MicroStation V8

Bentley Descartes

Bentley Descartes

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Bentley Descartes fundamentals

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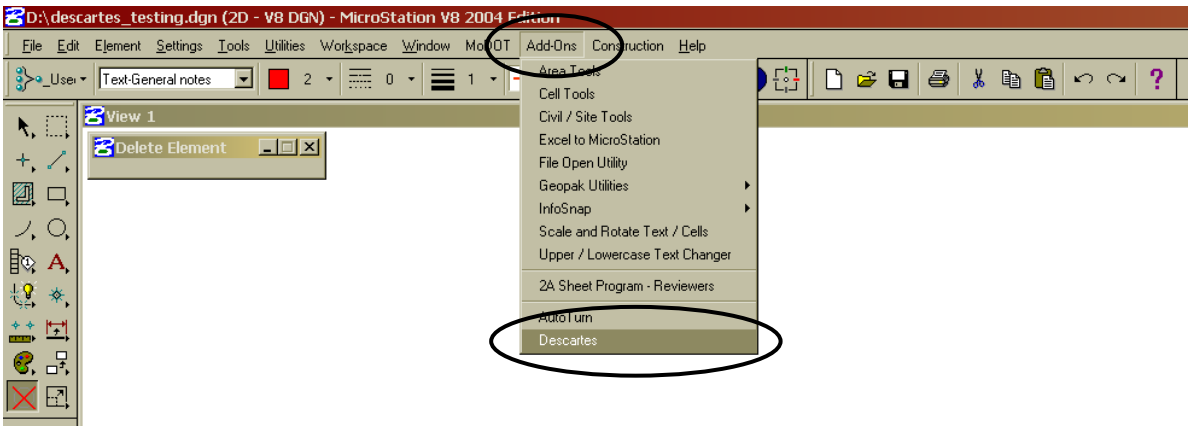
1.0 Loading and Starting Bentley Descartes

The first step in using Descartes is to open a MicroStation drawing.

Left click on the Add-Ons pull down menu just under the MicroStation V8 banner across the top of the screen.



After selecting the Add-Ons pull down click the Descartes option at the bottom of the pull down.

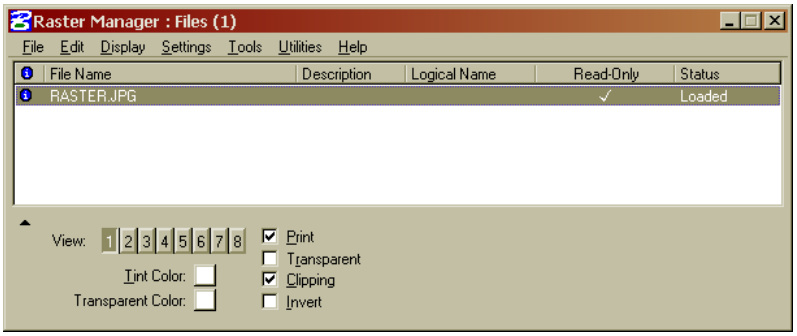
This will bring up the Descartes tool bar.

Loads Descartes

Unloads Descartes

Descartes Plotting

Clicking the Load Descartes icon from the Descartes tool bar will bring up the Raster Manager.



1.1 *Image Selection Set Support*

In previous version of Bentley Descartes, many functions were dependent on the image in focus or on the active image. This concept is no longer existent in the present version, as the functions now use the selected (highlighted) image(s) in Raster Manager. It is therefore possible to have more than one image selected at once, such that Bentley Descartes now adds image selection set support to Raster Manager. Several Bentley Descartes operations were enhanced to allow multiple images to be processed simultaneously.

The list of tools that support image selection follows:

Modify Image	Move	Scale	Rotate
Mirror	Square	Warp	Merge
Corridor	Clip	Unclip	Modify Clip
Paint	Erase	Cleanup	Register
Convert Text	Convert Cells	Undo/Redo	

Note that Image Selection Set is an additional feature only available when Bentley Descartes is loaded and running and not available with the Raster Manager alone.

Bentley Descartes has been designed to seamlessly integrate into the MicroStation environment. Therefore, you will find that all tool boxes, menus, dialog boxes, and other interface operations are consistent with MicroStation conventions.

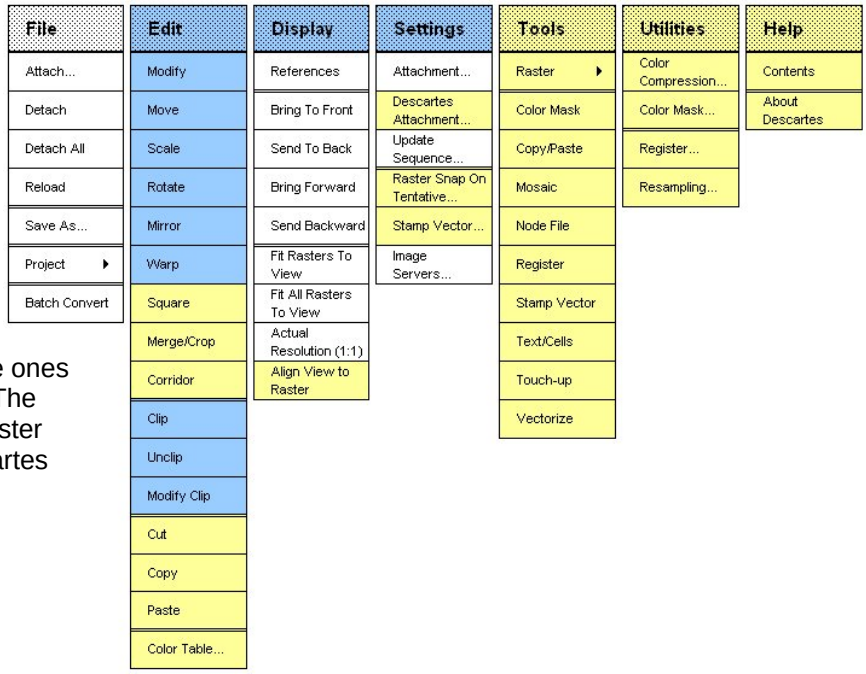
1.2 *Descartes Main Menu*

The main menu of Bentley Descartes is in fact the main Raster Manager dialog box. The structure of this menu is detailed in “Raster Manager Menu Structure”.

The menu items of each Raster Manager menu are explained in the section titled Navigating Bentley Descartes.

The Descartes Dialogs

Because Bentley Descartes relies on Raster Manager to access images, Bentley Descartes uses the Raster Manager dialog to display its menus. The table below displays the Raster Manager menu when Bentley Descartes is loaded.



The items highlighted in yellow are the ones added to the Raster Manager dialog. The items highlighted in blue represent Raster Manager tools to which Bentley Descartes adds more functionality.

1.3 Tool Frames and Tool Boxes

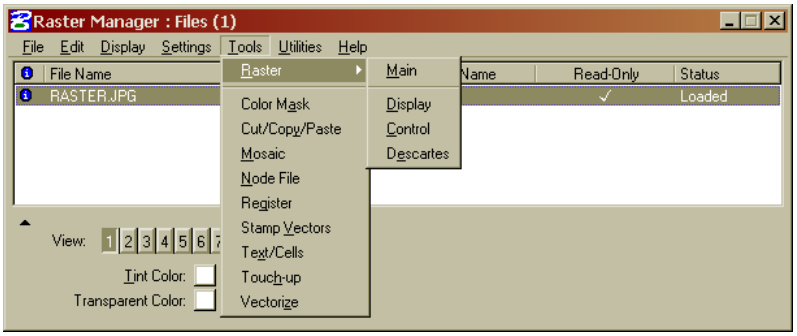
All of the functionality of Bentley Descartes is also accessible through the tool boxes.

Tool Boxes

Each tool box gives access to a few tools of the same family.
All tool boxes can be accessed from the Raster Manager Tools menu, where they are listed in alphabetical order.

Tool Frame

The Image tool frame is provided with Bentley Descartes. This tool frame can be accessed through the *MicroStation>Tools>Raster>Descartes* menu. It provides access to all the Bentley Descartes tool boxes.



1.4 Managing and Selecting Files

In Bentley Descartes, your project settings and status are managed through a standard file interface. Additionally, several distinct file types that are used as building blocks in your projects are also managed through the same file interface. If you are familiar with the standard file interfaces that are used in MicroStation, you should find the Bentley Descartes file interface easy to use.

In Bentley Descartes, the file interfaces are used to manage the following types of files:

File Type	Extension
Image files	iTIFF, HMR, CIT, COT, RGB, RLE, A, P, JPG, PCX, RS, TGA, TIF, BMP, CAL, RLC, TG4, C29, C30, C31, PNG, ECW, SID
Color Mask file	MSK
Node file	NOD
Register file	RGR
Resampling file	RSP

The file interface is used to create, open, select, and save the various types of files that are used in Bentley Descartes and the usual operations that are supported are New, Attach, Save and Save As.

To support the selection of files, Bentley Descartes provides a simple and standard selection interface. The files listed for selection in the File list box have an extension specific to the file type (for example, MSK is the extension for a Color Mask file). The current directory displays above the Directories list box. You can change any of these selections.

Navigating Descartes

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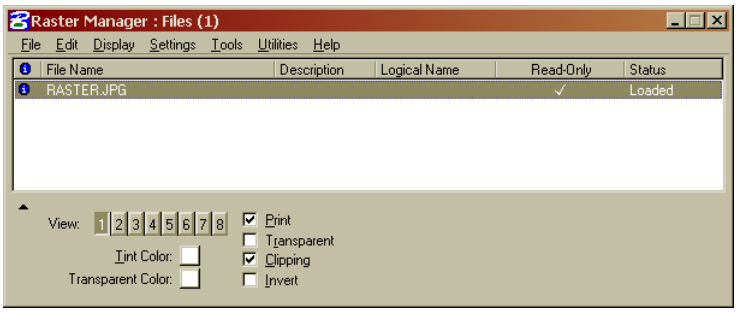
2.0 Navigating Bentley Descartes

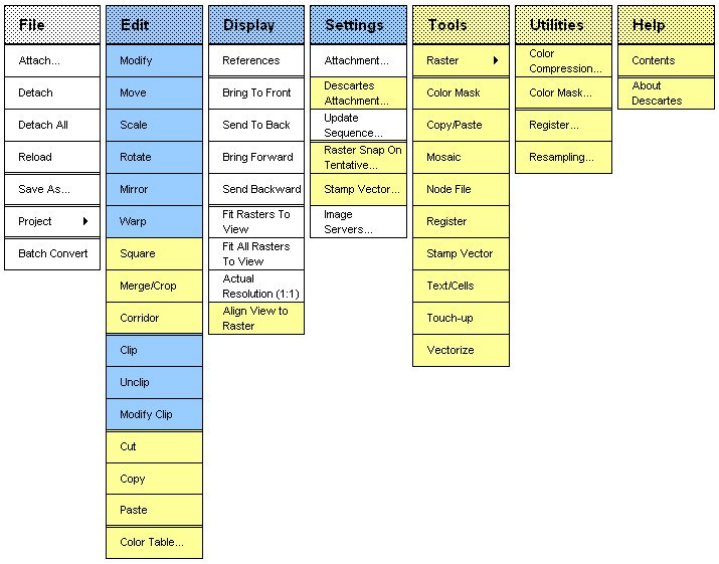
This chapter describes how to navigate through the user interface to access all functions or features such as dialog boxes, tool boxes, tools, or any specific item in the Raster Manager menu structure that is added or modified by the Bentley Descartes application.

Bentley Descartes uses the Raster Manager main dialog to display its menus. The Raster Manager menu bar provides access to seven menus.



- The *File menu* is not modified by the Bentley Descartes application.
- Several items are added to the *Edit* menu and some items are modified by the Bentley Descartes application.
- One (1) item is added to the *Display* menu by the Bentley Descartes application.
- Three (3) items are added to the *Settings* menu by the Bentley Descartes application.
- The *Tools* menu is added to the Raster Manager menu structure by the Bentley Descartes application.
- The *Utilities* menu is added to the Raster Manager menu structure by the Bentley Descartes application.
- The *Help* menu is added to the Raster Manager menu structure by the Bentley Descartes application.

The table below illustrates the menus and menu items that are specific to Bentley Descartes (highlighted in yellow) as well as those that are modified by the Bentley Descartes application (highlighted in blue).



2.1 Raster Manager Dialog Box

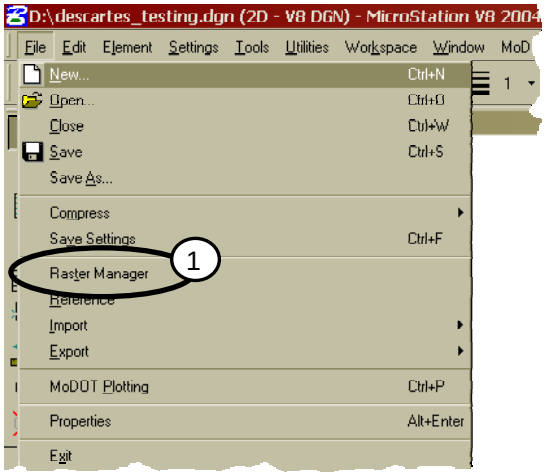
All Bentley Descartes functions can be accessed from the Raster Manager dialog box.

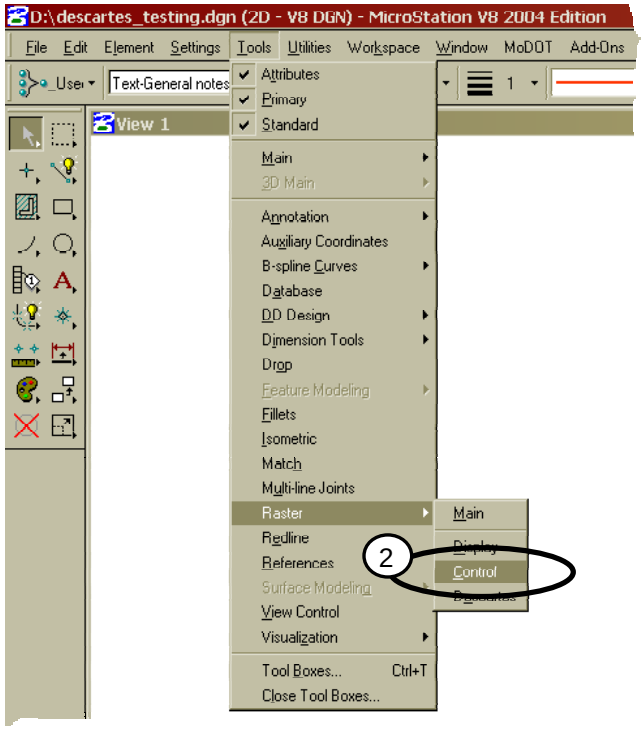
To open the Raster Manager dialog box

1. From the MicroStation File menu, choose Raster Manager. (1)

   or

2. From the MicroStation Tools menu, choose Raster > Control to open the Descartes Raster Control tool box, then select the *Raster Manager* tool.
   The Raster Manager dialog box opens, displaying names of any attached raster images. (2)





The Raster Manager dialog list box is customizable. You can selectively disable or enable individual fields from the list box menu bar using a contextual menu (right-click).

The following fields can be displayed:

- The *Quick Info* field is used to display a short description of the raster. When the cursor is placed over this field, a tool tip brings up the description corresponding to the raster.
- The *File Name* field is used to display the file name.
- The *Description* field is used to present a description of the file.
- The *Logical Name* field is used to display the file's logical name.
- The *Read-Only* field is used to indicate if the file is in read-only mode.
- The new *On-the-Fly* only works with MicroStation GeoGraphics. We do not use MicroStation GeoGraphics here at MoDOT at this time.
- The *Geo Priority* field is used to display the method used to geographically position the image. The available choices are Attachment, Raster Header and Sister File. The image may have native

geographic metadata stored in the image itself (raster header) or in a companion file (sister file or world file). When no native methods are present, the user geographically positions the image and the metadata is stored in the design file. This method is called “attachment”.

The geographic metadata is always preserved and updated in the Attachment. When specified otherwise, the alternate location is updated as well as the attachment. Hence, the attachment is constantly updated to reflect the current geographic information of the image.

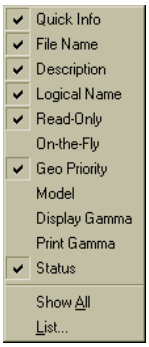
To change the Geo Priority, simply click in the Geo Priority column. This will open the Geo Priority dialog box. You can then change the selection.

Upon saving a raster file, the preferred Geo Priority for a raster attachment can be specified. When the raster file is reopened, if the raster cannot be reattached with the same Geo Priority, the raster will be displayed using a “dark yellowish” color in the Raster Manager dialog.

- The *Model* field is used to display the origin (design name and model name) of the raster reference. We do not use Models here at MoDOT at this time.

- The *Status* field displays the reference's status (Loaded, Referenced, Self-Referenced or Raster Not Found).

To show or hide a field from the list box menu bar



1. Open the Raster Manager dialog box.

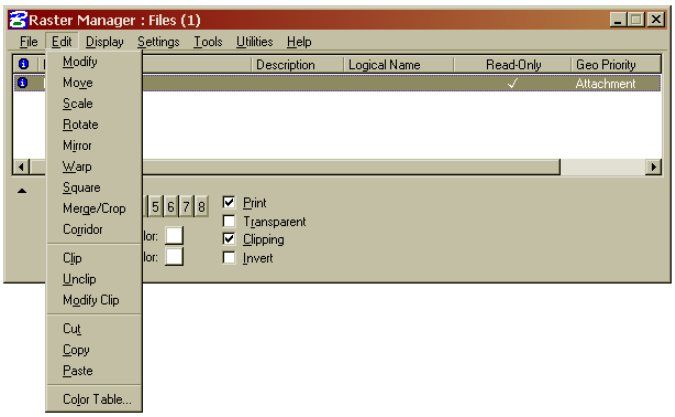
2. Position the pointer within the list box menu bar and right-click.
   The contextual menu displays. Enabled fields are indicated with checkmarks.

3. Choose the menu item for the field you want to hide or show.

2.2 Pull Down Menu Items

Edit menu

The Raster Manager Edit menu gives access to features for modifying, clipping, copying and pasting images.



Modify

Used to modify a raster image's origin, size, rotation or affinity.

Move

Used to move an image to a new location.

Scale

Used to change the proportionate dimensions of an image.

Rotate

Used to rotate an image.

Mirror

Used to mirror the selected raster image horizontally, vertically, or diagonally. Additionally, you can specify the axis about which the image is mirrored.

Warp

Used to adjust the size and shape of a raster image with a combination of move, scale, rotate, and skew options.

Square

Used to rotate a raster image by squaring a horizontal, vertical, or diagonal axis.

Merge/Crop

Used to copy and merge or to crop one or more images contained within a defined area.

Corridor

Used to copy the regions of one or more images contained within a polygon of the same shape.

Clip

Used to clip a raster image (Clip Boundary), or to define a masked area (Clip Mask).

Modify Clip

Used to modify the clipping polygon for a clipped raster image.

Unclip

Used to remove one or more clipping polygons from a raster image.

Cut

Removes (cuts) the selected element(s) to the clipboard for subsequent pasting.

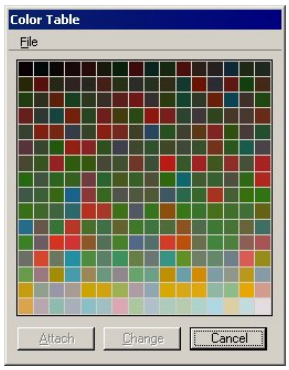
Copy

Used to copy an area from the active image to the clipboard.

Paste

Used to paste the image area in the clipboard at a specified location in the active image.

Color Table



Used to edit the selected image's color palette. This menu item is not available if no image is selected, if more than one image is selected, or if the selected image has no color palette.

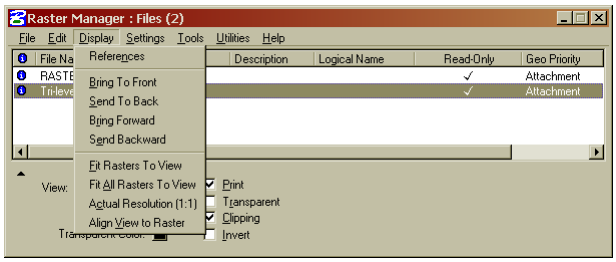
File menu > *Open* — Opens the Open Palette dialog box, which is used to load a new color table into the color tiles.

File menu > *Save As* — Opens the Save Palette dialog box, which is used to save the Color Table as a color table file.

File menu > *Revert* — Resets the Color Table to the active color table settings without closing the Color Table dialog box.

2.3 Display menu

The Raster Manager Display menu gives access to tools for displaying raster files.



References

Used to open the MicroStation Reference dialog box.

Bring to Front

Used to bring the selected raster image to the top of the other raster images.

Send to Back

Used to send the selected raster image to the back of the other raster images.

Bring Forward

Used to bring the selected raster image forward one raster image at a time.

Send Back

Used to send the selected raster image back one raster image at a time.

Fit Rasters to View

Used to fit the view to the selected raster image's boundary.

Fit All Rasters to View

Used to fit the view to all the raster images in the design file.

Actual Resolution

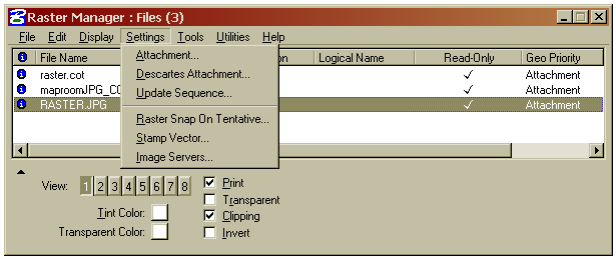
Used to view the selected raster image at a 1:1 actual resolution.

Align View to Raster

Used to align the view to the selected raster images rotation.

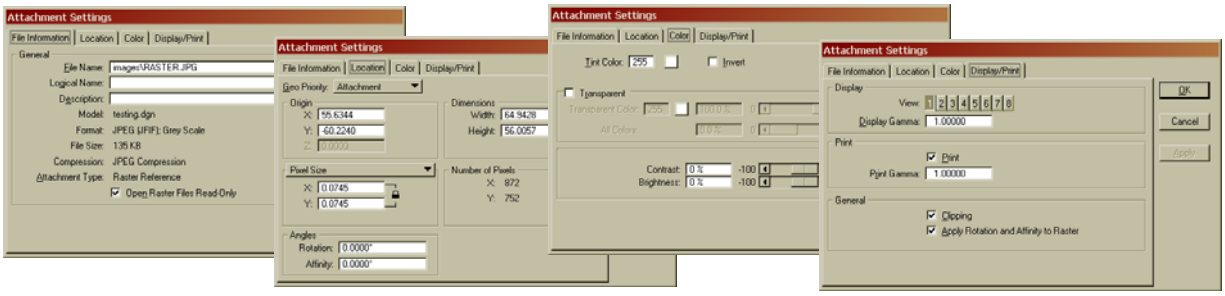
2.4 Settings menu

The Raster Manager Settings menu gives access to various setting boxes.



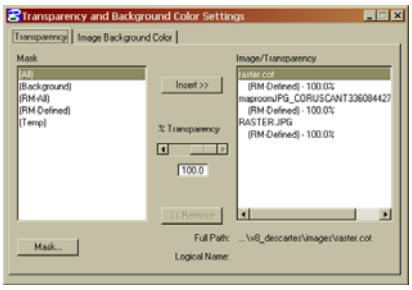
Attachment

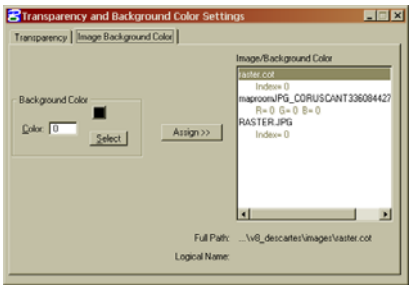
The attachment setting shows information about the file information, location, color, and display.



Descartes Attachment

Shows the transparency and image background color settings.





Update Sequence

Used to determine the order in which the raster images update.

Raster Snap on Tentative

Used to set up the snap options to a raster image.

Entity

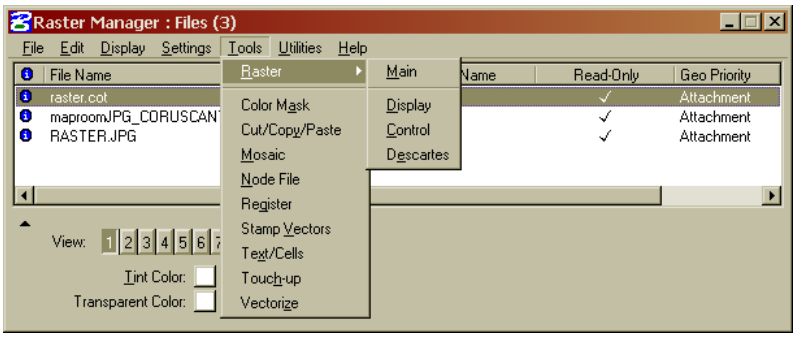
The Entity option menu lets you choose whether to snap at the center of the raster lines (Line), or on the edges of the raster objects or lines (Outline), or not to snap at all (None).

Mask

Used to select a color mask from the open Color Mask file, to determine the raster objects or lines on which to snap.

2.5 Tools menu

With the Raster Manager Tools menu, you can access all Bentley Descartes tool boxes.



Tool Boxes

Each tool box gives access to a few tools of the same family.
All tool boxes can be accessed from the Raster Manager Tools menu, where they are listed in alphabetical order.

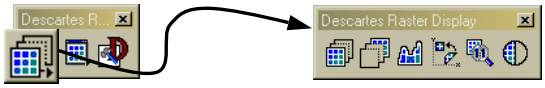
Tool Frame

The Image tool frame is provided with Bentley Descartes. This tool frame can be accessed through the *MicroStation>Tools>Raster>Descartes* menu. It provides access to all the Bentley Descartes tool boxes.

Raster

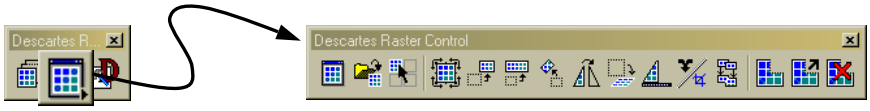
Toggles the display of the main Raster tool box, which contains tools for displaying and controlling raster files.

Raster Display



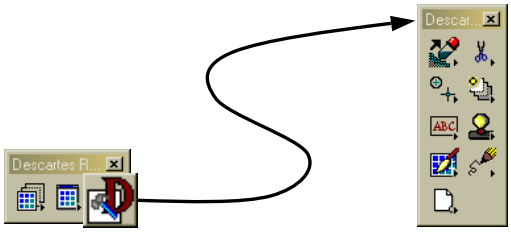
Opens the Raster Display tool bar, which contains tools for displaying raster files.

Raster Control



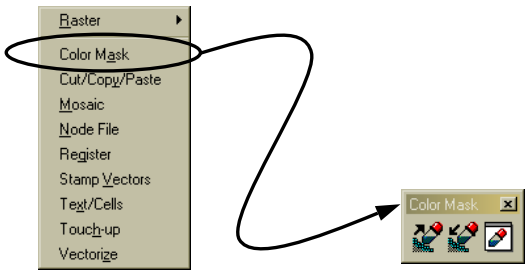
Opens the Raster Control tool box, which contains tools for controlling and manipulating raster files.

Raster Descartes



Opens the Image Main tool box, which provides access to all other tool boxes and, consequently, to all the functionality of Bentley Descartes.

Color Mask

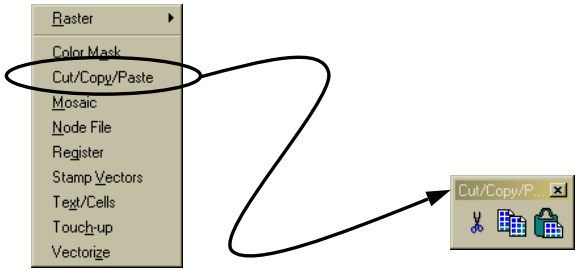


The Color Mask tool box provides tools to add colors to a mask, to subtract colors from a mask, or to open the Color Mask dialog box.

The Color Mask tool box gives access to the following tools:

- Add to Mask tool
- Subtract from Mask tool
- Color Mask Dialog tool

Cut / Copy / Paste



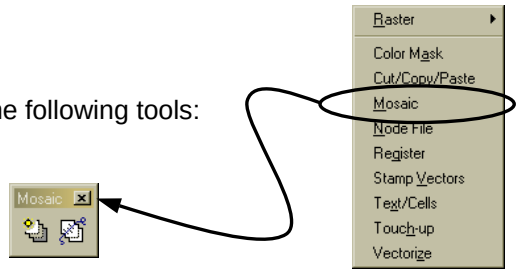
Opens the Cut / Copy / Paste tool box and gives access to the following tools:

- Cut Image Area
- Copy Image Area
- Paste Image Area

Mosaic

Opens the Mosaic tool box and gives access to the following tools:

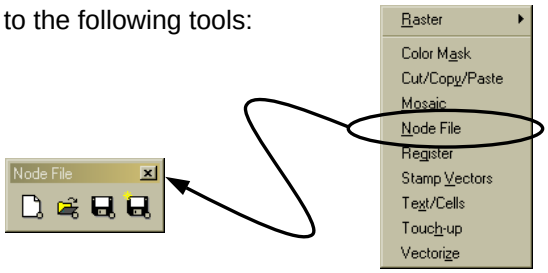
- Balance Tone
- Define Seam



Node File

Opens the Node File tool box and gives access to the following tools:

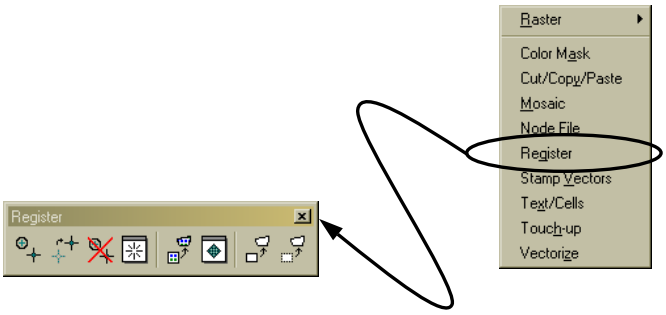
- New Node File
- Open Node File
- Save Node File
- Save Node File As



Register

Opens the Register tool box and gives access to the following tools:

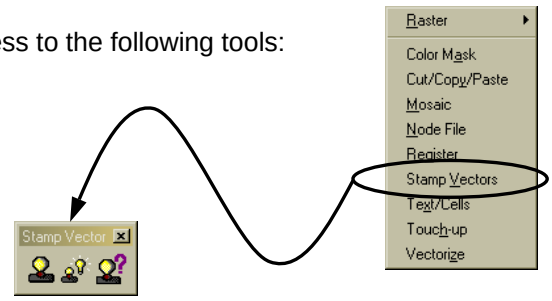
- Place Control Points
- Move Control Point
- Delete Control Points
- Register Dialog
- Resample Image
- Resampling Dialog
- Copy Vector
- Move Vector



Stamp Vector

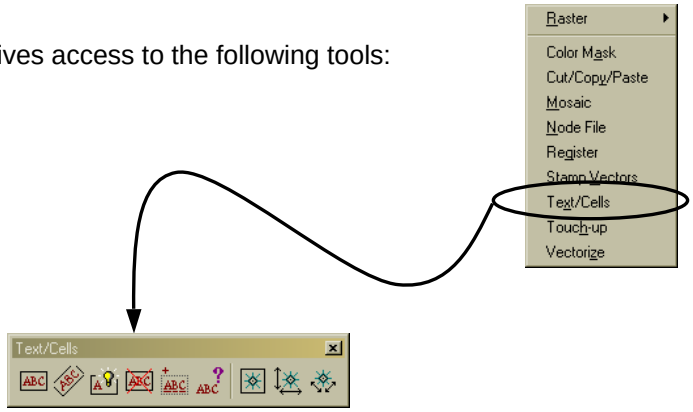
Opens the Stamp Vector tool box and gives access to the following tools:

- Stamp Vector
- Match Stamp Vector Settings
- Stamp Vector Settings



Text / Cells

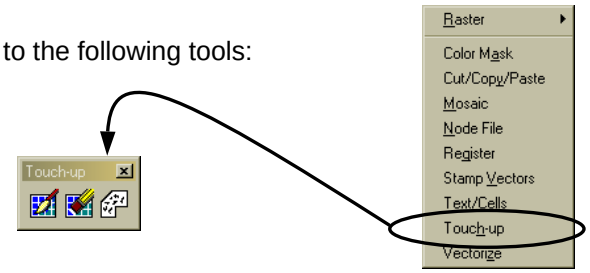
Opens the Text / Cells tool box and gives access to the following tools:



- Select Horizontal Text
- Select Oriented Text
- Select Multiple Text
- Delete Text Selection
- Convert Text
- Text Settings
- Convert Cell
- Convert Horizontal Cell
- Convert Oriented Cell

Touch-up

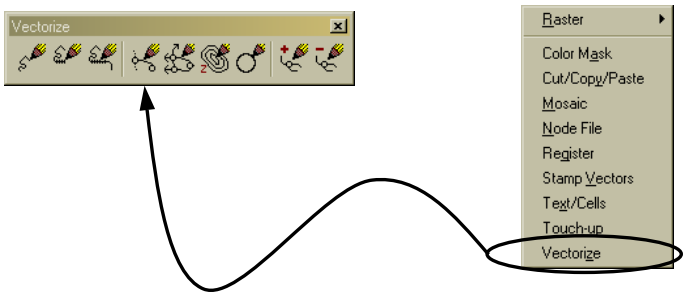
Opens the Touch-up tool box and gives access to the following tools:



- Paint
- Erase
- Cleanup

Vectorize

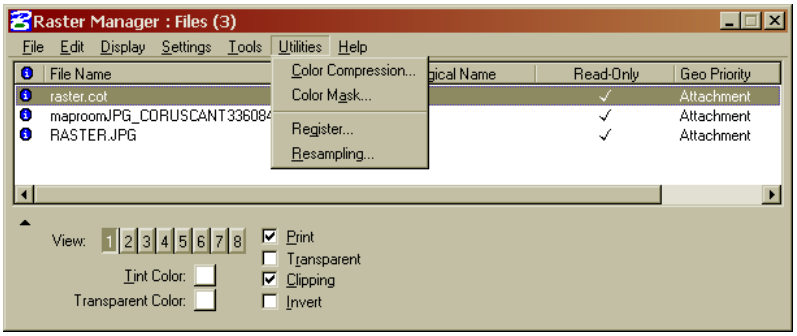
Opens the Vectorize tool box and gives access to the following tools:



- Place Element
- Continue Element
- Insert Element
- Convert Lines
- Convert All Connected Lines
- Convert Contour Lines
- Convert Circle
- Place Nodes
- Delete Nodes

2.6 Utilities menu

The Raster Manager Utilities menu gives access to various dialog boxes for enhancing or registering images, creating color composites, and for rasterizing images.



Color Compression

Used to open the Color Compression dialog box.

Color Mask

Use to create and manage Color Masks. A mask can be assigned to any image regardless of the pixel type (except for binary images). When adding colors to a mask, it is possible to select the area on any image currently open in Raster Manager.

Register

Used to open the Register dialog box.

Resampling

Used to open the Resampling dialog box in order to apply a geometric correction model to an uncorrected image.

Enhancing Images

Section 3

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3.2	**Transparency and Background Color Settings**	Page 301
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3.0 Enhancing Images

The image enhancement tools are used to create a color composite image through color compression, or render regions of an image transparent.

The transparent colors functionality is particularly useful in creating mosaics, since you can hide portions of images that you do not need.

The following options are available:

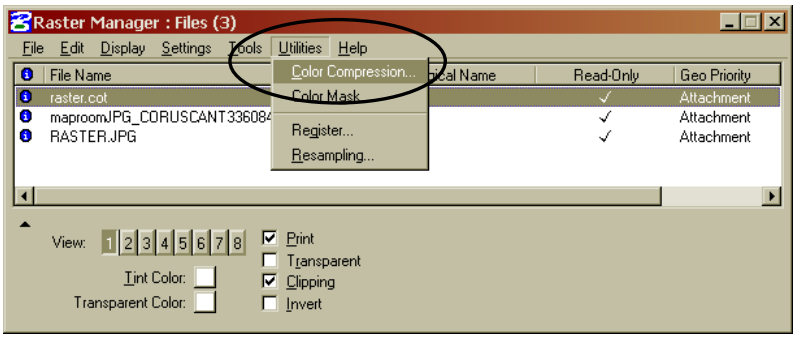
Color Compression

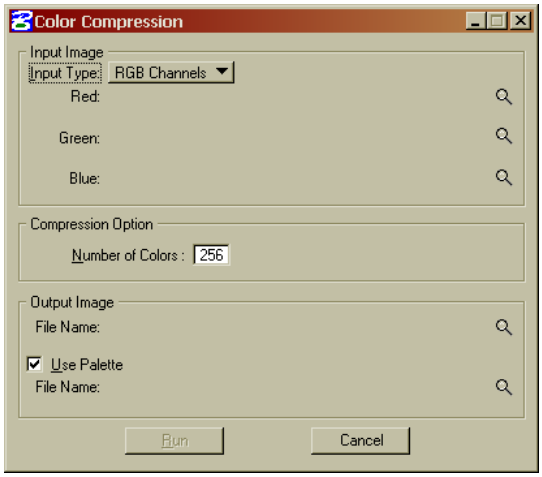
Transparency and Backfill Color

3.1 Color Compression dialog box

The Color Compression dialog box is used to enter the parameters for producing a color composite image through color compression. The output image can be a RGB combination of three input images as seen through red, green, and blue filters. It can also be the result of color compression applied to a single file.

To access the Color Compression dialog box, from the Raster Manager Utilities menu, select the Color Compression menu item.





Input Image
To select each of the input files, click the "Browse Location" buttons and use the Select Input Image dialog box.

When each of the input images has an appropriate contrast and displays with clarity, the color composite resulting from the color compression should be clear and correctly contrasted. Choose any valid type of file as input except Binary files.

Input Type

Choose the "RGB Channels" option if you want to produce a RGB combination of three input images.

Choose the "Single Channel" option if you want to apply a color compression on a single file.

If the "RGB Channels" is selected, the three files selected must be grayscale channels (R-G-B). The grayscale palette is also supported.

Compression Option

Use to select the Number of Colors of the output image.

Output Image

To specify the output file name, click the Browse Location button and use the Select Output Image dialog box. The file type, color mode and the data compression to be used can also be specified.

Use Palette

To use an existing palette, turn on the Use Palette toggle and use the Browse Location button to specify the raster file.

Run

The Run button can be accessed only when the parameters have been correctly entered. Click this button to create the output image with color compression. While the batch program is running, a Progress indicator displays.

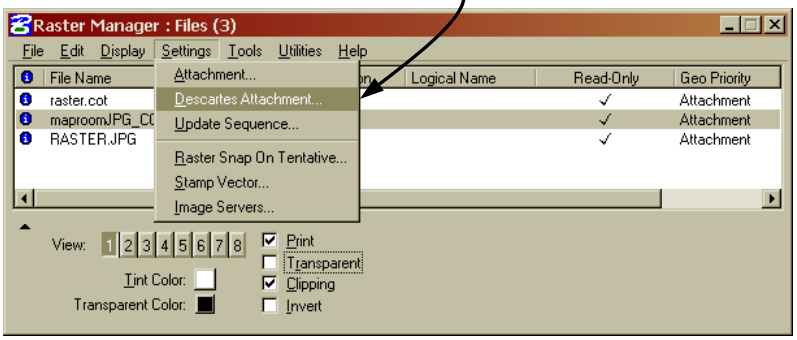
Cancel

If you decide not to use the present parameters, click Cancel and the dialog box then closes.

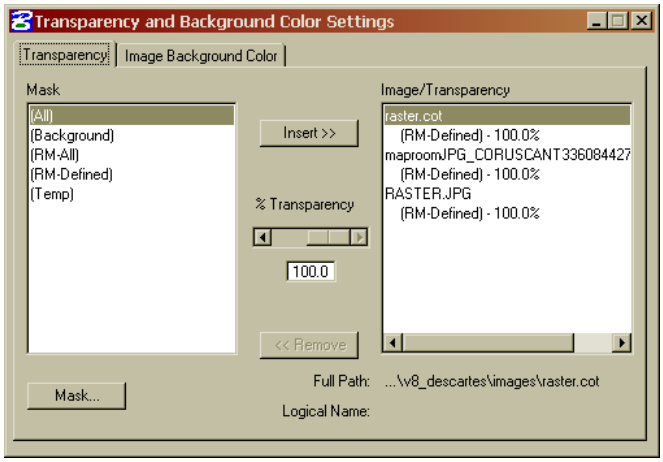
3.2 Transparency and Background Color Settings dialog box

This dialog is used to change the default background color and to apply transparency to images. In both tabs, the right section display the image opened in Raster Manager. This dialog is modeless and therefore this list is synchronized with the Raster Manager list.

To access the Transparency and Background Color Settings dialog box, from the Raster Manager Settings menu, choose Descartes Attachment.



3.2a Transparency tab



This tab is used to set transparency on images. Color masks are used to set colors as transparent. More than one mask can be assigned to an image. Each mask is applied with a percentage of transparency. If more than one mask is assigned to an image and the same color is set as transparent by more than one mask, the last mask applied to the image has priority.

The ***(All)*** mask is used to add all colors from the target image to the mask. This mask is a system mask and cannot be modified or deleted.

The ***(Background)*** mask is used to specify the color to be used for background operations (Erase, rotate,

etc.). The background color can be set under the “Image Background Color” tab. This is a system mask. It can be modified but cannot be deleted.

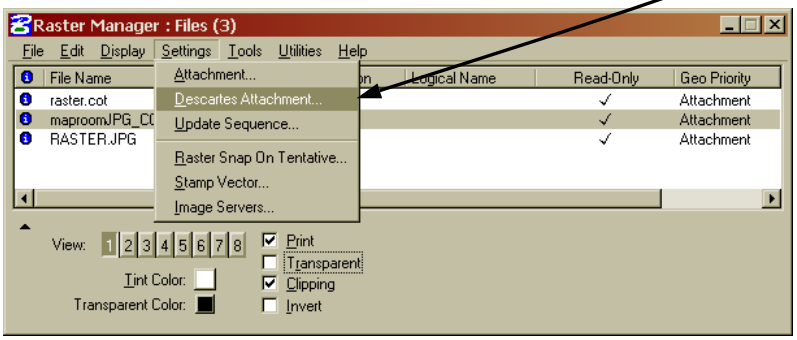
The ***(Temp)*** mask is used to temporarily add/subtract colors. It simply avoids creating a new mask for temporary usage. This is a system mask. It can be modified but cannot be deleted.

It is possible to assign the same mask to several images in one step. Multiple selections are supported in the image list. When using multiple selections, it is not possible to mix binary images with other image types. When binary images are selected, only two masks are available:

- “(Foreground)” – Redefines Raster Manager foreground color for binary images.
- “(Background)” – Redefines Raster Manager background color for binary images.

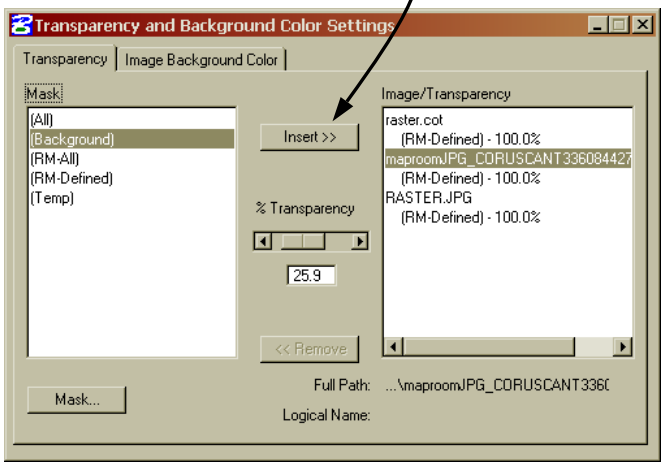
To open the Transparency and Background Color Settings dialog box:

1. From the Raster Manager Settings menu, select *Descartes Attachment*.



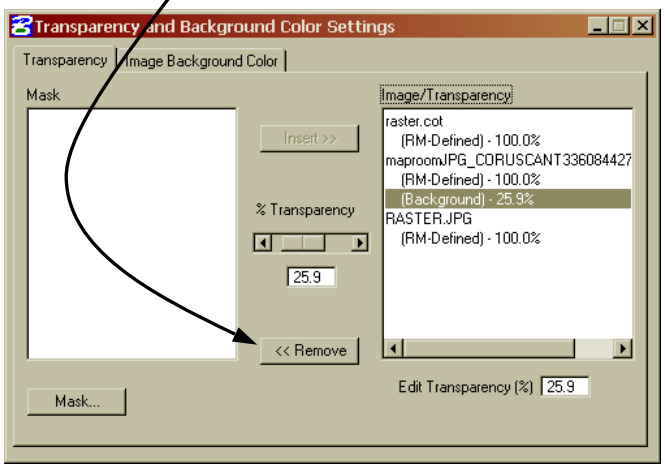
To assign a Mask and Transparency percentage to images:

1. From the Image/Transparency list, select the image(s) to which the mask will be assigned.
2. From the Mask list, select the mask to be assigned.
3. Set the percentage of transparency
4. Click on the Insert>> button.



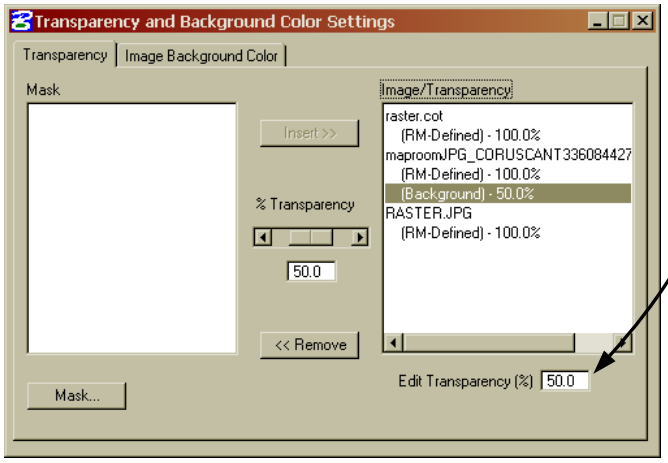
To remove a mask:

1. From the Image/Transparency list, find the image for which you want to remove a mask assignment and select the mask to be removed.
2. Click on the <<Remove button.



To modify the percentage of transparency of an assigned mask:

1. From the Image/Transparency list, find the image and select the mask you want to modify.
2. Change the percentage in the Edit Transparency field at the bottom right of the dialog.
3. Click Enter on the keyboard.



To modify the order masks are applied to the same image:

1. From the Image/Transparency list, select the image you want to modify and select the mask to be moved.

2. Right-click on the mask and select Move Up or Move Down.

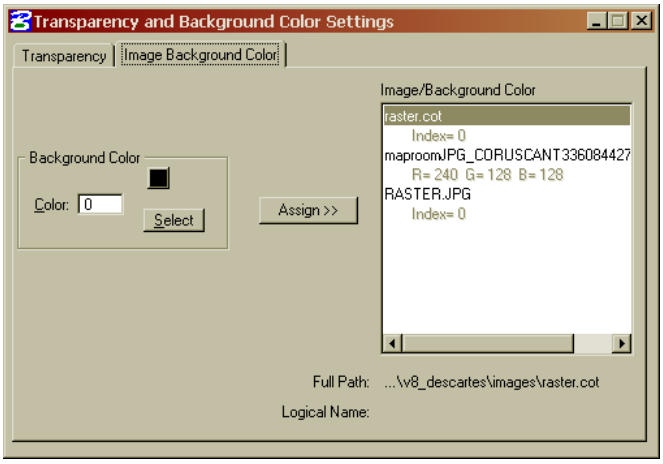
To add a new mask in the Mask list:

1. Click on the Mask… button on the lower left of the dialog. This will open the Color Mask dialog.

2. In the Color Mask dialog, select Tools > New Mask

3. Name the mask and press the enter key.

3.2b Image Background Color tab



When processing images, it is often necessary to define the background color. Images that are from different sources or scale may not all share the same background color value. Hence, it becomes tedious to set a different background color for each image included in a mosaic.

The background color can be assigned at the beginning of a workflow, by using a specific RGB color. This color will be used by Bentley Descartes whenever the background pixels need editing. By doing so, once a mosaic is completed, all the images will have the same background color.

The Image Background Color is used to assign a background color to an image. The background color is use by several Bentley Descartes tools. For example, when the Erase tool is used, all erased colors are replaced with the background color.

The default background color is assigned to all images.

- For binary images, the default is the Background color as defined by Raster Manager.
- For grayscale images, the default color is black (0,0,0)
- For 8-bit color images, the default is index 0.
- For 16 and 24-bit images, the default color is black (0,0,0)

Because color choices are different depending of the selected image, it is only possible to change one background color at a time.

To change a background color:

1. Select an image from the Image/Background Color list.

2. Select the color from the Background Color section and click the “Assign >>” button.

Once the background color is set, a background mask can be applied to make the background transparent. By doing so, an image will have its background automatically set as transparent.

Transforming Images

Section 4

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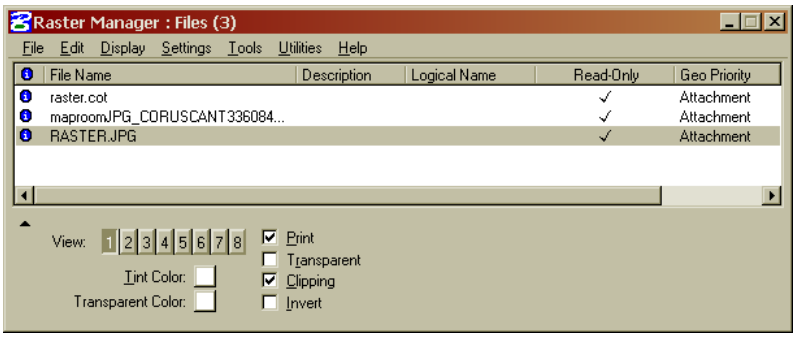
4.0 Transforming Images

This chapter shows how you can use the Descartes Raster Control tool box for quick transformations of raster objects, of image files or parts of image files in different geometric spaces.

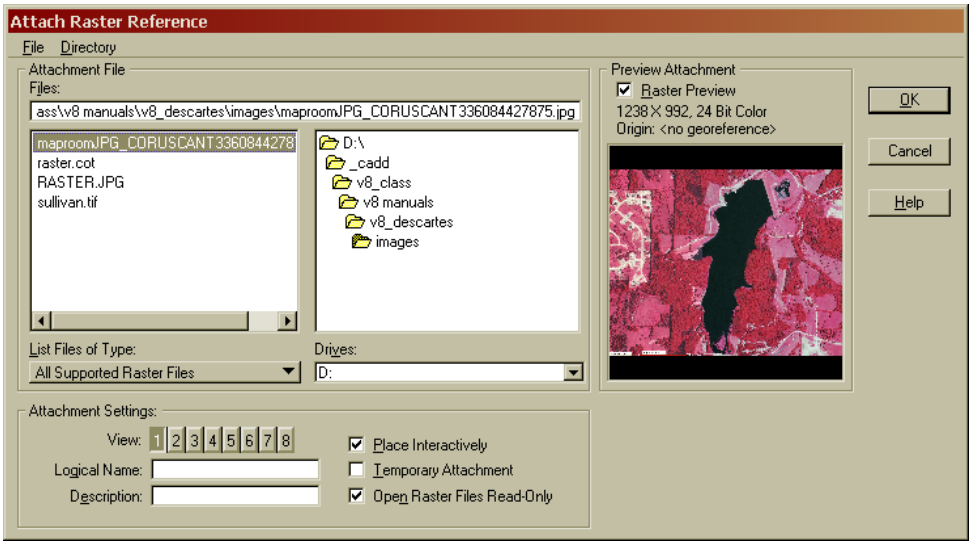
Raster Manager tool

Used to open the Raster Manager Dialog Box.



Attach tool

Used to open the Attach Raster References Dialog Box.

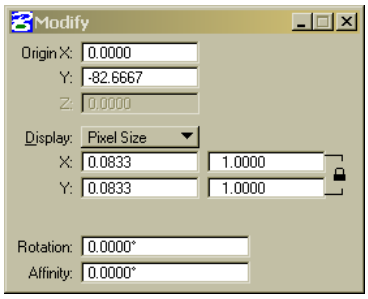


4.1 Raster Selection tool

Used to select a Raster file.

4.2 Modify Image tool

The Modify Image Tool allows the user to interactively change the shape of an image (location, scale, rotation, and affinity). This tool will affect the selected images. Multiple selections are allowed.



Tool Setting	Effect
Origin X, Y and Z	Sets the location, in working units, of the lower left corner of the selected raster file attachment. The Z field is grayed out when working with 2D images.
Display	When more than one image is selected, the Display will be based on the average pixel size of the selection set.
Rotation	Sets the rotation angle of the selected attached raster image.
Affinity	Sets the affinity angle for the selected attached raster image.

To Modify an image with the Modify Image Tool

1. From the Raster Control toolbox, select *Modify Image* tool.
2. Using the pointer, enter a data point on the image to modify.
3. Use the handles to move, scale, and rotate the image, as well as to modify the affinity angle.

The data point also identifies the location of the Origin handle.

When using the Modify tool to edit more than one image that are not all on the same z-axis, the images are surrounded by an imaginary cube, in order to visualize the relocated images. The imaginary cube displays in all views, except the Top View.

4.3 Move Raster tool

Used to move an image to a new location. Move adjusts the origin or placement of the image. The pixel size, dimensions, and number of pixels remain unchanged. Multiple selections are allowed. All the selected images are moved.

When using the Move Raster tool, you are able to snap to tentative points on an element. The AccuSnap mode is enabled when MicroStation Descartes is installed.

To move a raster:

1. From the Raster Control toolbox, select *Move Raster* tool.
   The tool settings window opens.

2. By default, the *Attach Copy* toggle is turned OFF in the tool settings window. If you wish to create a new attachment of the image, select *Attach Copy*.

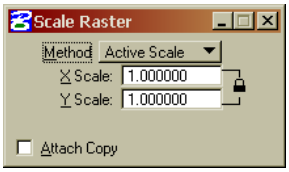
3. Enter a data point at a known location on the image. A rectangle outlining the image appears.

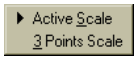
4. Move the cursor (the image outline follows) to the new location and enter a data point. This data point can be entered in any open view.

4.4 Scale Raster tool

Used to change the proportionate dimensions of an image. To scale an image, use an Active Scale or 3 Points Scale method. The Scale tool adjusts the origin, pixel size, and dimensions of the image. However, the number of lines and pixels remain unchanged. Multiple selections are allowed. All the selected images are scaled.

When using the Scale Raster tool, you are able to snap to tentative points on an element. The AccuSnap mode is enabled when MicroStation Descartes is installed.





Tool Setting	Effect
Method	Sets the method. • Active Scale — Scale by the active scale factors (X Scale and Y Scale). If a scale factor is 0-1 (for example, 0.25), size in that direction is decreased; if a scale factor is greater than 1, size in that direction is increased. • 3 Points Scale — Scale graphically, through the entry of three data points. The scale factors are computed by dividing the distance between the first and third points by the distance between the first and second points.
X Scale	Scale factor along view x-axis (horizontal), when Method is Active Scale.
Y Scale	Scale factor along view y-axis (vertical), when Method is Active Scale.
Attach Copy	Toggle ON to create a new attachment.

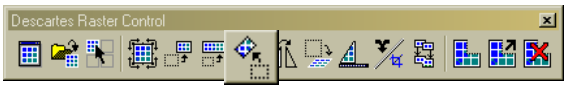
To scale an image using Active Scale:

1. From the Raster Control toolbox, select *Scale Raster* tool.
2. Choose Active Scale from the Method option menu.
3. Specify the scale by entering a factor in the Scale input box.
4. Enter a data point that remains at the same location, whatever the scale. All views where the image is displayed update to reflect your scale adjustments.

To scale an image using 3 Points Scale:

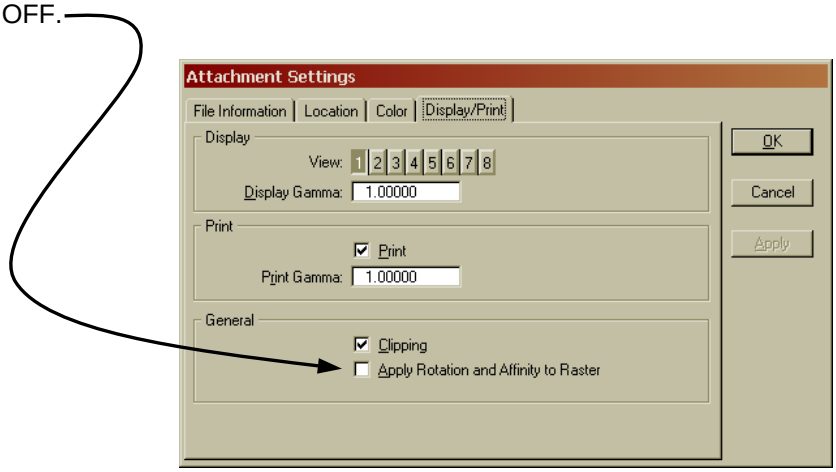
1. From the Raster Control toolbox, select *Scale Raster* tool.
2. Choose 3 Points Scale from the Method option menu.
3. Enter a data point that remains at the same location, whatever the scale.
4. Enter a second data point at a known location on the image. A cursor is placed where the data point was entered and a dynamic rectangle outlining the image appears.
5. Move the cursor so that the image outline increases or decreases to reflect the scale factor. Enter a data point to confirm/accept the new scale. This data point can be entered in any open view. When you move the cursor, observe that the image outline decreases until it reaches a minimum size and then increases again.

4.5 Rotate Raster tool

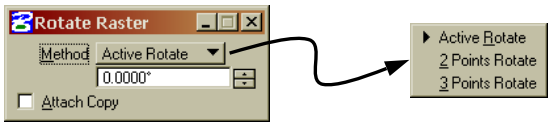


Used to rotate an image. Multiple selections are allowed. All the selected images are rotated

The Rotate Raster tool cannot be used on rasters which have their "Apply Rotation and Affinity to Raster" toggle set to OFF.



When using the Rotate Raster tool, you are able to snap to tentative points on an element. The AccuSnap mode is enabled when MicroStation Descartes is installed.



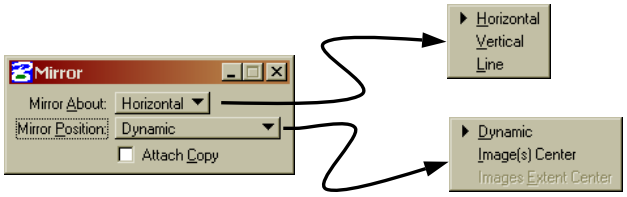
Tool Setting	Effect
Method	Sets the method used to rotate. • Active Raster — the raster is rotated by the angle value, which can be keyed in or selected. • 2 Points Rotate — the angle of rotation is defined by entering two data points. • 3 Points Rotate — the angle of rotation is defined by three data points.
Attach Copy	Toggle ON to create a new attachment.

To rotate an image to a specified angle:

1. From the Raster Control toolbox, select *Rotate Raster* tool.
2. Enter a data point to define the pivot point.
3. If Method is set to Active Rotate, enter the wanted angle value. The arrows will increase or decrease by 90 degrees at a time. Otherwise, continue with step 4.
4. If Method is set to 2 Points Rotate, enter a data point to define the angle of the rotation. Or if Method is set to 3 Points Rotate, enter a data point to define the start of the rotation. If Method is set to 2 Points Rotate, the raster is rotated; repeat to rotate the raster again. Otherwise, continue with step 5.
5. Enter a data point to define the angle of the rotation.

4.6 Mirror Image tool

Use the *Mirror Image* tool to flip the source image using a horizontal, vertical, or diagonal mirror. The image is transformed and can either replace the current file or is copied to a new file. Multiple selections are allowed. All the selected images are mirrored.



Tool Setting	Effect
Mirror About	Lets you choose, via an option menu, how to mirror the raster image. • Horizontal — Mirrors the selected image about a horizontal axis. • Vertical — Mirrors the image about a vertical axis. • Line — Mirrors the image about a user-defined line.
Mirror Position	Lets you define the mirror position, via an option menu. • Dynamic • Image(s) Center • Images Extent Center
Attach Copy	Toggle ON to create a new attachment.

To mirror an image using the transformation matrix

1. From the Descartes Raster Control tool box, select *Mirror Image*.
2. By default, the *Attach Copy* toggle is turned OFF in the tool settings window. This allows you to take advantage of the speed of the transformation matrix. If you wish to create a new attachment of the image, select *Attach Copy*.

3. Choose a data point on the image to mirror.

To reverse an image using a mirror creating a new output image

1. Select *Mirror Image* tool.
2. In the tool settings window, turn ON *Attach Copy* and select the appropriate options for the mirroring direction and position.
3. Position the image outline in the view.
4. Enter a data point.

4.7 Square Image tool

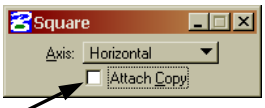
Select *Square Image* to rotate a raster image by squaring a horizontal, vertical, or diagonal axis. Multiple selections are allowed.

The default settings assumes you will use the transformation matrix, but it is possible to resample the image by checking the “Attach Copy” toggle box which appears in the *Square* tool setting.

To square an image

1. From the Raster Control tool box, select *Square Image*.
   The tool settings window opens.

2. By default, the *Attach Copy* toggle is turned OFF in the tool settings window. This allows you to take advantage of the speed of the transformation matrix. If you wish to create a new attachment of the image, select *Attach Copy*.



3. Select a data point on your image.

4. Choose two points on the appropriate axis and the image will be squared.

4.8 Merge/Crop Image tool

Use the *Merge/Crop Image* tool to merge or crop one or more images contained within a defined area. Multiple selections are allowed.

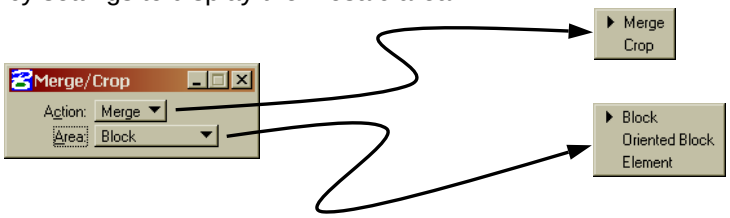
The Merge function applies to all the displayed rasters while the Crop function applies only to the selected rasters.

A new raster file is created when using the Merge tool only.

The Crop tool modifies the original raster file by removing the data outside the specified area on the selected rasters. With multiple selections, the Crop action will be applied on each selected image that is touched by the specified area.

The Merge function is WYSIWYG, meaning that contrast, brightness, gamma correction and more will be applied before the new image is created.

If images included in the input area are displayed in a mosaic where Transparency has been used, the output file contains all pixels visible in the input area. Therefore, the output file will be one uniform file that no longer requires the Transparency settings to display the mosaic area.



To merge images contained within a block

1. Select *Merge/Crop Image* tool.
   The tool settings window displays.

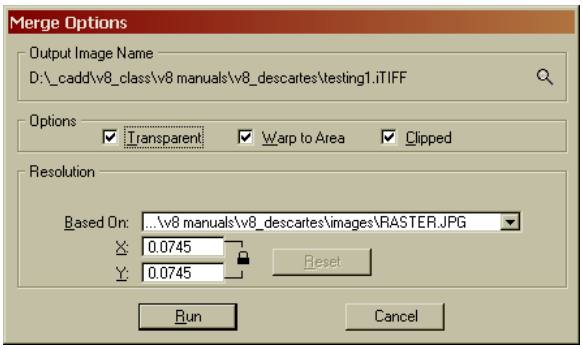
2. Select *Merge* from the Action option menu and *Block* from the Area option menu.

3. Enter a data point to fix the origin of the input area (block).
   As you move the cursor, a dynamic rectangle appears.

4. Enter a data point to fix the opposite corner.
   When the *Warp to Area* toggle is enabled, no matter in which order the data points are entered, the lower left corner of the block will always be considered as the origin and the lower right corner of the block will define the angle. If the view as no rotation, the ``Block´´ area will always have an angle of zero.
   You can enter the data point in any view. If there is no image in the area defined by the rectangle, an error message displays. Otherwise, the Merge Options dialog box displays.

5. In the Merge Options dialog box, enter the Output Image Name and select the resampling options and resolution parameters, then click Run.
   The output image is added to the list of the view in which the origin was entered. The view then updates.

When an output file is created with the Raster Control tools, the background color displays in all areas not occupied by the target input region. If you do not wish the background color to be displayed in a given view, turn on the Transparent and/or the Clipping toggle in the Merge Options dialog box.



To merge images contained within an oriented block

1. Select *Merge/Crop Image* tool.

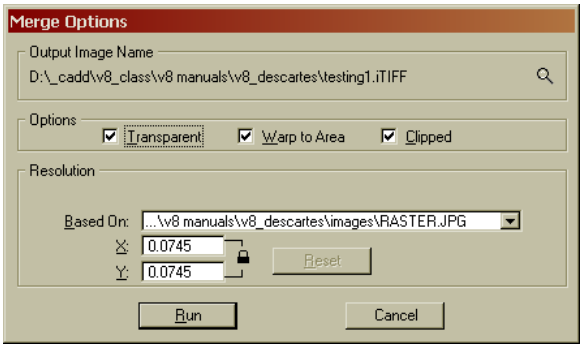
2. Select *Merge* from the Action option menu and *Oriented Block* from the Area option menu.

3. Enter a data point to fix the origin of the area (block).
   A rubber band appears as you move the cursor. Enter a secont data point to set the angle of the oriented block.

4. As you move the cursor, a dynamic rectangle appears. Set the resampling rectangle by entering a third data point in the appropriate direction to fix the opposite corner.
   When the *Warp to Area* toggle is enabled, no matter in which order the data points are entered, the lower left corner of the block will always be considered as the origin and the lower right corner of the block will define the angle. If the view as no rotation, the ``Block´´ area will always have an angle of zero.
   You can enter the data point in any view. The orientation is defined by an angle calculated from the design plane positive x-axis. If there is no image in the area defined by the rectangle, an error message displays. Otherwise, the Merge Options dialog box displays.

5. In the Merge Options dialog box, enter the Output Image Name and select the resampling options and resolution parameters, then click Run.
   The output image is added to the list of the view in which the origin was entered. The view then updates.

When an output file is created with the Raster Control tools, the background color displays in all areas not occupied by the target input region. If you do not wish the background color to be displayed in a given view, turn on the Transparent and/or the Clipping toggle in the Merge Options dialog box.



To crop images contained within a block

1. Select *Merge/Crop Image* tool.
   The tool settings window displays.

2. Select *Crop* from the Action option menu and *Block* from the Area option menu.
   The tool settings box expands to allow you to enable or disable the *Transparent* and *Clipped* toggles. When the *Transparent* toggle is enabled (default), transparency will automatically be applied to the output image. When the *Clipped* toggle is enabled (the default) the clipping will be applied to the output image.

3. Enter a data point to fix the origin of the input area (block).
   As you move the cursor, a dynamic rectangle appears.

4. Enter a data point to fix the opposite corner.
   The original raster file is modified by removing the data outside the specified area.

To crop images contained within an oriented block

1. Select *Merge/Crop Image* tool.
   The tool settings window displays.

2. Select *Crop* from the Action option menu and *Block* from the Area option menu.
   The tool settings box expands to allow you to enable or disable the *Transparent* and *Clipped* toggles. When the *Transparent* toggle is enabled (default), transparency will automatically be applied to the output image. When the *Clipped* toggle is enabled (the default) the clipping will be applied to the output image.

3. Enter a data point to fix the origin of the area (block).
   A rubber band appears as you move the cursor. Enter a secont data point to set the angle of the oriented block.

4. As you move the cursor, a dynamic rectangle appears. Set the resampling rectangle by entering a third data point in the appropriate direction to fix the opposite corner.
   The original raster file is modified by removing the data outside the specified area.

To crop images inside an element

1. Select *Merge/Crop Image* tool.
   The tool settings window displays.

2. Select *Crop* from the Action option menu and *Block* from the Area option menu.
   The tool settings box expands to allow you to enable or disable the *Transparent* and *Clipped* toggles. When the *Transparent* toggle is enabled (default), transparency will automatically be applied to the output image. When the *Clipped* toggle is enabled (the default) the clipping will be applied to the output image.

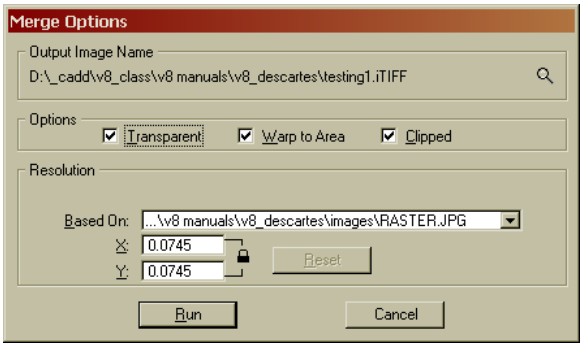
3. Click on the target polygon. Enter a data point to accept the element.
   When the *Warp to Area* toggle is enabled, the first two points of the shape that defines the area will determine the angle of the area.
   You can enter the data point in any view. If there is no image in the area defined by the rectangle, an error message displays. Otherwise, the Crop Options dialog box displays to permit you to set the resampling parameters.

4. In the Crop Options dialog box's Options field, choose the crop options, then click Run to resample the image.
   The original raster file is modified by removing the data outside the specified area.

The Crop function is not allowed on images with the Apply Rotation and Afiinity *option turned OFF. For Merge operations, the backfill is set to the MicroStation view's background color. For Crop operations, each raster will keep its backfill color. The* Fence *mode is not supported. The Crop function is not supported with References or with read-only images.*

4.8a Merge Options dialog box

Used to determine the characteristics of the output file created with the Merge Images tool.



Output File Name

Used to specify the name for the output file. A default file name will be generated following the same rules as in the old versions of Bentley Descartes. The *magnifying glass* opens the Select Raster File dialog. It now accepts all the supported file types. The compression and the file type are selected in this dialog.

Options

Use these toggles to preset features in the output image.

Transparent	When enabled (default), transparency will automatically be applied to the output image.
Warp to Area	When enabled, the raster's header or sister file will be modified to match the source element's origin and rotation. When disabled (the default), this option will invoke the Merge function without resampling the rotation. The image will not have any transformation (rotation affinity) stored in its header or sister files.
Clipped	When enabled (the default) the clipping will be applied to the output image.

Resolution

The Resolution parameters are used to adjust the output image. Each field and option is described below.

Based On	The user can select the default output pixel size. The available options in the "Based On" option button are: • One entry with the name of each touched image: The output pixel size can be set to the pixel size of any of the input images. • Average: The output pixel size can be set to the average pixel size (or scale factor) of the selected images.
X and Y	The "X" and "Y" fields can be edited.
Reset	If the Reset button is used, the X and Y values will be reset to their original values. The original values are determined by the "Based On" option.

Run

Click Run to create the output image. While the image is being created, a Progress indicator displays.

If there is not enough space on the destination disk to contain a file that will be compressed, you are warned and permitted to cancel the process. If you chose not to compress the output file and if there is not enough space on the destination disk, you are warned that the process cannot be performed.

Cancel

If you decide not to use the present parameters, click Cancel. The dialog box then closes.

4.9 Corridor Image tool

Use the *Corridor Image* tool to copy the regions of one or more images contained within a polygon to an output polygon of the same shape. The copied regions of the source images are merged into a new image and then copied to the output space defined by the polygon. Design elements (from the design file and associated reference files) that occupy the region contained within the polygon can also be copied to the output polygon. Multiple selections are allowed.

The Corridor Image function is now WYSIWYG, meaning that transparency, contrast, brightness, gamma correction and more will be applied before to new image is created.

When you use Corridor Image, both the input (source) and output (destination) polygons must be the same shape (usually a copy of the same element). However, the output polygon can be rotated, scaled, and moved to reflect the desired output result.

If the images in the input area are displayed with transparency to make a mosaic, the output file will contain all of the pixels that you can see, not the transparent parts. Therefore, the output file will be one uniform file that no longer requires the transparency settings in order to display the mosaicked area.

The Corridor Image tool creates an image using other images

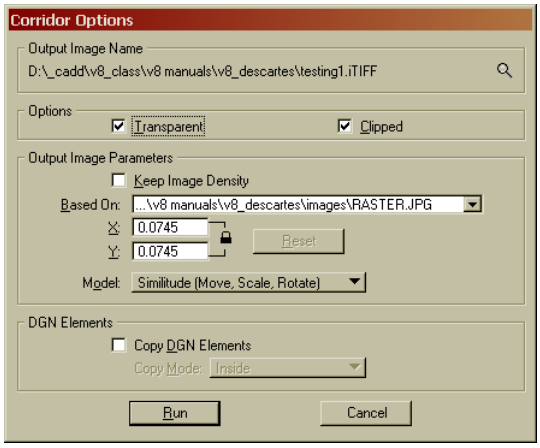
To use Corridor Image

1. Create a source and destination polygon.
2. Place the source polygon on the target region that you want to copy.
3. Select the *Corridor Image* tool.
4. Click on the source polygon and enter a data point to accept the element.
5. Click on the destination polygon. Enter a data point to accept the element.
   The *Corridor Option dialog box* displays to allow you to set the resampling parameters and to select the name of the output file.
   The output image is added to the file list for the view where you selected the output destination polygon. The view then updates.

The polygon must be a shape or complex shape, which contains only lines, and line strings. If a complex shape is used and it contains more than 100 points, then the Copy Design Elements feature is disabled.

When an output file is created with the Raster Control tools, the background color displays in all areas not occupied by the target input region. If you do not wish the background color to be displayed in a given view, turn on the Transparent toggle in the Output Settings dialog box and the Transparency toggle in the View Image Attributes dialog box for this view.

4.9a Corridor Options dialog box



Used to determine the characteristics of the output file created with the Corridor Image tool.

Output File Name

Use to specify the name for the output file. A default file name will be generated following the same rules as in the old versions of Bentley Descartes. The *magnifying glass* opens the Select Raster File dialog. It now accepts all the supported file types. The compression and the file type are selected in this dialog.

Options

The *Transparent* and *Clipped* toggles can be turned ON to preset these features in the output image. Upon completion of the corridor operation, Raster Manager will automatically attach the new image and, if turned on, the display options will automatically be applied.

Output Image Parameters

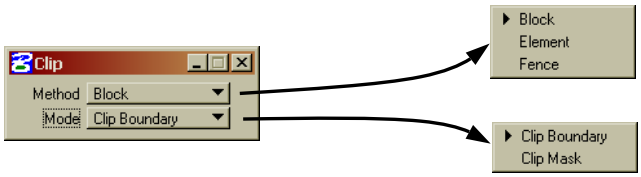
These parameters are used to adjust the output image. Each field and option is described below.

Keep Image Density	Conserve the source image's density in the output image.
Based On	The user can select the default output pixel size. The available options in the “Based On” option button are: • One entry with the name of each touched image: The output pixel size can be set to the pixel size of any of the input images. • Average: The output pixel size can be set to the average pixel size (or scale factor) of the selected images.
X and Y	The “X” and “Y” fields can be edited.
Reset	If the Reset button is used, the X and Y values will be reset to their original values. The original values are determined by the “Based On” option.
Model	Select the model to use for the Corridor operation. The available models are: • Align (Move, Scale) • Helmert (Move, Rotate) • Similitude (Move, Scale, Rotate) • Affine (Move, Scale, Rotate, Skew)

4.10 Clip tool

Used to clip a raster image (Clip Boundary), or to define a masked area (Clip Mask). An image can have one clipping boundary, but may have a number of clipping masks. Thus, when you create a new clipping boundary, any existing clipping boundary is cleared. When you create a clipping mask, however, it is added to any existing clipping masks for the selected image.

Multiple selections are allowed when using the Clip tool. However, when more than one image is selected, the clipping will not create one single polygon, but as many different clipping polygons as there are images. If the Modify Clip tool is subsequently used, and only one image is selected, only the clipping polygon associated to this single image will be modified and not all the clipping polygons as a whole.



Tool Setting	Effect
Method	This option menu lets you choose the type of Method to be used to clip the raster image. • Element — Lets you specify an existing (closed) element in the design file to use as a clipping polygon. • Fence — Lets you use an existing fence as a clipping polygon. • Block — Lets you interactively draw a block to be used as a clipping polygon.
Mode	This option menu lets you choose the clipping mode that is used to clip the raster image. • Clip Boundary — Used when cropping images. The image is cropped back to the limits of the clipping object. • Clip Mask — Used to mask a section within a raster image. This option lets you place a text box, for example, within a raster image file.

To <u>clip</u> a raster image using an <u>element</u> to define the boundary

1. Draw the element to define the clipping boundary.
2. Select the *Clip* tool.
3. In the tool settings window, set *Method* to Element and *Mode* to Clip Boundary.
4. If more than one raster image is attached to the design file, identify the raster image to be clipped.
5. Identify the clipping element.
6. Accept the element as the clipping polygon to clip the image.

To clip a raster image using a fence to define the boundary

1. Place a fence to define the clipping boundary.
2. Select the *Clip* tool.
3. In the tool settings window, set *Method* to Fence and *Mode* to Clip Boundary.
4. If more than one raster image is attached to the design file, identify the raster image to be clipped.
5. Accept the fence as the clipping polygon to clip the image.

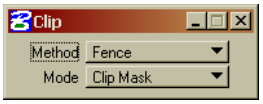
To clip a raster image using a block to define the boundary

1. Select the *Clip* tool.
2. In the tool settings window, set *Method* to Block and *Mode* to Clip Boundary.
3. If more than one raster image is attached to the design file, identify the raster image to be clipped.
4. Enter a data point to define the first point of the block.
5. Enter a data point to define the opposite corner of the block.
6. Accept the block as the clipping polygon to clip the image.

To mask an area of a raster image using an element to define the boundary

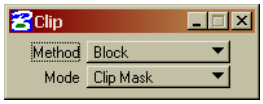
1. Draw the element to define the mask boundary.
2. Select the *Clip* tool.
3. In the tool settings window, set *Method* to Element and *Mode* to Clip Mask.
4. If more than one raster image is attached to the design file, identify the raster image to be clipped.
5. Identify the clipping element.
6. Accept the element as the clipping polygon to mask part of the image.

To mask part of a raster image using a fence to define the boundary



1. Place a fence to define the clipping boundary.
2. Select the *Clip* tool.
3. In the tool settings window, set *Method* to Fence and *Mode* to Clip Mask.
4. If more than one raster image is attached to the design file, identify the raster image to be clipped.
5. Accept the fence as the clipping polygon to mask the image.

To mask part of a raster image using a block to define the boundary



1. Select the *Clip* tool.
2. In the tool settings window, set *Method* to Block and *Mode* to Clip Mask.
3. If more than one raster image is attached to the design file, identify the raster image to be clipped.
4. Enter a data point to define the first point of the block.
5. Enter a data point to define the opposite corner of the block.
6. Accept the block as the clipping polygon to mask the image.

4.11 Modify Clip tool

Used to modify the clipping polygon for a clipped raster image.

Multiple selections are allowed when using the Clip tool. However, when more than one image is selected, the clipping will not create one single element, but different clip elements. If the Modify Clip tool is subsequently used, and only one image is selected, only the clip element associated to this single image will be modified and not all clip elements as a whole.

Tool Setting	Effect
Update After Each Modification	If ON, the raster image updates after each modification to the clipping polygon. If OFF, no modification is made to the display of the raster image until modifications to the clipping polygon are completed and you enter a Reset.

To modify a clipping polygon without automatic updating

1. Select the *Modify Clip* tool.
2. In the tool settings window, turn ***off*** Update After Each Modification.
3. Identify the raster image.
4. Identify the clipping polygon to modify at the point to be modified.
5. Make the modification.
6. (Optional) Repeat steps 4 and 5 for any further modifications that are required.
7. Enter a Reset to complete.
   The raster image updates to reflect the modifications to the clipping polygon.

To modify a clipping polygon <u>with</u> automatic updating

1. Select the *Modify Clip* tool.
2. In the tool settings window, turn ***<u>on</u>*** Update After Each Modification.
3. Identify the raster image.
4. Identify the clipping polygon to modify, then drag the polygon's outline to modify it.
5. Make the modification.
   The raster image updates to reflect the modification to the clipping polygon.
6. (Optional) Repeat steps 4 and 5 for further modifications.

4.12 Unclip tool

Used to remove one or more clipping polygons from a raster image. You can select the raster image graphically after selecting the *Unclip* tool. Alternatively, you may select the raster image first, via the Raster Manager dialog box or with the *Select Rasters* tool.

Tool Setting	Effect
Delete	Lets you choose between deleting all polygons in one step, or selected polygons. • All Polygons — Lets you delete all clipping polygons associated with a raster image. • Selected Polygon — Lets you choose the clipping polygons that you want to delete from a raster image.

To delete all clipping polygons from a raster image

1. Select the *Unclip* tool.
2. In the tool settings window, set *Delete* to All Polygons.
3. Identify the raster image from which the clipping polygons are to be removed.
   The clipping polygons for the selected raster image are highlighted.
4. Accept to delete all the clipping polygons.

To delete selected clipping polygons from a raster image

1. Select the *Unclip* tool.
2. In the tool settings window, set *Delete* to Selected Polygon.

3. Identify the raster image from which the clipping polygons are to be removed.
   The clipping polygons for the selected raster image are highlighted.

4. Identify a clipping polygon to delete.
   The selected clipping polygon highlights in a different color.

5. Accept to delete the clipping polygon.

6. (Optional) Repeat steps 4 and 5 to remove other clipping polygons from the selected image.

Registering Images and Vector Data

Section 5

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5.0 Registering Images and Vector Data

This chapter describes the Register utility and all the related features. Register is used to geometrically correct images or vector data to a given coordinate system by warping them to fit a reference or base document. The base document can be an image, a vector file, a drawing, a map sheet, or a list of known points.

Warping Images with Register

Register provides more control on establishing the transformation models and gives access to more sophisticated features, such as:

- Dynamic warping which overlays existing vector data over the uncorrected image, so you can verify the actual transformation model and decide whether it is good enough for running the resampling of the image.
- More flexibility for entering and managing control points. Any control point can be moved or deleted.
- Polynomials models which can be used for more severe distortion.
- A No-Residual Transformation model for precision in control points.
- Any number of control points. When there are more Dynamic Warping in Views Displaying Uncorrected Data than the minimum required, residuals can be used for inspecting and analyzing the actual model.
- Transformation of vector data through the same model.
- Batch resampling of images.

Transformation Models

Various warping transformation models are supported:

- Helmert
- Similitude
- Affine
- Projective
- Thin Plate Spline - *No Residuals*
- Polynomial

The unique design of Register lets you to visually determine if the transformation model is accurate. Since base vector data is displayed over the target image, it is simple to identify inaccuracies in the model. To assist you in the warping process, Register displays statistical information about the accuracy of the transformation model. You can also dynamically change the transformation model and interactively edit the control points on the base document.

When the transformation model is accurate, as many images as necessary can be resampled. Resampling methods include nearest neighbor, bilinear interpolation, and cubic convolution.

Concepts

Registering images or vectors requires that their geometry be altered to fit another geometry taken as a reference. The process consists of two steps. First, a transformation model is built. Second, the images or vectors are resampled through this transformation model.

Throughout this chapter, the terms *base* and *uncorrected* are used with a very specific meaning:

The *base* is the system of coordinates taken as a reference and onto which the uncorrected data is registered. The *base* can be vectors, digital images, hard copy, a series of known points, or some other geometric source.

The *uncorrected* data is a digital document targeted to fit the base after it is transformed through a mathematical model.

Building a Model

Building a model requires that a set of mathematical functions be built to establish correspondence between any point in the base geometry and the corresponding point in the target geometry.

The way that Register establishes this set of functions is by placing a set of corresponding points, called *control points*, and interpolating for the remainder of space around the control points. The control points are represented by color marks in both base and uncorrected spaces. The interpolation is done with smooth two-dimensional functions like Helmert, Affine, Similitude, Projective, and up to a third degree Polynomial.

To test the accuracy of the interpolation, Register warps a representation of the base vector data to fit the uncorrect data. This visualization illustrates the fit that occurs when you resample the uncorrect data to fit the base data.

This visual feedback assists you as you gather more points and improve the fit. After enough points are gathered to satisfy the requirements of the selected transformation model, the uncorrect image or vectors can be resampled using this model. Since the fit has already been determined visually, the result is “what you see is what you get” resampling.

Warping the base vector data is done dynamically and is normally fast. It is recommended that you warp a small but significant set of base vector data. The set of base vector data can be acquired by extraction from one or several base documents, in digital or analog formats: design files, digital images, analog maps, drawings, plans, lists of known points, and so forth.

With a design file, extract a few representative elements or parts of elements. With a digital image, extract a few representative elements by interpretation. With a hard copy document, digitize a few representative elements. With a list of known points, no base vector data set is needed to use the dynamic warping capability since the control point marks play this role.

You can also use Register to build a model without a set of base vector data and without dynamic warping, which resembles the method that is commonly used with most geometric correction software. However, with this method there is no means to test the accuracy of the model prior to resampling the image or vector file.

Another unique feature of Register is the alleviation of the constraint of finding “true” or “exact” control points. With Register, you can use *“fuzzy” control points*, because of the visual feedback provided by dynamic warping.

A true or exact control point is a point which can be precisely identified on both the base data set and on the data to be registered. Examples include the crossing of two roads, the corner of a part, the corner of a building, and so forth. A *fuzzy control point* is a point which can be localized approximately on both documents. Examples include the center of a lake, window, or field, or the top or side of a car, and so forth.

When you use fuzzy control points, pick each point approximately in the base space and pin it in the uncorrected space by determining its general position. The dynamic warping shows if your placement is accurate enough. If not, just move the point.

Image Resampling

The image resampling process creates a new image, pixel by pixel, by establishing an appropriate value for each pixel. The resulting image is similar to the one from which it is calculated, with a very close radiometry and with a slightly different geometry.

There are two steps in the image resampling process:

- For each pixel of the output image, the first step is to find the corresponding point in the input image by passing it through the established transformation model.
- The second step is to calculate the value of the output pixel by using the value of one or several pixels located on or around the corresponding point in the input image.

The Nearest Neighbor algorithm uses only one input pixel. Bilinear Interpolation uses the four nearest neighbors and calculates the weighted mean. Cubic Convolution uses a four by four matrix of pixels and calculates a type of weighted mean.

The Nearest Neighbor algorithm is faster, but it can cause jagged edges or lines on the output image. The Cubic Convolution algorithm takes longer, but the result is much smoother. The Bilinear Interpolation is a compromise between the other two methods in both speed and image quality.

The image resampling process can be independent of the process of building a model with control points. It is used with various other kinds of models such as translations, rotations, and scale changes, or even with a neutral model used only to cut images into pieces or to change the resolution of images. A set of standard models is provided with Bentley Descartes.

Image Resampling can also be done dynamically by choosing to use the transformation matrix of the image. This process is achieved simply by turning OFF the *Create a New Image* option from the Register dialog.

Vector Resampling

The vector resampling process copies or moves the selected design elements through the transformation model. The design elements are selected from the master file or from any reference file by using a fence or a selection set. You control whether each design element type will be considered or ignored by the transformation model. This flexibility is useful when processing many elements.

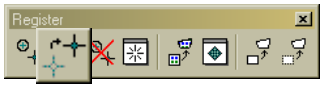
5.1 Register tool box

This tool box provides access to tools you can use to place, move, or delete control points, to copy or move vectors through the actual model, or to prepare the resampling of the actual image. The last button opens the Register dialog box, but it does not need to be open to use the other tools.

Place Control Points tool

Place a new pair of control points

Move Control Point tool



Move an existing control point mark.

Delete Control Points tool

Remove an existing pair of control points from the control points list box.

Register Dialog tool

Open the Register dialog box.

Resample Image tool

Open the Resampling dialog box and quickly prepare a fresh resampling page by setting all parameters with default values.

Resampling Dialog tool

Open the Resampling dialog box.

Copy Vector tool

Copy vectors through the active transformation model.

Move Vector tool

Move vectors through the active transformation model.

5.2 Place Control Points tool

Click the *Place Control Points* tool to place a new pair of control points.

The resulting pair of control points then displays in the control points list box in the Register dialog box, with the status set to on. The pair is inserted just after the previously selected line and the new line is now selected (highlighted). If Dynamic Warping in Views Displaying Uncorrected Data is on, the model updates and the base vector data warping updates in the specified views.

After a model is updated, the distance between the two corresponding marks reveals the residual for this pair of control points. As long as there are no extra points, the model is exact, i.e., there is no residual. Consequently, the two corresponding marks of each pair coincide.

To place control points

1. Select *Place Control Points*.
2. Move the base control point mark to the desired place relative to the base data.
3. Pin the base control point mark.
4. Move the uncorrected control point mark to the corresponding place on the uncorrected data.
5. Pin the uncorrected control point mark.

Placing Control Points

5.3 Move Control Point tool

Click the *Move Control Point* tool to move an existing control point mark.

The line in the list box corresponding to the modified control point is now selected (highlighted) and is rewritten with the adjusted coordinates. If Dynamic Warping in Views Displaying Uncorrected Data is on, the model updates and the base vector data warping refreshes in the specified views.

After a model is updated, the distance between the two corresponding marks indicates the residual for this pair of control points. As long as there is no extra point, the model is exact, i.e., there is no residual. Consequently, the two corresponding marks of each pair coincide.

To move a control point

1. Select *Move Control Point*.
2. Identify an existing control point mark (a base control point mark or an uncorrected control point mark).
3. Accept the control point mark, or reject and retry.
4. Move the control point mark to the desired place relative to the base or to the uncorrected data.
5. Pin the control point mark.

5.4 Delete Control Points tool

Click the *Delete Control Points* tool to remove an existing pair of control points from the control points list box.

When the identified point is accepted, both marks that belong to this pair are deleted and the corresponding line is removed from the list box. The rest of the list is renumbered. If Dynamic Warping in Views Displaying Uncorrected Data is on, the model updates and the base vector data warping refreshes in the specified views.

After a model is updated, the distance between the two corresponding marks reflects the residual for this pair of control points. As long as there are no extra points, the model is exact, i.e., there is no residual. Consequently, the two corresponding marks of each pair coincide.

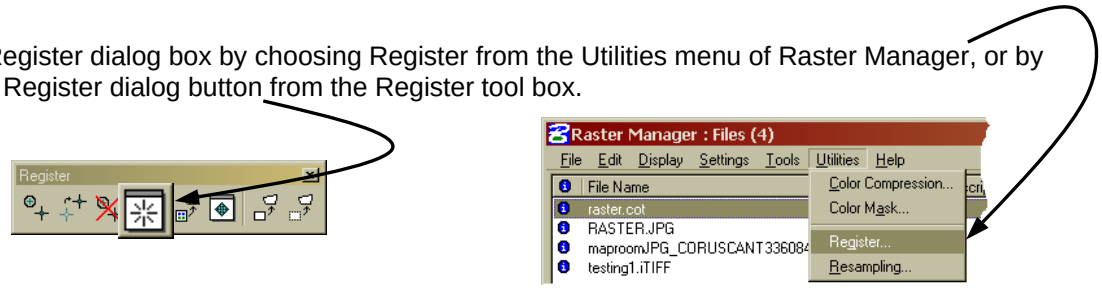
To remove (delete) a pair of control points

1. Select *Delete Control Points*.
2. Identify an existing control point mark, whether it is a base control point mark or an uncorrected control point mark.
3. Accept the control point mark, or reject and retry.

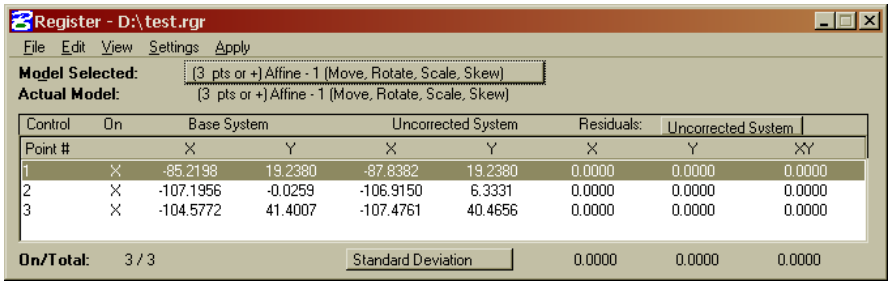
Only the points turned on can be deleted with the Delete Control Point tool, since the points turned off are not marked. If you want to toggle points on or off, double-click on the corresponding line.

5.5 Register dialog box

Access the Register dialog box by choosing Register from the Utilities menu of Raster Manager, or by selecting the Register dialog button from the Register tool box.



The title bar of the Register dialog box displays the name of the current model. If a model is not opened or if the current model has not been given a name, "Untitled" displays as the file name.



Model Selected

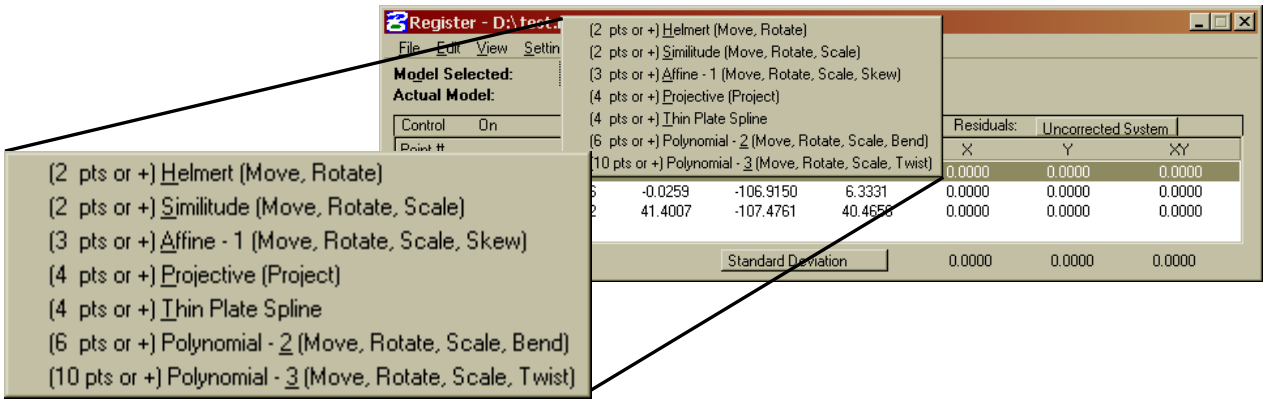
Use the Model Selected option menu to select the type of model. The Actual Model field provides feedback on the actual model that can be calculated from currently captured control points.

The control points used to control the building of a model are displayed below the menu bar of the dialog box and the Model Selection area.

This information provides feedback to assist you in the building of a model with control points. It includes nine columns, which contain the number of a control point, its on/off status, its X and Y coordinates in the base and uncorrected system, and its residuals relative to the actual model.

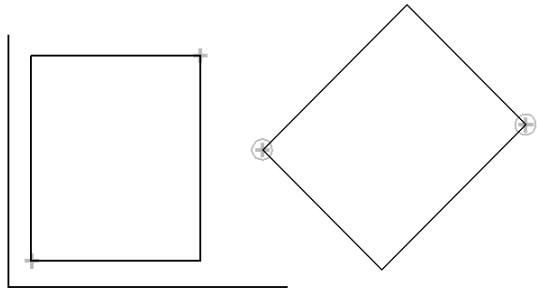
A model built with Register is a set of equations that define the correspondence between a point in the uncorrected system of coordinates and the equivalent point in the base system of coordinates.

The minimum number of required control points is indicated for each model in the following list:



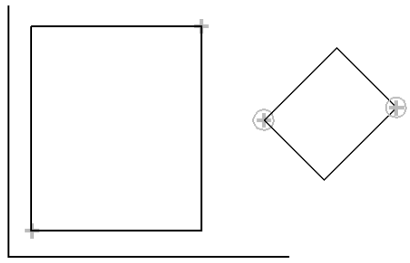
The Helmert model

The Helmert model, also called “rigid body,” performs a *rotation* and two translations (X and Y); however, *no scaling* is done. This model guarantees that the uncorrected data retains its proportions since the image or design elements are only moved and rotated.



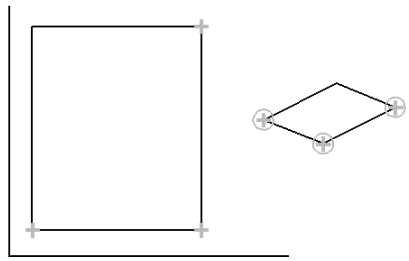
The Similitude model

The Similitude model performs a *rotation*, two translations (X and Y), and a *scaling* that has the same factor for the x- and y-axis. You can use a Similitude model to cut an image, to rotate an image, or to register two images with the same deformation relative to each other.



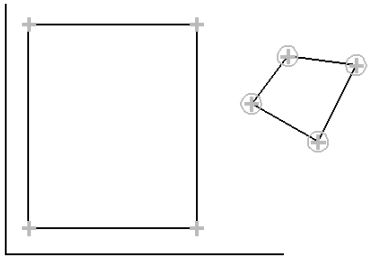
The Affine-1 model

The Affine-1 performs a *rotation*, two translations (X and Y), and *applies a different scale factor for the x-, y-axis as well as a factor that changes the orthogonality of these axes*. You can use the Affine-1 model to register a document that has very little deformation such as a scanned map.



The Projective model

The Projective model *projects one plane into another plane*. Like the Similitude and the Polynomial-1 models, it can be used to register a document that has very little deformation. For example, you can use it to register an aerial photograph that has little relief.



Thin Plate Spline mode

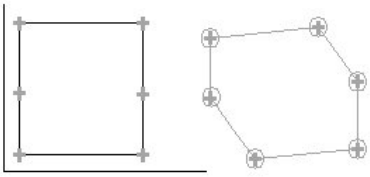
The *Thin Plate Spline model* is based on a four variable mathematical algebraic formula. This means that this model requires at least four pair of control points to resolve the transformation model.

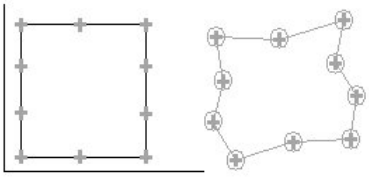
The benefits of this model resides in the fact that in order to compensate for the distortion caused by the rubbersheeting, instead of moving the control points to accommodate the residual values as in the traditional models, the *Thin Plate Spline* does not move the control points but instead, applies a correction elsewhere around the control points.

The trade-off is where it will most often be required to enter more control points than a traditional model. Control points will be positioned where the two systems (correct and uncorrected) do not aligned. Control points must be entered until the tanglement is satisfactory.

The Polynomial-2 and 3 models

The Polynomial-2 and 3 models are used to register documents that have moderate relief. However, they are not suitable for documents that contain accentuated relief. For example, you can use these models to register aerial photographs of a city with low hills, but should not use these models to register aerial photographs of a mountainous region.





Actual Model

When there are not enough points to build the requested model, a provisional model, needing less points, is calculated to support the dynamic warping.

When the minimum number of points is reached for the model requested, the Actual Model field displays the same name as the Selected Model option menu. If Dynamic Warping in Views Displaying Uncorrected Data is on and for any reason the model cannot be calculated with the present set of control points, the actual model shown is None.

Control Point #

The Control Point # column provides a sequential number for all control points entered. If a point is removed or if a new point is inserted between two existing points, the list renumbers.

On

The On column indicates whether the corresponding control point is on or off in the calculation of the actual model. An "X" indicates on. An empty space indicates that this point is turned off. Double-clicking a line of the list toggles the status of the corresponding control point between on and off.

Base System X, Y

The X and Y columns under Base System display the coordinates of control points in the “base” system of coordinates. This system is the one into which the image is to be transformed after it is resampled by applying the model.

Uncorrected System X, Y

The X and Y columns under Uncorrected System display the coordinates of control points in the “uncorrected” system of coordinates. The residual of a control point is the difference in location between the position where a control point is pinned on the uncorrected system as compared to the position it should be according to the actual model. When a model is built with the minimum number of control points, such as four points for the Projective, there is no residual (except for Helmert). This situation means that the model “trusts” you and puts the calculated point exactly where you pinned it on the uncorrected system.

In fact, since the model has only the minimum number of points, it must make this assumption. As soon as an extra point is provided, it can compare the position you “guessed” with the position it calculates through the model. The difference between your “guess” and the calculated position is the residual.

After a model is updated, the distance between the two corresponding marks reveals the residual for this pair of control points. As long as there is not an extra point, the model is exact, i.e., there is no residual (except for Helmert). Consequently, the two corresponding marks of each pair coincide.

The model supported is always the best fit to all points, when extra points are provided. Normally, when a control point is inconsistent with the others, its residual is greater. The residuals displayed in the Control Points List box are indications of points that can need adjustment. Turning off the point with the greatest residual normally improves the actual model.

Residuals are distances. The three columns X, Y, and XY under Residuals indicate the X component, the Y component, and the magnitude (XY) of this distance.

The Helmert model differs from the other models in respect to residuals. Because this model guarantees that the body of the uncorrected geometry stays rigid (without scale modification), the minimum number of control points usually generates residuals. In fact, with two control point pairs, the Helmert model moves and rotates the rigid body until the residuals are minimized.

Residuals

Used to specify whether the calculated and displayed residual values apply to the Base System or to the Uncorrected System.

On/Total

The On/Total field displays the number of control points turned on over the total number of control points in the present list.

File > Save As

It is now possible to save a register list of control points into a text file. To do so:

1. Open an existing RGR file or create one.
2. From the Register dialog box, select File>Save As.

   The Save Model dialog box opens.

3. In the Select Format To Save option menu, select “Text (Comma delimited) [*.txt]”
4. Enter a file name and a location folder.
5. Click OK

The resulting file can be opened in a text editor or imported in a spreadsheet application supporting Comma Delimited file formats.

Edit menu

The Edit menu provides access to various tools and dialog boxes that are used to create or modify a model. Use these features to enter, modify, delete, highlight, or locate pairs of control points, and to identify the coordinate system to which the base data belongs.

Edit > Add Control Points

Choose Add Control Points from the Edit menu to manually enter a pair of control points: (Base X, Base Y) and (Uncorrected X, Uncorrected Y).

The On/Off check button toggles this pair of points between on or off. When on, the pair of points is taken into account for the calculation of the actual model and the corresponding marks display in the appropriate views. When off, this pair is suppressed and the marks are not shown. The points, however, can be turned on and used again by using the Modify Control Points dialog box.

The new pair of points is always added after the previously selected line. If the new line is inserted before the last existing line, a renumbering of the following lines results.

In some situations, this result might not be desirable. Consider when an analog hard copy map is used as the base data. In this case, the corresponding numbers would be written directly on the map. Any changes in the sequence of the numbers requires a renumbering of the points on the hard copy. To avoid renumbering in such cases, add points to the end of the list.

If you wish to toggle points on or off, double-click on the corresponding line.

Edit > Modify Control Points

Choose Modify Control Points to modify the selected pair of control points by manually editing the following coordinates: (Base X, Base Y) and (Uncorrected X, Uncorrected Y).

The On/Off check button toggles this pair of points between on or off. When on, a pair is taken into account for the calculation of the actual model and the corresponding marks display in the appropriate views. When off, this pair of points is suppressed and the marks are not displayed. Alternatively, double-click on the corresponding line to toggle points on or off.

Edit > Delete Control Points

Choose Delete Control Points to remove the selected pair of control points from the list.

Edit > Highlight Control Points

Choose Highlight Control Points to highlight the selected pair of control points. This feature uses the same color that MicroStation uses for highlighting elements when they are selected or identified.

Edit > Locate Control Points

Choose Locate Control Points to locate and highlight the selected pair of control points in the center of views that are set for locating control points (See “View > Views Used to Locate Control Points”). This feature is useful for rapidly panning to the location of control points that are not visible. The highlighting is done with the same color that MicroStation uses for selecting elements.

Edit > Coordinate System

Choose Coordinate System to enter a description for the coordinate system for the base data. The coordinate system identified here should be the one into which the image or vectors will be transformed when it is resampled through the resulting model (the base coordinate system, i.e., the system to which the base vector data belongs).

View menu

The View menu provides access to two toggles. One toggle controls the dynamic warping mechanism and the other, the display of control points. Dialog boxes are also provided to let you to select the views which will display the dynamic warping of vector on uncorrected data and to select the views which will display the location of control points. A final dialog is used to set the warping window.

View > Dynamic Warping in Views Displaying Uncorrected Data

Dynamic Warping in Views Displaying Uncorrected Data permits you to control the dynamic warping mechanism inside each view where uncorrected data is displayed.

If on, it activates both the dynamic warping mechanism and the updating of the model. Each time that a pair of control points is entered or modified, the model is updated and the base vector data is warped. Base vector data is redrawn in views where uncorrected data is displayed, as an overlay to the uncorrected image(s) or vector(s), after being geometrically transformed through the actual model.

If on and the model cannot be calculated with the present set of control points, the actual model displayed will be None and the dynamic warping will not be activated.

Turn off to inhibit both the dynamic warping mechanism and the updating of the model; then, the Actual Model shown will be None.

The dynamic warping process can take time to complete. If you wish to abort it, press the <*Esc*> key. It is recommended that you use a small set of base vector data in order to accelerate the dynamic warping process. If using a small set of base vector data is not practical, set the warping window so that only the design elements inside the area that you wish to register are warped.

You can also control the warping process for each supported design element type.

Panning in a view displaying uncorrected data is not recommended when dynamic warping is on. The warping of vectors takes some time and in some circumstances causes MicroStation to not trap the release of the data point button. When this happens, the panning does not stop and performance is seriously degraded. To prevent this situation, move the mouse to another window and click the Reset button (or press the <*Esc*> key and immediately click the Data button) several times until the panning ceases.

View > Views Displaying Uncorrected Data

Choose Views Displaying Uncorrected Data to identify the view or views where the uncorrected data (the images or vectors to be corrected) will be displayed. If Dynamic Warping in Views Displaying Uncorrected Data is on, the base vector data will be warped over the uncorrected data in the specified views. It will be redrawn after being geometrically transformed through the actual model. In all other views, vector data will behave normally. The check button Also Display Non-Warped Elements controls the presence or absence of non-warped elements (i.e., the original design elements without transformation) in uncorrected views

View > Views Used to Locate Control Points

Choose Views Used to Locate Control Points to identify the view or views where the Locate Control Points feature will be activated (See “Edit > Locate Control Points”).

When the Auto Locate on Base Control Point Pinning toggle is on, the selected views will be automatically zoomed around a base control point just after it is pinned.

Use this feature when you want to refine the pinning of control points after you have done it approximately in a view with a smaller scale.

For example, use View 1 for a synoptic display of the whole image. Use View 2 as the detailed view where a zoom occurs automatically after a base control point is selected. Then, View 2 should be selected in the Views Used To Locate Control Points dialog box.

Here is a typical procedure you can follow as an example.

To use a synoptic view and a detailed view when pinning control points

1. Turn on View 2 in the Views Used To Locate Control Points dialog box.
2. Turn on the Auto Locate on Base Control Point Pinning toggle.
3. Select the Place Control Points tool from the Register tool box.
4. Pin a base control point in View 1. View 2 automatically zooms around this point.
5. If the pinning of this point needs refinement, press the Reset button. That removes the last base control point and allows you to pin it again (in the zoomed view).
6. Pin the uncorrected control point and iterate the process from step 4.

View > Warping Window

Choose Warping Window to set the size of the warping window. The warping window is the extent in which the dynamic warping occurs if Dynamic Warping in Views Displaying Uncorrected Data from the View menu is on. You should set the size of the warping window if the extent of the design elements is larger than the area that you wish to register. If you choose this option, the time to warp the design elements is reduced since registration does not consider the elements outside of the warping window.

View > Show Control Points

Show Control Points permits you to control the display of control point marks.

If on, activates the display of the control points mechanism. Then, both control points for all pairs of points are displayed according to the selected colors.

If off, suppresses the display of the control points mechanism.

Settings menu

Use Register/Settings to set the colors of the symbols that are used to mark the control points, to toggle on or off the Warning When Renumbering option, or to access the Elements Transformation dialog box.

Settings > Colors for Control Points

Choose Colors for Control Points to set the colors for the symbols that are used to mark control points. Colors for the base control points mark and the uncorrected control points mark can be set independently. Next to each field where the color number is entered, the actual color corresponding to this number displays on a color button. You can also select the color with the color picker that pops up when you click the color button.

Settings > Warning when Renumbering

Warning when Renumbering permits you to be warned when the list of control points is going to be renumbered. If a line is inserted or deleted before the last existing line in the control points list box, a renumbering of the next points results.

If on, you are warned when a renumbering is about to occur.

If off, you are not warned when a renumbering is about to occur.

Settings > Elements Transformation

Choose Elements Transformation to control which design element types are used for the dynamic warping process, the Copy Vectors command, and the Move Vectors command. To disable a specific design element type for the transformation process, select the None option for the appropriate option button.

To enable a specific design element type, select the appropriate option for each design element type:

- All Coordinates
- Origin Only
- Stroking & All Coordinates

When All Coordinates is selected, the transformation model is applied to each (X,Y) coordinate of the element.

When Origin Only is selected, the transformation model is applied only on the origin of the element. Others characteristics such as rotation angle, scale, and so forth are not modified.

When Stroking & All Coordinates is selected, the transformation process modifies the original structure (i.e., center point, start angle, etc.) of the element. First, the element is stroked into a complex chain based on the specified Tolerance. Second, the transformation model is applied to each (X,Y) coordinate of the element. If the element does not transform as expected, adjust the Tolerance and repeat the process.

Apply menu

Apply > To Image

Selecting To Image from the Apply menu opens the Resampling dialog box. Use the Resampling dialog box to set all parameters to resample an image through a geometric correction model built with Register.

5.6 Resample image tool

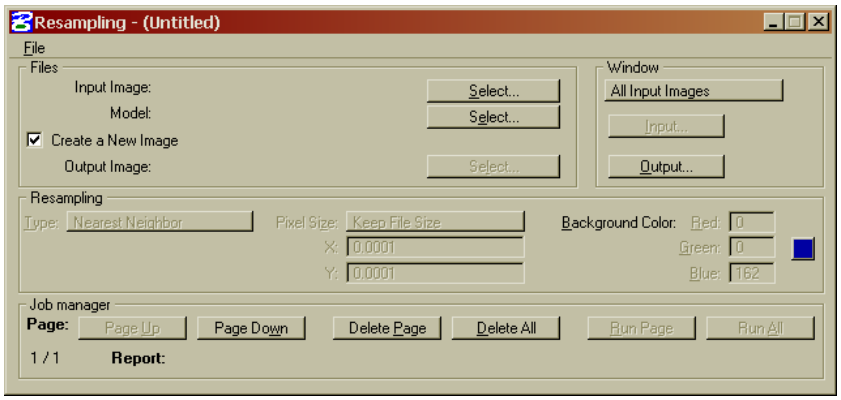
Used to open the Resampling dialog box and quickly prepare a “fresh” resampling page by setting all parameters with default values:

- In the Job Manager group, the tool goes to the first free page.
- Input Image: the active image (if there is no active image when *Resample Image* is pressed, a message displays).
- Output Image: the same name as Input Image, but with a sequential number (1, 2, 3, etc.) added at the end of the name. If the name already has eight characters, the last character(s) can be overwritten by the added digits.
- Window: All Input Image.
- In the Resampling group, all usual default are used.

You can edit any parameter, or keep all defaults and run the page at once.

Resampling dialog box

Used to apply a geometric correction model to an uncorrected image. The input data is transformed into an output data set that belongs to the base coordinate system, directly compatible with the base vector data that was used to create the model. Choose To Image from the Apply menu of the Register dialog box to access the Resampling dialog box.



Input Image field

The Input Image field displays the name of the input image file. Click the Select button to open the File Selection dialog box. This dialog box is used to select an existing image file for resampling.

Model field

The Model field displays the name of the transformation model file. If there is an active model in the Register dialog box, it displays in this field. You are prompted to save it if you have made changes since the last save.

To change the current selection, click the Select button to open the File Selection dialog box. This dialog box is used to select an existing RGR transformation model file for the resampling process.

Create a new image

Used to choose whether you would like to actually resample the image or simply use the transformation matrix to apply your changes.

The toggle is automatically checked when the Resampling Dialog opens, but when a Helmert, Similitude, or Affine model is selected, the toggle is automatically unchecked but remains enabled. When a Projective, Thin Plate Spline or Polynomial model is selected, the toggle is checked and disabled, since the transformation matrix does not support these models.

Because the transformation matrix is a new addition to Bentley Descartes, *Register* operations performed solely with the transformation matrix will not appear if the file is opened in Bentley Descartes 6.0. If you plan to use an image in a previous version of Bentley Descartes and would like it transformed, you may wish to resample the image at this time.

Only file formats which support a transformation matrix will maintain mirroring operations stored in the transformation matrix. For all file formats without a transformation matrix, such as standard TIFF or BMP files, Bentley Descartes adds a worldfile. However, if this TIFF or BMP are opened in an application where worldfiles are not supported, the information in the transformation matrix will not be applied to the image. If you plan to use a file format which does not support a transformation matrix in another application, you may wish to select *Create A New Image* and resample the image at this time.

If you decide to use a file format that does not support a transformation matrix, it is possible to resample the image using its own transformation matrix. In order to do this, simply leave the *Model:* field empty and resample. You can also resample a file with its own transformation matrix by using *Save As* or *Batch Convert*.

Output Image field

The Output Image field displays the name of the output image file. Click the Select button to open the File Selection dialog box. This dialog box lets you specify the name of the image file that will be created by resampling.

All Input Image

Use All Input Image to define the output window in such a manner that it covers the input image entirely.

All Input Image/Input

Click the Input button with the All Input Image option to open the Input Image Window dialog box. The name of the input image displays in the title bar. No parameter of this dialog box can be edited. This dialog box is used only to display the actual window of the input image, as well as with content reflected in the header of this image.

All Input Images/Output

Click the Output button with the All Input Image option to open the Output Window dialog box. The name of the output image displays in the title bar.

If an output image is not selected, Untitled is displayed. No window parameter (origin or dimension) of this dialog box can be edited. The dialog box is used only to display the window of the output image.

The output window is calculated automatically to cover the entire input image. Only the description of the output image and the pixel size can be entered using the Output Window dialog box. This information is used to prepare the header of the output image.

Specified through Input

Use the Specified through Input option to define the output window through another window which is set in the input system of coordinates.

Specified Through Input/Input

Click the Input button to specify the origin and the dimensions of the input window. The name of the input image and other information is displayed, but cannot be edited. When the output window is set through the input space, it adjusts accordingly and in such a manner that it covers the input window entirely.

Specified Through Input/Output

Click the Output button to open the Output Window dialog box. The name of the output image displays in the title bar. If an image is not selected, Untitled is displayed. No window parameter (origin or the dimensions) of this dialog box can be edited. The dialog box is used only to display the window of the target output image. The values are calculated automatically to cover the input window entirely. Only the description of the output image and the pixel size can be entered using the Output Window dialog. This information is used to prepare the header of the output image.

Warping Window

Use the Warping Window option to define the output window by setting its equivalent to the warping window defined with the Warping Window dialog box.

Specified in Output Space

Use the Specified in Output Space option to define the output window by setting it directly in the output space.

Specified in Output Space/Output

Click Output button with the Specified in Output Space option to open the Output Window dialog box. The name of the output image displays in the title bar. If an image is not selected, Untitled is displayed. This dialog box can be used to specify the true origin and dimensions of the output window. All other fields can also be entered or edited in order to prepare the header of the output image.

Type

Three algorithms can be chosen through the Type option menu:

- Nearest Neighbor
- Bilinear Interpolation
- Cubic Convolution

The Nearest Neighbor algorithm uses only one input pixel. Bilinear Interpolation uses the four nearest neighbors and calculates the weighted mean. Cubic Convolution uses a four by four matrix of pixels and calculates a type of weighted mean.

The Nearest Neighbor algorithm is faster, but it can cause jagged edges or lines on the output image. Cubic Convolution usually produces the best results, but the calculation requires more time to process than the other algorithms. The Bilinear Interpolation provides a compromise in quality of output and time to process.

Pixel Size

Three choices are available:

- Keep File Size
- Same Pixel Size
- User Defined.

Use the Pixel Size field to enter the size of pixels for the output image. With the “User Defined” option, you can enter different X and Y value.

Except for special effects, it is recommended that you set the pixel size of the output image equal to or close to the pixel size of the input image.

Background Color

The background color is a RGB color number used to initialize the output image file prior to resampling. Therefore, any part of the output image which is not covered by resampled pixels remains this color. You can enter the background color index into the Background Color field. You can also select the color with the color picker that pops up when you click the color button.

Page Up/Page Down

In Register, each file submitted for resampling has each of the resampling parameters displayed in the Job Manager group boxes. The values for each file can be viewed and edited by scrolling the individual pages. Use the Page Up or Page Down buttons to move from the current page to the previous or next page. If the Page Down button is pressed when there is not an additional page, a prompt asks you if you wish to open a new page. If you open a new page, it is created with the default parameters.

Delete Page

Click the Delete Page button to delete the current page and all of its parameters. This page is removed and all following pages are renumbered. If the first and only page is deleted, it remains open and the parameters are established with the default settings.

Delete All

Click the Delete All button to delete all pages but the first page. The parameters of the first page are established with the default settings.

Run Page

Click the Run Page button to start the resampling process according to the parameters of the current page. Before a job is run, the available disk space is checked based on the estimated file size. If the Data Compression is None and there is not enough space, the resampling job is not run and you are notified by a warning box.

While the batch program is running, a Progress window provides feedback. After the job is completed or terminated, a Report line displays the result of the processing corresponding to this page. It indicates whether the processing was successful and, if not, it declares what error or event caused it to be unsuccessful.

Run All

Click the Run All button to start the resampling process of all pages, one at a time, according to the parameters of each page. While the batch program is running, a Progress window provides feedback. For each page, a Report line displays the result of the batch processing job corresponding to this page. It indicates whether the processing of this job was successful and, if not, it declares what error or event caused it to be unsuccessful.

Page

The Page field indicates the number of the current page and the total number of pages prepared.

Report

For each page, a Report line displays the result of the processing that corresponds to this page. It indicates whether the processing was successful and, if not, it declares what error or event caused it to be unsuccessful.

File menu

The File menu of Resampling provides access to all necessary options to manage Resampling files (RSP files). A Resampling file is used to save a schedule of images to be resampled. It can be opened later and be batch processed.

5.7 Copy Vector tool

Click the *Copy Vector* tool to copy vectors through the active transformation model. To control which design elements types should be affected (See “Settings > Elements Transformation”).

If there is not an active transformation model, you are informed. In this circumstance, you should load a transformation model using the File/Open option from the Register dialog box or build one using the Control Points tools from the Register tool box.

To apply the registration model to the vectors

1. Select *Copy Vector*.
2. Choose the Direction of the transformation from the option button. Choices are Base to Uncorrected or Uncorrected to Base.
3. Identify an element from the appropriate geometry (Base or Uncorrected) according to the selected Direction.
4. Accept the element, or reject and retry.

To constrain the copy with a Fence or Selection Set

1. Select *Copy Vector*.
2. Choose the Direction of the transformation from the option button. Choices are Base to Uncorrected or Uncorrected to Base.
3. Draw a fence or build a Selection Set using the MicroStation tools.
4. Select *Copy Vector* again.
5. You are asked to confirm the operation on all selected elements. Click OK to proceed or Cancel to cancel.

5.8 Move Vector tool

Click the *Move Vector* tool to move vectors through the active transformation model. To control which design elements types should be supported (See “Settings > Elements Transformation”).

To apply the registration model to the vectors

1. Select *Move Vector*.
2. Choose the Direction of the transformation from the option button. Choices are Base to Uncorrected or Uncorrected to Base.
3. Identify an element from the appropriate geometry (Base or Uncorrected) according to the selected Direction (elements from a Reference file or locked elements cannot be identified).
4. Accept the element, or reject and retry.

To constrain the move with a Fence or Selection Sets

1. Select *Move Vector*.
2. Choose the Direction of the transformation from the option button. Choices are Base to Uncorrected or Uncorrected to Base.
3. Draw a fence or build a Selection Set using the MicroStation tools.
4. Select *Move Vector* again.
5. If at least one of the selected elements is in a reference file, you are informed that this operation is not possible. Otherwise, you are asked to confirm the operation on all selected elements. Locked elements are not moved. Click OK to proceed or Cancel to cancel.

Mosaicking

Section 6

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6.0 Mosaicking

The Mosaic tool box tools will help you create mosaics, making all images look alike by changing the color and by cutting the overlapping sections and applying the feathering tool to hide the seam of the cut.

6.1 Mosaic tool box

The Mosaic toolbox is used to balance the tone between all images of a mosaic and to automatically, or semi-automatically, create a mosaic by cutting the overlapping sections and applying the feathering tool to hide the seam of the cut.

The Mosaic toolbox displays two tools, *Balance Tone* and *Define Seam*.

To	Select in the Mosaic tool box
Balance the tone of colors between all of the images of a mosaic.	*Balance Tone Tool*
Define the position of the seam between two overlapping image portions of a mosaic and to remove the portion defined by the seam from the top image.	*Define Seam Tool*

6.2 Balance Tone tool

Use the *Balance Tone* tool to when you want to balance the tone of colors between all of the images of a mosaic.

Upon selecting the *Balance Tone* tool, the tool settings box displays two option lists, *Mode and Source Area*:

Tool Setting	Effect
Mode	**Mode represents the method to be used for tone balancing.** • Average - Averages the tone by using all selected images and averaging a unique color table that is applied to all the selected images. All selected images are altered based on the tone average and standard deviation from the image selection set. The *Average* method is useful when all images look good but are not perfectly balanced. *Average* is the default option. • From Reference - Utilizes a source image color table to balance the selected images. *From Reference* should be used when one image of the mosaic, or an area of the image, looks particularly good and all other images of the mosaic should look similar. *Tone Balance* is performed for each selected image, except the reference image, to match the *Reference Area*. The *Reference Area* is selected by using one of the available options under the *Source Area* option list

	When *Average* is selected, only *Entire Images* and *Overlaps* are available from the *Source Area* option list. The other areas, *Block, Oriented Block, Element* and *Fence* are not available.
Source Area	**Source Area represents the area of the selected images to which tone balance will be applied. Possible areas are listed below.** • **Entire Images** *Average mode:* All pixels of all selected images are used for the *Balance Tone* computation. *From Reference* mode: The complete reference image will be used. The Histogram of the Reference image is applied to the selected images. • **Overlaps** *Average* mode: Only the overlapping pixels of all the selected images are used for the *Balance Tone* computation. *From Reference* mode: Pixels of the overlapping portion of the reference are used to compute the new histogram that is applied to all selected images. • **Block** (Available with *From Reference* only) In the *Block* source area, the area is chosen by entering a block shape selection on the Reference Image. This technique allows you to sample pixels of a specific area of the reference image. • **Oriented Block** (Available with *From Reference* only) In the *Oriented Block* source area, the area is chosen by entering an oriented block shape on the Reference Image. This technique allows you to sample pixels of a specific area of the reference image. • **Element** (Available with *From Reference* only) In the *Element* source area, the area is chosen by selecting a closed design file element. This technique allows you to only sample pixels of a specific area of the reference image using a non-reticular shape. The pixels comprised inside the element are used to compute the new histogram that will be applied the all selected images. • (Available with *From Reference* only) In the *Fence* source area, the active fence is used to select the pixels that are used to compute the new histogram that is applied to the selected images.

To Tone Balance with Average Mode

1. From the Raster Manager Tools menu, choose *Image>Mosaic*
   The Mosaic toolbox opens

2. In the Mosaic toolbox, select the *Balance Tone* tool

3. From the Tools Settings box, set:
   Mode: Average
   Source Area: Entire Images

   If the images you want to process are already selected (multiple-selection) – proceed to step 6.

4. Select the first image by pointing at the image and enter a data point.

5. Repeat step 4 for remaining images to be balanced.

6. *Reset* to accept the image selection set.

7. Enter a data point to process the image selection set.

8. The images from the selection set are now balanced.

To Tone Balance with From Reference Mode

1. From the Raster Manager Tools menu, choose *Image>Mosaic*
   The Mosaic toolbox opens

2. In the Mosaic toolbox, select the*Balance Tone* tool

3. From the Tools Settings box, set:
   Mode: From Reference
   Source Area: Entire Image

   If the images you want to process are already selected (multiple-selection) – proceed to step 6.

4. Select the first image by pointing at the image and enter a data point.

5. Repeat step 4 for all the other images to be balanced.
   DO NOT select the image that is used as the reference.

6. *Reset* to accept the image selection set.

7. Select the reference image by pointing at the reference image and enter a data point.

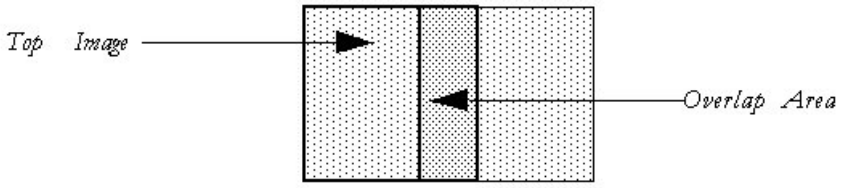
8. Enter a data point to process the image selection set.

9. The images from the selection set are now balanced using the reference image.

   The reference image is not modified.

6.3 Define Seam tool

Use the Define Seam Tool to define the position of the seam between two overlapping image portions of a mosaic and to remove the portion defined by the seam from the *top image*. *Define Seam* may also apply the *feathering* tool to the seam. All options are available through the tools settings dialog.



Example of an Overlap

Tool Setting	Effect
Seam Type	A seam is defined as a segment between the two intersection points of the overlapping area. • Quick: Used to quickly mosaic two images. The seam is automatically defined by the tool. If feathering is ON, you have control over the width of the feathering. • User-Defined: In this mode, the seam is attached to the pointer and you have control over the placement of the seam. You can enter as many points as required to position the seam. Once in place, a *reset* confirms the placement of the seam. The area that will be remove is processed exactly the same way as the Quick mode (see graphic above). Turning ON *Feathering* will feather the seam, equidistant from the center, using the value from the Width field. Turning ON *Save Seam* will, after the mosaicking process is executed, convert the seam into a design file element. It is therefore possible to utilize this seam again (see *Element* Mode below). • Element: In this mode, the seam line is defined by selecting a Design File Element. If an invalid seam is detected, it will be rejected and a message will be displayed in the status bar. • The element must not be closed, such as a Line String, and must have 2 intersection points with the overlapping area of the two images. • Smart In this mode, the seam line is drawn at the very middle of the overlapping area regardless of the image intersections.

Feathering	When this option is ON, *feathering* is enabled. *Feathering* is a “camouflage” technique that allows the seam “cut-line” to fade into the image.
Width	Used to specify the width of the feathering. The width is given in working units and is applied equidistantly on both sides of the seam. A good value for a seam is determined by the scale factor and the resolution of the image. Generally, the seam will be large enough to hide the cut line on the image created by the seam. Nevertheless, you may consider a narrower feather value if objects, such as buildings, are within the feathering area. Feathering can also be used to create aesthetic scenes such as embedding a thumbnail.

To Mosaic Two Images Using Quick Mode

1. From the Tools menu, select*Image>Mosaic*
   The Mosaic toolbox opens
2. Select *Define Seam* tool
3. From the Tools Settings box, set:
   Seam Type: Quick
   Feathering: ON
4. Select the first image to mosaic by moving the pointer over it and enter a data point.
   A blue outline surrounds the image.
5. Select the second image as in step 4.
   A blue outline surrounds the image. The “Seam” is displayed with the feathering width highlighted. Zoom in as necessary to see the width of the feathering.
6. Adjust the width as necessary by typing a new number in the width field of the tool settings box, then press Enter to activate the new width.
   The Seam will resize automatically.
7. When you are satisfied with the results, enter a data point to begin the mosaicking process.

The images now form a seamless mosaic!

Color Masking

Section 7

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7.0 Color Masking

This chapter discusses how to prepare color masks that will be used by various editing or vectorizing tools, as well as transformation tools.

The Color Mask tool (previously named filters) was enhanced to support 24-bit images. A color mask is a list of RGB colors defining a specific subset of colors. A color mask is normally assigned, to one or several images.

7.1 Color Mask Applications

A color mask lets you handle any image with more than two colors exactly as if it was a two-color image. It dynamically converts all colors of the mask into the “drawing” color, and all the rest into the “backfill” color. A color mask cannot be defined for two-color images, as they already have only a foreground color and a background color. All tools used for image editing or vectorization, normally work with binary (two color) images only. Because of the color mask feature, these tools can now be used with images that have more than two colors.

A color mask specifically determines what will be considered as the “drawing” colors for various “raster” operations. For a given image, you can define an unlimited number of color masks to be saved in the same color mask file. For example, all colors rendering red lines on a scanned map constitute a color mask, while all colors rendering green lines or bodies constitute another mask. Another class of raster objects can be rendered with a mixture of red and green pixels that compose another color mask. A given color can be present in more than one mask.

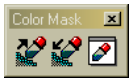
In the Color Mask dialog, one default mask will always be available even when no mask file is opened:

- The (Temp) mask is an editable mask that is never saved in a mask file.

A new mask concept, “Chameleon-Mask” is introduced in Bentley Descartes. This special mask is similar to the standard mask except that it can have one or more sub-masks that are a specialization of the parent mask for a specific image. The mask can be applied to any image and the sub-mask will be applied only on the image to which they have been assigned. The names of the masks included in the chameleon mask are automatically generated. Using the following rules generates the name of each mask:

- The name of the parent mask.
- An underscore.
- The name of the image to which the mask is attached (with no path).

7.2 Color Mask tool box

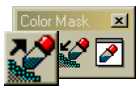


The Color Mask tool box provides tools to add color indices to a mask, to subtract indices from a mask, or to open the Color Mask dialog box.

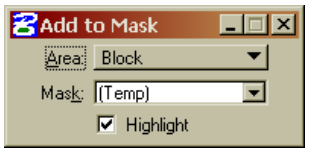
The Color Mask tools and functions are not available for two-color images.

To	Select in the Color Mask tool box
Add a selection set of color indices to the selected color mask.	*Add to Mask tool*
Remove a selection set of color indices from the selected color mask.	*Subtract from Mask tool*
Open the Color Mask dialog box.	*Color Mask Dialog tool*

7.3 Add to Mask tool



Used to add a selection set of color indices to the selected color mask.



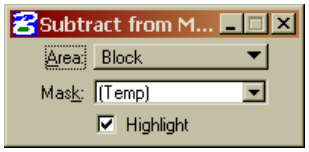
Tool Setting	Effect
Area	• Block: Using the pointer draw a rectangular block over the colors to add. • Element: Using the pointer, select a closed element that delimits the region to include. All colors comprised in the element are added to the color mask. • Fence: The colors in the fence are included.
Mask	Used to select in which mask the colors are added. The drop-down list shows the existing masks that can be edited.
Highlight	Use to turn the highlight feature ON or OFF. The highlight feature changes all pixels that match the color(s) of the selected color mask to the highlight color.

To add colors to a color mask

1. Click the Add to Mask tool.
   The tool settings window opens.
2. In the tool settings window, set the area (element, block or fence) and select the mask in which the colors will be added.
3. Select the area (element, block, or fence) in the image.
   All the colors found under the selected area are automatically added to the mask.

7.4 Subtract from Mask tool

Used to remove a selection set of color indices from the selected color mask.



Tool Setting	Effect
Area	• Block: Using the pointer draw a rectangular block over the colors to add. • Element: Using the pointer, select a closed element that delimits the region to include. All colors comprised in the element are added to the color mask. • Fence: The colors in the fence are included.
Mask	Used to select in which mask the colors are added. The drop-down list shows the existing masks that can be edited.
Highlight	Use to turn the highlight feature ON or OFF. The highlight feature changes all pixels that match the color(s) of the selected color mask to the highlight color.

To subtract colors from a color mask

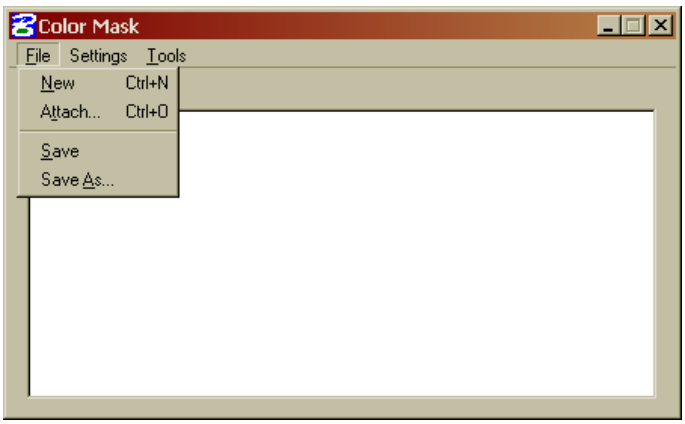
1. Click the subtract from Mask tool.
   The tool settings window opens.
2. In the tool settings window, set the area (element, block or fence) and select the mask from which the colors will be subtracted.
3. Select the area (element, block, or fence) in the image.
   All the colors found under the selected area are automatically subtracted from the mask.

7.5 Color Mask Dialog tool

Use to create and manage Color Masks. A mask can be assigned to any image regardless of the pixel type (except for binary images). When adding colors to a mask, it is possible to select the area on any image currently open in Raster Manager.

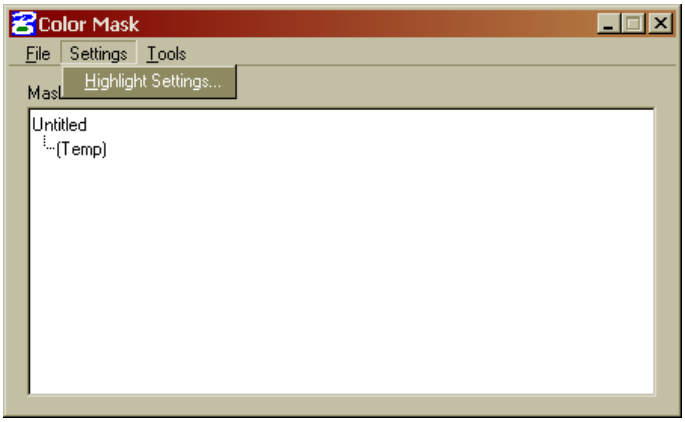
7.6 Color Mask tool settings

File Menu:

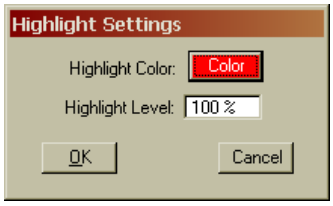


- New — Use to create a new empty color mask file.
- Attach — Use to attach a saved color mask file.
- Save — Use to save the active color mask file.
- Save As — Use to save the current color mask file under a different name.

Settings Menu:



Provides access to the Highlight Settings dialog.



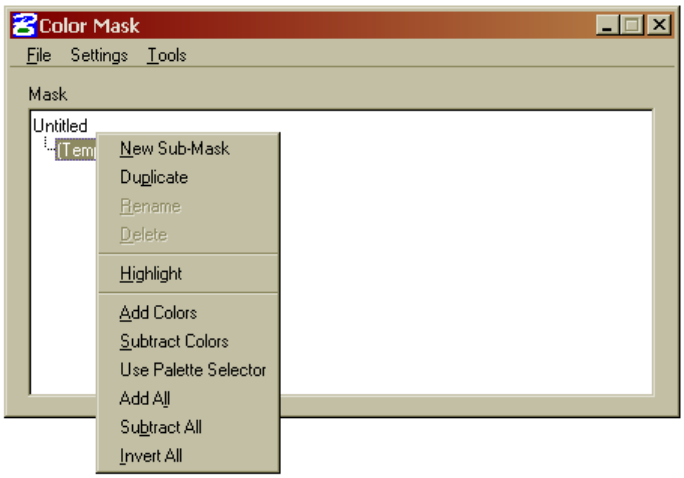
- Highlight Color — Opens the MicroStation color selector dialog to select the highlight color. The default color is red (255, 0, 0).

- Highlight Level — Selects the percentage of opacity for the highlight color. The default level is 100% (opaque).

Tools Menu:

The Tools menu offers different choices depending of the current selection in the Color Mask dialog.

A mouse right-click on the selection provides a context sensitive menu that corresponds to the tools menu.



- New Mask (or New Sub-Mask) — If a File Name is currently selected, a new mask is created.

  If a mask is currently selected, the mask is transformed to a chameleon mask and a sub-mask is created in the mask.

  If a chameleon mask is currently selected, a new sub-mask is created in the currently selected mask.

  Multiple selections are not supported.
- Duplicate — If a mask is currently selected, a copy of the mask "xyz" is made. The new mask is named "copy of xyz"

  Multiple selections are not supported.
- Rename — Changes the name of the currently selected mask or chameleon mask.

  Multiple selections are not supported.
- Delete — Delete the selected mask, chameleon mask or chameleon sub-mask from the mask file.

  Multiple selections are supported.
- Highlight — The selected mask, chameleon mask or chameleon sub-mask is highlighted until the next "refresh".

Multiple selections are not supported.

- Add Colors — Allows selection of colors by drawing a block on the screen to add colors to the selected mask.

  If a chameleon mask is selected, the new colors will be added to the parent mask.

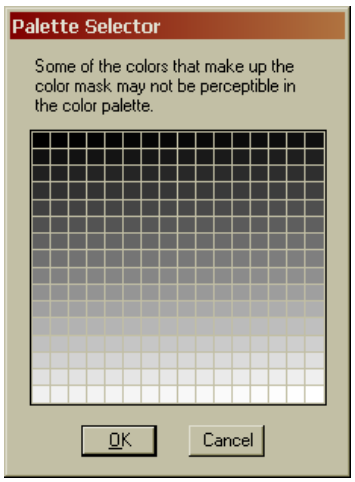
  Multiple selections are not supported.

- Subtract Colors — Allows to draw a block on the screen to subtract colors from the selected mask.

  If a chameleon mask is selected, the new colors will be subtracted from the parent mask.

  Multiple selections are not supported.

- Use Palette Selector — Allows to select colors from a color palette. Available only if the selected image has a color palette.



- Add All — Add all colors to the selected mask, chameleon mask or chameleon sub-mask.

  Multiple selections are not supported.

- Subtract All — Subtract all colors from the selected mask, chameleon mask or chameleon sub-mask.

  Multiple selections are not supported.

- Invert All — Invert all colors of the selected mask, chameleon mask or chameleon sub-mask.

  Multiple selections are not supported.

Editing Images

Section 8

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8.0 Editing Images

This chapter describes a set of tools that permit drafting and drawing in raster, erasing raster objects, cleaning images, copying and pasting pieces of images, as well as undoing and redoing image editing operations.

Bentley Descartes provides a rich set of tools to edit images.

Touch-up tools are used to remove unwanted pixels in an image, to improve the quality of raster linework or other objects or to paint images. Simple but powerful brushing tools are used to paint or edit an image. Copy and Paste tools are used to copy a region of an image and paste it to another image.

This set also provides flexible raster drafting tools. Stamp Vector tools are used to stamp design vectors into a raster file, or to draw directly in raster with the full range of MicroStation vector drawing and annotation tools.

With these tools, you can:

- Despeckle an image.
- Fill holes in an image.
- Copy a region of an image.
- Paste a copied region to an image or to a design file.
- Dynamically draw in raster with MicroStation vector tools.
- Stamp vectors into an image.
- Paint an image.

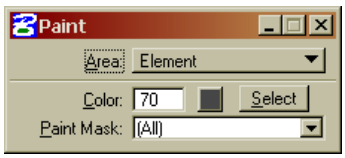
8.1 Touch-up tool box

The Touch-up tool box contains the following tools:

To	Select in the Touch-up tool box
Paint the image inside an area	*Paint Area tool*
Erase the image inside an area	*Erase Area tool*
Remove speckle from the image inside an area	*Cleanup tool*

8.2 Paint tool

Use to apply color to images. Use the Tool Settings to set specific parameters such as the Color Mask to use. Only the selected images are processed with the tools.



The Paint tool modifies only the pixels in the selected mask.

Tool Setting	Effect
Area	Use to select the shape of the brush. Available options are listed below. • Block: Using the pointer, select two data point to create a block. • Element: Using the pointer, select an element to paint all pixels within the element. • Fence: Using the pointer, the active fence is used to paint all pixels within the fence definition. • Image: Paints the entire image.
Color	Use to specify the paint color.
Paint Mask	Select the mask to use. For more details, please refer to the Color Mask section.

To paint inside an area

1. Select the *Paint Area* tool.
2. For images with more than two colors, select the appropriate color mask to determine the pixels to be painted, and select the target color.
3. Select the Area option.
4. Follow the instructions to define, select, or accept the area.
   The pixels inside the area are painted.

When the area is a raster object, this object highlights for acceptance before the paint is executed.

8.3 Erase tool

Select *Erase* from the Touch-up tool box to erase the image inside an area. Only the selected images are processed with the tools.

The Erase tool modifies all the pixels underneath the brush. The color mask "(All)" is used and the paint color is the "(Backfill)" color.

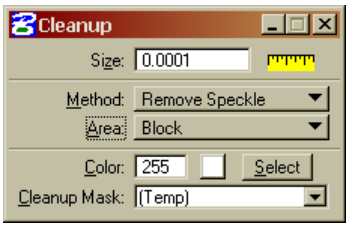
Tool Setting	Effect
Area	Use to select the shape of the brush. Available options are listed below. • Block: Using the pointer, select two data point to create a block. • Element: Using the pointer, select an element to paint all pixels within the element. • Fence: Using the pointer, the active fence is used to paint all pixels within the fence definition. • Image: Erase the entire image.

To erase an area on an image

1. Select the *Erase* tool.
2. For images with more than two colors, select the color.
3. Select the Area option.
4. Follow the instructions to define, select, or accept the area.
   The pixels are erased inside the area.

8.4 Cleanup tool

Used to cleanup an image area. Remove Speckle or Remove Hole are the available cleanup methods. Only the selected images are processed with the tools.



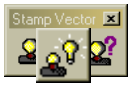
Tool Setting	Effect
Size	Displays the speckle (or hole) size to be removed in working units. The yellow ruler allows measuring the speckle on the screen.
Method	Select the method to use: “Remove Speckle” or “Remove Hole”.
Area	Define the area where the function will be applied.
Color	Select the color to use to paint over the speckles (or holes). For binary images, the backfill color is used for Remove Speckle and the drawing color for Remove Hole.
Cleanup Mask	Select the mask to use.

8.5 Stamp Vector tool box

The Stamp Vector tool box is used to stamp design vector elements into raster images in the specified view.

Use Stamp Vector to:

- Add raster representation of design elements to image files.
- Edit raster using MicroStation vector drawing and annotation tools.
- Create image files that contain raster and vector information and that can be exported easily for use in other applications.

To	Select in the Stamp Vector tool box
Stamp design vector elements into raster images.	*Stamp Vector tool*
Sets the Working Units section using the current zoom factor to determine the size for each Line Weight and Style.	 *Match Stamp Vector Settings Tool*
Opens the Stamp Vector Settings dialog box.	*Stamp Vector Settings tool*

8.6 Stamp Vector tool

Use *Stamp Vector* to stamp design vector elements into raster images. Vector elements can be stamped interactively or all selected vector elements can be stamped at once.

To interactively stamp a vector element into images

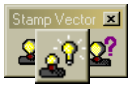
1. Unselect any selected elements by entering a data point with the MicroStation *Element Selection* tool.
2. Select *Stamp Vector*.
3. Specify the view in the Tool Settings dialog where you want to stamp vector elements.
4. Identify a design vector element.
5. Accept the element (or reject and retry).
   If there are no images or only read-only images underneath the vector element, it cannot be stamped and an alert displays.

To stamp a set of vector design elements into images

1. Select the elements you want to stamp with the MicroStation *Element Selection* tool.or
2. Place a fence around the elements you want to stamp.
   Only the Inside mode is supported.
3. Select *Stamp Vector*.
4. Specify the view where you want to stamp vector elements.
5. Enter a data point to accept the settings.
   If there are no images or only read-only images underneath the selected vector elements, no element can be stamped and an alert displays.
   With both of the above procedures, stamping occurs on all images which are on in the Raster Manager list box for the specified view. That is done in a WYSIWYG manner. If a vector element is displayed over an image in the specified view, the element is stamped into the non-transparent portion of this image. If two images overlap, the vector elements stamp into both images. Transparent parts of the images are not stamped.

Stamping large elements or a large number of elements may take time.

8.7 Match Stamp Vector Settings tool



Match Stamp Vector Settings provides an efficient way to setup the Stamp Vector Settings. Match Stamp Vector Settings sets the Working Units section using the current zoom factor to determine the size for each Line Weight and Style.

Since Line Weights and Styles always display at the same ratio regardless of the zoom factor, for each level of zoom, the element covers more or less pixels. Therefore, when zoomed far out, the element covers more pixels than when zoomed in. It is this coverage, in Working Units, that is used to modify the Stamp Vector Settings. This allows a constant ratio between View display and Raster Resolution.

To setup Stamp Settings with Match Stamp Vector Settings

1. From the Stamp Vector toolbox, select *Match Stamp Vector Settings*
2. Enter a data point to confirm the current zoom factor.

If you wish another zoom factor, simply select a tool of your choice and then reset to fall back to the *Match Stamp Vector Settings* tool in order to enter the data point conforming the current zoom factor.

3. The Stamp Vector Settings Working Units are now modified to reflect the raster resolution size for each weight at the current zoom factor.

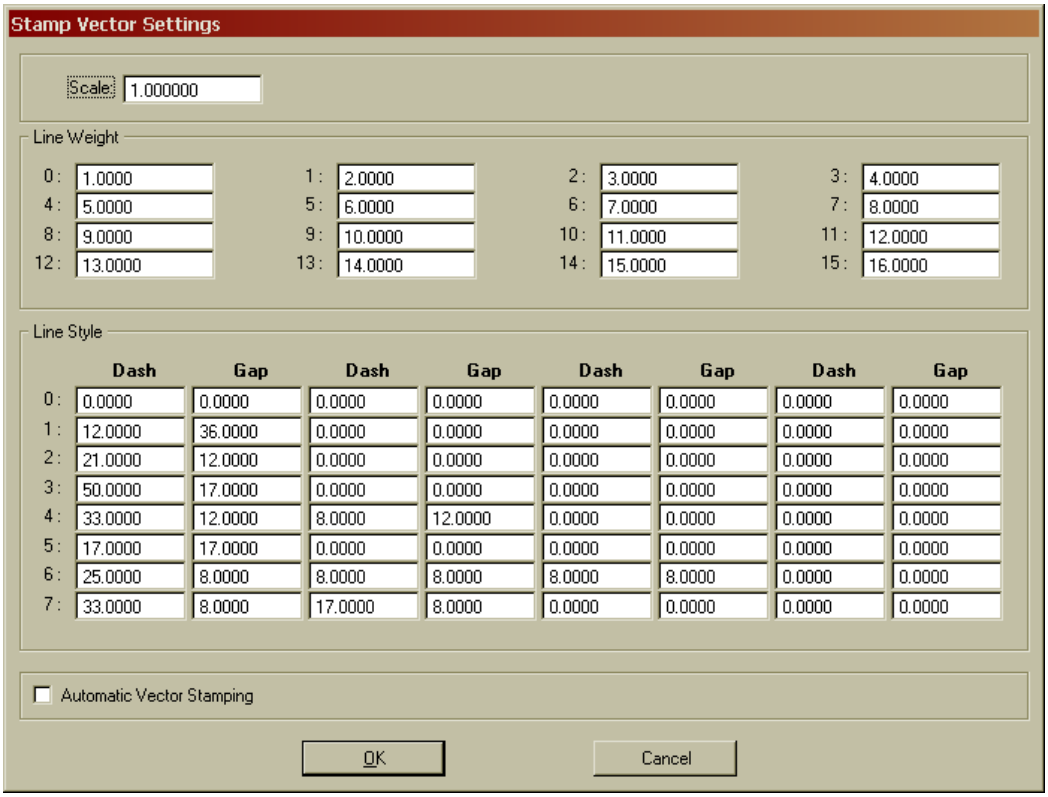
The Stamp Vector Settings for PIXELS are NOT changed.

8.8 Stamp Vector Settings tool

Selecting *Stamp Vector Settings* opens the Stamp Vector Settings dialog box.

Stamp Vector Settings dialog box

The Stamp Vector Settings dialog box is used to set the line weight and line style parameters used for rasterizing the vector elements, to turn on or off the Automatic Vector Stamping toggle, and to set other parameters controlling this function.



System Units for Line Weight and Line Style

This group is used to specify the units that will be used with the parameters in the Line Weight and Line Style groups, and to scale all displayed values.

Scale

All parameters in the Line Weight and Line Style group will be affected with this multiplying factor when a vector is stamped.

Line Weight

Use the Line Weight group to define each of the 16 standard line weights (0 to 15) in working units. If you are using a custom line style, the working units settings specified in MicroStation is determined automatically by the Stamp Vector tool. When a vector element is stamped into an image, the weight of a line is translated into the corresponding width specified in working units.

Line Style

Use the Line Style group to define each of the eight styles (0 to 7) in working units. If you are using a custom line style, the working units settings specified in MicroStation is determined automatically by the Stamp Vector tool. When a vector element is stamped into an image, the style of a line is translated into the corresponding set of dashes and gaps specified in working units. You can define a sequence of up to four pairs of dashes and gaps for each line style. This sequence is drawn repeatedly when a line is stamped.

Automatic Vector Stamping

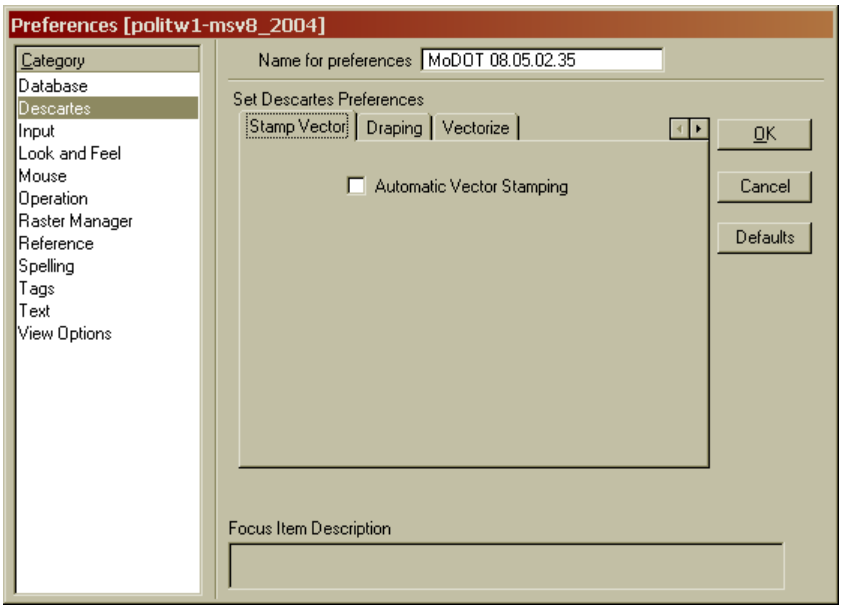
When on, all elements normally written to the design file will be stamped with the present settings.

OK

Use the OK button to save the present settings and close the dialog box.

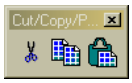
Cancel

Use the Cancel button to close the dialog box without saving the present settings.



A limited set of Stamp Vector Settings is also located in the Descartes category of the Preferences dialog box. From the MicroStation Workspace menu, select Preferences, then choose "Descartes" in the Category list, and select the Stamp Vector tab.

8.9 Cut/Copy/Paste tool box

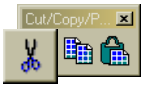


The Cut/Copy/Paste tool box is used to copy and paste regions of images, and to set parameters that control the copy/paste capabilities.

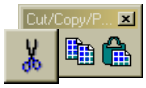
Copy only acts on the raster objects inside an area. The pixels inside this area that are not part of the raster objects are treated as transparent when the cut region is pasted into the image.

For two-color images, an image area is defined as all pixels of the foreground color inside an area.

For images of more than two colors, an image area is defined as all contiguous pixels that satisfy the active color filter inside an area.

To	Select in the Copy/Paste tool box
Cut an image area from the active image to the clipboard.	 *Cut Image Area tool*
Copy an image inside an area from the active image to the clipboard.	*Copy Image Area tool*
Paste an image area from the clipboard at a specified location in the active image.	*Paste Image Area tool*

8.10 Cut Image Area



Select *Cut Image Area* from the Cut/Copy/Paste tool box to cut an image inside an area from the active image to the clipboard for subsequent pasting.

It is not necessary to select any images to use this tool. Simply select an area on the screen and cut it to the clipboard, no matter which image is currently selected. The function will read sections in as many files as the area overlaps. If the pixel size is not the same in all the files, the images will be resampled to the smallest pixel size to avoid loosing information in any files.

To avoid problems caused by images with different color types, the information is kept in 24 bit in the clipboard.

The copy function is WYSIWYG, which means that transparency, contrast, brightness, gamma correction and more will be applied before the data is copied to the clipboard.

8.11 Copy Image Area tool

Select *Copy Image Area* from the Copy/Paste tool box to copy an image inside an area from the active image to the clipboard.

It is not necessary to select any images to use this tool. Simply select an area on the screen and copy it to the clipboard, no matter which image is currently selected. The function will read sections in as many files as the area overlaps. If the pixel size is not the same in all the files, the images will be resampled to the smallest pixel size to avoid loosing information in any files.

To avoid problems caused by images with different color types, the information is kept in 24 bit in the clipboard.

The copy function is WYSIWYG, which means that transparency, contrast, brightness, gamma correction and more will be applied before the data is copied to the clipboard.

8.12 Paste Image Area tool

Select *Paste Image Area* from the Copy/Paste tool box to paste an image area from the clipboard at a specified location in the active image.

When Paste Image Area is selected, the outline of the image area in the clipboard displays under the cursor. Move it to the desired location and enter a data point to paste the image area.

It is not necessary to select any images to use this tool. All the selected files touched by the paste will be modified. If one of the touched files is not selected, an Alert appears giving you the option to paste on this image or to automatically select the image.

If one of the touched file does not have a 24 bit color type, each pixel is moved to the nearest color available.

This tool allows you to interactively change the shape of the pasted area (location, scale, rotation, and affinity).