

55th Release
July 2004



V7.0 New Features

Highlight Features: ISO Spatial Reference System
Manifold Surfaces in 3D
Stereo in 2D and 3D
Advanced Extract/Convert/Merge
GraphTips
Geospatial Software Development Kit

ISO Spatial Reference System

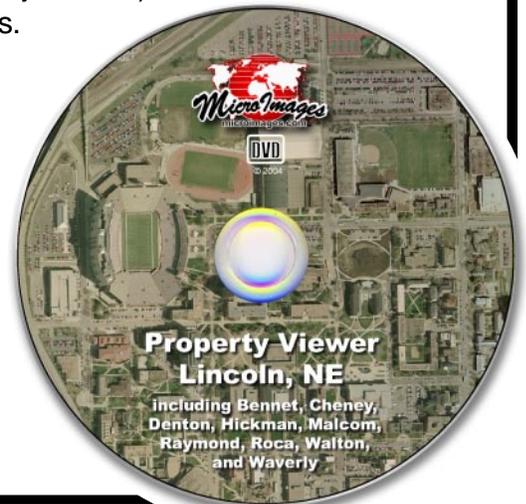
All TNT processes now use a new Spatial Reference System* that accesses a new service for all coordinate definitions and transformations. This new service conforms to ISO standard 19111:2003 entitled Spatial Referencing by Coordinates which in turn encompasses the Open GIS Consortium's standard entitled Spatial Referencing by Coordinates.

**A spatial reference system is a function which associates locations in space to geometries of coordinate tuples in a mathematical space, usually a real valued coordinate vector space, and conversely associates coordinate values and geometries to locations in the real world. (from OGC document)*

- Used to define all TNT coordinate systems.
(choose from 1000s of new coordinate systems by nation, region, and local)
- Use new simplified interface for selection/definition of all coordinate references.
(replaces Coordinate System/Projection Parameters window in all processes)
- Provides direct datum transformations without converting via WGS84.
(eliminates inaccuracies introduced by using multiple transformations)
- Controls all projection conversions.
(object to object, object to screen, in layouts, ...)
- Define axes in any supported units without conversion to meters.
(e.g., georeference control points no longer entered/stored only in meters)
- Retains all earlier TNT coordinate reference systems.
(backward compatible with objects in V6.9 or earlier TNT Project Files)
- Uses European Petroleum Survey Group's (EPSG) definitions.
(EPSG coordinate systems updated every 6 months)

Try the Lincoln Property Viewer sample TNT Atlas DVD distributed with V7.0. It will autostart in Windows and run from the DVD. It demonstrates the new features available in TNTmips 7.0 for use in your free TNT Atlases.

(see www.microimages.com/documentation/CP7001.htm)



System Level

Free TNTsdk

- Geospatial Software Development Kit (TNTsdk) is now free.
- LessTif graphics libraries replace Motif graphics libraries for Windows and Mac OS X.
- Change from Motif to LessTif completely transparent including use in SML and TNTsdk.
- Eliminates royalties for distribution of Motif libraries in TNTsdk for Windows / Mac OS X.
- Motif graphics libraries now only used for interface for Unix / Linux.
- Motif distributed free with every Unix and Linux therefore available free for TNTsdk.
- TNT products for use in Windows use Microsoft Visual Studio .NET 2003 C++.

Direct Display Using Auto Linking

- Directly display JPEG rasters.
Auto-georeferenced if have "same name" .tab, .jpw, or .erm auxiliary files.
- Directly display Portable Network Graphics (PNG) rasters.
Select files with or without compression.
Auto-georeferenced if have "same name" .tab, .jpw, or .erm auxiliary files.
Alpha channel converted and used as opacity mask raster subobject.
ICM color profile or gamma/chromaticity values used as ICM subobject.
- Direct display of shapefile layer now much faster via shape object.
Previous link via CAD layer required slower hidden import.
Styles and legends converted and used from AVL legend (*.avl) file.
- Direct display of MrSID (*.sid) files now on all TNT supported platforms.
(i.e., Mac OS X, LINUX, Windows, and Sun)

DataTips

- Improve the appearance of your DataTips.
Add text formatting codes to control of color, style, font, ...
Specify frame boundary as a rectangle or a polygon.
Color frame boundary and background for text.
Use more characters in a prefix.
- Use tabs in text blocks to align text.
- Specify multiple fonts using {~} codes to define font substitution.
- Identify fonts by family name (Times New Roman)
(in addition to using font name such as times.ttf).
- Font substitution for missing fonts provided using standard fonts.
- Default selection mode to 'all layers' if not previously set to specific layer.

GraphTips

- Pop-in to view like DataTips but present contents graphically.
- Graphic can be sensitive to position in view, object, nearest element, ...
- Create even more complex GraphTips using new SML display control script.
(e.g., like ToolScripts but automatically executed at every cursor move/pause).
- Your automatically executed SML script selects data for graphic and its labels.
(e.g., database fields, position of cursor, area of object, nearest element, ...)
- Graphic functions in script draw/redraw GraphTip with cursor pause/movement.
- Define your GraphTip using familiar DataTip control features.
(e.g., data fields, layer, scale range, ...)

Project File Maintenance

- Check any object's size (data content only or total size including subobjects).
- Text color highlights subobjects that are out-of-place in hierarchy.
(e.g. red for wrong parent, magenta if redundant, ...)
- Enable/disable auto-maintenance of standard attribute and element ID tables.

Miscellaneous

- Preference can now be set to always compute full binary pyramids for raster objects.
(e.g., compute 1st binary layer for 2 by 2 sampling adding 25% to size).

2D Display

Display Control Scripts

- Attach an SML script to a layout or group.
Script automatically executes when layout or group is displayed.
Continuously monitor mouse position in view to trigger further actions.
(e.g., view position context help or data such as a GraphTip)
Create startup conditions.

CAD Layers

- Use redesigned interface control panels.
Object tab panel for object, style, and georeference and new warp to model and scale range.
Elements tab panel for select, style, and new DataTip controls.
New label tab panel to clip labels into layer, show baselines, and to set frame styles.
Apply button to automatically change all settings without closing dialog.

GeoToolbox

- Sketch tool now has improved labeling.
Create multiline text elements for labels.
Add frames including type, color, font, ... for text elements used as labels.
Define straight or inflected leader lines from label to associated feature.
Use straight, exact, and splined baselines for text.
- Automatically create manifold surface object using cross-section tool.
- View graphical profile of data values for a selected cell from multiple rasters.

Miscellaneous

- Zoom at selected point.
- View-in-View will not show hidden layers/groups by default.
- Designate which raster layer to use for 1X (full resolution) zoom.
- See active element as highlighted even if layer is hidden.

3D Display

Surface Rendering Methods

- Select from 3 surface rendering methods (choose from speed versus quality).
- All features previously missing from these improved methods are now available.
 - View in stereo.
 - Fast wireframes via use of pyramid tiers.
 - Transparency for layers.
 - Relief shading with controls.
 - Add pedestals.
- Faster rendering of textures when terrain surface is flat (i.e., no DEM).
- All older rendering methods have been deleted.
 - (i.e., both versions of Dense Triangulation and of Ray Casting)

Manifold Surfaces

- Display planar or curved surfaces (as triangular facets) of any orientation.
 - (e.g., geologic and seismic profiles, archaeological cross sections, fence diagrams, above surface transects, subsea sensor maps, ...).
- Add as many manifold surfaces as you wish.
- View together with conventional 3D surfaces in 3D projection including stereo.
- Add 3D georeference control points to convert any object to a manifold.
 - (e.g., use a raster, vector, shape, CAD, ...)
- Add grid boxes to assist in depth perception.

Stereo Support

- Stereo is now generic and independent of view device.
- Select stereo to match your device setup mode from:
 - anaglyph, side-by-side, line-interleaved, and column-interleaved.
- View stereo of all terrain oriented 3D combined with manifold surfaces.

Georeferencing

- Assign/edit names and descriptions to control points.
- Improved management of point status (active/inactive).
- Link pair of points to define a hard edge.
- Link multiple points to define boundary for piecewise operations.
- Customize the features provided in the view window to simplify it as in Display.

Manifold Surfaces

- Add/edit control points to define manifold surface for any TNT object type.
- View object's current manifold TIN (triangulated) surface projected onto a plane.
- Toggle geodata content on/off when creating/editing its manifold control points.
- Toggle to review effects of any control point addition or edit action in 3D display.
- Define any triangle edge to be "hard" and thus preserved in any future retriangulation.
- Undefine any hard edge to release this hard edge boundary condition.
- Delete any triangle.
 - (e.g., to remove triangles not covered by object's 3D extents)
- Delete any triangle's edge.
 - (e.g., to remove triangles not covered by object's 3D extents)



- Extrapolate to add control points to object's extent corners.
(because typically control points can only be located within object, not at corners)
- Undo operations which have previously deleted elements.

Spatial Data Editor

- Use TAB key with right mouse button to toggle through all nearby elements.
Toggle selection through congested auto-positioned labels near cursor.
Toggle selection through complex tangle of hard-to-select CAD elements.
- Copy a region from a TIN or shape layer and paste into a vector layer.
- Standard edit UNDO feature has been added to the raster inspection tool.

Manifold Surfaces

- Add/create object with manifold georeference (i.e., manifold surface).
Create/edit this manifold layer in "flattened" form in 2D edit view.
Creating/adding a layer over a manifold surface used as a reference layer in 2D edit view adds the manifold's georeference to it.
- When a manifold layer is selected for editing in 2D view:
3D view of it automatically opens for 3D reference.
Group control dialog is also automatically opened for this 3D view.
Additional manifold surfaces can be added to this 3D view for 3D reference.

CAD Objects

- Create multiline text elements
- Add frames including type, color, font, ... for text elements used as labels.
- Define straight or inflected leader lines from label to associated feature.
- Use straight, exact, and splined baselines for text.
- Use redesigned interface control panels.
Object tab panel for object, style, and georeference and new warp to model and scale range.
Elements tab panel for select, style, and new DataTip controls.
New label tab panel to clip labels into layer, show baselines, and to set frame styles.
Apply button to automatically change all settings without closing dialog.

Geometric Object Conversion

Geometric objects are all TNT object types (vector, CAD, shape, region, TIN, ...) that are defined by points, lines, polygons, and so on. They exclude raster, raster set, hyperspectral, text, and database objects.

A single new and advanced conversion engine now converts between geometric objects. The processes of "Vector to CAD", "CAD to Vector", "Region to Vector", and "TIN to Vector" have been replaced by the following new processes all of which now support selection of multiple input objects of mixed types for one-pass conversion to the desired output object type. Also for each input object a region can be selected to extract the irregularly bounded input areas to be converted.

- Use "Geometric to Vector" to convert from CAD, TIN, shape, and region objects.
- Use "Geometric to CAD" to convert from vector, TIN, shape, and region objects.
- Use "Geometric to Region" to convert from vector, CAD, and shape objects.

Extracting Geometric Objects

Uses advanced conversion engine to provide same approach as outlined above for conversion of all geometric object types. As noted above, extract operations can now be included as part of conversion operations.

Merging Geometric Objects

Uses advanced conversion engine to permit extraction and conversion from mixed object types as part of a merge operation.

- Merge to a CAD object a mix of geometric object types without prior conversion.
- Merge to a vector object, with selected topology, any mix of other geometric objects.

Import/Export

- MapInfo (*.mif) files have improved support for fonts, color, and styles).
- Shapefile (*.avl) files now convert to TNT styles and legends.

Import

- PNG (*.png Portable Network Graphic) file's ICM (color profile) is imported.
- CARIS ASCII files (*.txt) imported into a vector object.
- Lizard Tech's MrSID (*.sid) imported on all platforms including Mac and LINUX.
- Sun raster (*.ras) import uses "same name" ArcWorld georeference file.
- ERDAS (*.img) images greater than 2 GB are imported.

Export

- GML (*.gml Geographic Markup Language) Open GIS file can be exported.
- PNG file now gets an alpha channel from raster object's opacity mask.
- Shapefile (*.shp) file export now handles labels.
- TIFF file default is now 'pack bits' compression instead of LZW compression.

Rendering Layouts to SVG

- Renders twice as fast.
- Add multiline entries and colors for text to SVG DataTip from TNT DataTip.
- DataTips "fade-in" instead of pop-in as in TNT source layout.
- Embed fonts (previously could only link).
- Link to JavaScripts (previously could only embed).
- Embed/link new JavaScripts to:
 - Add layer control panel.
 - Draw freehand line/polygon for length/area measurements.
 - Draw segmented line/polygon for length/area measurements.
 - Auto zoom-up (enlarge) point symbols when selected/highlighted.
- Uses XML entities for strings.
- Class added to SML to render SVG from a layout.

Landscape Builder

- Optionally apply JPEG2000 compression to texture objects for use in simulations.

Database Operations

- Use wizard to create new table and relate to existing tables.

Style Editor

- New user interface for editing styles file.
- Styles supported alphabetically.

Text Editor

- Non-roman language support improved on Mac/Linux/Unix.
- Use standard Cut/Copy/Paste keyboard shortcuts (ctrl+x, ctrl+c, ctrl+v).
- Double-clicking a word selects it.
- Triple-clicking selects the line the word is in.

Raster Combinations

- Compute mean and standard deviation from a set of rasters.
- Exclusive Union (XOR) operation added.

Warping CAD

- Densification can be applied during warping of CAD object to preserve shapes.

Map Calculator

- Completely redesigned user interface.
- Integrates new features of ISO 19111 Coordinate Reference System.
- Convert to/from 3D geocentric Earth-Centered, Earth-Fixed (ECEF) coordinates.
- Compute geodetic and projected distance between pairs of points.
- Compute azimuth between pairs of points.

Spatial Manipulation Language

- Sample script using each function/class now linked to its documentation.
- Syntax highlighted in color when editing script.
- Use hash variables (like arrays but without size specified in advance).
- Use “switch” statement (identical syntax to “C”).
- Use function “prototypes” (as in “C”).
- Use Exclusive Or operator (XOR).
- 27 new functions and 3 new classes.

TNTatlas

- Allow viewing of cross-section via GeoToolbox.
- Specify preference settings for LegendView size and DataTip view modes.
- Specify which tool is active when atlas is opened.
- Customize to remove ‘navigation’ icon buttons.

TNTsim3D

- Execute an SML file automatically at startup.
(e.g., define a position/view, fly a path, popup information or help, modify view setting, ...)
- Add clouds or other hemispherical textures as backgrounds.
- Color tint the views if observation point is below surface.
- Define a custom view.
(e.g., look backward from main view with same or different contents)
- Use JPEG2000 compressed texture objects for much smaller Landscape Files.

TNTserver V7.0

- Serve up composite view as JP2, PNG, SVG, or JPEG.
- Version numbers now synchronized with other TNT products.
- Weekly patches now posted as with all other TNT products.
- URL aliases simplify management of links to other data types (*.pdf, *.docs, etc.).

TNTclient

- Optionally use transparent panning buttons around view.
- Color text styles now used in DataTips as set-up in TNTAtlas.
- Uses UTF8 encoded strings to support more languages.
- User of browser can now choose which type of image to receive.
(e.g., JPEG by default or switch to JP2, PNG, or SVG)
- Optionally skip hyperlink list if only 1 link detected.

Reference Materials

- Approximately 50 new color plates.
- Approximately 12 new Quick Guides.

New Tutorial Booklets

- Working with Massive Geodata Objects.
- Working with TNTsdk.

Tutorials with Major Revisions

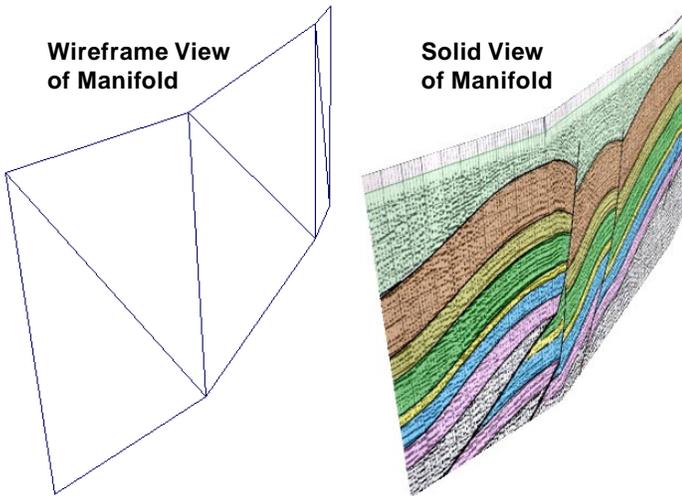
- Advanced Vector Editing.
- Using TNTsim3D for Windows.
- Glossary for Geospatial Science.

Local Languages

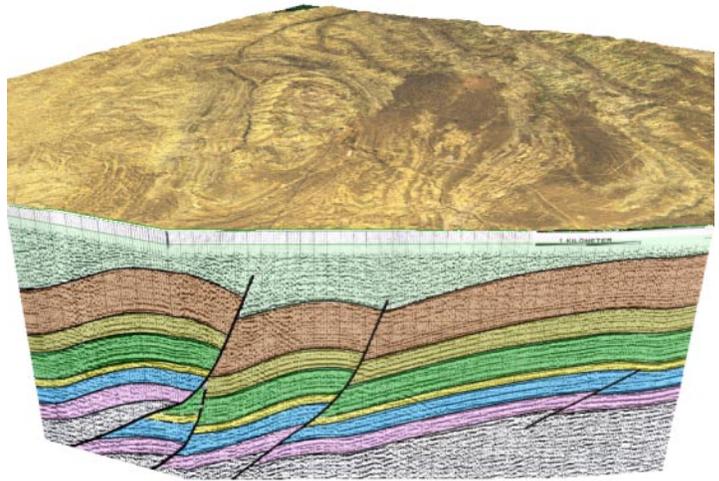
- Optionally exclude extensive help from the composite translation file.
- Generate report file of untranslated items.



Manifolds in 3D Views



A raster manifold showing a vertical seismic reflection profile acquired along a curving transect line. Displayed by itself in wireframe view (far left, showing the triangular mesh created from the control points) and solid view (center). Displayed at

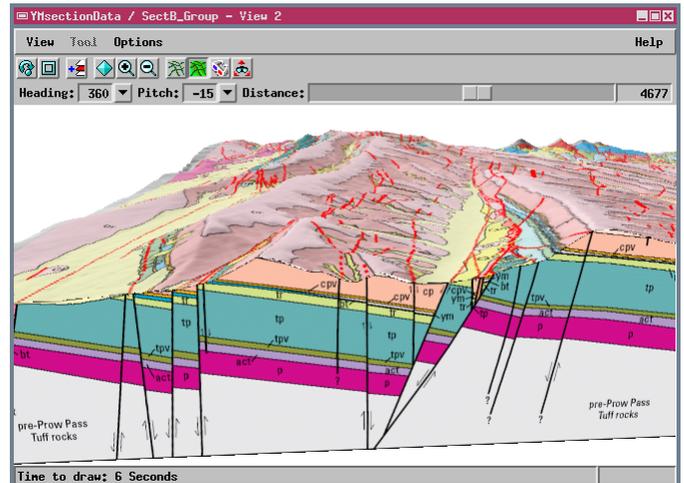
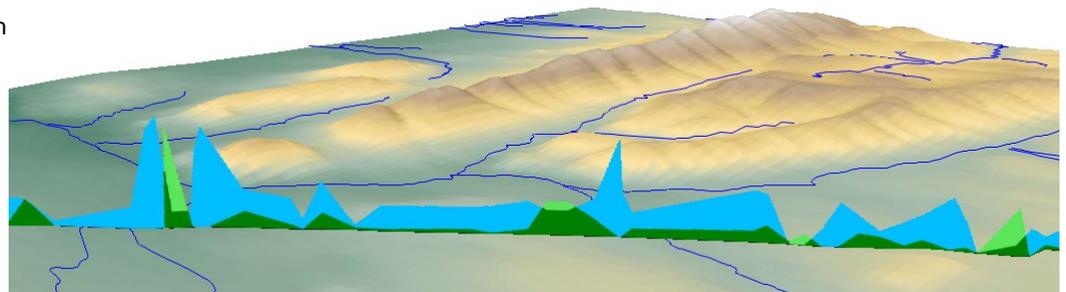


right in combination with an elevation surface and a satellite image as a drape. The drape raster is displayed with a mask to render the area in front of the section line transparent so that the subsurface manifold is visible from this view direction.

3D perspective views in the TNTmips Display process typically include a *surface raster*, whose cell values define the elevation variations of a surface, and one or more geospatial objects as *drapes*, which are projected onto that surface. Perspective views can also include *manifolds*: TNT raster or vector objects projected onto vertical planes, curving vertical curtains, and more general 3D shapes within the scene. A manifold contains its own shape and position information in the form of a set of 3D georeference control points. These control points define a 3D triangular mesh representing the manifold surface onto which the object is projected. A manifold can be viewed by itself in a perspective view, or in combination with a conventional surface raster and its drape(s).

Various examples of manifolds in 3D perspective views are illustrated on both sides of this page. The simplest and most obvious application of manifolds is the display of cross-sections showing the vertical distribution of some property along a transect line. For example, cross-sections showing the distribution of subsurface materials or their geophysical properties are widely used in the fields of geology, geophysics, mineral and petroleum exploration, engineering, and archeology. Cross-sections can also be used to show vertical variations in ocean or atmosphere properties. You can also use a manifold to show a graph of some measured property along a transect in the perspective view; examples might include the proportions of different vegetation types or the concentrations of chemicals or other pollutants in the soil, air, or water.

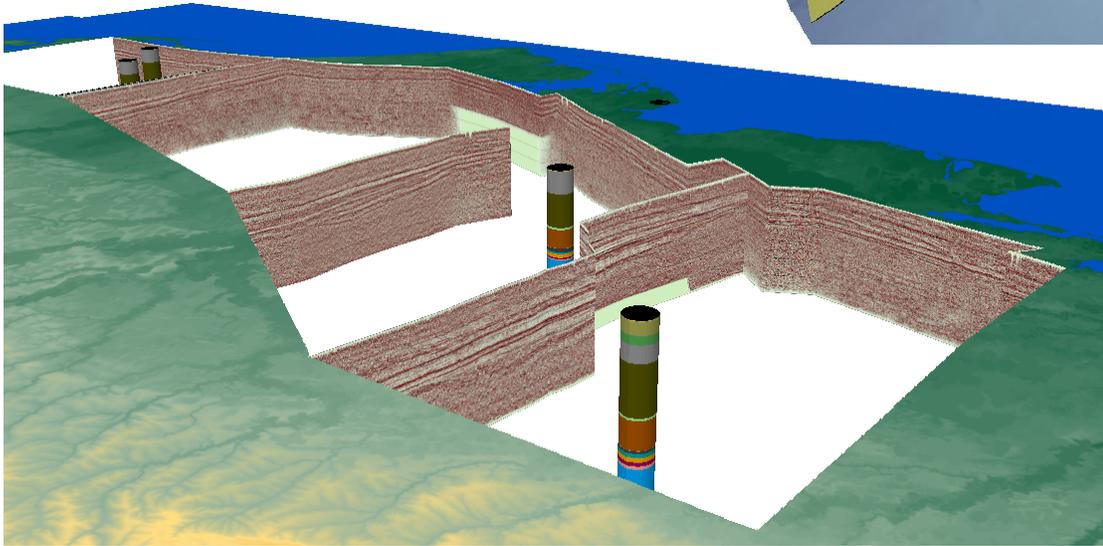
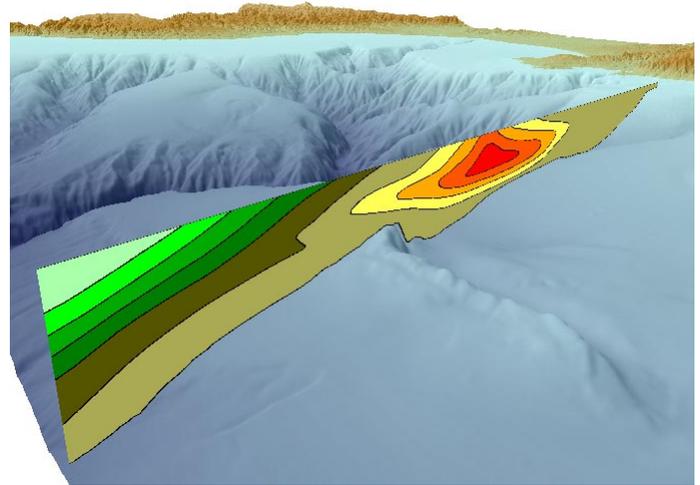
A raster manifold showing a graph of percentages of evergreen shrubs (green) and deciduous shrubs (blue) in the vegetation cover along a transect line in northern Alaska. The highest blue peak reaches 100%. The transparent part of the manifold has a single cell value set to be the null value for the raster.



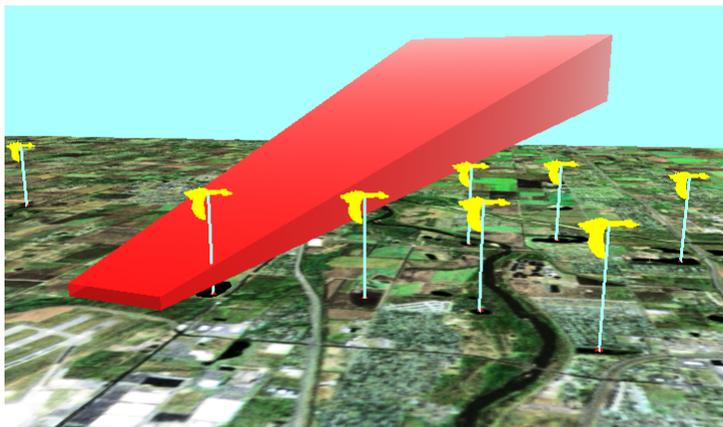
A raster manifold showing a vertical geologic cross-section (foreground). Behind the manifold is an elevation surface draped with a raster image of a hill-shaded geologic map.

You can set up a vector or raster object to display as a manifold in the Georeference process by assigning 3D control points using the 3D Piecewise Affine model. Objects with this special manifold georeference are displayed only in perspective views; the only 2D view windows that can display manifolds are those in the Georeference process and Spatial Data Editor, which display a “flat” view of the manifold object to allow editing operations.

The vector manifold in the illustration to the right represents a vertical cross-section from the ocean surface to the ocean floor south of Monterey Bay, California. The manifold is perpendicular to the coast and shows hypothetical velocity contours for coast-parallel offshore currents. The light green color represents maximum southeastward velocity, while red represents maximum northwestward velocity. The zero-velocity contour is the boundary between green and brown colors. The surface raster displayed with the manifold incorporates both bathymetry and land topography and is draped by a raster image of a color-shaded relief view of the surface. Monterey Submarine Canyon is visible immediately behind the manifold.

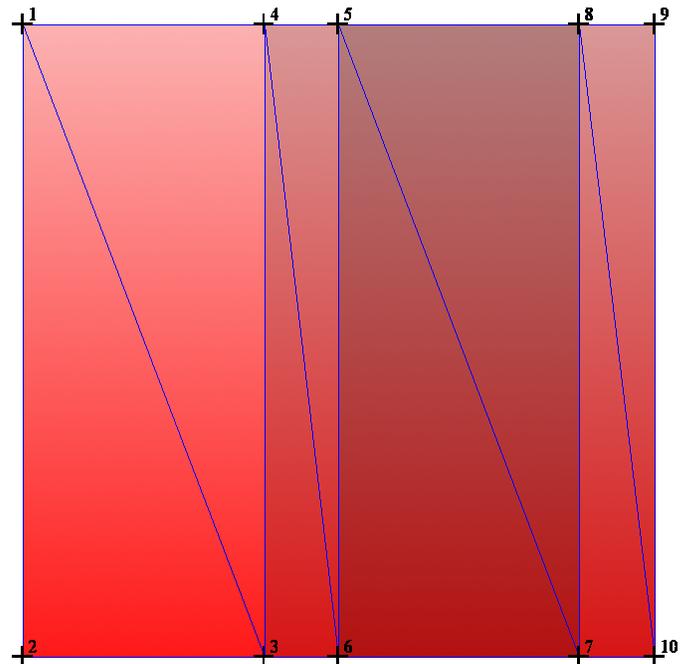


This view of data from the north coast of Alaska combines four raster manifold seismic reflection profiles with solid (extruded) circular polygons showing subsurface rock units (via color stack styling) encountered in exploratory wells in the region. Manifolds and wells are visible through a transparency mask used with the surface elevation drape.



The control points defining a manifold surface can create a closed or partially-closed shape that can be used to represent a volume in a 3D view. The wedge-shaped raster manifold in this illustration is meant to indicate the volume encompassing lines of aircraft approach and takeoff for an airport. The color gradients and shadings representing the different sides of the manifold were designed to accentuate the 3D effect. This raster was created as a TIFF file in a graphics software program and then georeferenced and displayed in TNTmips; the illustration at the right shows the raster in 2D view in the Georeference process with its control points and resulting triangulation.

This view also includes extruded points meant to show hypothetical locations of ponds frequented by flocks of waterfowl whose

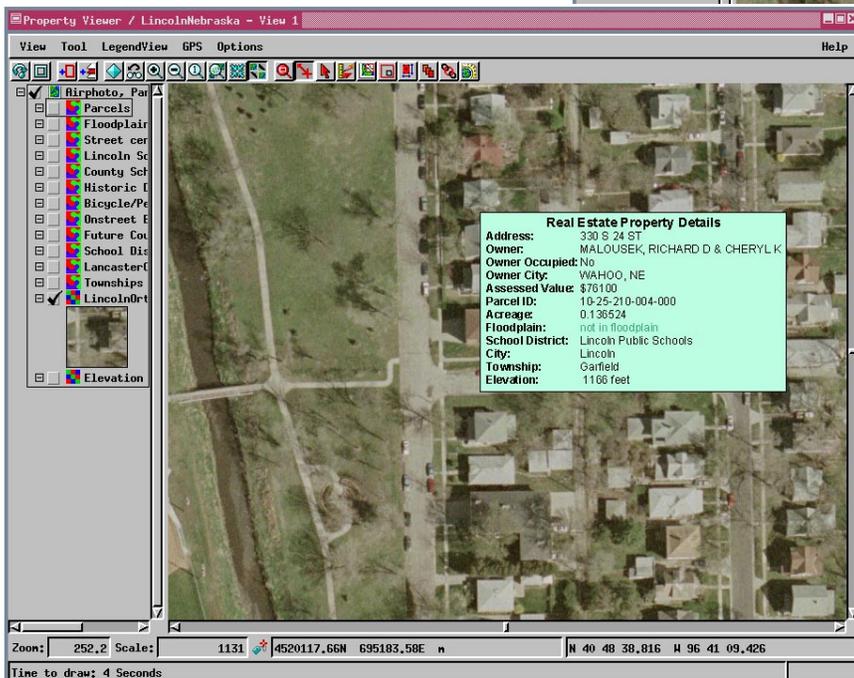
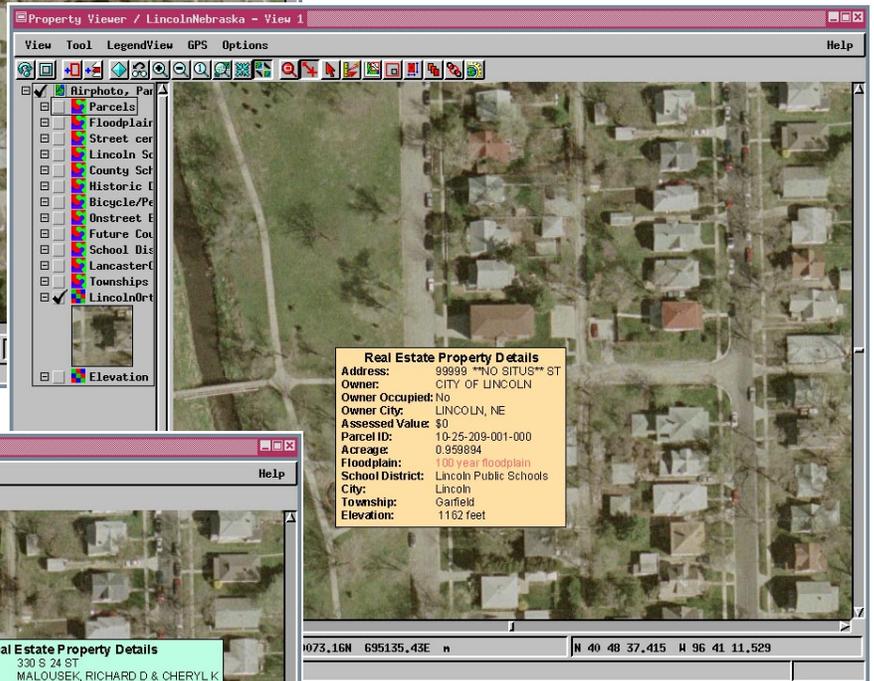
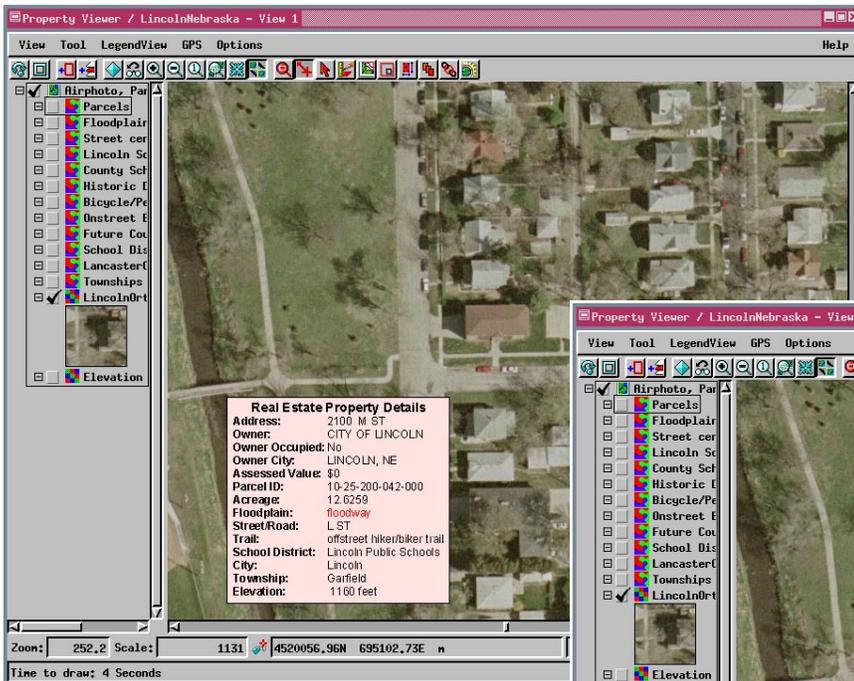


flights pose a significant hazard to aircraft near the airport. Note that the relative foreground-background positions of the point symbols, stalks, manifold, and surface drape are correctly resolved on a pixel-by-pixel basis in the perspective view.

Add Styling to DataTips

You can extend the functionality of your DataTips with a Control Script. The DataTip comes from the layers in the view, and a Control Script can modify its appearance. You may set up a DataTip for every layer in a layout or group and choose whether to show the DataTips for all layers, for visible layers, for the active or top layer, or not to show any DataTips. The content of the DataTip is set through the Layer Controls window. DataTips may come from any field in the tables for a layer including virtual fields. Using virtual fields allows you to create multiline DataTips with information from different fields, to incorporate style codes (see back of this page), and to convert database values into publicly understandable values. For example, the first seven lines in the DataTips illustrated come from a single

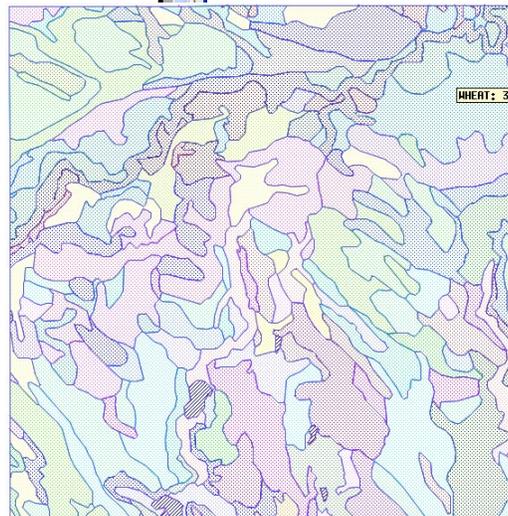
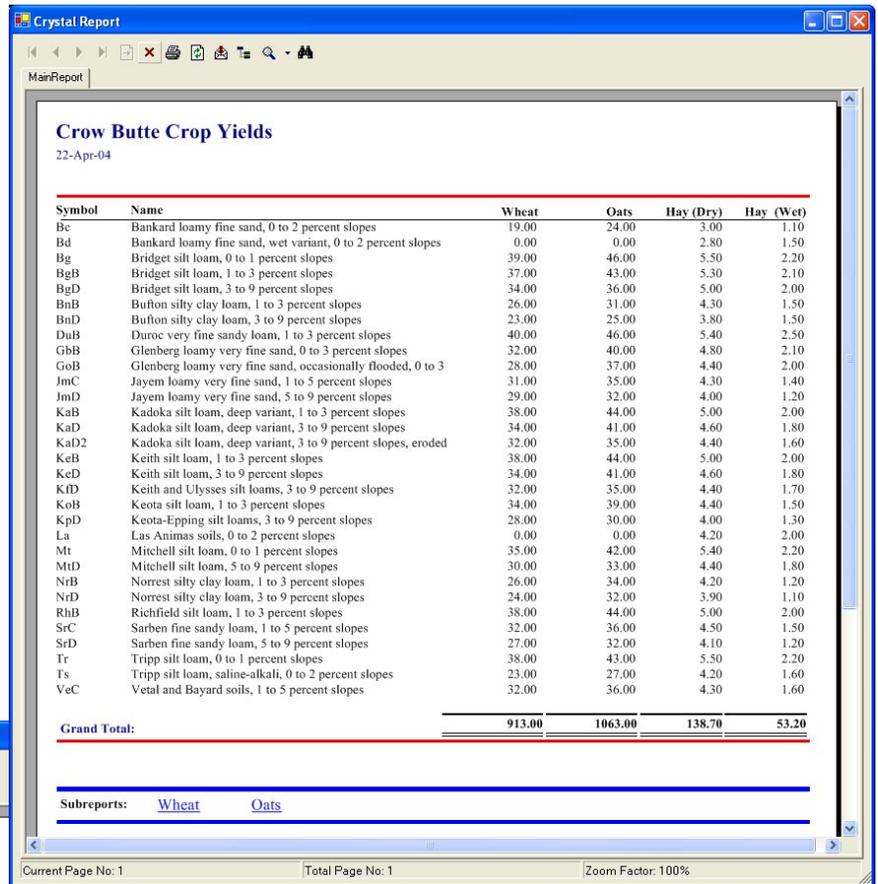
parcels layer; the DataTips incorporate bold and normal weight text, as well as different color text; and a coded floodplain field has been converted from codes 0, 1, 2, or 5 to: not in floodplain, 100 year floodplain, floodway, and 500 year floodplain, respectively. The control script applies to all DataTips regardless of their content.



In the illustrations, a Control Script (Layout/Edit Control Script or Group/Edit Control Script in the Layout or Group Controls window) is used to change the background color of the DataTip depending on the floodplain status of the current cursor geolocation. Note also that the DataTips have bold text for the prefix only and that there is tab alignment for data values. Also note that the floodplain status is shown in a different color when over the floodplain as a means to alert the viewer of the reason for the change in DataTip color. The number of lines in the DataTip will vary with the number of layers that have elements within the search distance when you have All Layers selected as your DataTip viewing option.

Create Crystal Reports with SML

SML can use Visual Basic to generate a Crystal Report and subreports for a vector database in the TNT products. This script (shown on the back) is data specific but readily adaptable for use with other vector objects. The script imports the form from Visual Basic, creates a class instance for the form, then prompts for the vector object to create the report for. The tables and fields desired for the report are specified in the script. Once the Visual Basic data table is initialized by the script, the specified fields from each record are read into the Visual Basic table, which is used to generate the Crystal Report. The script also makes use of prior settings made in Crystal Reports that specify which fields are available to the Crystal Reports engine and what subreports you want.

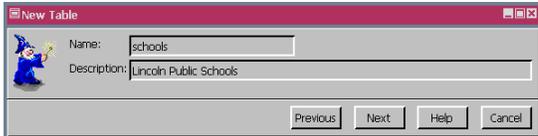


The subreports are listed at the bottom of the main report (shown above) until they have been opened and then they are available as tabbed panels (left). The setup of

the graph and which subreports to create are designated in Crystal Reports before running the SML script. If you ran the script in SML/Edit Script mode, you have to close the Crystal Report for the SML Editor functions to be active because the script is executing as long as the Crystal Report window is open. The subreport illustrated at the left makes it immediately clear which soil types are best for growing wheat.

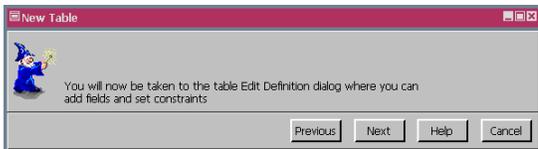
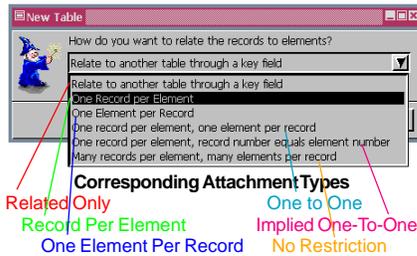
Database Table Creation Wizard

One important distinction between geodata in a GIS system and simple graphics is the addition of attributes as well as geographic information, which means you need to be know how to set up databases. If you are going to use a complicated relational structure for your database, you should set the database up in advance. However, if you are simply trying to add attributes as you work, such as while interpreting airphotos, you can set up tables while doing the analysis. In either case the Database Creation Wizard in the TNT products will assist you in setting up new tables when displaying or creating/editing any object type. You can easily create new vector objects, such as local schools, with a phone book and a local streets layer. High resolution, reference imagery greatly assists the ease and accuracy of placing points for such features. You should create your database table before you begin adding points (for example, for schools) or other elements when creating vector objects in this manner so you can be prompted for

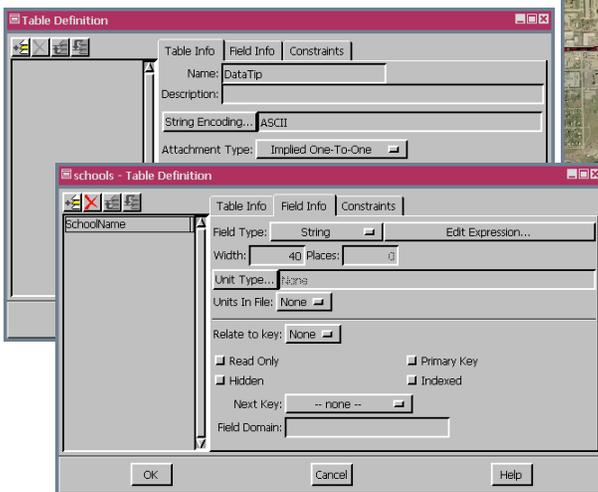


First you are prompted for a table name and description. If you do not want to enter a description, you will need to press <enter> or move the mouse off the window for the Next button to become active.

You are next asked how to relate elements to records. The choices shown correspond to the attachment types indicated below.



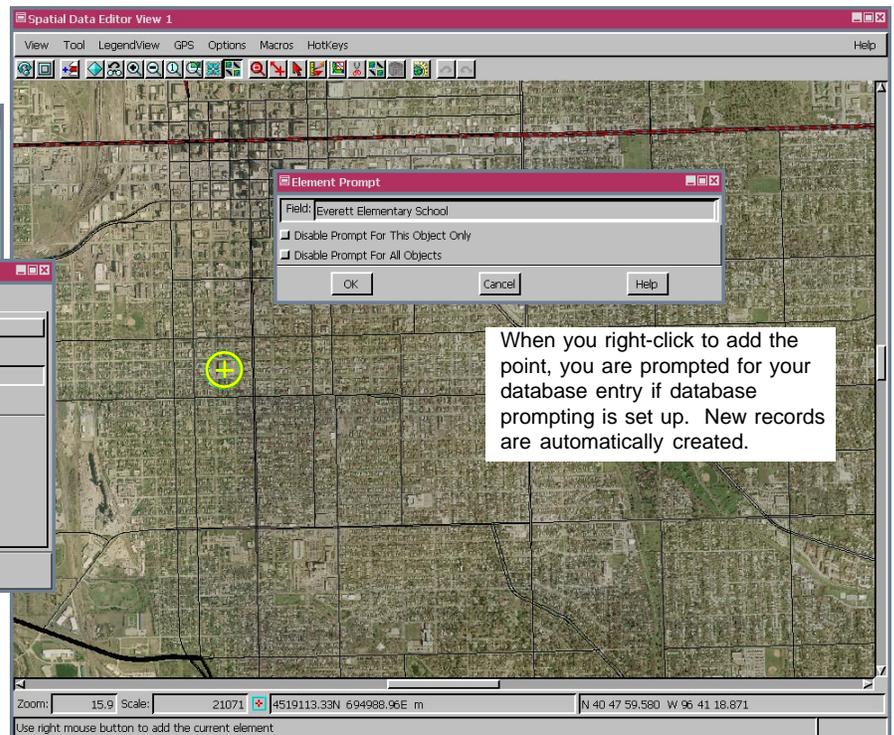
This last panel of the Wizard lets you know what will happen next.



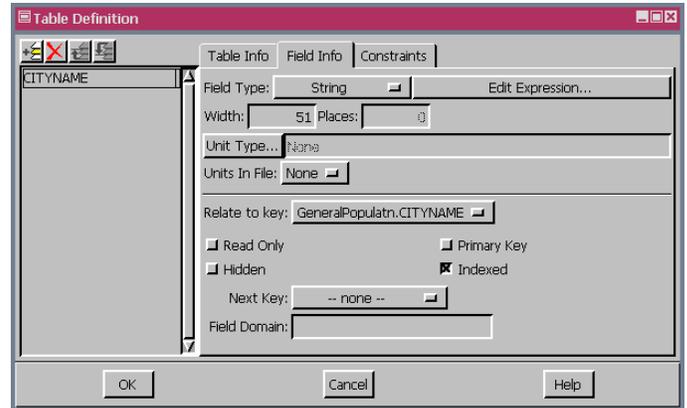
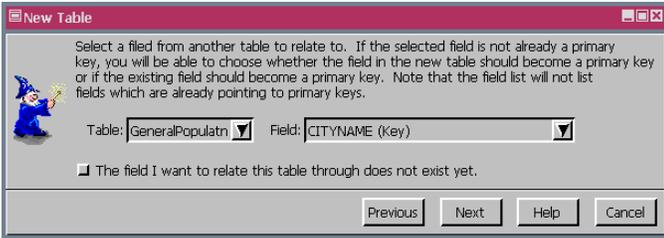
The Table Definition window initially opens showing the Table Info tabbed panel so you can review the relationship set and further specify encoding or other options if desired (upper window). Adding a field (lower window) automatically switches to the Field Info tabbed panel.

attribute entry when each element is added. Entering attributes when an element is added saves the time of having to reorient yourself to which element is which. The database Prompt feature also automatically creates a new record for each element you add. This feature is most useful for tables with One Record Per Element attachment types. You can create a new database table and then set up database prompting or create a new table while setting up database prompting. When you choose to create a table with either method, you get some assistance from the Database Table Creation Wizard to get you started.

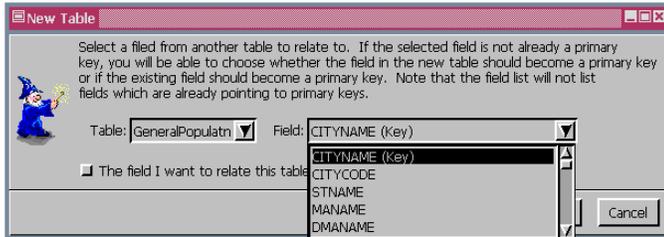
The second panel of the Wizard asks you how you want to relate records to elements, which has important implications for how the table is maintained throughout various operations. It also determines the next step in the Wizard and how the Table Definition window initially appears when opened by the Wizard. Five of the six choices take you through the path illustrated at the left. The other choice, *Relate to another table through a key field*, opens an additional Wizard panel to let you specify the primary key field that relates the tables and sets up the foreign key field pointing to it when the Table Definition window is opened. The additional Wizard panel is shown on the back of this page.



Additional Wizard Panel(s) for Related Only Tables



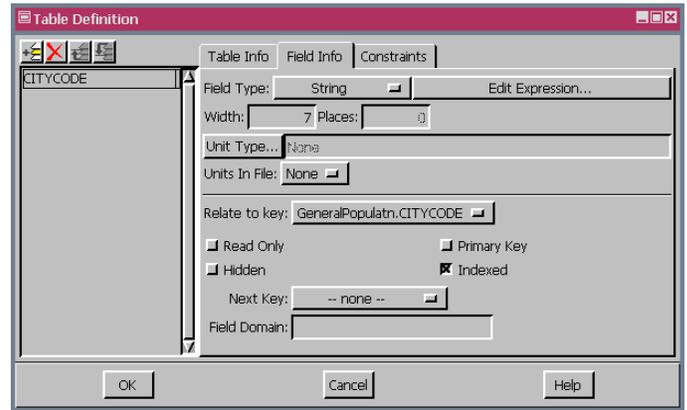
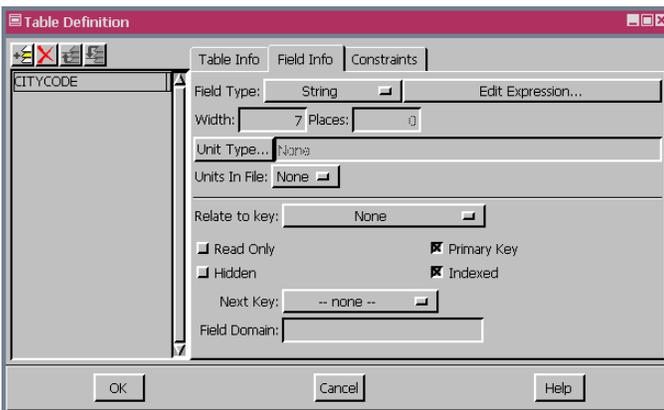
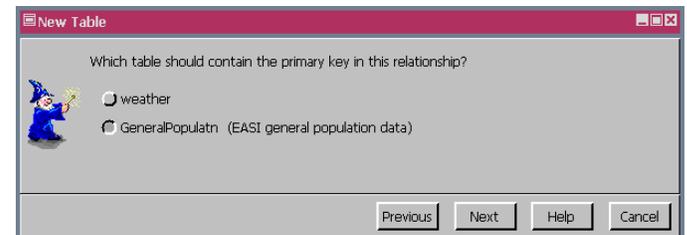
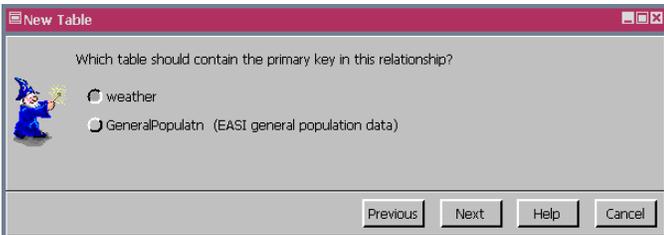
If you choose *Relate to another table through a key field*, you get this panel before going to the Table Definition window. Note that in addition to choosing the table and field to establish the relationship between tables you can instead indicate that the table does not exist yet. If you choose the primary key in an existing table, you get the table definition window at the right with a field named the same as the selected primary key and its foreign key relationship set up.



All fields in the selected table are listed to choose from. If you choose a field that is not currently a primary key field, you will get an additional panel in the Wizard (shown below) asking you to specify which of the two fields (the one in the new table or the one selected from an existing table) should become a primary key so the relationship can be established. If you click on *The field I want to relate this table through does not exist yet* toggle, the table Definition window opens with no initial fields or relationships as on the other side of this page. If there are no other tables in the database, this box is automatically checked.

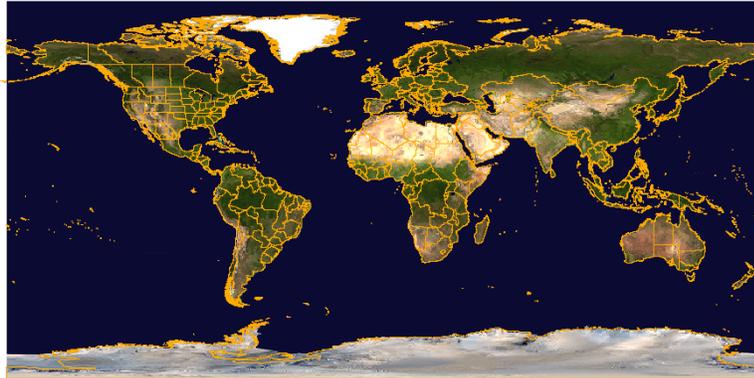
Choosing a field for the table relationship that is not currently a primary key causes the wizard to ask which table you want to contain the primary key. The result of picking the new table is shown below. When the new table is selected, a field of the same name as in the existing table is added, the *Primary Key* and *Indexed* toggles are checked, and the *Relate to key* option menu is set to None.

When the existing table is selected (below), a field of the same name is added to the new table and the *Relate to key* option menu points to the primary key in the existing table. The *Primary Key* toggle is not checked, but the *Indexed* toggle is on to speed relational searches.



Working with Massive Geodata

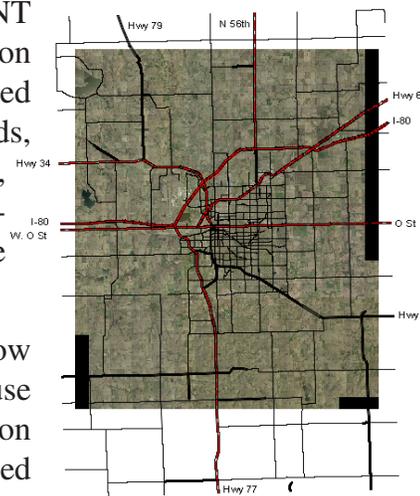
What is massive geodata? It is not defined by the geographic extents of an object but rather by its storage requirements. The type of object must also be taken into account. For raster data, we



will define massive as 2 GB or greater. The TNT products currently have a 4 TB storage limit on raster objects whether uncompressed or compressed with any of the supported compression methods, which include JPEG2000, Run Length Encoded, Standard Lossless, and Huffman. This limit applies to a single raster object stored in a single file and does not include its pyramids.

Massive raster geodata does not translate into slow display performance in the TNT products. The use of pyramids and quick JPEG2000 decompression displays the 500 MB JPEG2000 lossless compressed raster (above right with a vector overlay) in less than one second.

We arbitrarily define massive vector objects as over 100 MB. The TNT products support vector objects requiring up to 4 TB for storage, with up to 2 GB of storage per element type. 2 GB of storage is more than 134,000,000 nodes, points, or line vertices. Each 2D node, point, and line vertex requires 16 bytes. So a massive vector object, which is far smaller than the maximum size, would be made of more than 6,553,600 points or a single line with that many vertices or some combination of points, lines, and polygons that requires that amount for storage. The 4 TB limit does not include databases, style objects, and other subobjects, but these and all the other “behind the scenes” lists and other vector requirements must fit in the 16 TB Project File size limit.



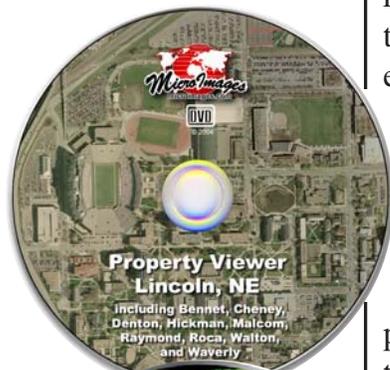
Vocabulary: TB or terabyte. A unit of measurement for 2^{40} (approximately) 1,000,000,000,000 bytes, 1,000,000,000 kilobytes, 1,000,000 megabytes, or 1,000 gigabytes.

Pages 5–10 discuss assembling raster data and dealing with null values. Pages 11–18 describe merging and cleaning up vector data including attributes and topology. Pages 19–22 discuss the importance of map scale control and DataTips. Additional vector filtering processes are discussed on p. 23.

Further Introduction to Massive Geodata



This display of world hydrology at full view took 26 seconds, but no individual elements can be discerned.



Massive vector data should be optimized to improve display times, but display at full view may be slow and meaningless. At full view, individual elements are rarely distinguishable. The use of map scale control to manage massive vector displays is discussed later.

If you have not noticed, the TNT products' limits on object size are not really limitations for most people. The maximum Project File size is 16 TB. Do you have storage for 16 TB? Do you even have storage for the 4 TB raster size limit?

As long as we're talking about size limits in regard to massive data, we will complete the list of primary object types in TNTmips even though MicroImages has acquired no data that could be considered massive in these formats. CAD blocks can be up to 4 TB and the object must fit within the 16 TB limit. A block can contain up to 2,147,483,648 elements.

TIN objects can also be up to 4 TB. Each TIN node requires 24 bytes of storage, edges 16 bytes, and triangles 40 bytes. Databases can be up to 16 TB with each table up to 4 TB. There is no size limit on ODBC linked databases, although file based databases usually have a 2 or 4 GB limit imposed by the software that created them or by the ODBC driver.

Generally, you are not working with an object in isolation; massive data frequently comes in sets. A practical definition for a massive data set is anything that doesn't fit on your chosen distribution medium (CD or DVD). In the case of vector data, massive data may fit on CD or DVD but is unnecessarily slow to display and larger than it needs to be, generally because of unnecessary nodes and database records. The Global Reference Geodata DVD distributed with the V6.9 release of the TNT products is a massive data set that consists of a massive raster, some massive vectors, some very small vectors, and others in between.