HIGHWAY DESIGN MANUAL

Chapter 20
CADD Standards and Procedures

Revision 86
(Limited Revision)

October 19, 2015

Includes errata corrections (EB 18-042)
# CADD STANDARDS AND PROCEDURES

<table>
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<tr>
<td>General</td>
<td>Hyperlinks were updated throughout the chapter. <em>(Rev. 86)</em></td>
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<tr>
<td>20.5.1.2</td>
<td><strong>Proposed Information</strong> was updated to correct the language regarding signs that do not have dimensions detailed in the MUTCD. <em>(Rev. 86)</em></td>
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<tr>
<td>20.5.1.4</td>
<td><strong>Details, Typical Sections and Tables</strong> was revised to recommend that tables be created in MS Excel and then linked to MicroStation files. Availability and location of instructions for linking MS Excel tables to MicroStation files were added. <em>(Rev. 86)</em></td>
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<tr>
<td>20.10</td>
<td><strong>Publishing Contract Plan Information</strong> was revised to require the use of grayscale base mapping and color utility information on plan sheets, and to encourage the use of gray shading where appropriate. Instructions for printing grayscale base mapping and color utility information were added. <em>(Rev. 86)</em></td>
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<tr>
<td>20.10</td>
<td><strong>Publishing Contract Plan Information</strong> was revised to delete reference to an obsolete requirement to provide a supplemental plan set for grayscale printing. <em>(EB 18-042)</em></td>
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<tr>
<td>20.10.2</td>
<td><strong>Color Tables and Pen Tables</strong> was updated to list the current recommended color and pen tables. Additional guidance was provided to assist in the selection of which pen table to use for different purposes/needs. <em>(EB 18-042)</em></td>
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20.1 INTRODUCTION

Chapter 20 provides requirements and guidance on CADD policies and procedures which are as current as practical. Following the contents of this chapter assures uniformity of practice and the creation of electronic data for projects designed by or for the Department. The objective is high quality through uniformity in process, electronic data, and presentation. In order to allow for the efficient use of drawings and data, achieve consistent plan appearance, and provide consistent reproduction quality, electronic documents must be created and populated with data in accordance with the standards stated in this chapter. This includes data created by Photogrammetry, Survey, Design, Structures, ROW Mapping, Construction, Geotechnical Engineering; data used to produce Standard sheets and Bridge Detail sheets; and data created by all other Department or Consultant suppliers of CADD information.

In most cases adherence to NYSDOT CADD standards is best achieved by using the resources and settings provided by the Department. For example, the Department provides many MicroStation DGN libraries, which preset level symbology, text styles, and dimension styles. A user needs only to select the correct level, text style, or dimension style to be in conformance with NYSDOT CADD Standards. The DGN library predetermines element color, weight, and linestyle, text font, the size of dimension arrows and scales according to the annotation scale. Where a configuration or setting automatically ensures conformance to the standards, specific reference is provided in this Chapter. The resources available from the Department’s public web site are the standard. More detailed information, such as text sizes at a particular plot ratio, or color RGB values, are outlined in Chapter 22 of this manual.

Variations from this chapter may be necessary for special or unusual conditions, or between the issuances of new or revised source documents, and any corresponding updates of this chapter. Consequently, instructions in this chapter do not preclude the exercise of individual initiative and judgment in reaction to project specific conditions or application of current state of the art practices. Initiative and judgment are encouraged when it is appropriate and there is a rational basis for deviation. However, it is most important that there be consistency in the application of this chapter.

Along with the content of this chapter other references or training may be necessary. Instructions from the Main Office, training manuals, publications and other related material may need to be referred to for further details, or clarification. Portions of the material in this manual may be specifically superseded by subsequent Department Official Issuances (e.g., Engineering Instructions).
CADD STANDARDS AND PROCEDURES

20.2 ENGINEERING APPLICATIONS MANAGEMENT TEAM

CADD standards and procedures are prepared by the Engineering Application Management Team (EAMT). This group was originally formed to create CADD standards, policies and procedures. On December 15, 1994, the Engineering Automation and CADD Policy, Procedures, Standards and Guidelines Committee held its first meeting. This group, currently called the EAMT, was formed by soliciting membership from every Region and Program Area. The EAMT is an important part of updating and maintaining CADD standards, policies and procedures. Through participation in the EAMT a process of continuous improvement exists, where these standards and policies are updated on a regular basis, to reflect changes in software, hardware, and design processes.

It is the mission of the Engineering Applications Management Team to create, coordinate and implement standards, procedures and best practices to better use CADD and related automation tools in the planning, design and construction of transportation facilities. The EAMT will promote these standards to create a more uniform product for our customers.

20.3 THE STANDARDIZATION PROCESS

Suggestions for changes, corrections or improvements to CADD standards and procedures are welcome. A list of each EAMT representative for the Regions and Main Office Program Areas is available on NYSDOT’s IntraDOT. Suggestions should be presented in writing to the appropriate team member for your Region or Program Area. Each EAMT representative is responsible to bring all suggestions to the attention of the Team for review and action. Each EAMT representative is also responsible to ensure that items available for review are distributed to all interested parties and inform staff of the Team’s activities. This Team meets on a regular basis to discuss these suggestions, and develop standards and policies for CADD and related Engineering Applications. Any questions or need for clarification can be addressed to a Team member. Team members are appointed by their Regional Design Engineer or applicable Program Area Manager to represent their area of responsibility on engineering technology topics. Team members should discuss team activities with their managers on a regular basis. Consultants are also encouraged to submit standardization suggestions to the Team through their Project Manager/Job Manager/Consultant Manager.

20.4 SUPPLIERS AND CUSTOMERS OF ELECTRONIC DATA

This chapter defines requirements for the format of electronic data during the project development process. Transfer of data is accomplished using ProjectWise. The Department’s ProjectWise policies are stated in Appendix 14 of the Project Development Manual. The supplier is a group or individual who is expected to create and provide the information in the specified format. The customer is a group or individual who will receive and then use the information to progress a project. Department suppliers refer to persons directly employed by NYSDOT. Consultant suppliers refer to consultant firms hired to provide engineering services for NYSDOT.
Following are several examples of data flow and the relationship between suppliers and customers:

a. A Regional Survey Group or consulting firm (the supplier) provides base mapping to the Regional Design Group or consulting firm (the customer) for use in progressing the design of a project.

b. A Regional Design Group or consulting firm (the supplier) provides engineering services for the entire design of a project and then provides that information to the Regional Construction Group (the customer) for use during construction of a project.

c. A Regional Design Group or consulting firm (the supplier) provides engineering services for Design Phases I through IV of a project and then provides that information to the Regional Design Group or consulting firm (the customer) for use during Design Phases V and VI of a project.

d. A Regional Design Group or consulting firm (the supplier) provides engineering services for the design of a project and provides information to a Main Office Program Area (the customer) to provide engineering services on a component of a project.

e. A Main Office Program Area or consulting firm (the supplier) provides engineering services for a component of the design of a project and provides information to a Regional Design Group (the customer).

While this is not an all encompassing list, it does cover the majority of electronic data transfers throughout the project development process.

20.5 ELECTRONIC DATA FORMAT REQUIREMENTS

The format of electronic data is important, because it ensures compatibility and usability of data among the various functional teams who contribute to designing and delivering a project. The supplier shall provide the customer with the information, in electronic format, described below in items a through l. **The supplier shall use MicroStation® and InRoads Civil Suite® to create files as outlined.**

a. The supplier shall submit graphic files in MicroStation (.DGN) format. All CADD Graphic files shall be created using MicroStation. Files which are .DXF, .DWG, .IGES, etc. are not acceptable formats.

b. The supplier shall submit surface files in InRoads Digital Terrain Model (.DTM) format. All DTM files shall be created using InRoads Civil Suite.

c. The supplier shall submit alignment and coordinate geometry point data for all existing features in an InRoads alignment file (.ALG) format. All ALG files shall be created using InRoads Civil Suite.

d. Record plan alignments shall be submitted in InRoads alignment file (.ALG) format. All ALG files shall be created using InRoads Civil Suite.

e. Right-of-way, property, highway boundary lines, and horizontal control shall be submitted in InRoads alignment file (.ALG) format. All ALG files shall be created using InRoads Civil Suite.

f. Text file(s) listing all survey data collected for the project shall be ASCII format.
g. There are additional requirements for electronic information submitted to the Office of Structures. These requirements are outlined in the Bridge Data Sheets and listed in the “Bridge Manual” Appendices 3A & 3B.

h. All submissions shall be compatible with the current versions of CADD software in use by the Department as designated in an annually issued Engineering Bulletin.

i. Department suppliers shall use approved versions of CADD software. Consultant suppliers shall use approved versions of MicroStation and InRoads Civil Suite.

j. Consultant suppliers may submit electronic documents in other than the stated versions of NYSDOT CADD software standards, as long as the documents are compatible with NYSDOT CADD software standards. A written request shall be sent to the Department stating the version of CADD software the consultant supplier is requesting to use for the submission. This request shall be directed to and approved by the Project Manager/ Job Manager/ Consultant Manager as applicable.

k. The supplier shall ensure that the contents of all electronic documents are the same as any hard copy information submitted (e.g., survey notes or paper plots).

l. The supplier shall name files and documents as stated in Appendix 14 of the Project Development Manual.

20.5.1 Graphic Requirements

All graphic files submitted shall be in a MicroStation (.DGN) format. The supplier shall use MicroStation for all graphical CADD work being submitted. All MicroStation elements shall be placed using the symbology defined by the level libraries (placement ByLevel) provided by the Department.

20.5.1.1 Existing Information

All graphic files containing existing project information shall be transmitted from the supplier (Regional Survey Group, Photogrammetry Section, Regional ROW Mapping, or consulting firm, etc.) to the customer (Regional or Main Office Design Group, or consulting firm, etc.) conforming to the following requirements:

a. All topography or base mapping files shall consist of graphic elements representing the existing topography as obtained for the purpose terrain data collection. Topography shall be drawn in its coordinated location using the Department’s standard coordinate system and vertical datums described in the Land Surveying Standards and Procedure Manual.

b. All features represented by linear or curvilinear elements shall be drawn using 3D Line strings or 3D Curve strings.

c. All topographic symbols shall be placed using cells from the applicable nyu_plan_(contents).cel cell library or with line styles from the nyu_linestyle_2006.rsc custom line resource file (or latest Department released custom line resource file).

d. Cells and line styles shall be placed at an active scale of 1 for a 1":1" scale B size plot. A scale factor adjustment shall be made for files mapped at any scale, e.g., a scale.
factor of 480 would be used for files mapped at a scale of 1:480 (1"=40’) for a B size plot.

e. Cells and lines styles for features designated as “Scale to Ground” shall be placed at a scale of 1.

f. Baseline alignments, centerline alignments, highway boundary lines, property lines, profiles, and cross sections shall be placed at elevation zero.

g. All text shall be placed at either elevation zero or at an elevation equal to that of the feature it is describing.

h. Text strings shall not overlap each other so that they become unreadable on a plot with all of the levels plotted. Point numbers for surveyed points may overlap.

i. Display of linear features in the topography file shall not be broken to make a text string easier to read. If necessary, place the text string off to the side and use a leader line to point to the location of the feature.

j. Either sign faces or a description of each sign shall be placed with the existing topography.

k. Standard “Manual of Uniform Traffic Control Devices” signs shall show the sign face and should be displayed using the nyu_plan_nmutcd_signface.cel cell library.

l. Nonstandard signs and guide signs, such as business signs, shall have measurements indicating the sign size. The actual face may be drawn or a description of the wording on the sign is acceptable.

20.5.1.2 Proposed Information

All proposed mapping files shall consist of graphic elements representing the proposed topography as designed.

a. Proposed mapping graphics shall be drawn in their coordinated location using the Department’s standard coordinate system and vertical datums described in the Land Surveying Standards and Procedure Manual. Graphic files shall be true three dimensional (3D) files.

b. The supplier shall submit a proposed break line file which accurately represents the intended proposed condition of the project after construction.

c. The proposed break line file shall be created by displaying features from the Digital Terrain Model and this file shall include an exterior boundary of the proposed work. All topographic symbols shall be placed using cells from the applicable ny_plan_(contents).cel cell library or with line styles from the nyu_linestyle_2006.rsc custom line resource file (or latest Department released custom line resource file).

d. Cells and line styles shall be placed at an active scale of 1 for a 1":1" scale B size plot. A scale factor adjustment shall be made for files mapped at any scale, e.g., a scale factor of 480 would be used for files mapped at a scale of 1:480 (1"=40’) for a B size plot.
e. Cells and lines styles for features designated as “Scale to Ground” shall be placed at a scale of 1.

f. Centerline alignments, property lines, right-of-way lines, profiles, and cross sections shall be placed at elevation zero.

g. All text shall be placed at either elevation zero or at an elevation equal to that of the feature it is describing.

h. The legend sheet should be the latest revision available in the nyu_sheet.cel cell library. If the supplier needs to add additional features not provided on the legend sheet, they must submit a modified legend sheet outlining these features to the Project Manager/Job Manager/Consultant Manager as applicable. Features designated on the legend sheet shall not be altered.

i. Standard “Manual of Uniform Traffic Control Devices” signs shall show the sign face.

j. Signs that do not have dimensions detailed in the MUTCD, such as guide signs and business signs, shall have measurements indicating the sign size. In addition, the actual face may be drawn or a description of the wording on the sign may be provided.

20.5.1.3 Profile Information

a. The preferences in the nyu_highway.ini have been preset for profiles drawn to 1”=40’ scale on a B size drawing. The InRoads Scale Factor shall be used to adjust text size for profiles generated at other scales.

b. Existing Ground Annotation shall be font 12. All other text shall be font 11.

c. The left axis annotation will be justified to center right, the right axis annotation will be justified to center left, and the bottom axis annotation will be justified to top center.

d. The scale bar shall be generated using NYSDOT.ma.

20.5.1.4 Details, Typical Sections and Tables

All graphic files containing proposed details, typical sections, and tables shall be drawn to real dimensions to scale, utilizing MicroStation Automatic Dimensioning. Details shall be labeled “Not to Scale”.

Since it is much easier to manipulate table information in a spreadsheet rather than within MicroStation, it is recommended that tables be created in MS Excel and then linked to MicroStation files. Instructions on how to link MS Excel tables to MicroStation files are available on the HDM Chapter 21 internet page.

20.5.1.5 Cross Section Information

a. Existing ground annotation shall be font 12. All other text annotation shall be font 11. Text height will be 7.5”, text width will be 5.6”, and text spacing will be 0.16 for B size
drawings plotted at 1” = 10’ scale. The nyu_highway.ini cross section spacing has been preset to generate 1”=10’ scale B size drawings for cross sections. For cross sections plotted at scales other than 1”=10’ scale B size, the InRoads Scale Factor can be used to adjust text size.

b. Cross sections shall be displayed using the NXSL cell from the nyu_sheet.cel cell library as a border. The preferences in the nyu_highway.ini cross section spacing have been preset to place cross sections with this border automatically.

c. The left axis annotation should be justified to center right, the right axis annotation should be justified to center left, and the bottom axis annotation should be justified to top center.

d. Features displayed on cross sections shall be annotated with the nyu_section_(Level Group).cel cell libraries.

e. The grid interval shall be placed at 2’.

20.5.2 Surface Requirements

The supplier shall use InRoads Civil Suite for all surfaces submitted. All surfaces shall be in InRoads (.DTM) format.

20.5.2.1 Existing Features

A DTM containing existing features shall be representative of the existing ground at the time of the survey/mapping and shall have been field edited. This file shall be feature based, using the feature/code names provided by the Department. The file should be created in a way that the graphics resulting from a display of the features is identical to the project base mapping. If a project contains one or more bridges, supplemental Digital Terrain Models (DTMs) shall be provided for each bridge deck surface. If the surveyed area includes an undercut area or overhang area, supplemental DTMs shall be created to accurately portray the field conditions.

20.5.2.2 Proposed Features

All DTMs containing proposed information shall represent the proposed ground as designed in the contract plans. DTMs should be created in a way that the graphics resulting from a display of the features is identical to the proposed design in the contract plans. DTMs shall be feature based, using the feature/code names as provided by the Department. These DTMs are used to develop cross sections, profiles, and quantities during the design and for layout and quantity verification in the construction of a project. All proposed DTMs shall be developed using the following requirements:

a. The point density interval for break line features shall be set to a maximum of 10 ft to allow for a sufficiently dense proposed surface.

b. Areas with several features, such as curbed areas, intersections, and areas of tight vertical curvature may require a smaller point density interval to accurately represent the proposed surface.
c. The point density interval for break line features shall be set such that the chord height generated does not exceed 0.03 ft.

d. Horizontal cardinal points, superelevation transition points, the beginning and ending of vertical curves, and the beginning and ending of pavement width transitions should all be included in the DTM.

e. The minimum Triangle Length should be set so that triangles do not make erroneous connections.

c. Surfaces shall include an exterior boundary. Inaccurate or extraneous triangles around the perimeter of the proposed ground shall be deleted. Inaccurate triangles include any surface information which does not reflect the actual intended proposed work.

d. Problems encountered when developing the surface shall be corrected by fixing the features in the DTM with the **Edit Feature** commands, and not by modifying or deleting a point used to create a triangle vertex.

e. All existing ground non-triangulated data shall be combined and provided as one comprehensive surface. Similarly, all proposed non-triangulated data shall be combined and provided as one comprehensive surface.

f. Locations that do not meet these requirements shall be clearly identified on the plans and cross sections and in a special note. The note should specify all inconsistencies between the DTM and the project design conveyed in the contract plans, and the rationale for these inconsistencies.

20.5.3 **Additional Data Requirements**

Additional data format requirements for coordinate geometry, survey information, and alignment information are as follows:

a. The supplier shall provide alignments and coordinate geometry points of existing survey. If the supplier is required to provide record plan alignments for the project, alignments shall be entered using coordinate geometry points or computed values rather than picking points from the graphic file. These coordinates of all points and computed values shall be input to four (4) decimal places

b. The supplier shall submit an ASCII file which contains a list of all of the surveyed points. The list of all points shall be in a linear format with no more than one point on each line of the file. Each line shall contain the point number, an X, Y, & Z coordinate, feature coding, and a short description of the surveyed point. Each description shall be readily identifiable using the Feature/Code Names supplied by the Department.

c. The supplier shall submit an ASCII file which contains a listing of Northings and Eastings of all final right-of-way and property line points.
d. The supplier shall submit proposed alignment files which include any and all horizontal control, vertical control, and super elevation shown on the contract plans. Geometry shall utilize Geometry Styles provided by the Department. Geometry information that may have been created during the course of design, but is not part of the contract plans, should be removed from the proposed geometry prior to submitting the file to the customer.

20.5.4 Quality Control of Electronic Data

20.5.4.1 Electronic Data

The supplier is responsible for the quality of the electronic data they create, and may use the same guidelines as the customer to evaluate conformance and quality. The customer may review and comment on the information provided by the supplier to ensure conformance with NYSDOT standards. The customer may run a virus check on every submission before doing any other review. If a virus is encountered, the submission will be returned immediately and the supplier will be notified what virus was found and what software package was used to discover the virus.

20.5.4.2 Graphics

Guidelines to evaluate quality and conformance of the graphics are as follows:

a. Review on a level by level basis to ensure adherence to symbology definitions provided by the Department.

b. View using dynamic view control to examine for elements at incorrect elevations. Elements at incorrect elevations are not acceptable.

c. Analyze for conformance using the information command within MicroStation for conformance with the designated sizes and other designated attributes.

d. Check submitted files for inconsistencies, by reviewing tie points or sign faces to ensure accuracy.

e. Determine if elements are in the correct State Plane Coordinates location using the InRoads Tracking command.

20.5.4.3 Surfaces

Guidelines in the evaluation of Digital Terrain Models (DTMs) are as follows:

a. Display features to look for inconsistencies between features in the DTM and elements shown in corresponding MicroStation base/proposed mapping files.

b. Generate contours and look for inconsistencies, such as a large group of close contours, or pavement areas that do not form Vs with the contours. Where these types of problems are encountered the customer may investigate further before requesting clarification.

c. Review profiles along the approximate centerline of all major roads and streams. The customer may review the profiles for unusual slopes or breaks.

d. Review cross sections from the approximate centerline of all major roads and streams.
e. Cross sections will be done at 10 ft intervals in most areas, and 3 ft intervals in the areas of bridges or culverts. The limit of each section will be the approximate limit of survey. These sections may be reviewed for unusual slopes or breaks.

f. Display the triangles in a new MicroStation file to ensure that erroneous triangles have been removed.

g. Verify surface elevations using survey methods consistent with the accuracy attainable by the original method of collection in consultation with the Regional Land Surveyor.

20.5.4.4 Geometry

a. Display the alignments and coordinate geometry points in a design file to see if they appear in the correct location in relation to the topography.

b. Generate InRoads reports based on the alignments and coordinate geometry points and compare it against the survey notes or plans submitted by the supplier for accuracy.

20.5.4.5 ASCII

The Department may review ASCII files to ensure they are in a format consistent with the file content.

20.6 REJECTION OF SUBMISSIONS FOR ALL ELECTRONIC DATA

Files submitted that do not meet the format requirements outlined in this chapter may be returned to the supplier for correction and resubmission. Upon return of any files, the customer should provide a written explanation of any areas that do not conform. The supplier shall be responsible for finding the source of any error, correcting it, and resubmitting the files.

Any contacts between a consultant supplier and NYSDOT should be done through the Project Manager/Job Manager/Consultant Manager.

20.7 SYMBOLOGY, LEVELS, FEATURES, AND ALIGNMENTS

An element’s symbology is predefined by the Level and/or Feature Style (DTMs) and Geometry Style (ALGs) used to generate it. To be in conformance with NYSDOT symbology standards, a user need only place an element as an InRoads Feature, using the correct Feature Style and/or Geometry Style definition; or place the element with the symbology set to By-Level and choose the correct Level.

Symbology is the definition of how elements in existing or proposed mapping appear visually. Existing or proposed mapping may either be point elements, such as mail boxes, trees, or drainage structures, or be linear elements, such as guiderail, pavement edges, or sanitary sewer lines. Symbols, or cells, are used to display point elements. Linestyles are used to display linear elements. Cells and linestyles each have definitions for color, line weight, and line style. In MicroStation, an element’s level defines what its symbology (color, line weight, and line style) will be. InRoads uses MicroStation to display its DTM and ALG information graphically. In InRoads, a Feature Style (DTMs) and Geometry Style (ALGs) define what level a feature or alignment will have, and therefore define its symbology.
20.7.1 MicroStation Symbology

When an element is placed in a MicroStation file, MicroStation stores coordinate locations of data points used to place the element, and data governing the element’s symbology. In MicroStation, an element’s symbology consists of color, weight, line style, dimension style and text style. MicroStation levels are used to define an element’s color, line weight, and line style.

Existing, proposed, and as-built features/levels typically have the same element attribute symbology, excluding weight. Existing features/levels typically have a weight of 0 and proposed features/levels typically have a weight of 2, as built features have a weight identical to that of their corresponding proposed feature/level.
20.7.1.1 Color

MicroStation stores the active color and the color attribute of each element as a Red, Green, Blue (RGB) value in the 0-255 range. Department defined RGB values for color numbers are outlined in Chapter 22 of this manual. To display an element in color, MicroStation looks in the active color table for the color that corresponds to the element color value. Each seed design file supplied with MicroStation has a color table attached. The user is able to modify colors in the active color table. MicroStation elements shall conform to the color numbers and corresponding RGB values defined in the color table provided by the Department. Adjustments to the color table RGB values on an individual’s PC may be made by staff that are unable to discern a color. Individuals should reattach the standard color table when work on the file is complete.

20.7.1.2 Weight

MicroStation stores the element weight attribute as a value in the 0-31 range. MicroStation elements shall conform to the weight numbers defined by the level libraries provided by the Department. Each weight number has a corresponding width defined in inches. Weight number thickness definitions are provided in Chapter 22.

20.7.1.3 Line Style

A line style definition can specify the following:

- A stroke pattern composed of dash strokes and gap strokes of varying lengths.
- Symbols and lines at varying intervals.

Built in MicroStation line styles (also known as line codes), numbered 0-7, are based on output device coordinates. Custom line styles can also be created. Standard symbology uses both built in MicroStation line styles and custom line styles. The appearance of custom line styles can be affected by both the scale it is placed at and the direction it is drawn in. The appearance of a custom line style is also affected by direction when the line style is not symmetrical. The appearance of a line style will change depending on whether the line is drawn from left to right or right to left. For example, the line style used for cut, the filled in triangle points in the direction of the cut.
20.7.1.4 Level Libraries and Symbology

A level library (or DGN Library) is a listing of available level names and symbology definitions that can be used by each MicroStation file. MicroStation elements shall be placed using the symbology defined by the standard level libraries (placement ByLevel), provided by the Department. The ByLevel option for placing elements used in conjunction with the NYSDOT standard level libraries is the most effective way to ensure file contents conform to the standard symbology defined by the Department.

20.7.2 InRoads Data

InRoads data is the primary component of a project design, it is spatially located using the Department's standard coordinate system and vertical datums, which includes 3D models (DTMs) of existing and proposed ground, and coordinated geometry (ALGs) of the project control. DTM consists of elements (points and lines) that form a framework, which is a representation of the original ground or proposed surface. These points and lines are assigned feature names that contain information about the element. Features can either be used to create the surface ground model, like pavement and sidewalk features (triangulated or contoured); or non-triangulated such as utility lines or drainage pipes (having a 3 dimensional spatial location, but not contoured).

An InRoads project is typically composed of surfaces, coordinate geometry projects, and drainage information as InRoads data files. There are also data creation support files, which are used to create InRoads data, such as typical section libraries, roadway libraries, survey field book data, a general preference file, and a geometry annotation preference file.

The DTM is used to generate the existing and proposed mapping files in MicroStation format. Existing mapping is generated with InRoads Survey. InRoads Survey uses custom operations to place existing text on corresponding comment levels, attribute information to a corresponding attribute level, and to generate point IDs to corresponding point levels. Proposed mapping, which have corresponding feature styles, is generated using the InRoads Surface>View Surface Features command.

The ALG is used to store coordinated geometry for existing and proposed alignments, highway boundaries, and ROW mapping lines; and to display this information in MicroStation format.

InRoads is also used to generate profiles graphics, cross-sections and other necessary tables to produce a set of design documents. By using Quantity Manager an engineer’s estimate can be generated from a DTM and this estimate can be input into Trns*port.
Exhibit 20-3 InRoads Data Workflow
20.7.3 **InRoads Feature and Geometry Style and MicroStation Level Naming Convention**

Features and Levels are grouped into categories defined by use. Systematic naming of Feature Styles and Levels identifies information that shares a common theme and enables the use of filters. The naming convention consists of the following format:

```
category – feature – type
```

### Exhibit 20-4 Explanation of Feature Style and Level Naming Convention

<table>
<thead>
<tr>
<th>Primary Feature and Level:</th>
<th>Description</th>
<th>Example</th>
<th>Example Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level Name/ Feature Name convention</td>
<td>Existing Feature</td>
<td>RGB</td>
<td>Roadway, Guide Rail, Box Beam</td>
</tr>
</tbody>
</table>

**Associated Existing Features and Levels:**

| category – feature – type_A | Existing Attribute, generated from ground survey | RGB_A | Roadway, Guide Rail, Box Beam – Attribute |
| category – feature – type_I | Existing Point Identification number, generated from ground survey | RGB_I | Roadway, Guide Rail, Box Beam – ID |
| category – feature – type_C | Existing text (comment) | RGB_C | Roadway, Guide Rail, Box Beam Guide Rail – Comment |

**Associated Proposed Features and Levels:**


**Associated As Built Features and Levels:**

| category – feature – type_P_Z | As Built Feature | RGB_P_Z | Roadway, Guide Rail, Box Beam Guide Rail, As Built |
| category – feature – type_P_Z_T | As Built Text | RGB_P_T_Z | Roadway, Guide Rail, Box Beam Guide Rail, As Built – Text |
20.7.3.1 Primary Feature and Level Categories

The first character of each Feature and Level name identifies which category it belongs to, and is used to create the category filter.

Exhibit 20-5 Level and Feature Categories

<table>
<thead>
<tr>
<th>1st Character</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Alignment</td>
</tr>
<tr>
<td>B</td>
<td>Bridge</td>
</tr>
<tr>
<td>C</td>
<td>Control</td>
</tr>
<tr>
<td>D</td>
<td>Drainage</td>
</tr>
<tr>
<td>E</td>
<td>Environmental</td>
</tr>
<tr>
<td>G</td>
<td>Geotech</td>
</tr>
<tr>
<td>I</td>
<td>ITS</td>
</tr>
<tr>
<td>L</td>
<td>Landscape, Natural, Terrain</td>
</tr>
<tr>
<td>M</td>
<td>ROW Mapping</td>
</tr>
<tr>
<td>N</td>
<td>Plan Sheets</td>
</tr>
<tr>
<td>O</td>
<td>Object Details</td>
</tr>
<tr>
<td>P</td>
<td>Pavement</td>
</tr>
<tr>
<td>R</td>
<td>Roadway</td>
</tr>
<tr>
<td>S</td>
<td>Signing and Striping</td>
</tr>
<tr>
<td>T</td>
<td>Traffic Control</td>
</tr>
<tr>
<td>U</td>
<td>Utilities, Lighting</td>
</tr>
<tr>
<td>X</td>
<td>Cross Sections and Profiles</td>
</tr>
</tbody>
</table>
Exhibit 20-6 Feature and Level Group Categories

- **L - Landscape Group**
  - Landscape includes a variety of features such as trees, cut and fill lines, walls, mailboxes and fences.

- **R - Roadway Group**
  - Roadway includes curb, sidewalk, snow storage, guardrail, and median barrier.

- **P - Pavement Group**
  - Pavement includes roadway crown, the pavement edge and edge of shoulder, and detour edges.

- **T - Traffic Control Group**
  - Traffic includes Work Zone Control and Signals.

- **A - Alignment Group**
  - Alignment includes project control, alignments stationing, and detour alignments.

- **D - Drainage Group**
  - Drainage includes culverts, ditches, drainage structures, and sections, and headwalls.

- **S - Signing & Striping Group**
  - Signing and Striping includes signs, pavement markings, and sign posts.

- **U - Utility Group**
  - Utility includes gas, water, sanitary sewers, lighting, cable, telephone, oil, fiber optic, etc.

**Other Feature/Level Groups:**
- **C - Control Group** – Includes Survey Baselines.
- **B - Bridge Group**
- **E - Environmental Group**
- **G - Geotech Group**
- **I - ITS Group**
- **M - ROW Mapping Group**
- **O - Detail (Object) Group**
- **N - Plan and Annotation Group**
- **X - Cross Section Group**
20.7.3.2 Feature
The second set of characters identifies the feature. Examples of second characters used to identify features:
- SW - sidewalk
- MB - mailbox
- FNC - fence
- T - tree

20.7.3.3 Type
The third set of characters (if necessary) identifies the feature type. The same letter may be used to identify different types. Examples of third characters used to identify feature types:
- B - Box beam
- C - Cable
- C - Coniferous
- D - Deciduous

20.7.3.4 Associated Features and Levels
Each existing mapping feature/level name has the potential to have a set of three level names associated, if it is generated by ground survey:
- **Attribute** (_A_) – attribute information about the existing feature/level generated during ground survey.
- **Identification Number** (_I_) – point identification number generated during ground survey.
- **Comment** (_C_) – existing text associated with the primary existing feature/level.

Generally each existing mapping feature/level name also has a proposed feature/level name associated:
- **Proposed** (_P_) – the proposed feature/level.
- **Proposed Text** (_T_) – text associated with the proposed feature.

*Not every feature has an existing, proposed, and as built level.*

20.7.3.5 Details, Plan Annotation, Cross Section and Profile Level Groups
The Object Details, Plan Sheet, Cross Section and Profiles categories typically have primary (_P_) and text levels (_T_) associated with them. These categories will only have a feature style if their symbology is generated using InRoads features (e.g. surfaces displayed on cross sections). **InRoads Feature Names and Descriptions (and Geometry Styles, if applicable) are identical to MicroStation Level Names and Descriptions.**

20.7.4 Filters
Filters allow for an effective way to sort and display similar information, such as all existing text, or all proposed text, or only the pavement items, or only the landscape items. Level filters are an important component to working efficiently with Levels. Standard filters have been created in each level library to allow for the quick and efficient sorting of information.
20.7.5 **Cell and Linestyle Naming Convention**

Cell names are identical to the level/feature style name for the existing feature it represents. For example, the cell name for an existing deciduous tree would be LTD (Landscape, Tree, Deciduous) which is identical to the level name. Each cell’s attributes are assigned ByLevel. Therefore, to place a proposed deciduous tree, a user would select the cell, LTD, and place the cell on the LTD_P (Landscape, Tree, Deciduous, Proposed) level. The cell automatically adopts the level’s symbology.

Linestyle names are also identical to level/feature style names for the existing feature it represents. For example the line style for existing box beam guiderail is RBG (Roadway, Guiderail, Boxbeam) and this line style is used for both existing and proposed guiderail.

20.8 **INROADS DATA NAMING CONVENTION**

In the past, typically one staff member has been responsible for InRoads related work on a project. Now more staff members are familiar with the use of InRoads, and typically will need to work with InRoads data. A systematic method of naming InRoads data increases its usability, provides an organized method to work more efficiently, and allows for a smooth transition of InRoads data between project contributors.

20.8.1 **Feature Naming Convention**

Features are an important part of a project design, they allow for modeling, estimating, cross section, profile, and plan display. It is important to be able to filter groups of features, not only by style, but by project control, for estimating. The format for features in a Digital Terrain Model (not created by Survey or Photogrammetry) is as follows:

```
name_style_short description
```

**e.g.**

```
370_pe_p_lt_1  - Route 370, paved edge proposed, left, number 1
9w_rbs_p_rt_2  - Route 9w, roadway buffer proposed, right, number 2
```

20.8.2 **Alignment Naming Convention**

Alignments are also an important part of project design, and all alignments used for project control, highway boundaries, and ROW lines should be named in a way that clearly defines what information they contain so they can be effectively used by other design staff and customers. The format for naming horizontal and vertical alignment names contained within an InRoads Geometry file is as follows:

```
name_style_short description
```

**e.g.**

```
370_ac_p        - Route 370, alignment control, proposed
9w_pe_p_rt     - Route 9w, paved edge, proposed, right
```
20.8.3 **Template/Typical Section Naming Convention**

Using InRoads templates/typical sections is one method of creating a surface along an alignment or feature. Templates/typical sections are created for a specific alignment, and are utilized in creating the basic model of the roadway. Templates/typical sections can also be used to model roadside treatments. When working with InRoads templates/typical sections, maintaining an organized method of naming helps facilitate the roadway design process, which is often iterative in nature, and makes design adjustments straightforward. It is also important to associate each typical section with its corresponding project control. The format for naming templates in a typical section/template file is as follows:

Alignment name_short description

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>370_ac_p_cl</td>
<td>Route 370, proposed, centerline</td>
</tr>
<tr>
<td>rsw_p_rt</td>
<td>Sidewalk, proposed, right</td>
</tr>
<tr>
<td>ddt_p_a</td>
<td>Drainage ditch, proposed, type a</td>
</tr>
</tbody>
</table>

20.8.4 **Roadway Naming Convention**

InRoads Roadways/Roadway Corridors define ranges of stations where a typical section/template is used. Much like InRoads typical sections/templates, maintaining an organized method of naming Roadways will help facilitate the roadway design process and make design adjustments easier. InRoads Roadways/Roadway Corridors should be named identical to their corresponding alignment and the Roadway/Roadway Corridor description should include applicable station ranges.

Alignment name

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>370_ac_p_cl</td>
<td>Route 370, proposed, centerline, roadway</td>
</tr>
<tr>
<td>9w_pe_p_rt</td>
<td>Route 9w, paved edge, proposed, right, roadway</td>
</tr>
<tr>
<td>12_ad_p_stg1</td>
<td>Route 12, alignment detour, proposed, stage 1, roadway</td>
</tr>
</tbody>
</table>

20.9 **DRAFTING STANDARDS**

Drafting standards work in conjunction with MicroStation attributes to ensure the uniform appearance and reproduction quality of CADD data presented on contract plan sheets, standard sheets and bridge data sheets; and advance the sharing of electronic information. CADD files shall conform to all aspects of this chapter. This includes files created by Photogrammetry, Survey, Design, Structures, ROW Mapping, Construction, and Geotechnical Engineering, used to produce Standard Sheets and Bridge Detail Sheets, and files created by all other Department or Consultant Suppliers of CADD information.

20.9.1 **Working Units**

MicroStation uses working units to define and display real world coordinates and dimensions. MicroStation master units shall be set to standard units, survey feet and the subunits shall be set to standard units, inches. Each model within a design file has a unique coordinate space defined by its working units. The units shall be labeled as ‘(feet) and “(inches).
Nearly all design mapping is based upon one of four zones within the New York State Plane Coordinate System of 1983; 3103(West), 3102(Central), 3101(East) or 3104(Long Island). A coordinate location may exist in more than one zone, so the zone must be identified by the mapper. The concurrent display of the entire State requires translation to a modified Universal Trans Mercator (NYTM) system, which is the basis for the Department's Quadrangle and GIS mapping. Coordinate Geometry operations (creating alignments, ROW lines, identifying stations and offsets, northing and easting etc.) should be performed using InRoads Civil Suite.

Seed documents are empty MicroStation files which MicroStation copies to create new design files with standard settings (i.e., working units, global origin, etc.). Standard seed documents have been created for working in 2D and 3D. All project related MicroStation documents, Standard Sheets, and Bridge Detail Sheets shall be created utilizing Department standard seed documents. (Standard metric working units are defined in Department seed documents for projects utilizing metric units.)

20.9.2 **Cells**

MicroStation utilizes cells. A cell is a frequently used drawing containing a grouped set of elements with or without text that can be manipulated as a whole or in part. The Department has cells that represent point symbology, like trees and utility poles. There are two important aspects of placing point cells:

1. Set the level you wish to place it on. The point cell “picks up” its symbology from the level.
2. Set the scale. Cells are not controlled by Model Annotation Scale.

There are also cells used as drawing borders, and frequently used details. The levels and symbology are predefined for these cells. They are typically drawn to 1”=1’ scale.

20.9.2.1 **Cell Selector**

The cell selector command in MicroStation, from the Main Menu Utilities > Cell Selector, provides additional capabilities when working with cells. In the Cell Selector dialog box, each button is associated with a cell stored in a cell library. In the dialog box’s default button configuration, clicking a button has the effect of activating the associated cell and selecting the Place Active Cell tool. The cell selector dialog box can be resized and customized with buttons for cells from different cell libraries. Cell selector is a useful tool for creating custom cell libraries of frequently used cells from various libraries. These customized libraries can be saved as cell selector files (.csf) for later use. Cell selector can also be used to quickly view all the cells contained within a cell library.

20.9.2.2 **Cell Library Utility**

The cell library utility (cellutil.ma) provides additional capabilities when working with cell libraries (e.g., the ability to quickly generate plots of cell libraries, and lists of the individual cells contained within a cell library). To load the cellutil.ma, choose Utilities > MDL Applications from MicroStation’s Main Menu. Then, in the MDL dialog under Available Applications, tag
the Browse button to open the Select MDL Application dialog. Select cellutil.ma located in the c:\NYSDOTCADD\Bentley\Workspace\Standards\mdl\ folder from the list box and OK to open the Cell Library Utility. To operate the Cell Library Utility, select the Tag All button, then choose from the available options under the tools pull down menu.

20.9.3 **Scale, Plot Ratio, and Media Size**

Scale, plot ratio, and media size are interrelated. The media size is the paper size that the printer or plotter uses. Typical paper sizes include A size (for use with projects without plans), B size (used for final plan submission), and D size (larger media size for meetings and public hearings). Media sizes and uses are illustrated in Exhibit 20-8. The scale of a plot, or plot ratio, determines the size of the information shown on a plot. The paper size should be determined by what the plot is to be used for, and the plot sent to a printer that accommodates the corresponding paper size. The B size plot ratio is double the D size plot ratio. Therefore the information shown on a B size plot is half the size of information shown on a D size plot, and B size paper is half the dimensions of D size paper.

**Exhibit 20-7 Relative Media Size**

\[
\begin{array}{c}
A \\
1 \text{"A" size sheet} \\
\hline
A & A \\
2 \text{"A" size sheets} \\
\hline
B \\
1 \text{"B" size sheet} \\
\hline
B & B \\
4 \text{"B" size sheets} \\
\hline
D \\
1 \text{"D" size sheet} \\
\end{array}
\]
Exhibit 20-8 Media Size and Use

“A” size (Letter) =
use for proposals

“B” size =
use for final plan submission

“D” size =
use for plans for meetings and public hearings

Most Roll Feed Plotters =
use for printing “D” size paper and printing plots of variable length

Large Format Printer

Paper Roll

Y = Approximately 36”

length of plot

X = Varies
CADD STANDARDS AND PROCEDURES

The scale of the plans and profiles will vary from project to project, and with the type of plan set (i.e., general plan, profile, pavement marking plan, etc.). Criteria for scale selection are as follows:

a. The plans are readable on B size paper.
b. The plans are developed in sufficient detail to assure the design is feasible.
c. Existing and proposed work is distinguishable.
d. Projects in urban areas or bridge replacement projects are typically prepared using 1” = 40’ B size scale (1:480).
e. Projects in rural areas are typically prepared using 1”=50’ B size (1:600) or 1” = 100’ B size scale (1:1200).

20.9.4 Mapping Scales

In general, cells and linestyles that represent existing and proposed mapping are scaled by the scale factor when placed. Line styles and cells which are constructed to specific dimensions (e.g. Striping dashed lines, concrete barrier, railroad tracks, drainage structures, etc.) should not be scaled. Other than its symbology, existing and proposed mapping represent precise locations, sizes and limits. The larger the scale factor, the smaller this information will appear on a plot and the smaller the scale factor, the larger mapping information will appear on a plot. For example mapping information shown on a 1”=40’ (1:480) B size plot will be larger than mapping information shown on a 1”=100’ (1:1200) B size plot; therefore more detail can be shown on a 1:480 plot, and it will take more plan sheets to encompass the area of work.

Exhibit 20-9 Relative Mapping Scales
20.9.5 **MicroStation Models**

A DGN file is composed of models. When elements are placed in the file, the elements are placed in the active model. Each model has its own Annotation Scale. **The Model Annotation Scale is used to set and adjust the scale of text and dimensions.** A new file contains a default model. Other models can be created in the same design file. There are two types of models:

- **Design Model** - can be either 2D or 3D. A design model can also be used as a reference or placed as a cell. In MicroStation, you can create an unlimited number of design models in a DGN file.

- **Sheet Model** - paper space, usually 2D, these models are most commonly used to compose finished and annotated drawings. MicroStation allows you to create an unlimited number of sheet models per DGN file.

When drafting details, models should be used to draft a detail 1 to 1 (and often 3D). These models may including various views (front, top, left, right, etc.), and may then be attached as a reference to a sheet border and annotated with the reference of the view scaled as needed.

20.9.6 **Text and Dimension Scales and Sizes**

Text and dimensions are drawn proportional to the scale of a plot. Therefore no matter what plan scale is chosen, the size of the text and dimensions on the printed B size plot will always be the same. Text and dimensions are scaled according the MicroStation annotation scale inside the MicroStation file.

Standard text size shall be 1/16” height text for a B-size drawing. Line spacing for text shall be one half the text height. Dimension arrows shall be 9.4” long by 4.5” wide when using a 1” = 10' scale plot ratio (B-size drawing). Dimension arrows are adjusted proportionally for other scales. The length of dimension arrow is 1.25 multiplied by the text height and the width is 0.6 times the text height. Text and Dimension sizes, spacing, arrow sizes, and fonts are predetermined by using the configurations and resources provided by the Department. **Selection of the correct Text Style or Dimension Style in conjunction with the NYSDOT standard dgn libraries is the most effective way to ensure file contents conform to the standard text and dimension requirements defined by the Department.**
20.9.7 **NYSDOT Standards Tool**

The Department provides a MicroStation utility, nysdot.ma, which includes a variety of productivity enhancing tools. One of these tools, **Text and Dimension Settings**, is accessed from the MicroStation Main Menu, by choosing, **Tools>NYSDOT Standards>Text and Dimension Styles**. To place text adhering to NYSDOT standards:

a. Set the **Model Annotation Scale** to the appropriate scale and make sure the Annotation Scale lock is on.

b. If the text is plan view text, set the active level to the appropriate text level for the feature the text is describing. (E.g. for text describing the position of proposed box beam guiderail, choose RGB_P_T).

c. If the text is for details **Text and Dimension Settings** sets the level automatically.

d. Choose N, T, or S from the **Text and Dimension Settings**, for Normal, Title, or Subtitle Text.

e. Select the appropriate **Text Style** (Existing, Proposed, As Built, or Detail).

f. Use the **Place Text** command and begin placing text.

To place dimensions adhering to NYSDOT standards:

a. Set the **Model Annotation Scale** to the appropriate scale and make sure the Annotation Scale lock is on.

b. If dimensioning plan view information, set the active level to the appropriate text level for the feature being dimensioned (E.g. to dimension a proposed culvert, choose DCP_P_T).

c. If the dimension is for details, **Text and Dimension Settings** sets the level automatically.

d. Choose Set Dimension Style, Set Dimension Style – Place Note, or Set Dimension Style – Lanes (Plan Only) from the **Text and Dimension Settings**.

e. Select the appropriate **Dimension Style** (Plan or Detail).

f. Use the **Dimension Element** command and begin dimensioning.

20.9.8 **Text Styles**

A text style comprises a group of text attributes that enable the user to place text within a model in a consistent and automated manner. Text attributes include the font, size, and spacing.

20.9.9 **Dimension Styles**

A dimension style comprises a group of dimension attributes that enable the user to place dimensions within a model in a consistent and automated manner. Dimension attributes include the arrow size and shape, the unit format, and spacing.
20.9.10 **Fonts**

The font is set by the text style; additional guidance regarding the use of fonts is as follows:

Fonts used for Details, Existing, Proposed and As-built mapping, Fonts 11, 12, and 13, contain the lowercase characters needed to label common units, such as ft and in. Special characters are available to square or cube these units. Use “q” to square a unit and “r” to cube a unit. For example; “ftq” will appear as “ft².

Fonts 7, 8, and 9 contain characters that are used to generate symbols with text. Exhibit 20-10 presents the symbols frequently used during plan preparation and the corresponding character listed in Exhibit 20-10 (generally a lowercase character). These are drawn by using the Place Text command in MicroStation and can be combined with the corresponding text font (10, 11 or 12).

### Exhibit 20-10 Symbol Key Characters – Fonts 7, 8, 9

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>B</td>
<td>b</td>
</tr>
<tr>
<td>Centerline</td>
<td>C</td>
<td>c</td>
</tr>
<tr>
<td>Property Line/Plate</td>
<td>P</td>
<td>p</td>
</tr>
<tr>
<td>Main Line</td>
<td>M</td>
<td>f</td>
</tr>
<tr>
<td>Plus/Minus</td>
<td>±</td>
<td>u</td>
</tr>
<tr>
<td>Degree</td>
<td>°</td>
<td>n</td>
</tr>
<tr>
<td>Delta</td>
<td>Δ</td>
<td>q</td>
</tr>
<tr>
<td>Diameter</td>
<td>φ</td>
<td>d</td>
</tr>
<tr>
<td>Greater than/Equal to</td>
<td>≥</td>
<td>w</td>
</tr>
<tr>
<td>Less than/Equal to</td>
<td>≤</td>
<td>l (alpha)</td>
</tr>
<tr>
<td>Infinity</td>
<td>∞</td>
<td>i</td>
</tr>
<tr>
<td>One-third fraction</td>
<td>⅓</td>
<td>` (Accent/Grave)</td>
</tr>
<tr>
<td>Perpendicular</td>
<td>⊥</td>
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<td>Square</td>
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<td>Square Root</td>
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<td>Subsection</td>
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<td>y</td>
</tr>
<tr>
<td>Half-Space</td>
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<td>v</td>
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</tbody>
</table>
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CADD STANDARDS AND PROCEDURES

20.10  PUBLISHING CONTRACT PLAN INFORMATION

Contract Plan sheets shall be published as PDF Documents. To improve legibility, all plan sets (i.e., General Plans, Drainage and Utility Plans, WZTC Plans, etc.) shall utilize gray scale base mapping and all utility information shall be displayed using the standard color assigned to each particular utility. Utility information shall be displayed in color on plan sets only and not on details, typical sections, profiles, etc.

In the past, the utilization of grayscale base mapping and shading have been discouraged due to the poor legibility of copies created from the originals. With printing and copying technology improving in recent years, as well as the increased availability of electronic plan sets from which new prints can be made, this is no longer the problem it once was. Because of the benefits gained in plan legibility, it is now required that base mapping be printed in grayscale and the use of gray shading, where appropriate, is encouraged. Instructions on how to plot color utility information, and use grayscale base mapping and gray shading are available on the NYSDOT HDM Chapter 21 internet page.

Due to the large number of hard copy prints that are required for each contract and the prohibitive cost associated with providing color prints, the designer shall also provide (in addition to the color PDF discussed above) a black and white PDF document of the sealed Contract Plans as supplemental information for printing purposes. This set will still require grayscale base mapping, but all utility information will be displayed in black and white instead of color.

All Contract Plan sheets should be printed to a minimum resolution of six hundred dots per inch (600 dpi).

20.10.1  The Plotting Process

Plotting within the Department is accomplished using network plotting software called InterPlot Client and ProjectWise Plot Server. Plots are sent (by a user) using the InterPlot Client software, to a queue on a server running the ProjectWise Plot Server software. The receiving server then directs plots from the queue to a plot device (printer). A queue is a waiting line of plot requests residing on the server that distributes the requests to the plot device.

20.10.2  Color Tables and Pen Tables

Using the standard color tables and pen tables provided by the Department is the most effective way to ensure published information conforms to the standard text and line weight requirements defined by the Department.

Color tables are used to determine the color of a plot. The Department’s standard color tables are outlined in Chapter 22 of this manual. The user can select which color table is attached to a plot. The two color tables which should be used most frequently are ny_bw.ctb, to plot black and white prints, and ny_color.ctb to plot color prints. These tables are consistent with the standard colors outlined in Chapter 22 of this manual. Adobe PDF documents can be created either in color or black and white using these tables.

Pen tables are used to define line and text width on a plot. The Department’s standard pen tables are outlined in Chapter 22 of this manual and shall be used to plot contract plans, ROW
maps, and cross sections. These pen tables set the line and text widths to the values stated in Chapter 22 of this manual. In addition, the pen tables also programmatically place the file name, user name, and date on the margin of the plan sheet. For contract plan sheet production, the two pen tables which should be most frequently used are ny_b_basic.pen, to plot black and white prints, and ny_b_gray_colorutil.pen to plot grayscale with color utilities prints. Each Pen tables whose name starts with “ny b ” are intended to be used for plotting to ANSI A, B, and D paper sizes. Pen tables whose name starts with “ny e ” are intended to be used for plotting to ANSI E paper size and other presentation display materials (sets the line thicknesses for better viewing from a distance). Pen table is named according to the paper size it is intended to be utilized with (i.e., A_size.pen, B_size.pen and D_size.pen).

For miscellaneous printing needs, to plot the colors as they are displayed on-screen (WYSIWYG), use the ny_b_fullcolor.pen or ny_e_fullcolor.pen pen table. If it is desired to print in full color but to have any utility features plot to the adjusted colors used for to display them on production plan sheets (not WYSIWYG), then use the ny_b_fullcolor_colorutil.pen or ny_e_fullcolor_colorutil.pen pen table. For all of these full color pen tables, the color 0 (white) and color 4 (yellow) are set to plot as black. To plot yellow or white, it is recommended to change the feature’s color to a different but very similar color (i.e., a slightly different shade/tone of white or yellow).

Other legacy special-use pen tables such as include no_yellowb.pen and no_yellowd.pen for plotting yellow as black on color B size and D size plots, or In addition, wt2thick.pen is available for plotting line weights which are twice as wide as those defined in Chapter 22 of this manual continue to be made available. These special use pen tables are alternate options for can be used to generating plots for meetings and public hearings.

20.10.3 InterPlot Organizer and Publishing to ADOBE PDF

InterPlot Organizer allows the user to quickly create and submit multiple plots from a MicroStation file or from several MicroStation files. InterPlot Organizer automatically recognizes the plan sheet border to create a plot. Adobe PDF documents can then be created directly from MicroStation using InterPlot Organizer. Adobe PDF is an excellent method to provide MicroStation information to non-CADD users and the general public or for electronic distribution.

The user should plot groups of MicroStation files using InterPlot Organizer and save the information about those plots in an IPlot Set file (*.ips). InterPlot Organizer also allows the user to edit plot sets (i.e., remove or add plots, change scale or size). Users should create an *.ips file for each group of drawings (e.g., details, typical sections, traffic control plans, general plans, utility and drainage plans, profiles, etc.). In addition, users should create an *.ips file which contains all of their contract plans in order, changing the plot description to the drawing number for easy reference. The user should also use InterPlot Organizer to plot cross sections or groups of cross section, changing the plot description to the station for easy reference.

20.10.4 Quantity Manager and Exporting to Trns*port Estimator

Quantity Manager is a project estimating software that allows the user to assign pay items directly to the feature properties of a project’s InRoads digital terrain models (DTMs) and/or Microstation graphic elements, and then produce an estimate based on the pay item assignments. The user can easily manage and assign pay items and quantity measurement
formulas to InRoads surface features using Quantity Manager. Pay items and pay item formulas are stored in a standard database (nyu_pay_item.mdb) which may be edited by the user to include project specific pay items. Project quantities may be computed at any phase of a project once surface features are created and assigned pay items and quantity formulas. The computed quantities are stored in a separate Quantity Manager output database (PIN#_fea_qm_out.mdb). Pay items and quantities may also be manually entered into the output database for pay items that are either not included in or cannot be computed from InRoads surface features (e.g. lump sum items, mobilization, earthwork, equipment, etc.).

The user can export the Quantity Manager output to the Trns*port Estimator program to generate the Project Engineer’s Estimate. The Quantity Manager output database should first be exported to an *.xml file format which can be imported into the Trns*port Estimator program. Prior to completing the file transfer from QM to Trns*port, the user should ensure that all of the pay items in the Quantity Manager output database exactly match the pay item codes of the Trns*port Estimator program. The user may browse and connect to the Trns*port database (aecXML Infrastructure v33) to edit and update any of the pay items that may not match. Once all pay item corrections are made, the user should enter the required project information (work type, highway type, season, county, etc.), add the appropriate contingency, enter the price information and then calculate the project cost using the Trns*port Estimator program.