



# Volume 2: **Requirements for** Building Information Modeling

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## 1 INTRODUCTION

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### 1.1 Target Audience

This document is targeted at anyone authoring or utilizing Autodesk Civil 3D® or Autodesk Revit® content for Los Angeles World Airports including both LAWA staff as well as external service providers. The format of this document assumes the reader has a base knowledge of CADD, Civil 3D®, Revit (all disciplines) and the workflows and terms common to the industry, and developed from the current LAWA CADD and GIS layer structures (for projects using Autodesk Civil 3D® software).

## 2 SUBSURFACE UTILITIES DATA

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### 2.1 Requirements for Subsurface Utility Data

Los Angeles World Airports (LAWA) has embarked on a robust program to collect sub-surface utility engineering surveys for all airport construction projects. All construction projects that expose the location of sub-surface utilities needs to accurately capture the location and provide the data to the Planning & Design Division. Construction plans should indicate when sub-surface utilities are to be uncovered and/or new utilities installed and coordinate with the Los Angeles World Airports Survey Department for the collection of all utility data prior to being covered. The LAWA Survey Department will be responsible for the collection of utility data including utilities, but notification to the LAWA Project Manager and Airport Survey Office is required by contractor three business days before items are uncovered. As-built CADD and GIS data submitted to LAWA shall contain all sub-surface utility locations and attributes in CADD and GIS format as outlined in this document.

#### 2.1.1 Purpose

This document establishes the procedures for CADD/Civil 3D® submittals to LAWA and coordination of CADD/Civil 3D®/GIS deliverables within LAWA. The procedures are necessary to ensure consistent collection and use of data as part of an Electronic Information Exchange (EIE) between LAWA and its consultants and contractors.

The procedures are designed to enforce commonality amongst data required throughout the life cycle of LAWA's airport facilities as well as ensure the compatibility of CADD/Civil 3D® data with the FAA's Airport Geographic Information Systems (AGIS) database, GIS standards, and Metadata standards. CADD/Civil 3D® developed internally as well as submittals from consultants are the basis of the Engineering/GIS data referenced by the LAWA. These procedures will assist LAWA in receiving and producing data that conforms to FAA Advisory Circular (AC) 150/5300/18b CHG1 and best practices in existing conditions data collection. By organizing data for better accessibility and maintainability, these CADD/Civil 3D® procedures are critical to supporting LAWA's infrastructure throughout its life cycle.

#### 2.1.2 Scope

This document provides procedures for the installation and use of the LAWA CADD template as well as management of files, naming conventions, layers, colors, linetypes, and other CADD related properties. The LAWA CADD procedures are based on the National CAD Standards (NCS) Version 4, AC 150/5300-18B CHG1, and LAWA's BIM Manual. This document and associated template are intended to provide LAWA consultants the baseline for creation of design drawings to be submitted to LAWA. The consultant shall follow the procedures provided in this manual and utilize the layering format in the LAWA CADD/Civil 3D® template.

A comprehensive set of layers is included in the CADD/Civil 3D® template to represent features typical for Airport projects and include layers provided in the NCS, FAA AC 150/5300-18B CHG1, and LAWA legacy standards. The layers provided in the CADD/Civil 3D® template will be used to define objects and other data required by the FAA as well as additional layers typically used for design purposes. It is the responsibility of the Consultant/User to choose the



appropriate layers and ensure that all data required by the FAA is submitted to LAWA in the proper format.

## 2.2 Utility Quality Level Attributes

The American Society of Civil Engineers (ASCE) developed standard guidelines for the collection and depiction of existing subsurface utility information, *Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data (ASCE/C-I 38-02)*, by the civil engineering profession, the FHWA, ASCE, AGC, and other national organizations. The guideline breaks down utility collection into four separate levels of confidence. The initial field collection and mapping for most airports is Quality Level (QL) D. These four separate levels of confidence are as follows:

### 2.2.1 Quality Level "D" - Existing Records:

Results from review of available records: It gives overall "feel" for congestion of utilities, but is highly limited in terms of comprehensiveness and accuracy. For projects where route selection is an option, this Quality Level is useful when combined with cost estimates for utility relocations following applicable "clear zone" and other accommodation policies.

### 2.2.2 Quality Level "C" - Surface Visible Feature Survey:

QL "D" information for existing records is augmented using surface visible feature survey and digitizing data into Computer-Aided Drafting and Design (CADD) drawings. The danger here is that much of the data is "digitized fiction." There may be as much as a 15-30% error and omission rate in QL "C" information.

### 2.2.3 Quality Level "B" - Designating:

Two-dimensional horizontal mapping: Obtain this information through surface geophysical methods. It is highly useful for design basis information for conceptual design and for proceeding prudently to QL "A". Do not use this level for design basis vertical information or where exacting horizontal tolerances are expected.

### 2.2.4 Quality Level "A" - Locating:

Three-dimensional points of conflict: This is the highest level of accuracy of subsurface utility engineering data. It provides horizontal and vertical design basis information for engineering, construction, maintenance, remediation, condition assessment, and related efforts.

## 2.3 Utility Research


Utility Research is important before setting out to capture utility data. Prior to beginning the designation work, the contractor should contact the utility known to be within the project limits. The contractor should ask for all record information within the project limits and specifically ask to speak to the Planning & Development Division to identify utility projects completed but not depicted in the utility owners' records section. The contractor is to prepare a utility record log per

ASCE standards, and maintain records for future reference. Review the record information for the following:

- Material type joining procedures that will influence equipment selection.
- Amount of utilities to be expected, which will influence number and phasing of personnel assigned to the project.
- Local geology/soil conditions if data is available, which may influence equipment selection.
- Number and type of access points, such as manholes, etc., which will influence safety procedures.
- Expected depth of utilities, which will influence equipment selection. Presence of rebar or other paving characteristics, affecting the methods/procedures/equipment.
- Advise the project owner regarding potential effects that the project may have on existing subsurface utilities.
- Inform the project owner regarding utility quality levels and reliability of data for each quality level. Such information may include a discussion of costs and benefits associated with obtaining quality levels.
- Recommend a scope for utility investigations dependent on project needs. This may include a list of the types of utilities for detection and depiction and the desired utility data quality level. It may include certain systems to be investigated and depicted at a lower quality level. It may include geographic sections of the project to have utilities investigated and depicted at various quality levels.
- Discuss and recommend formatting of deliverables to clearly distinguish quality levels.
- Discuss the sequence of acquiring appropriate quality level data throughout the planning and design process. This is dependent on project design elements, design timetables, the type of project, the criticality of utility service, and so forth.
- Prepare a utility composite drawing or file with appropriate supporting documents, in accordance with owner specification, that clearly identifies utilities at their desired quality levels at the appropriate time within project development. The deliverable may contain utilities depicted at quality levels A, B, C, and/or D.
- Review data with utility owners.
- Review plans as design develops to analyze the effects of design changes to current utility information.
- Recommend areas or particular utility systems for a “quality level” upgrade after review. Such an upgrade may be to quality level C, B, or A.
- Follow applicable one-call statutes or other applicable laws.
- Place a note on the plans explaining the different utility “quality levels.”
- Affix an engineer’s stamp on the plans that depict existing subsurface utility data at the indicated quality levels.
- Discuss utility accommodation and utility relocation policies.

## 2.4 Field Utility Locates

Conducting field utility locates require geophysical locating equipment and methods (combined with existing utility records and field observations), the marks that designate the utility on the surface of the ground can be performed. If the utility changes horizontal direction, but has no physical aperture at that point, every standard of care of the subsurface utility engineering profession will be taken to designate the point at which the utility ‘bends’ or changes direction. The temporary utility paint marks on the ground will follow the Utility Location and Coordination Council Uniform Color Codes. While the utility designating is taking place, the survey crew will simultaneously be collecting data for the utility features and the temporary paint marks over the utility line. The temporary utility paint marks on the ground will follow the Utility Location and Coordination Council Uniform Color Codes as shown below:

	<b>RED</b> – Electric power lines, cables, conduit and Lighting cables
	<b>YELLOW</b> – Gas, Oil, Steam, Petroleum or Gaseous Materials
	<b>ORANGE</b> – Communications, Alarm or Signal lines, cables or conduits
	<b>BLUE</b> – Potable Water
	<b>PURPLE</b> – Reclaimed Water, Irrigation, or Slurry lines
	<b>GREEN</b> – Sewers and Drain lines
	<b>PINK</b> – Temporary Survey Markings

## 2.5 Sub-Surface Utility Engineering Test Holes

Use of Sub-Surface Utility Engineering Test Holes are required of certain projects that require detailed high quality data such as vertical depths/elevations and condition assessments, complete Quality Level A test hole services. Digitally photograph the test hole sites before and after the test hole operations. For Quality Level A data, provide a certification form in addition to the plotted position of the utility with additional information. This certification information includes:

- Horizontal and vertical location of top and/or bottom of utility referenced to project datum,
- Elevation of existing grade over utility at test hole referenced to project datum,
- Outside diameter of utility and configuration of non-encased, multi-conduit systems,
- Utility structure material composition, when reasonably ascertainable,
- Benchmarks and/or project control used to determine elevations,

- Paving thickness and type, where applicable,
- General soil type and site conditions, and other pertinent information as is reasonably ascertainable from each test hole site.

References to the project datum will maintain vertical tolerances to  $\pm 0.05'$  based on benchmarks used or established with the base mapping deliverables and horizontal tolerances at  $\pm 0.25'$ .

### 3 SUBSURFACE UTILITY DATA CAPTURE

#### 3.1 Level of Capture for various systems:

- Water Force Mains and some service lines (PLASTIC OR METAL)
- Primary Electric
- Secondary electric (SITE LIGHTING, SIGNAGE, 480 VOLT/220/110 CONDUITS)
- Communications (PHONE, DATA, CABLE TV, FIBER)
- Gas Main's and service lines (PLASTIC OR METAL EVEN IF METALLIC PIPE OR TRACER WIRE IS NOT USED)
- Main Storm and Sanitary Sewer (INCLUDE SEPTIC TANKS, LEACH FIELDS, FIELD TILE PIPE, ETC)
- Misc. utility lines such as oxygen, steam, chilled water lines, nitrogen and other chemical/fuel transport type utilities.

#### Location Level of Capture (LLC)

All projects connecting to or placed on a site with existing utilities shall, at a minimum, provide LLC 1. For newly placed utilities and LLC 2. Civil 3D models for existing content

1. Survey Validation – This LLC is the highest level of accuracy. This occurs in the following conditions: when new utilities are placed into the ground on original installation. Actual survey validation with field survey points provided and modeled.
2. Visual Validation – This occurs through visual inspection of existing buried utilities using non-destructive inspection techniques such as Potholing.
3. Non-Visual - Utilities located using non-visual techniques such as Ground Penetrating Radar (GPR), Electromagnetic Induction.
4. Map Validation – Site Utility location based on mapped information such as GIS mapping or existing as-built documents

	Survey Validation:	Visual Validation	Non-visual validation	Map validation
Utility type	X	X	X	X
Pipe / Conduit type	X	X		
Pipe / Conduit size	X			
Utility location (Northing and Easting)	X	X	X	X
Utility Depth (Z elevation)	X	X	X	
Bedding material	X	X		
Direction of Flow	X			X

## 4 CADD/AutoCAD® Civil 3D® STANDARDS

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### 4.1 Target Audience

This document is targeted at anyone authoring or utilizing Autodesk Civil 3D® content for Los Angeles World Airports (LAWA) including both LAWA staff as well as external service providers. The format of this document assumes the reader has a base knowledge of CADD, Civil 3D® and the workflows and terms common to the industry, and developed from the current LAWA CADD and GIS layer structures.

The current LAWA approved version of Autodesk Civil 3d is 2014. Use of a year release other than the currently approved version will require written approval from LAWA Planning & Development Group.

### 4.2 Purpose

This document establishes the procedures for CADD/Civil 3D® submittals to Los Angeles World Airports (LAWA) and organization of CADD/Civil 3D® data within LAWA. The procedures are necessary to ensure efficient Electronic Data Exchange (EDI) between LAWA and its consultants, contractors, and local, state, and federal government agencies, including, Federal Aviation Administration (FAA), Transportation Security Administration (TSA), and law enforcement agencies.

The procedures are designed to enforce commonality amongst data required throughout the life cycle of LAWA's airport facilities as well as ensure the compatibility of CADD/Civil 3D® data with the FAA's Airport Geographic Information Systems (AGIS) database, GIS standards, and Metadata standards. CADD/Civil 3D® submittals from consultants are the basis of most Engineering/GIS data referenced by the LAWA. These procedures will assist LAWA in receiving and producing data that conforms to FAA Advisory Circular (AC) 150/5300/18b and best practices in planning/design/construction. By organizing data for better accessibility and maintainability, these CADD/Civil 3D® procedures are critical to supporting LAWA's infrastructure throughout its life cycle.

### 4.3 Scope

This document provides procedures for the installation and use of the LAWA CADD template as well as management of files, and other CADD related properties. The LAWA CADD procedures are based on the "CAD Standards August 2014", AC 150/5300-18B, and LAWA's Standards Manual. This document and associated template are intended to provide LAWA consultants the baseline for creation of Civil 3D design drawings to be submitted to LAWA. The consultant shall follow the procedures provided in this manual and utilize the layering format in the LAWA CADD/Civil 3D® template.

A comprehensive set of layers is included in the CADD/Civil 3D® template to represent features typical for Airport projects and include layers provided in the FAA AC 150/5300-18B, and LAWA legacy standards. The layers provided in the CADD/Civil 3D® template will be used to define objects and other data required by the FAA as well as additional layers typically used for design purposes. It is the responsibility of the Consultant/User to choose the appropriate layers and ensure that all data required by the FAA is submitted to the LAWA in the proper format.

## 4.4 Acronyms

AC	Advisory Circular
AEGIS	Airport Enterprise Geographic information System
BIM	Building Information Modeling
CADD	Computer Aided Design and Drafting
LAWA	Los Angeles International Airport
EDI	Electronic Data Interchange
FAA	Federal Aviation Administration
NCS	National CAD Standard
SDSFIE	Spatial Data Standard for Facilities Infrastructure and Environment
TSA	Transportation Security Administration

## 4.5 Definitions

Term	Definition
LAWA CAD Standard	The “CAD Standards for LAWA Projects” document defining process and content for the production of design documentation.
Design Documentation	The traditional set of 2d plans for construction of physical infrastructure or documentation of existing conditions.
3d Models	The digital equivalent of physical objects represented at varying levels of detail
BIM	A process of data acquisition, management and utilization that enables the users to share data and make more informed decisions.
Horizontal Disciplines	<p>Horizontal Disciplines have their design work located outside of buildings. Horizontal Disciplines produce the following types of drawings.</p> <p>G... General Layers (Please Note Not a true Trade, however used for LAWA Projects)</p> <p>C... Civil Layers</p> <p>L... Landscape Layers</p> <p>A... Architectural Layers</p> <p>S... Structural Layers</p> <p>M... Mechanical Layers</p> <p>P... Plumbing Layers</p> <p>E... Electrical Layers</p>

	<p>F... Fire Protection Layers</p> <p>V...Survey Layers</p> <p>X... Xrefs Layers (Attach Drawing References) (Not a true Trade, however used for LAWA Projects) This is not a complete list. Some disciplines listed are limited to that portion of their work positioned 5' or more beyond the outside of a building.</p>
XREF	Externally Referenced File inserted in the current drawing using the ATTACH command in AutoCAD.
Sheet Set Data File	A file with a .DST file extension used with Sheet Set Manager in AutoCAD. It contains custom properties for managing title block content.
Drawing Template File	A DWG file with the file extension .DWT
Model Files	DWG files where drawing content is only created in modelspace.
Sheet Files	DWG files containing XREFs in modelspace and Sheet specific drawing objects in paperspace.
DREF	Data Reference Files (DREFs) are model files containing the original Civil 3d AEC objects that have been published as data shortcuts.
Data Shortcuts	A set of tools in Civil 3d which allow a file containing a Civil 3d object to be referenced into another DWG file.
AEC Objects	AEC Objects are custom objects created by Civil 3d for use in Civil 3d only. Object enablers are built into AutoCAD and related verticals beginning in version 2012.
AutoCAD Objects	Objects in a DWG file that are not AEC objects and produced by AutoCAD commands. These objects are often referred to as native AutoCAD objects.
Object enablers	Object enablers are built into AutoCAD
modelspace	The drawing editor accessed through the Model tab. Objects are drawn at a 1:1 scale representing real world dimensions.
paperspace	The drawing editor environment accessed through Layout tabs and scaled for plotted dimensions to fit various paper sizes.

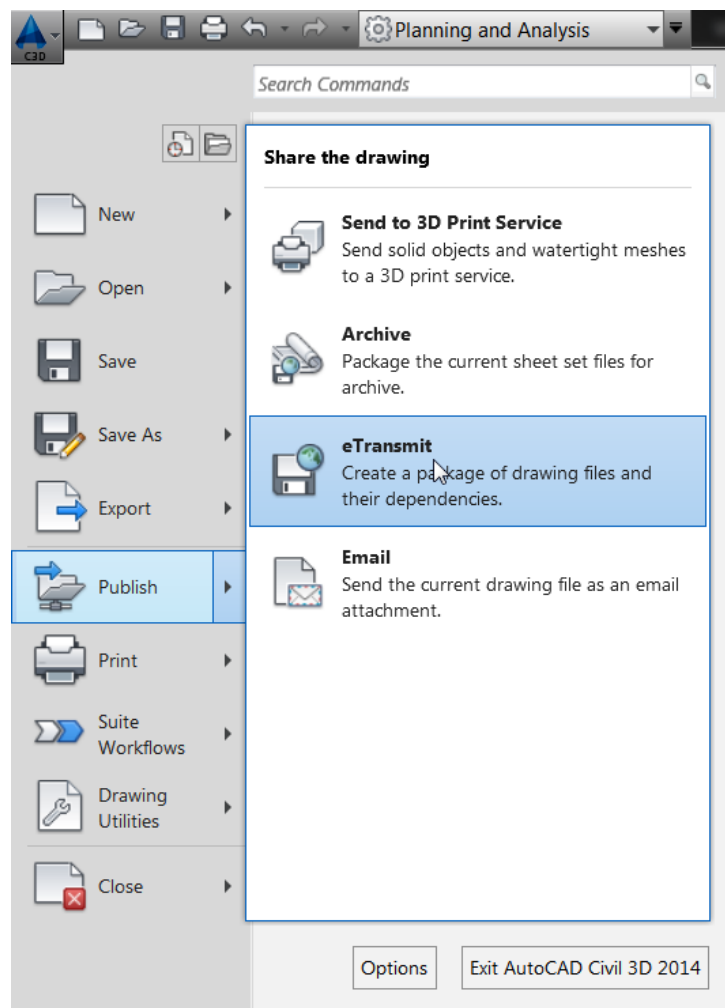


## 4.6 CADD Management and Organization

### 4.6.1 File Management

LAWA uses a standard file format, naming, and directory structure associated with the type of information contained within specific files to ensure consistency in file management, file transfer, and file security.

When delivering Civil 3D content to LAWA, use the built-in eTransmit function. This packages the document with all dependencies. From the Application menu (the button on the top left with C3D on it), select Publish, then eTransmit. Refer to Section 9.4 in this document for further detail on the eTransmit process.



### 4.6.2 File Type Definitions

The file types discussed in this section are used for developing project data. Configuration files such as Drawing Templates are discussed in the Workstation Configuration section.

#### **4.6.2.1 Model Files**

A model file contains the physical components of a site either existing or proposed (e.g., roads, drainage structures, terrain models, buildings, etc.). Model files are drawn at full scale and typically represent plans, profiles, sections, etc. A model file can contain both 2d and 3d objects. Model files can be generated either by adding AutoCAD or Civil 3d objects or from BIM model extractions.

#### **4.6.2.2 Design Files**

Design Files are Model Files where the majority of design activity takes place.

#### **4.6.2.3 Data Reference Files**

Data Reference Files (DREFs) are Model Files containing the original AEC objects produced by Civil 3d for the purpose of sharing their data across multiple Design Files. Data Shortcuts are the Civil 3d mechanisms utilized to share this data. Creating a Reference is the action taken to establish the link between the host and the source files for a particular AEC object.

#### **4.6.2.4 Reference Files**

Reference Files are Model Files. Reference Files can be DWG, DGN, PDF, DWF, and all image file formats supported by Civil 3d. Reference files usually provide background information for a model file or design information for a sheet file. DWG files that are referenced into other DWG files are often referred to as Xrefs. Model files can be referenced (Xref'd) into Sheet files. Sheet files are never used as Xrefs.

The XREF type should always be "Overlay"

#### **4.6.2.5 Sheet Files**

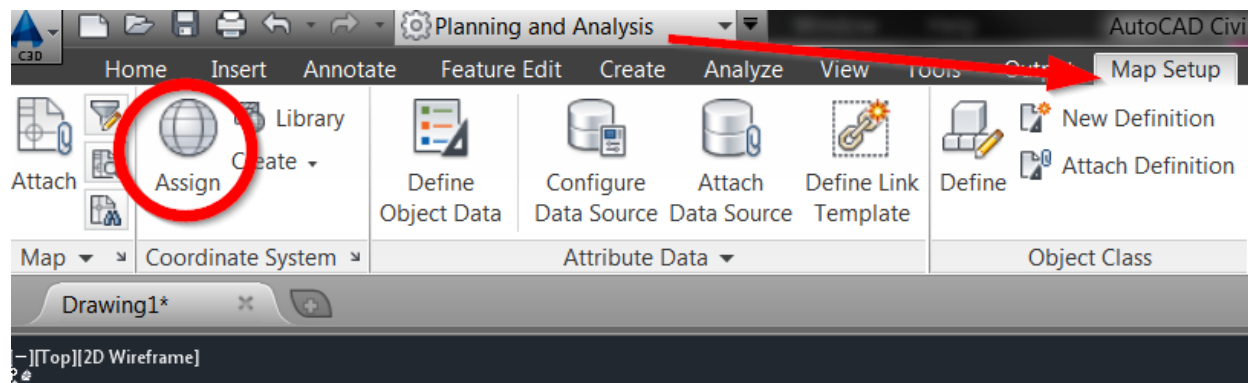
A sheet file is synonymous with a plotted CAD drawing file. A sheet file is a selected view or portion of referenced model file(s) within a border sheet introduction.

## 4.7 Coordinate Systems

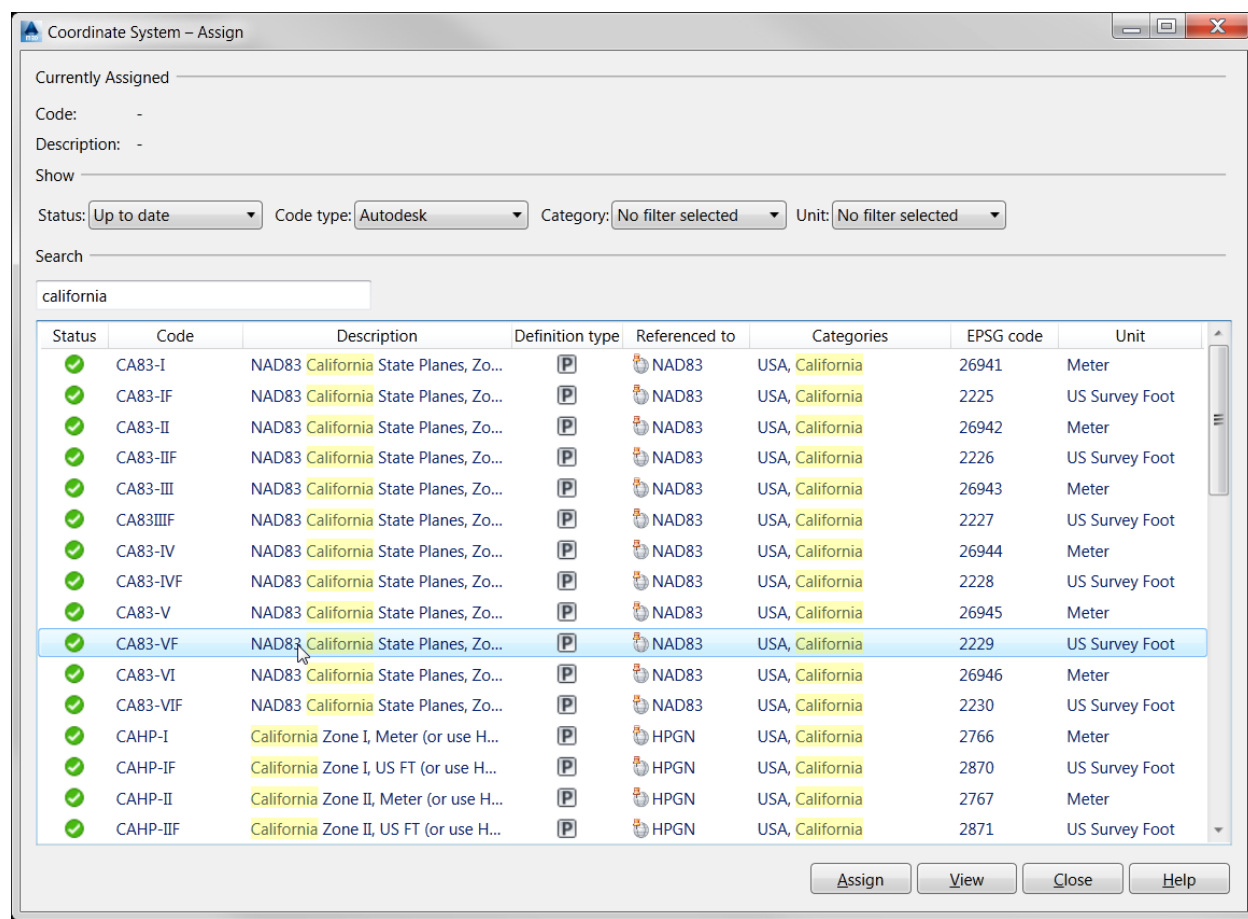
### 4.7.1 LAWA Civil 3D template

The LAWA Civil 3D template (.dwt) is preset with the current LAWA approved Coordinate System (CA83-VF). Modification of the Coordinate System should only be done at the direction of LAWA.

To set the Coordinate system in Civil 3D, first switch the Workspace to Planning and Analysis. Then from the Map Setup tab on the Ribbon, select Assign in the Coordinate System panel.



Select CA83-VF from the list and Assign at the bottom of the dialog box



## 5 FILE NAMING CONVENTIONS

These conventions standardize the naming and numbering of all project documents for tracking purposes. All CAD documents shall contain a numbering system according to the criteria outlined in the LAWA CAD Standards.

### 5.1 LAWA File Naming Components – Project Plan Files

The components used to identify a file will depend on the complexity and requirements of the project. The LAWA's file naming system will follow the requirements of the LAWA CAD Standards.

## 6 CONFIGURING THE WORKING ENVIRONMENT

This section describes the folder structure and content for the LAWA CAD Standard Templates. Files and folders described here are available, or "shared", to all LAWA staff and consultants working on LAWA projects respectively. As a point of clarification, content will be accessed differently by LAWA staff than LAWA consultants.

LAWA staff will have access to an internal "Master" Content library, a Project specific library, and Local Workstation folders from which to begin projects and maintain related standards material. A current reproduced copy will be provided to LAWA consultants from which to begin their respective projects.

### 6.1 CADD Projects Folder Structure

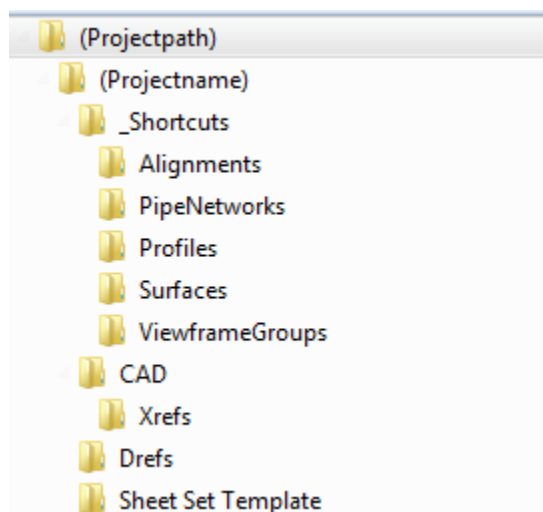
A Project Folder Template is shown below as the suggested folder structure for all Civil 3D projects.

Definitions.

[Projectpath] = Substitute your network path down to the root folder for your projects

[Projectname] = The folder name of the project

Typical Project Folders structure.



File Organization within Project Folders is described in each subheading

#### **6.1.1 [Projectname]**

Sheet Files and Sheet Sets (dst) go in the root [Projectname] folder

Use Sheet Set Manager to create an Index of Drawings

#### **6.1.2 \_Shortcuts**

Data shortcuts are automatically populated by Civil 3D. Do not delete anything in here.

#### **6.1.3 CAD**

CAD folder contains model drawings for design that are not data references. These dwg files are Xref'd into Sheet Files

#### **6.1.4 Xrefs**

Background drawings, reference files in other formats (PDF, DGN, DWF, image files) and project specific aerial photos are stored in this folder. GIS files used for background information are stored in this folder.

#### **6.1.5 Drefs**

Contains model drawings for design that are used as data references

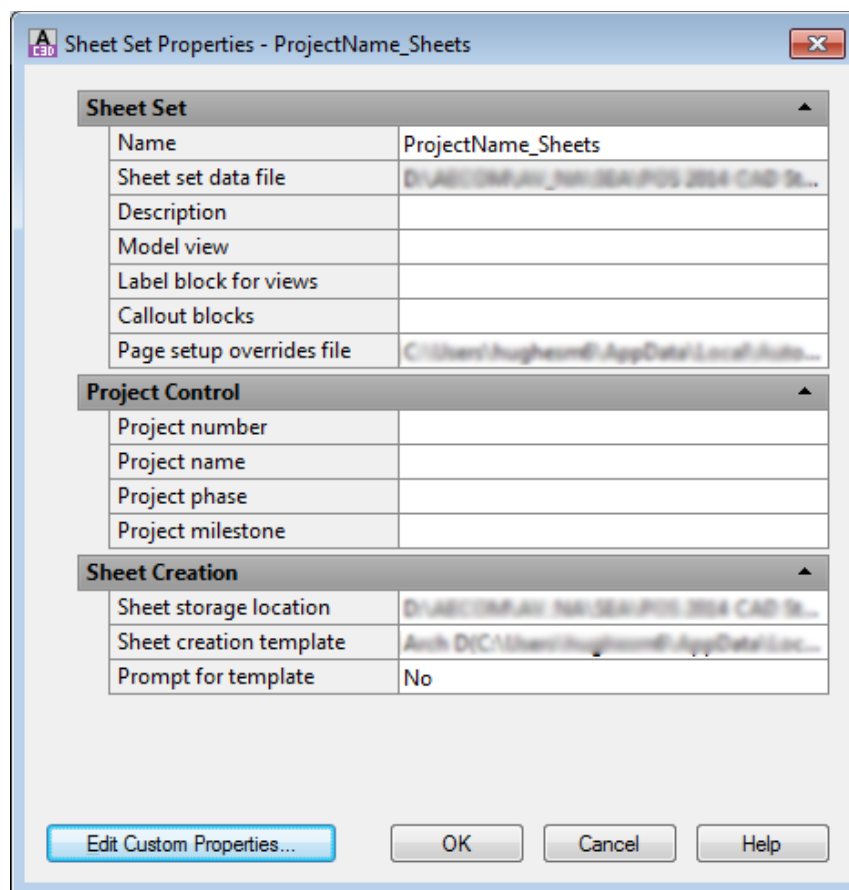
### **6.2 Sheet Set Template**

Contains the typical sheet set files that are specific to this project

Contains project specific Sheet Set Template file (.DWT)

Contains project specific Title Block drawings (.DWG)

Contains the project specific Master Sheet Set Definition file (renamed to "Project number".dst) Be sure to fill out all of the Sheet Set properties



Sheet Set	
Name	ProjectName_Sheets
Sheet set data file	D:\AEC\ONE\AIR_NAM\SEA-FPS 2014 CAD St...
Description	
Model view	
Label block for views	
Callout blocks	
Page setup overrides file	C:\Users\hughes\B\AppData\Local\Auto...

Project Control	
Project number	
Project name	
Project phase	
Project milestone	

Sheet Creation	
Sheet storage location	D:\AEC\ONE\AIR_NAM\SEA-FPS 2014 CAD St...
Sheet creation template	Arch DTC\Users\hughes\B\AppData\Loc...
Prompt for template	No

Edit Custom Properties... OK Cancel Help

### 6.3 LAWA Standard Symbols Tool Palette

LAWA CAD Standard Symbols are provided in the “LAWA Design Symbols” Folder as part of the LAWA CAD Standards package. The blocks are those provided in the various discipline based LAWA Design Symbols drawings, included in the LAWA CAD Standards package. The master symbols drawings are not to be modified unless permission is received from the LAWA Project Manager.

The intent of the Tool Palette is to improve production by locating all LAWA symbols used for design purposes within the AutoCAD C3D workspace. The symbols and blocks provided in the tool palette must be used in the design drawings submitted to the LAWA when applicable. These Design symbols must be incorporated into all applicable AEC objects in order to properly represent its 2D plan representation

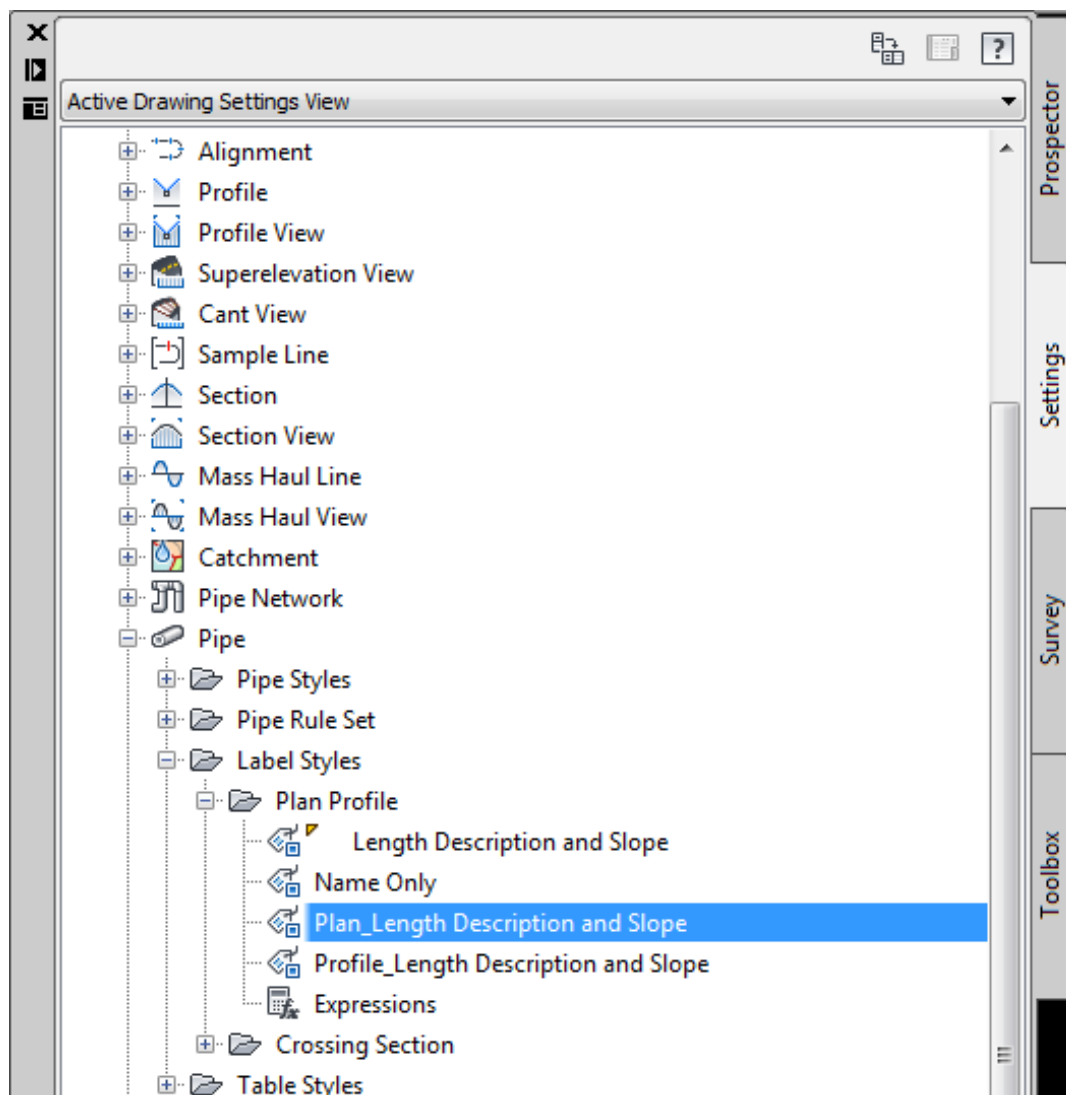
The symbols are arranged by a major discipline (Figure 6.1.3a). The individual discipline palettes are arranged into tabs located on the side of the tool palette. By clicking on a specific tab the selected discipline will move to the top, displaying the symbols within the discipline.



(Figure 6.1.3a)

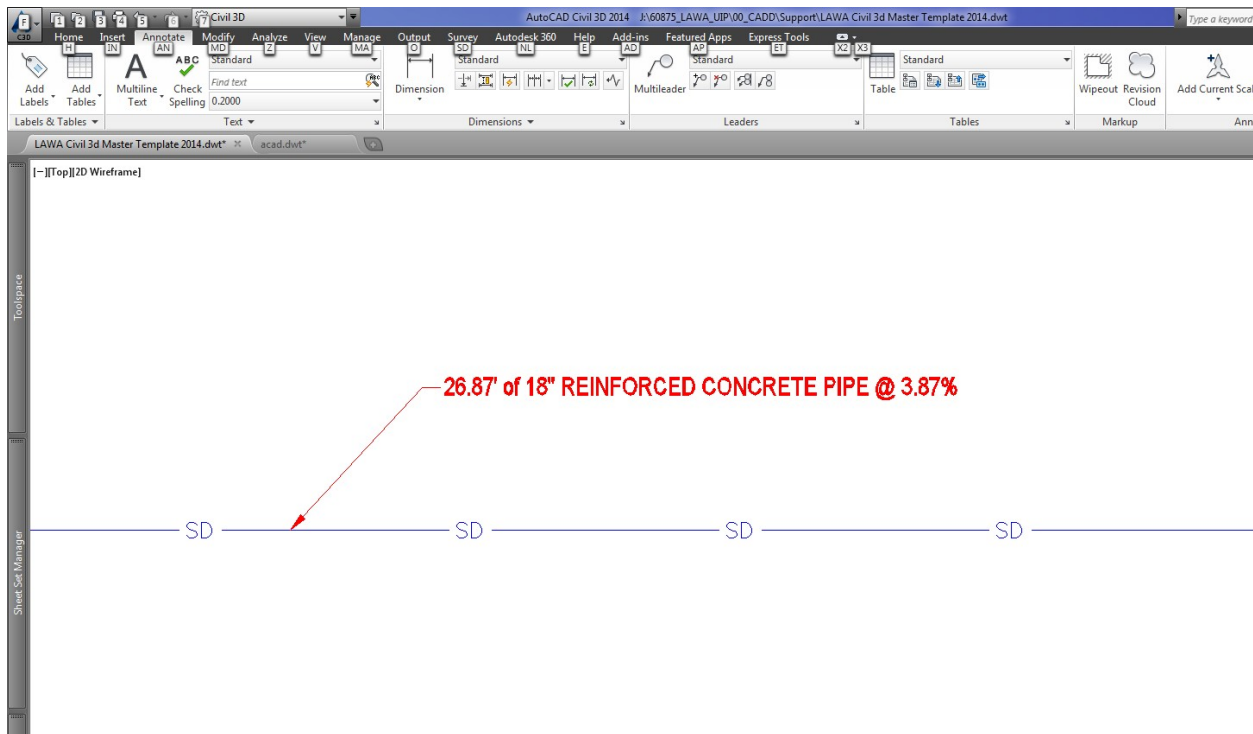
## 6.4 Civil 3D labels

Labels can be added to Civil 3D Pipes and Structures using data such as Pipe Material, Pipe, Length, and Slope. Label Styles can be created in the Settings Tab of the Toolspace Panel. Label Styles shall be created using the appropriate LAWA standards, including font and layer information.





Once a Label Style has been created, use the Add Labels button (located on the Annotate Tab of the Civil 3D ribbon) to bring up the Add Labels Dialog Box. Select the desired Label Style, and then follow the prompts to attach a label to the correct Civil 3D element. Once a label is attached, it should look similar to the following:

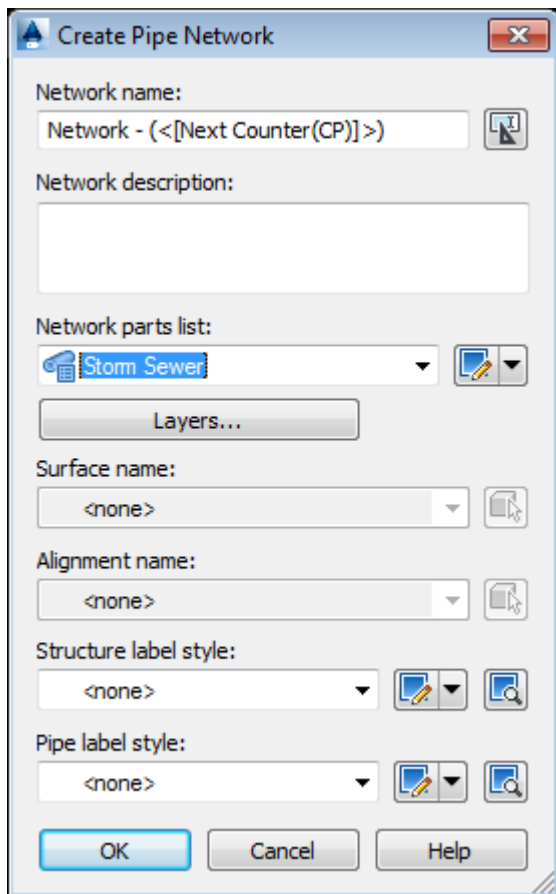


## 6.5 Civil 3D Parts Lists

The appropriate parts list must be selected when building LAWA Civil 3D pipe networks. NOTE: Pipe Networks differ from Pressure Networks, and the available parts list will be dependent on which network is being built. Individual Parts are set to use the compliant Pipe Styles which are set to use the LAWA layer standards.

### 6.5.1 Pipe Networks


Using the Pipe Network Creation Tool, select the appropriate Network Parts List from the available drop down menu.





**Create Pipe Network**




Network name:  





Network description:

Network parts list:  
 

Surface name:  
 

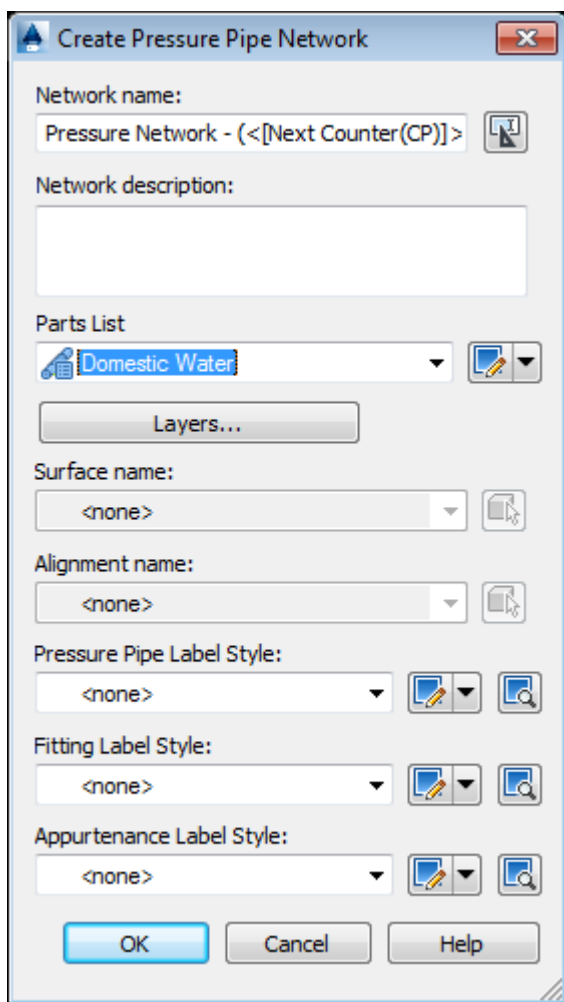
Alignment name:  
 

Structure label style:  
   


Pipe label style:  
   

### 6.5.2 Pressure Networks



Using the Pressure Network Creation Tool, select the appropriate Parts List from the available drop down menu.

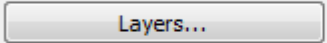



**Create Pressure Pipe Network**


Network name:  
Pressure Network - (<[Next Counter(CP)]> 




Network description:




Parts List  
Domestic Water  




Layers... 

Surface name:  
<none> 

Alignment name:  
<none> 

Pressure Pipe Label Style:  
<none>   

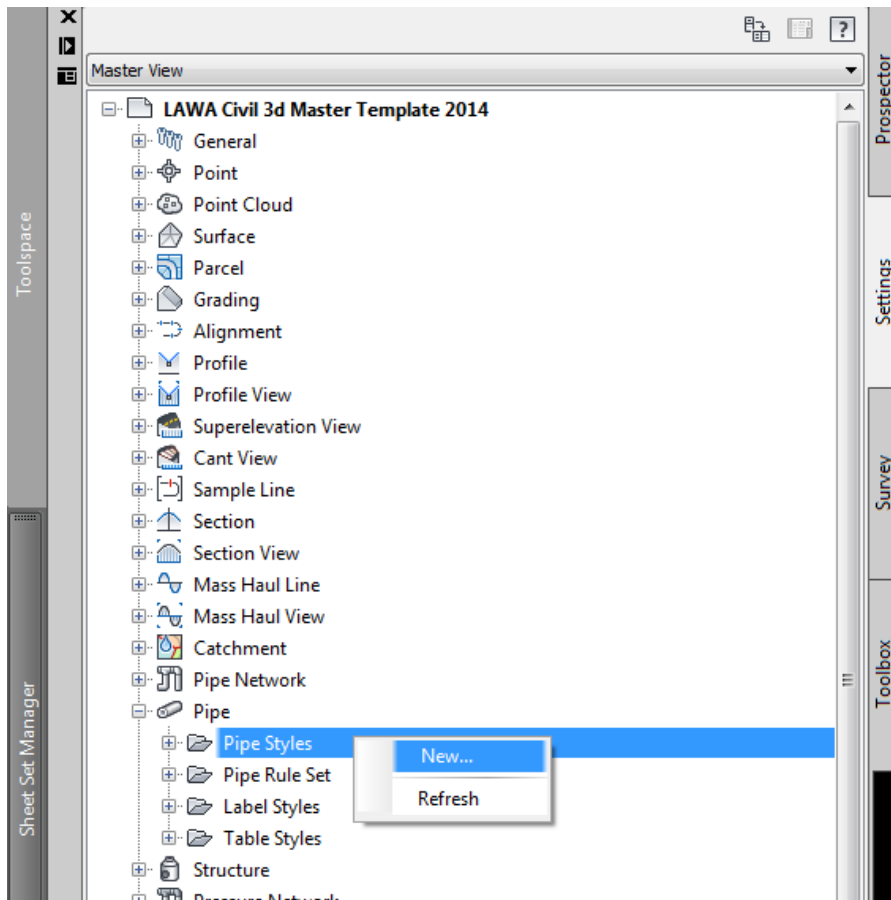
Fitting Label Style:  
<none>   

Appurtenance Label Style:  
<none>   

OK Cancel Help

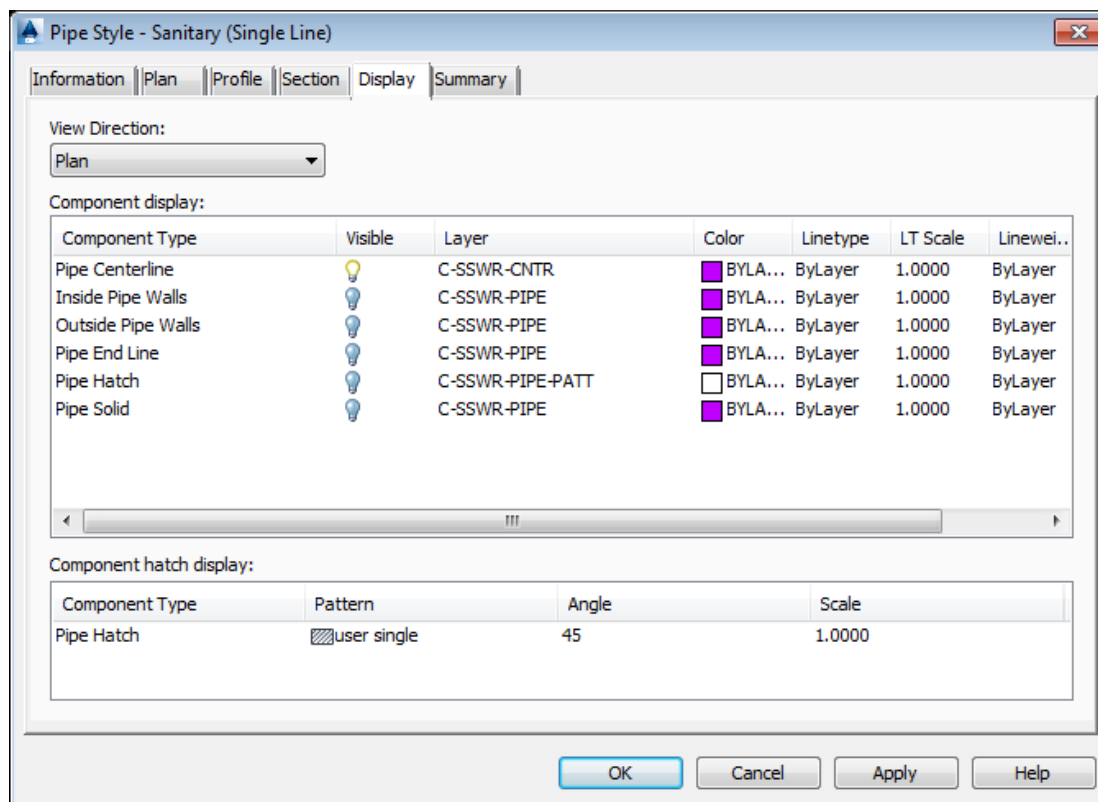
### 6.5.3 Civil 3D Pipe Styles

New Pipe styles are created using the Pipe Style Editor dialog box. This can be accessed via the Settings Tab on a drawing's Toolspace.



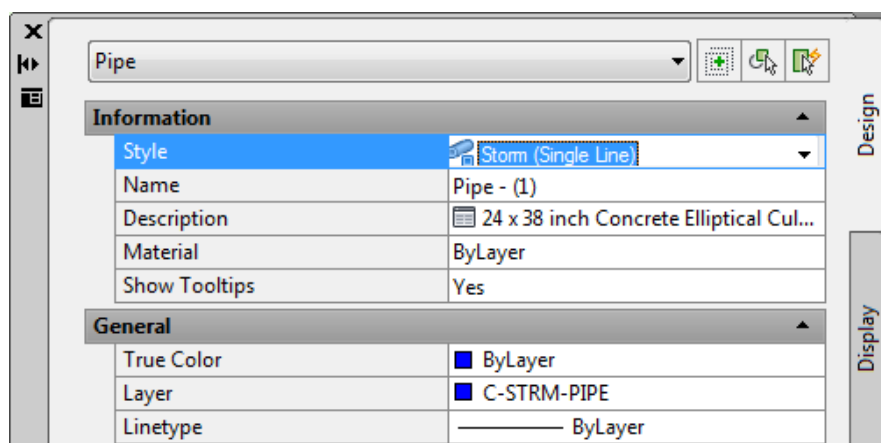
PAGE INTENTIONALLY LEFT BLANK

During the style creation process, the new Pipe Style should be properly assigned to LAWA's standard layers.

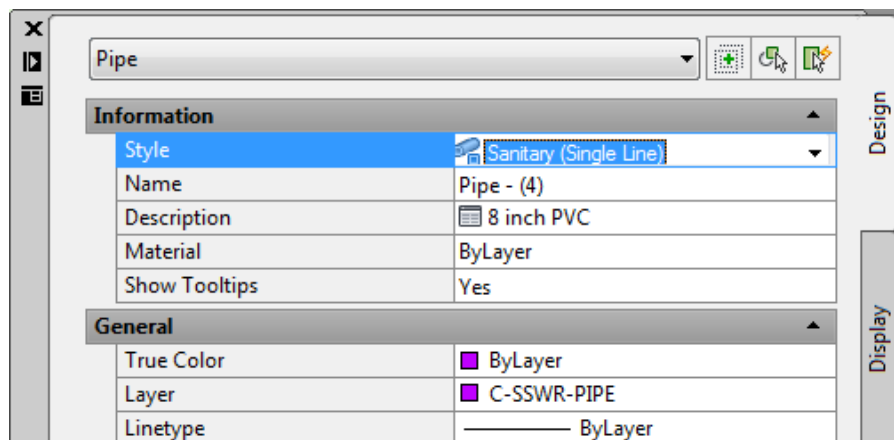


The Civil 3D Pipe Styles are automatically selected based on the Parts List being used. However, if the Pipe Style needs to be assigned after a pipe has been created; the following styles can be assigned for the appropriate system using the drop down menu from the Pipe Properties

### Storm Water & Drainage



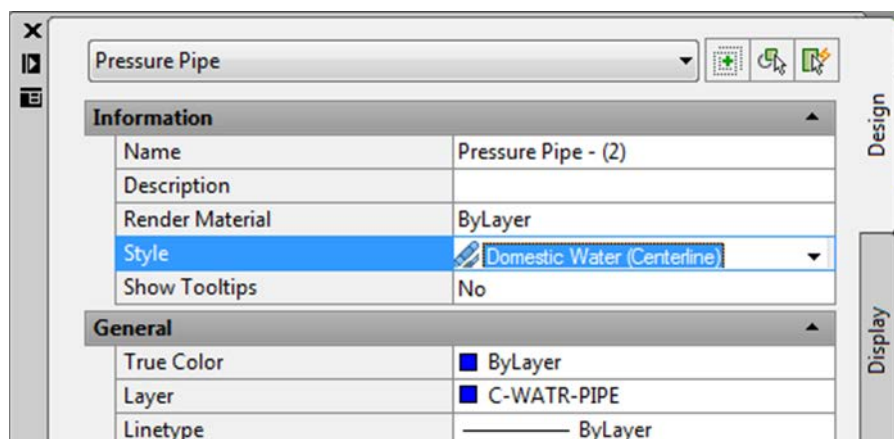
## Sanitary Sewer



Information	
Style	Sanitary (Single Line)
Name	Pipe - (4)
Description	8 inch PVC
Material	ByLayer
Show Tooltips	Yes

General	
True Color	ByLayer
Layer	C-SSWR-PIPE
Linetype	ByLayer

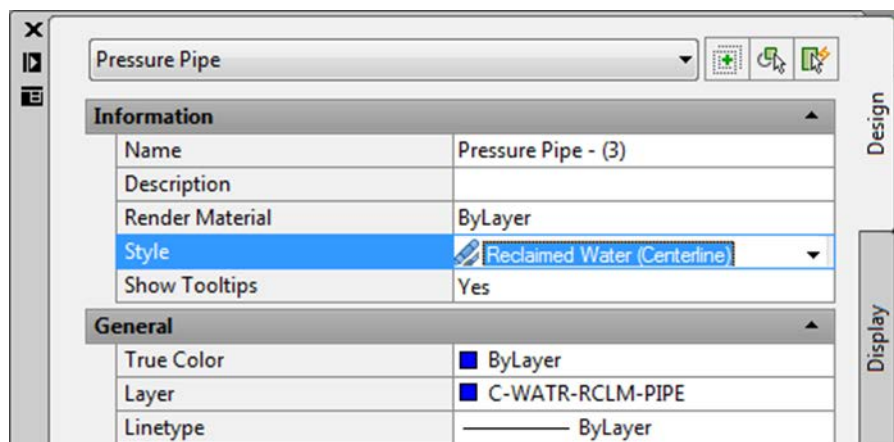
## Domestic Water



Information	
Name	Pressure Pipe - (2)
Description	
Render Material	ByLayer
Style	Domestic Water (Centerline)
Show Tooltips	No

General	
True Color	ByLayer
Layer	C-WATR-PIPE
Linetype	ByLayer

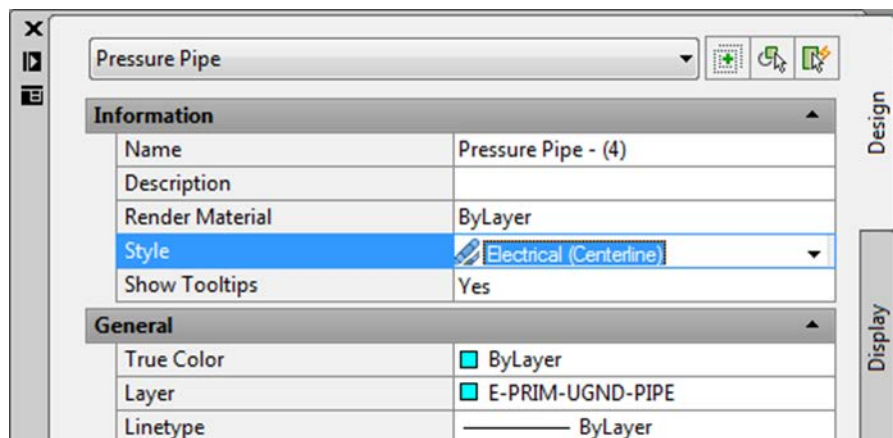
## Reclaimed Water



Information	
Name	Pressure Pipe - (3)
Description	
Render Material	ByLayer
Style	Reclaimed Water (Centerline)
Show Tooltips	Yes

General	
True Color	ByLayer
Layer	C-WATR-RCLM-PIPE
Linetype	ByLayer

## Electrical

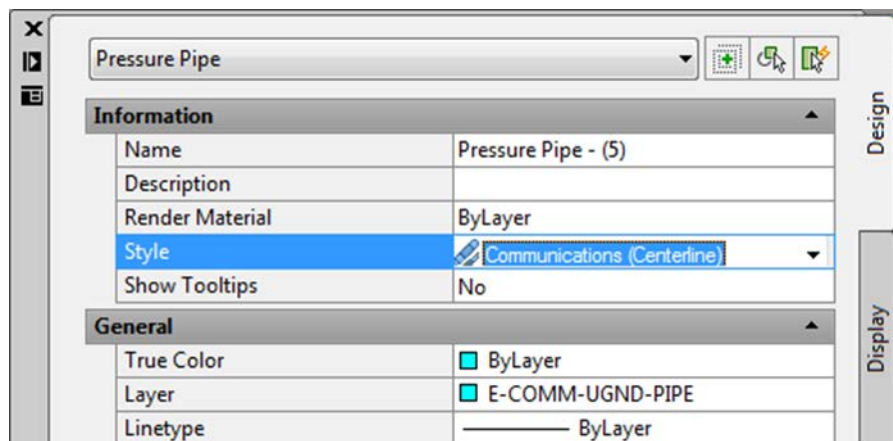


Pressure Pipe

Information	
Name	Pressure Pipe - (4)
Description	
Render Material	ByLayer
Style	Electrical (Centerline)
Show Tooltips	Yes

General	
True Color	ByLayer
Layer	E-PRIM-UGND-PIPE
Linetype	ByLayer

## Communications

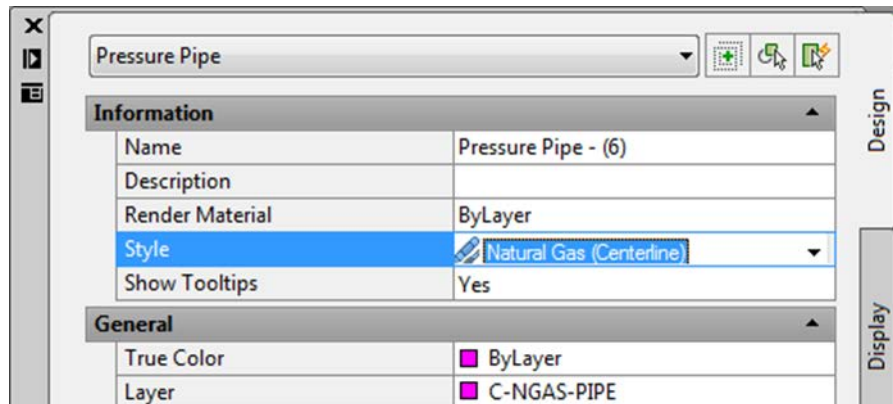


Pressure Pipe

Information	
Name	Pressure Pipe - (5)
Description	
Render Material	ByLayer
Style	Communications (Centerline)
Show Tooltips	No

General	
True Color	ByLayer
Layer	E-COMM-UGND-PIPE
Linetype	ByLayer

## Natural Gas

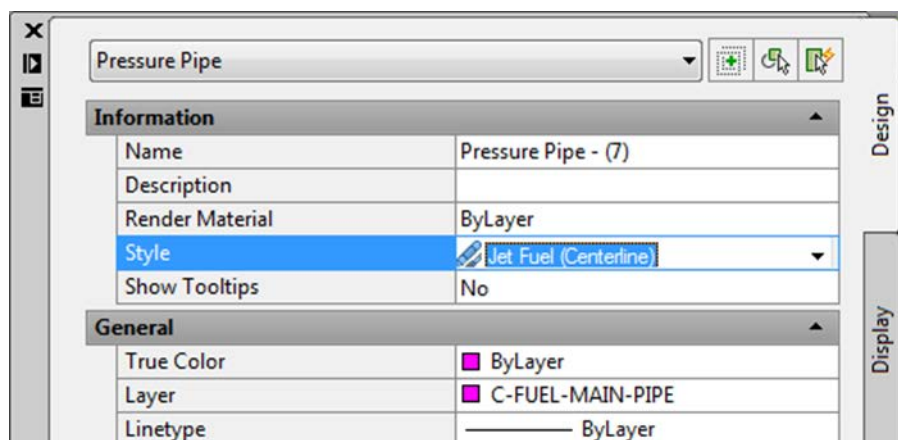


Pressure Pipe

Information	
Name	Pressure Pipe - (6)
Description	
Render Material	ByLayer
Style	Natural Gas (Centerline)
Show Tooltips	Yes

General	
True Color	ByLayer
Layer	C-NGAS-PIPE

## Jet Fuel

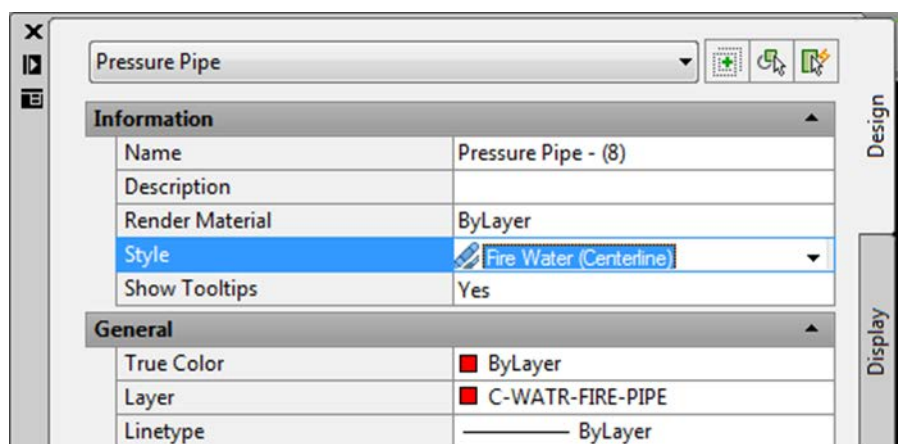


Pressure Pipe

Information	
Name	Pressure Pipe - (7)
Description	
Render Material	ByLayer
Style	Jet Fuel (Centerline)
Show Tooltips	No
General	
True Color	ByLayer
Layer	C-FUEL-MAIN-PIPE
Linetype	ByLayer

Design | Display

## Fire Water



Pressure Pipe

Information	
Name	Pressure Pipe - (8)
Description	
Render Material	ByLayer
Style	Fire Water (Centerline)
Show Tooltips	Yes
General	
True Color	ByLayer
Layer	C-WATR-FIRE-PIPE
Linetype	ByLayer

Design | Display



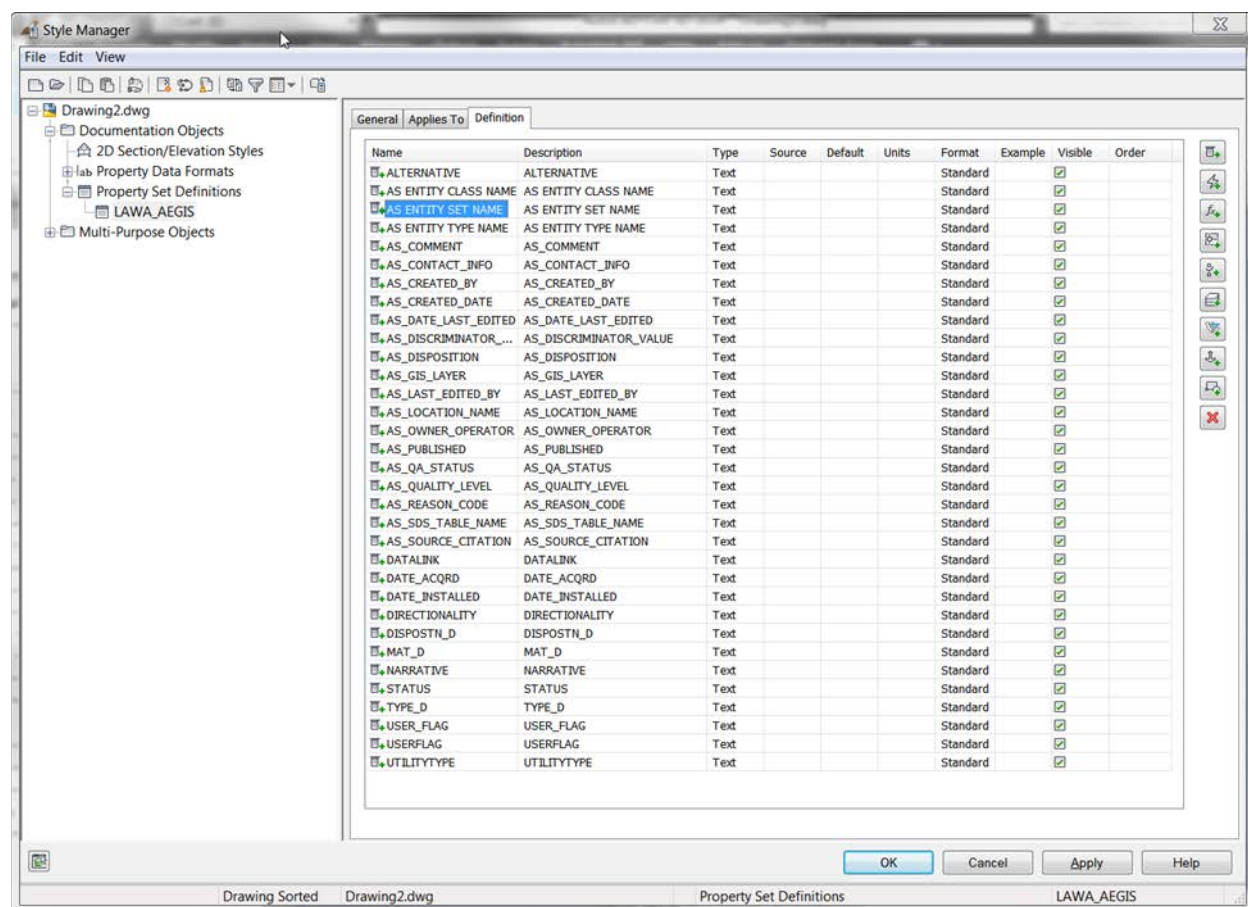
## 7 GIS ATTRIBUTE DATA

LAWA records specific attribute data for utilities in the Airport Enterprise GIS database (AEGIS). Property Set Definitions are used in Civil 3D in order to collect the required data.

For additional information, and specific attributes required for your project, see the LAWLA GIS Standards and contact the LAWLA GIS department.

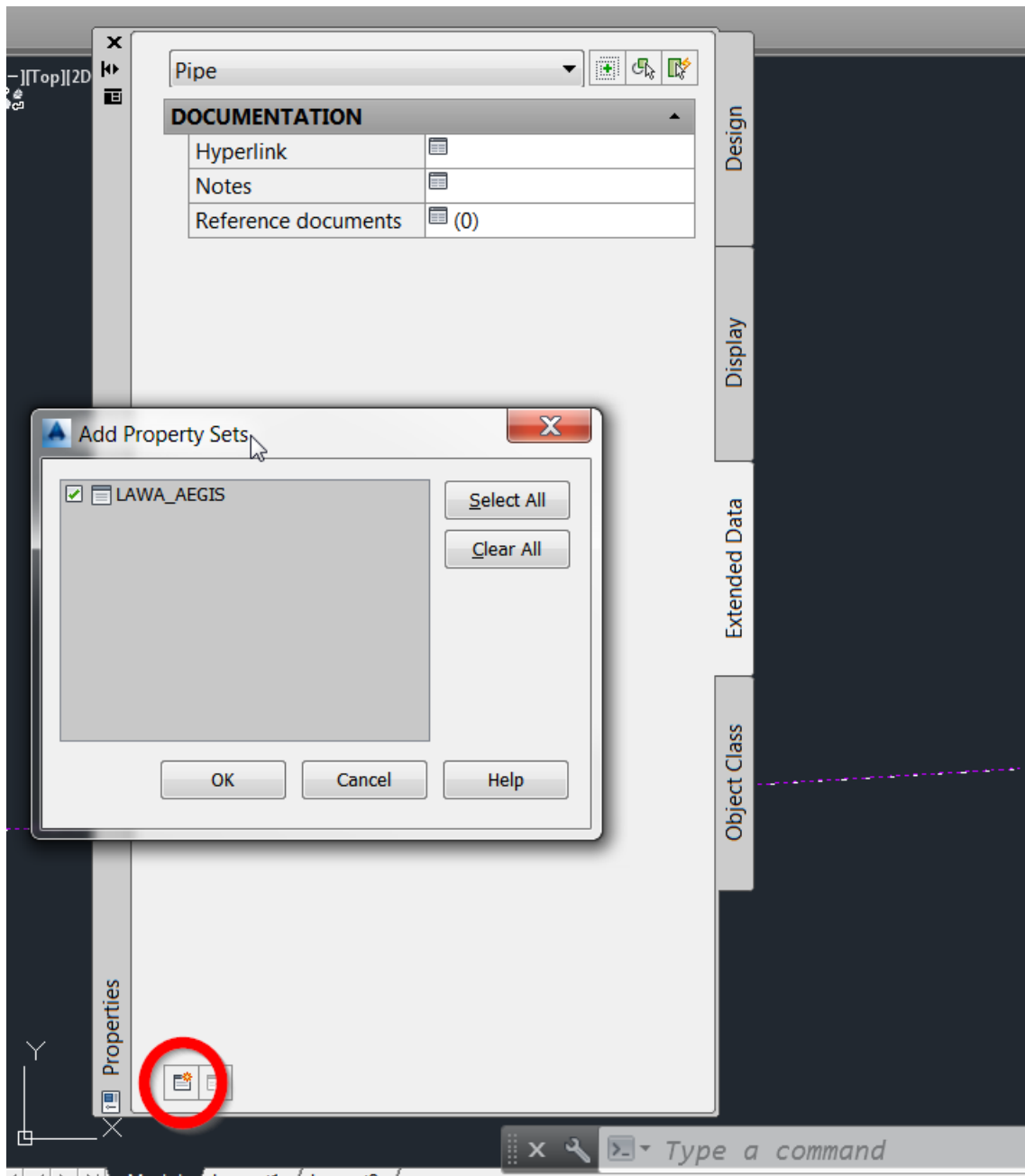
### 7.1 Autodesk Civil 3D Property Sets

To access Property Set Definitions in Civil 3D, type AECSTYLEMANAGER at the command line. Expand Documentation Objects and Property Set Definitions to reveal the LAWLA\_AEGIS Property Set. The LAWLA\_AEGIS Property Set can be added to lines, Polyline, Pipe, and Pressure Pipes as it is in the template. Additional categories can be added via the Applies to tab of the Style Manager. A sample set of metadata attribute fields have been prepopulated in the Property Set. **You must confirm the required attributes fields and acceptable values with LAWLA prior to deliverable submission.**

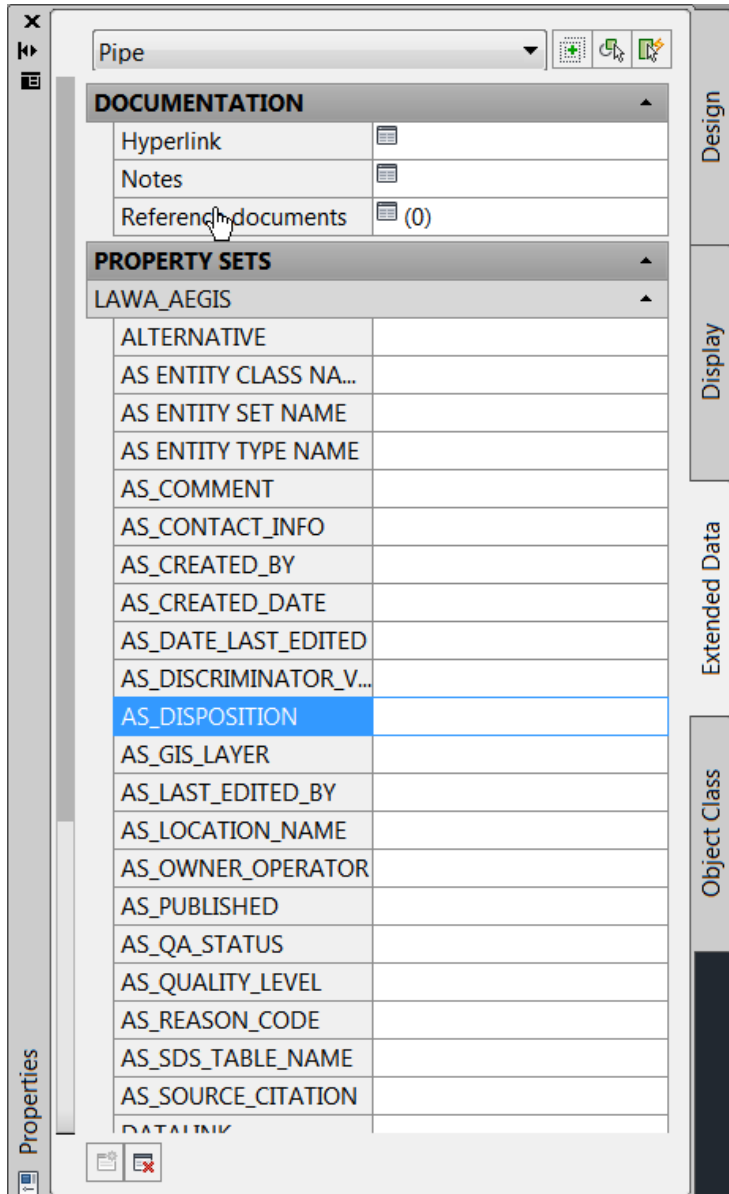


Use the tools on the right to create or delete Property Set Definitions based on the specific project requirements.

To add Property Set Definitions to objects in Civil 3D, first select the object or objects, then select the Extended Data tab of the properties palette and the Add Property Sets button at the bottom



Select the LAWA\_AEGIS Property Set to add the property Set definitions to the selected object(s). Once the Property Sets is added, the Property Set Definitions are visible on the Extended Data tab of the Properties Palette. Values can be manually input in this dialog. **Acceptable input values must be confirmed with LAWA prior to deliverable submission.**



## 8 PLAN PRODUCTION

The Plan Production techniques introduced herein are considered best practices for automating processes for producing nearly complete sheets in very few steps. Training is strongly recommended to acquire skills needed to utilize these tools effectively.

### 8.1 Overview

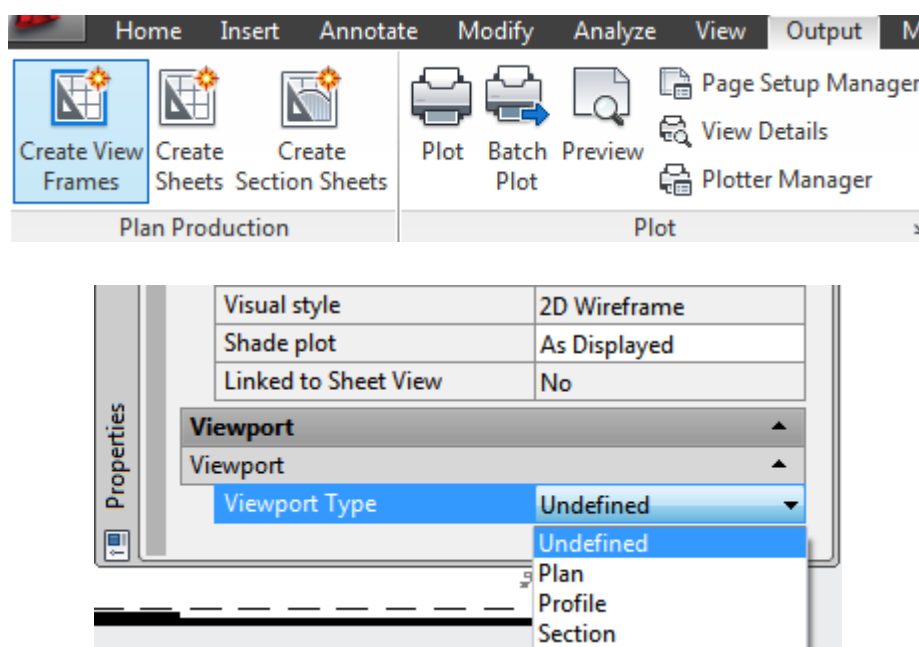
Plan Production is the process of creating individual Sheets for inclusion in a plan set. The end result of several possible Plan Production processes is a set of plans either plotted on paper or contained in a pdf file.

The Plan Production process can be as simple as creating Layouts manually and using the PUBLISH command to plot drawings. Another method employing a little more automation involves creating layouts, creating a Sheet Set and manually adding layouts. Using Sheet Set Manager you can batch plot drawings. You can use plain AutoCAD for both these techniques.

The most automated technique uses the Plan Production Tools found in Civil 3d. You can create Plan Sheets, Plan and Profile Sheets, or Section Sheets using Civil 3d's Plan Production Tools. The LAWA CAD Standard includes drawing templates (LAWA\_Design\_R1.0.DWT) and a Sheet Set data file (.DST) ready to use with the Plan Production Tools.

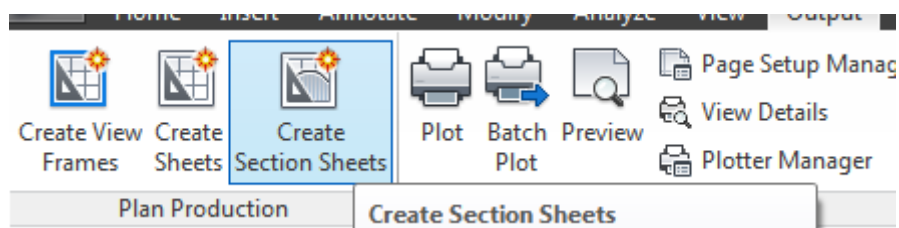
### 8.2 Plan Only, Plan/Profile, and Profile Only Sheets

The Plan Production Tools begin by creating View Frames along an Alignment.



The Create View Frames wizard requires you to select a template file that contains a pre-configured layout having a scaled viewport set to Plan as the Viewport Type. A View Frame Group is created when the Create View Frames wizard is completed. The Create Sheets command launches another wizard designed to produce a layout for each View Frame.

## 8.3 Section Sheets



Similar to the Create Sheets command the Create Section Sheets command starts a wizard that uses the Section Sample Line Group and other settings to create layouts that place Sections Views in scaled viewports.

## 8.4 Sheet Set Manager

With the Sheet Set Manager, you can create “links” to drawings (Layout Tabs) called sheets. Sheets can be organized under logical headings called subsets, can display thumbnail images and descriptions, and can be used to open the drawings. There is much more to Sheet Sets that can be learned in a short time by working through some tutorials or enrolling in a training class. Sheet Sets should be utilized on LAWA projects.



## 9 CIVIL 3D GUIDELINES: BEST PRACTICES

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### 9.1 Miscellaneous

- This list is only a summary of best practices. For a more comprehensive tutorial and Best Practices Guide, follow the link below:

<http://knowledge.autodesk.com/support/autocad-civil-3d/learn-explore/caas/documentation/CIV3D/2013/ENU/filesCBP/GUID-394E4463-964C-4233-BC27-5ECB5B03E4E3-htm.html?v=2013>.

- In Profile Views do not use a clipped grid.
- For Pipes in Profiles use the boundary option rather than the model option
- Label Styles - create a No Label style to give you the option of turning off labels without deleting the label
- For Point Label Styles put all text components in a single component instead of separate components.

### 9.2 Surfaces

- TINs are more memory intensive than DEM
- Use external ASCII point files rather than point objects in the drawing
- Create a surface snapshot after sampling the point file. The file size increases but the rebuild times improve.
- Adding contour data - Understand the settings for Minimizing Flat Areas
- Avoid Surface Editing - filling gaps and adding points is much faster than swapping edges. Plus you have no evidence for what has been altered.
- Minimize points used to create surfaces
- Surface Simplification is an Editing tool which decimates points without affecting accuracy
- Create a grid surface if you do not need the precision of a TIN Surface. You can grid a surface by exporting it to a DEM.
- Display of triangles and contours can slow down the display. Minimize displayed data when appropriate
- Use an outer boundary to reduce data processed in the surface.
- Use Data Clipping instead of Masking the surface
- Cropped Surfaces are linked to a parent surface but process a smaller portion of the data
- Query GIS Data to create a surface

### 9.3 Corridor Models

- In Subassembly styles use solid fills instead of hatch patterns.
- Turn off Rebuild Automatic
- Isolate Regions so you are not processing the entire corridor
- Reduce Cross Sections in the corridor drawing during preliminary design
- Xref the corridor into a separate drawing and sample sections in that drawing. Use a data shortcut for the alignment.

## 9.4 AutoCAD Best Practices

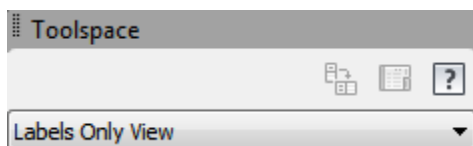
- Layoutregenctl is best set to 1
- Proxy Graphics should be turned off until you are ready to share your drawing with other non-civil 3d users
- Turn off Tool Tips and Event Viewer if not needed

## 9.5 Data Management Methods

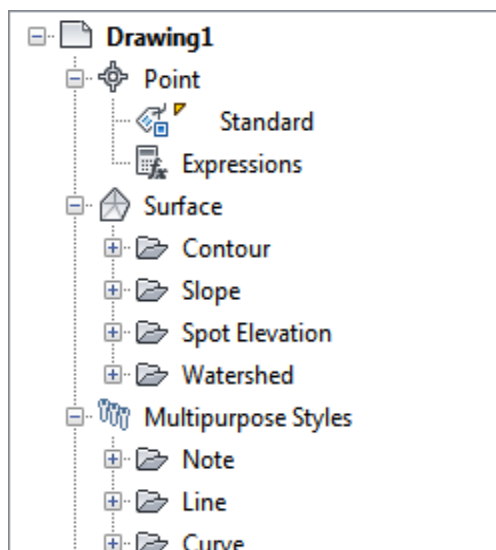
- Using 1 drawing is best suited for small projects.
- Using Data Shortcuts is best for sharing data across multiple drawings.
- Using Data Management Server applies the same principals as Data Shortcuts but has the requirement of a Server Component that may be undesirable for teams without adequate IT support.

## 9.6 Civil 3d Labels

Automatic labeling capabilities are found throughout Civil 3d. Label Styles control the behavior and content of these labels. Civil 3d Label Styles and Settings are located under the Settings Tab within the Toolspace palette. The Civil 3d drawing template “LAWA Civil 3d Master Template.dwt” contains the Label Styles for use on LAWA projects.



To view a list of just label styles choose the drop-down list on the Settings tab of the Toolspace and select Labels Only View. The following figure shows a list of the label styles in Civil 3d 2012.



## 9.7 Stationing

Stationing shall be indicated in relation to the scale as follows:

Scale	Station at
1" = 50'	Each 100 ft
1" = 100' or greater	Each 500 ft.

The station shall be identified by a tick mark 1/8" long. The numerals shall be 3/32" high. Station equalities shall be shown as a 1/8" open square. The equation shall be shown on a fine line drawn perpendicular to the stationed line.

## 9.8 Civil 3d Styles and Settings

The Civil 3d drawing template contains the pre-configured command settings and style definitions compliant with the LAWA CAD Standard. Begin all model files using this Civil 3d template. Survey Descriptor Codes

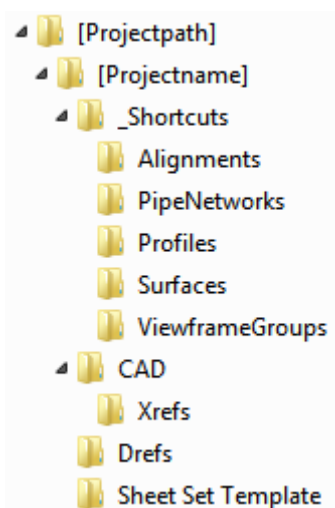
The Civil 3d drawing template provided in this Standard contains the Description Key Set defining the Survey Descriptor Codes.



## 10 DELIVERING CADD DATA TO LAW A

### 10.1 Overview

CADD data is mostly in the form of .dwg files. By following the LAW A CADD Projects Folder Structure you will have all the required files in just a few folders beneath the project root folder.



Files within this folder structure can be easily compiled into one zip file. The deliverable is a single zip file with the name following Sheet File naming convention.

### 10.2 Programs to create Zip files

Use WinZip or other compatible zip programs, ZipGenius for example. These programs will integrate with Windows Explorer's shortcut menu.

### 10.3 How to Create a Data Transmittal

Use one of the Options provided in this section to create a zip file for delivery to LAW A. Include an **eTransmit.txt** file containing a list of files and any comments you may feel will help the recipient understand what is being delivered and how to use it.

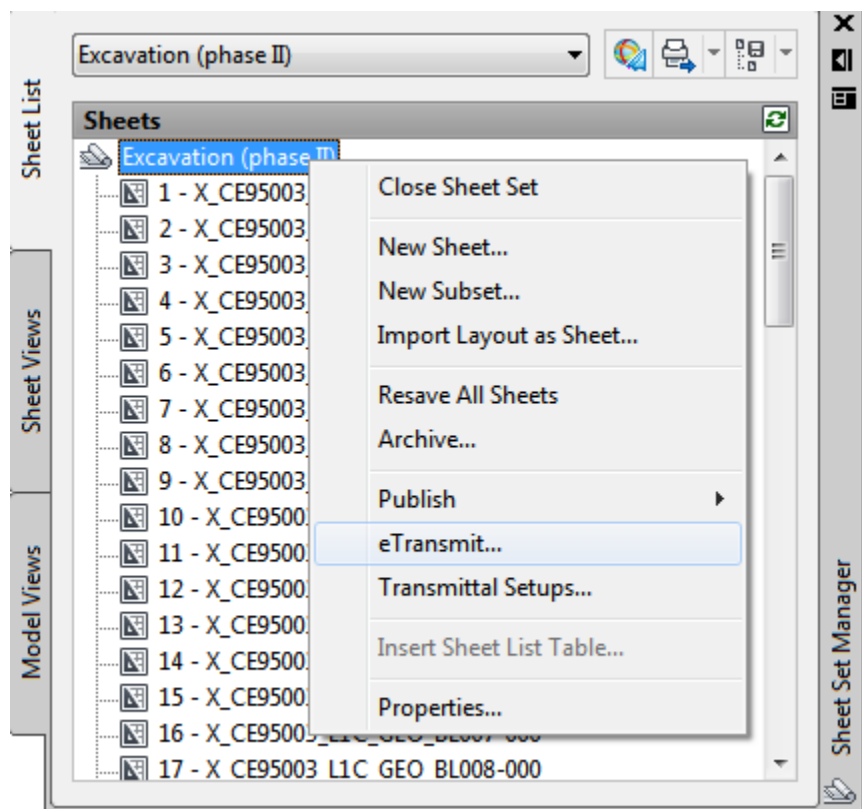
Zip files can contain other zip files. You may wish to use a combination of the **eTransmit** tools in AutoCAD and/or the zip tools in your zip program to assemble a single zip file with the necessary content to make a complete Data Transmittal.

#### 10.3.1 Option 1 - Include the entire project folder.

To package file for a submittal Right Click on the root folder of a project and create a zip file that includes all the files within the project folder structure and preserves the folder structure within the zip file.

#### 10.3.2 Option 2 - Use Sheet Set Manager

Use **eTransmit** from Sheet Set Manager to gather all the sheet files, reference files, and data reference files into a single zip file. Make sure to preserve the original folder structure within the zip file.

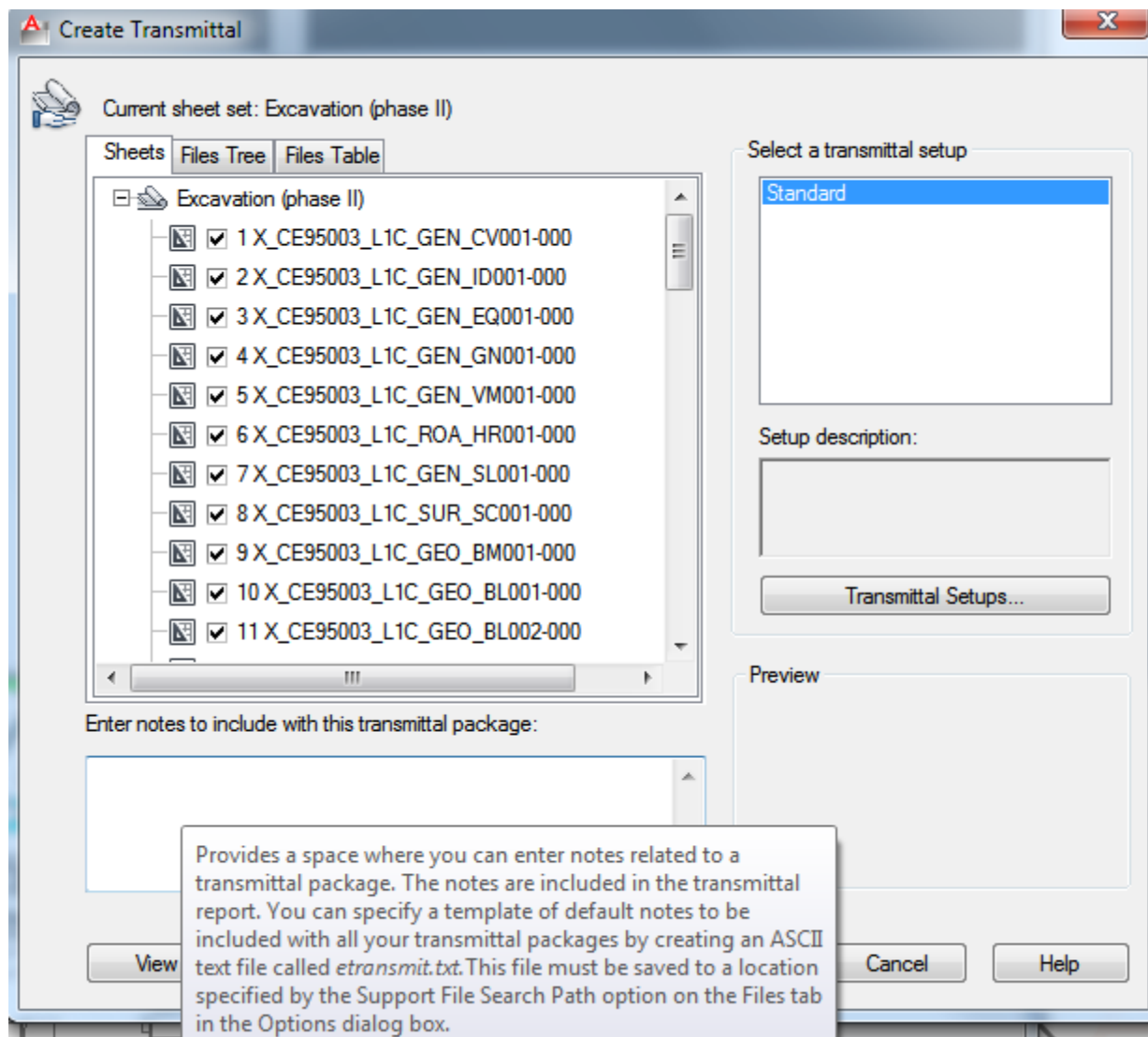


### 10.3.3 Option 3 - eTransmit

Use eTransmit command in Civil 3d to create a zip file of the current drawing, its reference files and data reference files.

## 10.4 etransmit.txt

Include a text file named etransmit.txt in the zip file. The **eTransmit** command has a transmittal document feature that does this automatically.





## 11 BIM “Revit” STANDARDS

This chapter provides a set of graphic and Revit file standards for any BIM project at Los Angeles World Airports (LAWA).

### 11.1 Introduction

LAWA recognizes that Building Information Modeling (BIM) represents a fundamental change to the industry. This change affects the traditional processes and deliverables for planning, architecture, engineering, construction and facilities management.

The goal of LAWA is to integrate BIM from cradle to grave in its organizational, planning, and maintenance departments.

LAWA also recognizes that BIM involves rapidly evolving processes, industry standards and technology. As building information modeling technology advances, LAWA will look forward to integrating those changes into existing processes.

As part of the first phase of integration of BIM at LAWA, the immediate goal is to take advantage of the information model created during design and construction to enhance and feed into existing and future facilities maintenance systems.

To achieve this first goal, LAWA has adopted these BIM requirements. These requirements apply to LAWA BIM Projects advertised on or after July 1, 2016

Requirements established here are baseline requirements for all BIM projects at LAWA. Any of these requirements may be superseded by Project Contract or the project’s specific BIM Project Execution Plan.

### 11.2 Acronyms

Refer to Section 4.4 of this document for acronyms list and definitions for CAD/Civil related deliverables.

BIM	Building Information Model
BPXP	BIM Project Execution Plan
CADD	Computer Aided Design and Drafting
LAWA	Los Angeles World Airports
LoD	Level of Development
EDI	Electronic Data Interchange
FAA	Federal Aviation Administration
NCS	National CAD Standard
SDSFIE	Spatial Data Standard for Facilities Infrastructure and Environment
TSA	Transportation Security Administration

### 11.3 Content Folders

This section describes the folder structure and content for the LAWA (shared) BIM libraries. Files and folders described here are available, or "shared", to all LAWA staff and consultants working on LAWA BIM projects respectively. All will have access to Project BIM library, a Project specific library, and Local

Workstation folders from which to begin projects and maintain related standards material. A current reproduced copy will be provided to LAWA consultants from which to begin their respective projects.

For LAWA consultants, this library (2016\_LAWA) will contain the LAWA “Kit of Parts” and will be transferred to their local server, or provided on a disk, after successful request to, and acceptance of, the LAWA Project Manager. This folder structure can then be integrated into the consultant’s office project folder structure, and made available to all project staff members. It is recommended that consultants maintain the “(Project Name)” folder structure on their network as this is a requirement for project milestone submission.

## 11.4 BIM Libraries

The BIM Libraries Folder holds all content for LAWA BIM work, including the shared libraries and the default Revit installed content. This content is the baseline from which all projects will begin. As project specific content is developed, reviewed and accepted, this content will be added to the BIM Libraries. The Library structure is defined with Custom folders and folders with a CSI MasterFormat 2004 (2010 Update) naming convention. As additional projects are developed, it is anticipated that this library will significantly increase over time, with project-ready, available content.

**NOTE: This library is organized in a different structure as the default installed Revit content (by Revit Category) with exceptions and structural differences illustrated and noted in the following sections.**

### 11.4.1 BIM Libraries Folders

Custom library folders (00\_MasterFormat 2004 Folders... – 06\_Annotations, and Annotations) include standards based content and files applicable across trades, whereas the MasterFormat folders (DIV-00 through DIV-49) contain project specific component families and their specific symbol annotations.

## 11.5 Combined (AEC Design Disciplines)- LAWA Revit Content

The Custom Library Content and MasterFormat folders are structured and combined to include content for all disciplines. This ensures continuity of developed content across trades. It is important to note that the maintenance of versioned libraries is necessary because of the lack of backwards compatibility within the Revit file format. As new versions are released, it is likely that some projects continue forward on the old release while new projects are started on the new release.

It is also important to note that this content will be updated accordingly for projects as they reach certain milestones of design, construction and operation.

## 11.6 Custom Folders

### 11.6.1 00\_MasterFormat 2004 Folders\_DIV Number Titles

Contains Master Format Docs for Reference

### 11.6.2 01\_Containers

Containers hold various system family and annotation family elements.

### 11.6.3 02\_Templates

Contains both project and family template files that all LAWA projects and content will be developed from.

### 11.6.4 03\_Titleblocks

Holds LAWA specific Titleblocks for project use across disciplines

### 11.6.5 04\_Hatch Patterns

Contains LAWA standards specific hatch patterns

### 11.6.6 05\_e-Specs

Contains Out-of-the-Box Revit Content

### 11.6.7 06\_Annotations

Contains original LAWA symbology and annotations

The LAWA content library combines content for all disciplines in a single tree structure based upon CSI MasterFormat 2004 with 2010 Updates.

## 11.7 Default Revit Content

The LAWA BIM Master Library contains properly built template files from which to create new content from. If default Revit content is used as the basis for the developed families, they shall be submitted for review as with all other custom family content.

## 11.8 Project Content

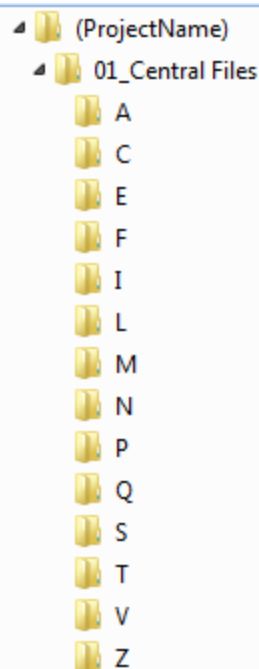
Part of the shared library structure, the Project Content folder contains a folder structure from which consultants will begin their LAWA BIM projects. **NOTE: All milestone and final LAWA BIM project submissions will be delivered to LAWA in this structure / format.** Because Revit is not backward compatible with previous releases, content must be available for those projects that will not be upgraded during the design process. This content should be maintained in parallel with the Autodesk product release cycle (i.e. Revit 2014, Revit 2016; folder names are shortened to just the year).

### 11.8.1 01\_Central Files

This is the location that all Project Central Files will reside, in their own discipline specific subfolders. See Workflow documents for specific linking file standards. Additional "Central File" folders may be added, and shall follow the NCS discipline codes.

Categories common to multiple disciplines are organized at the first level by Discipline. This structure is typical to several of the category folders.

A - Architectural  
 C - Civil  
 E – Electrical  
 F – Fire  
 I - Interiors  
 L – Landscape  
 M – Mechanical  
 N - Navisworks  
 P – Plumbing  
 Q – Equipment  
 S - Structural  
 T - Telecom/Data  
 V – Vertical Transportation  
 Z - Misc



#### **11.8.2 02\_Weekly Updates**

The Data folder is a location for storing pertinent database files.

#### **11.8.3 03\_Reference**

This folder contains all project related reference material, organized in logical file structures. Examples of this content would include product information and cut sheets, program information, etc.

#### **11.8.4 04\_Misc**

This folder includes the standard supporting text files (Keynotes, Shared Parameters, Import/Export lineweights) for Revit as well as customized Batch Files for various uses.

#### **11.8.5 05\_Scripts**

This folder contains all script files for customized operations such as the creation of local files from central files, etc.

#### **11.8.6 06\_Support**

This folder includes all content from various consultants used to supplement both the design and documentation of the project. Examples would include subfolders, drawings/ BIM files from consultants such as: kitchen design, lighting design, sound design, etc. This folder may also contain subfolders for 4D and 5D modeling as well as presentation materials.

#### **11.8.7 07\_Training**

This folder will contain training material for internal LAWA staff and Project Staff.



## 12 REVIT NAMING CONVENTIONS

### 12.1 Naming: Revit Project Files

\*\*\*This section outlines the LAWA naming convention for Revit project (.RVT) file naming. This is both for Central files as well as non-workset enabled files. Naming is divided and group formatted into 3 general categories as follows:

**<Facility Designator><LAWA Project Tracking Number><Discipline Designator><Sub Discipline (if required)>**.

Facility Designator	LAWA Project Tracking Number	Discipline Designator	Sub-Discipline (optional)
Acquired from Section 3.3 of the LAWA CAD Standards 2014	Up to 6 characters – Assigned by the Engineering Archive Systems Administrator	Single digit – Acquired from Section 3.3 of the LAWA CAD Standards 2014	Single digit – Acquired from Section 3.3 of the LAWA CAD Standards 2014
LAWA	XXXX	A	D

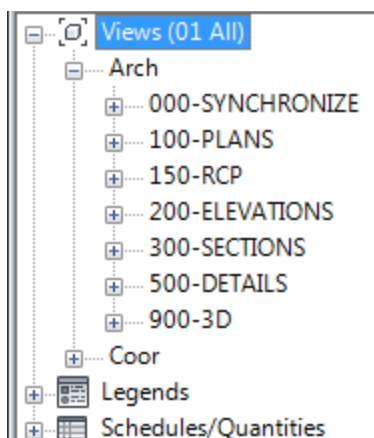
### 12.2 Naming: Sheet Numbering

\*\*\*Revit Sheet naming shall follow the same sheet numbering protocol as established in the LAWA CAD Standards 2014. A summary follows below:

- After the Trade / Sub-Discipline letter/s the next field shall contain three digits. i.e. E004
- Sheet numbers with (decimal points [.]) shall be replaced with
- (underscores [ \_ ]) i.e. E004.01 shall be E004\_01
- No Alpha characters (numerical only)

Facility Designator	LAWA Project Tracking Number	Discipline Designator	Sub-Discipline (optional)	Sheet Range	Sheet Number
				Sheet Ranges / Views are ordered in a structure similar to the National CAD Standard	Sheet Numbers are ordered in numeric order ascending from 00 – 99.
LAWA	XXXX	A	D	100	01

**\*\*\*Sections 12.1 and 12.2 should be considered as placeholders for this draft pending a comprehensive campus & facility designation methodology implementation.**



## 12.3 Deliverable Exports

Revit Sheet naming shall follow this sheet numbering protocol in order to allow the proper exported .dwg file export for the LAWA upon completion of the project.

## 12.4 Naming: Revit Family Files (RFA) Naming

This section outlines the naming format for LAWA Revit family files. Naming is divided and formatted into 4 categories as follows:

**<CSI Identifier><dash><Type>< dash >< Description>< dash ><Category>.**

### 12.4.1 CSI Master format 2004/2010

LAWA has formally adopted the 2004/2011 update MasterFormat system. The samples in this section use this format.

CSI Identifier Required	Type (optional)	Description Required	Category (optional)
8 Digits	Up to 6 characters	Up to 18 characters	2 characters Revit Category Identifier

### 12.4.2 CSI Identifier: 8 Digits (Required)

The CSI 2004/2010 format 8 digit identifier are used, no spaces.

08 13 00 13 hollow metal doors = 08130013

For conditions where conflicts occur, just first two characters are significant. For example a wood door (08 14 15) in hollow metal frame (08 12 13) leads to just 0800. Therefore it is important to provide all 8 digits to allow for proper sorting and differentiation of content.

### 12.4.3 Block Name: 6 Characters Max (Optional)

This is a flexible field and is used differently by different family types. The primary use of this is to provide a secondary sorting mechanism in Revit's Project Browser. The Block Name should be the same name as is designated within the LAWA Design Symbols library that is provided within the 2014 LAWA CAD Standards documentation

MEP can use this to separate out plan vs. other types of symbols. Specific types of annotation families such as title blocks can be separated out by adding this field. Doors and windows can use this to identify with shorthand interior, exterior, single, double.

#### 12.4.4 Description: 18 Characters Max (Required)

General description of the family. Use spaces within the field as necessary for clarity

#### 12.4.5 Category: 2 Characters Max (Optional)

This optional field is used to help users identify special types of families. Annotative elements may be created with Generic Annotation (GA), Detail components (DT), or even Generic Models (GM). See samples that follow for reference and uses.

#### 12.4.6 LAWA Design Symbol: Graphic Representation

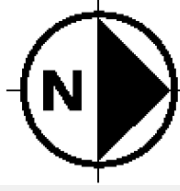
When a Family is created, it must be represented in plan using the approved LAWA Design Symbol. All families will be reviewed for compliance to this requirement. A description on how to create native Revit families using the existing CAD LAWA Design Symbols follows in the Graphics Standards Section. Not all examples below have a matching LAWA Design Symbol. Any Family that does not have a predefined LAWA Design Symbol must be submitted for approval.


### 12.5 Component Families Examples

08340013-EXTDBL-MTL Security Door

Object	CSI Identifier	Block Name	Description	Category	LAWA Design Symbol
Real World	8 Digit	8 digit max	18 digits max.	2 digit	
Exterior Double Metal Security Door	08340013	EXTDBL	MTL Security Door		
Curtain Wall entry door	08410013	EXTDBL	CW Door		
Hydronic Piping Pump	23210020		Hydronic Pump		



#### 12.5.1 Design Symbol (Annotation Family) Examples

Object	CSI Identifier	Block Name	Description	Category	LAWA Design Symbol
Real World	6 Digit	8 digit max	18 digits max.	2 digit	
North Arrow	000000	NAoRgt	North Arrow	GA	
Door Tag	080000		Door Tag		
Diffuser Tag	230000		Terminal Tag		

Object	CSI Identifier	Block Name	Description	Category	LAWA Design Symbol
Section Head	000000	SEC_DN_L	Section Head		
Keynote	000000		Keynote		
Generic Annotation Sheet Note	000000	Plan	Sheet Note	GA	
Generic Annotation Sheet Note	000000	Elev	Sheet Note	GA	

### 12.5.2 MEP Symbol (Annotation Families) Examples

Symbols will be generic annotations with the CSI Division rounded to six digits

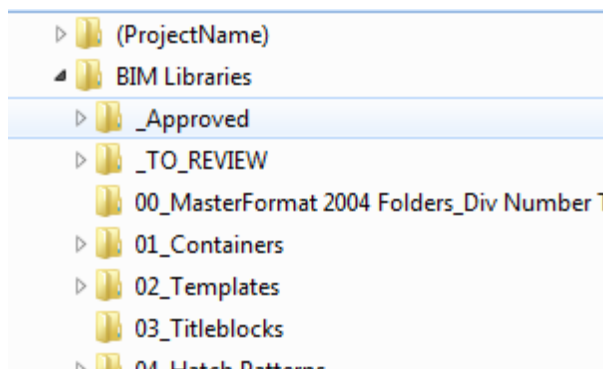
Object	CSI Identifier	Block Name	Description	Category	LAWA Design Symbol
Real World	6 Digit	8 digit max	18 digits max.	2 digit	
Hydronic Piping Pump	230000	Pump	Pump Symb		
Electrical, Equipment Cabinet	260000	ECB	Transformer Symb		

Symbols without plan or schematic type identifier are used in both plan and schematic views such as single line LAWA diagrams or flow diagrams.

## 12.6 Title Blocks

Revit Title Blocks can be located in the 03\_Titleblocks folder below and should be named using the standards LAWA naming convention. Title blocks that do not exist can be created using the conventions of the existing content and must be submitted for approval.

Object	CSI Identifier	Type	Description	Category
Real World	4 Digit	6 digit max	18 digits max.	2 digit
24 x 36 Title Block for Sheets	000000	TB	TBLK 24X36	
24 x 36 Cover Sheet	000000	CV	Cover 24X36	
24 x 36 Sheet Index	000000	SI	Sheet 24X36	
8 ½ x 11 RFI Sheet	000000	RFI	LAWA_TBLK_8X11-RFI	
11 x 17 Landscape	000000	SK	LAWA_TBLK_11x17	



## 12.7 Name and #: Room and Door Numbering

Room and door identification must be coordinated to assure maximum compatibility with all downstream LAWA uses including Maximo, and GIS applications. Door and Room naming will follow the established LAWA standard.

## 12.8 Areas

Areas will use the same naming and numbering convention as rooms unless created for special purposes such as code/egress diagrams or unique color fill presentations, or take offs of spatial regions per project.

## 12.9 Spaces

Spaces will use the same naming and numbering convention as rooms unless created for special purposes such as plenums per project.

Plenum Spaces will be defined by the inclusion of the prefix "P" before the name. Plenum spaces that cross over multiple rooms will take the name of the room that the space first crosses over in the lower left hand corner.

## 12.10 Naming: Other Revit Element Naming Conventions

### 12.10.1 Revit Walls Types

LAWA will provide wall types in both the template as well as container files. Each of these will be identified by the wall type ID. A separate data file will hold the complete description per wall type of the wall Width, Finish, Fire Rating and Sound Transmission Class rating.

LAWA WALL TYPES - MTL Framing	TYPE ID	REVIT PARTITION (TYPE) NAME
7/8" metal furring w/ 1 layer 5/8" gwb	D20	D20
1 1/2" stud w/ 1 layer 5/8" gwb	D14	D14
2 layer 4" studs, 1 1/2" air gap, 4 layer 5/8" gwb	B3	B3
8" CMU (2hr)	C1	C1
8" CMU (3hr)	C2	C2

## 13 VIEW MANAGEMENT

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Naming of views should make sense with the project.

- The name of the view will be the default title of the view when placed on a sheet
- While the National CAD standards lists an extensive system for naming DWG files, this system does not translate to BIM view naming.
- Review Project Browser organization functions prior to naming views based on a filterable parameter that already exists (sheet number).

### 13.1 Capitalization

All views that are CAPITALIZED are views to be placed on sheets.

All views that are not capitalized are working views and can be assumed will not be placed on sheets.

### 13.2 Temporary Views (Plans, Sections, Elevations, Schedules etc)

It is allowable to create temporary views that allow you to do your work. The intention of a temporary view is to create a view at a different scale or visibility graphic settings when a working view is in use by another member of the team.

Name these views **t\_<your\_Initials>\_description**

If you create one of these views, it is your responsibility to delete it when you are through with it. The project BIM leader can delete any temporary views in the project on a regular interval throughout the design phase.

### 13.3 Schedules Naming

In addition to the above conventions:

- "Key" in a schedule name indicates the scheduling of Revit Keys rather than building components  
These will likely never be placed on a sheet, but it is possible for some reason this is desirable. If a key schedule needs to go on a sheet, it must be renamed to all caps
- Lower case, and or "\_" prefix denotes a working schedule.  
These will never be placed on a sheet. The project BIM leader for the project may delete these if not use by the project
- "t\_<your\_Initials>" prefix denotes a temporary schedule  
If you create one of these views, it is your responsibility to delete it when you are through with it. The project BIM leader can delete any temporary schedules in the project on a regular interval throughout the design phase.

## 14 GRAPHIC STANDARDS

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Most of the LAWA graphic standards are established by the LAWA CADD Standards 2014 and are mostly incorporated into the LAWA template file. The base set of line weights, line types, fill patterns along with the standard set of annotation and tag symbols described there are mostly part of the template files. Although part of the template files, the graphic standards have been separated from the template discussion (next section) for clarity.

The Template establishes the standard for line weights, text styles, dimensions styles and annotative objects in the Revit model. If it is not in the template or the LAWA Revit Content Library, it has not been established as standard. In this case consultants are permitted to use their own once they have submitted their respective content for review and it has been approved for use.

## 15 REVIT TEMPLATE EMBEDDED STANDARDS

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A Revit file can contain all the elements needed for a construction document set in one file. In the Revit Project File (.RVT) are many aspects of the Building Information Model that in other modalities are standardized in many files or other systems.

For example, in CAD, Xref organization is extremely important. In Revit, most of what would be model or sheet xrefs are views built into the RVT file. Organizing this information is no less important in Revit than CAD, it is just done differently.

Inherent in the Revit project template files are:

- Graphic Standards (discussed in the previous section)
- Organization of the Views, Legends, schedules and sheets

The Revit template is instrumental in establishing these standards. The organization established by the LAWA Revit templates and documented here is also used by LAWA to maintain their facilities models.

Additionally, consistency in Worksets and Design Options organization and use has a great impact on the ability for diverse teams to be able to effectively utilize the model.

Because the models will become part of the facilities tools, it is important that the base set of standards established by the LAWA templates is maintained through the design and construction process.

### 15.1 LAWA Templates

LAWA maintains Revit Project Template files for architecture, site files and MEP files. These will be made available at the beginning of each new project upon request.

### 15.2 Views

Revit organizes what traditionally are many CAD files into one project file as views. Floor plans are views of the entire building model. Sections are just vertical views of the same model. Schedules are also just views of the same building model, but presented in tabular format rather than graphically. While schedules, legend and sheets technically are views to the Revit database, they are given separate sections in this document because their conventions and rules differ from the views listed in this section:

- Plans
- Elevations
- Sections
- Details

Keeping all the views of the building information model organized is no less important than having a predictable and organized structure in a DWG based project.

The structure outlined in this chapter is for projects started with the LAWA Architecture template file. Other LAWA templates may have only subsets of the views, legends schedules and sheets described here.

Many elements within the Revit Model are views. Schedules

### 15.3 Views: General Standards

The following conventions apply to all views in the project regardless of the view type; plan section, legend, or schedule.

#### 15.3.1 Original Views

Once section and elevation marks have started to be placed in the project, do not delete the original Level plan views. This is important as LAWA utilizes the "Referenced From" parameter. Deleting the original views will create issues with this system.

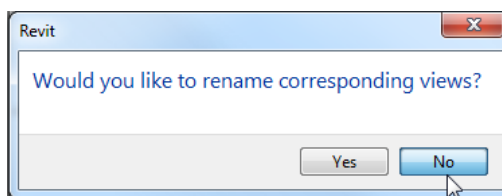


### 15.3.2 Creating New Views

When creating a new view/sheet by duplicating or creating new from scratch, do not just create the view and rename it. Open its properties and fill in the element properties which are used by your project for sorting and organization

### 15.3.3 Level Names

Level Names once set by the project BIM Lead are sacred. This means that the names that appear in elevations/sections should not be changed. Revit attempts to keep the name of a view coordinated with its Associated Level. This message appears when changing a view name that is the same as its Associated Level.



The answer is NO. Answering with YES will change the Level Name and that is usually not what is desired. This message appears when you change a Level name. A Yes response will cause Revit to keep any views that have a matching name coordinated.

### 15.3.4 Limit Duplication of Section Mark Types

Section -Detail types may not be duplicated.

### 15.3.5 Duplication of Drafting View Types

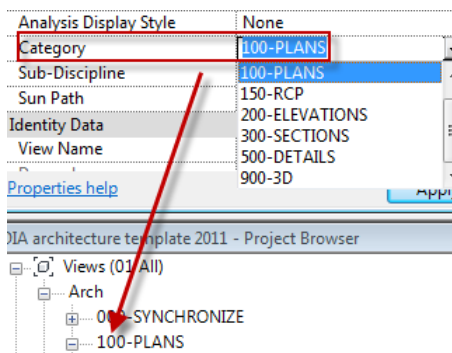
Drafting views TYPES may be duplicated in a project to help organize 2D details in projects. In large projects the view's browser driving parameters should be used.

## 15.4 View Organization Parameters

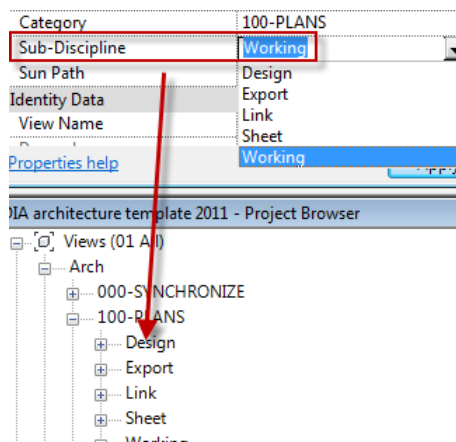
Most of the view types (Plans, Sections, Elevations, Detail and Drafting views) have two custom parameters **Category** and **Sub Discipline** which are used extensively to sort and organize the default views provided in any template.

Category	000-SYNCHRONIZE
Sub-Discipline	Working

The view parameter **Category** is used per the National CAD Standard sheet ordering system.



The view parameter **Sub Discipline** is used by the project browser. To organize the plan views into different categories based on how the view will be used in the project.

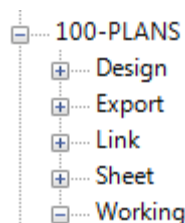


## 15.5 View Type Descriptions

### 15.5.1 Views: Plans

**Any project will require multiple plan views of each level of the project.**

Each plan view may only be placed on a single sheet. To create a first floor existing plan and a first floor dimension plan will require two different floor plan views. The LAWA Revit template is built to accommodate a basic set of floor and ceiling plans for each level in the template. Each of these views exists to serve a specific purpose.



These divisions are a common starting point for any project and are organized around the National CAD Standard sheet set organization system. These categories are described in the following section.

Any project may add to or modify these basic organizational sets for project specificity.

#### Design

These views are intended to be used for Presentation views, which may include colors, shading/shadows, and other Conceptual and/or Schematic Design information.

#### Export

These views are intended to be used for exporting to other CAD formats. There may be times when the export does not contain the same information as the construction document set. A Navis works export view shall be set up for each project. The view setting shall be set to "Fine" detail and "Realistic".

#### Link

These views will be used for:

- Linking in other CAD formats. Refer to best use practices "linking DWG files" for more information.
- A view with the active Revit Links made visible.

#### Sheet

These views are intended to become the Construction Document set. They are to contain final annotation and dimensions.

## **Working**

These views are intended to be used for the day-to-day creation of the model. These are views in which you can set the visibility graphics in a way to get your work done, hence "working view". These views are never placed on sheets, so any visibility graphic changes you make will never affect the printed set. These views are intended to be in-house views only, and should not go out to the public therefore should NOT be placed on any sheets nor should they be part of any drawing set

The tasks completed in a working view are primarily model element manipulations. Final annotations, dimensions and notes need to be placed in the view placed on a sheet.

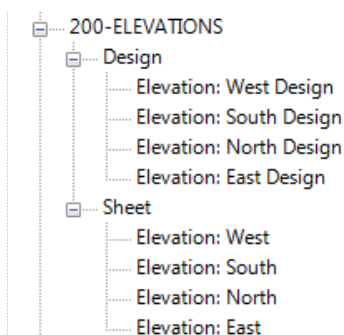
Some examples of tasks that might be better carried out in a working view:

As dimensions are one of the ways to draw accurately, often times you will dimension in Revit well before dimension are placed in the printed views. If you have laid out walls and want to use dimensions to move the walls into position. You can add these dimensions in the working view without regard to the dimensions final placement and without affecting any of your printed views.

As you are adding in rooms, it is useful to turn on the display of the room object so you can see where rooms have already been placed and if rooms have been placed in other rooms. You would not want to do this in any of your printed views, but is accepted practice to do this in a working view.

### **15.5.2 Views: Elevations**

#### **LAWA Templates Exterior Elevation Types**



Two different Exterior elevation types exist in the templates. Design elevations are intended to be used for color presentations. Sheet elevations are construction Documents

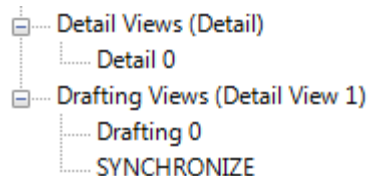
#### **Views: Sections and Detail Views**

Revit section views and detail views are added with the same tool, the section tool. The type definition determines the look of the mark as well as where the view appears in the project browser.

### **15.6 LAWA Templates Section and Detail View Types**

#### **15.6.1 Views: Drafting Views**

Brief description of the drafting view types in the template.



## 15.6.2 LAWA Drafting View Types

### Synchronize

This drafting view type is used specifically as the view that is the last open view when a file is saved at the end of the day. It is then always the view opened when a project is opened

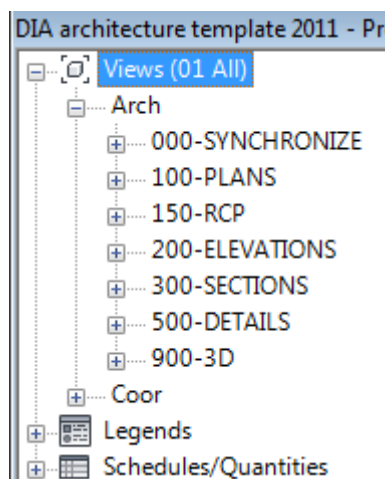
### Drafting View (Detail)

Standard Detail view for 2D details.

## 15.7 Browser Organization

As noted in the introduction to this section, Revit is internally organized around views of the building information model. The project browser provides access to this organization. Technically, Legends, Schedules and Sheets are also views of the building model. However they are organized independently within the project browser.

Views, regardless of their type; floor plans, sections or detail views share some common conventions. Legends and Schedules share some of these rules. Sheets and Families have their own rules.



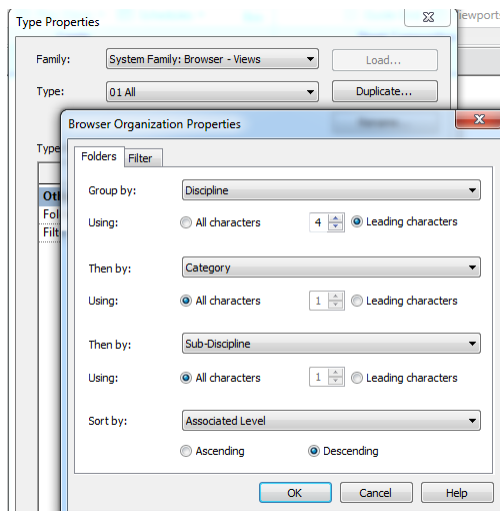
### 15.7.1 LAWA Browser Organizations for Views

The LAWA templates have 6 customized standard view organizations, and 2 standard Autodesk browser organizations.

Each of these different set of browser organizations utilize different parameters for the sorting and organization in the project browser. This list is not restrictive. Teams may develop their own browser organizations that make sense for the size and scope of the project. It is suggested however that teams do not add more parameters, but instead utilize the existing parameters.

Each organization definitions can sort and/or filter views in the project browser. Each uses up to 4 properties to sort the view list and up to four filters to display only specific views within the project browser. The parameters used to sort and filter for each of the browser organizations are recorded here. The first few are screen captured to illustrate the browser organization applied.

The LAWA standard (numbered) browser organizations use standard view parameters along with only two custom view parameters: Category and Sub Discipline to create all the different organization definitions in the project templates.



For example, in the 01 ALL organization, views are sorted first by Discipline, then Category, Sub discipline, and then by their Associated Level.

All views will be displayed. The advantage: groups of view types are packaged together: the user could create a "sub-discipline" called "Schematic Presentation" and place all the views into that package. Those views will remain with the project but will be separate from the rest of the DD and CD views.

## 15.7.2 Standards

### Naming

LAWA standard Browser Organizations have a number prefix.

All browser organizations which have a filter applied have (Partial) as a suffix.

If the organization is not filtered use (all) as the suffix

### Project Use

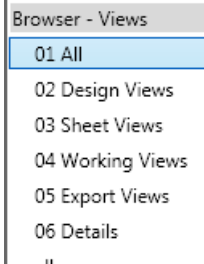
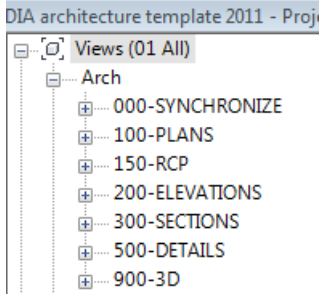
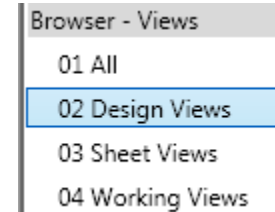
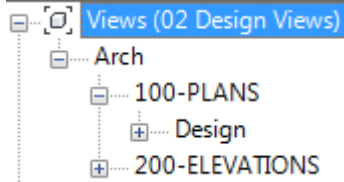
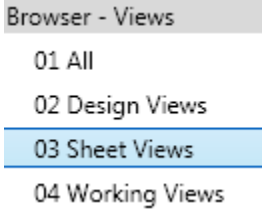
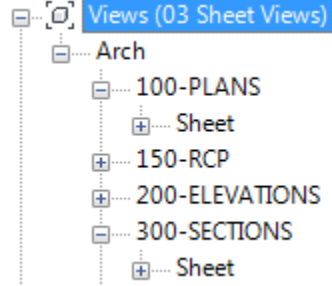
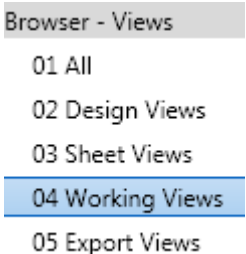
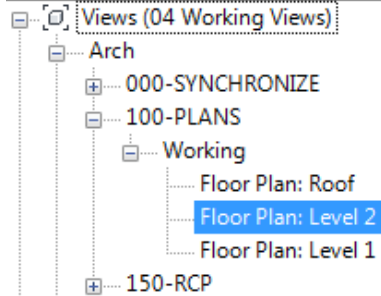
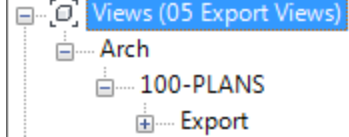
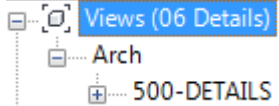
The base set of organizations in the project will cover many different uses; however it is impossible to conceive of all organizations which will be useful for the wide variety of project types at LAWA. It is expected projects will adapt/modify or create new browser organizations for their building type. However be aware of the parameters you are using in creating new browser organizations. If possible, use parameters already in use by the other browser organizations to limit the time spend in managing these parameters. The BIM leader for the project is responsible for maintaining the browser organizations.

### Creating New

The BIM Lead can add new project browser organizations. The BIM leader may remove any of the base set of organizations provided by the template by group consensus of the project team.

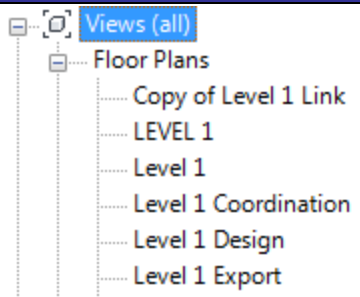
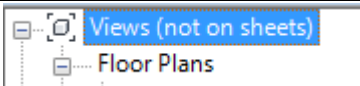
### 15.7.3 Template Browser Organizations: LAWA Standards (Numbered)

LAWA have several customized browser organizations built in. While these are standard LAWA browser organizations and should not be deleted, any project may add to this set for project specific organizations.

Browser Organization Name	Setting	Result
<b>01 All</b> 	Order: Discipline > Category > Sub discipline > Associated Level  Filter: None Applied  Views are ordered in a structure similar to the National CAD Standard	
<b>02 Design (Partial)</b> 	Order: Discipline > Category > Sub discipline > Associated Level  Filter: Sub Discipline = Design  Only Design views are shown in the project browser.	
<b>03 Sheet Views (Partial)</b> 	Order: Discipline > Category > Sub discipline > Associated Level  Filter: Sub Discipline = Sheet  Only Sheet views are shown in the project browser.	
<b>04 Working Views (Partial)</b> 	Order: Discipline > Category > Sub discipline > Associated Level  Filter: Sub Discipline = Working  Only Working views are shown in the project browser	
<b>05 Export Views (Partial)</b>	Order: Discipline > Category > Sub discipline > Associated Level  Filter: Sub Discipline = Export	
<b>06 Details (Partial)</b>	Order: Discipline > Category > Sub discipline > Associated Level  Filter: Category = 500-Details	

### 15.7.4 Template Browser Organizations: Autodesk

The following browser organizations exist in the template and are standard organizations provided by Autodesk.

Browser Organization Name	Setting	Result
<b>all</b> 05 Export View: 06 Details <b>all</b> not on sheets	Order: Family and Type > None > None > View Name  Filter: View Type = None  Views are ordered by Family and Type (plans, elevations, details etc)	
<b>not on sheets</b>	Order: Family and Type > None > View Name Filter: Sheet Name = None Filters to only show those views which have not yet been placed on sheets	

## 15.8 Legends

### 15.8.1 Legends: General Standards

The naming conventions used in the template are the same as views in general

- Legends for sheets are named with ALL CAPS.
- Legend which are informational or working legends not for sheets are lower case.

### 15.8.2 Legend Types

Two types of legends have been customized for LAWA. These include:

- Notes Legends
- Symbol Legends

### 15.8.3 Note Legends

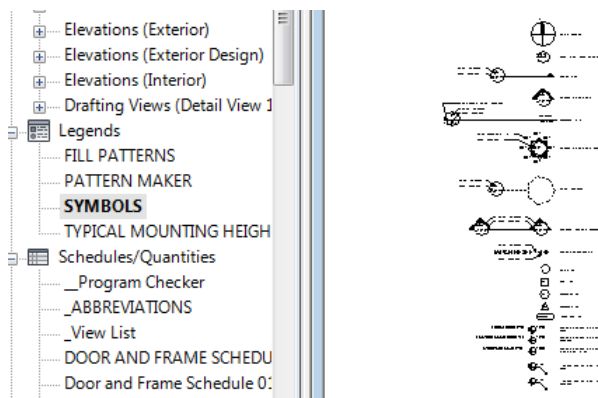
- General Note Legends
- Code Analysis

Due to limitations of the Revit Legend itself, some portions of annotation symbols which would be part of the symbol in a plan view, are represented with line work only.

### 15.8.4 Symbol Legends

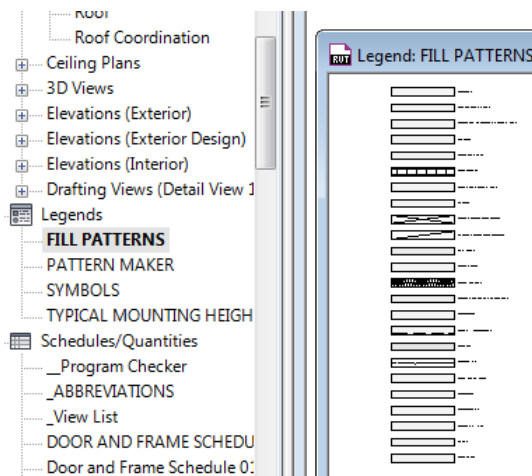


## SYMBOLS



- Add or remove symbols to represent the project's symbols.
- Resize as needed to fit on the project size sheets and reorganize the symbols
- If the symbol legend needs be split to appear on separate sheets, duplicate the view and adjust each to meet the needs of the project

## FILL PATTERNS



This list is the LAWA approved list of fill region definitions.

## 15.9 Schedules

Most data entry will happen through a schedule interface. Room Renumbering, Door renumbering, Programmatic requirements for rooms and areas are all tasks completed with a schedule. It is essential that everyone on the project understand how to effectively use a working schedule to sort and filter to just the information they are working with. This sorting and organizing WILL change the printed outputs so it is essential that this kind of work happen in a working schedule. Working schedules for every task are not provided in the template. Project members are expected to duplicate an existing schedule and create either a working or temporary schedule which conforms to the naming conventions listed in this section

Schedules break many of the rules associated with views.

- 1) Schedules can be placed on multiple sheets
- 2) Schedules have no "title on sheet" parameter. Renaming the schedule renames the title.



3) Schedule will sort alphabetically, not with the project browser organization.

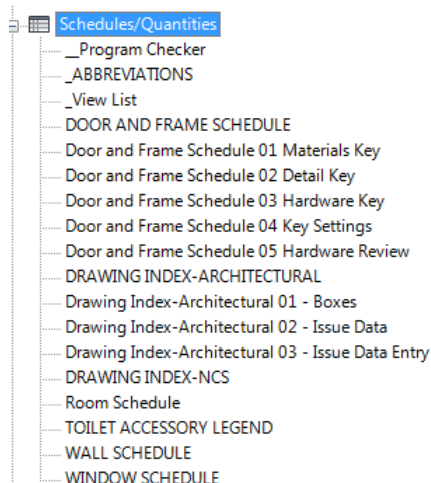
## 15.10 LAWA Template Schedules

This section documents the standard schedules available in the LAWA templates. Many of these schedules are highly customized. They are designed to be a very efficient way to do data entry in the Revit environment, but must be used in a particular way to be most efficient.

Refer to the section: Customized Revit Content for:

- **A brief summary of its use is provided along with a list of parameters which control these schedules.**
- The general workflow processes and picks and clicks instructions for how to use these schedules.

The following schedules are provided in the standard LAWA Architectural Revit Template:



## 15.11 Sheets

Sheets, like views have their own parameters which are used for sorting and organizing the sheets in the project browser. The same parameters used to sort and organize the sheets in the project browser are used to organize the sheets in the Drawing Index schedules.

### 15.11.1 General Standards, Naming, Numbering and Layout

Refer to “LAWA CAD Standards”, for direction on sheet naming conventions

### 15.11.2 Sheet Parameters

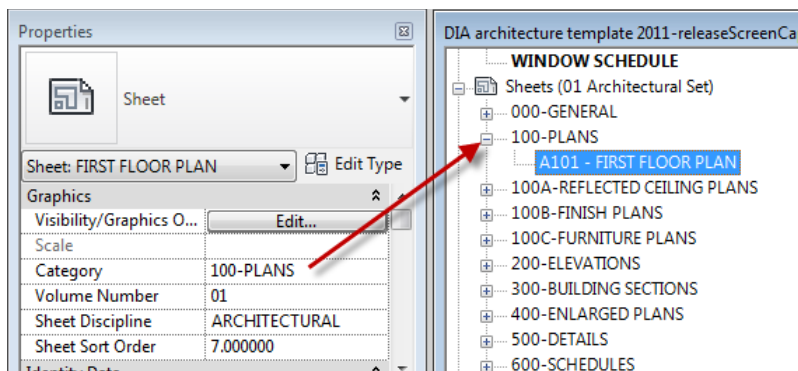
LAWA projects use the sheet parameters described in this section to organize the project browser and the drawing lists used in the printed sheets. The following section documents to which elements the parameters are assigned.

Similar to the view browser organizations, these are set in the template as a base set of schedules and browser organizations. This base set may be added to for any project.

### 15.11.3 Category

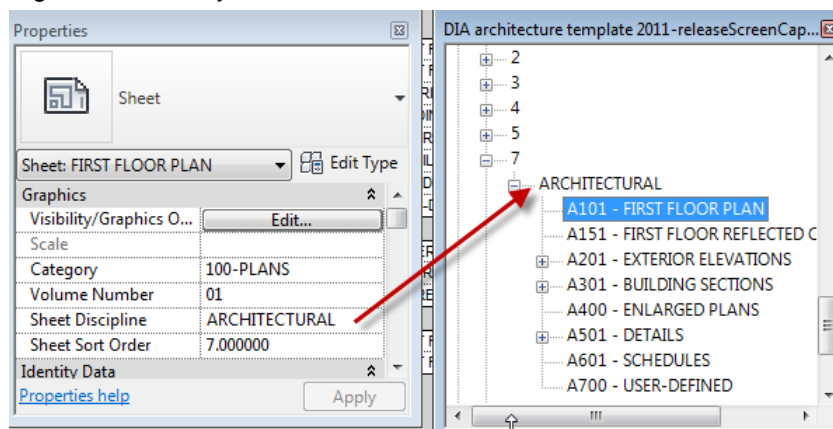
#### In Project Browser

Used for browser organization 01 Architectural Set, similar to view organization described in this document.



#### 15.11.4 Sheet Discipline

Used in Browser Organization 03 ByNCS



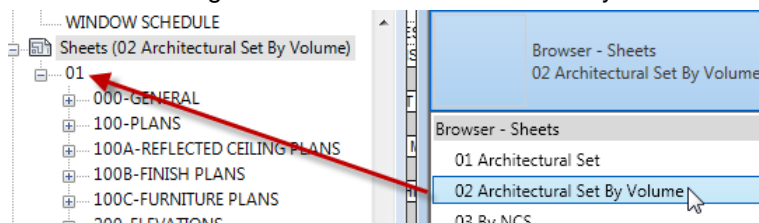
#### 15.11.5 Volume Number

Used for Drawing Index schedule to sort construction document sheets by volume if needed.

Sheet Sort Order (hide)	Volume Number (header and/or hide)	Sheet Discipline (hide)	SHEET #
GENERAL			
0	01	GENE	
0	01	GENE	
0	01	GENE	
HAZARDOUS MATERIALS			
1	01	HAZAR	
SURVEY MAPPING			

A red arrow points from the 'Volume Number' column header to the 'DRAWING INDEX-NCS' entry in the Project Browser on the right. The Project Browser shows a hierarchy starting with 'DIA architecture template 2011-release', followed by 'Drawing Index-Architectural C', 'DRAWING INDEX-NCS' (highlighted in blue), 'Room Schedule', 'TOILET ACCESSORY LEGEND', and 'WALL SCHEDULE'.


Volume is also used in the browser organization: 02 Architectural Set By Volume



#### 15.11.6 Sheet Sort Order

## 15.12 Issues

Issues are a highly customized aspect of the templates. Please refer to Customized Revit Content Section.

Sheet: FIRST FLOOR REFLECTED CEI ▾  Edit Type	
Sheet Issue Date	04/05/10
Issue 01 - Number	
Issue 01 - By	
Issue 01 - Description	
Issue 01 - Date	
Issue 01 - chk	
Issue 02 - Number	
Issue 02 - By	
Issue 02 - Description	
Issue 02 - Date	

Issues are intended to be used prior to the issuance of bid set, or Construction set after which Revisions should be used.

## 15.13 Revisions

Revisions are a basic Revit functionality. For Revisions refer to the general help file

## 15.14 Worksets

Workset enabled files are Revit's way of allowing multiple people to work on the same project.

### 15.14.1 General Standards

The BIM Leader for the project is responsible for creating and maintaining the worksets of the project.

Do NOT unload a linked Revit file and Synchronize with Central (use visibility graphics or opened=No).

Do NOT use worksets like layers. Small projects can be accomplished with the two default worksets.

The two factors determining the number of worksets are scale of the project and the number of people working on the project.

Do NOT create a workset for annotation or notes.

For new content created within an existing LAWA base model, the consultant shall create separate Worksets to allow for definition and separation of new content from existing.

### 15.14.2 Standard Worksets

All workset enabled projects will have at least the default worksets **Shared Levels and Grids** and **Workset 1**. These are appropriate for small projects. As project complexity increases worksets are added from the following list. This list is not exclusive. Projects may have other worksets, but are to use the workset names and general guidelines here before getting creative with additional workset names.

### 15.14.3 Primary List:

#### SHELL

Shell elements as the term is used in tenant improvements: Floors, Roof, Exterior walls, Shaft walls not part of core (exterior/ perimeter stairs).

#### CORE

Core elements to the building, elevator shafts, stairs, etc.

## FFE

Furniture, Fixtures and Equipment

## LANDSCAPE

This workset will allow the landscape design department to isolate their model work for selective open.

### 15.14.4 Special Purpose Worksets

#### LINKED DRAWINGS

- This workset will appear in most workset enabled files
- This workset will be created OFF by default in all views
- This is never set as the active workset.
- Link a DWG to all views, and then change its property to assign it to this workset.
- Use Visibility Graphics as needed per view to turn this workset on then isolate the individual drawing using the Imported Categories tab

#### LRA, LRS etc.

- Worksets for Linked Revit Files
- Create one workset per linked Revit model.
- These workset will appear in ALL workset files where another Revit file is linked.
- This allows users to use visibility graphics to turn off a linked Revit model or to use the worksets dialog box to set this to Opened=No
- Name:
  - Simple: LR <Discipline> such as LRA for Linked Revit Architecture, LRS for structure etc.
  - Complex: LR <Discipline> <Name> for projects where discipline models are broken into parts.

## INTERIORS

Walls, doors windows and other building components interior to the shell not included in the core or FFE worksets. This is only needed for very large projects or if TI is not used

#### TI <name>

Used only in projects where the model contains both the shell building as well as multiple tenant improvements in the same model.

## 15.15 Design Options

Design Options allow the creating of studies of multiple alternates within the Revit file.

### 15.16 General Standards

Create a null design option where no work is performed and keep it as the Primary design option. Create as many new views as are needed to present the different design options but leave the primary option untouched so work can continue while the decision is under consideration. This practice is least disruptive to the rest of the team working on the project.

Design Options are limited to area specific modifications for wholesale building changes, use save as.

Design Options are meant to be used for short term decisions which are cleaned from the project by "accepting Primary" which deletes all the unaccepted option.

Directly from Autodesk: from Autodesk white paper:  
revit\_platform\_2009\_model\_performance\_technical\_note.pdf

Limit the use of rooms in design options to necessities to avoid additional processor time spent on detecting room option conflict.

Use separate models for variations of the whole building wings.

Preserve design options only as long as they are useful to the project. Even though options may not be active and visible, when changes are made within the main model all design options will update to maintain the model's consistency.

Consider whether options should be preserved long term in separate models which can be linked as needed.

Unless specifically requested by the LAWA Project Manager, design options should be eliminated from the model file prior to submittal to LAWA.

### **15.17 Shared Parameters**

LAWA maintains a master shared parameter file for all projects. This is not contained in the shared Revit Content Library, but the parameters are available in the LAWA templates. A separate shared parameter file which has only the groups, but no specific parameters are provided as part of the base content. If new shared parameters are required by a project, they should be added to the project specific shared parameter file and notice given to the LAWA cBIM manager.

## 16 REVIT FILE QUALITY CONTROL

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This section outlines required best use practices which affect the health and/ or organization of the project.

### 16.1 Daily Use

A set of general rules to keep the Revit file healthy:

#### 16.1.1 Opening Files

- When opening Revit files: Use the Revit Open dialog box rather than double clicking the file in windows explorer.
- Open selective worksets for larger files as appropriate.

#### 16.1.2 Use View Browser Organization

Effectively finding the correct view in even medium size projects can take some time. Use the view parameters and browser organizations to keep views orderly. It is expected that submittals to LAWA submittals will have views that can be sorted and organized using the default browser organizations in the project.

#### 16.1.3 Review and Fix Warnings (Daily Use)

As the author of the BIM model it is no more acceptable to create overlapping walls as it is in AutoCAD to create 10,000 lines instead of using a hatch. Each user is responsible for maintaining the health of the BIM Model.

Realize that some errors are more important than others. Revit maintains this list of warnings. Revit thinks about this list every time you do something. If you have a wall overlapping another wall, anything you do to either wall will cause Revit to go back and check "did that action just performed correct this warning?"

This always-on function can be a HUGE drain on performance. Keep your project warnings to a minimum.

However, understand there are some warnings that are less critical (line is at slight angle). Others will go away over time: In conceptual design it is likely to generate many warnings of the type "Door and room number have duplicate numbers". However, as you start adding in schedules to renumber your doors and rooms these will go away.

While it is the project BIM leads responsibility to track warnings, it is the responsibility of the team to keep the number down.

#### Fix Warnings: Select BY ID

Often times it is difficult to see what element is causing the warning.

- Export the warning report then enter a 3D view.
- Open the report with word or excel.
- Use copy and paste to get the id in the report into the tool found in Manage > Inquiry > Select by ID dialog box
- Once the item is selected, use temporary isolate to find it in the 3D view
- Note, sometimes the warning is in a sketch line. These are very difficult to track down. The above process will allow you to find the item in question.

#### 16.1.4 Closing Files

The following process should be followed when closing a workset enabled file:

- Open and maximize the project's closing view (drafting view or legend)
- Close hidden windows
- In the Synchronize with Central dialog box:
- Verify you are relinquishing all elements
- Select "Save Local file before and after synchronizing with Central
- Close the Revit file.

This process ensures that the last opened view is not a memory intensive 3D view or shaded elevation which can increase the file open time substantially.

#### **16.1.5 Central File**

Only the project BIM Leader should open the central file directly.

#### **16.1.6 Finding Content**

When looking for content whether it is a tag or VAV box, the order listed here is the recommended search order.

- Source 1: Project File
- Source 2: Project's Family Folders
- Source 3: LAWA Content Libraries

#### **16.1.7 Outside Content Sources**

Content outside of the three sources noted above should only be integrated into the LAWA Content Libraries by the Project BIM Manager in coordination with the LAWA BIM Manager.

### **16.2 BIM Manager Project Maintenance & Quality Assurance**

Project Maintenance includes items to be completed by the Project BIM Leader or the most experienced Revit user on the project.

#### **16.2.1 Review Warnings**

Time Frame; weekly

The project BIM lead should generate an xml file and review the list to keep an eye on the progress of the project.

Prioritize the list and delegate the resolution of items to the team.

#### **16.2.2 Remove Unused Families and Types**

Remove unused families and types as needed and per development of model and prior to submittals. Use common sense whether this is a manual process from the project browser or a purge unused.

#### **16.2.3 Remove Unused Links**

Time Frame; as needed and per development of model.

ACAD links of background and reference drawings should be reviewed. Remove unused background and reference drawing links.

#### **16.2.4 Audit**

1x per week

#### **16.2.5 Compact Central File**

Compact the Central Files every couple weeks for small projects, every week for larger projects. Note all other users must save and exit their local projects while this is taking place and must create new local files once the transaction is complete.

#### **16.2.6 Families**

- 2D if possible 3D if it makes sense
- Develop 3D families only to 1/8" scale unless otherwise identified in the BIM Project Execution Plan
- Symbolic only in Plan View
- All 3D families should use symbolic line representations for plan views. All 3D elements should be turned off for plan views
- Family before Group
- Families are your friends, Groups a necessary evil.



- Within reason use families over groups. For a table and chair, there is no discussion this is a nested family. Entire unit or gate waiting area is a more difficult decision (no way to add walls in families).
- Keep in Mind Performance
- Families that HOST are more memory intensive. Families that cut host are the MOST intensive
- Parametric families are cool, but use memory. Autodesk even says limit their use, but just use common sense. If you have a casework cabinet in a laboratory and you are only using a 36" wide size, then do not make it parametric. On the other hand, if you have a lot of different sizes, then having 20 different families may have a larger impact on the file than a single parameter driven family.
- NO 3D ACAD Blocks
- Or only as exception, there are times I might create a single element (Convoluted nurbs based roof or ceiling feature modeled in MAX) but not something copied through the model.
- Revitcity is famous for families with ACAD blocks inside them, though they are available on the Autodesk web site in modern medium library (casework, columns and more). Do Not use these in LAWA BIM Projects.
- Hosted MEP Families
- All MEP families will either be hosted or not.
- Only Face-Based hosting is allowed as hosting method in LAWA projects.

### 16.2.7 Constraints

Constraints are memory intensive and are best avoided. Constrain to layout, but then remove the constraint. All of the following should be either be used and deleted or not used at all.

#### Dimension EQ

Any dimension that is equalized adds a constraint. This is a very useful tool in design and when laying out components. Remove constraint when done. It is acceptable to use sparingly on grids and levels.

#### ALIGN&LOCK

Align is fine, be sparing with align and lock.

#### DIMENSION LOCK

Like Dimension EQ and line and lock. This constraint is very useful in conceptual design and when building the initial building model. Unlock when you are done with the relationship.

## 17 DOCUMENT APPENDIX

LAWASM: BIM STANDARDS	TITLE
BPXP Documents	Volume 2: LAWA BIM Requirements.pdf
	Volume 3: LAWA - BPXP Template.docx
BPXP Worksheets	LAWA – BPXP BIM Matrix.xlsx
	01 - Team Members
	02 - BIM Matrix
	03 - Level Of Development
BPXP Process Maps	LAWA - BPXP Process Map Templates.vsd

Please direct any questions about this template to the cBIM Program Group.

### END OF BIM REQUIREMENTS