



# **CADD Roadway Drafting Reference Guide**

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# 1. Introduction

The guidelines within this document provide MicroStation, GEOPAK, and other roadway detailing information that shall be used in the preparation of roadway plans for the Illinois Department of Transportation. It is intended to be used in conjunction with the IDOT [CADD Roadway and Structure Project Deliverables Policy](#) as well as the Bureau of Design and Environment Manuals and documents.

For current versions of IDOT CADD software and additional information, refer to the IDOT CADD Support site at <http://www.dot.il.gov/cadd.html>.

## 2. MicroStation Information

### 2.1 MicroStation

IDOT has selected MicroStation and GEOPAK for its Department-wide computer-aided drafting and design software package, which is used to generate most contract plans. This document provides the Department's CADD criteria for plan development (e.g., cell library, levels, text styles). Using MicroStation's levels and reference files allows various users within the Department to work on the same set of plans without interfering with each other's design work. By integrating or linking MicroStation with other software packages (e.g., GEOPAK, AutoTURN, databases), the designer can use the computer to perform the actual design and layout of a project and calculate the quantities.

### 2.2 Configuration

Engineering Systems at IDOT has created a CADD environment (for MicroStation and GEOPAK) which contains a basic configuration and necessary resource files for the preparation of roadway and structure plans. This environment is available at <http://www.dot.il.gov/cadd.html> as a single download entitled "idotcad V2004.exe". To use the IDOT CADD environment, refer to the "ReadMeNow.txt" file contained within the executable file.

When beginning any project, verify that the latest configuration files, resource files, cell library and dgnlib's are installed. This can be accomplished via a comparison of installed files to those currently available from the IDOT CADD Support web page (i.e. through date, file size, etc.). Another way to verify currency is to be an active participant in the IDOT CADD Support Subscription Service. Subscribers are notified through e-mail whenever changes have been made to the contents of the CADD Support Site or the CADD Roadway Guidelines site. Refer to [Section 5.2](#) for information on where to sign up for the Subscription Service.

### 2.3 Resource Files

Included in the CADD environment are various files used to display linework and text symbology properly in design files. Over the course of changes to the Department CADD system, it has become necessary to carry historical resource data in the event that previous files are used on a current project.

Resource files necessary for the preparation of roadway plans are as follows:

- 3cc.rsc: table of three-center-curves for use with idot3cc.mvba program
- E99Lstly.rsc: Pre-MicroStation v8 IDOT English custom line styles (e#####)
- fontlib.rsc: IDOT's custom font library for roadway and structure projects
- IDOTcolor.tbl: IDOT color table for all roadway plans
- IDOTlines.rsc: Current IDOT roadway line styles used by IDOTLevel2004.dgnlib (See [Figure 2.3-2](#) through [Figure 2.3-4](#) for images)
- M99Lstyl.rsc: Pre-MicroStation v8 IDOT Metric custom line styles (m#####)
- Monochrome State Map.tbl: IDOT mapping color table
- Oppstyle.rsc: Current mapping custom line styles

- Scales.def: Definition file for setting the annotation scale. See [Figure 2.3-1](#) for table of standard scales used in roadway plans
- Statemap.rsc: Custom line styles for the Illinois state map
- Units.def: Units definition files for selecting the proper working units

<b>Engineering Scales</b>			
<b>Ratio</b>	<b>Scale</b>		
1:6000	1"	=	500'
1:2400	1"	=	200'
1:1200	1"	=	100'
1:600	1"	=	50'
1:480	1"	=	40'
1:360	1"	=	30'
1:240	1"	=	20'
1:120	1"	=	10'
1:60	1"	=	5'
1:24	1"	=	2'

**Figure 2.3-1 Standard Engineering scales used in roadway plans**

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LC	IMAGE	USED BY LEVEL
0107		Topo_Guardrail
0108		Topo_Base of Levee
0111		Topo_Noise Wall or Levee
0120		ROW_EX_County or Township Lines
0120		ROW_EX_Section Lines
0127		ROW_EX_Property Dashed Lines
0134		Design_PR_Railroad Track
0134		Topo_Railroad Active Track
0136		Drainage_PR_Profile Rightside
0136		ROW_EX ROW Line
0137		Utilities_EX_Underground Sanitary Sewer
0137		Utilities_PR_Underground Sanitary Sewer
0148		Signals_EX_Underground Cable
0148		Signals_PR_Underground Cable
0221		Topo_Railroad Abandon Track
0241		Not Assigned
0265		Topo_Woods and Brush
0277		Not Assigned
0280		Not Assigned
0400		ROW_PR ROW Line
0420		Design_PR_Guardrail
0425		Stage_Construction Edge Drums
0433		IDS_Pavement Joint Sawed
0437		IDS_Pavement Joint Keyed
0439		Design_PR_Aggregate Shoulder
0440		IDS_Pavement Joint Keyed without Bars
0447		Removal_Linear Items
0448		Drainage_PR_Pipe Underdrain
0486		Alignment_EX_## Centerline
0493		Landscaping_Fences
0493		Topo_Fence
0497		Drainage_EX_Pipe Underdrain
0519		Signals_EX_Underground Conduit
0519		Signals_PR_Underground Conduit
0550		Utilities_EX_Underground Telephone
0550		Utilities_PR_Underground Telephone
0551		Utilities_EX_Underground Electric
0551		Utilities_PR_Underground Electric
0557		Utilities_EX_Underground Water

**Figure 2.3-2 Line Styles used by roadway levels**

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LC	IMAGE	USED BY LEVEL
0557		Utilities_PR_Underground Water
0558		Utilities_EX_Underground Gasline
0558		Utilities_PR_Underground Gasline
0559		Utilities_EX_Underground Oil
0559		Utilities_PR_Underground Oil
0595		Not Assigned
0683		Not Assigned
0718		Not Assigned
0726		Lighting_EX_Aerial Cable
0726		Lighting_PR_Aerial Cable
0726		Utilities_EX_Aerial Lines
0726		Utilities_PR_Aerial Lines
0730		Lighting_EX_Cable in Duct
0730		Lighting_PR_Cable in Duct
0745		Lighting_EX_Conduit
0745		Lighting_PR_Conduit
0763		Landscaping_Mowline
0778		ROW_EX_Easement
0778		ROW_PR_Permanent Easement
0779		ROW_PR_Temporary Easement
0781		Topo_Vegetation Line
0782		Topo_Water Edge
0904		Topo_PMK Skip Dash Line
0905		Not Assigned
0906		Design_PR_PMK Dotted Line
0910		Design_PR_PMK Double Centerline
0912		Topo_PMK Stop Line
0913		Design_PR_PMK Stop line
0933		Drainage_PR_Storm Sewer
0936		Not Assigned
0937		Not Assigned
1006		Utilities_EX_Underground Fiber Optic
1006		Utilities_PR_Underground Fiber Optic
1008		Utilities_EX_Underground CableTV
1008		Utilities_PR_Underground CableTV
1010		Drainage_EX_Storm Sewer
1200		Drainage_EX_Aggregate Ditch
1200		Drainage_PR_Aggregate Ditch
1205		Erosion Control_Clearing and Grading
1210		Erosion Control_Dike
1230		Erosion Control_Fence
1245		Erosion Control_Temporary Fence
1250		Drainage_EX_Paved Ditch

**Figure 2.3-3 Line Styles used by roadway levels**

# CADD Roadway Drafting Reference Guide

LC	IMAGE	USED BY LEVEL
1250		Drainage_PR_Paved Ditch
1255		Erosion Control_Perimeter Barrier
1300		Design_PR_PMK Skip Dash Yellow
1305		Design_PR_PMK Skip Dash White
1310		Design_PR_PMK CL Markers 40
1312		Landscaping_Shrubs
1313		Lighting_EX_Buried Cable
1313		Lighting_PR_Buried Cable
1314		Topo_PMK Double Centerline
1315		Design_PR_PMK CL Markers 80
1316		Topo_PMK Dotted Line
1320		Design_PR_PMK LaneLine Marker 40
1325		Design_PR_PMK LaneLine Marker 80
1330		Design_PR_PMK LaneLine Dbl Markers
1335		Design_PR_PMK 2Way Left Turn Lane
1340		Design_PR_PMK CL Multilane
1350		ROW_PR_Excess Property Limits
1352		ROW_EX_Access Control
1354		ROW_EX_Access Control and ROW
1355		ROW_EX_Access Control and ROW with Fence
1356		ROW_PR_Access Control
1358		ROW_PR_Access Control and ROW
1359		ROW_PR_Access Control and ROW with Fence
1360		Design_PR_Concrete Barrier
1360		Topo_Concrete Barrier
1361		Not Assigned
1400		Topo_Railroad Abandon Lg_scale
1402		Topo_Railroad Active Lg_scale
1404		Topo_Levee Lg_scale
1500		Stage_Construction Sheet Piling
1503		Topo_Cable Barrier
1504		Design_PR_Cable Barrier
1505		ROW_EX_Quarter Section Lines
1506		ROW_EX_Quarter Quarter Section Lines
1601		Utilities_EX_Underground Combined Sewer
1602		Utilities_AB_Underground Electric
1603		Utilities_AB_Underground Gasline
1604		Utilities_AB_Underground Oil
1605		Utilities_AB_Underground Water
1606		Utilities_AB_Underground CableTV
1607		Utilities_AB_Underground Fiber Optic
1608		Utilities_AB_Underground Sanitary Sewer
1609		Utilities_AB_Underground Telephone
1610		Not Assigned

**Figure 2.3-4 Line Styles used by roadway levels**

## 2.4 Dgnlib Files

Dgnlib's are design library files with predefined settings. When an element is placed in a design file, MicroStation "looks" to the dgnlib for that element's predefined properties or settings. Once placed, they become part of the active design file. If changes are made to the dgnlib, those changes are not automatically updated in the design file. However, all or part of the settings can be updated from a revised dgnlib by executing the key-in command "dgnlib update (all, dimstyles, levels, etc.)". The available dgnlib's are:

- BridgeStyles.dgnlib:
  - Contains the following text styles:
    - Br1:001scale100: superscripts and subscripts
    - Br1:001scale140: general text and dimension text
    - Br1:001scale200: titles
    - Br1:001scale\_boring: text for soil boring logs (in-house)
    - Br1:001scale\_TOS\_Elev: top of slab elevation text for tables
  - Contains the following dimension styles:
    - Bridge1:001: basic dimension style
- IDOTLevel2004.dgnlib - contains all of the levels with assigned symbology settings for the different disciplines within IDOT
- IDOTStdCheck.dgnlib – Required for use with Standards Checker
- MappingStyles.dgnlib (Office of Planning and Programming – Internal use):
  - Contains the following text styles:
    - Map:(1200) 120' Fap 75'
    - Map:(1200) 120' Township
    - Map:(1200) 50' Road ID
    - Map:(1200) 50' Road ID Other
    - Map:(1200) 50' Streets-Roads-City
    - Map:(1200) 50' Streets-Roads-County
    - Map:(1200) 50' Tollway
    - Map:(1200) Adj. Cities
    - Map:(1200) Airport, Cem,Park,Dam,Ferry
    - Map:(1200) County Name 240'
    - Map:(1200) Cultural Feature
    - Map:(1 200) FC Adj Urban Limit Name
    - Map:(1200) Key Route Number For IRIS System FAP -FAU
    - Map:(1200) Lake
    - Map:(1200) Population
    - Map:(1200) Rivers
    - Map:(1200) Route Destination
    - Map:(1200) RR, Canal,Creek,Ditch
    - Map:(1200) School
    - Map:(1200) State 1200'
    - Map:(1200) TM Numbers-12000
    - Map:(1200) TM Numbers-600
    - Map:(1200) TWP Name
    - Map:(1200) TWP Range R6W T3N
    - Map:(800) 33' Streets-Roads 50'
    - Map:(800) 88' FAP 50'
    - Map:(800) 88' TWP,PARK,FAP 50'
    - Map:(800) Adj. Cities

- Map:(800) County Name 150'
- Map:(800) Fas-Ch if Needed
- Map:(800) FC Adj Urban Limit Name
- Map:(800) Key Route Number For IRIS System FAP -FAU
- Map:(800) Range Nos. 660'
- Map:(800) Rivers
- Map:(800) Route No. if Needed
- Map:(800) RR,Creeks,Lakes,To Dest.
- Map:(800) Section No. if Needed
- Map:(800) TM Numbers-12000
- Map:(800) TM Numbers-600
- Contains the following multi-line styles:
  - Border 800
  - Border 1200
  - Border For Use as Cell Only
  - Corporate Boundary Fill
  - Corporate Boundary Multi Line
  - Divided City St
- Rdwy\_Text.dgnlib:
  - Contains the following text styles:
    - Rdwy\_schedule100
    - Rdwy\_schedule120
    - Rdwy\_schedule140
    - Rdwy\_schedule175
    - Rdwy\_text100
    - Rdwy\_text120
    - Rdwy\_text140
    - Rdwy\_text175
    - Rdwy\_title200
    - Rdwy\_title240
    - Rdwy\_title350
    - Rdwy\_title500
    - Rdwy\_xsect120
    - Rdwy\_xsect140
    - Rdwy\_xsect175
    - Rdwy\_xsect200
  - Contains the following dimension styles:
    - Roadway120 (General roadway dimensions)
    - Roadway140 (Highway Standard dimensions)

## 2.5 Levels / Symbology

Levels and Filters are set up in the file "IDOTLevel2004.dgnlib" for each department discipline (bridge, roadway, mapping, aerial survey, etc.) within IDOT. All symbologies are preset within this design library (dgnlib file). Attributes include name, color number, line style and weight for each level. Before placing elements into a design file, first select the desired level. After selection, all of the associated symbology will be set automatically. (Note that the attribute buttons for color, line style and weight are required to be set to "By Level" in order for the automatic setting of symbologies).

Filters have been set up to make it easier to locate a particular discipline's group of levels. The Filter tool, located on the Attributes Toolbar, allows users to define the group of levels viewed within the Level Manager or Level Display dialogs.

For most projects, the levels already created suffice in the preparation of plans. There are unique situations that may require levels that do not already exist. For these situations, Level 1 through Level 63 may be used.

Fig. 2.5-1 lists the major prefixes used in the naming of levels. A complete list of all of IDOT's levels and their settings is included as an html file within the IDOT configuration discussed in Section 2.2.

Level Prefix	General description of use
Aerial Survey	Aerial Surveys elements
Alignment	Existing and Proposed alignment elements
Bridge	Structure elements (on structure portion of plans only)
Design	Proposed roadway elements
Drainage	Drainage related elements
Environmental	Environmental elements
Erosion Control	Erosion control elements
HS	Highway Standards elements (internal use only)
IDS	Intersection design elements
Landscaping	Landscaping elements
Level # (1-63)	MicroStation v7 conversion levels
Lighting	Lighting elements
Mapping	Mapping elements (OP & P - Internal use)
Removal	Removal elements
ROW	ROW elements
Signals	Traffic signal elements
Stage Construction	Stage construction elements
Structures	Structure elements (on roadway portion of plans only)
Topo	Topography elements
Utilities	Utility elements
XS	Cross section elements
XSC	Cross section criteria elements

Figure 2.5-1 Roadway level groups

## 2.6 Text Styles

The absence of guidance concerning the placement of text has, over time, led to the inconsistent, sometimes shoddy, appearance of contract plans (regardless of origin). In an attempt to remedy this, we have set up Text Styles within MicroStation as well as example plans to aid in some sort of standardization.

Text Styles are a feature in MicroStation which simplifies and standardizes the placement of text. When placing text, selecting a text style automatically adjusts the text settings. When used, it is not necessary to manually change font, text height, text width, line spacing or other properties independently. It is only necessary to identify the scale and turn on the Annotation Scale lock when a drawing is started. Information on how to do this is discussed later in this section.

An additional benefit to using Text Styles is the ability to modify the style in the dgnlib file where it is defined and globally make changes to a design file using the “dgnlib update” command. As an example, it may become necessary to move away from our custom IDOT fonts created in the 1980’s which are currently used and incorporated into the new Text Styles. Should this become necessary, we now have the ability with Text Styles to modify the text of a design file without requiring much, if any, cleanup.

Text styles are not currently supported by GEOPAK or the Axiom products used internally by the Department. They are to be supported in future releases; however, there is no time frame for their implementation. For this reason, it would be difficult to make their use mandatory at this time. We are only specifying preferred Text Styles (or their equivalent). The default settings of the text styles are to be used even if the text styles themselves are not used. These settings are listed in the table of [Figure 2.6-1](#).

Roadway Text Styles and Settings						
Text Style Name	font	height (inches)	width (inches)	line spacing 80% hgt (inches)	underline	justification
Rdwy_text100	32	0.100	0.100	0.080	no	Left-Center
Rdwy_text120	32	0.120	0.120	0.096	no	Left-Center
Rdwy_text140	32	0.140	0.140	0.112	no	Left-Center
Rdwy_text175	32	0.175	0.175	0.140	no	Left-Center
Rdwy_schedule100	40	0.100	0.100	0.080	no	Left-Center
Rdwy_schedule120	40	0.120	0.120	0.096	no	Left-Center
Rdwy_schedule140	40	0.140	0.140	0.112	no	Left-Center
Rdwy_schedule175	40	0.175	0.175	0.140	no	Left-Center
Rdwy_title200	115	0.200	0.200	0.160	no	Center-Center
Rdwy_title240	115	0.240	0.240	0.192	yes	Center-Center
Rdwy_title350	115	0.350	0.350	0.280	no	Center-Center
Rdwy_title500	115	0.500	0.500	0.400	no	Center-Center
Rdwy_xsect120	30	0.120	0.120	0.096	no	Left-Center
Rdwy_xsect140	30	0.140	0.140	0.112	no	Left-Center
Rdwy_xsect175	30	0.175	0.175	0.140	no	Left-Center
Rdwy_xsect200	30	0.200	0.200	0.160	no	Left-Center

**Figure 2.6-1 Text Style settings for ANSI D-size roadway plans**

The labeling tools in GEOPAK do not use text styles, but have the text settings as well as other attributes set up within a Labeling Style File (lsf). These labeling tools are briefly discussed in [Section 3.12](#) and [Section 3.14](#). The D&C Manager does make use of the text styles via an mvba created by the Department. The mvba is discussed later in this section.

Sixteen text styles have been set up for use in the preparation of roadway plans. It is not intended for them all to be used in each set of plans. [Figure 2.6-2](#) lists all of the text styles and identifies the preferred text styles, listing where they are generally to be used. This, in conjunction with the example plans available at <http://www.dot.il.gov/desenv/caddref.html> are to be used in identifying what text styles should be used throughout roadway plans. The text styles that do not have a use specified are intended for unique situations that might require them. An example

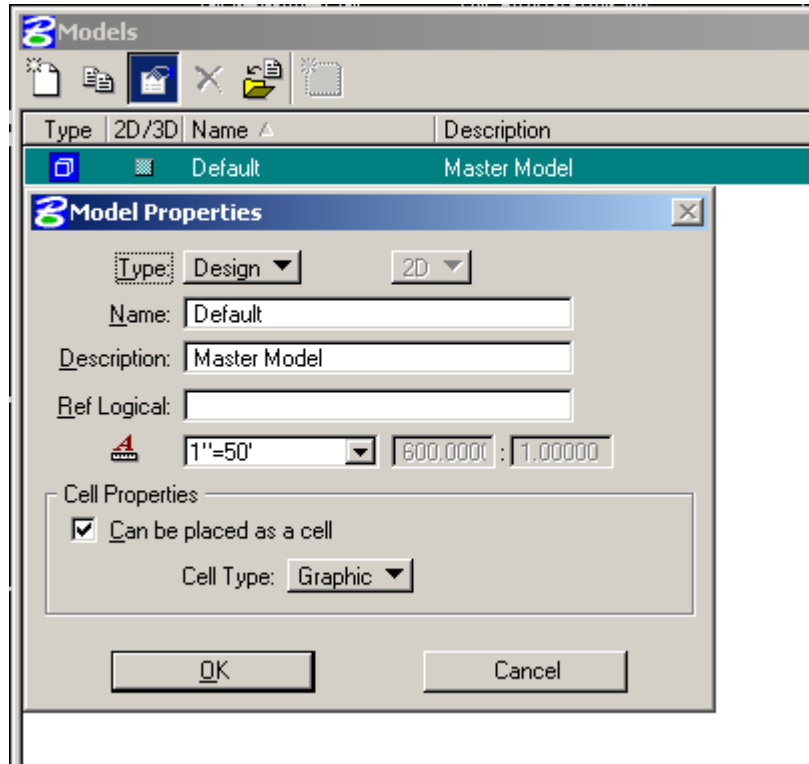
would be with a plan sheet covering a larger area than what is customary. In a situation such as this, the Rdwy\_text100 text style (or equivalent) could be used in place of Rdwy\_text120 for the plan text so that the dimensions and callouts would be clear. In other words, good judgment should dictate the text styles used; although every effort should be made to follow our preferred text styles.

Text styles	Use
Rdwy_text100	
Rdwy_text120	Generally used for plan text
Rdwy_text140	Highway Standard text
Rdwy_text175	
Rdwy_schedule100	
Rdwy_schedule120	Generally used for text in schedules and tables
Rdwy_schedule140	Summary of Quantities
Rdwy_schedule175	
Rdwy_title200	
Rdwy_title240	Generally used for titles and cross section stationing
Rdwy_title350	Highway Standard sheet title
Rdwy_title500	Cover sheet
Rdwy_xsect120	Generally used for cross section text
Rdwy_xsect140	Cross section grid offset text
Rdwy_xsect175	Cross section grid elevation text
Rdwy_xsect200	

**Figure 2.6-2 Preferred Text Style usage**

In order to use text styles, one must understand that they have been set up relative to the ANSI D-sized border which is literally 22" x 34". The borders that exist in the roadway cell library have already been scaled twelve times to simplify their insertion into a full-scale drawing. For instance, if a 1"=50' scale is desired, the border is placed at a scale factor of 50 even though the actual scale ratio is 600:1 (12 x 50 = 600).

Prior to using text styles within a design file, two things must be done. First, the annotation scale must be set. This is currently done through the Models dialog. Even though models are not generally used for roadway plans, each design file does contain at least one model, the default model. The Models dialog may be accessed either from the Primary Tools toolbar or from the File pulldown. Once available, the Model Properties must be edited by selecting the Edit Model Properties icon. This brings up another dialog where the annotation scale is actually set. It should appear similar to what is shown in [Figure 2.6-3](#). The pulldown in the middle of the dialog acquires the proper annotation scale from the file "scales.def" that is included in the IDOT configuration. You can see that when the scale of 1"=50' is chosen, that the annotation scale to the right is greyed out and set at 600:1. The second thing that must be done is that the Annotation Scale lock must be turned on. This can be done through the pull-down "Settings/Locks/Annotation Scale". The settings should be saved at this time. From this point on, text will be scaled up whatever the annotation scale is set to.



**Figure 2.6-3 Model Properties Dialog**

One item that should be mentioned here is that the text settings generally should not be overridden. Two exceptions are with the justification and occasionally the underline. Changing other settings defeats the purpose of having text styles.

Another item that should be mentioned here is if the dgnlib update command is run against a file with text or dimension styles, the overrides may inadvertently be switched to the default settings of the associated text styles or dimension styles. Because of this, caution should be exercised if executing this command.

To simplify the implementation of the new text styles (as much as currently possible), a MicroStation mvba has been written that sets the drawing scale as well as the annotation scale. The notation level may also be changed here should it differ from the active level. This mvba is called by the D&C Manager. It can also be run separately using the key-in: vba run [SetTextStyle]TextStyle.TextStyle. [Figure 2.6-4](#) shows how the mvba appears when executed.

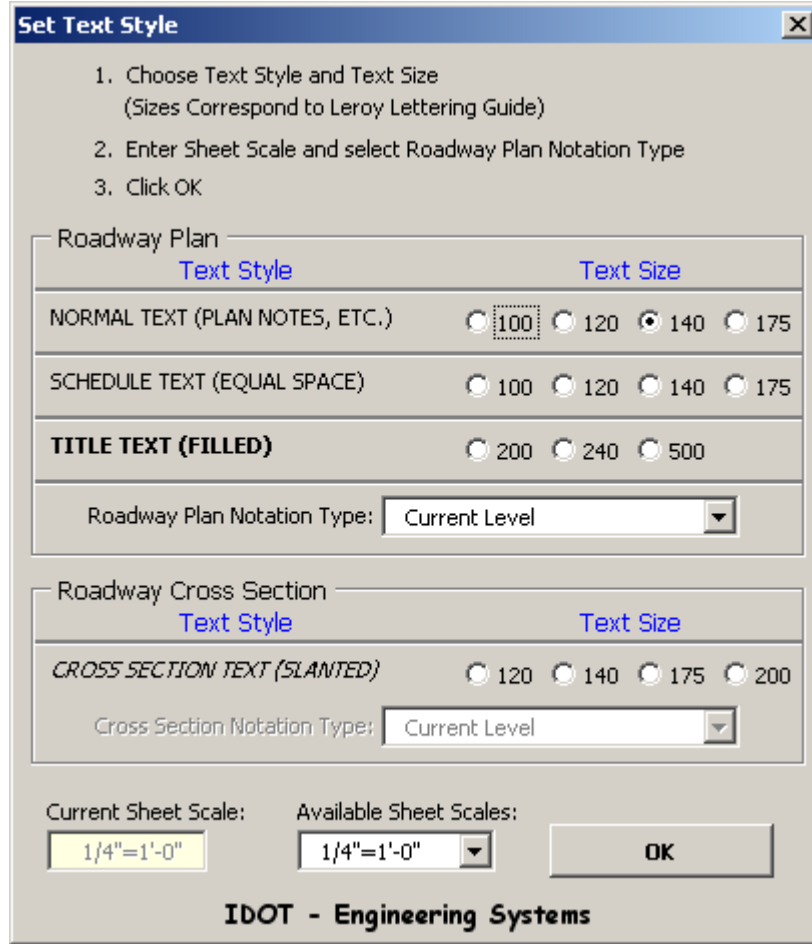


Figure 2.6-4 SetTextStyle.mvba

## 2.7 Dimension Styles

Dimension styles are a feature in MicroStation which simplifies placement of dimensions and promotes uniformity in dimensions. Similar to text styles, the dimension settings are pre-defined inside of "RoadStyles.dgnlib". They also require that the annotation scale be set and turned on in order for them to work properly.

There are currently two dimension styles that have been set up. They are listed in [Fig. 2.7-1](#).

Dimension Style Name	Use
Roadway120	General roadway dimensions
Roadway140	Highway Standard dimensions

Fig. 2.7-1 Dimension Styles

The use of Dimension Styles is not required. They may be manually placed.

## 2.8 Working Units

The working units are now set in survey feet as the master units and survey inches are set as the sub-units in the IDOT seed files. The working units are defined in all IDOT seed files and are extremely important in long distance design file measurements. Along with the working units the importance of the global origin setting of the design file affects the accuracy of the design. The department sets the global origin to x=0, y=0 and z=0 in all of the IDOT seed files.

## 2.9 Seed Files

The four basic seed files required for the preparation of roadway plans are as follows:

- IDOTeng.3d: English Aerial Survey plans 3D graphics seed file for DTM data
- IDOTmet.3d: Metric Aerial survey plans 3D graphics seed file for DTM data
- PLANeng.dgn: English roadway plan 2D graphics seed file
- PLANmet.dgn: Metric roadway plan 2D graphics seed file

Additional information concerning these seed files is available in the README.txt file in the IDOT configuration executable file.

Additional seed files exist in the IDOT configuration. They are as follows:

- FillOff\_PLANeng.dgn: Same as PLANeng.dgn file with “Fill” view attribute turned off
- Motif.dgn: Copy of PLANeng.dgn file
- SEED2D.cel: Default cell library seed file
- V7\_Seeds\ : Folder of previous version seed files

## 2.10 Visual Basic

Several visual basic files are available for use. They are listed and described in the V8mvba.doc file in the IDOT configuration executable file.

## 2.11 Cell Library

Currently, there is one cell library available for use in the preparation of roadway plans. It is titled IDOTroad.cel and is available in the IDOT configuration executable.

An Adobe Acrobat “pdf” file has been created for the roadway cell library and is available at <http://www.dot.il.gov/desenv/caddref.html>. This pdf contains a table of contents with individual images of the cells. The table of contents for the library contains links to these images.

Several borders exist within the roadway cell library. [Fig. 2.11-1](#) lists the borders that are required for all new jobs.

It is important to note that these borders, as well as the symbols in the roadway cell library, have already been scaled twelve times. This was done for convenience. For example, if a 1”=50’ scale is chosen, the border is inserted at a scale factor of 50 although the actual scale ratio is 600:1 (12 x 50 = 600).

Cell Name	Description
Sht_1 Plan 2 Profile	Single plan, double profile
Sht_2 Plan 2 Profile	Double plan, double profile
Sht_Cover	Cover sheet
Sht_Double Plan	Double plan
Sht_Double Profile	Double profile
Sht_Full Profile	Profile only
Sht_Ids A	Dist. 2 thru 9 IDS sheet
Sht_Ids B	Dist. 2 thru 9 IDS sheet
Sht_Ids C	Dist 1 IDS sheet (reconstruction)
Sht_Ids D	Dist 1 IDS sheet (new construction)
Sht_Ids D1	Dist 1 IDS sheet
Sht_Plan	Plan only
Sht_Plat Appraisal	Appraisal Plat
Sht_Plat of Hwy	Highway Plat
Sht_Plnprof	Single plan, single profile
Sht_Plnprof Urban	Urban single plan, single profile
Sht_Row Easement Plat	Easement Plat
Sht_Row Plans	ROW plans
Sht_Row Plat	ROW Plat
Sht_Triple Profile	Triple profile
XS_Sheet	Cross Sections (Landscape)
XS_Sheet Vertical	Cross Sections (Portrait)

Fig. 2.11-1 Current Roadway Borders

## 2.12 CADD Roadway and Structure Project Deliverables Policy

A link for the CADD Roadway and Structure Project Deliverables Policy exists at <http://www.dot.il.gov/desenv/caddref.html>. It addresses project file requirements, data transfer, coordination, design file management, file naming conventions as well as various FAQ's. Both the CADD Roadway Drafting Reference Guide as well as the CADD Structures Drafting Reference Guide are referenced by it.

## 2.13 Printing

The plan sheet borders included in the department roadway cell library "IDOTroad.cel" have been designed to facilitate the use of batch printing. The cells include a shape construction element that is on the outermost perimeter of the border to be used for the creation of ANSI B and D-sized prints. This element exists on the level "Sheets\_Printer Plotting Border."

Figure 2.13-1 is a table showing the line thicknesses used on full-size (ANSI D) prints. The line weights for quarter-size (ANSI B) plans should be set to one-half of these values.

In a similar manner, Figure 2.13-2 is a table showing the line strokes used on full-size (ANSI D) prints for defining MicroStation's built-in line codes. The line strokes for quarter-size (ANSI B) plans should be set to one-half of these values.

Weight	Thickness	Thickness	Pen
WT =	(in)	(mm)	Size
0	0.010	0.250	000
1	0.014	0.350	0
2	0.020	0.500	1
3	0.024	0.600	2
4	0.031	0.800	3
5	0.047	1.200	4

**Figure 2.13-1. Line Thicknesses for ANSI D-size Prints**

Line Code	Line	Space	Line	Space	Line	Space
LC =	(in)	(in)	(in)	(in)	(in)	(in)
1	0.015	0.0394				
2	0.0788	0.0788				
3	0.1574	0.0788				
4	0.1574	0.0788	0.0236	0.0788		
5	0.0552	0.0552				
6	0.1574	0.0552	0.0394	0.0552	0.0394	0.0552
7	0.1574	0.0552	0.0552	0.0552		

**Figure 2.13-2. Line strokes for ANSI D-size Prints**

## 3. GEOPAK Information

### 3.1 GEOPAK

GEOPAK is a comprehensive software package that covers every project phase from conceptualization to final quantities. The software works within the MicroStation graphic environment providing true interactive design. For example, a horizontal alignment can be created graphically; it can be calculated with the coordinate geometry component of GEOPAK or some interactive combination of the two. Dynamic on-screen design provides immediate interpretation of plan view geometrics for making design choices through visualization.

Using GEOPAK will help ensure consistency and accuracy of design work and generate significant timesaving in the overall effort of producing construction plans.

### 3.2 File Names

GEOPAK uses and/or creates files during the design process. The files are detailed in the table below.

<b>job###.gpk</b>	This binary file is created when the user starts a coordinate geometry (COGO) session for the first time or through Project Manager and may be appended to during the design process. All coordinate geometry elements are stored in this file. Multiple users can access this file at the same time, and only one file should be created for each project. The "###" is the only variable in this name. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.
<b>fname.inp</b> <b>Example: desxs.inp</b>	Any ASCII input file for running GEOPAK processes. Name is user defined with an .inp extension.
<b>fname###.ioc</b> <b>Example: align999.ijd</b>	ASCII input file for loading data during a COGO session. "###" represents the job number and "oc" is the operator code (users initials).
<b>fname###.ooc</b> <b>Example: align999.oho</b>	ASCII output file created by GEOPAK during a COGO session. Variables are the same as defined above.
<b>fname.dat</b>	A binary file that contains string and point information to be used for digital terrain model construction.
<b>fname.tin</b>	A binary file containing triangular surfaces also known as the digital terrain model (DTM).
<b>project.prj</b>	Binary file resulting from the creation of a new project.

### 3.3 GEOPAK Database (GPK)

The gpk file is the main project related GEOPAK file. It is usually stored in ProjectWise in ***IDOT Offices\District ?\Projects\????\CADDData\GEOPAK Project Mgr\GPK\*** or the working directory. When users are first involved in a project they should closely examine what information is presently available in the existing .gpk.

### 3.4 Design and Computation Manager

GEOPAK's Design and Computation Manager (D&C Manager) is a tool that may be used to draw features into a MicroStation design file using preset attributes and a designated GPK file. The D&C Manager is similar to the MicroStation Settings Manager, in that it can be used to draw a feature into a drawing setting the attributes of that specific feature to the current IDOT Drafting Standards. The default database for the D&C Manager should be ***IDOTCAD\Geofiles\Database\ldotRoad.ddb***. The following outlines describe the general hierarchies of the database.

#### [ldotRoad.ddb](#)

1. Plan Topo & Notation
  - 1.1. Alignments
  - 1.2. Alignments Plats and Plans
  - 1.3. Adjustment Items
  - 1.4. Boundaries
  - 1.5. Construction Pavement Details
  - 1.6. Construction Signing
  - 1.7. Contours
  - 1.8. Drainage
  - 1.9. General Details & Plan Sheets
  - 1.10. Highway Lighting Details
  - 1.11. Landscaping
  - 1.12. Non-Highway Improvements
  - 1.13. Pavement Marking
  - 1.14. Profiles
  - 1.15. Railroad Details
  - 1.16. Removal Items
  - 1.17. Right of Way
  - 1.18. Roadside Existing
  - 1.19. Roadway Existing
  - 1.20. Roadway Plan Notation
  - 1.21. Structure Improvement
  - 1.22. Traffic Sheet Details
  - 1.23. Traffic Signal Details
  - 1.24. Underground Utilities
  - 1.25. Utilities
  - 1.26. Vegetation
  - 1.27. Water Features
  - 1.28. XS Pattern Lines

2. Plan Pay Items
  - 2.1. Quantities
    - 2.1.1. Drainage
    - 2.1.2. Highway Lighting Details
    - 2.1.3. Landscaping
    - 2.1.4. Pavement Marking
    - 2.1.5. Railroad Details
    - 2.1.6. Right of Way
    - 2.1.7. Roadside Improvements
    - 2.1.8. Roadway Improvements
    - 2.1.9. Signing
    - 2.1.10. Structure Improvement
    - 2.1.11. Traffic Sheet Details
    - 2.1.12. Traffic Signal Details
    - 2.1.13. Underground Utilities
    - 2.1.14. Utilities
  3. Special Applications (see [Section 3.18](#) for further explanation)
  4. Geopak Lines

The D&C Manager has several advantages over the MicroStation Settings Manager; The D&C Manager draws Cogo features quickly, has been set up to include most of the state pay code numbers to perform quantity calculations (only underneath the Plan Pay Items folder) and has advanced highlighting capabilities.

### 3.5 Survey Manager

The **Survey Manager Database (SMD)** file is used in the translation of data from survey data collectors to MicroStation Design files using GEOPAK Survey. To begin the translation of data, the operator invokes the *User Preferences* from Applications>GEOPAK Road>User Preferences. Within the *User Preferences* dialog box press the Feature Preferences button. In the Feature Preferences dialog box the SMD Feature File path should be set to **IDOTCAD\Geofiles\Database\idotSurvey.smd**. The “Apply Feature Best Match” toggle should be turned on and the “Plot Scale” should be set to the appropriate factor. For *rural* projects the scale should be set to 50 and for *urban* projects the scale should be set to 20. The .SMD file is protected and cannot be edited. If any CADD operators have a need for additional items to be added into the .SMD file they should contact an IDOT District Survey support person. The feature codes, used by field personnel to enter data into their data collectors, are listed in the file IDOTCAD\Geofiles\Database\IDOTSurvey.xls.

#### Linking Codes

The linking codes need to be set in the Survey Project Preferences dialog box. They can be found under the Dataset tab in the Linking Codes item. Contact the appropriate district survey office for standards to be used.

### 3.6 Project Manager

Project Manager is a GEOPAK tool that associates a project with its respective .gpk job number, users, working directories and project files. This organization of the project keeps the user from having to maintain the different files and their locations associated with a particular project. In addition, many of the GEOPAK functions can be invoked by

simply pressing the appropriate button from the dialog, which is set up in a workflow or tool box format. When invoked, all previously defined data is displayed within the appropriate fields, saving the user the repetitive typing of frequently used information. Each processing of a particular dialog can be saved to a "run" and recalled via a simple pull down menu. The data for a project is stored in a file with the format \*.PRJ, where \* is a one to eight character alphanumeric name with no spaces. A new directory named PROJDBS is created (if necessary) under the current project directory. This directory stores the information for the users that have been created.

### 3.7 Drainage Library

GEOPAK Drainage is a comprehensive system for designing and analyzing storm drain systems, which can leverage many roadway design features to create a seamless information exchange to the drainage design process. A GEOPAK Drainage project may contain multiple drainage networks; each comprised of any number of topologically connected drainage areas, inlets, pipes and ditches. The GEOPAK Drainage workflow closely mirrors conventional design processes allowing for the design of the surface collection system (i.e. drainage areas, inlets) then the design of the subsequent conveyance system. The *Drainage Library* contains the Rainfall Parameters, standard inlet types, standard pipes configurations, spread sections, and land use symbology tables. All of these items are merely referenced by each project to accommodate standardization and information sharing among projects. The default *Drainage Library* for GEOPAK Drainage should be **IDOTCAD\Geofiles\Drainage\IDOT\_Drainage.dlb**.

### 3.8 Profile Preferences

The *Profile Preferences* are the Stopping Sight Distance K-values for crest and sag conditions for specified design speeds. IDOT uses the K-values found in the AASHTO 2001 edition of A Policy on Geometric Design of Highways and Streets. The default IDOT *K-value Table* is **IDOT\_KValues\_2001english.kvl** and can be found in **IDOTCAD\Geofiles\Profiles**. The Geopak tools that use this table for calculations are the COGO Print Profile command, Design & Computation Manager Plan/Profile Draw, Vertical Alignment Generator, Profile Labeler and Draw Profile.

### 3.9 Superelevation Tables

IDOT uses the AASHTO Method 5 radius tables to calculate the superelevation rate and length of runoff. The *Superelevation Tables* that IDOT uses can be found in the **IDOTCAD\Geofiles\SE\_Tables\English** folder. The **IDOT\_2001\_Engish.sep** file located in **IDOTCAD\Geofiles\SE\_Tables\English** is the Superelevation Preferences file that sets the various options for the e method, Runoff Length, Tangent Runout, Adjust Factors, Distribution, Rotation, Compound Curves and Short Curves.

### 3.10 Legal Description Editor

The Legal Description Editor is a GEOPAK tool that may be used to create Right of Way legal descriptions utilizing GEOPAK coordinate geometry, and predefined styles. The default IDOT Legal Description Library is **d2LegalEnglish.ldb** found in **IDOTCAD\Geofiles\Legal**. The general statements that are common to all descriptions are stored in the GEOPAK library. The Editor receives information unique to certain parcels from the GPK file, key-in, or lists provided in dialog boxes. Legal descriptions

and parcel data are typed one time and stored in GEOPAK. The Legal Description Editor can be used once the parcel is stored. Points, curves, and parcels must be stored in GEOPAK before using the Legal Description Editor. The Legal Description Editor is found in GEOPAK Road or GEOPAK Site under “\Geometry\Legal Description”.

### 3.11 Plan Sheet Layout

The GEOPAK Plan and Profile Sheet Layout provides an automated tool to generate IDOT standard plan and profile sheets from plan and profile view graphics. Each plan, profile and tabular data is referenced into the sheet design file to compile the plan and profile sheets. Four sheet libraries have been configured for IDOT use with IDOT's standard plan and profile sheet cells.

IdotPlanSheets.psl (default) ..... English Sheets, no match line (22" x 34")  
 IdotPlanSheetsML.psl .....English Sheets with match line (22" x 34")  
 IdotPlanSheetsMetric.psl ..... Metric Sheets, no match line (22" x 34")  
 IdotPlanSheetsMetricML.psl .....Metric Sheets with match line (22" x 34")

The IDOT Plan Sheet library is located in the following directory:

**\\IDOTCAD\Geofiles\Sheets\Plan.** If a sheet library other than the default is needed, use File>Attach to attach the desired library.

The table below lists the sheet layouts that are presently available:

#### **IdotPlanSheets.psl**

1P&1P Short (2 Grid) .....	1 - 30" Long Plan and 1 - 2 Scale Profile
1P&1P Long (2 Grid) .....	1 - 31.63" Long Plan and 1 - 2 Scale Profile
1P&1P Short (5 Grid) .....	1 - 30" Long Plan and 1 - 5 Scale Profile
1P&1P Long (5 Grid) .....	1 - 31.63" Long Plan and 1 - 5 Scale Profile
1P&1P Short (10 Grid) .....	1 - 30" Long Plan and 1 - 10 Scale Profile
1P&1P Long (10 Grid) .....	1 - 31.63" Long Plan and 1 - 10 Scale Profile
1P&2P Short (2 Grid) .....	1 - 30" Long Plan and 2 - 2 Scale Profiles
1P&2P Long (2 Grid) .....	1 - 31.63" Long Plan and 2 - 2 Scale Profiles
1P&2P Short (5 Grid) .....	1 - 30" Long Plan and 2 - 5 Scale Profiles
1P&2P Long (5 Grid) .....	1 - 31.63" Long Plan and 2 - 5 Scale Profiles
1P&2P Short (10 Grid) .....	1 - 30" Long Plan and 2 - 10 Scale Profiles
1P&2P Long (10 Grid) .....	1 - 31.63" Long Plan and 2 - 10 Scale Profiles
2P&2P Short (2 Grid) .....	2 - 30" Long Plans and 2 - 2 Scale Profiles
2P&2P Long (2 Grid) .....	2 - 31.63" Long Plans and 2 - 2 Scale Profiles
2P&2P Short (5 Grid) .....	2 - 30" Long Plans and 2 - 5 Scale Profiles
2P&2P Long (5 Grid) .....	2 - 31.63" Long Plans and 2 - 5 Scale Profiles
2P&2P Short (10 Grid) .....	2 - 30" Long Plans and 2 - 10 Scale Profiles
2P&2P Long (10 Grid) .....	2 - 31.63" Long Plans and 2 - 10 Scale Profiles
1P&1P U Short (2 Grid) .....	1 - 30" Long Urban Plan and 1 - 2 Scale Urban Profile
1P&1P U Long (2 Grid) .....	1 - 31.63" Long Urban Plan and 1 - 2 Scale Urban Profile
1P&1P U Short (5 Grid) .....	1 - 30" Long Urban Plan and 1 - 5 Scale Urban Profile
1P&1P U Long (5 Grid) .....	1 - 31.63" Long Urban Plan and 1 - 5 Scale Urban Profile

1P&1P U Short (10 Grid) .....	1 - 30" Long Urban Plan and 1 - 10 Scale Urban Profile
1P&1P U Long (10 Grid) .....	1 - 31.63" Long Urban Plan and 1 - 10 Scale Urban Profile
1 PLAN .....	Single Plan Sheet
2 PLAN .....	Double Plan Sheet
2 PLAN Staging .....	Double Plan Sheet for Staging
2 PROFILE .....	Double Profile Sheet
3 PROFILE .....	Triple Profile Sheet
FULL PROFILE (2 grid) .....	Full 2 Scale Profile Sheet
FULL PROFILE (5 grid) .....	Full 5 Scale Profile Sheet
FULL PROFILE (10 grid) .....	Full 10 Scale Profile Sheet

**IdotPlanSheetsML.psl**

1P&1P ML (2 Grid) .....	1 - 31.63" Long Plan with Match line and 1 - 2 Scale Profile
1P&1P ML (5 Grid) .....	1 - 31.63" Long Plan with Match line and 1 - 5 Scale Profile
1P&1P ML (10 Grid) .....	1 - 31.63" Long Plan with Match line and 1 - 10 Scale Profile
1P&2P ML (2 Grid) .....	1 - 31.63" Long Plan with Match line and 2 - 2 Scale Profiles
1P&2P ML (5 Grid) .....	1 - 31.63" Long Plan with Match line and 2 - 5 Scale Profiles
1P&2P ML (10 Grid) .....	1 - 31.63" Long Plan with Match line and 2 - 10 Scale Profiles
2P&2P ML (2 Grid) .....	2 - 31.63" Long Plans with Match lines and 2 - 2 Scale Profiles
2P&2P ML (5 Grid) .....	2 - 31.63" Long Plans with Match lines and 2 - 5 Scale Profiles
2P&2P ML (10 Grid) .....	2 - 31.63" Long Plans with Match lines and 2 - 10 Scale Profiles
1P&1P Urbn ML (2 Grid) .....	1 - 31.63" Long Urban Plan with Match line and 1 - 2 Scale Urban Profile
1P&1P Urbn ML (5 Grid) .....	1 - 31.63" Long Urban Plan with Match line and 1 - 5 Scale Urban Profile
1P&1P Urbn ML (10 Grid) .....	1 - 31.63" Long Urban Plan with Match line and 1 - 10 Scale Urban Profile
1 PLAN Match line .....	Single Plan Sheet with Match lines
2 PLAN Match line .....	Double Plan Sheet with Match lines
2 PLAN Stage Match line .....	Double Plan Sheet for Staging with Match lines

**3.12 Plan Sheet Labeling**

GEOPAK’s Plan View labeling tool allows a user to place “smart” labels in a MicroStation plan drawing. These labels have the ability to calculate XYZ coordinates, station, offset, direction, length, radius, degree of curvature, etc. of the associated element. Frequently utilized labels can be stored as Label Styles for subsequent recall. The complete label, including computed text inserts, user inserts, shapes, and leaders, are all stored within the Style. The default IDOT *Plan View Labeling Style* file is **IDOT\_plan.lsf** and can be found in **IDOTCAD\Geofiles\Labelers**.

**3.13 Cross Section Sheet Layout**

The GEOPAK Cross Section sheet layout command provides an automated tool to generate IDOT standard cross section sheets from cross section graphics. Each cross section is referenced into the sheet design file to compile the cross section sheets and labels such as baseline, station, offsets and elevation are added. Additionally, the process can also be used to place earthwork quantities as the sheets are generated.

The sheet library **IdotXsecSheets.xssl** has been configured for IDOT use with IDOT's standard cross section sheet cells. The library is located in the following directory: **\\IDOTCAD\Geofiles\Sheets\ XSection**.

The following default sheet values have been defined in **IdotXsecSheets.xssl**:

Active Cross section Sheet	Horizontal Scale	Vertical Scale	Width	Height
5 SCALE HORIZONTAL	5	2.5	34.00	22.00
5 SCALE VERTICAL	5	2.5	22.00	34.00
10 SCALE HORIZONTAL	10	5	34.00	22.00
10 SCALE VERTICAL	10	5	22.00	34.00
20 SCALE HORIZONTAL	20	10	34.00	22.00
20 SCALE VERTICAL	20	10	22.00	34.00

### 3.14 Cross Section Labeling

GEOPAK's Cross Section labeling tool allows a user to place "smart" labels in a MicroStation cross section drawing. These labels have the ability to calculate XY coordinates, station, offset, elevation, slope, chain name, etc. of the associated element. Frequently utilized labels can be stored as Label Styles for subsequent recall. The complete label, including computed text inserts, user inserts, shapes, and leaders, are all stored within the Style. The default IDOT *Cross Section Labeling Style* file is **IDOT\_xs.lsf** and can be found in **\\IDOTCAD\Geofiles\Labelers**.

### 3.15 Typical Section Generator

This feature within proposed cross sections was originally developed in order to automate (as much as possible) the development of cross sections for widening and resurfacing jobs, but it can also be used with new construction. It enables the user to select a typical section from a cell library, and then copies associated criteria files into the job directory. In addition, the criteria files are placed within the definition of the "side slope lt" and "side slope rt" statements. The results are that the user only has to specify the project values for the given variables, and then initiate the proposed cross section run. The *Typical Section Generator* can only be accessed through Project Manager. All of IDOT's Typical Sections are in the folder **Typicals\_E** in **\\IDOTCAD\Geofiles\**.

The following Typical Section Templates have been created for IDOT:

Typical Section Template Name	Description
EXPAVT	Existing pavement and shoulders
GRAIL	Guard rail for rural undivided areas
GRAILD	Guard rail for rural divided areas
OLLNPR	<b>OverLay Left New Bituminous Pavement Right</b>
OLRNPL	<b>OverLay Right New Bituminous Pavement Left</b>
RDNBIT	<b>Rural Divided New Bituminous pavement</b>
RDNPCC	<b>Rural Divided New PCC (Concrete)</b>
RESUME	<b>Resurfacing Undivided Match Existing</b>
RESUSC	<b>Resurfacing Undivided Slope Correction</b>
RSDCDW	Rural <b>Re-Surfacing Divided slope Correction</b> with proposed shoulders, <b>Ditches</b> and <b>Widening</b>

RSDMEW	<b>Re-Surfacing Divided Match Existing with Wedges</b>
RSDSCD	Rural <b>Re-Surfacing Divided Slope Correction</b> with proposed shoulders and <b>Ditches</b>

RSDSCW	<b>Re-Surfacing Divided Slope Correction Wedges</b>
RSUCDW	Rural <b>Re-Surfacing Undivided slope Correction</b> with proposed shoulders, <b>Ditches</b> and <b>Widening</b>
RSUMED	Rural <b>Re-Surfacing Undivided Match Existing</b> with proposed shoulders and <b>Ditches</b>
RSUSCD	Rural <b>Re-Surfacing Undivided Slope Correction</b> with proposed shoulders and <b>Ditches</b>
RSUSCW	<b>Re-Surfacing Undivided Slope Correction</b> with <b>Widening</b>
RUNBIT	Rural <b>Undivided New Bituminous</b>
RUNPCC	Rural <b>Undivided New PCC (Concrete)</b> construction
RUSCNL	Rural <b>Undivided Slope Correction</b> with <b>New Bituminous Lanes</b>
UDNBIT	<b>Urban Divided New Bituminous</b>
UDNPCC	<b>Urban Divided New PCC (Concrete)</b>
UDRSWD	<b>Urban Divided Re-Surfacing</b> with optional <b>Widening</b> and urban shoulders and proposed <b>Ditches</b>
ULRRSC	<b>Urban Left Rural Right undivided Slope Correction</b> with new bituminous lanes
UMRSBT	<b>Urban Median Rural outside Shoulders Bituminous</b> new divided pavement
UMRSPC	<b>Urban Median Rural outside Shoulders PCC</b> new divided pavement
URRLSC	<b>Urban Right Rural Left undivided Slope Correction</b> with new bituminous lanes
UUNBIT	<b>Urban Undivided New Bituminous</b>
UUNPCC	<b>Urban Undivided New PCC (Concrete)</b>
UURSWD	<b>Urban Undivided Re-Surfacing</b> with optional <b>Widening</b> and urban shoulders and proposed <b>Ditches</b>
UUSCNL	<b>Urban Undivided Slope Correction</b> with <b>New Bituminous Lanes</b>

### 3.16 Earthwork

GEOPAK provides the capabilities to calculate earthwork quantities from cross section elements or from DTM volume differences.

In order to compute earthwork, GEOPAK requires:

- MicroStation design file containing proposed cross section and existing ground lines.
- GEOPAK coordinate geometry database file (.gpk) if the baseline used to generate the cross sections has station equations.

GEOPAK computes earthwork using the Average End Area Method by reading and interpreting the MicroStation design files containing proposed and existing ground cross sections. This approach affords the user maximum flexibility in that it is irrelevant whether the cross section elements were created entirely by GEOPAK or were created or

modified using generic MicroStation commands. GEOPAK can compute earthwork volumes from any reasonable graphical representation of a cross section.

Cut/Fill quantities can be computed from very simple graphical cross sections as well as very complex cross sections using several types of unsuitable or removal materials and several fill material types.

GEOPAK is extremely flexible when computing earthwork, using several types of excavation and fill, numerous material types (known as soil types), and different shrink/expansion factors. In order to tell the software how to compute earthwork, a thorough understanding of these concepts is necessary.

### **Excavation Types**

Several types of excavation are supported in GEOPAK. These include:

- **Common excavation** – Excavation volumes that are not backfilled with an earthwork material. This includes the excavation required for cut sections as well as for pavement thickness, shoulder thickness, etc.
- **Subgrade excavation** – Excavation volumes that are backfilled with an earthwork material
- **Subsoil excavation** – Excavation required to remove unsuitable material either 1) down to the bottom of the proposed cross section or 2) down to the bottom of the unsuitable material layer

### **Embankment Types**

In addition to the excavation types, GEOPAK determines where fill material is required. The user does not specify where embankment is required as GEOPAK determines it from the graphic elements in the MicroStation cross section design file.

### **Functional Classes**

Functional classes identify the function or purpose of the cross section element. In order to compute the most basic earthwork, two functional classes are required. They are:

- Proposed Finished Grade
- Existing Ground

Functional classes are determined by the designer. With each functional class, additional project-specific information must be supplied in order for GEOPAK to compute the quantities. This information required includes:

- Soil Type
- Element Symbology of the Material
- Shrink/Swell Factors

### 3.17 Digital Terrain Model

A **Digital Terrain Model (DTM)** represents the topography data of a project from which a TIN can be extracted. The DTM can be drawn in a 3D file, and then rotated to see the existing surface of the project area. DTM's are often used for drawing

cross sections and earthwork. Usually DTM's are needed for both existing and as-built ground surfaces.

**Triangulated Irregular Network (TIN)** is derived from mass points and break-line data by means of a mathematical process that forms triangles representing the terrain surface. The triangulated model is stored in a binary file as a triangulated irregular network. GEOPAK DTM files are named with a .tin extension.

GEOPAK provides the capability to generate a DTM from a wide range of data sources including MicroStation elements, survey data, photogrammetric data, GEOPAK cross sections or ASCII files with X,Y,Z coordinates. For most design projects, a DTM will be provided from IDOT's District Survey personnel, central office Aerial Surveys Unit or from a contracted engineering consultant.

The DTM is used by GEOPAK to extract existing ground profiles and cross sections, display contours, display drainage flow patterns, etc.

### 3.18 Special Applications

In IDOT's Design and Computation Manager database **IdotRoad.ddb**, is a section called *Special Applications* that contains links to MicroStation vba applications or Geopak 3 port criteria files developed by either IDOT or outside sources. The following is a list of the *Special Applications* available for use.

Application Name	Description
AsciiROW	Generates an ASCII file with point type, chain name, station, offset, XY coordinates, and type of element for the lines in plan view at a keyed in interval along the centerline chain.
Chain_Chk	Generates a report of Ahead and Back direction information of a GEOPAK chain and reports on bearing mismatches.
ChainTable	Generates a table of coordinates and curve data for the control points of a selected GEOPAK Chain.
CheckSightDist	Checks the Sight Distance on a GEOPAK Profile based on a user selected Design Speed.
CurveWidening	Using a GEOPAK superelevation shapes input file, calculate Curve Widening in accordance with <b>AASHTO 2004</b> and draw to plan view.
GPK_Merge	Merge all elements or selected elements of one gpk file into another.
LabelProfileMis	Label station equations, high and low points on selected profile.
LockNew	Automatically lock all handwork after setting a mark in the MicroStation file. Also highlight or add locked elements to a MicroStation selection set.
PI_Angle	Compute angles between any three points either graphically, by COGO, or by keyins.

ProfileGrid	Draw an IDOT profile grid on a GEOPAK profile cell in a MicroStation file.
SheetLabeler	Label an IDOT Plan Sheet title block (22x34).
OldSheetLabeler	Label an older IDOT Plan Sheet title block (23x36).
RemoveData	Remove and or highlight previously attached GEOPAK D&C, COGO or ADHoc attributes from elements.
FeatureXS	On the fly cross sections of topo attributes.
XSLabeler	Label an IDOT Cross Section Sheet title block (22x34).
OldXSLabeler	Label an older IDOT Cross Section Sheet title block (23x36).
XSFoldLine	XS Fold Line for proposed cross-sections that are too wide to show entirely on the cross section sheet cell.
XSMovie1	Drive through the 2d cross sections.
XSTaperTable	Cross-section taper table.

## 4. Summary of Quantities

To date there has been no direction concerning the presentation of the Summary of Quantities for design plans. While this may not seem to be important to some, it does become very important when and if quantities of a project must be adjusted by the Department just before going to Letting. For this reason, minimum requirements are being provided in [Section 4.2](#).

### 4.1 Coded Pay Item Resources

The coded pay items are already available at <http://www.dot.il.gov/desenv/codedpayitems.html> as Adobe Acrobat pdf file, Excel xlsx file and a txt file. The data in these files can be manipulated and brought into the Summary of Quantities sheet(s) in MicroStation by various means. This data is maintained by the Bureau of Design and Environment.

An additional tool that is being made available is an Excel macro spreadsheet named English\_SOQ2010.xltn. It is available at <http://www.dot.il.gov/desenv/caddref.html>. This spreadsheet also contains all of the coded pay items. The macro takes the selected items and generates Summary of Quantities table(s), including the grid(s), in the file while removing the unselected coded pay items. The resulting text can be copied into MicroStation using the new cell, "SUMMARY\_OF\_QUANTITIES" located in the roadway cell library "IDOTroad.cel" (Note that this cell has been scaled 12X to be consistent with all other cells within the cell library). Third party software may be used instead in order to bring the resulting table and text into MicroStation. If using this macro spreadsheet, ensure that the date updated matches that of the data maintained by the Bureau of Design and Environment.

The basic procedure for using the macro spreadsheet is as follows:

- Open a copy of the file "English\_SOQ2010.xltn"
- In the "Header" tab of the spreadsheet, select the appropriate information from the pull-downs for the construction codes in the cells F4 through F6, G4 through G6, etc.
- In the "Summary of Quantities" tab, double-click the cell in column C corresponding to the desired coded pay item. The "N" will change to a "Y"
- Once all of the desired coded pay items have been selected, click on the "Create SOQ" button located in the cell "E1"
- Move/copy data into MicroStation design file

### 4.2 Requirements

The minimum requirements for all Summary of Quantities sheets:

- A grid must be used such as that generated by the Excel macro spreadsheet or the cell, "SUMMARY\_OF\_QUANTITIES" located in the roadway cell library. (Columns of the table cell may be added, removed, or modified as required)
- Coded pay item numbers, descriptions, units, and quantities must use the text style "Rdwy\_schedule140" or its equivalent
- Coded pay items must be double-spaced (i.e. a blank line between each row of coded pay items)

- The full description (not the abbreviated description) of the pay items must be used in the Summary of Quantities

Reference the Summary of Quantities in the example plans at <http://www.dot.il.gov/desenv/caddref.html> for an example of the desired appearance.

See Revised Section 4

## 5. Internet Information

### 5.1 Web Page

The Bureau of Design and Environment web page address is:

<http://www.dot.il.gov/desenv/demanuals.html>

Additional CADD resources are available as follows:

IDOT CADD Support Site: <http://www.dot.il.gov/cadd.html>

Bureau of Bridges and Structures: <http://www.dot.il.gov/bridges/bscadd2.html>

### 5.2 Subscription Service

Signing up for the CADD Support Subscription Service is strongly encouraged. Notifications are sent out via e-mail whenever changes are made to any items on the IDOT CADD Support page or the CADD Roadway Guidelines web pages. Subscribe at:

<http://www.dot.il.gov/CaddSubscription/menu.asp>

## 6. IDOT FTP Site

File transfers that exceed the allowable email attachment size may be placed in the appropriate district's folder on the public IDOT FTP site. It is located at: <ftp://ftp.dot.state.il.us/pub/> . The username and password should be obtained from the appropriate contact found in Section 7.

## 7. District and Central Office CADD Manager Contact Information

District 1	Shawn Ley	847-705-4008	<a href="mailto:Shawn.Ley@illinois.gov">Shawn.Ley@illinois.gov</a>
District 2	Jim Hogenson	815-284-5490	<a href="mailto:James.Hogenson@illinois.gov">James.Hogenson@illinois.gov</a>
District 3	Mike Wasilewski	815-434-8952	<a href="mailto:Michael.Wasilewski@illinois.gov">Michael.Wasilewski@illinois.gov</a>
District 4	Brian Keith	309-671-3395	<a href="mailto:Brian.Keith@illinois.gov">Brian.Keith@illinois.gov</a>
District 5	Justin Cearlock	217-466-7393	<a href="mailto:Justin.Cearlock@illinois.gov">Justin.Cearlock@illinois.gov</a>
District 6	Rhonda Laughlin	217-785-9102	<a href="mailto:Rhonda.Laughlin@illinois.gov">Rhonda.Laughlin@illinois.gov</a>
District 7	Mona Steffen	217-342-8313	<a href="mailto:Mona.Steffen@illinois.gov">Mona.Steffen@illinois.gov</a>
District 8	Sandy Phillips	618-346-3231	<a href="mailto:Sandra.Phillips@illinois.gov">Sandra.Phillips@illinois.gov</a>
District 9	Barbara Lavender	618-351-5221	<a href="mailto:Barbara.Lavender@illinois.gov">Barbara.Lavender@illinois.gov</a>
Engineering Systems (BIP)	Jim Leaf	217-785-4090	<a href="mailto:Jim.Leaf@illinois.gov">Jim.Leaf@illinois.gov</a>
Bureau of Bridges & Structures	Michael Mossman	217-782-1510	<a href="mailto:Michael.Mossman@illinois.gov">Michael.Mossman@illinois.gov</a>