Chapter 4

Data *(updated September 5, 2009)*

Data Editing

The DATA module allows you to add, modify or delete station, observation, and datum data currently in the project through an assortment of intuitive spreadsheet like grids. ***A complete project can be entered using these grids or by creating your project within an ASCII (Text) input file.***

You can also disable individual observations. Observations that are disabled will not be available for use in Network Adjustments, Network Pre-Analysis, or COGO Traverse computations.

There are three basic data components in COLUMBUS:

STATIONS	locations on the ground
OBSERVATIONS	measurements between stations
DATUMS	ellipsoidal parameters

When entering or editing data, it is very important to work with the units defined in the OPTIONS - UNITS dialog. If the linear units are set to meters, all linear quantities must be entered in meters, except the major axis for a datum, which must **always** be entered in meters. Internally, COLUMBUS converts all linear quantities to meters and angular measurements to radians. If the selected linear units are U.S. Survey Feet, COLUMBUS converts all applicable linear data from U.S. Survey Feet to meters before storing them internally. Upon output, the results are then reported back in U.S. Survey Feet.

Likewise, angular measurements must be made in the active angular units. COLUMBUS currently supports degrees and grad (or gon) units. See the OPTIONS chapter of this manual for more information on the supported angular formats.

Keeping track of the input units is easy when using the spreadsheet grids. When you select a cell to edit, the units of entry are displayed in the upper left corner of the current Tabbed Page.

If you enter a value that is out of range (in a cell), then move to another cell, an error message will be displayed in the upper left corner of the current Tabbed Page. **This message will indicate the proper numeric (or text) range for the cell you just left. The cell will also be restored to its orginal value (before the bad data was entered).**

Using The Data Grids

The data grids allow you to quickly enter or modify project data. Each grid serves a specific purpose, but they are all used in the same way (mouse + keystrokes or keystrokes alone). These grids utilize many of the same keystroke combinations found in popular spreadsheet software.

Keep and Exit:

After making changes in any grid, select the **Keep and Exit** button to accept the changes into the project. Data are not saved to disk until you invoke the **File - Save** or **File - Save As** command.

Cancel:

To cancel changes at any time, select the **Cancel** button. If any data changes have been made in the grids, you will be prompted with a message asking you if you really want to discard your changes.

When you select **Cancel**, COLUMBUS looks for any change in the grids. If changes exist (e.g., you added a new empty row), a scan is made to see if those changes would alter the project. If not (as in this example), no user prompt is made.

Suppose you opened an observation grid and changed a slope distance from 1300.25m to 1300.255m. Before closing the grid, you then changed that distance back to1300.25m. If you now select **Cancel**, no user prompt will be made, since the project data has not changed.

Add ’N’ Rows:

New data are always added to the bottom of the grid. You can add new rows by invoking the **Add ’N’ Rows** button or by repeatedly pressing the ENTER key to move to the last row and then add additional rows.

The user entered row order is not maintained in COLUMBUS. When the Station, Observation or Datum grids are activated, the data is always ordered alphabetically by; the AT station name (Stations), the AT, TO, BS station names (Observations), and the Datum name (Datums).

Empty rows are ignored and removed as soon as you move to another Tab or close the dialogs.

Delete Row:

To delete a row of data from the project, clear out all fields on that row. When **Keep and Exit** is selected, the data that was on that row will be removed from the project. When you delete a station (using this method) all observations connected to that station will also be deleted (including horizontal angles that backsight into the station).

Rename Station or Datum:

To rename a station, open the Station Tabbed dialogs and select any one of the Station Tabs (Geodetic, State Plane, etc). Change the desired station name (modify its text). The new name must not match any other station name currently in the grid or you will get an error message. When the **Keep and Exit** button is selected, the name will be changed in the project. **All observations linked to that name will also be automatically updated.**

To rename a datum, follow the same process.

Adding Similar Rows Of Data:

When adding several rows of data (for which many fields are identical) use copy/paste. First, add several blank rows to the grid. Second, using your mouse or keystrokes, highlight the entire row of data you wish to replicate. Use **Ctrl + C** to copy the row. Move to the beginning (first cell) of the first blank row and perform a paste **Ctrl + V**. Move to each additional blank row and paste the data in the same way. Make specific edits to the fields that are different.

When doing this operation within the Station or Datum grids, you will not want to add the station name (first cell in each row) to the copy/paste operation. If you do, you will get a duplicate name message after each paste. Instead, copy the 2nd thru n cells of each row (skipping cell 1 of each row.)

Column Widths:

You can change the width of any column. These changes are remembered by COLUMBUS.

Column Sorting:

You can perform column sorting by clicking on the desired column header. This will sort all rows based on the items in that column. Click on the column again to reverse the sort.

When sorting columns that contain Real numbers, you can sort by the abolute value by first enabling the VIEW - SORT BY ABSOLUTE VALUE command.

Keystroke Naviagtion Summary

Below is a list of the most commonly used keysrtoke combinations. You may discover that exclusive use of the keyboard (no mouse) is more efficient when entering large amounts of data.

Cell Modes:

Edit Mode	When editing a cell
Entry Mode	When on a cell, but not in edit mode

Navigation:

Ctrl + PgUp	Next Tab page to the left
Ctrl + PgDn	Next Tab page to the right
Ctrl + Tab	Next Tab page to the right
Ctrl + Shift + Tab	Next Tab page to the left
Tab	Move to cell to right (Edit Mode)
Shift + Tab	Move to cell to left (Edit Mode)
End	Move to last cell in row (Entry Mode)

Home	Move to first cell in row (Entry Mode)
Up Arrow	Move up one cell
Down Arrow	Move down one cell
Ctrl + Home	Move to upper left corner of grid
Ctrl + End	Move to lower right corner of grid
Alt + K	Keep changes and exit (Entry mode)

Select and Edit:

Alt + A	Add a row (Entry mode)
Alt + Space	Window menu
Ctrl + Space	Select entire column
Shift + Space	Select entire row
Ctrl + A	Select all cells
Ctrl + Left Click	Select multiple cells
Ctrl + C	Copy content of selected cells
Ctrl + X	Cut content of selected cells
Ctrl + V	Paste clip board to cells
Ctrl + ‘	Copy contents of cell above (Entry mode)
Shift + Left Arrow	Select multiple continuous cells to the left
Shift + Right Arrow	Select multiple continuous cells to the right
Shift + Left Mouse Click	Extend selection to selected cell
Shift + End	Select current cell and all cells to its right
Shift + Home	Select current cell and all cells to its left
Shift + PgUp	Select current cell and all cells above
Shift + PgDn	Select current cell and all cells below
Del	Delete contents of selected cells (Entry mode)
Del	Delete current character (Edit mode)

End	Move to right side of cell (Edit mode)
Home	Move to left side of cell (Edit mode)
Enter	When in Edit mode, changes to Entry mode
Esc	Exit grid and abandon changes (Entry mode)
Esc	Abandon cell changes (Edit mode)
Bksp	Delete cell contents (Entry mode)
Bksp	Delete character to left (Edit mode)

Creating A Project From Scratch

To use the data entry grids to create a project from scratch, do the following for optimal efficiency.

1. Create a new project (**File - New**) and select the datum to be active in the OPTIONS - DATUMS dialog.

2. Setup the view. If this will be a State Plane coordinate based project, set the view to State Plane (2D or 3D). For a Geodetic coordinate based project, set the view to Geodetic (2D or 3D), etc.. **This step allows COLUMBUS to automatically generate coordinate stations when you enter observations (below).**

3. If this is a State Plane, UTM (3TM, TM), or Custom Projection based project, select (or set up) the zone in the applicable OPTIONS dialogs. If this is a Local NEE project, set up the approximate latitude for the project in the OPTIONS - GLOBAL SETTINGS dialog.

4. Enter the applicable DATA - OBSERVATIONS tabbed dialog (Horizontal Angle Set, Direction Set, Azimuth Set, etc.) and begin entering station names (AT, TO, BS) and the observation data. **Be sure to be consistent with your station names when referring to the same point on the ground.** A station name of **TOP** is not the same as **Top** (these are two different station names). COLUMBUS station and datum names are case sensitive.

5. If an observation was not measured (for example a chord distance), leave the observation field blank.

6. After entering several observations, select the **Keep and Exit** button. Stations referenced by the observations will be created automatically. If the active view was set to State Plane (3D), then State Plane stations will be created.

7. Edit any station for which you have known coordinates (usually just your control stations).

8. Save your project using the **File - Save** command to prevent accidental loss of changes.

Editing Station Data

The DATA - STATIONS dialogs allow you to edit positional data for any station. COLUMBUS supports the following types of station data for any unique station name:

Geodetic	Latitude, longitude, height, etc.
Cartesian	Earth Centered Earth Fixed XYZ
State Plane	North, east, ortho height
UTM	North, east, ortho height
Local NEUE	North, east, up, orthometic height
Height	Vertical for leveling projects (orthometric or ellipsoidal)
Description	Text up to 40 characters to describe the station

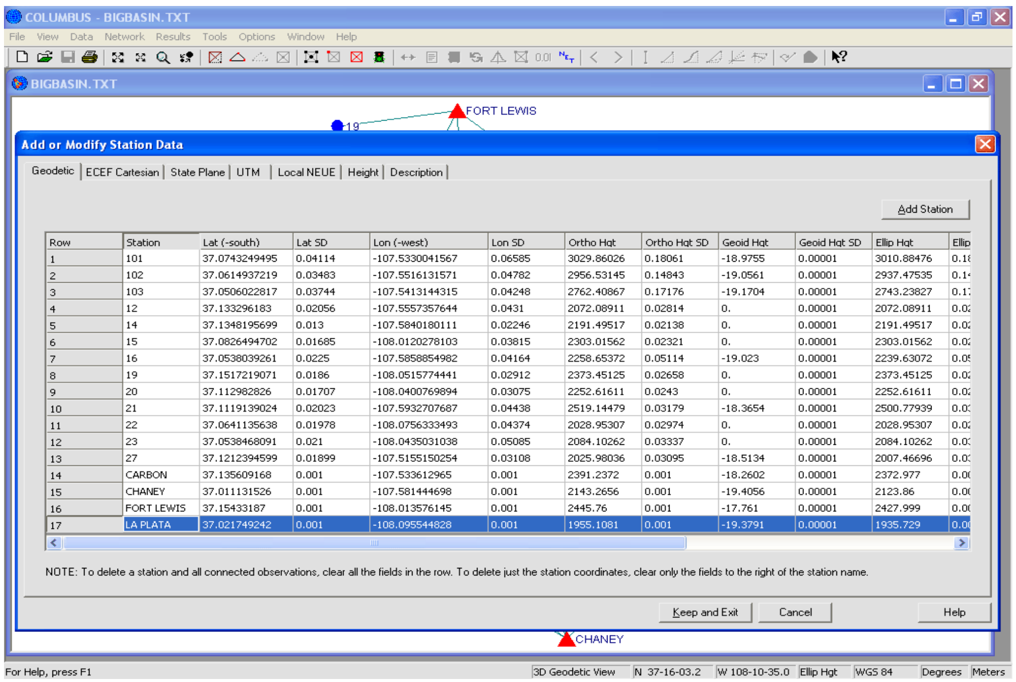
The station type you use will depend on your computational requirements. The geodetic station type is used for 2D and 3D geodetic networks. If you have ECEF (Earth Centered Earth Fixed) Cartesian, State Plane, UTM or Local NEUE stations and wish to use them in a geodetic network, they can be transformed to geodetic within the TOOLS module. The height station type is only applicable to 1D vertical networks. The seven types of station data are described on the following pages.

Removing an entire station row (in any of the station grids) deletes that station from the project. This will also result in all observations connected to this station being deleted. If you only want to delete the State Plane coordinates for station AAA, then only clear out the coordinate fields and not the station name. Of course if you make a mistake, simply Cancel out of the dialog.

Editing Geodetic Station Data

These stations are defined by Geodetic coordinates (latitude, longitude, orthometric height, geoidal height, ellipsoidal height, and deflection of the vertical in the north-south and east-west directions). Each component has a corresponding standard deviation field.

Because COLUMBUS uses one input screen dialog box for all types of Geodetic station applications, some cells may not be applicable to your needs. If a cell is not supplied by you, COLUMBUS will put in a default value of zero or near zero for standard deviations.



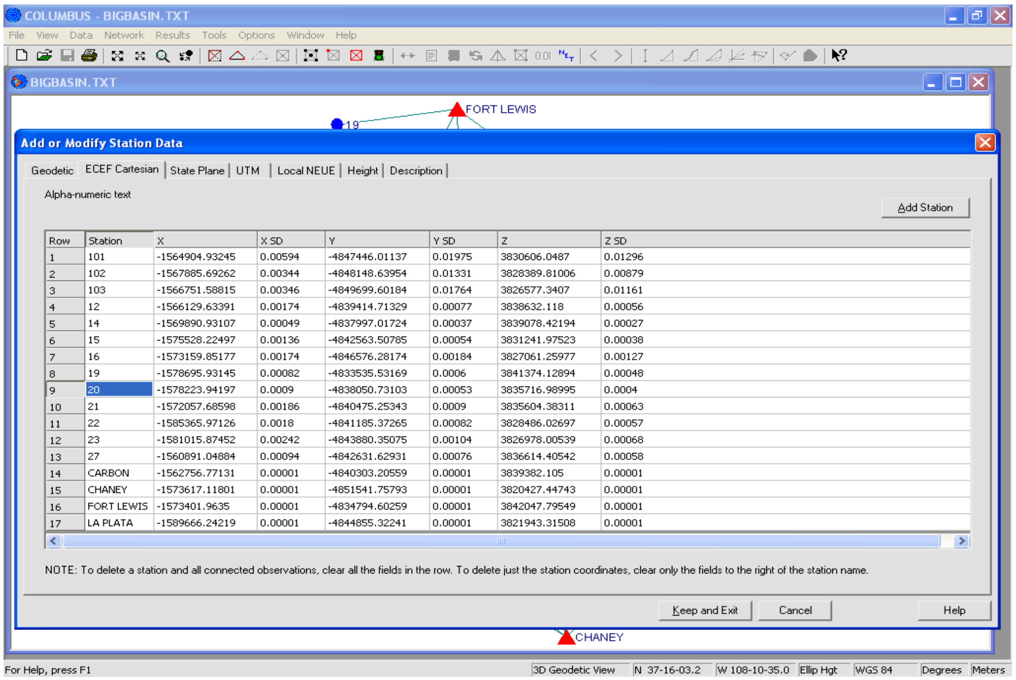
For our BIGBASIN.TXT network (shipped with COLUMBUS), the known coordinate data for control station LA PLATA is highlighted above. Other sample projects using this coordinate type include: GEO.TXT, MIXED.TXT, GPSONLY.TXT, TERRONLY.TXT, GEO_TRAV.TXT, BEAR2D.TXT and BIGBASIN_NET.TXT.

When you move to another Tab or invoke the **Keep and Exit** button, COLUMBUS will notify you if the three height components are inconsistent for any station. If they are inconsistent, you will then be prompted for the height component to modify to maintain the general relationship:

ellipsoidal height = orthometric height + geoidal height

Editing ECEF Cartesian Station Data

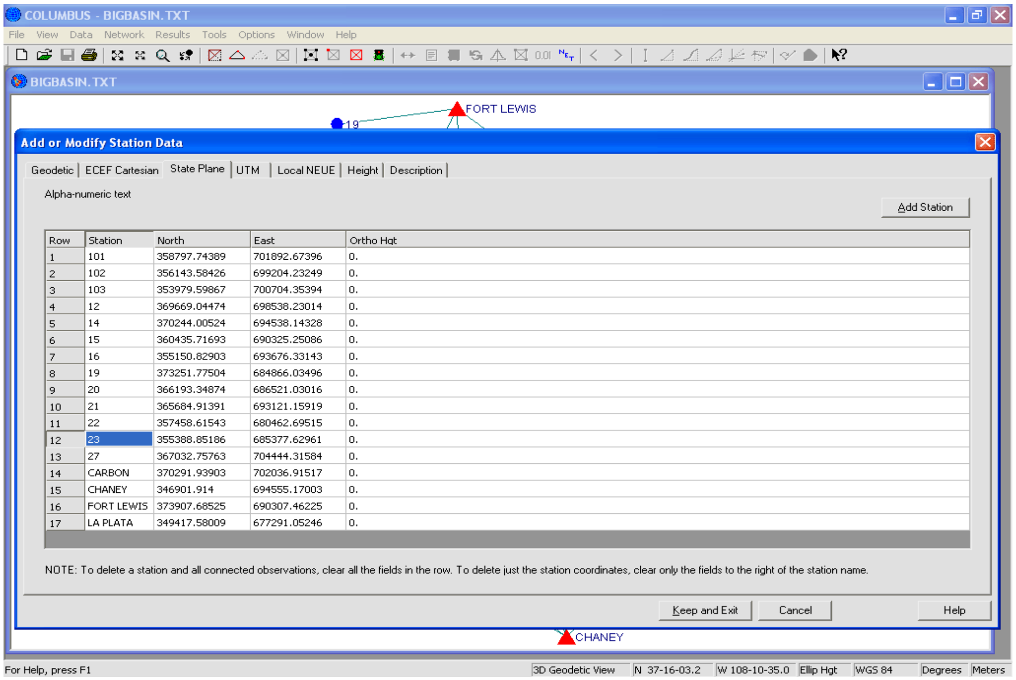
These stations are defined by an Earth Centered Earth Fixed (ECEF) Cartesian X, Y and Z coordinate and are usually provided by GPS measuring equipment. Cartesian coordinates can easily be transformed to 3D geodetic coordinates in the TOOLS module.



For our BIGBASIN.TXT network, the adjusted coordinates were transformed to Cartesian coordinates. Station 20 is highlighted above.

Editing State Plane Station Data

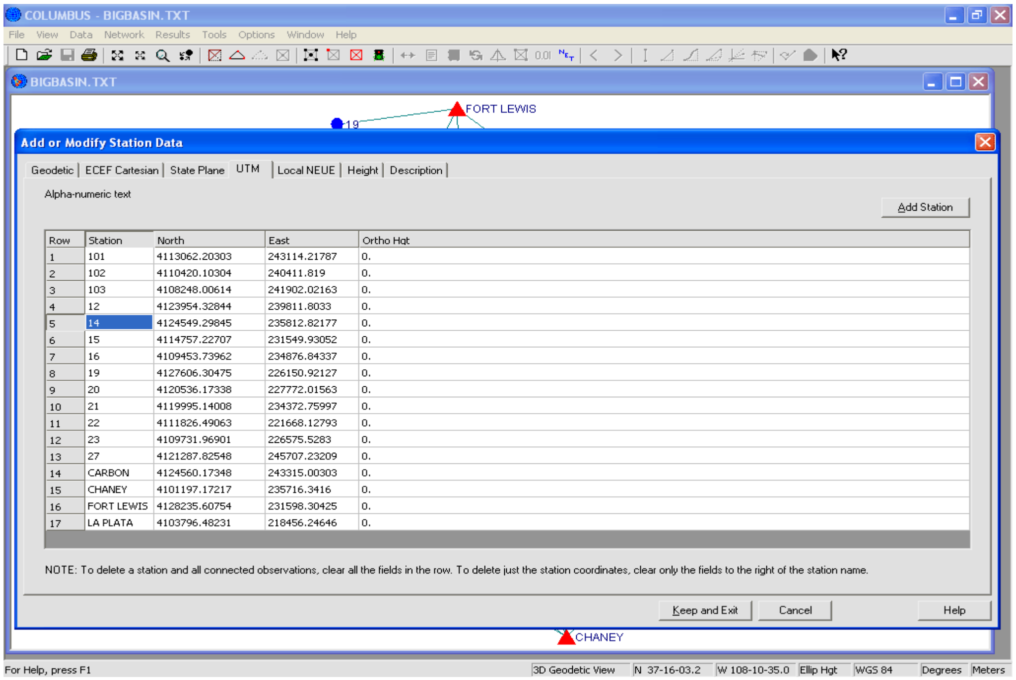
These stations are defined by a State Plane (or Custom Projection) North, East and Orthometric Height coordinate.



For our BIGBASIN.TXT network, the adjusted geodetic coordinates were transformed to State Plane coordinates. Station 23 is highlighted above. Other sample projects using this coordinate type include: STATEPLANE.TXT and STATEPLANE_TRAV.TXT.

Editing UTM Station Data

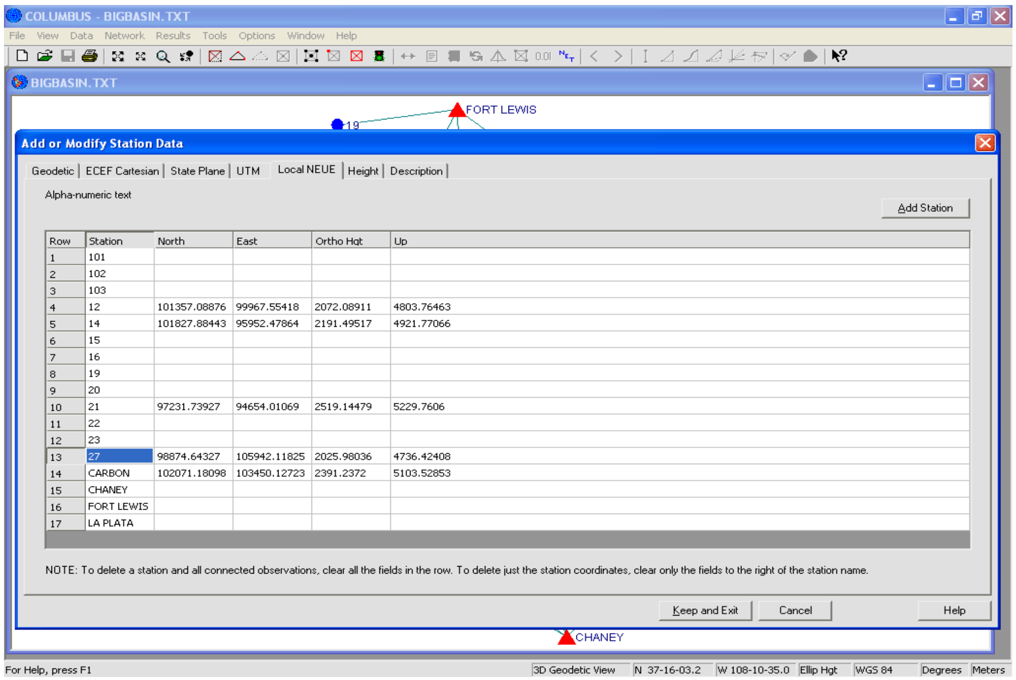
These stations are defined by a UTM, TM, 3TM, (or Custom Transverse Mercator Projection) North, East and Orthometric Height coordinate.



For our BIGBASIN.TXT network, the adjusted coordinates were transformed to UTM coordinates. Station 14 is highlighted above. Other sample projects using this coordinate type include: UTM.TXT and UTM_TRAV.TXT.

Editing Local NEUE Station Data

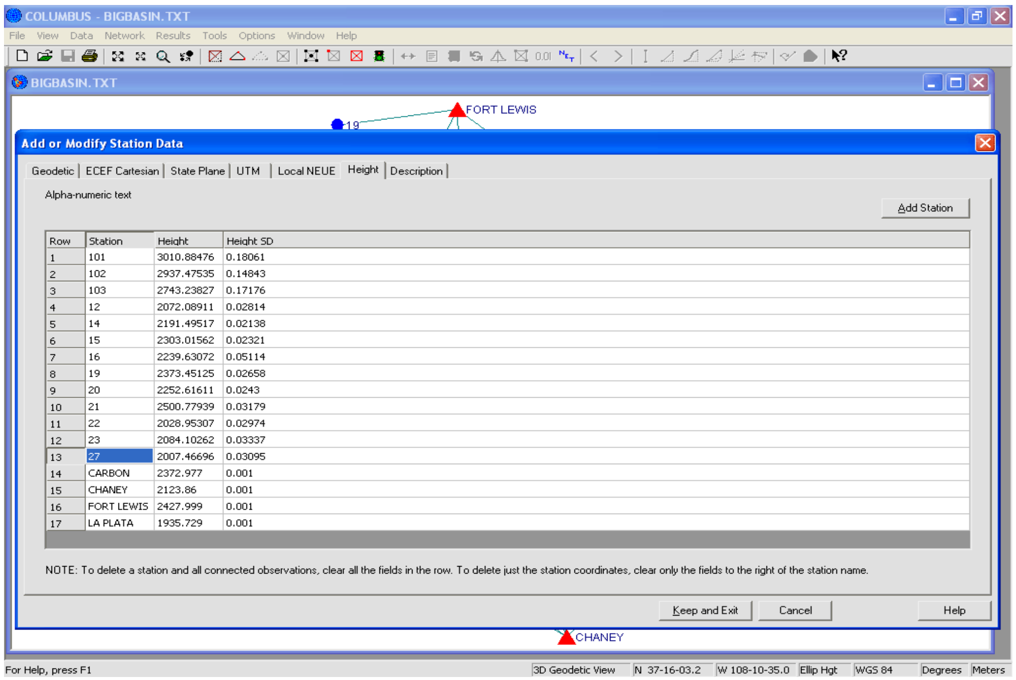
These stations are defined by a Local Horizon North, East, Up and Orthometric Height (Local NEUE) coordinate system. They are equivalent to a rectangular two-dimensional coordinate system with a vertical (Z or Up) component (in effect a local 3D horizon coordinate system.) **The Orthometric Height field is used in 3D Local NEE network adjustments.** The coordinates (NEU) can be transformed to geodetic if the point of tangency between the Local NEU plane and the reference ellipsoid is established.



For our BIGBASIN.TXT network, the adjusted coordinates were transformed to Local NEU coordinates. Station 27 is highlighted above. Other sample projects using this coordinate type include: NEE.TXT and NEE_TRAV.TXT.

Editing Height Station Data

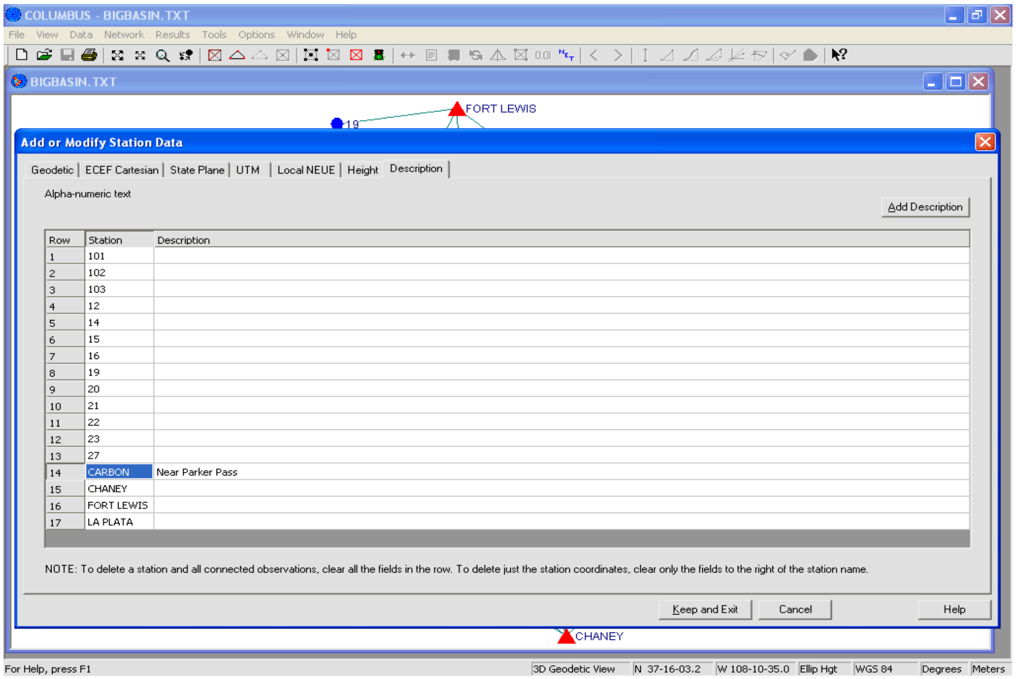
These stations are defined by a height component and are used when building 1D vertical (levelling) networks. If your network is based on differences in ellipsoidal height, the entered station heights should be based on ellipsoidal height. If your vertical network is based on differences in orthometric height (elevation - the most common), the entered station heights should be based on orthometric height.



For our BIGBASIN.TXT network, the adjusted height for each geodetic station was copied to the height station field. The height for station 27 is shown above. Other sample projects using this coordinate type include: VERTICAL.TXT and TRIGLEVEL.TXT.

Editing Station Description

Within this Tab you can enter a description (up to 60 characters) to better describe the station.



Editing Measured Observations Between Stations

The DATA - OBSERVATIONS tab dialogs allow you to edit existing observations or add new observations. COLUMBUS allows for the following types of observations between stations:

Type	Components of Observation Set
Hor/Zen/Chord	Horizontal angle, zenith angle and chord (slope) distance
Dir/Zen/Chord	Direction, zenith angle and chord (slope) distance
Az/Zen/Chord	Astro-Geodetic Azimuth, zenith angle and chord (slope) distance
Bear/Hor Dist	Bearing and horizontal distance
Height Diff	Height difference between stations
North/East/Up	Local delta North, East and Up
Az/Geodesic	Geodesic azimuth and geodesic distance
Az/Geo Chord	Geodetic azimuth and geodetic chord distance
Geo Coordinates	Geodetic coordinates
GPS XYZ	GPS delta XYZ baseline

COLUMBUS allows for any number of observation between stations. **If a complete observation set is not applicable, leave the unwanted observation fields empty.** For example, if only a zenith angle was measured between station ABC and EFG, enter the zenith angle (and its standard deviation) and leave the remaining observation fields blank. If you need to enter a zenith angle and/or chord (slope) distance between two stations, you can use either the Az/Zen/Chord, Dir/Zen/Chord or Hor/Zen/Chord observation set type.

The standard deviation is used to weight each observation. For a network adjustment, the larger the standard deviation of an observation, the greater the adjustment the observation could receive. The implication is that the observation is of poorer quality than observations with smaller standard deviations. Consequently, they should have less influence on the final adjusted coordinates.

Instrument/Target Centering error and PPM corrections are also supported within COLUMBUS. These corrections are applied during adjustment, pre-analysis, and/or traversing. These errors can be setup in three places:

1. Globally within the OPTIONS - NETWORK OPTIONS - CENTERING SD's and PPM DEFAULTS tabbed dialogs. This method will apply the entered values to all observations of the applicable type.

2. Individually by observation set within the DATA - OBSERVATIONS tabbed dialogs.

3. Within the COLUMBUS ASCII (Text) file using the $CENTERING_ and $PPM_ keywords. This method allows you to apply the same values to multiple observations. See Appendix A.

Horizontal centering error refers to the expected error by which the instrument and target are misaligned over the point on the ground. This value is usually very small (within millimeters).

Vertical centering error refers to the expected error by which the measured height of the instrument or target differs from its true value above/below the point on the ground. Like the horizontal centering error, the vertical centering error is usually with a few millimeters or less.

Entered centering errors are probagated to the applicable observation standard deviations. This will influence the computation results. Centering errors should always be entered in the **active linear units**.

PPM corrections refer to the expected errors that should be added to the current distance observation expected errors (standard deviations) in order to arrive at the best standard deviation for the adjustment. Distance measuring instruments are usually rated at some fixed expected error + a parts per million correction. The longer the measured length, the larger the correction applied.

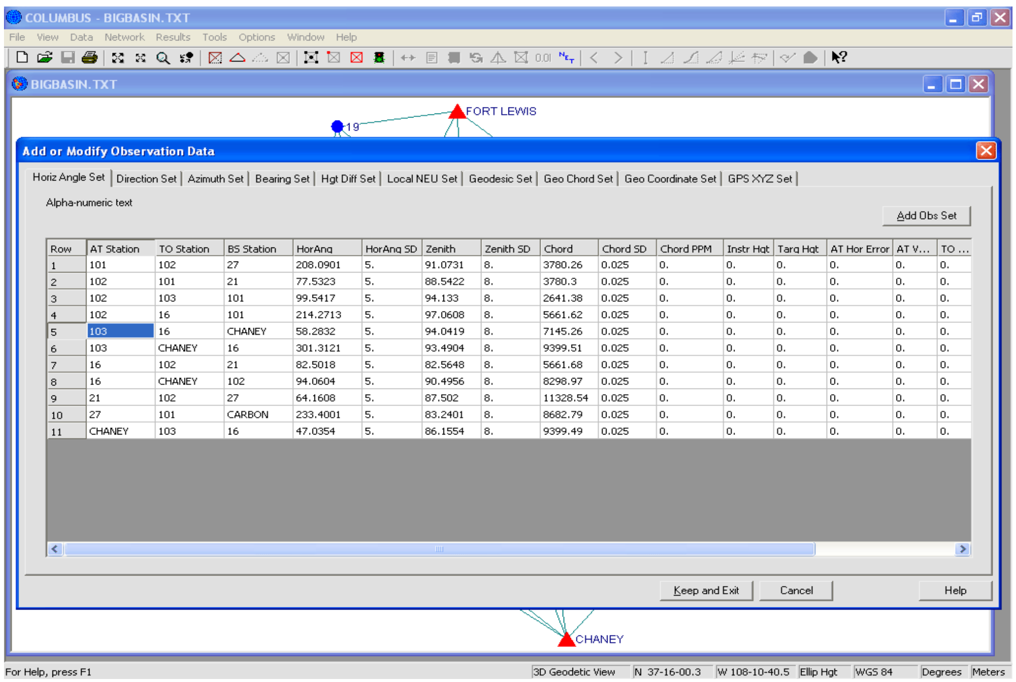
PPM corrections should be entered as a unitless PPM value. A PPM of 6.5 should be entered as 6.5. COLUMBUS will automatically divide this value by one million (1000000.0) before calculating the actual distance standard deviation correction.

Standard deviation correction due to PPM = (PPM / 1000000) * distance.

Editing Horizontal Angle Observation Data

The following screen displays the fields available for the Horizontal Angle observation set. This observation set consists of an astro geodetic horizontal angle, zenith angle and chord (slope) distance. These observations are commonly measured in the field using conventional surveying equipment.

Astro geodetic observations are measured with the instruments leveled in the direction of gravity. They can be automatically corrected to geodetic observations during network adjustment, if the deflections of the vertical are known, or can be estimated at the station they were observed. Geodetic observations are perpendicular to the ellipsoidal normal. The deflection of the vertical is the angular difference between this normal and the direction of gravity.



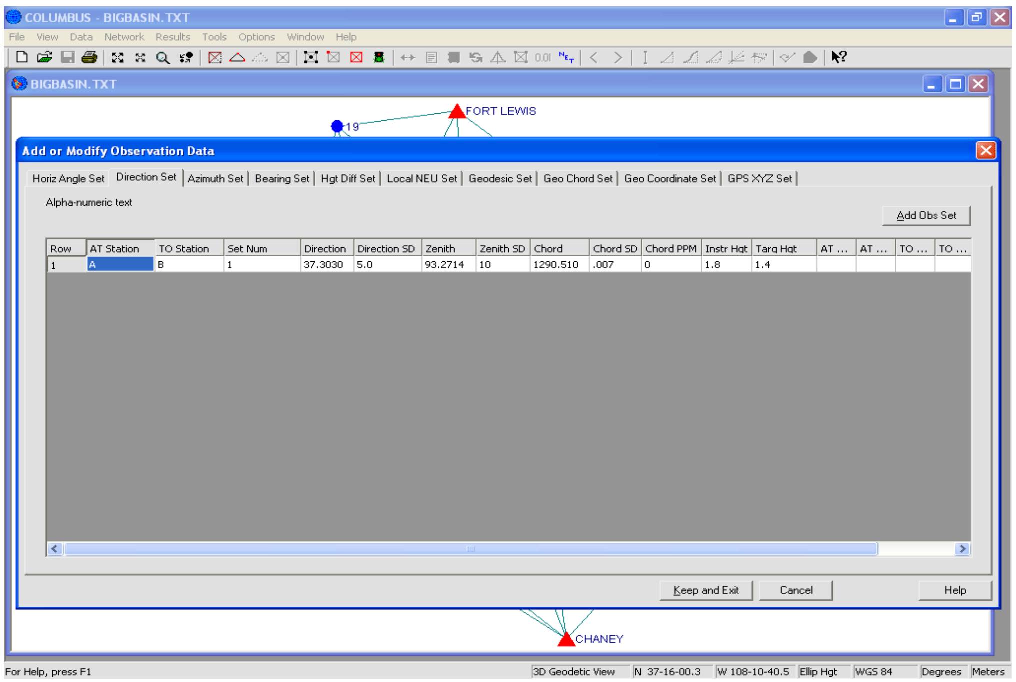
You can apply a zenith angle refraction correction or chord distance correction, but do not reduce the observations to 2D, unless you plan to perform a 2D computation (in which case, COLUMBUS will reduce the observations automatically). For the best 3D results, measure your instrument and target heights as carefully as possible.

This horizontal angle, zenith angle and chord distance can be used in both 2D and 3D networks.

Editing Direction Observation Data

The following screen displays the fields available for the Direction observation set. This observation set consist of an astro geodetic direction, zenith angle and chord (slope) distance. These observations are commonly measured in the field using conventional surveying equipment.

Astro geodetic observations are measured with the instruments leveled in the direction of gravity. They can be automatically corrected to geodetic observations during network adjustment, if the deflections of the vertical are known, or can be estimated at the station they were observed. Geodetic observations are perpendicular to the ellipsoidal normal. The deflection of the vertical is the angular difference between this normal and the direction of gravity.



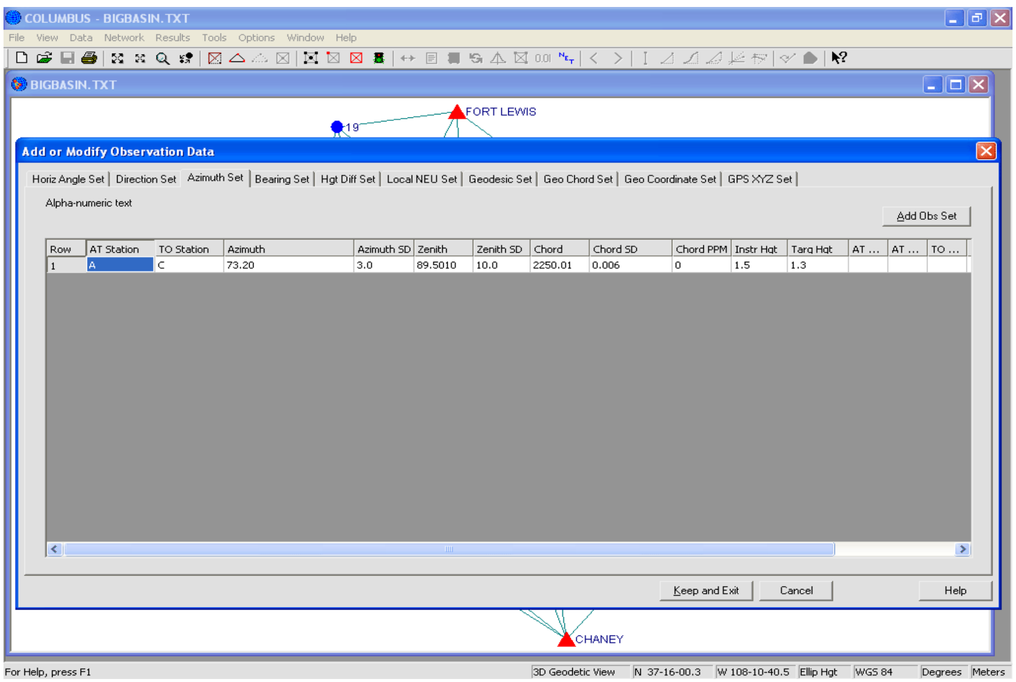
Directions are usually measured in sets. A direction set can have one or more TO stations; the first is usually the backsight or originating station. A set of directions all have the same originating direction. If you measure a set of directions at station AAAA on Monday and then return on Tuesday to measure another set from station AAAA, you should give the new set its own unique Set Number. You can measure up to 100 different direction sets at each station. The direction set number can range in value from 1 to 999999.

You can apply a zenith angle refraction correction or chord distance scale correction, but do not reduce the observations to 2D, unless you plan to perform a 2D computation (in which case, COLUMBUS will reduce the observations automatically). For the best 3D results, measure your instrument and target heights as carefully as possible.

Editing Azimuth Observation Data

The following screen displays the fields available for the Azimuth observation set. This observation set consists of an astro geodetic azimuth, zenith angle and chord (slope) distance. These observations are commonly measured in the field using conventional surveying equipment. The azimuth can be determined through celestial observation or by inverse computation between two known geodetic stations.

Astro geodetic observations are measured with the instruments leveled in the direction of gravity. They can be automatically corrected to geodetic observations during network adjustment, if the deflections of the vertical are known, or can be estimated at the station they were observed. Geodetic observations are perpendicular to the ellipsoidal normal. The deflection of the vertical is the angular difference between this normal and the direction of gravity.



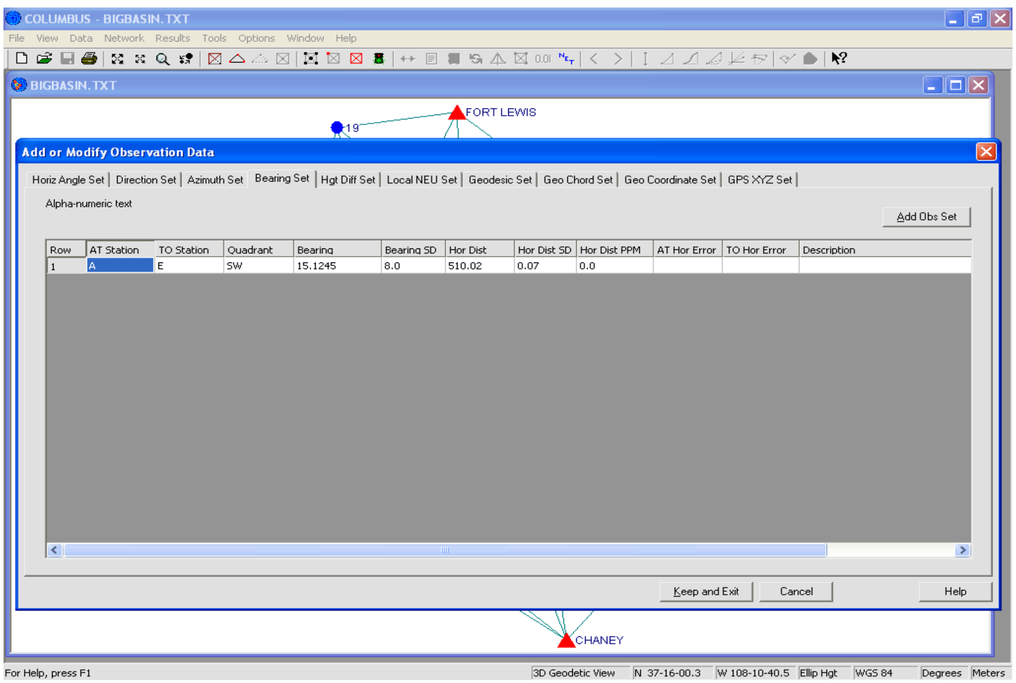
You can apply a zenith angle refraction correction or chord distance scale correction, but do not reduce the observations to 2D, unless you plan to perform a 2D computation (in which case, COLUMBUS will reduce the observations automatically). For the best 3D results, measure your instrument and target heights as carefully as possible.

Editing Bearing Observation Data

The following screen displays the fields available for the Bearing observation set. This observation set consists of a bearing and horizontal distance.

The bearing can be an average bearing between a station pair, in which case COLUMBUS has an optional switch to rotate it to a true azimuth during a network adjustment; or a bearing which is analogous to a true azimuth observation, but in quadrant form.

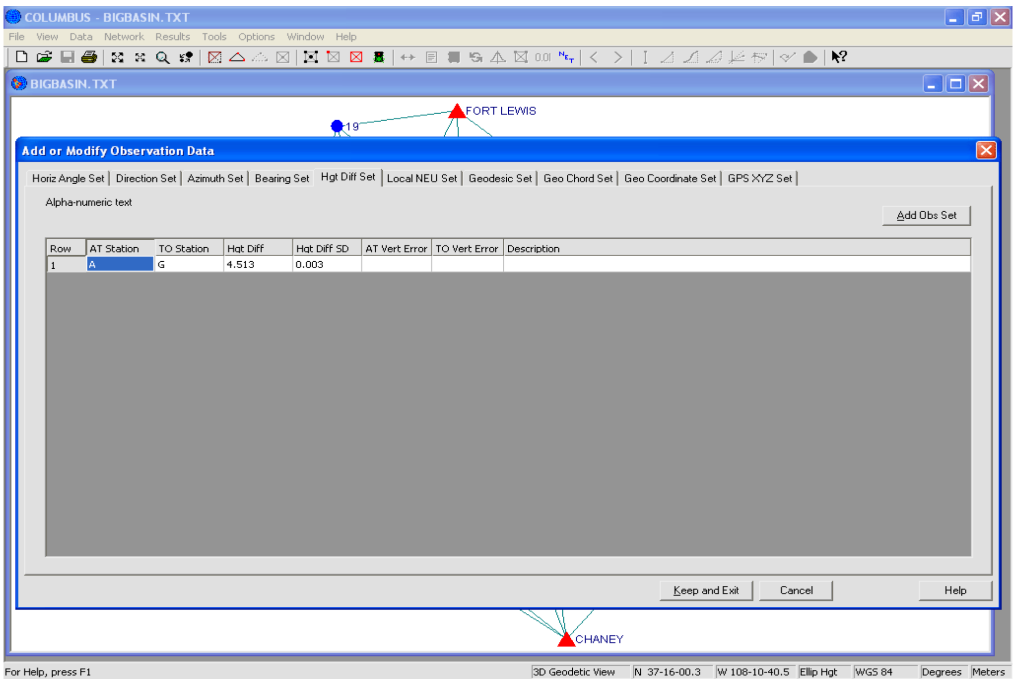
The horizontal distance is a local horizon tangent plane horizontal distance measured from the AT station to the TO station. It should be based on the *sin (zenith angle) x chord (slope) distance* measured from the AT station. It is **not** a mean horizontal distance; however, for uniform terrain and short distances, there is little difference between the two.



Editing Height Difference Observation Data

The following screen displays the fields available for the Height Difference observation set. This observation set consists of a difference in height between the AT and TO station pair. This type of observation is usually obtained through spirit levelling surveys.

The Height Difference Standard Deviation (Stan Dev) field is used to weight each height difference observation. **For 3D geodetic networks, this field is always interpreted as a standard deviation. For 1D vertical networks, this field can be interpreted as the distance between the stations, the number of setups between the stations or the standard deviation of the height difference observation**. How it is interpreted is dependent on the 1D Vertical Network setting in the OPTIONS - NETWORK OPTIONS - NETWORK SETTINGS dialog.



For 1D vertical networks, the weight for an observation of this type is either:

$$\frac{1}{Distance\ or\ Setups}$$ (for networks weighted by distance or number of setups) or

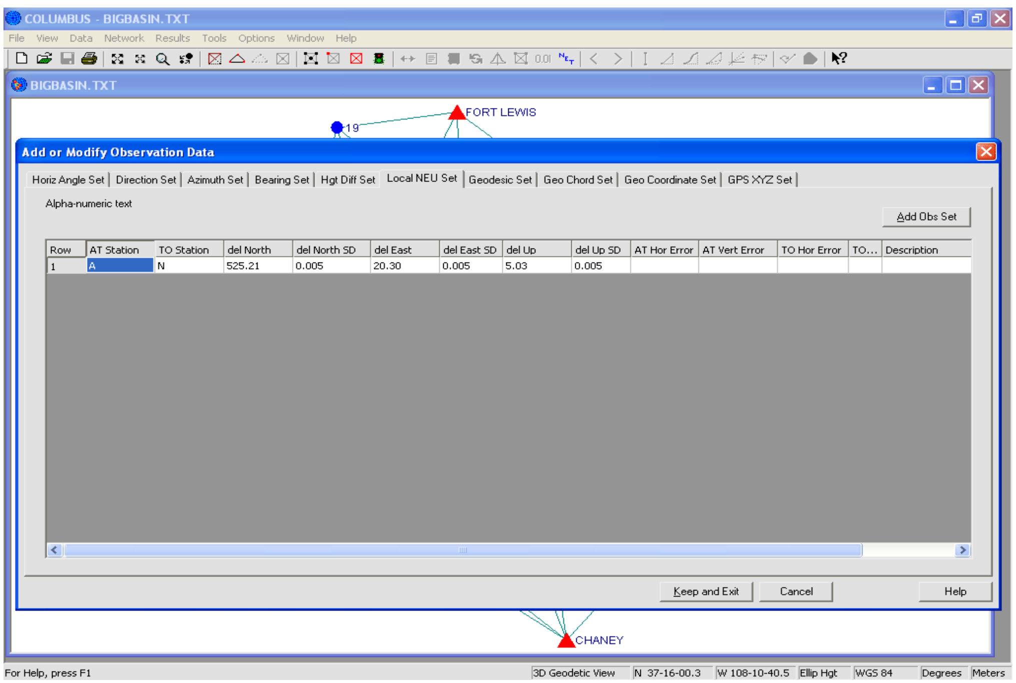
$$\frac{1}{Standard\ Deviation^{\ 2}}$$ (for networks weighted by standard deviation).

The maximum value that can be entered into the standard deviation field is 30.0 meters. When weighting an adjustment by number of setups or distances, you may need to scale the values to make them smaller. For example, when using distances that range from 30.0 meters to 1000.0 meters (as a weighting strategy), you will need to scale them down by at least 100 (to 0.30 to 10.0 respectively).

Editing Local NEU Observation Data

The following screen displays the fields available for the local horizon NEU observation set. This observation set consists of a local delta North, local delta East and local delta Up offset from the AT station. They are based on a local horizon plane tangent to the Earth at the AT station. Occasionally, you may see GPS baselines expressed in this form.

For short distances (a few hundred meters), the local horizon delta North, delta East and delta Up observation set from the AT station to the TO station would be similar to a local horizon delta North, delta East and delta Up observation set from the TO station to the AT station; only the signs will differ. As the two stations become farther apart, the local horizon tangent planes at the AT and TO stations will be oriented differently and the observation sets (forward and backward) will differ significantly, but their magnitude will be the same.

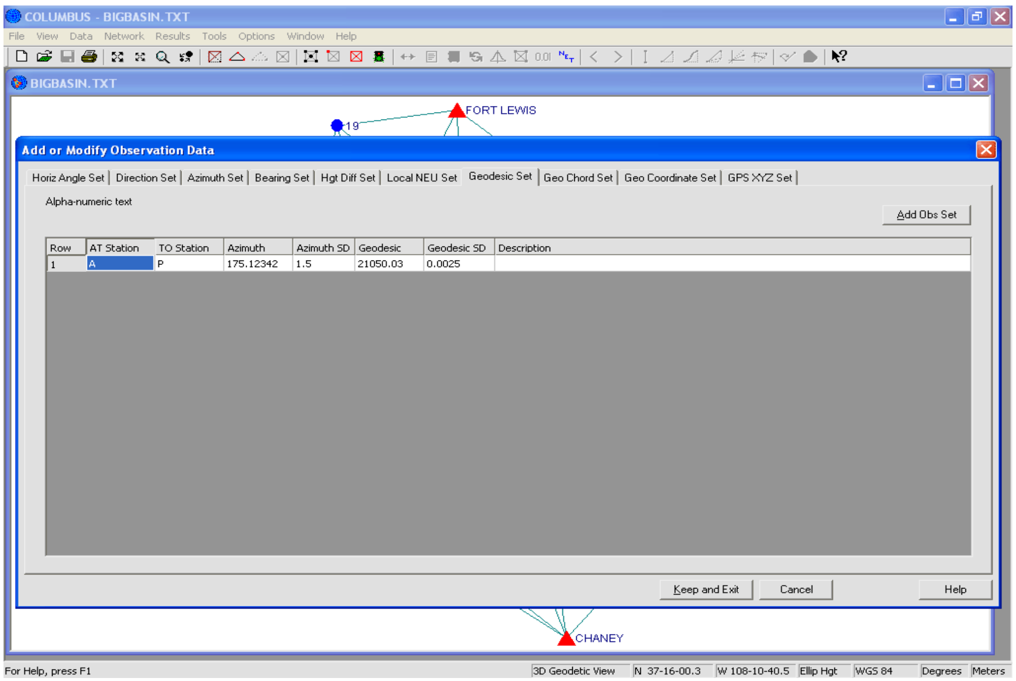


The North, East and Up components can be used in 3D networks. The North and East components can be used in 2D networks. The Up component can be used in 1D vertical networks.

Editing Geodesic Observation Data

The following screen displays the fields available for the Geodesic observation set. This observation set consists of a geodetic azimuth and geodesic distance. These observations are based on the surface (ellipsoidal height = zero) of the reference ellipsoid. The geodesic azimuth is an azimuth along the ellipsoidal surface. The geodesic distance is the shortest distance between the two stations along the ellipsoidal surface.

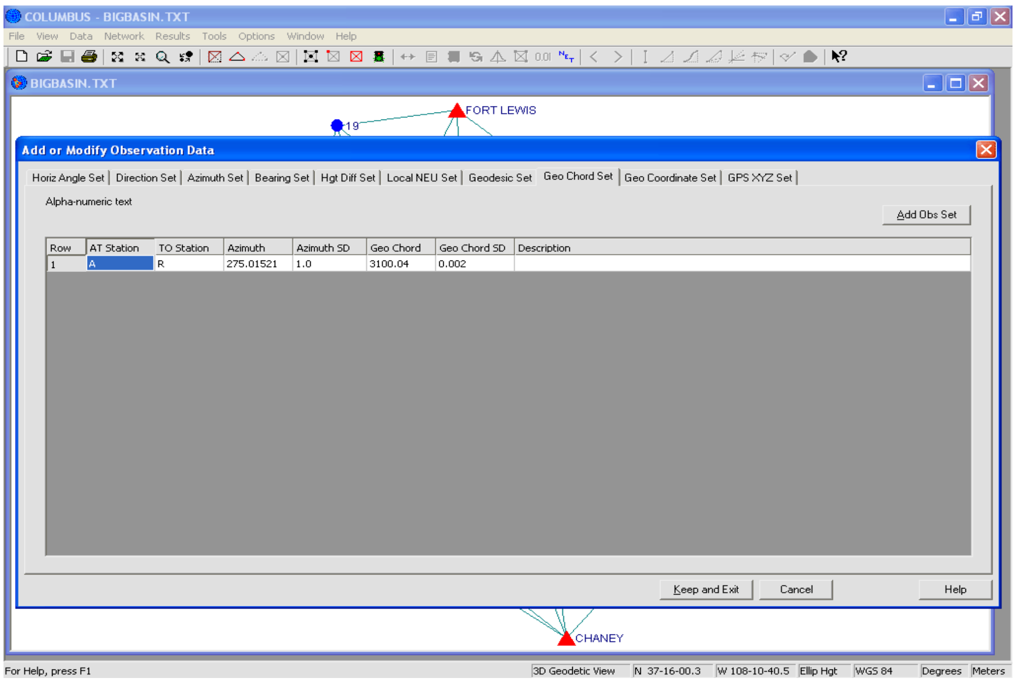
Most users will not use this type of observation set. However, if you have historical data of this type, you can integrate these observations into your 2D or 3D network adjustments.



Editing Geo Chord Observation Data

The following screen displays the fields available for the Geo Chord observation set. This observation set consists of a geodetic azimuth and chord distance. These observations are based on the surface (ellipsoidal height = zero) of the reference ellipsoid. The chord distance is a true chord distance between the two stations computed at an ellipsoidal height of zero, and it actually cuts through the ellipsoidal surface.

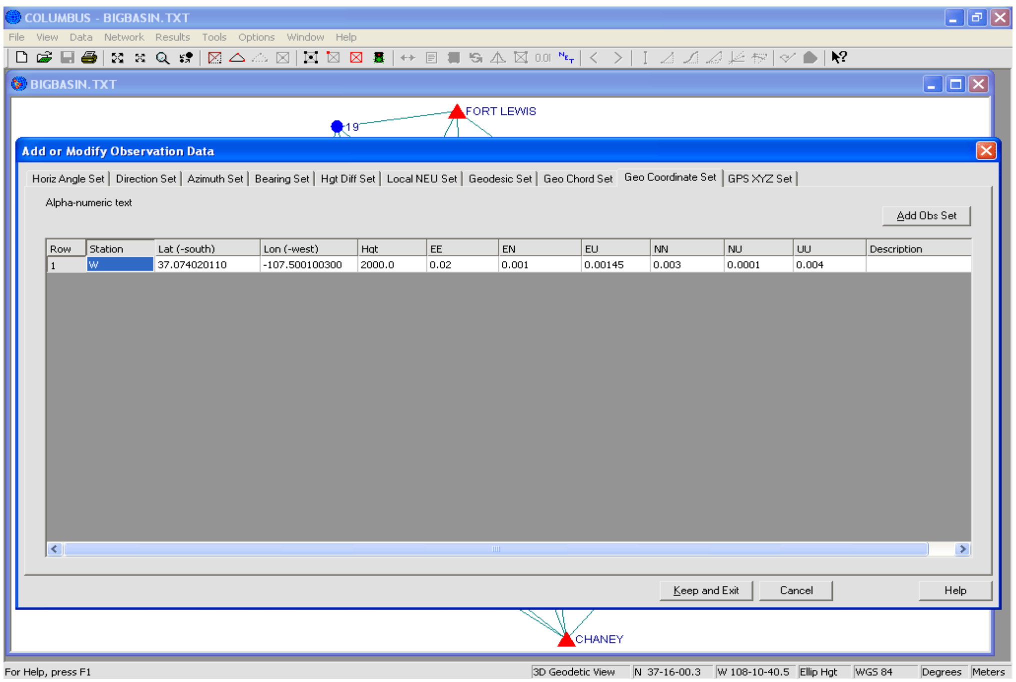
Most users will not use this type of observation set. However, if you have historical data of this type, you can integrate these observations into your 2D or 3D network adjustments.



Editing Geodetic Coordinate Observation Data

The following screen displays the fields available for the Geodetic Coordinate observation set. This observation set consists of a Latitude, Longitude and Height. If your adjustment will be based on orthometric height, provide orthometric height in this dialog. If your adjustment will be based on ellipsoidal height, provide ellipsoidal height in this dialog.

Coordinate observations are usually obtained from statistical output of prior surveys. This observation type is generally used to introduce statistical position uncertainty from prior surveys into the current survey analysis. **This observation type is also automatically generated by COLUMBUS when importing NGS (National Geodetic Survey) OPUS files.**



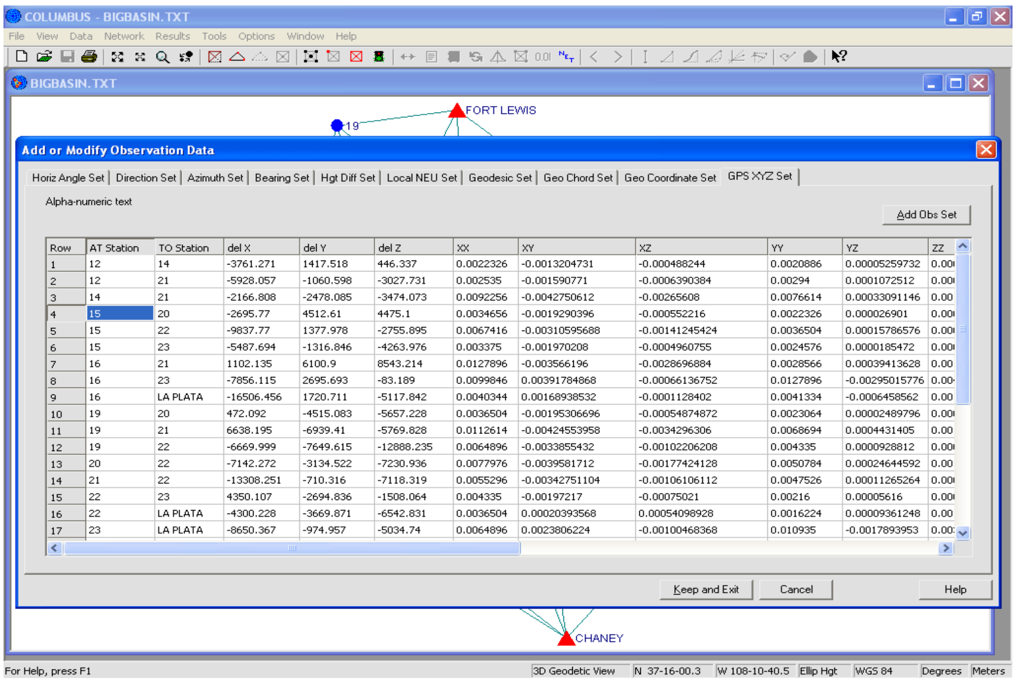
The variance-covariance matrix (shown here as EE, EN, EU, NN, NU and UU) is used to weight each coordinate observation in an adjustment. Its diagonal elements (EE, NN and UU) represent the variance of each observation (lon, lat and hgt, respectively). The square root of the EE, NN or UU variance is the standard deviation for the lon, lat and hgt observation, respectively. The off-diagonal elements (EN, EU and NU) are a measure of how the lon, lat and hgt components, respectively, are correlated (i.e., how the change in lon will affect a change in lat, etc.).

The Geodetic Coordinate observation set can be used in 2D and 3D geodetic networks.

Editing GPS XYZ Observation Data

The following screen displays the fields available for the GPS XYZ observation set. This observation set consists of an Earth Centered Earth Fixed (ECEF) Delta X, Y and Z vector. As the name implies (ECEF), these observations are usually based on the origin of the WGS 84 datum (near the center of the Earth). These types of measurements are made with GPS receivers designed for surveying applications.

The variance-covariance matrix (shown here as XX, XY, XZ, YY, YZ and ZZ) is used to weight each baseline in an adjustment. Its diagonal elements (XX, YY and ZZ) represent the variance of each observation (dX, dY and dZ, respectively). The square root of the XX, YY or ZZ variance is the standard deviation for the Delta X, Y or Z observation, respectively. The off-diagonal elements (XY, XZ and YZ) are a measure of how the dX, dY and dZ components, respectively, are correlated (i.e., how the change in X will affect a change in Y, etc.).

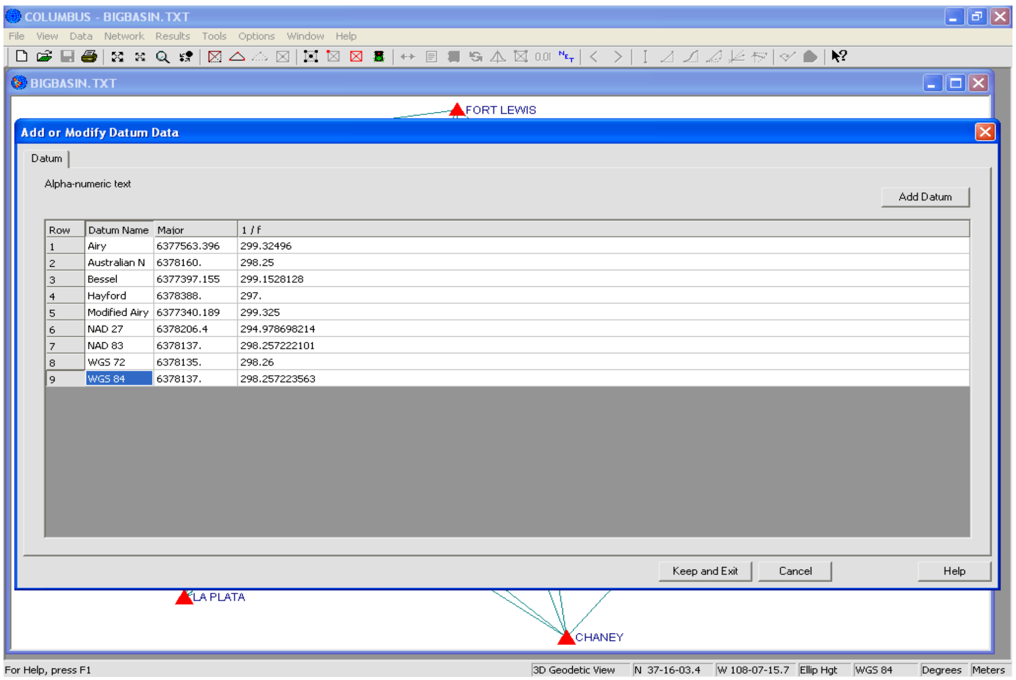


For a geodetic network adjustment, the larger the variance-covariance matrix, the greater the adjustment the baseline may receive. The implication is that the observation set (baseline) is of poorer quality than observation sets with smaller variance-covariance matrices. Consequently, they should have less influence than the better observation sets on the final adjusted coordinates.

The GPS XYZ observation set can only be used in 3D networks.

Editing Datum Data

This DATA - DATUMS dialog allows you to add and edit datums within COLUMBUS. COLUMBUS can maintain up to 250 different datum definitions for each Options Set within the Options Library (See Options Chapter). These datum definitions can be changed or removed at any time. If you need to restore the datum definitions shipped with COLUMBUS, simply reenter the datum data (found in the GETTING STARTED chapter of this manual).



When adding a new datum or modifying an existing dataum use the following units.

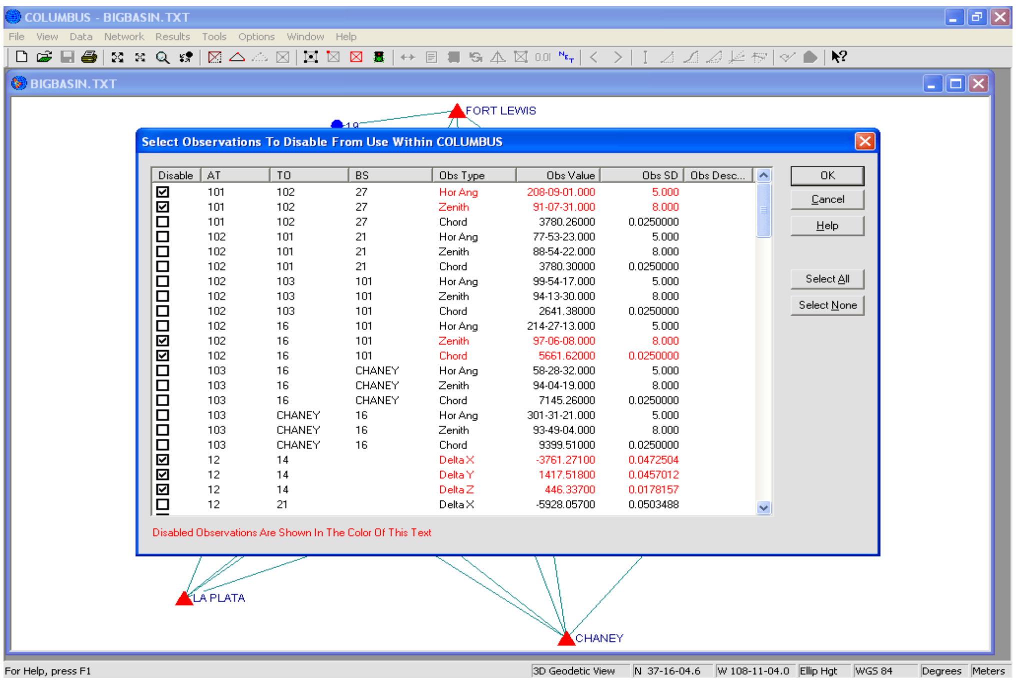
- The Major axis must **always** be entered in meters.
- The 1/f (f = flattening) is a unitless quantity.

In the screen above, the datum definition for the WGS 84 datum is shown.

Disable Observations

The DATA - DISABLE OBSERVATIONS dialog allows you to disable one or more observations within COLUMBUS. Disabled observations can also be set up in the COLUMBUS ASCII (Text) input file by using the $DISABLE_OBS_POS keywords (see Appendix A). Disabled observations will not appear in the Observation Selection dialog for network adjustments, network pre-analysis, or COGO traversing.

To disable and observation, check the box in the applicable observation list row. Upon disabling an observation, the text (in the list) will change color (configured in the OPTIONS - COLORS dialog). The line (representing the observation) in the graphical view will also change to this configured color.



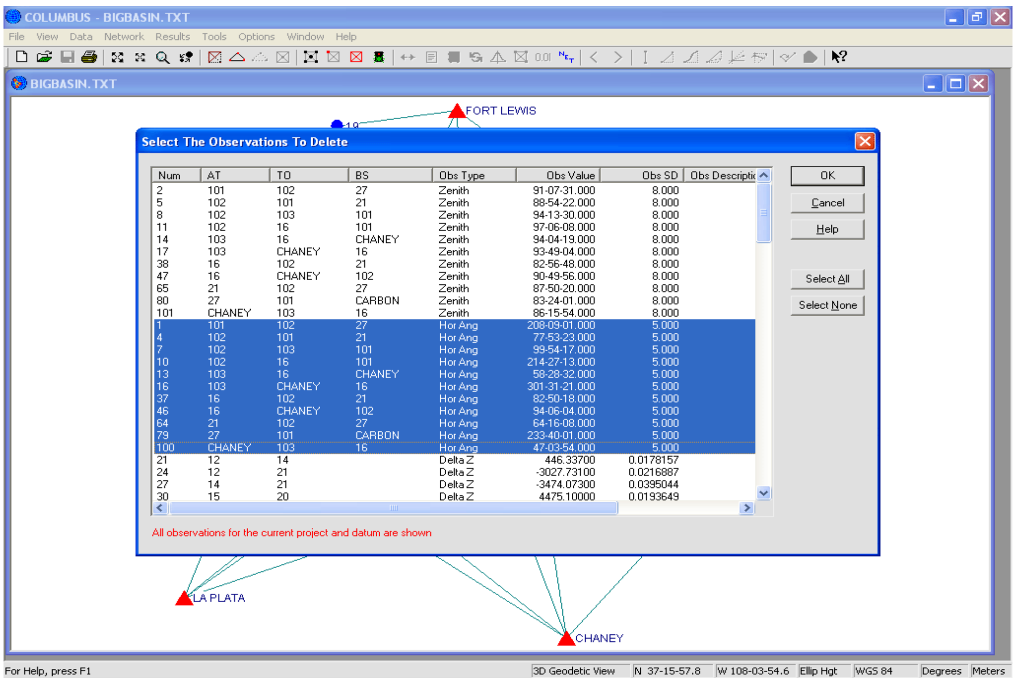
You can also disable observations within three of the adjusted report views; the adjusted observations view, the outlier observations view, and the no-check observations view. To enable a disabled observation, return to this dialog and uncheck the observation.

Delete Observations

The DATA - DELETE OBSERVATIONS dialog allows you to delete one or more observations (as a group) from your project.

To delete one or more horizontal angle observations, click on the Obs Type column to order all observations by observation type. Select the applicable horizontal angle observations (Hor Ang) to delete, then click on the OK button.

Selected observations are deleted from memory only. Your project file will not be changed until you re-save the project.



Observations can also be deleted within the observation grids. However, this tool may be easier in certain situations.

Delete Stations

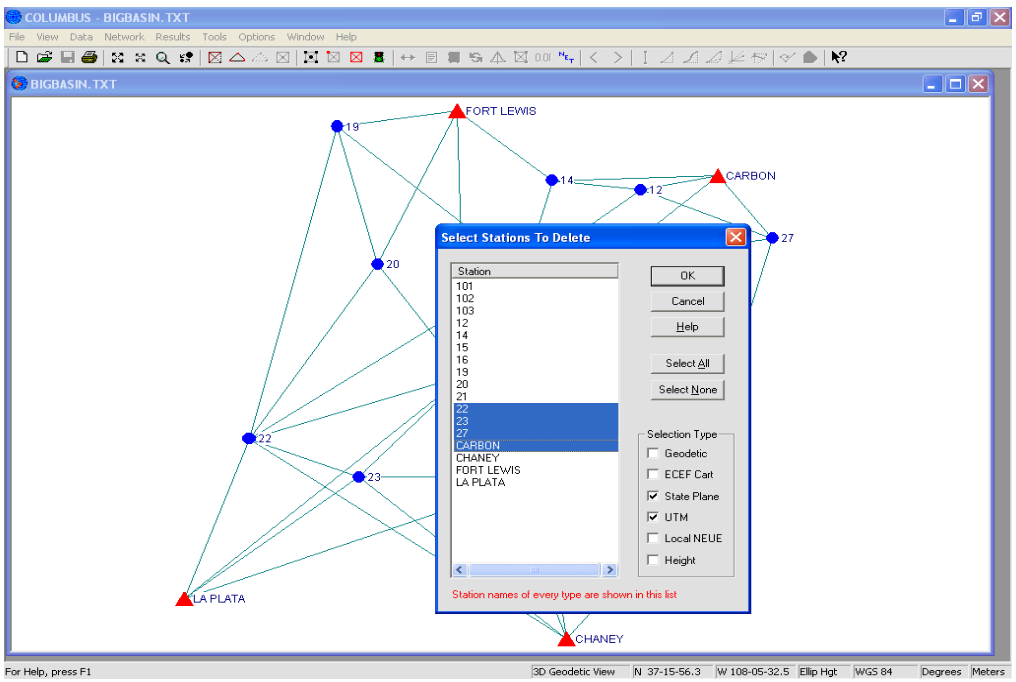
The DATA - DELETE STATIONS dialog allows you to delete one or more station types from your project.

Stations are deleted by the selected Station Type. To completely remove all traces of a station, put a check mark next to every possible station type. Then, pick one or more stations and click on the OK button.

If there are no stations of a certain type, that station type check box will be disabled.

When a station is completely removed (all types for that station name), all observations linked to that station (as a BS, FS, or AT station) will be deleted as well.

Selected stations (and any applicable observations) are deleted from memory only. Your project file will not be changed until you re-save the project.



Entire stations or individual coordinate types can also be deleted within the applicable station grids. However, this tool may be easier in certain situations.