
Plan Development CADD Standards

Design Manual
Chapter 20
Project Automation
Information

Originally Issued: 03-31-10

Revised: 06-25-19

INDEX

[Consultant / Designer Resources](#)

MicroStation

[MicroStation Automation](#)

[MicroStation Configuration](#)

[Seed Files](#)

[File Names and Project Directory Structure](#)

[Models](#)

[Levels](#)

[Color Tables](#)

[Cell Libraries](#)

[Resource Files](#)

[Plan Set Organization](#)

[Color Plans](#)

[Road Design Details](#) (tabs, typicals, standard notes, etc.)

[Standard Road Plans](#)

[Shell Letters](#)

Geopak

[Element and File Naming Conventions](#)

[Survey Tools and Feature Codes](#)

[Printing](#)

Consultant / Designer Resources

The [Consultant / Designer Resources Home](#) web page contains links for nearly all necessary Plan Preparation information. The remainder of this section is devoted to brief descriptions of separate Plan Preparation topics.

MicroStation

MicroStation Automation

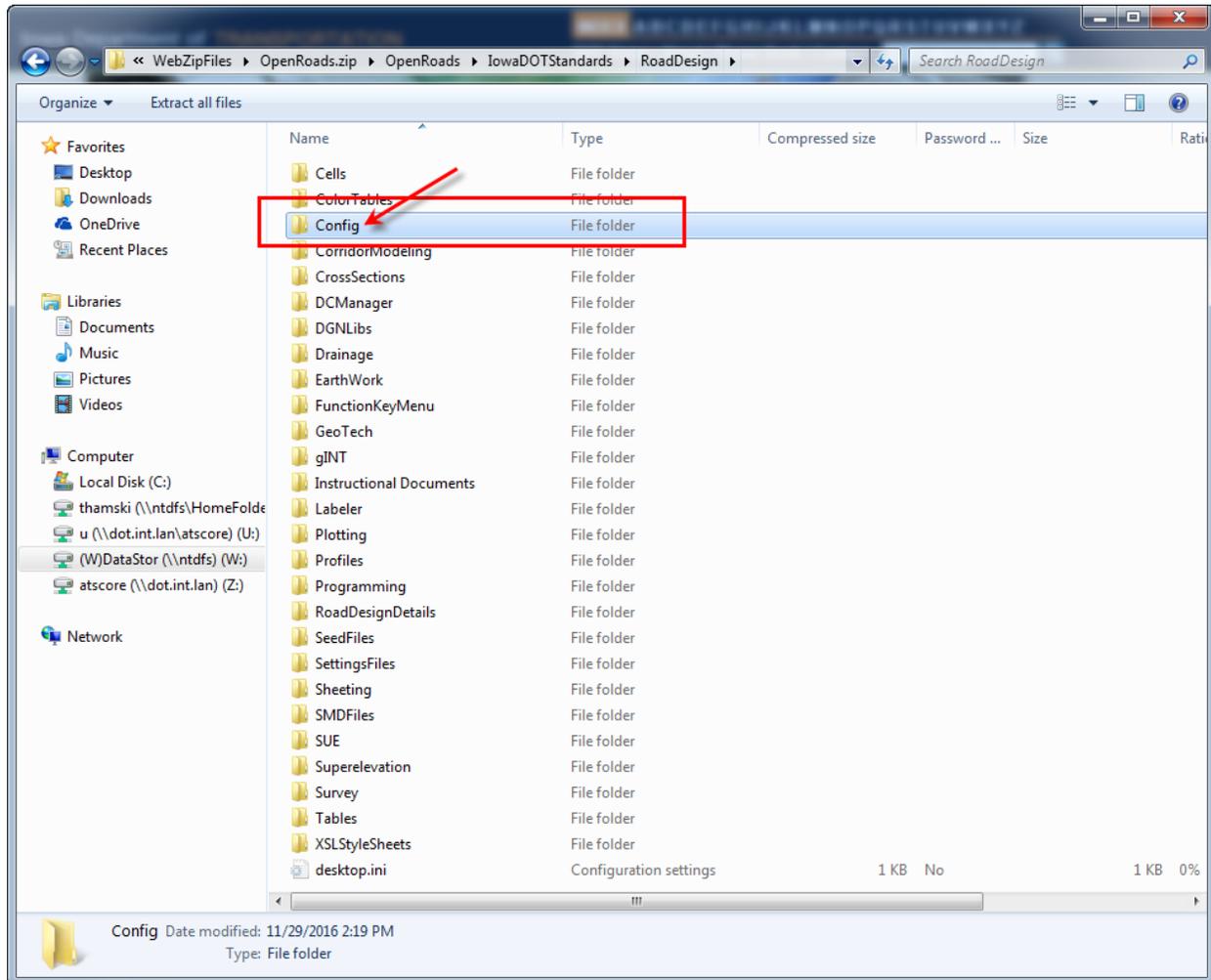
The Design Bureau presently uses Visual Basic and MicroStation VBA (Visual Basic for Applications) programming for MicroStation automation.

Most of the automation tools are launched from within the Geopak D&C Manager program. Geopak D&C was created as the primary drafting tool for Geopak, but it also serves as the command menu system for the Design Bureau. While it is possible to launch these tools directly from MicroStation and not from within the D&C Manager program, this is not recommended. Most of the automation tools are designed to assign an additional Geopak attribute to each of the drawn elements, which will not occur if not using D&C. While the D&C is definitely linked to the automation tools, it is available as a separate download on the Geopak portion of the Design Bureau website, since it may be updated on a different schedule than the automation tools.

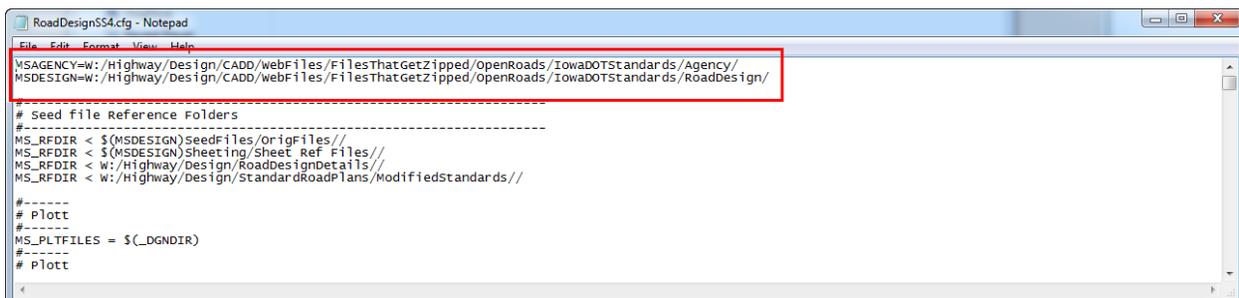
- **MicroStation VBA** is **V**isual **B**asic for the MicroStation **A**pplication. Each macro is saved as a single compiled file with the file extension of “.*MVBA*”. Because the file is compiled, it can only be edited by using the Visual Basic Editor found inside the MicroStation V8 program. The VBA macros are grouped into the [All CADD Files \(Zip file\)](#).
- **Visual Basic (VB)**, is a stand-alone programming language; therefore, VB programs are not run from within MicroStation. At this time, there are only a few VB programs that have been modified to run with MicroStation, but the number may increase over time. The VB programs are also grouped into the [All CADD Files \(Zip file\)](#).

MicroStation Configuration

A Zip file containing all configuration files can be downloaded from the [Design Bureau, Automation Tools](#) web page. Everything needed for OpenRoads (SS4) should be included in this single download, including a word document that contains these instructions. Save the Zip file to your computer/network and extract the contents to a location on your computer/network. You will then need to navigate within the extracted files to ...\\OpenRoads\\IowaDOTStandards\\RoadDesign\\Config and open the **RoadDesignSS4.cfg** configuration file using Notepad.



Change the locations called out in variables MSAGENCY & MSDESIGN to be where you extracted the contents of the zip file to your network/computer. Forward slashes “/” must be used.



After these have been changed, save the file and close it. Last, configure MicroStation/Geopak properly to include the RoadDesignSS4.cfg file within your external system to use the Iowa DOT SS4 workspace.

Seed Files

The concept of a Seed File is similar to that of a pre-made Shell Letter in that much of the file setup work has been done in advance. In the case of the Seed File, the initial file settings have been pre-set and many of the commonly used graphic files or text files have already been referenced (attached), scaled, rotated, and located as necessary. When new files are needed, the CopySeed program will use the Seed Files. For additional information, see Section [21C-54](#).

Often, a Seed File contains no active elements and is merely a collection of several attached reference files. Many Seed Files contain references of other files containing the original graphic elements, such as a file containing an original sheet border drawing. One sheet border file may be attached to thousands of other files that were created by copying a seed file that has the border file attached. The “seed file associated” files containing the original graphics are generally named with the letters “**Orig**” within the file name, such as **dsnOrigEng.border**. The parts of this file name are “**dsn**” for the Design Bureau, “**Orig**” for original graphics file, “**Eng**” for English file, and “.border” as a file extension brief explanation of what is contained in the file. The Seed Files are named with the word “**Seed**” in the filename. The name of the English Seed File for the “**A**” series sheets is “**dsnSeedEng.A**”. For a complete list of **Seed files** and **Orig files**, see Section [20B-1](#).

File Names and Project Directory Structure

The Design File Naming convention “CCRRRPPPGGG” refers to the 2 digit **C**ounty, 3 digit **R**oute, the 3 digit project **P**arenthesis number assigned to the project, and the 3 digit **G**eographic coordinate system (see to Section [20B-45](#)). For example, per this naming convention, a project number of *NHSX-163-1(062)--3H-77*, IARcs zone 8, would have file names beginning with *77163062Z08*. For sheet files. This number is to be followed by the sheet series designation, such as *_A*, *_B*, *_C*, etc. If the series contains multiple files, the sheet letter is to be followed by the first sheet number that file contains. For example, in the file *SHT_77163062Z08_K07.dgn*, the first sheet is *K.7*. All working cross section files are to start with the prefix *XS_*.

Section [20B-71](#) provides a listing and descriptions of all files created by the Design Bureau, including those created using the **CopySeed** program. This section also contains descriptions of files created by other offices. Section [20D-101](#) provides information on file naming conventions for OpenRoads files.

For additional information on naming files and the Project Directory folder structure, see Sections [20A-1](#) and [20B-71](#).

Models

Simply stated, a Model is a file within a file, and a file can contain any number of models. The Design Bureau does not use multi-model files; instead, each model will now be contained within its own file. Each model (within any given file) has a unique name and has its own drawing properties such as resolution, scale, etc.

For additional information on creating new files and file naming, see Section [20A-1](#).

Levels

The Design Bureau presently has over 500 Roadway Design levels, nearly 200 Photogrammetry/Survey levels, and about 100 levels for Soils. The Offices of Bridges & Structures, Right of Way, and others, have their own sets of levels.

MicroStation has the ability to create levels in one MicroStation file, and then call on that file from a different file to have it act as a level library. This allows the standardization of a set of levels that everyone can use to get consistent results.

MicroStation can read several different level libraries at the same time, and make all the resulting levels available to a graphics file at the same time. This is possible so long as none of the level library files use the same level numbers. The DOT has chosen to approach leveling on an office-by-office basis, with specific level number ranges being assigned to each office, as shown at the right. Each office develops and maintains its own level libraries. The level library files are then stored in one common location in ProjectWise so they are all available to the entire agency. The file named **DesignLevels.dgnlib** is the level library for the Design Bureau. Within the Design Bureau, the level naming convention has been structured into groups or disciplines, each with a three-letter prefix unique to that group. Examples: “dsn” for Design, “pho” for Photogrammetry, and “sol” for Soils levels. Within these groups, there are additional prefix naming conventions, as listed below. A summary of the approximate Design level number ranges and associated names is shown below. The following level list may be revised at any time without changes to this document.

Office	Level Range
Bridges & Structures	1000-1250
Construction	1500-1750
Design	2000-2499
Photogrammetry	2500-2699
Soils	2700-2849
Standards	2850-2999
District Design	3000-3250
ROW Design	4000-4499
Row Condemnation	4500-4600
Traffic Engineering	5000-5499
Traffic Tech	5500-5549
Engineering Operations Techs (EOT)	6000-6199
OLE Hearing	6200-6300
OLE Wetlands	7000-7199
OLE Cultural	7300-7350
TransData	7500-7999
Systems Planning	

General Level No. Range	Level Naming Scheme	Total Levels Available
2000 – 2224 2256 & 2286 2850 – 3022	dsn <i>LevelName</i> (general) (All dsn levels except those listed below) including groups such as: dsnAutotum , dsnCells , dsnInDGN , dsnIntake , dsnMass , dsnPaint , dsnPattern , dsnPavementShapes , dsnProfile , dsnPubHear , dsnShading , dsnShtPort , dsnShtPlot , dsnStd , dsn3D , and more	500
2250 - 2299 2888 - 2890	dsnText <i>LevelName</i>	> 50 levels
2375 – 2480 and 2887	dsnXs <i>LevelName</i>	> 105 levels
2500 – 2689	pho <i>LevelName</i> Includes groups such as: phoAlignment , phoTxt , phoUtl , phoEdge , phoFence , and more	190 levels
2695 – 2849	sol <i>LevelName</i> Includes groups such as: solBorrow , solCells , solPattern , solText , solXS , and more	155 levels
15001-15715	sur <i>LevleName</i> Includes groups such as: surAlignment , surTxt , surUtl , surEdge , surFence , and more	>330 levels

Design Levels (dsn) – The largest group of Design levels is devoted to general design items used by several groups (Design squads, Geometrics, Roadside Development, Methods, etc.) The five main divisions within this group are:

- **dsnLevelName** – (such as **dsnSideWalk**) Design items that appear in the plan or profile portion of a plan sheet. This group also includes a few miscellaneous sheeting and specialty levels. The plan sheet items are drawn at real world coordinates and rotations, so they are not rotation dependent, such as text elements would be.
- **dsnInDgnLevelName** – (such as **dsnInDgnROWProp**) Geopak InDGN elements that Geopak criteria refers to when drawing cross sections. These levels are now obsolete and should no longer be used moving forward using OpenRoads.
- **dsnTextLevelName** – (such as **dsnTextCulvertProp**) Text elements describing roadway items that will appear in the plan or profile portion of a sheet. These elements are affected by scale and rotation, which is why they are in a separate level group.
- **dsnXsLevelName** – (such as **dsnXSDitchBottom**) Roadway information on the Geopak roadway cross sections.
- **dsnStdLevelName** – (such as **dsnStdDimension**) Levels used by the Methods section to create the Road Standards.
- **dsnEcLevelName** – (such as **dsnEcSiltFence**) Levels used by the Roadside section to create the R series of sheets.
- **dsn3dDLevelName** – (such as **dsn3DPavementTop**) Levels used when generating corridors. Automatically assigned based on element and point names.

Photogrammetry/Survey Levels (pho/sur) – These levels are used by the Photogrammetry and Survey sections to create what are traditionally known as the “pho” and “sur” files. These files contain all the existing topography, as well as contours and existing utility information. PHO levels appear color 3 (green) and SUR levels appear color 10 (light green) in station, this implies the difference in accuracy of the topographic features. Both PHO and SUR will plot as color 3 (Green) with the appropriate pen tables/print settings. The main divisions within these groups are:

- **phoLevelName** – (such as **phoEdgeDraw**)
surLevelName – (such as **surEdgeRoadPaved**)
Existing roadway items that appear in the plan portion of a sheet. Usually, these items are drawn at real-world coordinates and rotations, so they are not rotation dependent like text elements may be.
- **phoTxtLevelName** – (such as **phoTxtEntrance**)
surTxtLevelName – (such as **surTxtDrainage**)
Text elements describing existing roadway items that will appear in the plan portion of a sheet. These elements are affected by scale and rotation, which is why they are in a separate level division.
- **phoUtilLevelName** – (such as **phoUtilElectric1**)
surUtilLevelName – (such as **surUtilElectric1**)
Existing utility lines. There is a level available for each utility encountered on a project, so a single utility or a group of utilities can be isolated in a drawing as needed.

Note: Section [20B-51](#).has more information regarding Preliminary Survey and Photogrammetry files and folders.

Soils Levels (sol) – This group of levels is used by the Soils Design section to create the collection of soils files. These files contain all the existing soils information and the proposed treatments and designs. The three main divisions within this group are:

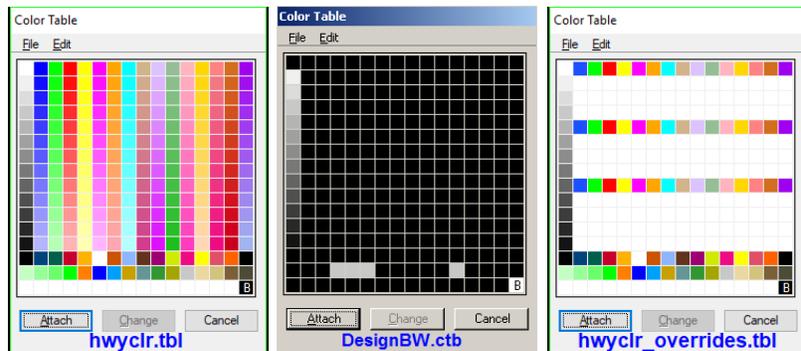
- **solLevelName** – (such as **SolSubdrain**) Soils roadway items that appear in the plan or profile portion of a sheet. Usually, these items are drawn at real world coordinates and rotations, so they are not rotation dependent like text elements may be.
- **solTextLevelName** – (such as **SolTextBoring**) These are text elements describing soils roadway items that will appear in the plan or profile portion of a sheet. These elements are affected by scale and rotation, which is why they are in a separate level division.

- **solXsLevelName** – (such as **SolXsCI10LayorCustomLine**) These levels are used in drawing soils information on Geopak cross sections.

Color Tables

The graphical representation of MicroStation color tables (see below) is used to correlate the visual color display and the RGB color values with the assigned color table number. The **hwyclr.tbl** is the one standard color table used by the Iowa DOT Highway Division for colored products.

The **DesignBW.ctb** (Black & White) color table is used for printing non-color products. The eye can only easily differentiate the color of elements placed using the top row of the **hwyclr.tbl** color table. Therefore, the **hwyclr_overrides.tbl** is used to either visualize or plot products as they would appear in the final color plan PDF files.



The **hwyclr_overrides.tbl** color table will override the colors used when placing elements with the **hwyclr.tbl**. This will cause the elements that were placed using the colors from **hwyclr.tbl** rows 2, 3, and 4 (and also the other white rows, excluding the grayscale colors on the left), to view or plot as if placed with color 0 (which is white on a black background or black on a white background). Example: This would allow using the “yellow, color 20” (in row two of the **hwyclr.tbl** color table) for a yellow display on the computer monitor, and then cause it to print as black (just like color “0”) by printing with the **hwyclr_overrides.tbl** color table.

The **hwyclr.tbl** is used for all MicroStation files. For additional information, see Section [1D-15](#).

Even though the **hwyclr.tbl** file is the only color table accepted for use for MicroStation display purposes in Design, different offices within the Highway Division may use various other color tables to obtain specific desired printing results. Additional details of color tables for printing purposes are included in Sections [21E-1](#), [21E-3](#), and [21E-4](#).

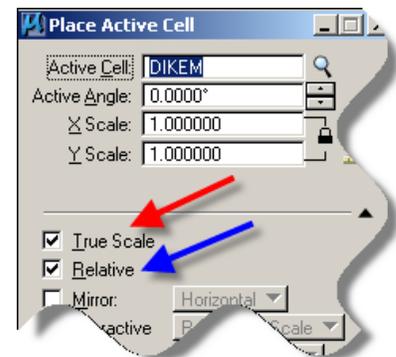
Cell Libraries

- **Cell Library Names** – The cell libraries have been renamed and condensed into topic groupings to better organize their contents. The cell libraries that currently exist are:
 - **dsnDrainage.cel** – Contains cells configured to be used with the Geopak Drainage software program.
 - **dsnEC_Patterns.cel** – Contains shading patterns for placement of erosion control measures.
 - **dsnErosionControl.cel** – Contains detailed graphics for erosion control measures.
 - **dsnGuardrail.cel** – Contains detailed graphics of various guardrail sections.
 - **dsnMethods.cel** – Contains cells used by the Design Methods Section for creating Standard Road Plans and Road Design Details.
 - **dsnPatterns.cel** – Contains shading patterns for creating Standard Road Plans and Road Design Details.
 - **dsnPavementMarkings.cel & trfeng-PAVEMENT_MARKINGS.cel** – Contains pavement marking symbols that coincide with the pavement marking tabulation.
 - **dsnPhoto.cel** – Contains cells used by the Photogrammetry Section for creating existing topographic files.
 - **dsnPhoto_SS4.cel** – Contains cells used by the Survey Sections for creating existing topographical 2D files that utilize line style scale for scalability.
 - **dsnPLNapron1X1_English.cel** – Contains roadway pipe apron plan view cells.
 - **dsnPubHearing.cel** – Contains legend and highway symbol cells for Public Information Meeting displays.

- **dsnRoad.cel** – Cells in this library are used by the design sections for creating general purpose roadway design sheets. Also contains annotation cells used by the D&C Manager tools.
- **dsnSeals.cel** – Contains cells that are only used by the Design Bureau for placing seals on final plan submittals.
- **dsnSignatures.cel** – Contains cells that are only used by the Design Bureau for placing signatures on final plan submittals.
- **dsnSoils.cel** – Contains cells that are used by the Soils Design section for creating Soils Information sheets.
- **dsnSUDA.cel** – Contains detailed 3D cells of the DR and SW series of standard road plans.
- **dsnSurvey2D.cel** – Contains cells used by the Survey Sections for creating existing topographical 2D files.
- **dsnSurvey3D.cel** – Contains cells used by the Survey Sections for creating existing topographical 3D files.
- **dsnSurveyAC_2D.cel** – Contains cells used by the Survey Sections for creating existing topographical 2D files that utilize line style scale for scalability.
- **dsnTrafficControl.cel** – Contains detailed cells that are used in creating traffic control [J sheets](#).
- **dsnUtilityCells.cel** – Contains cells that are used to draw Utility Symbols using the GEOPAK Ancillary Features tool. [21B-23.pdf](#)
- **dsnXSapron1X1_English_Ent.cel** – Contains English entrance pipe apron XS cells.
- **dsnXSapron1X1_English_RD.cel** – Contains English roadway pipe apron XS cells.
- **laDOT_SUE_brghdwl_001.cel** – Contains detailed 3D standardized reinforced concrete box headwall cells.
- **Iowa Utility Structures.cel** – Contains detailed 3D cells of the DR and SW standard road plan series. Used by SUDA/SUE tools. **This cell library is for testing purposes only.**
- **trfeng-PAVEMENT_MARKINGS.cel** – Contains detailed cells of pavement marking symbols that coincide with the pavement marking tabulation.

Cell Library Resolution – All cell file models have a resolution of either 10,000 per Survey Foot or 10,000 per Meter. For cells to be placed at the correct size in any file and model with any resolution, the “True Scale” place cell option should be checked ON, () in the Place Cell Tools Settings dialog, (as shown by the red arrow at the right). The “True Scale” setting is automatically turned on when any Place Cell program is run from the Geopak D&C Manager.

- **Cell Library Leveling** – All recent cells have been created on the named level dsnCellElements. All D&C Manager Place Cell programs turn on the “Relative” Place Cell option, (as located by the blue arrow, above), so cells will be placed on the active level, which has also been set by the D&C Manager Place Cell program.



Resource Files

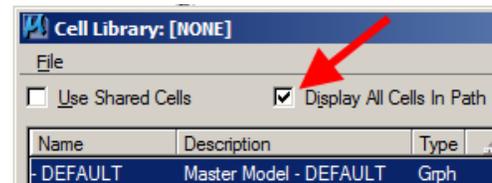
The Iowa DOT Highway Division currently uses two MicroStation Line Style resource files. AnnotationLinestyles.rsc will be used moving forward with SS4, and NonAnnotationLinestyl.rsc will be used with legacy projects that are being finished in the transition period. The line style resource files contain all the custom line styles that are available for use in a MicroStation file. Each custom line style is defined by a custom line style name. A single Font resource file, named idotfont.rsc, is used. The font resource file contains all of the fonts that can be used in a MicroStation file and each font is defined by a font number and a font name. Due to pre-set MicroStation variable definitions, these resource files are automatically accessed when MicroStation is initiated.



Do not modify any of the resource files without the approval of the Design Bureau. The AnnotationLineStyles.rsc, NonAnnotationLinestyles.rsc, and idotfont.rsc resource files must be used on Iowa DOT roadway projects.

Specifying Cell Names without Specifying Cell Library

If the full file paths to all cell library locations are included in the definition of the MicroStation variable MS_CELLLIST, all cells will be located automatically by entering the cell name only, without entering the specific file path. For all cells in the MS_CELLLIST path to display in the Cell Library dialog, the “Display All Cells in Path” option (in the Cell Library dialog) must be checked on () , as shown to the right.



Plan Set Organization

The final plan sheet CADD file name extension will be “.dgn” with a prefix of SHT_, for example SHT_CCRRRPPPGGGS##.dgn, where CC refers to the 2-digit County, RRR refers to the 3-digit Route, PPP refers to the 3-digit project Parenthesis number assigned to the project, GGG refers to the corresponding iaRCS zone, and S## refers to the Sheet Number, such as SHT_97029028Z08B01.dgn for the first “B” sheet file. Each plan sheet file can contain several sheets. If a second file is required, the numbering sequence the first sheet number contained in that file will be used, such as the next file starts with sheet 7, it would be SHT_97029028Z08B07.dgn.

The non-Plan/Profile type sheet files, such as A, B, G, J, U, etc., will normally contain up to 20 sheets per file in a horizontal row, but 20 sheets are not required. The first “B” file may contain the first five sheets, and the next one may contain the next seven sheets. The cross section (XS) sheet files may contain up to 100 sheets in five horizontal rows of 20 each. However, each XS sheet file is associated with a specific Geopak horizontal alignment, so a file may contain only a few sheets, or many. The Plan/Profile type of sheet file is also associated with a specific Geopak horizontal alignment and may contain only a few or many sheets per file.

The plan is organized alphabetically, with the “A” sheets first, followed by the B’s, C’s, etc. For complete details, see Section [1E-2](#).

For additional information on naming files and the Project Directory folder structure, see Sections [20A-1](#), [20B-71](#), and [20D-101](#).

Color Plans

For details on Color Plans, see Design Manual Sections [21E-4](#) and [21E-3](#).

Road Design Details

Road Design Details are a collection of standard drawings (commonly referred to as the "Green Book") developed to aid designers in the development of detailed design plans for Interstate and Primary road construction in the State of Iowa. These details are not intended to cover all design situations. When specific design problems require special solutions, the typical sections and design details may be modified. For guidelines on modifying Road Design Details refer to Section [1E-4](#). On the [Road Design Details](#) web site, the downloadable file links are available in PDF, DGN (MicroStation), and xlsx (Excel) format. The PDF files are available for immediate viewing, but the MicroStation and Excel versions must be downloaded for viewing or use. Some of the PDF files may contain several design details resembling a layout page in a book, while other PDFs may contain only one detail.

The ten types of road design details are:

- [100's](#) – Design and Tabulation Forms
- [200's](#) – Standard Notations
- [500's](#) – Design Detail Sheets
 - [Typical Components](#)
 - [Grading Typical](#)s
 - [Detour Typical](#)s
- [2000's](#) – Roadway Typical Sections and Drawings
- [3000's](#) – Multilane Paving
- [4000's](#) – Roadway Ditches
- [6000's](#) – Curbs
- [7000's](#) – Paving and Reconstruction
- [8000's](#) – Median Crossings, Guardrail, Barriers and Earthwork
- [9000's](#) – Pavement Markings

Individual topics or the entire book can be downloaded online. Each MicroStation Detail file may contain as few as 5 models, up to possibly 25-30 models for separate tabs, typicals, standard notes, etc.



See Section [20J-61](#) for additional Calc File information.

Each model contains a single unique drawing for use as a baseline in plan sets. The model names match the name of the Design Detail contained within the model, the extension contains the month and year the drawing was last revised. The model named *e0101-16.1009* would indicate the last revision was in 10/09 (October 2009). The Design Detail drawings have each been drawn to be easily be placed in sheet file as cells.

All Design Detail files are maintained by the Design Bureau Methods Section. The files are no longer available in a printed book form and must be downloaded for external use. Internal use is through the cell libraries.

Standard Road Plans

Standard Road Plan drawings have been developed to show standardized design features, construction methods, and approved materials to be used in design plans for Interstate, primary, and secondary road construction in the State of Iowa. On the [Standard Road Plans](#) web site, you can download either the entire book or individual standards. Refer to Section [1E-5](#) for guidelines on modifying Standard Road Plans.

Shell Letters

The [Shell Letters](#) web site contains many example letters for use during the various Design events, for Plan Revisions, etc.

Geopak

Element and File Naming Conventions

A specific naming convention has been established for all Geopak and OpenRoads files, Coordinate Geometry points, Alignment Chains, Horizontal and Vertical curves, etc. See Section [20D-2](#) for information related to Geopak Element and File Naming Convention, Section [20D-101](#) for information related to OpenRoads Files and Naming Conventions, and Section [20D-102](#) for information related to OpenRoads Element Naming Conventions.

Survey Tools

The Design Manual includes an extensive grouping of instruction files for **Geopak Survey Tools** and **Survey Feature Codes**, as follows:

40B Surface Topography Data Collection

40B-1	Feature Codes – Full Descriptions
40B-2	Feature Codes – Titles Only
40B-3	Feature Codes – Categories
40B-4	Feature Codes – Modifications
40B-5	Full and Partial DTM Surveys
40B-7	Bridge Data Collection
40B-8	Culvert Data Collection
40B-9	Storm Sewer Intakes and Manhole Data Collection
40B-10	Feature Codes for Roadway Survey
40B-11	Feature Codes for Entrance and Intersection Survey
40B-12	Feature Codes for Curb & Gutter Survey

40D MicroStation and GEOPAK Survey Mapping Process

40D-1	Folder Structure and File Naming
40D-2	Survey Preferences
40D-3	Loading Datasets
40D-4	Editing Survey Data
40D-5	Checking for Crossing Chains
40D-6	Creating Horizontal Alignments
40D-7	Processing Datasets in Models and Zones
40D-8	Build DTM from Elements
40D-9	Build DTM from Survey Data
40D-10	Editing the DTM
40D-11	Drawing Contours
40D-12	Using Design and Computation (D&C) Manager
40D-13	Drawing Horizontal Alignments
40D-14	Station and Offset Reports
40D-15	Completing the G Sheet
40D-16	GEOPAK Survey TOPO Model Links
40D-17	How to Use the Survey Information

Printing

The Design Bureau uses Print Organizer for multipage processing (see [21E-1](#)) and MicroStation Print for scroll production (see [21C-33](#)).

Chronology of Changes to Design Manual Section: 020A-003 Plan Development CADD Standards

6/25/2019	Revised Updated hyperlinks. Updated header logo and text.
11/20/2018	Revised Revised to reflect SS4 procedures, current file names and project directory structures, and current cell libraries.
6/30/2011	Revised Corrected level list, added graphics, general rewrite.
12/10/2010	Revised Updated
4/15/2010	NEW Replaces 1G-1 through 1G-13 series