

CADD DATA DELIVERY SPECIFICATION LEVELS

Mn/DOT specifies two levels for delivery of project CADD data.

Level 1 Basic CADD Data Delivery Specifications: Data in CADD files must be organized according to the following:

1. Within **Bentley MicroStation**[™] files named using Mn/DOT file naming requirements for the appropriate data type
2. With elements on **Bentley MicroStation**[™] levels as delivered through Mn/DOT's customized MicroStation design libraries (.dgnlib file's). Individual element attributes for elements within those levels are defined within the **Bentley GEOPAK**[™] DDB, SMD, GFD, LSF databases (found at <http://www.dot.state.mn.us/caes/index.html>) or elsewhere as specified within this site or by directive of the CADD Data Standards Manager.

Level 2 Enhanced CADD Data Delivery Specifications: Based on the complete Level 1 requirements and extending them to add detailed element symbology definitions and specifying:

1. Individual element attributes for elements on those levels as defined within the **Bentley GEOPAK**[™] DDB, SMD, GFD, LSF databases (found at: <http://www.dot.state.mn.us/caes/index.html>) or as elsewhere as specified within this site or by directive of the CADD Data Standards Manager.
2. **Bentley GEOPAK**[™] file components; element components which may include non-graphic attributes; requirements for settings to perform quantity computations based on graphical and non-graphical data and documentation thereof; specifications of graphical and non-graphical content and specifications of file size as deemed necessary for certain file types.

Internal file requirements may be defined and modified by the unit supervisor or project manager but must respect utilization of the CADD data throughout the project life-cycle by all functional groups within Mn/DOT. Thoroughly review the delivery requirements of your project before initiating work.

Excluding the information explicitly covering enhanced delivery requirements for **Bentley GEOPAK**[™] & Mn/DOT Visualization CADD Data Delivery Specifications, all information in this web site are to be considered Level 1 Basic CADD Data Delivery Specifications. The **Bentley GEOPAK**[™] & Mn/DOT Visualization sections outline the requirements to meet the Level 2 "Enhanced CADD Data Delivery Specifications" that may be called for by the project manager or within the contract language in the case of consultant work.

GEOPAK™

GEOPAK™ is Mn/DOT's CAD engineering software. To meet the Mn/DOT Level 2 "Enhanced" CADD file standard the file(s) must meet the specifications defined in this document section.

In general, all GEOPAK-related files needed to regenerate any part of the design should be included in the deliverables to Mn/DOT. This includes, but is not limited to, GPK files, input files, criteria, auto-shape input files, sheet quantities files.

All of Mn/DOT's publicly available GEOPAK resources referenced in this document are found at (<http://www.dot.state.mn.us/caes/index.html#geopak>)

GEOPAK™ STANDARD SPECIFICATIONS

General: Each project shall have only one geometrics database, i.e. .GPK file. This one database will contain all alignments, profiles, and other elements necessary to derive the final geometrics. Alignments are required for all roadways, cross streets, retaining and noise walls, and other structural items. Profiles names should match the alignment names in cases of roadways. Top and bottom of walls and other structures should reflect the respective alignment. Ditch profiles are also to be stored in the database. Roadway alignments and profiles will include inplace as well as proposed where appropriate.

Field collected survey information (in the form of points and survey chains) should also be included within the .GPK file. The Project Manager may approve the use of a second .GPK file for this information for large projects.

Documentation of the project geometrics should include a chart relating alignments and profiles in an approved spreadsheet format. All profiles and alignments within the database shall be included within the spreadsheet.

Design Files: The placement of all elements and text (including size) within a design file must conform to the Mn/DOT databases and Mn/DOT CADD Data Standards. This includes, but is not limited to, databases for the following GEOPAK tools:

- Design Database (DDB) Design and Computation Manager (English and Metric),
- Survey Manager database (one for both English and Metric) for field collection and use in the Survey Manager tools
- Legal description editor
- Drainage Library

Right of Way and Utility placement on cross sections: When utility and right of way information is placed on cross sections, the standard Mn/DOT cross section cell library will be utilized.

Generation of existing ground lines: When generating existing ground, a horizontal tolerance and a filter tolerance must be specified.

	HORIZONTAL TOLERANCE	FILTER TOLERANCE
English	0.3 feet	0.1 feet
Metric	0.1 meters	0.03 meters

This limits the creation of minute ground line elements, which impede the processing of proposed cross sections and may produce erroneous results in earthwork, while retaining accurate elevation data. Existing ground lines should subtend the limits of the topographic or digital terrain model corridor. GEOPAK™ cells should be a minimum of 10 master units past the ground line. Horizontal distance between cross sections and their component elements should be a minimum of 100 master units, measured from the right edge of the left cell to the left edge of the adjacent cell to its immediate right. The vertical distance between cross sections should be a minimum of 600 master units as measured from center of cell to center of cell.

Project Manager: The use of GEOPAK Project Manager is not mandatory, however, if it is utilized for project design, the appropriate files required to open and review all runs within the project must be included in the deliverables.

Project Setup: The existing ground lines, pattern lines, and shapes must be color coordinated for facilitation of proposed cross section processing. A cross section match line, when multiple alignments are utilized, must be supplied, in addition to the actual pattern line file. The match line diagram should have each pattern line labeled with the station. Symbolology of the text should match the pattern line.

Superelevation: Shapes must be color coordinated to pattern lines. In addition, a visual difference between dependent and independent shapes must be utilized. Shaping should be done for all roadways, acceleration and deceleration lanes, truck climbing lanes, but should exclude shoulders, except by approval of the Project Manager.

Staged Construction: If staged earthwork or staged cross sections are required and earthwork cannot be computed on a single set, a separate working cross section file must be provided for each stage where earthwork is to be computed. For single set sections showing multiple stages, appropriate excavation limits must be drawn and separate earthwork input and log files must be delivered.

Cross Section Files: Each alignment must have its own set of cross sections with the exception of a multiple configuration which may be on the same set of sections. The maximum number of cross sections per file is 500, unless earthwork balancing is required. If an alignment has less than ten sections such as cross streets, it may be combined with other alignments, however the total number of cross sections for these files should not exceed 100. A viable GEOPAK™ cross section cell (i.e. recognizable by the GEOPAK™ Cross Section Navigator dialog) must be present on each cross section at the correct location.

Cross sections will be labeled according to Mn/DOT criteria. The element symbology of all cross section elements shall be dictated by standard Mn/DOT criteria, or if standard criteria is not available, the design databases shall be utilized. Under no circumstances will the top and bottom layer of any cross section feature have identical symbology including pavement features. Separate layers shall be provided for each aggregate. Inplace features, including but not limited to topsoil, pavement and shoulders shall be drawn on the cross sections, if they affect earthwork quantities.

If cross section elements are generated with criteria generated or modified by the contractor, a copy of the criteria shall be delivered to Mn/DOT to use in its standard library. The standard variables (as listed in the sys*.var and project*.var) shall be used.

Earthwork: Earthwork shall be processed to a tolerance of 0.003 m (or .009 ft) and all input, log files and sheet quantities files shall be included. The results of the log files must be consistent with the graphic cross sections. Add volumes are permitted for unique circumstances on the project, i.e. driveway gravel quantities, but shall not be used in lieu of graphic elements for consistent trends in the sections, i.e. pavement or topsoil removal. A comment line added into the input file for each add volume shall specify the justification for the adjustment. Under no circumstances should existing features or proposed features extend beyond the limits of the GEOPAK™ cell. Earthwork shapes utilizing color stratification shall be included for all cross section files.

Match lines are permitted where necessary to match to adjoining alignments, however, they may not be placed where they dissect a superelevation shape. When placed for sheet separation, the original cell must be left intact. GEOPAK™ cross section cells should extend a minimum of ten master units beyond any cross section elements.

Proposed Cross Sections: All criteria files shall be provided so that if cross sections are re-run, they will coincide with provided sections for a minimum of 90% of the elements on the cross sections. An ASCII file denoting manual changes and the reason for changes shall be included. If manual changes are made, the appropriate construction text must be moved to the adjusted vertex.

All cross sections shall have text placed on the standard level "CNST TXT" to facilitate construction staking report creation. Text shall be standard text size, color 16 and line style zero. The text shall be center-center justified on the vertices of the elements and correspond to the marked point assigned in criteria. Centerline vertices must always have text. Bottom and top of pavement, and top of curb must also be marked. For inplace features, no text is required for topsoil removal elements. Muck, peat, and other layers affecting earthwork must be marked at the outer, lower limit and the tie down point with existing ground. Utilizing Mn/DOT criteria will address these standards. The specification of marked critical points and construction points can be found in the files Points.txt and Consttxt.doc and in the downloadable compressed file MNDOTV8GEOPAK.ZIP

Digital Terrain Modeling: The .TIN file shall be in GEOPAK™ binary format and its size shall not exceed 30 megabytes for traditional TINs and 150 megabytes for LIDAR or

other imaging software. Any TIN files larger than these specifications must have prior approval by the Project Manager. Any supplemental information to the original .TIN (i.e., filling of voids) shall be incorporated into the .TIN and GEOPAK™ .DAT file(s) provided. All .TIN files must be GEOPAK™ validated (via Utilities > Check Triangulation) and the hull and voids must be displayable.

Tabulations: Any tabulations including but not limited to locations or quantities, should be delivered in the spreadsheet format, in addition to within the MicroStation file.