MISSISSIPPI DEPARTMENT OF TRANSPORTATION
BRIDGE DESIGN DIVISION

CADD MANUAL

Instructions for installing and using the Bridge Division CADD Workspace.

For use with **Bentley Microstation© Version 8*i***
created (8.2009)

REVISIONS	
DATE:	REASON:
3-9-2010	Engineer's Stamp on Border Cell.

MDOT
BRIDGE DESIGN DIVISION

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Disclaimer

The CADD Manual is a publication of the Mississippi Department of Transportation Bridge Division. The specific objective of this manual is to obtain uniformity and establish standard policies and procedures in the preparation of design and construction plans for highway structures.

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Bridge Division Workspace

The Bridge Division Workspace is a set of files to aid in the production of bridge plans that adhere to the specifications required by the Bridge Division for the submission of electronic drawings. The use of the Workspace is required for Bridge Division personnel. The use of the Workspace by outside contractors/consultants involved in MDOT work is encouraged.

The workspace consists of Microstation design/seed files, macros, programs, cell libraries, reference files, and various other tools for use in bridge plan creation. Users have access to documentation and examples for most applications along with suggested courses of action for possible problems. The following sections contain in depth descriptions of the Workspace requirements, features and use.

Bridge Division currently supports one operating system, Windows Vista, and one CADD program, Bentley MicroStation version 8i.

Workspace Installation

This section explains how to extract the MDOT Bridge Workspace, install it and configure Windows Vista. (Note: You will need to have administrative privileges on the computer where the workspace will be installed.) The workspace is currently packaged in complete, uncompressed form in the "**bridgeV8i**" directory. All that is required is copying the entire contents as a unit to the destination drive. The install will require about 30MB of disk space. Once copied the files may have the "Read-Only" attribute set, if so, remove the Read-Only flag on this folder through Windows Explorer.

The next step is to define a System Environment variable named MDOT_BRIDGE. If the workspace is installed on drive C:, the variable MDOT_BRIDGE should be set to the value **c:\bridgeV8i**. The System Environment variable is set by following these steps:

1. Click **Start** and then click **Control Panel**.
2. Double-Click **System**, Under "Tasks" Click **Advanced System Settings**.
3. On the **Advanced** tab, click **Environment Variables**. See Fig. 1.
4. Under **System Variables**, click **New**. See Fig. 2.
5. In the **Variable Name** box type **MDOT_BRIDGE**, in the **Variable Value** box type **c:\bridgeV8i** (be sure to use the path where bridgeV8i was installed), and then click **OK**.

The last step in setting up the bridgeV8i workspace is to copy two files from the root directory of the workspace to the MicroStation directory.
We will use the abreviation "**<ustn>**" to refer to the location where you installed Microstation (typically **C:\Program Files\Bentley**).

1.Copy the file **bridgeV8i.ucf** to the **C:\ProgramData\Bentley\MicroStation\WorkSpace\Users** directory. This will add the workspace to the list of workspaces available to MicroStation. In order to use the bridgeV8i workspace, bridgeV8i must be selected from the MicroStation Manager dialog before starting MicroStation (See **Getting Started** (below) for more information).

2. Copy the file **bridgeV8i.cfg** to the ***<ustn>*\Microstation\Config** directory.

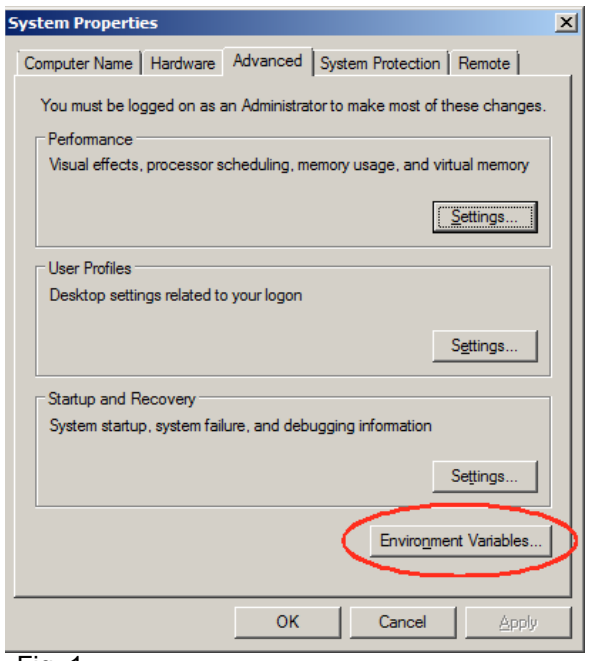


Fig. 1

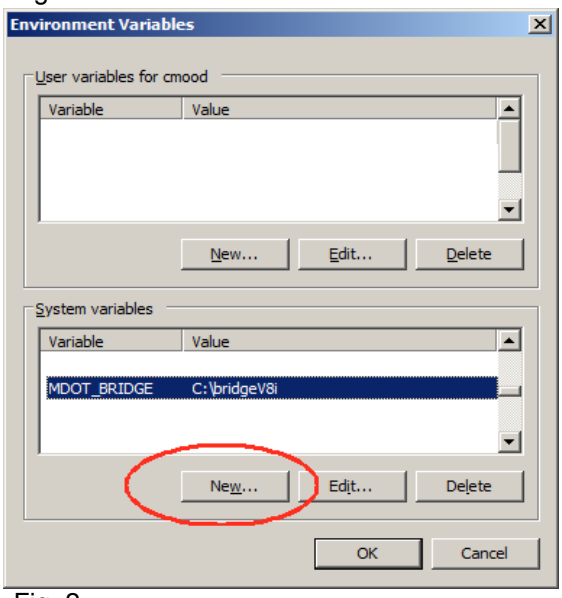
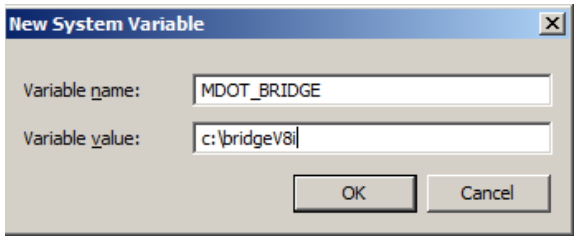
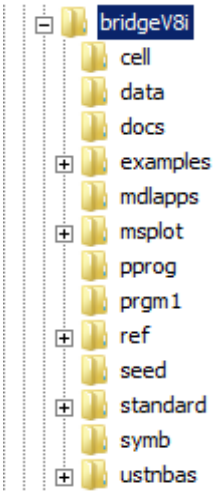


Fig. 2



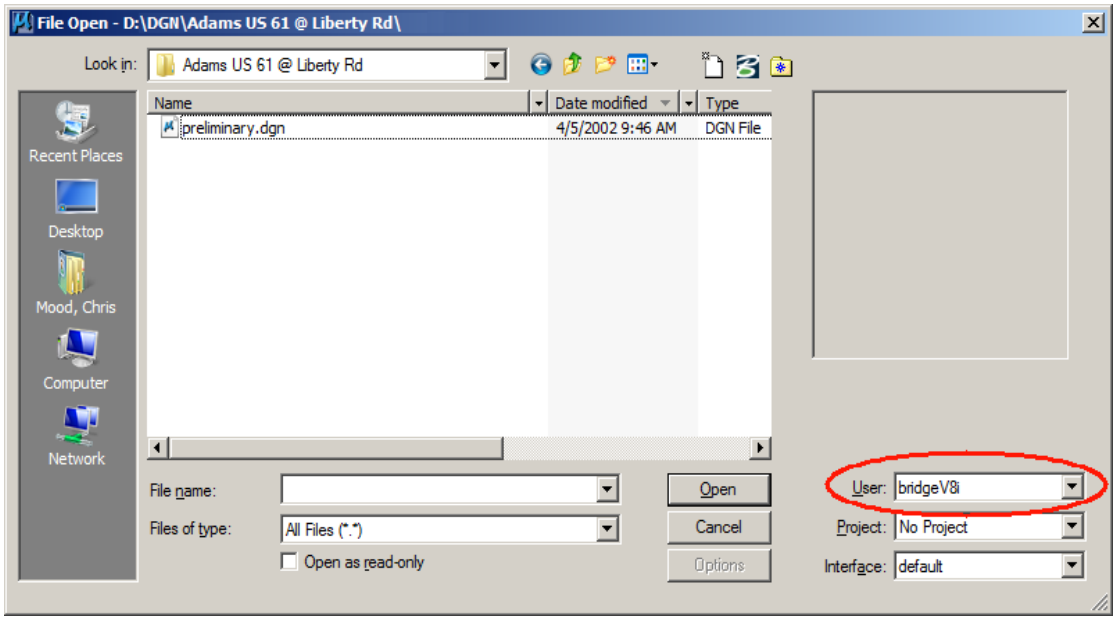
Getting Started

The Bridge Division Workspace is designed to have as little intrusion as possible to the host computer and MicroStation. The workspace is installed as a directory named **\bridgeV8i**. From this point on "**bridgeV8i**" will be used to indicate the root directory of the workspace. Only two files (bridgeV8i.ucf & bridgeV8i.cfg) must be copied outside of the workspace directory and only one environment variable must be set.



\cell - contains cell libraries for use by the programs and in general detailing.
\data - color tables and other MicroStation specific files.
\docs - Documentation for programs.
\examples - example data sets for programs.
\mdlapps - home for Bridge specific MDL applications.
\msplot - plot drivers, configuration files, pen tables, documentation, etc. for Bridge Division plotting
\prgm1 - Bridge Division specific design programs.
\ref - Bridge Division specific reference files.
\seed - seed files for bridge plan development.
\standard - standard insert sheets for bridge plans.
\symb - symbology files including fonts and user-defined line styles.
\ustnbas - basic macros for use in bridge plan detailing.

The decision to separate the Bridge Workspace files from MicroStation files was made to develop a package that could be easily updated/removed without interfering with a user's existing installation of Microstation.
It must be noted that user data should not be saved in the bridgeV8i directory structure and the user should not modify files or folders in the workspace directory. Revisions, bug fixes and upgrades require a full reinstall of the workspace directory and any user data will be lost.
Upon opening MicroStation for the first time, you must choose the Bridge Workspace for it to be used. The workspace can be selected from the dropdown box shown at the right. Select the workspace named "bridgeV8i" and open your file.
Due to the fact that the Bridge Workspace redefines the default seed file(s) you may have to exit MicroStation and invoke it again to completely change to the workspace.



If you do not see an entry in the list you may not have copied the configuration file as per the installation instructions. Copy the file "bridgeV8i.ucf" to **C:\ProgramData\Bentley\MicroStation\WorkSpace\Users** directory. Start MicroStation again and you should be able to select the Bridge Workspace.

Cell Libraries

The Bridge Workspace furnishes five cell libraries that can be used. The cell libraries are located in the **\bridgeV8i\cell** directory for bridge detailing use.

1. **brg1.cel** - general detailing cells.
2. **bridge.cel** - cells for use in general detailing.
3. **layout.cel** - cells specific to layout and foundation plan sheets.
4. **plan.cel** - cells for use in general detailing.

The "**bridge.cel"** cell library contains most of the cells used in general detailing. "**Plan.cel"** is used by the automated drafting programs and macros and should not be moved or modified in any way.

Reference Files

The Bridge Workspace currently furnishes users with two reference files found in the **\bridgeV8i\ref** directory: **"Layout.dgn"** and **"Spanwk.dgn"**. "**Layout .dgn"** contains several layout sheet templates designed for preliminaries and detour bridges. "**Spanwk.dgn"** contains templates for span detail sheets for AASHTO I-beams.
Bridge Division encourages the use of MicroStation reference files in the drafting process. The only requirement for plan submission is that any reference files linked to a particular plan file be merged with that plan file prior to submission. The Bridge Division appreciates the usefulness of reference files in making bulk changes to many files at once. However, once plans reach the submission stage all major changes should be resolved with the plans being essentially finished with the possible exceptions of 1st and 2nd order revisions.
The submission of reference files complicates the data transfer process and introduces the possibility of corrupting an entire set of plans. By merging the reference files into the individual drawing files each file becomes a standalone file with no reliance on external files.

Standard Insert Sheets

The Bridge Workspace provides five standard insert sheets. These sheets are found in the **\bridgeV8i\standard\English** directory. The sheet names and descriptions are as follows:

File Name	Description
Lrgpile_e.dgn	Seismic and Non-seismic pile sheets for pile sizes 24", 30" and 36"
Smlpile_e.dgn	Seismic and Non-seismic pile sheets for pile sizes 14", 16", 18" and 20"
Details.dgn	Miscellaneous span details sheet
Rail32.dgn	3'-2" height rail detail sheet.
Rail42.dgn	4'-2" height rail detail sheet

Seed Files

The Bridge Workspace currently furnishes users with a seed file (seed.dgnlib) located in the **\bridgeV8i\seed** directory: There are a number of parameters preset in this file that the drawing programs and macros require; therefore, users are encouraged to use this file when creating new plan sheets.

Plot Programs and MDL Applications

The Bridge Workspace contains a number of automated drafting programs. These programs, based on the Microstion development Language (MDL) have been carried over through the years & many different versions of Microstation and continue to function well.
The Bridge Workspace contains two MDL applications, the Bridge Toolbar (**brgmenu.ma**) and BridgeMaster (**brgmstr.ma**). The Bridge Toolbar is a custom "MDL" application created to aid in the development of design plans. The Bridge Toolbar is discussed in much greater detail in the chapter Bridge Division Menu Bar.

The BridgeMaster is a simple "drag & drop" program launcher used by the Workspace to “draw” detail sheets in MicroStation. It is loaded with the Workspace and intercepts all files that are dropped in MicroStation View Windows. The dropped file will be executed by BridgeMaster if the first line in the file contains a recognizable program name. If it does not find a program name it recognizes, an information dialog box is displayed with the message "The following file was not processed: **<filename>**". If this problem occurs the data file should be checked to ensure that a valid program name is on the first line.

For each file dropped into MicroStation, an output file is created in the same directory the data file is located. The output file created uses the same name as the data file with the extension “**out**”. The output file is a listing of all data that was read in by plot program. The output file can be used to troubleshoot plot errors.

Details drawn by the Plot Programs on detail sheets are divided into views. Each view is drawn as a separate Graphic Group. All elements in each view can be manipulated by turning on the Graphic Group Lock in MicroStation. Individual elements in the view can be manipulated by turning off the Graphic Group Lock.

The Workspace contains the programs and manuals as well as a large collection of sample data sets stored in the **\bridgeV8i\examples** directory. The plot program manuals are included as a separate manual called the “Plot Program Manual”. The plot programs listed in the Plot Program Manual utilize the BridgeMaster as described above to launch the program inside MicroStation. The following table lists all of the supported programs.

Program	Description
Beam Plot	Creates a beam detail sheet for AASHTO Type I, II, III or IV I-beams or BT-54, BT-63 or BT-72 Bulb-T beams.
End Bent Plot	Creates both sheets necessary for detailing an end bent. The plan and elevation views of the bent and cap are drawn on the first sheet while the cross sections and end view are placed on a second sheet directly above the first.
Index Sheet	Creates a Index Sheet for use in the plans.
Recap Sheet	Draws a complete Estimated Quantity Recap Sheet.
Summary Sheet	Draws a complete Summary of Quantities Sheet.
Layout Sheet	Creates a simple elevation view of a bridge for a layout sheet. Creates a complete plan view with details of a simple prestressed bridge span.
Simple Span	Creates a complete plan view with details of a simple prestressed bridge span.
Typical Section	Creates a typical section detail of a prestressed bridge span to be used with section detail sheets in **\bridgeV8i\ref\spanwk.dgn**.

Printing

MicroStation provides a way to batch plot drawing files. The batchplot utility allows the user to specify a cell as a plot boundary. The border cell (Border) used by Bridge Division is setup to plot both half-scale drawings and full-scale drawings. In order to simplify the batch plot process, the workspace is packaged with a batch plot specifications file (batchplt.spc) setup specifically for the printers in Bridge Division.

NOTE: For users outside the Bridge Division, the "bridgeV8i.ucf" file must be edited to remove the line "MS_BATCHPLT_SPECS = $(BRIDGE)msplot/batchplt.spc" to allow batchplot to work properly.

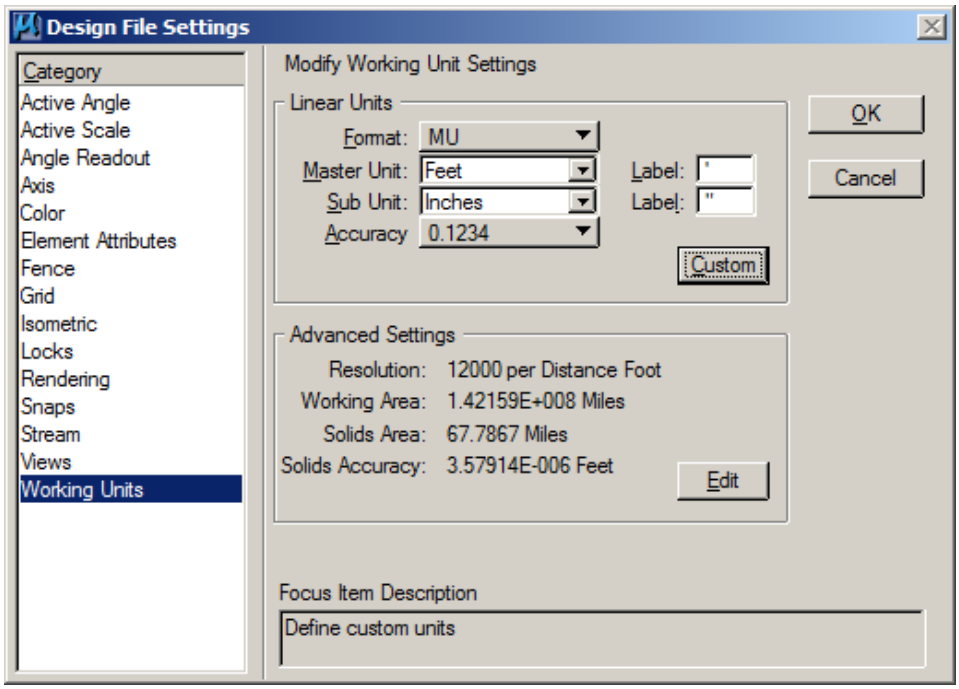
Drafting Practices

The purpose of this section is to provide guidelines for document preparation and submission for all digital bridge design plans submitted to or created in the Bridge Division.

Drawing Units

The Bridge Division Workspace only recognizes English units. A summary of how this system is implemented in MicroStation is explained here.

Bridge Division uses Master Units of feet (') and Sub Units of inches ("). By clicking “Settings” -> “Design File” in the microstation menu, the Design File Settings window will open. The settings should appear in MicroStation as shown in the DGN File Settings window below.



These parameters have already been set in the Bridge Division Workspace seed file (**seed.dgnlib**) located in the **\bridgeV8i\seed** directory. This file should be used to create all new drawing files.

Sheet Size

Bridge Division uses a maximum final sheet size of 23x36 inches. Final plotted sheets shall have a drawing area (inside border) of 21x33.8 inches. The border shall have a left hand margin of 1-3/4 inches and a right hand margin of 1/2 inch, and shall be approximately centered vertically. A minimum sheet size of 22x36 is acceptable provided the left and right hand margins are the same as above.

The sheet size is represented by a border cell located in the **bridge.cel** cell library and should be used on all drawings printed for final plans. The border cell has an outside red boundary that is 23ft x 36ft when placed inside MicroStation on a 1:1 scale. The actual drawing area on the border cell is 21ft x 33.8ft and is represented by the inside green boundary. The orange lines on the border cell mark printer limits for specific MDOT printers.

Drafting Scales

Drafting practice accepted by Bridge Division specifies two types of drawing views, **main** and **auxiliary**. Main views and auxiliary views are often drawn on the same sheet. The main view is the primary view (plan, elevation, side or sectional) and is drawn full size to a scale of 1:1. An auxiliary view is any view that must be scaled up or down (because of size constraints or for clarity) before being placed on the sheet. In order to determine a main view scale a "scaled" border cell is placed over the main view. The following example explains how this is done.

*Example: 100 foot prestressed beam. First, the PLAN and ELEVATION views (or Main Views) of the beam are drawn to a 1:1 scale. At this point, a border cell should be placed around the views. In order to place a border cell around this drawing the border cell must be "scaled" up (The 100ft long drawing is larger than the 33.8ft drawing area in the border cell.) Using the scales shown in the tables below a final sheet scale must be determined to assure the drawing will be plotted correctly. It is determined that a ¼ scale will be used as the final sheet scale; this requires the border cell to be "scaled" up four (4) times larger than its actual size. (4 x 33.8ft = 135.2ft) Scaling the border cell up by 4 will provide ample room for dimensioning the views and allow for any additional details to be shown on the sheet. By going through this process, the **main view scale** was determined to be ¼.*

The final sheet scale (**main scale**) used in the drawing determines the size of text and arrowheads for the entire sheet (**Auxiliary or Main Views**).

The following scales have been designated for use in plans.

Drawing Scales			
3/16	1/2	1:10	1:40
1/4	3/4	1:20	1:50
3/8	1	1:30	1:100

Drafting Colors, Weights & Levels

Bridge Division uses a very simple scheme with respect to colors, weights and levels. The Division plotting system maps a specific color to a corresponding weight at plot time. Element weights are NOT plotted and are disregarded by the Bridge Workspace plot drivers. The use of weights is generally discouraged because of clarity of viewing problems in MicroStation.

Bridge Division has developed the following color scheme for use in all bridge plans developed for final plans.

Color (number)	Usage	Approximate Plotted Width
White (0)	Normal text, concrete, structural steel	0.50mm
Blue (1)	Reserved for comments not intended to be plotted	N/A (This color is not plotted)
Green (2)	Title text, reinforcing steel and prestress strands	0.75mm
Red(3)	Dimension, reference and leader lines	0.35mm
Orange (6)	Reserved for comments on Border Cell	N/A (This color is not plotted)

The colors and numbers are based on a default color table used to plot design files. The color table is named color.tbl and is located in the **\bridgeV8i\data** directory of the Bridge Workspace. This table is attached to the default seed file (seed.dgnlib) and should always be used. Use of other colors for construction lines is permissible since these will not be plotted.

If a designer requires additional weights for final prints a formal proposal should be made to the Bridge Division. If the request is shown to be justified, additions to the color scheme will be implemented.

Levels 60-63 in the Bridge Workspace are not plotted by default; therefore no detail work should be placed on these levels. All other levels may be used as needed.

Drafting Fonts

Bridge Division supports the use of two fonts designated as fonts 110 and 111. These fonts are furnished as part of the Bridge Workspace in file brgfont.rsc located in the **\bridgeV8i\symb** directory. Font 111 is a normal slanted drafting font for use in all detailing. Font 110 is a standard block style font for creating titleblock information. The resource file provides several additional fonts for use in special instances (e.g., border cells) but their use is discouraged. Both fonts support fractions from 1/16 to 15/16 in increments of one sixteenth (1/16).

Both fonts support the following characters:

- a-z, A-Z, 0-9
- Colon (:)
- Semicolon (;)
- Comma (,)
- Period (.)
- Quote (“)
- Single Quote (‘)
- Forward Slash (/)
- Plus (+)
- Minus (-)
- Asterisk (*)
- Ampersand (&)
- Equal (=)
- Tilde (~)
- “at” Symbol (@)
- Underbar Character (_)
- Percent (%)
- Pound Symbol (#)
- Left and Right Parenthesis

Several keyboard characters have been used to assign special characters that are needed for detailing purposes. The symbols shown in the table below are displayed when the assigned keyboard character is typed.

Symbol	Keyboard Character	Symbol	Keyboard Character
ℙ	grave (`) - creates a "plate" symbol for use in dimensioning	∅	dollar ($) - creates a "diameter" symbol for use in dimensioning
±	"less than" (<) - generates a "plus/ minus" symbol	°	both the "greater than" (>) and "carat" (^) symbols - generate a degree symbol.
℄	question mark (?) - produces a "centerline" symbol	∠	"pipe" (|) - creates an "angle shape" symbol.
f_s	right bracket (]) - creates a allowable steel stress symbol	f_c	left bracket ([) - creates a allowable concrete stress symbol.

The table below lists the use and properties of the common text types.

Text Type	Text Height (in.)	Text Width (in.)	Text Color	Font	Usage
Dimension Text	0.125	0.125	0	111	Dimensions, Text, Notes, etc.
Minor Title Text	0.14583	0.14583	0	111	Title text for sub-views
Major Title Text	0.1667	0.1667	2	111	Title text for Main and Auxiliary Views
Title Block Text	0.2083	0.2083	2	110	Text for Title block
Title Small Text	0.125	0.125	0	110	Text for Project No. in top right corner of border cell.

NOTE: The text size shown above represents the text size when printed to a full sheet size (23”x36”)

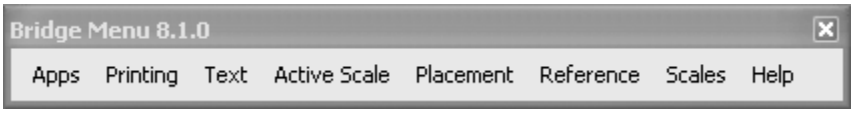
Drafting Line Styles

Bridge Division supports the use of all default line styles available in MicroStation. Typically, the only lines used will be the solid, dashed and centerline.

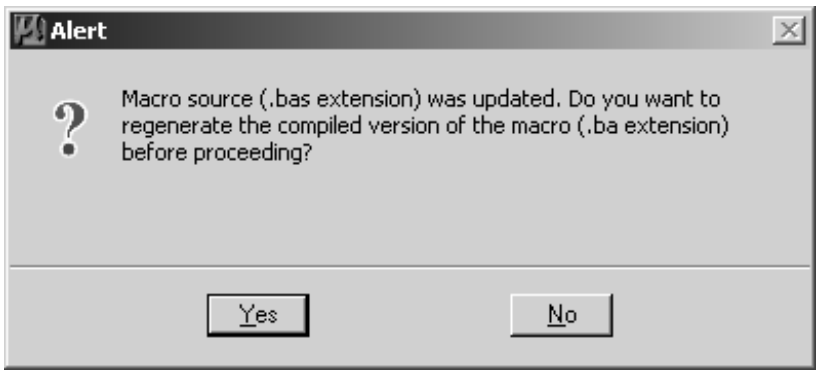
Bridge Division Menu Bar

Bridge Division offers a custom MDL application **brgmenu.ma** to speed the plan production process. This MDL application loads a menu bar with separate pull-down menus. The menu bar is intended to provide a short cut method for doing repetitious tasks. The menu bar is "dockable" at the top or bottom of the MicroStation windows or can be "torn away" from its docked position by double clicking or dragging the menu bar. The pull-downs available on the menu bar are hierarchical in nature and cannot be "torn away" from the menu bar.

The Bridge Menu can be accessed by typing **mdl load brgmenu** in the key-in window in MicroStation. The menu bar is displayed as eight separate pull-down menus, "Apps" through "Help" as shown below.



Some items, when picked for the first time will display an alert box. Choose **YES** in order for the macro to be compiled and updated.



The following is a summary of the pull down menu items:

Apps

This pull-down menu contains applications that can be used in MicroStation. The first option contains the **Plot File Editors** used to create data files for drawing various detail sheets. These editors simplify the process of editing existing data files and creating new data files. After the data file is created, the file can be drawn in MicroStation by using the "drag & drop" method explained in the **Bridge Division Workspace** section of this manual.

The "**Vertical Curve**" item calculates point elevations given vertical curve information defined by the VPC or VPI.

The "**Railing Bars**" item calculates the number of D & R rail bars to be used in transitioning or straight sections of railing.

The item "**Place Table**" creates a table from a comma delimited text file. (Excel files saved in the CSV format can be used.) The sample text file shown below (**Testable.txt**) is located in "**bridgeV8i\examples\brgtable**".

The sample text file looks like this:	The resulting table drawn in MicroStation looks like this:
Beam No.,A,B,C,D,$ 40-1,39-9 1/4",8 1/8",9 1/16",0",7>00'00" 40-2,39'-9",8",9 1/16",0",7>00'00" 40-3,39'-8 7/8",7 15/16",9 1/16",0",7>00'00" 40-4,39-9 3/4",8 3/8",9 3/16",0",10>12'00" 40-5,39'-9",8",9 3/16",0",10>12'00" 40-6,39'-8 3/4",7 7/8",9 3/16",0",10>12'00" 40-7,39-10 3/8",8 11/16",9 5/16",0",13>24'00" 40-8,39'-9",8",9 5/16",0",13>24'00" 40-9,39'-8 1/2",7 3/4",9 5/16",0",13>24'00" 40-10,39-11 1/8",9 1/16",9 1/2",1 13/16",16>36'00" 40-11,39'-9",8",9 7/16",1 13/16",16>36'00" 40-12,39'-8 3/8",7 11/16",9 7/16",1 13/16",16>36'00" 40-13,40-0 1/4",9 5/8",9 3/4",2 3/16",19>48'00" 40-14,39'-9",8",9 11/16",2 3/16",19>48'00" 40-15,39'-8 1/8",7 9/16",9 5/8",2 3/16",19>48'00"	

Beam No.	A	B	C	D	ϕ
40-1	39-9 1/4"	8 1/8"	9 1/16"	0"	7°00'00"
40-2	39'-9"	8"	9 1/16"	0"	7°00'00"
40-3	39'-8 7/8"	7 15/16"	9 1/16"	0"	7°00'00"
40-4	39-9 3/4"	8 3/8"	9 3/16"	0"	10°12'00"
40-5	39'-9"	8"	9 3/16"	0"	10°12'00"
40-6	39'-8 3/4"	7 7/8"	9 3/16"	0"	10°12'00"
40-7	39-10 3/8"	8 11/16"	9 5/16"	0"	13°24'00"
40-8	39'-9"	8"	9 5/16"	0"	13°24'00"
40-9	39'-8 1/2"	7 3/4"	9 5/16"	0"	13°24'00"
40-10	39-11 1/8"	9 1/16"	9 1/2"	1 13/16"	16°36'00"
40-11	39'-9"	8"	9 7/16"	1 13/16"	16°36'00"
40-12	39'-8 3/8"	7 11/16"	9 7/16"	1 13/16"	16°36'00"
40-13	40-0 1/4"	9 5/8"	9 3/4"	2 3/16"	19°48'00"
40-14	39'-9"	8"	9 11/16"	2 3/16"	19°48'00"
40-15	39'-8 1/8"	7 9/16"	9 5/8"	2 3/16"	19°48'00"

The item "**Spur Dike**" is a macro that draws the plan view of a standard size or user defined spur dike for use on the foundation plan.

The item "**Detail X&Y**" draws the standard railing detail showing the rail transition and drain curb at the bridge ends.

Printing

This pull-down configures the print settings in MicroStation and activates the print utility to plot various types of sheets to Bridge Division printers and plotters.

The **Batchprint** feature listed will activate the batchplot utility to plot half-scales, check prints or mylar sheets. The batchplot utility has a specifications file attached that contains predefined Bridge Division settings for each type of sheet to print. **NOTE: Batchprint will only plot sheets that use the border cell (border) provided in the bridgeV8i workspace.**

Text

This pull-down will set the text size, color, font and text justification for various text sizes used. Text sizes are explained in greater detail in the **Drafting Practices** section of this manual.
Active Scale
The item "**Scale?**" returns the Active Scale set in MicroStation.

Items "**10 thru 5**" when picked will set the Active Scale to the value picked.

Placement

This pull-down attaches a cell for placement in the drawing file. Note: The scale of these cells is controlled by the pull-down item "**Scales**". Cells for attachment have been organized to be easier to find.

The "**Place Note**" item opens a dialog box showing a library of saved notes that can be placed in the drawing file.

"**Place Pad**" is a macro to draw the neoprene bearing pads.

"**Place Scale**" allows placement of a text string displaying the current scale being used. (See "**Scales**" pull-down item below for more information on scales).

Reference

This pull-down places a copy of the standard details (Miscellaneous Span Details, Prestressed Concrete Pile Details and Concrete Railing Details) in the drawing file.

Scales

This pull-down is used to control the way the **Bridge Menu** interacts with MicroStation. Many of the pull-downs on the menu bar require a view and/or a drawing scale to be defined before the item will work correctly. For an explanation of how Bridge Division uses scales, see the Drafting Scales section under the Drafting Practices chapter of this manual.

"**Main**" is used to define the main view sheet scale of the drawing.

"**Aux**" is used to define an auxiliary view scale.

The Dimension Settings (font type and size and arrowhead type and size) for use with the Auto Dimensioning Tools in MicroStation are set based on the scale defined.

Help

This pull-down will open a web page with links to the "**Drafting**" and "**Design**" manuals. The consultant version of the Toolbar opens a PDF of each of the manuals located in the **bridgeV8i\docs** directory.

Engineer's Stamp Requirement (10/2009):

All bridge plans will use the new border cell with boxed area on the title block for placing a professional engineer's seal.

The new border cell is titled 'BORDER' and is located in the 'bridge.cel ' library under the bridge workspace cell subdirectory. It consists of elements located on levels 60, 61 & 62 as follows:

Level 60 – MDOT's in-house seal – (NOT for consultant use)
Level 61 – 'PRELIMINARY NOT FOR CONSTRUCTION'
Level 62 – A date line to accompany an MDOT-contracted professional engineer's stamp.

Requirements for usage in plan submittals are as follows:

CHECK PRINTS:

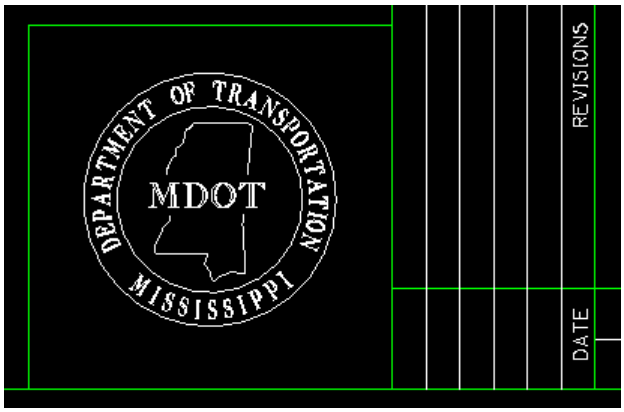
Consultants & MDOT in-house:

level 60 OFF
level 61 ON
level 62 OFF

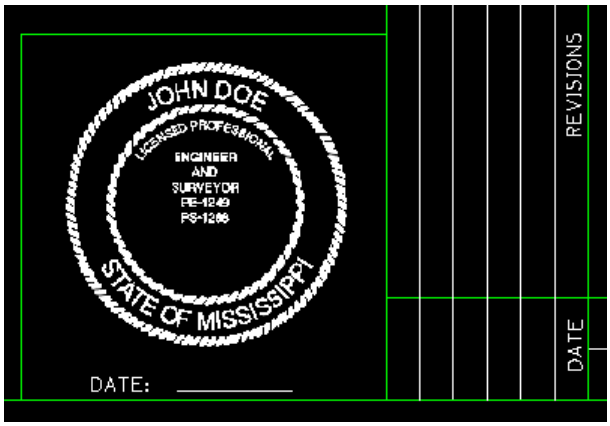
FINAL MYLARS:

MDOT in-house:

level 60 ON
level 61 OFF
level 62 OFF



Consultants:

Stamp applied, signed & dated by
MS Registered Professional Engineer.

level 60 OFF
level 61 OFF
level 62 ON