



BIM – Record File Standards

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About this book

The intent of these guidelines is to provide a framework for all Revit as-built deliverables, including:

- Revit Architecture
- Revit MEP
- Revit Structure

This guide is NOT intend to be a Revit tutorial, but rather assumes that the user has a sufficient level of proficiency to comprehend the requirements outlined in this guide.

By using these standards, LAWA will achieve a standardized approach to spatial data management and related record document(s) that will bring many benefits to both the organization and its staff. These benefits include, but are not limited to:

- consistent and more reliable data that will lead to more informed decision making
- closer integration with other LAWA information systems and LAWA spatial data users
- portability of staff skills
- greater interoperability with organizations outside of LAWA

Relation to existing standards

The LAWA standards have adapted and extended a series of BIM standards already developed or approved by USACE_CAD-BIM_Technology Center and the National BIM standard (United States):

Who should read this book

These BIM standards are for use in-house by LAWA and for architects, engineers, surveys and consultants delivering information to LAWA. The purpose of these standards is to ensure all relevant BIM data files and related geospatial datasets meet LAWA standards.

How this book is organized

After the introduction, this book contains the following sections:

- Data Segregation
- Folder Structure and File Naming Conventions
- Project Browser and View Organization for Record Files

Related documents

CAD, GIS, Survey, Metadata and EDI standards along with other documentation related to these standards are available on the LAWA website. [LAWA Standard Documents and Guidelines](#)

BIM Model organization

Revit files (.rvt) contain all views (model based or sheet based) in the same file.

Using agreed upon conventions makes it easy to identify the:

- Discipline
- Project number
- Project Zone (where applicable)
- Model description
- Revit Version

These guidelines focus primarily on adaptation of standards for practical and efficient application of BIM, particularly at the handover (Record - As-Built) stage of a project.

The objectives are:

- To maximize efficiency through adopting a coordinated and consistent approach to working in Revit Models.
- To define the standards, settings and best practices that ensures delivery of high quality data and uniform drawing output.
- To ensure that digital Revit files are structured correctly to enable efficient data sharing within LAWA.



Revit is the BIM software of choice within LAWA
The Revit software version will be determined and enforced per project
Revit, record files must reflect the As-Built conditions

Abbreviations

AEGIS	-	Airport Enterprise Geographical Information System
ANSI	-	American National Standards Institute
BIM	-	Building Information Modeling
CAD	-	Computer Aided Design and Drafting
CPPE	-	Capital Planning, Programming and Engineering
CSDGM	-	Content Standard for Digital Geospatial Metadata
DDMS	-	Document & Drawing Management System
EDI	-	Electronic Data Interchange
FAA	-	Federal Aviation Administration
FGDC	-	The Federal Geographic Data Committee
GIS	-	Geographic Information System
GISSSD	-	GIS Support Services Division
IMTG	-	Information Management Technology Group
ISO	-	International Organization for Standardization
LAWA	-	Los Angeles World Airports
LAX	-	Los Angeles International Airport
ONT	-	Ontario Airport
PMD	-	Palmdale Airport
SDSFIE	-	Spatial Data Standards for Facilities, Infrastructure, and Environment
VNY	-	Van Nuys Airport

Standards in use at LAWA

LAWA Standards

This section provides an overview of LAWA specific standards, plus related federal, local, and national standards. LAWA standards have been created to improve productivity and reliable information exchange through the full life-cycle of geospatial data, CAD and BIM files along with related documents.

LAWA Metadata Standards

Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information.

LAWA CAD Standards

The LAWA CAD standards are based largely on the AIA CAD Layer Guidelines and the National CAD Standards (NCS), adapted where necessary to suit LAWA-specific requirements.

LAWA GIS Standards

The LAWA GIS standards are directly based on the ANSI Spatial Data Standard for Facilities Infrastructure and Environment (SDSFIE), Release 2.60, extended in certain areas to handle specific information relevant to LAWA. *GIS Standards for LAWA Projects* presents the most important aspects of SDSFIE as it applies to LAWA.

LAWA Survey Standards

The LAWA Survey and Remote Sensing Standards are based on requirements laid out in Airport Circulars published by the FAA, adapted where necessary to suit LAWA-specific requirements.

LAWA BIM Standards

These guidelines focus primarily on adaptation of standards for practical and efficient application of BIM, particularly at the handover (Record - As-Built) stage of a project. Based on USACE_CAD-BIM_Technology Center: version 1.1 and National BIM standard (United States): version2.

LAWA EDI (Electronic Data Interchange) Standards

This Standard provides a framework for all data requests and all hard copy or electronic data submittals to or from LAWA, thus ensuring a streamlined data exchange process.



These standards along with other documentation related to these standards are available on the LAWA website. [LAWA Standard Documents and Guidelines](#)

National and International Standards

- USACE_CAD-BIM_Technology Center: version 1.1
- National BIM standard (United States): version2
- NCS – United States National CAD Standard: version 5

Compliance

Having timely up to date, accurate, fully compliant data available to the LAWA community forms an integral part of planning within any project. The aim of these standards is to ensure a smooth data transfer of information into the LAWA geospatial data base and efficient data maintenance through the complete data lifecycle. Accordingly, the terms and conditions of a LAWA contract require compliance with these standards.

Failure to comply with these standards may result in organizations being back-charged for any financial costs incurred by LAWA for rectifying inconsistencies and errors



See EDI for standards governing data submitted to LAWA, this along with other documentation related to these standards are available on the LAWA website. [LAWA Standard Documents and Guidelines](#)

The individual or organization submitting the files is also responsible for ensuring that all links between non-graphic data and graphic data, and all relationships between database tables, shall be preserved or automatically reconstructed when data is transferred to the LAWA GIS environment.

Request of Variance

Compliance with the LAWA standards and data deliverables demands are the cornerstone of achieving trustworthy and relevant data.

Suggestions for improvements or extensions to these standards and demands are encouraged, to meet unforeseen requirements and as a way to improve effectiveness and clarify any ambiguities; any such deviation must be approved by LAWA, in advance and in writing. . Requests need to be submitted on the “Request for variance” form, this form along with other documentation related to these standards are available on the LAWA website.

[LAWA Standard Documents and Guidelines](#)

Definitions

The following terms define the concepts of BIM and data structures used in this guideline.

Definitions	
BIM	Building Information Modelling (BIM): the creation and use of coordinated, internally consistent, computable information about a project in design and construction. In this document, specifically related to Revit files.
Views/ Output files	A generated rendition of graphical or non-graphical information (a plan, section, elevation, schedule, or other views of a project).
Central Files	The central file is the source of the Record (as-built) file The Central file is created the first time you save the project after sharing it. This file stores the current ownership information for all the Worksets in the project. The central file acts as the distribution point for publishing work to the rest of the team. All users should save their own local copies of the file, work locally, and then save changes back to the central file for other users to see their work.
Worksets	Autodesk Revit projects can be subdivided into Worksets. A Workset is a collection of building elements (such as walls, doors, floors, stairs, etc.) in the building. In the Autodesk Revit project, users have the option of checking out entire worksets or individual elements in a workset. All other team members may view these elements or Worksets, but are unable to change them, preventing possible conflicts in the project.
View Types	Defines some graphics properties, such as a reference label and tags for elevations, callouts, or sections. It can also specify a view template to apply to a new view, and whether template updates should be applied to existing views.
Coordinates	There are two coordinate systems in a Revit project: project internal and shared. Each system has essential features and limitations. Project Internal Coordinate System Every Revit project has an internal coordinate system referred to in several places as Project. The project coordinate system cannot be changed. Shared Coordinates The shared coordinate system consists of a single origin and true north orientation which can be synchronized between models and even AutoCAD drawings.
View Templates	A view template is a collection of view properties, such as view scale, discipline, detail level, and visibility settings. Use view templates to apply standard settings to views. View templates can help to ensure adherence to office standards and achieve consistency across construction document sets.

<i>Definitions</i>	
View Range	Every plan view has a property called View Range, also known as a visible range. The view range is a set of horizontal planes that control object visibility and display in the view. The horizontal planes are Top, Cut Plane, and Bottom. The top and bottom clip planes represent the topmost and bottommost portion of the view range. The cut plane is a plane that determines at what height certain elements in the view are shown cut. These 3 planes define the primary range of the view range.
Families	A family is a group of elements with a common set of properties, called parameters, and a related graphical representation. Different elements belonging to a family may have different values for some or all of their parameters, but the set of parameters (their names and meanings) is the same. These variations within the family are called family types or types . There are 3 types of Revit Families – System Families, Component Families and In-Place Families.
Object Styles	The Object Styles tool specifies line weights, line colors, line patterns, and materials for different categories and subcategories of model objects, annotation objects, and imported objects in a project. You can override project object styles on a view-by-view basis with Visibility Graphics.
Visibility Graphics	The visibility and graphics settings of a view define whether elements and categories are visible in the view and their graphical appearance (color, lineweight, and linestyle). The Visibility/Graphics Overrides dialog lists all categories in the project. Some examples of categories are furniture, doors, and window tags. The visibility status and appearance of each category can be modified for each view in the project. Use the context menu to modify the appearance and visibility of individual elements.

Introduction

To achieve technical excellence and a successful outcome to a project, it is essential that explicit attention is given to the management, display and quality of the Record (As-Built) data.

Below are a number of key principles that will facilitate efficient, high quality work products.



When submitting record files, the consulting company must clearly document what has been modeled and what level of development (LOD) has been provided

- All outstanding warnings and issues (that can be) must be resolved.
 - Any warnings that cannot be resolved must be detailed in the project submission documentation.
- All issues in Coordination Review within Revit should be resolved.
- All un-hosted / orphaned families should be reconciled onto the appropriate host.
- Record (As-Built) BIM Project Review should take place to ensure model integrity.
- Record model quality control procedures must be performed and documented
- Separate models submitted for each building and each disciplines (mechanical, electrical, plumbing etc...).
Further divide models within a discipline if the files sizes become too big or slow to operate.

Interoperability

Interoperability between software products is of paramount importance for LAWA. Whether it is output to 2D CAD for subsequent drawing production or output for GIS visualization or analysis, the preparation and methods adopted to compose the as-built BIM will ultimately determine its successful interoperability to other software packages and technologies

Central Files

The main central files from each discipline shall be supplied to the owner as the final record model. All essential linked models including Revit files, CAD files and Point Clouds must be provided as their own separate central files.

Files linked for the purpose of internal reference requirements and not needed for final record file shall be unlinked and removed using the tools within Revit.



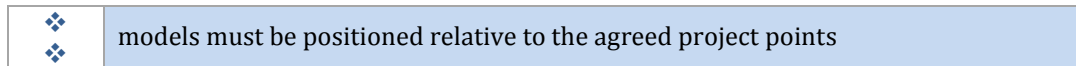
The central file is the source of the Record (As-Built) file

Coordinates

All Revit models supplied shall reference true coordinates and use the Revit shared coordinates functionality for all linked files that require coordinates with the final record files.

When referencing, Revit or CAD files, the models must be positioned relative to the **agreed** surveyed and benchmarked project points and also reference a Shared Coordinate system dictated in Revit.

All points must be specified in the mapping service tab of the Location dialog box within Revit.



Shared Coordinates

The shared coordinate system consists of a single origin and true north orientation which can be synchronized between models and any AutoCAD drawings.

Referencing file linking using Manage Links

Some projects may require that models of single buildings are split into multiple files and linked back together in order to maintain manageable model file size.

Revit models must always be kept separate by discipline, e.g. architecture, structure, mechanical, electrical, piping and plumbing.

Each discipline in a Revit model shall be in its own unique workset.

Ensure that all .RVT and .DWG or any other required files are linked and **not** imported into the Revit file.

All Linked files must be supplied as a part of the record file deliverables

Remove all links to irrelevant or extraneous files that are not required as record file deliverables.

View Filters

View Filters are used in Revit to provide a higher level of control of view details, whether for graphic representation or hiding of objects. All systems used in Revit shall have filters applied to their categories for an added level of control.

Families

All Revit families must follow a logical naming convention; this is true for all system, component and in-place families.

All families will be categorized in a correct Revit category. No families shall be reference as “generic model” only.

All Hosted Families, in linked models shall be linked and reconciled if orphaned.

Visibility Graphics

Objects in views shall be shown or hidden by category, view filter, or by workset.

Hide objects at the category level, by using visibility graphics, filters or worksets.

Only use element hiding when necessary.

Object Styles

Linetype, lineweight and drafting standards shall be set in the object styles dialog box to conform to the LAWA CAD standards.

View Templates

All views in the Revit model created for final sheets shall be controlled by a View Template applied to the view in a manner that is consistent with a logical naming convention.

These templates shall be created by the consultant within their own central file.

Scope Boxes

Scope Boxes shall be used on all views that require the division of a view layout and then applied to all levels that require the same division.

Manual editing of the crop area is not acceptable.

All Scope Boxes separating areas shall have appropriate naming conventions and matchlines attached.

Revit Model Requirements and Warnings

The following represents some examples of the Revit model requirements and possible warnings requiring attention and correction.

- Overlapping of design elements (especially walls and room boundaries).
- All floors are subdivided by space/room.
- Every space/room has a name and a number, including all shafts and stairs.
- LAWA room numbering conventions must be applied. Refer to FM@LAWA Facilities Management Handbook Building Space Naming Convention.
- There is only one space instance per space, per discipline, no duplicates.
 - Note: Some engineering spaces may fit exactly on top of linked architectural models
- All engineering spaces are defined level to level
- Plenums are defined; as a separate engineering spaces.
- Reconcile all orphaned families (resulting from using “copy/paste”. (in Revit this is known as reconciling an orphaned family)
- All mechanical systems are defined (every element belongs to a system). This can be verified using the Revit MEP system browser.
- Sidewall diffusers are placed in defined spaces and attached to corresponding walls.
- Ensure that all objects in a Revit project are placed in the correct workset.
- Ensure that all mechanical zones are defined.
- Ensure that there are no unassigned components (View/User Interface/System Browser).

Data Segregation

General Principles

The project BIM models should be constructed in a manner that allows LAWA to view and use the model without recourse to complicated introductions to the project methodology.

The methods adopted for data segregation shall take into account, and be agreed with LAWA.

The following practices shall be followed:

- No more than one building shall be modeled in a single file. Further divide within a building if the model file becomes too big or slow to operate.
- A model file shall contain data from one discipline only (although exceptions may apply for Building Services where multiple disciplines converge).
- Further segregation of the geometry may be required to ensure that model files remain workable on available hardware.
- Where multiple buildings (models) make up a single project, a site model should be considered, where all architectural models in the project are linked together using shared coordinates.

Example of Data Segregation:

<i>Discipline</i>	<i>Segregation</i>
Architecture	level by level
Structure	Major geometry splits, such as east-wing or west-wing, or movement joints between sections. All items shall be separated by their levels dictated by Revit.
Mechanical	Construction joints such as podium and tower. All mechanical systems shall be separated by levels.
Electrical	All distribution systems shall be separated by their levels.
Civil	Document sets Work allocation such as core, shell and interiors

Data segregation in the Revit Model must show/highlight/identify those points of integration across floors when exported to 2D plans (DWG). For those systems that span floors, all controls/valves/switches et cetera that isolate floors from those systems must be identified and highlighted in both the model and the dwg

Folder Structure and File Naming Conventions

Introduction

Even with BIM systems, the importance of model and file naming convention cannot be overstated and a clear and concise naming convention is critical to the successful identification of BIM data.

A naming convention is required to ensure that all files created on a project can be identified quickly, accurately and without ambiguity. Ownership, location, type of file and a unique number are all of paramount importance when identifying the content of a BIM file.

The following paragraphs provide the necessary guidelines for a model naming convention suitable for multi-discipline and multi-functional project.

Project Folder Structure

Record files will be submitted to LAWA within a clearly designated set of folders.

Where a project comprises of a number of separate elements such as multiple buildings, zones or areas, the BIM structure shall be maintained within a set of designated sub-folders representing the various project elements.

All record files shall be held within the standard project folder structure.

No spaces are to be used in the folder naming as this can potentially interfere with certain file management tools and collaboration across the internet.

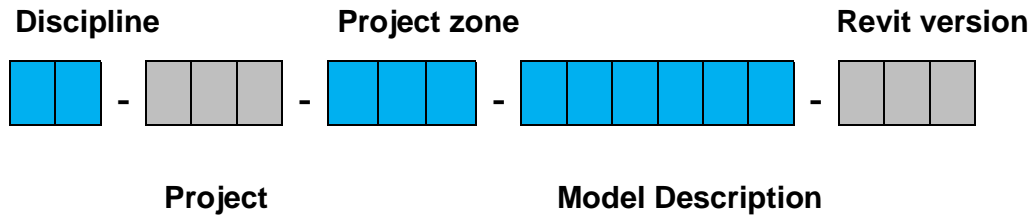
General Naming Conventions

- Use only letters A-Z, hyphen, underscore and numbers 0-9 for all fields.
- All fields shall be separated by a hyphen character “-” Do NOT use spaces.
- Within a field, either CamelCase or an underscore “_” shall be used instead of a space to separate words.
- A single period character “.” shall be used to separate the file name from the extension. This character should not be used anywhere else in the file name.
- The file extension shall not be amended or deleted.
- The scheme for zone and level sub-division shall be agreed with LAWA at the outset of the project.

BIM Record File Naming Convention

The following naming conventions must be used for all Record files

BIM Record file naming convention



<i>BIM Record file names</i>		
component	length	comment
Discipline designator		The discipline designator for a file name identifies the discipline. Where a file applies to a high-level discipline with a single-letter code, the second letter is replaced with a hyphen. Allowable characters for the discipline designator in sheet files are listed below.
Project code		Project codes are developed by LAWA or their authorized representative and are provided to the contractors for each project. Agreed project codes must be used in all LAWA files, to guarantee unique, consistent file names.
Project zone		These codes are defined per project, and generally identify a building, zone or area.
Model Description		Descriptive field to define the type of data portrayed in the file. Avoid repeating information codified in other fields. Can be used to describe any part of the previous fields, or to further clarify any other aspect of the contained data.
Revit Version		Version of Revit in which the file was created

Examples of Record file naming:

- A-1282-ZA-BuildingCore-R12 (includes a Project zone)
- A-1282-BuildingCore-R12 (Project zone is not applicable)

Discipline (2 char)

This is a simple list of single or double character codes identifying the Discipline.

<i>Discipline designators for View naming</i>			
discipline	Designator	discipline	designator
A	Architectural	I	Interior
B	Building Surveyors	K	Kitchen Consultant
C	Civil Engineers	L	Landscape
D	Electronics (Data/ Communication/Security)	M	Mechanical
E	Electrical	R	Irrigation Consultant
F	Fire	S	Structural
G	Surveyor	T	Vertical Transportation
H	Hydraulic	Z	General (non-specific)

<i>M - Mechanical</i>	
Sub-discipline	Designator
MH	HVAC
MP	Piping
MF	Fire Suppression

Where necessary this field should include an Originator code to help identify the owner of the contents. For example on larger projects where two architects are involved, it may be necessary to add the company's initials before the discipline, where logical character limits will apply:

For example:

ABC_A- ABC Architects

XYZ_A- XYZ Architects

Project zone Codes (examples)

<i>Project zone codes (examples)</i>	
Code	Description
01	Building or Zone 1
ZA	Zone A
B1	Building 1
CP	Car Park
A2	Area Designation 2

Revit Version (examples)

<i>Revit Version (examples)</i>	
Code	Description
R08	Revit 2008
R09	Revit 2009
R10	Revit 2010
R11	Revit 2011
R12	Revit 2012
R13	Revit 2013

Project Browser and View Organization for Record files

When handing over the Record (As-Built) Revit project file to LAWA all views that are created for sheet views shall be named in accordance with these standards.

For record files, only As-built views should be available within the project browser. All other views should be considered as working views and must be filtered out of the project browser

- ❖ Only Record (As-Built) information may be included in the sheets
- ❖ All relevant Record (As-Built) information must be available in the sheets

The Sheet Views (discipline sets) in the Revit Project Browser dictates the final product delivered by the consultant and should have all appropriate view filtering applied in the model to represent this state.

Within the discipline sets the sheets are organized as per sheet reference number

Sheet View Organization

The project browser must be organized according to the “disciplines sets” as shown below. This follows the recommended best practices from the NCS CAD standards. The prefix number allows for the correct sorting of sheets based upon their assigned discipline

- ❖ Use the sheet area to organize the Record (As-Built) final products.
- ❖ Organize the project browser as the sheets will appear in the set.

<i>Sheet Discipline sets</i>			
Code	Discipline	Code	Discipline
00	00 – Sketches	11	11 – Equipment
01	01 – General	12	12 – Fire Protection
02	02 – Hazardous Materials	13	13 – Plumbing
03	03 – Survey / Mapping	14	14 – Process
04	04 – Geotechnical	15	15 – Mechanical
05	05 – Civil Works	16	16 – Electrical
06	06 – Civil	17	17 – Telecommunications
07	07 – Landscape	19	19 – Other Disciplines
08	08 – Structural	20	20 – Contractor Shop Drawings
09	09 – Architectural	21	21 – Operations
10	10 – Interiors		

Within the discipline sets the sheets are organized as per sheet reference number

Sheet reference number:

Within the designated “sheet discipline” the sheets will be further organized according to their “sheet reference number”

Sheet references shall be based on the document and drawing numbering protocols established for the project. These names automatically match the text as it appears in the title block

The sheet identification format used by LAWA has the following components.

Example of a sheet reference number:

A	2	1	N	2
---	---	---	---	---

Architectural floor plan, level 01 area N2

A	N	L	R	R
---	---	---	---	---

Discipline Designator

A	N	L	R	R
---	---	---	---	---

Sheet Type Designator

A	N	L	R	R
---	---	---	---	---

Floor level and Floor region

BIM Sheet naming conventions		
Component	length	comment
Discipline designator	1	The discipline designator denotes the category of subject matter contained on the sheet. Allowable characters for the discipline designator in sheet files are listed below.
Sheet type designator	1	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.
Floor level	1	Floor level
Floor Region	2	Floor area or region

A = alphabetical character
N = alphanumerical character
L = numerical character
R = alphanumerical character

Discipline designator

This is a simple list of single character codes identifying the Discipline.

<i>Discipline designators</i>			
discipline	Designator	discipline	designator
A	Architectural	I	Interior
B	Building Surveyors	K	Kitchen Consultant
C	Civil Engineers	L	Landscape
D	Electronics (Data/ Communication/Security)	M	Mechanical
E	Electrical	R	Irrigation Consultant
F	Fire	S	Structural
G	Surveyor	T	Vertical Transportation
H	Hydraulic	Z	General (non-specific)

Sheet Type Designators

<i>Sheet type designators</i>			
Sheet type	Designator	Sheet type	Designator
1	Discipline General sheets	6	Sections
2	Plans (horizontal views)	7	Exterior Details
3	Reflected Ceiling Plans	8	Interior Elevations
4	Furniture, Fixtures and Equipment plans	9	Interior Details
5	Exterior elevations	0	Base sheets

Sheet description:

This is a more complete description, which provides an appropriate clarification on the location and content of the sheet

LAWA expects that the description will be sufficient to allow for easy recognition of the sheet content

Sheet description



Sheet reference number

<i>BIM Sheet naming conventions</i>		
Component	length	comment
Discipline designator	1	See sheet reference number.
Sheet type designator	1	See sheet reference number.
Floor level and region	1	See sheet reference number.
Floor Region	2	See sheet reference number.
Sheet description (D)		Appropriate clarification on the location and content of the sheet, separated with an underscore were appropriate

Example of sheet organization and naming:

09 – Architecture

A21N2-AreaN2_FloorPlan_Level_01

Discipline set: 09 – Architecture
Sheet Reference: A21N2
Sheet description: AreaN2_FloorPlan_Level01