

VDOT CADD MANUAL

CHAPTER 1

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1 INTRODUCTION

1.1 CADD MANUAL BACKGROUND

The Virginia Department of Transportation (VDOT) has established standards and procedures for the electronic development and delivery of Right of Way and Construction plans, along with other design related documents and drawings. These procedures are documented in this Computer Aided Drafting and Design (CADD) Manual and are applicable to all VDOT Division employees, as well as the consultants and contractors who are completing projects for VDOT. The standards must be maintained and uniformly applied across plans and projects in order to maintain high quality delivery of the documents and files.

This reformatted CADD Manual provides the general guidance needed to prepare plans according to VDOT's CADD Standards whereas the individual Job Aids referenced throughout provide the step-by-step processes and procedures necessary to perform specific tasks.

1.1.1 ADOPTED SOFTWARE AND STANDARDS

The VDOT CADD Committee adopted Bentley software, including MicroStation, as its standard drafting graphics package and OpenRoads/GEOPAK as its standard road design system. Future projects will be developed using Bentley's OpenRoads Designer (ORD) and OpenBridge Designer (OBD) software which are self-contained design/modeling/drafting platforms that do not require MicroStation to be running as a separate application. VDOT has developed customizations and modifications for both of these applications to meet VDOT's design and CADD standards. VDOT has adopted Bentley ProjectWise as the agency's file management system.

The standards set forth in this manual were developed to be used in conjunction with, and to meet the requirements of, the policies and procedures as stated in the VDOT [Road Design Manual](#), A Policy on Geometric Design of Highways and Streets by AASHTO, Divisional Instructional and Information Memoranda (IIM), and other discipline specific guidelines as set forth by VDOT.

1.1.1.1 BENEFITS OF STANDARDS

The utilization of a standard drafting and design package provides standards for files which can be utilized by survey, design, and construction. Also, VDOT's project management, construction estimating, and other computerized design systems for Traffic Engineering, Right of Way/Utilities, Structure and Bridge, Environmental Quality, and Materials are able to utilize the standard files created by the drafting and design programs.

The adoption of a standard drafting and design package allows the Department to utilize electronic data that has been developed by one group of VDOT employees or consultants to complete projects that might be recalled or re-assigned to another group of VDOT employees or consultants. This aids in providing seamless transitions between adjacent projects, or future modifications to a project location or corridor by utilizing the same platform of design information.

The Department has developed standards for the delivery of electronic files to the private sector contractors for design and construction bidding. Users must utilize the VDOT Standards, processes, job aids, and reference documents as provided in this manual for the creation and manipulation of design files. Users must also properly create, store, and maintain the files in VDOT's ProjectWise file management system in order to provide for a smooth and timely transfer of information between the various divisions, entities, agencies, consultants, and contractors who will use the files and data created during the project.

1.1.1.2 OPENROADS TECHNOLOGY ADOPTION REQUIREMENTS

Prior to 2016, VDOT required the use of Bentley's GEOPAK as the road design software on VDOT projects. Bentley subsequently developed OpenRoads technology which VDOT began using on projects in 2016.

As documented on VDOT's [When to use OpenRoads webpage](#), OpenRoads technology will be used by VDOT employees and consultant design firms on all minimum plan projects and above where new survey was completed on or after January 1, 2016. As an option, OpenRoads technology can be used on other projects that were surveyed before January 2016 if these projects have not entered the Public Involvement phase.

1.1.1.3 OPENROADS DESIGNER TECHNOLOGY ADOPTION REQUIREMENTS

In October 2020, VDOT formally began the migration process to Bentley's OpenRoads Designer (ORD) Connect Edition as documented in a [Letter from the State Location and Design Engineer](#).

VDOT has developed an [OpenRoads Designer \(ORD\) Connect Edition webpage](#) which provides the specific information regarding the rollout of ORD including training and migration of projects. This webpage provides the specific requirements, dates, and details regarding VDOT's transition to ORD from GEOPAK and OpenRoads technology.

1.2 OVERVIEW

1.2.1 INDIVIDUAL DIVISION STANDARDS

The CADD Manual includes standards for all Preliminary Engineering Divisions including Location and Design, Right of Way, Environmental, and Materials. The Structure and Bridge CADD Standards are provided separately in the Manual of the Structure and Bridge Division. The Location and Design Division consists of multiple program areas including the following: CADD Support; GeoSpatial Program (GIS, Photogrammetry, Survey); Hydraulics and Utilities (Hydraulic Design, Utilities Design, River Mechanics); Roadway Design and Special Projects (Roadway Design, Landscape Architecture); Standards, Special Design, Policy and Quality Assurance (Design Standards, Special Design); Traffic Design (Traffic Control Device Plans, Traffic Analysis, Traffic Studies); and Water Resources Program (MS4, Stormwater Management, Resiliency). General information and standards applicable to the majority of the program areas are provided throughout the chapters of the manual while information and processes pertaining to specific program areas are contained in Chapter 4.

Although the manual will be maintained by the Location and Design Division, the individual Program Areas within the Location and Design Division will be responsible for setting and maintaining their respective standards. The Location and Design CADD Support Section will provide support and guidance to other divisions as needed to ensure their standards are consistent.

This manual will be revised by the respective support groups as needed to ensure that it is up to date with the latest VDOT standards and processes.

NO CADD STANDARDS, CELLS, TEXT SIZES, FONTS, ETC., ARE TO BE REVISED BY ANYONE OUTSIDE THE SUPPORT GROUPS FOR THE RESPECTIVE PROGRAM AREAS.

1.2.2 ORGANIZATION

The CADD Manual is broken into individual chapters as noted below:

- Chapter 1 – Introduction: Describes the background and purpose of the CADD Manual
- Chapter 2 – ProjectWise: Describes VDOT's file management system and folder structure for storage and access of files created during a project
- Chapter 3 – CADD Standards: Describes the VDOT CADD Standards used in the development of project related CADD files
- Chapter 4 – CADD Production: Provides the guidance for CADD production across multiple disciplines along with links to individual Job Aids which document the specific

processes and procedures required for creating and manipulating the CADD files and generating the required deliverables

- Chapter 5 – CADD Delivery: Describes the requirements and processes for Sealing and Signing, Electronic Delivery, archiving, and providing 3D (BIM/CIM) data
- Chapter 6 – Quality Assurance & Quality Control: Provides information on VDOT's quality control checklist and process

1.2.3 FORMAT

The information provided in the CADD Manual is presented in several formats which include: text, tables and figures contained within the written chapters of the manual; individual job aids referenced by the manual (via hyperlinks); and separate files including extensive tables and other detailed data referenced by the manual (via hyperlinks). Each of these formats are described in the sections below.

1.2.3.1 CHAPTER TEXT

The text contained in the individual chapters provide written information with tables and figures where possible to concisely explain VDOT's standards, processes, and procedures. When the type of information to be presented describes either a detailed process or procedure, or contains an extensive amount of information that would otherwise be spread across many pages of the manual in tabular or similar format, the information is instead being placed in separate documents including job aids and separate files as described below. This allows for the detailed data and processes to be edited alone without impacting the actual display and layout of the written chapters, and for ease of future revisions.

1.2.3.2 JOB AIDS

Job Aids are used to capture the detailed processes and instructions developed by the CADD Support Section or individual disciplines. Job Aids often contain a series of screen shots and step by step instructions in order to create or develop a specific file or type of data. Since these processes are subject to change and refinement over time, they are best captured in individual documents developed by the parties responsible for the process or instructions being discussed. Links are provided to the individual documents or folder containing the documents.

1.2.3.3 SEPARATE FILES

Separate files are provided where necessary for reference data including extensive lists and tables of data. These separate files include lists of file names, lists of file types or extensions, tables of level names with symbologies, list and tables of custom line styles, lists of cell libraries and cells, and other similar types of data. The types of information contained in these files is subject to change over time with new information being added and old information being deleted as feedback on the CADD standards is incorporated, and as the CADD standards evolve. These separate files are maintained by the CADD Support Section in consultation with

the individual disciplines. Links are provided to the individual documents or folder containing the documents.

1.3 FEEDBACK

If you have suggestions, corrections or additions to this manual, please submit them to the CADD Support Section preferably via E-mail to CADDsupport@vdot.virginia.gov or via phone at 804-786-1280. All correspondence will be forwarded to the appropriate individual or Division for review and will then be evaluated and brought to the attention of the appropriate Subject Matter Experts. The Subject Matter Experts will then determine whether or not to incorporate your suggestion into the standards.

1.4 REFERENCES

The following links provide direct access to information utilized during design and CADD development on VDOT projects:

[VDOT's Manuals, Guides, and IIM webpage](#)

[Project Development Process](#)

[Electronic Plan Submission Flow Chart](#)

[Instructional and Informational Memoranda](#)

[Road and Bridge Standards](#)

[Road Design Manual](#)

[Drainage Manual](#)

[Survey Manual](#)

[Traffic Engineering Design Manual](#)

[Manual of the Structure and Bridge Division](#)

1.5 ABBREVIATIONS AND ACRONYMS

Table 1-1: Abbreviations and Acronyms

Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ACES	Access Certificates for Electronic Services
AES	Automated Engineering Support
ADV	Advertisement Submission
AMG	Automated Machine Guidance
CAD	Computer Aided Design
CADD	Computer Aided Design and Drafting
CII	Critical Infrastructure Information
CIM	Civil Integrated Management
CFMS	CADD File Management System
CFG	Configuration
DB	Database
DTM	Digital Terrain Model
DGN	MicroStation Design File Format
DAT	Data File
DES	Design
D&C	Design and Computational Manager
DMS	Data Management System
ELS	Enterprise Licensing Subscription
Engr_ser	Engineering Services

Abbreviations and Acronyms

ESC, E&S	Erosion and Sediment Control
FHWA	Federal Highway Administration
FAQ	Frequently Asked Questions
FI	Field Inspection
FS	Final Submission
FTP	File Transfer Protocol
GDF	GEOPAK Drainage File
GO	Global Origin
GPS	Global Positioning System
GSA	U.S. General Services Administration
HMR	Bentley MicroStation Raster Image
IIM	Instructional & Informational Memoranda
iPM	Integrated Project Manager
ITS	Intelligent Transportation System
L&D	Location and Design
LOD	Level of Detail
LOE	Level of Effort
MDL	MicroStation Development Language
MOT	Maintenance of Traffic
MUTCD	Manual of Uniform Traffic Control Devices
OBM	OpenBridge Modeler
ORD	OpenRoads Designer
PAC	Pre-Advertisement Conference

Abbreviations and Acronyms

PAT	Pattern
PC	Personal Computer
PCR	Plan Coordination Review
PDP	Project Development Process
PE	Preliminary Engineering
PFI	Preliminary Field Inspection
PH	Public Hearing
PKI	Public Key Infrastructure
PLA	Plans
PPTA	Public Private Transportation Act
PRF	Plot Request File
PROF	Profile
PROJ	Project
PS&E	Plans, Specifications and Estimates
PW	ProjectWise
PWDM	ProjectWise Deliverables Management
PUFI	Preliminary Utility Field Inspection
RDM	Road Design Manual
REF	Reference Files
ROW, R/W, or RW	Right of Way
RTK	Real Time Kinematic
S&B	Structure and Bridge
SARA	System Access Request Application

Abbreviations and Acronyms

SOC	Sequence of Construction
SSI	Sensitive Security Information
SUDA	Subsurface Utility Design and Analysis
SUE	Subsurface Utility and Engineering
SWM	Storm Water Management
TCD	Traffic Control Device
TED	Traffic Engineering Division
TEDM	Traffic Engineering Design Manual
TIN	Triangulated irregular Network Data
TMP	Transportation Management Plans
TNM	Traffic Noise Model
TTC	Temporary Traffic Control
UFI	Utility Field Inspection
UPC	Universal Project Code
VBA	Visual Basic Application
VDOT	Virginia Department of Transportation
VITA	Virginia Information Technologies Agency
VPI	Vertical Point of Intersection
XML	Extensible Markup Language
XS	Cross Sections

1.6 DESIGN (JOB) AIDS FOR DETAILED DISCIPLINE SPECIFIC PROCESSES/PROCEDURES

As previously noted, detailed discipline specific processes and procedures have been placed in separate standalone documents (job aids) which are referenced through the chapters of this manual. These individual job aid documents are centrally located for ease of access on VDOT's website at the link below.

[VDOT Job Aids](#)

1.7 QUICK LINKS

The following links provide direct and quick access to CADD support information for development on VDOT projects:

[CADD Support Section Website](#)

[CADD Support Section Helpdesk Webpage](#)

[CADD Software and Application Support Webpage](#)

[CADD Support Section ProjectWise Webpage](#)

[CADD Training Webpage](#)

[MicroStation / OpenRoads Standards 2016 Webpage](#)

[VDOT OpenRoads Guide and FAQ Webpage](#)

[OpenRoads Designer \(ORD\) Connect Edition Webpage](#)

[ProjectWise Web Server](#)

[3D Model Development Manual](#)