [D5030]		Communications	D50 - Electrical, D- Electrical Distribution	E		200	E			200	E			300	E			500	E	
	D6010		Data Communications		E			E				E				E					
D6020		Voice Communications		E			E				E				E						
D6030		Audio-Video Communication		E			E				E				E						
D6060		Distributed Communications and Monitoring		E			E				E				E						
D6090		Communications Supplementary Components		E			E				E				E						
D70 [D5030]		Electronic Safety and Security	D50 - Electrical, D- Electrical Distribution	E		200	E			200	E			300	E			500	E		
D7010		Access Control and Intrusion Detection		E			E				E				E						
D7030		Electronic Surveillance		E			E				E				E						
D7050		Detection and Alarm		E			E				E				E						
D7070		Electronic Monitoring and Control		E			E				E				E						
D7090		Electronic Safety and Security Supplementary Components		E			E				E				E						
D80		Integrated Automation	D50 - Electrical, D- Electrical Distribution	E		200	E			200	E			300	E			500	E		
D8010		Integrated Automation Facility Controls		E			E				E				E						
E. EQUIPMENT & FURNISHINGS	E		EQUIPMENT & FURNISHINGS																		
E10			Equipment																		
E1010			Vehicle and Pedestrian Equipment		E		200	E			200	E			300	E			300	E	
E1010.10			Vehicle Servicing Equipment																		
E1010.30			Interior Parking Control Equipment																		
E1010.50			Loading Dock Equipment																		
E1010.70			Interior Pedestrian Control Equipment																		
E1030			Commercial Equipment		E		200	E			200	E			300	E			300	E	
E1030.10			Mercantile and Service Equipment																		
E1030.20			Vault Equipment																		
E1030.25			Teller and Service Equipment																		
E1030.30			Refrigerated Display Equipment																		
E1030.35			Commercial Laundry and Dry Cleaning Equipment																		
E1030.40			Maintenance Equipment																		
E1030.50			Hospitality Equipment																		
E1030.55			Unit Kitchens																		
E1030.60			Photographic Processing Equipment																		
E1030.70			Postal, Packaging and Shipping Equipment																		
E1030.75			Office Equipment																		
E1030.80			Foodservice Equipment																		
E1040			Institutional Equipment																		
E1040.10			Educational and Scientific Equipment																		
E1040.20			Healthcare Equipment																		
E1040.40			Religious Equipment																		
E1040.60			Security Equipment																		
E1040.70			Detention Equipment																		
E1060			Residential Equipment																		
E1060.10			Residential Appliances																		
E1060.50			Residential Stairs																		
E1060.70			Residential Ceiling Fans																		
E1070			Entertainment and Recreational Equipment																		
E1070.10			Theater and Stage Equipment																		
E1070.20			Musical Equipment																		
E1070.50			Athletic Equipment																		
E1070.60			Recreational Equipment		A		200	A			200	A			200	A			300	A	



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						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 مجلس الإنعاش والتعمير والإصلاح Expenditure Efficiency & Projects Authority	E1090		Other Equipment														
	E1090.10		Solid Waste Handling Equipment														
	E1090.30		Agricultural Equipment														
	E1090.40		Horticultural Equipment														
	E1090.60		Decontamination Equipment														
	E20		Furnishings														
	E2010		Fixed Furnishings		A		200	A			200	A			200	A	
	E2010.10		Fixed Art														
	E2010.20		Window Treatments														
	E2010.30		Casework														
	E2010.70		Fixed Multiple Seating														
	E2010.90		Other Fixed Furnishings														
	E2050		Movable Furnishings		A		200	A			200	A			200	A	
	E2050.10		Movable Art														
	E2050.30		Furniture														
	E2050.40		Accessories														
	E2050.60		Movable Multiple Seating														
	E2050.90		Other Movable Furnishings														
F. SPECIAL CONSTRUCTION & DEMOLITION	F		SPECIAL CONSTRUCTION & DEMOLITION														
	F10		Special Construction														
	F1010		Integrated Construction														
	F1020		Special Structures														
	F1030		Special Function Construction														
	F1050		Special Facility Components														
	F1060		Athletic and Recreational Special Construction														
	F1080		Special Instrumentation														
	F20		Facility Remediation														
	F2010		Hazardous Materials Remediation														
	F30		Demolition														
	F3010		Structure Demolition														
	F3030		Selective Demolition														
	F3050		Structure Moving														
G. BUILDING SITEWORK	G		BUILDING SITEWORK														
	G10		Site Preparation		C		200	C			200	C			300	C	
	G1010		Site Clearing														
	G1020		Site Elements Demolition														
	G1030		Site Element Relocations														
	G1050		Site Remediation														
	G1070		Site Earthwork														
	G107010		Grading														
	G20		Site Improvements		C		200	C			200	C			300	C	
	G2010		Roadways														
	G2020		Parking Lots														
	G2020.10		Parking Lot Pavement														
	G2020.20		Parking Lot Curbs and Gutters														
	G2020.40		Parking Lot Appurtenances														
	G2030		Pedestrian Plazas and Walkways														
	G2040		Airfields														
	G2050		Athletic, Recreational, and Playfield Areas														
	G2060		Site Development														
	G2080		Landscaping														
	G30		Liquid and Gas Site Utilities		C		200	C			200	C			300	C	
	G3010		Water Utilities														
	G3010.10		Site Domestic Water Distribution														
	G3010.30		Site Fire Protection Water Distribution														
	G3020		Sanitary Sewerage Utilities														
	G3020.20		Sanitary Sewerage Piping														
	G3020.50		Sanitary Sewerage Structures														



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						Stage			Stage			Stage			Date:		
						Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
 هيئة كفاءة الإنشاء والمشروعات الحكومية Expenditure Efficiency & Projects Authority	G3030		Storm Drainage Utilities														
	G3050		Site Energy Distribution														
	G3060		Site Fuel Distribution														
	G3090		Liquid and Gas Site Utilities Supplementary Components														
	G40		Electrical Site Improvements	E	200	E		200	E		300	E		500	E		
	G4010		Site Electric Distribution Systems														
	G4050		Site Lighting														
	G50		Site Communications	E	200	E		200	E		300	E		500	E		
	G5010		Site Communications Systems														
	G90		Miscellaneous Site Construction														
G9010		Tunnels															
		Products															
		Structural and Exterior Enclosure Products															
		Mechanical Fasteners, Adhesives, and Sealants															
		Mechanical Fasteners															
		Structural Concrete Products															
		Concrete Formwork															



Project Automation Requirements & Deliverables Guideline



BIM LEVEL OF DEVELOPMENT MATRIX 2 - CIVIL WORKS

Civil Information Modeling refers to Civil Work Models generated using tools such as Autodesk Civil3D and Bentley Systems InRoads.

Model Element Author (MEA)		Level of Development (LOD)		LOD Interpretation	
MEA	Discipline	LOD 100	The Model element may be graphically represented in the model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. Cost per square foot, tonnage of HVAC etc.) can be derived from other Model Elements	Approximate location using 2D centerline or surface, rough excavation	
A	Architectural	LOD 200	The Model Element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location and orientation. Non-graphic information may also be attached to the Model Element.	Approximate location using 3D centerline/ surface/ model element. 3D surface based on manual points or 2D surface specifying substructure, rough excavation along 3D model element.	
S	Structural	LOD 300	The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.	Accurate location using 3D model element/ surface. 3D surface based on point cloud or 3D surface with connection to terrain, excavation as 3D surface with preliminary sloping.	
C/S	Civil / Structural	LOD 350	The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element	Final location using 3D model element/ surface post coordination with nearby elements. 3D surface based on point cloud or 3D surfaces final sloping down to terrain, excavation as 3D surface with final sloping/ walls.	
A/S	Architectural / Structural	LOD 400	The Model Element is graphically represented within the Model as a specific System, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly and installation information. Non-graphic information may also be attached to Model Element	Final location using 3D model element with detail and accuracy for fabrication/ construction, post coordination with nearby elements. 3D surface based on point cloud and 3D surfaces sloping down to terrain, excavation as 3D surface with final sloping/ walls.	
A/M	Architectural / Mechanical	LOD 500	The Model is a field verified representation in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Elements.	Final location using 3D model element is field verified.	
M	Mechanical	RECORD/ HANDOVER of the Model(s) to support the population and implementation of the Asset Information Management System (AIM) per Project Agreement and outlined in the discipline specific DSRs. See Asset Information Handover section of BIM Execution Strategy (ESB) D, for more information.			
E	Electrical				
C	Civil				
N/A	Not applicable				

Model Object Category		CODE	Details	Model Element	For model contents definitions for stages see EPM-KE0-PPH-000010 - 3D Model Review Procedure											
					30% Design Review Stage			60% Design Review Stage			90% Design Review Stage			RECORD/HANDOVER		
					Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes	Date:	LOD	MEA	Notes
P. TERRAIN		P	INFORMATION ELEMENTS TERRAIN	C		200	C			300	C			350	C	
Q. LEVELLING/GRADINGS		Q	LEVELLING/GRADINGS	C		200	C			300	C			400	C	
R. FOUNDATION EXCAVATION		R	FOUNDATION EXCAVATION	C		200	C			300	C			400	C	
S. PIPEWORK EXCAVATION		S	PIPEWORK EXCAVATION	C		200	C			300	C			400	C	
T. ROAD AND RAILWAY		T	ROAD AND RAILWAY	C		300	C			300	C			400	C	
U. ROAD AND RAILWAY EQUIPMENT		U	ROAD AND RAILWAY EQUIPMENT	C		200	C			200	C			400	C	
V. EXISTING PIPEWORK IN TERRAIN		V	EXISTING PIPEWORK IN TERRAIN	C		200	C			200	C			400	C	
W. DRAINAGE		W	DRAINAGE	C		200	C			300	C			400	C	