User Manual

Version V1.1-20240913

Tersus Geo Office 2

User Manual

Sales enquiry: sales@tersus-gnss.com

Technical Support: support@tersus-gnss.com

More details, please visit www.tersus-gnss.com

Revision History

Revision	Description	Date	Owner
1.0	Issued for Release	2024/01/22	ZCG
1.1	Added GNSS, Roads, Point Clouds, etc.	2024/03/05	ZCG
	Modified Coordinate System, GNSS Import, GNSS Adjustment, etc.	2024/09/13	ZCG

Catalogs

Tersus Geo Office 2 User Agreement

CAUTION! Please read this notice carefully before using software. Use of Tersus Geo Office 2 software indicates acceptance of the terms and conditions of the User Agreement.

Thank you for using Tersus Geo Office 2! This agreement is a legally binding contract between Tersus GNSS Inc. and you regarding the user of TGO 2. Please read all the terms and conditions listed in the agreement carefully. Use of TGO 2 indicates that you have agreed to accept all of the terms of this Agreement. If you have any questions about the content of the terms of this Agreement, please contact Tersus GNSS Inc. If you do not agree to any of the terms and conditions of this Agreement, please do not proceed with the subsequent operations.

1. License

Tersus provides users with free licenses for Tersus Geo Office 2 and related materials, for the purpose of product needs and improvement, when users use Tersus products. Tersus does not guarantee that the free license will not be changed. The license fee will be calculated according to the price published on Tersus official website www.tersus-gnss.com. Before you pay the license fee as agreed, Tersus will reserve the right not to provide you with TGO 2 and related materials. Without the permission of Tersus, users are not allowed to resell it to a third party or use TGO 2 and related materials to obtain income through other means in any way.

2. Proprietary Rights

The user agrees that TGO 2 and related materials shall belong to Tersus, and Tersus retains exclusive ownership of the trademarks and service marks represented by its company name and logo and all of the documentation related. The user agrees that all technologies, algorithms and processes contained in TGO 2 constitute commercial secrets, and the user will protect them. User may not reverse engineer, decompile or disassemble the software, nor alter images used in the software and the documentation. The user are not allowed to copy, modify, and reproduce relevant information, no matter it is modified or translated into another language, unless the permission of Tersus is obtained. The user agrees that if the user violates this agreement, he will

be liable for damages determined by the court.

3. Customer Service

According to the situation of users using TGO 2, Tersus will continue to add features, improve performance and experience. Although it is the Tersus's customary practice to provide reasonable assistance and support in the use of Tersus products to customers, Tersus shall not be obligated to any user to provide technical assistance or support through this agreement, and may at Tersus's sole election charge a fee for customer service.

4. Update Policy

Tersus may regularly or irregularly, update TGO 2 to add functions or fix issues. Tersus is not obliged to provide updates or modifications to any user, nor do we guarantee that that updates or modifications are fully in line with expectations.

5. Disclaimer

Tersus will try best to make that the function of TGO 2 run normally and the data calculation is correct, but Tersus does not guarantee that all functions of the software meets the expectations, the data calculation is correct and the stability of the software runs stably. Tersus and distributors will not be liable for any indirect, special, incidental, consequential or exemplary damages caused in any way.

6. Termination

This agreement is hereby terminated by mutual agreement or by any breach of any one or more provisions of this agreement by either party. In such cases, all rights of Tersus shall remain in force and effect. Any protected information data of user maintained on database shall upon notice to the user and at the discretion of Tersus may be destroyed.

7. Copyright

Tersus Geo Office 2 and related materials (including, but not limited to, any images, photographs, animations, video, audio, music or text incorporated into the software), and all intellectual property rights associated with it, whether exists in a tangible media or in an electronic media is owned by Tersus. You may not remove or alter any trademark, logo, copyright and other proprietary notice in or on the products.

8. Other

Tersus has the right to amend all the contents of this agreement and product policy, and the right

to interpret them within the scope of law.

This agreement will be effective once it is published, and Tersus has the right to modify the content of the agreement at any time, and the modified results will be published on the Tersus website. If you do not agree with the modifications made, you have the right to stop using TGO 2. If the user continues to use, it is deemed that the user accepts the modifications.

The conclusion, implementation and interpretation of this agreement and the settlement of disputes shall be governed by the laws of China and subject to the jurisdiction of the Chinese courts. If any dispute arises between the parties regarding the content of this agreement or its implementation, the parties shall try to resolve it through friendly consultation; if consultation fails, either party may file a lawsuit in the court where Tersus GNSS is located.

1. Overview

- Introduction
- Installation
- Main Interface

1.1 Introduction

Tersus Geo Office 2 is a desktop data processing software based on Windows OS, designed by Tersus GNSS Inc. and all right reserved. Tersus Geo Office 2 (hereinafter referred to as TGO2) has various functions, covering multiple business modules for professional users, supporting GNSS post-processing, online and imported basemap display, road design and inspection, RTK project processing and point clouds data processing.

Main features of TGO2 software:

- Projects, coordinate systems and antennas management.
- Basic view operation, 3-demensionalized display and tool measurement.
- GNSS static data post processing.
- Stop and Go data post processing.
- Road design data import, editing, and visualization.
- Tersus Nuwa projects import and data processing.
- Point clouds data editing, DTM generation and earthwork calculation.

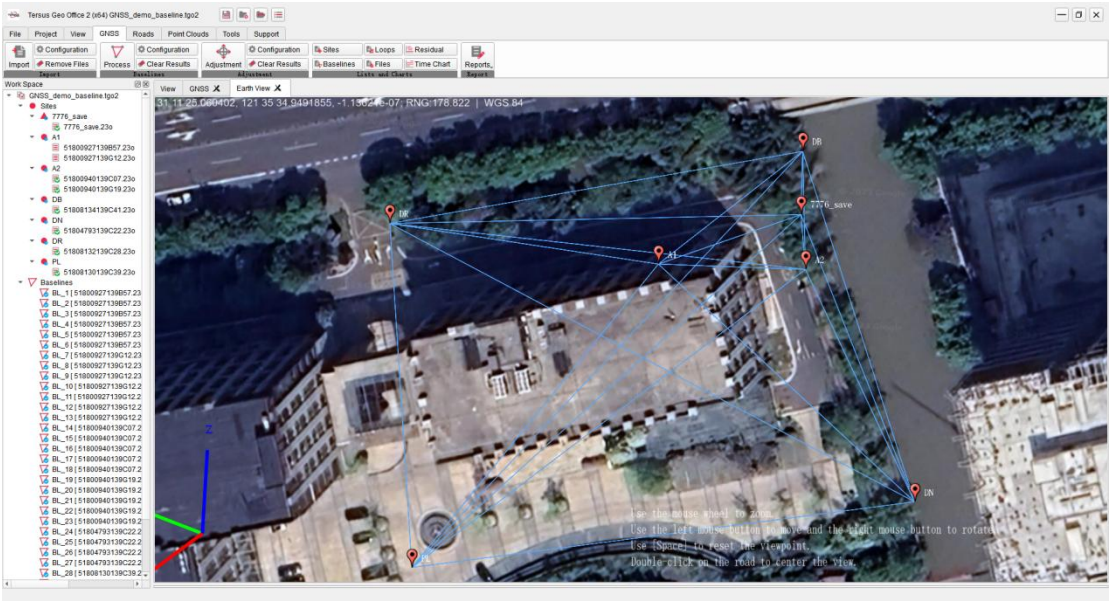


Figure 1.1 Tersus Geo Office 2

1.2 Installation

Installation process:

1. Click on the TGO2 software .exe installation package to enter the installation program.

2. Click and select the installation directory to begin the installation. If there is an older version, the old version will be uninstalled first.

3. Click on the TGO2 icon on the desktop or in the start menu list to enter the software.

Figure 1.2 TGO2 Startup Interface

1.3 Main Interface

After launching TGO2 software, the interface of the software is shown in the figure below. The historical projects are displayed in the Project Manager list. Click on the project in the list to open it directly, create a new project or click to open other local project files.

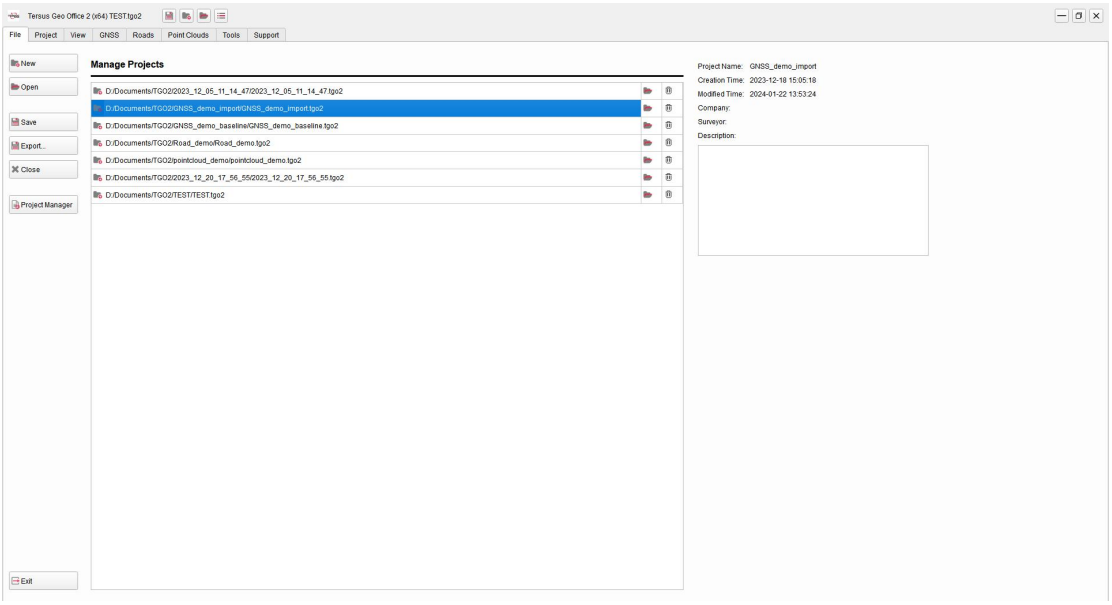


Figure 1.3 Projects Manager Interface

After opening a project or clicking other menu bar tab buttons, it will jump to the main interface of the software, as shown in the following figure. The main interface is generally divided into five parts: title bar, menu bar, work space, view section and property window.

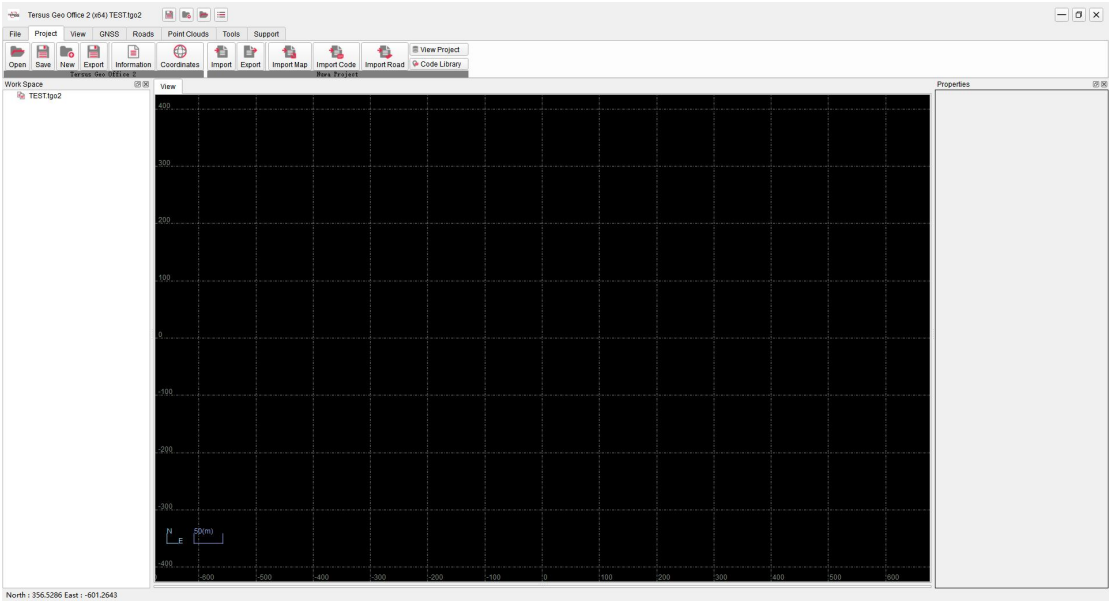


Figure 1.4 TGO2 Main Interface

2. Quick Start

- New Project
- Edit Coordinate System
- GNSS Post Processing
- Road Data Editing
- Point Clouds Data Processing

2.1 New Project

Click File menu, click [New] button, enter the project name or use current time as the default name, select the directory, click [OK] to create a new project.

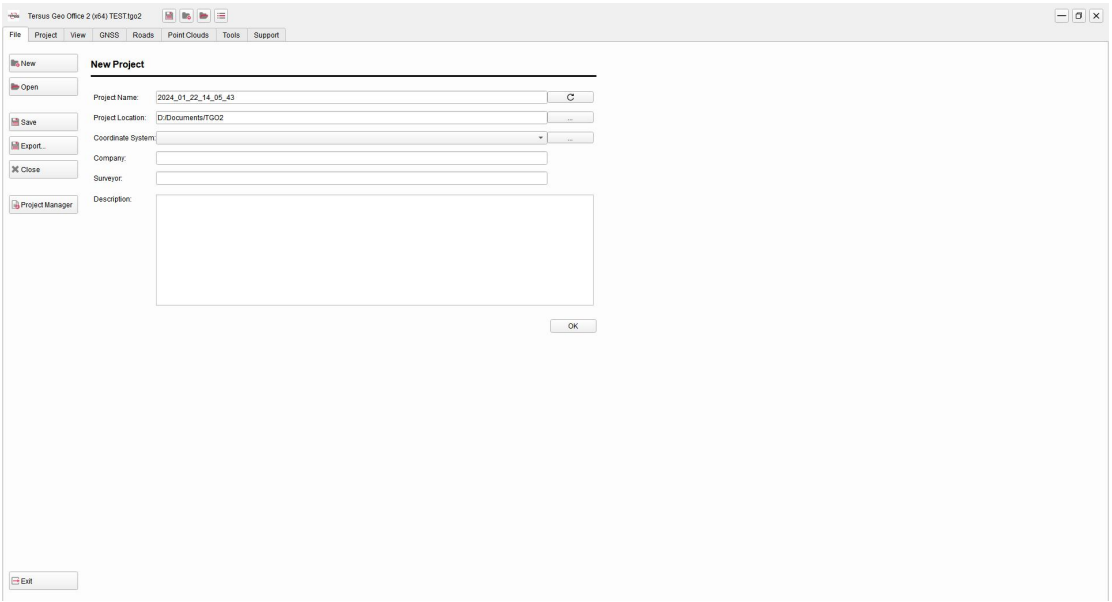


Figure 2.1 Quick Start - Create New Project

When creating new projects, select none coordinate system, or select from drop-down list. If there is no coordinate system that meets the requirement in the list, click [...] to open the coordinate system manager. Select the coordinate system in the predefined list or customized list, click [Add] to add it to the selectable coordinate system list on the left.

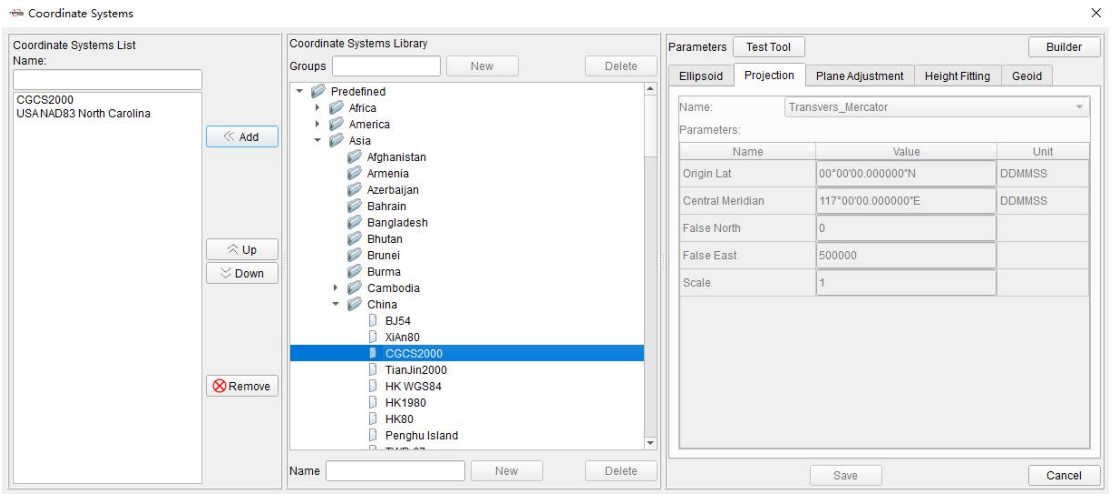


Figure 2.2 Quick Start - Coordinate System Manager

2.2 Edit Coordinate System

Click Project Menu after opening a project, click [Coordinates] to check or edit the coordinate system parameters of the current project. Edit the local ellipsoid and datum conversion parameters in Ellipsoid. Edit the projection and parameters such as central meridian, false north, false east in Projection. Select geoid model file in Geoid.

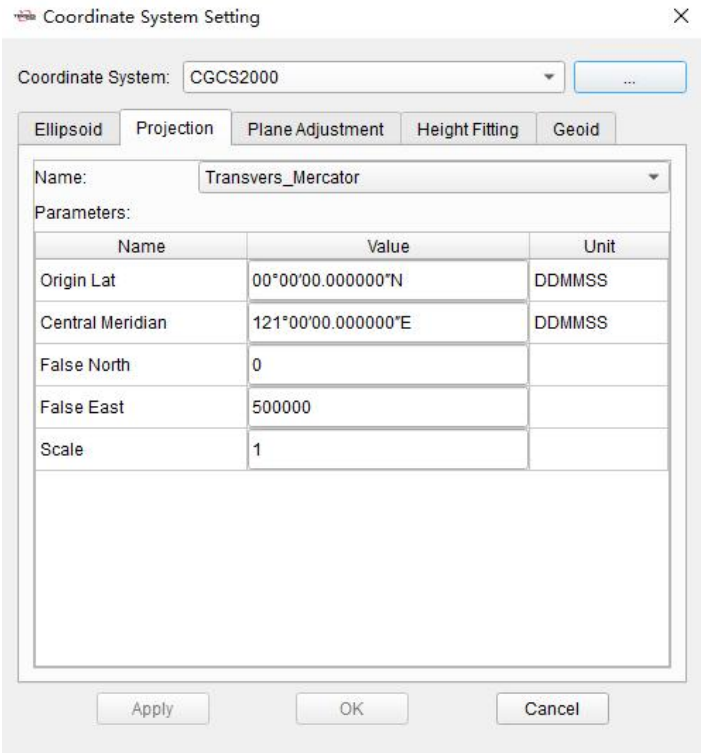


Figure 2.3 Quick Start - Edit Coordinate System

Switching the coordinate system by selecting it directly from the drop-down list is also allowed. If there is no coordinate system that meets the requirement in the list, click [...] to open the coordinate system manager. Select the coordinate system in the predefined list or customized list, click [Add] to add it to the selectable coordinate system list on the left.

2.3 GNSS Post Processing

Click GNSS Menu, click [Import] and select GNSS files in RINEX format or TRS format to import. The workspace on the left will show the imported data, containing stations, baselines and loops. The view interface will show the location of stations and baselines.

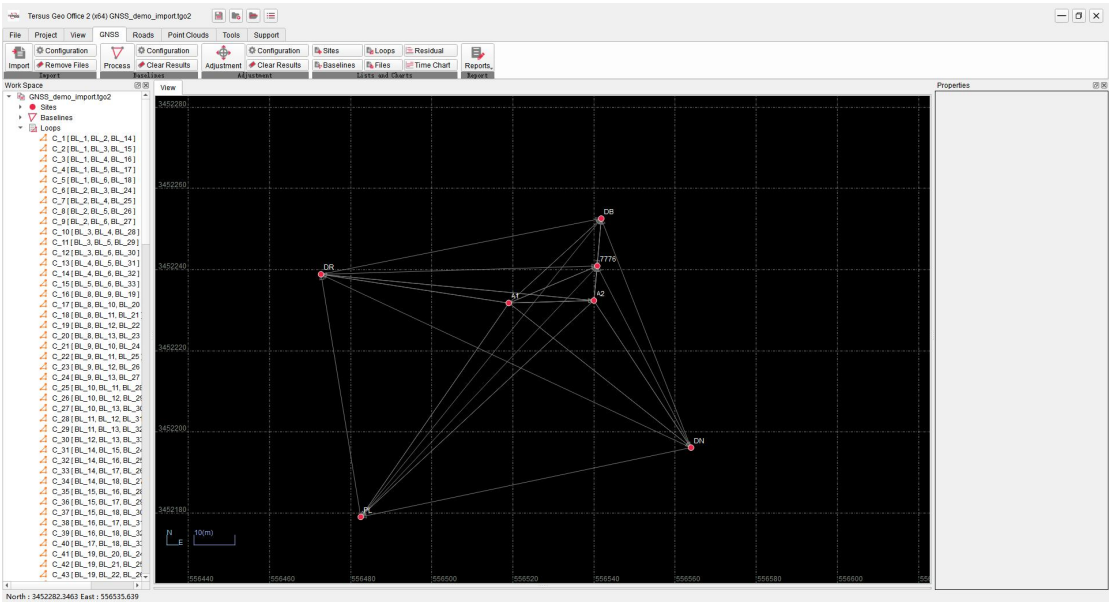


Figure 2.4 Quick Start - GNSS Data Import

Click [Files] under the GNSS TAB to display the information of files in a list. Click an file, and confirm or edit the station name, receiver information and antenna information of the corresponding station if the properties window on the right.

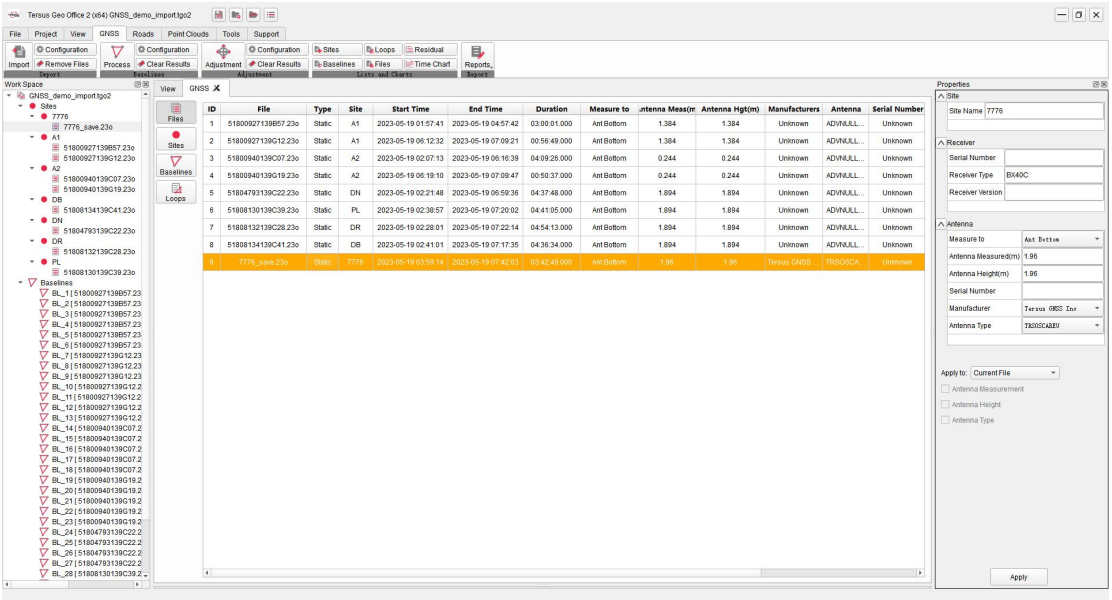


Figure 2.5 Quick Start - GNSS Data Edit

Click [Process] under the GNSS TAB to perform baseline processing. Baselines in the view will be highlighted, indicating the baselines have been processed. Click [Baselines] under GNSS TAB to display the detailed information of the baselines in a list.

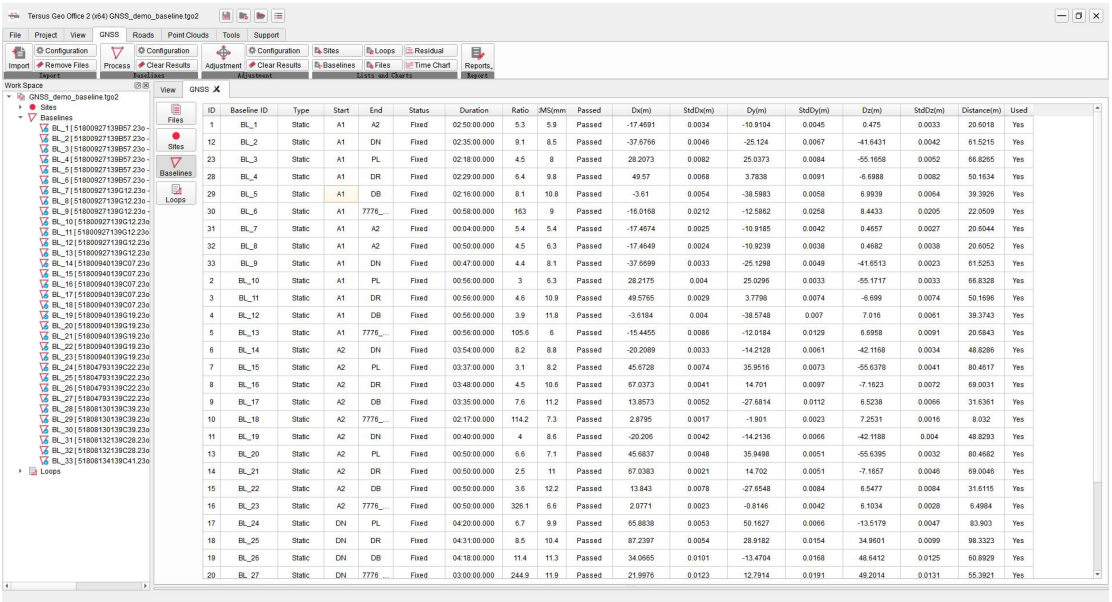


Figure 2.6 Quick Start - GNSS Baselines

If the baseline can not get a fixed solution, or the RMS value in the baseline processing result is large, select the baseline and right click on [Residual Plot]. Click the satellite or click [Previous] and [Next] to display the residuals of each satellite. According to the residuals, set the satellite unused, or draw a box to delete part of the observation data of the satellite and re-process it to get a more accurate result.

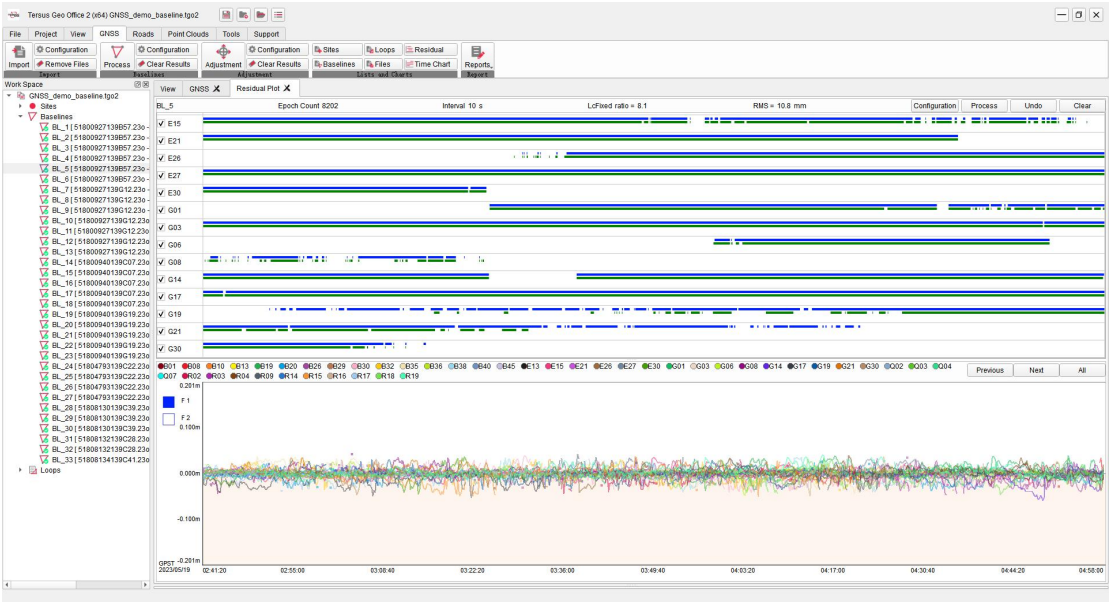


Figure 2.7 Quick Start - GNSS Baseline Residual Processing

After the baselines processing is completed, start network adjustment next. If there are control points, click [Sites] and select control points in the list, click [Constraint] in the right properties window, select WGS84 Constraint or Local Constraint and enter the constraints coordinates, then the known points in the sites list will be labeled.

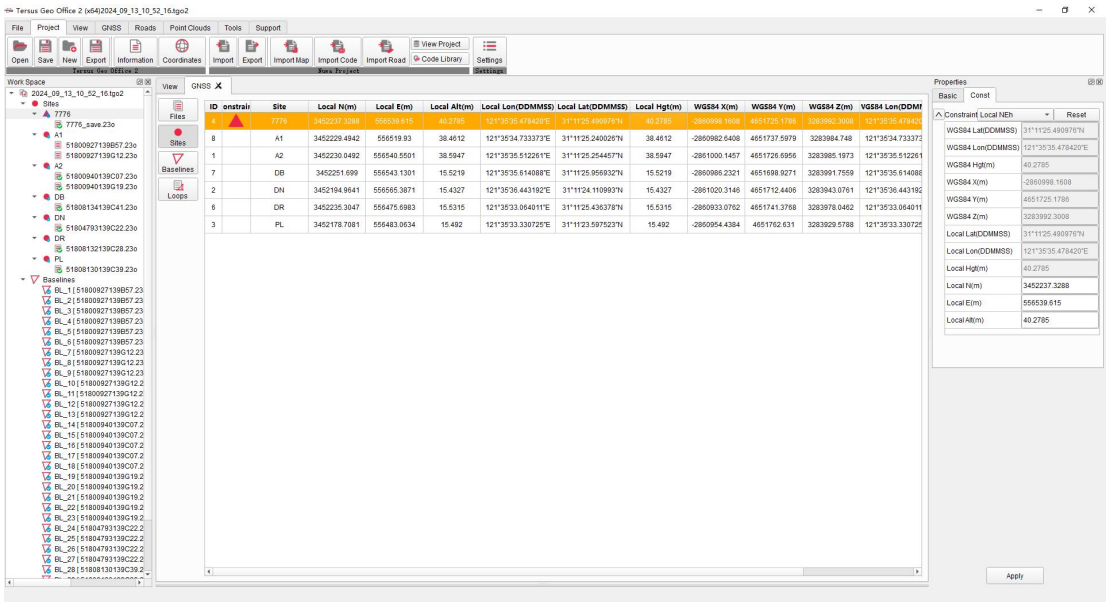


Figure 2.8 Quick Start - GNSS Constraints

Click [Adjustment] under the GNSS TAB, select [Auto] to perform adjustment according to the constraints. Click [Report] to open and view the report in browser, or click [Reports] under GNSS TAB and select other reports from the drop-down menu to open.

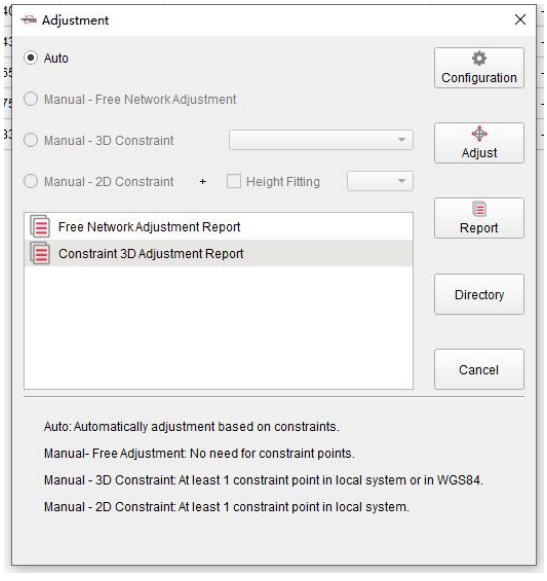


Figure 2.9 Quick Start - GNSS Network Adjustment

2.4 Road Data Editing

Click [New Road] under the Roads TAB and enter a road name to create a new road, or click [Import] and select a local road file in .trd format to import.

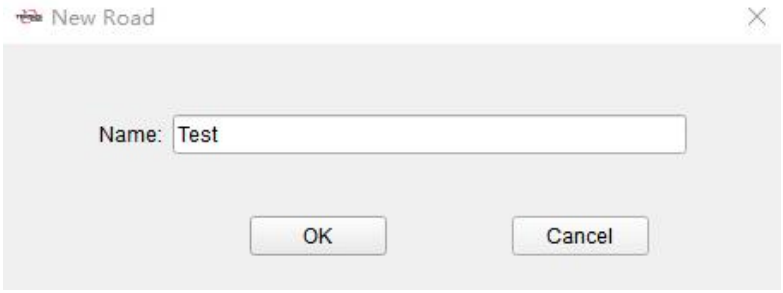


Figure 2.10 Quick Start - New Road

Click [Alignment] under the Roads TAB, input the starting point parameters of the road in properties window on the right side, and input the center line parameters in the road design window at the bottom in Intersection Method or Elements Method. After inputting, the graph of the alignments corresponding to the inputted parameters will be displayed in the view window.

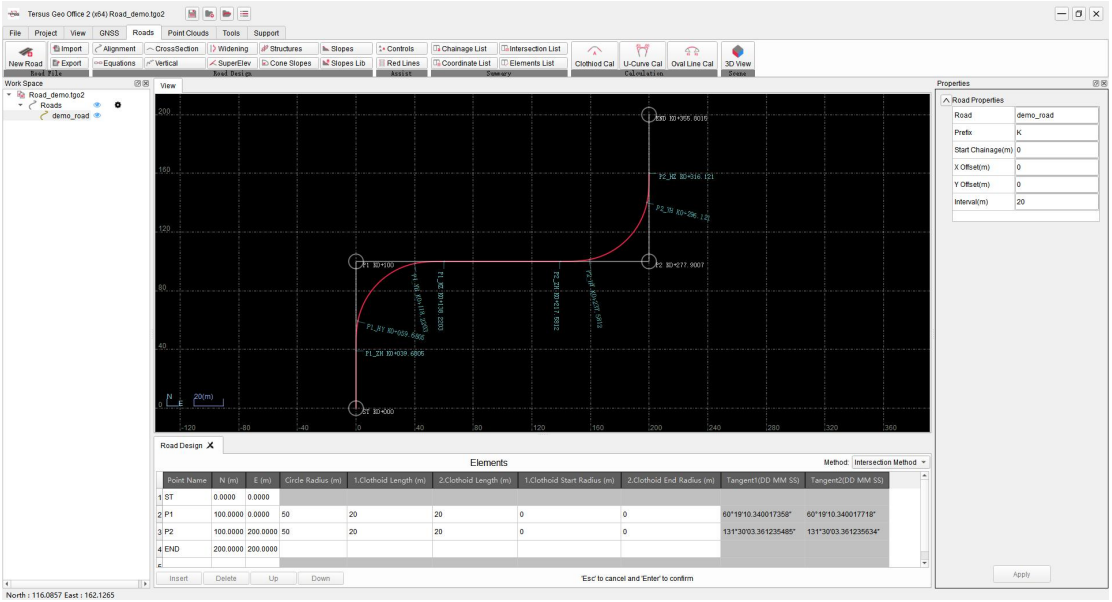


Figure 2.11 Quick Start - Road Alignments Parameters Editing

Click [Equations], [Vertical], [Cross Section] and other buttons under the Roads TAB to input the parameters of the road and display the corresponding graphics.

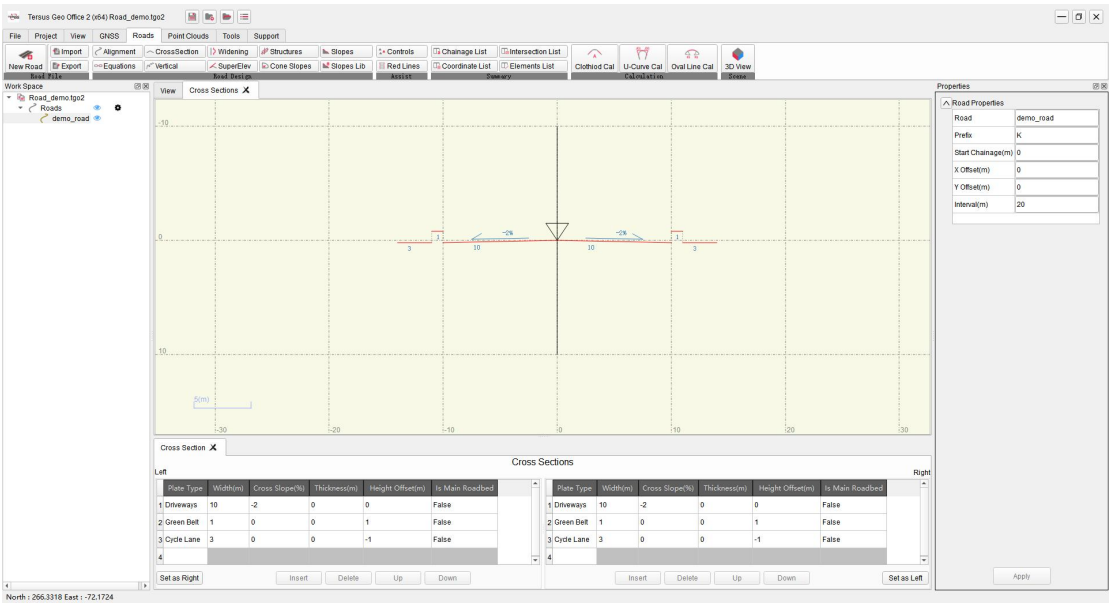
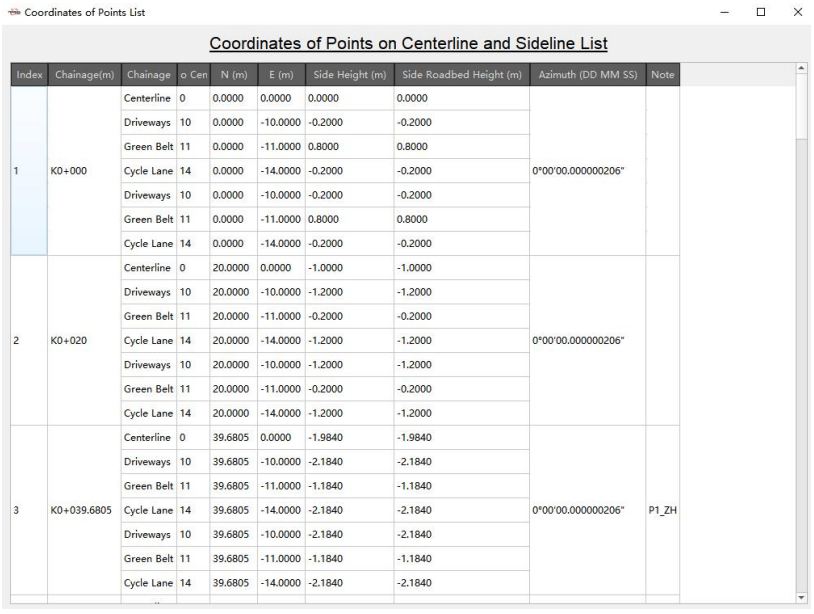


Figure 2.12 Quick Start - Road Cross Sections Parameters Editing

Click [Coordinate List] to check the edited road coordinates. Click [3D View] to view the edited road graphics. Then click [Export] to export edited road in .trd format and send it to Tersus Nuwa App to stake the road on field.



Index	Chainage(m)	Chainage	o Cen	N (m)	E (m)	Side Height (m)	Side Roadbed Height (m)	Azimuth (DD MM SS)	Note
1	K0+000	Centerline	0	0.0000	0.0000	0.0000	0.0000		
		Driveways	10	0.0000	-10.0000	-0.2000	-0.2000		
		Green Belt	11	0.0000	-11.0000	0.8000	0.8000		
		Cycle Lane	14	0.0000	-14.0000	-0.2000	-0.2000	0°00'00.000000206"	
		Driveways	10	0.0000	-10.0000	-0.2000	-0.2000		
		Green Belt	11	0.0000	-11.0000	0.8000	0.8000		
		Cycle Lane	14	0.0000	-14.0000	-0.2000	-0.2000		
2	K0+020	Centerline	0	20.0000	0.0000	-1.0000	-1.0000		
		Driveways	10	20.0000	-10.0000	-1.2000	-1.2000		
		Green Belt	11	20.0000	-11.0000	-0.2000	-0.2000		
		Cycle Lane	14	20.0000	-14.0000	-1.2000	-1.2000	0°00'00.000000206"	
		Driveways	10	20.0000	-10.0000	-1.2000	-1.2000		
		Green Belt	11	20.0000	-11.0000	-0.2000	-0.2000		
		Cycle Lane	14	20.0000	-14.0000	-1.2000	-1.2000		
3	K0+039.6805	Centerline	0	39.6805	0.0000	-1.9840	-1.9840		
		Driveways	10	39.6805	-10.0000	-2.1840	-2.1840		
		Green Belt	11	39.6805	-11.0000	-1.1840	-1.1840		
		Cycle Lane	14	39.6805	-14.0000	-2.1840	-2.1840	0°00'00.000000206"	P1_ZH
		Driveways	10	39.6805	-10.0000	-2.1840	-2.1840		
		Green Belt	11	39.6805	-11.0000	-1.1840	-1.1840		
		Cycle Lane	14	39.6805	-14.0000	-2.1840	-2.1840		

Figure 2.13 Quick Start - Road Coordinates

2.5 Point Clouds Data Processing

Click [New Clouds] under the Point Clouds TAB, to create a new point clouds data first.

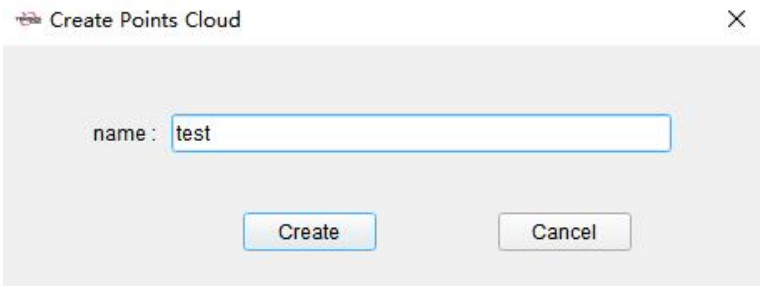


Figure 2.14 Quick Start - Create Point Clouds

Click [Edit Clouds] to open the Point Clouds windows. Click on the Las source files [+] to select one or more .las files to import.

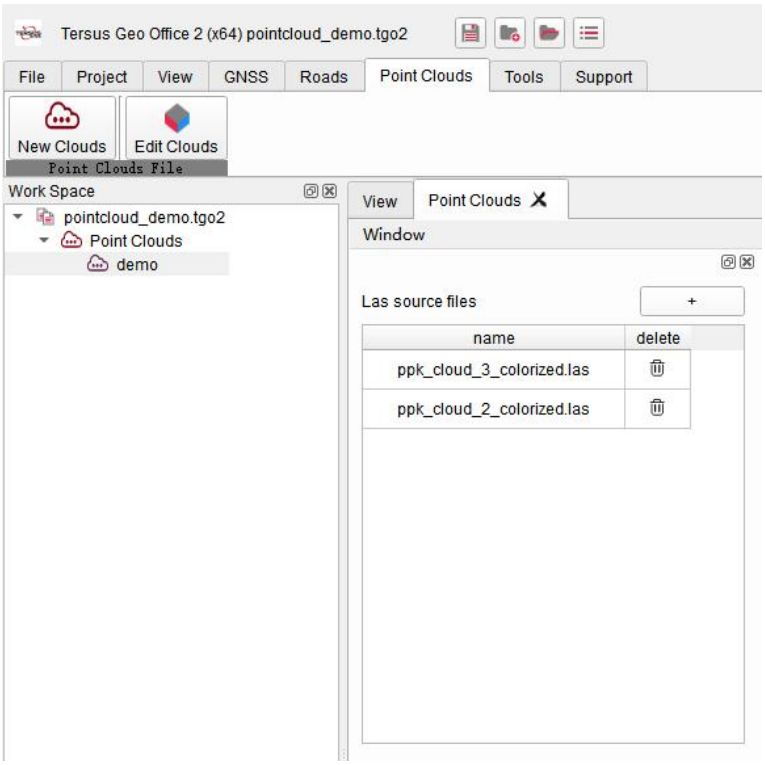


Figure 2.15 Quick Start - Point Clouds LAS Files Import

Click on the Datasets [+] and check the attributes column of the LAS files, enter the name and wait for the data import of the checked attributes to complete.

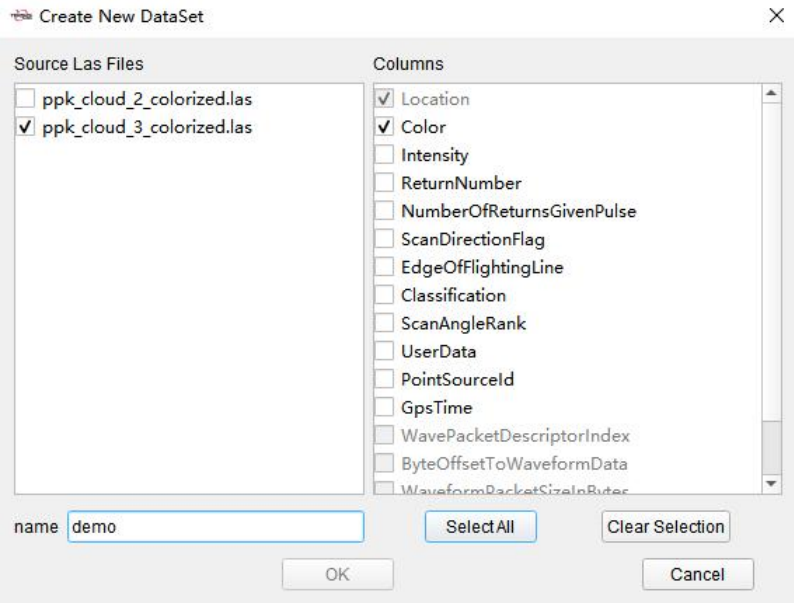


Figure 2.16 Quick Start - Point Clouds Datasets Import

After successful import, the view interface shows the point clouds graph. Use the mouse wheel to zoom, the left mouse button to adjust the view angle, and the right mouse button to move.

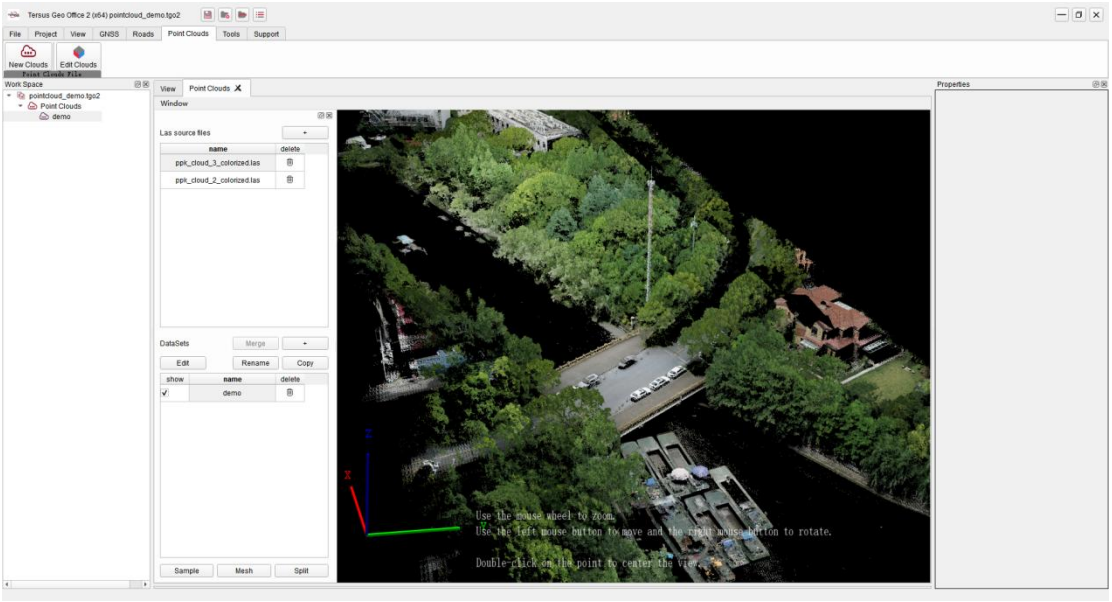


Figure 2.17 Quick Start - Point Clouds Display

Select the item in the datasets list to Sample, Mesh, Split. Or click [Edit] for marking, selecting, earthwork calculation or other operations.

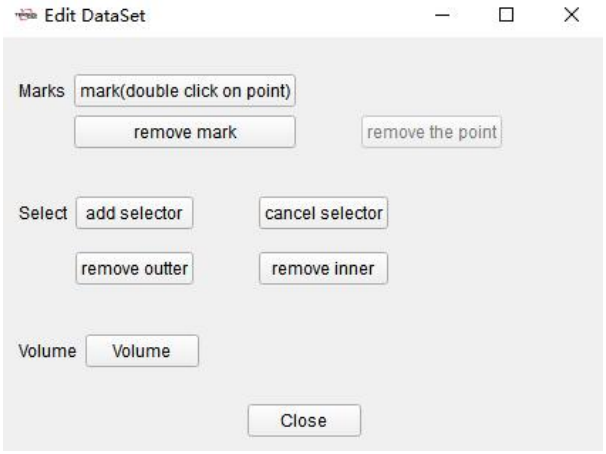


Figure 2.18 Quick Start - Point Clouds Data Editing

3. File

- New Project
- Open & Close
- Save & Export
- Project Manager
- Exit Software

3.1 New Project

Click File menu, click [New] button, enter the New Project interface.

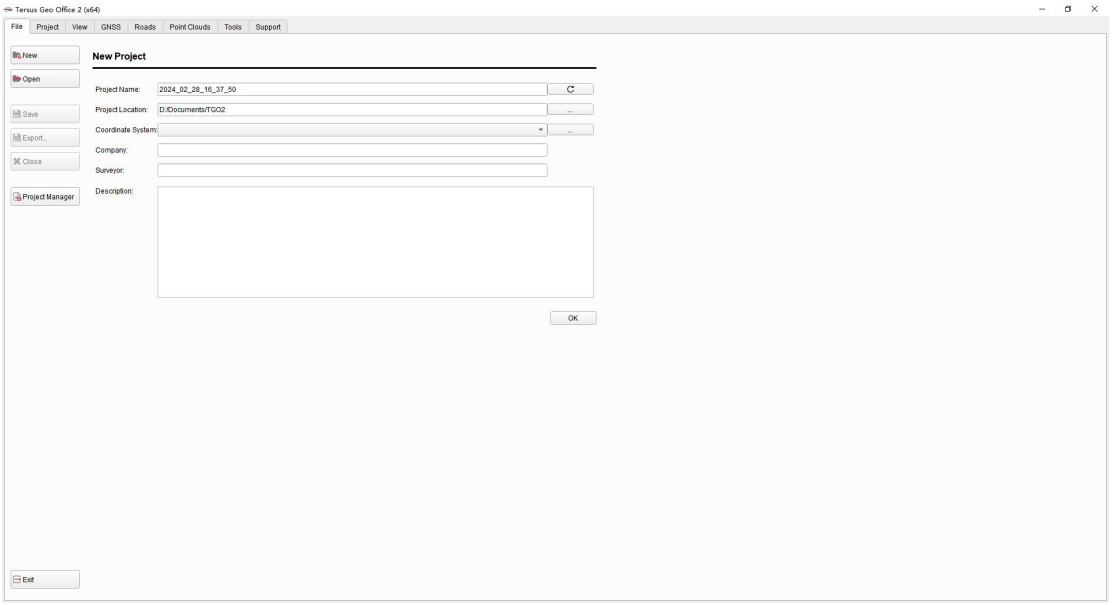


Figure 3.1 New Project Interface

Project Name	Enter new project name, default use the current time as the name, click refresh button  to refresh the current time display.
Project Location	Enter or click  to select the local path for new project.
Coordinate System	Select the coordinate system from the drop-down list for new project, or click  to add more coordinate systems to the list in the Coordinate Systems tool to select. Please refer to section 9.1 for the operation of Coordinate System tool. When creating the new project, if you select none as the coordinate system, the software will automatically create a coordinate system with the name of WGS84, which uses WGS84 as the ellipsoid and Transverse Mercator as the projection after importing GNSS data.
Company	Company information for new project, non-required fields
Surveyor	Surveyor information for new project, non-required fields
Description	Description information for new project, non-required fields

3.2 Open & Close

Click File menu, click [Open] button, select the .tgo2 project file in the local path to open. If a project is currently opened, close the current project first then open another project.

Click File menu, click [Close] button, to close currently opened project. If no project is opened, the button can not be clicked.

3.3 Save & Export

Click File menu, click [Save] button, to save currently opened project.

Click File menu, click [Export] button, select the local path to export currently opened project to another path.

If no project is opened, the buttons can not be clicked.

3.4 Project Manager

Click File menu, click [Project Manager] button, to display the list of projects.

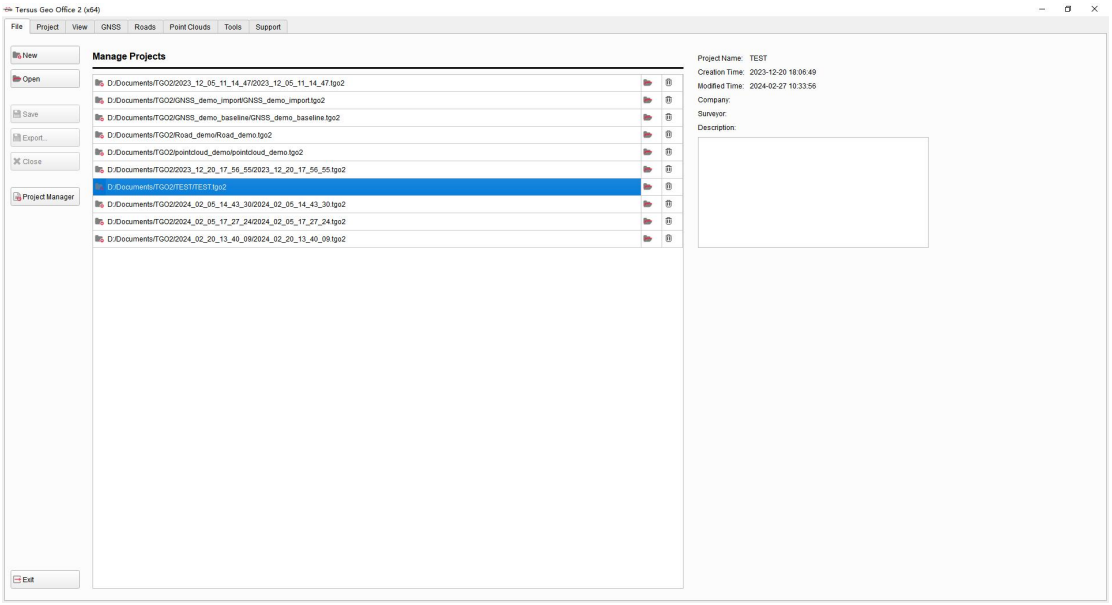


Figure 3.2 Project List Interface

Click project in the list to show the project information on the right side.

Double click project in the list to open the project.

Click the folder icon  in list to open the folder where the project data is located.

Click the delete icon  in list to remove the project from the list or directly delete the project folder and all data of the project.

3.5 Exit Software

Click File menu, click [Exit] button, to close the currently opened project and exit Tersus Geo Office 2 software.

4. Project

- Project Management
- Coordinate Systems
- Nuwa Project
- Settings

4.1 Project Management

Click Project menu, click [Open] button, select the .tgo2 project file in the local path to open. If a project is currently opened, close the current project first then open another project.

Click Project menu, click [Save] button, to save currently opened project.

Click Project menu, click [New] button, to jump to new project interface.

Click Project menu, click [Export] button, select the local path to export currently opened project to another path.

Click Project menu, click [Information] button, open the project information dialog, displaying project name, creation time, modified time, company, surveyor, description and other information, of which the company, surveyor and description can be modified.

4.2 Coordinate Systems

Click Project menu, click [Coordinates] button, open the coordinate system setting dialog, displaying coordinate system and parameters of the current project.

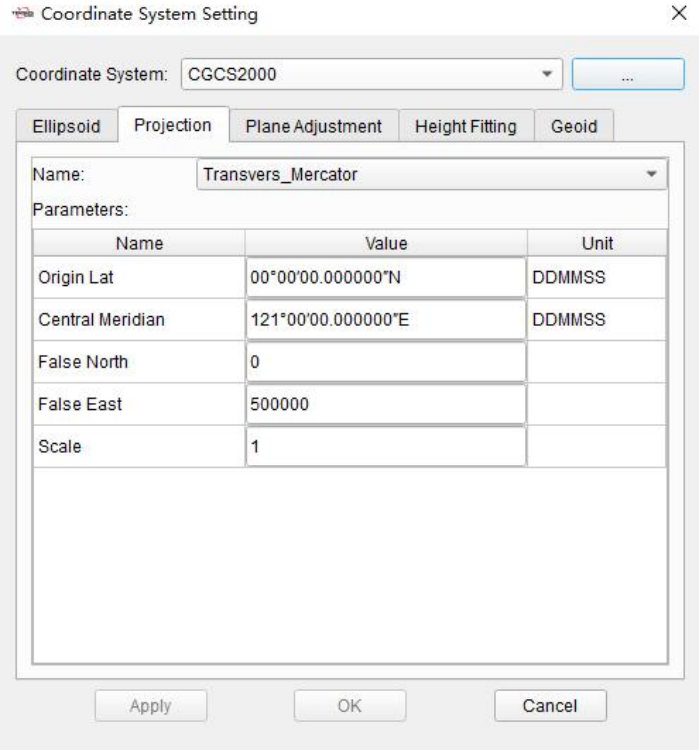


Figure 4.1 Coordinate System Parameters

Coordinate System	The name of the current coordinate system. Click to switch to another coordinate system from the drop-down list and parameters of ellipsoid, projection, plane adjustment and height fitting will be changed accordingly. Or click  to add more coordinate systems to the list in the Coordinate Systems tool to select. Please refer to section 9.1 for the operation of Coordinate System tool.
Ellipsoid	The local ellipsoid of of the current project, including ellipsoid and datum transformation. When editing ellipsoid parameters, you can select it from the drop-down list, and the parameters such as a and 1/f will be changed accordingly. The datum trans includes None, Three Parameters and Seven Parameters. In the current project, the ellipsoid and datum trans are used to realize the conversion calculation of Lat/Lon/Hgt coordinates under WGS84 and local system.
Projection	The projection of the current project. Select projection type from the drop-down list, and enter parameters according to projection type, such as Origin Lat, Central Meridian, False North, False East, Scale and so on. In the current project, the projection is used to realize the conversion calculation of Lat/Lon coordinates and North/East coordinates under local system.
Plane Adjustment	The plane adjustment parameters of the current project. In the current project, the plane adjustment is used to realize the conversion calculation of projected North/East coordinates and known coordinates in site calibration.
Height Fitting	The height fitting parameters of the current project. In the current project, the height fitting is used to realize the conversion calculation of ellipsoidal height coordinates and known altitude coordinates in site calibration.
Geoid	The geoid model of the current project.

In the current project, the geoid model file selected is used to calculate altitude above mean sea level from ellipsoidal height.

4.3 Nuwa Project

Click Project menu, click [Import] button, open Nuwa Project Import dialog. Select Nuwa project, base map file, road file or code file in local path or connecting device to import.

Click Project menu, click [Export] button, open Nuwa Project Export dialog. Select Nuwa project, base map file, road file or code file to export to local path or connecting device.

Click Project menu, click [Import Map] button, select base map file in local path or connecting device to import.

Click Project menu, click [Import Code] button, select code file in local path or connecting device to import.

Click Project menu, click [Import Road] button, select road file in local path or connecting device to import.

Click Project menu, click [View Project] button, to display Survey Points, Staking Points, Control Points and Poly Lines in Nuwa project in lists.

Click Project menu, click [Code Library] button, to display code and code list data imported in dialog.

4.4 Settings

Click Project menu, click [Settings] button, open the software settings dialog.

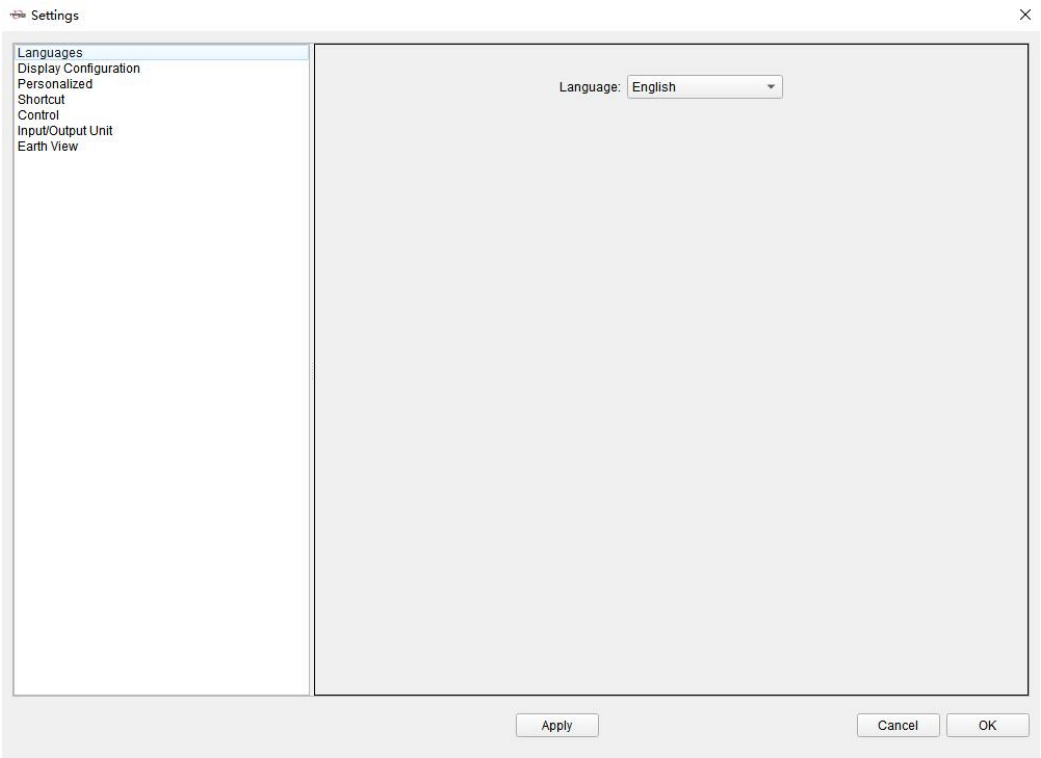


Figure 4.2 Software Settings

Languages	Software display language, select English or Simplified Chinese.
Display Configuration	Coordinates: Select the coordinates display order, the unit, and decimal precision of Lat/Lon, Height, North/East coordinates, Elevation, etc. Time: Select the time display format, the unit and decimal precision of pressure and temperature. General: Select the unit and decimal precision of general numbers, distance, height, angle, etc.
Personalized	Software display theme style, select Standard or Deep Color. Select the display color of different data in the view in different states.
Shortcut	Enable and define shortcuts operations.
Control	Turn on or off the display of position coordinates in the view.
Input/Output Unit	Select the unit for importing base map files.
Earth View	Configure the image source in Earth View, choose online ArcGIS, Google Map and other maps to display the data and images overlaid.

5. View

- Select
- Scene
- Earth View
- Measurement
- Windows

5.1 Select

Click View menu, click [Select] button, to tap or box the data elements in the view, to perform processing on the selected data.

Click View menu, click [Move] button, to drag the display area in the view.

Click View menu, click [Rect Select] button, to construct a polygon selection range in the view with the left mouse button and complete the selection range with the right mouse button, to perform processing on the selected data.

Select, Move and Rect Select functions are also available in the view by clicking the right mouse button.

5.2 Scene

Click View menu, click [Zoom All] button, adjust the display area in the view to show all data elements.

Click View menu, click [Zoom Center] button, adjust the display area in the view to center the left mouse button click position.

Click View menu, click [Show Grids] button, to show or hide the coordinate grid in the view.

Click View menu, click [Zoom Out] button, and then click the left mouse button to zoom out the view centered on the click position.

Click View menu, click [Zoom In] button, and then click the left mouse button to zoom in the view centered on the click position.

Zoom All, Show Grids, Zoom Out and Zoom In functions are also available in the view by clicking the right mouse button.

5.3 Earth View

Click View menu, click [Earth View] button, open the earth view interface.

In earth view interface, use the mouse wheel to zoom the display. Use the left mouse button to drag the display and the right mouse button to rotate the display, to adjust the 3D display angle of Earth View.

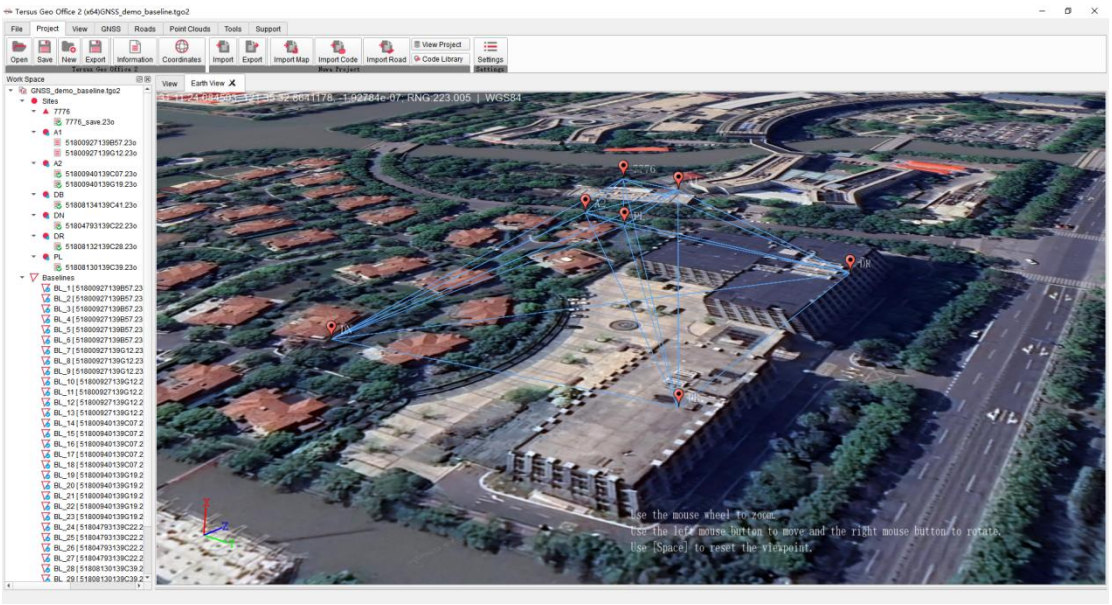


Figure 5.1 Earth View

5.4 Measurement

Click View menu, click [Distance] button, select two or more points with the left mouse button in the view to measure the distance value, and exit measurement with the right mouse button.

Click View menu, click [Area] button, select three or more points with the left mouse button in the view to measure the area value, and exit measurement with the right mouse button.

Click View menu, click [Angle] button, select three or more points with the left mouse button in the view to measure the angle value, and exit measurement with the right mouse button.

Click View menu, click [Clear Results] button to clear all measurement results displayed on the view.

5.5 Windows

Click View menu, click [Work Space] button to show or hide the Work Space window.

The Work Space window displays all the data and their relationships in the project, and the display of each data can be configured.

Click View menu, click [Log Info] button to show or hide the Log Info window.

The Log Info window displays errors, warnings and information prompts in the operation.

Click View menu, click [Properties] button to display or hide the Properties window.

The Properties window displays the attribute parameters of selected data, and the attribute parameters can be configured in properties window.

6. GNSS

- Import
- Baselines
- Adjustment
- Lists and Charts
- Report

6.1 Import

6.1.1 Import Data

Click GNSS menu, click [Import] button, select GNSS observation files in local path and import them. RINEX format and TRS format are supported, and multiple files selection is supported by CTRL or SHIFT keys.

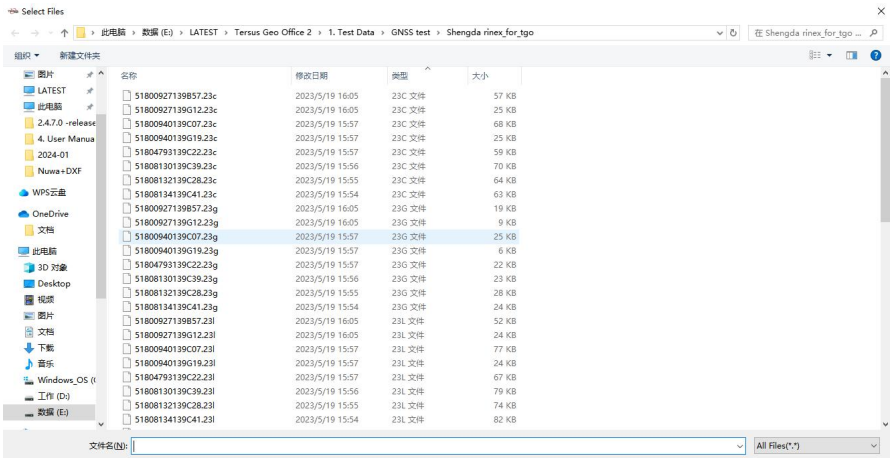


Figure 6.1 Import GNSS Data

Click Open to start importing the selected files, wait for the process bar to complete.

Figure 6.2 Import Data Process Bar

After importing files, if the coordinate system of current project has not been configured, the software will prompt and ask whether to set Transverse Mercator as the default projection. If the central meridian of the configured coordinate system for current project differs greatly from the sites in imported files, the software will prompt whether to modify the central meridian , then the coordinates system configuration dialog will be opened and the central meridian will be set to the average longitude of sites if you click Yes.

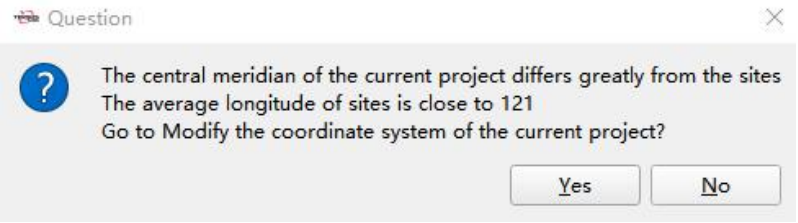


Figure 6.3 Prompt for Editing Central Meridian

After importing GNSS files and configuring the correct coordinate system parameters, a graphical representation of the sites, baselines and their relationships will be displayed in projection coordinates in the view interface. Items of sites, files, baselines and loops will be displayed in Work Space window. If a site or baseline is selected in view, the item in work space window will be highlighted and more information will be displayed in properties window.

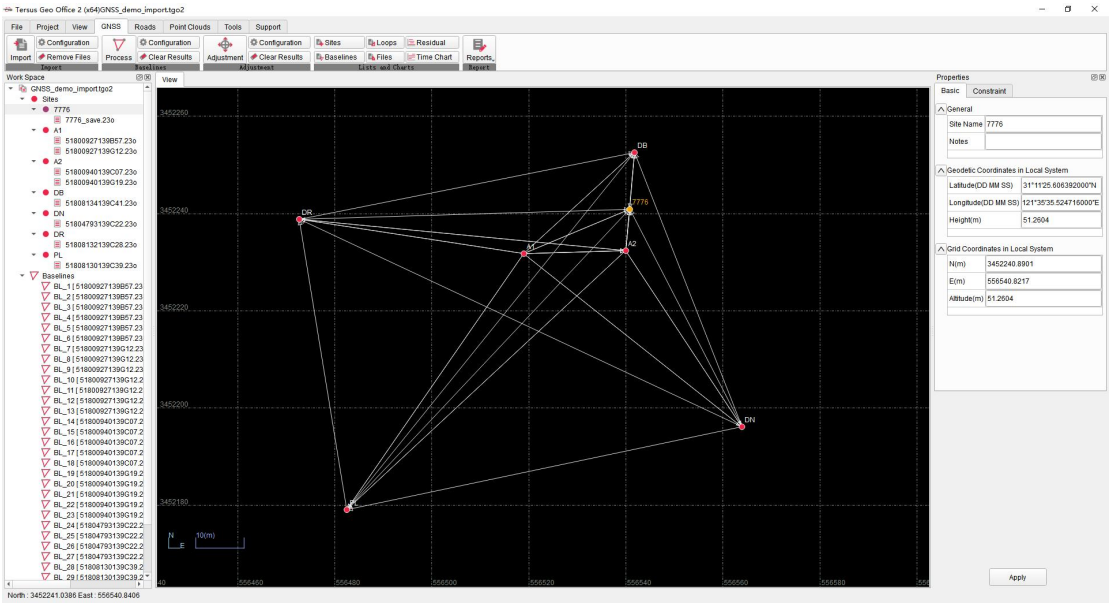


Figure 6.4 After Data Import

Click GNSS menu, click [Files] button, to display imported GNSS observation files in list. Click to select files in the Files list, to display and modify Site Name, Receiver information and Antenna parameters of the selected file.

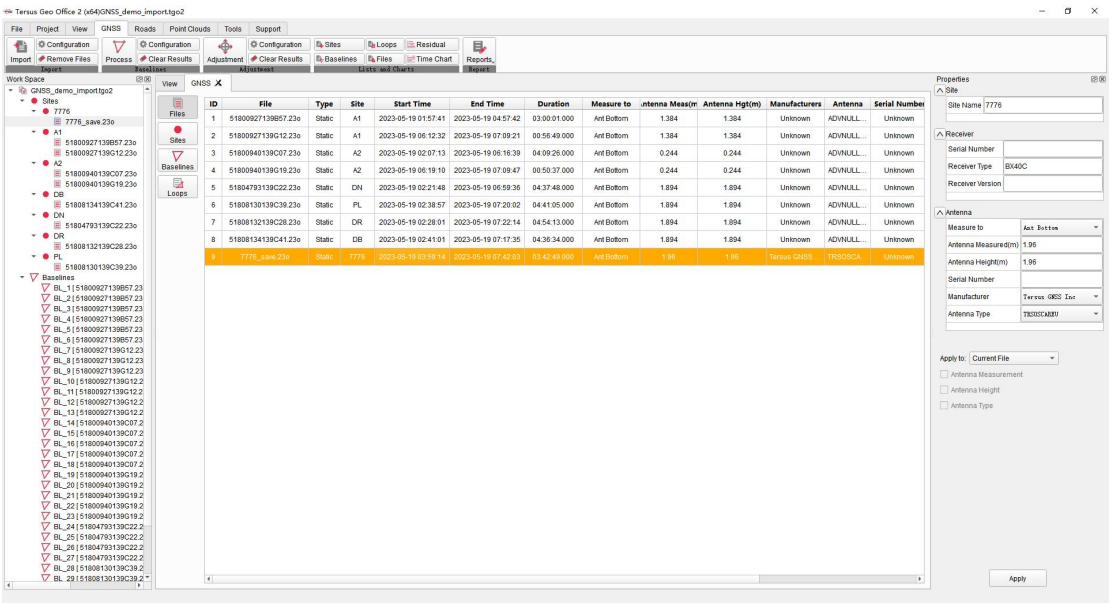


Figure 6.5 Files List

When modifying antenna parameters, select [Measure to] [Ant Bottom], which means the vertical height from the ground point to the antenna bottom, or [Slant Height], which means the slant distance from the ground point to 13cm length measuring board. Enter [Antenna Measured], that is the reading in antenna measurement, and the software will automatically calculate [Antenna Height] of the antenna reference point. Select the correct antenna [Manufacturer] and [Antenna Type] for software to calculate the antenna phase center height. After modification, choose to apply to the current file or other more files.

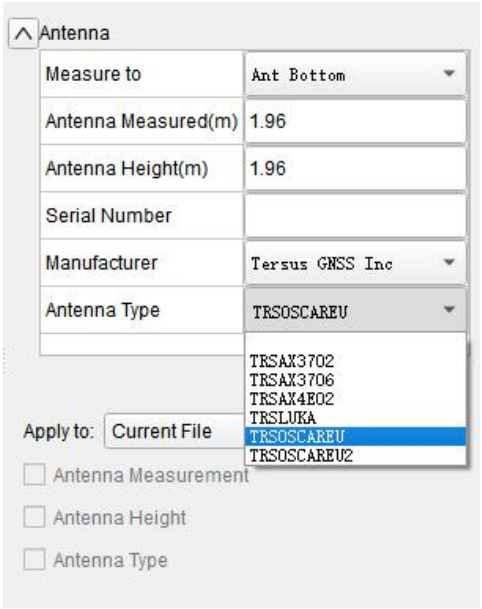


Figure 6.6 Antenna Parameters Modifying

6.1.2 Import Configuration

Click GNSS menu, click import configuration, open the import configuration dialog, where to edit parameters of baselines rules, sites merging rules and loops rules.

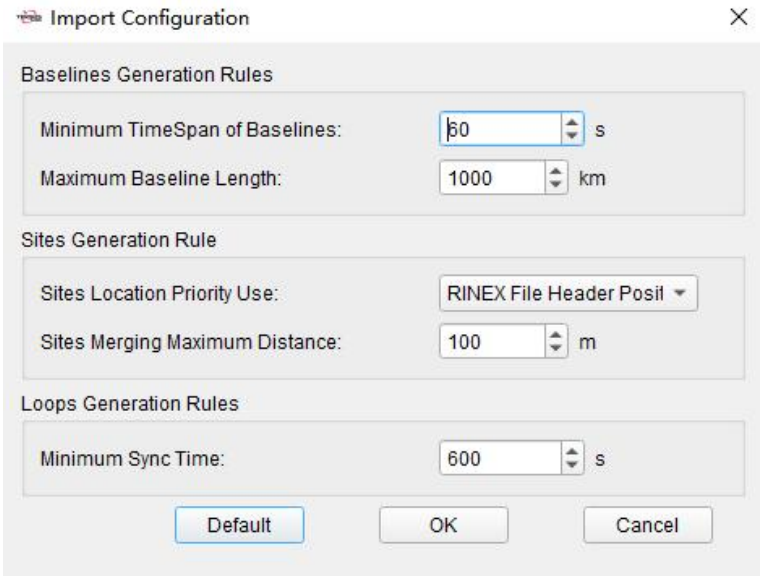


Figure 6.7 Import Configuration

Baselines Generation Rules	Minimum Time Span of Baselines	The default is 60 seconds. Software will not generate a baseline between sites if the synchronization time of sites is less than this configured threshold.
	Maximum Baseline Length	The default is 1000 km. Software will not generate a baseline between sites if the distance is greater than this configured threshold.
Sites Generation Rules	Sites Location Priority Use	The default is Autonomous Position, which means the calculated value of the autonomous position in the observation files will be used as the sites coordinates. It could be changed to RINEX File Header Position, which means the calculation of approximate coordinates in RINEX file header if recorded will be used as the sites coordinates.

	Sites Merging	The default is 100 meters. When importing two or more files recorded as the same site name, and the distance between their autonomous positions is less than this configured threshold, software will consider the files are observed on the same site at different times and record them under one site in work space window.
	Maximum Distance	When importing two or more files recorded at the same name, and the distance between their autonomous position is greater than this configured threshold, software will consider the files are not observed on the same site but wrongly recorded as the same name, then will automatically rename it as a different site.
Loops Generation Rules	Minimum Sync Time	The default is 600 seconds. If the synchronization time of the three baselines or the three sites that make up the closed loop is greater than this this configured threshold, software will consider the loop to be a synchronous loop, otherwise it is an asynchronous loop.

6.1.3 Remove Files

Click GNSS menu, click remove files, to clear all GNSS data in the current project.

6.2 Baselines

6.2.1 Baselines Process

After importing GNSS files and completing modification, click GNSS menu, click [Process] button, to process all baselines.

Figure 6.8 Baseline Process

Wait for the process bar to complete. After baselines process, baselines will be displayed in different colors in view interface to indicator that baselines have been processed. Click [Baselines] under GNSS menu, to show baselines parameters in list.

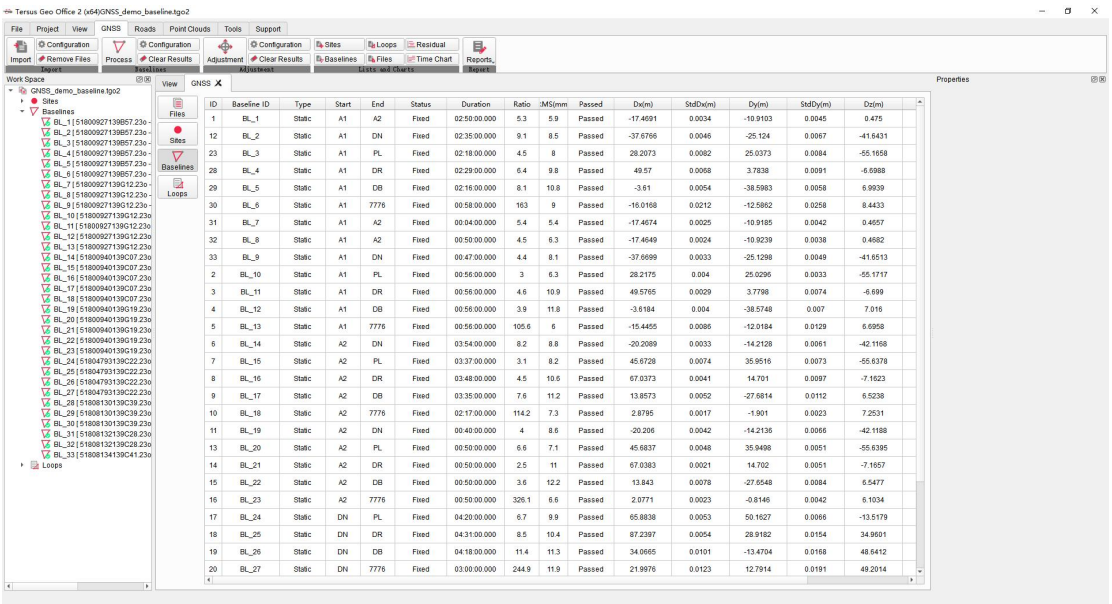


Figure 6.9 Baseline List

Select one or several baselines in view interface or work space window, click the right mouse button to process only selected baselines.

6.2.2 Residual Process

After baselines process, if some of baselines solution cannot get fixed, or RMS values in baselines solution are large, select the baseline and right-click on [Residual Plot] to open residual plot of the selected baseline to process and improve the precision.

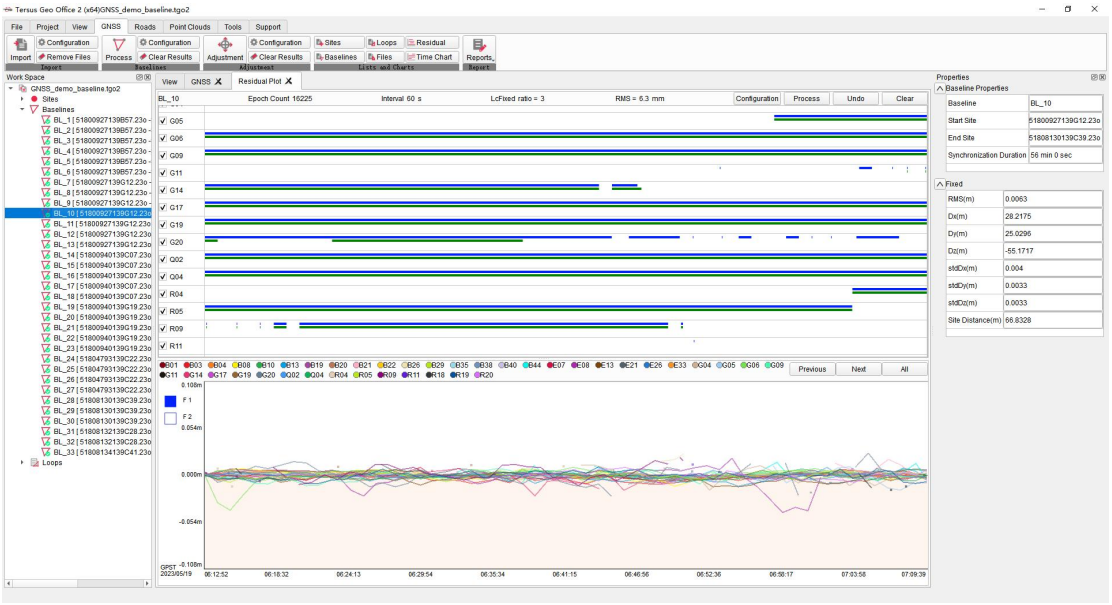


Figure 6.10 Residual Plot

In the residual plot interface, the upper part shows the observation of each satellite and frequency, the lower part shows the residual of satellites compared with the reference satellite in each epoch during the baseline processing. The residual of each satellite can be displayed by clicking on the satellite number in the lower part or by clicking [Previous] and [Next] buttons. The displayed residuals can be zoomed on the vertical axis by using the mouse wheel.

According to the residuals, disable or enable the satellite by click the check box before satellite name in the upper part. Or click and drag to draw a box on the satellite observation data bar to delete the observation data corresponding to the larger part of the residuals. After residuals process, click [Process] to re-process the baseline and check the change in RMS value to see if a higher precision result is obtained.

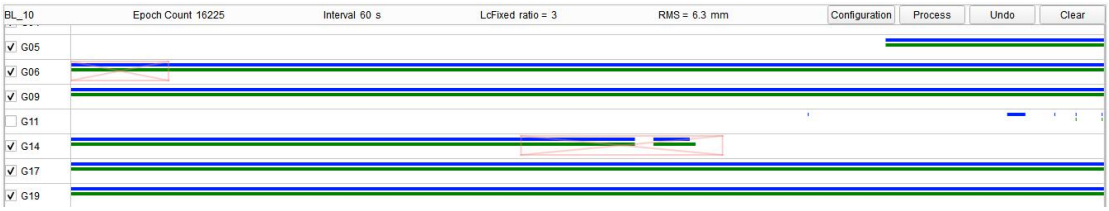


Figure 6.11 Satellites and Observation Process

6.2.3 Process Configuration

Click GNSS menu, click Process Configuration, open the process configuration dialog, where to edit parameters of baseline process, atmospheric model and baseline processing quality thresholds.

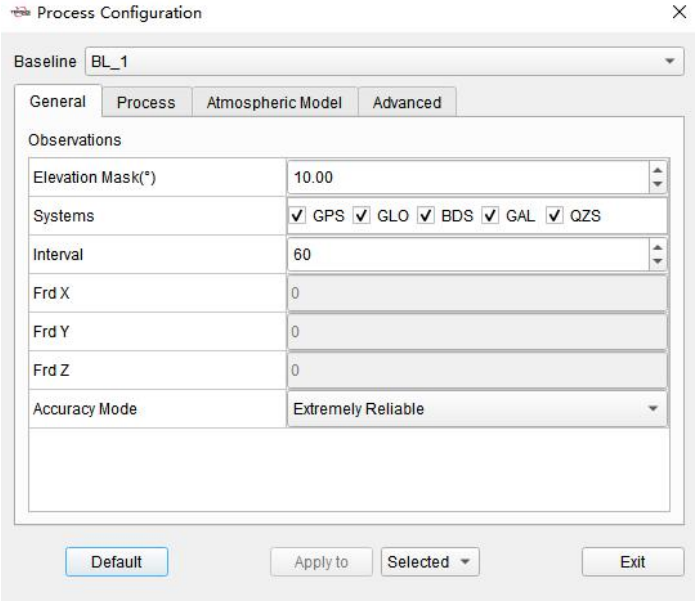


Figure 6.12 Process Configuration

General Observations	Elevation Mask	The default is 10 degrees. Only satellites with elevation angle greater than this configured threshold will be computed during baseline process.
	Systems	Satellite system used in baseline process.
	Interval	The default is 60 seconds. Sampling the observation data for processing according to the configured interval, and the smaller the sampling interval, the larger amount of processed data.

	Frd X /Y / Z	Not configurable.
	Accuracy Mode	The algorithm strategy during baseline process. The options are Rapid Fix, Balanced and Extremely Reliable. Rapid Fix, software will prioritize solutions where baselines get fixed. Extremely Reliable, software will prioritize the accuracy when baselines are fixed.
Process Process Mode	Process Mode	The options are Auto, Static and PPK. When Auto is selected, software will select static or PPK mode according to the observation file type.
Atmospheric Model	Troposphere Model	Not configurable. The Hopfield tropospheric model is used during baseline process.
Meteorological Data	Temp / Press / Humid	Not configurable. The default parameters is used during baseline process.
Advanced Quality Control	RMS Limit	The default is 0.04 m. If the RMS value in processing result is greater than this configured threshold, software will consider it fails.
	Frequency	Not configurable. Software automatically determines the combination of frequencies during baseline process.
Advanced	Use LC Combine	Not configurable. Software uses a combination of LC observations during baseline processing.

6.2.4 Clear Process Results

Click Clear Process Results under GNSS menu, to clear the processing results of all baselines and revert to the state when they were not processed.

6.3 Adjustment

6.3.1 Constraints

After baseline processing and before network adjustment, if there are sites with known coordinates, click [Sites] button under GNSS menu and select the sites in the list, then click [Constraint] in Properties window to enter known coordinates.

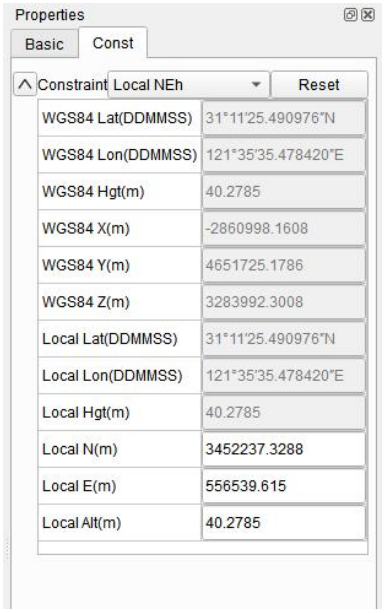


Figure 6.13 Known Coordinates

According to the adjustment requirements and known coordinates, select to input WGS84 XYZ coordinates, WGS84 Lat/Lon/H coordinates, Local Lat/Lon/H coordinates or Local N/E/h coordinates. Save the constraints and the sites with known coordinates will be marked by red triangle in the sites list.

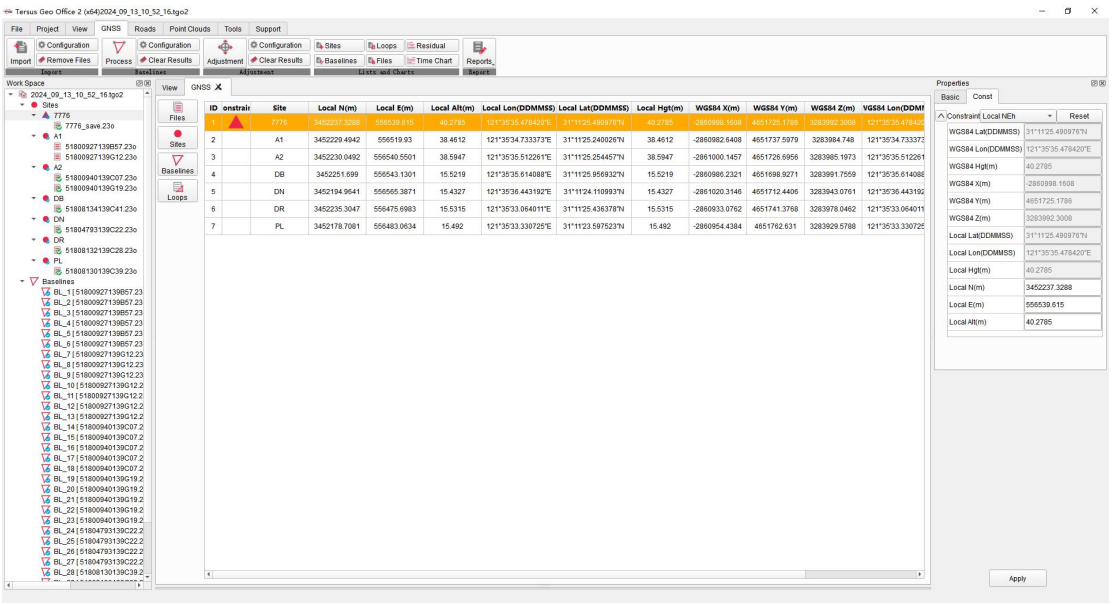


Figure 6.14 Site with Constraints

6.3.2 Adjustment

Click [Adjustment] button under GNSS menu, open the adjustment dialog. Select Auto and click [Adjust], then software will perform network adjustment and generate reports according to the constraints.

If there are no constraints, software only perform free network adjustment and generates Free Network Adjustment Report. If there are WGS84 XYZ coordinates, WGS84 Lat/Lon/H coordinates, Local Lat/Lon/H coordinates or Local N/E/h coordinates as constraints, software will perform free network adjustment and constraint 3D adjustment, then generates Free Network Adjustment Report and Constraint 3D Adjustment Report.

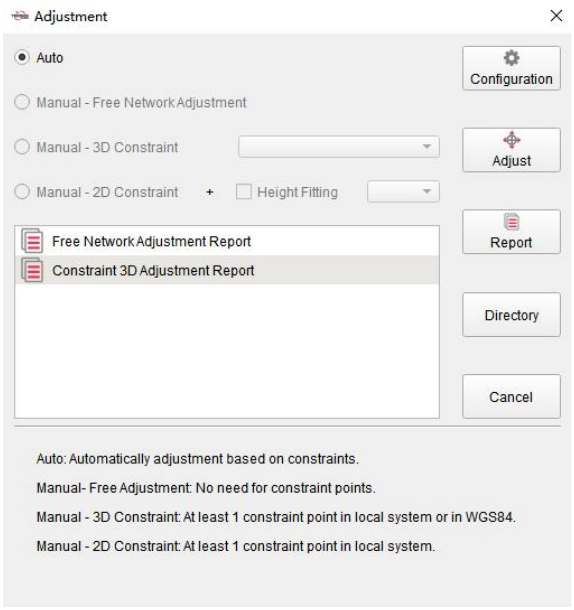


Figure 6.15 Adjustment

Click [Configuration] to open adjustment configuration dialog to modify the parameters during adjustment. Click [Adjust] in adjustment dialog to redo the adjustment. After adjustment, according to requirements and known coordinates, select report and click [Report] to view the report in the browser. Click [Directory] to open the directory where the reports is located. After adjustment, the coordinates in sites list will be displayed according to the adjustment results.

6.3.3 Adjustment Configuration

Click GNSS menu, click adjustment configuration, open the adjustment configuration dialog, where to edit parameters of quality threshold, weights and free network adjustment strategy during adjustment.

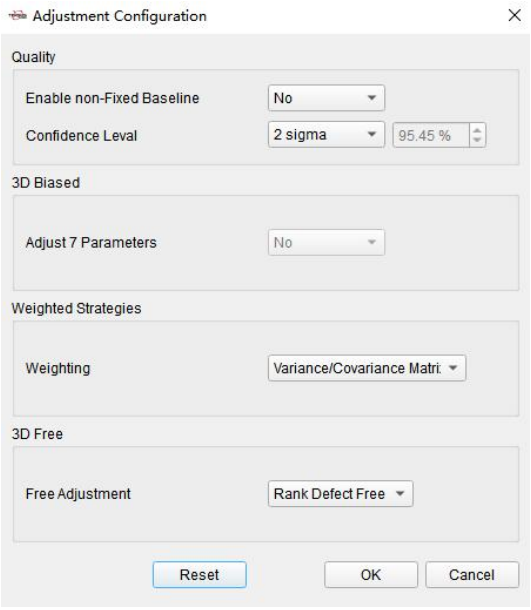


Figure 6.16 Adjustment Configuration

Enable non-Fixed Baseline	The default is No, indicating that the non-fixed baselines will not participate in the network adjustment calculation.
Confidence Level	The default is 2 sigma, optional 1 / 2 / 3 sigma, indicating confidence requirements in chi-square test in adjustment.
Adjust 7 Parameters	Not configurable, indicating that 7 parameters are not used in adjustment.
Weighting	The default is Variance / Covariance Matrix, can be changed to Fixed Standard and enter parameters, indicating baseline weighting strategy in adjustment.
Free Adjustment	The default is Rank Defect Free, can be changed to Fixed One Point, indicating whether the coordinates of a site are fixed in free network adjustment.

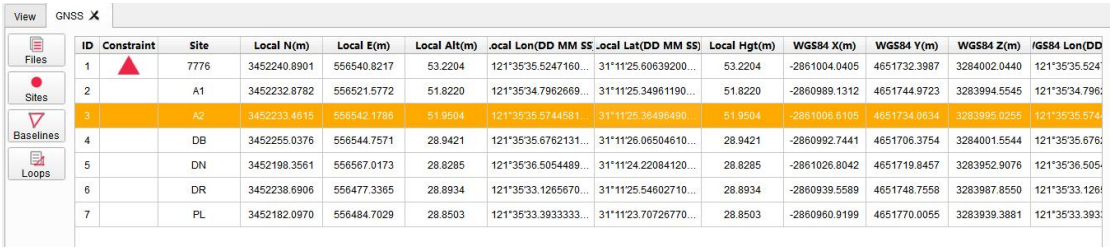
6.3.4 Clear Adjustment Results

Click clear adjustment results to clear the results of adjustment and revert to the state when no adjustment was performed.

6.4 Lists and Charts

6.4.1 Sites

Click [Sites] button under GNSS menu, to display sites and sites information in list.



ID	Constraint	Site	Local N(m)	Local E(m)	Local Alt(m)	.ocal Lon(DD MM SS	.ocal Lat(DD MM SS)	Local Hgt(m)	WGS84 X(m)	WGS84 Y(m)	WGS84 Z(m)	/GS84 Lon(DD
1	▲	7776	3452240.8901	556540.8217	53.2204	121°35'35.5247160...	31°11'25.60639200...	53.2204	-2861004.0405	4651732.3987	3284002.0440	121°35'35.524
2		A1	3452232.8782	556521.5772	51.8220	121°35'34.7962669...	31°11'25.34961190...	51.8220	-2860989.1312	4651744.9723	3283994.5545	121°35'34.796
3		A2	3452233.4615	556542.1786	51.9504	121°35'35.5744581...	31°11'25.36496490...	51.9504	-2861006.6105	4651734.0634	3283995.0255	121°35'35.574
4		DB	3452255.0376	556544.7571	28.9421	121°35'35.6762131...	31°11'26.06504610...	28.9421	-2860992.7441	4651706.3754	3284001.5544	121°35'35.676
5		DN	3452198.3561	556567.0173	28.8285	121°35'36.5054489...	31°11'24.22084120...	28.8285	-2861026.8042	4651719.8457	3283952.9076	121°35'36.505
6		DR	3452238.6906	556477.3365	28.8934	121°35'33.1265670...	31°11'25.54602710...	28.8934	-2860939.5589	4651748.7558	3283987.8550	121°35'33.126
7		PL	3452182.0970	556484.7029	28.8503	121°35'33.3933333...	31°11'23.70726770...	28.8503	-2860960.9199	4651770.0055	3283939.3881	121°35'33.393

Figure 6.17 Sites List

Click to select sites, information and constraints can be modified in properties window. Right mouse click, to open site report, open site report directory or delete the site.

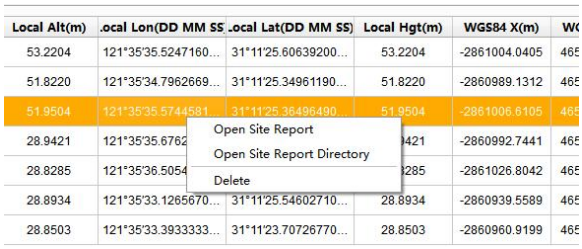


Figure 6.18 Sites Right Mouse Click

Open Site Report	View site report in browser, containing sites information and coordinates.
Open Site Report Directory	Open the directory where the site report is located.
Delete	Delete selected site, associated observation files, baselines and loops.

6.4.2 Baselines

Click [Baselines] button under GNSS menu, to display baselines and information in list.

ID	Baseline ID	Type	Start	End	Status	Duration	Ratio	RMS(mm)	Passed	Dx(m)	StdDx(m)	Dy(m)	StdDy(m)	Dz(m)
1	BL_1	Static	A1	A2	Fixed	02:50:00.000	5.3	5.9	Passed	-17.4691	0.0034	-10.9103	0.0045	0.475
12	BL_2	Static	A1	DN	Fixed	02:35:00.000	9.1	8.5	Passed	-37.6766	0.0046	-25.124	0.0067	-41.6431
23	BL_3	Static	A1	PL	Fixed	02:18:00.000	4.5	8	Passed	28.2073	0.0082	25.0373	0.0084	-55.1658
28	BL_4	Static	A1	DR	Fixed	02:29:00.000	6.4	9.8	Passed	49.57	0.0068	3.7838	0.0091	-6.6988
29	BL_5	Static	A1	DB	Fixed	02:16:00.000	8.1	10.8	Passed	-3.61	0.0054	-38.5983	0.0058	6.9939
30	BL_6	Static	A1	7776	Fixed	00:58:00.000	163	9	Passed	-16.0168	0.0212	-12.5862	0.0258	8.4433
31	BL_7	Static	A1	A2	Fixed	00:04:00.000	5.4	5.4	Passed	-17.4674	0.0025	-10.9185	0.0042	0.4657
32	BL_8	Static	A1	A2	Fixed	00:50:00.000	4.5	6.3	Passed	-17.4649	0.0024	-10.9239	0.0038	0.4682
33	BL_9	Static	A1	DN	Fixed	00:47:00.000	4.4	8.1	Passed	-37.6699	0.0033	-25.1298	0.0049	-41.6513
2	BL_10	Static	A1	PL	Fixed	00:56:00.000	3	6.3	Passed	28.2175	0.004	25.0296	0.0033	-55.1717

Figure 6.19 Baselines List

Right mouse click, to manipulate the selected baselines in the menu.

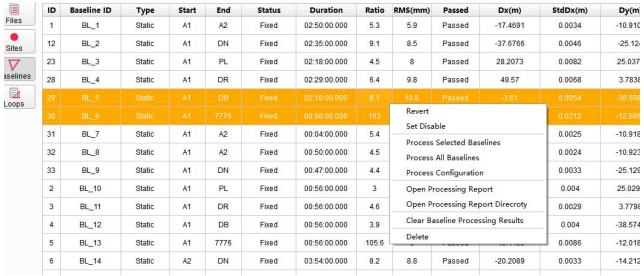


Figure 6.20 Baselines Right Mouse Click

Revert	Revert baselines direction by change start and end sites.
Set Enable/Disable	Enable or disable baselines, disabled baselines do not participate in processing.
Process Selected Baselines	Perform baseline process on selected baselines.
Process All Baselines	Perform baseline process on all baselines.
Process Configuration	Open baseline process configuration dialog.
Open Processing Report	Open baseline process report for selected baselines.
Open Processing Report Directory	Open directory where baseline process reports are located.
Clear Baseline Processing Results	Clear baseline processing results.
Delete	Delete the selected baselines, and corresponding loops.

6.4.3 Loops

Click [Loops] button under GNSS menu, to display loops and information in list.

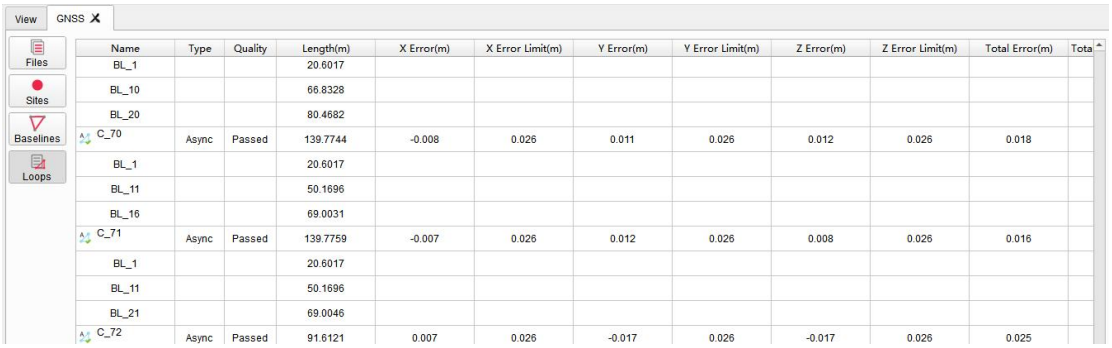


Figure 6.21 Loops List

Right mouse click, to open loop report, open loop report directory or delete the loop.

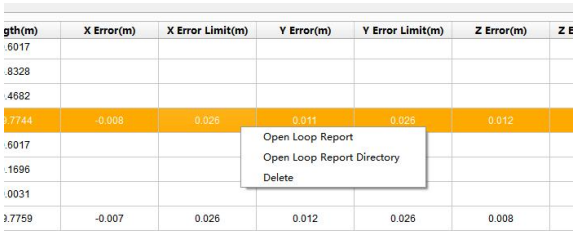
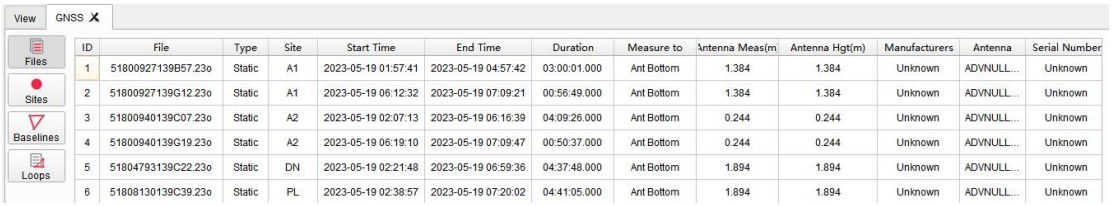


Figure 6.22 Loops Right Mouse Click

Open Loop Report	View loop report in browser, containing loops parameters and inspection information.
Open Loop Report Directory	Open the directory where the loop report is located.
Delete	Delete selected loops.

6.4.4 Files

Click [Files] button under GNSS menu, to display files and information in list.



ID	File	Type	Site	Start Time	End Time	Duration	Measure to	ntenna Meas(m	Antenna Hgt(m)	Manufacturers	Antenna	Serial Number
1	51800927139B57.23o	Static	A1	2023-05-19 01:57:41	2023-05-19 04:57:42	03:00:01.000	Ant Bottom	1.384	1.384	Unknown	ADVNULL...	Unknown
2	51800927139G12.23o	Static	A1	2023-05-19 06:12:32	2023-05-19 07:09:21	00:56:49.000	Ant Bottom	1.384	1.384	Unknown	ADVNULL...	Unknown
3	51800940139C07.23o	Static	A2	2023-05-19 02:07:13	2023-05-19 06:16:39	04:09:26.000	Ant Bottom	0.244	0.244	Unknown	ADVNULL...	Unknown
4	51800940139G19.23o	Static	A2	2023-05-19 06:19:10	2023-05-19 07:09:47	00:50:37.000	Ant Bottom	0.244	0.244	Unknown	ADVNULL...	Unknown
5	51804793139C22.23o	Static	DN	2023-05-19 02:21:48	2023-05-19 06:59:36	04:37:48.000	Ant Bottom	1.894	1.894	Unknown	ADVNULL...	Unknown
6	51808130139C39.23o	Static	PL	2023-05-19 02:38:57	2023-05-19 07:20:02	04:41:05.000	Ant Bottom	1.894	1.894	Unknown	ADVNULL...	Unknown

Figure 6.23 Files List

Right mouse click, to manipulate the selected files in the menu.

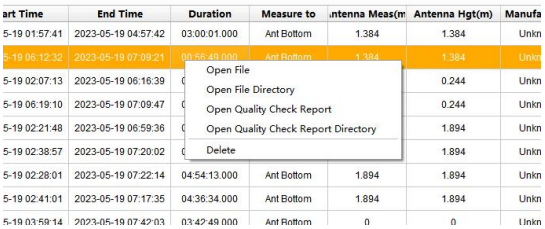


Figure 6.24 Files Right Mouse Click

Open File	View files in notepad.
Open File Directory	Open the directory where the file is located.
Open Quality Check Report	View quality check report in browser, containing rate and multi-path information.
Open Quality Check Report Directory	Open the directory where the quality check report is located.
Delete	Delete the selected files, corresponding sites and baselines.

6.4.5 Residual

Select the baseline after processed, click [Residual] button under GNSS menu, to display residuals during baseline processing.

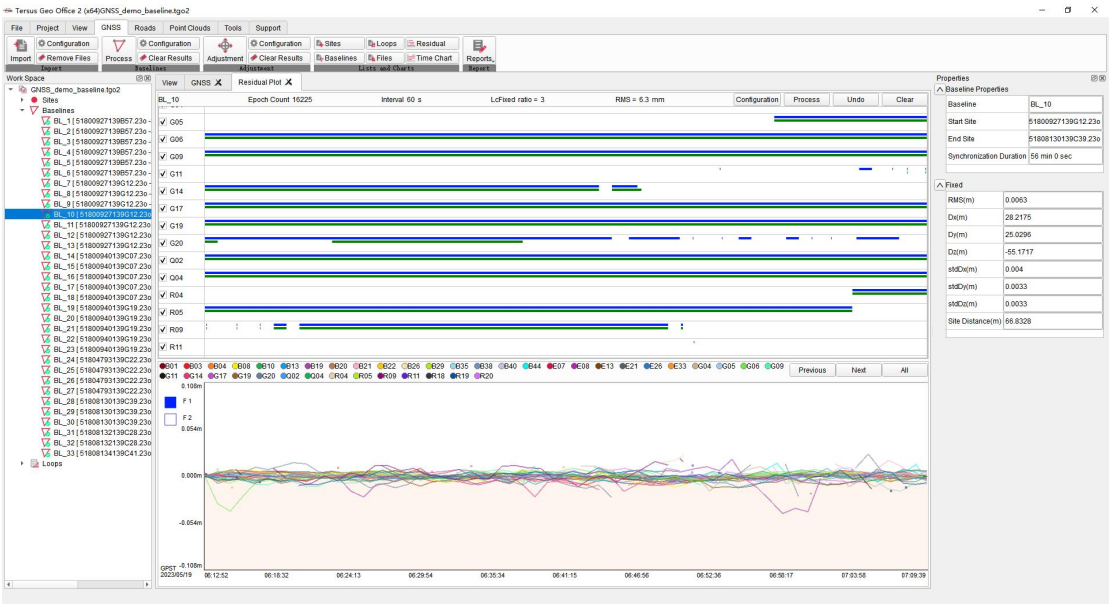


Figure 6.25 Residual Plot

In residual interface, modify the satellites and observations according to residuals to improve the precision.

6.4.6 Time Chart

After importing GNSS files, click [Time Chart] button under GNSS menu, to display time and synchronization coverage of files.

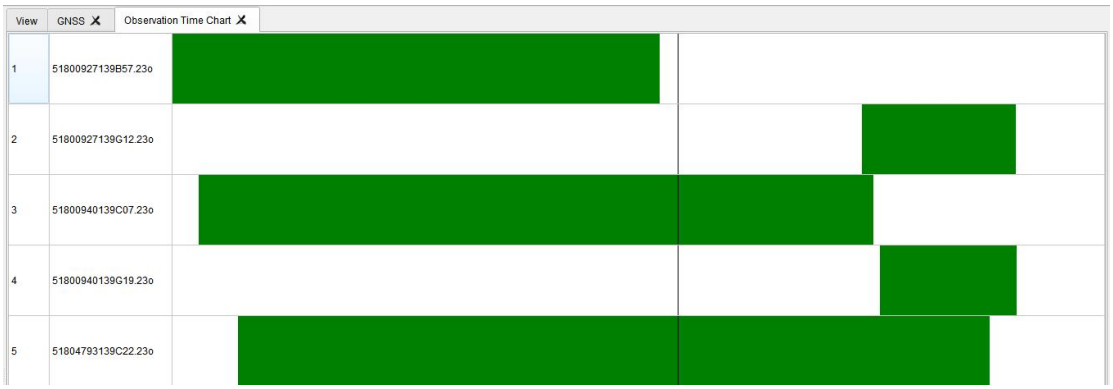


Figure 6.26 Time Chart

6.5 Report

6.5.1 Tolerance Configuration

Click GNSS menu, click [Reports] button, and then click [Tolerance Config] in the drop-down menu to open Tolerance Configuration dialog. Configure tolerance parameters, software will calculate error limits of loops according to the fixed error and scaling error to determine whether loops passes or not.

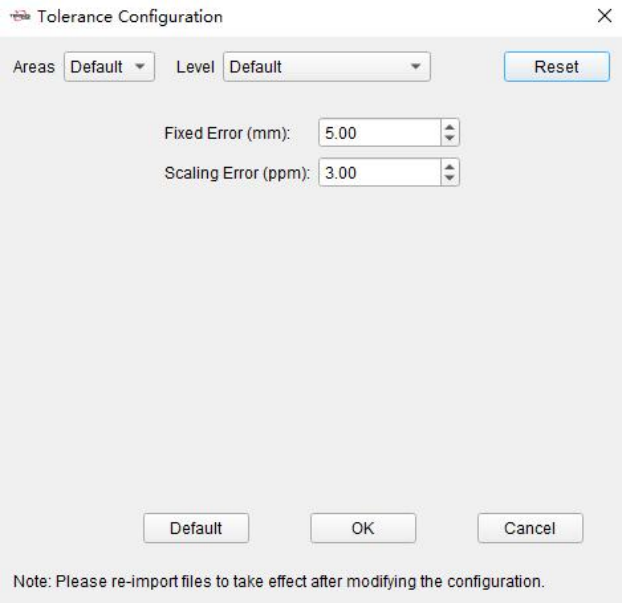
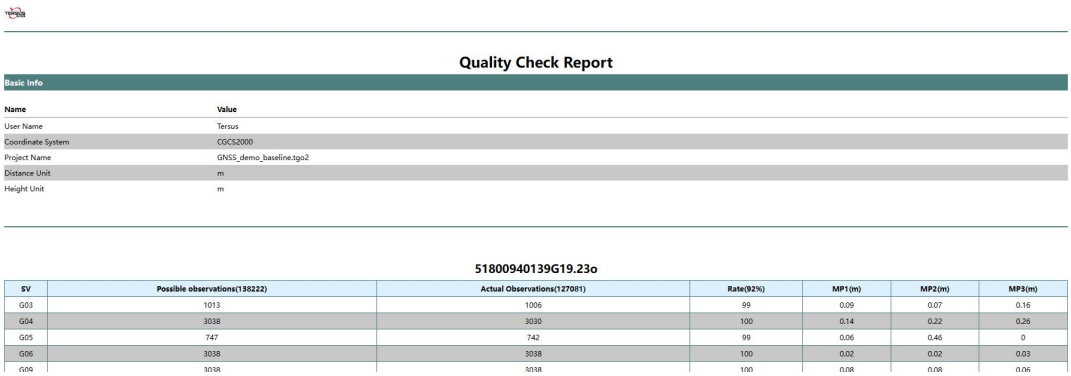


Figure 6.27 Tolerance Configuration

6.5.2 Quality Check Report

Select observation file in files list, click [Reports] button under GNSS menu, and then click [Quality Check Report] in the drop-down menu, to open quality check report of selected observation file in the browser, containing rate and multi-path information.



Quality Check Report

Basic Info

Name	Value
User Name	Tersus
Coordinate System	CGCS2000
Project Name	GNSS_demo_baseline.tgo2
Distance Unit	m
Height Unit	m

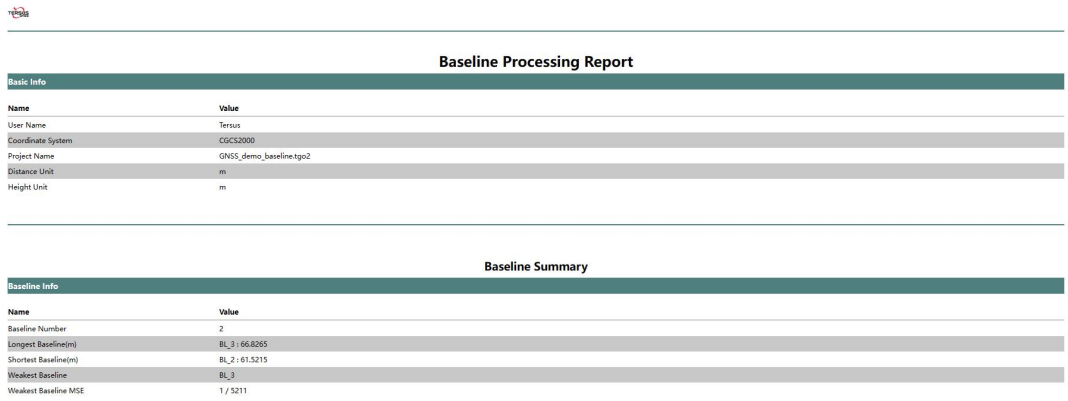
51800940139G19.23o

SV	Possible observations(138222)	Actual Observations(127081)	Rate(92%)	MP1(m)	MP2(m)	MP3(m)
G03	1013	1006	99	0.09	0.07	0.16
G04	3038	3030	100	0.14	0.22	0.26
G05	747	742	99	0.06	0.46	0
G06	3038	3038	100	0.02	0.02	0.03
G09	3038	3038	100	0.08	0.08	0.06

Figure 6.28 Quality Check Report

6.5.3 Baseline Process Report

Select one or several baselines in baselines list, click [Reports] button under GNSS menu, and then click [Baseline Process Report] in the drop-down menu, to open baseline process report in browser, containing baselines information and processing results.



Baseline Processing Report

Basic Info

Name	Value
User Name	Tersus
Coordinate System	CGCS2000
Project Name	GNSS_demo_baseline.tgo2
Distance Unit	m
Height Unit	m

Baseline Summary

Baseline Info

Name	Value
Baseline Number	2
Longest Baseline(m)	BL_3 : 66.8265
Shortest Baseline(m)	BL_2 : 61.5215
Weakest Baseline	BL_3
Weakest Baseline MSE	1 / 5211

Figure 6.29 Baseline Process Report

6.5.4 Loop Report

After baselines processing, click [Reports] button under GNSS menu, and then click [Loop Report] in the drop-down menu, to open loops report in browser, containing loops parameters and inspection information.

Sync Loop Results

C_1

C_1 (BL_1(5180092713987.23o->5180094013907.23o), BL_2(5180092713957.23o->5180479313922.23o), BL_14(5180094013907.23o->5180479313922.23o))

Name	Value	Limit
Type	Sync Loop	
Quality Check	Passed	
X Error[m]	-0.001	0.002
Y Error[m]	0.001	0.002
Z Error[m]	0.001	0.002

C_2

C_2 (BL_1(5180092713987.23o->5180094013907.23o), BL_3(5180092713957.23o->5180813013939.23o), BL_15(5180094013907.23o->5180813013939.23o))

Name	Value	Limit
Type	Sync Loop	
Quality Check	Failed	
X Error[m]	-0.004	0.002
Y Error[m]	0.004	0.002
Z Error[m]	0.003	0.002

Figure 6.30 Loops Report

6.5.5 Adjustment Report

After network adjustment, click [Reports] button under GNSS menu, and then click [Adjustment Report] in the drop-down menu, to open adjustment report in browser, containing adjustment results and sites coordinates.

5. Adjusted Geodetic Coordinates in Local System

Site Name	Notes	Latitude(DD MM SS)	Longitude(DD MM SS)	H(m)	Lat Error(DD MM SS)	Lon Error(DD MM SS)	H Error(m)	3D Error(m)
7776		31°11'25.570727100"N	121°35'35.426966000"E	48.8532	00°00'00.035664900"S	000°00'00.097750000"W	-4.3672	5.194
A1		31°11'25.313946700"N	121°35'34.698516500"E	47.4549	00°00'00.000000700"N	000°00'00.000000500"E	0.0000	0
A2		31°11'25.329299800"N	121°35'35.476708200"E	47.5832	00°00'00.000900200"S	000°00'00.015481800"W	-1.2082	1.2761
DB		31°11'26.029381400"N	121°35'35.578462700"E	24.5749	00°00'00.044161400"N	000°00'00.014578700"E	-3.3805	3.6643
DN		31°11'24.185175400"N	121°35'36.407699500"E	24.4613	00°00'00.035595400"N	000°00'00.018983500"E	-3.7780	3.9658
DR		31°11'25.510361500"N	121°35'33.028815200"E	24.5262	00°00'00.041202500"S	000°00'00.076587200"E	-7.2749	7.6581
PL		31°11'23.671600800"N	121°35'33.295582200"E	24.4832	00°00'00.061948800"N	000°00'00.014413800"W	-5.0708	5.4313

6. Adjusted Grid Coordinates in Local System

Site Name	Notes	N(m)	E(m)	h(m)	N Error(m)	E Error(m)	h Error(m)	3D Error(m)
7776		3452239.7778	556538.2395	48.8532	0.2479	0.2060	0.2315	0.3968
A1		3452231.7659	556518.9949	47.4549	0.0757	0.0644	0.0644	0.1184
A2		3452232.3492	556539.5964	47.5832	0.1217	0.1038	0.1113	0.1949
DB		3452253.9253	556542.1749	24.5749	0.2438	0.2369	0.2318	0.4115
DN		3452197.2438	556564.4351	24.4613	0.1882	0.1453	0.1731	0.2941
DR		3452237.5783	556474.7542	24.5262	0.2331	0.2508	0.2513	0.4248
PL		3452180.9846	556482.1207	24.4832	0.2455	0.1719	0.1947	0.3574

7. Weakest Baseline and Site

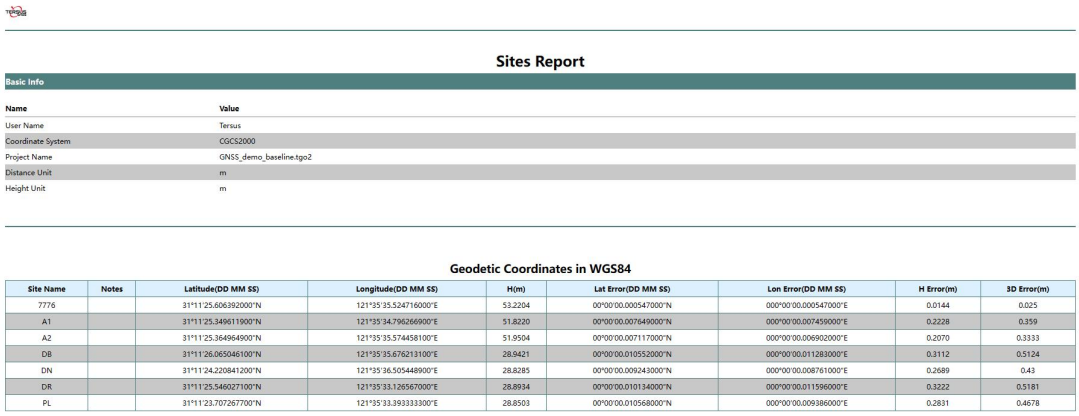
Weakest Baseline	Start End	DX(m)	Std.DX(m)	DY(m)	Std.DY(m)	DZ(m)	Std.DZ(m)	Slant(m)	MSE(m)	Relative MSE(m)
BL_31	5180813213902B.23o -> 5180813413902.23o	-53.1825	0.0041	-42.3687	0.006	13.7024	0.0056	69.3631	0.7287	1/95

Weakest Site Name	N(m)	N MSE(m)	E(m)	E MSE(m)	Height(m)	Height Error(m)	Site Position MSE(m)
DR	3452238.6907	0.2670	556477.3364	0.3055	28.8934	0.3222	0.5181

Figure 6.31 Adjustment Report

6.5.6 Site Report

Click [Reports] button under GNSS menu, and then click [Site Report] in the drop-down menu, to open sites report in browser, containing sites information and coordinates.



Sites Report

Basic Info

Name	Value
User Name	Tersus
Coordinate System	CGCS2000
Project Name	GNSS_demo_baseline.tgo2
Distance Unit	m
Height Unit	m

Geodetic Coordinates in WGS84

Site Name	Notes	Latitude(DD MM SS)	Longitude(DD MM SS)	H(m)	Lat Error(DD MM SS)	Lon Error(DD MM SS)	H Error(m)	3D Error(m)
7776		31°11'25.606392000"N	121°35'35.524716000"E	53.2204	00°00'00.000547000"N	000°00'00.000547000"E	0.0144	0.025
A1		31°11'25.349611900"N	121°35'34.796266900"E	51.8220	00°00'00.007649000"N	000°00'00.007459000"E	0.2228	0.359
A2		31°11'25.364964900"N	121°35'35.574458100"E	51.9504	00°00'00.007117000"N	000°00'00.006902000"E	0.2070	0.3333
DB		31°11'26.065046100"N	121°35'35.676213100"E	28.9421	00°00'00.010552000"N	000°00'00.011283000"E	0.3112	0.5124
DN		31°11'24.220841200"N	121°35'36.505448900"E	28.8285	00°00'00.009243000"N	000°00'00.008761000"E	0.2689	0.43
DR		31°11'25.546027100"N	121°35'33.126567000"E	28.8934	00°00'00.010134000"N	000°00'00.011596000"E	0.3222	0.5181
PL		31°11'23.707267700"N	121°35'33.393333300"E	28.8503	00°00'00.010568000"N	000°00'00.009386000"E	0.2831	0.4678

Figure 6.32 Sites Report

6.5.7 Open the Report Directory

Click [Reports] button under GNSS menu, and then click [Open the Report Directory] in the drop-down menu, to open directory where reports are located in.

7. Roads

- Road File
- Road Design
- Data Lists
- Calculation
- 3D View

7.1 Road File

7.1.1 New Road

Click Roads menu, click [New] button to open New Road dialog. Input the name of the new road and click [OK] to complete the road creation. The new road will be added to the list of roads in Work Space window. Since the parameters of the new road has not been entered yet, the road curve will not be displayed in the view interface.

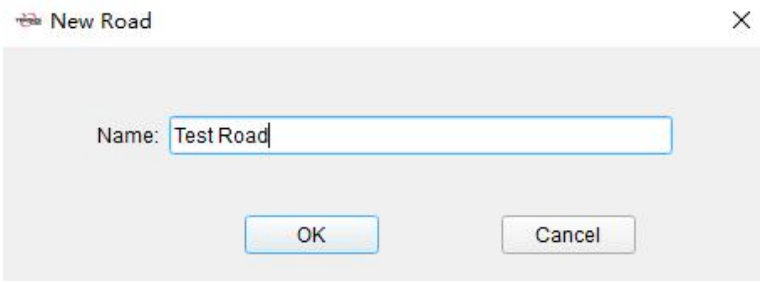


Figure 7.1 New Road

7.1.2 Import Road

Click Roads menu, click [Import] button and select the road file in local path or connected device to import the road if you already have a road .trd file to be edited. After successful import, the imported road will be added to the list of roads in Work Space window and the road curve will be displayed in the view interface.

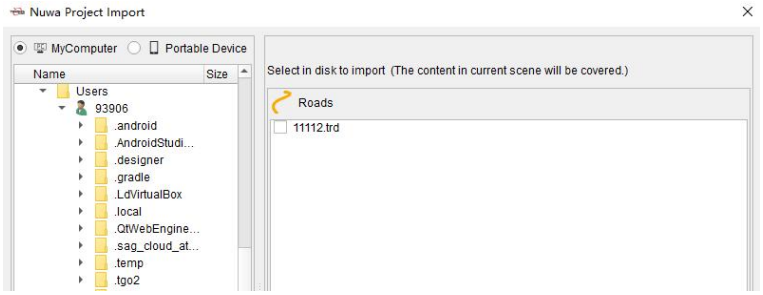


Figure 7.2 Import Road

7.1.3 Export Road

After finishing the edit and checking the parameters of the road, click [Export] button under Roads menu to export the edited road to the selected local path or connected device, then the road can be field staked in application such as Nuwa software.

7.2 Road Design

7.2.1 Alignment

After creating or importing the road, click [Alignment] button under Roads menu to edit the center line of road in the form.

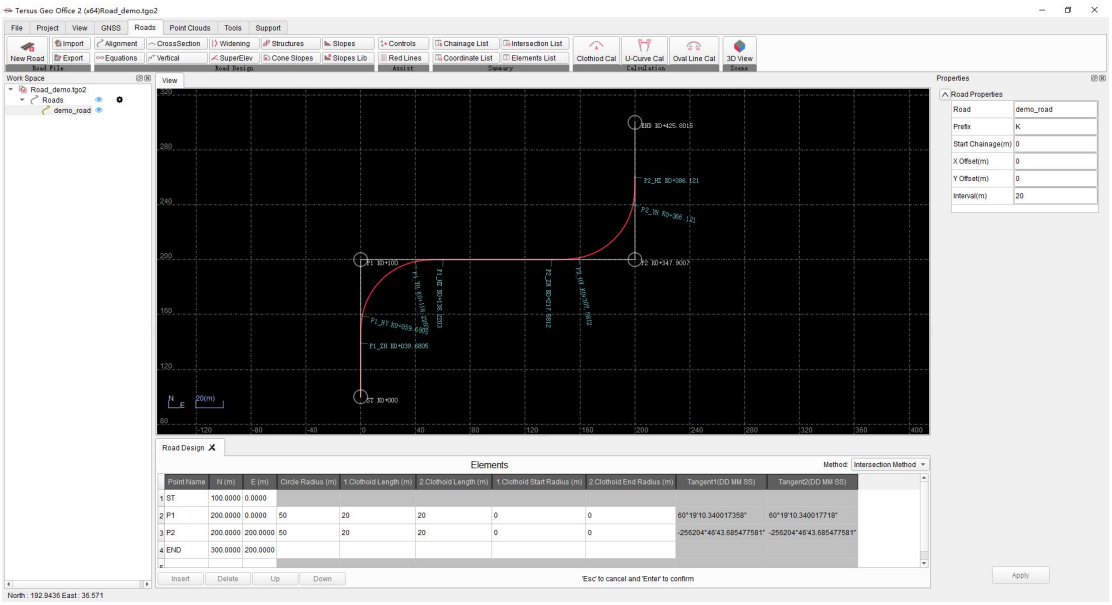


Figure 7.3 Alignment Parameters

Click the road in the Work Space window, input the start point, offset and other parameters of the road in the Properties window on the right.

Input the road center line parameters in the road design form according to Intersection Method or Elements Method. Then to road center line image will be drawn in the view interface according to the alignment parameters.

7.2.2 Equations

After creating and importing the road, click [Equations] button under Roads menu to edit the parameters of the equations of the road in the form.

7.2.3 Cross Section

Click [Cross Section] button to edit the cross sections parameters of road in the form.

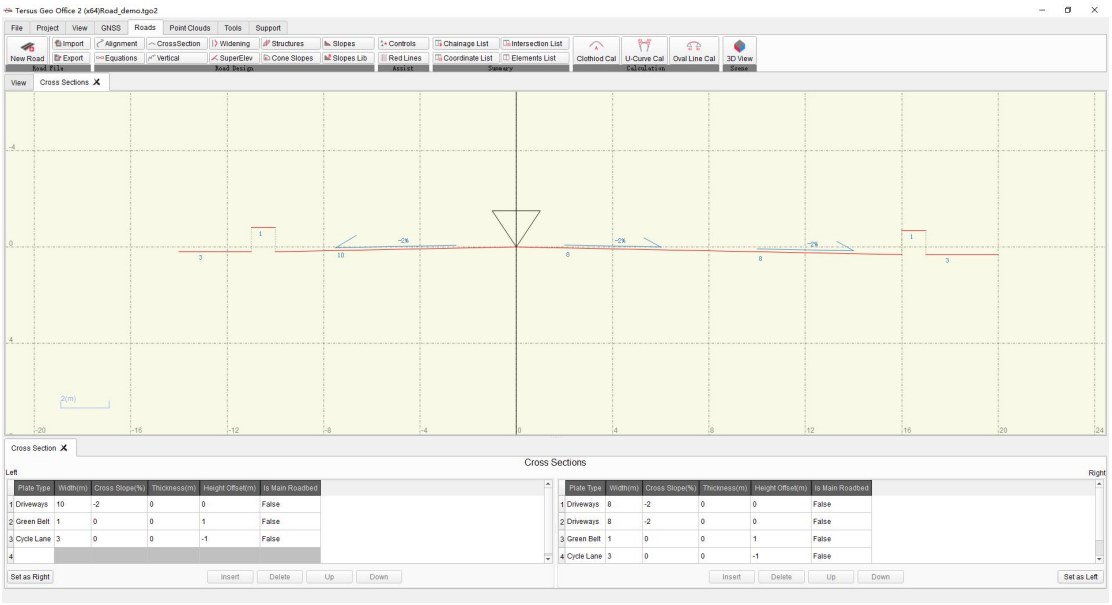


Figure 7.4 Cross Section

Input parameters of plates, the cross section graphic will be drawn in cross sections view.

7.2.4 Vertical

Click [Vertical] button to edit the vertical profile parameters of road in the form.

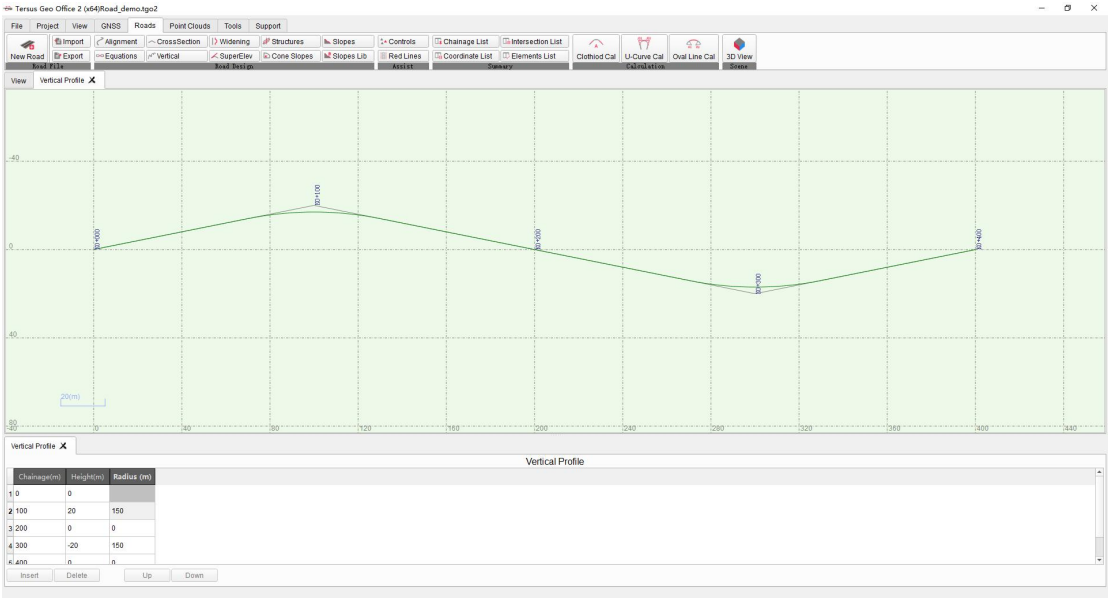


Figure 7.5 Vertical Profile

Input parameters of vertical profile, the graphic will be drawn in vertical profile view.

7.2.5 Widening & Super Elevation

Click [Widening] and [Super Elev] buttons to edit the parameters of the width and elevation changes of the cross sections at different mileages in the forms.

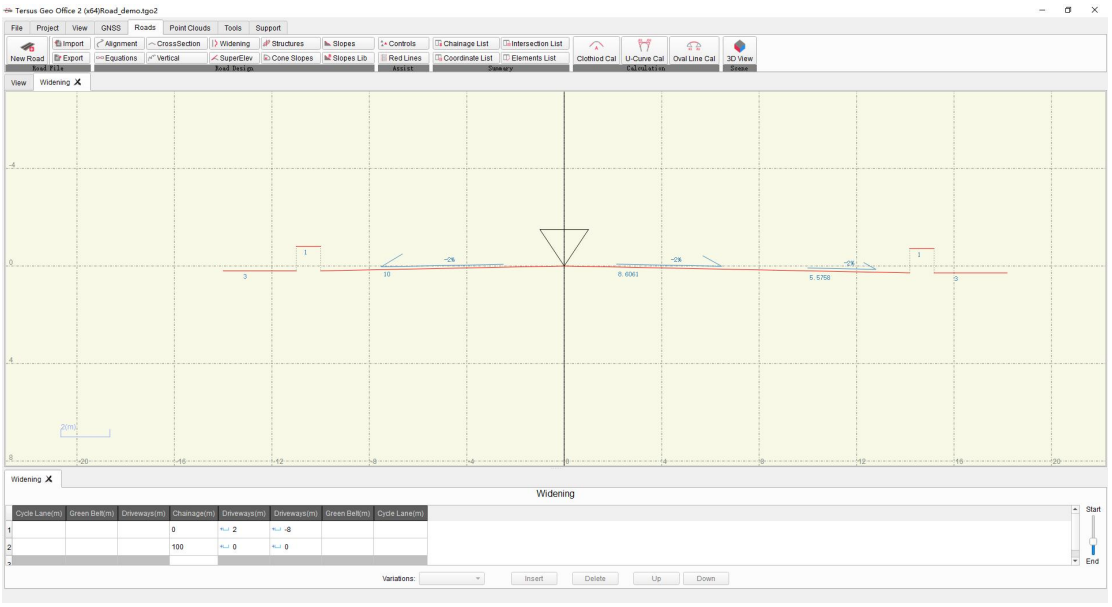


Figure 7.6 Widening

Enter the change parameters relative to standard cross section in the form, then drag the mileage progress bar on the right side of form to show cross sections change in the view.

7.2.6 Structures

Click [Structures] button to enter the structure parameters and preview it in the form.

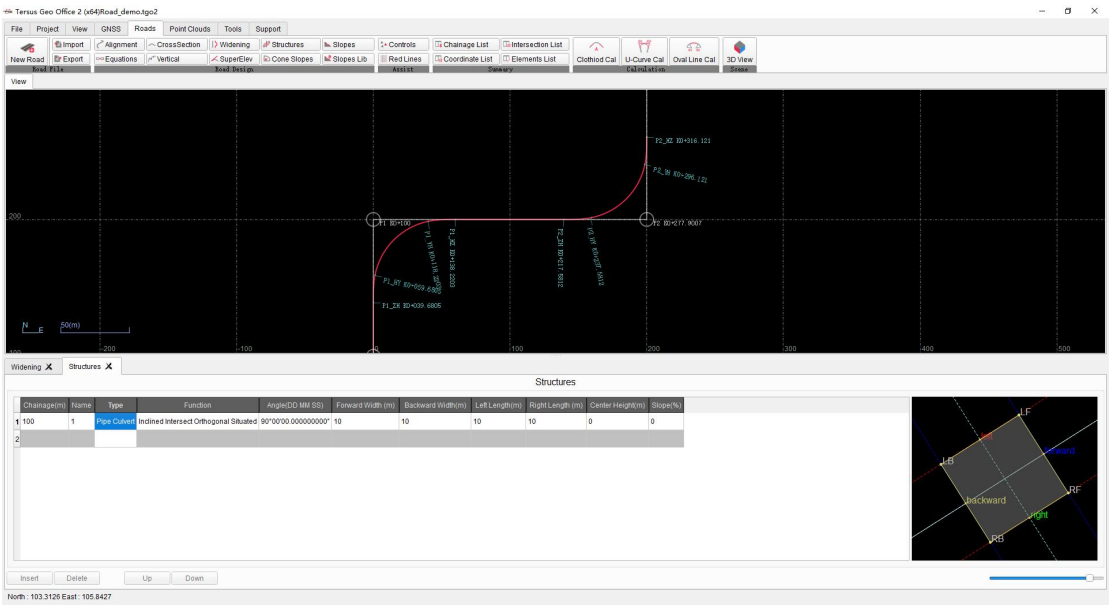


Figure 7.7 Structure

7.2.7 Cone Slopes

Click [Cone Slopes] button to edit parameters of cone slope in the form and preview it.

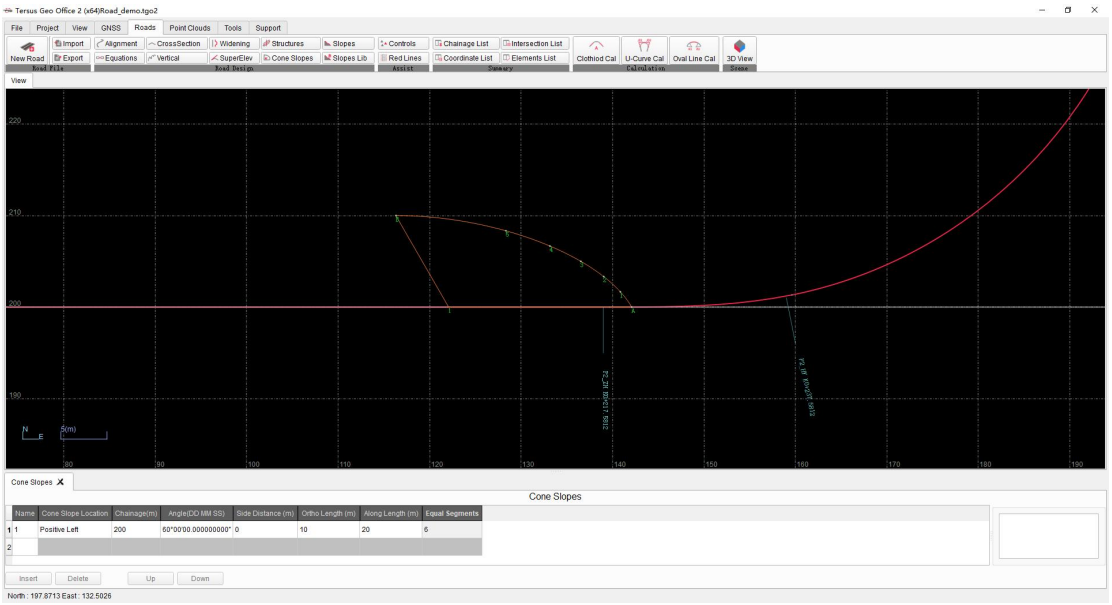


Figure 7.8 Cone Slopes

7.2.8 Slopes & Slopes Lib

Click [Slopes Lib] button to edit slopes library in form.

Click [Slopes] button to edit slope parameters and select using template from Slopes Lib, and then preview in slopes view.

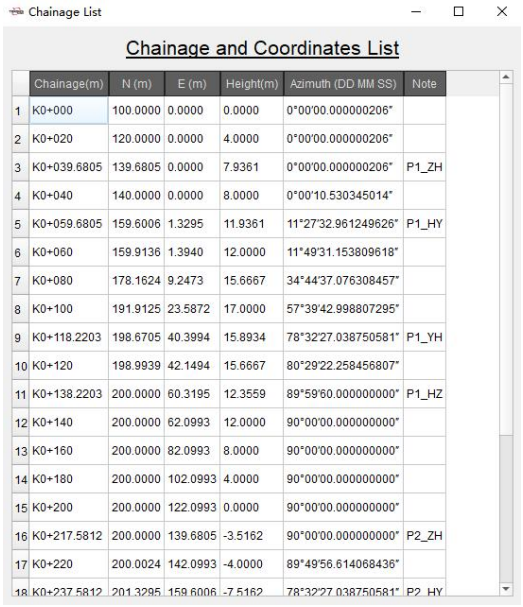
7.2.8 Controls & Red Lines

Click [Control Points] button to edit the road control points in the form.

Click [Red Lines] button to edit the red line of land acquisition on the left and right sides of road in the form.

7.3 Data Lists

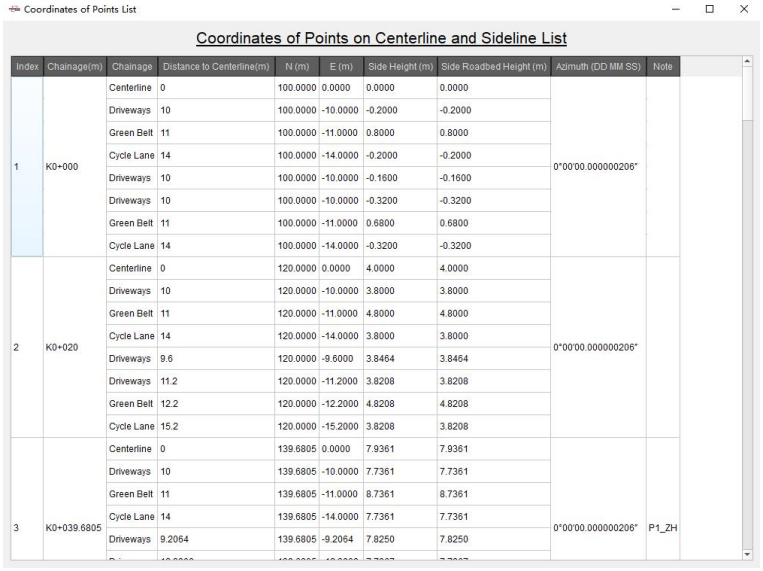
After editing roads parameters, click [Chainage List] button under Roads menu to display Chainage and Coordinate List, where shows coordinates and parameters of center line at different mileages according to interval set in properties window.



	Chainage(m)	N (m)	E (m)	Height(m)	Azimuth (DD MM SS)	Note
1	K0+000	100.0000	0.0000	0.0000	0°00'00.000000206"	
2	K0+020	120.0000	0.0000	4.0000	0°00'00.000000206"	
3	K0+039.6805	139.6805	0.0000	7.9361	0°00'00.000000206"	P1_ZH
4	K0+040	140.0000	0.0000	8.0000	0°00'10.530345014"	
5	K0+059.6805	159.6006	1.3295	11.9361	11°27'32.961249626"	P1_HY
6	K0+060	159.9136	1.3940	12.0000	11°49'31.153809618"	
7	K0+080	178.1624	9.2473	15.6667	34°44'37.076308457"	
8	K0+100	191.9125	23.5872	17.0000	57°39'42.998807295"	
9	K0+118.2203	198.6705	40.3994	15.8934	78°32'27.038750581"	P1_YH
10	K0+120	198.9939	42.1494	15.6667	80°29'22.258456807"	
11	K0+138.2203	200.0000	60.3195	12.3559	89°59'60.000000000"	P1_HZ
12	K0+140	200.0000	62.0993	12.0000	90°00'00.000000000"	
13	K0+160	200.0000	82.0993	8.0000	90°00'00.000000000"	
14	K0+180	200.0000	102.0993	4.0000	90°00'00.000000000"	
15	K0+200	200.0000	122.0993	0.0000	90°00'00.000000000"	
16	K0+217.5812	200.0000	139.6805	-3.5162	90°00'00.000000000"	P2_ZH
17	K0+220	200.0024	142.0993	-4.0000	89°49'56.614068436"	
18	K0+237.5812	201.3295	159.6006	-7.5162	78°32'27.038750581"	P2_HY

Figure 7.9 Chainage List

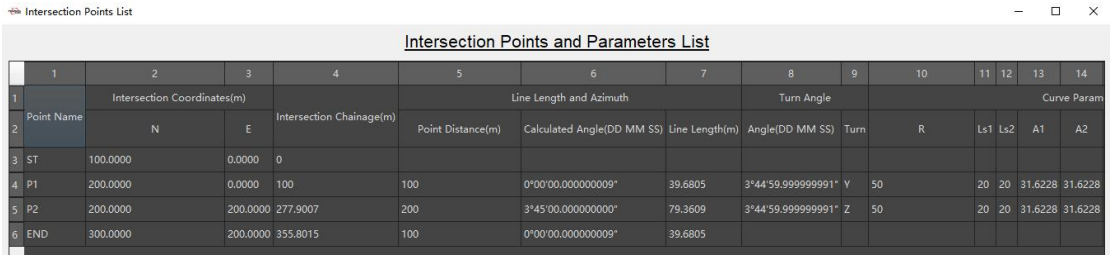
Click [Coordinate List] button under Roads menu to display Coordinates of Points on Center-line and Side-line List, where shows coordinates and parameters of points on cross sections at different mileage.



Index	Chainage(m)	Chainage	Distance to Centerline(m)	N (m)	E (m)	Side Height (m)	Side Roadbed Height (m)	Azimuth (DD MM SS)	Note
1	K0+000	Centerline	0	100.0000	0.0000	0.0000	0.0000	0°00'00.000000206"	
		Driveways	10	100.0000	-10.0000	-0.2000	-0.2000		
		Green Belt	11	100.0000	-11.0000	0.8000	0.8000		
		Cycle Lane	14	100.0000	-14.0000	-0.2000	-0.2000		
		Driveways	10	100.0000	-10.0000	-0.1600	-0.1600		
		Driveways	10	100.0000	-10.0000	-0.3200	-0.3200		
		Green Belt	11	100.0000	-11.0000	0.6800	0.6800		
		Cycle Lane	14	100.0000	-14.0000	-0.3200	-0.3200		
2	K0+020	Centerline	0	120.0000	0.0000	4.0000	4.0000	0°00'00.000000206"	
		Driveways	10	120.0000	-10.0000	3.8000	3.8000		
		Green Belt	11	120.0000	-11.0000	4.8000	4.8000		
		Cycle Lane	14	120.0000	-14.0000	3.8000	3.8000		
		Driveways	9.6	120.0000	-9.6000	3.8464	3.8464		
		Driveways	11.2	120.0000	-11.2000	3.8208	3.8208		
		Green Belt	12.2	120.0000	-12.2000	4.8208	4.8208		
		Cycle Lane	15.2	120.0000	-15.2000	3.8208	3.8208		
3	K0+039.6805	Centerline	0	139.6805	0.0000	7.9361	7.9361	0°00'00.000000206"	P1_ZH
		Driveways	10	139.6805	-10.0000	7.7361	7.7361		
		Green Belt	11	139.6805	-11.0000	8.7361	8.7361		
		Cycle Lane	14	139.6805	-14.0000	7.7361	7.7361		
		Driveways	9.2064	139.6805	-9.2064	7.8250	7.8250		

Figure 7.10 Coordinate List

Click [Intersection List] button under Roads menu to display Intersection Points and Parameter List, where shows intersection parameters of road alignment.


Intersection Points List

Intersection Points and Parameters List

	1	2		3	4	5	6	7	8	9	10	11	12	13	14
1		Intersection Coordinates(m)				Line Length and Azimuth			Turn Angle			Curve Param			
2	Point Name	N		E	Intersection Chainage(m)	Point Distance(m)	Calculated Angle(DD MM SS)	Line Length(m)	Angle(DD MM SS)	Turn	R	Ls1	Ls2	A1	A2
3	ST	100.0000		0.0000	0										
4	P1	200.0000		0.0000	100	100	0°00'00.000000009"	39.6805	3°44'59.999999991"	Y	50	20	20	31.6228	31.6228
5	P2	200.0000		200.0000	277.9007	200	3°45'00.000000000"	79.3609	3°44'59.999999991"	Z	50	20	20	31.6228	31.6228
6	END	300.0000		200.0000	355.8015	100	0°00'00.000000009"	39.6805							

Figure 7.11 Intersection List

Click [Elements List] button under Roads menu to display Elements List, where shows elements and parameters of road alignment.


Elements List

Elements List

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Point Name	Stack(m)	Chainage(m)	N (m)	E (m)	Length(m)	Turn	Start Radius(m)	End Radius(m)	Start Curve	End Curve	Start Bearing(DD MM SS)	End Bearing(DD MM SS)	Type	A	Index
2	ST		0	100.0000	0.0000											
3	P1_ZH		39.6805	139.6805	0.0000	39.6805	1	0	0	0°00'00.000000000"	0°00'00.000000000"	0°00'00.000000003"	0°00'00.000000003"	1		0
4	P1_HY		59.6805	159.6006	1.3295	20	1	0	50	0°00'00.000000000"	0°01'12.000000000"	0°00'00.000000003"	0°12'00.000000003"	21	31.6228	1
5	P1_YH		118.2203	198.6705	40.3994	58.5398	1	50	50	0°01'12.000000000"	0°01'12.000000000"	0°12'00.000000003"	1°22'14.866776462"	3		11
6	P1_HZ		138.2203	200.0000	60.3195	20	1	50	0	0°01'12.000000000"	0°00'00.000000000"	1°22'14.866776462"	1°34'14.866776462"	22	31.6228	12
7	P2_ZH		217.5812	200.0000	139.6805	79.3609	1	0	0	0°00'00.000000000"	0°00'00.000000000"	1°34'14.866776462"	1°34'14.866776462"	1		22
8	P2_HY		237.5812	201.3295	159.6006	20	-1	0	-50	0°00'00.000000000"	0°-1'12.000000000"	1°34'14.866776462"	1°22'14.866776462"	21	31.6228	23
9	P2_YH		296.121	240.3994	198.6705	58.5398	-1	-50	-50	0°-1'12.000000000"	0°-1'12.000000000"	1°22'14.866776462"	0°12'00.000000003"	3		33
10	P2_HZ		316.121	260.3195	200.0000	20	-1	-50	0	0°-1'12.000000000"	0°00'00.000000000"	0°12'00.000000003"	0°00'00.000000003"	22	31.6228	34
11	END_ZZ		355.8015	300.0000	200.0000	39.6805	1	0	0	0°00'00.000000000"	0°00'00.000000000"	0°00'00.000000003"	0°00'00.000000003"	1		44

Figure 7.12 Elements List

7.4 Calculation

Click [Clothoid Cal] button under Roads menu to open Clothoid Calculation tool, where to calculate parameters of clothoid.

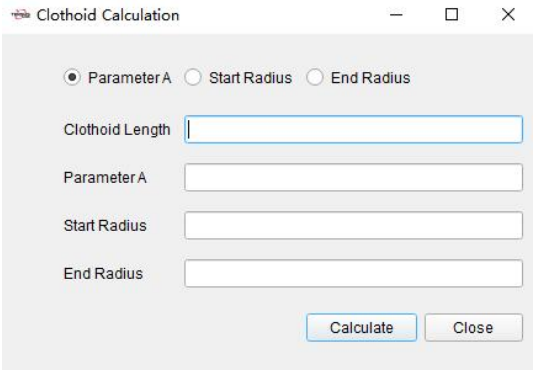


Figure 7.13 Clothoid Cal

Click [U-Curve Cal] button to open U-Curve Calculation tool, where to decompose virtual intersection of u-curve into two intersections for normal input in intersection method.

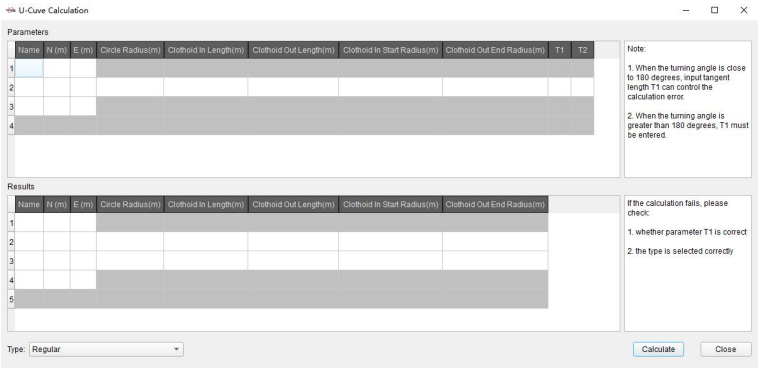


Figure 7.14 U-Curve Cal

Click [Oval Cal] button to open Oval Calculation tool, where to decompose intersection of oval curve into two intersections for normal input in intersection method.

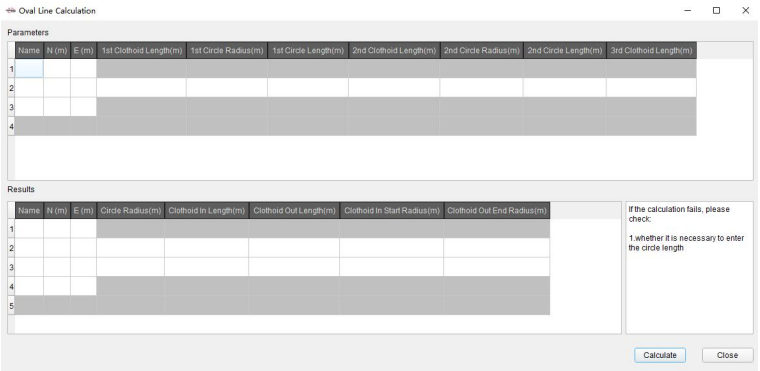


Figure 7.15 Oval Cal

7.5 3D View

After editing road parameters, click [3D View] button under Roads menu, open 3D view display. In 3D view interface, use the mouse wheel to zoom the display. Use the left mouse button to rotate the display and the right mouse button to drag the display, to adjust the 3D display angle of road.

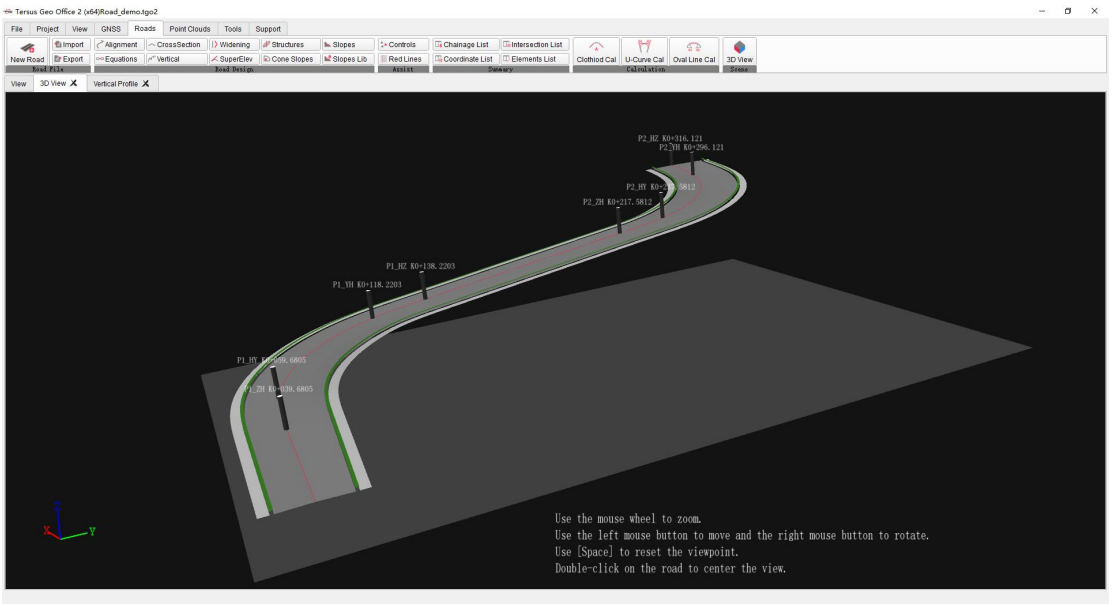


Figure 7.16 3D View

8. Point Clouds

- Point Clouds File
- LAS Source File
- Datasets
- Datasets Edit
- Datasets Operation

8.1 Point Clouds File

Click Point Clouds menu, click [New Clouds] button, then enter the name in Create Point Clouds box and click [Create].

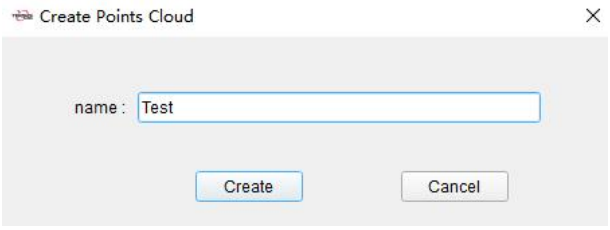


Figure 8.1 New Clouds

After creating clouds, the new clouds will be displayed in Work Space window.

Click Point Clouds menu, click [Edit Clouds] button, to open clouds editing interface for subsequent LAS file import and point clouds datasets editing operations.

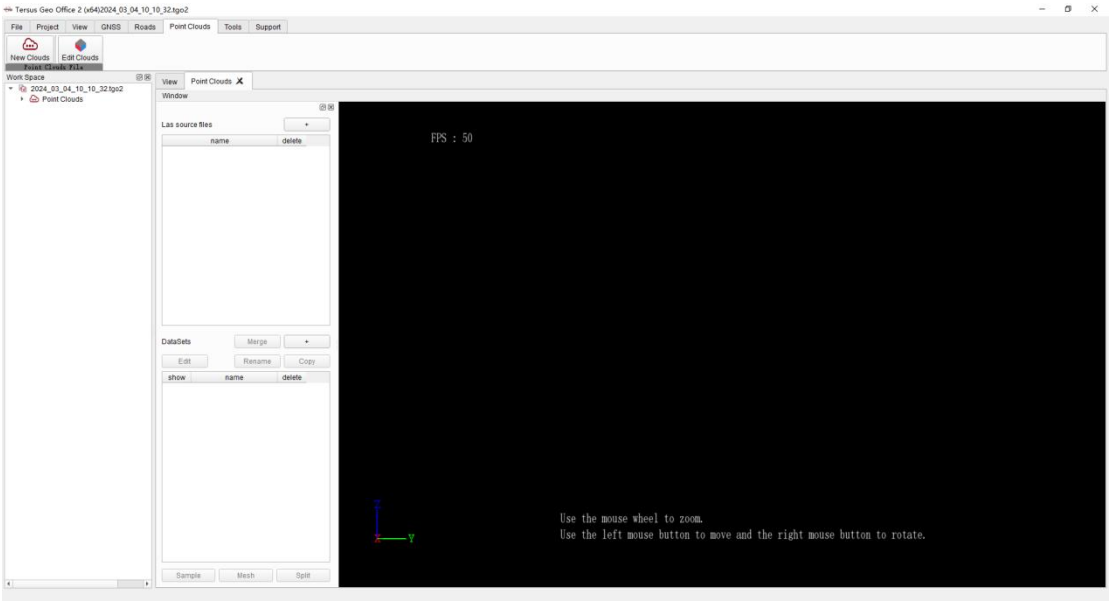


Figure 8.2 Edit Clouds

8.2 LAS Source File

Click LAS Source File [+] button to select .las files to import.

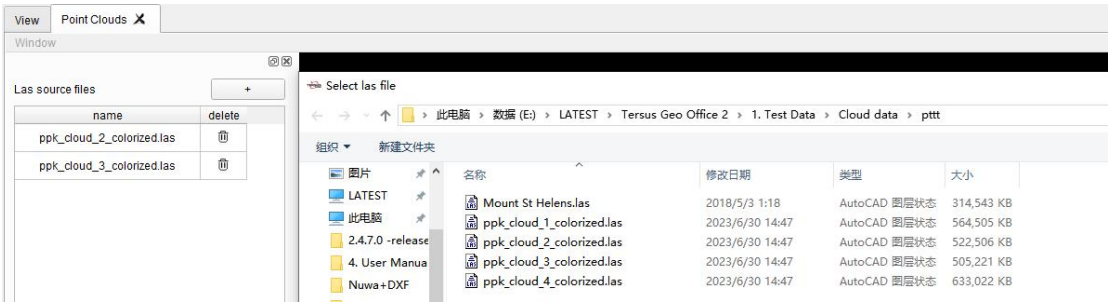


Figure 8.3 LAS File Import

After importing, the imported files will be displayed in the Las source file list. And the item could be deleted if the delete icon is clicked.

8.3 Datasets

Click Datasets [+] button, check the LAS files that need to be imported into datasets, and check the column attributes in LAS files to import. Input the name, click [OK] and wait for the import to complete.

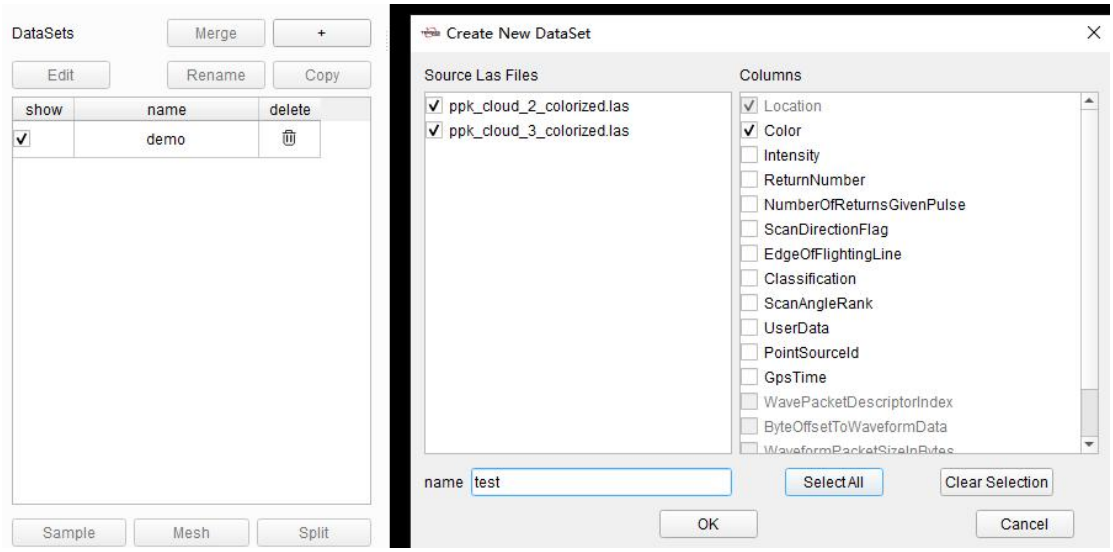


Figure 8.4 Datasets Import

After datasets importing, the imported datasets will be displayed in the datasets list. And the item could be deleted if the delete icon is clicked. The interface displays the point

clouds graphic for the checked datasets. Use the mouse wheel to zoom the display. Use the left mouse button to rotate the display and the right mouse button to drag the display, to adjust the 3D display angle of point clouds.

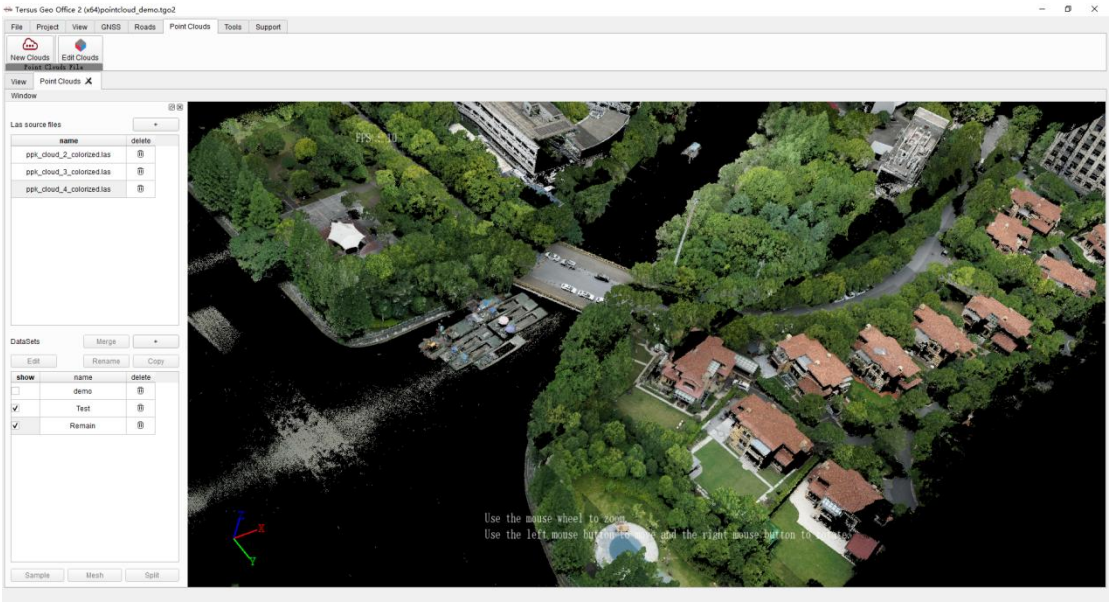


Figure 8.5 Point Clouds Display

In datasets list, select item and lick [Rename] to change the name of selected item.

Select item and click [Copy] to copy the selected item, avoiding subsequent edits affecting the original dataset.

Select two or more datasets, click [Merge] and enter the name of merged datasets to merge LAS data contained in the two datasets into one dataset.

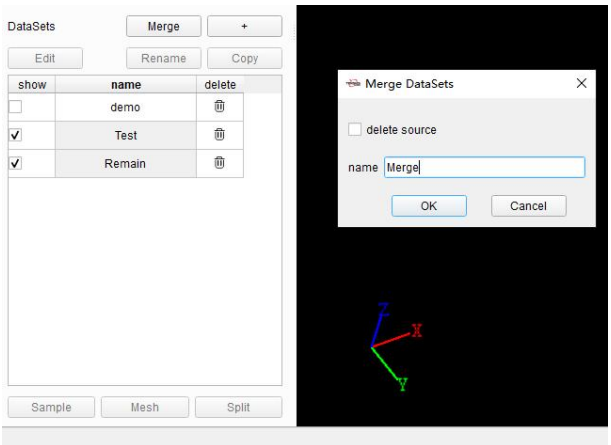


Figure 8.6 Datasets Merge

8.4 Datasets Edit

Select dataset and click [Edit] button, open Edit DataSet dialog to edit selected dataset.

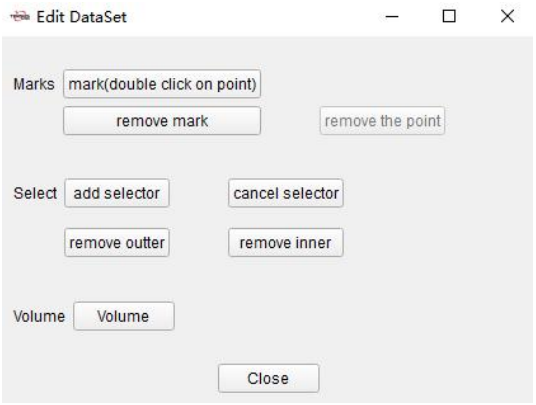


Figure 8.7 Edit DataSet

Click [Mark] button, and double click on point in point clouds to get coordinates and other information.

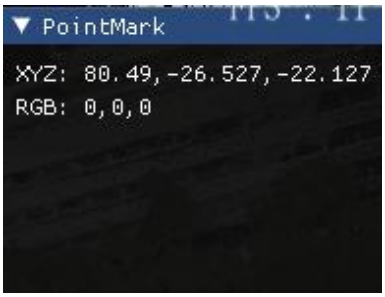


Figure 8.8 Mark Point

Click [Add Selector] button, input the center point and size of box, or input center point and radius of sphere, a selector will be displayed on point clouds, to remove the outer part or inner part.

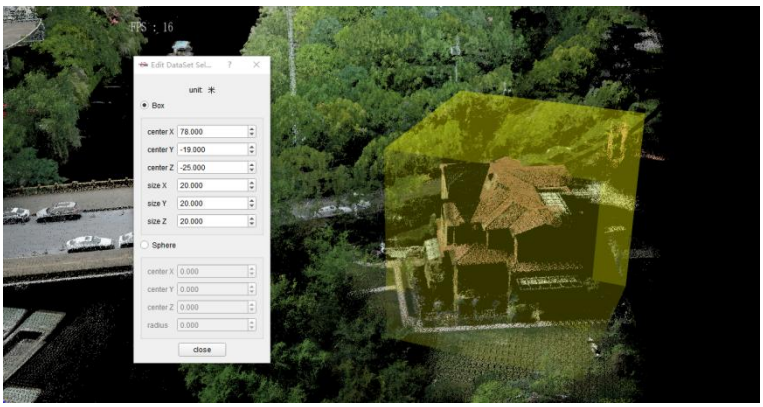


Figure 8.9 Selector Display

Click [Volume] button, to make DTM first in Volume dialog.

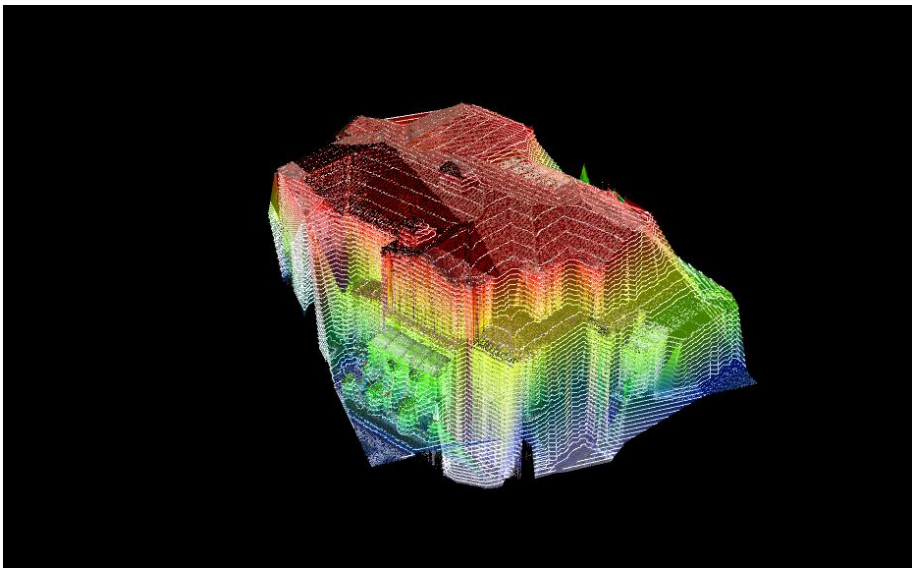


Figure 8.10 Make DTM

Then click Areas [+] button, select item in areas list, click [begin select], and double click on point clouds to create the boundary. Input fixed target height or select average height as the target height, software will calculate and show the dig and cut part.

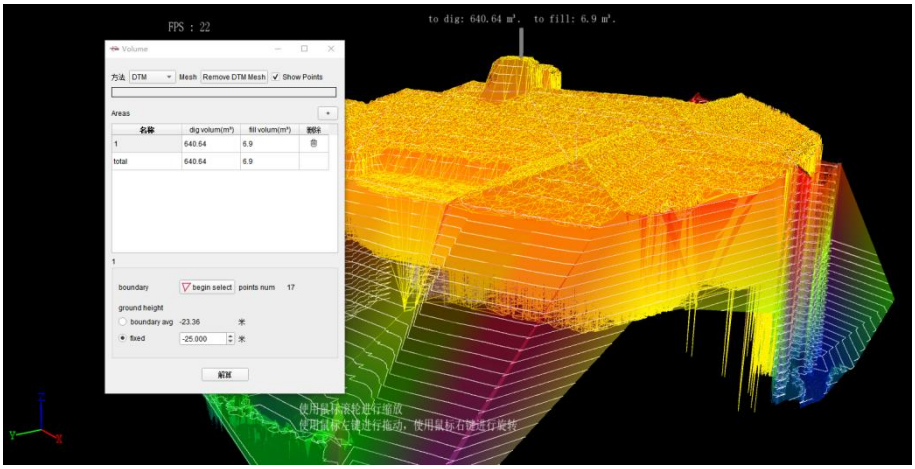


Figure 8.11 Volume Calculation

8.5 Datasets Operation

Under the datasets list, click [Sample] button to open sample dialog. Select function, then software will sample the point clouds in dataset according to configured target percents, and save the result as a new dataset.

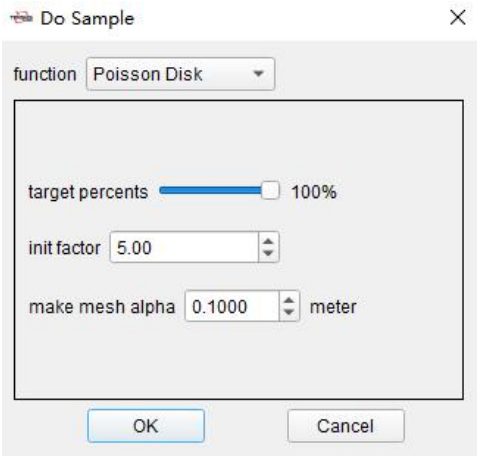


Figure 8.12 Sample

Click [Mesh] button, select function in dialog to make Mesh for point clouds in dataset and save the result as a new dataset.

Figure 8.13 Mesh

Click [Split] button, select function in dialog to split point clouds in dataset and save the result as a new dataset.

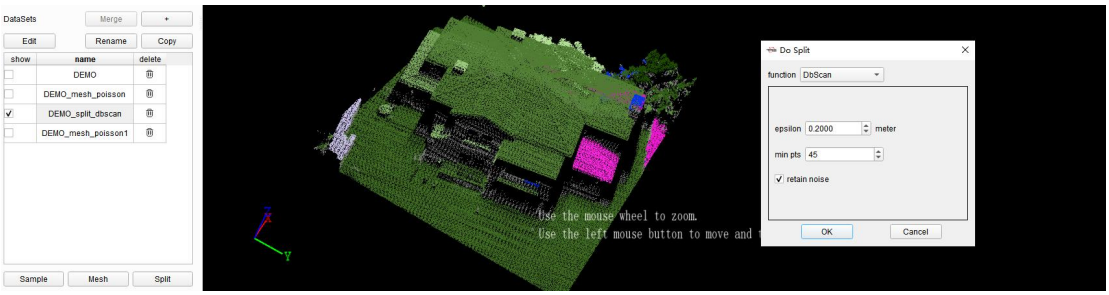


Figure 8.14 Split

9. Tools

- Coordinate Systems
- Antennas

9.1 Coordinate Systems

Click Tools menu, click [Coordinate Systems] button, to open the coordinate systems tool.

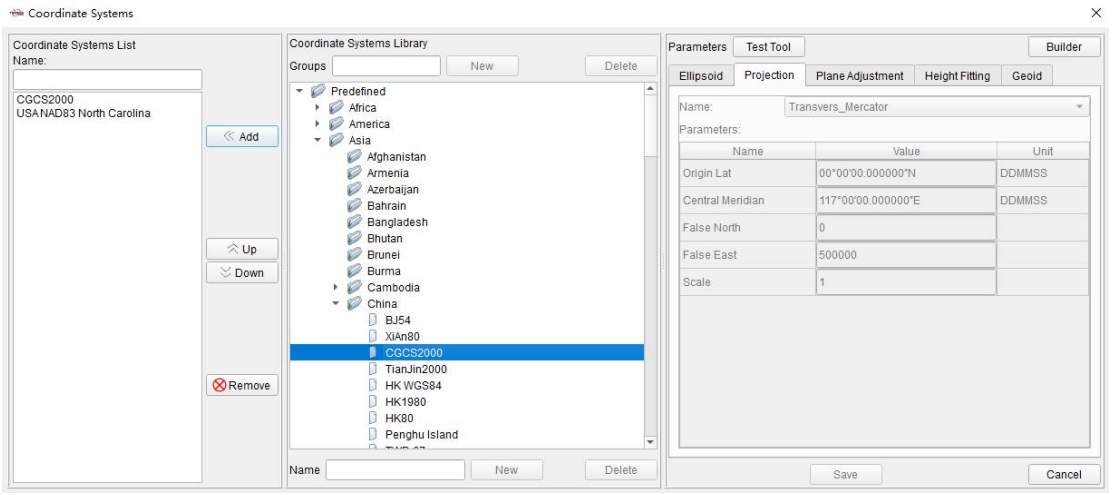


Figure 9.1 Coordinate Systems Tool

The tool is divided into three parts, Coordinate System List on the left, Coordinate System Library in the center and Parameters on the right.

The coordinate systems in Coordinate System List can be displayed and selected directly when creating new project or setting coordinate systems of projects. Click [Add] to add coordinate systems from Coordinate Systems Library to the list. Click [Up] or [Down] to adjust the sorting in the list. Click [Remove] to remove items in the list. Click items in the list, the detailed information will be displayed in Parameters part on the right side.

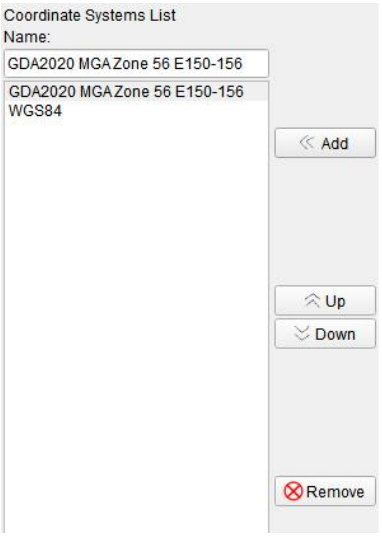


Figure 9.2 Coordinate Systems List

In Coordinate Systems Library, there are predefined coordinate systems and customized coordinate systems. The predefined coordinate systems are categorized according to continents and regions. Click on predefined coordinate systems, the parameters will be displayed on the right side but cannot be edited.

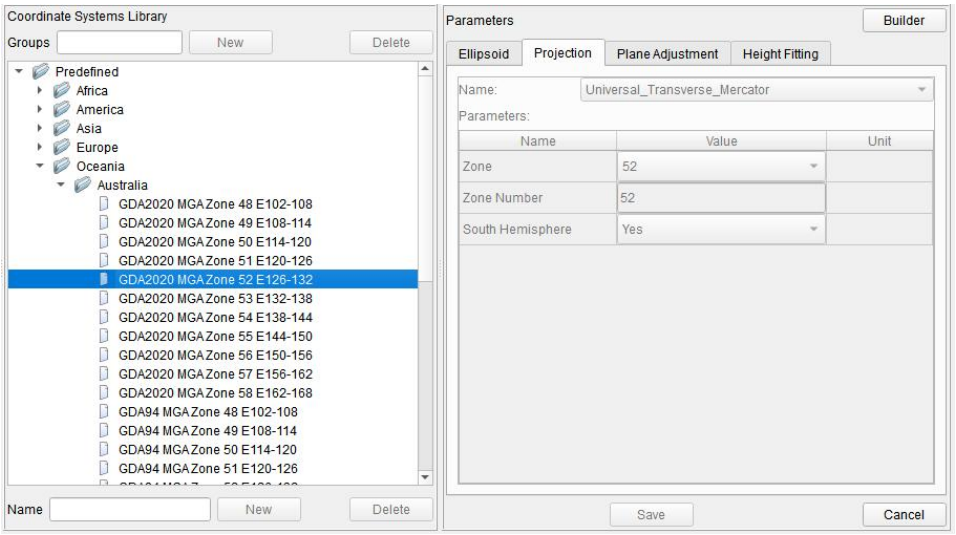


Figure 9.3 Predefined Coordinate Systems

Select a predefined coordinate system, right click on it and click [Sent to Customized] to copy it from predefined group to customized group. Click on customized coordinate systems, the parameters will be displayed on the right side and can be edited. It is also possible to create groups and create coordinate systems in customized group, then configure and edit coordinate system parameters.

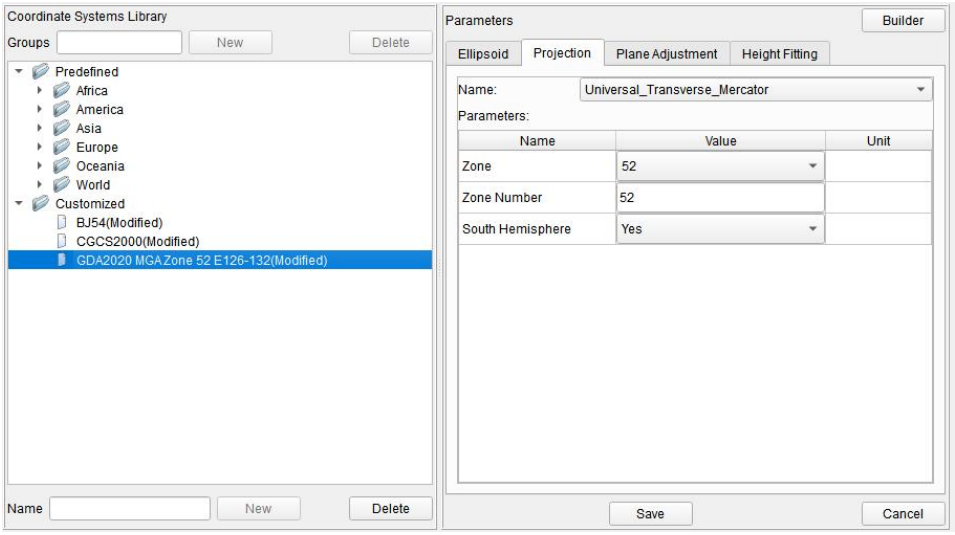


Figure 9.4 Customized Coordinate Systems

There are Ellipsoid, Projection, Plane Adjustment, Height Fitting and Geoid in Parameters part.

Ellipsoid	The local ellipsoid of of the current project, including ellipsoid and datum transformation. When editing ellipsoid parameters, you can select it from the drop-down list, and the parameters such as a and 1/f will be changed accordingly. The datum trans includes None, Three Parameters and Seven Parameters. In the current project, the ellipsoid and datum trans are used to realize the conversion calculation of Lat/Lon/Hgt coordinates under WGS84 and local system.
Projection	The projection of the current project. Select projection type from the drop-down list, and enter parameters according to projection type, such as Origin Lat, Central Meridian, False North, False East, Scale and so on. In the current project, the projection is used to realize the conversion calculation of Lat/Lon coordinates and North/East coordinates under local system.
Plane Adjustment	The plane adjustment parameters of the current project. In the current project, the plane adjustment is used to realize the conversion calculation of projected North/East coordinates and known coordinates in site calibration.
Height Fitting	The height fitting parameters of the current project. In the current project, the height fitting is used to realize the conversion calculation of ellipsoidal height coordinates and known altitude coordinates in site calibration.
Geoid	The geoid model of the current project. In the current project, the geoid model file selected is used to calculate altitude above mean sea level from ellipsoidal height.

9.2 Antennas

Click Tools menu, click [Antennas] button, to open Antennas tool.

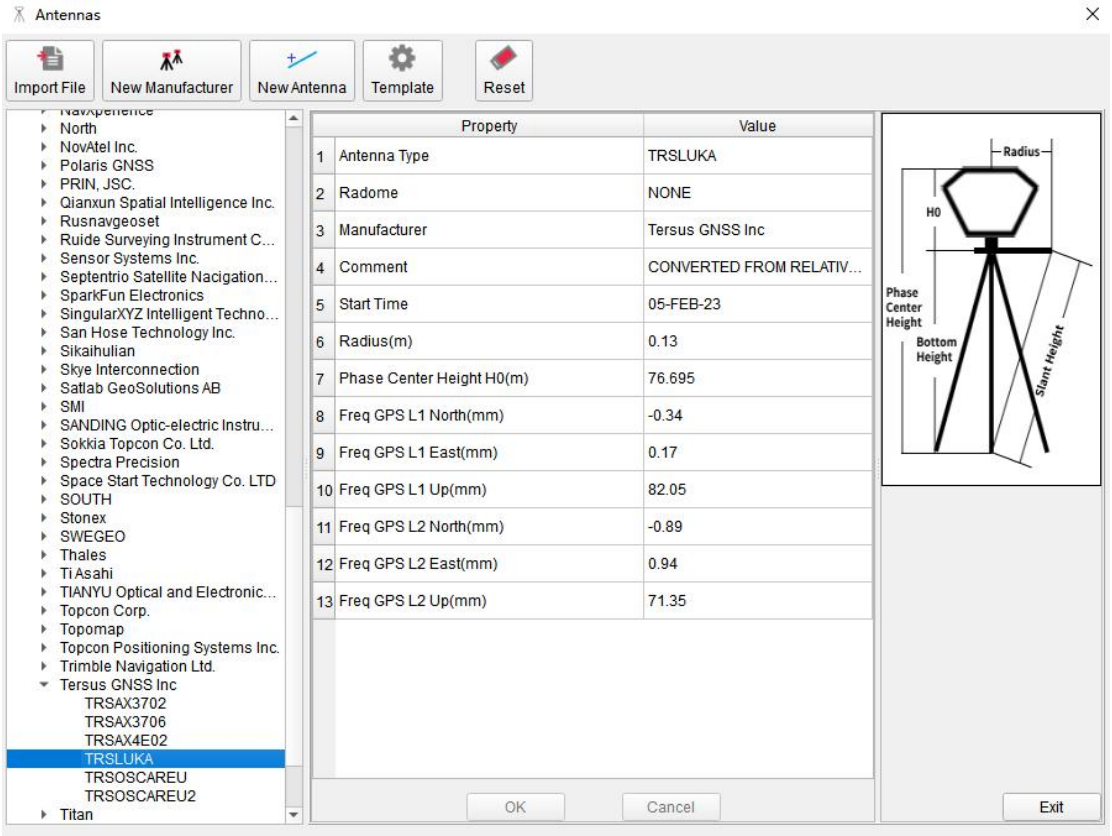


Figure 9.5 Antennas Tool

In the tool, antennas in the list are categorized according to manufacturers. Click on antenna item to display properties and values.

When importing GNSS files, software will automatically recognize antenna information recorded in observation files, match the antenna type and parameters in Antennas tool in calculations. If there is no matching antenna type in the tool, you can click [Import File] to import antenna file or click [New Manufacturer] and [New Antenna] and input antenna parameters manually.

10. Support

Click Support menu, click [Help] button to open software user manual.

Click Support menu, click [Release Notes] button to open release notes documentation.

Click Support menu, click [About] button to open the dialog that displays software version, website, support email and other information.

11. Terminology

Abbreviation	Definition
GNSS	Global Navigation Satellite System
PPK	Post-Processing Kinematic
RINEX	Receiver Independent Exchange format
RMS	Root Mean Squares
RTK	Real-Time Kinematic
WGS84	World Geodetic System 1984

12. File Format

[.exe]:executable program file

[.las]: LIDAR data binary file

[.tgo2]: TGO2 project file

[.trd]: Tersus Road file format

[.trs]: Tersus raw observation data file

Proprietary Notice