UMass Chan Medical School

Office of Facilities

BIM STANDARDS

Design Technology Group

March 2026

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TABLE OF CONTENTS

Navigate to sections by clicking on the headings.

1. INTRODUCTION

1.1 PURPOSE OF THE STANDARDS

UMass Chan plans to implement a BIM Execution Plan (BIMxP) for most capital projects. Designers and contractors must submit Revit or Navisworks models at project closeout. While BIM standards evolve, basic standards ensure consistency. Refer to UMass Chan's latest BIM Standards.

UMass Chan regularly interacts with design team documents to monitor progress. This document outlines file requirements to ensure models are effective for UMass Chan's use. Design teams may create additional processes for coordination.

UMass Chan maintains a Revit model of the entire building. This document details how to use the existing conditions file and add new construction content. Firms must redraw details using UMass Chan lines and components if asked to use the UMass Chan template.

This document is a resource for Project Managers, Architects, Engineers, and Contractors on UMass Chan projects. These standards promote the development of models suitable for UMass Chan. Consistency and compatibility are achieved by adhering to these standards. Electronic drawings produced with these standards have greater value to UMass Chan's Office of Facilities.

All projects will be designed in Revit, with exceptions granted for certain projects. Additional documents can be requested through the Project Manager.

1.2 CONTACT INFORMATION

Group Name: UMass Chan Design Technology Group

- Email: DesignTechGroup@umassmed.edu

Group Name: Facilities Engineering and Construction Management

- Email: FECRequests@umassmed.edu

2. BIM OVERVIEW

2.1 WHAT IS BIM

Building information modeling (BIM) is the holistic process of creating and managing information for a built asset. Based on an intelligent model, BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations.

BIM is a digital representation of a building's physical and functional characteristics. It enables a collaborative process, allowing various stakeholders - such as architects, engineers, contractors, and facility managers - to work on a shared platform. Unlike traditional 2D drawings, BIM provides a three-dimensional (3D) virtual model that is enriched with detailed data and information.

2.2 BENEFITS OF BIM

Building Information Modeling (BIM) connects teams, workflows, and data across the entire project lifecycle to realize better ways of working and better outcomes.

Key Benefits of BIM in Construction

1. Enhanced Collaboration and Communication

One of BIM's greatest strengths is its ability to improve collaboration across project teams. The shared BIM model acts as a centralized data repository that enables real-time collaboration, helping stakeholders coordinate and resolve conflicts. This level of connectivity reduces errors, minimizes rework, and improves overall project efficiency.

2. Improved Project Documentation and Accuracy

The 3D nature of BIM offers a more comprehensive view of a building's design and functionality. By embedding detailed information about materials, quantities, and specifications within the model, BIM enables accurate cost estimation, material procurement, and scheduling. It also allows teams to simulate construction processes, identifying potential issues and optimizing workflows before construction begins.

3. Streamlined Project Lifecycle and Facility Management

BIM's impact doesn't stop at construction. From design through construction and into facility management, BIM provides valuable insights throughout a building's entire lifecycle. BIM integrates with software tools like energy analysis, facility management systems, and maintenance databases, ensuring smooth operations and reducing energy costs. This integration helps improve operational efficiency, reduce maintenance costs, and enhance occupant comfort.

3. BIM EXECUTION PLAN (BIMxP)

3.1 BIM EXECUTION PLAN TEMPLATE

All BIM projects must complete and execute the BIM Execution Plan throughout the life of the project. Please see UMass Chan Medical School BIM Execution plan.

3.2 ROLES AND RESPONSIBILITIES

Each party is responsible for contributing modeling content and must assign a BIM Lead to the project. The BIM Lead from each party has the following, but not limited, responsibilities:

- Transferring modeling content from one party to another at specified dates. This includes sharing models to consultants, contractors, and UMass Chan.
  - Autodesk Construction Cloud Management.
- Validating the level of detail and controls as defined for each project phase.
- Validating modeling content during each project phase.
- Participating in design review and model coordination sessions.
- Communicating any modeling issues to cross-company teams.
- Assuring UMass Chan standards are followed.
- Assuring model consistency. This includes, but not limited to, naming conventions, graphic conventions, view scales, etc..
- Managing file version control.
- Creating all important dated backups.
- Model maintenance

Document all project BIM Lead contacts in the project BIMxP.

4. DELIVERABLE REQUIREMENTS

Provide UMass Chan progress and final design and construction documents as outlined in this section. Follow the requirements as indicated in this document.

- ➔ Upload closeout to the appropriate folders in PMIS, and/or email to the address above.
- ➔ Complete and submit the Drawings Index (Appendix D) with all drawing sets.

4.1 SUBMISSION SCHEDULE

Designers and Contractors must submit documents to UMass Chan at the following project phases. Additional submissions may be required at UMass Chan's request. Document all submission requirements in the BIMxP.

- ➔ Progress Design Phase - **30% Schematic Design**
- ➔ Progress Design Phase - **60% Design Development**
- ➔ Progress Design Phase - **90% Design Development**
- ➔ Design Phase - **Construction Set**
    - o The model submitted with the conformed documents for construction (commonly identified as "Issued for Construction" documents) is the Construction Documents model, modified to include any addenda issued during the bidding or negotiation process, as well as accepted alternates. The model must be developed to Level of Development (LOD) 300.
- ➔ Post-Construction - **As-Built Drawings**
    - o As-Built Drawings: Definitions may vary by organization, but UMass Chan defines As-Built drawings as those prepared by the Contractor at the end of the project. These drawings reflect the actual work installed.
- ➔ Post-Construction - **Record Drawings**
    - o Record Drawings are prepared by the Architect and incorporate red-line changes noted by the Contractor in the As-Built drawings. They clearly document any changes made during construction from the original Construction Document (CD) set and are typically compiled as a set of on-site modifications made under the owner/architect contract. This is distributed to the owner as part of the closeout documentation.

4.2 SUBMISSION CONTENTS

Below are the minimum set of files required for construction projects. The files submitted for each deliverable must be documented in the BIMxP.

Progress Design Phases

- ➔ Revit file(s)
    - o Revit file for each discipline.

  - Follow UMass Chan's Revit version requirements. Click here for more information.
  - UMass Chan Revit standards are highly encouraged, but not required.
  - Follow UMass Chan Revit Model Submission Requirements.
- ➔ Navisworks file(s)
  - Navisworks file per discipline.
- ➔ Two clash detection reports. One at 60% CDs and another at 90%.

Design Phase – Construction Set

- ➔ Revit file(s)
  - Revit file for each discipline.
  - Follow UMass Chan's Revit version requirements. Click here for more information.
  - Follow UMass Chan Revit standards and submission criteria.
- ➔ All files linked into the Revit model. This includes the following files; keynotes, Shared Parameters, CAD formats, topography, images, PDF, and point cloud files. For any CAD files submitted, follow the UMass Chan CAD standards.
- ➔ Navisworks file(s)
  - A file per discipline.

Post-Construction Phases

- ➔ Revit file(s). Before performing the work, the contractor is required to model the building systems to ensure constructability. The contractor may use the architectural and structural model for their use.
  - Revit file for each discipline.
  - Follow UMass Chan's Revit version requirements. Click here for more information.
  - Follow UMass Chan Revit standards and submission criteria.
- ➔ All files linked into the Revit model. This includes the following files; keynotes, Shared Parameters, CAD formats, topography, images, PDF, and point cloud files. For any CAD files submitted, follow the UMass Chan CAD standards.
- ➔ Navisworks file(s)
  - A file per discipline.
- ➔ One clash detection report.

4.3 REVIT MODEL SUBMISSION REQUIREMENTS

Revit model cleanup must be completed for each submission. Content that is not part of the design shall be deleted from the model. This includes the following:

- Warnings shall be kept to a minimum. Warnings shall not consist of any room, room bounding, area, area bounding, duplicate instances in the same space, duplicate type mark or mark, or overlapping walls.
- Delete all elements specific for rendering or presentation views. This includes, but is not limited to plantings, people, vehicles, and studio lights.
- Accept all Design Options.
- Ungroup all Groups.
- Maintain all views and sheets associated with the contract documents. Purge all sheets not used for construction documents. Purge all Views not on Sheets. Purge all unused View Templates.
- Purge all unused loadable and system families.
- Purge all unused/empty elevation tags.
- Purge all unused Rooms, Spaces, and Areas.
- Remove all unused links.
- Use Ideate Style Manager or an equivalent Revit add-in to remove all unused Object Styles, Line Styles, Line Patterns, Dimension Styles, Text Styles, Filled Regions, Fill Patterns, Materials, and Material Assets.

4.4 EXPORTING CAD FILES

The design team must provide UMass with CAD files exported from Revit. UMass Chan will use these files as underlays in their facility system. The CAD exports must be clean in nature. For example, turn off:

- Surface patterns
- Clearance lines
- All annotations, except room numbers. This includes elevation tags, section tags, and callouts. This also includes dimensions, notes, wall tags, door tags, window tags, etc.
- Interior layers of walls. Only show the lines representing the finish face of the walls.
- Furniture must use minimal linework.

5. MODEL DEVELOPMENT

5.1 GENERAL MODEL REQUIREMENTS

Follow the UMass Chan sheet numbering convention. In the UMass Chan Revit Template, use view types that correspond to the sheet types.

5.1.1 REVIT VERSION

Submitted Revit versions must follow the UMass Chan Revit Upgrade schedule. A project may be required to upgrade mid-project if the schedule straddles upgrade milestone dates.

Revit Version / Upgrade Schedule:

January 2025 – March 2027: All delivered models must be in Revit 2025.

April 2027 – March 2029: All delivered models must be in Revit 2027.

April 2029 – March 2031: All delivered models must be in Revit 2029.

April 2031 – March 2033: All delivered models must be in Revit 2031.

April 2033 – March 2035: All delivered models must be in Revit 2033.

April 2035 – March 2037: All delivered models must be in Revit 2035.

5.1.2 TEMPLATE

- ➔ Start all projects using the UMass Chan standard template for all design work.
- ➔ Use the starter View Types for all views. Designers are welcome to make additional View Types where necessary. Follow the naming conventions of the template.
- ➔ Use all annotation elements provided in the template.

5.1.3 REVIT FILE NAMING CONVENTION

Use the following revit file naming convention for all submitted revit files:

[Project Number] _ [Project Name] _ [Discipline] _ [Revit Version] _ [Date Of Submission] _ [Submission Description] .rvt

For Example: 0000_Project Name_Arch_R23_YYYY-MM-DD_Record.rvt

5.2 SHEET NUMBERING AND IDENTIFICATION

- ➔ The sheet identification format goes by first the Discipline Designator, Sheet Type Designator, then Sheet Sequence Number.

5.2.1 DISCIPLINE DESIGNATOR

- ➔ The Discipline Designator denotes the category of subject matter contained on the specific layer. The Discipline Designator is a two-character field. The first character is the discipline character, and the second character is an optional modifier (Level 2). The example denotes Architectural, Wall.

A	Architectural
B	Geotechnical
C	Civil
D	Process
E	Electrical
F	Fire
G	General
H	HazMat
I	Interiors
L	Landscape
M	Mechanical
P	Plumbing
Q	Equipment
R	Resource
S	Structural
T	Telecom
V	Survey / Mapping
W	Other Disciplines
Z	Contractor / Shop Drawings

5.2.2 SHEET TYPE DESIGNATOR

➔ The Sheet Type Designator is a single numerical character that identifies the sheet type. All sheet types may apply to all discipline designators. It is not necessary to use all the sheet types for a project or within a discipline.

0	General	Symbols, legend, notes, etc.
1	Plans	Horizontal views and combination plan & profile
2	Elevations and Profiles	Vertical views
3	Sections	Sectional views, wall sections
4	Large Scale Views	Scaled up reproduction plans, elevations, or sections that are not details
5	Details	
6	Schedules and Diagrams	
7	User Defined	For types that do not fall in other categories, including typical detail sheets

8	User Defined	For types that do not fall in other categories
9	3D Representation	Isometrics, Perspectives, Photographs

5.2.3 SHEET SEQUENCE NUMBER

- ➔ The Sheet Sequence Number is a two-digit number that identifies each sheet in a series of the same discipline and sheet type. Sequence numbering starts with 01; sheet number 00 is not permitted. The first sheet of each series is numbered 01, followed by 02 through 99. The example below denotes Architectural Plans Sheet 3.
- ➔ Number sheets in Revit with two spaces between the sheet type and the sheet number. For example, **A-1 03**. The 2 spaces will wrap the characters correctly for the Revit title block.

Example Sheet Numbering:

A-1
03

5.2.4 SHEET IDENTIFICATION REQUIREMENTS

- Drawing title – Describes the drawing content.
- Sheet identification – Follow the Sheet Identification Requirements in Section 3.
- North Arrow showing the orientation of the drawing.

5.2.5 TITLE BLOCK REQUIREMENTS

- For UMass Chan projects use the UMass Chan Medical School Title Block provided by the Design Technology Group. For example, **UMass Chan Titleblock 24x36.rfa**
- The standard UMass Chan sheet size is 24x36. UMass Chan and the design team must determine the sheet size appropriate for each project.
- Title block information must contain the following information:
    - A/E/C – Consultant responsible for producing the drawings should be clearly identified.
    - Project Name – Assigned by UMass Chan.
    - Project Number – Assigned by UMass Chan.
    - Building Name – Name of the building as per UMass Chan naming convention.
    - Submission date.
- For full floor plan As-Builts ensure the Title Block is set up on each level with sheets sized 11x17, 18x24, 24x36. Print 100% to scale.

5.3 DRAWING GRAPHIC QUALITY

Use UMass Chan standard annotation elements so all UMass Chan projects have a consistent graphic quality. All standard annotation elements exist in the UMass Chan Revit template. This includes, but not limited to, line styles, dimension styles, text styles, filled regions, elevation tags, section tags, callouts, viewport titles, level marks, tags, keynotes, graphic scales, revision clouds, and title blocks.

All text on all drawing sheets must be in ALL CAPS.

5.4 LEVEL OF DEVELOPMENT (LOD)

LOD, or Level of Development, refers to the degree of detail and accuracy of a BIM model element at a specific stage of a project. LODs range from LOD 100 to LOD 500, where LOD 100 represents a conceptual idea and LOD 500 signifies the most developed, as-built version of a model element.

Model elements' LOD requirements must be defined in the BIMxP. LOD may vary from object to object. As a rule of thumb, architectural and structural elements are modeled LOD 300. Landscape, Mechanical, Plumbing, Electrical, and Technology elements are modeled to LOD 200 during design, LOD 400 by the contractor before construction begins, and LOD 500 after construction is complete.

Level of Development Explanations:

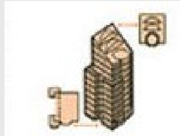
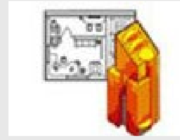
LOD 100	LOD 200	LOD 300	LOD 350	LOD 400	LOD 500
					
The Model Element may be ***graphically represented*** in the Model with a ***symbol or other generic representation***, but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements	The Model Element is graphically represented within the Model as a ***generic*** ***system, object, or assembly*** with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.	The Model Element is graphically represented within the Model as a **specific system, object or assembly** in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.	The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, and ***interfaces*** with other building systems. Non-graphic information may also be attached to the Model Element.	The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with ***detailing, fabrication, assembly, and installation information***. Non-graphic information may also be attached to the Model Element	The Model Element is a ***field verified representation*** in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Elements.
Interpretation: LOD 100 elements are ***not geometric*** representations. Examples are information attached to other model elements or symbols showing the existence of a component but not its shape, size, or precise location. Any information derived from LOD 100 elements must be considered approximate.	**Interpretation:** At this LOD elements are generic placeholders. They may be recognizable as the components they represent, or they may be volumes for space reservation. Any information derived from LOD 200 elements must be considered approximate.	**Interpretation:** The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs. The project origin is defined and the element is located accurately with respect to the project origin.	**Interpretation:** Parts necessary for coordination of the element with nearby or attached elements are modeled. These parts will include such items as ***supports and connections***. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.	**Interpretation:** An LOD 400 element is modeled at sufficient detail and accuracy for fabrication of the represented component. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.	**Interpretation:** Since LOD 500 relates to field verification and is not an indication of progression to a higher level of model element geometry or non-graphic information, this Specification does not define or illustrate it.
DESIGN ◄			► **CONSTRUCTION**		
Refer to BIM Forum Level of Development Specification for more detailed description of element specific LOD https://bimforum.org/resource/lod-level-of-development-lod-specification/					

Figure 1 - BIM Forum LOD Specification 2020

5.5 MODEL SETTINGS

5.5.1 LANGUAGE

All project content must be developed in English.

5.5.2 UNITS AND PRECISION

Models should include all appropriate dimensions as needed for design intent, analysis, and construction. Models shall use consistent units and measurements across the project.

Default project units shall be:

Length: Imperial feet and fractional inches to the nearest 1/256”, but all dimensions should be within 1/8” increment. It is acceptable for detail elements to have a higher precision.

Angle: Degrees to 2 decimal places.

5.5.3 NAMING CONVENTIONS

Use the following naming conventions in the Revit files and on sheets.

LEVELS

The word **Level** then followed by the level digit. For renovation work, follow the existing building levels.

Examples: **Level 01**, **Level Basement**, **Level Roof**

GRIDS

Grids that run East-West shall be labeled Alphabetically. ‘A’ shall start on the right side of the plan. Intermediate grids numbers with a single decimal suffix indicating the approximate position from the previous grid. (ie. Grid line 60% between grids B and C would be B.6)

Grids that run North-South shall be labeled Numerically. ‘1’ shall be on the top of the plan. Intermediate grids numbers with a single decimal suffix indicating the approximate position from the previous grid. (ie. Grid line 60% between grids 7 and 8 would be 7.6)

Pin all grids to avoid grids accidentally moving.

VIEWS

View names must describe the view type and location. View names must appear as all capitalized. Follow the conventions of the following view name examples:

LEVEL 1 LIFE SAFETY PLAN
LEVEL 1 DEMOLITION FLOOR PLAN
LEVEL 1 DEMOLITION REFLECTED CEILING PLAN
LEVEL 1 FLOOR PLAN
LEVEL 2 FLOOR PLAN
ROOF PLAN
LEVEL 1 REFLECTED CEILING PLAN

LEVEL 2 REFLECTED CEILING PLAN
EAST ELEVATION
WEST ELEVATION
WEST ELEVATION - WEST WING
BUILDING SECTION A
BUILDING SECTION B
WALL SECTION A
WALL SECTION B

ELEVATION - ROOM ##
PLAN - ROOM##
PLAN - STAIR A
PLAN DETAIL - PILASTER
SECTION DETAIL - SILL
SECTION DETAIL - NOSING

SECTION DETAIL - SHAFT WALL AT FLOOR
SECTION DEATIL - DOOR HEADER
SECTION DETAIL - BASE CABINET 3 DRAWERS
LEVEL 1 FINISH FLOOR PLAN
LEVEL 2 FINISH FLOOR PLAN

5.5.4 ORIGIN POINTS

UMass Chan may provide the design team with existing Revit models. Link these existing model(s) into the design team's new Designer Model(s) via Internal Origin to Internal Origin. After linking the existing models do not move the origin points.

If UMass Chan does not provide existing Revit models to link, the origin points shall be close, but outside, the building. Preferably in the bottom left of the building. The Project Base Point and Survey Point must match the Internal Origin in X, Y, and Z locations.

Link Revit models **Internal Origin to Internal Origin**.

Project North shall be set so the building is orthogonal on a page with True north generally pointing up. No need to set True Noth. It can match Project North.

If the project requires more complex origins or rotations, collaborate with UMass Chan on setting Origin Points. For example, setting True North accurately for sun studies, or setting levels to show height above sea level.

5.5.5 LEVELS

Use Level Lines for the following:

- ➔ Top of the structural floor for every floor area more than 5% of the overall floor plate. For small sections of floor plans at different heights, position elements relative to the nearest level.
- ➔ Top of the roof structure
- ➔ Top of parapet
- ➔ Top Plate
- ➔ Top or Bottom of Footings

Do not use level lines for any purposes other than what is listed above.

Avoid multiple levels at the same elevation. When copying/pasting elements from a level to a level that shares an elevation, Revit will paste the elements on the first level created, not necessarily the desired level.

Model top of structural floor to the level line. In other words, floor finishes will be above the level line.

The bottom of Revit roofs are placed on the level line, rather than the top of the roof structure. For this reason, flat roofs shall use floors as the structure of the roof (ex: metal deck and concrete) and use a roof as the finishes (insulation and membranes).

Pin all levels to avoid levels accidentally moving.

5.5.6 WORKSETS

For worksharing models use the Workset naming conventions and strategies below. Not all Worksets below will be used in a project and additional project-specific Worksets are welcome. The best practice is to minimize the number of Worksets.

WorkSet Name	Description
_Architecture	(Required - rename Workset 1)
_Entourage Exterior	(Studio Lights, Entourage)
_Entourage Interior	(Studio Lights, Entourage)
_Finish Floors	(Thin finish floors)
_Furniture	(Furniture)
_Levels and Grids	(Required - Levels, Grids, Reference Planes, Scope Boxes)
_Site and Context	(Building context and topography)
Link-CAD	(Civil drawings, etc.)
Link-REVIT	(Structural, Mechanical, etc.)
Link-Point Cloud	
Others as needed	

5.5.6 PHASES

Use Revit Phasing features for Phased elements. Do not use Worksets, Design Options, filters, or other methods to delimit between new, existing, and demolished elements. As a standard, project must use the following Phases:

- ➔ Existing
- ➔ New Construction

For projects that require more complex phasing, collaborate with UMass Chan for Phasing naming conventions and to define the scope of each phase. Document these decisions in the BIMxP.

5.5.7 REVISIONS

Revision use is as follows:

- ➔ Each Revit Revision represents a submission. This could be a Bulletin, Addendum, etc.
- ➔ Each Revision submission shall be numbered sequentially.
- ➔ Each submission may include responses to one or multiple Requests For Information (RFI) requests.
- ➔ Issue entire sheets when issuing a change submission. In other words, avoid 8.5x11 sketches.

- ➔ Show Revision Clouds and Revision Tags when issuing Revisions. For older revisions, hide the cloud, and tag.
- ➔ Number Revisions per Project, not per Sheet.
- ➔ Revisions will automatically populate title block Revision Schedules when a Revision appears on a view placed on a sheet.
- ➔ Revision Clouds shall be drawn on views rather than on sheets except:
  - For schedules - Schedule Revision Clouds must go on a sheet.
  - Title block, such as a sheet number.

Tips:

- ➔ Revisions can be added to a Sheet Revision Schedule even if there are not any bubbles on the sheet by using the **Revisions on Sheet** Sheet Parameter. This is helpful for conformed sets.
- ➔ Revisions on Legend Views will not populate on the Title Block Revision schedule. The Revision must be added by using the **Revision on Sheet** Sheet Parameter, or by bubbling the Legend View directly on the sheet.

5.5.8 REVIT WARNINGS

Revit is constantly monitoring warnings against model changes. Any model change that addresses a warning will automatically clear\resolve the warning. A long list of warning messages will slow down computer performance for everyone on the team. Each team is responsible for monitoring and minimizing the number of warnings in the project.

5.6 MODEL CONTENT AND WORKFLOWS

5.6.1 MODEL ELEMENTS

- ➔ Building elements shall be modeled in 3D with the correct overall size and correct location. The shape may be approximated when the shape does not impact coordination with nearby elements. 2D representations of building elements are acceptable for detail elements.
- ➔ Interior architectural Walls heights must not extend through multiple levels - except shaft walls.
- ➔ Interior Architectural Columns shall not extend through multiple levels.
- ➔ The structure must be modeled as 3D elements. Detail elements such as bolts, rebar, and fireproofing are not required to be modeled in 3D.
- ➔ Mechanical and Piping systems must be used to define system use, but are not required to complete a closed system or be used for system calculations.
- ➔ Pipes must be modeled as 3D elements. Associated valves, gauges, and insulation must be modeled with approximate shape, but precise overall size. Couplings, fittings, hangers, and related structures are not required to be modeled in 3D.
- ➔ Ducts and insulation must be modeled as 3D elements. Flanges, fittings, hangers, and related structures are not required to be modeled in 3D.

- Cable trays must be modeled as 3D elements. Wires are not required to be modeled in 3D.
- Conduit smaller than 2” does not need to be modeled.
- Fabrication Parts shall not be used.
- Analytical elements are not required to be used.
- All content to represent the design shall be native Revit content. Other file types shall not be used to represent the building design. This includes but is not limited to, .dwg, .skp, .3dm, .rws. .axm, .fbx, .sat, .stl, .dae, .dxf, .obj, ifc.
    - This includes content nested in Revit families. For example, a 3D .dwg file is not allowed to be nested in a Revit family.
- Revit content that requires the use of external Revit Add-ins to view or modify the content, is not allowed.

5.6.2 FAMILIES

- Use the UMass Chan family library as much as possible. If content is missing, use the Autodesk standard content library. If content is stil not available, create new families.
- While it is possible to model building geometry with a tool that was designed for a different building category, it is not permitted without consensus from UMass Chan. For example, it’s possible to model a railing with a curtain wall. All objects are expected to be modeled in the appropriate corresponding Revit category. If no category is appropriate for the geometry use the “generic models” category.

5.6.3 LOADABLE FAMILY NAMING CONVENTION

UMass Chan’s standard content uses a prefix or suffix of **+** (plus) to define it as a UMass standard element. UMass Chan’s standard loadable content, as opposed to styles, materials, and system families, prefix the family name with a Revit Category abbreviation, and a suffix of the **+** (plus) sign.

For example: **DR-Single +.rvt**

Custom families must contain the category prefix, but include a suffix of the project number. This includes any new content or modified UMass Chan content.

For example: **DR-Single 2654.rvt**

The family name after the prefix uses “descriptive” naming, providing general detail first and moving towards more detail. Do not include any information in the family name that describes types contained within the family. (For example, the size or material).

Revit Category	Prefix
Annotation	**+** (plus sign)
Balusters	BA
Casework	CW
Columns (Architectural)	CO

Curtain Wall Mullions	CWM
Curtain Panels	CWP
Detail Components	DC
Doors	DR
Electrical Equip & Fixtures	EL

Entourage	ET
Furniture	FN
Furniture Systems	FN
Generic Model	GM
Lighting Fixtures	LF
Masses	MA
Mechanical	ME
Parking	PA
Planting	PL
Profiles	PR
RPC	RP
Specialty Equipment	EQ
Structural Columns	ST

Structural Foundation	ST
Structural Framing	ST
Structural Trusses	ST
Windows	WN

In-Place Families	
Ceilings	CL
Floors	FL
Railing	RL
Roof	RF
Stair	STR
Walls	W

5.6.4 LOADABLE FAMILIES - DOORS

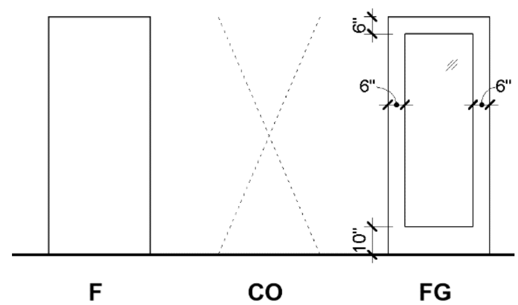
UMass Chan's doors are complex, but with the aim to provide flexible, consistent, and accurate models, inside a coordinated drawing set. Use UMass Chan's doors for ALL door locations.

- ➔ Door numbers must use the Mark parameter.

Below are a few key features of the UMass Chan Doors.

Door Panels

Door panels are nested families that are 'shared'. This means, if properties of a panel family are changed, such as rail widths, the change will propagate across the entire model, to all door families that use the panel. The panel family is defined in the Door Type Properties.



It is best practice to modify the properties of panel families or set the panel type used in the door from the project directly, rather than through the door family. You can find the door panels in the project browser as Generic Models.

Panel families should not have multiple types. If a variation of the panel is required, save-as the family as a new family with a unique name. The Type name must match the Family name.

The door panels are described on a Legend View with Legend Components. If the Door Panel Family is modified, the changes will be reflected automatically in the Legend View.

Door Frames

View type parameters, the door frame can be set to stretch with the wall thickness, or be a fixed depth, or, for presentation views, have no frame.

Door Swings

The door swing is a nested family. The swing angle can be adjusted via instance parameters.

Door Clearances

Door Clearance configurations can be set via instance parameters for both the pull and push sides of the door.

Door Clearances visibility can be set per door via instance parameters, or per view via Object Style Detail Item, Subcategory Clearance Lines.

Door Trim

The door trim is built into the door family. The trim sizes can be controlled view type properties.

Door Schedules

The Schedule **DOOR SCHEDULE** must be used in the project to describe the doors.

Working Schedules are used to help enter and review door information. Further instructions are included on the working schedules in the template.

5.6.5 USAGE OF IN-PLACE MODEL FAMILIES

In-place models are intended for "custom one-off" situations in a building. If a family occurs at more than one location in a building it should be developed as a loadable component family. The exception to that is for any "system" family.

5.6.6 SYSTEM FAMLIES – WALLS

The UMass Chan Revit template contains pre-made walls – interior partitions, exterior walls, and curtain walls. Projects must use the walls in the template. Do not modify the walls in the template. If the project requires additional walls, create new walls using UMass wall naming conventions. See the wall designation legends for more information about the naming conventions.

UMass Chan does not provide partition details, schedules, or general notes.

5.6.7 SYSTEM FAMILIES – NON WALLS

Use UMass Chan standard system families where possible, such as ACT ceilings, or wall mounted handrails. UMass provides very few non-wall system families. Most system families will be project-specific. Designers are expected to create system families. This includes, but is not limited to floors, ceilings, roofs, stairs, and railings. UMass Chan does not have a standard convention for these systems, such as floor/ceiling assemblies.

5.6.8 ROOMS

UMass Chan will provide the design team with all room names and numbers. The number must contain the building designation, level number, a dash, and then the number.

For example: **S1-600**

Revit Requirements:

- ➔ All Rooms in the design are to be modeled in the Phase **New Construction**.
- ➔ Include the Room name in the **Name** parameter.
- ➔ Include the Room Number in the **Mark** parameter.
- ➔ Include the room type, such as the Conference Room, Lab, or Closet, in the Room parameter **Department**.

5.6.9 SCHEDULES

In the UMass Chan Revit template, for sheets to group and sort correctly on both the Project Browser and the Sheet List Schedules, complete the following parameters:

Parameter	Description
Appears in Sheet List	Check to include the sheet in the sheet list.
Sheet Grouping	Set to group the sheets and order correctly. See chart below for more information.
Sheet Heading	Enter the heading for each group to appear on the Schedule.
Sheet Number	Sheets are sorted by Sheet Number.

The **Sheet Grouping** add **Sheet Heading** parameter information must match the chart below:

Sheet Grouping	Sheet Heading
00 - Title	TITLE
01 - Survey	SURVEY
02 - Civil	CIVIL
03 - Landscape	LANDSCAPE
04 -	Open for project customization
05 - General	GENERAL
06 - Architectural Demolition	ARCHITECTURAL DEMOLITION
07 - Architectural	ARCHITECTURAL
08 -	Open for project customization
09 - Structural	STRUCTURAL
10 - Mechanical	MECHANICAL
11 - Electrical	ELECTRICAL
12 - Plumbing	PLUMBING
13 - Fire Protection	FIRE PROTECTION
14 - Technology	TECHNOLOGY

Use the Schedule **+Working Sheet List** to fill in all parameters. The final sheet list hides most of this information but is used for sorting.

5.6.10 KEYNOTES

UMass Chan encourages, but does not require, the use of keynotes to quickly annotate typical notes. When using keynotes, use Generic Annotations for the keynote, and a Note Block schedule to list the keynote descriptions. The UMass Chan template includes the following elements for keynoting:

- ➔ For demolition keynotes, use the Schedule **DEMOLITION KEYNOTES** which lists the Generic Annotation **+Note Block – Demolition**.
- ➔ For new construction keynotes, use the Schedule **NEW CONTRUCTION KEYNOTES** lists the Generic Annotation **+Note Block - New Construction**.

To create more keynotes, add more types to the Generic Annotation families.

5.6.11 CALLOUTS AND DETAILS

For Enlarged Plans, create a new Plan View and crop the view rather than creating a view via a new callout. When callouts are required on the parent view, draw a callout that references the previously created Plan View.

For Details, use a mix of **Drafting Views** and **Detail Views**. Drafting views are used for typical details such as door and window jambs, interior partition types, roof drains, ceiling details, etc. Detail views are used for unique conditions where modeled elements must be shown to ensure proper coordination, such as parapet or balcony edge details.

Section Drawings as Detail View vs Section View types:

There are subtle differences between Detail Views and Section Views. Most of these differences relate to the Detail View's relation to the parent view. Use view types as follows:

- ➔ Use Detail views for views ¾"=1'-0" and finer.
- ➔ Use Section views for views ½"=1'-0" and courser.

Plan Drawings as Detail View vs Plan View

Use View Types as follows:

- ➔ Use Detail views for views ¾"=1'-0" and finer.
- ➔ Use Plan views for views ½"=1'-0" and courser.

5.6.12 UNDEFINED WORKFLOWS

The model author may invent workflows undefined in this document. This may include but is not limited to, documenting signage, listing equipment in a room, key plan symbols, or using Rhino.inside.

5.7 SYSTEM ASSETS

5.7.1 DUCT SYSTEMS

Use the following Duct System names and abbreviations for all Revit Duct Systems.

Duct	
E	Exhaust Air
R	Return Air
S	Supply Air

F	Fresh Air Intake

5.7.2 PIPING SYSTEMS

Use the following Piping System names and abbreviations for all Revit Piping Systems.

Plumbing	
CD	Condensate Drain
CW	Domestic Cold Water
FCW	Filtered Cold Water
FM	Forced Main
GRW	Grease Waste
GV	Garage Vent
GW	Garage Waste
HW	Domestic Hot Water
HWR	Domestic Hot Water Recirculation
IW	Indirect Waste
KV	Kitchen (Grease) Vent
KW	Kitchen Waste
NCW	Non-potable Cold Water
NHW	Non-potable Hot Water
NHWR	Non-Potable Hot Water Recirculation
OD	Secondary Storm
PD	Pumped Discharge
RW	Reclaim Water
ST	Storm
SV	Separator Vent
SW	Separator Waste
TP	Trap Primer
TW	Tempered Water
TWR	Tempered Water Recirculation
UV	Vent Below Grade
V	Vent

Process Piping	
AWV	Acid Waste Vent
BV	Biologic Waste Vent
BW	Biologic Waste

CA	Compressed Air
CAI	Compressed Air Intake
CO2	Carbon Dioxide
CS	Clean Steam
EG	Elevated Pressure Natural Gas
FW	Flushing Water
G	Natural Gas
GTV	Gas Train Vent
GV	Natural Gas Vent
LV	Laboratory Vent
LW	Laboratory Waste
LWPD	Laboratory Waste Pump Discharge
N2	Nitrogen
O2	Oxygen
O2R	Oxygen Relief
PBW	Pumped Biologic Waste
PLW	Pumped Lab Waste
PW	Purified Water
RO	Reverse Osmosis Water
RODI	Reverse Osmosis Deionized Water
RODIR	Reverse Osmosis Deionized Reject Water
S	Sanitary
TLW	Treated Lab Waste
V	Vent
VAC	Vacuum
VE	Vacumm Exhaust

Fire Protection	
DR	Drain
DS	Dry Sprinkler (Deluge)
F	Fire Main Piping
FM	FM 200
PA	Preaction Sprinkler
SP	Standpipe
TH	Test Header
WS	Wet Sprinkler

Mechanical Piping	
BBD	Boiler Blowdown
BFW	Boiler Feed
CD	Condensate Drain
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
CWM	City Water Makeup
CWR	Condenser Water Return
CWS	Condenser Water Supply
D	Drain
DTR	Dual Temperature Return
DTS	Dual Temperature Supply
FOF	Fuel Oil Fill
FOG	Fuel Oil Gauge
FOO	Fuel Oil Overflow
FOR	Fuel Oil Return
FOS	Fuel Oil Supply
FOV	Fuel Oil Vent
GHWR	Glycol Hot Water Return
GHWS	Glycol Hot Water Supply
GR	Glycol Return
GS	Glycol Supply
GWR	Glycol Water Return
GWS	Glycol Water Supply
HPWR	Heat Pump Water Return
HPWS	Heat Pump Water Supply
HSR	High Pressure Steam Return (Condensate)
HSS	High Pressure Steam Supply
HWR	Hot Water Return
HWS	Hot Water Supply
LPS	Low Pressure Steam
LSR	Low Pressure Return (Condensate)
LSS	Low Pressure Steam
MSR	Medium Pressure Return (Condensate)

MSS	Medium Pressure Steam
MU	Makeup Water
PC	Pumped Condensate
PCHWR	Primary Chilled Water Return
PCHWS	Primary Chilled Water Supply
RHG	Refrigerant Hot Gas
RL	Refrigerant Liquid Line
RS	Refrigerant Suction Line
SCHWR	Secondary Chilled Water Return
SCHWS	Secondary Chilled Water Supply
SHWR	Secondary Hot Water Return
SHWS	Secondary Hot Water Supply
V	Vent

6. SCAN TO BIM STANDARDS

For projects that require laser scanning and BIM modeling from the Point Cloud follow the following standards.

Follow UMass Chan Medical School BIM Standards outlined elsewhere in this document, this includes, but not limited to, Revit version, Level naming conventions, origin points, etc. If there is conflicting information (such as units), follow the Scan to BIM Standards for Scan to BIM projects.

The goal of a scan to BIM model is for designers to design from these models, immediately and effectively. These standards discuss what content is modeled, where it is modeled, and how it is modeled.

Model the building from the point cloud scans and the panoramic photo imagery.

6.1 SCANNING REQUIREMENTS

- ➔ Provide panorama imagery with the point cloud scans.
- ➔ Decimate files to 8mm.
- ➔ Deliver a colorized .rcs file. (or e57)
- ➔ If .rcs files are anticipated to be larger than 15GB, split the point clouds per level and/or wing.
- ➔ For above ceiling scans, place scanning equipment above the ceiling for best scan coverage.
- ➔ Noise? Reflection?
- ➔ Point density at distance
- ➔ Accuracy
- ➔ Base level hardware requirements.
- ➔ Site setup practices
    - ➔ Noise
    - ➔ Above ceiling

6.2 MODEL REQUIREMENTS

6.2.1. MODELING SETUP

Template:

For scan-to-BIM projects used by a design team, use the designer’s template and families. For scan to BIM projects delivered directly to UMass, use Autodesk out of the box templates and families. Families not provided by Autodesk must be created following similar object style conventions.

Orientation:

Confirm the Project North orientation with UMass Chan Medical School before modeling.

Levels:

Unless otherwise directed by UMass Chan Medical School, model the First Floor at 0'-0" relative to the Project Base Point.

Set all level heights to the nearest ½" above the floor below. For sagging floors, set the height the its most average floor height, while also considering that the floor-to-floor heights in a building is likely the same. For example, if one floor-to-floor height appears to be 9'-11" and another appears to be 10'-1" make them both 10'-0".

6.2.2. MODELING REQUIREMENTS

Phase:

Model all content on the Phase Existing.

Accuracy:

Elements must be located adjacent to other building elements to the nearest 1/2". For example, the distance between 2 walls must be 12'-6 ½" not 12'-6 5/8". For another example, set the ceiling height to 9'-10 ½" even if 9'-10 $^{7}/_{16}$" appears more accurate to the point cloud.

Base outermost dimensions on typical construction practices, rounded to nearest half inch.

Tolerances:

UMass Chan Medical School recognizes two different types of building elements. Each type has its tolerance requirements.

- ➔ Elements that are easily scanned and photographed.
  - Building element locations and sizes must represent the actual conditions within +/- ½". The smallest fraction permitted is ¼".
- ➔ Elements that are not completely captured with scans or photos. Typically these are elements above ceiling or pipes layered behind other pipes or equipment. This most often refers to mechanical equipment, ducts, pipes, conduits, and associated accessories.
  - Building element locations must represent the actual conditions with +/- 2". The smallest fraction permitted is ¼".
  - Model pipes, ducts, or conduits that slope/sag as flat. Exception, if over the length of the element it slopes more than 2", model the element as sloped.
  - Building element sizes must represent the actual conditions with +/- ½". The smallest fraction permitted is ¼".
  - Complete runs of ducts, pipes, and conduits are more important than accurate locations. Assumptions will need to be made when connecting elements masked by other elements. Make the assumptions. UMass Chan Medical School recognizes that accuracy will be diminished in these situations.

Building Geometry:

Elements that are nearly parallel, perpendicular, and plumb to each other, must be modeled as perfectly parallel, perpendicular, and plumb.

For elements built angled from Project North, use angles in increments of 0.25 degrees. For example, if the element is angled 2.43 degrees from nearby elements, round the angle rotation to 2.5 degrees. Exception, if the angled element, over its length, drifts away from the actual condition by more than 2”, rotate the element to the nearest tenth of a degree to better match the point cloud location. This condition is most common with very long exterior walls.

Elements that sag must be modeled as flat. This includes items such as floors, ceilings, pipes, ducts, or conduits. (Sloping pipes? More than 2” over it’s length?)

Family Construction:

Families representing different products or trades must model these elements as separate families. For example, door casing must not be nested in the door family, or a wall mount heat pump must not be nested with the window family.

Families must not have geometry and voids in the same family. They must be separate families. For example, a railing support family inset in a wall could contain a void in the railing family for the support to cut the wall niche. As part of the design, if the railing support is demolished but the niche remains, the niche/void must be made out of a separate family so the wall doesn’t infill incorrectly.

Walls must never include sweeps or reveals as part of the wall assembly. They should be built as separate elements.

Elements must be hosted to the nearest level.

6.3 MODEL DELIVERY

Views:

Provide Floor Plan and Reflected Ceiling Plan views of each level, including a roof plan. Provide overall dimensions on the floor plan views.

Provide Exterior Elevations of each elevation.

Provide building section views, 2 perpendicular sections (North/South & East/West) for each wing of the building.

Name these views following the template naming convention, and locate the views following the template’s typical project browser organization. Typically these views prefix or suffix with **EXISTING**.

Remove all working views created during the modeling process. Remove any working view templates used during the modeling process.

Other Elements:

Remove all working Reference Planes used during the modeling process.

7. APPENDICES

A. GLOSSARY OF TERMS

As-Built Drawings:

As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents. This set of drawings depicts the actual conditions of the completed construction “as it was built”.

Basis of Design:

The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the Owner’s Project Requirements. The basis of design describes the systems, components, conditions, and methods chosen to meet the intent. Some reiteration of the Owner’s Project Requirements may be included.

Bid Documents:

Documents required to be submitted in response to an Invitation to Bid (ITB). These include the prescribed bid form, drawings, specifications, timelines, charts, price breakdowns, etc.

Construction Drawings:

Drawings that provide all the necessary information, both graphic and written, to build the project. These drawings provide specific, detailed information regarding walls, doors, furniture, equipment, lighting, outlets, and so on.

Design Drawings:

Technical drawings are used to define requirements fully and clearly for engineered items so that they may conform to the design aesthetic. The purpose of such a drawing is to capture all the geometric features of a product or a component that will allow a manufacturer to produce that component accurately and unambiguously.

Record Drawings:

Record drawings are prepared by the architect, engineer, and reflect on-site changes the contractor noted in the as-built drawings. They are often compiled as a set of on-site changes made for the owner per the owner-architect contract.

Sketches:

A simple, technical drawing created to isolate a particular engineering/architectural item and provide specific requirements related to that item.

Working Drawings:

A complete set of plans and specifications showing and describing all phases of a project; architectural, structural, mechanical, electrical, civil engineering, and landscaping systems, to the degree necessary for the purposes of accurate bidding by contractors and for the use of artisans in constructing the project.

B. PHASING CHECKLIST

UMass Chan will require the following information and documents as required for each project. Requirements will differ per project.

- Concept Design 15%
  Conceptual Design is the process of creating the initial idea for a project and establishing its broad outlines. It's an early stage in the design process that involves research, brainstorming, and developing ideas into tangible solutions.

- Schematic Design 30%
  Schematic design (SD) phase often produces a site plan, floor plan(s), sections, an elevation, and other illustrative materials, computer images, renderings, or models. Typically, the drawings include overall dimensions, and a construction cost is estimated.

- Design Development 60%
  Design Development (DD) phase typically includes plans, sections, elevations, and details with dimensions. This drawing set also includes structural drawings, MEP (mechanical, electrical, and plumbing) drawings, civil engineering drawings, landscape architecture drawings, and initial specifications.

- Design Development 90%
  (See Above for DD terminology)

- Construction Documents 100%
  Construction Documents (CD) phase, a full bid set is required with plans, costs, submittals, and specifications.

C. ADDITIONAL RESOURCES

These additional resources are available:

- Deliverables Checklist
- Drawings Log Template
- Quality Assurance Checklist
- Phasing Checklist
- BIM Execution Plan

To have one of these emailed to you, email DesignTechGroup@umassmed.edu.

END OF DOCUMENT