BASIC CONCEPTS

Introduction to

Basic TNT Concepts

with

TNTmips®

TNTedit™ and TNTview®

Before Getting Started

This booklet, formerly entitled *Navigating*, supplies the basic information you need to utilize the integrated system provided in all TNT products. Consult these pages for an introductory survey of basic system operations. The TNT products appear with the familiar graphical user interface of your computer platform (Windows and Mac OS X) while at the same time they present an interface that is identical in the essentials across all computer platforms. The TNT products have identical features and interface elements on every computer platform.

Prerequisite Skills This booklet assumes that you have completed the exercises in the tutorial *Displaying Geospatial Data*. The exercises in that booklet show you how to select and view spatial objects stored in Project Files. You should know how to zoom, pan, and enhance display objects, and how to use the reference materials. This booklet does not present these basic skills again. Please consult *Displaying Geospatial Data* 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 CD, you can download the data from MicroImages' web site. This booklet uses files in the CB_DATA, BEREA, EDITRAST, and BASIC data collections. Make a read-write copy of these files on your hard drive so changes can be saved when you use this data.

More Documentation This booklet is intended only as an introduction to basic system operations. Much more detailed information about Project Files and the tools for working with them is provided in the *Understanding and Maintaining Project Files* booklet.

TNTmips® Pro and TNTmips Free TNTmips comes in three versions: the professional version, the low cost TNTmips Basic version, and the TNTmips Free version. This booklet refers to all versions as "TNTmips." If you did not purchase the professional version (software license key required), TNTmips operates in TNTmips Free mode, which limits object size.

Basic system operations are common to TNTmips, TNTedit, TNTview, and TNTatlas. All exercises can be completed in TNTmips Free with the sample geodata provided.

Keith Ghormley and Merri P. Skrdla, Ph.D., 4 March 2009

You can print or read this booklet in color from MicroImages' web site. The web site is also your source for the newest tutorials on other topics. You can download an installation guide, sample data, and the latest version of TNTmips Free:

http://www.microimages.com

The TNT Products

TNTmips is a robust, full-featured GIS and image processing system. It can display, analyze, and process raster, vector, shape, CAD, and TIN data of any size and complexity. TNTmips has exactly the same features for Windows and Mac OS X and is available for both 32- and 64-bit systems. This shared feature set is made possible by maintaining one version of programming code that is subsequently prepared for all of these platforms. With a single version of the code you do not need to worry about your product's features lagging behind when updates and new versions are released.

There are no add-ons to buy—all features are included in TNTmips. To acquire a similar set of features with other software packages may take many additional, expensive software extensions. Because TNTmips contains so many features for a wide variety of applications, many users (particularly those in locations with multiple licenses doing production work) may not require the full TNTmips package. MicroImages provides lower cost, derivative products that use the same code as TNTmips but do not allow access to all its features: TNTedit and TNTview. TNTview supports the advanced display features of TNTmips, onscreen image interpretation, the use of MicroImages' scripting language (SML), import and export of the hundreds of formats supported by TNTmips, and a variety of utility programs, such as the map calculator and tools for managing Project File contents. TNTedit adds the spatial data editing process and georeferencing capability to the features available with TNTview.

The family of TNT products is rounded out by two free products, TNTmips Free and TNTatlas, and one very low cost product, TNTmips Basic. See MicroImages' web site for additional information on these products.

TNTmips

TNTedit

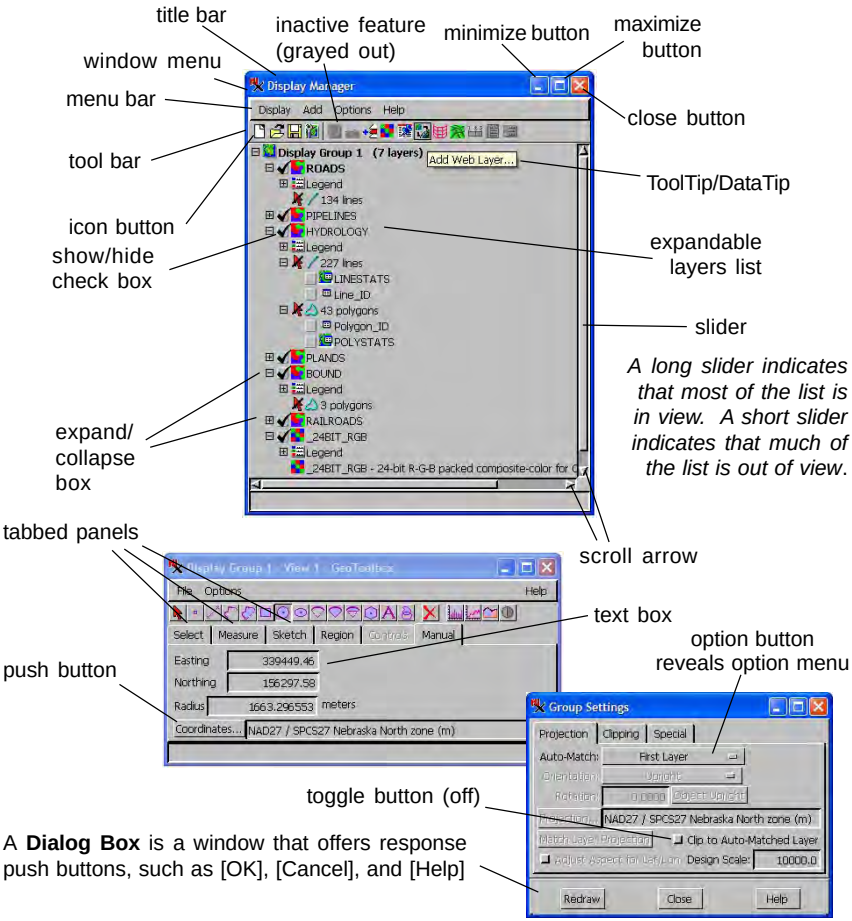
TNTview

TNTatlas

The first exercises (pages 4-6) introduce TNT interface terminology and Project FIle structure. Object types, naming and maintenance procedures are covered on pages 7-17. Other system basics are covered on pages 18-23.

Interface Vocabulary

The TNT products provide a consistent and recognizable style for interface elements such as scroll bars, check boxes and menu cascades. This consistency makes you instantly familiar with the interface components when you go to a different computer. The tutorial booklets, Technical Guides, and other documentation use a carefully defined vocabulary to refer to the elements of the graphical interface. Review the basic terms, concepts, and appearance of the interface elements on this page.

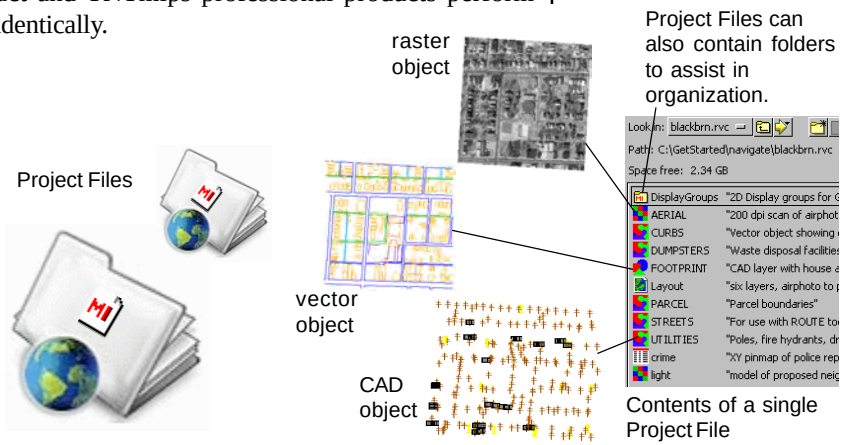


The Project File

TNT products use a single data structure, the Project File, that can hold all of your project materials. A Project File appears as a single file with an RVC extension to your operating system but functions more like a folder in the TNT products. A Project File can hold any combination of raster, vector, CAD, shape, TIN, region, text, and database materials, so all of your data that pertains to a project or task can be kept together easily. The Project File was designed with cross-platform users in mind. The TNT processes all use special read and write routines so that any TNT Project File can be used interchangeably by any Windows or Macintosh computer. From your point of view, all cross-platform conversion and translation issues are automatic and transparent.

The TNTmips Free product differs from the TNT professional products in one major way: object size. TNTmips Free and TNTmips Basic are limited in the size of the objects contained in a Project File. Except for the restricted object size, the TNTlmips Free product and TNTmips professional products perform identically.

An **object** is one complete data entity in a Project File that all the TNT products handle as a unit, like one airphoto scan (raster) or one imported CAD file. A **subobject** is attached to an object and contains supplemental material, like color display information or georeference data. When navigating in a Project File, such as when using Project FIle Maintenance, subobjects are presented under the associated object. Project Files appear in your operating system with a *.rvc extension. Objects and subobjects are not shown by the operating system. You may have as many Project Files as the capacity of your storage devices allows.



Contents of a single Project File (Blackbrn.rvc).

Locked Files: The TNT system always LOCKS a Project File while you are using it so that only one user or process can write to it at a time. If your computer gets interrupted while a Project File is open, the .lok file that TNT uses may not be erased as it should. As a result, the next time you try to open that Project File, the system will see the .lok file, and report that the file is locked. In such a case, you can delete the .lok file located in the same directory as the Project File as you would any other unwanted file on your computer.

Subobjects and Project File Hierarchy

☑ choose Tools/Manage Project Files and navigate through the levels of the BLACKBRN Project FIle and the WESTERNUS shapefile in the BASIC data collection

For a list of external formats supported for direct use see the Technical Guide entitled *System: Direct Use of Geodata Files*.

Subobjects, like objects, are not visible at the file level of your operating system. Subobjects are not visible within TNTmips unless your selection procedure pertains to a subobject.

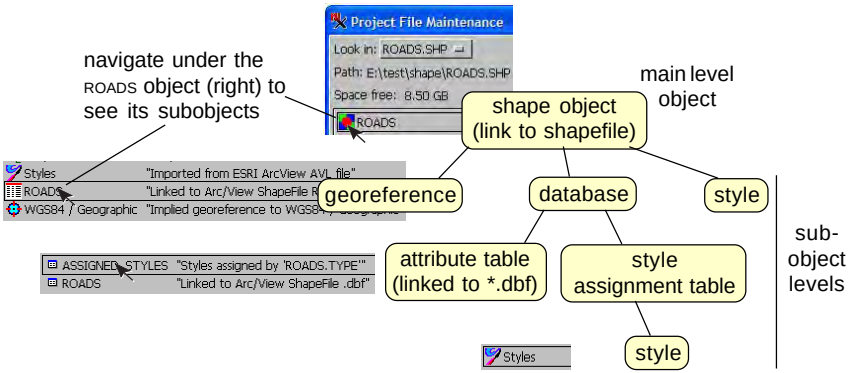
Objects within a Project File generally have a number of subobjects that supply ancillary information for use of the object in the TNT products. Subobjects are essentially object modifiers. TNT supports direct use of many external formats. The information contained in same-named files in other formats (e.g., the *.prj, *.dbf, and *.avl files that provide georeference, database table, and style information for a *.shp file) are maintained as subobjects "under" main level objects in transparent link files in the TNT product. These link files are "transparent" because they are not visivble to the user in the TNT products. At the operating system level, these link files show as same-named *.rlk files.

Subobjects are only visible in the TNT products when selection of a particular subobject is necessary, such as a style subobject, or when you are navigating the Project File hierarchy in the Project File Maintenance process, which is discussed in a later exercise. Subobjects may also be presented on an option menu for selection (e.g., georeference, contrast, and color palettes in the Raster Layer Controls).

automatically available TNT choices for raster contrast

user-defined contrast table (saved as subobject)

To navigate into a Project File or object in the Project File Maintenance process (shown in gray), click once on its icon or double-click on its name. The hierarchy for linked files is often much simpler than for native Project Files that may contain a variety of object types, with more than one database (vectors only). Databases for any object type may have multiple attribute tables.



Raster Objects

A raster object is a two-dimensional numeric array with cells that contain values of a single data type. Each number in the raster object represents the value of some spatial parameter, like spectral reflectance, image color, elevation, type of ground cover, or chemical concentration. Cell values in a raster object are used to control the color and intensity of pixels on a display screen. When the dimensions of a raster object exceed the resolution of the display, the image can be zoomed or panned to accommodate the size difference.

The Examine Cell Values feature is available from a raster object's right-button menu in the Manager's layer list. You can use Examine Cell Values to view the numeric cell values that correspond to the raster display.

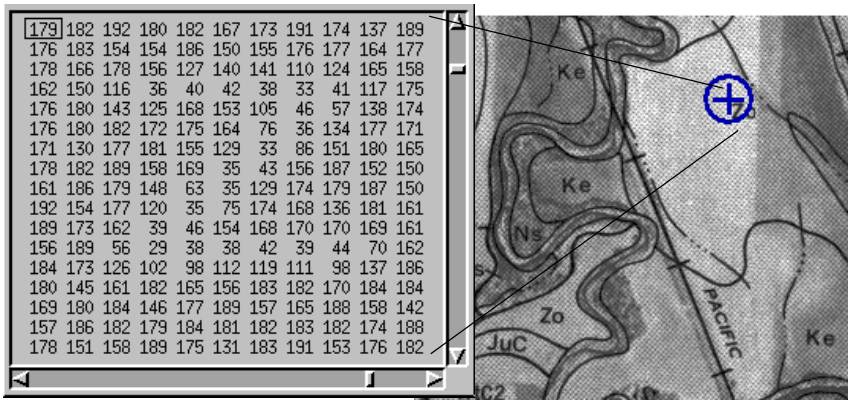
Cell data type refers to the number of storage bits assigned to each cell. Raster object cells can have data types of 1-bit (binary), 4-bit, 8-bit, 16-bit, 32-bit, or 64-bits of either integer or real number values. 128-bit raster objects are supported for special processes that deal with the real and imaginary or phase and magnitude components of complex numbers.

☑ display and examine the SHEET45_LITE raster object in the LANCSOIL Project File from the EDITRAST collection

Raster objects in TNTmips Free are limited to 314,368 cells with 1024 as the maximum dimension. Thus 1024 x 300, 614 x 512, and 300 x 1024 all fit the TNTmips Free limits. Raster objects in TNTmips Basic are limited to 4,000,000 cells with 4000 as the maximum dimension. Thus 4000 x 100, 2000 x 2000, and 640 x 6250 all fit in the TNTmips Basic limits.

> Object sizes in TNTmips Pro are essentially unlimited.

Techniques for displaying raster objects in color, pseudo-color, and enhanced grayscale are presented in a later exercise.



The window shows the numeric cell values for part of the 8-bit grayscale raster object illustrated. The letter "Z" which shows in a soil type label in the image can be visually distinguished in the numeric array by the lower cell values.

Vector Objects

☑ display and examine the PARCEL vector object in the BLACKBRN Project File from the BASIC data collection

A vector object is the collection of vector elements (points, lines, polygons, nodes, and/or labels) and attributes stored together in a TNT Project File. Points, lines, and polygons can be assigned to classes, have attached database records, and be displayed in a selected drawing style (such as point symbols, line patterns, and polygon fill patterns).

The TNT products support three levels of vector topology: polygonal, planar, and network. For more information on the levels of vector topology supported by the TNT products, refer to the *Vector Analysis Operations* tutorial booklet.

Processes that manipulate and analyze vector objects can do so only with vector objects that have a consistent and complete topology. The TNT products automatically enforce one of three levels of vector topology. Polygonal topology is the most rigorous level, ensuring that a point lies in at most one polygon, and that no two lines intersect. Automatic polygonal topology maintenance requires a certain amount of internal bookkeeping about the relationship of vector elements to one another, including

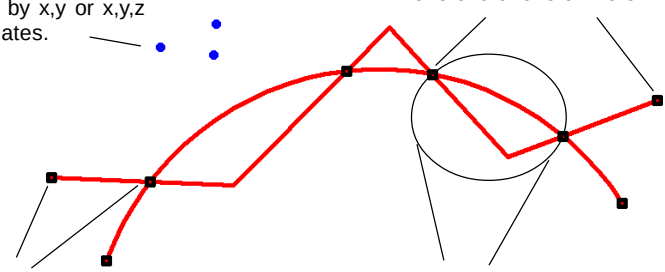
- which lines emerge from a particular node,
- what polygon elements are on either side of a line element,
- which line elements form a particular polygon,
- which polygons are islands within other polygons, and
- what polygons they are islands within.

Vector objects in TNTmips Free and TNTmips Basic are limited to 1500 lines, 500 polygons, and 1500 points.

Vector topology does not support the idea of "layered elements" as CAD topology does.

A vector **point** element is defined by x,y or x,y,z coordinates.

A vector **node** element terminates one end of one or more line elements.



A vector **line** element has a node at each end.

A vector **polygon** element consists of one or more line elements that define a closed shape.

CAD Objects

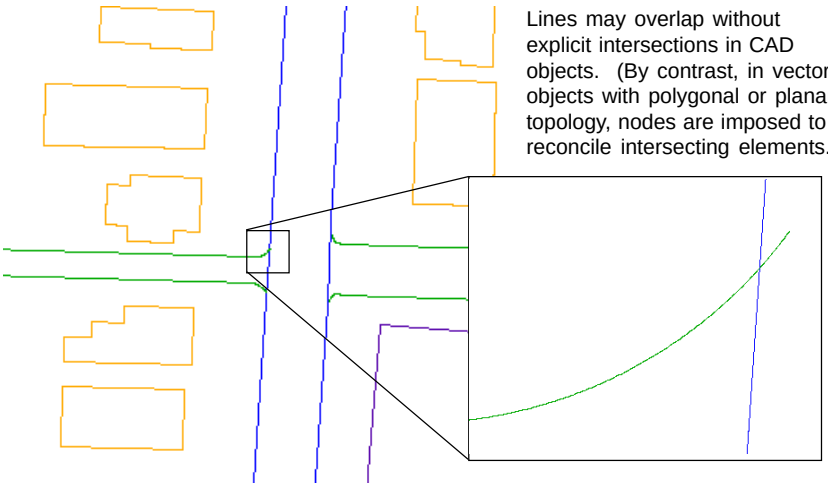
A CAD object has a free-form topology and is useful for applications that do not require an exact record of the spatial relationships between an object's elements. The CAD object data structure does not reconcile line intersections or polygon overlaps and islands, and thus supports the concept of layered elements. That is, you can move CAD elements around in a drawing without triggering the topological reconciliation of overlapping elements.

The CAD object data structure also allows for the geometric description of elements. For example, in a vector object, an element that appears to be a circle is actually always a polygon, so that at a high enough magnification, the circular shape resolves into discrete vertices and line segments. By contrast, a circle in CAD object is defined by its center point and radius. Thus, at any magnification, a CAD circle looks circular. Unlike a vector polygon, it can be resized simply by changing its radius, or moved by changing the location of its center point.

Types of CAD elements include: **points, circles, arcs, arc chords, lines, rectangles, polygons, ellipses, arc wedges,** and **text**. Individual CAD elements can be organized into **blocks** that are inserted at one or many positions within a single object.

☑ display and examine the FOOTPRINT CAD object in the BLACKBRN Project File from the BASIC collection

CAD objects in TNTmips Free and TNTmips Basic are limited to 500 elements.



Lines may overlap without explicit intersections in CAD objects. (By contrast, in vector objects with polygonal or planar topology, nodes are imposed to reconcile intersecting elements.)

Shape Objects

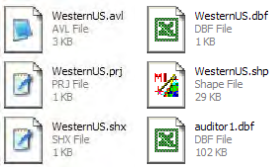
- ☑ display and examine the WESTERNUS shape object in the the BASIC collection
- ☑ in Project File Maintenance, navigate to the object and subobject levels within the shapefile

Shape objects in TNTmips Free and TNTmips Basic are limited to 500 elements.

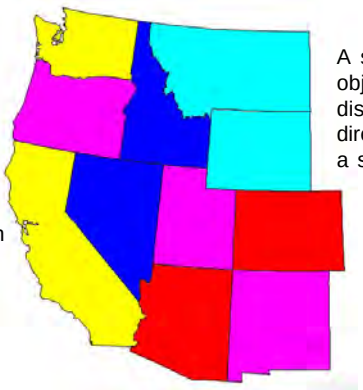
A shape object is one of the geometric object types supported by TNTmips. Unlike other object types, shape objects do not have a representation in TNT's internal format—all exist as links to files in their original format, such as ESRI shapefiles and Oracle Spatial tables. Some of these formats can be directly accessed (ESRI shapefiles) with links created automatically while others require links set up in the import process (e.g., ESRI Personal Geodatabase, MySQL Spatial layers). These links allow for the object to be maintained in their original format as well as in the TNT products. Changes made by external programs are detected and the links are rapidly rebuilt when the object is next used in the TNT products. These external geometric objects can be imported to CAD or vector format but then changes to the original files are not reflected in these imported objects and vice versa.

Vocabulary: an **implied one-to-one** relationship means that each shape element has one and only one database record attached and the record number corresponds to the element number.

Shape objects can have only one element type: polygon, line, or point. Shape files in their native formats have only one database table, which has an implied one-to-one relationship. This single table can become part of a relational database when a shape object is viewed in the TNT products. Tables you add are stored in the link file and are only available for viewing and editing when the associated object is viewed in the TNT products.



These six files exist at your operating system level to provide the style, georeference, and database information for the shapefile elements. In Project File Maintenance you only see the *.shp file, which contains a shape object that has style georeference, and database subobjects.



A shape object displayed directly from a shapefile.

TIN Objects

A TIN, or Triangulated Irregular Network, is composed of node and line data that represent a surface as a set of adjacent, conterminous triangles constructed from irregularly spaced three-dimensional points. The topology of a TIN object is more restrictive than that of vector objects because in a TIN, every node is part of some polygon, and every polygon is a triangle. The TIN structure is carefully defined so that for any set of nodes in 3D space, there is only one TIN that connects all the nodes. The minimal size and uniqueness of TIN objects make them ideal for processes that treat 3D surfaces.

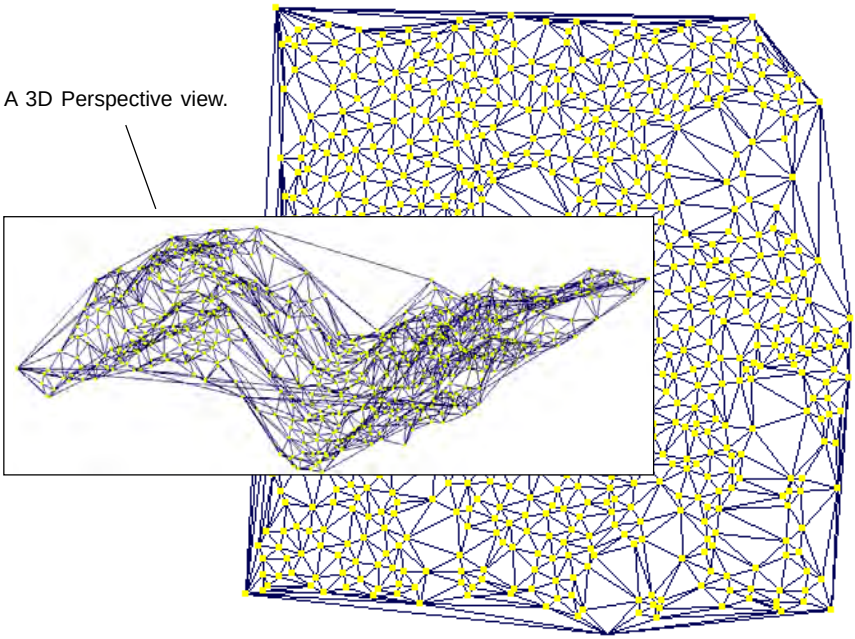
TIN objects can be displayed in 2D or in 3D Perspective as a three-dimensional surface.

☑ display and examine the TINLITE TIN object in the TINLITE Project File from the BASIC collection

TIN objects in TNTmips Free and TNTmips Basic are limited to 1500 nodes.

A TIN object in a normal 2D view.

A 3D Perspective view.



Region Objects

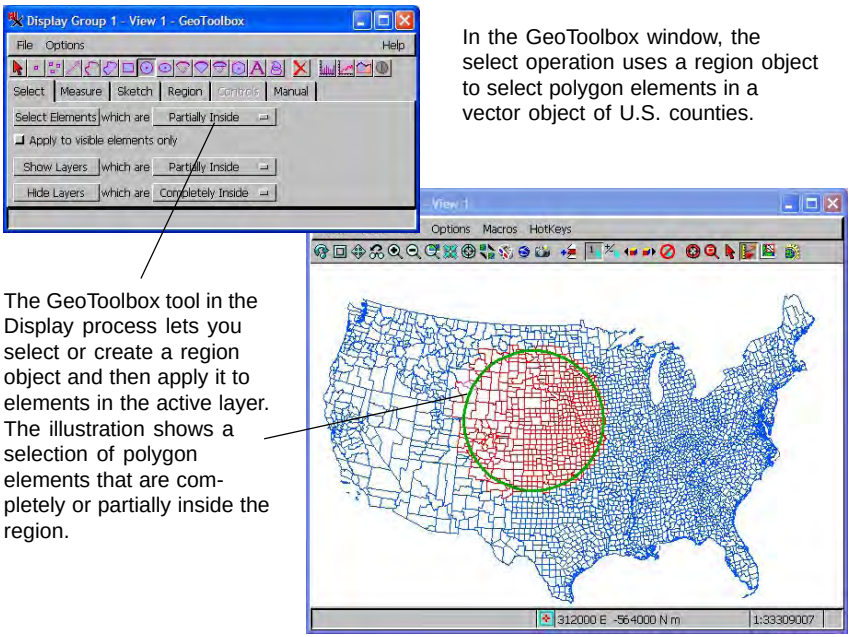
Region objects in TNTmips Free have no explicit limits since they are useful only in conjunction with other objects (which already have TNTmips Free limits).

Look for more information in the tutorial booklet *Interactive Region Analysis.*

A region object is a special type of polygon construct that defines a complex collection of areas (including any islands) and stores it in a map projection. Regions can be created in display processes and in the data Editor by generating them over a georeferenced image. Once defined, a region can be used as a control object in other processes: for element selection or area definition for processing, or in the application of other geospatial manipulations and analyses.

Region objects are useful only in conjunction with other geospatial objects (raster, vector, shape, CAD, TIN, and database); they have no particular usefulness by themselves. Region objects are particularly useful in element selection operations, which are introduced on page 20.

The illustration on this page shows a U.S. counties vector object with polygon elements selected by a region object with a 400-mile radius.



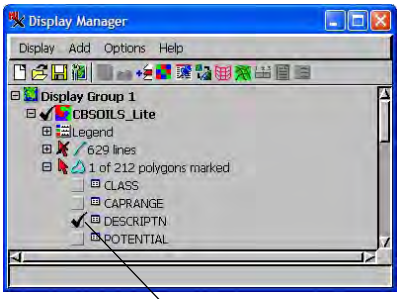
In the GeoToolbox window, the select operation uses a region object to select polygon elements in a vector object of U.S. counties.

The GeoToolbox tool in the Display process lets you select or create a region object and then apply it to elements in the active layer. The illustration shows a selection of polygon elements that are completely or partially inside the region.

Database Objects

TNT database objects can store both direct geospatial data and related reference information for other Project File objects. Database tables with coordinate information in each record can be directly displayed as a database pinmap with the same style options as vector or CAD points. Database files can be linked or imported either as primary objects for pin mapping, or as subobjects that contain data cross-referenced to elements in raster, vector, shape, CAD, or TIN objects. Databases can be linked to a Project File from a variety of formats, which allows manipulation of contents in both TNT and their native software.

Database tables in TNTmips Free and TNTmips Basic are limited to 1500 records.

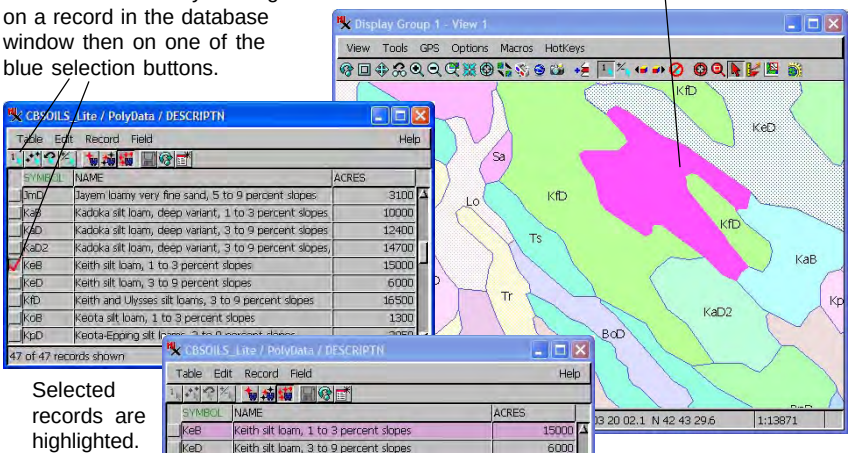


Open a database table by clicking its show/hide checkbox in the layer list.

Database objects can be manipulated relationally, that is, a field in one table can refer to a record in another table. Thus, a chain of relational links can be established whereby an element references a record containing field(s) tied to records in other tables. Records in more than one table can also be attached to a single element. Complex logical constructs can be applied to values in multiple databases to govern selection and processing operations "by query" in many TNT processes.

Select a record by clicking on an element in the display.

Select an element by clicking on a record in the database window then on one of the blue selection buttons.



Selected records are highlighted.

Raster Color Maps

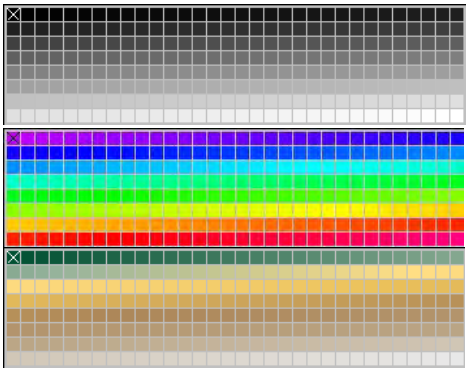
STEPS

- ☑ display the CB_DATA / CB_TM / ELEVATION raster object 
- ☑ select Edit Colors* from the layer's right-button menu in the Manager
- ☑ select Rainbow1 from the Palette menu in the Color Palette Editor window
- ☑ click Redraw in the View window 
- ☑ experiment with color spread and editing tools clicking Redraw to view the effects

A raster object is a two-dimensional array of numbers. Display processes use the values in the rows and columns of a single raster object such that the color and intensity of each image display pixel is determined by a corresponding cell value in the raster object. A variety of techniques are used to create grayscale and color images from the cell values in one or more raster objects.

A color map (also color table or palette) subobject associates 8-bit raster data values (0-255) with various display colors. Color maps can also be applied to 16-bit grayscale images with the colors stretched over the data range.

* Edit Colors is not on the right mouse button menu for raster types that cannot have color maps applied, such as composite color rasters.

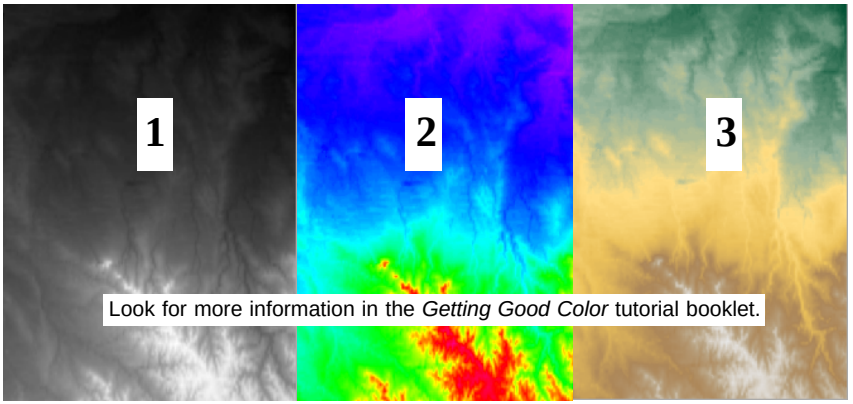


Three color maps applied to the same 8-bit elevation raster object.

1 (1) A simple grayscale spread from 0 (black) to 255 (white);

2 (2) A rainbow color spread that traverses the color space from 0 (violet) to 255 (red);

3 (3) A two-range color spread: from 0 to 122 (dark green to green), and 123 to 255 (olive drab to yellow).



Look for more information in the *Getting Good Color* tutorial booklet.

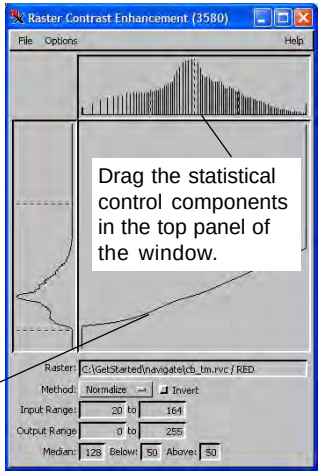
Raster Contrast Tables

To improve display appearance, the TNT display process applies contrast enhancements to grayscale images. The display process can use an existing contrast table subobject or it can create one. A contrast table can project a narrow range of cell values into a wide range of display intensities, making the brights brighter and the darks darker for better visual appearance.

STEPS

- ☑ display the CB_DATA / CB_TM / RED raster object
- ☑ select Enhance Contrast from the layer's right-button menu in Manager
- ☑ experiment with contrast editing

You can adjust the visual appearance of grayscale images by creating and selecting different methods of contrast enhancement. The display processes let you choose from linear, normalized, equalized, exponential, and user-defined translation curves. The Enhance Contrast selection on the layer's right-button menu opens a Raster Contrast Enhancement window to let you select or interactively create a contrast curve. Make the adjustments you want and click Redraw to see the effect.

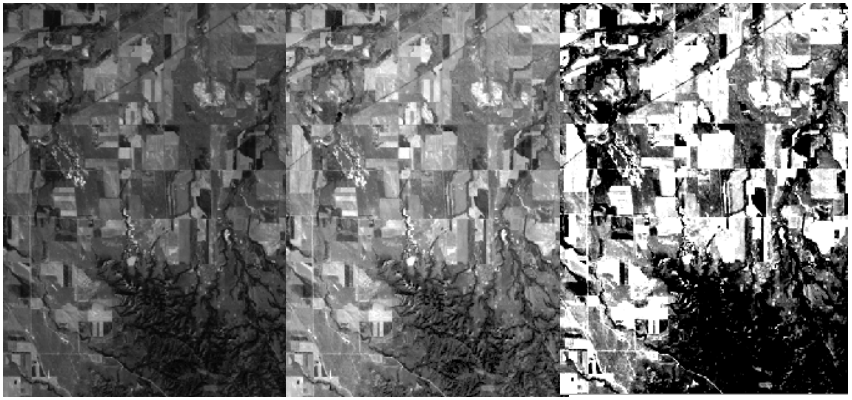


In User Defined mode, you can use freehand drawing techniques to reshape the contrast curve.

In this image, the cell values range from 20 to 164.

A normalized contrast improves the appearance.

A narrow range puts more cells at the extremes.



File and Object Naming

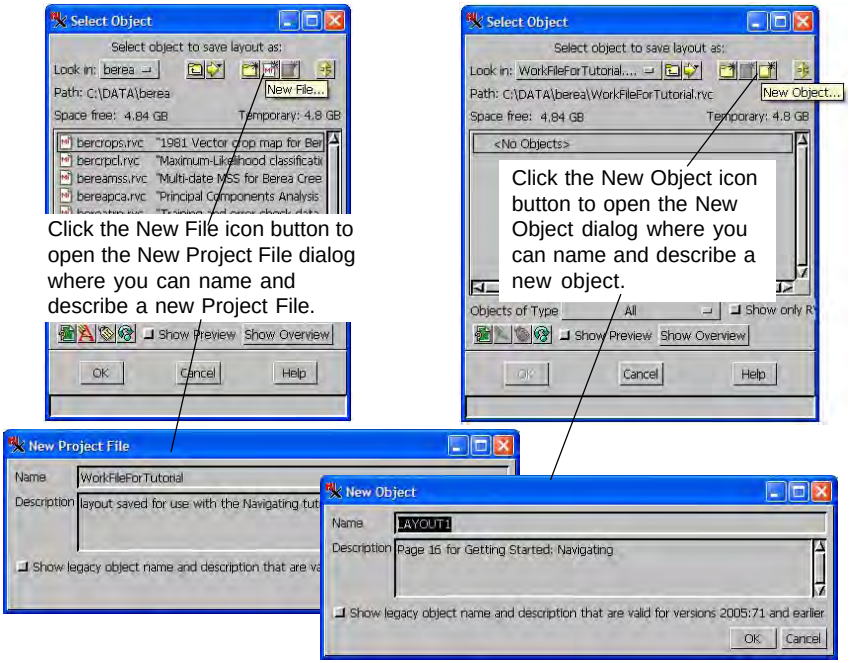
STEPS

- ☑ in the Display Manager, open BEREA / LAYOUTS / LAYOUT1
- ☑ choose Save As from the Display menu in the Manager window
- ☑ navigate to the file level and click the New File icon button
- ☑ type in a file name and description and click [OK]
- ☑ click the New Object icon button
- ☑ type in an object name and description
- ☑ click [OK] to complete the operation

If you have a large collection of project materials, you need to follow a good organization and naming practice. Use descriptive names and give a clear description with each name. Project File and object names and descriptions can be of unlimited length.

Project File names always use "rvc" as the file extension. Note that you may need to tailor your file names to comply with the limitations of your operating system and network environment. (Special characters allowed by one system but not another.)

The names of folders, objects, and subobjects in a Project File may have an optional text description. Object names must be unique for each object type within a file. Similarly, subobject names must be unique within an object. Objects and subobjects can be copied, renamed, and erased with the Project File Maintenance process (Tools / Manage Project Files) described on the next page.



Manage Project Files

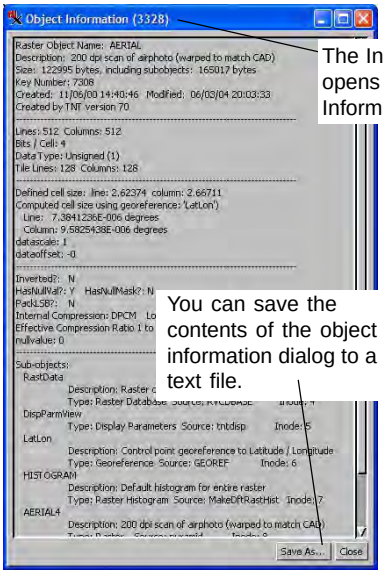
A Project File is a single data structure organized in a multi-level, logical hierarchy that may contain raster, vector, CAD, database, region, and TIN objects and their subobjects. During the course of your work, you may have occasion to copy an object from one Project File to another or perform other maintenance functions. To access Project File Maintenance, select Tools / Manage Project Files from the menu. The Project File Maintenance dialog opens and displays a list of directories and files. Maintenance operations are applied to the currently selected item with the push buttons at the bottom of the window.

Use the Info button to get general information, such as an object's type, source, and a list of attached subobjects. The Edit button lets you modify the item's name and description and some other information, depending on the type of object. For example, you can use Edit to change the assigned null value and cell size for a raster object.

STEPS

- ☑ select Tools / Manage Project Files from the main menu
- ☑ select any object from any Project File
- ☑ click the Info icon button and examine the Object Information dialog and its contents

- **Copy** copies a Project File to a new location or an rvc object to a new or existing Project File
- **Delete** removes an object.
- **Link To** lets you link to read-only objects, such as objects on CD or DVD, and have read-write subobjects.



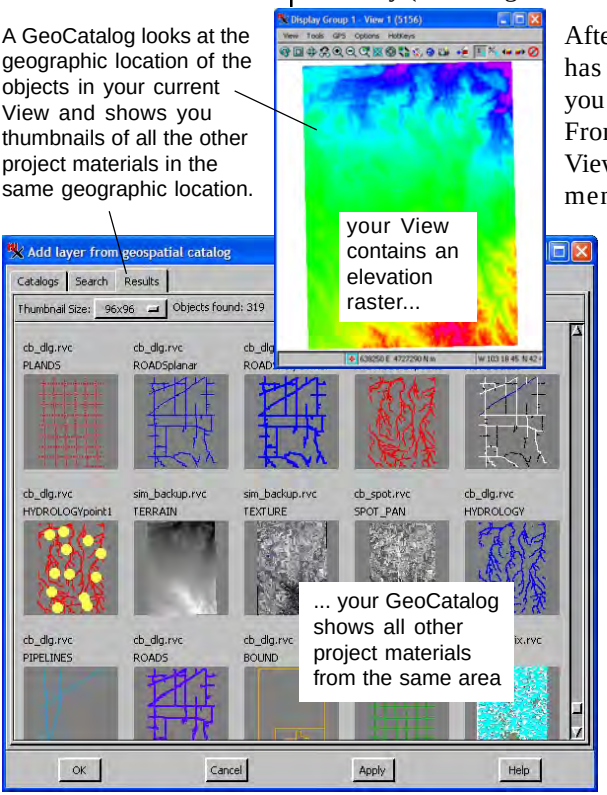
Geospatial Catalogs

The geospatial catalog dialog offers tabbed panels that let you select one or more catalog files, the types of objects to include, and the method used to determine geographic "matches" (extents by Range, by Point, or by Region).

If you have large collections of project materials, organizing and selecting materials is a constant challenge. The GeoCatalog gives you a quick way to get a geographic overview of all the project materials in a selected directory on your system. You use a GeoCatalog in the object selection process to quickly find all the objects that are in the same geographic location as the object in your current View.

Prepare each GeoCatalog ahead of time by selecting Tools / Geospatial Catalog Manager from the main TNT menu. First you create or select a GeoCatalog file. Then you specify which folder or directory you want the catalog manager to scan. The new catalog file records all the geospatial objects in whatever directory (including all subdirectories) you select.

A GeoCatalog looks at the geographic location of the objects in your current View and shows you thumbnails of all the other project materials in the same geographic location.

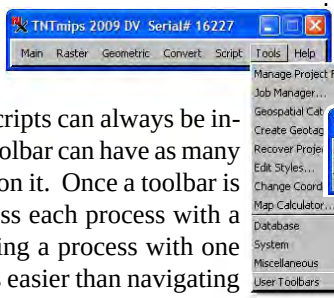


After the GeoCatalog has been assembled, you can use it by selecting From GeoCatalog on the View window's Add Layer menu. Just select the GeoCatalog file, and then pick the objects you want from the thumbnails in the *Add layer from geospatial catalog* dialog.

For more detail and options, see the online Technical Guides on the MicroImages web site.

Custom Toolbars

TNT lets you create custom toolbars so that your favorite processes and SML scripts can always be instantly available. A toolbar can have as many processes as you like on it. Once a toolbar is created, you can access each process with a single click. Launching a process with one click from a toolbar is easier than navigating through a series of cascading menus to find the process you want. For example, to use Feature Mapping, you could navigate three levels of menu cascades for the process (Raster / Interpret / Feature Map), or you could simply click a Feature Mapping icon in a custom toolbar.



Design a toolbar by picking an icon and label text for each process you select.

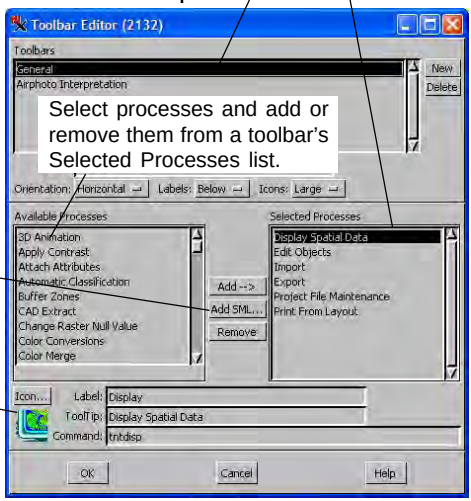
Select User Toolbars / Edit from the Tools menu.

You can create as many different custom toolbars as you like and have any number of tool bars open at a time. You can create your tool bars with labels, and later turn off the label display after you are familiar with the icons. ToolTips are present automatically over every process-level toolbar icon.

Labels are optional.

To create a toolbar, select Edit from the Tools / User Toolbars menu. The controls in the top panel of the Toolbar Editor dialog let you create and delete toolbars. Select a process from the scrolling list on the left, and add it to the process list on the right.

Pick a toolbar from the list to modify the selection of processes it contains.



Use this button to choose an SML script for your toolbar.

Choose a process icon, label, and ToolTip text.

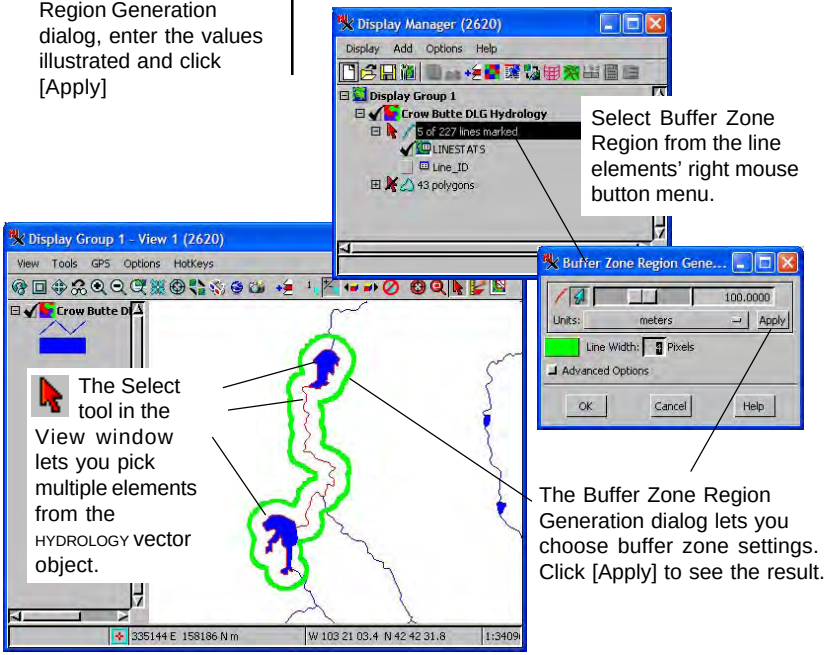
Geometric Element Selection

STEPS

- ☑ display BASIC / CBUTTE / HYDROLOGY 
- ☑ zoom in on the two lakes in the north-west quadrant as illustrated below 
- ☑ expand the DLG layer in the Display Manager and enable marking for line element 
- ☑ choose the Select tool and the Toggle Marked mode in the View window 
- ☑ click on both lakes and the hydrology that connects them
- ☑ in the Manager, select Buffer Zone Region on the line elements' right mouse button menu
- ☑ in the Buffer Zone Region Generation dialog, enter the values illustrated and click [Apply]

In many TNT processes, you will want to apply certain operations to *marked*, or selected, elements only. For example, you may want to select a single polygon element to view its attached database records or to select multiple line and polygon elements to create a buffer zone around them. Element selection is controlled with tools in the View and Display Manager windows. Follow the steps listed for this exercise to use the interactive buffer zone tool, which is just one application of the flexible element selection controls.

Other element selection features are available in the GeoToolbox window. Click the GeoToolbox icon on the menu bar in the View window and inspect the selection, measurement, and region tools in the GeoToolbox window. Refer to the *Interactive Region Analysis* and *Sketching and Measuring* booklets for more information about the powerful and flexible features in TNT's GeoToolbox.



Map Projections

In order to draw portions of a spherical surface on a flat page or display, the surface must be geometrically projected onto the drawing plane. The science of cartography has defined many techniques for projecting portions of the earth's surface onto planar maps. The choice of a map projection determines the appearance and map qualities of the results you produce.

For many applications, particularly when the extent of the project area is local (rather than regional or continental), the choice of a map projection makes little visible difference—the curve of the earth's surface is too slight to matter for short distances. But even at local scales, mixing project materials of different geometry can result in layers that "don't match" other layers. The TNT display processes automatically reconcile different map projections on the fly, but some factors remain that may affect the alignment of features and overlays.

If you want to be more than a casual participant in the profession of GIS and cartography, you need to develop a strong grasp of the fundamentals of map projections so that you can make informed choices for your mapping projects.

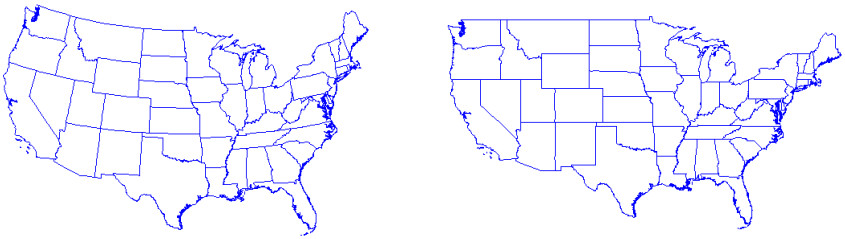
STEPS

- ☑ display the STATES vector object from the USA_STATE Project File
- ☑ click on the Group  icon in the Manager's layer list to open the Group Settings dialog
- ☑ on the Projection panel of the Group Settings dialog, change Auto-Match to None
- ☑ click [Projection...] and choose a different System

Refer to the tutorial booklet *Understanding Map Projections*.

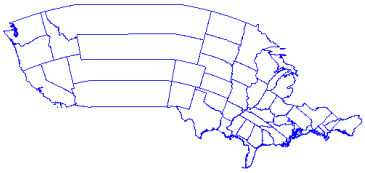
For best results:

- Keep all related project materials in the same map projection.
- If visual discrepancies persist, resample raster objects to the geometry of the map projection.



Your choice of map projection affects the geometry of the display.

Large-extent materials show big differences of geometry caused by map projection.

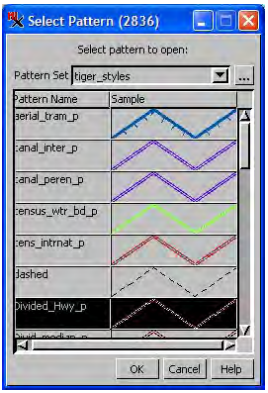


Misapplication of map projections and parameters can cause unwanted distortions.

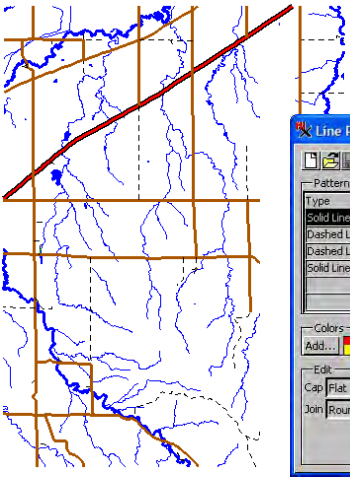
Style Assignment

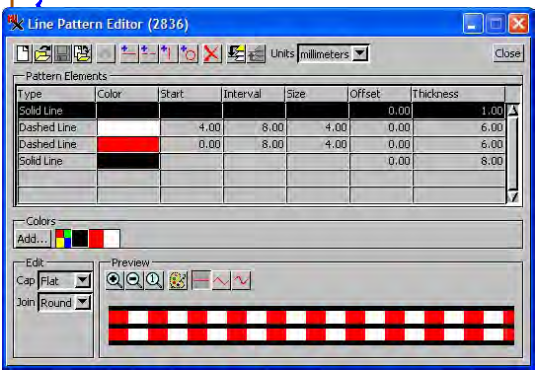
- ☑ open a new 2D group and add the HYDROLOGY and ROADS vector objects from the CBUTTE Project File
- ☑ open the Vector Layer Controls for the ROADS object, and on the Lines panel, select Style: By Attribute, and click on [Specify...]
- ☑ in the Assign Styles by Attribute dialog, click [Edit Styles...]
- ☑ in the Style Editor dialog, select a pattern sample and then click the Create or Edit Pattern button
- ☑ in the Line Pattern Editor window, click the Open icon button
- ☑ in the Select Pattern dialog, select a pattern to open and click [OK]
- ☑ survey the tools in the Line Pattern Editor window

Point, line and polygon elements in vector, shape, and CAD objects can be displayed in an endless variety of drawing styles. For example, you could make points display as oil well symbols, lines with highway patterns, and polygons filled with repeating geologic symbols. You can choose to display all elements of the same type in the same style, or you can use values from attached databases to determine style selection "by attribute." You can also design styles by theme based on a numeric attribute of your data.



TNTmips offers a rich feature set in support of style selection and design. This exercise should give you some idea about style operations in the TNT products. For more information, refer to the tutorial booklets entitled *Creating and Using Styles* and *Theme Mapping*.



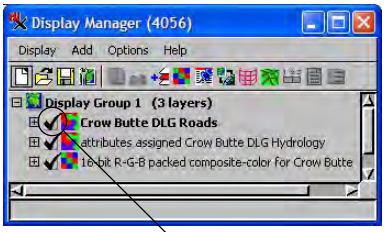


Multiple Views and Displays

The Display process lets you select and arrange complex views of your spatial data. A *group* can contain many *layers* of geospatial objects and a *layout* may contain many groups. When you add layers to a new group or layout, a *View* window also opens. You can open additional View windows and manipulate the controls for each View separately, to give you multiple views of the geospatial objects in that group or layout. While many processes in TNTmips have View windows, the main Display process is the only one that allows multiple groups in a single view.

The complex capabilities of the display process are compounded when you realize that you can also open multiple groups with each group visible in multiple View windows. Even more complexity is possible inasmuch as a View can be either 2D or 3D.

If you have a single monitor on your computer, you can quickly fill it with many groups and Views. If your computer is configured with multiple monitors, you can drag multiple groups and views to different monitors and spread out your work.

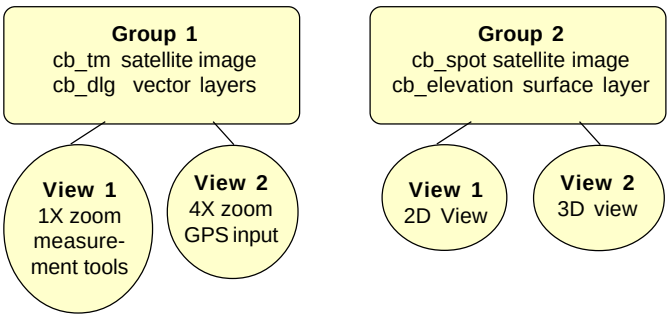


The Hide/Show icon in the Manager toggles a layer's display in all Views. The Hide/Show icon in a window's Legend toggles the display for that View only. You can also right-click on the Hide/Show icon to toggle display of a layer in any open View or Locator.

STEPS

- ☑ open a new display group with NAVIGATE /CBUTTE/ _16BIT_RGB, HYDROLOGY, and ROADS
- ☑ select Display / Open view in the Manager
- ☑ apply different view controls and tools to View 1 and View 2
- ☑ experiment with the Hide/Show icons for each layer and view, both in the Manager and in the LegendViews

You can open multiple groups, and look at each group in multiple View windows.



Refer to the tutorial *3D Perspective Visualization*. Many of the Quick Guides also focus on specific display tools.

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 Pro 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 in a wide variety of formats.

TNTview TNTview has the same powerful display features as TNTmips and is perfect for those who 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 can be used on any popular computing platform.

TNTserver TNTserver lets you publish TNTatlases on the Internet or on your intranet. Navigate through geodata atlases with your web browser and TNTmap, which is WMS compliant.

TNTmips Free TNTmips Free is a free version of TNTmips for students and professionals with small projects. You can download TNTmips Free from MicroImages' web site, or you can order TNTmips Free on CD-ROM.

Index

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