CADD Manual

In reference to the FDOT Design Manual (FDM)

For FDOT Connect and FDOT C3D

TOPIC NUMBER: 625-050-001

January 2024

PRODUCTION SUPPORT CADD OFFICE
TALLAHASSEE, FLORIDA
http://www.fdot.gov/cadd/

[THIS PAGE INTENTIONALLY LEFT BLANK]

Contents

[THIS PAGE INTENTIONALLY LEFT BLANK]

Chapter 1
INTRODUCTION

1.1 PURPOSE

The ***CADD Manual*** addresses the requirements to utilize Computer Aided Design and Drafting (CADD) for production and delivery of digital project data for the Florida Department of Transportation (Department). In addition to software and configuration requirements, it identifies tools, techniques, applications, standards and procedures that are used to produce a consistent and quality CADD product for the Department.

The ***CADD Manual*** establishes *minimum* CADD standards to ensure a consistent, predictable and repeatable CADD data set for Department's projects. The ***CADD Manual*** also serves to provide professional services administrators, project managers, consultants, in-house designers, and others with a procedure to be incorporated by reference into scopes and other contract documents for services.

> ***Note*** Following the requirements within this manual does not guarantee an acceptable work product, as this procedure does not address the quality of the engineering or survey work performed.

1.2 AUTHORITY

Florida Statutes (F.S.), Title IV, Chapter 20, Section 20.23(3) (a)

Florida Statutes (F.S.), Title XXVI, Chapter 334, Section 334.048(3)

1.3 REFERENCES

Construction Project Administration Manual (CPAM) Topic No. 700-000-000

FDOT Approved Certificate Authorities

FDOT Design Manual, Topic No. 625-000-002

Federal Highway Administration - 3D Modeling

Florida Administrative Code, Chapter 1B-26.003(10) Electronic Storage Media

Florida Permanent Reference Network (FPRN)

Florida Statutes

General Tolling Requirements (GTR)

IdenTrust

LandXML

Level of Development (LOD) Secification Part I & Commentary by BIM Forum Participating Organization

National BIM Standard - United States Version 3 (NBIMS-US V3) shall apply

Project Development and Environment Manual (PD&E Manual), Topic No. 650-000-001

Standard Plans

Standard Operating System, Topic No. 025-020-002

Structures Manual, Topic No. 625-020-018

Surveying and Mapping Documents & Publications

Transportation Technology Manual, Topic No. 325-000-002

1.4 DEFINITIONS

The following definitions used in the ***CADD Manual*** relate to electronically generated project data and deliverables for consistency of understanding and interpretation of processes and criteria contained within. For a more complete listing use the following: **FDOT Enterprise Business Glossary (windows.net)**

3D Design: The process of creating 3D Models for a project.

3D Engineered Model Quality Control Checklist: A draft document that contains the data producer's written assurances that the 3D deliverable items required by the Department's ***CADD Manual*** are included in the delivered project data and that certain Quality Control functions were performed.

3D Model: A 3D model is a digital graphical representation of proposed facility/site data consisting of X, Y, and Z coordinates for producing objects in three dimensions to convey design intent useful for visualization, analysis, animation, simulation, plans, specifications, estimates production, and life-cycle asset management. An accurately designed 3D model will be tied to a defined geographic coordinate system.

AIM: Asset Information Management System

Alpha Testing: Initial testing of CADD Software products or enhancements by the development staff and testing by the support staff outside of the development environment.

Authentication: For Digital Signature, Authentication is the process where Digital Signatures are compared with identity data held by the issuer of a Digital Certificate (the Certificate Authority) to validate the identify of a Signatory; and that a document that has been signed with a Digital Signature has not been modified since signing. This is an automated process of the document software (such as with Adobe Reader or Acrobat) that provides feedback to the user that the file being examined is signed, the signatures are valid, and the document is unmodified since the Signatory signed it.

Automated Machine Guidance (AMG): Automated machine guidance uses data from sources such as 3D engineered models to guide in which construction equipment is used during earth work and paving operation. The source is linked directly to the operation of machinery with a high level of precision, improving the speed and accuracy of construction processes. The AMG can utilize the GPS or robotic total stations for positioning information.

Beta Testing Coordinator: An individual responsible for facilitating the beta testing of CADD software.

Beta Testing: Secondary testing of CADD Software products performed in a production-like environment by end-users.

Bid Set: A sub-set of files consisting of data derived from the overall Project Data Set containing only those files needed for the advertisement and letting of a project. The files needed for the Bid Set remain in their source folder structure derived from the Project Data set. For Digital Delivery projects, the data in the Bid Set is usually compiled manually and put in a ZIP file with a naming convention defined later in this chapter.

BIM: Building Information Modeling - An intelligence-based 3D CADD system used for planning, designing, staged construction, maintenance, and operations of infrastructure facilities and Contract management. These CADD platforms are advanced in that they include custom business metadata with the elements created as part of the design process. E.G. FDOT Pay Items, Project Alignments or Project FPID specifics. It is Open Technology based and it advances CADD work from 2D graphical plans to 3D digital modeling.

ByLayer (Autodesk): A property that, when turned on, causes the object on a specific layer to retrieve its definition from the Layer Properties of that layer, such as Color, Linetype, and Line weight.

ByLevel (Bentley): A setting that, when turned on, causes the element on a specific level to retrieve its definition from the Level Symbology of that layer, such as Color, Line Style, and Line Weight defined by the Level Symbology.

CADD: (Acronym for: *Computer Aided Design and Drafting*) Software and methods used to design and represent objects graphically on the computer. CADD facilitates the visual presentation of Engineering Data.

CADD Community: The CADD Community encompasses all CADD users, (i.e., Department, consultants, contractors, and other agencies) utilizing Department supported CADD platforms and custom software.

CADD Hardware: The workstations, servers, printers, and all other computer equipment used in the Department's design production effort.

CADD Manager: The CADD Manager is responsible for (1) support of the core CADD Software products in the work units and (2) a variety of Final Plans functions including but not limited to the receipt, acceptance, and management of digital deliveries of project data.

CADD Production: The development of projects utilizing CADD applications, software, and discipline-based processes.

CADD TAC: (Acronym for: *Computer Aided Design and Drafting Technical Advisory Committee*) A discipline-based group sanctioned by the Statewide CADD Coordinator consisting of District and Central Office representatives charged to meet and work on statewide technical issues dealing with CADD applications, procedures, testing, training, and implementation.

CADD Software: Any software procured, developed, distributed and supported by CADD.

CADD Support: The technical and operational activity necessary to ensure that a production environment is maintained, which includes:

a) Selection, development and distribution of production CADD software, related procedures, criteria and standard operating instructions,
b) Provision of training opportunities for CADD users,
c) Management of design data produced with the CADD software,
d) Statewide procurement of: CADD software, training services, and software development assistance.

Calculations Folder: Excel files, Portable Document Format (PDF) files and any associated quantity backup data for the plan summary tables.

Certificate Authority: The 3rd party entity that issues the Digital Certificate to the professional signatory and validates the identity of the signatory.

CIM: Civil Integrated Management: Provides strategic planning, leadership, and support for operational technology/data within the Florida Department of Transportation.
https://www.fdot.gov/cim

Compliance Certification Checklist: A draft document that contains the data producer's written assurances that items required by the Department's CADD Manual are included in the delivered project data and that certain Quality Control functions were performed.

Compliance Indicator: Evidence that the critical requirements which are being applied are producing the desired result.

Common CADD File Extensions: Common file types by File Extension used in CADD Production.

Extension	File Description	Saved-in Folder
.3pc	3 Port Criteria Files	Most appropriate component/discipline folder
.pdf	Files for the PLANS	Root project folder for *fpid*-PLANS.pdf for Digital Delivery
.pdf	Files for the SPECS	\Specifications\ sub-folder for *fpid*-SPECS.pdf
.dxf	Autodesk ASCII Drawing Interchange File	Most appropriate component/discipline folder
.dwg	Autodesk Design Files	Most appropriate component/discipline folder
.dst	Autodesk Drawing Sheet Set	\eng_data\ sub-folder for the component/discipline
.dwt	Autodesk Drawing Template	\Seed\ sub-folder of the project
.lin	Autodesk Linetype	\Symbology\ sub-folder of the project
.pc3	Autodesk Printer Configuration	Most appropriate component/discipline folder or \Symbology\ sub-folder of the project
.shx	Autodesk Shape Compiled	\Symbology\ sub-folder of the project
.shp	Autodesk Shape Files are ASCII Files	\Symbology\ sub-folder of the project
.stb	Autodesk Plot Style Tables	Most appropriate component/discipline folder or \Symbology\ sub-folder of the project
.csv	Comma Separated Values	Most appropriate component/discipline folder
.gpk	Coordinate Geometry Database Files	Most appropriate component/discipline folder
.alg	Corridor Modeling Alignment Database	Most appropriate component/discipline folder
.xlp	Corridor Modeling Cross Section Labeling Preference File	Most appropriate component/discipline folder
.xin	Corridor Modeling Drafting Standards	Most appropriate component/discipline folder
.rdp	Corridor Modeling Roadway Design Preference File	Most appropriate component/discipline folder
.ird	Corridor Modeling Roadway Designer Database	Most appropriate component/discipline folder
.dtm	Corridor Modeling Surface Database	Most appropriate component/discipline folder
.itl	Corridor Modeling Template Library	Most appropriate component/discipline folder
.hmr	Descartes Raster Image Files	Most appropriate component/discipline folder
.gpk	GEOPAK COGO Database	Most appropriate component/discipline folder
.x	GEOPAK Criteria Files	Most appropriate component/discipline folder
.ddb	GEOPAK D&C Manager Database Files	Most appropriate component/discipline folder
.gdf	GEOPAK Drainage File	Most appropriate component/discipline folder
.dlb	GEOPAK Drainage Library	Most appropriate component/discipline folder
.inp	GEOPAK Input Files	Most appropriate component/discipline folder
.prj	GEOPAK Project Manager Project File	Most appropriate component/discipline folder
.tin	GEOPAK Surface Database	Most appropriate component/discipline folder
.gif	Graphics Interchange Format	Most appropriate component/discipline folder

.jpeg,/.jpg	Joint Photographic Experts Group	Most appropriate component/discipline folder
.log	Log File	Most appropriate component/discipline folder
.xls(x)	Microsoft Excel Spreadsheets	Most appropriate component/discipline folder
.doc(x)	Microsoft Word Documents	Most appropriate component/discipline folder
.rsc	Bentley Resource Files	\eng_data\ sub-folder for component/discipline
.cel	Bentley Cell Libraries	\Cell\ sub-folder of the project folder
.dgn	Bentley Design Files	Most appropriate component/discipline folder
.tbl	Bentley Pen Tables	\eng_data\ sub-folder for component/discipline
.plt	Bentley Print Drivers	\eng_data\ sub-folder for component/discipline
.pset	Bentley Print Organizer Print Set	Most appropriate component/discipline folder
.pcf	Bentley Project Configuration	Project Root folder
.dgnlib	Bentley Standards Database	\Symbology\ if copied to local project
.sid	Multi-resolution Seamless Image Database	Most appropriate component/discipline folder
.ps	Postscript Sheet Image Files	\eng_data\ sub-folder for component/discipline
.xcp	QC Exception Files	\eng_data\ sub-folder for component/discipline
.txt	QC Reports, QC "Folder Name", Project Validation Reports, Project QC Reports	\eng_data\ sub-folder for component/discipline
.tif	Tagged Image File	Most appropriate component/discipline folder
.htm/.html	Web Pages	Project Root folder and \Data\ sub-folder
.xml	XML Files	Most appropriate component/discipline folder

Component: A categorization of design plans as defined in the **FDOT Design Manual (FDM) 302.5**. The list of plans components for Digital Delivery is comprised of the following:

1. Roadway
2. Signing and Pavement Marking
3. Signalization
4. Intelligent Transportation System (ITS)
5. Lighting
6. Landscape
7. Architectural
8. Structures
9. Toll Facilities

The plans components do not directly correspond to the project's folder structure. For example, drainage files have a \Drainage\ folder below the root level project folder, but it may be included as part of the Roadway Plans Component.

Composite PDF: A document containing the plan sheet images composing the plans set in their index order. This document must be in Adobe Portable Document Format (PDF) format and reside in the project's root folder.

CPR: Consistent, Predictable and Repeatable

Data Model: The organizational structure, outline, and approach to defining and applying data

Design File: An electronic CADD file that conforms to Bentley® (DGN) or Autodesk® (DWG) graphics formats.

Design Quantities and Estimates System (DQE): An application for FDOT Estimators used to produce Construction Cost Estimates. It is also used to maintain pay items and the Basis of Estimates.

Digital Certificate: In cryptography, a digital certificate uses a digital signature to bind together a public key with an identity — information such as the name of a person or an organization, their address, and so forth. The certificate can be used to verify that a public key belongs to an individual. The signatures on a certificate are attestations by the certificate signer that the identity information and the public key belong together. The type of Digital Certificates used for the Department's design work must meet the Federal Government's Access Certificates for Electronic Services (ACES) program. The Department currently uses **IdenTrust** to provide those digital certificates.

Digital Delivery: A method to deliver project data which relies upon creating a compressed archive (ZIP file) of project data, PDF files of Plans and Specifications documents. Plans and Specifications are signed and sealed with a Digital Signature.

Digital Signature Appearance: A graphical representation that appears on an electronic document indicating that a digital signature has been applied. As a minimum, the appearance must contain the name of the signatory and a date-time stamp at the instant of signature. When a digital signature is used as an application of a professional's signature and seal, specific language must accompany the digital signature appearance. See the Department's ***FDM 303*** Exhibits for further explanation and examples. When the digital signature is an application of a professional engineer's signature and seal, The Signature Appearance is not proof of authenticity, only that a signature was applied. Authenticity is proven through the Validation process (see Validation definition).

Digital Signature: Cryptographic data applied to an electronic file which is unique to the signatory and is very difficult to forge. In addition, the digital signature assures that any changes made to the data or electronic file that has been signed cannot go undetected. A Digital Signature is much the same as a conventional handwritten signature that identifies a person signing the document. While traditional signatures are on paper, every digital signature will store information that will identify the person signing. There can also be information about changes made to a digitally signed document since the first signature was applied. In Digital Delivery, Digital Signatures are applied to Signature Sheet(s) in the plans or may be applied to documents that Professional(s) of Records are taking responsibility for.

Digital Signature Root Certificate: Cryptographic information installed on a computer that identifies the Certificate Authority and allows the identity of the Signatory to be validated against the identity records held by the Certificate Authority. This process usually requires a connection to the Internet.

Digital Terrain Model (DTM): A DTM is a digital topographic model of the earth's surface minus objects such as trees, vegetation, and structures that can be manipulated through computer-aided design programs. All elements of the DTM are spatially related to one another in three dimensions.

Digitally Created Seal: An image of a seal created by electronic means and placed in an electronically produced document. In the CADD environment digitally created seals are usually placed by inserting a block/cell resembling an embossed seal. These may also be produced by means of a "stamp tool" in PDF editing software. The digitally created seal is an image to further communicate the idea that the adjoining digital signature appearance is the application of professional license. The digitally created seal is only an image and has no means of validation whatsoever. A digitally created seal is not to be confused with a digital certificate or digital signature. (For engineering seals, see Florida Administrative Code (F.A.C.) 61G15-23.002 Seals Acceptable to the Board).

Drawing Units (Autodesk): The real-world units used in an Autodesk drawing that represents the measurement system used to construct the real-world design, such as US Survey Feet.

Early Works: Sheets inserted into the plan set that were prepared early in or prior to the design process. See section 8.10.1 of this document. **Project CD**: Media (CD, DVD, USB, etc.) containing all data associated with a project. The contents must include the entirety of the Project Folder/Project Data Set.

Engineering Data: Those electronic files that represent the critical geometric and quantitative controls or other data supporting the graphical representation (design) of a project.

Federated Model: A collective BIM that is compiled by importing different models from different disciplines together into one model.

File Checker: An application to assist with the verification of Quality Control (QC) compliance to Delivery standards, such as folder structure, file naming, etc.

Font Library: A file in which text characters styles, symbols, or patterns are stored.

GIS – Geographic Information System

Global Origin (Bentley)**:** Origin location of the Cartesian coordinate system in the design plane coordinates (UORs) for Bentley files. When design plane positions are specified or reported in working units, they are relative to the global origin.

IFC: The Industry Foundation Classes (IFC) is a standardized, digital description of the built asset industry. It describes architectural, building and construction (AEC) industry data adopted by AASHTO. It is a platform neutral, open file format specification that is not controlled by a single vendor or group of vendors. It is a data model in object-based file format developed by building SMART to facilitate interoperability in the (AEC) industry, and is a commonly used collaboration format BIM based projects. It is registered by ISO and is an Official **International Standard ISO 16739-1:2018**.

Item Types: A technology introduced in the MicroStation CONNECT edition that allows a standard library of database attributes to be organized and then applied to the model geometry. These item types can be created, ad hoc in the dgn or created in advance and deployed as a part of the workspace of a DGN library file (dgnlib).

These attributes can be authored and applied in the CONNECT edition with the use of a custom Visual Basic for Applications (VBA) recently written by Bentley (Asset Manager).

Journal: Electronic file(s) that document development, correspondence, decisions made, methodology used, exceptions to standards, or other descriptive information about the project. The Electronic Journal includes details that must give future users insight about the project data.

Layer Symbology (Autodesk): The definition of the properties an object inherits when placed on a layer using the "ByLayer" property. The layer definition contains properties such as Color, Linetype, and Line weight.

Letting: The process of advertising, selection, and awarding of a contract for the construction of a project.

Level/Layer: Data in the design file segregated into drawing levels or layers.

Level Symbology (Bentley): The definition of the symbology an element inherits when placed on a level using the "ByLevel" setting. The level definition contains symbology such as Color, Line Style, and Line Weight

Line Style (Bentley): Part of the symbology of an element: for example, whether a line is represented a solid, composed of dashes, dots and dashes, and so on. Each element has its own line style.

Line weight (Autodesk): The thickness of a line used for display or print purposes defined in millimeters.

Line Weight (Bentley): An index that designates the thickness of the lines used to draw or print a graphic element. Each element has its own line weight.

Linetype (Autodesk): Part of the property of an object: for example, whether a line is represented by a continuous line or a series of dots and/or dashes and spaces.

Model Space: The "space" in which most of an AutoCAD drawing resides. Even though it didn't have a "space" designation attached to it until Release 11, Model Space has been around since AutoCAD was first developed - version 1.0. In Model Space, everything exists as in the real world, where 1 foot = 1 foot.

Master Units (Bentley): The largest unit in common use in a design file, usually represented in US Survey Feet for most of the Department's seed files.

LOA: Level of Accuracy - a measure of how close and correct a stated value is to the actual, real value being described; accuracy may be affected by rounding, the use of significant figures or designated units or ranges in measurement.

LOD: This abbreviation can be used in many contexts including but not limited to:

- **Level of Detail** – With respect to 3D modeling, this means to what level of totality and precision the 3D geometry matches the real world or design intent. For example, modeling the outside areas or physicality of a concrete structure is a low level of detail; a model that includes the outside structure, internal rebar, and associated accouterment would be a high level of detail.
- **Level of Development** – Functionally, this term means the same thing as Level of Detail but is a more common way of expressing development/detail when discussing BIM object and system as a whole. Level of Development is the degree to which the element's geometry and attached information has been thought through – the degree to which project team members may rely on the information when using the model. In essence, Level of Detail can be thought of as input to the element, while Level of Development is reliable output.
- **Level of Deflection** – Also known as Allowable Deflection, this is an expression of the acceptable sag on bend in a structural member under a specific load. This is generally expressed as a fraction of the span in inches.

OIT Personnel Supporting CADD: Office of Information Technology (OIT) personnel assigned to support the CADD program to perform the role of management and related tasks of the Department's IT infrastructure.

Paper Space: An area used in AutoCAD to plot (print) the drawing created in model space. Paper space is a lot more powerful than simply letting us plot the entire model space drawing, we can set up views called Viewports within the paper space area to separately show different areas of the model space drawing.

Plans Change: (FDM 131.2 definition) Modifications to the plans, specifications or quantities after District Estimates Office changes the Project Preconstruction (PrP) Workflow/Phase and before the Plans are sent to Central Office are referred to as Plan Changes. Plan Changes include revision, deletion, or addition of data on individual sheets, or adding and deleting entire sheets. Changes are not noted in the Revision Block on the sheets.

Project: Projects are identified by the Department through the Financial Project IDentification (FPID) number which becomes the name of the project's root folder. Note that multiple deliveries can occur for a single project, each representing the status of the project at the time of delivery.

Project Component/Discipline: All electronic files that represent and support a delivery by a discipline as part of a project.

Project Data Set: All of the files used or produced during the development of the project and placed in the Project Folder structure.

Project Component/Discipline Folder: The data structure and organization of electronic files on the storage media, as a sub-folder of the project's root folder.

Project Folder: The parent folder of a project containing all project component Folders and data (see Project Root Folder).

Project Manager: The person responsible for ensuring that the scope of work is accomplished for a project and the receipt, acknowledgment, validation, and acceptance of the project data.

Project QC Report: The single QC file created before Project submittal named ProjectQCReport.txt stored in the Project "_meta_info" sub-folder.

Project Root Folder: The file system folder that contains all projects' files and folders. The project root folder should not contain files that do not pertain to the project, nor should files that are part of the project reside outside of the project root folder, or one of its sub-folders.

Project Validation Report: The file named, ProjectValidationReport.txt stored in the Project "_meta_info" sub-folder.

Properties (Autodesk): The settings applied to an element for visualization/printing purposes, such as Color, Linetype, Line weight, Transparency, etc.

Quality Assurance (QA): The planned, coordinated, and continued activities performed to measure processes against predetermined critical requirements.

Quality Assurance (QA) Monitoring Plan: A QA work plan for CADD developed with District input that identifies what, where, when and how monitoring, reporting, tracking and follow up are to be performed.

Quality Control (QC) Reports: Reports that must be included with the final project delivery, including the Compliance Certification Checklist Report and all reports listed therein. Some reports are produced by software within the Department's CADD Software.

Quality Control (QC): The planned, integrated activities performed during work processes to ensure completeness, accuracy, proper decision making, and conformance with all other valid requirements.

Reference File: A Bentley design file or other file type that is attached to and viewed simultaneously with the active design file.

Resolution: The number of addressable points across a given area. For example, printer resolution is measured in lines or dots per inch, while screen resolution is usually given indicating the number of pixels across the width and height of the largest image that can be displayed. Bentley design files have a user-definable resolution, called Units of Resolution (UORs).

Revision Set: The set of files that includes only the changed files from one revision to the next.

Revision: FDM 131.2.2 defines a design revision as a modification to the ***Plans, Specifications & Estimates*** (PS&E) Submittal after it has been accepted by Final Plans.

ROADS: Reliable, Organized and Accurate Data Sharing Initiative began in March 2015. The goal of the initiative is to improve data reliability and simplify data sharing across FDOT. This initiative includes defining and documenting FDOT Data Governance, completing an inventory of the Department's information assets, a recommended future state information management architecture, and a roadmap implementation plan to implement the recommendations.

ROI: Return of Investment

Seed File: A predefined settings file used to create new design files or cell libraries.

Seed Project: A predefined folder structure that contains all folders listed further in this chapter, as well as other project configuration files. The "seed" is the beginning structure of a project which gets populated with data as the project development occurs.

Sheet Index: An application which runs within MicroStation, allowing users to browse and open MicroStation files containing sheets for verification or editing. Its purpose is to 'tag' sheets with data that supports later processes for both Indexing and Printing. It is a foundation utility for delivery processes and should be run against every MicroStation design file containing sheets.

Sheet: A single page in a multipage PDF.

Sheet Set Organizer (SSO): An application which runs in conjunction with Autodesk's Sheet Set Manager. Its purpose is to combine and organize FDOT Sheet Set (.dst) files created by Sheet Set Manager. It updates fields in DWG files with data that supports later indexing and printing. It is a foundation utility for subsequent delivery processes using Autodesk Civil 3D, ensuring sheet data can be extracted properly.

Signatory: The person or professional who secures files in a delivery using electronic cryptographic means such as Digital Signature. If the signatory is a professional, signatures will be governed by the rules defined by the Florida Boards of Professional Engineers (FBPE) regulations.

Signature Sheet(s): The Digital Delivery process uses a Signature Sheet to define a professional's area of responsibility for portions of the document being digitally signed. Signature Sheet(s), in the case of a plans set, is one or more sheets following a Key sheet which bears the digital signatures of the Professional(s) of Records. The Signature Sheet is a convenient location for placing a digital signature appearance when there are multiple individuals signing a plan set. By placing a digital signature on the signature sheet of a plans set, the Professional(s) of Record associates his/her professional signature with the entire plan set (for example: 61G15-23.004); therefore, notation must be provided on the signature sheet for a scope delineating the extent of the Professional's responsibility and an index of the specific sheets in the plan set for which the Professional is accepting responsibility (also 61G15-30.003 Minimum Requirements for Engineering Documents). (See the Department's FDM 302 with Exhibits 302-1 & 302-2 and Chapter 303 with Exhibits 303-1 & 303-2, for further explanation and examples.)

Signing and Sealing: Digital Signature relies upon Public Key Infrastructure to embed secure data into a file the Signatory signs or signs and seals. Any restriction upon the scope of responsibility, usability, or reliability of the file being signed must show with the appearance of the digital signature in that document.

Software Ecosystem: Software ecosystem includes Design, Analysis, Coordination, Visualization, Review, Documentation, and Quantity Takeoff.

Standard Operating Instructions: Instructions for operating CADD applications intended to help guide the user in CADD production activities.

Statewide CADD Coordinator: Individual in the Central Office responsible for coordinating amongst the Districts to implement a uniform policy and standards for CADD operations for the Department.

Strung Project: Two or more projects let in the same contract.

Sub-Consultant: A consultant, separate from the primary consultant, who performs work for a project under the hire of a prime consultant.

Sub-Delivery: A delivery of files made by a sub consultant to a consultant, prime consultant or project manager, where that delivery is only a portion of the overall project.

Supporting CADD Files: Any file, including Resource Files (such as fonts, line styles, pen tables, cell/block libraries, etc.) required to produce the printable sheet images of a plan set.

Surface: A surface, in the context of 3D engineered models, represents an element of design such as existing ground, final grading, or pavement in a three-dimensional workspace. All elements of the surface are spatially oriented to one another.

Symbol: A character placed from a TrueType font, Bentley font library, or Autodesk font file.

Symbology (Bentley): The settings applied to an element for visualization/printing purposes, such as Color, Line Style, Line Weight, Transparency, etc.

Text Attributes/Properties: The color, weight, font, height, and width of text.

Text Element/Objects: Text in (Bentley/Autodesk) design files as a distinct type of element.

Units of Resolution (UORs) (Bentley): The distance between adjacent points in a Bentley design plane. There are a very large number of fixed discrete positions or UORs along each coordinate axis that are defined as real world coordinates by master units and sub-units (collectively, working units).

Validation: Validation is done in Digital Signature; however, the validating application will compare hashes embedded cryptically within the file against ones calculated "on the fly" to see if a document has changed. The Validation extends to the hosting application verifying the identity of Signatory by using the Root Certificate to contact the Certificate Authority over the internet and checking identity records to ascertain the authenticity of the Signatory.

Working Area (Bentley): Size, in working units square, of design plane.

Working Units (Bentley): The real-world units in Bentley that the design plane is configured to, such as US Survey Feet.

Xref – An Autodesk drawing file or other file type that is attached to and viewed simultaneously with the active drawing file.

1.5 SCOPE

The ***CADD Manual*** is to be used by all personnel producing projects utilizing CADD for the Department. It is to be referenced in contracts requiring engineering plans and 3D Models preparation utilizing CADD. This manual affects all offices of the Department and all consultants, contractors and others who utilize CADD applications. The Districts are monitored for critical requirements to meet the Department's CADD Quality Assurance objectives.

1.6 ORGANIZATION

The Department's Production Support CADD Office, with input from the districts and industry, will develop and maintain procedures and standards for the Department's CADD production and related activities.

The following chapters are included:

Chapter 1 **INTRODUCTION***:* Describes and implements the *CADD Manual*.

Chapter 2 **CADD COMPUTER SYSTEMS**: Establishes the minimum requirements for procurement, maintenance, and technical support of the Department's CADD systems.

Chapter 3 **CADD SOFTWARE, DEVELOPMENT AND DISTRIBUTION**: Establishes how the Department's CADD Software is developed, tested, approved and distributed.

Chapter 4 **CADD SUPPORT**: Establishes the Department's CADD support structure and services, including the statewide training.

Chapter 5 **CADD STANDARDS**: Establishes the Department's critical CADD Standards to be used in the production of the Department's CADD projects.

Chapter 6 **CADD PRODUCTION PREREQUISITES**: Establishes the initial steps and processes for preparing the final Computer Aided Design and Drafting (CADD) Projects for the Department.

Chapter 7 **CADD PRODUCTION SUPPORT:** Establishes the minimum CADD project production requirements for the Department's CADD projects.

Chapter 8 **CADD DELIVERY**: Establishes the minimum requirements and functions necessary for Department's CADD project delivery process.

Chapter 9 **CADD QUALITY ASSURANCE AND QUALITY CONTROL**: Establishes the minimum requirements and functions necessary for Department's CADD project review process.

1.7 ROLES AND RESPONSIBILITIES

1.7.1 CADD Office

The CADD Office establishes policies, procedures, and standards to provide automation and quality assurance for the production requirements of CADD projects.

The CADD Office is responsible for the publication of the Department's CADD Manual.

The CADD Office provides software customization, training and support for CADD applications and recommended application workflows to the Department's CADD community.

The CADD Office coordinates with CADD Managers and CADD Technical Advisory Committees (TACs) on revisions, additions, issues, etc. to the CADD Manual and CADD Software.

1.7.2 CADD Managers

CADD Managers in Department offices ensure adherence to the policies, procedures, and standards of the CADD Manual.

The CADD Manager is responsible for communicating needs regarding application development, customization, support, training, quality control, document management, etc. to the CADD Office. This includes identified application issues reported by the CADD Community.

CADD Managers assist the CADD Office in developing CADD policies, procedures, and standards and provide reviews to the CADD Manual.

CADD Managers help develop CADD users in specialized application areas and identify members for consideration for the various CADD Technical Advisory Committees (TACs).

1.7.3 CADD Technical Advisory Committees (TACs)

CADD TACs is organized by CADD application Components/Disciplines, i.e., roadway, drainage, traffic, structures, construction, etc. TACs meet on a regular basis, usually quarterly, to discuss CADD topics related to their Component/Discipline. General guidelines for Department TACs are accessible by FDOT staff from the Production Support CADD Office SharePoint website link:

FDOT CADD TAC Sharepoint Website (FDOT Staff Only)

The Districts and Central Office are both represented on the TACs by knowledgeable and proficient CADD users. TACs are empowered to advance and improve the CADD policies, procedures, and standards and to identify application issues and needs for their specific Component/Discipline. All recommendations for change are processed through the applicable TACs and provided to the CADD Managers and the CADD Office to implement.

BIM CADD TAC
Construction TAC
Consultant TAC *
Drainage TAC *
Environmental TAC
Geotech TAC
Roadway Design TAC
Structures Autodesk TAC *
Structures Bentley TAC *
Traffic Plans TAC

Note * Includes invited representation from Consultants.

1.8 DISTRIBUTION

The ***CADD Manual*** is distributed in electronic format and may be downloaded from the **Production Support CADD Office** website.

The FDOT CADD Community can register to receive notification of updates and Production Support Office Bulletins online through the Department's Contact Management Database at: **FDOT | Contact Management | Login (state.fl.us)**

1.9 REVISIONS AND UPDATES

The FDOT CADD Community is encouraged to submit comments and suggestions for changes to the manual to the Production Support CADD Office; see Forms Section at the end of this chapter. When ideas or suggestions are received, they will be reviewed by appropriate CADD Support staff in a timely manner and will be coordinated with other offices affected by the proposed change. Items warranting immediate change will be made with the approval of the State CADD Engineer and/or Production Support Office Manager in the form of a Bulletin or Memorandum.

Production Support Office Bulletins and Memorandums are numbered based on the two-digit calendar year and bulletin number (i.e., PSB20-01, PSM19-01) Notices are sent to all users who are registered to receive notifications for Production Support CADD Bulletins. Production Support CADD Office Bulletins will remain effective until either:

1. An official manual revision is published; or

2. The Bulletin is made void.

Production Support Office Bulletins are posted online: **Bulletin and Memorandums (fdot.gov)**

1.10 TRAINING

Training issues and opportunities are identified within **Chapter 4** of this document.

1.11 LINKS AND FORMS

1.11.1 CADD Quick Links

CADD Conferences, Events, & Presentations CADD Links

CADD Software Currently Supported

CADD Software Downloads

CADD Support Bentley Community

CADD Support Autodesk Community

CADD Support Email

CADD Technical Advisory Committees (TACs) ***(FDOT Staff Only)***

CADD Training Course Guides

- **FDOT Roadway Design and 3D Modeling Training Guide**
- **FDOT Automated Quantities Training Guide**

CADD Training Webinars - Live

CADD Training Webinars - Posted

CADD Website

FDOT CIM Office

FDOT 3D Deliverables Support Resource

FDOT CADD Rule File Tables

FDOT Approved Digital Certificate Authorities

FDOT Construction Publications

FDOT Contact Management Alert System

FDOT Contact Management

FDOT Custom Line Styles/Linetypes Table (Standard Symbols)

FDOT_DimensionStylesTable

FDOT Standard Plans FY 2018-19 Revisions Log

FDOT Standard Abbreviations

FDOT Structures Manual

FDOT Survey & Mapping Office Documents and Publications

FDOT Survey Feature Codes Table

FDOT Training YouTube Channel

Geospatial County Maps

GeotechDataSheet

GoToMeeting

Hardware Minimum Configuration Standards ***(FDOT Staff Only)***

Model Element Breakdown

National CAD Standard

QC Review for 3D Engineering Models Webinar

QuickStart using gINT Civil Tools

Request CADD Support

Roadway Design Memorandum 18-02 - Project Documentation

Unicode Mapping Standard

Uniform Drawing System (UDS)

U.S. CADD/GIS Technology Center

1.11.2 Forms

1.11.2.1 Suggestions, Comments, or Questions for the CADD Manual

Chapter 1 of this document authorizes the development and implementation of the ***CADD Manual*** and is the only chapter subject to the Executive Review Process. Substantive revisions to this chapter that result in policy change must be coordinated with the Executive Committee ***in*** accordance with ***Procedure No. 025-020-002, Standard Operating System***.

The remaining chapters of this document will be updated and approved by the Statewide CADD Coordinator with input from the Districts and offices within the Central Office that may be affected. All updates must be coordinated with the Forms and Procedures Office prior to distribution to ensure conformance with and incorporation into the Department's Standard Operating System.

The Suggestion and Comment sheet displayed below provide an opportunity for feedback regarding the CADD Manual. All proposed changes, either in draft or final form, will be reviewed for implementation.

State of Florida Department of Transportation

SUGGESTIONS, COMMENTS, OR QUESTIONS for the CADD Manual

NAME OF FDOT DEPARTMENT/FIRM & ADDRESS:

_____

_____

_____

_____

NAME OF PERSON(S) RESPONSIBLE FOR SUGGESTIONS/COMMENTS:

_____

_____

TELEPHONE NO: ( ) _____ - _____

FAX NO: ( ) _____ - _____

E-MAIL: _____

SUGGESTION, COMMENT, or QUESTION:

(Comments or Suggestions may be attached as marked up copies of pages from the manual.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Submit Comments or Suggestions or Questions to:

Request CADD Support:	**https://fdotservicedesk.dot.state.fl.us/**
E-mail:	**cadd.support@dot.state.fl.us**
Mail:	**FLORIDA DEPARTMENT OF TRANSPORTATION** **PRODUCTION SUPPORT CADD OFFICE** **605 SUWANNEE STREET, MS 40** **TALLAHASSEE, FLORIDA 32399-0450**
Phone:	**PRODUCTION SUPPORT CADD OFFICE** **(850) 414-4380**

1.11.2.2 Compliance Certification Checklist

All Department Project deliveries must be provided to the Department's Project Manager, unless an alternate agreement is reached, along with a Compliance Certification Checklist (or similar document). This basic checklist may be employed to help the data producer consider critical items in their QC review for delivery. For more details see Section 8.4.6 of this document.

Note The Department's Districts may use a more comprehensive Compliance Certification Checklist in their QA process than the example in this document. The Department recommends this type of QC compliance documentation be submitted digitally inclusive within the \Administrative\ or \Data\ project sub-folders.

State of Florida Department of Transportation

COMPLIANCE CERTIFICATION CHECKLIST

FPID: _____

Effective CADD Manual date: _____

✓	(N/A)	Location to include		Checklist Items	Reference
☐		/_meta_info	1.	The ProjectProperties.xml file has been requested from the District	7.4
☐			2.	Reference Manager/Checker has been run to create the report indicating no missing reference files or custom resources (fonts or linestyles(.lin)/shapes(.shx)).	8.4.6
☐			3.	The Department's Project QC report, *ProjectQCReport.txt,* has been generated for all CADD Project design files.	Chapter 5
☐			4.	The Department's Project Validator report, *ProjectValidationReport.html,* has been generated for the CADD Project.	Chapter 5; 7.4 ; 8.4
☐	☐	/3D Deliverables	5.	The 3D Deliverable files have been created and signed and sealed, if applicable.	8.4.6.1
☐		/Administrative	6.	A Project Journal file has been created containing all required project information.	7.7
☐		CADD files with GCS	7.	The Geographic Coordinate System Report has been generated for all required files, with the correct project coordinate system set for each relevant file.	5.5
☐		Digital Signatures	8.	The project .zip file has been renamed to BIM.zip if any model files are included in the manifest to be signed and sealed as a legal document.	8.4.7
☐			9.	Digital Signature(s) are applied to the correct files, signed with the appropriate Digital Certificate, and independently validated.	8.5

Certified by EOR: _____

Chapter 2
CADD COMPUTER SYSTEMS

2.1 PURPOSE

This chapter establishes the minimum requirements for procurement, maintenance, and technical support of the Florida Department of Transportation (Department's) Computer Aided Design and Drafting (CADD) systems.

2.2 SCOPE

These requirements apply to all computer technology and services within the responsibility of the Production Support CADD Office, the CADD Managers of each District, Office of Information Technology (OIT), and Information Technology (IT) personnel assigned to support the CADD program.

2.3 PROCUREMENT OF CADD HARDWARE AND SOFTWARE

The CADD Managers and OIT personnel review the statewide CADD computer hardware needs to provide recommendations for procurement of any of the Department's CADD hardware where appropriate and do so in accordance with ***Office of Information Technology Manual, Topic No. 325-000-002.***

The Production Support CADD Office participates with OIT in the development of the Information Technology Resource Standards and evaluation of the Department's computer hardware to be procured for use in CADD.

The Production Support CADD Office, in conjunction with the Technical Advisory Committees (TACs) and CADD Managers, reviews the statewide CADD Software needs to support the Department's production efforts.

2.4 MINIMUM SYSTEM REQUIREMENTS

The Department's CADD Software is developed, tested, and configured on the Department's Minimum Hardware Configurations. The Hardware Minimum Configuration Standards can be accessed by FDOT staff from the Department's Office of Information Technology (OIT) intranet SharePoint website:

FDOT Hardware Minimum Configuration Standards (internal FDOT Link)

Other software configurations may operate with the Department's CADD Software. The use and support of the Department's CADD Software on other configurations are the sole responsibility of the user.

CADD Workstations should operate with the currently supported versions of the Department's CADD Software for the Department's projects, unless otherwise exempted by either the project's Scope of Services or a written exemption by the Department's Project Manager.

2.4.1 Optimal CADD Hardware (Minimum Specifications Listed)

Processor	RAM	Video Card	Video Card Memory	Monitors	Miscellaneous	Use Case
I7-6700	16 GB	Nvidia Quadro K420	3 GB	Various sizes	256gb NVMe PCIe drive	Midrange Desktop PC
I7-6700	32 GB	Nvidia Quadro K420	3 GB	(2)24" 1920x1200	256gb NVMe PCIe drive	CADD Workstation
I7-6700	32 GB	Nvidia GTX 980	6 GB	(2)24" 1920x1200	256gb NVMe PCIe drive	Viz workstation
I7-8650U	16 GB	Intel UHD 620		15" 1920x1080	256gb NVMe PCIe drive	Laptop

2.4.2 Current Supported Software Versions

A list of software versions currently supported by the CADD Office can be found at the following link:

CADD Software Currently Supported

Chapter 3

CADD SOFTWARE, DEVELOPMENT AND DISTRIBUTION

3.1 PURPOSE

This chapter establishes how the Florida Department of Transportation (Department's) Computer Aided Design and Drafting (CADD) software is developed, tested, approved and distributed by the Production Support CADD Office.

3.2 SCOPE

This chapter applies to the Department's supported CADD Software products procured or developed to produce the Department's projects and covers the steps used to develop, test, approve and distribute these CADD Software products. The Department's CADD Software is the responsibility of the Production Support CADD Office (CADD) and other designated offices.

3.3 SUPPORTED CADD PLATFORMS

The Department supports both Autodesk's AutoCAD and Bentley's MicroStation CADD platforms. Civil Design software applications for both Autodesk and Bentley, e.g., Civil 3D, PowerGEOPAK, OpenRoads Designer, etc. are supported by the CADD Office for the CADD Community. All efforts are made to support development and training of CADD Software whether Autodesk or Bentley software is used so the resulting contract deliverable products are transparent for the end users of CADD projects. Other CADD related software for specific applications is used and supported by the Department for component/discipline specific needs. Current software supported by the CADD office can be found at the following website:

CADD Software Currently Supported

3.4 CADD SOFTWARE DEVELOPMENT

Development by the CADD Office encompasses Department specific CADD Software applications, enhancements to existing CADD Software (added features), and maintenance releases of CADD software. Development is based upon needs identification and may include the purchase of commercial software when appropriate.

CADD Software needs are communicated to the CADD Office by the District CADD Managers, CADD Technical Advisory Committees (TACs) or the CADD Community. The CADD Office also identifies needs based upon experiences with CADD support activities and the evolution of trends in the CADD Software industry.

Development requests are managed by the CADD Office and coordinated through TACs, CADD Managers and OIT personnel assigned to support CADD.

The CADD Office will decide whether to develop CADD Software in-house, contract for development services, or purchase a CADD Software product. The CADD Office will keep the user community informed as to procurement status (including training and implementation schedules) of major CADD development projects of statewide interest via FDOT Contact Mailer.

3.5 CADD SOFTWARE UPDATES

The CADD Office, with input from Central Office Design, Districts Design and the CADD community, develops and maintains the Department's CADD Standards for CADD production and related activities. The CADD Office delivers the Department's CADD Software to reflect those standards and maintains the ***CADD Manual*** in coordination with the CADD Software to document those standards.

The Department's CADD Software is upgraded as needed to include major and minor platform version changes, new or updated resource files and cutom application enhancements that have occurred since the last upgrade. All CADD Software releases are tested and approved by the CADD Office.

3.5.1 CADD Software Testing

The CADD Office performs alpha testing of new CADD Software products during software development prior to the scheduled quarterly releases. At times beta testing is performed prior to major releases of CADD software. The beta testing by the CADD Community will be managed by the CADD Office and specific users will be identified and approved by the CADD Office, CADD Manager or CADD IT Services. The request for approval to proceed with beta testing, based on the appropriate recommendation, will be initialized by the CADD Office.

3.5.2 CADD Software Release Notifications

The CADD Office sends notification of the CADD Software releases to the CADD community via:

Production Support CADD Office website

FDOT Contact Management Alert System

(*See **FDOT Contact Manager** for how to register for alerts*)

Training Session announcements

Emails

CADD Support

Other venues as appropriate.

3.5.3 CADD Software Release Distribution

The CADD Office is responsible for the distribution of the quarterly CADD Software releases and CADD Maintenance Releases (MRs) using Service Requests opened with the FDOT Service Desk to notify IT Services and CADD Managers when new releases are posted for internal FDOT CADD users. The District IT Services, in coordination with the CADD Managers, are responsible for distributing the approved software for production use to the end users. The CADD Software is accessed through the **CADD Office Download** website.

Chapter 4
CADD SUPPORT

4.1 PURPOSE

This chapter establishes the primary components of the Florida Department of Transportation (Department's) Computer Aided Design and Drafting (CADD) support structure and services, including the statewide training, and defines the applications and tools supported by the Production Support (CADD Office).

4.2 SCOPE

This chapter applies to the CADD Community to establish the hierarchy of CADD-related support roles and responsibilities from the peer level to the statewide level of the CADD Office, the District CADD support function, and the CADD Technical Advisory Committees (TACs).

4.3 OVERVIEW

The Department supports a core group of CADD Software products for in-house production as specified herein. The CADD Community support is generally limited to the Department developed CADD Software modules, interfaces, and configurations. The statewide CADD support is coordinated through the CADD Office. Currently supported versions of CADD Software products can be found on the CADD websites:

CADD Software Currently Supported

CADD Software Downloads & Installation Requirements

Note	Most of the core CADD Software products are commercial programs that the Department has purchased a license to use. The Department makes no warranty, expressed or implied, as to the documentation, functionality or performance of these or other Department developed programs described herein.

The primary components of the CADD Support structure include:

Systems Support

Operational Support

Training Support

Reporting of CADD Issues (online)

The Department maintains a self-serve **FDOT Contact Management Alert System** for email notifications on specific Departmental topics of interest. Users can Register and Sign up for notices sent out for CADD Software releases, CADD Training, CADD Notifications, etc. by selecting the options for "CADD". For "How to…" assistance select **How to Sign Up for FDOT Contact Manager Alerts** help document or **FDOT Contact Manager Alerts** webinar.

4.4 SYSTEM SUPPORT

The CADD Office manages and coordinates the testing, selection, procurement, and maintenance of the supported CADD systems used by the engineering community to perform the Department's CADD production with assistance from the district CADD Managers and/or OIT personnel assigned to support CADD.

The hierarchy of Systems Support is as follows:

First Level: The First Level of Systems Support is the District staff. The CADD Manager and/or District CADD IT contacts are the primary liaisons with the CADD Office for addressing CADD systems issues. District CADD Manager and/or OIT personnel support responsibilities include the following:

Identify the users' hardware and software needs.
Distribute and setup of equipment and CADD software.
Provide input for the statewide procurement.
Provide day-to-day technical support of the computer hardware and CADD Software systems used in the District.

Second Level: The Second Level of Systems Support is the OIT staff. The OIT support responsibilities include the following:

Manage the budget for procurement of CADD hardware.
Procure CADD hardware and maintenance.
Provide inventory management associated with the statewide CADD hardware.
Provide as-needed technical support for the hardware.

4.5 OPERATIONAL SUPPORT

The CADD Office manages and coordinates the development, enhancement and support of the CADD Software applications used by the engineering community to perform the Department's CADD production with assistance from the district CADD Managers and/or OIT personnel assigned to support CADD.

The hierarchy of Operational Support is as follows:

First Level: The First Level of Operational Support is through local Peer Support.

Second Level: The Second Level of Operational Support is through the Technical Advisory Committee (TAC) Members Support, who represent the Districts and Component/Disciplines on task teams to communicate and resolve support issues of statewide interest. Contact information can be found on the CADD Office website:

CADD Technical Advisory Committees (TACs) ***(FDOT Staff Only)***

Third Level: The Third Level of Operational Support is District Support Staff, including, but not limited to your: CADD Managers, CADD IT contacts, and engineering services personnel. These support personnel, collectively, are responsible for supporting the core CADD Software products for each respective district.

Fourth Level: The Fourth Level of Operational Support is the CADD Office support staff. The CADD Office is responsible for the Department's CADD application development, enhancements, and support to provide or procure required vendor services, as necessary, for user assistance.

4.6 TRAINING SUPPORT

The Department through the CADD Office manages and coordinates the provision of CADD technical materials and training to assist in maintaining user proficiency with assistance from the district CADD Managers and/or OIT personnel assigned to support CADD.

The CADD Training Plan will encompass the core CADD Software and CADD production procedures. The District CADD Managers, District and Unit Training Coordinators, and/or OIT personnel assigned to support CADD are responsible for respective District CADD training coordination.

Training instructors will be pulled from the Department's Central Office experts or from the augmented Training Support Contracts specifically set up for this training. The CADD Training Plan will cover all software platforms and will offer three (3) areas of training format opportunities:

CADD Regional Training – Full scheduled workflow instructor-led curriculum covering the standard CADD production workflow topics scheduled within the Districts. Participation is credited to each Departmental staff training records upon completion of courses.

CADD Academy Training – Full scheduled workflow web-based curriculum set in the Department's statewide Learning Curve system. Participation is credited to each Departmental staff training records upon completion of course modules.

District Project Based Training – One (1) Week per district of Project based hands-on training coordinated by each district with the Production Support CADD Office to schedule as needed.

The CADD Office offers other opportunities and resources for training users in the Department's CADD Software including, but not limited to:

CADD Support Community – Online discussion of ongoing Bentley issues monitored and used by the CADD office. Autodesk Discussion Groups access is provided on the software Help ribbon.

CADD Training Course Guides - Full line of training for the Department's CADD Software used within the course or self-help for the individual user and complete with data sets.

CADD Training Webinars - Live – Online registration for GOTO Webinars addressing the hottest topics and most frequently asked questions.

CADD Training Webinars - Posted - List of FDOT CADD Webinar, also found on FDOT Training YouTube Channel.

FDOT Training YouTube Channel – The CADD Office offers all the current recorded webinars and training for all users to access via YouTube. These match what is available from the CADD Office website.

GoToMeeting - Daily one-on-one support, utilizing the GoToMeeting software to connect with any user computer for instant assistance. GoTo Meeting can also be accessed from the FDOT Menu within a design software session.

CADD Links - List of the on-line resources used when researching CADD issues.

CADD Conferences, Events, & Presentations - The CADD Office offers seminars at various Conferences and events throughout the state, such as, Florida Local Users Group (FLUG), the FDOT Transportation Symposium, etc.

4.7 REPORTING OF CADD ISSUES

When reporting CADD issues, requests, or comments the following information *(where applicable)* is needed for CADD Support staff to assist:

User Contact information (include both phone and e-mail)

CADD Software platform and version, configuration and/or related applications used

Description of issue & how to reproduce (attach applicable files, screen shots, etc.)

Impact to user workflow

Best time to contact user

The Department offers the following venues, managed, and coordinated by the CADD Office, to report CADD issues, requests or comments:

Request CADD Support - The CADD Office facilitates a user Support portal to directly input an issue ticket into the Department's service desk. This requires a one-time request to create a user login account. Your ticket will be routed to the next available CADD Support staff who will contact you for assistance. Once entered the user may login at any time to check the status of their open issues.

Note The Request CADD Support option is also available within both Bentley and Autodesk software platforms.

FDOT CADD Bentley (BE) Support Community - The CADD Office facilitates an online Bentley discussion group accessing the CADD community resources for solutions to issues. Along with the CADD Community, the CADD Support staff monitors and utilizes this site through an automated alert system to respond to incoming issues.

FDOT CADD Autodesk Discussion Forum - The CADD Office facilitates an online Autodesk discussion group accessing the CADD community resources for solutions to issues. Along with the CADD Community, the CADD Support staff also monitors and utilizes this site to respond to incoming issues.

CADD Support Email - The CADD Office facilitates a CADD Support email address that routes all incoming email to the whole CADD Support staff to ensure that the first available staff can address CADD issues on a timely basis. This email should always be used in lieu of any direct email request, comment or suggestion in the case the individual CADD Support staff is out of the office or unavailable.

CADD Technical Advisory Committees (TACs) - *Internal FDOT Sharepoint link.* The CADD Office facilitates statewide self-directed work teams representing all CADD users of CADD systems and programs in a functional area or Component/Discipline for issues that involve requests for changes in the way of doing business or enhancements..

By Phone – (850) 414-4380 (Main) - There is the main reception line for the Production Support Office with someone to route your call to the first available CADD Support staff.

Chapter 5
CADD STANDARDS

5.1 PURPOSE

This chapter defines the Florida Department of Transportation (Department's) critical Computer Aided Design & Drafting (CADD) Standards to be used in the production of the Department's CADD projects.

5.2 SCOPE

These CADD Standards apply to all projects produced by and for the Department using CADD in addition to the Department's custom criteria, standards, and procedures of the various Components/Disciplines within the Department.

5.3 GENERAL

The Department develops CADD Standards through the Production Support (CADD Office) for production of Florida transportation plans and BIM files to be delivered with the aid of the CADD Software. The CADD Office manages and coordinates these CADD Standards through customizations within the Department's approved CADD Software platforms and the tools contained within the CADD Software ecosystem.

The CADD Software includes standard design libraries/templates to propagate the CADD Standards definitions of levels/layers and symbology (color, line styles/linetypes, weights), multi-line styles, text styles, dimension styles, cells, element templates, menu customizations, customized tools, tool groups, and tasks for two platforms: Bentley and Autodesk. The Department's custom CADD resource definitions for CADD drawings are generally consistent between the Bentley and Autodesk platforms. The following are examples of platform conventions cross walk:

Bentley	**Autodesk**
Database file	Database file
Seed file	Drawing Template
Design Library	Drawing Template
Cell Library	Block Drawing
Cell Name	Block Name
Print Configuration	Print Configuration
File Name	File Name
Features Definitions	Object Collections
Level Name	Layer Name
Color	Color
Line Style	Linetype
Line Weight	Line Weight
Reference	Xref

Projects will be maintained and updated to the current version of supported FDOT CADD Software and FDOT CADD Standards published and downloadable from the CADD Office website. Exceptions must be approved by the Department's District Project Manager, documented and delivered as part of the Department's project.

5.4 DATABASE RESOURCES

5.4.1 Bentley Connect Edition platform

For Bentley Connect Edition (FDOTConnect) projects, the software utilizes ***Item Types*** and ***Feature Definitions*** for the design process, where Item Types apply the Pay Item information for Quantities and Feature Definitions In addition to controls of the display Levels and Symbology. Feature Definitions also include properties, such as Item Type.

5.4.2 Autodesk platform

For Autodesk projects the Department's CADD Software includes an Entity Manager Pay Item Database (Payitemdb) file set up specifically to create drawing entities and attach pay item data according to the Department's CADD Standards.

5.4.3 Custom Database Resources

The Payitemdb database may need to be modified for project specific items or to comply with District standards. If the Payitemdb database is customized, a copy of this custom database must be saved into the project folder in the *Symbology*\ project sub-folder to ensure the modified database will be delivered with the project. When modifying project specific database resources, the following naming convention must be used:

Project Financial Project Identification Number [Component/Discipline Designation].xml

Where *Component/Discipline Designation* would be one from the following:

dr	(drainage)
it	(intelligent transportation system)
ld	(landscape)
lt	(lighting)
rd	(roadway)
sg	(signalization)
sp	(signing and pavement markings)
u	(utilities)

Example: Modified Signalization XML: ***19728125201sg.xml*** stored in ***19728125201\Symbology***\ project subfolder.

Project specific item type data may also be stored in the FDOTProject.xlsm file. This file should be stored in the project \Symbology\ sub-folder. Do not change the filename of this file.

5.5 SEED/SHEET TEMPLATE FILES

Seed files used in the FDOT Connect workspace are listed in the following resource file:

FDOT Design Model Seed Files

Currently the official datum of the United States is the NAD83 (2011). The FDOT CADD Office delivers the Create File application to assist in producing Design files with the standard Geographic Coordinate System. The Geographic Coordinate System must be set in production drawings derived from the seed files to the appropriate zone:

NSRS11(NAD83/2011) Florida, East Zone, US Foot

NSRS11(NAD83/2011) Florida, North Zone, US Foot

NSRS11(NAD83/2011) Florida, West Zone, US Foot

5.5.1 Bentley Connect Edition Seed Files

OpenRoads Designer (ORD) and OpenBridge Modeler (OBM) uses "seed" files to create all design files. Working units and global origin are two of the most important settings in the seed file. Working units are expressed as master units and sub-units. All Bentley Connect Edition standard seed files have been defined based on a master unit of "Survey Feet" with a sub-unit of "Survey Inches." The global origin is located at the center of the design plane for all seed files.

Seed Filename	Description
FDOT Drawing Seed.dgn	Sheets Seed File
FDOT Sheet Seed.dgn	Sheets Seed File
FDOT-ORD-KeyMap.dgn	Roadway Key Map Seed File
FDOT-ORD-Seed2D.dgn	Roadway 2D Seed File
FDOT-ORD-Seed3D.dgn	Roadway 3D Seed File
FDOT-ORD-TypicalPackageSeed.dgn	Roadway Typical Package Seed File
FDOT-ORD-RWseed.dgn	Right of Way Seed File
FDOT-ORD-StructSeed2D.dgn	Structures 2D Seed File
FDOT-ORD-StructSeed3D.dgn	Structures 3D Seed File
FDOT-OBM-StructuresSeed2D.dgn	Structures 2D Seed File
FDOT-OBM-StructuresSeed3D.dgn	Structures 3D Seed File

The resolution in Bentley files is defined per the master unit and determines the size (working area) of the design plane, which must encompass an area large enough for any State Plane coordinate zone in Florida. The resolution is set to 304800 units of resolution (UORs) per Survey Foot.

5.5.2 Autodesk Sheet Template Files

The FDOT Standard Sheet Borders, used for Autodesk Civil 3D plan production for all Components/Disciplines, are listed below. The user accesses these files when using any of the Autodesk Create Sheets wizard. Upon selection of the appropriate sheet template, a drawing scale is selected. Each Sheet Template file contains sheet layouts at designated scales along with fields in the border that can be automatically updated with project information, such as Sheet Title, Sheet Number, County, etc. The Cross Section sheet templates update with the appropriate material volume when sections sheets are created based on the material list selected in Autodesk.

Component/Discipline	Template Filename	Description
Right of Way	CSCOVR.dwt	Control Survey Cover Sheet
Right of Way	CSDETL.dwt	Control Survey Detail Sheet
Right of Way	MMCOVR.dwt	Maintenance Map Cover Sheet
Right of Way	MMDETL.dwt	Maintenance Map Detail Sheet
Right of Way	RWCOVR.dwt	Right of Way Cover Sheet
Right of Way	RWDETL.dwt	Right of Way Detail Sheet
Right of Way	RWPS.dwt	Right of Way Parcel Sketch Sheet
Right of Way	RWSHT.dwt	Right of Way Sheet
Right of Way	RWSPS.dwt	Right of Way Specific Purpose Survey Sheet
Right of Way	RWTAB.dwt	Right of Way Tabulation Sheet
Roadway	CTLSRD.dwt	Reference Points Horizontal Vertical Control Sheet Border
Roadway	SHDrainMap.dwt	FDOT Drainage Map Sheet Border
Roadway	SHPLAN.dwt	FDOT Sheet Border
Roadway	SHPlanDual.dwt	FDOT Dual Plan View Sheet Border
Roadway	SHPlanDual-Top.dwt	FDOT Dual Plan View Sheet Border
Roadway	SHPlanProfOpt.dwt	FDOT Plan Profile Optional Sheet Border
Roadway	SHPlanProfOpt-Intersection.dwt	FDOT Plan Profile Optional Intersection Sheet Border
Roadway	SHPlanProfStd.dwt	FDOT Plan Profile Standard Sheet Border
Roadway	SHProfDual.dwt	FDOT Dual Profile Sheet Border

Component/Discipline	Template Filename	Description
Roadway	SHProfDualOpt.dwt	FDOT Dual Profile Optional Sheet Border
Roadway	SHProfile.dwt	FDOT Profile Sheet Border
Roadway	SHProfOpt.dwt	FDOT Profile Optional Sheet Border
Roadway	SHXSC.dwt	FDOT Cross Section 2' Grid Sheet Border
Roadway	SHXSC1EW2.dwt	FDOT Cross Section 2 Material Sheet Border
Roadway	SHXSC1EW3.dwt	FDOT Cross Section 3 Material Sheet Border
Roadway	SHXSC1EW3-Overbuild.dwt	FDOT Cross Section 2 Material with Overbuild Sheet Border
Roadway	SHXSC2EW2.dwt	FDOT Dual Vertical Cross Section 2 Material Sheet Border
Roadway	SHXSG.dwt	FDOT Cross Section 1' Grid Sheet Border
Roadway	SHXSG1EW2.dwt	FDOT Cross Section 1' Grid 2 Material Sheet Border
Roadway	SHXSG1EW3.dwt	FDOT Cross Section 1' Grid 3 Material Sheet Border
Roadway	SHXSG2EW2.dwt	FDOT Dual Vertical Cross Section 1' Grid 2 Material Sheet Border
Structures	StructuresKeySheetTemplate.dwt	Structures Key Sheet
Structures	StructuresPlanProfile.dwt	Structures Plan & Profile

5.6 DESIGN LIBRARIES/TEMPLATES

CADD Standard Design Library (dgnlib)/Design Template (dwt) files have been customized containing data that is shared throughout the Department's standard files and among users. These shared resources consist of, but not limited to, the Department's standard Cells, Levels, Styles, and Features.

5.6.1 Bentley Connect Edition Design Libraries

CADD Standard Design Library (dgnlib files have been customized containing data that is shared throughout the Department's standard files and among users. These shared resources consist of, but not limited to, the Department's standard Cells, Levels, Styles, and Features.

Type	Design Library Name (DGNLIB)
Civil_Cells	FDOT_2D-Curb_Lines_And_Endings.dgnlib
Civil_Cells	FDOT_2D-Directional_Median_Openings.dgnlib
Civil_Cells	FDOT_2D-Driveways.dgnlib
Civil_Cells	FDOT_2D-FDM_Exhibit_Lines.dgnlib
Civil_Cells	FDOT_2D-Intersection_Details.dgnlib
Civil_Cells	FDOT_2D-Ramp_Terminals.dgnlib
Civil_Cells	FDOT_2D-Sidewalk_Curb_Ramps.dgnlib
Civil_Cells	FDOT_3D-Bus_Turn_Out.dgnlib
Civil_Cells	FDOT_3D-Driveways.dgnlib
Civil_Cells	FDOT_3D-Intersection_Details.dgnlib
Civil_Cells	FDOT_3D-Ponds.dgnlib
Design Standards	FDOT_DesignGeometricsCriteria.dgnlib
Display Styles	FDOT Display Styles.dgnlib
Display Styles	FDOT_DetailingSymbolStyles.dgnlib
Feature Definition	FDOT_Item_Types.dgnlib
Feature Definition	FDOT_OBM_Standards_Features.dgnlib
Feature Definition	FDOT_Standards_Features.dgnlib
Feature Definition	FDOT_SUE_Drainage.dgnlib
Feature Definition	FDOT_SUE_Utilities.dgnlib

Type	Design Library Name (DGNLIB)
Feature Definition	FDOT_Text Favorites_Text Styles_Dimension Styles
Graphic Filters	FDOT_GraphicalFilters.dgnlib
GUI	FDOT_MSCE_RIBBON_TAB.dgnlib
GUI	FDOT_OBM_RIBBON_TAB.dgnlib
GUI	FDOT_RIBBON_TAB.dgnlib
GUI	FDOTtoolboxes.dgnlib
Print Styles	FDOT_PrintStyles.dgnlib
Sheet Seeds	11x17 BridgeHydraulicRecommendationNamedBoundary.dgnlib
Sheet Seeds	11x17 Cross Sections Named Boundary.dgnlib
Sheet Seeds	11x17 DrainageMap Named Boundary.dgnlib
Sheet Seeds	11x17 Plan Only Named Boundary.dgnlib
Sheet Seeds	11x17 Plan Over Plan Named Boundary.dgnlib
Sheet Seeds	11x17 Plan Over Profile Named Boundary.dgnlib
Sheet Seeds	11x17 Pond Cross Section Named Boundary.dgnlib
Sheet Seeds	11x17 Profile Only Named Boundary.dgnlib
Sheet Seeds	11x17 Profile Over Profile Named Boundary.dgnlib
Sheet Seeds	11x17 Special Profiles Named Boundary.dgnlib
Sheet Seeds	36x48 Cross Sections Named Boundary.dgnlib
Sheet Seeds	36x48 Drainage Detail Named Boundary.dgnlib
Sheet Seeds	36x48 Plan Only Named Boundary.dgnlib
Sheet Seeds	36x48 Plan Over Plan Named Boundary.dgnlib
Sheet Seeds	36x48 Plan Over Profile Named Boundary.dgnlib
Sheet Seeds	36x48 Triple Plan Named Boundary.dgnlib
Sheet Seeds	36x72 Cross Sections Named Boundary.dgnlib
Sheet Seeds	36x72 Drainage Detail Named Boundary.dgnlib
Sheet Seeds	36x72 Plan Only Named Boundary.dgnlib
Sheet Seeds	36x72 Plan Over Plan Named Boundary.dgnlib
Sheet Seeds	36x72 Plan Over Profile Named Boundary.dgnlib
Sheet Seeds	36X72 Triple Plan Named Boundary.dgnlib
Sheet Seeds	KeyMapSheetSeed.dgnlib
Sheet Seeds	ROW Control Plan Named Boundary.dgnlib
Sheet Seeds	ROW Maintenance Plan Named Boundary.dgnlib
Sheet Seeds	ROW Plan Named Boundary.dgnlib
Sheet Seeds_OBM	ElevationNamedBoundary.dgnlib
Sheet Seeds_OBM	FDOT_DRAWINGSEED_OBM.dgnlib
Sheet Seeds_OBM	KeyMapStructuresNamedBoundary.dgnlib
Sheet Seeds_OBM	PlanNamedBoundary.dgnlib
Sheet Seeds_OBM	PlanOverElevationNamedBoundary.dgnlib

5.6.2 Autodesk Civil3D Design Template Files

Autodesk Civil 3D uses "style-based template" files to create design files. Drawing units are US Survey Feet and the geographic coordinate system for production drawings derived from templates must be set to the appropriate zone of the ***State Plane Coordinate System of 1983*** as defined in Section 5.5.

Template	Description
digitalsignature.dwt	Digital Signature
fdotmaster.dwt	Master Template
keysht.dwt	Key Sheets
planrd.dwt	Sheet Border for Details, Typical Sections & Summary Boxes
rwdtrd.dwt	Right of Way Detail for Roadway
rweng10.dwt	Right of Way
spst10.dwt	Structures
StructuresTemplateDetail.dwt	Structural Details
StructuresTemplatePlan.dwt	Structural Plans
survey.dwt	Survey Development Model
toporw.dwt	Existing Topography for Right of Way
TypSectionPkg.dwt	Typical Section Package
utadrd.dwt	Utilities Adjustment
utprrd.dwt	Utilities Proposed

5.7 PROJECT FOLDER STRUCTURE

FDOT CADD projects are organized and delivered using a standard Project folder structure. The Department's standard project folder structure and file naming conventions are based on the anticipated workflow of the Department's projects and the usual separation of work. The Project folders can contain Component/Discipline sub-folders for organization of discipline specific project files and other related resources, QC reports, journals files. etc.

5.7.1 Component/Discipline Sub-Folders

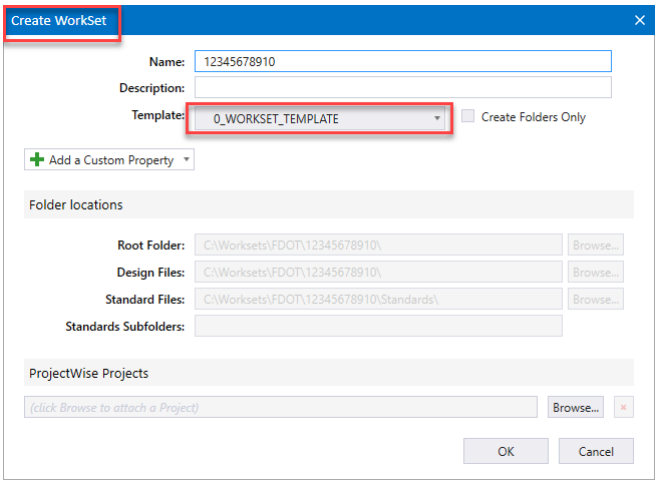
Component/Discipline sub-folders of a project are generally defined for the division of work and the files they typically would contain. Roadway designers would typically place files they create and "own" under the \Roadway\ sub-folder of the project, Surveyors under the \Survey\ sub-folder, and so forth. etc.

5.7.2 FDOT Standard CADD Project Folders

All CADD Projects are created with the Financial Project Identification Number (FPID) folder name. The table below displays the Department's standard Project sub-folder names.

FDOT Project Folder Names
_Meta_Info
_Shortcuts *
3DDeliverables
Administrative
Architectural
BridgeInspection
Calculations
Cell
Concepts
Construction
Data
Drainage
EvironmentalManagement
Estimates
Geotechnical
GIS
ITS
Lanscape
Lighting
Maintenance
Materials
Permits
Planning
Pre-estimates
Roadway
ROWMap
Seed
Signalization
SigningAndMarking
Specifications
Structures
Survey
Symbology
Traffic Operations
Utilities
*Autodesk Only

Note Bentley Platform: All new Worksets (projects) should be created from the 0_Workset Template in the Create Workset dialog. This will create the standard sub-folder names for the CADD project files.



5.7.3 Custom Sub-Folders

In some cases, it is desirable to create "non-standard" or custom sub-folders for additional segregation of work management. This is common when multiple parties work in a single component/discipline. These additional sub-folders can be created under the component/discipline standard project sub-folders; but **must not** be created under the root folder for the project.

These custom sub-folders must adhere to the restrictions for sub-folder names as defined below:

Certain special characters are not recognized by some programs for sub-folder names and must be avoided (even if they are valid characters for Windows folder names). Characters that interfere with operating system path specifications or XML interpretation such as: (/ \. : ;, < & # >") must be avoided.

Letters (A-Z, a-z), numbers (0-9), dashes (-), and underscores (_) characters are the only legal characters for sub-folder names.

Spaces must not to be used in any folder or file name for the Department projects.

Sub-folder names must not exceed 16 characters. Filenames may exceed 16 characters; but should be kept as concise as possible to help meet full path length restrictions.

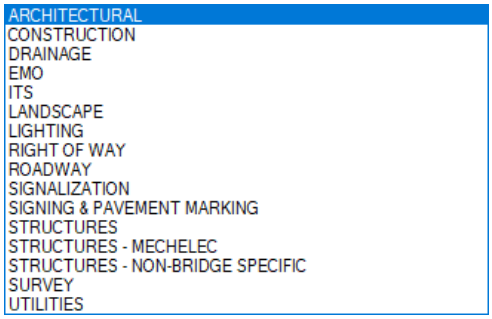
Full path lengths are also generally limited to 1024 characters (or less) total by some software. Path length (path plus filename) must be considered When creating folder (and file) names and may limit the number of sub-folder levels below the project level folder.

5.7.4 Engineering Data

The Engineering Data, /eng_data/, folders in the Project Folder Structure are a working sub-directory used to store project documentation during the design process of an FDOT Project. For Final Project design documentation, see Chapter 8 in Project Documentation.

5.8 DESIGN FILENAMES

The Department has defined a standard file naming convention for use in the production of the Department's CADD projects. Specific standard design Filenames are defined within each Component/Discipline and associated with the Department's standard CADD Rules *(Section 5.13 of this document)*. Standard model names are also provided. These standard Filenames are stored within the specified Component/Discipline folders of the Department's Project folder structure. The following displays the current CADD Component/Discipline:



The Standard Filename table is provided and accessible from the link below. The table displays complete listings of applicable Standard Filenames by Component/Discipline, File Group Descriptions, associated CADD Rules and standard Model names.

FDOT Standard Filename Table

5.8.1 Design File Naming Convention

The Department utilizes standard naming conventions for design files and provides applications that depend on these naming conventions being met. The naming convention also confers information to downstream users about the data contained within the design file. The Department delivers the Create File application to assist in producing Design files with the standard naming convention.

There must not be duplicate CADD (DGN, DWG, etc.) design filenames within a project folder structure. This is necessary to ensure proper reference attachments in CADD files**.** The Department delivers a *Project Validator* application to help find duplicate filenames within the project folder structure. Bentley and Autodesk, as part of their search sequence, will use the first occurrence of a filename found as they traverse a folder structure looking for reference attachments with no paths. Duplicate filenames for source attachments can "corrupt" data references. Always use the "relative path" option, but never "full" or "no path" when attaching references.

Note In the event a non-standard file name is required for the project, either the Project Manager or the District CADD Manager will be consulted to determine and approve of a proper filename to utilize. These files will not be checked by the QC Inspector and must be documented in the project journal with approvals.

5.8.1.1 Standard Design File Name Format:

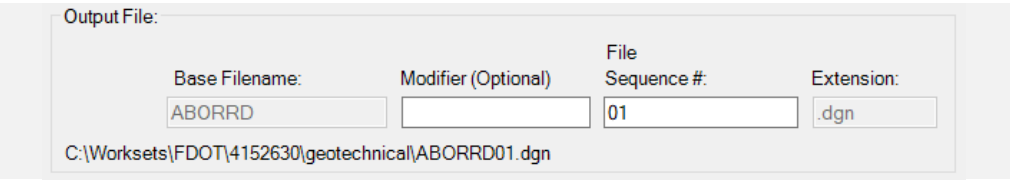
AAAABB(Modifier) (Sequence #).(Extension)

Base Filename: The first *six (6) characters* (*AAAABB*) of the standard design file naming convention described above are critical triggers for QC software and symbology filters.

- ***AAAA* - Abbreviated File Description, specific for each Component/Discipline**
- ***BB* - Component/Discipline Designation**

For Example: *rdxsrd01.dgn* – Indicates the first proposed Roadway cross section file.

Note Using the FDOT Create File application to create Project files auto-populates the Base Filename to the CADD Standards of the Output File upon selection of Discipline, File Group and File Type.



Modifier (Optional): Additional Project specific identifying information to be inserted after the Base Filename and preceding the Sequence #. This is open to the User discretion.

Note Letter (A-Z, a-z), number (0-9), dash (-), and underscore (_) are the only legal characters in FDOT Filenames. Spaces and characters, such as, (/ \. : ;, < & # >") must be avoided as they interfere with operating system path specifications or XML interpretation.

For Example: *rdxsrd-rampA-01.dgn*, indicates this proposed cross section file includes Ramp A.

Sequence #: A two-digit Sequence # (with padded integer, i.e., "00", "01", "02" … "99"). The Sequence # should be limited to two digits, but large projects may necessitate the need to exceed two-digit sequence numbers (100+).

Note The FDOT Create File application auto-populates the Sequence # to incrementing the number if the filename currently exists within the Project.

Extension: File Extension indicating the type of file.

Note The FDOT Create File application auto-populates the Extension to the preset Standard FDOT Filenames (i.e., dgn or .dwg)

5.8.1.2 Structures Design File Name Format

The Department identifies Structural project design files with additional File Naming attributes to address and document specific bridge information. Structural Files must be created using the supplied Structures Seed/Template resource files included with the Department's CADD Software package. The Structures Seed/Template files for the FDOT Structures Workspace differs from other Seed files in unit labeling.

The Department delivers the **Create File** application within the CADD Software to ensure files are named, created and stored to Department CADD Standards in the \Structures\ folder of the Project folder structure.

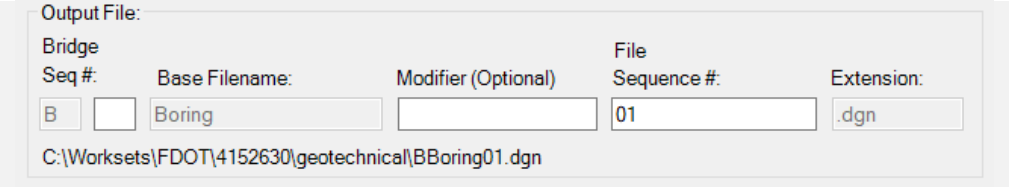
Note The Department's Structures Standard Filenames are defined in the **FDOT Standard Filenames by Component** tables found in Section 5.7.

- ***Standard Filenames for Bridges format: B#AAAA…(Modifier) (Sequence #).(Extension)***

Bridge Sequence #: (B#) - Bridge Plans Sequence Number specific for Structures Filenames that are critical triggers for QC software and symbology filters.

Base Filename: (AAAA…) - Abbreviated File Description, specific for Structures Filenames that are critical triggers for QC software and symbology filters.

Note Using the FDOT Create File application to create Project Structure files auto sets the "B" portion of the Bridge Sequence # and auto sets the Base Filename to the CADD Structures Standards of the Output File upon selection of Discipline, File Group and File Type.



Modifier (Optional): Additional Project specific identifying information to be inserted after the Base Filename and preceding the Sequence #. This is subject to User discretion.

Letter (A-Z, a-z), number (0-9), dash (-), and underscore (_) are the only legal characters in FDOT Filenames. Spaces and characters, such as, (/ \. : ;, < & # >") must be avoided as they interfere with operating system path specifications or XML interpretation.

Note Using the FDOT Create File application to create Project files auto sets the Sequency # to follow any existing filenames within the Project.

Sequence #: A two-digit Sequence # (with padded integer, i.e., "00", "01", "02" … "99"). The Sequence # should be limited to two digits, but large projects may necessitate the need to exceed two-digit sequence numbers (100+).

Extension: File Extension indicating the type of file.

For Example: B1EndBent01.dgn – Indicates the first EndBent sheet of Bridge 1 in a plan set.

Note Files containing Data Table cells should be named *B#DataTable##.dgn* and should be placed in the plans with the corresponding component detail sheet. Geotech files are listed in the Structures Filenames table to show the order of placement within the Structures plans component only. They should be stored in the \Geotechnical\ Project component/discipline folder and should follow Geotechnical Standards listed in this document.

- ***Non-Bridge Related Filenames:***

Non-bridge related files are created in the Structures workspace using Structures seed files. Mast Arm and Overhead Sign Structure sheets are included in the Roadway plans. All other non-bridge related sheets are included in the Roadway plans when no Structures plans are present.

5.8.1.3 Architectural Design File Name Format

Autodesk Architectural Standard Files are 3D for large plans, elevations or sections that contain the physical building components (walls, doors, water piping, beams…). These files are drawn in Model Space full scale. These files are referenced in whole or part into sheet files where text and dimensions are added, then printed.

- ***Architectural File Naming Convention: AA-FP#.dwg***

  *Examples**: Project Identifiers, Codes and File Sequence Numbers. For more detailed information refer to National CAD Standards.***

  Architectural Project Identifier (A _-_ _ _.dwg)

  Architectural, this differentiates architectural building projects from bridges and roadway projects.

  Note Add "A" before Discipline Code as published in National CAD Standards. This distinguishes Building drawings from Roadway and Structures Plans.

  Discipline Code (A -_ _ _.dwg)

_A -_ _ _.dwg	Architectural
_C -_ _ _.dwg	Civil
_Z -_ _ _.dwg	Contractor/Shop Drawings
_Q -_ _ _.dwg	Equipment
_E -_ _ _.dwg	Electrical
_M -_ _ _.dwg	Mechanical
_X -_ _ _.dwg	Other Disciplines
_P -_ _ _.dwg	Plumbing
_D -_ _ _.dwg	Process
_R -_ _ _.dwg	Resources
_S -_ _ _.dwg	Structural
_T -_ _ _.dwg	Telecommunications

  Drawing Type Code (general and discipline related) (_ _- FP _.dwg)

_ _- FP _.dwg	Floor Plan
_ _- SP _.dwg	Site Plan
_ _- DP _.dwg	Dimension Plan
_ _- XP _.dwg	Existing Plan
_ _- EL _.dwg	Elevation
_ _- SC _.dwg	Section
_ _- DT _.dwg	Detail
_ _- CP _.dwg	Ceiling Plan
_ _- EP _.dwg	Enlarged Plan
_ _- NP _.dwg	Finish Plan
_ _- RP _.dwg	Furniture Plan
_ _- SH _.dwg	Schedules
_ _- 3D _.dwg	Isometric/3D
_ _- DG _.dwg	Diagrams

  File Sequence Number (_ _- _ _ 1.dwg)

_ _-_ _ 1.dwg	1st drawing file in sequence
_ _-_ _ 2.dwg	2nd drawing file in sequence
_ _-_ _ 3.dwg	3rd drawing file in sequence

➢ *Architectural Sheet Naming Convention*

An Architectural Sheet File is a border sheet with dimensions and/or text added to a portion of a referenced model space file. Plotted sheet files make up the plans set.

Examples: Project Identifiers, Codes and Sheet File Sequence Numbers. For more detailed information refer to National CAD Standards.

Architectural Project Identifier (A _-_ _ _.dwg)

Architectural, this differentiates Architectural building projects from bridges and Roadway projects.

Note Add "A" before Discipline Code as published in National CAD Standards. This distinguishes Building drawings from Roadway and Structures Plans.

Discipline Code (_ A-_ _ _.dwg)

_A-_ _ _.dwg	Architectural
_C-_ _ _.dwg	Civil
_Z-_ _ _.dwg	Contractor/Shop Drawings
_Q-_ _ _.dwg	Equipment
_E-_ _ _.dwg	Electrical
_F-_ _ _.dwg	Fire Protection
_G-_ _ _.dwg	General
_B-_ _ _.dwg	Geotechnical
_H-_ _ _.dwg	Hazardous Materials
_I-_ _ _.dwg	Interiors
_M-_ _ _.dwg	Mechanical
_X-_ _ _.dwg	Other Disciplines
_P-_ _ _.dwg	Plumbing
_D-_ _ _.dwg	Process
_R-_ _ _.dwg	Resources
_S-_ _ _.dwg	Structural
_T-_ _ _.dwg	Telecommunications

Drawing Type Code (general and discipline related) (_ _- 1 _ _.dwg)

_ _-0 _ _.dwg	General (symbols, legend, notes…)
_ _-1 _ _.dwg	Floor Plan
_ _-2 _ _.dwg	Elevation
_ _-3 _ _.dwg	Sections
_ _-4 _ _.dwg	Large Scale
_ _-5 _ _.dwg	Details
_ _-6 _ _.dwg	Schedules and Diagrams
_ _-7 _ _.dwg	User Defined
_ _-8 _ _.dwg	User Defined
_ _-9 _ _.dwg	3D Views (isometrics, perspectives)

File Sequence Number (_ _- _ 01.dwg)

_ _-_ 01.dwg	1st sheet in sequence
_ _-_ 02.dwg	2nd sheet in sequence
_ _-_ 03.dwg	3rd sheet in sequence

Detail File Name Format (_ _- _ _ _ - B2.dwg)

The Detail File Name includes the sheet identifier and the detail identification number. Sheet Identifier is the sheet file that the detail is placed in. The detail identification number represents the location of the detail within the sheet file border.

Schedule File Name Format (_ _- _ _ _ - C3.dwg)

The Schedule File Name includes the sheet identifier and the schedule identification number. Sheet Identifier is the sheet file that the detail is placed in. The detail identification number represents the location of the schedule within the sheet file border.

5.9 FEATURE DEFINITIONS / OBJECT COLLECTIONS

5.9.1 Bentley Platform:

FDOTConnect for OpenRoads Designer includes standard Features within the delivered workspace resource libraries.

Feature definitions contain many different settings that are customized within the workspace to support CADD standardization. The symbology settings in the feature definitions explain which Feature Symbology is used for a specific feature definition. Feature Symbology definitions further explain the definitions of the CADD Element Templates for all views, Plan, Profile, 3D, inter-section, cross-section.

Element Templates are named sets of element parameters that are used to set active element placement parameters such as Color, Line Style, Line Weight, Class, Etc.

Features definitions also are used for standard element naming, cell placement, and custom attributes for automating quantities, etc.

See the list below for links to the specific Feature Definitions, Feature Symbology, and Element Templates developed for FDOTConnect:

FDOT **Feature Definition**

FDOT **Feature Symbologies**

FDOT **Element Templates**

5.9.2 Autodesk Platform

The Department's CADD Software includes standard Civil 3D Object Collections within the delivered FDOTC3D State Kit resource template.

FDOT Civil 3D Object Collections Table

Note This is only a preliminary table with updates to follow.

5.10 LEVELS/LAYERS AND SYMBOLOGY

The Department's CADD Software includes standard design libraries/templates to propagate the CADD standards definitions of (Bentley) Levels/(Autodesk) Layers. The Bentley libraries are delivered under the C:\FDOTConnectXX\Organization-Civil\FDOT\Dgnlib\Feature Definitions folder and the Autodesk templates are delivered under the FDOTXXXX.C3D\Data\Templates\ folder.

The Department's Level/Layer standards for projects define specific "ByLevel" Color, Style/Linetype and Weight Symbology for graphic elements for both the Bentley and Autodesk platforms. In nearly every instance, the Level/Layers and Symbology are the same between the platforms for consistency.

FDOT Standard CADD Levels Table

FDOT Standard CADD Rules Table

5.10.1 Levels/Layers Naming Convention

The Department's FDOTConnect *Libraries* define Bentley *Level Names*. The FDOTC3D State Kit design *Templates* define the Autodesk *Layer Names*. Designers must use these standard Level/Layer Names in the Department's plans production of all CADD standard design files.

5.10.1.1 General CADD Level/Layer Name convention format: object_sv (maximum of 18 characters)

Where: ***(object)*** = **Element Type**	(s) = **State Designations**	(v) = **View Designations**
	p (Proposed)	**p** (Plan)
	d (Drafting element)	**r** (Profile)
	e (Existing)	**x** (Cross Section)
		m (Model)

Note Level/Layer Names with no "_sv" suffix added are assumed to be "_pp" (Proposed state & Plan view).

Example: With this one can determine the following about the example Level/Layer names below:

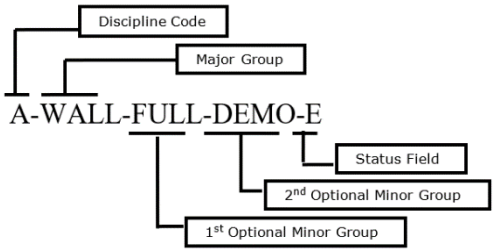
gas	- Proposed state & Plan view elements for "gas" related items
gas_ep	- Existing state & Plan view elements for "gas" related items
gas_px	- Proposed state & Cross Section view elements for "gas" related items
gas_pm	- Proposed state & 3D view elements for "gas" related items

5.10.1.2 Architectural Levels/Layers and Symbology

For Architectural Levels/Layers and Symbology, refer to the National CADD Standards and Layer Symbology produced by the U.S. CADD/GIS Technology Center, US Army Engineer Research and Development Center. These standards include space filenames, sheet filenames, detail filenames, schedule filenames, abbreviations, symbols, layers, linetypes, and text styles.

All drawings must be drawn at Full Scale 1:1 in Model space using Architectural Units. Text and dimensions should be added in Model space. The Title block Sheet should be in Paper space and viewport scaled for scalable printing.

All Level/Layer Names must follow the format detailed in the National CAD Standards. Below is a brief description of the layer naming convention.



- **Discipline Code**

A-_ _ _ _-_ _ _ _-	Architectural
E-_ _ _ _-_ _ _ _-	Electrical
F-_ _ _ _-_ _ _ _-	Fire Protection
M-_ _ _ _-_ _ _ _-	Mechanical
ETC.	

- **Major Group**

-WALL- _ _ _-	Walls
-DOOR- _ _ _-	Doors
-LITE- _ _ _-	Lighting fixtures
-COLS- _ _ _-	Columns
ETC.	

- **1st Optional Minor Group**

_-_ _ _ _-FULL-	Full height
_-_ _ _ _-DIMS-	Dimension
ETC.	

- **2nd Optional Minor Group**

_-_ _ _ _-_ _ _ _-IDEN-	Identification
_-_ _ _ _-_ _ _ _-PATT-	Pattern
ETC.	

- **Status Field**

_-_ _ _ _-_ _ _ _-N	New work
_-_ _ _ _-_ _ _ _-D	Demolition
_-_ _ _ _-_ _ _ _-T	Temporary work
_-_ _ _ _-_ _ _ _-F	Future work
ETC.	

5.10.1.3 Structures Levels/Layers and Symbology

For the FDOTConnect Workspace, standard element Level/Symbology are defined in the *FDOT_OBM_Standards_Features.dgnlib* Structures Level Library and must be selected from the Bentley level manager. Each level contains a defined "ByLevel" color, line weight, line style, and print property.

Note For a complete listing of Structures Levels/Layers and Symbology, see Section 5.10 or 5.13 under the STRUCTURES.

For Autodesk, FDOT Structures object Layer Property Standards are defined in the *StructuresTemplateDetail.dwt* and *StructuresTemplatePlan.dwt* template files and must be selected from the Autodesk layer selector. Each layer contains a defined color, line weight, linetype, and print property. Color must remain set to ByLayer and line weight & line style may be modified as needed.

User created Levels ARE NOT acceptable. If additional Levels/Layers are needed, contact the Structures Design Office. The Level named "Default" (in Bentley) or Layer 0 (in Autodesk) is not QC compliant and is not to be used for drawing elements. If a discrepancy occurs, the FDOT_OBM_Standards_Features.dgnlib Structures Level Library or StructuresTemplate file supersedes the FDOT CADD Rule Tables found in Section 5.8 of this document.

5.10.1.4 Survey Levels/Layers and Symbology

For Survey Levels/Layers and symbology refer to the standard CADD Rule Tables for the listing of the Right of Way (RIGHTOFWAY) Rule. The list of elements shown may not contain all elements that appear within a Right of Way map, as this list would be extensive. The elements shown are those that are required for specific types of Right of Way maps.

All Right of Way Levels/Layers are 'Critical' levels, meaning that the attributes: Level, Color, Line Style/Linetype and Weight will all be checked for QC compliancy. The exception is for Text levels, where the Style attribute will be set as Non-Critical and excluded from compliance checking.

Right of Way elements must match the standard symbology for the Right of Way file they reside in. Non-Right of Way elements will be drawn in the symbology of their intended file type. For example: Edge of Pavement drawn in RWDETL01.DGN would be given the symbology as if drawn for DSGNRD01.DGN. All Right of Way Level/Layer Symbology must use ByLevel settings

5.10.2 Color Symbology

The Department uses the default Bentley color table to visually recognize elements in files and for consistency in color printing. The default Bentley color table which defines 256 colors for CADD elements.

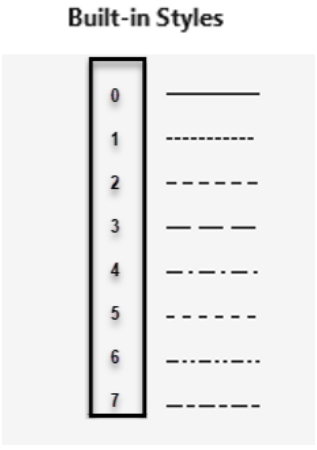
5.10.3 Line Style/Linetype Symbology

Bentley Line Style (or Autodesk Linetype) is part of the symbology of graphic elements, which defines a line's appearance. Each element has its own Line Style/Linetype which can be set to a standard Line Style/Linetype or to a Custom Line Style/Linetype.

FDOT delivers custom resources files for line styles/linetypes as shown below:

Bentley Connect Edition Custom Line Style Resource Files	**Autodesk Custom Linetype Resource Files**
FDOT_3D-Guardrail Double Sided.rsc	FDOT.LIN
FDOT_3D.rsc	
FDOT_3D-Cable Barrier.rsc	
FDOT_3D-Chain Link Fence.rsc	
FDOT_3D-Channelizer Cone.rsc	
FDOT_3D-Construction Barrel.rsc	
FDOT_3D-Guardrail Flared End.rsc	
FDOT_3D-Jersey Barrier.rsc	
FDOT_3D-Pavement Marking.rsc	
FDOT_3D-Reflector Post.rsc	
FDOT_3D-Traffic Cone.rsc	
FDOT_3D-Wrought Iron Fence.rsc	
FDOT_ORD_MOT.rsc	
FDOT_ORD_Rdwy.rsc	
FDOT_ORD_Road.rsc	
FDOT_ORD_ROW.rsc	
FDOT_ORD_Striping.rsc	
FDOT_ORD_Utilities.rsc	

5.10.3.1 Standard Bentley Line Styles



5.10.3.2 Standard Autodesk Linetypes

The following table shows the comparison of Line Styles vs. Linetypes

Bentley Line Style	Autodesk Linetype
0	Continuous
1	DGN1
2	DGN2
3	DGN3
4	DGN4
5	DGN5
6	DGN6
7	DGN7

5.10.3.3 Custom Line Styles/Linetypes

The CADD Office creates, maintains, and provides standard Custom Line Style/Linetype resource (.rsc) files, listed below, in the CADD Software for both platforms: Bentley and Autodesk for use in the design process of the Department's CADD projects. A Custom Line Style/Linetype Table is provided inclusive of a complete listing with sample images and can be accessed from the following link:

Custom Line Styles/Linetypes Table

Note Some Bentley Custom Line Styles containing leaders, complex markings and striping placed to scale are not created as Autodesk Linetypes. Autodesk tools such as Entity Manager, Place Block Group and the Pavement Marking tool can create these types of additional striping. In most instances, the Bentley Custom Line Style name will match the Autodesk Linetypes.

5.10.3.4 User-defined Custom Line Styles/Linetypes

The Department's standard Custom Line Style/Linetypes can be complex and contain arrangements of line segments and/or symbols. Users must not modify these Custom Line Style/Linetypes resource files, nor create conflicting custom line styles/linetypes with the same Line Style/Linetype names.

If User-defined Custom Line Style/Linetypes are required for a design, these must be defined in a resource file delivered in the \Symbology\ sub-folder of the FDOT Project folder structure. <OR> embedded in the design file. User-defined Custom Line Style/Linetypes resource files must be unique in both name and appearance.

5.10.4 Line Weight Symbology

Line weight for Bentley is defined by index value in the range of 0 to 31 that selects the stroke width (thickness) of the line used to draw and print a graphic element. Each element has its own line weight. The standard line width (thickness) of an element is usually in inches on the paper defined by a print driver file.

Printed output from the design file must be of a quality legible on 2nd generation copies. Line weights/thicknesses in the following table are default settings (also set in Department delivered print drivers). These may need to be user-adjusted depending on hardware to produce the required quality of printed documents.

Bentley/Autodesk Line Weight Mapping			
MS Weight	*MS Plot(inches)*	*Autodesk (inches)*	*Autodesk (mm)*
0	0.003	0.004	0.09
1	0.006	0.006	0.15
2	0.009	0.008	0.20
3	0.012	0.012	0.30
4	0.015	0.014	0.35
5	0.018	0.016	0.40
6	0.021	0.021	0.53
7	0.024	0.024	0.60
8	0.027	0.028	0.70
9	0.030	0.031	0.80
10	0.033	0.035	0.90
11	0.036	0.035	0.90
12	0.039	0.039	1.00
13	0.042	0.042	1.06
14	0.045	0.047	1.20
15	0.048	0.047	1.20
16	0.051	0.055	1.40
17	0.054	0.055	1.40
18	0.057	0.055	1.40
19	0.106	0.083	2.11
20	0.105	0.083	2.11
21	0.110	0.083	2.11
22	0.115	0.083	2.11
23	0.120	0.083	2.11
24	0.125	0.083	2.11
25	0.130	0.083	2.11
26	0.135	0.083	2.11
27	0.140	0.083	2.11
28	0.145	0.083	2.11
29	0.150	0.083	2.11
30	0.155	0.083	2.11

Available Autodesk Line Weights	
inches	*mm*
0	0.000
0.002	0.050
0.004	0.090
0.005	0.130
0.006	0.150
0.007	0.180
0.008	0.200
0.01	0.250
0.012	0.300
0.014	0.350
0.016	0.400
0.02	0.500
0.021	0.530
0.024	0.600
0.028	0.700
0.031	0.800
0.035	0.900
0.039	1.000
0.042	1.060
0.047	1.200
0.055	1.400
0.062	1.580
0.079	2.000
0.083	2.110

5.11 CELL LIBRARIES/BLOCK DRAWINGS

Bentley Cells/Autodesk Blocks are frequently used as repeated components of drawings made up of complex symbols, notations, details, or parts of drawings that can be inserted into one or many other drawings. Cells are defined and stored in Bentley design files called a Cell Libraries (*.cel)* and in Autodesk are called Blocks Drawings (.dwg). Each Cell/Block library group common cells/blocks as indicated by the libraries name. Users may create a Project Cell/Block library and store it under the Project\Cell folder.

Cells/Blocks have been grouped by disciplinary usage into the Department's Standard Cell Libraries/Block Drawings and are delivered with the CADD Software.

Note As referenced in the **Standard Plans FY 2018-19 Revisions Log**, Design Standard Index 002 was removed from the new Standard Plans, referencing the ***CADD Manual*** for users to find the Standard Symbols within the CADD Standard Custom Line Types and Cell Libraries setup to use in the design of a set of plans

FDOT Cell Libraries / Block Drawings

Note Bentley Connect Edition (FDOTConnect) Cell Libraries differ from the Bentley V8i (FDOT SS4) with scaling and are not compatible between platforms.

Cell Library / Block Drawing Name	Bentley Connect Edition Cell Libraries	Autodesk Block Drawings
Alphabet & Numbers	alphabet.cel	
Cross Sections	xsections.cel	
Distance & GuidSIGN Arrows	arrows.cel	arrows.dwg
Drainage - Existing	drplan_ex.cel	drplan_ex.dwg
Drainage - Proposed	drplan.cel	drplan.dwg
Drainage 3D *(3 Dimensional used for SUDA)*	Drain3D.cel	
Drainage Bottom 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Curbs 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Grate 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Junction 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Nodes 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Outlet 3D *(3 Dimensional used for SUDA)*		*(Autodesk Drainage Parts)*
Drainage Structure Cross Sections	DrainXS.cel	DrainXS.dwg
Florida Traffic Plans Signs	ftpsigns.cel	ftpsigns.dwg
Geotechnical	geotech.cel	geotech.dwg
Intelligent Transportation Systems Signs (ITS)	its.cel	its.dwg
Landscape	Landscape.cel	landscape.dwg
Lighting	Lighting.cel	lighting.dwg
Manual on Uniform Traffic Control Devices (MUTCD)	Mutcd.cel	mutcd.dwg
Pavement Markings	PavementMarkings.cel	pavementmarkings.dwg
Photogrammetry	Photogrammetry.cel	Photo.dwg
Professional Seals for Digital Signatories	Seals.cel	Seals.dwg
Right of Way	row.cel	ROW.dwg
Roadway	Roadway.cel	Roadway.dwg
Sheets	Sheets.cel	
Signalization	Signalization.cel	signalization.dwg
Structures	Structures2D.cel	TTF_v8Structures.dwg
Structures Patterns	Structures2Dpatterns.cel	
Structures Standard Data Tables	StructuresDataTables.cel	TTF_StdDataTables.dwg
Survey	Survey.cel	Survey.dwg
Toll Plaza Signs	TollPlaza.cel	TollPlaza.dwg
Traffic Control Plans	TrafficControlPlans.cel	TrafficControlPlans.dwg
Traffic Control Typicals	TrafficControlTypicals.cel	TrafficControlTypicals.dwg
Traffic Plans Labels	tplabels.cel	tplabels.dwg
Typical Sections	TypicalSection.cel	TypicalSections. dwg
Utilities	utilities.cel	utilities.dwg
Utilities 3D (3 Dimensional)	Utilities3D.cel	*(Autodesk Parts)*

- ***Standard Dynamic Cell Libraries/Block Drawings***

Autodesk Dynamic Blocks	Description
BoreHOLE.dwg	Bore Holes
CurbGutter.dwg	All Curb & Gutter Types
CurbRamp.dwg	Curb Ramps
Driveway.dwg	Driveway for Layout & Modeling
MastArmAsseblies.dwg	Mast Arm Assemblies (Poles & Arms)
Master Table Drawing.dwg	Master of All Summary Tables
Sheet Border.dwg	Sheet Borders
SheetPOR-Consultant.dwg	Professional of Record for Consultants

5.12 TEXT

The Department delivers a set of True Type Font *(*TTF) files to ensure text uniformity between applications supporting TTF fonts and legibility of CADD drawings. The Department's CADD Software delivers a set of proportional and uniform spaced True Type Font files using vertical and slanted characters, the detail of which is reflected in the table below. These font files have additional characters added into the gaps of the Unicode definition, so engineering symbols like: ℄, ℉, ℔, ∆ and fraction combinations are supported in the FDOT fonts directly. The Bentley based *zdotfont.rsc* and *structuresfont.rsc* resource files are also delivered with the CADD Software to maintain legacy compatibility for older CADD files predating the use of True Type fonts.

Note If the FDOT TTF files are registered with the Windows operating system, the fonts may be used in any standard Windows program like Word, Excel, or any other applications supporting TTF.

5.12.1 FDOT CADD Font

FDOT Fonts are still delivered and used by Text Styles with modified scaling in the Bentley Connect Edition. FDOT Vert fonts are no longer utilized.

Font	Description
FDOT	Standard slanted proportional spaced font used for most annotations
FDOT Bold	Bold version of the FDOT font
FDOT Heavy	Heavier Bold version of the FDOT font
FDOT Imprint	Chiseled font (*Used mainly within the FDOT sheet border*)
FDOT Imprint Bold	Bold version of FDOTImprint font *(Used mainly within the FDOT sheet border)*
FDOT Mono	Standard mono-spaced font *(Used mainly in tables to keep characters aligned vertically)*
FDOT Mono Bold	Bold version of FDOTMono font
FDOT Mono Heavy	Heavier Bold version of FDOTMono font

5.12.1.1 FDOT Text Styles

FDOT_ Text Styles in $(MS_DGNLIBLIST_TEXTSTYLES)

Text Styles	Font	Height	Width
Annotation	168 Structures_proportic	.000207	.000207
Bearing Label	FDOT	.0058	.0058
Cardinal Station Labels	FDOT	.0058	.0058
Cross Section - Annotation - Dimension Label	FDOT	.0058	.0058
Cross Section - Annotation - Dimension Text	FDOT	.070	.070
Cross Section - Annotation - Grading Slope Label	FDOT	.0058	.0058
Cross Section - Annotation - Grid Elevation	FDOT	.0058	.0058
Cross Section - Annotation - Grid Horizontal Title	FDOT	.0058	.0058
Cross Section - Annotation - PGL Elevation	FDOT	.0058	.0058
Cross Section - Station Label	FDOT	.0058	.0058
Curve Label Left Arc	FDOT Mono	.0058	.0058
Curve Label Right Arc	FDOT Mono	.0058	.0058
Default	FDOT	.0058	.0058
Dynamic Label	FDOT	.0058	.0058
FDOT (Large)	FDOT	.010417	.010417
FDOT (Medium)	FDOT	.008333	.08333
FDOT (Small)	FDOT	.005833	.005833
FDOT Bold (Large)	FDOT Bold	.010417	.010417
FDOT Bold (Medium)	FDOT Bold	.008333	.08333
FDOT Bold (Small)	FDOT Bold	.005833	.005833
FDOT Mono (Small)	FDOT Mono	.006	.006
FDOT Mono Bold (Medium)	FDOT Mono Bold	.100	.100
FDOT Mono Bold (Small)	FDOT Mono Bold	.070	.070
FDOT Signs	FDOT	.010	.010

Text Styles	Font	Height	Width
FDOT Structures Initials	FDOT	.0058	.0058
FDOT Structures Superscript	FDOT	.0044	.0044
FDOT Structures	FDOT	.0063	.0063
FDOT Structures Annotation	FDOT	.0063	.0063
FDOT Structures Dimensions	FDOT	.0063	.0063
FDOT Structures Revision	FDOT	.005	.005
FDOT Structures Subscript	FDOT	.04165	.0451
FDOT Structures Views_SectionArrow	FDOT Bold	.008	.008
FDOT_SHEET_COUNTY	FDOT Bold	.005833	.005833
FDOT_SHEET_DESCRIPTION	FDOT Imprint Bold	.010417	.010417
FDOT_SHEET_FPID	FDOT Bold	.005833	.005833
FDOT_SHEET_REVISION_DATE	FDOT Mono	.005	.004
FDOT_SHEET_REVISION_DESCRIPTION	FDOT Mono	.005	.004
FDOT_SHEET_SR	FDOT Bold	.005833	.005833
Line Length Label	FDOT	.0058	.0058
PI Station Labels - LT	FDOT	.0058	.0058
PI Station Labels - RT	FDOT	.0058	.0058
Profile - Annotation - Horizontal Axis Labels	FDOT	.0083	.0083
Profile - Annotation - Length-K Label	FDOT	.0058	.0058
Profile - Annotation - Strip Grade Existing	FDOT	.005833	.0058
Profile - Annotation - Strip Grade Proposed	FDOT	.0058	.0058
Profile - Annotation - Tangent Label Ahead	FDOT	.0058	.0058
Profile - Annotation - Tangent Label Back	FDOT	.0058	.0058
Profile - Annotation - Vertical Axis Labels	FDOT	.0083	.0083
Profile - Annotation - VPC - VPT Crest Labels	FDOT	.0058	.0058
Profile - Annotation - VPC - VPT Sag Labels	FDOT	.0058	.0058
Profile - Annotation - VPI Crest Labels	FDOT	.0058	.0058
Profile - Annotation - VPI Sag Labels	FDOT	.0058	.0058
Station Equations	FDOT	.0058	.0058
Station Labels Major	FDOT	.0083	.0083
Survey Labels	FDOT	.005833	.005833
Survey Point Description	FDOT	.005833	.005833
Survey Point Elevations	FDOT	.005833	.005833
Text Dimensions (CB)	FDOT	.070	.070
Text GeoDimensions (CB)	FDOT	.070	.070
Text Note (LC)	FDOT	.070	.070

5.12.1.2 FDOT Text Size

The Department CADD Software provides standard Text Levels and Text Styles to ensure uniformity and legibility on CADD drawings. The actual displayed text size in the drawing model is dependent on the annotation scale selected **FDOT Sheet Annotation Scales List** Since the most important issue with text is legibility, the font, weight and text size may vary when necessary using the appropriate text styles listed above. Text line spacing, on average three-fourths of the text height, is implemented in the Text Styles.

5.12.2 FDOT Standard Abbreviations

The FDOT Standard Abbreviations can be accessed from the new Standard Plans at the following link:

FDOT Standard Abbreviations - FY 2020-21Standard Plans

5.12.3 FDOT Special Symbols

The Department's TTF files contain special characters used by designers that are not normally found in standard publishing fonts. (*See the Unicode Mapping Standard:* ***http://www.unicode.org/charts/***). These characters include, but are not limited to fractions, mathematical symbols, survey symbols, boring symbols, Greek letters, or Super/Sub Scripts. These characters may be accessed via the Insert Symbol tool provided in the Bentley Text Editor/Word Processor or Autodesk MText editor dialog.

- ***FDOT Special Symbols:***

Symbol	Description
℄	Center Line
ℙ℄	Plate Line
𝔹℄	Base Line
𝔽℄	Flow Line
𝕄℄	Main Line
▽	Estimated High Water table
▽	0 hour Water Elevation
▼	24 hour Water Elevation
¼ - ¾	Fractions in 1/4 increments
⅛ - ⅞	Fractions in 1/8 increments
1⁄16 - 15⁄16	Fractions in 1/16 increments
1⁄32 - 31⁄32	Fractions in 1/32 increments
1⁄64 - 63⁄64	Fractions in 1/64 increments
⅓ - ⅔	Fractions in 1/3 increments
⅕ -⅘	Fractions in 1/5 increments
⁰ - ⁹	Superscript 0 - 9
⁺,⁻,⁼,⁽,⁾,ⁿ	Superscript operators
₀ - ₉	Subscript 0 - 9
₊,₋,₌,₍,₎,ₐ,ₑ,ₒ,ₓ,ₔ	Subscript operators
Ⅰ - Ⅿ	Capitol Roman Numerals
ⅰ - ⅿ	Lowercase Roman Numerals
◉	CPT Sounding
⊕	Auger Bore
✥	SPT Bore
®	Refusal (Geotech)
⊷	Probe (Geotech)

5.12.4 FDOT Dimension Styles

The FDOT Dimension Styles can be accessed at the following link:

5.13 FDOT_Dimension Styles in MS_DGNLIBLIST_DIMENSIONSTYLESCADD RULES

The Department provides standard CADD Rules defining a prescribed group of Levels/Symbology related to a given component/discipline, or design purpose and used for compliancy validation of CADD design through the Department's Quality Control (QC) process. Specific CADD Rules are automatically associated with each of the Department's CADD standard design filenames within the CADD applications.

FDOT Standard CADD Rules Table

FDOT Standard CADD Levels Table

5.13.1 Level/Layer Compliance Classification

All Level/Layers within all design files of an FDOT Project will be checked for compliancy, including all Level/Layers used within any of the FDOT CADD Cells.

FDOT CADD Cells/Blocks with invalid contents cannot be corrected using the FDOT QC tool but must be manually corrected within the cell. No Rule Exceptions can be created for cells/blocks.

5.13.2 Standard CADD Rules & Descriptions

CADD Rule tables are provided and accessible from the link below. They include comprehensive listings of the Department's CADD Rules with the associated CADD Levels/Layers and Symbology information.

Rule Name	Description
algnrd	Alignment Design
autosp	AutoTURN
cliprd	Clip Border/View Frames
drdtrd	Drainage Detail
drexrd	Drainage Existing
drmprd	Drainage Map
drprrd	Drainage Proposed
drxsrd	Drainage Cross Section
dsgnld	Landscaping Design
dsgnlt	Lighting Design
dsgnrd	Roadway Design
dsgnsg	Signalization Design
dsgnsp	Signing & Pavement Marking Design
dtmrd	Digital Terrain (Proposed)
gdtmrd	Digital Terrain (Existing)
geotech	Geotechnical
gisalgn	Geographical Information System
gispar	Geographical Information System
gisrwdt	Geographical Information System
gswksp	GuidSIGN
irrgld	Irrigation

Rule Name	Description
itssp	Intelligent Transportation System
keysht	Key Sheets
msarsp	Mast Arm Details
open	All Levels and Symbology Accepted
pdxsrd	Pond Cross Section
planrd	Roadway Plan Sheet
plprrd	Roadway Plan/Profile Sheet
qtdsrd	Quantity Computation
rdxsrd	Roadway Cross Section
rdxssp	Signing & Pavement Cross Section
rwdtrd	Right of Way Detail for Roadway
RightOfWay	Right of Way
Structures	Structural
survrd	Survey Development Model
tcdsrd	Traffic Control
topord	Existing Topography for Roadway
typdrd	Typical Section Data
utadrd	Utilities Adjustment
utexrd	Utilities Existing
utprrd	Utilities Proposed

5.13.3 Exceptions to the CADD Rules

Exceptions are deviations from the standard CADD Rules for any given project folder. For example, if a municipality required a special symbology for an element not covered in a CADD Rule, that element could be drawn with the special symbology and all occurrences of that symbology would be counted as one exception. The Department allows up to 10 exceptions per Standard Rule, per Project folder, before the compliance threshold begins to diminish.

5.14 CADD STANDARDS COMPLIANCE

Design Files must meet a minimum 90% compliance threshold for the following FDOT CADD Standards:

1. **FDOT CADD Standard Design Filenames** located in
2. **FDOT CADD Standard Project folders** and using
3. **FDOT CADD Standard Levels/Layers** in accordance with the FDOT CADD Standard Rule.

If the compliance threshold requirement is not met, a written variance from the Department's Project Manager with supporting documentation must be included within the Project Journal.

Note The threshold percentage is calculated as the number of graphical elements in the design file on the prescribed level symbology divided by the total number of elements in that design file.

A final Project QC Report is required for Project Validation. Intermediary reports may be run at any time during production, but the final "ProjectQCReport.txt" file, stored in the Project _meta_info folder along with the "ProjectProperties.xml" file, will be used for Project Validation.

All CADD files listed in the Project QC Report must be found in the Project folder structure and must pass hash coding to be a valid project. All CADD files found in the Project folder structure that ARE NOT listed in the Project QC Report cause an invalid project status. All Non-CADD files (such as: .cel, .dgnlib, .dxf, xml, kmz, & xsl files) are not checked for any type of compliance.

Note CADD drawing files will be hashed in the QC Report. Any changes to the drawing files after the report is run will invalidate that hash code. The Project QC Report contents itself is also hashed. Any manual manipulation of the report will invalidate the report.

5.15 REFERENCE FILES

A reference file can be many file types, such as a Bentley design file, an Autodesk drawing file, a raster image file (such as a SID, TIF, or HMR), or a PDF. A reference file is attached as a "background file" to an active design file being edited, thus allowing multiple users to share the information in the reference file without the need to copy the reference file(s) into the active design file folder (creating unnecessary and prohibited duplicates).

Important! - Under no circumstances should the "absolute" or "full path" be used when attaching a reference file. Use relative referencing - always!

All reference files for the project must reside within the project folder structure.

5.15.1 Bentley Referencing

Bentley reference paths are managed by an application setting (*FDOTConfig*) that is run at startup of any Bentley file opened in the FDOT Workspace. This application looks for the _Meta_Info\ folder, moves up one folder to set the root folder for the project and then dynamically sets the Bentley configuration variable, MS_RFDIR, to search downward from the root folder through all found sub-folders to identify any reference files. All design files for a project must reside within the Department's standard Project Folder Structure or its sub-folders to be located as a reference file.

Note If duplicate filenames exist in the sub-folders of the project, Bentley software will attach the first matching filename it finds in the path. Therefore, duplicate filenames are prohibited!

5.15.2 Autodesk Referencing

In Autodesk Civil 3D, there are two types of reference files used:

X-references (X-Ref) (Design files)

Data References (D-Ref) (Data shortcut files located in the _Shortcuts folder within a project)

5.15.3 Sharing of CADD Files

FDOT CADD supports the practice of "single source of truth" for all created data. Every project utilizes the standard folder structure regardless of the project requirements. Data for each component/discipline is maintained in their respective sub-folder. If a component/discipline requires information from another component/discipline, the needed file(s) must be referenced from the original folder, not copied. Shared files between two component/discipline groups must have the creation and ownership of these files coordinated between these groups.

For example, the Signing and Pavement Marking design file (*DSGNSP*) references the Roadway design file (*DSGNRD*) and the Topography file (*TOPORD*). These files should not be copied into the Signing and Pavement Marking component/discipline sub-folder.

5.16 MODELING STANDARDS

5.16.1 FDOT 3D Initiatives and BIM Integrated Modeling

FDOT supports the following adopted 3D Initiatives to help move the department toward designing and delivering integrated 3D BIM models:

1. To provide a higher quality of design with an intent to reduce cross component conflicts, better clash detection, improve constructability and ease field design changes, etc.
2. To provide for AMG in construction of earthwork, paving, resurfacing, and concrete, etc.
3. To serve as the Legal Contract Document, digitally signed by the EOR as the model of record for construction.
4. To provide BIM data for the infrastructure lifecycle.

Additional known benefits are:

5. To streamline project management per CPR. Research has shown that high ROI is expected from the BIM practice considering the long-range planning of the project and vast resource saving in the global economy.
6. To manage collaboration and define responsible parties per model progression.

The Department intends to use BIM data for design authoring and documentation. Projects should conform to the Department standards for BIM Project Execution Planning and Modeling. While the entire BIM-related Electronic Engineering Documents may or may not be construction contract documents, the Department will systematically develop contract documents to include BIM requirements on pilot projects. The department may also require the BIM related Electronic Engineering Documents to be delivered as reference documents for construction.

The BIM-related Electronic Engineering Documents shall be developed to comply with the Minimum Modeling Requirements defined herein regardless of whether or not the construction contract documents are generated from BIM.

The Design CADD office's BIM effort is a collaborative effort with the Transportation Technology Civil Integrated Management (CIM) office on CIM technology implementation without the finance details.

5.16.2 Modeling Requirements

Most projects can benefit from some or all discipline specific model-centric development of designs for construction. District leadership will determine the requirements of BIM designs (a.k.a. 3D Delivery) for each project. The current FDOT supported CADD platforms (ORD, OBM and C3D, etc.) are model centric design programs to support these requirements.

5.16.2.1 Project Considerations

As the BIM industry develops, project teams continue to advance the design methods and workflows, impacting scope, schedule, and budget. Below is a list of things to consider on projects with BIM delivery objectives:

Coordinate with District to ascertain if your project should be considered for BIM delivery

Reinforce project objectives that support the department's 3D Initiatives for model-centric designs

Develop a Model Management plan (see FDM 911) for BIM designs prior to the kick-off meeting

Build a scope and schedule that reflect the objectives for BIM delivery

Plan for BIM delivery on survey early in the design.

Ensure the schedule accommodates the curation, creation, and review of all the BIM files and formats that make up the BIM design submittal

Possibility to replace part of 2D plan sheets with detailed digital 3D model files at the same or better quality of details, signed and sealed by EOR. The ultimate goal is to fully transition to BIM contracting documents.

Clarify the Level of Development (LOD) for each discipline involved.

5.16.3 Modeling Scope

Ideally, a fully integrated BIM data delivery provides 3D models for the following design components:

Survey

Existing and Proposed Roadways

Existing and Proposed Drainage Structures

Existing and Proposed Utilities

Geotechnical Samplings

Signing and Pavement Markings

Lighting

Landscaping

Signalization

Proposed Buildings - Architectural

Structures

Temporary Traffic Control

District leadership will determine discipline requirements for BIM data delivery for each project. The Level of Development, Level of Details, Level of Definition and Level of Accuracy can vary with different platform project details and discipline and should also be determined during the scoping of the project. General requirements can be found in Section 5.16.5 and 5.16.6. The FDOT is an active participant on the AASHTO Joint Technical Committee for Electronic Engineering Data Standards (JTCEES) and the Task Team for LOD and LOA. FDOT anticipates following the standards and guidelines developed by this team and will reference more information as it is developed.

Each discipline identified shall have a Discipline Model. The Discipline Models shall be developed on one of the Florida Geographic Coordinate System as noted in Section 5.5. Discipline Models shall be referenced into a Federated Model. It is the lead discipline's responsibility to manage and resolve conflicts within the Federated Model.

Guidelines for the development and delivery of BIM data are provided in the Production Support Standard Scope of Services and Staff hour Estimation documents **Scope of Services and Staff Hour Estimation (fdot.gov)**

5.16.3.1 BIM Project Execution Planning (Future Requirements not yet implemented)

BIM Execution Plan (BEP) serves to jump start the development of BIM Deliverables for a project. The BEP provides a baseline document, approved by the FDOT Project Manager, to guide the project team in achieving goals set with regards to BIM deliverables throughout the project. The BEP specifies the roles and responsibilities of project members when using Building Information Modelling (BIM) at different stages of a project. It contains details with regards to the BIM deliverables and the process through which the deliverables are created, maintained, and shared, to meet a set of project goals. Typical content of a BEP includes the following:

Project information

Project members

Project goals

BIM delivery plan for each stage of a project

Model authoring software and version for each BIM deliverables

Model elements breakdown workbook to document

level of details and attributes for each BIM deliverable file

Process for BIM creation, maintenance, release and collaboration.

Documentation of the folder structure, file naming conventions and object naming conventions that sufficiently describes the model to enable a third party to correctly reconstruct the Discipline and Federated models and locate information

Clarify responsible parties and model delivery signing and sealing requirements

Quality Control procedures, including IFC/IMODEL Validation procedures

Data Security and Document Management procedures Technical Environment; and

Others

The BEP is defined at the start of the project and can be updated to accommodate new project members or new uses of BIM. All updates should be made with the FDOT Project Managers consent or his appointed BIM Manager. The BEP can be defined by the client, and made reference by the Principal Agreement via the BIM Conditions

Consultants may develop a BIM Project Execution Plan (PxP) to manage the process of developing the BIM and associated electronic engineering document deliverables. The PxP shall include sufficient detail to enable the Department to access the Federated and Discipline Models for the purpose of conducting reviews. Model Delivery

The department vision is to transition from a delivery format of 2D contract plan with proprietary CADD files to a common data exchange delivery format of 2D and 3D BIM files for contract documents to streamline design to construction information exchange and to support the CIM data warehouse. Project data delivery requirements for BIM designs are defined in the CADD Delivery Chapter 8.

5.16.4 General Level of Accuracy (LOA) Definitions

The following table provides general definitions for the Level of Accuracy for existing conditions and the project types the level supports:

LOA	Definition	Supports
100	Basis of the original ground surface is unknown or there is a high probability that the original ground has changed. Examples include aerial imagery pulled from a mapping service or terrains created from USGS data.	Proposal only projects
200	Old survey data was used, and the overall surface quality is not defined. There is a low probability that field conditions have changed.	Applies to a variety of projects and is generally not preferred
300	Interpolated mapping has a 95% confidence level that meets the following vertical tolerances: Hard Surface = ±0.05' Soft Surface = ±0.50'	Mill and resurface projects, or projects where only minor front slope corrections are anticipated
400	Interpolated mapping has a 95% confidence level that meets the following vertical tolerances: Hard Surface = ±0.05' Soft Surface = ±0.25'	Reconstruction projects or projects with major earthmoving activities are expected.

5.16.5 General Level of Development (LOD) Definitions

The following table provides general definitions for Level of Development for modeled elements to support Design and BIM delivery uses:

LOD	Definition
100	The modeled element is graphically represented in the model with a symbol (2D), derived from a database, or other generic representation. Non-Graphical information may be attached to the modeled element.
200	The modeled element is graphically represented within the model as a specific system in the XY plane (2D). Size, shape, and orientation can be derived directly from the modeled element with minimal need for plan sheet notes or dimensions. Non-Graphical information may be attached to the modeled element.
300	The modeled element is graphically represented within the model as a specific system in the XYZ plane (3D). Size, shape, orientation, and interfaces with other objects can be derived directly from the modeled element without the need for plan sheet notes or dimensions. Non-Graphical information should be attached to the modeled element.
400	The modeled element is graphically represented within the model as a specific system in the XYZ plane (3D). Size, shape, and orientation, interfaces with other objects, and fabrication instructions can be derived directly from the modeled element. Non-Graphical information has been attached to the modeled element.
500	The modeled element is graphically represented within the model as a specific system in the XYZ plane (3D). Size, shape, orientation, interfaces with other objects. The modeled element represents the digital as built (Digital Twin) of the constructed asset. Major transportation asset class attributes are linked to the modeled elements. Modeled elements objects or assets are useable and updatable by all stakeholders.

BIM delivery for PD&E Projects, LOD 200 to LOD 300 is acceptable for 3D model development during PD&E development. LOD 200 is acceptable in early stages since the conceptual modeling tools (Inventor, Concept Station, Infraworks, etc.) may not have libraries of FDOTspecific content. For example, they have barrier walls, but they likely do not match FDOT Standards precisely and are generic placeholders. Conversely, if modeling using the OpenRoads Design or Civil 3D, FDOT standard walls are included in the FDOT CADD workspaces. Most design phase elements will likely be LOD 300, so less detail in the concept phase is acceptable.

5.16.6 General BIM Use Cases

The following table provides general list of BIM uses to support Design, Construction, Operations, and ROADS/CIM/AIM

BIM Effort Use Case	Benefits				
	Planning	Design	Construction	Operations	ROADS/CIM/AIM
2D Plan Development(pdf)	X	X	X	X	
2D Plan Development(digital)	X	X	X	X	X
3D Design Modeling	X	X	X	X	X
3D Visualization	X	X	X		
Pay Item Information attached		X	X	X	X
Other Asset Information attached			X	X	X
Multi-discipline Analysis	X	X	X		
Spatial Geometric Analysis	X	X	X	X	X
ADA Standards Analysis		X	X	X	X
3D Deliverables for AMG			X		
3D Model for Construction Inspection			X		
3D Model for Construction Estimating			X		
3D Model for Constructability Review		X	X		
3D Models for Construction Stages (supporting traffic control plans)		X	X		
Geospatial Digital- As-Builts*	X	X	X	X	X
3D Details for Fabrication - Shop Drawings		X	X		X
3D Model for Project Construction Simulation (4D and 5D)	X	X	X		

* - supports only future or adjacent design efforts.

5.16.7 Model Element Breakdown Workbook

Consultants shall develop a BIM Model Element Breakdown (MEB) workbook to manage the process of developing the BIM and associated electronic engineering document deliverables (currently only required for the approved district AMG pilot projects). A sample FDOT MEB spreadsheet to be used on projects is provided at the link **Model Element Breakdown Workbook**

The Workbook contains information on most of the component elements created in the 2D and 3D design models, separate tabs are included for each discipline. The following information should be documented for each of the component elements:

- Model Element Name
- Included in Project
- LOD Standard
- Data Model
- BIM Use
- Contract or FIO
- Projessional of Record
- Source CADD file
- Source CADD level
- Required Element Data Attributes
- FDOT Specification
- Limitations
- Required Reports
- Documents attached
- Comments

5.16.8 Minimum Modeling Standards

5.16.8.1 Existing Features

A 3D model of the existing ground surface.

A 3D model of existing features, including depth information and appropriate feature definitions for pavement, shoulder, sidewalk, curb, guardrail, etc.

5.16.8.2 Proposed Features

A 2D geometric layout in plan view.

A 2D profile view with proposed profiles and/or existing profiles as needed.

Superelevation information, such as superelevation shapes and sections

Typical section information in the form of assemblies or templates, used to generate corridors.

A 3D Model of proposed features, with appropriate feature definitions, symbologies, material types, and quantity information for each component.

For traditional projects using the FDM 300 series, cross section views should also be provided where needed. These may also need to be included for NexGen projects using the FDM 900 series depending on project scope and FDM requirements.

5.16.8.3 Template Drop Interval

5.16.8.3.1 Corridor Frequency Interval Spacing for 3D Design

Design software used by the Department samples the 3D corridor models at user defined intervals to create surfaces. To ensure reasonable fidelity in surface models for AMG operations, maximum sampling intervals are described below:

Note The designer may choose to sample more frequently to more accurately represent his design model, although, there is a limiting return (larger files and poorer computer performance) if sampling too frequently. Designers must balance these competing consequences when deciding appropriate sampling frequency for their projects.

Maximum Corridor Frequency Interval Spacing (Feet)			
Context Classification	**Tangent**	**Curve**	**Intersection**
C1	20	10	5
C2	20	10	5
C2T	10	5	2
C3R	15	5	2
C3C	20	10	5
C4	15	5	2
C5	10	5	2
C6	10	5	2
Shared Use Path	10	5	1
Interstate	25	15	n/a
Ramps	20	10	5
Gore	5	2	n/a

The above maximum spacings would also apply to 3D elements built without corridors, such as, detail modeling for radius returns.

The corridor models used in design are to be submitted intact in the native CADD file format (MODLRD##.dwg/dgn) as part of the CADD.zip or BIM.zip file in part to ensure that reviewers can verify the correct interval spacing was used on the project.

5.16.8.3.2 Critical Stations

Additional sampling intervals will normally be needed at critical locations in horizontal geometry stations (i.e., PC's, PT's), superelevation transition locations, and at profile geometry critical locations (i.e., PVC's, PVT's, and profile high/low points). The designer must also add sampling at other critical regions along the corridor, such as changes of typical section, critical drainage locations, approach and interior to intersections, and median crossovers.

5.16.8.3.3 Curve Densification

Additional processing along horizontal and vertical curves will normally be needed to assure the recommended interval spacing in the not exceeded. If a corridor following both tangents and curves is set to use curve densification this should allow it to meet the tighter interval criteria for curves.

5.16.8.4 Drainage

A 2D geometric layout in plan view – this plan view can be the same one as used for road and site design or the road/site design can be referenced to a separate utility plan model. In either case, the road/site geometry and surfaces can be used to define or constrain the utility design.

A 2D profile view – this is the identical profile view technology used in OpenRoads road/site.

A 3D model –3D drainage structures are placed by the software and user interaction. These are geometrically accurate to the current FDOT Standard Plans for Road Construction 400 series Index.

5.16.8.5 Utilities

A 2D geometric layout of existing and proposed utilities in plan view. All UAO utility locations should be shown in the same design files, i.e., SURVRD01 or UTEXRD01. When multiple segments are defined on a project model management plan, additional design files for utilities should follow the naming sequence in the model management plan, i.e., UTEXRD01, UTEXRD02, etc. Individual utilities should not be separated into individual design files.

A 3D model—3D utilities can be placed by software and user interaction. These should have dimensions and elevation representing known or assumed information depending on LOA and LOD. All UAO utilities should be shown in the same design files, i.e., MODLRD_Existing_Utilities_01. When multiple files are necessary, follow the naming sequence. MODLRD_Existing_Utilities_01, MODLRD_Existing_Utilities_02, etc. Individual utilities should not be separated into individual design files.

5.16.8.6 Traffic: Signing, Markings, Signal and Lighting

A 2D geometric layout in plan view – this plan view can be the same one as used for road and site design, or the road/site design can be referenced to a separate utility plan model. In either case, the road/site geometry and surfaces can be used to define or constrain the utility design.

Optionally, a 3D modeled version can be provided. For signals and overhead signs, this could be useful for verifying vertical clearances. For pavement markings, this could be useful for 3D renderings for visualization purposes. Additionally, 3D modeling of all underground foundations for traffic equipment can be useful for determining potential underground conflicts with other utilities.

5.16.8.7 Structures

A BIM (3D digital model) in reference to given horizontal geometry, vertical profile, superelevation (if any) and terrain surface. All alignment and terrain shall be referenced in the design model file, in lieu of created within the design file.

Consultant shall include at least the minimum BIM LOD requirements specified by the district directives when developing contract plans. The consultant is encouraged to develop higher LOD wherever possible. The format of the construction contract documents is noted for each element or system. Where the LOD designation is less than 350, Consultant shall develop 2D plans and/or details to provide the full construction information. Where the LOD is equal to or greater than 350, Consultant shall develop the full construction information within BIM and generate contract documents from BIM and signed and sealed by EOR.

Chapter 6
CADD PRODUCTION PREREQUISITES

6.1 PURPOSE

This chapter defines the initial steps and processes for preparing the final Computer Aided Design and Drafting (CADD) projects in reflection of the **FDOT Design Manual (FDM)** for the Florida Department of Transportation (Department).

6.2 SCOPE

These processes impact anyone preparing contract deliverables for Department projects.

6.3 PROJECT DEVELOPMENT & ENVIRONMENT

Project Development and Environment (PD&E) study is the process for considering and evaluating environmental impacts as required by the National Environmental Policy Act (NEPA) and applicable laws and regulations for federal projects and other regulations for state funded projects. PD&E study is used to find the most appropriate design concept that meets the purpose and need for the project. Project alternatives are developed during the PD&E study to a level of engineering sufficient to address the purpose and need for the project and evaluate environmental impacts.

PD&E study involves production of design concepts to depict the extent of the proposed improvements and potential impacts, and present complex technical information in a comprehensible and visual manner to the public. Project alternatives and design concepts are developed using CADD Standards, where appropriate, to facilitate a seamless transfer of PD&E CADD files to the final design phase. The objective of using CADD Standards in PD&E is to minimize duplicative work and rework of concept plans in the design phase.

The PD&E process is documented in the PD&E Manual at:

Project Development and Environment (PD&E) Manual

6.3.1 PD&E CADD Deliverables

Preliminary design performed during PD&E study may include preparation of:

Base map

Digital terrain model or 3D surface

Alternative alignments

Alternative concept layouts/plans

Intersection/Interchange concepts

Profiles

Typical Sections

Drainage maps

Conceptual drainage and storm water pond plans

Preliminary structure plans for bridges, wall, and noise barriers

Utilities

GIS-kmz files

Visualization files

Design files shall be created according to the Department's CADD Standards.

Concept plans, calculations, data and files that are used to develop project alternatives should be placed under the \Environmental\ component/discipline folder, which is the Department's standard folder for concept plans and files created during PD&E. Additional sub-folders may be created under the \Environmental\ component/discipline folder to segregate and further organize data.

Data and files used to prepare preliminary design of the preferred alternative for a PD&E project with concurrent Design phase should be included in the respective component/disciplines folders such as roadway, survey, drainage, utility, and structure.

100 or higher is acceptable for 3D elevation and surface data for PD&E development. LOA 100 definition includes United States Geological Survey (USGS) data and surfaces from Rapid 3D Modeling Tools. Refer to CADD Manual Section 5.16.4 for more LOA definitions.

6.4 RIGHT OF WAY MAPPING

The Surveying and Mapping Office through spatial technology expertise supports surveying and mapping activities statewide for Florida's transportation system by providing policies, procedures, guidelines, and training. This office provides expertise in Aerial Surveying and Mapping, Location Surveying, Right of Way Mapping, and Mobile Mapping.

The Department's ***Surveying and Mapping Procedure***, Topic 550-030-101 and the ***Surveying and Mapping Handbook*** governs the requirements for Right of Way Mapping procedure for the Department's projects.

The following is a link to the Surveying & Mapping Office Documents and Publications:

Surveying & Mapping Office Documents & Publications

6.4.1 Right of Way CADD Deliverables

Right of Way Mapping may have multiple component sets for a specific project as defined in chapter/activity 29 of the FDOT General Scope of Services. These components may include control survey maps, right of way maps, maintenance maps, sketches, other miscellaneous survey maps, and legal descriptions as required for this project in accordance with all applicable DEPARTMENT Manuals, Procedures, Handbooks, District specific requirements, and Florida Statutes. All data delivered to the Department should be placed under the \ROWMap\ component/discipline folder, which the Department's standard folder structure is included for this purpose. Additional sub-folders may be created under the \RWMap\ component/discipline folder to segregate and further organize data.

A complete set of Right of Way Maps may include the following:

R/W Map Master Design File

Cover Sheet

Key Map Sheet

Detail Sheet

Project Network Control Tabulation Sheet

R/W Tabulation Sheet

6.5 SURVEY

The Surveying and Mapping Office through spatial technology expertise supports surveying and mapping activities statewide for Florida's transportation system by providing policies, procedures, guidelines, and training. This office provides expertise in Aerial Surveying and Mapping, Location Surveying, Right of Way Mapping, and Mobile Mapping.

The Department's ***Surveying and Mapping Procedure***, Topic 550-030-101 and the ***Surveying and Mapping Handbook*** governs the requirements for surveying procedure for the Department's projects.

The following is a link to the Surveying & Mapping Office Documents and Publications:

Surveying & Mapping Office Documents & Publications.

6.5.1 Survey CADD Deliverables

A Survey may have multiple component sets for a specific project as defined in chapter/activity 27 of the FDOT General Scope of Services. These components support a digital survey/document as defined by chapter 5J-17, F.A.C. and as required for this project in accordance with all applicable DEPARTMENT Manuals, Procedures, Handbooks, District specific requirements, and Florida Statutes.

The digital survey/document CADD file(s) may consist of a Control Survey, supporting Right of Way Mapping, a single file for Design Survey purposes or multiple component/discipline specific files also for Design Survey purposes. Due to the transition of Roadway Design from Criteria-based to 3D Modeling Surveying is required to support both legacy survey deliverables and a single digital Design Survey file when applicable.

Note All "Signed and Sealed" digital surveys must be accompanied by a Survey Report as per Rule Chapter 5J-17, F.A.C.

The SURVRD (Survey Development Model) when created as a Design Survey can serve as a complete survey database. SURVRD contains or replaces the following legacy files:

1. Existing Drainage file (DREXRD)
2. Existing Surface/Terrain Model (GDTMRD)
3. Existing Topography (TOPORD, TREERD)
4. Existing Utilities (UTEXRD, UTVHRD)
5. Project Control (CTLSRD)

Note

6.5.2 Survey Data File

Additional geometry input files are also created for delivery to design. For example: files of existing points, profiles, survey chains, alignments, surfaces, etc., should be created in LandXML 1.2 format. For information about LandXML (see: **http://www.LandXML.org**).

All data delivered to the Department should be placed under the \Survey\ component/discipline folder, which the Department's standard folder structure is included for this purpose. Additional sub-folders may be created under the \Survey\ component/discipline folder to segregate and further organize data. For example: the case where a CAiCE project is placed within the project folder structure under the \Survey\ component/discipline folder for delivery.

6.5.3 County Mapping

The production of County Maps is an internal function of the Department's Geographic Information Systems Office. For information regarding file naming conventions and other standards in use during the production of the Department's County Maps, contact Geographic Mapping in the Department's Geographic Information Systems Office at (850) 414-4111.

Note Only PDF County Map files are allowed in the current Standards / Workflow.

County General Highway Maps

6.5.4 Utility Quality Levels

Chapter 556, F.S. incorporate locates as described in the 1999 Utility Accommodation Manual (UAM), Section 11.3 Locates. These are no longer described in the UAM. Quality Levels for existing utilities are defined in the ***Surveying and Mapping Handbook*** at the link below:

Survey and Mapping Handbook

FDOT has provided for the identification of these Utility Quality Levels within the design process through the creation and association of specific CADD Standard Levels for each Utility Quality Level where applicable.

6.6 GEOTECHNICAL

Projects are evaluated to determine likely subsurface conditions and foundation alternatives in sufficient detail to estimate the total number, type, and depth of exploratory borings for Roadways and Structures. Projects could include evaluation of roadway subgrade or embankment stability/settlement related to sinkholes, soft clays, organic soils and/or high groundwater. Projects could also require geotechnical guidance for the following situations:

- normal cut and fill, recommendations for realignment,
- surcharge, excavation and replacement,
- subgrade reinforcement using geosynthetics and/or underdrains,
- soil improvement by lime/cement subgrade stabilization,
- deep dynamic compaction,
- vibro-flotation,
- compaction grouting,
- pile reinforced embankments.

6.6.1 Geotechnical Data that may be submitted for Roadway Plans Set

Boring Location Plan

Delineation Limits of Unsuitable Material Plan

Soil Profile Sheet

Report of Core Boing Sheet

Roadway Recommendations

6.6.2 Geotechnical Data that may be submitted for Structures Plans Set

Detailed Boring Location Plan

Report of Core Boring Sheet (SPT and Auger)

Location Map

SCS Soil Survey Map

USGS Terrain Map

Design LBR

Parameters for Water Retention Areas

Monitor Existing Bridge Data

Treatment of Problematic Soils

Pavement Condition/Evaluation

Bridge and Associated Wall Design Recommendations

Sign, Signal, Box Culverts, High Mast Lighting

6.6.3 Geotech Data Manager (FDOTConnect and FDOTC3D)

The Department has adopted a standard input file format **GeotechDataSheet** for the FDOT Geotech Data Manager tool. Geotechnical information shall be delivered in a file with the naming convention <**fpid-geotech.xlsx**> in Microsoft Excel (xlsx) format. :

> ***Note*** The FDOT Geotech Data Manager tool creates an export of the Excel data to an XML file for use by the Geotech CADD tools. This <fpid_geotech.xml> file may be delivered in lieu of the Excel file.

6.7 TRAFFIC DATA

The traffic analysis report and its supporting documentations, such as technical memorandums and data submitted in the appendices as prepared by transportation practitioners during Project Development & Environment (PD&E), should be made available for Design purposes. This is presented in the following formats:

Tabular format

Graphical format

Animation (microsimulation analysis only)

The report should contain traffic projections, observed traffic and historical trends, proposed roadway and transit network improvements, and land use projections. Traffic Data used in design is defined in FDM 120.2.2

6.8 TYPICAL SECTIONS PACKAGE

The typical section package will be approved as part of the Project Development & Environment (PD&E) process. Requirements for the Typical Section Package are defined in FDM 120.2.3.

6.9 DRAINAGE

The Drainage Manual sets forth drainage design standards for Florida Department of Transportation (FDOT) projects. This Manual is available for downloading from the website below:

Roadway Design Drainage Manuals & Handbooks

CADD provides software resources for Drainage plans preparation using, OpenRoads Drainage and Utility Engineering and Civil 3D Storm and Sewer Design. Some Districts utilize other Drainage analysis and design applications, such as Automated Storm Sewer Analysis and Design (ASAD). The Drainage databases produced by drainage design applications must be delivered with the CADD project.

6.10 PAVEMENT

The pavement selection and design should be completed as early in the design process as possible. The Rigid and Flexible Pavement Design Manuals are available through Pavement Management Publications. The pavement design data report is used to support CADD design.

Roadway Design Pavement Management Publications

6.11 UTILITIES

The **Utility Accommodation Manual (UAM)** is used to establish the utility installation or adjustment requirements for utilities within the Florida Department of Transportation's (FDOT) right of way (R/W).

There are several options available for the Utility Agency/Owner (UAO), i.e., the entity that owns the utility, to share files with the Department:

Exchange of design files (DGN or DWG) – the preferred option

Create American Standard Code for Information Interchange (ASCII) files

Import of Geographic Information System (GIS) data

Marked-up drawing

6.11.1 Sharing of Design Files

Design files are created to the Department's CADD Standards and returned to the District for review. The UAO will use these files as references to create the existing or proposed utility files. These files (existing or proposed) would also be submitted back to the District. It is the District's responsibility to coordinate with the UAO for delivery of design files. For Autodesk DWG files, all line work for utilities should be preferably in 3D and saved as polylines or feature line objects.

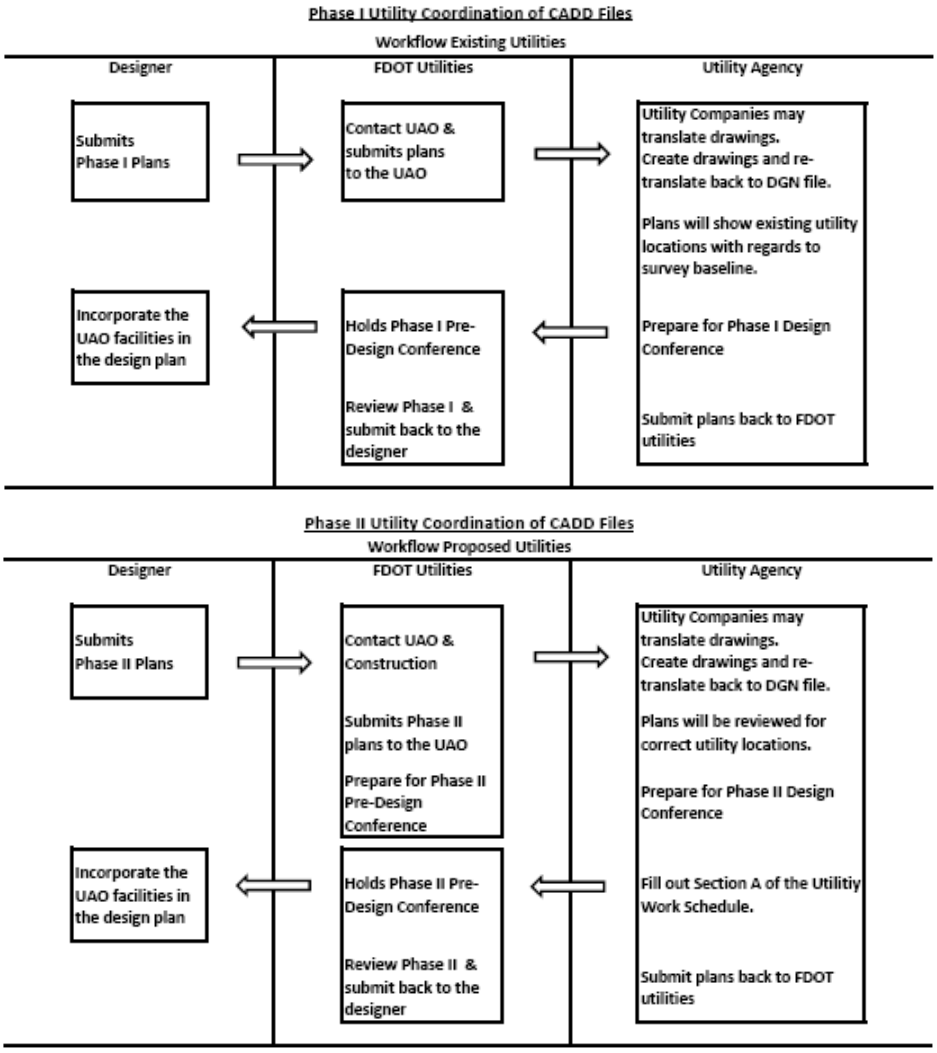
6.11.2 ASCII Input File

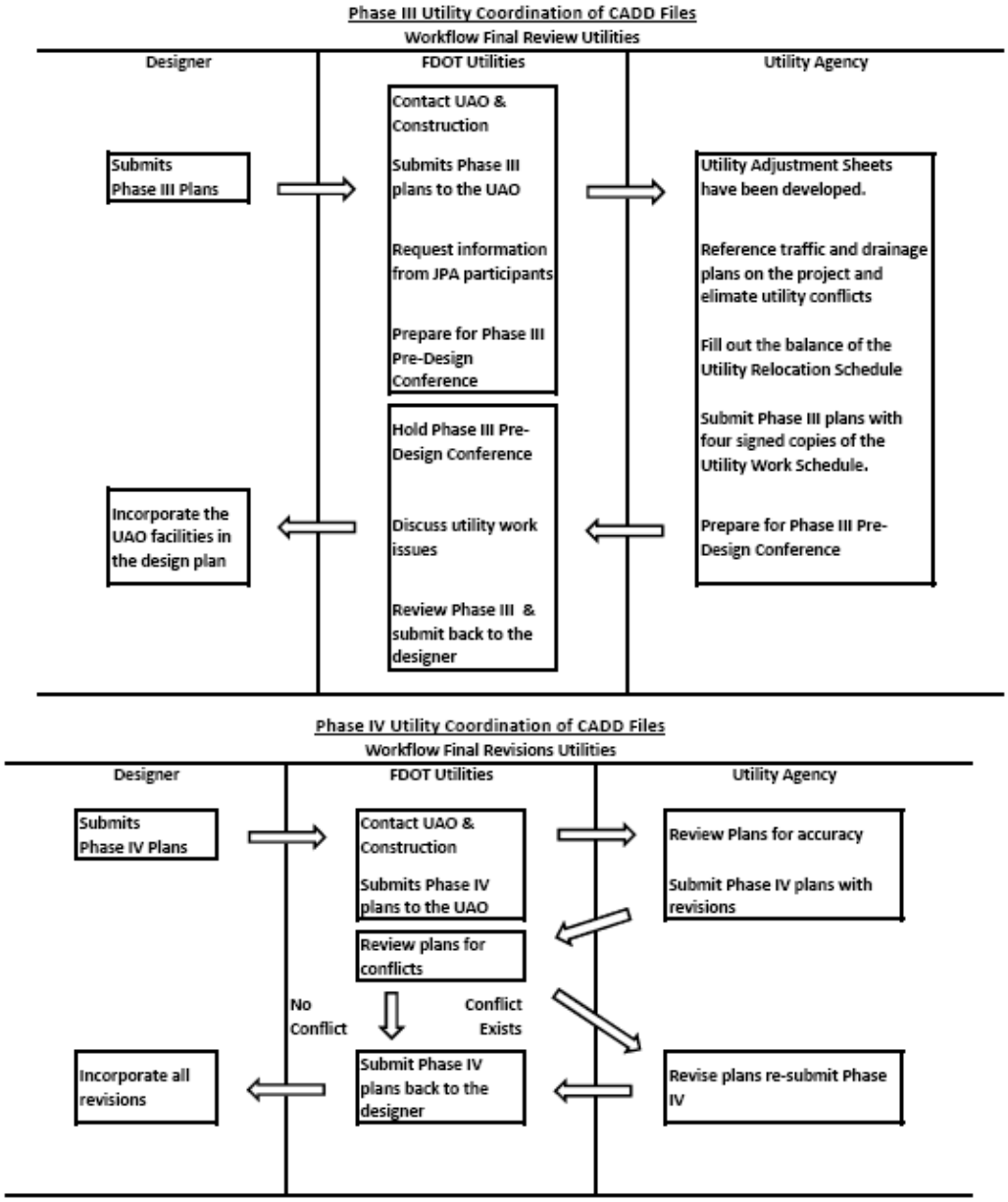
The second option is the ASCII file that can be created from existing or proposed utilities. The ASCII file format will be either LandXML or GEOPAK input format for Station/Offset/Elevation or Northing/Easting/Elevation (State Plane coordinates). These files must contain information pertinent to the location of the utility, as well as the type of utility and where it is located referenced to the (survey baseline) alignment or state plane coordinates.

6.11.3 Geographic Information System (GIS) File

When UAO maintains a GIS database of utility data, that data may be exchanged in GIS shape files.

6.11.4 Utility Coordination





6.11.5 Exchange of Design Files

After the Department's District Utilities Office (via Utility Coordinator) has received the current phase submittal from the Designer, they must contact the involved utilities and notify them of the phase submittal. The UAO will then receive the phase documents from the Department that must contain the Roadway Plans, the necessary CADD files and any Utility Relocation Agreements and Schedules. The required electronic files include the proposed roadway design; the existing topography, the existing and proposed R/W and the existing utilities gathered from the survey and previously supplied data.

No editing of any files provided by the Department will be accepted. The UAO will be placing data into newly created files. File naming standards must always be current.

6.11.6 Utility Work by Highway Contractor Agreement Plans

Major highway construction elements such as pavement areas, bridges, drainage structures, right of way, lane widths, control of access limits and highway-straight-line numbers should appear in the Utility Work by Highway Contractor Agreement Plans.

The Department's plans marked by the UAO will use the following color code:

Red: Existing utilities either (a) To be removed or relocated horizontally or (b) to be placed out-of-service (deactivated) but left in place.

Green: Existing utilities to remain in place with no adjustment.

Brown: Either (a) Existing utilities to be adjusted vertically but to remain in the same horizontal alignment, or (b) Completely new utilities to be installed.

One set of the plans should be returned to the Department with each copy of the Utility Agreement.

6.11.7 ASCII Files of Utility Data

ASCII Files of utility data are to be exchanged in the LandXML format which is ubiquitous with most civil design and GIS software. Information about LandXML can be found at:

LandXML.org

The File Naming Convention for this ASCII files must be:

utilex##.xml for Existing Utilities

utilpr##.xml for Proposed Utilities

Alternately, ASCII files of Utility Data File Naming Convention must be:

utilex##.inp for Existing Utilities. Note the *inp* extension for GEOPAK input

utilpr##.inp for Proposed Utilities. Note the *inp* extension for GEOPAK input

Where ## will be a sequencing number (01, 02, 03, etc.).

Each electronic ASCII report file must be stored on media according to the Department's CADD Deliverable Standards. If the provider does not have capability to deliver in LandXML format, a GEOPAK Input format file will also be an acceptable substitute. When delivery is made in GEOPAK Input format, the ASCII report must be accompanied by a printed hardcopy.

6.11.8 Utility Scanned Images

If the Utilities are handled through a Joint Utility Agreement and electronic files are not provided to the District for the Utility plans, the paper plans must be scanned. The format must be a published format with a minimum resolution of 300DPI. The required formats are PDF or Group 4 TIFF.

6.12 STRUCTURES

The Structures Design Office supports Structures design activities statewide for Florida's transportation system by providing policies, procedures, guidelines, and training. The governing document is the Structures Manual. The following is a link to the Structures Manual:

FDOT Structures Manual

Preliminary design performed may include preparation of:

Base map

Digital terrain model or 3D surface

Coordinate Roadway Alignments

Coordinate Roadway Profiles

Typical Sections

Drainage maps

Conceptual drainage

Preliminary structure plans for bridges, wall, and noise barriers

Utilities

GIS-kmz files

Visualization files

Refer to Geotechnical Section 6.6

6.12.1 Existing Bridge Plans

Existing Bridge plan sheets must be submitted in PDF format, not DGN, and manually inserted into the plans using sheet numbers. The January **FDOT Structures Manual** Section 3.1 B states the following:

> *"….At the end of the plan set, place all existing bridge sheets for each bridge in one PDF file named "B1ExistingPlans.pdf" for the first bridge (number sheets sequentially "BX1-1", "BX1-2", etc.) and "B2ExistingPlans.pdf" for the second bridge, etc."*

Traditionally existing Bridge Plans have been made as a part of the contract documents and therefore should be made part of the plans set; likewise, the PDF file(s) representing the existing Bridge Plans would reside in the \Structures\ project folder.

Note The person responsible for assembling the plan set including existing bridge plans may wish to apply a stamp on each existing bridge plan sheet that indicates "FOR INFORMATION ONLY" and the current contract FPID being designed.

Chapter 7
CADD PRODUCTION SUPPORT

7.1 PURPOSE

This chapter establishes the minimum CADD project production requirements for the Florida Department of Transportation (Department's) Computer Aided Design and Drafting (CADD) projects in accordance with the Department's plans preparation procedures and practices set out in the FDOT Design Manual (FDM).

7.2 SCOPE

These procedures are applicable to the CADD applications utilized by and for the Department in the production process. They are intended to complement and support the policies, procedures and standards of the Department in accordance with ***Procedure No. 025-020-002, Standard Operating System***.

7.3 PROFESSIONAL ACCOUNTABILITY

These procedures do not exempt the professional from performing responsible engineering, surveying and mapping or architecture. The policies and procedures of the Department and appropriate professional practice take precedence when providing professional services for the Department. The professional must have the final responsibility for the accuracy of all input and output of CADD applications.

7.4 PROJECT SETUP

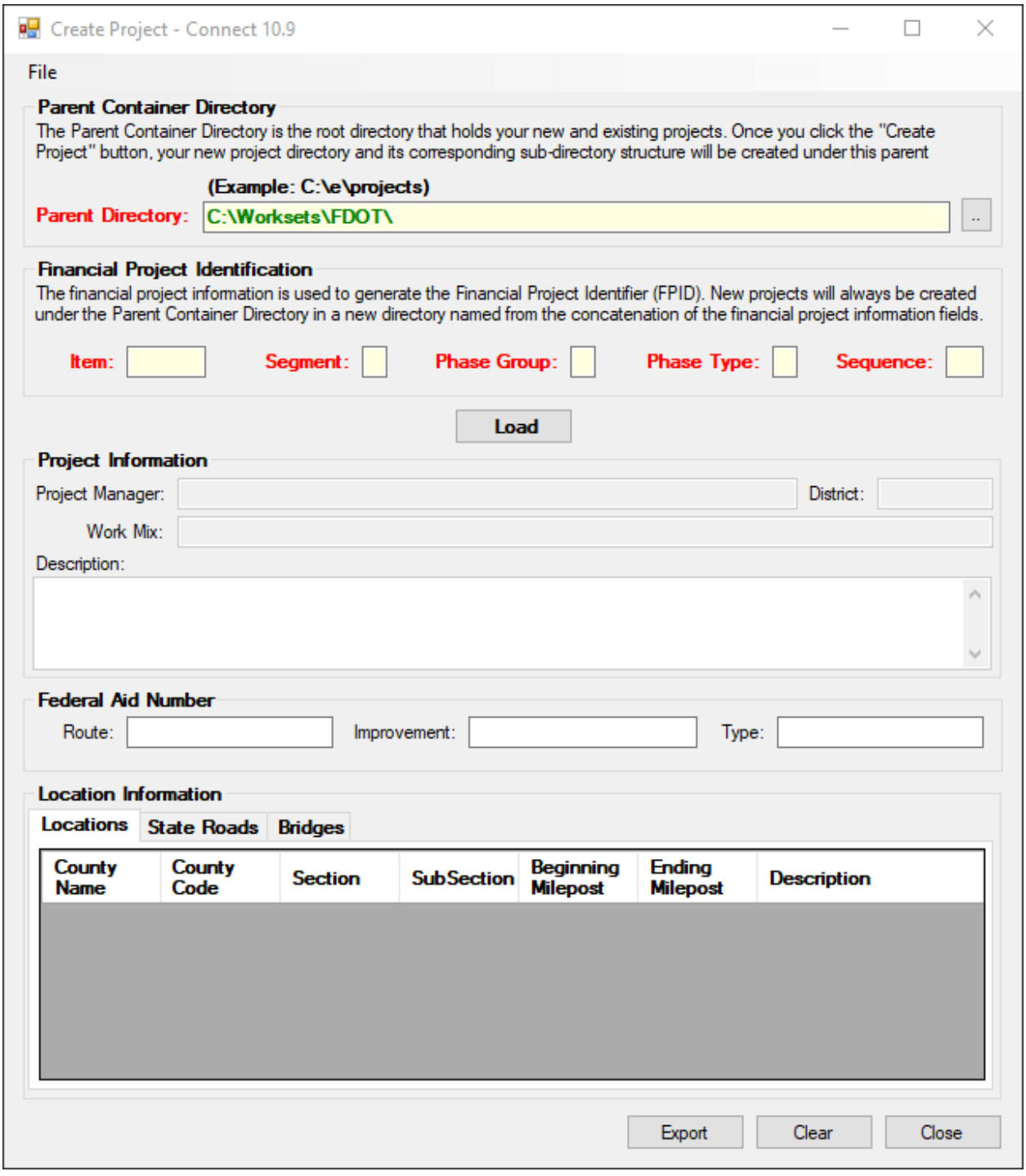
Project setup activities involve the creation of a framework for meeting the Department's CADD Standards and delivery requirements. Activities include the creation of the Project folder structure.

Use the CADD Create Project application to create a Project folder structure with the appropriate project property information. This application populates Project properties from the FDOT Financial Management (FM) System based on the project Florida Project Identification (FPID) number. The newly generated Project folder structure and its content are referred to as the "seed project". The Project Folder (Project Root Folder) must be named the Department's FPID, using all eleven digits.

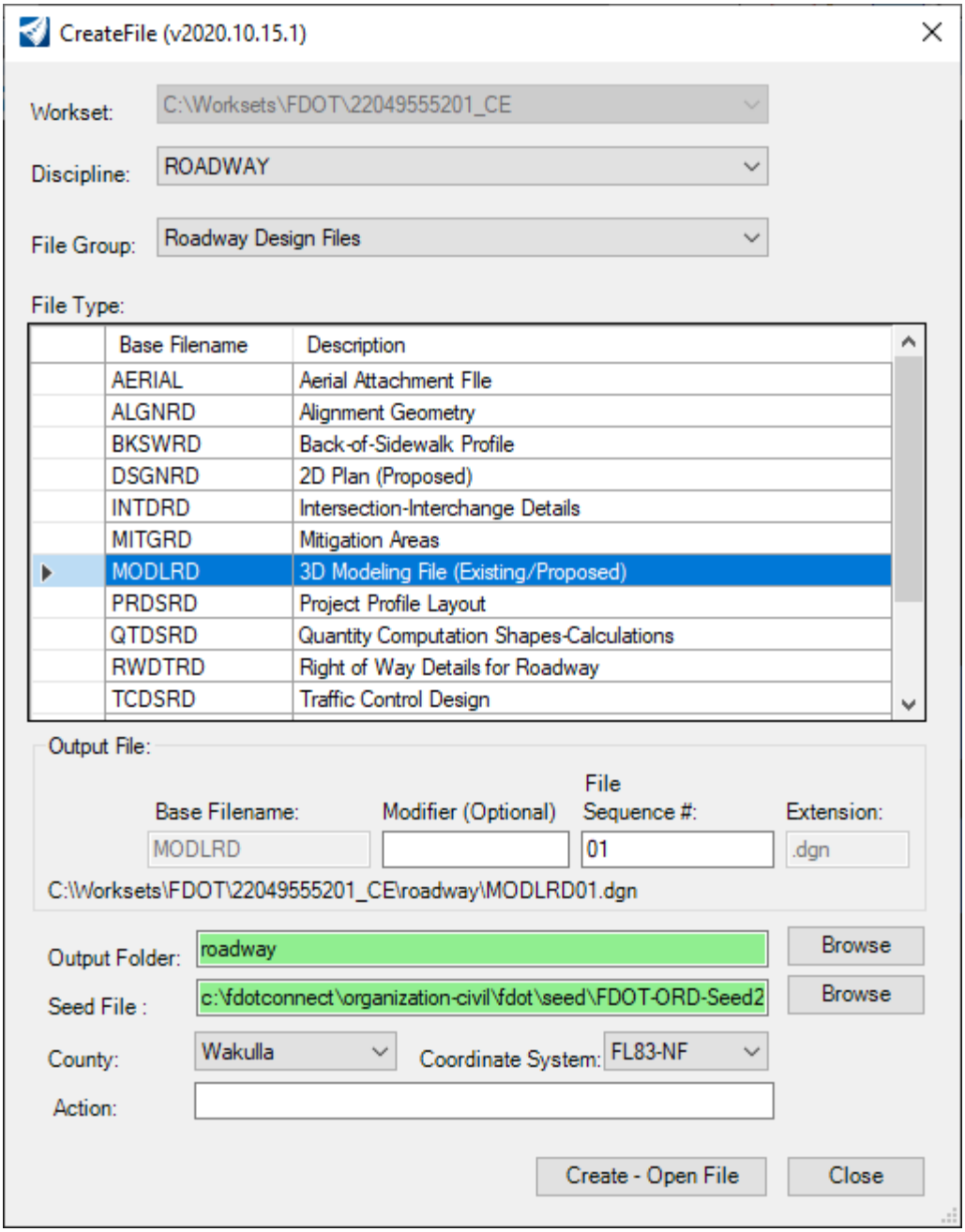
The project properties are created in an XML file format (*ProjectProperties.xml*) and stored in the _meta_info\ sub-folder of the project. The _Meta_Info\ sub-folder is required and must not be removed for delivery.

The responsible party for creating the CADD Project should be determined by the District Project Manager. The District Project Manager will provide the project folder to all necessary parties on the project.

7.4.1 Create Project Tool



7.4.2 Create File Tool



7.5 PRODUCTION WORKFLOW

During the production phase, tasks are performed prior to the creation of the media for delivery of the data meeting the Department's delivery requirements.

General tasks performed during the production phase include (but not limited to):

Follow the Project folder structure and file naming requirements for Delivery.

Produce CADD design files to the Department's CADD Standards, using the Department's workspaces and resources provided in the CADD Software.

Assemble any non-standard user created CADD resource files, such as custom created cell libraries, in appropriate folders and document their use in the Project Journal file(s).

Document all approved deviations from the Department's CADD Standards in the Project Journal file(s), including important applications, methods and decisions made during design. This is important for downstream users of data to follow in the designer's footsteps.

Create required Engineering Data and output files.

Generate Quality Control (QC) Reports for all design files using the CADD QC tool provided. These reports indicate compliance to the Department's CADD Standards.

Merge any external project files into the Project folder structure, including all files from sub-consultants, external reference files, scanned images for sheets (if any) and specifications documents.

Bundle any non-standard graphics dependent resource files into the Project sub-folders:

- **Symbology**\ - to include user created fonts, shape files and/or line styles/linetypes
- **Cell**\ - to include project specific/user created cell or block libraries

Check for any duplication of files and resolve. Remove non-essential file duplication. Remove non-essential "junk" files. Remove empty Project folders.

Review the Project for completeness, accuracy, and compliance with the Department's CADD Delivery standards. The application *Project Validator* is provided to help assist with this task.

Create any files needed to support 3D Modeling as required by the scope and to communicate design intention to the contractor.

7.6 SUPPORTED CADD SOFTWARE BY COMPONENT/DISCIPLINE

The Department supports several applications and resources to aid the user in meeting the Department's specific requirements. The Production Support (CADD) Office website has links to supported software:

Production Support CADD Office Website

7.6.1 Roadway

Roadway Plans are usually the lead component of the Department's CADD projects with all other components as subset components. However other components may hold the lead.

7.6.1.1 OPENROADS, CIVIL3D

The Production Support CADD Office provides custom resource files for both Bentley and Autodesk civil engineering platforms. These are delivered with our FDOT workspace and State Kits, respectively. The Department also provides custom configuration files to support OpenRoads and Civil3D. The Production Support CADD Office provides these workspaces and state kit to correspond with specific releases of OpenRoads and Civil3D, staying current with contemporary versions as soon as all resources have been adequately configured. Specific features of the software can be found at the following links:

Bentley OpenRoads - Civil Design Software for Road Networks

Bentley Civil Design Software

Autodesk Civil3D Infrastructure Design

7.6.2 Signing and Pavement Marking

Signing and Pavement Marking Plans are usually a component set of Roadway Plans. However, if the Signing and Pavement Marking Plans are the lead plan set, then the standards set in the Roadway Standards, pertaining to elements that are specific to the lead plan set, will apply to the Signing and Pavement Marking plan set (i.e., Traffic Control files and elements, preliminary estimate sheets, etc.).

The Department's projects requiring minor Signing and Pavement Marking construction work may include these features detailed on sheets in the Roadway Plans. If this is the case, the Signing and Pavement Markings element symbology standards apply. However, an exception to the Standard Rules must be created and documented in the Roadway component/discipline journal file.

When prepared as component plans, Signing and Pavement Parking plans will be assembled as a separate plan set complete with a key sheet, and all other relevant Signing and Pavement Marking sheets. The sheets must be numbered consecutively, with sheet numbers prefixed by the letter "S".

7.6.2.1 Pavement Marking Design

- ***Bentley Connect Edition / Autodesk*** *(FDOTConnect, FDOT2019.C3D, FDOT2020.C3D)*

The Department's Pavement Marking application (FDOT PavementMarking) is included in the State Kit for Autodesk and workspace for FDOTConnect. It requires the project's pay item database (payitemdb.xml), also used by Entity Manager, to provide automated pay item associations.

7.6.2.2 Sign Design

- ***Bentley Connect Edition / Autodesk*** *(FDOTConnect, FDOT2019.C3D, FDOT2020.C3D)*

FDOTConnect/Autodesk the Department's Signs application (FDOT Signs) is included in the State Kit for Autodesk and workspace for FDOTConnect. It requires the project's pay item database (payitemdb.xml), also used by Entity Manager, to provide automated pay item associations.

- ***Sign Tool for All Platforms***

GuidSIGN is the standard sign design software used by the Department for all platforms. However, using GuidSIGN is not required and other sign design programs available in the industry may be used. The Department's Level/Symbology Standards must still be met regardless of the software used.

GuidSIGN is a tool to create sign panels. Sign panel design and creation require two (2) separate files: *GSWKSP##.dgn (DWG)* for sign panel design and the worksheet and the *DSGNSP##.dgn (DWG)* file for sign panel placement on the project. There is no limit to the number of sign panels that can be placed in a file.

7.6.2.3 Turn Radius Design

Transoft AutoTURN and Autodesk Vehicle Tracking are the standard turn radius design software used by the Department. However, using AutoTURN or Vehicle Tracking is not required. Other vehicle wheel path design software available in the industry may be used for designing the turning movements of roadway intersections. The Department's Level/Symbology Standards must still be met regardless of the software used.

7.6.3 Signalization

Signalization Plans are usually a component set of Roadway Plans. However, if the Signalization Plans are the lead plan set, then the standards set in Roadway Standards, pertaining to elements that are specific to the lead plan set will apply to the Signalization plan set (i.e., Traffic Control files and elements, preliminary estimate sheets, etc.)

The Department's projects requiring minor signalization construction work may include these features detailed on sheets in the Roadway Plans. If this is the case, the Signalization Element Level/Symbology Standards within this Section will still apply. However, an exception to the Standard Rules must be created and documented in the Roadway component/discipline journal file.

When prepared as component plans, Signalization Plans will be assembled as a separate plan set complete with a key sheet, and all other relevant signalization sheets. The sheets must be numbered consecutively, with sheet numbers prefixed by the letter "T". The Signalization Plans show the construction details, signal phasing and other relevant data.

7.6.4 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) Plans are usually a component set of Roadway Plans. The Department's Projects with minor ITS involvement may include these features on various applicable sheets in the Roadway plans set. They can also be shown in the Signalization plans set or on applicable Signalization sheets.

7.6.5 Lighting

Highway Lighting Plans are usually a component set of Roadway Plans. However, if the Highway Lighting Plans are the lead plan set, then the standards set in, Roadway Standards, pertaining to elements that are specific to the lead plan set will apply to the Highway Lighting plan set (i.e., Traffic Control files and elements, preliminary estimate sheets, etc.).

When prepared as component plans, Highway Lighting Plans will be assembled as a separate plan set complete with a key sheet, and all other relevant lighting sheets. The sheets must be numbered consecutively, with sheet numbers prefixed by the letter "L".

7.6.5.1 Lighting Design Software

AGI32 Lighting Software is the standard Lighting Design software used by the Department. However, using AGI32 is not required. Other Lighting design software available in the industry may be used for the Lighting Design. If AGI32 is not used, the Department's Level/Symbology Standards must still be met to be compliant with CADD Standard Rules and Digital Delivery.

7.6.6 Landscape

Landscape means any vegetation, mulches, irrigation systems and any site amenities, such as, street furniture, decorative paving, fences and lighting (excluding public utility streets and area lighting). Landscape plans may be a component set of the Roadway Plans or be prepared independently.

The Department's Projects with minor Landscaping may include landscaping features on separate sheets in the Roadway Plans set or landscaping features may be detailed on the Roadway plans sheets.

When prepared as component plans, Landscape Plans will be assembled as a separate plan set complete with a key sheet, and all other relevant Landscape sheets. The sheets must be numbered consecutively with the sheet numbers prefixed by the letters "LD".

A complete set of Landscape plans may include the following:

Key Sheet

Planting Sheets

Irrigation Layout

Details Sheet

Other relevant plan sheets as required Pay Items Notes, General Notes or Maintenance Notes and Schedules.

These sub-components should be listed on the Landscape Plans Key Sheet under the "Components of Contract Plan Sets" heading.

Note Hardscape Design files must use the same symbology standards as the Landscape Design file.

7.6.7 Architectural

Architectural plans consist of all sheets pertaining to Architectural (Building) design, and their component plans. These plans may be comprised of any of:

General Plans

Hazardous Materials Plans

Survey Plans (Following the Survey CADD Standards)

Geotechnical Plans (Following the Geotechnical CADD Standards)

Civil Plans (Following the Roadway CADD Standards)

Landscape Plans (Following the Landscape CADD Standards)

Structural Plans

Architectural Plans

Interior Plans

Fire Protection Plans

Plumbing Plans

Mechanical Plans

Electrical Plans

The list above represents an Architectural plan set on a Department Project where the building is the focal point of the project. Architectural (often referred to as "Building") projects within the Right of Way typically do not include Survey, Civil, Geotechnical, or Landscape plans. These component/disciplines are normally included in the Roadway Plans. However, when present in the Architectural plans, the Department's CADD Standards of the appropriate component/discipline must be used.

Bascule Bridge Control House Architectural plans are to be prepared using the Department's Structures CADD Standards.

7.6.7.1 Architectural Adopted CADD File Format

The Department has adopted Autodesk as the Standard platform format for Architectural projects. All CADD files for Architectural plan sets, including those component/disciplines within the building (i.e., plumbing, mechanical, electrical and structural) will be submitted in Autodesk (*.dwg)* format. Plans outside the building envelope must follow the Department's CADD Standard format for the component/discipline.

7.6.7.2 Architectural Adopted CADD Standards

The Department has adopted the US National CAD Standards as the standard format for Building Projects. This Section is a synopsis of the US National CAD Standards. More information can be found at:

National CAD Standard
National Institute of Building Sciences
1090 Vermont Ave., NW, Suite 700
Washington, D.C. 20005-4905
(202) 289-7800
Website: **http://www.nationalcadstandard.org/ncs6/**

7.6.7.3 Architectural Projects

Architectural standards apply to the building and building related component/disciplines outlined in the following list of project types.

7.6.7.4 *Building Projects:*

- Work Program Projects
  - **Rest Areas**
  - **Weigh Stations**
- Fixed-Capital Outlay (FCO) Projects
  - **Office Buildings**
  - **Construction & Maintenance Facilities**
  - **Other 'Off Right of Way (ROW)' Facilities**

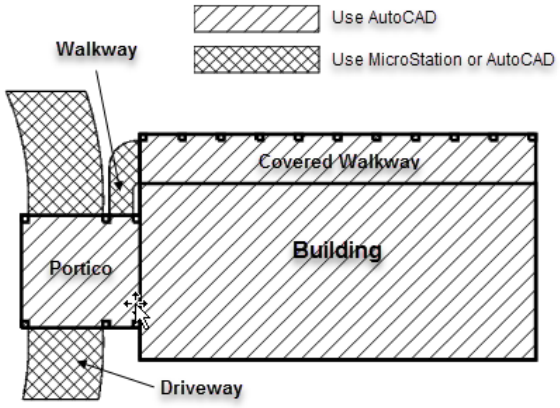
7.6.7.5 Delineation between Architectural & Engineering Plans

Delineation Line at 'footprint' of Building:

- Face of Exterior Wall
- Area enclosed by buildings Columns and/or Walls, i.e. Porticos, Carports, covered Walkways and Covered Patios
- Roof and Building Overhangs

Use Autodesk *inside* the Delineation Line. Items inside the Delineation Line Includes 'Building-Oriented' Facilities & Equipment that are typically designed by an Architect, including but not limited to, picnic shelters, planters which are part of the building and site furniture in covered areas.

CADD Delineation Example



Items outside the delineation or "footprint" of Building must be produced and submitted following the CADD standards for their component/discipline as defined in their respective chapters, including but not limited to:

- Pavement
  - Driveways, Parking, Sidewalks
- Landscape Plans
- Site Utilities
  - Electrical, Water, Sanitary Sewer, Storm Sewer, Drainage
- Site Fencing and Walls

7.6.7.6 Architectural Scale Chart

The following chart is intended to aid the user in determining the appropriate scale for placing the border and text on a drawing based on the actual size of the drawing. Calculations are based on a 9 1/2" x 15 1/2" drawing area inside the border.

Note Sheet files must be assembled in paper space & printed at 1:1

Drawing Scales for Sheets			
Architectural Scales		**Engineering Scales**	
Drawing Scale	**Plot Scale**	**Drawing Scale**	**Plot Scale**
Full size	1	1" = 5'	60
6" = 1'-0"	2	1" = 10'	120
3" = 1'-0"	4	1" = 20'	240
1 ½" = 1'-0"	8	1" = 30'	360
1" = 1'-0"	12	1" = 40'	480
¾" = 1'-0"	16	1" = 50'	600
½" = 1'-0"	24	1" = 100'	1200
3/8" = 1'-0"	32	1" = 200'	2400
¼" = 1'-0"	48	1" = 500'	6000
3/16" = 1'-0"	64	1" = 1000'	12000
1/8" = 1'-0"	96	1" = 1250'	15000
3/32" = 1'-0"	128	1" = 2500'	30000
1/16" = 1'-0"	192	1" = 5000'	60000

7.6.7.7 Formulas:

AS = 12 x Drawing Scale, Ex. 1" = 10', then 12 x 10 = 120, Therefore AS = 120

7.6.8 Structures

The use and generation of CADD files by Structures for the Department's Projects must be in accordance with the general standards for all component/disciplines, unless superseded by instructions contained within this section.

FDOT Structures Manual

7.6.8.1 OPENBridge, CIVIL3D

The Production Support (CADD) office provides custom resource files for both Bentley and Autodesk civil engineering platforms. These are delivered with our FDOTConnect workspace and State Kits, respectively. The Department also provides custom configuration files to support OpenBridge and Civil3D. The Production Support (CADD) Office provides these workspace and state kit to correspond with specific releases of OpenBridge and Civil3D, staying current with contemporary versions as soon as all resources have been adequately configured.

7.6.8.2 Structures Borders and Scales

Draw all elements at "Full Size" completely before placing text or dimensions. Sheets that reside in the Structures Component of the plan set must use the Structures Border cell "Sheet-Border". Sheets requiring Structures design that reside within other components/disciplines of the plan set (Roadway, Lighting, etc.) must use the Border Roadway w/Initials cell "Sheet-Rdwy".

Show the scale of the drawing and related details inside the display area of the file, but outside of the Sheet Border area. This is helpful to all users who work on the file.

7.6.8.3 Structures Dimension Settings

Dimension styles are defined in the FDOT_OBM_Standards_Features.dgnlib (Bentley) or Structures Template files (Autodesk). Styles are provided for Dimensioning and Notes for various terminators and leaders. Make every effort to use automatic dimensioning with element association enabled.

7.6.9 Toll Facilities

As per the ***FDM 301***, Toll Facility Plans should be prepared in accordance with the Florida's Turnpike Enterprise current **General Tolling Requirements (GTR)** found at the following link:

GENERAL TOLLING REQUIREMENTS (GTR)

7.7 PROJECT JOURNAL

A Project Journal must be produced and stored in the Administrative folder of the Project directory for all projects to document details on project data, design aspects, processes and decisions made during the development that would communicate important information to a down-stream user of the project data. The Project Journal is the responsibility of the Project Manager and must incorporate the contents of the Discipline Specific journals. The Journal must be delivered with the Project in either MS Word (*.doc* or *.docx*) or Acrobat (*.pdf*) formats.

Discipline Specific Journal file(s) may be produced to document the specific alternate production activities outside the normal course of operations for a given component/discipline (i.e., a Surveyor's Journal) and stored in the Eng_Data folder under each applicable Discipline folder of the Project directory.

For example: If custom line styles were created, the justification for the custom line style and the resource file name containing the custom line style should be documented in the Journal. Any information that would help in the regeneration of CADD files and/or prints should be recorded. The critical geometry information, database, controlling alignment(s) and profile names, relevant survey and cross section information and the methodology used to obtain the final geometric controls in the CADD product should be recorded.

7.7.1 Sample Project Journal

Below is a sample project journal format showing some of the minimum information to be included.

Project:

FPID: 123456-1-51-01

Project Description: Resurfacing from SR ## to SR ## with curb ramp replacement and light journaling

Software:

FDOTConnect 10.10.02.22 MR 11

Bentley OpenRoads Designer 10.10.22.11

Autodesk Civil3D 2023 13.11.122.1

FDOT2023 C3D 1.11.22.1

Exceptions:

There are no exceptions to the QC rules on this project, because the designers followed the CADD Manual perfectly and ran into no software issues.

7.8 EXISTING AS BUILT PLAN SHEETS

In some cases, designers have no choice but to scan pre-existing hardcopy sheets to create digital sheet files. For example, some plan sheets may already exist as hardcopies and were signed & sealed conventionally by wet ink signature and impression seal at some time in the past. This might occur when either pre-existing plans are incorporated into the current delivery, or some professional component/discipline does not have legal authority to sign and seal their plans digitally. In such cases, those plan sheets should be scanned to an acceptable PDF format according to FDM 130.

7.9 SHEET PRODUCTION

7.9.1 Sheet Models

7.9.1.1 Annotation Scales for Bentley or Viewport scale for Autodesk

The following table is intended to aid the user in determining the appropriate Annotation Scale for Bentley of Viewport Scale for Autodesk. For the given scale, the chart provides maximum range the border working area may accommodate. For given range of the project, the chart aid in choosing the right scale by limiting the project within the referenced range

Estimated Range of Project Area

Scale Annotation Scale or ViewPort Scale	Paper Size and Workable Area					
	Letter **8.5” X 11”**	**Legal** **8.5” X 14”**	**Tabloid** **11” X 17”**	**Large Format** **24” X 36”**	**Large Format** **36” X 48”**	**Large Format** **36” x 72”**
	0.590'X0.875'	**0.590’X1.125’**	**0.800’X1.283’**	**1.833’X2.750’**	**2.880’X3.950’**	**2.880’X5.950’**
1 = 1	0.5900' X 0.875'	0.590’ X 1.125’	0.800’ X 1.283’	1.833’ X 2.750’	2.880’ X 3.950’	2.880’ X 5.950’
6” =1’	1.180' X 1.750'	1.180’ X 2.250’	1.600’ X 2.566’	3.666’ X 5.500’	5.760’ X 7.900’	5.760’ X 11.900’
3” =1’	2.360' X 3.500'	2.360’ X 4.500’	3.200’ X 5.123’	7.332’ X 11.000’	11.520’ X 15.8’	11.52’ X 23.8’
1 ½" = 1'	4.720' X 7.000'	4.720' X 9.000'	6.400' X 10.264'	14.664' X 22.000'	23.400' X 31.600	23.400' X 47.600'
1" = 1'	7.080' X 10.500'	7.080’ X 13.500'	9.600' X 15.396'	21.996' X 33.000'	34.560’ X 47.400'	34.560’ X 71.400'
3/4" = 1'	9.440' X 14.000'	9.440’ X 18.000’	12.800’ X 20.528’	29.328’ X 44.000’	46.080’ X 63.200'	46.080’ X 95.200'
½" = 1'	14.160' X 21.000'	14.160’ X 27.000’	19.200’ X 30.792’	43.992’ X 66.000’	69.120’ X 94.800'	69.120’ X 142.80'
3/8" = 1'	18.880' X 28.000'	18.880’ X 36.000’	25.600’ X 41.056’	58.656’ X 88.000’	92.160’ X 126.40'	92.160’ X 190.40'
1/4" = 1'	28.320' X 42.000'	28.320’ X 54.000’	38.400’ X 61.584’	87.984’ X 132.00’	138.240’ X 189.60'	138.240’ X 285.60'
3/16" = 1'	37.760' X 56.000'	37.760’ X 72.000’	51.200’ X 82.112’	117.31’ X 176.00’	184.32’ X 252.80'	184.32’ X 380.80'
1/8" = 1'	56.6.4' X 84.000'	56.640’ X 108.00’	76.800’ X 123.17’	175.97’ X 264.00’	276.48’ X 379.20'	276.48’ X 571.20'
3/32" = 1'	75.520' X 112.00'	75.520’ X 144.00’	102.40’ X 164.22’	234.62' X 352.00'	368.64’ X 505.60'	368.64’ X 761.60'
1/16" = 1'	113.28' X 168.00'	113.28’ X 216.00’	153.60’ X 246.34’	351.94' X 528.00'	552.96’ X 758.40	552.96’ X 1142.4'
1” = 10’	70.800' X 105.00'	70.800’ X 135.00’	96.000’ X 153.96’	219.96' X 330.00'	345.60’X 4747.00'	345.60’X 714.00'
1” = 15’	106.20' X 157.50'	106.20’ X 202.50’	144.00’ X 230.94’	329.94' X 495.00'	518.40’ X 711.00	518.40’ X 1071.0'
1” = 20’	141.60' X 210.00'	141.60’ X 270.00’	192.00’ X 307.92’	439.92' X 660.00'	691.20' X 948.00'	691.20' X 1428.0'
1” = 30’	212.40’ X 315.00’	212.40’ X 405.00’	288.00’ X 461.88’	659.88' X 990.00'	1036.8' X 1422.0'	1036.8' X 2142.0'
1” = 40’	283.20’ X 420.00’	283.20’ X 540.00’	384.00’ X 615.84’	879.84' X 1320.0'	1382.4' X 1896.0'	1382.4' X 2856.0'
1” = 50’	354.00’ X 525.00’	354.00’ X 675.00’	480.00’ X 769.80’	1099.8' X 1650.0'	1728.0' X 2370.0'	1728.0' X 3570.0'
1” = 60’	424.80’ X 630.00’	424.80’ X 810.00’	576.00’ X 923.76’	1319.8' X 1980.0'	2073.6' X 2844.0'	2073.6' X 4284.0'
1” = 80’	566.40’ X 840.00’	566.40’ X 1080.0’	768.00’ X 1231.7’	1759.7' X 2640.0'	2764.8' X 3792.0'	2764.8' X 5712.0'
1” = 100’	708.00’ X 1050.0’	708.00’ X 1350.0’	960.00’ X 1539.6’	2199.6' X 3300.0'	3456.0' X 4740.0'	3456.0' X 7140.0'
1” = 120’	849.60’ X1260.0’	849.60’ X1620.0’	1152.0’ X 1847.5’	2639.5' X 3960.0'	4147.2' X 5688.0'	4147.2' X 8568.0'
1” = 150’	1062.0’ X1575.0’	1062.0’ X2025.0’	1440.0’ X 2309.4’	3299.4' X 4950.0'	5184.0' X 7110.0'	5184.0' X10 710'
1” = 200’	1416.0’ X 2100.0’	1416.0’ X 2700.0’	1920.0’ X 3079.2’	4399.2' X 6600.0'	6912.0' X 9480.0'	6912.0' X 14280'
1” = 250’	1770.0’ X 2625.0’	1770.0’ X 3375.0’	2400.0’ X 3849.0’	5499.0' X 8250.0'	8640.0' X11850'	8640.0' X 17850'
1” = 300’	2124.0’ X3150.0’	2124.0’ X4050.0’	2880.0’ X4618.8’	6598.8' X 9900.0'	10368' X 14220'	10368' X 21420'
1” = 400’	2832.0’ X4200.0’	2832.0’ X 5400.0’	3840.0’ X 6158.4’	8798.4' X 13200'	13824' X 18960'	13824' X 28560'
1” = 500’	3540.0’ X 5250.0’	3540.0’ X 6750.0’	4800.0’ X 7698.0’	10998' X 16500	17280' X 23700'	17280' X 35700'

7.9.2 Sheets Numbering

Roadway plans are typically the primary component of the Department's Project plans set containing multiple plan components/disciplines and can have non-prefixed sheet numbers (1, 2, 3, etc.). Other component/disciplines can also be the primary plans component/discipline - only in the absence of a Roadway plan component/discipline. For example: A Lighting only project may omit the plans component prefix and use the numbering format of 1, 2, 3, etc.

The FDOT CADD Office has custom application tools to manage sheet organization on projects; Plan Set Manager in OpenRoads and Sheet Set Organizer in Cvil3D.

Sheet numbers used in title blocks of plan sheets are composed using the format: **AAA-####Z,** where:

AAA **-** Represents the sheet number prefix, using multiple alpha characters.

Note *Refer to the* ***FDOT Design Manual (FDM)*** *and* ***FDOT Structures Manual****.)*

Prefix	Component
CTL	Roadway Plans –Project Control Sheets
GR	Roadway Plans – Early Works - Soil Survey and Report of Core Borings normally associated with the roadway plans set *(including miscellaneous structures but excluding bridges and walls)*
TR	Roadway Plans – Early Works - Tree Survey Sheets
UTV	Roadway Plans – Early Works - Verified Utility Locate Sheets
[No prefix]	Roadway Plans – *(Typical - only an integer is used for most of these sheet numbers)*
SQ	Roadway Plans – Summary of Quantities / Tabulation of Quantities (when required)
TD	Roadway Plans – Tree Disposition Plans
S	Signing and Pavement Marking Plans
T	Signalization Plans
IT	Intelligent Transportation System (ITS) Plans
L	Lighting Plans
LD	Landscape Plans
A	Architectural Plans
B	Structures – Common Sheets
BQ	Structures – Bridge Quantity Sheets
B1, B2, B3…	Structures – 1st, 2nd, 3rd… Bridge sheets
BW	Structures – Bridge Walls
BX1, BX2, BX3…	Structures – Existing Bridge Plans
BP	Structures – Pedestrian Bridge Data Sheets
	Toll Facilities
U	Utility Work by Highway Contractor Agreement Plans

- Defines the numeric order of the sheets within the Plans Component.

(Z) - The optional (Z) suffix allows for the insertion of appended sheets after the project has started, such as the case during revisions. A single alpha character suffix, A-Z, is added for each subsequent sheet inserted for a revised sheet.

Example Sheet Numbers: S-001A, S-001B, CTL-01A-15, A-16, T-1, T-2, and 1, 2, 3, etc.

7.9.2.1 Structural Sheet Numbers

The Structural sheet numbers must be prefixed with the target component/discipline's sheet prefixes. Sheet Order reflects placement within the Structures Component of the Contract Plan Set. See ***Structures Manual*** for complete details on sheet numbering instructions.

7.9.3 Professional of Record Note

For those sheets that are digitally signed and sealed by a Professional Engineer, place the following note along the right edge of plan sheets that are digitally signed and sealed:

"THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C."

Note See the **FDOT Design Manual (FDM) 130, 302 & 303** for further information about Professional of Record Note and Signature Sheets.

The rule number referenced in the note above applies to the engineering professional that is signing and sealing the sheet. A non-engineering licensed professional should use the rule number that applies to their profession:

Surveyors, Rule 5J-17.062, F.A.C.

Geologists, Rule 61G16-2.005, F.A.C.

Landscape Architects, Rule 61G10-11.011, F.A.C.

Architects, Rule 61G1-16.005, F.A.C.

Sheets that are signed by multiple Signatories of different professional types (such as an Architect and an Engineer) will not bear the note unless it can be combined and fit legibly on the border. In such a case, the note might read:

"THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C., AND RULE 61G1-16.005, F.A.C."

Note Signatory Sheets have similar notes placed in the body of the sheet within the section for each Signatory and will not have the note placed along the sheet border. See examples in the FDM 303.

7.9.4 Professional of Record Seals Cell Library

The Professional of Record Note may be placed on the sheet at any time during the plan's production process; however, the note has no force or effect until the actual sheet signing and sealing. FDOT has provided a *Seals.cel* cell library to assist with this process: *(See Section 5.11 Links)*

Bentley Connect Edition *(FDOTConnect)* **Cell Libraries**	**Autodesk** *(FDOT2019.C3D, FDOT2020.C3D)* **Block Drawings**	**DESCRIPTION**
Seals.cel	Seals.dwg	Professional Seals for Digital Signatories

7.10 STANDARD PLANS INDEX MODIFICATIONS

Modifications to Standard Plans may be needed if the Standard Plans do not meet a project specific need. When this occurs, modifications of a Standard Plan require the approval of the District Design Engineer. To facilitate the process, CADD files are available on the Standard Plans website. When Modifications to Standard Plans are needed, the modifications must be performed under the direct supervision of a Florida Licensed Professional Engineer and as outlined the **FDM 115.2.5**.

When used within the set of plans of an FDOT Project, they must pass CADD QC Compliancy.

7.11 PRINTS

All printing will be generated from the native design files. All print images (PDFs) are produced to scale to match the native application.

Note Not all printer hardware will print paper sheets exactly to scale, even if the source design file, or a resulting print image file (PDF) is to scale.

The Department's standard sheet borders are defined for the component/disciplines. Sample print drivers are also provided to generate "drawn to scale" print images for the printer hardware supported. Standard sheet borders delivered with the CADD Software comply with the Department's sheet appearance formats, as defined in the FDM and other controlling procedures.

7.11.1 Bentley Connect – Named Boundaries

FDOTConnect Named Boundaries	
Group	Name
From Named Boundary	KeyMapLayout
From Named Boundary	KeyMapLayoutFederal
From Named Boundary	Map For Key Sheet
From Named Boundary	ROW Control Detail
From Named Boundary	ROW Control Plan
From Named Boundary	ROW Cover Map
From Named Boundary	ROW Maintenance Detail
From Named Boundary	ROW Maintenance Plan
From Named Boundary	ROW Plan
From Named Boundary	ROW Plan Detail
From Named Boundary	TypSectionPackageCover
From Named Boundary	11x17 Bridge Hydraulic Map
Civil Plan	11x17 Bridge Hydraulic Recommendation - Plan
Civil Profile	11x17 Bridge Hydraulic Recommendation - Profile
Civil Cross Section	11x17 Cross Section
Civil Cross Section	11x17 Cross Section Detail
Civil Plan	11x17 Drainage Map - Plan
Civil Profile	11x17 Drainage Map - Profile
Civil Plan	11x17 Plan Only
Civil Plan	11x17 Plan Over Plan
Civil Plan	11x17 Plan Over Profile - Plan
Civil Profile	11x17 Plan Over Profile - Profile
Civil Cross Section	11x17 Pond Cross Section
Civil Profile	11x17 Profile Only
Civil Profile	11x17 Profile Over Profile
Civil Profile	11x17 Special Profile - Bottom Left
Civil Profile	11x17 Special Profile - Bottom Right
Civil Profile	11x17 Special Profile - Top Left
Civil Profile	11x17 Special Profile - Top Right
Civil Cross Section	36x48 Cross Section

FDOTConnect Named Boundaries	
Group	Name
Civil Plan	36x48 Drainage Detail - Plan
Civil Profile	36x48 Drainage Profile - Bottom
Civil Profile	36x48 Drainage Profile - Middle
Civil Plan	36x48 Plan Only
Civil Plan	36x48 Plan Over Plan
Civil Plan	36x48 Plan Over Profile – Plan
Civil Plan	36x48 Triple Plan
Civil Cross Section	36x72 Cross Section
Civil Plan	36x72 Drainage Detail - Plan
Civil Profile	36x72 Drainage Profile - Bottom
Civil Profile	36x72 Drainage Profile - Middle
Civil Plan	36x72 Plan Only
Civil Plan	36x72 Plan Over Plan
Civil Plan	36x72 Plan Over Profile – Plan
Civil Plan	36x72 Triple Plan

7.11.2 Print Drivers

The sample print driver files and the sheet settings provided with the CADD Software are used to generate prints to scale. These driver files are considered "examples," due to the various site-specific configurations and types of printers that may be encountered. The print driver files were tested and work with the printers for which they were developed, so adjustments may be required if their equipment varies.

Each printer has its own "printable" area defined for a paper size which may differ slightly from printer model to printer model. It is the sole responsibility of the person creating the prints to ensure hardcopy printing is operating acceptably for their hardware. All Bentley print driver files supplied by the Department have raster printing enabled. Autodesk uses Page Setups and Plot Style tables.

Note See Section 7.11.3 Print Resource Files of this document for a list of Bentley print driver files delivered by the Department.

7.11.2.1 Bentley Half-Toning

The color 20 is used to define half-toning in the Department's Bentley printer driver files. Half-toning of the minor grid lines on the cross section sheets, the profile portion of the plan/profile sheet and the profile sheet is shown in the ***FDM, Part 3 Exhibits***. The Department's Project Manager must approve half-toning of any other graphical elements in the design files.

Some Districts have specified half-toning of certain reference files from one component/discipline to another. For example, the topography file could be half-toned when referenced to the proposed design. This must be approved on a per District basis. A pen table can be set up to equate any referenced file to color 20, thus half-toning the entire reference file at print time.

7.11.2.2 Quality and Reproduction

Printed output from the design files or plan sheet image file PDF's must be legible and of a quality to be reproducible on 2nd generation copies. Line weights as defined in Chapter 3 are default settings, but may need to be adjusted, depending on printer hardware, to produce the required quality of hard-copy printed documents.

7.11.3 Print Resource Files

7.11.3.1 Bentley Connect

The Department's CADD Software supplies several Bentley print configuration example files to generate prints to scale using the sheet cells (also provided with the CADD Software) on those specific printers. All print configuration files supplied have raster printing enabled. These print configuration files are examples due to various site-specific configurations and the types of printers that might be encountered.

The table below lists the print configuration filenames and the type of printer on which it was developed/tested. Each printer has its own printable area on the paper for which it can print. For this reason, if a specific printer is not listed below, the print configuration file may require modification by the user to be used for another printer.

PRINT RESOURCE FILES	PRINTER	DESCRIPTION
36x24.pro	N/A	Controls postscript image/print output for 36" x 24" prints
Color.pltcfg	N/A	Color 11x17 (Raster Capable) Uses FDOT.**TBL** pen table and PSCRIPT.PRO prolog file.
Color_FDOTPDF.pltcfg	N/A	Creates a color Portable Document Format (PDF) file. (Raster Capable) Uses FDOT.TBL pen table.
Color_Keysheet.pltcfg	N/A	To be used when printing key sheets containing maps with filled shapes.
FDOT.tbl	N/A	Pen table that also enters username, date time, and sheet border path.
FDOT_GrayExisting.tbl	N\A	Pen table that enters username, date time, sheet border path, and applies gray scale to files named like: TOPO*, UTEX*, and DREX*
FDOT_Keysheet.tbl	N/A	Pen table that enters username, date time, sheet border path, and applies settings for printing PDF key maps on key sheets.
FDOT_Letter.pltcfg	Windows Printer	Copy of Bentley's PRINTER.PLT with weights and styles set to CADD standards. Uses FDOT.TBL pen table. Specifically, for printing 8.5" x 11" letter-sized prints.
FDOT_Letter.pro	N/A	Controls postscript image/print output for 8.5" x 11" letter-sized prints
FDOTPDF.pltcfg	N/A	Creates a .PDF file. (Raster Capable) Uses FDOT.TBL pen table.
FDOTprinter.pltcfg	Windows Printer	Copy of Bentley's PRINTER.PLT with weights and styles set to CADD standards. Uses FDOT.TBL pen table.
HP1055.pltcfg	HP 1055 CM	Monochrome 36x24 (Raster Capable) Uses 36x24.PRO prolog file.
HP1055C.pltcfg	HP 1055 CM	Color 36x24 (Raster Capable) Uses 36x24.PRO prolog file.
HP5000.pltcfg	HP 5000 GN	Monochrome 11x17 (Raster Capable) Uses FDOT.TBL pen table and HPTTABL1.PRO prolog file.
HP5000Legal.pltcfg	HP 5000 GN	Monochrome 8.5x14 (Raster Capable) Uses FDOT.TBL pen table and HPTLEGAL.PRO prolog file.
HP5000Letter.pltcfg	HP 5000 GN	Monochrome 8.5x11 (Raster Capable) Uses FDOT.TBL pen table and HPTLETER.PRO prolog file.
hpglrtl.pltcfg	Large Format	Intended for use when printing large format monochrome sheets. (Raster Capable)
hpglrtl_c.pltcfg	Large Format	Intended for use when printing large format color sheets. (Raster Capable)
hpta3.pro	N/A	Controls postscript image/print output
Hpta4.pro	N/A	Controls postscript image/print output
hptlegal.pro	N/A	Controls postscript image/print output for 8.5" x 14" legal-sized prints
hptleter.pro	N/A	Controls postscript image/print output
hpttabl1.pro	N/A	Controls postscript image/print output for 11" x 17" tabloid-sized prints
Hpttabl2.pro	N/A	Controls postscript image/print output for 11" x 17" tabloid-sized prints
jpeg.pltcfg	N/A	Copy of Bentley's PRINTER.PLT with weights and styles set to CADD standards. Uses FDOT.TBL pen table. Prints output to JPEG file.
postscript.pltcfg	N/A	Creates postscript image file. (Raster Capable) Uses FDOT.TBL pen table and HPTTABL1.PRO prolog file.
postscript36x24.plt	N/A	Creates postscript image file. (Raster Capable) Uses FDOT.TBL pen table and 36x24.PRO prolog file.
pscript.pro	N/A	Controls postscript image/print output
XS.tbl	N/A	Pen table that also enters username, date time, and sheet border path. Used for Cross Section sheets

7.11.3.2 Autodesk Civil 3D

The Department's CADD Software supplies several Autodesk print configuration files to generate prints to the Department's print standards.

PRINT RESOURCE FILES	DESCRIPTION
FDOT.stb	Controls the color mapping of display objects when printing. Uses black and grey scales when printing.
FDOT-Color.stb	Controls the color mapping of displayed objects when printing. Uses objects color when printing.
FDOT-Pagesetups.dwt	Contains the named page setups and layout templates commonly used to print/publish or plot FDOT standard size drawings.

7.11.4 Print Borders

For Bentley printing, the Department's standard sheet files have a print border embedded for each sheet. The defined search criteria for constituting a print area on a sheet is illustrated in the table below.

Note *PlotBorder_dp* and *ShtPlotBorder_c levels* are the current print border level symbology used in the CADD Software. Typical print border dimension for 11x17 plan sheet prints: 16.5" x 10.6".

	Border 1	Border 2	Border 3	Border 4	Border 5
Type	Shape	Shape			Shape
Level	PlotBorder_dp	PlotBorderSht	PlotShape	ShtPlotBorder_c	51
Color	BYLEVEL	BYLEVEL	BYLEVEL	BYLEVEL	3

For Autodesk printing, the Department prints sheets defined in Layout tabs, require no search criteria.

7.11.5 Print Image Files

The PDF print capability provided by both Bentley and Autodesk is the required print format for plans. When PDF files are produced, the user must ensure that no encryption or other PDF security is embedded in the PDF to ensure those print files may be subsequently manipulated (such as rotation to proper viewing orientation, combining into larger multi-page PDF documents, or digitally signing and sealing later in the production process). Note that once a file is digitally signed and sealed, it cannot be manipulated later without invalidating the signatures already applied.

7.11.5.1 Print Image File Naming Convention

Bentley projects use the FDOTConnect workspace application *Plan Set Manager* to organize component plan sheets and apply title block data from design files containing sheet models. The sheet models and content data referenced can be printed to a multipage PDF. The naming convention for the Component PDF is defined in Chapter 8 of this manual.

Autodesk Civil 3D projects use a similar tool called *Sheet Set Organizer (SSO)*. *SSO* also uses the source design file name and data extracted from the sheet layouts in drawings assigned to Autodesk's Sheet Set Manager (*.dst*) files for names and organizes plans components of the project.

PDF files are the required format for producing an electronic image of Plans for Digital Delivery. Multi-sheet PDF files representing Plans and/or Specifications have been ruled acceptable to the Boards of Professional Regulation and may be signed and sealed with single or multiple digital signatures. Provisions were made to resolve any potential ambiguity regarding who is responsible for content by using a Signature Sheet (see the Department's FDM 910.3) for each file signed with a Digital Signature. If more than one professional must sign any given file, a Signature Sheet must appear in that Plans Set (or Component Set) to bear the appearance of each Signatory and include a definition of the portions of that Set each Signatory is taking responsibility for. Data producers are no longer required to retain or sign single files representing each individual sheet of a Plans set.

7.11.5.2 Print Image File Naming Format

Applications that support printing, such as Plan *Set Manager and Sheet Set Organizer* implement a file naming scheme for PDF files it manages that removes ambiguity about which sheet the file represents (regardless of the sheet-numbering scheme used in the design file) and supports more complex sheet numbering being expected by some component/disciplines. Digital Delivery does not require individual sheet image files to be delivered, however.

If individual sheets are printed to PDF and retained, they must follow the naming convention shown below:

EX: 01_Plan-10_planrd01.extension

Plans Component Code Sheet # Parent Drawing File Name

Note Image file extension must be Portable Document files (PDF) and Tagged Image Format files (TIF).

Plans Component Code - [01] The first two numbers represent the Plans Component with zero (0) padding (for file name sorting purposes). The Department's Standard Plans Component codes (as corresponding to the FDM 901.1) are as follows:

01 – Roadway
02 – Signing and Pavement Marking
03 – Signalization
04 – Intelligent Transportation Systems (ITS)
05 – Lighting
06 – Landscape
07 – Architectural
08 – Structures
09 – Toll Facilities
10 – Utility Work by Highway Contractor Agreement Plans
99 – Unknown (if the Plans Component cannot determine)

Sheet # - After the Plans Component Code, an underscore (_) is inserted as a separator, followed by the actual sheet number (Plan-10) appearing in the title block of the sheet.

Parent Drawing File Name - After the Sheet #, an underscore (_) is inserted as a separator followed by the name of the source design file (planrd01).

Chapter 8
CADD DELIVERY

8.1 PURPOSE

This chapter establishes the minimum requirements and functions necessary for Florida Department of Transportation (Department's) Computer Aided Design and Drafting (CADD) project review, packaging and delivery process of electronic files. These processes create a CADD project for the Department.

8.2 SCOPE

The CADD Delivery process applies to all projects produced by and for the Department, in addition to the Department's custom criteria, standards and procedures of the various Components/Disciplines within the Department.

Note It is the Designer's responsibility to ensure that the software tool provides accurate information.

8.3 RECEIPT AND ACCEPTANCE OF ELECTRONIC DATA

The District Project Manager is responsible for ensuring that the terms of the scope of services of a project for the Department have been met, including the assurance that the Department's Quality Control (QC) requirements were fulfilled during the Plans Production process of the electronic data.

8.3.1 Translation of Files

The Department requires Bentley DGN format or Autodesk DWG format compatible with the Department's currently supported CADD software (see Section 7.6) Exceptions subject to approval by the CADD Office.

The data producer is solely responsible for any translation required for delivery to the Department, including the accuracy of translation of the design files, adherence to the standards and specifications, and the validity of the geometric elements contained in the ***CADD Manual***.

8.3.2 Receipt of Data

The District Project Manager must receive electronic data under a Letter of Transmittal.

8.3.3 Acceptance

The District Project Manager ensures that the delivery is checked for completeness and meets the terms, conditions and requirements outlined herein. Once the delivery has been determined to be compliant, a Record of Acceptance must be made.

8.3.4 Validation

Upon receipt of the delivery media, the Department will validate all digitally signed files.

8.4 PRODUCTION DELIVERABLE FILES

Refer to FDM Section 901.2.5 PS&E Submittal for details on Production deliverables.

FDOT Design Manual (FDM) 901

8.4.1 Plans Component PDF Files

Plans will be divided by plans components. The Department's Standard Plans Component codes (corresponding to the component order defined in the ***FDOT Design Manual (FDM) 302.5*** are as follows:

01 – Roadway Plans

02 – Signing and Pavement Marking Plans

03 – Signalization Plans

04 – Intelligent Transportation System (ITS) Plans

05 – Lighting Plans

06 – Landscaping Plans

07 – Architectural Plans

08 – Structures Plans

09 – Toll Facilities

10 – Utility Work by Highway Contractor Agreement Plans

Note Utility Work by Highway Contractor Agreement Plans have a separate Financial Project ID and are typically treated as a strung project. (See FDM 302.11)

Each plan component will be delivered as a separate PDF file. Component file PDFs will have one of the applicable filenames from the table below.

fpid-PLANS-01-ROADWAY.PDF	*fpid*-PLANS-06-LANDSCAPE.PDF
fpid-PLANS-02-SIGNINGMARKING.PDF	*fpid*-PLANS-07-ARCHITECHTURAL.PDF
fpid-PLANS-03-SIGNALIZATION.PDF	*fpid*-PLANS-08-STRUCTURES.PDF
fpid-PLANS-04-ITS.PDF	*fpid*-PLANS-09-TOLLFACILITIES.PDF
fpid-PLANS-05-LIGHTING.PDF	*fpid*-PLANS-10-UTILITYWORK.PDF

Each Plans Component PDF will contain all sheets in that component set in consecutive order and suitable for inclusion in the plan set. The only exception to this requirement is ***Early Work*** sheets discussed in Section 8.4.1.1.

Each Plans Component PDF will have its own key sheet. If there is more than one professional of record signing a plan component, a signature sheet(s) will be inserted directly behind the key sheet to contain the digital signatures. If a plan component or an early work sheet has only one professional of record signing, then NO signature sheet will accompany that component or Early Work sheet. In the instance of a single signer the digital signature appearance will be placed on the lead sheet in the set in the same location as a physical wet-ink signature and seal would appear; on the key sheet for a component set or the first sheet for an Early Work sheet set.

Produce Plan Component PDF's and Early Works Sheets in Black and White or Grayscale, unless color PDFs are required. Production of the PDF in color enlarges the file size considerably. All plans' sheets must be produced in the PDF in the same reading orientation, preferably Landscape, with the title block displayed at the bottom of the sheet.

Note For strung projects, each "Lead" and "Goes-with" Project dataset and Bid Set data is delivered separately. Each "lead" and "Goes-with" will have its own set of PDFs, *fpid*-CADD.ZIP, etc.

8.4.1.1 Early Work Sheets of Plan Sets

Portions, certain Early Works sheets of a plan set that are delivered early in the project development cycle as per the FDM 130.2.1 and FDM 302.6.1 may be digitally signed at the time of sheet development. In so doing, the professional of record signs said Early Works sheets only once when those sheets are completed, unless subsequent changes are made to the sheets.

Early Works may only be provided as follows: Geotechnical Core Borings, Verification of Underground Utilities Survey, or a Tree Survey. Each Early Work set is provided as a separate multi-sheet PDF file. Those PDF files will be named accordingly using the following file naming convention:

Geotechnical:	<*fpid*>-PLANS-<*component code*>-<*component*>- **COREBORINGS**.PDF
Underground Utilities:	<*fpid*>-PLANS-<*component code*>-<*component*>-**VERIFIEDUTILITIES**.PDF
Tree Survey:	<*fpid*>-PLANS-<*component code*>-<*component*>-**TREESURVEY**.PDF

Typically, these are delivered with the roadway component. An example where the primary plans component is roadway (01-ROADWAY), early works are delivered is shown in the following table:

fpid-PLANS-01-ROADWAY-**COREBORINGS**.PDF
fpid-PLANS-01-ROADWAY-**VERIFIEDUTILITIES**.PDF
fpid-PLANS-01-ROADWAY-**TREESURVEY.PDF**

As another example, if the primary plans component is structures (08-STRUCTURES), then the early work sheets will be named as shown in the following table:

fpid-PLANS-08-STRUCTURES-**COREBORINGS**.PDF
fpid-PLANS-08-STRUCTURES-**VERIFIEDUTILITIES**.PDF
fpid-PLANS-08-STRUCTURES-**TREESURVEY.PDF**

Likewise, with other plans components.

8.4.1.2 Plans Component PDF Deviation

In the rare event that the complexity and sheer size of a project dictates that the project be further subdivided than by the means provided by the above filenames, an approval may be granted as follows:

A request to deviate from the required process must be made in writing by the District Project Manager to the FDOT CADD Office.

The request must be specific regarding the proposed file structure and delivery method that will be used for the project in question.

The request should be made as early in the design phase as practical, but no later than Phase III Plans Submittal.

Central Office, Program Management Office will grant approval if the need for deviation is demonstrated, and the proposed process is acceptable.

Note An approval granted on one project may not be construed as to extend to other projects regardless of similar circumstances. Approvals are granted on a project by project basis.

8.4.2 Specifications PDF Files

Specifications must be prepared in accordance with the Program Management policies and procedures. Statewide implemented specifications files are distributed by the State Specifications Office through the District Specifications Offices. The Specification needs to address which model takes precedent legally if conflicts exist between 2D PDF or 3D PDF.

For Digital Delivery Bid Sets, the Specification files are copied from the \Specifications\ sub-folder structure for delivery. Specification file naming convention for Digital Delivery submittals is: *fpid*-SPECS[-].pdf:

fpid = full (11digit) Financial Project IDentification number without dashes.

SPECS = item description

[-] = any additional naming specific to the project (optional)

Supplement file naming convention for submittals is: *fpid*-SPECS-SUPP##[-].pdf, where:

fpid = full (11digit) Financial Project IDentification number without dashes,

SPECS = item description

SUPP = Identifier

= sequential numbering of the supplements: 01, 02, 03, etc.

[-] = any additional naming specific to the project (optional)

BOE# = Bases of Estimates – Pay Item number

TSP = Technical Special Provision

Original Delivery	***Supplement1***	***Supplement2***
fpid-SPECS[-].PDF	*fpid*-SPECS-SUPP01[-].PDF	*fpid*-SPECS-SUPP02[-].PDF
fpid-SPECS-TSP[BOE#][-].PDF	*fpid*-SPECS-TSP[BOE#]-REV01[-].PDF	*fpid*-SPECS-TSP[BOE#]-REV02[-].PDF

For Example: Begin with the *FPID* number, then the item description (SPECS), then supplement number (SUPP##), and finally any naming [-] specific to the project (optional).

This file naming convention allows project files to collate as sorted and combined in a single folder. Text, numbers and dashes are allowed. Characters that interfere with operating system path specifications or XML paths must be excluded, such as underline and spaces and (/ \ . : , < & # >).

8.4.2.1 Technical Special Provisions

When the use of a Technical Special Provision (TSP) is authorized by the District Specifications Office, the PDF of the TSP file(s) is individually signed and sealed. For Digital Delivery, certificate based Digital Signature must be used. The TSP must include the electronic statement incorporated on the TSP cover page. When a TSP is manually signed and sealed, it must be scanned in grey scale for seal visibility and no electronic statement is needed.

8.4.2.2 File Structure (Specs Only Projects)

Specifications Folder Structure

Supplemental Specifications Folder Structure

Technical Special Provisions (TSP)

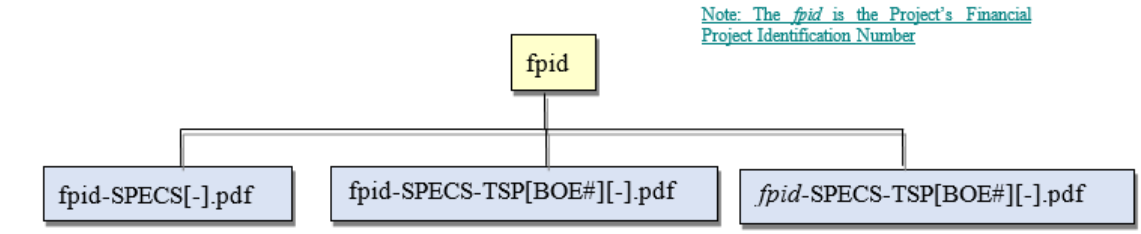
Note If a TSP is applicable to the project, then the folder for TSP(s) would apply to both the Project CD and Bid CD data set. Multiple TSP files may exist in the delivery.

The Specification Package is delivered as fpid-SPECS.pdf. Subsequent TSPs are delivered as fpid-SPECS-TSP[BOE#].pdf as shown in Section 8.4.2 .

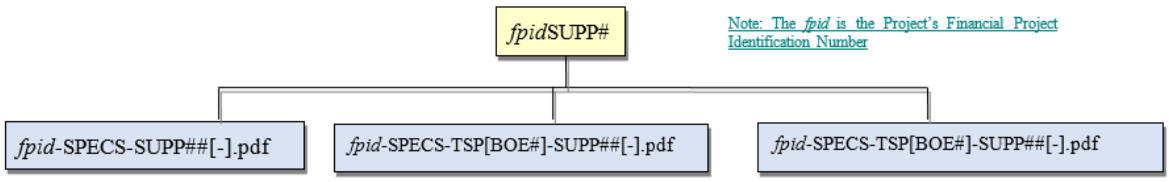
1. Create the project folder using all eleven digits of *fpid* Number. (i.e., 12345678900).
2. Inside the created (project) \FPID\ folder. This is where the Specifications package file (*fpid*-SPECS[-].pdf) is placed.
3. For Supplements, continue to use the ORIGINAL \FPID\ folder created in Step 1.
4. For Supplements. This is where the Supplement package file (*fpid*-SPECS-SUPP##[-].pdf) is placed.
5. Use digital signature to sign and seal the Supplement package file (*fpid*-SPECS-SUPP##[-].pdf).

Note **DO NOT** re-submit the entire Specification package for a Supplemental.

Example of a
Specifications Only Package
Folder Structure



Example of a
Supplemental Specifications Only Package Folder
Structure



8.4.3 Estimated Quantities Report PDF

FDOT requires that all quantities be documented via spreadsheets located in the Calculations Folder of the Project and exported to a single PDF report in the Estimates Folder of the Project. The Estimated Quantities Report must be delivered according to the guidelines and formats defined by FDOT Design Manual (FDM), Basis of Estimates Manual, and the Structures Manual, along with verbiage stated herein. The file naming convention for Digital Delivery submittals for the Estimated Quantities Report is: *fpid*-ESTIMATES-QUANTITIES[-].pdf

Note A copy of the *fpid*-ESTIMATES-QUANTITIES[-].pdf shall be digitally signed and sealed and delivered in accordance with FDM 901.2.5

8.4.3.1 FDOT Summary Tables

The following is a list of Summary Tables that may be included in the Estimated Quantities Report PDF. All Summary Table spreadsheets must be created with the Quantity Takeoff Manager (QTM). Reports noted with an asterisk (*) can be auto populated by QTM with quantity data from the design files. All other spreadsheets must be created with QTM and completed by the designer. Note: Spreadsheet filenames and formats are critical for the Summary Reports Builder tool to create the Estimated Quantities Report PDF. Do not modify the filenames or formats of the spreadsheets in any way other than to add the required quantity data

Box Culverts
Clearing Grubbing and Removal Items
Curbs*
Ditch Pavement*
Drainage*
Driveway Base*
Earthwork*
Erosion Control and Sediment Control Devices*
Fencing*
General Items
Geotechnical Items
Guardrail*
Intelligent Transportation Systems Items*
Landscape Items
Lighting Items*
Litter Removal and Mowing
Lump Sum Items
Mailboxes*
Miscellaneous Asphalt*
Miscellaneous Drainage Items
Pavement*
Pedestrian Longitudinal Channelizing Devices*
Performance Turf*
Permanent Barriers*
Permanent Crash Cushions*
Permanent Driveways*
Railing*
Sidewalk and Detectable Warnings*
Signalization Items*
Signing and Pavement Marking*
Special Detours
Structure Quantities
Temporary Crash Cushions*
Temporary Driveways*
Temporary Highway Lighting
Temporary Signalization and Detection
Temporary Traffic Control Plan Items
Traffic Monitoring Site Items
Utility Adjustments*
Utility Items
Walls

Note See the FDOT Automated Quantities Training Guide for FDOTConnect for more instructional information **FDOTConnect Automated Quantities**

8.4.4 Project Documentation

The Engineering Data, /eng_data/, folders in the Project Folder Structure are a working sub-directory during the design process of an FDOT Project.

Final Project design documentation (e.g., pavement design report, typical section package, exceptions, variations, architectural calculations, drainage calculations, lighting design analysis report, permits, geotechnical reports, structural calculations, toll facility calculations, utility schedules, etc.) will be delivered per FDM 111.7. Here are the links to the related documents.

FDM 111.7 Project Documentation

FDM 133 Retention of Electronic Documents

Policy & Process Management – Records Management 050-020-025

State of Florida Electronic Records & Records Management Practices

8.4.5 3D Model PDF Files

All projects modeled in 3D will deliver a separate 3D PDF file. Project file PDFs will have the file name:

fpid-3DMODEL.PDF

8.4.6 CADD ZIP File

An archive of the Project folder structure containing the CADD files (Native DGN's/DWG's of the platform used to design the project) and supporting data files from which the final plans were developed will be delivered in the format of a ZIP file (*fpid*-CADD.ZIP). This ZIP file is not signed and sealed and is delivered as a separate file outside of the project folder structure.

The designer must determine which files should be included inside the *fpid*-CADD.ZIP file to support the plans and facilitate the contractor constructing the project. Ensure that folder structure inside fpid-CADD.ZIP closely resembles the Project Folder structure (as a sub-set), where files found in *fpid*-CADD.ZIP would be found at the same path as in the project Folder structure.

As a minimum, the *fpid*-CADD.ZIP should include:

All Native CADD Files use to produce plan sheets in pdf (2D and 3D) *(DGNs, DWGs, etc.)*

All Native CADD Files that include 3D model data

Engineering Data Files *(described later in this chapter and prior chapters)*

Summary of Quantity Design Files *(includes data such as, shapes and area identifications)*

3D Deliverable Files *(exported selection of files from the Project specifically for the contractor)*

Note **DO NOT** include the following files (and their variants) in the *fpid*-CADD.ZIP:

fpid-PLANS-<component code>-<component>.PDF

fpid-PLANS-<component code>-<component>-REV##.PDF

fpid-SPECS[-].PDF

fpid-SPECS-SUPP##.PDF

fpid-ESTIMATES-QUANTITIES[-].pdf

Note Because *fpid*-CADD.ZIP does not represent the entire Digital Delivery, certain tools, such as *Project Validator,* should not be run against only the contents within *fpid*-CADD.ZIP. *Project Validator* should only be run against the full Project folder structure containing all Digital Delivery.

8.4.6.1 3D Deliverables Supporting AMG Project Folder

The Department has adopted basic CADD and LandXML formats as the standard for delivery for Automated Machine Guidance (AMG). Contractors have requested the Department create these files to be used in Construction.

Additionally, the department has adopted 3D Initiatives to include other BIM data files for Construction, Maintenance and Operations.

The 3D Deliverable folder may contain following types of files:

LandXML files formats as the standard for delivery.

Discipline specific 3D Models in native CADD format.

Discipline specific models or federated model proprietary browser format (i.e., imodels).

Note For more information on creating these files see Chapter 10 of ***FDOT Roadway Design and 3D Modeling*** training guide:

FDOT Roadway Design and 3D Modeling Training Guide

For the supporting documentation on 3D Deliverable files for Automated Machine Guidance see:

FDOT 3D Deliverables Support Resource

Table 8.4.6.1 describes 3D deliverable file(s) Supporting AMG for 3D Projects for Construction. Files shall be named and delivered in accordance with the Model Management Plan for the Project.

Table 8.4.6.1

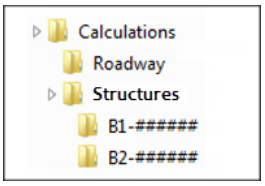
3D DELIVERABLES SUPPORTING AMG
(Store in project folder: 3DDeliverables)

Category	File Name	Description
Design Alignments and Profiles	AMG-ALGN##.xml	All Alignments and Profiles exported from the \Roadway\ALGNRD, PROF or model files and \Roadway\DSGNRD or CORRRD files in LandXML format.
2D Proposed Planimetrics Design	AMG-2DSGN##.dwg/dgn	2D proposed Roadway design exported from the \Roadway\DSGNRD file(s). (Production of this file for construction is at the designer's discretion.)
	AMG-2DRPR##.dwg/dgn	2D proposed Drainage design exported from the \Drainage\DRPRRD file. (Production of this file for construction is at the designer's discretion.)
	AMG-2PDPL##.dwg/dgn	2D proposed Pond design exported from the \Drainage\PDPLRD file. (Production of this file for construction is at the designer's discretion.)
3D Existing Survey *Note: Single survey Planimetrics file.*	AMD-3SURVRD##.dwg/dgn	3D existing Topography, Drainage, and Utilities from the \Survey\SURVRD file
3D Surfaces	AMG-3SURFACEEX##.xml	3D existing surface terrain to be exported from the \Survey\GDTMRD or SURVRD file as LandXML format.
	AMG-3SURFACEPR##.xml	3D finished (top) surface terrain to be exported as LandXML format from the \Roadway\MODLRD file(s).
	AMG-3SURFACEML##.xml	3D milling (bottom) surface terrain, if project includes milling, to be exported as LandXML format from the \Roadway\MODLRD file(s).
	AMG-3SURFACEUM##.xml	3D Unsuitable Material (bottom) surface terrain, if unsuitable material present in project limits. To be generated from triangulation between boreholes at the bottom of the unsuitable material layer and exported to LandXML format. (Production of this file for construction is at the designer's discretion.)
3D Surfaces for Earthwork	AMG-3SURFACEEX_EW##.xml	3D existing (bottom) surface terrain to be created from the \Roadway|MODLRD_Existing_Features file(s) as LandXML format. (This surface will typically follow the bottom of hard surfaces i.e., pavement, asphalt base, sidewalks, curbs, etc.)
	AMG-3SURFACEPR_EW##.xml	3D finished graded (bottom) surface terrain to be created from the \Roadway\MODLRD file(s) as LandXML format.
	AMG-3SURFACESE##.xml	3D Subsoil Excavation (bottom) surface terrain, if Subsoil Excavation needed for project, to be created from the \Roadway\MODLRD file(s) as LandXML format.
3D Proposed Break Lines	AMG-3DSGN##.dwg/dgn	3D Roadway break lines exported from the \Roadway|MODLRD file(s).
3D Proposed Model (Optional format)	AMG-MODLRD0#.ifc/i.dgn	Master roadway 3D model file, exported to the available BIM format based on platform, Industry Foundation Classes format (.ifc) preferred but imodel (i.dgn) acceptable for Bentley projects.
	AMG-DRPRRD0#.ifc/i.dgn	Master drainage 3D model file, exported to the available BIM format based on platform, .ifc preferred but.imodel (i.dgn) acceptable for Bentley projects.
	AMG-B#MODLBR0#.ifc/i.dgn	Master bridge 3D model, exported to the available BIM format based on platform, .ifc preferred but imodel (i.dgn) acceptable for Bentley projects. One file per bridge.

8.4.6.2 Project Calculations Folder

The \Calculations\ Project sub-folder contains the Excel summary report files generated by the Quantity Takeoff Manager tool. Once all project Summary Report spreadsheets have been created, the Summary Reports Builder is used to combine the spreadsheets from this folder into a single PDF Estimated Quantities Report in the Estimates Folder.

Additional subfolders may be created under the \Calculations\ sub-folder to aide in organization of documentation. Any supplementary spreadsheets, PDF or TIFF files of hand drawn sketches and calculations, PDF files generated from other programs (i.e., Mathcad), and any associated *quantity backup data* for the Summary Reports should be included in subfolders here.



8.4.6.3 Estimates Project Folder

This folder contains:

EQRSignature.pdf; created from the EQRSignature.xlsx in the Calculations folder.

FPID-Estimates Quantities Report; only the compiled PDF summary reports (not digitally signed).

Project Edit Report generated from AASHTOWare WebGate (optional)

8.4.6.4 GIS Project Folder

This folder contains CADD files for specific Geographic Information Systems (GIS) conversion needs (.dgn/.dwg or related files such as LandXML), as well as GIS files (shapefiles, .shp, or Google Earth .kml/.kmz files). Only those files needed for GIS should be present.

CADD files intended for GIS conversion are typically expected to be provided by the designer when required by the FDM so others can do the conversion after the project is submitted. People processing the data will be unfamiliar with CADD and with the project. The file(s) must have the correct zone of State Plane Coordinate System of 1983 and geolocation applied. Care should be taken to ensure that no extraneous elements are on the levels intended for export to GIS, and that the elements are on the standard CADD level in accordance with the CADD rules, as the import to GIS will look for levels based on CADD standards. This will ensure feature identification needed for conversion. Elements must also have any applicable pay item information set.

8.4.6.4.1 Green Pavement for GIS conversion

If there are green colored pavement markings used with bike facilities on the project, the CADD file with those pavement markings should be copied over to the GIS folder and set up as mentioned above. The Engineer of Record (EOR) will check for the file(s) in the GIS folder of the Final Projects folder and email it to **CO-CIMGIS@dot.state.fl.us**. The following link provides guidance and procedures required for submitting files to be included in the statewide Green Colored Pavement Marking GIS feature class: **https://www.fdot.gov/gis/bim/green-pavement**.

8.4.6.4.2 Google Earth KMZ / KML Files

KMZ is a zip file of KML (Keyhole Markup Language), a GIS format used by Google Earth. If required by the project scope, KMZ files should follow the guidelines below.

The provider of the KMZ will validate that the file delivered is compatible with Google Earth. Do not include any of the following characters in the file name(s): & { } ~ # % _

The KMZ file structure will follow FDM 301 establishing design component plan layers containing separate layers for existing and proposed features. All KMZ deliverables will have layers with naming convention that follows the contract plan set naming convention for the major Components Plans Sets as identified in FDM 301. The following list is presented in a tiered fashion to indicate the layering and naming that is required for the KMZ file setup. Levels/Layers without content shall be omitted from the KMZ.

1. Roadway Component
   a. Drainage Map
      Proposed
      Labels
   b. Interchange Drainage Map
      Proposed
      Labels
   c. Alignment Baselines
   d. Existing Features
      Topo
      Wetlands
   e. Right of Way
   f. Roadway Plan
      Proposed
      Labels
   g. Drainage
      Existing
      Proposed
      Labels
   h. Ramp Terminal
      Proposed
      Labels
   i. Intersection Layout
      Proposed
      Labels
   j. Outfall/ Lateral Ditches and Ponds
      Proposed
   k. Improvements
   l. Contours
      Existing Contours
      Labels
   m. Utilities
      Existing
      Proposed Adjustments
      Labels
   n. Traffic Control Plan
      Phase X
      - Proposed
      - Work Area
      - Temporary Drainage
      - Labels

      Phase Y
      - Proposed
      - Work Area
      - Temporary Drainage
      - Labels

      Phase Z
      - Proposed
      - Work Area
      - Temporary Drainage
      - Labels

      etc....
   o. Signing and Pavement Marking
      Existing
   p. Proposed
      Labels
   q. Signalization
      Proposed
      Labels
   r. ITS
      Proposed
   s. Labels
   t. Lighting
      Proposed
   u. Labels
   v. Landscaping
      Proposed
      Labels
2. Structures
   a. Proposed improvements or modifications
   b. Labels
3. Toll Facility Plans
4. Civil/Site Plans
   a. Existing
   b. Proposed
   c. Labels
5. Electrical Plans
   a. Existing
   b. Proposed
   c. Labels
6. Utility Plans
   a. Existing
   b. Proposed
   c. Labels

Note KMZ layer colors should reflect FDOT CADD layer/level standards.

8.4.6.4.3 ESRI GIS Files (.shp or .gdb and related files)

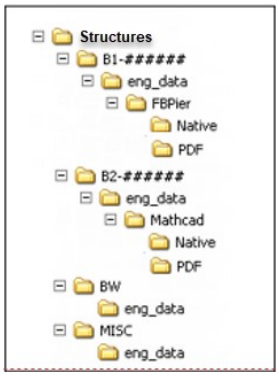
These GIS files are used primarily by ESRI products such as ArcGIS. If required by the project scope, these shapefiles or geodatabase files should follow the guidelines below.

The provider of the file will validate that the file delivered is compatible with ArcGIS, if GIS files are provided for Green bike lane markings.

8.4.6.4.4 Metadata for GIS

When project details are not in a GIS attribute table, they may be in the form of an Excel spreadsheet and also submitted in this folder.

8.4.6.5 Structures Engineering Data



Under the project *Structures*\ folder, create separate sub-folders for each bridge and/or structure in the project. Name these sub-folders using the sheet prefix and bridge numbers (when applicable) and locate the design files for each bridge under these sub-folders. (e.g..*Structures**B*\; *Structures**B1-######*\)

Under each bridge and/or structure sub-folder, create an *eng_data*\ sub-folder for the Engineering Data related to the design of the project. (e.g...*Structures**B**eng_data*\; *Structures**B1-######**eng_data*\). Computer input and output files include files used for all aspects of bridge, retaining wall, and/or miscellaneous structures design. These include, but are not limited to, files generated from the following computer programs:

- FDOT Structural Software
- GTStrudl
- STADD
- RISA
- Mathcad Spreadsheets
- Excel Spreadsheets
- FBPier
- LEAP Software
- BD2
- MDX
- BC
- Adapt

Under each of the \eng_data\ sub-folders for each bridge and/or structure in the project, create subfolders for the applicable programs with two sub-folders: \PDF\ and \Native\. Place the appropriate input and output files in each sub-folder. Only sign and seal these PDF files when required by Contract.

8.4.6.6 Merging External Project Files

Files must be merged into the main Project folder structure prior to the project delivery. These include CADD system dependency files, and files provided from outside sources, such as those produced by sub-consultants.

8.4.6.7 CADD *System Dependency Files*

Certain CADD references might reside external to the project folder during the production phase. Before delivery to the Department, these files must be placed in the appropriate locations within the Project folder structure. It is strongly recommended that these files be included in the Project folder structure early on in project development and verified that referencing functions work properly.

Note Reference files must also be attached without the "save full path" option checked and should be located by their relative paths from the root of the Project folder.

For printing purposes, any user created custom line style/linetype, font resource, and cell/block library files used for the project must be included with the project in the sub-folder \Symbology\. In addition, any external design files that are referenced, such as sheet border files, must be copied to the project folder. This allows the view or recreation of prints matching the original delivery for future customers of the data.

Note The designer does not need to include the Department's standard CADD resources delivered in the Department's CADD Software (either Bentley or Autodesk resources). However, the Department's *CADD Software version information must be provided in the Project Journal.*

8.4.6.8 *Files from Outside Sources*

Files that come from an outside source include files produced by a sub-consultant. Files from sub-consultants must be delivered to the primary consultant, or the Department's designer, following the same requirements for Delivery.

8.4.6.9 *Merging Previously Digitally Signed Documents:*

Once a document is signed using a digital certificate, the document is valid when it is completely unaltered. Merging two or more documents together, even if those documents are signed and completely valid independently, produces a completely new document - thus an altered document. When merging previously signed documents, the PDF editing software will strip off all digital signatures that have been applied.

In situations where it is necessary to merge previously digitally signed documents, retain the original signed documents from which the merged document is produced. If it is necessary for the merged document to be signed, then it must be signed by the original signatories or their successors.

8.4.7 BIM ZIP File

The CADD delivery will only contain either a CADD.ZIP or BIM.ZIP, not both.

When any file or files within the CADD Project Folders are delivered as contract documents and shown on the signature page to be digitally signed , then *fpid*-CADD.ZIP shall be renamed and delivered as *fpid*-BIM.ZIP. The *fpid*-BIM.ZIP replaces the *fpid*-CADD.ZIP.

A manifest of the digitally signed files to be delivered as contract documents will be shown on a signature sheet in the *fpid* - Plans Component.pdf. FDOT provides a tool, BIM Cryptor, to create the required manifest spreadsheet to be linked with LDM to a Signature Sheet. All digitally signed files will be delivered as 'READ ONLY'. The workflow for creating the manifest of digitally signed CADD files has been recorded and provided at the following link:

BIM Cryptor Tools - YouTube

8.4.8 Project QC Files

All Department Project deliveries must be provided to the Department's Project Manager, unless an alternate agreement is reached, along with a Compliance Certification Checklist (or similar document). A basic **Compliance Certification Checklist**, sample found in Section 1.10.2 of this document, may be employed to help the data producer consider critical items in their QC review for delivery.

> ***Note*** Department's Districts may use a more comprehensive Compliance Certification Checklist in their QA process than the example in this document. The Department prefers this, or similar documentation of QC compliance be submitted digitally and included in the \Administrative\ or \Data\ project sub-folders.

The Department's CADD Software provides tools (including *QC Inspector, QCProject Inspector* and *Project Validator*) to help ensure quality control which helps enable a successful review. One must use due diligence to make sure all delivery requirements are met. It is the responsibility of the producer to perform a thorough review. This procedure does not prescribe every potential item that might need to be checked.

Example: Some items to review would include:

Take care to look for missing sheets, gaps in the sheet numbering, duplicate sheet numbering, etc. Check for misspellings in sheet borders and other grammatical errors.

Take care to find multiple files in the Project folder structure with the same file name, but different content, which must be resolved. Likewise, find files with the same content, but different filenames (which could occur as with the case of the files beginning with "AMG…" as described previously).

Make certain the Professional of Record Note appears on plan sheets indicating the source of the official record.

Ascertain whether the Component PDF's and Early Works Sheets contain all sheets, in a properly indexed order, and is scaled and rotated properly.

Validate the digital signatures of signed files.

Confirm that the Project Journal(s) are complete and accurate.

8.4.8.1 Compliance Certification Checklist

All Department Project deliveries must be provided to the Department's Project Manager, unless an alternate agreement is reached, along with a Compliance Certification Checklist (or similar document).

Note Department's Districts may use a more comprehensive form in their QA process than the following example. The Department prefers this, or similar documentation of QC compliance be submitted digitally and included in the \Administrative\ or \Data\ project sub-folders.

All electronic data submittals are to be transmitted to the Department's Project Manager. At a minimum, the questions provided in the **Sample Form in Section 1.10** of this document must be addressed before submittal, and this (or a similar checklist) will be given to the Project Manager along with the submittal.

8.5 SIGN AND SEAL PROJECT FILES

The Department supports the use of digital signature certificates for the signing and sealing of documents for digital delivery. Use of digital certificates for this purpose is in accordance with **Florida Statute (F.S.) 668.003** and **Florida Administrative Code (F.A.C.)** as it applies to various professionals.

Please see **FDOT Design Manual (FDM) 130.2.1** for a list of professionals and corresponding F.A.C. Codes, as well as further guidelines for signing and sealing documents using digital signature certificates.

The Department's Office of Information Systems maintains a list of third-party Department-approved digital certificate authorities from which certificates may be acquired. Certificates must adhere to the National Institute of Standards and Technology Level of Assurance 3 (LOA3) according to Department policy. This list is available at this link: **FDOT Approved Digital Certificate Authorities**

Digital certificates can be used to sign files in PDF, DGN, DWG, DOCX, and XLSX format in their native applications. The Department has also created an FDOT XML Signing Tool for signing XML documents (such as LandXML) using digital certificates.

8.5.1 Legacy Electronic Signature Projects

Provenance and uninterrupted legal record of the project data must occur, whether it be by product or management practice. Therefore, it is important that both the data producer and the Department make a sensible effort to ensure the documents supporting the digital signing and sealing of files by a professional signatory and the securing of the delivery be preserved in a manner consistent with those responsibilities under the rules of the Boards of Professional Regulation in Florida.

For projects that were once performed under the old Electronic Delivery process, the Department will maintain the paper copies of retention Signature and Manifest documents until it is determined how these records may be preserved in other media that meets the requirements of the Florida Department of Business and Professional Regulation.

8.6 FINAL PLANS OFFICE

Final Plans Office is a division of the Program Management Office responsible within the Department for preparing and posting project deliverables for contract letting documents. This includes the packaging of all CADD data for the **Plans, Specifications and Estimates (PS&E) Submittal** contained in a project.

Final Plans Office involves the review and acceptance of a Delivery and making that Delivery available to the Department's internal services for posting. Functions include receipt and authentication of delivery media and placement of project data into systems for general use.

Upon receipt of the secured Delivery package and the accompanying documents, the Compliance Certification Checklist(s) must also be reviewed for completion and the signed files must be opened and authenticated.

Note Following the requirements within this manual does not guarantee an acceptable work product, as this procedure does not address the quality of the engineering or survey work performed.

Once the Delivery is accepted, the electronic project will be imported into the Department's file management systems for subsequent use. *(See FDM 133 Retention of Electronic Documents)*. Various stakeholders such as Construction and Maintenance have access to submittals via the Department's file management system.

Construction has many Publications that are utilized by both Department staff and external customers. These include manuals, forms, procedures, and reports. Please use the hyperlink below to view the most recent versions of these resources.

Office of Construction Documents & Publications

8.6.1 Contract Packaging

Final Plans Office coordinates the contract packaging requirements for a delivery for a letting found in the **FDOT Design Manual (FDM).**

The Contract Package is made available to contractors for bidding during the advertisement period and generally includes:

Plans Component PDF file(s) representing the Plans Set

Specifications PDF file(s)

Archival native CADD ZIP file (including Automated Machine Guidance files)

8.6.2 Publication and Distribution

Final Plans is responsible for publication and distribution of electronic data in accordance with procedures or requests, including but not limited to publishing electronic data to different media.

8.6.3 Archive and Security of Data

Final Plans must ensure that prescribed safeguards for the data have been met and the archival package for data includes all electronic data available for a project. The data must be preserved where it can be retrieved at future dates, meeting records retention standards set for such data.

Note For additional information regarding the Department's Final Plans, Specifications and Estimates (PS&E) package. Office

8.7 REVISIONS

Revisions to the Department's projects require the files that have changed since the previous delivery. Revision files use the original file name with a "-REV##" suffix after the file type, CADD, PLANS, SPECS.

As an example, the first revision to a Roadway Component will be named as follows:

fpid-PLANS -01-ROADWAY-REV01.PDF

The first revision to CORE BORINGS, Early Work sheets as part of a Roadway Component, for example, will be named as follows:

fpid-PLANS-01-ROADWAY-COREBORINGS -REV01.PDF

A second revision will have a "REV02" suffix, third revision will have a "REV03" suffix, and so forth.

The designer must deliver:

- ❖ Ensure the Department has a complete copy of the original Delivery:
  The native CADD files delivery fpid-CADD.ZIP

The plan component PDF files fpid-PLANS-[component code-component].PDF
The initial specifications document fpid-SPECS.PDF
The initial Technical Special Provisions fpid-SPECS-TSP[BOE#].PDF
The initial EQ Report *fpid*-ESTIMATES-QUANTITIES[-].pdf

- The Revision: (The Bid Set must only contain the changed files in the revision/supplement.)
  fpid-CADD-REV01.ZIP
  fpid-PLANS-[component code-component]REV01.PDF
  fpid-SPECS-SUPP01.PDF
  fpid-SPECS-TSP[BOE#]-REV01.PDF.
  fpid-EQ Report *fpid*-ESTIMATES-QUANTITIES[REV01].pdf
- The complete Project folder structure with all contemporary files included.

8.8 RE-LET PROJECTS AND ROLL BACK REVISIONS

In rare cases, the Department must Re-Let a project. If no revisions have occurred to the project set for Re-Letting, the Department will simply re-advertise and Let the project with the submitted Project CD or Bid Set CD data. However, if a revision has been applied to the project set for Re-Letting, then the revision is no longer relevant. The Re-Let project is essentially an original letting all over again. In this case, the data producer may be asked to Roll Back the revision indexing as if the Delivery were an original Delivery. This could involve updating the plan sheets to remove the revision enumerations. The changes to plans that were once identified as a revision are now considered a plan change.

8.9 STRUNG PROJECTS

Digital Delivery requires that each "Lead" and "Goes-with" project be delivered as separate datasets under their own *fpid*, and never combined or intermingled in their respective project folder structures. Strung projects are delivered in separate folders just as individual projects in the above procedure. These ARE NOT combined under a folder with an ETC suffix.

8.10 AS-BUILT PROJECTS

As-Built Project CD shall include all files in the latest native version of CADD software the drawings were produced in along with a PDF set of prints and a complete set in Autodesk DWG files.

Example: If the project CD was produced using Revit, the submittal will include all files in Revit RVT, Autodesk DWG and a complete set of PDF files.

8.11 DESIGN BUILD PROJECTS

The Scope of Services between the designer and contractor defines the deliverables to one another. If either party is bound by the agreement to make a delivery of data to the Department, then the guidance for Digital Delivery should be applied.

8.12 PROJECT STORAGE AND ARCHIVAL

FDOT uses Autodesk Vault software to manage and store files used for the design of transportation projects. All CADD drawing files and related engineering documentation for each project are stored within the Vault system organized by folders named to match the Financial Project Number. Each district maintains a "production" Vault for active projects where different design component/disciplines have corresponding read/write permissions for component/discipline folders. Each district also maintains an "archive" Vault to store projects once they have been completed and delivered, this Vault is "read only" for all users.

Chapter 9

CADD QUALITY ASSURANCE AND QUALITY CONTROL

9.1 PURPOSE

This section establishes the basis for Quality Assurance (QA) monitoring of the Florida Department of Transportation (Department) District Computer Aided Design and Drafting (CADD) functions, including the areas of responsibility, frequency of monitoring and reporting methods.

Offices under the direction of the Department's Chief Engineer are responsible for determining the critical QA requirements for their functional areas and develop plans to monitor those requirements. The Production Support CADD Office defines the critical Quality requirements for deliverables in this manual. These include standard file formats and components for data delivery, adherence to a standard Project folder structure, file naming conventions and CADD Standards for electronic files. CADD also establishes a QA monitoring plan for CADD to facilitate compliance with these deliverable requirements.

Each District office function has the responsibility of monitoring the implementation of policies, procedures and standards established for their respective processes. This manual applies to all CADD functions and will be monitored.

9.2 AUTHORITY

Florida Statutes (F.S.), Title IV, Chapter 20, Section 20.23(3)(a) states that the Department must ensure quality and monitor implementation of policies and procedures.

Quality Assurance and Quality Control Policy, Topic No. 001-260-001 states that it is the policy of the Department to use a systematic but flexible approach to QA and Quality Control (QC) to monitor work processes to implement laws, rules, procedures, policies and standards. This is intended to ensure compliance and quality performance by the Central Office and District units responsible for the delivery of transportation products, services and information.

9.3 QUALITY CONTROL PLAN

Production units must follow the procedures for preparing plans, maps and models. Each district must establish A Quality Control Plan for each FDOT design project as outlined in the ***FDOT Design Manual (FDM) Section 124 QA/QC Management Plan*** that reflects quality compliance indicators for all projects and monitor performance and compliance using those indicators. Consultants are agents of the Department and are responsible for the quality of projects they prepare. They must comply with the Department's ***CADD Manual*** and must perform QC activities to ensure the completeness and accuracy of services performed for the Department.

Each district must maintain an established review process to determine and report the quality and compliance levels of project data. Each district is also responsible for having a management plan as outlined in the ***FDM Section 124 QA/QC Management Plan*** for quality control of the Delivery with the expectation that quality control plans comply with this manual.

The Department provides tools to help ensure the creation of a standard Project folder structure, standard filenames and the standard level symbology for all design files. The Department provides QC software to check a design file's adherence to the Department's level-symbology standards at any time during the production phase of the project. Tools are listed below:

QCInspector – An application tool used to periodically check, correct and report the compliancy of elements within any design file. All checking and reporting are performed in real time and the results are saved to the **QCReport.txt** file in the eng_data sub-folder of active discipline folder, i.e., Roadway\eng_data.

QCProjectInspector– An application tool used to perform final check and report the compliancy of elements within all project design files. The report is saved to ProjectQCReport.txt in the *_meta_info* folder of the active project. This file is required to run Project Validator.

Project Validator – An application tool used to create a report of the Delivery compliance with FDOT CADD standards and business rules. This report is mandatory per the CADD Compliance Certification Checklist *(Section 1.10.2.2 of this document)*. The report is saved to **ProjectValidationReport.txt** in the *_meta_info* folder of the active project.

9.3.1 Quality Control of Corridor 3D Models and Extracted Surface

3D Design for roadways is intended to produce output of a corridor model from which surfaces may be derived. It is incumbent upon the designer to verify these corridor and surface models representing their design intent, so the resulting models and data derived from them can be relied upon.

The previous Section describes maximum sampling intervals for developing corridor models based upon facility and design speed; however more frequent sampling may be required to achieve the desired accuracy or resolution of the 3D model. There are several methods that can be used to check the "quality" of the proposed models and surfaces, and many checks rely upon visualization techniques on the data. These can include the following and should assess 3D models as outlined in the ***FDM Section 124 QA/QC Management Plan***:

Visual inspection through examining the models/surfaces using 3D perspective views and orbits. The Z (elevation) can sometimes be exaggerated during these operations to show discontinuity in the surfaces where problems might lie.

Visual inspection through examining the models/surfaces using drive through and fly through view manipulations and animations. Other simulation techniques can be employed also.

Visual inspection of the model using Virtual Reality or Augmented Reality to fly through and view the model in a simulated reality.

Contouring the surface models and examining the resulting contours.

Surface display by means of rendered/stylized surfaces (and solids). In some software these views can be thematically colored and or shaded, indicating slope or elevation change.

Cross Section and Profile extraction – Do these extractions corroborate the contract plans? Equally, are plan sections and profiles contemporary with the model?

"Rain Drop" analysis to see where water distributed over a surface would flow or accumulate if the surface were treated as if it were impervious and perfectly smooth.

Representing elements in either wireframe or as solid bodies, where they can be examined for conflict or "interference" relative to neighboring or crossing elements.

Use of temporary dimensioning and labels to test the model's elements for appropriate length, elevation, slope, etc.

Design geometrics can also be checked against the defined tables found in the ***FDM*** for sight distance, K-value, rate of curvature, cross slope, curve widening, etc.

Visualization can be embellished with applications of various rendering materials, lighting, and shading.

Visual inspection of the XML 3D Deliverables using the LandXMLVisualizer provided with the FDOT software.

Visual inspection and earthwork quantity corroboration using Trimble Business Center or equivalent construction software.

QC Review for 3D Engineering Models Webinar

9.4 QUALITY ASSURANCE PLAN

The Quality Assurance (QA) Plan identifies the critical areas of CADD to be monitored, critical requirements and the criteria to measure process compliance as outlined in the **FDM Section 125 Quality Assurance**. Compliance indicators will be used by the CADD Office to determine how well the process is performing.

The monitoring plan provides the method for monitoring CADD processes, the frequency of team visits, the method for reporting and sharing monitored results with the districts, and the method for tracking and eliminating non-compliance issues.

The plan covers the major delivery requirements in this manual, but users are reminded that quality CADD production is the result of performing many individual CADD activities correctly and in accordance with the current criteria and standards.

Note The ***CADD Quality Assurance Monitoring Plan*** is published on the Department's SharePoint or available on request per Department policy for internal use only.

9.5 QUALITY ASSURANCE REVIEWS (QARs)

CADD QARs will be conducted per Department requirements as outlined in the **FDM Section 125 Quality Assurance**. The Districts will be monitored through the QAR program for compliance with Department policies, procedures, and manuals and expected to ensure that their own Process Management Plan is in place for Delivery with projects in compliance with that process.

The QARs of the Districts will be conducted annually following the CADD QA monitoring plan. Reports are distributed to the District Secretaries, Federal Highway Administration (FHWA) and other affected offices.

End of CADD Manual