AUS DIGITAL GOVERNANCE

BIM Guide and Standards

October 30, 2024
Version 2.2

Austin-Bergstrom International Airport

HNTB

This page is intentionally left blank.

Table of Contents

SUMMARY OF REVISIONS:

While this document is intended as a reference that can be cited in agreements such as contracts and BIM execution plans, it is recognized that the use of BIM in design and construction is evolving. To accommodate this evolution this document will be updated periodically in clearly identifiable versions. A project can adopt a specific version and then has the option to remain with that version or update if an updated version is published. Initially the target update frequency is annually, but that may change in the future. In addition, interim updates may be issued if needed.

Table 0.01 summarizes changes made to the BIM Manual from the previous approved version. Information displayed is for reference only.

TABLE 0.01: REVISION HISTORY

Revision	Date	Author	Approver	Description
1.0	12OCT22	AUS		First Version of BIM Standards
1.1	05MAY23	AUS		Addition of CAD Standards
2.0	26FEB24	AUS		Additions throughout from workshops and discovery
2.1	10MAY24	AUS		Titleblock size changed to 30x42
2.2	30OCT24	AUS		Added requirements to capture Owner 3D model comments in Section 7.01 and updates to Section 4.15: Phasing and Section 5.02: Layers

INTRODUCTION

If used effectively, Building Information Modeling (BIM) provides opportunities to vastly improve upon traditional methods of design and construction coordination thereby reducing the potential for costly change orders, providing multiple opportunities for Owner review and participation by means of 3D visualization of the project and specialty spaces, and reducing design and construction schedules. In addition, BIM creates opportunities for reusing data for multiple purposes, including the operation and maintenance of Austin Bergstrom International Airport (AUS) facilities. To achieve these ends, the BIM must be structured to achieve the required purposes. This document describes AUS requirements for the production and use of Building Information Models (BIMs) in the design, construction, and maintenance of its facilities.

PURPOSE OF BIM GUIDE AND STANDARDS

The AUS BIM Guide and Standards ensure that the design team will produce, release, and receive data in a consistent format. This will maintain an efficient exchange of data between disciplines, compatibility of each discipline's BIMs with various outside consultants, and all government agencies, including Federal Aviation Administration (FAA) and the City of Austin (COA). AUS BIM practice is comprised of several Autodesk products. The AUS BIM Guide and Standards will use terminology and references that are common to the Autodesk-based software applications.

The BIM Guide and Standards is a live document and should be maintained by the BIM Department. External Companies are required to contact the AUS Planning and Development Project Manager or BIM Department for the current version and referenced documentation. Any modifications, deletions, or variances to these standards will not be allowed without the permission of AUS BIM Department.

CHAPTER 1: BIM USES

This section defines BIM Uses that could potentially be required on a project, as defined by contract. Uses expected by the AUS Department of Aviation (DOA) in the design & documentation phase may include, but are not limited to, the sections listed below.

Refer to Appendix A2 for a detailed explanation of BIM Uses and the process to establish them for each project. BIM Uses shall be included in the BIM Execution Plan (BEP) for each project. Use Appendix A3 to develop the project BIM Uses worksheet.

1.01: Design Authoring

Design Authoring tools allowed for the creation of BIMs based on the project's design criteria, and as per requirements defined in this standard. It also includes a series of attributes within its database.

1.02: Design Review

Design Review tools allowed all stakeholders to view the data contained within BIMs, in 2D and 3D, and provide feedback to validate multiple design aspects, such as the program, the spaces, the payout, its proportions, conflicts, etc.

1.03: Sustainability Evaluation

Sustainability Evaluation tools allowed to study, evaluate, and track the performance of a project by using standardized score system, such as LEED or Green Globes.

1.04: Engineering Analysis

Engineering Analysis tools allowed to develop, simulate, optimize, and refine the behavior of BIM models, such as Structural, Lighting, Mechanical, Energy, etc. to reduce the project's life cycle cost.

1.05: 3D Coordination

3D Coordination tools allowed to automate the process of identifying geometric conflicts within the BIMs.

1.06: Quantity Take-Offs

Quantity Take-Off tools allowed to automate the process of extracting and counting the number of items, elements and/or objects associated with a project.

1.07: Cost Estimation

Cost Estimation tools allowed to assist in the generation of accurate pricing of the project by associating unit cost to the items, elements and/or objects identified as part of the Quantity Take-Offs.

1.08: Additional BIM Uses

- Reality Capture
- Existing Conditions Modeling

- Compile Record Model
- Phase Planning (4D Modeling)
- Monitor Maintenance
- Monitor Assets
- Monitor Space Utilization
- Analyze Emergency Management

Refer to Appendix A6 for example process maps.

CHAPTER 2: BIM PROCESS AND TEAM

The BIM process sets the plan for sharing information throughout the project lifecycle and the related staff responsible for successful BIM implementation.

2.01: BIM Authoring Software

The Architects, Structural Engineers and MEPF Designers must model their systems in Revit. The Civil Engineer shall deliver DWG files from Autodesk Civil 3D. The version number of any software to be used including collaboration software (e.g., Revit, Civil 3D, Navisworks, etc.) must be documented in the BEP at the start of the project and must be maintained throughout project close-out unless the team agrees to upgrade to a newer version. Refer to Table 2.01 for the approved list of authoring software.

TABLE 2.01: AUS APPROVED SOFTWARE

Discipline	Software	Comments
Architectural	Revit 2023	
Structural	Revit 2023	
MEPF	Revit 2023	
Civil	Civil 3D 2023	
BIM Collaboration	Navisworks 2023	

2.02: BIM Kick-Off Meeting

A BIM kick-off Meeting shall be scheduled at the project kick-off to discuss the expectations for compliance with the AUS BIM process along with how BIM will be implemented in the project.

2.03: Project Collaboration Environment

Collaboration platforms are digital environments for sharing files specific to a project and/or site. Platforms may include additional functionality such as meeting tracking, submittals, requests for information (RFI), mark-up tools, etc. AUS approved sites must be used. If a new site is required for a specific project, AUS shall review and provide approval prior to its use.

Autodesk Construction Cloud (ACC)

Autodesk Construction Cloud connects workflows, teams, and data at every stage of construction to reduce risk and maximize efficiency. It is an Autodesk cloud-based solution that allows project teams to effectively work in a collaborative environment. In the Architecture, Engineering, and Construction (AEC) industry, it connects all project stakeholders to execute projects from conceptual design through construction and project turnover. Construction Cloud is the overarching concept that is comprised of various modules focusing on distinct aspects of the project lifecycle. Refer to the ACC Standards, Appendix D3, for more information.

Procore

Procore is a web-based Project Management platform for recording Reports, Submittals, RFIs, Meeting Minutes, Tasks, Documentation, Reviews, and more. Refer to Procore documentation for more information.

2.04: Roles and Responsibilities

1. AUS BIM Manager
   The AUS internal BIM Manager will be the main contact for receiving airport standards and files. The Lead Project BIM Manager shall work directly with the AUS Project Manager to use the current approved standards and review all potential additions or changes. The AUS BIM Manager is responsible for:
   - Develop first version of Project BEPs with Project Manager coordination.
   - Coordinates issues, questions, and comments with AUS Project Manager
   - Provides current version of Digital Governance documentation to AUS Project Manager
   - Attends coordination and clash detection meetings if selected as AUS representative.
   - Review project milestone deliverable native files with deliverable checklist
   - Collect, archive, publish, update, and distribute BIMs for internal integrations.
   - Update AUS Federated models.
   - Distribute latest versions of Digital Governance documentation and provide to AUS website team for public access.

2. Lead Project BIM Manager
   Each project utilizing BIM shall have a Lead Project BIM Manager designated in the BEP as the point of contact for the AUS Project Manager. The Lead is responsible for:
   - Complete project BEPs following project kick-off.
   - Responsible for management of the Autodesk Construction Cloud project
   - Maintains project Federated model.
   - Conducts clash detection and review meetings.
   - All correspondence is conducted through the Project Manager
   - Coordinates BIM for all disciplines on the project
   - Distributes and oversees the adherence to AUS standards.
   - Assists in submitting deliverables with the transmittal to AUS.
   - Hosts spatial and clash detection coordination meetings.
   - Updates project BEP as effort progresses

3. Discipline BIM Manager
   Each contributor to BIMs shall have a BIM Manager designated in the BEP as the point of contact for all BIM related interactions. The Discipline BIM Manger is responsible for:
   - Coordinating AUS BIM requirements to their team
   - Review models and attend clash review meetings.
   - Distributes and oversees the adherence to AUS standards at the team level.
   - Oversees development and production of deliverables and BIMs.
   - Assists in submitting deliverables with the transmittal to AUS.
   - Provides model exports to Lead Project BIM Manager for spatial and clash detection coordination.
   - Attends spatial and clash detection coordination meetings.
   - Distributes and assists discipline team with clashes and review comments.

4. Discipline BIM Contributor
   The Project BIM Coordinator is responsible for:
   - Development of BIMs for their team
   - Updating native files from quality, coordination, or clash reviews
   - Adherence to the AUS standards

CHAPTER 3: MODEL AND CAD CONVENTIONS

Computer Aided Design (CAD) comprises the graphical and modeling requirements on all projects regardless of the authoring software. Following AUS drafting practices produces a uniform package.

3.01: Naming Conventions

Electronic files shall be named following the AUS naming conventions, including Revit files (RVT), Sheet files (PDF), Revit Family files (RFA), Navisworks files (NWF, NWC, NWD), AutoCAD files (DWG), Image files (JPG), Animation files (AVI), Microsoft Office files (DOC, XLS, HTML, TXT) among others. Naming conventions apply to all disciplines awarded scope on AUS projects. For additional file naming conventions coordinate with AUS Document Control for the latest naming convention standards.

Files

All digital design files use the structure shown in Figure 3.01, except for sheets (Figure 3.02). Refer to Appendix D4 for the discipline and file type codes. Version specific file types, such as Revit or AutoCAD, shall include the version within the file name. For example, an Architectural model developed in Revit would be named:
"74159-A-3-23.rvt."

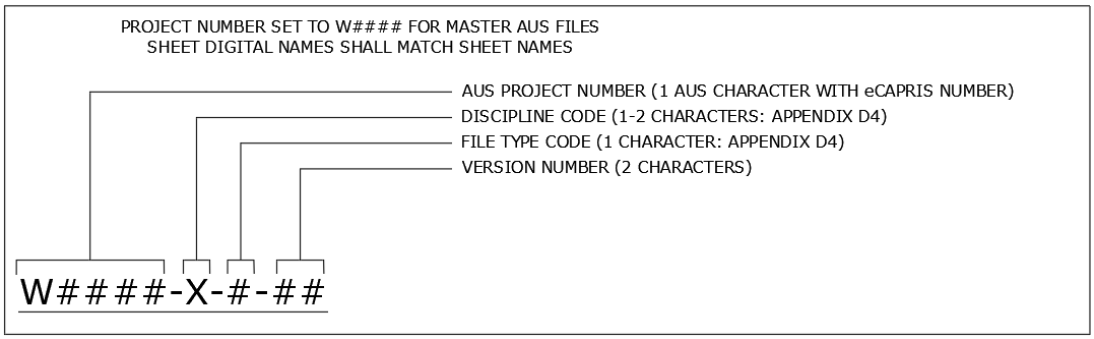

FIGURE 3.01: FILE NAMING CONVENTION

Sheets

Sheet files follow a similar structure as other files, but with the replacement of file type for sheet type. Sheet types organize a package to group drawing categories for each discipline. Refer to Appendix D4 for sheet type codes. The AUS project number shall only be applied to the sheet file and is removed within the titleblock field for sheet number.

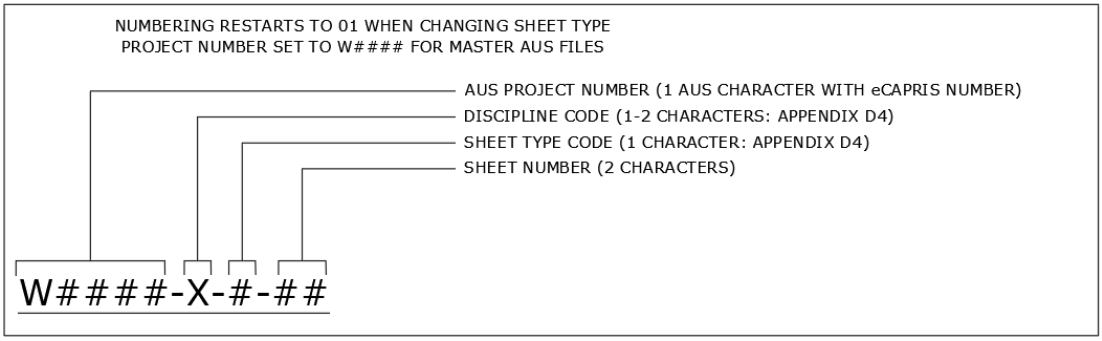

FIGURE 3.02: SHEET NAMING CONVENTION

Rooms and Spaces

Rooms represent volumes of occupiable spaces within a building/structure, while Spaces include volumes above ceilings such as chases or plenums. Rooms are typically used by Architectural, and spaces are utilized by Engineering. Names and numbers shall follow the AUS structure. Spaces inherit the names and numbers from the linked Architectural model(s). Rooms and Spaces shall be placed based on the standards defined in Building Owners and Managers Association's (BOMA) Mixed-Use Properties: Standard Methods of Measurement. Both rooms and spaces must be added to each Revit phase listed, refer to section 4.15.

Room and Space naming is not established in version 2.0 of the BIM Guide and Standards. Coordinate room and space requirements with the AUS Project Manager, BIM, and GIS Departments.

Layers

Layers are specific to AutoCAD products (Section 5.02), but impact authoring software including Revit and Navisworks. Layers must follow the structure shown in Figure 3.03. The structure follows the National CAD Standard (NCS) and is aligned to City of Austin's (COA) approach, unless otherwise noted. Refer to Appendix D4 for approved layer naming requirements. New layers, not defined in the BIM Guide and Standards, must be reviewed, and approved by the AUS BIM Department.

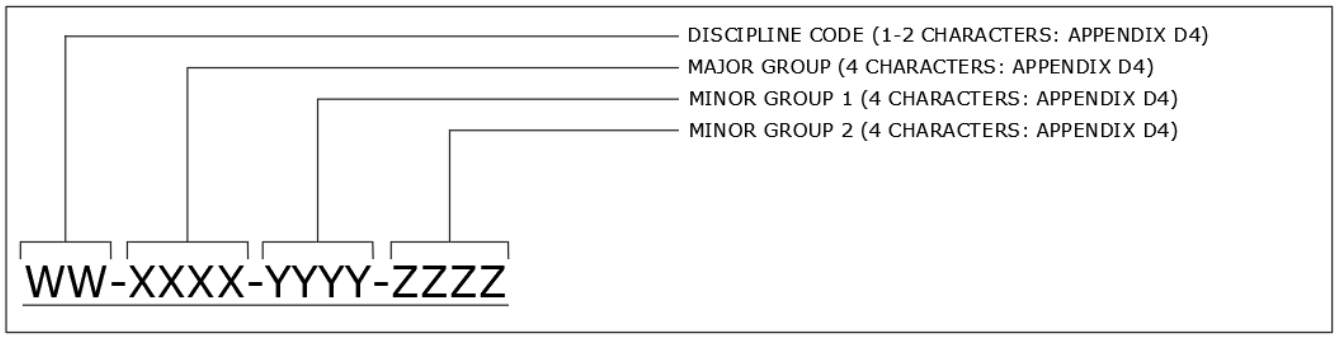

FIGURE 3.03: LAYER NAMING CONVENTION

References

References, like Layers, are specific to AutoCAD products (Section 5.05) and must follow the structure shown in Figure 3.04. Refer to Appendix D4 for approved reference naming requirements.

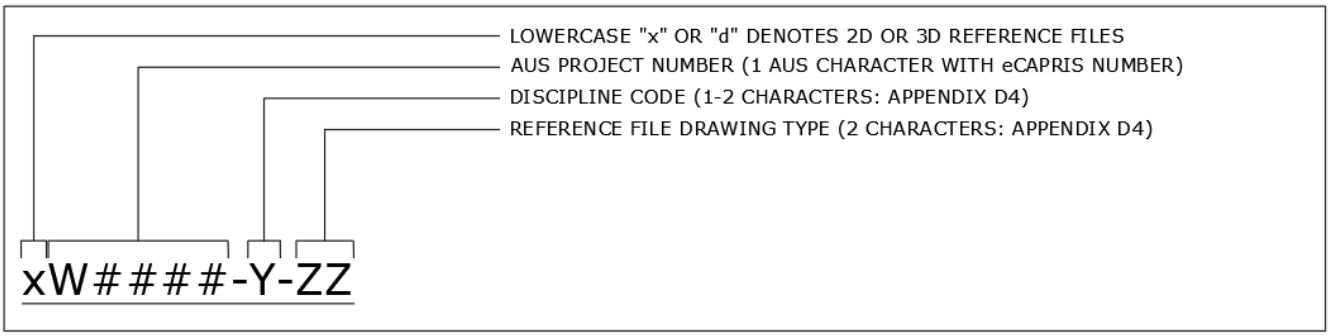

FIGURE 3.04: REFERENCE NAMING CONVENTION

3.02: Annotation

Text

To ensure consistency between consultants and their documents, the approved font for all construction documents will be a True Type font “ARIAL.” However, for certain conditions such as presentation or conceptual graphics, other fonts may be more desirable. To ensure consistency only true type fonts will be allowed. The use of fonts in this manner will ensure consistency throughout the set of construction documents and eliminates the management of any specific resource files.

The standard text size shall be 3/32” and is the minimum allowed. Except for Cover Sheets and Titleblocks, text larger than 1/4” will not be used in the development of any construction documents.

Text shall be Top Left justified and oriented in the horizontal or vertical direction only. Vertical text shall be displayed to read from the bottom to top.

Leaders

Leader lines shall be straight lines with an angle to differentiate from other drawing lines. Leaders shall not cross other annotation elements. When terminating to the left, leaders shall be top-left justified and bottom-right justified while terminating right.

Dimensions

Dimensions shall indicate a unit of measure within the construction documents. All dimensions are middle bottom justified with the lead lines below the text. When placed to the right or left of the leader, text shall be centered with the line starting on the side pointing towards the center of the drawing.

Abbreviations and Acronyms

All words or terms shown on sheets should be spelled completely and abbreviations or acronyms should not be used unless necessary to save space or for clarity. All must follow the AUS approved list in Appendix D4. Discipline specific terms must be included on package lead sheets.

3.03: Sheets

Sheets represent the drawings issued in a package and must follow the items outlined within this section.

Titleblocks

Titleblocks are the border of a drawing containing project information such as name, number, purpose, and status. The project size shall be determined and recorded in the BEP. Table 3.01 contains the available sizes and approved uses.

TABLE 3.01: AUS TITLEBLOCK SIZES

Name	Size (Inches)	Approved Uses
ANSI A	8.5 x 11	Design Sketches
ANSI B	11 x17	Design Sketches
ARCH E1	30 x 42	Preferred project size

Keyplan

Keyplans represent the scope boundaries of a project within the AUS properties and/or buildings. Vertical projects shall contain keyplans consisting of the building perimeter with shaded regions for the drawing scope of work. Regions must follow the approved zoning set by AUS. Enlarged plans shall use the matching zone where the scope is located, and a callout is required on an overall or zone plan. Horizontal Site and Civil drawings must include a keyplan of the property in place of the building footprint. Building indication shall match the approved abbreviation or number. All project cover sheets will include a location map indicating scope of work within the AUS site. Supporting drawings including lead sheets, details, schedules, etc. do not require a keyplan.

Building and Site zones are not established in version 2.0 of the BIM Guide and Standards. Coordinate zone requirements with the AUS Project Manager, BIM, and GIS Departments.

North Arrow

North arrows display the direction of a plan view in relation to the geographical true north orientation. Project north shall be set to reduce drafting at angles outside of 90 degrees. North arrows are placed within the title block and should be near the keyplan. If drawings contain views with multiple orientations, a north arrow is required for each and located near/on the viewport.

Views

Views represent the design content displayed within a titleblock. All views must include a view title placed below in the bottom left-hand corner. View titles will include view number, view description, text, and graphical scales.

Scales

Scales set the size ratio of content displayed on a drawing. Overall building and zone scales shall be determined at the start of the project. Additional scales can be used for sections, elevations, enlarged plans, site and civil drawings. Sheets with multiple scales, “As Indicated” shall be noted within the titleblock. Views not to scale shall be indicated by “N.T.S.” When all views are not to scale, it will be noted in the titleblock with “N.T.S.”

Graphical representation of scale (bar scale) is required for all sheets containing a plan view. Bar scales shall be located below the view title and match the text scale. If the horizontal and vertical scales are different, both graphical scales must be included.

Keyplan zones approved within section 3.03 shall use the scales in Table 3.02 in replacement of selecting a scale at project start.

TABLE 3.02: KEYPLAN SCALES

Location	Zones	Scale

Stamps

Titleblocks will contain an area reserved for the City of Austin, Professional Architect/Engineers, and additional departments on a per project basis. All drawings must be stamped and signed when issuing bid, permit, or construction documents. Stamps must be inserted into sheets individually and cannot be referenced.

Revisions

A revision line must be added for deliverables issued at each milestone. Revision lines will consist of Number, Date (DDMMMYY), Description, and Initials of Architect/Engineer of record. Numbering will be alphanumeric, starting with A, for milestones prior to construction documents. When issuing construction documents (CD) numbering will switch to numeric, starting with 0, and all pre-construction revisions will be removed from the revision schedule. Following construction documents, all future addendums or bulletins will contain revision clouds, with adjacent triangle, encompassing changes from the previous submission. Clouds and triangles from previous revisions shall be turned off to not display on drawings but will remain within the project file.

Titleblocks are limited in lines available for revisions. If the number exceeds the limit, the oldest will be deleted and the newest added to the current revision field.

The following revision descriptions are standard names for AUS milestones and submissions.

- ISSUED FOR SCHEMATIC REVIEW
- ISSUED FOR 30% REVIEW
- ISSUED FOR 60% REVIEW
- ISSUED FOR 90% REVIEW
- ISSUED FOR 100% REVIEW
- ISSUED FOR PERMIT
- ISSUED FOR CONSTRUCTION
- ISSUED FOR ADDENDUM
- ISSUED FOR BULLETIN
- ISSUED FOR RECORD

If an additional revision is required, revision information shall be provided by the AUS Project Manager and formatted to match the content displayed in the titleblock, examples below.

"A |##ZZZ## | ISSUED FOR 30% REVIEW | XXX”
“0 |##ZZZ## | ISSUED FOR CONSTRUCTION | XXX”
“1 |##ZZZ## | ISSUED FOR ADDENDUM X | XXX”

Notes, Legends, Abbreviations

Information, notes, legends, abbreviations, and acronyms associated with a single plan drawing may be added to a sheet. All remaining general information, notes, legends, abbreviations, and acronyms must be on separate sheets.

Cover Sheet

Cover sheets represent the first sheet in a drawing package and may include a 3D view, project contributors, and AUS information. Projects are required to include a cover sheet. Cover sheets must include a site map with indicating the scope(s) of work location. Locations shall be marked with the word “SITE” and related leader, pointing to a hatch of the scope boundary.

Index

Sheet indexes contain the full list of drawings issued and is required for all projects. The index shall have a dedicated sheet and will follow the cover sheet as the second drawing. Indexes will be grouped by discipline and each sheet shall be listed in numerical order with the related submitted revisions. The total for each discipline and overall sheet count shall be indicated within the index.

Site Plan

Site plans represent the overall AUS campus on a single sheet. All projects must include a site plan sheet indicating the location of the scope. AUS master development plans must follow City of AUS Ordinance No. 20230914-101 for site plan standards. Request ordinance from AUS Project Manager.

Voids

Voids represent portions of a sheet that shall be removed from the project. Voided areas shall be outlined with an “X” spanning the outline. The word “VOID” shall be placed at the center of the “X.” If an entire sheet will be voided, the “X” shall extend from corner to corner of the titleblock. The word “VOID” shall be placed across the sheet number in the titleblock and sheet index as well.

3.04: Symbols

Each discipline is required to maintain an accurate lead sheet containing the symbols used on drawings. Symbols will consist of both annotations and design elements. AUS standard symbols will be available in the provided kit-of-parts.

3.05: Hatches

Hatches represent graphical patterns. All information represented by hatches shall be clearly indicated. Refer to Appendix D5 for more information.

3.06: Color

The use of color shall be limited to indicate elements, systems, models, etc. for collaboration purposes only. Color shall not be used for deliverables, except when indicated by AUS.

3.07: Units

Units shall be Imperial Inches or Feet; Metric units are unacceptable for AUS projects.

3.08: Coordinates

Design files are to use the AUS coordinate system **U.S. NAD-83 Texas Central Zone with NAVD-88 for vertical datum**. Refer to Tables 3.04-3.06 and Figure 3.05 for point locations. The BEP or Reality Capture Execution Plan (RCEP) shall contain the selected coordinates for each project. Coordinates established shall be listed under the BEP or RCEP for documentation and review by AUS. Selected coordinates shall be marked in all design files to verify exports and links are aligned.

TABLE 3.04: AUS SHARED COORDINATES

Name	X Coord. (usft)	Y Coord. (usft)	Z Coord. (usft)	Description	Geodetic Position
Runway 36L (FAA)	3,135,379.554	10,039,191.590	487.3	TX State Plane NAD-83, Central Zone	Lat: 30° 10’ 47.7956” N Long: 97° 40’ 42.5089” W
BERGS	3,139,597.378	10,042,904.719	480.5	TX State Plane NAD-83, Central Zone	Lat: 30° 11’ 23.5405” N Long: 97° 39’ 53.4534” W

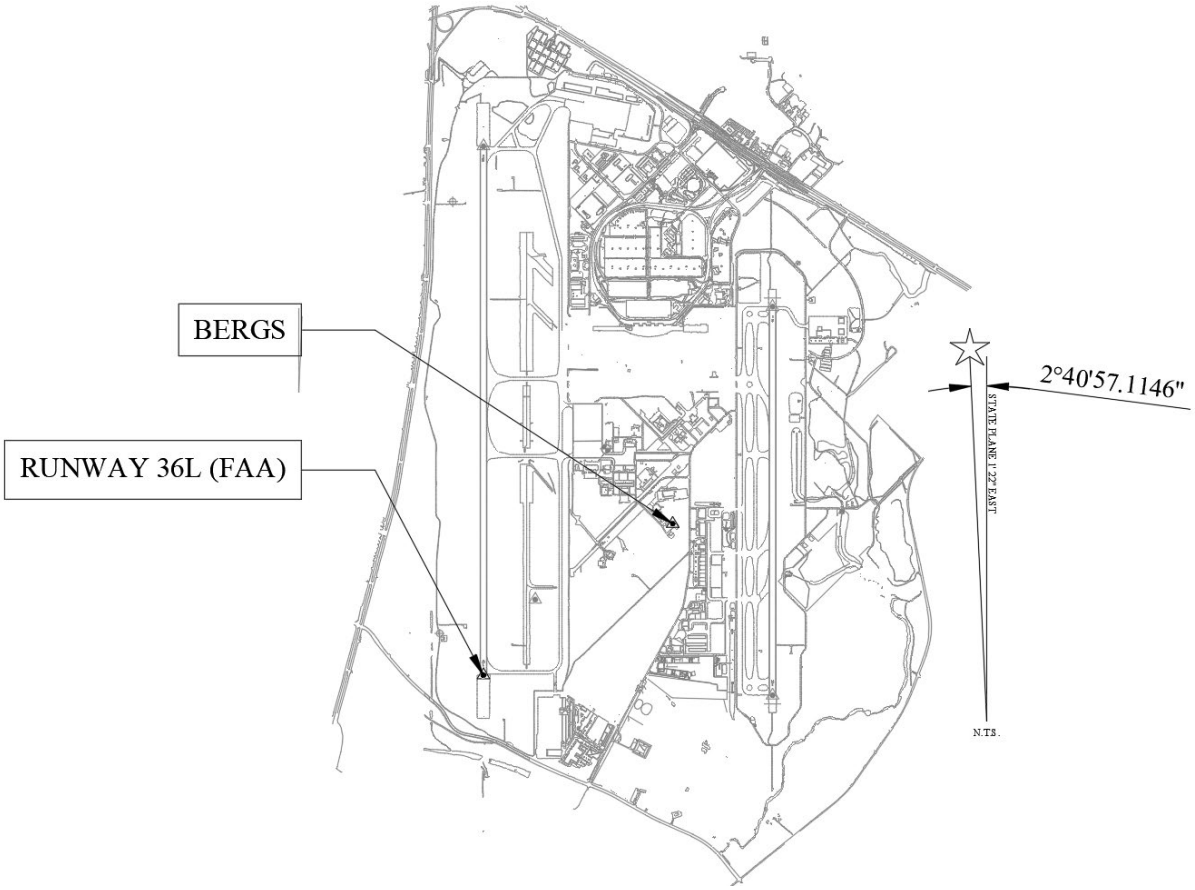

FIGURE 3.05: EXISTING SHARED COORDINATE LOCATIONS

The project north arrow will be dependent of the building orientation displayed on drawings. All approved north arrow rotations shall be listed in Table 3.05.

TABLE 3.05: NORTH ARROW DATA

Building/Model	Project Rotation from True North

The project elevations for both horizontal and vertical designs shall be indicated for each project and must use the elevations in Table 3.06 throughout the project lifecycle to maintain reference with the selected shared coordinates. New elevations shall be listed in the project BEP for AUS review.

TABLE 3.06: PROJECT ELEVATIONS

Building/Model	Elevation Name	Elevation (FT-IN)

CHAPTER 4: MODELING REQUIREMENTS

Modeling requirements take the information set under Chapter 3 and defines how each software structures and utilizes the content. Software listed under this section are the approved platforms. Unapproved authoring software must be reviewed with AUS and have the functionality to produce files in the formats under Chapter 6. This section covers software used for generating deliverables only.

Revit is the primary design software, but in specific cases AutoCAD and Civil 3D are acceptable alternatives (Chapter 5).

4.01: Model Level of Development

The BIM Level of Development (LOD) describes the level of completeness a BIM is developed and their minimum requirements. The LOD is accumulative and should progress from Level to Level. At a minimum, all required BIMs shall be detailed to the Level of Development required by each design phase.

BIMs shall be created and include all geometry, physical characteristics, information, and data necessary to meet the requirements, as described in this document and the AUS BEP. All drawings, and services required for analysis and review shall be exports from the BIMs.

The intent and requirements for a modeled building element is different for each discipline, phase, and LOD. It is to provide overall size, shape, clearances, information, data, and the orientation of a modeled building element for its installation and coordination with other required work, as well as for the population of required schedules. Required building elements need not illustrate/depict individual parts that are required for the assembly and/or the manufacture of the modeled building element.

Reference Appendix A4 and A5 for Level of Development Worksheet/Matrix.

Note:
The BIMForum LOD Specification Guide December 2020 has been used as a reference when defining the AUS minimum LOD requirements.

LOD 100

The model element may be graphically represented in the BIM 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.
BIMForum 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.

LOD 200

The model element is graphically represented within the BIM 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.

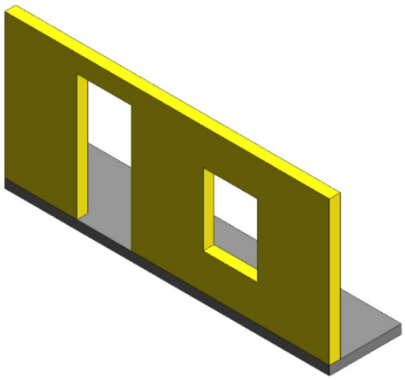

FIGURE 4.01: BIMFORUM LOD 200 EXAMPLE

BIMForum 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.

LOD 300

The model element is graphically represented within the BIM 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.

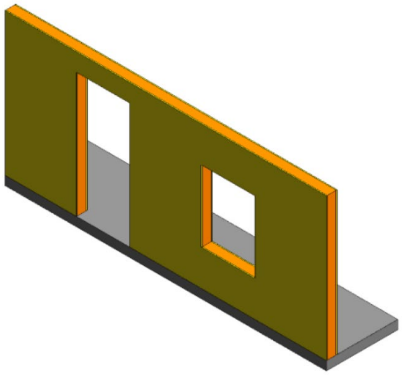

FIGURE 4.02: BIMFORUM LOD 300 EXAMPLE

BIMForum 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 callouts. The project origin is defined, and the element is located accurately with respect to the project origin.

LOD 350

The model element is graphically represented within the BIM 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.

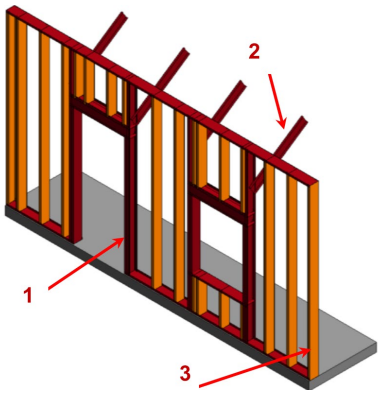

FIGURE 4.03: BIMFORUM LOD 350 EXAMPLE

BIMForum 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 callouts.

LOD 400

The model element is graphically represented within the BIM 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.

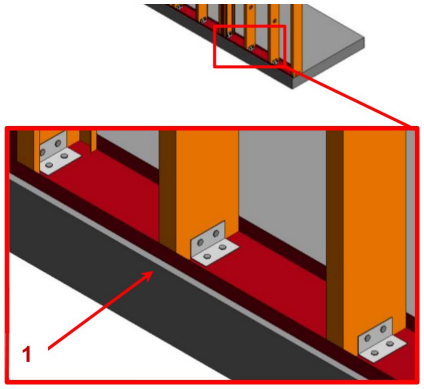

FIGURE 4.04: BIMFORUM LOD 400 EXAMPLE

BIMForum 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 callouts.

4.02: Model Quality

AUS requires that all BIMs be developed using object-based elements only, such as Columns, Beams, Walls, Doors, Windows, etc. along with their associated parametric information. This requirement shall be maintained throughout the entire project.

4.03: Project Browser

Content within Revit is sorted by the Project Browser based on preset Revit type grouping: Views, Legends, Schedules, Sheets, Families, Groups, and Revit Links.

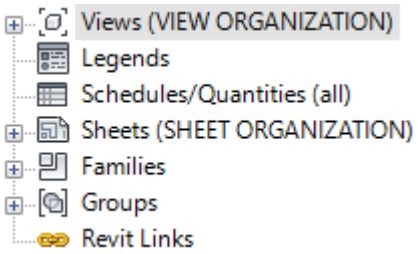

FIGURE 4.05: AUS PROJECT BROWSER

4.04: Views

The views in the browser are organized by View Category (primary grouping) > View Group (secondary grouping) > View Type (tertiary grouping).

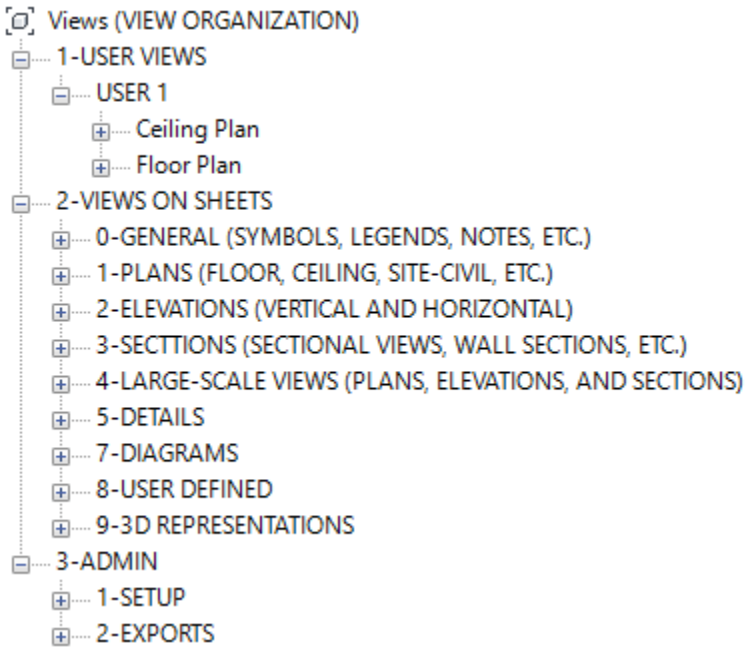

FIGURE 4.06: VIEW SECTION OF PROJECT BROWSER

4.05: Sheets

Sheets in the browser are organized by sheet category (primary grouping). Design contributors on all AUS projects shall follow the Sheet Set organization as shown below:

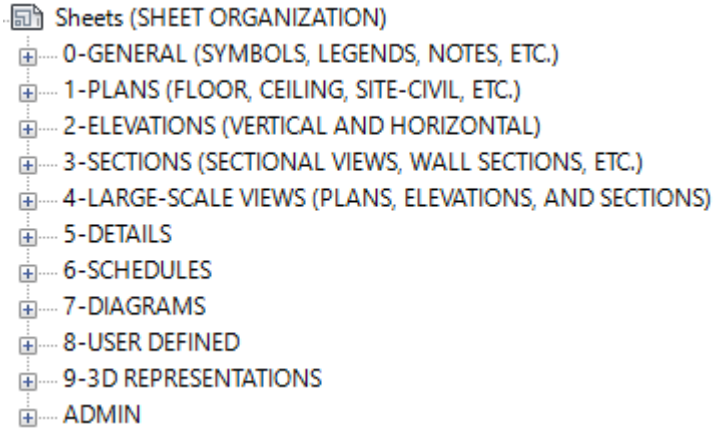

FIGURE 4.07: SHEET SECTION OF PROJECT BROWSER

4.06: Project and Shared Parameters

Parameters are data fields within Revit used for storing information. Information can be utilized throughout the model, linked models, and other AEC platforms. Shared parameters must follow the naming structure below and in ALL CAPITALS. AUS specific parameters are available in the standard shared parameter text file with the provided kit-of-parts.

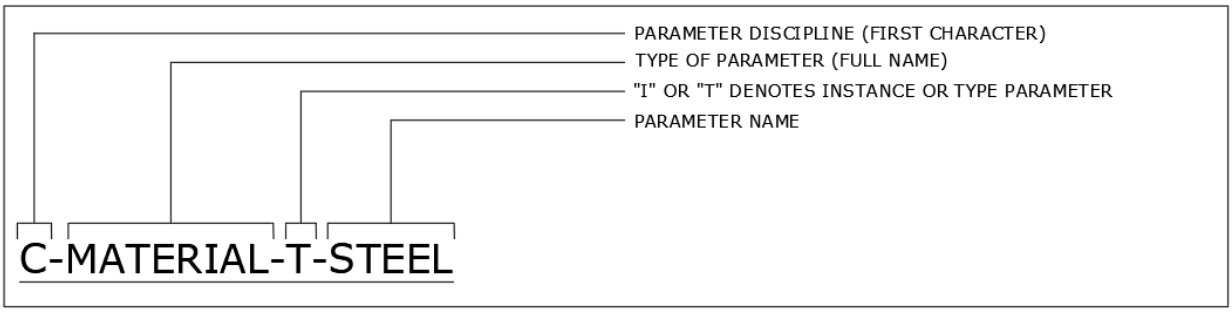

FIGURE 4.08: SHARED PARAMETER NAME STRUCTURE

4.07: View Naming Conventions

Views defined with Sentence Case are considered working views and will not appear on package sheets. Views with names in ALL CAPITALS are considered sheet views are intended to be placed on titleblocks.

4.08: Level Naming Conventions

Levels must be clearly named indicating the elevation in relation to a horizontal or vertical design. Similar elevations shall include the building name, number, or code. Refer to the project BEP for the selected levels.

4.09: View Templates

View Templates are visibility and graphic settings saved as a snapshot for future use. AUS template does not contain view templates and external parties may use their companies' standards.

4.10: Styles

Standard styles are defined in the AUS Revit template(s) and should be used by all contributors in projects for AUS. Styles include:

- Line Styles (Widths and Patterns included)
- Text Types
- Dimension Types
- Annotation symbols and tags
- Filled Regions

4.11: Families

Families are 2D or 3D model elements, within Revit, and are the building blocks for generating a design. AUS standard families are available within the provided kit-of-parts. The latest kit-of-parts will be provided at project kick-off. External parties may use their companies' families for design and construction where AUS families are not available or standardized.

4.12: Assets & Attributes

Assets and related attributes are defined within the AUS Asset Management Standards, Appendix D2. Revit families and schedules shall utilize AUS shared parameters to incorporate attribute data into the model.

4.13: Worksets

A Workset is a collection of Elements/Objects, Components, Systems and/or Services, such as Columns, Walls, Doors, Windows, Ducts, Pipes, etc. that can be accessed by multiple users at a given time but ensures that individual elements/objects are only ever edited by a single user at a time. No member of the team shall ever be listed as an owner of a Workset but shall instead be listed as a borrower. This ensures that they have not locked out other team members from editing all content on that Workset.

To help manage file performance, users can load or unload model geometry and data from individual Worksets if they do not need to see or edit the content on them. This is done via the Open and Close option in the Worksets dialog window and is available during the File Open dialog as well.

Any 3D content created will reside on the Workset listed as 'Active'. These elements can be moved to other Worksets later by selecting the Object and modifying the Workset Parameter information in its Properties under the Identity Data Group.

When working with Worksets, users must use the following settings to ensure changes are saved to the Local and the Central models, as well as relinquish previously owned Worksets. Reload Latest, in place off Synchronize, will be used until Local updates need to be uploaded to the Central model. This will reduce synchronization time and issues with concurrent syncs.

1. Reload Latest (Load Central model updates without uploading Local changes)
2. Synchronize with Central (Load Central model and upload Local changes)
3. Save to Local
4. Relinquish All Mine

When worksharing a model, Revit automatically generates two worksets "Working1" and "Shared Levels and Grids". Working1 shall be renamed to match the discipline of the model. The list below shall be included in all models. Additional Worksets can be added but should be used sparingly. Worksets are not to be used as a tool to turn elements on/off. These should be thought of as buckets to group elements beyond the capabilities of Visibility and Graphics.

1. AutoCAD Links
2. Revit Links (One per model)
3. Discipline (Working1)
4. Shared Levels and Grids
5. Scope Boxes and Matchlines

4.14: Design Options

Design options are groups of model elements to generate multiple choices of the design. Options shall be used sparingly, and both the set and instances must be labeled clearly. Option labels cannot be named “Option 1” or “A”. Primary options are the default design displayed for all views and linked models. As a project progresses, the primary option must be updated to the most anticipated selection. Design options must be accepted following selection and all unselected options deleted. All design options must be removed when submitting Record deliverables.

4.15: Phasing

Phasing allows the representation of different elements of the model in different periods of the project for design, scheduling, and construction purposes. All objects added to a project have a phase created and a phase demolished parameter.

Revit tracks the phase in which elements are created or demolished and utilizes phase filters representing distinct stages of construction. Demo-specific phases shall not be created. Refer to Appendix D5 for more information on phasing graphics.

Phases within the project shall be consistent and coordinated across all disciplines. By default, Revit models contain “Existing” and “New Construction” phases that will be replaced with selected project phases. Selected phase names must match across linked-design models and other AUS projects referencing the model. All selected phases shall be added to the project BEP with a description identifying the phase’s content.

4.16: Linking

Project models are to be linked across all disciplines, regardless of whether it is required to produce deliverables. By linking models, the full project design is available for collaboration. Revit has the capability of linking external file types including DWGs, NWCs, IFCs, etc. The Lead BIM Manager should review external files to determine optimal linking. For DWGs, Revit has a secondary function for Importing. Importing should not be used for any reason. Linked models are to be Overlay only. Attached linking requires review by the Lead BIM Manager. Attaching will cause redundant references.

4.17: Printing

When plotting sheets to PDFs, the Revit template shall contain preset settings structuring the setup for all drawings in a project. New settings or alterations to existing must be reviewed with the AUS BIM department.

4.18: Exceptions

List out exceptions to the requirements described in Chapter 4 within the project BEP.

CHAPTER 5: AUTOCAD AND CIVIL 3D

AutoCAD and Civil 3D are secondary design software with specific cases where the platforms are optimal in comparison to Revit. Chapter 5 shall describe the specific cases and the authoring practices required. Authoring practices are developed based on the National CAD Standards (NCS) Version 6, the FAA Advisory Circular 150/5300-18B, and the City of Austin.

5.01: Use Cases

Master Maps (Base Files)

1. Basemap
2. Airport Layout Plan (ALP)
3. Utility Area Plan (UAP)
4. Signage and Marking Plan

Topography

Civil

Properties

Survey

Survey drawings must follow the standards defined in the BIM Guide and Standards and City of Austin's Survey Guidelines, Appendix B1.

5.02: Layers

Layers represent the grouping of elements based on a name, color, line style, and plot type. Refer to Appendix D5 for the complete layer list. Projects utilizing multiple phases, section 4.15, shall include the phase name or abbreviation as a minor code to separate content and align with Revit models.

5.03: Lines

Line styles should follow basic drafting principles in the selection of line styles wherever possible avoid the use of custom line styles. Refer to Appendix D5 for the complete line style list.

5.04: Blocks

Blocks are groups of 2D or 3D elements, which are referenced multiple times throughout the project. The symbology defined in Section 3.04 shall be used to graphically represent each block. All blocks shall be scaled at 1:1 with elements set to Layer 0. Layering shall be applied to the block within the model or layout space.

5.05: References

References (Xrefs) are linked files that operate in an equivalent manner to Revit as the environment the design is modeled in. References can be either horizontal or vertical and must be modeled at 1:1 scale. Vertical references shall be exported from Revit as cuts based on the related level/elevation. Exports must be from a Revit plan view with shared coordinates and units set to

Feet; sheets are not acceptable for referencing. All references must have insertion units set to Feet.

5.06: Sheets

Per Section 3.03, sheets are uniform for all design software, but AutoCAD and Civil 3D require linked references before plotting. References are to be linked as Overlay only to prevent circular references. Titleblocks will be placed in layout (paper) space, references with all required consultant logos and project information for efficient updating throughout a project. Drawing specific information shall be added to the layout (“paper”) space only, within the titleblock blocks. Notes, annotations, dimensions, callouts, and text required to convey design may be added under the sheet file’s model space. Multiple sheets can be stored within a single drawing file, where information is continued from one sheet to the next. For example, three sheets displaying a continuation of a site utility. Multiple sheets shall be used sparingly.

5.07: Printing

Printing from AutoCAD software must utilize the plot settings defined in Appendix D5 for all AUS projects. These settings shall be used for plotting PDFs and TIFFs.

5.08: Templates

AutoCAD and Civil 3D templates preset the information described in Chapters 3 and 5 to automatically start drawings with the same content. Templates shall be provided at the start of each project within the kit-of-parts.

5.09: Exceptions

List out exceptions to the requirements described in Chapter 5 within the project BEP.

CHAPTER 6: NAVISWORKS

Navisworks is an Autodesk collaboration platform which accepts a wide range of file types. A federated project model shall be generated by appending all design files and maintained throughout the project life cycle. The project BEP shall contain the date required to create the federated model.

6.01: Search Sets

Search Sets provide efficient selection of similar elements, systems, disciplines, etc. within the federated collaboration model. Sets shall utilize information extracted from the authoring software. Information must be located under the same data fields, attributes, or parameters, to provide accurate results. Search Sets are required for proper use of the Appearance Profiler and Clash Comparisons. Refer to Table 6.01 for complete list of Search Set definitions.

TABLE 6.01: SEARCH SET DEFINITIONS

Search Set	Category	Property	Condition	Value
Overall Discipline Model	Item	Name	Contains	-Discipline Code- EX: -A-
Model Category	Element	Category	=	Revit Model Category EX: Air Terminals

6.02: Appearance Profile

An Appearance Profile adds coloring to the federated model based on Table 3.06 and the Search Sets defined in Section 6.01. Disciplines can be separated to provide additional detail. New colors must be included in the project BEP.

TABLE 6.02: COLOR CODES

Discipline	**Color** (RGB Code)	Discipline	Color (RGB Code)
Architectural	**Set by Revit Graphics**	Operations	**(165-0-0)**
Geotechnical	**Set by Civil 3D Layers**	Plumbing	**(0-0-255)**
Civil	**Set by Civil 3D Layers**	Equipment	**(0-0-0)**
Process	**(255-0-128)**	Resource	**(82-165-165)**
Electrical	**(255-255-0)**	Structural	**Set by Revit Graphics**
Fire Protection	**(255-0-0)**	Telecommunications	**(189-189-126)**
General	**(165-124-82)**	Survey/Mapping	**Set by Civil 3D Layers**
Hazardous Material	**(255-127-0)**	Distributed Energy	**(255-170-170)**
Interiors	**(191-0-255)**	Other Disciplines	**(0-255-63)**
Landscape	**Set by Civil 3D Layers**	Contractor/Shop Drawings	**Set by Civil 3D Layers**
Mechanical	**(103-165-82)**		

6.03: Clash Comparisons

The Interference Check Tool can be used during the design process to coordinate major building elements/objects, components, systems and/or services allowing the identification of interferences earlier in the design process.

This tool can be used to find single-discipline or cross-discipline interferences, enabling effective identification, inspection and/or reporting of any interference. The use of the Interference Check Tool in Navisworks will have three outcomes within our BIM practice:

1. No Clash: This will be the perfect case scenario.
2. Soft Clash: Such as Ducts going through Partition Walls for example. This type of Clash will not require any additional action from the Team.
3. Hard Clash: Such as Columns going through Equipment for example. This type of Clash will require action from the Team.

The plan and schedule for clash resolution will be project specific and listed under the BEP. Refer to Table 6.02 for the recommended comparisons for clash coordination. Comparisons only apply if the disciplines are within the project scope. Adjacencies present all disciplines compared in one group. Groups can be separated as required for a project for more detailed clash reports. Contractor and shop drawings shall use the same comparisons based on the matching discipline of the drawing.

TABLE 6.03: CLASH COMPARISONS

Comparison	Comparison
Architectural vs. Adjacencies	Mechanical Piping vs. Electrical
Civil vs. Adjacencies	Mechanical Piping vs. Fire Protection
Electrical vs. Fire Protection	Mechanical Piping vs. Plumbing
Electrical vs. Plumbing	Other Disciplines vs. Adjacencies
Equipment vs. Electrical	Plumbing vs. Fire Protection
Equipment vs. Fire Protection	Process vs. Electrical
Equipment vs. Mechanical	Process vs. Fire Protection
Equipment vs. Plumbing	Process vs. Mechanical
Equipment vs. Process	Process vs. Plumbing
Hazardous Material vs. Adjacencies	Structural vs. Electrical
Interiors vs. Adjacencies	Structural vs. Equipment
Mechanical Ductwork vs. Electrical	Structural vs. Fire Protection
Mechanical Ductwork vs. Fire Protection	Structural vs. Mechanical
Mechanical Ductwork vs. Mechanical Piping	Structural vs. Plumbing
Mechanical Ductwork vs. Plumbing	Structural vs. Process
Mechanical Equipment vs. Adjacencies	Telecommunication vs. Adjacencies

6.04: Appending Files

Navisworks is designed to accept most file formats in the AEC industry. To maintain uniformity, NWC files shall be exported from authoring software and appended. NWC exports from Revit must use the settings shown in Figure 6.01. Exported 3D views must be set to show previous and new, detail level = fine, and graphic style = shaded prior to exporting. Native file types are to be used sparingly.

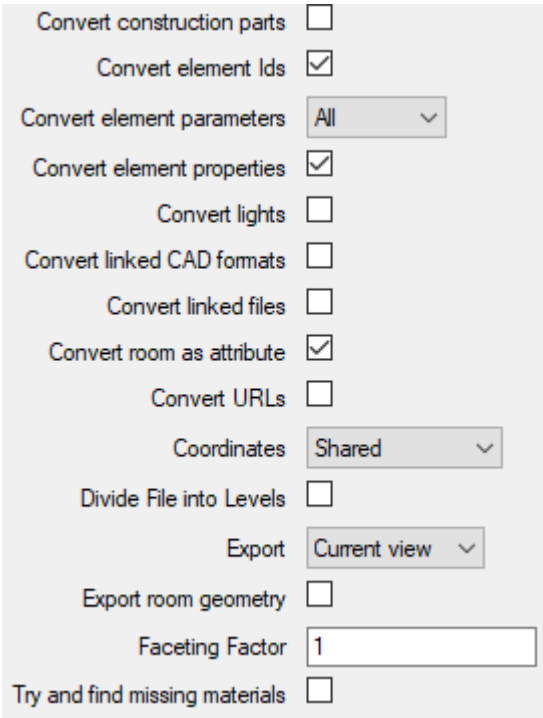

FIGURE 6.01: REVIT NWC EXPORT SETTINGS

6.05: Exceptions

List out exceptions to the requirements described in Chapter 6 within the project BEP.

CHAPTER 7: MODEL REVIEW

7.01: Spatial and Clash Resolution

Spatial and Clash Resolution is the process of identifying, reviewing, and fixing issues within the federated model. All projects must conduct Navisworks spatial and clash coordination and resolution during design and construction as defined in the project BEP. The Lead Project BIM Manager or designated clash detection coordinator shall generate the project's federated Navisworks model. Coordination shall be conducted by the project team and an AUS representative must be included in all reviews. AUS representatives from all disciplines affected by the project scope are recommended to be invited to reoccurring coordination sessions.

Coordination reports including but not limited to clash totals, assignments, resolution comments, owner comments, and resolution status must be submitted to the project team and AUS representative(s) following each review. The Lead Project BIM Manager or designated clash detection coordinator shall collect all comments and generate the reports. Reports shall be uploaded to the AUS project management platform for distribution.

Clashes must be grouped to condense the total number and provide a more accurate representation of the federated model's coordination status. For example, a pipe running through a duct will have a clash when entering and exiting the duct. The two clashes will be grouped to show as one overall clash.

7.02: Revit Models

Revit models shall be reviewed by each Discipline BIM Manager to maintain "healthy" models throughout the project lifecycle. At a minimum, the following items must be checked and resolved prior to submitting:

1. Warnings are resolved to maintain a minimal number.
2. Unused Families and Types are purged.
3. Unused links or imports are removed.

7.03: Project Federated Models

Project Federated models represent multiple BIMs combined to create one overall model of a horizontal or vertical structure. To maintain federated models, each must be reviewed on a consistent basis to incorporate changes from the project team or other AUS projects. The following steps must be conducted by the Lead Project BIM Manager or designated coordinator to incorporate changes into a federated model:

1. Verify all discipline models and references are uploaded and appended.
2. Check appended files are the latest version based on the update frequency established in the project BEP.
3. Verify all appended files are set to the appending settings in Section 6.04.
4. Coordinate with the Lead Project Manager and AUS Project Manager for additional updated files from other active or completed projects.
5. Save updated NWF to the project's ACC project.
6. Publish an updated NWD to the project's ACC project for spatial and clash coordination.

CHAPTER 8: DELIVERABLES

8.01: BIM Execution Plan (BEP)

As part of their respective proposals/bid submittals, the Architect and the General Contractor must review the AUS project BIM Execution Plan describing processes and procedures used to coordinate and deliver the BIMs and associated data according to the guide and standards contained herein. AUS will evaluate the proposals for alignment to the project BEP and provide feedback to BIM project requirements. Following award, the responsible party will take ownership of the project BEP and complete the remaining sections prior to modeling.

8.02: Model and Data Delivery

All models and associated support files shall reside on the project collaboration platform and will be received by AUS at the conclusion of the project.

8.03: Hardcopy Deliverables

Hard copies of drawings shall be provided when indicated within the AUS project contract, AUS BEP, or upon request by the AUS Project Manager.

8.04: Electronic Deliverables

BIMs and electronic files are required deliverables as indicated in the AUS contract documents. The following are data requirements for all deliverables:

- Architectural, Structural, MEPF, FA, FS, Communication, etc. 3D model(s) in Revit and Civil model(s) in Civil 3D at project milestones, final record, and as-built document submittals.
- Schedule deliverables as generated from the parameters embedded in the Revit model objects.
- Tag Image File Format (TIFFs) images for all submitted drawings. TIFFs must meet the resolution and file compression listed below.
    - Black and White drawings - 300 dpi with a Group 4 compression
    - Greyscale drawings - 300 dpi with a JPEG level 8 compression
    - Color drawings - 300 dpi with a JPEG level 6 compression
- Provided in the native file format used in the authoring software (As specified in the project BEP)
- PDFs of issued drawings contain page labels matching the drawing number and name. Each drawing with drawing references has a hyperlink to the sheet file.
- BIM files submitted to AUS, 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)
- Permit Packages sent to the COA Development Services Department (DSD) must be submitted in Vector PDF format using the online COA DSD Electronic Plan (ePlan) Review. COA DSD will not accept hardcopies. Consultants are responsible to permit the project through ePlan Review.

8.05: Transmittals

A transmittal is required for all deliverable packages summarizing the content and listing the provided files with matching revisions. All files within the transmittal shall be attached in the listed file format. If changes have been made to the drawings, the transmittal shall include a summary of changes, upon request by the AUS Project Manager. All submittals with transmittals shall be uploaded to the project collaboration environment with a notification sent to the AUS Project Manager and BIM Department.

8.06: Protection of Sensitive Security Information (SSI)

Any documentation submitted to the Aviation Department must comply with Section 01555 Airport Security Construction Requirements and the provisions described in the National Archives Code of Federal Regulations sections 49 CFR 15 and 49 CFR 1520.13. Transmittals must also indicate the documentation and electronic files classified as SSI.

8.07: Quality Review and Adherence

It is the expectation of AUS that the standards herein are reviewed, understood, and adhered to. This expectation applies to AUS staff, regional partners, and contractors or consultants performing services for AUS.

All submissions of deliverables received from external parties will be quality reviewed in accordance with these standards. Should all or part of a deliverable not be satisfied as adhering to these standards, AUS has the right to reject and require correction of any required deliverable that does not meet the requirements specified. Record packages shall not have any errors due to previous reviews during the project lifecycle.

APPENDICES:

TABLE OF FIGURES:

TABLE OF TABLES:

WORKS CITED:

“Level of Development Specification,” BIMForum, Dec-2021. [Online]. Available: https://bimforum.org/lod/.

“BIM Project Execution Planning Guide, 3.0,” Computer Integration Construction Program. [Online]. Available: https://psu.pb.unizin.org/bimprojectexecutionplanning/.

CREDITS

This manual was developed for and coordinated with the Aviation Department of the City of Austin and the AUS BIM Department. It is a tool that is provided to assist in the implementation of BIM as required per AUS standards and contracts.

Please direct any questions about this manual to the AUS Project Manager. Please do not contact any of the other contributors pertaining to this manual.

End of Document