
Chapter 2 - Survey

TABLE OF CONTENTS

CHAPTER 2.....	2
2.1 Survey Information.....	2
2.1.1 Introduction	2
2.2 Survey Standards.....	3
2.2.1 File Structure.....	3
2.2.2 Survey Directory.....	5
2.2.3 File locations in the Survey Directory.....	6
2.2.4 Falcon Directory	8
2.2.5 Survey Updates.....	8
2.2.6 Survey File Standards.....	9
2.2.7 Level Structure	9
2.2.7.1 Level Naming structure.....	9
2.2.8 Text Standards.....	12
2.2.9 Line and Labeling.....	13
2.2.10 Cells and Symbols	14
2.2.11 Scale Standard - Cells and Line Styles	14
2.2.11.1 Cells.....	14
2.2.11.2 Line Styles	15
2.3 Survey Files.....	16
2.3.1 Survey Design Planimetric Master File (sUPC#)	16
2.3.1.1 Coordinate Plan Sheet (Legacy)	16
2.3.1.2 Horizontal Control Plan Sheet	17
2.3.1.3 Title Block	18
2.3.1.4 Planimetric Data	18
2.3.2 Survey Design Utility Master File (suUPC#)	19
2.3.2.1 Utility Owners.....	19
2.3.2.2 The Utility Key.....	20
2.3.2.3 The Utility Topography.....	21
2.3.3 Survey Property Owner File (spoUPC#)	21
2.3.4 Survey Design Boundary File (sbdUPC#)	21
2.3.5 Survey Master Survey File (smUPC#)	21
2.3.6 Survey Lot/map check Files (sp###UPC#)	22
2.3.7 Survey Bridge Situation file (s(UPC#)b(bridge#))	23
2.3.7.1 Title Block	23
2.3.7.2 Utility Owners.....	23
2.3.7.3 Note	24
2.3.7.4 LD-23 Bridge Data Sheet.....	24
2.3.7.5 Bridge Portion	24
2.3.7.6 Profiles and Cross-Sections	25
2.3.7.7 Bridge Situation Grid.....	27
2.3.7.8 Plotting the Bridge Situation	27
2.3.8 Contents of a DTM MicroStation File (sdt3Dupc#)	28
2.3.9 Contents of a GEOPAK Project	30
2.3.10 Contents of a Wetland File (swUPC#)	30
2.3.11 Contents of a Contour File (scrUPC#)	31
2.3.12 Survey Control & Legend File (sctlUPC#)	31

Chapter 2

2.1 Survey Information

2.1.1 Introduction

VDOT survey will provide updated seed files (working units set to U.S. survey feet), level structure, updated line styles, updated project coordinate system, and annotative cells & text for use with all **NEW** survey projects. Internal VDOT survey staff will be using the new field to finish process to complete surveys after implementation in each respective district.

Consultant surveys: All legacy survey and design projects must continue to use the old legacy seed files and cells for the duration of the project for consistency due to the working unit settings.

VDOT surveys: All legacy survey and design projects must continue to use the old legacy seed files for the duration of the project for consistency due to working unit settings. When VDOT survey staff provides supplemental data for a legacy projects, the old seed files must be used using the new field to finish processing. The supplemental file will need to be referenced into the legacy files.

All VDOT and consultant staff are responsible for verifying and using the proper seed file when work is assigned.

New seed Files: USFootSeed3D.dgn or USFootSeed.dgn

Note: Metric references shown here are for legacy files only and have NOT been setup in the 2014 standard.

The survey section of VDOT has the established practice of securing, preparing and submitting accurate, complete and uniform survey data. As the technology continues to evolve with the modification of instruments and software, Survey has continued to maintain the established criteria and standards in the Survey manual.

2.2 Survey Standards

Standards have been established for all survey information used within CADD software and are illustrated on the next several pages and in Appendix B. These standards were established with input from survey, design, RW, CADD personnel, personnel in charge of the Road Design Manual and the CADD Standards Committee (a subcommittee of the Statewide CADD Users Group). These standards were established, where possible, in accordance with the [Road Design Manual](#). If there are differences between the two, then the Road Design Manual will be revised where possible. For additional information see the Survey manual

2.2.1 File Structure

The files which the survey section uses shall be named using the following convention:

s + FILE TYPE + UPC # + EXTENSION

EXAMPLE: scr(UPC#).dgn (Contour Data File)

EXAMPLE: swl(UPC#).dgn (Wetland Data File)

The survey master files will use the following standard conventions:

File Name	Contains	Format
*sctl(UPC#).dgn	Survey Design Control data	Microstation
*sm(UPC#).dgn	Survey Master file	Microstation
s(UPC#).dgn	Survey Design planimetric data	MicroStation
*sbd(UPC#).dgn	Survey Design Boundary data	MicroStation
spo(UPC#).dgn	Property Owner File	MicroStation
su(UPC#).dgn	Survey Design utility data	MicroStation
*sparcel(UPC#).dgn or sp###(UPC#).dgn	Lot/Map Check 1 parcel per model or per Parcel ###	MicroStation
s(UPC#)a.dgn	Update planimetric data	MicroStation
su(UPC#)a.dgn	Update utility data	MicroStation
s(UPC#)b(bridge#).dgn	Bridge situation data	MicroStation

File Name	Contains	Format
scr(UPC#).dgn	Contour File	MicroStation
swl(UPC#).dgn	Wetland file	MicroStation
sdt(UPC#).dgn **	Design 3D points and break lines data	MicroStation
sdt(UPC#)a.dgn **	Update 3D points and break lines data	MicroStation
s(UPC#).dat **	Design XYZ File	GEOPAK
s(UPC#).tin	Design Triangle Irregular Network File	GEOPAK
str(UPC#).dgn	Design Triangle File	MicroStation/IG
spt(UPC#)a.dgn	Master Plat File	MicroStation
s(UPC#).doc	Survey Report	Word
*sp###(UPC#).doc	Survey Legal Description	Word

** Submit if Requested

* Five new files have been added for new projects (2014):

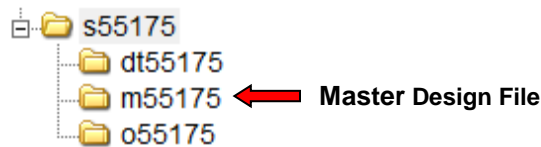
- **sm(UPC#).dgn** This file will only be used by survey and will contain the original field run survey data. The design files referenced above will be created from this file. This file will be stored in the m sub folder of the survey folder. This file will be signed electronically.
- **sctl(UPC#).dgn** All project control information will be placed in this file and stored in the s folder for the project.
- **sbd(UPC#).dgn** All boundary and right of way will be placed in this file and stored in the s folder for the project. All text for the boundary and right-of-way will be placed in this file.
- **sp###(UPC#).dgn** or **sparcel(UPC#).dgn** ### is the RW parcel number assigned. The sp### file will be used to lot/map check parcel takes and easements for each parcel or the sparcel(UPC#) file can be used to incorporate all parcels into 1 dgn file using a separate model for each parcel. This file will be stored in the r folder for the project and referenced to each RW sheet that the parcel is shown. Display will be set to off for each parcel file referenced after checking is complete.

- **Sp###(UPC#).doc** This file will contain a legal description for the parcel. This will only be created for total takes, special properties, or upon request from RW section.

The survey section places the final survey master files, on the FALCON CADD Server and registers the files in the Falcon Database. Project designers will have access to design survey files. The m sub folder under survey will be locked to survey access only.

2.2.2 Survey Directory

A survey directory will be created in [Falcon](#) (UPC#)\s(UPC#) for storing the master survey files. These directories will contain all of the completed survey files. When a survey is completed, the operator is to place the files in the survey directory in Falcon as well as keeping an archive for themselves and also on the Survey Server in the central office \\501coidms01\proj\(\DISTRICT)\(PROJECT#).(UPC#). A letter notifying the designer and Project manager of the completed survey shall list the CADD file names for all files in the directory.



The design group, as well as the survey group, will have group privileges to the Survey Directory with the exception of the m sub-folder.

THE DESIGN GROUP IS NOT TO CHANGE ANY DATA IN THE SURVEY DESIGN FILES WITHOUT PRIOR APPROVAL FROM THE DISTRICT SURVEY MANAGER. THE DESIGN OPERATOR IS ONLY ALLOWED TO MOVE TEXT AS NECESSARY TO PLACE THE DESIGN IN A FILE OR FOR SHEET CUT OUTS.

After placing the completed survey file in the survey directory, the survey personnel can back up the file from his personal directory if they choose.

The design operators will use survey files as reference files only (some may be nested).

The survey personnel will place all GEOPAK DTM files in the Falcon folder for use by the designer. Use the following format for naming the GEOPAK files.

s(UPC##).tin

The designer will only need to use the TIN file.

2.2.3 File locations in the Survey Directory

	Format	Local	Falcon UPC Directory	Notes
Office Files				
sctl(UPC#)	dgn	x	s(UPC#)	
sm(UPC#)	dgn	x	s(UPC#)\m(UPC#)\	
s(UPC#)	dgn	x	s(UPC#)	
sbd(UPC#)	dgn	x	s(UPC#)	
su(UPC#)	dgn	x	s(UPC#)	
scr(UPC#)	dgn	x	s(UPC#)	
swl(UPC#)	dgn	x	s(UPC#)	
sdt(UPC#)	dgn	x	s(UPC#)	1
s(UPC#)	dat	x	s(UPC#)	1
s(UPC#)	tin	x	s(UPC#)	
S(UPC#)b(br.#)	dgn	x	s(UPC#)	
str(UPC#)	dgn	x	s(UPC#)	1
spo(UPC#)	dgn	x	s(UPC#)\o(UPC#)\	
sp###(UPC#) or sparcel(UPC#)	dgn	x	r(UPC#)	
sp###(UPC#)	doc	x	r(UPC#)	2
Updates				
s(UPC#)a.dgn	dgn	x	s(UPC#)\m(UPC#)	3
su(UPC#)a.dgn	dgn	x	s(UPC#)\m(UPC#)	3

	Format	Local	Falcon UPC Directory	Notes
Data Collector				
s(UPC#)	crd	x	s(UPC#)\m(UPC#)	
s(UPC#)	rw5	x	s(UPC#)\m(UPC#)	
s(UPC#)	txt	x	s(UPC#)\m(UPC#)	
s(UPC#)	mdb	x	s(UPC#)\m(UPC#)	4

1. Optional if the tin files and master survey files are provided.
2. Mandatory on Total Take parcels and by request only on partial takes.
3. Increment suffix alphabetically as updates occur a, b, c, etc..
4. Internal VDOT legacy files.

2.2.4 Falcon Directory

The survey directory of the Falcon CADD Server will contain all of the completed survey files. Select employees and consultants will receive granted rights to read and write to that District or CO folder.

How VDOT Employees Request Falcon Access:

1. VDOT employees **must** use SARA to request access to projects in Falcon.
<http://sara/>

How Consultants Request Access to Projects in Falcon:

1. Each employee of the firm who will be using the Falcon Web Site will need an individual login and password. You can acquire access by downloading the form below using the links provided.
2. [Download the Falcon Access & Security Agreement Form Now!](#)
3. Once you have downloaded the form, please fill it out and send it via fax or e-mail to CADDSupport@vdot.virginia.gov.
4. You will be contacted, by email, with your official login and password.
5. Then you will need to fill out an [LD-894](#) for each project you need to access.

2.2.5 Survey Updates

When it is necessary to update a project with additional survey, the survey section will create a new file containing the updated or otherwise revised data. This file will be placed in the \\501coidms01\proj\ (DISTRICT)\ (PROJECT#) (UPC##) directory and using the following naming convention and show in Sec. 2.2.1:

s + FILE TYPE + UPC NUMBER + a (ETC.) + EXTENSION

EXAMPLE: s(UPC NUMBER)a.dgn (1st Survey Update)
 su(UPC NUMBER)a.dgn (1st Survey Utilities Update)
 s(UPC NUMBER)b.dgn (2nd Survey Update)

NOTE: a = 1st Update
 b = 2nd Update

The survey section will then delete the old data from the original survey file located in \\(UPC##)\s(UPC##) and merge the additional survey into the original survey file. The same notification procedure is to be used for survey updates as for original completed surveys.

2.2.6 Survey File Standards

Standards have been established for placing survey data into the CADD System. These standards include standardized cells, symbols, level structure and text. Survey data will follow the level, cell, and line styles outlined in Appendix B(2014) based on the legacy or 2014 standards, For consultant surveys, level, cells, and line styles will remain on the old standards for legacy projects until completion. For internal VDOT projects, the old seed file and new cells, levels, and line styles will be used and referenced into the legacy file as needed. Examples of all survey standards are illustrated in [Appendix B](#) of this manual.

2.2.7 Level Structure

2.2.7.1 Level Naming structure

New named levels have been provided.

Example: Planimetric

CELL NAME	DESCRIPTION
SURVEY_PLAN_GRAVE	Survey Planimetric Cemetery Line work
SURVEY_PLAN_GRAVE_NODE	Survey Planimetric Cemetery Node
SURVEY_PLAN_GRAVE_SYM	Survey Planimetric Cemetery Symbols
SURVEY_PLAN_GRAVE_TXT	Survey Planimetric Cemetery Text
SURVEY_PLAN_GUARD	Survey Planimetric Guardrail Line work
SURVEY_PLAN_GUARD_JB	Survey Planimetric Guardrail Jersey Barrier
SURVEY_PLAN_GUARD_L	Survey Planimetric Guardrail Line Left
SURVEY_PLAN_GUARD_R	Survey Planimetric Guardrail Line Right
SURVEY_PLAN_GUARD_SYM	Survey Planimetric Guardrail Symbols
SURVEY_PLAN_GUARD_NODE	Survey Planimetric Guardrail Node
SURVEY_PLAN_GUARD_TXT	Survey Planimetric Guardrail Text

Example: **SURVEY_PLAN_GRAVE**

SURVEY Discipline.

Choices: SURVEY – Survey field run
PHOTO – Photogrammetry

Example: **SURVEY_PLAN_GRAVE**

PLAN File location

Choices: Plan - Planimetric (s)
DTM - Terrain Model (sdt)
UTIL_LVL_AB Utilities Level A or B (su)
UTIL_LVL_CD Utilities Level C or D (su)

Example: **SURVEY_EXISTING_GRAVE** (Post January, 2014)

EXISTING - Existing Boundaries (sbd)

Example: **SURVEY_PLAN_GRAVE**

GRAVE Feature See tables:

Suffixs:

Example: **SURVEY_PLAN_GRAVE_NODE**

Choices: “blank” Line work not defined by styles

Example: SURVEY_PLAN_GRAVE

NODE Points

SYM Cells

TXT Text

JB Custom line styles name

Example: SURVEY_PLAN_GUARD_JB

Example: Utilities Levels

LEVEL NAME	DESCRIPTION
SURVEY_UTIL_LVL_AB_WATER_PIPE_36	Survey Utility Level A or B Water Pipe 36"
SURVEY_UTIL_LVL_AB_WATER_PIPE_36_ABD	Survey Utility Level A or B Water Pipe 36" Abandoned
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_ABD	Survey Utility Level C or D Cable TV Duct Abandoned
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_DATR	Survey Utility Level C or D Cable TV Duct DATR
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_MISS	Survey Utility Level C or D Cable TV Duct Miss Utility

Additional levels and line styles have been added for better clarification of each utility's designation quality. New line styles with symbology have been added to designate Abandoned, DATR (Determined according To Records), and Miss Utility locations for each existing utilities.

Levels named with LVL_AB_ are for subsurface utilities designated at SUE quality levels A or B. The colors for AB levels will match the American Public Works Association (APWA) Uniform Color Codes for temporary marking of underground utilities.

Levels named with LVL_CD_ are for subsurface utilities designated at SUE quality level C or D. The colors for CD levels will be white only.

LEVEL NAME	LINE STYLE	LINE SYMBOLOGY
SURVEY_UTIL_LVL_AB_WATER_PIPE_36	W36	N/A
SURVEY_UTIL_LVL_AB_WATER_PIPE_36_ABD	W36_ABANDONED	◇
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_ABD	UTVDUCT_ABANDON-ED	◇
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_DATR	UTVDUCT_DATR	o
SURVEY_UTIL_LVL_CD_COMM_CTV_DUCT_MISS	UTVDUCT_MISS UTILITY	⊗

The Appendixes of this manual outline the level structure, as well as line weights and line styles. The MicroStation CADD V8 software is capable of assigning more than the previous 63 different levels numbered or named for the placement of graphics. The operator has the ability to turn on or off any combination of levels to view only certain information. Also, the data is placed on specific individual levels to give us various plotting capabilities. Custom line styles were developed by the Survey Support Section to meet the needs of VDOT.

[Appendix B](#) depicts graphic examples of the north arrow, scale bar and blank plan sheet. These items are all placed on an independent level 61 because all plan development personnel use them.

2.2.8 Text Standards

Text size and font standards for all information on road plan surveys has been established as listed below:

ENGLISH – Annotation, C/L, EASEMENTS & Property owners						
C/L TEXT – MATCH DESIGN REQUIREMENTS						
ANNOTATION/BOUNDARY				PROPERTY OWNERS		
Scale	Text Size	Weight	Line Spacing	Text Size	Weight	Line Spacing
1" = 25'	3'	3	1.5	4'	7	2
1" = 50'	6'	3	3	8'	7	4
1" = 100'	12'	3	6	16'	7	8

EXISTING EASEMENTS			
Scale	Text Size	Weight	Line Spacing
1" = 25'	2'	2	1
1" = 50'	4'	2	2
1" = 100'	8'	2	3

Several Text Styles have been preset for Survey		
Survey_Text	Standard Survey Text	Left Top Justified
Survey_Text_LB	Standard Survey Text	Left Bottom Justified
Survey_Owner_Text	Text for Owner's Name	Center Center Justified
Survey_Owner_DBPG_Text	Owner's Deed Book/Page Text	Center Center Justified
Survey_Easement_Text	Standard Existing Easement Text	Left Top Justified

All annotation will be placed in the survey file according to the project scale standards (Legacy or 2014), first letter uppercase and the rest lower case (Example Curb & Gutter). There is one exception. Property owner names will be shown in ALL capital letters (ex. JOHN Q. PUBLIC). The annotation is placed to read from left to right or bottom to top in the direction the centerline runs. When placing annotation in the file it is required to have the utility file referenced to make sure annotation is not overlapping items in the utility file.

2.2.9 Line and Labeling

LINE & LABELING – Survey & Stream Traverse		
Item	Weight	Line Code
Line	5	0
Control Points	3	0
Labeling	3	0
Sub Tangent Lines	3	3
Ticks	5	0

STATION INCREMENT & CONTROL POINTS					
Scale	Control Point Radius	Equality Line Length	Station Ticks Every	Station Label Every	Examples
1" = 25'	2.34375'	8'	100	100	290, 291, 292
1" = 50'	4.6875'	16'	100	500	290, 295, 300
1" = 100'	9.375'	32'	100	500	290, 295, 300
1 : 250 m	0.714375 m	2.3225 m	20	100	290, 291, 292
1 : 500 m	1.42875 m	4.645 m	20	100	290, 291, 292
1 : 1000 m	2.8575 m	9.29 m	20	100	290, 291, 292

2014 standards are the same except text is preset to annotative and will size based on the selected drawing scale.

2.2.10 Cells and Symbols

All standard survey cell libraries are stored in the directory \\0501cosurvey\sur_sup\cel\. All cells are shown graphically in [Appendix B](#) of this manual with a table of contents for each library. These drawings are graphic representations only and are not displayed at the same size as they will be in the design file.

There are three survey cell libraries:

Survey - For all legacy cells

SurveyV14 - New projects 2014

SurveyPhoto – New Photogrammetry projects 2014

NO CELL IN THE LIBRARY IN \\coapp52\proj\sur_supv8\cel\ or C:\proj\sur_sup\cel IS TO BE CHANGED AND NO NEW CELLS ARE TO BE ADDED WITHOUT THE PERMISSION OF STATE SURVEY PROGRAM MANAGER.

2.2.11 Scale Standard - Cells and Line Styles

2.2.11.1 Cells

All legacy survey cells are created on the basis of 100 scale plans (1:1200 for imperial and 1:1000 for metric) unless otherwise noted. Therefore, they should be placed in a file using the following active scales.

Active Scale	Imperial	Metric
AS = 1	100 Scale	1:1000
AS = 0.5	50 Scale	1:500
AS = 0.25	25 Scale	1:250
AS = 0.10	10 Scale	1:100

Cells in 2014 cell library (SurveyV14) are preset to annotative and will size based on the selected drawing scale.

NOTE: Although topography is drafted to actual size and can be plotted accurately at any scale, there are some items on a plan sheet that you do not want to show to actual size (to scale); i.e.: manholes, utility poles, etc.. These items plotted to actual size will be either too large or too small to read. This is why you must attach these cells using the above referenced active scale so that they will appear on the design plan at a reasonable size.

2.2.11.2 Line Styles

Legacy line styles will be placed by weight as described in the legacy files in [Appendix B](#). **The 2014 line styles have been assigned to an individual level with color and weight preset** as described in [Appendix B](#).

Active scale will need to follow the table below based on scale. Please note the exceptions listed at the bottom and place them at a scale of 1.

Active Scales:		
English	Metric	Scale
1" = 25'	1 : 250 m	0.25
1" = 50'	1 : 500 m	0.5
1" = 100'	1 : 1000 m	1.0

EXCEPTIONS: Railroad Tracks, Right-of-way lines, Curb, Curb & Gutter, Pipe Culverts, Sidewalks, Walks, Graves, Paved Ditches, Jersey Barriers, State Lines, County Lines, City Lines, and Town Corporate Limits should always be placed using a SCALE of 1 regardless of the file scale.

IT IS CRITICAL TO DETERMINE THE SCALE FOR A PROJECT, SETTING THE ACTIVE SCALE AND TEXT SIZES, PRIOR TO INPUTTING THE SURVEY ON ALL PROJECTS.

The State's Location and Design Division's Road Design Manual contains the standards for determining a project appropriate scale.

2.3 Survey Files

The survey CADD files will be in MicroStation (dgn) format. The files will contain all information pertaining to the survey project. The digital terrain information is required to be in a 3D MicroStation file (dtm) format, and a GEOPAK .tin file. **Survey data will follow the level, cell, and line styles outlined in Appendix B (2014) based on legacy or 2014 standards.** Legacy topography collected from 1995 to present will be separated into three files. Each of the following files is submitted in a digital form. One file will contain the planimetric data, one file will contain the utility information; the other will contain the property owner information each described in more detail below. Three additional files have been added for new projects. **All project dgn files must use the same seed file (International or US Survey foot) used to create the planimetric file so the working units match.** The survey support section in the Central Office will maintain all standards for survey files. See CADD Manual [Chapter 5](#) for Right of Way plan sheet information. Please contact the manager of the survey support section in the Central Office with suggestions for changes to these standards.

< > denotes logical file name as a reference.

2.3.1 Survey Design Planimetric Master File (sUPC#) <survey>

In July of 1995, VDOT created the **Survey Planimetric Master File** separately from the **Survey Utility Master File**, mainly to permit the planimetric data to be displayed separately from the utility data. In July 2001, the **Survey Property Owner File** was created to separate property owner information from the master file.

The Survey Planimetric Master File will contain all of the following information:

2.3.1.1 Coordinate Plan Sheet (Legacy)

The Coordinate Plan Sheet is very important in identifying the survey alignment information and the coordinate values of the project. This sheet is also used by designers to display construction alignments. The Coordinate Plan Sheet is created in MicroStation by selecting the cell named "CORPLA". The cell is placed to the left of the survey file at the scale of the project. The Coordinate Plan Sheet lists all survey alignment data and will be arranged in a table format containing the following information in the order shown below:

1. Station ID's - PI's, PC's, PT's, etc.
2. Stations
3. Tangent Bearings
4. Curve data
5. Station Coordinates

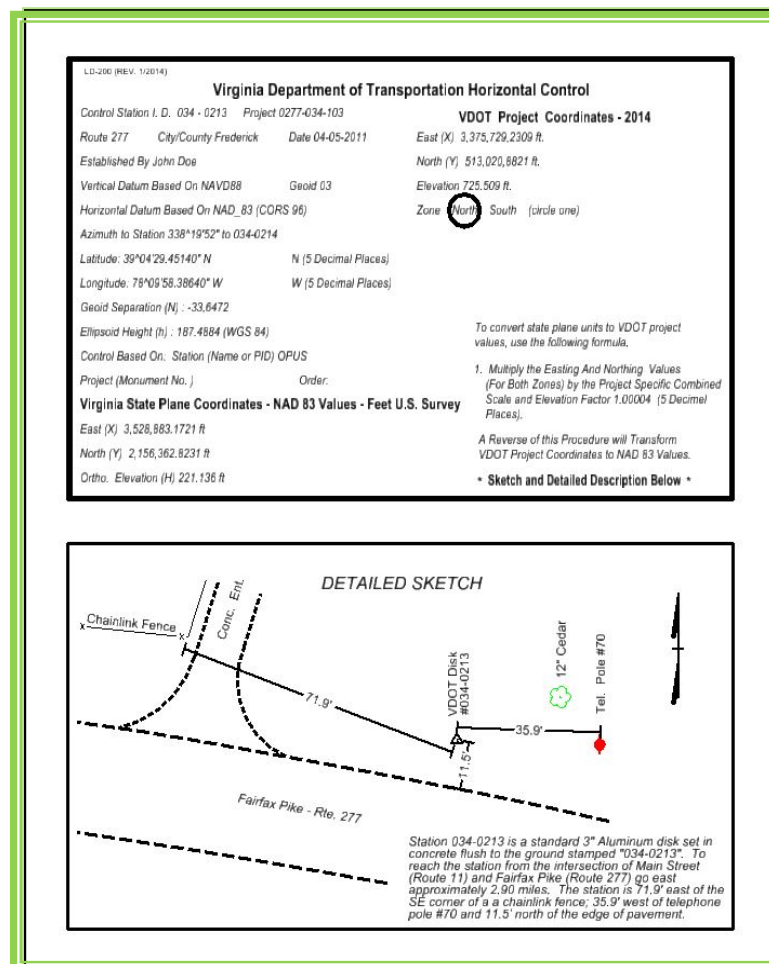
SURVEY ALIGNMENTS				
POINT ID.	STATION	BEARING	PROJECT NORTH(Y)	COORDINATES EAST(X)
SS	101+43.390		196,904.719	3,912,965.010
		S 78° 55' 43" W		
PC	101+43.385		196,904.720	3,912,965.014
PI	108+90.890		196,761.175	3,912,231.421
		$\Delta = 42^\circ 45' 00''$ Rt. D = 3,0000	T = 747.505'	
		L = 1,424.999'	R = 1,909.859'	
PT	115+68.385		197,153.730	3,911,595.290
		N 58° 19' 17" W		
PI	115+68.390		197,153.733	3,911,595.286

2.3.1.2 Horizontal Control Plan Sheet (Legacy)

The Horizontal Control Plan Sheet (**Example below**) depicts both Horizontal and Vertical datum and all references that were used to control the survey. Accurate descriptions and detailed sketches are important when referencing control points, as surveyors will use these references to locate field survey control. The Horizontal Control Plan Sheet is placed to the right of the Coordinate Plan Sheet and at the scale of the job. This Plan Sheet will contain all control and datum information for the survey. All control monuments will be verified. The following types of field survey control will be shown on this Plan sheet.

LD-200 cards (A cell named "ld200" (metric "mld200"))

1. Federal government monuments
2. VDOT control monuments
3. Control monuments established by the survey party
4. Local government monuments
5. Bench marks
6. Reference points



2.3.1.3 Title Block

The Title Block (**See Example**) gives a great deal of useful information for surveyors and engineers involved in the project. The cell called “tb” (metric mtb) is a cell inside of MicroStation and is a standard Title Block that will be used to describe the survey. The Title Block cell is placed to the right of the **Horizontal Control Plan Sheet** and centered with the beginning of the survey baseline and placed at the same scale as the project. To add text to this cell while in MicroStation, drop the status on it and place the text at the size and line spacing for the scale of the project. The following fields are included in the Title Block and must be accurately completed.

Project Number: (VDOT Project Number)
District:
County:
From: (Where project starts)
To: (Where project ends)
Horizontal Datum Based On:
Vertical Datum Based On:
Surveyed By: (Name of the surveyor)
Operator: (Name of the CADD operator)
Date :
Scale :
UPC# :
Notes: (hazardous waste, etc.)

Example:

*Route : 1
Project : 0001-026-107-PI01,C501
District : Richmond
County : Dinwiddie
From : 0.16 Mi.N.Of Int.Rte.1 & Rte.226
To : 0.15 Mi.S.Of Int.Rte.1 & Rte.226
Horizontal Datum Based On NAD 83 (93)
Vertical Datum Based On NAVD 88
Survey By : Albert Borland L.S.
Operator : P.W. Herman
Date : 7 - 13 - 09
Scale : 1" = 25'
UPC* : 73268*

2.3.1.4 Planimetric Data

The **Planimetric Data**, or “**Topo Data**”, is collected by Surveyors and used to create an accurate set of base plans for a project. The field information is collected in many ways but must be created in a Microstation (dgn) format. The level structure and weights are defined in [Appendix B](#). All legacy files will have the boundary information included in the planimetric data. All new files will have a separate sbd (UPC#) file for all existing boundary and right of way information.

Structures associated with utilities will **always** be shown in the Survey Utility File.

2.3.2 Survey Design Utility Master File (suUPC#) <survey_utility>

In July of 1995, VDOT began creating the **Survey Utility Master File** separately from the **Survey Planimetric Master File**, enabling the utility data to be displayed separately from the planimetric data. The Survey Utility Master File will contain all of the following information:

2.3.2.1 Utility Owners

The Utility Owner information is used as a reference for anyone who may need to contact a utility company on a project. The utility owner's information is at the text size for the scale of the project a line spacing for the scale of the project. It has a weight of 3, and is placed above Title Block as shown in the example.

List each utility owner complete with address and phone number.

1. Gas
2. Electric
3. Sanitary Sewer
4. Telephone (Including fiber optic)
5. Cable Television
6. Traffic Control
7. Water

Example:

UTILITY OWNERS :

*Water: Newport News Water Works
2600 Washington Avenue
Newport News, Va. 23605*

*Sewer: Hampton Roads Sanitation District
P. O. Box 5000
Virginia Beach, Va. 23455*

*Gas: Virginia Natural Gas
5100 E.Va. Beach Blvd.
Norfolk, VA 23502*

*Electric: Dominion Virginia Power
1600 Hamilton Ave.
Portsmouth, VA 23707-3528*

*Cable T.V.: Cox Communications
1323 W. Pembroke Ave.
Hampton, VA 23661*

*Telephone: Verizon Virginia Inc.
5701 Cleveland St., 5th Floor
Virginia Beach, VA 23462*

2.3.2.2 The Utility Key

The Utility Key is a cell called “UK” inside of MicroStation and gives a standard key that will be used in all surveys in describing the utilities. The Utility Key is placed below the Title Block and at the scale for the project. To add text to this cell while in MicroStation, drop the status and place the text at the scale of the project.

Example:

— — — — W — — — —	Water Line
— — — — W Duct — — — —	Water Line Duct
⊙	Water Valve
⊗	Water Meter
⊕	Water Manhole
⋄	Fire Hydrant
— — — — CATV — — — —	Underground Television Cable
— — — — CATV Duct — — — —	Underground Television Cable Duct
— — — — CAFO — — — —	Fiber Optic Cable Television
⊞	Television Hand Hole
⊞	Television Pedestal
⊞	TV Manhole
— — — — T/Tg — — — —	Underground Telephone Cable
— — — — T/Tg Duct — — — —	Underground Telephone Cable Duct
— — — — TFO — — — —	Telephone Fiber Optic
— — — — FO — — — —	Underground Fiber Optic
— — — — FO Duct — — — —	Underground Fiber Optic Duct
⊙	Fiber Optic Marker
⊞	Telephone Pedestal
⊞	Telephone Manhole
●	Telephone Pole
⊞	Telephone Hand Hole
— — — — TC — — — —	Underground Traffic Control
— — — — TC Duct — — — —	Underground Traffic Control Duct
— — — — TCFO — — — —	Traffic Control Fiber Optic
⊞	Traffic Control Hand Hole
⊞	Traffic Control Manhole
●	Traffic Signal Pole
— — — — E — — — —	Underground Power Cable
— — — — E Duct — — — —	Underground Power Cable Duct
■	Power Pole
⊞	Electric Box
⊞	Electric Manhole
■	Combination Pole
*	Light Pole
⊞	Electric Meter
⊞	Electric Hand Hole
— — — — G — — — —	Gas Line
— — — — G Duct — — — —	Gas Line Duct
⊞	Gas Manhole
⊙	Gas Valve
⊞	Gas Meter
⊞	Gas Well
— — — — SFM — — — —	Sanitary Force Main
⊞	Sanitary Force Main Valve
— — — — S — — — —	Gravity Sewer
⊞	Sanitary Manhole
⊞	Sewer Clean Out
⊞	Storm Manhole
⊞	Rail Road Signal / Gate
⊞	Rail Road Telephone Pole
⊞	Utility End Point
— — — — VS — — — —	Vacuum Sewer
— — — — FUEL — — — —	Fuel Line (above or below ground)
— — — — CHEM — — — —	Chemical Line (above or below ground)
— — — — Unk — — — —	Unknown Utility Line
(DATUR)	Depicted According To Utility Records
(AATUR)	Abandoned According To Utility Records
(AATFI)	Abandoned According To Field Inspection

2.3.2.3 The Utility Topography

The **Utility Topography** is collected by Surveyors and used to create an accurate set of base plans for a project. The field information is collected in many ways but must be created in a MicroStation (dgn) format. The following items listed below will be shown in the utility topography file.

- All utility structures above and below ground within the project's defined area and to the next structure outside the limits of the survey.
- All municipal sanitary and water services will be shown in the su drawing.
- All Miscellaneous Utility Notes are placed on level (62).
- Planimetric Data will not be included in this file.

2.3.3 Survey Property Owner File (spoUPC#) <po>

Implementation of the survey property owner file began in 2001 and was created for the purposes of keeping the property owner information separate from the survey master file and to give right of way personnel access to the file to make necessary changes. The property lines, bearing, and distance will remain in the master survey file.

Items to be included in the property owner file:

- All owner's complete names and in all capital letters
- Tax Map, Will Book, Deed Book, Plat Book, and pages numbers
- Tax Parcel # or GPIN
- Recorded Acreage

2.3.4 Survey Design Boundary File (sbdUPC#) <survey_bndy>

This file will hold all boundary and right-of-way line work and text associated with it. No planimetric data will be placed in this file. Ownership information for parcels will be placed in the spo file and can be referenced in as needed. This file will be stored in the s folder.

2.3.5 Survey Master Survey File (smUPC#) <N/A>

This file is will only be used by survey and will contain the original field run survey data. The survey (s and/or su) files will be created from this file for new projects. This file will be the survey master file for all data and will be signed and sealed.

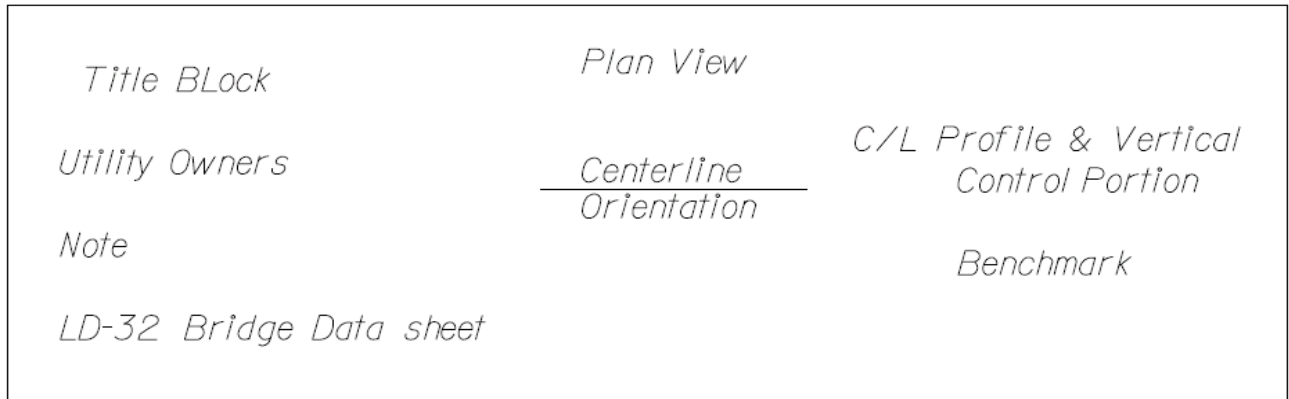
2.3.6 Survey Lot/map check Files (sp###UPC#) <parcel>

This file will contain the line work for each area map check for prescriptive easements, RW takes and each type of easements acquired the parcel. This file will be referenced to the RW sheet with display off. Only the following levels will be used:

Name	Description
RW_CHECK_ESMT_COMMUNICATIONS	RW - Survey Area Check for Communications Easement
RW_CHECK_ESMT_ELECTRIC	RW - Survey Area Check for Electric Easement
RW_CHECK_ESMT_GAS	RW - Survey Area Check for Gas Easement
RW_CHECK_ESMT_PERMANENT	RW - Survey Area Check for Permanent Easement
RW_CHECK_ESMT_SEWER	RW - Survey Area Check for Sewer Easement
RW_CHECK_ESMT_TEMPORARY	RW - Survey Area Check for Temporary Easement
RW_CHECK_ESMT_TEMPORARY_ENT	RW - Survey Area Check for Temporary Entrance Easement
RW_CHECK_ESMT_VDOT_JOINT_USE	RW - Survey Area Check for VDOT Joint Use Easement
RW_CHECK_ESMT_VDOT_WATER	RW - Survey Area Check for Water Easement
RW_CHECK_LIMITED_ACCESS	RW - Survey Area Check for Limited Access
RW_CHECK_RW	RW - Survey Area Check for RW

2.3.7 Survey Bridge Situation file (s(UPC#)b(bridge#)) <survey>

The Bridge Situation Survey should provide sufficient information for the engineers and the designers to layout a structure and make the necessary hydraulic and impact studies for all significant physical and cultural features that would be adversely affected by the construction. The following sections will explain what is needed to create the Bridge Situation and how to compile it in a MicroStation (.dgn) format. The diagram below is the typical for a sheet roll layout.



2.3.7.1 Title Block

The Title Block gives countless amounts of useful information. The cell called “tb” (metric “mtb”) inside of MicroStation is a standard Title Block that will be used in all bridge situations to describe the survey, see [Section 2.3.1.3](#). The Title Block is a cell in MicroStation, at the active scale of 0.125 is placed in the top left corner of the bridge situation as shown above. To add text to this cell, while in MicroStation, drop the status and place the text at text size of 1.5 (metric 0.375), a line spacing of 0.75 (metric 0.1875), and at a weight of 5.0. The following fields will be added to the bottom of the Title Block and must be accurately completed.

1. Bridge # (Construction Bridge Number)

2.3.7.2 Utility Owners

The Utility Owner information is used as a reference for anyone who may need to contact a Utility Company on a project. The Utility Owners, at the text size of 1.5 (metric 0.375), a line spacing of 0.75 (metric 0.1875), and a weight of 5.0, is placed below the Title Block and above the LD-23 Bridge Data Sheet as shown above. Each utility owner should be listed according to standards as shown in [Section 2.3.2.1](#).

2.3.7.3 Note

The note (**see below**) is to inform the designer that the bridge portion of the bridge situation file is based on the project coordinates. The plan portion refers to the master file for the project coordinates. The note is placed, at the text size of 1.5 (metric 0.375), a line spacing of 1.0 (metric 0.1875), and a weight of 5.0, below the utility owners and above the LD-23 Bridge Data Sheet.

The note for an English project will read as follows:

Note: Coordinate Values for bridge portion Scale: 1" = 10'

For the plan portion see survey design planimetric & utility file. (Give survey design file name and location)

The note for a Metric project would read as follows:

Note: Coordinate Values for bridge portion Scale: 1: 100 m

For the plan portion see survey design planimetric & utility file. (Give survey design file name and location)

2.3.7.4 LD-23 Bridge Data Sheet

The Bridge Data Sheet has been designed to give as much pertinent data on the bridge as possible. It also contains current information and conditions of the bridge which includes: existing structure data, stream flow data at proposed site, site conditions, influence and control of site, and railroad grade separation structure site data. The **LD-23 Bridge Data Sheet** is a cell in the surv.cel library called "ld23" (metric mld23). The Bridge Data Sheet will be prepared on all proposed design bridges by the Surveyor in charge, [LD-23 Bridge Data Sheet](#). The cell "ld23" (metric "mld23") contains text fields for data entry and will be placed, at a scale of 0.75 (metric 0.19), and in the lower left corner of the grid. Note: The grid is to be removed from the bridge data sheets area.

2.3.7.5 Bridge Portion

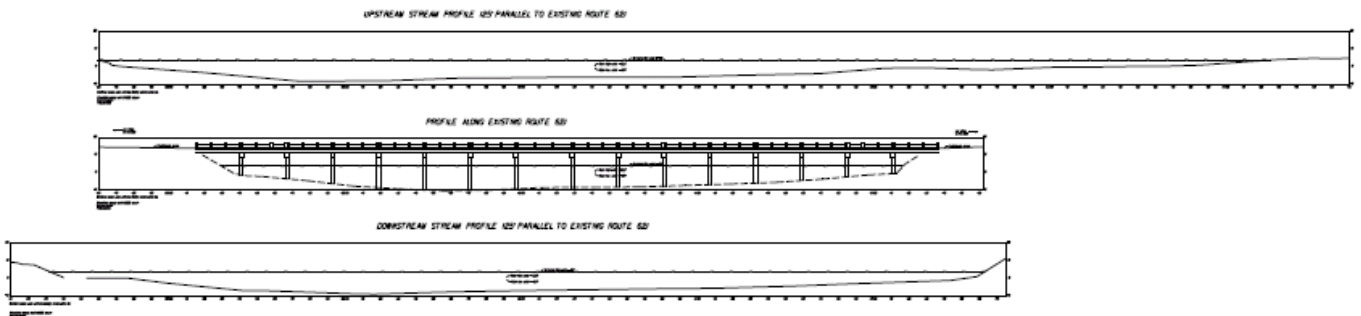
The Bridge Portion provides an accurate picture of the existing site conditions. The quality of the final design is heavily dependent on the accuracy and thoroughness of the survey data. The bridge portion is a section of the master survey file, including the master utility file, property owner file, wetland file, and contour file; starting and ending on a station 50' or more from each end of the proposed bridge and 200' wide. The Bridge Portion is copied into the bridge situation file and will remain in the same position so the coordinates of any point will remain true to the project. All cells and patterns should be at an active scale of 0.25 unless listed in the exception, and then the cells and patterns will be at a scale of 1. Line styles will be at a scale of 0.25, unless listed in the exception box, and then the line styles will be at a scale of 1. Topo annotation text will be at a text size of 1.5 (metric 0.375) and the property owner text will be at a text size of 2.0 (metric 0.5). Next, increase the weight of all elements by a weight factor of 2 in the bridge portion (ex. annotation with a weight of 3 will now be a weight of 5), so that when bridge

situation is plotted everything will stand out over the grid. Obscured contours are those that pass under a bridge or structure and are not visible when viewed in plan. All obscured contours will be shown as a broken line with a line style of 3.

2.3.7.6 Profiles and Cross-Sections

1. Centerline Profile

The Centerline Profile (**see below**) of existing & proposed bridges must in all cases extend along the survey centerline to cover and define the high water spread area and, where practical, to cover an area at least two feet above high water. High water data is of great importance to the engineer for the hydraulic analysis. The centerline profile text size will be 1.5 (metric 0.375). The description and elevation of the benchmark on which the bridge situation is based must be shown above the centerline profile. The centerline profile shall, where possible, be plotted directly beneath the bridge portion to a scale of one inch to ten feet 1" = 10' (metric 1: 100 m) both vertically and horizontally. The profile can be offset to the right and plotted in the usual manner if available space under the bridge portion will not accommodate it. The elevation of normal water, low water and extreme high water will be plotted with the profile. The month and year of high water and the name of the individual furnishing the information must be noted above the high water line on the Centerline profile.



2. Road Profile

The Road Profile under the existing bridge or at the proposed bridge will be along the high point of the road, 100' each side of centerline of the existing bridge or at the proposed bridge. The profile reading needs to be tied to the centerline of the road. The road profile text size will be 1.5 (metric 0.375). The road profile shall be plotted beneath the centerline profile to a scale of one inch equals ten feet 1" = 10' (metric 1: 100 m) for vertical and one inch equal to project scale for horizontal. The road data is used to determine many things such as the height of the bridge when it ties into the existing pavement.

3. Railroad Profile

The Railroad Profile will be along the high rail 300' each side of centerline. The profile reading needs to be tied to the centerline of the railroad. The railroad profile text size will be 1.5 (metric 0.375). The railroad profile shall be plotted beneath the centerline profile to a scale of one inch equals ten feet 1" = 10' (metric 1: 100 m) for vertical and one inch equal to project scale for horizontal. Railroad track elevation information is crucial for the need to determine the clearance for trains passing under the new bridge.

4. Stream Profile

The Stream Profile will be collected at 1000' each side of the centerline (streambed, normal water, etc.). The stream flow and flood information is very important to the height and placement of the new bridge as hydraulic engineers use this information to determine potential flood problems. The Stream profile will be plotted to the right of the bridge plan, or in the case of a grade separation or railroad, the Stream profile will follow. The stream profile shall be plotted to a scale of one inch equals ten feet 1" = 10' (metric 1: 100 m) for vertical and one inch equal to project scale for horizontal.

5. Flood Plain Cross-Sections

The Flood Plain Cross-Sections when necessary will be plotted to the right of the stream traverse profile. The cross-section information is very important to the height and placement of the new bridge as hydraulic engineers use this information to determine potential flood problems. Cross-sections will be secured at right angles (90°) to the flow of the stream at the proposed bridge site and will extend far enough to cover all the area under high water and where practical, shall extend to cover an area at least two (2) feet above high water. Cross-sections will be secured 100', 500' & 1,000' (metric 30 m, 150 m, 300 m) downstream and 100', 500' & 1,000' (metric 30 m, 150 m, 300 m) upstream of all proposed and existing structures. Intermediate cross-sections will be secured at areas obstructing stream flow and where the engineer designates. The stream profile and flood plain cross-section text size will be 1.5 (metric 0.375). The flood plain cross-section shall be plotted to a scale of one inch equals ten feet 1" = 10' (metric 1: 100 m) for vertical and one inch equal to project scale for horizontal.

Project Scale				
Width			Length	
Scale	Grid	Equals	Grid	Equals
1" = 25'	22"	550'	35"	875'
1" = 50'	22"	1100'	35"	1750'

Project Scale				
Width			Length	
1 : 250 m	0.6 m	150 m	0.889 m	222.5 m
1 : 500 m	0.6 m	300 m	0.889 m	444.0 m

Project Scale	
Scale	Scale Factor
1" = 25'	0.25
1" = 50'	0.5
1 : 250 m	0.25
1 : 500 m	0.5

2.3.7.7 Bridge Situation Grid

The Bridge Situation Grid is used as an overlay for plotting profiles and cross-sections. It is centered over the bridge situation after all the parts are complete and in place. The grid is then merged with the bridge situation. The grid can be initiated by selecting the grid tool on the Survey tool palette or running the *mdl graph.ma* from within MicroStation. The Survey tool palette and the graph.ma were developed at VDOT and are loaded on all survey desktops.

2.3.7.8 Plotting the Bridge Situation

The Bridge Situation file will be plotted at a scale of 1" = 10' (metric 1: 100 m).

2.3.8 Contents of a DTM MicroStation File (sdt3Dupc#)

The 3-Dimensional **MicroStation file** or **DTM file** is used to create a detailed triangulated surface in the GEOPAK software. The designer uses the surface to create cross-sections and profiles for the proposed project plans. The file contains the x, y and z values for each point that is placed in the file. Points are either spot elevation points or connecting points along a break line. For legacy files, the following shows the proper setting for **Points** and **Break lines** in the **DTM file**. In Select Series >2, this is integrated into the tin and master files and is automatically created by Geopak and stored in the dgn. The TIN is exported as necessary for designers working in Select Series 2 as needed.

VDOT CADD DTM FILE STANDARDS (Legacy)			
EXISTING FEATURES	LEVEL	WEIGHT	LINE TYPE
Obscured Areas	12	5	
Spot Points	13	5	Active Point
Break lines	14	1	Line String
Helicopter Spot Low Level	3	5	Active Point
Helicopter BL Low Level	4	5	Line String
Photogrammetry Spots	23	5	Active Point
Photogrammetry Lines	24	1	Line String
Spot Shots/LiDAR	33	5	Active Point
Break lines/LiDAR	34	1	Line String
Spot Shots/USGS DEM	43	5	Active Point
Low Accuracy for S.Walls	53	5	Active Point
Low Accuracy for S.Walls	54	1	Line String

Named levels have been provided in the 2014 standard for each item.

BRIDGE DECK (FOR FIELD USE ONLY) (Legacy)			
EXISTING FEATURES	LEVEL	WEIGHT	LINE TYPE
Bridge Deck Break lines	40	1	Line String
Bridge Deck Points	41	5	Active Point
CONTOURS (Legacy)			
EXISTING FEATURES	LEVEL	TEXT	LINE WEIGHT
Intermediate Contour	9		1
Index Contour	10	10	3
Spots Elevations	11	11	3

2014 VDOT SYMBOLOGY STANDARDS	
<i>Rev. 3/1/14</i>	
(For weights and line styles, refer to LEGACY VDOT Symbology Standards For DTM Data Files above)	
LEVEL	DTM Data Source
PHOTO_DTM_HCOPTER_SPOT_SYM	Helicopter Photography (Low Level): Spot Shots
PHOTO_DTM_HCOPTER_BREAKLINE	Helicopter Photography (Low Level): Break lines
PHOTO_DTM_OBSCURE	Obscure Areas
SURVEY_DTM_SPOT_SYM	Field Survey: Spot Shots
SURVEY_DTM_BREAKLINE	Field Survey: Break lines
SURVEY_DTM_INDEX	Index Contour Line Work
SURVEY_DTM_INTERMEDIATE	Intermediate Contour Line Work
PHOTO_DTM_SPOT_SYM	Standard Aerial Photography: Spot Shots
PHOTO_DTM_BREAKLINE	Standard Aerial Photography: Break lines
LIDAR_DTM_SPOT_SYM	LIDAR spots
LIDAR_DTM_BREAKLINE	LIDAR Created Break lines

2014 VDOT SYMBOLOGY STANDARDS

Rev. 3/1/14

(For weights and line styles, refer to LEGACY VDOT Symbology Standards For DTM Data Files above)

LEVEL	DTM Data Source
PHOTO_DTM_BRIDGE_SPOT_SYM	Bridge Decks: Spot Shots
PHOTO_DTM_BRIDGE_BREAKLINE	Bridge Decks: Break lines
NOT IN USE	USGS Digital Elevation Model: Spot Shots
PHOTO_DTM_LOWACC_SPOT_SYM	Low Accuracy Aerial Photography: Spot Shots (Orthophoto, Sound wall, etc.)
PHOTO_DTM_LOWACC_BREAKLINE	Low Accuracy Aerial Photography: Break lines (Orthophoto, Sound wall, etc.)

NOTE! Place all Contours in a separate MicroStation 2D (scrUPC#.dgn) file.

It is important to check your **DTM files** for cells, text, shapes and complex strings before importing it into GEOPAK because GEOPAK cannot recognize these items. Remove all cells, text, shapes and complex strings or drop status on them to make them either points or lines.

2.3.9 Contents of a GEOPAK Project

VDOT has selected GEOPAK as its design package of the future. ***Any survey project that is started after March 14, 2003 will be designed and built using GEOPAK.*** Please note many older projects have been converted to GEOPAK per designer request. Survey personnel will provide a tin file for GEOPAK. The .tin (Triangulated Irregular Network) file is the most powerful and useful file created by GEOPAK. The s(UPC#).tin file is what the designer uses to process everything: cut cross-sections, calculate drainage, compute cut and fills etc. The triangles created in this file are essential to project development

2.3.10 Contents of a Wetland File (swlUPC#)

This is a MicroStation file that contains exclusively wetlands. It is totally separate from the survey master file. The 2D MicroStation will be named swl (UPC#).dgn. The only items included in this file are: Wetland boundaries and any annotation associated with flagging placed by wetland delineation specialist. Wetland flag cells should be used to represent actual flag locations. Legacy files: All items will be on levels 27 & 57. Please note this is a change from past manuals. Older wetland files were named swl (UPC#).dgn.

2014 Standard – Levels have been provided for cells and line styles.

2.3.11 Contents of a Contour File (scrUPC#)

This is a MicroStation file that contains exclusively contours. The contour file is created from the GEOPAK Tin file (3D surface). It is totally separate from the survey master file. The 2D MicroStation file will be named scr (UPC#).dgn. Legacy projects: The contours will be placed on Levels 9 & 10. The 2014 standard provides named levels for index and intermediate contours. The contour file is required for the final submission

2.3.12 Survey Control & Legend File (sctlUPC#)

For new projects: The Coordinate Plan Sheet is very important in identifying the survey traverse information and the coordinate values of the project. The Coordinate Plan Sheet is created in Microstation by selecting the cell named "CORPLAv14". The cell is placed to the left of the survey file(referenced) at the scale of the project. The Coordinate Plan Sheet lists all survey traverse data and will be arranged in a table format containing the following information in the order shown below:

1. Point ID's – Monuments and Point Numbers
2. Bearings and Distances
3. Point Coordinates (NEZ)
4. Adjustment results

The Horizontal Control Plan Sheet depicts both Horizontal and Vertical datum and all references that were used to control the survey. Accurate descriptions and detailed sketches are important when referencing control points, as surveyors will use these references to locate field survey control. The Horizontal Control Plan Sheet is placed to the right of the Coordinate Plan Sheet and at the scale of the job. This Plan Sheet will contain all control and datum information for the survey. All control monuments will be verified.

The following types of field survey control will be shown on this Plan sheet.
LD-200 cards (A cell named "ld200v14")

1. Federal government monuments
2. VDOT control monuments
3. Control monuments established by the survey party
4. Local government monuments
5. Bench marks
6. Reference points

A survey/utility key will be placed on this sheet showing the standard survey and utility symbology. The Utility Key is a cell called "UKv14" inside of MicroStation and gives a standard key that will be used in all surveys in describing the planimetric and utility features.