Mn/DOT CADD DATA Standards – General Information

PREFACE

The scope of this web-site is to document and standardize the Minnesota Department of Transportation's CADD (computer aided drafting and design file specifications). The CADD standards contained herein are English based except as noted.

Mn/DOT's establishment of CADD data standards is to ensure consistent data aggregation, element symbology, object usage, and locational accuracy of project CADD data which effectively enables:

1) Project data to be shared among functional business units in an integrated manner throughout the project design process.
2) CADD data to be accessible for use in specialized non-design project design process.
3) Engineering Consultant electronic deliverables to concur with Mn/DOT design and IRM policies.

The primary focus of the CADD specifications is the organization of the graphical model contained in the file and the format of the file(s). File ownership and data placement responsibilities are beyond the scope of this document. While the functional area sections define file types and data placement, district deviations in methodologies prevent this being a definitive ownership and placement reference. These standards are considered a baseline and contract language may require more or permit less rigorous standards to satisfy usage of the data. The project manager has final say regarding, and responsibility for, the specific CADD Data Standards of a particular project. Exceptions should only be granted when no remedy is available under the existing standards and should be fully documented. Copies of the documentation for exceptions to the Mn/DOT CADD Data Standards should be forwarded to the CADD Data Standards Manager.

USE STATEMENT

After reviewing the general file information contained in this section, select the functional area (hydro, bridge, etc.) for the type of data to be created.

GENERAL FILE INFORMATION

COMPUTER AIDED DRAFTING & DESIGN (CADD) FILE TYPE

Mn/DOT CADD files will be binary graphics files created using ***Bentley Systems MicroStation™*** at the current department standard version. Mn/DOT has determined that ***Bentley Systems MicroStationV8/2004™*** and higher to have met basic agency

compatibility standards for file use. Mn/DOT reserves the right to specify explicit versions of the Bentley MicroStation V8/2004 software, or superseding certified release platforms, on a project by project basis.

The file specifications are based on Mn/DOT's need to have complete file compatibility across different functional areas as they use CADD files. This facilitates use of automated software, consistent archival and retrieval procedures and organized business practices to maximize efficiency within the agency.

In the case of consultant files supplied under a state contract, it is required that all files be in the contract specified ***Bentley MicroStation V8/2004™*** format and a minimum version step of 08.05.02.27. Formats, translations, etc., and the accuracy of data contained therein will be the total responsibility of the contracted source. The files delivered under contract must work in the ***Bentley MicroStation V8/2004™*** environment as described above with no adjustments, modifications, translations or alterations while retaining all required element properties.

In cases of CADD data involvement with other agencies using public information, a school district map, for instance, Mn/DOT would review the translation issues individually.

FILE NAMING CONVENTIONS

Mn/DOT's file naming system is based on four components:

- Functional Group designator - (design, survey, right of way, etc.)
- State Project number or State Identifier number - (bridge, intersection)
- File Type designator - (construction plan, erosion control plan, etc.)
- Sub-file designator

FILE MANAGEMENT STATEMENT

These file extensions and naming conventions are based on a sound model of MnDOT work flow and processes. It is required that this file naming convention be used. The most common CADD files are represented in this document. In the event you encounter a file type not addressed in this document, consult immediately with the project manager to determine the proper file parameters. Ultimate responsibility for adherence to the file naming and file management system rests with the project manager and systems managers. Mn/DOT's goal is to have uniform data practices for information exchange and management abilities.

CADD DATA DELIVERY SPECIFICATION LEVEL

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.

DATA TRANSFER DOCUMENTATION

Whenever CADD files are transferred between parties or functional areas as part of the project development process, a written record of the transaction must be created that specifies the associated project and the nature and content of the files.
Electronic "README" informational files used in lieu of paper documentation for CADD files will be ASCII format.

DATA FILE CHECK LIST-TO BE INCLUDED WITH DATA TRANSFER:

1. State Project Number
2. File Naming Codes that may have been used
3. Project Manager including contact information.
4. Designer/Draftsperson including contact information.
5. File history, revision dates, etc.
6. Directory structure-for reference files & archive information
7. All Reference file information including names, attachment details, etc.
8. Plotting notes
9. GEOPAK database information

It is very important that this information be included in all data exchanges. The file structure (reference file directory tree organization) and set-up parameters used to recreate plots and database relationships (GEOPAK™ Jobxxx .GPK) must be maintained.

DATA EXCHANGE FORMAT

The specific hard medium used for the physical, non-network, transfer of data must be specified. This should include file medium type (CD, DVD, etc.) general recording format and any compression formats. Both parties of a data exchange transactions should maintain a record of the formats agreed to and their intended use as part of the project documentation.

FILE COORDINATE SYSTEMS

Mn/DOT files are drawn in real world coordinates. The type of file that you are working in will dictate what coordinate system to use. The normal highway detail design or pre-design file will be in a County Coordinate system. State and Street series mapping files are usually drawn in State Plane Coordinate system. Some projects may be available with Universe Transverse Mercator. Contact the district surveyor or project manager to determine which system is acceptable for the project.

BASIC ELEMENT INFORMATION

Mn/DOT CADD files are to be considered models or real maps. Files should not be broken into sheets but drawn as contiguous layouts, maps, models, etc. Mn/DOT uses reference filing across the functional areas. Each area creates file information with specific levels and symbology allowing files to be added to or “stacked” as reference files to compile full engineering maps and models.

The files need to be created using base elements. *Bentley MicroStation*™ lines and arcs are generally the only element types needed. A filet as opposed to a curve, for

example, is the preferred method of drafting a highway center line alignment. The fillet is a circle segment with endpoints and a radius point, as opposed to the curve which is a point to point chord approximation of the alignment. Automated software usually requires base elements for computation and manipulation. Complex *Bentley MicroStation*™ file elements (complex element chains, stream curves, etc.) are not to be used unless specified as a deliverable standard under this site or required by the unit or project manager. Cells, custom lines, and patterning are not considered complex elements within this context.

Mn/DOT CADD files are to be considered working engineering drawings with the appropriate accuracy, meaning exact mathematical models with only the computer pixels limiting their graphic accuracy, generally to be plus or minus 0.001 meters or .001 feet.

Actual computational accuracy is dictated, at times, by software but will always be expected to meet or exceed industry standards. (AASHTO, Mn/DOT, etc)

BASIC DESIGN FILE SETTINGS

Units: All Mn/DOT road design and related project file measurement units will be specified on a project by project basis. The default measurement system is English.

- **Coordinate Readout:** 123456.789 using X, Y, Z.
- **Angular Measurement**: DD.MM.SS or DD.DDDD as required
- **Station Format:** 1+12.123 for English, 1+123.123 for metric,
- **Direction:** Use Azimuths and Delta,
- **Active Angle**: 0 Degrees @ azimuth of 90 Degree

DESIGN ELEMENT SIZE & SCALE

Mn/DOT's File structure and setup assumes drawing design elements as they exist in the real world. Scaling is handled in the plotting environment. Mn/DOT does most plotting with *Bentley*™ *Iplot*™ software.

Office of Transportation Data and Analysis - GIM/Cartographic unit creates mapping files that may have different factors to consider and may vary from above. Contact the unit or project manager to determine the parameters and methodologies for your specific need.

Map files used as index maps, for example on the title sheet, are scaled in the reference file attachment.

ELEMENT ATTRIBUTES – CADD SYMBOLOGY

CADD file graphic symbology shall meet the current published standard Mn/DOT symbology as specified under the Mn/DOT CADD Data Standards web site on the day of contract acceptance for consultants or on the day of project initiation for Mn/DOT staff, and as will meet either Level 1 or Level 2 as required by Mn/DOT specification. Printed copies of the standards data from the web site must always be considered questionable when attempting to establish the correct version of the standards applicable. Copies of the web site material are valid for establishing the content on a specific date, however Mn/DOT records are the final determinant when questions arise.

Additional CADD graphic symbology resources provided by Mn/DOT include ***Bentley MicroStation™*** format:

- Cell libraries, which are symbolic graphic representations of common items used in drafting and design by the Mn/DOT functional areas. Some cell libraries are used throughout Mn/DOT, others are functional area specific.
- Resource files:

1. Fonts – Contains the approved graphic text (fonts) allowed in Mn/DOT files.
2. Custom Line Style – Contains the approved custom line style definitions.

ELEMENT DISPLAY AND PLOTTING

Mn/DOT does not, at this time, specify or provide pen tables used for plotting to external clients. Because of the variety of plotting solutions, each external consultant is expected to have the necessary expertise in using their plot system to match Mn/DOT publication requirements. The primary evaluators for published black and white documents are (1) the printed width of MicroStation elements of specific weights and (2) text sizes based on plot scale and hard-copy size. For color plotting, source graphics are displayed in the correct screen color using the Mn/DOT Standard color table. Color plotting to hard copy should be verified with the project manager to verify that hard copy color meet and support the intended use for the document. The Mn/DOT standard color table is available within the Mn/DOT CADD Standards downloads. This file may be used as a common base for color plotting. The color number is the critical specification for element attributes when setting color. The color number specified in the element is expected to be followed, regardless of how the operator defines the color to appear on computer screen. Plotting will not be addressed because of the large range of plotting hardware and plotting techniques.