NavView User Guide – 03 Geodesy

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3. GEODESY

If Roles and Privileges are enabled, the following are what is allowed for each role:

Roles	Privileges
Not Logged In	Cannot add, edit or remove a Horizontal or Vertical CRS
User	Cannot add, edit or remove a Horizontal or Vertical CRS
Online/Supervisor	Cannot add, edit or remove a Horizontal or Vertical CRS
Admin (Administrator)	Can add, configure/edit or remove a Horizontal or Vertical CRS

3.1 EPSG DATABASE

NavView has adopted the European Petroleum Survey Group (EPSG) Geodetic Parameter Set maintained and published by the Geomatics Committee of the International Association of Oil and Gas Producers (OGP) (https://spatialreference.org/ref/). This dataset includes parameters for Coordinate Reference Systems (CRS), coordinate operations and units, each with its own unique identifier.

The NavView installation and update processes copy the EPSG database included in the installation package to the following folder:

C:\ProgramData\4D Nav\Geodesy\EPSG

Note: When User defined Horizontal CRS and transformations are added to NavView, these are written to the EPSG database file located in this folder. If a NavView update is applied, the EPSG database file located in this folder will be overwritten resulting in the loss of these. Therefore, it is recommended that when using User defined CRS and/or transformations, a backup copy of the EPSG database file be kept so it can be copied back to the above folder after any NavView updates.

3.2 COORDINATE REFERENCE SYSTEMS

NavView uses EPSG Horizontal and Vertical CRS. A Horizontal CRS can be Geographic 2D or Projected.

A Geographic 2D CRS is used for positioning on the surface of an ellipsoid, i.e., latitude and longitude. Associated with the Geographic 2D CRS is a datum defining the relationship of the CRS to the earth. An example of a Geographic 2D CRS is *WGS 84*.

A Projected CRS is used for positioning on a map projection. A Projected CRS always has a source Geographic CRS and therefore an associated datum. Examples of a Projected CRS are *WGS 84 / UTM zone 31N*, whose source Geographic CRS is WGS 84, and *ED50 / UTM zone 31N*, whose source Geographic 2D CRS is ED50.

A Vertical CRS uses the direction of gravity in the definition of the height and depth of a position. An example of a Vertical CRS is Mean Sea Level (MSL).

Note: EPSG also supports a Geographic 3D CRS for position on and above/below the ellipsoid. However, NavView supports the use of a separate EPSG based Vertical datum in conjunction with either the Geographic 2D or Projected CRS. This is referred to as a Compound CRS.

In addition, NavView supports user defined CRS for cases where the EPSG database does not address the requirements. These are added to the local copy of the EPSG database and available for use in the same manner as standard EPSG CRS are.

NavView allows the operator to add multiple Horizontal CRS to be used as required for a given project, one of which at any given time is set to be the Working CRS. This enables NavView to support switching back and forth between contiguous map projection zones in real time and to accept and output positions in a CRS other than WGS 84 or the local working datum. The former facilitates operations that start in one zone and finish in another, such as a rig move. The latter is of particular interest when working with USBL and DP systems that are configured to present and accept positions in WGS 84 UTM.

Note: Only a Projected CRS can be set to Working because the Working requires both map projection and geographic coordinate support.

Note: NavView automatically adds the WGS 84 Geographic 2D CRS, EPSG code 4326. This CRS cannot be removed.

Note: When NavView opens a new project, the Projected CRS WGS 84 / World Mercator, EPSG code 3395, is automatically added and set to Working.

Similarly multiple Vertical CRS with their associated transformations can be added and used with only one set as Working at any one time.

3.3 TRANSFORMATIONS

The transformations supported by NavView are as defined by EPSG and included in the EPSG database.

In addition, NavView supports user defined transformations for cases where the EPSG database does not address the requirements. These are added to the local copy of the EPSG database and available for use in the same manner as standard EPSG transformations are.

The following user defined transformations are included with the EPSG database shipped with NavView installations:

- EPSG Code 99010 ITRF2014 to NAD27(1)
  - Source CRS: ITRF2014 EPSG Code 9000
  - Target CRS: NAD27 EPSG Code 4267
- EPSG Code 99020 ITRF2014 to NAD83(CSRS)(1)
  - Source CRS: ITRF2014 EPSG Code 9000
  - Target CRS: NAD83(CSRS) EPSG Code 4617
- EPSG Code 99030 ITRF2014 to ETRS89(1)

- Source CRS: ITRF2014 EPSG Code 9000
- Target CRS: ETRS89 EPSG Code 4258

- EPSG Code 99040 ITRF2008 to NAD27(1)
  - Source CRS: ITRF2008 EPSG Code 8999
  - Target CRS: NAD27 EPSG Code 4267
- EPSG Code 99050 ITRF2014 to WGS84(1)
  - Source CRS: ITRF2014 EPSG Code 9000
  - Target CRS: WGS84 EPSG Code 4326
- EPSG Code 99060 ITRF2014 to NAD83(2011)(1)
  - Source CRS: ITRF2014 EPSG Code 9000
  - Target CRS: NAD83(2011) EPSG Code 6318
- EPSG Code 99061 ITRF2014 to NAD83(2)
  - Source CRS: ITRF2014 EPSG Code 9000
  - Target CRS: NAD83 EPSG Code 4269

3.4 COORDINATE OPERATIONS

The NavView geodesy supports standard coordinate operations, changing coordinates from one CRS (source) to another CRS (target). Conversions refer to coordinate changes where the datum of the source and target CRS is the same. For example, the conversion of WGS 84 / UTM zone 31N map projection coordinates to WGS 84 geographic coordinates.
Transformations refer to coordinate changes where the datum of the source and target CRS are different. For example, WGS 84 to ED50.

3.5 ACCESS GEODESY CONFIGURATION

The Geodesy configuration is viewed and configured via the Project Explorer or the Setup ribbon.

1. Expand Setup Ribbon.
2. Click the Horizontal CRS button in the Project section.

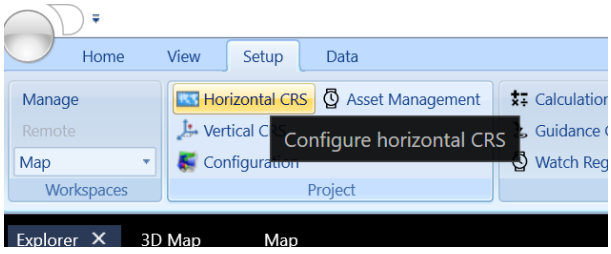

FIGURE 3-1 HORIZONTAL CRS CONFIGURATION ACCESS

3. Click the Vertical CRS button in the Project section.

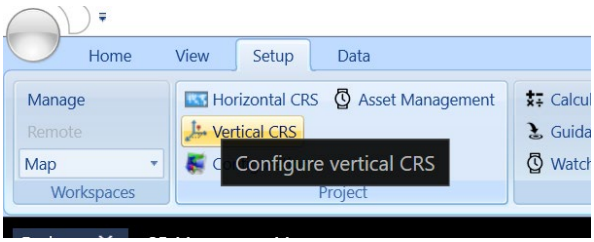

FIGURE 3-2 VERTICAL CRS CONFIGURATION ACCESS

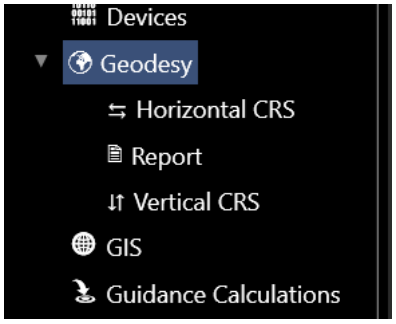

FIGURE 3-3 ACCESS IN EXPLORER

3.6 USING THE HORIZONTAL CRS VIEW

The Horizontal CRS view presents the Horizontal CRS and associated coordinate operations for review and editing. The view has two main tabs: Horizontal CRS and Transformations. Each of these displays a list of the respective items in the left panel and associated Details and Test tabs in the right panel. The Details tab includes hypertext (underlined blue text) that when clicked expand to provide additional information for that item.

3.6.1 HORIZONTAL CRS TAB

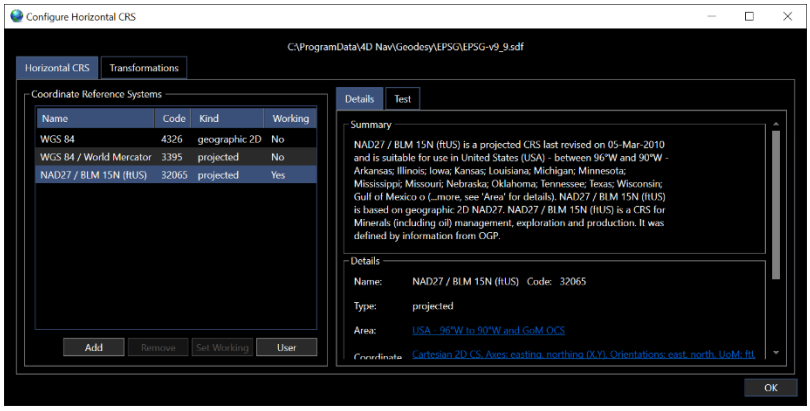

FIGURE 3-4 HORIZONTAL CRS - DETAILS TAB

Coordinate Reference Systems lists the Horizontal CRS currently setup for use in NavView in a data grid sortable by columns.

Name: EPSG name or user entered name

Code: EPSG code, including those assigned to user created CRS

Kind: Projected or geographic 2D

Working: Yes, if CRS is the Working Projected CRS, No if not

Details tab displays the parameters for the selected CRS. Click on the hyperlinks in the Details to view the EPSG details for that item.

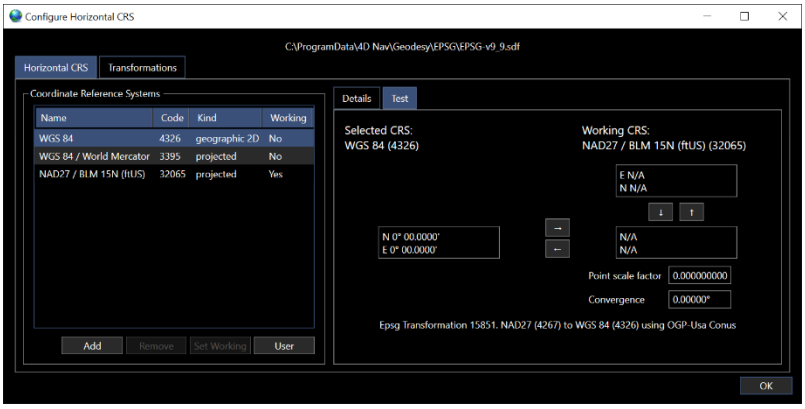

FIGURE 3-5 HORIZONTAL CRS - TEST TAB

Test tab displays the coordinate operations for the selected CRS with respect to the Working CRS.

Selected	**Coordinate Operations**
Projected CRS:	Selected Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
	Selected source Geographic 2D coordinate transformation to/from Working Projected CRS source Geographic 2D CRS
	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
Geographic 2D:	Selected source Geographic 2D coordinate transformation to/from Working Projected CRS source Geographic 2D CRS
	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
Working CRS:	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates

3.6.2 TRANSFORMATIONS TAB

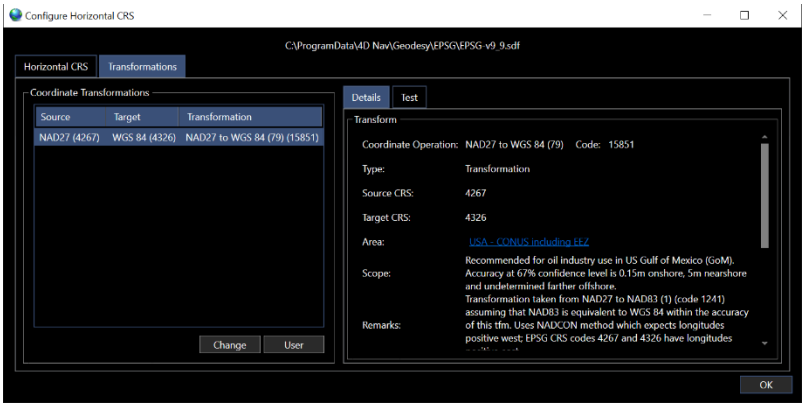

FIGURE 3-6 TRANSFORMATIONS – DETAILS TAB

Coordinate Transformation lists all the coordinate transformations required to support transformations between any of the CRS currently setup for use in NavView. These are displayed in a data grid sortable by columns.

Source: EPSG or user assigned name and code of the source geographic 2D CRS

Target: EPSG or user assigned name and code of the target geographic 2D CRS

Transformation: EPSG or user assigned name and code of the transformation

Details tab displays the parameters for the selected transformation. Click on the hyperlinks in the Details to view the EPSG details for that item.

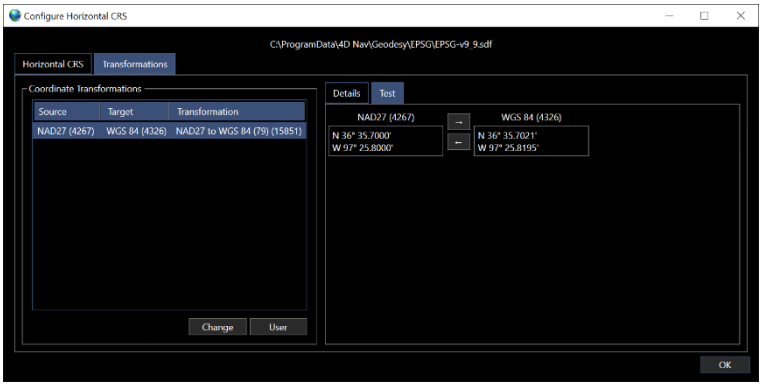

FIGURE 3-7 TRANSFORMATIONS - TEST TAB

Test tab displays the coordinate operation for the selected transformation, Source Geographic 2D CRS coordinate transformation to/from the target Geographic 2D CRS.

3.6.3 ADD A HORIZONTAL CRS TO NAVVIEW

All CRS that are required for a specific NavView application must be added to be available for use. This includes the Working CRS to be used for the general NavView operation as well as

any required to support special operations such as position output, input or included in a report where the position is not on either the WGS84 or Working CRS. For example, providing WGS84 UTM coordinates for a DP system.

In addition, if a project spans multiple map projection zones, i.e., multiple Projected CRS, each of these must be added.

1. Access the Horizontal CRS view.
2. Select Horizontal CRS tab.
3. Click Add to launch a wizard to step through the searching for and adding of a CRS.

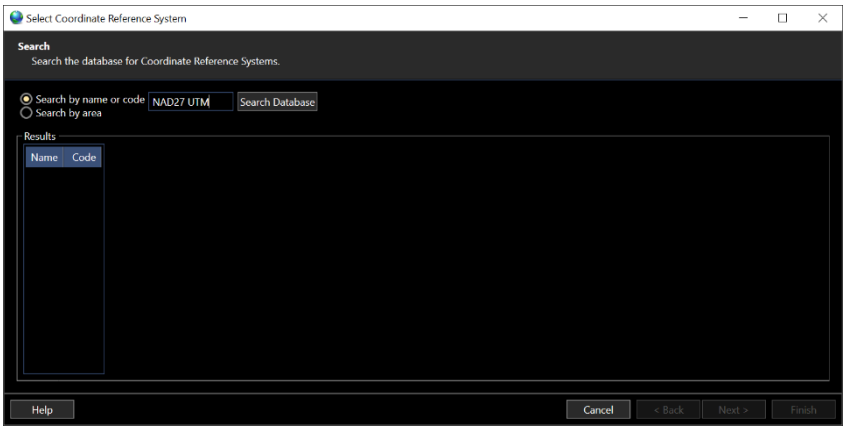

FIGURE 3-8 SELECT CRS - SEARCH BY NAME OR CODE

4. Select Search by name or code if either have been provided.
   a. Enter the EPSG code or name in the associated entry box and click Search Database

Note: The EPSG code and name options include user created CRS. These are assigned an EPSG code when assigned and added to the local database.

Note: When entering a name, the search looks for those EPSG CRS whose name or alias contains the entry after removing the blanks (whitespaces) in both the entry and CRS name and alias. For example, entering **ed50** will result in a list of all EPSG CRS with ED50 in the name, such as ED50 and ED50 / TM 0 N; entering **ed50/utm** will result in a list of ED50 / UTM zone 28N to ED50 / UTM zone 38N.

Note: When entering the EPSG CRS code, the search is specific and only lists the EPSG CRS with that exact code.

5. Or select Search by area if unsure of the EPSG code or name of the required CRS.

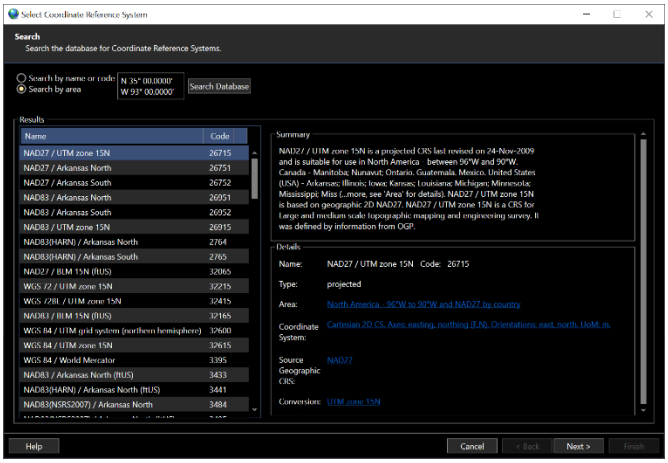

FIGURE 3-9 SELECT CRS - SEARCH BY AREA

a. Enter a position within the work area and click Search Database

6. If the search is unsuccessful, Search failed will display in red below the entry box.
7. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry.

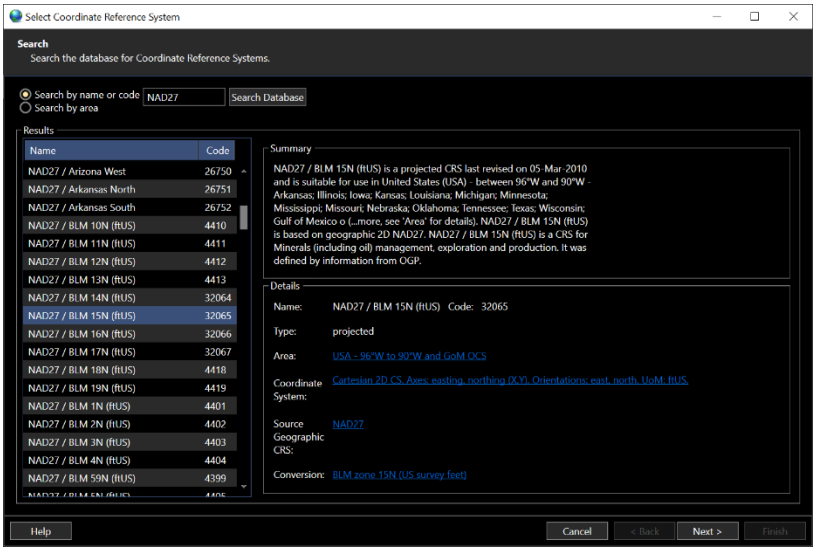

FIGURE 3-10 SELECT CRS - FOUND CRS

a. Selecting a CRS from the list will display the respective CRS details in the right panel
b. Clicking on any hyperlink will expand that item to display its details
c. If the search does not result in the required CRS, repeat the search process, otherwise
d. Select the desired CRS in the list, confirm the details, then click Next

Note: If the CRS selected is a Geographic 3D CRS, the Next button will not enable. NavView does not support the selection of Geographic 3D CRS for use.

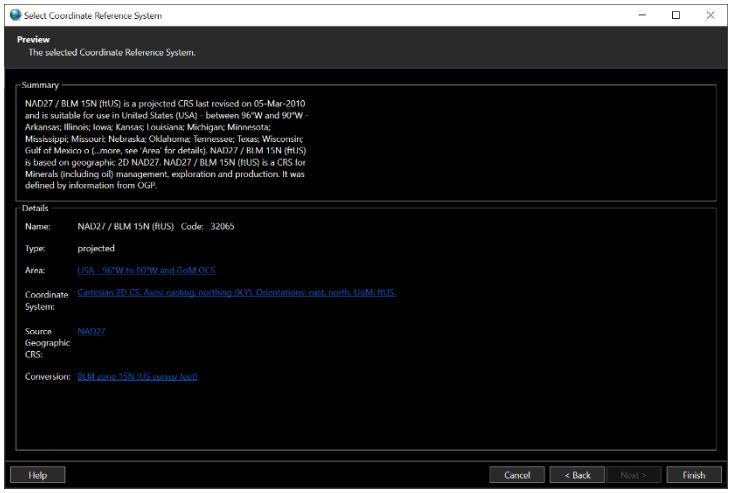

FIGURE 3-11 SELECT CRS - FINISH SELECTION

e. Review the details to confirm they define the required CRS
   i. Click Finish if correct
   ii. Click Back or Cancel if not

8. You will be prompted with an option to set the newly added CRS as the working, answer accordingly.

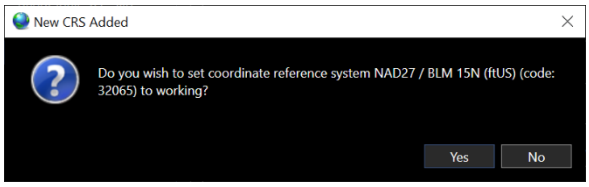

FIGURE 3-12 NEW CRS ADDED - SET TO WORKING PROMPT

9. You will be prompted with an option to go directly to configuring the associated transform, answer accordingly.

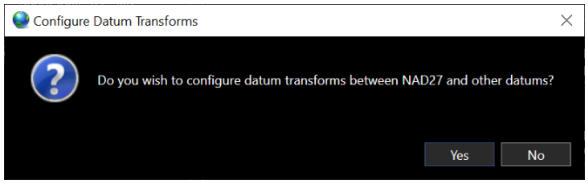

FIGURE 3-13 NEW CRS - CONFIGURE TRANSFORM PROMPT

10. Answering No in step 9 will result in returning to the Configure Horizontal CRS window Horizontal CRS tab with the new CRS listed, answering Yes will result in returning to the Configure Horizontal CRS window Transform tab (see Configure Transformations).

3.6.4 CREATE AND CHANGE A USER PROJECTED CRS

A user can add and configure a Projected CRS to address cases where an existing EPSG CRS does not apply.

Note: The User CRS is added to the local copy of the EPSG database and is then available to be added as one of the CRS to be used by NavView. It is not automatically added to the Horizontal CRS in use by NavView.

1. Access the Horizontal CRS view.
2. Select Horizontal CRS tab.
3. Click User to display all the User created CRS currently present in the database.

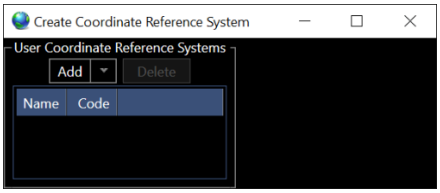

FIGURE 3-14 USER PROJECTED CRS

Note: All User created CRS present in the local EPSG database are displayed in this view.

4. To add a new CRS, click the Add split button and select to add either a Transverse Mercator or Lambert Two Standard Parallel Projected CRS.

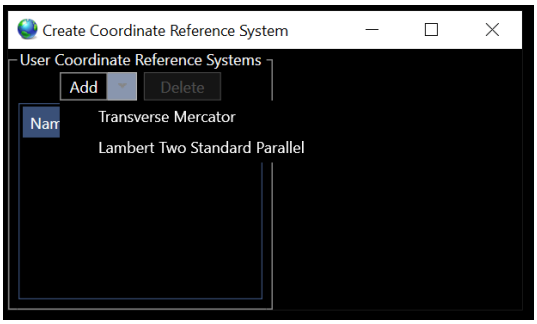

FIGURE 3-15 USER CRS - OPTIONS

   a. NavView will look for and use the lowest available EPSG code that can be assigned to the user CS and generate a default Projected CRS and add it to the database

Note: The allowed range of codes is 40000 to 49999

   b. The new CRS will be added to the list and ready for configuration
5. To configure a User CRS, select it in the list.
   a. **Details tab** presents and behaves here as it does in the main Horizontal CRS view, displaying the CRS parameter summary complete with hypertext allowing the operator to view greater details

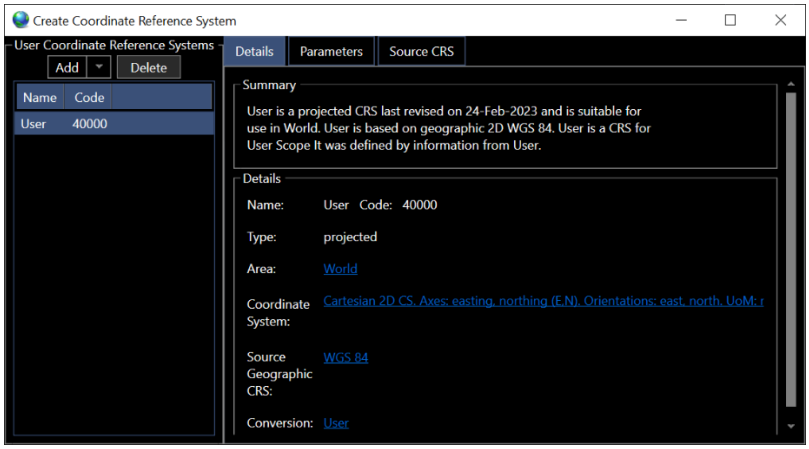

FIGURE 3-16 USER CRS - DETAILS TAB

b. **Parameters tab** presents the respective map projection parameters for review and editing
   i. Edit as required
   ii. Click Save to save changes
   iii. Click Revert to dump changes and revert to last saved parameters

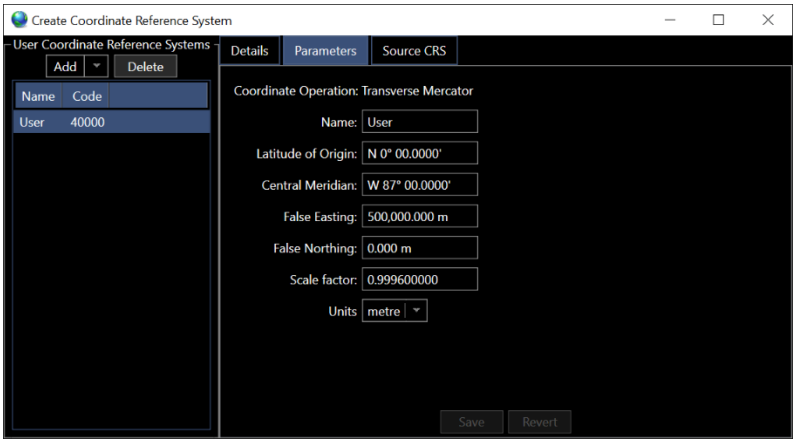

FIGURE 3-17 USER CRS - PARAMETERS TAB

c. **Source CRS tab** presents current source CRS (default is WGS 84, code 4326), this tab behaves in the same manner as the search database page in the wizard for Add a Horizontal CRS
   i. Enter the EPSG name or code of the required Geographic 2D CRS, or a position in the work area
   ii. Click Search Database
   iii. If the search is unsuccessful, Search failed will display in red below the entry box
   iv. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry
   v. Select the appropriate CRS and review the details for this CRS
   vi. Click Save to save the selection as the Source CRS
   vii. Click Revert to dump changes and revert to last saved Source CRS

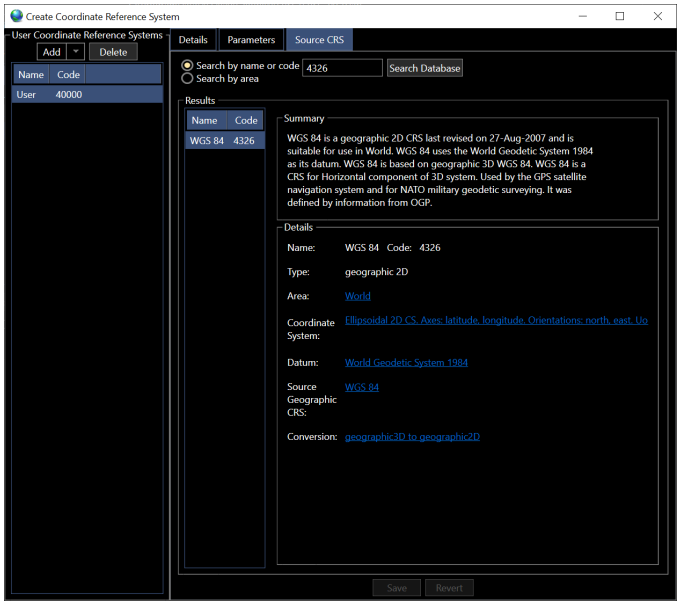

FIGURE 3-18 USER CRS – SOURCE CRS TAB

6. Close the window by clicking the X

3.6.5 SET THE WORKING PROJECTED CRS

NavView requires that one Projected CRS be always set as the Working CRS.

1. Access the Horizontal CRS view.
2. Select Horizontal CRS tab.
3. Select the CRS to be set to Working.
4. Click Set Working.
5. This CRS in the list will show Yes in the Working column.

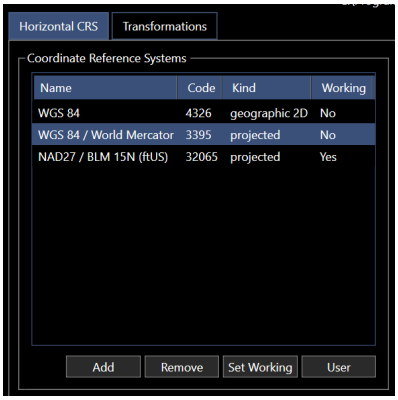

FIGURE 3-19 WORKING CRS (PROJECTED)

Note: Only a Projected CRS can be set to Working. The Set Working button is therefore only enabled when a Projected CRS that is not already set to Working is selected.

3.6.6 REMOVE A HORIZONTAL CRS FROM NAVVIEW

If a CRS currently added to NavView is no longer required, it can be removed. Note that this does not remove it from the EPSG database.

6. Access the Horizontal CRS view.
7. Select Horizontal CRS tab.
8. Select the CRS to be removed.
9. Click Remove.
10. Respond to the confirmation prompt accordingly.
    a. Yes to continue with the action and remove the CRS
    b. No to abort the process and leave the CRS added to NavView

Note: The Remove button will only enable if the selected CRS can be removed. The WGS 84 CRS, code 4326, and the CRS set Working cannot be removed.

3.6.7 DELETE A USER PROJECTED CRS

If a User created CRS is no longer required, it can be deleted from the local EPSG database.

1. Access the Horizontal CRS view.
2. Select Horizontal CRS tab.
3. Click User to display all the User created CRS currently present in the database.
4. Select the CRS to be removed from the EPSG database.
5. Click Delete.
6. Respond to the confirmation prompt accordingly.
    a. Yes to continue with the action and delete the CRS from the database
    b. No to abort the process and leave the CRS in the database

Note: A User created CRS cannot be removed if it is currently added to a CRS used by NavView. If such a User created CRS is selected, the Delete button will not be enabled.

7. Close the window.

3.6.8 CONFIGURE TRANSFORMATIONS

NavView automatically adds a transformation operation place holder for every possible pairing of different Geographic CRS(s) added to NavView. These require configuration as there is often more than one transformation option for a given pairing.

1. Access the Horizontal CRS view.
2. Select Transformations tab.

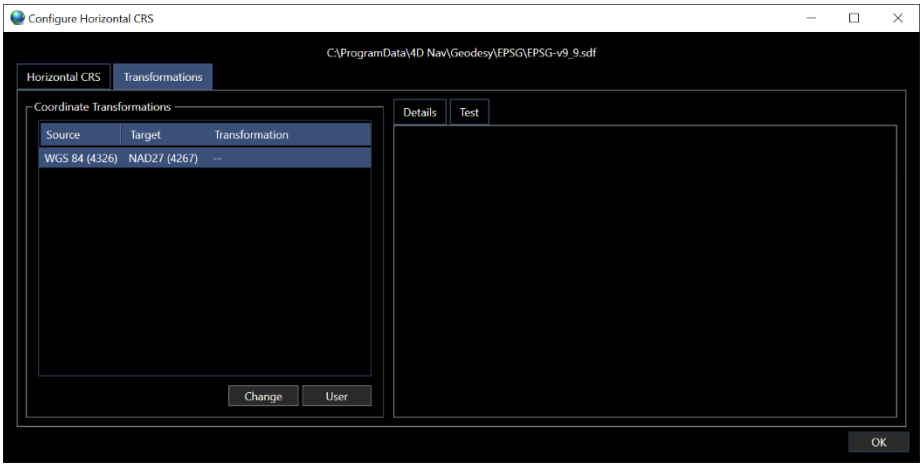

FIGURE 3-20 CONFIGURE TRANSFORMATIONS

3. Select the Transformation to configure.

Note: If the Transformation has been previously configured, the details for the current setting will display in the Details tab. If it has not been configured, no information is displayed in this tab.

4. Click Change to display a list of transformations that apply to the respective source and target CRS.

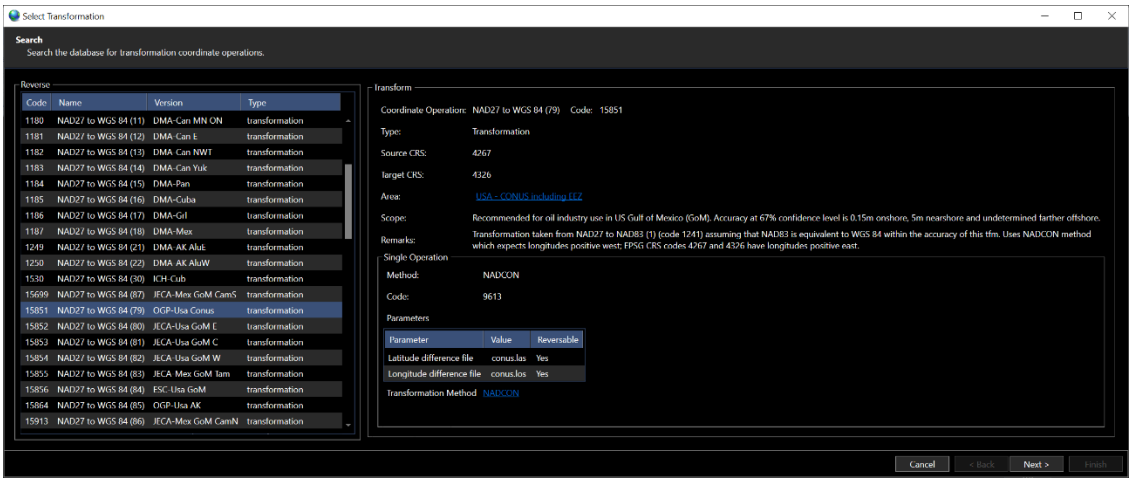

FIGURE 3-21 AVAILABLE TRANSFORMATIONS

a. Selecting a Transformation from the list will display the respective details in the right panel.
b. Clicking on any hyperlink will expand that item to display its details
c. Select the desired Transformation and click Next

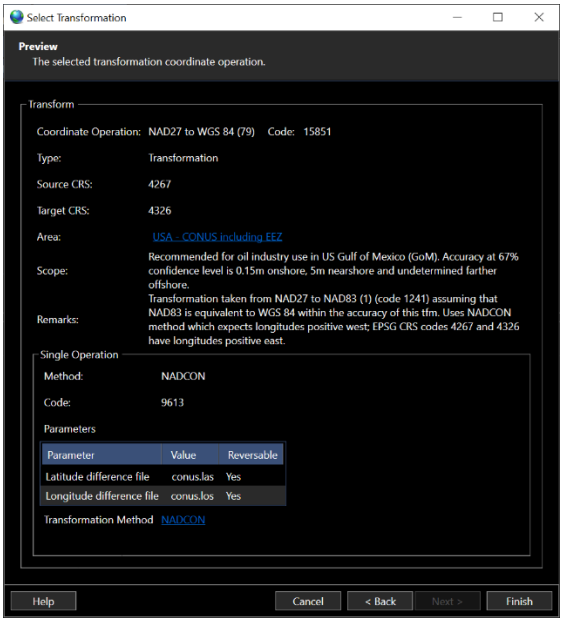

FIGURE 3-22 REVIEW SELECTED TRANSFORMATION

d. Review the details to confirm they define the required Transformation
   i. Click Finish if correct
   ii. Click Back or Cancel if not

5. The newly configured Transformation will display in the Transformation tab with the respective source and target CRS.

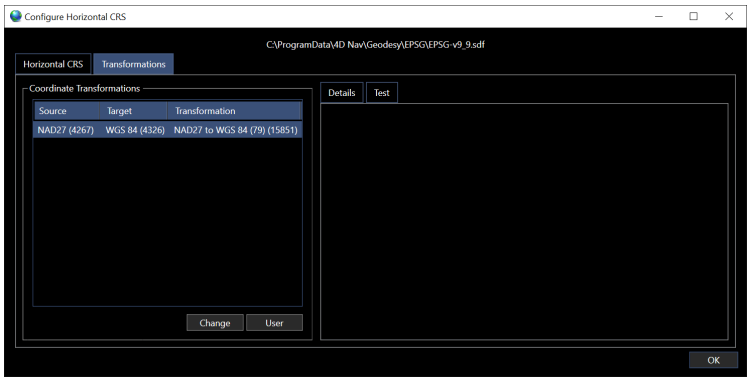

FIGURE 3-23 CONFIGURED TRANSFORMATION

3.6.9 CREATE AND CHANGE A USER TRANSFORMATIONS

A user can add and configure a transformation to address cases where an existing EPSG transformation does not apply. The transformation is added to the local copy of the EPSG database and is then available to be selected as part of Configure Transformations.

Note: The sign convention supported for the NavView User transformation is the Coordinate Frame Rotation (EPSG code 1032) for source CRS to target CRS as summarized below. For further information, see Coordinate Conversions and Transformations including Formulas, OGP Publications 373-7-2 available at Guidance Note 7 Part 2 (tiny.cloud)

Translation Vector (dX, dY, dZ): Added to the position vector in the source CRS to obtain the position vector in the target CRS.

Rotations (rX, rY, rZ): Applied to the coordinate reference frame, positive is clockwise rotation looking out from the origin in the positive direction of respective axis.

Scale: Applied to the position vector in the source CRS to obtain the position vector in the target CRS.

Note: If the transformation parameters to be used are provided in Position Vector Transformation convention, the translation and scale parameters are applied as is in the Coordinate Reference Frame convention, but the rotation sign convention is reversed.

1. Access the Horizontal CRS view.
2. Select Transformations tab.
3. Click User.

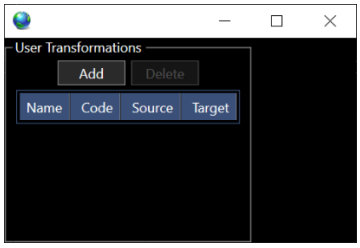

FIGURE 3-24 CREATE USER TRANSFORMATION

Note: All User created transformations present in the local EPSG database are displayed in this view by Name, EPSG Code, Source CRS and Target CRS.

4. To add a new transformation, click Add.
   a. NavView will look for and use the lowest available EPSG code that can be assigned to the user transformation, generate a default transformation and add it to the database

Note: The allowed range of codes is 50000 to 59999

   b. The new transformation will be added to the list and ready for configuration
5. To change a transformation, select it in the list.

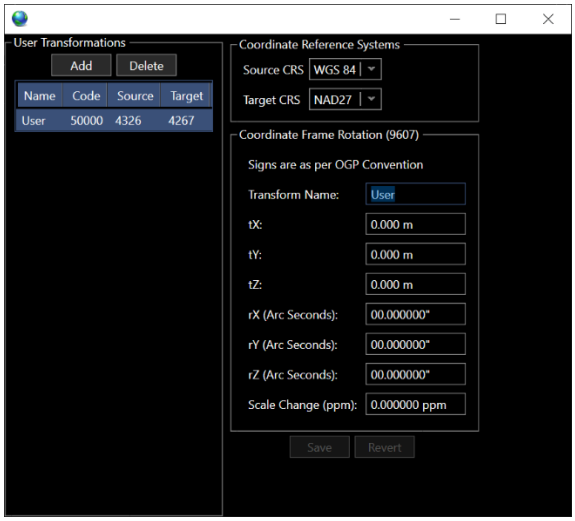

FIGURE 3-25 USER TRANSFORMATION PARAMETERS

6. Configure the transformation

Source CRS: Select a CRS from the drop-down list populated by those Geographic 2D CRS present in NavView

Target CRS: Select a CRS from the drop-down list populated by those Geographic 2D CRS present in NavView

Note: If a previously User created Transformation has as its Source and/or Target CRS, a CRS that is no longer present in NavView, it will still display in the respective list.

Coordinate Frame Rotation: Enter the respective transformation parameters paying particular attention to the sign convention, including a suitable name

a. Click Save to save changes
b. Click Revert to dump changes and revert to last saved parameters

Note: Until Save is executed, a newly created transformation is not saved to the local EPSG database.

7. Close the view by clicking X.

3.6.10 DELETE A USER TRANSFORMATION

1. If a User created transformation is no longer required, it can be deleted from the local EPSG database.
2. Access the Horizontal CRS view.
3. Select Transformations tab.
4. Click User to display all the User created transformations currently present in the database.
5. Select the transformation to be removed from the EPSG database.
6. Click Delete.
7. Respond to the confirmation prompt accordingly.

a. Yes to continue with the action and delete the transformation from the database
b. No to abort the process and leave the transformation in the database

Note: A User created transformation cannot be removed if it is currently in use by NavView. If such a User created transformation is selected, the Delete button will not be enabled.

8. Close the window.

3.6.11 TEST COORDINATE OPERATIONS

NavView supports a coordinate operations test feature to simplify the confirmation that the geodesy is correctly configured. This is available in the Test tab for both the Horizontal CRS and Transformations tab of the Horizontal CRS view.

The test coordinate operations available in the Horizontal CRS tab depend upon the CRS present and the one selected and always involve the Working Projected CRS.

Selected CRS	**Supported Coordinate Operations**
Geographic 2D CRS:	Transformation between the Selected Geographic 2D CRS and the Working Projected Source Geographic 2D CRS
	Conversion between the Working Projected Source Geographic 2D CRS and its projection

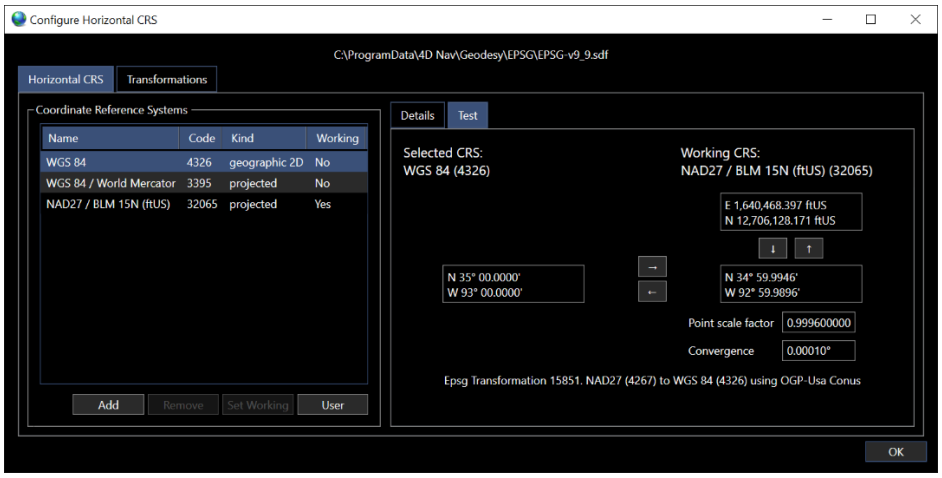

FIGURE 3-26 HORIZONTAL CRS TEST TAB - GEOGRAPHIC 2D CRS COORDINATE OPERATION

Projected CRS:	Transformation between Selected Geographic 2D CRS Source Geographic CRS and the Working Projected CRS Source Geographic CRS
	Conversion between the Selected Projected CRS Source Geographic CRS and its projection
	Conversion between the Working Projected CRS Source Geographic CRS and its projection

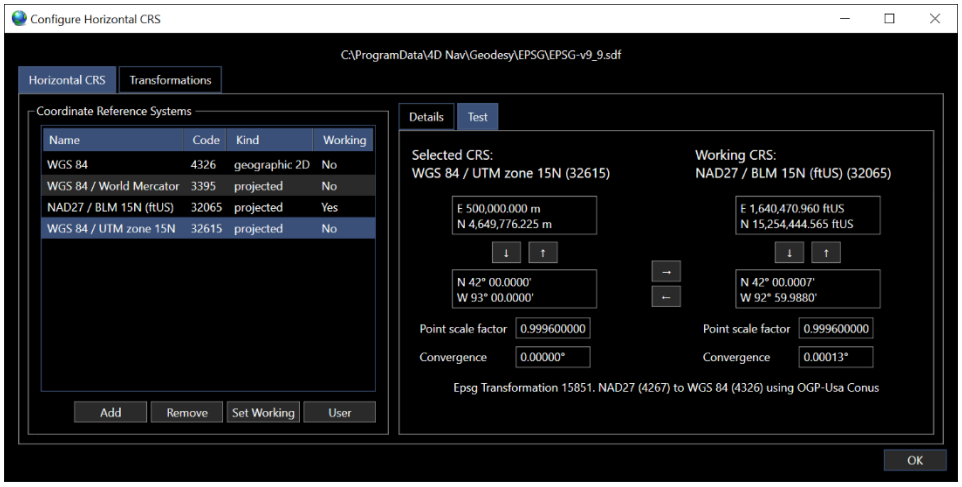

FIGURE 3-27 HORIZONTAL CRS TEST TAB - PROJECTED CRS COORDINATE OPERATIONS

Working CRS: Conversion between the Working Projected CRS Source Geographic CRS and its projection

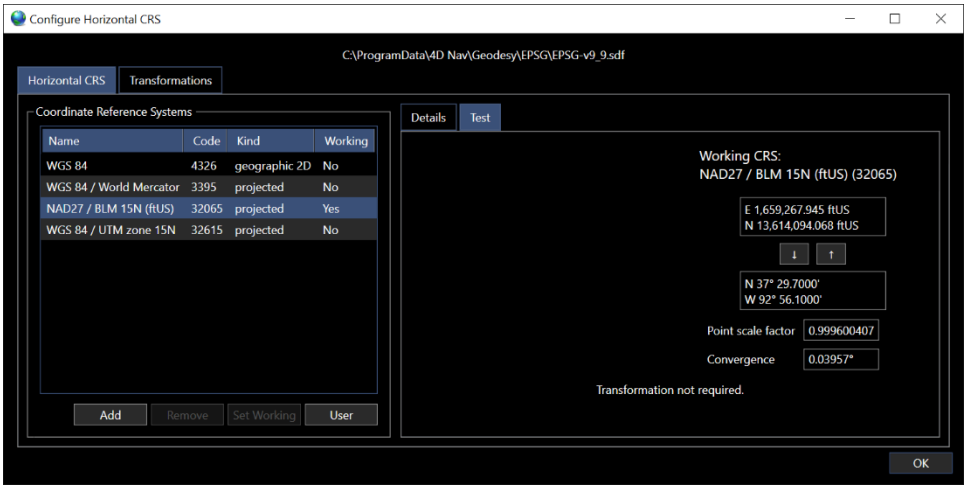

FIGURE 3-28 HORIZONTAL CRS TEST TAB - WORKING CRS COORDINATE OPERATIONS

The test operation available in the Transformations tab is a transformation between the Source and Target CRS of the selected Transformation.

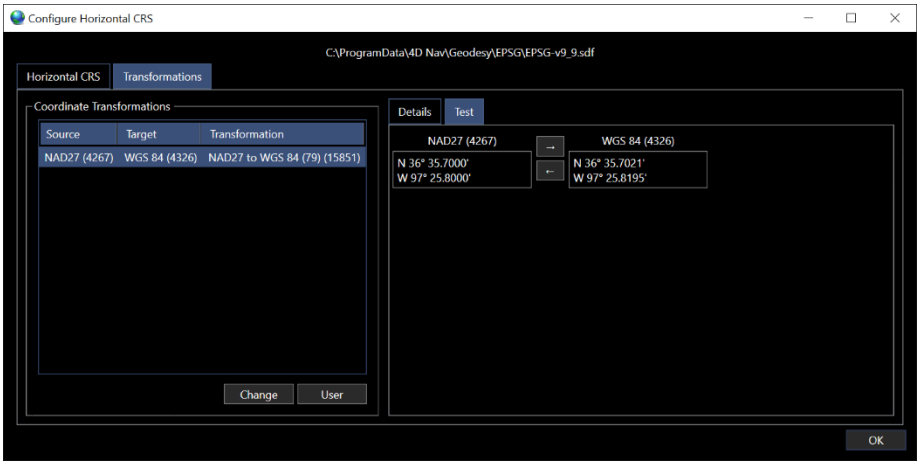

FIGURE 3-29 TRANSFORMATIONS TEST TAB - COORDINATE OPERATION

Note: Coordinates are displayed based on the respective Projected CRS units and NavView Preference settings.

3.6.12 HORIZONTAL CRS TEST COORDINATE OPERATIONS

1. Access the Horizontal CRS view.
2. Select the Horizontal CRS tab.
3. Select the Horizontal CRS to test.
4. Select the Test tab.

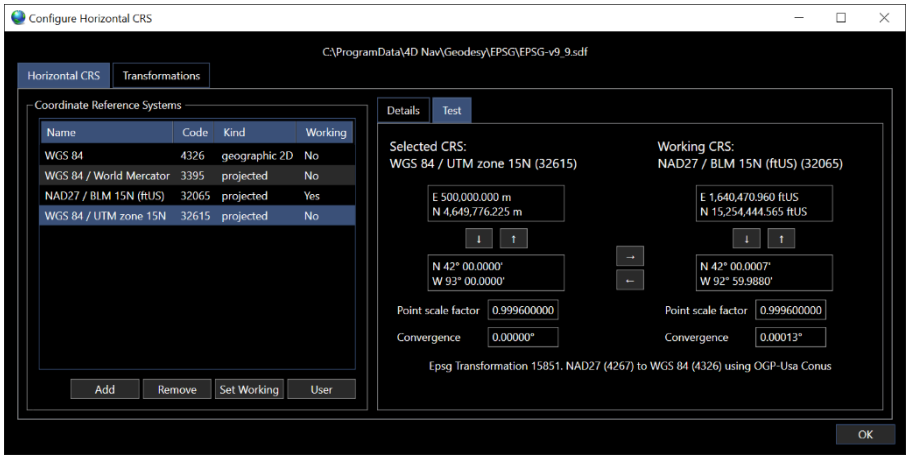

FIGURE 3-30 HORIZONTAL CRS COORDINATE OPERATION EXAMPLE

5. Enter a coordinate in the appropriate entry box and click an arrow pointing away from that box to automatically perform all possible coordinate operations using the entered coordinate as the base.

3.6.13 TRANSFORMATIONS TEST COORDINATE OPERATION

1. Access the Horizontal CRS view.
2. Select the Transformations tab.
3. Select the Transformation to test.

4. Select the Test tab.

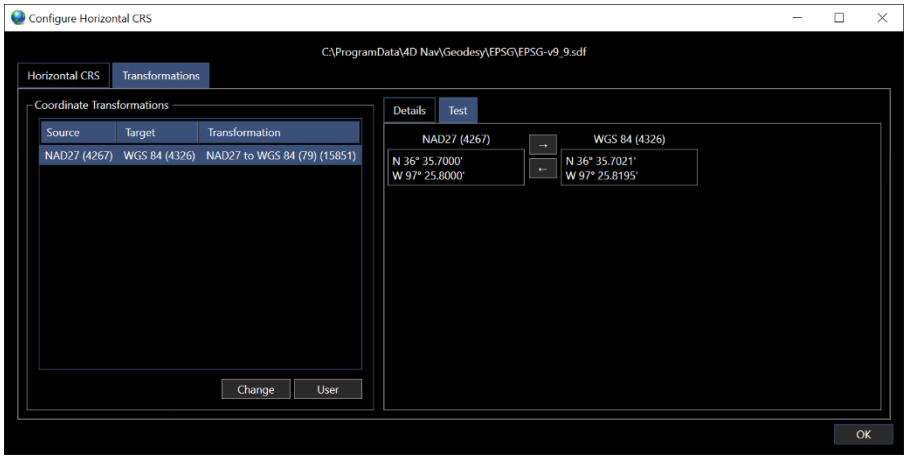

FIGURE 3-31 TRANSFORMATIONS COORDINATE OPERATION EXAMPLE

5. Enter a coordinate in the appropriate entry box and click the arrow pointing away from that box to perform the transformation coordinate operation.

3.7 USING THE VERTICAL CRS VIEW

The Vertical CRS defines the vertical datum and the default vertical units used by NavView when dealing with elevation, depth and height terms. In some cases, such as the import of a digital terrain model (DTM) the vertical CRS and units defaults to the Working Vertical CRS but can be edited to reference another vertical CRS. However, in the case of 3D model files, these must be in the same units as the Working Vertical CRS.

The Vertical CRS view presents the Vertical CRS and associated coordinate operations for review and editing. The view has two main tabs: Vertical CRS and Transformations. Each of these displays a list of the respective items in the left panel and associated Details and Test tabs in the right panel. The Details tab includes hypertext (underlined blue text) that when clicked expand to provide additional information for that item.

3.7.1 VERTICAL CRS TAB

Coordinate Reference Systems lists the Vertical CRS currently setup for use in NavView in a data grid sortable by columns.

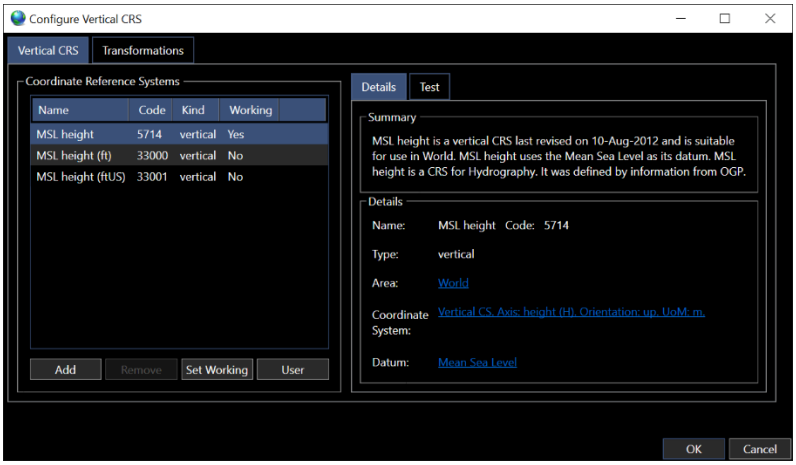

FIGURE 3-32 VERTICAL CRS

Name: EPSG name or user entered name

Code: EPSG code, including those assigned to user created CRS

Kind: Vertical

Working: Yes, if CRS is the Working Vertical CRS, No if not

Details tab display the parameters for the selected CRS. Click on the hyperlinks in the Details to view the EPSG details for that item.

Test tab does not display anything.

3.7.2 TRANSFORMATION TAB

The Vertical CRS transformation involves an offset to relate one Vertical CRS to another.

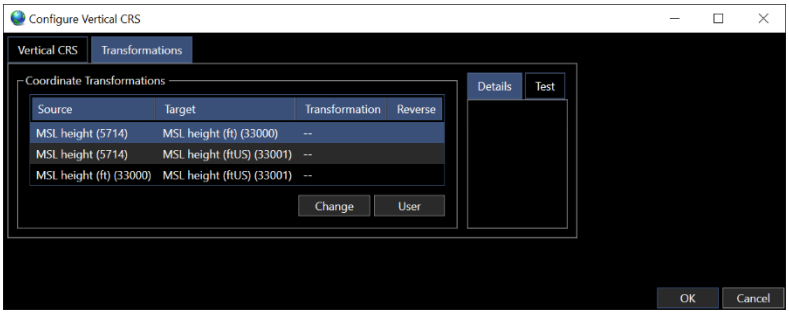

FIGURE 3-33 VERTICAL CRS TRANSFORMATIONS - DETAILS TAB

Coordinate Transformation lists all the coordinate transformations required to support transformations between the Vertical CRS currently setup for use in NavView. These are displayed in a data grid sortable by columns.

Source: EPSG or user assigned name and code of the source vertical CRS

Target: EPSG or user assigned name and code of the target vertical CRS

Transformation: EPSG or user assigned name and code of the transformation

Reverse: Indicates if transformation is applicable to being used to transform from source CRS to target CRS and back

Details tab does not display anything.

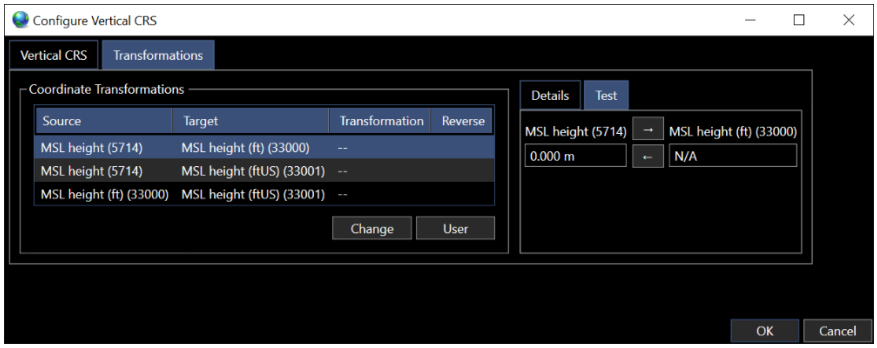

FIGURE 3-34 VERTICAL CRS TRANSFORMATIONS - TEST TAB

Test tab displays the coordinate operation for the selected transformation, Source Vertical CRS to/from the target Vertical CRS.

3.7.3 ADD A VERTICAL CRS

All Vertical CRS that are required for a specific NavView application must be added to be available for use. By default, NavView loads the following vertical CRS:

- MSL height, EPSG code 5714
- MSL height (ft), EPSG code 33000
- MSL height (ftUS), EPSG code 33001

If a one or more other vertical CRS are required, they must be added, access the Vertical CRS view.

1. Click the Add button to launch a wizard to step through the searching for and adding of a vertical CRS.

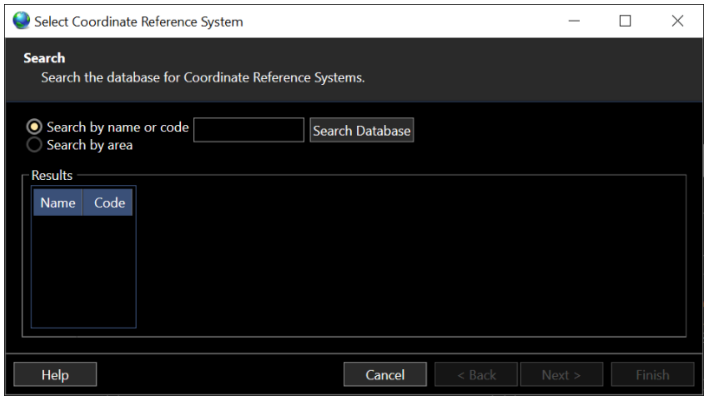

FIGURE 3-35 ADD VERTICAL CRS – SEARCH BY NAME OR CODE

2. Select Search by name or code if either have been provided.
   a. Enter the EPSG code or name in the associated entry box and click Search Database

Note: The EPSG code and name options include user created CRS. These are assigned an EPSG code when created and added to the local database.

Note: When entering a name, the search looks for those EPSG CRS whose name or alias contains the entry after removing the blanks (whitespaces) in both the entry and CRS name and alias. For example, entering **msl** will result in a list of all EPSG vertical CRS with msl in the name, such as MSL depth, MSL height, etc.

Note: When entering the EPSG CRS code, the search is specific and only lists the EPSG CRS with that exact code.

3. Or select Search by area if unsure of the EPSG code or name of the required CRS.

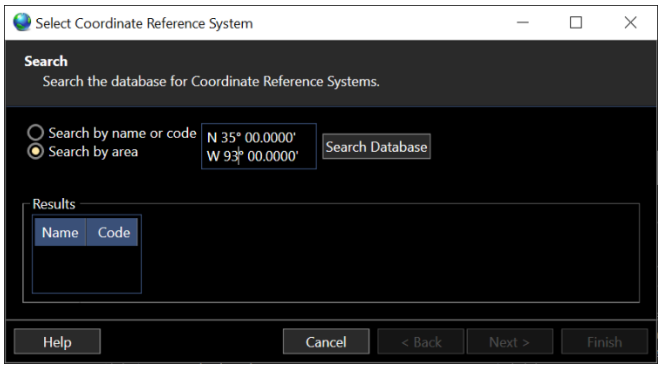

FIGURE 3-36 ADD VERTICAL CRS - SEARCH BY AREA

   a. Enter a position within the work area and click Search Database
4. If the search is unsuccessful, Search failed will display in red below the entry box.
5. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry.

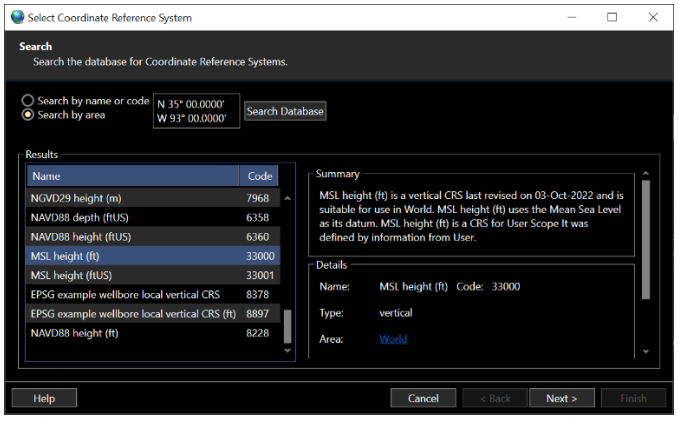

FIGURE 3-37 ADD VERTICAL CRS - FOUND CRS

   a. Selecting a CRS from the list will display the respective CRS details in the right panel
   b. Clicking on a hyperlink will expand that item to display its details
   c. If the search does not result in the required CRS, repeat the search process

d. Select the desired CRS in the list, confirm the details, then click Next

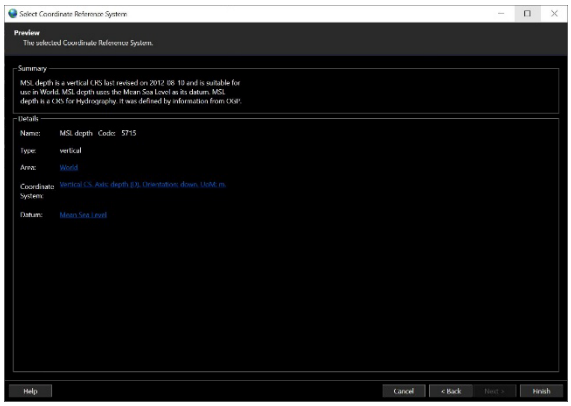

FIGURE 3-38 ADD VERTICAL CRS - FINISH SELECTION

e. Review the details to confirm they define the required CRS
   i. Click Finish if correct
   ii. Click Back or Cancel if not

6. You will be prompted with an option to set the newly added CRS as the working, answer accordingly.

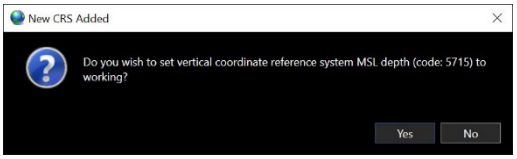

FIGURE 3-39 ADD VERTICAL CRS - SET TO WORKING PROMPT

3.7.4 CREATE AND CHANGE USER VERTICAL CRS

A user can add and configure a Vertical CRS to address cases where an existing EPSG CRS does not apply.

Note: The User CRS is added to the local copy of the EPSG database and is then available to be added as one of the CRS to be used by NavView. It is not automatically added to the Vertical CRS in use by NavView.

1. Access the Vertical CRS view.
2. Select Vertical CRS tab.
3. Click User to display all the User created Vertical CRS currently present in the database.

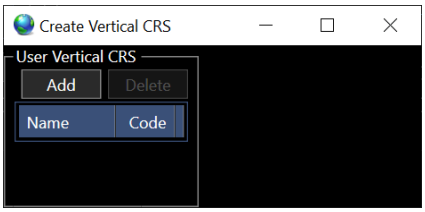

FIGURE 3-40 USER VERTICAL CRS

4. To add a new CRS, click the Add button.

a. NavView will look for and use the lowest available EPSG code that can be assigned to the user CRS and generate a default Vertical CRS and add it to the database

Note: The allowed range of codes is 40000 to 49999

b. The new CRS will be added to the list and ready for configuration

5. To configure a User Vertical CRS, select it in the list.
   a. **Details tab** presents and behaves here as it does in the main Vertical CRS view, displaying the CRS parameter summary complete with hypertext allowing the operator to view greater details

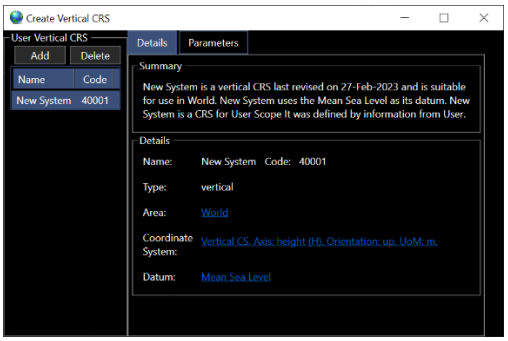

FIGURE 3-41 USER VERTICAL CRS – DETAILS TAB

   b. **Parameters tab** presents the respective CRS parameters for review and editing
      i. **Name:** Enter an appropriate name for the new CRS
      ii. **Coordinate System:** From the drop-down list select the option that combines the desired orientation (up positive or down positive) and units
      iii. **Datum:** from the drop-down list select the datum, if it is not present, click the Add button and enter a name and origin for the CRS

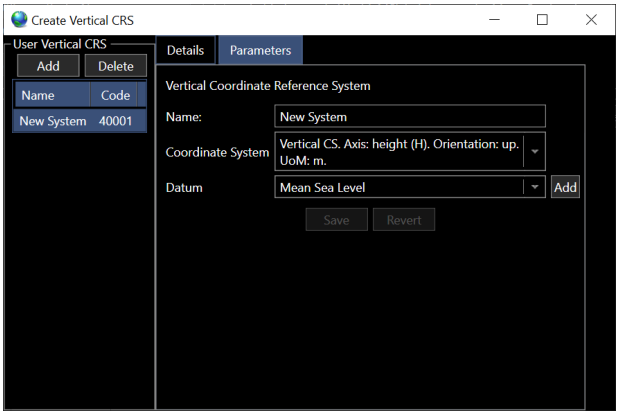

FIGURE 3-42 USER VERTICAL – PARAMETERS TAB

   c. Click **Save** to save the parameters, or click **Revert** to dump the changes

6. Close the window by clicking on the X.

3.7.5 SET THE WORKING VERTICAL CRS

NavView requires that one Vertical CRS be always set as the Working Vertical CRS.

1. Access the Vertical CRS view.

2. Select Vertical CRS tab.
3. Select the Vertical CRS to be set to Working.
4. Click Set Working.

3.7.6 REMOVE A VERTICAL CRS FROM NAVVIEW

If a Vertical CRS currently added to NavView is no longer required, it can be removed. Note that this does not remove it from the EPSG database.

5. Access the Vertical CRS view.
6. Select Vertical CRS tab.
7. Select the Vertical CRS to be removed.
8. Click Remove.
9. Respond to the confirmation prompt accordingly.
    a. Yes to continue with the action and remove the CRS
    b. No to abort the process and leave the CRS added to NavView

3.7.7 DELETE A USER VERTICAL CRS FROM EPSG DATABASE

If a User created Vertical CRS is no longer required, it can be deleted from the local EPSG database.

1. Access the Vertical CRS view.
2. Select Vertical CRS tab.
3. Click User to display all the User Vertical CRS currently present in the database.
4. Select the Vertical CRS to be removed from the EPSG database.
5. Click Delete.
6. Respond to the confirmation prompt accordingly.
    a. Yes to continue with the action and delete the CRS from the database
    b. No to abort the process and leave the CRS in the database

Note: A User created CRS cannot be removed if it is currently added to those CRS used by NavView. If such a User created CRS is selected, the Delete button will not be enabled.

7. Close the window.

3.7.8 CONFIGURE VERTICAL TRANSFORMATIONS

NavView automatically adds a coordinate operation place holder for transformations between every possible pairing of the Vertical CRS added to NavView. These require configuration as there may be more than one transformation option for a given pairing.

1. Access the Vertical CRS view.
2. Select Transformations tab.

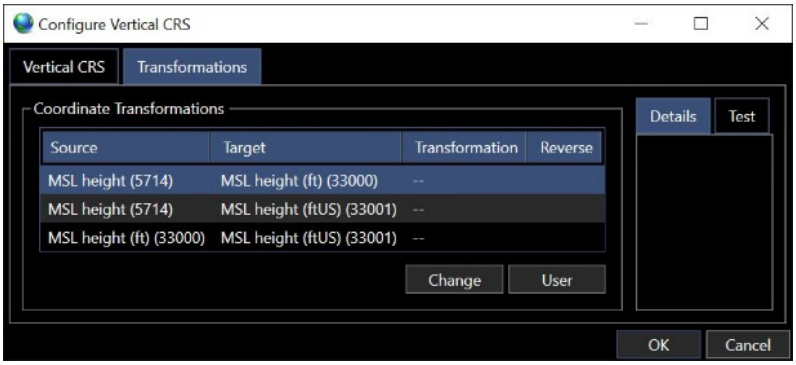

FIGURE 3-43 VERTICAL CRS TRANSFORMATION TAB

3. Select the transformation to configure.

Note: If the Transformation has been previously configured, the details for the current setting will display in the Details tab. If it has not been configured, no information is displayed in this tab.

4. Click Change to display a list of transformations that apply to the respective source and target CRS.
   a. Selecting a Transformation from the list will display the respective details in the right panel.
   b. Clicking on any hyperlink will expand that item to display its details
   c. Select the desired Transformation and click Next
   d. Review the details to confirm they define the required Transformation
      i. Click Finish if correct
      ii. Click Back or Cancel if not

Note: If no transformations are detected as being applicable for the selected transformation none are listed, click Cancel.

5. The newly configured Transformation will display in the Transformation tab with the respective source and target CRS.

3.7.9 CREATE AND CHANGE A USER VERTICAL TRANSFORMATION

A user can add and configure a transformation to address cases where an existing EPSG transformation does not apply. The transformation is added to the local copy of the EPSG database and is then available to be selected as per Configure Vertical Transformations.

1. Access the Vertical CRS view.
2. Select Transformations tab.
3. Click User.

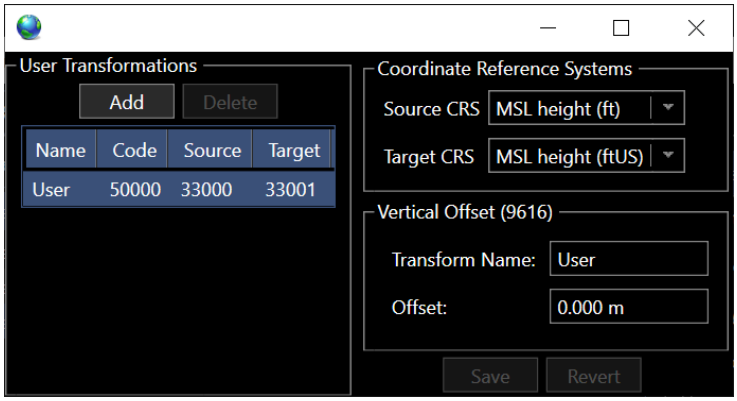

FIGURE 3-44 USER VERTICAL TRANSFORMATION

4. To add a new a new transformation, click Add.
   a. NavView will look for and use the lowest available EPSG code that can be assigned to the user transformation, generate a default transformation and add it to the database

Note: The allowed range of codes is 50000 to 59999

   a. The new transformation will be added to the list and ready for configuration

5. To change a transformation, select it in the list.
6. Configure the transformation.

Source CRS: Select a CRS from the drop-down list populated by those Vertical CRS present in NavView

Target CRS: Select a CRS from the drop-down list populated by those Vertical CRS present in NavView

Note: If a previously User created Vertical Transformation has as its Source and/or Target CRS, a CRS that is no longer present in NavView, it will still display in the respective list.

Transform Name: Enter a suitable name

Offset: Enter the offset to be added to the Source CRS elevation to obtain the Target CRS elevation

7. Click Save to save changes.
8. Click Revert to dump changes and revert to last saved parameters.

Note: Until Save is executed, a newly created transformation is not saved to the local EPSG database.

9. Close the view.

3.7.10 DELETE A USER VERTICAL TRANSFORMATION FROM EPSG DATABASE

If a User created Vertical Transformation is no longer required, it can be deleted from the local EPSG database.

1. Access the Vertical CRS view.
2. Select Transformation tab.
3. Click User to display all the User Vertical Transformations currently present in the database.
4. Select the Vertical Transformation to be removed from the EPSG database.
5. Click Delete.
6. Respond to the confirmation prompt accordingly.
   a. Yes to continue with the action and delete the transformation from the database
   b. No to abort the process and leave the transformation in the database

Note: A User created transformation cannot be removed if it is currently in use by NavView. If such a User created transformation is selected, the Delete button will not be enabled.

7. Close the window.

3.7.11 VERTICAL TRANSFORMATION TESTS

NavView provides a test feature to confirm that a selected vertical transformation is correctly configured.

1. Access the Vertical CRS view.
2. Select Transformation tab.
3. Select the vertical transformation to test.
4. Select the Test tab .

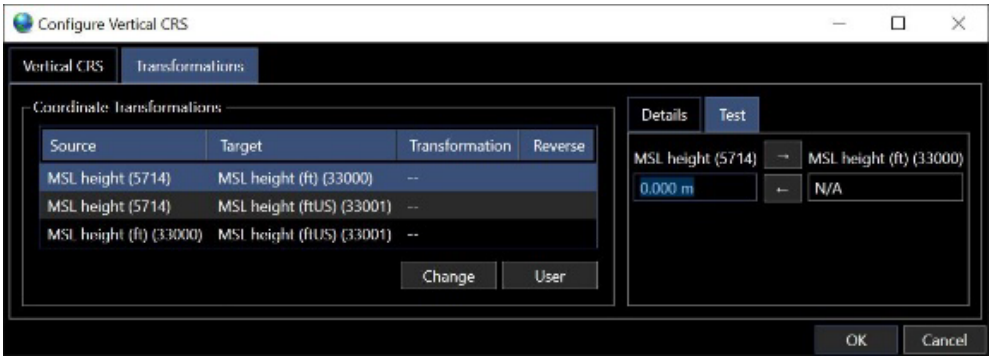

FIGURE 3-45 VERTICAL TRANSFORMATION TEST

5. Enter an elevation in the Source CRS (left) and click the arrow pointing to the right.
6. Confirm that the transformation offset is added to the Source CRS elevation to obtain the correct Target CRS elevation.
7. Enter an elevation in the Target CRS (right) and click the arrow pointing to the left.
8. Confirm that the transformation offset is subtracted from the Target CRS elevation to obtain the Source CRS elevation.
9. Click OK to close the window.