

SOUTH CAROLINA

DEPARTMENT OF TRANSPORTATION

SUBSURFACE UTILITY ENGINEERING CADD DEVELOPMENT MANUAL

REVISED AUGUST, 2012



INTRODUCTION

This document outlines and describes the Standard Operating Procedures (SOP) for Subsurface Utility Engineering (SUE) Computer Aided Drafting and Design (CADD) file(s) preparation as required by the South Carolina Department of Transportation. This document also includes General Utility Locating Guidelines to insure uniformity of data collection quality and consistency.

While this document outlines specific procedures for the CADD development of SUE projects, it is not intended to be absolute for all instances. SUE project range from simple to painfully complex and the best judgment of practices for the development of individual projects is the responsibility of the SUE professional. The department encourages the SUE consultants to use these methods and tools to best suit the needs of the consultant and the engineering team involved with each project.

For guidelines on surveying SUE projects, please refer to the **SCDOT PRECONSTRUCTION SURVEY MANUAL**.

Please direct any questions concerning the Departments SUE Program to the acting SUE Engineer at (803) 737-2047 or via email at BaileySC@scdot.org.

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1.0 GENERAL GUIDELINES

SUE project data will be submitted in CADD and plotted format. All files will be developed using border sheets, Microstation resource files, and examples provided by the Department and available online at http://www.scdot.org/doing/cadd_SUE.aspx . All CADD files will be submitted in the current version of Microstation (currently, V8i SELECT series 1- Version 08.11.07.180).

1.01 PROVIDED CAD FILES

The following is a list and brief description of the files provided by the Department and should be employed when producing project files:

File Name	Description
01scdot_sue_tst_12.dgn	Title & Utility Reference sheet for SUE plans
02scdot_sue_lgd_12.dgn	Legend for symbols and example of line formats
03scdot_sue_bdr_12.dgn	Border sheet for SUE planimetry plots
04scdot_sue_upd_12.dgn	Utility & Pole Data Sheet with embedded Excel spreadsheet
05scdot_sue_upd-alt_12.dgn	Utility & Pole Data Sheet without Excel spreadsheet
06scdot_sue_vxd_12.dgn	Test Hole Data Sheet with embedded Excel spreadsheet
06scdot_sue_vxd-alt_12.dgn	Test Hole Data Sheet without Excel spreadsheet
06scdot_sue_vxd-stk_12.dgn	Test Hole Data Location / Cross Section Sketch Sheet
07scdot_uc_usht_12.dgn	Utility Relocation Plan Sheet with Utility & Pole Data

Table 1 Provided CAD Files

1.02 PROVIDED CAD RESOURCE FILES

The Department provides resource files that contain the standard line-styles, color table, font library, level library, and CADD seed files which are listed and described below:

Resource File	Description
LSTYLE.rsc	Standard Line Styles
ROAD.tbl	Standard Color Table
FONT.rsc	Standard Font Library
LEVEL.lib	Standard Level Library
SEED.dgn	Standard CADD Seed File ¹
SCDOTV8.smd	Standard Geopak smd file
RoadDesignLN.dgnlib	Standard Level Library
08scdot_sue_cel_12.cel	SUE & Utility Coordination Cell Library
09scdot_sue_txt_12.rsc	SUE & Utility Coordination Line-style Library
10scdot_sue_cdt_12.dgnlib	SUE CADD Drafting Tool Library
11scdot_sue_smd.smd	SUE & Utility Coordination Geopak smd file
12scdot_sue_tables.xlsx	Utility, Pole, and Test Hole data tables

Table 2 Provided CAD Resource Files

¹ SCDOT provides a Microstation seed file that contains the Department's standard CADD setting such as Global Origin, Unit Resolution, etc. SUE planimetry files will be created using the seed file to ensure the correct spatial referencing with other Department CADD files

2.0 REQUIRED SUE SUBMITTALS

Deliverables for SUE projects will include both Hard Copy ² material and digital files.

2.01 HARD COPY SUE PLANIMETRY PLAN SET

Hard Copy SUE plan sets will be plotted using the provided SCDOT border files, in black ink, at a 1"=50' graphic scale on 22" x 36" sheets and numbered in accordance with the Highway Design Manual (HDM) Chapter 34, Par. 34.1.5. Two (2) copies of all applicable SUE project sheets will be sealed, dated, and signed by the PE or PLS in responsible charge of the project and submitted to the Department.

Plan sets will include the following SUE sheets:

- Title Sheet with original PE / PLS seal, signature, and date.
- Legend Sheet
- Utility & Pole Data Sheets
- Test Hole Data Sheets
- Any Miscellaneous Detail Sheets (if required)
- Planimetry Sheets of all SUE work within Project Limits

2.02 HARD COPY TEST HOLE INFORMATION

When Test Holes are performed for the Department, Hard Copy Test Hole report will be submitted for each hole excavated. Each Test Hole report will include an original PE / PLS seal, signature, and date. A sample Test Hole Report is included in this manual in the appendix.

² "Hard Copy" is printed or plotted sheets to be archived in the physical project contract file for future reference if necessary.

2.03 OTHER POSSIBLE SUBMITTALS

In addition to the CADD files, as described above, the following files will be submitted in accordance with the applicable SUE project Scope of Services:

COGO Database – Submit either a comma delineated ASCII file or a Geopak gpk file that contains all surveyed and calculated points used to draft the submitted CADD files.

Test Hole Report – Test Hole Report forms must meet or exceed to minimum requirements as described in the ASCE “Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data” CI/ASCE 38-02. An example is included in this document.

Manhole Reports – Utility consultants may use the SCDOT Manhole Report Form or a pre-approved equivalent. An example form is included in this document.

3.0 GENERAL SUE CADD GUIDELINES

3.01 UTILITY UNIFORM COLOR CODES

SCDOT attempts to follow the APWA⁴ Uniform Color Codes in the CAD Development of SUE design files as per the following chart;

Color	Screen	Print	Utility
	WHITE	BLACK	Proposed Excavation, SUE Sweep Limits
	PINK	PINK	Temporary Survey Markings, Misc & Unknown Designated SUE
	RED	RED	Electric Power Lines, Cables, Conduits Lighting Cables
	YELLOW	YELLOW	Gas, Oil, Steam, Petroleum or Gaseous Material
	ORANGE	ORANGE	Communications, Alarm, and Traffic Signal
	BLUE	BLUE	Potable Water
	PURPLE	PURPLE	Reclaimed Water, Irrigation, Slurry
	GREEN	GREEN	Sanitary Sewer and Storm Drains

Table 4 Uniform Color Code

⁴ American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

3.02 UTILITY UNIQUE IDENTIFIER LINES-STYLES

The SCDOT provides a specialized line-style library for delineating utility lines. Each of these line-styles contains a **Utility Unique Identifier (UUI)** that is to be assigned each utility with project specific properties as shown in the following table:

UTILITY	LOCATION	UNIQUE ID	LINE	LINESTYLE
	METHOD		APPEARANCE	NAME
ELECTRIC	LEVEL B	E1 THRU E10	DASHED	SDE1 – SDE10
ELECTRIC	LEVEL C	E1 THRU E10	SOLID	SRE1 – SRE10
ELECTRIC	LEVEL D	E1 THRU E10	SOLID	SRE1 – SRE10
AERIAL UTILITY	N/A	OH1 THRU OH20	SOLID	SROH1 – SROH20
AERIAL GUY WIRE	N/A	GW	SOLID	SGW
TRAFFIC CONTROL	LEVEL B	TF1 THRU TF5	DASHED	SDTF1 – SDTF5
TRAFFIC CONTROL	LEVEL C	TF1 THRU TF5	SOLID	SRTF1 – SRTF5
TRAFFIC CONTROL	LEVEL D	TF1 THRU TF5	SOLID	SRTF1 – SRTF5
AERIAL TRAFFIC SIGNAL	N/A	SIG	SOLID	SIG
TELEPHONE	LEVEL B	T1 THRU T10	DASHED	SDT1 – SDT10
TELEPHONE	LEVEL C	T1 THRU T10	SOLID	SRT1 – SRT10
TELEPHONE	LEVEL D	T1 THRU T10	SOLID	SRT1 – SRT10
CABLE TV	LEVEL B	TV1 THRU TV10	DASHED	SDTV1 – SDTV10
CABLE TV	LEVEL C	TV1 THRU TV10	SOLID	SRTV1 – SRTV10
CABLE TV	LEVEL D	TV1 THRU TV10	SOLID	SRTV1 – SRTV10
GAS	LEVEL B	G1 THRU G10	DASHED	SDG1 – SDG10
GAS	LEVEL C	G1 THRU G10	SOLID	SRG1 – SRG10
GAS	LEVEL D	G1 THRU G10	SOLID	SRG1 – SRG10
STEAM LINE	LEVEL B	ST1 THRU ST5	DASHED	SDST1 – SDST5
STEAM LINE	LEVEL C	ST1 THRU ST5	SOLID	SRST1 – SRST5
STEAM LINE	LEVEL D	ST1 THRU ST5	SOLID	SRST1 – SRST5
FUEL / PETROLEUM	LEVEL B	F1 THRU F5	DASHED	SDP1 – SDP5
FUEL / PETROLEUM	LEVEL C	F1 THRU F5	SOLID	SRP1 – SRP5
FUEL / PETROLEUM	LEVEL D	F1 THRU F5	SOLID	SRP1 – SRP5
GASEOUS MATERIAL	LEVEL B	CA1 THRU CA5	DASHED	SDCA1 – SDCA5
GASEOUS MATERIAL	LEVEL C	CA1 THRU CA5	SOLID	SRCA1 – SRCA5
GASEOUS MATERIAL	LEVEL D	CA1 THRU CA5	SOLID	SRCA1 – SRCA5
WATER	LEVEL B	W1 THRU W10	DASHED	SDW1 – SDW10
WATER	LEVEL C	W1 THRU W10	SOLID	SRW1 – SRW10
WATER	LEVEL D	W1 THRU W10	SOLID	SRW1 – SRW10
IRRIGATION	LEVEL B	I1 THRU I5	DASHED	SDI1 – SDI5
IRRIGATION	LEVEL C	I1 THRU I5	SOLID	SRI1 – SRI5
IRRIGATION	LEVEL D	I1 THRU I5	SOLID	SRI1 – SRI5
RECLAIMED / SLURRY	LEVEL B	R1 THRU R5	DASHED	SRR1 – SRR5
RECLAIMED / SLURRY	LEVEL C	R1 THRU R5	SOLID	SRR1 – SRR5

UTILITY	LOCATION	UNIQUE ID	LINE	LINESTYLE
	METHOD		APPEARANCE	NAME
RECLAIMED / SLURRY	LEVEL D	R1 THRU R5	SOLID	SRR1 – SRR5
GRAVITY SEWER	LEVEL C	S1 THRU S10	SOLID	SRS1 – SRS10
GRAVITY SEWER	LEVEL D	S1 THRU S10	SOLID	SRS1 – SRS10
FORCED SEWER	LEVEL B	FS1 THRU FS10	DASHED	SDSF1 – SDSF10
FORCED SEWER	LEVEL C	FS1 THRU FS10	SOLID	SRSF1 – SRSF10
FORCED SEWER	LEVEL D	FS1 THRU FS10	SOLID	SRSF1 – SRSF10
DUCT BANK	LEVEL B	DB1 THRU FB5	DASHED	SDB1 – SDB5
DUCT BANK	LEVEL C	DB1 THRU DB5	SOLID	SRB1 – SRB5
DUCT BANK	LEVEL D	DB1 THRU DB5	SOLID	SRB1 – SRB5
UTLITY TUNNEL	LEVEL B	TNL	SOLID	SDTNL
UTLITY TUNNEL	LEVEL C	TNL	SOLID	SRTNL
UTLITY TUNNEL	LEVEL D	TNL	SOLID	SRTNL
MISC	LEVEL B	M1 THRU M5	DASHED	SDM1 – SDM5
MISC	LEVEL C	M1 THRU M5	SOLID	SRM1 - SRM5
MISC	LEVEL D	M1 THRU M5	SOLID	SRM1 - SRM5
UNKNOWN	DESIGNATED	UNK	DASHED	UNK
SWEEP LIMITS	N/A	SUE	SOLID	SUE

Table 5 Utility Unique Identifiers

Utilities will be arranged by groups, combining the most common attributes such as utility type, size, material, capacity, etc. These groups will be assigned an UUI to delineate the utility lines and appurtenances on the planimetry file and referenced on the Utility & Pole Data Sheet.

For example, if a project has two telephone providers that each have lines that are both direct buried copper cable, then the lines could be simply identified as T1 for one owner and T2 as the other. For projects where there are a high number of utility types and providers, the use of **Supplemental Utility Line Labels (SULs)** (section 3.11) will need to be utilized. SULs can be used to depict or meet any information requirements for the SUE plan sheets as deemed appropriate by the SUE professional.

The figure below shows the use of SULs among other drafting strategies presented in this manual.

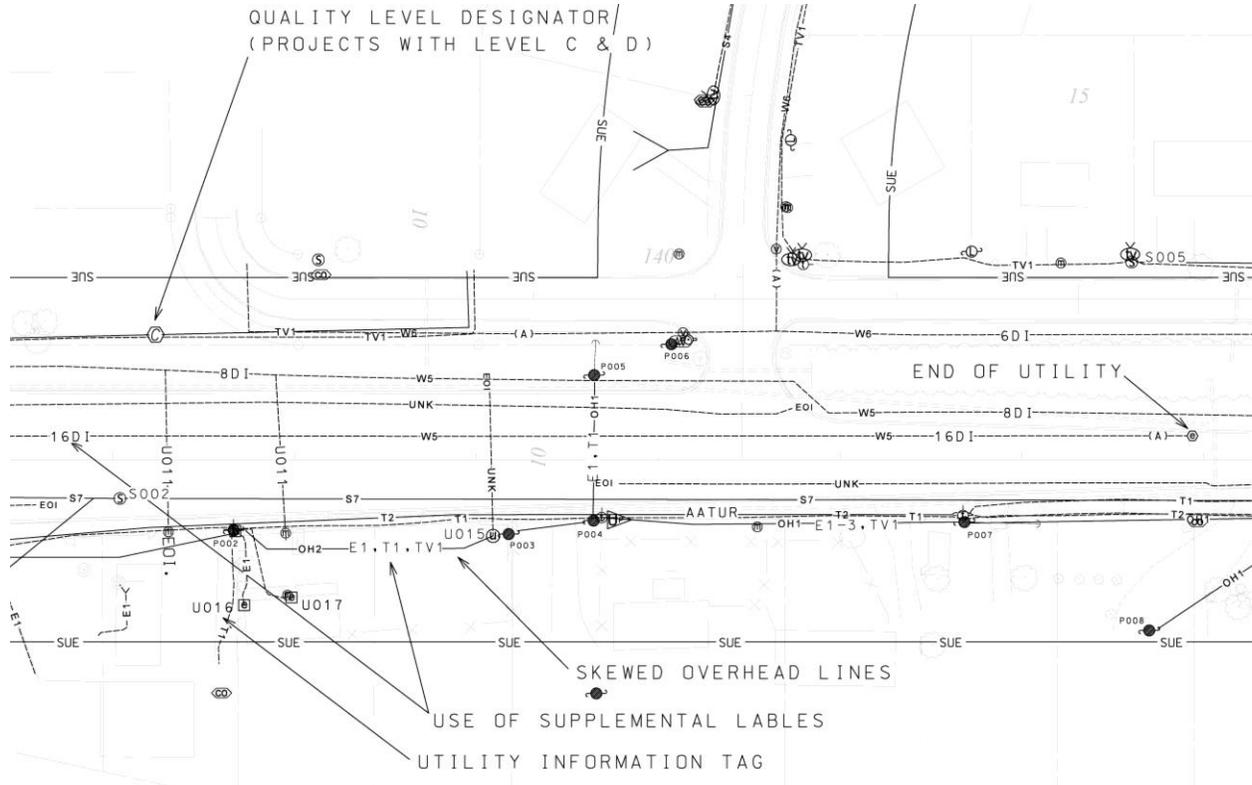


Figure 1 Supplemental Utility Line Label Example

3.03 SUE LINE-WORK

One of the most challenging aspects of drafting utility lines is making the UIIs and other labels legible. The UUI line-style text is formatted to appear every 250 linear feet in the CAD file. Here are a few methods to minimize UUI text overlap and congestion.

- In Microstation, line-styles patterns and text can be shifted linearly along the drafted line-work by using the **MODIFY LIFESTYLE SHIFT** “Key In” command.
- Lengthy Line-Strings may need to be segmented to control the frequency of the line-style text.
- For line-style text that appears upside down, or running the opposite direction, use the **CHANGE DIRECTION** “Key-in” command.

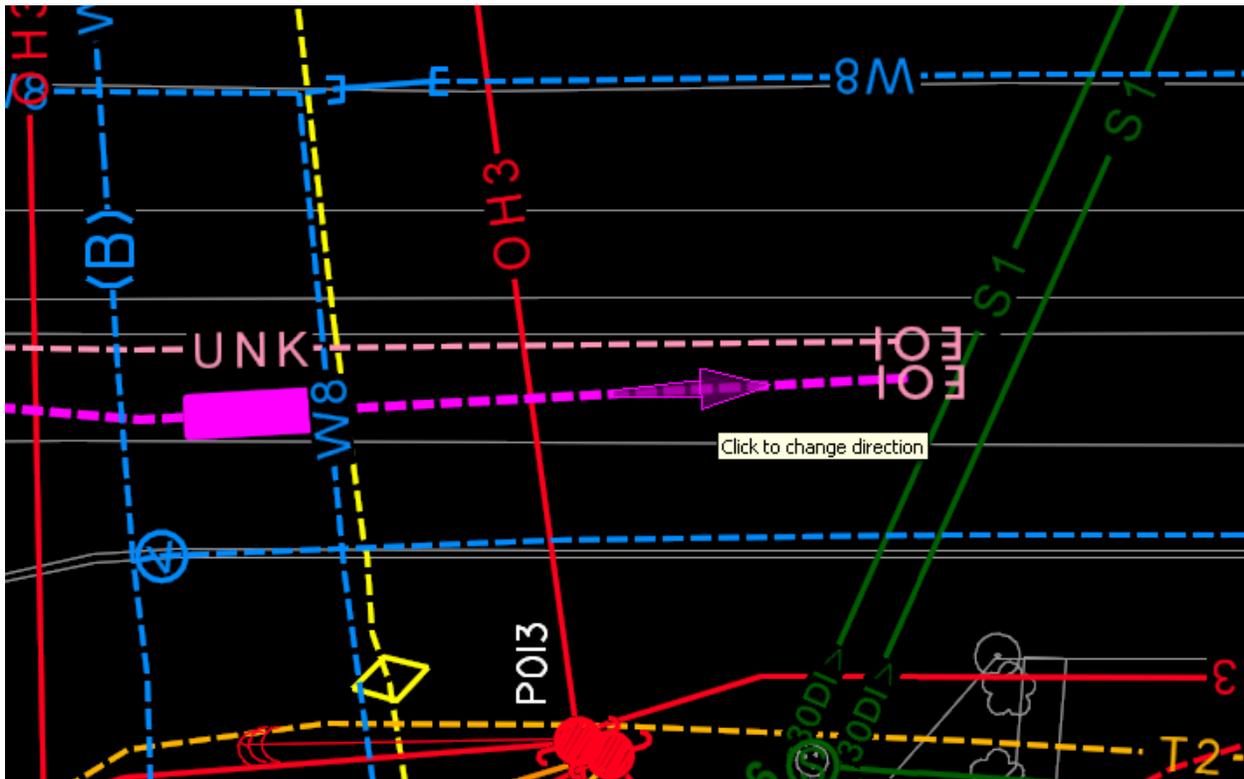


Figure 2 Change Direct Key-In

3.04 GRAPHIC SCALE & TEXT

The CADD drafting standards described herein intended to produce hardcopy plans at a scale of one inch equals fifty feet (1"=50'). All borders provided are meant to plot on 22" x 36" sheets. All cells provided (ROADV8.cel) will be inserted into the CADD files at an active scale of 1.0.

Instructions for and examples of the standard Text font can be found in the provided CADD files. Use the following fonts, Heights, and Widths unless otherwise specified:

Item	Font	Height	Width
Supplemental Utility Line Labels	3	4	4
Descriptions, Tags, & Abbreviations	3	4	4
Utility Pole ID Numbers	3	3	3
Sewer Inverts & SMN	65	4	4
Survey or Misc Notes	23	5	5

Table 6 SUE Text Size

3.05 PLACING SUE LABELS

Often SUE projects require extensive notes and labels to accurately describe the utilities conditions. In order to produce an un-cluttered planimetry SUE file, SCDOT SUE drawings will reference these notes on a Utility & Pole Data Sheet with the use of Tags. These Tags can be an alpha, numeric, or alpha-numeric combination system of codes to label the SUE features in a clear manner. The exact coding may vary from project to project and is determined by the consultant to meet the methodology of data collection, drafting, or professional preferences. These Tags include the following:

- Utility Information Tags
- Sanitary Sewer Manhole Numbers
- Utility Pole ID Numbers
- Test Holes Labels

3.05 PLACING UTILITY POLE ID NUMBER LABELS

All utility poles will be labeled with a **Utility Pole ID Number (UPIN)** which is an alpha-numeric coded label (*e.g.* – **P001**) that will be shown in the SUE planimetry CADD file and referenced on the Utility & Pole Data Sheet. The appropriate descriptive information will be placed on the Utility & Pole Data Sheet. An example of the UPIN can be found on the SUE Legend Sheet.

Projects may require collection of the **Utility Pole Birthmark (UPB)**. Birthmarks may differ in the configuration of the information stamped into the pole, but a common arrangement is shown below.

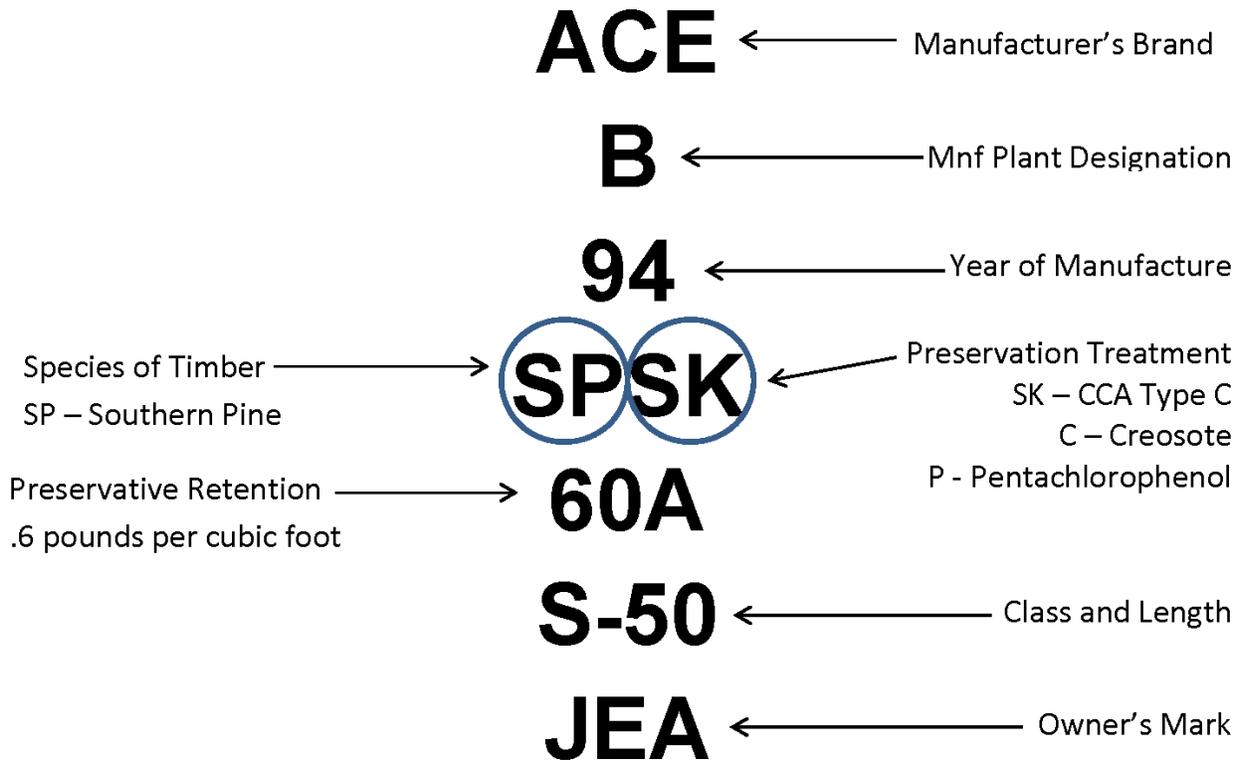


Figure 4 Utility Pole Birthmark

3.07 SANITARY SEWER MANHOLE NUMBER LABELS

All sanitary sewer manholes will be labeled with a **Sewer Manhole Number (SMN)** which will be an alpha-numeric coded label (*e.g.* – **S001, 2-1, etc**) that will be shown in the SUE planimetry file. The SMN will be used on the Utility & Pole Data Sheet to list rim and invert elevations and other associated information. An example of the SMN can be found on the SUE Legend Sheet.

SCDOT has developed Text Styles for the labeling the SMN and limited pipe elevation information in the planimetry file. The graphic below depicts a typical manhole labeling method where the SMN is shown, pipe elevations are given, and the invert out pipe size, elevation, and flow direct is provided. Detailed elevation and pipe information would be provided on the Utility & Pole Data Sheet.

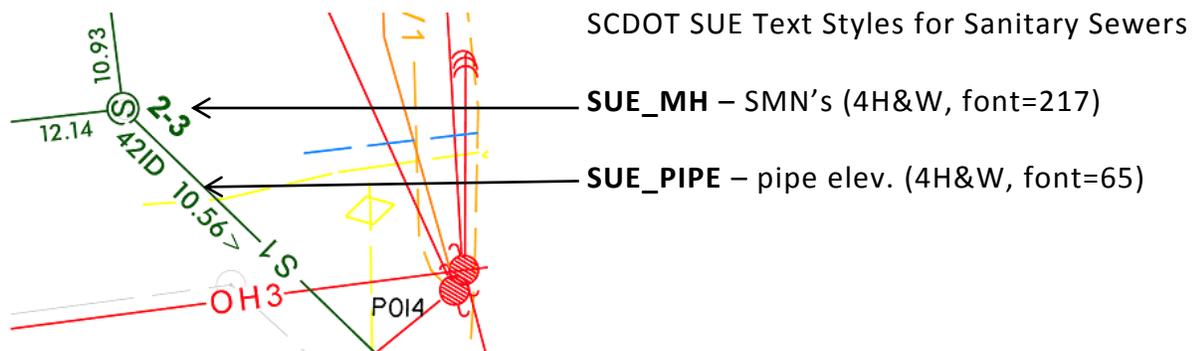


Figure 5 Sewer Manhole Number

3.06 PLACING AERIAL (OVERHEAD) UTILITY LINES

In situations where the graphic depiction of the utility line-work becomes cluttered and possibly confusing, the overhead utility lines may be drafted on an offset. Aerial utility lines do not necessary have to be drawn directly from pole to pole, but may be drawn and arranged in a schematic manner that shows the correct inter-pole connectivity as well as the required utility labeling. See the following example:

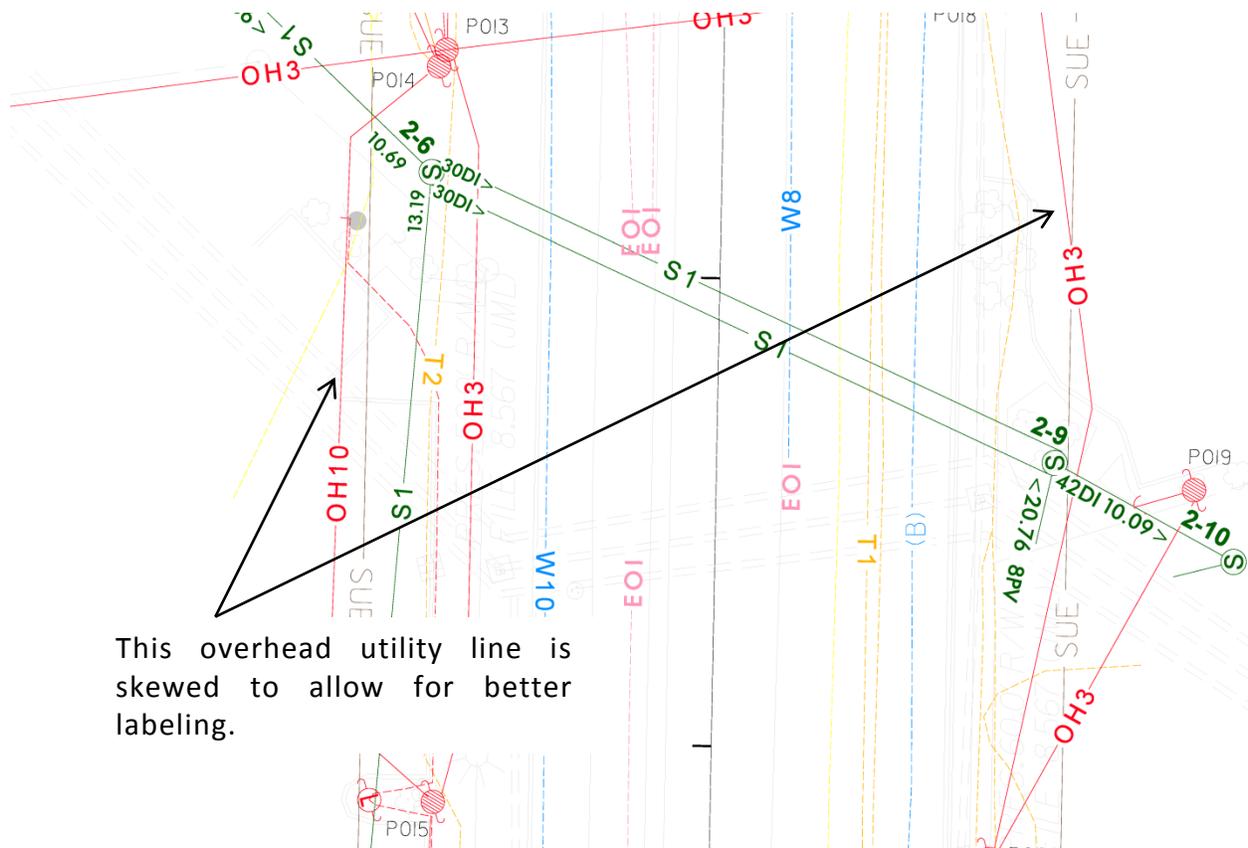


Figure 6 Overhead Utility Line-Work

3.09 TEST HOLE LABELS

Test Holes will be labeled in the SUE planimetry file with a “TH” along with the corresponding Test Hole number (e.g. **TH-01**). Test Hole numbers will match the numbering sequence as used on the Test Hole Report and on the Test Hole Data Sheet.

3.10 UTILITY ABBREVIATIONS

The following are lists of abbreviations used for SCDOT SUE projects. Custom abbreviations for materials and/or utilities not listed below are allowed provided that the custom abbreviations are added to the SUE Legend Sheet and shown as Project Specific Custom Abbreviations.

3.10.01 UTILITY ABBREVIATIONS

E	Electric (Power)	DB	Duct Bank
W	Water	TF	Traffic Control
G	Gas	UNK	Unknown
PUPS	Palmetto Utility Protection Services	H	Hydrogen Peroxide
T	Telephone	ST	Steam Line
TV	Cable Television	F	Fuel / Petroleum Line
S	Sanitary Sewer	CA	Compressed Gases
FS	Forced Sanitary Sewer	TNL	Tunnel
I	Irrigation	R	Reclaimed Water / Slurry

Table 7 Utility Abbreviations

3.10.02 MATERIAL ABBREVIATIONS

C	Copper	PV	PVC
CI	Cast Iron	RC	Reinforced Concrete
CO	Concrete	S	Steel
DI	Ductile Iron	TC	Terra Cotta
F	Fiber Optic	SWC	Steel Wrapped Coated
P	Plastics	AC	Asbestos Cement
TF	Traffic Signal Cable		

Table 8 Material Abbreviations

3.10.03 INFORMATIONAL ABBREVIATIONS

EOI	End of Surface Geophysical Information	NAP	No Associated Piping Found From Structure
EORI	End if Recorded Information	NAC	No Associated Cables Found From Structure
AATUR	Abandoned According to Utility Records	DATFI	Depicted According to Field inspection
AATFI	Abandoned According to Field Inspection	EATFI	Empty According to Field Inspection
EATUR	Empty According to Utility Records		

Table 9 General Information Abbreviations

3.11 SUPPLEMENTAL UTILITY LINE LABELS

Many times, Utility Coordinators will want specific utility information on the plan sheet. This information can be anything deemed appropriate to the project by the SUE professional. If labeling a utility line is necessary, lines will be labeled in the following manner and shown on the Utility Legend Sheet. Use the SCDOT provided SUE font style when making supplemental labels. In general, lines will be labeled at 250 foot increments using **Font 3, Height 4, Width 4, CENTER – CENTER Justification, Line Spacing -0.50, and Interchar Spacing 0.250**. CADD technicians will make every effort to place the labels with minimum overlap of other labels, cells, etc.

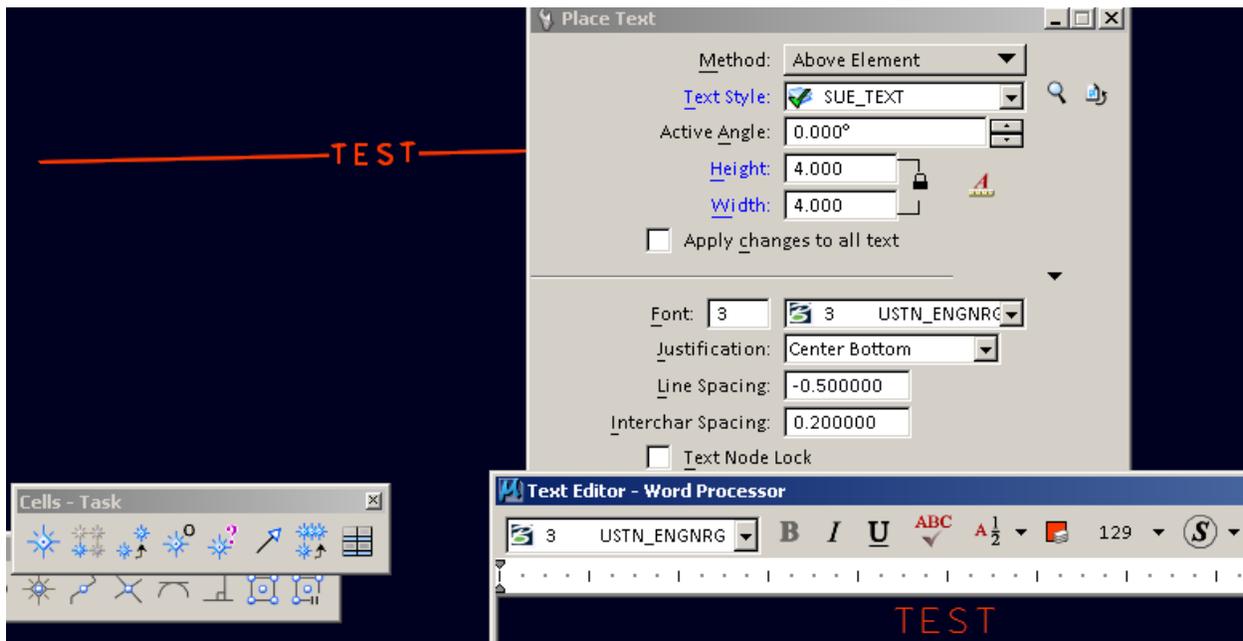


Figure 7 Place Text Dialog Box

A Text Style incorporating a Background Color of **225 (BG)** will be used on Utility Line Labels.

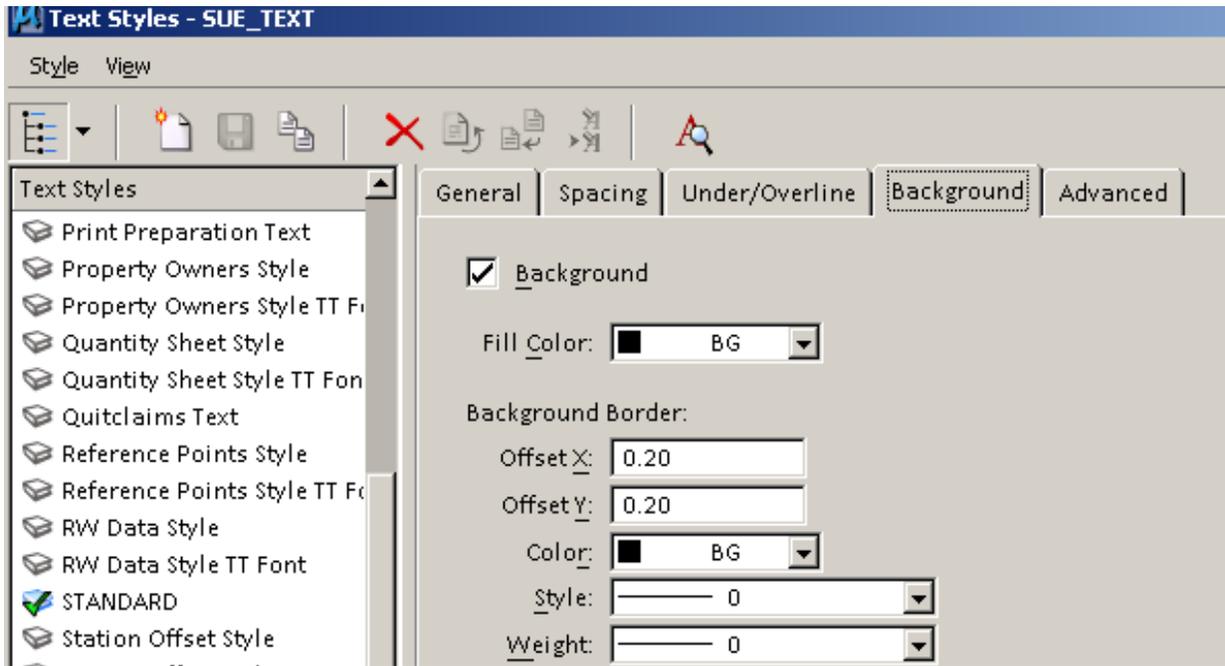


Figure 8 Text Style Dialog Box

This labeling method will give the appearance of broken line elements. Below are some examples of possible uses for SULs.

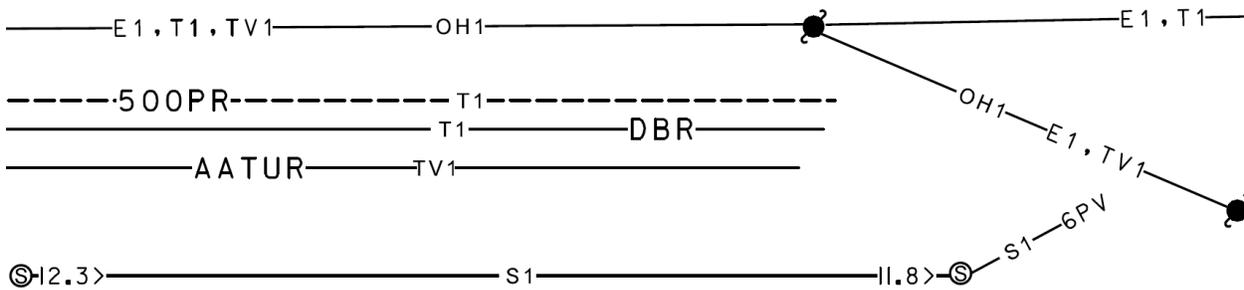


Figure 9 Possible SUL Usages

3.11.01 QUALITY LEVEL LINE CODES

Some SUE project will combine Level C and Level D SUE Quality Levels. Since construction plans are plotted in black ink only, it can be necessary to differentiate between the Quality Levels. Using the Supplemental Line Label methods, as described above, the SUE Quality Level of lines can be depicted using the following symbol codes:

	Quality Level C
	Quality Level D

Figure 10 Quality Level Codes

3.11.02 SUE OWNERSHIP CODES

The complexities of some SUE projects will greater detail in line descriptions than the SCDOT Line-style library contains. In cases where the available line-styles are not sufficient due to multiple SUE owners, ownership of lines can be depicted with **SUE Ownership Codes (SOC)**. Using the Supplemental Labeling method, place a SOC for the utilities by a letter system inside of parenthesis. See the following example:

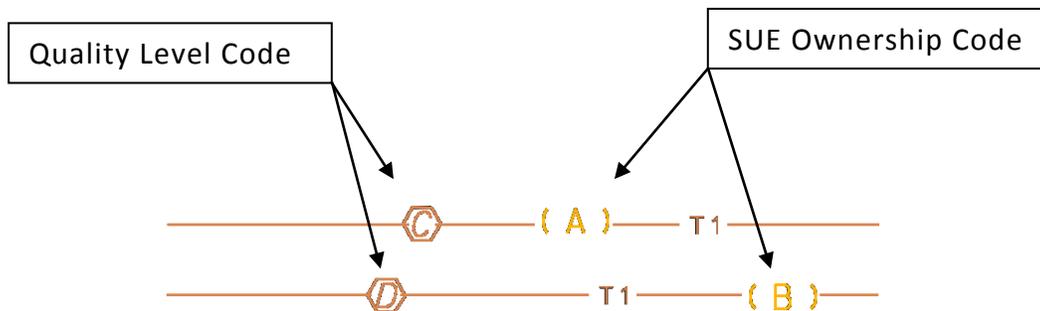


Figure 11 SUE Ownership Codes

3.12 UTILITY TOWERS AND TRANSMISSION LINES

Utility towers will be located and drafted by the shape of its footprint using the **Utility Poles** level (RD_EX_SU_Poles) and a solid line-style (0). Towers will be tagged with a **UPIN** and all pertinent information required will be placed on the Utility & Pole Data Sheet.

Some projects may require the Transmission pole/tower bent widths measured or the approximate horizontal location of the transmission lines. All detailed information should be noted on the Utility & Pole Data Sheet. Notes on measuring and/or surveying methods should be placed on the SUE Legend Sheet in the Project Specific Note section.

3.13 SCDOT SUE CADD DRAFTING TOOL

A CADD drafting toolbar is available for Microstation users and is included with the SUE Microstation workspace files. This toolbar contains menu controlled buttons for all SUE test styles, levels, line-styles and cells.



Figure 12 SCDOT SUE CADD Drafting Toolbar

Each button has “fly-out” descriptions and many of the toolbar functions, the cell toolbar, can be brought out into a separate toolbar.

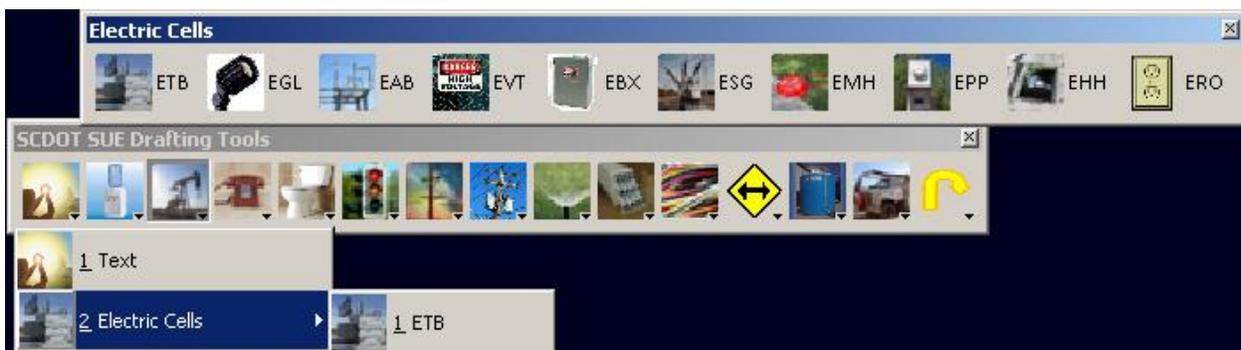


Figure 13 CADD Toolbar Menu Options

4.0 CADD FILES, SHEETS AND DESCRIPTIONS

4.01 TITLE & UTILITY REFERENCE SHEET

This sheet contains Subsurface Utility Engineer consultant’s firm name and contact information. It also contains all of the project utility owner names, contact information, and owner identifier used in the Utility Line Labels found in the SUE planimetry file. Each utility owner can be given an Owner Reference Abbreviation for further references in the Utility & Pole Data Sheets. Utility owner information will typically appear as follows:

WATER (UTILITY TYPE)	OWNER REF. ABBR -	CAW
COUNTY WATER AUTHORITY	(OWNER NAME)	
123 HAPPY STREET	(ADDRESS)	
CITY, STATE ZIP		
JOE SMITH	(CONTACT NAME)	
000-123-4567	(CONTACT NUMBER)	

4.02 SUE LEGEND SHEET

This sheet contains the descriptions and names of the symbols (cells) found in the SUE planimetry file. Examples of the line formats and descriptions of the Utility Unique Identifier Line Labels are shown on this sheet. Any project specific custom symbols or abbreviations will be added to this sheet and labeled as “**Project Specific Utility Symbols**”.

Included on this sheet are notes explaining the quality levels of the SUE data, the quality level applied to the project, survey control used, and any miscellaneous information pertinent to the overall project.

This sheet contains space to place Project Specific Notes. This area will be used to note the following information;

- Graphic information that varies from the standard legend
- Surface Geophysical Methods used in designation
- Dates of Designation (Level B), Location (Level A), and Surveying (A, B, C)
- Any Consultant Certifications, Statements, or Disclaimers

4.03 SUE PLANIMETRY

All SUE mapping will be contained in this 2d Microstation CADD file. All Survey COGO data points and information may be included in this file and placed on the appropriate levels.

In most cases, engineer CAD files are aligned to plot with the reference alignments to appear horizontally across the plan sheets. Stationing will almost always run from left to right across the plan sheets. Generally, all SUE text and labels should be arranged to appear parallel with the nearest reference alignment and to read left to right going up-stationing. It is important to verify the engineer's layout and to request specific guidance on the orientation appearance of the SUE planimetry information.

All structure information, including, but not limited to, elevations, record information, field conditions, pole data, etc. should not be shown in the planimetry file, but referenced using the labeling scheme as described in the CAD manual. All structure data will be shown on the Utility & Pole Data Sheets.

All Survey Control used for SUE projects will be mapped per the **SCDOT PRECONSTRUCTION SURVEY MANUAL**.

4.04 UTILITY & POLE DATA SHEET

All information relative to utility appurtenances and utility pole is shown on the sheet. Information about utility relocation items will be shown on this sheet when applicable. All items will be grouped by reference alignment and will be listed in an up-station order whenever possible. The information required ⁵ for this sheet is as follows:

COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05
POLE	Reference the Utility Pole ID Number (UPIN)	P001, P25
ALIGNMENT ROUTE RD	Reference the Alignment used for stationing Use design alignments when available	MAIN ST. MAIN ST RELOC
STATION RANGE SCSP N ⁷	a) Apx station ⁶ of the begin & end of linear utility b) Apx station location of utility appurtenance c) Apx station location of manhole	01+23 - 45+67 01+23 01+23
OFFSET RANGE SCSP E ⁹	a) Apx offset ⁸ of the begin & end of linear utility b) Apx offset location of utility appurtenance c) Apx offset location of manhole	15R - 15R 25L 25L
ITEM IN PLACE	a) Reference utility type, size, & material b) Reference the utility appurtenance type c) Reference manhole	TELEPHONE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH
OWNERSHIP	Reference utility owner by name or by Owner Reference Abbreviation From Title Sheet	LOCAL POWER CO or LPC
POLE DATA	Reference Owner Number, Height, Diameter, and Material of pole	DPC123, 35', 12", WOOD
REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record info, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

Table 10 Utility & Pole Data Sheet

⁵ All Utility & Pole Data fields may not be necessary for each SUE project. Applicable data included in the Utility & Pole Data sheets should be determined before the project begins.

⁶ Apx Stations will be considered scaled data and should be shown to the nearest foot.

⁷ South Carolina State Plane Grid Coordinate NAD83 (NSR2007) Northing values only

⁸ Apx Offset will be considered scaled data and should be shown to the nearest foot.

⁹ South Carolina State Plane Grid Coordinates NAD83 (NSR2007) Easting Value only

4.04.01 SPECIFIC UTILITY POLE INFORMATION

For some SUE projects, utility pole locations would be better described in State Plane Grid Coordinates rather than using station and offsets. For these projects, the “Station” and “Offset” columns on the Utility & Pole Data sheet can be used for “Northings” and “Eastings”. To prevent future confusions, this option should be only be used when the project datum is based on South Carolina State Plane Grid NAD83/07 Coordinates. Provide coordinates only to the tenth decimal place.

4.05 TEST HOLE DATA SHEET

All information relative to the test hole is shown on this sheet including detailed information about the location and results of the test holes performed on the project including the following:

1. Elevation of top and/or bottom of the utility tied to the project datum, to a vertical accuracy of +/- 0.05 feet (15 mm).
2. Elevation of existing grade over utility at test hole.
3. Horizontal location referenced to project coordinate datum, to a horizontal accuracy consistent with applicable DOT survey standards.
4. Field sketch showing horizontal location referenced to a minimum of three (3) swing ties to physical structures existing in the field and shown on the project plans.
5. Approximate centerline bearing of utility line.
6. Outside diameter of pipe, width of duct banks, and configuration of non-encased multi-conduit systems.
7. Utility structure material composition, when reasonably ascertainable.
8. Identity of benchmarks used to determine elevations.
9. Utility facility condition.
10. Pavement thickness and type when applicable.
11. Soil type and site conditions.
12. Identity of utility owner/operator.
13. Other pertinent information as is reasonably ascertainable from test hole.

The Test Hole Data plan sheet has two portions, each on its own sheet. The first sheet is the data table which shows all of the information that is commonly shown on a Test Hole Certification Sheet. The following charts show standard abbreviations that will be used in the data table:

SOIL DESCRIPTION LEGEND KEY					
COMPACTION	ABV	WATER CONTENT LEVEL	ABV	SOIL TYPE	ABV
LOOSE	L	DRY	D	CLAY	C
SOFT	S	MOIST	M	LOAM	L
HARD	H	WET	W	SAND	S
SOLID	HH	STANDING WATER	WW	SILT	Z

Table 11 Soil Description Legend Key

SURFACE DESCRIPTION LEGEND KEY	
SURFACE TYPE	ABV
ASPHALT	A
INTERLOCKING BRICK	I
CONCRETE	C
NATURAL GROUND	N

Table 12 Surface Description Legend Key

The following chart is a basic guide to properly identifying soil types:

SANDY LOAM SL	SANDY FEEL. ADHERES TO AT LEAST ONE FINGER. NOT SOAPY OR STICKY. READILY WORKED.
SILTY LOAM ZL	
SILT Z	RARE AS A TEXTURE. SILKY SOAPY FEEL.
LOAM L	NO PREDOMINATING FEEL. ROUGHLY EQUAL QUANTITIES OF S, Z, AND C. ADHERES TO FINGER AND THUMB. READILY WORKED.
SAND CLAY LOAM SCL	MODERATELY SILKY AND SANDY FEEL. ADHERES TO FINGER AND THUMB.
SILT CLAY LOAM ZCL	MODERATELY STICKY WITH SILKY SOAPY FEEL. ADHERES TO FINGER AND THUMB. MODERATELY STIFF WORKABILITY.
CLAY LOAM CL	STICKIER AND HARDER TO WORK. LESS SOAPY THAN ZCL AND LESS SANDY THAN SCL. ADHERES TO FINGER AND THUMB.
SANDY CLAY SC	STICKY WITH SANDY FEEL. TAKES A ROUGH POLISH. STIFF TO WORK.
SILTY CLAY ZC	VERY STICKY WITH SOAPY FEEL. TAKES A POLISH. STIFF WORKABILITY.
CLAY C	EXTREMELY STICKY AND DIFFICULT TO WORK.

Table 13 Soil Identifiers

The second portion, on the second sheet, provides areas for the “Three Point Tie” sketches. These sketches are required to show the minimum amount of detail to accurately show the test hole location as measured from three physical features. An example is shown below:

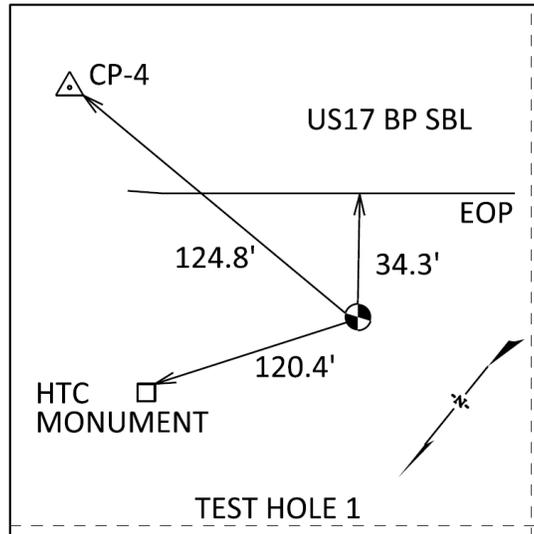


Figure 14 Test Hole Three Point Tie Sketch

Also on the second sheet is an area for cross-sectional view sketches to depict the configuration or arrangement of the utility lines. An example is provided below:

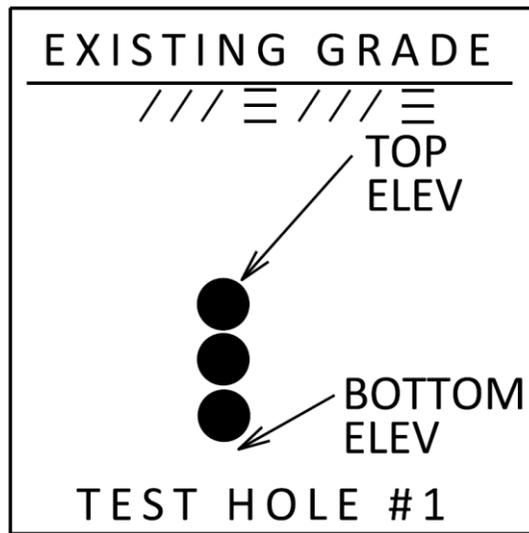


Figure 15 Test Hole Cross Section Sketch

4.06 MICROSTATION SYMBOLS, & SURVEY CODES

The cell library (**08scdot_sue_cel.cel**) provided by the Department contains most of the graphic symbols required to produce SUE project files and plans. For structures not found in the cell library, custom symbols may be used. All custom symbols must be added to the SUE Legend Sheet, shown as a Project Specific Custom Symbol, and given a brief description.

4.06.01 ELECTRIC

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
TRANSFORMER BOX	SUE_ETB		ETBS	
ELECTRIC MANHOLE	SUE_EMH		PMS	
POWER HAND HOLE	SUE_EHH		PHHS	
GROUND / LANDSCAPE LIGHT	SUE_EGL		EGLS	
ELECTRIC VAULT	SUE_EVT		EVTS	NOTE DIMENSION ON UTILITY DATA SHEET*
ELECTRIC BOX	SUE_EBX		EBXS	
ELECTRIC PEDESTAL	SUE_EPP		EPPS	
ELECTRIC GEAR SWITCH BOX	SUE_EGS		ESBS	
ELECTRIC AIR BRAKE	SUE_EAB		EABS	
RESIDENTIAL OUTLET	SUE_ERO			

Table 14 Electric Cell Table

4.06.02 TRAFFIC CONTROL

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
TRAFFIC SIGNAL CONTROL VAULT	SUE_TFV		TFVS	NOTE DIMENSION ON UTILITY DATA SHEET*
TRAFFIC SIGNAL JUNCTION BOX	SUE_TFJ		TFJS	
TRAFFIC CONTROL HAND HOLE	SUE_TFHH		TFHS	

Table 15 Traffic Control Cell Table

4.06.03 GAS

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
GAS METER	SUE_GM		GMS	
GAS VALVE CAP	SUE_GVC		GVS	
GAS VENT	SUE_GVT		GVTS	
GAS PRESSURE REGULATOR	SUE_GR		GRS	
GAS MANHOLE	SUE_GMH		GMHS	
GAS TEST POINT	SUE_GTP		GTPS	
GAS TAP FARM	SUE_GTF		GTFS	NOTE DIMENSION ON UTILITY DATA SHEET*

Table 16 Gas Cell Table

4.06.04 TEST HOLE

TEST HOLES	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
TEST HOLE SYMBOL	SUE_TH		THS	NOTE TH # ON SAME LEVEL

Table 17 Test Hole Cell Table

4.06.05 SANITARY SEWER

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
SEWER CLEAN OUT	SUE_SCO		SCOS	
SEWER MANHOLE	SUE_SMH		SMHS	
SEWER AIR RELEASE VALVE	SUE_SAR		SARS	
SEWER STEP TANK	SUE_SST		SST	
SEWER CHECK VALVE BOX	SUE_SCV		SCVS	
GRINDER / PUMP STATION	SUE_SGP		SGPS	NOTE DIMENSION ON UTILITY DATA SHEET*
SEWER VALVE	SUE_SSV		SSVS	
LIFT STATION	SUE_SLS			

Table 18 Sanitary Sewer Cell Table

4.06.06 MISCELLANEOUS

MISC	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
MISC / UNKNOWN VALVE CAP	SUE_MUC		MUCS	
UTILITY WITNESS MARKER	SUE_MUP		WTSS	
END OF INFORMATION	SUE_MOI	EOI		
PAVED / BURIED MANHOLE / CAP	SUE_MPB		MPBS	
UTILITY TERMINI / ENDS	SUE_MUE		MUES	

Table 19 Miscellaneous Cell Table

4.06.07 WATER

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
WATER METER	SUE_WM		WMS	
WATER VALVE	SUE_WV		WVS	
MONITORING WELL	SUE_WMW		WMWS	
FIRE HYDRANT	SUE_WFH		FHS	
WATER MANHOLE	SUE_SMH		WMHS	
AIR RELEASE VALVE	SUE_WAR		WARS	
WELL HOUSE	SUE_WWH		WELLS	NOTE DIMENSION ON UTILITY DATA SHEET*
BLOW OFF VALVE	SUE_WBO		WBOS	
BACK FLOW PREVENTER	SUE_WBP		WBPS	
FIRE DEPARTMENT CONNECTION TEE	SUE_WFC		FDCS	
VALVE BOX	SUE_WVB		WVBS	
POST INDICATOR VALVE	SUE_WPV		WPV	

Table 20 Water Cell Table

4.06.08 NON-POTABLE WATER

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
IRRIGATION CONTROL VALVE	SUE_ICV		ICVS	
IRRIGATION CONTROL BOX	SUE_ICB		ICBS	
IRRIGATOR HEAD / SPRINKLER	SUE_IRH		IRHS	

Table 21 Non-Potable Cell Table

4.06.09 TELECOMMUNICATION

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
CABLE TV PEDESTAL	SUE_TVP		TVS	
TELEPHONE PEDESTAL	SUE_TPP		TPPS	
TELEPHONE MANHOLE	SUE_TMH		TMHS	
FIBER OPTIC HAND HOLE	SUE_TFOH		FHHS	
TELEPHONE HAND HOLE	SUE_THH		THHS	
CABLE TV HAND HOLE	SUE_TVHH		TVHHS	
U/G CABLE TV PEDESTAL	SUE_UTV		UPTVS	
U/G TELEPHONE PEDESTAL	SUE_UTP		UPTS	
U/G TELEPHONE VAULT	SUE_TUV		UVTS	NOTE DIMENSION ON UTILITY DATA SHEET*
CABLE TV BOX	SUE_TVXB		TVBXS	
TELEPHONE REPEATER	SUE_TRP		RPTS	
TELEPHONE BOX	SUE_TBX		TBXS	
TELEPHONE BOOTH	SUE_TB		TBS	
SPLICE BOX	SUE_TXB			

Table 22 Telecom Cell Table

4.06.10 UTILITY POLE

SUE ITEMS	CELL NAME	CELL GRAPHIC	SMD CODE	SPECIAL INSTRUCTIONS
POWER POLE	SUE_PP		PPS	
METER POLE	SUE_PMP		MPS	
LIGHT POLE	SUE_PLP		LPS	
GUY POLE	SUE_PGP		GPS	
TRANSMISSION POLE	SUE_PTN		PLTS	
TELEPHONE POLE	SUE_PTP		TPS	
CELL PHONE TOWER	SUE_PCT		CTS	
OTHER USE POLE	SUE_POP		OPS	
SIGNIFICANT POLE (STEEL, CONC)	SUE_PSP		SGPS	
TRAFFIC SIGNAL POLE	SUE_PTF			

Table 23 Utility Pole Cell Table

4.07 MICROSTATION UTILITY UNIQUE IDENTIFIER LINES

The following chart shows the basic UII line-styles (09scdot_sue_txt.rsc);

MICROSTATION LEVEL	UTILITY TYPE	COLOR	SUE TYPE	LINE GRAPHICS
RD_EX_SU_ELEC	ELECTRICITY	(127)	LEVEL B	E1
			LEVEL C	E1
		210*	LEVEL D	E1
RD_EX_SU_GAS	GAS	(231)	LEVEL B	G1
			LEVEL C	G1
		230*	LEVEL D	G1
RD_EX_SU_GAS	STEAM	(231)	LEVEL B	ST1
			LEVEL C	ST1
		228*	LEVEL D	ST1
RD_EX_SU_GAS	GASEOUS MATERIAL	(231)	LEVEL B	CA1
			LEVEL C	CA1
		232*	LEVEL D	CA1
RD_EX_SU_GAS	FUEL	(231)	LEVEL B	F1
			LEVEL C	F1
		229*	LEVEL D	F1
RD_EX_SU_H2O	WATER	(155)	LEVEL B	W1
			LEVEL C	W1
		180*	LEVEL D	W1
RD_EX_SU_Telecom	TELEPHONE	(6)	LEVEL B	T1
			LEVEL C	T1
		82*	LEVEL D	T1
RD_EX_SU_Telecom	CABLE TV	(6)	LEVEL B	TV1
			LEVEL C	TV1
		80*	LEVEL D	TV1
RD_EX_SU_Nonpot	IRRIGATION	(49)	LEVEL B	I1
			LEVEL C	I1
		50*	LEVEL D	I1
RD_EX_SU_Nonpot	RECLAIMED WATER or SLURRY	(49)	LEVEL B	R1
			LEVEL C	R1
		51*	LEVEL D	R1
RD_EX_SU_Ovhd	AERIAL UTILITIES	(127)	na	OH1
	GUY WIRES		na	GW
	AERIA TRAIFFIC	(132)	na	SIG
RD_EX_SU_SEWER	GRAVITY SEWER	(194)	LEVEL C	S1
		193*	LEVEL D	S1
RD_EX_SU_SEWER	FORCED SEWER	(194)	LEVEL B	FS1
			LEVEL C	FS1
		195*	LEVEL D	FS1
RD_EX_SU_Dbank	UTILITY DUCT BANK	(60)	LEVEL B	DB1
			LEVEL C	DB1
		59*	LEVEL D	DB1
RD_EX_SU_Misc	MISCELLANEOUS	(28)	LEVEL B	M1
			LEVEL C	M1
		27*	LEVEL D	M1
RD_EX_SU_H2OTank	A/G & U/G TANKS	(1)	na	
RD_EX_SU_Swplmt	SWEEP LIMITS	(8)	na	SUE
RD_EX_SU_Pole	TOWER OUTLINE	(127)	na	

Figure 16 SUE UII Graphics

4.08 SURVEY SUE LINE CODES

The following chart details the SUE Surveying codes found in the SCDOT Standard SMD File (11scdot_sue_smd.smd);

LEVEL NAME	UTILITY	SUE TYPE	SURVEY CODES
RD_EX_SU_Elec	ELECTRIC	LEVEL B	ES01 ES10
RD_EX_SU_Trfc	TRAFFIC CONTROL	LEVEL B	TFS01 TFS10
RD_EX_SU_Gas	GAS	LEVEL B	GS01 GS10
	STEAM LINE	LEVEL B	STS1 STS5
	GASEOUS MATERIAL	LEVEL B	CAS1 CAS5
	FUEL LINE	LEVEL B	PFS1 PFS5
RD_EX_SU_H2O	WATER	LEVEL B	WS01 WS10
RD_EX_SU_Telecom	TELEPHONE	LEVEL B	TS01 TS10
	CABLE TV	LEVEL B	TVS01 TVS10
RD_EX_SU_Nonpot	IRRIGATION	LEVEL B	SDI1 SDI5
	RECLAIMED WATER / SLURRY	LEVEL B	SDR1 SDR5
RD_EX_SU_Sewer	GRAVITY SEWER	N/A	SS01 SS10
	FORCED SEWER	LEVEL B	FSS01 FSS10
RD_EX_SU_Dbank	UTILITY DUCT BANK	LEVEL B	DBS1 DBS5
RD_EX_SU_Misc	MISCELLANEOUS	LEVEL B	MULS1 MULS5
RD_EX_SU_Tank	A/G & U/G TANK OUTLINES	N/A	TKS1 TKS5
RD_EX_SU_Pole	POLE & TOWER OUTLINES	N/A	EPLS

Table 24 SUE Survey Line Codes

5.0 GENERAL UTILITY LOCATING GUIDELINES

These general guidelines are not intended to dictate the procedures, methods, processes, and standards employed by a professional utility engineering firm, but to serve as an outline to the specific items and areas as required by the Department. All utility data collection should meet or exceed the standards as described in the “Standard Guideline for the collections and depiction of Existing subsurface Utility Data (CI/ASCE 38-02)” as published by the American Society of Civil Engineers.

All land surveying involved with the location of the surface and subsurface utility data will meet or exceed the requirements as described in the “Minimum Standards Manual for the Practice of Land Surveying in South Carolina”.

5.01 SUBSURFACE QUALITY LEVELS

The reliability and graphic accuracy of Subsurface Utility Engineering data collection is quantified by four (4) accumulative “Quality Levels” ranging from least reliable to within a foot as referenced to the project datum. These levels are listed and described as follows:

Level D. This level information comes solely from existing utility records. It may provide an overall “feel” for the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities.

Level C. This level involves surveying visible aboveground utility facilities (e.g., manholes, valve boxes, posts) and correlating this information with existing utility records. When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, should be confined to rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

Level B. This level involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. This activity is called “designating.” Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations.

Level A. This level involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material and other characteristics. This activity is called “locating.” It is the highest level presently available. When surveyed and mapped, precise plan and profile information are available for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the designer can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information (e.g., utility materials, condition, size, soil contamination, paving thickness) also assists the designer and Utility Company in their decisions.

5.02 UTILITY RECORD RESEARCH

The Department requires all utility records collected during the course of a SUE project to be available upon request.

5.03 UTILITY POLES AND OVERHEAD UTILITY LINES

All utility poles within the SUE Sweep Limits should be located using the project coordinate datum and the following data will be collected:

Owner

Owner Tag Number

Pole Material & Diameter

Pole Height (distance from the natural ground to the pole to the top of the pole)

Riding Utilities (including utility capacities where possible)

Pole Birthmark (per project requirements)

Overhead utility lines should be shown in their entirety within the project limits. Accurate line directions in areas where the overhead utilities extend beyond the Sweep Limits will be shown by locating connecting utility poles outside the project area.

5.04 SUBSURFACE UTILITY DESIGNATION

All subsurface utility lines will be located using the appropriate surface geophysical methods as determined by the utility engineer consultant. The horizontal accuracy of the marked lines is anticipated in the approximate horizontal location of the subsurface utility.

Telecommunication utility lines rated with a capacity less than 100 pair will be located by **Level C** methods only unless specified otherwise in contract documents.

Residential water and gas utility service lines will be located by **Level C** methods only unless otherwise specified in contract documents.

Location of Gravity Sanitary Sewer lines is considered a **Level C** effort. Structure rim and pipe invert elevations will be surveyed and shown in the CADD files.

APPENDIX A – TEST HOLE REPORT FORM

SCDOT SUE Text Hole Report Form

City, County, State: _____ Route/Gen Location: _____ Utility Owner: _____ Recorded Utility Type: _____ Recorded Util Material: _____ Pavement Condition Prior to Excavation: _____ Survey Project Datum Provided by: _____ BM # 1 Elev= _____ Description: _____ is _____ BM # 2 Elev= _____ Description: _____ is _____ Benchmark Check: _____ Test Hole Elev ref to: _____ Located Utility Type: _____ Size: _____ Material: _____ Utility Condition: _____ Additional Utilities in Hole: _____ (see remarks) Field Conditions: _____ Pvmnt Thickness & Type: _____ Soil Type: _____ Installed Tape Color: _____ Existing Grade of: _____ Elev= _____ TH Ref Alignment: _____ TH Station: _____ TH Offset: _____ Ref. Survey Cntl Pnt: _____ N= _____ E= _____ Elev= _____ TH Survey Marker _____ N= _____ E= _____ Elev= _____ Centerline of Utility: _____ N= _____ E= _____	Test Hole No: _____ SCDOT PIN: _____ Report Date: _____ Plan Sheet Ref: _____ Consultant Ref No: _____ SUE Tech: _____ Truck/Form: _____	Contact & Number: _____ Address: _____ Consultant: _____
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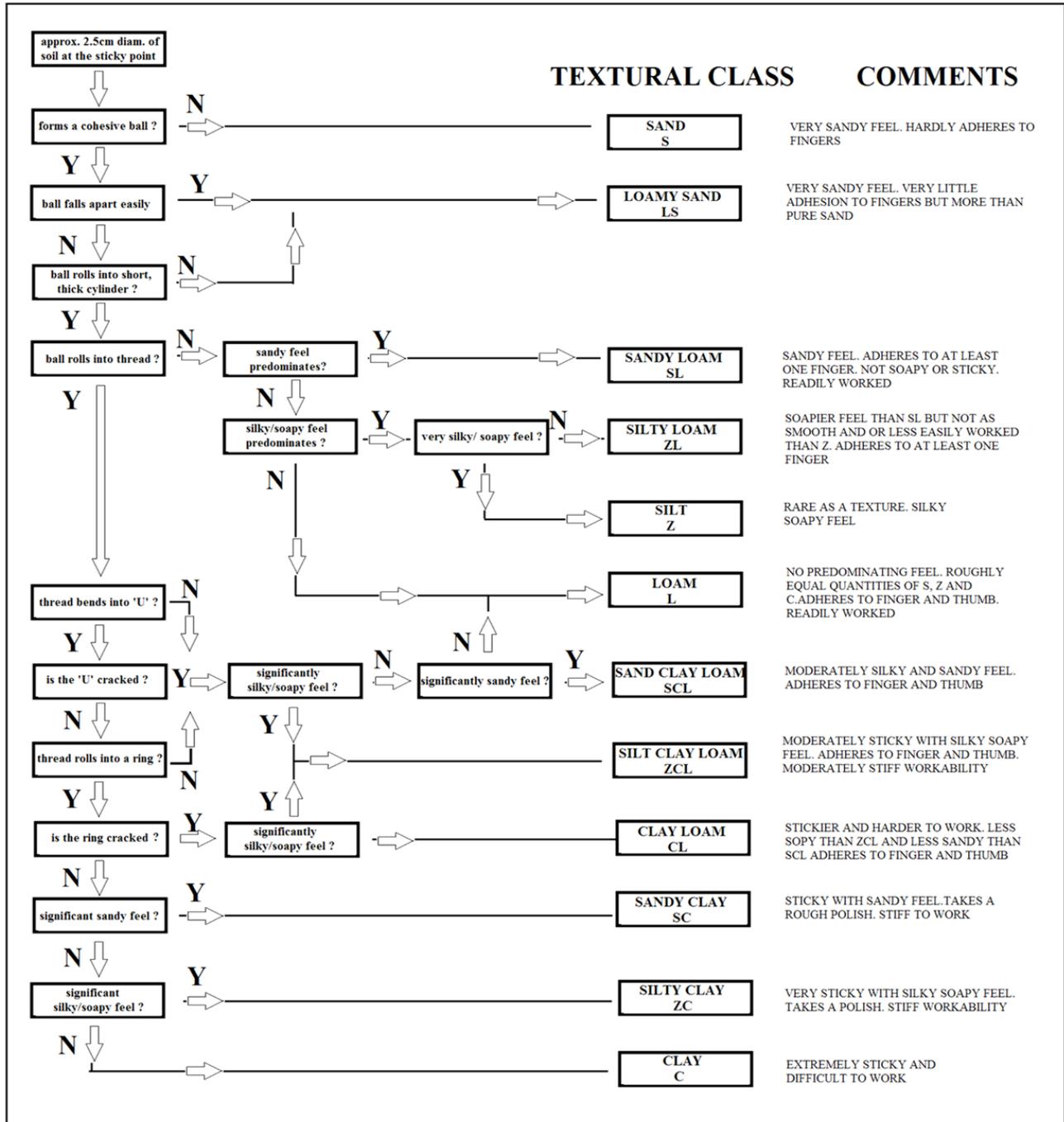
Cross Section Facing:

Remarks: _____

Plan View Sketch:

Engineer/Surveyor Hand, Seal & Date

APPENDIX C – SOIL TEXTURE ANALYSIS CHART



Sticky point: moisture content at which dry soil being wetted just begins to adhere to fingers

Workability: easy with which soil can be moulded between the fingers. Because consistence varies greatly with moisture, samples must be properly and uniformly wetted up

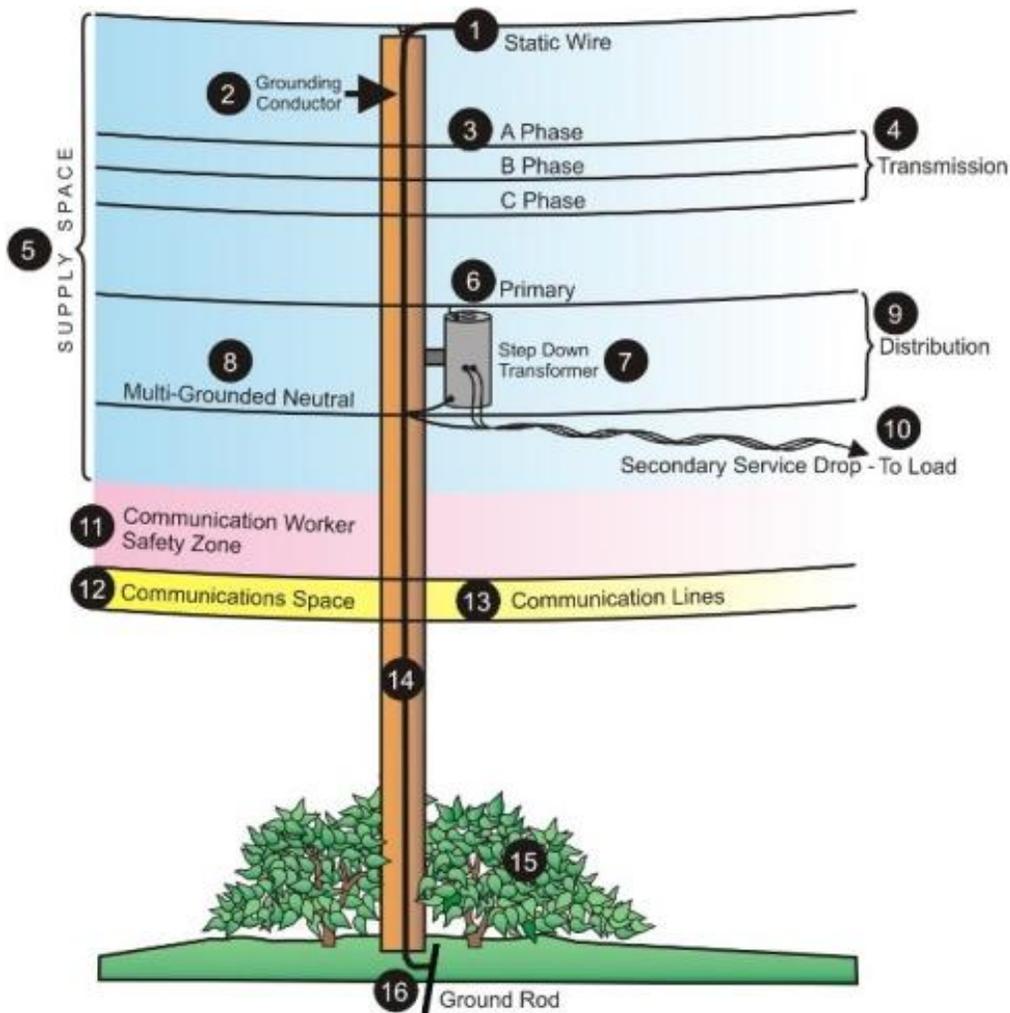
Cylinder: approx 5cm long and 1.5cm diameter

Thread: approx 13cm long and 0.6cm diameter

Ring: approx 2.5cm diameter formed from about 8cm of above thread.

Guide to field assessment of mineral soil texture by S. Nortcliff & J.R. Lang. From Rowell (1994)

APPENDIX D – UTILITY POLE CHART



<p>1</p>	<p>Static Wire is the pole's top wire which bleeds lightning surges off the power lines during a storm. Without a static wire, lightning induced voltage would otherwise build up on power line conductors during a lightning strike and cause damage. The static wire is connected to the grounding conductor.</p>
<p>2</p>	<p>Grounding Conductor The grounding conductor is a wire that connects the static wire to the ground rod. You can recognize the grounding conductor because this wire runs the entire length of the pole.</p>
<p>3</p>	<p>A – B – C Phase These transmission wires carry high voltage electricity from the power plants in three phases, usually labeled A, B, and C. The three phase wires carry the power to substations where the voltage is reduced. From the substations, the power is distributed by lines called feeders.</p>
<p>4</p>	<p>Transmission wires carry electricity at voltages of 69-500 kilovolts (kV) from the generating plants to the substations. You might think of voltage as the pressure behind the electric current pushing the electricity to its destination.</p>
<p>5</p>	<p>Supply Space Usually the upper area of the pole, the supply space is used for electric lines and other supply equipment. The National Electric Safety Code (NESC), started in 1913, sets the standards for the construction, maintenance, and safety of electric lines in the United States.</p>
<p>6</p>	<p>Primary The primary phase conductors are part of the distribution system wires and carry electricity from the substations at 5-30 kilovolts (kV). On older poles, you'll often see the primary wires supported by the crossbars.</p>

<p>7</p>	<p>Step Down Transformer The transformer, easy to recognize by its large canister shape, converts the high primary voltage to the lower voltage needed for home use. Look closely and you'll see that the high voltage transformer terminal is connected to one of the primary phase conducting wires. The transformer case is attached to the ground wire on the pole to prevent dangerous differences in voltage from developing.</p>
<p>8</p>	<p>Multi-Grounded Neutral (MGN) Distribution lines have a grounded neutral conductor to provide a return path for the electricity. On many poles, if the distribution line is also connected to the ground wire (or grounding conductor), the line is called a multi-grounded neutral.</p>
<p>9</p>	<p>Distribution lines carry electricity from the electric substation to homes and businesses. The power in distribution lines can be one, two, or all three phases.</p>
<p>10</p>	<p>Secondary Service Drop – To Load The secondary service drop is the cable that brings electricity to the end user. Follow the wire from your home to the utility pole, and you'll see that the secondary service drop consists of the three conductor wires. The two insulated "hot" wires come from the transformer, and the bare neutral wire is connected to the ground wire at the pole. The secondary lines commonly have a voltage of 120/240 V.</p>
<p>11</p>	<p>Communication Worker Safety Zone This safety zone, also called neutral space, is the space between the lowest supply conductor or equipment and the highest communication cables or equipment. In addition to separating the high voltage lines and communications wires, the safety zone provides maneuvering room for linemen and communication workers.</p>
<p>12</p>	<p>Communications Space Usually the lowest area on the pole, the communications space is used for cable television, broadband, and telephone wires. All attachments require the pole owner's permission.</p>
<p>13</p>	<p>Communication Lines Cable television and broadband wires are usually the uppermost communication lines. Telephone cables are often lashed to a steel strand in the lower area of the communications space. A true telephone pole supports only telephone wires, while a joint use utility pole has both electric and communications cables attached.</p>
<p>14</p>	<p>14. Utility Pole Poles range from 20-100 feet tall; the standard pole is 35 feet tall. Popular pole trees include Douglas fir, Southern pine, and Western red cedar. Poles are buried about 6 feet in the ground and spaced about 125 feet apart. The wood pole's lifespan is about 30-40 years. Sounding, drilling, and coring inspections give information about the pole's condition. Attachment weight, moisture content, vibration, and settling add stress to poles. Utility poles may also be made of concrete, steel, or a fiberglass composite.</p>
<p>15</p>	<p>Vegetation All plants and trees planted around poles and under wires should be trimmed regularly to avoid interference with the electric system, especially during a storm. Utility companies are responsible for pruning vegetation on their easements, and homeowners can plant smaller bushes and trees that will stay below the overhead lines.</p>
<p>16</p>	<p>Ground Rod The ground rod is buried in the soil near the base of the utility pole. Since the ground rod is connected to the grounding conductor, when lightning strikes a pole or static wire, the high voltage surge travels down the grounding wire to the ground rod and safely into the earth.</p>

APPENDIX E – SCDOT SUE DRAFTING TOOLS

