

Vermont Agency of Transportation

CADD Standards and Procedure Manual 2014

VT R.R. TYPICAL SECTION

SCALE 1/4" = 1'-0"

* 2" TYPE III OVER
2" TYPE III OVER
2 3/4" TYPE II OVER
3 1/4" TYPE II

Version 08052014

Section 1 -	<u>INTRODUCTION TO VAOT CSPM</u>	<u>1</u>
1.1.	DISTRIBUTION	
1.2.	REVISIONS AND UPDATES	
1.3.	TRADEMARKS	
Section 2 -	<u>ENGINEERING FILE MANAGEMENT SYSTEM</u>	<u>3</u>
2.1.	MAPPING THE CADD WORKING SHARE	
2.2.	FOLDER STRUCTURE	
2.3.	PROJECT SUBFOLDER STRUCTURE	
2.4.	PROJECT PHASE SUBFOLDERS	
2.5.	MAP AOTCADD SERVER > T: DRIVE	
2.6.	THE T: DRIVE AND ITS STRUCTURE	
2.7.	FILE LOCATION TABLE	
2.8.	CREATE DGN FILE FROM VAOT SEED	
Section 3 -	<u>FILE FORMAT AND TRANSFER REQUIREMENTS</u>	<u>9</u>
3.1.	SUBMISSION OF ELECTRONIC INFORMATION	
3.2.	GRAPHIC FILE REQUIREMENT	
3.3.	SURFACE FILE REQUIREMENTS	
3.4.	GENERAL FILE REQUIREMENTS & DISCLAIMER	
3.5.	ACCEPTANCE OF ELECTRONIC INFORMATION	
Section 4 -	<u>FILE NAMING CONVENTIONS</u>	<u>15</u>
4.1.	STANDARD VAOT GROUP PREFIX LETTER	
4.2.	PPMS NUMBERS	
4.3.	DESCRIPTION SEGMENT OF THE FILE NAME	
4.4.	FILE NAME EXAMPLE: z05j025sv.dgn	
4.5.	NEW OR PROPOSED ALTERNATES ALIGNMENT DESIGN	
4.6.	SUFFIX USAGE FOR PROJECT PHASES	
4.7.	COMMON DESIGN FILE NAMES AND USAGE	
4.8.	InRoads FILE NAMES AND INTERNAL DATA NAMES	
Section 5 -	<u>U.S. SURVEY FEET & VT STATE PLANE GRID</u>	<u>25</u>
5.1.	MicroStation UNIT DEFINITIONS	
5.2.	VERMONT STATE PLANE GRID	
Section 6 -	<u>VAOT LEVEL LIBRARY AND LEVEL USAGE</u>	<u>27</u>
6.1.	CATEGORY PREFIX AND DEFINITION	
6.2.	THE MAJOR CATEGORIES	
6.3.	PAVEMENT VS. ROADWAY	
6.4.	LEVEL NAMES AND DESCRIPTIONS	
6.5.	STRUCTURE OF THE LEVEL NAME	
6.6.	STRUCTURE OF THE LEVEL DESCRIPTION	
6.7.	LEVEL USAGE DEFINED	
6.8.	ANNOTATION COMMENT LEVEL	
6.9.	STANDARD SURVEY DATA LEVELS	
6.10.	LIST OF LEVELS & DESCRIPTIONS	
6.11.	LEVEL LIBRARIES	
6.12.	VTLevel TOOL BOX	
6.13.	CROSS REFERENCE 1-63 TO STANDARD LEVELS	
6.14.	LEVEL SEPARATION vs. GROUPING	
6.15.	BENEFITS OF NAMED LEVELS	

Section 7 -	<u>DRAFTING STANDARDS</u>	<u>39</u>
7.1.	DESIGN FILE BASICS	
7.2.	SHEET BORDER SIZE & SCALE	
7.3.	LINE WEIGHT STANDARDS	
7.4.	LINE STYLE AND CUSTOM LINE STYLES	
7.5.	TEXT AND ANNOTATION	
7.6.	DIMENSION STANDARDS	
7.7.	COLOR TABLE STANDARDS	
7.8.	SHEET CORNER CARD STANDARD	
Section 8 -	<u>CELLS AND CELL LIBRARIES</u>	<u>57</u>
8.1.	CELL TYPE	
8.2.	CELL LIBRARY UTILITY	
8.3.	CELL LIBRARIES	
Section 9 -	<u>SURVEY</u>	<u>61</u>
9.1.	TYPICAL PROJECT REQUIREMENTS	
9.2.	PROJECT SPECIFICATIONS	
9.3.	ORIGINAL GROUND DRAWING	
9.4.	DIGITAL TERRAIN MODELS (DTMs)	
9.5.	GEOMETRY FILES	
9.6.	SURVEY DATA	
9.7.	TIE PROCEDURE	
Section 10 -	<u>DESIGN</u>	<u>67</u>
10.1.	PROJECT SETUP STANDARD	
10.2.	DESIGN STANDARD DRAWINGS	
10.3.	EROSION CONTROL DETAIL DRAWINGS	
10.4.	EXCEL SPREADSHEET FORMS	
Section 11 -	<u>SHEETING & PLOTTING</u>	<u>73</u>
11.1.	GREATER PROJ#bdr.dgn (SHEET BORDER FILE)	
11.2.	SHEETING THE PROJECT	
11.3.	STEPS TO SHEET THE PROJECT	
11.4.	CREATE LAYOUT "SHEET MODELS"	
11.5.	SHEET MODEL FROM SEED	
11.6.	REFERENCING DATA & BDR FILE	
11.7.	SHEET MODEL LEVEL & REFERENCE DISPLAY SETTINGS	
11.8.	DIRECT ATTACHMENT OF NESTED REFERENCES	
11.9.	TITLE SHEET GENERATION	
11.10.	READY FOR PLOTTING	
11.11.	CREATE SECOND GENERATION LAYOUT "SHEET MODELS"	
11.12.	SHEET MODEL STEP BY STEP CHECK LIST	
11.13.	RIGHT OF WAY PLAN GENERATION	
11.14.	PLAN SET PLOTTING	
Section 12 -	<u>APPENDIX</u>	<u>83</u>
12.1.	Appendix A - EXAMPLE TRANSFER & FILE SUBMISSION FORMS	
12.2.	Appendix B - LEVEL NUMBERS TO STD LEVEL CROSS REFERENCE	
12.3.	Appendix C – SUPPLEMENTAL	
12.4.	Appendix D - CUSTOM LINE STYLE REFERENCE	
12.5.	Appendix E - SURVEY DATA SUBMISSION CHECK LIST	
12.6.	Appendix Z - CSPM AMENDMENTS LISTING	

Notes:_____



SECTION 1 - INTRODUCTION TO VAOT CSPM

1. INTRODUCTION

The primary functions of the CADD Standards and Procedure Manual are to:

1. Provide requirements and guidance on CADD methods and policies which are as current as practical.
2. Assure uniformity of practice for projects designed by or for the Agency.

This manual does not eliminate the need for other references or training. Instructions from CADD support, books, publications and other related material may need to be referred to for further details, or clarification. Portions of the material in this manual may be specifically superseded by subsequent Official Issuances of the Agency (e.g., Engineering Instructions).

Variations from this manual will be necessary for special or unusual conditions, or between the issuances of new or revised source documents and any corresponding updates of the CADD Standards and Procedure Manual. Consequently, instructions in this document are not intended to preclude the exercise of individual initiative and judgment in reaction to project specific conditions or application of current state of the art practices. Rather, such initiative and judgment is encouraged when it is appropriate and there is a rational basis for deviation. However, it is equally important that there be consistency in the application of this manual. The objective is uniformity of process and presentation.

1.1. DISTRIBUTION

This manual, in its entirety, may be freely copied and distributed for the purpose of providing a consistent guide to the CADD requirements of the Vermont Agency of Transportation. The manual, Standard CADD files and other support files can be downloaded from the VAOT CADD website at the following address.

<http://www.aot.state.vt.us/caddhelp>

1.2. REVISIONS AND UPDATES

The office of VAOT CADD support IT section, with input from the VAOT CADD Technical Committee, CADD users and the consultant and construction community, will develop and maintain standards and Procedure for the Agency's CADD related activities. CADD Manual holders are encouraged to submit comments and suggestions for improvements to the manual or VAOT CADD Standards. If you have comments or suggestions please email: AOTCaddMaster@state.vt.us

The Vermont Agency of Transportation strives to stay current with state of the art trends in AEC technical advancements. Impacts on project delivery schedules and the resources necessary to provide future support for new features must be considered prior to any change.

Updating this manual is intended to be an ongoing process. Revisions will be issued periodically and posted at the CADD website address shown in section 1.1 Distribution.

Revisions to this manual will be documented in the appendix Z - Amendments.

1.3. TRADEMARKS

"MicroStation", "InRoads", "InterPlot" and "ProjectWise", are all registered trademarks of Bentley Systems, Incorporated. Other trade names computer protocols, and file formats mentioned in this manual are the trademarks of their respective owners. In no event will the appearance of any graphic, description of a graphic, picture, screen display, or any other method of conveying meaning, be considered to impair the rights of the respective owners.

SECTION 2 - ENGINEERING FILE MANAGEMENT SYSTEM

2. INTRODUCTION

Where are Files located and how are they accessed? VAOT has a standard file storage and folder structure designed for all Engineering project data and related project data files. This file management system is based on the standard hierarchal, folder, subfolder and file name system. VAOT designated a specific folder structure and a file naming convention that is replicated in all projects resulting in consistent reliable data retrieval throughout the VAOT Engineering staff. This system allows for maximum efficiency in file management and accounts for a network of file referencing and identifies the location of references through the logical path. Design staff are aware of the path and name of files they are required to compile to create their portions of the project to supply finished Engineering Plan sets. Finished Plan set documents are currently produced in Portable Document Format (PDF) then then paper hard copies when required for construction and reference material.

2.1. MAPPING THE CADD WORKING SHARE

All Computer Aided Design and Drafting project files are accessed through the mapped network Drive letter (M:). The network share [\\aotcadd\caddwrk\\$](#) must be mapped to access project CADD files. Standardizing the drive letter to M: insures that all refereeing and linking through agency departments works consistently. All VAOT CADD users must map this drive. Use the Windows Explore > Tools > Map Network Drive... > to access the map network drive dialog. Select the Drive letter M: from the pull down list. In the Folder: window type in [\\aotcadd\caddwrk\\$](#) and toggle on the Reconnect at logon option then click the Finish button.

2.2. FOLDER STRUCTURE

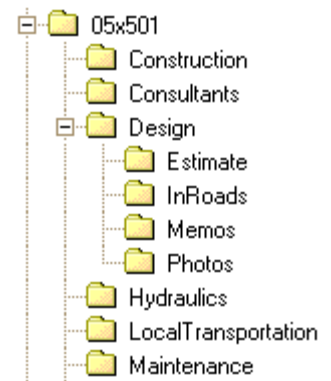
Currently all Engineering Files are stored in the directory path under the Projects folder then under one of the Engineering disciplines or functions shown below. The typical location for a VAOT project is M:\Projects\{PPMS#}\{Section}\...

VAOT Engineering File Management System, Development disciplines.

- | | |
|------------------------|-----------------------|
| 1. Construction | 9. Rail |
| 2. Consultants | 10. Resource |
| 3. Design | 11. RightOfWay |
| 4. Hydraulics | 12. Structures |
| 5. LocalTransportation | 13. Survey |
| 6. Maintenance | 14. Traffic |
| 7. MaterialResearch | 15. TrafficOperations |
| 8. PavementManagement | 16. Utilities |

2.3. PROJECTS SUBFOLDER STRUCTURE

Each of 16 discipline folders has an established a directory structure, as defined and documented by personnel responsible for each discipline. An example shown to the right project 05x501 has a subfolder named Design for Roadway Design files. All DGN or CADD files should be stored in the Design folder, subfolders below that can be created to store InRoads data files, Photos, and Memos related to the project etc. NOTE: creating folder names that are longer than necessary can effect file management and documentation. Remember not to push Design files any deeper into the directory structure than necessary.



2.4. PROJECT PHASE SUBFOLDERS

In occurrences where a project is divided into Phases, Subfolders directly under the section folder can be used to separate the various Phases of a project such as P1, P2, and P3 etc. All DGN or CADD files would be stored in the Phase (P*) folders. Subfolders under the phase folders would store InRoads data, Memos etc. For the purpose of this document a **Phased project** is a project that has been divided into segments to be constructed and/or designed separately but under the same PPMS number.

(Consultants) *Consultants should replicate the directory structure shown in this Section. All projects should have a folder with the VAOT PPMS numbers as the name, then subfolders as shown above. Files received from VAOT as reference material should be placed in the proper VAOT discipline folder. All consultant files should be stored in the Consultants folder. When delivering files to VAOT; send the project Consultant folder and its required content only.*

2.5. PROJECT CONSULTANT DELIVERABLES

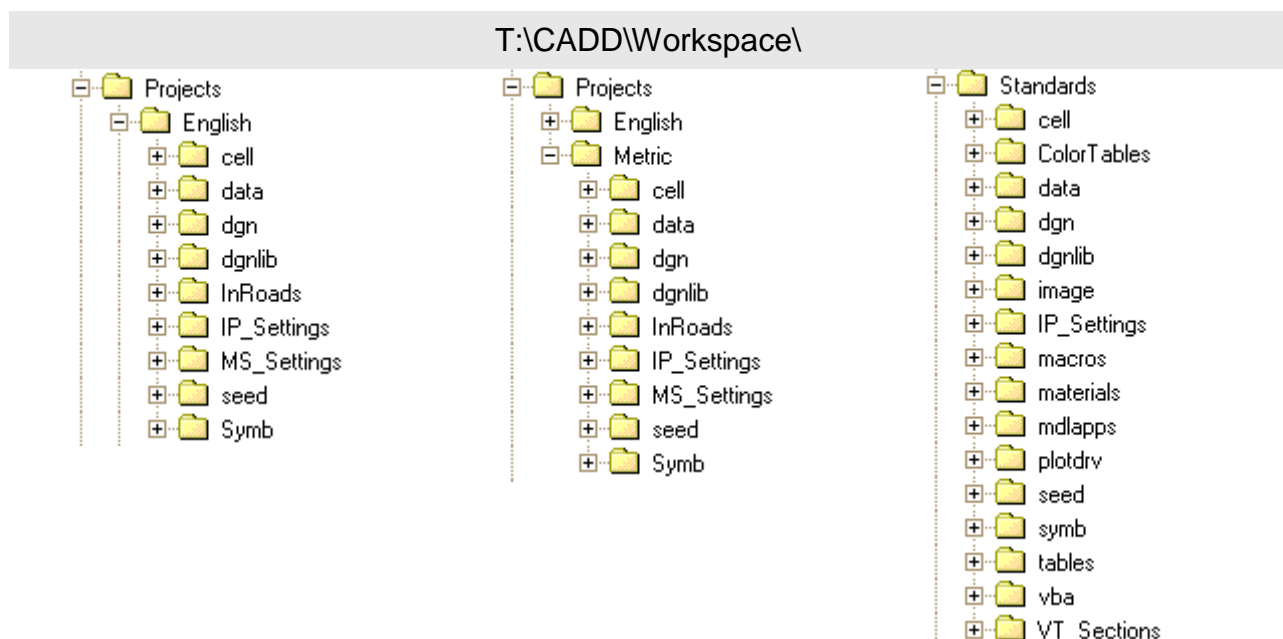
All Agency projects that are being designed by Consulting Engineering contracts are required to follow the Agency CADD Standards as shown in this manual or as directed by Agency Project Managers. All project CADD data files are also required to be submitted to the agency at project milestones and as directed by Agency Project Managers. Files submitted are subject to standard checks for validation of standards compliance. Any files that are not in strict conformance to Agency CADD Standards may be rejected and require resubmission with modifications to meet the standards. The Agency expects that Consulting Engineering firm personnel working on Agency projects are knowledgeable and keep up-to-date with Agency CADD Standards. Agency CADD Standards are in place to maintain CADD data integrity across all projects. The Agency is responsible for keeping and maintaining state infrastructure data. CADD data is a valuable data source, useful in tracking quantity values, and infrastructure management, as well as providing intelligent construction data models. These same principles of CADD Standards compliance and data integrity apply to Agency in-house projects equally.

2.6. MAP AOTCADD SERVER > T: DRIVE

[\\aotcadd\caddv8i](#) VAOT has a CADD server, this server stores all project related design files and documentation stored on the EFM system. In addition to project related storage the CADD server stores all CADD application configurations and standards utilized by VAOT. For MicroStation to work properly the [\\aotcadd\caddv8i](#) network connection must be established as the mapped drive T: on your workstation. **Each user must map the T: drive** on each workstation they are assigned.

2.7. THE T: DRIVE AND ITS STRUCTURE

- T:\CADD\Workspace
 - Standards – Non unit specific MicroStation and other CADD files are located under this Folder; examples shown below.
 - Color Tables – MicroStation and IPLOT color tables
 - Plot Drivers – MicroStation print/plot Drivers
 - MDLapps – A collection of MDL applications such as Modz.ma
 - Projects
 - English –
 - Cells – MicroStation Cell library files
 - Dgn – Drawing Standards, details and forms
 - IP_Settings – InterPlot Organizer (*.ips) settings files
 - Seed – VAOT MicroStation Seed file
 - Symb – Line Style resource file storage
 - Metric –
 - Cells – (Same as English)
 - Dgn – (Same as English)
 - IP_Settings – (Same as English)
 - Seed – (Same as English)
 - Symb – (Same as English)



2.8. FILE LOCATION TABLE

The information below will aid in location of the various files stored on the AOTCADD server mapped as T: Drive.

Project English or Metric specific <T:/CADD/Workspace/Projects>

Files that are unit specific (**Imperial or SI**) are categorized into two project folders i.e. *English* and *Metric*. The English and Metric project folders are located as show below.

<T:/CADD/Workspace/Projects/English> or <T:/CADD/Workspace/Projects/Metric>

A description of files and the extended address paths beyond the English or Metric folders are shown in the table listing below. This table is for your assistance in file location.

Table 2a

File Description	English	Metric
General CADD files		
MicroStation DGN seeds	...\seed\vtseed3d.dgn	...\seed\vtmseed3d.dgn
Cell Library file locations	...\cell	...\cell
General Detail DGNs	...\dgn\details	...\dgn\details
Erosion Control Detail DGNs	...\dgn\details\Erosion	...\dgn\details\Erosion
NETC Rail Detail DGNs	...\dgn\details\NETC_Rail	...\dgn\details\NETC_Rail
Traffic Calming Detail DGNs	...\dgn\details\Traffic_Calming	...\dgn\details\Traffic_Calming
Excel Worksheet Forms	...\dgn\Excel-Forms	...\dgn\Excel-Forms
DGN Worksheet Forms	...\dgn\forms	...\dgn\forms
VAOT Design Standard DGNs	...\dgn\std	...\dgn\std
*Location Map DGNs (By County)	...\dgn\Map\ [?-County]	N/A
State Map DGN (GIS 2003)	...\dgn\Map\VtAllroads.dgn	N/A
Ortho Photo Index (Grid No Ref.)	...\dgn\Map\orthoidx.pdf	N/A

* Location Map DGNs were created in an earlier version of MicroStation and have scale factor and resolution irregularities, for this reason you should make sure to toggle off the true scale option when referencing up these files. There is still the possibility that these files will not reference in at the proper scale so care should be taken when using these files.

InRoads Specific Files

Preference Files	...\InRoads\Prefs	...\InRoads\Prefs
VAOT Super Elevation Tables	...\InRoads\super	...\InRoads\super
Typical Section Library (seed)	...\InRoads\template	...\InRoads\template
Survey Preference Files	...\InRoads\Prefs\Survey	N/A
Survey Options File	...\InRoads\Prefs\Survey	N/A
Survey Feature Table	...\InRoads\Prefs\Survey	N/A

Plot Settings and Resymbolization Files

Standard Iplot Settings File	...\IP_Settings	...\IP_Settings
------------------------------	-----------------	-----------------

Engineering Settings Files	...\IP_Settings\Engineer	...\IP_Settings\Engineer
Plot Pentable Files (pen)	...\IP_Settings\Pentables	...\IP_Settings\Pentables
MicroStation Pentables (tbl)	...\IP_Settings\Pentables	...\IP_Settings\Pentables

VAOT standard color table files are in <T:/CADD/Workspace/Standards/ColorTables>

2.9. CREATE DGN FILE FROM VAOT SEED

As shown in the table above we have two seed files; one for English projects and one for Metric projects. These seed files can be dragged into the project folder and renamed when a new DGN file is required. Alternately users can open a seed file (Read-only) and perform a “Save As” on it to your project folder location.

The main difference in the two seed files is the master units; and sub units as shown below:

- English Seed file - vtseed3d.dgn
 - Settings > Design File > Working Units
 - Master Units = Survey Feet ‘
 - Sub Units = Survey Inches “
- Metric Seed file - vtmseed3d.dgn
 - Master Units = Meters **m**
 - Sub Units = Millimeters **mm**

VAOT seed files contain the above master unit and sub unit design file settings. Deviations from the above shown “Working Units” settings are not permitted.

SECTION 3 – FILE FORMATS & TRANSFER REQUIREMENTS

3. INTRODUCTION

This section defines requirements for the preparation and transfer of CADD related information during the project development process. In addition, an outline of what information is to be transferred, the specific format of the information, who is expected to provide the information (the supplier), and who will receive the information (the customer) is defined. Agency suppliers refer to persons directly employed by VAOT. Consultant suppliers refer to consultant firms hired to provide engineering services for VAOT.

Following are several examples of data flow:

1. A Private Survey Group or consulting firm (the supplier) provides base mapping survey data to an Agency Design Group or consulting firm (the customer) for use in progressing, the design of a project.
2. A Private Design Group or consulting firm (the supplier) provides engineering services for the entire design of a project and then provides that information to the Agency Construction Group (the customer) for use during construction of a project.
3. A Private Design Group or consulting firm (the supplier) provides engineering services for Design Phases I through IV of a project and then provides that information to an Agency Design Group or consulting firm (the customer) for use during Design Phases V and VI of a project.
4. A Private Design Group or consulting firm (the supplier) provides engineering services for the design of a project and provides information to a VAOT Design group (the customer) to provide engineering services on a section of the project.

While this is not an all encompassing list, it does cover the majority of electronic data transfers throughout the project development process.

3.1. SUBMISSIONS OF ELECTRONIC INFORMATION

Requirements for the submissions of electronic information are as follows:

1. The supplier shall provide the customer with the information, in electronic format, described below in items (a) through (e). The supplier shall use MicroStation and InRoads Civil Suite products to create all files submitted as outlined.
 - a. The supplier shall submit graphic files in MicroStation (.DGN) format. All CADD Graphic files shall be created using MicroStation. Files which are .DXF, .DWG, .IGES, etc. are not acceptable formats.
 - b. The supplier shall submit surface files in InRoads Digital Terrain Model (.DTM) format. All DTM files shall be created using InRoads Civil Suite products.

- c. The supplier shall submit alignment and coordinate geometry point data for all existing features in an InRoads alignment file (.ALG) format. All ALG files shall be created using InRoads Civil Suite products.
 - d. Record plan alignments shall be submitted in InRoads alignment file (.ALG) format. All ALG files shall be created using InRoads Civil Suite products.
 - e. Survey data collected shall be provided in ASCII format *.raw, *.rw5 collection data and *.FWD InRoads Survey Field book data format. Additional audit trail logs should be provided for all data collection edits through InRoads Survey and saved in the FWD.
2. Consultant suppliers shall submit files through the Agency's FTP site <ftp://www.aot.state.vt.us>. Consultant suppliers can obtain access to the FTP CADD\Incoming folder by requesting the CADD FTP User Name: _____ and the Password _____ from the VAOT Project Manager or Designated Agency Contact.
3. All files shall be checked for computer viruses before submission. Files which contain viruses are not acceptable.
4. For every project submission a **transmittal letter** in the form of the (File Submission Index form **FSI**) to and from the customer (VAOT) shall be prepared which includes a listing of files being submitted. This transmittal letter shall be included with the project submission to the appropriate FTP CADD\Incoming folder. An email with hyper link to the FTP folder will then be sent to the appropriate VAOT Project Manager or Designated Agency Contact. The **FSI** listing shall include Project Name:, Project Number (VAOT PPMS):, The **FSI** should be address with attention VAOT Project Manager or Designated Agency Contact, then a list of other participating contacts. The submission shall also be numbered and dated, e.g., Submission #1, 02/09/2006. Modification or Revisions will be briefly described on the FSI form. Multiple FSI sheets can be used if required.
5. All submissions shall be compatible with the current versions of CADD software in use by VAOT as designated in this manual and the VAOT CADD status web page.
6. Agency suppliers shall use approved versions of CADD software. Consultant suppliers shall use approved versions of MicroStation and InRoads Civil Suite products.
7. Consultant suppliers may submit electronic files in other than the stated versions of VAOT CADD software standards, as long as the files are compatible with VAOT CADD software standards. A written request shall be sent to VAOT stating the version of the VAOT CADD software standard the consultant supplier is requesting to use for the submission. This request shall be directed to and approved by the Project Manager or Agency Designated Contact.

8. The supplier shall ensure that the contents of all electronic files are the same as any hard copy information submitted (i.e., survey notes or paper plots).
9. The supplier shall name all files as stated in Section 4 of this manual. The **FSI** shall be named in accordance with the standard naming convention (e.g. z05x501fsi_1.doc) where the z, indicates a consultant file; 05x501 is the VAOT PPMS number; fsi, is the description; _1 matches the submission number; doc, indicates this is a word document.

3.2. GRAPHIC FILE REQUIREMENTS

Requirements for all graphical CADD files are as follows:

1. All graphic files submitted shall be in a MicroStation (.DGN) format. **The supplier shall use MicroStation for all graphical CADD work being submitted.** All graphic files shall conform to applicable Sections in this manual. Any questions regarding items not included in this manual, or interpretations of this manual should be addressed to the CADD support Section of the VAOT. Consultant suppliers should direct questions regarding interpretations of this manual to the CADD support Section through the Project Manager or VAOT Designated Contact as applicable.
2. All text shall conform to the requirements outlined in Section 7 (Drafting Standards) of this manual.
4. Text shall be readable from left to right or bottom to top of the final printed drawing.

Existing Information **(See General File Requirements)**

Proposed Information **(See General File Requirements)**

Detail Drawings and Tables **(See General File Requirements)**

3.3. SURFACE FILE REQUIREMENTS

Existing Features **(See General File Requirements)**

Proposed Features **(See General File Requirements)**

3.4. GENERAL FILE REQUIREMENTS & DISCLAIMER

1. The Vermont Agency of Transportation (Agency or VAOT) has developed these requirements to ensure that all electronic CADD files delivered to and taken from the Agency are in formats that can be utilized for engineering purposes without modification. The following will explain the requirements set forth by the Agency for developing and transferring projects in electronic formats. The Agency will not accept or pay for any CADD files relating to a project which do not adhere to these requirements. All supporting documents referenced in this document are available on the VAOT web page at <http://vtranscaddhelp.vermont.gov/>.

2. All projects must adhere to the deliverable requirements of the lead program in their entirety. The projects requiring a MicroStation native binary format deliverable only, can be created and modified using any graphics software; however, the consultant shall be responsible for any and all translations, at no additional cost to the Agency, and shall be in full compliance with the VAOT CADD Standards as outlined in the appropriate program workflow for the project found on the VAOT web page at <http://vtranscaddhelp.vermont.gov/> . All other projects requiring MicroStation/InRoads shall be created, modified, and transferred to and taken from the Agency in MicroStation/InRoads native binary format. See attached matrix for additional deliverable requirements.
3. All CADD files shall be created and transferred to the Agency utilizing the VAOT naming convention. All consultants shall utilize a prefix of “z” in order to distinguish the files as consultant project files. Refer to the prefix definitions table Section 4.1 of this manual.
4. Electronic files shall be transferred to and taken from the Agency in Windows NT or Windows XP compatible systems utilizing one of the following methods, (coordination of all file transfers shall go through the VAOT Project Manager or Designated VAOT Contact):
 - a. File Submission via FTP, (refer to Section 3.4 this document) with all data files in accordance with this manual.
 - b. CD or DVD optical read media, with all data files in accordance with this manual.
 - c. With prior approval From VAOT Project Manager or VAOT Designated Contact other File Submission could be acceptable.
5. All files shall be created from the proper VAOT seed file containing the correct working units for the specified design file. Seed files are available on the VAOT CADD web page at <http://vtranscaddhelp.vermont.gov/> .
6. All three dimensional (3D) files shall be drawn with elements at true elevations and tied to Vermont State Plane Grid, unless otherwise specified in the program workflow. Elements which do not have an elevation (e.g. cross sections, typical sheets, profiles, alignment centerlines, and text descriptors) shall be created at elevation zero.
7. All data pertaining to a surface model shall be transferred to and taken from the Agency in InRoads Digital Terrain Model (DTM) binary format. The same InRoads DTM binary file representing the original ground survey shall be used throughout the project development process.
8. All level structures and level symbology shall be in compliance with VAOT CADD standards. Projects requiring the use of InRoads shall utilize the appropriate preference files which contain specified level structures, level symbology, text sizes and fonts. Standards and InRoads preference files as outlined in the appropriate program workflow for the project are available on the VAOT web page at <http://vtranscaddhelp.vermont.gov/> .
9. Any files (e.g. PROJ#sav.dgn, PROJ#-og.dtm) transferred to and taken from the

Agency containing original survey data shall never be modified, but shall be utilized only as a reference file.

10. All cells utilized on a project (including existing topographic features) shall be from the appropriate VAOT cell library which is available on the VAOT CADD web page at <http://vtranscaddhelp.vermont.gov/> . VAOT font resource file (font.rsc) and line style symbology files (elines.rsc or mlines.rsc) are required on all work for the Agency (this allows a consistent appearance on all projects).
11. A document entitled PROJ#fsi_1.doc shall be created for all projects reflecting the parameters of all electronic files (refer to Section 3.1 par 4 this document). The PROJ#fsi_1.doc shall be transferred to with the data file transmission.
12. Raster image file formats shall be in compliance with one of the following:
 - JPEG for color and grayscale
 - TIFF (CIT type 4) for monochrome line work raster
13. Any output in color for use as a display (e.g. public hearing, necessity hearing) shall be created using the VAOT color table which is available on the VAOT CADD web page at <http://vtranscaddhelp.vermont.gov/> .
14. All plots shall be created maintaining contiguous project files and shall follow VAOT plotting and sheeting workflows as outlined in Section 10 of this Document.
15. VAOT WEB PAGE AND FTP SITE DISCLAIMER:

The files located through the server are subject to change. The recipient will be responsible for maintaining contact with the Vermont Agency of Transportation to determine if any future VAOT changes affect the work being produced by the recipient. Although VAOT makes every effort to ensure the accuracy of its work, it cannot guarantee that the transferred files are error free. VAOT is not responsible in any way for costs or other consequences, whether direct or indirect, that may occur to the recipient or any subsequent users of the information due to errors, whether detected or not, that may or may not be detected.

The data conveyed to the recipient was developed for the Bentley CADD system and there are many areas where file data cannot be made compatible with other CADD software. The recipient is responsible for determining the incompatible file data and the resolution of any incompatibilities.

3.5. ACCEPTANCE OF ELECTRONIC INFORMATION

3.5.1. All Files

Acceptance of submissions for all files will be as follows:

1. The customer may review and comment on the information submitted by the supplier to ensure conformance with VAOT standards.

2. The customer may run a virus check on every submission before doing any other review. If a virus is encountered, said submission will be deemed invalid then deleted. Immediately the supplier will be notified that a virus was detected, what software package was used to discover said virus and that the submission was not accepted.

3.5.2. Graphic Files

The supplier is responsible for conformance with this Section and may use the same guidelines as the customer to evaluate conformance. Guidelines which shall be used by VAOT in its evaluation of the graphic files are discussed in items 1 through 5:

1. Graphic files may be reviewed on a level by level basis to ensure adherence to element attributes as described in this manual.
2. Graphic files may be viewed from several view rotations (including isometric, front and side views) to examine for elements at incorrect elevations. Elements at incorrect elevations are not acceptable.
3. Graphic elements may be analyzed using the information command within MicroStation for conformance with the prescribed sizes and other designated attributes.
4. InRoads tracking command may be used to determine if elements are in the correct coordinate location.
5. Right of Way plans and tiles section plans shall be drawn in 2 Dimension files only, no 3 Dimensional ROW plans shall be accepted.



SECTION 4 - FILE NAMING CONVENTIONS

4. INTRODUCTION

VAOT has an established file naming convention. This file naming convention is in part intended to eliminate the duplication of any file name throughout the entire collection of CADD data files. VAOT has accumulated a large number of DGN and other file formats. A system has been established to identify the data content of a file, such as a DGN MicroStation file or InRoads data file by the name of the file (the naming of the file identifies the type of file and data contained in the file). This naming convention identifies the file and assures that everyone understand what the file is and what data it contains. Establishing naming conventions is a very important part of managing digital engineering data. Graphical engineering data files will eventually be referenced or compiled to create Engineering plan sets or Construction Documents. Construction Documents, after a project is completed and “as constructed” notations are documented, will then go on into a Document management system for archival and future reference.

The efficient sharing and transfer of information from consultants to VAOT and vice versa, relies on the use of a systematic file naming convention. This section outlines a consistent, comprehensive file naming convention for graphic and associated files used in the CADD environment which shall be used for all projects.

Standard naming conventions shall be used for all design files, standard input files and InRoads data files. In the event a particular file type for the project is not addressed by this manual, use the file naming convention as a template for selecting an appropriate name.

(Consultants) *All files submitted to the customer VAOT will be listed by file name on the FILE SUBMISSION INDEX FORM or FSI. The FSI will be retained as a record of each files transmission.*

4.1. STANDARD VAOT GROUP PREFIX LETTER

Prefix letters Link to >> [Standard Prefix Groups Table](#) In accordance with **EFM** system it is essential that no duplication of file names occur within the file management system. Individuals that do not follow the “**No duplication**” of file name rule will cause problems especially during Data migration procedures where a reference file search scan is implemented. Each Design Section must begin all their files with standard prefixes established in the table. If files are copied from one section to your section, you must rename the file by adding your prefix letter (no exceptions).

Prefix	Group	Title / Division
b	cta	Contract Administration
c	cst	Construction
d	des	Design
g	gar	Garage
h	hyd	Hydraulics
i	ift	Information Technology
k	ltf	Local Transportation Facilities
m	mar	Material and Research
n	man	Maintenance
p	pav	Pavement Management
r	row	Right of Way
s	str	Structures
t	tfc	Traffic
u	utl	Utilities
w	env	Environmental Resources
x	sur	Survey
y	rai	Rail
z	cos	Consultants

4.2. PPMS NUMBERS

VAOT uses **P**reconstruction **P**roject **M**anagement **S**ystem (PPMS) number identifier system. From the inception of a project a PPMS number is assigned to each project. This number is critical to the VAOT **EFM** system and plays a key roll in file naming. All project related Design Files have the PPMS number directly following the section or division prefix letter. The PPMS number is used to name the principal project folder in the **EFM** system. All project related files are then stored in Section or Divisions subfolders i.e. Design, Structures, and Survey etc.

4.3. DESCRIPTION SEGMENT OF THE FILE NAME

In the EFM system we have established the standard structure of folders within the project and its naming conventions. We have established a standard naming convention for all project related design files and its importance in the EFM system. The description segment of this file naming convention is the individual files content description which will standardize the identification of the contents of the Design file for all VAOT design data. Below is listed the rules for the description segment of the file name:

- Located directly following the last number of the PPMS.
- Size between 2 to 8 characters in length.
- Normally all lower case letters.
- No spaces or (\ / > < , . ; : ~ ! @ # \$ % ^ & * () | `) special characters allowed.
- Locating a file in a different folder does not exempt it from the “*No File Name Duplication Rule*”; all Design files that are part of a project design package need to follow the file naming rules.

4.4. FILE NAME EXAMPLE: x05j025sv.dgn

This is the original ground design file from the Survey Section. This file is never manipulated or altered; it is an informational reference file only. Future design files can be copied from this file but graphics should be deleted and the file must be renamed. The sv.dgn file should be referenced into plan topographic sheets and used to show existing ground features such as Edge of Road, Building, Rivers Edge etc.

4.5. NEW OR PROPOSED ALTERNATES ALIGNMENT DESIGNS

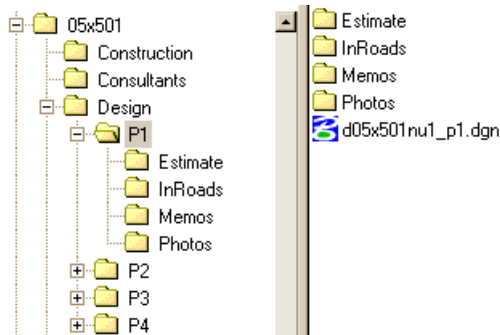
New or proposed feature drawings often have several alternate design options. The standard descriptive segment of this drawing file is “**nu1**”. This drawing contains the bulk of the projects graphical roadway design data. It is often the case in preliminary design to have several (often 3 to 4) alternate design options. An accepted naming convention to handle this scenario is to use the descriptor **alt1**, **alt2**, **alt3** and so on.

As a clarification a design alternate is not the same as file versioning. Alternates are simultaneously designed and presented to achieve consensus on what is the best case design alternate. File versioning is a form of saved backup for linear changes made to a file (versioning is not used in VAOT graphical Design data files).

When the best case design alternate is chosen, the alt# file that contains the graphical data for this design is saved as the **nu1** file. The nu1 file always contains the accepted design data. All agency section personnel should understand and be able to rely on the **nu1** file to be the most up-to-date and accurate design graphical data solution. Use of the **nu1** file and other naming conventions insures that we can always find the proper data (via file name) using the rules established by the VAOT standard file naming convention.

4.6. SUFFIX USAGE FOR PROJECT PHASES

In the case where a project is phased a suffix is used to achieve proper naming and avoid file name duplication. As stated in Section 2, Phase folders (P*) may be created in the projects sections folders. These phase folders would be named to match the projects phase; i.e. Phase1 or P1. A project that is phased would have design data files related to each phase. As an example, project PPMS Number 05x501 under



Design has 4 phases i.e. Phase 1-4. If this was a Roadway Design project the project folder structure would be as shown here. In the Design folder a subfolder for each phase was created within the folders, subfolders for each phase specific data files were then created. Drawing or DGN files are stored in the P1 folder directly and the naming convention for a typical new or proposed feature drawing is shown correctly with the 2 character suffix option usage.

First, the lower case (**d**) is the section prefix; then, the full PPMS number (**05x501**); then, the descriptive segment of the file name (**nu1**); then, add a suffix of (**_p1**). In summation, this file contains graphical data (indicated by the **.dgn**) pertaining to Phase-1(**_p1**) with the new or proposed features (**nu1**) of the project (**05x501**) generated by the Roadway Design Section (**d**) of VAOT.

4.7. COMMON DESIGN FILE NAMES AND USAGE

PROJ#sv.dgn

This is the planimetric graphics of existing ground topography. This file is generated from survey data, generally by the Agency Survey Section. This file is never manipulated or altered - it is an export (or graphical report) of survey data. All sv.dgn files from the VAOT survey Section will have the prefix (**x**) and will be located in the Survey Folder of the EFM system. This is a 3 Dimensional topographical file representing original ground features and points in Vermont State Plane Grid and the North American Vertical Datum.

(Consultants) Consultant zPROJ#sv.dgn files (when the consultants performed the actual survey) will be located in the projects Consultant folder. Consultants files submitted with any prefix other than (**z**) will not be accepted by VAOT. If a consultant uses a VAOT survey file they should not rename the file nor attempt to submit it to VAOT. All edits needed regarding existing topographic data are handled using annotation in the zPROJ#top.dgn.

PROJ#wrk.dgn

This is the InRoads work file where all InRoads work is performed. Create this file by creating a new DGN from seed. The **PROJ#sv.dgn** is referenced into this file so existing topographical information can be obtained as needed i.e. survey points, location of breaklines, etc.

When a suitable alignment has been attained, a profile and cross sections are generated. The alignment information is copied into **PROJ#nu1.dgn** and the profile and cross sections are generated into **PROJ#xs.dgn** where the finishing touches are added for the submittal being prepared. The **wrk** file serves as a blank CAD drawing, available to view geometry and surface information without the clutter of other active elements in the file. Working in a blank drawing, you can turn all the levels on to avoid viewing something and having to “hunt” for it; then finding that the level was turned off. In many projects it is necessary for each designer working on the project to have their own **wrk** file, adding their initials as a suffix to the file name. Remember graphics in any **wrk** file are never considered part of the project; this file is a blank slate for working InRoads Design data.

(Consultants) The **wrk** drawing file need not be submitted with new or proposed graphical data as part of the design. While the **wrk** file is often referenced by the **nu1** it should never be the source of the design data. No **wrk** file graphical data will be considered acceptable by VAOT. If it is part of the design then it needs to be in the proper file i.e. **nu1.dgn**, **xs.dgn** etc. We will not use or accept any data in the **wrk** file received from Consultants. All **wrk** file graphical data is considered deficient or oddments; no exceptions.

PROJ#xs.dgn

This is the cross section design file and contains profiles and cross sections for the project. On very large projects that have many profiles and cross sections it may be necessary to have a separate file for profiles but this is usually not necessary.

After the profiles and sections have been generated in the **PROJ#wrk.dgn** file and are in their final stages of design, they will be regenerated in this file and annotation added for the project submittal. This allows the User to delete the profiles and cross sections

from the **PROJ#wrk.dgn** file which reduces the size of **PROJ#wrk.dgn** considerably. Another advantage of having a separate file for profiles and cross sections is so you can continue design work in the **PROJ#wrk.dgn** file while someone else can be annotating and finalizing in the cross section file.

PROJ#nu.dgn

This file contains all of the **new or proposed features** of the project including the new alignment, curve data, bridge, proposed notation (drainage flag notes, construction notes, etc.) and stationing. Much of the information in this file, with the exception of the proposed notation (i.e. Begin/End Bridge, etc.) and construction notes can be copied from the InRoads working file **PROJ#wrk.dgn**.

In the event that the alignment changes and new alignments are created, it is advisable that you use a different preference set for that alignment in the **PROJ#wrk.dgn**. This way you can generate the new alignment in the file and it will be on a different level than the original alignment. You will be able to shut one alignment off when required while leaving other alignments on. The VAOT preference file provides 5 options for different alignment levels.

PROJ#top.dgn

This is the topographic annotation file. It contains existing feature annotations for the project. Existing **topographic** notation is stored in this file. It is often helpful to use the **PROJ#rw5** file from survey that contains the surveyor's comments when adding your topo annotation. Minor changes to existing topographic elements can be annotated and or drawn in this file. For example if a tree no longer exists in a certain location, a note can be shown in the top.dgn so that all users of the top.dgn and sv.dgn are aware of the discrepancy. The top.dgn is used in conjunction with the sv.dgn. The sv.dgn shows topographical features and survey data while the top.dgn is used to annotate the topographical features.

PROJ#bdr.dgn

This is the border file it contains layout sheet borders, layout scales, north arrows, MATCHLINES and reference file clipping boundary elements. All design layout cut sheets are created from this design file with the necessary files referenced and clip boundary lines (Level NBC1-NBC6) are drawn appropriately. With the introduction of sheet files we will still maintain the use of the **bdr** file for organizing and placement of layout border cells. The **bdr** file will be referenced into the sheet files or models where reference clipping and rotations will be setup. Sheet files or models are then added into a batch plot application such as plot organizer for paper printing or generating a Portable Document Format (PDF). The Title Sheet border can be added to the bdr.dgn or a separate title.dgn may be used. The title sheet border is referenced not copied into its respective bdr.dgn or title.dgn. All annotation associated with the Title Sheet should be on level NBT and NBT_T.

The bdr.dgn can be used to setup Sheet Models or Model based Plotting. This is where you clip bound the reference files and organize the levels as needed for the particular sheet's plotting. A bdr.dgn can contain several sheet definitions. The number of sheets setup in a file can vary; some may prefer to have a one sheet per design file,

while others prefer to cluster layouts in one design file resulting in a design file with several sheet model definitions. In the clustering system you would have a sheet file for all drawing disciplines i.e. you would use a **bdr.dgn** for standard layouts and a **bdr_ero.dgn** for erosion control layouts. If you have a 1 to 1 scenario you will have a Sheet file DGN for every cut sheet. The cluster method has obvious advantages but requires a good understanding of MicroStation models. Sheeting Models contain no design graphics (features or annotation), they only contain sheet/plotting parameters. In any method used all project borders are laid out in the bdr.dgn. Sheet files/models will contain **no project graphical data** only references to the bdr.dgn and project topographical files.

(Consultants) Submission of the border file should be included with proposed topographical data files submissions. The border file is the key to plotting and creating plan documents.

PROJ#frm.dgn

This is the design file that has form files attached, contains linked spread sheets or imported text, and includes typical form sheets for the project.

PROJ#ti.dgn

This file contains survey control information including GPS Control Points with their General Descriptions, Traverse Points with coordinates and field ties, and Alignment data with final alignment point coordinates and/or curve data. Field ties are shown here. The tie or (ti) sheet identifies a project's Datum (see Section 5) and coordinate shift values when applicable. The Agency Route Survey Manual contains specific information for horizontal and vertical control Tie procedures. Assembling the Tie DGN is covered in the Survey Section of this manual.

Other Common File names and Typical Usage Descriptions are listed below. All file names must include the group prefix followed by the PPMS number then the descriptors as shown below. Typically file name characters are in lower case letters.

ero.dgn	Erosion Control Drawing File
notes.dgn	Standard Notes Drawing File
detour.dgn	Temporary Construction Detour Drawing File
sub.dgn	Bridge Substructure Drawing File
sup.dgn	Bridge Superstructure Drawing File
typ.dgn	Roadway Typical Sections Drawing File
hrg.dgn	Hearing Roll Plans Drawing File
pro.dgn	Alignment Profile Drawing File
pe.dgn	Plan and Elevation Drawing File
row.dgn	Right of Way Drawing File (2D only)
detail.dgn	Typical and Custom Details Drawing File
lds.dgn	Proposed Landscaping Drawing File
ts.dgn	Traffic & Safety Design Drawing File

4.8. InRoads FILE NAMES AND INTERNAL DATA NAMES

InRoads data files are used throughout a project's life cycle. Standard naming of all InRoads data files is critical to maintain coordinated collaboration of design data. The existing surface is surveyed and the Original Ground Digital Terrain Models is created. This xPPMSog.dtm file will be the basis for design of the proposed alignment and surface models. Use of proper naming both internally with InRoads and externally from a File management standpoint insures project collaboration in utilizing design data effectively. Proposed Roadway Alignments or surface modes that are not properly documented are of little or no use. It cannot be stressed sufficiently how internal names organize and make InRoads Data useful for all aspects of the project life cycle. VAOT InRoads Design specifics are covered in the VAOT InRoads Fundamentals Manual.

INROADS FILE NAMES AND INTERNAL DATA NAME TABLE:

File/Data type	Internal name	Internal Description	Standard File name
Geometry Project	s89j099prop	Burke proposed Geometry	s89j099prop.alg
	x89j099og	Burke old ground Geometry	x89j099og.alg
Horizontal Alignment	TH7ex	TH7 Exist. Centerline	N/A
	TH7prop	Downstream Alternate	N/A
Vertical Alignment	TH7_V1	Match existing grade	N/A
	TH7_V2	Raise for SSD	N/A
Superelevation	S1	Super 1	N/A
Typical Section Library	s89j099	Burke Typical Sections	s89j099.itl
Roadway Library	s89j099	Burke Roadway Library	s89j099.ird
Roadway Definition	TH7-Prop	TH7 Proposed Roadway	N/A
Project File	s89j099	Burke Project File	s89j099.rwk
Surfaces	x89j099og	Burke old ground Surface	x89j099og.dtm
	s89j099prop	Burke Proposed Roadway surface	s89j099prop.dtm

Notes:

1. In these examples, the prefix **s** denotes a file from the Structures Section and the prefix **x** denotes a file from the Survey Section; each group must use the proper prefix.
2. A PMS number of 89j099 was used in this example
3. A road name of TH 7 has been used to show examples.
4. In all cases, when using ProjectWise the ProjectWise File Name and the ProjectWise Document Name are identical.
5. In all cases, when using ProjectWise the internal description and the ProjectWise description are identical.

SECTION 5 - U.S. SURVEY FEET & VT STATE PLANE GRID

5. INTRODUCTION

The following definition is taken from the 1991 edition of *ASTM publication E380-89a (Standard Practice for Use of International System of Units)*:

The U. S. Metric Law of 1866 gave the relationship, 1 meter equals 39.37 inches. Since 1893 the U.S. yard has been derived from the meter. In 1959 a refinement was made in the definition of the yard to bring the U.S. yard and the yard used in other countries into agreement.

The U.S. yard was changed from 3600/3937 m to 0.9144 m exactly. The new length is shorter by two parts in a million. At the same time it was decided that any data in feet derived from and published as a result of geodetic surveys within the U.S. would remain with the old standard (1 ft = 1200/3937 m) until further decision. This foot is named the U.S. survey foot.

Therefore the following definitions are in existence today:

- Foot = 0.3048000 m
- Survey Foot = 1200/3937 m \approx 0.30480060960 m

5.1. MICROSTATION UNIT DEFINITIONS

The foot used by MicroStation in the standard unit list is based on the International Foot definition, not the US Survey Foot definition. This is the correct definition for most work outside of the United States Civil Engineering and Surveying disciplines. Many states (**Including Vermont**) base survey work on the US Survey Foot. All State of Vermont, Agency of Transportation survey data is done in US Survey Foot not the international foot. When data is based on US Survey Foot survey measurements, using the standard foot definition (International Feet) in MicroStation will yield incorrect results on the order of 2 feet at a coordinate of 1,000,000 feet.

MicroStation does not include the Survey Foot in the standard unit list. However, MicroStation does understand the Survey Foot; the definition simply needs to be enabled. All MicroStation units are defined in a *units.def* file. VAOT has enabled the "Survey Foot" and "Survey Inches" definitions in the VTunits.def file and configured our CADD standards use this unit definition file.

(Consultants) VAOT provides English units (based on U.S. Survey Foot) definitions as part of the standard **VAOT V8 CADD Project Configuration & Resource Files** download available at [VAOT CADD Resource download web site](#). Included in this download is a VTransEng project configuration file that point to the VTunits.def file. For more information on MicroStation configuration please consult your CADD manager.

When converting MicroStation pre-V8 files to V8 versions or later, within the VAOT project configurations, MicroStation should use "Survey Foot" "Survey Inches" as defined in the VTunits.def file. All pre-V8 files being converted to V8 or later should have the units verified after the conversion process. Elements drawn in design files that

have incorrect units (i.e. International Foot) will yield incorrect results especially when dealing with VT state plane coordinate data. *Simple changing the units after elements are generated does not rectify the issue.* All file transfers from Private Survey Group or consulting firm (the supplier) to an Agency Design Group or consulting firm (the customer) or visa versa should verify the proper units are in use. MicroStation design file working units can be viewed and modified from the MicroStation menu > Settings > Design File > Working Units (All English projects should have Master units of **Survey Feet** and Sub Units of **Survey Inches**).

Throughout this manual units, referred to as (FT, ft, ', Foot, Feet, etc.) are referring to the Foot as the U.S. Survey Foot Definition. All references to the inches in this manual refer to the inch as 1/12 of the U.S. Survey Foot Definition.

5.2. VERMONT STATE PLANE GRID

All states have a defined grid system that is best suited to their needs. These grid systems are limited in size to reduce error accumulation when the curvature of the earth is ignored. This grid system provides for plan geometry and trigonometric calculation to be preformed with ease. The Vermont state plan grid projection can be referenced by its Central Meridian and to the equator so that translation to geographic coordinates can be accomplished.

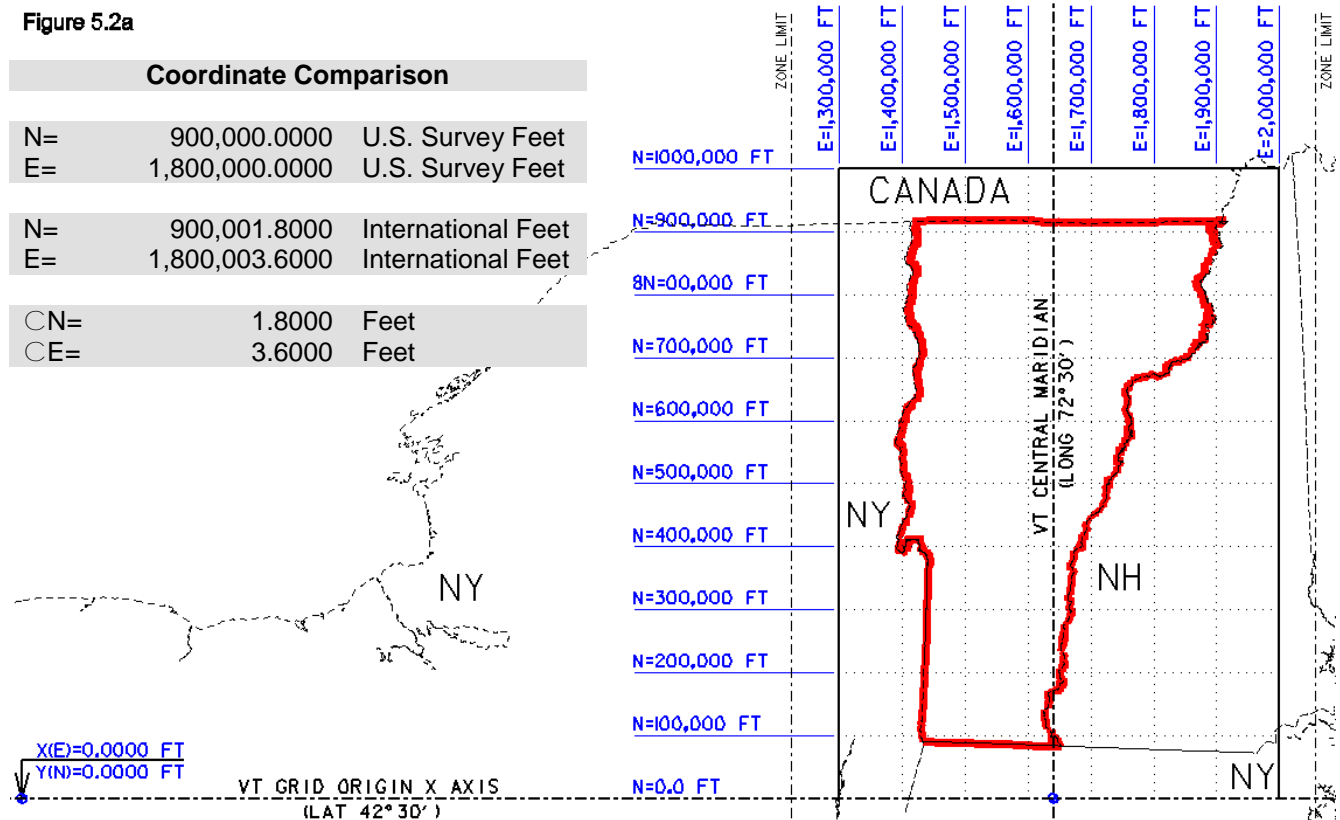
5.2.1. NAD 1983 State Plane Vermont FIPS 4400

The Vermont State plan grid has a base reference point located at the intersection of the VT Central Meridian line (Longitude -72° 30') and a Grid Origin X axis (Latitude 42° 30'). The intersection of the VT Central Meridian is assigned the X axis location of 1,640,416.6667 Feet or (500,000 meters) and the X axis is assigned the Y value of 0.000. This gives the VT State plane Grid a Grid Origin (Northing 0.0000 FT Easting 1640416.6667 FT). The N = 0.000, E = 0.000 is located over NY state in the Cattaraugus county. [[VERMONT U. S. Survey Feet NAD 1983 State Plane Grid Reference Map](#)]

5.2.2. U.S. Foot vs. International Foot error

The error caused by the International Foot is most obvious in the North East regions of Vermont. The errors are smaller and less noticeable in the South West regions. As an example take a point in the North East corners of Vermont with N = 900,000 FT and E= 1,800,000 FT. [Conversion \[1 U.S. Foot = \(1200/3937\) meters\]](#)

Figure 5.2a



As shown in Figure 5.2a with the Coordinate Comparison, Easting values have an error value of 3.6 Feet while the Northing error value is 1.8 Feet at example coordinates. In VAOT CADD drawings all coordinates are based on the drawing file origin of (XY=0, 0) where the X values represent Easting and the Y values represent Northing. The International foot error values are larger the further you are from the (XY=0, 0) origin.

5.2.3. North American Datum (NAD) (NAVD)

Survey data must have a tie to some control network. The current horizontal control datum used by Vermont is the North American Datum or (**NAD-83**). NAD 83 covers the North American Continent, including Greenland and parts of Central America. Vermont's Horizontal control benchmarks were adjusted in (1992) and again in (1996). Vertical controls for all Vermont survey data is tied to the North American Vertical Datum or (**NAVD-88**). Vertical control benchmarks have been established as points of reference. Unlike the state plan grid systems the United State and Canada share a Vertical datum. All vertical datum elevations are calculated relative mean sea level with an assigned value of 0.0 FT or 0.0 Meters.



SECTION 6 - VAOT LEVEL LIBRARY AND LEVEL USAGE

6. INTRODUCTION

CADD files must be created and populated with data in accordance with the standards stated in this manual in order to create consistent plan appearance, improve reproduction quality, and allow for efficient manipulation of drawings and data. CADD files shall conform to all aspects of this chapter. This includes files created by Survey, Roadway Design, and all Project Design groups; files used to produce Standard Sheets and Bridge Data sheets; and files created by all other Agency or Consultant Suppliers of CADD information. The Agency has created and maintains an extensive library of CADD resource files including Level Library files. Consistent use of these files is essential if CADD is to be used effectively and efficiently.

NOTE: The term **FEATURE** will refer to graphical elements drawn in MicroStation

6.1. CATEGORY PREFIX AND DEFINITION

VTrans has developed a Level naming convention. CADD support and CADD management personnel have research and developed this naming convention based on VTrans requirements and other DOT standards. One of our goals was to standardize or make an effort to standardize with other DOT. We have developed VTrans level naming standards using the NYSDOT level library as a template

6.2. THE MAJOR CATEGORIES

The major categories have been developed to organize and standardize the Level Names. Table 6a lists the major categories and gives a definition for features that will be in these categories. The categories are intended to give separation to the major types of features used in generating civil engineering drawings. Each category is assigned a prefix character. The first character of the Level Name identifies the category

6.3. PAVEMENT VS. ROADWAY

The Pavement Category has been separated from the Roadway Category. The Pavement Category is defined as, durable surfacing of a road, airstrip, or similar area. The primary function of a pavement is to transmit loads to the sub-base and underlying soil. Gravel, Asphalt, Concrete are examples of modern pavement materials. The Category of Pavement has been separated from Roadway to accommodate level separation for surface areas designed for traffic.

Table: 6a

Prefix	Category Name	Category Description - (Definition)
A	Alignments	Horizontal Alignments; Stationing; PI; Horizontal curve set information; Event points; and all horizontal Alignment Annotation
B	Bridge	Bridge related items; Superstructure; Substructure; Approach Slabs; Bridge Railing; Temporary bridge structure;
C	Control	Survey Control; Baseline; Control points; Monuments; ID number; description; point and attributes.
D	Drainage	Drainage; Drainage structures; Gutters; Culverts; Manhole; Ditches; etc.
E	Environmental	Environmental notation; wetland; critical habitat; Flood plains; Arch. Area; PDF- Project Demarcation Fence; Soil marking; Historical areas; etc.
G	Geotechnical	Boring information; Boring logs; Boring log text; Test Pits; etc.
L	Landscape	Natural, Terrain, Survey features; Ground features; Perimeter (exterior boundary); Stone walls; Dams; Spillways; Trees; Contours; Contour elevation text; Edge of water; Ledge (Rock); Woods; etc.
M	Mapping (ROW)	Right of Way; Easements; Property Lot Lines; Jurisdiction (State/Town); Record Baseline; Take Lines; etc.
N	plan Levels	Sheet borders; Reference clip bounds; Match-lines; North arrow; Title text; Sheet layout specific text (notes); Scales; etc.
O	Object Details	Object lines; Steel; Concrete; Hidden Lines; Drafting lines for detailing; Dimension lines; Dimension Text; Annotations; Leaders; etc.
P	Pavement	Durable surfacing of a roadway i.e. (Gravel, Asphalt, Concrete etc.) airstrips or similar area. Paved Edge of roads; Paved Shoulders; Paved Detours; etc.
R	Roadway	Drive Ways; Parking Lots; Curbs; Sidewalks; Guard Rail; Buffer Strips; Railroad; Roadway text; Trails; etc.
S	Signing & Striping	Roadway Striping lines; Cross Walks; Roadway Signs; Delineators; Parking meters; Detour Signs; etc.
T	Traffic	Traffic control; loops; ITS; Traffic Signals Control Boxes; Readers; Detectors; Junction Boxes; etc.
U	Utilities	Underground Utilities; Aboveground Utilities; Electric line; Gas line; Water line; Cable line; Communication conduits; etc.
X	Cross Sections	Cross Sections and Annotation; Profile and Annotation; Grids; Sheet annotation and sheet borders; Surface Lines; etc.

6.4. LEVEL NAMES AND DESCRIPTIONS

The Level Name has been kept short and at first glance may appear cryptic, while Level descriptions are long and informative. The Level Names are short mainly for InRoads data files and lplot plot file level manipulation. The long descriptions will be much more

useful in the MicroStation Level Display dialog when selecting the proper level to place elements. As you work with the Level Names more you will become proficient with the Level Naming Convention

6.5. STRUCTURE OF THE LEVEL NAME

As previously mention in section 2.1 the first character in the Level Name identifies the Category. The second character(s) in the Level Name identifies the feature. Examples of second characters used to identify features:

G	- Guide rail
SW	- Sidewalk
MB	- Mailbox
FNC	- Fence
T	- Tree

The third character(s) (if necessary) identifies the feature type. The same letter may be used to identify different types. Example for RGC the "C" indicates cable, where for LTC the "C" indicates coniferous. Examples of third characters used to identify feature types:

B	- Box beam
C	- Cable
C	- Coniferous
D	- Deciduous

6.6. STRUCTURE OF THE LEVEL DESCRIPTION

The level Description provided in MicroStation is structured, in general, to follow the level naming convention. The first word in the description is the same as the level category. The second word in the description identifies the feature and, in general, the first letter of the second word in the description matches the second letter in the level name

6.7. LEVEL USAGE DEFINED

Each existing mapping feature/level name has two level name sets associated with it: proposed level, and the proposed text level. In the example shown below in Table 6.7a, RGR (Roadway, Guide Rail) is the primary level name for the existing feature Guide Rail, RGR_P is the level name for Proposed feature Guide Rail, generally every Proposed feature has an associated level for Text RGR_P_T. Not all features/Level names follow this rule exactly. Not all existing features have a corresponding proposed feature. Likewise not all proposed features have a level for existing features.

Table 6.7a

Level Name	Category	Level Description in MicroStation	Description
RGR	Roadway	Roadway, Guide Rail	Existing Level and Feature Name

RGR_P	Roadway	Roadway, Guide Rail, Proposed	Proposed Level and Feature Name
RGR_P_T	Roadway	Roadway, Guide Rail, Proposed - Text	Proposed Text Level

6.8. ANNOTATION COMMENT LEVEL

There is one Annotation Comment Level in each of the major categories. This level has the naming convention ♠ANNOT_C where the ♠ represents the prefix letter of the category; example: the Utility category has a prefix of U and the name of the Annotation comment Level is UANNOT_C. This level is intended for annotation of existing features in that category such as information pertaining specifically to an existing utility

6.9. STANDARD SURVEY DATA LEVELS

There are four levels in each category designated for survey point data. These levels are generally used by InRoads Survey and the Survey Feature Table to place point data collected by VTrans Survey crews

6.9.1. Attribute = ♠_A

The Attribute level located in each category is suffixed by the characters _A. The first character in the level name as always identifies the category while the _A identifies that this is the level for attributes entered into the Survey Data Collector in the field. The _A level A.K.A. the ALPHA code level, since this is the level ALPHA code data for each point will be annotated

6.9.2. Comment = ♠_C

The Comment level located in each category is suffixed by the characters _C. This level will be used for information collected by the Survey crews and entered into the data collector as additional comments or information. This level for example will contain information on the species and size of a tree. This level will also be where InRoads Survey locates survey error comments from the data collector

6.9.3. ID Number = ♠_I

The ID Number level located in each category is suffixed by the characters _I. This level is the level that point number data for each collected point will be located.

6.9.4. Tic = ♠_TIC

The Tic level located in each category is suffixed by the characters _TIC. This level is the level that all point (x) for standard shots or (+) for bridge shots or other cell symbols will be located for each shot.

6.10. LIST OF LEVELS & DESCRIPTIONS

(See the VAOT MicroStation Level Library for a complete list)

A = Alignments (Sample Alignments Levels)

Level Name	Level Description
AC1_P	Alignment, Control-1, Proposed
AC1_P_T	Alignment, Control-1, Proposed - Text
AC1P_P_T	Alignment, Control-1, Points, Proposed - Text

B = Bridge (Sample Bridge Levels)

Level Name	Level Description
BAS	Bridge, Approach, Slab
BB	Bridge, Beam
BB_P	Bridge, Beam, Proposed

C = Control (Sample Control Levels)

Level Name	Level Description
CB	Control, Baseline
CBP	Control, Baseline, Point
CBPOL	Control, Baseline, Point on Line

D = Drainage (Sample Drainage Levels)

Level Name	Level Description
DCP	Drainage, Culvert, Pipe
DCP_P	Drainage, Culvert, Pipe, Proposed
DCP_P_T	Drainage, Culvert, Pipe, Proposed - Text

E = Environmental (Sample Environmental Levels)

Level Name	Level Description
EB_P	Environmental, Blanket
EB_P_T	Environmental, Blanket - Text
EBA_P	Environmental, Basin

G = Geotechnical (Sample Geotechnical Levels)

Level Name	Level Description
GA_P	Geotech, Auger
GA_P_T	Geotech, Auger - Text
GCP_P	Geotech, Cone Penetrometer

L = Landscape (Sample Landscape Levels)

Level Name	Level Description
LAAS	Landscape, Area, Archeological Site
LABL	Landscape, Area, Brush Line
LAFL	Landscape, Area, Field Line
LAHR	Landscape, Area, Hedge Row
LANT	Landscape, Antenna
LANT_P	Landscape, Antenna, Proposed
LANT_P_T	Landscape, Antenna, Proposed - Text

LAON	Landscape, Area, Orchard/Nursery/Vineyard
LAPB	Landscape, Area, Planting Bed
LAQP	Landscape, Area, Quarries & Pits

M = Mapping (ROW) (Sample Mapping (ROW) Levels)

Level Name	Level Description
MEE	Mapping, Easement, Exsiting
MEEP	Mapping, Easement, Exsiting, Point
MEP_P	Mapping, Easement, Permanent, Proposed
MEP_P_T	Mapping, Easement, Permanent, Proposed - Text

N = Plan Levels (Sample Plan Levels)

Level Name	Level Description
NBC1	Plan, Border, Clipping-1
NBLNC1	Plan, Border, Layout, Notation, Construction-1
NBLND1	Plan, Border, Layout, Notation, Drainage-1

O = Object Levels (Sample Object Levels)

Level Name	Level Description
OANN1_P_T	Details, Annotation 1, Proposed - Text
OB	Details, Border
OB_T	Details, Border - Text

P = Pavement (Sample Pavement Levels)

Level Name	Level Description
PET	Pavement, Edge of Travelway
PET_P	Pavement, Edge of Travelway, Proposed
PET_P_T	Pavement, Edge of Travelway, Proposed - Text

R = Roadway (Sample Roadway Levels)

Level Name	Level Description
RBS	Roadway, Buffer, Strip
RBS_P	Roadway, Buffer, Strip, Proposed
RBS_P_T	Roadway, Buffer, Strip, Proposed - Text
RC	Roadway, Curb
RCC_P	Roadway, Curb, Concrete, Proposed
RCG_P	Roadway, Curb, Granite, Proposed
RCM_P	Roadway, Curb, Marble, Proposed
RCP_P	Roadway, Curb, Paved, Proposed
RCW_P	Roadway, Curb, Wood, Proposed
RD_P_T	Roadway, Driveways, Proposed - Text
RDC	Roadway, Driveways, Concrete
RDC_P	Roadway, Driveways, Concrete, Proposed

S = Signing & Striping (Sample Signing & Striping Levels)

Level Name	Level Description
SDEL	Sign, Delineators
SDEL_P	Sign, Delineators, Proposed
SDEL_P_T	Sign, Delineators, Proposed - Text

T = Traffic (Sample Traffic Levels)

Level Name	Level Description
TCBJ	Traffic Control, Box, Junction
TCBJ_P	Traffic Control, Box, Junction, Proposed
TCBJ_P_T	Traffic Control, Box, Junction, Proposed - Text

U = Utilities (Sample Utilities Levels)

Level Name	Level Description
UC	Utility, Conduit, Underground
UC_P	Utility, Conduit, Underground, Proposed
UC_P_T	Utility, Conduit, Underground, Proposed - Text
UCH	Utility, Conduit, Hanging
UCH_P	Utility, Conduit, Hanging, Proposed
UCH_P_T	Utility, Conduit, Hanging, Proposed - Text
UCO	Utility, Conduit, Overhead
UCO_P	Utility, Conduit, Overhead, Proposed
UCO_P_T	Utility, Conduit, Overhead, Proposed - Text

X = Cross Sections (Sample Cross Sections Levels)

Level Name	Level Description
XANNOT_P_T	Cross Section, Annotation, (labels, titles, etc.)
XAX_P	Cross Section, Axis, Line
XAXTIC_P	Cross Section, Axis, Tics
XAXTXT_P_T	Cross Section, Axis, Text

6.11. LEVEL LIBRARIES

A level library refers to a component of a DGN library that contains the level structure. The level structure includes the level name and the corresponding definition of the symbology of elements placed on the level. Elements can either be placed with their own independent symbology (independent of the level library) or placed to use the symbology defined by the level library (placement **ByLevel**). The **ByLevel** option for placing elements used in conjunction with the VTrans standard level libraries is the most effective way to ensure file contents conform to the standard symbology outlined throughout this chapter. VTrans maintains standard level library files these files are automatically attached when MicroStation opens each design file. Proposed changes to the contents of the level library should be submitted to CADDsupport and will be considered as to validity and necessity.

6.11.1. Control of Level Attributes

The user while in a design file does have the ability to change attributes in the level manager (i.e. color, line code, line weight) however changes to these attributes are controlled by the level library and will be updated on the next level update initiation or the file is opened. Elements can be placed using independent symbology using by element attributes symbology to override Bylevel symbology.

6.11.2. Level Filters

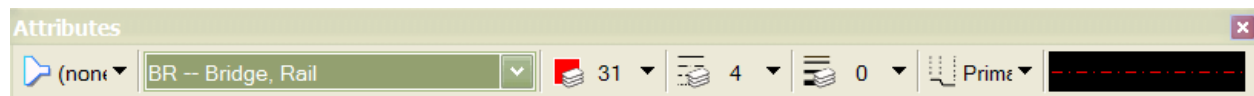
MicroStation levels can be filtered at any time to make only specific levels within a level library available during the design process. Standard filters have been created in each level library to allow the user to quickly and efficiently manipulate the information. These filters are outlined in Table 6.11a.

Table 6.11a

Filter Name	Filter	Description
Cross Sections and Profiles	X*	All Cross Section and Profile Levels
<input type="checkbox"/> Elements	-_T	Cross Section and Profile Elements, No Text
<input type="checkbox"/> Text	*_T	Cross Section and Profile Text only
Details (Object Details)	O*	All Detail Levels
<input type="checkbox"/> Elements	-_T	Detail Lines and Reinforcing Levels
<input type="checkbox"/> Text	*_T	Detail Text Levels
Mapping – All	-X* &-O*&-Level*&-N*&-Default	All Mapping Levels
Mapping – Existing	_-_P&-X* &-O*&-Level*&-N*&-Default	Existing Mapping Levels
Mapping – Proposed	__P&-X &-O&-Level*&-N&-Default	Proposed Mapping Levels
Plan Sheets	N*	Plan Sheet Levels

6.11.3. Attributes Tool Box

The MicroStation Attributes tool box contains frequently used drawing tools and controls for frequently used settings.



The first button identifies the active filter being applied to the level list (none) indicates there is no currently no active filter. The next field indicates the active level with the description and the pull down arrow displays a list of levels allowing the selection of a new active level. The next three buttons indicate the current attribute color, line style, line weight, and the white level icons on these buttons indicates that these attributes are set by level. The next button indicates active element class and then there is a preview of the active settings.

6.11.4. Auto Synchronize Attributes

The active color, active line style, and active line weight will reset to ByLevel each time the active level changes. This enables standardization of drawing symbology, by setting the active level you automatically have the standard attributes defined in the level library. The ByLevel attributes can be overridden using the standard element symbology commands.

6.11.5. MicroStation Level Display Dialog

Key-in: leveldisplay dialog Open

Level Display Dialog is the primary tool used to manipulate levels. The dialog can be used to set the active level by double clicking on the level name. By selecting with the pointer you can turn levels ON or OFF. With a right click in the level display area you will get a short cut menu with options for manipulation of levels.

6.11.6. Column Display

The level display dialog has columns that can be tuned off and on depending on user preferences. By right clicking on a column heading you get the shortcut menu listing all the possible columns to be displayed. By selecting the column heading you can sort the level list, by selecting the name column you toggle the alphabetical order of the levels. When selecting the “USED” heading you group the used levels together for manipulation.

6.11.7. Level Symbology (OFF vs. ON)

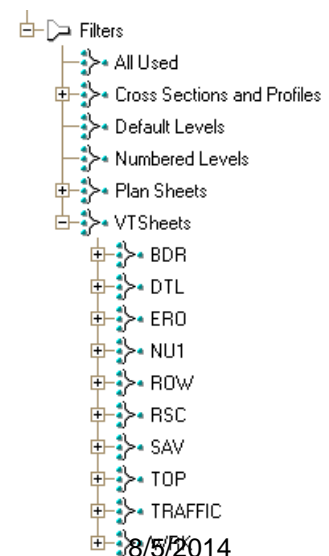
Key-in: SET LVLSYMB [OFF | ON | TOGGLE]

VTrans standard design file setting, symbology should be off. Turning off the level symbology displays the element attributes as defined in the level library if the element attributes are set to bylevel. If elements are set with independent color symbology, LVLSYMB OFF will allow the independent color to display. Turning symbology overrides ON displays all elements as defined in the symbology overrides level manager. The current color setting for symbology overrides are set as each major level category survey data level has a specific color assigned the other level colors are set to a standard colors.

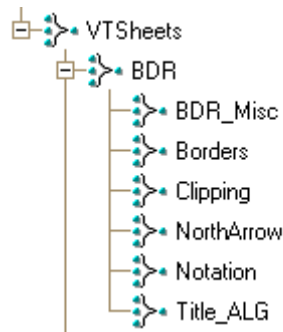
6.11.8. Titled and Untitled filters

VTrans has provided Titled filters as part of the level library. The titled filters can be accessed from the level display dialog, the level manager dialog and on the attributes tool box. The title filters are setup in the structure as shown below.

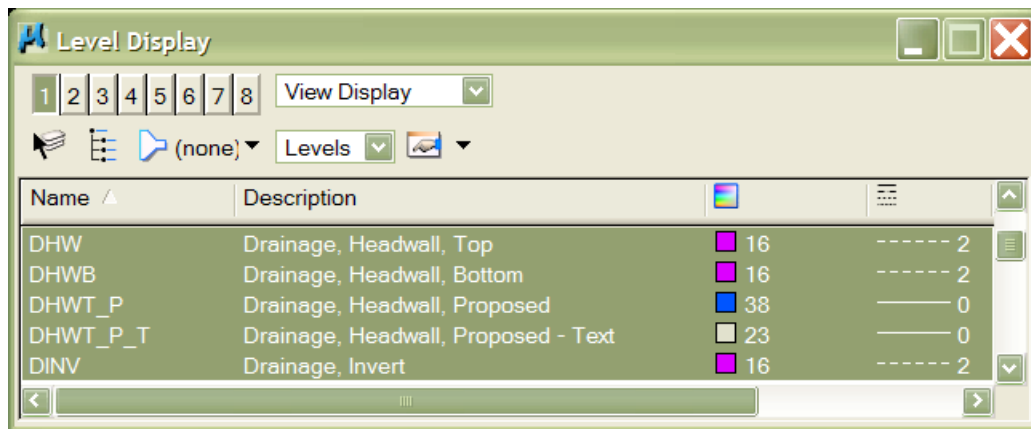
Where there is a Plus (+) symbol in the tree above subordinate filters have been defined. The sub filters impose additional criteria beyond parent filters. For example if you have a filters that displays only Plan Sheet levels (N*) then impose a sub filter that displays only text levels (*_T) the level list will display only



text levels in the Plan sheet category. This parent child filter capability is widely implemented under the VTSheets filters as shown below.



In the level display dialog box by selecting the untitled filters, entry fields will appear at the top of the columns. You can type filter criteria into the entry field creating on the fly filters. An example would be to type a 1 in the field above the “used” column this will display only levels that are utilized, a 0 would do the opposite showing only unused levels.



6.11.9. VTLevels TOOL BOX

VTrans has created a tool box to aid in the manipulation of levels. This tool box can be located in the list with all other MicroStation tool boxes under Tools > Tool boxes, or Shortcut key Ctrl + T. This tool box provides an all levels off button, all levels on button, off by element section button and a set active level by element selection button, as well as other level on/off buttons relative to level categories.

6.12. CROSS REFERENCE 1-63 TO STANDARD LEVELS

With this migration to the Standard Level naming convention there are several issue relating to past practices. Once upon a time long ago there were only 63 levels. Elements that were of no similarity were placed on the same level and separation was only achieved by drawing in a separate design file. Long list were generated defining what level and what design file elements would be drawn. This list of level numbers to design file separation has been provided with a cross reference to the standard levels now in effect. For legacy design file purposes we are providing this list so elements drawn on these numbered levels will have meaning. See the appendix B for this reference data.

6.13. LEVEL SEPARATION vs. GROUPING

The standard level naming convention adapted by the Vermont Agency of Transportation in November of 2004 was a joint effort by CADD support and Engineering staff. Levels have been provided to allow for significant separation of features and elements. While separation of different types of features and elements is useful over separation would be detrimental. In several cases levels have been provided for the separation but are not always utilized. An example of this would be; there is a Proposed Text level for almost all proposed feature levels this level would only be utilized if information specific to the proposed features required separation. General notations for proposed construction would be placed on layout notation levels.

6.14. BENEFITS OF NAMED LEVELS

Named levels along with corresponding level description in the design file provide for intelligent data. Selecting an element that is on a level with a name and description provides the user (not necessarily the creator) with feedback as to what this feature or element represents. Conversely selection of an element that is on "Level 2" the data tells the user nothing and is meaningless except to the creators of the design file. Experience and new designers will have the ability to draw on levels that define the feature or elements that are generated. Elements being placed with ByLevel attributes will automatically have the proper or standard color, line style, and line weight. Using a combination of level naming and ByLevel symbology we have a standard settings managements system in affect.



SECTION 7 - DRAFTING STANDARDS

7. INTRODUCTION

This section is intended to outline Vermont Agency of Transportation (VAOT) Standard Drafting concepts. **Consistency** and **Clarity** are important qualities of Engineering Design Plans. Engineering plan sets contain vast amounts of information. VAOT Engineering plans are printed using black ink on white paper. The use of standardized line weight and line styles is the primary method of feature identification on engineering plans. In most instances the line styles or drafted symbolisms are representations of design features or parameter (i.e. Limit of Construction or edge of Roadway pavement etc.). In some instances legends are provided to aid in identification of features by line symbolism. Engineering and Construction professionals recognize and identify the features through a history of standard symbolism. In addition to standardized line symbology it is important to use standard text symbology that will aid in identifying the annotations. The use of standard text sizes, plan scale factors, border types and corner card information all aid in generation of a professional set of Engineering plans ready for construction. **Consistency** and **Clarity** of information also improve the ability to identify errors during the engineering and design phases of the project. For a deeper look at VAOT drafting standards see the [Drafting Standards Manual](#) supplemental.

7.1. DESIGN FILE BASICS

MicroStation is the platform application for the VAOT Computer Aided Design and Drafting (CADD) requirements in the Civil Engineering Departments. We use InRoads with MicroStation to produce roadway geometric alignments and Digital Terrain Models (DTM) of the existing and proposed surfaces. InRoads, is the primary Roadway Design application used by VAOT. Standards for both MicroStation and InRoads have been developed by VAOT to implement standardized design file outputs. These standards are in some cases automated by the software applications. CADD applications are not entirely intended to make the engineering process simple. The main purpose of CADD applications is to reduce repetitive tasks, generate standard outputs, increase accuracy, reduce errors and create more intelligent usable data for construction and estimating procedures.

7.1.1. Design File Models

MicroStation V8 has the ability to have multiple models in one DGN file. This is a useful function when used properly and standardized. VAOT generates all design information in the **Default model of a DGN file**. Multiple models can lead to confusion for the users that do not use multiple models. This problem is especially visible when referencing up a DGN file, many users assume the Default model is the only model in the DGN and do not look for other possible models. We have created standard file naming conventions that allows designers and CADD users to understand what files contain what data. The inclusion of multiple design models into a DGN file does not conform to the VAOT file naming convention.

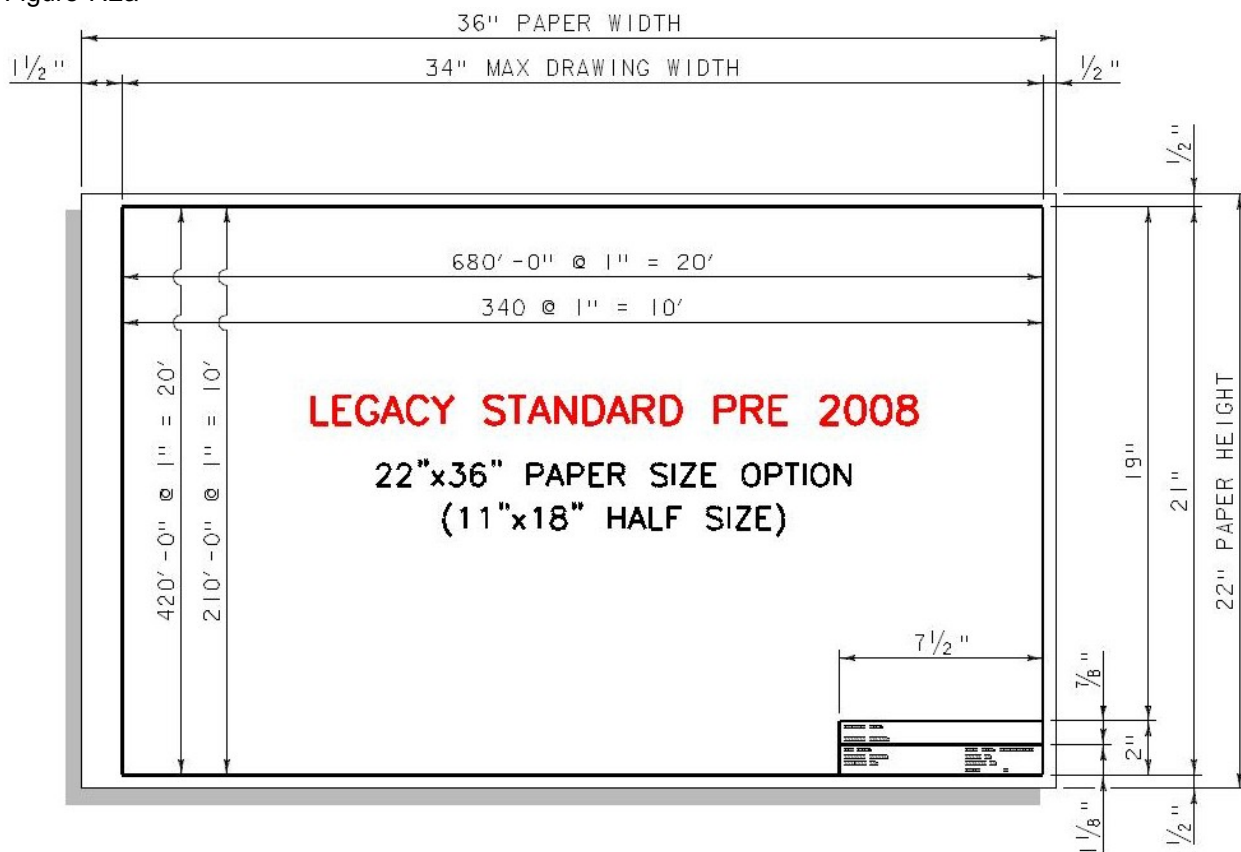
Multiple Sheet Models in a DGN can have advantages. Sheet models should never contain any graphical elements. Sheet models should only contain references to

standard design files that contain design data such as the nu.dgn, and the bdr.dgn. DGN file Default models including the bdr.dgn are referenced into sheet models then rotated and clipped to the bdr.dgn border layouts, as required for the purpose of creating sheeted document output such as paper or PDF plots. Never move or rotate the references to topographic sheet this will ruin the special aspect of the plots.

7.2. SHEET BORDER SIZE & SCALES

The VAOT legacy paper size (pre 2008) for plotting scaled plans is a 22"x36" sheet of paper. Sheeting was setup with the 22"x36" paper size. VAOT **rdy_desinglib.cel** cell library file contains the legacy border cell **LAYOUT22x36**. This cell is drawn at 1in = 1ft scale, in the cell library file. This cell has a border that is sized to create a 1/2" margin on the top, bottom and right side of the legacy sheet size, the left margin is set to be 1 1/2" to allow space for a staple binder edge. Figure 7.2a illustrates the sheet size, legacy border size and standard margins.

Figure 7.2a



Most VAOT plotters have 36" roll paper. As shown below Arch D is the closest industry standard paper size available and is an acceptable paper size if custom cut paper sizes are not a viable option.

Architectural

Architectural represents a series of paper sizes that have been created to suit the needs of the Construction industry.

The Architectural paper sizes are listed to the right.

Arch A	9 x 12 in
Arch B	12 x 18 in
Arch C	18 x 24 in
Arch D	24 x 36 in
Arch E	36 x 48 in
Arch E1	30 x 42 in
Arch E2	26 x 38 in
Arch E3	27 x 39 in

7.2.1. Half Size Plots

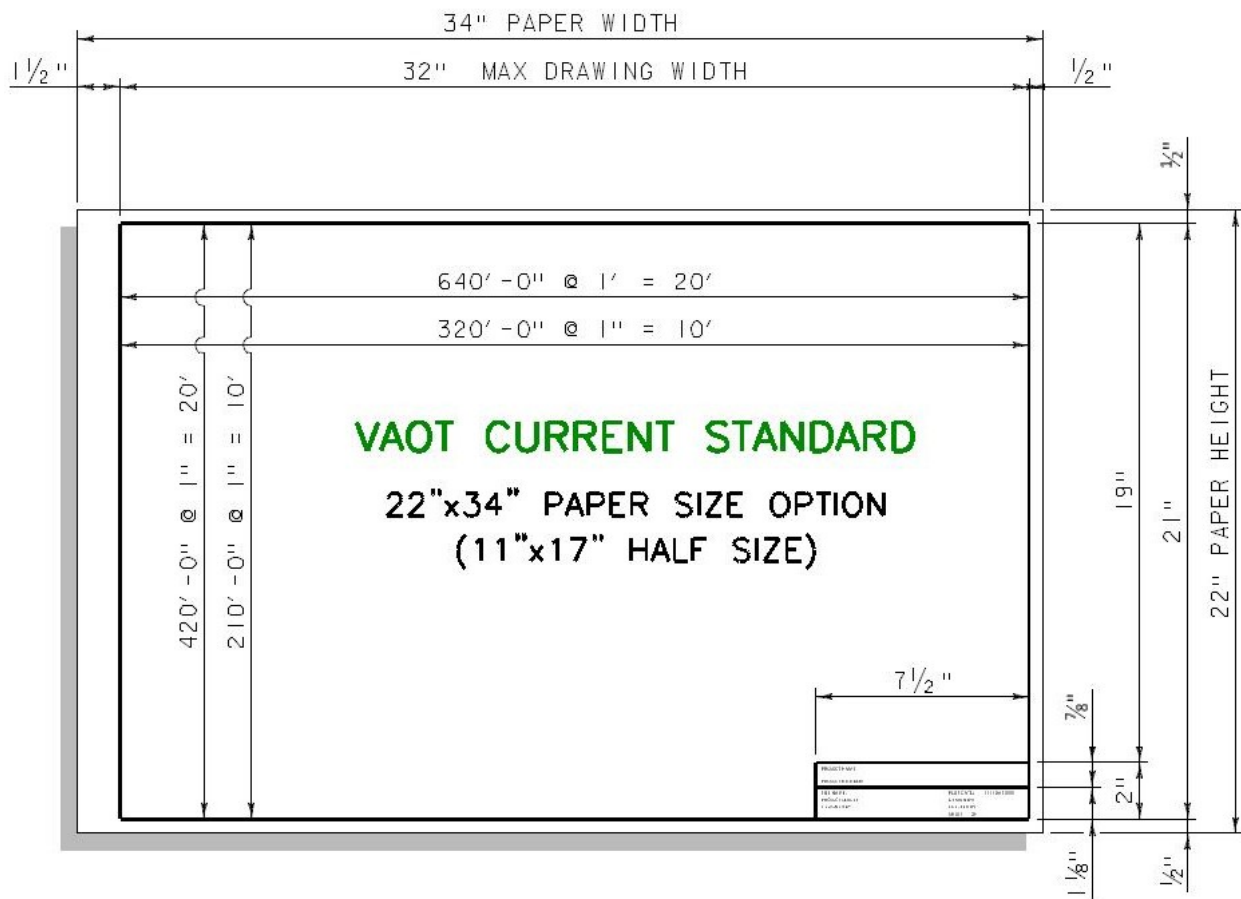
Have half size plots for reference materials and check prints are standard practice. It is also common to have half size prints for plan submissions including semi-finals, finals and Contract plans. A true half size print of the VAOT Legacy standard paper would be 18"x11". As shown above Arch B is the nearest industry standard paper size available and is an acceptable paper size for half size prints if custom cut paper sizes are not a viable option.

7.2.1.1. Standard Sheet Size 22"x34"

ANSI D, is the **VAOT Standard Sheet** size is used on current projects. ANSI paper sizes are based on the 8 ½" x 11" letters size. These paper sizes are supported on general use printers making printing of plans and plans sets more convenient. The standard Sheet size is 22" x 34" or ANSI D [Figure 7.2b] making half size plans 11"x17" or ANSI B. A layout cell border has been created for this size paper and is located in the rdy_design.cel library, name = **LAYOUT22x34**.

ANSI A	8 ½ x 11
ANSI B	11 x 17
ANSI C	17 x 22
ANSI D	22 x 34
ANSI E	34 x 44

Figure 7.2b



7.2.2. Setup Plans & Details to Engineering Scales

All engineering design plans are drawn full scale (1:1) in the respective DGN default model. As a standard roadway and structural proposed layout plans are setup, to be plotted at a scale of 1" = 20' (1:240) or in metric units 1:200 scale. For more information on setting up and plotting topographical plan layouts see Section 11 of this manual.

When setting up detail sheets, layout borders are placed directly into the DGN default model with the details. Details should be drawn full scale (1:1) whenever possible. Layout borders will be placed in the DGN and scaled to fit around the full scale details. As an example if you draw several 1/4" = 1'-0" (1:48) typical cross section details you would place the LAYOUT cell in the DGN scaled up 4 times (the *LAYOUT cell is drawn at a scale of (1:12) and it needed to be at a (1:48) scale*). This will allow all future edits and measurements to the typical cross sections to be done without scale factor issues.

Bridge Super Structure and Substructure details (as well as all VAOT detailing) should be drawn full scale and remain full scale in the DGN file. Typically the bridge abutments plan and elevation details can be plotted at 1/4" scale. It is often necessary to plot abutment cross sections details at 3/8" or 1/2" scale. One detail sheet may have a plan and elevation at 1/4" scale and a cross section detail at 1/2" scale. In a situation where more than one scale detail is presented on one sheet, this sheet would be set up at the predominant scale and other details would be referenced in and scaled accordingly. In this situation we have a plan and elevation to be plotted at 1/4" scale so the border layout would be placed for plotting at 1/4" scale, then a cross section detail to be plotted at 1/2" scale will be self referenced into the DGN model, scaled x2 and placed inside the 1/4" scale border layout with the 1/4" scale plan and elevation details. Once the 1/2" scale detail is placed inside the border layout it can be clipped, moved, and rescaled as needed using MicroStation reference tools. Work on the 1/2" scale detail would be done on the original drawn detail and all changes will show in the self referenced detail. This self referencing of details eliminates problems associated with drawing details then scaling graphics to fit on a sheet that will be plotted at some alternate scale. The ability to retain a 1:1 ratio reduces dimensioning and scaling errors and eliminates the necessity to use different dimension scale factors on details and you draw or edit.

7.2.3. Sheet Scale Notation


Each Sheet in a plan set must indicate the scale a drawing can be measured. On Layout plan sheets, where one scale can be used to measure the entire sheet, a Bar Scale with scale notation is inserted below the sheet title or near the corner card. On Layout plan sheets where multiple scales are used, a Bar Scale for each scale must be inserted either below the title of each detail or near the corner card of the sheet. Bar scales are provided in several cell library files including the rdy_design.cel and str_maslib.cel. Bar Scales should be inserted and labeled to measure correct on a full size (22"x34") plans. One reason for the bar scale is to aid in the use of engineering scales when plans are produced at half size or not to scale plots. Detail sheets such as Typical Sections or Structural Detail Sheets, which are drawing to scale, should include scale notation, but no graphical scale bare is required. Graphical scale bars are typically for mapping or layout plan sheets. Typical Sections or Structural Details should typically not be scale from the paper plans the scale notation is essentially a design and drafting aid.




7.3. LINE WEIGHT STANDARDS

Line weights, or the varying line thicknesses used in engineering drawing, are essential in creating a drawing that communicates efficiently. Line weight is used to aid in making elements or features in a drawing stand-out. VAOT basically uses 4 different line weights in the production of plans and details. Very heavy or thick line weights are used sparingly for specialized purposes or large title annotations. While line weight is important, it is only so on hard copy documents. Different line thicknesses on screen are of no value and in fact, are sometimes a hindrance. MicroStation has the ability to toggle line weights on or off from the settings attribute dialog, so always have weight turned ON in your DGN when plotting.

The general concept is to have the new or proposed features stand-out more than existing features. Existing features are sometimes dithered to 75% of black to help new or proposed features stand-out. Existing features are shown with a line weight of 0 (wt=0). New or proposed features are shown with a line weight of 1 (wt=1). A line weight of 2 (wt=2) is used to emphasize certain features even more. Examples of features and their standard line weights are shown in table 7.3a.

Table 7.3a (Note: N/P = New or Proposed)

Line Weight	Graphic or Feature (Examples)
 0	<ul style="list-style-type: none"> Graphics in the Survey (sv or sav) file Existing Topographic file (top) graphics Details of Existing Structures Cross Hatching Fill patterns Dimension Lines Extension Lines Leader Lines Flow Arrows Existing Text and Annotation

	1	<ul style="list-style-type: none"> N/P Pavements Edges N/P Alignments N/P Alignment annotations N/P Contour Lines N/P Surface Lines in Cross Section 	<ul style="list-style-type: none"> N/P Surface Lines in Profile N/P Standard Text and Annotation Dimension Text N/P Utility Lines
	2	<ul style="list-style-type: none"> Utility Poles Limits of Construction Lines Large Text (weight as needed) 	<ul style="list-style-type: none"> Border Lines ROW Lines Rebar Lines
	3	<ul style="list-style-type: none"> Matchlines ROW Lines 	<ul style="list-style-type: none"> Large Text (weight as needed)

7.3.1. Level Library Line Weight

The VAOT level library has line weight assignments for each level. These line weight assignments are available when lines are placed using Bylevel symbology. The weights in the library are assigned according to the most common weight that elements on that level will likely require. In some cases By element line weight will be necessary to acquire an alternate line weight for the design circumstances.

7.3.2. Line Thickness on paper

MicroStation Plot Driver files specify the mapping of DGN line weights to line thickness on paper. These plot driver files are delivered with MicroStation. VAOT does not modify the standard line thicknesses. We do have modified plot driver files for use with half size printing if required. Table 7.3b indicates the paper thickness of lines as related to the MicroStation WT= (number).

Table 7.3b

Plot Size	Line Weight in MIL						
WT =	0	1	2	3	4	5	6
Full Scale	9.8	14.8	19.7	24.6	29.5	34.4	39.4
Half Scale	4.9	7.4	9.8	12.3	14.8	17.2	19.7

As shown in the table, lines of weight 1 (wt=1) in a MicroStation design file are plotted on full size prints at 14.8 one-hundredths of an inch or 14.8 MIL. Plots made at ½ of the full size prints having a wt=1 have a line thickness of 7.4 one-hundredths of an inch or 7.4 MIL. On our network drive we have several MicroStation plot driver files available. VAOT half size plot driver is available in the (T:\CADD\Workspace\Standards\plotdrv) directory along with several others. The standard MicroStation plot driver files including the PDF plot driver that will create PDF files directly from MicroStation are located in the (T:\CADD\Workspace\System\plotdrv) directory.

7.3.3. InterPlot IPS Line Weight



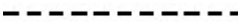
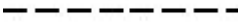
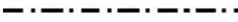
VAOT currently uses InterPlot or iplot to do most of our plotting. The above Plot driver files work with MicroStation plotting not with iplot or the IPS file. Half size plotting with IPS files is done in the VAOT reprographics print room with a 50% scale factor on the plotter. The IPS file does not output different scale plots directly; you would need to change the scale factor and the iplot pen table of each plot in the IPS file. This method is not advisable due to duplication of iplot files, one for full size and one for half size. The line thickness definitions in the iplot pen tables match the MicroStation plot drive line thicknesses show above in table 7.3b.

7.4. LINE STYLES AND CUSTOM LINE STYLES

Line styles, or the varying of line symbology in engineering drawings, are essential in creating a drawing that communicates efficiently. Line styles are used to aid in identification of elements or features in drawing. There are 2 basic categories of line styles, MicroStation delivers 8 standard line styles LC=0 through LC=8, the other type is custom line styles.

7.4.1. Standard Line Styles

The 8 standard line styles or line codes are used for the majority of drafting on design plans. The MicroStation key in of LC=0 will make active the line code of 0; this is your basic solid line and is the most common. The table 7.4a below indicates VAOT usage of the 8 standard line codes.

LC=	Preview	VAOT Common Usage
0		Typical solid line use for Proposed objects such as: <ul style="list-style-type: none"> • Edge of Roadway • Center of Roadway • Major Surface contour lines • This is the most common line style or line code
1		This is a dotted line use for: <ul style="list-style-type: none"> • Clip boundary shapes • Existing Bridge • Survey Control lines
2		This is a typical hidden line used for: <ul style="list-style-type: none"> • Existing roadway features • Existing Bridge abutments • Typical Existing Feature line style or code • Proposed Surface minor contour lines
3		This is a typical dash line used for: <ul style="list-style-type: none"> • Existing Ground minor contour lines
4		This is a Line-dot-Line used for: <ul style="list-style-type: none"> • Bridge Beam proposed • Drainage Flow Line • Existing Bridge Rail • Drainage Structures

5	-----	This is a short dashed line used for: <ul style="list-style-type: none"> No common use at this time
6	This is a typical line-dot-dot-line used for: <ul style="list-style-type: none"> No common use at this time
7	-----	This is the typical center line use for : <ul style="list-style-type: none"> Centerline symbology

7.4.2. VAOT Custom Line Styles

VAOT has many custom line styles defined in our elines.rsc MicroStation resource file. This file is automatically loaded to your MicroStation session when you are using the VAOT network setup. This file is also available for download on the VAOT CADD help web site with the download resource package. Each level in the level library has either a standard line style or a custom line style assigned to it. This line style assignment works when lines are placed using the Bylevel Line Style settings. The line styles in the library are assigned according to the most common line style that elements on that level will likely require. In some cases By element line styles will be necessary to acquire the proper or best line style for the design circumstances.

For a complete list of VAOT Custom line styles see Appendix D. This line style reference was generated for this document. The line style scale of these lines has been modified in some cases for clarity.

7.5. TEXT AND ANNOTATION

Engineering plan sets are graphical representations and instruction documents for construction projects. Line weight and line styles aid in identification of elements and features. Text and annotation on the plans will further identify features and clearly indicate information required to properly and efficiently construct the project to meet specifications. Text and Annotations are a vital component of engineering plans. Consistency and Clarity in annotation is important.

Annotation Consistency is accomplished with standard text sizes and fonts. The use of Text Styles in MicroStation V8 will aid in consistency. Consistency in text size, font, text justification, and line spacing throughout all drawings shows attention to detail and professionalism.

Annotation Clarity is accomplished in part by maintaining consistency. Other methods for clear text and annotations include keeping appropriate white space between notes, proper spelling, and appropriate line weight. There are many factors involved in clearly annotating engineering plans.

7.5.1. Text Size

Text size on all VAOT CADD drawings will follow the standard as indicated in this section. VAOT standard text size is 0.14 inches on the plotted full size plans. The 0.14 inch standard is also referred to as the Leroy L140 size. Existing topographical annotations shown in the Survey original ground DGN (sav or sv) and existing topographical annotation drawing (top) are L120 or 0.12 inches on the plotted full size plans. The reduced size L120 of existing annotation with a line weight of 0; aids in identification of the proposed annotations that are shown at L140 with a line weight of 1.

To mathematically determine the appropriate text size for Engineering scale, use the following equation: $0.14 \times (\text{plotted scale}) = \text{Text Size (FT)}$. For example if you are plotting a drawing at 1"=20' scale, the standard text size should be $0.14 \times 20 = 2.8$. It should be noted that titles are $\pm 50\%$ larger in size 0.20 or 0.24. Table 7.5a is a table of text size with the applied annotation scale for sheet plot scales.

Table 7.5a

Sheet Plot Scale	Leroy Text Size (Units are Feet)						Scale Ratio
	120	140	175	200	240	290	
Full Size 1=1	0.12	0.14	0.18	0.20	0.24	0.29	1:1
1"=10'	1.20	1.40	1.75	2.00	2.40	2.90	1:120
1"=20'	2.40	2.80	3.50	4.00	4.80	5.80	1:240
1"=25'	3.00	3.50	4.38	5.00	6.00	7.25	1:300
1"=30'	3.60	4.20	5.25	6.00	7.20	8.70	1:360
1"=40'	4.80	5.60	7.00	8.00	9.60	11.60	1:480
1"=50'	6.00	7.00	8.75	10.00	12.00	14.50	1:600
1"=60'	7.20	8.40	10.50	12.00	14.40	17.40	1:720
1"=80'	9.60	11.20	14.00	16.00	19.20	23.20	1:960
1"=100'	12.00	14.00	17.50	20.00	24.00	29.00	1:1200
1"=150'	18.00	21.00	26.25	30.00	36.00	43.50	1:1800
3"=1'-0"	0.04	0.05	0.06	0.07	0.08	0.10	1:4
1 1/2"=1'-0"	0.08	0.09	0.12	0.13	0.16	0.19	1:8
1" = 1'-0"	0.12	0.14	0.18	0.20	0.24	0.29	1:12
3/4"=1'-0"	0.16	0.19	0.23	0.27	0.32	0.39	1:16
1/2"=1'-0"	0.24	0.28	0.35	0.40	0.48	0.58	1:24
1/4"=1'-0"	0.48	0.56	0.70	0.80	0.96	1.16	1:48
1/8"=1'-0"	0.96	1.12	1.40	1.60	1.92	2.32	1:96

To determine the appropriate text size for Architectural Scales use the following equation:

$$0.14 \times (\text{Scale Ratio}/12) = \text{Text Size (FT)}$$

7.5.2. Standard Font

Text Font on all VAOT CADD drawings will follow the standard as indicated in this section. VAOT standard text fonts are MicroStation fonts named FONT 1 or FONT 5. Below is an example of MicroStation Font 5:



The primary VAOT standard Font is named **5 NYBRADD FONT** or **FONT 5**. This is basically MicroStation FONT 1 with some modified font spacing to achieve a more even spacing between letters. Below is an example of the VAOT FONT 1:



The MicroStation FONT 60 is sometimes used. Font 60 is a true block character where all characters have the same width. This font is very useful in tables and lists such as the Index of sheets or listing construction items by stationing where proper alignment of characters is important to achieve clarity.

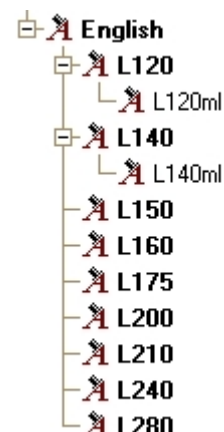


5 NYBRADD FONT or FONT 5 is used in General annotations, Title annotations, Dimension Text, and is considered the Standard VAOT font. Font 60 and Font 1 are used sparingly when VAOT Font 5 will not provide sufficient spacing attributes.

7.5.3. VAOT Text Styles

Text styles have been setup in MicroStation for use when annotating your design. These text styles are based on the settings shown in the Text Size table 7.5a. All text styles are setup to plot at Full Scale (1:1) for designs that are to be plotted at a specific scale i.e. 20 scale; MicroStation annotation scale must be set to 1" = 20' and then annotation lock must be activated for the Text Styles to factor accordingly.

Shown to the right are VAOT Text styles that have been created. L140 is the standard proposed text size; the L140ml and L120ml are the same size text with the minor changes made to accommodate Multi Line text strings. When working in a **Metric Drawing** the English text styles are available and the use of the MicroStation Annotation Scale will factor the text to work in metric files (Hard Conversion).



7.5.4. Text Justification

Text justification has an important roll in clarity with which notes and call outs are read. Proper Justification allows the reader of the text to easily follow along from line to line or from note to note. Left side justification is proper and standard for all construction notes, call out notes, specification notes, notes with leader lines etc. When possible, notes should line up vertically with the note above and or below to create a margin-line. As with any English written document we read from left to right, the left side margin-line aids in following along down a list of notes and annotations. Two exceptions to the left side justification standard are Dimension Text and Title Text, these are normally center justified.

Many VAOT standard cells contain text with irregular text justification. These cells or details were drawn long ago when there was no multi-line text and changing text justification was more difficult. Computer aided drafting has become much more capable. Creating clean margin-lines and properly justifying text is very simple. There are many tools available to aid in placing text in well organized, legible, columns and groups. Well placed, well organized engineering text and annotations will aid Quality Control & Quality Assurance checks as well as create professional looking plans.

7.6. DIMENSIONING STANDARDS

Engineering plan sets are graphical representations with instructions, for construction projects. Engineering drawings are drawn to scale representing true life sizes and relative location. True scale drawings insure proper design measurements and attempt to replicate the conditions and space requirements during construction. Engineering plans could be measured using engineering scales however, measurements required to construct the project must be provided. Scaling or measuring off paper plans for construction purposes is never recommended.

All design drawings and detail drawings are drawn with a 1:1 ratio or true scale. MicroStation provides very useful tools that measure and annotate the size of elements. VAOT provides dimension styles that aid in standardizing dimension annotations. Good dimensioning is a skill that requires experience and attention to detail. Dimensions are a vital component of engineering plans. Consistency and Clarity in Dimensioning is important. Well organized standardized dimensions will aid in Quality Control & Quality Assurance check as well as create professional looking plans.

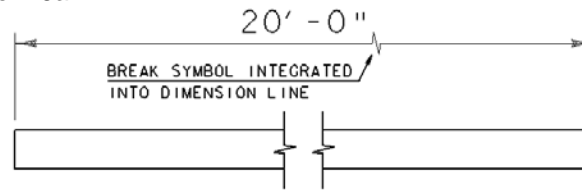
7.6.1. Dimension Line

The dimension line is the primary component of dimension symbolization. A VAOT standard dimension line has the following attributes:

1. Solid line (LC=0)
2. Weight of line is 0 (WT=0); on site layout plans (WT=1) is used to help identify proposed dimensions
3. Level = ODIML_P (Details, Dimension & Extension, Lines, Proposed) from the standard VAOT level library.
4. Standard DIMARO cell shown at both extents of the Dimension line.
5. Never broken (always connect extension lines with a dimension line).
6. If not drawn to scale a break-line symbol is integrated into the line indicating a **Not To Scale** dimension. Below is an example of a 20'-0" bar broken for display

purpose but dimensioned with a breakline symbol to indicating it is not to scale. Note; the dimension line is never broken; it's but a continuous line from extension line to extension line (with an integrated symbol). Alternately adding the suffix NTS to the dimension text can be used.

Figure 7.6a



7. Dimension lines are given Component **Priority of 1** (more on Component Priorities to follow)
8. When stacking dimensions the space between dimension lines is 3x height of the text ((0.14x3)x Scale Factor) as explained in Section 7.5.1 (See Dimension line stacking example below)

Figure 7.6b

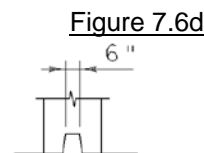
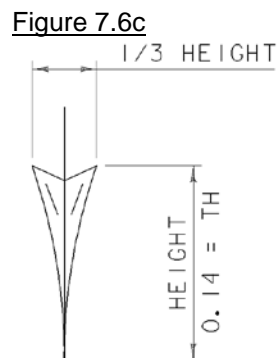
7.6.2. Dimension Text

Dimension Text, is the primary annotation component of dimension symbolization. This text follows the standards as indicated in Section 7.5 Text and Annotation. A VAOT standard Dimension Text has the following attributes:

1. Orientation: is aligned with the Dimension Line and Centered on the Dimension Line (if possible)
2. Location: is above the Dimension Line, the margin between the text and Dimension Line is $\frac{1}{2}$ the Dimension Text height or $((0.14/2) \times \text{Scale Factor})$ as explained in Section 7.5.1
3. Justification: Center of the text string
4. Shown with a line weight of 1 (WT=1)
5. Drawn on Level ODIML_P as a standard or Level ODIM_T when and if level separation is needed
6. Dimension Text is given Component **Priority of 2** (more on Component Priorities to follow)
7. Examples of Dimension Text are shown in figures 7.6a and 7.6b above.

7.6.3. Dimension Terminators

Dimension Terminators are components of the dimension line that terminate or identify the end of the dimension line. VAOT standard Dimension Terminators are arrow heads. The height of the arrow is 0.14" on full size plotted plans to match the text height. The width of the arrow is 1/3 the height of the arrow. Dimension Terminator arrows are placed as shown in figures 7.6a and 7.6b. Figure 7.6c shows standard arrow terminator sizing parameters.



VAOT standard terminators are placed inside the extension line. When sufficient space between the extension lines does not allow for terminators to be inside, outside terminators are utilized. When outside terminators are used the dimension line must continue to connect from extension line to extension line as shown in figure 7.6d.

7.6.4. Extension Line

Extension Lines are components of dimension symbolization that extends from the dimension line terminators to the objects getting dimensioned. Extension Lines are shown in all 7.6 Figures above. A VAOT standard Extension Lines have the following attributes:

1. Are always used when Dimension Lines do not extend directly to the object lines. Normally Dimension Lines are placed outside the object getting dimensioned. In situations where Dimension Lines are inside the object or the dimension line extends directly to the objects edge extension line are omitted.

2. Offsets of $\frac{1}{2}$ the text height are used between the start of the extension line and the identified element getting dimensioned.
3. Extension lines extend $\frac{1}{2}$ the text height beyond the Dimension Line
4. Drawn on Level ODIML_P with a WT=0); on site layout plans (WT=1) is used to help identify proposed dimensions
5. Extension Lines are given Component **Priority of 4** (more on Component Priorities to follow)

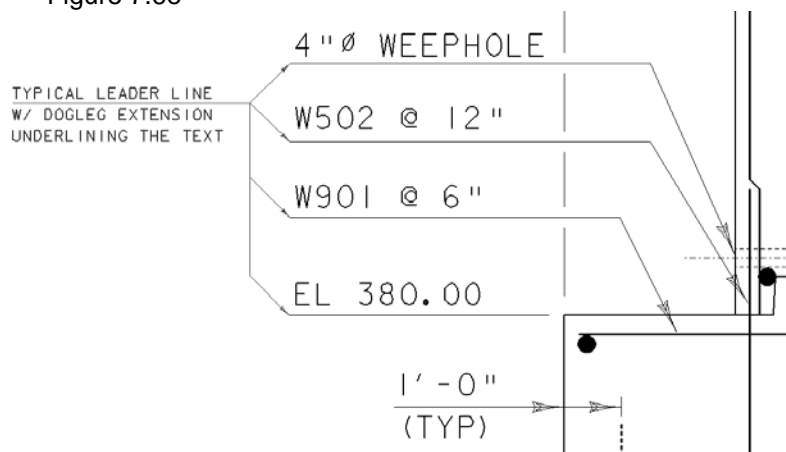
7.6.5. Leader Lines with Notes

Leader Lines are a cross between text and annotations and Dimensions. Leaders Lines with Notes fall in the dimension category as far as standards. Dimension levels, Dimension Terminators and Dimension Text are all used in creating the component of Dimensions annotations.

The leader line itself follows several of the dimension line rules. Attributes of the Leader Line are as follow:

1. Solid line (LC=0)
2. Weight of line is 0 (WT=0)); on site layout plans (WT=1) is used to help identify proposed leader annotations
3. Level = ODIML_P (Details, Dimension & Extension, Lines, Proposed) from the standard VAOT level library.
4. Standard DIMARO cell shown as the terminator of the Leader line.
5. The dogleg of the leader extends as an underline for the first line of Leaders Annotation. (See Figure 7.6e)
6. Leader terminators or the arrow tip should extend to the object being annotated there is no gap between the arrow tip and the object
7. Leader Lines have component **Priority of 3**.

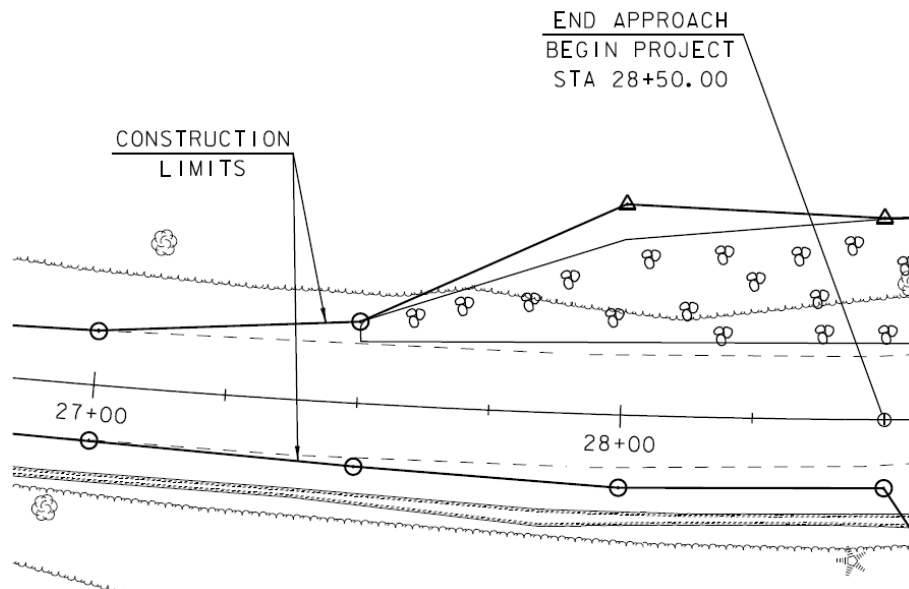
Figure 7.6e



In Figure 7.6e note the leader lines with Dogleg extension underlining the annotations. This is a VAOT standard on both site plans and details plans. When multi line annotations are utilized the dogleg extension acts as an under line for the first line of the note, as shown in the red figure annotation "Typical leader line" call out.

Figure 7.6f shown below is an example of leader line annotations as they are used on site layout plans. Note the dogleg usage under the first line of the multi line text.

Figure 7.6f



Leader notes or annotations are similar to Dimension Text. Leader notes have the following attributes:

1. Orientation: is aligned with the Dogleg Extension
2. Text is generally Left side justified. Site plan layout notes are sometime center justified. Left side justification is preferred especially when annotating details and when several annotations can be lined up in a list format. Left side justification helps to line notes up and group annotations together.
3. Shown with a line weight of 1 (WT=1)
4. Drawn on Level ODIML_P as a standard or Level ODIM_T when and if level separation is needed.
5. Text that is multi line has a line spacing equivalent to the text height. Where large construction notes or narrative are used line spacing can be adjusted for proper appearance. Line spacing of $\frac{1}{2}$ or $\frac{3}{4}$ the text height often looks better on large notations; these types of notes usually do not have leader lines.
6. Examples of Note or Annotation text are shown in figures 7.6e and 7.6f above.
7. Text and Annotation are given component **Priority of 2**.

7.6.6. Dimension Component Priorities

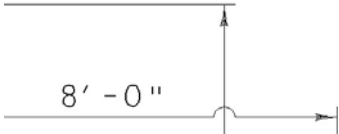
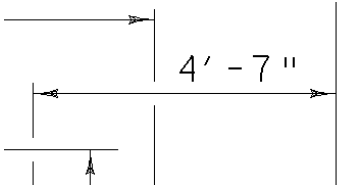
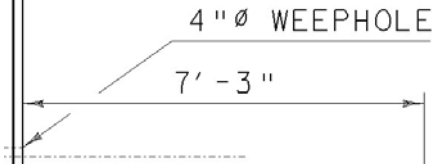
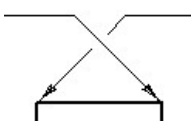
Dimension Components are the different types of elements that makeup dimension symbology. Components of dimensions often overlap and cross each other i.e. extension lines often cross dimension line and leader lines; dimension lines sometimes cross other dimension lines. The **Priority Level** as assigned in the above Sections 7.6.1 through 7.6.5 and summarized below in Table 7.6a are intended to define component conflict symbology creating clear standard dimensioning.

Table 7.6a

COMPONENT	PRIORITY LEVEL
Dimension Line - (Dim Line)	1
Dimension Text - (Dim Text)	2
Leader Line - (Ldr Line)	3
Extension Line - (Ext Line)	4

In dimension component prioritizing (1 being the highest priority) if a conflict or crossing occurs, components with the lower priority will yield to components with the higher priority. A simple example of a component yielding to a higher level component is when an Extension Line crosses a Leader Line, the extension line would be broken at the crossing point. Several examples of extension lines yielding to Leader Lines can be seen in Figure 7.6e above. See Table 7.6b below for possible conflicts and a drafting standard symbology to solve or clarify the conflict.

Table 7.6b

CONFLICT	SYMBOLY SOLUTION
Dim Line X Dim Line	 <p>The Jump over symbology shown here is used when two components of priority 1 cross. This symbol is a half circle with diameter equal to the text height.</p>
Dim Line X Ext Line	 <p>The mask symbology shown here is used when components of ≠ priority cross. Components with the lower priority are broken. This mask or break is equal to the text height.</p>
Dim Line X Ldr Line	 <p>The mask symbology shown here is used when components of nonequivalent priority cross. This mask or break is equal to the text height.</p>
Ldr Line X Ldr Line	 <p>The mask symbology shown here is used when components of priority 3 cross. This mask or break is equal to the text height.</p>

Ldr Line X Ext Line		The mask symbology shown here is used when components of ≠ priority cross. Components with the lower priority are broken. This mask or break is equal to the text height.
Ldr Line X Dim Text		The mask symbology shown here is used when components of nonequivalent priority cross. This mask or break is made larger to avoid dimension text.
Ext Line X Ext Line		The mask symbology shown here is used when components of priority 4 cross. This mask or break is equal to the text height.

The example conflicts in this table were created for the purpose of demonstrating the conflicts. Conflicts or crossing dimension components can be greatly reduced with proper dimension layout skills.

7.6.7. VAOT Dimension Styles

Dimension styles have been setup in MicroStation. These Dimension styles are based on the settings shown in Section 7.6 of this manual. All Dimension styles are set up to plot at Full Scale (1:1). For designs plotted at a specific scale i.e. 1"=20' scale, MicroStation annotation scale must be set to 1" = 20' and then annotation lock must be activated for the Dimension Styles to factor accordingly.






















To the right is listed the 3 VAOT standard dimension styles. The one English works for all plans and details. There are two Metric dimension styles one for site plans where the unit of measure is Meter (m) and one for details where the unit of measure is Millimeters.

VAOT Dimension Styles

English (ft-in)	English STD Dimensions
Metric (m)	Metric Plan Dimensions
Metric (mm)	Metric Detail Dimensions

7.7. COLOR TABLE STANDARDS

VAOT uses several different color tables. The color table shown below **vtrans.tbl** or **vaot.ctb** (top-left) is the VAOT default color table. This color table is use as a standard on the survey original ground file. Several other common color tables are shown below **struct.ctb** (top-right), **hear.ctb** (bottom-left) and **hear-rev.ctb** (bottom-right). Note that all VAOT color tables use color 1-63 only. The level library assigns a standard color number from 1-63 to each level. Colors other than the 1-63 colors are not used on standard drawing files. All project construction plan sets are printed in black ink on white paper: colors are relatively speaking not important.

File Name: vtrans.tbl or vaot.ctb	File Name: struct.ctb	File Name: hear.ctb	File Name: hear-rev.tbl
 0 0,205,195  1 255,255,255  2 0,235,255  3 245,255,0  4 0,255,0  5 255,0,0  6 220,0,255  7 255,155,95	 0 245,218,137  1 71,245,245  2 0,235,255  3 0,178,194  4 0,255,0  5 255,0,0  6 220,0,255  7 221,0,255	 0 255,255,255  1 0,0,0  2 255,255,255  3 0,255,0  4 255,0,0  5 255,255,0  6 255,168,168  7 255,115,0	 0 225,255,205  1 211,211,211  2 201,201,201  3 191,191,191  4 181,181,181  5 171,171,171  6 161,161,161  7 150,150,150

Plans printed for public hearings are printed in color as a visual aid and/or prop. Public meetings require different standards due to the color issue. VAOT has color tables that are commonly used in creating hearing plans and detail drawing. The two common hearing roll color tables are **hear.ctb** (bottom-left) and **hear-rev.ctb** (bottom-right). A legend for all hearing roll plans is provided to aid in identification of features by color and other symbology.

SECTION 8 - CELL AND CELL LIBRARIES

8. INTRODUCTION

MicroStation 2D and 3D drawings are created in a design (DGN) file as individual drawings or models. Each model can then be designated a cell and placed in the active design file. 2D and 3D cells can be placed in the same DGN file as well as the same cell library. A cell library in MicroStation is simply a DGN file with multiple models in it. Cell libraries have a .CEL extension.

VAOT has created a series of standard cell libraries used by most sections at VAOT. Using these standard cell libraries in place of redrawing common details or symbology facilitates standardization, saves time, and avoids costly errors.

8.1. CELL TYPE

When you create a cell, you define the cell origin (the location around which the cell is placed) and the cell type. There are three types of cells: graphic, point, and menu (menu cell will not be discussed here).

The symbology (color, line style, and line weight) of a graphic cell is determined when it is created, whereas a point cell assumes the active symbology when placed. A graphic cell rotates when a view is rotated, while a point cell is view-independent. A point cell can be especially useful for text.

A point cell has one “snappable” point — its origin — and is always placed on the Active Level, regardless of the level(s) on which its components were created. A graphic cell, however, is level-independent. That is, it can be placed on levels relative to the Active Level or on the same levels as when created, depending on whether Relative is on. The differences between graphic and point cells are summarized in this table:

Attribute	Graphic Cell	Point Cell
Level	level independent	placed on active level
Rotation	with view	view independent
Snap	to key points	to cell origin
Symbology	active settings when created	active settings when placed

Because most standard cells have been created at a default scale of 1:12 for 36"x22" size plot, the active/drawing scale to be used for placing cells in a file will be equal to the drawing scale in feet. For example, if the designer is preparing a plan sheet which is to be plotted at a scale 1"=20' (or plot ratio) of 1:240, the drawing scale for cells would be 20 or 240/12. If a detail drawing is to be plotted at the ratio of 1"=50', the drawing scale for placing cells would be 50. VAOT cells were created in an earlier version of MicroStation; the resolution units of the cells do not always match the resolution units of the DGN file you are working in. For this reason you should always toggle on the **TRUE SCALE** option for VAOT cells. True Scale when on scales cells *created* in a model with different units from those of the active model, the cells are scaled to adjust them to the units of the active model.

8.2. CELL LIBRARY UTILITY

The cell library utility (cellutil.ma) provides users with additional capabilities when working with cell libraries (e.g., the ability to quickly generate plots of cell libraries, and lists of the individual cells contained within a cell library).

To load the cellutil.ma, choose Utilities > **MDL Applications** from the MicroStation Main Menu. Then, in the MDL dialog under **Available Applications**, click the cellutil.ma MDL located in the T:\CADD\Workspace\Standards\mdlapps folder (or key-in: mdl load cellutil). Step by step instructions for using cellutil:

1. Attach a cell library.
2. Start cellutil.ma
3. Select the cells to be placed in a grid.
4. Select one of the three grid formats.
5. Data on the view to place the grid(s).

8.3. CELL LIBRARIES

VAOT has several cell library files. Each design section has specific cell library files that are use as a standard. The cells library files have been named in according to a relevant VAOT design section usage. All cell library files are prefixed to help define the cells contained. The prefixes are as follow:

PREFIX	RELEVANT DESCRIPTION
con_	Construction
mat_	Materials and Research
pav_	Pavement Management
rdy_	Roadway Design (Survey)
Row_	Right of Way
str_	Structures
trf_	Traffic
VT_	Vermont VAOT General
env_	Environmental / Storm Water

Each cell library contains cells which share a common theme. Specific cells have been created for use by each design section. All cells are available for use as need on the network drives as indicated in **Section 2.10 File Location Table**. Below is a listing of the Standard English cell library files and a description of the content. The metric cells are similar in name and content and are being phased out.

ENGLISH CELL LIBRARIES	CONTENT
env_stormWaterMgt.cel	Storm Water Management Cells
con_finals.cel	Construction Finals cells
das.cel	Unknown cells
env_stormWaterMgt.cel	Storm Water Management Cells
hear.cel	Hearing Plans related cells
mat_soils.cel	Materials and Soils lab cells
pav_lesw.cel	Pavement cells
rdy_designlib.cel	Roadway Symbolology Standard cells
row_row.cel	Right of Way cells
row_row3d.cel	Right of Way cells
row_titnote.cel	Right of Way Title Note cells
str_maslib.cel	Structures Symbolology Symbols cells
str_select.cel	Structures Standard Details cells
trf_pavemtmark.cel	Traffic Pavement Marking cells
trf_signalequip.cel	Traffic Signal Equipment cells
trf_signbike.cel	Traffic Sign for Bikes cells
trf_signbiked.cel	Traffic Sign for Bikes Dimensioned cells
trf_signfreewy.cel	Traffic Sign Freeway cells
trf_signguide.cel	Traffic Guide Sign cells
trf_signguided.cel	Traffic Guide Sign Dimensioned cells
trf_signmisc.cel	Traffic Sign Miscellaneous cells
trf_signposts.cel	Traffic Sign Post cells
trf_signregul.cel	Traffic Sign Regulatory cells
trf_signreguld.cel	Traffic Sign Regulatory Dimensioned cells
trf_signrest.cel	Traffic Sign Rest Area cells
trf_signroadwd.cel	Traffic Sign Road Work Dimensioned cells
trf_signroadwk.cel	Traffic Sign Road work cells
trf_signwarn.cel	Traffic Sign Warning cells
trf_signwarnd.cel	Traffic Sign Warning Dimensioned cells
trf_traffic.cel	Traffic Default cells
trf_trafmisc.cel	Traffic Miscellaneous cells
VT_inroads.cel	VAOT InRoads Symbolology cells

SECTION 9 - SURVEY

9. INTRODUCTION

Consistent survey information is an essential element to any project. This chapter provides both suppliers and customers with a summary of the files and services that may be provided by the survey data collection method to assist with the production of highway and/or bridge project plans. This Section applies to all survey files produced for the Vermont Agency of Transportation. Files listed are based on the file naming convention outlined in Section 4 of this manual and are for a typical highway and/or bridge project.

9.1. TYPICAL PROJECT REQUIREMENTS

Using the InRoads Survey Preferences we create a set of files that will be used during the design of a roadway project or other Agency Project. The standard files required for the design of a project are as follows:

Original Ground 3D surface Design File..... x98j099sv.dgn

Original Ground Digital Terrain Model..... x98j099og.dtm

Original Ground Geometry File.....x98j099og.alg

OG Interactive Coordinate Geometry Subsystem File.....x98j099og.ics

Other requirements may be required by the Vermont Agency of Transportation Route Survey Section. Some files are created and kept in original format for legal archives. See Appendix E for an example of the "Survey Data Submission Check List".

9.2. PROJECT SPECIFICATIONS

VAOT Route Survey Manual	Provided by Route Survey Section
VAOT Roadway Design Manual	Provided by Roadway Design Section
VAOT Structures Manual	Provided by Structures Section
VAOT Other Sections	Provided by Other Sections

Each VAOT design section will have specific requirements for the survey of original ground.

9.3. ORIGINAL GROUND DRAWING

Survey data collected in the field is imported into InRoads Survey. Survey data is checked for any errors then corrected. The data is then written to MicroStation DGN graphics, creating the original ground drawing (*.sv). This file is a critical step in the design process. After a design section receives notification that the original ground has been surveyed, the drawing should be checked by the project engineer for proper location and extents.

For more information on the original ground drawing see Section 4.7 of this manual.

9.4. DIGITAL TERRAIN MODELS (DTMs)

Survey data collected in the field is imported into InRoads Survey. Survey data is checked for any errors then corrected. The data is written to InRoads data format known as the DTM or digital terrain model. This model is important data in the design process. The DTM is a 3D mathematically triangulated representation of the terrain. This model should be checked by the project engineer to insure the model is sufficiently accurate for the project.

9.5. GEOMETRY FILES

As with the DTM model, once the data has been imported and corrected a geometry (*.alg) file is created. This file takes all the features collected and converts them to geometry data. This data is sometimes used for measuring of existing features.

The geometry ALG file can be converted to an ICS or Interactive Coordinate Geometry Subsystem file. This is an ASCII format file of the geometry. ICS files can be imported into InRoads and saved back to ALG. The ICS file serves as a backup and cross checking file when and if required.

9.6. SURVEY DATA

The following files shall be archived with the project for the purpose of saving the survey notes:

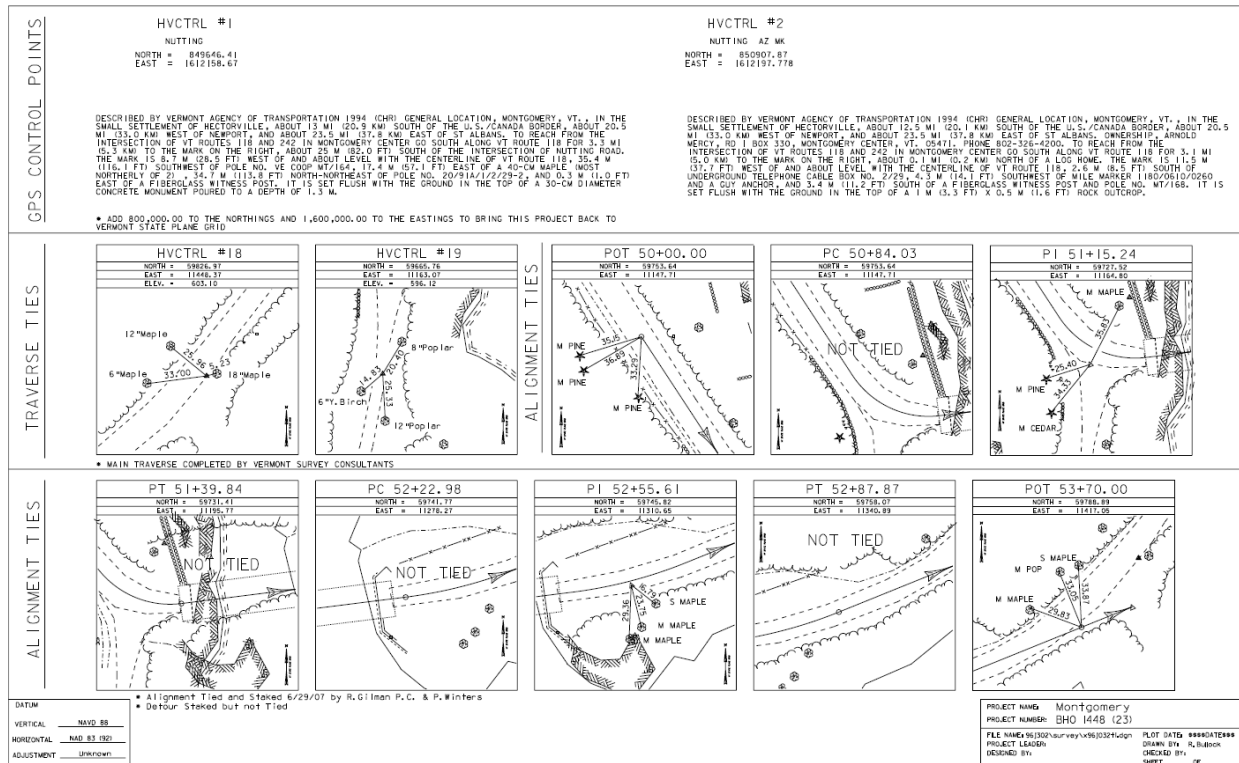
<u>File Name</u>	<u>Contents</u>
xPPMS.rw5	Tripod Data Systems survey data collector file
xPPMS.raw	Survey data collector file unedited
xPPMS.fwd	InRoads Survey Field book including edited survey observations
xPPMS.log	InRoads Survey Field book Audit Trail File

These files are named according to the file naming convention shown in Section 4 of this manual. If data collection software, other than Tripod Data Systems (TDS) is used, similar data collector files using the data collection software file extensions should be submitted.

9.7. TIE PROCEDURE

The following describes content and standards used to create a Tie Sheet. The Tie Sheet must contain all pertinent data that the Surveyor will need, to recreate any project alignments in the field. This process is intended to be used on all projects that used electronic data collection and will be used even if the datum is assumed.

Example of a Completed Tie (ti) Sheet



The Tie Sheet is divided into three parts with the upper section containing geodetic control information (when provided). Most projects contain at least (2) Horizontal and Vertical Control points that are listed in the Geodetic Control portion of the Tie or (ti) sheet. Control points are shown with true datum coordinate values, below the description any shift for assumed project coordinates is defined.

Example of Geodetic Control Information

HVCTRL #2

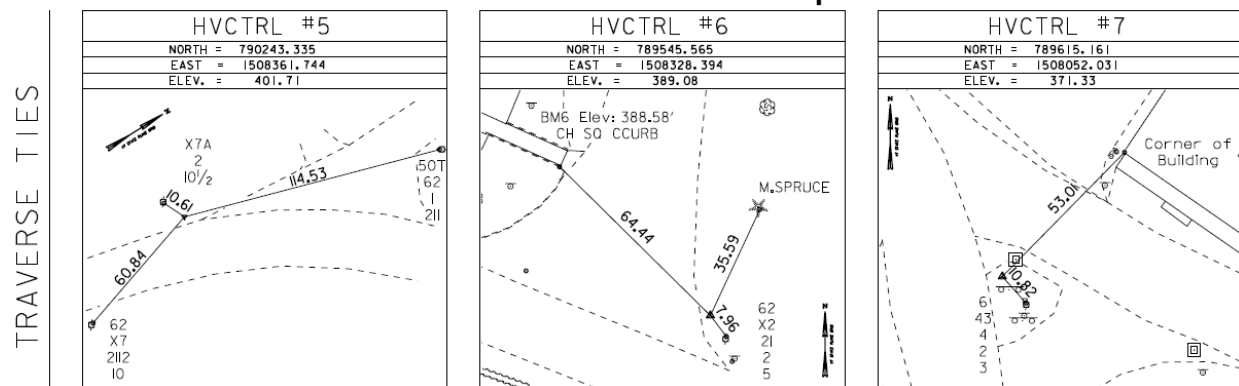
HILLCREST AS MK

NORTH = 792293.557
EAST = 1508349.102
ELEV. = 480.372

To reach from the Intersection of VT route 104A (Highbridge Road) and VT Route 104 (Main St) go southeast along route 104 for 1.0 mi to the intersection of Huntville Road left. Turn left and go northeast along Huntville for 0.5 mi to the intersection of Huntville Road left and Boissonault Road right. Turn right and go south along Boissonault Road for 0.3 mi to the site of the mark on the right. The mark is set 2" below ground surface in the top of a Feno-style monument. It is 19' west of and about .7' lower than the centerline of Boissonault Road, 87.6' northwest of pole #9, 205.7' south of a guy pole, 222' southwest of pole #602/7, 178.8' southwest of the centerline of the gravel drive leading to house #87, and .7' north of a fiberglass witness post.

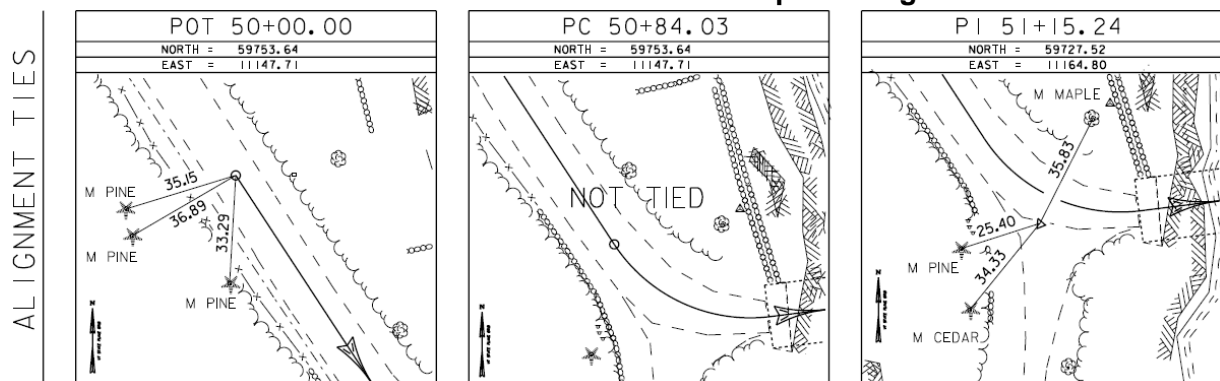
The *middle section* contains traverse tie information that the surveyors used for collecting the topology. For traverse points, box ties shall be shown with the Description, Northing, Easting, and Elevation of the point given. The Description shall be the control point number given in the survey data **PROJ#.rw5** or **PROJ#.ics** file (i.e. HVCTRL #5). The coordinates of these points are given in the **PROJ#.fwf** or **PROJ#.ics** file.

Example of Traverse Tie Information



The *lower section* contains alignment tie information for the proposed alignment. The lower section will be blank when making the survey request and will be filled in later with information provided by the surveyors. The ties do not need to be placed to scale, but they should be oriented correctly relative to the alignment and other points shown.

Example of Alignment Tie Information



Coordinates for Geometry (Alignment) points can be reported or generated using InRoads Geometry Report Commands. All Tie distances must be horizontal measured, field observations to existing features, not computer distance measurements made from CADD applications.

9.7.1. TIE GPS Control Points

On most projects, the surveyors establish horizontal control for the project by running a traverse to the project site from nearby geodetic survey disks with known coordinates. When this is the case, these GPS control points shall be described on the tie sheet with the name of the disk, northing, easting, elevation if known and description of the location. On older surveyed projects the Survey section can provide a paper copy of that information. On current or recent projects, the Survey section will have a tie sheet for each project and this PROJ#ti.dgn can be referenced or copied into our files. If these disks are shown with ties, then the ties should be shown. If no ties are shown, then the description is adequate.

9.7.2. TIE Drawing Setup

The VAOT Standard Cell library *rdy_designlib.cel* contains the template for creating the Tie sheet border and tie boxes. This cell is named **TIESHT**, this is the standard VAOT LAYOUT border with tie boxes for the 3 section i.e. Control, Traverse, Alignment. Each Tie Box can reference up the PROJ#sv.dgn or other such as PROJ#nu1.dgn, file and references in this sheet can be rotated and moved then clipped to fit the tie box. A north direction indicator should be present in each tie box. Tie boxes can be moved and reorganized as shown in the examples if there are more than (5) alignment ties, but are not to be resized. Tie box details need not be drawn to a specified scale, but as mentioned all points should be shown in relative location not schematic. Each Tie Box contains only one point tie, Traverse or Alignment.



SECTION 10 - DESIGN

10. INTRODUCTION

This section documents standards and directs suppliers to resource material as it relates to the design of a project. Consistency in the development of design and data files is essential due to the need to have several people work on a project and to be able to effectively transfer information to Construction once design is complete.

10.1. PROJECT SETUP STANDARD

During project scoping, a “start-up” meeting should be held to determine CADD requirements and design strategy for a project. Attendees at this meeting should vary depending on the specific requirements of the project. The meeting should typically include the designer, the Project Manager / Project Engineer / Project Supervisor, representatives from other Agency or non-Agency entities may be required.

10.1.1. Alignment Criteria

Consensus should be reached at the project start-up meeting regarding which types of alignments are to be progressed to complete the project.

Refer to VAOT Road Design Manual for roadway Alignment design criteria

Refer to VAOT Structures Manual for Bridge Alignment design criteria

Refer to other VAOT Section Design manuals as required for the design criteria

10.1.2. Check Existing Files

The designer should identify all existing files in the project and verify that they have been incorporated into a project “job file”. Consultant suppliers should check all files transferred to them at the beginning of a project. It should be verified that all files necessary to begin design are available.

The evaluation of the Digital Terrain Model (DTM) prior to design is a critical step in the initiation of a project. An understanding by the designer of the type of survey and corresponding accuracy is important. The quality of the design produced is directly dependent on the type of survey used. Since survey data is often ordered prior to project scope closure, the details of the design requirements are often not known at the time of survey request. The level of accuracy of the plans forwarded to construction must correspond to the level of accuracy of the survey. This does not imply that a designer must always receive or order the most accurate survey available. More accurate survey can be obtained in critical areas of the project during design or verified by construction as part of the contract. The designer should be familiar with the DTM Model and design accordingly.

10.1.3. Create MicroStation Files

Creating MicroStation files before the information to include in them is complete allows the designer to define reference file attachments at the onset of a project and have necessary files available as they are needed. The designer should create the following MicroStation files:

PROJ#nu1.dgn	PROJ#top.dgn	PROJ#bdr.dgn	PROJ#wrk.dgn
PROJ#ero.dgn	PROJ#dtl.dgn	PROJ#typ.dgn	

10.1.4. Create InRoads Files

The following InRoads files should be created:

- PROJ#.alg All alignments are usually contained in one PIN##.alg or project alignment file. However, a project may be divided into two or three PIN##.alg files depending on the nature of the project. For example, Northbound and Southbound alignments may be in separate PIN##.alg files so InRoads tasks can be worked on by two people.
- PROJ#.itl Project Typical sections are usually contained in one itl file.
- PROJ#.ird Project Roadway Definitions usually contained in one ird file.
- PROJ#.rwk The InRoads project file is user specific.
- InRoads allows for both a name and description when creating alignments, templates, roadways, DTMs, etc. Both name and description should be added. Names should be limited to 10 characters and should not contain spaces or symbols. More than 10 characters may not display in the active window tools.
- Alignments: The name should be brief and logical. The name of the roadway (route number or common name) should be part of the name. The description should describe the type of alignment (centerline, edge of pavement, detour, etc.), limits of the alignment (station to station or reference marker to reference marker.), and origin (record plans, feature, graphical)

Examples:

Name:	US_2
▪ Description:	US ROUTE 2 PROPOSED
▪ Name:	RAMP_A_ON
▪ Description:	I89 RAMP A ON

- Typical Sections: Typical section naming should only describe the typical section since the same typical can be applied to multiple alignments using Roadway Library.
- Roadways: Describe the alignment and typical section, and limits of model.
- DTMs: Describe DTM and origin (modeler, break line, contour, etc.).

10.1.5. Create Project/CADD Notebook

A notebook containing CADD information should be created during the project set-up stage and maintained and updated throughout the life of the project. This notebook, usually a three ring binder, is intended to be a reference that can be used without accessing a computer. The CADD notebook should contain a complete set of working plots (plans, profiles, and sections). These plots are necessary for immediate reference, field work, sketching of design alternatives, and quality control reviews. The CADD notebook is useful for answering questions and taking on field trips and serves as a hard copy record that is available to anyone who may have to take charge of a project prior to completion of design.

The CADD Notebook should contain current copies of the following information:

- All InRoads generated reports as they are created (e.g. alignment, superelevation, volume, etc.).
- 12x18 or 11x17 size cross sections, profiles, and plan sheets.
- Any other pertinent CADD information specific to the project that warrants documentation.

10.1.6. Determine the Plot Scale

Contract plans should be developed to plot on VAOT standard paper size (detailed in Section 7.2 of this manual) at standard engineering scales (10, **20**, 30, etc.) scales. Portions of projects, very simple projects, some structure plans, and alternate size sheet drawings may require other scales. Profiles are generally developed at the same horizontal scale as the general plans with enough vertical exaggeration to adequately show needed details, typically (2 or 4) vertical to (1) horizontal.

10.2. DESIGN STANDARD DRAWINGS

VAOT maintains design standard drawings sheets. These drawing are incorporated into the design plans. Standard drawings are owned by 1 of 7 sections/units of VAOT. Standard drawing owners are responsible for the creating and maintaining the content of the Agency design standards. The official standard DGN files are stored on the AOTCADD server. These DGN files and PDF format files with signatures are available on the CADD Help download web site.

Standard Drawing files within the Agency should never be copied to project folder or any other storage location. Agency Design Standards DGN files when required are referenced into your drawings or opened as read-only from the AOTCADD server. Making unauthorized copies Agency CADD standards drawings is prohibited.

Consultants coping standards from the VAOT CADD download web are required to insure they are using the most current version. Revision dates are posted on the Standards Download web page with the download link as well as an ASCII file index of all standards.

10.2.1. VAOT Reprographic & Design Standards

Standard drawings are never included in the project plot set. Standards are listed on the Project Index of Sheets with the approval date. VAOT reprographics section has current copies of signed standard documents in a scanned image format. These signed standards are added to the plan sets by the VAOT reprographics section at the time of printing. These are the only sheets reprographics will add to plan sets all other details and plans must be included in the standard project plot set.

10.3. EROSION CONTROL DETAIL DRAWINGS

Erosion Control Detail files within the Agency should never be copied to project folder or any other storage location. Erosion Control Detail DGN files should always be referenced into your file from the AOTCADD server (see Table 2a for location of these details). Making unauthorized copies Agency Erosion Control Detail drawings is discouraged. Changes made to these details may be posted to the AOTCADD server without notification. Referencing of these details is the preferred method for using the Erosion Control Detail Drawings.

10.4. EXCEL SPREADSHEET FORMS

These are standardized spreadsheet forms developed by VAOT for use in plan production. Standard forms in Microsoft Excel format include:

Table 10.3a

ENGLISH	METRIC	DESCRIPTION
engreinf.xls	metreinf.xls	Reinforcing Steel Schedule
engpi.xls	metpi.xls	Preliminary Information Sheet
engquant.xls	metquant.xls	Quantity Sheet (OLD)
EngROWDetailsheet.xls	MetricROWDetailsheet.xls	ROW Details Sheet
enggeneral.xls	metgeneral.xls	General Notes Sheet
engboring.xls	metboring.xls	Boring Log Sheet
engindex2.xls	metindex2.xls	2 Column Index Sheet
eng3colew.xls	met3colew.xls	3 Column EarthWorks Sheet
engitemdetail.xls	metitemdetail.xls	Item Details Sheet
engdrain.xls	metdrain.xls	Drainage Details Sheet
engitemdrain.xls	n/a	Item Details & Drainage Sheet
VAOT_quant.xls	VAOT_quant.xls	Quantity Builder Sheet

These forms are located as shown in Table 2a of this manual. Excel data from the above forms is linked to DGN models for plotting.

10.4.1. Linking Excel Forms to DGN models

Step-1) Select the area of the workbook to be linked; Edit -> Copy to clipboard

Step-2) In the MicroStation DGN file:

- a) Insert a Standard Layout at 1:1 Scale
- b) Drop the Layout Cell (not Line String/Shape)
- c) Delete the Corner Card
- d) Change the level of the Layout border shape to NBC1.

Step-3) MicroStation Menu Edit -> Paste Special:

- a) Select Linked Microsoft Excel Worksheet -> Paste.
- b) Paste OLE [Link] and [By Corners].
- c) Snap to upper Right corner of border.
- d) Next, snap to the mid point of the bottom border line.

Step-4) To update the linked Excel data use the MicroStation menu Edit -> Update links. Updating the links is necessary after the Excel worksheet has been modified; automatic updating does not function for Excel worksheets.

SECTION 11 - SHEETING & PLOTTING

11.INTRODUCTION

The purpose of this section is to provide information needed to produce a standard VAOT project plot setup and plans. Narration is provided to give reasons (if available) explaining why we do things the way we do. The workflow for most procedures is shown using bullet statements.

The main emphasis in this document is that topographic features are **never** copied or rotated from the original survey file. Rather, the sheet borders are rotated and moved to surround the topographic features which remain in their original position. Using this method, the user can take full advantage of reference files and avoid duplicating work. Once layout sheet borders are positioned the creation of the sheeted models or (Sheet models) is the final step before plotting or batch plotting.

11.1. CREATE PROJ#bdr.dgn (SHEET BORDER FILE)

PROJ#bdr.dgn is the border file and will contain the cut sheet borders for a particular set of sheets i.e. Roadway Layout or Erosions Layout etc, matchlines, north arrows, and bar scales are also drawn in the bdr.dgn. This file begins by copying an Agency seed file. *English:* [\[vtseed3d.dgn\]](#) | *Metric:* [\[vtmseed3d.dgn\]](#)

Agency seed files are located as shown in the [File Location Map](#) section of CADD Help.

11.2. SHEETING A PROJECT IN THE PROJ#bdr.dgn FILE

Before continuing with CADD work, the user should "sheet" the project to know the active angle to use when placing proposed annotation in other CADD data. "Sheeting" is done in **PROJ#bdr.dgn** file and involves placing sheet borders along the mainline alignment with the long axis of the sheet border parallel to the mainline alignment. If a bridge is involved, it is good practice to center the bridge on a sheet. All sheet borders should be placed at elevation zero or Z=0 in the design file.

When multiple sheet borders are used, the sheets must overlap one another and therefore must be put on successive levels. This is done so when "Sheet Models" are created the user can turn off the levels of adjacent sheet borders so they will not show in the final plot. The procedure that should be used to place sheet borders is:

First, place the cell, **layout**, at the location and angle of the first Layout sheet on level **NBL1**. Second, enter the corner card data accordingly. Third, copy the modified cell along the alignment at desired angles along the mainline alignment (keeping the cell rotation at even increments can aid in view rotation when using the keying `rv=0,0,value()` rotate view method). Fourth, change the levels of the borders to appropriate levels. (**NBL1 – NBL6** For layouts). Alternating border levels will allow for level separation in the sheet layout. Last, change or add the correct data to each corner card. When additional sheets sets are required such as Erosion Control sheets, you can copy the layout bdr file (bdr_ero) to replicate the layout then edit the corner card appropriately.

Matchlines must be placed at whole-numbered stations on level **NML_P** to show where one sheet clipping boundary begins and the next one ends. Each matchline must be labeled on the correct levels on both sides, so that the label appears on the outside edge of the matchline. (Example: Layout Sheet #2 would use **NBL2_T** for labels on the outside edge of that sheets matchlines, **NBL1_T** for the label on the inside left and **NBL3_T** for the label on the inside right.) Matchline labeling must match up with your border layout leveling, on the **_T** level for Plan Border Layout – Text.

Next, clipping boundaries are generated for reference files. Clipping boundaries are simply MicroStation shapes and are created by snapping to the corners of the sheet borders, title block and the appropriate matchlines. A fence is created later using these clipping boundaries. The clipping boundaries are placed on Levels **NBC1 – NBC6** and are by default "no plot" levels; they will not plot and will be used later during "Sheet Model" setup process.

When a sheet border has been placed, rotate the view (not the design) so that the long axis of the sheet is horizontal on the screen. This makes it very easy to read and also allows the user to place text and cells etc. at an active angle of 0 degrees and have it be oriented correctly on the sheet.

Once you have placed all borders in the design file and completed the steps above, you may want to save views for each sheet. This will help you move from layout to layout and have the correct levels and view rotation. The first layout sheet saved view should be named **L01** and continue sequentially for all layout sheets. The saved view for the first layout sheet is created by keying in **sv=L01**.

- Use **L##** for Layout Sheets Model Names
- Use **TS##** for Traffic Sheets Model Names
- Use **EC##** for Temp. Erosion Control Sheets Model Names
- Use **U##** for Utility Sheets Model Names

Saving views while very useful when working in the bdr.dgn are not needed or used in creating the sheet models. Sheet models should be individual DGN files or models within a DGN file. All sheet models should be geospatially correct not topographic drawings or data should be moved to a sheet border location. This will enable geospatial referencing of sheet files and PDF plots that are generated from the Sheet Models.

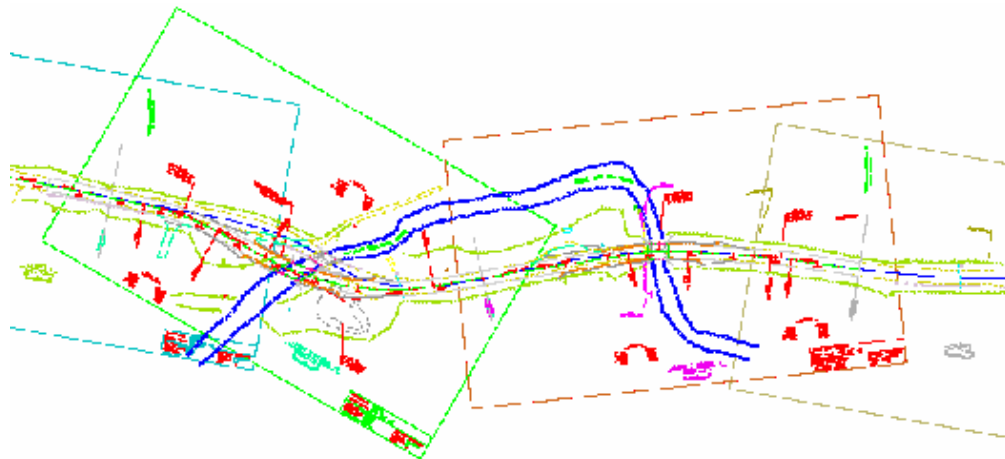
11.3. STEPS TO SHEET THE PROJECT

1. Enter the File Management System and open **PROJ#bdr.dgn** using MicroStation.
2. Reference up **PROJ#sv.dgn** from Survey and **PROJ#nu1.dgn**. Turn off **PROJ#sv.dgn** point annotations Levels **(*_I,*_A,*_C,*_TIC)**.
3. Place the cell, **layout**, at the correct active scale, angle, and location of the first Layout sheet on level **NBL1**. (**Scale**: usually set to 20 scale English or 250:1 Metric, **Angle**: usually set to the first tangent on the mainline alignment (optional:

rounded to the nearest degree), **Location**: usually placed at the beginning of the main alignment.)

4. Enter the corner card data as required.
5. Copy the modified border cell and place copies in the location where they will cover the entire alignment and enclose the topographic features shown in **PROJ#sv.dgn**. The user will have to change the active angle when placing the sheet borders so that the long axis of the sheet is parallel to the mainline tangents. (Use even increments when placing a rotated border cell).
6. Change the level of each of these sheet borders so that they are on successive levels beginning with **NBL1**. Sheets must overlap one another (see Figure 11a) and therefore must be put on successive or alternating levels. This is done so when "Sheet Models" are setup the user can turn off the level of the adjacent sheet borders and they will not show in the final plot.

Figure 11a



7. Change or add the correct data to each corner card.
8. Place matchlines on **NML_P** and Line weight 2 at an even-numbered station to separate one sheet boundary from the next.
9. Label the matchline both above and below or left and right using text on the same sheet level used, and use weight 1.

(Example: Layout Sheet #2 would use NBL2_T for labels on the outside edge of that sheet's matchlines, NBL1_T for the label on the inside left and NBL3_T for the label on the inside right.)

10. Construct clipping boundaries (shapes); Layout 1 clipping boundary shape will be on level **NBC1**. Place the shape by snapping to the sheet corners, title block and matchlines of the appropriate sheet border for each sheet. The level of the clipping boundary and the level of sheet border it defines the clip area for, should have corresponding levels. Example sheet borders on level **NBL1** will have a clipping shape on level **NBC1**, like wise **NBC2** | **NBL2** and so on.
11. Window Area around each sheet border individually and create a saved view for each one. Make sure to turn off the master files levels except the levels of the

border **NBL1**, **NBL1_T**, **NML_P** before saving the view. (e.g. Layout #1 would have a saved view name of **L01**). Repeat this process for each layout in the design manipulating the Plan, levels as required for each layouts saved view.

12. Now the user has sheeted the project, the area that will be plotted within each sheet and the active angle of each sheet is known. Knowing this the user can add necessary annotation in other design files and be sure that it will be oriented correctly and placed in the proper location. For example when in the nu1.dgn you will reference the bdr.dgn, this will provide each sheets extent and rotation for placing new and proposed feature annotations in the nu1.dgn.

11.4. CREATE LAYOUT “SHEET MODELS”

Topographic plan (site plan) layouts will be setup in a MicroStation design models as defined in STEPS TO SHEETING THE PROJECT, all plot parameters will be setup and saved in models designated as sheets. Sheet Models will contain all the information required to plot plans with proper level [on | off] status as well plot areas and clip boundary definitions. The main advantage to Sheet Models is that plot sets will not rely on external applications to define setting for each plot that is created and saved for the duration of the project. All plot configuration and settings are controlled, saved and viewed directly from within a design file sheet model definitions. Batch plotting applications simply read the sheets from the Design File Sheet Definition to plot.

TIP: When the sheet model method of setting up plots is utilized, at no time should the user edit properties of iparms such as level (on | off) status or reference file display. All changes must be made directly to the sheet models, then utilize the update plot command from iplot organizer before plotting.

After sheeting the project, the next phase is to create “Sheet Models” for plotting purposes. All Sheet Models for the Title Sheet and Layout Sheets are typically setup in the PROJ#bdr.dgn or if needed the PROJ#title.dgn may be used. Traffic Sheets, Erosion Control Sheets, ROW Sheets and all other layout sheeting are generated using the **PROJ#bdr.dgn** as a seed. It is important that proper level assignment be utilized so that information not applicable to a specific “Sheet” can be turned OFF or ON as needed.

11.5. SHEET MODEL FROM SEED

When creating Layout, Traffic, Erosion, or ROW Sheet “Sheet Models”, make sure all necessary reference files are attached and clip boundary shapes are present. First, under MicroStation file menu select Models, Second, on the models dialog select create a new model button. Third, on the Create Model dialog set the Type to Sheet from Seed, on the Seed model field browse to the agency standard sheet model seed file, shtmodel.dgn (the agency seed may already be attached). Fourth, from the Select Models dialog select the sheet model that represents the scale the sheet will plot at 1”=20’ scale is standard for layout sheets (other scales may be provided in the sheet seed file). Fifth, in the Create Model dialog Name the sheet model appropriately, LA1 for example for Layout Sheet 1 or ELA1 for Erosion Layout Sheet 1. You now have a sheet model with a predefined Sheet Boundary. This predefined Sheet Boundary can be turned off from the model properties dialog we generally do not use it.

11.6. REFERENCING IN DATA & BDR FILE

Now that you have a sheet model, reference in the **PROJ#bdr.dgn** default model and place it into the “Sheet Model”. Using MicroStation attach reference command, attach the **PROJ#bdr.dgn** in the Reference Attachment Settings dialog select the default model enter in a logical name **data**, under Orientation select “**Coincident**” if not already selected. For Nesting Attachments select Live Nesting and the Depth should be set to (1), Select OK. Now fit the MicroStation view to the attached reference files. Rotate the view to the Layout border you are setting up the sheet for.

NOTE: At this point the user will rotate the view and clip bound the files as need to show the data and borders as the plotted sheet will appear. This sheet model will be the source for plotted graphics. No graphical element should resid directly in the sheet models all graphics are referenced from standard design files such as nu.dgn, sv.dgn, top.dgn, bdr.dgn etc.

The clip boundary shape (Bunny....Trail) created earlier in the process (Design Model) can be used in the “Sheet Model” to create reference clips by element. Using the MicroStation clip reference tools clip the files referenced into the “Sheet Model”. Using the reference clip tools and the by element option select the (Bunny....Trail) and use it to clip the selected references.

You have clipped the files referenced into the sheet model but you have in the process clipped out your plan border layout corner card. To get your corner card back use the copy reference tool in the reference dialog box, with the **data** reference selected click the copy tool then data-point 2 times in the same location) on the view. Select the copied reference in the reference dialog right click and select Settings. On the Settings dialog box change the logical name to **bdr** and change nesting to no nesting. Clip this corner card reference along the plot area border (as needed).

11.7. SHEET MODEL LEVEL & REFERENCE DISPLAY SETTINGS

At this point the sheet model layout is setup and ready for plotting, you should do a save settings on the model key-in *filedesign all* this will save the settings of all models in the DGN file simultaneously. MicroStation now has a sheet model that is setup and has level status (ON | OFF) for the nested reference file linked to the master design file (in this case PROJ#bdr.dgn) if you toggle off the tree line level LTD in top or sav in the master file the LTD will be toggled off in the layout sheet.

TIP: Setting up a function key to save settings can greatly increase you productivity in sheet model work because level manipulation via the level display dialog box requires a save settings to stick. Key-in *filedesign all* go to the MicroStation menu Workspace > Function Key select F1 > Edit > then from the key in history select *filedesign all* or enter in the command. The standard save settings (*filedesign*) will only save the settings of the active model; (*filedesign all*) will save the settings of all models in the DGN. It is important to save the settings for level manipulation to be saved.

11.8. DIRECT ATTACHMENT OF NESTED REFERENCES

The steps above make use of the nested reference file capability of MicroStation. The nested reference option is useful, but can cause problems when multiple design

personnel are using the same design file reference. As an example, the bdr file is used in setting up a set of layouts, the nested references are displayed and levels are manipulated according to the standard. Later in the design process a designer opens the bdr file and references in an erosion control DGN or PROJ#ero.dgn. This ero.dgn now appears in the original layout sheet models even though it was created prior to attachment of the ero.dgn to the bdr.dgn. When using nested reference in this sheeting process the bdr.dgn files should not be used as general working or viewing because the setting in the bdr.dgn file controls plotting properties.

Live nesting can be very powerful, but in VAOT sheet modeling standards, live nesting is only utilized in creating the sheet models. Once the sheet models are setup the live nested references are transferred to the sheet models as direct attachments. First, select the nested references from the reference dialog box. Second; do a right click, Third; select the “Make Direct Attachment” option. Fourth, data point on the screen to accept the action. Fifth, Change the live nested master file is set to “No Nesting” this can be done with a right click shortcut then select settings, then set the nesting attachments toggle to **“No Nesting”**. A step by step workflow has been generated for setting up sheet models using the no nesting option. See Appendix C Supplemental Procedures.

11.9. TITLE SHEET GENERATION

A title sheet is required for each project or separate contract. The title sheet changes from time to time but each project must reference up the appropriate title sheet design. Each Standard Title sheet states the STANDARD SPECIFICATIONS FOR CONSTRUCTION DATE _____ and other project specification details. All approved title sheet DGN files are available for download at the CADD Help Download web site. In house Agency design project reference the title sheet directly to the bdr.dgn or a project specifies PPMS#title.dgn file from our cadd server, consultants can download the appropriate title sheet and reference it into the bdr.dgn or title.dgn.

Requirements for the project title sheet are covered in the Agency Road Design Manual, Chapter 3 – Preparation of Plans, available from Project Developments Road Design Section.

The process for setting up the “Title sheet DGN” is very simple. First follow the procedure shown above for setting up the standard layout sheets in the bdr.dgn. Once the border file is completed you will attach the title__.dgn, when attaching you will want to interactively move and scale the title.dgn to your project location in the drawing. This can be done using standard MicroStation move and scale reference tools. The scale will be determined by the size of the Area Map. The Area Map will show the projects alignment at the largest practical size. Annotation and existing topo specified in the Road Design Manual must also be shown.

11.10. READY FOR PLOTTING

Now the “Sheet Model” looks the way you want it, you can use lplot command and create the iparm plot file. This iparm is a snap shot of the “Sheet Model” and will be used to plot this layout sheet, the iparm can be updated from the inside the IPS file if and when changes have been made to the “Sheet Model” or to its references. The

creation of iparms can be done several ways and is the topic of other documented processes.

Creating the Title Sheet Model is relatively simple and involves turning on the display of the Title reference file and setting the proper levels [on | off] for each reference file, then creating a Sheet Model. The steps for creating a title sheet model are: similar to the layout sheeting process previously described. Reference file clipping of the title sheet may not be necessary because the entire project extents are often shown in the Title Sheet, Sheet Model.

11.11. CREATE SECOND GENERATION LAYOUT “SHEET MODELS”

The Second Generation Layouts are defined as Layouts of the identical geospatial areas. The geospatial area of a project sheeted in **Layout 1** is normally the identical area sheeted in **Erosion Control Layout 1**; therefore Layout 1 being the First generation, Erosion Control Layout 1 would be a second generation. In the case of erosion control drawings it may be required to have 3 erosion control plans for each design layout plan, each of the 3 erosion plans (Existing Site, Construction Site, and Final Site) would be a second generation. Once you have the standard bdr.dgn setup and associated sheets, these file can be copied to create the bdr_ero.dgn and associated sheets, this insures that all layout plans align matchline to matchline. Sheeting the file properly is a very important part of the process. The ability to go into the drawings and see the sheeting setup is critical to the usefulness of the digital data. Also by setting up bdr.dgn files consistently we are able to share the layouts from design discipline to discipline.

Important Note: As mentioned several times in this document the project bdr.dgn is a critical part of the Agency CADD Standard. Its setup and procedure is not optional. All Agency Projects must have a properly configured project bdr.dgn. Alterations to the Standard are not acceptable!

If there are any questions or concerns on how to properly setup an agency project bdr.dgn file, please contact Agency [CADD personnel](#) for assistance and guidance.

11.12. SHEET MODEL STEP BY STEP CHECK LIST

1. **Save all layout views.** Setup all borders and corner cards in the standard layout procedure (bdr.dgn) manipulate the levels as needed for the layouts you are creating and save the view i.e. lay1, lay2, ero1, ero2 etc. The saved views are optional.
2. **Create a sheet model from seed.** VAOT sheet model seed should be shown in the create sheet model dialog, select the appropriate scale for your layout, name the sheet model appropriately i.e. lay1, lay2, ero1, ero2 etc then create the sheet model.
3. The Sheet property Sheet Name and Sheet number fields are optional and are not utilized in our standard plan set setup. The **"Display Sheet Boundary"** is toggled OFF in the sheet model seed and is not used due to its non spatial location within the design plane. If it is used, then it should be moved to the location of the graphics, do not move data or reference drawings to the Sheet Boundary space. The standard sheet plot area is 21"x32" resulting in a 22"x34" paper sheet size.
4. Copy this new sheet model or create another for each layout plan being sheeted.
5. **Select (Make Active) the first sheet model.**
6. **Reference the bdr file Default Model.** This is likely the design file you are working in and is similar to a self reference.
7. From the Reference dialog the **Orientation** should be set to **Coincident**.
8. **Set the Reference with Line Nesting on (1).** This will enable the attachment to the .bdr file such as .nu1, .top etc. to be displayed in the sheet model. Higher level nesting may be needed but at least (1) is required.
9. **Select OK place reference.**
10. **Never Move** topographic reference files. Never draw elements directly in sheet models as a VAOT standard this file should be completely void of graphical elements.
11. **Clip Reference to Bunny Trail Lines.** Bunny Trail line refers to the element that is generally place to use as a clip boundary element.
12. **Show Hieratical Reference Pane select nested reference files and make direct attachment.** By right clicking on the nested references you will see the make direct attachment in the shortcut list.
13. **Back to the main bdr reference attachment change the nesting value to no nesting.** The nesting value is no longer needed because you have attached the nested references directly in the previous step. This make direct attachment step is optional it is intended to simplify the sheet model setup, not necessarily easier but simpler.
14. **Delete the Clip Boundary for the border file reference and re-clip to the sheet border.** This will allow the full border cell to be shown for this reference including the corner card data.
15. **Fit view and Save Settings.**
16. **Repeat steps 1-15 for each layout.** This process is very specific and skipping steps may result in plotting problems.

11.13. RIGHT OF WAY PLAN GENERATION

Right of Way drawings rPROJ#row.dgn and rPROJ#bdr.dgn are an example of second generation layout sheets. The geospatial parameters of a row.dgn are based on the limits of construction defined in the nu1.dgn file. The row.dgn always references up the nu1 file as well as other related design files. Right of Way existing property lines are generated. A comparison of existing ROW to required ROW is used in generation of proposed ROW property lines or Take Lines. The Take Lines will define the amount of land the State of Vermont must acquire to construct the proposed project. The rPROJ#bdr.dgn is the ROW sheeting file. The bdr.dgn file is a copy of the bdr.dgn file. It is important that the Row_bdr.dgn file for a project be identical in geospatial and sheeting layout to the bdr.dgn and it is created using the properly setup project bdr.dgn.

All sizeable proposed projects include Right of Way impacts and require ROW plans. Each design and section i.e. VAOT supplier or Consultant supplier, should realize that the VAOT Right of Way section requires that the project bdr.dgn file be setup properly and usable in creation of the Right of Way Plan sets. Adherence to standards and procedure outlined in this manual will assure that all VAOT project design data files are in a usable standardized format. VAOT or Consultant project design data files that do not comply with this manual may be identified as noncompliant to VAOT standards. Noncompliant data files may be rejected or cause substantial delays in the projects land acquisition process. Projects can be derailed for seeming small faults if the landowners aggressively oppose the project. Deciphering nonstandard or noncompliant design data files can be time consuming. All right of way line work (row.dgn) should be generated in 2 Dimensional file only. This will help eliminate area measurements being adversely affected by non plainer lines.

11.14. PLAN SET PLOTTING

In this age of environmentally friendly workflows the idea of printing to paper plans or processing hard media is unfitting. When possible, digital media or electronic transfers should be utilized. PDF (Portable Document Format) is an Agency preferred receivable for plan sets and should be sent through the Agency [FTP](#) site or e-mail and not via CD or DVD delivery. The delivery of PDF provides a reliable set of plans that can be dispersed across the entire design team nearly instantaneously. Admitted in the end many paper plots are generated from the PDF, but less as we move forward.

Plans sets for each stage of a project i.e. semi finals, finals, contract plans, can be generated in PDF format and stored for later viewing. PDF plan set files can be used to generate paper plan sets when (if) needed. It has become standard practice within the agency to create PDF plans sets for preview/review prior to paper plan plots. The Agency print room will print plans directly from the reviewed PDF through the standard print request e-mail form. This reduces reprinting of plans due to plan set plotting errors i.e. pen tables, rotation, missing or added references, scaling etc. The PDF plans set then serves as a record copy for each stage of the project. Additionally it is the hopeful that the PDF format will become a contract plan set document of record, though wet signed paper copies will be stored for legal reasons.

THE END



FILE SUBMISSION INDEX FORM

PROJECT NAME:
Company:
Name:
Address:
Phone:

SUBMISSION	DATE:	PROJECT NUMBER:	Sheet
1	12/17/2013		1 of 1
ATT:			
RE:			

WE ARE SENDING YOU THE FOLLOWING: (Check all that apply)

- ☐ Drawing DGN files ☐ PDF Plans Sheets ☐ Excel Spread Sheets ☐ Word Documents
☐ Survey Data Files ☐ RAW RW5 data files ☐ InRoads FWD data ☐ Other _____
☐ Image Files ☐ Image Plan Sheets ☐ DXF format files ☐ ASCII Format

File Submission Index of Sheets (Use additional Sheets as Required)

☐ Replace Previous File Submission[illegible]

THESE ARE TRANSMITTED as checked below: (Check all that apply)

- | | | |
|---|--|---|
| <input type="checkbox"/> For your use | <input type="checkbox"/> Supersedes Prior Submittals | <input type="checkbox"/> Conceptual Plans Submission |
| <input type="checkbox"/> As requested | <input type="checkbox"/> Discard Prior Submittals | <input type="checkbox"/> Preliminary Plans Submission |
| <input type="checkbox"/> For review and comment | <input type="checkbox"/> Resubmit with corrections | <input type="checkbox"/> Final Plans Submission |
| <input type="checkbox"/> Contract Plan Submission | <input type="checkbox"/> For Plan Set Distribution | <input type="checkbox"/> Other |

REMARKS:

COPY TO:

SIGNED:

If enclosures are not as noted, kindly notify us at once.

VAOT Level Cross Reference

	WRK.DGN Old Levels	WRK.DGN New Levels
1	Axis Lines for Sections and Profiles	XAX_P
2		
3	Axis Annotation on Sections and Profiles	XAXTXT_P_T
4	Mainline Centerline	AC1_P
5	Mainline Stationing for Layout Sheet	AC1P_P_T
6	Alignment 2 Centerline	AC2_P
7	Alignment 2 Stationing for Layout Sheet	AC2P_P_T
8	Alignment 3 Centerline	AC3_P
9	Alignment 3 Stationing for Layout Sheet	AC3P_P_T
10	Alignment 4 Centerline	AC4_P
11	Alignment 4 Stationing for Layout Sheet	AC4P_P_T
12	Channel Centerline	AC5_P
13	Channel Stationing for Layout Sheet	AC5P_P_T
14		
15		
16		
17		
18		
19	Mainline Stationing for Title Sheet	ACT_P_T
20	Old Ground Triangles	LSOGT
21	Surface 1 Triangles	LS1T_P
22	Surface 2 Triangles	LS2T_P
23	Surface 3 Triangles	LS3T_P
24	Surface 4 Triangles	LS4T_P
25	Surface 5 Triangles	LS5T_P
26		
27		
28		
29		
30	Old Ground Contours and Labels	LSOGCMA & LSOGCMA_T
31	Surface 1 Contours and Labels	LS1CMA_P & LS1CMA_P_T
32	Surface 2 Contours and Labels	LS1CMA_P & LS2CMA_P_T
33	Surface 3 Contours and Labels	LS1CMA_P & LS3CMA_P_T
34	Surface 4 Contours and Labels	LS1CMA_P & LS4CMA_P_T
35	Surface 5 Contours and Labels	LS1CMA_P & LS5CMA_P_T
36		
37		
38		
39		
40	Old Ground Perimeter	LSOGP
41	Surface 1 Perimeter	LS1P_P
42	Surface 2 Perimeter	LS2P_P
43	Surface 3 Perimeter	LS3P_P
44	Surface 4 Perimeter	LS4P_P
45	Surface 5 Perimeter	LS5P_P
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62		
63	Grid Lines for Cross Sections and Profiles	XGL_P

VAOT Level Cross Reference

	NU1.DGN	NU1.DGN New Levels
1		
2	Subtangents and Notations	AC1ST_P
3		
4	Mainline Centerline	AC1_P
5	Mainline Stationing for Layout Sheet	AC1S_P_T
6	Alignment 2 Centerline	AC2_P
7	Alignment 2 Stationing for Layout Sheet	AC2S_P_T
8	Alignment 3 Centerline	AC3_P
9	Alignment 3 Stationing for Layout Sheet	AC3S_P_T
10	Alignment 4 Centerline	AC4_P
11	Alignment 4 Stationing for Layout Sheet	AC4S_P_T
12	Channel Centerline	AC5_P
13	Channel Stationing for Layout Sheet	AC5S_P_T
14	Geometry Points (PT & PC)	AC1P_P (1-6)
15		
16		
17		
18	Title Sheet Traffic Data and Index of Sheets text	NBT_T
19	Mainline stationing for Title Sheet	ACT_P_T
20	Flag Notation on Layouts (New Drainage)	NBLND1
21		
22	Const. Notes Layouts (Beg/End Project/Approach/Bridge etc.)	NBLNC1
23	Bridge Const. Notes Layout (tabular form for Bridge Rail, etc.)	NBLNC2
24	R.O.W. Notes	MDEFAULT_C
25	Traffic Notes	TDEFAULT_P_T
26	Utility Notes	U*_P_T (* = Electric, Gas, Water, ect.)
27	New Roadway Const. (Edge of Road, Sidewalk, Curb, Drives, etc.)	PE_P & RSW_P & RC*_P & RD*_P
28	New Drainage (All Drainage except Bridge and Superstructure)	D*_P (* = Culvert, Ditch, Gutter, ect.)
29	New Utilities	U*_P (* = Electric, Gas, Water, ect.)
30	Cut and Fill Lines and Symbols	NLC_P
31	New Face of Rail and New Guard Rail	BR_P & RGR_P
32	Landscaping	L*_P (* = Tree, Shrub, Planting Bed, Hedge Row, ect.)
33	New Approach Slab	BAS
34	New Deck Perimeter (fascias, face of curb, begin/end deck)	BDET_P & BDSW_P
35	New Abutment and Wingwall Stem	BST_P
36	New Footing Perimeter	BFT_P
37		
38	Permanent New Stone Fill	LASF_P
39		
40	R.O.W. ??	MEP_P
41	R.O.W. ??	MET_P
42	Detour Signs	SDET_P
43	Detour Pavement Markings	STS & STD
44	New Signs	SSGN_P & S*_P (* = Delineator, Parking Meter, Reference, ect.)
45	New Pavement Markings	ST*_P (* = Solid, Broken, Dotted, Stop Bar, ect.)
46		
47		
48		
49		
50	Traffic Turning Movement Diagrams	TDEFAULT_P
51	New Rail Road Signals	TCSP_P
52	Clear Zone	UDEFAULT_P
53		
54	New Urban Sewer Topo	USA_P
55	New Urban Sewer Notes	USA_P_T
56	New Urban Drainage Topo	DD*_P (* = Grass, Paved, Stone, ect.)
57	New Urban Drainage Notes	DD*_P_T (* = Grass, Paved, Stone, ect.)
58	New Urban Water Topo	UW_P
59	New Urban Water Notes	UW_P_T
60	New Urban Gas Topo	UG_P
61	New Urban Gas Notes	UG_P_T
62		
63		

VAOT Level Cross Reference

	TOP.DGN	TOP.DGN New Levels
1	Survey Horizontal and Vertical Control	CPSM
2		
3		
4		
5		
6		
7		
8		
9		
10	Town/County, Municipal boundaries and State Lines	MEE
11	Exist. Roadway Features (roads, drives, driveways)	PET & PEU & RDW & RDP
12	Exist. Manmade Features (guardrail, fence, stone walls)	RGR & LFNC & LWS
13	Exist. Buildings	LBC & LBF
14	Exist. Natural Features and Vegetation (trees, woodline, ledge)	LTD & LTC & LAWA & LARO
15	Exist. Utilities (water, sewer, elect./tele. poles, gas, cable TV)	U* (* = Water, SAnitary, Electric, ect.)
16	Exist. Drainage and Hydro. Features (swamps, brooks, wetlands)	LWET, EWFS, LAWE
17	Exist. Natural Drainage (rivers, lakes)	LAWE
18	Boundary Markers (iron pins, property markers, State bounds)	MPIP, MPIR, MPL, MJS
19		
20		
21	All Layout Sheet Notation	*ANNOT_C (* = Major Category Prefix)
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23		
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32		
33		
34	Exist. Bridge Deck Features (deck, curb, fascia, rail)	BDET, BDC, BDET, BR
35	Exist. Bridge Abut. Features (top stem, bottom stem, bridge seat)	BST, BSE
36	Exist. Bridge Footing Features (top footing, bottom footing)	BFT
37	Exist. Bridge Support Member Features (truss, supports, pier)	BB, BSUPM, BSUBM
38	Exist. Stone Fill	LASF
39	Exist. Bridge Pier Features (top pier, bottom pier)	BSUBM
40		
41		
42	Exist. R.O.W.	MHR
43	Exist. Signs	SSGN, SSO, SRM, SDEFAULT
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
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59	Existing Drainage (Pipes and Culverts)	D* (* = Culvert, Ditch, Gutter, ect.)
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63		

VAOT Level Cross Reference

	SAV.DGN	SAV.DGN New Levels
1	Survey Horizontal and Vertical Control	CPSM
2		
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5		
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8		
9		
10	Town/County, Municipal boundaries and State Lines	MEE
11	Exist Roadway Features (roads, drives, driveways)	PET & PEU & RDW & RDP
12	Exist Manmade Features (guardrail, fence, stone walls)	RGR & LFNC & LWS
13	Exist Buildings	LBC & LBF
14	Exist Natural Features and Vegetation (trees, woodline, ledge)	LTD & LTC & LAWA & LARO
15	Exist Utilities (water, sewer, elect./tele. poles, gas, cable TV)	U* (* = Water, SAnitary, Electric, ect.)
16	Exist Drainage and Hydro. Features (swamps, brooks, wetlands)	LWET, EWFS, LAWE
17	Exist Natural Drainage (rivers, lakes)	LAWE
18	Boundary Markers (iron pins, property markers, State bounds)	MPIP, MPIR, MPL, MJS
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34	Exist Bridge Deck Features (deck, curb, fascia, rail)	BDET, BDC, BDET, BR
35	Exist Bridge Abut Features (top stem, bottom stem, bridge seat)	BST, BSE
36	Exist Bridge Footing Features (top footing, bottom footing)	BFT
37	Exist Bridge Support Member Features (truss, supports, pier)	BB, BSUPM, BSUBM
38		
39	Exist Bridge Pier Features (top pier, bottom pier)	BSUBM
40		
41		
42		
43	Exist Signs	SSGN, SSO, SRM, SDEFAULT
44		
45		
46	Survey Point Descriptions (preference names)	*_A (* = Bridge, Roadway, Landscape, ect.)
47	Survey Tic Marks (marking point coordinates)	*_TIC (* = Bridge, Roadway, Landscape, ect.)
48	Survey Point Numbers and breakline linestrings (crown road)	*_I (* = Bridge, Roadway, Landscape, ect.)
49	Survey Horiz. Cogo Numbers	*_C (* = Bridge, Roadway, Landscape, ect.)
50		
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59	Existing Drainage of Pipes and Culverts (bottom of DI)	D* (* = Culvert, Ditch, Gutter, ect.)
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VAOT Level Cross Reference

	ERO.DGN	ERO.DGN New Levels
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19		
20	Legend	NANNOT_C
21		
22	Construction Notes	NBLNC1
23	General Notes	NBLNC2
24	Seeding Formulas	NBLNC3
25		
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35		
36	Temporary Silt Fence & Filter Curtain	EFNS_P & ECT_P
37	Temporary Hay Bales	EBLHS_P
38	Temporary Stone Fill	LASF
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VAOT Level Cross Reference

	BDR.DGN	BDR.DGN New Levels
1	Layout Sht. 1	NBL1
2	Layout Sht. 2	NBL2
3	Layout Sht. 3	NBL3
4	Layout Sht. 4	NBL4
5	Layout Sht. 5	NBL5
6	Layout Sht. 6	NBL6
7	Layout Sht. 7	NBL1 (Only 6 Layout Shts)
8	Layout Sht. 8	NBL2 (Only 6 Layout Shts)
9	Layout Sht. 9	NBL3 (Only 6 Layout Shts)
10	Layout Sht. 10	NBL4 (Only 6 Layout Shts)
11	Traffic Sht. 1	NBL1
12	Traffic Sht. 2	NBL2
13	Traffic Sht. 3	NBL3
14	Traffic Sht. 4	NBL4
15	Traffic Sht. 5	NBL5
16	Traffic Sht. 6	NBL6
17	Traffic Sht. 7	NBL1 (Only 6 Layout Shts)
18	Traffic Sht. 8	NBL2 (Only 6 Layout Shts)
19	Traffic Sht. 9	NBL3 (Only 6 Layout Shts)
20	Traffic Sht. 10	NBL4 (Only 6 Layout Shts)
21	Temp. Erosion Sht. 1	NBL1
22	Temp. Erosion Sht. 2	NBL2
23	Temp. Erosion Sht. 3	NBL3
24	Temp. Erosion Sht. 4	NBL4
25	Temp. Erosion Sht. 5	NBL5
26	Temp. Erosion Sht. 6	NBL6
27	Temp. Erosion Sht. 7	NBL1 (Only 6 Layout Shts)
28	Temp. Erosion Sht. 8	NBL2 (Only 6 Layout Shts)
29	Temp. Erosion Sht. 9	NBL3 (Only 6 Layout Shts)
30	Temp. Erosion Sht. 10	NBL4 (Only 6 Layout Shts)
31	Utilities Sht. 1	NBL1
32	Utilities Sht. 2	NBL2
33	Utilities Sht. 3	NBL3
34	Utilities Sht. 4	NBL4
35	Utilities Sht. 5	NBL5
36	Utilities Sht. 6	NBL6
37	Utilities Sht. 7	NBL1 (Only 6 Layout Shts)
38	Utilities Sht. 8	NBL2 (Only 6 Layout Shts)
39	Utilities Sht. 9	NBL3 (Only 6 Layout Shts)
40	Utilities Sht. 10	NBL4 (Only 6 Layout Shts)
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		
61	Scale	NBL* T (* = 1 - 6)
62	North Arrow	NNA* P (* = 1 - 3) & NNA_P
63	Match Line All Shts	NML_P

VAOT Level Cross Reference


	STRDTL.DGN	STRDTL.DGN New Levels
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	Existing Roadway (roads, drives, driveways)	PE
12	Existing Manmade Features (guardrail, fence, stone walls)	RGR & LFNC & LWS
13	Existing Buildings	LBC & LBF
14	Ledge	LARO
15	Existing Utilities	U* (* = Water, SAnitary, Electric, ect.)
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27	Bridge Pavement	PE_P
28		
29	New Utilities	U*_P (* = Water, SAnitary, Electric, ect.)
30		
31		
32		
33		
34	Existing Bridge Deck (deck, curb, fascia, rail)	BSUPM
35	Existing Bridge Abutment (stem,footing)	BSUBM
36		
37	Existing Bridge Support Member (beams,concrete T-beams)	BB & BSUPM
38	Existing Stone Fill	OOBJ
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49	Sheet Piling	OS3
50	Expansion joints + curb plates	BDJ
51	Scuppers and Downspouts	OS2
52	Bearings	OS3
53	Text,Dimensions, Centerline Bearings	ODIM_T & ODIML_P
54	Superstructure (deck, curb, fascia)	OC1
55	Substructure (Stems and Footings)	OC2
56	Approach Slabs	OC3
57	Structural Steel	OS1
58	Reinforcing Steel	OR1 & OR2 & OR3
59	Piles	OC3
60		
61		
62		
63		

VAOT Level Cross Reference

	TRAFFIC.DGN	TRAFFIC.DGN New Levels
1		
2		
3		
4	Centerline - Mainline	AC1_P
5	Stationing - Mainline	AC1_P_T
6	Centerline - Sideline #1	AC2_P
7	Stationing - Sideline #1	AC2_P_T
8	Centerline - Sideline #2	AC3_P
9	Stationing - Sideline #2	AC3_P_T
10	Centerline - Sideline #3	AC4_P
11	Stationing - Sideline #3	AC4_P_T
12	Centerline - Channel	AC5_P
13	Stationing - Channel	AC5_P_T
14		
15		
16		
17		
18	Title Sheet Traffic Data and Index of Sheets Text	NBT_T
19	Title Sheet - Mainline Stationing	ACT_P_T
20		
21		
22	Construction Notes on Layouts	AC1P_P_T (1-6)
23		
24	R.O.W. Notes	MDEFAULT_C
25	Traffic Notes (Pavement Marking Notes, Signage Notes)	TDEFAULT_P_T
26	Utility Notes	U* _P_T (* = Electric, Gas, Water, ect.)
27	New Roadway Construction (edge of road, sidewalk, curb, drives)	PE_P & RSW_P & RC*_P & RD*_P
28	New Drainage	D* _P (* = Culvert, Ditch, Gutter, ect.)
29	New Utilities	U* _P (* = Electric, Gas, Water, ect.)
30	Cut and Fill Lines and Symbols	LFILL_P & LCUT_P
31	New Guard Rail	BR_P & RGR_P
32	Landscaping	L*_P (* = Tree, Shrub, Planting Bed, Hedge Row, ect.)
33		
34		
35		
36		
37		
38		
39	Erosion Control	EDEFAULT
40	R.O.W.	MEP_P
41	R.O.W.	MET_P
42	Detour Signs	SDET_P
43	Detour Pavement Markings	STS & STD
44	New Signs	SSGN_P & S*_P (* = Delineator, Parking Meter, Reference, ect.)
45	New Pavement Markings	ST*_P (* = Solid, Broken, Dotted, Stop Bar, ect.)
46	Signal Notes	TCSP_P_T & TSCH_P_T
47	New Traffic Signals	TCSP_P & TCSH_P
48	Lighting Notes	ULP_P_T
49	New Lighting	ULP_P
50	Traffic Turning Movement Diagrams	TDEFAULT_P
51	New Rail Road Signals	TCSP_P
52		
53		
54	New Urban Sewer Topo	USA_P
55	New Urban Sewer Notes	USA_P_T
56	New Urban Drainage Topo	DD*_P (* = Grass, Paved, Stone, ect.)
57	New Urban Drainage Notes	DD*_P_T (* = Grass, Paved, Stone, ect.)
58	New Urban Water Topo	UW_P
59	New Urban Water Notes	UW_P_T
60	New Urban Gas Topo	UG_P
61	New Urban Gas Notes	UG_P_T
62		
63		

VAOT Level Cross Reference

	ROW.DGN	ROW.DGN New Levels
1	Existing ROW, Running Distance Along ROW	MHR
2	Take Line, Running Distance Along Take Line	MTL_P & MTL_P_T
3	Property Line, Property Owner Name, Running Distance Bubbles	MPL
4		
5	Parcel Numbers, Flags (Station & Offsets)	MDEFAULT_C
6		
7	All Rights, Additional Topo	MRBLTP
8		
9		
10	Begin & End Text	
11		
12		
13		
14		
15	Title Sheet Information	NBT
16	Arrowheads (cells)	ODIML_P
17	Additional Rights To Be Acquired	MHB
18		
19		
20	Square Foot Areas and Acreage (never plotted)	MANNOT_C
21		
22		
23		
24		
25		
26		
27		
28		
29		
30	Additional Easement Limits	MEP_P & MET_P
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		
51	ROW Gas Notes	UG_P_T
52	ROW Gas Notes	UGMK_P_T
53	ROW Drainage Notes (Note I)	NBLND1
54	ROW Drainage Notes (Note II)	NBLND2
55		
56		
57		
58		
59		
60	Borders, Forms	
61		
62		
63		



Appendix C – Supplemental

C-1. INTRODUCTION

The primary function of Appendix C - Supplemental:


- Provide additional links and information to required Vermont Agency of transportation CADD Standards and Procedure.
- Supplemental information to the CADD Standards and Procedure Manual are provided to update the Standards and Procedure. By referencing additional requirements.
- Links to all supplemental documents will be provided and maintained on the [Agency CADD Help - Supplemental](http://www.aot.state.vt.us/caddhelp) web page.

<http://www.aot.state.vt.us/caddhelp>

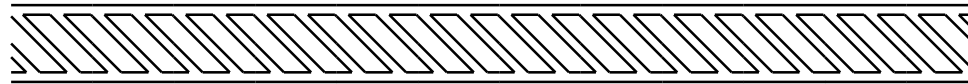
Supplemental documents and references are to be considered part of the Agency CADD Standards and Procedure Manual. All supplemental references are to be adhered to with the same intent as this manual. Any Agency documentation or agreement that requires compliance or adherence to the Agency CADD Standards and Procedure Manual likewise is required to comply to the supplemental reference documents.

Supplemental document and references may change or be updated. Supplemental documents may in some situation amend, clarify or override CADD Standards and Procedure Manual, as directed in each supplement.

VAOT CUSTOM LINE STYLES

 ZigZag /\//


 x-walk :::


 x-walk

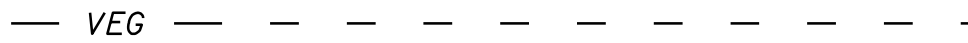
 woods-rt

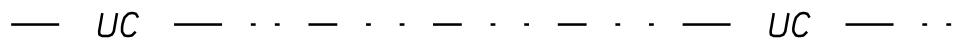
 woods-lt


 wetland-rt


 wetland-lt


 water


 veg

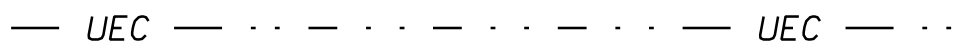
 ug tv

 ug tel

 UG ET

 UG ELECT

 UG ECT

 UG EC

— UCT — . . — . . — . . — . . — UCT — . . UG CT

T&E ————— *T&E* ————— *T&E* ————— *T&E* ————— thr. & end. spec.

— T — . . — . . — . . — . . — T — . . Telephone

----- t-line

StitchLine




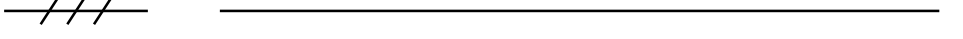
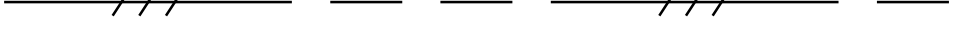










//////////////////////////////////// SlashLine

silt fence-rt






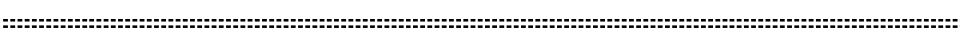
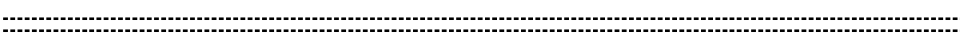
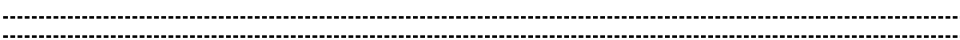
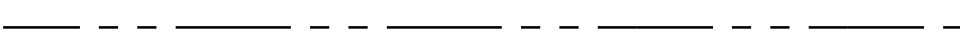
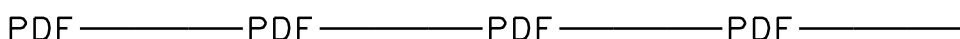

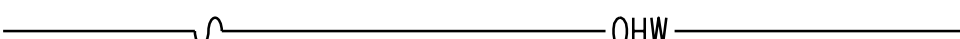



 silt fence-lt

Appendix D

VAOT CUSTOM LINE STYLES

	sewer
	SegmentWall
	s-line
	RowExistLimited
	ROW TAKE-///-
	row take line
	row hearing
	row
	river-rt
	river-lt
	rail road
	Property Line (P/L)
	Property Line
	pro water
	pro ug tv

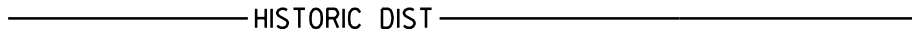
VAOT CUSTOM LINE STYLES

	pro ug tel
	pro ug elect
	pro ug e & t
	pro sewer
	pro gas
	pipe-small
	pipe-med
	pipe-lg
	Phantom
	PDF
	PD Line
	OHW
	ledge-rt
	ledge-lt
	lake-rt

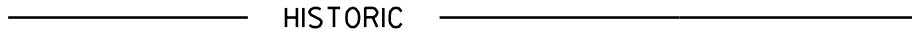
VAOT CUSTOM LINE STYLES



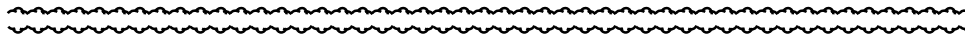
lake-lt



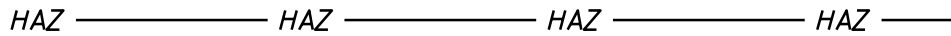
historic dist.



Historic



hedge



haz. waste



hay



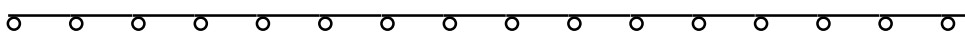
gas



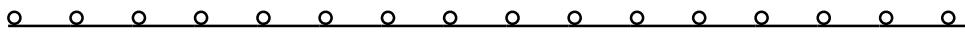
garden-rt



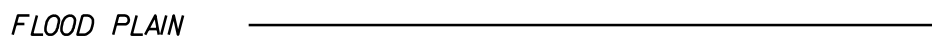
garden-lt



g-rail-rt



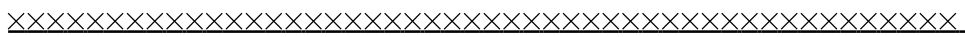
g-rail-lt



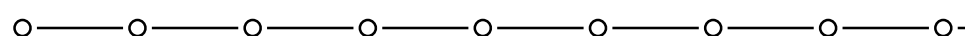
fld. plains



FenceWood



FenceProtection



FenceChainLink

VAOT CUSTOM LINE STYLES

x—x—x—x—x—x—x—x—x—x—	fence
_____	ex. struct
- - - - -	Easement - Temp
- . - . - . - . - . - . - . - .	Easement - Permanent
- . . — . . — . . — . . — . . — . .	Divide
—◆—◆—◆—◆—◆—◆—◆—◆—	Diamond
D———D———D———D———	D Line
<i>HABITAT</i> ————— <i>HABITAT</i> —————	critical hab.
— - - — - - - — - - - — CZ — - - —	clear zone
▶—▶—▶—▶—▶—▶—▶—▶—▶—▶—▶—	Check Dam
-----	c-line
_____	BreakLine
_____	bldgrm
BF —x—x—x— BF —x—x—x— BF —x—x—x— BF —x—x—x—	BF_WWF
<i>ARCH</i> ————— <i>ARCH</i> ————— <i>ARCH</i> ————— <i>ARCH</i>	arch. area

VAOT CUSTOM LINE STYLES

— ET — . . — . . — . . — . . — ET — . . AIR ET

— ECT — . . — . . — . . — . . — ECT — . . AIR ECT

— EC — . . — . . — . . — . . — EC — . . AIR EC

— CT — . . — . . — . . — . . — CT — . . AIR CT

— C — . . — . . — . . — . . — C — . . AIR C

AG ————— AG ————— AG ————— AG - agricult. land

— AER E&T — . . — . . — . . — . . — AER E&T a e r i a l e & t

— AER E — .. — . . — . . — . . — AER E Elect Aerial

— E — . . — . . — . . — . . — E — . . elect

$$6f \text{ ————— } 6f \text{ ————— } 6f \text{ ————— } 6f - 6f \text{ property}$$
$$4f \text{ ————— } 4f \text{ ————— } 4f \text{ ————— } 4f - 4f \text{ property}$$

- - - - - 2-4 dotted

 2 ft stop bar

_____ 10-30 dashed

Vermont Agency of Transportation – Route Survey Checklist

Route Survey Checklist Project Information		
Project Name:		
Project Number:		Date:
PMS Number:		Checked By:
Survey Crew or Consultant:		
<u>DELIVERABLES</u>		<u>REMARKS</u>
1) _____	Proper plat of survey • Contour intervals (Major to Minors)	
2) _____	File naming prefix convention followed • (Consultant – zPROJ#.*, Survey – xPROJ#.*)	
3) _____	File naming of individual files • (xPROJ#sav.* etc.)	
4) _____	All applicable files submitted • (.dgn, .dtm, .rw5, .ics, .fwd, .alg, .leg)	
5) _____	MicroStation Design File	
6) _____	Vermont State Plane Grid Coordinates utilized	

Vermont Agency of Transportation – Route Survey Checklist

<u>FIELD ITEMS TO CHECK</u>		<u>REMARKS</u>
1) _____	Proper file headers <ul style="list-style-type: none"> • (Project name, project number, surveyed by, Date, location, etc.) 	
2) _____	Proper datum utilized <ul style="list-style-type: none"> • See survey request or scope of work 	
3) _____	Survey Adjustment file <ul style="list-style-type: none"> • Horizontal and Vertical 	
4) _____	Proper survey closure (Min. Standard) <ul style="list-style-type: none"> • 1:10,000 	
5) _____	Traverse ties – documented <ul style="list-style-type: none"> • See section 4-2 of Survey Manual 	
6) _____	Field sketches submitted	
7) _____	Notations included in field survey files <ul style="list-style-type: none"> • (Poles, signs, mm, etc.) 	
8) _____	Photos taken of project area and bridge	
9) _____	Survey Audit Trail File <ul style="list-style-type: none"> • (Record of Changes and/or edits made to survey) 	

Vermont Agency of Transportation – Route Survey Checklist

<u>CADD ITEMS TO CHECK</u>		<u>REMARKS</u>
1) _____	Proper shot spacing (60 Feet or 20 Meters) • (Refer to survey manual page 5-2)	
2) _____	Complete collection of data • (Bridge seats etc.)	
3) _____	Correct collection of break line data	
4) _____	Proper feature code utilized	
5) _____	Followed route survey manual of procedures for collection of data • (Curb points collected across from each other etc.)	
6) _____	MicroStation Design file • (Not converted from AutoCAD; Proper DGN seed file used, w/ unit Setting Resolution of 1000 per Millimeter for English and Metric)	
7) _____	Proper Working Unit Settings <input type="checkbox"/> English: Master Units: (Survey Feet) Sub Units:(Survey Inches) <input type="checkbox"/> Metric: Master Units: (Meters) Sub Units:(Millimeters)	
8) _____	InRoads preference files utilized	
9) _____	Level symbology set correctly • (Level = color, only color override on) (Font resource and Cell files utilized)	
10) _____	Scale at run time used for metric projects	

Vermont Agency of Transportation – Route Survey Checklist

<u>CADD ITEMS TO CHECK (Cont.)</u>		<u>REMARKS</u>
11) _____	Line style resource file utilized	
12) _____	Proper levels utilized	
13) _____	VAOT Sort routine utilized to filter ground shots	
14) _____	Proper Procedure for adding break lines • (Not dams in river)	
15) _____	Free of black holes	
16) _____	Triangulation across buildings • (No obscure areas)	
17) _____	Triangles segments length • [1.5ft (0.5m) bridge, 10ft (3m) road, 100ft (35m) other]	
18) _____	Proper Trimming of triangles	
19) _____	No Crossing line segments	
20) _____	Original crossing line segments • Were they modified correctly?	
21) _____	Front view – fit (not spikes shown)	
22) _____	No crossing contours • (InRoads can not models over-hangs)	
23) _____	Design file compressed and view saved to project area.	
24) _____	Meets survey request	
25) _____	Meets route survey requirements to be transferred	

APPENDIX Z –AMENDMENTS LISTING

<u>Section</u>	<u>Description</u>	<u>Date</u>
2 2.1	Remove all reference to the Project Wise document management software. This was deactivated in February 2006.	12 February 2007
2.5	Project Consultant Deliverables paragraph added to reinforce Standard compliance (also equally important for in-house projects)	
3.5.2 4.7 11.14	VAOT Right of Way Plans and Title section will use a 2D drawing file for all right of way plan work. This was done to eliminate the possibility of area measurements being affected by non plainer line work.	21 February 2007
4.7	Added to the description of the original ground survey DGN (*sv.dgn); noting the sv.dgn is a 3D drawing of original ground.	17 July 2007
5.2.1	Made the Longitudinal value a negative. This should be a know but jut to be sure it now shows as -72°	19 June 2013
8.3	Add env_stormWaterMgt.cel to the cell library list	17 July 2007
11.12	Add “11.13 - STEP BY STEP CHECK LIST” bumped The ROW Plan Generation to section to 11.14.	17 July 2007
4.4	Revise sv.dgn example content stating that the sv.dgn is a back up and is often saved as to make the top.dgn.	30 September 2013
4.7	Remove the notes regarding title sheet text in the nu.dgn file. The current practice is to put it in the bdr.dgn or a separate title.dgn file.	19 June 2013
4.7	Revise the PROJ#sht_lay.dgn to read PROJ#bdr_nu.dgn to better reflect current practice and reworded this files description for clarification. Revised the Description of the tie sheet.	13 November 2007
4.7	Reword and clarify sv.dgn, top.dgn, usage and standard practice. Also revised some references to sheet model practices where the drawings were moved to the sheet rather than the sheet being created in place to retain spatial attributes.	21 August 2013
4.7	Revise the bdr.dgn definition where were two bdr.dgn definitions they have been combined.	31 July 2014
4.8	Add link to VAOT InRoads Fundamentals Manual	13 November 2007
5.2.1	Add link to VERMONT US Survey Feet Ref Map	13 November 2007
7.2.3	Clarification on when to use a Bar Scale and notation and when to use notation only.	31 July 2014

7.5.2	Clarification on FONT 5 and FONT 1 usage.	31 July 2014
8.3	New Cell Category env_ Environmental and Storm Water	13 November 2007
10.1.4	InRoads Template Library and Roadway Definition file name references revised to reflect InRoads XM changes	13 November 2007
10.3	Erosion Control Detail Drawing Procedure Changes	13 November 2007
7.2	Modified references to Standard Sheet and Alternative Sheet Size. 22"x34" Sheet Size not is the Agency Standard Sheet size with 11"x17" half size compatibility. And the 22"x36" sheets are not referred to as the Legacy Sheet size pre 2008.	19 June 2013
7.2.2	Attempted to clarify the details of drawing at 1:1 while plotting at alternated scales Sheet setup.	14 November 2007
7.5.1	Table 7.5a Leroy Text Size table number have been corrected.	19 June 2013
9.7	Add a procedure and information regarding creating a project tie or ti.dgn sheet information	14 November 2007
11.2 – 11.13	Revised Sheet model process to eliminate the use of non geospatial sheet models. This is to insure that all plan set plot set PDF files are geospatial correct for data management.	19 June 2013
11 – 11.11	Reworked sheeting terminology an procedure to reflect most currently practice	19 November 2007
11.14	Add section for PLAN SET PLOTTING to describe plan sets and plotting media practices	20 November 2007
Appendix D	Add VAOT new Linestyles to the Listing.	26 November 2007
Appendix D	Add new Linestyles to the listing, specifically more utility linestyles, but may be a few others.	19 June 2013
7.2.1.1	Added Alternate Paper Size definition ANSI D 22x34 and Figure 7.2b to show layout	27 December 2007
Appendix C	Added to this manual to define supplemental documents and references.	17 December 2013

