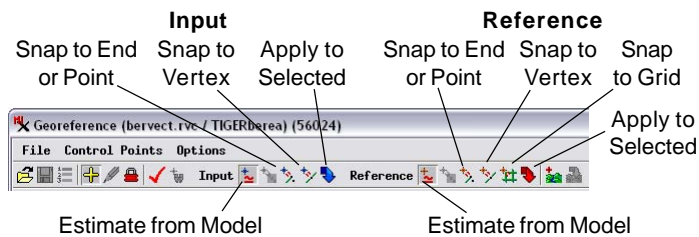


Snap Control Points to Elements or Reference Grid

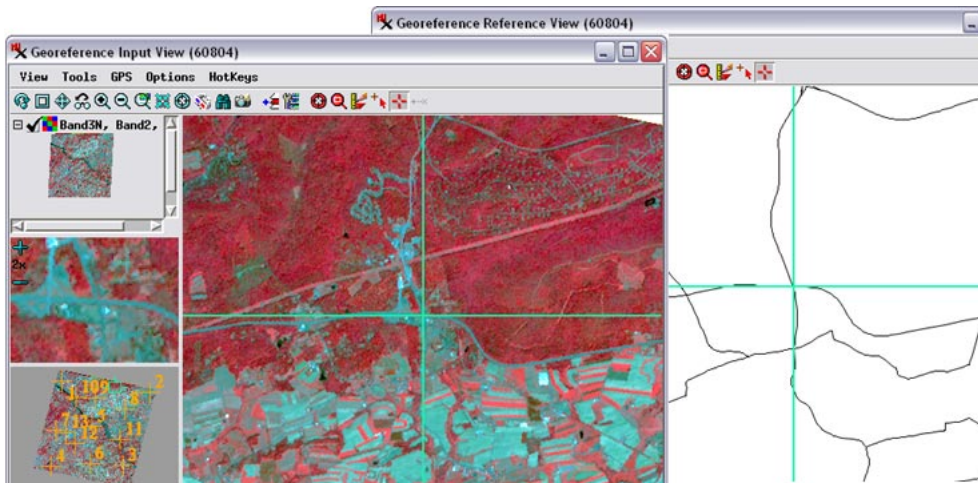
The Georeference process in TNTmips provides several different modes for adding or editing control points. These modes are designed to assist you in placing the points. For example, when you are georeferencing to a reference object, the default mode is Estimate from Model. When adding control points in this mode, initially positioning the crosshairs in the input view not only sets the input coordinates for the point, it automatically computes candidate map coordinates based on the current point set and model (when there are sufficient points to compute a solution) and shows these coordinates in the control point list. You can override these automatic coordinates simply by moving the crosshair in the reference view or by editing the coordinate fields. Conversely, placing the crosshair in the reference view sets the map coordinates and computes estimated object coordinates.

Several other helper modes for placing control points are also available. You can snap individual control points to elements in an input or reference geometric object (vector, CAD, or shape). Separate options are available to snap to the nearest line or point and to

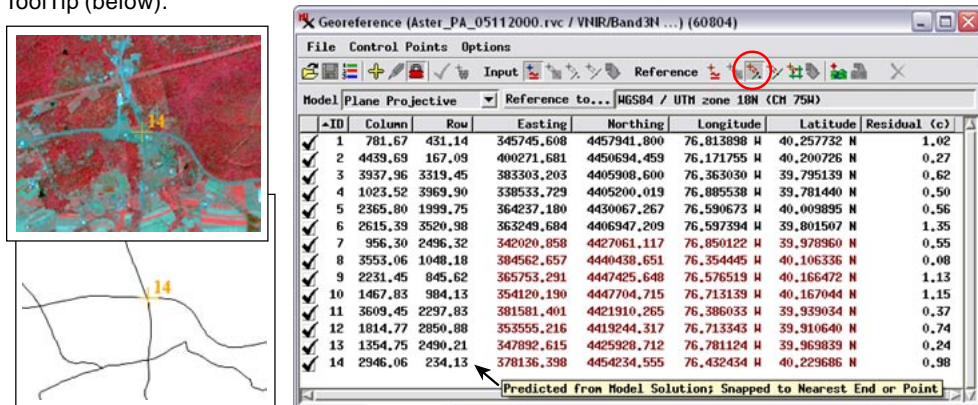


snap to the nearest line vertex. You can also set up a virtual map grid in any map coordinate system and snap control points to the nearest grid intersection. This latter option does not require a reference object, and is most appropriate when georeferencing map sheets that include map grid lines or tick marks.

These modes for adding or editing control points are set separately for the input and reference object using icon buttons in the Input and Reference sections of the toolbar on the Georeference window, as illustrated above. The individual snap options are described in more detail and illustrated below and on the reverse.



The illustrations above show an ASTER satellite image (in Input View, left) being georeferenced using a shapefile of state roads (in Reference View, right). A new control point is being added with the Reference object mode set to *Snap to End or Point* (input is in default *Estimate from Model* mode). With these settings, manually positioning the Input View crosshairs tool on a highway intersection (left illustration) results in the reference crosshairs automatically snapping to the nearest road intersection (coincident line ends) in the reference shape object. The accepted control point is illustrated below left. Its map coordinates are shown in color in the control point list (for the duration of the current session) and its source is described by a ToolTip (below).



| ID | Column | Row | Easting | Northing | Longitude | Latitude | Residual (c) |
|----|---------|---------|------------|-------------|-------------|-------------|--------------|
| 1 | 781.67 | 431.14 | 345745.608 | 4457941.800 | 76.813898 W | 40.257732 N | 1.02 |
| 2 | 4439.69 | 167.09 | 400271.681 | 440694.459 | 76.171755 W | 40.290726 N | 0.27 |
| 3 | 3937.96 | 3319.45 | 383303.203 | 4405908.600 | 76.363030 W | 39.795139 N | 0.62 |
| 4 | 1023.52 | 3969.90 | 338533.729 | 4405200.019 | 76.885538 W | 39.781440 N | 0.50 |
| 5 | 2365.80 | 1999.75 | 364237.180 | 4430067.267 | 76.590673 W | 40.009895 N | 0.56 |
| 6 | 2615.39 | 3520.98 | 363249.684 | 4406947.209 | 76.597394 W | 39.801507 N | 1.35 |
| 7 | 956.30 | 2496.32 | 342020.858 | 4427061.117 | 76.850122 W | 39.978960 N | 0.55 |
| 8 | 3553.06 | 1048.18 | 384562.657 | 4440438.651 | 76.354445 W | 40.106336 N | 0.08 |
| 9 | 2231.45 | 845.62 | 365753.291 | 4447425.648 | 76.576519 W | 40.166472 N | 1.13 |
| 10 | 1467.83 | 984.13 | 354120.190 | 4447704.715 | 76.713139 W | 40.167044 N | 1.15 |
| 11 | 3609.45 | 2297.83 | 381581.401 | 4421910.265 | 76.386033 W | 39.939034 N | 0.37 |
| 12 | 1814.77 | 2850.88 | 353555.216 | 4419244.317 | 76.713343 W | 39.910640 N | 0.74 |
| 13 | 1354.75 | 2490.21 | 347892.615 | 4425928.712 | 76.781124 W | 39.969839 N | 0.24 |
| 14 | 2946.06 | 234.13 | 378136.398 | 4454234.555 | 76.432434 W | 40.229686 N | 0.98 |

Snap to Nearest Line End or Point

You can use the *Snap to End or Point* mode to snap to the ends of line elements (nodes) or points in an input geometric object and/or in a reference geometric object. (The Snap to End or Point icon button is active for both input and reference if both are geometric objects.) A reference geometric object can be in any coordinate reference system, which need not match the reference system being used for the control points. This mode is particularly useful with reference geometric objects depicting intersecting line features, such as road or stream networks.

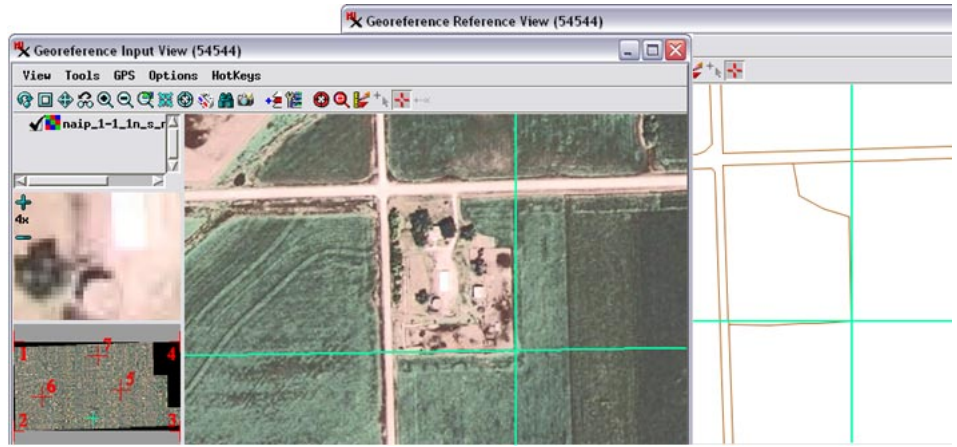
Snap to End or Point mode automatically snaps the control point in the designated View to the nearest line endpoint or point element when the crosshairs tool in the other view is manually positioned. The example illustrated to the left shows a new control point being added to an input raster using this mode for a reference shapefile depicting a road network. When the point is manually placed on the image in the Input View using the crosshairs tool, the crosshairs tool in the Reference view is automatically snapped to the nearest line end (in this case a road intersection) to provide the necessary map coordinates for the new point. Note that in this case a number of different nearby crosshairs positions in the Input (over)

View yield the same snapped map coordinates; correct placement of the input crosshairs on the image is your responsibility. If the Snap to End or Point mode is used simultaneously for both input and reference geometric objects, both input and reference crosshairs automatically snap to the nearest corresponding features when either tool is manually repositioned.

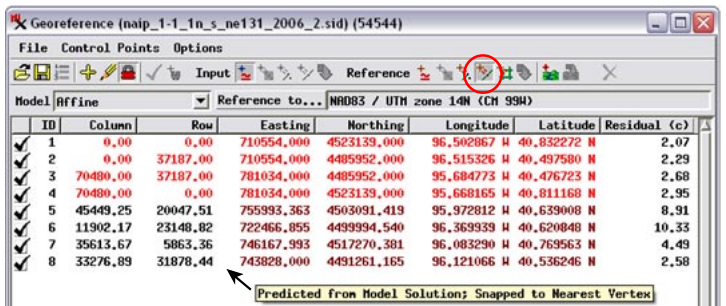
You can also use the Snap to End or Point mode when editing control points (e.g. points that were manually placed). In Edit mode, you must manually reposition the crosshairs tool in the view for which snapping is set in order to trigger the snapping action.

Snap to Vertex

The *Snap to Vertex* mode is available for input and/or reference geometric objects. Its operation is similar to the Snap to End or Point mode, except that it snaps the crosshairs tool in the specified view to the nearest line vertex. This mode is most useful for geometric objects with many non-intersecting polygons, such as agricultural field boundaries, building footprints, and street curb lines (block boundaries) in which you can use sharp corners of polygons (which may or may not be line ends) as reference positions. An example using agricultural field boundaries in a reference shapefile is illustrated to the right.



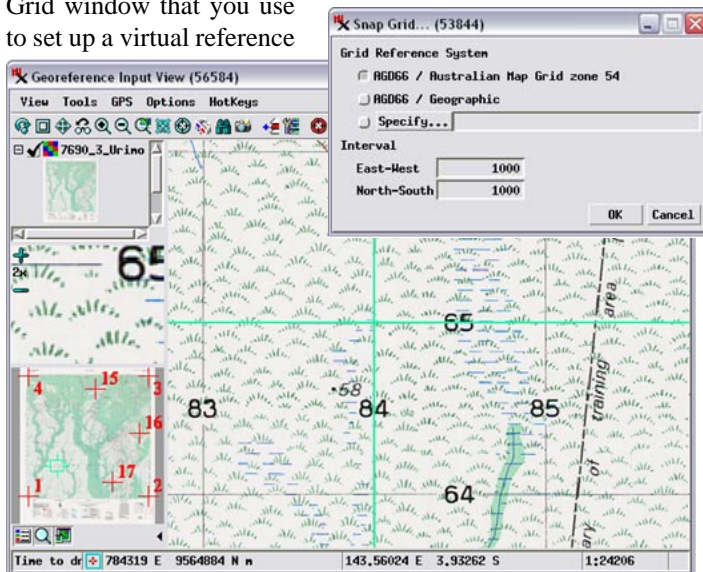
The illustrations above show an orthoimage of a rural county (in Input View, left) being georeferenced using a shapefile of agricultural field boundaries (in Reference View, right). A new control point is being added with the Reference object mode set to *Snap to Vertex*. Manually placing the crosshairs tool in the Input View results in the Reference View crosshairs tool automatically snapping to the nearest vertex at the corner of a field. The accepted control point is illustrated to the left and shown in the control point list below.



Snap to Map Grid Intersections

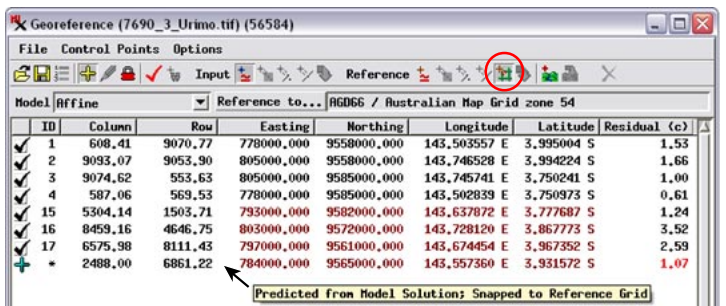
The *Snap to Grid* mode is available on the Reference toolbar for any type of input object. For input objects that include map grid lines or grid intersection tick marks, such as scanned topographic maps, you can use this mode to quickly snap map coordinates to the nearest grid intersection. Using this mode requires enough previously entered control points to compute a solution to the registration model.

Turning on the Snap to Grid mode automatically opens the Snap Grid window that you use to set up a virtual reference



map grid. You set the map grid's coordinate reference system, which may differ from the reference system being used for the control points, and set the grid line spacing interval in both east-west and north-south directions.

Once the virtual grid is established, placing the crosshairs tool in the Input View automatically sets that control point's map coordinates to the nearest virtual grid intersection. Correct placement of the point relative to the input object is your responsibility.



The illustration to the left shows a scanned topographic map that includes grid lines in the Australian Map Grid with 1,000-meter spacing. This map is being georeferenced with the aid of the Snap to Grid feature. The Snap Grid dialog window (above left) is used to set the coordinate reference system for the map grid and east-west and north-south grid spacing. Placing the crosshairs tool on or near a grid line intersection automatically sets map coordinates from the nearest grid intersection in the virtual map grid (as shown by the map coordinates in the control point list illustrated above). Only the image coordinates require manual adjustment to provide correct registration.