

Tutorial



EDIT
CAD

Editing CAD Geodata



in
TNTmips®
and **TNTedit™**

Before Getting Started

This booklet introduces techniques for creating, altering, and updating CAD geospatial objects in the powerful Editor in TNTmips® and TNTedit™. CAD objects that you make or import contain point, line, geometric 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. TNT's 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 the tutorials *Displaying Geospatial Data* and *TNT Product Concepts*. Those exercises introduce essential skills and basic techniques that are not covered again here. Please consult those booklets and other TNT Reference Materials (installed or on MicroImages' web site) for any review you need.

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 DVD, 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 DVD.

More Documentation This booklet is intended only as an introduction to CAD editing in TNT's Editor. The tutorial *Editing Vector Geodata* is also recommended, since many vector editing operations are essentially the same.

TNTmips® Pro and TNTmips Free TNTmips (the Map and Image Processing System) comes in three versions: the professional version of TNTmips (TNTmips Pro), the low cost TNTmips Basic version, and the TNTmips Free version. All versions run exactly the same code from the TNT products DVD and have nearly all the same features. If you did not purchase the professional version (which requires a software license key) or TNTmips Basic, then TNTmips operates in TNTmips Free mode.

Keith Ghormley and Merri P. Skrdla, Ph.D., 21 November 2013

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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 tutorial booklets on other topics. You can download an installation guide, sample data, and the latest version of TNTmips Free:

<http://www.microimages.com>

Spatial Data Editing Overview

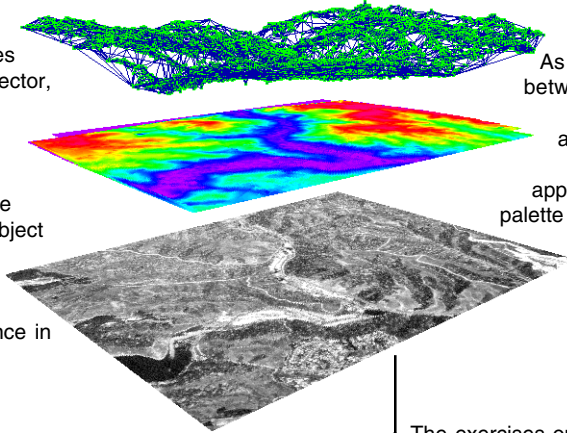
TNT's Editor (Main / Edit) offers a flexible, editing environment that can be used for simple one-object tasks or complex multi-layer, multi-object manipulations. You can have a single object in one layer, or a combination of read-only reference layers with other editable layers. You can have multiple 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).

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.

You may see editing tools like those in TNT in other software products, but the important advantage of TNT's 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 coordinate reference systems. Thus, all the new objects you create can automatically derive their georeference from other layers, so all of your project materials have the 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

STEPS

- select Main / Edit to launch TNT's Editor
- click the Add Reference Objects icon

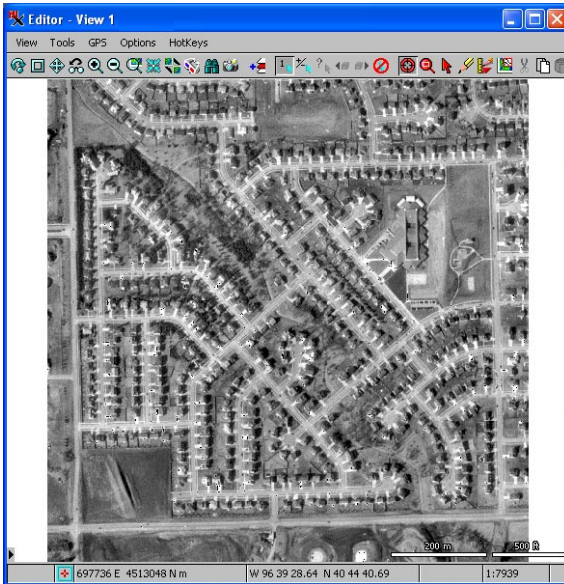


- select the PINELAKE raster object in the EDITCAD sample Project File

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

CAD objects support many shapes with geometric definitions and are not subject to the topological constraints of vector objects. CAD elements can overlap and be moved up or down in the drawing order. Those elements with geometric definitions can be manipulated after they are added (for example, the radius of a circle can be changed). In contrast once a geometric shape is added to a vector object, it becomes one or more line or polygon elements with all intersections resolved by nodes and is subsequently edited like a line/polygon. Each CAD element can have a unique drawing style that is assigned when it is added that is separate from assigned styles determined by database attributes.

Your first task is to create a new CAD object that contains georeferenced road line elements. You will use a raster reference layer that contains a georeferenced airphoto of a new housing subdivision, and you will trace over the streets with the TNT editing tools. Every line that represents a single road can be a continuous line with a unique drawing style.



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

The PINELAKE raster object is part of an airphoto that shows new subdivision street features.

* In the TNT professional products you can use a variety of layers located on the web, including Bing Maps layers, as a reference layer.

Create a CAD Object

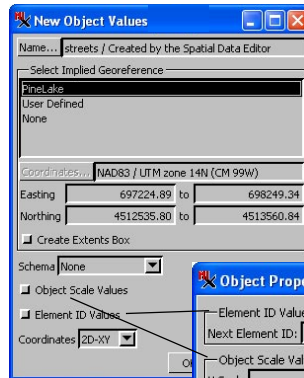
The New Object Values dialog that opens when you create a new object in the Editor lets you specify georeference, scale and other parameters for your new CAD object. Some of these parameters, such as scale and next element ID, can be altered later in the Editor and others, such as georeference and coordinate type information, cannot. 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 Coordinate Reference System as the PINELAKE

reference layer. Automatically acquiring georeference information is one of the important benefits of using a reference layer when you create new spatial objects: your new object will automatically relate correctly to all of your other georeferenced project materials.

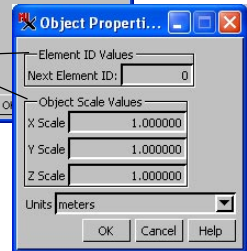
Although you cannot alter the georeference information in the Editor after the object is created, TNTmips provides other processes that let you alter this information if it later turns out there is some problem with the georeference of the reference layer you selected. For example, Tools / Change Coordinate Reference System lets you change the CRS if it was simply misidentified. More serious georeference problems may require remedy in the Georeference process and warping of the object you created.

STEPS

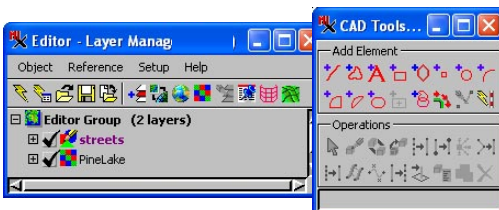
- click on the Create Object icon and select CAD from the drop down menu
- click [Name] in the New Object Values window and name the new CAD object STREETS
- verify that the georeference selected is the PINELAKE raster
- click [OK] to complete the new object setup



The New Object Values dialog opens when you click Create Object.

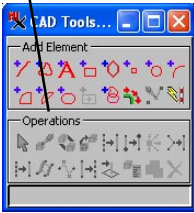


There are two toggle buttons that open additional panels in the New Object Values window. These same panels appear in the Object Properties window opened from Object / Properties in the Editor Layer Manager at any time after the CAD object is created.






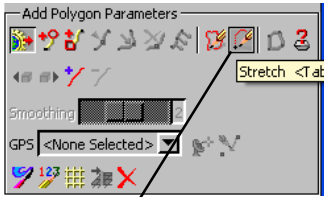
Select Add Line Tool

Since your new CAD object has no existing elements, all Operations icons are inactive.



STEPS

- click the Add Line tool icon 
- in the Add Line Parameters panel, 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 



Select the stretch drawing mode (the tab key switches between Stretch and Draw modes when the View window has focus).

Your newly created CAD layer may be listed in the Layer Manager by the name you gave it on the preceding page or by its default description depending on your default layer name setting (Setup/Preferences/Layer in Editor Layer Manager). When an editable CAD object, such as the STREETS object you created on the previous page, is the active layer (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 tools for adding elements to CAD objects operate the same as when adding elements to vector objects. The editing operations for all CAD element types besides lines and polygons differ between the two object types. Once any element that has a geometric definition (e.g., circle, ellipse, arc) is added to a vector object, it is edited as a line or polygon. These same element types are edited using the same geometric tools used to add them in a CAD object.

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. This ability to move a segment as you draw to align with the reference image underneath is very helpful. You can further adjust your lines as they are being drawn by inserting vertices between existing vertices (cursor is a diamond shape) and/or deleting vertices (cursor is a plus shape) then continuing to draw the new line.

The Editor shows the starting point of a **prototype line** with a box graphic.

The last segment ends with a circle graphic. You can drag the end by holding down the left mouse button until the segment is where you want it.

You can alter the thickness and color of the prototype line by changing the graphic tool settings (Setup/Preferences/Color).

Each click adds a new prototype **segment** to the line.

Add Line Element

You are now ready to begin tracing road features, creating new line elements as you work. “Trace” in this context means to draw over a reference layer. Adding lines to a vector object has a trace mode, in addition to draw and stretch modes, that lets you exactly copy line segments from another vector object (see the *Advanced Vector Editing* booklet).

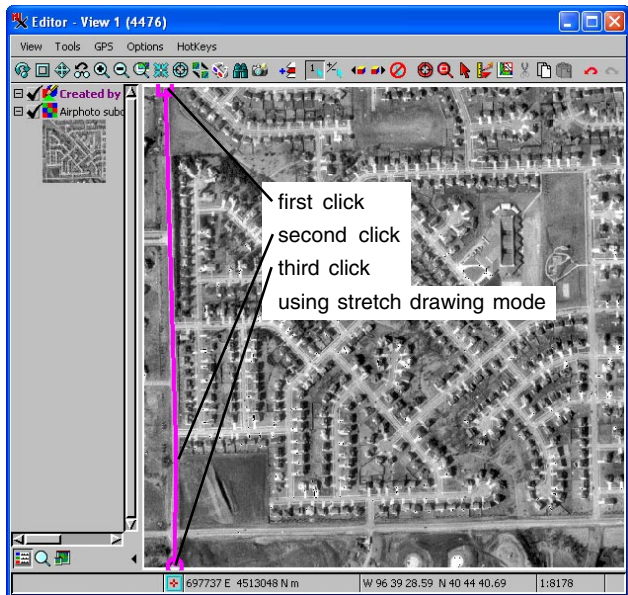
You may wish to zoom in to enlarge the area you are tracing initially, or you can wait and refine the line later. With the Add Line tool active in Stretch mode, each time you click the mouse, the editor adds a vertex to the line element. Your first click defines the starting point of the line. In this case choose the place where the main road that runs north and south along the west edge goes off the top of the reference airphoto.

The Editor draws a prototype segment that joins your first two click points. Since you are in stretch mode, you can pull out elastic segments by dragging each new vertex to just the right spot, which is the spot before the prototype line begins to diverge from alignment with the feature you are tracing. 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 (magenta in the illustration).

STEPS

- zoom in on a selected portion of the reference image if desired using the View Position or Zoom tool
- click the left mouse button to set the initial end point of a road feature at the upper left of the image
- click the left mouse button and extend the line feature over the road in the reference image
- repeat the click, draw, and release cycle as you trace the road feature to the bottom of the image and right-click



Accept Line Elements

STEPS

- ☑ start another line element at the left edge of the image over the lower road, and trace it across the image
- ☑ use the View Position and Zoom tools, as well as the hot keys, in the view window to adjust your view position as you work if needed
- ☑ add line elements for all the road features in the image

Although you could create continuous lines that go around corners in a CAD object, you want to consider which lines would have different attributes (in this case, different street names) as you decide where to end lines and begin new lines. Recall that in CAD topology, elements may overlap one another. 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 the tutorial *Editing Vector Geodata*).

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

Remember that you can go back over a line before it is added and modify positions of vertices or add more vertices to generate a better fit to the feature you are interpreting from the reference image.

A total of four lines are shown in the CAD object illustrated at the left. There would be a total of seven lines, if these lines had been created in a vector object with snapping on.

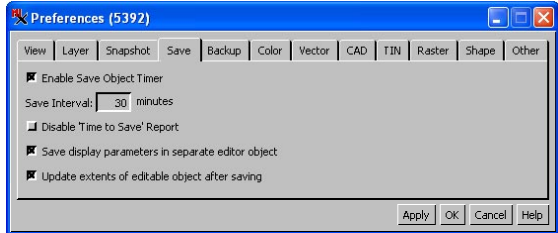


Save Your Work

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.”

After the new CAD object has been saved, you can continue to edit it. After your initial save of an object, if you choose Save rather than Save As, you are asked if you want to save over the original object and given the opportunity to save to a new object or save over the original. Once you have chosen to save over your last saved version, you are no longer presented this prompt. You can have the Editor remind you to save your work periodically by selecting Setup / Preferences and turning on the Enable Save Object Timer option on the Save panel. Note that the Backup panel contains additional options and will save all editable layers in the current session to a backup file that you are prompted to open the next time you open the Editor if the previous session terminated abnormally.

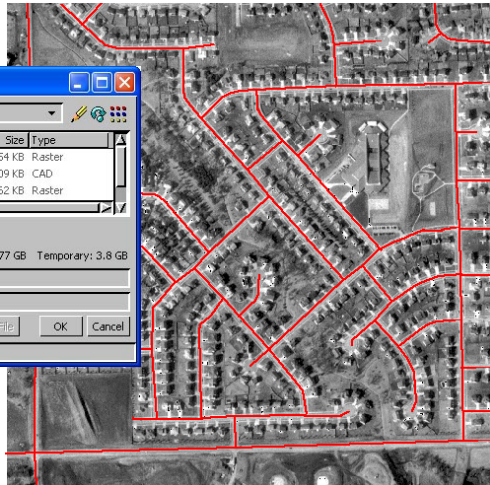
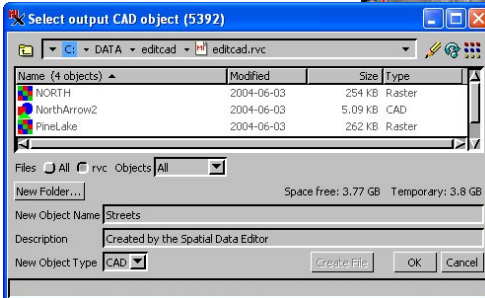
Enable automatic reminders on Setup / Preferences / Save tabbed panel.



STEPS

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

Note: you can choose Object / Save Group As when you want to save the group composition, which includes reference layers and editable layers*.



* This option does not save changes to individual editable objects.

Right Mouse Button Settings

STEPS

- choose Setup / Right Mouse Button in the Editor Layer Manager
- turn on any combination of toggles you think would be useful being sure that Edit Element is selected and remembering that adding choices you seldom use may slow selection from the menu
- use the View Position or Zoom tool or the + key to zoom in on an element you would like to edit
- right-click on the element, and choose Edit Element

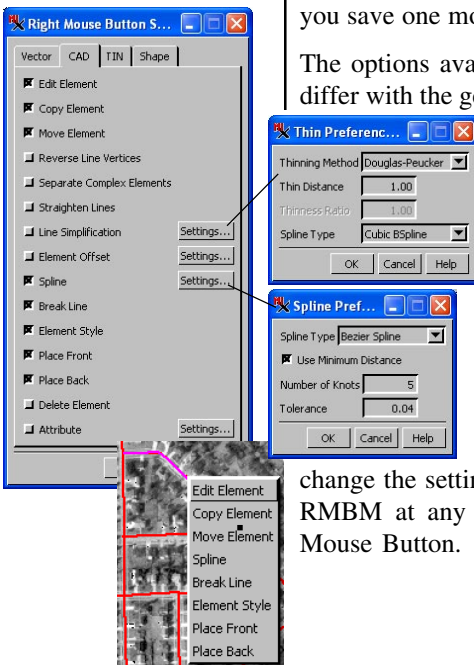
Adding operations to the right mouse button menu is equivalent to providing shortcuts to and between any of the operations on that menu. Normally you would select an operation in the CAD tools window, left-click to select the element to apply the operation to, and then right-click to activate the selected element for that operation. Placing operations on a right mouse button menu (RMBM), lets you right-click and select the operation, perform the operation, complete it by right-clicking, then right-click on another element and choose the same or a different operation.

When you are doing the same operation repeatedly, there is no real advantage to using the RMBM—after the initial operation selection, left-click then right-click is all that is needed to activate any element for that same operation. However, when you are constantly switching operations while editing, you save one mouse action with every operation.

The options available for addition to the RMBM differ with the geometric object type, but Edit Element is available for all types.

Note that some of the options for the RMBM for vector, CAD, and shape objects have a Settings button. Any time you choose the operation these same settings will be used. You can experiment with the effects of the settings on an operation by choosing the operation in the CAD Tools window or from the RMBM. Of course you can

change the settings used with an operation on the RMBM at any time by choosing Setup / Right Mouse Button.



Edit Existing or in Progress Lines

You can reshape a line by inserting, deleting, or dragging vertices while the line is being added or after it has been added. To follow the example on this page, find a place where the street element you traced does not accurately follow the reference feature. Use the interactive line editing features to re-shape the line as necessary.

Note that as you move the cursor over the selected line, the cursor shape changes to reflect its current action. When the cursor is diamond shaped, a vertex will be inserted in the line or added to the end of the line. When the cursor is a plus (+) shape, the closest vertex can be dragged to a new position. If you middle-click the mouse, the cursor becomes a circle shape and you can delete the closest vertex.

Choose a segment that strays from its reference street feature. Practice changing the shape of the line as different operations become active while you move the cursor over the active line.



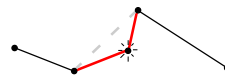
STEPS

- select a line element and right-click to activate it for editing
- move the cursor over the line to activate the different editing functions
- click the right mouse button to save your edits



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 its shape does not conform to the reference feature.

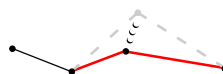
Line Editing Actions



insert a vertex




delete a vertex



drag an existing vertex to a new position

Add Text

STEPS

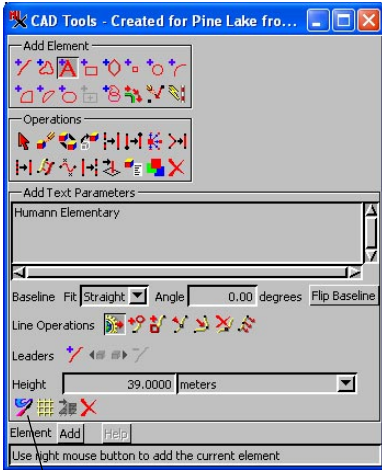
- click the Add Text icon button 
- type in the label text illustrated
- position and size the text tool crosshair
- click on the Add button to complete the label
- right-click on the group name in the Layer Manager and choose Remove All Layers

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.

When the text tool is active, your left mouse button moves and resizes the text tool crosshair. As you type in the label text in Add Text Parameters panel of the CAD Tools window, the label text appears in outline at the text tool crosshair. You can make the text larger or smaller by entering a height in the CAD

Tools window or by resizing the tool itself (grab the + symbol at the upper left of the tool and drag).

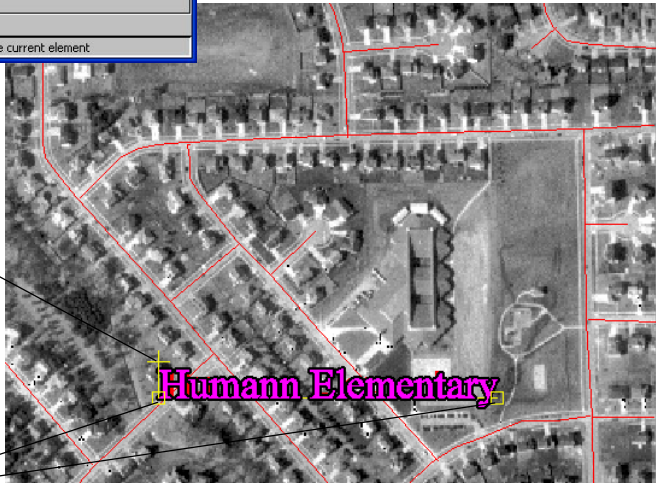
You can change the font, font style, and color in the in the Style Editor window. (The prototype label continues to display in outline until you add the text element.) When you click on the Add button or right-click to finish the label, the Editor displays the text in the selected style.



Click on this icon to open the Style Editor and set the text style.

Grab here and drag to resize the text.

Click here and drag to rotate the text around the opposite end of the text string.





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 regardless of the tool used to add them, many 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 and can be edited using this definition after the element has been added.

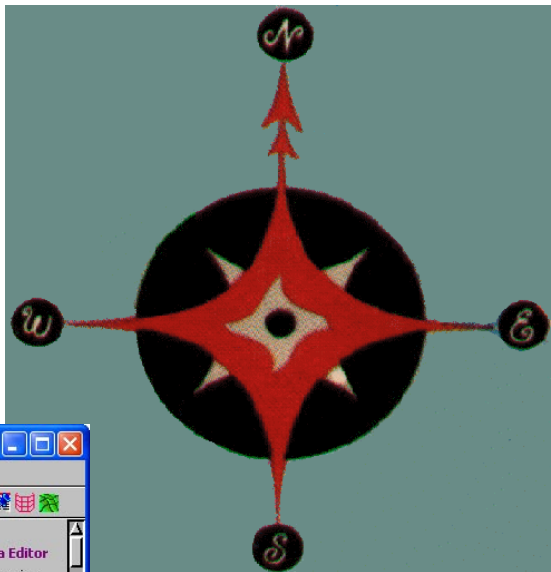
Thus CAD objects are especially suited to certain kinds of drawing layers, such as logos and other cartographic enhancement elements. CAD objects are also well-suited to drawings with repeated elements or combinations of elements, such as architectural drawings, where these elements can be organized into blocks and used over and over again at the same or different scales without having to be redrawn.

Select the EDITCAD / NORTH raster object as a tracing reference and create a new CAD object for a map north arrow, which you can use with various map layouts.

STEPS




- click the Add Reference Objects  icon button and select EDITCAD/NORTH
- click the Create Object button and select CAD 

The NORTH raster object is a scanned reference image that you can use for tracing.



Baselines and Circles

STEPS

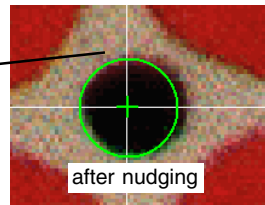
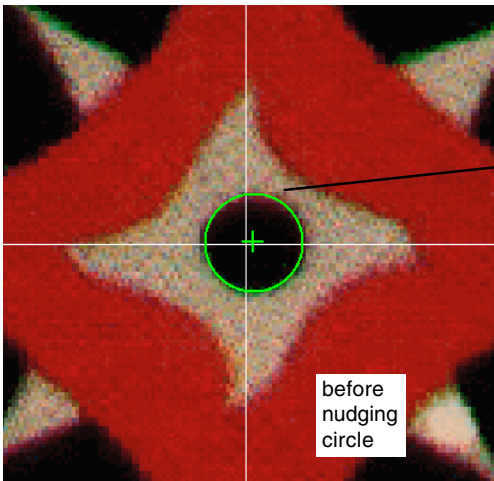
- select the Add Circle tool and draw the small circle in the middle 
- select the Add Line tool and draw N-S and E-W reference axes 
- if you have difficulties drawing a straight line, click on the Manual Entry icon and change the X coordinate for one end of the vertical line and the Y coordinate for one end of the horizontal line to match the other end 
- 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, right-click to accept it

You will draw the components of the new NORTHARROW CAD object as several separate elements. Changing the drawing order of CAD elements is described in a later exercise. 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, use the CAD drawing tools and some simple drafting techniques to create regular geometric figures that approximate the reference image.

Drawing reference lines, which can later be removed, for the N-S and E-W axes helps you to position the elements you add so they are all centered on the same position. You can adjust the position of the reference lines 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.

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 example, the four triangular areas that extend beyond the pinwheel diamond shapes could be drawn individually with the Add Regular Polygon tool or as a single or separate polygons with the freeform 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 tip of the shape touches a reference line, and the curve pulls back slightly before crossing the line on its way to the next tip. Draw the polygon and then adjust/add vertices for symmetry and balance.


When you are satisfied with the small pinwheel, use the polygon tool to draw the larger pinwheel and 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 with a font similar to 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.

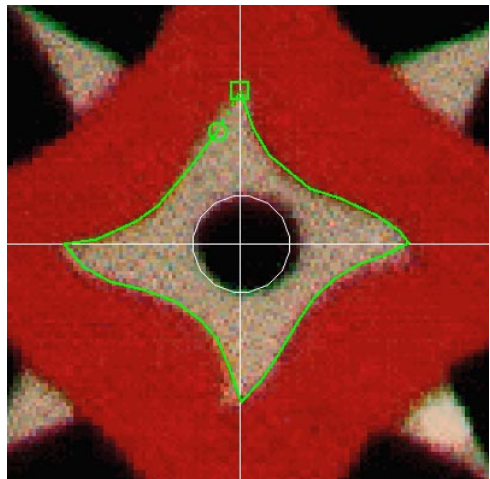
Use the polygon tool to trace the pinwheel shape in the middle of the image.

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

STEPS

- select the Add Polygon tool and  trace the small, central, pinwheel
- refine the fit of the polygon according to the techniques described on page 11
- add polygons, circles, and text for each of the other components

Note: when adding the circles at the cardinal points, you may want to turn off the Clear Tool After Add toggle on the CAD tabbed panel of the Setup/ Preferences window to easily create four same size circles that simply need to be repositioned not redrawn.



Apply Fill and Line Styles

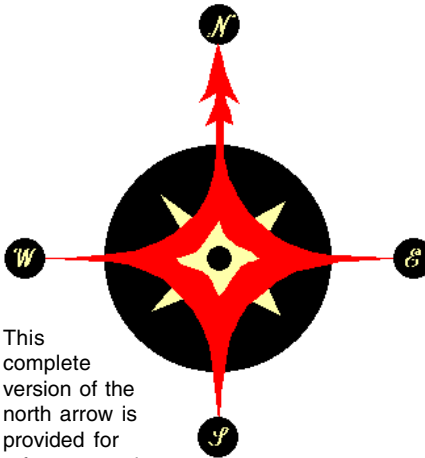
STEPS

- ☑ right-click and choose Edit Element or left-click on the Edit Element operation then on the element you want to edit, and right-click to activate the selected element
- ☑ click on the Edit Style icon in the Edit Element Parameters panel of the CAD Tools window
- ☑ in the Style Editor dialog, choose None for Border Type, pick a fill color, and choose Solid for Fill Style Type
- ☑ click [OK] and then [Save] for the element
- ☑ repeat these steps until each element has been styled

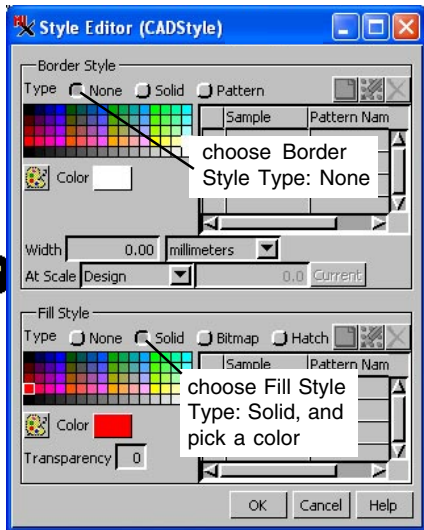
Note: you may have to click on the Unmark All icon to have the element shown in the newly assigned drawing style.

After you have created each of the graphic elements, it remains to set their drawing style, in this case fill color, and set the drawing order of the elements. You could have set the drawing style as each element was added. Elements could also be created with the correct drawing order, but that takes considerable forethought. Elements created first are beneath, or behind, those created later.

Because CAD elements may overlap, it is sometimes difficult to select the element you want. If you have difficulty selecting the element you want to style, right-click on the CAD elements icon in the Layer Manager, and choose Mark All from the menu. Then use the Next Marked and Previous Marked icon pair on the View window toolbar to step through the marked elements until the one you want is shown in the active color. Once the desired element is highlighted, right-click to activate it for editing. You can use the same procedure to select CAD elements for any operation.



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

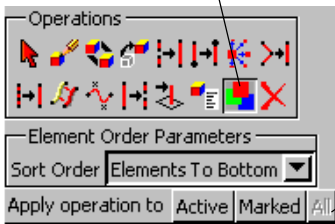


Change Layer Order

Unlike raster, vector, or TIN objects, CAD objects support the idea of overlapping elements within the object topology. You can draw CAD elements “on top of” other CAD elements, and move elements forward and backward in the drawing order. You use the Element Order operation to put the components of your NORTHARROW CAD object in the correct drawing order.

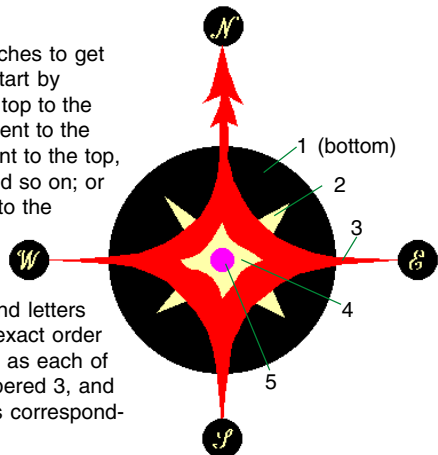
The reason the elements were initially drawn unfilled in the previous exercises was so they would not seem to disappear when you added other elements that overlapped them. In areas that overlap, the top element is the one initially selected. If you have difficulty selecting the desired element, use the techniques described in the second paragraph of the previous exercise to select the element you want.

Select the Element Order operation to move an element(s) to the top or bottom in the drawing order.





The All button is never active for this operation because moving all elements to the back or front would have no effect on element order.

You can use a number of different approaches to get elements into the correct drawing order: start by sending the element that should be on the top to the bottom, then send the next to the top element to the bottom, and so on; send the bottom element to the top, then the second to the bottom element, and so on; or you can send some to the top and others to the bottom. The element numbering in this illustration indicates their order where these elements overlap. There are eight elements not numbered: the four circles and letters that indicate the cardinal directions. The exact order of these elements does not matter as long as each of the four circles is above the element numbered 3, and each of the four text elements is above its corresponding circle.







STEPS

- click on the Element Order icon in the Operations panel 
- select the large background circle in the view window
- choose Elements to Bottom for the Sort Order
- click [Active] to apply the operation
- select each component in turn and bring it to the front or back until the drawing sequence is correct
- click Unmark All to turn off selection highlights and view the assigned drawing colors 

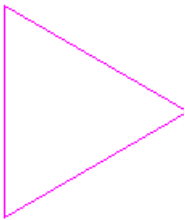
Copy and Move Operations

STEPS

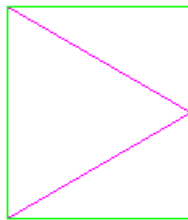
- ☑ right-click on the Editor Group entry in the Layer Manager and choose Remove All Layers
- ☑ click the Create Object button and select CAD 
- ☑ click Add Regular Polygon and draw an element for practice 
- ☑ click the Copy Element icon in the Operations panel 
- ☑ select the element you drew and click the right mouse button
- ☑ drag the copy box to a new location and click the right mouse button
- ☑ switch to the Move Element operation 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 represent the elements to copy or move. You drag the copy box to the target position and click the right mouse button to complete the operation. Note: you can resize and rotate the box in move and copy operations to change the aspect and orientation of the element.

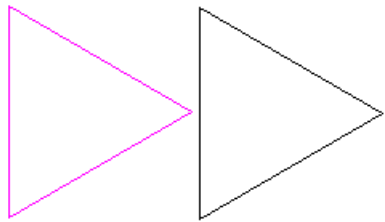
In addition to the Copy operation, which lets you copy a single selected element and paste it into the same editable object, there is also a Copy icon on the View window toolbar. This View copy function lets you copy multiple selected elements from any editable or reference layer and paste the copied element(s) into any editable layer. You can also choose to copy either marked or all elements within a saved region or a region you define by drawing. When selecting by region, there is no element clipping as there is for vectors. You do, however, specify whether to include the elements partially or entirely within or outside the defined region. Unlike the Copy operation that you use in this exercise, pasting is not an integral part of the copy function from the View toolbar. Pasting is initiated from a separate icon that provides an initial placement rectangle that can be moved, resized, and rotated.



The original element, selected for copying



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

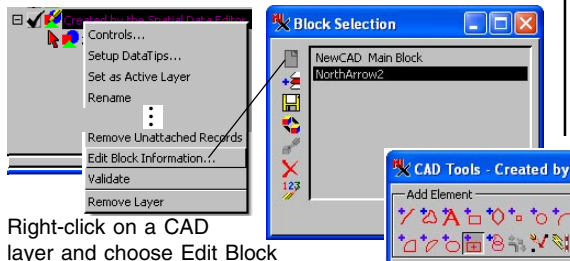


Drag the copy box to the desired destination and click the right mouse button to place the copy.

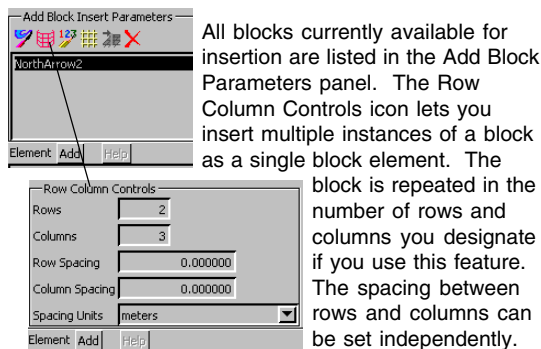
Working With Blocks

TNT's 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 NORTHARROW2 block on this page is composed of several polygon, text, and circle 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. The only editing operations you can perform on a block are to move, resize, and rotate it.

To create a block, create a new CAD object, compose the block with the elements you want, and save the object. For example, the NORTHARROW2 block on this page was created and saved in the exercises on pages 13-17 of this booklet.



Right-click on a CAD layer and choose Edit Block Information to select saved CAD objects to act as blocks in the object you are editing. After you have added one or more blocks to this list, the Add Block Insert tool is active in the CAD Tools window.



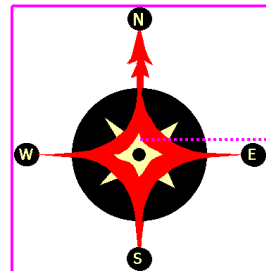
All blocks currently available for insertion are listed in the Add Block Parameters panel. The Row Column Controls icon lets you insert multiple instances of a block as a single block element. The block is repeated in the number of rows and columns you designate if you use this feature. The spacing between rows and columns can be set independently.

Where Next?

Complex relations can be defined to associate CAD elements with database tables. Refer to the tutorials *Editing Vector Geodata* and *Managing Relational Databases* 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.



The NORTHARROW2 CAD object can be inserted as a block, which is resized and rotated as a unit.

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