

Getting Started



EDIT  
CAD

# Editing CAD Geodata



in  
**TNTmips®**  
and **TNTedit™**

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# Before Getting Started

This booklet introduces techniques for creating, altering, and updating CAD geospatial objects in the powerful Spatial Data Editor in TNTmips® and TNTedit™. CAD objects that you make or import contain point, line, shape, and polygon elements in one or more drawing layers. Each element has associated attributes and can be connected with complex databases. The exercises in this booklet introduce you to the basic editing tools for CAD elements. The Spatial Data Editor also has tools for editing your vector, raster, database, and TIN geodata.

**Prerequisite Skills** This booklet assumes that you have completed the exercises in *Getting Started: Displaying Geospatial Data* and *Getting Started: Navigating*. Those exercises introduce essential skills and basic techniques that are not covered again here. Please consult those booklets and the TNT Reference Manual for any review you need. *Getting Started: Editing Vector Geodata* is recommended, since many vector editing operations are essentially the same.

**Sample Data** The exercises presented in this booklet use sample data that is distributed with the TNT products. If you do not have access to a TNT products CD, you can download the data from MicroImages' web site. In particular, this booklet uses objects in the EDITCAD Project File in the EDITCAD data collection. Make a read-write copy of that file on your hard drive; you may encounter problems if you work directly with the sample data on the CD-ROM.

**More Documentation** This booklet is intended only as an introduction to CAD editing in the Spatial Data Editor. Consult the TNT Reference Manual, which includes over 200 pages on the Spatial Data Editor, for more information.

**TNTmips and TNTlite™** TNTmips comes in two versions: the professional version and the free TNTlite version. If you did not purchase the professional version (which requires a software license key), TNTmips operates in TNTlite mode, which limits object size, and enables data sharing only with other copies of TNTlite. The Spatial Data Editor in TNTmips is also distributed as TNTedit. It is not available in TNTview or TNTatlas. All the exercises can be completed in TNTlite using the sample geodata provided.

*Keith Ghormley, 13 March 2000*

It may be difficult to identify the important points in some illustrations without a color copy of this booklet. You can print or read this booklet in color from MicroImages' web site. The web site is also your source for the newest Getting Started booklets on other topics. You can download an installation guide, sample data, and the latest version of TNTlite:

**<http://www.microimages.com>**

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## Editing CAD Geodata

The TNT Spatial Data Editor ( Edit / Spatial Data) offers a flexible, editing environment that can be used for simple one-object tasks or complex multi-layer, multi-object manipulations. You can have a single object in one layer, or a combination of read-only reference layers with other editable layers. You can have multiple types of objects open at the same time, stacked in any front-to-back order.

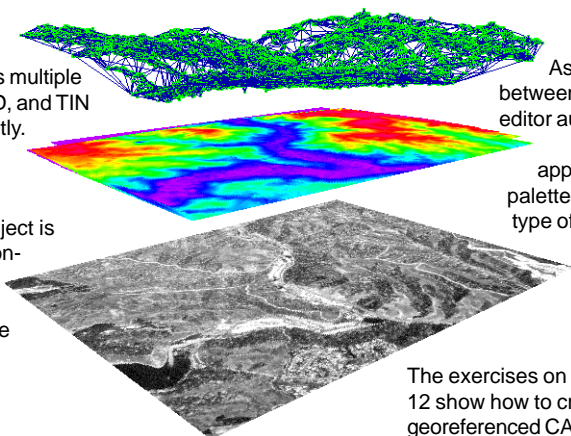
Editing operations apply to the currently “active” layer. As you switch from layer to layer, the editing tools automatically change according to the data type of the active layer (raster, vector, CAD, or TIN).

You may see editing tools like those in TNT in other software products, but the important advantage of

Whenever you switch to an editable CAD layer, the CAD Tools palette opens. Likewise if you switch to an editable raster layer, the Raster Tools palette opens. Of course if you switch to a reference layer (one that is not open for editing), the editor offers no tool palettes.

The editor handles multiple raster, vector, CAD, and TIN objects concurrently.

The georeference control in each object is automatically reconciled to relate it correctly to the georeference in the other layers.



As you switch between layers, the editor automatically opens the appropriate tool palette for the data type of the current layer.

the TNT Spatial Data Editor is the way you can edit *multiple geospatially related* objects of different types easily and intuitively. You can concurrently edit project materials of all types while TNT automatically retains and reconciles their map registrations. This means that all the new objects you create can automatically derive their map registration from other layers, so all of your project materials have a correct geospatial relationship.

The exercises on pages 4 - 12 show how to create a georeferenced CAD object that contains line elements traced from an airphoto in a reference layer. Pages 13-17 introduce techniques for creating non-georeferenced CAD objects for map annotation layers. Page 18 reviews the Copy and Move operations, and page 19 surveys features of the Editor that are not introduced in this booklet.

## Add Reference Object

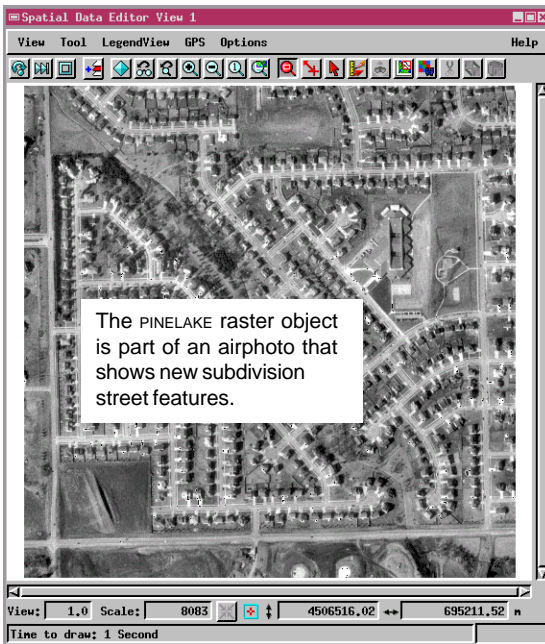
Click Add Layer to add a reference layer. Select the PINELAKE raster object in the EDITCAD sample Project File.



Your first task is to create a new CAD object that contains georeferenced road line elements. You will use a reference layer that contains a georeferenced airphoto that shows a new housing subdivision, and you will trace over the streets with the TNT editing tools.

Launch the TNT Spatial Data Editor by selecting Edit / Spatial Data from the main TNTmips menu. TNT opens the Spatial Data Editor window. Most menu and icon buttons in this window are the same as those you are already familiar with in the Display / Spatial Data process.

First, add the reference layer. Click on the Add Reference Layer icon button, and use the standard TNT Select Object process to choose the PINELAKE



raster object from the EDITCAD Project File in the EDITCAD sample data.

The Spatial Data Editor View window shows the PINELAKE reference layer and offers the same display controls as the view window in the familiar Display / Spatial Data process.

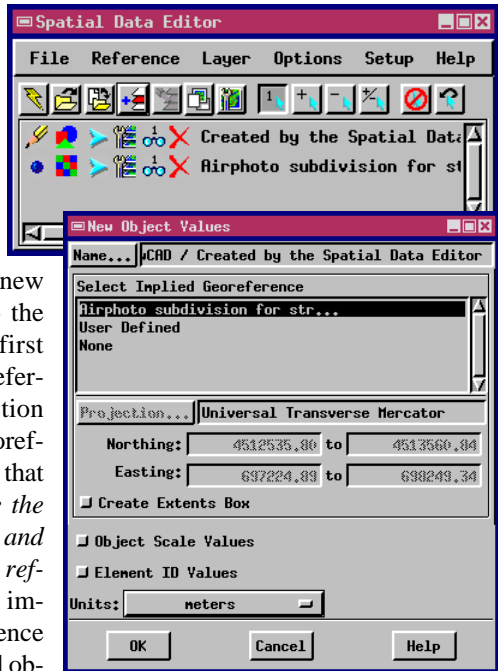
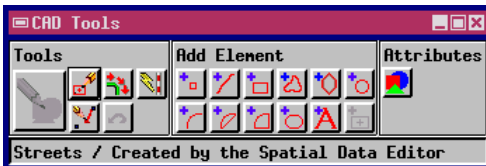
The Spatial Data Editor is the easiest way to update vector or CAD maps from recent airphotos that show recent construction or other new features.

## Create a CAD Object

Click the Create New Object icon button and select CAD from the drop down menu. TNT adds a new CAD object to the layer list in the Spatial Data Editor window and opens a New Object Values window.


Use the New Object Values window to tell the Editor how your new CAD object relates spatially to the PINELAKE reference layer. The first panel lists your choices for georeference, and by default, the selection highlight is on the Pine Lake georeference. Choosing that item means that *your new CAD object will have the same spatial extents, orientation, and map registration as the PINELAKE reference layer*. This is one of the important benefits of using a reference layer when you create new spatial objects: your new object can take its map control automatically from existing georeference, and thus it will automatically relate correctly to all of your other georeferenced project materials.

When you are finished, click the OK button at the bottom of the window. The editor copies the PINELAKE georeference control to your new CAD object, and opens the CAD Tools window (described on the next page).



The New Object Values window opens when you click Create New Object

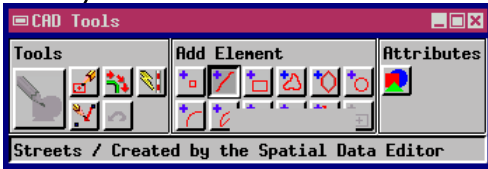
### STEPS

- click Create New Object and select CAD from the drop down menu 
- click [Name] in the New Object Values window and name the new CAD object STREETS
- verify that the georeference selected is the PINELAKE raster
- click [OK] to complete the new object setup



# Select Line Tool

Since your new CAD object has no existing elements, the Edit Elements button is inactive

Whenever an editable CAD object such as your STREETS object is selected in the layer list, the editor opens the CAD Tools window. The CAD Tools window presents a selection of tools for creating and editing elements in a CAD object. The large tool button on the left opens the Edit Element tool window (discussed later in this booklet) which is used to modify existing elements. Since



## STEPS

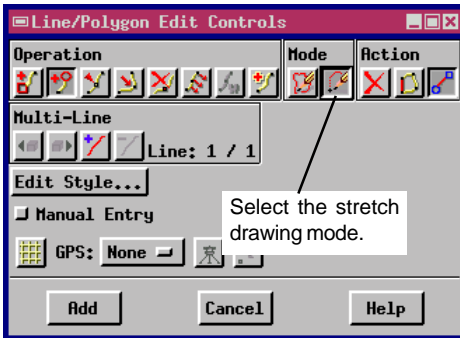
- click the Add Line tool icon 
- in the Line / Polygon Edit Controls window, click the Stretch mode icon button 
- click [Edit Style] and use the standard style selection process to choose solid red lines, at least 2 pixels wide

you want to add new line elements, click the Add Line icon button in the top row.

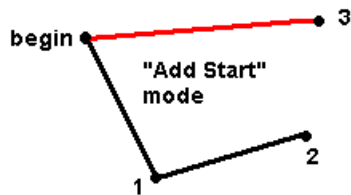
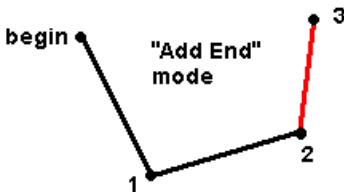
The Editor opens a Line / Polygon Edit Controls window. The Add End operation is the default selection. In the Add End operation, each time you click the mouse, the editor extends the active line element by adding a new segment at the end of the existing line.

The Add Start operation is used to extend an existing line by adding vertices to its beginning.

Two drawing modes are offered: Draw and Stretch.



The Stretch mode lets you see your new line segment and drag the position of its endpoint before you place it. For tracing operations, this ability to move a segment as you draw to align with the reference image underneath is very helpful.





## Add Line Element


You are now ready to begin tracing road features, creating new line elements as you work.

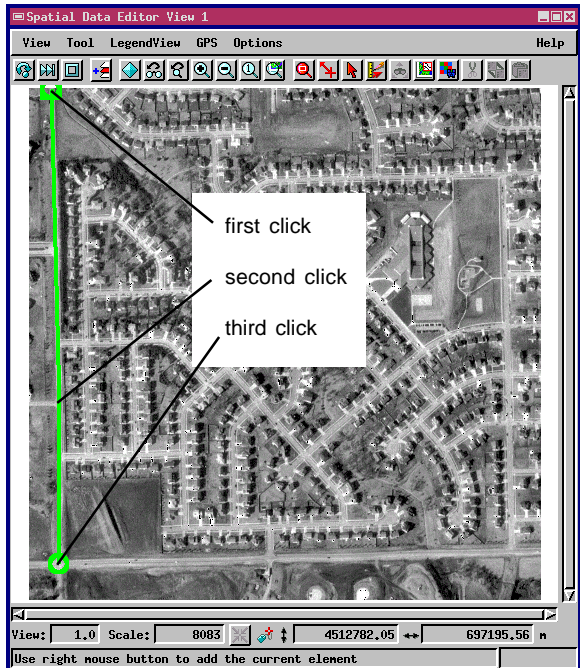
You may wish to zoom in to enlarge the northwest corner of the airphoto as illustrated. With the Add Line tool active, each time you click the mouse, the editor adds a vertex to the line element. Your first click defines the starting point of the line, so choose the place where the main road that runs north and south along the west edge goes off the top of the reference airphoto. Then move the cursor down a short distance and click on one of the light street pixels.

The editor draws a prototype segment that joins your first two click points. Click again, a little farther along the street feature to add another segment. Since you are in stretch mode, you can drag out elastic segments by dragging each new vertex to just the right spot. The prototype line does not show in the red line style we selected as long as the line remains a prototype.

As you draw, your prototype line element shows in a prototype highlight color (green in the illustration)

### STEPS

- zoom in on a selected portion of the reference image 
- click the left mouse button to set the initial end point of a road feature you have chosen to trace
- click the left mouse button to extend the line feature as you trace the road across the reference image



# Accept Line Elements

## STEPS

- add vertices and extend your first prototype line feature to the edge of the image
- click the right mouse button to accept the line
- start another line element and trace it across the image
- use the pan and zoom tools in the view window to adjust your view position as you work
- add line elements for all the road features in the image

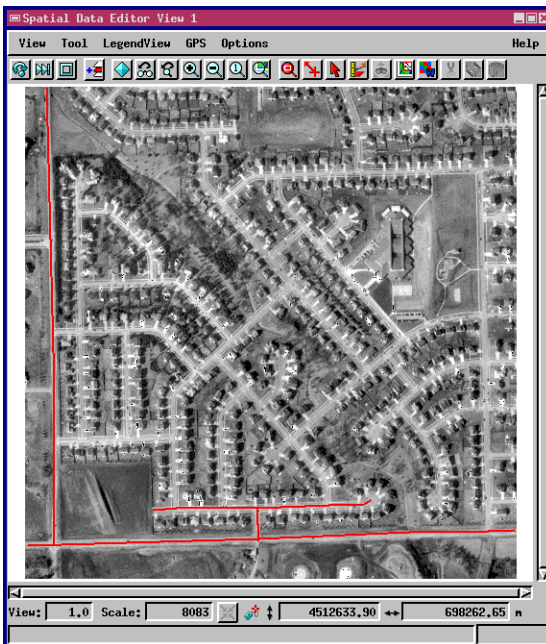
Trace the prototype street feature south to the southern edge of the airphoto. If you made mistakes and want to start over, cancel the prototype line by pressing the Clear button in the Edit Controls window. Otherwise, click the right mouse button when you finish a line to accept it. The editor redraws the new line element in the selected line style. (A later exercise describes techniques of deleting or reshaping a line after it has been added.)

Add a second line element by tracing another street feature. Recall that In CAD topology, elements may overlap one another in separate drawing layers. As you add line elements therefore, overlapping lines do not automatically intersect as they would in a vector object, and lines that almost meet are likewise not automatically snapped together. If you want to create a network of lines that forms a closed system of intersecting elements, create

a vector object, not a CAD object. (Refer to *Getting Started: Editing Geospatial Vectors.*)

At any time, you can zoom in to work at a higher magnification, and if you are zoomed in, use the scroll bars to continue working on a line that goes off the edge of the window. All of the standard display tools are available in the View window.

Add line elements for street features across the entire map.





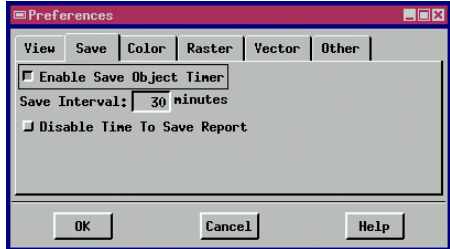
# Save Your Work

As every experienced computer user knows, you should save your work frequently. No matter what kind of software you are using, from a simple word processor to the most sophisticated scientific and engineering application, the best advice is “Save Early, and Save Often.”

Enable automatic reminders in Setup / Preferences / Save

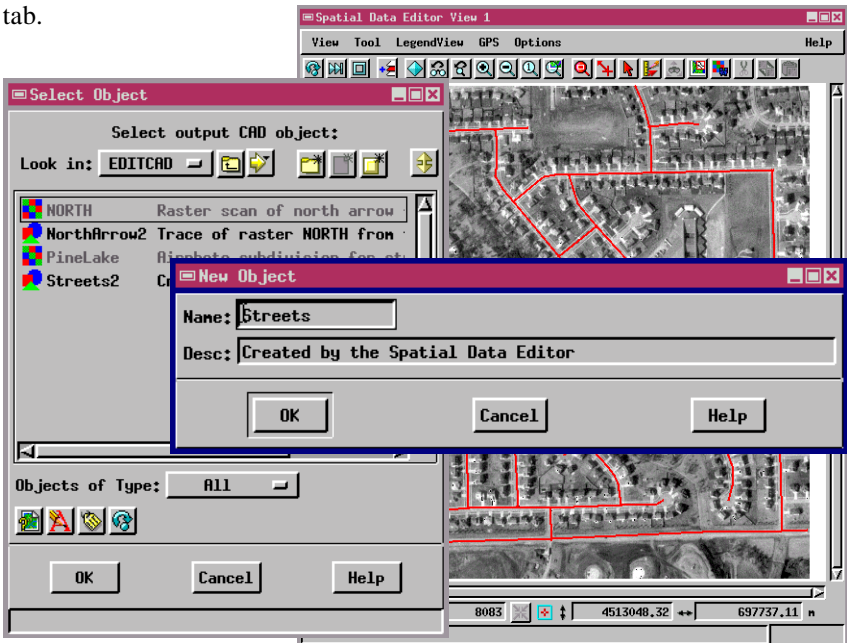
Select Save from the File menu in the Spatial Data Editor window. Use the standard Select Object process to create a new object. Name the new CAD object STREETS and save it in the EDITCAD Project File.

After the new CAD object has been saved, you will continue to edit it. Every so often, select Save from the File menu to update your changes. You can have the Spatial Data Editor remind you to save your work periodically by selecting Setup / Preferences and turning on the Enable Save Object Timer in the Save tab.

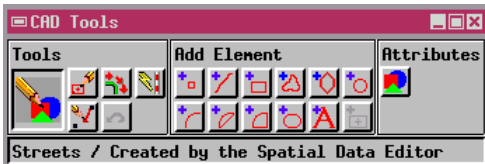


## STEPS

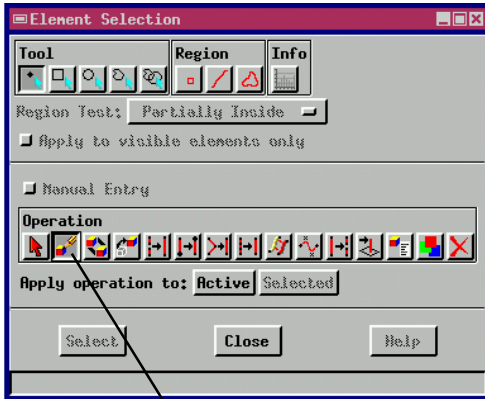
- select File / Save from the menu
- use the standard File / Object selection techniques to create a STREETS object in the EDITCAD Project File



# Select an Element for Editing



After you accept a line, the Editor draws it in the currently selected line style. You can extend it or change its shape with the edit tools.



Select the Edit Elements tool in the Vector Tools window. The editor opens an Element Selection window. This window provides many editing controls, only a few of which are discussed in this booklet. As the window name implies, editing operations involve two steps: first, element selection, and second, element editing. Element selection can be complex, involving operations that are applied to multiple elements that are selected in a number of ways. (The Reference Manual treats multiple element selection and editing.) In our simple example, you will select just one line element.

The Element Select window provides tools for editing existing elements.

Click the Edit Element operation in the Element Selection window. Left click on one of the STREETS line elements to select it. The editor displays **selected** lines in a special highlight color. Click the right mouse button to open the selected element for editing.

Click the Edit Element operation in the Element Selection window. Left click on one of the STREETS line elements to select it. The editor displays **selected** lines in a special highlight color. Click the right mouse button to open the selected element for editing.



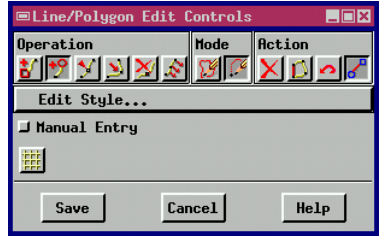
## STEPS

- click the Edit Elements icon button in the CAD Tools palette
- click Edit Element
- select a line element
- right click to open the selected element for editing



# Insert, Delete and Drag Vertices

When a single line is selected, you can **activate** it for editing by clicking the right mouse button. The editor removes the line highlight, makes the line element **active**, and opens the Line / Polygon Edit Controls window (which was introduced on page 6).



You can reshape a line by inserting, deleting, or dragging vertices. To follow the example on this page, find a place where the street element you traced does not accurately follow the reference feature. Where the line element “cuts corners” on a curve, you will use the insert vertex tool to correct it.

Practice using the three primary editing operations: Insert, Delete, and Drag. Zoom in on a line segment, perhaps choosing a segment that strays from its reference street feature. Activate the segment, and open the Line / Polygon Edit Controls window. Select the Insert, Drag, and Delete tools in turn and practice changing the shape of the line.

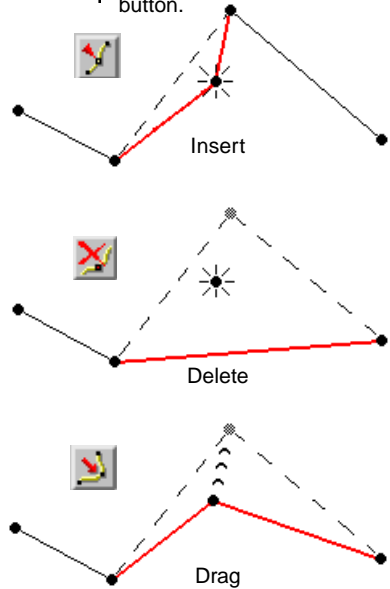
### STEPS

- select a line element and right click to open it for editing
- practice using the insert, delete, and drag tools
- click the right mouse button to save your edits

Single clicks work with Insert and Delete. The Drag operation requires you to press and hold the mouse button.





When you select a line for editing, its color changes to show it is active. You may wish to zoom in so you can see the underlying feature in the reference image. Use the editing tools to correct the line wherever it does not conform its shape to the reference feature.



## Add Text

### STEPS

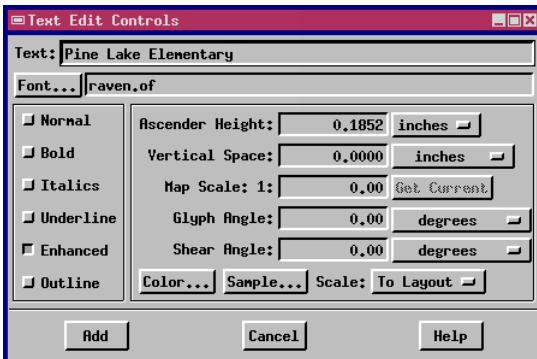
- Click the Add Text icon button 
- Type in the label text illustrated in the Text Edit Controls window
- position and size the text tool crosshair and box
- click [Add] to complete the label
- click the Remove Layer icon button to  clear the Editor for the next exercise

A text element in a CAD object has position and style information much like a point element has. Just as you can change the drawing style and position of a point element, so you can change the font, text, size, and color of a label.

To add a label element to the STREETS object, select the text tool. When the text tool is active, your left mouse button moves the text tool crosshair and the Text Edit Controls window opens. As you type in the label text in the Text Edit Controls window, the label text appears in outline at the text tool crosshair. To make the label larger or smaller, just resize the text tool box.

You can change the font style and color in the Text Edit Controls window. (The prototype label continues to display in outline until you finish it.)

When you click [Add] or the right mouse button to finish the label, the editor displays it in the selected style.



Type in the label text in the Text Edit Controls window. You can also choose font, typeface, color, and size.

Use the text tool to add an annotation that identifies the elementary school in the northeast corner of the PINELAKE raster object.



## Geometric Shapes

CAD objects are unique in that they support geometric descriptions of elements. Whereas line and polygon elements in a vector object are always composed of discrete line segments connecting a series of vertices, elements in a CAD object can be defined geometrically. Thus a circle in a vector object is really a polygon consisting of many short line segments that appear to describe a circle. But in a CAD object, a circle can be defined by a center point and radius.

Thus CAD objects are especially suited to certain kinds of drawing layers, such as logos, legends, and other cartographic elements. For this exercise, open the NORTH raster object in the EDITCAD Project File as a reference layer. Use this scanned north arrow as a tracing reference to create a CAD north arrow which will be available for use with various map layouts.

Click the Create New Object icon button and select CAD from its drop down menu. The NewCAD object will hold your trace of the north arrow.

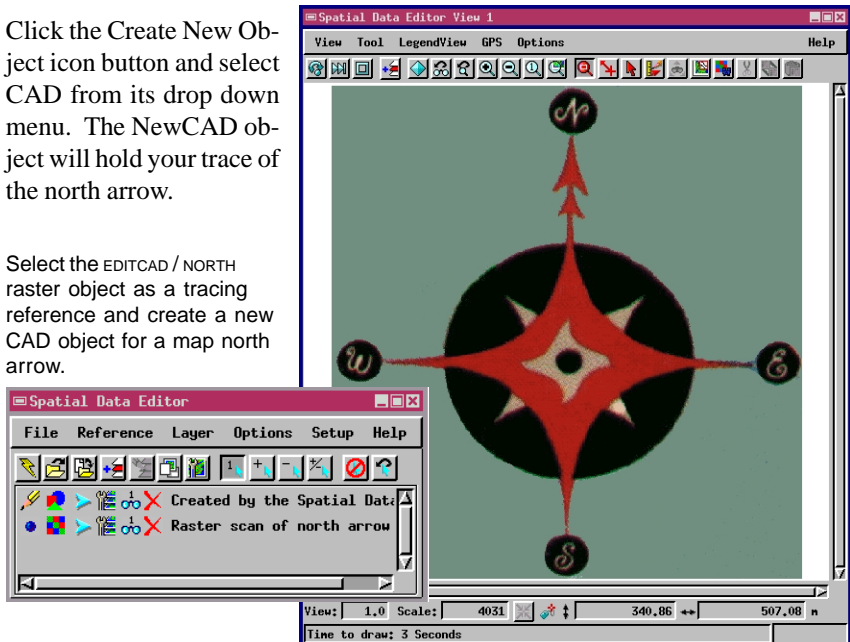
Select the EDITCAD / NORTH raster object as a tracing reference and create a new CAD object for a map north arrow.

### STEPS

- click the Add Layer icon button and select EDITCAD / NORTH
- click the Create New Object button and select CAD





The NORTH raster object is a scanned reference image that you can use to trace a CAD object.



## Base Lines and Circles

### STEPS

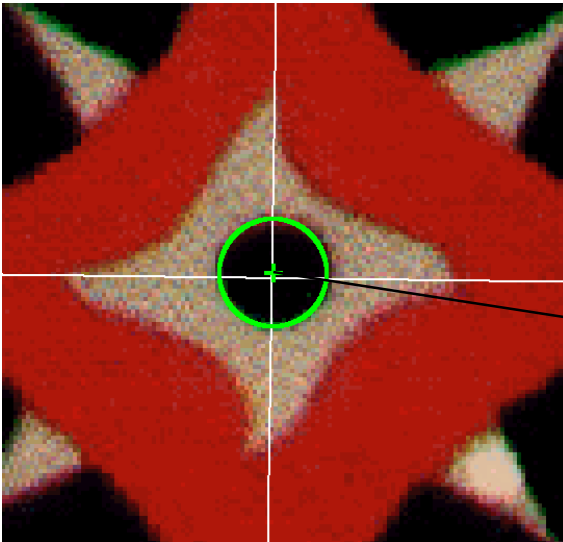
- select the Add Line tool and draw N-S and E-W reference axes 
- select the Add Circle tool and draw the small circle in the middle 
- use the arrow keys to nudge the circle's center to the intersection of the reference axes
- when the circle is sized and positioned correctly, click the right mouse button to accept it

You will draw the components of the new NORTHARROW CAD object in several layers. Since the geometry of the reference image is slightly skewed, you will get irregular results if you trace it exactly. Therefore, instead of trying to create an exact trace, we will use the CAD drawing tools and some simple drafting techniques to create regular geometric figures that approximate the reference image.

First, draw two reference lines for the N-S and E-W axes. Adjust their position so they intersect in the center of the image, even though the ends do not line up with the cardinal circles of the reference image.

Next, draw the small circle at the center of the image. The Editor's circle tool draws from the center point outwards. When the circle is still in prototype form, you can drag it and nudge its position with the arrow keys on your keyboard so that the circle's crosshair lines up with the intersection of the reference lines. For now, leave the circle with a

white line style and no solid fill. After all the shapes have been created, you can order their drawing layers and assign fill and stroke color.



Draw reference lines that intersect in the middle of the graphic, and then add the small center circle. Nudge the prototype circle with the arrow keys on the keyboard.



## Drawing Other Shapes

The diamond and arrow shapes of the reference image could be created in several ways. The CAD editor offers a number of flexible shape drawing tools. For this exercise, we will simply trace them with the polygon tool.


Select the polygon tool and trace the pinwheel diamond at the center. Put enough vertices along the outline to represent the curved edge. Since the shape is irregular with respect to your reference axes, decide how you want to treat the irregularity. In the illustration, the point at each corner of the shape touches a reference line, and the curve pulls back slightly before crossing the line on its way to the next corner. Draw the polygon and then select it for editing to adjust its symmetry and balance.

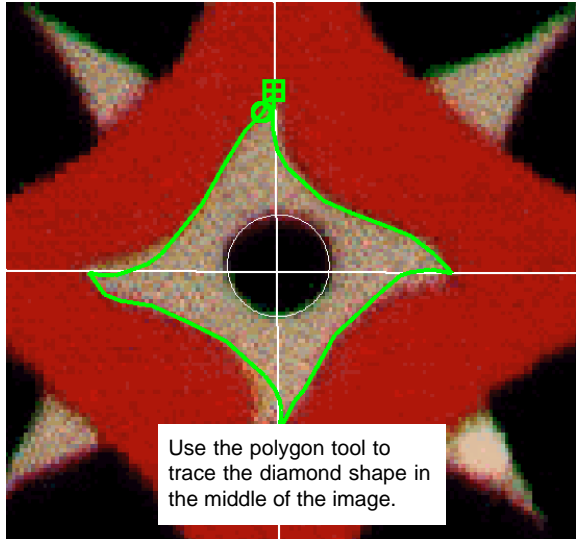
When you are satisfied with the small diamond at the center, use the polygon tool to draw each of the other shapes including the large red star and its double arrow. Use the circle tool for the large black circle, and each of the cardinal circles. Use the Text Tool for the N, S, E, and W text labels, using a font similar the one in the reference image, or any TrueType font you have.

In order to provide balance and symmetry, you may wish to add temporary lines, rectangles, circles, and other shapes for alignment and proportion. Feel free to depart from the reference image, and experiment with the chord, arc, and wedge shapes to create designs of your own.

Remember to File / Save your work. Give the new CAD object a name like NORTHARROW and put it in the EDITCAD Project File.

### STEPS

- select the Add Polygon tool and trace the small central diamond 
- click the right mouse button to accept the polygon
- select the polygon for editing according to the techniques described on pages 10- 11
- add polygons, circles, and text for each of the other components



# Apply Fill and Line Styles

**STEPS**

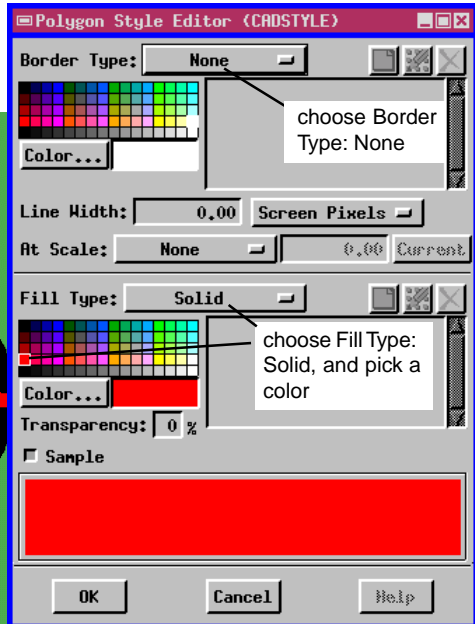
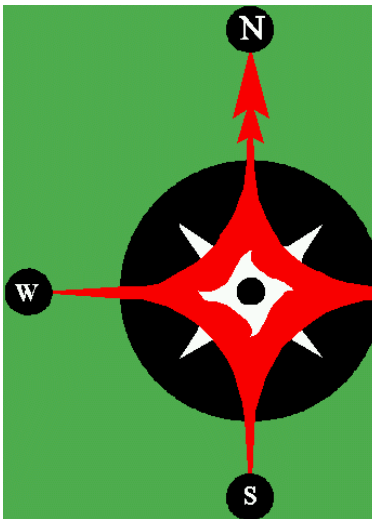
- click Edit Elements in the CAD tool palette
- click Edit Element
- select one of the polygon shapes in the View window
- right-click to open the Line / Polygon Edit Controls window
- click [Edit Style]
- in the Polygon Style Editor window, choose None for Border Type, pick a fill color, and choose Solid for Fill Type
- click [OK] and then [Save]



After you have created each of the graphic elements, it remains to set their fill color and order their drawing layers. Click the Edit Elements button in the CAD Tools window to open the Element Selection window. Select the Edit Element tool in the Element Selection window and click on one of the graphic elements to select it. Right-click the selected element to open the Line / Polygon Edit Controls window, and click [Edit Style] to open the Polygon Style Editor window. For each of the shapes in the northarrow object, choose None for Border Type, and Solid for the Fill Type.

When you have finished changing the border and fill styles, click [OK] to close the Polygon Style Editor window, and then click [Save] to close the Line / Polygon Edit Controls window. When the Editor redraws the polygon elements, they will display in the selected styles.

This complete version of the north arrow is provided for reference and comparison in the EDITCAD Project File as the NORTHARROW2 CAD object.





## Change Layer Order

Unlike raster, vector, or TIN objects, CAD objects support the idea of layers within the object topology. You can draw CAD elements “on top of” other CAD elements, and move elements forward and backward in the drawing layers. Use the layer controls to put the components of the NORTHARROW CAD object in the correct drawing order.

Select the Order tool in the Operation panel. Then select the large circle in the View window. Send the circle to the back of the drawing order by selecting To Back in the Order Method option button, and clicking [Active].

Select each element in turn and move it to the front or back of the drawing order until all the elements are sequenced correctly. If an element is hidden behind another, the element on top is always selected first. But if you click again in the same place, the editor selects the next element down in the drawing order at the click point.

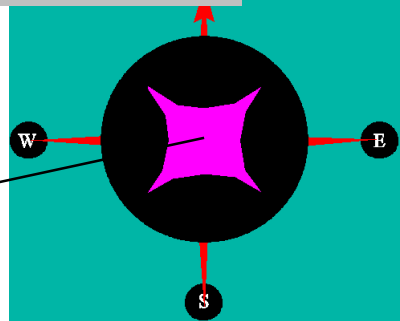
### STEPS

- select the Order tool in the operation panel 
- select the large background circle in the view window
- select To Back in the Order Method option button
- click [Active] to apply the operation
- select each component in turn and bring it forward or backward until the drawing sequence is correct
- click Unselect All to turn off selection highlights and view the assigned drawing colors 

Select the Order operation, To Front or To Back, and click [Active] to apply it to the highlighted element.









Whenever several elements overlap (as they do in this sample CAD object), the one you want to select may be hidden behind a larger object on top of it. When you make a selection click, the topmost element is selected first. If you click a second time in the same place, the editor selects the next object down in the drawing order. This diamond shape was selected by a second click in the middle of the large black circle, which was on top.



# Copy and Move Operations

## STEPS

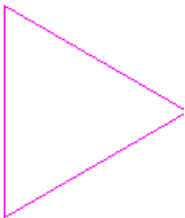
- ☑ clear the layer list of any object from previous exercises 
- ☑ click the Create New Object button and select CAD 
- ☑ click Add Regular Polygon and draw an element for practice 
- ☑ click Edit Elements in the tool palette 
- ☑ click the Copy icon button in the Operations panel 
- ☑ select the element you drew and click the right mouse button
- ☑ drag the copy box to a new location and click the right mouse button
- ☑ switch to the move tool and practice the same steps 

Copy and Move operations are slightly different than those you may be familiar with from simple draw and paint programs. The Object Editor uses a copy box to identify the elements that will be copied or moved. You drag the copy box to the target position and click the right mouse button to complete the operation.

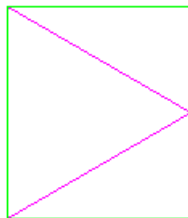
Clear the layer list in the TNTmips Object Editor window. Click the Create New Object icon button and select CAD from its drop down menu. Choose the Add Regular Polygon from the CAD Tools palette and draw an element such as the triangle illustrated below. (Click the right mouse button to place the element.)

Click the Edit Elements icon in the tool palette to open the Element Selection window. Click the Copy icon in the Operation panel and select the element you drew in the View window. Right click to activate the copy box, drag the copy box, and right click to place the copy.

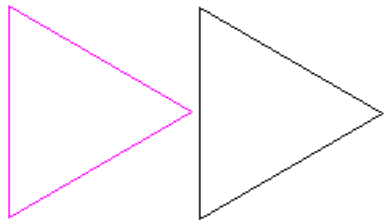
The Move operation works the same way. Select the move operation, select the element, right click to activate the move box, drag the box, and right click to complete the move. Note: you can resize and rotate the box in move and copy operations to change the aspect and orientation of the element.



The original element, selected for copying



Click the right mouse button to see the copy box around the selected element



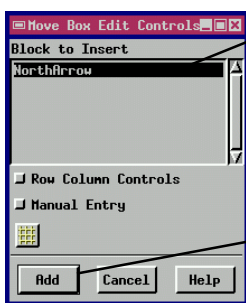
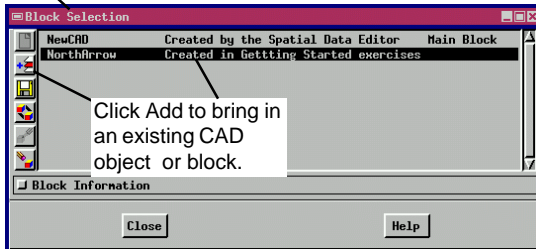
Drag the copy box to the destination and click the right mouse button to place the copy.

# Working With Blocks

The Spatial Data Editor supports the block data structure in CAD objects. A block is a “super element” composed of one or more individual elements. For example, the “NorthArrow” block on this page is composed of several polygon, text, and shape elements. Once you have created a block, you can use it again and again without recreating it each time. Blocks are efficient data elements, since the block definition is recorded only once and that definition is referenced for each instance of that block.

To create a block, create a new CAD object, compose the block with the elements you want, and save the object. For example, the “NorthArrow” block on this page was created and saved in the exercises on pages 13-17 of this booklet.

Click Edit Block to open the Block Selection window.



Click Add Block Insert to open the Move Box Edit Controls window. Then drag and resize the placement box.

Click Add to complete the operation and place the selected block into the CAD object.

## Where Next?

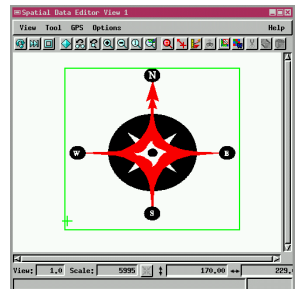
Complex relations can be defined to associate CAD elements with database tables. Refer to *Getting Started: Editing Geospatial Vectors*, *Getting Started: Managing Databases*, and the TNTmips reference manual for more information.



The editor provides Arc, Arc Chord, and Arc Wedge tools. They work just like the circle and rectangle tools: you drag out a prototype shape, adjust its size and position, and click the right mouse button to place it.



The Coordinate Geometry (COGO) process includes COGO functions used in professional surveying and civil engineering applications. A Getting Started booklet (planned) will be devoted to the use of COGO in the Object Editor.



The NORTHARROW CAD object can be inserted as a block.

# Advanced Software for Geospatial Analysis

MicroImages, Inc. publishes a complete line of professional software for advanced geospatial data visualization, analysis, and publishing. Contact us or visit our web site for detailed product information.

**TNTmips** TNTmips is a professional system for fully integrated GIS, image analysis, CAD, TIN, desktop cartography, and geospatial database management.

**TNTedit** TNTedit provides interactive tools to create, georeference, and edit vector, image, CAD, TIN, and relational database project materials. TNTedit can access geospatial data in a wide variety of commercial and public formats.

**TNTview** TNTview has all the same powerful display features for complex visualization and interpretation of geospatial materials as TNTmips. TNTview is perfect for those who need flexible access to the TNT project materials but do not need the technical processing and preparation features of TNTmips.

**TNTatlas** TNTatlas lets you publish and distribute your spatial project materials on CD-ROM at low cost. TNTatlas CDs contain multiple versions of the TNTatlas software so that a single CD can be used on any popular computing platform.

**TNTserver** TNTserver lets you publish TNTatlases on the Internet or on your intranet. Navigate through massive geodata atlases with your web browser by using the free, open-source TNTclient Java applet (or any custom applet you create) to communicate with TNTserver.

**TNTlite** TNTlite is a free version of TNTmips, TNTedit, and TNTview for students and professionals with small projects. You can download TNTlite for your computer (about 100MB) from MicroImages' web site, or you can order TNTlite on CD-ROM with the current set of *Getting Started* tutorial booklets (shipping and reproduction charges apply).



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