

5. Plotting at Caltrans

5.1 Why Do We Plot

Caltrans uses plotting to produce a hard copy of CADD files for checking and reviewing a project throughout the life of the project. Plotting is most notably used when a project is finalized and is made ready for advertising. Plotting is also used to produce map displays for public hearings as well as capturing and documenting the completion of a particular phase of a project.

5.2 Interplot Plotting

A. Overview

Interplot software is a Bentley Corporation product and is the official plotting solution for all Final Contract Plans at Caltrans. Interplot works within a Windows environment. It requires software and printers to be installed on a plot server and client software to be installed on each workstation that utilizes Interplot.

B. Why a Single Plotting Solution

Interplot offers a convenient user interface both inside and outside of MicroStation for creating plots and saving plot sets for later processing. It also allows for easy creation and management of batch plotting.

A single plotting solution minimizes technical support and ensures uniform quality plotting statewide. It also allows for centralizing of resource files and settings files to produce the same quality results for all users.

Caltrans Office of Office Engineer (HQ-OE) issues Final Contract Plans to the public. For each design file (.dgn) submitted to Office Engineer, an Interplot parameter file (.i) must accompany it in order for the plan sheet to plot exactly as intended. One plotting solution allows for statewide consistency and accuracy.

C. Using Interplot at Caltrans

Each workstation needs to be on a domain network, which allows the user to create network attachments to printers that reside on the Interplot server within the district. District computer support is responsible for configuring and maintaining Interplot for their district, which also includes the settings and resource files for plotting.

5.3 Term's and Definitions

Interplot Organizer

Is a Windows application that runs outside of MicroStation. It allows batch plotting for a variety of different types of files, such as MicroStation (dgn), AutoCad (dwg) and raster image file formats such as TIFF and JPEG. Plot requests are added by selecting the CADD files, Image files or Plot parameter files (such as iparms) via the supplied browser.

lparm (*.i)

Stands for "Interplot parameter file". It contains instructions on how to process a single plot request for a single MicroStation design file (dgn). It contains information such as; which design file region, levels and display attributes will be plotted. It also lists which pen table is to be used in order to further control the look of the plot. These files are usually created while in the design file using the "save" command from the "lplot-Main" dialog. Organizer can then be use to read in these iparms for batch plotting at a later time.

Note: Creating lparms for PS&E is covered under section 5.5 in this manual.

Interplot Plot Set file (*.ips)

Contains a set of individual plot requests packaged into a single file, including all parameter settings for each plot request.

Note: Caltrans HQ-OE does NOT accept PS&E submittals with "ips" files. HQ-OE only accepts lparm "i" files because it makes file management easier at the time of submittal in that each design file will have a matching lparm with the same name.

Settings files (*.set)

Settings files contain default plotting parameters such as specifying a pen table, form size and display attribute settings.

They can be categorized as follows:

1. Automatic settings – The setting file named “lplot.set” found in the “auto” subdirectory is always read when opening Interplot Organizer and applied when adding plot requests involving MicroStation design files. “lplot.set” is also applied upon initiating the “lplot-Main” dialog within MicroStation. This file is meant to contain default settings that would be desirable no matter which plotter is to be use.

Note: Caltrans utilizes this file to turn off undesired display attributes like construction elements and ‘fast’ displays (such as ‘fast cell’ and ‘fast text’).

2. Printer settings – Settings files can be set up with names that correspond with existing printer queues so that when a particular printer queue is selected, it’s corresponding settings file will be applied. These settings files reside in the “auto” subdirectory and are mainly used for setting up the most commonly used form size, plot size and pen table for each particular plotter/printer.

The pen tables that are usually set up are as follows:

Full-sized monochrome plotters	-	“fullbw.pen”
Small monochrome printers	-	“halfbw.pen”
Full-sized color plotters	-	“fullclr.pen”
Small color printers	-	“halfclr.pen”

3. Manual settings – Any user may create settings files for a specific purpose. By default they will normally be located under the “manual” subdirectory. These settings files are manually selected by a user and are normally used for additional functions such as defining plot regions via a pre-defined shape.

Meta files

A Meta file (.m) is temporarily created when submitting a plot request from within MicroStation or the DOS command line. This Meta file contains information from the active design file, any reference files, and pen table information controlling the plot when sent to the plot server.

Direct Meta files

A Direct Meta file (.dpr) is temporarily created when submitting a request from within MicroStation or the DOS command line that contains raster reference attachments. This does not refer to imported images in a design file, which are stored as MicroStation elements when they are imported into the design file. Direct Meta files are necessary because Interplot handles design and raster information differently.

Print Driver

In basic terms, a print driver is a translator between the plotting software and the plotting device. Interplot supports various plotters with their own enhanced print drivers. Other vendor supplied print drivers can also be used since Interplot uses Windows print services. An administrator sets up print drivers at the time of creating the printer queues on the plot server.

Integrate

Integrate is a feature of the Interplot client application which allows the user to select the CADD product that will submit the plot. Integrate is accessed via the "Integrate" button on the "Interplot Client Configure" dialog.

Translucent plotting

Translucent plotting allows the user to tint or colorize an area without obscuring the underlying image or element. Interplot plot drivers support the translucent function, which is accessed via commands in the pen table.

5.4 Accessing Interplot

There are 3 ways that Interplot can be accessed.

A. Within MicroStation via "Iplot-Main" dialog:

This is best used for creating Iplot parameter files (iparms) or creating single preliminary "review" plots. Interplot is accessed by selecting "Iplot" under the Microstation File pull-down, typing "Iplot" at the Microstation command line or by selecting the "Iplot" tool icon.

B. From Windows via "Interplot Organizer":

Organizer utilizes the "iparm files" for batch plotting MicroStation design files. It allows one to quickly organize and send batches of plots. Besides MicroStation design files, it supports various other file types such as AutoCad files, TIFF and JPEG. Organizer is accessed via the Window's start bar "Start >Programs >Interplot Utilities >Interplot Organizer for Microstation J"

C. From the DOS command line:

This requires that you have knowledge of the Interplot command line syntax. A user can create, modify and submit Iparms from the window's DOS command line. Caltrans has mainly made use of this functionality to enable scripts that modify "Iparms" in batch mode.

5.5 **Creating Interplot Parameter Files (iparms) for PS&E**

One Interplot parameter file (lparm) needs to be submitted for each Final Contract Plan sheet (1 design file “dgn”) submitted at PS&E. Iparms should be created after the design file naming convention has been applied to the contract plan sheets. This will avoid the need to modify or create new lparms. Changing the name of a design file after creating the lparm makes the user have to modify the original name of the design file, that is stored in the lparm, to the new name.

The following procedure is recommended:

1. Open the design file and fit the border sheet with the proper view parameters (zero degrees rotation).
2. Place a fence exactly around the cut lines of the border sheet.
3. Open the “lplot-Main” dialog box.
4. Select the plotter that will accommodate a full-sized 22” x 34” plot. This is the official size of all contract plan sheets at PS&E.
5. Check that the correct size (22” x 34”) is displayed in the Paper Size field.
6. Under the “Select Plotting Files” option, make sure the correct Pen Table is selected (fullbw.pen).
7. Use the “File >Save” pull-down command in the “lplot-Main” dialog to save an “lparm”. The new lparm will either appear in the same directory as the design file or in a default directory depending on how Interplot is configured. If the “lparms” are in a default directory, the user should copy the lparms to the same directory where the design files are located. This will allow the user to utilize the correct lparm throughout the design stage.

5.6 Plotting to Tiff image files

A. Primary function of the “Tiff Output” queue:

Tiff Image files are created at final PS&E by HQ-OE and submitted to the state reprographic department, which uses them to print the final bid books. For Authority to Advertise District Delegation (AADD) projects, district OE needs to create Tiff Image files before submitting the project as AADD qualified.

B. How to plot to a Tiff image file:

Caltrans has established a printer queue on most of the Interplot servers named “Tiff Output”. Instead of printing an actual plot on paper, this printer queue will create a Tiff image file at a pre-designated directory on the plot server, (usually “\\plot server name\TiffOut”).

Note: This printer queue is usually for final PS&E work but other queues may be set up on the plot server for other purposes.

C. Standard Properties of Tiff Images generated by “Tiff Output”

Tiff image files should have the following properties when submitting projects to HQ-OE or the state reprographic department.

File format:	400 dpi Monochrome Tiff
Compression:	CCITT group 4
Size:	22” x 34”

5.7 Things to watch out for when using Interplot

1. Do NOT create “Iparms” that utilize UNC protocol “\\” for navigating to a directory containing the design files. This may cause major slow downs with the computer when another district or HQ uses these “Iparms”. You should open your design files by browsing to a drive letter. You may need to “map a network drive” if you cannot browse to your files using a drive letter.
2. It is recommended to always use Iplot’s browser when handling files. This enables Interplot to find corresponding design files that reside in the same directory as the Iparms when a different directory was originally listed in the Iparm. This might happen when moving files to another directory during PS&E submittals.
3. When sending a request to an “offline” raster output queue, via Organizer, to create Tiff image files, you should select “separate print jobs” under the “submit plots as” section. “Separate print Jobs” creates one Tiff image file per sheet. “One print job” (which is the default) will result in creating one Tiff image file with all the sheets in it.
4. Interplot has an auto align function that functions in one of two ways depending on configuration.
 - It may align to the closest axis, in which case it may not necessarily plot right side up (“I PLOT_ALIGN_METHOD = parallel”).
 - It can also align to the direction of a fence or plot shape (“I PLOT_ALIGN_METHOD = coincident”).
5. Plotting raster images requires Interplot 10.01 or later. (MicroStation Print/Plot can also be used for raster plotting).
6. Plot requests that contain raster reference attachments are processed differently than a design file that has an imported image. A Direct Meta file (.dpr) is generated instead of a Meta (.m) file. A (.dpr) file uses the font and line style resources loaded on the client (workstation) instead of the plot server’s resource files.

5.8 **MicroStation Print / Plot**

A. Overview

MicroStation “Print / Plot” refers to the printing solution that is packaged within MicroStation and is accessed by selecting “Print / Plot” via the MicroStation File pull-down. MicroStation “Print / Plot” is primarily used to plot raster images (especially long display maps). MicroStation “Print / Plot” is not to be used for PS&E submittals.

B. Using Print / Plot at Caltrans

Print drivers are supplied as part of the standard Caltrans MicroStation load. Some drivers and pen tables approximate the plotting functions that are in the Interplot pen tables.

Recommended settings:

- For general printing use “printer.plt”
- To approximate Interplot plotting, use “printer_CT_full.plt” along with pen table “CT_dropout-bw.tbl”.

Note: When using Descartes to plot raster images, you must use the Descartes supplied print drivers.

5.9 Caltrans Pen Tables

A. What is a Pen Table

Pen Tables are files that contain instructions that are supplied to the plotting application to control how certain elements are to be plotted. Usually the plotting application allows the user to choose which pen table is appropriate when creating a plot request.

B. The History of the Caltrans Pen Tables

Caltrans established certain plotting standards for roadway drawings back when CADD was first introduced in 1987. The most noticeable feature of the Caltrans roadway pen tables is the changing of all elements on levels 2 through 9 and 11 to a fine dotted pattern. These levels are commonly referred to as “dropout levels”, which contain existing design information. This simulates the “screened out” affect that was used by the reprographics department on non-CADD drawings. Another feature is the adjustment of line weights. Weighted lines are reduced if they are on a dropout level. This allows the proposed design information to stand out more boldly against the existing design information.

C. The Standard Caltrans Roadway Pen Tables

Caltrans has 4 standard pen tables. All 4 are based on the same plotting logic and process files in the same way. Full-Size plotting is 22” x 34”, which is the standard size for all Final Contract Plans at PS&E. Half-Size printing is used to review and check plans at various milestones.

The 4 standard pen tables are listed below:

Fullbw.pen	For Full-Size plotting (22” x 34”) in black and white. Is always used for the final PS&E drawings.
Halfbw.pen	For Half-Size printing (11” x 17”) in black and white. Line weights and patterns are reduced to simulate a half-size reduction.
FullClr.pen	For Full-Size plotting in color. (A gray scale affect will result when submitting to a black and white printer/plotter).
HalfClr.pen	For Half-Size printing in color. (A gray scale affect will result when submitting to a black and white printer/plotter). Line weights and patterns are reduced to simulate a half-size reduction.

D. Functions and Features of the Caltrans Standard Pen Table

DROPOUT

1. Converts all elements on Levels 2-9,11 to the specified 'dropout' pattern, as long as the color of an element is not 101 thru 116.

Note: Colors 101 thru 116 are used when one wishes not to dropout an element that resides on a dropout level.

2. Converts all elements with color 85-100 to the specified 'dropout' pattern.

Note: Colors 85 thru 100 are used when one wishes to dropout an element that does not reside on a dropout level.

WEIGHTS

3. All elements on level 9 are set to weight = 1 (for Major profile grid).
4. Reduced weight (WT =) assignments for elements on dropout levels (2-8, & 11) except with colors 101 thru 116.
5. Reduced weight (WT =) assignments for elements with dropout colors (85-100).
6. The reduced weight assignments for dropout features are as follows:
 - a. Weight 1 is converted to weight 0.
 - b. Weight 2 & 3 are converted to weight 1.
 - c. Weight 4 & 5 are converted to weight 2.
 - d. Weight 6 & 7 are converted to weight 3.

LINE THICKNESS

7. Weight 0 is set to .005 inches.
8. Weight 1 is set to .0125 inches.
9. Weight 2 is set to .02 inches with subsequent weights graduating at a .005 inch increment.

TIME / DATE STAMP

10. Certain characters or text strings are substituted to print specific information at the time of a plot. These characters are included in the standard border sheet. The substitutions are listed below:

Characters to be substituted	Information plotted
\$TIME	Time of plot
\$DATE	Date of plot
\$USER	Person who sent plot request
\$REQUEST	Design file name
\$FREQUENT	Directory path with design name
\$QUE (not part of border cells)	Name of the printer queue used

USING COLORS TO PLOT

11. Colors 1-127 are set to black (for black and white plotting/printing). Elements can be placed with colors 128-254 if needed for a color or a gray shade affect.

Note: This feature only pertains to the pen tables for black and white plotting/printing.

12. R/W monument cells use color for area masking. It allows a shape to have a black fill color (on the workstation monitor) to match the preferred monitor background and then be plotted with a white fill to match the white paper. Color 250 and 251 are defined to allow the masking of an opaque shape.
13. Translucent plotting can be done over a raster image (aerial photo) or MicroStation elements. It can be utilized by placing shapes using the Caltrans line style "zz-fillshape1". The shape does not need to be filled with a color. This helps because MicroStation does not support translucency as an element property.

When the "zz-fillshape1" line style is used to create a shape, the tinting (translucency) will take on the same color as the boundary of the shape. In addition to the tinting, the boundary will be converted to the color white in order to separate different tinted areas.

Translucent plotting is only support by plotters/printers that use Interplot drivers (Interplot supplied drivers usually have "IP" in the driver name).

Note: Interplot only supplies drivers for full-size plotters, which include Xerox 8830 monochrome and HP-1055 color plotters.

MISCELLANEOUS

14. Corners are set to curve (not mitered) for text, shapes, line strings and line styles to prevent the problem of a 'spiked' affect that occurs with some printers.