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REVIT STANDARDS 2.1

Multnomah County Oregon (also referred to as the County and Multco) establishes these standards to provide general direction and minimum requirements for producing Building Information Models (BIM) in Revit for Multnomah County Facilities and Property Management Division. Organizations contracted to provide such services are hereafter referred to as the AE Service Provider. AE Service Providers are organizations contracted to provide planning and/or design services and shall include, but are not limited to, architects, engineers, consultants, drafting services, furniture installers, interior designers, space planners, general contractors, subcontractors, or design-build contractors (who have professional liability insurance and the capability to produce digital models and documents). ***It is the AE Service Provider's contractual responsibility to ensure that any subcontracted work they receive adheres to these standards.***

Essence Statement

Multnomah County's BIM goals are to maintain accurate, real-time information about our facilities, and to provide clear and accurate data to our Operations and Maintenance Staff. Keeping these goals in mind should guide your focus and decision-making throughout any work on County projects. Our Operations and Maintenance Staff rely on rich, accessible data to provide safe, comfortable, and functional county facilities. Therefore, asset parameters are just as important to the County as spatial data when it comes to BIM. We are invested in high quality outcomes, so please do not hesitate to reach out to fpm.bdmc@multco.us with any questions about the following standards.

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Updates from 2.0

Links to Multnomah County BDMC Tutorial videos have been added throughout the Standards:

1. Essence Statement
2. Definitions
3. Produce Models in Revit 2024.2 or later (make sure all collaborators use same to avoid corruption)
4. Revit Level Naming
5. Which Model Does It Go In?
6. Compliant Discipline Codes - Updated
7. Alternate Room Naming Tutorial
8. Multco Sheet Naming Tool (Multnomah County Sheet Identification Chart is no longer valid)
9. COBie Guidelines have been removed
10. All Safety Equipment must now contain Required Asset Parameters
11. Only Shared Parameters 2.1 file is to be used
12. Families featuring ADA Clearances
13. Example As-built Tolerances added
14. BDMC YouTube Channel is where Tutorial Videos will be uploaded. Please subscribe!
15. Multiple Door Numbering now requires a hyphen between the number and lower case character. Examples Added.

General Objectives

The County issues these standards to:

1. Ensure the successful use and control of Revit Models for all Multnomah County-owned and operated facilities.
2. Establish minimum requirements for consistent format, professional appearance, and data interchangeability among Revit Models and drawing documents.
3. Create accurate, accessible, and current documentation.
4. Expedite project delivery.
5. Ensure modeling produced by AE Service Providers maintains functionality in County systems used for Facilities Management.

Cross-Reference

1. National BIM Standard - United States® Version 3
2. Multnomah County Specifications Standards 2022
3. Multnomah County Signage Standards (June 2016)

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Issues

If the AE Service Provider has a question, finds a conflict, believes that these standards do not address a particular need or issue, or is requesting a deviation from these standards, the AE Service Provider must contact the County Building Data Management Center to seek a resolution.

Contact Information

Building Data Management Center: fpm.bdmc@multco.us

Supplemental Material

The County publishes the Multnomah County Revit Templates Package. The AE Service Provider is responsible for obtaining a copy of the National BIM Standard Version 3 (NBIMS-US V3) available for download at the National Institute of Building Sciences (NIBS) website www.nationalbimstandard.org

Compliance Guidelines

1. Follow AIA(American Institute of Architects) Guidelines.
2. Follow the most recent National BIM Standard where requirements are not provided by the County.
3. Adhere to the Multnomah County AE Project Document Standard.

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Definitions

As-Built Model: General Contractor developed model incorporating all Sub-Contracted work with asset parameter data added by General Contractor and Subcontractors (Accompanies As-Built Drawings).

Record Model: As-Built Model then adjusted by the architect to reflect on-site changes the contractor noted during construction.

Facilities Management Model: A copy of the Record Model that contains only the modeled elements, their parameter data, and base views of the New Construction. This model is digested to the County's Main Facilities Management Model (Digital Twin) that controls facilities operations.

Coordination Model: The Coordination Model is the Model used by the team during Integration Reviews. This is typically an Autodesk Navisworks file.

Modeling Standards

REVIT Format

1. Use the Multnomah County Revit Template package (Multco Revit Template).
2. Produce Models in Revit 2024 (Models from previous versions will be upgraded upon delivery).
3. **ALL FINAL SUBMISSIONS TO THE COUNTY MUST BE IN REVIT.**
4. Use the Sheet Template and Attributes provided in the Multnomah County Revit Template.
5. Only edit the sheet template to add company logos beneath the County logo DO NOT CHANGE Title Block.
6. Populate Project Information before starting design.
7. All files will be 3D solid object format. No wire frame object files will be accepted.
8. Use the same Architectural Base Model reference for each discipline.
9. Use Multnomah County view templates to create discipline specific base plans. (you may make minor changes to show necessary objects)
10. Use Multnomah County Room Naming Conventions ONLY for all Rooms (Alternate Room Naming Tutorial).
11. Clearly differentiate between existing, demo, and new features. DO NOT leave elements unspecified.
12. Purge all unused elements, annotation styles, pattern, materials, etc from models before submitting.
13. Models should not contain anything unused.
14. DO NOT Allow level extents to exceed 100 feet past the property lines.
15. DO NOT Modify or Remove IBM parameters from County Models.

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Naming

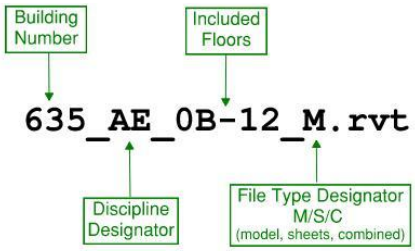
File Naming

There are two distinct ways in which BIM design software platforms manage files: the traditional method where only one sheet, floor or model will exist per file, and the newer generation of software which can contain a complete project within one file. In this document, the multi-file platforms are referred to as drawing-based file platforms while the other is referred to as project-based file platforms.

Design Software	File Management Type
AutoCAD (including Architecture, MEP and all other verticals)	Drawing-based file platform
Revit (all versions)	Project-based file platform

Standard

1. Drawing-based file platforms will use the most current Multnomah County CAD Standard (found within A/E Project Documentation Standards) for all file naming. This document makes no changes to the existing standards for drawing-based file platforms. **CAD FILES ARE ALLOWED BY EXCEPTION ONLY** (contact BDMC).
2. Project-based file platforms will use a four part file name consisting of:
    a. The Multnomah County assigned building ID or site ID
    b. 1 character major discipline / trade designator
    c. 1 character minor discipline / trade designator
    d. 5 characters to define contained floors
    e. 1 character type designator M/S/C (model, sheets, combined)



3. Each discipline should be a separate model linked to the main AE.
4. The Facilities Management Model will have the Building number preceded by “FM-” (FM-635_AE_0B-12_M.rvt).

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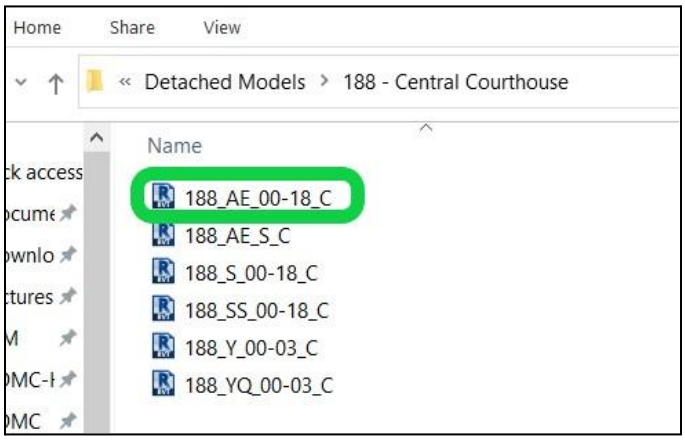
Example



Example of several Revit models in the standard folder structure.

File Name: 188_AE_00-18_C.rvt (Project Model)
Most projects will be Combined files or C files. These have both the BIM and supporting sheets in a single file.

- *Architectural Elements file;*
- *Combined sheets and model file*
- *Contains floors basement 00 through 18*

Note: Files must be named correctly, and be properly stored within the approved folder structure. See Data Submittal Standards.

Revit Level Naming

Floor and Roof Levels are named in the “01 - First Floor” format **ONLY.**
See Floor Level Numbering And Floor Level Prefix for more information.

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Which Model Does It Go In?

A “Project Model” or a “Facilities Management Model” is actually up to 7 separate trade specific models linked together. Please see the color coding below along with the Compliant Discipline Codes chart to identify the correct model for your work.

Note: Ceilings are to exist only in the Architectural Model. Therefore in all other linked models any ceiling-hosted families **MUST** be face-hosted families.

Architectural Model
Structural Model
Site Model (only separate from architectural on multi-building sites)
Mechanical Model
Electrical Model
Plumbing Model
Interior Furniture Model

Compliant Discipline Codes

Use Multco Sheet Naming Tool to create compliant sheet numbers (Multco Sheet Identification Chart is no longer valid).

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Discipline	Sub-Discipline	Abr.	Description
A - Architectural	Ceiling	AC	General architectural
	Demolition	AD	Protection and removal
	Elements	AE	Columns, trusses, joists, beams,walls
	Finishes	AF	Paint, bases, paneling, flooring
	Graphics	AG	Signage
	Interiors	AI	Casework
	Site	AS	Site elements
C - Civil	Demolition	CD	Structure removal and site clearing
	Erosion	CE	Erosion and sedimentation control plans
	Layout	CL	Dimensions and coordinates for aboveground site features
	Grading and Paving	CP	Excavation, grading, roads and parking lots
	Survey (Site)	CS	Plats, topographic, dimension control
	Utilities	CU	Water, sanitary sewer, storm sewer, power, and communications
E - Electrical	Demolition	ED	Protection, termination and removal
	Grounding	EG	Grounding and Lightning Protection
	Instrumentation	EI	Controls, relays, instrumentation and measurement devices
	Lighting	EL	Fixtures
	Power	EP	N/A
	Site	ES	N/A
F - Fire Protection	Detection and Alarm	FA	Devices and circuiting (Electrical)
	Suppression	FX	Fire extinguishing system and equipment (Plumbing)
G - General	Contractual	GC	Phasing, schedules, staging areas, haul routes
	Information	GI	Cover sheet, list of sheets and symbols, code summary, orientation maps

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	Resource	GR	Photographs, soil borings
I - Interiors	Demolition	ID	Protection and removal
	Furnishings	IF	All furniture
	Graphics	IG	Murals and visuals
	Design	IN	N/A
L - Landscape	Demolition	LD	Protection and removal of existing landscaping
	Irrigation	LI	Mainlines, valves, controller, pumps, etc.
	Lighting	LL	N/A
	Site	LS	Site elements
M - Mechanical	Demolition	MD	Protection, termination and removal
	HVAC	MH	Ductwork, air devices and equipment
	Instrumentation	MI	Instrumentation and controls
	Piping	MP	Piping
P - Plumbing	Demolition	PD	Protection, termination and removal added
	Fixtures	PL	Domestic water, sanitary and storm drainage fixtures
	Piping	PP	Domestic water, sanitary and storm drainage pipe, fixtures and equipment
	Equipment	PQ	Pumps and Tanks
Q - Equipment	Athletic	QA	Gymnasium, exercise, aquatic and recreational
	Bank	QB	Vaults, teller units, ATM, drive-thru
	Detention	QD	Prisons and Jails
	Educational	QE	Chalkboards, library
	Food Service	QF	Kitchen, bar, service, storage and processing
	Medical	QH	Medical, exam and treatment
	Laboratory	QL	Science labs, hoods, benches

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R - Resource / For Reference Only	Architectural	RA	N/A
	Civil	RC	N/A
	Electrical	RE	N/A
	Mechanical	RM	N/A
	Structural	RS	N/A
S - Structural	Substructure	SB	Foundations, piers, slabs
	Demolition	SD	Protection and removal
	Framing	SF	Columns, trusses, joists, beams
T - Telecommunications	Audio Visual	TA	N/A
	Clock and program	TC	N/A
	Telecommunications General	TG	Telephone, network, voice, data, alarm, nurse call, security, CCTV, PA, clock
	Public address system	TI	N/A
	Wireless networks	TJ	N/A
	Monitoring	TM	N/A
	Data networks	TN	N/A
	Telephone	TT	N/A
	Security	TY	N/A
V - Survey	Aerial	VA	Aerial surveyed points and features
	Field	VF	Field surveyed points and features
	Digital	VI	Digitized points and features
	Combined Utilities	VU	N/A

3D Image Naming

3D Imaging data is considered any non-model based 3D data. On most projects, this data will come from 3D laser scanning. See the 3D Imaging standard for additional information on the capture and use of 3D image data on Multnomah County projects.

Given the diverse nature of 3D Imaging software, a traditional naming standard cannot be developed. The producer of the 3D imaging data is highly encouraged to engage Multnomah County BDMC in a discussion of how to apply the naming standard to the specific software being used to process the scans.

Standard

1. A naming convention will be established under the BEP.
    a. All project participants will follow the established naming convention.
2. The naming convention will be hierarchical based on established divisions of the site. For example; interior building data should be named "Area ## - Room #### - ##" where the last two digits are sequential numbers to support multiple scans of the same room.
    a. The hierarchical divisions are to be: Building > Floor > Area > Room
3. Hierarchical divisions are not to be repeated. For example, if the building or site name is contained in the folder name of the data's location, it should not be repeated in the name of a single scan.
4. Naming will be consistent across the project, even when multiple capture firms are present.
5. If previous data for the same site exists and conforms to the standard, the naming convention established by that data is to be followed for all new data.
6. All naming within the point cloud data is to follow the General Naming Guidelines.
7. The use of non-standard names for the purposes of logically organizing the data is allowed.
    a. Non-standard names must meet common naming requirements.
    b. Non-standard names may only be used when standard names, such as floor or area, do not describe the contents of the folder or file.

Note: Files must be named correctly, and be properly stored within the approved folder structure. See Data Submittal Standards.

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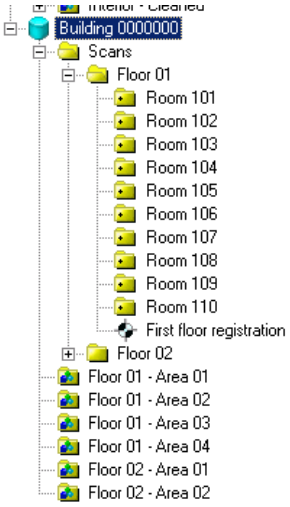
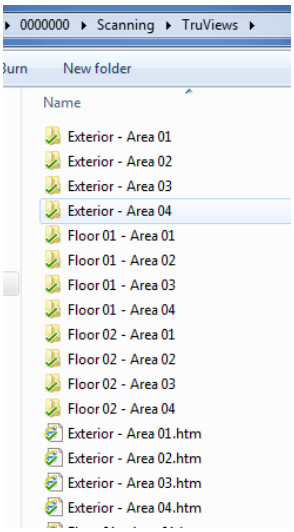
Examples

Scans in authoring application



Data in the authoring application. In this example, Leica Cyclone is being used to process the scan data. Notice that the database is named using the building number. The individual scans are grouped under a scan folder for the purpose of data organization. The scans are further separated by floor and then named by room.

The model spaces are grouped by floor then area, Floor 0x - Area 0x.



TruView data in standard folder structure
Leica TruView data in filesystem. Note that the standard folder structure is being used putting this data in the folder ../0000000/Scanning/TruViews/. Since the building number is in the root folder, it is not needed in the individual file or folder names.

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Standard Equipment Abbreviations

Multnomah County has standardized shorthand for common mechanical and electrical equipment. When the use of abbreviations is prudent, these standard abbreviations should be used.

Standard

When using abbreviations for electrical and mechanical equipment, the following abbreviations are to be used:

This list contains letters A through W (there are no other letters beyond W).

1. Aerator: **AER**
2. Air Blower: **ABL**
3. Air Compressor: **CMP**
4. Air Compressor, Recip: **CMP**
5. Air Conditioner Package: **ACU**
6. Air Conditioner, Window: **ACW**
7. Air Curtain: **ACT**
8. Air Dryer: **ADR**
9. Air Handling Unit, 25 ton thru 50 ton: **AHU-02**
10. Air Handling Unit, 3 ton thru 24 ton: **AHU-01**
11. Air Handling Unit, Computer Room: **AHU-04**
12. Air Handling Unit, over 50 ton: **AHU-03**
13. Backflow Prevention Device: **BFP**
14. Boiler, Electric: **BLR-E**
15. Boiler, Hot Water, Oil/Gas/Comb, 120 to 500 MBH: **BLR-HW2**
16. Boiler, Hot Water, Oil/Gas/Comb, 500 to 1000 MBH: **BLR-HW3**
17. Boiler, Hot Water, Oil/Gas/Comb, over 1000 MBH: **BLR-HW4**
18. Boiler, Hot Water, Oil/Gas/Comb, up to 120 MBH: **BLR-HW1**
19. Boiler, Steam, Natural Gas: **BLR-ST2**
20. Boiler, Steam, Oil/Gas/Comb: **BLR-ST2**
21. Boiler, Steam, Oil/Gas/Comb, 500 to 1000 MBH: **BLR-ST3**
22. Boiler, Steam, Oil/Gas/Comb, over 1000 MBH: **BLR-ST4**
23. Boiler, Steam, Oil/Gas/Comb, up to 120 MBH: **BLR-ST1**
24. Building Automation System, DDC: **BAS-01**
25. Building Automation System, Pneumatic: **BAS-02**
26. Building Automation System, Terminal End Devices: **BAS-03**
27. Cabinet Heater: **CHT**
28. Carbon-Monoxide Detection Sensors: **CMD**
29. Chiller, Absorption unit, 500 to 5000 tons: **CHL-A2**
30. Chiller, Absorption unit, up to 500 tons: **CHL-A1**
31. Chiller, Centrifugal, water cooled, over 100 tons: **CHL-CW2**
32. Chiller, Centrifugal, water cooled, up to 100 tons: **CHL-CW1**
33. Chiller, Recip, Air Cooled, over 25 tons: **CHL-RA2**
34. Chiller, Recip, Air Cooled, up to 25 tons: **CHL-RA1**
35. Chiller, Recip, Water Cooled, over 50 tons: **CHL-W2**
36. Chiller, Recip, Water Cooled, up to 50 tons: **CHL-W1**
37. Chiller, Screw, Water Cooled: **CHL-S1**
38. Chiller, Screw, Water Cooled: **CHL-S2**
39. Clean-Agent Fire-Extinguishing Systems: **FSP-04**
40. Computer Room A.C.1 (CRAC Unit): **CRAC**
41. Condenser, Air-Cooled: **ACC**
42. Condenser, Water-Cooled: **WCC**
43. Cooling Tower: **CTR**
44. Davits/Roof Anchors/Fall Protection: **DAV**
45. Deaerator Tank: **DEA**
46. Dish/Tray Busing Conveyor: **DSH-3**
47. Dishwasher - Elect: **DSH-1**
48. Dishwasher - Steam: **DSH-2**
49. Drinking Fountain, Packaged: **EWC**
50. Dry-Pipe Sprinkler Systems: **FSP-02**
51. Duplex Sewage Ejector: **DSE**
52. Electric Traction Elevator: **ELV-2**
53. Emergency Diesel Generator: **EMG-01**
54. Emergency Lighting: **ELT**
55. Emergency Natural Gas Generator: **EMG-02**
56. Escalator: **ESC**
57. Evaporative Cooler: **EVP**
58. Exit Signs: **EXS**
59. Expansion Tank: **EXT**
60. Exterior Doors: **DOR**
61. Exterior Walls: **WAL**
62. Exterior Windows: **WIN**
63. Fan Coil Unit: **FCU**
64. Fan, Axial: **FAN-01**
65. Fan, Centrifugal: **FAN-02**
66. Fan, Make-up: **FAN-03**
67. Fan, Utility Set: **FAN-04**
68. Fences and Gates: **FNG**
69. Filter, OR: **FLT-1**
70. Filter, Sand: **FLT-2**
71. Filter, Water: **FLT-3**
72. Fire and Smoke Dampers: **FSD**
73. Fire Detection and Alarm System: **ALM**
74. Fire Door - Sliding & Rolling: **FDR-02**
75. Fire Door - Swinging: **FDR-01**
76. Fire Extinguishers: **FEX**
77. Fire Hose / Hose Connections: **HSE**
78. Fire Hydrant: **HYD**
79. Fire Pump, Diesel: **FPM-02**
80. Fire Pump, Electric-Drive: **FPM-01**
81. Fryer, Pressurized Broaster, Gas/Electric: **DFF**
82. Fuel-Gas Detection Sensors: **GDS**
83. Furnace, Forced Air, Natural Gas: **FAF**
84. Garbage Disposal: **GBG**
85. Glycol Feed System: **GFS**
86. Grease Trap: **GTP**
87. Grill: **GRL**
88. Heat Exchanger, Flat Plate: **HXR-01**
89. Heat Exchanger, Tube (Shell and Tube): **HXR-02**
90. Heat Pump, Air Cooled: **HTP-1**
91. Heat Pump, Water Cooled: **HTP-2**
92. Heater, Baseboard: **BSB**
93. Heating & Ventilating Units: **HVU**
94. Heating/Cooling Unit: **HCU**
95. Humidifier, Evaporative Pan w/ Heating Coil: **HUM**
96. Humidifier, Steam: **SHS**
97. Hydraulic Elevator: **ELV-1**

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98. Ice Machine: **ICE**
99. Irrigation Pump: **PMP**
100. Kettle, Steam: **KTL**
101. Metering Devices: **MTR**
102. Mixer, Electric: **MIX**
103. Motor: **MOT**
104. Motor Control Center: **MCC**
105. Motor, Fan: **MOT-01**
106. Motor, Pump: **MOT-02**
107. Oven, Convection, Gas or Elect: **OVN-1**
108. Oven, Rotary, Elect: **OVN-2**
109. Oven, Rotary, Gas: **OVN-3**
110. Package Unit, Air Cooled: **RTU**
111. Package Unit, Water Cooled: **RTU**
112. Panelboard, Lighting & Appliance: **PNB**
113. Panelboard, Power Distribution: **EPB**
114. Parking Arm Gates: **PAG**
115. Parking Lots (Paving): **LOT**
116. Powered Doors: **PDR**
117. Preaction Sprinkler Systems: **FSP-03**
118. Pump: **PMP**
119. Pump, Centrifugal: **PMP-01**
120. Pump, Chemical Feed: **PMP**
121. Pump, Chilled Water: **PMP-02**
122. Pump, Circulating: **PMP**
123. Pump, Circulating, Hot Water: **PMP**
124. Pump, Condensate: **PMP-03**
125. Pump, Condensate Return: **PMP-04**
126. Pump, Condensate Return, Duplex: **PMP-05**
127. Pump, Condenser: **PMP-06**
128. Pump, Fuel Oil: **PMP-07**
129. Pump, In-line: **PMP-08**
130. Pump, Re-Circulation: **PMP-09**
131. Pump, Vacuum, Duplex: **PMP**
132. Pump, Water, Boiler Feed: **PMP-10**
133. Radiator, Finned Tube: **RAD-01**
134. Radiator, Steam: **RAD-02**
135. Range, Gas: **RNG**
136. Refrigeration Machine: **RFR**
137. Refrigerator unit/display case w/external condenser: **FRG**
138. Refrigerator/Freezer, walk-in box w/external condenser: **FRZ**
139. Roof System and Drains: **RFS**
140. Smoke Detection Sensors: **SDS**
141. Snow Melt System: **SMS**
142. Space Heater: **UHT-01**
143. Steam Station: **STS**
144. Steam Trap: **STR**
145. Sump Pump: **SMP**
146. Switch, Automatic Transfer: **ATS**
147. Switch, Disconnect: **DCT**
148. Switchboard, Electrical: **SWB**
149. Tank, Fuel: **TNK-01**
150. Tank, Hot Water: **TNK-02**
151. Tank, Oil Storage: **TNK-03**
152. Tank, Water: **TNK-04**
153. Terminal Unit: **TMU**
154. Transformer, Dry: **DTT**
155. Transformer, Oil-Filled: **TRN**
156. Underground Storage Tank (UST): **UST**
157. Unit Heater: **UHT-02**
158. Unit Heater, Cabinet: **UHT-03**
159. UPS (Uninterruptible Power Supply): **UPS**
160. Vacuum Pump: **VCP**
161. Valve (Shut Off): **VLV-X**
162. Valves: **VLV**
163. Variable Frequency Drive: **VFD**
164. VAV (Variable Air Volume Boxes): **VAV**
165. Voltage Regulator: **VLT**
166. Water Bottle Fill Station: **WBF-1**
167. Water Bottle Fill Station Combo: **WBF-2**
168. Water Heater, Electric: **WHT-01**
169. Water Heater, Natural Gas: **WHT-02**
170. Water Softener: **WSF**
171. Water Treatment (Chemical): **WTM**
172. Wet-Pipe Sprinkler Systems: **FSP-01**
173. Wheelchair Lift: **WLF**

General Naming

The guidelines listed below will apply to any objects present in the dataset at the time of delivery to Multnomah County. Temporary or working data that will be purged from the file before submission is excluded.

Guidelines

- Naming schemes should be consistent throughout the project data.
- Names should be MasterFormat Number followed by object name
- Names of people should not be used in naming any object. For example, "John's Workset" is unacceptable.
- Non-English language should not be used except for non-English manufacturer names.
- Abbreviations should be kept to a minimum and if used, they should be consistent throughout the project.
- Standard title case should be used for all names.
- Imperial units in names should appear as a' – b c/d" x a' – b c/d". In most cases, sizes should be in inches i.e. aa" x bb".
- Sequential numbering should not be used. For example, Exterior 01, Exterior 02, etc. These numbers should be replaced by descriptive text, highlighting the difference between the objects being named. The exception is using sequential numbering as a means of forcing a particular sort order.

Minimum Attributes

At an absolute minimum, the following non-visual data must be attached to model data. The data creator is only responsible for attaching these fields to the object. The party responsible for entering the data will vary and should be defined within the project BEP. Completion of this information corresponds with Level of Detail (LOD) requirements defined by Multnomah County Revit Standards. The minimum attributes are further defined in the Level of Detail section of the Multnomah County Revit Standards. They are to be followed and may not be overridden in the BEP. What level an individual firm is responsible for will vary and is defined in either the standard Model Progression Matrix or a custom MPM that was defined as part of the project's BEP.

Required Asset Parameters

The following parameters must be integrated into all assets that may require future maintenance. In addition all safety equipment must also have the parameters integrated. If you are unsure email fpm.bdmc@multco.us. These should be integrated as instance type parameters. These parameters are used for Multnomah County Asset tracking.

All tracking parameter names will be delineated by beginning with MC (ie “MC Warranty URL”):

1. Manufacturer
2. Model
3. Serial Number
4. Location Description (ie “In ceiling NE corner”)
5. O&M Manual Link (URL to County Google Drive)
6. Warranty Link (URL to County Google Drive)
7. Warranty End Date
8. Barcode (for future use)
9. Photo of Asset (URL to County Google Drive)
10. Photo of Nameplate (URL to County Google Drive)
11. Installed - County Project Number

Standard

General:

1. When authoring data within Autodesk Revit, the Multnomah County provided Shared Parameters 2.1 file must be used, with no exceptions.
2. When possible, data created outside of the Revit platform must be defined using the same GUID found in the Revit Shared Parameters file to identify the property.
3. If an attribute is provided, it will be used and not duplicated under a different name unless it is one of the Multnomah County Asset Tracking parameters. MCAT parameters can be duplicated.

URL Data

URL data is to be added to all projects as the types indicated below. The URL data will link to a specific file. The targeted data is to follow the structure outlined in the Data Submittal Standard.

All links must be relative and follow the URL guidelines outlined in the Referencing and Linking section of the standard. Links containing "hard" paths will be rejected.

Attribute / Parameter	Type	Description
URL As-Built Drawings	Instance	A URL link pointing to one or more as-built drawings, in a single PDF. (Bluebeam)
URL MSDS	Type	A URL link pointing to one or more MSDS, in a single PDF.
URL Op and Maint Manuals	Type	A Google Drive URL link pointing to one or more operation or maintenance manuals in PDF form. Please contact fpm.bdmc@multco.us for access to the O&M Google Drive.
URL Owner Manual	Type	A URL link pointing to one or more owner manuals, in a PDF.
URL Photos	Instance	A URL link pointing to one or more digital photographs, typically JPGs. If included - Asset and Nameplate photos will be a Google Drive URL link pointing to an Asset Photo folder for the building . Please contact fpm.bdmc@multco.us for access to Google Drive.
URL Product Data	Type	A URL link pointing to one or more product data or information documents, in a PDF.
URL RFIs	Instance	A URL link pointing to one or more scanned RFIs from the project, in PDFs.
URL Shop Drawings	Instance	A URL link pointing to one or more shop drawings, in DWGs or PDFs.
URL Sketches	Instance	A URL link pointing to one or more sketches, in DWGs, PDFs, or JPGs.
URL Warranty Information	Type	A Google Drive URL link pointing to one or more warranties in PDF form. Please contact fpm.bdmc@multco.us to access the Warranties Google Drive.

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URL Guidelines

Most BIM applications allow for attaching URLs (Universal Resource Locators) to individual BIM objects. This allows many forms of data to be connected directly to the BIM object.
When using URLs in as-built or record data for Multnomah County, there are certain rules that need to be followed to ensure that the URLs will continue to work once the data is submitted.

Standard

General:

- All URLs must be verified as working before submitting the data to Multnomah County.

URL to Local Files:

- URLs to Local files are not allowed.

URL to Internet Address:

- Only URLs to Internet Addresses owned by Multnomah County will be permitted (ie MultCo's Google Drive).

MasterFormat Number

Design components used to generate the virtual model must be associated with a MasterFormat Number and MasterFormat Title. This allows organization and understanding of design intent. This effort occurs in all design and construction phases. Within a Revit environment, it can be addressed in the family. Most family templates have this information already, however, if the predetermined information is not accurate to the component, it is the responsibility of either AE or GC (based on LOD) to be corrected.

Model Placement

All models must be correctly located in 3 Dimensional Space (x, y, and z coordinates).
FOR MULTI-BUILDING SITES - Contact BDMC for Coordination.

Site Models

For sites with multiple buildings only, please create site features as a separate linked Revit File. Use a local state plane to correctly locate models. Modeled Site Topography and features are preferred, however 2D CAD topography is allowed. Site Models must use the correct latitude and longitude coordinates obtained from a site survey. Please contact your County Project Manager for the correct Site Number and Site Name.

Reference this video on coordination: ArcGIS Coordinates In Revit

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Tolerances

Model(s) and their elements must be within standard practice tolerances for each discipline. Asset families should be modeled as accurately to the true dimensions as possible. Asset placements in the Record Model and subsequent Facility Management Model should reflect as-built conditions as accurately as possible without the incursion of excess as-built measurements.

3” As-built Deviation tolerance

- MEP Equipment & Connections

6” As-built Deviation tolerance

- LowVoltage
- Electrical
- Mechanical
- Plumbing
- Fire Protection

12” As-built Deviation tolerance

- Underground Utilities (beneath the building to 5’ out)
- Interiors FF&E

Modeling Level of Detail

Level of Design / Development / Detail (LOD) is the overall state of your information model at a particular point in its design process. This includes not only graphical objects, but also the data associated with the objects. Your model should develop over time from a very coarse design to the record set model. This process has been distilled into five distinct categories.

Model Progression

At the core of the five layer LOD is the concept of model progression. It is important to realize that the model will not progress at the same rate for all elements and that not all elements will be present in all levels. For example, fittings on mechanical systems may only exist in level 400 while core structural elements may progress through all 5 levels.

Specific disciplines will also progress through the process at different rates. It is very common to have structural steel reach 400 level before all mechanical has reached 300 level. The entire team must recognize this and plan accordingly, making sure objects do not make it to the field if their final design will be influenced by objects not yet defined in the model. For example, steel must not be released from the 300 level before mechanical loads are known. This is not to say that mechanical must be complete to the same level, only that the loads needed to calculate the steel are true. As the

model progresses from conceptual through record set, ownership of graphical objects and their associated data may pass from one group to another. This may also involve the transition from one data format to another. It is critical that data fidelity be maintained through this process.

Defining LOD

It is critical to have a clear definition of what is included in the information model at different points in a project's life-cycle. Understanding expectations, roles, and responsibilities is one of the most important aspects of a successful BIM-based project. To assist in this, Multnomah County has developed several resources:

- Basic Definitions of Level of Detail (listed below)

Detailed definitions of the development of individual objects through the design life-cycle.

- Model Progression Matrix

Assigning the responsible party to each object across the five phases of development.

- Approved Use Matrix

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LOD 100 - Conceptual

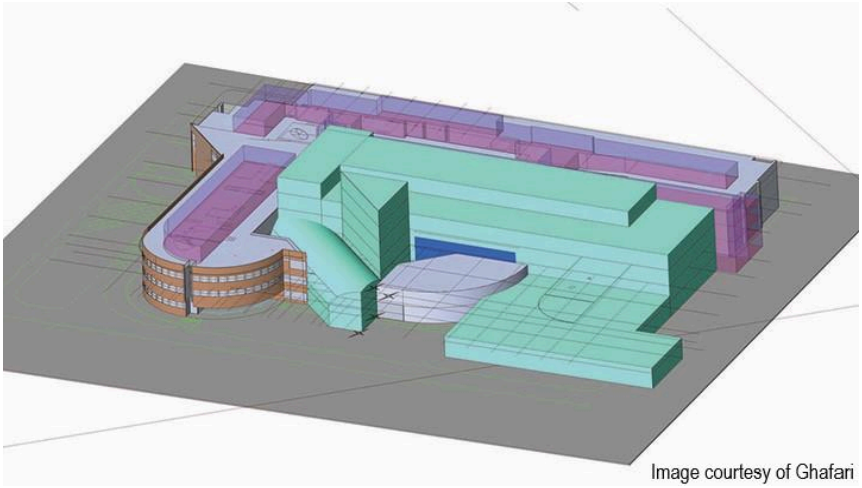
Image courtesy of Ghafari

LOD 100 Example

LOD 100 is the beginning of a project and may not be a part of many county projects. LOD 100 is much like the traditional conceptual design phase. During this phase, a model will be at its most primitive. The building will be sited and roughly sized, a basic site layout may exist, and some very preliminary analyses may be performed. These analyses could include whole building energy analysis, conceptual cost based on cost per square foot, and preliminary whole site construction phasing.

In some cases there may be no model data associated with LOD 100. There may only be analysis data and 2D CAD data or even hand sketches. When possible, any model data should be created with the understanding that it will need to move to a BIM design tool. Since the future design (200 & 300) will be completed using Revit, a tool which is compatible with Revit should be considered for 100 level massing, modeling and analysis.

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LOD 200 - Approximate Geometry

LOD 200 Example

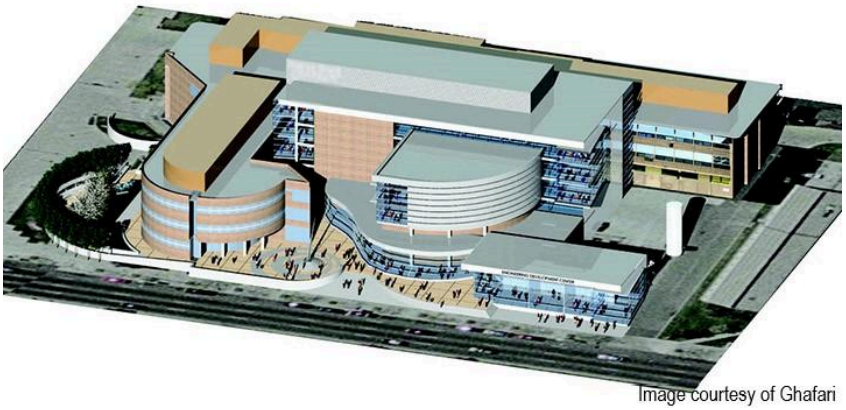

Image courtesy of Ghafari

LOD 200 is like schematic design and design development. It is the phase that will transition the conceptual massing model and associated data into a model ready for the creation of construction documents. This is one of the longest phases that any model will go through as it encompasses both the traditional schematic design and design development efforts.

At the conclusion of this 200 level, a model will contain the approximate quantity, size, location, and systematic relationships of most objects that will eventually be installed. The data about all objects will be preliminarily filled in with basic information. Although specific object information may not yet be available, at a minimum space claims for each object or system should be accounted for. Preliminary high level coordination should be happening throughout this stage. Coordination should be focused on planning and not hard clashes (e.g. vertical space allotment for utilities not pipe-on-pipe collisions). This coordination should be cross discipline and be handled in the project coordination meetings as defined in the project's BEP.

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LOD 300 - Precise Geometry

LOD 300 Example

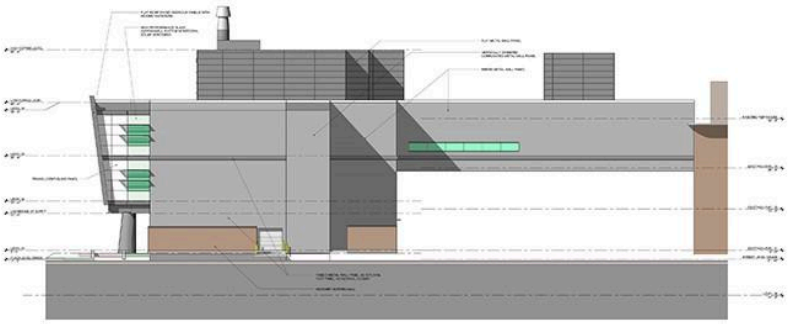

Image courtesy of Ghafari

LOD 300 is similar to construction documents, the phase where a design begins to accurately resemble what will be installed. Specific elements are confirmed as 3D object geometry. Object dimensions, capacities, and connections defined.

At the conclusion of 300 levels, a model will contain the accurate quantity, size, location, and systematic relationships of all objects that will eventually be installed. Data on all objects will be filled with all basic information. No space claims or rough shapes should exist for any object that will be installed (space claims to protect space for code compliance or similar will still be present). Individual object level coordination should be happening throughout this stage. Coordination should be focused on major hard clashes (e.g. pipe-on-pipe collisions). The AE and Constructors should be involved in the coordination meetings at this point.

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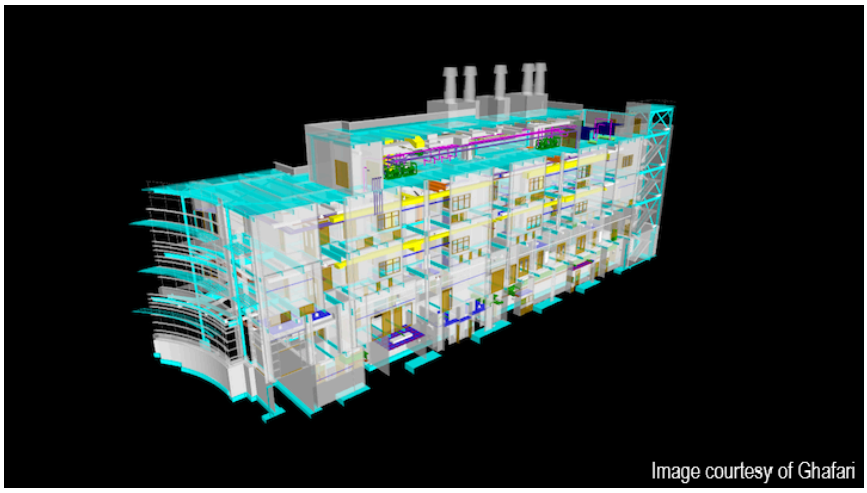
LOD 400 - Precise Geometry



LOD 400 Example

LOD 400 is achieved when fabrication and assembly can be driven directly from the model. For most object types, the trade partners with input from the AE create the level 400 information model solely. It is common in this stage of development for the design information model to go dormant as fabrication models are derived from them on a different CAD platform. The tools required for fabrication level models are not the same that are needed for design or as-built models.

A key difference of LOD 400 is trade scheduling. At 100 through 300 levels, different trades are completing the stages at different times. For example, structural steel and foundations will often be at least one level above the other trades, followed by architectural elements and lastly by MEP. In LOD 400 this will change and all disciplines will align instead by physical area, such as by floor. Coordination must continue throughout the 400 phase. All parties should be included in this coordination and no fabrication should begin until the entire team agrees that an area is ready. The end result of level 400 coordination will be installation certainty.

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LOD 500 - Record Set

LOD 500 Example

LOD 500 is the post construction record set stage of a project. This is the final first cost stage of any project. At the 500 level conclusion. The model is given to the County Building Data Management Center. The process of creating a 500 level model will often involve the integration of the 400 level fabrication model data into the 300 level model.

At LOD 500, the model will contain all building elements. They will be geometrically accurate while not showing excessive fabrication level detailing. For example, duct work will be sized correctly as installed but will not have flanges modeled. Objects will contain county asset tracking parameters, maintenance requirements (links and data), object specific data (e.g. fan CFM) and any other data relevant to the life cycle management of the building.

Grouping & Relationship

Relationships

For BIMs to be useful as more than a basic 3D model, they must contain an inherent hierarchical relationship structure. In applied terms, this means that every object within a model will have one or more relationships with other objects in the model. These relationships fall within five categories; Composition, Assignment, Connectivity, Association, and Definition.

- Composition - captures a whole-part relationship having exclusive containment such as subdividing a building into floors and rooms or a wall into studs and sheathing.
- Assignment - captures assignment relationships where one object consumes the services of another object, such as a labor resource assigned to a task, or a task assigned to a building element.
- Connectivity - indicates connectivity between objects such as a floor slab connected to a beam or a pipe connected to a sink.
- Association - indicates external references for an object such an external IFC library file where an object is defined.
- Definition - indicates an instance-of relationship such as a pipe segment being of a particular type.

Currently, Multnomah County has standards covering composition and connectivity relationships.

Grouping

BIM objects are also sorted, or classified, into logical groups within the model. These groups go by many different names and many are automatically assigned. For example, an object placed within the confines of a room is automatically grouped or classified to be a member of that room. Other classifications are not automatic and must be managed by the data creator.

MEP Objects (Systems)

In BIM, MEP objects are assigned to a system. These systems are structured to represent actual or proposed, real-world systems within the building.

Standard

- System names must follow the General Naming Guidelines.
- When supported by the BIM, authoring software systems are to be properly named and classified.
- All MEP objects are to be placed and maintained on the correct system.

- Systems are to be developed and assigned to all MEP objects by the project design team (Architects and Engineers) in consultation with the Multnomah County Project Manager and/or BDMC.

Composition Relationships

A composition relationship captures a whole-part relationship having exclusive containment such as subdividing a building into floors and rooms or a wall into studs and sheathing.

Standard

- All objects shall be properly related (hosted) to the correct parent element.
- Where applicable, every object is to be related to its correct floor.
- In no cases should unnecessary offsets be used as a way to position an object within the model.
- Composite objects must be constructed using the Revit to establish correct relationships.

Connectivity Relationships

A connectivity relationship indicates connection between objects such as a floor slab connected to a beam or a pipe connected to a sink. Achieving robust connectivity relationships within the BIM is an important step in ensuring the model will be ready for downstream uses.

Connectivity relationships are often difficult to preserve when converting data between BIM applications. Care must be taken to ensure that these relationships are maintained when importing to Revit from another authoring software.

Standard

- Where supported by the authoring application, objects shall be properly connected to a system.
- The network of connections is to be maintained to the furthest extents of the project's scope.
- BIMs which feature objects broken into individual elements when logical systems are available will not be accepted.

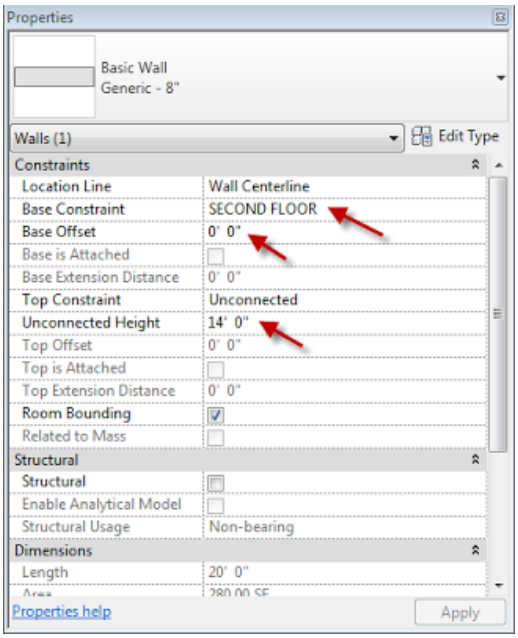
Grouping and Relationship Examples

The examples below show several different applications of both proper and improper models. The concept of grouping, categorizing, and relating objects within the BIM is complicated. Fixing these issues after model creation is very time consuming. If you have any questions or concerns you should contact BDMC.

Composition Relationships - Wall Example

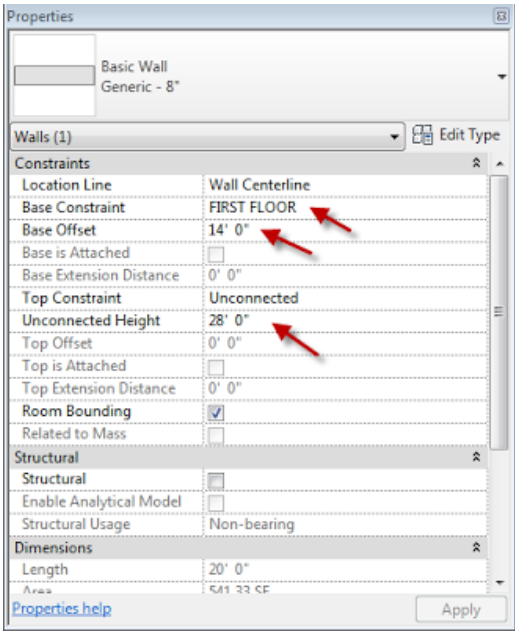
In the example shown, a wall has been improperly related to level within Revit. Although this may work properly within the Revit environment, it will not work in downstream applications such as energy analysis and property management.

Proper Use



Revit properties window showing a wall that is properly related (hosted) to a floor object.

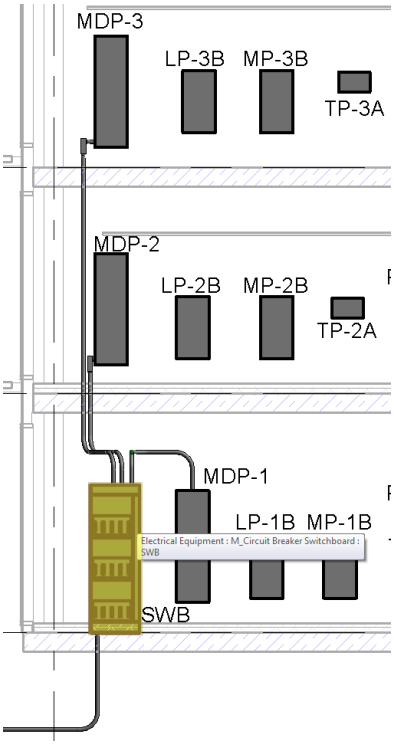
Improper



Revit properties window showing a wall that is improperly related (hosted) to a floor object. Notice the large offset used to force the wall up a floor.

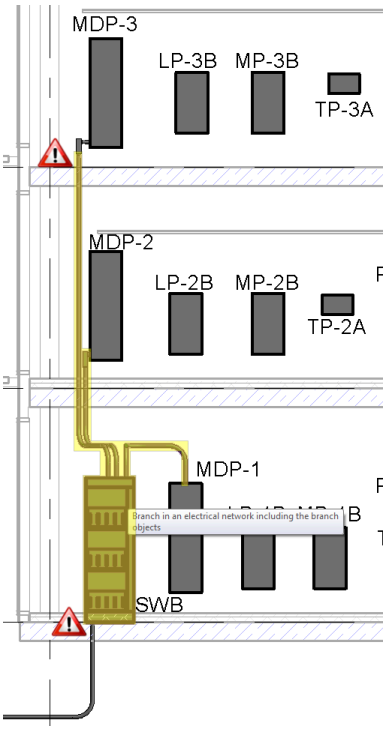
Example - Electrical Distribution

Single Object



Within most BIM authoring tools, checking for proper connectivity is simple. Within Revit this is done by pressing the TAB key while hovering over an object.

Branch of Objects

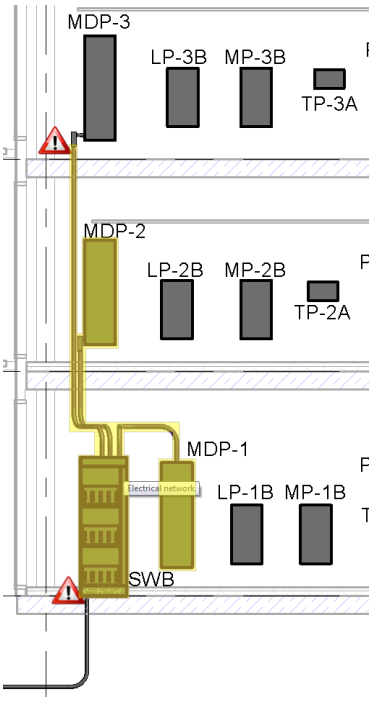


Pressing the tab once will highlight the first level of connectivity. In this example, the branches of conduit off the circuit breaker switchboard are highlighted.

Notice the disconnects in connectivity at the marked points above.

- The feed conduit coming into the base of the panel is not properly connected.
- MDP-3 is also not connected due to a break in the connectivity at the elbow.

Network of Objects



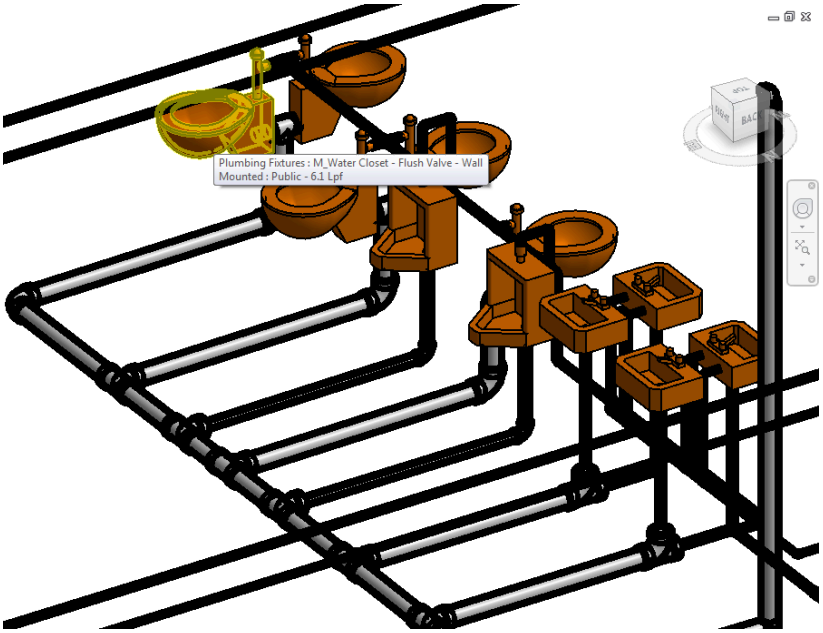
Pressing a tab a second time will now highlight the entire connected network.

It becomes very clear at this point there are issues in the connectivity. These errors will cause severe issues when leveraging the BIM.

- No draw is being posted back to the building power distribution from this system.
- Anything connected to MDP-3 is not being calculated as a load on the switchboard.
- Facility Management software will not be able to establish what circuit is supplying MDP-3.

Example - Plumbing

Fixture in plumbing network



At the fixture level only the fixture itself is selected.

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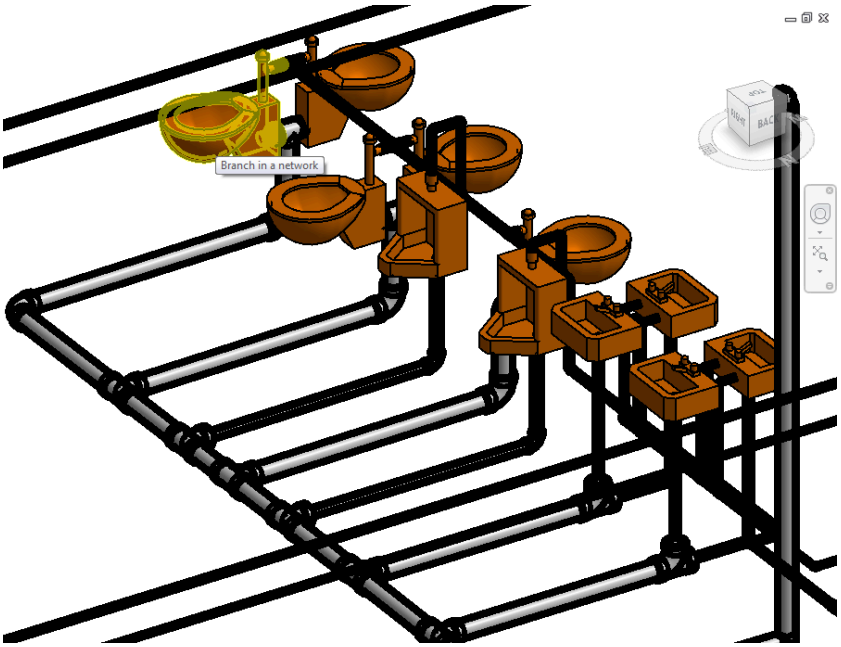
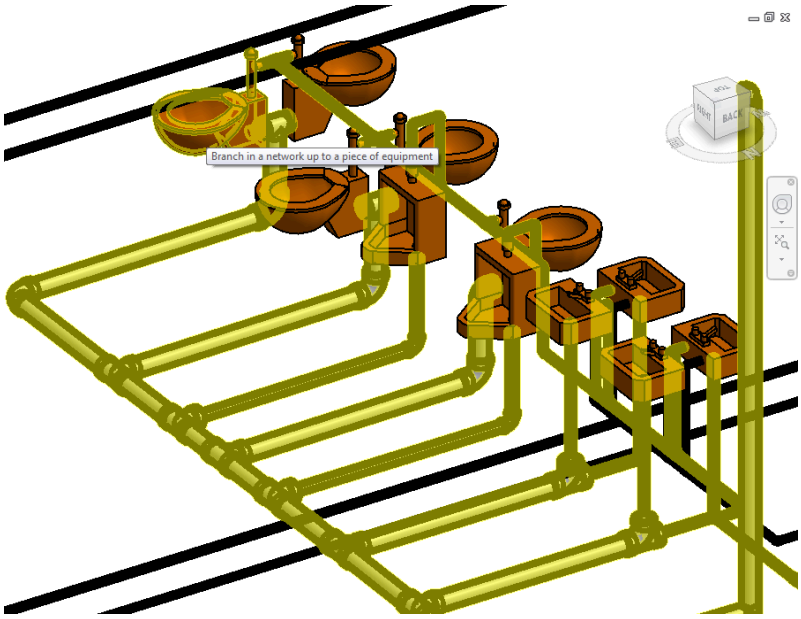
Branch in plumbing network



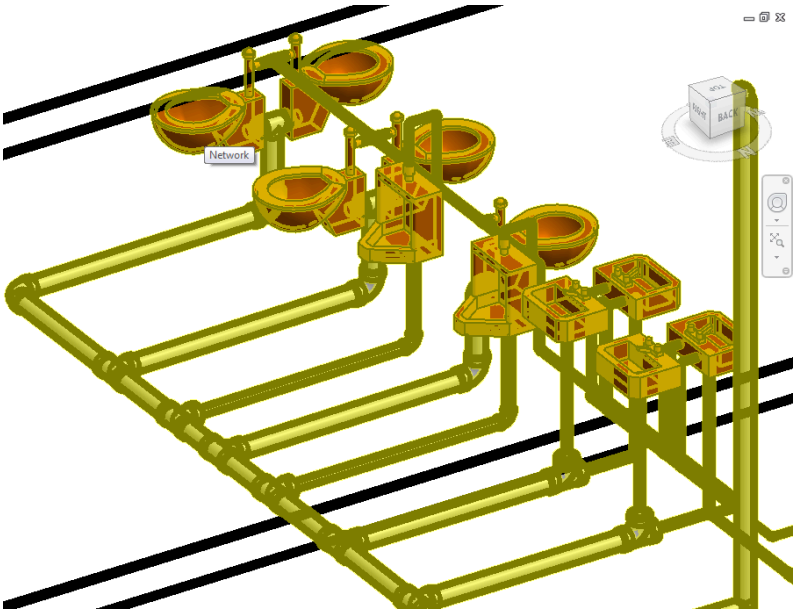
The next level is the branch level. At this level you will have selected all objects up to the first fitting on the branch. In the image above, notice that both the supply and waste have been highlighted up to the first fitting.

Branch in a network (up to equipment)



In the third level of selection you have selected all objects in the network from the initial fixture up to, but not including, other fixtures.

Complete network

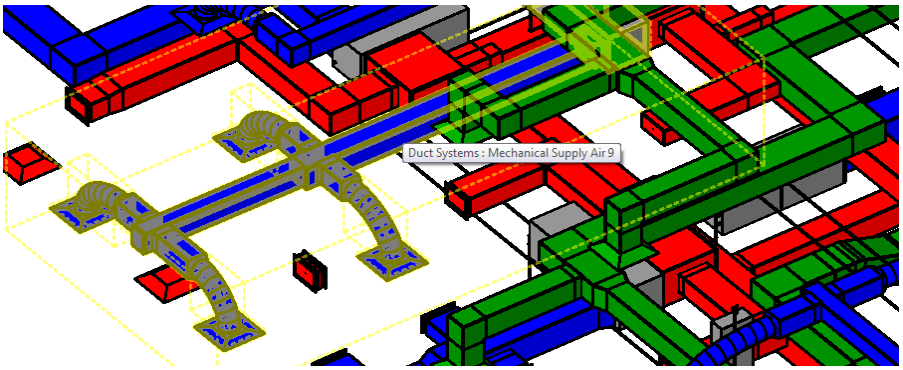


The final selection level will select all objects connected to the network. It is at this level you are most likely to see defects in the construction of your network.

Example - Duct System vs. Duct Connectivity Network

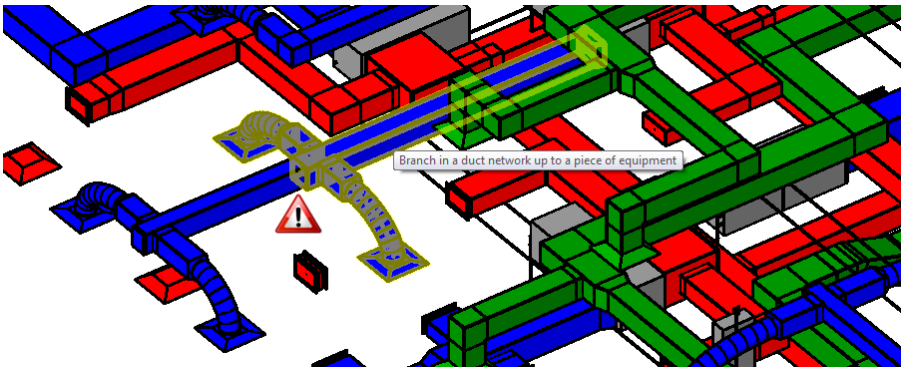
This example highlights the fact that an object can be placed in the correct system while still not being connected to the network. Both are required under the Multnomah County Revit Standard.

Duct System



The image shows a duct system highlighted within Revit.

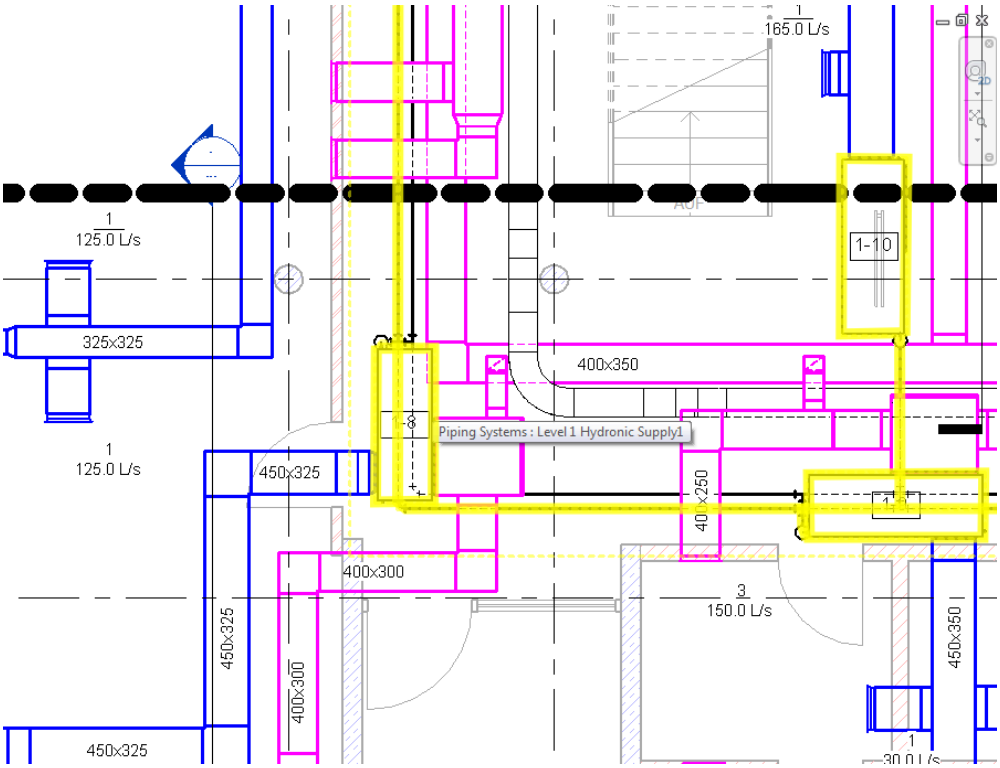
Broken Duct Connection



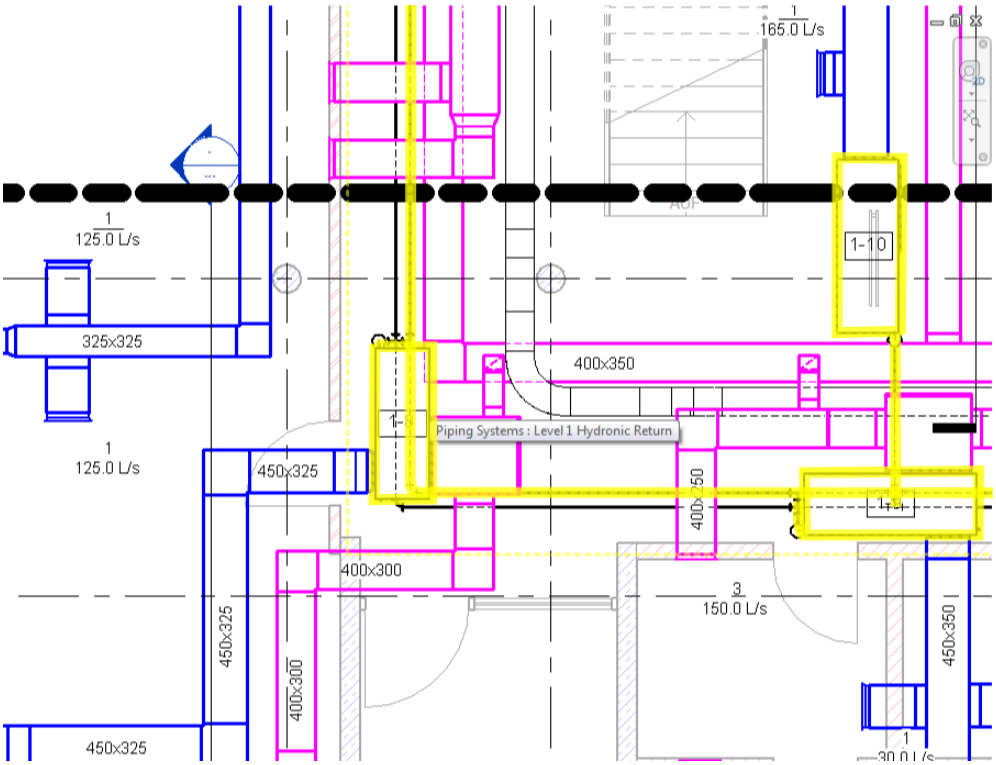
In this image you can see the same duct selected by the network. Note that most of the duct system is not selected. This is caused by improper construction of the model and is not permitted under the Multnomah County Revit Standard. Proper object connectivity is required for all supported objects.

Example - VAV

This example highlights how a single object can be assigned to multiple systems.



Multiple systems, one object



Any object can be part of multiple systems. The mechanical equipment shown in this example is part of many systems. In fact, this equipment is part of 6 different systems.

Referencing & Linking

External References

An external reference is any data that is viable yet does not reside within a particular file. The practice of referencing external data exists within all major BIM platforms and goes by several different names including: Xrefs, References, Link. This section applies to all of these. Multnomah County encourages minimizing external references, especially to any 2D drawings, including AutoCad files. An excessive amount of referencing such 2D files can clog up the linking process and cause improper linking or can even crash the model. 2D drawings should be generated in Revit to minimize any negative consequence of opening the files.

Standard

General Rules:

- Master files should always be referenced origin to origin (base point to base point, 0,0,0 to 0,0,0).
- Reference nesting should be avoided, especially on project-based BIM platforms.
- Whenever possible, all references must have relative paths, as opposed to absolute paths.

Referencing vs. Inserting
There are a few basic rules to consider when deciding whether files should be referenced together or inserted into one another.

- Each real world object may exist in only one BIM. At no time should this data be duplicated.
- By inserting, you are taking ownership of the inserted objects. If you do not own the objects they should be referenced.
- Whenever possible, attempt to deal in native formats. For example the direct insertion of AutoCAD data into a Revit model should be avoided, instead, convert the DWG data into native Revit geometry and then merge the two Revit models.

Naming
The naming of linked files should adhere to the standards already defined in this document. The one exception to this is when referencing another party's data into your model. If at the time of model submission you will have another party's data referenced to your model, you must append the beginning of that file with an "x" to denote that it is used as reference only. For example, a file named 00000000_AI_B4-50_B.rvt that is being used as reference must be renamed and linked under the name x00000000_AI_B4-50_B.rvt.

Using Uniform Resource Locators (URLs)

Most BIM applications allow for attaching URLs (Uniform Resource Locators) to individual BIM objects. This allows many forms of extended data to be connected directly to the BIM object. When using URLs in as-built or record data for Multnomah County, there are certain rules that need to be followed to ensure that the URLs will continue to work once the data is submitted.

Note: The proper use of URLs on Multnomah County projects requires that the project be established using the Multnomah County standard folder structure. This folder structure is available as a template and is documented within the Data Submittal Standard.

Standard

- All URLs must be verified as working before submitting the data to Multnomah County.
- All URLs must point to either a folder or file which resides within the folder structure outlined in the Data Submittal Standards.
- Several URL fields, parameters, or attribute names are defined in the Multnomah County Revit Guidelines. These URLs must exactly match the naming outlined in the Minimum Attributes Standard URL section.

  Note: Additional URL attributes may be added to the BIM if required for the project.

URL to Local Files

- URLs to local files or folders are not allowed under Multnomah County Revit Standards.

URL to Internet Address

- Care must be used when linking to internet based resources. It is unlikely that they will be available, with address unchanged, for the life-cycle of the building.
- Internet URLs must only be used when product data that is not a part of the Required Asset Parameters.

URL to County Google Drive

- BDMC must grant drive folder permissions.
- AE Service Providers will lose access to granted folders after BDMC records project completion.
- URL links must follow Warranty/Operation & Maintenance Manual Upload Procedure

Parametric Components

Parametric components are dynamically changed instance-based objects. They go by different names in different BIM platforms. These standards are applicable to all forms of these objects. This includes Revit families, AutoCAD components/dynamic blocks, and all similar types of data from all platforms.

Graphical information of components will be required to adjust based on Level of Detail (LOD). As the design progresses, so will the detail level of the graphical information. Common representations are a representation for LOD 100-200 (course detail), LOD 300 (medium detail), and LOD 400-500 (fine detail).

Information (metadata) is an important aspect of this type of object. It is very important that parametric components contain information relevant to the component and to the project. Level of Detail will dictate the amount and type of information required. See Minimum Attribute Standards for more information on this topic. Design components used to generate the virtual model should be associated with a MasterFormat Number and MasterFormat Title. This allows organization and understanding of design intent. This effort occurs in all design and construction phases. Within a Revit environment, it can be addressed in the family. Any family templates generated by Multnomah County will have this information already, however, if the predetermined information is not accurate to the component, it is the responsibility of either AE or GC (based on LOD) to be corrected.

Standard

- The priority of standards for the creation of parametric components is as follows: Multnomah County Revit Standards → Autodesk Revit Standards → any in-house parametric component guidelines or standards.

- If an industry or software vendor standard exists for the creation of parametric components, you are expected to follow it.

Naming of Parametric Components

Given that parametric components are such a critical part of any BIM, it is necessary to have some level of consistency in the naming of the components. The following rules should be followed when naming parametric components:

Good Naming	Poor Naming
Exterior - Marble Paneled - 30 3/4"	EXT-Sht-CMU-8"
Concrete Ceiling - 1 1/2"	New system
Curtain Wall H Mullion Level	CUSTOM - 1

Provided Revit Families

The Multnomah County BIM Template does not require the use of any special Revit Families for proper use. However, the county may provide families. These Families will be developed by Multnomah County and will be provided for Multnomah County teams to deploy on their projects. These Families are provided "As-Is" and are not required.

MEP Color Mapping

To achieve consistency across files, the Multnomah County Revit Standard has developed color assignments for MEP systems. All project data should conform to these to the extent possible within the authoring application.

Standard

- All MEP files, regardless of software authoring platform, must follow the color coding defined on this page.
  - If a data format does not support application of color by element they will be allowed.
  - When working in a platform that supports multiple color schemes, such as Revit, only the master, discipline and 3D views must have the color scheme.
- When using AutoCAD, the ACI or RGB color number is permitted.

Index

Common Piping and Plumbing Systems

System	Revit Color	AutoCAD Color	RGB
Compressed Air	5	5	0,0,255
Storm Drain	128-000-255	190	128,0,255
Storm Drain Overflow	219-183-255	191	219,183,255
Domestic Cold Water	0-63-255	160	0,63,255
Domestic Hot Water Return	255-170-170	11	255-170-170
Domestic Hot Water Supply	255-060-060	10	255,60,60
Natural Gas	2	2	255,255,0
Sanitary	255-127-0	30	255,127,0
Sanitary Vent	255-191-0	40	255,191,0
Unknown Pipe	076-038-038	17	76,38,38

Unknown Pipe is only to be used when it is absolutely necessary. Only when an existing pipe must be shown, but its contents are unknown, should a pipe be classified as unknown.

HVAC Systems

System	Revit Color	AutoCAD Color	RGB
Heating Hot Water Return	255-0-127	230	255,0,127
Heating Hot Water Supply	255-0-63	240	255,0,63
HVAC - Exhaust	3	83	103,165,82
HVAC - Outside	0-191-255	140	0,191,255
HVAC - Return	0-255-127	110	0,255,127
HVAC - Supply	000-127-255	150	0,127,255
Condensate - Gravity	127-255-000	70	127,255,0
Condensate - Pumped	0-104-78	126	0,104,78

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Fire Protection Systems

System	Revit Color	AutoCAD Color	RGB
Fire Protection - Sprinkler	1	1	255,0,0
Fire Protection - CO2	255-0-191	220	255,0,191
Fire Protection - Halon	255-170-234	221	255,170,234
Fire Protection - Inert Gas	189-0-141	222	189,0,141

Steam Systems

System	Revit Color	AutoCAD Color	RGB
Steam - High Pressure	0-94-189	152	0,94,189
Steam - Medium Pressure	126-157-189	153	126,157,189
Steam - Low Pressure	170-212-255	151	170,212,255

Heating and Cooling Systems

System	Revit Color	AutoCAD Color	RGB
Chilled Water Return	191-0-255	200	191,0,255
Chilled Water Supply	234-170-255	201	234,170,255
Cooling Tower Water Return	141-0-189	202	141,0,189
Cooling Tower Water Supply	173-126-189	203	173,126,189

Electrical / Telcom

System	Revit Color	AutoCAD Color	RGB
Telecommunication	189-189-126	53	189,189,126
Power Distribution	189-189-0	52	189,189,0

Lighting	255-255-170	51	255,255,170
Security	255-255-0	50	255,255,0

Uncommon / Specialized Systems

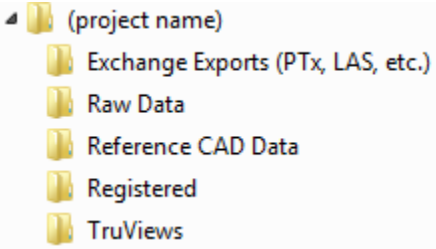
System	Revit Color	AutoCAD Color	RGB
Deionized Water	165-165-82	53	165,165,82
Dual Temperature Return	000-063-255	160	0,63,255
Dual Temperature Supply	191-000-255	200	191,0,255
Energy Recovery	082-165-165	133	82,165,165
Fuel Gas	255-127-127	11	255,127,127
Fuel Oil	082-082-165	173	82,82,165
Fuel Vent	165-165-82	53	165,165,82
Laboratory Gas	165-124-82	33	165,124,82
Medical Gas	165-082-165	213	165,82,165
Nitrogen	5	5	0,0,255
Non-Potable Water	165-000-000	12	165,0,0
Potable Water	000-255-063	100	0,255,63
Propane	5	5	0,0,255
Refrigerant Liquid	4	4	0,255,255
Refrigerant Suction	5	5	0,0,255
Reverse Osmosis Water	165-000-000	12	165,0,0
Vacuum	082-165-165	133	82,165,165

3D Imaging

3D imaging, also known as laser scan or point clouds, is the process of recording existing conditions into 3D point data. This document assumes the reader is familiar with this form of data acquisition. Those unfamiliar with the technology should begin by reading section one of the GSA National BIM Guide Series 3.

The use of 3D imaging (scanning) to capture existing conditions must be a team based collaborative project. What, when, how a site is scanned must be agreed upon by the entire team prior to execution. This process is described in the 3D Laser Scanning Quality Management Program Guide, which is required.

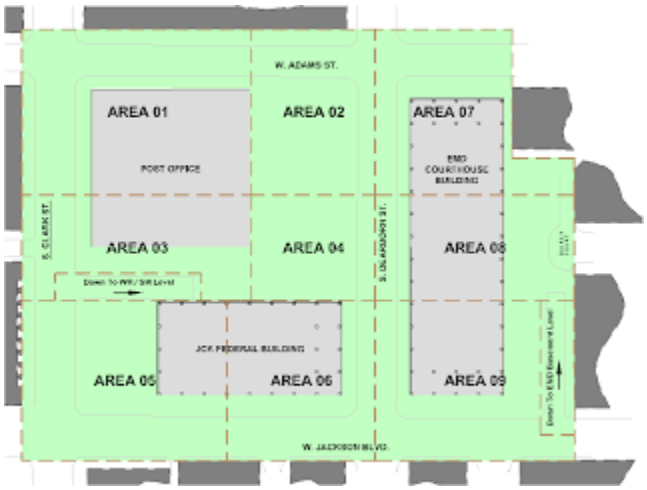
File Structure and Organization



A clear and well organized data set will help ensure success on the project. This structure should be planned before processing the 3D imaging data.

Multnomah County requires that all scan data be delivered in native authoring software (Faro, Leica, etc.) and in ASTM E57 format. It is the scan provider's responsibility to convert all data to the ASTM E57 format.

Area Map



Once scanning is complete, the team will meet to discuss the strategy for structuring the 3D imaging data. The output of this meeting will be the project's area map. The area map will drive the overall data structure and the naming convention for the 3D imaging data. Each area will become an individual data file to be referenced into the BIM authoring software.

Note: Small projects may feature simpler area maps but still require them.

Standard

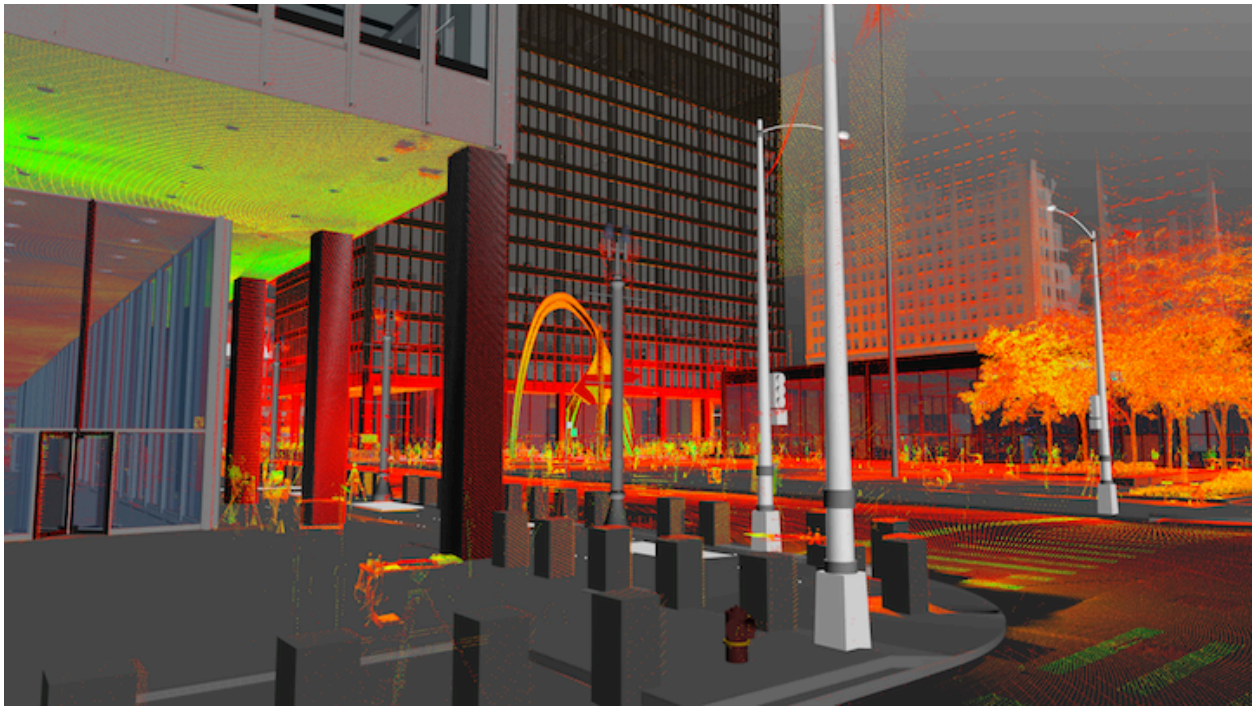
- The size of each area should be chosen based on achieving a workable file size for each area. Each area may vary in size based on the number of scans taken and the density of points captured.
- Where possible, existing area breakdowns should be used. Items such as the project's key plan should be considered as a basis for the area map.
  - This may include sub-divisions of an existing area plan.
- No single area should generate a working point cloud file greater than 20GB in size.
  - This size may be increased or decreased as part of the BEP development.

Data Origin Point (Coordinate Frame)

At a minimum, one set of registered point cloud data is to be in the same coordinate frame (origin point) as the BIM data on the project. This data should directly align to the BIM, when referenced to the origin point of the BIM, without manually moving the data within the BIM. Where possible, this should be handled via a UCS rather than a WCS. Scan World Coordinate System should be maintained in the city or state coordinate frames. See File Structure and Organization standard for additional information.

Standard

One set of data must share an origin point with the project's BIM data. In cases where the project has inconsistent origin points across its BIMs, the largest of the BIMs is to be used to establish the origin point.



Revit model based on laser scan

Naming Standards

Clear and concise naming is required to ensure future use of 3D imaging data. For data which has a default, manufacturer naming will be rejected. The specifics of the naming convention are to be established as part of the BEP and must follow the standards outlined in the Naming Standard.

Maintaining Data Quality

Multnomah County has adopted the GSA National laser scanning quality procedures, as outlined in the 3D Laser Scanning Quality Management Program Guide [DOCX - 4 MB].

Note: Although this guide is geared toward Lidar based data, it is to be followed for all 3D imaging technologies used.

Standard

It is required that the creators of all 3D imaging project data will follow the QA/QC process outlined within the guide and that they will complete and deliver;

- Quality Management Program Checklists
- Laser Scanning Information Sheet
- Contractor - QA Project Plan Checklist
- Contractor - Data Acquisition Certification Report Checklist
- Contractor - Data Processing Certification Report Checklist

- Contractor – Field Quality Demonstration Report Checklist
- Contractor – Final Project Data Deliverable Report Checklist

Note: For complete information on required 3D imaging quality requirements, see the Data Submittal standards.

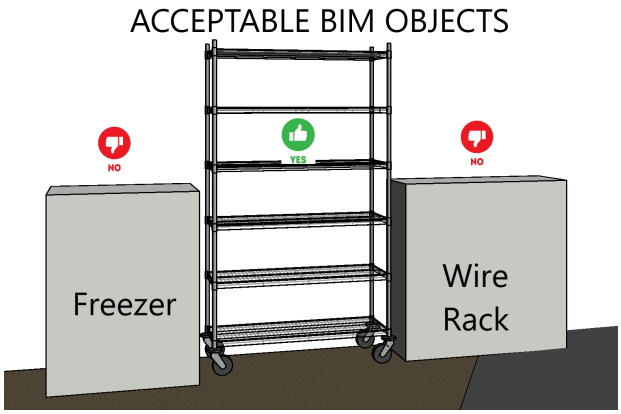
Revit Families

Family Naming

Multnomah County suggests naming families as follows. (MasterFormat Number-Make-Model#)
Examples (links to actual product for reference)
(22 41 16-Kohler-K-2660-1-0)
(10 56 13-Steelton-NSF Chrome 5-Shelf)
(23 81 40-Carrier-38AUQA12A0A6-0A0A0)

Family Creation

1. Use families created by product manufacturers, unless the manufacturer-provided object is overly detailed and slows down the model. (We are only interested in exterior modeling of objects. Interior components are not required or advised).
2. If families are not available from the manufacturer a generic family can be used if its visual representation is accurate in dimension, shape, and the object contains all Required Asset Parameters. Some of this information will need to be added toward the end of a project when the as-built information is input into the model.



3. **Families featuring ADA Clearance must contain an on/off type based checkbox parameter for the clearance lines.**

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Views

Base View Components

Base Views are simple stripped down “clean” views used to make maps and markups in the future. They should reside in their own plans section of the project browser.

Base Plan Views

1. Grids (Marks, Lines, Dimensions) **HIDE THESE ELEMENTS**
2. Enclosures (Columns, Walls, Partial Walls, Railings, Fences, Headers, Soffits)
3. Openings (Doors, Windows, Roof Hatches, Skylights)
4. Fixed Furniture (Benches, Lockers, Toilet Compartments); Fixed Fixtures (Casework, Bollards, Pallet Racks); Fixed Equipment (Garment Conveyors, Motorized Projection Screens, Waste Compactors)
5. Major Vertical Penetrations (Dumbwaiters, Elevators, Stairs, Shafts, Mechanical Chases)

Base Plans DO NOT include project-specific information, such as:

1. Title blocks (Base Plan Sheet Template included in Template package)
2. Schedules and diagram
3. Construction lines and guidelines
4. Objects in the file associated with demolition
5. General notes, keynotes, and symbol legends
6. Notes and annotations that give specific direction for construction
7. Detail, section, elevation, and reference tags associated with construction
8. Drawings other than floor plans (e.g. wall sections, door details, elevations)

Furniture Plan Views

1. All elements listed in Base Plan View Section
2. Workspace Enclosures (Cubicle Walls)
3. Work Surfaces (Desks, Tables)
4. Non-Fixed Storage (File Cabinets, Rolling Carts)
5. Seating/Accessory Furniture

Facility Management Model contains (if applicable)

Plan Views - For each Floor

1. “All View” - Floor Plan View with nothing hidden
2. Base Plan
3. Furniture Base Plan
4. Reflected Ceiling Base Plan

5. Custodial Plan - **By County Only**
6. Egress Plan - **By County Only**
7. Area Plans (Gross Building) - **By County Only**
8. Area Plans (Rentable) - **By County Only**
9. Electrical Base - Power
10. Electrical Base - Lighting
11. Plumbing Base
12. Mechanical Base - Wet
13. Mechanical Base - Dry
14. Fire Protection Base - Alarm
15. Fire Protection Base - Sprinkler
16. Security Base
17. Telecom Base

Plan Views - Site

1. Site Base
2. Pre Incident Utility Plan - **By County Only**
3. Snow Map - **By County Only**
4. Electrical Base - One Line

Schedules

1. Area Schedule (Gross Building) - **By County Only**
2. Area Schedule (Rentable) - **By County Only**
3. Custodial - **By County Only**
4. IBM.Floor (Levels) - **By County Only**
5. IBM.Space (Area Scheme Gross Building) - **By County Only**
6. IBM.Space (Area Scheme Rentable) - **By County Only**
7. IBM.Space (Rooms) - **By County Only**
8. Room Schedule
9. Door Schedule
10. Electrical Panel Schedule
11. Electrical Lighting Schedule
12. Mechanical Equipment Schedule

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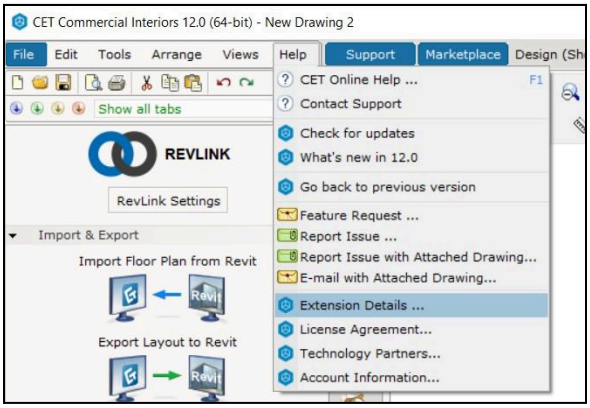
View Naming

Structure

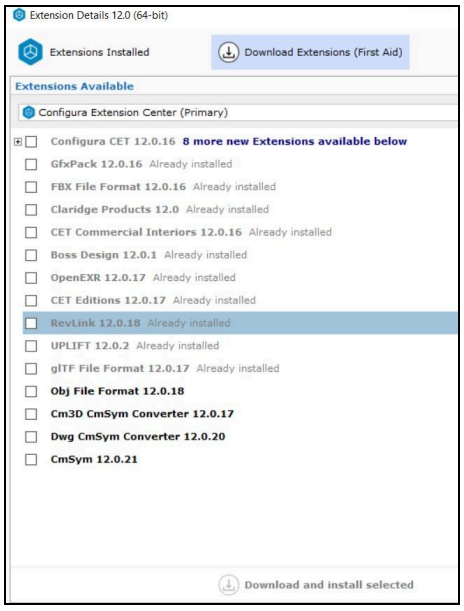
1. Views must follow the naming format (01 - First Floor - “Discipline”)
2. Additional view name information should be added following the Discipline (01 - First Floor - “Discipline” - Additional info)

CET Designer Instructions

1. Install RevLink addon in Revit (skip to Step 3 if already installed)

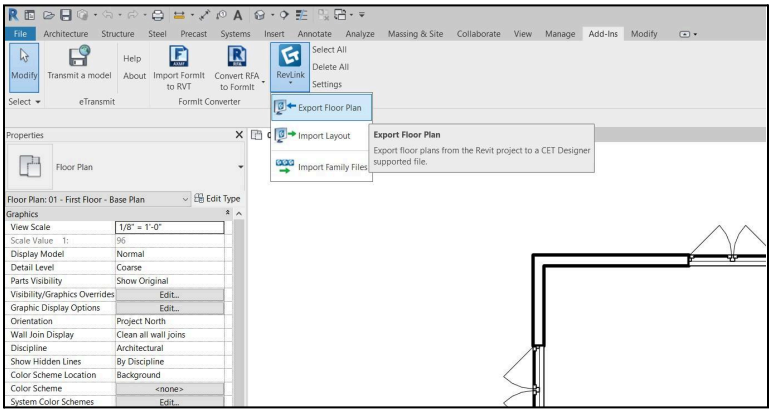


2. Install Revlink addon in CET



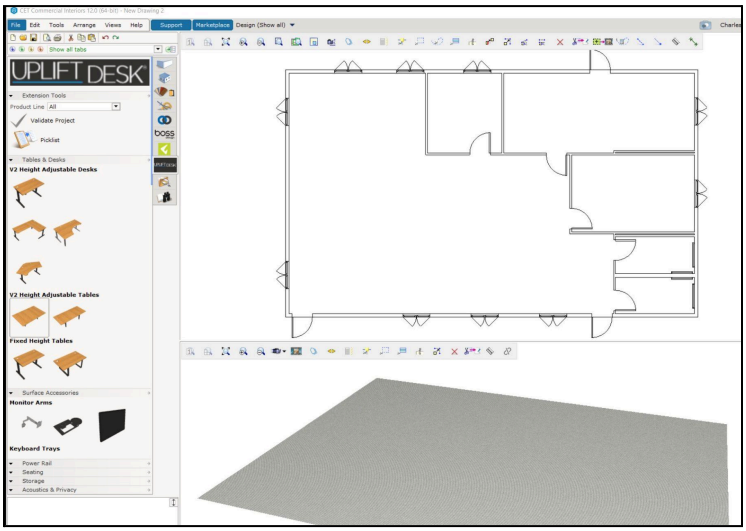
Check the Revlink box and click “Download and Install” at the bottom.

3. In Revit, Export Floor Plans with RevLink Addin

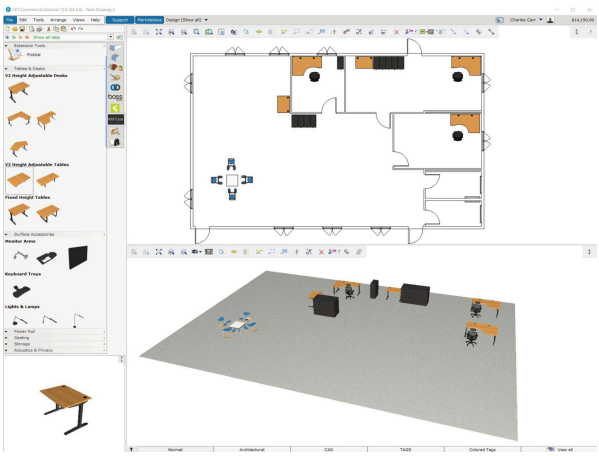


4. In CET Import the file you Exported in Revit

5. You should see something similar to this (you will not see walls in 3D)

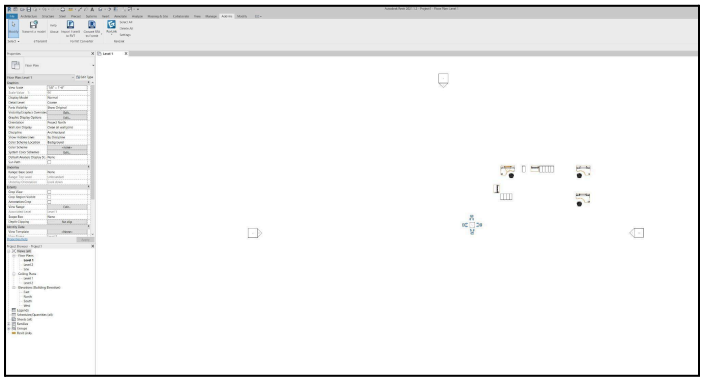


6. Add Furniture (Should look something like this)



7. Export Layout in CET RevLink

8. In Revit, Import the file you just Exported using RevLink (you will only see the furniture which is correct)



9. Save as .rvt file
10. Name the file (Building number - IF - Floor number) (ie. 297-IF-01)
11. Send RVT file to BDMC

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Model Progression Matrix

The Model Progression Matrix (MPM) is intended to define the team members' roles and responsibilities on BIM-enabled projects. Depending on the size and scope of the project, a custom MPM may be defined. When no custom MPM exists, it is expected that the default table outlined below is followed.

Existing Conditions

When responsibility is assigned, it includes developing the model for both new and existing conditions unless otherwise noted in the project's BEP. This may include reusing and updating existing BIM data supplied by BDMC.

Key

- A - Architect
- M - Mechanical Engineer
- P - Plumbing Engineer
- E - Electrical Engineer
- S - Structural Engineer
- AE - Architect / Engineer Team
- GC - General Contractor and/or trade partners
- SM - Scan & Modeling Team
- Technology
- Fire Suppression
- Fire Alarm

In many cases one firm may have the responsibility of several disciplines. Assignment of disciplines (if in question) must be finalized as part of the BEP.

Element (ASTM Uniformat II Classification)						**Level of Detail (LOD) and Model Component Author (MCA)**							
						Design Concept		Design Development		Construction Documents		Construction / Fabrication	
						LOD	MCA	LOD	MCA	LOD	MCA	LOD	MCA
A	SUBSTRUCTURE	A10	Foundations	A1010	Standard Foundations	100	AE	200	AE	300	GC	400/500	GC
				A1020	Special Foundations	100	AE	100	AE	300	GC	400/500	GC
				A1030	Slab on Grade	100	AE	200	AE	300	GC	400/500	GC

		A20	Basement Construction	A2010	Basement Excavation	100	AE	200	AE	300	GC	300	GC
				A2020	Basement Walls	100	AE	200	AE	300	GC	400/500	GC
B	SHELL	B10	Superstructure	B1010	Floor Construction	100	AE	200	AE	300	AE	300	GC
				B1020	Roof Construction	100	AE	200	AE	300	AE	300	GC
		B20	Exterior Enclosure	B2010	Exterior Walls	100	AE	200	AE	300	GC	400/500	GC
				B2020	Exterior Windows	100	AE	200	AE	300	GC	400/500	GC
				B2030	Exterior Doors	100	AE	200	AE	300	GC	400/500	GC
		B30	Roofing	B3010	Roof Coverings	100	AE	200	AE	300	GC	300	GC
				B3020	Roof Openings	100	AE	200	AE	300	GC	300	GC
C	INTERIORS	C10	Interior Construction	C1010	Partitions	100	AE	200	AE	300	AE	400/500	GC
				C1020	Interior Doors	100	AE	200	AE	300	AE	400/500	GC
				C1030	Fittings	100	AE	100	AE	300	AE	400/500	GC
		C20	Stairs	C2010	Stair Construction	100	AE	200	AE	300	GC	400/500	GC
				C2020	Stair Finishes	100	AE	100	AE	100	GC	100	GC
		C30	Interior Finishes	C3010	Wall Finishes	100	AE	100	AE	100	AE	100	GC
				C3020	Floor Finishes	100	AE	100	AE	100	AE	100	GC
				C3030	Ceiling Finishes	100	AE	100	AE	100	AE	100	GC
D	SERVICES	D10	Conveying	D1010	Elevators & Lifts	100	AE	200	AE	300	AE	400/500	GC
				D1020	Escalators & Moving Walks	100	AE	200	AE	300	AE	400/500	GC
				D1030	Other Conveying Systems	100	AE	200	AE	300	AE	400/500	GC
		D20	Plumbing	D2010	Plumbing Fixtures	100	AE	100	AE	300	GC	400/500	GC
				D2020	Domestic Water Distribution	100	AE	100	AE	300	GC	400/500	GC
				D2030	Sanitary Waste	100	AE	100	AE	300	GC	400/500	GC

				D2040	Rain Water Drainage	100	AE	100	AE	300	GC	400/500	GC
				D2090	Other Plumbing Systems	100	AE	100	AE	300	GC	400/500	GC
		D30	HVAC	D3010	Energy Supply	100	AE	100	AE	300	GC	400/500	GC
				D3020	Heat Generating Systems	100	AE	200	AE	300	GC	400/500	GC
				D3030	Cooling Generating Systems	100	AE	200	AE	300	GC	400/500	GC
				D3040	Distribution Systems	100	AE	100	AE	300	GC	400/500	GC
				D3050	Terminal & Package Units	100	AE	100	AE	300	GC	400/500	GC
				D3060	Controls & Instrumentatio n	100	AE	100	AE	100	GC	100	GC
				D3070	Systems Testing & Balancing	100	AE	100	AE	100	GC	100	GC
				D3090	Other HVAC Systems & Equipment	100	AE	100	AE	300	GC	400/500	GC
		D40	Fire Protection	D4010	Sprinklers	100	AE	100	AE	300	GC	400/500	GC
				D4020	Standpipes	100	AE	100	AE	300	GC	400/500	GC
				D4030	Fire Protection Specialties	100	AE	100	AE	300	GC	400/500	GC
				D4090	Other Fire Protection Systems	100	AE	100	AE	300	GC	400/500	GC
		D50	Electrical	D5010	Electrical Service & Distribution	100	AE	100	AE	300	GC	400/500	GC
				D5020	Lighting and Branch Wiring	100	AE	100	AE	300	GC	400/500	GC
				D5030	Communicatio ns & Security	100	AE	100	AE	100	GC	100	GC
				D5090	Other Electrical Systems	100	AE	100	AE	100	GC	100	GC
E	EQUIPMENT & FURNISHINGS	E10	Equipment	E1010	Commercial Equipment	100	AE	100	AE	300	GC	400/500	GC

				E1020	Institutional Equipment	100	AE	100	AE	300	GC	400/500	GC
				E1030	Vehicular Equipment	100	AE	100	AE	300	GC	400/500	GC
				E1090	Other Equipment	100	AE	100	AE	300	GC	400/500	GC
		E20	Furnishings	E2010	Fixed Furnishings	100	AE	100	AE	300	AE	400/500	AE
				E2020	Movable Furnishings	100	AE	100	AE	100	AE	100	AE
F	SPECIAL CONSTR. & DEMO	F10	Special Construction	F1010	Special Structures	100	AE	200	AE	300	AE	400/500	AE
				F1020	Integrated Construction	100	AE	100	AE	300	AE	400/500	AE
				F1030	Special Construction Systems	100	AE	100	AE	300	AE	400/500	AE
				F1040	Special Facilities	100	AE	100	AE	300	AE	400/500	AE
				F1050	Special Controls & Instrumentatio n	100	AE	100	AE	100	AE	100	AE
		F20	Selective Bldg Demo	F2010	Building Elements Demolition	100	AE	200	AE	300	AE	400/500	GC
				F2020	Hazardous Components Abatement	100	AE	100	AE	100	AE	100	GC
G	BUILDING SITEWORK	G10	Site Preparation	G1010	Site Clearing	100	AE	100	AE	100	AE	100	GC
				G1020	Site Demolition & Relocations	100	AE	200	AE	300	AE	300	GC
				G1030	Site Earthwork	100	AE	200	AE	300	AE	300	GC
				G1040	Hazardous Waste Remediation	100	AE	100	AE	100	AE	100	GC
		G20	Site Improvements	G2010	Roadways	100	AE	200	AE	300	AE	300	GC
				G2020	Parking Lots	100	AE	100	AE	300	AE	300	GC
				G2030	Pedestrian Paving	100	AE	100	AE	300	AE	300	GC
				G2040	Site Development	100	AE	100	AE	300	AE	300	GC

				G2050	Landscaping	100	AE	100	AE	300	AE	300	GC
		G30	Site Civil/Mech Utilities	G3010	Water Supply & Distribution Systems	100	AE	100	AE	300	GC	400/500	GC
				G3020	Sanitary Sewer Systems	100	AE	100	AE	300	GC	400/500	GC
				G3030	Storm Sewer Systems	100	AE	100	AE	300	GC	400/500	GC
				G3040	Heating Distribution	100	AE	100	AE	300	GC	400/500	GC
				G3050	Cooling Distribution	100	AE	100	AE	300	GC	400/500	GC
				G3060	Fuel Distribution	100	AE	100	AE	300	GC	400/500	GC
				G3090	Other Civil/Mechanical Utilities	100	AE	100	AE	300	GC	400/500	GC
		G40	Site Electrical Utilities	G4010	Electrical Distribution	100	AE	100	AE	300	GC	400/500	GC
				G4020	Site Lighting	100	AE	100	AE	300	GC	400/500	GC
				G4030	Site Communications & Security	100	AE	100	AE	300	GC	400/500	GC
				G4090	Other Electrical Utilities	100	AE	100	AE	300	GC	400/500	GC
		G50	Other Site Construction	G5010	Service Tunnels	100	AE	100	AE	300	GC	400/500	GC
				G5090	Other Site Systems & Equipment	100	AE	100	AE	300	GC	400/500	GC

Data Submittal

First cost is only the beginning for BIM data. The expectation of Multnomah County is that data will live on past construction to support all phases of the building's life-cycle. To achieve the goals of Multnomah County's BIM initiative, BDMC implements rigorous standards for submitting BIM data.

Schedule

Unless otherwise specifically overridden within the project Scope of Work you are required to submit your BIM data to a BIM Champion on the completion of each of the five project milestones listed below. The BIM Champion will submit completed phases to BDMC for Technical Review.

All of the requirements for formal data submittals (with the exception of CD phase & Closeout phase) may be waived by BDMC if real-time access to all project BIM data is provided to BDMC. Please consult with `fpm.bdmc@multco.us` to initiate this exception.

1. Design Concept Phase - AE
2. Design Development (DD) Phase - AE
3. Construction Documents (CD) Phase - AE
4. Construction Delivery Phase - GC
5. Closeout Phase (As-Built and Record Drawings - GC / AE)

Standards

These standards apply to all data formally submitted to Multnomah County Facilities and Property Management Building Data Management Center.

General

- All submitted BIM data shall follow all Multco Revit Standards as documented in the Multnomah County Revit Standard at the time of contract signing.
- All submitted data must open without errors. This includes any missing links. BDMC will reject data submitted with unresolved links.
- The data submitted will meet the Level of Detail as defined within the Model Progression Matrix and will be in a condition for downstream uses as defined within the Approved Use Guide.
- All submitted BIM data shall be cleaned of extraneous "scrap" or "working space" layers, stories, abandoned designs, object creation and testing places, empty layers, and other content which is typically produced in BIM production.
- Any Revit data being submitted must be submitted with its corresponding Shared Parameters file.

- Any Revit data being submitted is to have it's Project Browser Organization set to the standard VIEWS
- No data submitted to BDMC is to have an expiration date.

External References

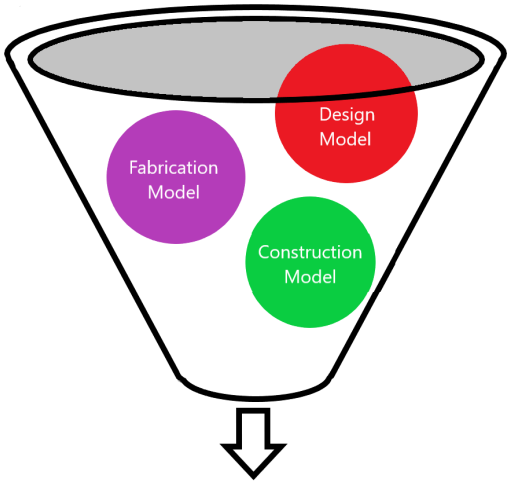
- Only data belonging to the submitter shall be submitted to the BIM Champion. The BIM Champion will confirm all files/Models are referenced correctly before submitting to BDMC for Technical Review or Closeout. For Example when a subcontractor submits a mechanical Model to the BIM Champion, the BIM Champion will confirm the correct Architectural, Structural Models etc are referenced.
- Care should be taken to reduce the hardware requirements for submitted data. To this end, only data which is of critical importance to the submitted BIM should be actively referenced to it. Any data that is not critical to the proper display or functioning of the BIM should be detached or unloaded (hidden) prior to the data being submitted. For example, point cloud data referenced into a Model should be hidden prior to that Model being submitted to Multnomah County.
- All submitted data must have the reference paths verified as being correct. It is BDMC's suggestion that Architectural and Structural Models be referenced as attachments and all other disciplines should be referenced as overlays.

3D Imaging Data (optional)

- 3D Imaging (point cloud) data is welcome to be delivered to the County at the conclusion of the project as supplemental information with closeout. This is not a contractual obligation unless otherwise noted. Delivered point cloud data must follow all standards outlined within the Multnomah County BIM Guidelines for Revit and must:
  - Be in both native authoring format and ASTM E57 format.
  - Be named according to the Naming Standards.
  - Contain one set of data ready to import into a BIM authoring platform.
  - Be separated into manageable areas as defined by the project's Area Map.
  - The import ready data-set must align to the BIMs project coordinates.
  - Include 100% of the collected data.
  - If photos were taken as part of the data collection, they must be included.
    - When available, free viewers for the native data are to be included as part of the deliverable.
    - Include a completed point cloud quality report.

Deliverables

Single Model Workflow



Single Multco LOD 500 Model

During a project, various reviews of deliverables are expected by Multnomah County. The largest of these staged deliverables will be the final data submittal which must meet all requirements of the County Revit Standard. These deliverables are not limited to BIM data. As part of the project's BEP development, teams should address the specifics of how deliverable objectives will be met.

Defining Deliverables

Many deliverables are required as part of the Multnomah County Revit Standards. It will require cooperation and planning by the entire team to ensure that the deliverable requirements are met on a timely basis. Should your team have any questions on exactly what is contained in a deliverable, they should seek guidance from BDMC as soon as possible to avoid data rework.

Standard 2D Deliverables

- Standard 2D documents that conform to the Multnomah County CAD Standards.

Typical Model LOD

- The overall LOD must be conveyed to Multnomah County. It is critical that Multnomah County understands the development level of your submitted Model. It is not expected that submittals prior to the final Record Set submittal have a single LOD. It is understood by Multnomah County that the Model will evolve at different rates. The expectation is only that you clearly define to Multnomah County what parts of your Model are developed to what LOD.

Project Model Package

- These are all files used in the authoring of the BIM Model, including not only the primary files, .RVT for example, but also all supporting files. This includes, but is not limited to:
  - Any supporting text files such as Revit Shared Parameters
  - Blocks or Families used on the project stored as individual
  - All referenced data; images, 2D drawings, etc.
- Exclusions to the Model are Digital Professional Stamps and Multnomah County Classified Data.

Facility Management Model

As part of the team's final deliverable to Multnomah County, a cleaned version of the Record Model is required. This Model is stripped of all project specific design and construction information and contains only the information required for the ongoing maintenance and future renovations of the building.

Coordination Model

- The Coordination Model is the Model used by the team during Integration Reviews. This is typically an Autodesk Navisworks file.
- The coordination Model is to contain all data assembled in a manner which can be easily understood. Naming is to be clear and adhere to the general naming guidelines outlined in the Multnomah County Revit Standards.
- If the coordination Model is an Autodesk Navisworks file, the individual source files are to be provided (NWF, NWC, NWD).

BIM Manual

- This is an evolving narrative that gives the reader a high level concept of the BIM Model. How it was developed, design history, participants, and other key information should be covered in the BIM Manual. Much of this information should be part of your project's BEP, Section H, in particular.

BIM Support Files

- These are all files used in the production of the BIM Model, including shared parameters, families, blocks, and other related files. Even files supplied to the team by Multnomah County, such as shared parameters, must be included.

Folder Structure

The final data submittal is to have all data organized into a folder structure as outlined in the File Structure and Organization Standard. The team is encouraged to use this folder structure during the project. Doing so will put the team in a good position for final delivery to Multnomah County.

Required Deliverables - Design Stage

Multnomah County BIM Standard has identified 3 phases to the Design Stage of a typical project: Design Concept Phase, Design Development Phase, and Construction Documents Phase. At the conclusion of each Design Stage phase, a formal delivery of BIM data to Multnomah County is required, and should coincide with technical reviews. As part of the BEP, the team will have planned out the specifics of the deliverables such as LOD based on the project's Model Progression Matrix. Note: If real-time data access has been provided to Multnomah County, the need for formal data submittal at this stage may be waived. Please contact fpm.bdmc@multco.us for a waiver from this deliverable.

Deliverable	Design Concept Phase - AE	Design Development (DD) Phase - AE	Construction Documents (CD) Phase - AE
Standard 2D Deliverables	X	X	X
Typical Model LOD	100 - 200	200 - 300	300
Project Model	X	X	X
Coordination Model	Optional	Optional	X
Quality Control Report	X	X	X
BIM Manual	X	X	X
BIM Support Files	X	X	X
Model in Standard Folder Structure	Optional 2	Optional 2	X

Note: Although optional, it is highly recommended that all project data be stored in the Multnomah County BIM Standard folder structure from the very beginning of the project.

Required Deliverables - Construction Stage

At least one time during the Construction Delivery phase of the project, an informal submittal of data to Multnomah County is to occur. The purpose of this submittal is to allow Multnomah County an opportunity to assist and advise on preparing the data for As-Built and Record Drawings. If the team

or specific members of the team are new to the Multnomah County requirements, it is suggested that several submittals and meetings take place during the construction phase to ensure a smooth closeout to the project.

Deliverable	**Construction Documents (CD) Phase - AE**	**Construction Delivery Phase - GC**	**Closeout Phase (As-Built and Record Drawings - GC / AE)**
Standard 2D Deliverables	X	X	X
Typical Model LOD	300	400-500	500
Project Model	X	X	X
Facility Management Model	-	Optional 1	X
Coordination Model	X	X	X
Quality Control Report	X	X	X
BIM Manual	X	X 2	X
BIM Support Files	X	X	X
Model in Standard Folder Structure	Optional 4	Optional 4	X

- It is highly recommended that teams which have not completed previous projects under the Multnomah County Revit Standards submit a copy of their Facility Management Model for review by BDMC.
- A nearly complete BIM Manual should be included in the Project Close-out Phase submittal for Multnomah County approval.
- Although optional, it is highly recommended that all project data be stored in the Multnomah County Standard folder structure from the very beginning of the project.

Final Model Delivery

The final delivery of the Record Set Model (Final Project Model) to Multnomah County will be a complete set of data for the project. It is to conform to the Multnomah County BIM Standard folder structure and all other Revit Standards. This data will be provided to Multnomah County on either a USB hard drive, USB flash drive, or secured FTP site (dropbox or similar). The data will be verified as working through the supplied media. All links will properly resolve.

Standard

- All links, references, and URLs will resolve correctly.
- Complete data set will conform to all Multnomah County Revit Standards.
- Data will be unencrypted unless required by Multnomah County data rules.
- No restriction will be placed on any of the supplied data. For example, coordination Models will not have an expiration date.

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Approved Use Matrix

The Approved Use Guide is intended to clearly define what the BIM should be capable of at various points in its development. For example, a LOD 200 BIM can be used to create time scaled, ordered appearance of major activities when used for 4D scheduling.

Authorized Uses

MODEL CONTENT	LOD 100	LOD 200	LOD 300	LOD 400	LOD 500
3D Model Based Coordination	Site level coordination	Major large object coordination	General object level coordination	Design certainty coordination	N/A
4D Scheduling	Total project construction duration Phasing of major elements	Time-scaled, ordered appearance of major activities	Time-scaled, ordered appearance of detailed assemblies	Fabrication and assembly detail including construction means and methods (cranes, man-lifts, shoring, etc.)	N/A
Cost Estimating	Conceptual cost allowance Example $/sf of floor area, $/hospital bed, $/parking stall, etc. Assumptions on future content	Estimated cost based on measurement of generic element (i.e. generic interior wall)	Estimated cost based on measurement of specific assembly (i.e. specific wall type)	Committed purchase price of specific assembly at buyout	Record costs
MODEL CONTENT	**LOD 100**	**LOD 200**	**LOD 300**	**LOD 400**	**LOD 500**
Program Compliance	Gross departmental areas	Specific room requirements	FF&E, casework, utility connections		
Sustainable Materials	LEED strategies	Approximate quantities of materials by LEED categories	Precise quantities of materials with percentages of recycled and/or locally purchased materials	Specific manufacturer selections	Purchase documentation
Analysis/Simulation	Strategy and performance criteria based on volumes and areas	Conceptual design based on geometry and assumed system types	Approximate simulation based on specific building assemblies and engineered systems	Precise simulation based on specific manufacturer and detailed system components	Commissioning and recording of measured performance

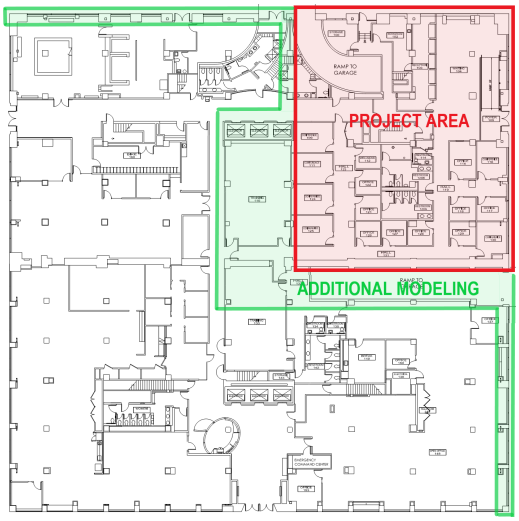
Facilities Management vs Project Models

One of the core concepts of Multnomah County's strategy is the concept of a Facility Management Model. Unlike the fractured workflows of the past where design and construction data were often contained in separate Models, Multnomah County requires a separate Model be delivered that contains only the completed building information. Duplication of data, especially at final submittal, will

not be accepted. Teams who do not plan for this may find themselves having to recreate large amounts of the project's data to merge the Models at the end of the project.

Facility Management Model

The Facility Management Model is the final product that Multnomah County will use to manage the facility through its lifecycle. This Model will be purged of all project specific views, sheets, schedules, legends,. Only information needed for continued maintenance and future work on the structure will be kept in the Facility Management Model.



- If you are creating a new building, you will be creating the initial Facility Management Model with your project.
- If Multnomah County has a Facility Management Model prior to the start of your project, it will be provided as a base Model.
- If Multnomah County does not have a Facility Management Model, and your project is a 50+% remodel you may be asked to Model the rest of the building to minimum standards (i.e. general layout). This will be identified in the BEP.
- If Multnomah County does not have a Facility Management Model, and your project contains less than 50% of the facility, BDMC will coordinate general modeling requirements on the BEP for areas surrounding your project. For example: If your project is to remodel ¼ of a building, we may ask you to Model the complete exterior walls, and immediate general layout of the building that connects to your project area. (See Example).
- **ALL MODELING OF COUNTY FACILITIES WILL BE DONE WITH THE** Facility Management Model in mind.

Record Model	Facility Management Model
The Project Model: ● Have all information specific to both the project and building. ● Contain all schedules, views, sheets, and details required for a complete design history of the project. ● Be cleaned of all "working" views and sections. ● In suitable condition for another design or construction firm to review the project as history for any new work. ● Contain a start-up page which will contain a basic project summary and information specific to the use of the Model.	The Facility Management Model will: ● Contain only information specific to the completed building. Project specific information will be removed. (Remove all Worksets) ● Have only views and sheets specific to the building's ongoing use and development.(Base,Furniture, etc) ● Contain only SDM schedules. All other schedules will be removed. ● Be cleaned of all phasing and temporary objects. ● Have one 3D view per discipline. These will be colored per the MEP Color Mapping standard. ● Have all "working" views and sections removed. ● A single floor plan view per floor, and per discipline.

Standard

- All demolished and temporary objects such as shoring, construction walls, and placeholder objects will be removed from the Facility Management Model.
- The Facility Management Model will be created as a duplicate of the project's primary Project BIM(s) and then have project specific information removed.
- Both the Project Model and a Facility Management Model will be supplied to Multnomah County.
- All worksets must be removed before submission to the county.
- Only views and sheets which support the ongoing use of the building will remain in the Facility Management Model. Project specific views, sheets, and schedules will be stripped from the Facility Management Model.
- All objects in the Facility Management Model will be set to the existing phase.
    - Exceptions may be granted when Multnomah County specifically directs a team otherwise. For example, Multnomah County may wish for a proposed addition to remain in the Model in a future phase.
- The Facility Management Model will not contain any legacy information such as demolished items.

- Working views, sheets, and schedules will be removed from the Model.
- The Facility Management Model will conform to all Multnomah County Revit Standards.
- SDM(Spatial Data Management) schedules will be in the Facility Management Model, all other schedules will be removed from the Model. (DO NOT ALTER OR REMOVE IBM PARAMETER FIELDS)
- A clean 3D view for each discipline will be included. This view should highlight the discipline specific objects and only show other disciplines as needed for context.
    - 3D views will conform to the MEP Color Mapping Standards.
- The following base views and schedule will be included in the Facility Management Model. These will, at a minimum, be per floor, and be cleaned of project specific annotation. These will include non-project specific information like room names and equipment tags. Those marked “Provided by Multco” will be created and managed by BDMC after project completion.
- If “Provided by Multco” views are contained in a FM model you receive at the start of a project, do not delete them. Multco will adjust them after your project.

Facility Management Model contains (if applicable)

Plan Views - For each Floor

1. “All View” - Floor Plan View with nothing hidden
2. Base Plan
3. Furniture Base Plan
4. Reflected Ceiling Base Plan
5. Custodial Plan - **By County Only**
6. Egress Plan - **By County Only**
7. Area Plans (Gross Building) - **By County Only**
8. Area Plans (Rentable) - **By County Only**
9. Electrical Base - Power
10. Electrical Base - Lighting
11. Plumbing Base
12. Mechanical Base - Wet
13. Mechanical Base - Dry
14. Fire Protection Base - Alarm
15. Fire Protection Base - Sprinkler
16. Security Base
17. Telecom Base

Plan Views - Site

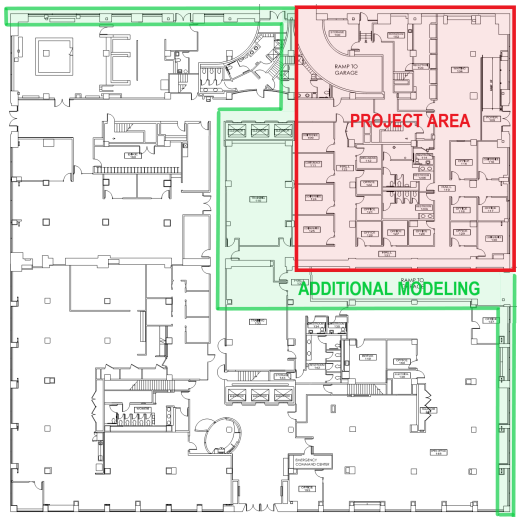
1. Site Base
2. Pre Incident Utility Plan - **By County Only**
3. Snow Map - **By County Only**
4. Electrical Base - One Line

Schedules

1. Area Schedule (Gross Building) - **By County Only**
2. Area Schedule (Rentable) - **By County Only**
3. Custodial - **By County Only**
4. IBM.Floor (Levels) - **By County Only**
5. IBM.Space (Area Scheme Gross Building) - **By County Only**
6. IBM.Space (Area Scheme Rentable) - **By County Only**
7. IBM.Space (Rooms) - **By County Only**
8. Room Schedule
9. Door Schedule
10. Electrical Panel Schedule
11. Electrical Lighting Schedule
12. Mechanical Equipment Schedule

Note: For more information contact fpm.bdmc@multco.us

Project Model



The Project Model is the final product that Multnomah County will use as a record of the changes that were made during the project. This does not negate the requirement for a full Record Set of documents, but the Record Set will be contained within, and derive from the Project Model. Project Models should start with a pre-existing Facility Management Model (if available). If no Facility Management Model is available, projects will be started with current CAD Base Plans obtained from the BDMC Database.

Note: A Project Model started with CAD Base Plans will still be asked to fulfill the additional modeling requests stated in the Facility Management Model section above.

Extra Modeling Expectations

When providing extra modeling

- Default level heights 10 ft if unknown
- Use Revit generic parametric families when possible
- Only Additional modeling areas should be modeled with generic aspects needed for space management (i.e. correct height, width, and placement, but no materials, compositions,etc).
- Additional modeling areas should be accurately measured to at least a 1” tolerance (address with BDMC in BEP if needed).

BIM Execution Plans

The intent of the BIM Execution Plan (BEP) is to define a foundational framework to ensure successful deployment of advanced design technologies on your BIM enabled project. The BEP is about optimizing work and model flow across the project, as contrasted with optimizing siloed interests. The key is good planning of the design-to-engineering-to-construction-to-owner handoff process to minimize downstream surprises, rework, redundancies or gaps in the flow of (model-based) information.

On smaller renovation projects with little engineering or build-side involvement, the standard BEP may adequately address the BIM workflow. On larger projects with multiple team members on both the design and build side, a BEP will be required of the AE and the GC to better synchronize the BIM workflow. No matter the size of the project, a copy of the BEP must be sent to fpm.bdmc@multco.us There are no exceptions to this requirement.

As a minimum requirement, the BEP outlined below must be completed and submitted to BDMC and each stakeholder's BIM Champion (or designee) within 30 days after the project kickoff meeting. The BEP is to be completed in a collaborative environment at the project's kick-off meeting. The data entry to, and distribution of, the project's BEP is the responsibility of the Project Architect unless another design-side team member is better qualified to coach the team on collaborative workflows. Additional planning information should also be included.

The A/E team shall schedule a follow-up BIM meeting to review BEP, process, and guidelines with all stakeholders, including BDMC.

If build-side partners are available on a timely basis, the A/E is strongly encouraged to discuss the design-side BEP before finalizing, as synchronizing the A/E and GC BEPs is pivotal to a more seamless transfer of BIMs.

Obtaining and Completing the BEP

The latest BEP can be downloaded from this site. The file is a Microsoft Word document and should be completed using a computer -- it should NOT be handwritten. The BEP should then be digitally signed by all project participants, and placed in a central location where all project participants will have easy access to the signed document. This will help ensure that all team members are able to clearly understand the process outlined in the BEP.

It is expected that every BIM-enabled project completes the basic BEP as outlined below. The team and not a single individual should fill out the questions. It is expected that there will be in-depth discussion into the specifics of some of the items. The BEP is laying the foundation for your entire BIM project and errors made in this early stage of planning will have major negative downstream implications.

Formatting Conventions of the BEP Document

There are several formatting conventions deployed through the BEP. These are intended to give the user visual cues on how to complete the document. All these styles are embedded within the Word document and should be used.

Text Style	Description
Main Body Text	10 pt, black text. The Main Body Text is text that is intended to be a part of every BEP. Although this text can be changed, most teams should not need to change it.
Instruction Text	10 pt, light gray. Instruction text is included to help guide the user in completing the BEP. The final BEP should have all instruction text removed.
Example Text	10pt, dark gray. Example text is included to give the users a reference for what their final BEP may look like. In some cases, this text may be applicable to the project. In those cases, the text format can be changed to Main Body Text.

Basic Information (Sections A - C)

Sections A, B, and C are typical sections for any form of BEP. These deal in the basic facts of the project such as project number, site and building address, major milestones, and project contacts. The BIM Project Execution Plan Overview (section A) should be extended, based on the specifics of the project. It should be written on a very macro level similar to an executive summary. If a reader were to only read sections A, they should gain a basic understanding of how the project was implementing BIM techniques.

Section B covers the basic information needed for the project. Care should be taken to only list information pertinent to the overall project in this section. For example, individual partner companies should not list their internal project numbers under the Project Numbers sections. This section is for numbers affecting the entire project.

Use Section C to list all project contacts. Keep in mind the goal of BIM is to flatten the traditional project organization such that a modeler from the mechanical sub-partner can directly contact the architectural modeler to resolve model conflicts. Listing only managers in Section C would not enable this communication.

Section D

Before an objective can be achieved the whole team must first understand it. Section D seeks to establish these objectives for the project. A major BIM goal or objective is one not required by the project's contracts, but rather a goal the team has decided will benefit the project. Use section D-1 to

clearly define the goal. Since a goal without measure is not a useful tool, you will also define the metrics that will be used in measuring the success of the goal.

For goals to be achieved on a project, all team members must understand the expectations. Use Subsection 2 to define these expectations. To what level will the cost estimating model data be taken -- 100, 200, 300? If it is not clear, confusion will arise and data may be misused. Using the cost estimating example, what would be the effects if the Project Estimator assumed that the data was in LOD 300 when in actuality the data was LOD 200?

Section E

At the heart of BIM is collaboration and Section E works to define its implementation on your project. Begin by defining the overall strategy for collaboration on the team (Subsection 1). Layout what meetings will be scheduled to facilitate team communication (Subsection 2), and agree to how and when model data will be exchanged (Subsection 3). Refer to the tutorial on Integration Reviews for more information on how to have successful review meetings.

Subsection 4 deals with interactive workspaces. These so-called "big-rooms" have been successfully deployed on many BIM projects to large success. Teams should consider the practicality of co-located workrooms for their projects. Co-located workspaces allow the entire team to work on their models in a single space. On co-located projects, the modelers and designers will bring their computer to the co-located site and work collaboratively as a group. Often, project size will dictate co-location opportunities.

Electronic communications are addressed in subsection 5. Within this section document not only file and model sharing but also any other technology based communications. For example, will the team be using Google Meet or Zoom? Define what will be required by the team such that software may be installed and configured.

A common issue on BIM based projects is a lack of knowledge on both the process and tools used for BIM execution. The team should never assume that any member has the knowledge to properly execute the project's BIM goals. The team should have an open and honest discussion on training and education that extends far beyond how to use any one software package. There should be further analysis on whether team members understand the process. Define what training is required in Subsection 6.

Identify tools and techniques that will be used to encourage team collaboration and BIM sharing including how Integration Sessions will be used to coordinate, share, and update model data. Within Subsection 7 the team should agree to model integration methodology: set-up, objectives, facilitation, stakeholder, roles, frequency, location, resolution. See the tutorial on Integration Reviews for additional guidance.

Section F

Quality control is critical to Multnomah County. Within Subsection 1 clearly define how the team will implement a quality control procedure to ensure the highest quality of both building and data for Multnomah County. Use Subsection 2 to ensure the team knows exactly what is going to be checked.

Technology and Standards (Sections G - I)

The majority of Sections G, H, and I are covered in much greater detail in the Multnomah County Revit Standards than within the BEP. These sections of the BEP should serve as a reminder to the team to consult the full BIM standards and define any standards which exceed the scope of the Multnomah County Revit Standards. Completing these sections may also require the inclusion of IT personnel from the project stakeholders.

Section J

Since no BEP template can accommodate all project's requirements, Section J is for adding any additional information the team feels would benefit the project. Several suggested documents are listed and the team is highly encouraged to add additional documents as needed.

Integration Reviews

Integration sessions are recurring, typically weekly, which enable team oriented (model) reviews to minimize surprises, validate scope, improve schedule and reduce costs. Frequently enhanced with interactive SmartBoard technology in a “big-room” environment, these sessions facilitate the architectural/engineering integration and design-to-construction transition - in contrast to a “throw it over-the-wall” hand-off with the waste (and frustration) that can accompany such silo-based approaches. The objective is to optimize the flow and efficiency of the project – not the silos.

The results of these reviews serve to prioritize issue resolution, minimize RFI’s and reduce change orders from field coordination. These collaborative reviews bring increased transparency in decision making, based on the teams’ “real-time” review of the right information at the right time, and the same image at the same time – in contrast to individual interpretations of what a 2D drawing represents and the dilemma of belated mark-ups. Integration sessions should not be an add-on activity – they should be synchronized to the project schedule and deliverables, as defined in the team-developed BIM Execution Plan.

Outlined below are the preparations required to conduct productive integration sessions.

Selecting the Facilitator

Designate someone from the project team to serve as the project Facilitator for the recurring sessions. The Facilitator's primary role is to lead and coordinate the integration meetings. The Facilitator should be an individual who has both experience with project management and a deep technical understanding of the tools and techniques which will be used on the project.

While the Project Manager may be the obvious choice as Facilitator, projects that are engineering intensive or primarily build oriented may warrant other selections. Select your Facilitator with prior successful experience to avoid false starts.

Minimum Responsibilities of the Facilitator

- Define BIM enabled workflows appropriate to the project’s supply chain:
  - Specifics of how the Multnomah County Revit Standards will be implemented on the project
  - Subject key subsystems to recurring model integration sessions
  - Encourage coordinated solutions that will facilitate potential for off-site fabrication preassembly and timely (if not Just-In-Time) delivery and/or installation
  - Encourage use of models to improve design and/or construction sequencing (4D)
  - Drawings generated from coordinated model files
- Set-up/maintain the team contact list, meeting information, and issues log
- Set-up protocols for recurring BIM integration sessions for collaborative reviews:
  - Pre-Session
    - Discuss model status with the Integrator project.
    - Ensure that all team members have the required meeting information and understand their expected level of involvement at the meeting.

    - Integration Session
        - Facilitate the meeting, holding the focus of the group and sidelining topics that should be discussed offline
        - Capture issues for distribution to team
        - Track clash curve and other metrics as defined in the project's BEP
        - Encourage team to improve the integration/workflow process
        - Synchronize model review sessions with master project schedule
    - Post-Session
        - Distribute minutes, issues list, and metrics to the team
        - As needed, facilitate any topics sidelined from the primary meeting
        - Ensure that each team member clearly understands the expectations of them for the next meeting

Selecting the Integrator

Designate someone from the project team to serve as the project Integrator for the recurring sessions. While flying through the master model for visual review is part of the process, effective integration requires a consistent strategy to identify, assess, prioritize, and resolve detected issues. The team should track avoided items as part of in-progress metrics to gauge success.

While the Project Architect may be the obvious choice as integrator, projects that are engineering intensive or primarily build oriented may warrant other selections. Select your integrator with prior successful experience to avoid false starts.

Minimum Responsibilities of the Integrator

- Setup the defined BIM enabled workflows:
    - Oversee the implementation the Multnomah County Revit Standards on the project
    - Ensure the team adhere to Multnomah County Spatial Data Management (SDM) Standards
    - Subject key subsystems to recurring model integration sessions
    - Give technical guidance on coordinated solutions that will facilitate potential for off-site fabrication preassembly and timely (if not Just-In-Time) delivery and/or installation
    - Give technical guidance on the use of models to improve design and/or construction sequencing (4D)
    - Verify that drawings are generated from coordinated model files
- Set-up/maintain the model sharing approach
- Set-up protocols for recurring BIM integration sessions for collaborative reviews:
    - Pre-Session
    - Review models for readiness for integration
    - Work with individual team members to correct mistakes prior to the meeting
    - Conduct preliminary clash detection for prioritization
    - Assemble composite models for team clash detection, coordination
    - Discuss the status of the model with the project Facilitator

- Integration Session
- Conduct live session to identify/resolve prioritized clash/coordination issues (Google Meet, Zoom, or Other enabled for remote participation)
- Save views which coordinate with the issues list being kept by the Facilitator
- Encourage team to improve the integration/workflow process
- Synchronize model review sessions with master project schedule
- Post-Session
- Verify that the team is adhering to the Multnomah County Revit Standards. Inform each team member individually if they are out of compliance
- Distribute clash resolution assignments
- Archive all integration session's clash results
- Distribute NavisWorks (or equal) models to the team with embedded issue/saved views containing resolution commitments

Design vs. Construction Meetings

On Design-Bid-Build projects, a major shift occurs once the general contractor is selected and comes on board. This shift is particularly apparent in the Integration Meetings. The team should plan for (and expect the focus of the Integration Meetings to shift from) a focus on design to a focus on construction. During this transition, it is not uncommon for the Design team's role to diminish, however, it is critical to the project that the design team stay engaged. At a minimum, the Lead Architect or representative should attend every Integration Meeting.

In preparation for the transition to more construction focused meetings, the team should attempt to resolve as many design issues as possible. The goal should be for the design team to have an LOD 300 model ready once the construction team comes onboard. The design team must stay engaged throughout the remainder of the project but may consider transferring ownership of the coordination model and the roles of Integration and meeting Facilitator to members of the construction team.

Typical Design Level Meeting

A typical design level integration meeting may see the following people attend the meeting.

Every Design Meeting

- Project Architect
- Lead Architectural Designer
- Lead Interiors Designer
- Architectural Modeler
- Lead Mechanical Design Engineer
- Mechanical Design Modeler
- Lead Electrical Design Engineer
- Electrical Design Modeler
- BDMC BIM Champion

- Multnomah County Project Manager

Some of the Design Meetings

- Future occupants of the space.
- Multnomah County Trades Leads or Managers
- Suppliers of proposed building materials.
- Code compliance staff, like building inspectors.
- Various domain specialists, like security consultants.

Typical Construction Level Meeting

A typical construction level integration meeting may see the following people attend the meeting.

Every Construction Meeting

- Project Architect or Lead Architectural Designer
- GC Project Manager
- Construction Scheduler
- Construction Manager
- Lead Mechanical Fabricator
- Lead Electrical Fabricator
- Multnomah County Project Manager
- BDMC BIM Champion

Some of the Construction Meetings

- Future building maintenance staff.
- Future occupants of the space.
- Lead Architectural Designer
- Lead Interiors Designer
- Lead Mechanical Design Engineer
- Lead Electrical Design Engineer
- Suppliers of proposed building materials.
- Code compliance staff, like building inspectors.
- Various domain specialists, like security consultants.

Early Build-Side Input

Early build-side input during the integration sessions is crucial to transition from design to construction stakeholders. (Sub)contractors may be expected to:

1. Actively participate in the weekly Integration Sessions per BEP - as early as possible to facilitate the design to construction transition.
2. Resolve identified issues on a timely basis.
3. Update models on a timely basis for scheduled Integration Session.
4. Develop models to the LOD specified in the BEP.
5. Attendees of the Integration Sessions must have:
   a. 3D modeling capabilities.
   b. Experience with trade specific means/methods and decision making authority.
   c. A good understanding of installation costs and labor rates to contribute to cost analysis and value engineering.

Note: The BIM Execution Plan should address which of the above, and/or other, BIM functions are required for the project. See BEP for additional details.

Who Should Attend

Integration reviews should involve the entire project team. Not all members will need to be present for all meetings. It is suggested that every meeting be set up as a web-based collaborative meeting, such as Google Meet, WebEx, Microsoft Teams, or Zoom.

	Design Concept Phase	**Design Development Phase**	**Construction Documents Phase**	**Construction Delivery Phase**	**Project Close-out Phase**	**FM Hand-off**
Multco Project Team	Every meeting	Every meeting	Every meeting	Every meeting	Every meeting	Every meeting
BDMC BIM Representative	Attend as needed	Attend as needed	Attend as needed	Attend as needed	Every meeting	Every meeting

Lead Architect or Architectural Project Manager	Every meeting	Every meeting	Every meeting	Every meeting	Every meeting	Every meeting
Lead Engineer(s) or Engineering Project Manager(s)	Attend as needed	Every meeting	Every meeting	Every meeting	Every meeting	Most meetings
Building stakeholders; tenets, facility managers, etc.	Attend as needed	Attend as needed	Attend as needed	Most meetings	Every meeting	Every meeting
Contractor or contractor input	Attend as needed	Attend as needed	Most meetings	Every meeting	Every meeting	Every meeting
Trade contractors	Attend as needed	Attend as needed	Most meetings	Every meeting	Every meeting	Attend as needed
Suppliers of proposed building elements	Attend as needed	Attend as needed	Attend as needed	Attend as needed	Attend as needed	Attend as needed

Important reviews

During the course of the project, there will be several key review points. These will be larger than normal meetings involving many extended attendees who do not normally attend. These meetings will be critical in establishing direction for the project.

FM engagement

Facility managers must be involved at several key points throughout the project:

- Between conceptual and schematic design, meet with the facility managers to establish what BIM attributes will be available at the completion of the project. The outcome of this meeting will be incorporated into the project's BEP.
- Several times during the schematic design and design development phases, have the facility managers attend the meeting to review the design progression and give feedback.
- During the construction documents and construction phase, the facility managers should be attending most meetings.
- FM Hand-off meetings require that facility managers attend.

Conducting the integration session

Setup

It is recommended that an online collaborative environment is used for modeling to allow real-time access to all stakeholders . It will allow each party to work on the issues on their own time and resolve them, if possible, prior to the session. After each party reviews and corrects the items, all comments and corrections should be communicated back to the facilitator. The facilitator then identifies the outstanding items that need to be discussed at the session and prepares the agenda accordingly for the session.

Minimum Meeting Setup

- Session scheduled as a recurring meeting with instructions in advance.
- Consistent space/location/time/duration.
- Online whiteboard with access for all attendees.
- Central location for all models to be posted to prior to the integration meeting.

Optimal Meeting Setup

- Session scheduled as a recurring meeting with instructions in advance.
- Consistent space/location/time/duration.
- Online whiteboard with access for all attendees.
- Clash log and issues list provided to all attendees prior to meeting.
- Connectivity to provide 24/7 access to stakeholder models (for referencing).

Pre-session

- Subsystem models posted several hours before the Integration Session.
- The facilitator is responsible for sending an agenda to all parties in advance before the session. The agenda should clearly indicate the issues for discussions, who the primary responsible party is, and duration of discussion for each item.

- Subsystem models comply with BEP requirements to remove extraneous work, comply with LOD and origin points to facilitate model integration.
- Model construction: Make sure that systems are constructed properly and they conform to the File Structure and Organization Standard. Verify that the correct objects are being used. (For example, ensure that roofs are roof objects and not elevated floor slabs.)
- Confirm that BEP specified file names, referencing, folder and browser structures are adhered to.
- Resolve minor discipline coordination/interferences. Each discipline/trade should have reviewed and cleaned their models of obvious interferences before posting.
- Address interferences flagged for resolution during the previous session.
- Ensure that applicable BIM standards are being adhered to including, for example: origin points in common, Sensitive But Unclassified data isolated, and required parameter data fields being filled correctly.

Integration Session

- Come prepared: review agenda in advance, have the right talent at the table.
- Participate – actively – to help the team address coordination issues.
- Stakeholders should provide consistent representation across the integration series to facilitate decision making. Specialized expertise can be added as required.
- Periodically revisit the project BEP: Update as required. (Resubmit to BDMC if updated)
- Review Spatial Data Management, coordination, and constructability issues in priority order. (Emphasis will depend on project phase and scope). Model may also be used to review circulation, ADA, code, operational, maintenance, or FM considerations. Timing and need should be addressed in BEP.
- Capture saved views (with annotations preferably) of new issues for distribution.
- Record unresolved items as rolling Issues List to be addressed at each session. Describe issue, date opened, date closed, responsible party and comments.
- If required for the project, distribute as a meeting report with the Issues List attached.
- Stay on track: if coordination issues cannot be addressed in 15 min - assign to break-out group.
- Stretch Objective: once a team agrees to coordination resolution – make model changes during the session if possible, then re-review to validate the solution and close the issue.
- Review attributes to confirm that, per the project BEP, data is being added as the model progresses.
- Suggest ways for the team to improve the integration process.
- Adjust this list, per BEP, to suit the project.

Post-Session

- Review saved views of prioritized coordination issues, identify priorities and responsible parties, and deadline for resolution (by default: in time for next session).

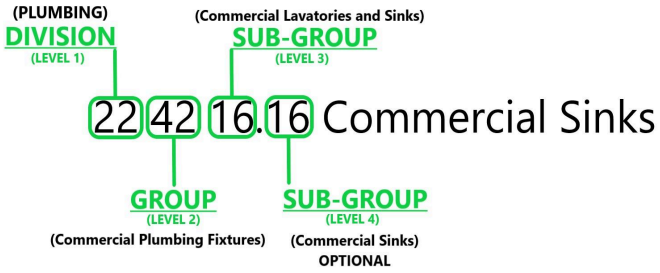
- Extended data: Ensure that all objects contain the attribute data as required by the Minimum Attribute Standard, and any additional fields added through the BEP. Verify that the attributes are being filled in as the project progresses.
- For items not resolved during the session, the facilitator is responsible for recording those issues in a log to ensure the resolution at the following session.

Warranty and O&M Manual Upload Procedure

PLEASE READ ENTIRELY BEFORE UPLOADING.

Please contact fpm.bdmc@multco.us for access to your buildings folder structure.
An asset information spreadsheet should be exported from your model before this process is started. The data entered during this process should then be uploaded back to the model. If you have questions about how to do this please contact fpm.bdmc@multco.us.

Multnomah County's folder structure for Warranty/Operation & Maintenance Manuals follows Construction Specification Institute's MasterFormat naming convention. Our preset folder structure divides down to Sub-Groups (Level 3). Stakeholders may add Level 4 Sub-Groups (two digits after decimal) following the naming convention provided in the accompanying file "CSI Masterformat List.pdf" at their discretion. Any questions or concerns should be directed to fpm.bdmc@multco.us



PROCESS

1. Request Access to Building Folders from fpm.bdmc@multco.us (Request for PM and GC).
2. Name the PDF to be uploaded as follows "Manufacturer - Model"
3. Identify the correct MasterFormat number for the PDF to be uploaded using the "CSI Masterformat List.pdf" inside the building folder.
4. Upload the PDF to the corresponding numbered folder in either the "Warranties" or "Operations & Maintenance Manuals" folder structure.
5. Right click on the newly uploaded google drive file and select "Get link".
6. Copy and paste the link in a corresponding spreadsheet (please be sure to provide the file name on the spreadsheet as well).
7. Include Spreadsheet of links in Project Closeout Documentation.

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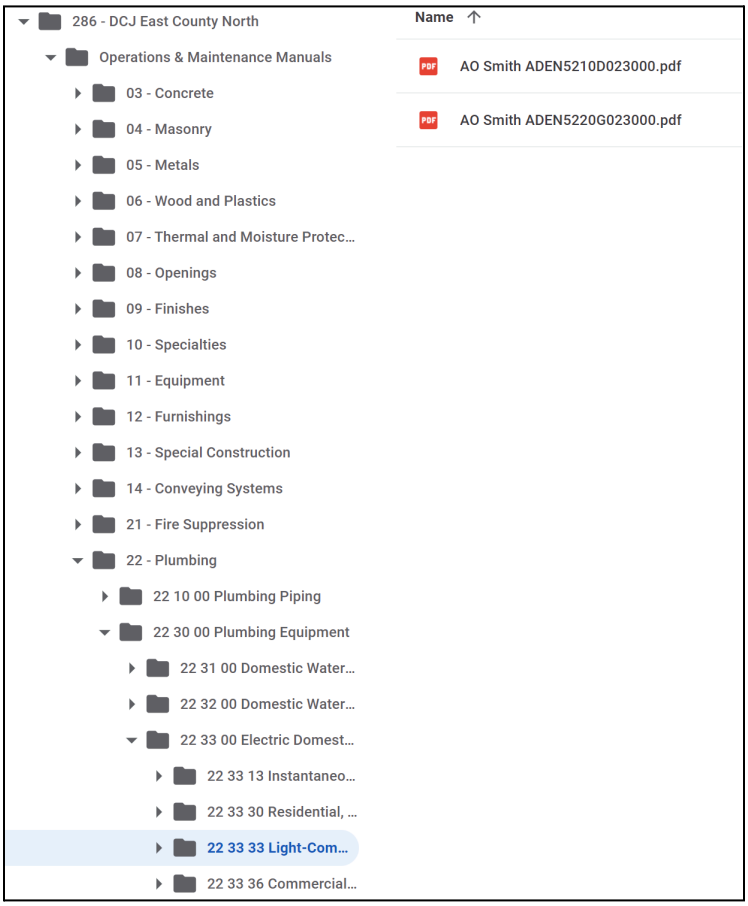
EXAMPLES

File Structure: O&M manuals for 2 slightly different water heaters installed in the same building.



Drafting Standards

Drafting Guidelines

1. Include building grids, overall dimensions, room name, and room number in each plan and section view. For elevations include building grid and overall dimensions.
2. Standardize View Scale for full plans, partial plans (e.g. restrooms), interior and exterior elevations, and wall and building sections.
3. Standardize, where possible, the view size of each drawing type (e.g. plans, elevations, and sections).
4. On Project Drawings, clearly differentiate between existing and new features in the drawing (and between background and foreground elements). Use halftone and screening to achieve this clarity.
5. Produce clean models free of non-functionary information.

Sheet Format Requirements

1. Use Sheet Size ARCH D (24” x 36”). Contact BDMC Technical Review Unit at fpm.bdmc@multco.us for an exemption of this requirement.
2. Use Font Style Arial and Uppercase
3. Use Font Size 3/32” at ⅛” = 1’ scale
4. Project Sheet Contents
5. Project Team
6. Project Sheet Index
7. General Notes
8. Project Description
9. Project Location
10. Vicinity Map
11. Key Plan
12. Format Discipline Sheet Contents
13. Discipline Sheet Index
14. General [Discipline] Notes
15. Abbreviations
16. Graphic Legend
17. Include General Notes
18. Express scale both numerically and graphically for all drawings.
19. Place the North Arrow at the lower right of the drawing. Use the Title Mark and North Arrow tags provided in the Multnomah County BIM Template. Plan “N” always points to the top of the drawings. The thick line should be rotated within the family to True North.

20. Orient the view to maximize the size of the floor plan.
21. Cover Sheet is optional.

Title Block Requirements

1. Use the Title Block in the template which includes the Title Block Attributes already placed.
2. Place the AE Service Provider Identification. (Insert in Template)
3. Populate Project Number and other corresponding information to Title Block.

   Note: The County Project Manager will provide the County Building Number and Project Number (E.g. 614 – CP14.01.01)

   a. County Project Number
   b. Date
   c. Drawn By/Checked By/Approved By
   d. County Building Number – Project Number
   e. Populate the Sheet Title Block with the Discipline, Sheet Type, and Specific Contents for the Sheet.
   f. Populate the Sheet Identification with the Date of Drawing, Sheet Number, Discipline Designator

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Sheet Naming

1. Sheets are grouped by discipline.
2. Use the Multco Sheet Naming Tool to generate compliant sheet numbers.

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Sheet Content

1. Populate Room Names (Reference the Naming Convention chart below.)
2. Drawing Numbering format is from top-down, right to left. The lowest numbers appear first as the sheet is opened.
3. Place a Hazardous Materials stamp in the lower right-hand corner on all demolition drawings.
4. Record Drawings are Construction Documents revised to show significant changes made during the construction process, usually based on the marked-up prints, drawings, and another date furnished by the contractor to the architect. (NO REDLINES)
5. Populate the Sheet Content appropriately for the Sheet Type.
6. Each Floor requires its own individual sheet.
7. Floor Levels, Room Numbers, and Door Numbers should be correctly assigned.
8. A Key Plan is required for all partial floor plans. For entire floor plans identify the work area.

Naming Convention

1. Multnomah County standardizes names for functional locations and equipment in County-owned and leased space as described below.
2. Multnomah County assigns a name for each room (e.g. Conference). Label each room according to its primary function. The table below lists “Room Name” labels to be indicated on drawings and specifications.

Room Naming

APPROVED ROOM NAME	ROOM DESCRIPTION
ACCESS	Space to access or service building systems.
ACTIVITY	Room designed for programmed and extracurricular activities. [See WELLNESS]
AISLE	Office area exceeding OFFICE requirements.
ALCOVE	A recess, typically in the wall of a room or hall.
ARCADE	Exterior covered passageway between buildings or entry to a building.
ATM	Separate space for an automatic teller machine.
ATRIUM	A many storied court in a building usually with a skylight.
ATTIC	Unused, accessible space above occupied room or area.
AUDITORIUM	Large meeting space with fixed podium, or raised stage.
BEDROOM	Room with 1 -2 beds. [See DORM]
BED BUG REMEDIATION	Room with specially designed equipment to raise the temperature to kill the bed bugs.
BIKE	Bike storage.
BIOMEDICAL WASTE	Room containing infectious (or potentially infectious) materials waste.
BOILER	Room for boiler equipment.
BREAK	Separate room with tables, chairs, appliances or vending machines for employee use.
CATTERY	Cat boarding or breeding facility.
CELL	Single, group or special purpose detention room.
CHAPLAIN	Room assigned to house a chaplain or related activities.
CHILLER	Room for chiller equipment.
CITY OF PORTLAND	City of Portland.
CLINIC	An establishment or hospital department where outpatients are given medical treatment or advice, especially of a specialist nature.
CLOSED STACKS	Contains books and other items that are not available for viewing or browsing by the general public.
COMMAND	Space to supervise and direct inmates.
COMMONS	Primary flexible space for resident activities, and socializing. May include non-dedicated dining (Primarily for Shelters)
COMPRESSOR	Room dedicated to compressor equipment.
CONFERENCE	6 person or more meeting area.
CONTROL	Room with multiple control systems (e.g. DDC and Fire Control Panel).
COOLER	Room to store refrigerated food storage or material (e.g. evidence).
COPY	Room for copiers only with associated supplies or copier/mail arrangements [See MAIL].
COURTROOM	Court space including bench, jury box, tables, and public area.
COURTYARD	Open uncovered space unobstructed to the sky, bounded on three or more sides.
CRY ROOM	A support room where parents may sit with their infants.
CUSTODIAL	Room for custodial service or custodial supply storage.

DATA CENTER	A data center, also called a server farm, is a facility used to house computer systems and associated components, such as telecommunications and storage systems.
DAY CARE	Room to oversee child care.
DAY ROOM	Common area for detainees to mingle outside of individual cells.
DINING	Separate eating area associated with cafeteria or kitchen.
DISPATCH	Room for organizing and conveying the delivery goods or services. (E.g. FPM Dispatch, Help Desk)
DOCK	Specialty space designed to load and unload material.
DORM	Three or more beds in a single room [See BEDROOM].
DRESS	Room for disrobing and gowning.
DROP	Specialty space designed for collecting and sorting deposits (E.g. ballots, books).
ELECTRICAL	Room for gear, panels, and other electrical equipment.
ELEVATOR	Room for elevator only.
ELEVATOR EQUIPMENT	Room for elevator related equipment only.
ELEVATOR LOBBY	A centrally located room at the entrance of an elevator or elevators that serves as a waiting area for elevator rides.
ELEVATOR PIT	That portion of an elevator shaft or hoistway extending below the level of the bottom landing saddle to provide for bottom over-travel and clearance, and for elevator parts that require space below the bottom limit of car travel.
EXAM	Space designed for dental or health examination.
EXERCISE	Space designed for fitness or wellness sessions, including gymnasiums.
FIRE CONTROL	Room for the fire alarm control panel.
FIRE PUMP	Room for the building master fire pump and main shut-off.
FIRING RANGE	A shooting range or firing range or archery range or pistol range or rifle range or shooting gallery or shooting ground is a specialized facility designed for archery or firearms practice.
FOYER	An entrance hall or other open area in a building used by the public. [Use HALL for a main or intermediate room for passage between rooms.]
FREEZER	Specialty space designed to store frozen material. (e.g. evidence)
FUEL STORAGE	Room housing main fuel tank for emergency generator. [See BOAT STORAGE, GENERATOR, STORAGE]
FUTURE ELEVATOR	Room for a future elevator.
GARAGE	Vehicle shelter (includes carport and indoor parking). [See BOAT STORAGE]
GENERATOR	Room for emergency generator and related equipment only.
GRAND JURY	Room assigned to Grand Jury proceedings.
GREASE TRAP	A grease trap is a plumbing device (a type of trap) designed to intercept most greases and solids before they enter a wastewater disposal system.
GUARD STATION	Occupied room designed to secure populations.
HALL	Main or intermediate passageway between rooms. [Use FOYER for a transitional space from the exterior to the interior of a building. Do not use Vestibule.]
HEARING	Specially-designed 10-20 person space for public appeal or informal proceedings.
HOISTWAY	Shaft for moving elevators or dumbwaiters (includes pit).
HUDDLE	Less than 6 person meeting area.
INTERVIEW	Specially-designed 3-4 person meeting space. (e.g. depositions, counsel)
JUDGE CHAMBER	Private and secure office area for judges.
JURY ROOM	Separate private and secure deliberation room used by Jury.
KENNEL	Shelter for animals.

KITCHEN	Room to prepare meals.
LAB	Specialty space designed for testing and analysis.
LACTATION	A private space where a nursing mother can use a breast pump.
LAUNDRY	Specialty space designed to wash and dry clothing or linens (includes garment conveyors).
LIBRARY	A depository built to contain books and other materials for reading and study.
LIVING	Separate space for congregation in a residential facility.
LOBBY	A centrally located room at the entrance of a building, office or elevator that serves as a gathering or waiting area.
LOCKER	Locker and storage area.
LOUNGE	A communal room for waiting or relaxing.
MAIL	Room for mail collection and distribution only. [See COPY]
MECHANICAL	Room for fans, pumps, and other HVAC equipment.
MEETING	A room in a building, such as an office building, is set aside for people to hold meetings.
MEN	Toilet area or space for urine sample collection for men only.
MULTIMEDIA	A room in which the equipment or media for mass communication (as telephone, fax, computer, etc.) is fitted.
MULTIPURPOSE	Large space usable or modifiable for more than one purpose.
NURSE STATION	Separate room for nurses and practitioners to collaborate in a semi-private atmosphere.
OBSERVATION	A separate room from which doctors can observe the patient without disturbing them.
OFFICE	Rooms less than 1,000 SF and less than 5 desks or workstations used for bureaucratic and clerical functions as opposed to specific programmed functions. (e.g. exam, shop, retail, storage, or judge chambers)
OPEN BELOW	Indicates an open area, such as an atrium space or major vertical penetration.
OPEN OFFICE	Office area exceeding OFFICE requirements.
OPEN STACKS	Having or being a system of library management in which patrons have direct access to stacks for browsing and selecting books.
PAINT SHOP	The part of a building where goods are painted, typically by spraying.
PARKING	A covered parking area in the building footprint.
PHARMACY	Specialty space designed for drug storage and dispensing.
PREP	A room for organization and preparation.
PUMPHOUSE	A building where pumps and other pumps have been installed.
QUIET	A room that provides a quiet space.
READING	Room designated for reading material or records (adjacent to RECORDS or RESOURCE).
RECEPTION	Separate room for employee-occupied built-desk or counter area (use HALL or LOBBY for public side).
RECORDS	Separate file storage area or secured file storage room.
RECYCLE	Separate material recycling storage area only. [Use WASTE for a separate room for waste containment and recycling.]
REFRIGERATOR	A storage area used to keep food or medical supplies cool.
RESCUE	Separate room used as an area of Rescue Assistance.
RESOURCE	Separate material and equipment resource storage and use area.
RESTROOM	Gender inclusive toilet area or space for urine sample collection.
RETAIL	Multiple areas, spaces or rooms (leased out space only, not contracted services).
SALLYPORT	A secured controlled entryway to an enclosure (commonly used for inmates)
SAUNA	Separate room for spa or sauna.

SECURITY CONTROL	Unoccupied room for security system building controls.
SERVERY	Room for Food Service.
SHAFT	Interior vertical penetration for air movement, piping or conduits.
SHELTER	A space to provide temporary housing for the city's homeless.
SHOP	Shared workspace for manufacture, repair, test, & maintenance.
SHOWER	Shower area.
SPRINKLER	Sprinkler main, riser, shut off, or emergency fire pump.
STAGE	Space within building utilized for entertainment and presentations.
STAIRS	Separate room for each floor-to-floor vertical stair run.
STORAGE	Space designed to store material (including coats) or equipment (room, shed, trailer). [See FUEL STORAGE, BOAT STORAGE]
TANK	Cell or enclosure used especially for receiving inmates.
TELECOM	Separate room for telephone, data, and network equipment.
TRAINING	Specially-equipped room (e.g. computer, presentation). Includes classroom.
TRASH	Separate room for waste containment, or waste containment and recycling. [Use RECYCLE for a separate room for recycling only.]
UNUSABLE	Unused, inaccessible space above or below occupied space.
UPS	Separate room for uninterruptible power supplies.
UTILITY	Separate space that houses more than one building support function. For example, custodial sink, telecom, fire pump and/or sprinkler valve.
VAULT	A room or compartment, often built of steel, to store valuables.
VEHICLE SALLYPORT	Specialty space designed for secure vehicle loading/unloading
VENDING	Vending machine area.
VESTIBULE	An antechamber, hall, or lobby next to a building's outer door. [Use HALL for a main or intermediate room for passage between rooms.]
VISITING	Specialty spaces designed for secure visitations.
WAITING	A room for people to wait.
WELLNESS	Room designed for programmed and extracurricular activities. See ACTIVITY.
WOMEN	Toilet area or space for urinal sample collection for women only.

Space Management

Floor, Room, And Door Numbering

Floor Level Numbering And Floor Level Prefix

Assign floor level numbers using this guideline. The floor level number also acts as a prefix for suite and room numbers. The only exceptions for using the floor level number as a prefix for suite and room numbering are for partial floor levels such as mezzanines (or sectors and common areas that are described later).

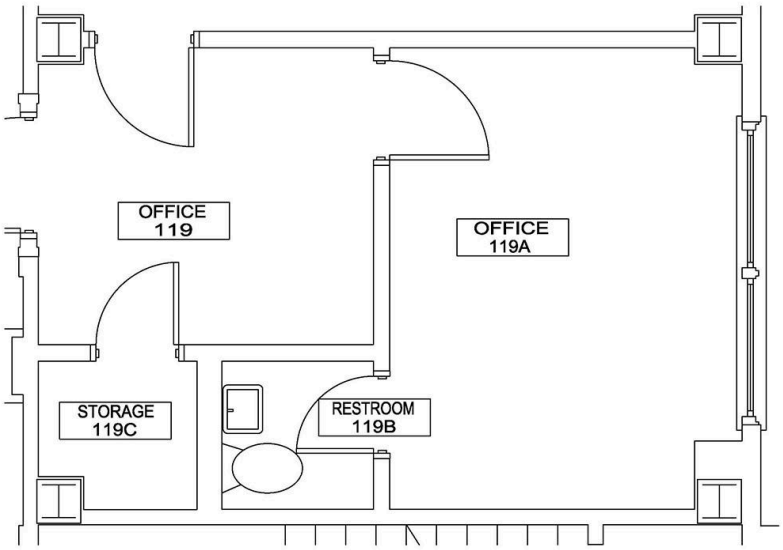
1. The First Floor (or Ground Level) shall be 01 for the highest floor level that directly accesses grade.
2. The Basement (or Grade Level) shall be 00 for the floor directly below the First Floor Level. Where the floor below the First Floor can be directly accessed from grade (as in a sloping site), it will be referred to as the Grade Level. Otherwise, it will be called Basement.
3. All floor multi levels below the First Floor shall be labeled alphabetically, with the floor level closest to the First Floor always being “0A (Lower Level 1), 0B (Lower Level 2), etc.”
4. All floor multi-levels above the First Floor shall be numbered sequentially. Starting with the Second Floor shall be 02, 03. 04…
5. Any Mechanical (or Penthouse Level) shall be numbered as the next number in sequence from the floor below. Do not use “M” or “P” as prefixes.
6. Any Roof Level shall be numbered as the next number in sequence from the floor below. Do not use “R” as a prefix.
7. Any Mezzanine Level shall be labeled with a preceding letter “M” followed by the number of the floor below, the Mezzanine shall be M1, M2, M3, …

Sector Approach

In linear buildings, it may be appropriate to divide a floor into multiple sectors. In linear buildings where the quadrant approach is ineffective, determine the minimum number of sectors desired to clearly delineate the space. The intent of the sectors is to divide the facility into discrete, recognizable building areas, such as wings or annexes. The sector model provides unlimited tenant assignable room numbers per floor. Begin room numbering in the NW corner of each sector and proceed to number rooms in a counterclockwise direction. The following is a sample of the sector approach:

1. Sector A: Rooms A100 through A199
2. Sector B: Rooms B100 through B199
3. Sector C: Rooms C100 through C199

Major Vertical Penetrations



Major Vertical Penetrations are stairwells, elevator shafts, flues, pipe shafts, vertical ducts, and enclosing walls. Atria and similar penetrations above the finished floor are included in this definition. Refer to the Standard Method for Measuring Floor Area in Office Buildings for specific examples. Identify major vertical penetrations with the following significant upper case Letters: “S” for Stairwells. “E” for Elevator shafts, and “X” for other MVP objects. Use a dash after the letter designator.

1. For a given floor, assign a unique room number sequence to each elevator hoistway and stairwell. (E.g. S-101, S-102, E-101, E-102, X-101, X-102…)
2. Where possible, assign the same Room-number to all major vertical penetrations that are duplicated from floor to floor (except for the floor level prefix).

Suites

A suite is defined as a group of rooms on any given floor, where those rooms are self-contained (i.e. accessible from one another without leaving the suite) and well defined (e.g. bounded by common and contiguous perimeter walls on all sides). Assign the suite number to the largest area common to the rooms in the suite. Assign the suite numbers with a number divisible by the integer 5 (e.g. Suite 110, Suite 305). Number the remaining rooms sequentially with the suite number plus a capital letter suffix (e.g. 350A, 350B, 350C…), following a clockwise route along the main corridor. Do not use the letters “I” or “O” as a capital letter prefix. Where there are more than 20 rooms in a suite, the Facilities & Property Management Division will customize a numbering scheme.

Examples of rooms that may have inner rooms are:

1. Office Suite
2. Courtrooms with foyers,
3. Restrooms with adjoining locker rooms and shower rooms,
4. Shops with storage rooms and workrooms, and
5. Detention dorms with living rooms and sleeping rooms.

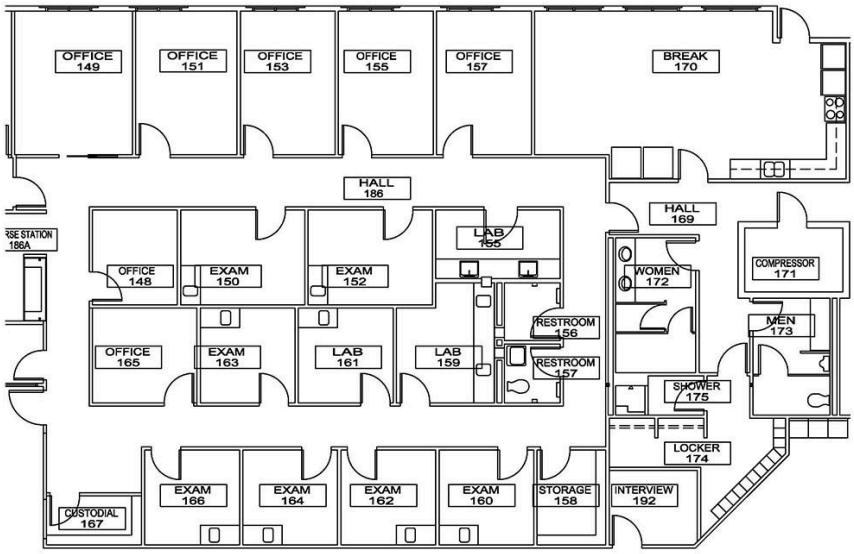
Rooms

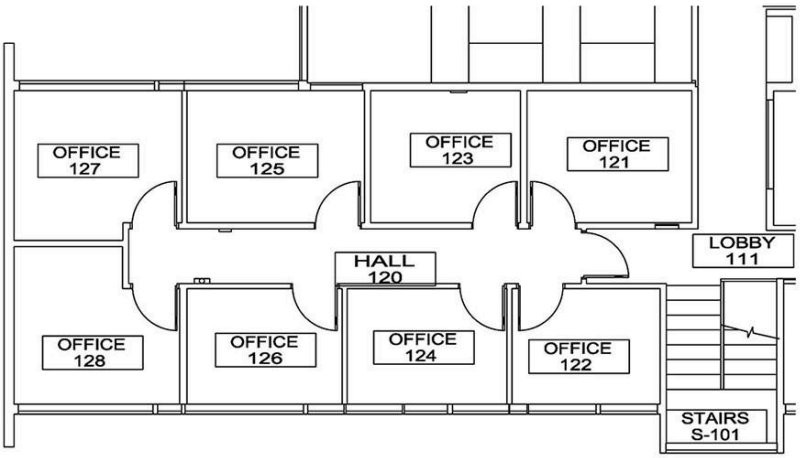
A room is defined as a single contiguous space bounded by walls, windows, doors, floor, and sometimes other building elements such as a ceiling or roof. A room must have an entryway that has or could have a door or access panel. The use of floor-to-ceiling casework, built-ins, or partitions may divide an area into two distinct rooms. Assign a room number to every room that has full-height door access, including closets and storerooms. – Reference Figure 7 – Rooms.

Assign room numbers in accordance with this guideline:

The first part of the room identifier should match the floor number. Room numbering consists of a floor number prefix and a 2 digit sequential set of numbers.

1. Evenly distribute room numbers on any given floor to allow possible subdivision into smaller rooms or groups of rooms.
2. Number rooms sequentially (e.g. 101, 102, 103...) following a clockwise route along the main corridors, beginning at the front entrance or lobby of a floor.
3. Note: Along double-loaded corridors, even numbers should be on the left side and odd numbers on the right. In some instances, it may be necessary to skip some room numbers to maintain succession with the room numbers on the opposite side of the corridor. When a corridor contains large rooms, such as training rooms or meeting rooms on both sides of the corridor, skip room numbers to allow for future renovation of a large space into smaller spaces. Reserve sufficient numbers to allow for large spaces to be divided into standard size office spaces. – Reference Figure 8 – Double Loaded Corridors.
4. Where practical, assign the same room number to all rooms that are duplicated from floor to floor (except for the floor level prefix). – Reference Figure 9 – Clockwise Room Numbering.





Door Numbering

Each door opening in a building must have a unique identifier. If a room has one door opening, the door opening number is the same as the secure side room number. If more than one door opening in a room exists, door openings within that room are identified by the room number followed by a hyphen then a lower case alpha character starting clockwise from the corridor access door opening.

Door Number: 101
Suite Door Number: 101A
Multiple Doors: 101-a, 101-b
Multiple Suite Doors: 101A-a, 101A-b

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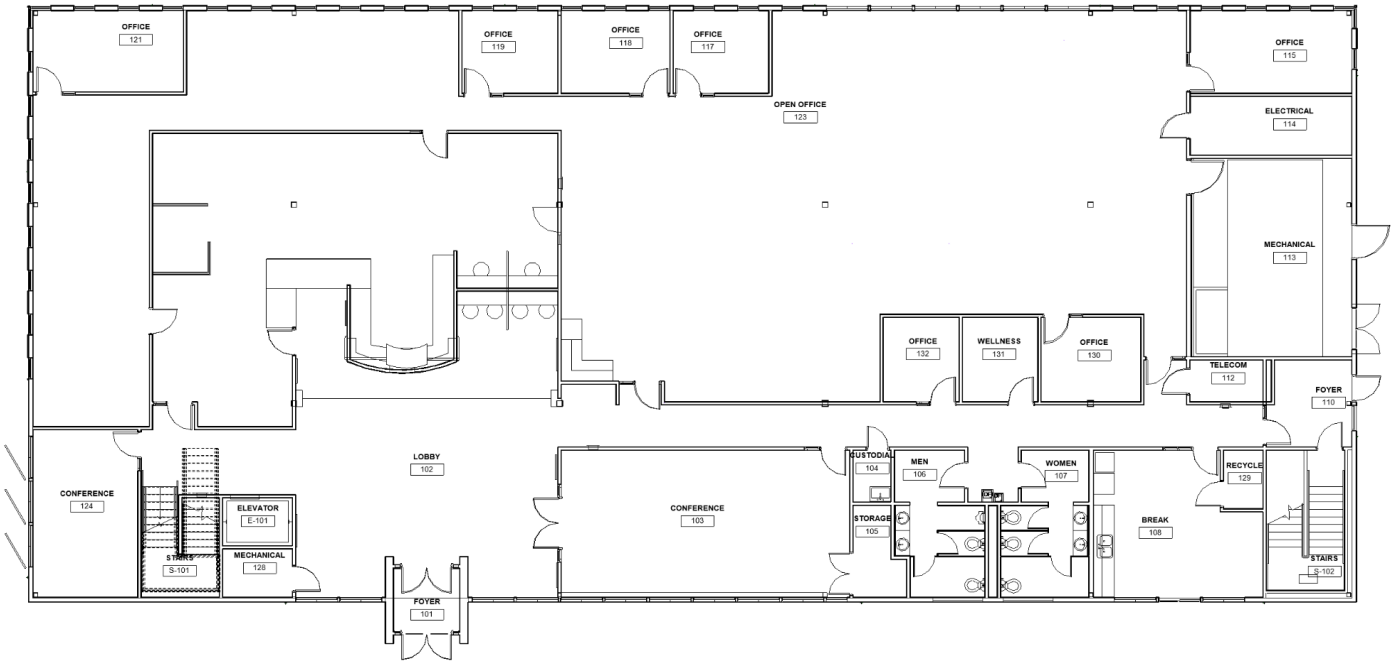
EXAMPLES

The following pages show examples of what minimum views and properties should look like. Shared parameters have been built into the Multco Revit Template.

Base Plan Example



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Sheet Example