



Hi-Target Business Center

User Manual

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Hi-Target Business Center

User Manual

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Preface

Introduction

Welcome to the Hi-Target Business Center. This introduction describes how to use this product.

Experience Requirement

In order to help you use the Hi-Target series' products better, we suggest you carefully read the instructions. If you are unfamiliar with the products, please refer to <http://www.hi-target.com.cn/>

Tips for Safe Use



Notice: The contents here are special operations and need your special attention. Please read them carefully.

The contents here are very important. The wrong operation may damage the machine, lose data, break the system and endanger your safety.

Exclusions

Before using the product, please read these operating instructions carefully: they will help you to use it better. Hi-Target Surveying Instrument Co., Ltd will assume no responsibility if you fail to operate the product according to the instructions, or operate it wrongly due to misunderstanding the instructions.

Hi-Target is committed to constantly perfecting product functions and performance, improving service quality and we reserve the right to change these operating instructions without notice.

We have checked the contents of the instructions the software and hardware, without eliminating the possibility of error. The pictures in the operating instructions are for reference only. In the case of non-conformity with products, the products shall prevail.

Technology and Service

If you have any technical issues, please refer to Hi-Target's technology department for help.

Relevant Information

You can obtain this introduction by:

1. Purchasing Hi-Target products: you will find this manual in the instrument container to guide you on operating the instrument.
2. Logging onto the Hi-Target official website, download the electronic version introduction at *Download center* → *Partners* → *Partner center*.

Advice

If you have any comments and suggestions for this product, please email info@hi-target.com.cn. Your feedback will help us to improve the product and service.

Chapter 1

Software Introduction

This chapter contains:

- Instruction Manual Use
- Instruction Manual Introduction
- Experience Requirements
- Liability Waiver
- Technical Services
- Your Service

1.1 Instruction Manual Use

Welcome to use Hi-Target Business Center (full text abbreviated as HBC) software, this article is the HBC software help manual, that is, the manual.

1.2 Instruction Manual Introduction

This manual describes in detail the installation and configuration of HBC software and the use of each function module, in order to guide you to learn to use each operation of HBC software quickly and accurately.

1.3 Experience Requirements

In order for you to use the HBC software better, CNOOC recommends that you have a certain level of measurement knowledge and read this manual carefully. If you have any questions, please contact us.

1.4 Liability Waiver

Before using this product, please be sure to read the instruction manual carefully, which will help you to use this product better. Hi-Target is not responsible for any damage caused by operating the product without following the requirements of the instruction manual or misusing the product without understanding the requirements of the instruction manual correctly.

Hi-Target is committed to continuously improving the functions and performance of its products and services, and reserves the right to make changes to the contents of the instruction manual without prior notice.

We have checked the consistency of the printed content and the hardware and software, however, we do not exclude the possibility of deviations, the pictures in this manual are for reference only, if there is any discrepancy with the actual product, please refer to the actual product, the final interpretation right belongs to Guangzhou Hi-Target Survey Instruments Co.

1.5 Technical Services

If you have any technical problems, you can contact the technical center of each branch or the technical department of the headquarters by phone, and we will answer your questions promptly.

1.6 Your Service

If you have any comments and suggestions on this manual, please contact us, your feedback will be a great improvement to the quality of our manual.

Chapter 2

Installation and Licensing

This chapter contains:

- Installation
- Operating Environment
- Software Registration

2.1 Installation

Copy the installation file to the device and double-click the installer file to install the software.

Select the path and agree to the license conditions.

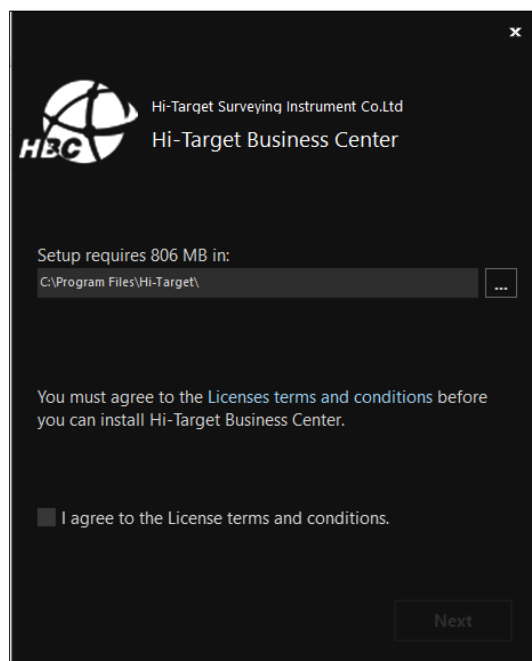


Figure 2-1-1 Install

Select the module to be installed.

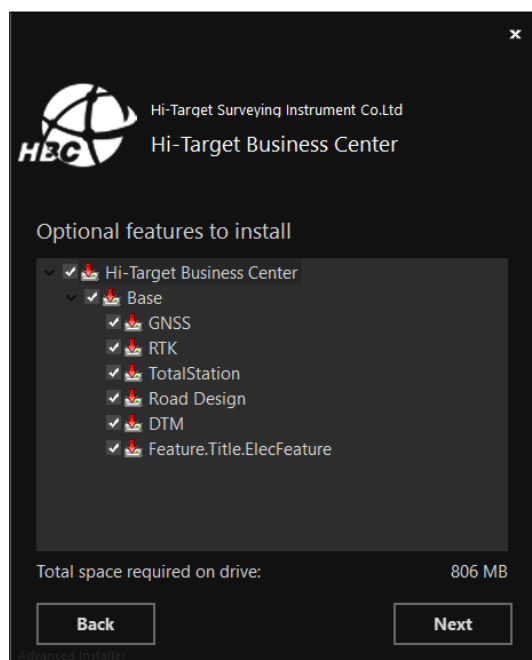


Figure 2-1-2 Install

Creating application shortcuts.

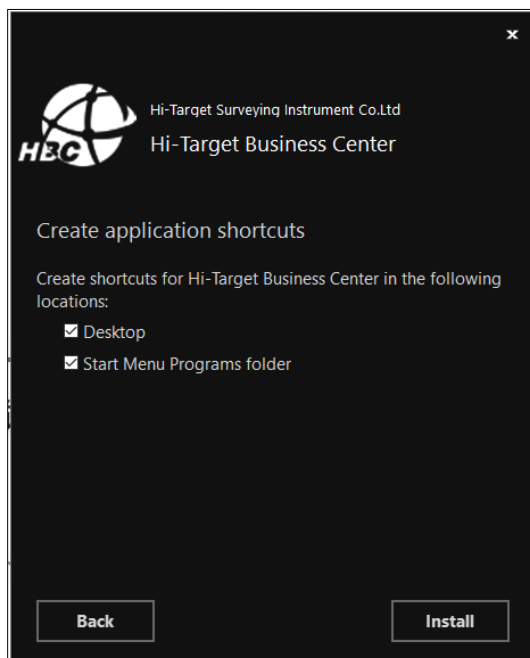


Figure 2-1-3 Install

Perform installation.

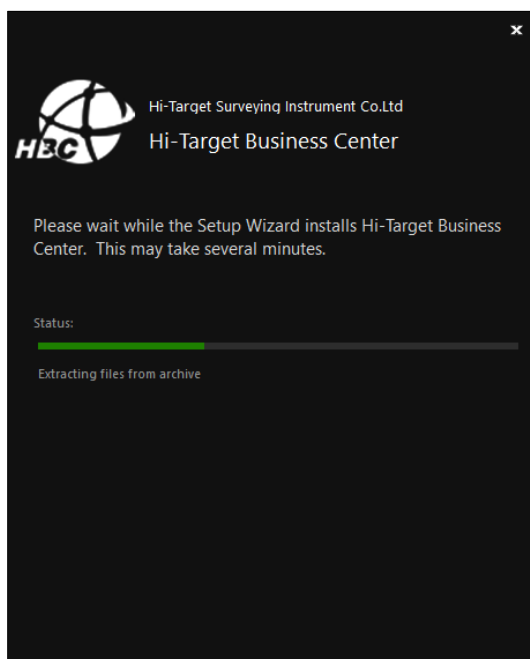


Figure 2-1-4 Install

Complete installation.

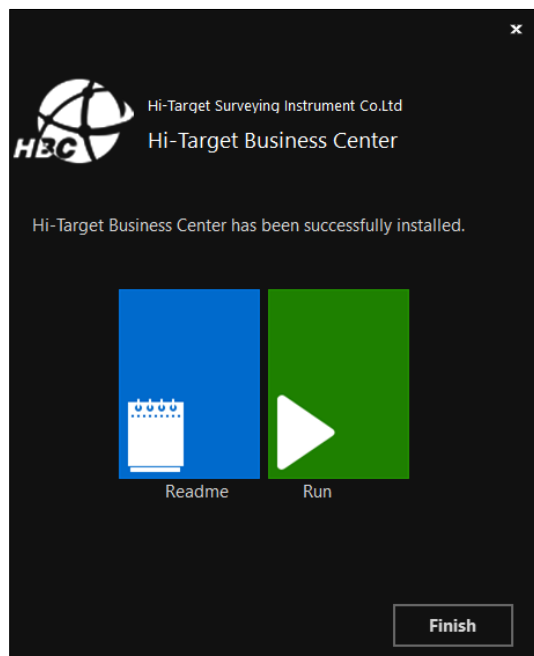


Figure 2-1-5 Install

2.2 Operating Environment

HBC software supports Windows 7, Windows 10 64-bit operating system.

Environment: win7 win10 operating system, CPU Core Duo 2.0 or above Hard disk:500G or above
Memory: 4G or above, graphics card driver support OpenGL3.3 or above.

2.3 Software Registration

Open the software registration screen.

The software registration interface will pop up automatically when the advanced modules [GNSS PPK Solver] and [Single BDS Solver] are not registered, or click [Registration] under [Support] after opening the software, the software registration interface is as follows.

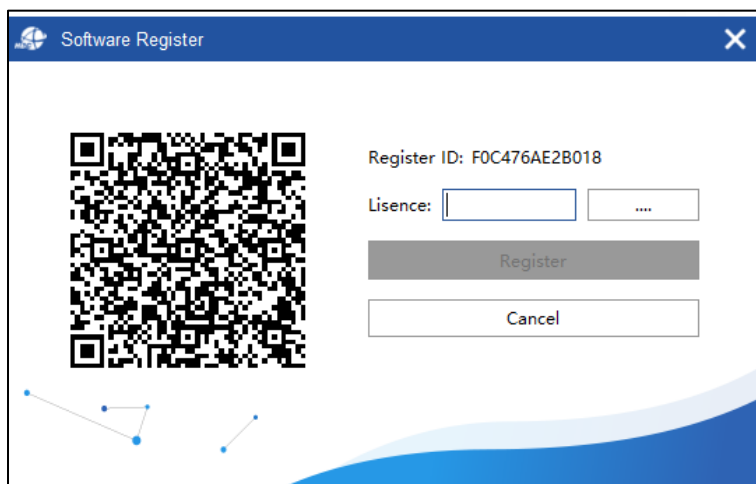


Figure 2-3-1 Register

The software will automatically generate a serial number based on the computer configuration information, enter the registration code or license file obtained from this serial number.

If you do not use the advanced [GNSS PPK Solver] and [Single BDS Solver] modules, you can enter the software directly by clicking the [Cancel] button.

Click [Register] to complete advanced module registration.

Note: New users will have a one-month trial period by default after the installation of the software, during which users can use the functions of the advanced modules.

Chapter 3

Start

This chapter contains:

- New Construction
- Open
- Save
- Save As
- Save As Template
- Close
- Recently Used
- Exit

3.1 New Construction

1.Interface

Open the HBC software and click [New] on the left side of the interface as follows.

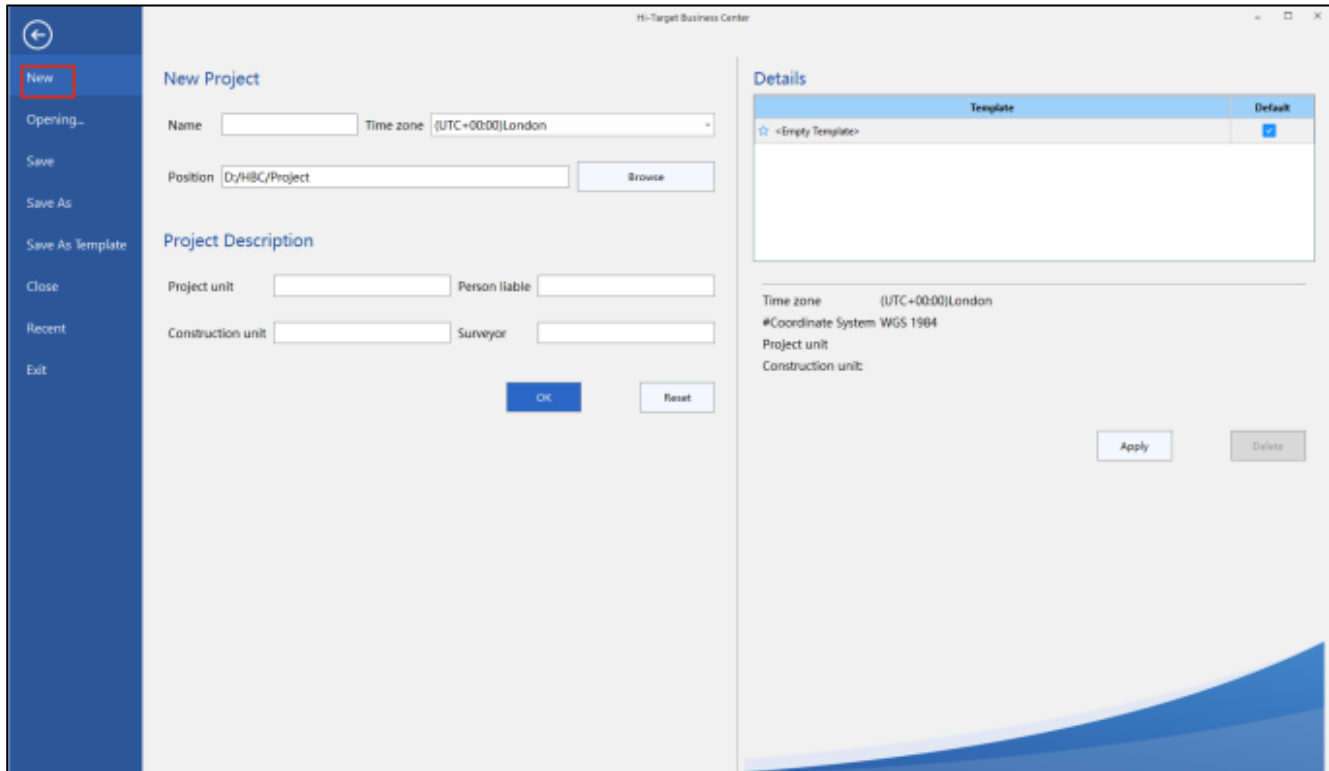


Figure 3-1-1 Start

The fields with "*" are required, the name defaults to the current time, and the location path records the location of the last selected project folder.

Note: The maximum length of the project name is 50 characters.

2.New Construction Information

Enter the project name, select the time zone, and choose the project storage path.

3.Project Description

Enter the information of project unit, responsible person, construction unit and surveyor respectively.

Click OK to complete the project creation.

4.Stopping Window

Right mouse click on the top menu bar or the title bar of each docking window can choose to open/close the corresponding docking window, such as open: project management, output information docking window, pay attention to other docking windows, such as RTK project under the point panning open way need to click [RTK] under the [point panning] to open.

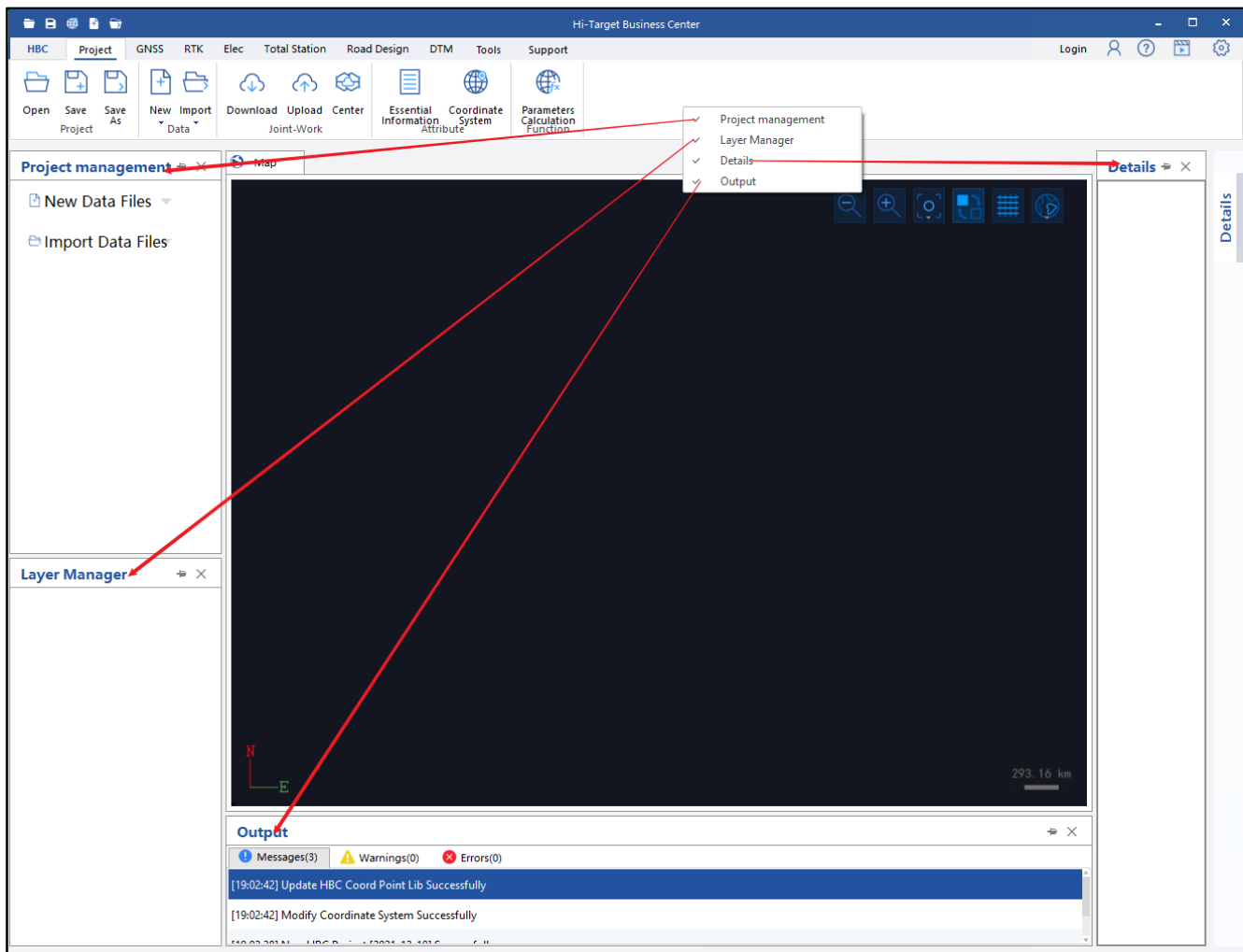


Figure 3-1-2 Start

3.2 Open

[Method I] Open the HBC software and click [HBC] in the upper left corner, the software pops up a side menu.

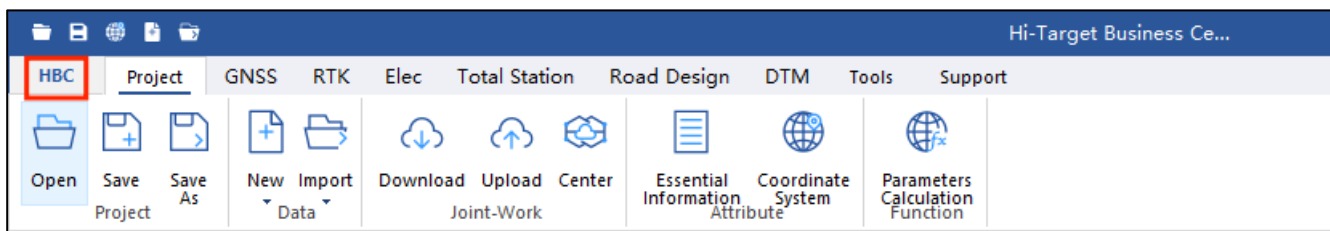


Figure 3-2-1 Open

Click [Open] in the drop-down menu, the software pops up the file selector, and the path is the default path to store the project.

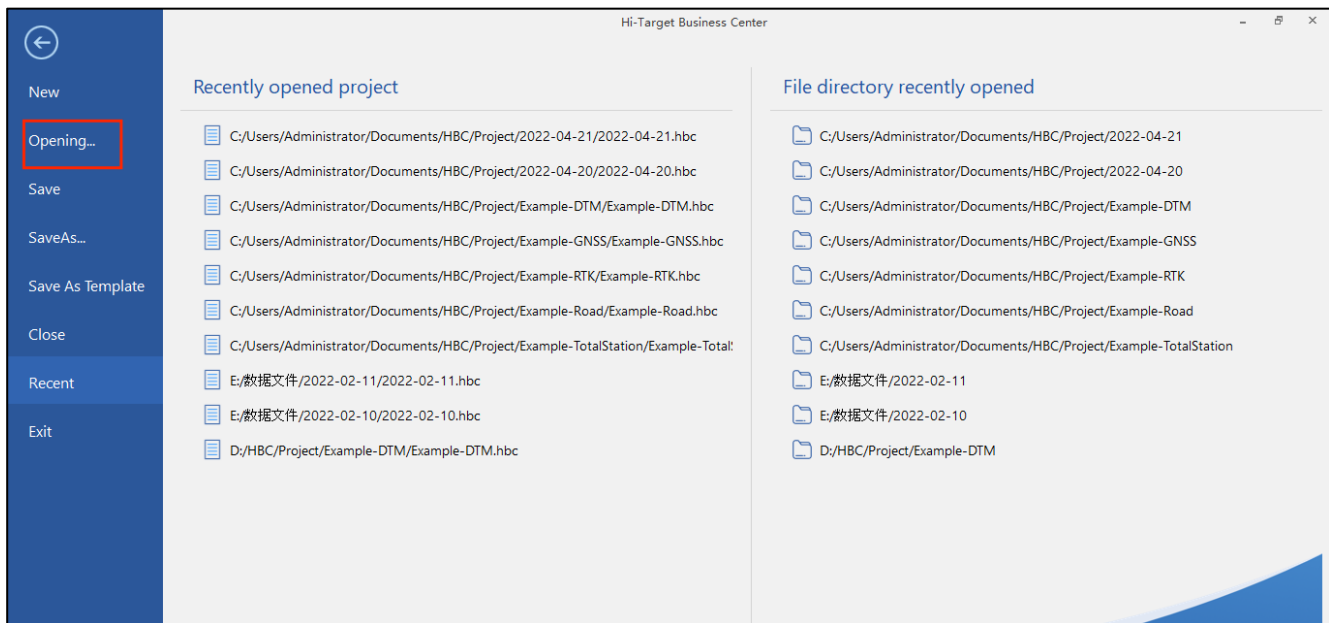


Figure 3-2-2 Open

Select the HBC project file to be opened, click [Open] on the selector, and the software opens the HBC project.

[Method 2] Open the HBC software and click the [Open] icon under the [Project] toolbar in the upper left corner, the software will also pop up the same file selector.

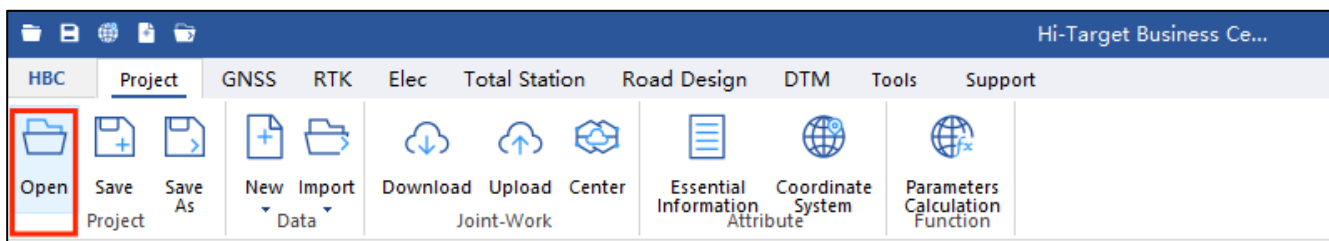


Figure 3-2-3 Open

[Method 3] Open the HBC software and click [HBC] in the upper left corner, the software will pop up a side menu. Click [Recently Used] in the drop-down menu, double click any of the recently used projects, the software will open the project.

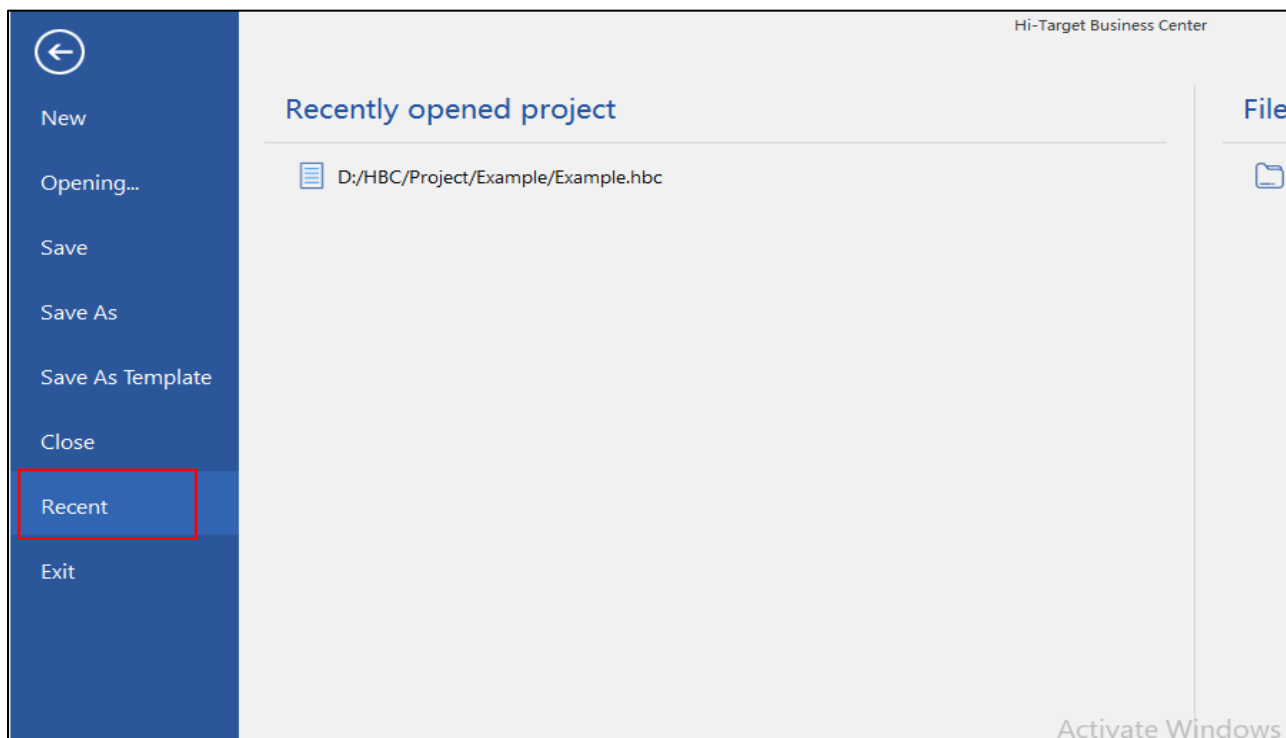


Figure 3-2-4 Open

[Method 4] Open the HBC software and click the open icon at the top, the software pops up the file selector, the path is the default path to store the project.

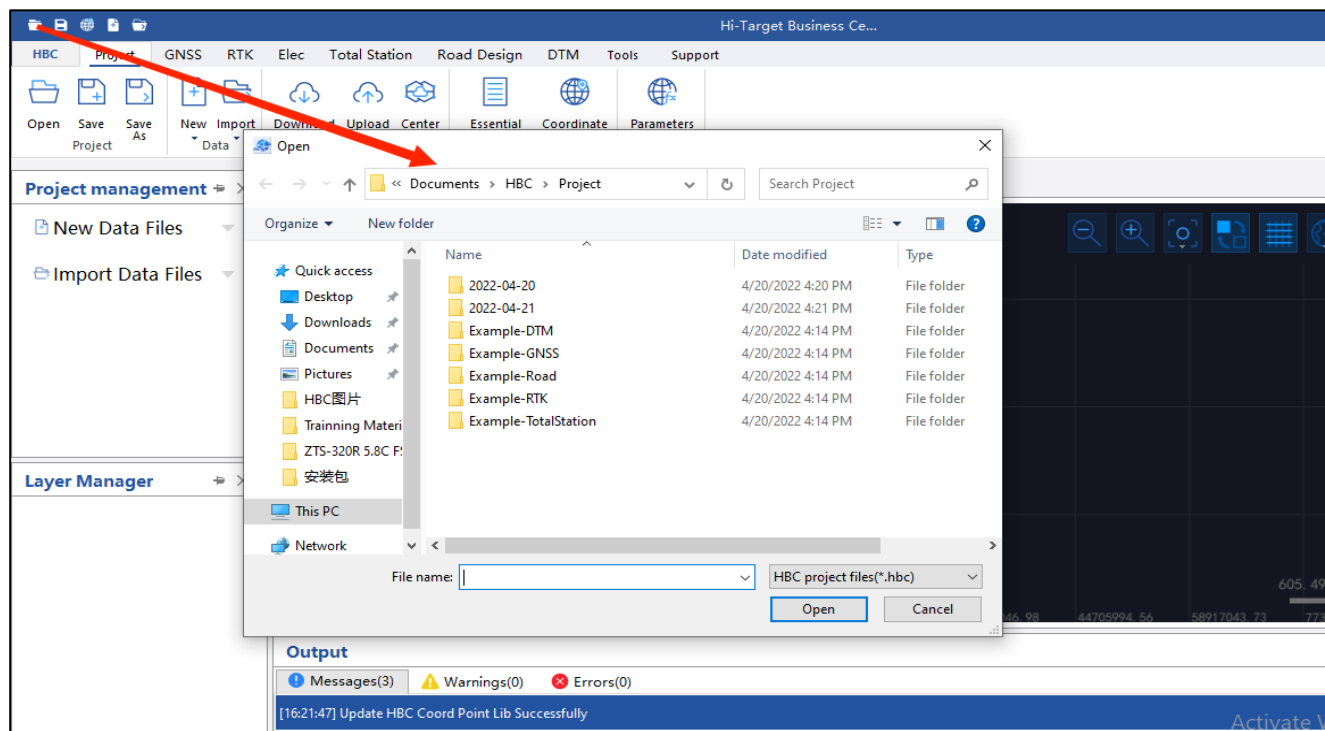


Figure 3-2-5 Open

3.3 Save

[Method 1] Click [HBC] in the upper left corner of the HBC software, and then click [Save] in the software pop-up side menu.

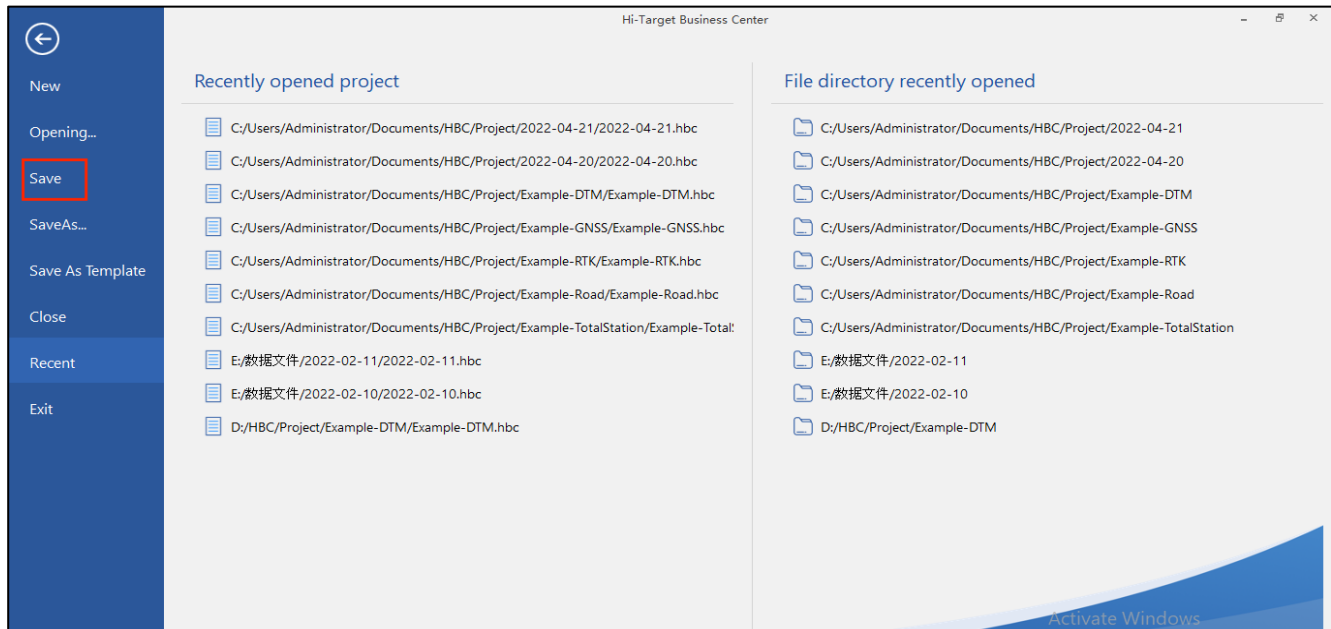


Figure 3-3-1 Save

[Method 2] Click the [Save] icon under the [Project] toolbar in the upper left corner of the HBC software.

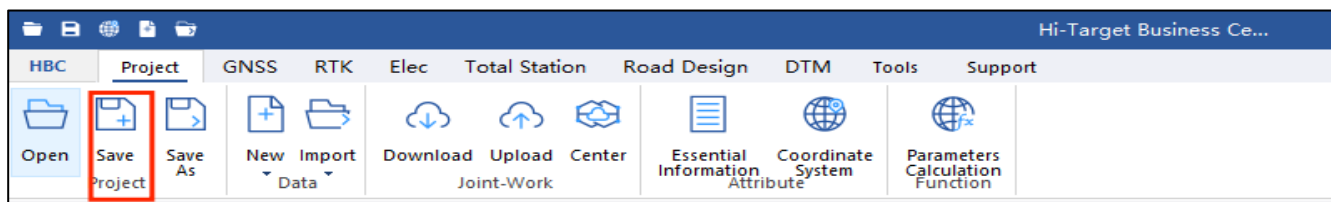


Figure 3-3-2 Save

3.4 Save As

[Method 1] Click on the HBC software and click on [HBC] in the upper left corner, then click on [Save as] in the side menu that pops up in the software.

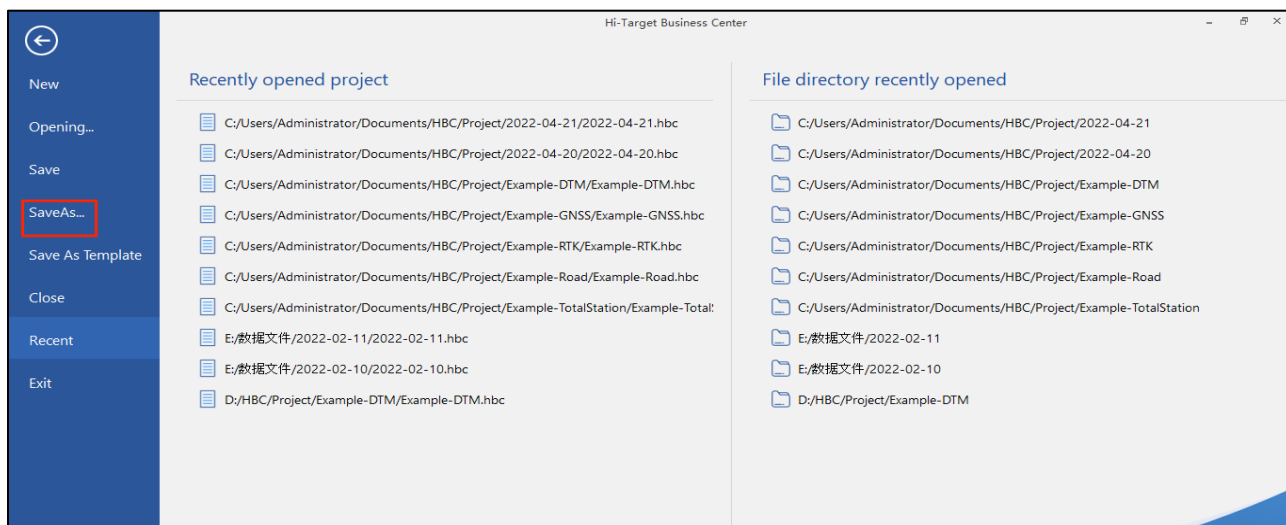


Figure 3-4-1 Save As

The software pops up the file selector, and the path is the default path to store the project.

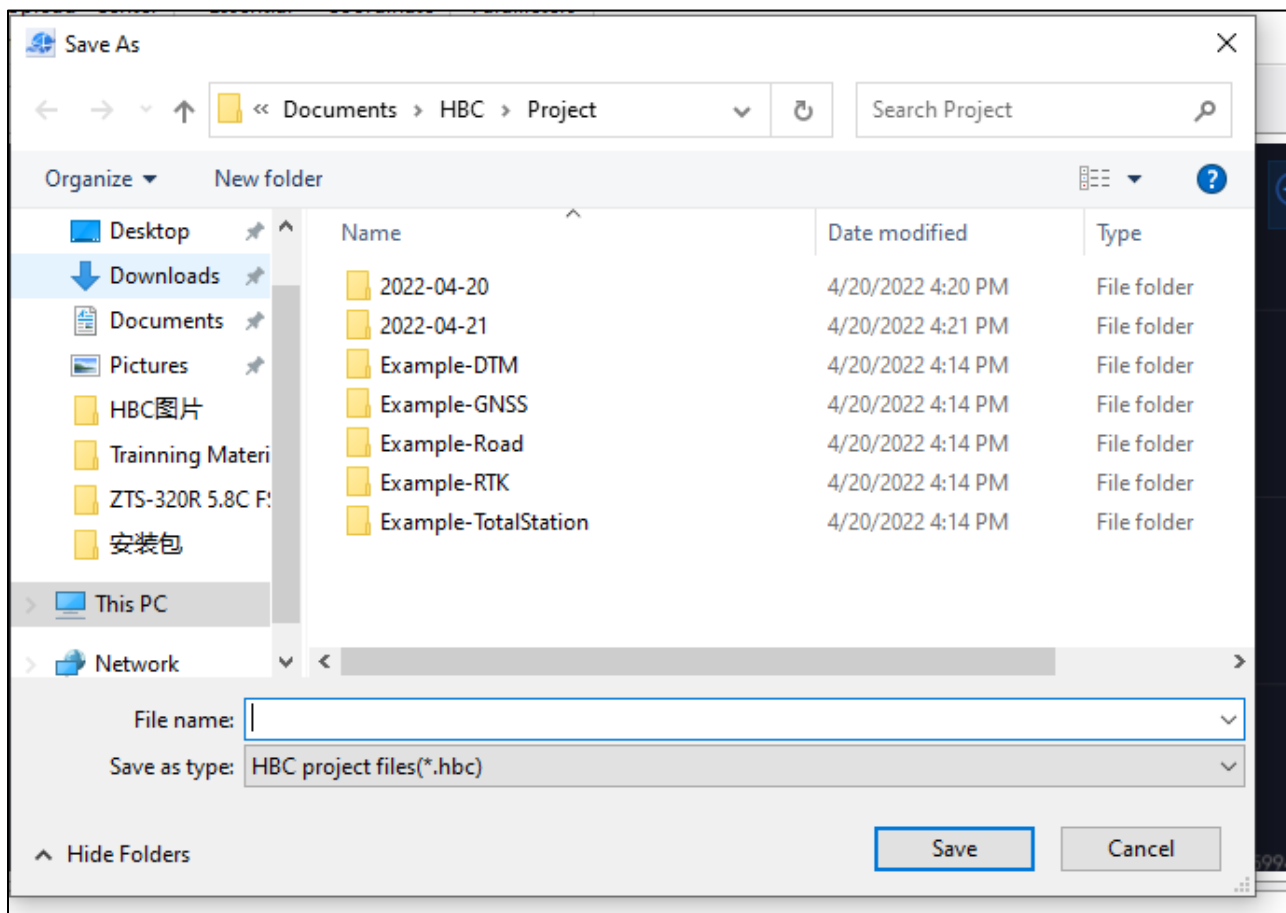


Figure 3-4-2 Save As

Select the path where you want to save the project file, enter the name of the project you want to save as in the file name, and click [Save].

[Method 2] Click the [Save As] icon under the [Project] toolbar in the upper left corner of the HBC software, and the software will also pop up the same file selector.

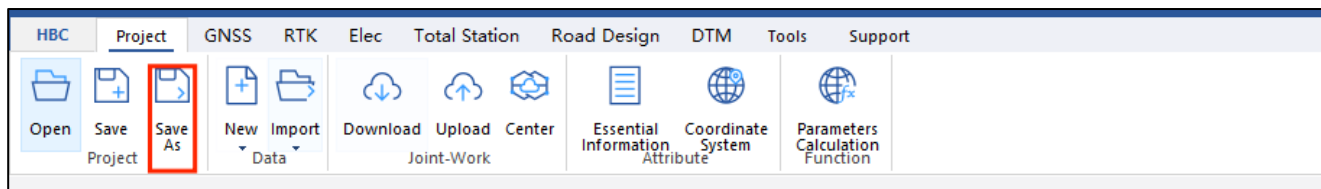
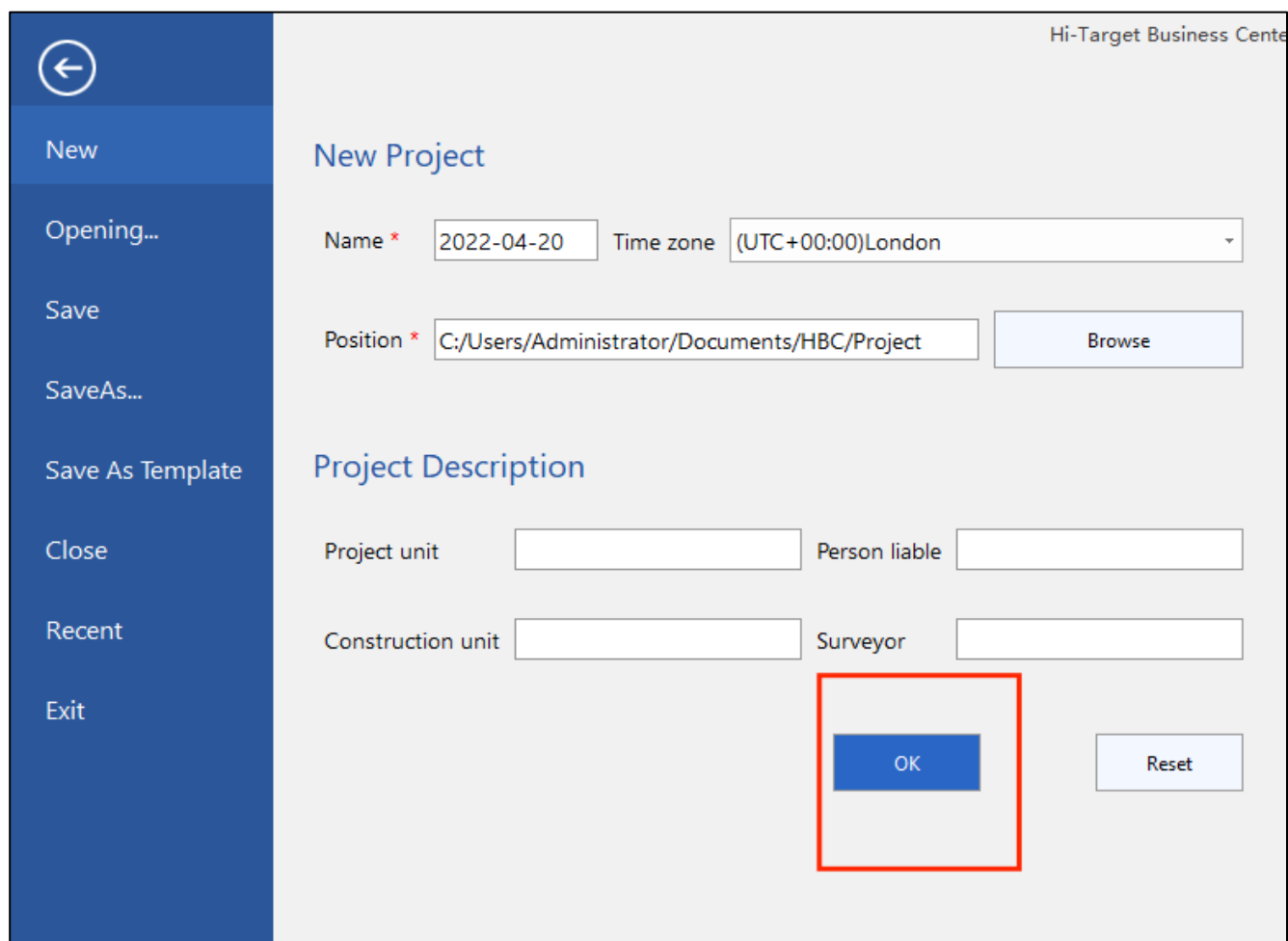


Figure 3-4-3 Save As

3.5 Save As Template

1. Save Template

New Construction



Hi-Target Business Center

New Project

Name * Time zone

Position *

Project Description

Project unit Person liable

Construction unit Surveyor

Figure 3-5-1 Save as Template

Click [Save As Template], enter the template name, and click [OK].

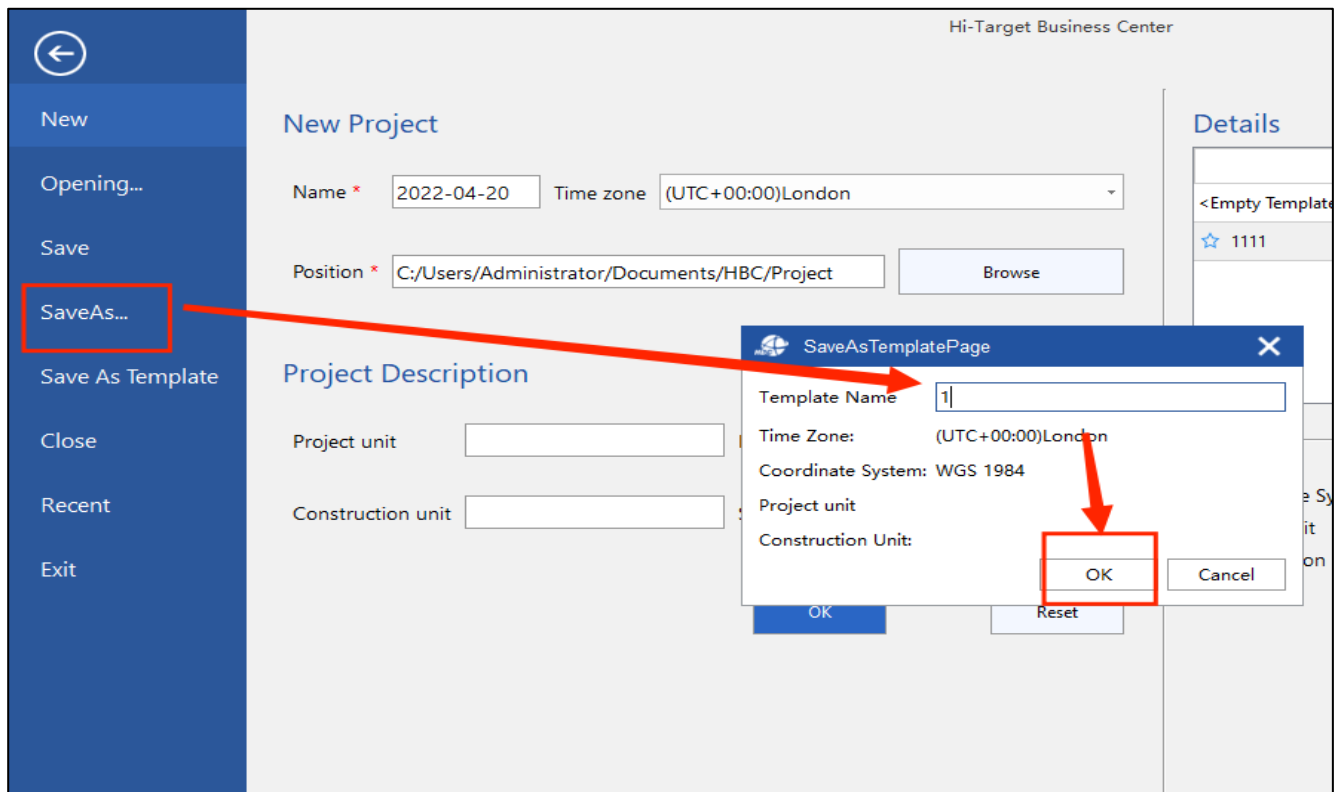


Figure 3-5-2 Save as Template

New project template is added to the template details page, and the template information is displayed below the list, the asterisk represents the current project using the template, and the default box is checked to represent the new project using the template by default.

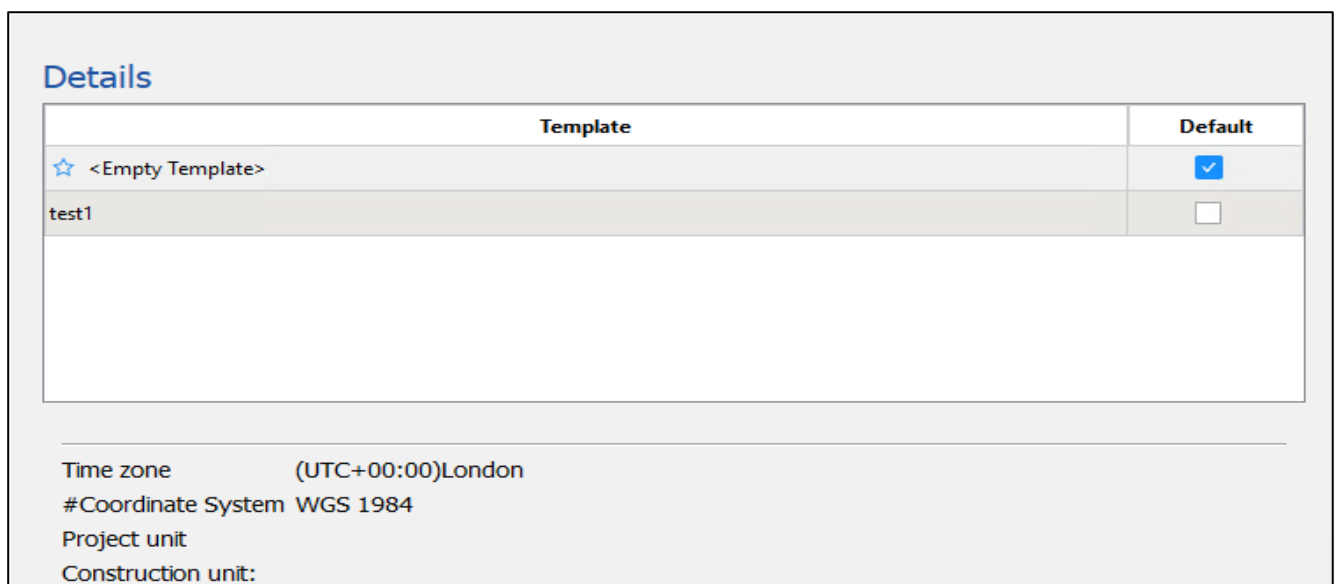
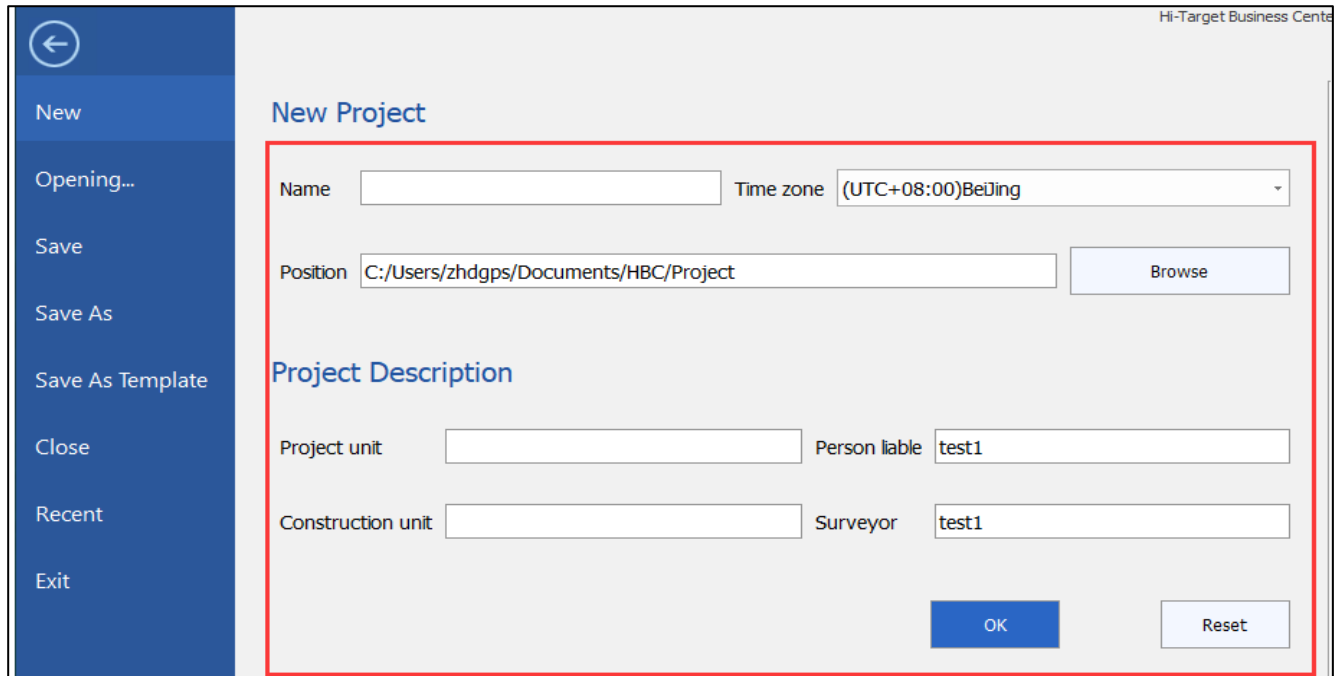


Figure 3-5-3 Save as Template

2.Application Templates

Select the project template, click [Apply], and the template information will be filled automatically on the left.



Hi-Target Business Center

New Project

Name Time zone

Position

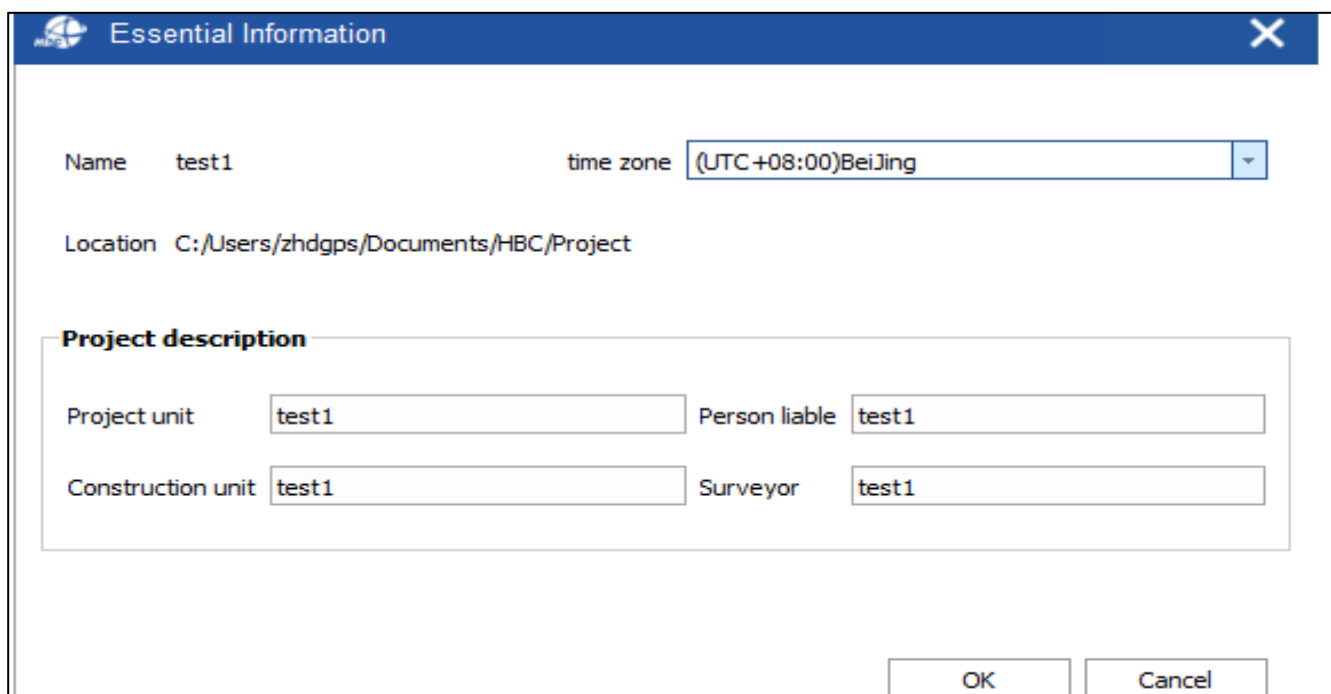
Project Description

Project unit Person liable

Construction unit Surveyor

Figure 3-5-4 Save as Template

View [Project] - [Basic Information], display content consistent with the template.



Essential Information

Name test1 time zone

Location C:/Users/zhdgps/Documents/HBC/Project

Project description

Project unit Person liable

Construction unit Surveyor

Figure 3-5-5 Save as Template

3.6 Close

Click the HBC software and click [HBC] in the upper left corner, then click [Close] in the side menu that pops up in the software.

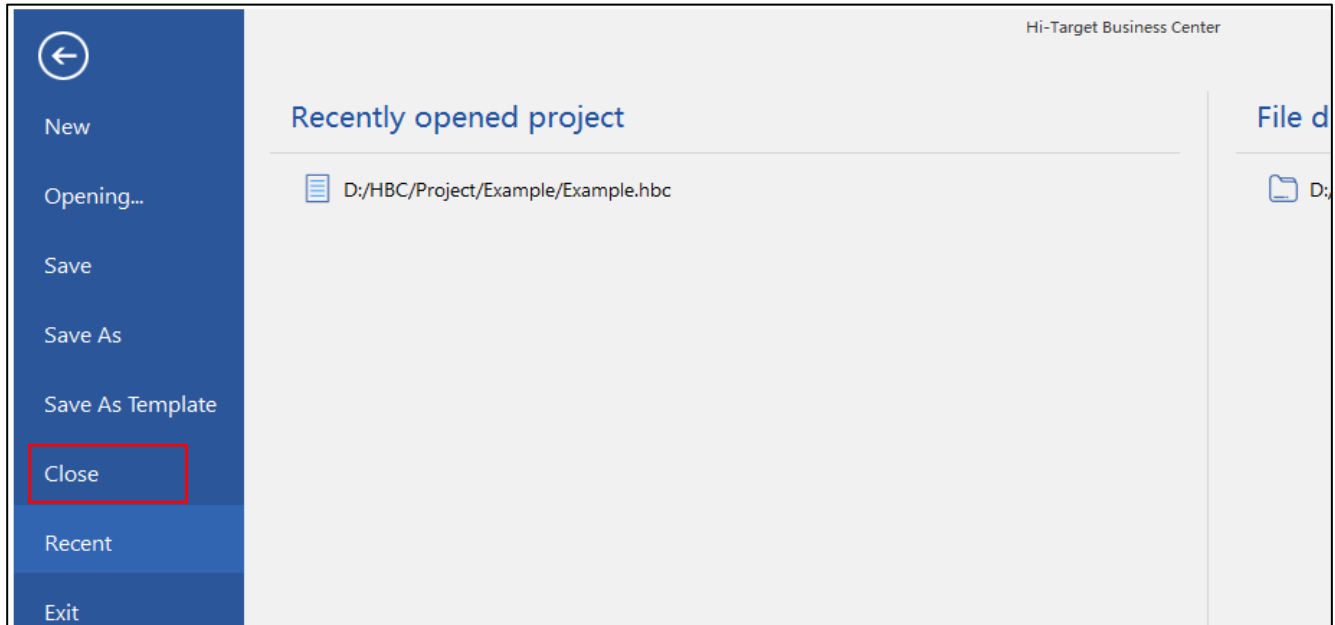


Figure 3-6-1 Close

The software pops up the closing prompt box "The current project has been modified, whether to save".



Figure 3-6-2 Close

Click [Yes] to close the project after the software saves the current project; click [No] to close the current project directly without saving; click [Cancel] to close the prompt window message, without saving or closing the current project.

3.7 Recently Used

Click [HBC] in the upper left corner of the HBC software, click [Recently Used] in the pop-up menu of the software, the software pop-up panel shows the list of recently opened historical projects and the list of file locations where the corresponding projects are located. Double-click any of the recently opened file directories to open the file directory location in Explorer.

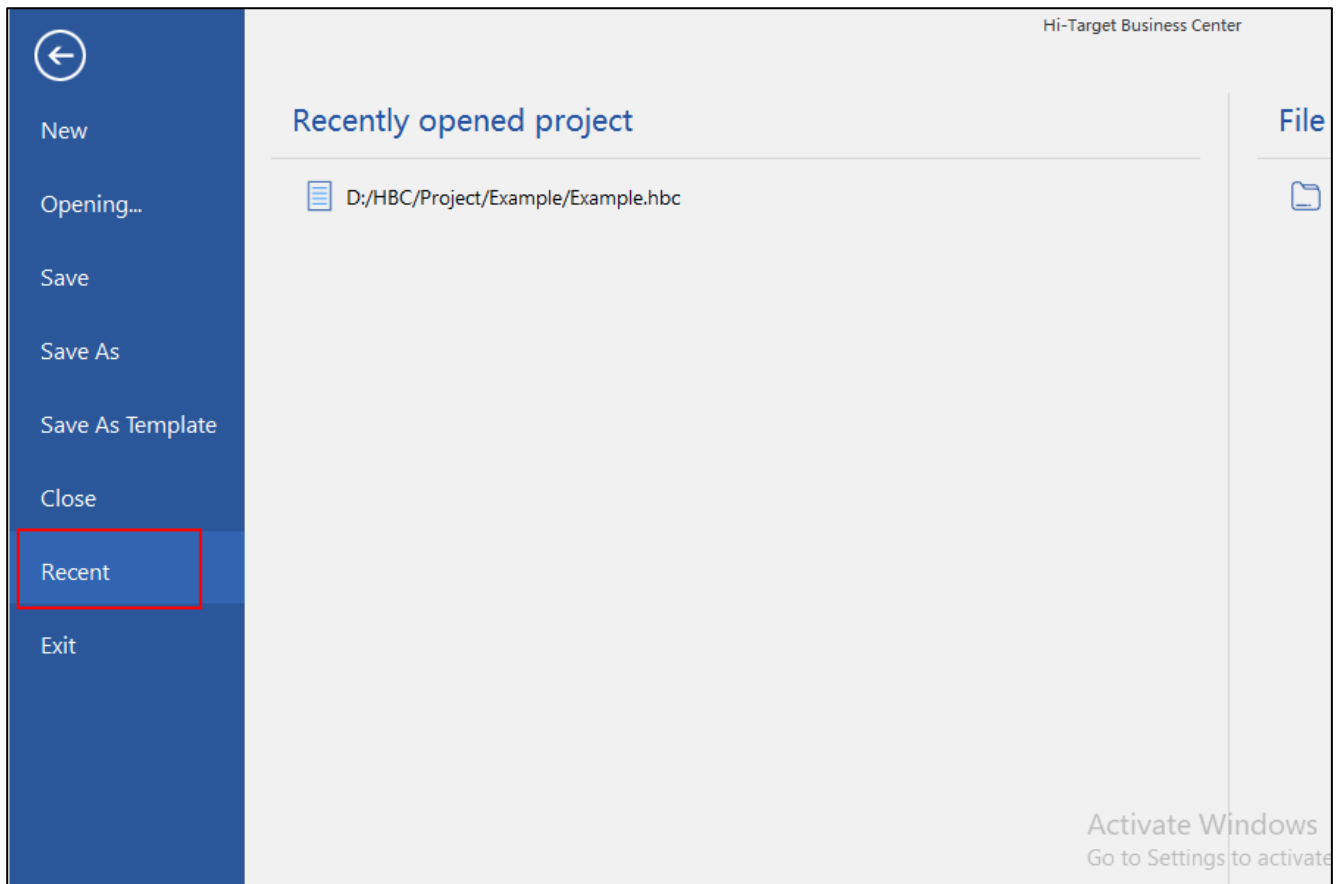


Figure 3-7-1 Recently Used

Double click any project in the history project list, the software will open the project.

3.8 Exit

[Method 1] Click [HBC] in the upper left corner of the HBC software, and click [Exit] in the side menu that pops up in the software.

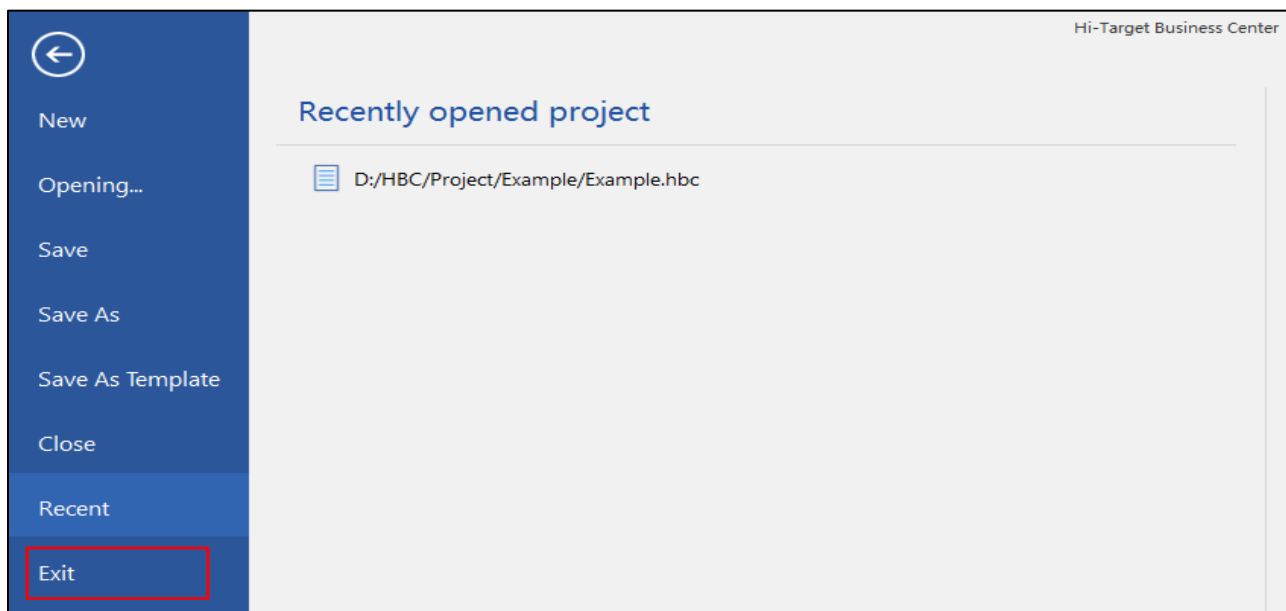


Figure 3-8-1 Exit

If there is an open project is not closed, the software pop-up prompt box "the current project has been modified, whether to save", click [Yes] will save the current project and exit the software; click [No] will directly exit the software does not save the current project.

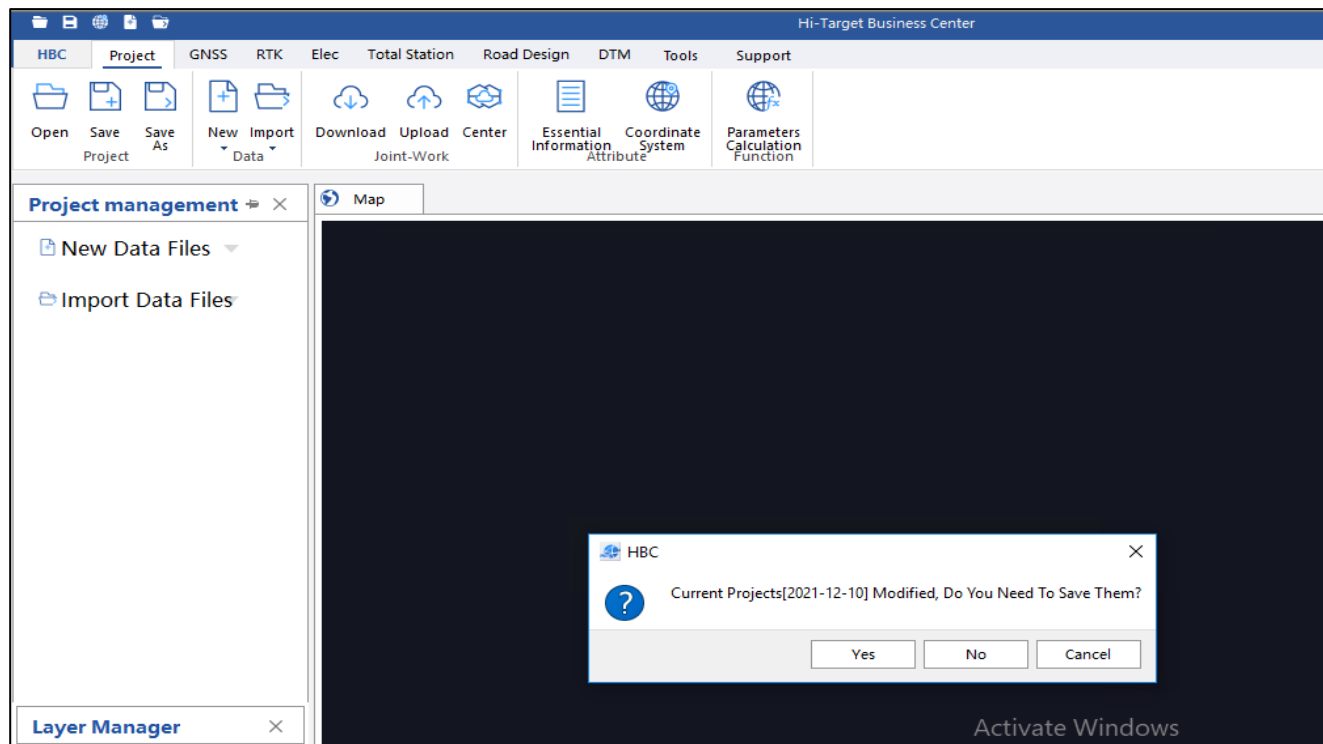


Figure 3-8-2 Exit

If there is no open project, the software pops up a confirmation exit prompt box "Are you sure you want to exit?" Click [Yes] to exit the software; click [No] to close the prompt box and do not exit the software.

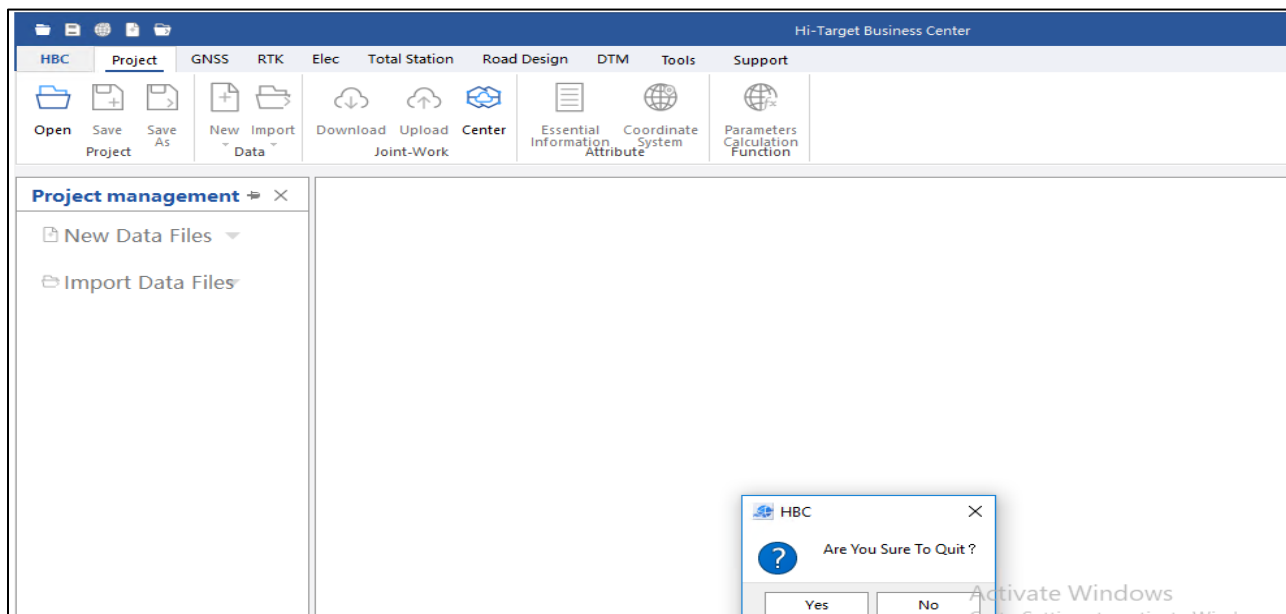


Figure 3-8-3 Exit

[Method 2] Click the [x] icon in the upper right corner of the HBC software directly.

If there is an open project is not closed, the software pop-up prompt box "the current project has been modified, whether to save", click [Yes] will save the current project and exit the software; click [No] will directly exit the software does not save the current project.

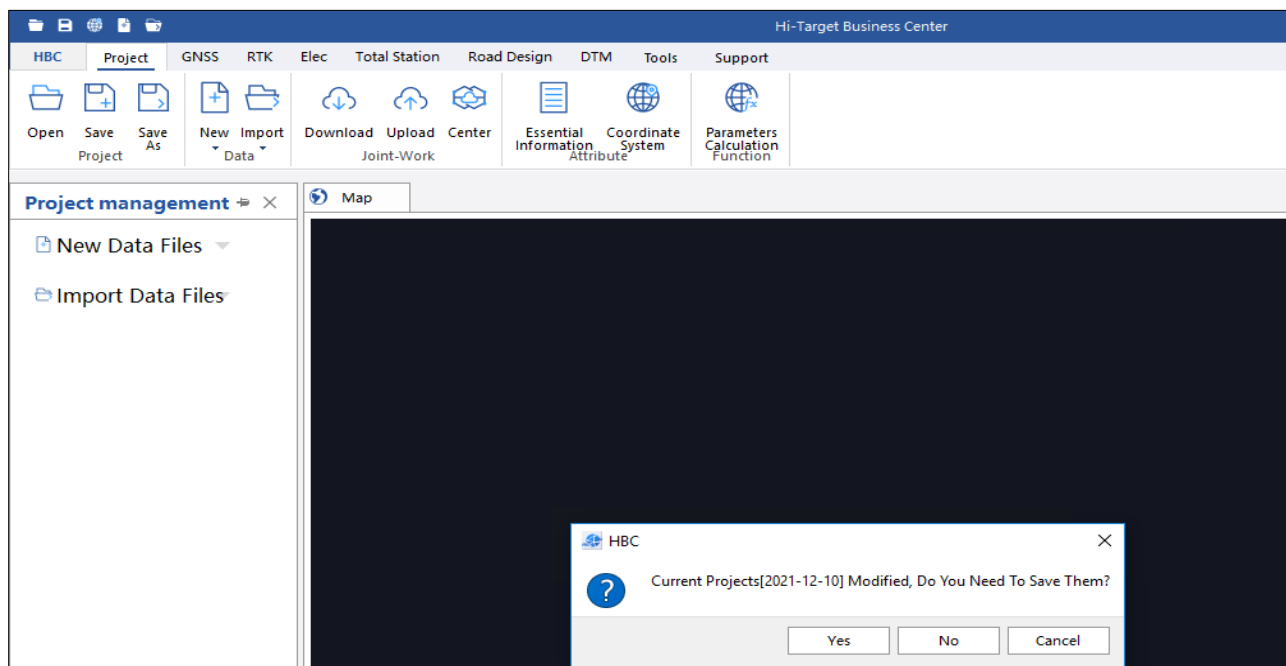


Figure 3-8-4 Exit

If there is no open project, the software pops up a confirmation exit prompt box "Are you sure you want to exit?" Click [Yes] to exit the software; click [No] to close the prompt box and do not exit the software.

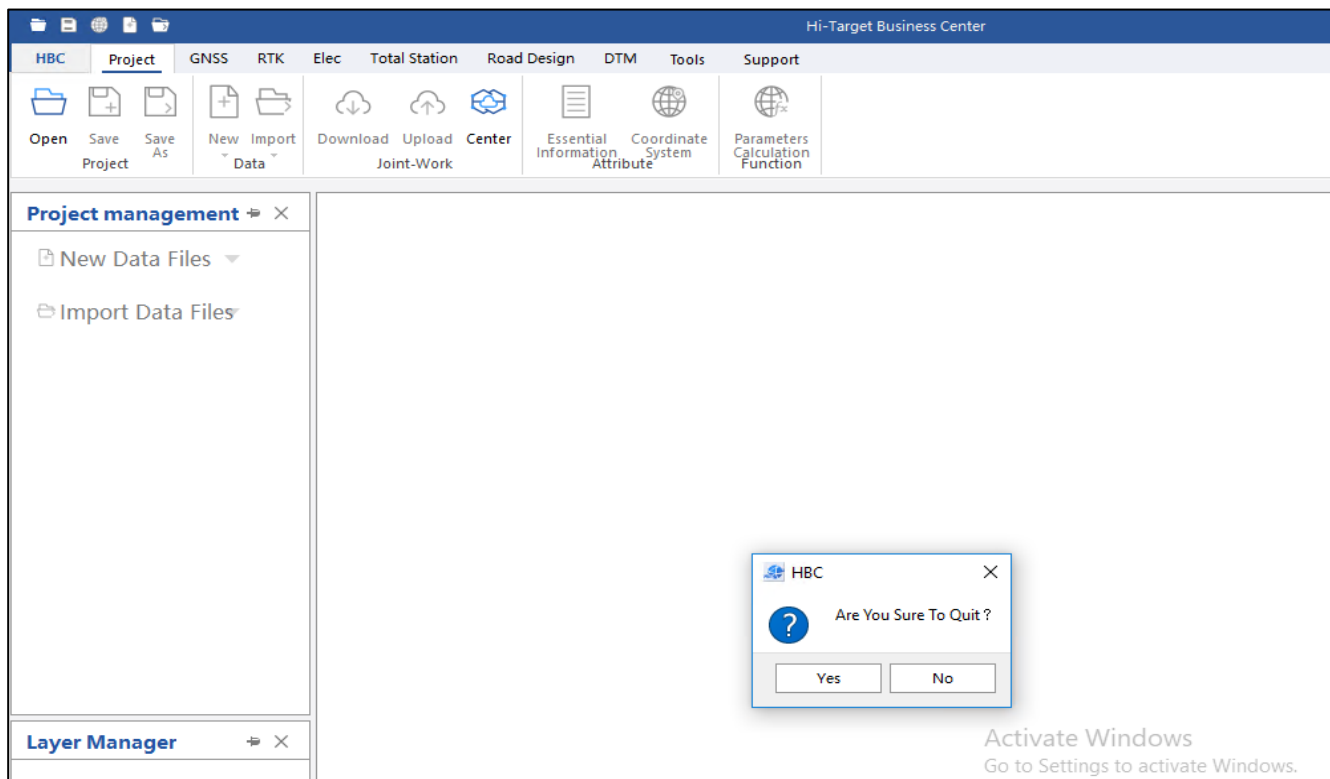


Figure 3-8-5 Exit

Chapter 4

Project

This chapter contains:

- Open
- Save
- Save as
- Essential Information
- Coordinate System
- Joint-Work Center
- Parameter Calculation Widget

4.1 Open

Open the HBC software and click the [Open] icon under the [Project] toolbar in the upper left corner.

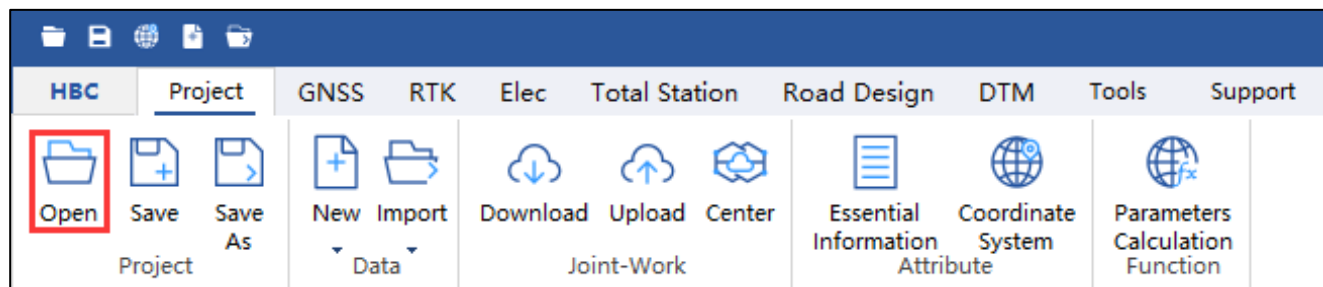


Figure 4-1-1 Open

The software pops up a file selector, and the path is the path where the project is stored by default. Select the HBC project file to be opened, click [Open] on the selector, and the software will open the HBC project.

4.2 Save

Click the [Save] icon under the [Project] toolbar in the upper left corner of the HBC software.

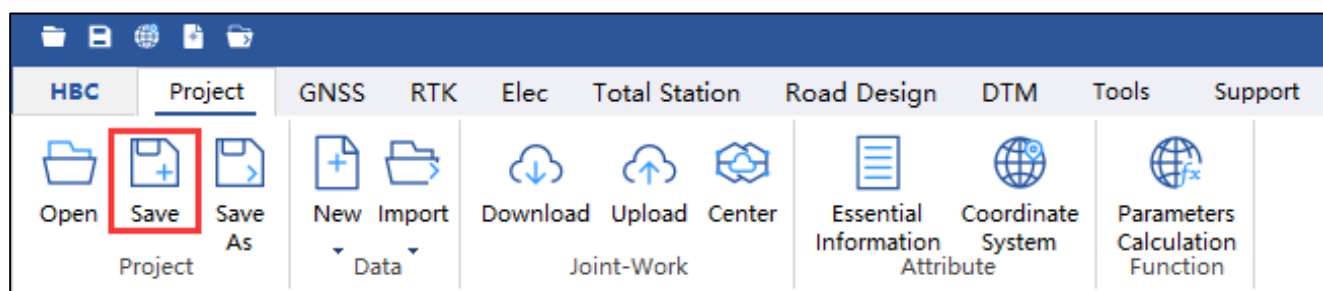


Figure 4-2-1 Save

4.3 Save As

Click the [Save As] icon under the [Project] toolbar in the upper left corner of the HBC software.

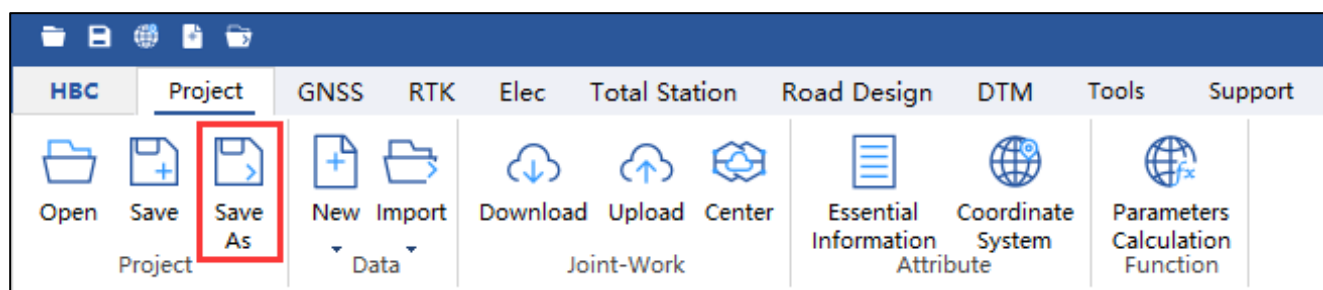


Figure 4-3-1 Save As

The software pops up a file selector with the path as the default storage project path.

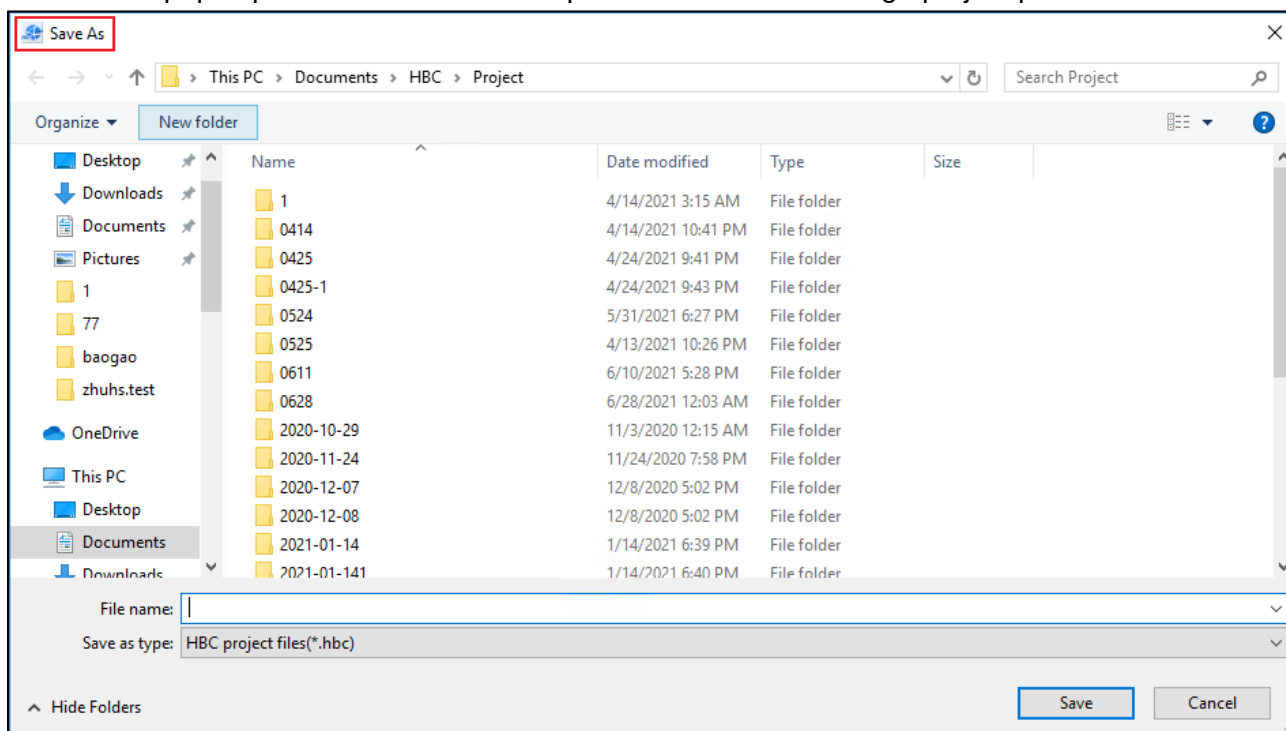


Figure 4-3-2 Default Storage Project Path

4.4 Essential Information

Click the [Essential Information] icon under the [Project] toolbar in the upper left corner of the HBC software.

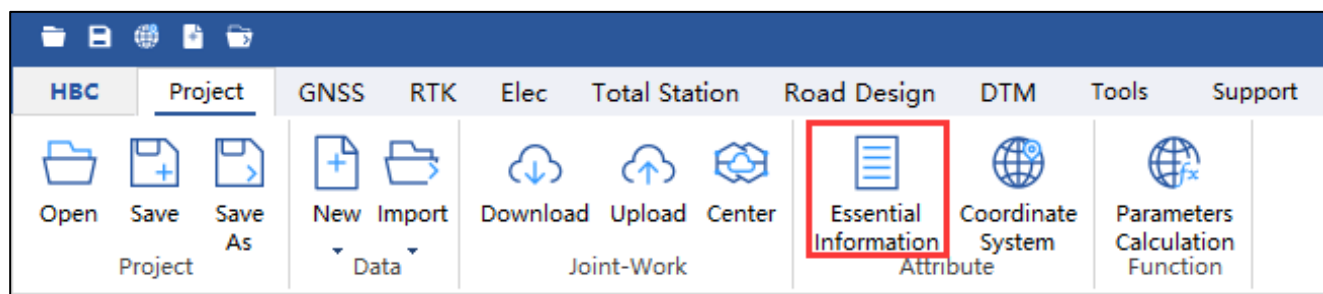
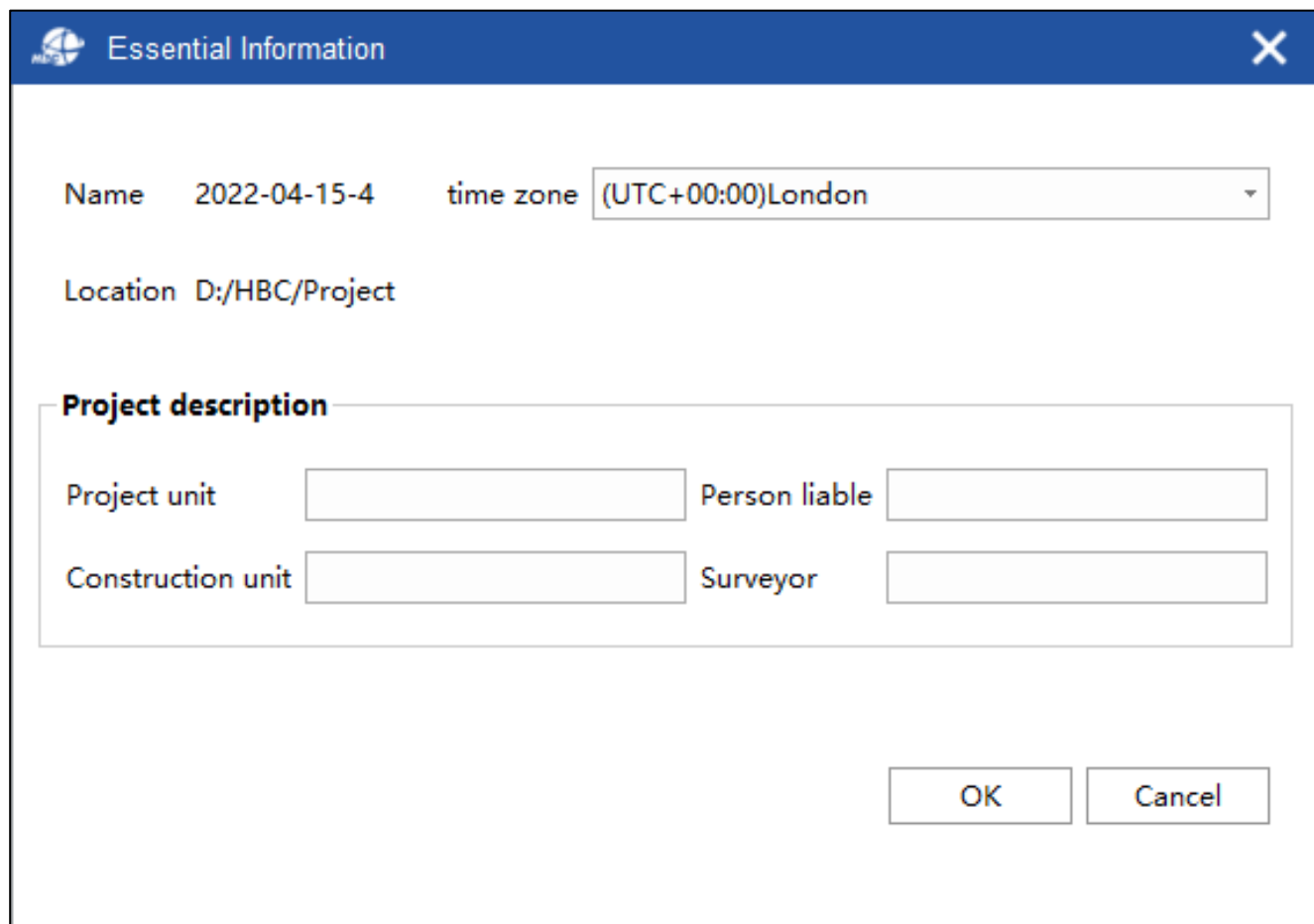


Figure 4-4-1 Essential Information

The software pops up a essential information box, including the project name, time zone, location, and project description.



The dialog box titled "Essential Information" contains the following fields:

- Name:** 2022-04-15-4
- time zone:** (UTC+00:00)London
- Location:** D:/HBC/Project
- Project description section:**
 - Project unit:** [Empty text box]
 - Person liable:** [Empty text box]
 - Construction unit:** [Empty text box]
 - Surveyor:** [Empty text box]
- Buttons:** OK, Cancel

Figure 4-4-2 Essential Information

You can edit the time zone, description. After editing, click [OK] to update the essential information of the current project.

4.5 Coordinate System

1.Interface

Click the [Coordinate System] icon under the [Project] toolbar in the upper left corner of the HBC software to enter the coordinate system interface.

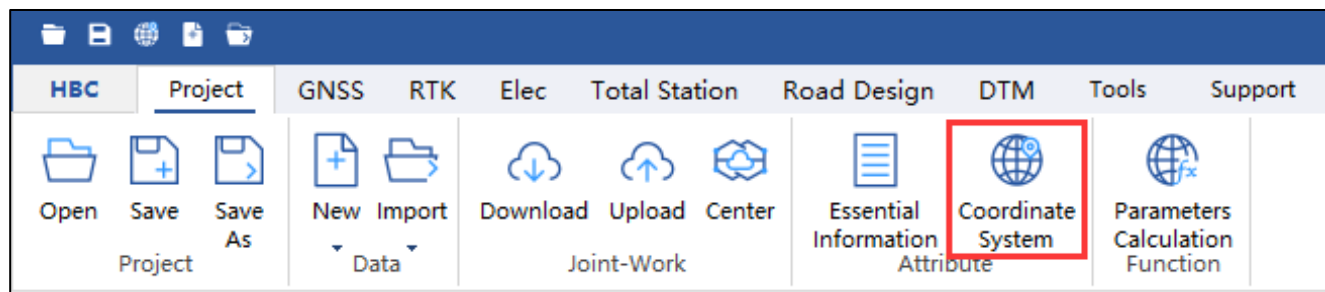


Figure 4-5-1 Coordinate System


Coordinate System - WGS 1984
✕

Projection
Datum
Ellipsoid Transformation
Plane Transformation
Height Fitting
Gr

Source Ellipsoid
WGS 1984

a(m)
6378137.000000

1/f
298.257224

Local Ellipsoid
WGS 1984

a(m)
6378137.000000

1/f
298.257224

Share
Get
Import
Manager
OK
Cancel

Figure 4-5-2 Coordinate System Interface

2.Import

Click [Import], the software pops up a file selector, the default path is the directory where the Project folder of the HBC project is located, select the corresponding coordinate system file, the file types that can be selected are dam file (*.dam) and dc file (*.DC).

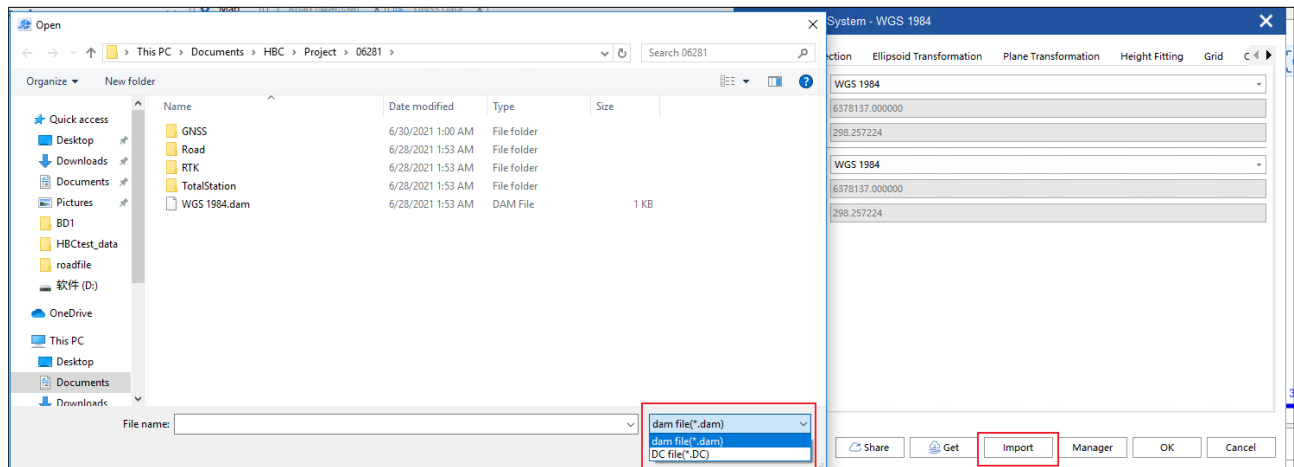


Figure 4-5-3 Import Coordinate System

Click [Open]. After successful reading, the parameters in the configuration items such as projection, datum plane, and plane transformation in the coordinate system will be filled. Click [OK], and the software will update the coordinates of the points in the point library according to the imported coordinate parameters.

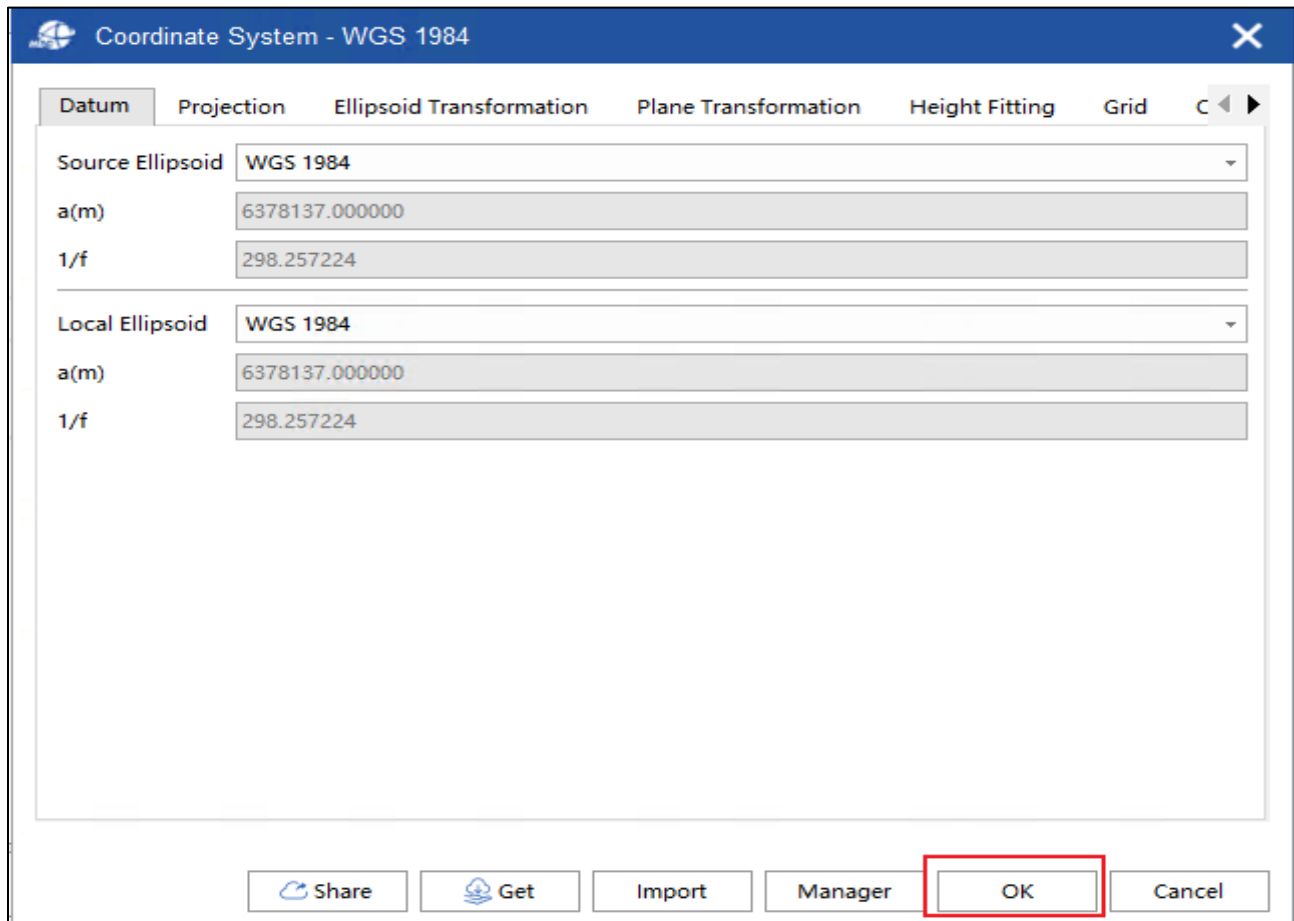


Figure 4-5-4 Import Coordinate System

3. Coordinate System Option Settings

(1) Select the [Options] tab page to open the option sub-page.

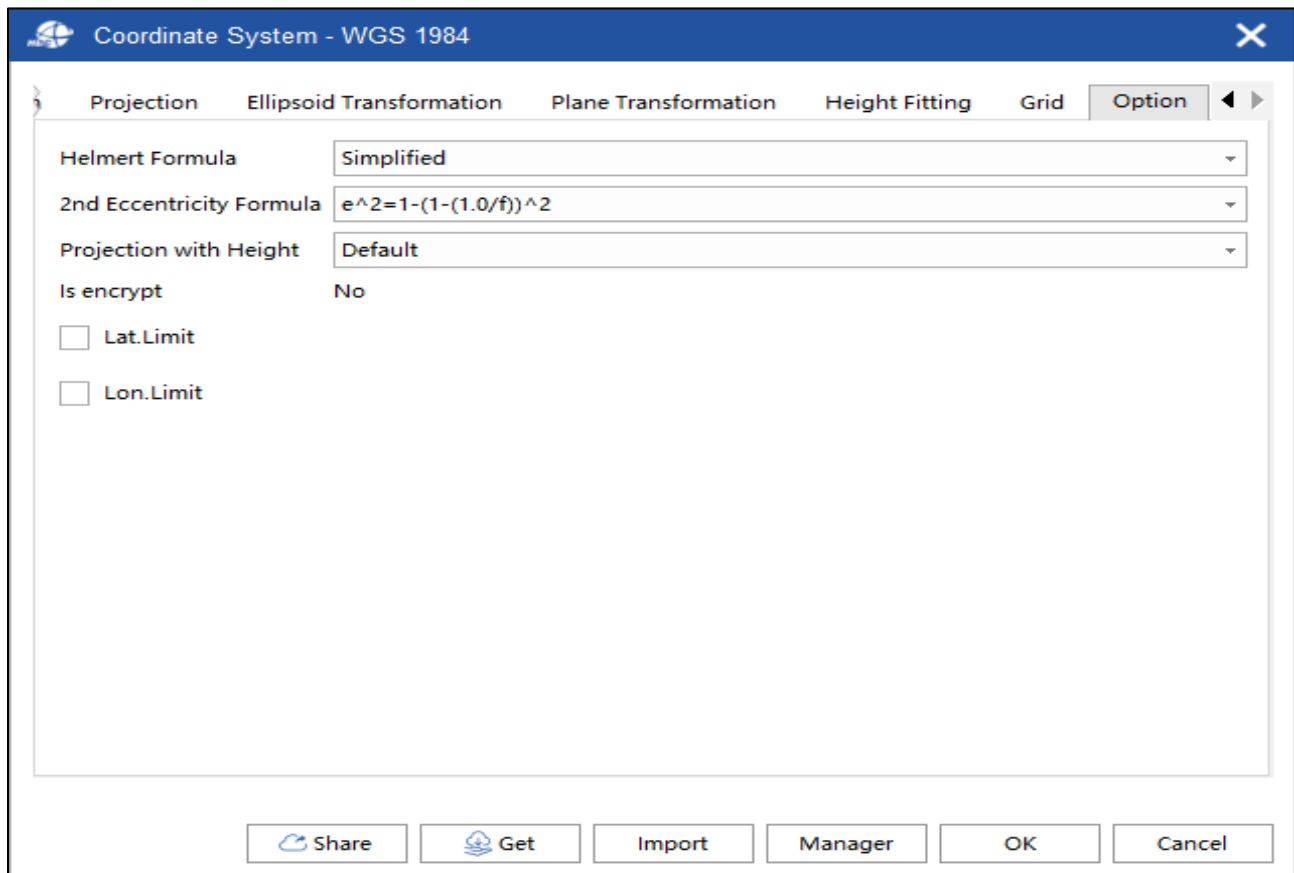


Figure 4-5-5 Coordinate System Option

(2) You can select and change the formula parameters in the options sub-page:

- [Helmert Formula]: Simplified/Complete.
- [2nd Eccentricity Formula]: $e^2=1-(1-(1.0/f))^2$, $e^2=(a*a-b*b)/(b*b)$.
- [Projection With Height]: Default, Expand, Translate, Morph.

(3) The latitude and longitude range configuration item is disabled by default when a new coordinate system is created, and the user can set the maximum and minimum range of the latitude and longitude of the coordinate system.

(4) After modifying the above formula parameters, click [OK] to modify the dam file under the current project with the same name as the project name. If the reference ellipsoid is currently converted, the coordinate value of the coordinate point will change.

4. Datum Plane Parameter Settings

(1) The software loads the corresponding datum plane parameters in the current coordinate system parameters by default (in general, they are obtained from the corresponding coordinate system parameter files).

(2) Select or set the name of the corresponding source ellipsoid (if it is a pre-built ellipsoid in the software, the ellipsoid parameters under the corresponding target ellipsoid name will be automatically loaded and the ellipsoid parameters cannot be edited; the ellipsoid added by the user can be edited of).

(3) Select the transformation model, which is 'none' by default. Currently, there are seven parameters of Bursa, three parameters of Molodensky, one-step method, polynomial regression model, and ten parameters (among them: seven parameters of Bursa, three-parameter of Molodensky and one-step method will carry out the parameter calculation use case, and the rest need to enter the corresponding value).

(4) After clicking [OK], the software will modify the current coordinate system parameter file and update the coordinate value in the current project.

5. Projection Parameter Settings

(1) The software loads the corresponding projection parameters in the current coordinate system parameters by default (in general, they are obtained from the corresponding coordinate system parameter files).

(2) Select the corresponding projection method.

(3) Set the central meridian, north plus length, east plus constant, mean latitude, scale factor, plus belt number, and XY forward and other values..

(4) After clicking [OK], the software will modify the current coordinate system parameter file and update the coordinate value in the current project.

6. Plane Transformation Parameter Settings

(1) The software loads the corresponding plane transformation parameters in the current coordinate system parameters by default (in general, they are obtained from the corresponding coordinate system parameter files).

(2) The default plane transformation model for the software is 'none'.

(3) The transformation models that can be selected are: four parameters (parameter values can be entered manually, or values can be obtained after parameter calculation), TGO horizontal adjustment (manually entered parameters), FreeSurvey plane transformation (manually entered parameters), polynomial fitting (parameters entered manually).

(4) After clicking [OK], the software will modify the current coordinate system parameter file and update the coordinate value in the current project.

7. Elevation Fitting Parameter Settings

(1) The software loads the corresponding elevation fitting transformation parameters in the current coordinate system parameters by default (in general, they are obtained from the corresponding coordinate system parameter files).

(2) The default elevation fitting transformation model of the software is 'none'.

(3) The available transformation models are: parameter fitting, TGO vertical adjustment, and FreeSurvey elevation fitting.

(4) After clicking [OK], the software will modify the current coordinate system parameter file and update the coordinate value in the current project.

8. Grid Fit Parameter Settings

(1) The software loads the grid fitting parameters corresponding to the current coordinate system parameters by default (in general, they are obtained from the corresponding coordinate system parameter files).

(2) The switches of the software B grid, L grid, NE grid, NEZ grid, and elevation grid are disabled by default, and the grid file drop-down box on the right cannot be selected. If the switches of B grid, L grid, NE grid, NEZ grid, and elevation grid are turned on, the user can select the imported grid file (existing in the HBC/GeoPath directory) in the grid file drop-down box on the right.

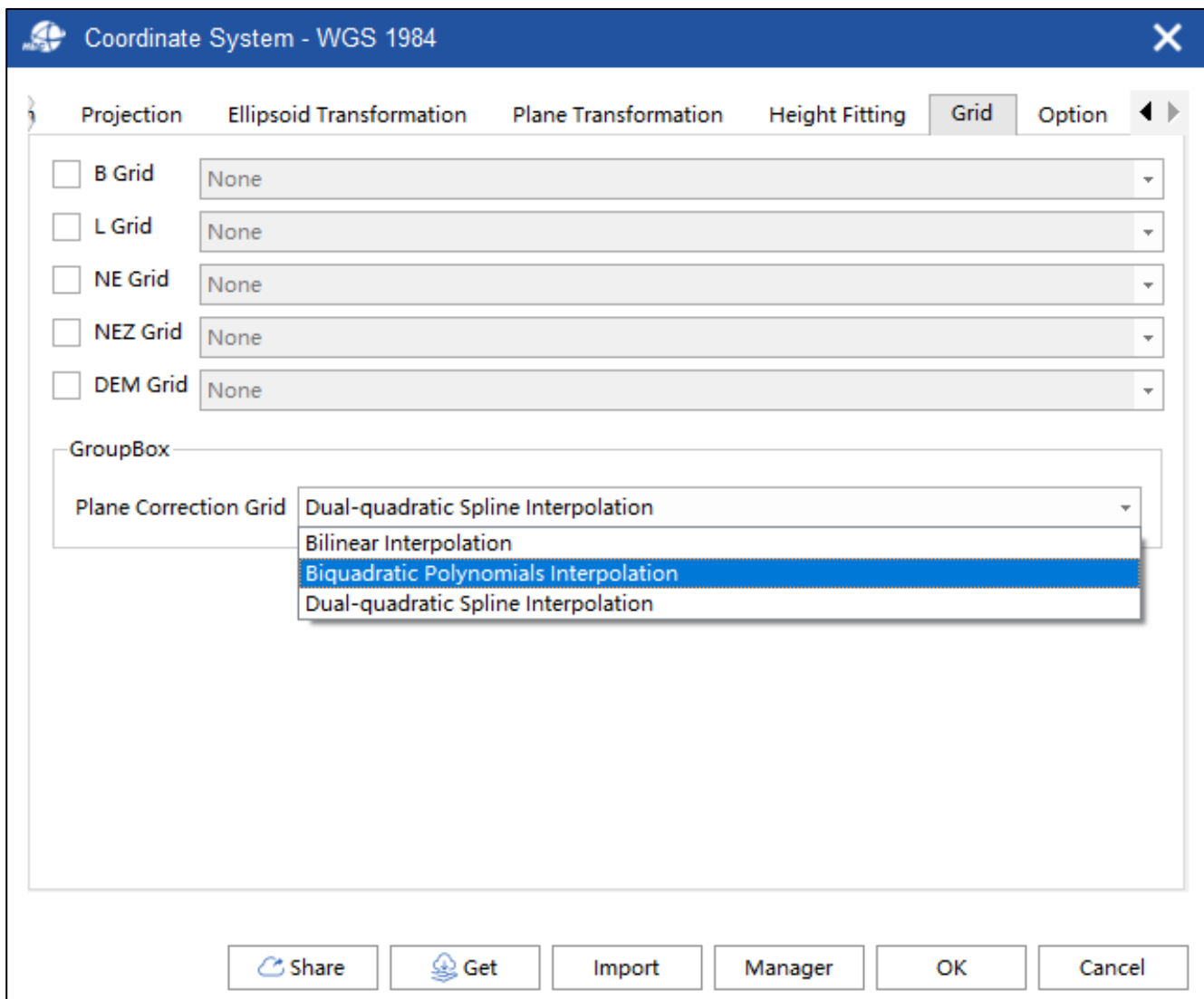


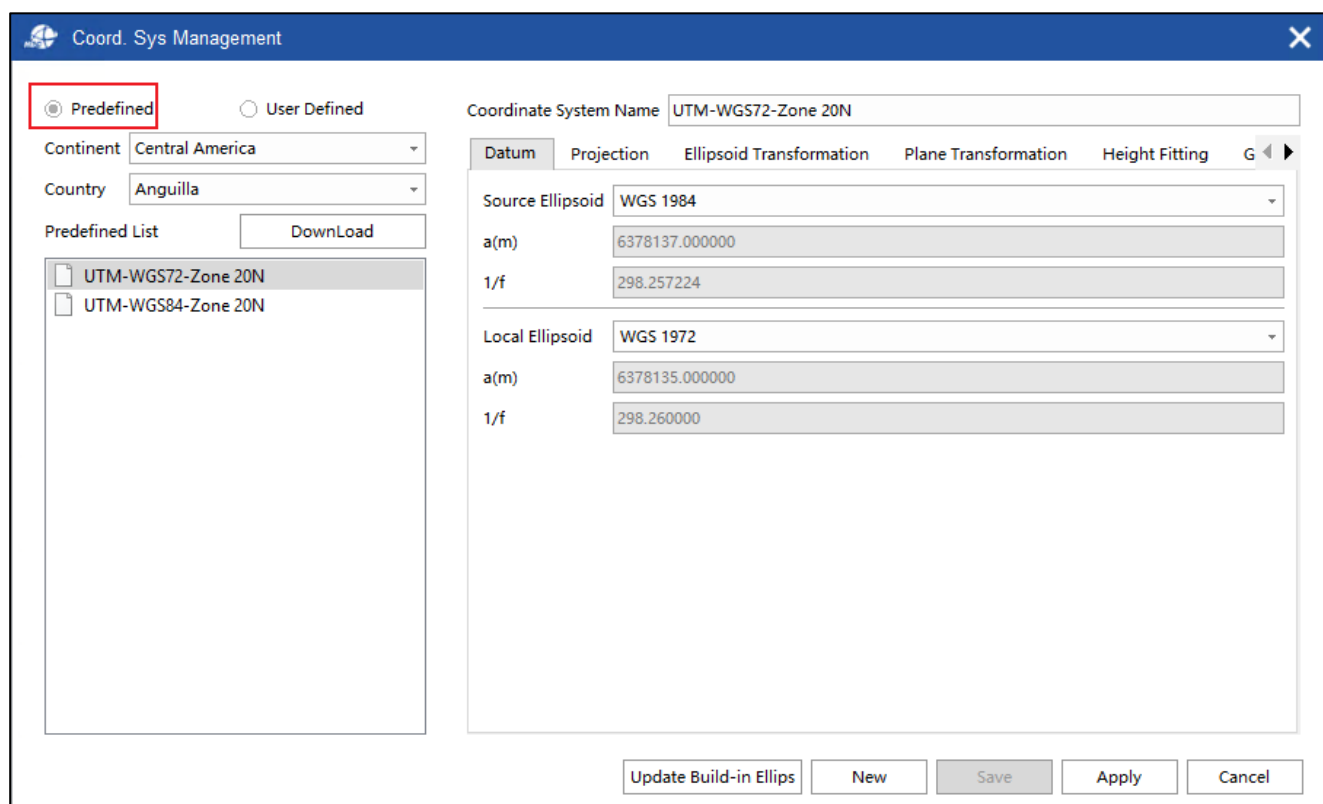
Figure 4-5-6 Grid

(3) Select the plane grid correction method, the default is double spline interpolation.

(4) After clicking [OK], the software will modify the current coordinate system parameter file and update the coordinate value in the current project.

9. Coordinate System Administration

(1) Click [Coordinate System Management] to enter the coordinate system management interface, and then click [Update Built-in Ellips] to update the latest ellipsoid coordinate system online.



Coord. Sys Management

☒ Predefined ☐ User Defined

Continent: Central America

Country: Anguilla

Predefined List:
 [icon] UTM-WGS72-Zone 20N
 [icon] UTM-WGS84-Zone 20N

Download

Coordinate System Name: UTM-WGS72-Zone 20N

Datum Projection Ellipsoid Transformation Plane Transformation Height Fitting G

Source Ellipsoid: WGS 1984

a(m): 6378137.000000

1/f: 298.257224

Local Ellipsoid: WGS 1972

a(m): 6378135.000000

1/f: 298.260000

Update Build-in Ellips New Save Apply Cancel

Figure 4-5-7 Coord. Sys Management

(2) Click the [Predefined] radio button in the upper left corner, and select an item in the [Continent] drop-down box to display the corresponding country and the list of built-in coordinate systems in that country. Click [Download] to download the coordinates system and grid files of countries that do not exist locally.

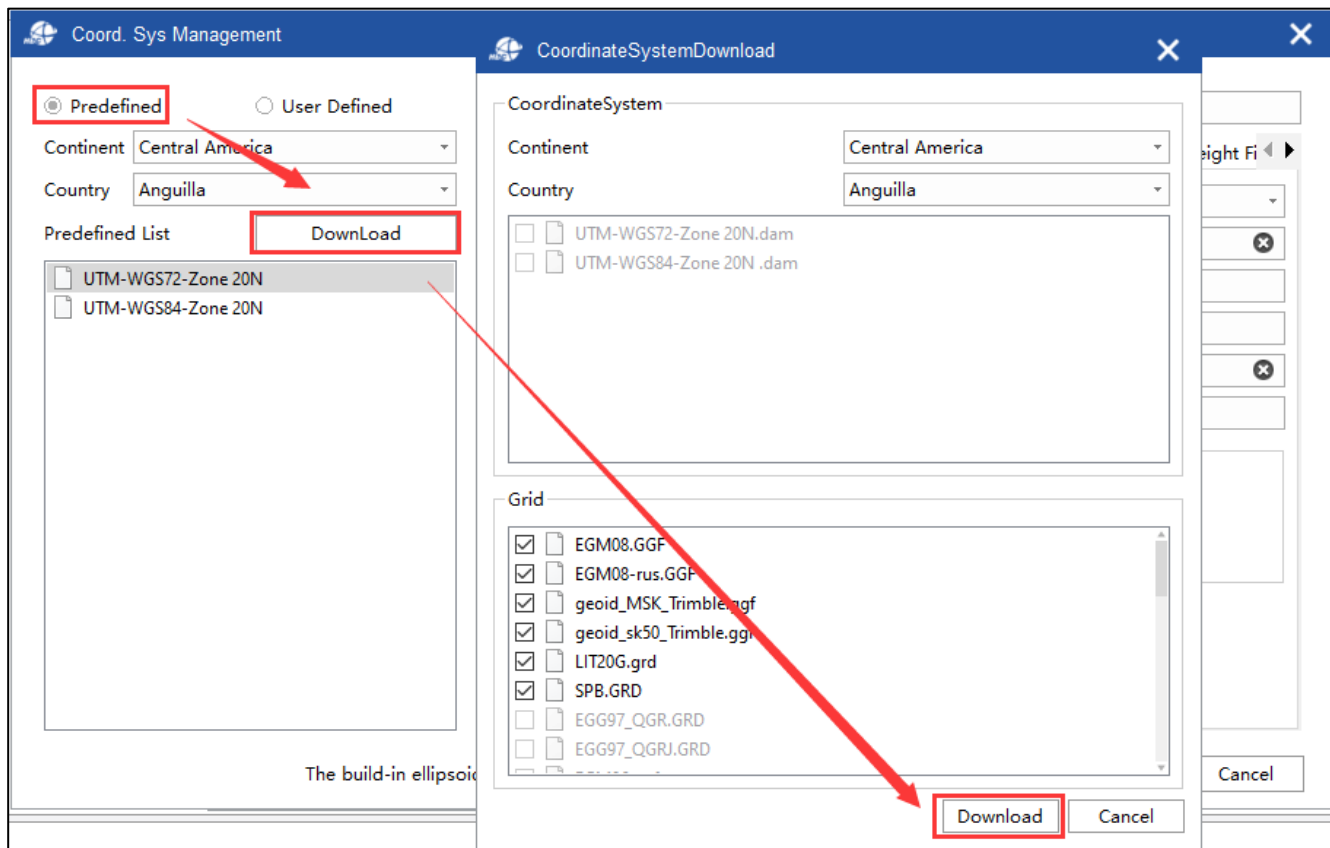
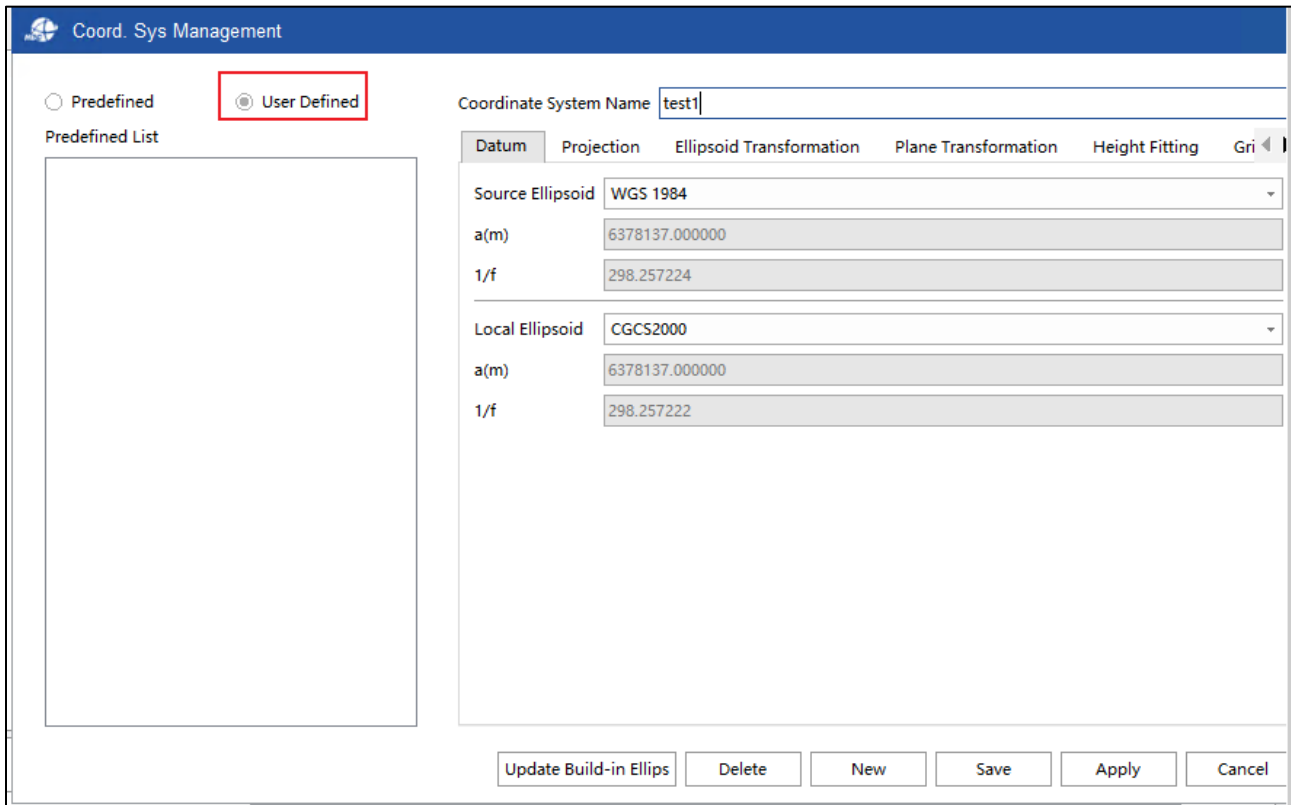


Figure 4-5-8 Coord. Sys Management-predefined

(3) Click the [User Defined] radio box in the upper left corner to display a custom list of coordinate systems.



Coord. Sys Management

☐ Predefined
 ☒ **User Defined**

Coordinate System Name: test1

Datum Projection Ellipsoid Transformation Plane Transformation Height Fitting Gri

Source Ellipsoid: WGS 1984

a(m): 6378137.000000

1/f: 298.257224

Local Ellipsoid: CGCS2000

a(m): 6378137.000000

1/f: 298.257222

Update Build-in Ellips Delete New Save Apply Cancel

Figure 4-5-9 Coord. Sys Management-user Defined

- (4) Click the coordinate system in the coordinate system list, the details of the selected coordinate system parameters are displayed on the right, and the coordinate system name cannot be edited.
- (5) Click the coordinate system in the custom coordinate system list, and click the [Delete] custom button to remove the coordinate system from the coordinate list, and there is no coordinate system file under HBC/GeoPath.
- (6) Click [New], the coordinate system name is cleared, enter the coordinate system name, edit the coordinate system parameters, click [Save], the custom coordinate system is successfully saved, and the newly saved custom coordinate system is displayed in the custom coordinate system. In the coordinate system list, the file is stored under HBC/GeoPath, and the coordinate system name in the coordinate system parameter cannot be edited.

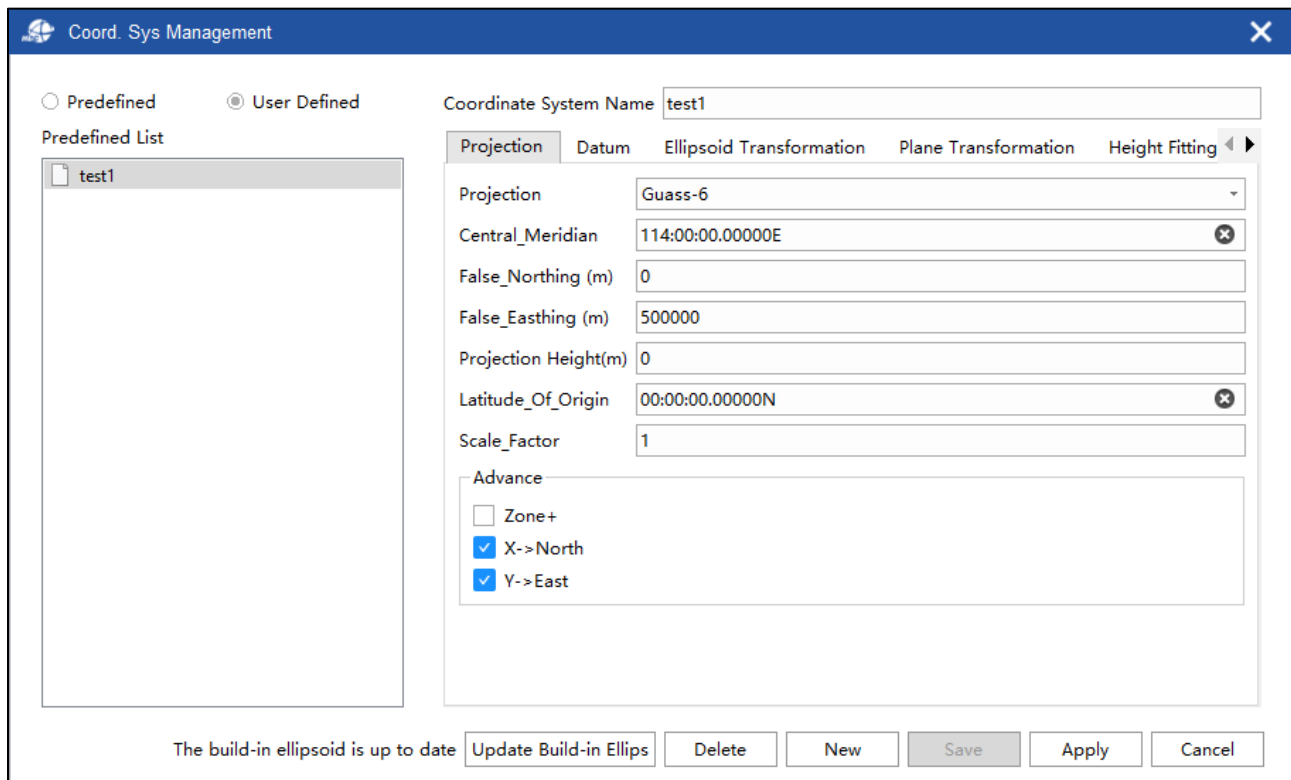


Figure 4-5-10 Coord. Sys Management-user Defined-new

(7) Click [Apply], a message box will pop up prompting 'Whether to apply the [NAME] coordinate system to the current project?'. Select [Yes], the coordinate system management interface closes and returns to the coordinate system interface, displaying the coordinate system parameters applied by the coordinate system management interface, select [No], which stays in the current coordinate system management interface.

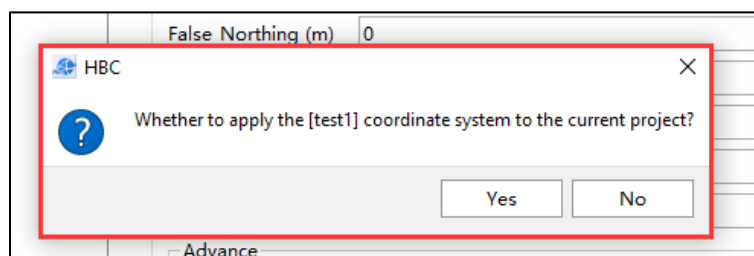


Figure 4-5-11 Coord. Sys Management-user Defined-apply

(8) Click [Cancel] to close the coordinate system management interface and return to the coordinate system interface.

10. Automatic Detection And Correction of Central Meridian

When importing GNSS data file, the software will automatically correct the central meridian according to the coordinates of the first station and the set projection.

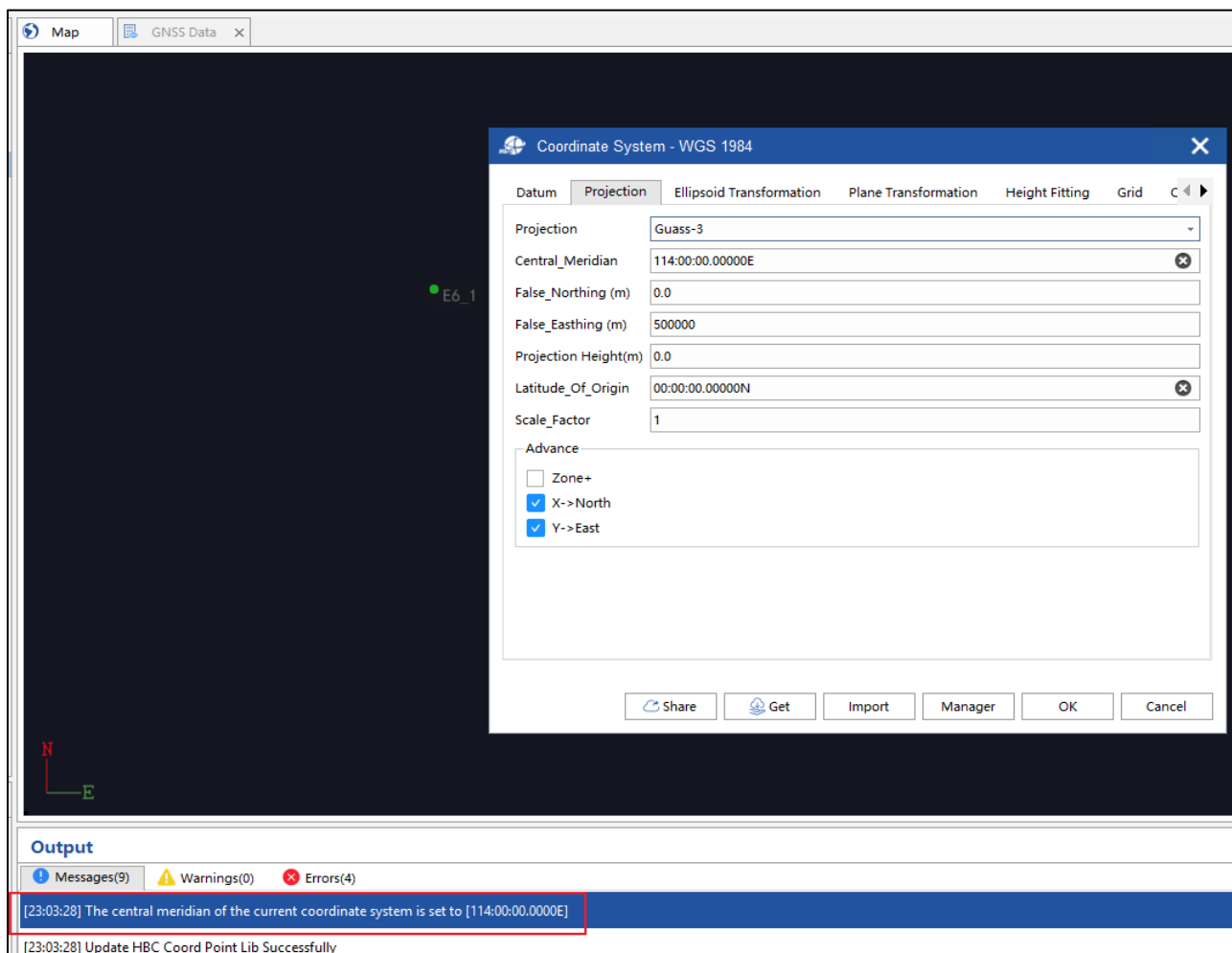


Figure 4-5-12 Automatic Detection and Correction of Central Meridian

4.6 Joint-work Center

This module is a federated operations center for users in the software terminal (HBC, Hi-Survey) and the cloud for data interaction and task assignment.

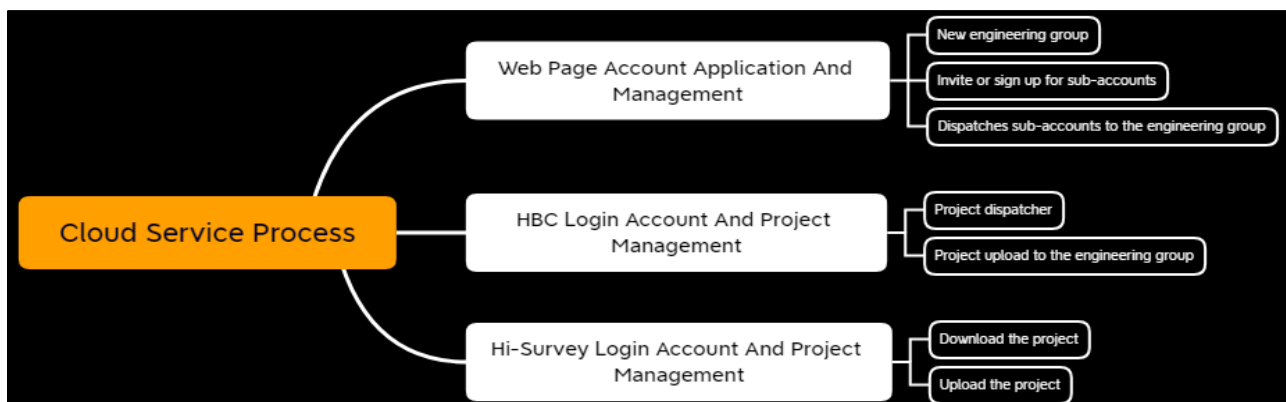


Figure 4-6-1 Cloud Service Process

There are two kinds of accounts for the joint operation center, one is the administrator account and the other is the ordinary user account.

Administrator account: The account registered by the user through the registration interface is the administrator account, which has the permissions to register sub accounts and add groups.

Ordinary user account: The sub account registered by the administrator is an ordinary user account. The ordinary user account does not have the permission to register sub accounts and add groups. It only has the permission to upload and download data in the groups assigned by the administrator.

4.6.1 Web Side Operations

1. Account Application

(1) Browser login URL: <http://cloud.zhdgps.com:8012/> Or, after installing HBC software, HBC opens the embedded page below.

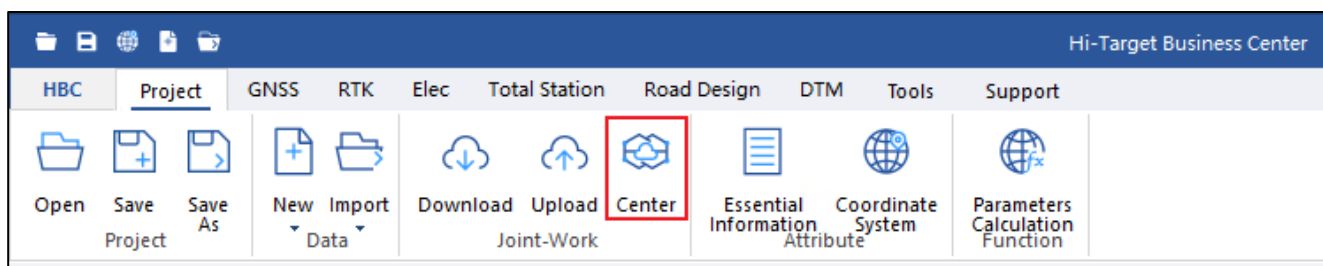


Figure 4-6-2 Cloud Service Process

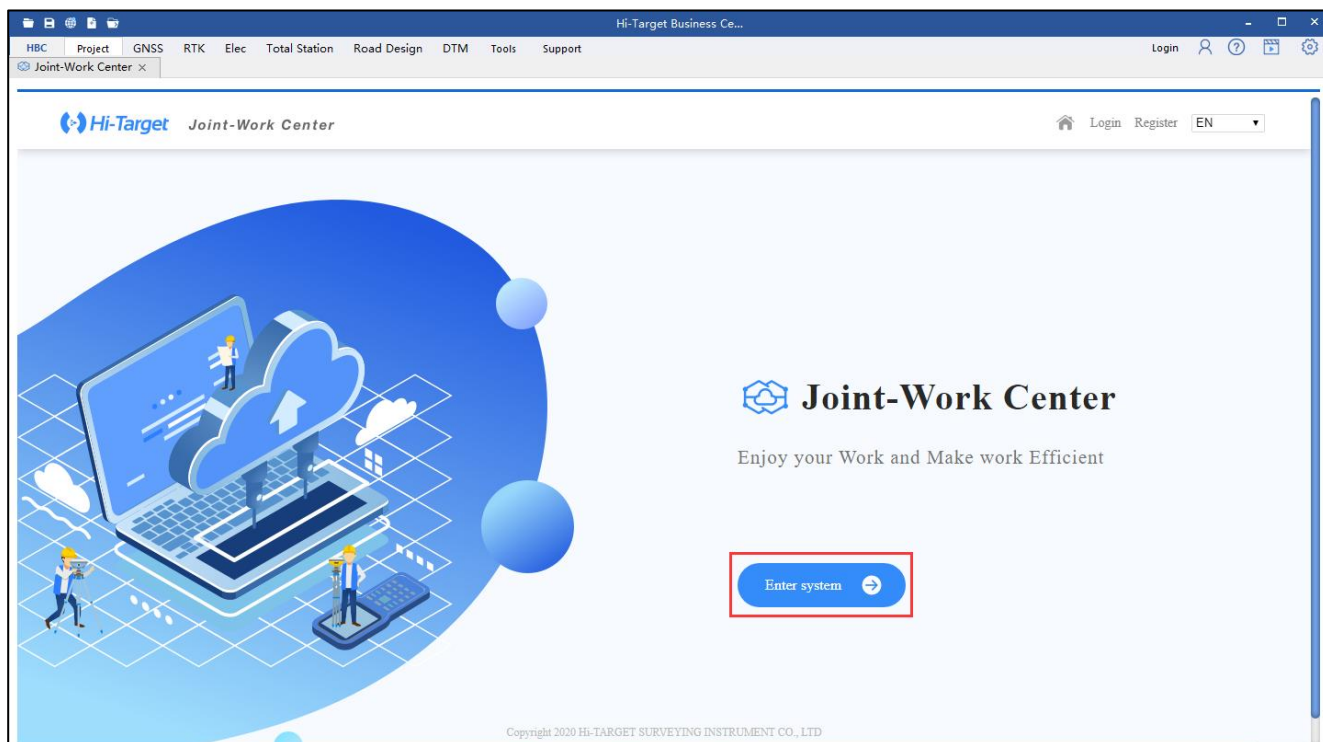


Figure 4-6-3 Cloud Service Process

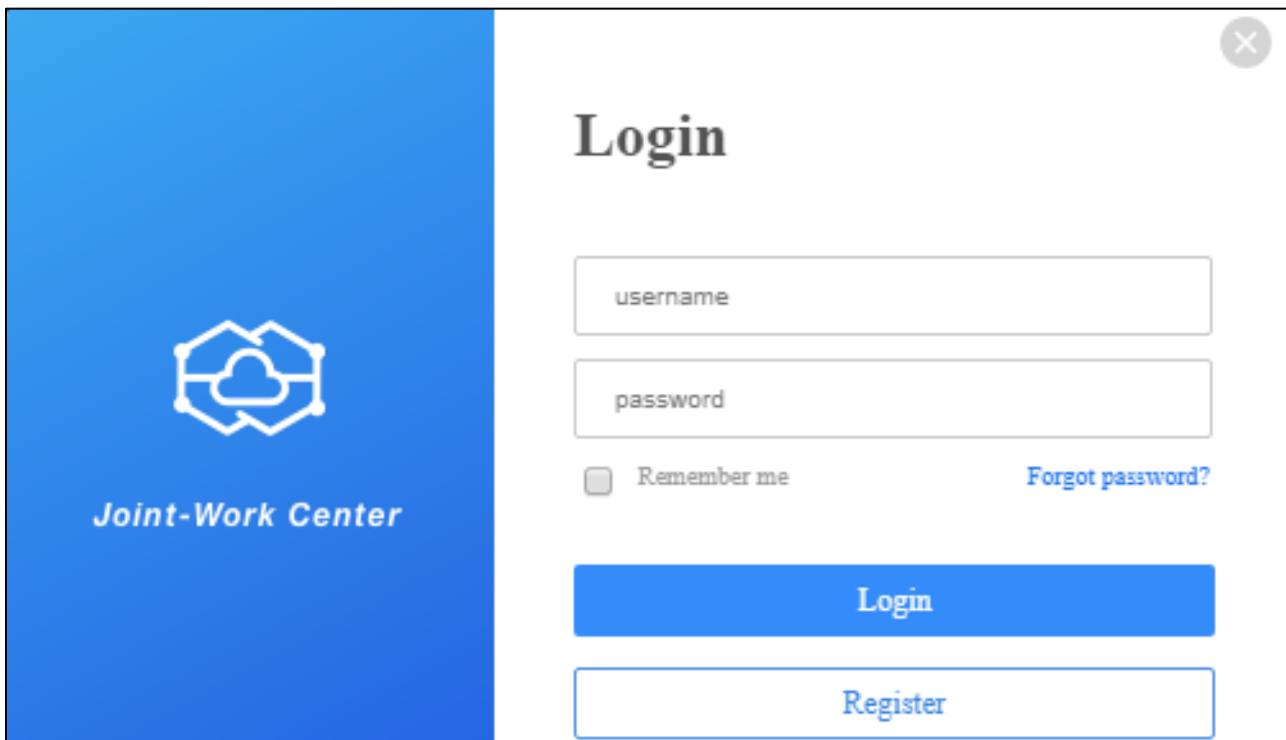


Figure 4-6-4 Login

(2) Click [Register] and fill in the following necessary information.

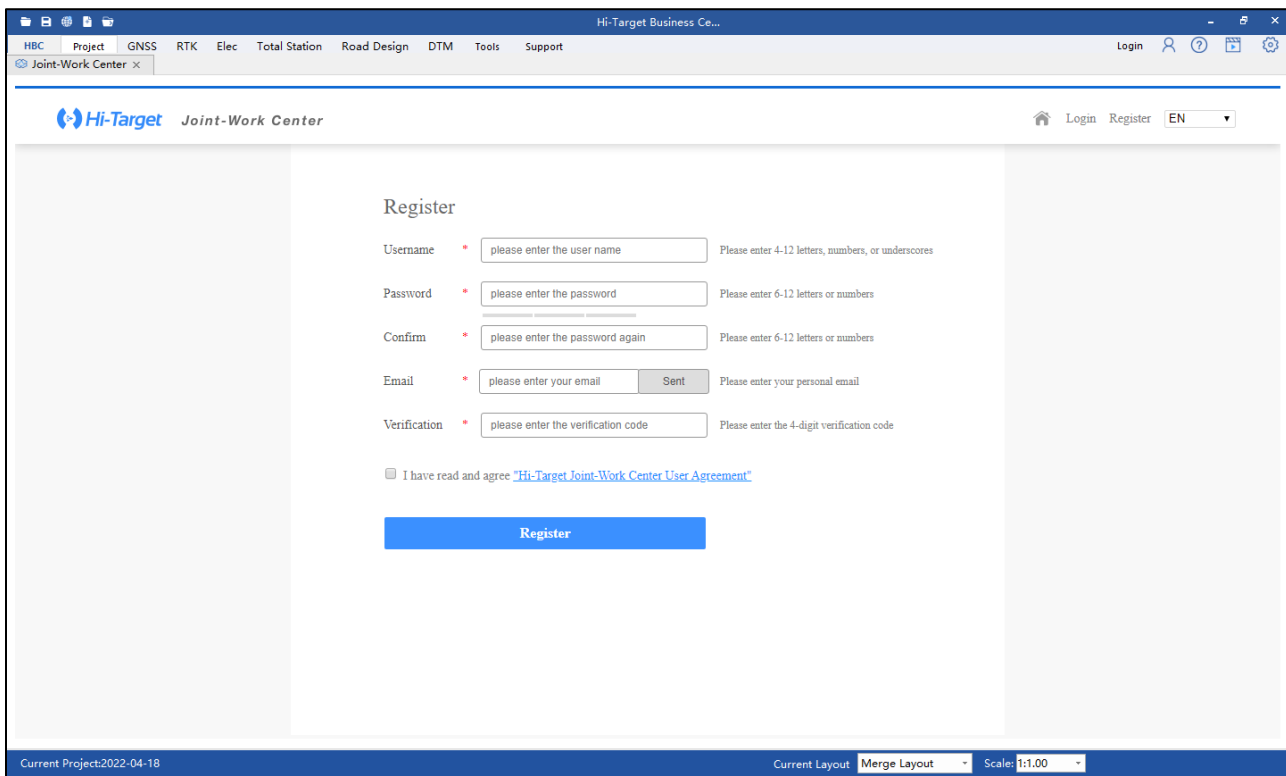


Figure 4-6-5 Register

2. New Engineering Group - add Group

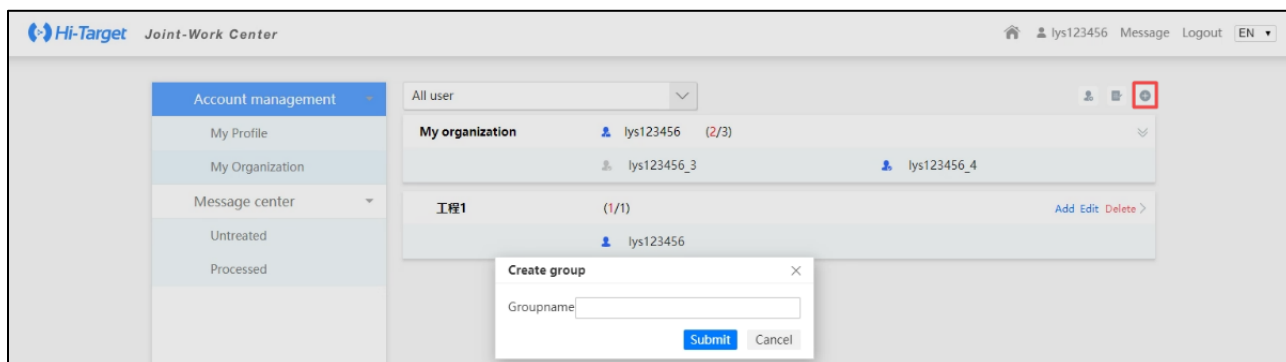


Figure 4-6-6 Create Group

3. Invite or Register A Sub-account

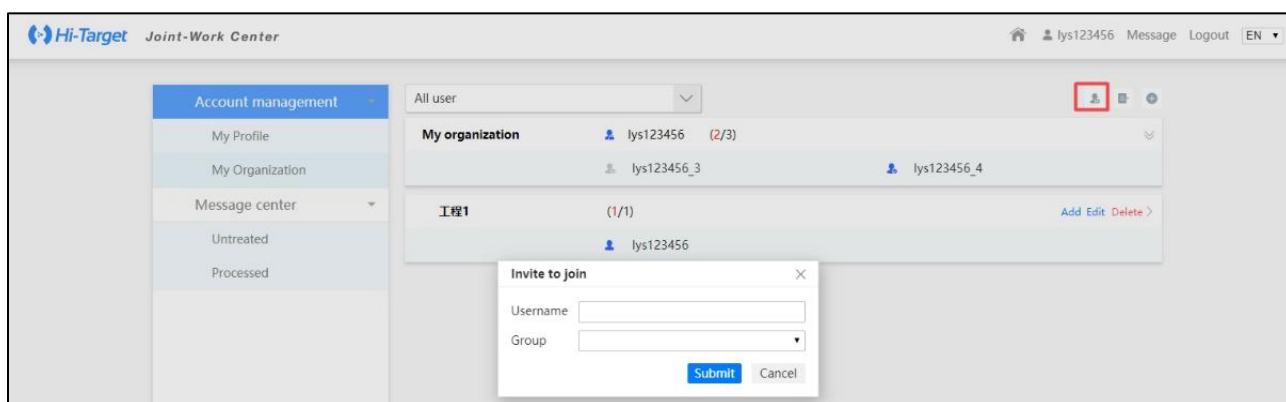


Figure 4-6-7 Invite to Join

4. Assign Sub-accounts to Engineering Groups

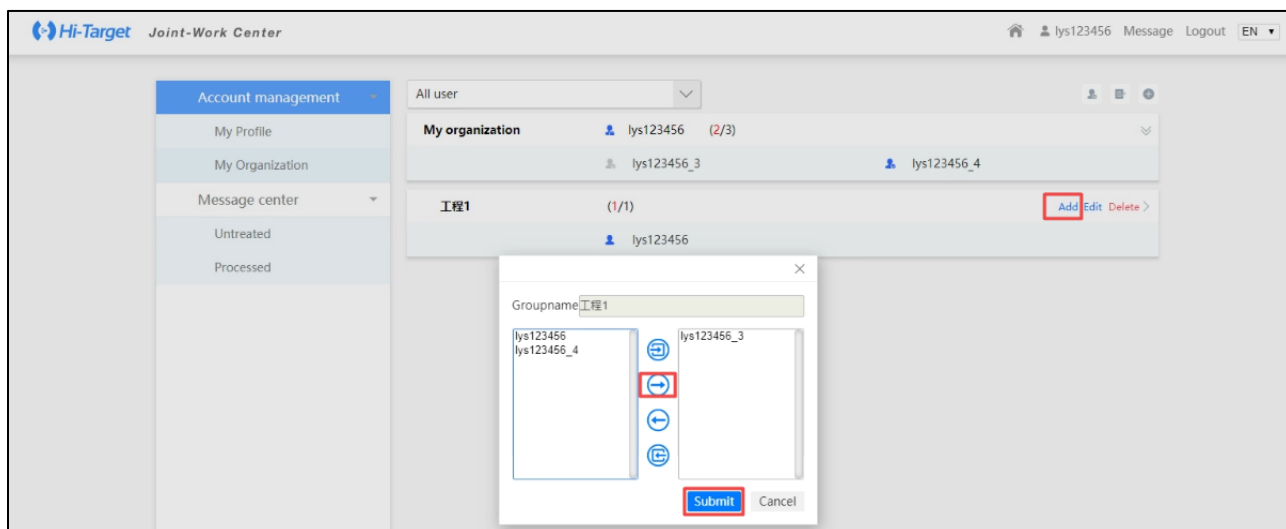


Figure 4-6-8 Assign Sub-accounts

5. Language switching

The Joint-Work Center supports switching between Chinese, English and Russian languages.



Figure 4-6-9 Language Switching

4.6.2 HBC Side Upload and Download

1. RTK Project Interaction

Upload and download RTK project data series operations under the HBC software Joint-Work Center (need to complete the necessary steps for account application in 4.6.1).

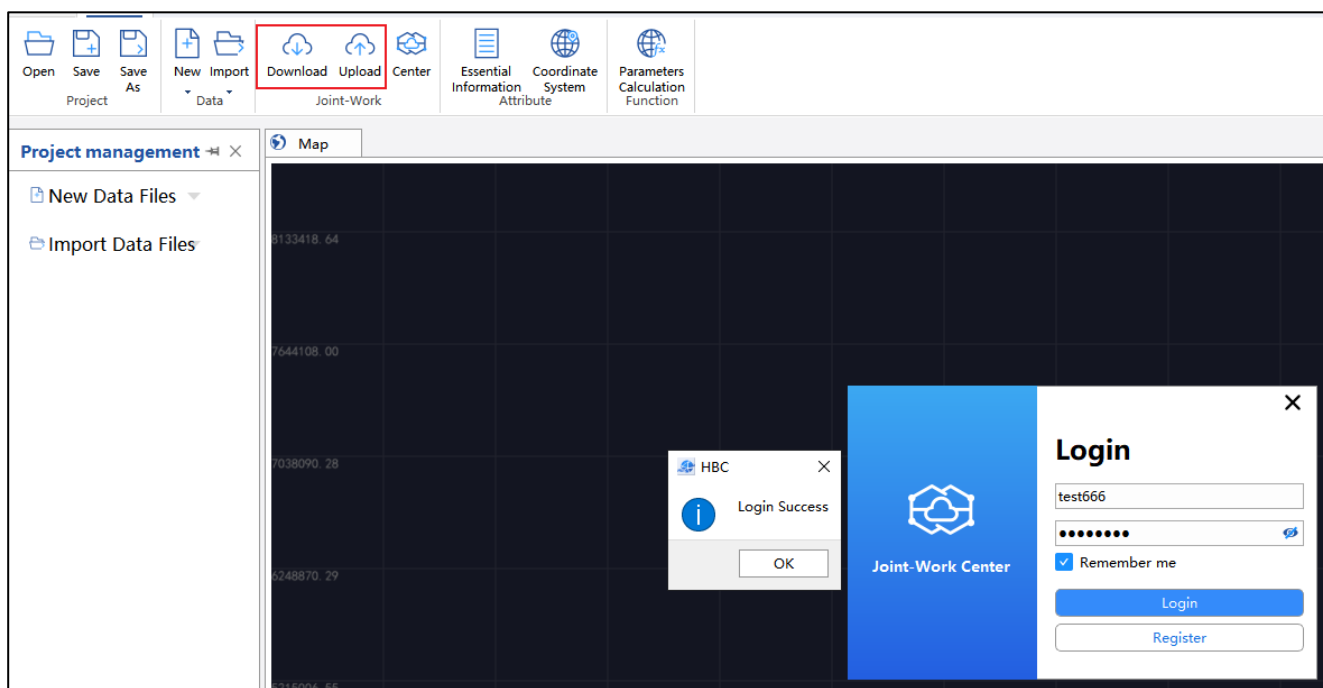


Figure 4-6-10 Login

(1) RTK project upload

If HBC has created RTK project data locally or has opened the RTK manual project, you can select it in the list and upload it to the corresponding group of the Joint-Work Center (RTK projects must be assigned personnel before they can be uploaded for the mobile terminal corresponding account to log in and download).

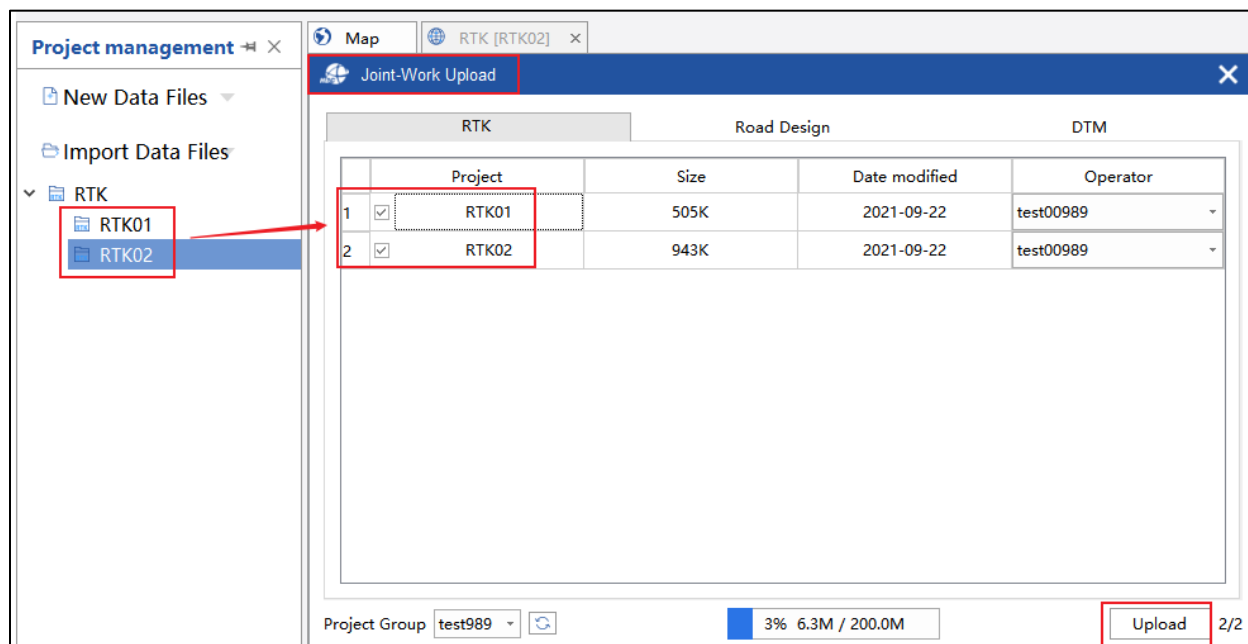


Figure 4-6-11 RTK Project Upload

(2) RTK project download

When the mobile terminal Hi-Survey software has completed the RTK project data collection and uploading operations, the HBC side of the office can log in to the account and select the RTK project data to download under the corresponding project group.

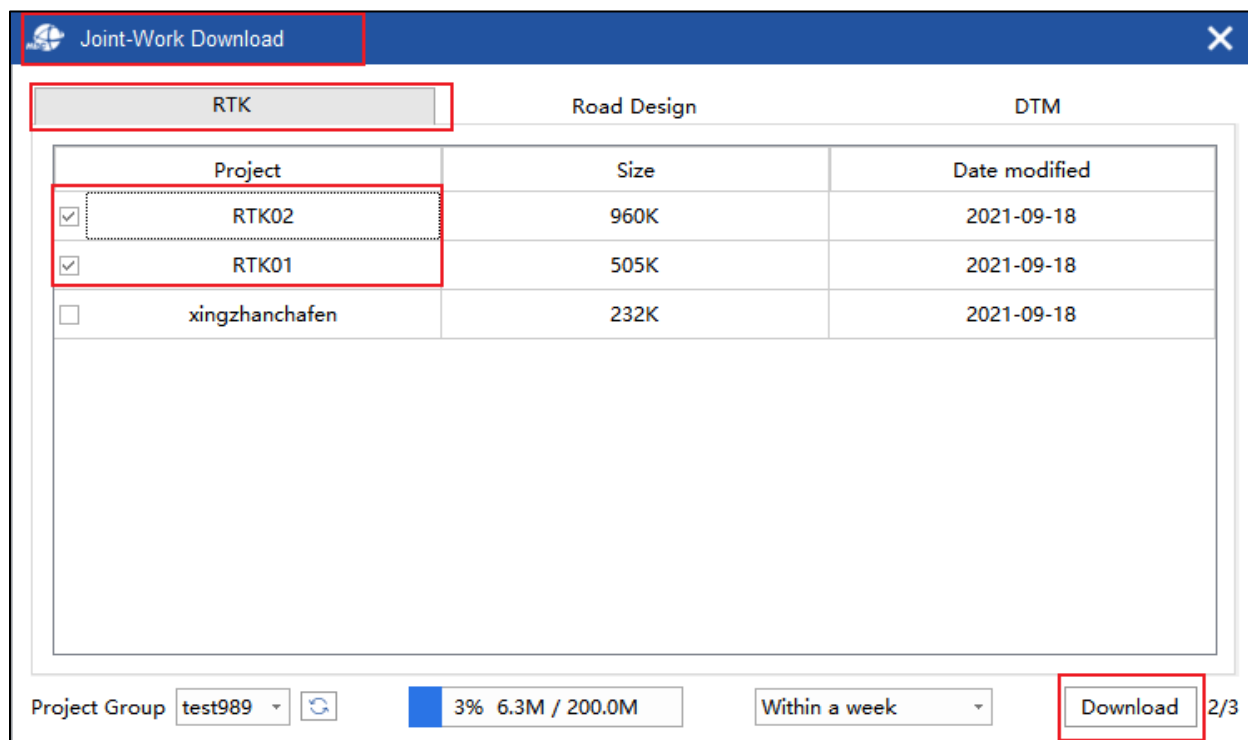


Figure 4-6-12 RTK Project Download

2. Road Data Interaction

Upload and download the road file series operations under the HBC software Joint-Work Center (need to complete the necessary steps for account application in 4.6.1).

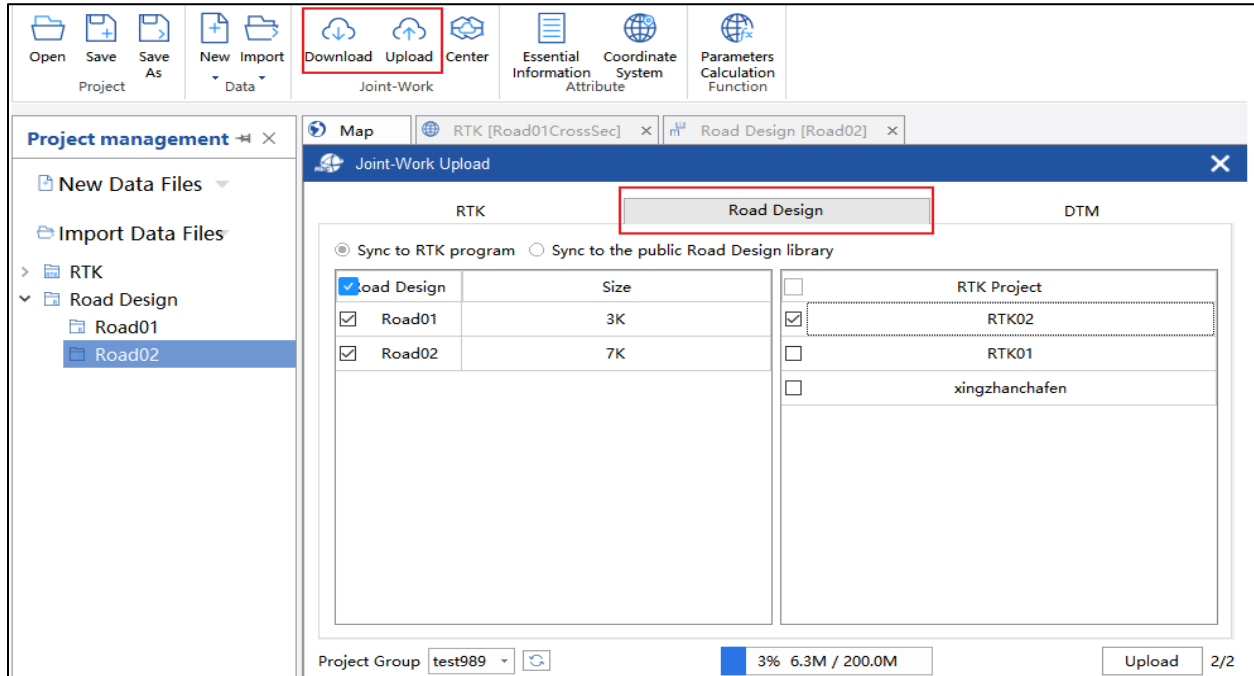


Figure 4-6-13 Road Data

(1) Road Data Upload

If HBC has created road data locally or has opened the road file, you can select it in the list and upload it to the corresponding group of the Joint-Work Center.

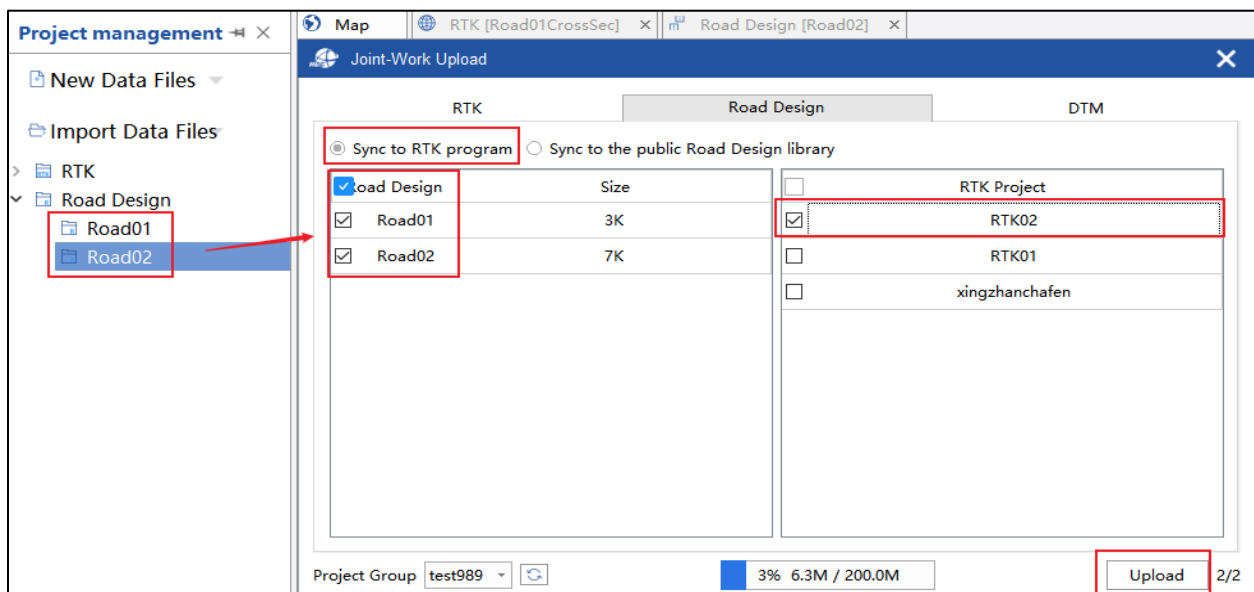


Figure 4-6-14 Road Data Upload

(2) Road Data Download

For the data files in the same project group, the HBC side of the office can select the corresponding road files to download and share.

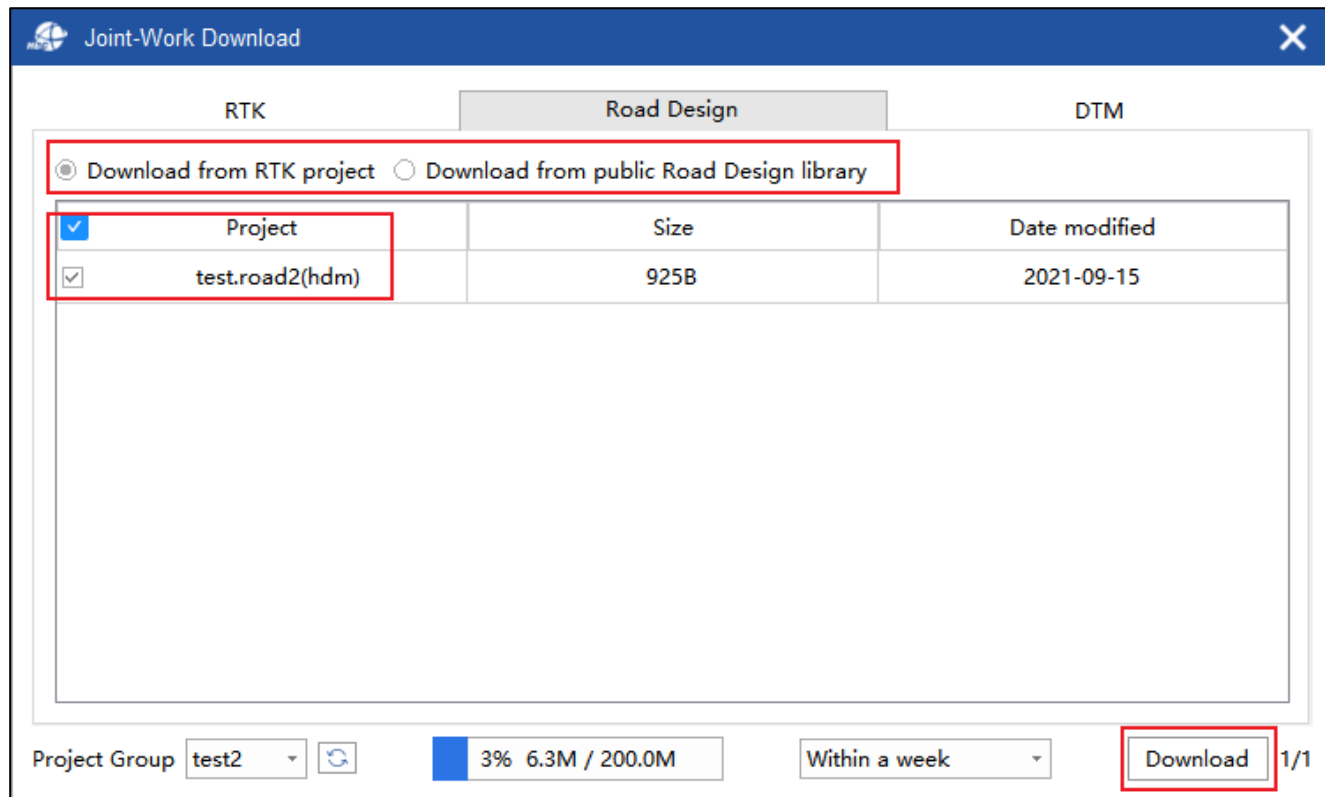


Figure 4-6-15 Road Data Download

3. DTM Data Interaction

Upload and download DTM file series operations under the HBC software Joint-Work Center (need to complete the necessary steps for account application in 4.6.1).

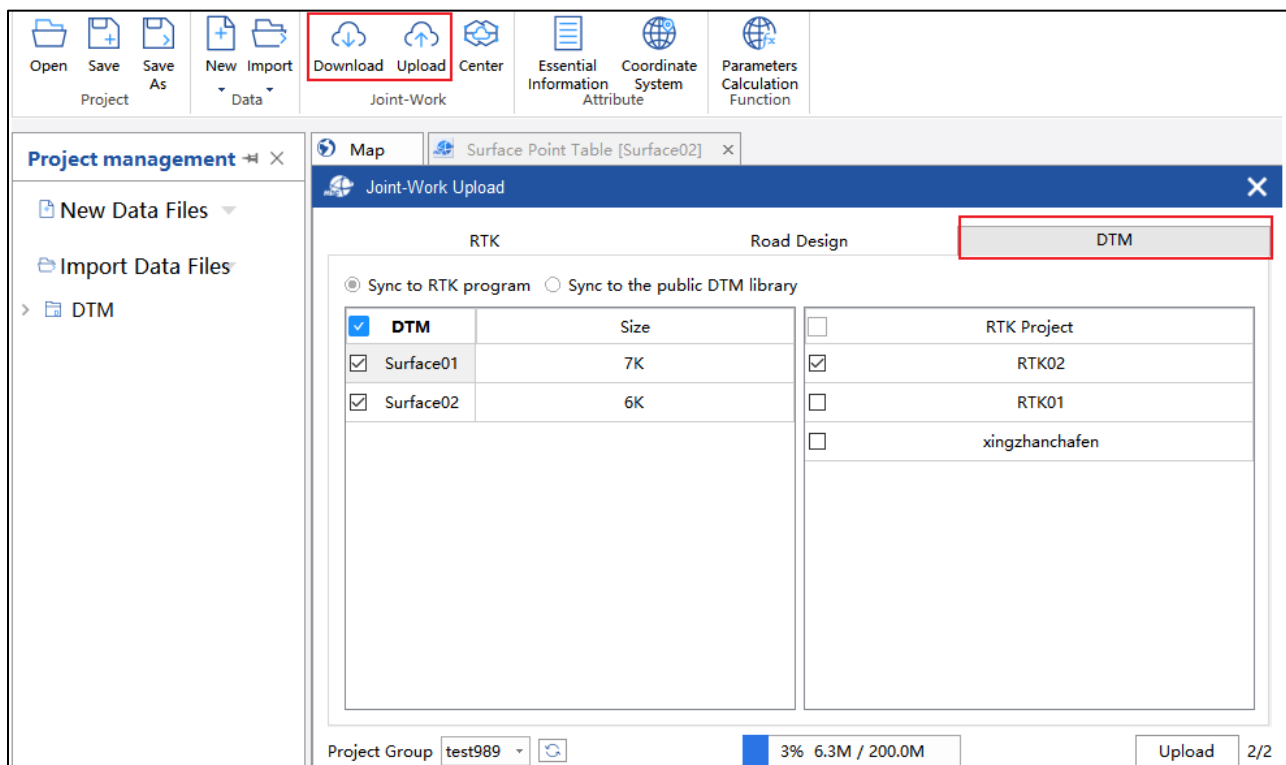


Figure 4-6-16 DTM

(1) Ttin Data Upload

HBC has local ttin data to create DTM or has already opened the DTM file, you can select it in the list and upload it to the corresponding group of the joint operation center.

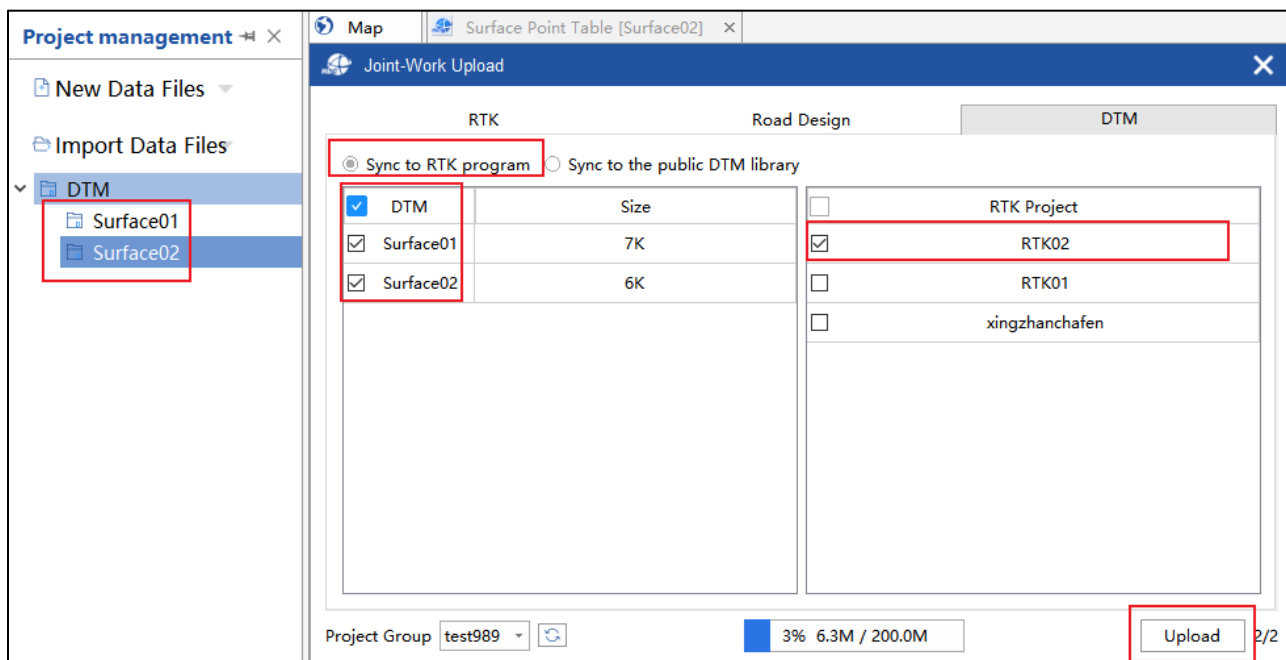


Figure 4-6-17 DTM Data Upload

(2) Ttin Data Download

For the data files in the same project group, the HBC side of the office can select the corresponding DTM file to download and share.

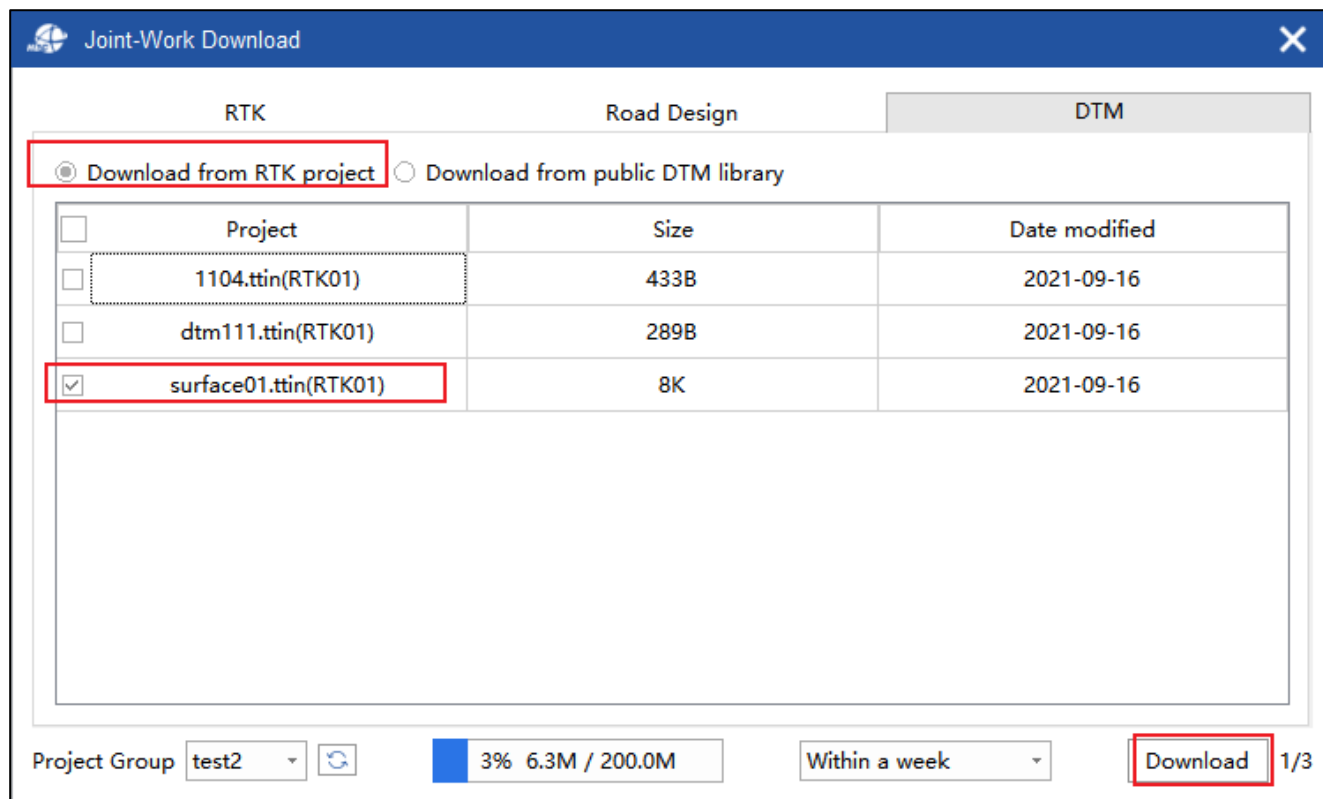


Figure 4-6-18 DTM Data Download

4.6.3 Hi-Survey Side Upload and Download

1. RTK Project Interaction

Log in to the Joint-Work Center account on the project information interface of the Hi-Survey mobile terminal to upload and download RTK projects.

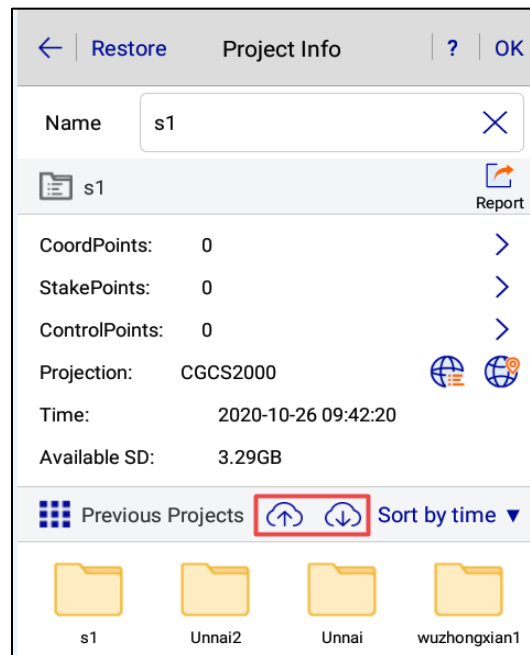


Figure 4-6-19 RTK Project Interface

(1) RTK Project Upload

After the mobile terminal Hi-Survey software completes the field data collection, click upload on the project information interface to upload the handbook project to the Joint-Work Center, and the accounts that the corresponding engineering team of the internal HBC software has permission to view can be downloaded to the HBC desktop terminal to open.

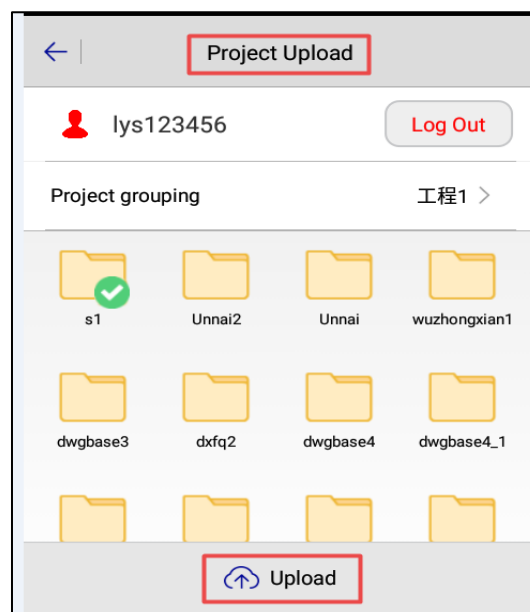


Figure 4-6-20 RTK Project Upload

(2) RTK Project Download

After the office HBC software uploads the created and configured handbook project to the joint operation center, the field Hi-Survey software can directly log in to the account to download and open the operation. After the operation is completed, it can also be directly uploaded back to the joint operation center for the office to download.

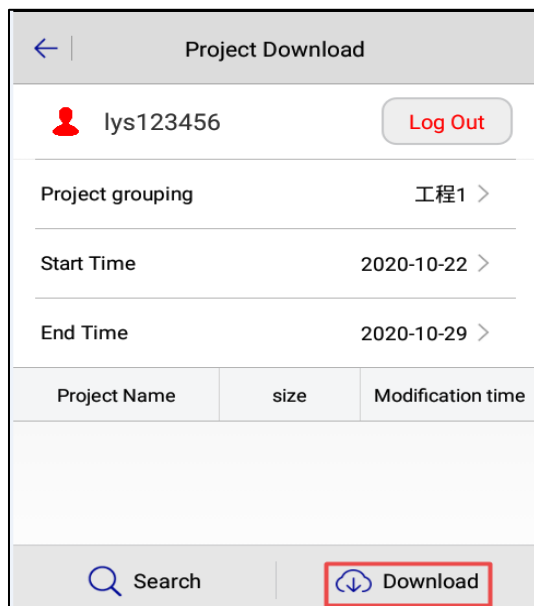


Figure 4-6-21 RTK Project Download

2. Road Data Interaction

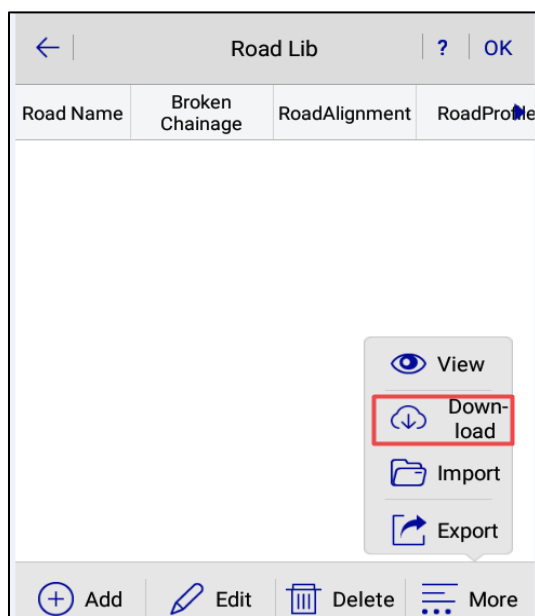


Figure 4-6-22 Road Data Interface

(1) Road Data Download

In the same data file in the engineering group, the field Hi-Survey terminal can select the corresponding road file to download and use.

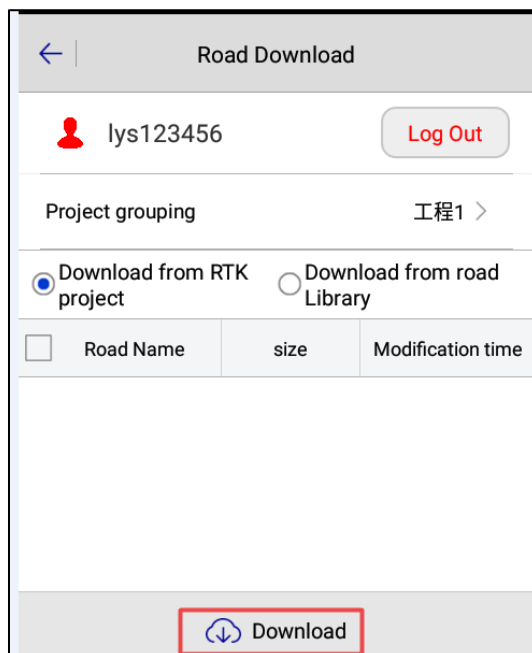


Figure 4-6-23 Road Data Download

3. DTM Data Interaction

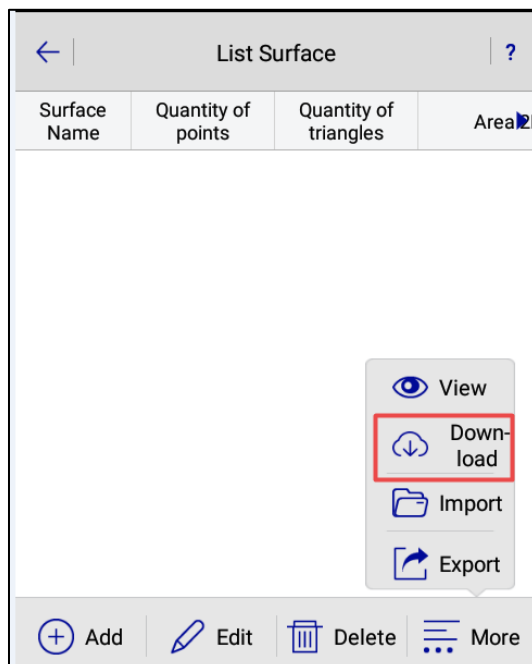


Figure 4-6-24 DTM Data Interface

(1) Ttin Data Download

For the data files in the same engineering group, the field Hi-Survey terminal can select the corresponding DTM file to download and use.

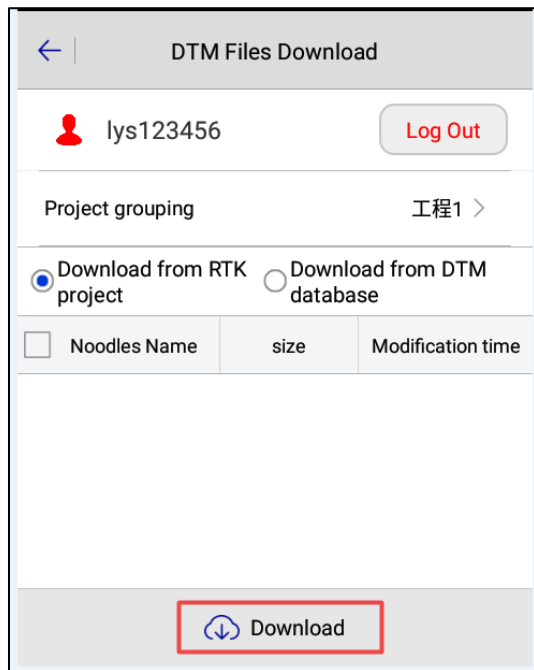


Figure 4-6-25 DTM Data Download

4.6.4 Share to Get

1. Coordinate System Sharing and Getting

(1) The user logs in to the Joint-work Center account, sets the coordinate system, clicks [OK], opens the coordinate system page again, and clicks [Share] to get a 30-minute sharing code.

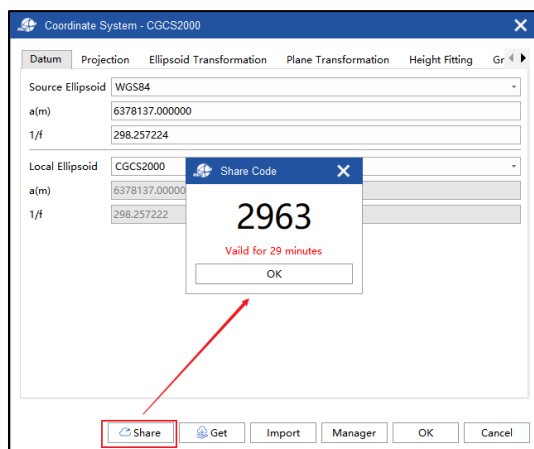


Figure 4-6-26 Coordinate System Sharing

(2) The user logs in to the Joint-work Center account, opens the coordinate system, clicks [Get], and enters the correct four-digit verification code to obtain the coordinate system settings shared by other users.

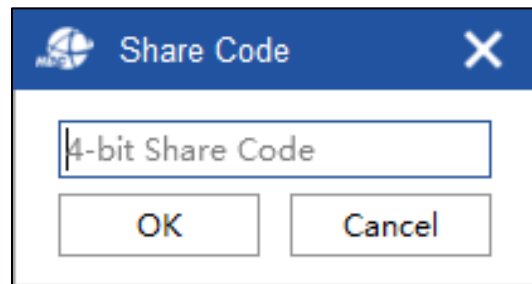


Figure 4-6-27 Coordinate System Getting

2. Road File Sharing and Acquisition

(1) There is a road file in the road sub-node, right-click the road file you want to share under the sub-node, and click [Share] to get a 30-minute sharing code.

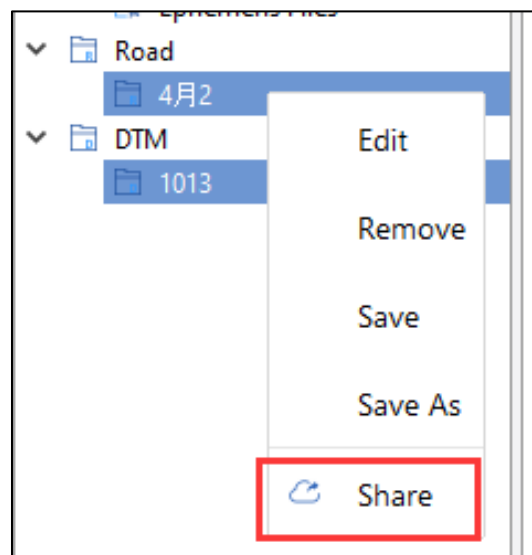


Figure 4-6-28 Road Project Sharing

(2) Right-click the road sub-node, click [Get], and enter the correct four-digit verification code to obtain road files shared by other users.

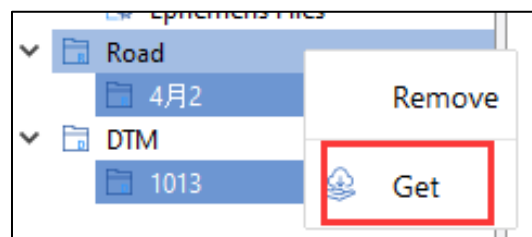


Figure 4-6-29 Road Project Getting

3. DTM File Sharing and Acquisition

(1) There is a DTM file in the road sub-node, right-click the DTM file you want to share under the sub-node, and click [Share] to get a 30-minute sharing code.

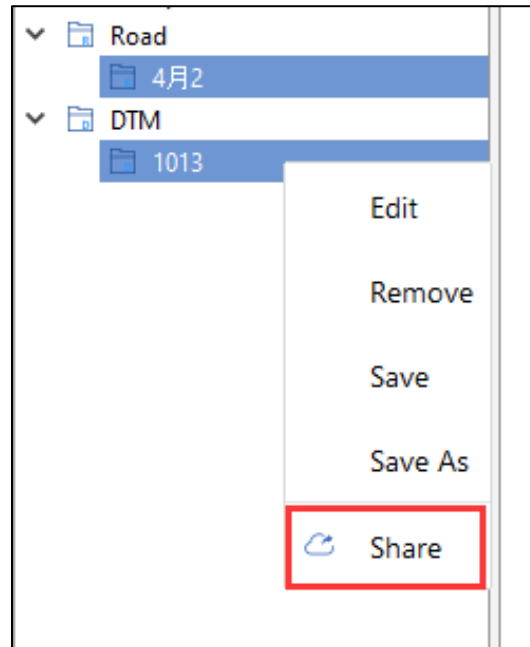


Figure 4-6-30 DTM File Sharing

(2) Right-click the DTM sub-node, click [Get], and enter the correct four-digit verification code to obtain the DTM files shared by other users.

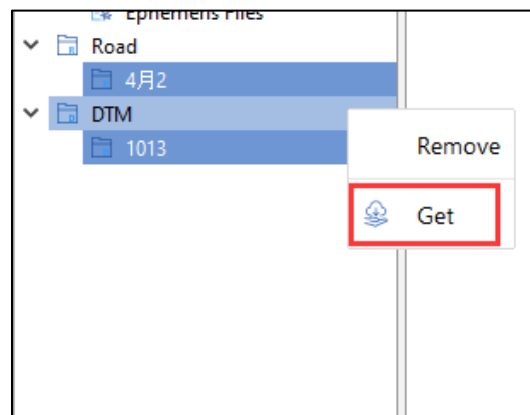


Figure 4-6-31 DTM File Getting

4.7 Parameter Calculation Widget

It is used to calculate the coordinate transformation relationship between two coordinate systems. The parameter calculation types include: seven-parameter, three-parameter, four-parameter + elevation fitting and one-step method.

1. Add

Open HBC software and select [Project]-[Parameter Calculation]-[Add].

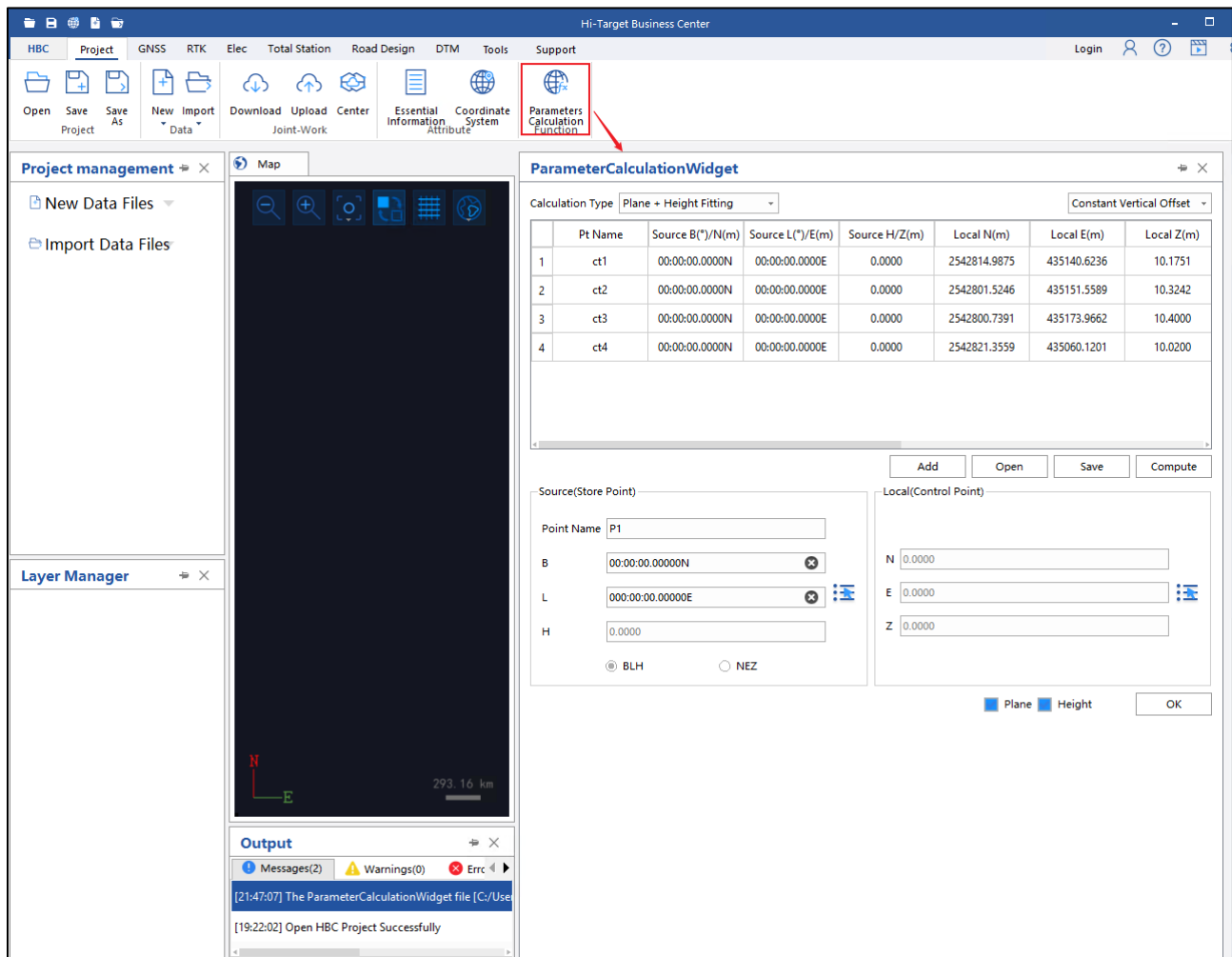


Figure 4-7-1 Parameter Calculation

The source coordinates and target coordinates of the added point can be manually input or selected by list selection. The target point coordinates can be manually input or obtained from the point library. After inputting the point, click [OK]. If you need to operate the existing point information, right-click the row of point information to edit or delete it.

In the list selection method, you can select the station list and control point list of the GNSS module; the coordinate point list, stakeout point list, control point list, graph root point list, cross-section point list and other lists of the RTK module to select points.

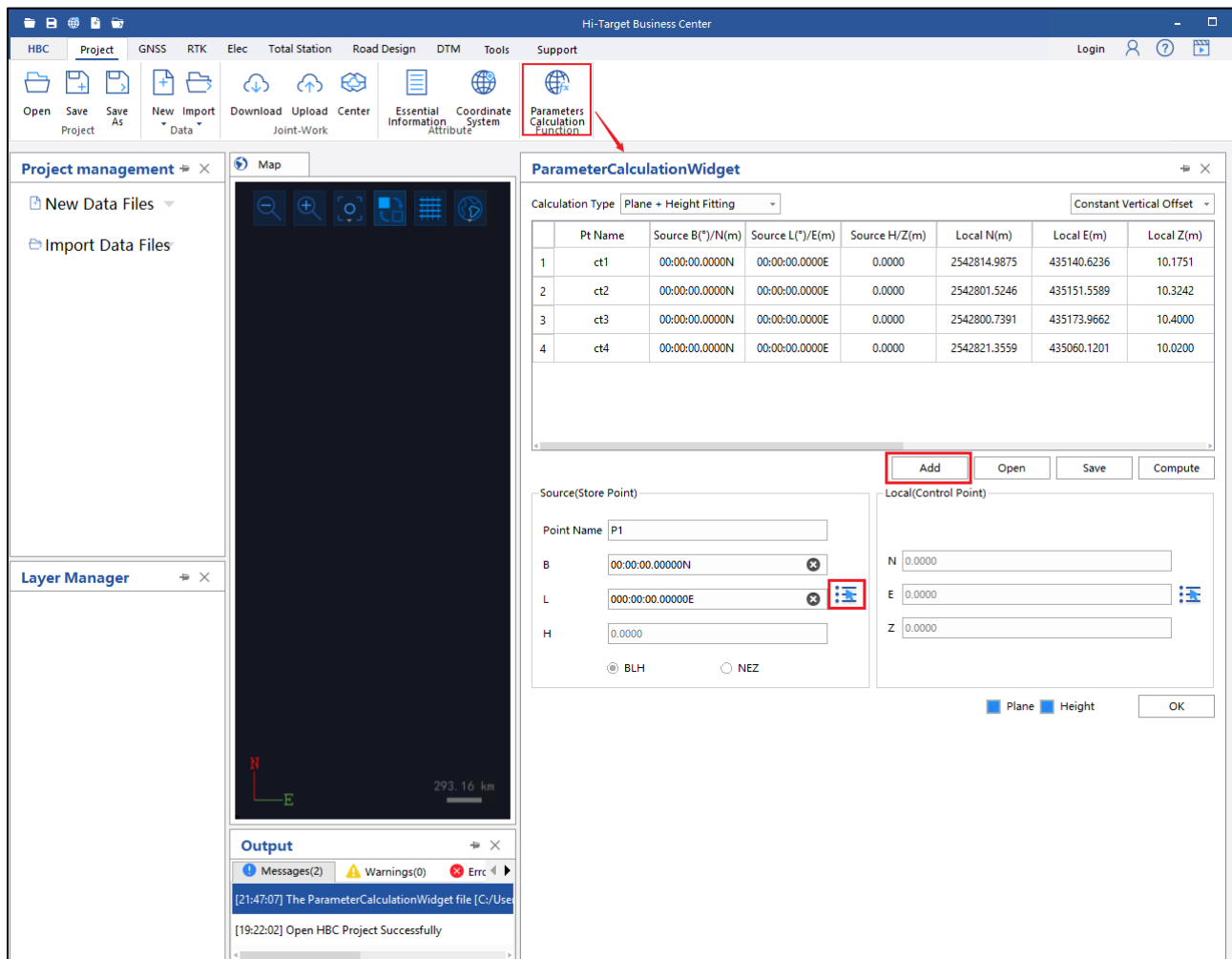


Figure 4-7-2 Parameter Calculation- add

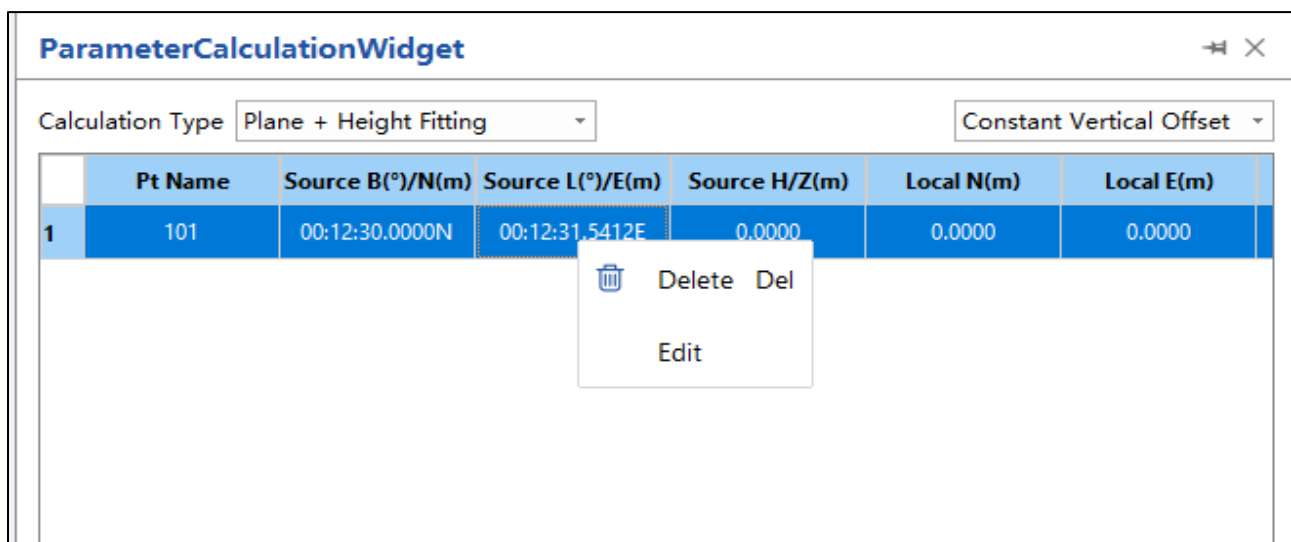


Figure 4-7-3 Parameter Calculation Widget

2. Open

Add parameter calculation point pair file (*.txt), Carlson localization parameter file (*.loc), and custom (*.txt) from the file directory.

3. Save

Save the coordinate information of the current point pair, and support saving the 'parameter calculation point pair file (*.txt) and custom (*.txt) format'. Among them, 'custom (*.txt) format' can set the angle format of point pair, export fields, etc. After saving, you can open the save directory to view the file.

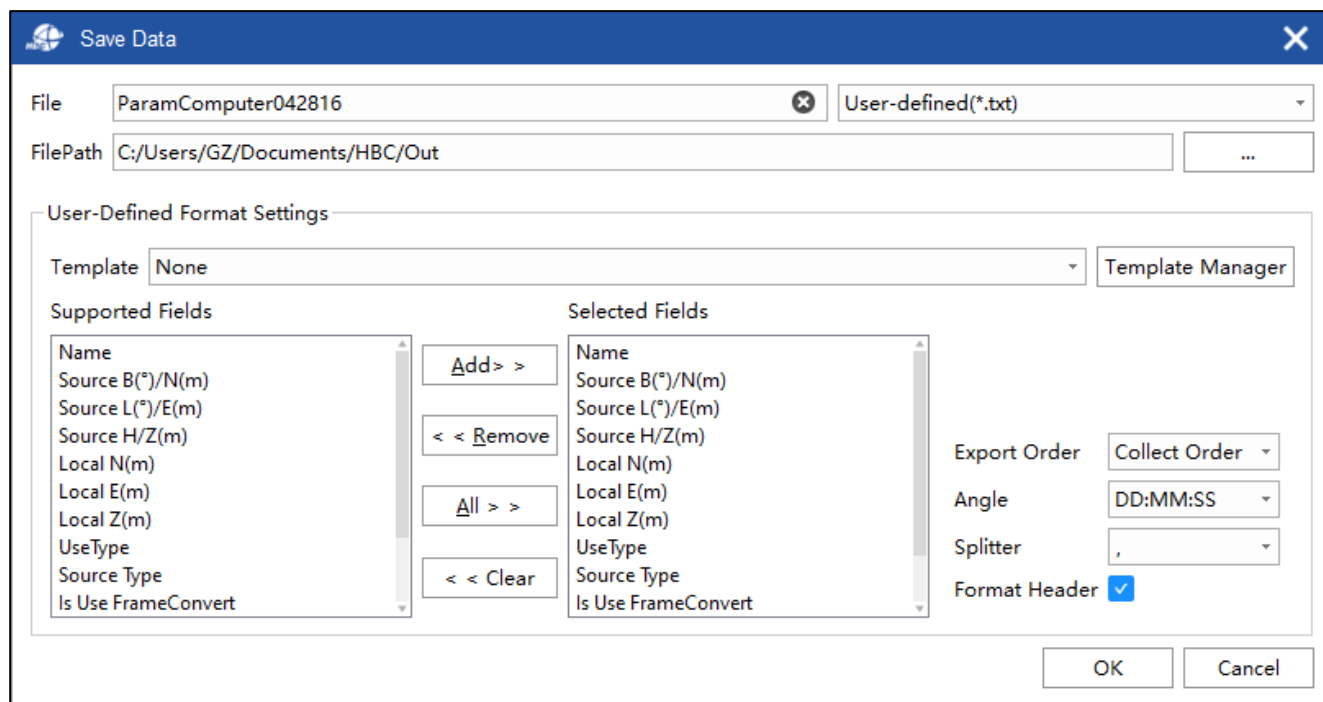


Figure 4-7-4 Save

4. Calculation

Perform parameter calculation, solve the conversion parameters from the source coordinates to the target coordinates, click [Compute], the software will automatically calculate the parameters and the maximum horizontal residual, the maximum vertical residual, the smaller the residual value, the better the accuracy of the point. Calculation types include: seven-parameter, three-parameter, four-parameter + height fitting, four-parameter, height fitting, and one-step method.

ParameterCalculationWidget

Calculation Type

Plane + Height Fitting

Constant Vertical Offset

	Pt Name	Source B(°)/N(m)	Source L(°)/E(m)	Source H/Z(m)	Local N(m)	Local E(m)	Local Z(m)	H Residuals	V Residuals
1	pt9	22:58:52.6492N	113:22:07.4771E	9.9318	2542801.5246	435151.5589	10.3242	4.6898	0.2283
2	pt12	22:58:52.6853N	113:22:06.6319E	9.5455	2542814.9875	435140.6236	10.1751	7.2467	-0.0090
3	pt15	22:58:52.3850N	113:22:05.1492E	9.3352	2542814.9875	435140.6236	10.1751	2.6141	-0.2193

Add

Open

Save

Compute

Calculation Results

DX(m)

2293167.076667

DY(m)

-95846.503840

Rotation

055:06:21.15513

K(ppm)

0.227458

Max H Residuals

7.246674(pt12)

A

-0.620638

Max V Residuals

0.228250(pt9)

Apply

Cancel

Figure 4-7-5 Parameter Calculation Widget-calculation Result

5. Applications

The current calculation result is applied to the corresponding coordinate parameters, and the coordinate point library is updated when the parameter calculation result is applied to the current project.

6. Cancel

Cancel the parameter calculation result and exit the parameter calculation interface.

7. Description

The specific type can be set for the point-to-coordinate information input under the four-parameter + elevation fitting calculation.

Check 'Plane': use the plane coordinates N, E of the point;

Check 'Height': use the elevation coordinate Z of the point;

Check 'Plane' and 'Height' at the same time: use the plane coordinates and elevation information of the point at the same time to participate in the four-parameter and elevation fitting operations;

ParameterCalculationWidget

Calculation Type

Plane + Height Fitting

Constant Vertical Offset

	(m)	Source L(°)/E(m)	Source H/Z(m)	Local N(m)	Local E(m)	Local Z(m)	H Residuals	V Residuals	Plane	Height
1	N	113:22:07.4771E	9.9318	2542801.5246	435151.5589	10.3242	4.6898	0.2283	✓	✓
2	N	113:22:06.6319E	9.5455	2542814.9875	435140.6236	10.1751	7.2467	-0.0090	✓	✓
3	N	113:22:05.1492E	9.3352	2542814.9875	435140.6236	10.1751	2.6141	-0.2193	✓	✓

Add

Open

Save

Compute

Calculation Results

DX(m)

2293167.076667

DY(m)

-95846.503840

Rotation

055:06:21.15513

K(ppm)

0.227458

Max H Residuals

7.246674(pt12)

A

-0.620638

Max V Residuals

0.228250(pt9)

Apply

Cancel

Figure 4-7-6 Parameter Calculation Widget-calculation Result Check

'Plane' and 'Height' in the parameter point pair list are marked in green, and both plane and elevation coordinate information are used for point pair; if only 'Plane' is marked in green, only plane coordinate information is used for point pair; if only 'Height' is used Marked in green, point pairs only use elevation coordinate information.

The user can choose to use the 'Plane' coordinate information or the 'Height' coordinate information by double-clicking the corresponding 'Plane' and 'Height' options of the point pair.

Chapter 5

GNSS

This chapter contains:

- Importing
- Options
- QC Quality Inspection
- Baseline Solver Configuration
- Searching For Closed Loops
- Baseline Processing
- Network Adjustment
- Data Charts
- Export
- Tools
- GNSS Quick Start
- Static Baseline Processing
- Dynamic Baseline Processing
- Network Adjustment

5.1 Importing

This part is mainly used to import the original observation files and control point files required by GMSS. The original observation files support the ZHD format (*.GNS) and Rinex format (*.??O), and the control point files support the HBC standard format (*.cp) and all files (*.*) .

1. Import Raw Observation Files

(1) Click the [Import] icon under the [Project] menu bar of the HBC software, select [Raw GNSS Observation Files]\[GNSS Observation Dir] under [GNSS Files], the software will pop up the Import GNSS Observation File dialog box.

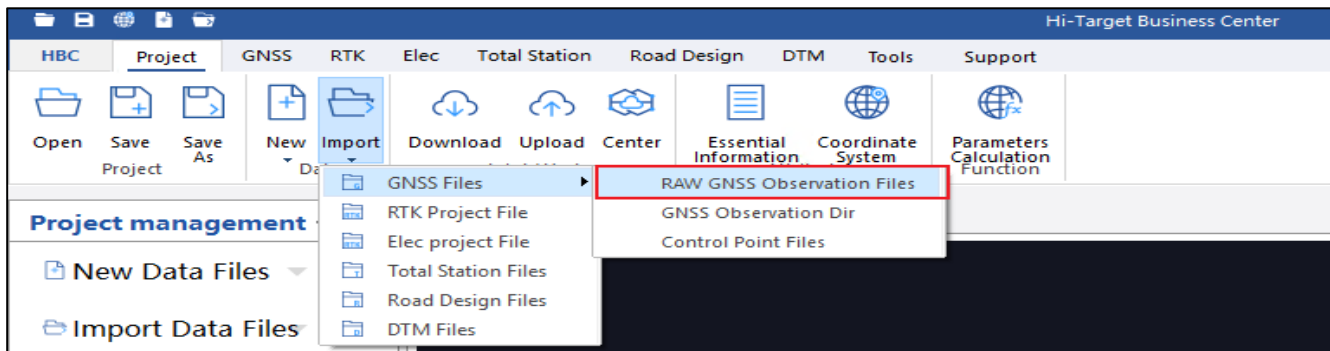


Figure 5-1-1 Import Interface

(2) Select a file in *.GNS or *.??O format in the import dialog box, click [Import], the software will execute the opening operation, and there will be a corresponding prompt message.

Note: You can use the CTRL key or the SHIFT key to select multiple observation files to import.

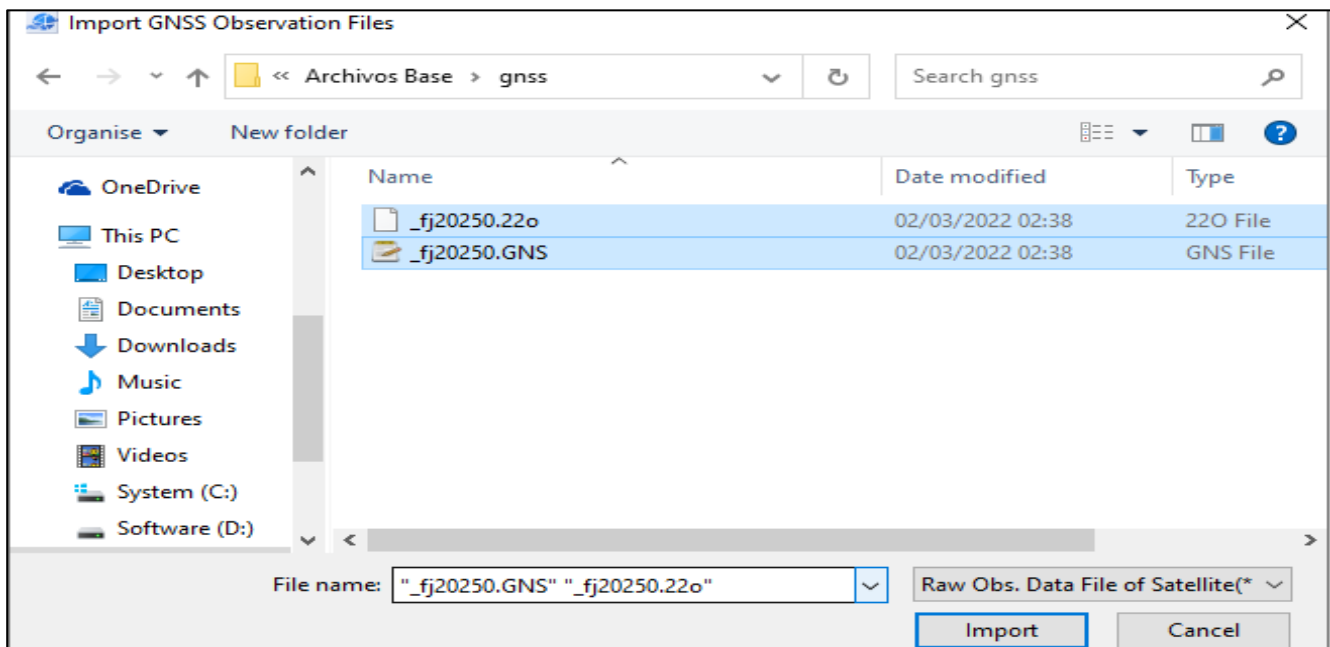


Figure 5-1-2 Import GNSS Observation Files

(3) Import the original observation file and view the [Observation File] list page, including File name, Station, Mode, Start Time, End Time, Time Span, Interval, Measurement To, Antenna Height, True Height, Antenna Type, Receiver Type, Receiver Machine SN number and File Path.

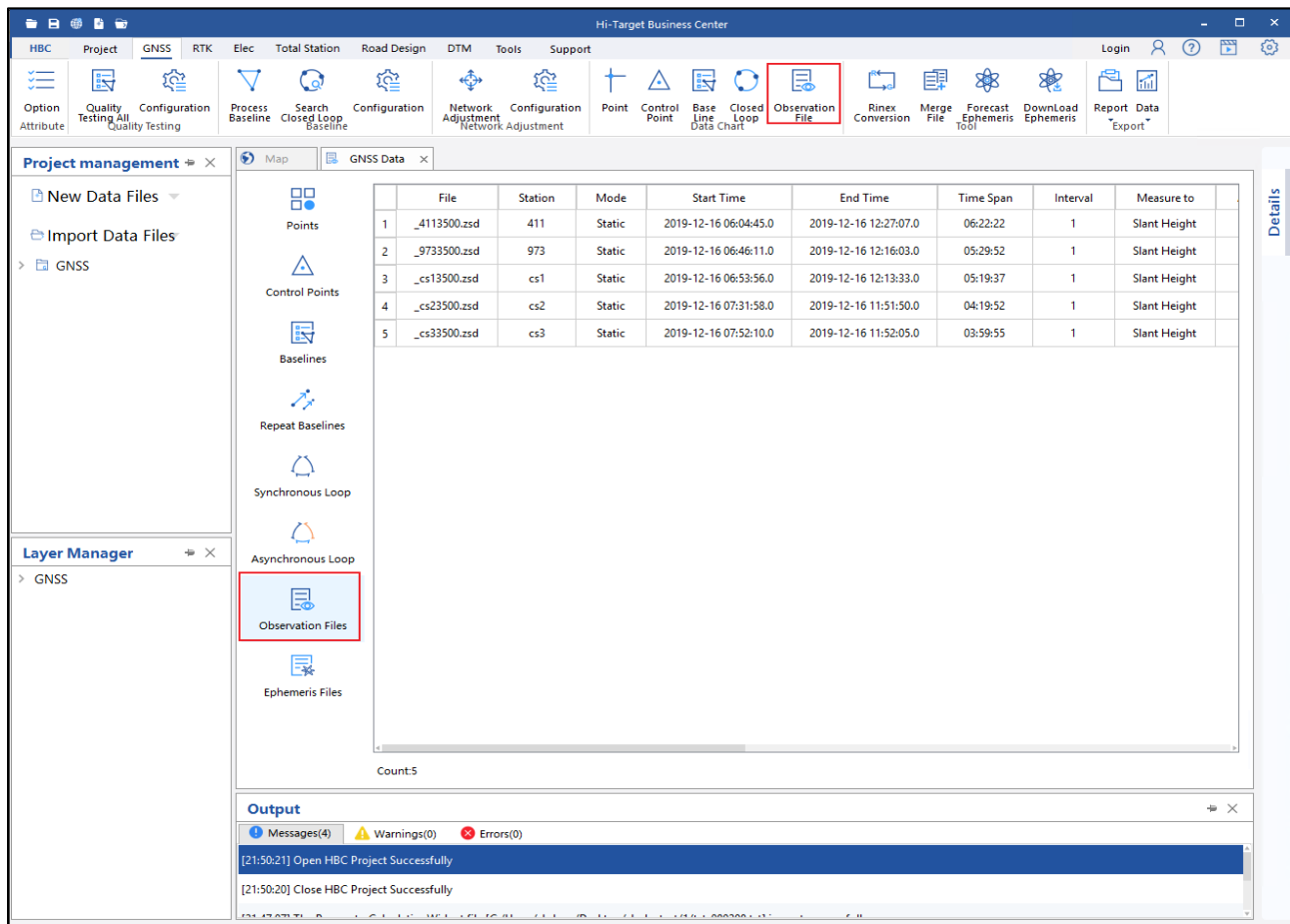


Figure 5-1-3 Observation Files

2. Import Observation Folder

(1) Click the [Import] icon under the [Project] menu bar of the HBC software, and select [GNSS Observation Dir] under [GNSS Files].

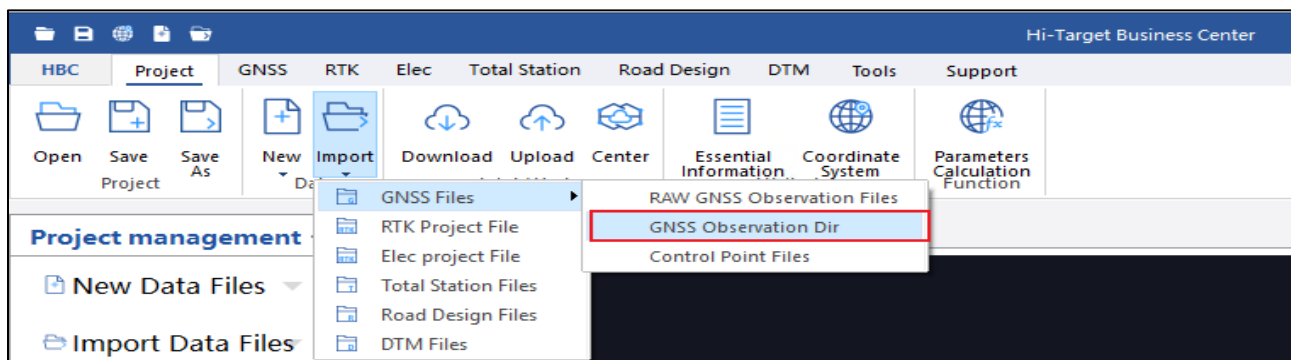


Figure 5-1-4 Import Interface

(2) Select the folder containing *.GNS or *.??O format, click [Select Folder], the software will execute the opening operation, and there will be corresponding prompt information.

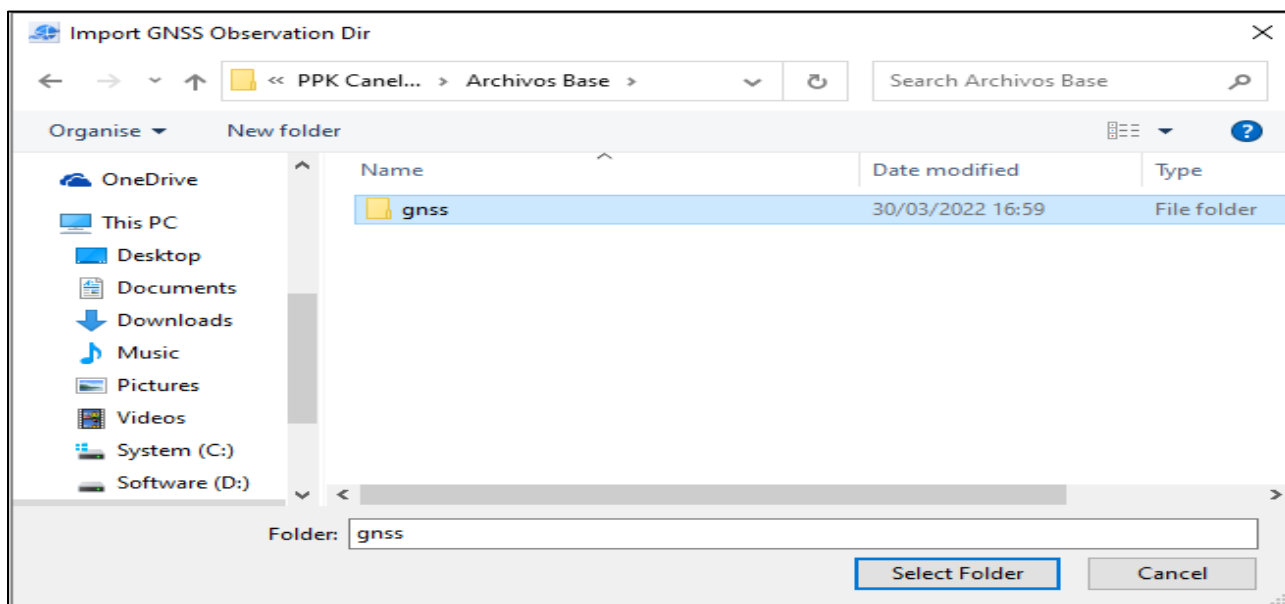


Figure 5-1-5 Import GNSS Observation Dir

(3) If the station names in the observation file are repeated, and the distance between the repeated stations is bigger than 100m, after the file is imported, the station automatic correction window will pop up.

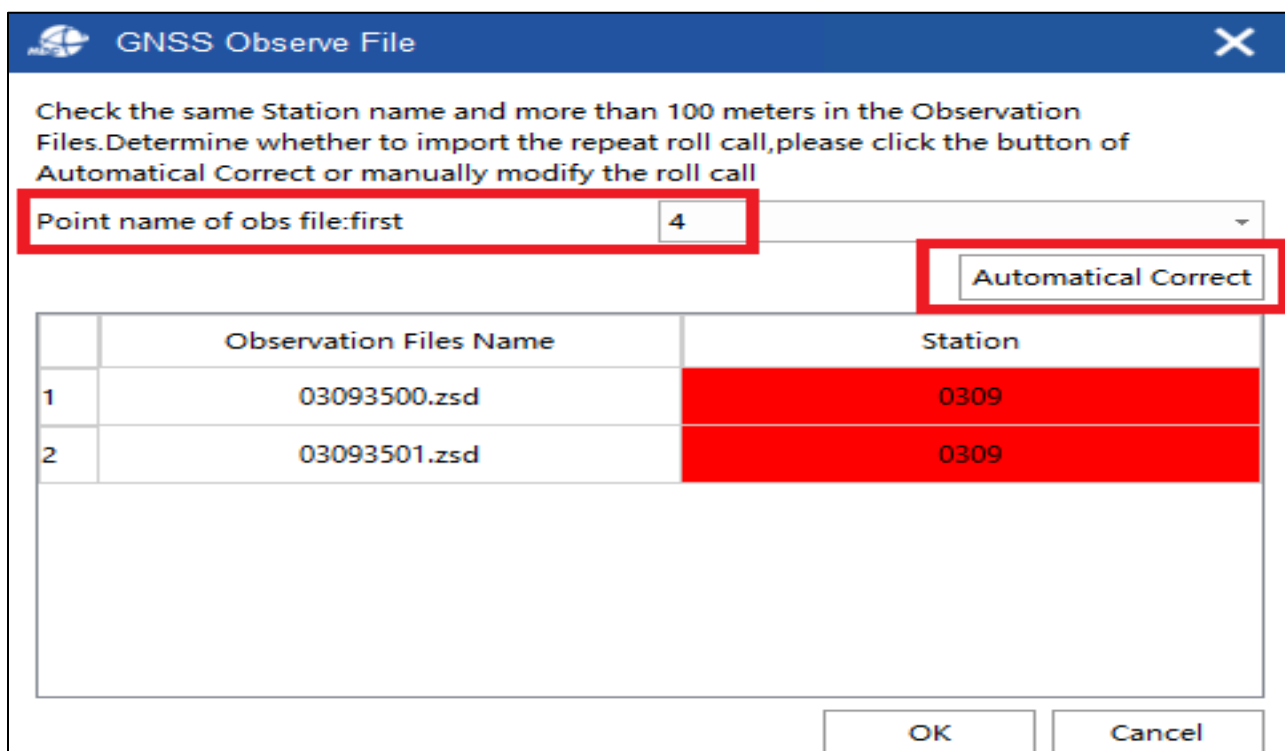


Figure 5-1-6 Prompt for the Same Station Name

The station name under the red background is a duplicate station name. You can select the automatic correction rules of 'Top 4 file names' and 'Top 8 file names'. After the automatic correction rules are corrected, there are still duplicate station names. Click the [Automatic Correct] button, Station names with the same name are renamed in the way of [Point Name_1][Point Name_2].

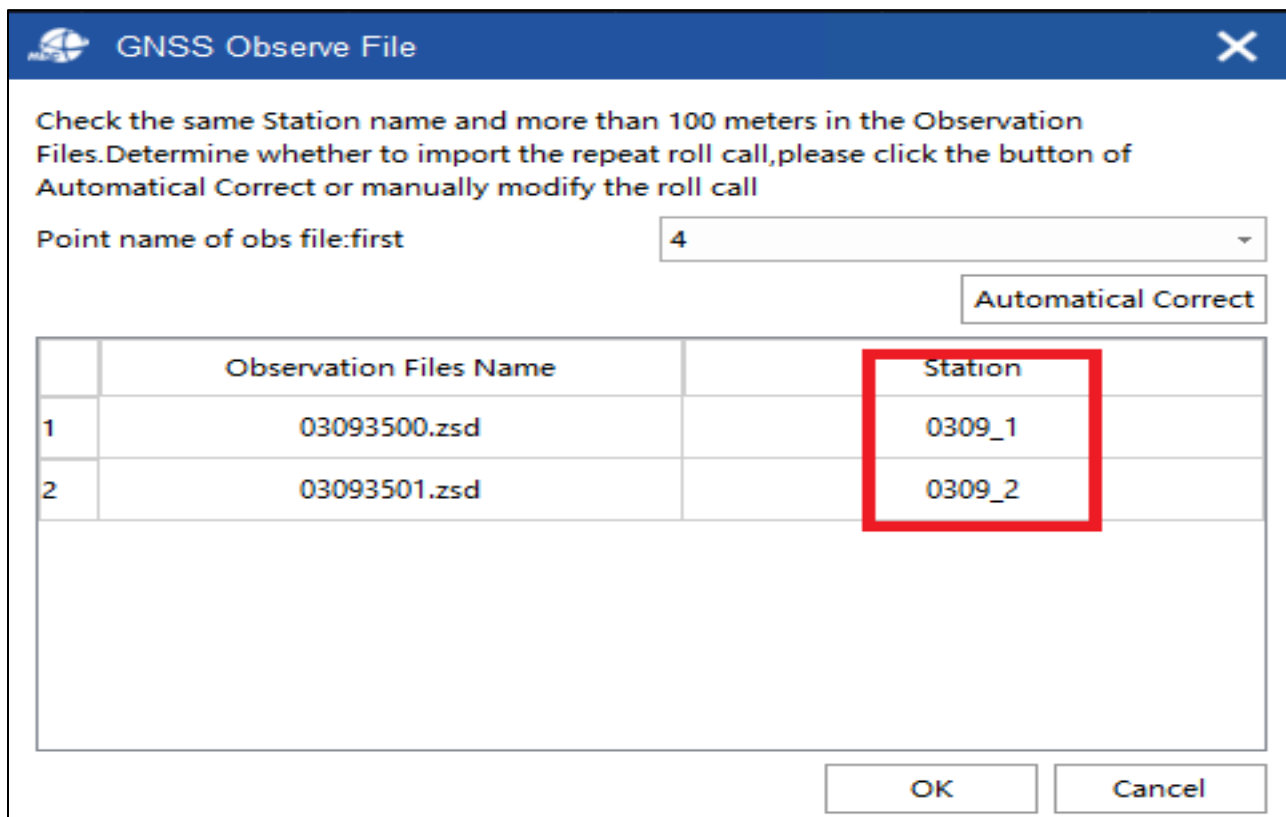


Figure 5-1-7 Automatical Correct the Same Station Name

3. Import the Control Point File

(1) Click the [Import] icon under the [Project] menu bar of the HBC software, select [Control Point Files] under [GNSS Files], or right-click [Import Control Point File] in the control point list, the software will pop up the control point import interface.

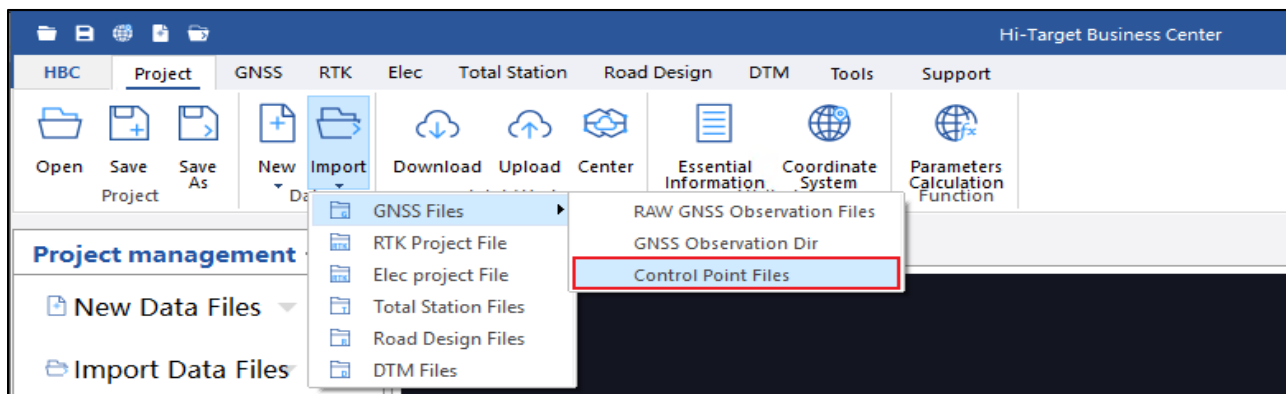


Figure 5-1-8 Import Control Point Files from GNSS Files

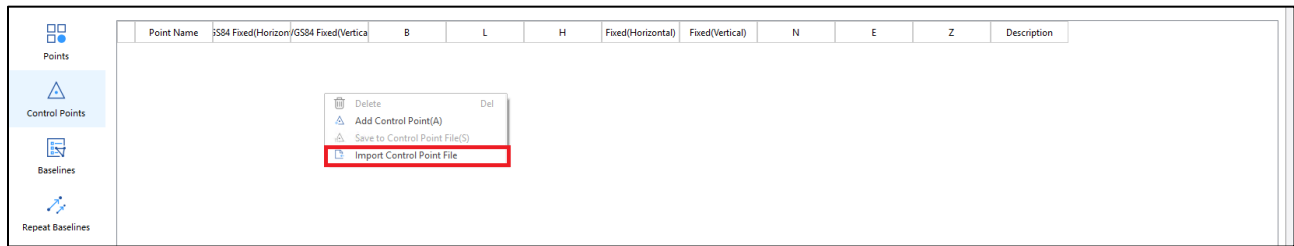


Figure 5-1-9 Import Control Point File from Control Points List

(2) Click the path selection button to pop up the data file selection interface, and select the general format file. The control point supports HBC standard format (*.cp) files, and the stakeout point supports selecting all files (*.*), and then you can customize the import.

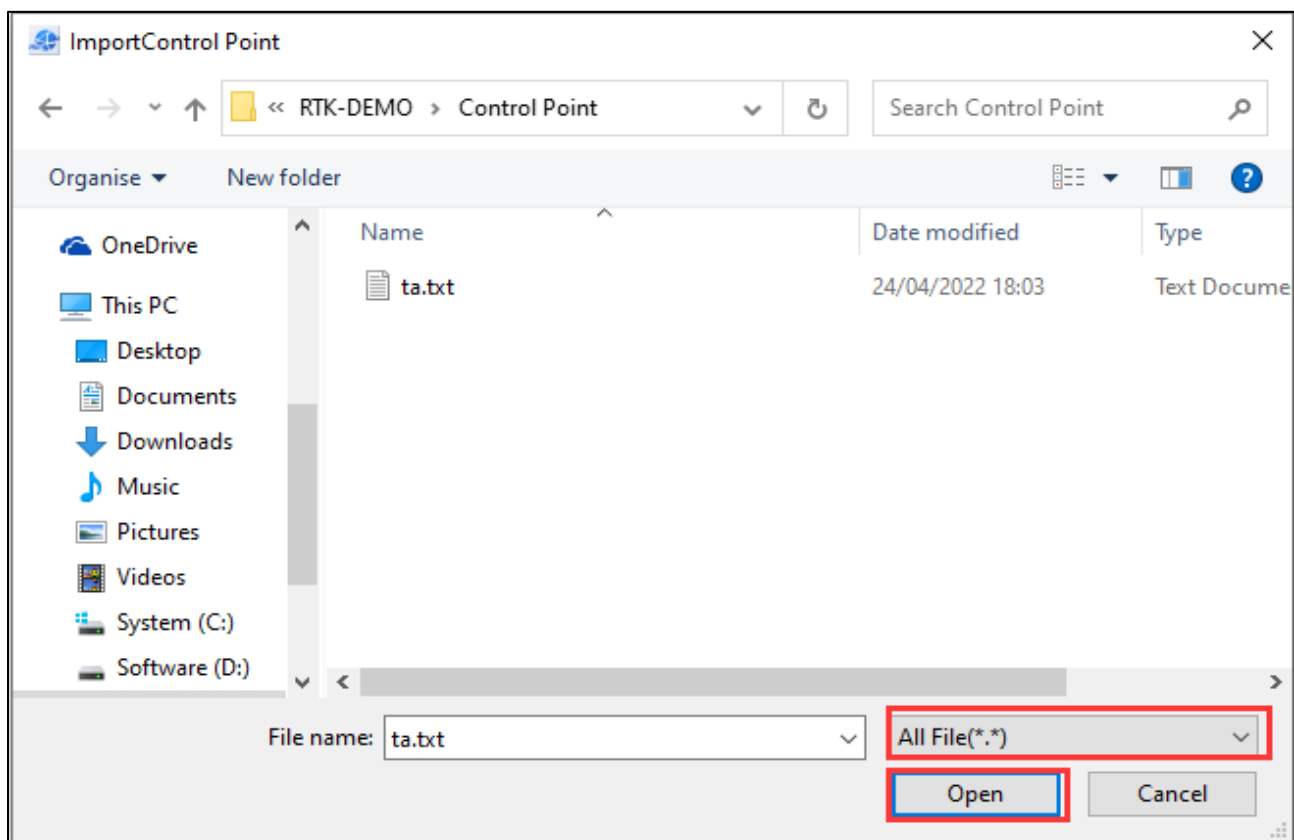


Figure 5-1-10 Select Control Point Files

Click [Import] to return to the software import interface to set the custom format.

(3) Select the fields to be imported in the 'Supported Fields' list, the selected fields are automatically filled into the 'Selected Fields' list, and click 'Remove' to delete the fields in the 'Selected Fields' list. At the same time, you can click 'All' or 'Clear' to add or delete all fields. At the same time, you can set the angle format, splitter and whether to display the file header.

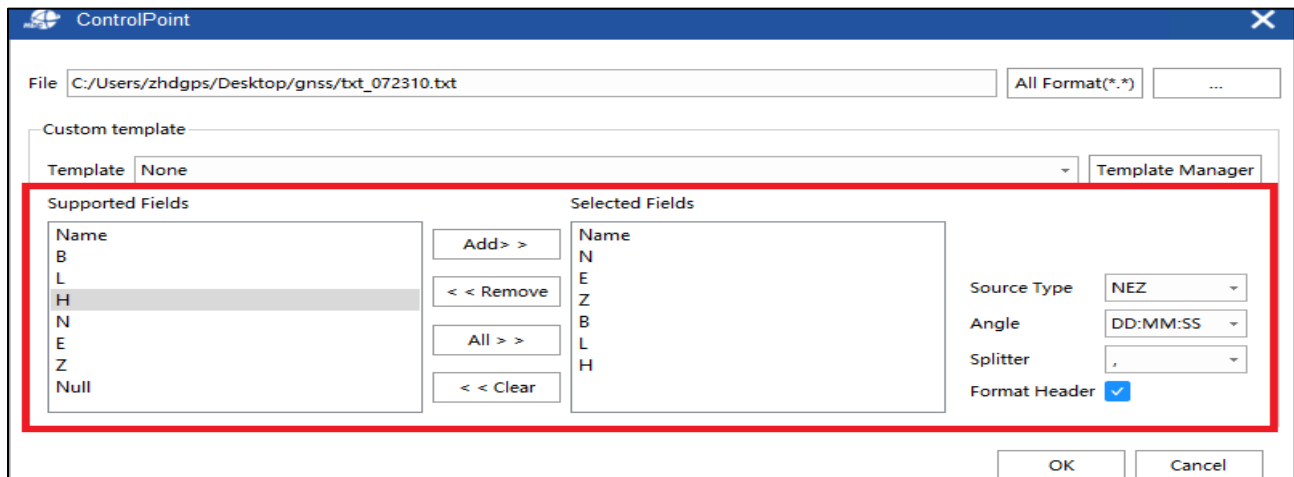


Figure 5-1-11 Select Fields of Control Point Files

After the setting is complete, click [OK] to complete the custom import of the file.

5.2 Options

This part is mainly used to set the GNSS measurement specification. Click the [Option] icon under the [GNSS] menu bar of the HBC software, the software will pop up the options dialog box, and the user can set the properties.

1. Tolerance

The user can set the Standard, Precision, Relative Precision, and if user adds measurement standard, it will appear the level parameter list and display the parameters corresponding to the measurement standard.

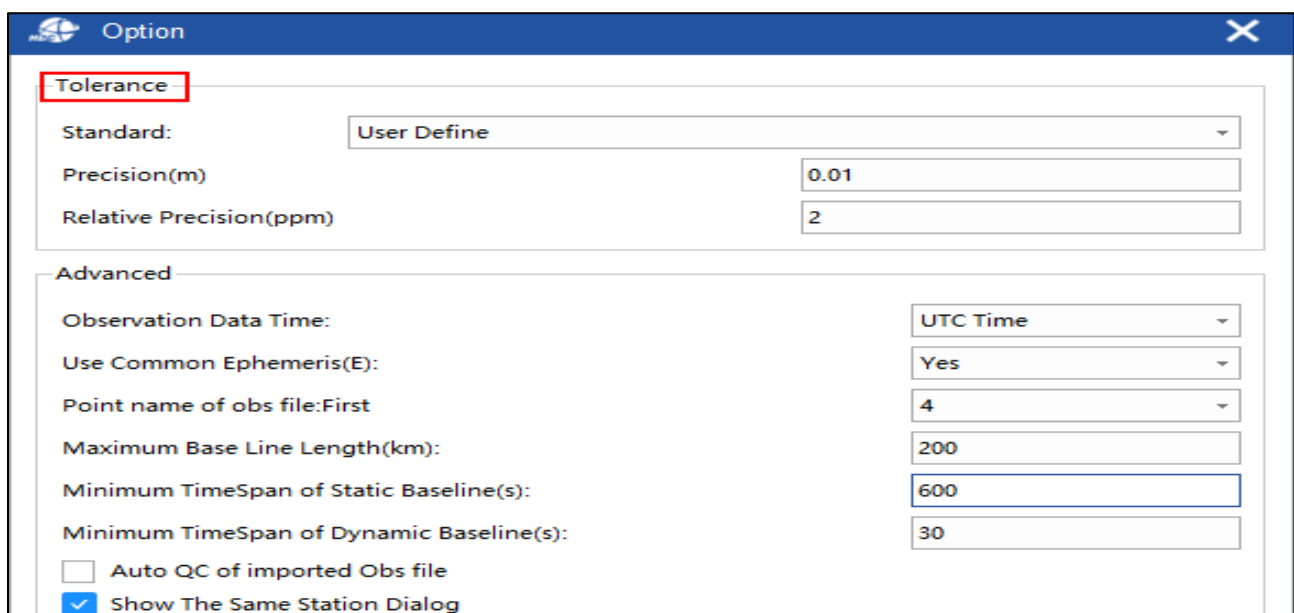


Figure 5-2-1 Option-tolerance

2. Advanced

Advanced options mainly include the following 8 items:

‘Observation Data Time’: UTC Time or Local Time;

‘Use Common Ephemeris’: Whether to use public ephemeris in baseline processing;

‘Point name of obs file:First’: The rules for the software to display the site name;

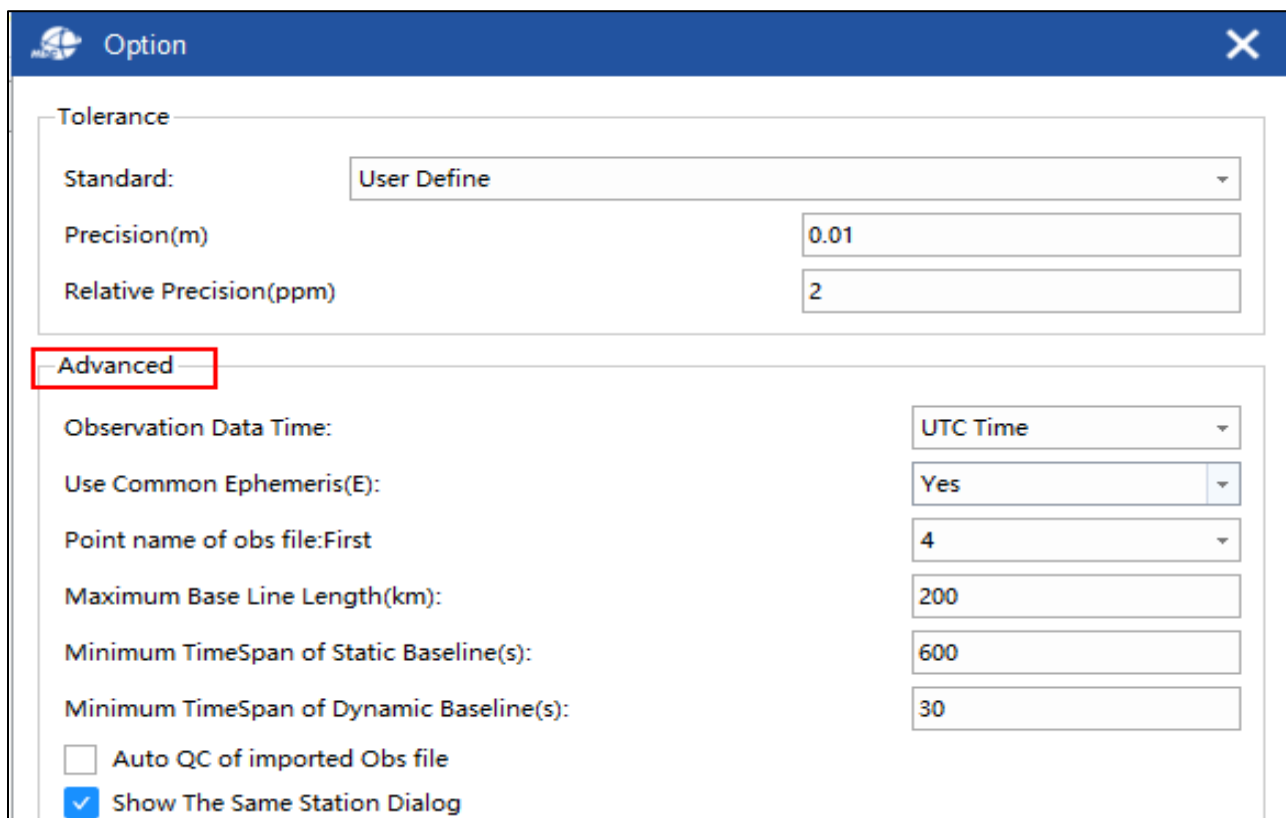
‘Maximum Base Line Length(km)’: If the length of the baseline exceeds this value, it will not constitute a baseline;

‘Minimum TimeSpan of Static Baseline(s)’: The minimum synchronization time required in static processing;

‘Minimum TimeSpan of Dynamic Baseline(s)’: The minimum synchronization time required in dynamic processing (PPK);

‘Auto QC of imported Obs file’: Check this setting, the software will automatically perform quality inspection on observation files when importing them, which can be viewed on the Quality Inspection Information/Quality Inspection Summary Information page;

‘Show The Same Station Dialog’: Check this setting, when importing observation files with the same site name and a distance of more than 100m, the software will prompt the relevant same name. If it is not checked, no prompt will be given.



Option

Tolerance

Standard: User Define

Precision(m): 0.01

Relative Precision(ppm): 2

Advanced

Observation Data Time: UTC Time

Use Common Ephemeris(E): Yes

Point name of obs file:First: 4

Maximum Base Line Length(km): 200

Minimum TimeSpan of Static Baseline(s): 600

Minimum TimeSpan of Dynamic Baseline(s): 30

☐ Auto QC of imported Obs file

☒ Show The Same Station Dialog

Figure 5-2-2 Option-advanced

5.3 QC Quality Inspection

1. Quality Inspection Observation Documents

(1) Import observation files, click [Quality Testing All] / right-click on the observation file node to QC all observation files, or right-click on the observation file list page [QC Info] to QC a single observation file.

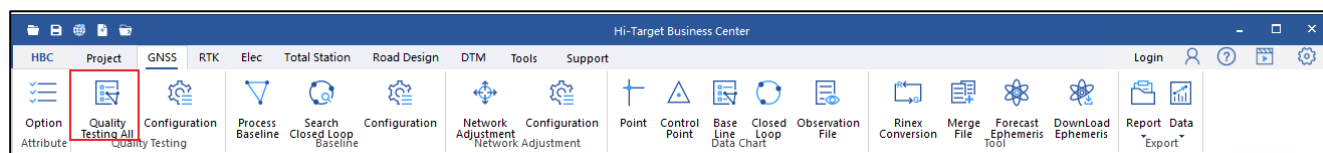


Figure 5-3-1 Quality Testing All

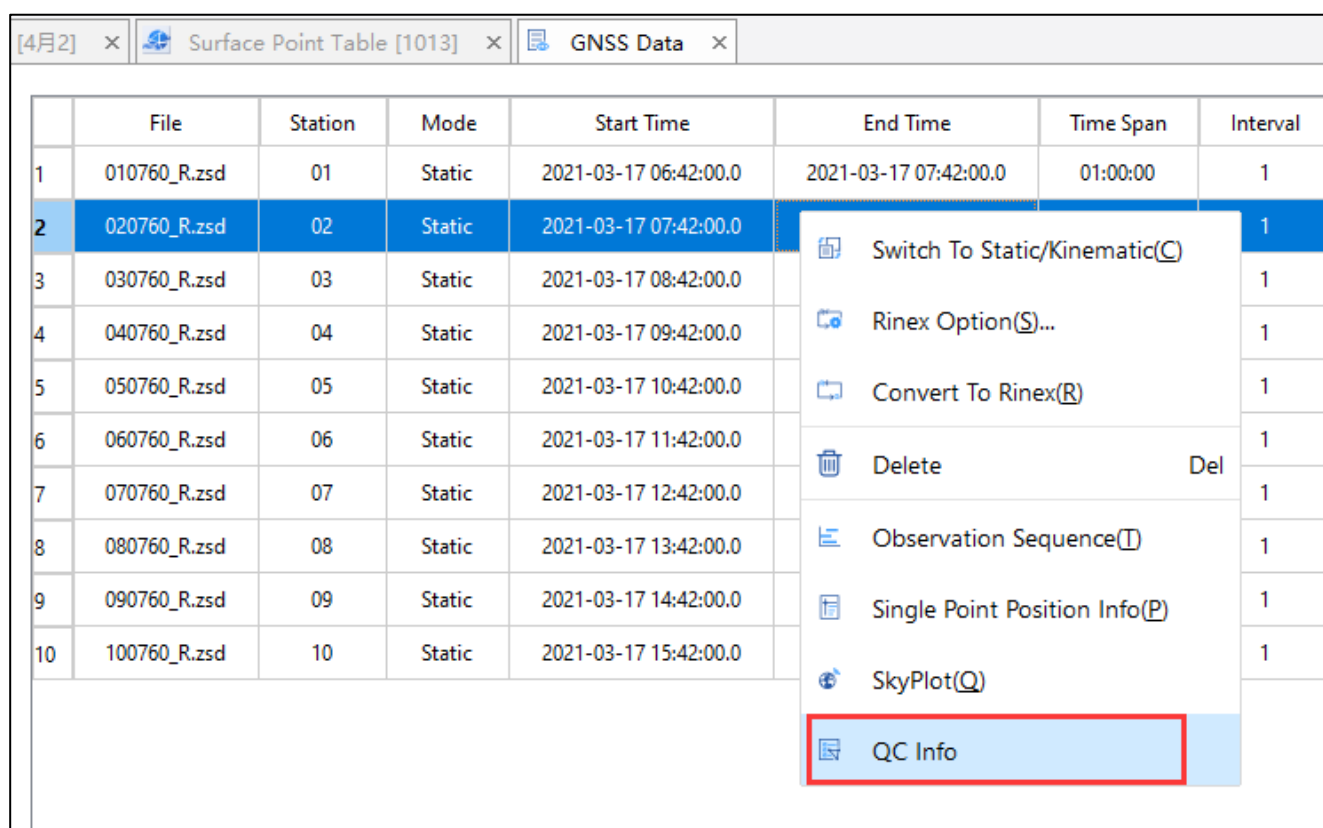


Figure 5-3-2 QC Info

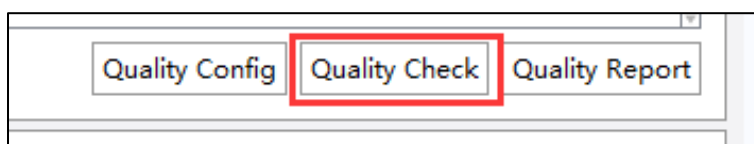


Figure 5-3-3 Quality Check

2. View Quality Inspection Information

(1) Right-click [QC Info] in the observation file list to view the quality inspection results.

Map Road [4月2] Surface Point Table [1013] GNSS Data QC Info[020760_R]															
	Time of first obs	Missed obs	Session length	Data Completeness%	MP1	MP2	MP3	MP4	MP5	Slip Num	Slips	S1	S2	S3	S4
GPS	2021-03-17 07:42:00.0	0	1.0000	98.9782	0.5654	0.3455	0.5549	0.0000	0.0000	35	210	46.4479	44.2885	47.7794	0.0000
GLO	2021-03-17 07:42:00.0	0	1.0000	70.7074	0.3890	0.2282	0.0000	0.0000	0.0000	2	1274	44.6179	43.1043	0.0000	0.0000
BDS	2021-03-17 07:42:00.0	0	1.0000	71.3426	0.2568	0.2135	0.2093	0.0000	0.0000	14	617	45.3465	45.6405	44.0035	0.0000
GAL	2021-03-17 07:42:00.0	0	1.0000	92.8988	0.2599	0.2420	0.3251	0.1266	0.0000	2	1674	48.2311	46.8552	48.5175	49.5158
GNSS		0	1.0000	81.8369	0.3979	0.2688	0.3438	0.1266	0.0000	53	413	45.9443	45.0996	45.8558	49.5158
Satellite Details															
PRN	MP1	MP2	MP3	MP4	MP5	Possible obs	Actual Observations	Data Completeness%	Slip Num	Slips					
G1	0.2081	0.1441	0.1627	0.0000	0.0000	721	721	100.0000	0	721					
G3	0.7898	0.3958	0.8720	0.0000	0.0000	661	660	99.8487	4	165					
G7	0.2276	0.1635	0.0000	0.0000	0.0000	721	721	100.0000	0	721					
G8	0.3589	0.3683	0.4656	0.0000	0.0000	721	721	100.0000	0	721					
G9	0.5813	0.2509	0.5856	0.0000	0.0000	135	135	100.0000	0	135					
G14	0.9139	0.4269	0.6844	0.0000	0.0000	721	721	100.0000	0	721					
G17	0.6349	0.3229	0.0000	0.0000	0.0000	721	721	100.0000	0	721					
G19	0.8005	0.3548	0.0000	0.0000	0.0000	153	150	98.0392	3	50					
G21	0.3505	0.1788	0.0000	0.0000	0.0000	721	721	100.0000	0	721					
G22	0.4099	0.4905	0.0000	0.0000	0.0000	721	651	90.2913	22	29					
G28	0.8284	0.5080	0.0000	0.0000	0.0000	721	719	99.7226	6	119					
											Quality Config Quality Check Quality Report				

Figure 5-3-4 QC Info Interface

(2) Right-click the observation file node to view the Spp and QC Result Report.

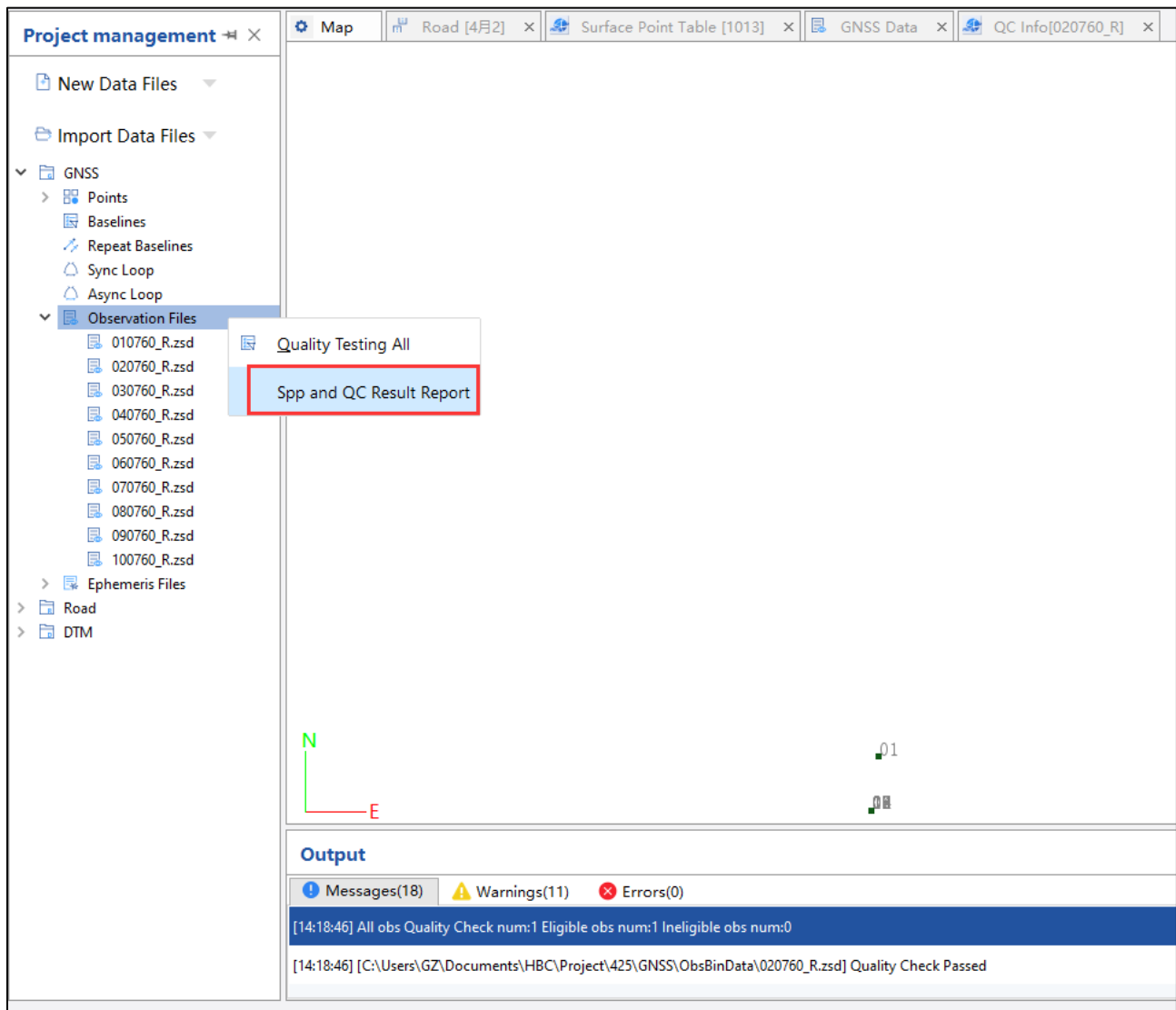


Figure 5-3-5 SPP and QC Result Report

3. Quality Inspection Configuration

(1) Click [Configuration] in the menu bar or click [Quality Config] on the quality inspection information page to configure the quality inspection of single or multiple observation files and output different quality inspection results.

Note: All satellite channels only support dual frequency and above, and do not support single frequency quality inspection.


Quality Testing Config

☒ Quality Inspection

Eligibility Threshold

Completeness Rate >	95	%	Cycle Slips Ratio >	4000	
Signal Noise Ratio S1 >	35		Multi Path mp1 <	0.5	m
Signal Noise Ratio S2 >	35		Multi Path mp2 <	0.5	m
Signal Noise Ratio S3 >	35		Multi Path mp3 <	0.5	m
Signal Noise Ratio S4 >	35		Multi Path mp4 <	0.5	m
Signal Noise Ratio S5 >	35		Multi Path mp5 <	0.5	m


Advanced

Calculation Options

1). Elevation Mask(°)

10.00

Interval(s)

5.00

☐ SynchronouObservation Data Collection Inte

2). GPS Frequency Num

☒ L1
☒ L2
☒ L5

3). GLONASS Frequency Num

☒ G1
☒ G2
☒ G3

4). GALILEO Frequency Num

☒ E1
☒ E5a
☒ E5b
☒ E5(a+b)
☒ E6

5). BDS Frequency Num

☒ B1
☒ B2
☒ B3
☒ B1C
☒ B2a

6). Auto Detection Frequency
☐

Satellite System

☒ GPS
☒ GLONASS
☒ GALILEO
☒ BDS

Participating satellite

GPS

GLONASS

GALILEO

BDS

Apply To

All Selection

OK

Cancel

Figure 5-3-6 Quality Testing Configuration

5.4 Baseline Solution Configuration

This part is mainly used to set baseline solution parameters, including three options: general, tropospheric, dynamic and advanced; Click the [Configuration] icon in the baseline module under the [GNSS] menu bar in the upper left corner of HBC software, the software pops up the baseline solution configuration dialog box, and the user can set the baseline solution parameters.

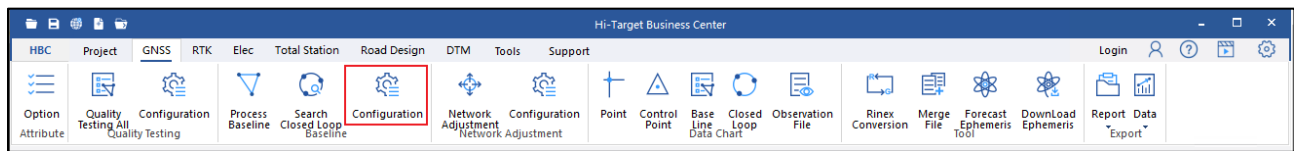


Figure 5-4-1 GNSS Configuration

1. General

General parameters include the following.

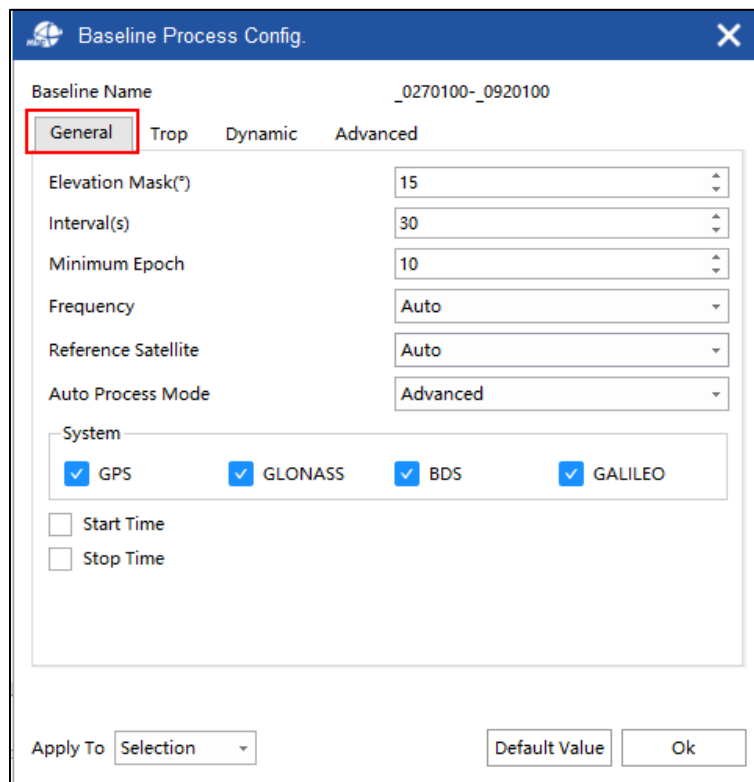


Figure 5-4-2 GNSS Configuration-general

‘Elevation Mask(°)’: In GNSS measurement, the masking height angle set to shield the satellite data from the effects of occlusions and multipath effects, below which the satellite data do not participate in the baseline solving, and the default value of the software is 15 °.

‘Interval(s)’: Epoch interval, the time interval for extracting the original observation when solving the baseline, the default value of the software is 30s.

‘Minimum Epoch’: In GNSS measurement, the quality of baseline solving is affected by the discontinuity of observation data due to week hop and other reasons. Therefore, in the baseline processing, the software will eliminate the observations with the number of consecutive epochs not more than the minimum number of epochs, the default value of the software is 10.

‘Frequency’: You can choose to use different observation values when baseline solving, the software supports L1, L2, L1L2, Ln, Lw, Lc, the software default setting is automatic, the software will automatically select the best observation values for solving when baseline solving.

‘Reference Satellite’: Set the reference satellite in the baseline solution configuration.

‘Auto Processing Mode’: Including ordinary and enhanced, which indicates the elimination degree of data quality. The software can automatically eliminate the data with poor quality. The software defaults to ‘enhanced’.

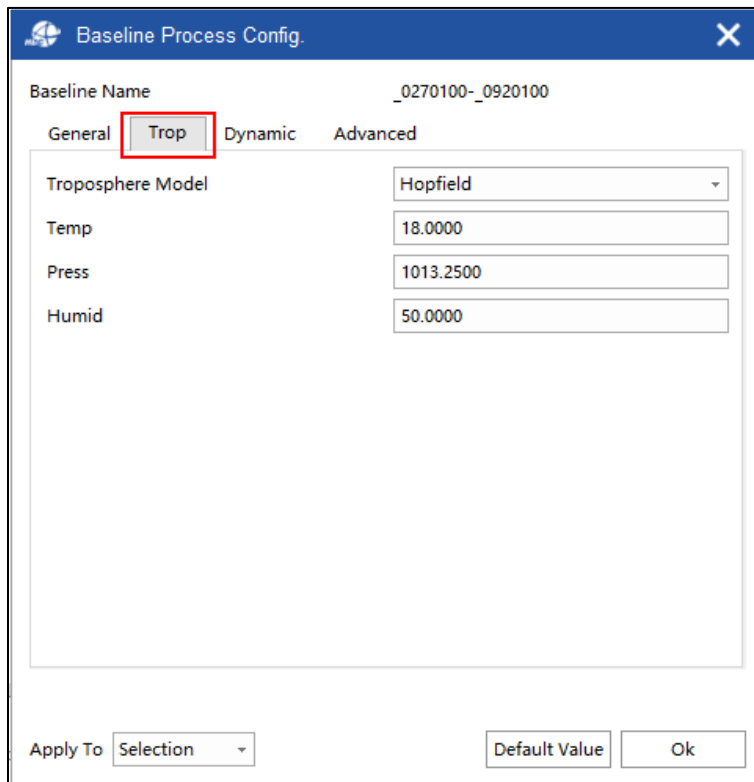
‘System’: The satellite system involved in baseline calculation. The software supports four satellite systems, BDS, GPS, GLONASS and Galileo, users can choose and combine them at will.

‘Start Time’: The software will select the observation value in a certain period of time for baseline calculation. The start time is the starting time of this period of time, which is not set by default.

‘Stop Time’: The software will select the observation value in a certain period of time for baseline calculation. The end time is the deadline of this period of time. The software does not set it by default.

2. Trop

The Trop parameters consist mainly of the following.



Baseline Process Config.

Baseline Name: _0270100-_0920100

General **Trop** Dynamic Advanced

Troposphere Model: Hopfield

Temp: 18.0000

Press: 1013.2500

Humid: 50.0000

Apply To: Selection

Default Value Ok

Figure 5-4-3 GNSS Configuration-trop

‘Troposphere Model’: Includes Hopfield, Saatamonien, software defaults to Hopfield.

‘Temp’: The software default value is 18 degrees Celsius.

‘Press’: The software defaults to 1013.25 Hauba.

‘Humid’: Software default value is 50%.

3. Dynamic

The dynamic calculation parameters mainly include the following items.

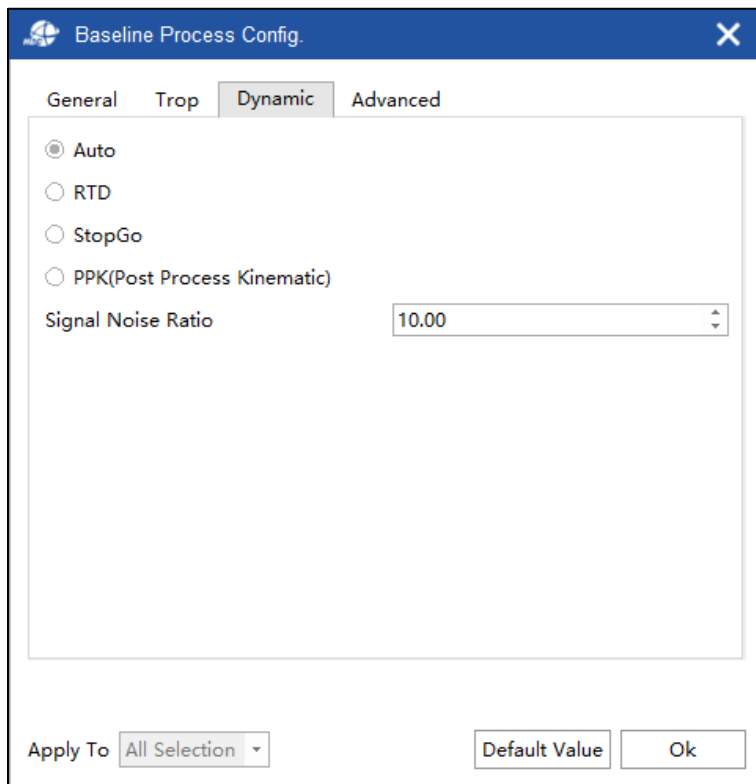
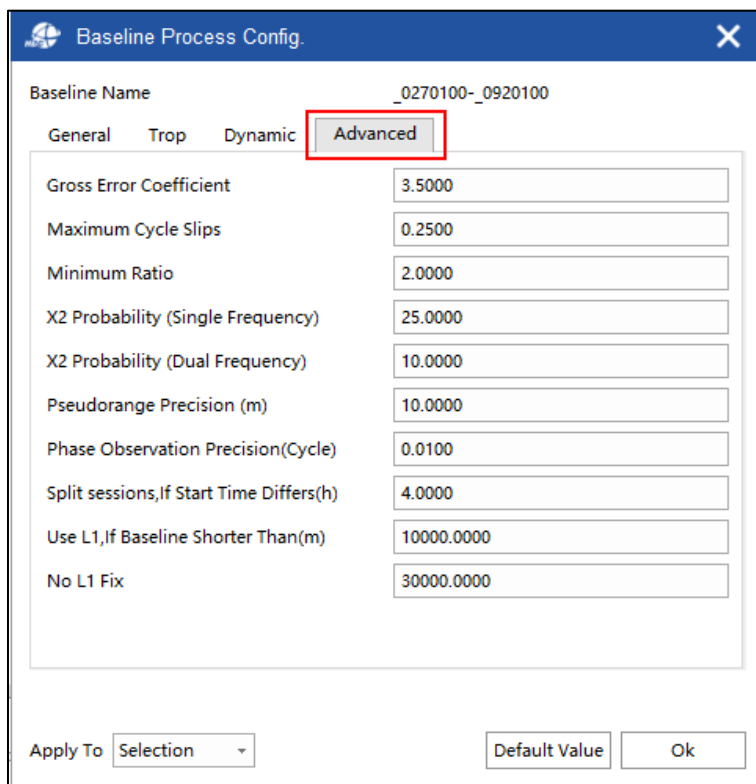


Figure 5-4-4 GNSS Configuration-dynamic

‘Signal Noise Ratio’: The software default value is 10.

4. Advanced

Advanced parameters include the following.



Baseline Process Config.	
Baseline Name	_0270100-_0920100
General Trop Dynamic Advanced	
Gross Error Coefficient	3.5000
Maximum Cycle Slips	0.2500
Minimum Ratio	2.0000
X2 Probability (Single Frequency)	25.0000
X2 Probability (Dual Frequency)	10.0000
Pseudorange Precision (m)	10.0000
Phase Observation Precision(Cycle)	0.0100
Split sessions, If Start Time Differs(h)	4.0000
Use L1, If Baseline Shorter Than(m)	10000.0000
No L1 Fix	30000.0000
Apply To: Selection Default Value Ok	

Figure 5-4-5 GNSS Configuration-advanced

‘Gross Error Coefficient’: The software default value is 3.5.

‘Maximum Cycle Slips’: The software default value is 0.25.

‘Minimum Ratio’: The software default value is 2.

‘X2 Probability (Single Frequency)’: The software default value is 25.

‘X2 Probability (Dual Frequency)’: The software default value is 10.

‘Pseudorange Precision(m)’: The software default value is 10.

‘Phase Observation Precision(Cycle)’: The software default value is 0.01.

‘Split sessions, If Start Time Differs(h)’: The software default value is 4.

‘Use L1, If Baseline Shorter Than(m)’: The software default value is 10000.

‘No L1 Fix’: The software default is 30000.

5.5 Searching for Closed Loops

This part is mainly used for searching closed loop again, click [Search Closed Loop] in the baseline module under [GNSS] menu bar of HBC software, the software pops up the Search Closed Loop dialog box. Asynchronous Ring Information.

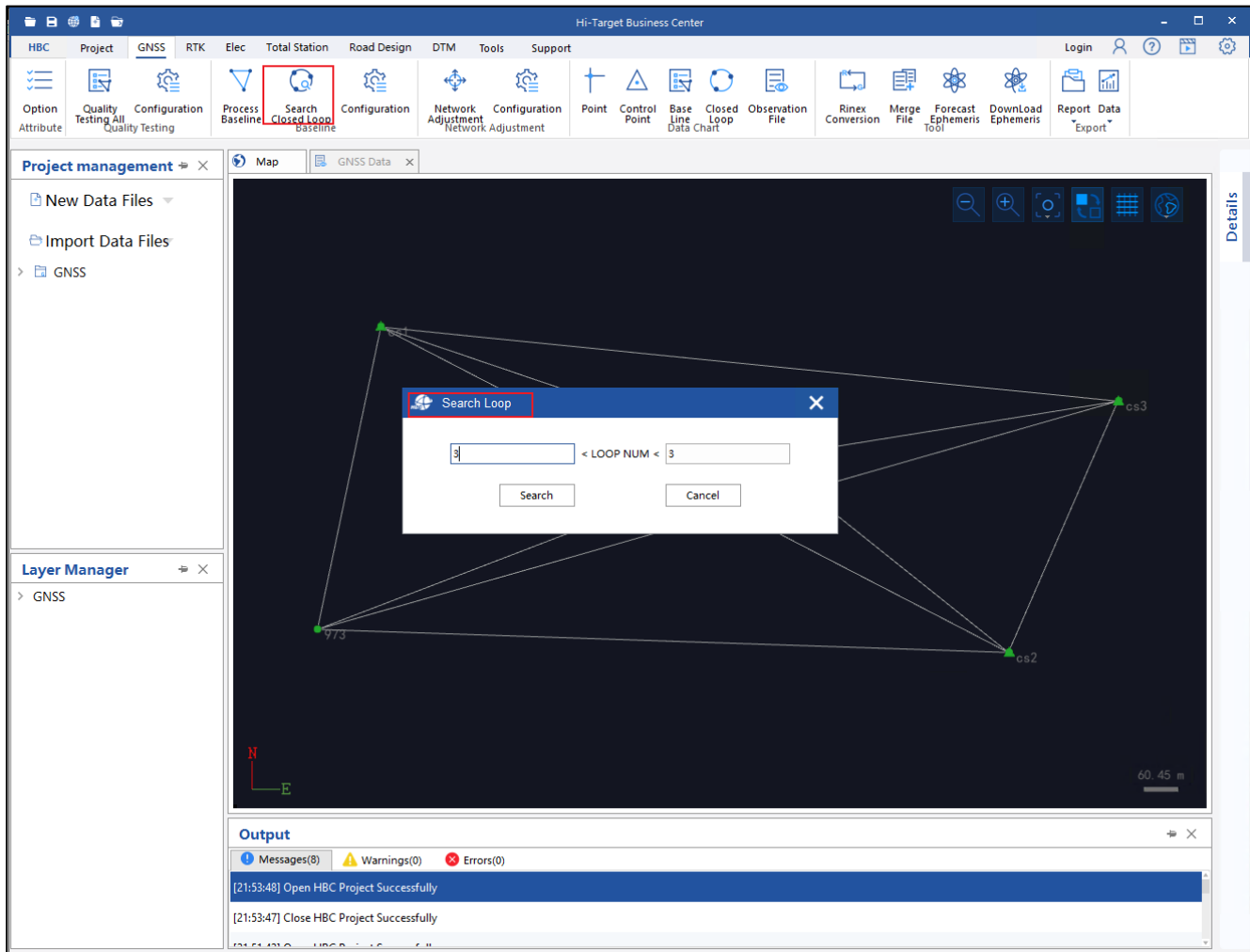


Figure 5-5-1 Search Closed Loop

5.6 Baseline Processing

This part is mainly used for baseline processing, click [Process Baseline] under [GNSS] menu bar in the upper left corner of the HBC software, the software will perform baseline solving according to the baseline solving configuration and pop up the baseline solving progress bar.

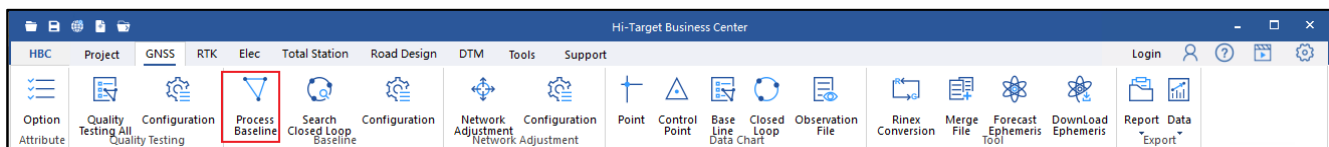


Figure 5-6-1 Process Baseline

1. Calculation

(1) Click [Process Baseline] under [GNSS] menu bar in the upper left corner of the HBC software to process all baselines.

(2) Right-click [Process All Baselines]\[Process Selected Baselines] in the GNSS baseline list to perform baseline solving.

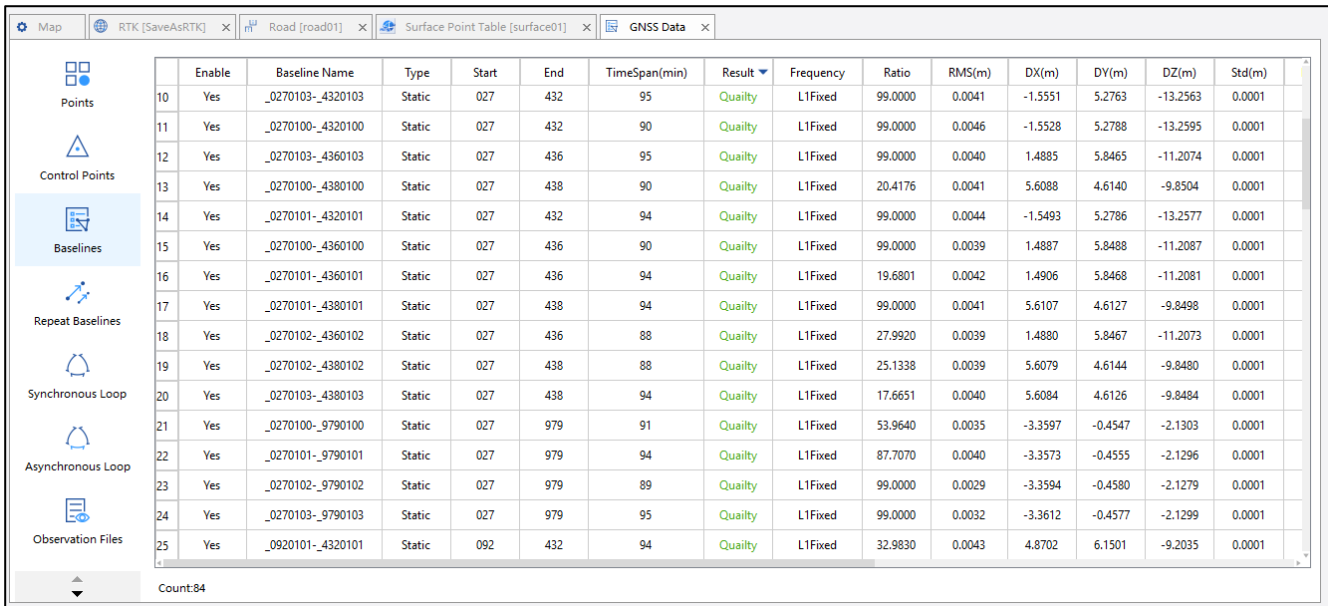
(3) Select a baseline, right-click [residual sequence diagram (T)] to enter the residual sequence Tab page of the baseline, click [solve].

2. Cancel

In the baseline solving process, click [Cancel] in the progress bar, the software will cancel the baseline solving operation.

3. Baseline Solver Results

After the baseline solving is complete, the baseline solving results will be refreshed in the [Baselines] list.



	Enable	Baseline Name	Type	Start	End	TimeSpan(min)	Result	Frequency	Ratio	RMS(m)	DX(m)	DY(m)	DZ(m)	Std(m)
10	Yes	_0270103-_4320103	Static	027	432	95	Quality	L1Fixed	99.0000	0.0041	-1.5551	5.2763	-13.2563	0.0001
11	Yes	_0270100-_4320100	Static	027	432	90	Quality	L1Fixed	99.0000	0.0046	-1.5528	5.2788	-13.2595	0.0001
12	Yes	_0270103-_4360103	Static	027	436	95	Quality	L1Fixed	99.0000	0.0040	1.4885	5.8465	-11.2074	0.0001
13	Yes	_0270100-_4380100	Static	027	438	90	Quality	L1Fixed	20.4176	0.0041	5.6088	4.6140	-9.8504	0.0001
14	Yes	_0270101-_4320101	Static	027	432	94	Quality	L1Fixed	99.0000	0.0044	-1.5493	5.2786	-13.2577	0.0001
15	Yes	_0270100-_4360100	Static	027	436	90	Quality	L1Fixed	99.0000	0.0039	1.4887	5.8488	-11.2087	0.0001
16	Yes	_0270101-_4360101	Static	027	436	94	Quality	L1Fixed	19.6801	0.0042	1.4906	5.8468	-11.2081	0.0001
17	Yes	_0270101-_4380101	Static	027	438	94	Quality	L1Fixed	99.0000	0.0041	5.6107	4.6127	-9.8498	0.0001
18	Yes	_0270102-_4360102	Static	027	436	88	Quality	L1Fixed	27.9920	0.0039	1.4880	5.8467	-11.2073	0.0001
19	Yes	_0270102-_4380102	Static	027	438	88	Quality	L1Fixed	25.1338	0.0039	5.6079	4.6144	-9.8480	0.0001
20	Yes	_0270103-_4380103	Static	027	438	94	Quality	L1Fixed	17.6651	0.0040	5.6084	4.6126	-9.8484	0.0001
21	Yes	_0270100-_9790100	Static	027	979	91	Quality	L1Fixed	53.9640	0.0035	-3.3597	-0.4547	-2.1303	0.0001
22	Yes	_0270101-_9790101	Static	027	979	94	Quality	L1Fixed	87.7070	0.0040	-3.3573	-0.4555	-2.1296	0.0001
23	Yes	_0270102-_9790102	Static	027	979	89	Quality	L1Fixed	99.0000	0.0029	-3.3594	-0.4580	-2.1279	0.0001
24	Yes	_0270103-_9790103	Static	027	979	95	Quality	L1Fixed	99.0000	0.0032	-3.3612	-0.4577	-2.1299	0.0001
25	Yes	_0920101-_4320101	Static	092	432	94	Quality	L1Fixed	32.9830	0.0043	4.8702	6.1501	-9.2035	0.0001

Figure 5-6-2 Baseline List

4. Baseline Processing Result Test

After the baseline processing is complete, the software will automatically check the baseline results according to the baseline processing configuration parameters.

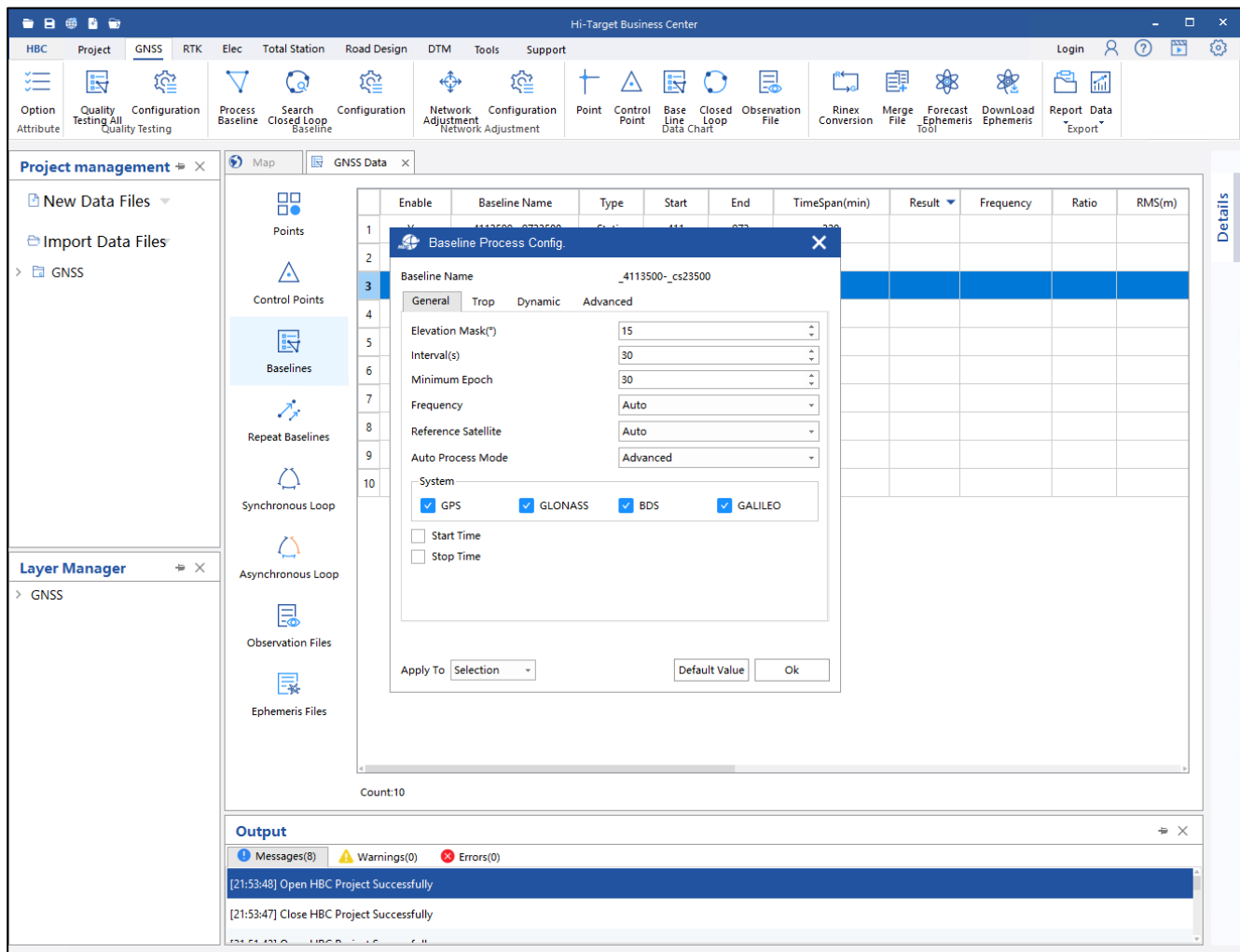


Figure 5-6-3 Baseline Processing Result Test

Note: In the baseline list, select the baseline data and click [Copy] or [Copy Contain Header] to copy the baseline list results to other tables.

5. Repeatedly Process A Baseline

When a baseline is unqualified, you can enter the residual sequence Tab page of the baseline, by changing the baseline settings or editing the baseline period and disabling repeated processing of a baseline.

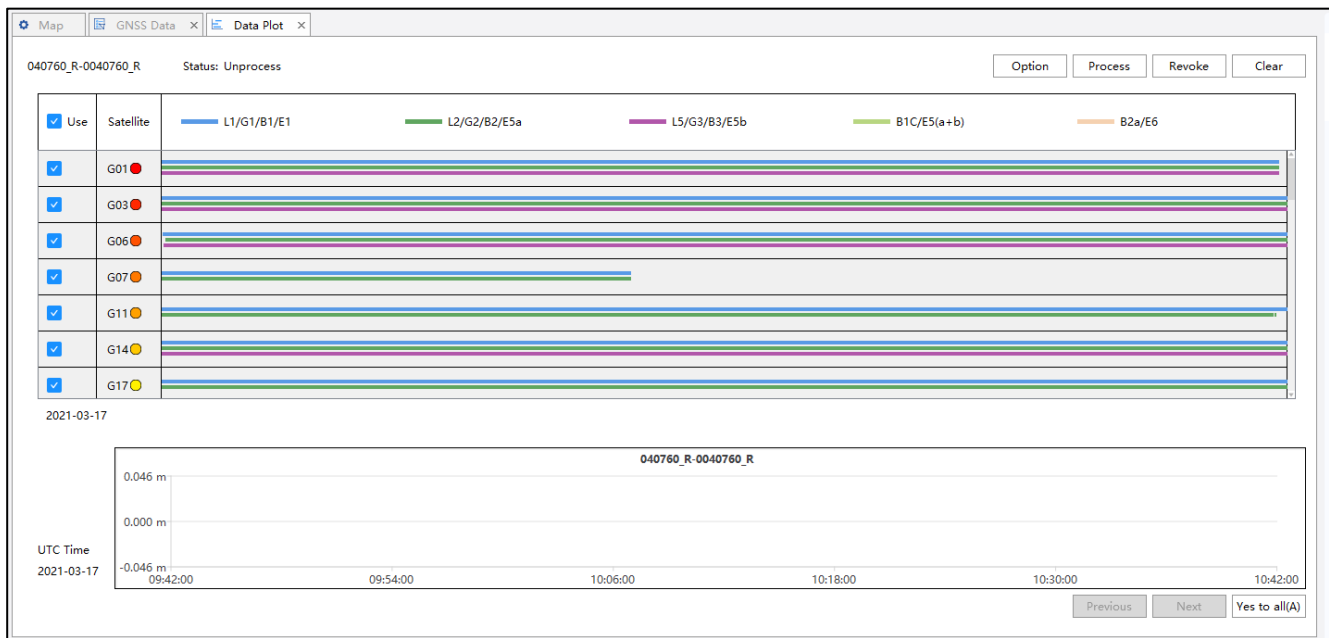


Figure 5-6-4 Data Plot-repeatedly Process A Baseline

6. Check the Map after Processing

In the solution state, the qualified baseline is green, the unqualified baseline is red, and the unresolved baseline is gray.

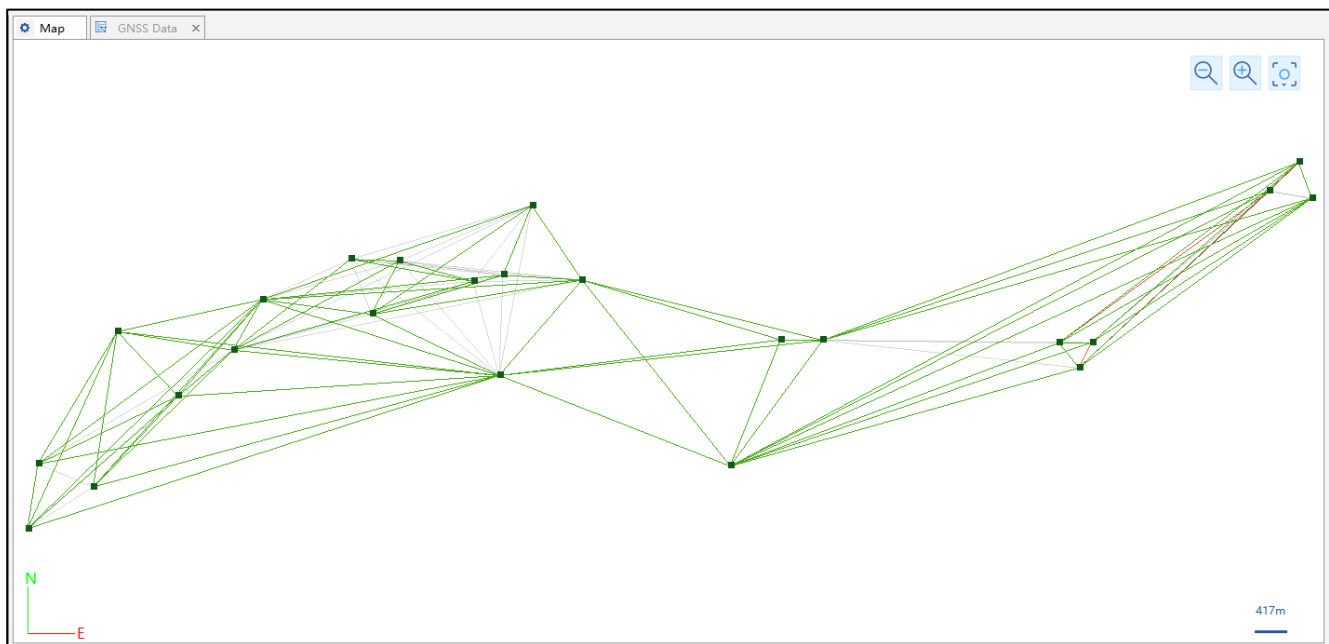


Figure 5-6-5 Map-check The Processed Baseline

Note: When the mouse is placed on the line chart of the baseline residual sequence, the cursor becomes a cross. You can zoom in and out by rolling the mouse wheel, click and drag to choose to disable part of the time.

- (1) Configuration: Click [Configuration] software pop-up baseline solving configuration box, by modifying the baseline solving configuration parameters to re-process the baseline.
- (2) Disable satellites: Disable a satellite from participating in satellite calculations by unchecking a satellite's enable box.
- (3) Disable the time period: click on the prn number of the satellite in the baseline residuals list to display the corresponding residual map of the satellite, click and drag the mouse to disable a time period according to the size of the residuals in the residual map or the continuity of the time period in the sequence map, so that the time period does not participate in the baseline solving.
- (4) Undo Disable: Undo the previous disable operation by clicking on the [Undo], or right-click on the disable time period to undo the disable operation; at the same time you can click on the [Clear] to undo all the disable operations.

7. Map Right-click Shortcut Menu

Select a site in the map and right-click the shortcut menu to delete, convert to control point and delete associated control point.

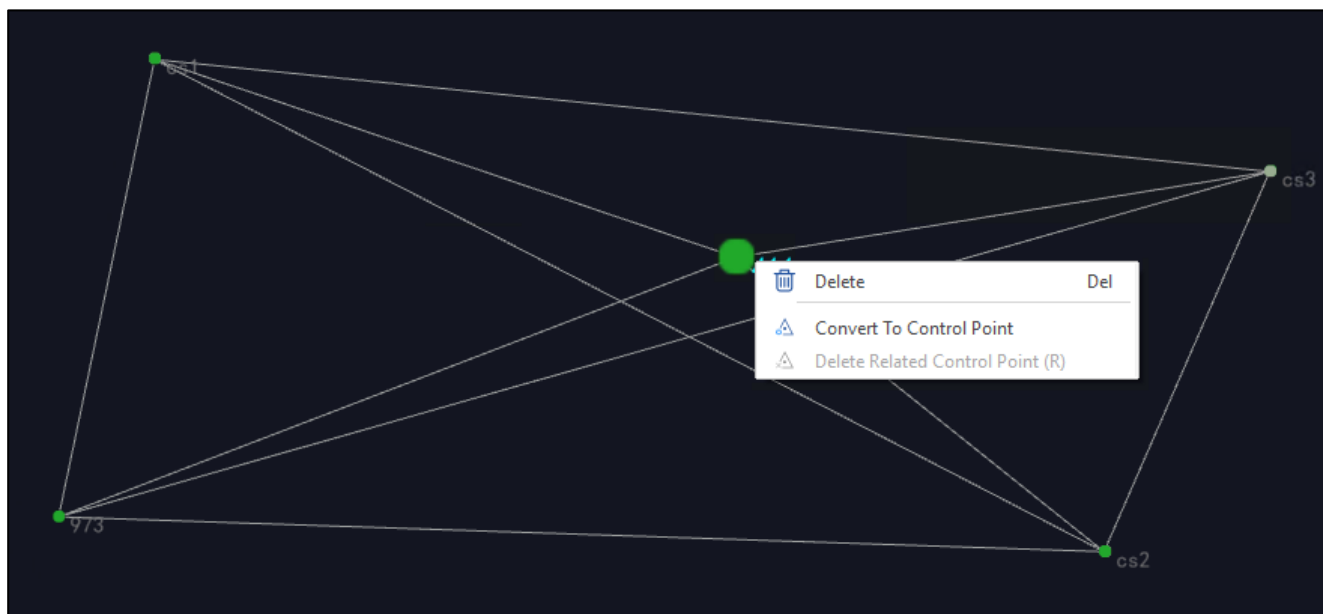


Figure 5-6-6 Map Right-click Shortcut Menu

Select a control point in the map, and delete and save it as a control point file through the right-click shortcut menu.

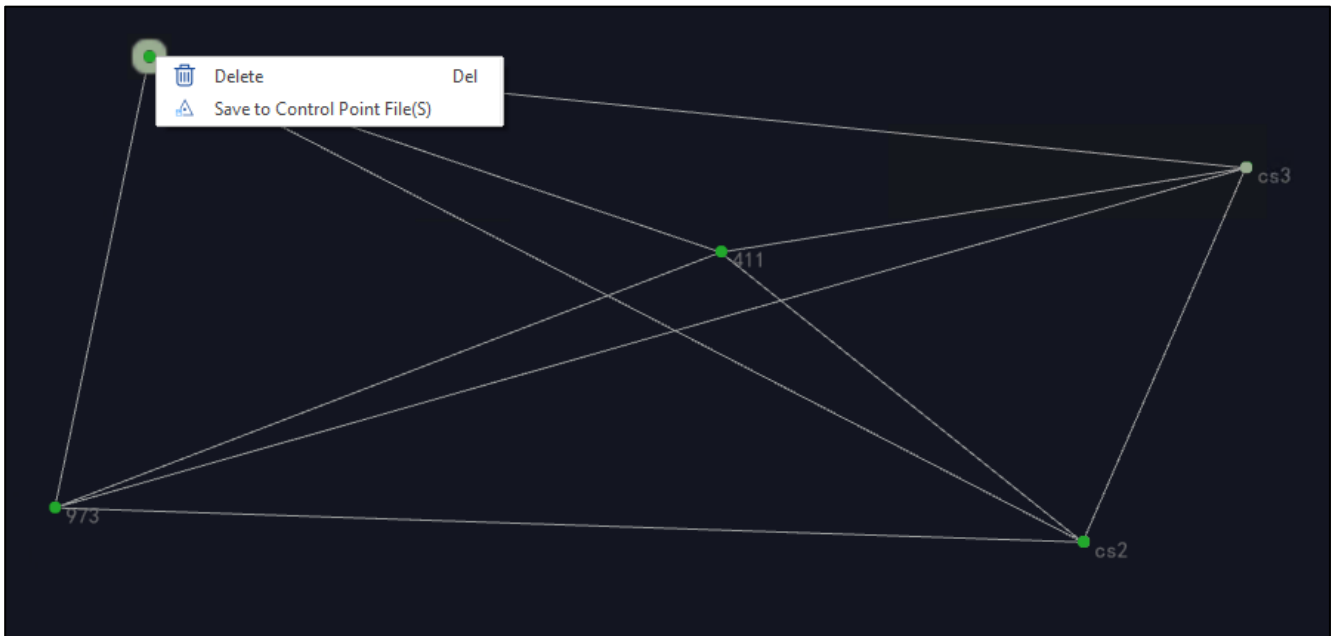


Figure 5-6-7 Map Right-click A Control Point

Select the baseline in the map, configure the baseline solution, process the selected baseline, process all baselines, set the baseline report, open the baseline report directory, delete, disable, exchange the start and end points, and the residual sequence diagram through the right-click shortcut menu.

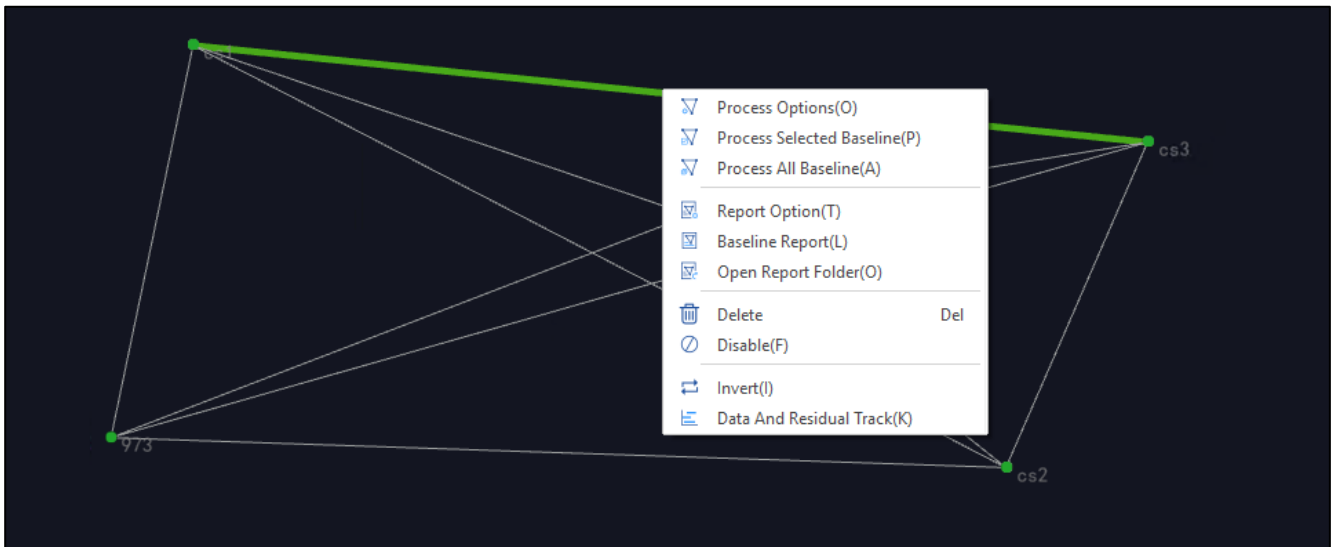


Figure 5-6-8 Map Right-click A Baseline

5.7 Network Adjustment

This section introduces the general flow of the software Network Adjustment, the software supports free Network Adjustment, 2D constraint Network Adjustment and elevation fitting, WGS84 coordinate system constraint leveling, and target coordinate system constraint leveling.

1. Network Adjustment Process

- (1) Configuration: coordinate system settings, Network Adjustment configuration.
- (2) Data Preparation: control points, baseline processing results.
- (3) Parity: software autocomplete.

2. Coordinate System Settings

Before Network Adjustment, you need to check the coordinate system parameters are set correctly, click HBC software [Project] - [Coordinate System] pop-up coordinate system dialog box, check the parameters are set correctly.

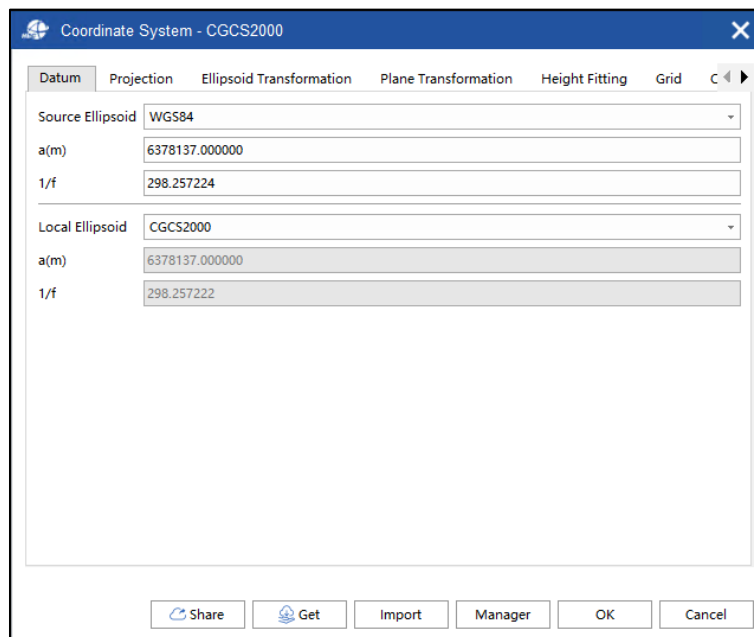


Figure 5-7-1 Coordinate System Setting

3. Network Adjustment Configuration

Click on [Configuration] under the HBC software [GNSS] Network Adjustment module, the Network Adjustment configuration dialog box will pop up.

(1) General

'Enable None-Fixed Baseline in adjustment': 1, yes; 2, no, the software default setting is no.

'3D Free': 1, Fixed anyone point; 2, Rank Defect Free; the software default setting is fixed anyone point.

'3D Biased': 1, Calculate 7 Parameter(S); 2, Don't Calculate 7 Para(T).

'Height Fitting': 1, none; 2, fixed difference correction; 3, plane fit; 4, quadratic surface fit; the software default is set to none.

'TAU Test': Fixed Error: the software default is 0.01m, 'Proportional Error': the software default is 1.00ppm.

'Significance': The software default is 1%;

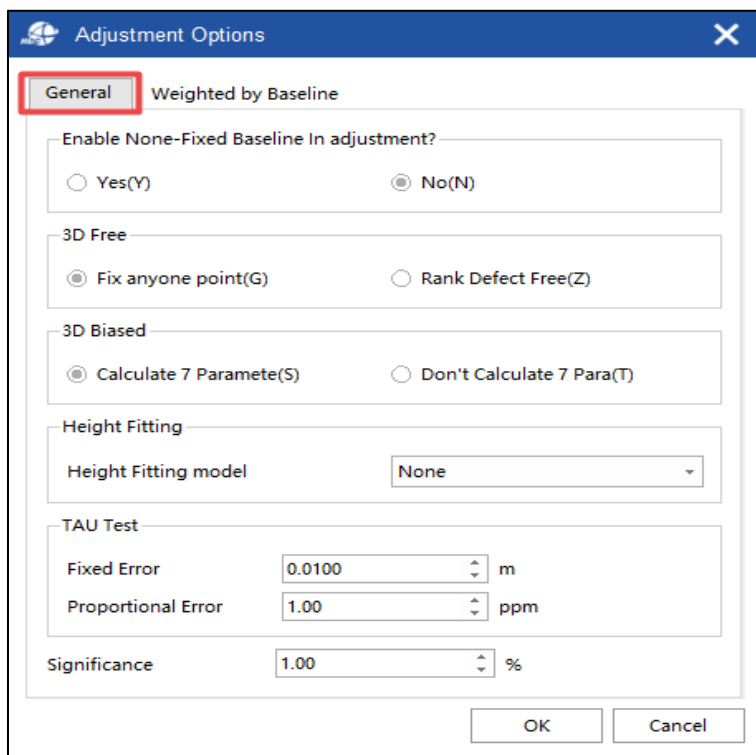


Figure 5-7-2 Adjustment Options-General

(2) Weighted by Baseline

'Coefficient of baseline Std.Dev': the software defaults to 10.0.

'Weighting': 1. Variance/Covariance Matrix(S); 2. Fixed Standard deviation(T).

which includes the following Fixed Standard Deviations:

'Fixed Standard Deviation': The default value of XYZ is 0.005m, and the default value of the relative error of XYZ is 1.0ppm.

'Rubost Estimation': The software defaults to Disable(N).

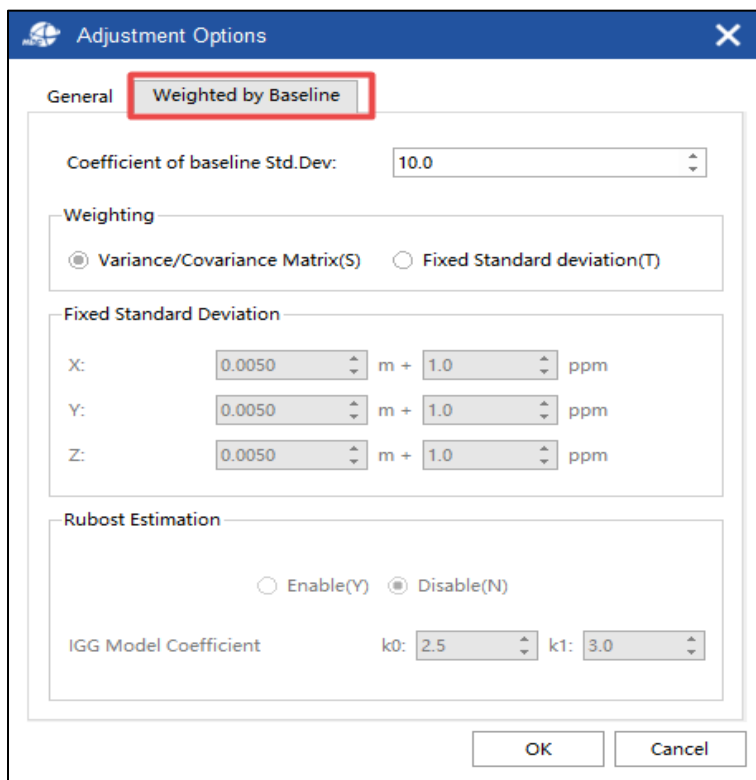


Figure 5-7-3 Adjustment Options-weighted by Baseline

4. Setting Control Points

(1) Click HBC Software [Project] - [Import] - [GNSS File] - [Control Point File] to import the control point file.

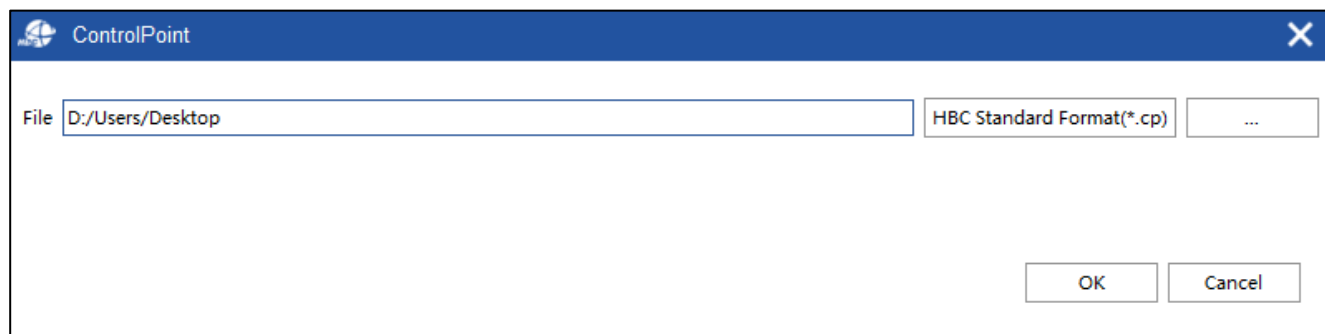


Figure 5-7-4 Import Control Point

(2) Convert the site to a control point by right-clicking on the site [Convert To Control Point], which can be edited in the properties window of the converted control point.

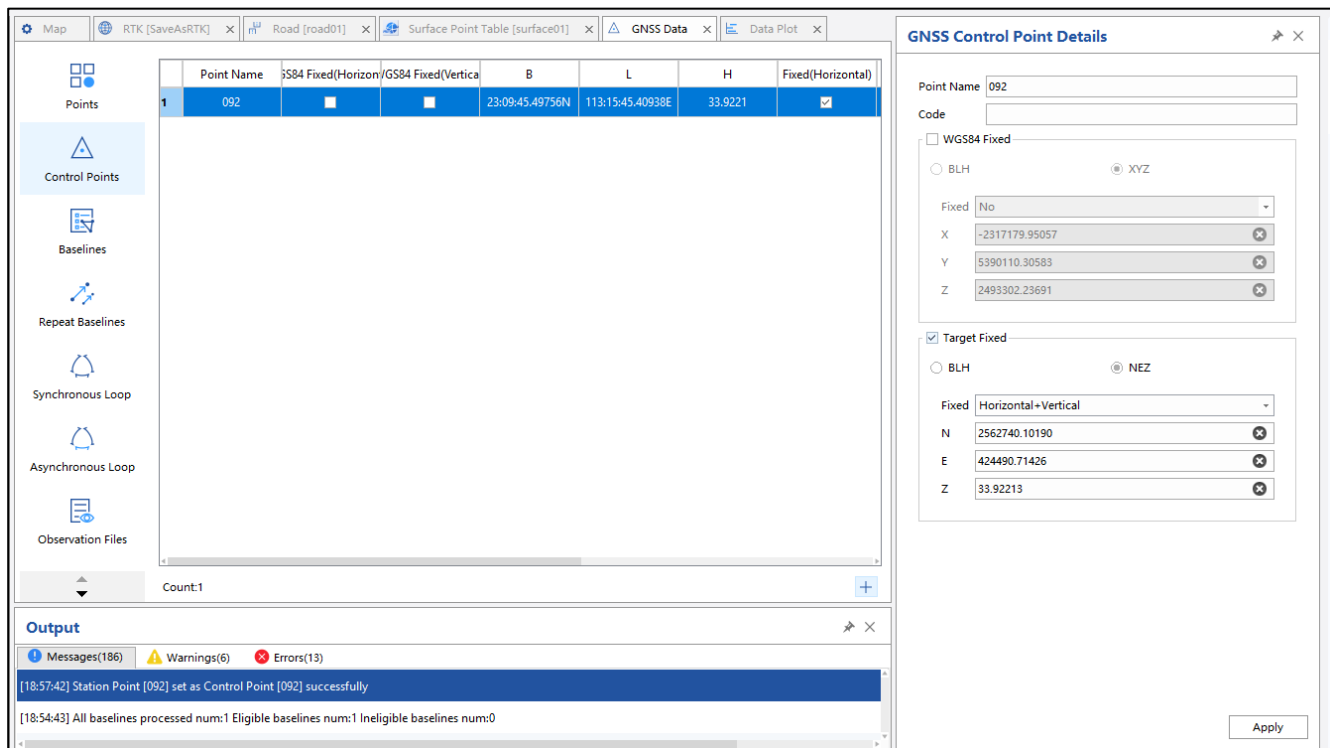


Figure 5-7-5 Set A Point to Control Point

(3) In the control point interface, right-click [Add Control Point (A)].

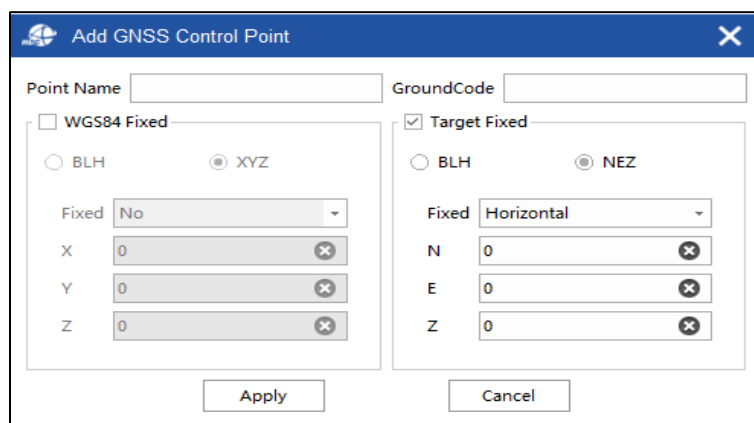


Figure 5-7-6 Add GNSS Control Point

5. Network Adjustment

Click HBC software [GNSS]-[Network Adjustment], the software pops up the dialog box of network spreads, when the spreads are finished, the information of the spreads will be displayed in the list, at the same time, you can click [Report] to view the results of the network spreads.

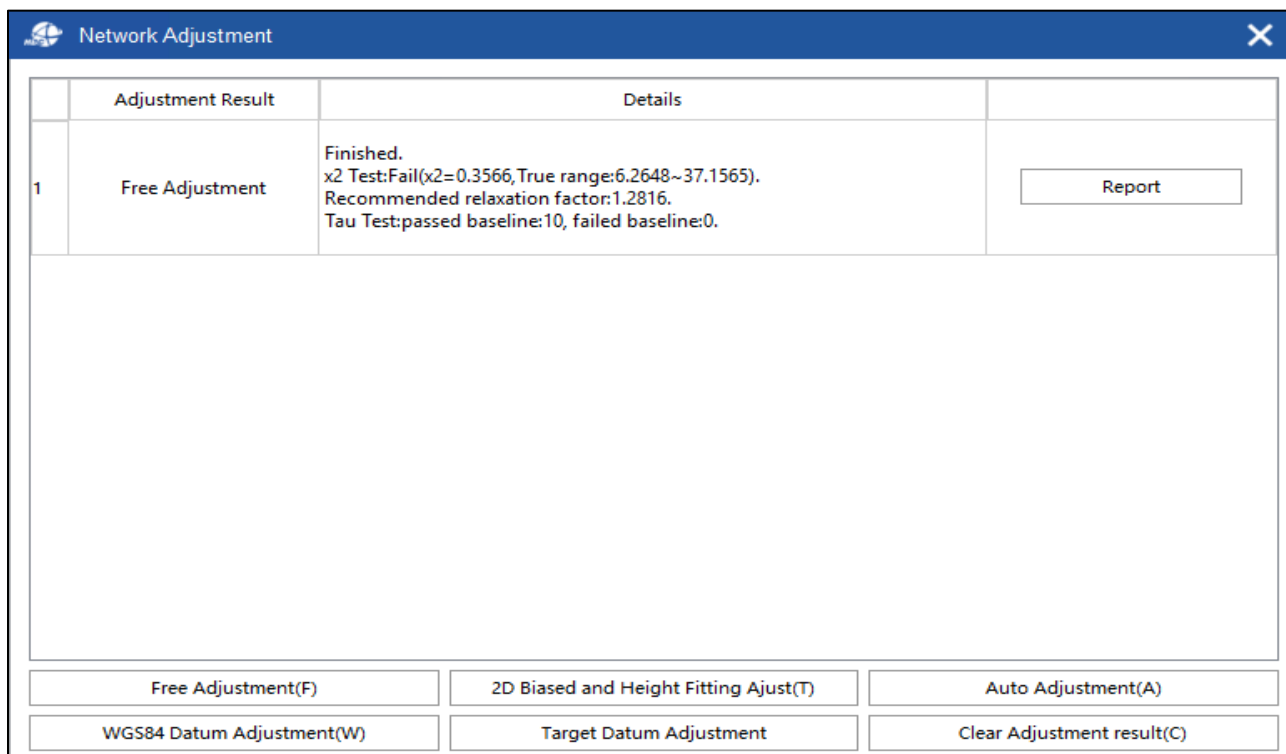


Figure 5-7-7 Network Adjustment Interface

- (1) Free Adjustment: The software automatically performs free adjustment based on baseline solving results, adjustment configuration, and observation station coordinates.
- (2) 2D Biased and Height Fitting Adjust: At least 2 locally constrained control points exist.
- (3) Auto Adjustment: At least 3 locally constrained control points if seven parameters are computed, at least 1 locally constrained control point if seven parameters are not computed.
- (4) WGS84 Datum Adjustment: At least 1 WGS84 constraint control point exists.
- (5) Target Datum Adjustment: Automatic corresponding levelling based on the number of control points and constraints.
- (6) Clear Adjustment results: Clear all parity results.

5.8 Data Charts

This section is used to display GNSS data, including Points, control points, baselines, repeating baselines, synchronous rings, asynchronous rings, observation files, and ephemeris files.

1. Points

(1) Points List Information

The point name of the Points, the geodesic coordinates of the Point under the source ellipsoid (BLH) and the planar coordinates of the site in the target coordinate system (NEZ).

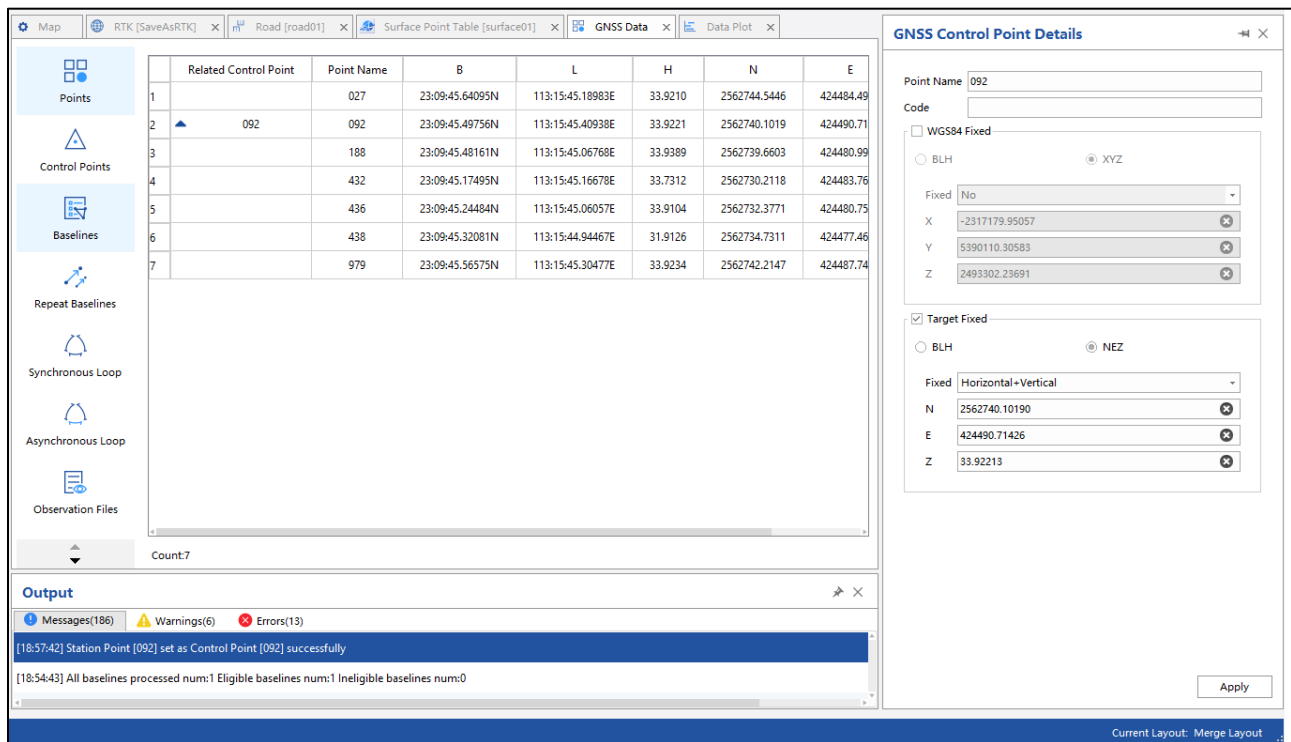


Figure 5-8-1 Point List Information

(2) Points List Right-click Shortcut Menu

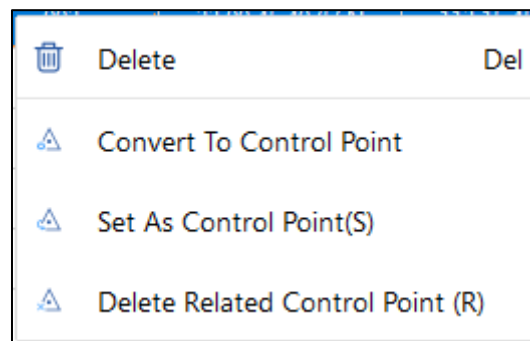


Figure 5-8-2 Points List Right-click Shortcut Menu

Delete: delete the Point;

Convert to Control Point: Converts the currently selected Point to a control point;

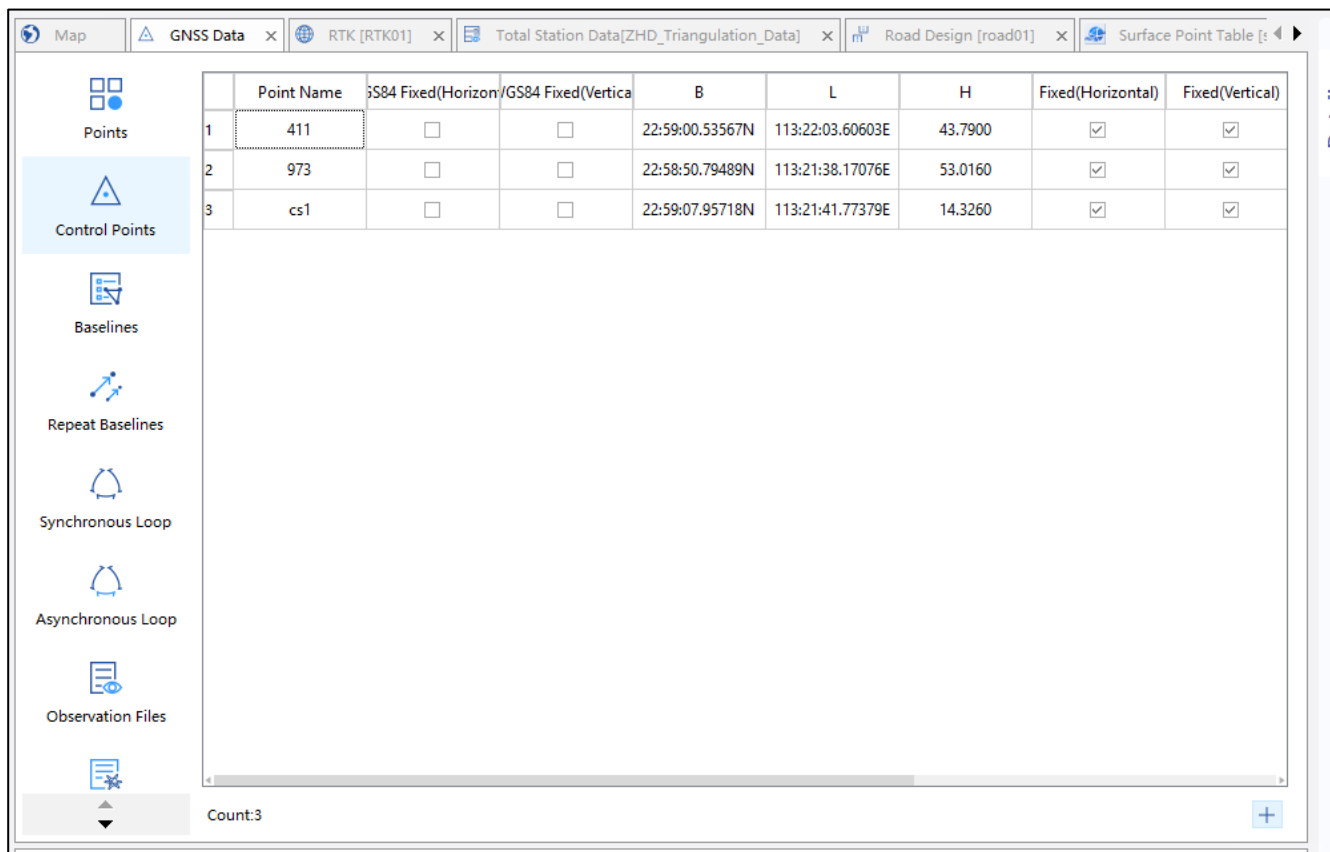
Set As Control Points(S): Associated control points for the selected Point;

Delete Related Control Points(R): Delete control points.

2. Control Points

(1) Control Point List Information

Point name, WGS84 Fixed(Horizontal), WGS84 Fixed(Vertical), BLH, Target Fixed(Horizontal), Target Fixed(Vertical), NEZ, Description.



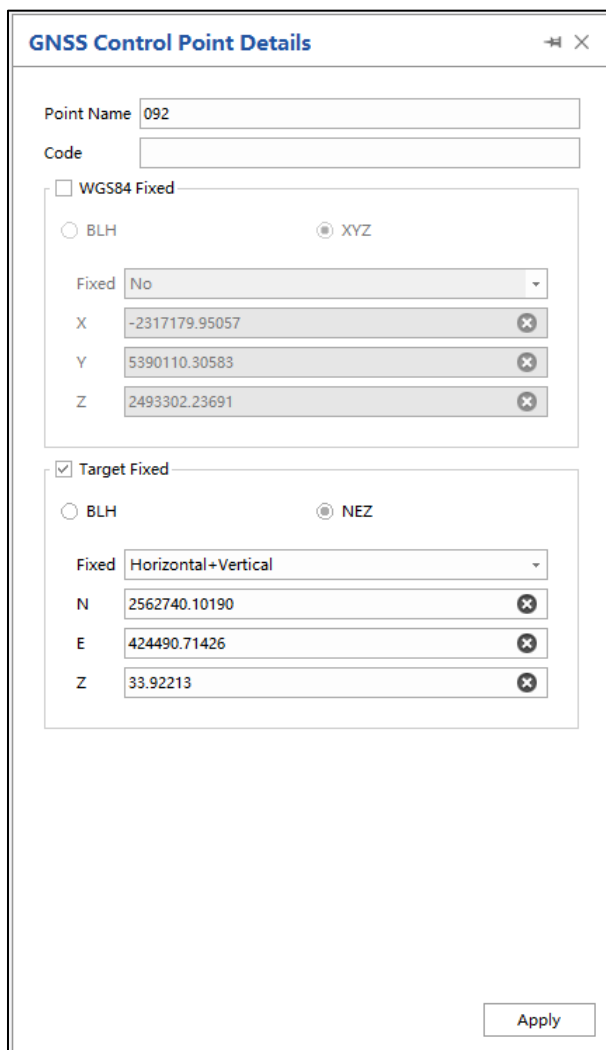
	Point Name	WGS84 Fixed(Horizon)	WGS84 Fixed(Vertical)	B	L	H	Fixed(Horizontal)	Fixed(Vertical)
1	411	☐	☐	22:59:00.53567N	113:22:03.60603E	43.7900	☒	☒
2	973	☐	☐	22:58:50.79489N	113:21:38.17076E	53.0160	☒	☒
3	cs1	☐	☐	22:59:07.95718N	113:21:41.77379E	14.3260	☒	☒

Count:3

Figure 5-8-3 Control Point List Information

(2) Control Point Details

Click on the list of control points and the software pops up the properties sidebar for that control point, which allows you to edit the information about the properties of the control point.



GNSS Control Point Details

Point Name: 092

Code:

☐ WGS84 Fixed

☐ BLH ☒ XYZ

Fixed: No

X: -2317179.95057

Y: 5390110.30583

Z: 2493302.23691

☒ Target Fixed

☐ BLH ☒ NEZ

Fixed: Horizontal+Vertical

N: 2562740.10190

E: 424490.71426

Z: 33.92213

Apply

Figure 5-8-4 GNSS Control Point Details

(3) Control Point List Right-click Shortcut Menu

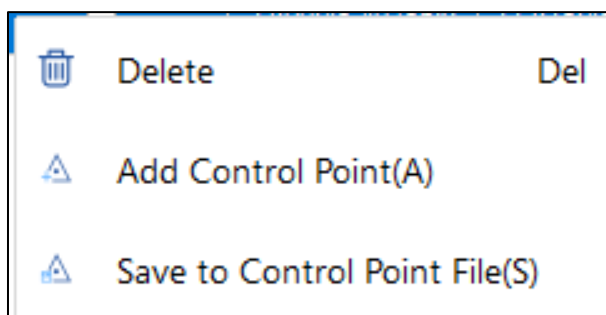


Figure 5-8-5 Control Point List Right-click Shortcut Menu

Delete: Delete the Control Point.

Add control point (A): Add control point.

Save as control point file: Save the control point information as a '*.cp' file.

3. Baselines

(1) Baselines List Information

Enable, Baseline Name, Type, Start, End, TimeSpan (min), Result, Solution Status, Ratio, RMS(m), DX(M), DY(m), DZ(m), Std (m), Length (m), Projection Length (m), Height Difference (m), Relative Error (ppm), Baseline Azimuth (dms).

Map

RTK [SaveAsRTK]

Road [road01]

Surface Point Table [surface01]

GNSS Data

Data Plot

Points

Control Points

Baselines

Repeat Baselines

Synchronous Loop

Asynchronous Loop

Observation Files

Count:84

	Enable	Baseline Name	Type	Start	End	TimeSpan(min)	Result	Frequency	Ratio	RMS(m)	DX(m)	DY(m)	DZ(m)	Std(m)	Length(m)
7	Yes	_0270102_-1880103	Static	027	188	89	Quality	L1Fixed	99.0000	0.0043	2.4277	3.1485	-4.5017	0.0003	6.0060
8	Yes	_0270103_-1880103	Static	027	188	95	Quality	L1Fixed	99.0000	0.0037	2.4271	3.1504	-4.5009	0.0008	6.0060
9	Yes	_0270102_-4320102	Static	027	432	88	Quality	L1Fixed	99.0000	0.0041	-1.5529	5.2773	-13.2537	0.0001	14.3500
10	Yes	_0270103_-4320103	Static	027	432	95	Quality	L1Fixed	99.0000	0.0041	-1.5551	5.2763	-13.2563	0.0001	14.3520
11	Yes	_0270100_-4320100	Static	027	432	90	Quality	L1Fixed	99.0000	0.0046	-1.5528	5.2788	-13.2595	0.0001	14.3550
12	Yes	_0270103_-4360103	Static	027	436	95	Quality	L1Fixed	99.0000	0.0040	1.4885	5.8465	-11.2074	0.0001	12.7280
13	Yes	_0270100_-4380100	Static	027	438	90	Quality	L1Fixed	20.4176	0.0041	5.6088	4.6140	-9.8504	0.0001	12.2380
14	Yes	_0270101_-4320101	Static	027	432	94	Quality	L1Fixed	99.0000	0.0044	-1.5493	5.2786	-13.2577	0.0001	14.3530
15	Yes	_0270100_-4360100	Static	027	436	90	Quality	L1Fixed	99.0000	0.0039	1.4887	5.8488	-11.2087	0.0001	12.7300
16	Yes	_0270101_-4360101	Static	027	436	94	Quality	L1Fixed	19.6801	0.0042	1.4906	5.8468	-11.2081	0.0001	12.7290
17	Yes	_0270101_-4380101	Static	027	438	94	Quality	L1Fixed	99.0000	0.0041	5.6107	4.6127	-9.8498	0.0001	12.2380
18	Yes	_0270102_-4360102	Static	027	436	88	Quality	L1Fixed	27.9920	0.0039	1.4880	5.8467	-11.2073	0.0001	12.7280
19	Yes	_0270102_-4380102	Static	027	438	88	Quality	L1Fixed	25.1338	0.0039	5.6079	4.6144	-9.8480	0.0001	12.2360
20	Yes	_0270103_-4380103	Static	027	438	94	Quality	L1Fixed	17.6651	0.0040	5.6084	4.6126	-9.8484	0.0001	12.2360
21	Yes	_0270100_-9790100	Static	027	979	91	Quality	L1Fixed	53.9640	0.0035	-3.3597	-0.4547	-2.1303	0.0001	4.0040
22	Yes	0270101- 9790101	Static	027	979	94	Quality	L1Fixed	87.7070	0.0040	-3.3573	-0.4555	-2.1296	0.0001	4.0010

Output

Messages(186)

Warnings(6)

Errors(13)

[18:57:42] Station Point [092] set as Control Point [092] successfully

[18:54:43] All baselines processed num:1 Eligible baselines num:1 Ineligible baselines num:0

Figure 5-8-6 Baselines List Information

(2) Baselines List Right-click Shortcut Menu

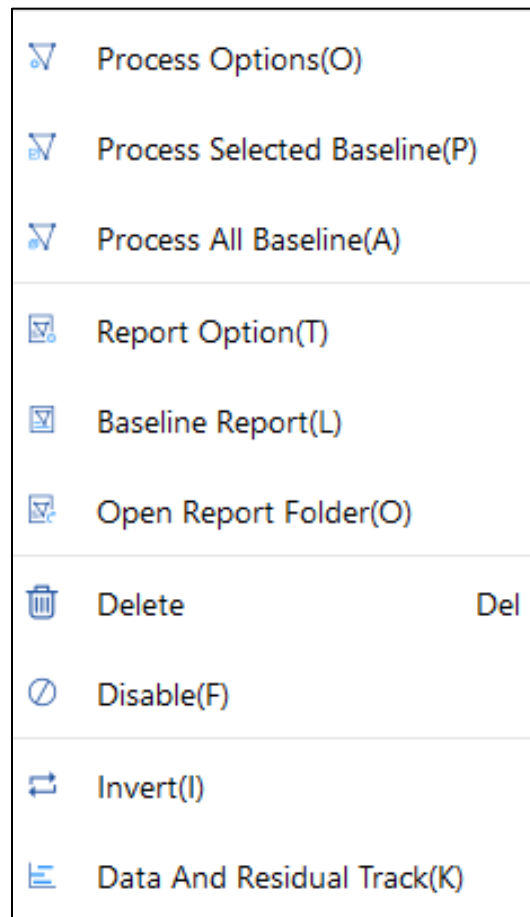


Figure 5-8-7 Baselines List Right-click Shortcut Menu

Process Options(O): sets the baseline solving parameters.

Processing Selected Baseline(P): solves the currently selected baseline.

Processing All Baseline(A): solving all baselines.

Report Option(T): sets the information exported from the baseline report.

Baseline Report(L): exporting the baseline report.

Open Report Folder(O): opens the folder where the baseline report is located.

Delete(D): deletes the currently selected baseline.

Disable(F): disables baseline solving for the currently selected baseline.

Invert(I): the start and end points of the exchange baseline.

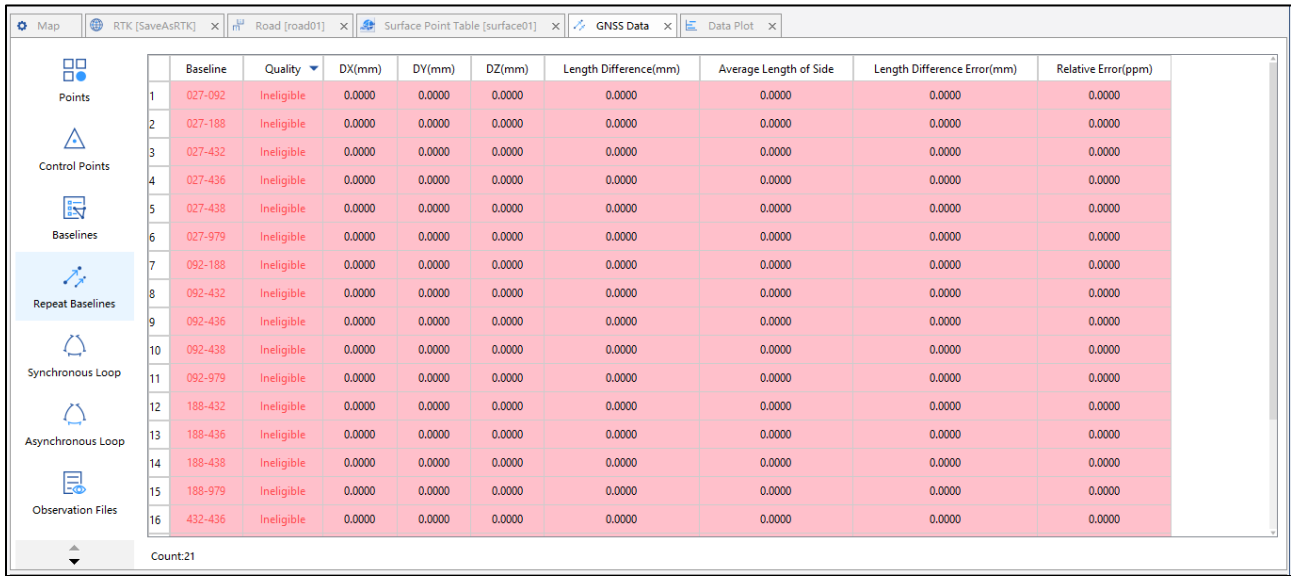
Data And Residual Track(T): residual sequence diagram for baseline.

4. Repeat Baseline

Repeat baseline list information: The repeat baseline list mainly shows the repeat baseline quality check results, which will be checked automatically after the baseline solving, and the unqualified check items will be marked red by the software.

The duplicate baseline list will display the duplicate baseline quality check results.

Baseline, Quality, DX (mm), DY (mm), DZ (mm), Length Difference (mm), Average Length of Side (m), Length Difference Error (m), Relative Error (ppm).



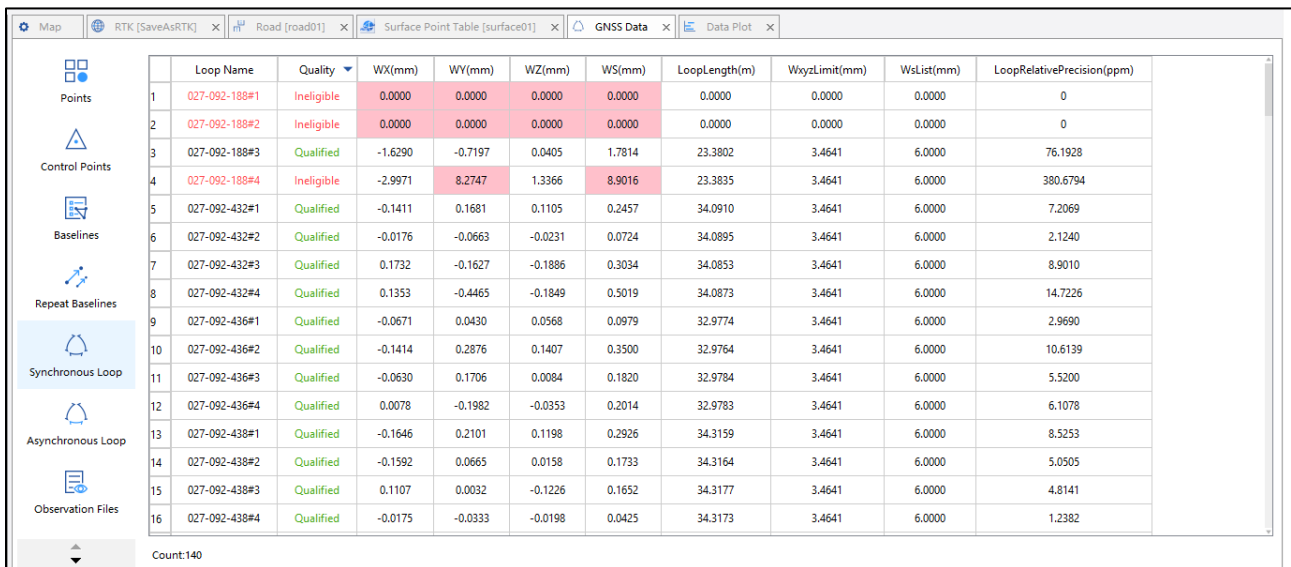
	Baseline	Quality	DX(mm)	DY(mm)	DZ(mm)	Length Difference(mm)	Average Length of Side	Length Difference Error(mm)	Relative Error(ppm)
1	027-092	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	027-188	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	027-432	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	027-436	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	027-438	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	027-979	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	092-188	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	092-432	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	092-436	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	092-438	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	092-979	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	188-432	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	188-436	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	188-438	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	188-979	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	432-436	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Count:21

Figure 5-8-8 Repeat Baseline List

5. Synchronous Ring

The list of synchronized closed rings mainly includes name, Quality, WX(mm), WY(mm), WZ(mm), WS(mm), LoopLength (m), WxyzLimit (mm), WsList (mm), LoopRelativePresion (ppm).



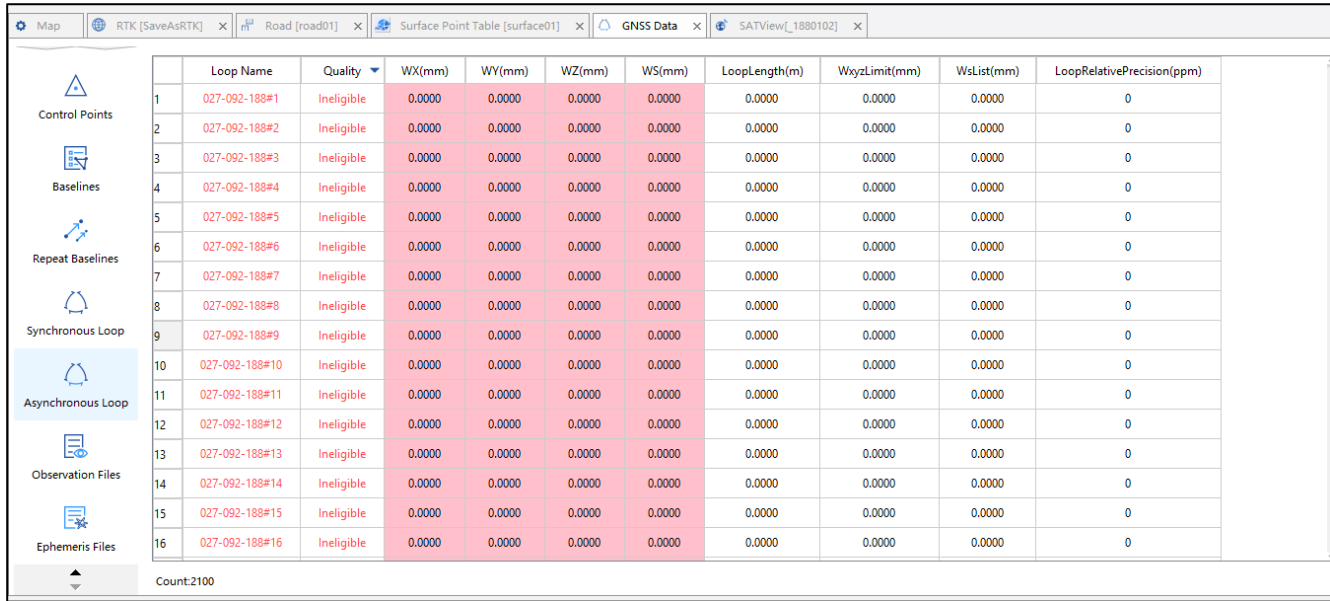
	Loop Name	Quality	WX(mm)	WY(mm)	WZ(mm)	WS(mm)	LoopLength(m)	WxyzLimit(mm)	WsList(mm)	LoopRelativePrecision(ppm)
1	027-092-188#1	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
2	027-092-188#2	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
3	027-092-188#3	Qualified	-1.6290	-0.7197	0.0405	1.7814	23.3802	3.4641	6.0000	76.1928
4	027-092-188#4	Ineligible	-2.9971	8.2747	1.3366	8.9016	23.3835	3.4641	6.0000	380.6794
5	027-092-432#1	Qualified	-0.1411	0.1681	0.1105	0.2457	34.0910	3.4641	6.0000	7.2069
6	027-092-432#2	Qualified	-0.0176	-0.0663	-0.0231	0.0724	34.0895	3.4641	6.0000	2.1240
7	027-092-432#3	Qualified	0.1732	-0.1627	-0.1886	0.3034	34.0853	3.4641	6.0000	8.9010
8	027-092-432#4	Qualified	0.1353	-0.4465	-0.1849	0.5019	34.0873	3.4641	6.0000	14.7226
9	027-092-436#1	Qualified	-0.0671	0.0430	0.0568	0.0979	32.9774	3.4641	6.0000	2.9690
10	027-092-436#2	Qualified	-0.1414	0.2876	0.1407	0.3500	32.9764	3.4641	6.0000	10.6139
11	027-092-436#3	Qualified	-0.0630	0.1706	0.0084	0.1820	32.9784	3.4641	6.0000	5.5200
12	027-092-436#4	Qualified	0.0078	-0.1982	-0.0353	0.2014	32.9783	3.4641	6.0000	6.1078
13	027-092-438#1	Qualified	-0.1646	0.2101	0.1198	0.2926	34.3159	3.4641	6.0000	8.5253
14	027-092-438#2	Qualified	-0.1592	0.0665	0.0158	0.1733	34.3164	3.4641	6.0000	5.0505
15	027-092-438#3	Qualified	0.1107	0.0032	-0.1226	0.1652	34.3177	3.4641	6.0000	4.8141
16	027-092-438#4	Qualified	-0.0175	-0.0333	-0.0198	0.0425	34.3173	3.4641	6.0000	1.2382

Count:140

Figure 5-8-9 Synchronous Ring List

6. Asynchronous Ring

The asynchronous closed ring mainly includes name, Quality, WX(mm), WY(mm), WZ(mm), WS(mm), LoopLength (m), WxyzLimit (mm), WsList (mm), LoopRelativePresion (ppm).



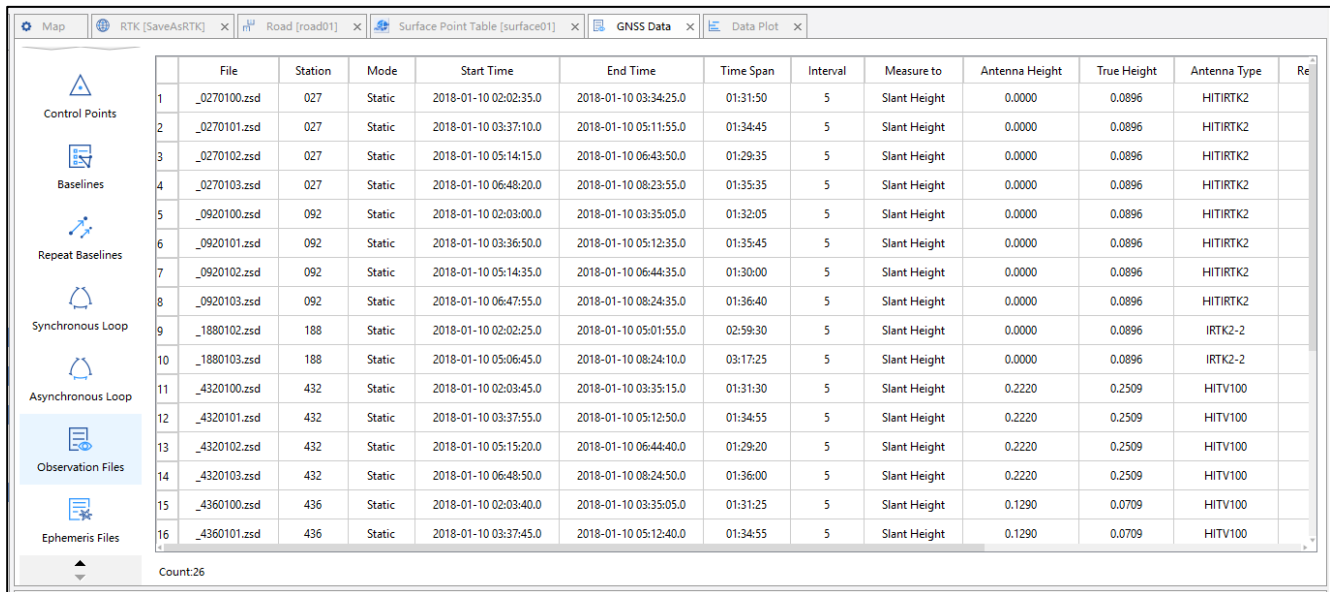
	Loop Name	Quality	WX(mm)	WY(mm)	WZ(mm)	WS(mm)	LoopLength(m)	WxyzLimit(mm)	WsList(mm)	LoopRelativePrecision(ppm)
1	027-092-188#1	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
2	027-092-188#2	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
3	027-092-188#3	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
4	027-092-188#4	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
5	027-092-188#5	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
6	027-092-188#6	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
7	027-092-188#7	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
8	027-092-188#8	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
9	027-092-188#9	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
10	027-092-188#10	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
11	027-092-188#11	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
12	027-092-188#12	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
13	027-092-188#13	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
14	027-092-188#14	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
15	027-092-188#15	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
16	027-092-188#16	Ineligible	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0

Figure 5-8-10 Asynchronous Ring List

7. Observe Files

(1) Observation Files List Information

File, Station, Mode, Start Time, End Time, Time Span, Interval, Measure to, Antenna Height, True Height, Antenna Type, Receiver Type, Receiver SN, File Path.

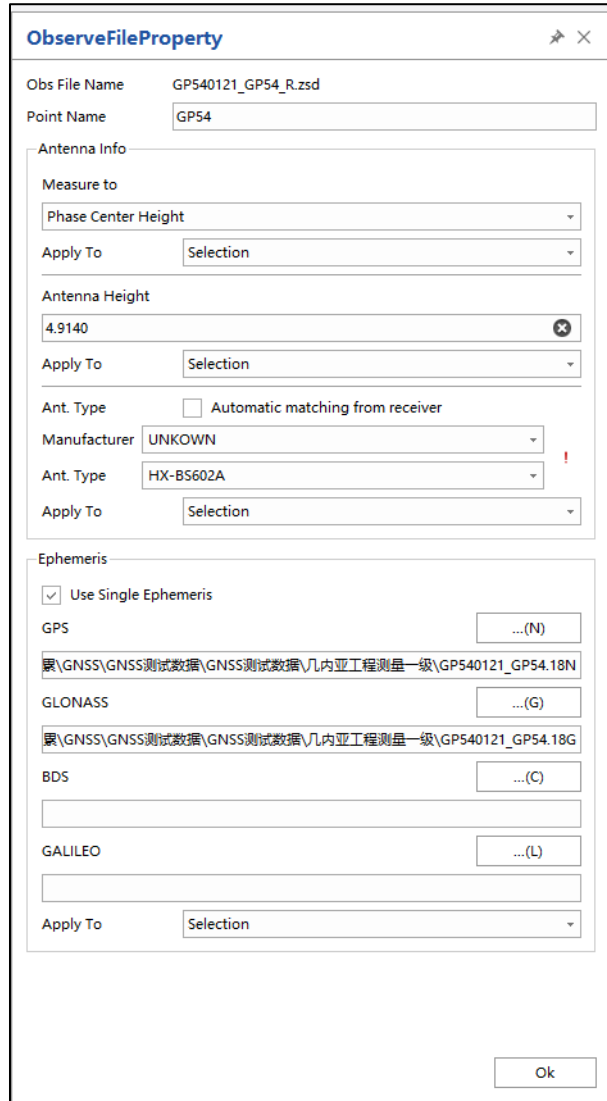


	File	Station	Mode	Start Time	End Time	Time Span	Interval	Measure to	Antenna Height	True Height	Antenna Type	Re
1	_0270100.zsd	027	Static	2018-01-10 02:02:35.0	2018-01-10 03:34:25.0	01:31:50	5	Slant Height	0.0000	0.0896	HITIRTK2	
2	_0270101.zsd	027	Static	2018-01-10 03:37:10.0	2018-01-10 05:11:55.0	01:34:45	5	Slant Height	0.0000	0.0896	HITIRTK2	
3	_0270102.zsd	027	Static	2018-01-10 05:14:15.0	2018-01-10 06:43:50.0	01:29:35	5	Slant Height	0.0000	0.0896	HITIRTK2	
4	_0270103.zsd	027	Static	2018-01-10 06:48:20.0	2018-01-10 08:23:55.0	01:35:35	5	Slant Height	0.0000	0.0896	HITIRTK2	
5	_0920100.zsd	092	Static	2018-01-10 02:03:00.0	2018-01-10 03:35:05.0	01:32:05	5	Slant Height	0.0000	0.0896	HITIRTK2	
6	_0920101.zsd	092	Static	2018-01-10 03:36:50.0	2018-01-10 05:12:35.0	01:35:45	5	Slant Height	0.0000	0.0896	HITIRTK2	
7	_0920102.zsd	092	Static	2018-01-10 05:14:35.0	2018-01-10 06:44:35.0	01:30:00	5	Slant Height	0.0000	0.0896	HITIRTK2	
8	_0920103.zsd	092	Static	2018-01-10 06:47:55.0	2018-01-10 08:24:35.0	01:36:40	5	Slant Height	0.0000	0.0896	HITIRTK2	
9	_1880102.zsd	188	Static	2018-01-10 02:02:25.0	2018-01-10 05:01:55.0	02:59:30	5	Slant Height	0.0000	0.0896	IRTK2-2	
10	_1880103.zsd	188	Static	2018-01-10 05:06:45.0	2018-01-10 08:24:10.0	03:17:25	5	Slant Height	0.0000	0.0896	IRTK2-2	
11	_4320100.zsd	432	Static	2018-01-10 02:03:45.0	2018-01-10 03:35:15.0	01:31:30	5	Slant Height	0.2220	0.2509	HITV100	
12	_4320101.zsd	432	Static	2018-01-10 03:37:55.0	2018-01-10 05:12:50.0	01:34:55	5	Slant Height	0.2220	0.2509	HITV100	
13	_4320102.zsd	432	Static	2018-01-10 05:15:20.0	2018-01-10 06:44:40.0	01:29:20	5	Slant Height	0.2220	0.2509	HITV100	
14	_4320103.zsd	432	Static	2018-01-10 06:48:50.0	2018-01-10 08:24:50.0	01:36:00	5	Slant Height	0.2220	0.2509	HITV100	
15	_4360100.zsd	436	Static	2018-01-10 02:03:40.0	2018-01-10 03:35:05.0	01:31:25	5	Slant Height	0.1290	0.0709	HITV100	
16	_4360101.zsd	436	Static	2018-01-10 03:37:45.0	2018-01-10 05:12:40.0	01:34:55	5	Slant Height	0.1290	0.0709	HITV100	

Figure 5-8-11 Observation Files List

(2) Observe File Attributes

Click the list of observation files and the software pops up the properties sidebar for the currently selected observation file.



ObserveFileProperty

Obs File Name: GP540121_GP54_R.zsd

Point Name: GP54

Antenna Info

Measure to: Phase Center Height

Apply To: Selection

Antenna Height: 4.9140

Apply To: Selection

Ant. Type: ☐ Automatic matching from receiver

Manufacturer: UNKNOWN

Ant. Type: HX-BS602A

Apply To: Selection

Ephemeris

☒ Use Single Ephemeris

GPS: ... (N)

累\GNSS\GNSS测试数据\GNSS测试数据\几内亚工程测量一级\GP540121_GP54.18N

GLONASS: ... (G)

累\GNSS\GNSS测试数据\GNSS测试数据\几内亚工程测量一级\GP540121_GP54.18G

BDS: ... (C)

GALILEO: ... (L)

Apply To: Selection

Ok

Figure 5-8-12 Observe File Property

Point Name: Users can edit and modify the site name.

Measure to: GNSS measurement antenna height measurement mode, mainly includes 'reference point - straight height (V)', 'reference point - slope (S)', 'instrument', and 'the height of the antenna'. /The antenna bottom - mast height (P)', 'antenna phase center - antenna height' 4 measurement methods for users to select.

Antenna Height: the user can modify the height of the antenna measure.

Ant Type: The software automatically matches the antenna manufacturer and antenna type according to the receiver by default, if it can't match the corresponding antenna type, the software will display a

red exclamation mark after the antenna type, prompting the user with no matching antenna parameters; at the same time, the user can remove the self-matching checkbox according to the receiver, and choose the antenna manufacturer and antenna type on their own.

Antenna type: The software automatically matches the antenna manufacturer and antenna type according to the receiver by default.

Apply To: selected, all, the user can choose to apply the modified observation file properties to the currently selected file or all files.

(3)Observe the File List Right-click Shortcut Menu

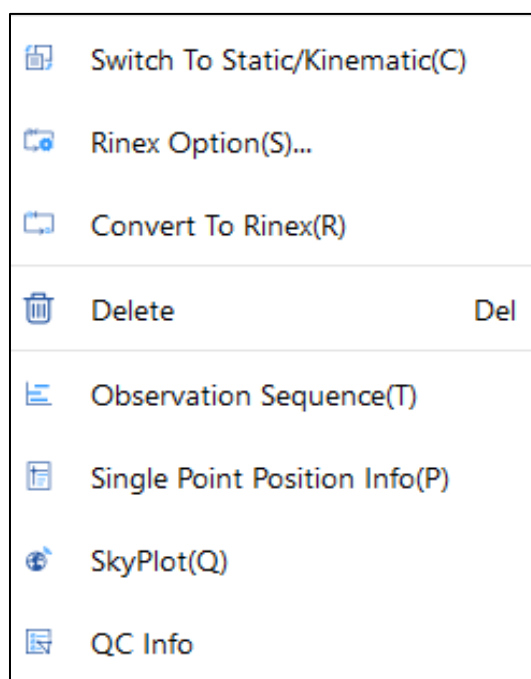


Figure 5-8-13 Observation Files List Right-click Shortcut Menu

Convert to Rinex(R): the software converts the currently selected file to a Rinex file.

Delete:Delete the currently selected observation.

Observation Sequence(T): displays the observation sequence information for the currently selected observation file.

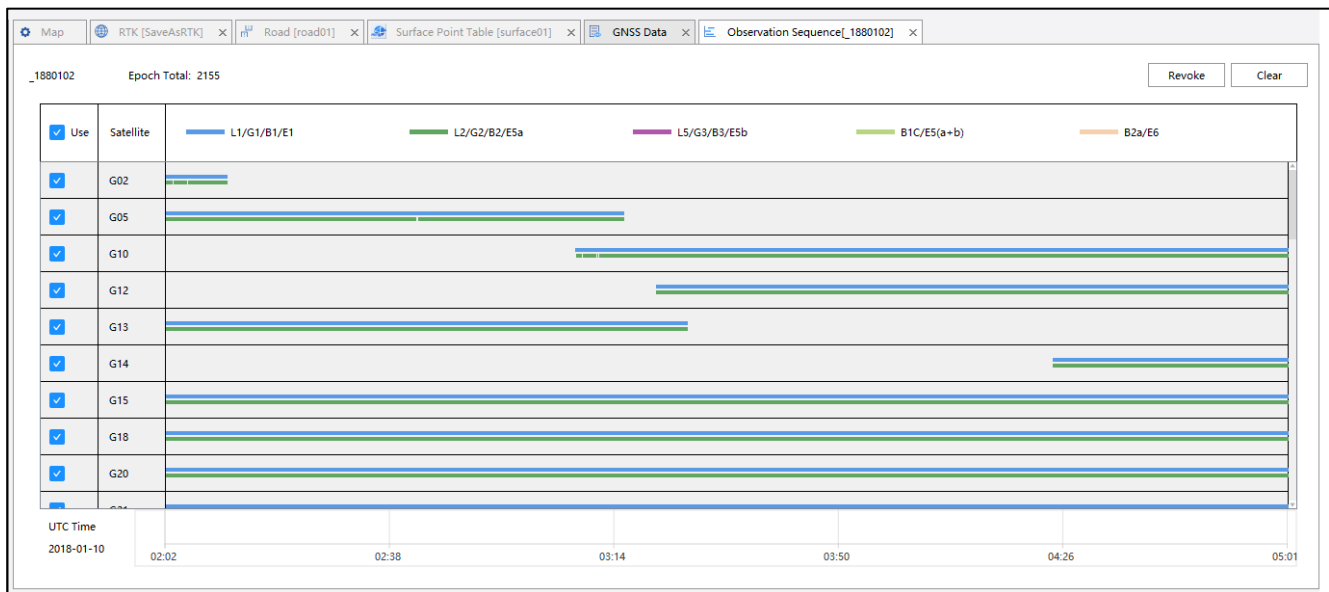


Figure 5-8-14 Observation Sequence

Single point location information (P): displays single point location information for the currently selected observation file.

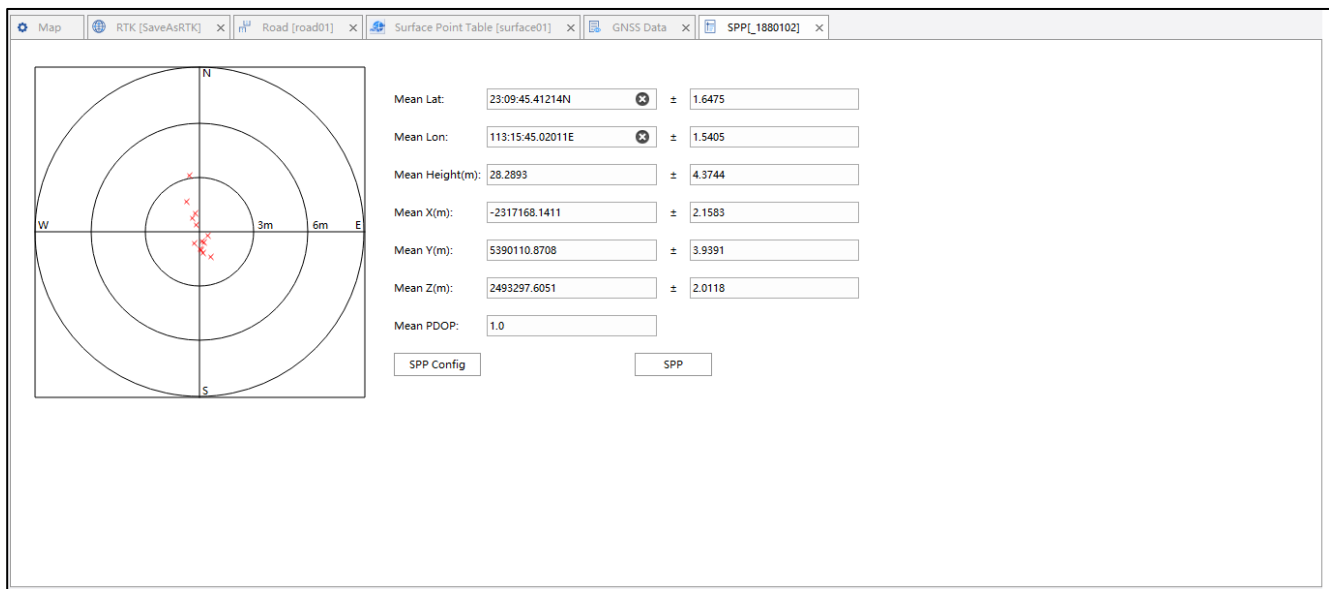


Figure 5-8-15 Single Point Position Information

The user can modify the single-point positioning configuration to recreate the single-point positioning solver for this file.

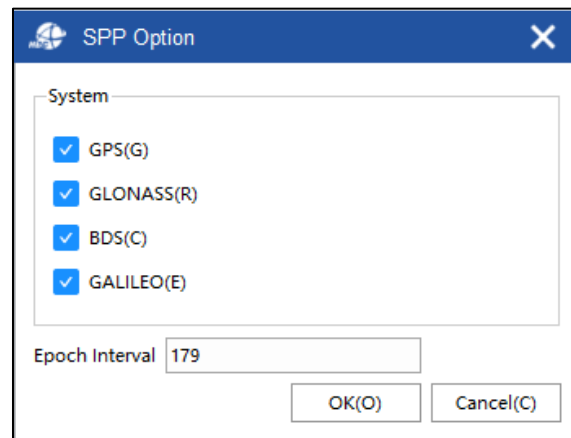


Figure 5-8-16 Single Point Position Option

SATView: satellite map mainly displays satellite map and signal-to-noise ratio histogram.

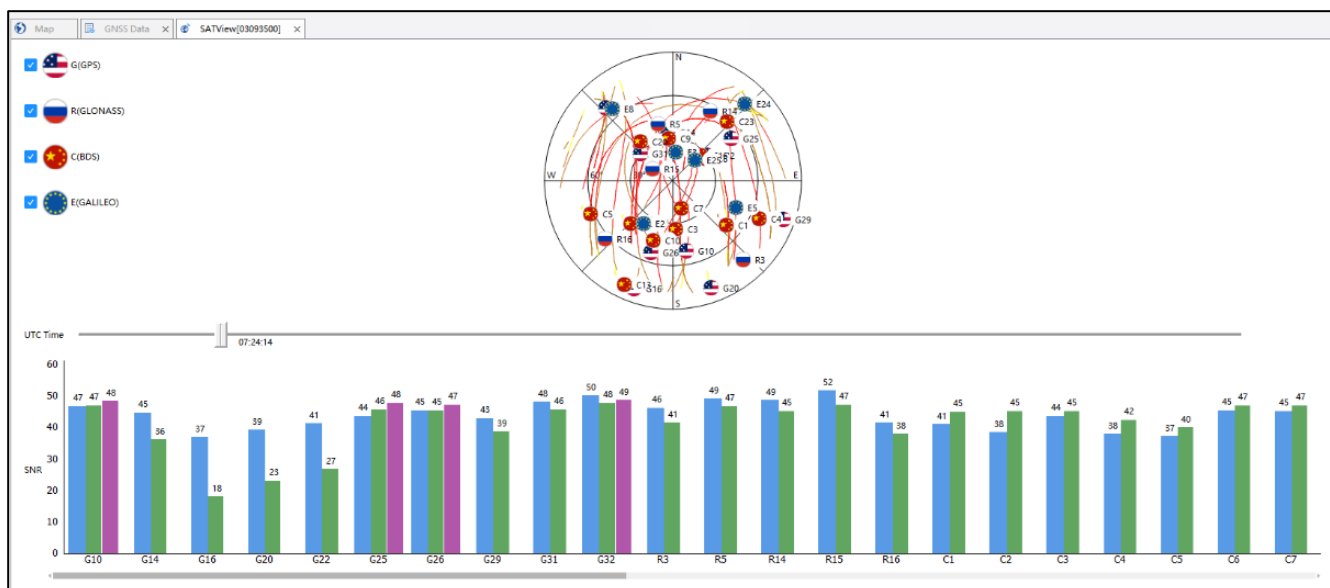


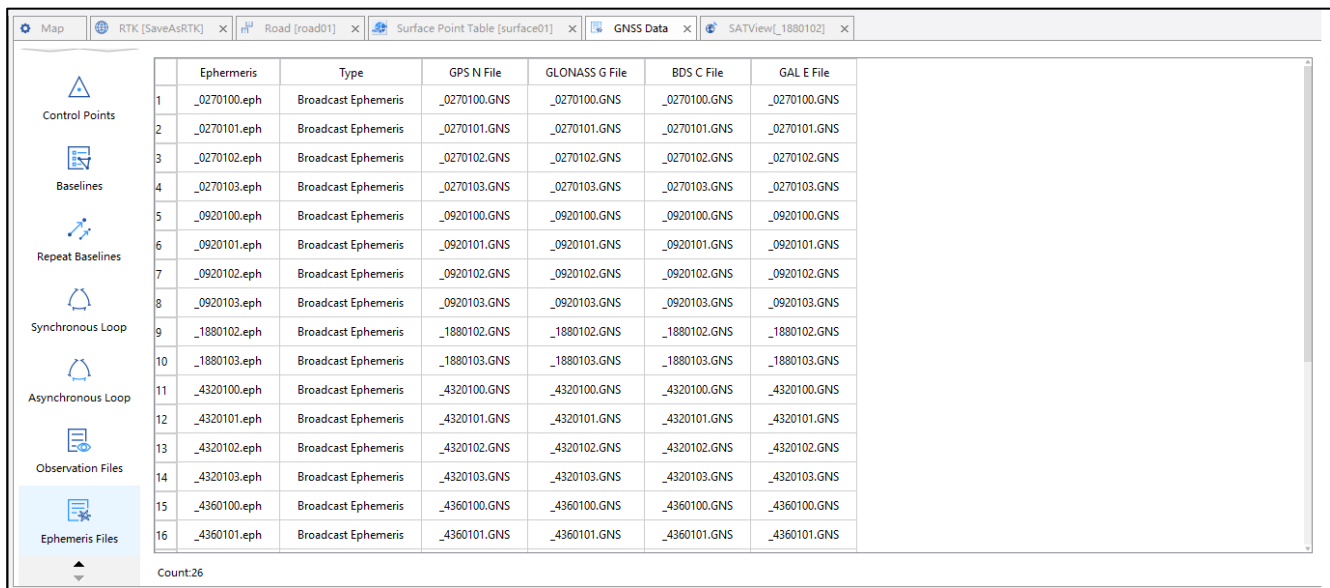
Figure 5-8-17 SATView

Users can drag the time bar to view the satellite map and signal-to-noise ratio histogram at different times.

7. Ephemeris Files

History file list information

Ephemeris, Type, GPS N File, GLONASS G File, BDS C Files, Galileo E Files.



	Ephemeris	Type	GPS N File	GLONASS G File	BDS C File	GAL E File
1	_0270100.eph	Broadcast Ephemeris	_0270100.GNS	_0270100.GNS	_0270100.GNS	_0270100.GNS
2	_0270101.eph	Broadcast Ephemeris	_0270101.GNS	_0270101.GNS	_0270101.GNS	_0270101.GNS
3	_0270102.eph	Broadcast Ephemeris	_0270102.GNS	_0270102.GNS	_0270102.GNS	_0270102.GNS
4	_0270103.eph	Broadcast Ephemeris	_0270103.GNS	_0270103.GNS	_0270103.GNS	_0270103.GNS
5	_0920100.eph	Broadcast Ephemeris	_0920100.GNS	_0920100.GNS	_0920100.GNS	_0920100.GNS
6	_0920101.eph	Broadcast Ephemeris	_0920101.GNS	_0920101.GNS	_0920101.GNS	_0920101.GNS
7	_0920102.eph	Broadcast Ephemeris	_0920102.GNS	_0920102.GNS	_0920102.GNS	_0920102.GNS
8	_0920103.eph	Broadcast Ephemeris	_0920103.GNS	_0920103.GNS	_0920103.GNS	_0920103.GNS
9	_1880102.eph	Broadcast Ephemeris	_1880102.GNS	_1880102.GNS	_1880102.GNS	_1880102.GNS
10	_1880103.eph	Broadcast Ephemeris	_1880103.GNS	_1880103.GNS	_1880103.GNS	_1880103.GNS
11	_4320100.eph	Broadcast Ephemeris	_4320100.GNS	_4320100.GNS	_4320100.GNS	_4320100.GNS
12	_4320101.eph	Broadcast Ephemeris	_4320101.GNS	_4320101.GNS	_4320101.GNS	_4320101.GNS
13	_4320102.eph	Broadcast Ephemeris	_4320102.GNS	_4320102.GNS	_4320102.GNS	_4320102.GNS
14	_4320103.eph	Broadcast Ephemeris	_4320103.GNS	_4320103.GNS	_4320103.GNS	_4320103.GNS
15	_4360100.eph	Broadcast Ephemeris	_4360100.GNS	_4360100.GNS	_4360100.GNS	_4360100.GNS
16	_4360101.eph	Broadcast Ephemeris	_4360101.GNS	_4360101.GNS	_4360101.GNS	_4360101.GNS

Figure 5-8-18 Ephemeris Files

5.9 Export

GNSS export includes report export and data export.

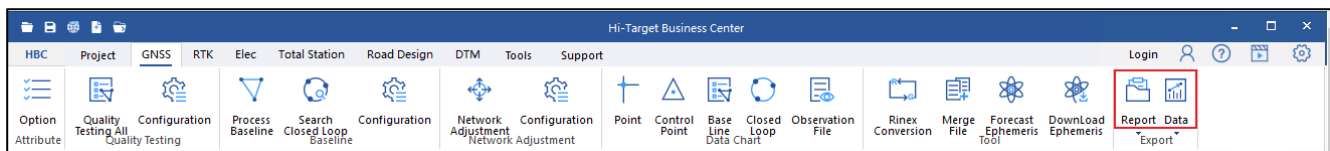


Figure 5-9-1 Export

Note: after GNSS report is exported, the report directory will be opened automatically.

1. Report

GNSS report includes project general report, baseline report, network adjustment report and quality inspection summary report. Users can selectively output corresponding reports as needed.

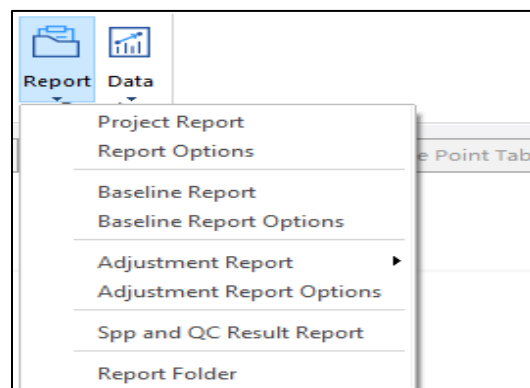


Figure 5-9-2 Report List

(1) Project General Report Settings

Click [GNSS] – [Report] – [Report Options] to open the project report setting dialog box, where you can set the information to be exported from the project report.

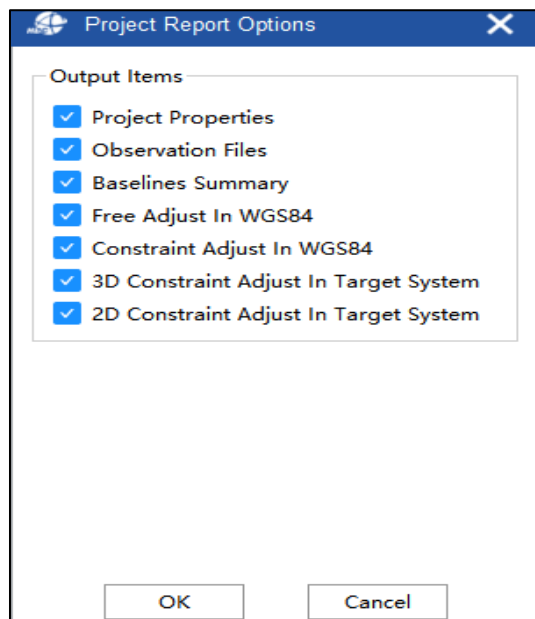


Figure 5-9-3 Report-project Report Options

(2) General Project Report

Click [GNSS] - [Report] - [Project Report] to open the report Export dialog box. The software supports three formats '*. HTML', '*. PDF' and '*. Docx'. Enter the file name and select the format to export. Click Save to export the general project report.

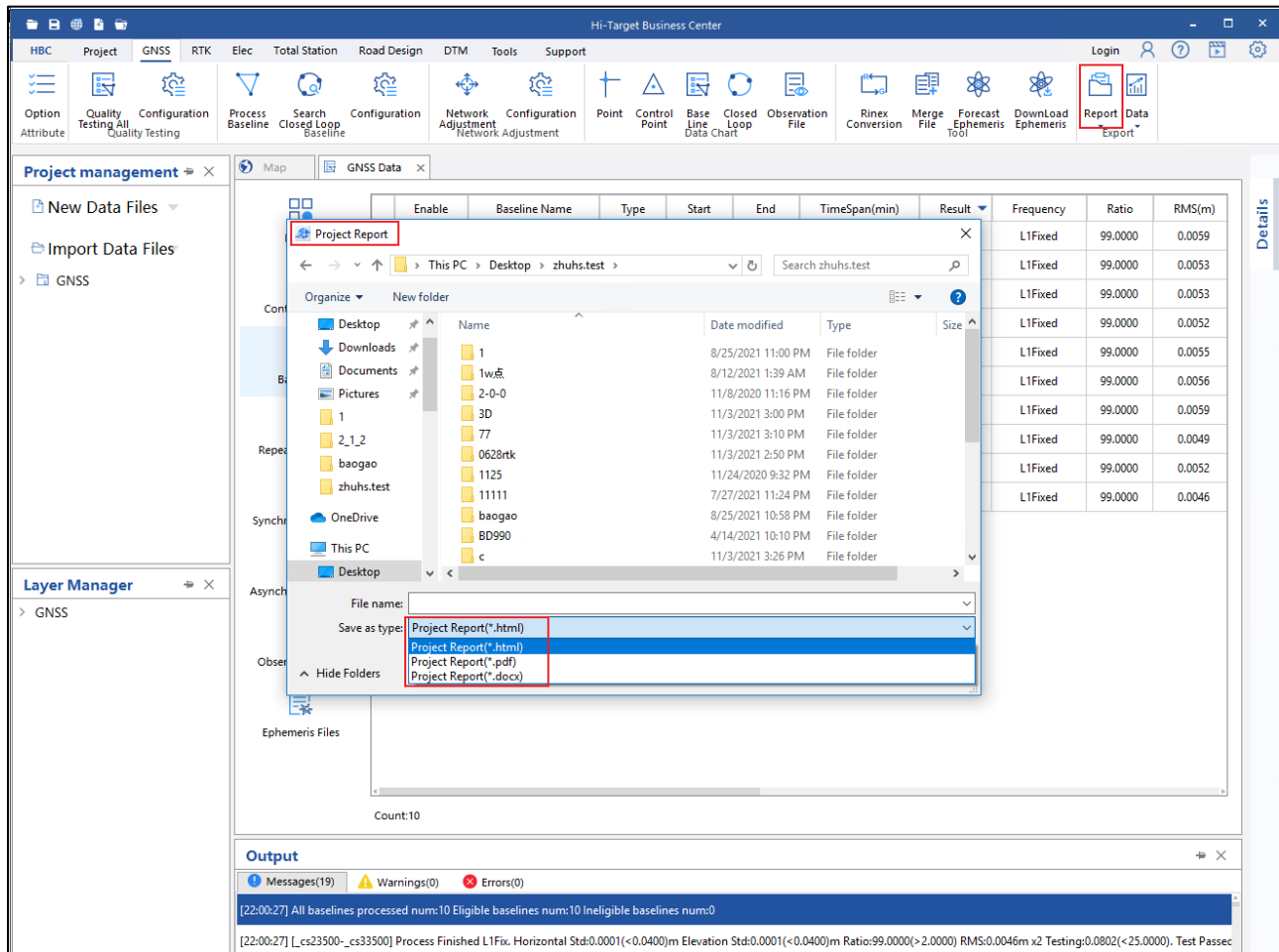


Figure 5-9-4 Report-project Report

(3) Baseline Report Settings

Click [GNSS] – [Report] – [Baseline Report Option] to open the baseline report setting dialog box, where you can set the information to be exported from the baseline report.

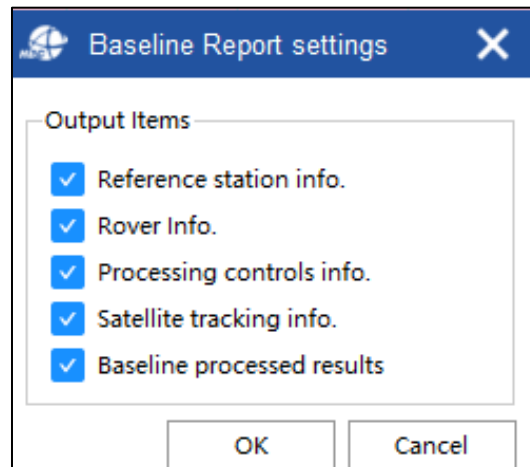


Figure 5-9-5 Report-baseline Report Settings

(4) Baseline Report

Click [GNSS] - [Report] - [Baseline Report] to open the baseline report dialog box. The software supports three formats '*.html', '*.pdf' and '*.docx'. Enter the file name and select the format to export, and click Save to export the baseline report.

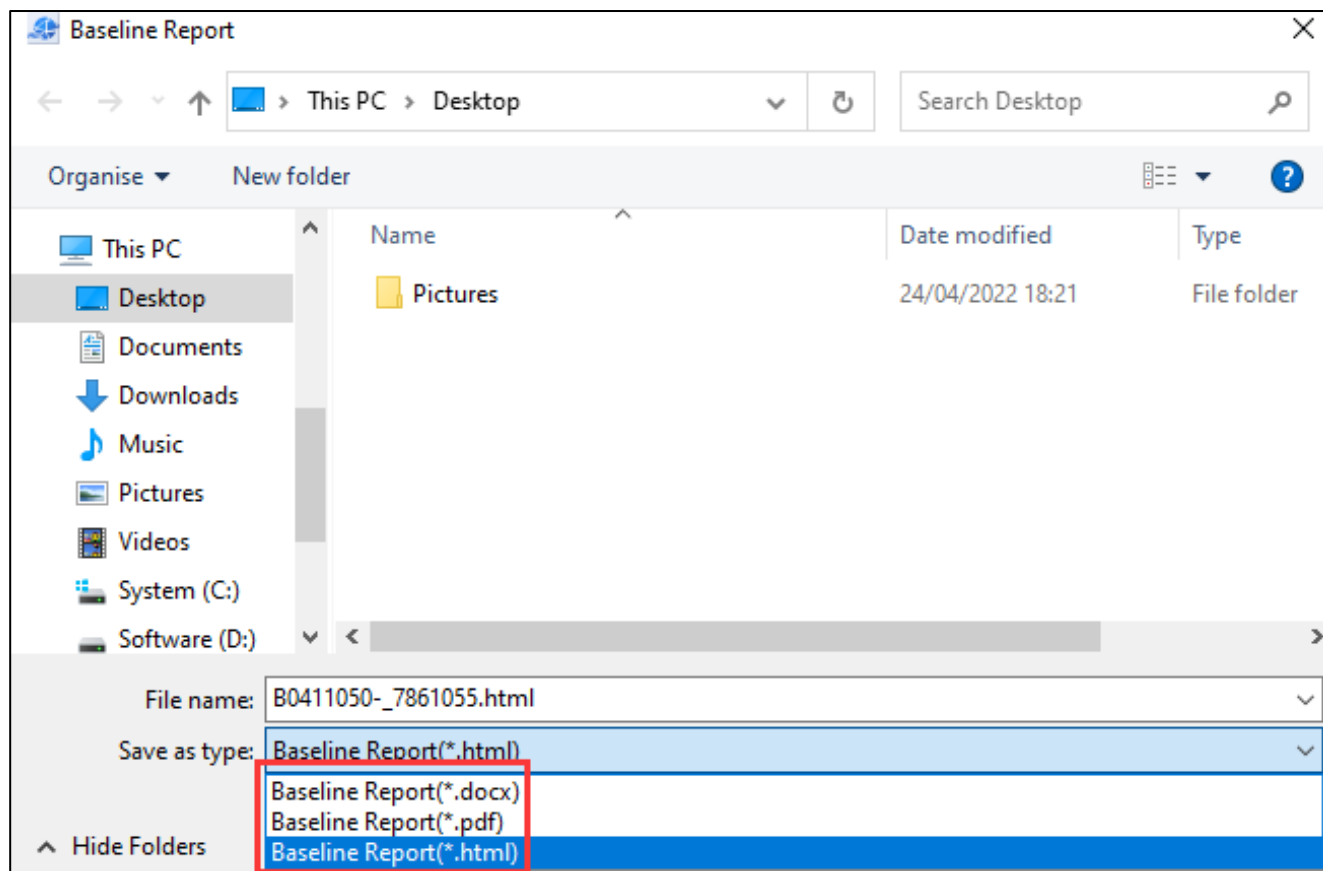


Figure 5-9-6 Report-baseline Report

(5) Network Adjustment Report Settings

Click [GNSS] - [Report] - [Adjustment Report Option] to open the network adjustment report setting dialog box, where you can set the information to be exported from the network adjustment report.

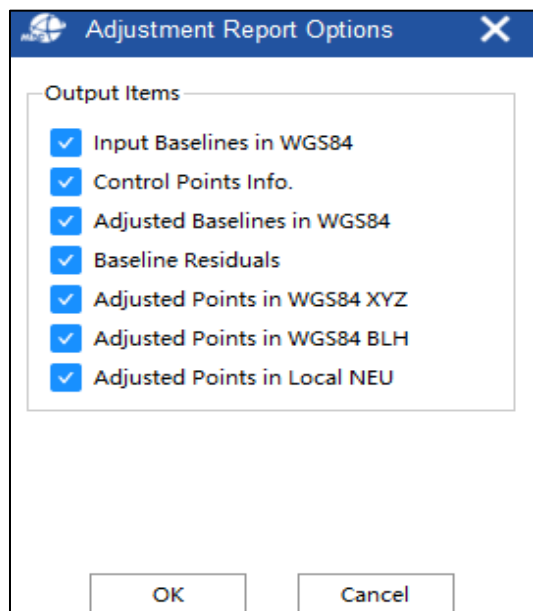


Figure 5-9-7 Report-adjustment Report Options

(6) Network Adjustment Report

Click [GNSS] - [Report] - [Adjustment Report], you can select four export report types: Free 3D Adjustment Report, WGS84 Datum Adjustment Report, Target Datum Adjustment Report, 2D Biased and Height Fitting Adjustment Report. Select one of the reports and click to open the corresponding export report dialog box. The software supports three formats '*.html', '*.pdf' and '*.docx'. The user enters the file name and selects the format to be exported. Click Save to export the network adjustment report.

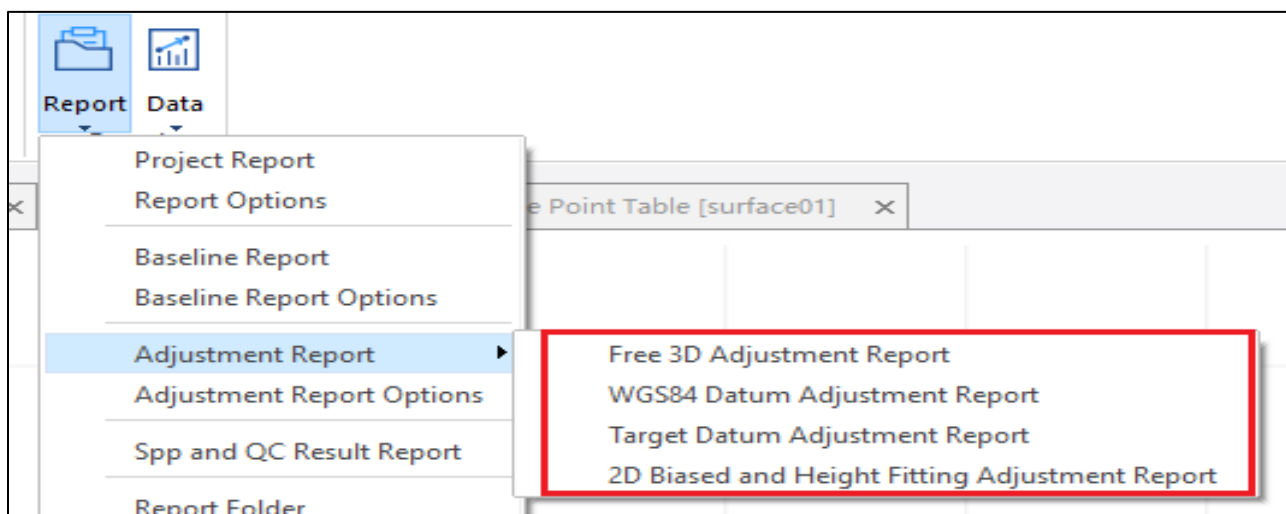


Figure 5-9-8 Report-adjustment Report

(7) Quality Inspection Summary Report

Click [GNSS] – [Report] – [Spp and QC Result Report] to select style 1 and style 2 reports to export. Enter the file name and select the format to export. Click Save to export the quality inspection summary report.

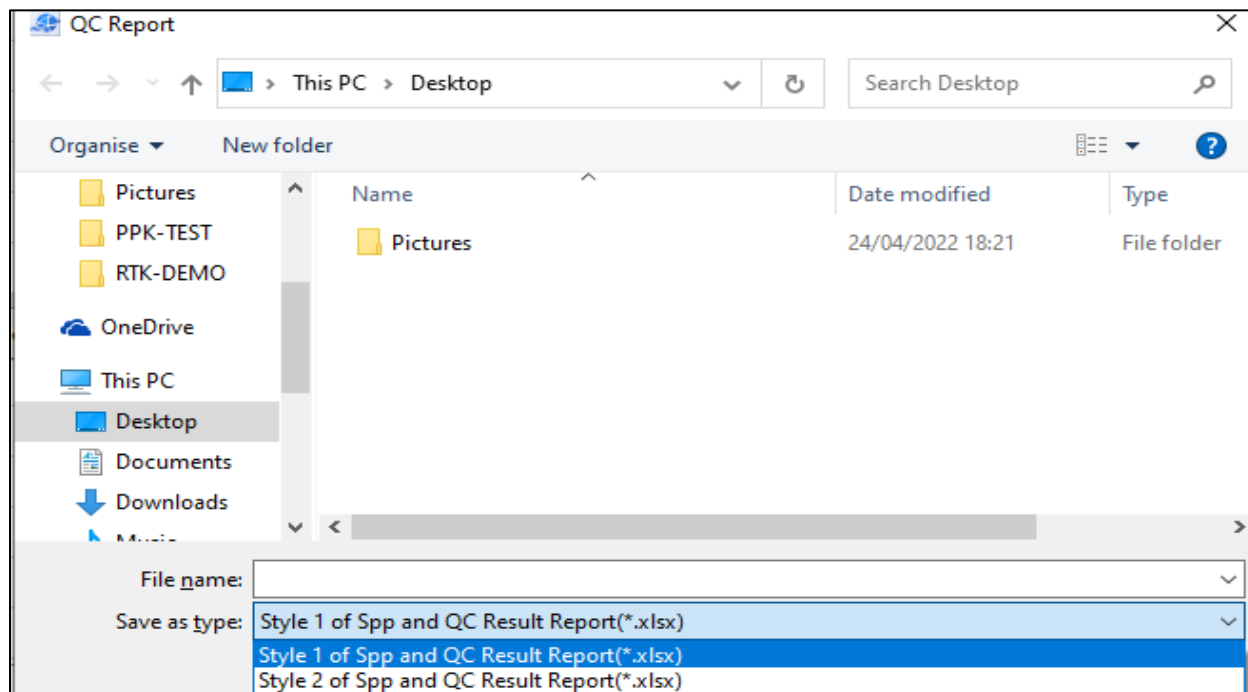


Figure 5-9-9 Report-QC Report

(8) Report Folder

Click [GNSS] - [Report] - [Report Folder] to open the folder where the report is exported and stored.

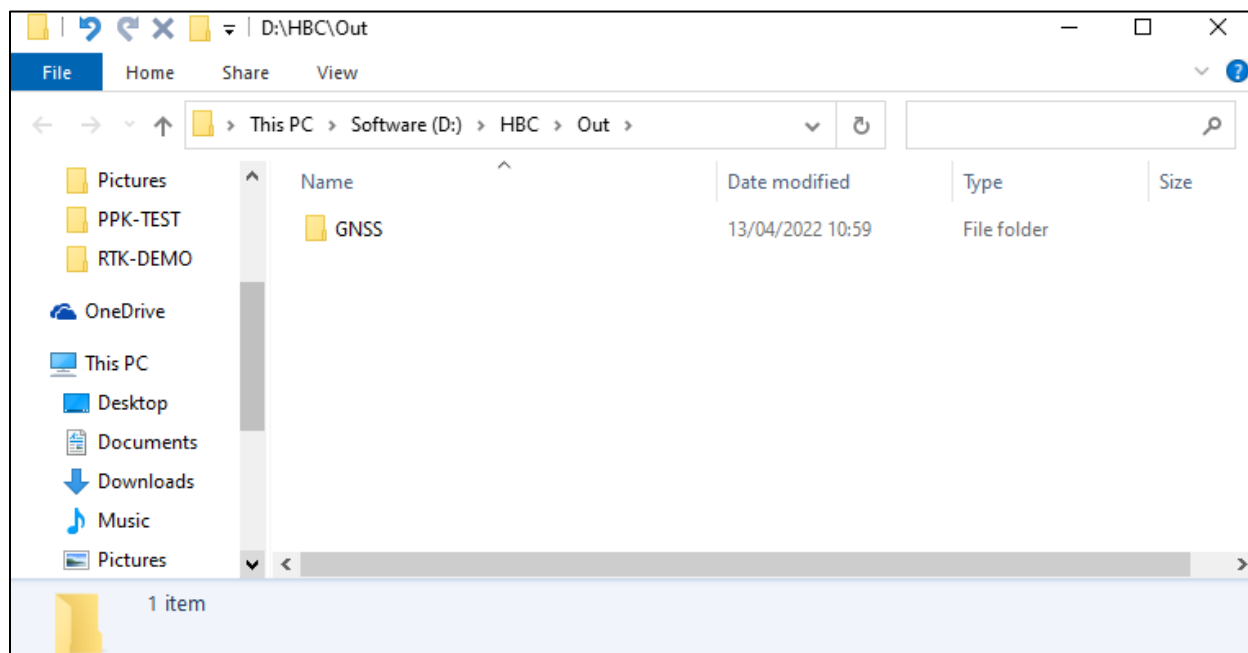


Figure 5-9-10 Report- report Folder

2. Data

Data export mainly includes the export of RINEX Data, Station Point Data, Control Point Data and Baseline Data.

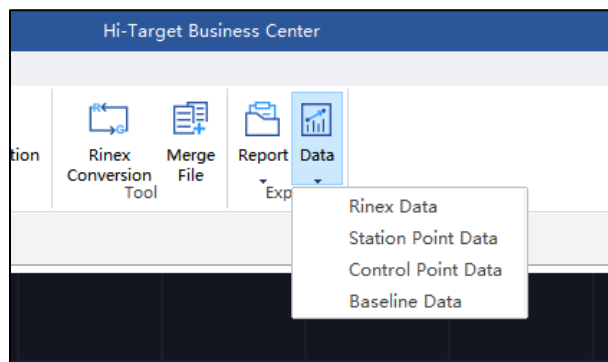


Figure 5-9-11 Data List

(1) Rinex Data

Click [GNSS] - [Data] - [RINEX Data] to open the export RINEX output options box. The software supports exporting RINEX versions of 2.11, 3.02 and 3.04. Click export to export all observation files under the current GNSS as RINEX files.

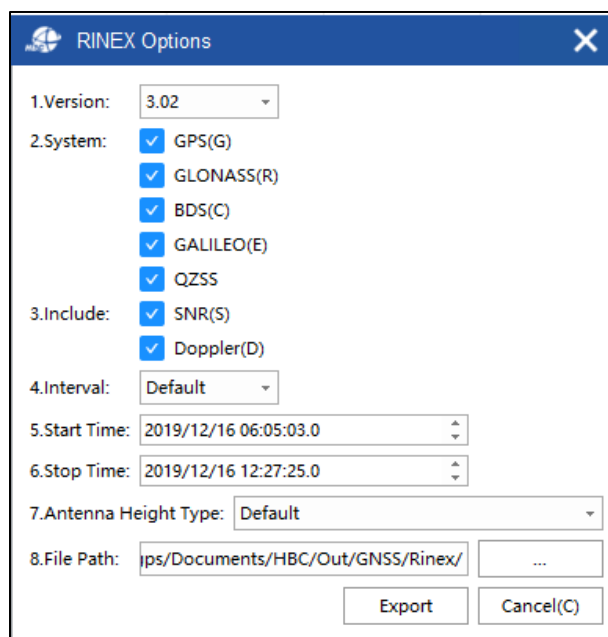
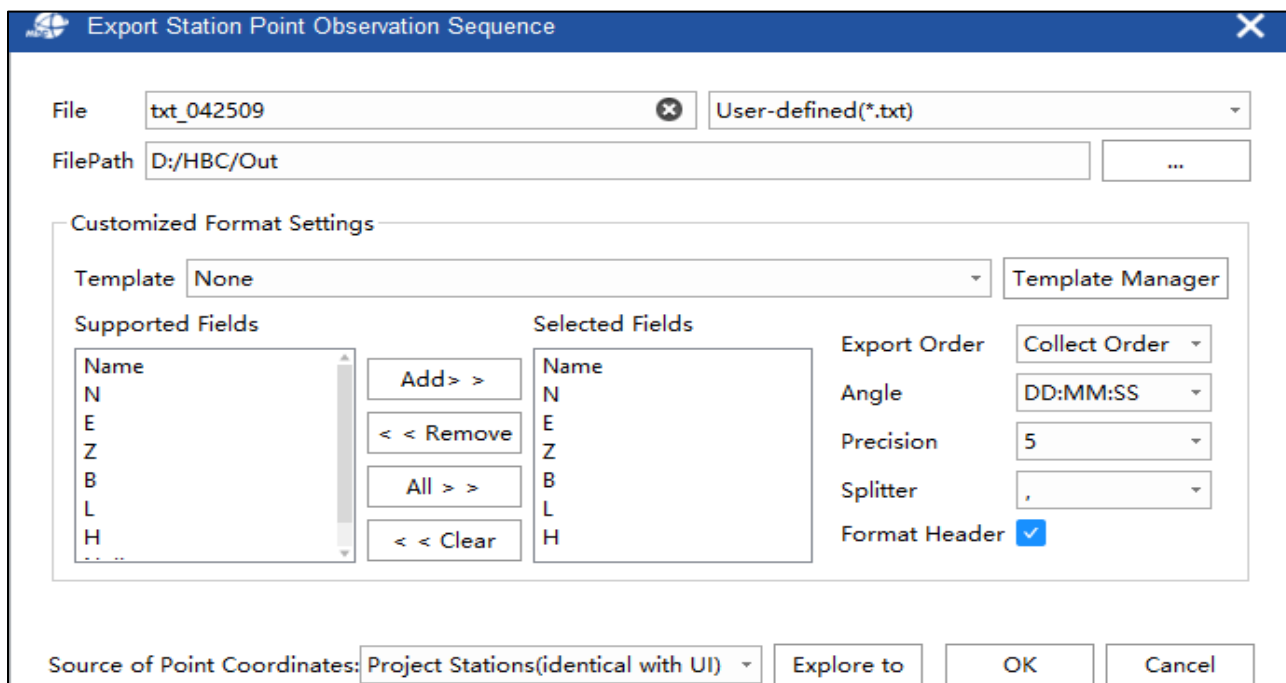


Figure 5-9-12 Data-export RINEX Data

Version 2.11 only supports the export of GPS and GLONASS satellite data; Versions 3.02 and 3.04 support the export of GPS, GLONASS, BDS, Galileo and QZSS satellite data.

(2) Station Point Data

Click [GNSS] - [Data] - [Station Point Data] to open the Export dialog box, where you can export stations under GNSS:



The dialog box is titled "Export Station Point Observation Sequence". It features a "File" field with the text "txt_042509" and a file type dropdown set to "User-defined(*.txt)". Below this is a "FilePath" field containing "D:/HBC/Out" and a browse button "...".

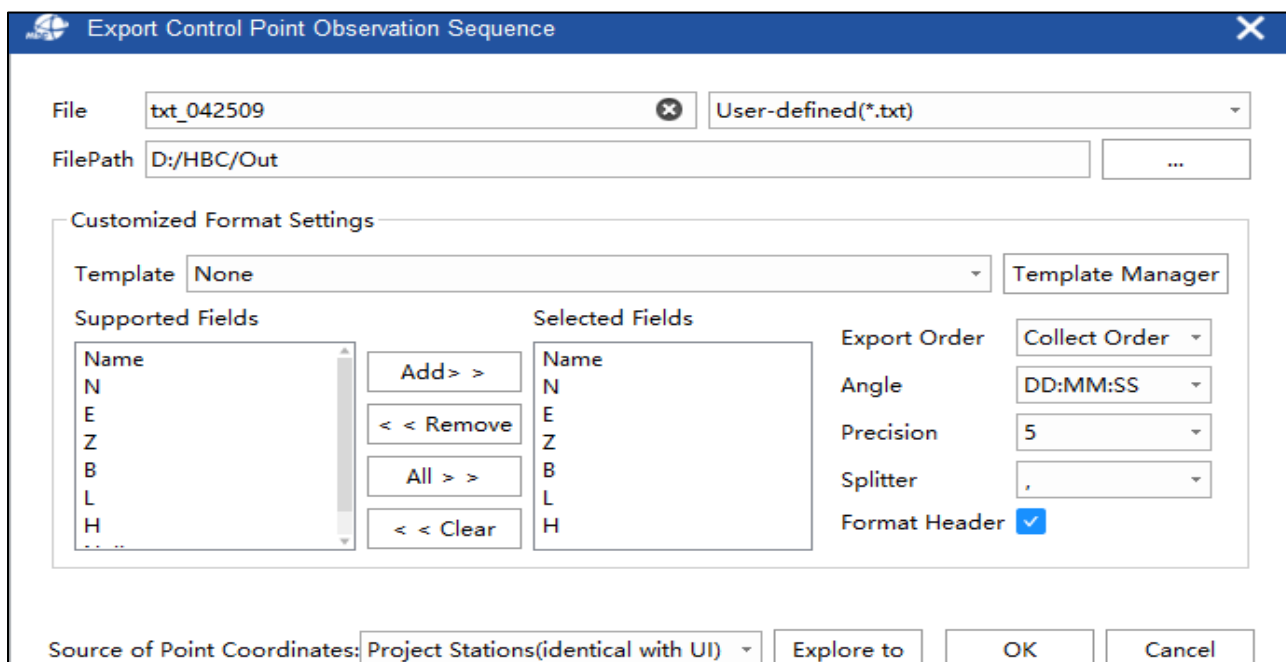
The "Customized Format Settings" section includes a "Template" dropdown set to "None" and a "Template Manager" button. It also contains two lists: "Supported Fields" and "Selected Fields", both containing "Name", "N", "E", "Z", "B", "L", and "H". Between these lists are buttons: "Add > >", "< < Remove", "All > >", and "< < Clear". To the right of the "Selected Fields" list are settings for "Export Order" (set to "Collect Order"), "Angle" (set to "DD:MM:SS"), "Precision" (set to "5"), "Splitter" (set to ","), and "Format Header" (checked).

At the bottom, the "Source of Point Coordinates" is set to "Project Stations(identical with UI)", with an "Explore to" button and "OK" and "Cancel" buttons.

Figure 5-9-13 Data-export Station Point Observation Sequence

(3) Control Point Data

Click [GNSS] – [Data] – [Control Point Data] to open the Export dialog box, where you can export control points under GNSS.



The dialog box is titled "Export Control Point Observation Sequence". It features a "File" field with the text "txt_042509" and a file type dropdown set to "User-defined(*.txt)". Below this is a "FilePath" field containing "D:/HBC/Out" and a browse button "...".

The "Customized Format Settings" section includes a "Template" dropdown set to "None" and a "Template Manager" button. It also contains two lists: "Supported Fields" and "Selected Fields", both containing "Name", "N", "E", "Z", "B", "L", and "H". Between these lists are buttons: "Add > >", "< < Remove", "All > >", and "< < Clear". To the right of the "Selected Fields" list are settings for "Export Order" (set to "Collect Order"), "Angle" (set to "DD:MM:SS"), "Precision" (set to "5"), "Splitter" (set to ","), and "Format Header" (checked).

At the bottom, the "Source of Point Coordinates" is set to "Project Stations(identical with UI)", with an "Explore to" button and "OK" and "Cancel" buttons.

Figure 5-9-14 Data-export Control Point Observation Sequence

(4) Baseline Data

Click [GNSS] - [Data] - [Baseline Data] to open the export baseline data dialog box. The software supports three formats: 'Trimble Baseline Data *.asc', 'Cosa Baseline Data Exchange File *.txt' and 'DXF File *.dxf'. The user enters the file name and selects the format to export, and then click [Save] to export the baseline data report.

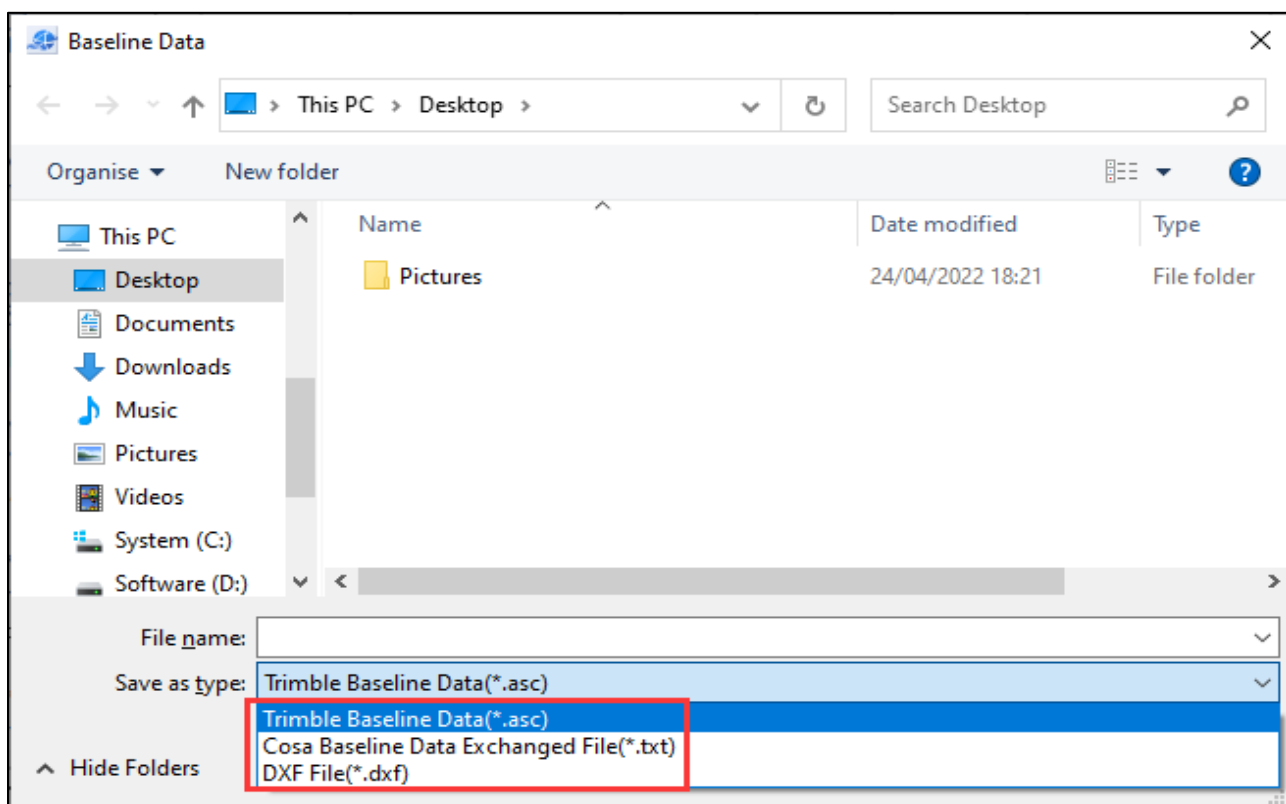


Figure 5-9-15 Data-export Baseline Data

5.10 Tools

GNSS tools include RINEX conversion, file merging and ephemeris Forecast.

RINEX conversion is to convert '*.GNS' files into RINEX files.

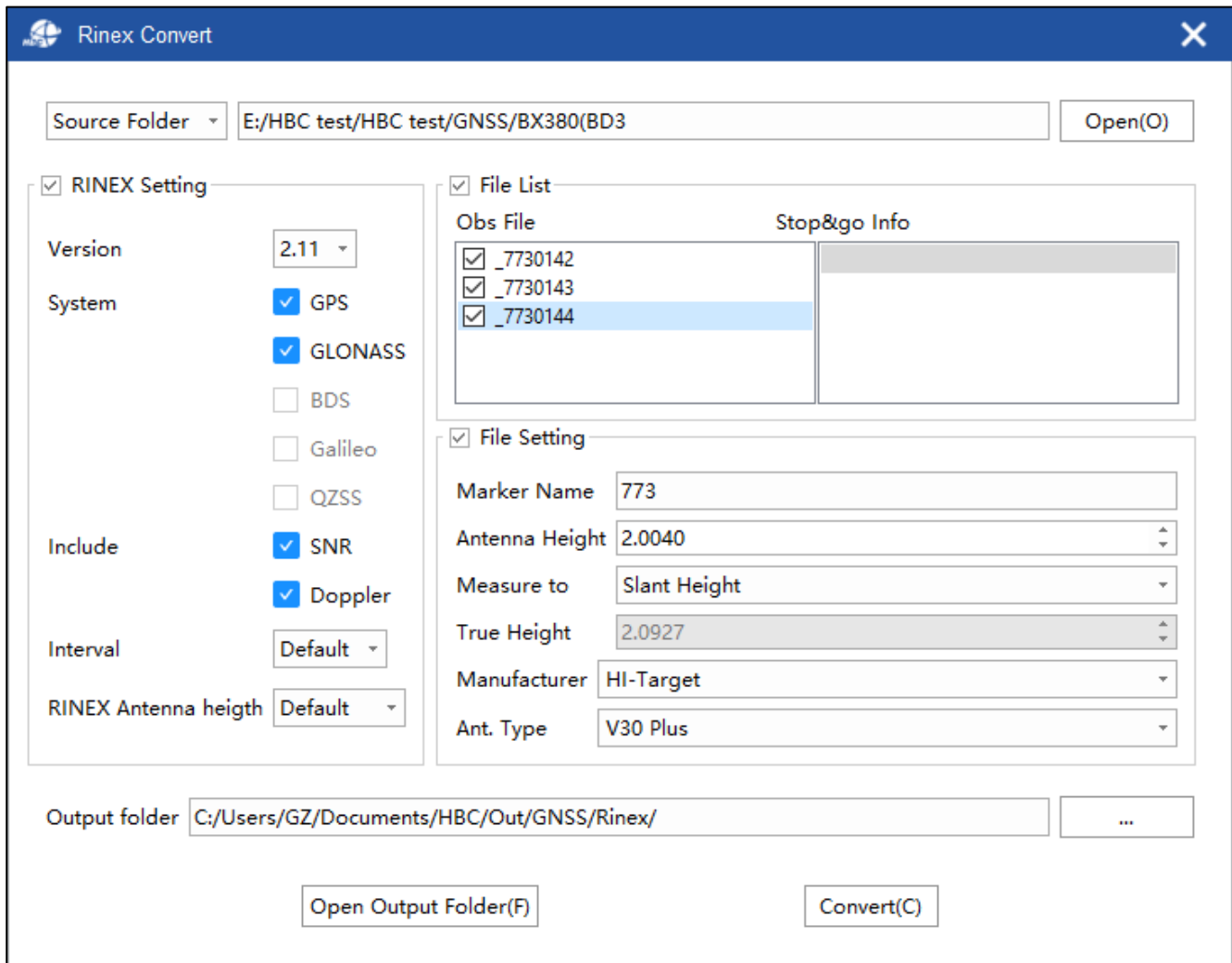
File merging merges several different '*.GNS' files into one file.

Ephemeris forecast is to report the distribution of satellites at specific positions and specific periods in the future to users according to the satellite almanac data received by GPS satellite receiver. Therefore, it is planned to select a suitable time period for GPS field data acquisition, so as to improve the efficiency of field operation and data utilization.

5.10.1 RINEX Convert

Click [GNSS] - [RINEX Convert], the software pops up the RINEX Convert dialog box.

Note: When converting GNS files in batches, you can select the files to be converted by checking/deleting the list files in the observation file box.



Rinex Convert

Source Folder: E:/HBC test/HBC test/GNSS/BX380(BD3) Open(O)

☒ **RINEX Setting**

Version: 2.11

System: ☒ GPS ☒ GLONASS ☐ BDS ☐ Galileo ☐ QZSS

Include: ☒ SNR ☒ Doppler

Interval: Default

RINEX Antenna height: Default

☒ **File List**

Obs File	Stop&go Info
☒ _7730142	
☒ _7730143	
☒ _7730144	

☒ **File Setting**

Marker Name: 773

Antenna Height: 2.0040

Measure to: Slant Height

True Height: 2.0927

Manufacturer: HI-Target

Ant. Type: V30 Plus

Output folder: C:/Users/GZ/Documents/HBC/Out/GNSS/Rinex/ ...

Open Output Folder(F) Convert(C)

Figure 5-10-1 Rinex Convert

(1) RINEX Option

Version: The software supports 2.11, 3.02, 3.04 Rinex version, the software is selected by default according to rinex version.

System: The software supports GPS, GLONASS, BDS, Galileo, QZSS, the software default full selection.

Include: Signal-to-noise ratio, Doppler value, software default all selections.

Interval: The software defaults to the sampling interval of the source observation file.

RINEX Antenna height type: the software defaults to the type of antenna in the source observation file.

(2) File Setting

The user can edit and modify the properties of the observation file.

(3) Dynamic File Conversion

Users can add stop&go information for dynamic file conversion.

5.10.2 Files Merge

Click [GNSS] - [File Merge], the software pops up the file merge dialog box, HBC software allows users to select up to 3 files to merge.

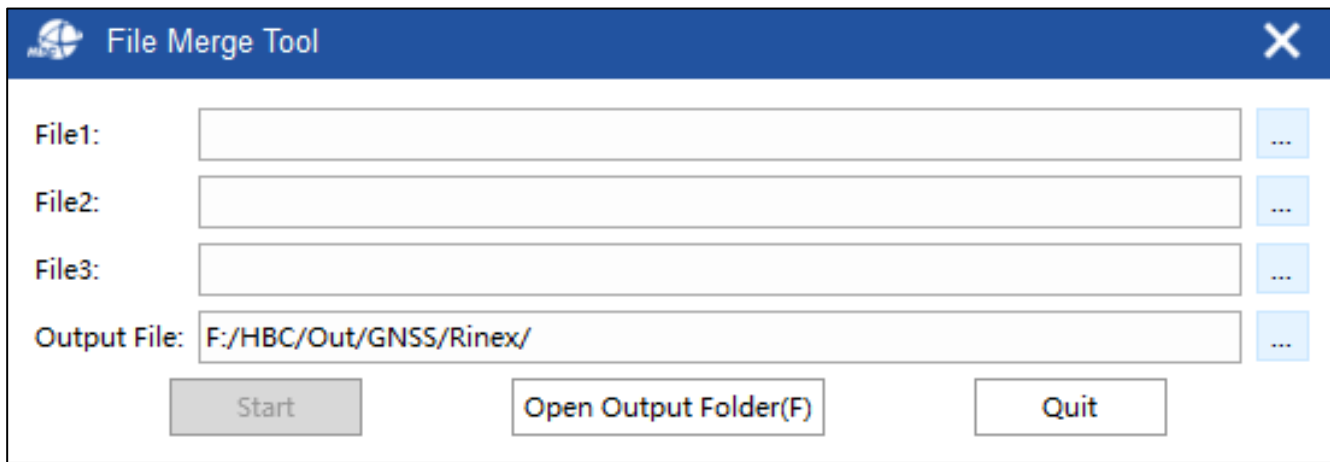


Figure 5-10-2 File Merge

5.10.3 Ephemeris Forecast

Ephemeris forecast is to report the distribution of satellites at specific positions and specific periods in the future to users according to the satellite almanac data received by GPS satellite receiver. Therefore, it is planned to select a suitable time period for GPS field data acquisition, so as to improve the efficiency of field operation and data utilization.

The general steps of using ephemeris prediction software include:

- (1) Update historical data;
- (2) Set the station position, time period, height cut-off angle;
- (3) Forecast, check the time sequence diagram of the number of satellites and DOP value, and select the measurement time.

1. Entry of Almanac Data

For ephemeris forecast, the software needs to load the recent almanac data. The program will use the satellite orbit and other information recorded in the almanac data to calculate the satellite position. The almanac data generally adopts Yuma format, and you can click to download the almanac file in the test state.



Figure 5-10-3 Entry of Almanac Data

2. Coordinate and Time Period Setting of Observation Station

After loading the almanac data, it is necessary to set the longitude and latitude, elevation, height cut-off angle and observation period of the observation point. The software will use these parameters for calculation.

First, you can set the date in the status bar. The default date is the date of the computer system time. You can select any day by clicking previous day, today, next day or user defined.

Status

NAME	DATA
Time	2021-11-03
Zone	GMT +08:00
Lat.	N 023:00:08
Lon.	E 113:19:00
Date	2021-11-03
Start-End	00:00 - 24:00
Mask Angle	10 deg
Channels	12
Sample	5 /minute
GPS	current. alm
GLO	current. alm
BD	current. alm
Sat Num	21 svcs
PDOP	4.0
Obs Time	00:00
Result	Over
Time	

Time: 00:00

00:00
24:00

Pre
Today
Next
Manual

G

☒ GPS

✓

R

☒ GLONASS

✓

✓

C

☒ BD

✓

S

☒ SBAS

7

☐ Bad Star

Select Point
From Google->



Figure 5-10-4 Observation Station Status

Select [Options] in the navigation bar to set the longitude and latitude, elevation, height cut-off angle and observation time period of the observation position.

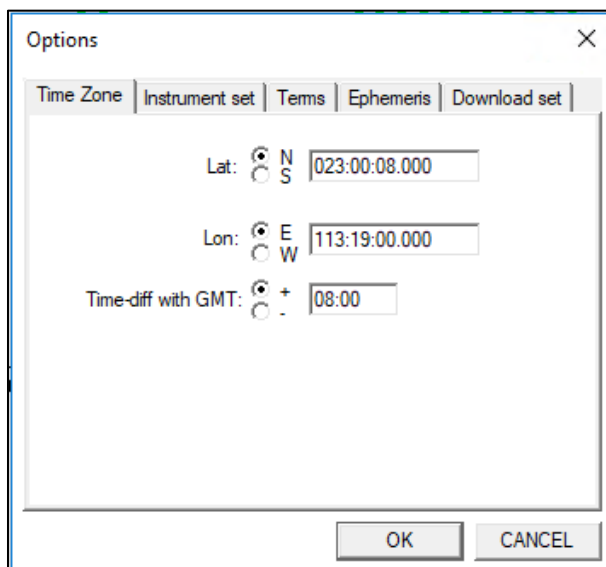


Figure 5-10-5 Options-time Zone Settings

Longitude and latitude generally do not need to be very accurate, with an accuracy of about one or two kilometers.

If the user does not know the latitude and longitude, the following methods can be adopted:

Using the attached coordinate conversion software, users can convert the known standard rectangular coordinates into longitude and latitude, and then input the software for ephemeris forecast.

Use other GPS instruments that can display local longitude and latitude, such as iRTK5, V200, A16 and other instruments shall observe for a period of time, record the displayed or output longitude and latitude, and input them into the software.

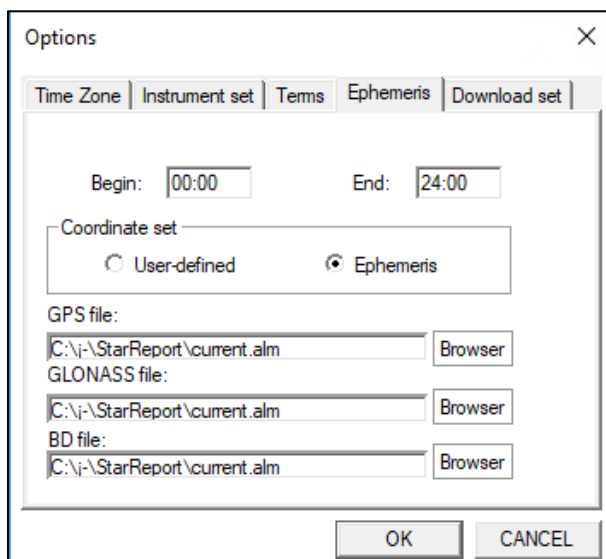


Figure 5-10-6 Options-ephemeris Settings

When setting the time period, you should pay attention to the selection of local time and GPS time. When using the 'local time' method to enter the time period, you should pay attention to whether the time difference between local time and UTC time is correct. Usually, when installing the operating system, the computer will prompt you to select the time zone. For example, Beijing time is 8 hours earlier than UTC (international standard time). If the 'local time' input method is not used, the software defaults to Beijing time.

Generally, when setting the observation period, the difference between the start time and the end time is several hours, and the maximum length of the period can not exceed one day. Of course, the end time can not be earlier than the start time.

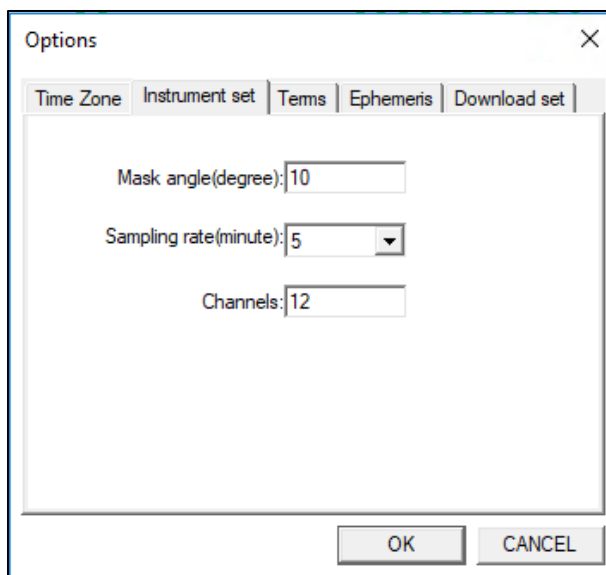


Figure 5-10-7 Options-instrument settings

The altitude angle can control the altitude angle of the prediction satellite, and only the satellite exceeding the altitude angle will be displayed. The sampling rate controls the time interval of text output. The lower the sampling rate, the more detailed the output.

3. Forecast Satellite Status

After inputting the observation position and time period and selecting [OK], the predicted satellite status can be viewed in various views of the software.

(1) Satellite Details Text Output

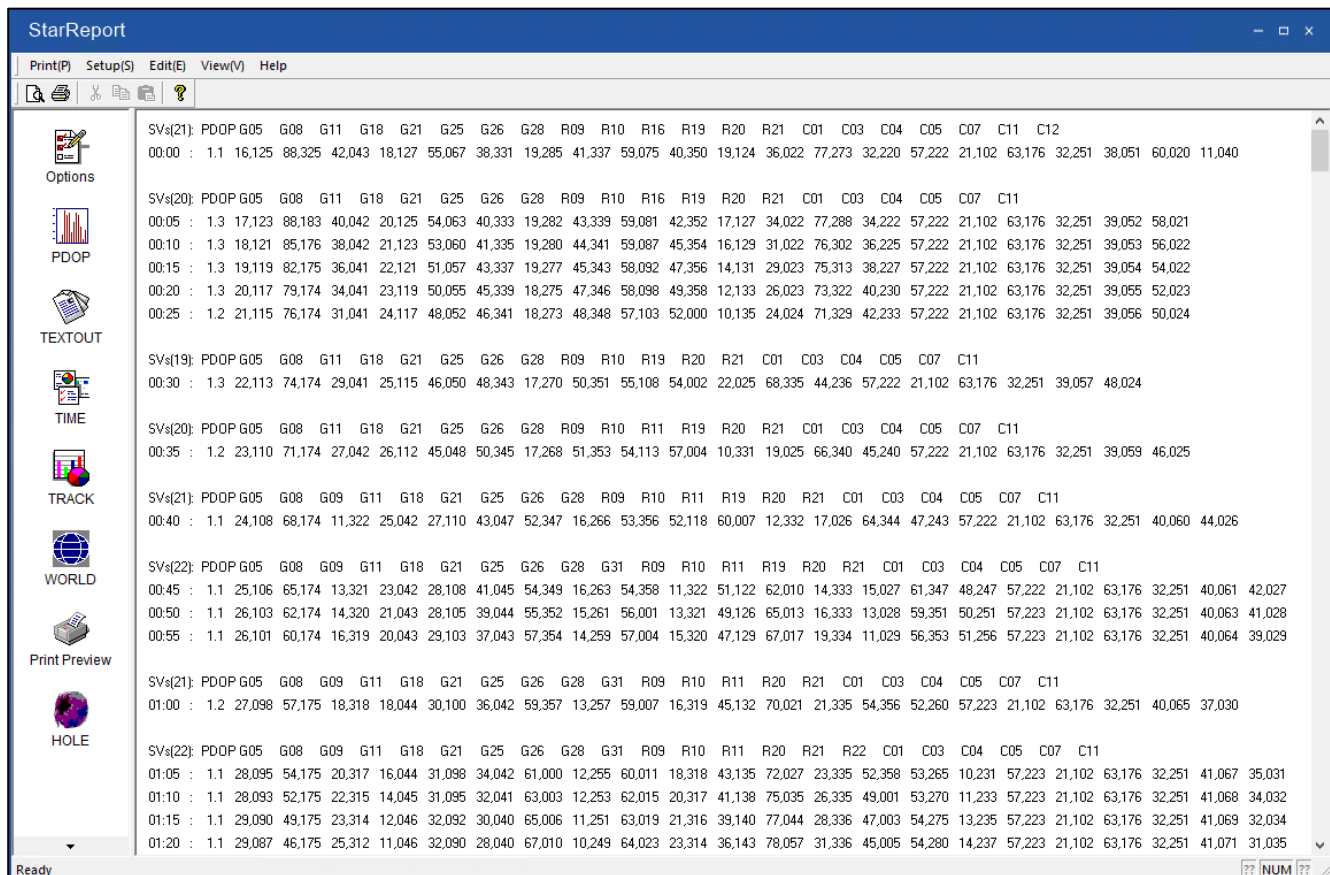


Figure 5-10-8 Satellite Details Report

(2) Satellite Time Chart

The satellite time period map reflects the change of the number of visible satellites with time in a given time period. The abscissa is the time span and the ordinate is the number of satellites. According to the tracking map, the time period with relatively large number of satellites in the planned observation time can be selected for field measurement with high requirements.

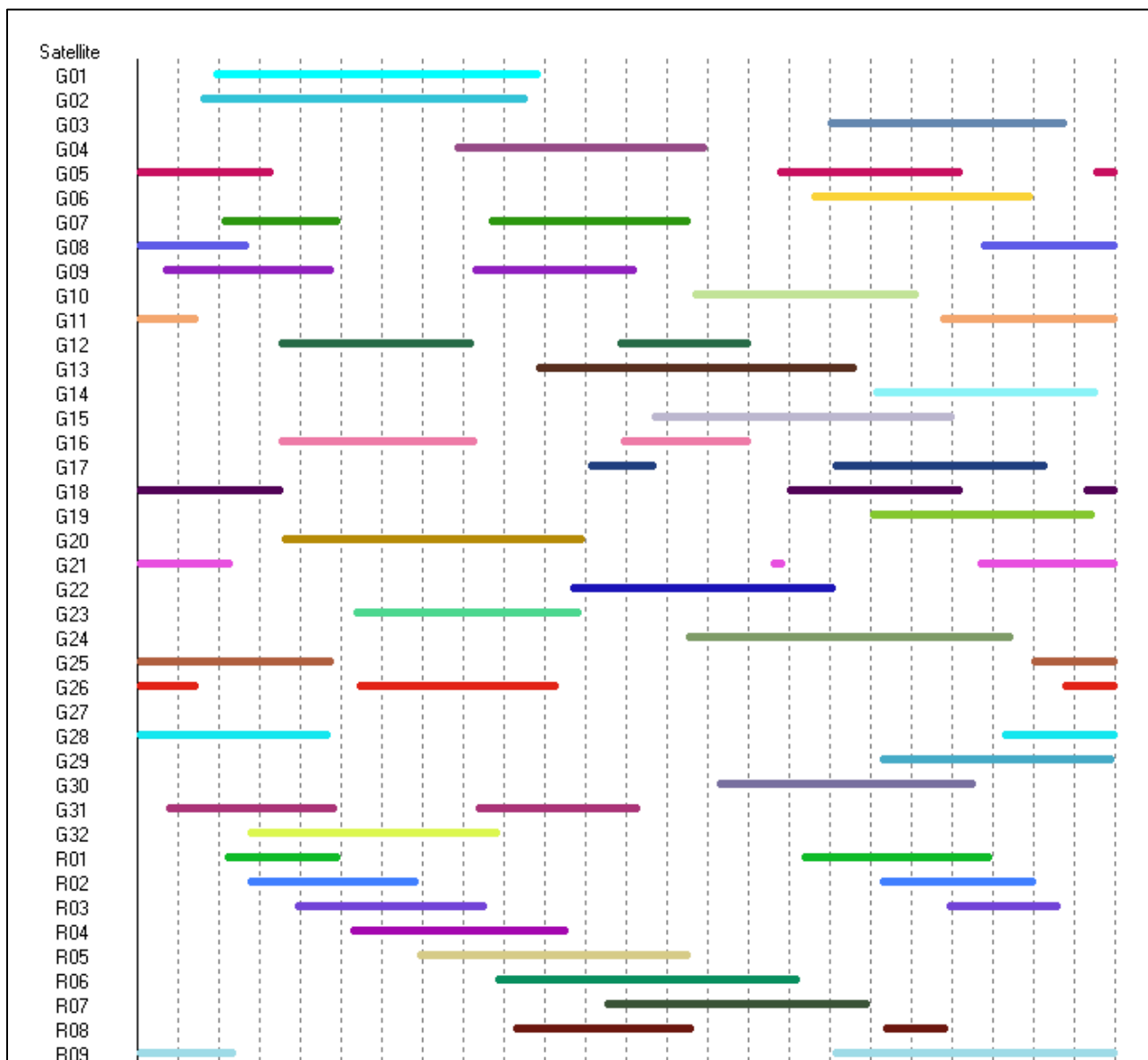


Figure 5-10-9 Satellite Time Chart

(3) Satellite Distribution Map

The satellite distribution map gives the satellite distribution and its motion direction at a given position in a given time period. Because GPS satellites are always in motion, we use the visual satellite map to represent the number of visible satellites in the sky at the observation time. The number of visible satellites is closely related to the satellite altitude angle. In the figure below, satellite 26 moves from north to south, while satellite 10 will rise in the southeast sky during observation. In this view, the longitude, latitude and time period of observation points are listed at the same time.

The direction shown in the view is the same as that of the map. It is the customary direction of up, north, down, South, left, West and right east. The outermost circle represents the ground plane, the two

imaginary circles represent the cut-off angles of 60 degrees and 30 degrees, and the center of the circle represents the zenith.

By pulling the time slider in the status bar, you can see the satellite sky distribution at half an hour intervals in the measurement section.

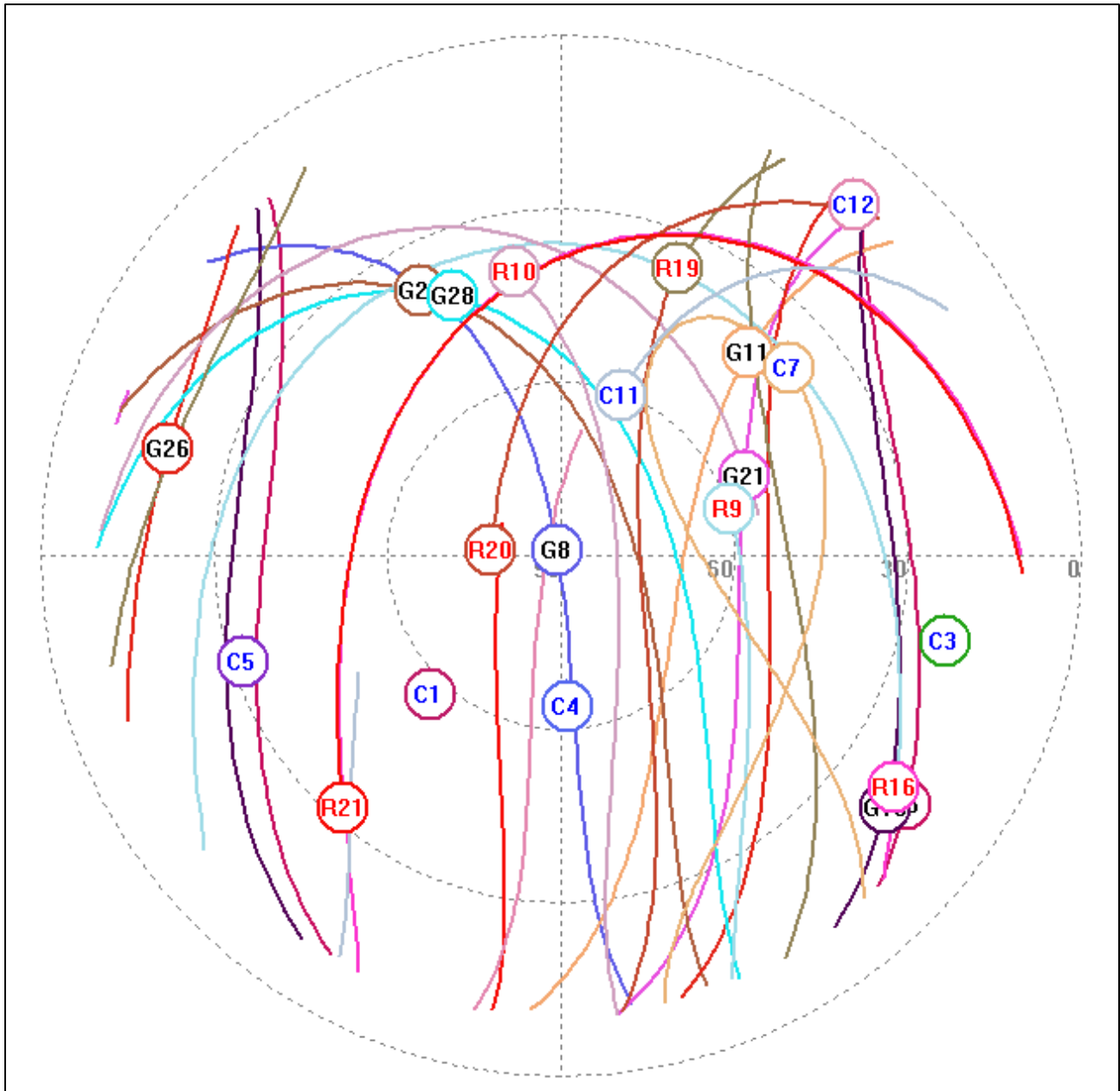


Figure 5-10-10 Satellite Distribution Chart

(4) Number of Visible Satellites

The number of visible satellites is expressed in the coordinate system. The number of visible satellites in a given time period is counted to intuitively express the relationship between the number of visible satellites and time.

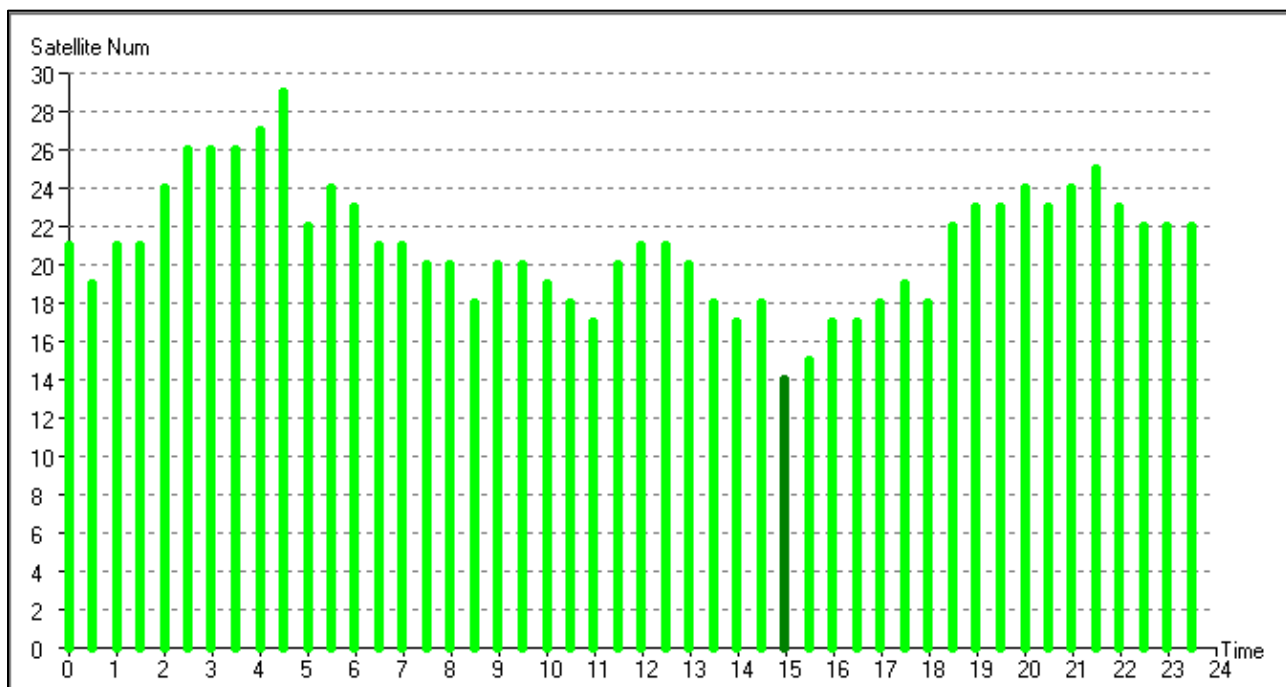


Figure 5-10-11 Number of Visible Satellites

(5) Geometric Accuracy Factors

The geometric accuracy factor, PDOP, indicates the influence of satellite distribution on positioning accuracy. Sometimes, the more visible satellites, the better positioning accuracy. Generally, when the value of PDOP is less than 4, the observation results are considered to be reliable.

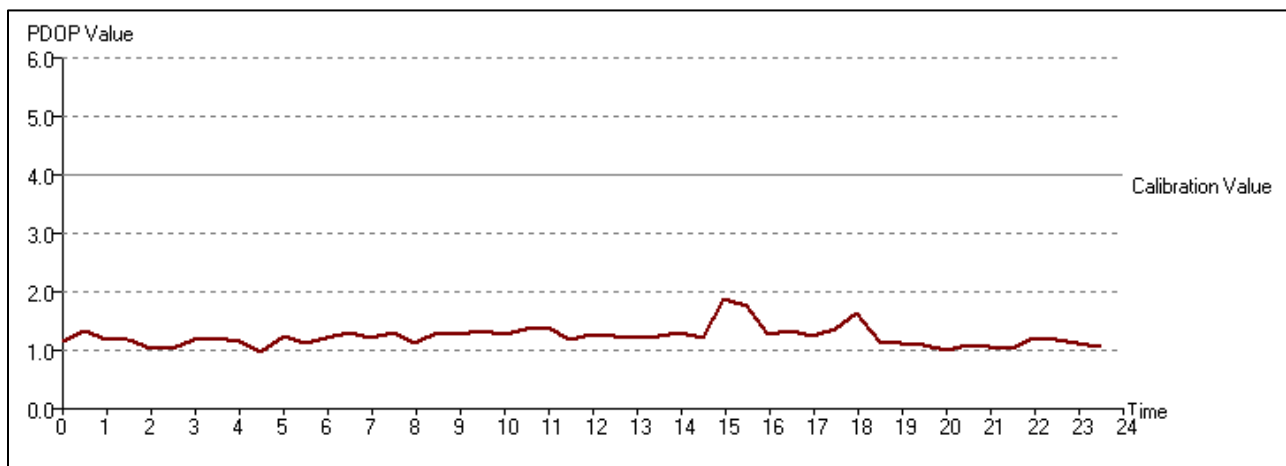


Figure 5-10-12 Geometric Accuracy Factors

(6) Satellite Orbit Map

Through the satellite orbit map, you can view the trajectory of satellites in the world and the satellite distribution at the current time of the sliding rod. When viewing the orbit map, you can select GPS and BDS system.

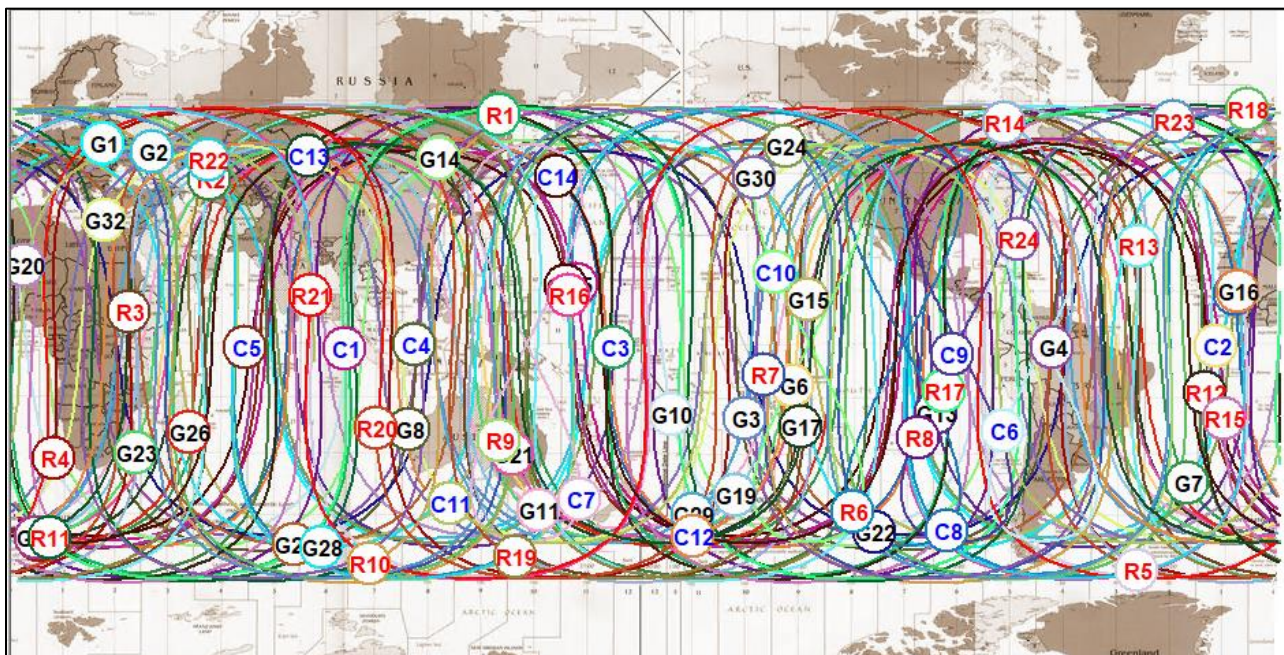


Figure 5-10-13 Satellite Orbit Map

(7) Print Preview

Text results, number of satellites, PDOP value and satellite sky distribution can be printed out through print preview and print functions.

5.10.4 Ephemeris Download

The ephemeris download tool can provide users with precise satellite orbit and clock error files released by Igs.

Click [GNSS] – [Ephemeris Download] in the HBC software menu to open the ephemeris download window. Users can download the precise ephemeris they need through simple configuration.

The general steps of using the precise ephemeris download tool include:

1. Select the download period;
2. Set the storage directory;
3. Select the site to download (some sites may not be available);
4. Select the ephemeris type to download (Ultrafast / fast / final);
5. Click the [Start] button to start the download process.

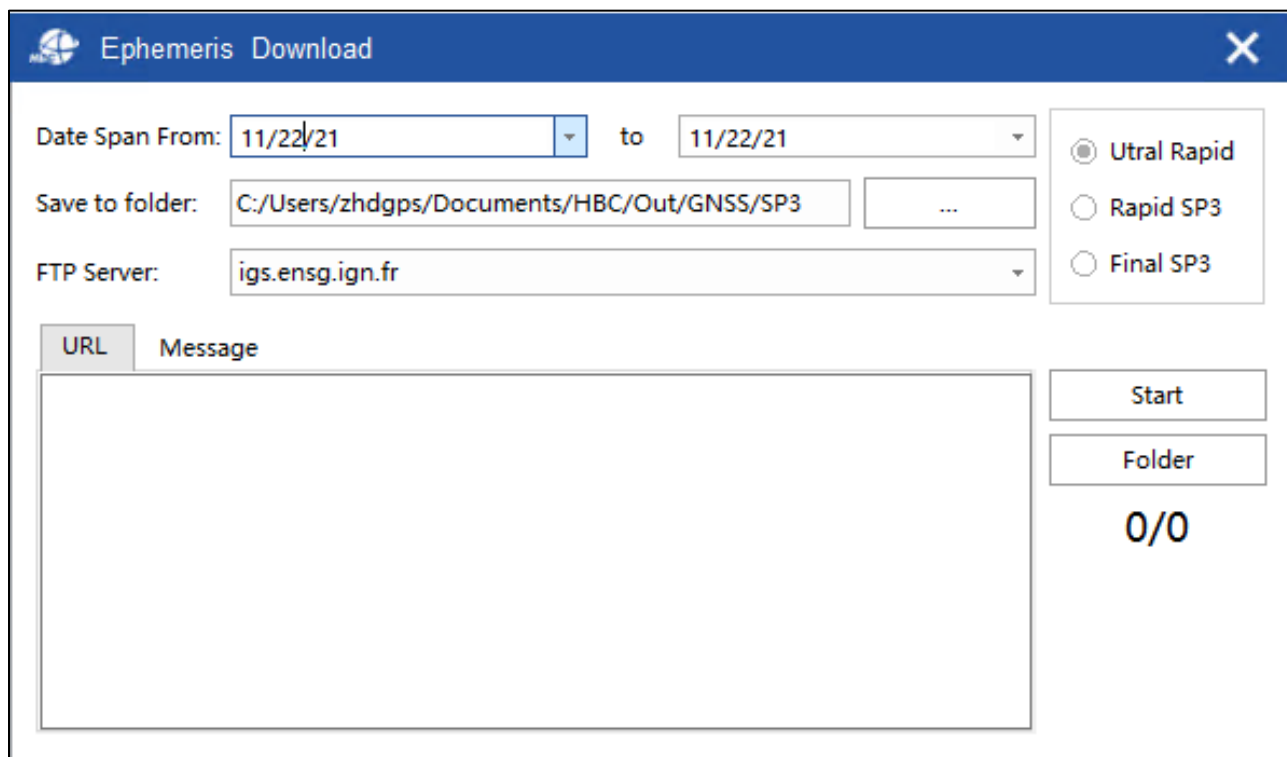


Figure 5-10-14 Ephemeris Download

5.11 GNSS Quick Start

This chapter mainly explains the general process of HBC data processing software solution through an example. Enable users to quickly understand the use method of the software in a short time. This chapter is suitable for users who have just started using the software.

This chapter only introduces the general use process of GNSS module data processing of HBC software. For other more detailed and advanced use methods, please refer to the following chapters. The general steps of static data processing include:

1. Create a new project and set the coordinate system;
2. Import data and edit file information;
3. The baseline is calculated and adjusted according to the residual information until the baseline quality is qualified;
4. Network adjustment: after inputting control point information, complete free network adjustment - > 84 constrained adjustment - > local 3D constrained adjustment or 2D constrained adjustment;
5. Export various solution reports.

5.11.1 Static GPS Data Processing

1. New Project

Execute the main program and start the post-processing software.

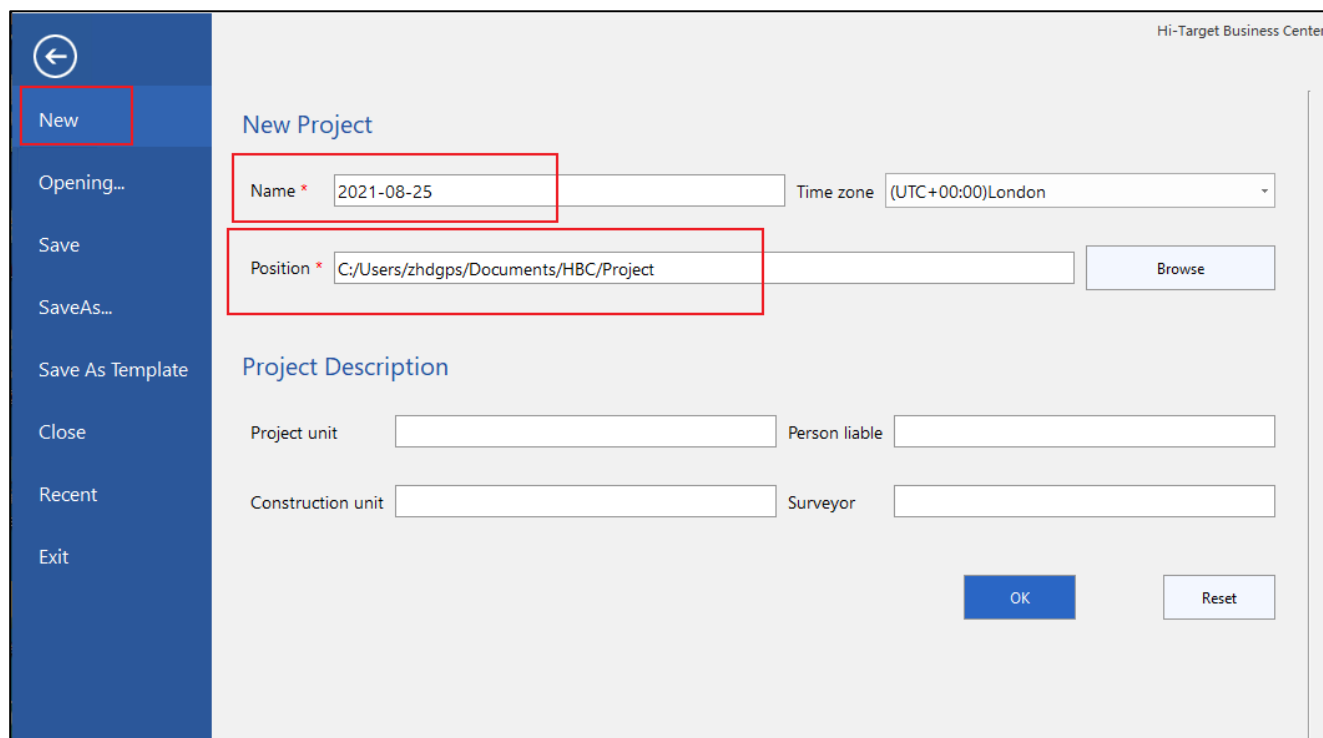


Figure 5-11-1 New Project

Click [New] to enter the new project interface. Enter the project name in 'Name' and select the folder where the project is stored. The path of the existing project file is displayed in 'Position'. Press [OK] to complete the creation of the new project.

2. Coordinate System Settings

After setting the project name and location, the system will automatically pop up the coordinate system setting dialog box, which mainly sets the local reference ellipsoid, projection method and parameters.


Coordinate System - WGS 1984
✕

Datum
Projection
Ellipsoid Transformation
Plane Transformation
Height Fitting
Grid
C ◀ ▶

Source Ellipsoid
WGS 1984

a(m)
6378137.000000

1/f
298.257224

Local Ellipsoid
WGS 1984

a(m)
6378137.000000

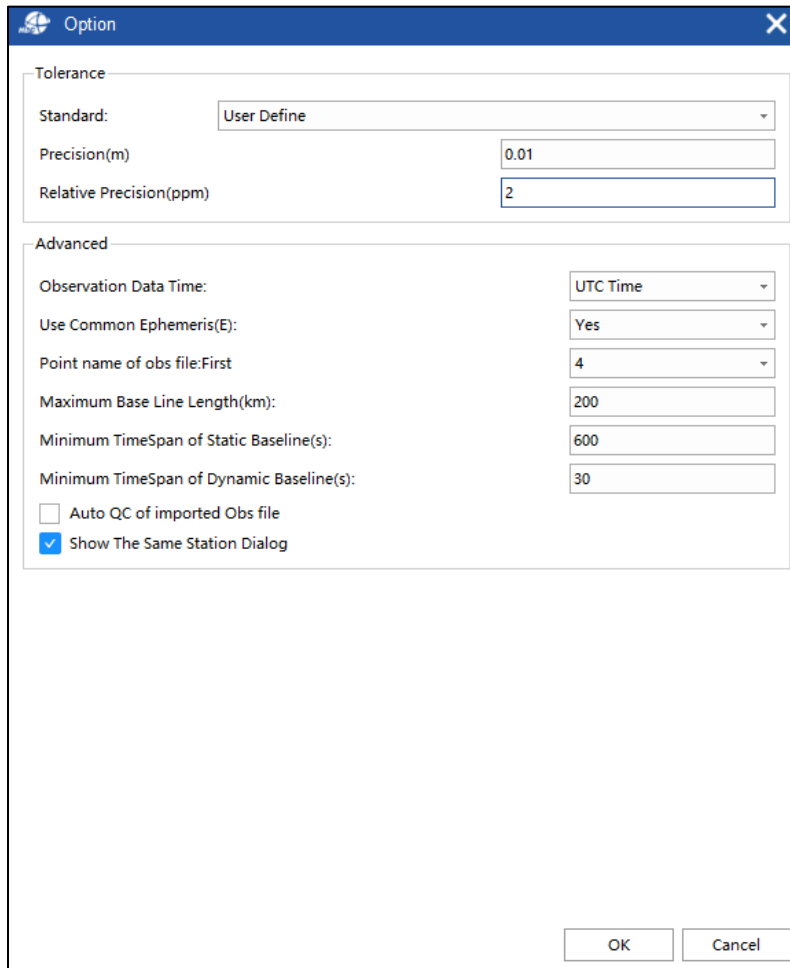
1/f
298.257224

Share
Get
Import
Manager
OK
Cancel

Figure 5-11-2 Coordinate System

3. Project Attribute Modification

Select options in the GNSS menu, and the options dialog box will pop up automatically. You can set the details of the item. Here, you can set the tolerance item.



The 'Option' dialog box is shown with the following settings:

- Tolerance**
 - Standard: User Define
 - Precision(m): 0.01
 - Relative Precision(ppm): 2
- Advanced**
 - Observation Data Time: UTC Time
 - Use Common Ephemeris(E): Yes
 - Point name of obs file:First: 4
 - Maximum Base Line Length(km): 200
 - Minimum TimeSpan of Static Baseline(s): 600
 - Minimum TimeSpan of Dynamic Baseline(s): 30
 - ☐ Auto QC of imported Obs file
 - ☒ Show The Same Station Dialog

Buttons: OK, Cancel

Figure 5-11-3 Project Properties

4. Import File

After the task is completed, start loading the observation data file. Select [Import Data File] – [GNSS Files] – [RAW GNSS Observation Files] / [GNSS Observation Dir] to enter the file selection dialog box.

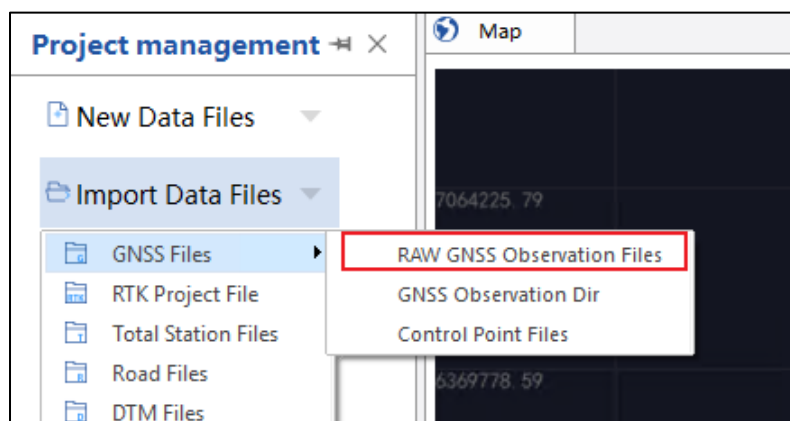


Figure 5-11-4 Import Data Files

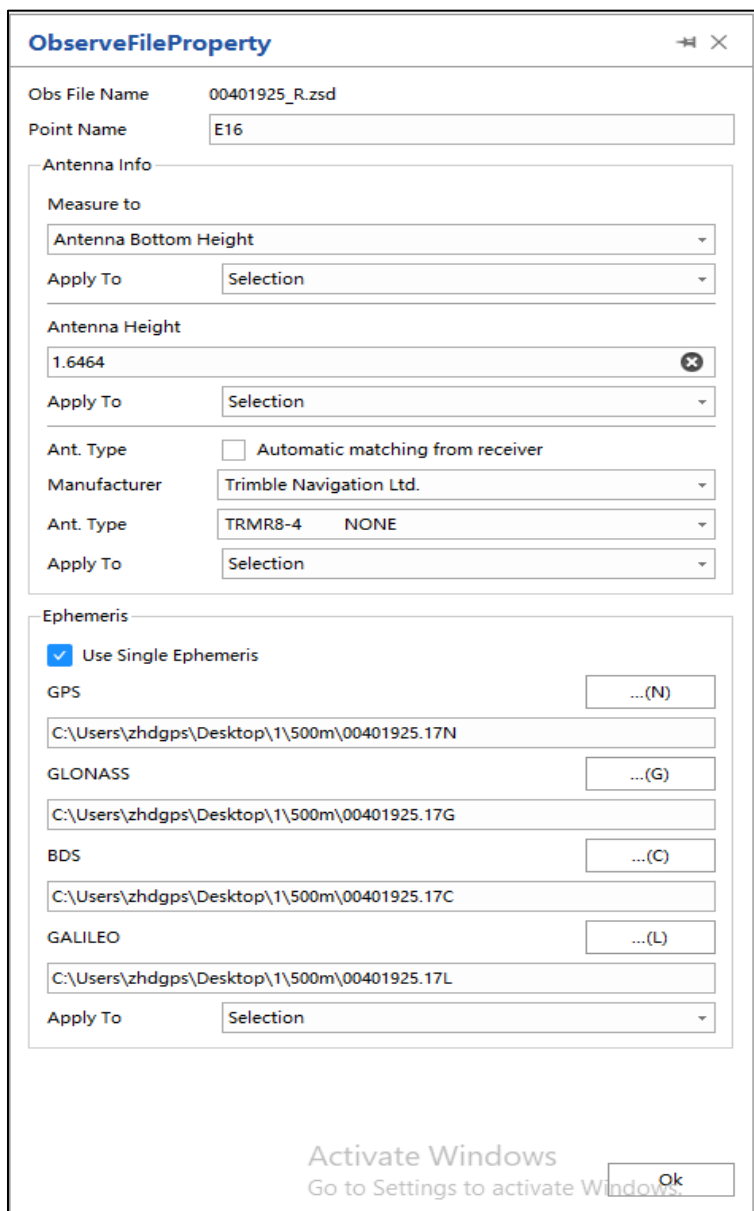
After importing data, the software automatically forms baseline, synchronous loop, asynchronous loop, repeated baseline and other information. The display window is as follows.

GNSS Data													
	File	Station	Mode	Start Time	End Time	Time Span	Interval	Measure to	Antenna Height	True Height	Antenna Type	Receiver Type	
1	00401925_R.zsd	E16	Static	2017-07-11 07:21:00.0	2017-07-11 09:51:00.0	02:30:00	15	Antenna Bottom Height	1.6464	1.7235	TRMR8-4	NONE	TRIMBLE R8-4
2	E17_1920_R.zsd	E17	Static	2017-07-11 02:14:30.0	2017-07-11 04:41:00.0	02:26:30	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14	NONE	LEICA GS14
3	E17_1921_R.zsd	E17	Static	2017-07-11 04:45:00.0	2017-07-11 06:25:15.0	01:40:15	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14	NONE	LEICA GS14
4	E17_1922_R.zsd	E17	Static	2017-07-11 06:27:45.0	2017-07-11 09:13:45.0	02:46:00	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14	NONE	LEICA GS14
5	00401921_R.zsd	E18	Static	2017-07-11 01:42:15.0	2017-07-11 05:01:45.0	03:19:30	15	Antenna Bottom Height	1.4120	1.4891	TRMR8-4	NONE	TRIMBLE R8-4
6	00401923_R.zsd	E18	Static	2017-07-11 05:02:45.0	2017-07-11 06:14:30.0	01:11:45	15	Antenna Bottom Height	1.4120	1.4891	TRMR8-4	NONE	TRIMBLE R8-4
7	00361921_R.zsd	E19	Static	2017-07-11 02:51:15.0	2017-07-11 04:20:15.0	01:29:00	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4	NONE	TRIMBLE R8-4
8	00361923_R.zsd	E19	Static	2017-07-11 04:22:00.0	2017-07-11 06:36:00.0	02:14:00	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4	NONE	TRIMBLE R8-4
9	00361925_R.zsd	E19	Static	2017-07-11 06:57:00.0	2017-07-11 10:04:00.0	03:07:00	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4	NONE	TRIMBLE R8-4
10	00121923_R.zsd	E20	Static	2017-07-11 04:56:45.0	2017-07-11 06:22:30.0	01:25:45	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4	NONE	TRIMBLE R8-4
11	00121925_R.zsd	E20	Static	2017-07-11 06:23:45.0	2017-07-11 07:41:00.0	01:17:15	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4	NONE	TRIMBLE R8-4
12	00121927_R.zsd	E20	Static	2017-07-11 07:44:45.0	2017-07-11 09:45:15.0	02:00:30	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4	NONE	TRIMBLE R8-4
13	F14_1920_R.zsd	F14	Static	2017-07-11 02:35:30.0	2017-07-11 04:31:00.0	01:55:30	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14	NONE	LEICA GS14
14	F14_1921_R.zsd	F14	Static	2017-07-11 04:33:15.0	2017-07-11 06:39:30.0	02:06:15	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14	NONE	LEICA GS14
15	F14_1922_R.zsd	F14	Static	2017-07-11 06:42:00.0	2017-07-11 08:48:00.0	02:06:00	15	Phase Center Height	0.0000	0.0000	!		

Figure 5-11-5 Observation Files List

5. File Information Editing

When the data is loaded, all files will be displayed. Click [Observation Files] in the upper menu bar to view the detailed file list. Double click a line to pop up the editing interface, which is mainly used to determine the antenna height, receiver type and antenna type. Complete the input or editing of all file antenna information in the same way. The user can also directly modify the point name, antenna type and antenna height information in the file list processing.



ObserveFileProperty

Obs File Name: 00401925_R.zsd

Point Name: E16

Antenna Info

Measure to: Antenna Bottom Height

Apply To: Selection

Antenna Height: 1.6464

Apply To: Selection

Ant. Type: ☐ Automatic matching from receiver

Manufacturer: Trimble Navigation Ltd.

Ant. Type: TRMR8-4 NONE

Apply To: Selection

Ephemeris

☒ Use Single Ephemeris

GPS: ... (N)
C:\Users\zhdgps\Desktop\1\500m\00401925.17N

GLONASS: ... (G)
C:\Users\zhdgps\Desktop\1\500m\00401925.17G

BDS: ... (C)
C:\Users\zhdgps\Desktop\1\500m\00401925.17C

GALILEO: ... (L)
C:\Users\zhdgps\Desktop\1\500m\00401925.17L

Apply To: Selection

Activate Windows
Go to Settings to activate Windows.

Ok

Figure 5-11-6 Observe File Property

6. Processing Baseline

When the data is loaded, the system will display all GPS baseline vectors, and the [Map] will display the situation of the whole GPS network. Next, perform baseline processing. Click [Baseline] - > [Baseline Processing] in the menu bar to process all baseline vectors using the default baseline processing settings.

During processing, the progress of the whole baseline processing process is displayed.

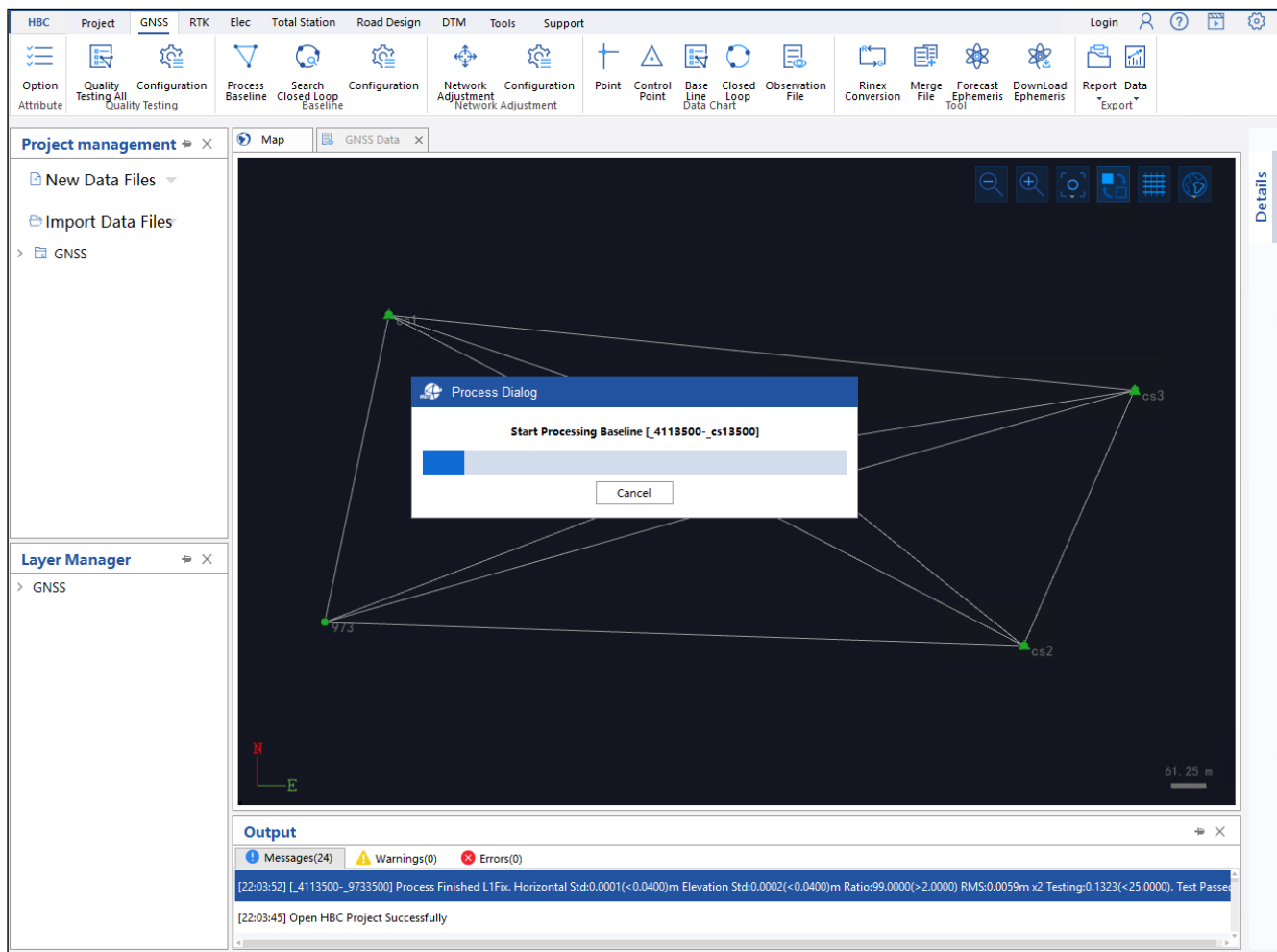


Figure 5-11-7 Processing Baseline

The time of baseline calculation is determined by the number of baselines, the length of baseline observation time, the setting of baseline processing, and the speed of the computer. After processing all baseline vectors, all baseline solutions will be listed in the baseline list window, and the original unsolved baseline in the network diagram will change from light color to dark green.

7. Setting Before Adjustment

After the baseline processing is completed, the baseline processing results need to be checked. Since this chapter is a quick start, we assume that all baselines involved in the solution are qualified. Generally, if the observation conditions are good, all baselines can be processed successfully at one time. After the baseline solution is qualified, some baselines need to be removed according to the synchronous observation of the baseline, which will not be introduced here.

Now let's go directly to the preparation of network adjustment. First, determine which sites are control points.

Click [Points], right-click the selected site and select [Convert To Control Point]. These points will be automatically added to the control point list.

GNSS Data								
	Related Control Point	Point Name	B	L	H	N	E	Z
1		E16	30:22:27.10162N	113:34:07.98434E	14.3161	20447070.9843	14080967.5619	14.3161
2		E17			10.3684	20454783.6979	14087208.4600	10.3684
3		E18			16.5417	20458263.7744	14085982.5601	16.5417
4		E19			14.0550	20449842.9709	14089318.9544	14.0550
5		E20	30:21:56.94649N	113:34:28.40184E	9.3437	20458694.9992	14091186.6329	9.3437
6		F14	30:22:27.10162N	113:34:07.98434E	11.9068	20454086.4762	14084477.0981	11.9068

Figure 5-11-8 Convert to Control Point

Switch to the [Control Point] list and double-click a site name to edit it.

GNSS Control Point Details

Point Name

Code

☒ WGS84 Fixed

☒ BLH ☐ XYZ

Fixed

B

L

H

☒ Target Fixed

☐ BLH ☒ NEZ

Fixed

N

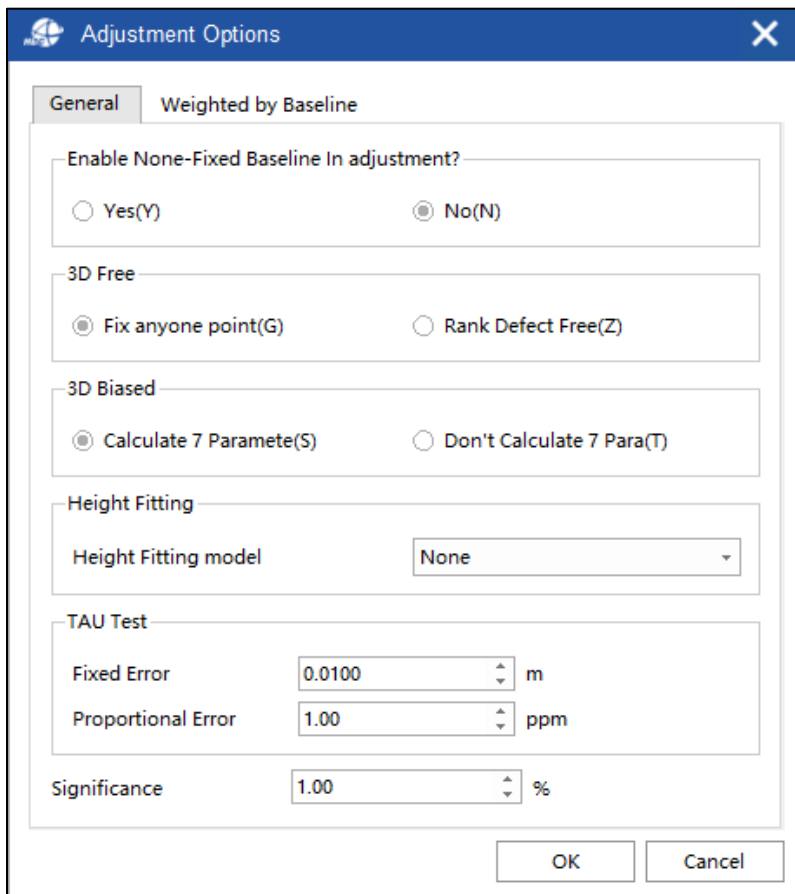
E

Z

Figure 5-11-9 GNSS Control Point Details

In the same way, all known point coordinates are input.

Select [Network Adjustment] -> [Adjustment Options] in the menu to enter the [Adjustment Options] window.



The image shows a software dialog box titled "Adjustment Options" with a close button (X) in the top right corner. The dialog has two tabs: "General" (selected) and "Weighted by Baseline".

Under the "General" tab, there are several sections:

- Enable None-Fixed Baseline In adjustment?**: Two radio buttons, "Yes(Y)" and "No(N)". "No(N)" is selected.
- 3D Free**: Two radio buttons, "Fix anyone point(G)" and "Rank Defect Free(Z)". "Fix anyone point(G)" is selected.
- 3D Biased**: Two radio buttons, "Calculate 7 Paramete(S)" and "Don't Calculate 7 Para(T)". "Calculate 7 Paramete(S)" is selected.
- Height Fitting**: A label "Height Fitting model" followed by a dropdown menu currently showing "None".
- TAU Test**: Three input fields with units:
 - Fixed Error: 0.0100 m
 - Proportional Error: 1.00 ppm
 - Significance: 1.00 %

At the bottom right of the dialog are "OK" and "Cancel" buttons.

Figure 5-11-10 Adjustment Options

8. Network Adjustment

Execute the [Network Adjustment] in the menu bar, and the adjustment tool will pop up. See the figure below.

Network Adjustment			
	Adjustment Result	Details	
1	Free Adjustment	Finished. x2 Test:Fail(x2=110183.0042,True range:64.0633~135.4330). Recommended relaxation factor:332.3570. Tau Test:passed baseline:16, failed baseline:21.	Report
2	WGS84 Datum Adjustment	Finished. x2 Test:Fail(x2=1460186.4515,True range:76.3768~153.1218). Recommended relaxation factor:1128.0519. Tau Test:passed baseline:15, failed baseline:22.	Report
3	Target Datum Adjustment	Finished. x2 Test:Fail(x2=, True range:73.0745~148.4236). Recommended relaxation factor:0.0. Tau Test:passed baseline:0, failed baseline:37.	Report
4	2D Biased and Height Fitting Ajust	Finished. x2 Test:Fail(x2=7317.4302,True range:44.8431~106.6476). Recommended relaxation factor:98.2882. Tau Test:passed baseline:3, failed baseline:34.	Report
Free Adjustment(F)		2D Biased and Height Fitting Ajust(T)	Auto Adjustment(A)
WGS84 Datum Adjustment(W)		Target Datum Adjustment	Clear Adjustment result(C)

Figure 5-11-11 Network Adjustment

Click [Auto Adjustment(A)], and the software will automatically complete free network adjustment, constrained adjustment under WGS84 coordinates, local 3D constrained adjustment and 2D constrained adjustment according to the starting conditions. And form a list of adjustment results. You can select the results to view and click [Report] to view the report.

9 Output of Achievements

In [Report] in the menu bar, select [Adjustment Report Options] to specify and select the output content and format.

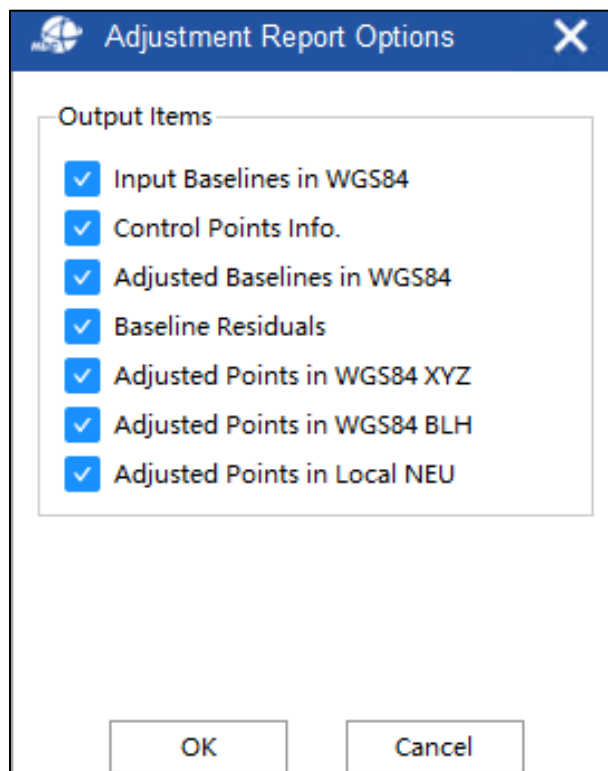


Figure 5-11-12 Adjustment Report Options

Then select the corresponding adjustment report in [Report] – [Adjustment Report] in the menu bar to export the corresponding adjustment report.

Taking the generation of HTML format report as an example, all the contents in the adjustment result are output into an HTML report form.

1. Input Baselines in WGS84		Free 3D Adjust Report							
2. Adjusted Baselines in WGS84									
3. Baseline Residuals									
4. Adjusted Points in WGS84 (XYZ)									
5. Before and after adjustment(BLH)									
6. Adjusted Points in WGS84 (BLH)		1. Input Baselines in WGS84							
7. Adjusted Points in Target System(NEZ)		Baselines	Tau	DX(m)	Std.Dev(mm)	DY(m)	Std.Dev(mm)	DZ(m)	Std.Dev(mm)
8. Weakest Baseline and Point		00401925_R-E17_1922_R	No	-1139.7470	0.5	-104.1884	1.1	-622.3142	0.5
		00401925_R-F14_1922_R	No	-1032.9537	1.0	-292.2725	1.9	-252.2836	0.8
		E17_1922_R-F14_1922_R	No	106.7857	0.4	-188.0675	0.8	370.0344	0.3
		E17_1920_R-F14_1920_R	No	107.3065	0.1	-189.2507	0.2	369.2803	0.2
		E17_1921_R-F14_1921_R	No	107.3031	0.2	-189.2489	0.3	369.2806	0.2
		E17_1922_R-F14_1921_R	No	107.3043	0.5	-189.2500	0.8	369.2808	0.5
		00401923_R-E17_1921_R	Yes	509.0331	0.3	410.8070	0.4	-307.3599	0.2
		00401921_R-E17_1921_R	No	509.0309	0.5	410.8060	0.8	-307.3564	0.5
		00401921_R-E17_1920_R	Yes	509.0287	0.2	410.8081	0.2	-307.3596	0.2

Figure 5-11-13 Adjustment Report Example

So far, a complete baseline solution result and the coordinate results of each station after adjustment have been obtained, and the static solution has been completed.

5.11.2 Dynamic GPS Data Processing

The dynamic route will have two files, one is the base station data file and the other is the mobile station file.

After importing the file according to the above method, set the mobile station file as dynamic type in the right-click menu, and then click baseline solution, and the software can process the data according to the dynamic line mode.

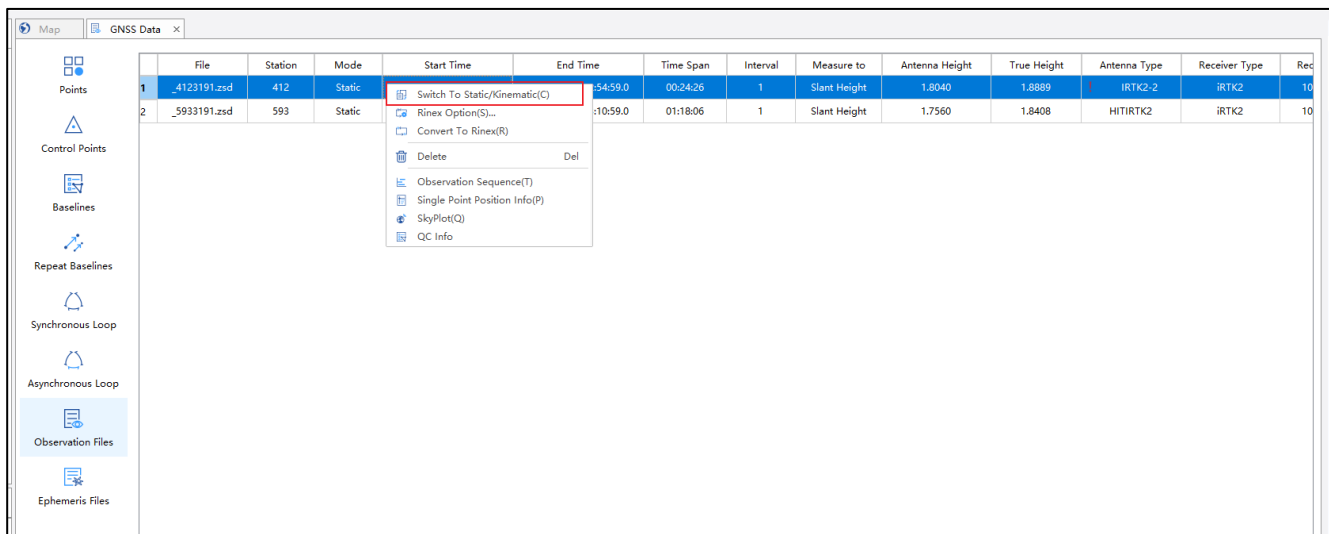


Figure 5-11-14 Switch to Static/Kinematic

At this time, switch to the baseline list, and you can see that the baseline type formed by the two files is 'dynamic'.

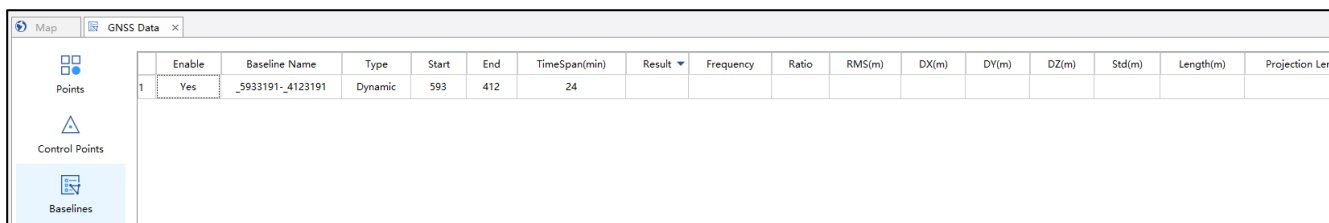


Figure 5-11-15 Baseline List

Click [Baseline Processing] in the menu bar, and the software starts to solve the dynamic baseline. After the solution is completed, the report can be exported and viewed in [Report] - [Baseline Report], forming the positioning results of each epoch.

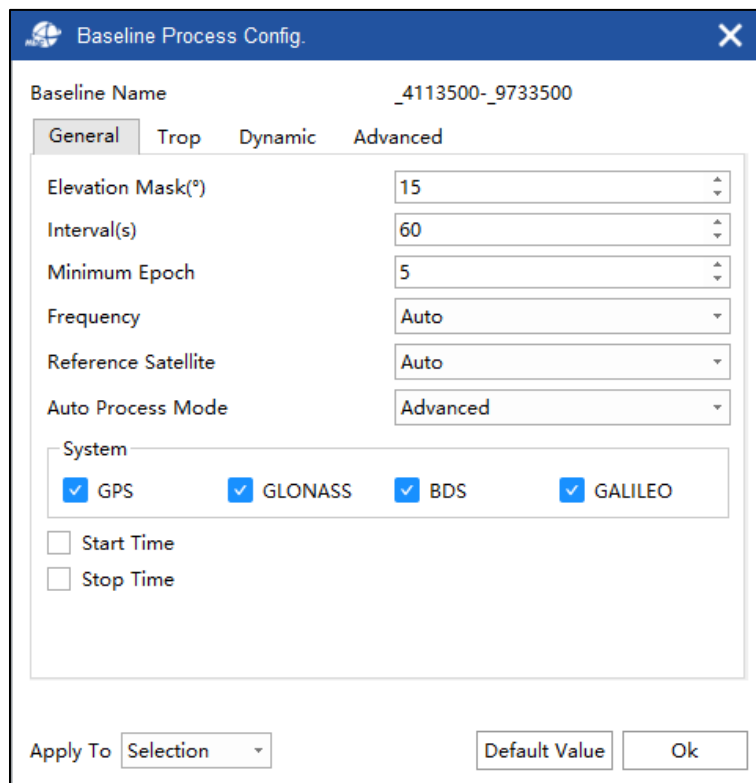
1. Reference station info.		Base East(m): 500000						
2. Coordinate Parameter								
3. Go Report								
ID	Name	Time	Status	Mode	Ratio	Horizontal Std.(mm)	Vertical Std.(mm)	RMS(mm)
Sats	WGS84-B	WGS84-L		WGS84-H(m)	North(m)	East(m)	Up(m)	
1	pt0	2020-11-14 12:30:32.999	Passed	L1L2Fixed	62.9054	6.6	8.2	10.5
	28	41:42:46.84700N	86:13:04.49314E	895.9903	4620056.6884	434913.0768	895.9903	
2	pt1	2020-11-14 12:30:33.999	Passed	L1L2Fixed	62.6957	6.8	8.3	10.7
	28	41:42:46.84704N	86:13:04.49330E	895.9931	4620056.6896	434913.0806	895.9931	
3	pt2	2020-11-14 12:30:34.999	Passed	L1L2Fixed	62.3515	7.2	8.3	11.0
	28	41:42:46.84687N	86:13:04.49332E	895.9928	4620056.6844	434913.0809	895.9928	
4	pt3	2020-11-14 12:30:35.999	Passed	L1L2Fixed	62.2348	7.1	8.1	10.8
	28	41:42:46.84701N	86:13:04.49342E	895.9898	4620056.6886	434913.0833	895.9898	
5	pt4	2020-11-14 12:30:36.999	Passed	L1L2Fixed	15.7642	4.5	6.0	7.5
	28	41:42:46.84687N	86:13:04.49314E	895.9875	4620056.6843	434913.0768	895.9875	
6	pt5	2020-11-14 12:30:37.999	Passed	L1L2Fixed	16.6605	4.4	5.8	7.2
	28	41:42:46.84691N	86:13:04.49310E	895.9921	4620056.6838	434913.0759	895.9921	
7	pt6	2020-11-14 12:30:38.999	Passed	L1L2Fixed	15.5312	4.3	5.7	7.1
	28	41:42:46.84677N	86:13:04.49308E	895.9887	4620056.6814	434913.0754	895.9887	
8	pt7	2020-11-14 12:30:39.999	Passed	L1L2Fixed	16.9018	4.2	5.6	7.0
	28	41:42:46.84690N	86:13:04.49296E	895.9908	4620056.6855	434913.0726	895.9908	
9	pt8	2020-11-14 12:30:40.999	Passed	L1L2Fixed	17.2873	4.2	5.6	7.0
	28	41:42:46.84697N	86:13:04.49315E	895.9897	4620056.6874	434913.0771	895.9897	
10	pt9	2020-11-14 12:30:41.999	Passed	L1L2Fixed	19.4694	4.1	5.6	7.0
	27	41:42:46.84700N	86:13:04.49308E	895.9872	4620056.6883	434913.0755	895.9872	
11	pt10	2020-11-14 12:30:42.999	Passed	L1L2Fixed	19.5823	4.1	5.5	6.9
	27	41:42:46.84696N	86:13:04.49315E	895.9818	4620056.6873	434913.0771	895.9818	

Figure 5-11-16 Baseline Report

5.12 Static Baseline Processing

5.12.1 Baseline Processing Settings

To set baseline vector processing before baseline vector processing, execute [Baseline Processing Config] under [Baseline] in the menu bar, and the following dialog box appears.



Baseline Process Config.

Baseline Name: _4113500_-9733500

General Trop Dynamic Advanced

Elevation Mask(°): 15

Interval(s): 60

Minimum Epoch: 5

Frequency: Auto

Reference Satellite: Auto

Auto Process Mode: Advanced

System

☒ GPS ☒ GLONASS ☒ BDS ☒ GALILEO

☐ Start Time

☐ Stop Time

Apply To: Selection

Default Value Ok

Figure 5-12-1 Baseline Process Configuration

The dialog box consists of four pages, including general settings, tropospheric and ionosphere settings, dynamic settings and advanced settings.

The meaning of each item in the dialog box is briefly introduced below.

1. General Settings

(1) Elevation Mask

The elevation mask is used to limit the satellite data with relatively low altitude so that it does not participate in the baseline calculation.

Due to the complex influence of the atmosphere on the satellite signals with relatively low altitude, it is difficult to correct them with the model, and because the signals with relatively low altitude are vulnerable to various factors such as multipath, electromagnetic wave and so on, their signal quality is usually relatively low. Therefore, they are usually eliminated in data processing.

For example, from the point of view of atmospheric refraction, the height cut-off angle can be reduced for short-distance observation; For long-distance observation, the height cut-off angle should be increased, because the shorter the distance, the easier it is for the influence of atmospheric refraction to offset each other. Of course, the setting of height cutoff angle depends on the environment around the observation station.

During field observation, the height cut-off angle shall be reduced according to the satellite distribution, so as to collect as much data as possible and facilitate processing.

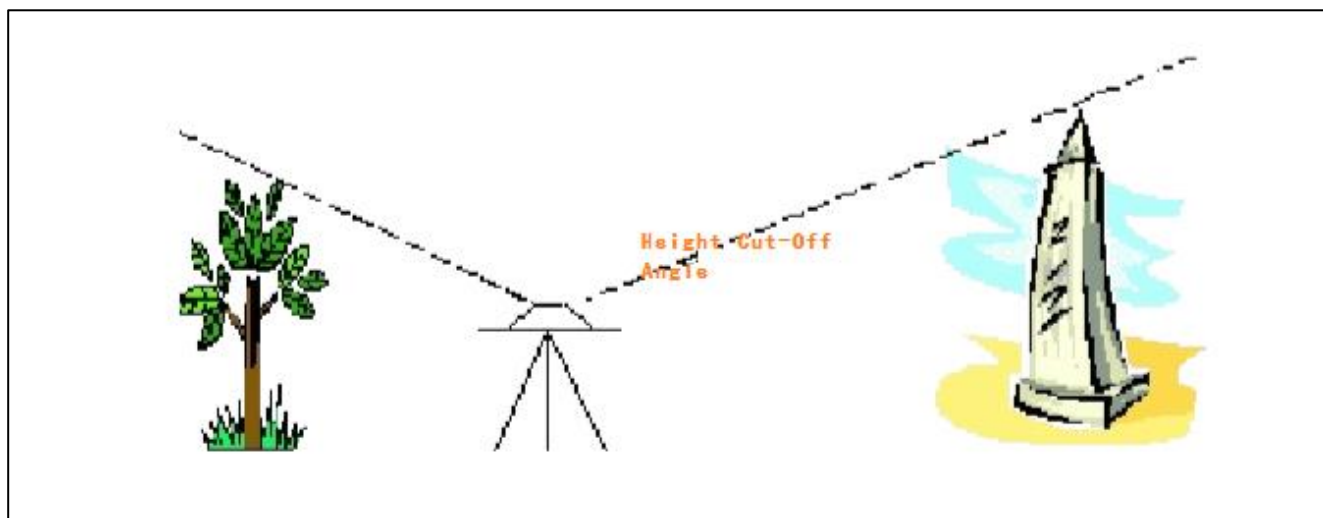


Figure 5-12-2 Height Cut-off Angle

The default Elevation Mask is 20 degrees.

(2) Sampling Interval

The so-called epoch interval is the interval at which the software extracts data from the original observation data during baseline processing.

For example, the two instruments are set to collect a set of data every 5 seconds during static observation, but such high-density observation data usually can not significantly improve the accuracy of baseline, but will greatly increase the time of baseline processing. Therefore, in order to improve the speed of baseline processing, the user can appropriately increase the sampling interval of data processing.

So, what is the appropriate sampling interval? It is generally believed that for the short side and the observation time is short, the sampling interval can be appropriately reduced, while for the long side, the sampling interval can be appropriately increased. For example, when the static baseline is within 2 km and the observation time is within 20 minutes, we can set the sampling interval to 5 seconds. However, when the baseline is long, the sampling interval can usually be increased to 60 seconds or 120 seconds.

So why do we need to set a relatively small sampling interval during field observation? This is because when bad data are encountered, due to the randomness of the observation data and the limitation of the function of the software itself, the processing results can often be improved by modifying the epoch interval and reprocessing the baseline.

The default epoch interval of the software will change with the observation time. It is 5S in 10 minutes, 30s in 10 minutes to two hours, 60 in two hours to six hours, and 120s in more than six hours.

(3) Minimum Epoch

In the process of observation, the receiver must observe the continuous carrier phase. If a section of data has continuous cycle slip, the quality of this section of data is usually very poor, which often affects the quality of baseline processing. Therefore, it should be eliminated. Therefore, in the process of baseline processing, the software will eliminate the data segment with the number of observation continuous epochs not exceeding the minimum number of epochs.

(4) Frequency

Different combined observation values can be selected for baseline calculation, such as wide term combination LW, narrow lane combination LN, etc. When the automatic mode is adopted, the software will automatically select the observation value type according to the baseline length. Generally, the baseline less than 10km is calculated by L1 observation value, and the baseline greater than 10km is calculated by LC ionospheric combination observation value.

(5) Reference Satellite

Since the double difference observation value is formed by the difference of the single difference observation value between satellites, in order to facilitate processing, the software adopts the method of selecting the reference satellite.

The default setting is automatic. At this time, the software will select the satellite with the most observation data and high altitude angle as the reference satellite. However, due to the influence of observation conditions, such selection may not be the most reasonable. When the reference satellite is not selected properly, the baseline processing results will be affected. At this time, the user needs to reset the reference satellite according to the observation data.

(6) Automatic Process Mode

The baseline solution engine of HBC has the function of automatically eliminating gross error satellite data, which can help users reduce the work of manually eliminating data and make the baseline solution qualified in the shortest time. This function can be enabled only when this item is set to 'Advanced'. If the user wants to manually eliminate the data and does not want the software to automatically delete the problem data, this item can be set to 'General'.

(7) System

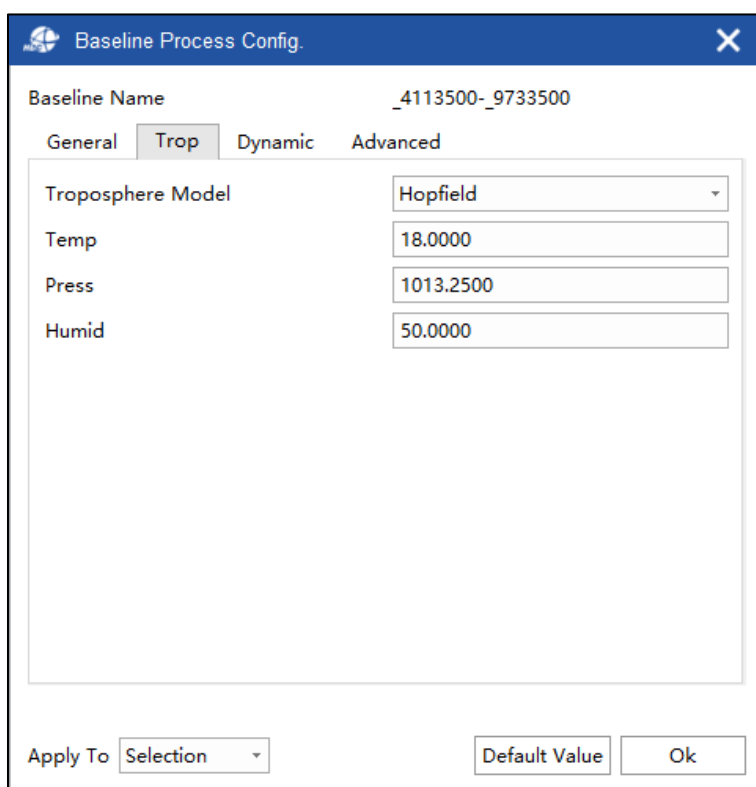
HBC software supports any combination of GPS, GLONASS, Compass and Galileo systems.

(8) Processing Time

The software processes all public data of the base station and mobile station by default. If you need to process data in a fixed time period, you can manually set the start and end times.

2. Trop Setting

Generally, there is no need to change the trop settings. The medium and long baseline can be set according to the actual situation to improve the solution accuracy.



The image shows a screenshot of the 'Baseline Process Config' dialog box with the 'Trop' tab selected. The 'Baseline Name' is '_4113500-_9733500'. The 'Trop' tab is active, showing settings for the Troposphere Model (Hopfield), Temp (18.0000), Press (1013.2500), and Humid (50.0000). At the bottom, there is an 'Apply To' dropdown menu set to 'Selection', and buttons for 'Default Value' and 'Ok'.

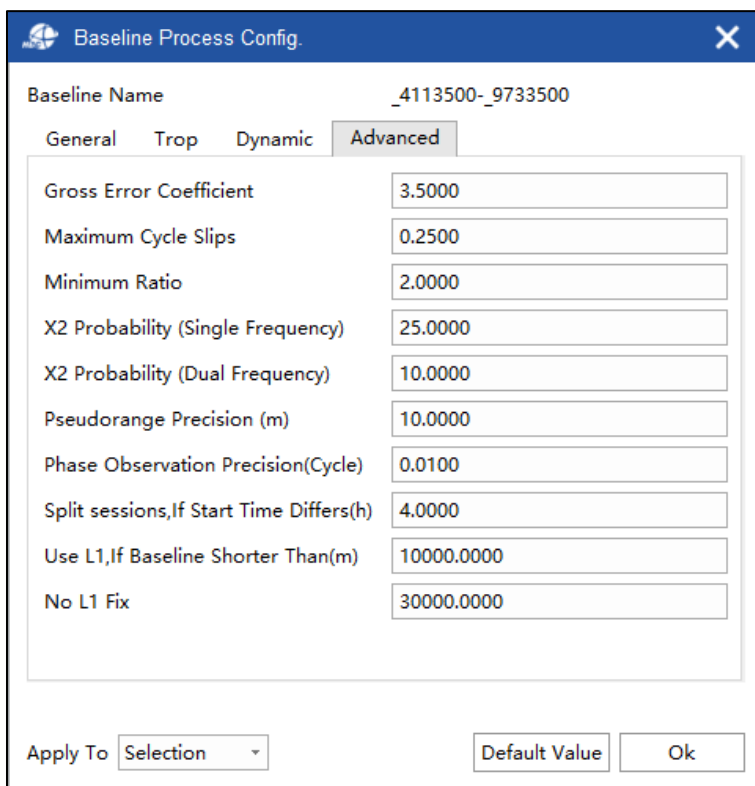
Parameter	Value
Troposphere Model	Hopfield
Temp	18.0000
Press	1013.2500
Humid	50.0000

Figure 5-12-3 Baseline Process Configuration-trop

3. Advanced Setting

The following figure shows the advanced settings dialog box. Under normal circumstances, the default value can meet the requirements. It is not recommended that users make illegal changes, which will affect the stability of the solution engine.

- (1) Gross Error Coefficient: When calculating the baseline, the coefficient of gross error data is automatically eliminated according to the size of double error residual, that is, when the double error residual generated by an observation data is greater than the gross error coefficient * RMS, the observation data is eliminated.
- (2) Maximum Cycle Slips: The tolerance threshold of cycle slip repair. If the difference between the cycle slip value and the rounded integer is less than the threshold, cycle slip repair will be carried out, otherwise it will be regarded as gross error.
- (3) Minimum Ratio: a threshold value with fixed ambiguity using lambda algorithm.
- (4) X2 Probability: The Probability in X2 test of RMS.
- (5) Pseudorange Precision: Observation error of pseudorange.
- (6) Phase Observation Precision: Observation error of carrier phase.
- (7) Split sessions, If Start Time Differs: When the baseline data observation period exceeds this value, it is solved in two periods.
- (8) Use L1, If Baseline Shorter Than: When the automatic processing model is used for baseline calculation, L1 model is used when the baseline length is less than this value, and LC model is used when it is greater than this value.
- (9) No L1 Fix: When the single frequency baseline length is greater than this value, the ambiguity is not fixed, and the floating solution is directly output.



Baseline Process Config.	
Baseline Name: _4113500_-9733500	
General Trop Dynamic Advanced	
Gross Error Coefficient	3.5000
Maximum Cycle Slips	0.2500
Minimum Ratio	2.0000
X2 Probability (Single Frequency)	25.0000
X2 Probability (Dual Frequency)	10.0000
Pseudorange Precision (m)	10.0000
Phase Observation Precision(Cycle)	0.0100
Split sessions,If Start Time Differs(h)	4.0000
Use L1,If Baseline Shorter Than(m)	10000.0000
No L1 Fix	30000.0000
Apply To	Selection
Default Value Ok	

Figure 5-12-4 Baseline Process Configuration-advanced

4. Baseline Processing Menu

Click [GNSS] in the menu bar to pop up the baseline processing menu.

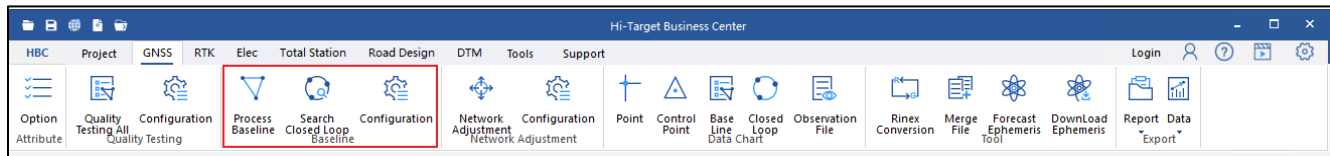


Figure 5-12-5 Baseline Process Menu

Of which: [Search Closed Loop]: search the qualified closed loop according to the set maximum and minimum edges of the closed loop, and the search results are displayed in the tree view on the left.

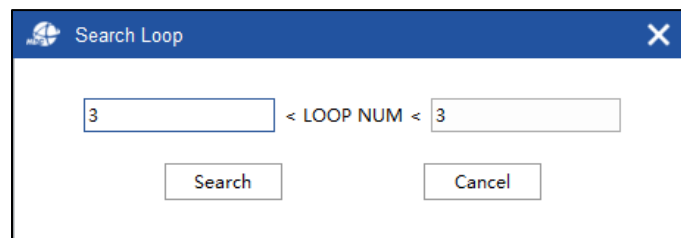


Figure 5-12-6 Search Closed Loop

5.12.2 Baseline Processing

After making the above preparations, execute [Baseline Processing] under the [Baseline] menu, and the program starts to process all baselines one by one, and the information dialog box appears.

In the dialog box, the name, progress and information of each baseline are listed respectively.

The baseline solution runs in the background in a multithreaded manner. During operation, you can select [Cancel] to stop the baseline processing.

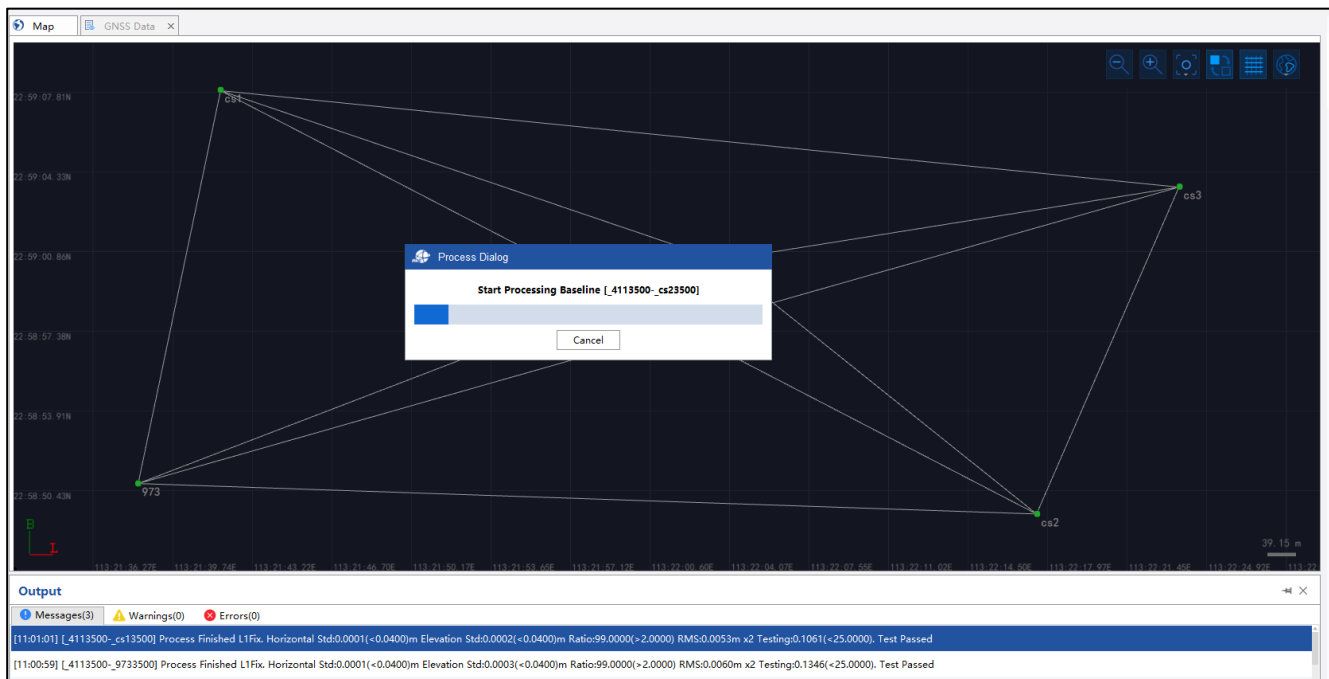
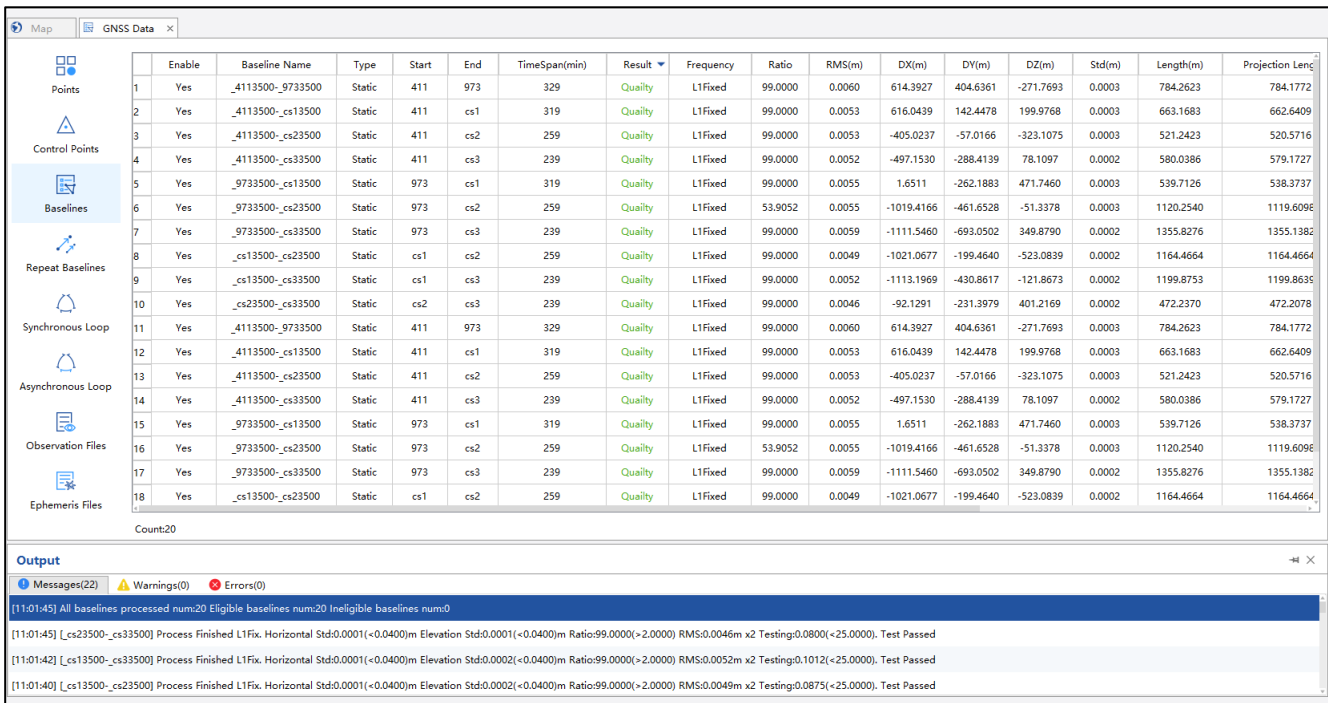


Figure 5-12-7 Baseline Processing

After the baseline processing is completed, the results of the baseline processing will be obtained in the calculation window.



	Enable	Baseline Name	Type	Start	End	TimeSpan(min)	Result	Frequency	Ratio	RMS(m)	DX(m)	DY(m)	DZ(m)	Std(m)	Length(m)	Projection Leng
1	Yes	_4113500_-9733500	Static	411	973	329	Quality	L1Fixed	99.0000	0.0060	614.3927	404.6361	-271.7693	0.0003	784.2623	784.1772
2	Yes	_4113500_-cs13500	Static	411	cs1	319	Quality	L1Fixed	99.0000	0.0053	616.0439	142.4478	199.9768	0.0003	663.1683	662.6409
3	Yes	_4113500_-cs23500	Static	411	cs2	259	Quality	L1Fixed	99.0000	0.0053	-405.0237	-57.0166	-323.1075	0.0003	521.2423	520.5716
4	Yes	_4113500_-cs33500	Static	411	cs3	239	Quality	L1Fixed	99.0000	0.0052	-497.1530	-288.4139	78.1097	0.0002	580.0386	579.1727
5	Yes	_9733500_-cs13500	Static	973	cs1	319	Quality	L1Fixed	99.0000	0.0055	1.6511	-262.1883	471.7460	0.0003	539.7126	538.3737
6	Yes	_9733500_-cs23500	Static	973	cs2	259	Quality	L1Fixed	53.9052	0.0055	-1019.4166	-461.6528	-51.3378	0.0003	1120.2540	1119.6096
7	Yes	_9733500_-cs33500	Static	973	cs3	239	Quality	L1Fixed	99.0000	0.0059	-1111.5460	-693.0502	349.8790	0.0002	1355.8276	1355.1382
8	Yes	_cs13500_-cs23500	Static	cs1	cs2	259	Quality	L1Fixed	99.0000	0.0049	-1021.0677	-199.4640	-523.0839	0.0002	1164.4664	1164.4664
9	Yes	_cs13500_-cs33500	Static	cs1	cs3	239	Quality	L1Fixed	99.0000	0.0052	-1113.1969	-430.8617	-121.8673	0.0002	1199.8753	1199.8635
10	Yes	_cs23500_-cs33500	Static	cs2	cs3	239	Quality	L1Fixed	99.0000	0.0046	-92.1291	-231.3979	401.2169	0.0002	472.2370	472.2078
11	Yes	_4113500_-9733500	Static	411	973	329	Quality	L1Fixed	99.0000	0.0060	614.3927	404.6361	-271.7693	0.0003	784.2623	784.1772
12	Yes	_4113500_-cs13500	Static	411	cs1	319	Quality	L1Fixed	99.0000	0.0053	616.0439	142.4478	199.9768	0.0003	663.1683	662.6409
13	Yes	_4113500_-cs23500	Static	411	cs2	259	Quality	L1Fixed	99.0000	0.0053	-405.0237	-57.0166	-323.1075	0.0003	521.2423	520.5716
14	Yes	_4113500_-cs33500	Static	411	cs3	239	Quality	L1Fixed	99.0000	0.0052	-497.1530	-288.4139	78.1097	0.0002	580.0386	579.1727
15	Yes	_9733500_-cs13500	Static	973	cs1	319	Quality	L1Fixed	99.0000	0.0055	1.6511	-262.1883	471.7460	0.0003	539.7126	538.3737
16	Yes	_9733500_-cs23500	Static	973	cs2	259	Quality	L1Fixed	53.9052	0.0055	-1019.4166	-461.6528	-51.3378	0.0003	1120.2540	1119.6096
17	Yes	_9733500_-cs33500	Static	973	cs3	239	Quality	L1Fixed	99.0000	0.0059	-1111.5460	-693.0502	349.8790	0.0002	1355.8276	1355.1382
18	Yes	_cs13500_-cs23500	Static	cs1	cs2	259	Quality	L1Fixed	99.0000	0.0049	-1021.0677	-199.4640	-523.0839	0.0002	1164.4664	1164.4664

Count:20

Output

Messages(22) Warnings(0) Errors(0)

[11:01:45] All baselines processed num:20 Eligible baselines num:20 Ineligible baselines num:0

[11:01:45] [_cs23500_-cs33500] Process Finished L1Fix. Horizontal Std:0.0001(<0.0400)m Elevation Std:0.0001(<0.0400)m Ratio:99.0000(>2.0000) RMS:0.0046m x2 Testing:0.0800(<25.0000), Test Passed

[11:01:42] [_cs13500_-cs33500] Process Finished L1Fix. Horizontal Std:0.0001(<0.0400)m Elevation Std:0.0002(<0.0400)m Ratio:99.0000(>2.0000) RMS:0.0052m x2 Testing:0.1012(<25.0000), Test Passed

[11:01:40] [_cs13500_-cs23500] Process Finished L1Fix. Horizontal Std:0.0001(<0.0400)m Elevation Std:0.0002(<0.0400)m Ratio:99.0000(>2.0000) RMS:0.0049m x2 Testing:0.0875(<25.0000), Test Passed

Figure 5-12-8 Baseline Processing Result

There will be warning information in the status bar. Click the warning information to display the corresponding baseline in the list.

The processing results of baseline solution can also be exported by clicking baseline report in report.

GNSS Baseline Report	
1. Project Properties	
2. Reference station info.	
3. Rover Info.	
4. Processing controls info.	
5. Satellite Selection	
6. Baseline processed results	
7. Final Coordinates	

1. Project Properties	
Baseline:	_4113500_9733500
Project Name:	Example
Ellipsoid:	WGS84
Time Zone:	(UTC+08:00)Beijing
Software Version:	HBC V1.1.1.825
Process time:	Friday 27 August 2021 11:01:45

2. Reference station info.	
Marker name:	411
WGS84 X(m):	-2330146.7522
WGS84 Y(m):	5392998.8303
WGS84 Z(m):	2475052.4892
WGS84 latitude:	22:59:00.53567N
WGS84 longitude:	113:22:03.60603E
WGS84 height(m):	43.7900
N(m):	2542848.0300
E(m):	435162.9483
Z(m):	43.7900
Receiver type:	iRTK5
Receiver version:	
Receiver S/N:	13674411
Antenna type:	HITRTK5
Antenna S/N:	
Antenna height(m)	0.1970
Measured to:	slant height

Figure 5-12-9 Baseline Processing Report

5.12.3 Baseline Processing Result Inspection

1. Baseline Quality Control

After baseline calculation, the quality of baseline calculation can be measured by several quality indicators such as RATIO, RMS and Point Accuracy.

(1) RATIO

RATIO is the ratio of sub minimum RMS to minimum RMS after integer ambiguity decomposition. Namely:

$$\text{RATIO} = \frac{RMS_{sec}}{RMS_{min}}$$

RATIO reflects the reliability of the determined whole week unknown parameters. This index depends on many factors, which is related to the quality of observation values and observation conditions.

RATIO is the most critical value to reflect the quality of baseline. Generally, ratio is required to be bigger than 1.8.

(2) RMS

RMS is root mean square error, Namely:

$$\text{RMS} = \sqrt{\frac{V^T P V}{n - f}}$$

Of which:

V is the residual of the observed value;

P is the weight of the observed value;

n-f is the total number of observations minus the number of unknowns.

RMS indicates the quality of the observations. The smaller the RMS, the better the quality of the observed value; On the contrary, it indicates that the worse the quality of observations. It is not affected by observation conditions (such as satellite distribution).

According to the theory of mathematical statistics, the probability of observation error falling within the range of 1.96 times RMS is 95%.

(3) Point Accuracy

The point position accuracy is an important indicator reflecting the accuracy in the solution results and the result of the joint action of the geometric figure strength of the satellite constellation and RMS. It can be divided into horizontal accuracy, vertical accuracy, baseline length accuracy, etc. the software will test different accuracy indicators according to the setting of the tolerance in the project attribute.

2. Closed Loop Test

(1) Definition of Closure Error

Closed loop inspection is a powerful method to detect baseline quality.

Closed loop can be divided into synchronous loop, asynchronous loop and repetitive baseline.

The closing error of the closed loop should be 0 in theory. In actual measurement, it is allowed to deviate from a certain value. Please refer to relevant literature for the limit error of the closed loop.

The closure and difference of rings can be divided into the following categories:

1) Component closure error, Namely:

$$\begin{cases} \varepsilon_{\Delta X} = \Sigma \Delta X \\ \varepsilon_{\Delta Y} = \Sigma \Delta Y \\ \varepsilon_{\Delta Z} = \Sigma \Delta Z \end{cases}$$

2) Relative closure error of the whole length, Namely:

$$\varepsilon = \frac{\sqrt{\varepsilon_{\Delta X}^2 + \varepsilon_{\Delta Y}^2 + \varepsilon_{\Delta Z}^2}}{\Sigma S}$$

Where S is the ring length

(2) Synchronous ring, asynchronous ring and repetitive baseline

1) Synchronous closed loop

The closure error of synchronous loop is the closure error of closed loop composed of synchronous observation baseline.

Because there is a certain internal relationship between synchronous observation baselines, the closure error of synchronous loop should always be 0 in theory. If the closing error of the synchronization ring exceeds the limit, it indicates that at least one baseline vector in the baselines constituting the synchronization ring is wrong. On the contrary, if the closing error of the synchronization ring does not exceed the limit, it can only be considered that the static baseline is qualified in quality in most cases, which does not mean that all baselines constituting the synchronization ring are absolutely qualified in quality.

2) Asynchronous closed loop

A closed loop that is not completely composed of synchronous observation baselines is called an asynchronous loop. The closure error of asynchronous loop is called the closure error of asynchronous loop.

When the closing error of the asynchronous loop meets the tolerance requirements, it indicates that the quality of the baseline vector constituting the asynchronous loop is qualified. When the closing error of the asynchronous loop does not meet the tolerance requirements, it indicates that at least one of the baseline vectors constituting the asynchronous loop is unqualified. To determine which baseline vectors are unqualified, multiple adjacent asynchronous loops or repeated baselines can be used.

3) Repeat baseline

The observation results between the same two stations in different observation periods are the so-called repeated baseline. The difference between these observations is the poor repetition baseline.

4) Free network adjustment test

For free net adjustment inspection, see the chapter 'Network Adjustment' later.

5.12.4 Discrimination of Various Influencing Factors

1. Influence Factors

The main factors affecting the baseline solution results are as follows:

1) The starting point coordinates set during baseline solution are inaccurate. Inaccurate starting point coordinates will lead to deviation in scale and direction of baseline.

2) The observation time of satellites is too short to accurately determine the whole week unknowns of these satellites. When the observation time of the satellite is too short, the whole week unknowns related to the satellite cannot be determined accurately. As for baseline calculation, if the whole week unknowns related to the satellites involved in the calculation are not accurately determined, the whole baseline processing results will be affected.

3) In the whole observation period, there are too many weekly jumps in some time periods, resulting in imperfect repair of weekly jumps.

- 4) During the observation period, the multipath effect is serious, and the correction number of the observed value is generally large.
- 5) The influence of tropospheric or ionospheric refraction is too large.
- 6) The electromagnetic wave has too much influence.
- 7) There is a problem with the receiver itself, resulting in poor data quality. For example, the phase measurement accuracy of the receiver is reduced, the clock of the receiver is inaccurate, and so on.

2. Discrimination and Measures of Influencing Factors

(1) Discrimination of factors affecting GPS baseline solution results.

1) Summary

Some factors affecting the GPS baseline solution results are easy to identify, such as too short satellite observation time, too many cycle jumps, serious multipath effect, too large tropospheric or ionospheric refraction, but it is difficult to judge other factors, such as inaccurate starting point coordinates, etc.

2) Discrimination of inaccurate baseline starting point coordinates

At present, there is no easy method to distinguish the impact of inaccurate starting point coordinates on the quality of baseline solution. Therefore, in the actual work, only try to improve the accuracy of the starting point coordinates to avoid this situation.

3) Discrimination of short satellite observation time

The judgment on the problem that the satellite observation time is too short is relatively simple. Just check the amount of observation data related to each satellite in the record file of observation data. HGO GPS post-processing software also outputs the visibility map of the satellite, which is more intuitive.

4) Discrimination of too many cycle jumps

In the case of too many cycle jumps in satellite observations, it can be analyzed from the residual of observations obtained after baseline calculation. At present, most baseline processing software generally adopts double difference observation values. When the observation values of a satellite at a certain station contain unrepaired cycle slips, the residuals of all related double difference observations will increase significantly by an integer multiple.

5) Discrimination of severe multipath effect and excessive influence of tropospheric or ionospheric refraction

For the discrimination of multipath effect and tropospheric or ionospheric refraction, we also use the residual of observed values. However, different from the cycle jump, when the multipath effect is serious and the influence of tropospheric or ionospheric refraction is too large, the observed residual does not increase by an integer multiple as the cycle jump is not repaired, but only by a non integer multiple. Generally, it does not exceed 1 week, but it is obviously larger than the residual of normal observation value.

(2) Countermeasures

1) Countermeasures for inaccurate coordinates of baseline starting point

To solve the problem of inaccurate baseline starting point coordinates, you can use the point with high coordinate accuracy as the starting point of baseline solution. The more accurate starting point coordinates can be obtained through single point positioning for a long time or joint measurement with WGS-84 coordinates, or the coordinates of all baseline starting points can be derived from one point coordinate during baseline calculation of the whole network, Make the baseline results have a certain system deviation, and then introduce the method of system parameters in GPS network adjustment.

2) Countermeasures for short satellite observation time

If the observation time of a satellite is too short, the observation data of the satellite can be deleted and not allowed to participate in the baseline solution, so as to ensure the quality of the baseline solution results.

3) There are too many ways to deal with cycle slips

If multiple satellites often have cycle slips in the same time period, the method of deleting the time period with serious cycle slips can be used to try to improve the quality of baseline solution results. If only individual satellites often have cycle slips, the method of deleting the observed values of satellites with cycle slips can be used to try to improve the quality of baseline solution results.

4) Serious multipath effect

Due to the large residual of observation values caused by multipath effect, the observation values with large residual can be eliminated by reducing the editing factor. In addition, the method of deleting time periods or satellites with serious multipath effect can also be used.

5) Countermeasures for excessive influence of tropospheric or ionospheric refraction

For the problem of too great influence of tropospheric or ionospheric refraction, the following methods can be adopted:

1)) Improve the cut-off height angle and eliminate the low altitude angle observation data that are easily affected by the troposphere or ionosphere, but this method has certain blindness, because the signal with low altitude angle is not necessarily affected by the troposphere or ionosphere.

2)) The tropospheric and ionospheric delays are corrected by the model respectively.

3)) If the observation value is a dual frequency observation value, the observation value that eliminates the influence of ionospheric refraction can be used for baseline calculation.

(3) A powerful tool for baseline refinement - residual diagram

During baseline calculation, it is often necessary to judge the factors affecting the quality of baseline calculation results, or determine which satellite or period of time has problems in the quality of observation values. The residual diagram is very useful for completing these works. The so-called residual diagram is a kind of chart drawn according to the residual of observed values. Select the double difference residuals of the previous and next visible satellites:

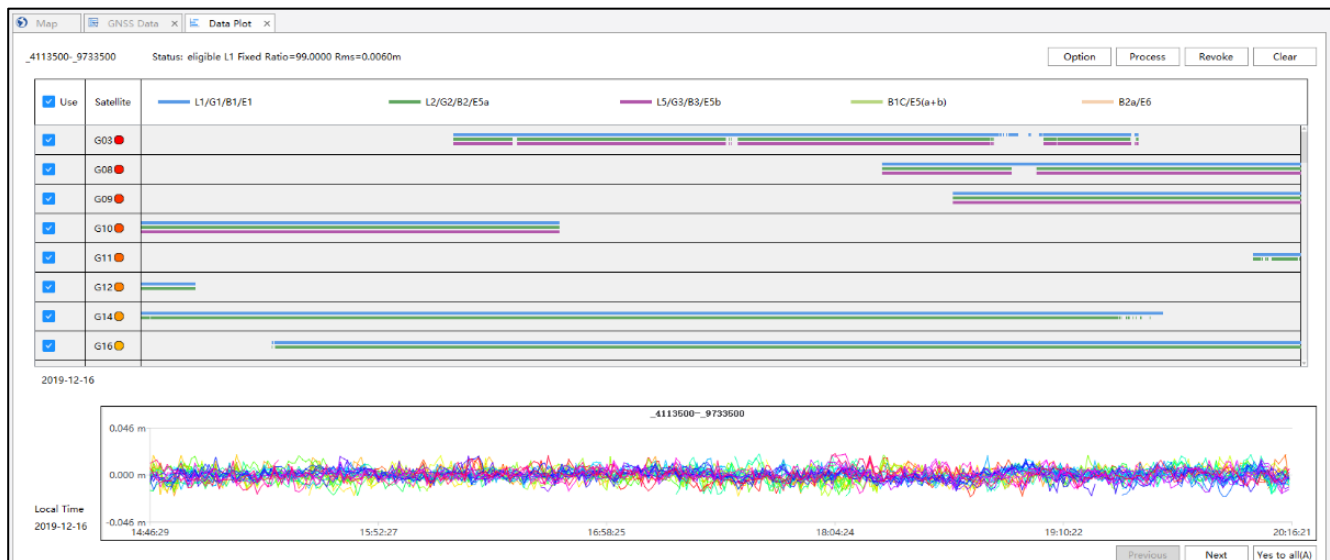


Figure 5-12-10 Data Plot

The above figure is a common form of residual diagram of double difference observation values. Its horizontal axis represents the observation time and its vertical axis represents the residual of observation values.

5.12.5 Repeat One Baseline

After determining the causes affecting baseline quality, a baseline can be processed repeatedly by modifying baseline processing settings or editing baseline period.

In the observation data graph, drag the mouse to select the deleted data. The data in the dotted box will be shielded and will not be processed by the software. Restore the previous operation, click [Revoke], cancel all shielding, and click [Clear].

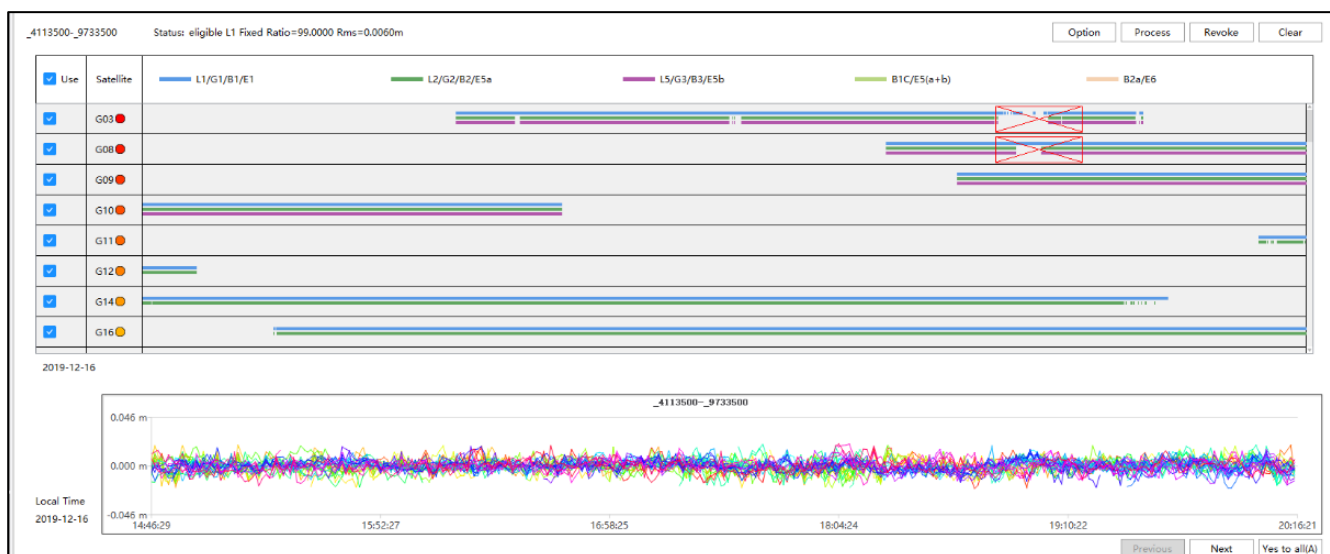


Figure 5-12-11 Repeat One Baseline

In baseline measurement, it is sometimes found that the baseline processing is unqualified. In this case, it may be necessary to modify the baseline processing settings or edit the period for many times, or even the baseline cannot obtain a qualified solution. When this happens, it is necessary to make this baseline not participate in network adjustment or delete it. If this baseline is essential in the baseline control network, it needs to be retested.

5.13 Dynamic Baseline Processing

5.13.1 Baseline Processing Settings

1. Dynamic Baseline Solution Type Settings

Before baseline vector processing, set baseline vector processing, execute [Configuration] under the menu bar of [GNSS], select the [dynamic] interface, and the Dynamic setting tab appears. The tab is used to set the dynamic solution mode, including Automatic, RTD, Stop&Go and PPK.

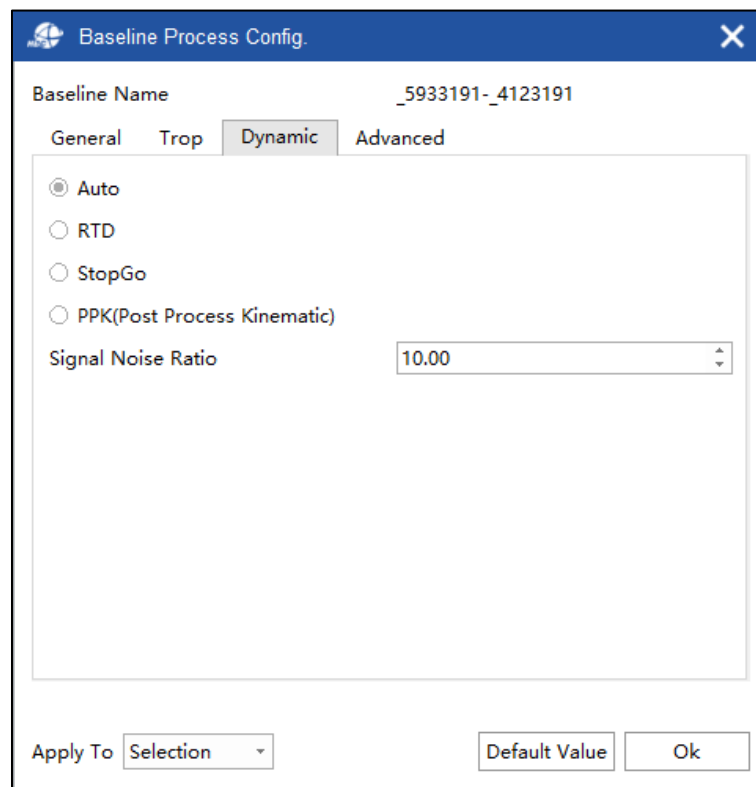


Figure 5-13-1 Baseline Process Configuration-auto

‘Auto’: Select ‘Stop&Go’ or ‘RTD’ respectively according to whether there is an RSP file.

‘RTD’: pseudo range difference with low accuracy.

‘Stop&Go’: high processing accuracy, suitable for long distances, high requirements for field operations, and need to load time files (RSP files) synchronously.

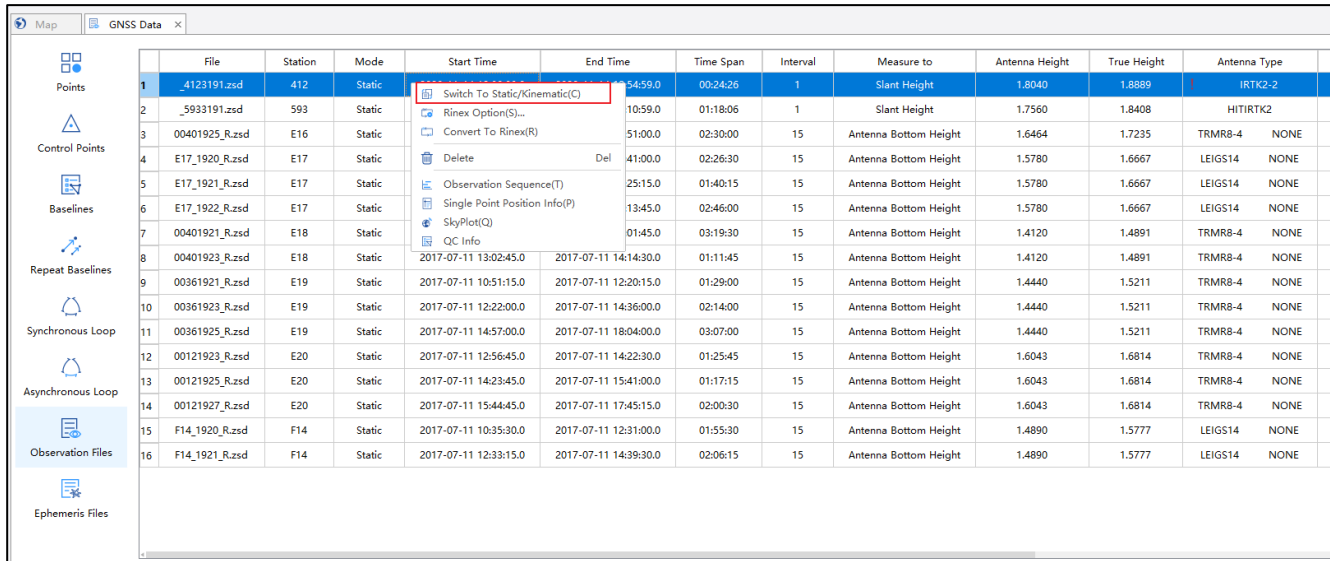
‘PPK’: high processing accuracy, suitable for medium and short distances.

2. Dynamic Baseline Solution Data

Dynamic GPS data processing generally includes two kinds of data, static data of reference station and dynamic synchronous data of mobile station. Before data input, confirm which files are static data files and which files are dynamic data files, and import data in the way of static data.

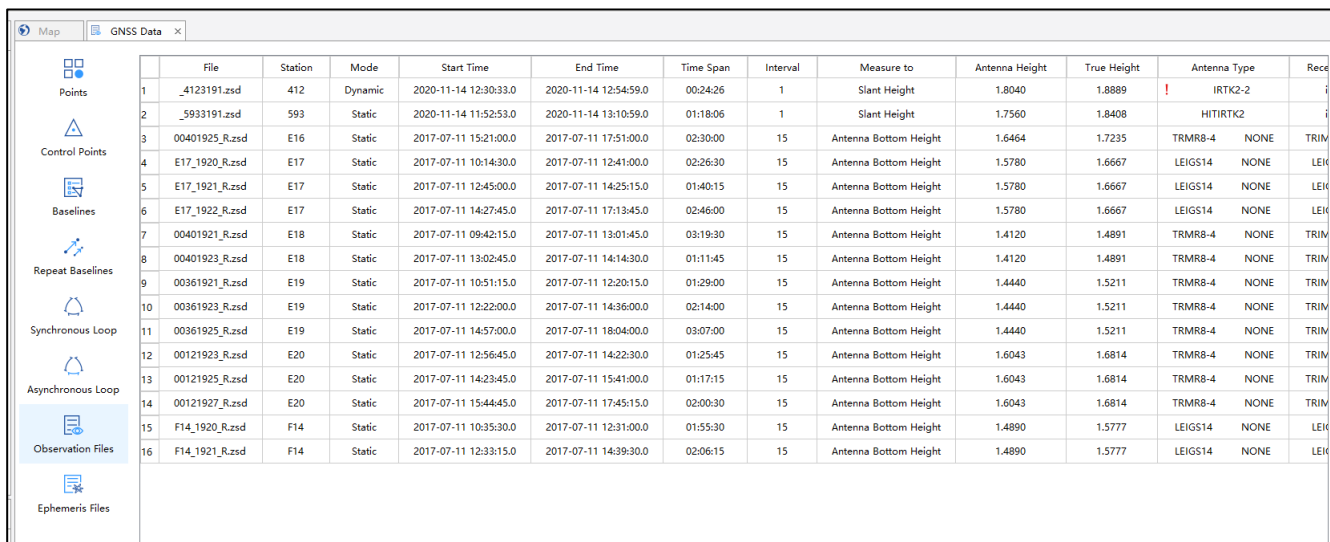
3. Set Observation File and Site Properties

When Automatic, RTD and PPK operation modes are selected, select the dynamic observation file and right-click [Switch To Static/Kinematic] to convert the observation file into dynamic file.



	File	Station	Mode	Start Time	End Time	Time Span	Interval	Measure to	Antenna Height	True Height	Antenna Type
1	_4123191.zsd	412	Static	2017-07-11 13:02:45.0	2017-07-11 14:14:30.0	01:11:45.0	15	Antenna Bottom Height	1.4120	1.4891	TRMR8-4 NONE
2	_5933191.zsd	593	Static	2017-07-11 10:51:15.0	2017-07-11 12:20:15.0	01:29:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE
3	00401925_R.zsd	E16	Static	2017-07-11 12:22:00.0	2017-07-11 14:36:00.0	02:14:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE
4	E17_1920_R.zsd	E17	Static	2017-07-11 14:57:00.0	2017-07-11 18:04:00.0	03:07:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE
5	E17_1921_R.zsd	E17	Static	2017-07-11 12:56:45.0	2017-07-11 14:22:30.0	01:25:45.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE
6	E17_1922_R.zsd	E17	Static	2017-07-11 14:23:45.0	2017-07-11 15:41:00.0	01:17:15.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE
7	00401921_R.zsd	E18	Static	2017-07-11 15:44:45.0	2017-07-11 17:45:15.0	02:00:30.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE
8	00401921_R.zsd	E18	Static	2017-07-11 10:35:30.0	2017-07-11 12:31:00.0	01:55:30.0	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14 NONE
9	00401921_R.zsd	E18	Static	2017-07-11 12:33:15.0	2017-07-11 14:39:30.0	02:06:15.0	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14 NONE

Figure 5-13-2 Switch to Static/Kinematic



	File	Station	Mode	Start Time	End Time	Time Span	Interval	Measure to	Antenna Height	True Height	Antenna Type	Receiver
1	_4123191.zsd	412	Dynamic	2020-11-14 12:30:33.0	2020-11-14 12:54:59.0	00:24:26.0	1	Slant Height	1.8040	1.8889	IRT2K2-2	IRTK2-2
2	_5933191.zsd	593	Static	2020-11-14 11:52:53.0	2020-11-14 13:10:59.0	01:18:06.0	1	Slant Height	1.7560	1.8408	HITIRTK2	HITIRTK2
3	00401925_R.zsd	E16	Static	2017-07-11 15:21:00.0	2017-07-11 17:51:00.0	02:30:00.0	15	Antenna Bottom Height	1.6464	1.7235	TRMR8-4 NONE	TRMR8-4
4	E17_1920_R.zsd	E17	Static	2017-07-11 10:14:30.0	2017-07-11 12:41:00.0	02:26:30.0	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14 NONE	LEIGS14
5	E17_1921_R.zsd	E17	Static	2017-07-11 12:45:00.0	2017-07-11 14:25:15.0	01:40:15.0	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14 NONE	LEIGS14
6	E17_1922_R.zsd	E17	Static	2017-07-11 14:27:45.0	2017-07-11 17:13:45.0	02:46:00.0	15	Antenna Bottom Height	1.5780	1.6667	LEIGS14 NONE	LEIGS14
7	00401921_R.zsd	E18	Static	2017-07-11 09:42:15.0	2017-07-11 13:01:45.0	03:19:30.0	15	Antenna Bottom Height	1.4120	1.4891	TRMR8-4 NONE	TRMR8-4
8	00401923_R.zsd	E18	Static	2017-07-11 13:02:45.0	2017-07-11 14:14:30.0	01:11:45.0	15	Antenna Bottom Height	1.4120	1.4891	TRMR8-4 NONE	TRMR8-4
9	00361921_R.zsd	E19	Static	2017-07-11 10:51:15.0	2017-07-11 12:20:15.0	01:29:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE	TRMR8-4
10	00361923_R.zsd	E19	Static	2017-07-11 12:22:00.0	2017-07-11 14:36:00.0	02:14:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE	TRMR8-4
11	00361925_R.zsd	E19	Static	2017-07-11 14:57:00.0	2017-07-11 18:04:00.0	03:07:00.0	15	Antenna Bottom Height	1.4440	1.5211	TRMR8-4 NONE	TRMR8-4
12	00121923_R.zsd	E20	Static	2017-07-11 12:56:45.0	2017-07-11 14:22:30.0	01:25:45.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE	TRMR8-4
13	00121925_R.zsd	E20	Static	2017-07-11 14:23:45.0	2017-07-11 15:41:00.0	01:17:15.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE	TRMR8-4
14	00121927_R.zsd	E20	Static	2017-07-11 15:44:45.0	2017-07-11 17:45:15.0	02:00:30.0	15	Antenna Bottom Height	1.6043	1.6814	TRMR8-4 NONE	TRMR8-4
15	F14_1920_R.zsd	F14	Static	2017-07-11 10:35:30.0	2017-07-11 12:31:00.0	01:55:30.0	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14 NONE	LEIGS14
16	F14_1921_R.zsd	F14	Static	2017-07-11 12:33:15.0	2017-07-11 14:39:30.0	02:06:15.0	15	Antenna Bottom Height	1.4890	1.5777	LEIGS14 NONE	LEIGS14

Figure 5-13-3 Observation Files

5.13.2 Baseline Processing Menu

Click [GNSS] in the menu bar to view the baseline processing menu.

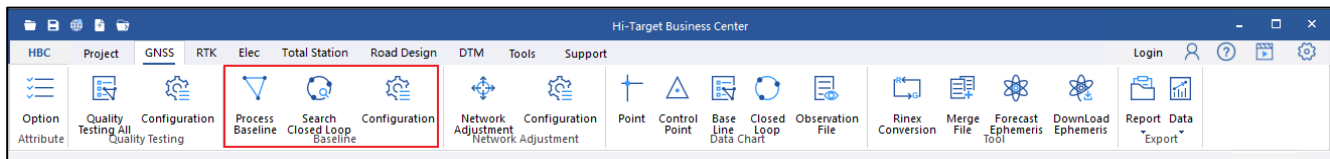


Figure 5-13-4 Baseline Processing Menu

Of which:

[Configuration]: mainly used to set baseline solution parameters.

[Baseline Processing]: HBC automatically selects the baseline solution engine to be called according to the category of baseline.

30	Yes	00121923_R-F14_1921_R	Static	E20	F14	85	Quality	L1Fixed	33.8271	0.0087	687.0744	-211.4541	801.7125	0.0004	1076.8134	10
31	Yes	00121925_R-E17_1922_R	Static	E20	E17	73	Quality	L1Fixed	96.6414	0.0106	579.7724	-22.1990	432.4384	0.0008	723.6241	7
32	Yes	00121925_R-F14_1921_R	Static	E20	F14	15	Quality	L1Fixed	5.5244	0.0091	687.0772	-211.4553	801.7163	0.0010	1076.8182	10
33	Yes	_5933191-_4123191	Dynamic	593	412	24	Quality								3933.6746	

Figure 5-13-5 Baseline Processing Result

5.13.3 Baseline Processing

After making the above preparations, execute [baseline processing] under the menu bar, and the program starts to process all baselines one by one, and the information dialog box appears.

In the dialog box, the name, progress and information of each baseline are listed respectively.

The baseline solution runs in the background in a multithreaded manner. During operation, you can select [Cancel] to stop the baseline solution.

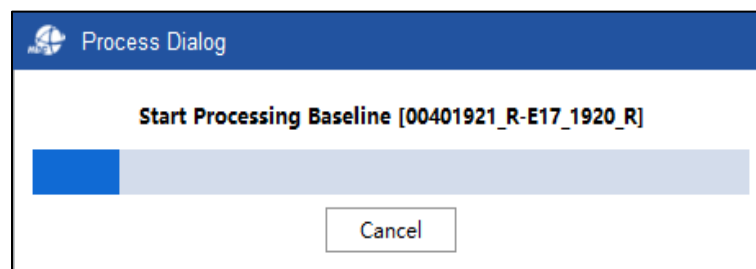


Figure 5-13-6 Baseline Process Dialog

After the baseline solution is completed, the results of the baseline solution will be obtained in the calculation window.

5.13.4 STOP&GO Dynamic Baseline Processing

1. Baseline Processing Settings

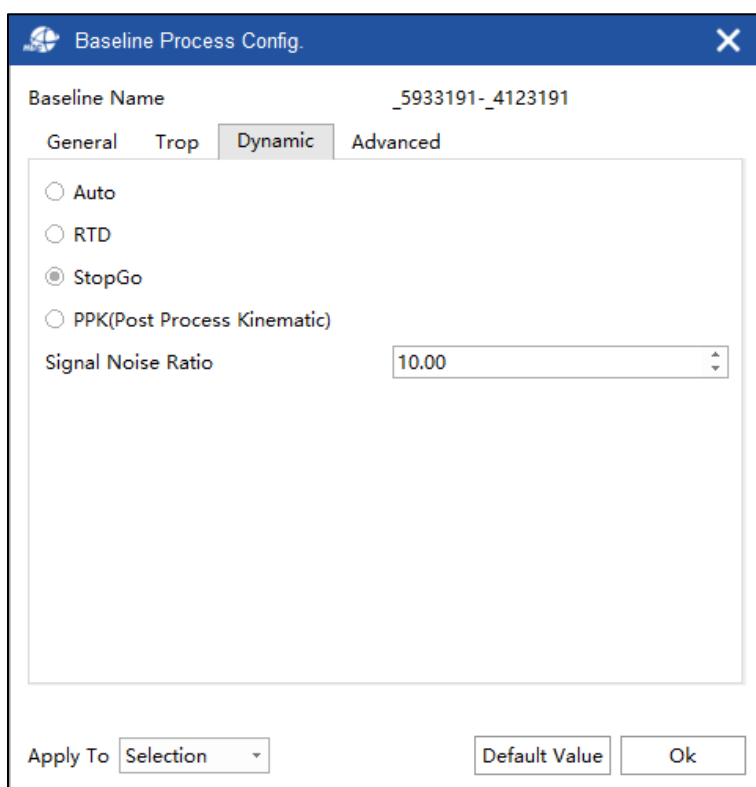
In the baseline list, select dynamic baseline and right-click [Process Option] to set it.

	Enable	Baseline Name	Type	Start	End	TimeSpan(min)	Result	Frequency	Ratio	RMS(m)	DX(m)	DY(m)	DZ(m)	Std(m)	Length(m)	Projection Len
1	Yes	_5933191-_4123191	Dynamic	593	412	24										

Process Options(O)
 Process Selected Baseline(P)
 Process All Baseline(A)
 Report Option(T)
 Baseline Report(L)
 Open Report Folder(O)
 Delete
 Disable(F)
 Invert(I)
 Data And Residual Track(K)

Figure 5-13-7 Process Option

Note: If the Stop&Go mode is adopted, it is recommended that the minimum number of epochs be 180 by default. If the minimum number of epochs is set too small, the whole week ambiguity of the baseline may not be fixed.



Baseline Name: _5933191-_4123191

General Trop **Dynamic** Advanced

☐ Auto
☐ RTD
☒ StopGo
☐ PPK(Post Process Kinematic)

Signal Noise Ratio: 10.00

Apply To: Selection Default Value Ok

Figure 5-13-8 Baseline Process Configuration- Stop&Go

2. Baseline Processing

After setting, right-click [Process Selected Baseline] to complete baseline calculation.



Figure 5-13-9 Stop&Go Baseline Processing Result

After the processing is completed, the dynamic track route is displayed on the plan view.

3. Report Output

Right click [Baseline Report] to export the dynamic processing report for viewing.

3. PPK Stop Report								
ID	Name Sats	Time WGS84-B	Status WGS84-L	Mode WGS84-H(m)	Ratio North(m)	Horizontal Std.(mm) East(m)	Vertical Std.(mm) Up(m)	RMS(mm)
1	307-1	2020-11-14 12:30:19.19	Passed	L1L2Fixed	0.0000	3.6	2.5	4.4
	27	41:42:46.84691N	86:13:04.49317E	895.9857	4620056.6857	434913.0776	895.9857	
2	3070	2020-11-14 12:30:41.409	Passed	L1L2Fixed	0.0000	4.0	2.8	4.9
	28	41:42:46.84706N	86:13:04.49310E	895.9868	4620056.6902	434913.0760	895.9868	
3	3071	2020-11-14 12:31:04.039	Passed	L1L2Fixed	0.0000	3.0	2.0	3.6
	28	41:42:46.84712N	86:13:04.49322E	895.9861	4620056.6920	434913.0787	895.9861	
4	304-1	2020-11-14 12:53:19.19	Passed	L1L2Fixed	0.0000	4.3	3.9	5.8
	23	41:46:06.55052N	86:10:25.29699E	886.5275	4626252.4474	431292.0247	886.5275	
5	3040	2020-11-14 12:53:53.53	Passed	L1L2Fixed	0.0000	4.3	3.2	5.4
	21	41:46:06.55050N	86:10:25.29703E	886.5342	4626252.4468	431292.0258	886.5342	
6	3041	2020-11-14 12:54:15.149	Passed	L1L2Fixed	0.0000	3.6	2.5	4.4
	22	41:46:06.55044N	86:10:25.29713E	886.5401	4626252.4447	431292.0280	886.5401	

Figure 5-13-10 Stop&Go Baseline Processing Report

5.13.5 PPK Dynamic Baseline Processing

1. Baseline Processing Settings

In the baseline list, select dynamic baseline and right-click [Configuration] to set it.

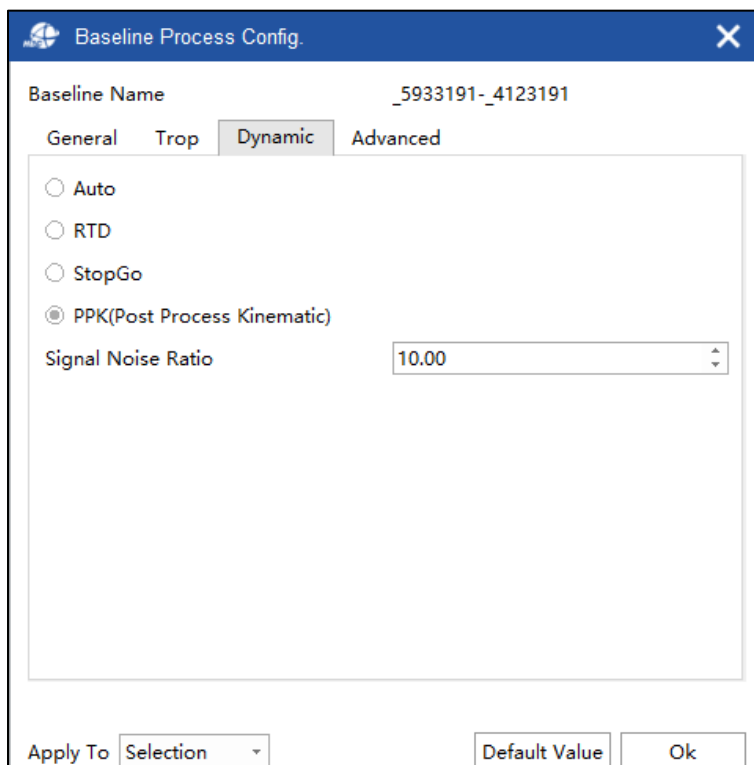


Figure 5-13-11 Baseline Process Configuration- PPK

2. Baseline Processing

After setting, right-click [Process Selected Baseline] to complete baseline processing, where green points represent RTK fixed solution.

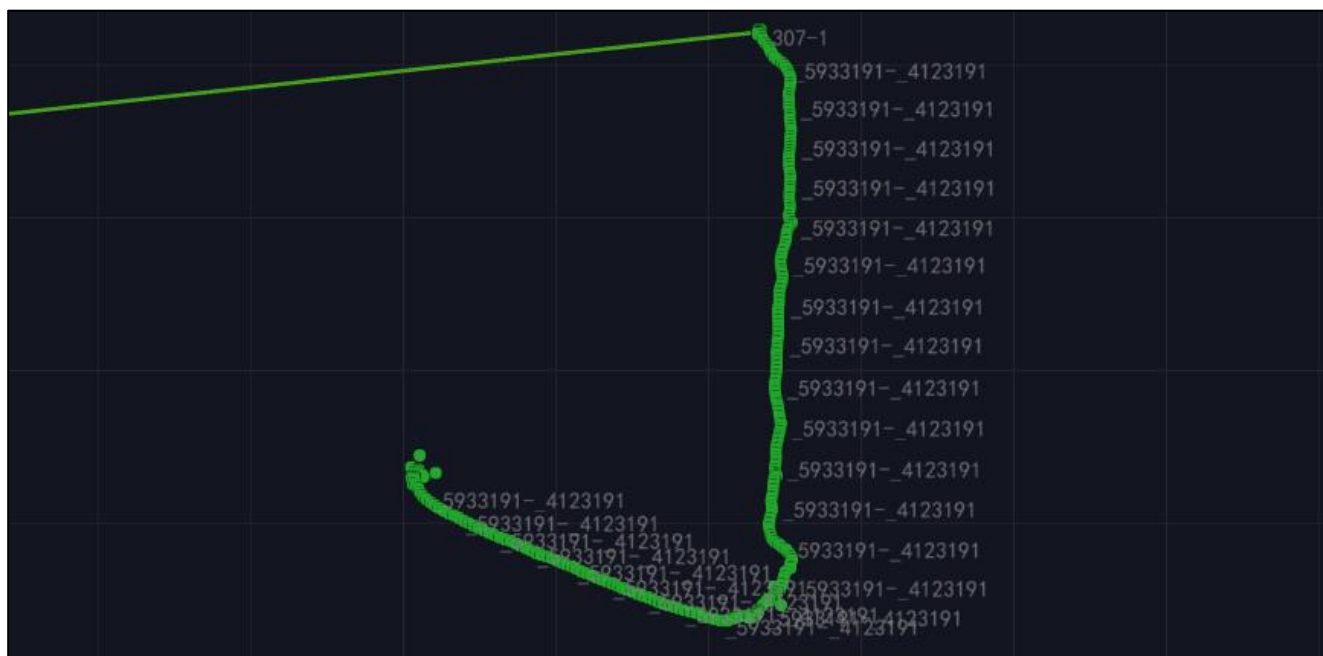


Figure 5-13-12 PPK Baseline Processing Result

After the processing is completed, the dynamic track route is displayed on the plan view.

3. Report Output

Right click [Baseline Report] to export the dynamic processing report for viewing. The fixed solution is qualified, and the unqualified solution result is highlighted on the red background.

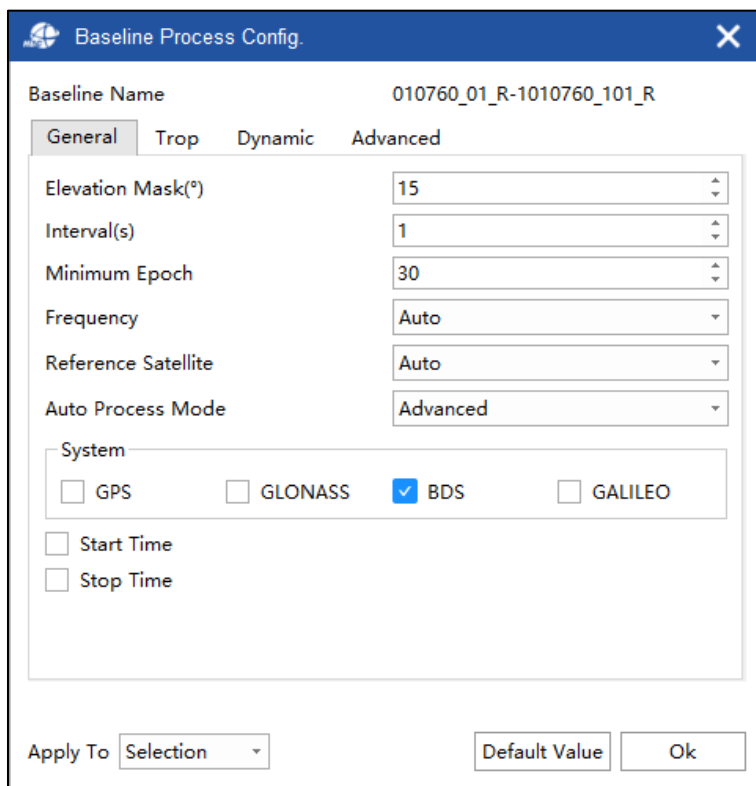
PPK Report	
1. Reference station info.	
Variable	Value
Marker name	
Marker code	593
WGS84 X(m)	318649.0568
WGS84 Y(m)	4758654.7285
WGS84 Z(m)	4222000.6408
WGS84 latitude	41:42:27.70742N
WGS84 longitude	86:10:08.68364E
WGS84 height(m)	870.6377
North(m)	4619504.2539
East(m)	430843.1050
Up(m)	870.6377
Receiver type	iRTK2
Receiver version	
Receiver S/N	10018593
Antenna type	HITIRTK2
Antenna S/N	
Antenna height(m)	1.8408
Measured to	Slant Height
2. Coordinate Parameter	
Datum Name:	CGCS2000
Ellipsoid:	CGCS2000
Major Axis:	6378137.0
Inverse Flattenning:	298.257
Projection Method:	Guass-3
Central Meridan:	87:00:00.00000E
Central Latitude:	00:00:00.00000N
Scale:	1
Projection Height(m):	0
False North(m):	0
False East(m):	500000

Figure 5-13-13 PPK Baseline Processing Report

5.13.6 Single BDS Baseline Processing

1. Baseline Processing Settings

In baseline processing setting, only check BDS system and click Save to all to perform single BDS solution for baseline.



Baseline Process Config.

Baseline Name: 010760_01_R-1010760_101_R

General Trop Dynamic Advanced

Elevation Mask(°): 15

Interval(s): 1

Minimum Epoch: 30

Frequency: Auto

Reference Satellite: Auto

Auto Process Mode: Advanced

System

☐ GPS ☐ GLONASS ☒ BDS ☐ GALILEO

☐ Start Time

☐ Stop Time

Apply To: Selection

Default Value Ok

Figure 5-13-14 Baseline Process Configuration- Single BDS

The method of setting single BDS processing also includes:

- (1) disabling satellites other than BDS in the observation sequence diagram list;
- (2) Disable satellites other than BDS in the residual sequence diagram list;
- (3) Import observation files containing only BDS data.

2. Baseline Processing

After setting, click [Baseline Process] to solve all.

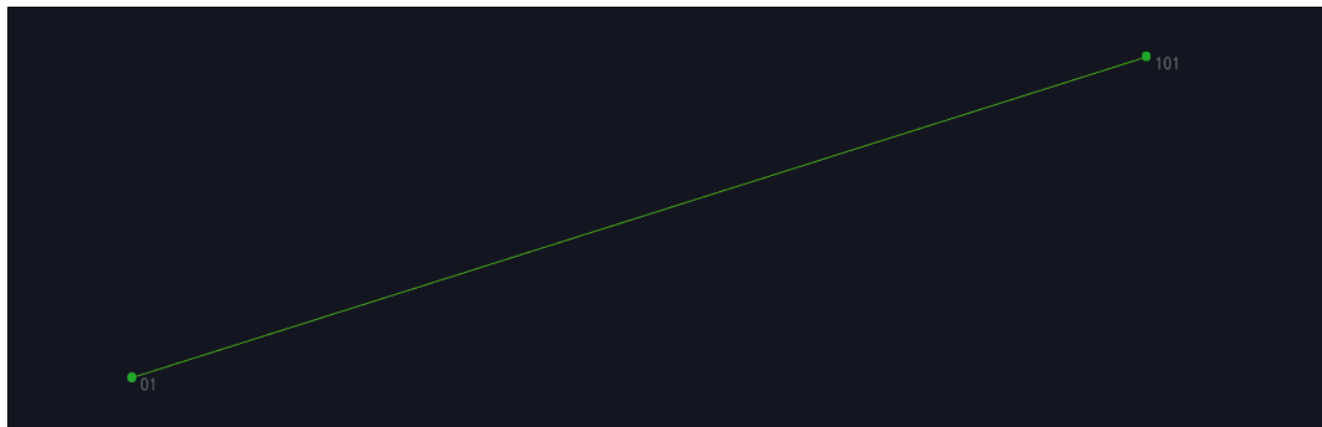


Figure 5-13-15 Baseline Processing Result Single BDS

3. Report Output

Right click [Baseline Report] to export the dynamic processing report for viewing.

5. Satellite Selection										
Manually disable the GPS satellite(PRN):										
Manually disable the GLONASS satellite(PRN):										
Manually disable the Beidou satellite(PRN):										
Manually disable the Galileo satellite(PRN):										
6. Baseline processed results										
Frequency	DX(m)	DY(m)	DZ(m)	Std.Dev_DX(mm)	Std.Dev_DY(mm)	Std.Dev_DZ(mm)	RMS(mm)	Horizontal Std(mm)	Vertical Std(mm)	Baseline Azimuth(dms)
Triple_L1	-543.7403	-341.1843	173.7253	578.2	879.5	323.5	4.7085	601.7	922.2	72:54:48.85252
Float_L1	0.0000	0.0000	0.0000	0.0	0.0	0.0	0.0000	0.0	0.0	00:00:00.00000
Fixed_L1	-543.8268	-341.0874	173.7737	0.1	0.2	0.1	7.4352	0.1	0.2	72:54:53.72869
7. Final Coordinates										
1.Reference Station: 01					2.Rover: 101					
WGS84 latitude:	22:58:54.00245N					22:59:00.43980N				
WGS84 longitude:	113:21:41.42949E					113:22:03.70650E				
WGS84 height(m):	58.9392					37.0774				
N(m):	2542649.7806					2542845.0684				
E(m):	434530.4154					435165.7971				
Z(m):	58.9392					37.0774				

Figure 5-13-16 Single BDS Baseline Process Report

5.14 Network Adjustment

After baseline vector processing, users usually need to further test the baseline processing results, optimize the results of baseline vector and convert them into national coordinates or local coordinates required by users, which is the work completed by network adjustment. The network adjustment of this software is carried out by the least square method.

5.14.1 Functions and Steps of Network Adjustment

HBC data processing software can realize free network adjustment, three-dimensional constrained adjustment and elevation fitting, WGS84 coordinate system constrained adjustment and target coordinate system constrained adjustment.

The basic steps of network adjustment by HBC data processing software can actually be divided into three processes.

The following figure shows the basic steps of network adjustment by HBC data processing software. It can be seen from the figure that network adjustment can actually be divided into three processes:

- (1) Preliminary preparations, which are carried out by users. That is, before network adjustment, it is necessary to set the coordinate system and load the control point information.
- (2) The actual implementation of network adjustment is completed automatically by software.
- (3) The quality analysis and control of processing results is also a process requiring user analysis and processing.

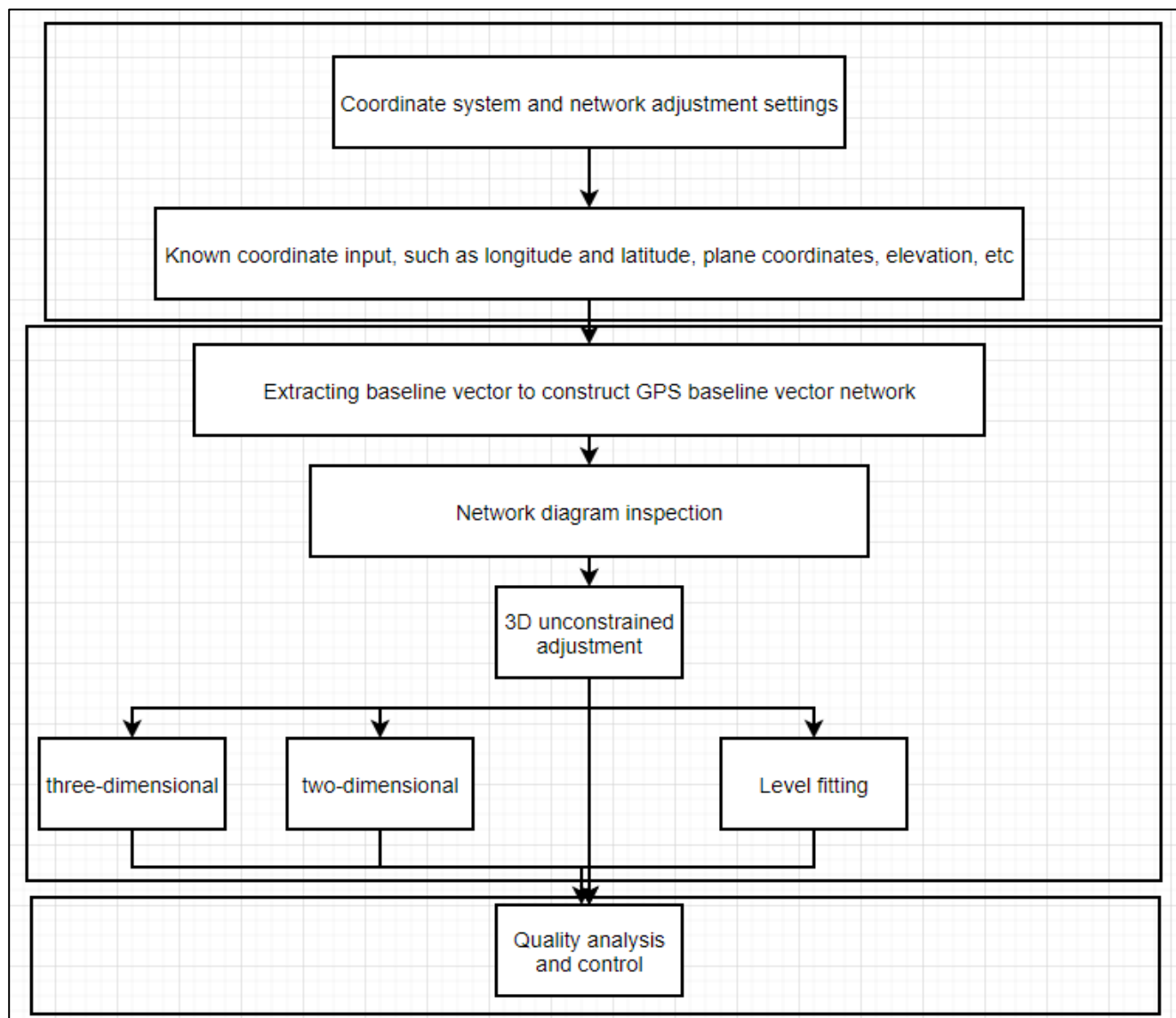


Figure 5-14-1 Steps of Network Adjustment

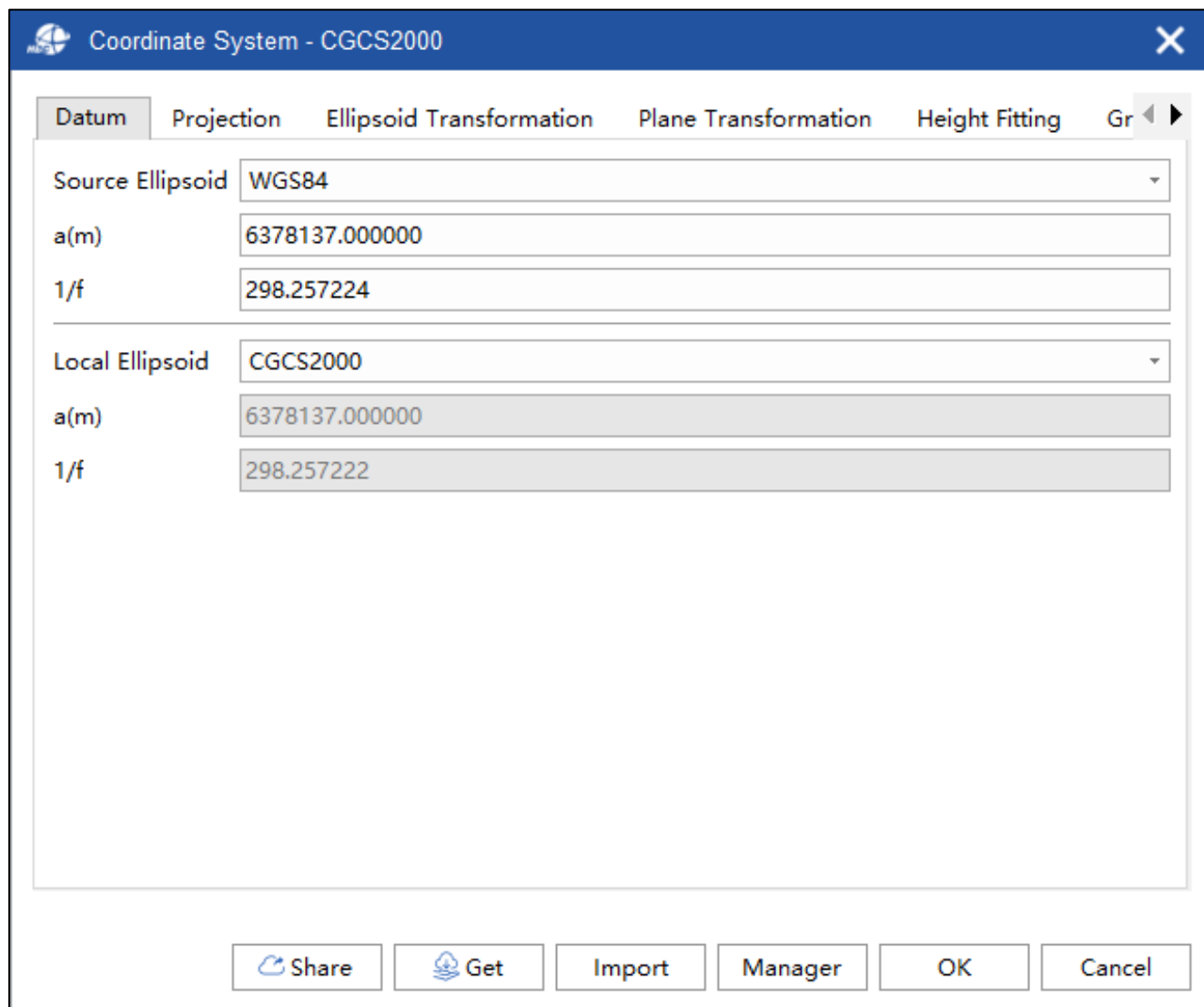
It can be seen that the software only realizes the solution of network adjustment. More importantly, users need to participate and finally make correct judgment. It should be noted that this is usually an iterative process.

5.14.2 Preliminary Preparation for Network Adjustment

1. Coordinate System Setting

Before setting the network adjustment, check whether the coordinate system is set correctly. Users need to specially set the central meridian, the addition constants in X and Y directions, etc.

The coordinate system can be set in the menu bar [Project] - [Coordinate System].



The dialog box is titled "Coordinate System - CGCS2000". It features a tabbed interface with the following tabs: Datum, Projection, Ellipsoid Transformation, Plane Transformation, Height Fitting, and Gr. The "Datum" tab is currently selected. Under this tab, there are two sections: "Source Ellipsoid" and "Local Ellipsoid". Both sections have a dropdown menu and two input fields for "a(m)" and "1/f".

Section	Ellipsoid	a(m)	1/f
Source Ellipsoid	WGS84	6378137.000000	298.257224
Local Ellipsoid	CGCS2000	6378137.000000	298.257222

At the bottom of the dialog box, there are six buttons: Share, Get, Import, Manager, OK, and Cancel.

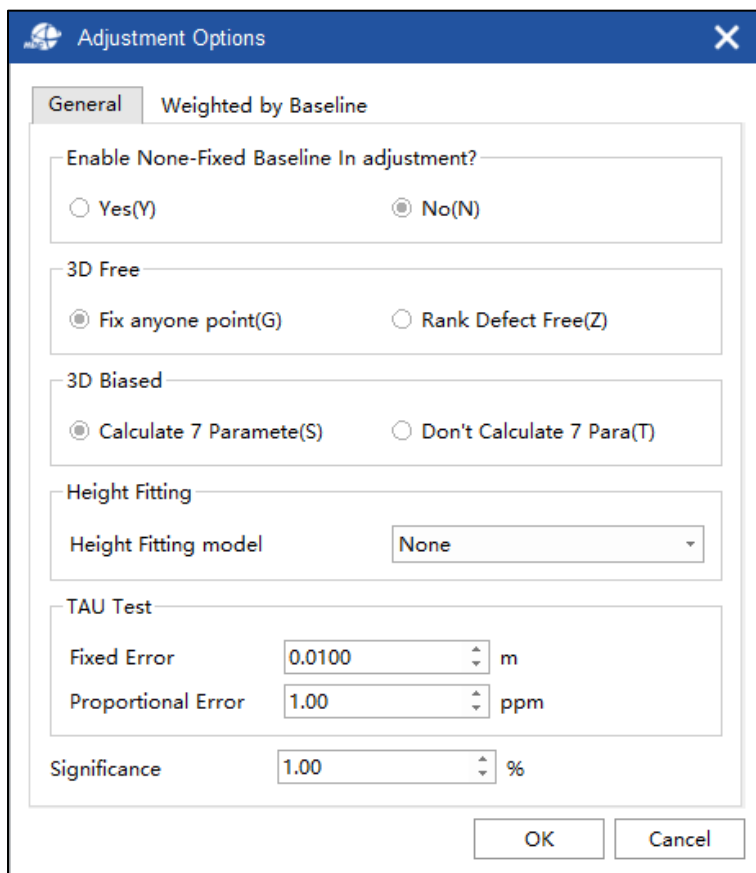
Figure 5-14-2 Coordinate System Settings

The purpose of setting the coordinate system before network adjustment is to further check the parameters of the coordinate system.

For the setting of coordinate system, you can refer to relevant materials.

2. Setting of Network Adjustment

Select [Network Adjustment Configuration] in the menu bar of 'GNSS', and the following dialog box will appear, which can set various adjustment parameters and inspections.



The image shows a software dialog box titled "Adjustment Options". It has a blue header bar with a close button (X) on the right. Below the header, there are two tabs: "General" (selected) and "Weighted by Baseline". The "General" tab contains several sections:

- Enable None-Fixed Baseline In adjustment?**: Two radio buttons, "Yes(Y)" and "No(N)". "No(N)" is selected.
- 3D Free**: Two radio buttons, "Fix anyone point(G)" and "Rank Defect Free(Z)". "Fix anyone point(G)" is selected.
- 3D Biased**: Two radio buttons, "Calculate 7 Paramete(S)" and "Don't Calculate 7 Para(T)". "Calculate 7 Paramete(S)" is selected.
- Height Fitting**: A label "Height Fitting model" followed by a dropdown menu showing "None".
- TAU Test**: Two input fields with spinners. "Fixed Error" is set to "0.0100" with a unit of "m". "Proportional Error" is set to "1.00" with a unit of "ppm".
- Significance**: An input field with a spinner set to "1.00" with a unit of "%".

At the bottom right of the dialog box are two buttons: "OK" and "Cancel".

Figure 5-14-3 Adjustment Options

3. Control Point Information

After setting the network adjustment, you need to enter the control point information, otherwise the constraint adjustment cannot be carried out. You can enter the control point information through the following methods:

- (1) In the right-click menu of the points list, click Convert to control point to convert the point to control point.
- (2) In the right-click menu of control point list, click [new control point] to add control point information.
- (3) In the right-click menu of the control point list, click Import control point file to directly import the existing control point file into the project.

After the control point information is input, click [Save As Control Point File] in the right-click menu of the control point to save the entered control point information as a separate file for next use.

Points

Control Points

Baselines

	Related Control Point	Point Name	B	L	H	N	E	Z	
1	411	411	22:59:00.53567N	113:22:03.60603E	43.7900	2542848.0300	435162.9483	43.7900	
2		973	22:58:50.79489N	113:21:38.17076E	53.0160	2542551.5091	434437.1652	53.0160	
3	cs1	cs1	22:59:07.95718N	113:21:41.77379E	14.3260	2543079.0344	434542.0901	14.3260	
4		cs2	22:58:49.48718N	113:22:17.43920E	16.0660	2542506.4476	435555.5049	16.0660	
5	cs3	cs3	22:59:03.75067N	113:22:23.66333E	8.2760	2542944.4835	435734.6659	8.2760	

Figure 5-14-4 Set Control Point

5.14.3 Network Adjustment

Run [Network Adjustment] from the [GNSS] menu, and the network adjustment tool will appear.


Network Adjustment
×

Adjustment Result	Details

Free Adjustment(F)

2D Biased and Height Fitting Ajust(T)

Auto Adjustment(A)

WGS84 Datum Adjustment(W)

Target Datum Adjustment

Clear Adjustment result(C)

Figure 5-14-5 Network Adjustment

Generally, you only need to click [full automatic adjustment], and the software can carry out all possible adjustments according to the existing conditions. After the adjustment is completed, a list of adjustment results will be formed. Select an adjustment result, and then click report to view the corresponding adjustment report.

1. Extracting Baseline Vector Network

The first step of network adjustment is to extract the baseline vector network. The principle of constituting the baseline vector network is as follows:

- (1) This baseline is in this project and has not been deleted;
- (2) Baseline with starting point name and calculating point name;
- (3) This baseline has been understood and calculated, and the qualified baseline is displayed in the baseline vector list;
- (4) The baseline is not disabled.

Baselines meeting the above four conditions will be automatically loaded in the first step of network adjustment to form a baseline vector network.

2. Connectivity Test of Baseline Vector Network

If the adjustment is carried out when the network diagram is not connected, the network adjustment will not converge. Therefore, before the network adjustment, the software will automatically check the connectivity of the network diagram. If the network diagram is not connected, a prompt will appear. Please check the baseline vector constituting the baseline vector network, observation site name, and so on. The inspection steps are as follows:

- (1) First, check whether the network diagram is divided into several parts and whether there are isolated survey stations or baselines. If so, delete isolated points or blocks for adjustment;
- (2) Secondly, check whether any key baseline is not solved successfully or is prohibited from participating in network adjustment. If so, reprocess or even retest it;
- (3) Thirdly, check whether there are the same survey stations in the network diagram and take different survey station names. The reflection on the network diagram is that there is another survey station on the same survey station at a very close position. Because these two points are observed at the same point in different periods of time, they do not form any baseline between them, making the network diagram discontinuous, The solution is to correct the wrong station name in the observation data attribute.

3. Adjustment Report

The adjustment results will be reflected in the report. The output options and display form of the adjustment report can be set in [Adjustment Report Options]. Taking free net adjustment as an example, the adjustment results of web version are as follows:

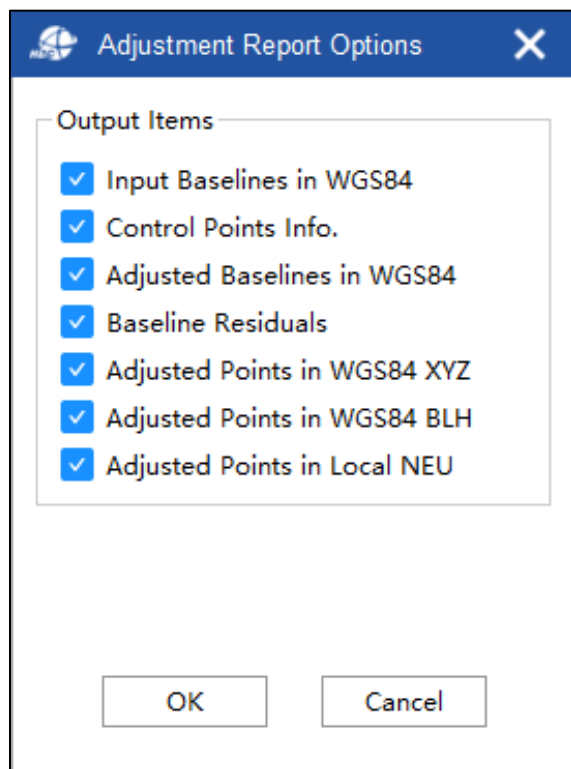


Figure 5-14-6 Adjustment Report Options

1. Input Baselines in WGS84

2. Adjusted Baselines in WGS84

3. Baseline Residuals

4. Adjusted Points in WGS84(XYZ)

5. Before and after adjustment(BLH)

6. Adjusted Points in WGS84(BLH)

7. Adjusted Points in Target System(NEZ)

8. Weakest Baseline and Point

Free 3D Adjust Report

Point Name	Value
Number of GPS Baselines:	20
Number of Adjusted Points:	5
Confidence level:	10.0000%
Significance Level for Tau Test:	1.0000%
Ratio of Standard Error of Unit Weight:	0.0148
X2 Test Value:	0.7115
X2 Test Range:	26.5106-76.9688
X2 Test Result:	False

1. Input Baselines in WGS84								
Baselines	Tau	DX(m)	Std.Dev(mm)	DY(m)	Std.Dev(mm)	DZ(m)	Std.Dev(mm)	
_4113500_9733500	Yes	614.3927	0.1	404.6361	0.2	-271.7693	0.1	
_4113500_cs13500	Yes	616.0439	0.1	142.4478	0.2	199.9768	0.1	
_4113500_cs23500	Yes	-405.0237	0.1	-57.0166	0.2	-323.1075	0.1	
_4113500_cs33500	Yes	-497.1530	0.1	-288.4139	0.2	78.1097	0.1	
_9733500_cs13500	Yes	1.6511	0.1	-262.1883	0.2	471.7460	0.1	
_9733500_cs23500	Yes	-1019.4166	0.1	-461.6528	0.2	-51.3378	0.1	
_9733500_cs33500	Yes	-1111.5460	0.1	-693.0502	0.2	349.8790	0.1	
_cs13500_cs23500	Yes	-1021.0677	0.1	-199.4640	0.2	-523.0839	0.1	
_cs13500_cs33500	Yes	-1113.1969	0.1	-430.8617	0.1	-121.8673	0.1	
_cs23500_cs33500	Yes	-92.1291	0.1	-231.3979	0.1	401.2169	0.1	
_4113500_9733500	Yes	614.3927	0.1	404.6361	0.2	-271.7693	0.1	
_4113500_cs13500	Yes	616.0439	0.1	142.4478	0.2	199.9768	0.1	
_4113500_cs23500	Yes	-405.0237	0.1	-57.0166	0.2	-323.1075	0.1	
_4113500_cs33500	Yes	-497.1530	0.1	-288.4139	0.2	78.1097	0.1	
_9733500_cs13500	Yes	1.6511	0.1	-262.1883	0.2	471.7460	0.1	
_9733500_cs23500	Yes	-1019.4166	0.1	-461.6528	0.2	-51.3378	0.1	
_9733500_cs33500	Yes	-1111.5460	0.1	-693.0502	0.2	349.8790	0.1	
_cs13500_cs23500	Yes	-1021.0677	0.1	-199.4640	0.2	-523.0839	0.1	
_cs13500_cs33500	Yes	-1113.1969	0.1	-430.8617	0.1	-121.8673	0.1	
_cs23500_cs33500	Yes	-92.1291	0.1	-231.3979	0.1	401.2169	0.1	

Figure 5-14-7 Example of Network Adjustment Report

5.14.4 Network Adjustment Test Results

After the network adjustment is completed, the network adjustment results shall be tested. The network adjustment test is mainly evaluated by correction number, mean square error and corresponding mathematical statistics test results.

The mathematical statistical tests of network adjustment mainly include χ^2 test and tau gross error test. The χ^2 test result shows the reliability of the adjustment result. If the χ^2 test value is less than the theoretical value range, it indicates that the error of the adjustment result is smaller than the theoretical error, that is, the adjustment result is better than expected. At this time, there is generally no need to deal with it or pass the χ^2 test by selecting an appropriate 'baseline standard deviation confidence (relaxation factor)'; If it is greater than the theoretical value range, it means that the adjustment result error exceeds the allowable range. It should be caused by the excessive error of the baseline solution result or the gross error of the control point information. The problem baseline or control point should be found, corrected and solved again until the inspection passes.

Tau test is to check whether there is gross error in the baseline participating in adjustment. Generally, the test result is determined by the correction number of each baseline after adjustment. If a baseline tau test fails, it is necessary to recalculate the baseline and participate in adjustment, or disable the baseline directly.

Point Name	Value
Number of GPS Baselines:	20
Number of Adjusted Points:	5
Confidence level:	10.0000%
Significance Level for Tau Test:	1.0000%
Ratio of Standard Error of Unit Weight:	0.0148
χ^2 Test Value:	0.7115
χ^2 Test Range:	26.5106-76.9688
χ^2 Test Result:	False

Figure 5-14-8 Network Adjustment Test Results

If the network adjustment result fails to pass the inspection, the reasons for the unqualified network adjustment result need to be found from the following aspects:

- (1) Check whether the coordinate system is set correctly.
- (2) Check whether the control points are correct and within a coordinate system.
- (3) Check whether the baseline vector network is correct. For the unqualified static baseline, it can not participate in the network adjustment. If the baseline cannot be deleted or is very important in the baseline network, it needs to be solved again. If necessary, field observation should be carried out again.
- (4) Check whether the observation station and antenna height of the observation file are correct. In this case, the results of closure error or free network adjustment are very poor.

Of course, observations with poor quality can also be deleted directly. During network adjustment, it is found that there is a baseline duplicate with this baseline. If this baseline is deleted, the structure of the

whole network adjustment will not be affected. Therefore, after deleting this baseline, the network adjustment is carried out again, and it is found that the results also meet the requirements.

Generally, under the condition that the network diagram meets the requirements and the baseline solution meets the specification requirements, the three-dimensional unconstrained adjustment can be successfully completed through two tests.

Chapter 6

RTK

This chapter contains:

- Open
- Save
- Save As
- Synchronization
- Coordinate Data
- Line/ Face Data
- Map Right-click Menu
- Point Shift
- Legend Encoding
- Importing
- Exporting
- Report

6.1 Open

1. RTK Module Main Interface

After you finish creating the HBC project, click [RTK] at the top and the interface is as follows.

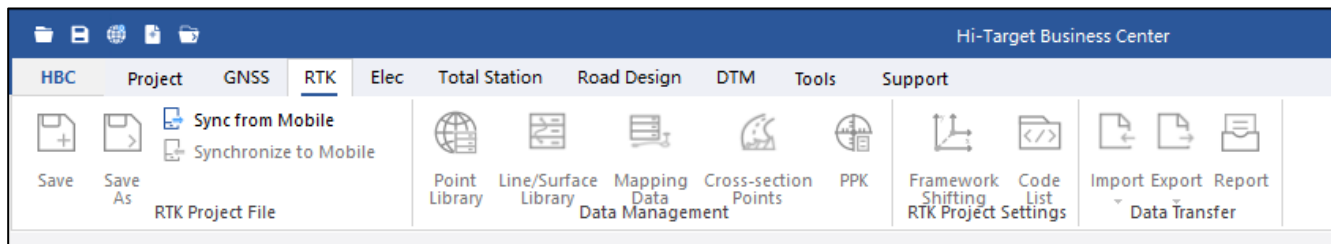


Figure 6-1-1 RTK Interface

2. Open An Existing RTK Project

[Method 1] Click the [Import] button under the [Project] drop-down box in the [RTK Project File], select the RTK project storage path, double-click the prj suffix or click the prj file and click [OK], after the success of the software at the bottom of the information column prompt to open the successful information.

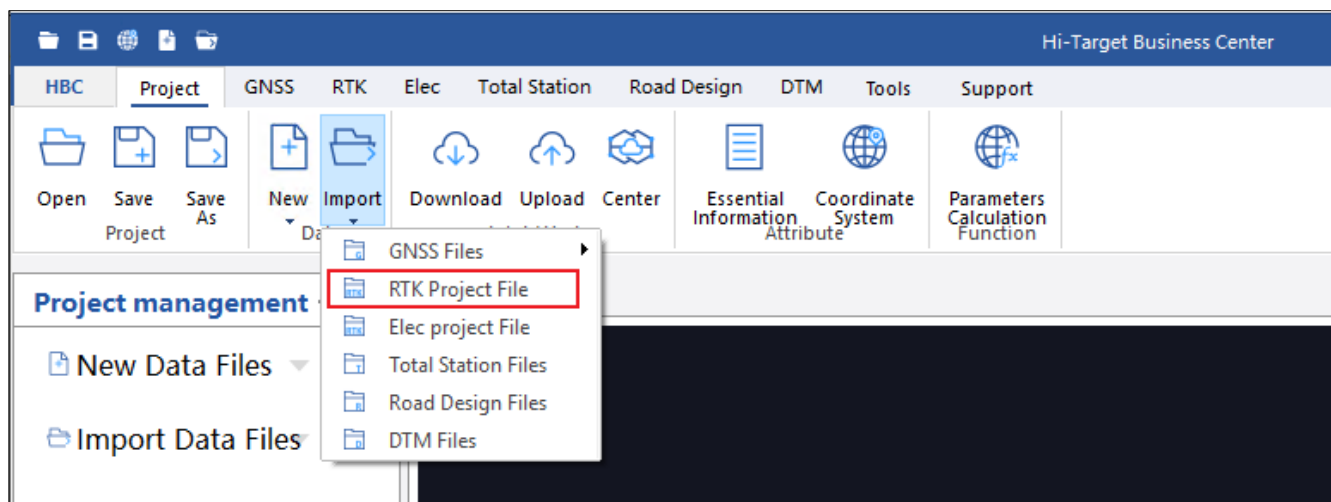


Figure 6-1-2 Import- RTK Project File

[Method 2] Click [Import Data Files] under the [RTK Project File] option, select the RTK project storage path, mouse double click prj suffix or click prj file and click [OK], after the success of the software at the bottom of the information column prompt to open the successful information.

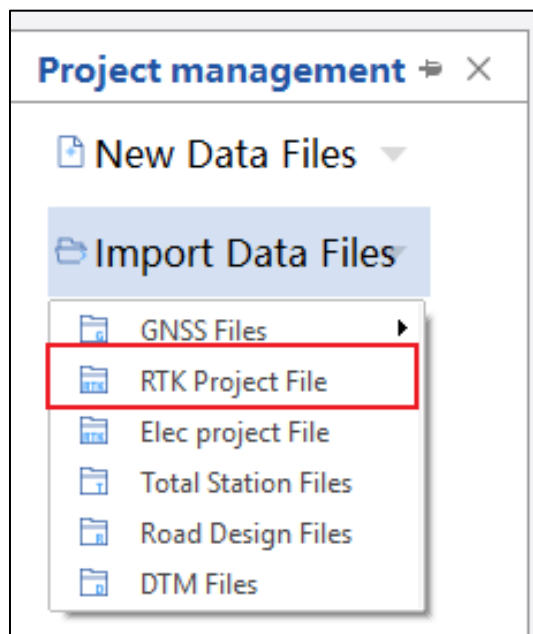


Figure 6-1-3 Import Data Files- RTK Project File

[Method 3] Click the [Import] icon at the top of the menu bar, click the [RTK Project File] option, select the RTK project storage path, double-click the prj suffix or click the prj file and click [Import]. After successful opening, the software will prompt the information related to successful opening in the information bar at the bottom.

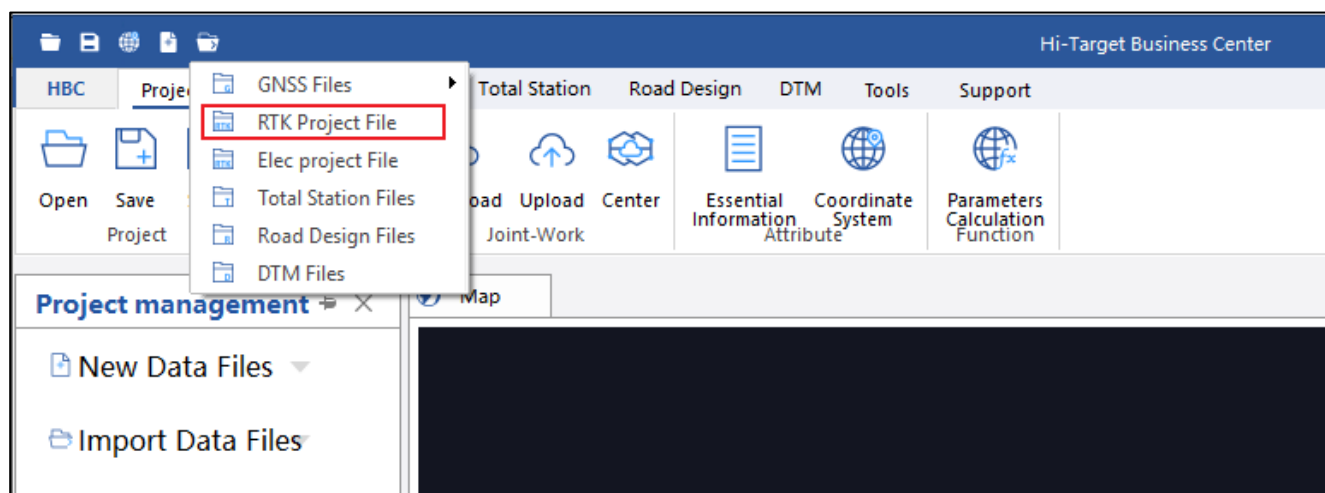


Figure 6-1-4 Import RTK Project File

3. View RTK Project Data

Switch to click on [Point Library] [Line/Surface Library] [Mapping Data] etc. to view the open RTK project data respectively.

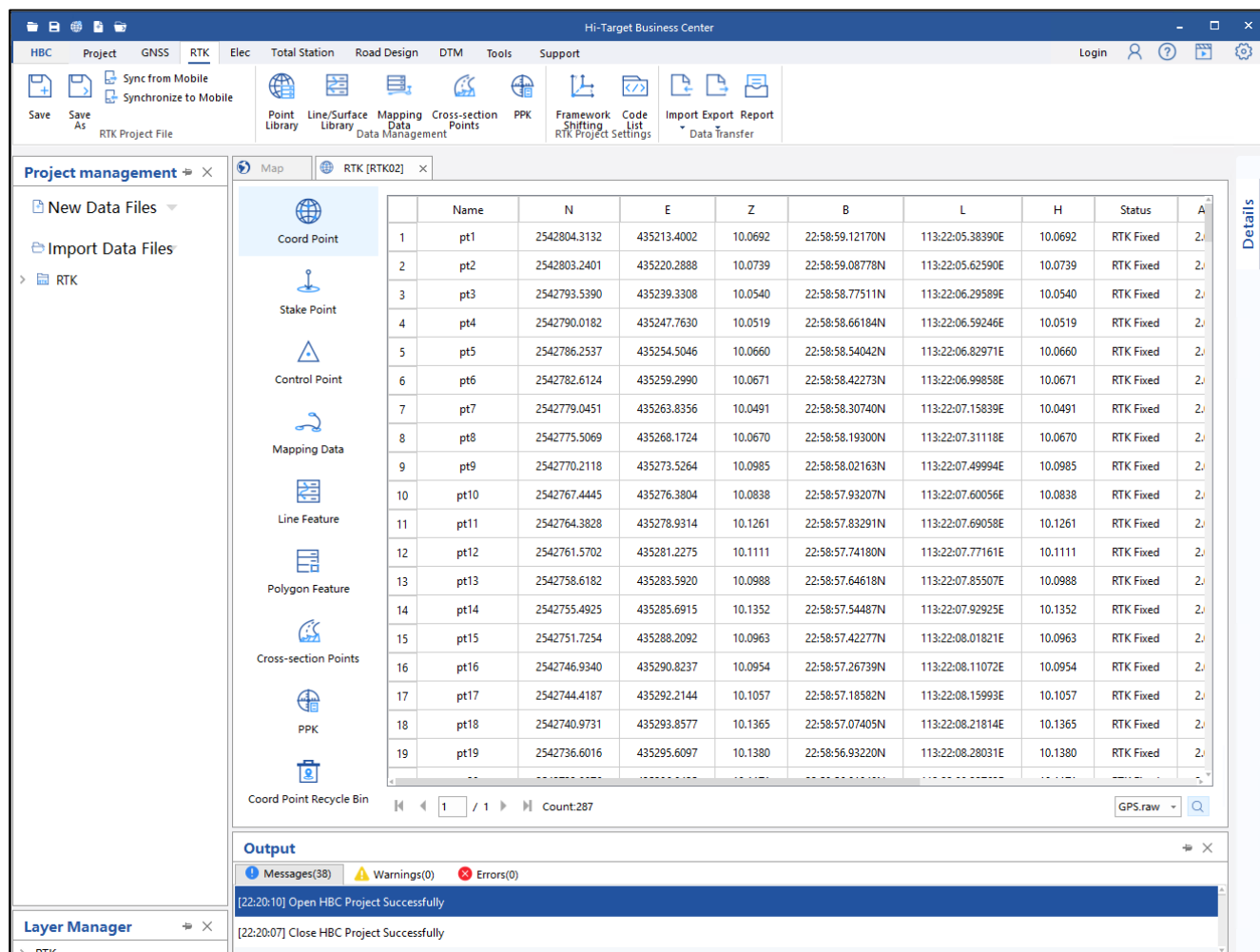


Figure 6-1-5 View RTK Project Data

6.2 Save

After finishing editing the RTK project, click the [Save] button under the top bar, the software will save the current RTK project content to the path where the RTK project is located, and at the bottom of the information bar suggests the information about the success of the save.

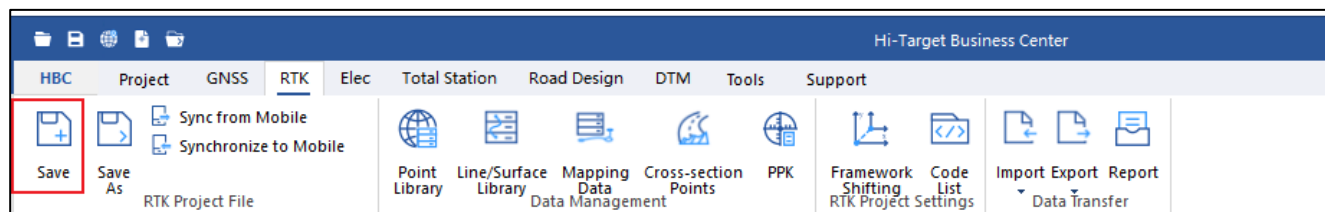


Figure 6-2-1 Save RTK Project File

6.3 Save As

1. Execute Save As

After you finish editing the RTK project, click the [Save As] button under the top bar, select the path and corresponding file name you want to save in the pop-up path selection box, click [Save].

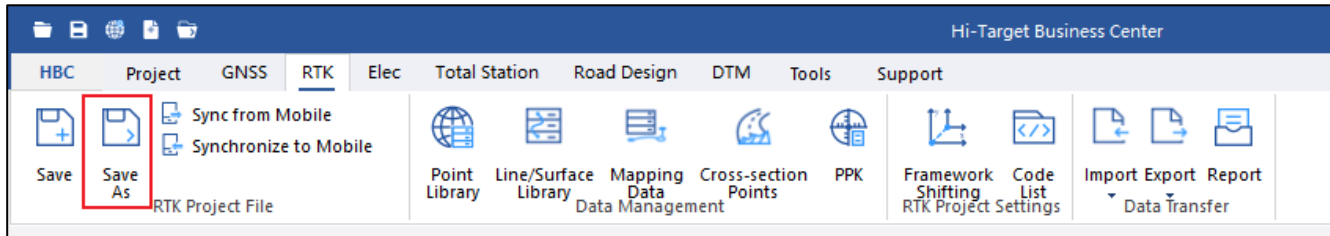


Figure 6-3-1 Save as RTK Project File

2. Save Separate Items

After the project is saved, the following file structure will appear in the file where the corresponding filename is located.

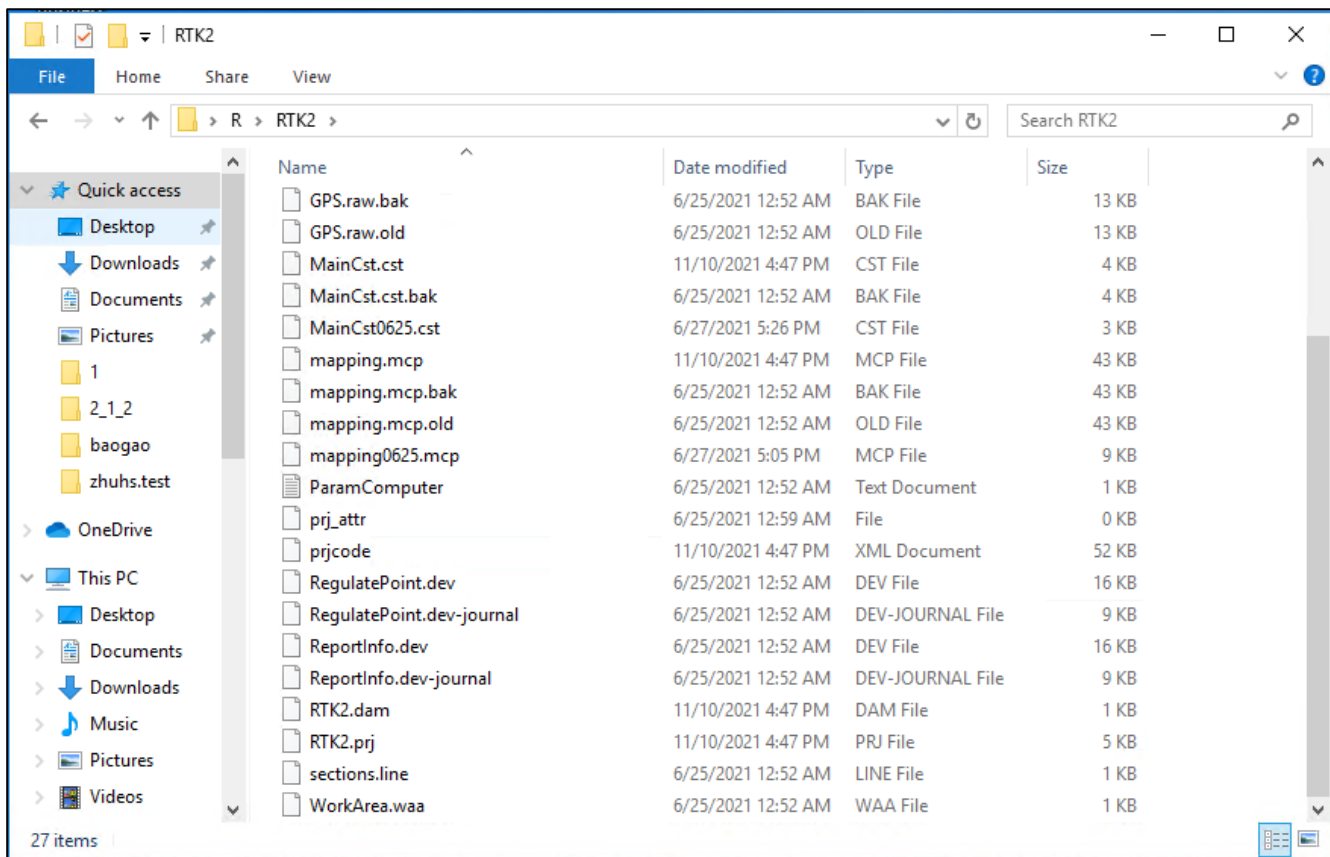


Figure 6-3-2 Saved RTK Project File

6.4 Synchronization

After finishing editing the RTK project, users can synchronize the RTK project data with the mobile via the [Sync from Mobile]/ [Synchronize to Mobile] button on the top bar.

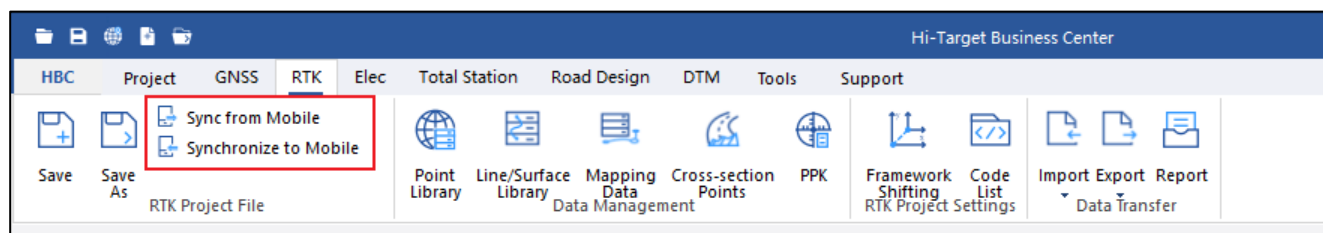


Figure 6-4-1 Synchronize the RTK Project

6.4.1 Syncing from Mobile

1. Enter the Address and Port

After the FTP function is enabled on the mobile software, click on the [Sync from Mobile] button on the top bar, enter the address and port information (according to the mobile configuration, choose to enter the user name and password) and click on Connect.

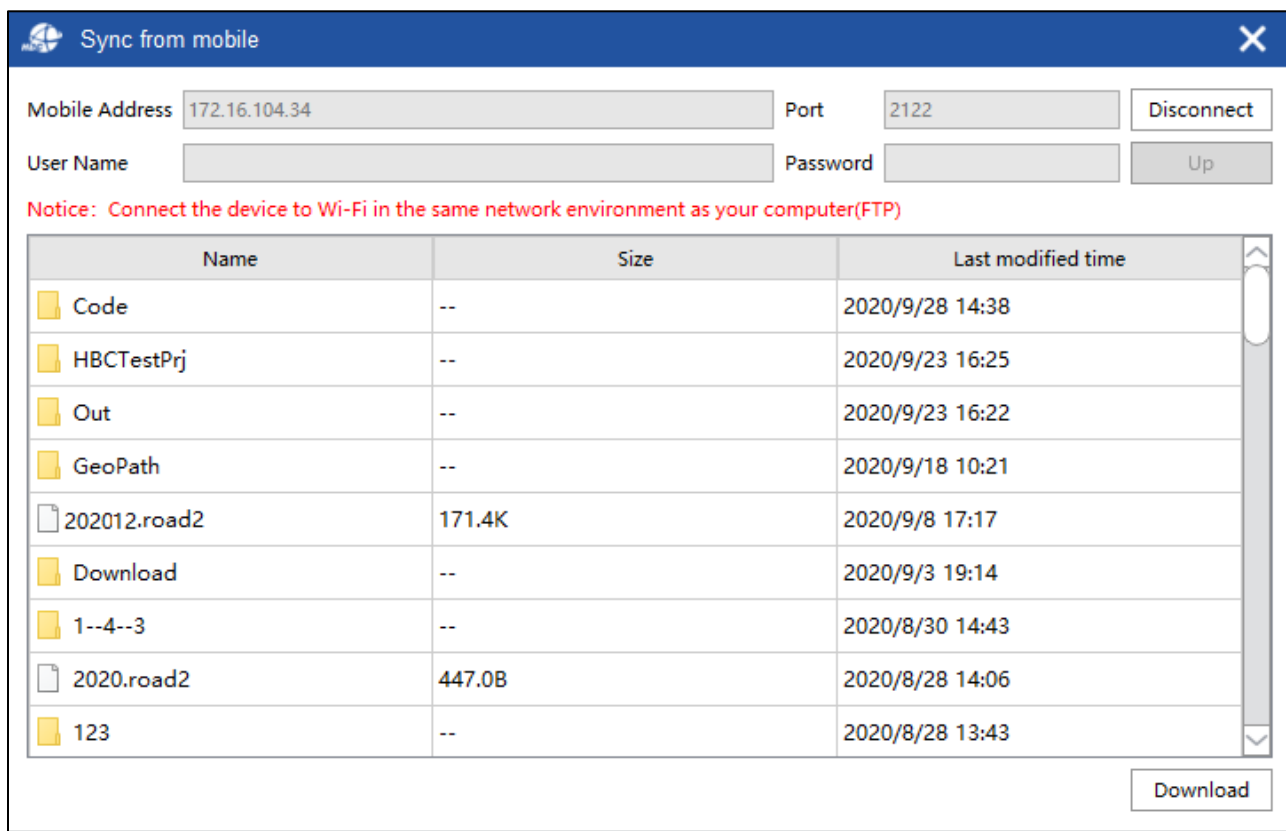


Figure 6-4-2 Sync from Mobile

2. Synchronizing Mobile Projects

After the connection is successful, select the corresponding RTK project folder, click the [Download] button to open the mobile project synchronously.

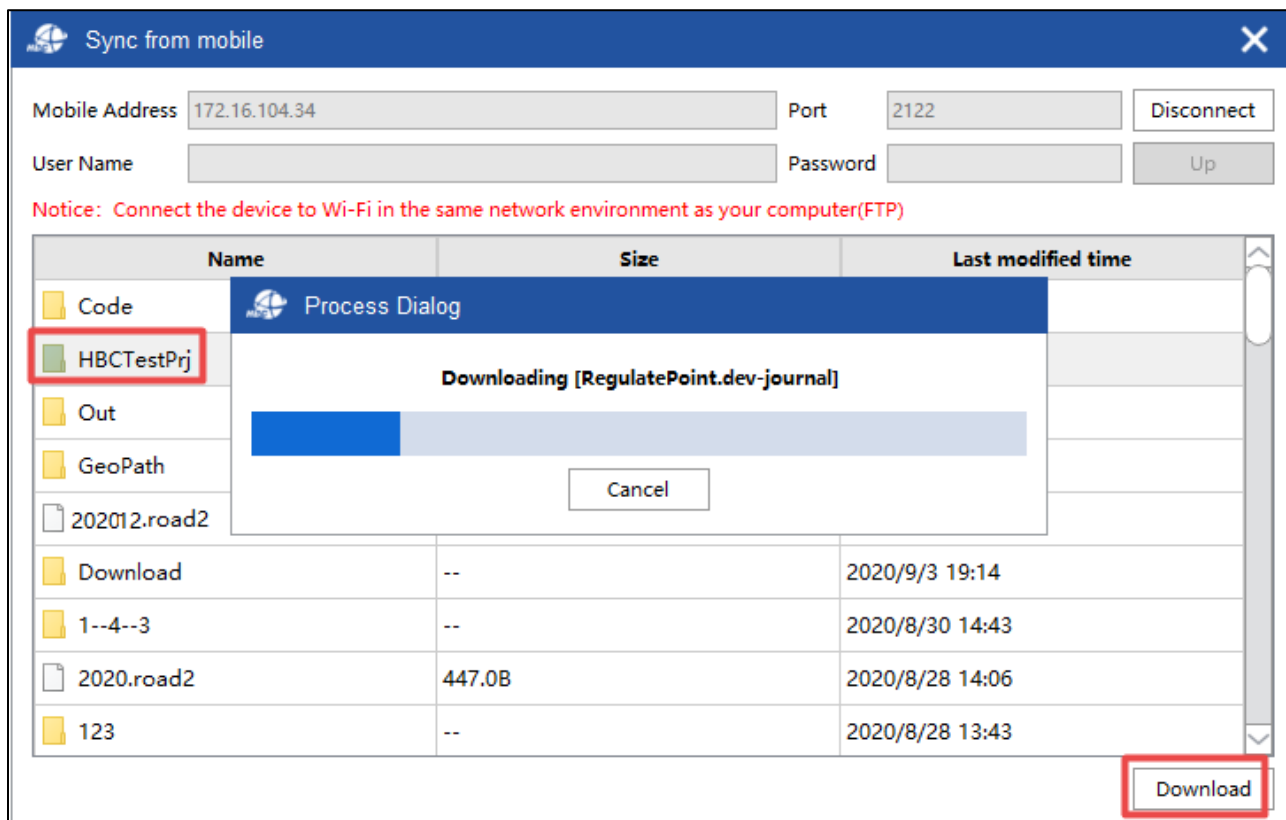


Figure 6-4-3 Download RTK Project

6.4.2 Sync to Mobile

1. Enter the Address and Port

After the FTP function is enabled on the mobile software, click the [Sync to Mobile] button on the top bar, enter the address and port information (according to the mobile configuration, choose to enter user name and password) and click Connect.

 Sync to mobile [Saveproject] ✕

Mobile Address Port

User Name Password

Notice: Connect the device to Wi-Fi in the same network environment as your computer(FTP)

Name	Size	Last modified time
 Code	--	2020/9/28 14:38
 HBCTestPrj	--	2020/9/23 16:25
 Out	--	2020/9/23 16:22
 GeoPath	--	2020/9/18 10:21
 202012.road2	171.4K	2020/9/8 17:17
 Download	--	2020/9/3 19:14
 1--4--3	--	2020/8/30 14:43
 2020.road2	447.0B	2020/8/28 14:06
 123	--	2020/8/28 13:43

Figure 6-4-4 Sync to Mobile

2. Synchronizing Projects to Mobile

After the connection is successful, select the target folder and click the [Start Synchronize] button to sync the current RTK project to the mobile terminal.

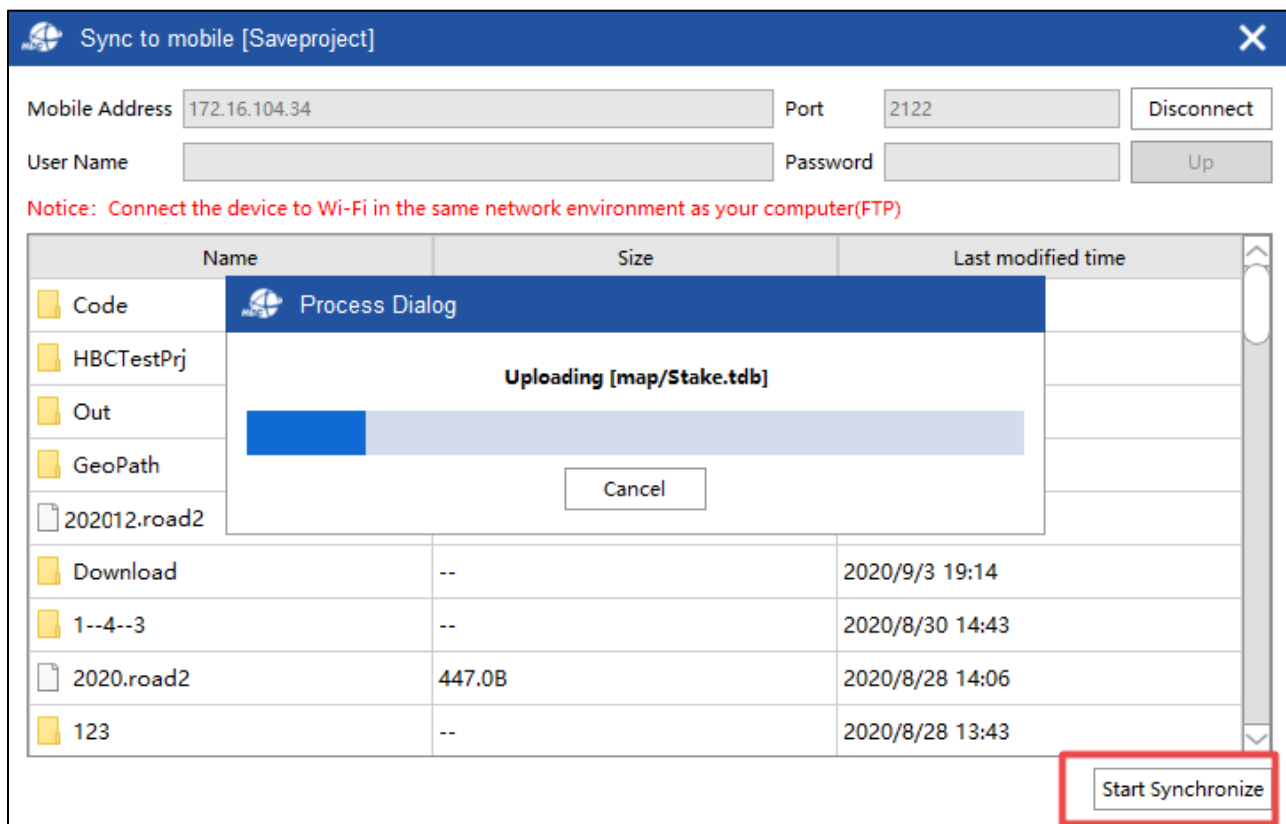
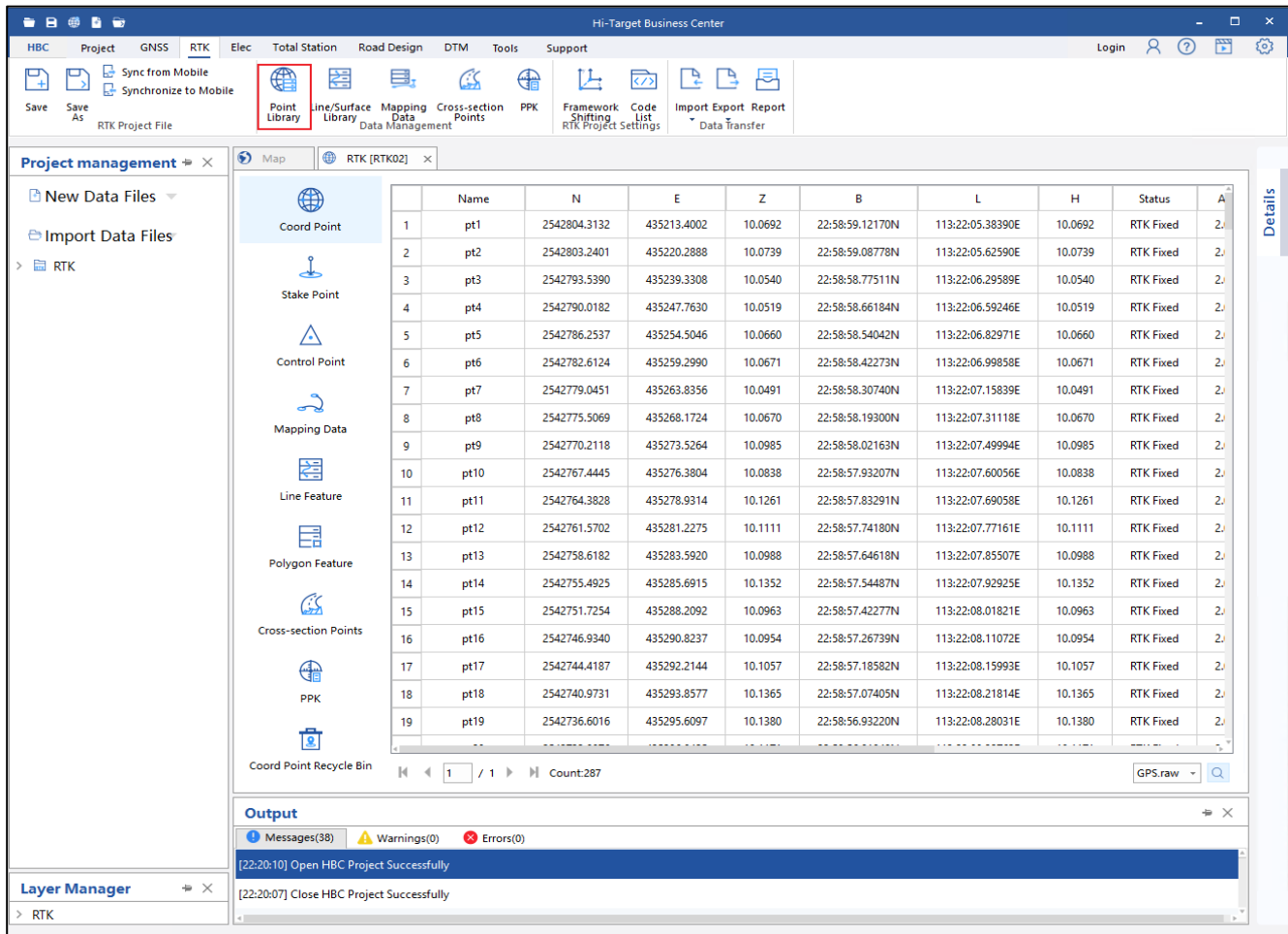


Figure 6-4-5 Synchronize the RTK Project to Mobile

Note: when the road data is synchronized to the mobile terminal, it is generally synchronized to zhd \ project \ road \ XXX \ data \ roadfile, where XXX is the RTK project folder. If it is synchronized to this directory, open the project in hi survey, and you can directly see the synchronized data in road design.

6.5 Point Library

After opening the RTK project, the user can enter the RTK project coordinate data view main interface through the [Point Library] button on the top bar.



The screenshot shows the Hi-Target Business Center software interface. The 'Point Library' window is open, displaying a table of 19 coordinate points. The table has columns for Name, N, E, Z, B, L, H, Status, and A. The 'Point Library' icon in the top toolbar is highlighted with a red box. The left sidebar shows 'Project management' and 'Layer Manager' tabs. The bottom panel shows an 'Output' window with messages.

	Name	N	E	Z	B	L	H	Status	A
1	pt1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	RTK Fixed	2.0
2	pt2	2542803.2401	435220.2888	10.0739	22:58:59.08778N	113:22:05.62590E	10.0739	RTK Fixed	2.0
3	pt3	2542793.5390	435239.3308	10.0540	22:58:58.77511N	113:22:06.29589E	10.0540	RTK Fixed	2.0
4	pt4	2542790.0182	435247.7630	10.0519	22:58:58.66184N	113:22:06.59246E	10.0519	RTK Fixed	2.0
5	pt5	2542786.2537	435254.5046	10.0660	22:58:58.54042N	113:22:06.82971E	10.0660	RTK Fixed	2.0
6	pt6	2542782.6124	435259.2990	10.0671	22:58:58.42273N	113:22:06.99858E	10.0671	RTK Fixed	2.0
7	pt7	2542779.0451	435263.8356	10.0491	22:58:58.30740N	113:22:07.15839E	10.0491	RTK Fixed	2.0
8	pt8	2542775.5069	435268.1724	10.0670	22:58:58.19300N	113:22:07.31118E	10.0670	RTK Fixed	2.0
9	pt9	2542770.2118	435273.5264	10.0985	22:58:58.02163N	113:22:07.49994E	10.0985	RTK Fixed	2.0
10	pt10	2542767.4445	435276.3804	10.0838	22:58:57.93207N	113:22:07.60056E	10.0838	RTK Fixed	2.0
11	pt11	2542764.3828	435278.9314	10.1261	22:58:57.83291N	113:22:07.69058E	10.1261	RTK Fixed	2.0
12	pt12	2542761.5702	435281.2275	10.1111	22:58:57.74180N	113:22:07.77161E	10.1111	RTK Fixed	2.0
13	pt13	2542758.6182	435283.5920	10.0988	22:58:57.64618N	113:22:07.85507E	10.0988	RTK Fixed	2.0
14	pt14	2542755.4925	435285.6915	10.1352	22:58:57.54487N	113:22:07.92925E	10.1352	RTK Fixed	2.0
15	pt15	2542751.7254	435288.2092	10.0963	22:58:57.42277N	113:22:08.01821E	10.0963	RTK Fixed	2.0
16	pt16	2542746.9340	435290.8237	10.0954	22:58:57.26739N	113:22:08.11072E	10.0954	RTK Fixed	2.0
17	pt17	2542744.4187	435292.2144	10.1057	22:58:57.18582N	113:22:08.15993E	10.1057	RTK Fixed	2.0
18	pt18	2542740.9731	435293.8577	10.1365	22:58:57.07405N	113:22:08.21814E	10.1365	RTK Fixed	2.0
19	pt19	2542736.6016	435295.6097	10.1380	22:58:56.93220N	113:22:08.28031E	10.1380	RTK Fixed	2.0

Figure 6-5-1 Point Library

6.5.1 Coordinate Points

1. Data Deletion

Users can right mouse click on any row of data via a list of coordinates.

Map RTK [RTK02] x									
	Name	N	E	Z	B	L	H	Status	A
1	pt1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	RTK Fixed	2.0
2	pt2	2542803.2401	435220.2888	10.0692	22:58:59.12170N	113:22:05.62590E	10.0739	RTK Fixed	2.0
3	pt3	2542793.5390	435239.3308	10.0692	22:58:59.12170N	113:22:06.29589E	10.0540	RTK Fixed	2.0
4	pt4	2542790.0182	435247.7630	10.0692	22:58:59.12170N	113:22:06.59246E	10.0519	RTK Fixed	2.0
5	pt5	2542786.2537	435254.5046	10.0660	22:58:58.54042N	113:22:06.82971E	10.0660	RTK Fixed	2.0
6	pt6	2542782.6124	435259.2990	10.0671	22:58:58.42273N	113:22:06.99858E	10.0671	RTK Fixed	2.0
7	pt7	2542779.0451	435263.8356	10.0491	22:58:58.30740N	113:22:07.15839E	10.0491	RTK Fixed	2.0
8	pt8	2542775.5069	435268.1724	10.0670	22:58:58.19300N	113:22:07.31118E	10.0670	RTK Fixed	2.0
9	pt9	2542770.2118	435273.5264	10.0985	22:58:58.02163N	113:22:07.49994E	10.0985	RTK Fixed	2.0
10	pt10	2542767.4445	435276.3804	10.0838	22:58:57.93207N	113:22:07.60056E	10.0838	RTK Fixed	2.0
11	pt11	2542764.3828	435278.9314	10.1261	22:58:57.83291N	113:22:07.69058E	10.1261	RTK Fixed	2.0
12	pt12	2542761.5702	435281.2275	10.1111	22:58:57.74180N	113:22:07.77161E	10.1111	RTK Fixed	2.0
13	pt13	2542758.6182	435283.5920	10.0988	22:58:57.64618N	113:22:07.85507E	10.0988	RTK Fixed	2.0
14	pt14	2542755.4925	435285.6915	10.1352	22:58:57.54487N	113:22:07.92925E	10.1352	RTK Fixed	2.0
15	pt15	2542751.7254	435288.2092	10.0963	22:58:57.42277N	113:22:08.01821E	10.0963	RTK Fixed	2.0
16	pt16	2542746.9340	435290.8237	10.0954	22:58:57.26739N	113:22:08.11072E	10.0954	RTK Fixed	2.0
17	pt17	2542744.4187	435292.2144	10.1057	22:58:57.18582N	113:22:08.15993E	10.1057	RTK Fixed	2.0
18	pt18	2542740.9731	435293.8577	10.1365	22:58:57.07405N	113:22:08.21814E	10.1365	RTK Fixed	2.0
19	pt19	2542736.6016	435295.6097	10.1380	22:58:56.93220N	113:22:08.28031E	10.1380	RTK Fixed	2.0

Figure 6-5-2 Delete Coordinate Point

Click the [Delete] button for data deletion operations.

Click the [Search] button or click the search icon in the lower right corner to enter the point name and description for data search.

After data search, click [Refresh] to display all data.

Click [Show Average Points] to view the smoothing data.

Modify the point library file in the lower right corner to switch between different store point files.

Map

RTK [RTK02] x



Coord Point



Stake Point



Control Point



Mapping Data



Line Feature



Polygon Feature



Cross-section Points



PPK



Coord Point Recycle Bin

	Name	N	E	Z	B	L	H	Status	A
1	pt1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	RTK Fixed	2.0
2	pt2	2542803.2401	435220.2888	10.0739	22:58:59.08778N	113:22:05.62590E	10.0739	RTK Fixed	2.0
3	pt3	2542793.5390	435239.3308	10.0540	22:58:58.77511N	113:22:06.29589E	10.0540	RTK Fixed	2.0
4	pt4	2542790.0182	435247.7630	10.0519	22:58:58.66184N	113:22:06.59246E	10.0519	RTK Fixed	2.0
5	pt5	2542786.2537	435254.5046	10.0660	22:58:58.54042N	113:22:06.82971E	10.0660	RTK Fixed	2.0
6	pt6	2542782.6124	435259.2990	10.0671	22:58:58.42273N	113:22:06.99858E	10.0671	RTK Fixed	2.0
7	pt7	2542779.0451	435263.8356	10.0491	22:58:58.30740N	113:22:07.15839E	10.0491	RTK Fixed	2.0
8	pt8	2542775.5069	435268.1724	10.0670	22:58:58.19300N	113:22:07.31118E	10.0670	RTK Fixed	2.0
9	pt9	2542770.2118	435273.5264	10.0985	22:58:58.02163N	113:22:07.49994E	10.0985	RTK Fixed	2.0
10	pt10	2542767.4445	435276.3804	10.0838	22:58:57.93207N	113:22:07.60056E	10.0838	RTK Fixed	2.0
11	pt11	2542764.3828	435278.9314	10.1261	22:58:57.83291N	113:22:07.69058E	10.1261	RTK Fixed	2.0
12	pt12	2542761.5702	435281.2275	10.1111	22:58:57.74180N	113:22:07.77161E	10.1111	RTK Fixed	2.0
13	pt13	2542758.6182	435283.5920	10.0988	22:58:57.64618N	113:22:07.85507E	10.0988	RTK Fixed	2.0
14	pt14	2542755.4925	435285.6915	10.1352	22:58:57.54487N	113:22:07.92925E	10.1352	RTK Fixed	2.0
15	pt15	2542751.7254	435288.2092	10.0963	22:58:57.42277N	113:22:08.01821E	10.0963	RTK Fixed	2.0
16	pt16	2542746.9340	435290.8237	10.0954	22:58:57.26739N	113:22:08.11072E	10.0954	RTK Fixed	2.0
17	pt17	2542744.4187	435292.2144	10.1057	22:58:57.18582N	113:22:08.15993E	10.1057	RTK Fixed	2.0
18	pt18	2542740.9731	435293.8577	10.1365	22:58:57.07405N	113:22:08.21814E	10.1365	RTK Fixed	2.0
19	pt19	2542736.6016	435295.6097	10.1380	22:58:56.93220N	113:22:08.28031E	10.1380	RTK Fixed	2.0

1 / 1

Count:287

GPS.raw

Figure 6-5-3 Modify the Coordinate Point Library File

2. Data Editing

(1) The user can click a row of data to be edited in the coordinate point list with the left mouse button to trigger to enter the detailed information interface on the right.

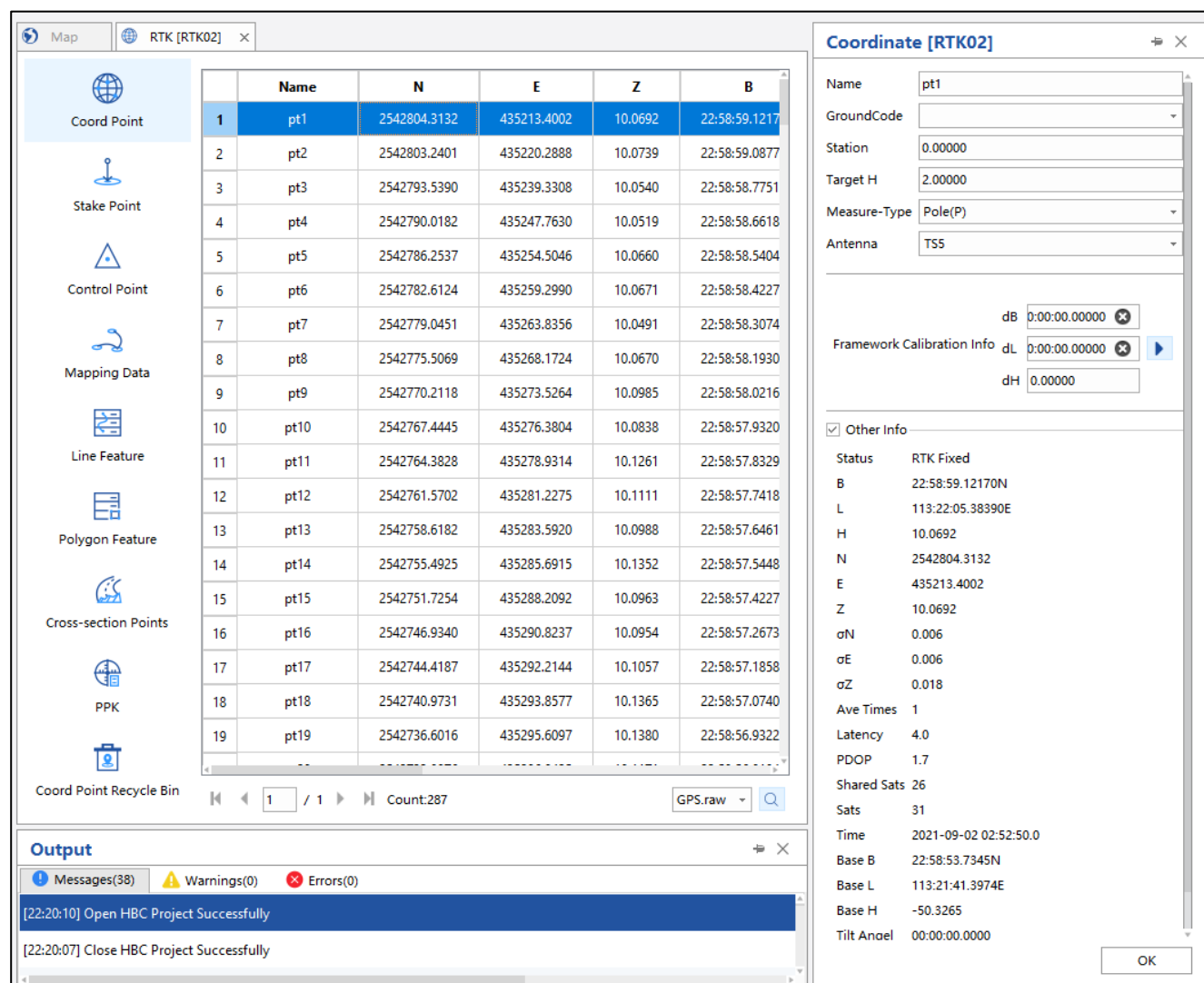


Figure 6-5-4 Edit the Coordinate Point

In the details screen, users can edit the point name, description, target height, antenna type and other information, after editing, click [OK] below to complete the update.

In particular, the point verification information can also be updated directly by editing point pairs or parameters.

[Compute]: calculate the coordinate correction amount $dBdLdH \setminus dNdEdZ$ according to the current point and known points. Calculation steps of point verification:

Step 1: Obtain the coordinates of the current point;

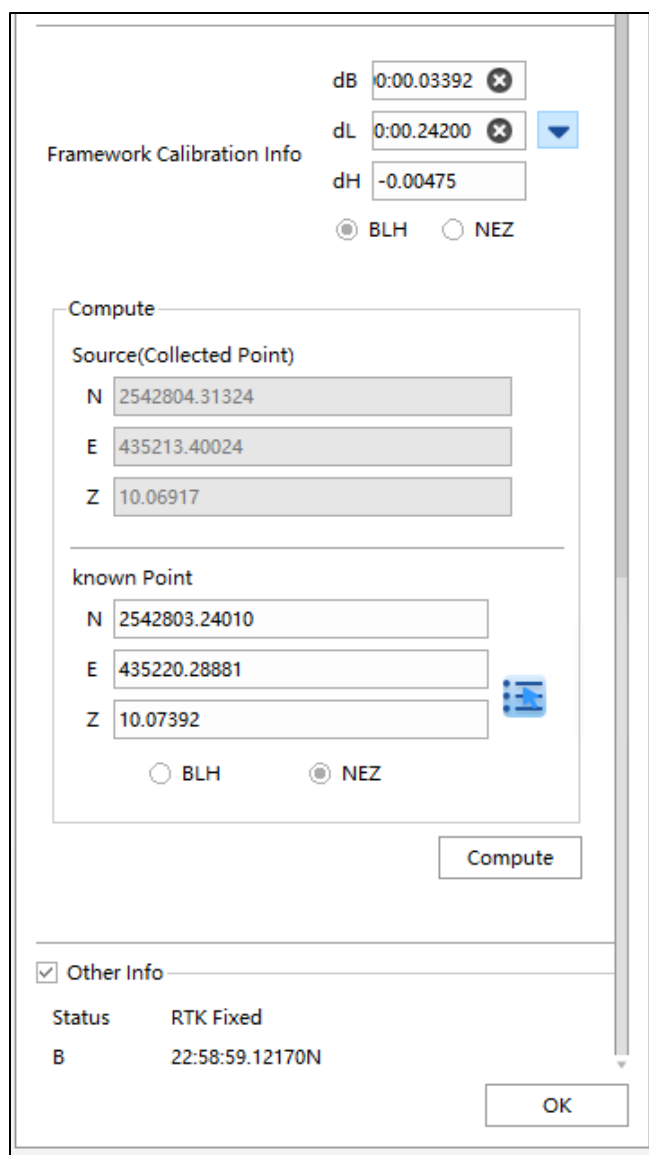
Step 2: Obtain the coordinates of known points;

Step 3: Click Compute.

The known points can be input in two ways: select from the list and input the coordinates directly.

Click the BLH \ NEZ radio box to change the known point coordinate type to the corresponding BLH \ NEZ form, and click the BLH \ NEZ radio box to change the point verification information coordinate type to the corresponding dBdLdH \ dNdEdZ form.

Click [OK] apply the calculated correction amount to the project.



Framework Calibration Info

dB 0:00.03392 ✕

dL 0:00.24200 ✕ ▼

dH -0.00475

☒ BLH ☐ NEZ

Compute

Source(Collected Point)

N 2542804.31324

E 435213.40024

Z 10.06917

known Point

N 2542803.24010

E 435220.28881

Z 10.07392

☐ BLH ☒ NEZ

Compute

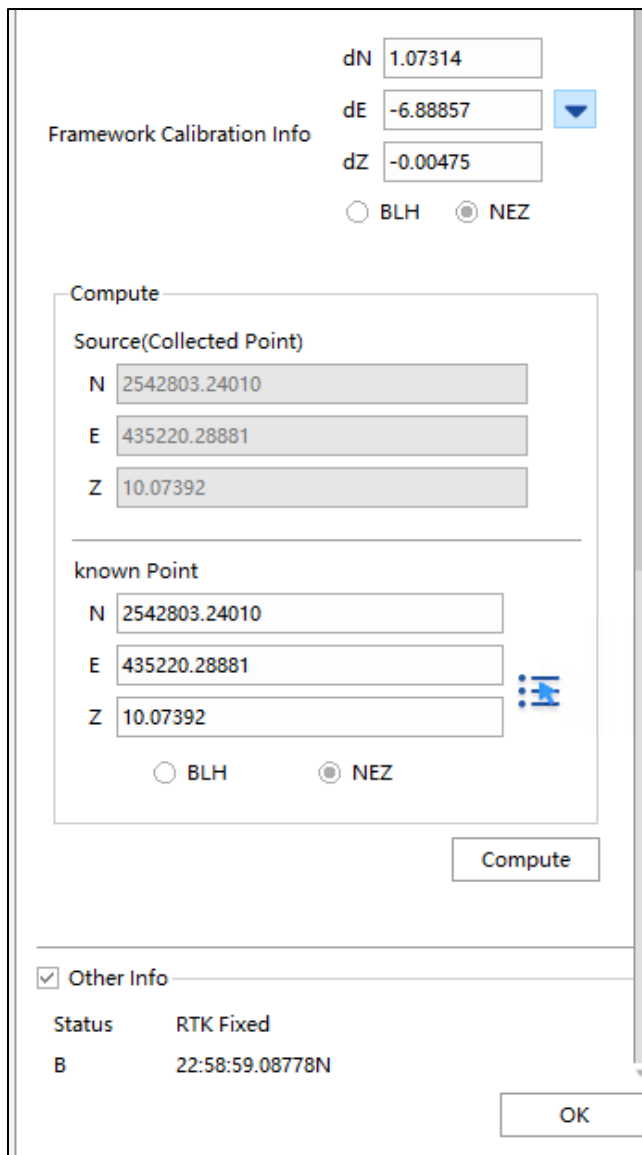
☒ Other Info

Status RTK Fixed

B 22:58:59.12170N

OK

Figure 6-5-5 BLH Point Verification



Framework Calibration Info

dN 1.07314

dE -6.88857 ▼

dZ -0.00475

☐ BLH ☒ NEZ

Compute

Source(Collected Point)

N 2542803.24010

E 435220.28881

Z 10.07392

known Point

N 2542803.24010

E 435220.28881

Z 10.07392

☐ BLH ☒ NEZ

Compute

☒ Other Info

Status RTK Fixed

B 22:58:59.08778N

OK

Figure 6-5-6 NEZ Point Verification

(2) You can press Ctrl or Shift multiple coordinate points and double-click the last piece of data to batch edit; Check the field check box and enter the corresponding information in the input box. After editing, click OK below to update the selected coordinate points.

Map
RTK [RTK02]

Coord Point
Stake Point
Control Point
Mapping Data
Line Feature
Polygon Feature
Cross-section Points
PPK
Coord Point Recycle Bin

	Name	N	E	Z	B
1	pt1	2542804.3132	435213.4002	10.0692	22:58:59.1217
2	pt2	2542803.2401	435220.2888	10.0739	22:58:59.0877
3	pt3	2542793.5390	435239.3308	10.0540	22:58:58.7751
4	pt4	2542790.0182	435247.7630	10.0519	22:58:58.6618
5	pt5	2542786.2537	435254.5046	10.0660	22:58:58.5404
6	pt6	2542782.6124	435259.2990	10.0671	22:58:58.4227
7	pt7	2542779.0451	435263.8356	10.0491	22:58:58.3074
8	pt8	2542775.5069	435268.1724	10.0670	22:58:58.1930
9	pt9	2542770.2118	435273.5264	10.0985	22:58:58.0216
10	pt10	2542767.4445	435276.3804	10.0838	22:58:57.9320
11	pt11	2542764.3828	435278.9314	10.1261	22:58:57.8329
12	pt12	2542761.5702	435281.2275	10.1111	22:58:57.7418
13	pt13	2542758.6182	435283.5920	10.0988	22:58:57.6461
14	pt14	2542755.4925	435285.6915	10.1352	22:58:57.5448
15	pt15	2542751.7254	435288.2092	10.0963	22:58:57.4227
16	pt16	2542746.9340	435290.8237	10.0954	22:58:57.2673
17	pt17	2542744.4187	435292.2144	10.1057	22:58:57.1858
18	pt18	2542740.9731	435293.8577	10.1365	22:58:57.0740
19	pt19	2542736.6016	435295.6097	10.1380	22:58:56.9322

Coord Point Recycle Bin
1 / 1
Count:287
GPS.raw

Batch editing Coord Point [RTK02]

*Note: Check to box to enable the setting

☐ GroundCode
☐ Station
☐ Target H
☐ Measure-Type
☐ Antenna

dN 1.07314
dE -6.88857
dZ -0.00475

BLH
NEZ

☐ Framework Calibration Info

OK

Output

Messages(5)
Warnings(0)
Errors(0)

[18:53:43] Framework Calibration Info The point selection has ended

[18:53:28] Framework Calibration Info Please select the point in the data list

Figure 6-5-7 Batch Edit the Coordinate Point

3. Coordinate Point Recycle Bin

If you delete a coordinate point by mistake, you can restore and delete the coordinate point in the [Coordinate Point Recycle Bin].

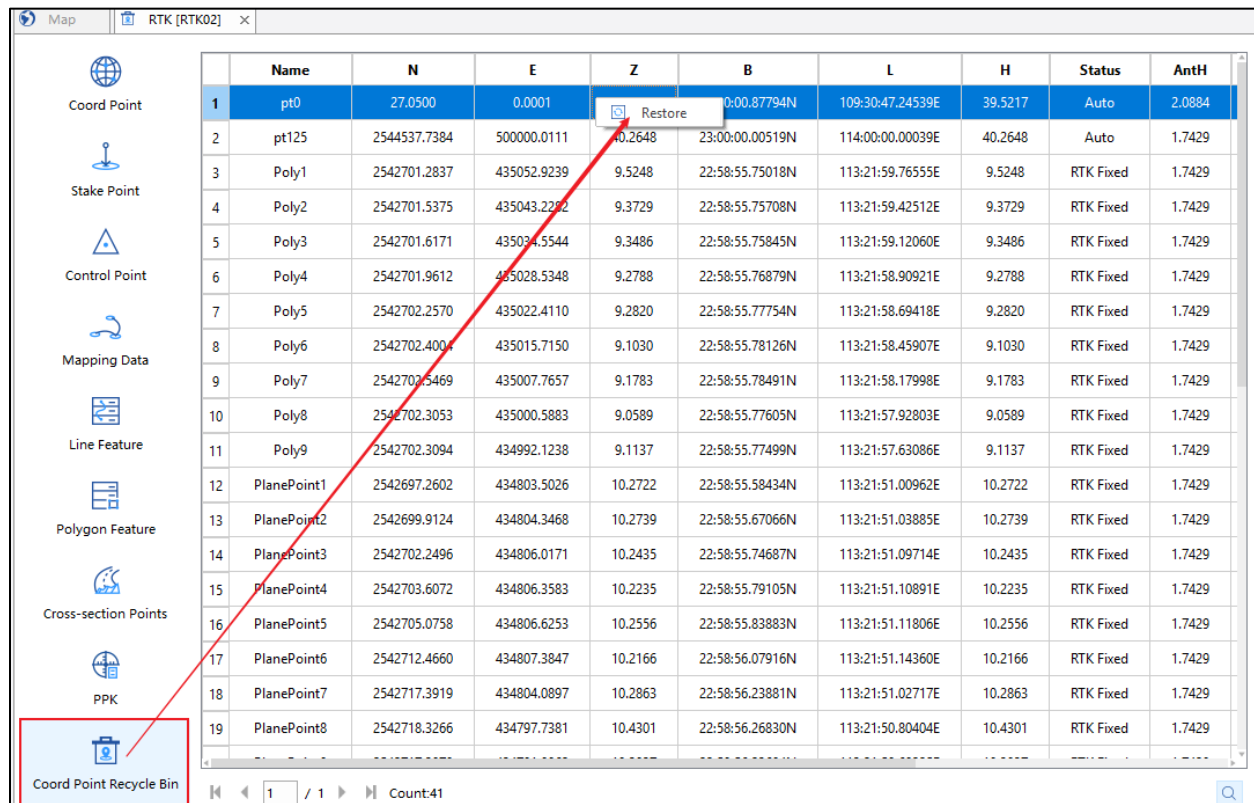


Figure 6-5-8 Restore the Deleted Coordinate Point

6.5.2 Stake Points

1. Data Deletion

Users can right-click on any row of data from the stake point list.

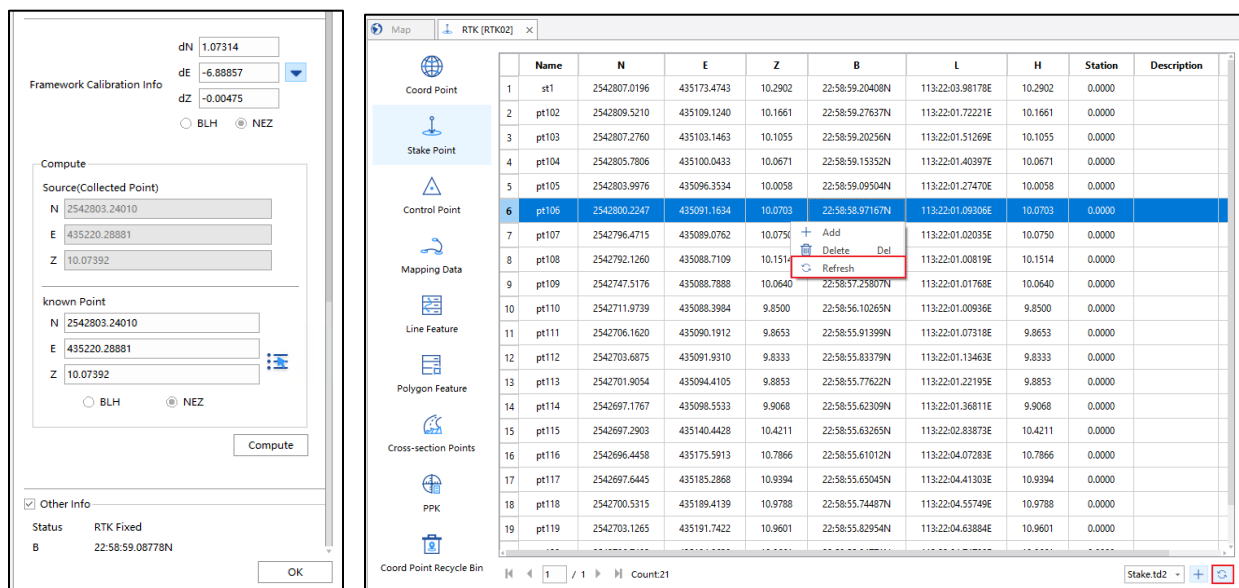


Figure 6-5-9 Delete the Stake Point

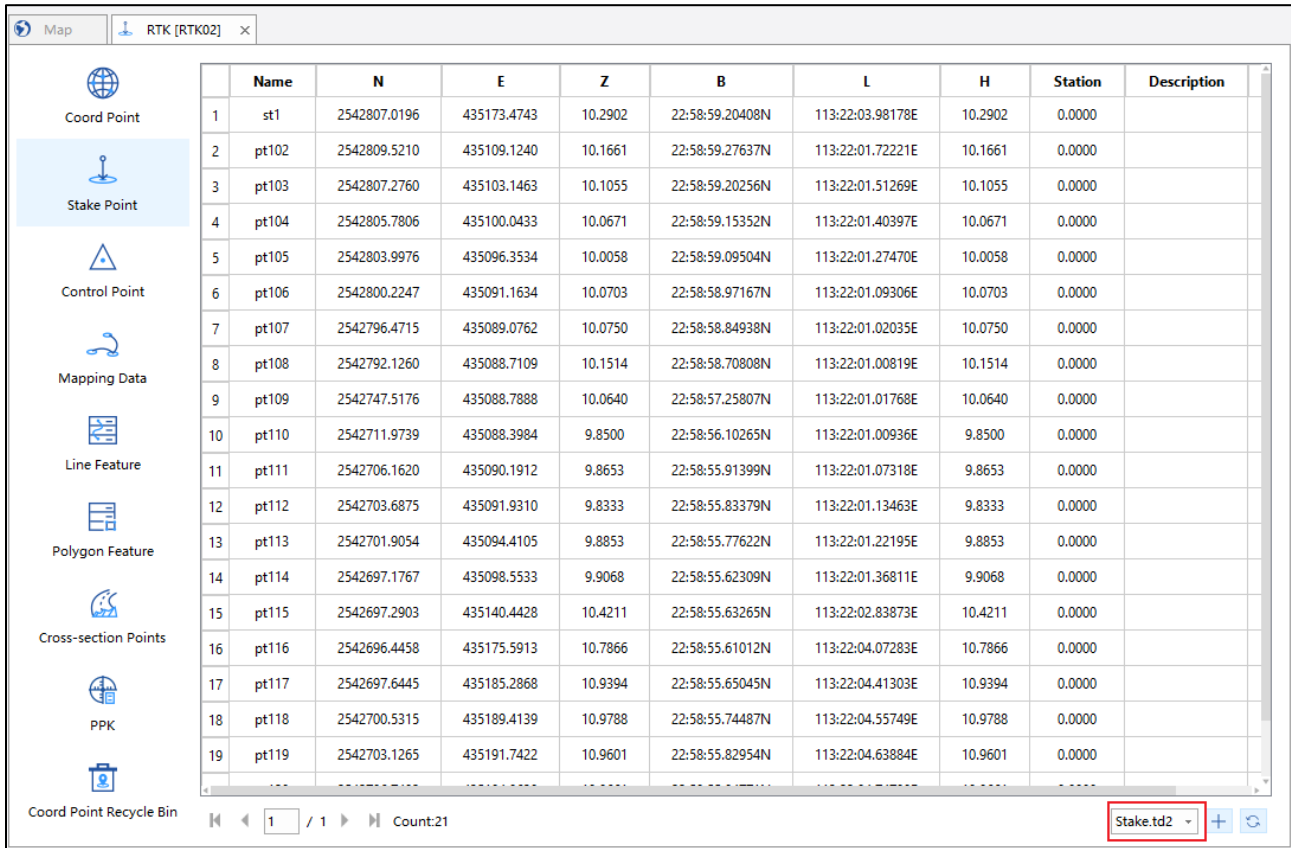
Click the [Delete] button for data deletion operations.

Click the [Search] button or click the search icon in the lower right corner to enter the point name and description for data search.

After data search, click [Refresh] to display all data.

Click [Add] or the '+' button at the bottom right to add the stake point data.

Modify the point library file in the lower right corner to switch between different stake point files.



	Name	N	E	Z	B	L	H	Station	Description
1	st1	2542807.0196	435173.4743	10.2902	22:58:59.20408N	113:22:03.98178E	10.2902	0.0000	
2	pt102	2542809.5210	435109.1240	10.1661	22:58:59.27637N	113:22:01.72221E	10.1661	0.0000	
3	pt103	2542807.2760	435103.1463	10.1055	22:58:59.20256N	113:22:01.51269E	10.1055	0.0000	
4	pt104	2542805.7806	435100.0433	10.0671	22:58:59.15352N	113:22:01.40397E	10.0671	0.0000	
5	pt105	2542803.9976	435096.3534	10.0058	22:58:59.09504N	113:22:01.27470E	10.0058	0.0000	
6	pt106	2542800.2247	435091.1634	10.0703	22:58:58.97167N	113:22:01.09306E	10.0703	0.0000	
7	pt107	2542796.4715	435089.0762	10.0750	22:58:58.84938N	113:22:01.02035E	10.0750	0.0000	
8	pt108	2542792.1260	435088.7109	10.1514	22:58:58.70808N	113:22:01.00819E	10.1514	0.0000	
9	pt109	2542747.5176	435088.7888	10.0640	22:58:57.25807N	113:22:01.01768E	10.0640	0.0000	
10	pt110	2542711.9739	435088.3984	9.8500	22:58:56.10265N	113:22:01.00936E	9.8500	0.0000	
11	pt111	2542706.1620	435090.1912	9.8653	22:58:55.91399N	113:22:01.07318E	9.8653	0.0000	
12	pt112	2542703.6875	435091.9310	9.8333	22:58:55.83379N	113:22:01.13463E	9.8333	0.0000	
13	pt113	2542701.9054	435094.4105	9.8853	22:58:55.77622N	113:22:01.22195E	9.8853	0.0000	
14	pt114	2542697.1767	435098.5533	9.9068	22:58:55.62309N	113:22:01.36811E	9.9068	0.0000	
15	pt115	2542697.2903	435140.4428	10.4211	22:58:55.63265N	113:22:02.83873E	10.4211	0.0000	
16	pt116	2542696.4458	435175.5913	10.7866	22:58:55.61012N	113:22:04.07283E	10.7866	0.0000	
17	pt117	2542697.6445	435185.2868	10.9394	22:58:55.65045N	113:22:04.41303E	10.9394	0.0000	
18	pt118	2542700.5315	435189.4139	10.9788	22:58:55.74487N	113:22:04.55749E	10.9788	0.0000	
19	pt119	2542703.1265	435191.7422	10.9601	22:58:55.82954N	113:22:04.63884E	10.9601	0.0000	

Figure 6-5-10 Modify the Stake Point Library File

2. Data Editing

Users can trigger access to the right side of the details screen by left-clicking on any line in the stake point list.

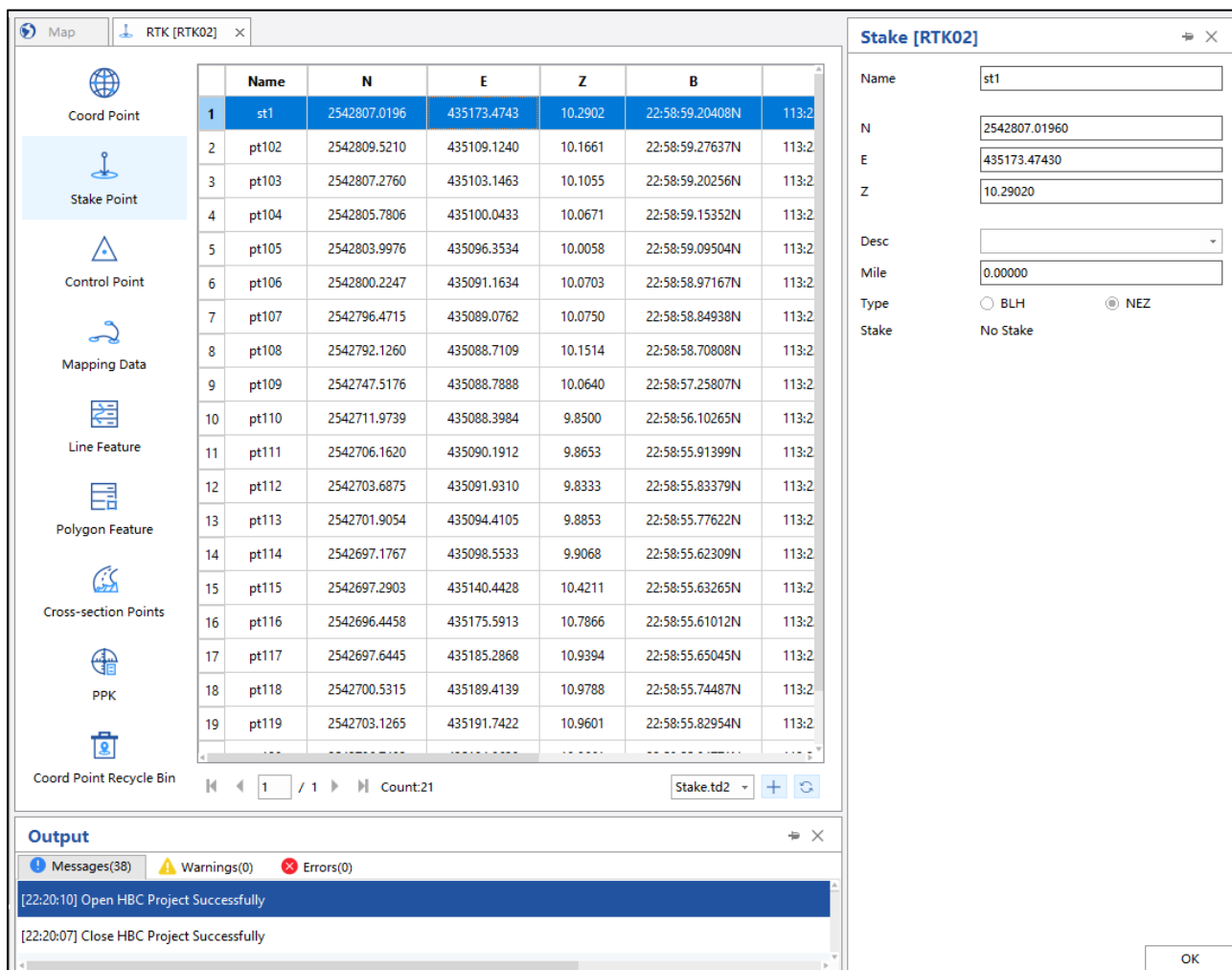


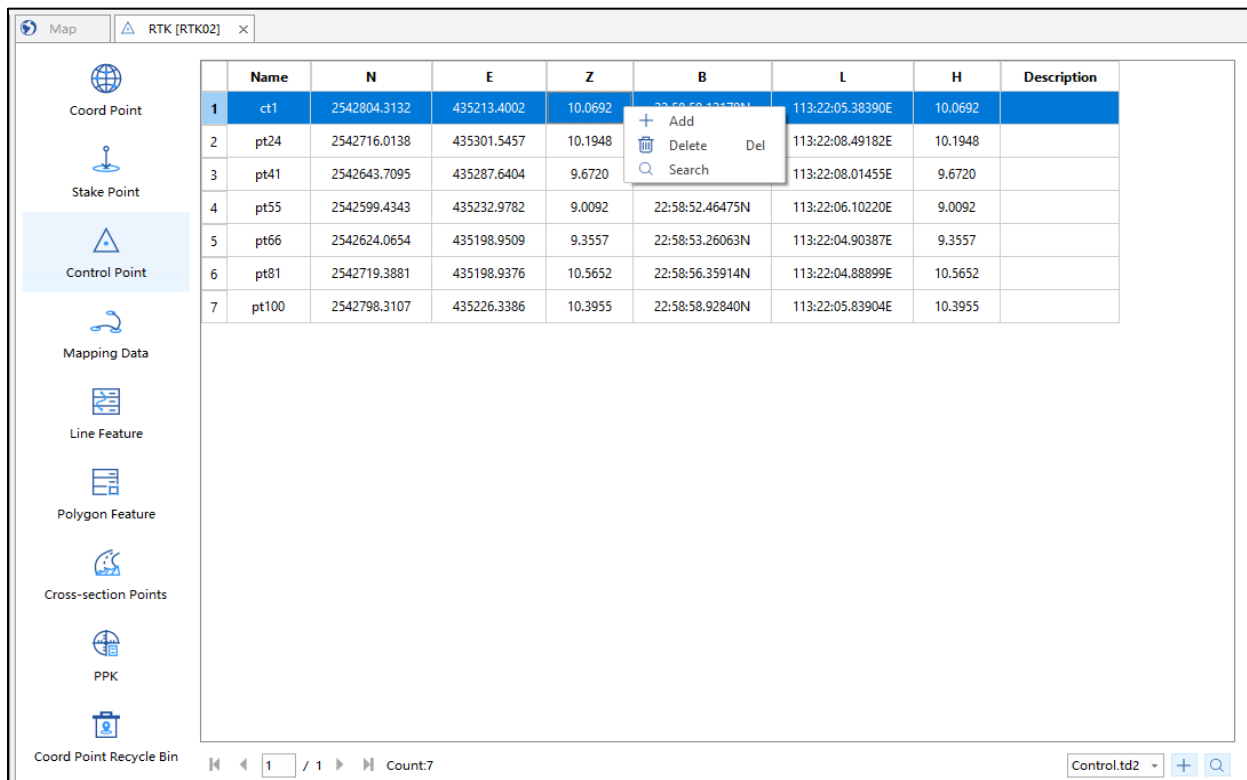
Figure 6-5-11 Edit the Stake Point

In the details screen, users can edit the point name, description, mileage, coordinates and other information, after editing, click [OK] to complete the update.

6.5.3 Control Points

1 Data Deletion

Users can right-click on any row of data from a list of control points:



Map RTK [RTK02] x

Coord Point

Stake Point

Control Point

Mapping Data

Line Feature

Polygon Feature

Cross-section Points

PPK

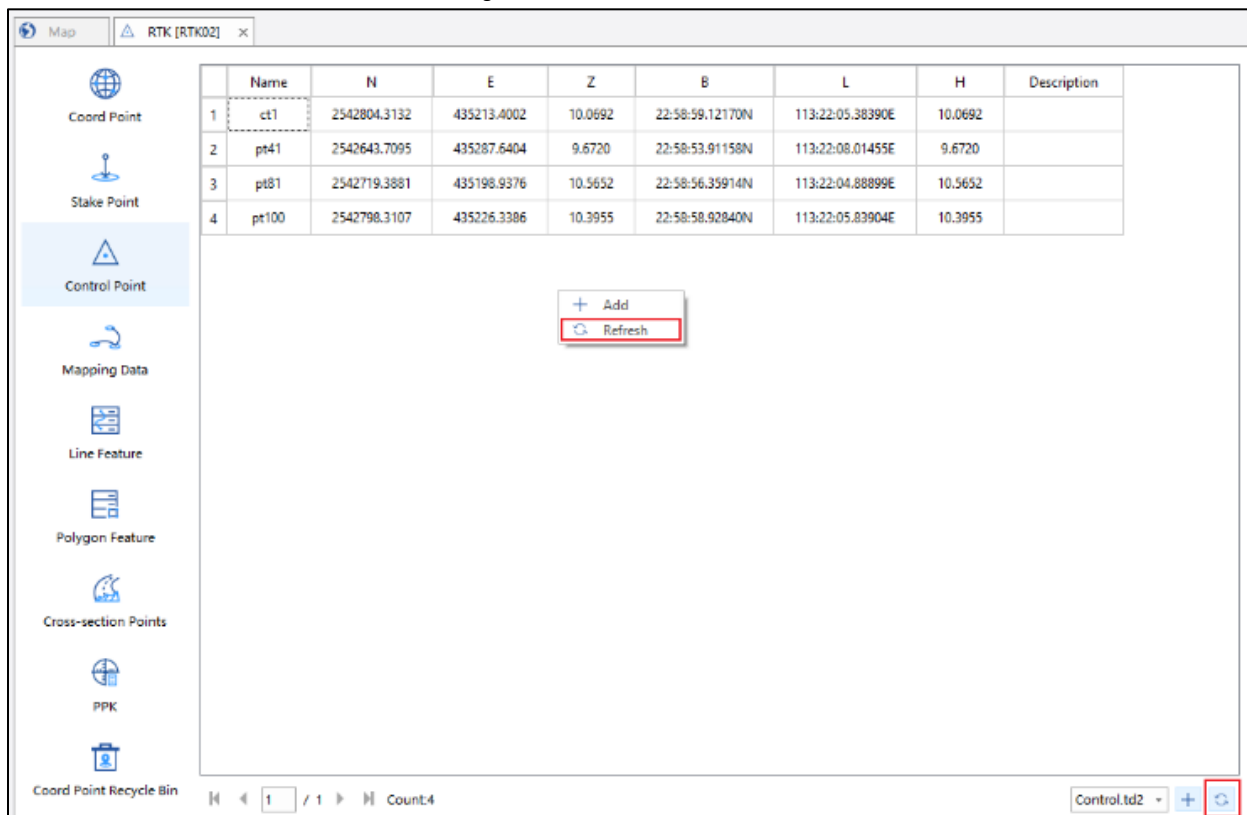
Coord Point Recycle Bin

	Name	N	E	Z	B	L	H	Description
1	ct1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	
2	pt24	2542716.0138	435301.5457	10.1948	22:58:53.91158N	113:22:08.01455E	10.1948	
3	pt41	2542643.7095	435287.6404	9.6720	22:58:56.35914N	113:22:04.88899E	9.6720	
4	pt55	2542599.4343	435232.9782	9.0092	22:58:58.92840N	113:22:05.83904E	9.0092	
5	pt66	2542624.0654	435198.9509	9.3557			9.3557	
6	pt81	2542719.3881	435198.9376	10.5652			10.5652	
7	pt100	2542798.3107	435226.3386	10.3955			10.3955	

Count:7

Control.td2 + 🔍

Figure 6-5-12 Delete the Control Point



Map RTK [RTK02] x

Coord Point

Stake Point

Control Point

Mapping Data

Line Feature

Polygon Feature

Cross-section Points

PPK

Coord Point Recycle Bin

	Name	N	E	Z	B	L	H	Description
1	ct1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	
2	pt41	2542643.7095	435287.6404	9.6720	22:58:53.91158N	113:22:08.01455E	9.6720	
3	pt81	2542719.3881	435198.9376	10.5652	22:58:56.35914N	113:22:04.88899E	10.5652	
4	pt100	2542798.3107	435226.3386	10.3955	22:58:58.92840N	113:22:05.83904E	10.3955	

Count:4

Control.td2 + ↻

Figure 6-5-13 Refresh the Control Point

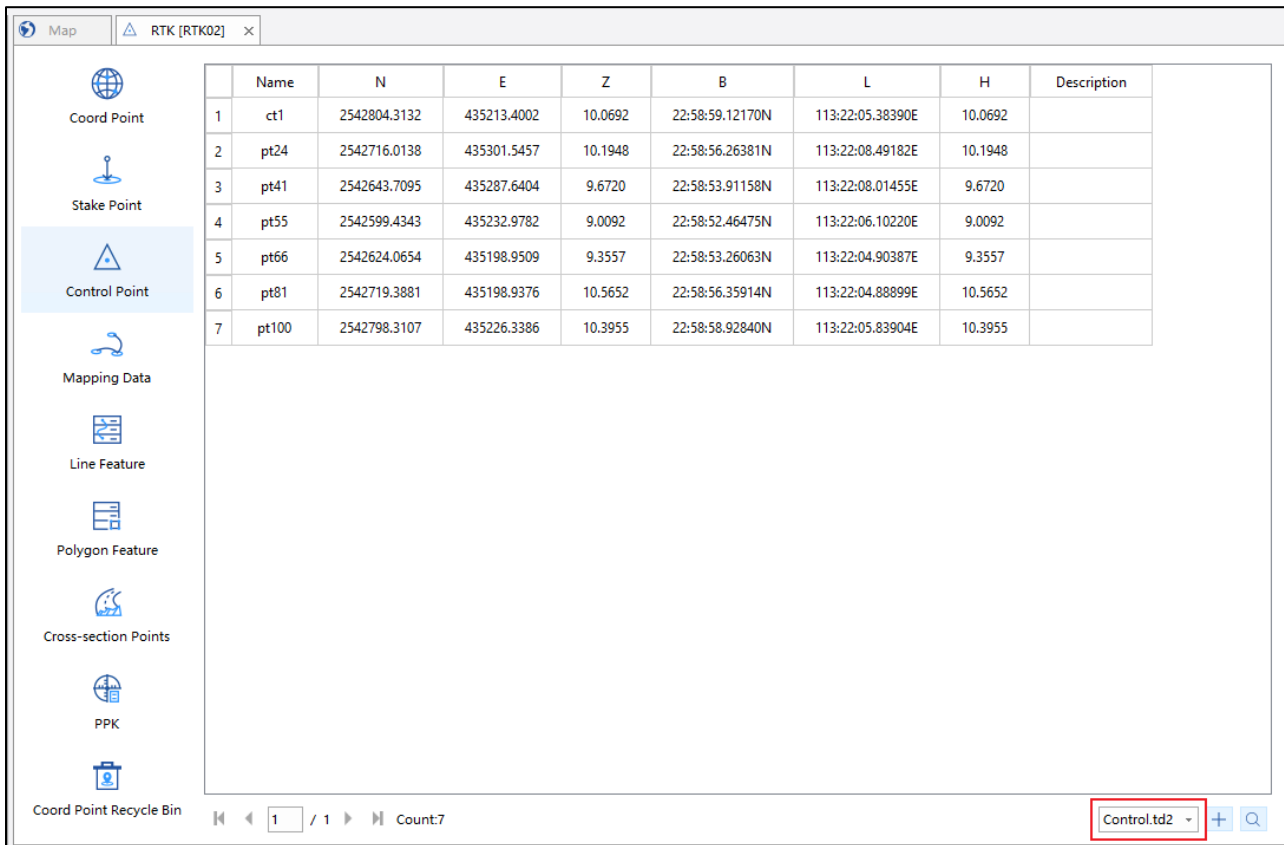
Click the [Delete] button for data deletion operations.

Click the [Search] button or click the search icon in the lower right corner to enter the point name and description for data search.

After data search, click [Refresh] to display all data.

Click [Add] or the '+' button at the bottom right to add new control point data.

Modify the point library file in the lower right corner to switch between different control point files.



The screenshot displays the Hi-Target Business Center software interface. On the left is a vertical toolbar with icons for various features: Coord Point, Stake Point, Control Point (highlighted), Mapping Data, Line Feature, Polygon Feature, Cross-section Points, PPK, and Coord Point Recycle Bin. The main area shows a table of control points with columns: Name, N, E, Z, B, L, H, and Description. The table contains 7 rows of data. At the bottom right, a dropdown menu is open, showing 'Control.td2' as the selected file. Below the table, there is a status bar with navigation icons, a page indicator '1 / 1', and a count 'Count:7'.

	Name	N	E	Z	B	L	H	Description
1	ct1	2542804.3132	435213.4002	10.0692	22:58:59.12170N	113:22:05.38390E	10.0692	
2	pt24	2542716.0138	435301.5457	10.1948	22:58:56.26381N	113:22:08.49182E	10.1948	
3	pt41	2542643.7095	435287.6404	9.6720	22:58:53.91158N	113:22:08.01455E	9.6720	
4	pt55	2542599.4343	435232.9782	9.0092	22:58:52.46475N	113:22:06.10220E	9.0092	
5	pt66	2542624.0654	435198.9509	9.3557	22:58:53.26063N	113:22:04.90387E	9.3557	
6	pt81	2542719.3881	435198.9376	10.5652	22:58:56.35914N	113:22:04.88899E	10.5652	
7	pt100	2542798.3107	435226.3386	10.3955	22:58:58.92840N	113:22:05.83904E	10.3955	

Figure 6-5-14 Modify the Control Point Library File

2. Data Editing

Users can trigger access to the right side of the detail screen by left-clicking on any line in the control point list.

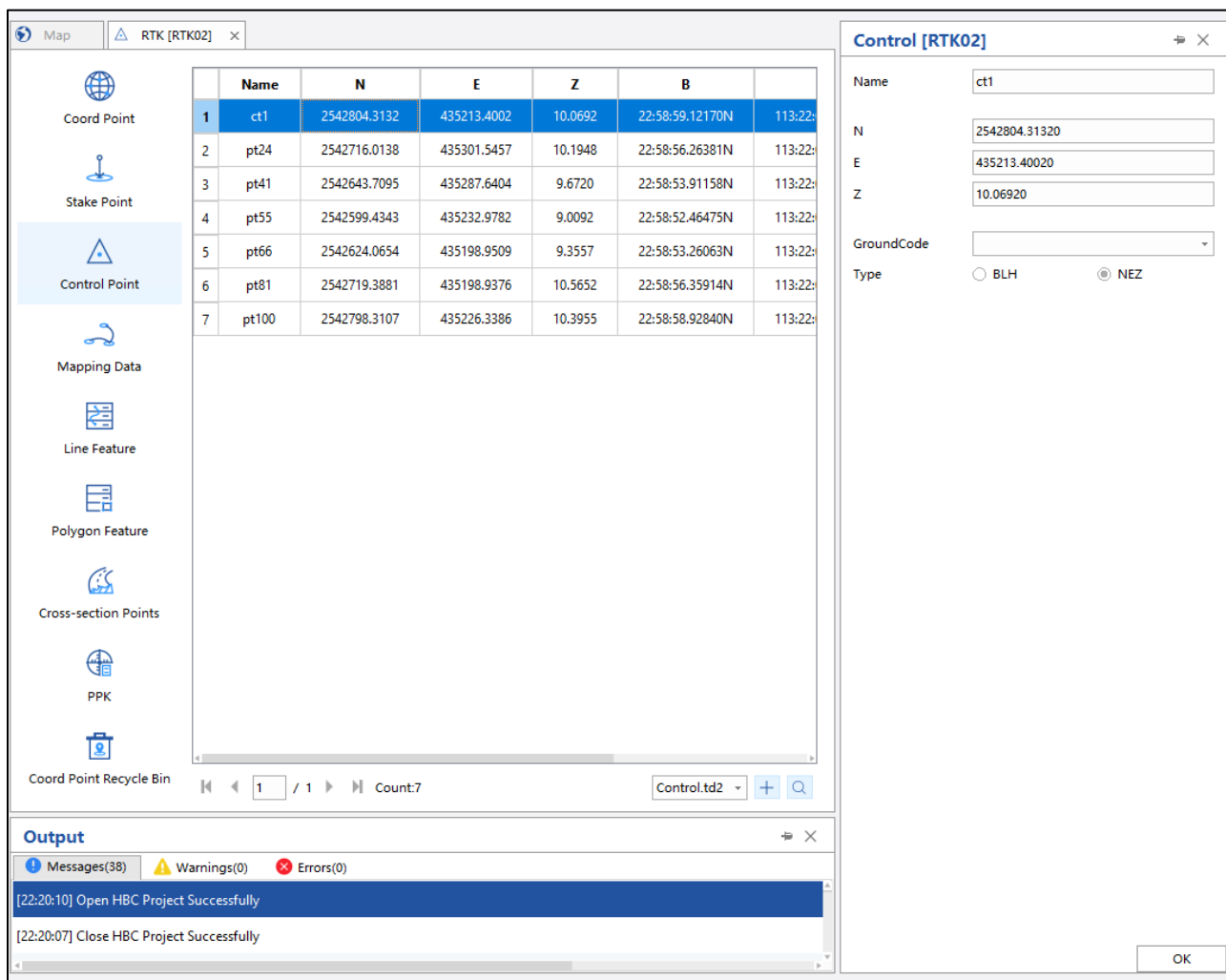


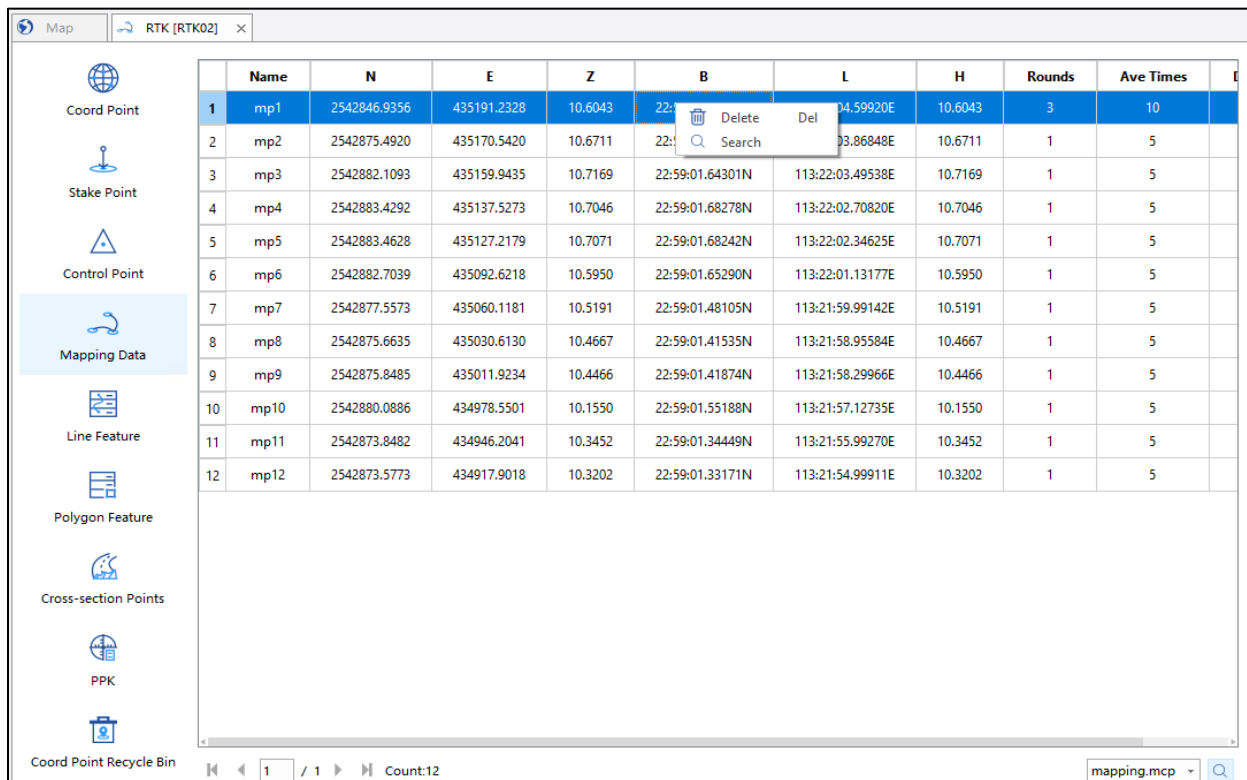
Figure 6-5-15 Edit the Control Point

The user can edit the point name, description, coordinate value (BLH and NEZ switch) and other information in the detail interface, click [OK] below to complete the update.

6.5.4 Mapping Data

1. Data Deletion

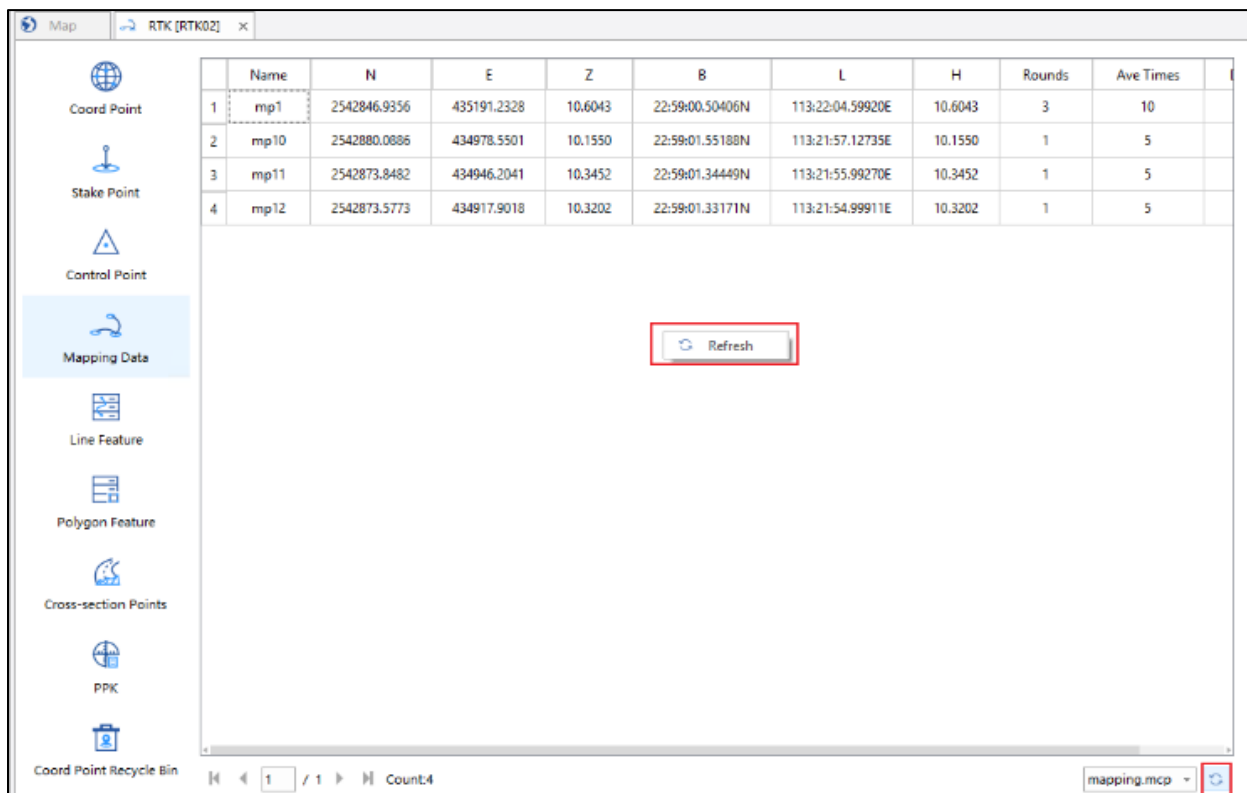
Users can right-click on any row of data via the mapping data list.



The screenshot shows the Hi-Target Business Center interface. On the left is a sidebar with icons for various features: Coord Point, Stake Point, Control Point, Mapping Data (highlighted), Line Feature, Polygon Feature, Cross-section Points, PPK, and Coord Point Recycle Bin. The main area displays a table of Mapping Data. A context menu is open over the first row (mp1), showing options: Delete, Search, and Del. The table has columns: Name, N, E, Z, B, L, H, Rounds, Ave Times, and a final empty column. The status bar at the bottom shows 'Count:12' and a dropdown menu set to 'mapping.mcp'.

	Name	N	E	Z	B	L	H	Rounds	Ave Times	
1	mp1	2542846.9356	435191.2328	10.6043	22:59:00.50406N	113:22:04.59920E	10.6043	3	10	
2	mp2	2542875.4920	435170.5420	10.6711	22:59:01.64301N	113:22:03.49538E	10.6711	1	5	
3	mp3	2542882.1093	435159.9435	10.7169	22:59:01.68278N	113:22:02.70820E	10.7169	1	5	
4	mp4	2542883.4292	435137.5273	10.7046	22:59:01.68242N	113:22:02.34625E	10.7071	1	5	
5	mp5	2542883.4628	435127.2179	10.7071	22:59:01.65290N	113:22:01.13177E	10.5950	1	5	
6	mp6	2542877.5573	435060.1181	10.5191	22:59:01.48105N	113:21:59.99142E	10.5191	1	5	
7	mp7	2542875.6635	435030.6130	10.4667	22:59:01.41535N	113:21:58.95584E	10.4667	1	5	
8	mp8	2542875.8485	435011.9234	10.4466	22:59:01.41874N	113:21:58.29966E	10.4466	1	5	
9	mp9	2542880.0886	434978.5501	10.1550	22:59:01.55188N	113:21:57.12735E	10.1550	1	5	
10	mp10	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:21:55.99270E	10.3452	1	5	
11	mp11	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:21:55.99270E	10.3452	1	5	
12	mp12	2542873.5773	434917.9018	10.3202	22:59:01.33171N	113:21:54.99911E	10.3202	1	5	

Figure 6-5-16 Delete the Mapping Data



The screenshot shows the Hi-Target Business Center interface after deleting the first row. The table now contains 4 rows (mp10, mp11, mp12, and an empty row). A red box highlights a 'Refresh' button in the center of the table area. Another red box highlights the 'mapping.mcp' dropdown menu in the status bar at the bottom right.

	Name	N	E	Z	B	L	H	Rounds	Ave Times	
1	mp1	2542846.9356	435191.2328	10.6043	22:59:00.50406N	113:22:04.59920E	10.6043	3	10	
2	mp10	2542880.0886	434978.5501	10.1550	22:59:01.55188N	113:21:57.12735E	10.1550	1	5	
3	mp11	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:21:55.99270E	10.3452	1	5	
4	mp12	2542873.5773	434917.9018	10.3202	22:59:01.33171N	113:21:54.99911E	10.3202	1	5	

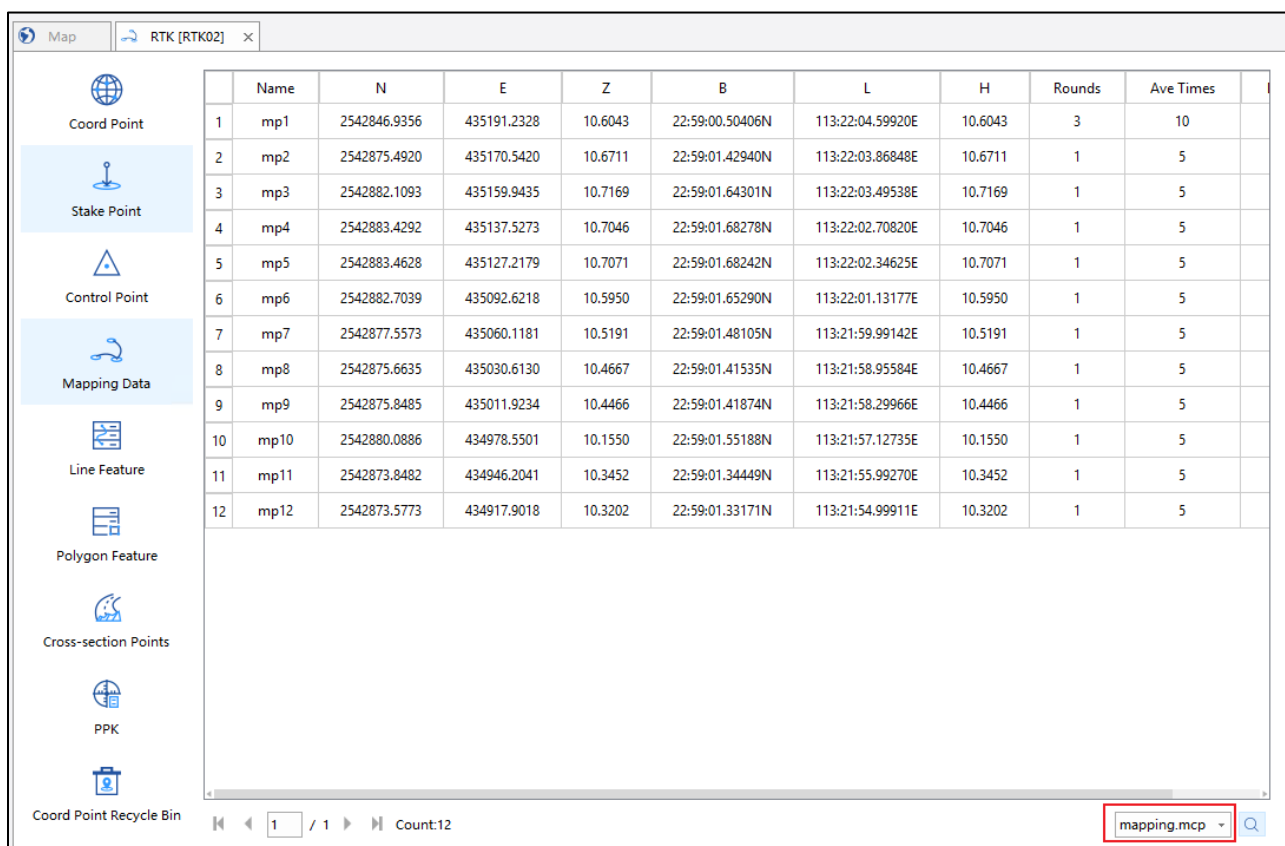
Figure 6-5-17 Refresh the Mapping Data

Click the [Delete] button for data deletion operations.

Click the [Search] button or click the search icon in the lower right corner to enter the point name and description for data search.

After data search, click [Refresh] to display all data.

Modify the dot library file in the lower right corner to switch between different mapping point files.

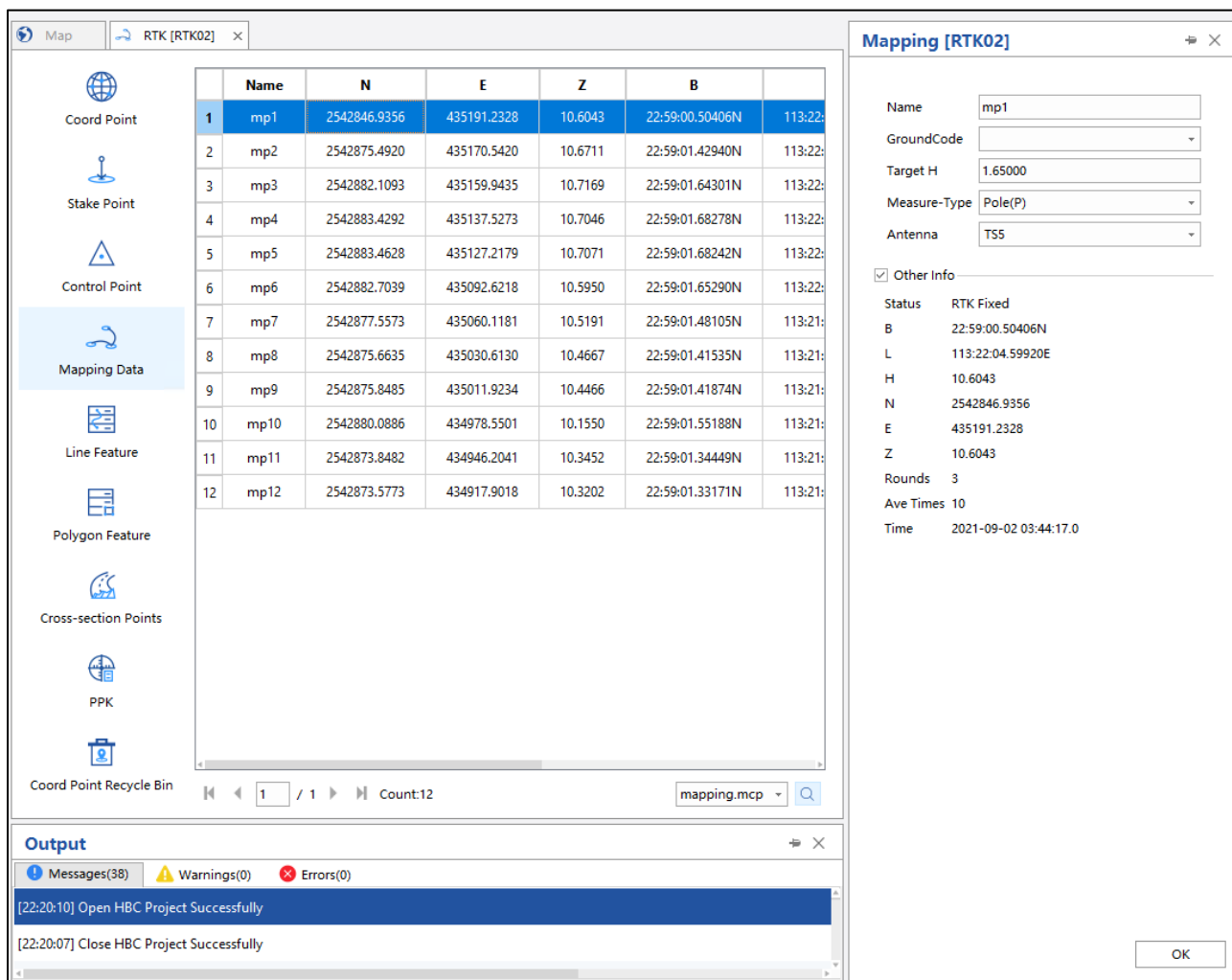


	Name	N	E	Z	B	L	H	Rounds	Ave Times
1	mp1	2542846.9356	435191.2328	10.6043	22:59:00.50406N	113:22:04.59920E	10.6043	3	10
2	mp2	2542875.4920	435170.5420	10.6711	22:59:01.42940N	113:22:03.86848E	10.6711	1	5
3	mp3	2542882.1093	435159.9435	10.7169	22:59:01.64301N	113:22:03.49538E	10.7169	1	5
4	mp4	2542883.4292	435137.5273	10.7046	22:59:01.68278N	113:22:02.70820E	10.7046	1	5
5	mp5	2542883.4628	435127.2179	10.7071	22:59:01.68242N	113:22:02.34625E	10.7071	1	5
6	mp6	2542882.7039	435092.6218	10.5950	22:59:01.65290N	113:22:01.13177E	10.5950	1	5
7	mp7	2542877.5573	435060.1181	10.5191	22:59:01.48105N	113:21:59.99142E	10.5191	1	5
8	mp8	2542875.6635	435030.6130	10.4667	22:59:01.41535N	113:21:58.95584E	10.4667	1	5
9	mp9	2542875.8485	435011.9234	10.4466	22:59:01.41874N	113:21:58.29966E	10.4466	1	5
10	mp10	2542880.0886	434978.5501	10.1550	22:59:01.55188N	113:21:57.12735E	10.1550	1	5
11	mp11	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:21:55.99270E	10.3452	1	5
12	mp12	2542873.5773	434917.9018	10.3202	22:59:01.33171N	113:21:54.99911E	10.3202	1	5

Figure 6-5-18 Modify the Mapping Data Library File

2. Data Editing

Users can trigger access to the right side of the detail screen by left-clicking on any line in the list of mapping data.



Mapping [RTK02]

	Name	N	E	Z	B	
1	mp1	2542846.9356	435191.2328	10.6043	22:59:00.50406N	113:22:04.59920E
2	mp2	2542875.4920	435170.5420	10.6711	22:59:01.42940N	113:22:04.59920E
3	mp3	2542882.1093	435159.9435	10.7169	22:59:01.64301N	113:22:04.59920E
4	mp4	2542883.4292	435137.5273	10.7046	22:59:01.68278N	113:22:04.59920E
5	mp5	2542883.4628	435127.2179	10.7071	22:59:01.68242N	113:22:04.59920E
6	mp6	2542882.7039	435092.6218	10.5950	22:59:01.65290N	113:22:04.59920E
7	mp7	2542877.5573	435060.1181	10.5191	22:59:01.48105N	113:22:04.59920E
8	mp8	2542875.6635	435030.6130	10.4667	22:59:01.41535N	113:22:04.59920E
9	mp9	2542875.8485	435011.9234	10.4466	22:59:01.41874N	113:22:04.59920E
10	mp10	2542880.0886	434978.5501	10.1550	22:59:01.55188N	113:22:04.59920E
11	mp11	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:22:04.59920E
12	mp12	2542873.5773	434917.9018	10.3202	22:59:01.33171N	113:22:04.59920E

Mapping [RTK02] Details:

Name: mp1
GroundCode:
Target H: 1.65000
Measure-Type: Pole(P)
Antenna: TS5

☒ Other Info

Status: RTK Fixed
B: 22:59:00.50406N
L: 113:22:04.59920E
H: 10.6043
N: 2542846.9356
E: 435191.2328
Z: 10.6043
Rounds: 3
Ave Times: 10
Time: 2021-09-02 03:44:17.0

Output

Messages(38) Warnings(0) Errors(0)

[22:20:10] Open HBC Project Successfully
[22:20:07] Close HBC Project Successfully

OK

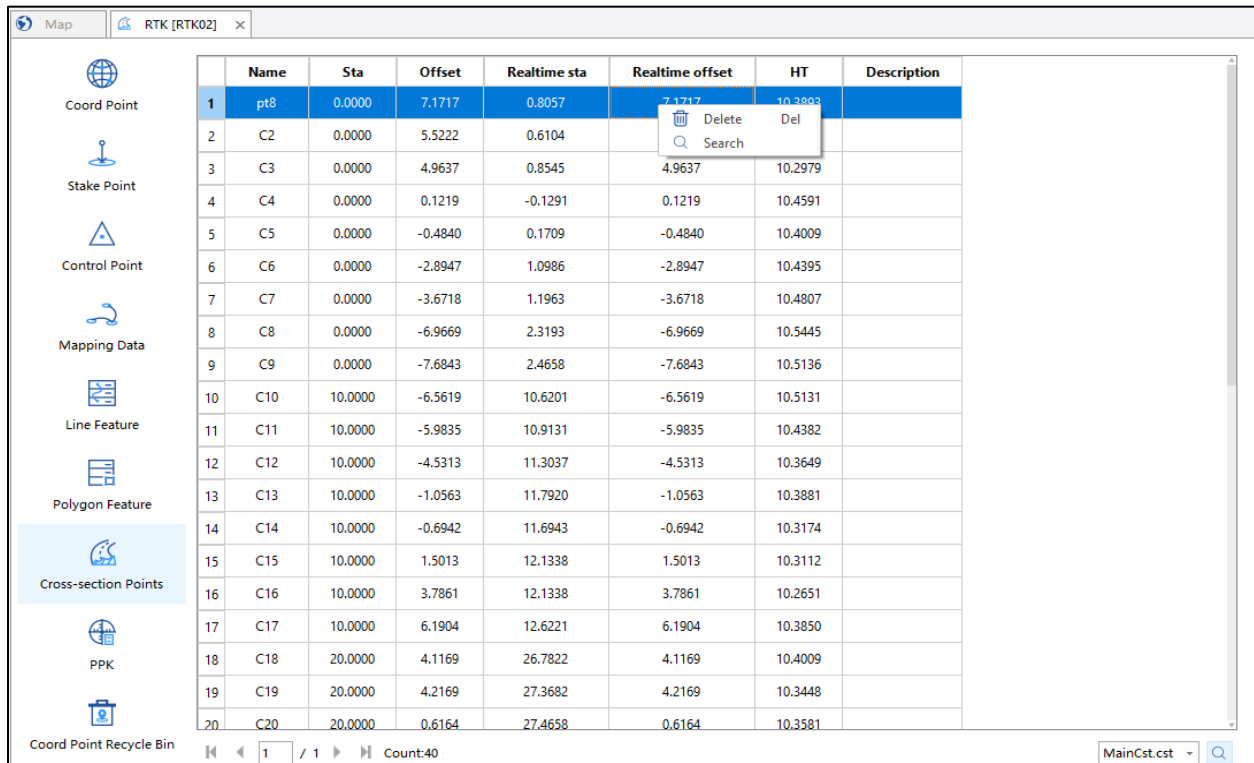
Figure 6-5-19 Edit the Mapping Data

In the details screen, users can edit the point name, description, target height, antenna type and other information, after editing, click [OK] below to complete the update.

6.5.5 Cross-section Points

1. Data Deletion

Users can right-click on any row of data via a cross-section point list.



Map RTK [RTK02] x

Coord Point

Stake Point

Control Point

Mapping Data

Line Feature

Polygon Feature

Cross-section Points

PPK

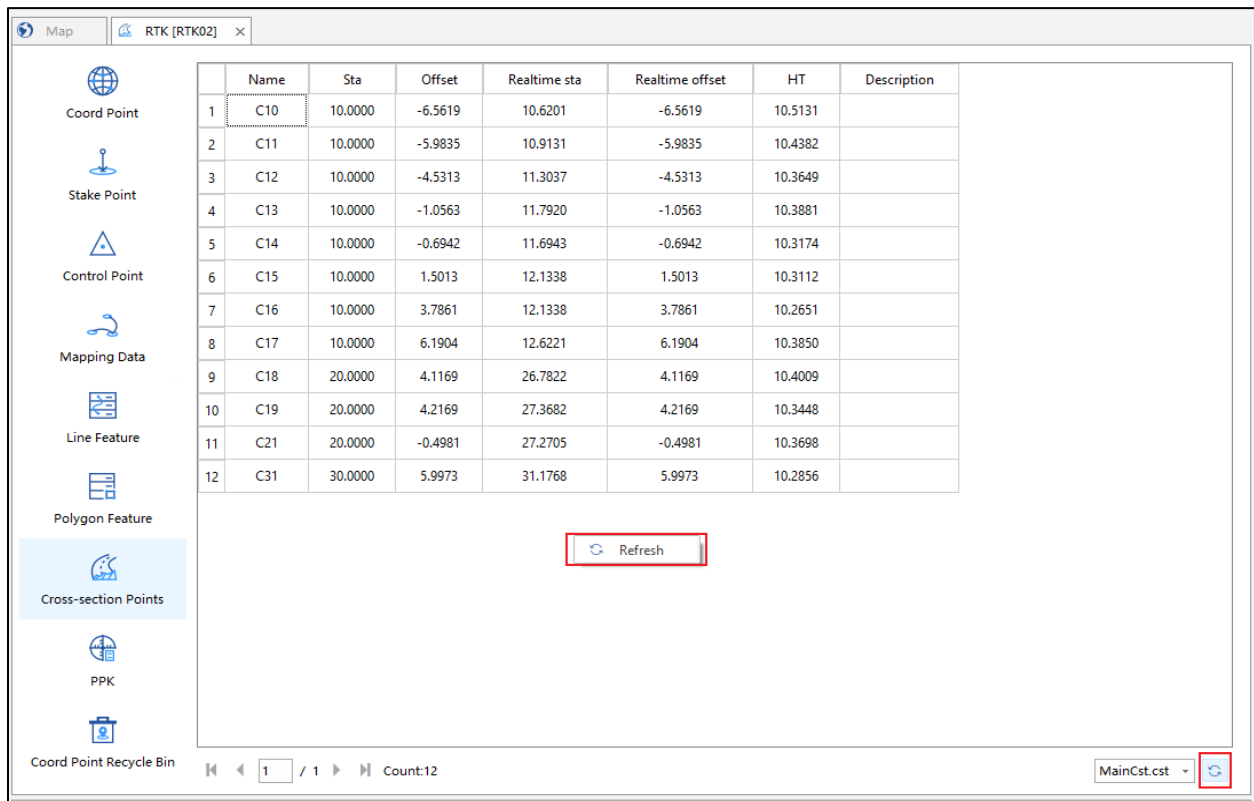
Coord Point Recycle Bin

	Name	Sta	Offset	Realtime sta	Realtime offset	HT	Description
1	pt8	0.0000	7.1717	0.8057	7.1717	10.3893	
2	C2	0.0000	5.5222	0.6104			
3	C3	0.0000	4.9637	0.8545	4.9637	10.2979	
4	C4	0.0000	0.1219	-0.1291	0.1219	10.4591	
5	C5	0.0000	-0.4840	0.1709	-0.4840	10.4009	
6	C6	0.0000	-2.8947	1.0986	-2.8947	10.4395	
7	C7	0.0000	-3.6718	1.1963	-3.6718	10.4807	
8	C8	0.0000	-6.9669	2.3193	-6.9669	10.5445	
9	C9	0.0000	-7.6843	2.4658	-7.6843	10.5136	
10	C10	10.0000	-6.5619	10.6201	-6.5619	10.5131	
11	C11	10.0000	-5.9835	10.9131	-5.9835	10.4382	
12	C12	10.0000	-4.5313	11.3037	-4.5313	10.3649	
13	C13	10.0000	-1.0563	11.7920	-1.0563	10.3881	
14	C14	10.0000	-0.6942	11.6943	-0.6942	10.3174	
15	C15	10.0000	1.5013	12.1338	1.5013	10.3112	
16	C16	10.0000	3.7861	12.1338	3.7861	10.2651	
17	C17	10.0000	6.1904	12.6221	6.1904	10.3850	
18	C18	20.0000	4.1169	26.7822	4.1169	10.4009	
19	C19	20.0000	4.2169	27.3682	4.2169	10.3448	
20	C20	20.0000	0.6164	27.4658	0.6164	10.3581	

Count:40

MainCst.cst

Figure 6-5-20 Delete the Cross-section Point



Map RTK [RTK02] x

Coord Point

Stake Point

Control Point

Mapping Data

Line Feature

Polygon Feature

Cross-section Points

PPK

Coord Point Recycle Bin

	Name	Sta	Offset	Realtime sta	Realtime offset	HT	Description
1	C10	10.0000	-6.5619	10.6201	-6.5619	10.5131	
2	C11	10.0000	-5.9835	10.9131	-5.9835	10.4382	
3	C12	10.0000	-4.5313	11.3037	-4.5313	10.3649	
4	C13	10.0000	-1.0563	11.7920	-1.0563	10.3881	
5	C14	10.0000	-0.6942	11.6943	-0.6942	10.3174	
6	C15	10.0000	1.5013	12.1338	1.5013	10.3112	
7	C16	10.0000	3.7861	12.1338	3.7861	10.2651	
8	C17	10.0000	6.1904	12.6221	6.1904	10.3850	
9	C18	20.0000	4.1169	26.7822	4.1169	10.4009	
10	C19	20.0000	4.2169	27.3682	4.2169	10.3448	
11	C21	20.0000	-0.4981	27.2705	-0.4981	10.3698	
12	C31	30.0000	5.9973	31.1768	5.9973	10.2856	

Count:12

MainCst.cst

Refresh

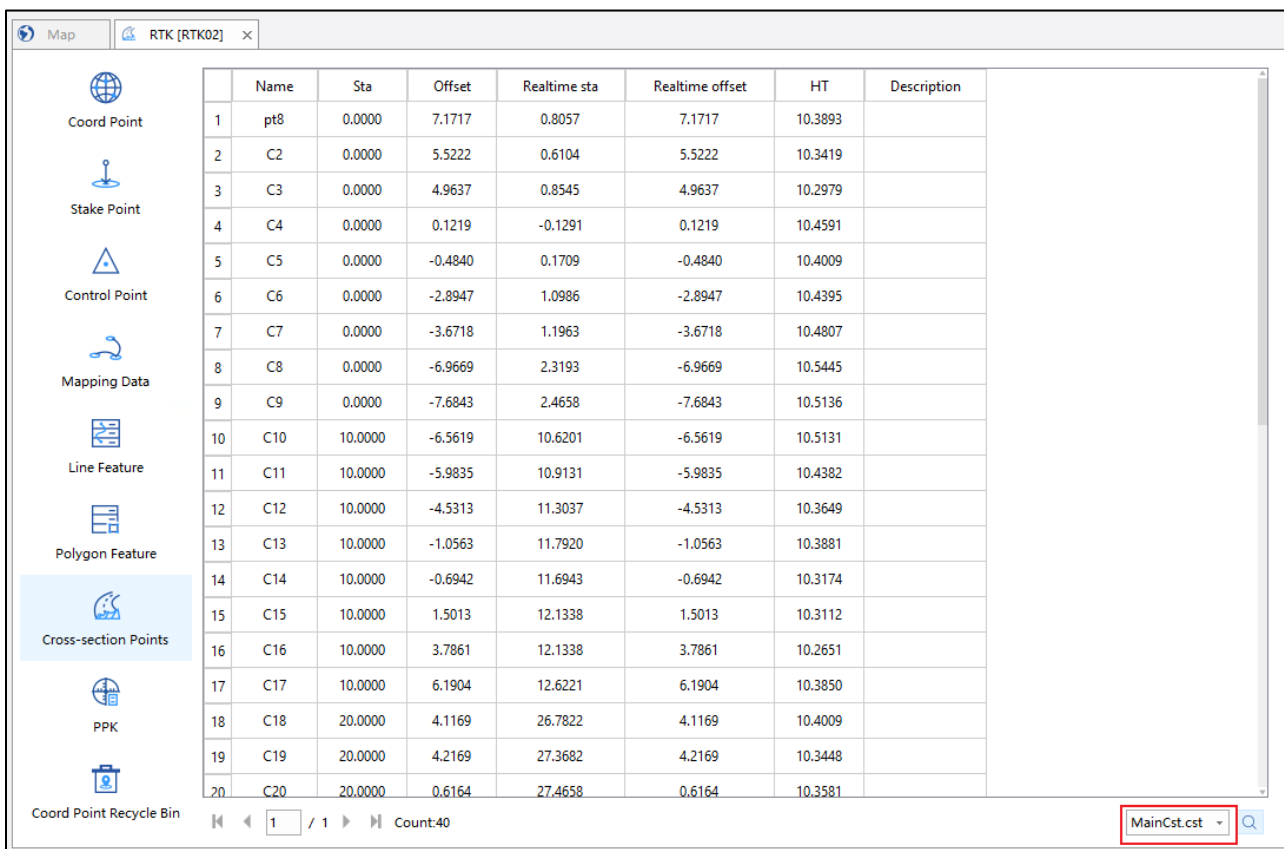
Figure 6-5-21 Refresh the Cross-section Point

Click the [Delete] button for data deletion operations.

Click the [Search] button or click the search icon in the lower right corner to enter the point name and description for data search.

After data search, click [Refresh] to display all data.

Modify the point library file in the lower right corner to switch between different cross-section point files.



The screenshot shows the Hi-Target Business Center software interface. On the left is a vertical toolbar with icons for various features: Coord Point, Stake Point, Control Point, Mapping Data, Line Feature, Polygon Feature, Cross-section Points (highlighted), PPK, and Coord Point Recycle Bin. The main area displays a table of cross-section points. The table has columns for Name, Sta, Offset, Realtime sta, Realtime offset, HT, and Description. The table contains 20 rows of data, numbered 1 to 20. At the bottom of the interface, there is a status bar showing '1 / 1' and 'Count:40'. In the bottom right corner, there is a dropdown menu labeled 'MainCst.cst' and a search icon.

	Name	Sta	Offset	Realtime sta	Realtime offset	HT	Description
1	pt8	0.0000	7.1717	0.8057	7.1717	10.3893	
2	C2	0.0000	5.5222	0.6104	5.5222	10.3419	
3	C3	0.0000	4.9637	0.8545	4.9637	10.2979	
4	C4	0.0000	0.1219	-0.1291	0.1219	10.4591	
5	C5	0.0000	-0.4840	0.1709	-0.4840	10.4009	
6	C6	0.0000	-2.8947	1.0986	-2.8947	10.4395	
7	C7	0.0000	-3.6718	1.1963	-3.6718	10.4807	
8	C8	0.0000	-6.9669	2.3193	-6.9669	10.5445	
9	C9	0.0000	-7.6843	2.4658	-7.6843	10.5136	
10	C10	10.0000	-6.5619	10.6201	-6.5619	10.5131	
11	C11	10.0000	-5.9835	10.9131	-5.9835	10.4382	
12	C12	10.0000	-4.5313	11.3037	-4.5313	10.3649	
13	C13	10.0000	-1.0563	11.7920	-1.0563	10.3881	
14	C14	10.0000	-0.6942	11.6943	-0.6942	10.3174	
15	C15	10.0000	1.5013	12.1338	1.5013	10.3112	
16	C16	10.0000	3.7861	12.1338	3.7861	10.2651	
17	C17	10.0000	6.1904	12.6221	6.1904	10.3850	
18	C18	20.0000	4.1169	26.7822	4.1169	10.4009	
19	C19	20.0000	4.2169	27.3682	4.2169	10.3448	
20	C20	20.0000	0.6164	27.4658	0.6164	10.3581	

Figure 6-5-22 Modify the Cross-section Point Library File

2. Data Editing

Users can trigger access to the right side of the detail screen by left-clicking any line in the cross-section point list.

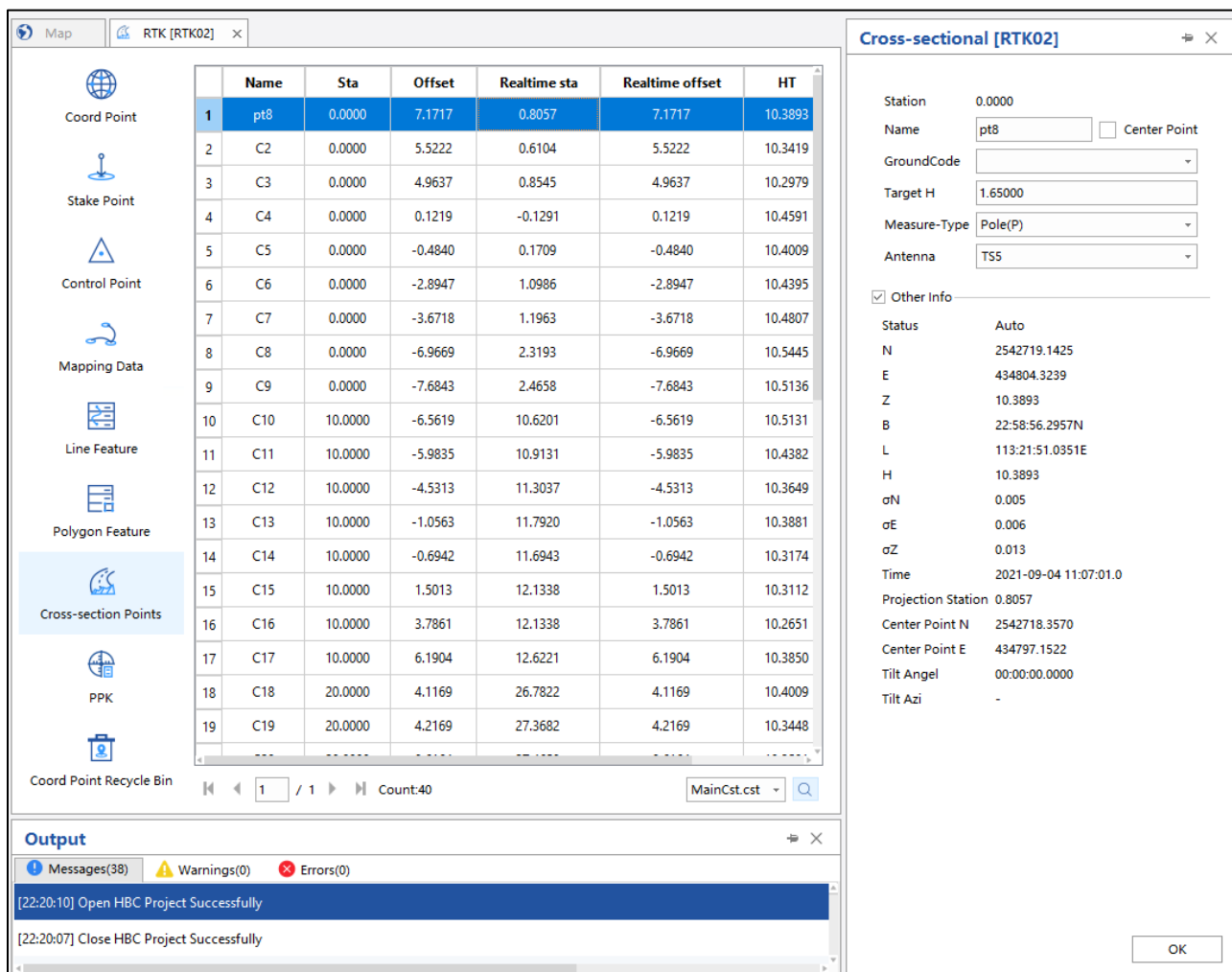


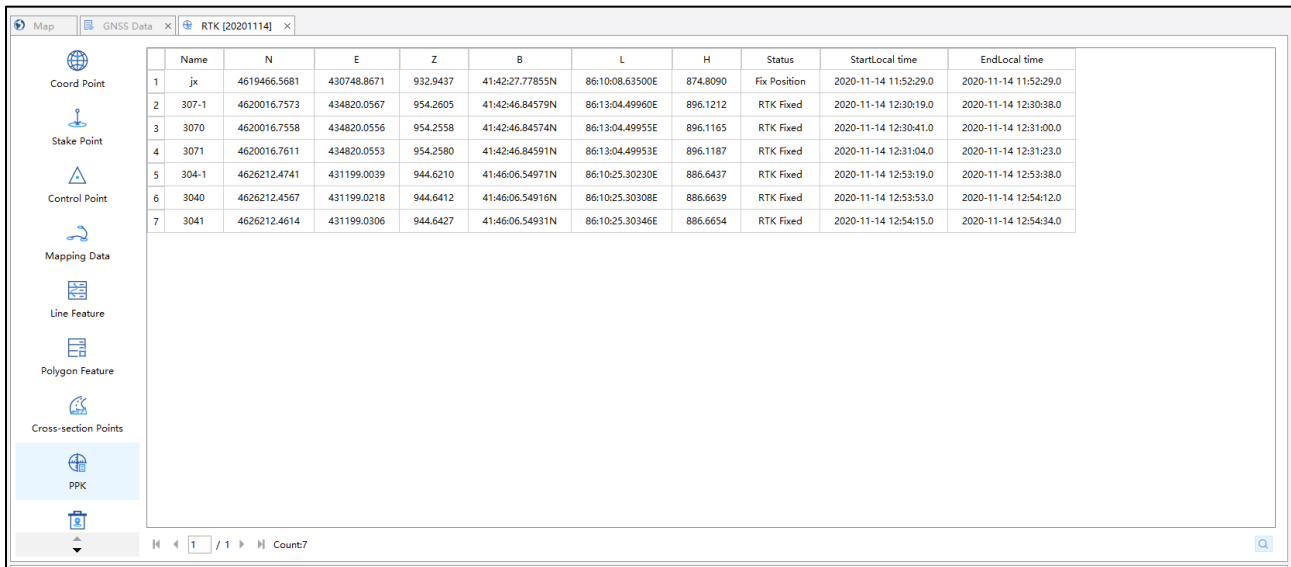
Figure 6-5-23 Edit the Cross-section Point

Use the detailed information interface to edit the point name, description, target height, antenna type, stakes and other information, after editing, click [OK] below to complete the update.

6.5.6 PPK

The PPK list mainly records the coordinate data corrected by PPK solution. The specific steps are:

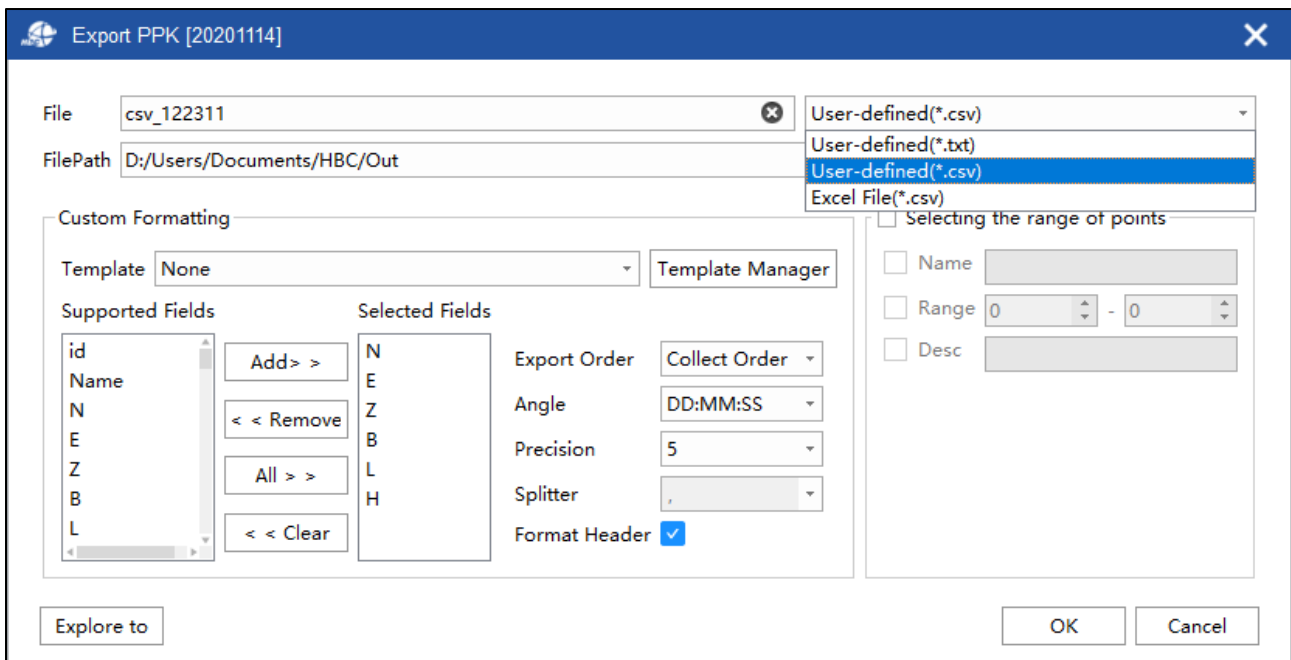
1. After importing RTK project file and GNSS observation file, the user performs PPK solution in GNSS module, and the solution is successful.
2. Switch to RTK module and click PPK in the menu bar to view the coordinate data corrected by PPK in the list.



	Name	N	E	Z	B	L	H	Status	StartLocal time	EndLocal time
1	jx	4619466.5681	430748.8671	932.9437	41:42:27.77855N	86:10:08.63500E	874.8090	Fix Position	2020-11-14 11:52:29.0	2020-11-14 11:52:29.0
2	307-1	4620016.7573	434820.0567	954.2605	41:42:46.84579N	86:13:04.49960E	896.1212	RTK Fixed	2020-11-14 12:30:19.0	2020-11-14 12:30:38.0
3	3070	4620016.7558	434820.0556	954.2558	41:42:46.84574N	86:13:04.49955E	896.1165	RTK Fixed	2020-11-14 12:30:41.0	2020-11-14 12:31:00.0
4	3071	4620016.7611	434820.0553	954.2580	41:42:46.84591N	86:13:04.49953E	896.1187	RTK Fixed	2020-11-14 12:31:04.0	2020-11-14 12:31:23.0
5	304-1	4626212.4741	431199.0039	944.6210	41:46:06.54971N	86:10:25.30230E	886.6437	RTK Fixed	2020-11-14 12:53:19.0	2020-11-14 12:53:38.0
6	3040	4626212.4567	431199.0218	944.6412	41:46:06.54916N	86:10:25.30308E	886.6639	RTK Fixed	2020-11-14 12:53:53.0	2020-11-14 12:54:12.0
7	3041	4626212.4614	431199.0306	944.6427	41:46:06.54931N	86:10:25.30346E	886.6654	RTK Fixed	2020-11-14 12:54:15.0	2020-11-14 12:54:34.0

Figure 6-5-24 PPK List

3. In the RTK module, click export and select PPK to export the coordinate data corrected by PPK. The export types include custom (*.txt), custom (*.csv) and excel file (*.csv).



Export PPK [20201114]

File:

FilePath:

File Type: (Dropdown menu shows: User-defined(*.txt), User-defined(*.csv), Excel File(*.csv))

Custom Formatting

Template:

Supported Fields: id, Name, N, E, Z, B, L

Selected Fields: N, E, Z, B, L, H

Export Order: (Dropdown menu)

Angle: (Dropdown menu)

Precision: (Dropdown menu)

Splitter: (Dropdown menu)

Format Header: ☒

Selecting the range of points:

☐ Name

☐ Range -

☐ Desc

Figure 6-5-25 Export PPK

6.6 Line/ Surface Library

After opening the RTK project, the user can enter the main interface of the RTK project line/surface data view via the [Line/Surface Library] button in the top bar.

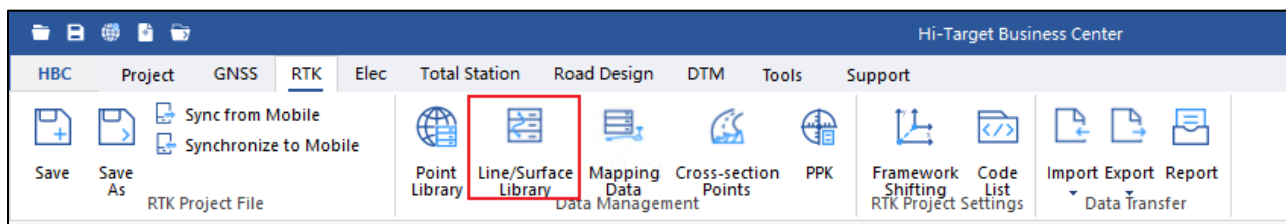


Figure 6-6-1 Line/Surface Library

6.6.1 Line Data

1. Data Deletion

Users can right mouse click on any row of data via the line list.

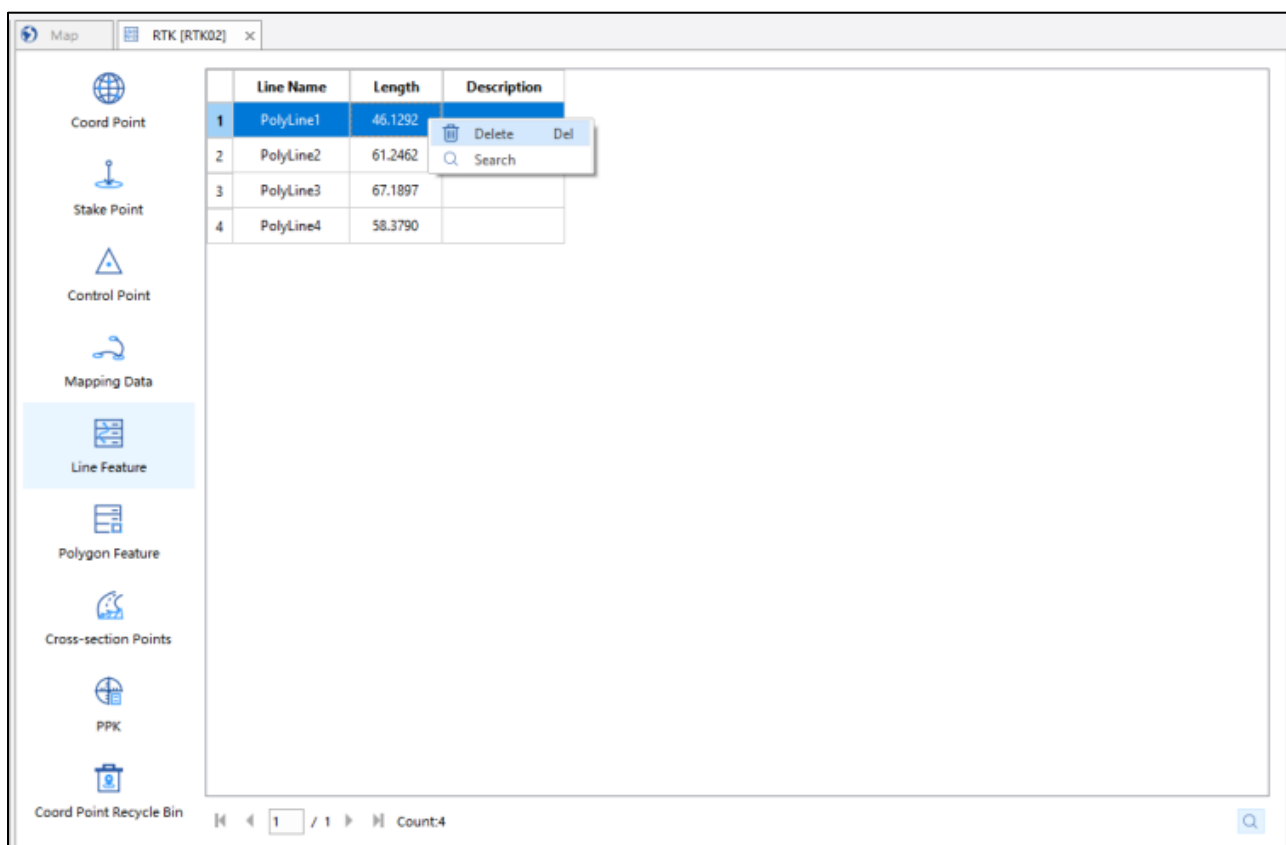


Figure 6-6-2 Line Feature List and Delete Line Feature Data

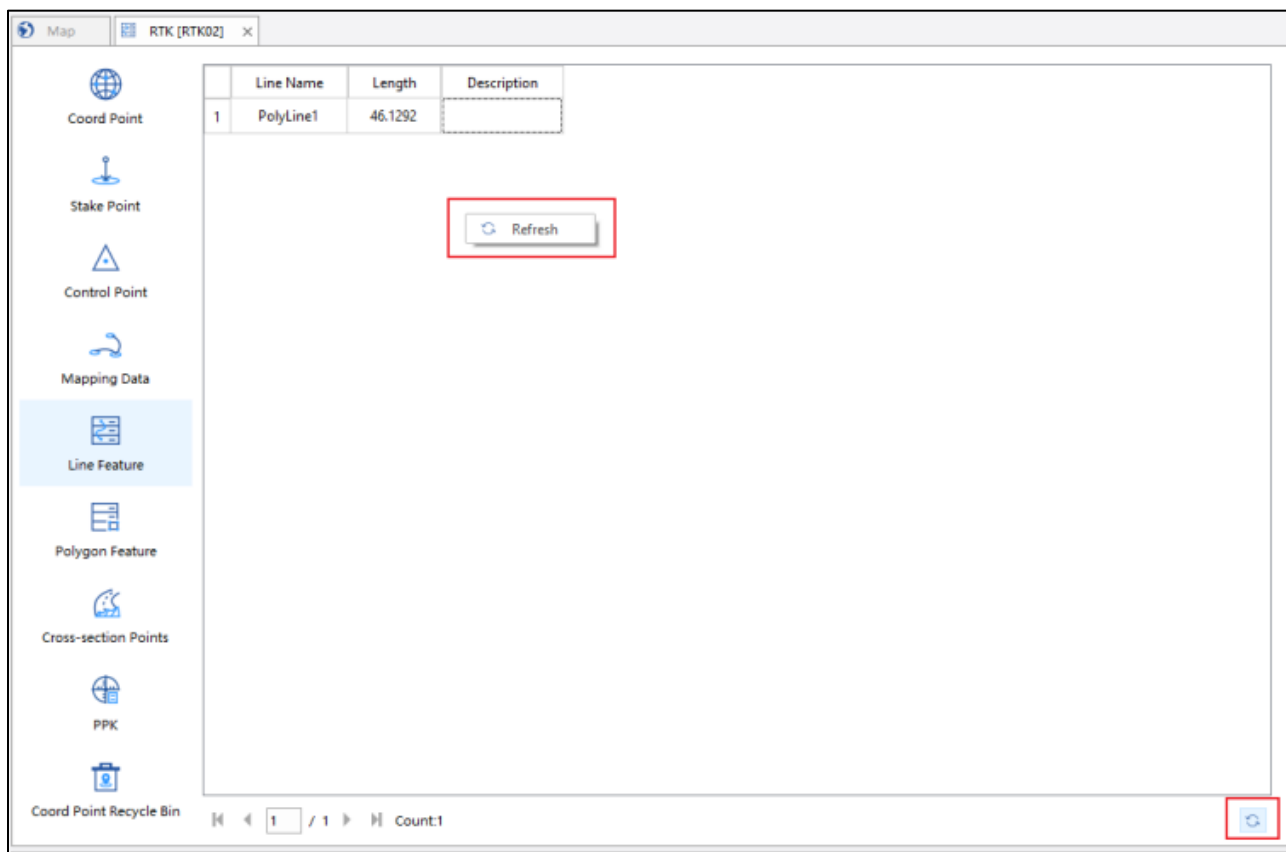


Figure 6-6-3 Refresh Line Feature

Click the [Delete] button for data deletion operations.

Click the [Search] button to enter a line name and description to find the data.

Click the [Refresh] button to display all the data.

2. Data Editing

Users can trigger access to the right side of the details screen by left-clicking any line in the line list.

Line [SaveAsRTK]

Line Name
road side

Length
116.6306 meter

GroundCode
TechRoad

OK

	IndexID	N	E	Z
1	0	2542606.1533	435248.0961	9.5455
2	1	2542599.4410	435232.6628	9.4729
3	2	2542596.4808	435219.5378	9.4390
4	3	2542597.0990	435205.8219	9.3352
5	4	2542597.2221	435185.1275	9.2066
6	5	2542596.7400	435162.1230	8.9174
7	6	2542596.8114	435133.2110	8.8365

1 / 1
Count:7

N
2542597.22206

E
435185.12745

Z
9.20657

OK

Figure 6-6-4 Edit Line Feature

In the details interface, you can edit the line name, description, node coordinates and other information. You can move the data up or down through the up and down arrows at the bottom right. After editing, click OK below to complete the update.

6.6.2 Polygon Data

1.Data Deletion

Users can right-click on any row of data in the polygon list.

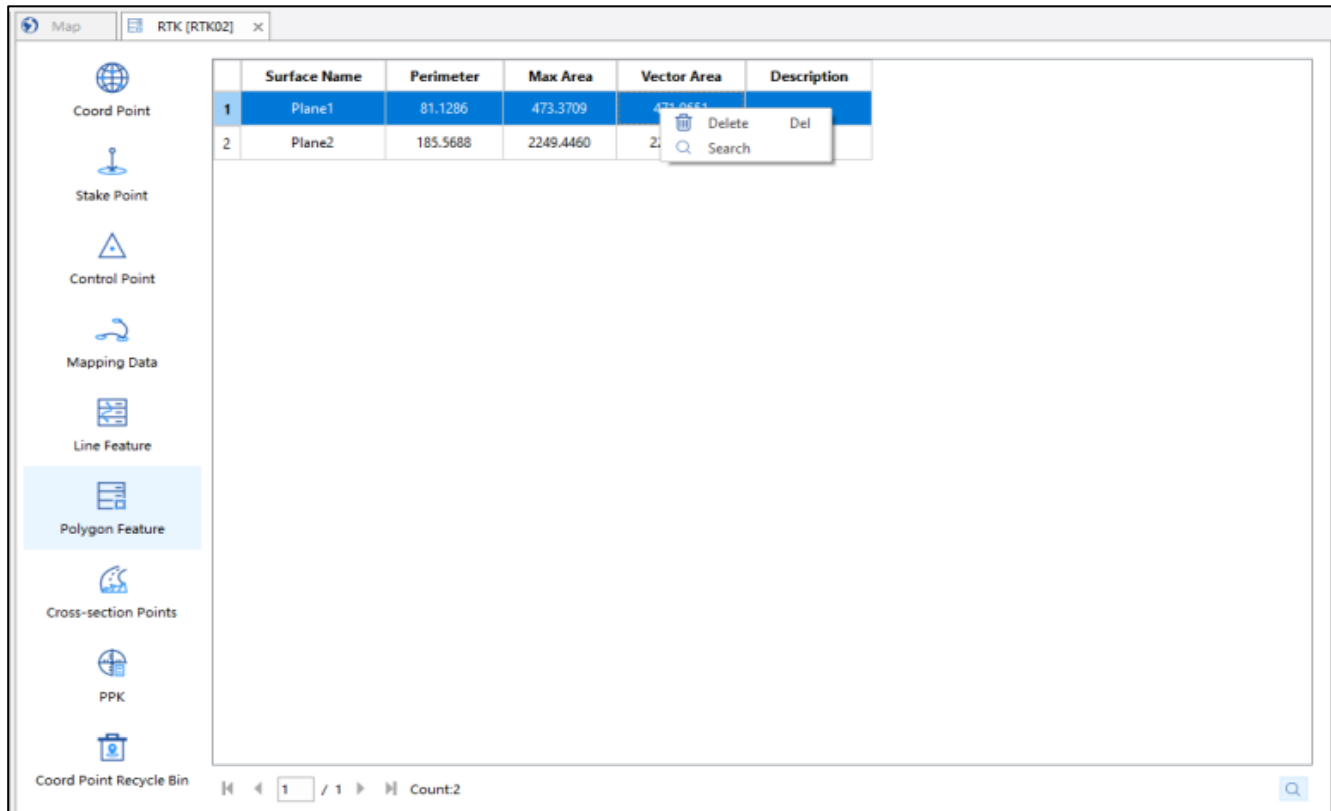


Figure 6-6-5 Delete Polygon Feature Data

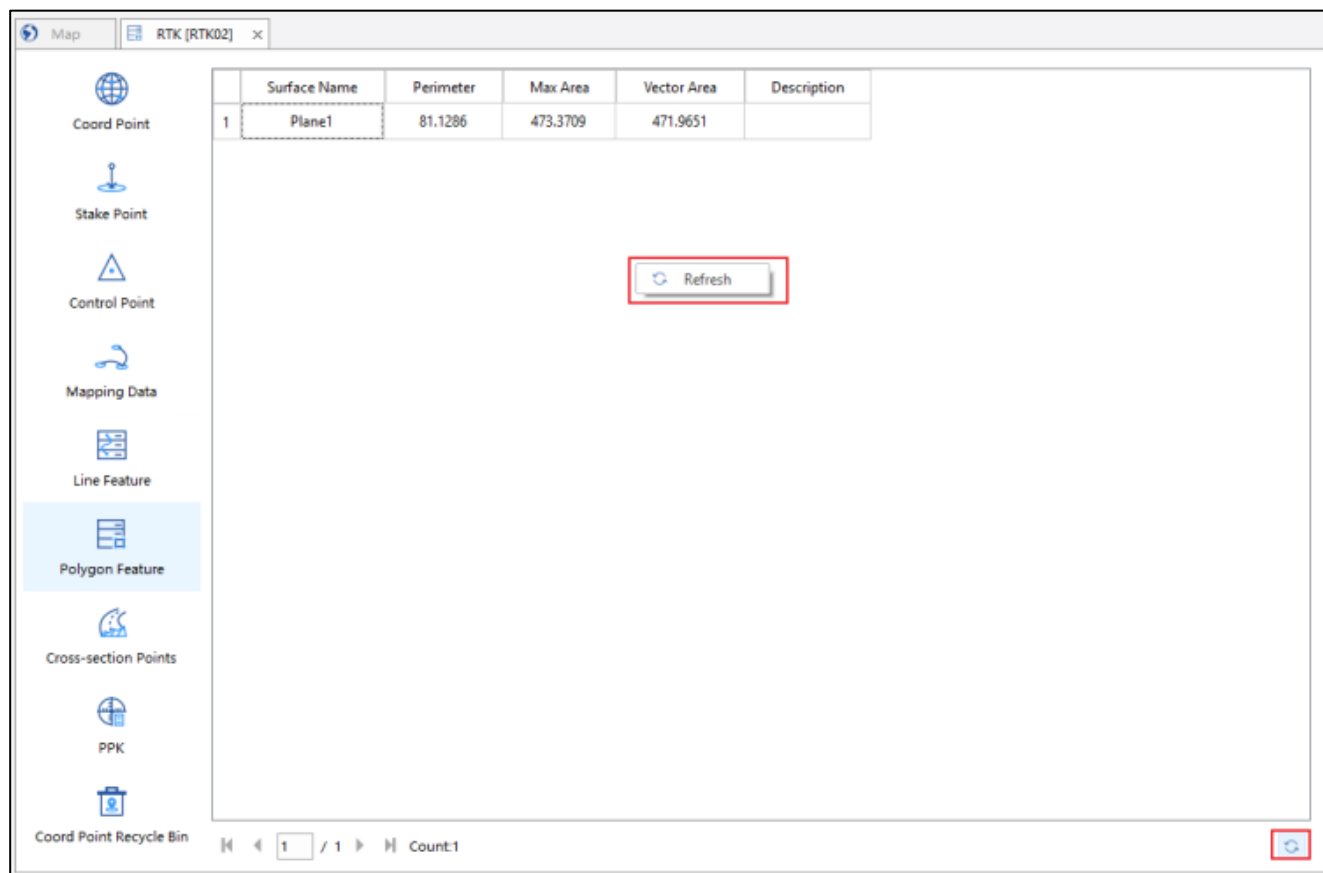


Figure 6-6-6 Refresh Polygon Feature Data

Click the [Delete] button for data deletion operations.

Click the [Search] button to enter a polygon name and description to find the data.

Click the [Refresh] button to display all the data.

2. Data Editing

Users can trigger access to the right side of the details screen by left-clicking on any polygon in the polygon list.

Surface [SaveAsRTK]

Name

side walk2

Perimeter

49.6929meter

Max Area

96.6193square meter

Vector Area

96.6217square meter

GroundCode

white

OK

	IndexID	N	E	Z
1	0	2542684.3079	434942.7863	8.7271
2	1	2542689.3614	434942.7969	8.7903
3	2	2542689.3771	434922.5284	8.8533
4	3	2542684.7583	434923.0713	8.9636

Count:4

1 / 1

Count:4

1 / 1

N

2542684.75826

E

434923.07126

Z

8.96364

OK

Figure 6-6-7 Edit Polygon Feature Data

In the details interface, you can edit the polygon name, description, node coordinates, and move the data up or down through the up and down arrows in the lower right corner. After editing, click OK below to complete the update.

6.7 Map Right-click Menu

Select coordinate points in the map, and you can add to DTM surface, delete and display smooth data through the right-click shortcut menu.

Select the stake point in the map, which can be added to the DTM surface and deleted through the right-click shortcut menu.

Select a control point in the map, which can be added to the DTM surface and deleted through the right-click shortcut menu.

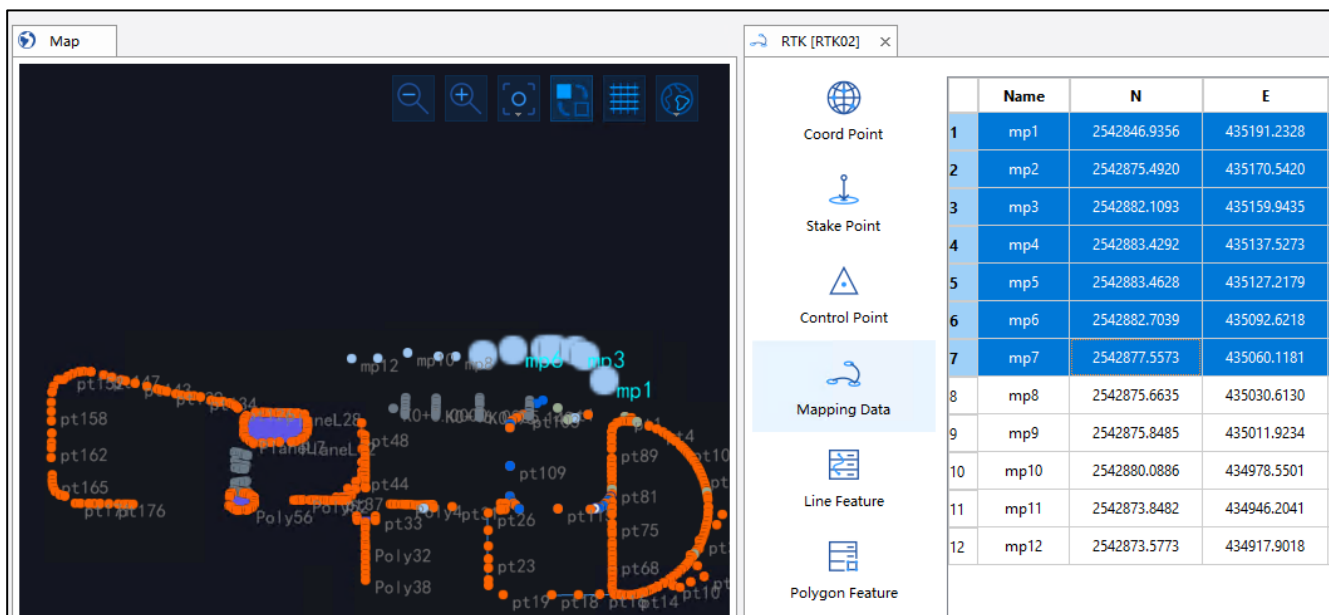
Select the map root point in the map, which can be added to the DTM surface and deleted through the right-click shortcut menu.

Select a line in the map, which can be deleted through the right-click shortcut menu.

The selected polygon of the map can be deleted through the right-click shortcut menu.

Select the cross-section point of the map, and you can add it to the DTM surface and delete it through the right-click shortcut menu.

Note: when you select data in the list, the data corresponding to the map will also be selected.



The screenshot displays the Hi-Target software interface. On the left, a map window titled 'Map' shows a dark background with various colored points (blue, orange, green) and lines. Some points are labeled with IDs like 'pt158', 'pt162', 'pt165', 'pt176', 'Poly56', 'Poly32', 'Poly38', 'pt109', 'pt89', 'pt10', 'pt81', 'pt75', 'pt68', 'pt23', 'pt19', 'pt18', 'pt14', 'pt10', 'pt11', 'pt12', 'pt13', 'pt14', 'pt15', 'pt16', 'pt17', 'pt18', 'pt19', 'pt20', 'pt21', 'pt22', 'pt23', 'pt24', 'pt25', 'pt26', 'pt27', 'pt28', 'pt29', 'pt30', 'pt31', 'pt32', 'pt33', 'pt34', 'pt35', 'pt36', 'pt37', 'pt38', 'pt39', 'pt40', 'pt41', 'pt42', 'pt43', 'pt44', 'pt45', 'pt46', 'pt47', 'pt48', 'pt49', 'pt50', 'pt51', 'pt52', 'pt53', 'pt54', 'pt55', 'pt56', 'pt57', 'pt58', 'pt59', 'pt60', 'pt61', 'pt62', 'pt63', 'pt64', 'pt65', 'pt66', 'pt67', 'pt68', 'pt69', 'pt70', 'pt71', 'pt72', 'pt73', 'pt74', 'pt75', 'pt76', 'pt77', 'pt78', 'pt79', 'pt80', 'pt81', 'pt82', 'pt83', 'pt84', 'pt85', 'pt86', 'pt87', 'pt88', 'pt89', 'pt90', 'pt91', 'pt92', 'pt93', 'pt94', 'pt95', 'pt96', 'pt97', 'pt98', 'pt99', 'pt100'. On the right, a panel titled 'RTK [RTK02]' contains a list of points with columns 'Name', 'N', and 'E'. The list is numbered 1 to 12. The 'Mapping Data' section is highlighted in blue.

	Name	N	E
1	mp1	2542846.9356	435191.2328
2	mp2	2542875.4920	435170.5420
3	mp3	2542882.1093	435159.9435
4	mp4	2542883.4292	435137.5273
5	mp5	2542883.4628	435127.2179
6	mp6	2542882.7039	435092.6218
7	mp7	2542877.5573	435060.1181
8	mp8	2542875.6635	435030.6130
9	mp9	2542875.8485	435011.9234
10	mp10	2542880.0886	434978.5501
11	mp11	2542873.8482	434946.2041
12	mp12	2542873.5773	434917.9018

Figure 6-7-1 Check Data in Map

6.8 Framework Shifting

1. Points Panning Interface

After opening the RTK project, the user can trigger access to the point-shift interface via the [Framework Shifting] button in the top bar.

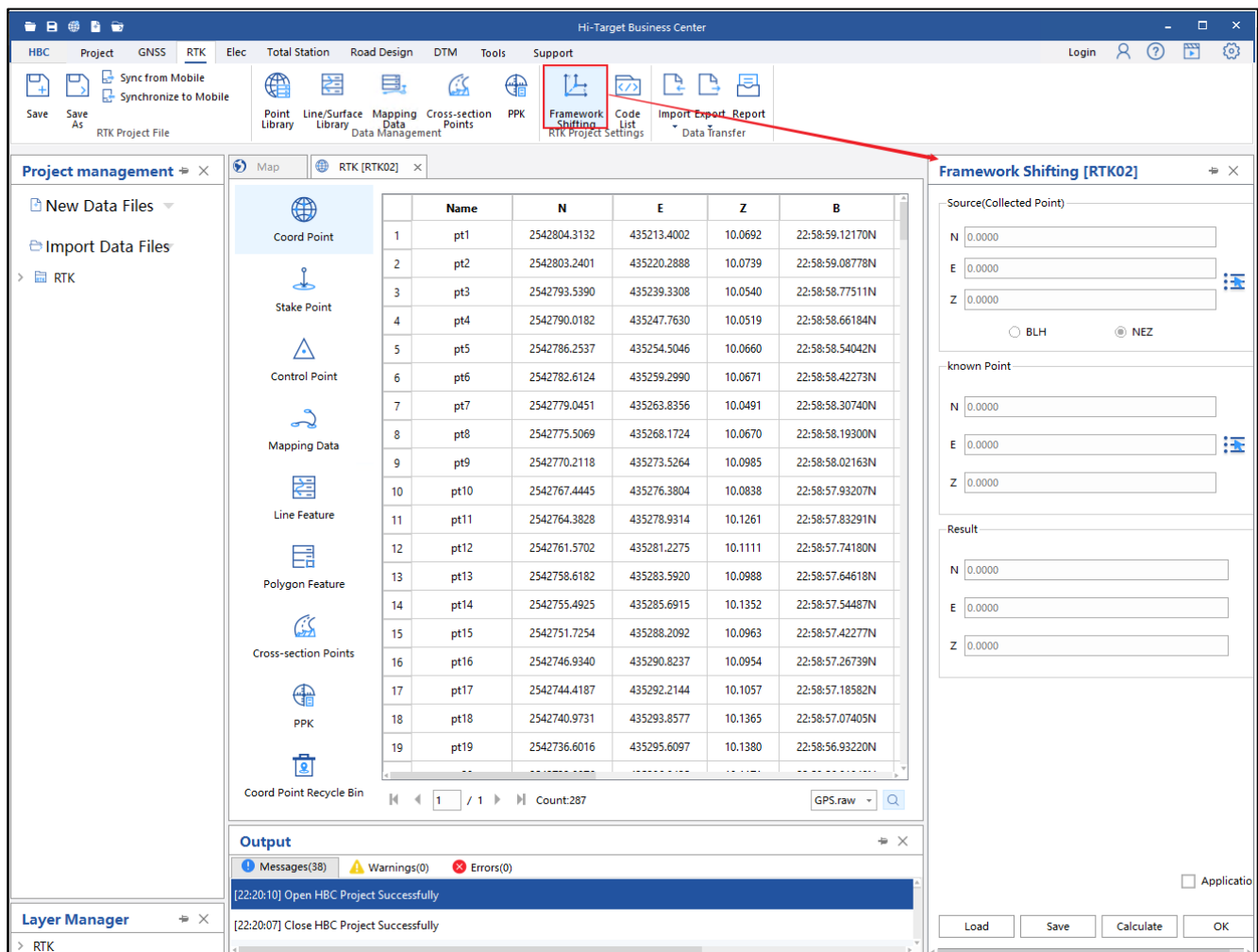


Figure 6-8-1 Framework Shifting Interface

The point translation is used to calculate the plane and elevation translation parameters between two coordinate systems. The main application is for some engineering users who want the local NEZ, which is converted by GNSS, to be translated according to the coordinates of a point, such as assigning the coordinates of the upper-left corner of the survey area directly to (0,0,0), and then translating the rest of the coordinates according to this point to an independent project coordinate system. Therefore, when the point translation parameter is enabled, the BLH coordinates of the saved original data are still the original values outputted by GNSS, and the NEZ coordinates are the local project coordinates.

2. Calculation

Framework Shifting [SaveAsRTK]

Source(Collected Point)

N 0.0000

E 0.0000

Z 0.0000

☐ BLH
☒ NEZ

known Point

N 0.0000

E 0.0000

Z 0.0000

Result

N 0.0000

E 0.0000

Z 0.0000

☐ Application

Load

Save

Calculate

OK

Figure 6-8-2 Framework Shifting Calculate

Calculate the point translation dN, dE, dZ from the current point and the known point.

Calculation steps for point translation:

In the first step, get the coordinates of the source point (i.e., the current point);

Second step, get known point coordinates;

Step 3, click on the [Calculate] button.

Known points and source points can be selected from the point library or the coordinates can be entered directly.(Points can be selected from the point Library of GNSS station list, control point list, RTK coordinate point list, stake out point list, control point list, mapping data list, cross-section point list and coordinate point recycle bin list.).

3. Results

[Apply]: Choose whether or not to apply the calculated change to the project.

[Load]: Loads the existing point shift file.

[Save]: Stores the calculated correction parameters as a txt file.

[OK]: Stores the calculated correction parameters and updates the point translation information for the project.

6.9 Legend Encoding

1. Legend Encoding Interface

After opening the RTK project, the user can enter the legend encoding management interface through the [legend encoding] button on the top bar.

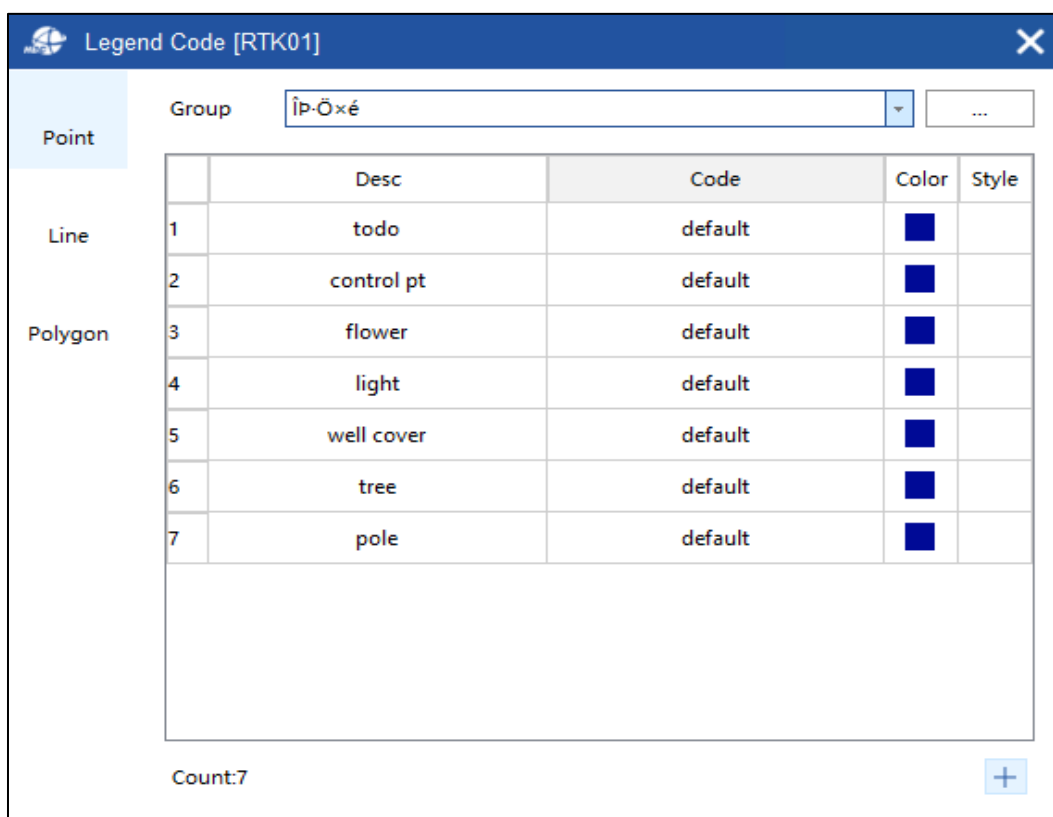


Figure 6-9-1 Legend Encoding Interface

2. Group Management

When you enter the legend code management interface, you can enter the group management by the [...] button after the group. button after the group, users can add, delete and edit the legend code group.

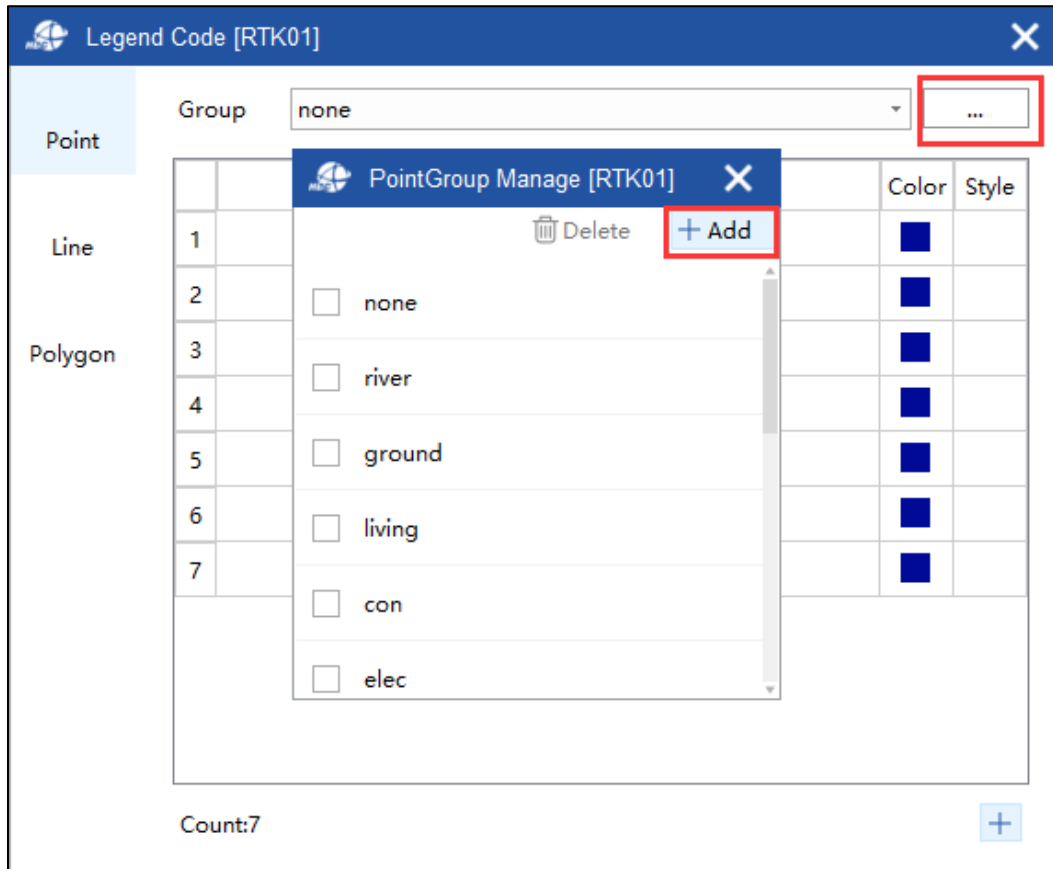


Figure 6-9-2 Point Group Management -add

3. Legend Management

In the lower right of the legend management [Add] button, the user can add a project legend.

Right-click on any row in the legend list and users can edit and delete the legend.

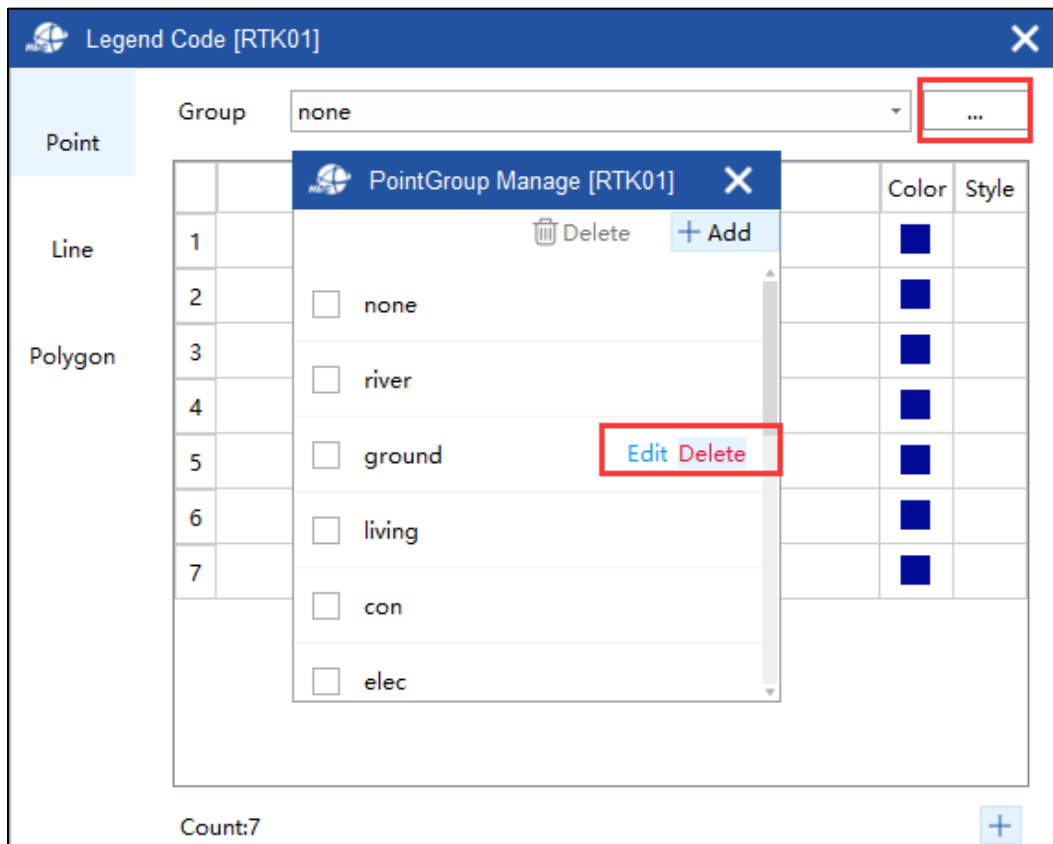


Figure 6-9-3 Point Group Management- edit or Delete

The legend encodes open code, group, color, size, style and other edits:

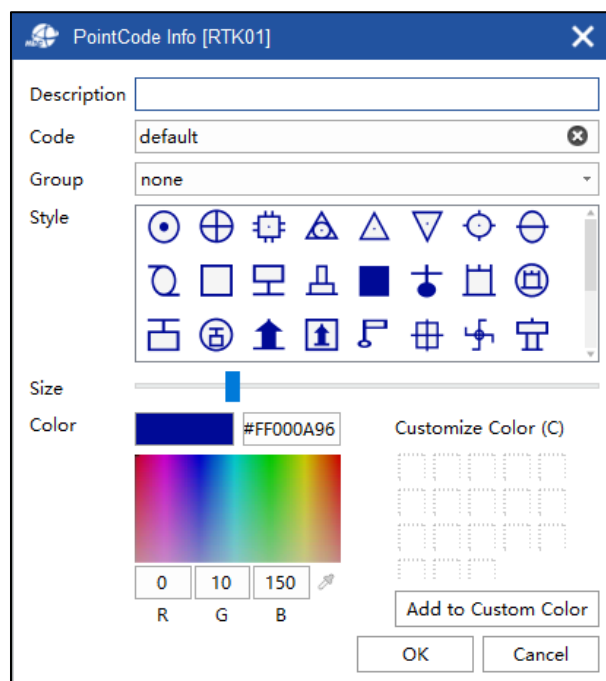


Figure 6-9-4 Point Code Information

6.10 Importing

This section is used to import the release point files and control point files needed for RTK projects, and the software supports both common format and custom file import.

1. Generic Format Import

Open HBC software and select [RTK] - [Import] to import stake points or control points:

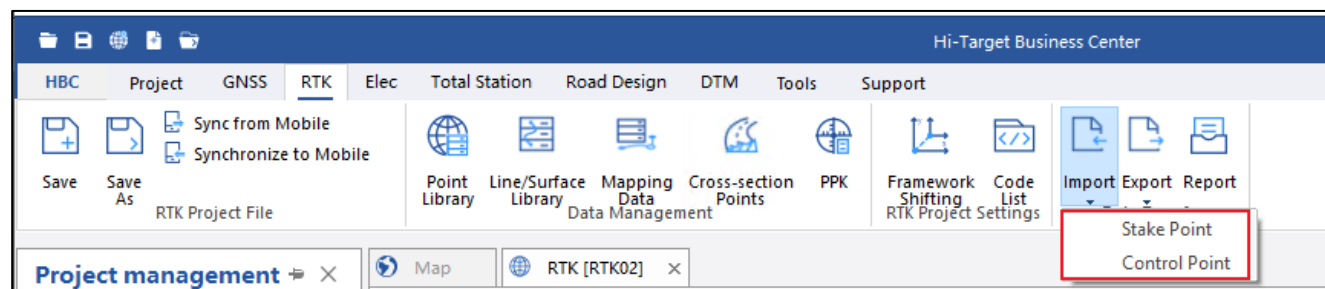


Figure 6-10-1 Generic Format Import

When you select a stake point or control point, the file selector pops up.

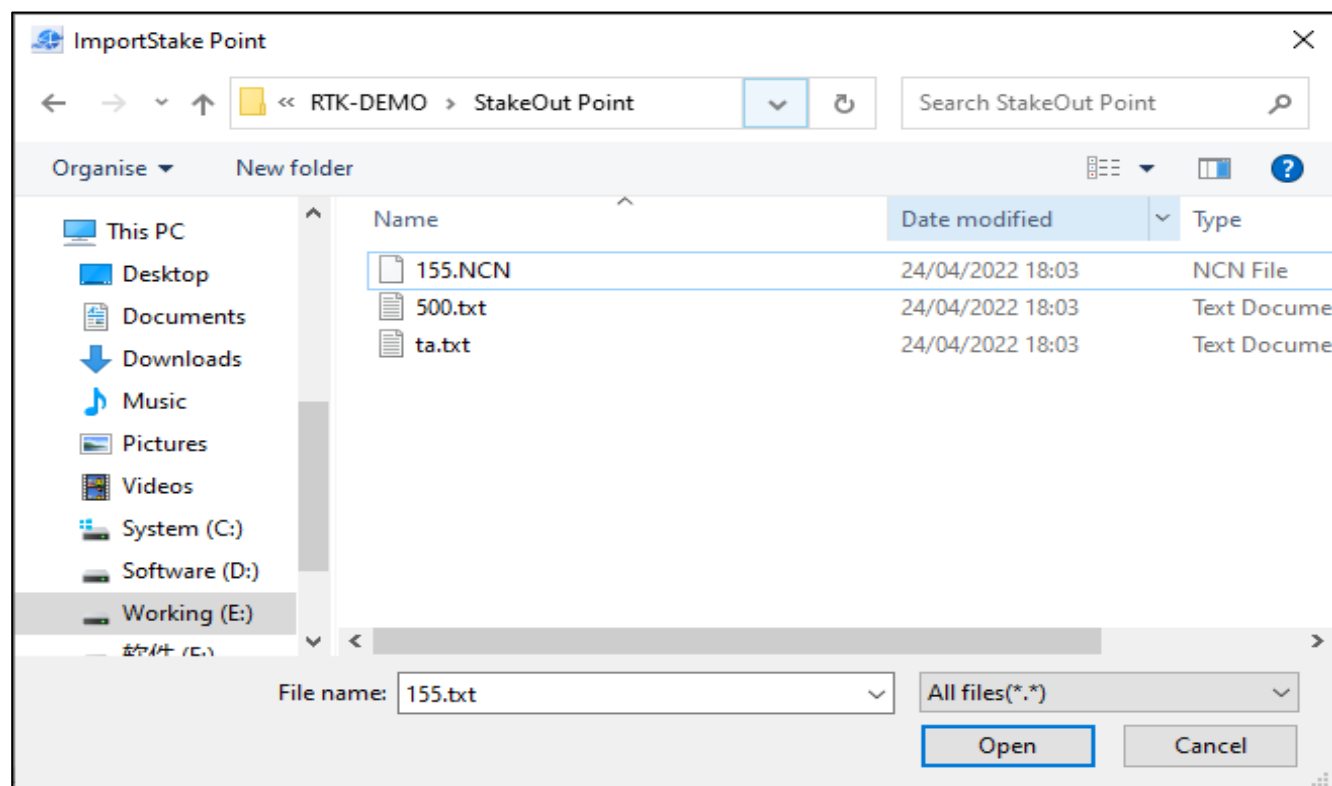


Figure 6-10-2 Import Stake Point

Click the file format drop-down box and select the general format file. Which stake point support NETCAD (*.NCN), Civil 3D (*.xml) files, control point support Hi-RTK control point (*.ctl) files.

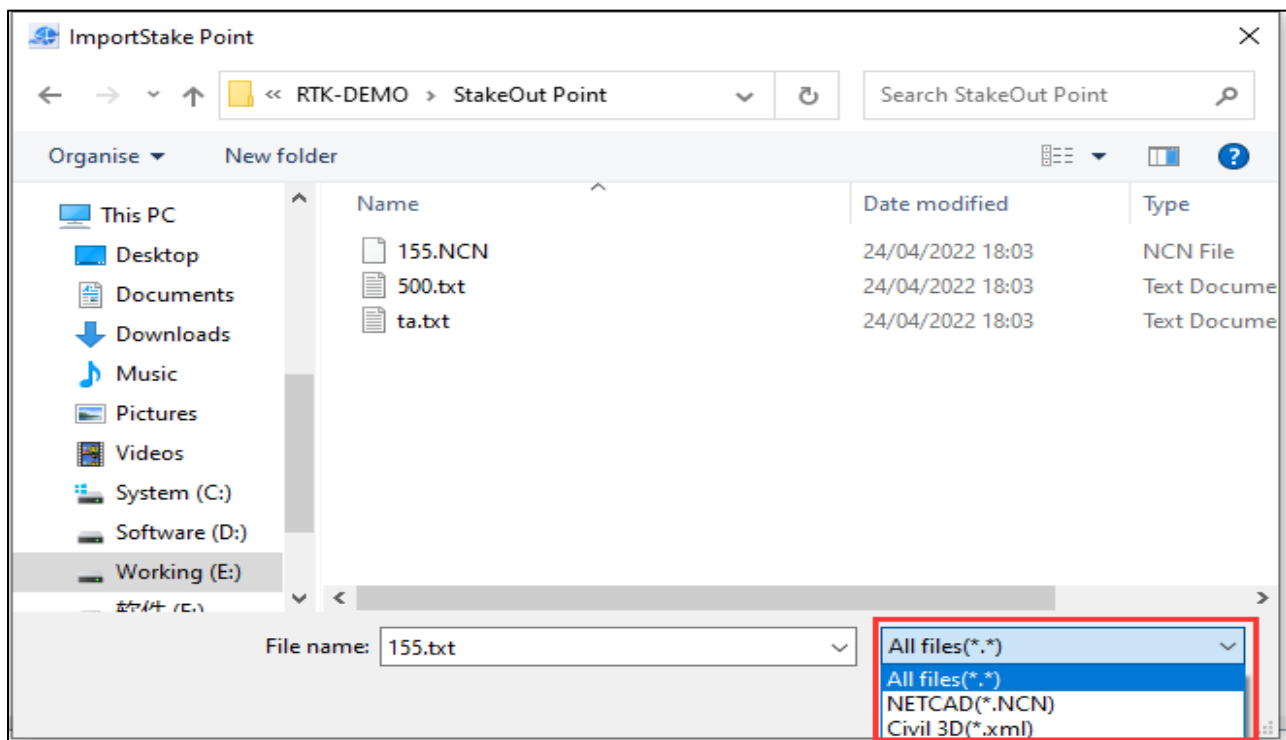


Figure 6-10-3 Select the File Format for Importing Stake Point

Click the [Open] button to return to the software import interface, and then click the [OK] button to complete the file import.

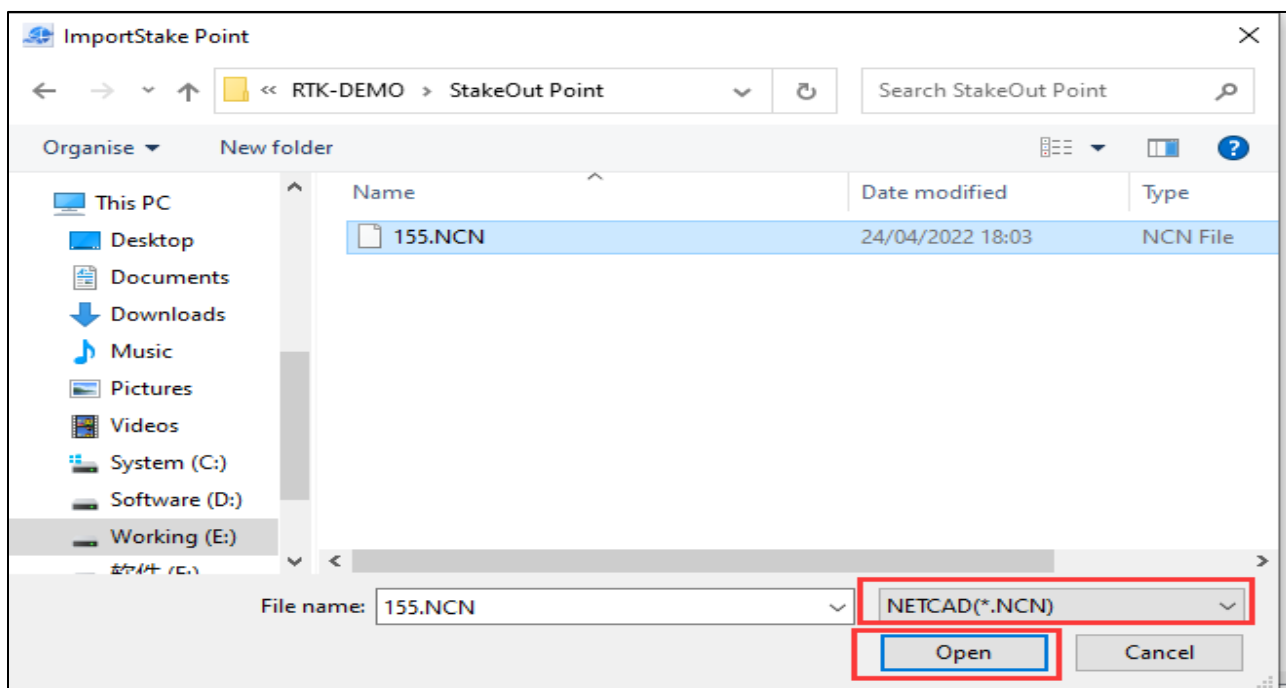


Figure 6-10-4 Import the Selected Stake Point File

Click the file format drop-down box and select the general format file. The control point supports the selection of all files (*.*) and then custom import.

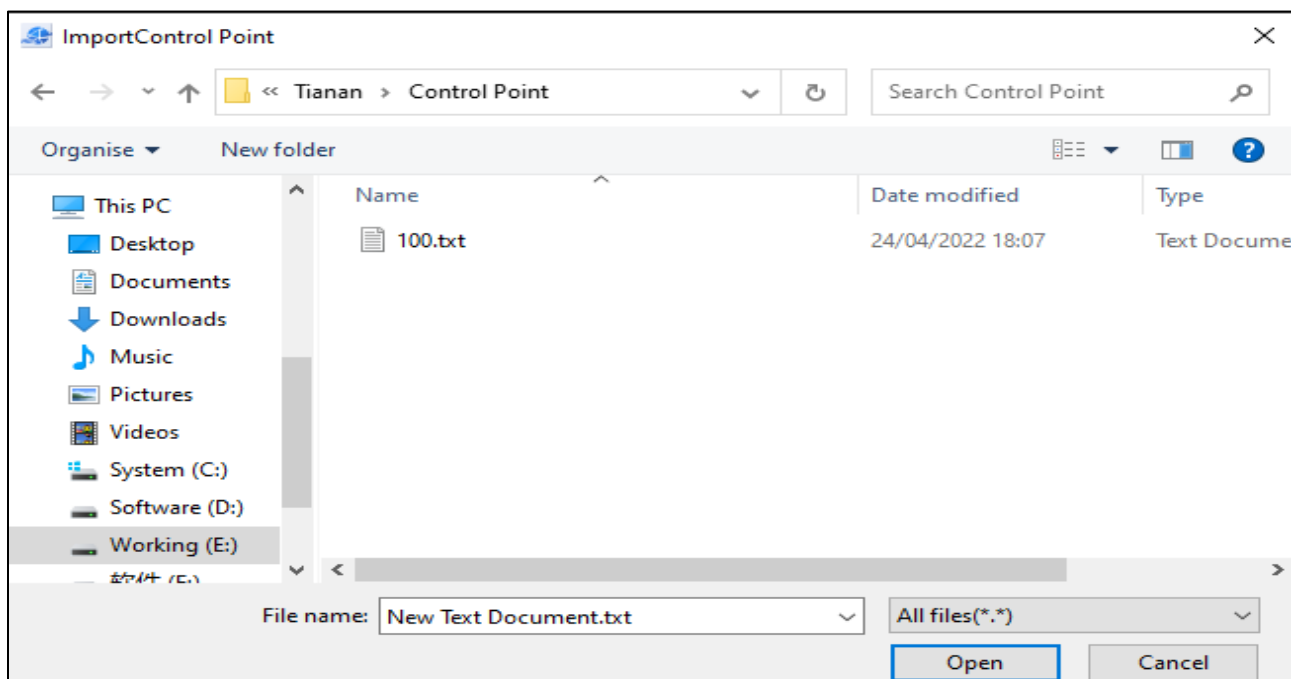


Figure 6-10-5 Import the Control Point File

2. Custom Import

File format Select all files (*.*), select the files to import.

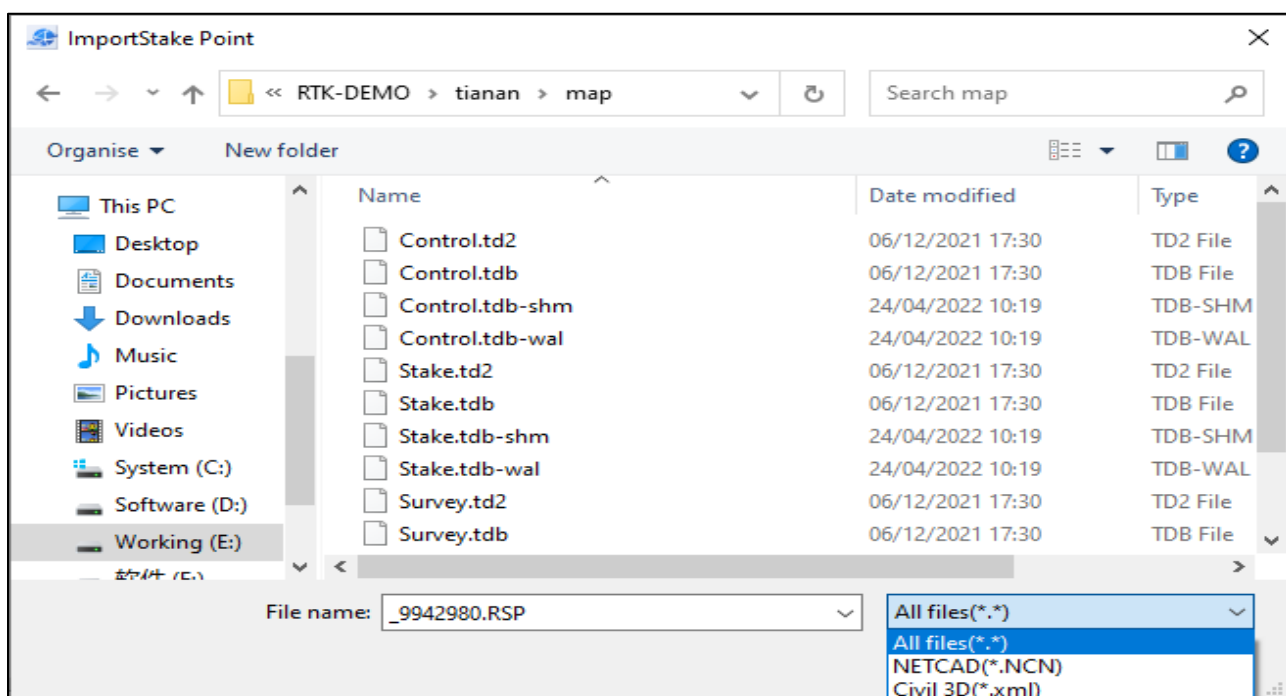


Figure 6-10-6 Custom Import File Format

Click [Open] to return to the software import interface to set the custom format.

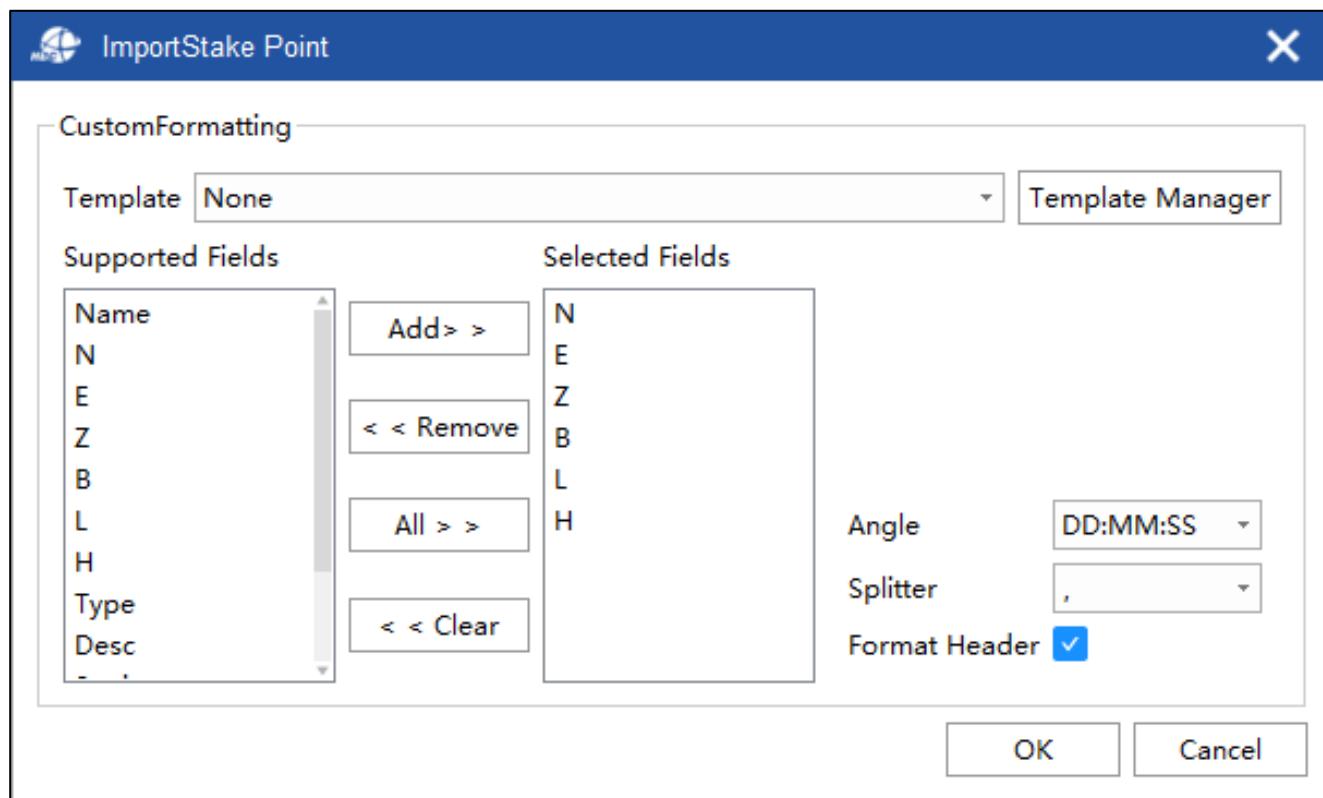


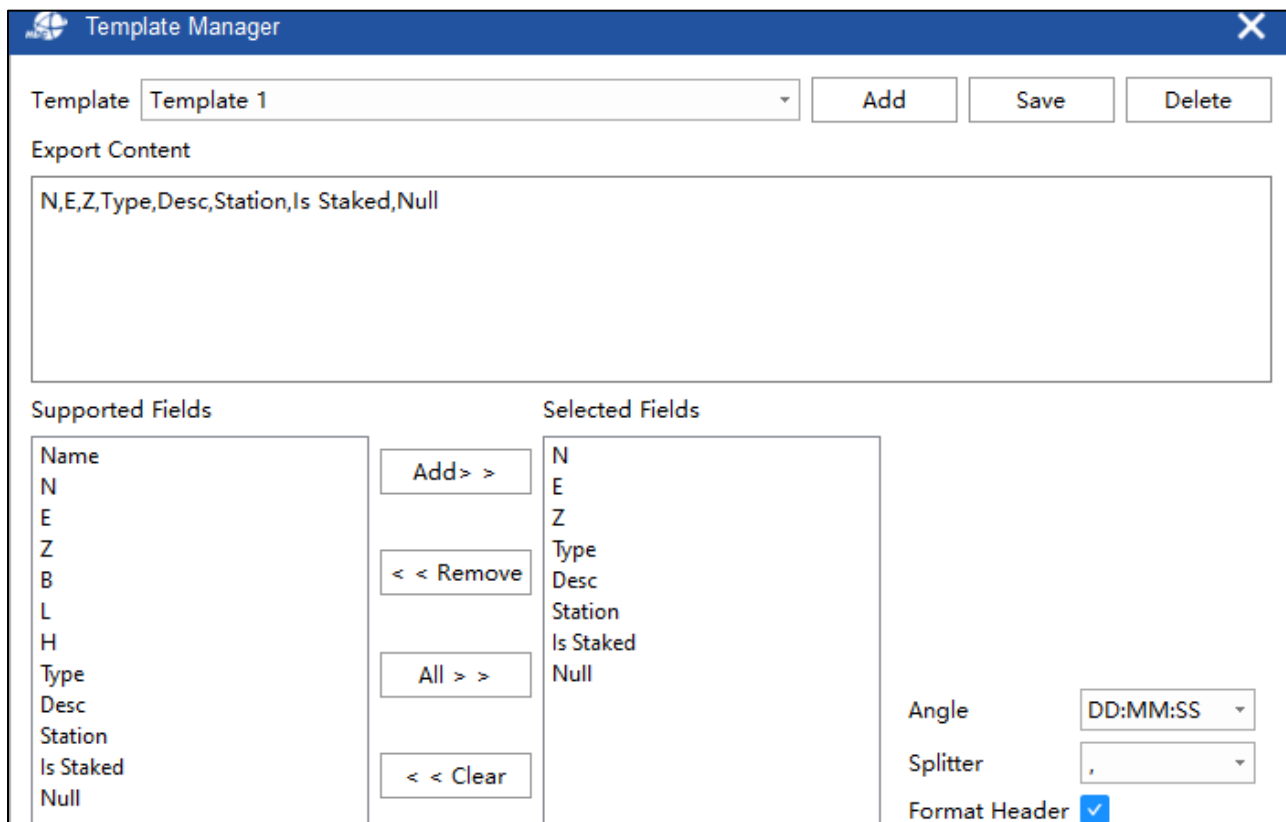
Figure 6-10-7 Custom Import File Fields

In the 'Supported Fields' list, select the fields that need to be imported, select the fields automatically filled to the 'Selected Fields' list, click [Remove] to delete list of selected fields. You can also add or delete all fields by clicking [All] or [Clear]. You can also set the angle format, delimiter and whether or not to display the file header.

After the settings are complete, click [OK] to finish the custom import of the file.

3. Template Management

Custom import can not only set the file format directly, but also set the file format through the template. After you select a custom file and return to the software import interface, click on [Template Management], then the custom template management interface will pop up.



The screenshot shows the 'Template Manager' window. At the top, there's a 'Template' dropdown set to 'Template 1', with 'Add', 'Save', and 'Delete' buttons. Below is the 'Export Content' section with a text box containing 'N,E,Z,Type,Desc,Station,Is Staked,Null'. The main area is divided into 'Supported Fields' and 'Selected Fields'. 'Supported Fields' lists: Name, N, E, Z, B, L, H, Type, Desc, Station, Is Staked, Null. 'Selected Fields' lists: N, E, Z, Type, Desc, Station, Is Staked, Null. Between these lists are buttons: 'Add > >', '< < Remove', 'All > >', and '< < Clear'. On the right, there are settings for 'Angle' (DD:MM:SS), 'Splitter' (comma), and 'Format Header' (checked).

Figure 6-10-8 Template Management

You can customize the formatting in this interface, and then click [Add] and [Save] to complete the custom template settings.

Now you can select the template you have set in the software import interface, click [OK], and the software will import the file according to the format set by the template.

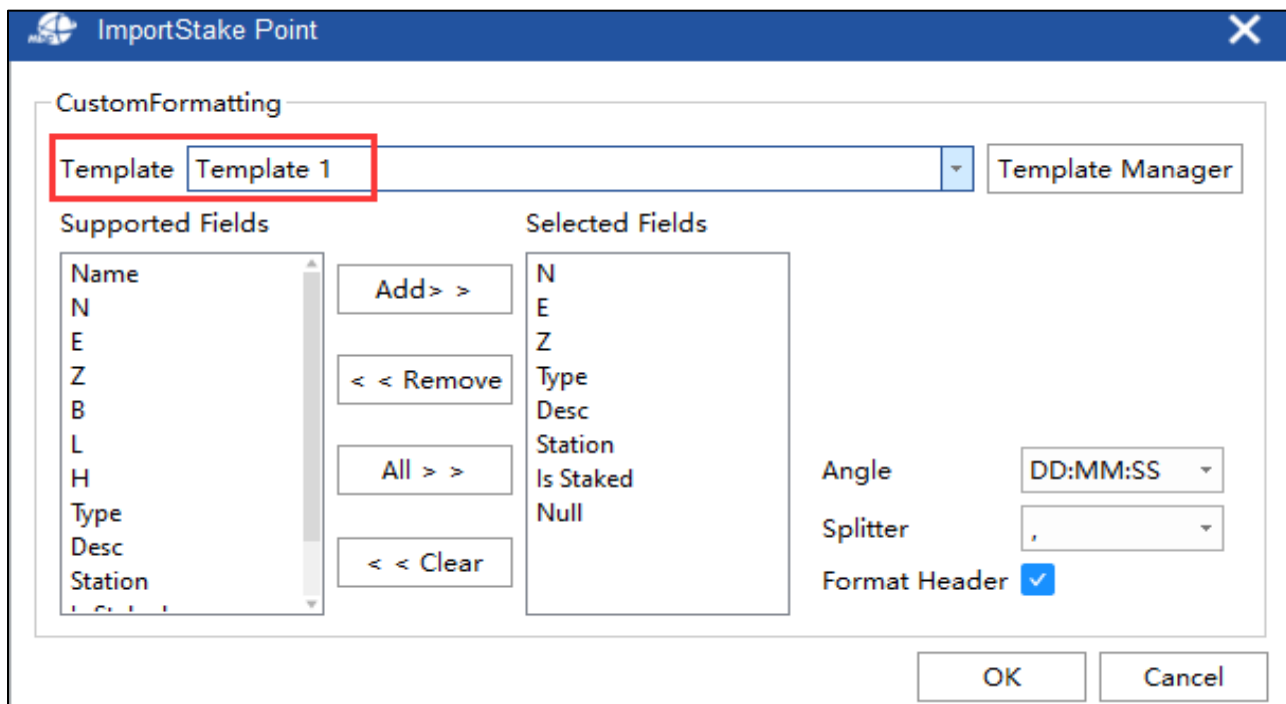


Figure 6-10-9 Select Custom Template

6.11 Exporting

Export the project's coordinate points, stake points, control points, and detailed information in the map root data in different formats for the convenience of users to view and use. Click [OK] to overwrite the original data or click [Cancel] to input the new file.

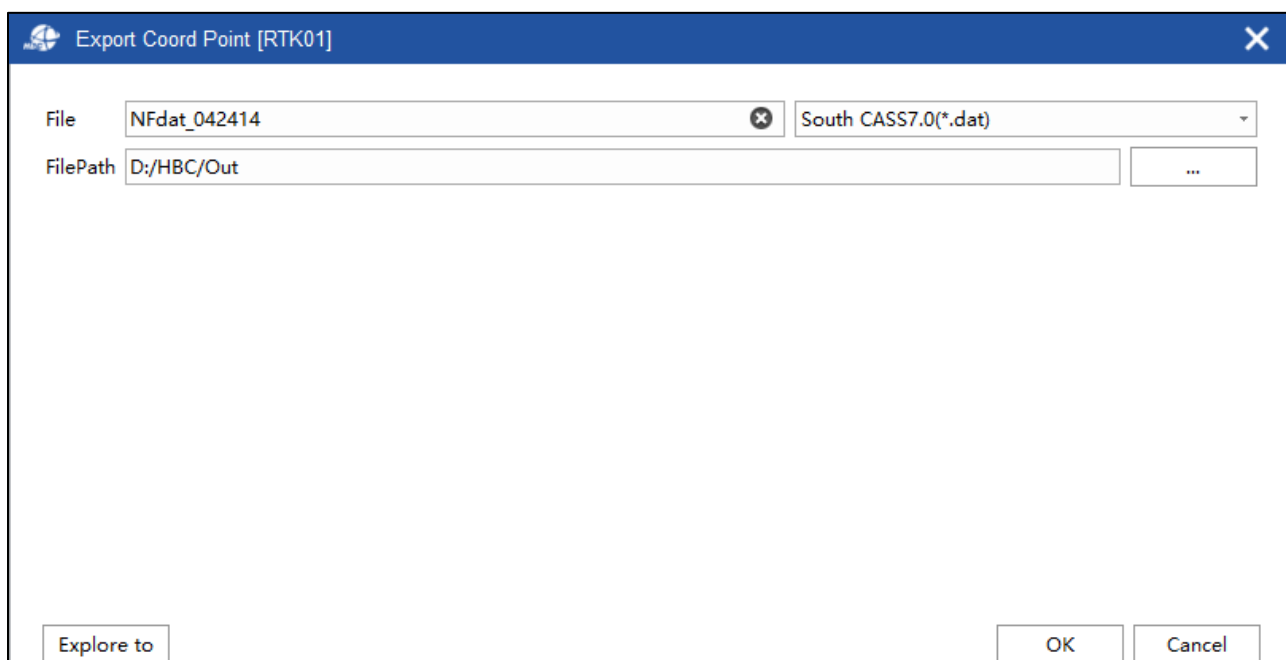


Figure 6-11-1 Export Coordinate Point

Coordinate points, stakeout points, control points, map root data can be customized format settings for the exported data, including optional fields, export order, angle format, floating point precision, separator, whether there are file header and export points range.

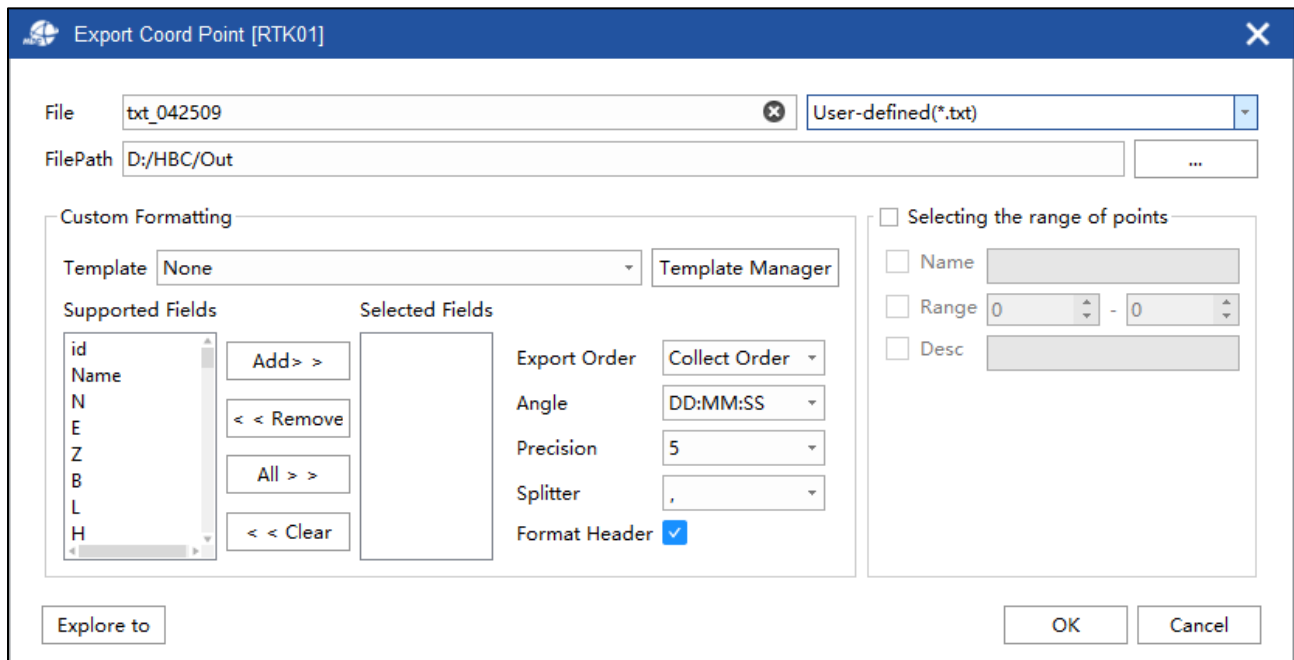


Figure 6-11-2 Export Custom Format Coordinate Point

Coordinate point export formats include custom (*.txt), custom (*.csv), dxf file (*.dxf), NEZ shp file (*.shp), BLH shp file (*.shp), Excel file (*.csv), Southern Cass 7.0 (*.dat), Kaith Scsg2000 (*.dat), PREGEO (*.dat), asc files (*.asc), kml files (*.kml), NETCAD (*.NCN), southern cass features (*.dat).

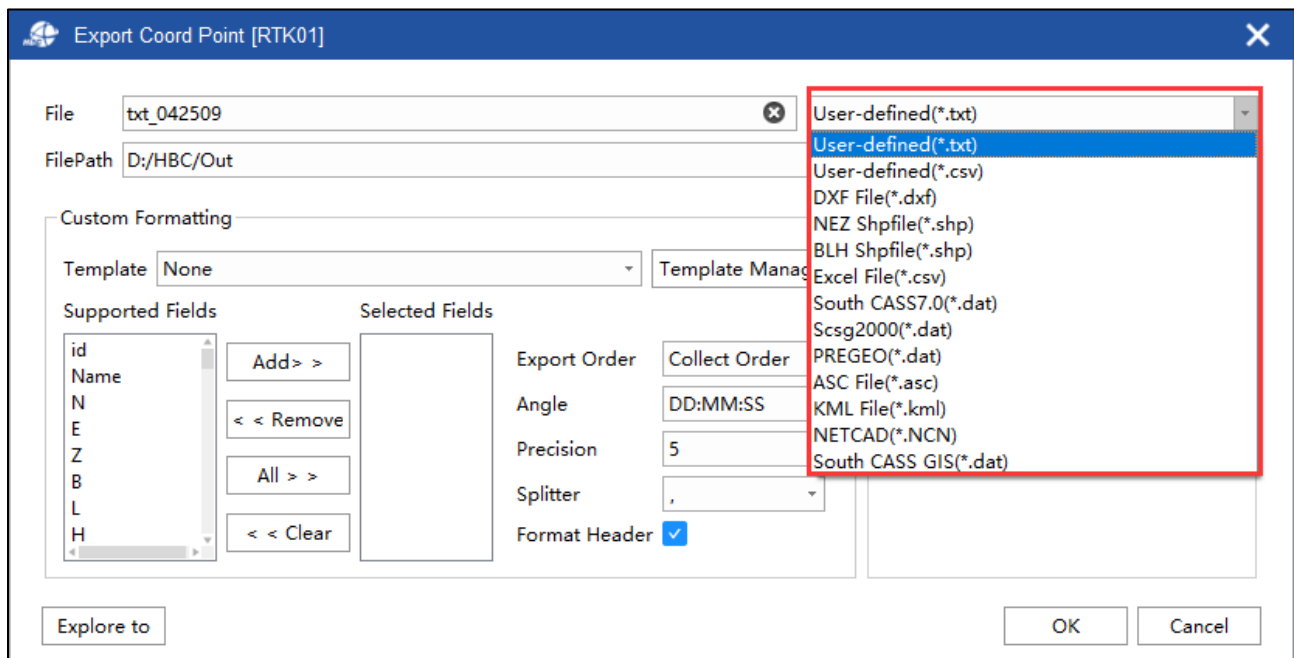


Figure 6-11-3 Export Formats List- Coordinate Point

Layout and control points are exported in Excel file format (*.csv).

Mapping data export formats are Custom (*.txt), Custom (*.csv), dxf file (*.dxf), NEZ shp file (*.shp), BLH shp file (*.shp), Mapsurvey Excel file (*.csv), Mapsurvey Excel2.0 file (*.csv), Southern Cass 7.0 (*.dat), CASSG2000 (*.dat), PREGEO (*.dat), Mapping data Measurement Report (*.html), Tugan Measurement Report 2.0 (*.html).

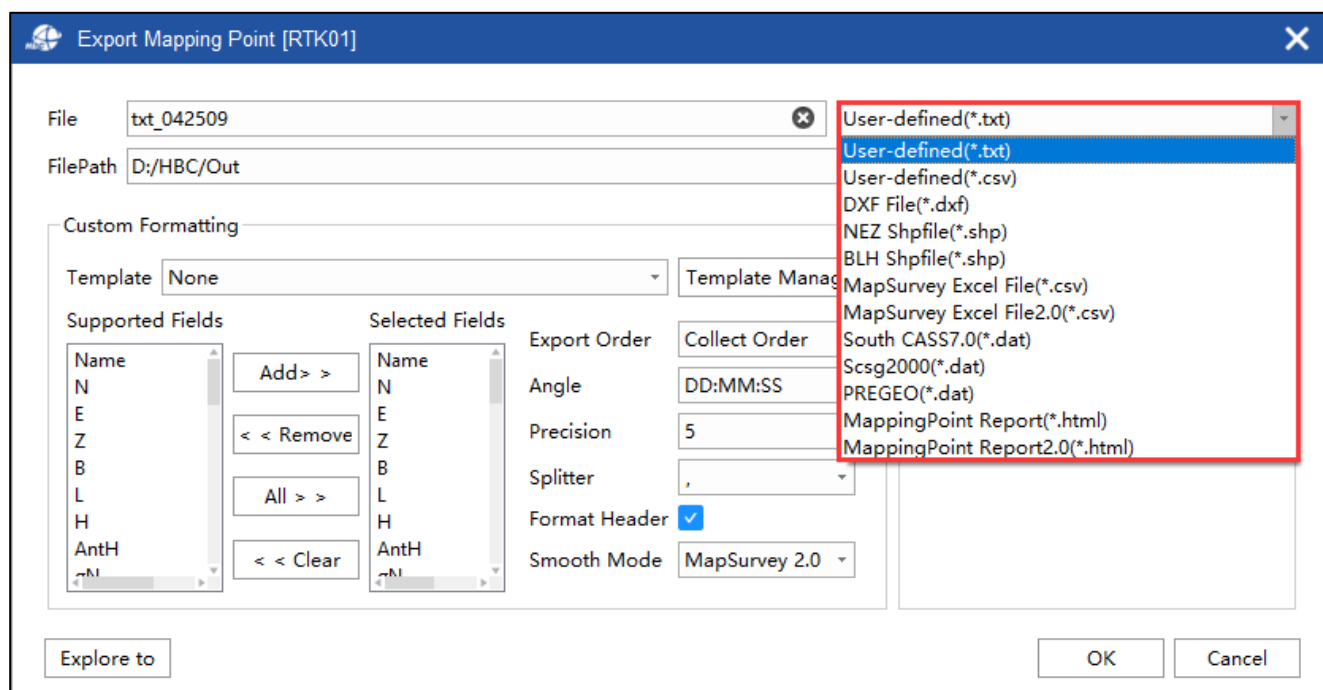


Figure 6-11-4 Export Formats List- mapping Point

To export cross-section point data, you can check 'Implement mileage reduction (collecting back and forth)' according to your needs. The export formats include Haiti cross-section format (*.DMX), China Railway consulting format (*.txt), and Latitude cross-section format (*.hdm), latitude profile format (*.dmx), Hongye data format (*.bghn), Southern Cass7.0 (*.dat), Southern cass7.0 (*.hdm), custom (*.txt), Haiti profile format (*.DMG), EICAD design format (*.HDX), DXF format (*.dxf).

Note: If the option of real-time mileage reduction is not checked, the cross-section points will be sorted in the order of mileage from small to large and offset distance from small to large; if the option of real-time mileage reduction is checked, the cross-section will be The pastries are sorted in the order of real-time mileage from small to large, and real-time offset from small to large.

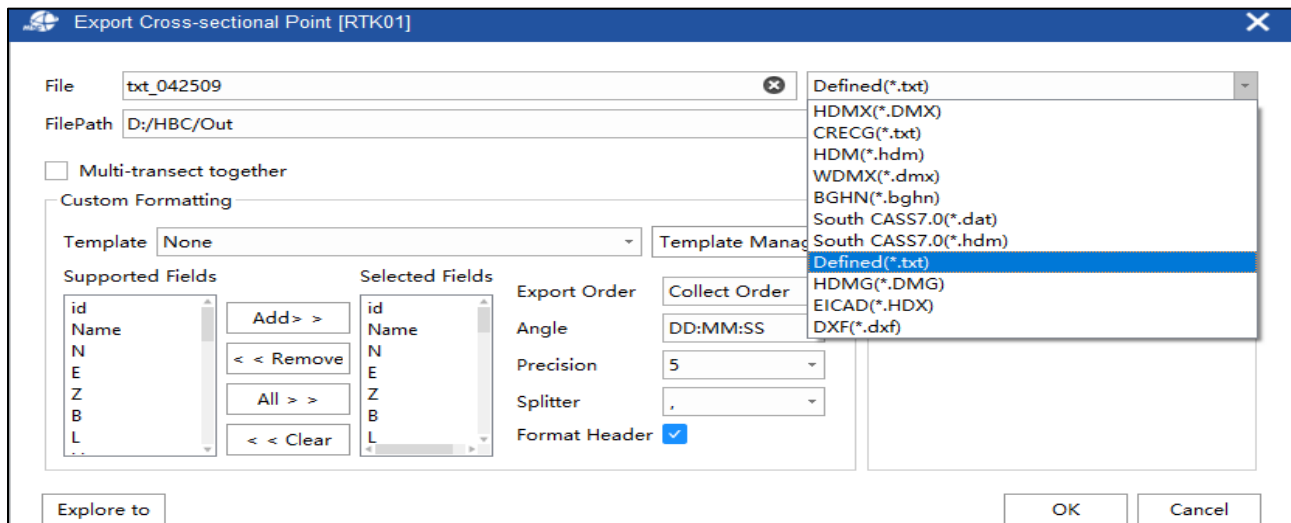


Figure 6-11-5 Export Formats List- cross-section Point

6.12 Report

This section is used to export project reports, including project report (*.txt), project report (*.html), project report - base station grouping (*.txt), project report - base station grouping (*.html), project report 2.0 (*.txt), project report 2.0 (*.html). Open the HBC software and select [RTK] - [Report], the report export interface will pop up.

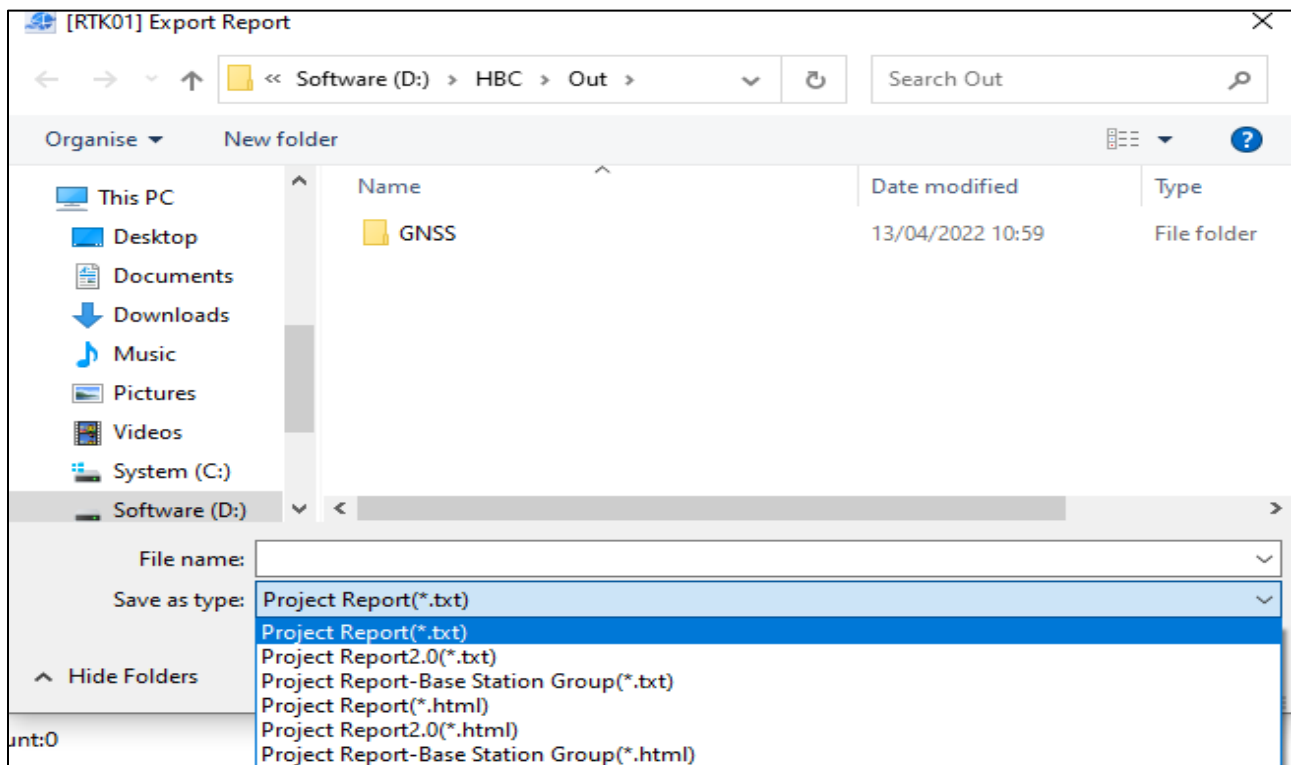


Figure 6-12-1 Export Report Format List

Enter the report name, select the report format you want to export, and click [Save] to save the project report to the specified path.

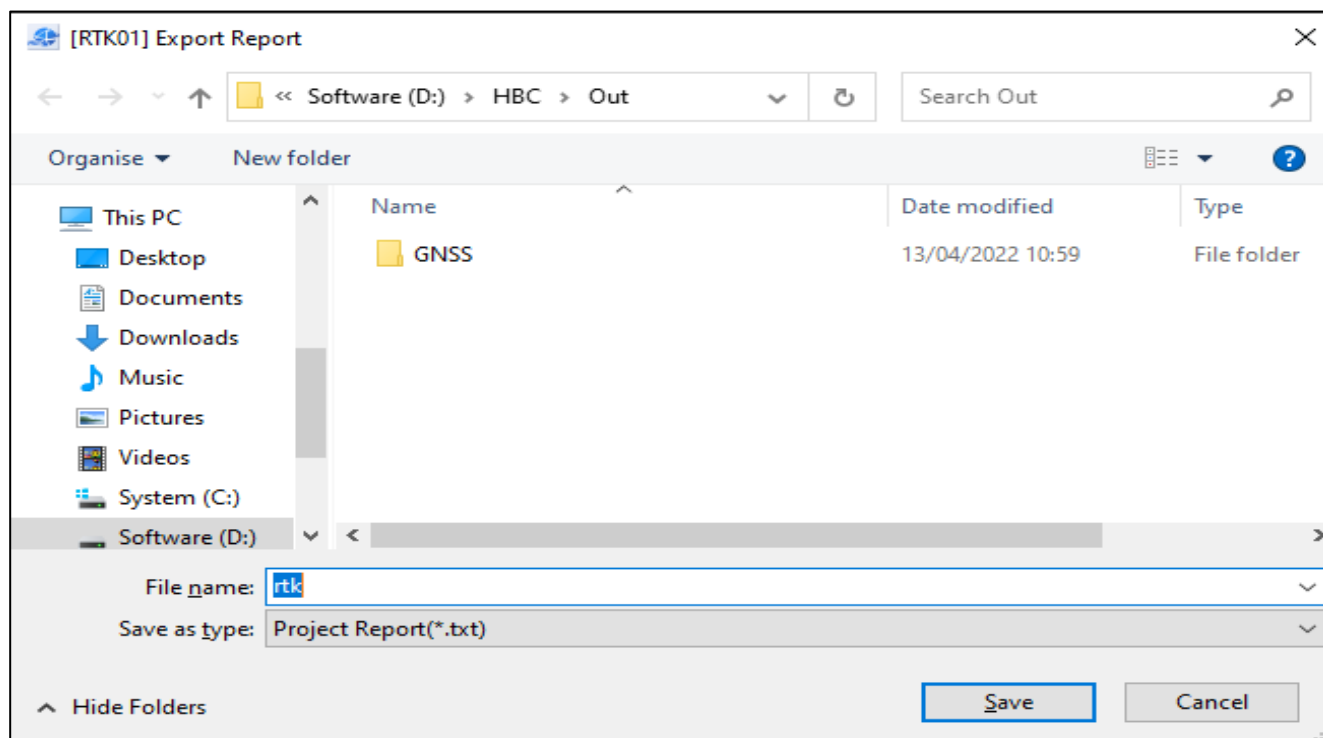


Figure 6-12-2 Export Report

Chapter 7

Elec

This chapter contains:

- Open
- Save
- Save As
- Elec Data
- Elec Point Processing
- Export

7.1 Open

1. Elec Module Main Interface

After you finish creating the HBC project, click [Elec] at the top and the interface is as follows.

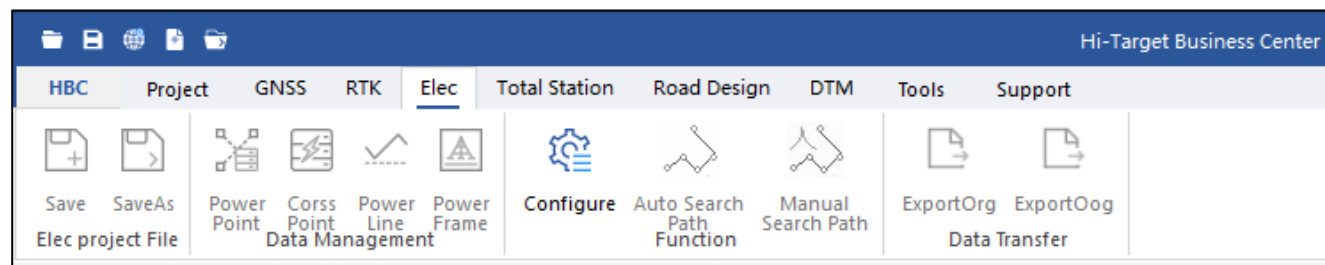


Figure 7-1-1 Electricity Interface

2. Open an Existing Elec Project

[Method 1] Click the [Import] button under the [Project] drop-down box in the [Elec project file], select the Elec project storage path, double-click the prj suffix or click the prj file and click [OK], after the success of the software at the bottom of the information column prompt to open the successful information.

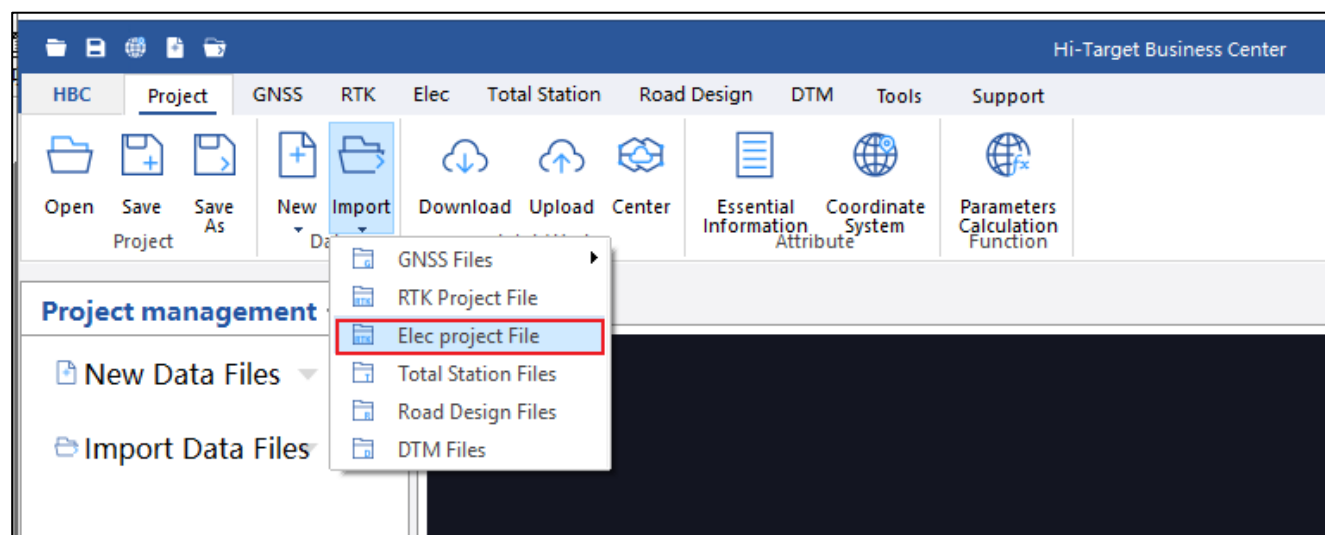


Figure 7-1-2 Import Elec Project File from [Project]

[Method 2] Click [Import Data Files] under the [Elec project file] option, select the Elec project storage path, mouse double click prj suffix or click prj file and click [OK], after the success of the software at the bottom of the information column prompt to open the successful information.

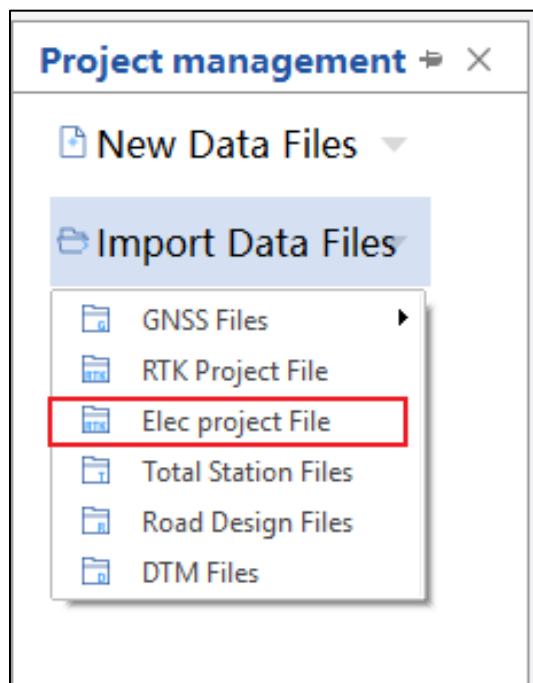


Figure 7-1-3 Import Elec Project File from [Import Data Files]

[Method 3] Click the [Import] icon at the top of the menu bar, click the [Elec project file] option, select the Elec project storage path, double-click the prj suffix or click the prj file and click [Import]. After successful opening, the software will prompt the information related to successful opening in the information bar at the bottom.

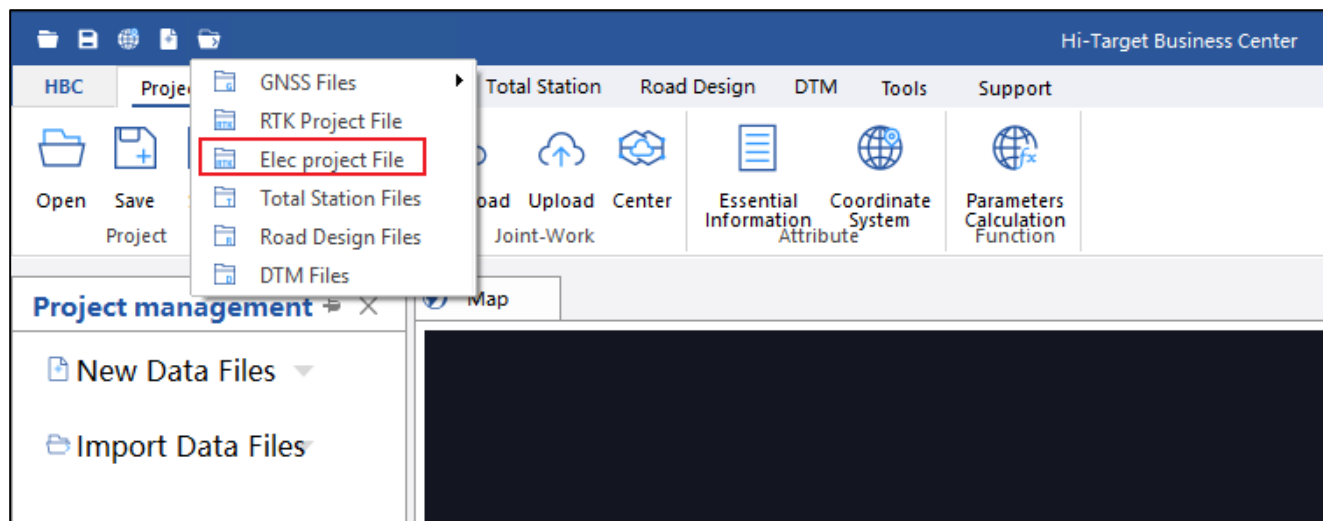


Figure 7-1-4 Import Elec Project File from the Top of Menu Bar

3. View Elec Project Data

Toggle click on [Power Point] [Cross Point] [Power Line] [Power Frame] etc. to view the open Elec project data respectively.

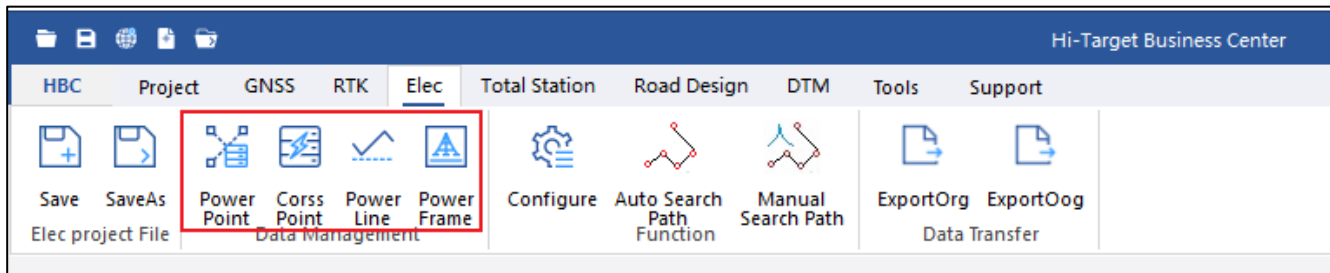


Figure 7-1-5 Elec Interface

7.2 Save

After finishing editing the Elec project, click the [Save] button under the top bar, the software will save the current Elec project content to the path where the Elec project is located, and at the bottom of the information bar suggests the information about the success of the save.

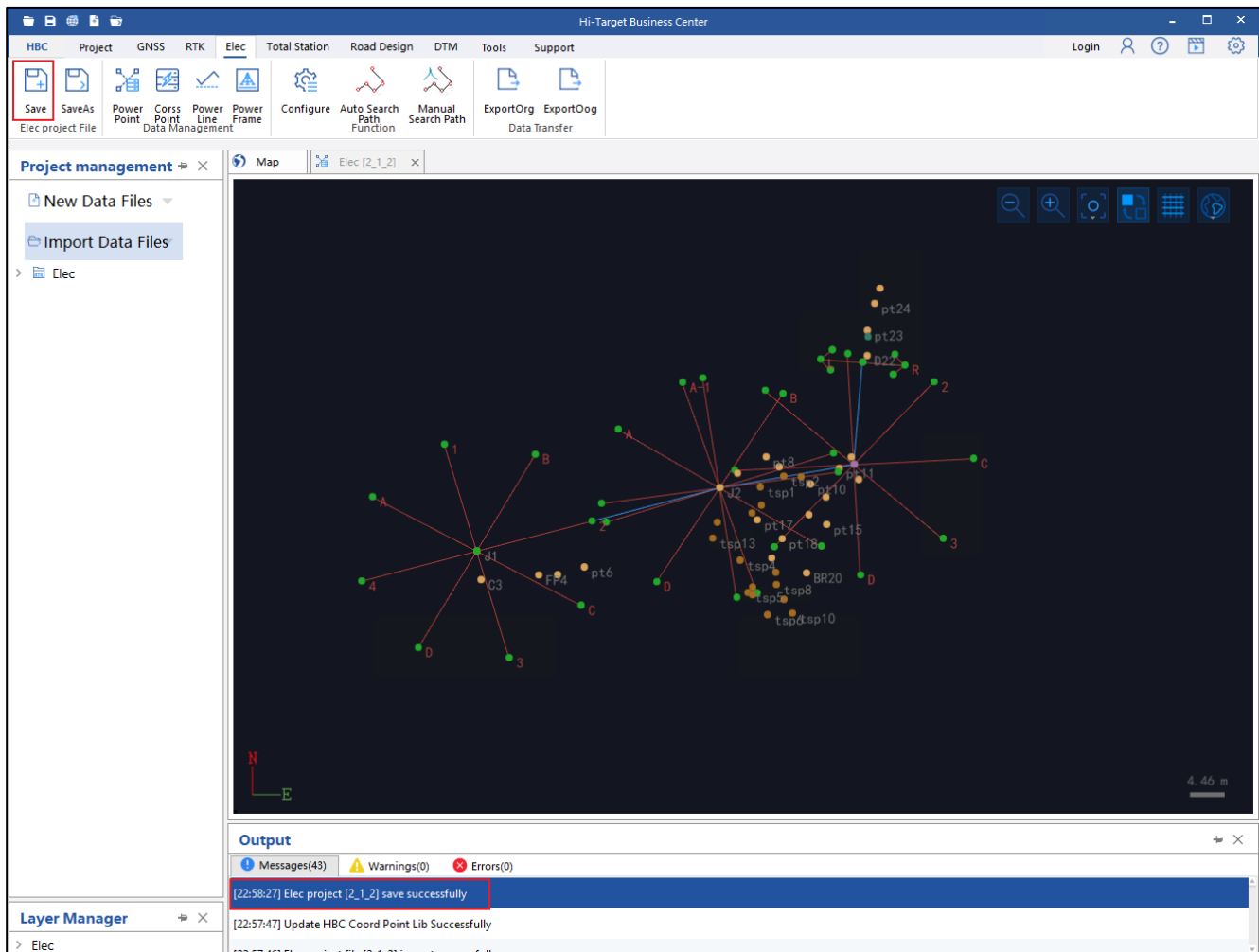


Figure 7-2-1 Save

7.3 Save As

1. Execute Save As

After you finish editing the Elec project, click the [Save As] button under the top bar, select the path and corresponding file name you want to save in the pop-up path selection box, click [Save].

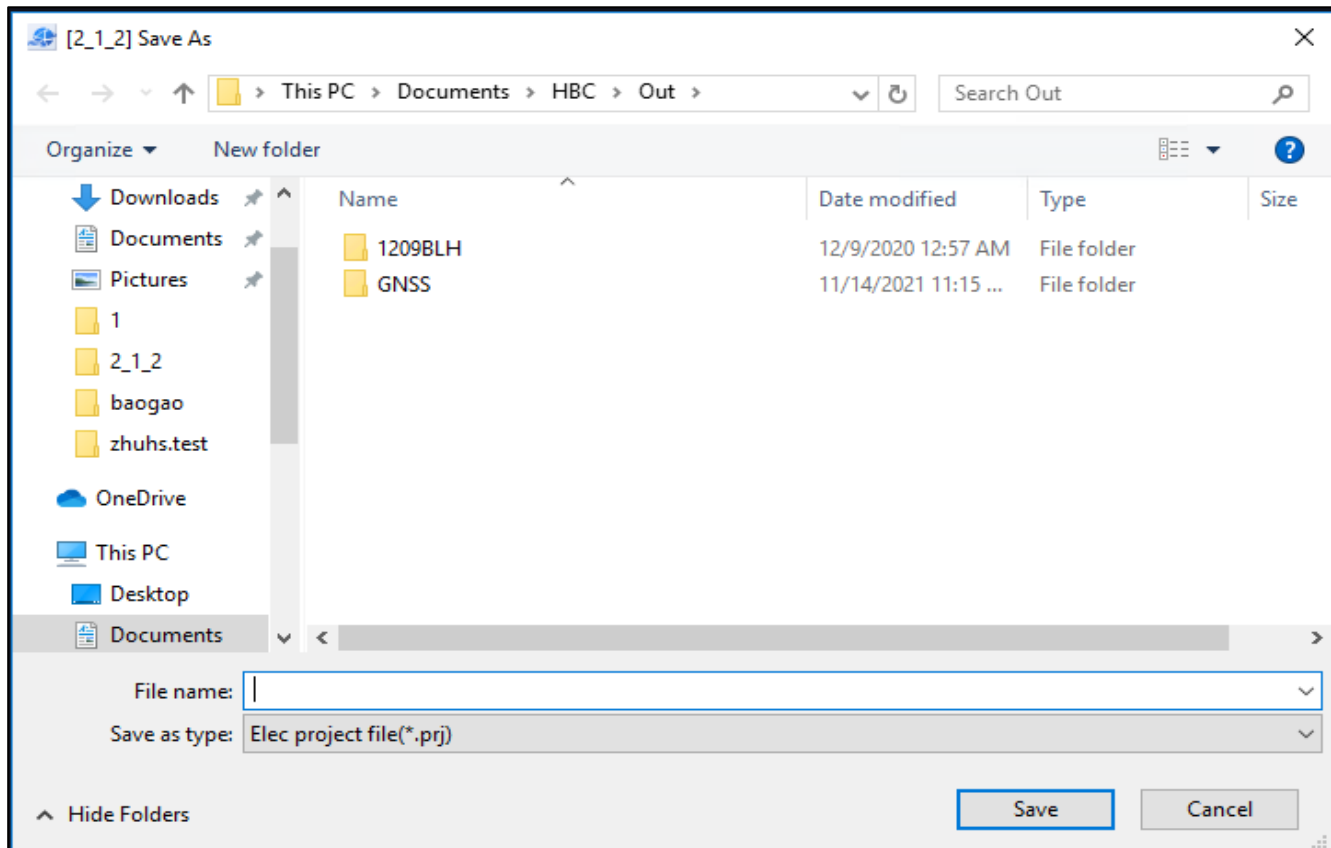


Figure 7-3-1 Save as

2. Save Separate Items

After the project is saved, the following file structure will appear in the file where the corresponding filename is located.

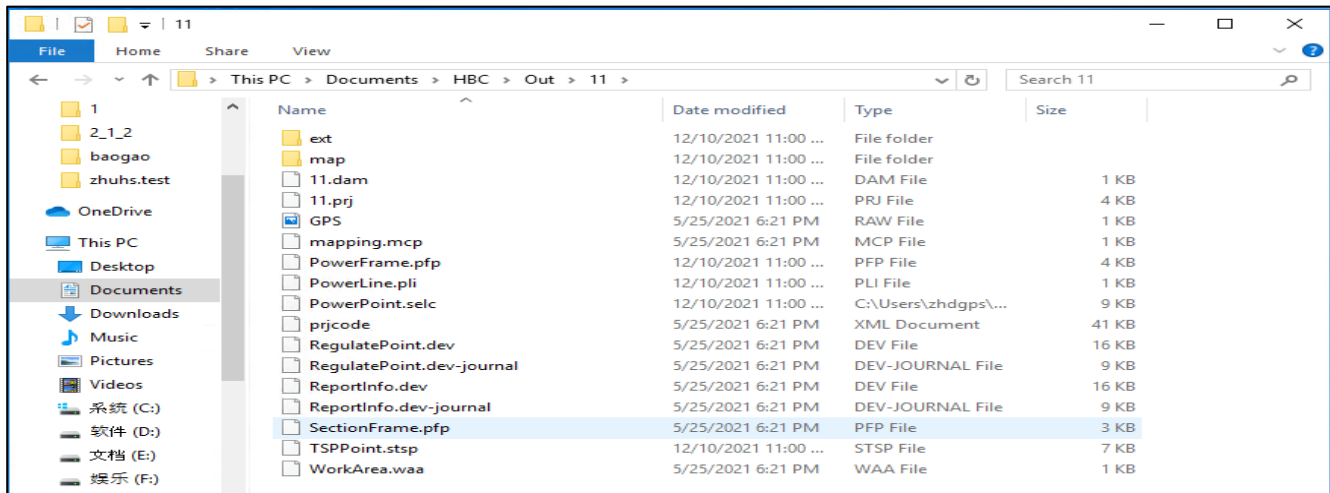


Figure 7-3-2 Saved File

7.4 Elec Data

After opening the Elec project, the user can enter the Elec project Elec data view main interface through the [Power Point] button on the top bar.

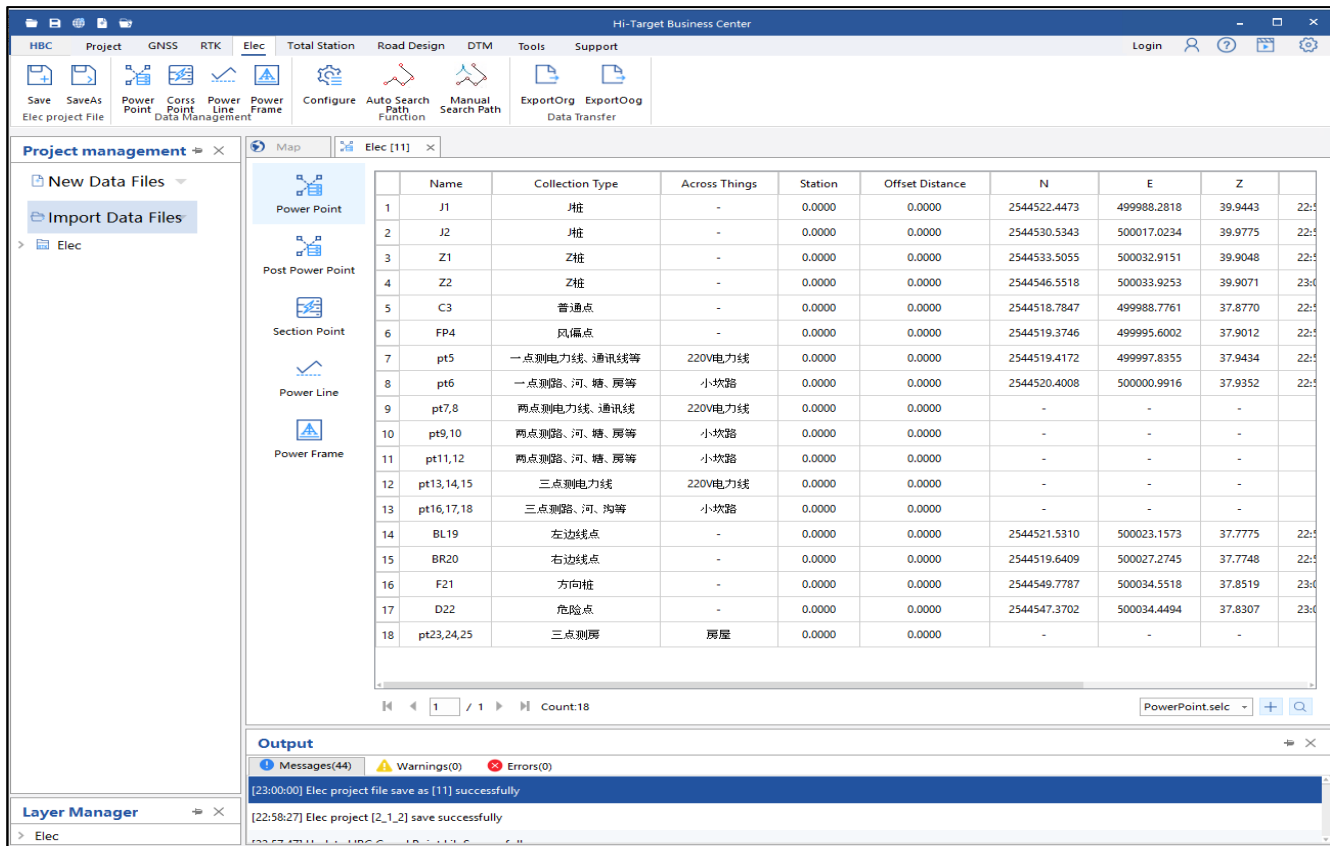
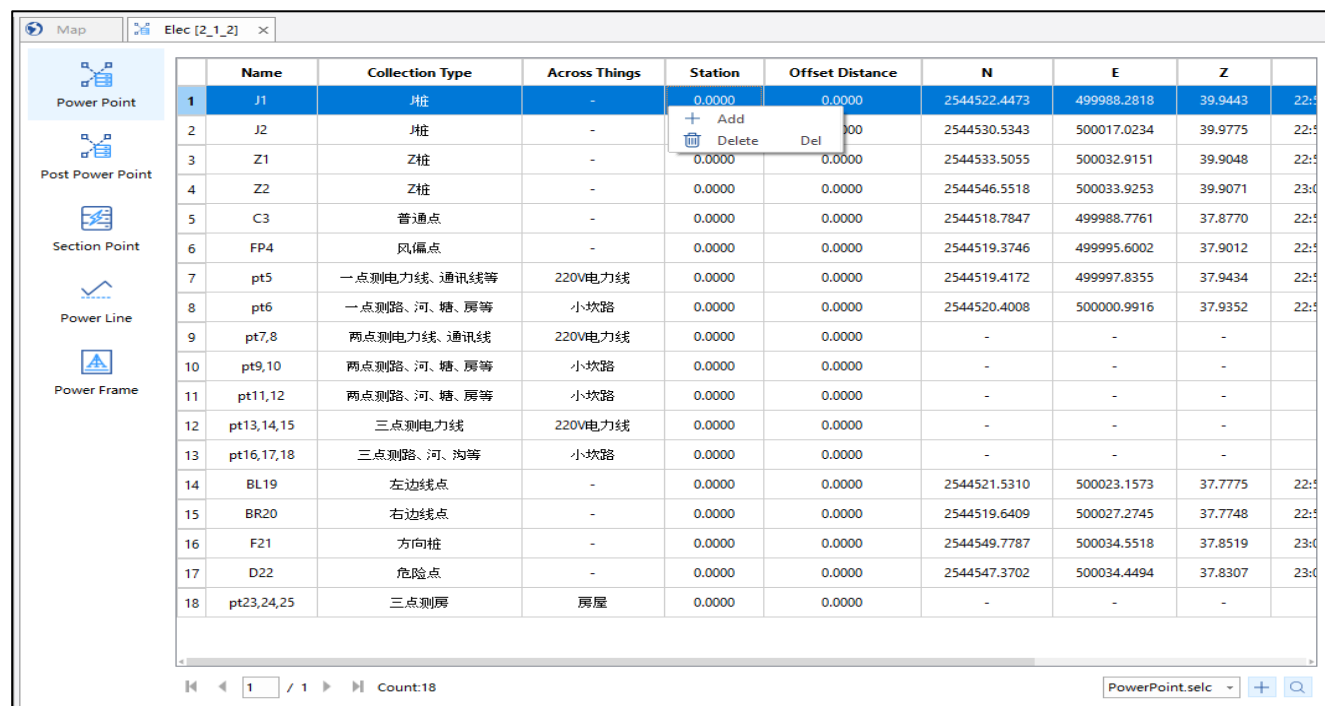


Figure 7-4-1 Power Point

7.4.1 Power Point

1. Data deletion

The user can right-click any line of data in the power point list.

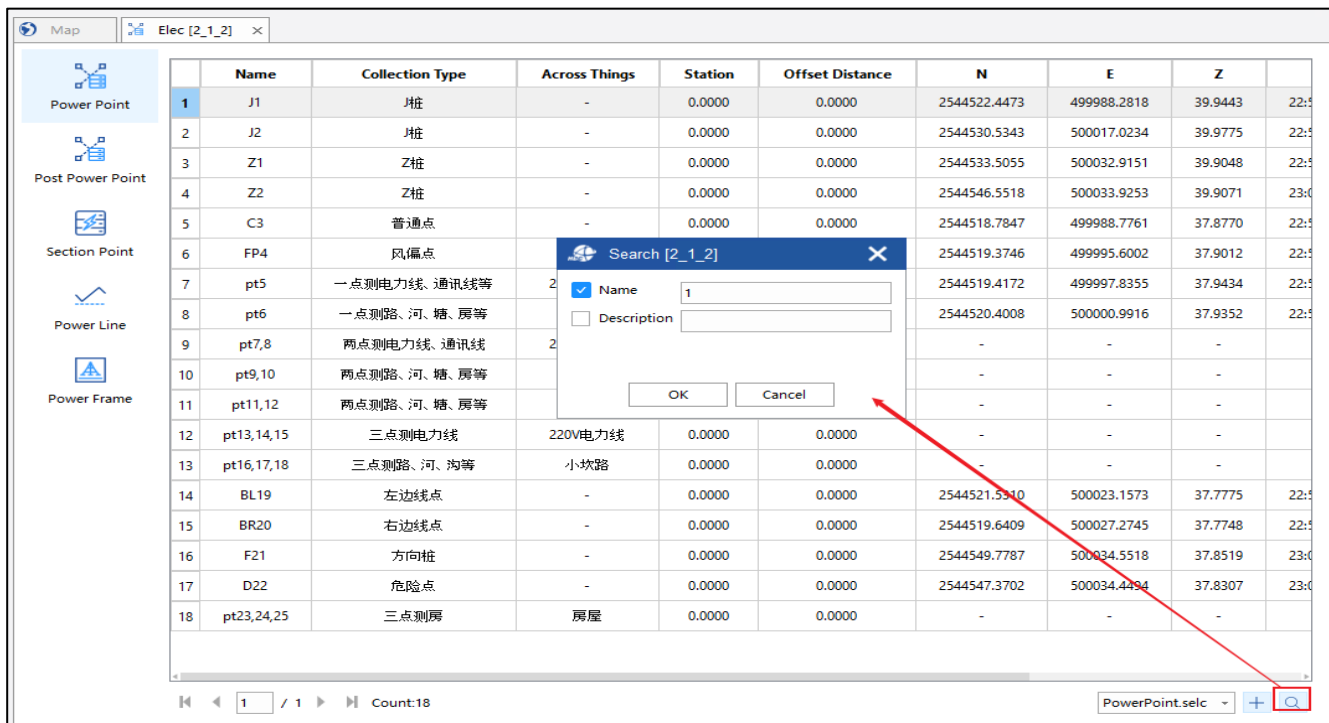


	Name	Collection Type	Across Things	Station	Offset Distance	N	E	Z	
1	J1	堆	-	0.0000	0.0000	2544522.4473	499988.2818	39.9443	22:5
2	J2	堆	-	0.0000	0.0000	2544530.5343	500017.0234	39.9775	22:5
3	Z1	Z桩	-	0.0000	0.0000	2544533.5055	500032.9151	39.9048	22:5
4	Z2	Z桩	-	0.0000	0.0000	2544546.5518	500033.9253	39.9071	23:0
5	C3	普通点	-	0.0000	0.0000	2544518.7847	499988.7761	37.8770	22:5
6	FP4	风偏点	-	0.0000	0.0000	2544519.3746	499995.6002	37.9012	22:5
7	pt5	一点测电力线、通讯线等	220V电力线	0.0000	0.0000	2544519.4172	499997.8355	37.9434	22:5
8	pt6	一点测路、河、塘、房等	小坎路	0.0000	0.0000	2544520.4008	500000.9916	37.9352	22:5
9	pt7,8	两点测电力线、通讯线	220V电力线	0.0000	0.0000	-	-	-	
10	pt9,10	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	
11	pt11,12	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	
12	pt13,14,15	三点测电力线	220V电力线	0.0000	0.0000	-	-	-	
13	pt16,17,18	三点测路、河、沟等	小坎路	0.0000	0.0000	-	-	-	
14	BL19	左边线点	-	0.0000	0.0000	2544521.5310	500023.1573	37.7775	22:5
15	BR20	右边线点	-	0.0000	0.0000	2544519.6409	500027.2745	37.7748	22:5
16	F21	方向桩	-	0.0000	0.0000	2544549.7787	500034.5518	37.8519	23:0
17	D22	危险点	-	0.0000	0.0000	2544547.3702	500034.4494	37.8307	23:0
18	pt23,24,25	三点测房	房屋	0.0000	0.0000	-	-	-	

Figure 7-4-2 Delete Power Point

Click [Delete] to delete data.

Click the search icon in the lower right corner and enter the point name and description to search the data.



Map Elec [2_1_2] x

Power Point

Post Power Point

Section Point

Power Line

Power Frame

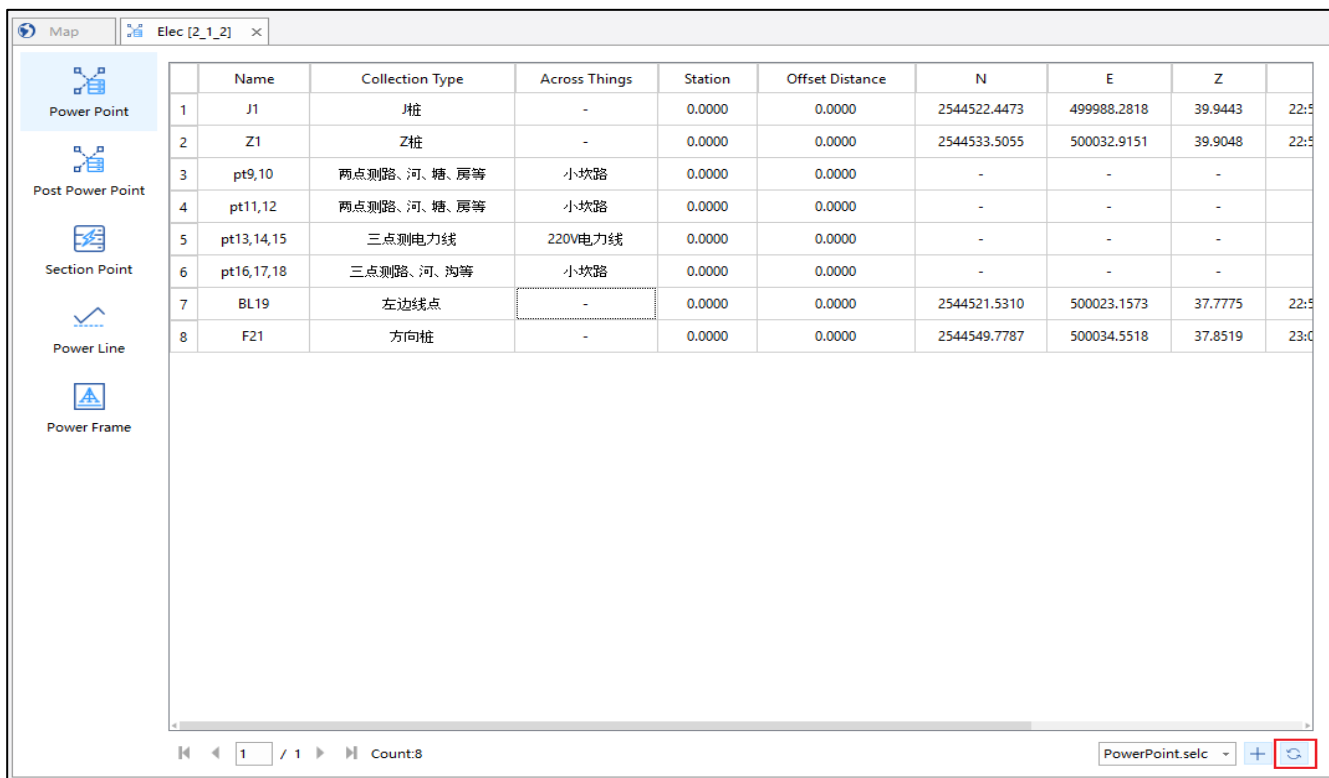
	Name	Collection Type	Across Things	Station	Offset Distance	N	E	Z	
1	J1	井桩	-	0.0000	0.0000	2544522.4473	499988.2818	39.9443	22:5
2	J2	井桩	-	0.0000	0.0000	2544530.5343	500017.0234	39.9775	22:5
3	Z1	Z桩	-	0.0000	0.0000	2544533.5055	500032.9151	39.9048	22:5
4	Z2	Z桩	-	0.0000	0.0000	2544546.5518	500033.9253	39.9071	23:0
5	C3	普通点	-	0.0000	0.0000	2544518.7847	499988.7761	37.8770	22:5
6	FP4	风偏点	-	0.0000	0.0000	2544519.3746	499995.6002	37.9012	22:5
7	pt5	一点测电力线、通讯线等	2	0.0000	0.0000	2544519.4172	499997.8355	37.9434	22:5
8	pt6	一点测路、河、塘、房等	-	0.0000	0.0000	2544520.4008	500000.9916	37.9352	22:5
9	pt7,8	两点测电力线、通讯线	2	0.0000	0.0000	-	-	-	-
10	pt9,10	两点测路、河、塘、房等	-	0.0000	0.0000	-	-	-	-
11	pt11,12	两点测路、河、塘、房等	-	0.0000	0.0000	-	-	-	-
12	pt13,14,15	三点测电力线	220V电力线	0.0000	0.0000	-	-	-	-
13	pt16,17,18	三点测路、河、沟等	小坎路	0.0000	0.0000	-	-	-	-
14	BL19	左边线点	-	0.0000	0.0000	2544521.5310	500023.1573	37.7775	22:5
15	BR20	右边线点	-	0.0000	0.0000	2544519.6409	500027.2745	37.7748	22:5
16	F21	方向桩	-	0.0000	0.0000	2544549.7787	500034.5518	37.8519	23:0
17	D22	危险点	-	0.0000	0.0000	2544547.3702	500034.4494	37.8307	23:0
18	pt23,24,25	三点测房	房屋	0.0000	0.0000	-	-	-	-

Count:18

PowerPoint.selc + Refresh

Figure 7-4-3 Search Power Point

After data search, click refresh in the lower right corner to display all data.



Map Elec [2_1_2] x

Power Point

Post Power Point

Section Point

Power Line

Power Frame

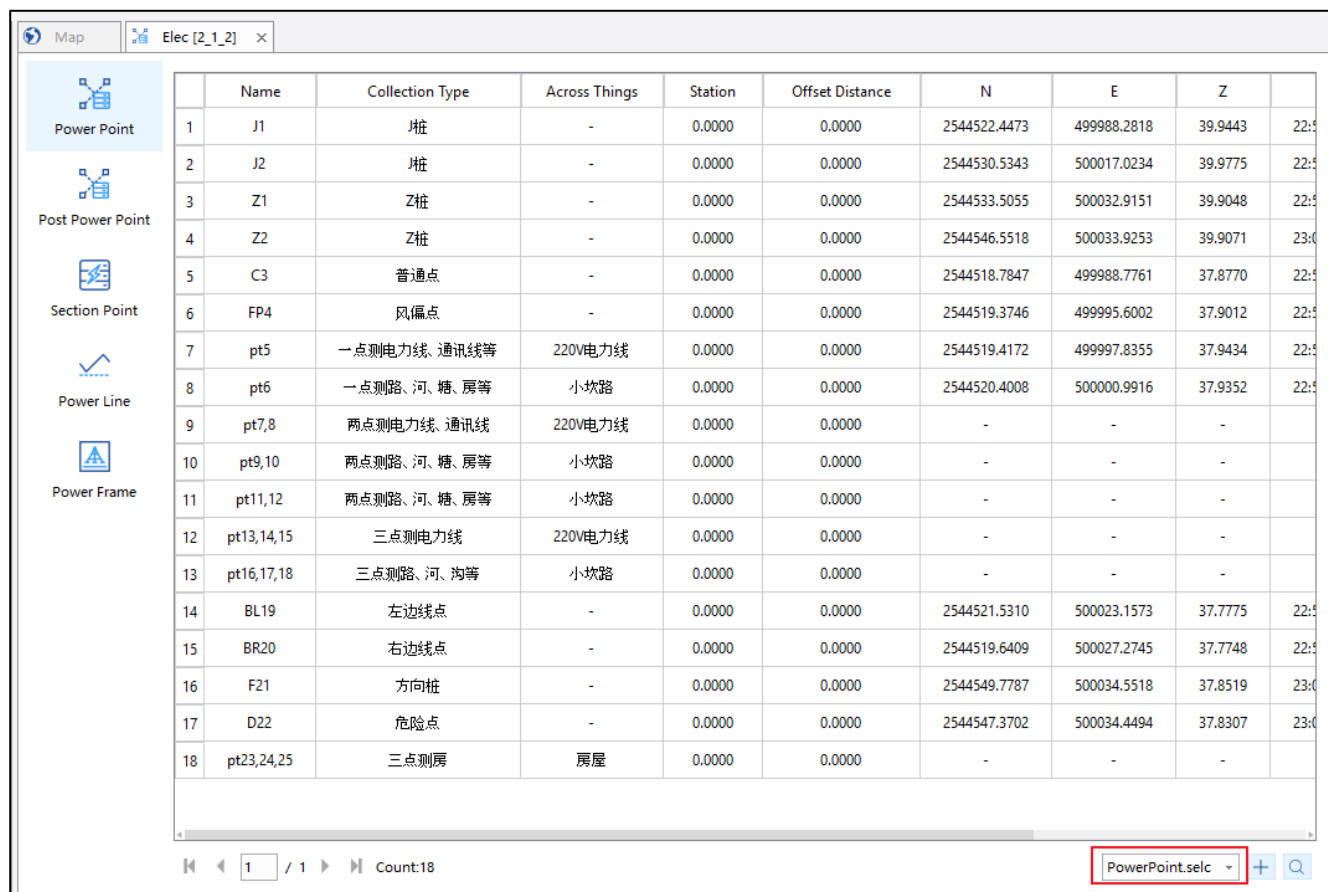
	Name	Collection Type	Across Things	Station	Offset Distance	N	E	Z	
1	J1	井桩	-	0.0000	0.0000	2544522.4473	499988.2818	39.9443	22:5
2	Z1	Z桩	-	0.0000	0.0000	2544533.5055	500032.9151	39.9048	22:5
3	pt9,10	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	-
4	pt11,12	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	-
5	pt13,14,15	三点测电力线	220V电力线	0.0000	0.0000	-	-	-	-
6	pt16,17,18	三点测路、河、沟等	小坎路	0.0000	0.0000	-	-	-	-
7	BL19	左边线点	-	0.0000	0.0000	2544521.5310	500023.1573	37.7775	22:5
8	F21	方向桩	-	0.0000	0.0000	2544549.7787	500034.5518	37.8519	23:0

Count:8

PowerPoint.selc + Refresh

Figure 7-4-4 Refresh Power Point

Modify the point library file in the lower right corner to switch different power point files.

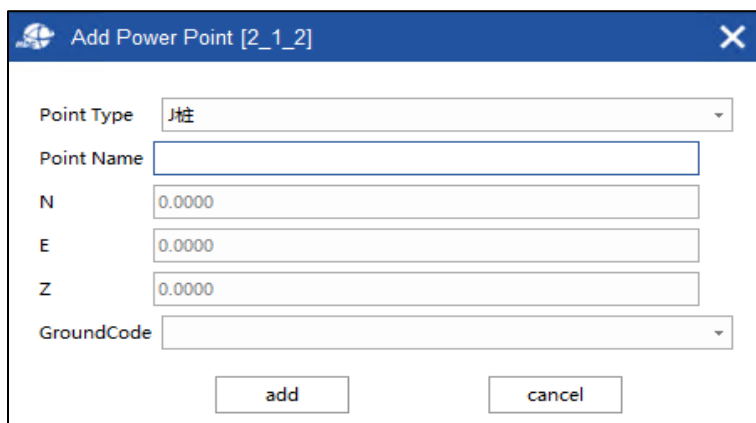


	Name	Collection Type	Across Things	Station	Offset Distance	N	E	Z	
1	J1	桩	-	0.0000	0.0000	2544522.4473	499988.2818	39.9443	22:5
2	J2	桩	-	0.0000	0.0000	2544530.5343	500017.0234	39.9775	22:5
3	Z1	Z桩	-	0.0000	0.0000	2544533.5055	500032.9151	39.9048	22:5
4	Z2	Z桩	-	0.0000	0.0000	2544546.5518	500033.9253	39.9071	23:0
5	C3	普通点	-	0.0000	0.0000	2544518.7847	499988.7761	37.8770	22:5
6	FP4	风偏点	-	0.0000	0.0000	2544519.3746	499995.6002	37.9012	22:5
7	pt5	一点测电力线、通讯线等	220V电力线	0.0000	0.0000	2544519.4172	499997.8355	37.9434	22:5
8	pt6	一点测路、河、塘、房等	小坎路	0.0000	0.0000	2544520.4008	500000.9916	37.9352	22:5
9	pt7,8	两点测电力线、通讯线	220V电力线	0.0000	0.0000	-	-	-	
10	pt9,10	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	
11	pt11,12	两点测路、河、塘、房等	小坎路	0.0000	0.0000	-	-	-	
12	pt13,14,15	三点测电力线	220V电力线	0.0000	0.0000	-	-	-	
13	pt16,17,18	三点测路、河、沟等	小坎路	0.0000	0.0000	-	-	-	
14	BL19	左边线点	-	0.0000	0.0000	2544521.5310	500023.1573	37.7775	22:5
15	BR20	右边线点	-	0.0000	0.0000	2544519.6409	500027.2745	37.7748	22:5
16	F21	方向桩	-	0.0000	0.0000	2544549.7787	500034.5518	37.8519	23:0
17	D22	危险点	-	0.0000	0.0000	2544547.3702	500034.4494	37.8307	23:0
18	pt23,24,25	三点测房	房屋	0.0000	0.0000	-	-	-	

Figure 7-4-5 Modify the Power Point Library File

2. Data Addition

The user can right-click the [add] button or click the Add button in the lower right corner to add power points through any line of data in the power point list, select the type in the acquisition type, and enter the point name and NEZ coordinates.



Add Power Point [2_1_2]

Point Type: 桩

Point Name:

N: 0.0000

E: 0.0000

Z: 0.0000

GroundCode:

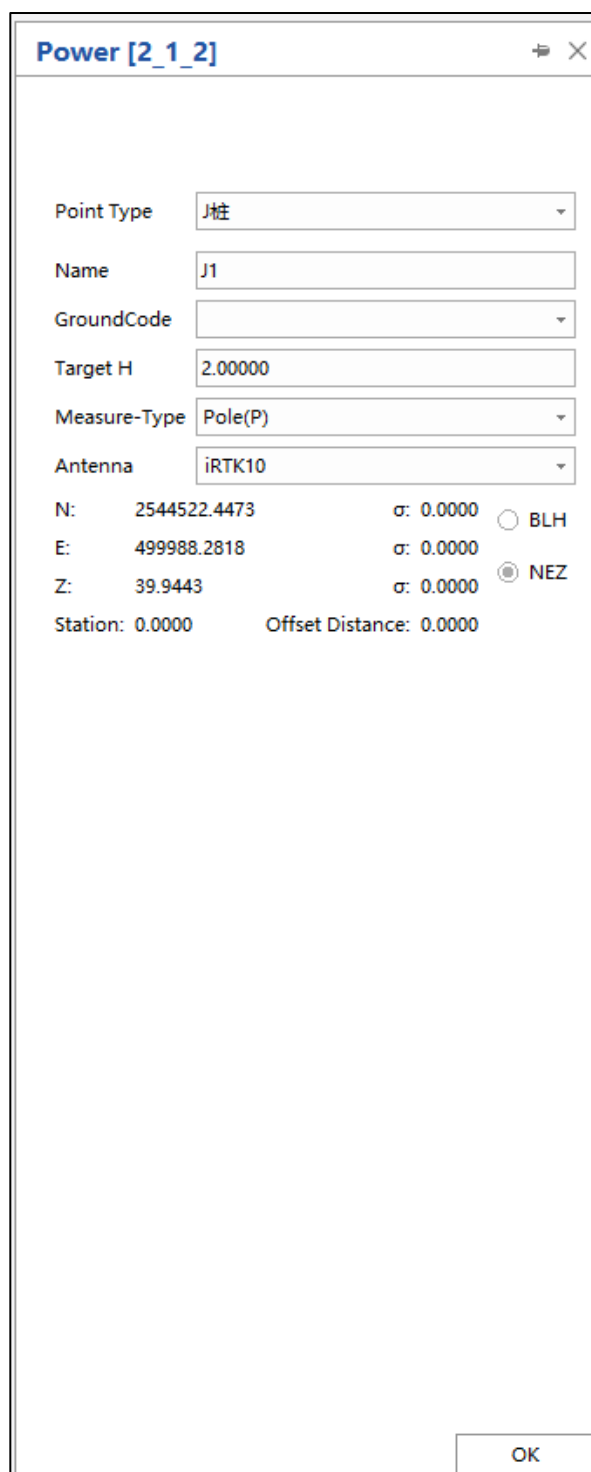
add

cancel

Figure 7-4-6 Add Power Point

3. Data Editing

The user can double-click any line of data in the power point list to enter the power point details page for editing, and modify the acquisition type, point name, target height, measurement type, antenna and attribute acquisition.



Power [2_1_2]

Point Type: J桩

Name: J1

GroundCode:

Target H: 2.00000

Measure-Type: Pole(P)

Antenna: iRTK10

N: 2544522.4473 σ : 0.0000 ☐ BLH

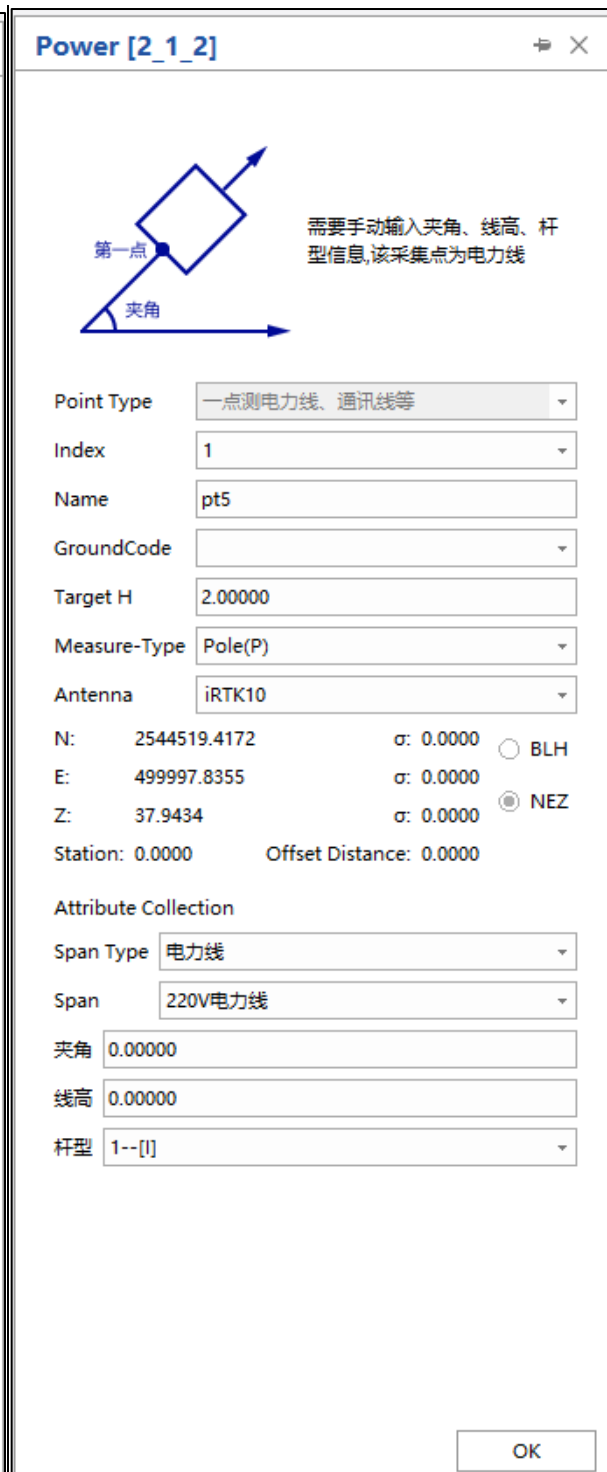
E: 499988.2818 σ : 0.0000

Z: 39.9443 σ : 0.0000 ☒ NEZ

Station: 0.0000 Offset Distance: 0.0000

OK

Figure 7-4-7 Edit Power Point-1



Power [2_1_2]

第一点 夹角

需要手动输入夹角、线高、杆型信息,该采集点为电力线

Point Type: 一点测电力线、通讯线等

Index: 1

Name: pt5

GroundCode:

Target H: 2.00000

Measure-Type: Pole(P)

Antenna: iRTK10

N: 2544519.4172 σ : 0.0000 ☐ BLH

E: 499997.8355 σ : 0.0000

Z: 37.9434 σ : 0.0000 ☒ NEZ

Station: 0.0000 Offset Distance: 0.0000

Attribute Collection

Span Type: 电力线

Span: 220V电力线

夹角: 0.00000

线高: 0.00000

杆型: 1--[I]

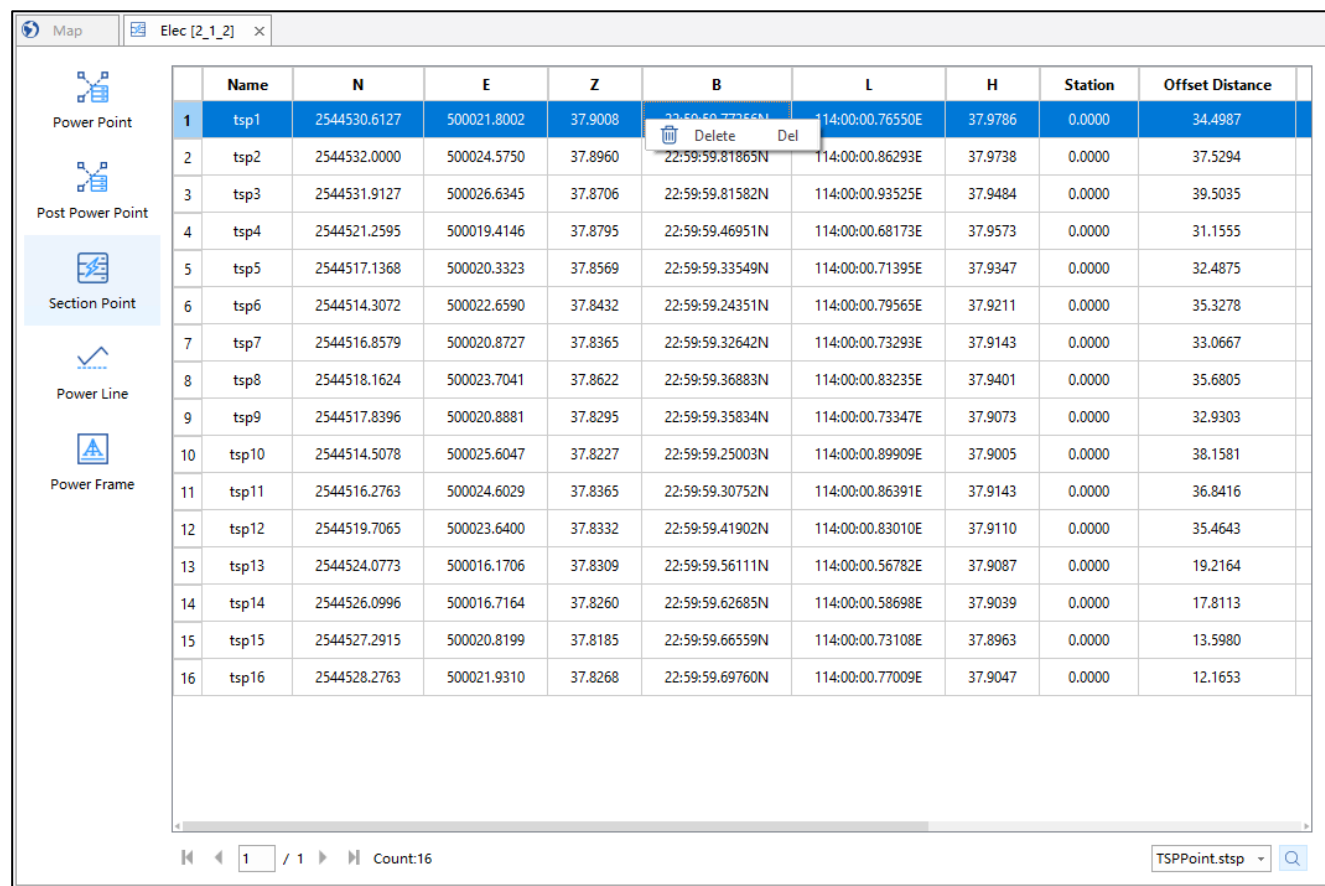
OK

Figure 7-4-8 Add Power Point-2

7.4.2 Section Point

1. Data Deletion

You can right-click any row of data through the section point list.



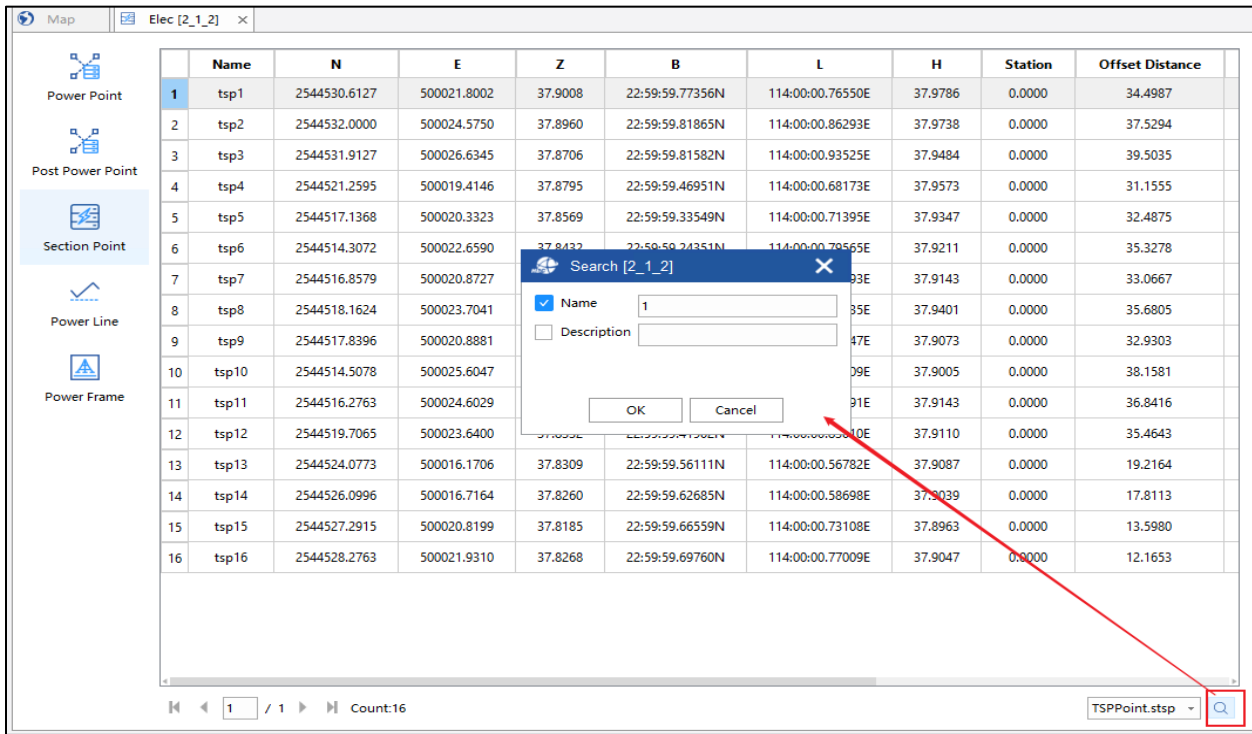
	Name	N	E	Z	B	L	H	Station	Offset Distance
1	tsp1	2544530.6127	500021.8002	37.9008	22:59:59.77255N	114:00:00.76550E	37.9786	0.0000	34.4987
2	tsp2	2544532.0000	500024.5750	37.8960	22:59:59.81865N	114:00:00.86293E	37.9738	0.0000	37.5294
3	tsp3	2544531.9127	500026.6345	37.8706	22:59:59.81582N	114:00:00.93525E	37.9484	0.0000	39.5035
4	tsp4	2544521.2595	500019.4146	37.8795	22:59:59.46951N	114:00:00.68173E	37.9573	0.0000	31.1555
5	tsp5	2544517.1368	500020.3323	37.8569	22:59:59.33549N	114:00:00.71395E	37.9347	0.0000	32.4875
6	tsp6	2544514.3072	500022.6590	37.8432	22:59:59.24351N	114:00:00.79565E	37.9211	0.0000	35.3278
7	tsp7	2544516.8579	500020.8727	37.8365	22:59:59.32642N	114:00:00.73293E	37.9143	0.0000	33.0667
8	tsp8	2544518.1624	500023.7041	37.8622	22:59:59.36883N	114:00:00.83235E	37.9401	0.0000	35.6805
9	tsp9	2544517.8396	500020.8881	37.8295	22:59:59.35834N	114:00:00.73347E	37.9073	0.0000	32.9303
10	tsp10	2544514.5078	500025.6047	37.8227	22:59:59.25003N	114:00:00.89909E	37.9005	0.0000	38.1581
11	tsp11	2544516.2763	500024.6029	37.8365	22:59:59.30752N	114:00:00.86391E	37.9143	0.0000	36.8416
12	tsp12	2544519.7065	500023.6400	37.8332	22:59:59.41902N	114:00:00.83010E	37.9110	0.0000	35.4643
13	tsp13	2544524.0773	500016.1706	37.8309	22:59:59.56111N	114:00:00.56782E	37.9087	0.0000	19.2164
14	tsp14	2544526.0996	500016.7164	37.8260	22:59:59.62685N	114:00:00.58698E	37.9039	0.0000	17.8113
15	tsp15	2544527.2915	500020.8199	37.8185	22:59:59.66559N	114:00:00.73108E	37.8963	0.0000	13.5980
16	tsp16	2544528.2763	500021.9310	37.8268	22:59:59.69760N	114:00:00.77009E	37.9047	0.0000	12.1653

Figure 7-4-9 Delete Section Point

Click [Delete] to delete data.

2. Data Search

Click the search icon in the lower right corner and enter the point name and description to search the data.



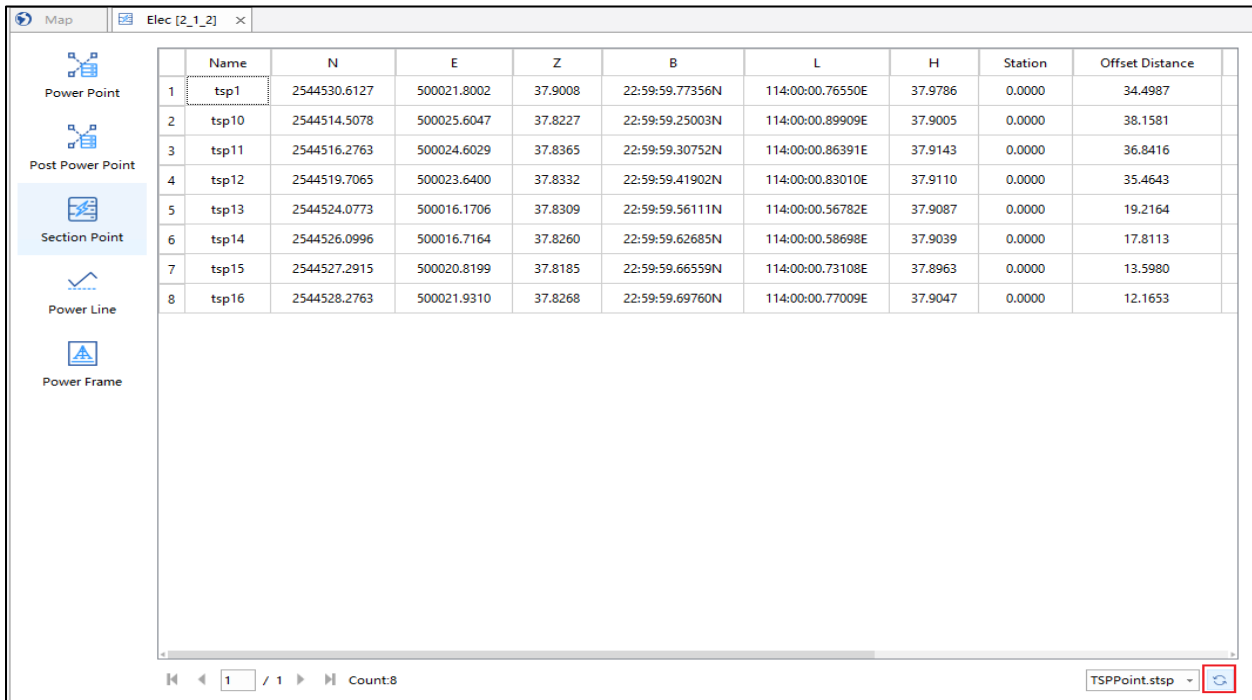
The screenshot shows the 'Elec [2_1_2]' window with a table of section points. A search dialog box is open, displaying the search criteria: Name: 1, Description: (empty). The dialog box has 'OK' and 'Cancel' buttons. A red arrow points to the search icon in the bottom right corner of the table area.

	Name	N	E	Z	B	L	H	Station	Offset Distance
1	tsp1	2544530.6127	500021.8002	37.9008	22:59:59.77356N	114:00:00.76550E	37.9786	0.0000	34.4987
2	tsp2	2544532.0000	500024.5750	37.8960	22:59:59.81865N	114:00:00.86293E	37.9738	0.0000	37.5294
3	tsp3	2544531.9127	500026.6345	37.8706	22:59:59.81582N	114:00:00.93525E	37.9484	0.0000	39.5035
4	tsp4	2544521.2595	500019.4146	37.8795	22:59:59.46951N	114:00:00.68173E	37.9573	0.0000	31.1555
5	tsp5	2544517.1368	500020.3323	37.8569	22:59:59.33549N	114:00:00.71395E	37.9347	0.0000	32.4875
6	tsp6	2544514.3072	500022.6590	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
7	tsp7	2544516.8579	500020.8727	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
8	tsp8	2544518.1624	500023.7041	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
9	tsp9	2544517.8396	500020.8881	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
10	tsp10	2544514.5078	500025.6047	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
11	tsp11	2544516.2763	500024.6029	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
12	tsp12	2544519.7065	500023.6400	37.8432	22:59:59.24851N	114:00:00.78565E	37.9211	0.0000	35.3278
13	tsp13	2544524.0773	500016.1706	37.8309	22:59:59.56111N	114:00:00.56782E	37.9087	0.0000	19.2164
14	tsp14	2544526.0996	500016.7164	37.8260	22:59:59.62685N	114:00:00.58698E	37.9039	0.0000	17.8113
15	tsp15	2544527.2915	500020.8199	37.8185	22:59:59.66559N	114:00:00.73108E	37.8963	0.0000	13.5980
16	tsp16	2544528.2763	500021.9310	37.8268	22:59:59.69760N	114:00:00.77009E	37.9047	0.0000	12.1653

Figure 7-4-10 Search Section Point

3. Data Refresh and Modify the Point Library

After data search, click refresh in the lower right corner to display all data.

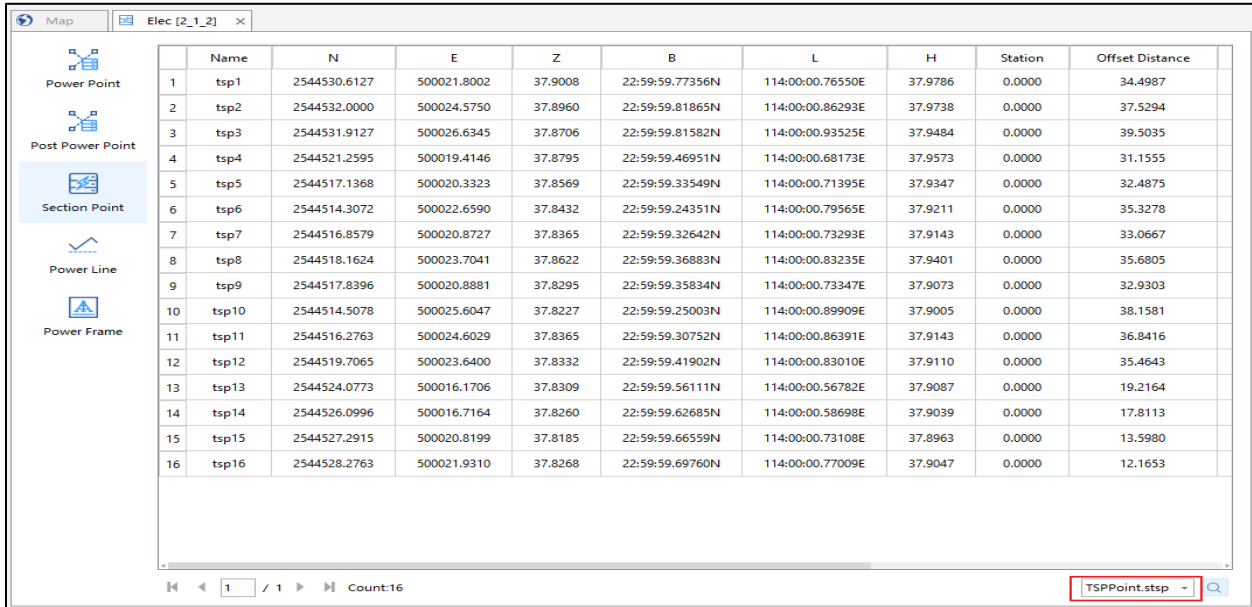


The screenshot shows the 'Elec [2_1_2]' window with a refreshed table of section points. The search dialog box is no longer present. The table now displays 8 rows of data. A red arrow points to the refresh icon in the bottom right corner of the table area.

	Name	N	E	Z	B	L	H	Station	Offset Distance
1	tsp1	2544530.6127	500021.8002	37.9008	22:59:59.77356N	114:00:00.76550E	37.9786	0.0000	34.4987
2	tsp10	2544514.5078	500025.6047	37.8227	22:59:59.25003N	114:00:00.89909E	37.9005	0.0000	38.1581
3	tsp11	2544516.2763	500024.6029	37.8365	22:59:59.30752N	114:00:00.86391E	37.9143	0.0000	36.8416
4	tsp12	2544519.7065	500023.6400	37.8332	22:59:59.41902N	114:00:00.83010E	37.9110	0.0000	35.4643
5	tsp13	2544524.0773	500016.1706	37.8309	22:59:59.56111N	114:00:00.56782E	37.9087	0.0000	19.2164
6	tsp14	2544526.0996	500016.7164	37.8260	22:59:59.62685N	114:00:00.58698E	37.9039	0.0000	17.8113
7	tsp15	2544527.2915	500020.8199	37.8185	22:59:59.66559N	114:00:00.73108E	37.8963	0.0000	13.5980
8	tsp16	2544528.2763	500021.9310	37.8268	22:59:59.69760N	114:00:00.77009E	37.9047	0.0000	12.1653

Figure 7-4-11 Refresh Section Point

Modify the point library file in the lower right corner to switch different section point files.



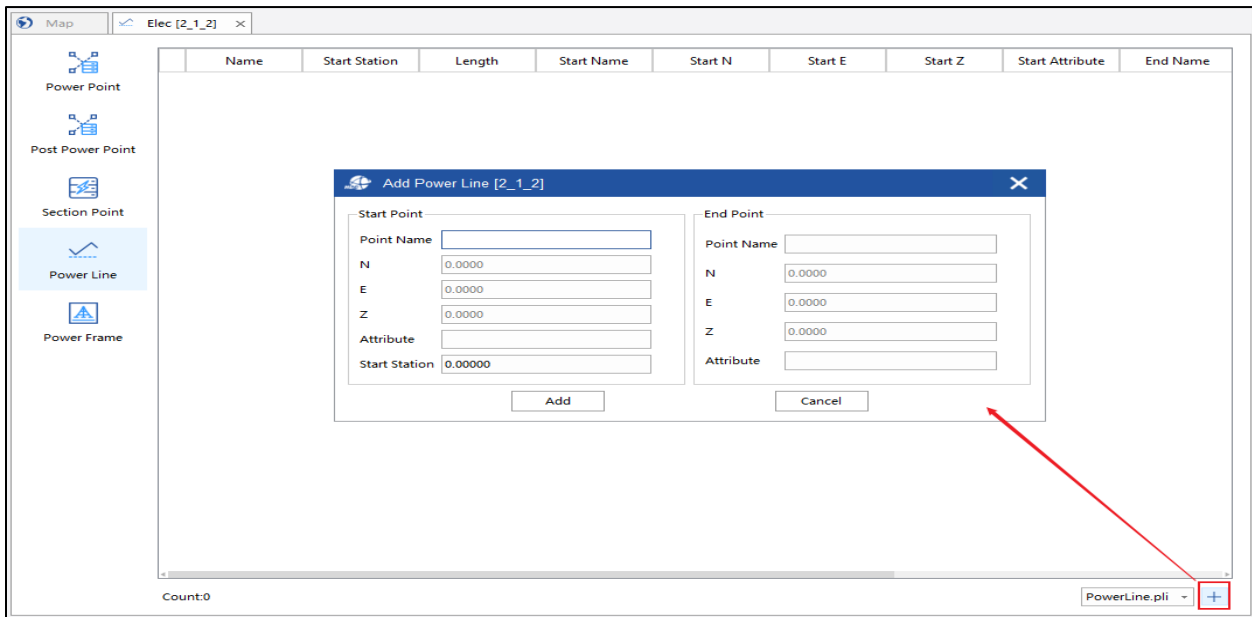
	Name	N	E	Z	B	L	H	Station	Offset Distance
1	tsp1	2544530.6127	500021.8002	37.9008	22:59:59.77356N	114:00:00.76550E	37.9786	0.0000	34.4987
2	tsp2	2544532.0000	500024.5750	37.8960	22:59:59.81865N	114:00:00.86293E	37.9738	0.0000	37.5294
3	tsp3	2544531.9127	500026.6345	37.8706	22:59:59.81582N	114:00:00.93525E	37.9484	0.0000	39.5035
4	tsp4	2544521.2595	500019.4146	37.8795	22:59:59.46951N	114:00:00.68173E	37.9573	0.0000	31.1555
5	tsp5	2544517.1368	500020.3323	37.8569	22:59:59.33549N	114:00:00.71395E	37.9347	0.0000	32.4875
6	tsp6	2544514.3072	500022.6590	37.8432	22:59:59.24351N	114:00:00.79565E	37.9211	0.0000	35.3278
7	tsp7	2544516.8579	500020.8727	37.8365	22:59:59.32642N	114:00:00.73293E	37.9143	0.0000	33.0667
8	tsp8	2544518.1624	500023.7041	37.8622	22:59:59.36883N	114:00:00.83235E	37.9401	0.0000	35.6805
9	tsp9	2544517.8396	500020.8881	37.8295	22:59:59.35834N	114:00:00.73347E	37.9073	0.0000	32.9303
10	tsp10	2544514.5078	500025.6047	37.8227	22:59:59.25003N	114:00:00.89909E	37.9005	0.0000	38.1581
11	tsp11	2544516.2763	500024.6029	37.8365	22:59:59.30752N	114:00:00.86391E	37.9143	0.0000	36.8416
12	tsp12	2544519.7065	500023.6400	37.8332	22:59:59.41902N	114:00:00.83010E	37.9110	0.0000	35.4643
13	tsp13	2544524.0773	500016.1706	37.8309	22:59:59.56111N	114:00:00.56782E	37.9087	0.0000	19.2164
14	tsp14	2544526.0996	500016.7164	37.8260	22:59:59.62685N	114:00:00.58698E	37.9039	0.0000	17.8113
15	tsp15	2544527.2915	500020.8199	37.8185	22:59:59.66559N	114:00:00.73108E	37.8963	0.0000	13.5980
16	tsp16	2544528.2763	500021.9310	37.8268	22:59:59.69760N	114:00:00.77009E	37.9047	0.0000	12.1653

Figure 7-4-12 Modify the Section Point Library File

7.4.3 Guide

1. Data Addition and Editing

You can right-click [add] in the auxiliary line list or click the [add] button in the lower right corner, and enter the starting point coordinates and ending point coordinates to complete the addition of auxiliary lines.



Name	Start Station	Length	Start Name	Start N	Start E	Start Z	Start Attribute	End Name
------	---------------	--------	------------	---------	---------	---------	-----------------	----------

Figure 7-4-13 Add Power Point

You can double-click any row of data in the auxiliary line list to enter the auxiliary line details page for editing. You can modify the start point name, start Nez coordinate, start attribute, start mileage, end point name, end Nez coordinate and end attribute.

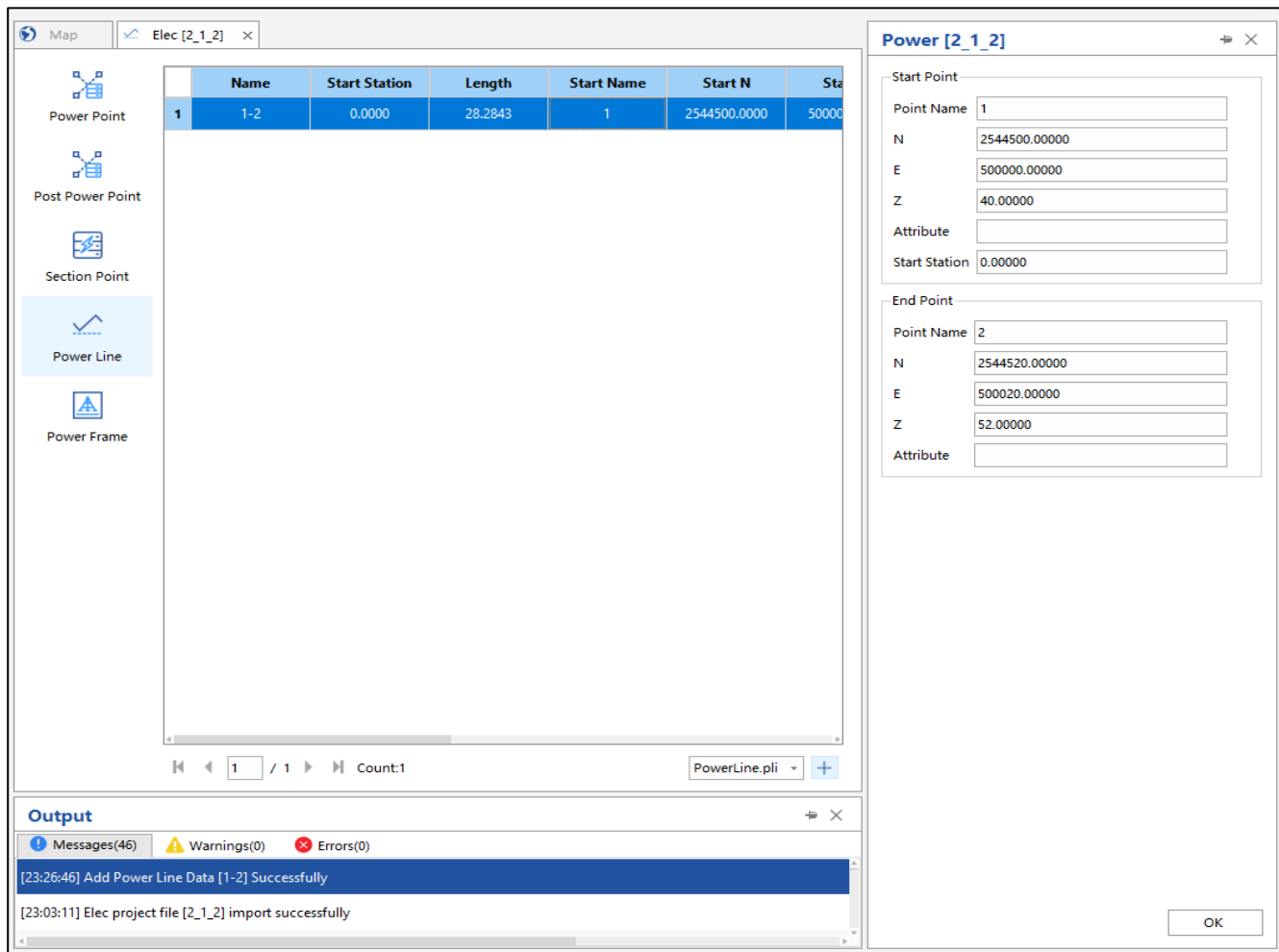


Figure 7-4-14 Edit Power Point

2. Data Deletion

You can right-click any row of data in the guide line list.

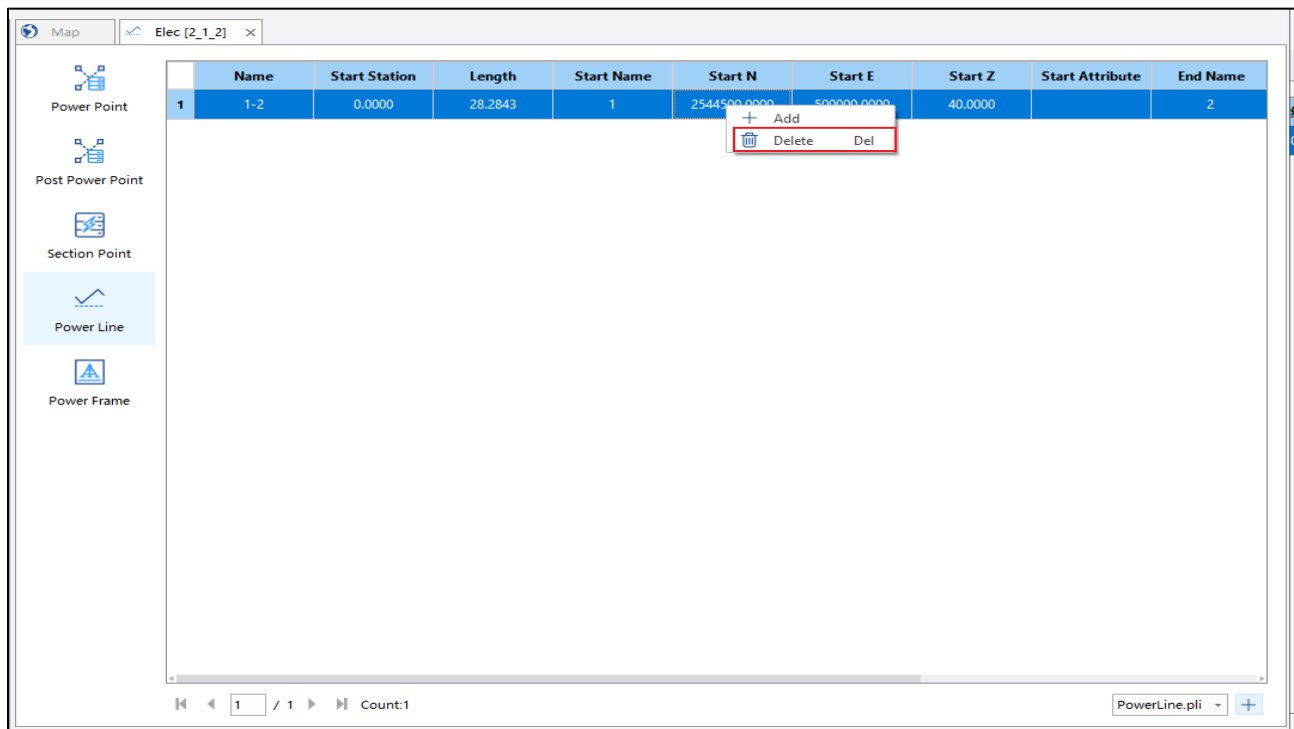


Figure 7-4-15 Delete Power Line

Click [delete] to delete data.

Modify the lower right corner point library file to switch different guide line files.

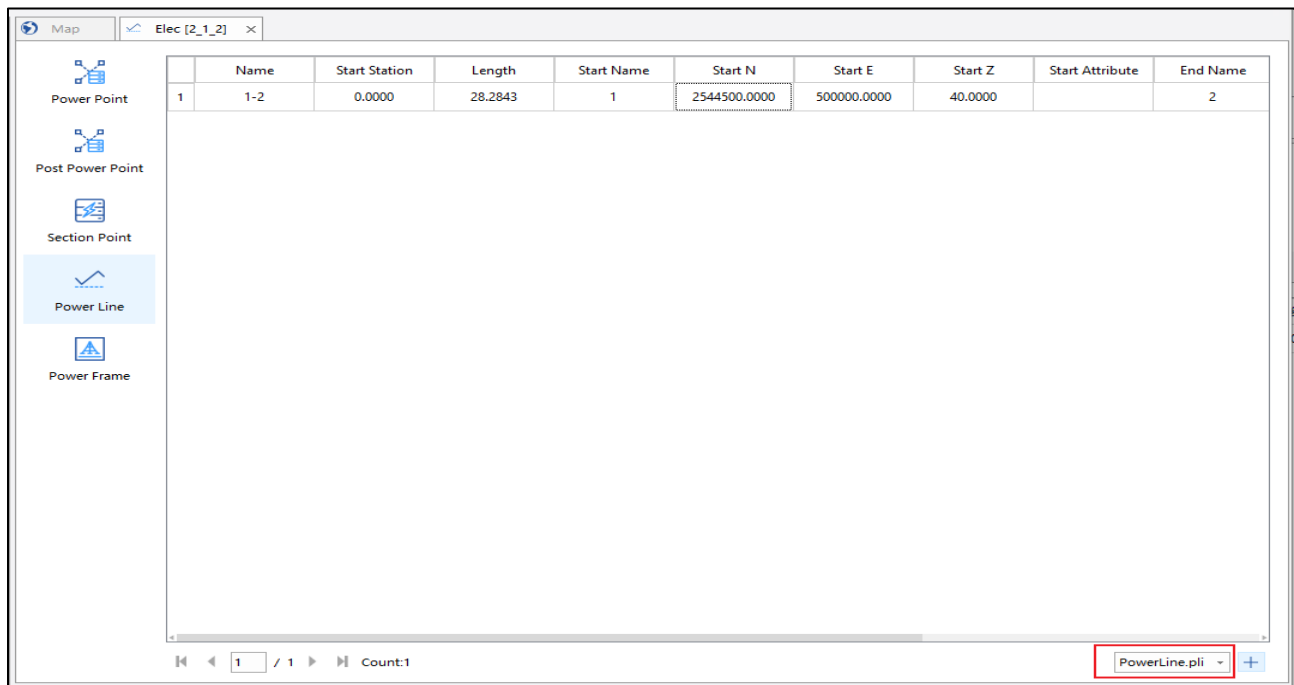


Figure 7-4-16 Modify Power Line Library File

7.4.4 Power Frame

1. Data Deletion

You can right-click any row of data in the power frame list.

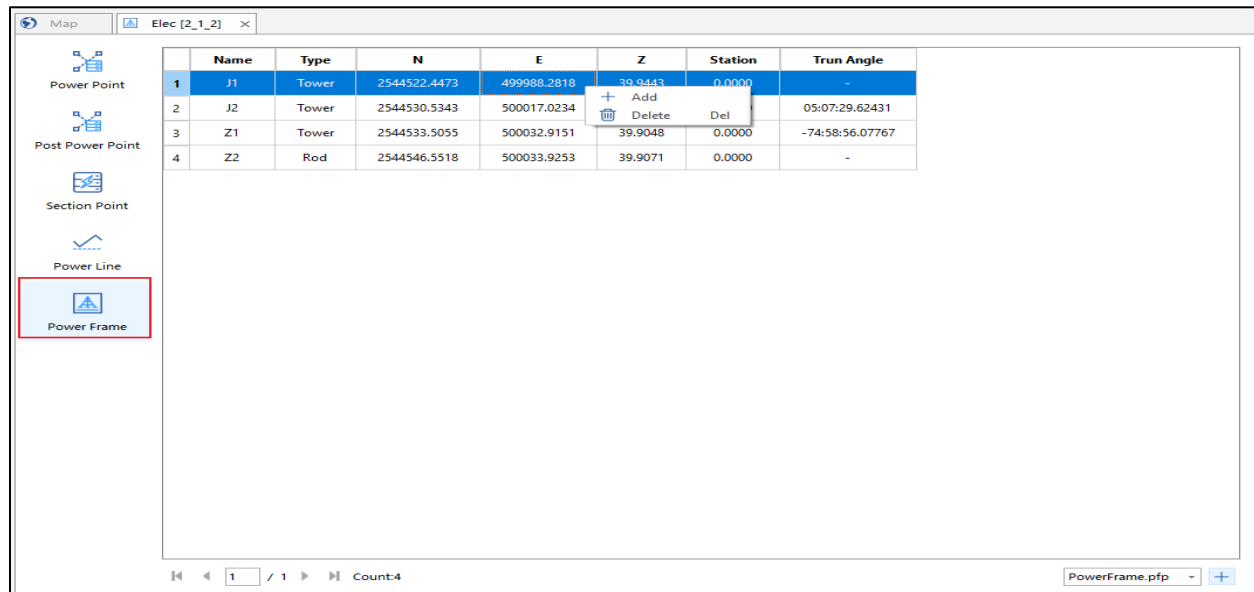


Figure 7-4-17 Delete Power Frame

Click [Delete] to delete data.

Modify the library file at the lower right corner to switch between different power frame files.

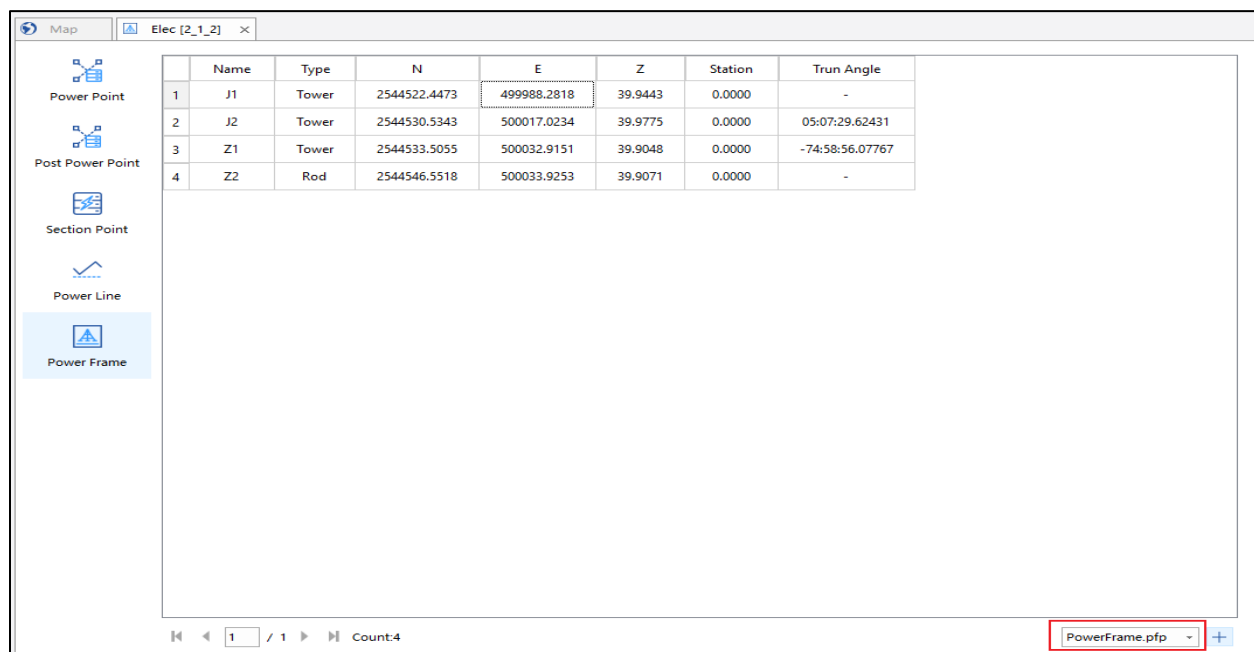


Figure 7-4-18 Modify Power Frame Library File

2. Data Addition

Right click the [Add] button or click the [Add] button in the lower right corner to add the power tower, select the pile position type in the pile position information, input the point name, coordinates and mileage value and set the parameters.

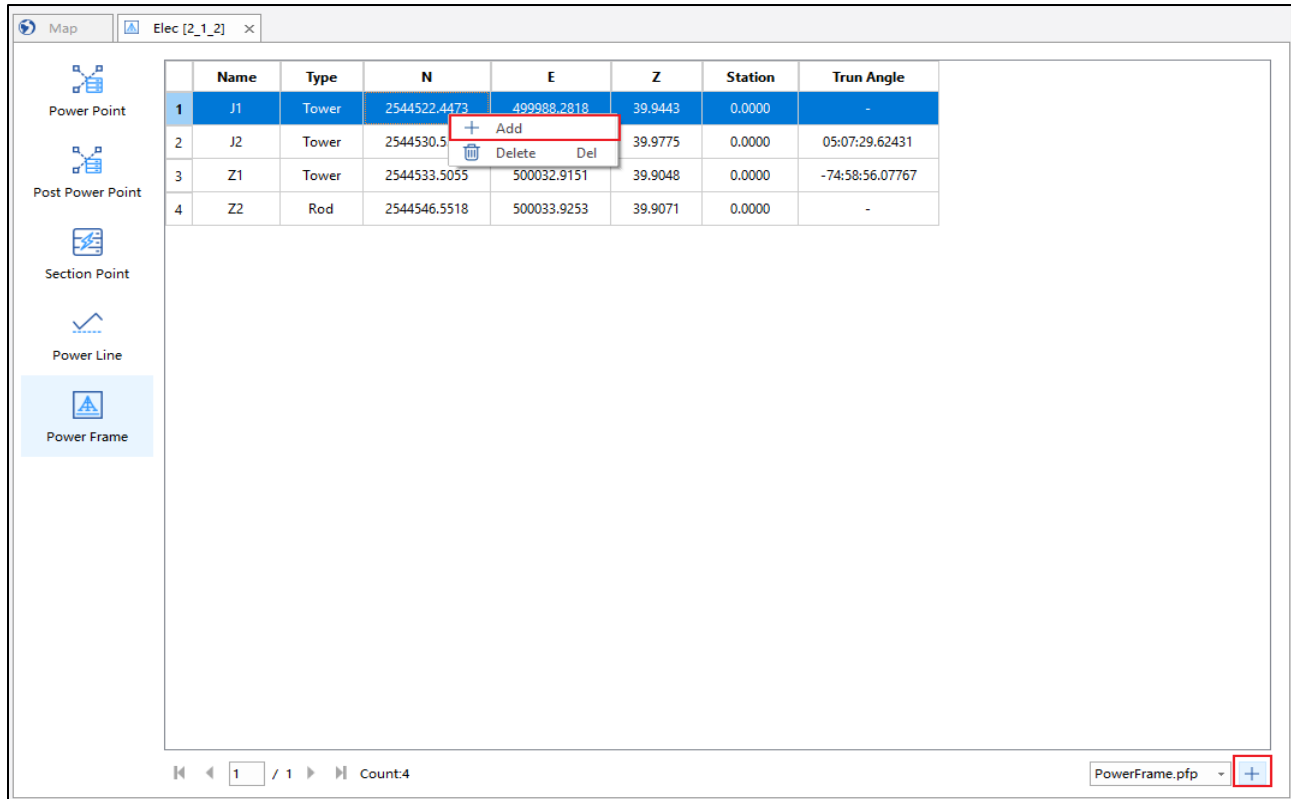


Figure 7-4-19 Add Power Frame

Take the tower as an example: select the type of tower, enter the point name, coordinates, mileage, and enter the tower base parameters (all entered here are half root open, that is, half the length and width).

There are three types of towers: square tower, rectangular tower and square tower [omnidirectional]. For square tower, the value of half root opening a must be entered, and for rectangular tower, the value of half root opening a and B must be entered. The value of half root opening must be greater than 0. When it is less than or equal to 0, adding tower will prompt error. If pile feet need to be added, the included angle can only be less than 45°. Set the included angle between the newly added pile foot line and the original pile foot line in the 'Add Power Frame' edit box.

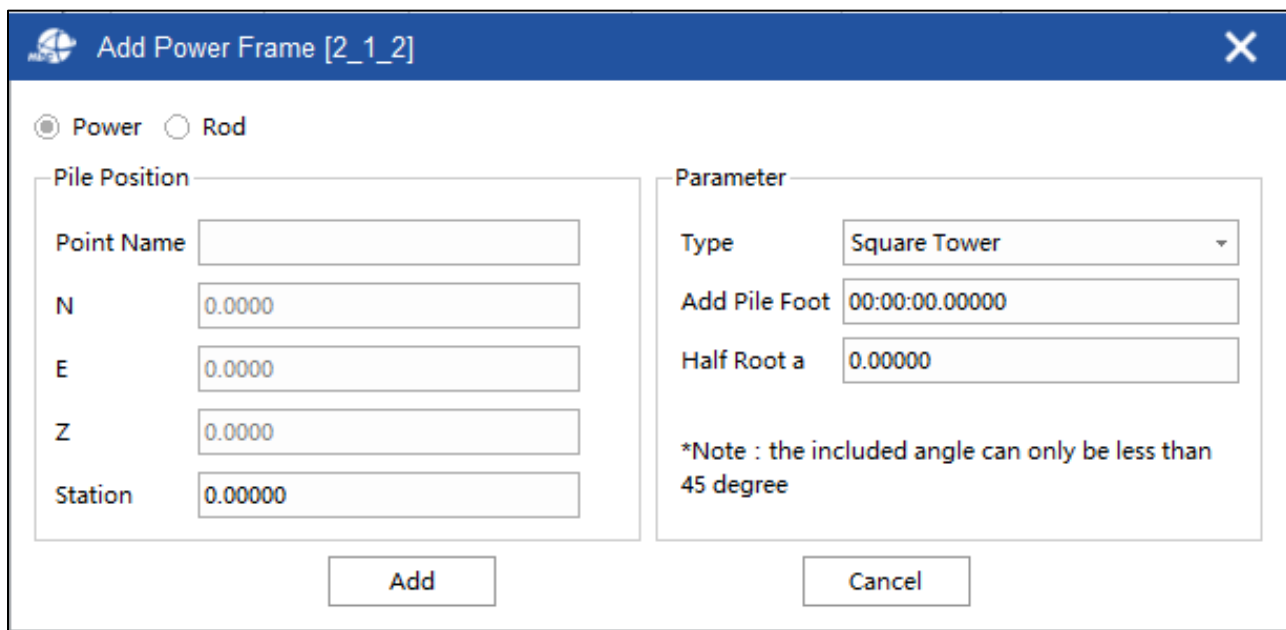


Figure 7-4-20 Add Power Frame-power

Take the pole as an example: input the point name, coordinates and mileage, and input the pole parameters: left width, right width, deflection angle to the ground and call height.

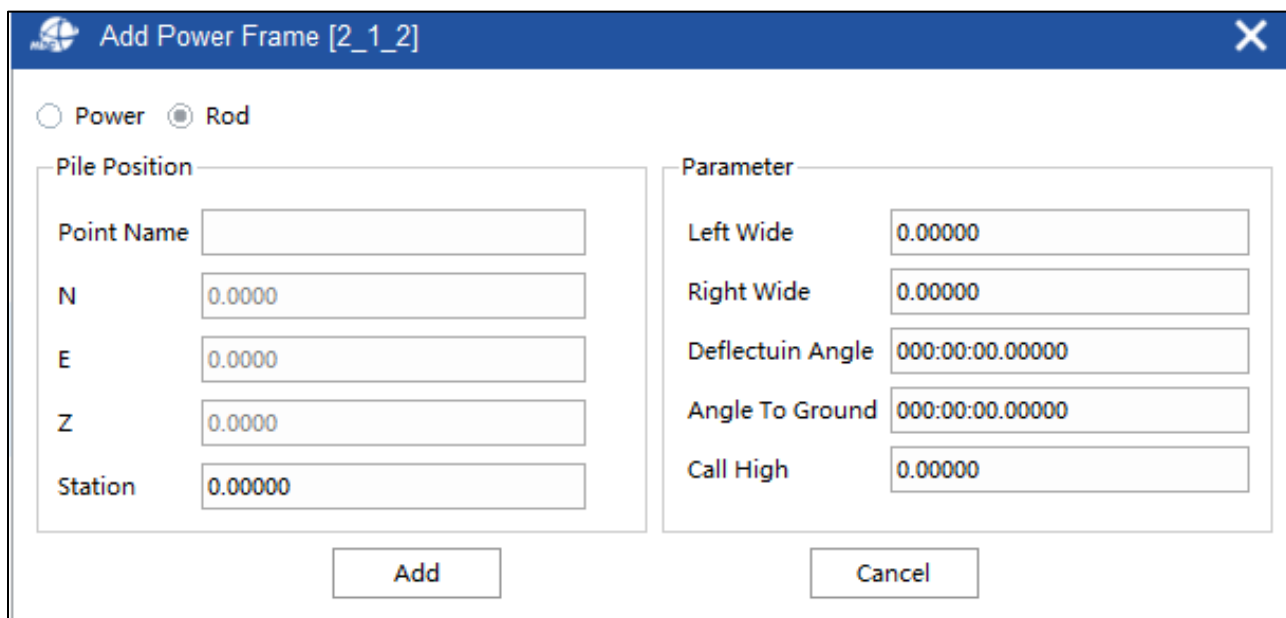


Figure 7-4-21 Add Power Frame-rod

3. Data Editing

You can double-click any row of data in the auxiliary line list to enter the auxiliary line details page for editing, and you can modify the tower type, pile position and parameter data.

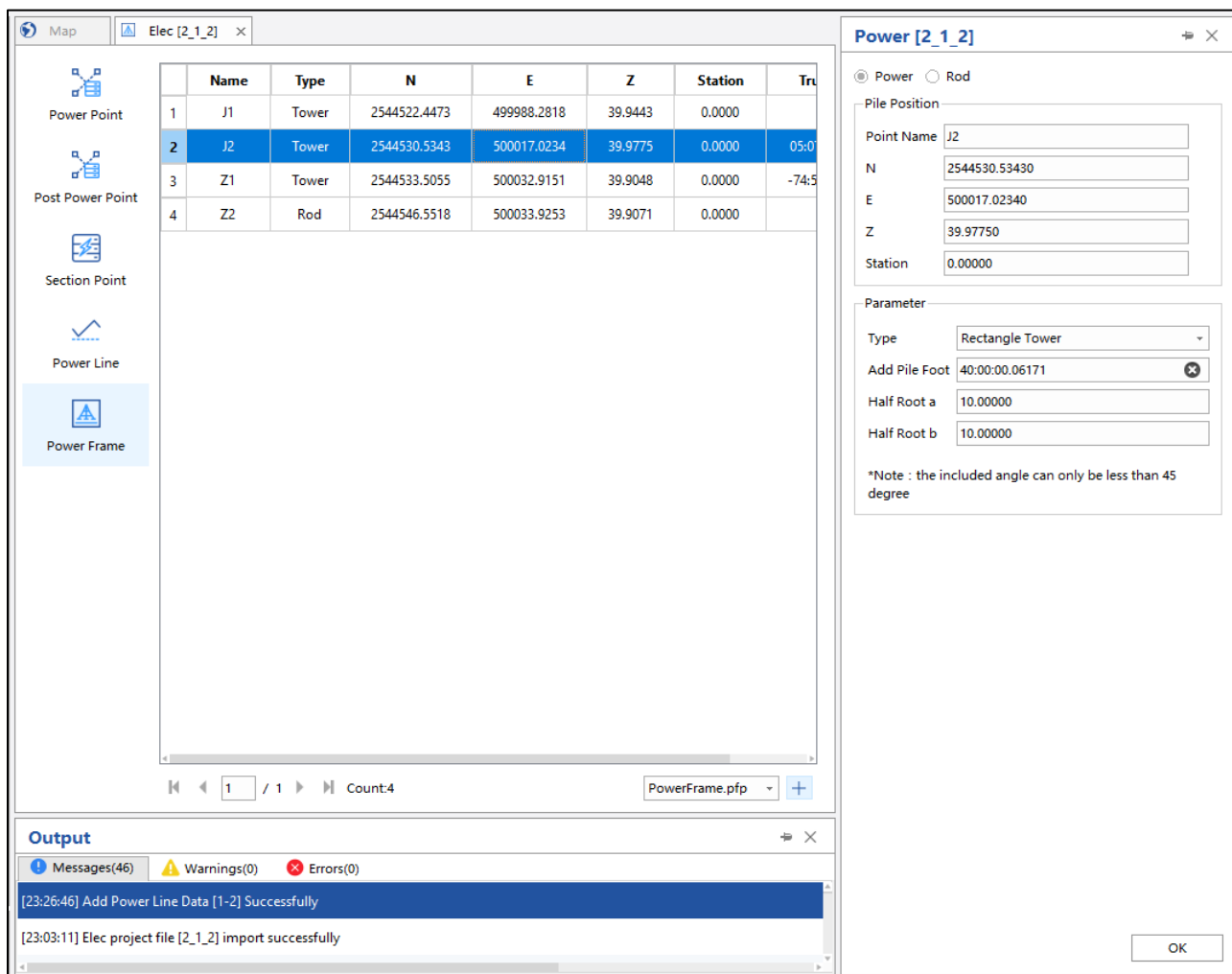


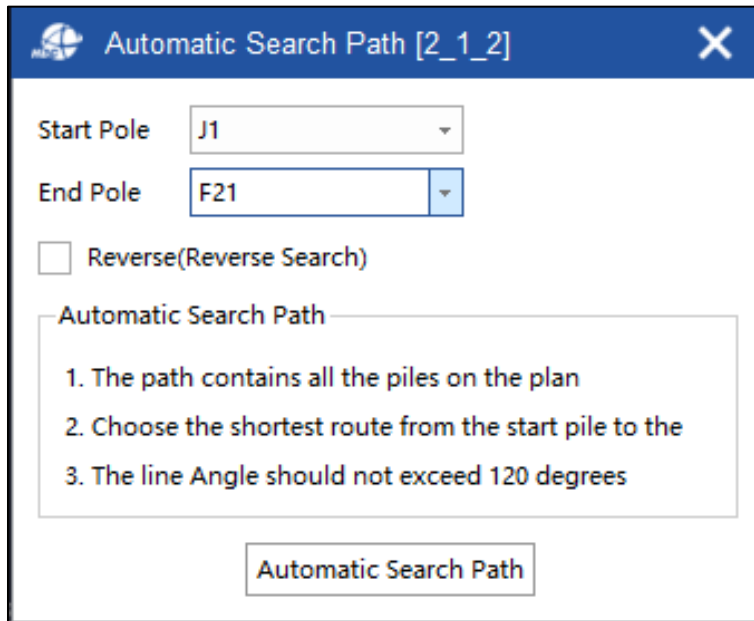
Figure 7-4-22 Edit Power Frame

7.5 Elec Point Processing

Note: At present, only power point data processing in Dao Heng format is supported.

1. Automatic Search Path

The automatic search path is that the software automatically sorts the path according to the imported data. The path includes all piles on the plan. The shortest line from the starting pile to the ending pile is preferred, and the line angle does not exceed 120 degrees.



The image shows a software dialog box titled "Automatic Search Path [2_1_2]". It features a blue header bar with a small icon on the left and a close button (X) on the right. The main area is white and contains the following elements: a "Start Pole" dropdown menu with "J1" selected, an "End Pole" dropdown menu with "F21" selected, an unchecked checkbox labeled "Reverse(Reverse Search)", and a text box titled "Automatic Search Path" containing three numbered instructions: "1. The path contains all the piles on the plan", "2. Choose the shortest route from the start pile to the", and "3. The line Angle should not exceed 120 degrees". At the bottom center is a button labeled "Automatic Search Path".

Figure 7-5-1 Automatic Search Path

Click the [automatic search path] icon in the menu bar to pop up the automatic search path window, select the start pile and end pile, set the automatic search path, and then pop up the prompt box for successful search after the software search, and calculate the path length. After clicking [OK], you can see the automatically searched paths on the map and sort them manually according to the actual situation.

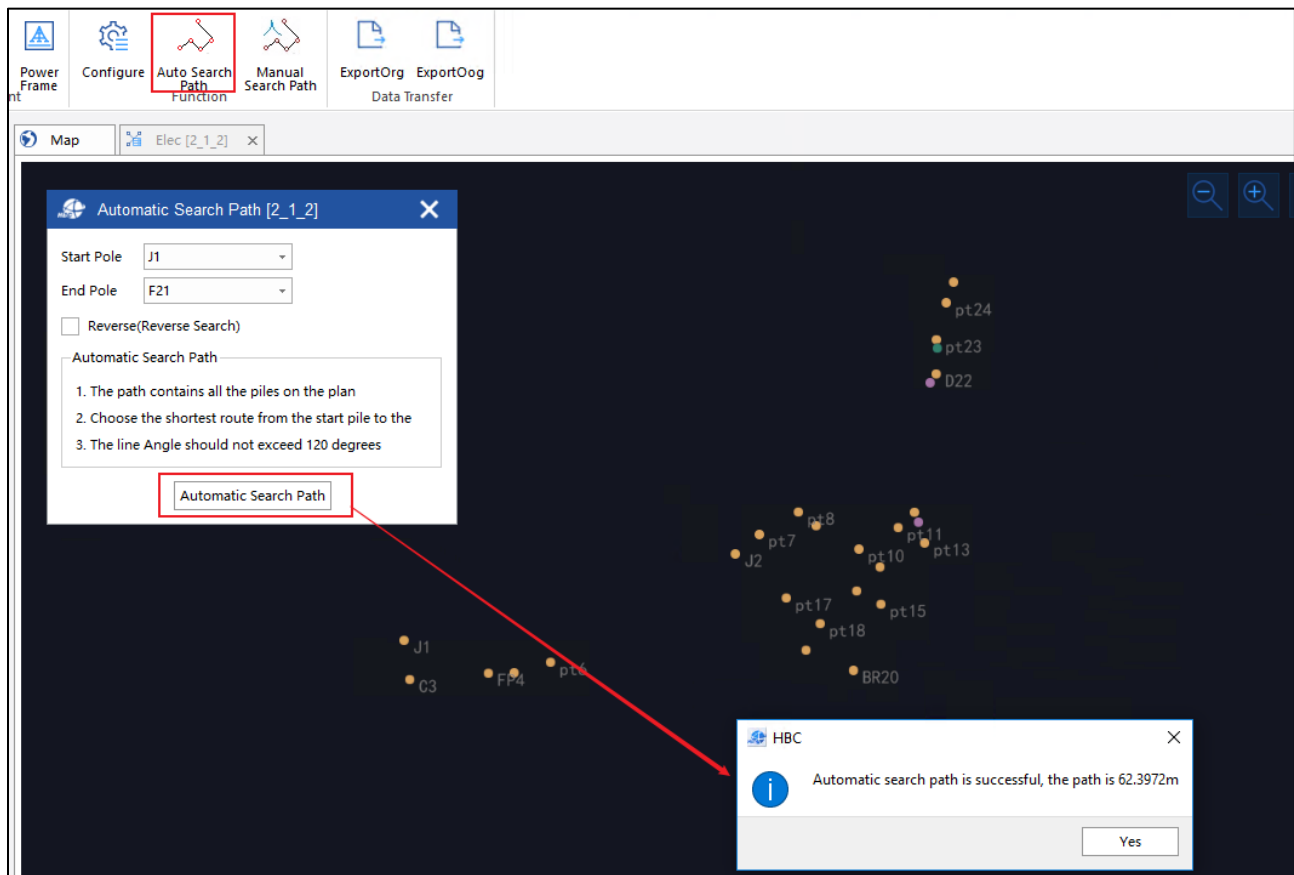


Figure 7-5-2 Automatic Search Path Result



Figure 7-5-3 Automatic Search Path Result

When automatically searching the path, a prompt box will pop up if the mileage is negative. Click [OK] to delete the point, and click [Cancel] to keep it.

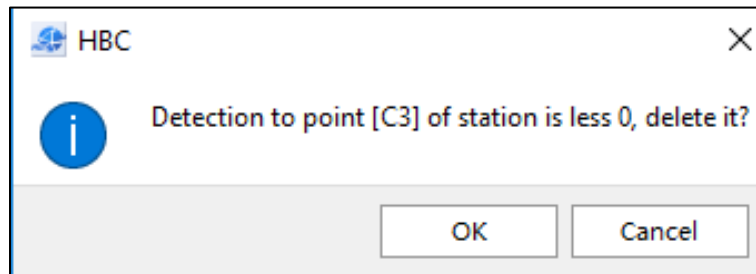


Figure 7-5-4 Delete the Point of Negative Mileage

After the software searches, the points in the list will be renamed according to the order of the path, and the interval of each point can be viewed in the 'Range' column.

	Name	Origin Name	Collection Type	Across Things	Station	Offset Distance	N	E	Z	B	L	H	Fore Section Point	Back Section Point	Range
1	J1	J1	测点	-	0.0000	0.0000	2544522.4473	499988.2818	39.9443	22:59:59.50812N	113:59:59.58852E	39.9438			***
2	1	FP4	风偏点	-	6.2126	-4.9400	2544519.3746	499995.6002	37.9012	22:59:59.40823N	113:59:59.84550E	37.9027			J1-J2
3	2	pt5	一点测电力线, ...	220V电力线	8.3759	-5.5045	2544519.4172	499997.8355	37.9434	22:59:59.40962N	113:59:59.92399E	37.9449			J1-J2
4	3	pt6	一点测路、河、...	小坎路	11.6804	-5.4125	2544520.4008	500000.9916	37.9352	22:59:59.44159N	114:00:00.03482E	37.9367			J1-J2
5	J2	J2	测点	-	29.8576	0.0000	2544530.5343	500017.0234	39.9775	22:59:59.77101N	114:00:00.59776E	39.9791			***
6	4	pt7	两点测电力线, ...	220V电力线	32.3612	1.1880	2544532.3560	500019.1116	37.8908	22:59:59.83023N	114:00:00.67109E	37.8923			J1-J2
7	5	pt17	三点测路、河、...	小坎路	33.0001	-5.1656	2544526.4129	500021.4475	37.8067	22:59:59.63703N	114:00:00.75311E	37.8083	pt16		J1-J2
8	6	BL19	左边测点	-	33.3237	-10.3281	2544521.5310	500023.1573	37.7775	22:59:59.47833N	114:00:00.81315E	37.7790			J1-J2
9	7	pt18	三点测路、河、...	小坎路	35.1823	-8.2742	2544524.0116	500024.3901	37.7976	22:59:59.55897N	114:00:00.85644E	37.7992	pt17	pt16	J1-J2
10	8	pt8	两点测电力线, ...	220V电力线	36.1861	2.2934	2544534.4560	500022.4941	37.9032	22:59:59.89849N	114:00:00.78986E	37.9047	pt7		J1-J2
11	9	BR20	右边测点	-	36.7751	-13.2627	2544519.6409	500027.2745	37.7748	22:59:59.41689N	114:00:00.95772E	37.7763			J1-J2
12	10	pt9	两点测路、河、...	小坎路	37.3234	0.6423	2544533.1747	500024.0361	37.8747	22:59:59.85684N	114:00:00.84401E	37.8763			J1-J2
13	11	pt16	三点测路、河、...	小坎路	39.0555	-6.1861	2544527.0707	500027.5530	37.8380	22:59:59.65841N	114:00:00.96750E	37.8395			J1-J2
14	12	pt10	两点测路、河、...	小坎路	40.3044	-2.4717	2544530.9845	500027.7491	37.8577	22:59:59.78564N	114:00:00.97439E	37.8593	pt9		J1-J2
15	13	pt15	三点测电力线	220V电力线	40.7456	-7.9488	2544525.8316	500029.6573	37.8281	22:59:59.61813N	114:00:01.04139E	37.8296	pt14	pt13	J1-J2
16	14	pt14	三点测电力线	220V电力线	41.6114	-4.5773	2544529.3116	500029.5776	37.8164	22:59:59.73126N	114:00:01.03859E	37.8179	pt13		J1-J2
17	15	pt11	两点测路、河、...	小坎路	44.1261	-1.4542	2544532.9991	500031.1524	37.8560	22:59:59.85113N	114:00:01.09389E	37.8575			J1-J2
18	16	pt12	两点测路、河、...	小坎路	45.8759	-0.4564	2544534.4335	500032.5665	37.8828	22:59:59.89776N	114:00:01.14355E	37.8844	pt11		J1-J2
19	17	pt13	三点测电力线	220V电力线	45.9466	-3.4571	2544531.5641	500033.4473	37.8515	22:59:59.80448N	114:00:01.17448E	37.8531			J1-J2
20	21	21	测点	-	46.0247	0.0000	2544533.5055	500033.0151	39.0048	22:59:59.86758N	114:00:01.15570E	39.0063			J1-J2

Figure 7-5-5 Post Power Point List

2. Manually Arrange Paths

The manual arrangement path is a supplement to the automatic arrangement. If some points in the automatic arrangement path do not meet the actual requirements, they need to be adjusted manually. Click the 'manual arrangement path' icon in the menu bar to pop up the manual arrangement path window. In the pop-up current path list, the points with a corner greater than 90 degrees will be highlighted and adjusted by moving up or down until the requirements are met.

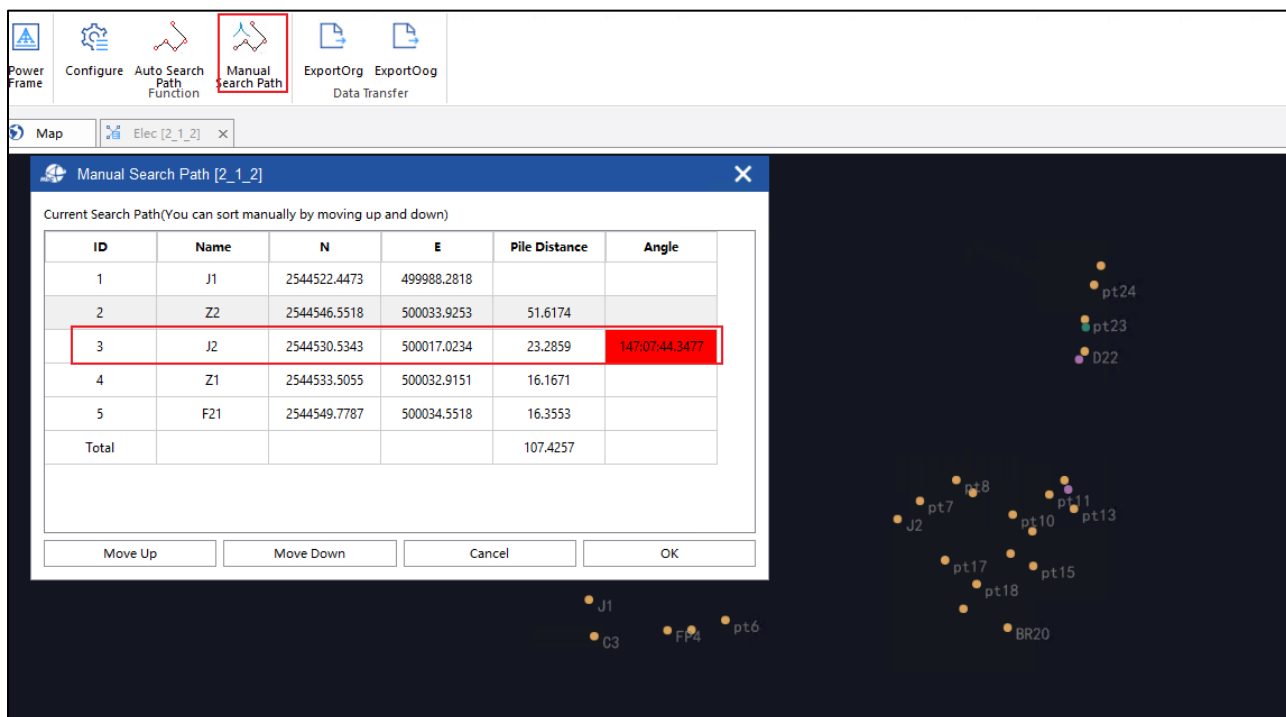


Figure 7-5-6 Manual Search Path

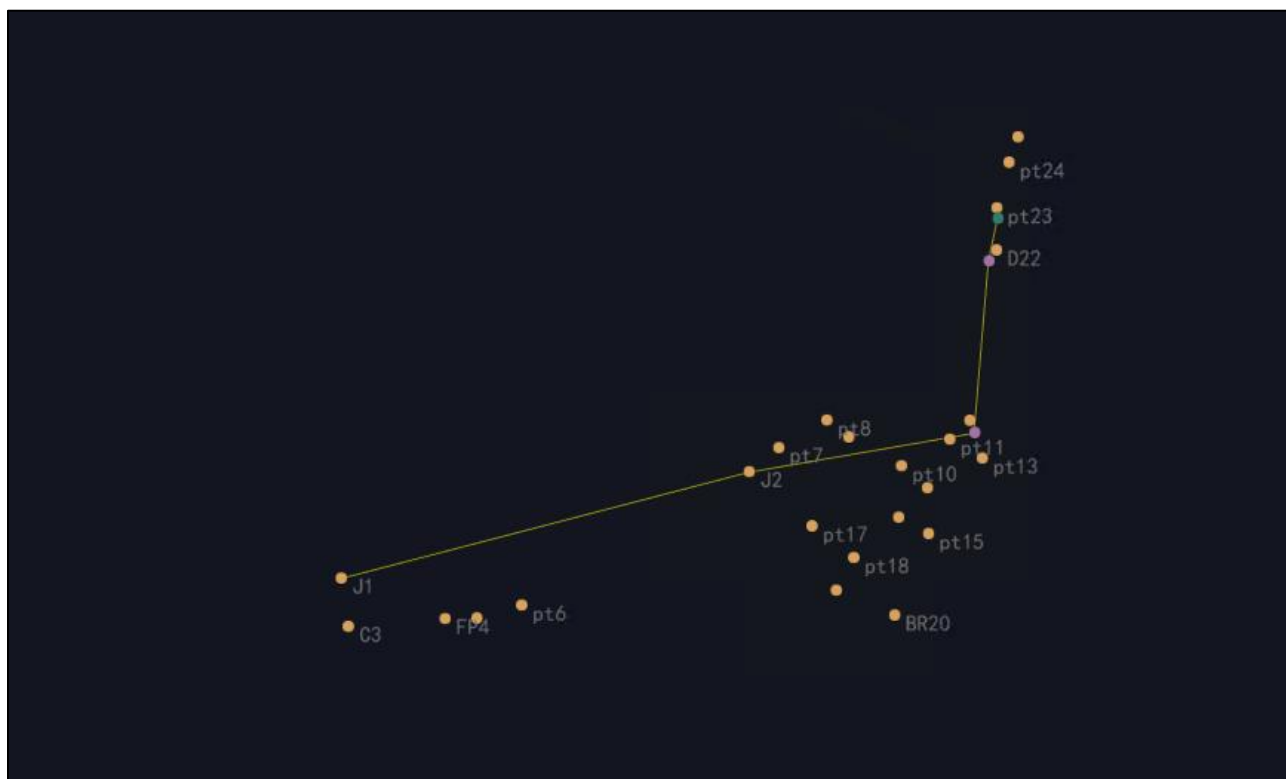


Figure 7-5-7 Manual Search Path Result

7.6 Export

1. Export OOG

To export OOG format, mileage values of all power points need to be calculated. After the file is imported, use path sorting, and use the method of 'automatic search path' and 'manual arrangement path'. After the path search is successful, ensure that the mileage is correct and export the OOG file.

If there is no j-pile or the coordinates of j-pile are wrong, you need to edit j-pile. After editing, you need to re sort the path, check the 'mileage' column of the list to ensure that the mileage of all power points is processed, and then you can export OOG format files.

After successful export, a *. oog file.

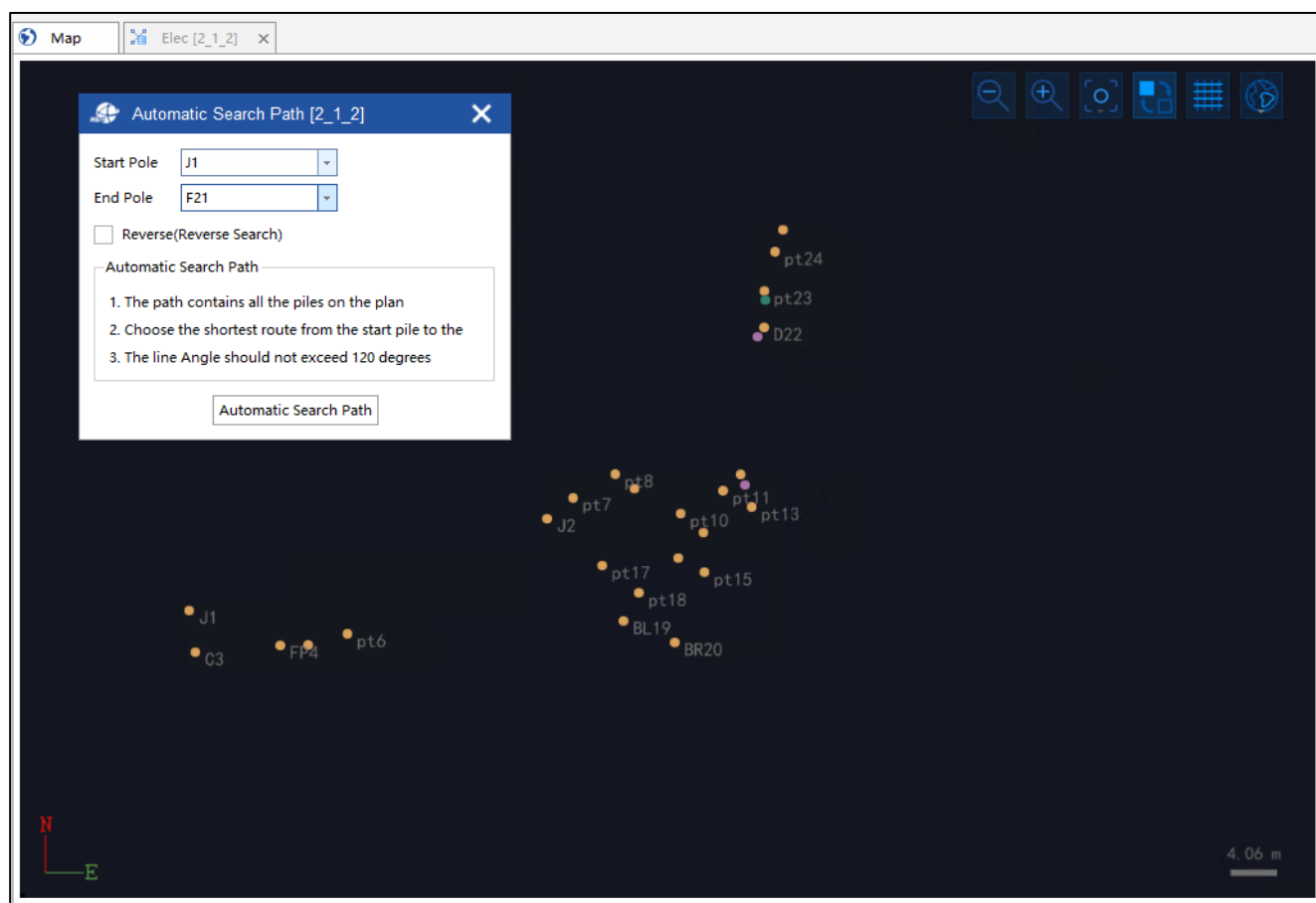


Figure 7-6-1 Automatic Search Path

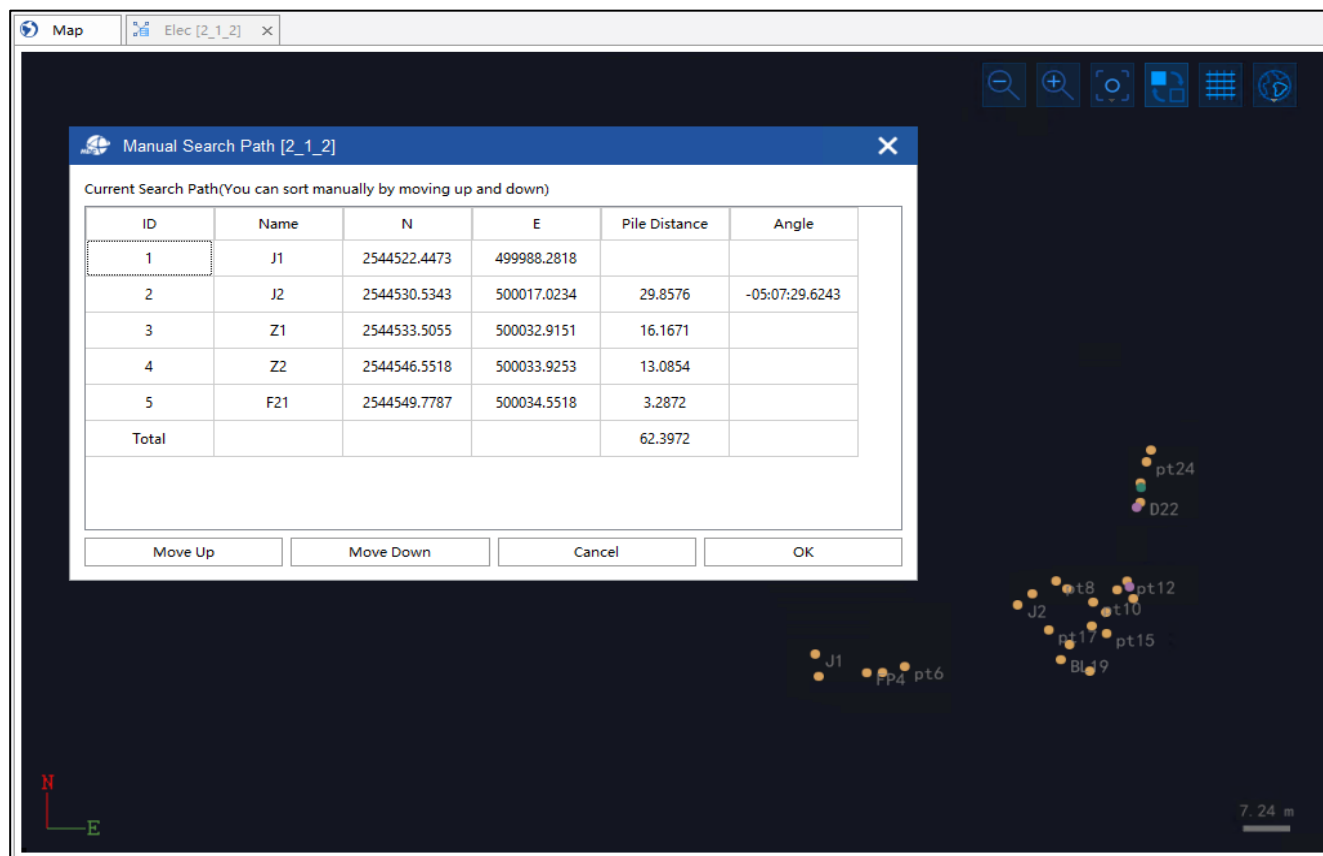


Figure 7-6-2 Manual Search Path

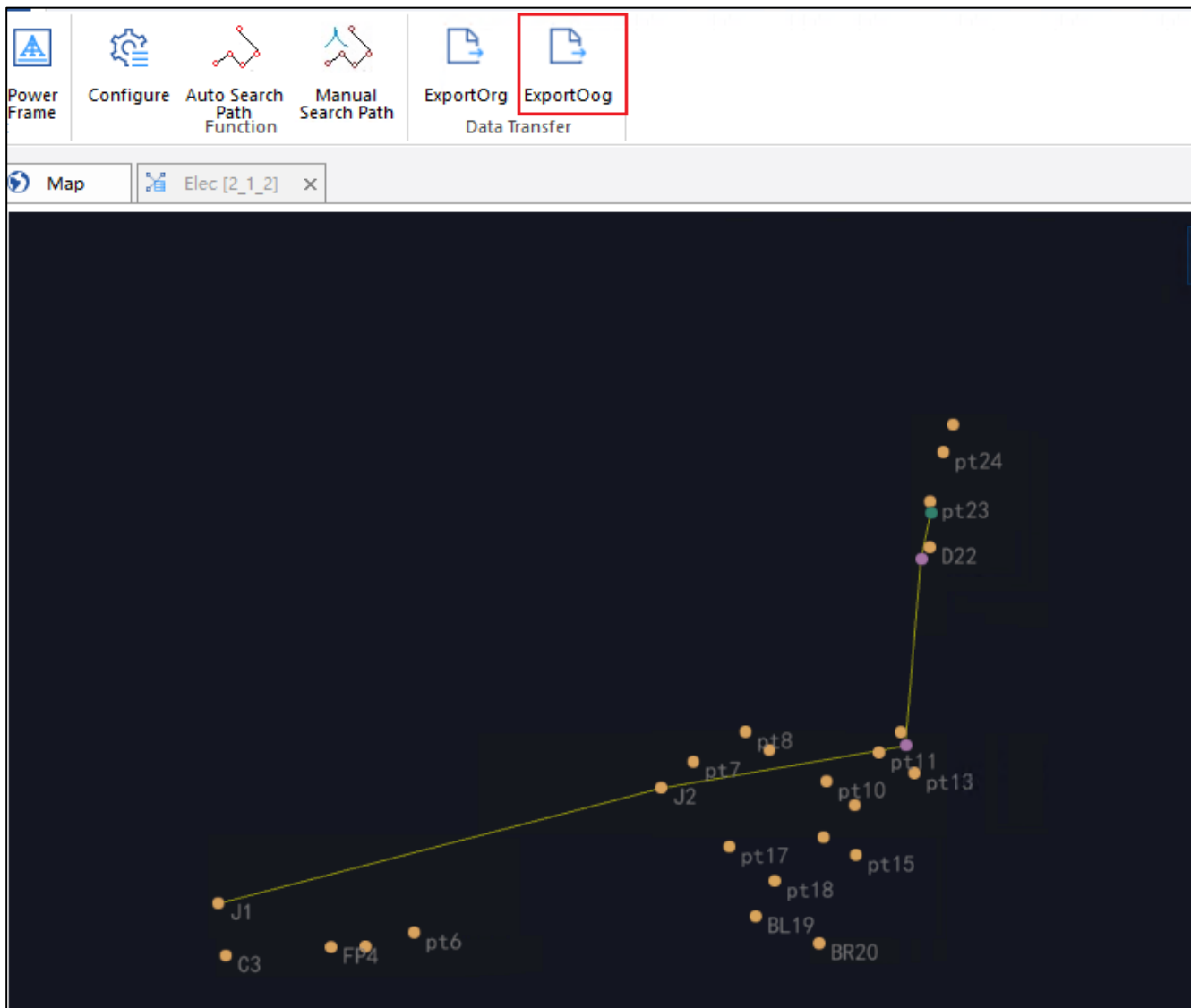


Figure 7-6-3 ExportOog

The exported OOG format file can be opened using Dao Heng SLCAD software.

2. Export ORG

Section points can be exported and can be exported as Dao Heng section files (*. ORG).

	Power Frame		Configure		Auto Search Path Function		Manual Search Path		ExportOrg		ExportOog		Data Transfer
	Map		Elec [2_1_2]										
	Power Point												
	Post Power Point												
	Section Point												
	Power Line												
	Power Frame												

Figure 7-6-4 ExportOrg

The exported file can be opened normally with SLCAD software, that is, the org format is exported successfully.

TSPFileExportWidget [2_1_2]

File

org_121000

DH Cross File(*.org)

FilePath

C:/Users/zhdgps/Documents/HBC/Out

Horizontal Scale

1:200

Vertical Scale

1:200

☐ Show fine millimeter style

☒ ABCD four feet in the same picture

Multiplication factor

0.707

Explore to

Ok

Cancel

Figure 7-6-5 Export

Chapter 8

Total Station

This chapter contains:

- Open
- Save
- Save As
- Attribution Configuration
- Tolerance Calculations
- Data
- Parity Report

8.1 Open

1.Total Station Module Main Interface

After completing the HBC project creation, click the [Import] button at the top to import the total station data file or click the sidebar [Project Management]->[Import Data File] and the interface is as follows.

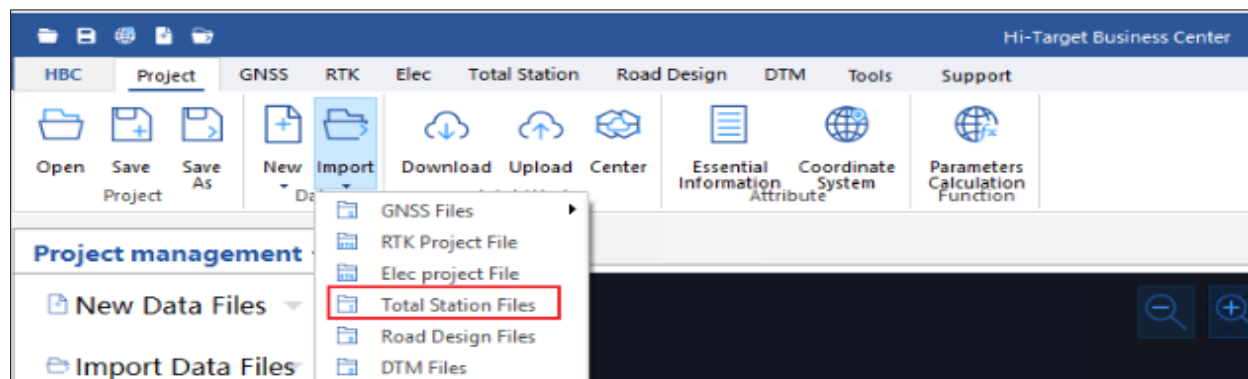


Figure 8-1-1 Total Station Files

2.Open Existing Total Station Data

Click the sidebar [Project Management] under the [Import Data File] button or the top bar [Import Data File], import [Total Station Data File], select the total station data storage path, double-click the corresponding file with the mouse or click the file and click [OK], after the success of the open software at the bottom of the information column prompt to open successful information. (Current software support to open the 'Hi-target total station data file(*.htf,*.txt)' 'Keshu traverse file (*.IN2)' 'coordinate data point file(*.dat)').

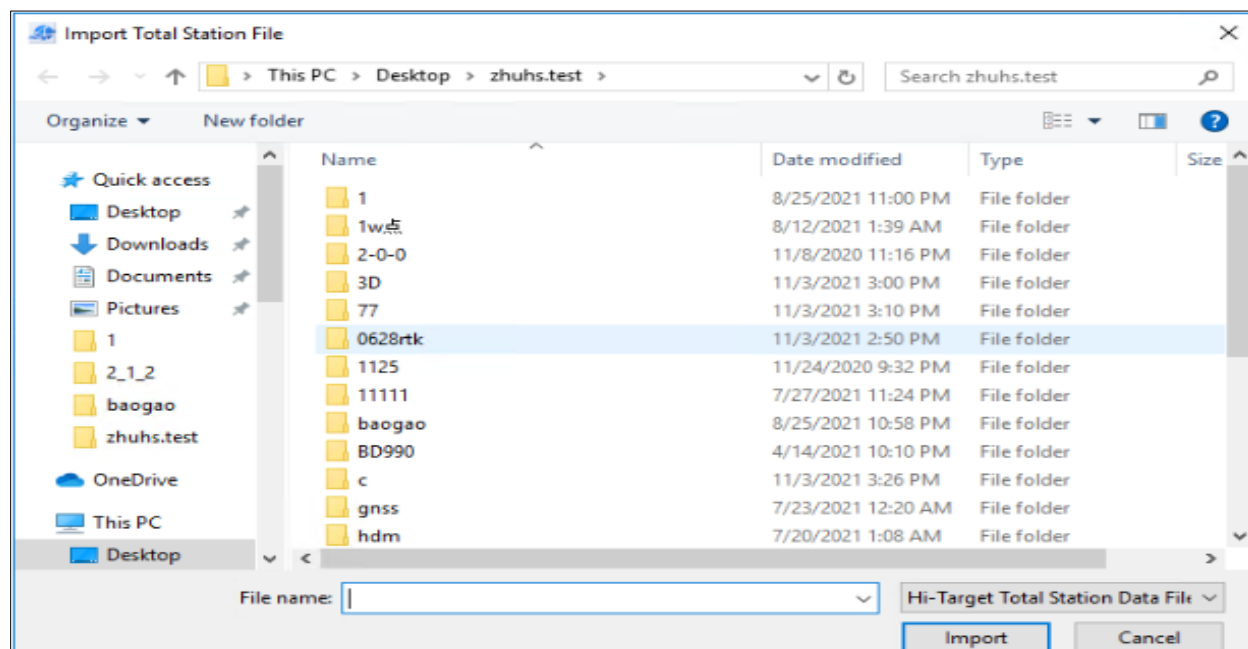
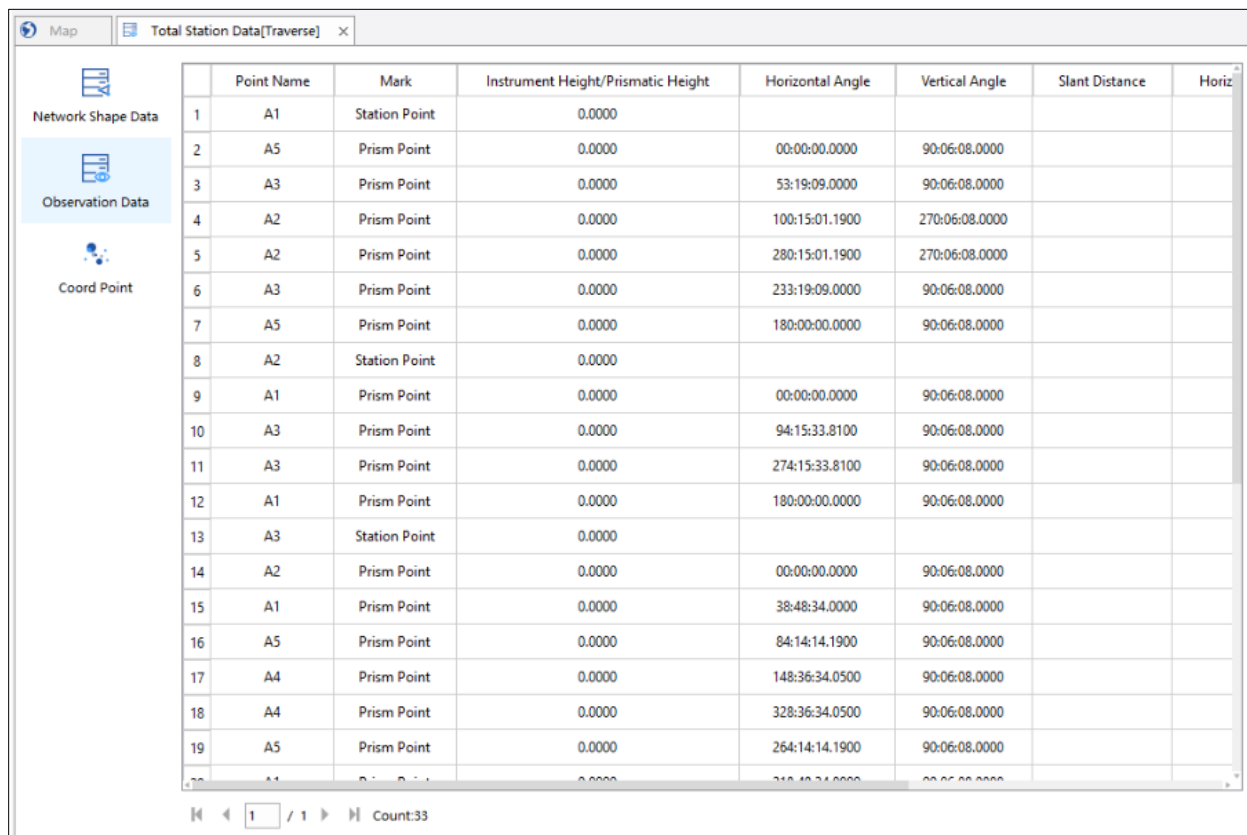


Figure 8-1-2 Import Total Station Data File

3.View Total Station Data

Switch and click [network point data], [observation point data], [coordinate point data] respectively to view the open total station data.

[coordinate point data] data can only be displayed after adjustment calculation. See 7.5 summary for details of adjustment calculation.



	Point Name	Mark	Instrument Height/Prismatic Height	Horizontal Angle	Vertical Angle	Slant Distance	Horiz
1	A1	Station Point	0.0000				
2	A5	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
3	A3	Prism Point	0.0000	53:19:09.0000	90:06:08.0000		
4	A2	Prism Point	0.0000	100:15:01.1900	270:06:08.0000		
5	A2	Prism Point	0.0000	280:15:01.1900	270:06:08.0000		
6	A3	Prism Point	0.0000	233:19:09.0000	90:06:08.0000		
7	A5	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
8	A2	Station Point	0.0000				
9	A1	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
10	A3	Prism Point	0.0000	94:15:33.8100	90:06:08.0000		
11	A3	Prism Point	0.0000	274:15:33.8100	90:06:08.0000		
12	A1	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
13	A3	Station Point	0.0000				
14	A2	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
15	A1	Prism Point	0.0000	38:48:34.0000	90:06:08.0000		
16	A5	Prism Point	0.0000	84:14:14.1900	90:06:08.0000		
17	A4	Prism Point	0.0000	148:36:34.0500	90:06:08.0000		
18	A4	Prism Point	0.0000	328:36:34.0500	90:06:08.0000		
19	A5	Prism Point	0.0000	264:14:14.1900	90:06:08.0000		

Figure 8-1-3 View Total Station Data

8.2 Save

1.Execute Save

After finishing editing the total station data, click the [Save] button under the top column, the software will save the current total station data content to the path where the total station data is located, and at the bottom of the information column to indicate the information about the successful saving.

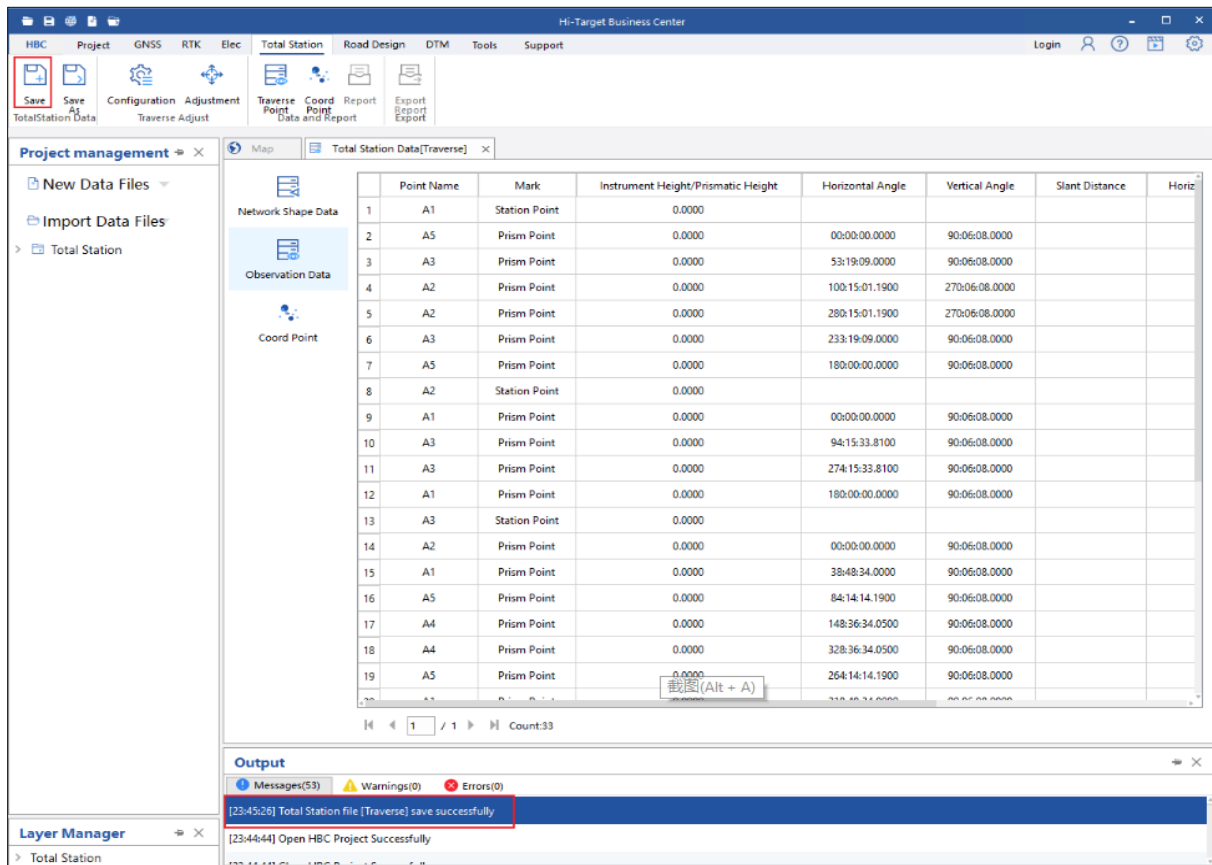


Figure 8-2-1 Execute Save

8.3 Save As

1. Execute Save As

After finishing editing the total station data, click the [Save As] button under the top bar, select the path and corresponding file name you want to save in the pop-up path selection box, and click [Save As]: It can be saved as Hi-target total station data file (*.txt) and Kesha traverse file (*.IN2) format.

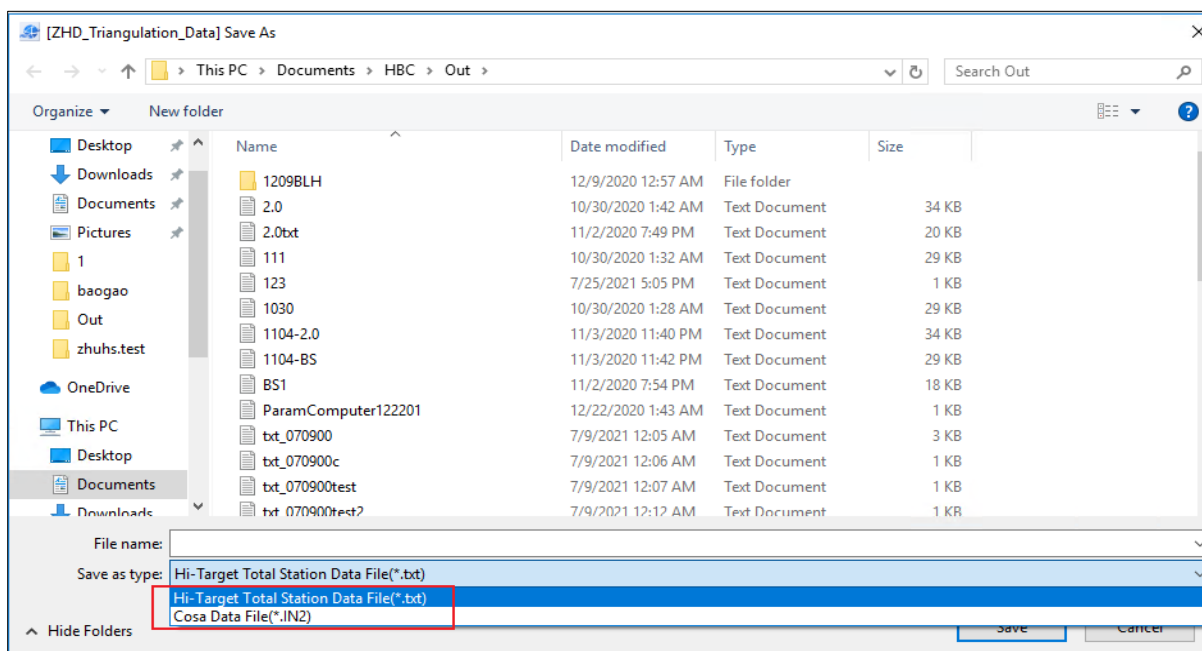


Figure 8-3-1 Execute Save As

2. Save Data Separately

After saving the data, a file appears in the corresponding path, and the software prompts that the save was successful.

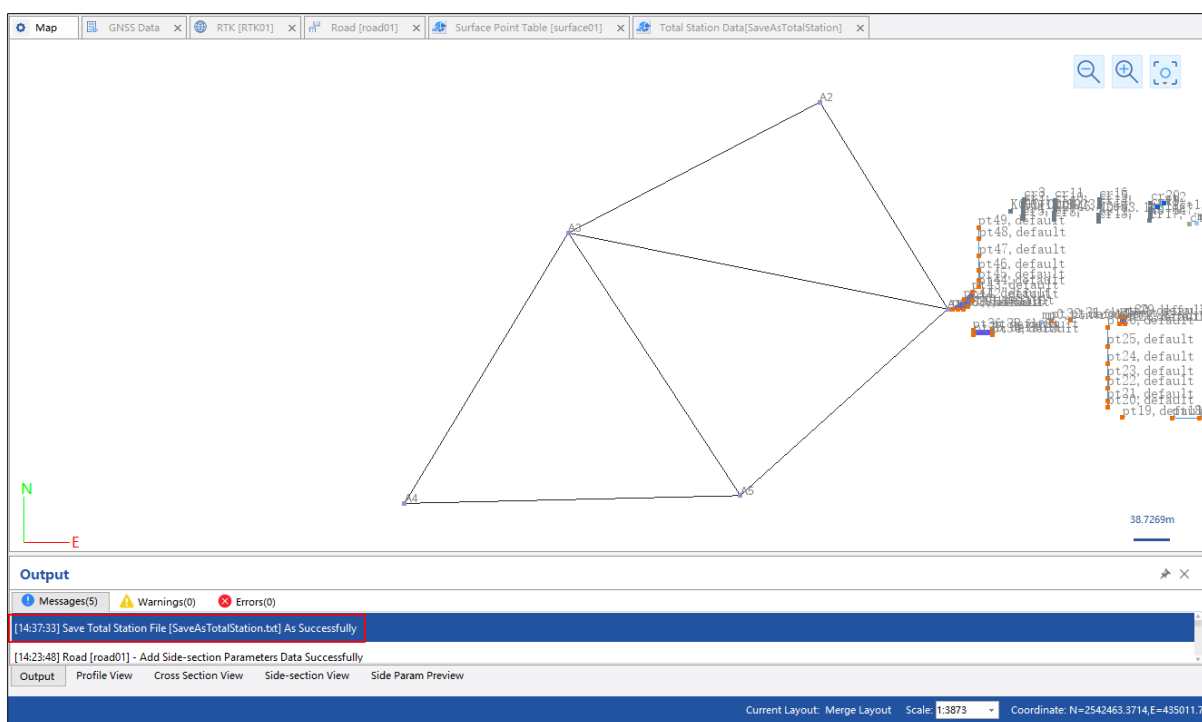


Figure 8-3-2 Save Data Separately

8.4 Property Configuration

1. Attribute Configuration Interface

After opening the total station data, the user can trigger into the property configuration interface via the [Property Configuration] button on the top bar.

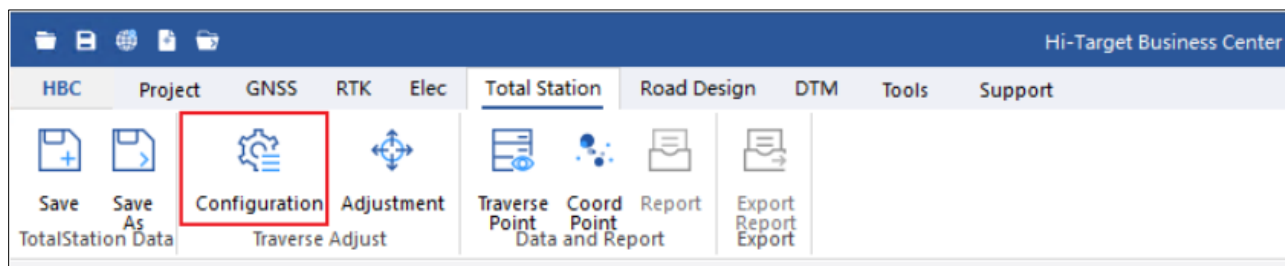


Figure 8-4-1 Attribute Configuration Interface

2. Configuring With Parity

After entering the attribute configuration interface, users can configure the parameters related to parity, as shown below, after modification, click [OK] to take effect.

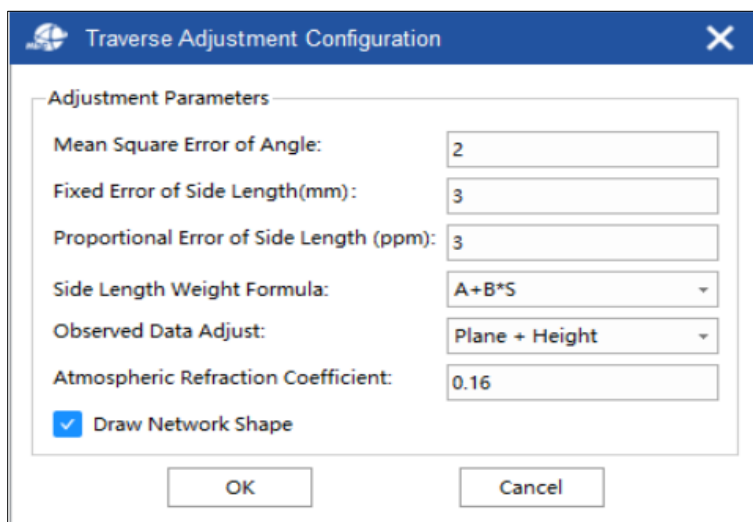
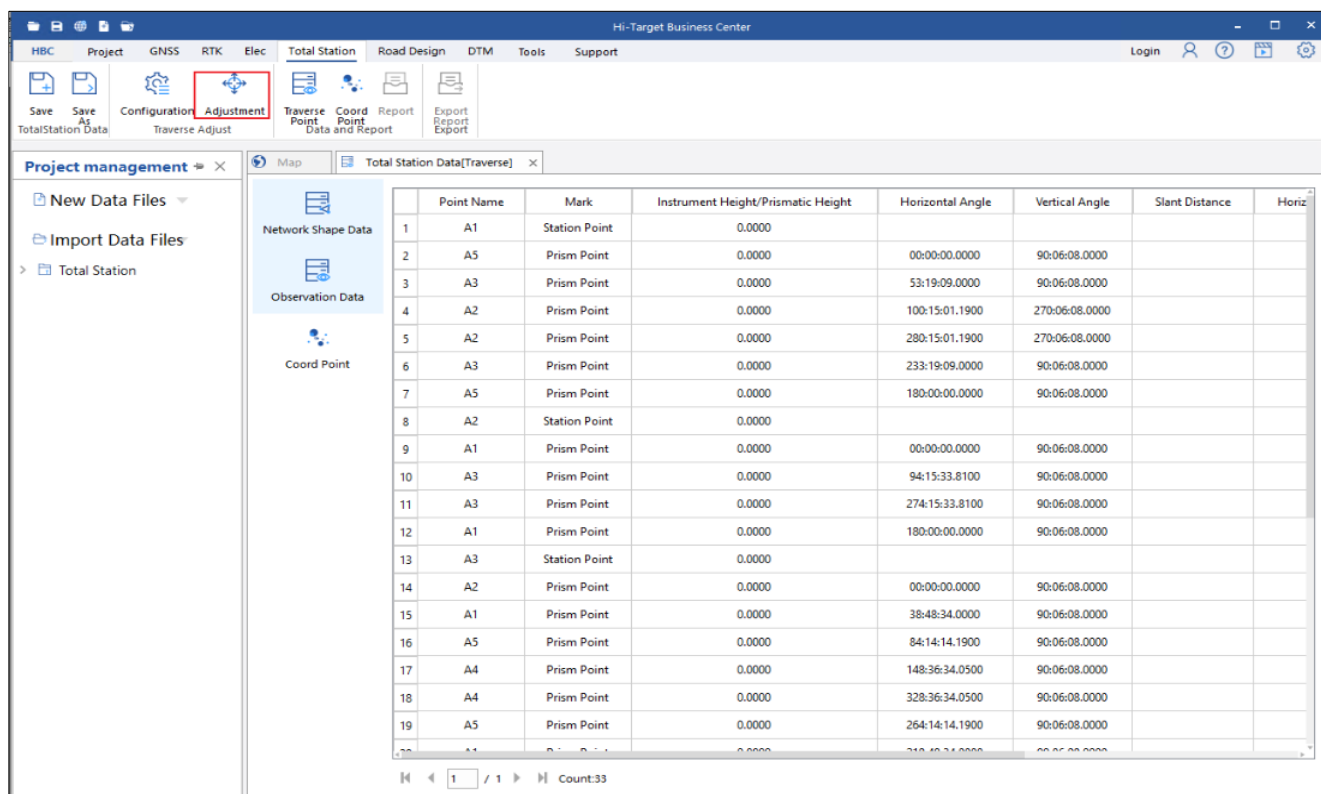


Figure 8-4-2 Configuring With Parity

8.5 Tolerance Calculations

1. Calculation

After finishing the wire data import editing and leveling configuration, users can trigger the software to calculate via the [leveling calculation] button on the top bar.



The screenshot shows the Hi-Target Business Center software interface. The top menu bar includes HBC, Project, GNSS, RTK, Elec, Total Station, Road Design, DTM, Tools, and Support. The 'Adjustment' option under the 'Total Station' menu is highlighted with a red box. The left sidebar shows 'Project management' with options for 'New Data Files' and 'Import Data Files'. The main window displays a table of data for 'Total Station Data[Traverse]'. The table has columns for Point Name, Mark, Instrument Height/Prismatic Height, Horizontal Angle, Vertical Angle, Slant Distance, and Horizontal Distance. The data is organized into three sections: Network Shape Data, Observation Data, and Coord Point.

	Point Name	Mark	Instrument Height/Prismatic Height	Horizontal Angle	Vertical Angle	Slant Distance	Horizontal Distance
1	A1	Station Point	0.0000				
2	A5	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
3	A3	Prism Point	0.0000	53:19:09.0000	90:06:08.0000		
4	A2	Prism Point	0.0000	100:15:01.1900	270:06:08.0000		
5	A2	Prism Point	0.0000	280:15:01.1900	270:06:08.0000		
6	A3	Prism Point	0.0000	233:19:09.0000	90:06:08.0000		
7	A5	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
8	A2	Station Point	0.0000				
9	A1	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
10	A3	Prism Point	0.0000	94:15:33.8100	90:06:08.0000		
11	A3	Prism Point	0.0000	274:15:33.8100	90:06:08.0000		
12	A1	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
13	A3	Station Point	0.0000				
14	A2	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
15	A1	Prism Point	0.0000	38:48:34.0000	90:06:08.0000		
16	A5	Prism Point	0.0000	84:14:14.1900	90:06:08.0000		
17	A4	Prism Point	0.0000	148:36:34.0500	90:06:08.0000		
18	A4	Prism Point	0.0000	328:36:34.0500	90:06:08.0000		
19	A5	Prism Point	0.0000	264:14:14.1900	90:06:08.0000		
20	A1	Station Point	0.0000	00:00:00.0000	90:06:08.0000		

Figure 8-5-1 Calculation

2.Results

After the software finishes calculating the level difference, the main interface pops up the following calculation results, the user can slide to view it.

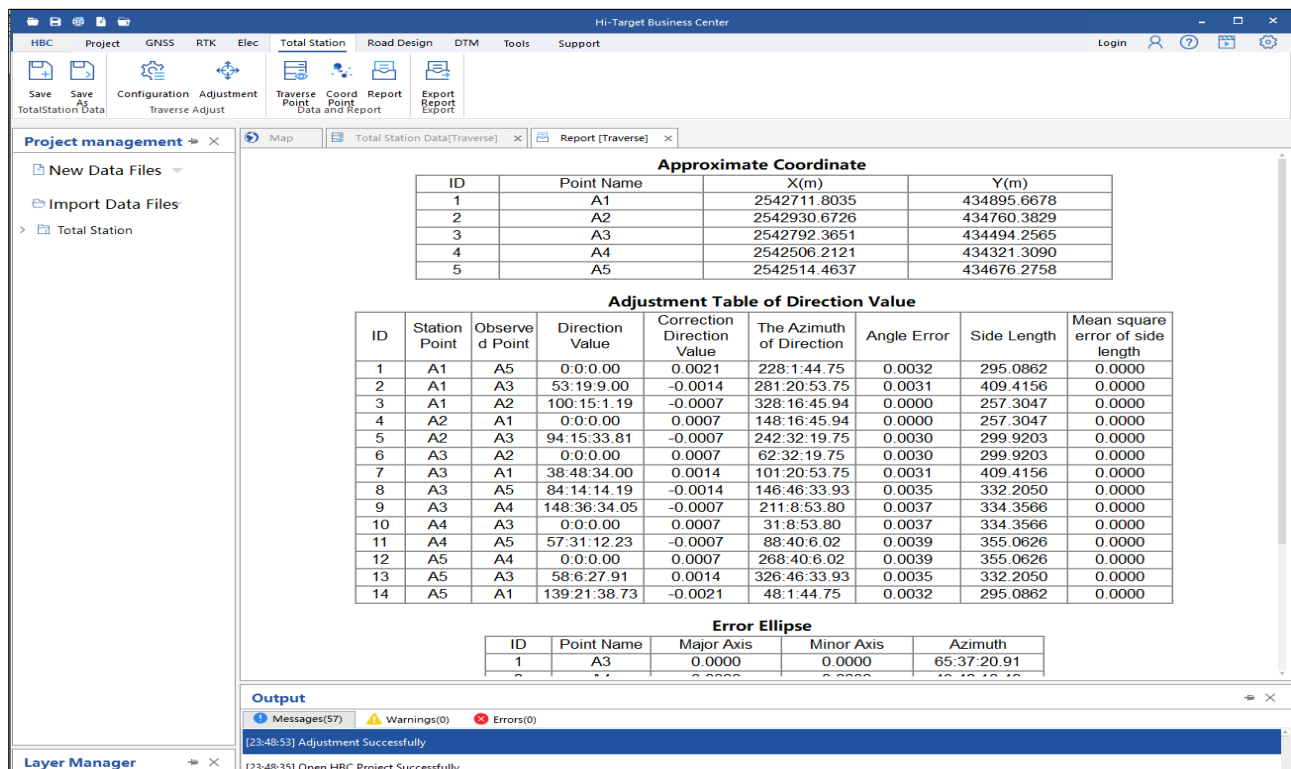


Figure 8-5-2 Calculation

3.Map Display

Before the adjustment calculation, the software draws the graph according to the NEZ coordinates of the survey station and the NEZ coordinates of the prism point of the observation point data (the survey station is displayed as a small flag on the map, and the prism point is displayed as an ordinary point on the map).



Figure 8-5-3 Map Display

After the software performs adjustment calculation, draw the graph according to the coordinate point data (the survey site is displayed as a small flag on the map, and the prism point is displayed as an ordinary point on the map).

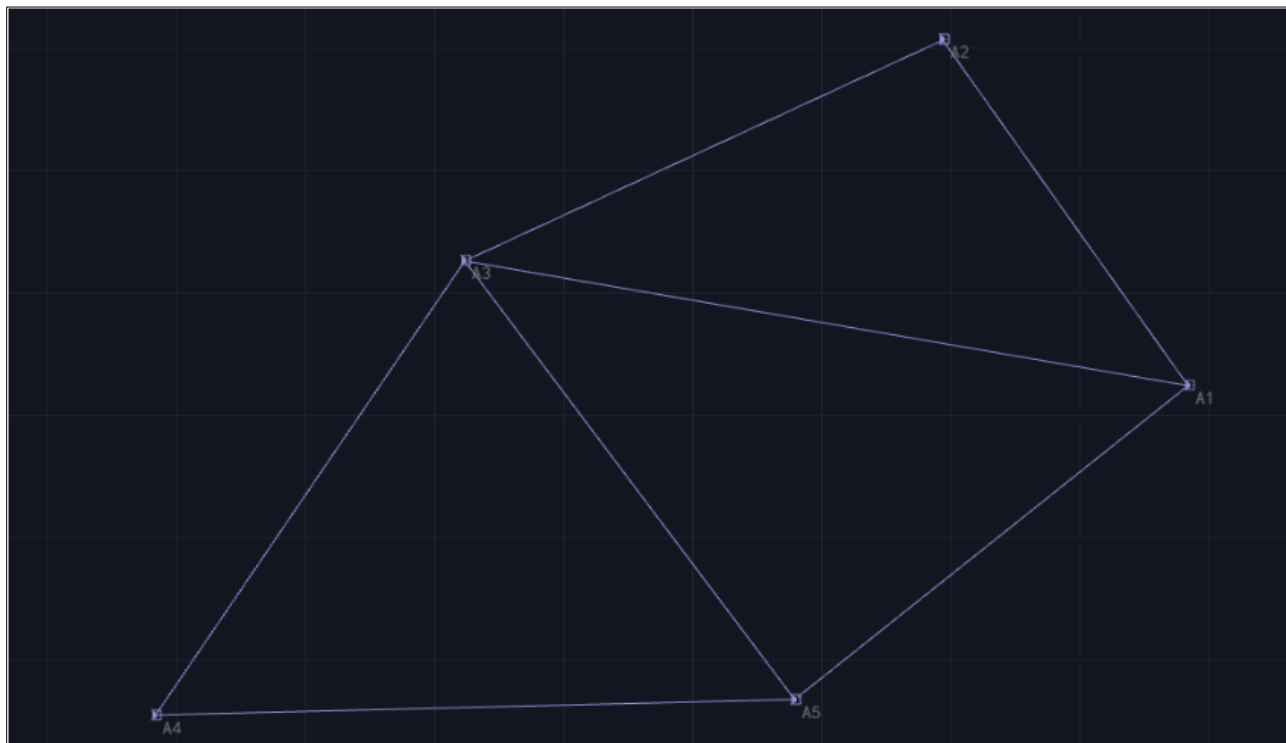
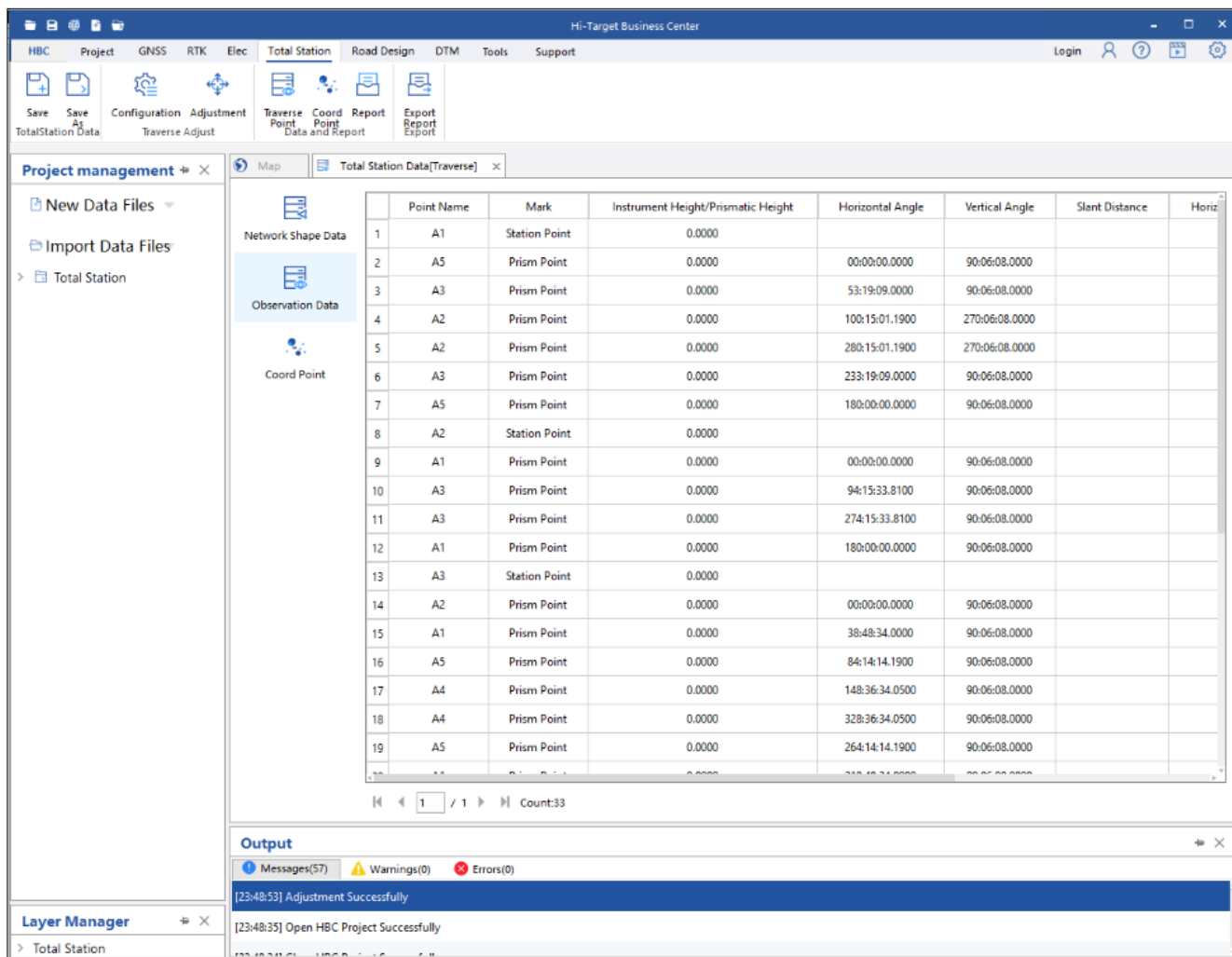


Figure 8-5-4 Map Display

8.6 Data

1.Data Support

The data types supported by the current software total station module to open are: 'Hi-target total station data file(*.htf,*.txt)' 'Keshu traverse file (*.IN2)'. Coordinate data point file(*.dat)'. Users open the corresponding data, through the top [wire point] [coordinate point] and side bar [network point data] [wire point data] [coordinate point data] button to switch to view: (IN2 data open only network point data).



The screenshot displays the Hi-Target Business Center software interface. The main window shows a table of Total Station Data. The table has columns for Point Name, Mark, Instrument Height/Prismatic Height, Horizontal Angle, Vertical Angle, Slant Distance, and Horiz. The data is organized into rows, with the first row being a Station Point and subsequent rows being Prism Points. The interface includes a Project management sidebar on the left, a top menu bar with options like HBC, Project, GNSS, RTK, Elec, Total Station, Road Design, DTM, Tools, and Support, and an Output panel at the bottom showing messages and warnings.

	Point Name	Mark	Instrument Height/Prismatic Height	Horizontal Angle	Vertical Angle	Slant Distance	Horiz
1	A1	Station Point	0.0000				
2	A5	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
3	A3	Prism Point	0.0000	53:19:09.0000	90:06:08.0000		
4	A2	Prism Point	0.0000	100:15:01.1900	270:06:08.0000		
5	A2	Prism Point	0.0000	280:15:01.1900	270:06:08.0000		
6	A3	Prism Point	0.0000	233:19:09.0000	90:06:08.0000		
7	A5	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
8	A2	Station Point	0.0000				
9	A1	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
10	A3	Prism Point	0.0000	94:15:33.8100	90:06:08.0000		
11	A3	Prism Point	0.0000	274:15:33.8100	90:06:08.0000		
12	A1	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
13	A3	Station Point	0.0000				
14	A2	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
15	A1	Prism Point	0.0000	38:49:34.0000	90:06:08.0000		
16	A5	Prism Point	0.0000	84:14:14.1900	90:06:08.0000		
17	A4	Prism Point	0.0000	148:36:34.0500	90:06:08.0000		
18	A4	Prism Point	0.0000	328:36:34.0500	90:06:08.0000		
19	A5	Prism Point	0.0000	264:14:14.1900	90:06:08.0000		

Count:33

Output

Messages(57) Warnings(0) Errors(0)

[23:48:53] Adjustment Successfully

[23:48:35] Open HBC Project Successfully

Figure 8-6-1 Data Support

8.6.1 Coordinate Points

1.Data Deletion

Users can right mouse click on any row of data via a list of coordinates.

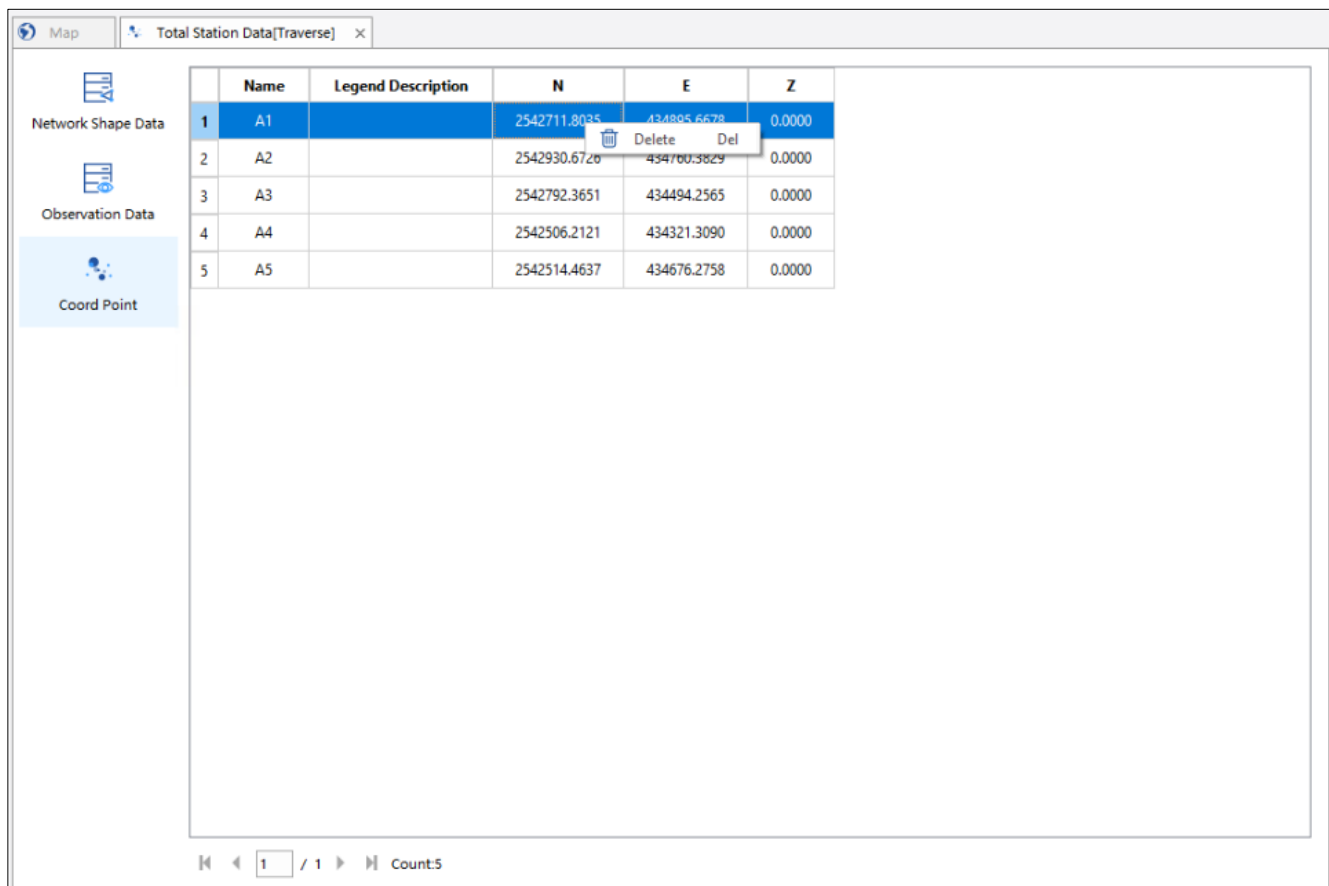


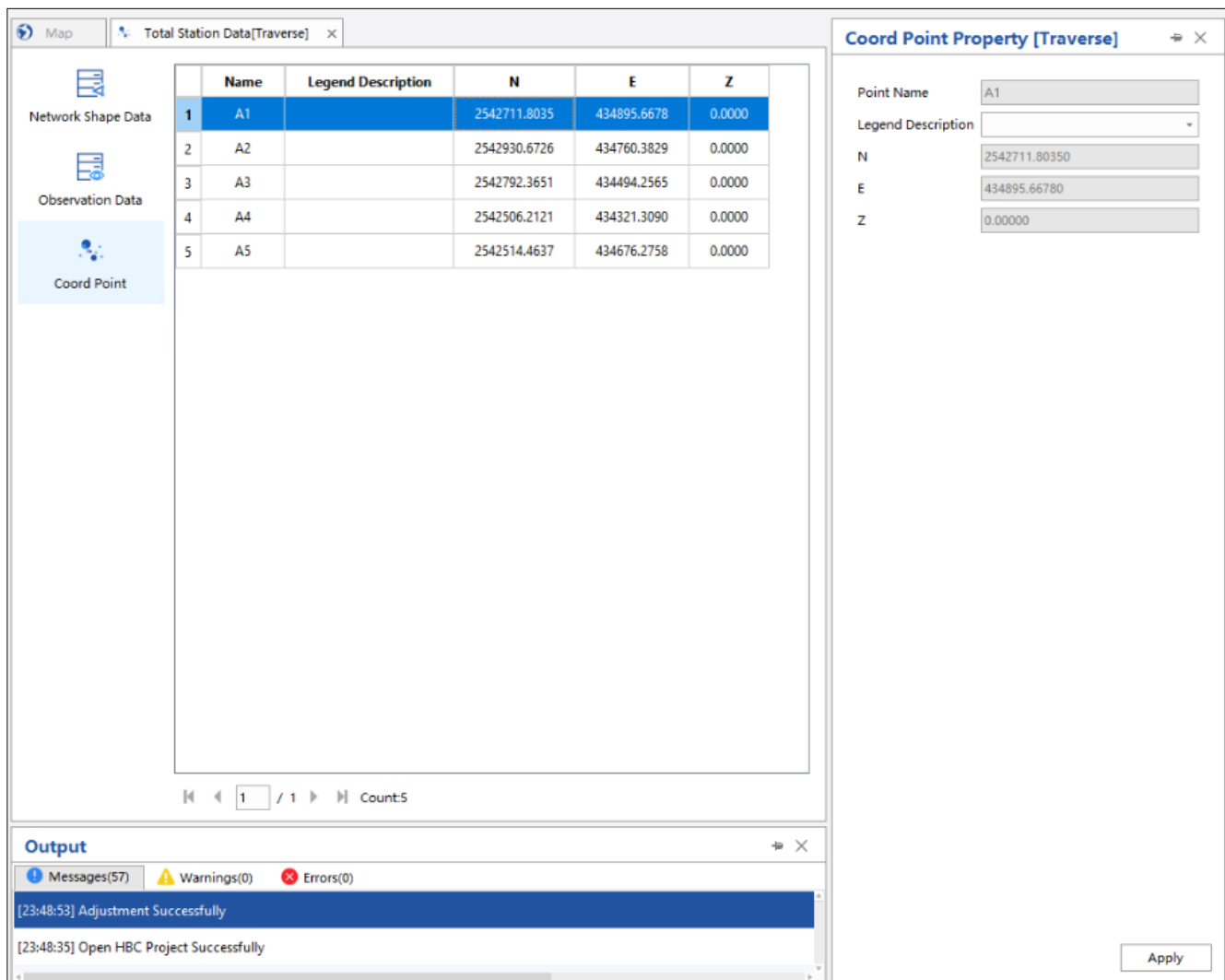
Figure 8-6-2 Data Deletion

Click [delete] to delete data; Or select coordinate point data in the map and delete it through the right-click menu.

Click the [Find] button to enter a point name and description to find the data.

2.Data Editing

Users can trigger access to the right side of the details screen by left-clicking on any line in the list of coordinates.



The screenshot displays the Hi-Target Business Center software interface. The main window, titled 'Total Station Data[Traverse]', contains a table with 5 rows of data. The first row is highlighted in blue. To the right, the 'Coord Point Property [Traverse]' window is open, showing the details for point A1. The 'Output' window at the bottom shows two messages: '[23:48:53] Adjustment Successfully' and '[23:48:35] Open HBC Project Successfully'.

	Name	Legend Description	N	E	Z
1	A1		2542711.8035	434895.6678	0.0000
2	A2		2542930.6726	434760.3829	0.0000
3	A3		2542792.3651	434494.2565	0.0000
4	A4		2542506.2121	434321.3090	0.0000
5	A5		2542514.4637	434676.2758	0.0000

The 'Coord Point Property [Traverse]' window shows the following details for point A1:

- Point Name: A1
- Legend Description: (empty dropdown)
- N: 2542711.80350
- E: 434895.66780
- Z: 0.00000

The 'Output' window shows the following messages:

- [23:48:53] Adjustment Successfully
- [23:48:35] Open HBC Project Successfully

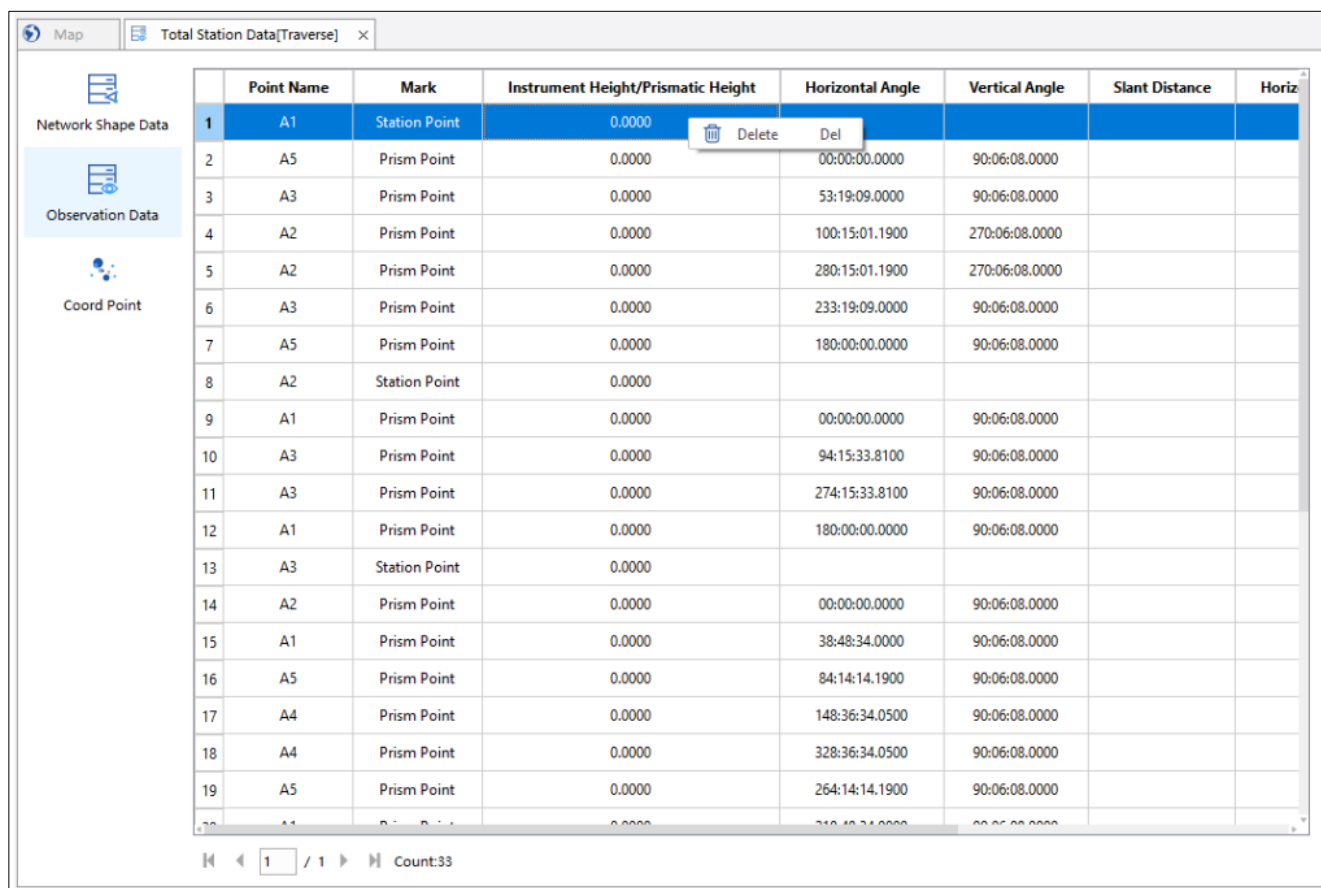
Figure 8-6-3 Data Editing

In the details screen, users can edit the point name, description, N, E, Z, and then click [OK] below to complete the update.

8.6.2 Guidepoints

1.Data Censoring (Observational Data)

Users can right-click on any row of data in the list of observations.



	Point Name	Mark	Instrument Height/Prismatic Height	Horizontal Angle	Vertical Angle	Slant Distance	Horiz
1	A1	Station Point	0.0000				
2	A5	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
3	A3	Prism Point	0.0000	53:19:09.0000	90:06:08.0000		
4	A2	Prism Point	0.0000	100:15:01.1900	270:06:08.0000		
5	A2	Prism Point	0.0000	280:15:01.1900	270:06:08.0000		
6	A3	Prism Point	0.0000	233:19:09.0000	90:06:08.0000		
7	A5	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
8	A2	Station Point	0.0000				
9	A1	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
10	A3	Prism Point	0.0000	94:15:33.8100	90:06:08.0000		
11	A3	Prism Point	0.0000	274:15:33.8100	90:06:08.0000		
12	A1	Prism Point	0.0000	180:00:00.0000	90:06:08.0000		
13	A3	Station Point	0.0000				
14	A2	Prism Point	0.0000	00:00:00.0000	90:06:08.0000		
15	A1	Prism Point	0.0000	38:48:34.0000	90:06:08.0000		
16	A5	Prism Point	0.0000	84:14:14.1900	90:06:08.0000		
17	A4	Prism Point	0.0000	148:36:34.0500	90:06:08.0000		
18	A4	Prism Point	0.0000	328:36:34.0500	90:06:08.0000		
19	A5	Prism Point	0.0000	264:14:14.1900	90:06:08.0000		
20	A1	Prism Point	0.0000	310:10:34.0000	90:06:08.0000		

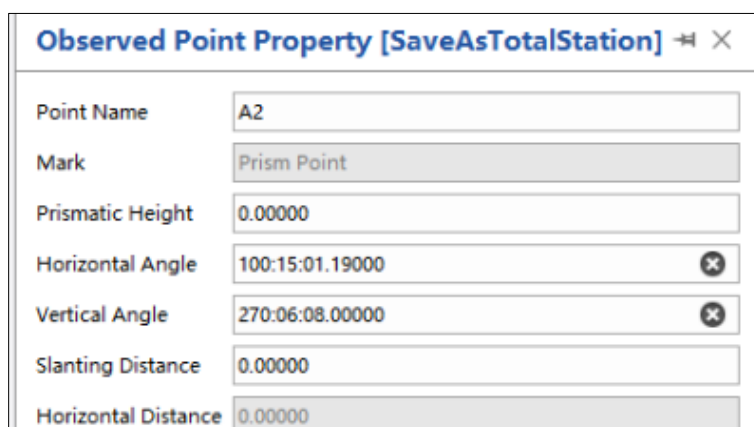
Figure 8-6-4 Data Censoring

Click [delete] to delete data; Or select the observation point data in the map and delete it through the right-click menu.

Click the [Find] button to enter a point name and description to find the data.

2.Data Editing

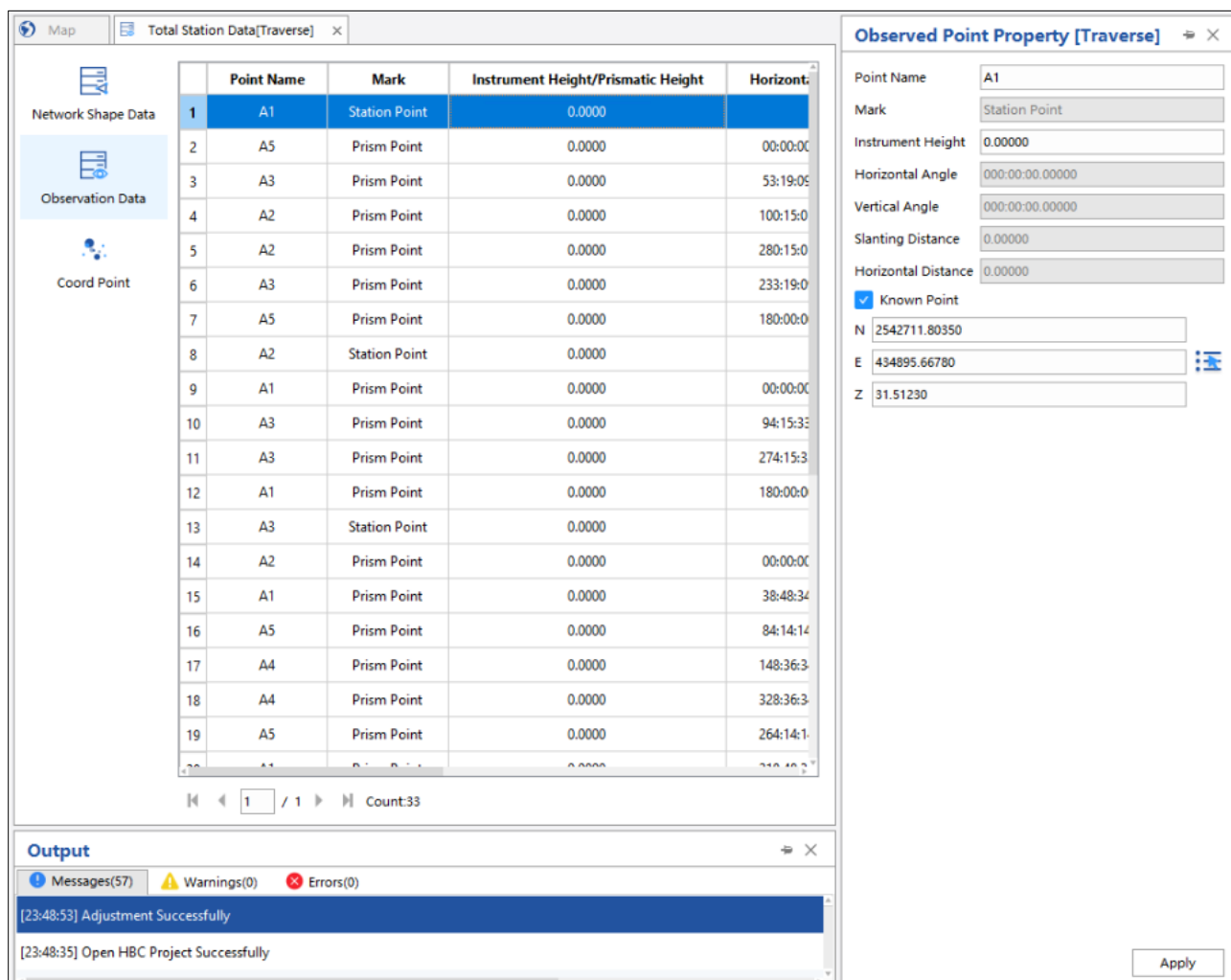
Users can click on any row of the list of observations with the left mouse button to trigger access to the right side of the details screen.



Observed Point Property [SaveAsTotalStation]

Point Name	A2
Mark	Prism Point
Prismatic Height	0.00000
Horizontal Angle	100:15:01.19000
Vertical Angle	270:06:08.00000
Slanting Distance	0.00000
Horizontal Distance	0.00000

Figure 8-6-5 Data Editing



	Point Name	Mark	Instrument Height/Prismatic Height	Horizontal Angle
1	A1	Station Point	0.0000	
2	A5	Prism Point	0.0000	00:00:00
3	A3	Prism Point	0.0000	53:19:05
4	A2	Prism Point	0.0000	100:15:00
5	A2	Prism Point	0.0000	280:15:00
6	A3	Prism Point	0.0000	233:19:00
7	A5	Prism Point	0.0000	180:00:00
8	A2	Station Point	0.0000	
9	A1	Prism Point	0.0000	00:00:00
10	A3	Prism Point	0.0000	94:15:32
11	A3	Prism Point	0.0000	274:15:32
12	A1	Prism Point	0.0000	180:00:00
13	A3	Station Point	0.0000	
14	A2	Prism Point	0.0000	00:00:00
15	A1	Prism Point	0.0000	38:48:34
16	A5	Prism Point	0.0000	84:14:14
17	A4	Prism Point	0.0000	148:36:32
18	A4	Prism Point	0.0000	328:36:32
19	A5	Prism Point	0.0000	264:14:14

Observed Point Property [Traverse]

Point Name: A1

Mark: Station Point

Instrument Height: 0.00000

Horizontal Angle: 000:00:00.00000

Vertical Angle: 000:00:00.00000

Slanting Distance: 0.00000

Horizontal Distance: 0.00000

☒ Known Point

N: 2542711.80350

E: 434895.66780

Z: 31.51230

Output

Messages(57) Warnings(0) Errors(0)

[23:48:53] Adjustment Successfully

[23:48:35] Open HBC Project Successfully

Apply

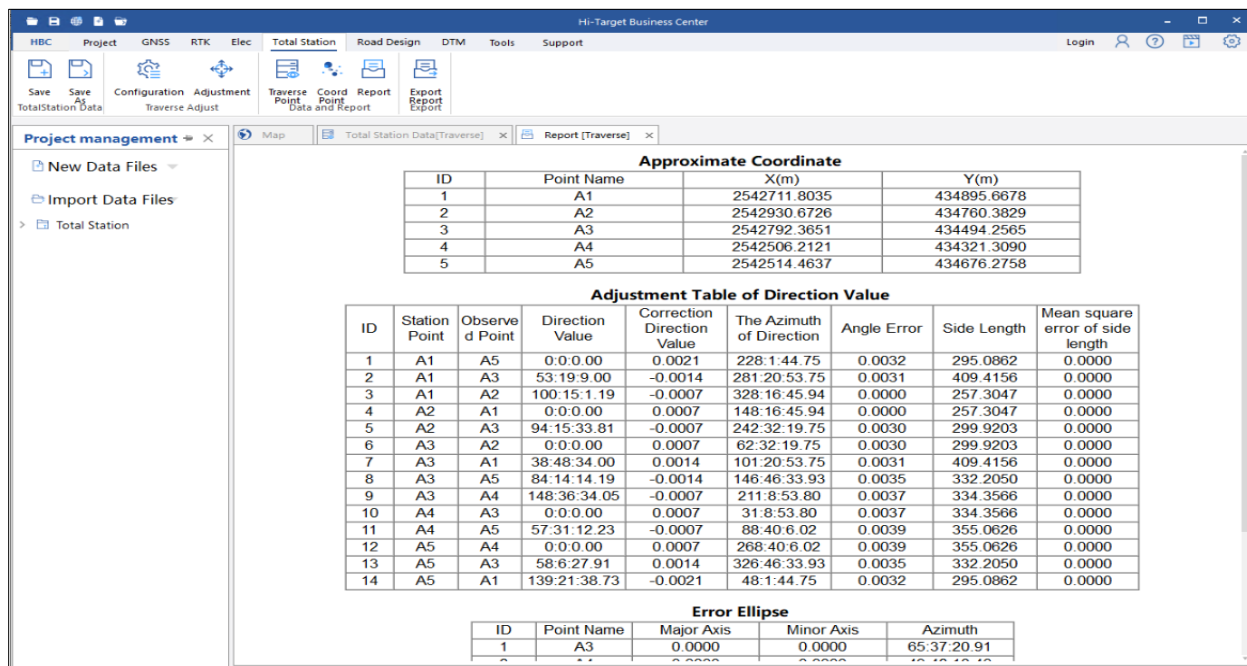
Figure 8-6-6 Data Editing

In the details interface, you can edit the point name, known point coordinates for users of the measurement site; for prismatic points, you can edit the point name, horizontal angle, vertical angle, slope, and click [OK] below to complete the update.

8.7 Parity Report

1. Report Preview

After the wire data is calculated, the software automatically jumps to the value of the report preview interface is as follows, you can also manually click on the top column [report] to bring up the view.



Approximate Coordinate

ID	Point Name	X(m)	Y(m)
1	A1	2542711.8035	434895.6678
2	A2	2542930.6726	434760.3829
3	A3	2542792.3651	434494.2565
4	A4	2542506.2121	434321.3090
5	A5	2542514.4637	434676.2758

Adjustment Table of Direction Value

ID	Station Point	Observed Point	Direction Value	Correction Direction Value	The Azimuth of Direction	Angle Error	Side Length	Mean square error of side length
1	A1	A5	0:0:0.00	0.0021	228:1:44.75	0.0032	295.0862	0.0000
2	A1	A3	53:19:9.00	-0.0014	281:20:53.75	0.0031	409.4156	0.0000
3	A1	A2	100:15:1.19	-0.0007	328:16:45.94	0.0000	257.3047	0.0000
4	A2	A1	0:0:0.00	0.0007	148:16:45.94	0.0000	257.3047	0.0000
5	A2	A3	94:15:33.81	-0.0007	242:32:19.75	0.0030	299.9203	0.0000
6	A3	A2	0:0:0.00	0.0007	62:32:19.75	0.0030	299.9203	0.0000
7	A3	A1	38:48:34.00	0.0014	101:20:53.75	0.0031	409.4156	0.0000
8	A3	A5	84:14:14.19	-0.0014	146:46:33.93	0.0035	332.2050	0.0000
9	A3	A4	148:36:34.05	-0.0007	211:8:53.80	0.0037	334.3566	0.0000
10	A4	A3	0:0:0.00	0.0007	31:8:53.80	0.0037	334.3566	0.0000
11	A4	A5	57:31:12.23	-0.0007	88:40:6.02	0.0039	355.0626	0.0000
12	A5	A4	0:0:0.00	0.0007	268:40:6.02	0.0039	355.0626	0.0000
13	A5	A3	58:6:27.91	0.0014	326:46:33.93	0.0035	332.2050	0.0000
14	A5	A1	139:21:38.73	-0.0021	48:1:44.75	0.0032	295.0862	0.0000

Error Ellipse

ID	Point Name	Major Axis	Minor Axis	Azimuth
1	A3	0.0000	0.0000	65:37:20.91

Figure 8-7-1 Report Preview

2.Report Export

Users can export word and pdf formats by clicking [Export Report] in the top bar.

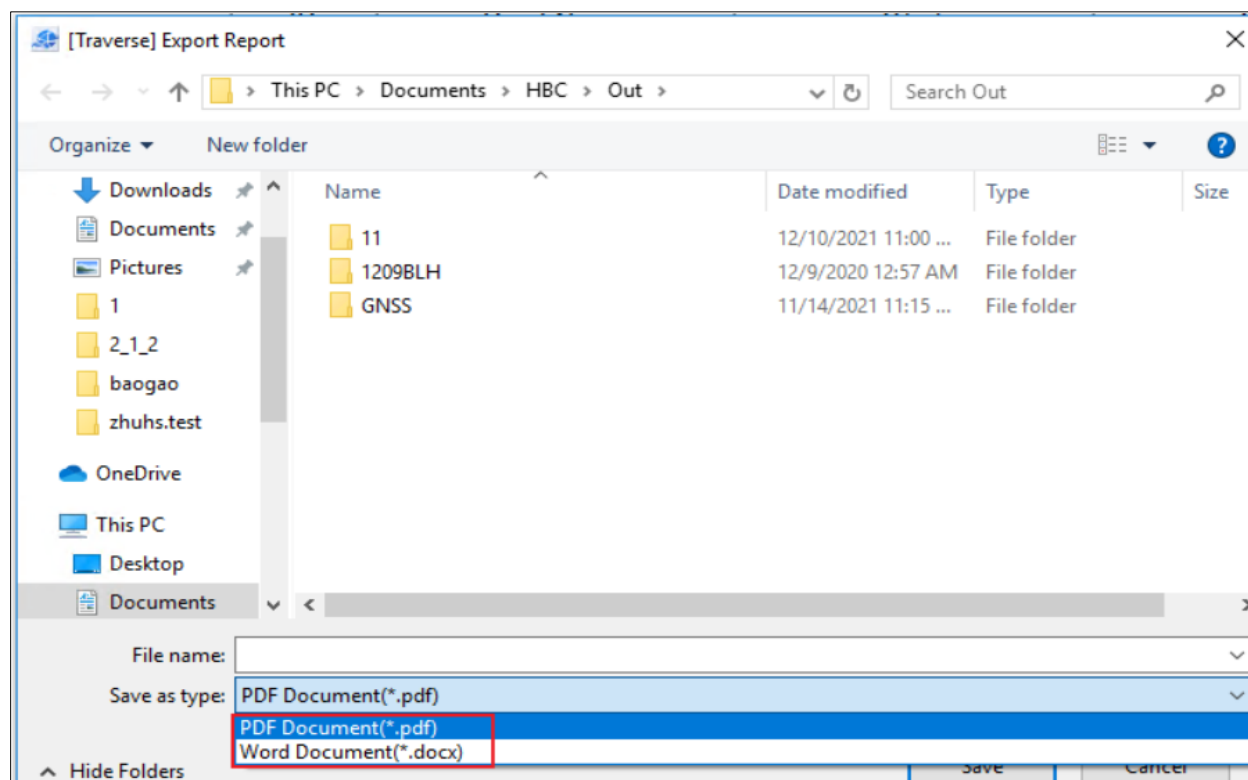


Figure 8-7-2 Report Export

Chapter 9

Road Design

This chapter contains:

- New
- Importing Data
- Save
- Save As
- Synchronization
- Road Design
- Calculation Results
- Tools
- Line Element

9.1 New

(1) Click the [Create Data File] icon on the left side of the HBC software under the [Project Management] toolbar, the software pops up the New dialog box, and then click [Road Design Files].

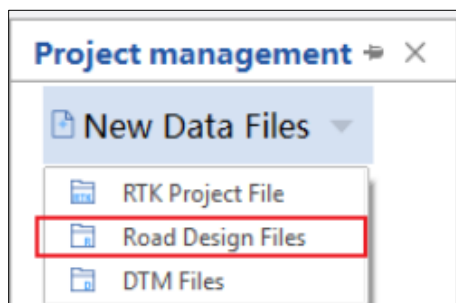


Figure 9-1-1 Road Design Files

(2) In the new dialog box, select *.road design file and the path to save the file, the path is the path of the default storage project, and enter the file name, click [Save], the software will automatically generate xxx.road file in the path selected by the user, and then it will show in the message window: xxx.road design file was created successfully, the left side of the road. The new road file name is added under the tree node.

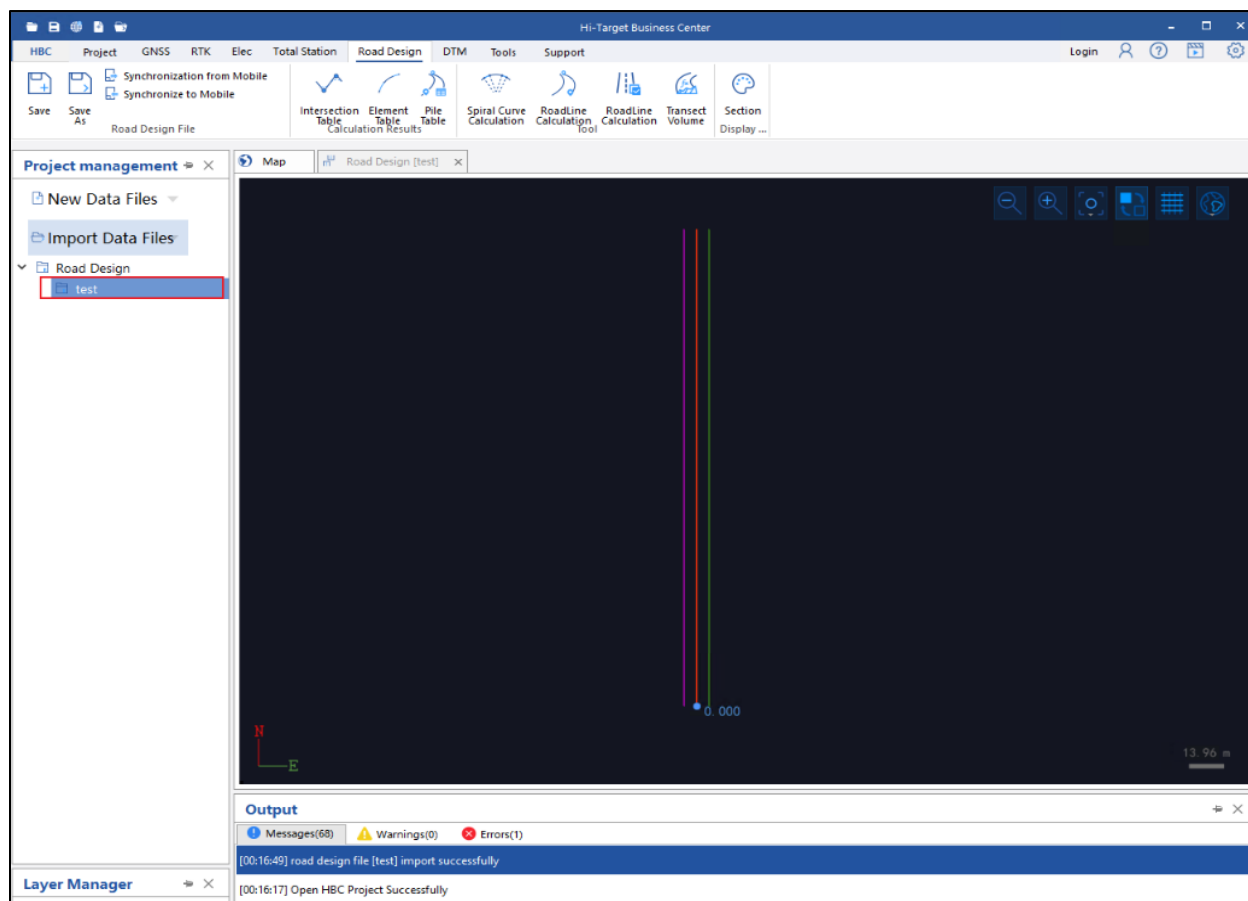


Figure 9-1-2 Road Design Files

9.2 Importing A Data File

(1) Click the [Import Data File] icon on the left side of the HBC software under the [Project Management] toolbar, and then select [Road Design File], the software will pop up a loading dialog box.

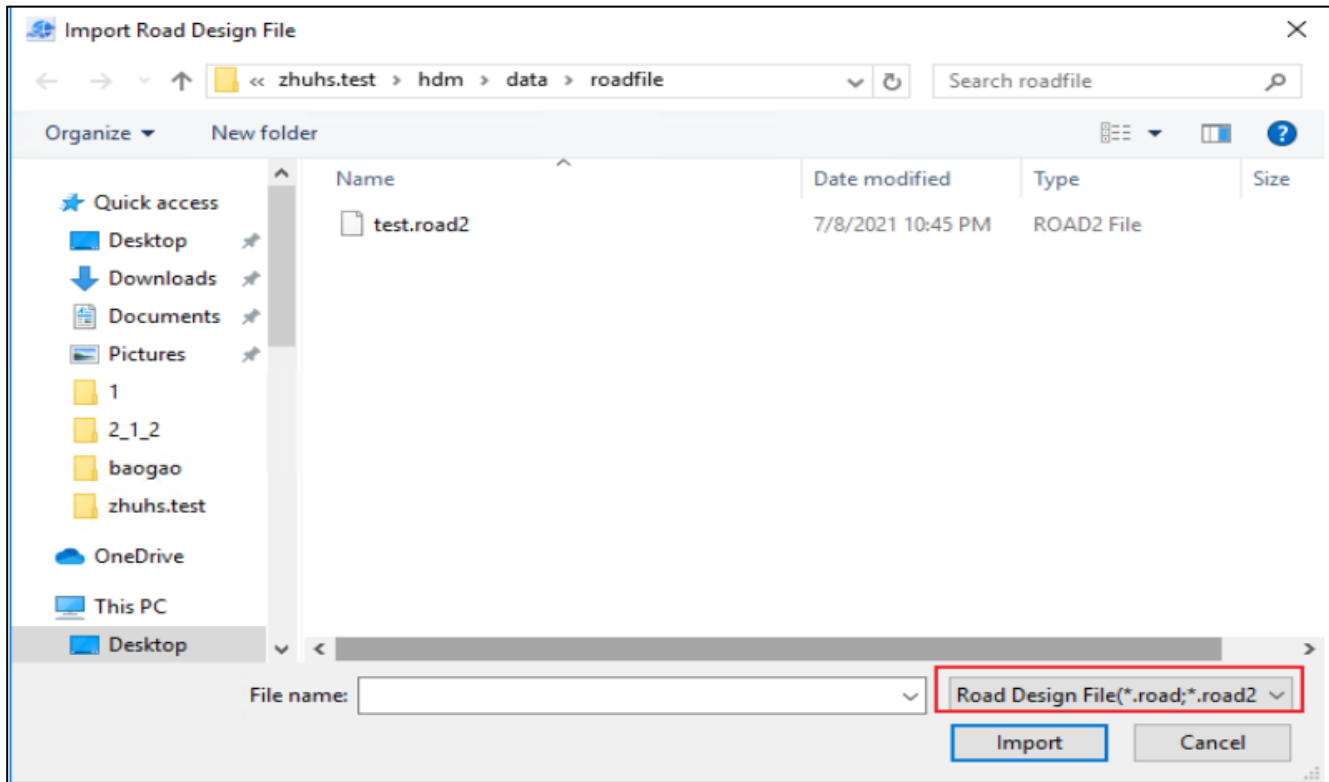


Figure 9-2-1 Importing A Data File

Select the file path in the dialog box, select the road file (*.road,*.road2) in the file type drop-down box, click [Open] or double click the file you want to import, the software will automatically load the road design file (*.road,*.road2).

If the original open road data (broken chain, level section (intersection method, line element method, coordinate method, five pile files), longitudinal section, standard cross-section, super high, widening, slope,slope parameters , structures) have been manipulated (add, delete, change), the prompt 'Road Design file [XXX] has been modified, whether to save the changes? ' . Click [Yes], the software saves the XXX file, click [No], the software does not save the file.

After successful import, the new open road file name will be added under the left road tree node, if the road file name already exists under the current project node, the road design file will be selected directly.

9.3 Save

(1) Click the [Save] icon in the upper left corner of the HBC software under the [Road] toolbar, the current road design file is saved successfully, the software will display in the message window: 'Road Design file [xxx] saved successfully'.

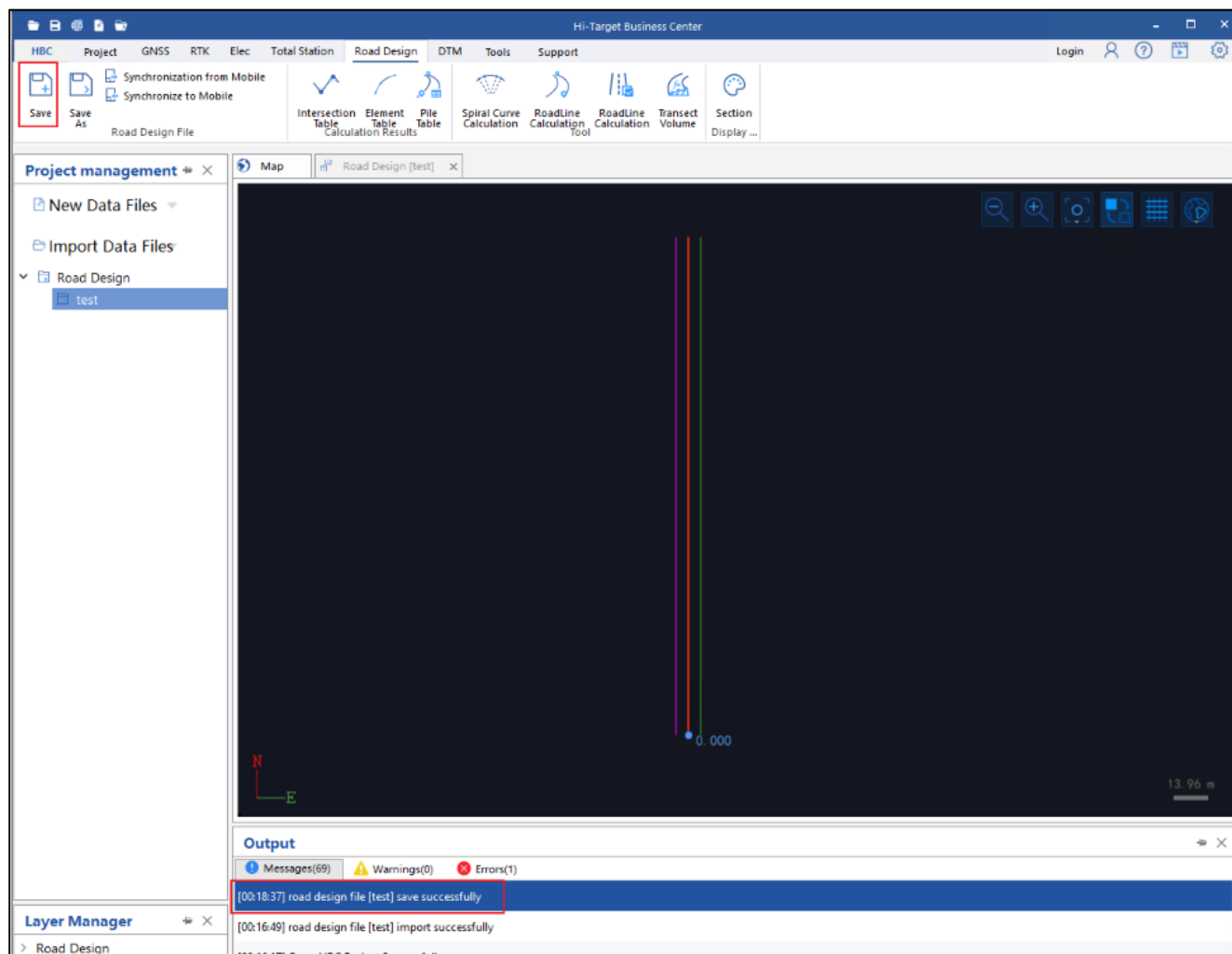


Figure 9-3-1 Save

9.4 Save As

(1) Click the [Save As] icon in the upper left corner of the HBC software under the [Road] toolbar, the software pops up the file selection box, select the path to save as, enter the file name and click [Save].

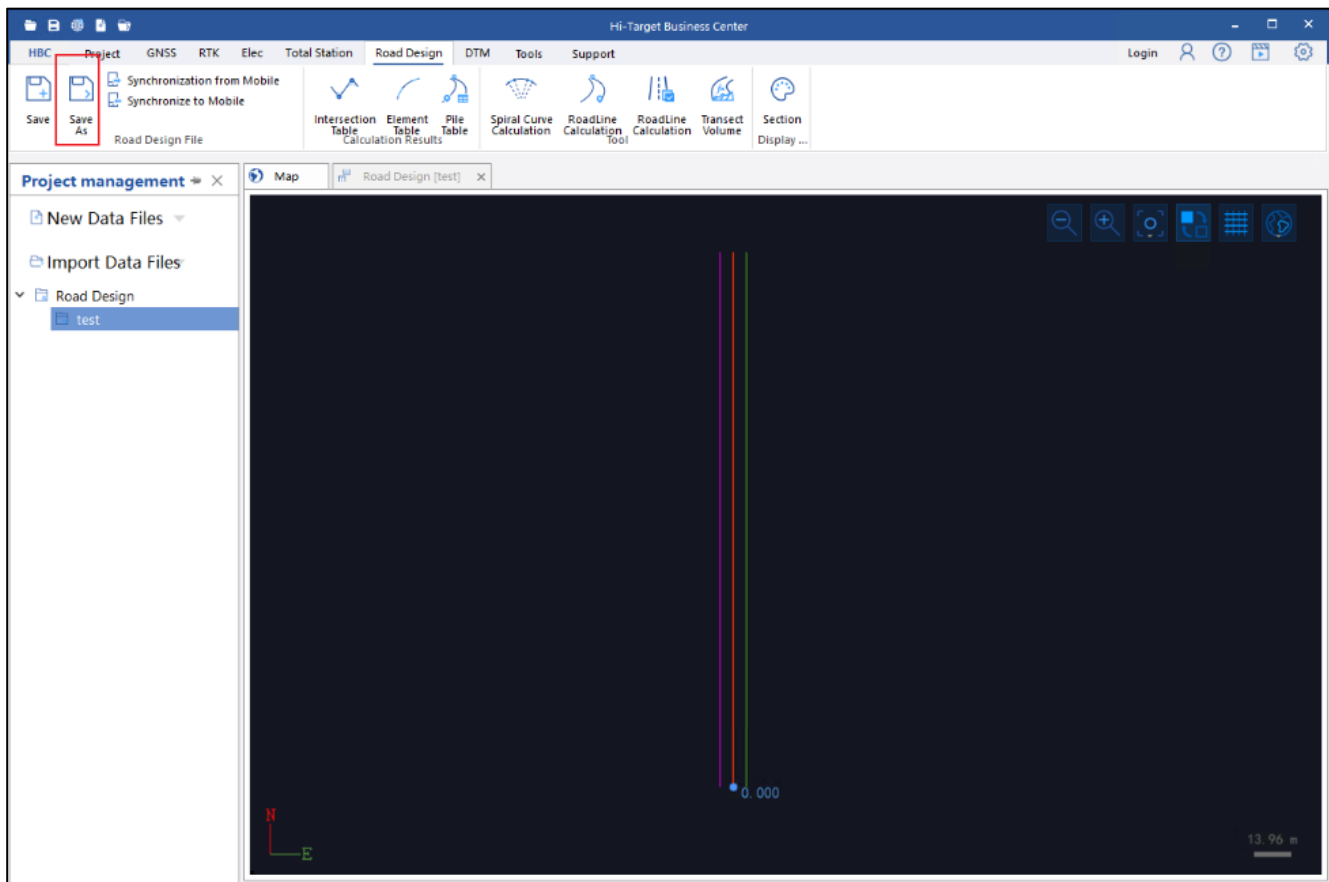


Figure 9-4-1 Save As

(2) The software will save the data to the corresponding path selected, and at the same time, the open file path of the original record of the current project will be switched to the path saved as, and the information column at the bottom of the software will prompt 'Save road design file as [xxx] successfully'.

9.5 Synchronization

1.Sync from Mobile

1) Open a *.road project in the software; turn on the FTP transfer function in the handbook side of the software and the PC and handbook are in the same LAN.

(2) Click the [Sync from Mobile] icon in the upper left corner of the HBC software under the [Road Design] toolbar, the software pops up the Sync from Mobile interface.

(3) Click on [Connect].

(4) Select the road file in a project in the list and click [Sync to Local].

2.Sync to Mobile

(1) Open a *.road project in the software; turn on the FTP transfer function in the handbook side of the software and the PC and handbook are in the same LAN.

(2) Click the [Sync to Mobile] icon in the upper left corner of the HBC software under the [Road Design] toolbar, the software pops up the Sync to Mobile interface.

(3) Click on [Connect] and then click on [Start Sync], if the user name and password are set in the mobile terminal, you need to enter the corresponding user name and password.

9.6 Road Design

9.6.1 Broken Link

Breakage chain refers to the discontinuity of the pile number due to local rerouting or segmental measurement. Overlapping pile numbers are called long chains and interrupted pile numbers are called short chains. In general, the existence of broken chains in the road will be directly marked in the straight curve table, as shown below.

K1+475.869	K1+495.869	K1+503.353	K1+510.838	K1+530.838	20.36	87.1895	173° 36' 00"	
					61.14569	123.8572	153° 33' 50.9"	
K1+591.983	K1+616.983	K1+625.341	K1+633.699	K1+658.699	-4.4E-05	66.08082	103° 29' 49.7"	短链: 62.863m K1+737.137 = K1+800
K1+658.699	K1+678.699	K1+689.609	K1+700.519	K1+720.519	65.54448	181.5638	119° 28' 15.9"	
K1+848.926	K1+888.926	K1+933.280	K1+977.634	K2+017.634	-2.6E-05	125.5172	100° 45' 13.1"	
K2+017.634	K2+042.634	K2+054.990	K2+067.345	K2+092.345	43.7242	134.2525	164° 02' 49.6"	长链: 4.486m K2+235.756 = K2+231.270
K2+136.069	K2+161.069	K2+185.912	K2+210.755	K2+235.755	55.90427	158.1215	152° 47' 10"	
K2+287.173	K2+317.173	K2+331.742	K2+346.311	K2+376.311				

Figure 9-6-1 Broken Link

1. Broken Link Design Interface

Click [Road Design] to open the road module, create or load a new road design file, click [broken chain design] in the left menu to enter the broken chain design interface as follows.

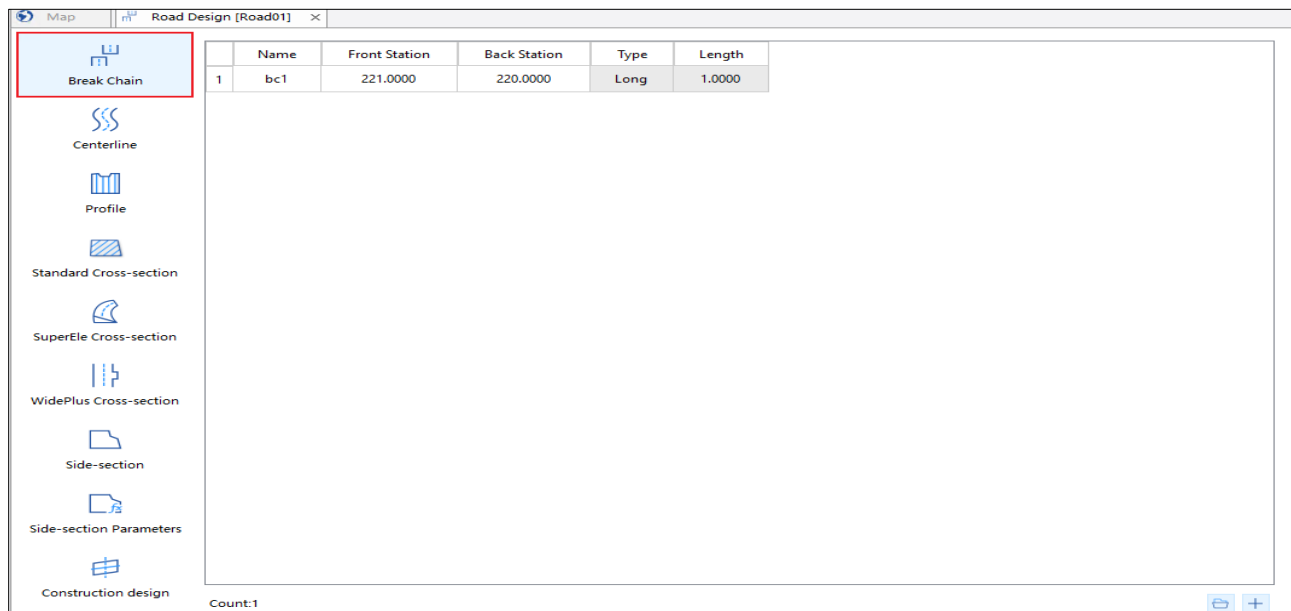


Figure 9-6-2 Broken Link Design Interface

2.Adding Broken Links

Click the add icon in the lower right corner of the broken link design interface, click the right mouse button and select [Add], the software added a new line of data at the end of the list of broken link data, you can double-click the cell in the list to edit.

The software adds a new line of data at the end of the list of broken links.

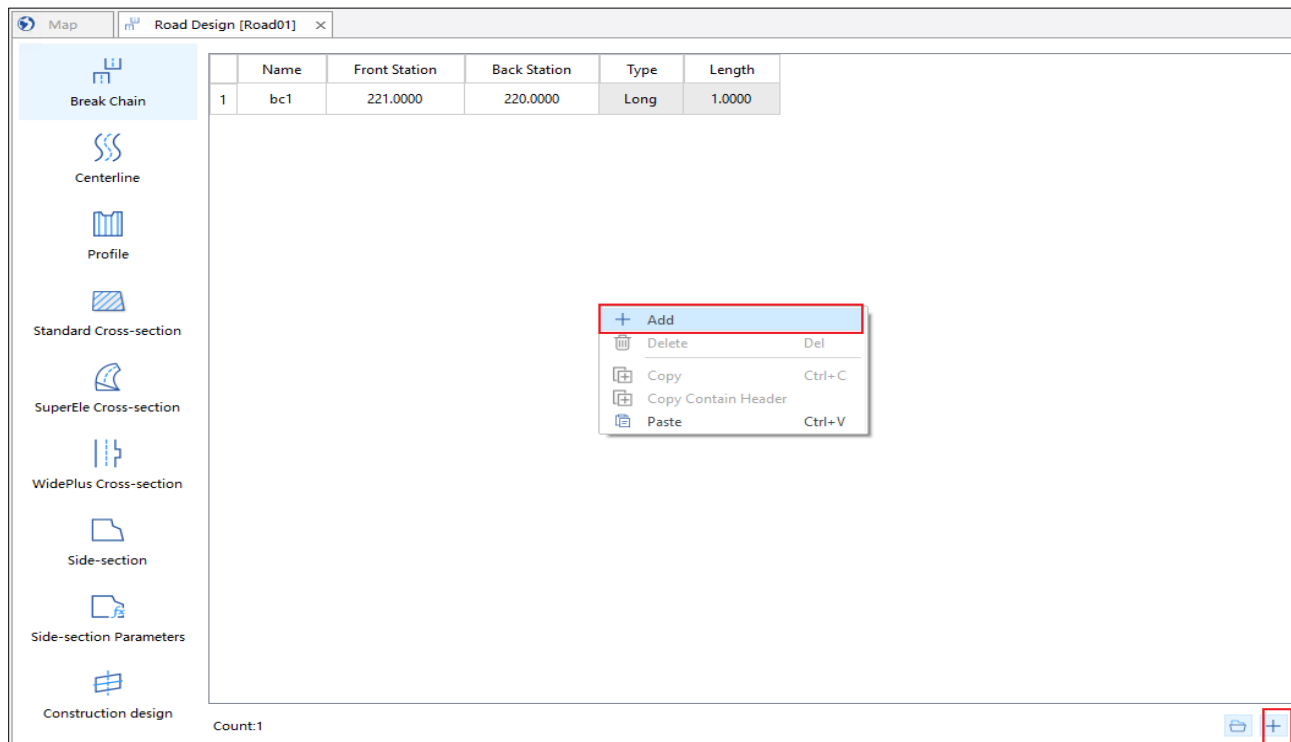


Figure 9-6-3 Adding Broken Links

3.Edit Broken Links

Enter the broken chain design interface, select a line of broken chain data, double-click the cell to directly edit the properties.

4.Remove Broken Links

(1) Enter the broken chain design interface, select a line of broken chain data, select a broken chain data, right-click [Delete].

(2) Software prompts 'OK to delete?' , point [yes] then the software in the list to delete the selected data, point [no], the prompt box disappears.

The software will delete the selected data in the list.

5.Loading the Broken Link File

Click on the folder icon in the bottom right corner of the broken link design interface and the software pops up the file selector.

(2) Select the location of the broken link file that needs to be loaded, select the broken link file to be loaded, and click [Open] in the file selector interface.

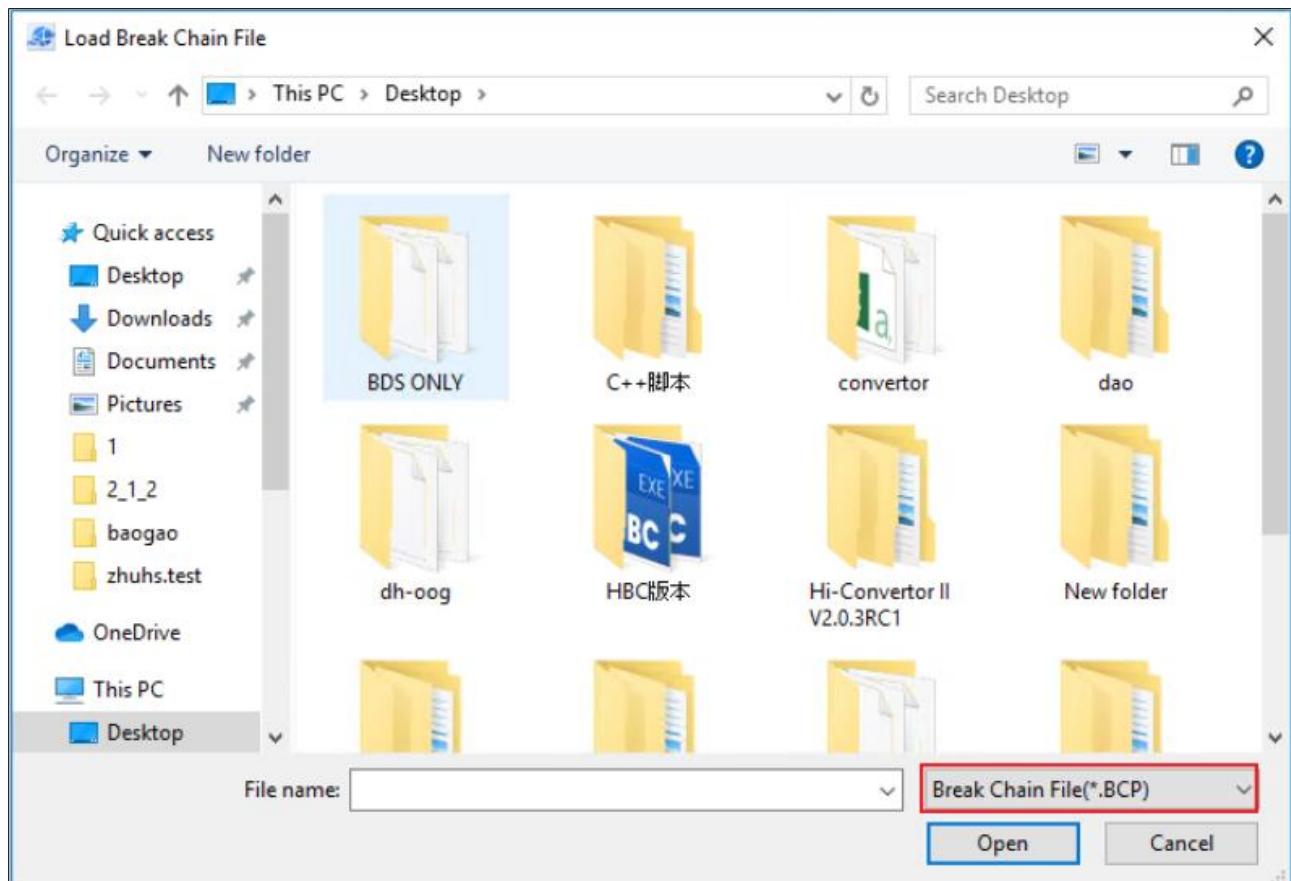


Figure 9-6-4 Loading the Broken Link File

(3) The software prompts 'The broken link file was loaded successfully', and the list of broken links shows the loaded data.

6.Copy And Paste

You can copy the broken link data in the project to another project or other tables through copy, copy including header and paste.

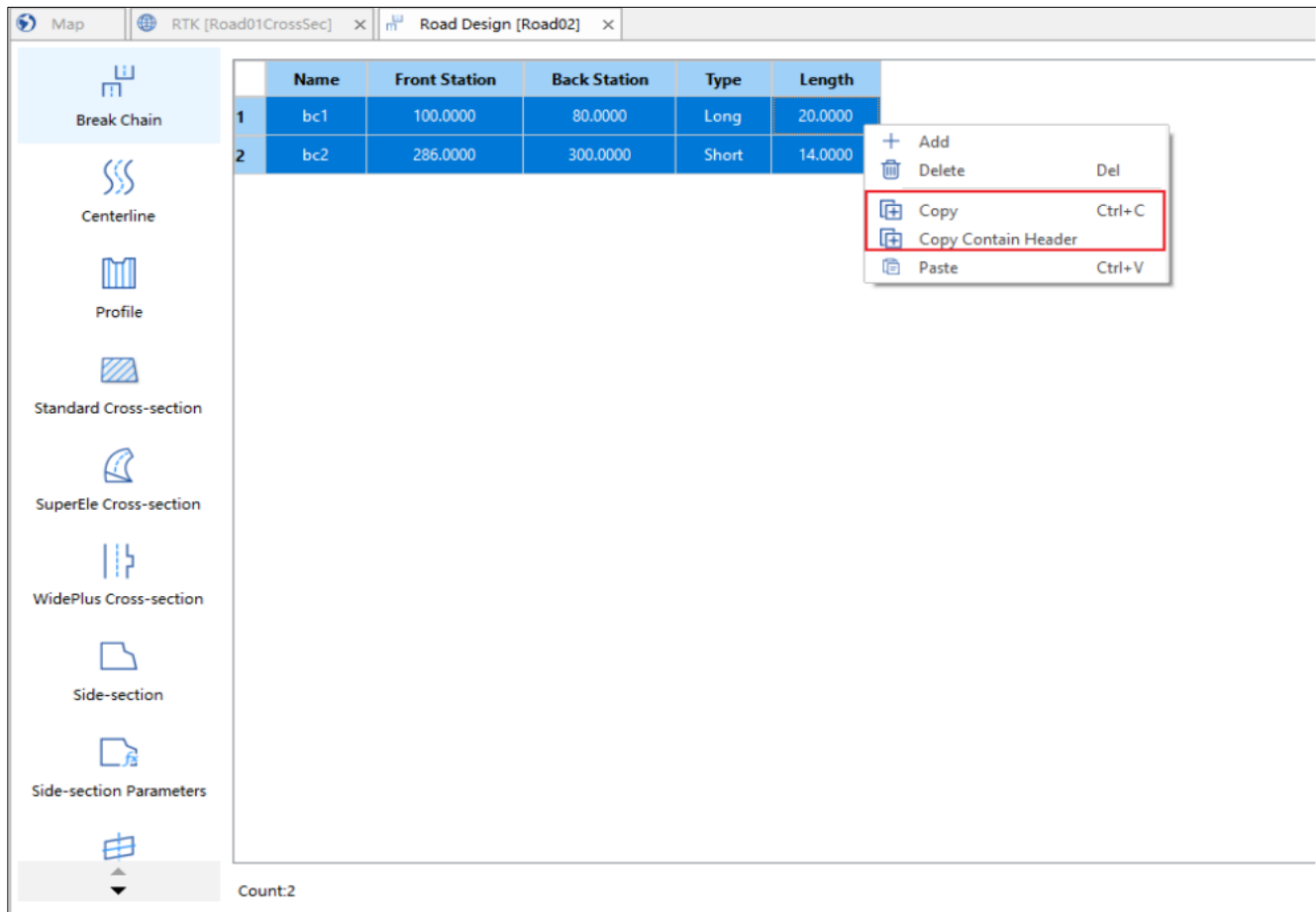


Figure 9-6-5 Copy

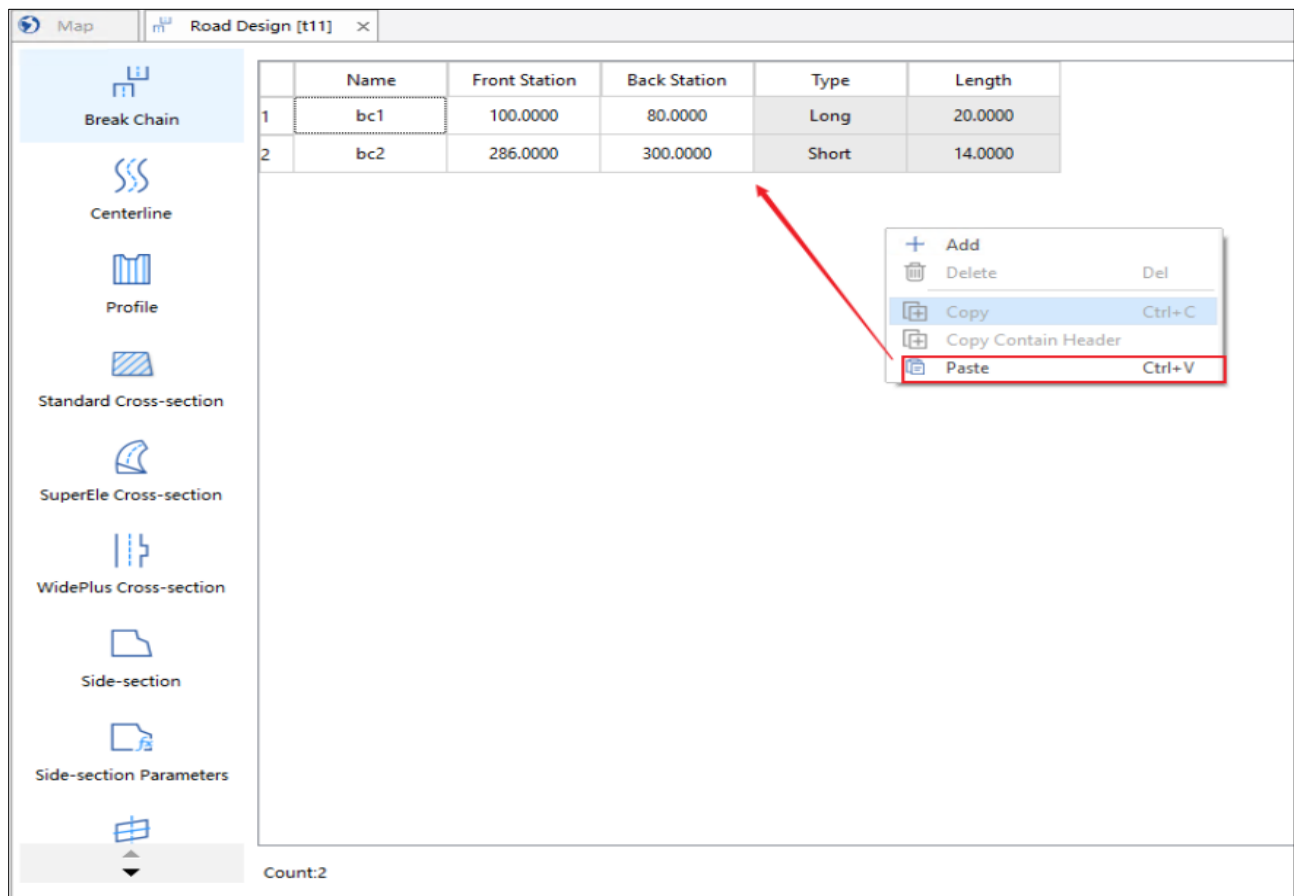


Figure 9-6-6 Paste

9.6.2 Flat Sections

1.Flat Cross-sectional Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [flat section design] in the left menu to enter the flat section design interface as follows.

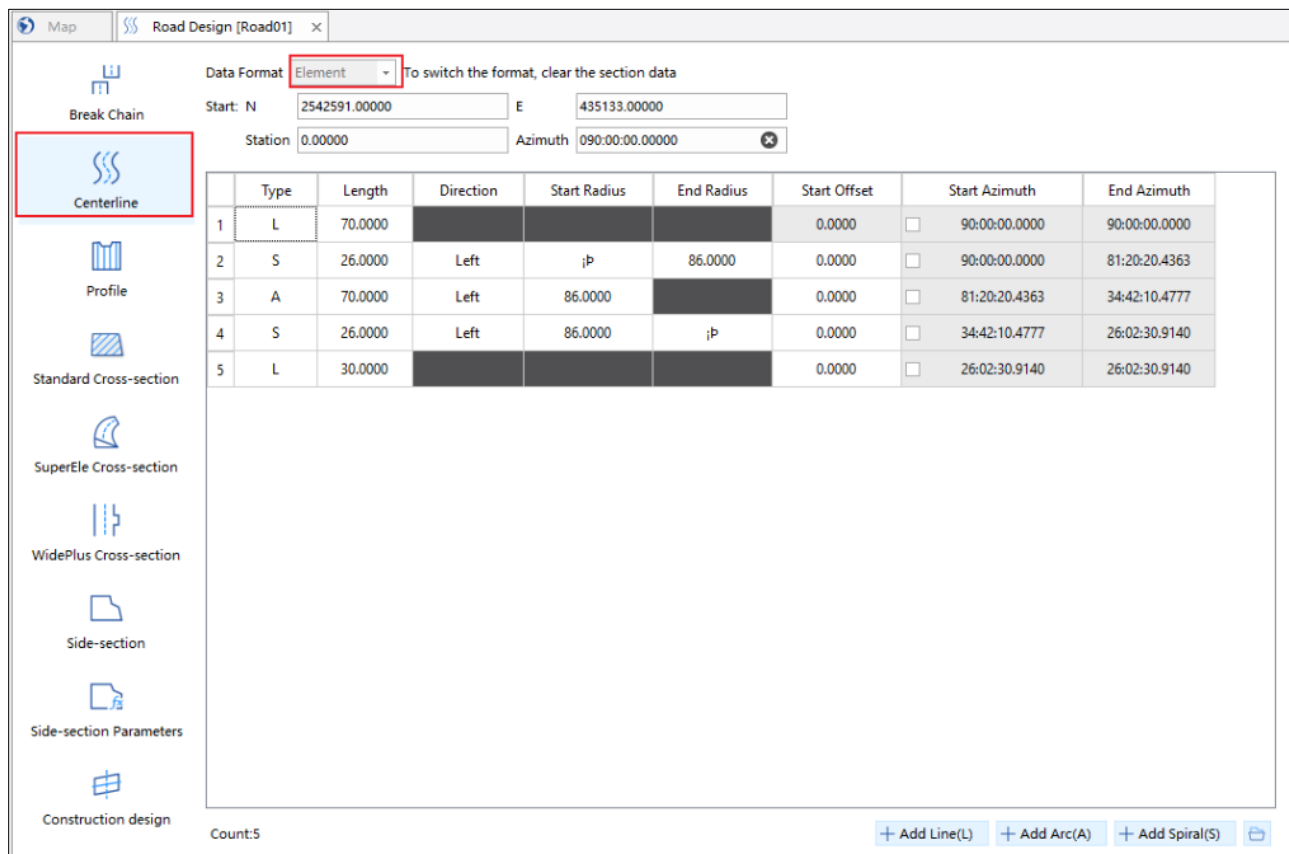


Figure 9-6-7 Flat Cross-sectional Design Interface

Click on the data format drop-down box has three flat section design formats to choose from: intersection method, line element method, and five major piles. The following is a description of each of these three data formats, the method of data entry level cross-sectional data.

2. Intersection Method

(1) Applicable Line Range

Basic curves (curves controlled within the intersection are full first-flattening-rounding-second-flattening), pure round curves (curves controlled within the intersection are rounding), and side-band moderating curves (first-flattening is 0 or second-flattening is 0).

(2) Added

The intersection method constructs the whole road according to the intersection information entered in the curvilinear table and the line element information corresponding to the intersection control. Click the [Add] icon at the bottom right corner to add a new line at the end of the list of intersection data in the software. According to the road straight curve table information, input: intersection name, N (north coordinate), E (east coordinate), mileage (only at the first and second intersection need to enter the mileage value), radius (if any), the first curve length (if any), the second curve length (if any); and then click [Add] to enter the next intersection.

点号	N (X)	E (Y)	交点桩号	转角值	半径	缓和曲线长度	缓和曲线参数	切线长度	曲线长度	外距	校正值
点名	2	3	4	5	6	7	8	9	10	11	12
BP	3941077.978	512313.1611	AK0+000		半径						
JD1	3941203.035	512422.0771	AK0+165.837	6° 19' 41.1" (Y)	3000	第一缓和曲线		165.837	331.3372	4.5802	0.337
JD2	3941510.196	512755.8979	AK0+619.135	67° 46' 55.4" (Y)	360	90.000	180.000	287.797	494.3595	75.014	59.174
						93.889	260.000	265.736			
JD3	3941341.748	513114.4568	AK0+956.116	20° 21' 21.8" (Y)	720	0	0	130.420	297.4857	11.717	2.793
						83.368	245.000	169.859			
JD4	3941046.554	513404.3435	AK1+367.055	33° 04' 28.1" (Z)	670	89.59	245	243.873	476.3527	29.431	11.393
JD5	3940987.764	513670.7294	AK1+628.458	1° 39' 25.4" (Z)	2000	第一缓和曲线 = 第二缓和曲线		28.923	57.8417	0.2091	0.004
JD6	3940976.735	513728.6122	AK1+687.378	1° 22' 30.4" (Y)	2500			30.001	60	0.18	0.003
EP	3940970.414	513757.9402	AK1+717.377								

Figure 9-6-8 Added

Generally, when the length of the first reprieve (into reprieve curve) and the second reprieve (out of reprieve curve) are equal, only one value is written in the rectangle table, such as the length of reprieve curve 89.59, which is controlled by JD4 in the figure above. For example, the JD2 control has a first retardation length of 90 and a second retardation length of 93.889.

Specifically, if there is no straight line between JD2 and JD3 and the steering is the same, then the line between JD2-JD3 is: slow - round - slow (JD2 control) - round - slow (JD3 control), the square of the second moderate curve of JD2 moderate curve parameter $\neq$ radius * moderate curve length, so this moderate curve is JD2 and JD3. Common to JD3, the radius of the moderating curve changes from 360 at JD2 to 720 at JD3 instead of infinity, especially when switching to the line element method of input.

Considering that this kind of data appears more often in the actual project, the current intersection method has targeted the identification and adaptation of the data that there is a jogging two at the previous intersection and no jogging one at the next intersection. If it is inconsistent, it means that there is no common mitigation curve, just click OK; if it is inconsistent, it means that there is common mitigation curve, and the information inputted by the regular intersection method is not enough to construct the line accurately, so the user needs to correct the line according to the corresponding parameter values in the curvature table.

(3) Virtual Intersection

In the highway measurement, when the intersection can not be reached or obstacle blocking, often use virtual intersection solution algorithm to get the intersection corner and virtual intersection edge length,

in order to complete the curve measurement. The virtual intersection in the straight curve table generally have obvious explanation and label.

交点号	交点坐标		交点桩号	转角值	曲线要素值 (m)							曲线主点桩号				
	N (X)	E (Y)			半径	缓和曲线长度	缓和曲线参数	切线长度	曲线长度	外距	校正值	第一缓和曲线起点	第一缓和曲线终点或圆曲线起点	曲线中点	第二缓和曲线起点或圆曲线终点	第二缓和曲线终点
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
BP	3533421.357	36425813.16	K0+000													
JD1	3533493.042	36425873.5	K0+093.694	50° 48' 54.9" (Y)	90	40	60	63.068	119.8204	10.456	6.316	K0+030.626	K0+070.626	K0+090.536	K0+110.446	K0+150.446
JD2	3533491.117	36425996.08	K0+209.976	18° 16' 03.5" (Z)	150	20	54.772	34.133	67.82458	2.0389	0.442	K0+175.843	K0+195.843	K0+209.755	K0+223.667	K0+243.667
JD3	3533562.975	36426225.83	K0+450.257	158° 11' 50.4" (Y)	25.24168	25	25.121	148.77	94.6939	113.64	202.85	K0+301.487	K0+326.487	K0+348.834	K0+371.181	K0+396.181
JD3-1	3533527.806	36426113.38		79° 47' 42.1" (Y)				30.957								
JD3-2	3533488.211	36426134.06		78° 24' 08.3" (Y)				30.404								
JD4	3533452.5	36426090.23	K0+422.314	34° 49' 32.4" (Y)	51.15491	20	31.966	26.133	51.0931	2.7978	1.173	K0+396.181	K0+416.181	K0+421.728	K0+427.274	K0+447.274

Figure 9-6-9 Virtual Intersection

As shown in the figure, JD3 is the original intersection, JD3-1 and JD3-2 constitute a set of virtual intersection, the above figure is an example of adding virtual intersection data, the original JD3 data is no longer input, input JD3-1 intersection N, E coordinates and JD3 radius, the first moderate curve length and the second moderate curve length; JD3-2 only need to input N, E coordinates. and check the virtual intersection.

Map
Road Design [Road02]

Data Format: Intersection To switch the format, clear the section data

Break Chain
☐ Take The Second Point As The Station Starting Point

Centerline

Profile

Standard Cross-section

SuperEle Cross-section

WidePlus Cross-section

Side-section

Side-section Parameters

Construction design

	Name	N	E	Station	Radius	L of Spiral in	L of Spiral out	Virtual Point	L of Parame
1	QD	2542596.8114	435133.2110	0.0000					
2	JD	2542425.2559	435133.4467	151.5557	200.0000	68.0000	68.0000	☐	
3	ZD	2542340.7968	435255.4506	282.5428	0.0000	0.0000	0.0000	☒	

Count:3

Figure 9-6-10 Virtual Intersection

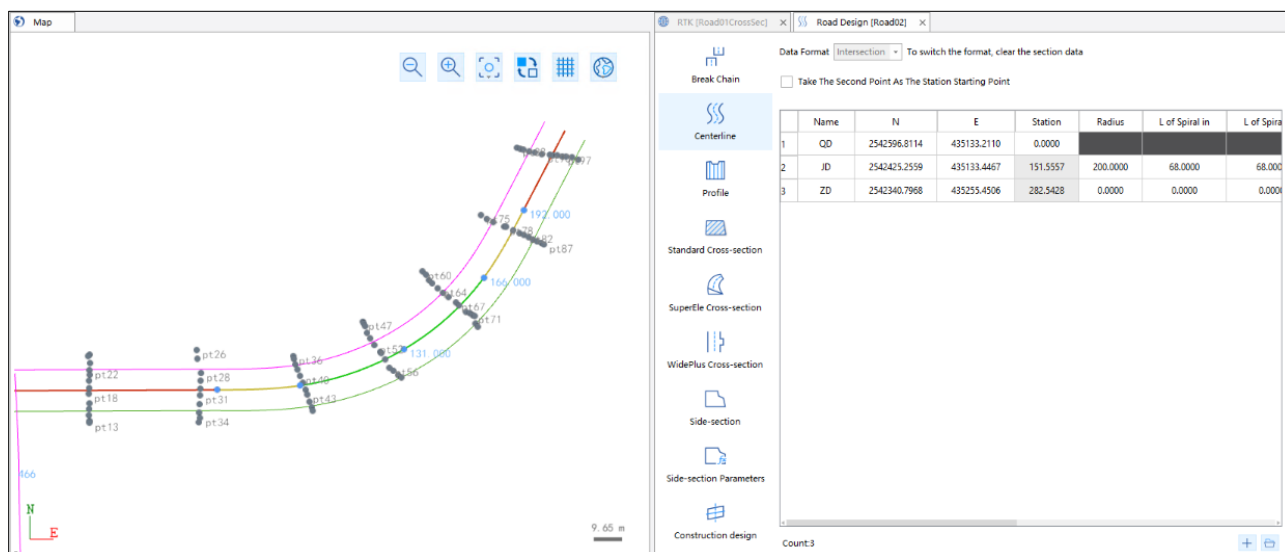


Figure 9-6-11 Virtual Intersection

(4) Insert

Select a line of data, right-click [Insert], add an empty line of data in front of the currently selected line of data, you can double-click the cell in the list to edit.

(5) Edit

Select a line of intersection data, in the cell can be edited directly on the properties, the properties that can be edited are: name, mileage, N, E, the first intersection limit radius, the first curve length, the second curve length, whether it is a virtual intersection.

(6) Delete

After selecting a piece of intersection data, right-click delete, and the software will pop up a prompt box: 'are you sure to delete the line?'. Click Yes to delete the selected data in the list, and click No to disappear.

(7) Delete Empty Lines

Click the [Delete Empty Rows] button in the lower right corner to delete empty data in one click.

(8) Paste Data

Copy the data in the list, enter the node interface, click the data list or select a cell, press Ctrl+V or right click [Paste], then you can paste the data to the node data list.

(9) Loading Data

Click the [load] icon in the lower right corner, the software pop-up file selector, select the path to load the data file, drop down to select the data format to load: intersection file (*.PHI), five pile file (*.CSV), four hospitals (*.XY), Hongye road file (*.hjd); double-click the data file, or click [load] to load the data file. Open], the software loads data to the intersection list.

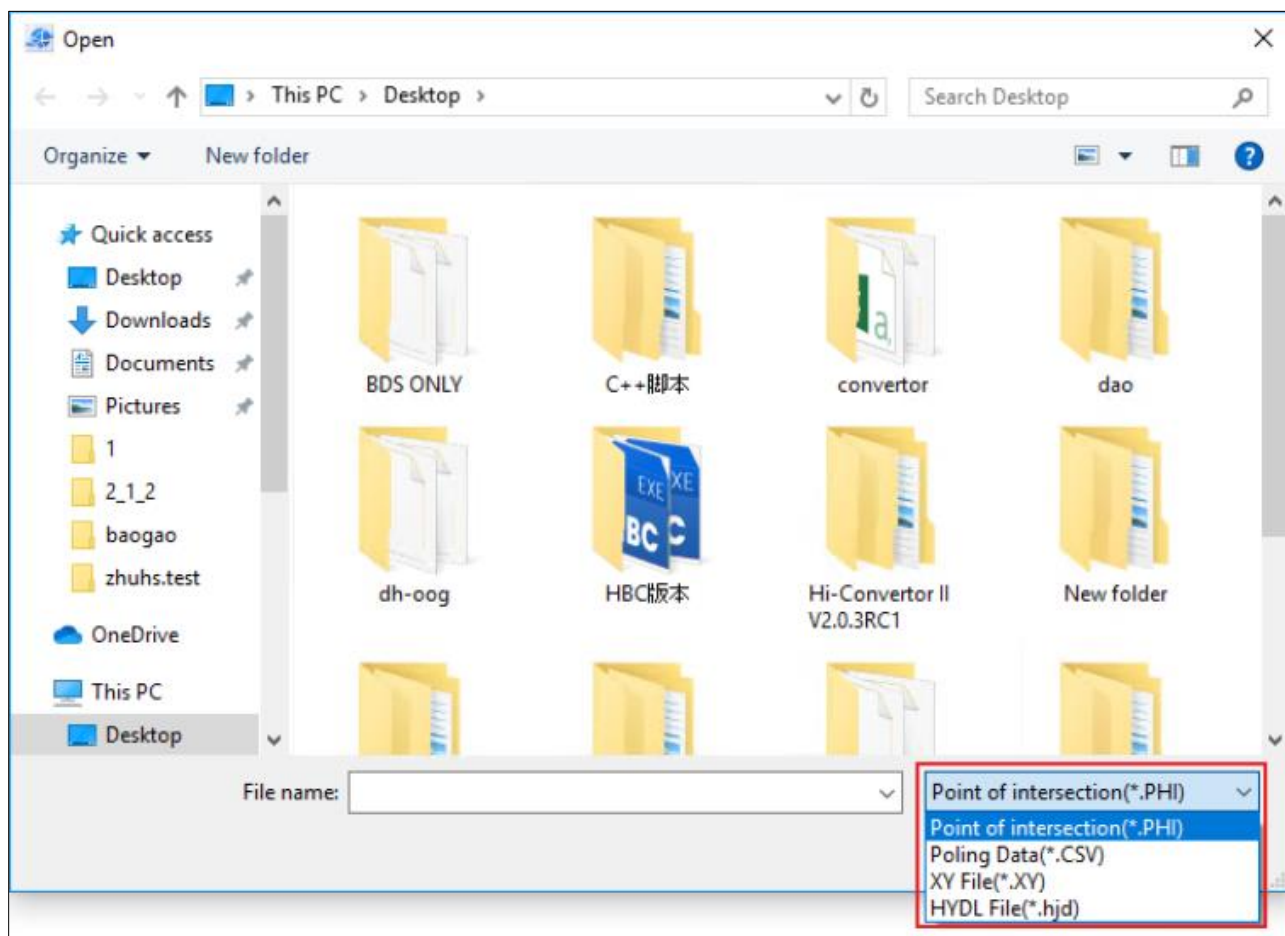


Figure 9-6-12 Loading Data

(10) The Second Point Is the Mileage Starting Point

By default, the first point is the mileage starting point. If checked, the second point will be the mileage starting point.

(11) Refresh

Right click refresh in the plane section list to refresh the data.

(12) Mark Special Intersections

Select a row of data, right-click mark special intersection to mark the data as special intersection, and right-click mark special intersection again to cancel.

(13) Copy, Including Header

In the plane section list, select the data, right-click [copy] or [copy including header], copy the data, and copy the data to another project or other software through the paste button.

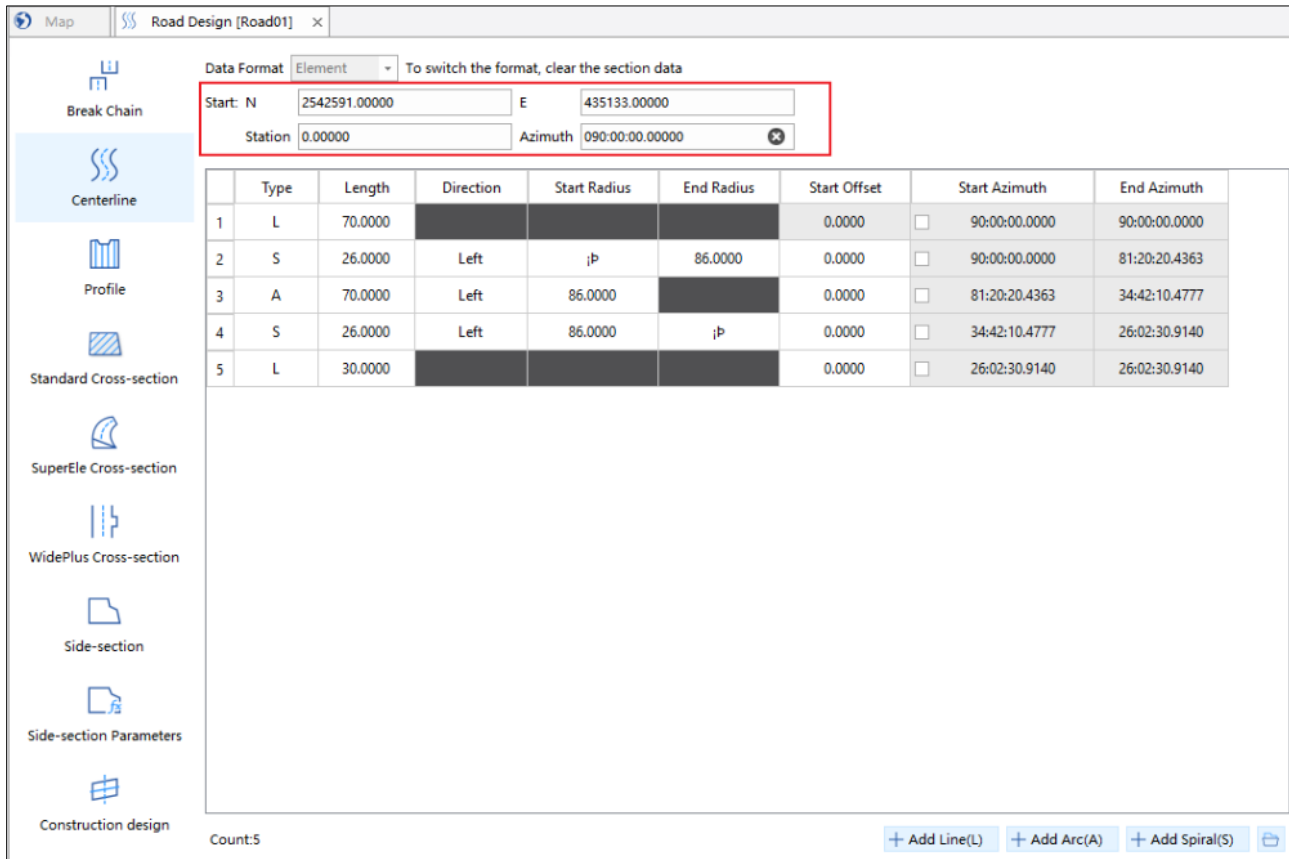
3.Line Metamethods

Line element legal line is also called the legal building block line, it is a complex combination of highway plane linear 'integer into zero' decomposition into a number of linear units. If the starting point of the known route plane curve information such as coordinates, tangent direction and radius of curvature, then start from the starting point to set up any unit, along any direction of extension, the information of the end of the unit, such as coordinates, tangent azimuth, curve radius can be calculated, at the same time, as the next unit of the starting point of the same information to be used.

If you want to be able to do this, you can do it in the same way as if you were building blocks.

(1) Set the Starting Point

After selecting the data format as [line element method], fill in the starting point information in [starting point], including the starting mileage of the road, N (northern coordinates), E (eastern coordinates), the starting line (tangential) azimuth.



Data Format: **Element** To switch the format, clear the section data

Start: N 2542591.00000 E 435133.00000
 Station 0.00000 Azimuth 090:00:00.00000

	Type	Length	Direction	Start Radius	End Radius	Start Offset	Start Azimuth	End Azimuth
1	L	70.0000				0.0000	90:00:00.0000	90:00:00.0000
2	S	26.0000	Left	∞	86.0000	0.0000	90:00:00.0000	81:20:20.4363
3	A	70.0000	Left	86.0000		0.0000	81:20:20.4363	34:42:10.4777
4	S	26.0000	Left	86.0000	∞	0.0000	34:42:10.4777	26:02:30.9140
5	L	30.0000				0.0000	26:02:30.9140	26:02:30.9140

Count:5

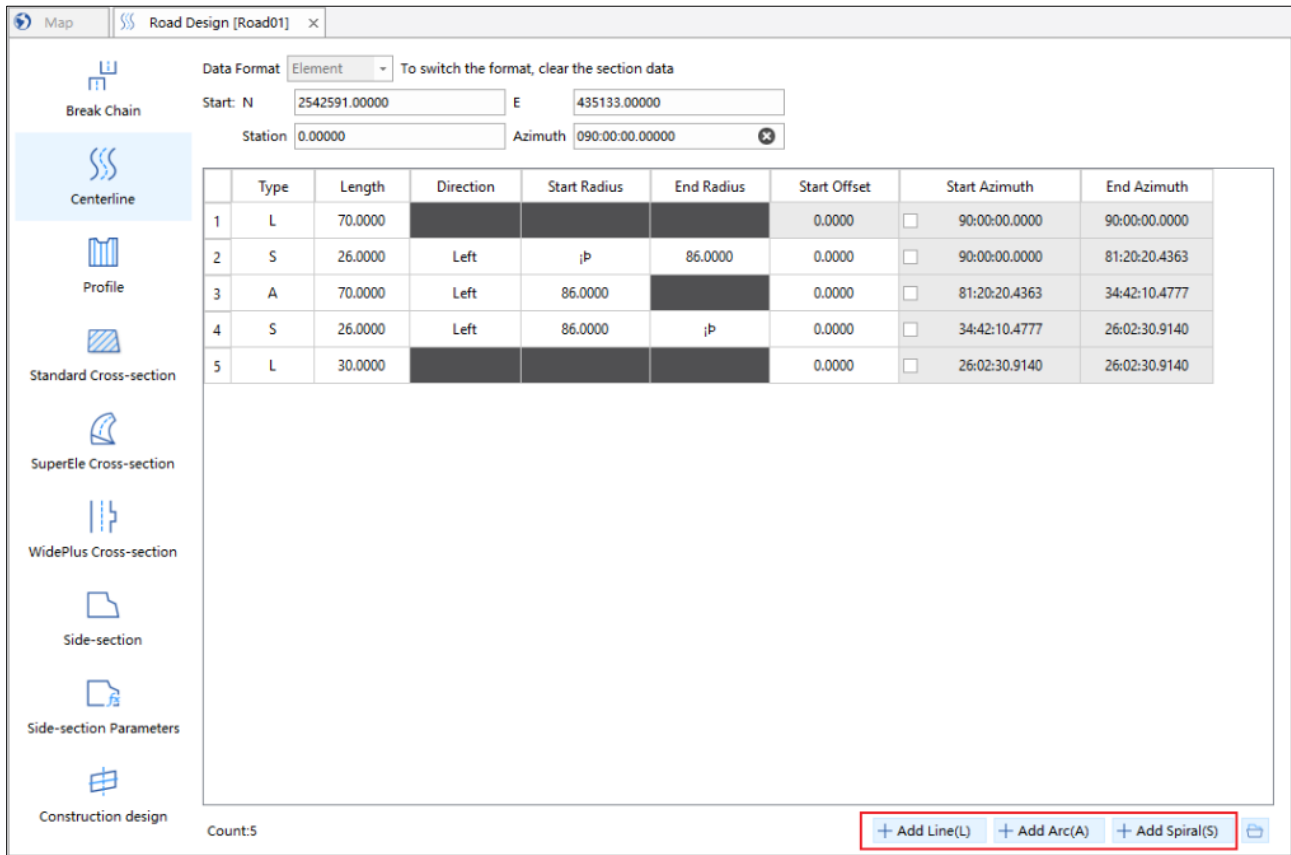
+ Add Line(L) + Add Arc(A) + Add Spiral(S)

Figure 9-6-13 Set the Starting Point

(2) Adding Line Elements

According to the road straight curve table information, enter the road line element information, including straight line (element length, start offset, start azimuth), arc (radius, element length, check the steering, start offset, start azimuth), moderate curve (start radius, end radius, element length, check the steering, start offset, start azimuth). When adding, press: Line - First Moderating Curve - Round Curve - Second Moderating Curve - Line - ... to add cycle (each section is added if there is any). Click the [Add xxx] icon

at the bottom right corner corresponding to the line element you want to add, a new line will be added at the end of the software line element data list, you can double-click the cell in the list to edit.



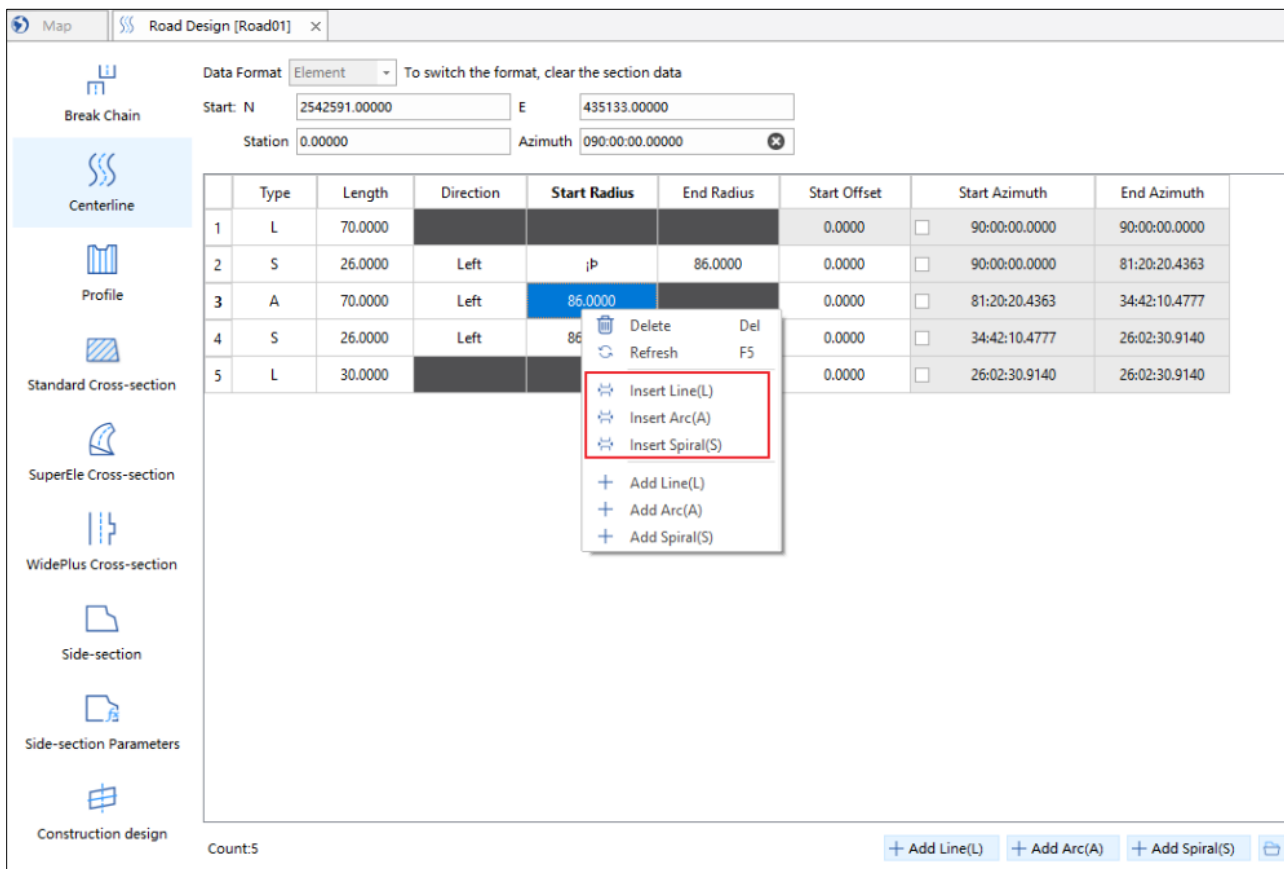
	Type	Length	Direction	Start Radius	End Radius	Start Offset	Start Azimuth	End Azimuth
1	L	70.0000				0.0000	90:00:00.0000	90:00:00.0000
2	S	26.0000	Left	∞	86.0000	0.0000	90:00:00.0000	81:20:20.4363
3	A	70.0000	Left	86.0000		0.0000	81:20:20.4363	34:42:10.4777
4	S	26.0000	Left	86.0000	∞	0.0000	34:42:10.4777	26:02:30.9140
5	L	30.0000				0.0000	26:02:30.9140	26:02:30.9140

Figure 9-6-14 Adding line elements

It should be emphasized that the starting radius of the first moderate curve is infinity (∞) and the ending radius is the radius of the circle controlled by the corresponding intersection, the starting radius of the second moderate curve is the radius of the circle controlled by the corresponding intersection and the ending radius is infinity. But in case of common moderate curve (the linearity of the road between two intersection points is: moderate-circle-simultaneous (common)-circle-simultaneous), the above rule is not applicable, you can judge whether the middle section of moderate curve is common or not by the corresponding formula 'the square of moderate curve parameter (A^2) = radius (R)*length of moderate curve (L_s)'. If they are not equal, then the two intersections share a curvature, and if the curvature is added, the starting radius is the radius of the circle before the intersection, and the ending radius is the radius of the circle after the intersection; if they are equal, then they are entered in the general case.

(3) Inserting A Line Element

Select a line of data, right-click [insert xxx], the software online metadata list has been selected before the location of the item to add a new line of corresponding metadata, you can double-click the editable cell to edit the data.



Data Format: **Element** To switch the format, clear the section data

Start: N 2542591.00000 E 435133.00000

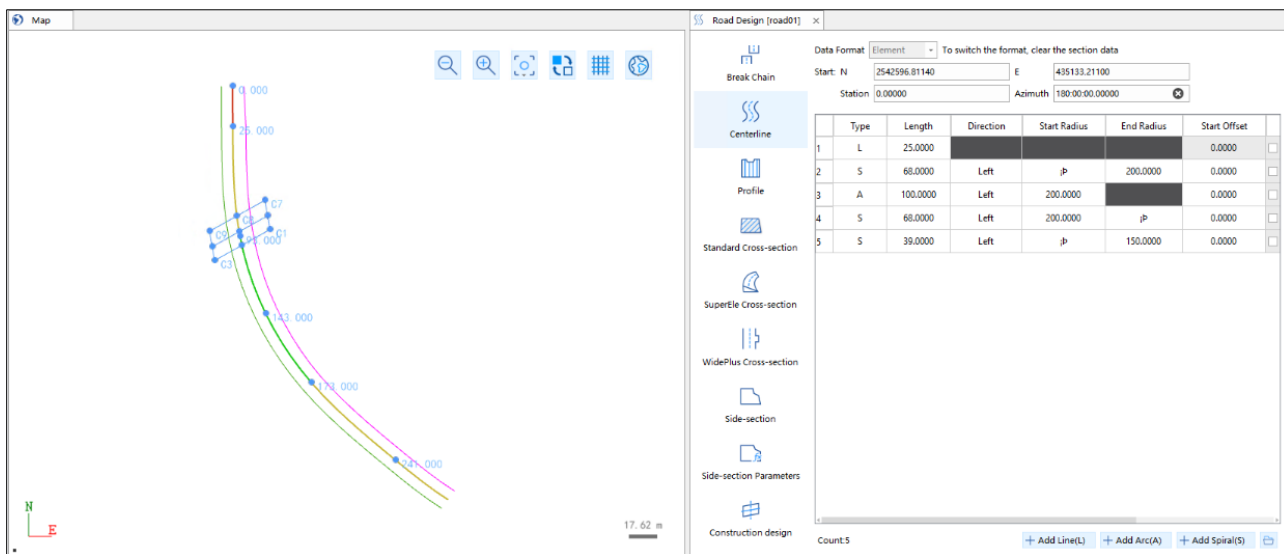
Station 0.00000 Azimuth 090:00:00.00000

	Type	Length	Direction	Start Radius	End Radius	Start Offset	Start Azimuth	End Azimuth
1	L	70.0000				0.0000	90:00:00.0000	90:00:00.0000
2	S	26.0000	Left	jp	86.0000	0.0000	90:00:00.0000	81:20:20.4363
3	A	70.0000	Left	86.0000		0.0000	81:20:20.4363	34:42:10.4777
4	S	26.0000	Left			0.0000	34:42:10.4777	26:02:30.9140
5	L	30.0000				0.0000	26:02:30.9140	26:02:30.9140

Count:5

+ Add Line(L) + Add Arc(A) + Add Spiral(S)

Figure 9-6-15 Inserting A Line Element



Data Format: **Element** To switch the format, clear the section data

Start: N 2542596.81140 E 435133.21100

Station 0.00000 Azimuth 180:00:00.00000

	Type	Length	Direction	Start Radius	End Radius	Start Offset
1	L	25.0000				0.0000
2	S	68.0000	Left	jp	200.0000	0.0000
3	A	100.0000	Left	200.0000		0.0000
4	S	68.0000	Left	200.0000	jp	0.0000
5	S	39.0000	Left	jp	150.0000	0.0000

Count:5

+ Add Line(L) + Add Arc(A) + Add Spiral(S)

Figure 9-6-16 Inserting A Line Element

(4) Edit line element

Select a line of metadata and double-click the cell to edit the properties directly.

(5) Delete line element

Select a line metadata, right-click delete, and the software prompts 'are you sure to delete line?'. Click Yes to delete the selected data in the list. Click No to disappear the prompt box.

(6) Load data

Click the lower right corner [load] icon, the software pop-up file selector, select the path to load the data file, drop down to select the data format to load: meta file (*.sec), Haitian format (*.pm), latitudinal format (*.pm), five pile file (*.CSV), Elcad format (*.ICD). Double-click the data file, or click [Open], and the software will load the data to the line element list.

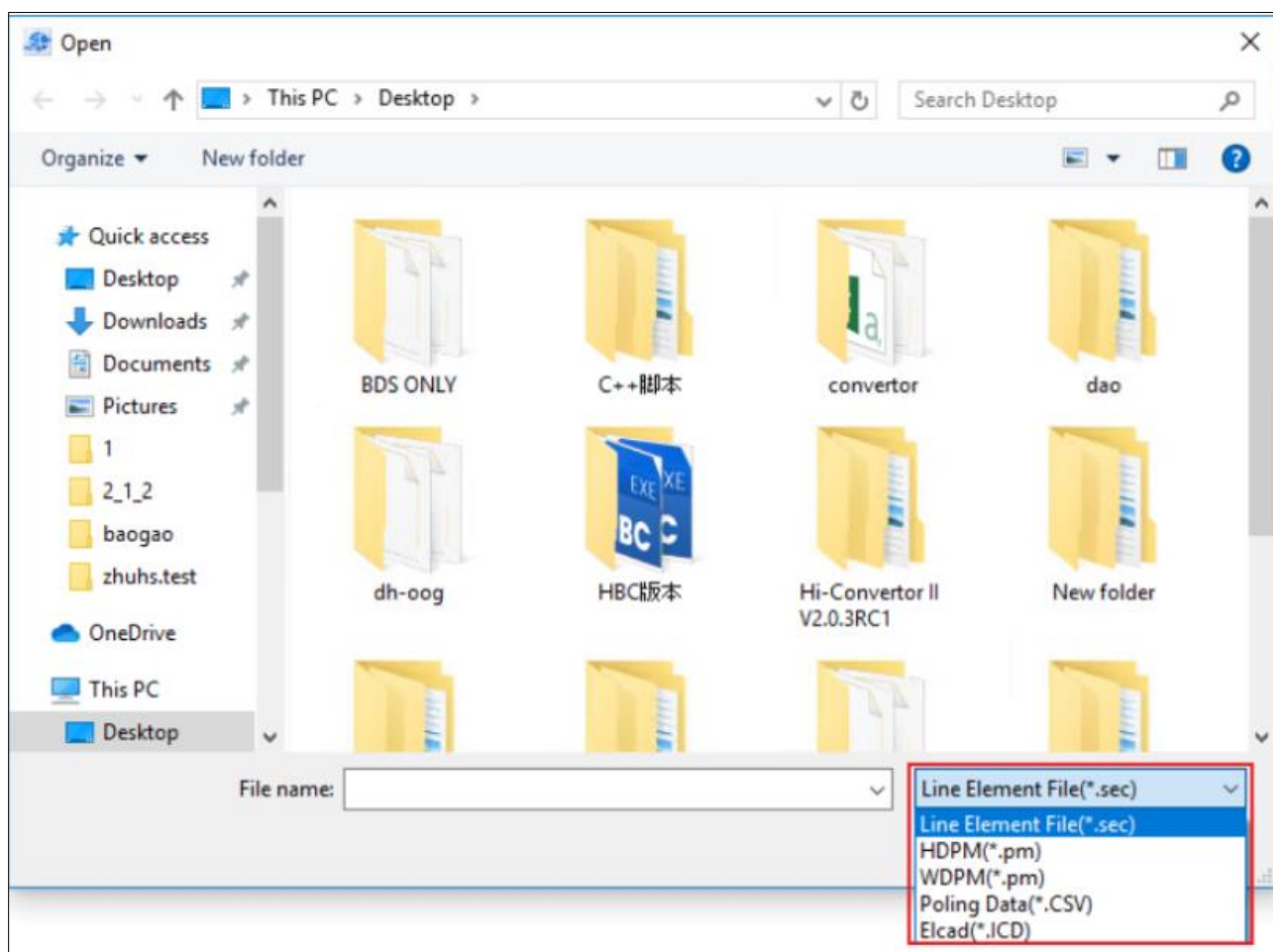


Figure 9-6-17 Load Data

(7) Refresh

Right click refresh in the plane section list to refresh the data.

4 The Five Piles

(1) Paste data

You can copy and paste the straight curvature data by column directly into the corresponding list of the five major piles. Enter the interface of plane-section design, switch to the interface of five pile files, click on the data list or select a cell, press Ctrl+V or right click on [Paste].

(2) Delete empty lines

If there are blank rows in the list of five pile data, click the [Delete Blank Rows] icon at the bottom right corner to delete the blank rows.

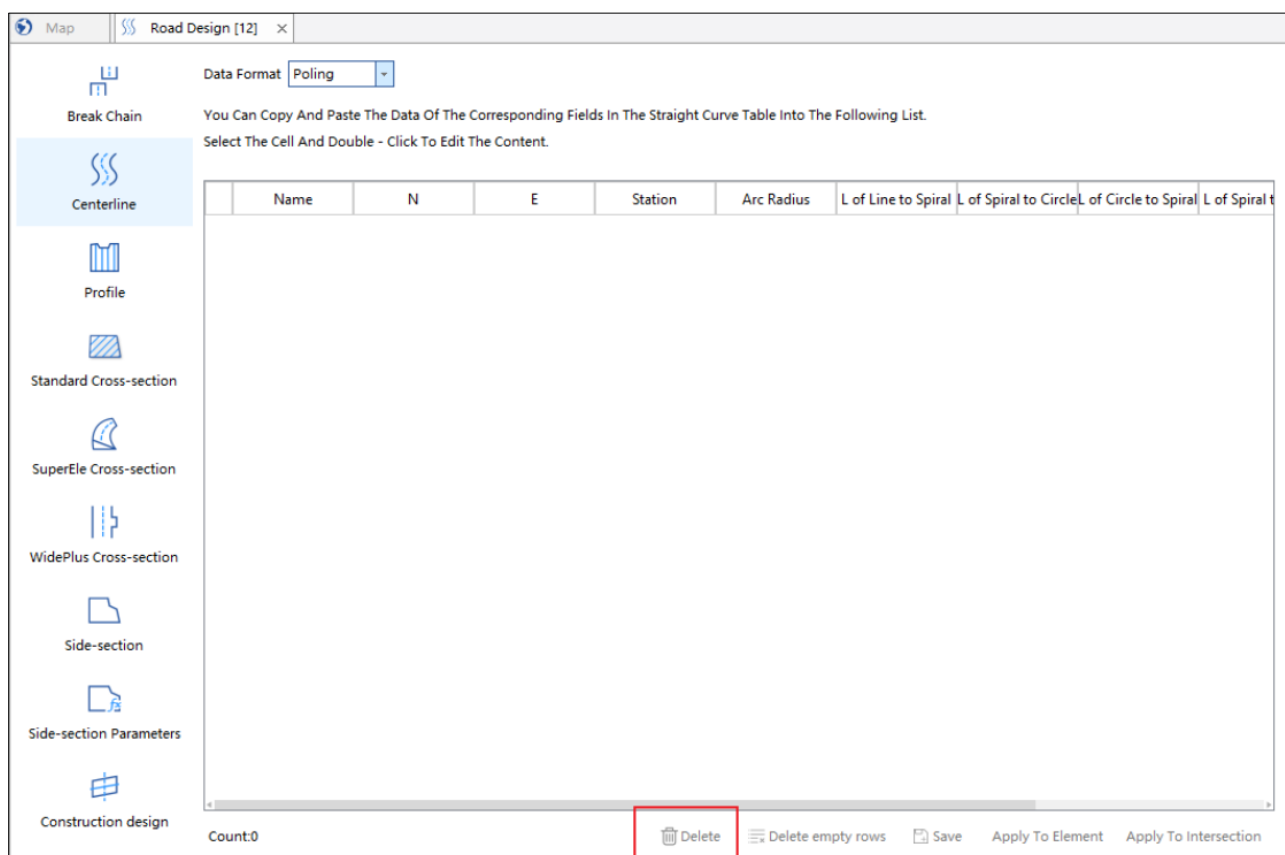


Figure 9-6-18 Delete Empty Lines

(3) Delete Lines

Select one of the five pile data, right-click [delete row] or directly click [delete row] icon in the lower right corner, the software prompts 'Are you sure to delete the row?'. , point [yes] then the software in the list to delete the selected data, point [no], the prompt box disappears.

The software will delete the selected data in the list.

(4) Apply to node data

When you finish inputting the five pile data, click [Apply to intersection data] icon at the bottom right corner, the software will convert the five pile data to the intersection data and switch to the corresponding interface of the intersection method.

(5) Apply to line metadata

When you finish inputting the five pile data, click the [Apply to Line Element Data] icon at the bottom right corner, the software will convert the five pile data to line element data and switch to the corresponding interface of line element method.

(6) Refresh

Right click refresh in the plane section list to refresh the data.

(7) Copy, including header

In the plane section list, select the data, right-click [copy] or [copy including header], copy the data, and copy the data to another project or other software through the paste button.

9.6.3 Vertical Sections

The longitudinal section is an expression of the longitudinal trend of the road (line elevation), and the line longitudinal section elements can be entered manually or imported from a file with a variable gradient file (*.PVI).

1. Longitudinal Section Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [Longitudinal Section Design] in the left menu to enter the longitudinal section design interface as follows:

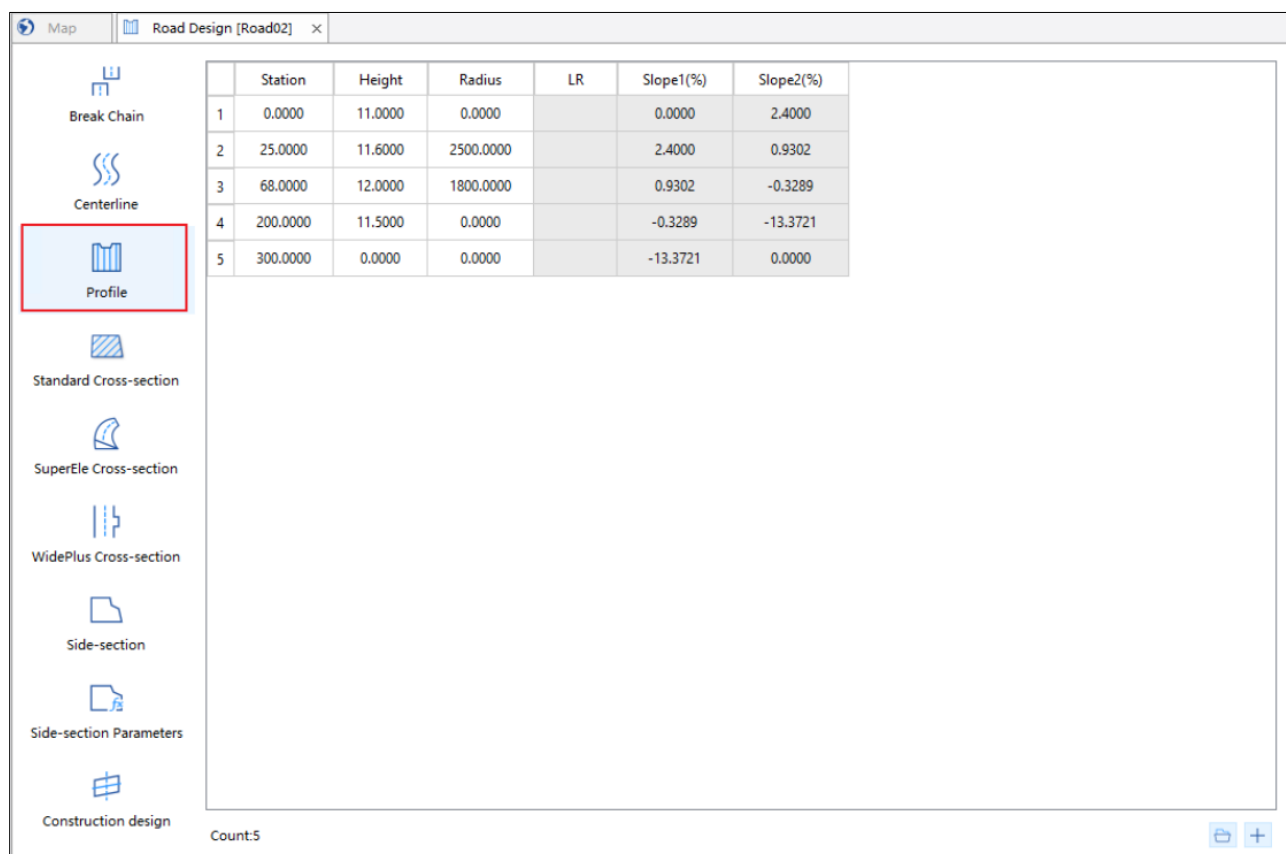


Figure 9-6-19 Longitudinal Section Design Interface

2.Adding A Change of Slope Point

Enter the interface of longitudinal section design, click the add icon at the bottom right corner, a new line of data will be added at the end of the software variable slope data list, you can double-click the cell in the list to edit.

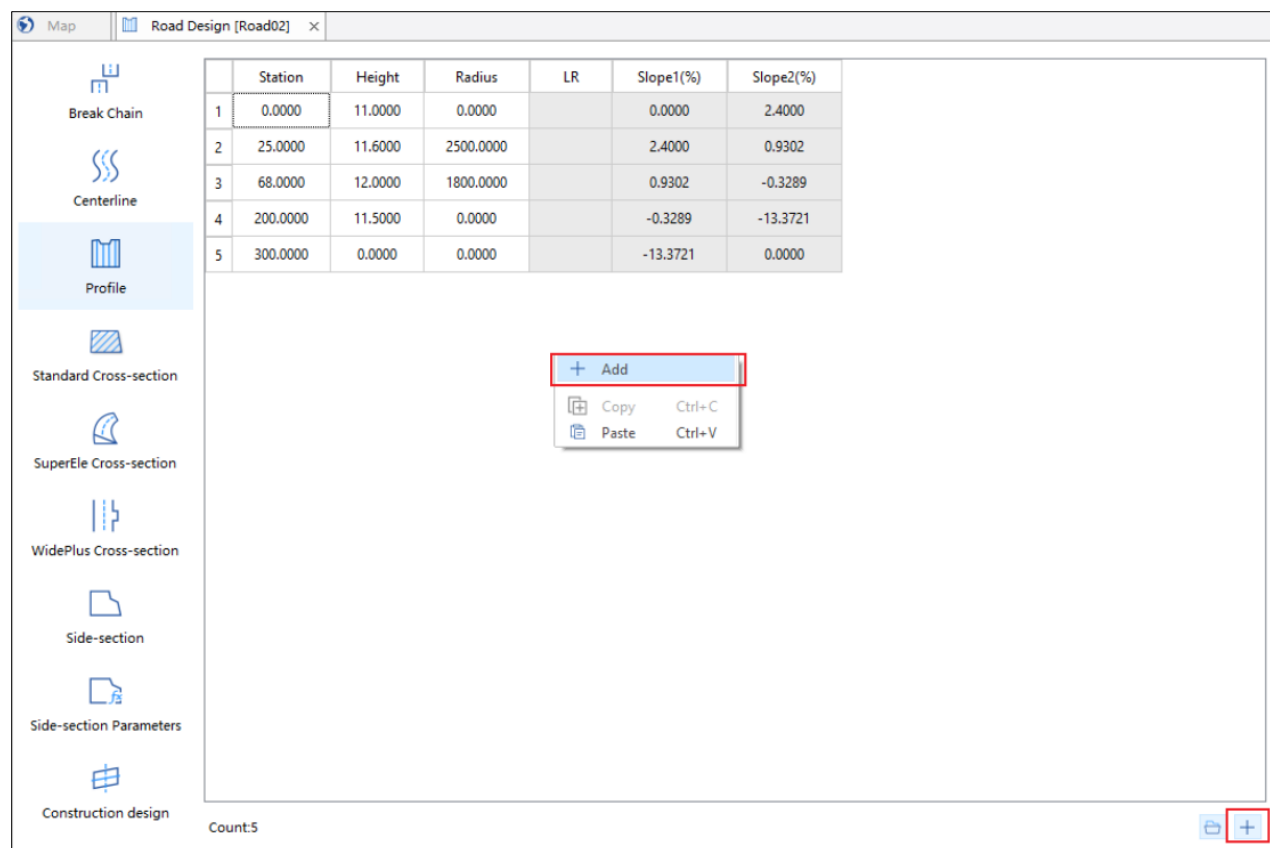


Figure 9-6-20 Adding A Change of Slope Point

The longitudinal section data generally comes from the vertical curve table (vertical slope table), according to the table data can be added in turn.

纵坡及竖曲线表									
公路 段		高程 (m) 高程	凹凸	R (m)	T (m)	E (m)	变坡点 间距 (m)	直坡段 长 (m)	坡度 (%)
序号	桩号 里程								
1	K145+610.0000	2058.245		半径			2900.0000	2839.9956	-0.3000
2	K148+500.0000	2049.545	凹	15000.0000	60.0044	0.1200	5739.3300	5602.9764	0.5001
3	K154+239.3300	2078.245	凸	15000.0000	76.3492	0.1943	870.0000	793.6508	-0.5179
4	K155+109.3300	2073.739	凹	0.0000	0.0000	0.0000	570.0000	570.0000	-0.4221
5	K155+679.3300	2071.333	凸	0.0000	0.0000	0.0000	610.0000	610.0000	-0.4808
6	K156+289.3300	2068.400	凸	0.0000	0.0000	0.0000	400.0000	400.0000	-0.5010
7	K156+689.3300	2066.396	凹	0.0000	0.0000	0.0000	600.0000	600.0000	-0.4664
8	K157+289.3300	2063.598	凸	0.0000	0.0000	0.0000	2597.1580	2538.1038	-0.4802
9	K159+886.4880	2051.125	凸	15000.0000	59.0542	0.1162	1512.8240	1453.7698	-1.2676
10	K161+399.3120	2031.948							

Figure 9-6-21 Adding A Change of Slope Point

3.Insert Variable Slope Points

Select a line of variable slope data, right-click [Insert], the software will add a new line of data before the selected item in the variable slope data list, you can double-click the editable cell to edit the data.

4.Editing the Variable Slope Point

Select a row of variable slope point data, the properties can be edited directly in the cell.

5.Deleting A Change of Slope Point

Select a variable slope point data, right click [delete], the software prompts 'OK to delete?'. If you click [Yes], the software will delete the selected data in the list, click [No], the prompt box disappears.

The software will delete the selected data in the list if you click [Yes].

6.Copy and Paste

You can copy the profile data in the project to another project or other tables through [copy] or [copy with header] and [paste].

7.Loading the Variable Slope Point File

Click the folder icon in the bottom right corner of the interface, the software pops up the file selector, select the location of the variable slope file to be loaded, select the file to be loaded, click [Open] in the file selector interface.

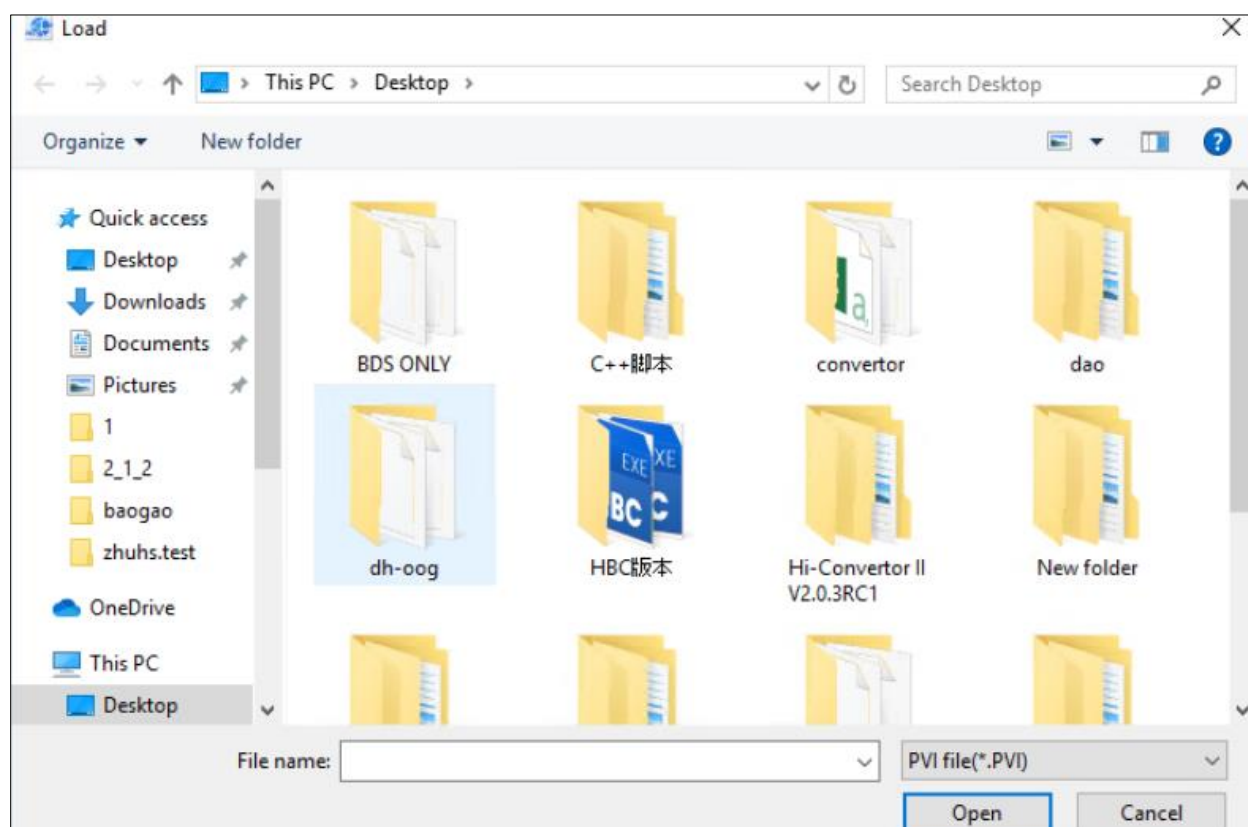


Figure 9-6-22 Loading the Variable Slope Point File

8.Profile Preview

After adding profile data, you can view the profile in the profile preview view below.

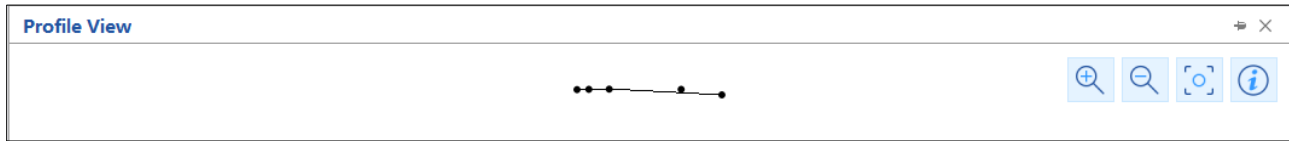


Figure 9-6-23 Profile Preview

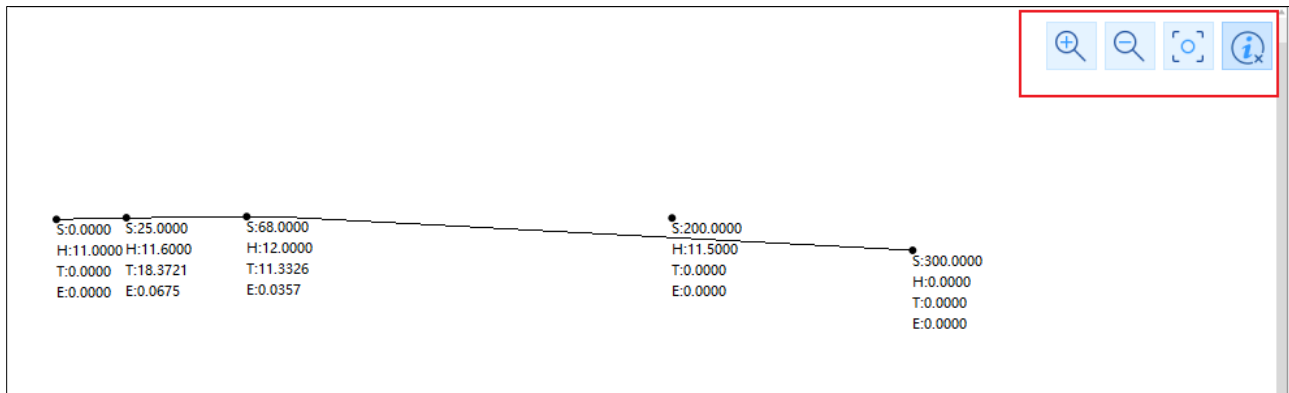


Figure 9-6-24 Profile Preview

You can use the zoom in, zoom out and center buttons in the upper right corner to zoom in, zoom out and center the profile.

You can view the details of each mileage of the profile through the details button in the upper right corner.

S:Mileage

H:Altitude

T:Tangent length

E:External sagittal distance

9.6.4 Cross-sections

1.Standard Cross-sectional Design

Standard cross-section perpendicular to the centerline of the road, highway and urban road cross-section composition is different. The main components of the road cross-section are: carriageway (road surface), shoulders, gutter, slope, green belt, divider, retaining wall, etc.; urban road cross-section is composed of: carriageway (road surface), pavement, curbs, green belt, divider, etc. In high embankment and deep graben, it also includes retaining wall. In sections with high embankments and deep grabens, retaining walls are also included.

The standard cross-section consists of standard plates, entered one by one in left and right, starting from the centerline of the road. Each plate is defined by the slope, width and road teeth. The kerb is the height difference (height of the kerb) between the current plate and the previous plate. The following figure demonstrates standard cross-sectional data entry as an example.

(1) Standard Cross-sectional Design Interface

Click [Roadway] to open the road module, create or load a road file, click [Standard Cross-sectional Design] in the left menu to enter the standard cross-sectional design interface as follows.

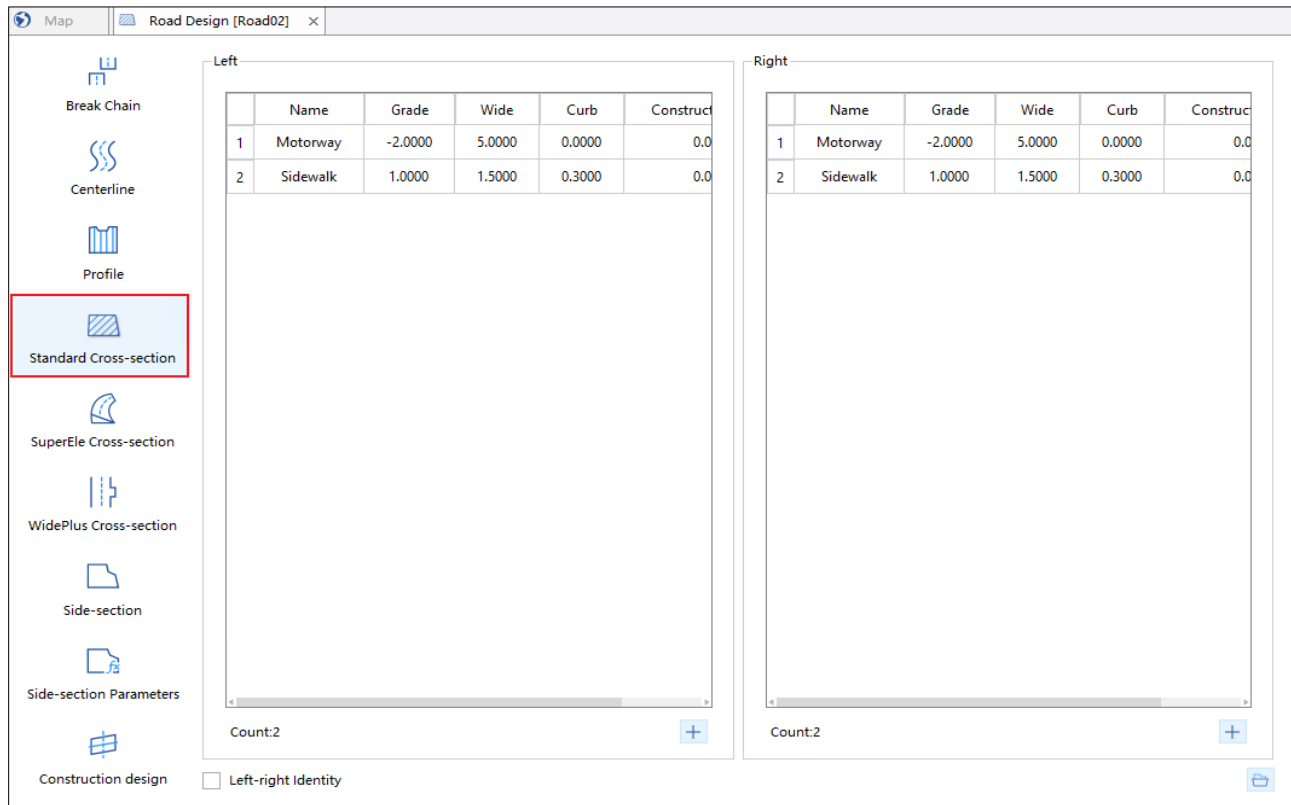


Figure 9-6-25 Standard Cross-sectional Design Interface

(2) Add A Forum

Select the left cross-sectional data, click the add icon, the last position of the left side cross-sectional point data list to add a new line of data, you can double-click the cells in the list to edit. Select the right cross-sectional data, click the add icon, the right side of the cross-sectional data list at the end of the point to add a new line of data, you can double-click the cell in the list to edit it. You can double-click the cell in the list to edit it. If the same checkbox is selected, you can edit only the left cross-sectional data, and the right side will be updated simultaneously.

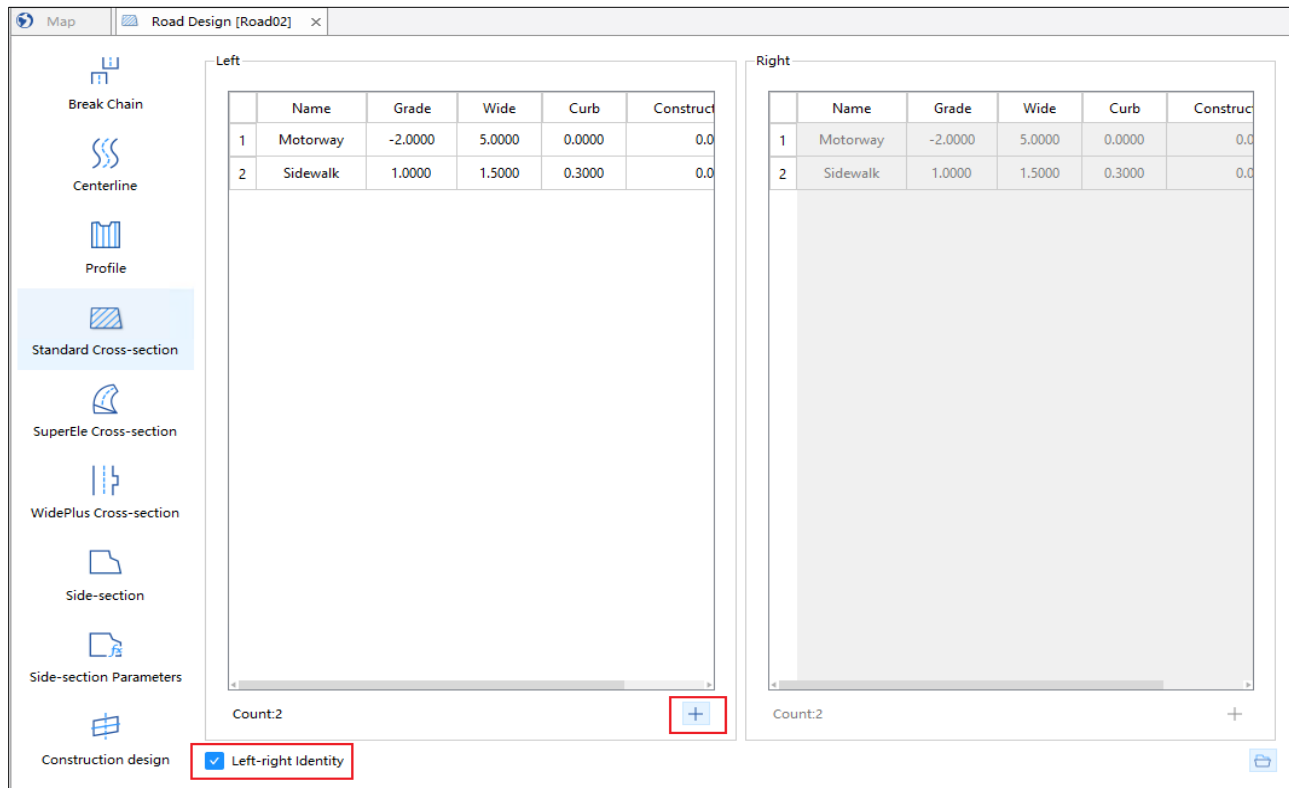


Figure 9-6-26 Add A Forum

(3) Insert Forum

Select a line of data, right-click [Insert], the software in the cross-sectional data list before the selected item to add a new line of data, you can double-click the editable cell to edit the data.

(4) Edit Section

Select a row of cross-sectional data and you can edit the properties directly in the cell.

(5) Delete Forum

Select a cross-sectional plate data, right-click [Delete], the software prompts 'OK to delete?'. If you want to delete the selected data in the list, point [Yes], the software will delete the plate associated with the ultra-high and widened data, point [No], the prompt box disappears.

(6) Copy and Paste

You can copy the cross-section data in the project to another project or other tables through copy, copy including header and paste.

2.Ultra High Design

In order to reduce the centrifugal force generated by the vehicle driving on the curved road, the road surface is made into a one-way cross slope in the form of an outer high and inner low called super high.

(1) Ultra High Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [Super High Design] in the left menu, enter the Super High Design interface as follows.

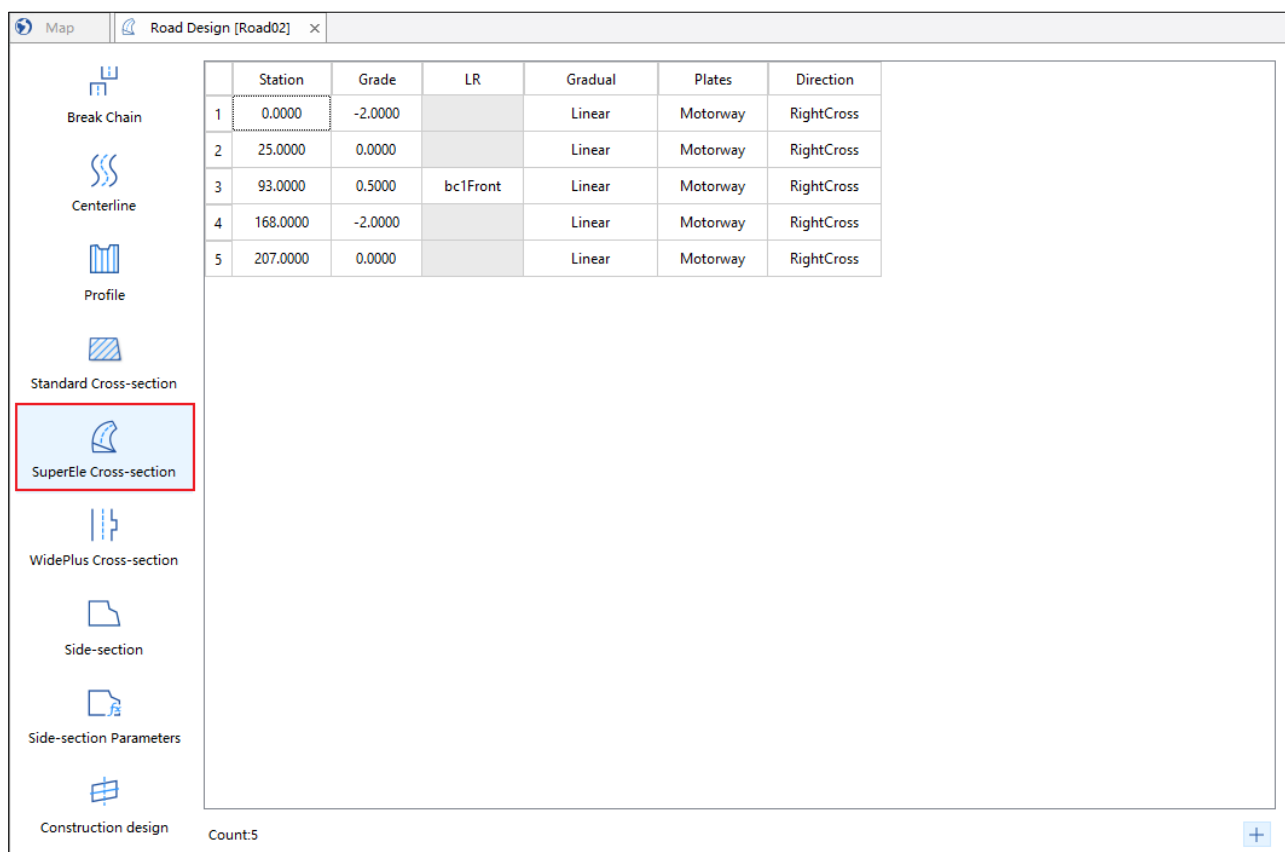


Figure 9-6-27 Ultra High Design Interface

(2) Add Super High Points

enter the super high design interface, click on the bottom right corner of the add icon, super high point data list last position to add a new line of data, you can double-click on the list of cells to edit. In the ultra-high part, you can enter the ultra-high change point information according to the design drawings, and select the corresponding ultra-high role of the cross-sectional plate.

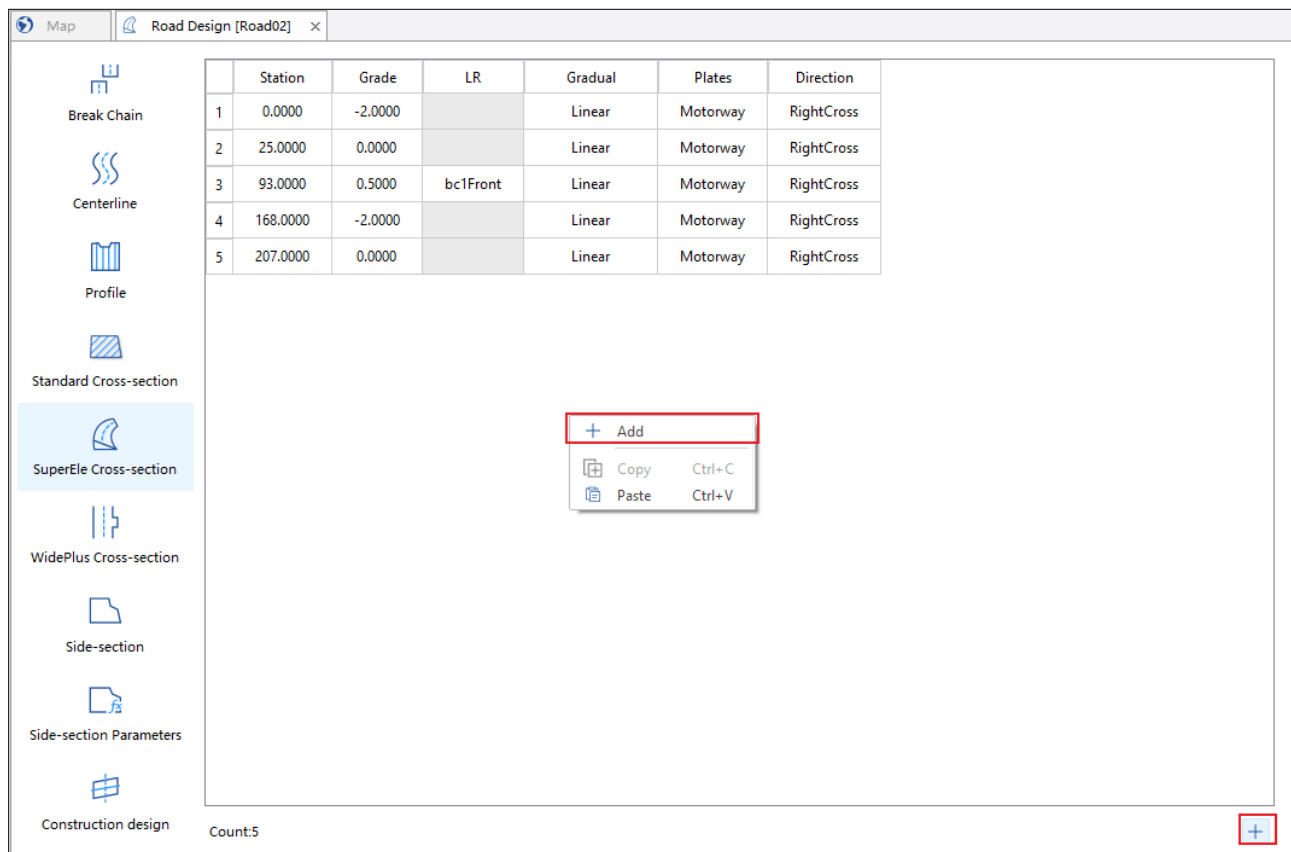


Figure 9-6-28 Add Super High Points

(3) Edit Super High Points

Select a row of ultra-high point data, the properties can be edited directly in the cell.

(4) Remove Super High Points

Select an ultra-high point data, right-click [delete], the software prompts 'OK to delete?'. , point [yes] then the software in the list to delete the selected data, point [no], the prompt box disappears. The software will delete the selected data in the list.

(5) Copy and Paste

You can copy the superelevation design data in the project to another project or other tables through copy, copy including header and paste.

3. Widening Design

In order to transition the pavement from the normal width to the curve, a widened width is set, which requires a widened relief section. In the widening relief section, the pavement has a gradual change in width. The widening design data is shown in the figure.

曲 线		地 面 高 程 (m)	设计 高 程 (m)	填挖高度 (m)		路 基 宽 度 (m)										以下		
						左 侧				中分带	右 侧				左			
	凸 型			填	挖	W1	W2	W3	W4	W0	W4	W3	W2	W1	A1	A2	A3	
-2% 150	QD	911.12	913.00	1.88			0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.23	912.60	1.37			0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.86	912.20	0.34			0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.97	911.80		0.17		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.77	911.40		0.37		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
0	YK60+785	912.87	910.99		1.88		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.80	910.55		1.25		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		911.48	910.08		1.40		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		910.66	909.58		1.08		0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		909.54	909.05		0.49		0.00	4.00	13.66	3.00	11.50	4.00	0.00			-0.06	-0.0	
-3% 230	ZD +915	908.13	908.49	0.36			0.00	4.00	14.50	3.00	11.50	4.00	0.00			-0.08	-0.0	
		907.60	907.90	0.30			0.00	4.00	13.26	3.00	11.50	4.00	0.00			-0.06	-0.0	
		906.24	907.30	1.06			0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		905.73	906.70	0.97			0.00	4.00	11.50	3.00	11.50	4.00	0.00			-0.02	-0.0	
		904.64	906.10	1.46			0.00	4.00	11.50	3.00	13.37	4.00	0.00			-0.02	-0.0	
231																		

Figure 9-6-29 Widening Design

(1) Widen the Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [widening design] in the left menu to enter the widening design interface.

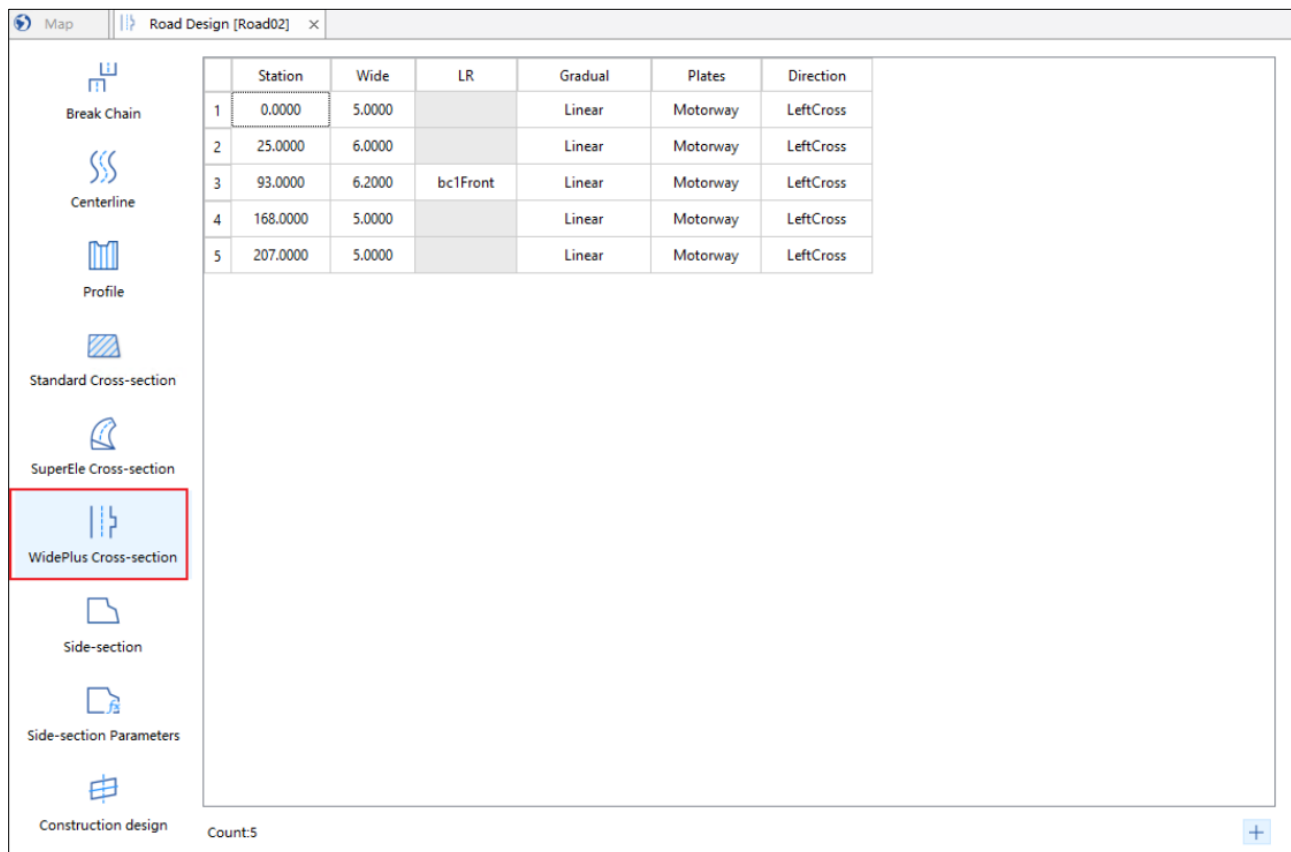


Figure 9-6-30 Widen the Design Interface

(2) Add A Widening Point

In the widening design interface, click the add icon at the bottom right corner, a new line will be added at the end of the widening point data list, you can double click the cell in the list to edit. In the widening section, you can enter the widening change point information according to the design drawing, and select the corresponding cross-sectional plate for the widening effect.

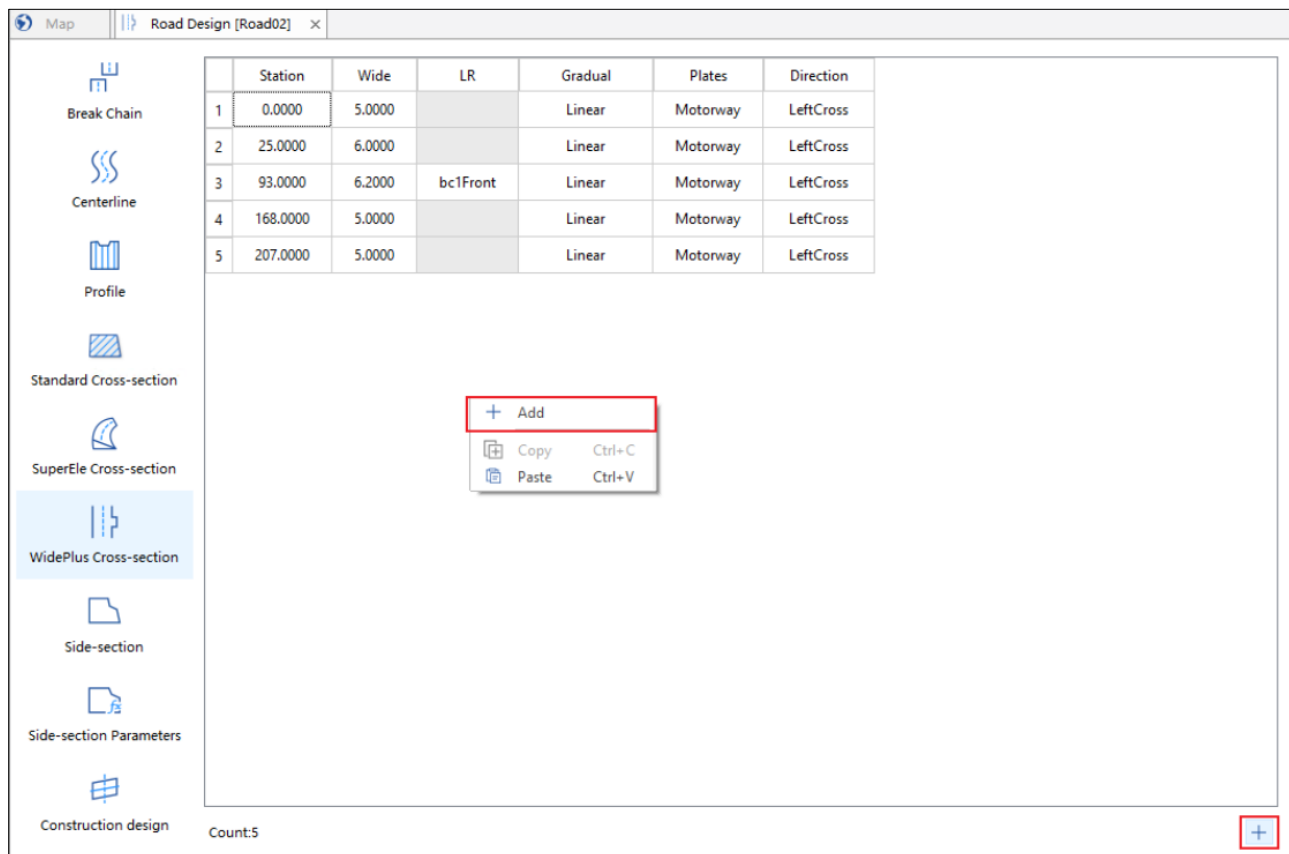


Figure 9-6-31 Add A Widening Point

(3) Edit the Widening Points

Select a row of wide-point data, and you can edit the properties directly in the cell.

(4) Delete the Widening Point

Select a widening point of data, right-click [Delete], the software prompts 'OK to delete?'. , point [yes] then the software in the list to delete the selected data, point [no], the prompt box disappears.

The software will delete the selected data in the list.

(5) Copy and Paste

You can copy the widening design data in the project to another project or other tables through copy, copy including header and paste.

4.Loading Cross-sectional Files

Enter the standard cross-sectional interface, click the folder icon in the bottom right corner, the software pops up the file selector. Select the location of the cross-sectional file you want to load, select the file you want to load and click [Open] in the file selector interface.

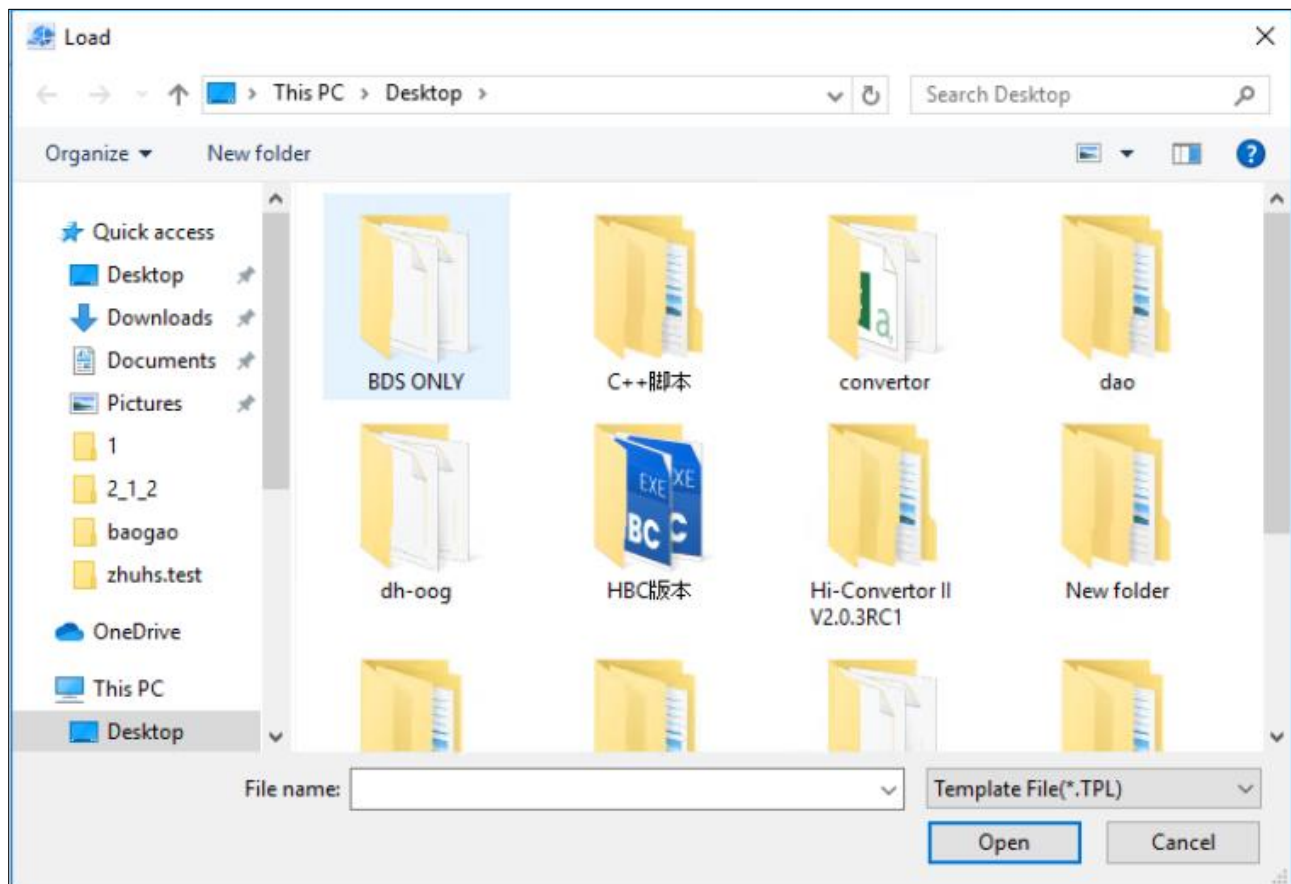


Figure 9-6-32 Loading Cross-sectional Files

S:Slope

D:Width

Cur:Incisors

H:Thickness of structural layer

Enter the mileage in the mileage box to view the section preview under different mileage.

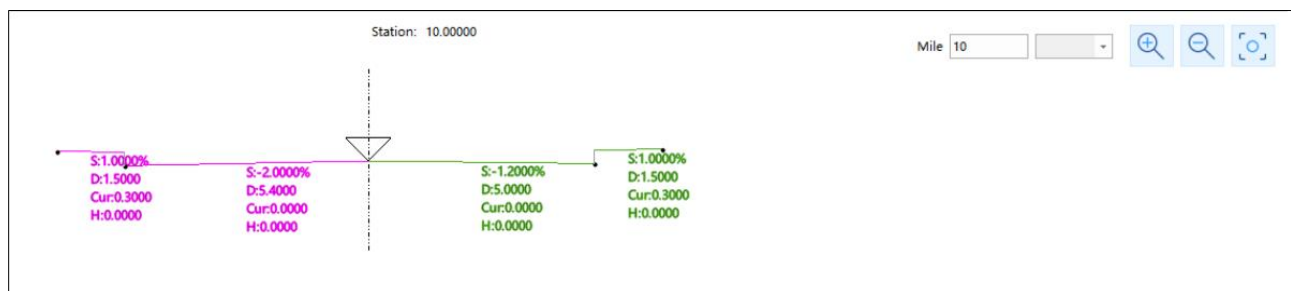


Figure 9-6-33 The Section Preview

You can use the zoom in, zoom out and center buttons in the upper right corner to zoom in, zoom out and center the profile.

9.6.5 Side Slopes

1. Slope Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [slope design] in the left menu to enter the slope design interface as follows.

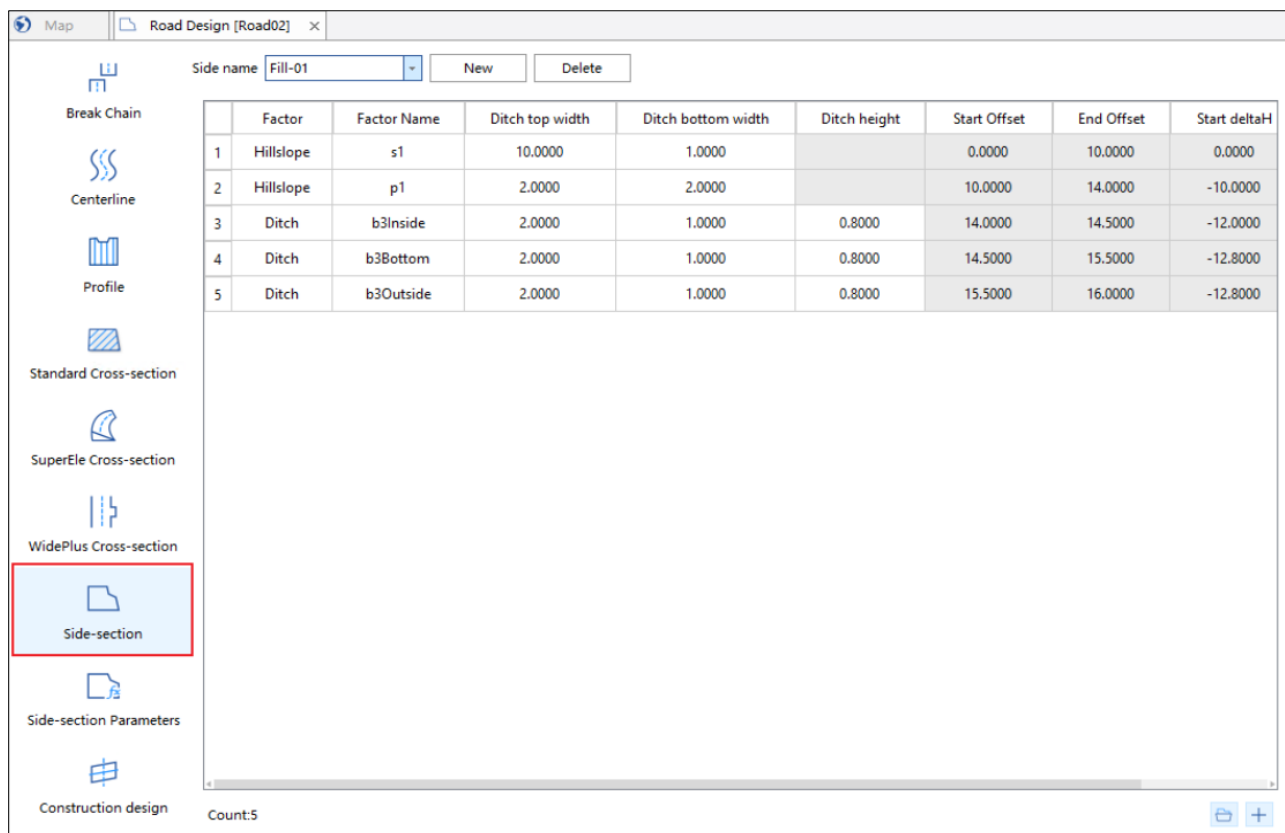


Figure 9-6-34 Slope Design Interface

2. New Slope Sections

Click [New], the software pops up the new slope section interface, enter the slope section name, check the slope type (filled or excavated), and then click [OK], the software prompts the new slope section successfully. After the new section is created, the slope section list will show the newly added slope section and the list of slope section elements for that slope section.

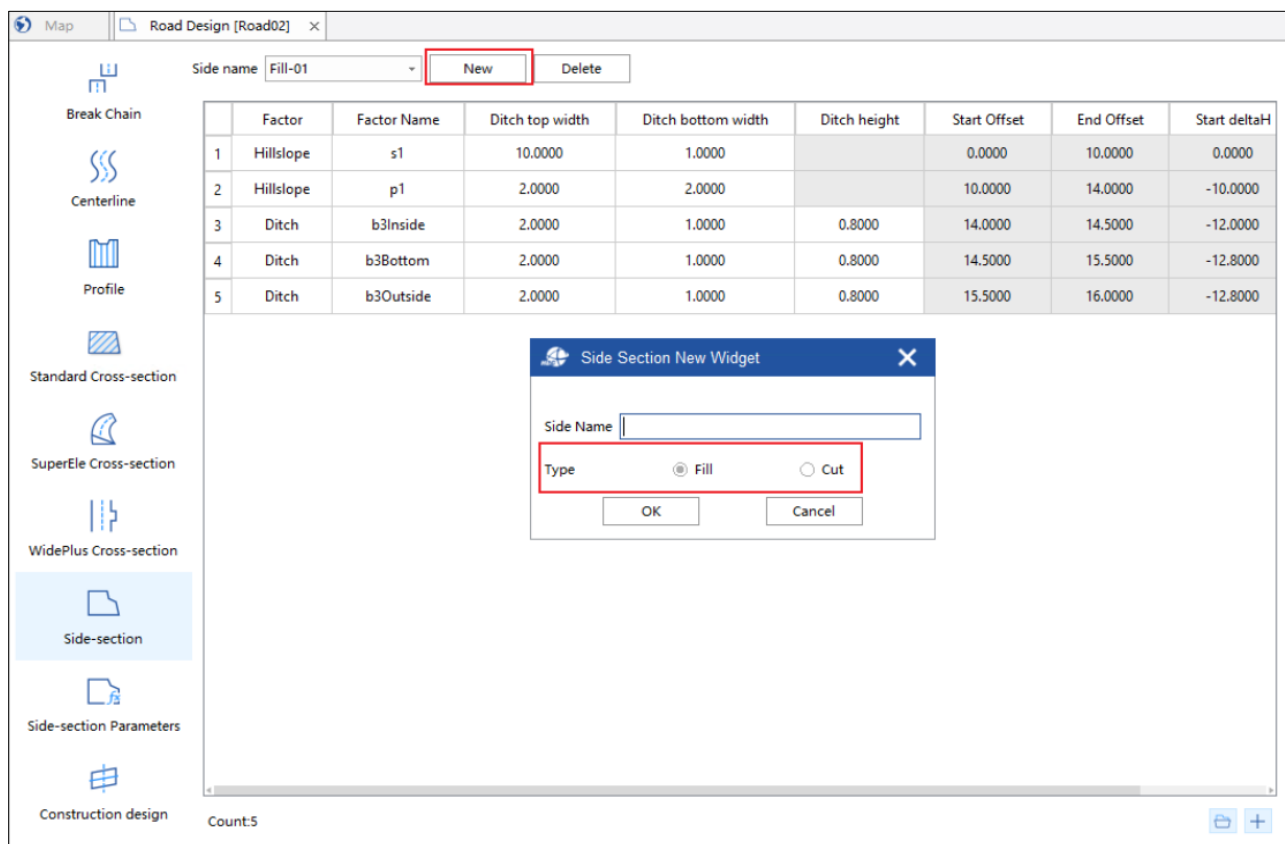


Figure 9-6-35 New Slope Sections

3.Remove Slope Sections

In the [Name] drop-down box, click to open the slope section to be removed, click [Remove], the software pop-up prompt box: 'Make sure you want to delete the selected [xxx],' point [Yes] software to delete the slope section, point [No] to close the prompt box.

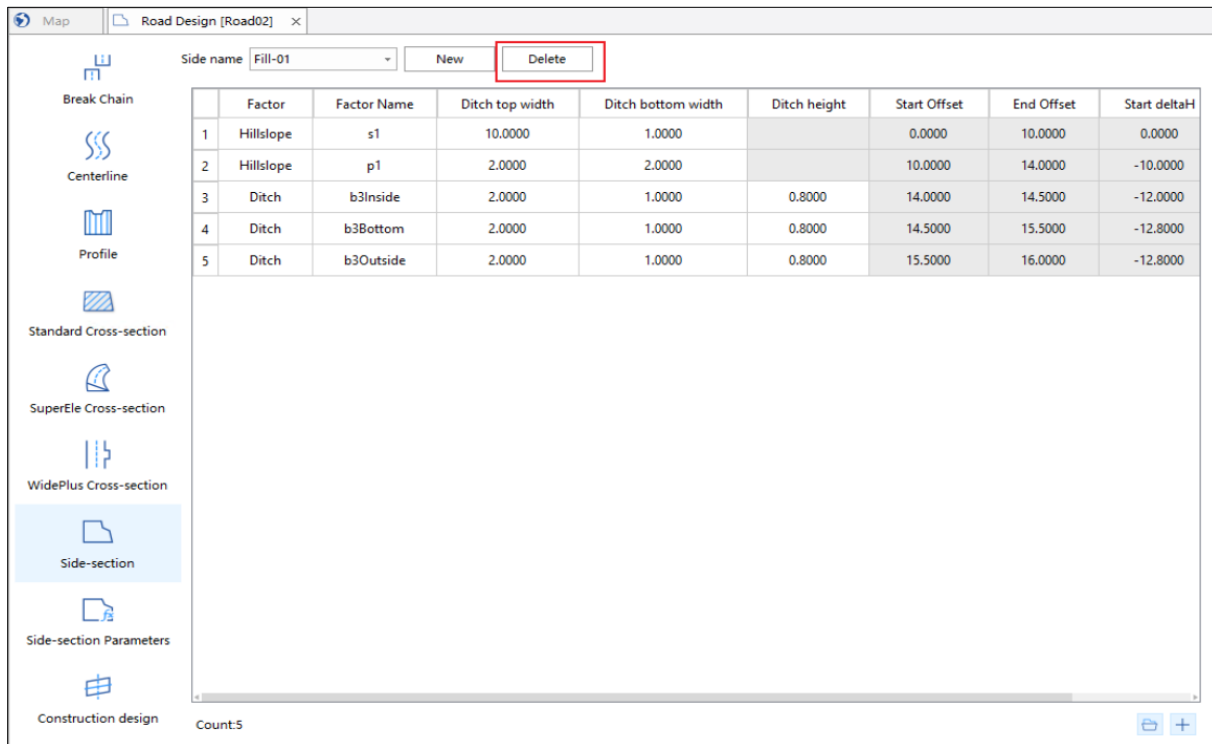


Figure 9-6-36 Remove Slope Sections

4.Add Slope Section Elements

Enter the slope design interface, click the add icon in the bottom right corner, a new line of data will be added at the end of the slope section elements list, you can double click the cell in the list to edit.

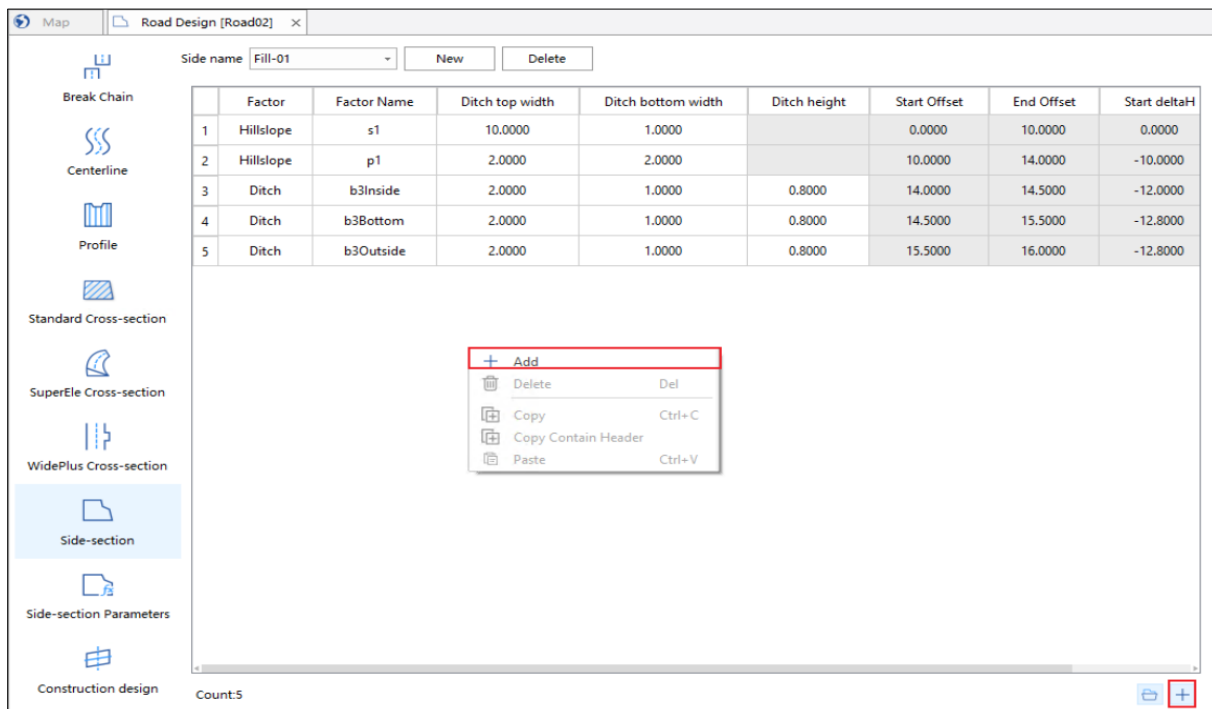


Figure 9-6-37 Add Slope Section Elements

5.Edit Slope Section Elements

Enter the slope design interface, select a line of slope section data, you can directly edit the properties in the cell.

6.Delete Slope Section Elements

Enter the slope design interface, select a slope section data, right-click [delete], the software prompts 'OK to delete?'. The software deletes the selected data in the list, and at the same time deletes the element information contained in the slope section, point [No], the prompt box disappears.

The software will delete the selected data in the list.

7.Loading the Slope Section File

Enter the slope design interface, click the folder icon in the lower right corner, the software pops up the file selector. Select the location of the slope design file you want to load, select the file you want to load, and click [Open] in the file selector interface.

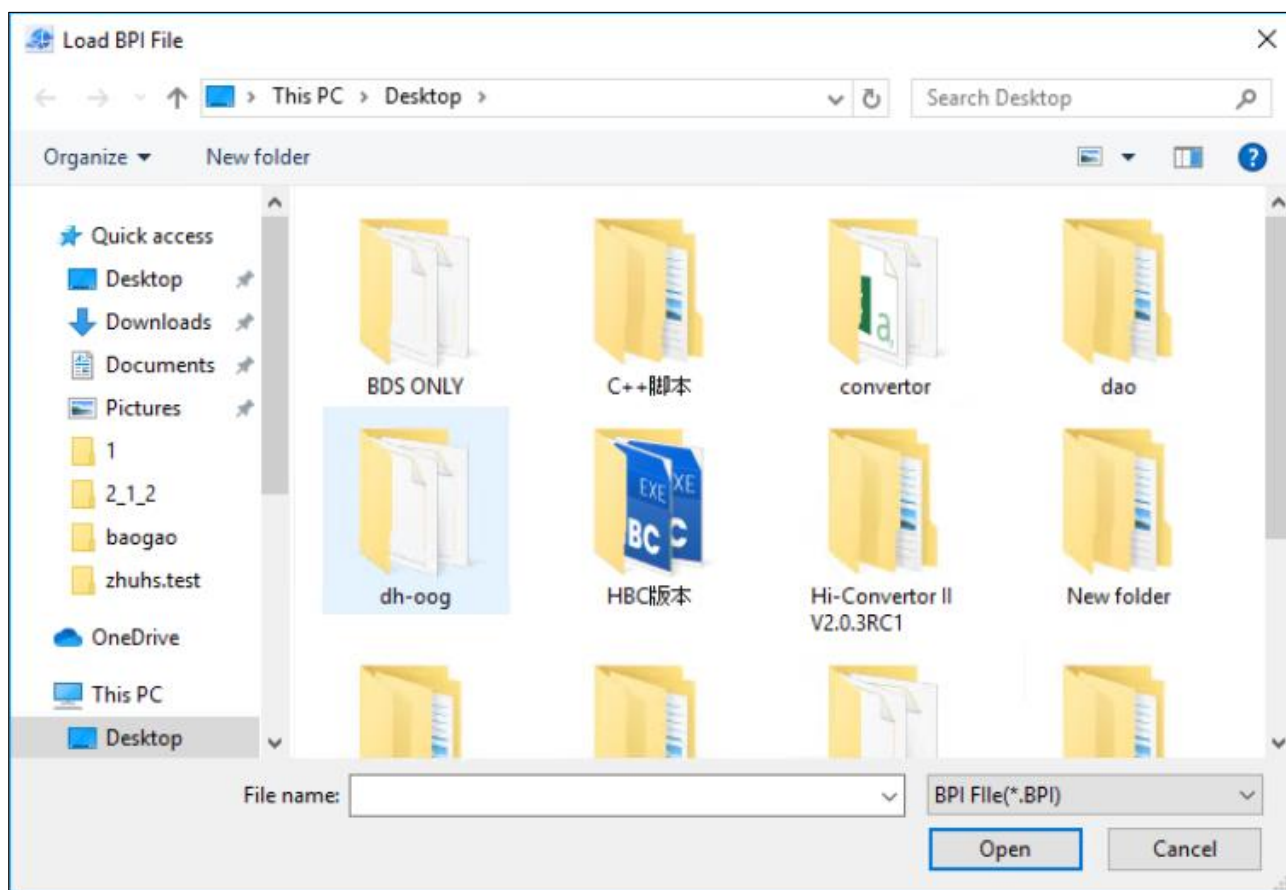


Figure 9-6-38 Loading the Slope Section File

8.Copy and Paste

You can copy the slope data in the project to another project or other tables through copy, copy including header and paste.

9.Slope Section Preview

After adding the slope design data, you can view the slope section in the lower slope section preview view.



Figure 9-6-39 Slope Section Preview

You can mirror the daylight section to the other side through the mirror button in the upper right corner.



Figure 9-6-40 Slope Section Preview

You can use the zoom in, zoom out and center buttons in the upper right corner to zoom in, zoom out and center the profile.

9.6.6 Constructs

1.Building Design Interface

Click [Road Design] to open the road module, create or load the road design file, click [structure design] in the left menu to enter the structure design interface as follows.

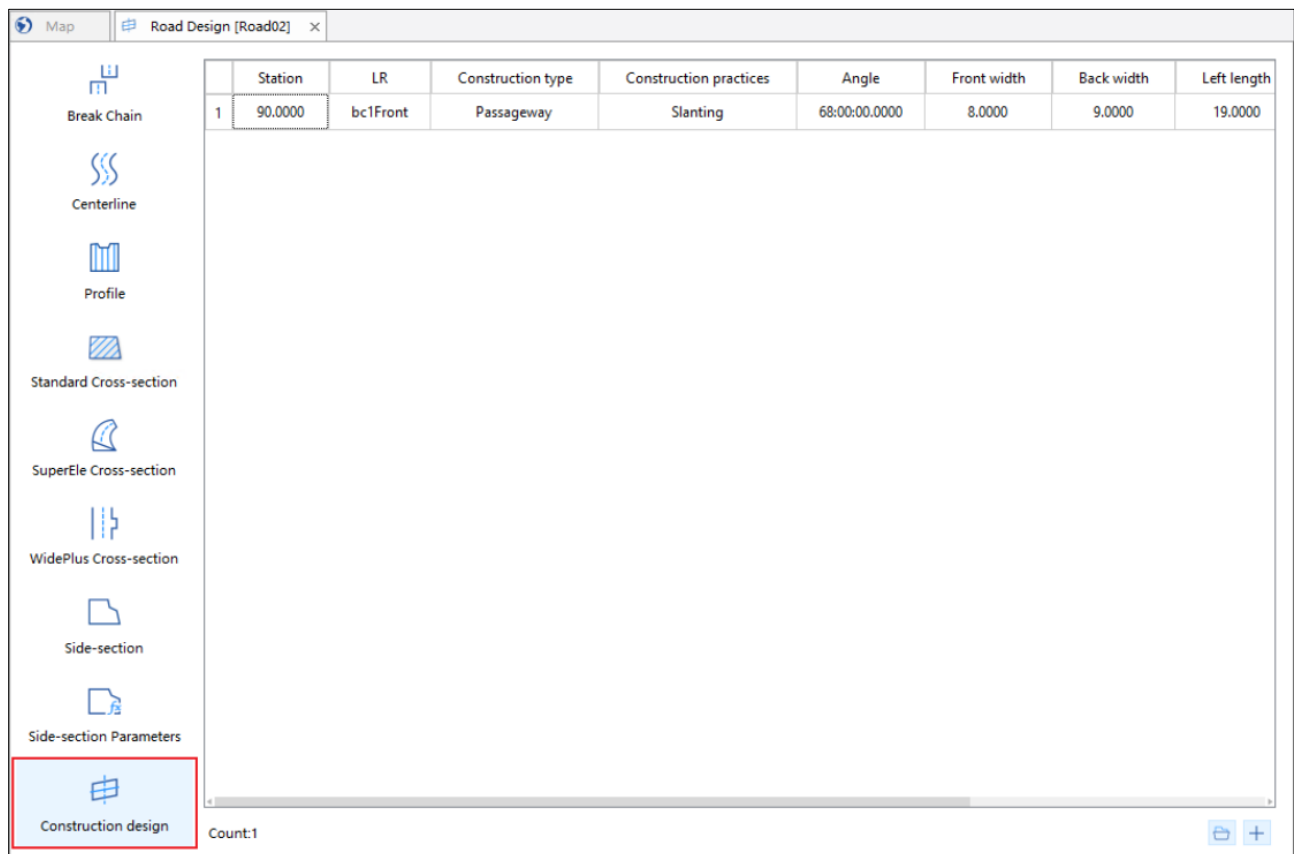


Figure 9-6-41 Building Design Interface

2.Added

Enter the slope design interface, click the add icon in the lower right corner, add a new line of data at the end of the structure data list, you can double-click the cell in the list to edit.

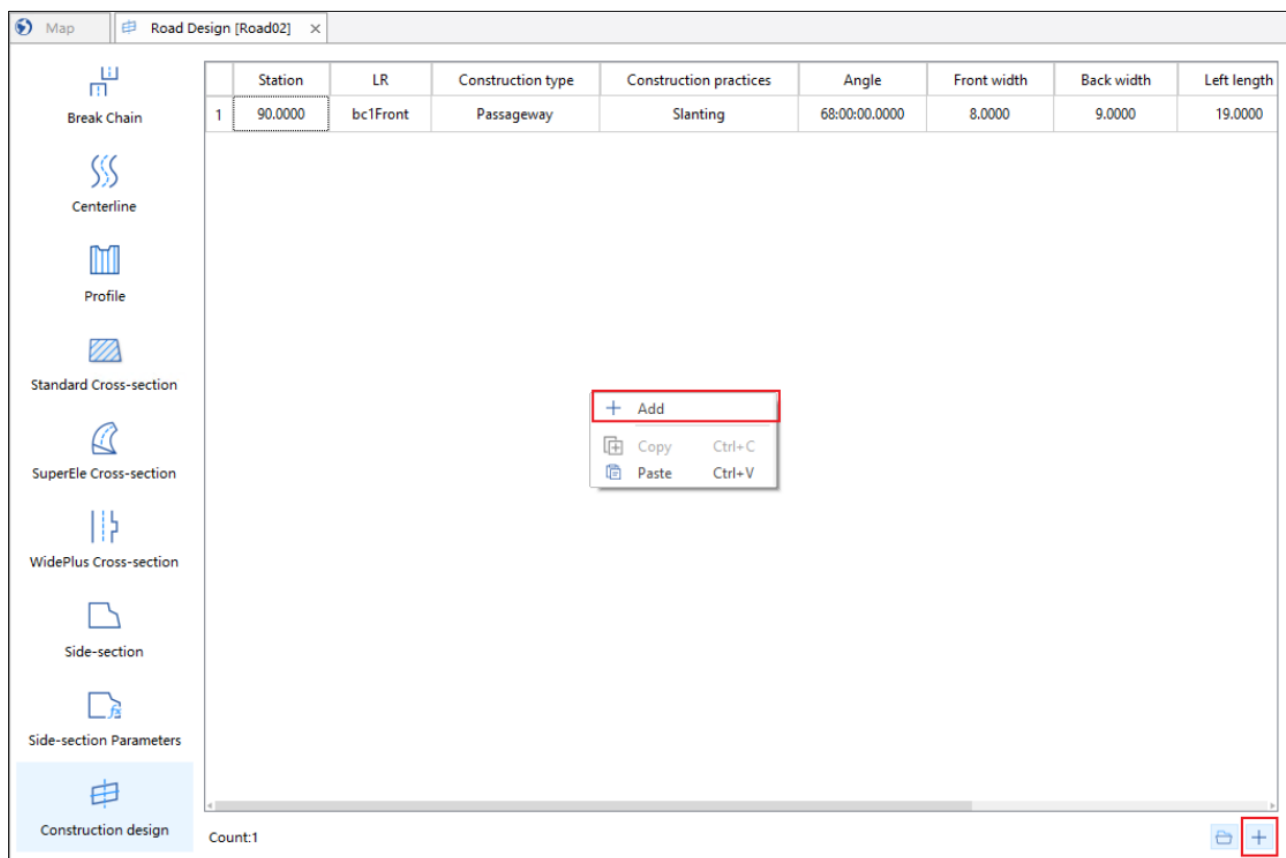


Figure 9-6-42 Added

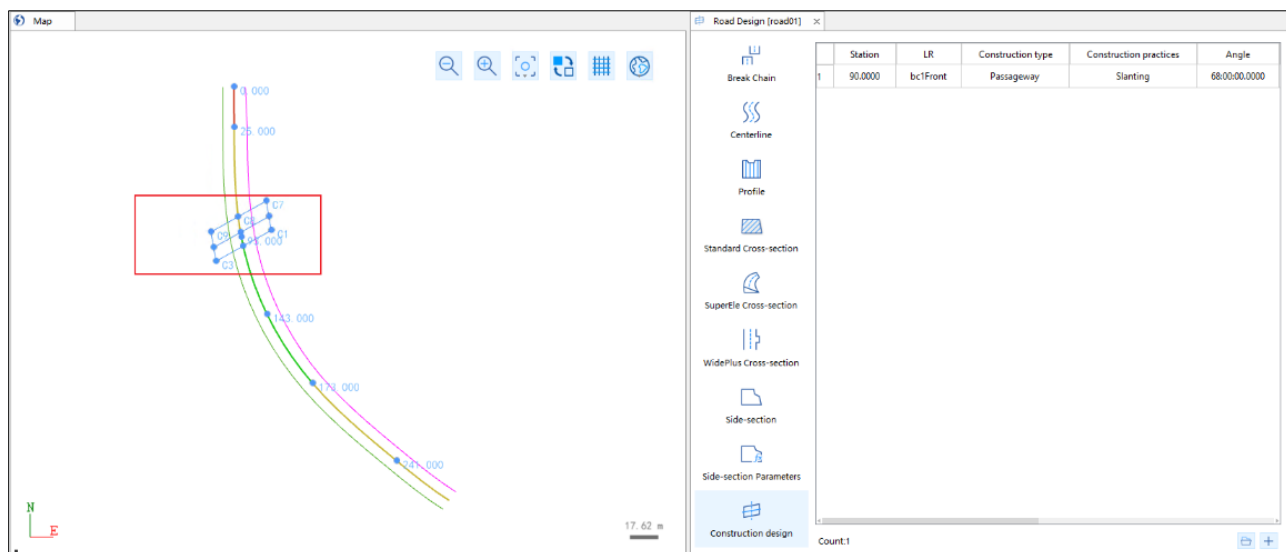


Figure 9-6-43 Added

3.Edit

Enter the building design interface, select a line of data, you can directly edit the properties in the cell.

4.Delete

Enter the building design interface, select a data, right-click [delete], the software prompts 'OK to delete?'. , point [yes] then the software in the list to delete the selected data, point [no], the prompt box disappears.

The software will delete the selected data in the list.

5.Loading A Structures File

Enter the building design interface, click the folder icon in the lower right corner, the software pops up the file selector. Select the location of the building design file you want to load, select the file you want to load, and click [Open] in the file selector interface.

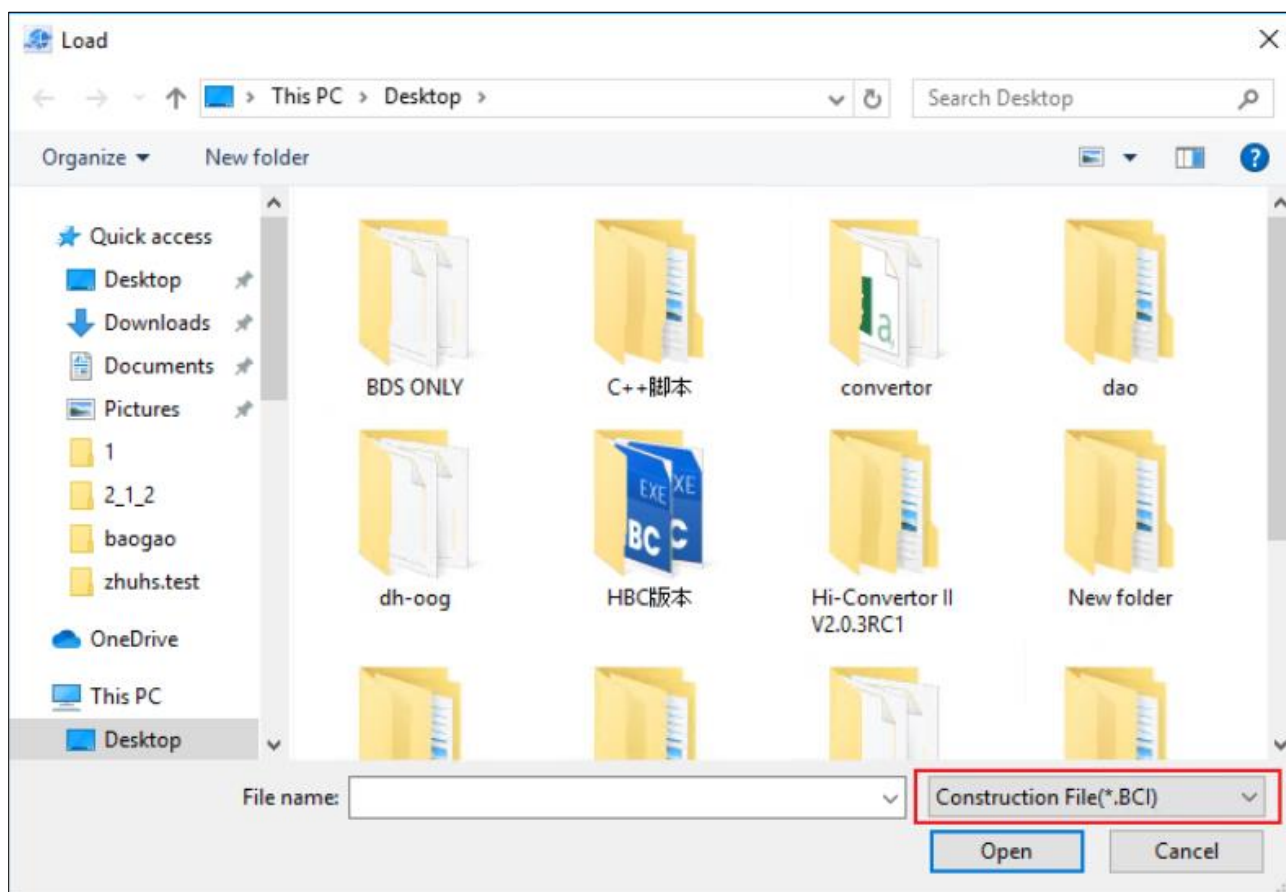


Figure 9-6-44 Loading A Structures File

6.Copy and Paste

You can copy the structure data from a project to another project or other table by [Copy] or [Copy containing table header] and [Paste].

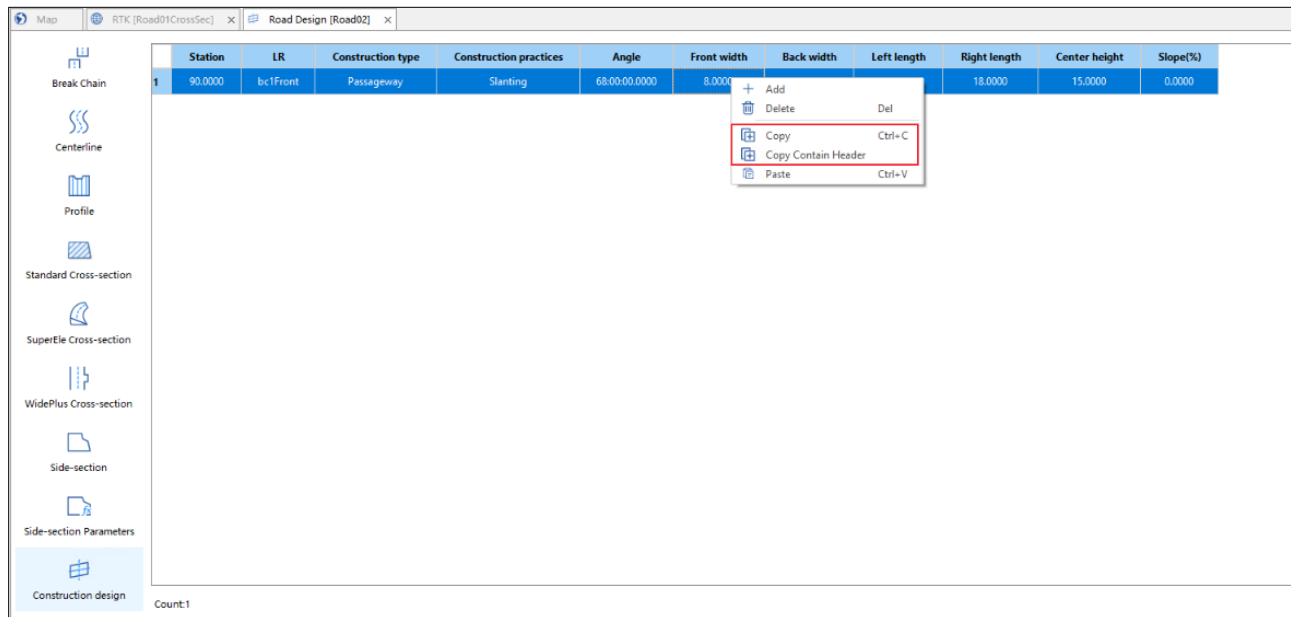


Figure 9-6-45 Copy

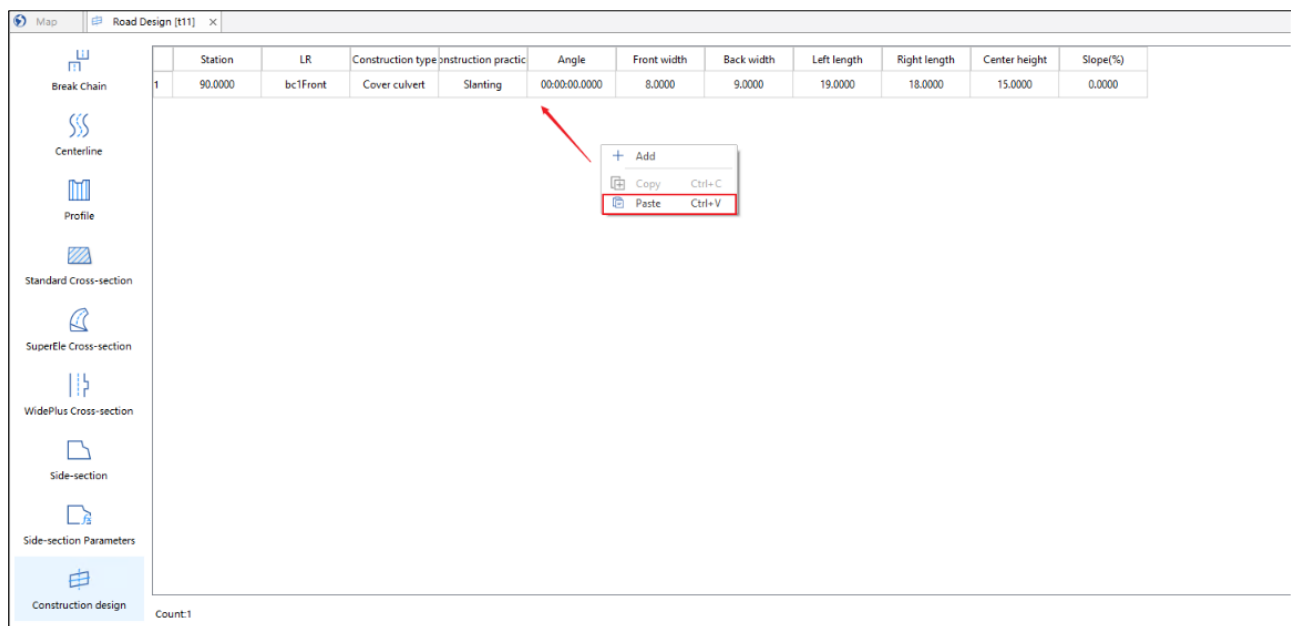


Figure 9-6-46 Paste

9.6.7 Slope Parameters

1. Slope Parameter Interface

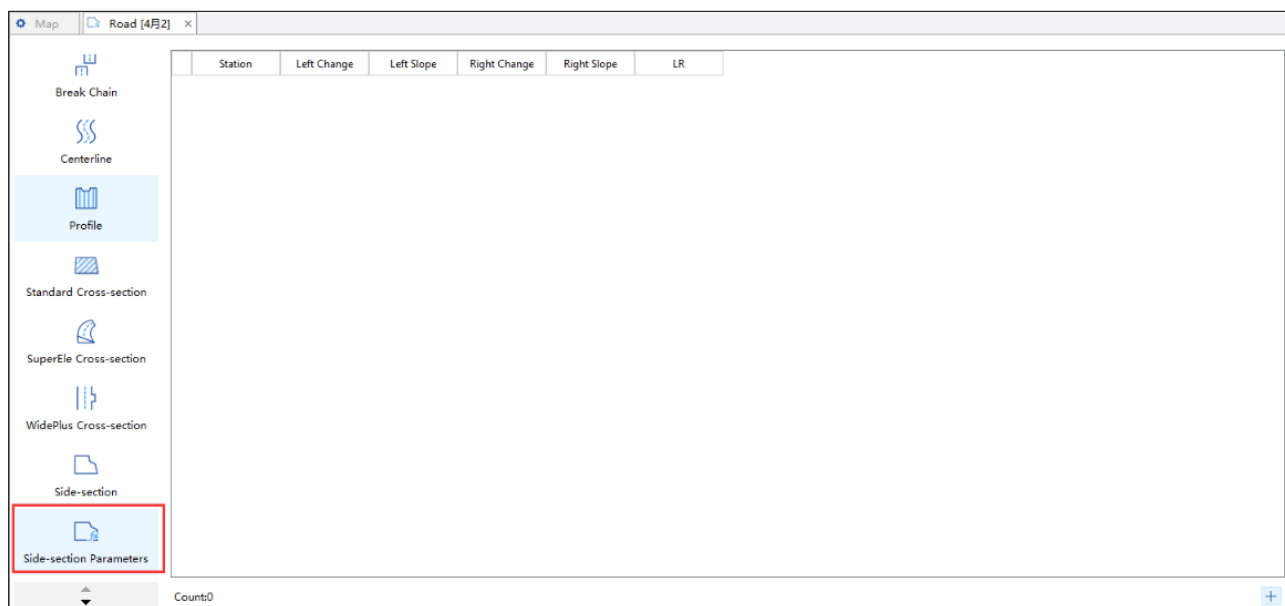


Figure 9-6-47 Slope Parameter Interface

2.New Slope Parameters

Under the premise of the existing slope section, right-click or click the lower right corner to create a new slope parameter, modify the mileage, left/right change mode, select the left/right slope, select the data, and the slope parameter preview will display the corresponding graph.

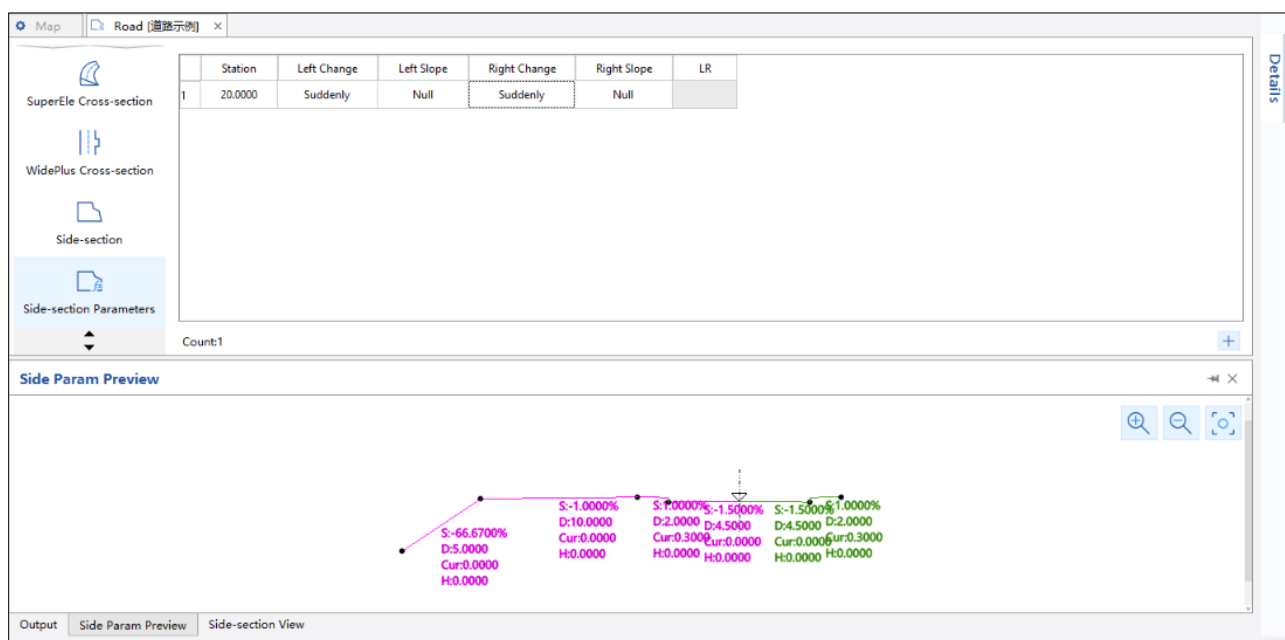


Figure 9-6-48 New Slope Parameters

3.Edit

Left/right change mode can be modified to suddenly/linear gradient.

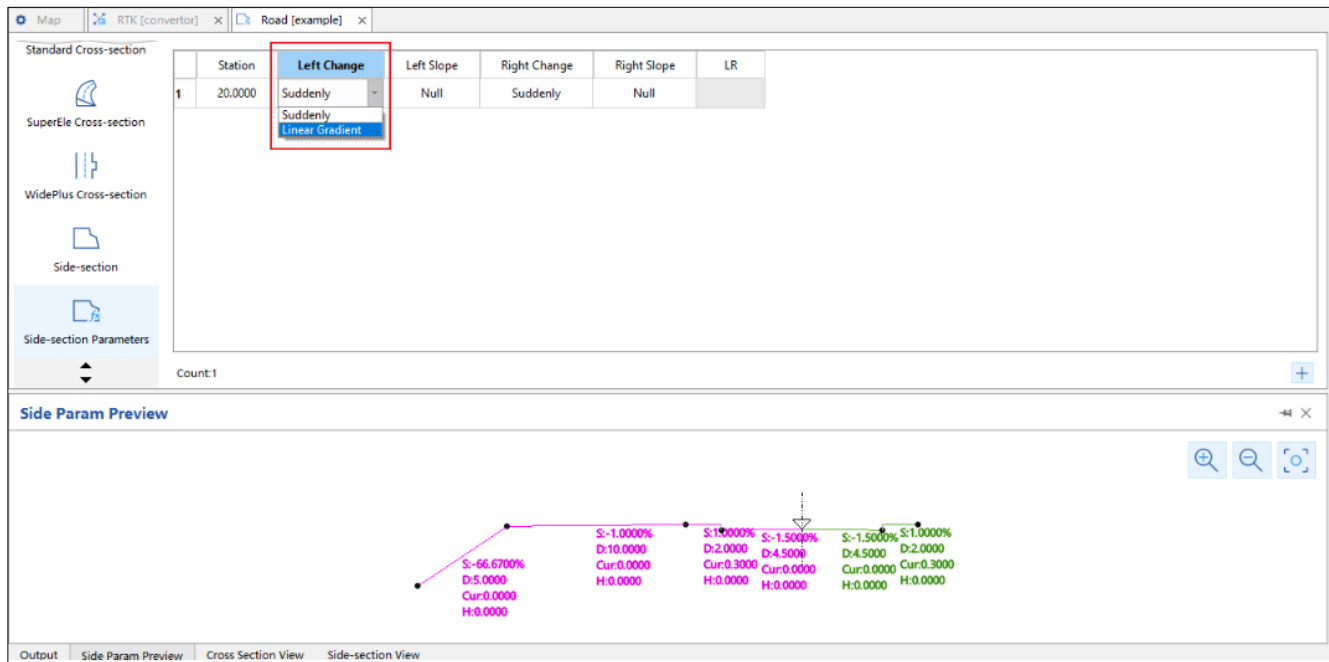


Figure 9-6-49 Edit

The left/right slope can be modified to user-defined slope section data.

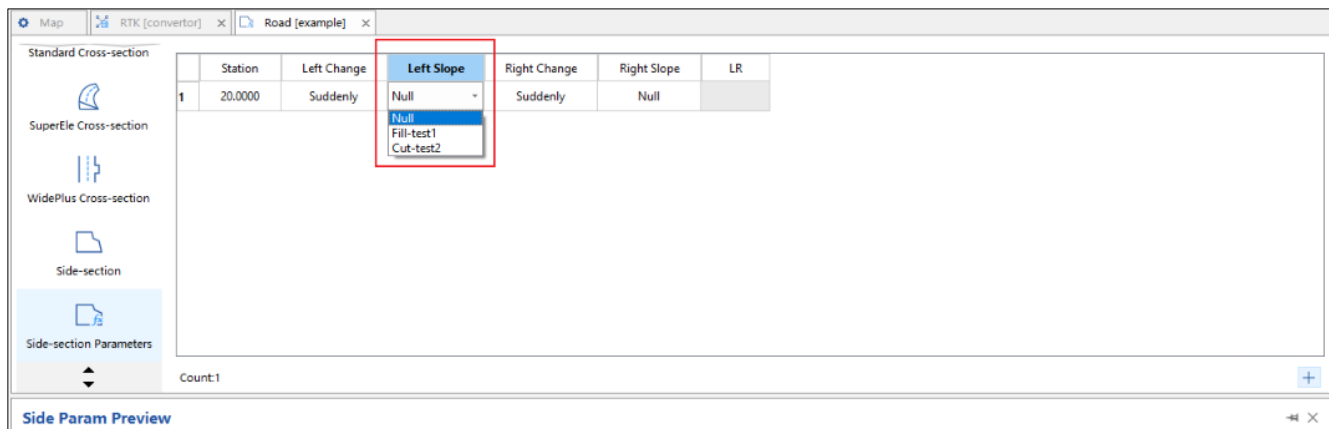


Figure 9-6-50 Edit

※When there is a broken link-long chain, when the mileage is in the long chain, [LR] can be modified to bc1 front/bc1 back

4.Delete

Enter the slope parameter interface, select a piece of data, right-click [Delete], the software prompts 'OK to delete?', click [Yes] to delete the selected data in the list, click [No] , The prompt box disappears.

5.Copy And Paste

You can copy the slope parameter data in the project to another project or other tables through copy, copy including header and paste.

6. Section Preview of Slope Parameters

After adding the slope parameter data, you can view the slope parameter section in the preview view of the slope parameter section below.

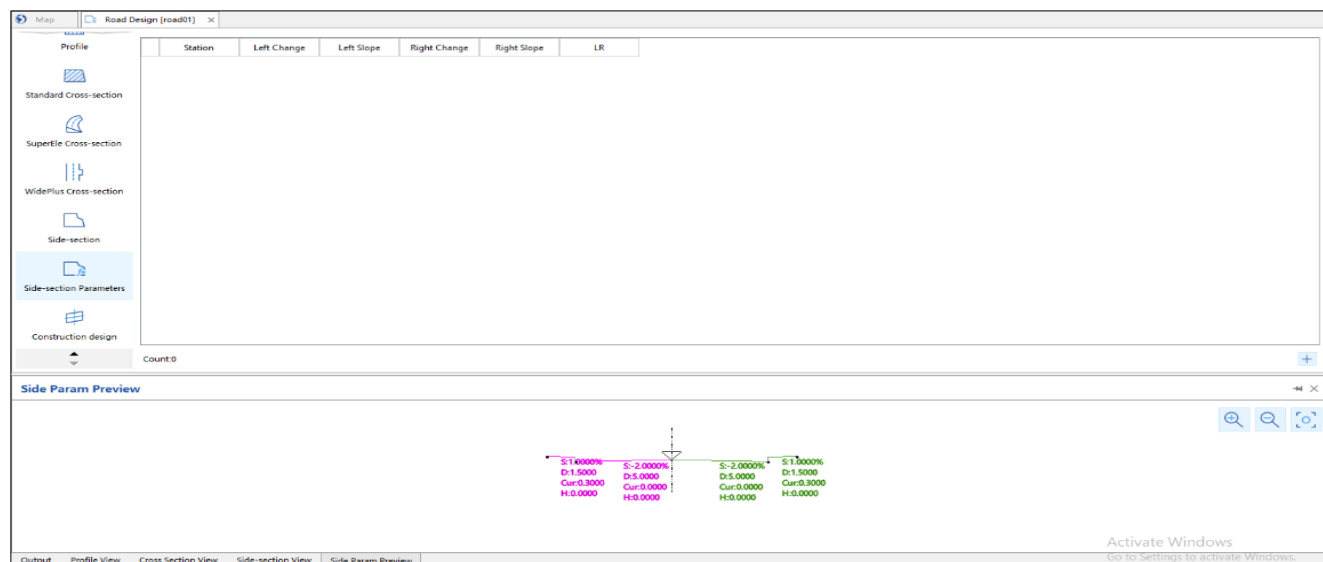
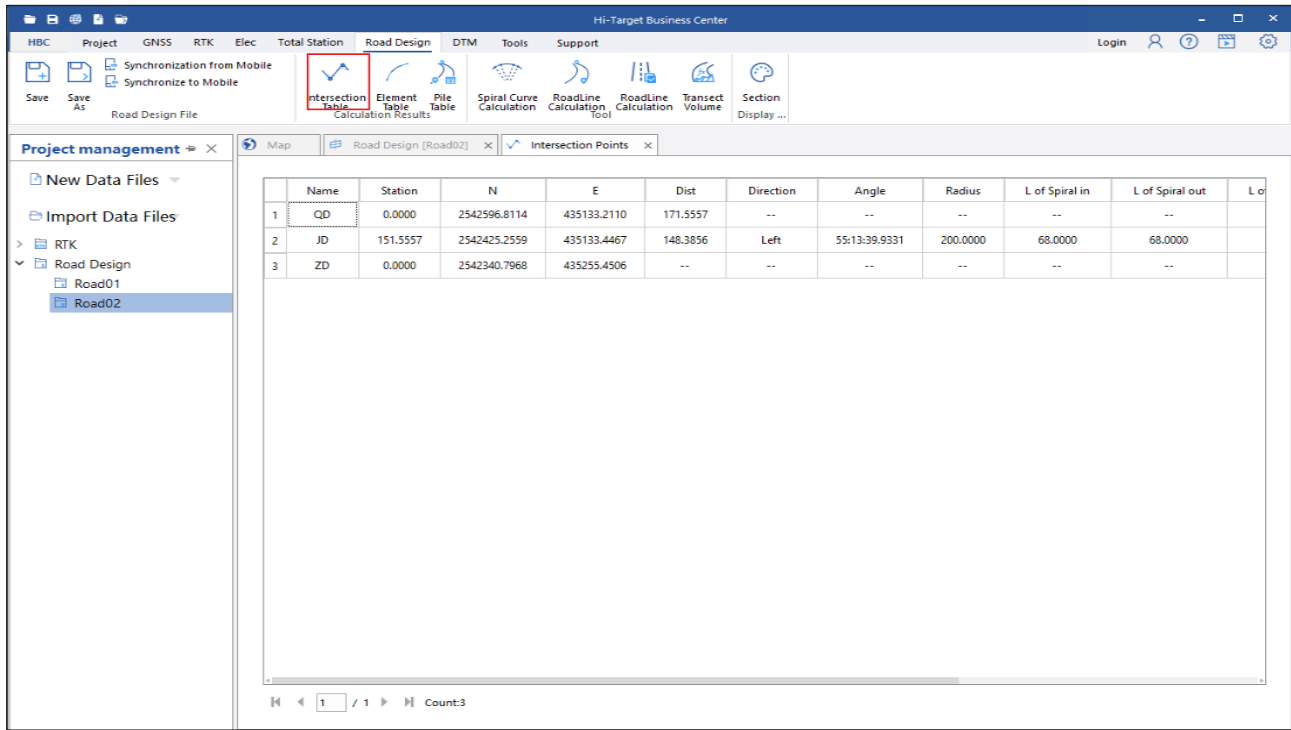


Figure 9-6-51 Section Preview of Slope Parameters

9.7 Calculations Results

1. Intersection Table

Click [Road Design]-[Calculation Results]-[Intersection Table] to view the information of each intersection of the road.



The screenshot shows the Hi-Target Business Center software interface. The top menu bar includes HBC, Project, GNSS, RTK, Elec, Total Station, Road Design, DTM, Tools, and Support. The 'Road Design' menu is open, showing options like Intersection Table, Element Table, Pile Table, Spiral Curve Calculation, RoadLine Calculation, RoadLine Calculation Tool, Transect Volume, and Section Display. The 'Intersection Table' option is highlighted with a red box. Below the menu, the 'Project management' pane on the left shows a tree view with 'New Data Files', 'Import Data Files', and 'RTK' expanded to show 'Road Design' with sub-items 'Road01' and 'Road02'. The main window displays a table titled 'Intersection Points' with the following data:

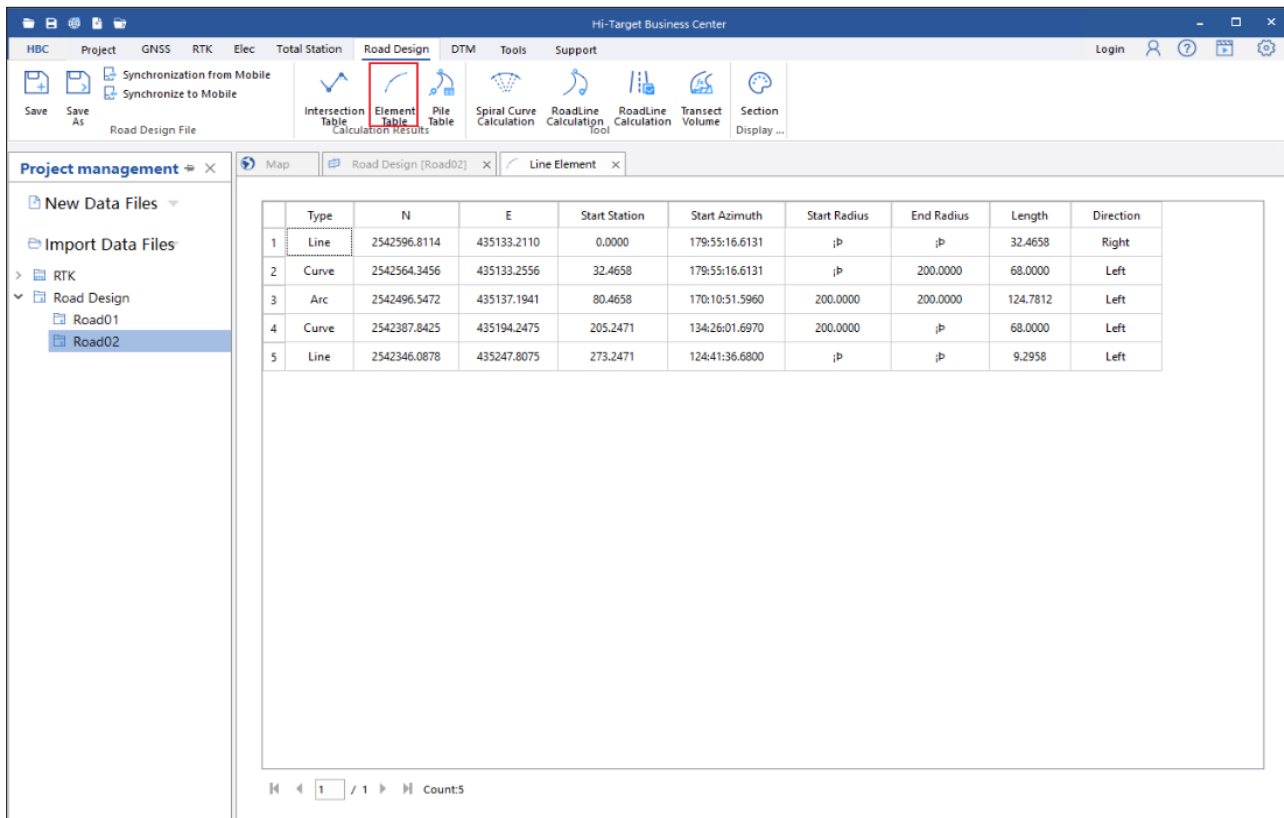
	Name	Station	N	E	Dist	Direction	Angle	Radius	L of Spiral in	L of Spiral out	L of
1	QD	0.0000	2542596.8114	435133.2110	171.5557	--	--	--	--	--	
2	JD	151.5557	2542425.2559	435133.4467	148.3856	Left	55:13:39.9331	200.0000	68.0000	68.0000	
3	ZD	0.0000	2542340.7968	435255.4506	--	--	--	--	--	--	

At the bottom of the table, there is a status bar showing '1 / 1' and 'Count:3'.

Figure 9-7-1 Intersection Table

2.Line Element Table

Click [Road Design]-[Calculation Results]-[Line Element Table] to view the information of each line element of the road.



The screenshot shows the Hi-Target Business Center software interface. The 'Road Design' tab is active, and the 'Element Table' button is highlighted with a red box. The 'Line Element Table' is displayed, showing a list of road elements with columns for Type, N, E, Start Station, Start Azimuth, Start Radius, End Radius, Length, and Direction. The table contains 5 rows of data.

	Type	N	E	Start Station	Start Azimuth	Start Radius	End Radius	Length	Direction
1	Line	2542596.8114	435133.2110	0.0000	179:55:16.6131	∅	∅	32.4658	Right
2	Curve	2542564.3456	435133.2556	32.4658	179:55:16.6131	∅	200.0000	68.0000	Left
3	Arc	2542496.5472	435137.1941	80.4658	170:10:51.5960	200.0000	200.0000	124.7812	Left
4	Curve	2542387.8425	435194.2475	205.2471	134:26:01.6970	200.0000	∅	68.0000	Left
5	Line	2542346.0878	435247.8075	273.2471	124:41:36.6800	∅	∅	9.2958	Left

Figure 9-7-2 Line Element Table

3.Pile by Pile

Click [Road Design]-[Calculation Results]-[Pile-by-Pile Table], the user can export/generate the required pile-by-pile table information by setting the baseline, starting mileage, ending mileage, mileage interval, and piling mode; the baseline can be selected The center line of the road or the edge of the cross section.

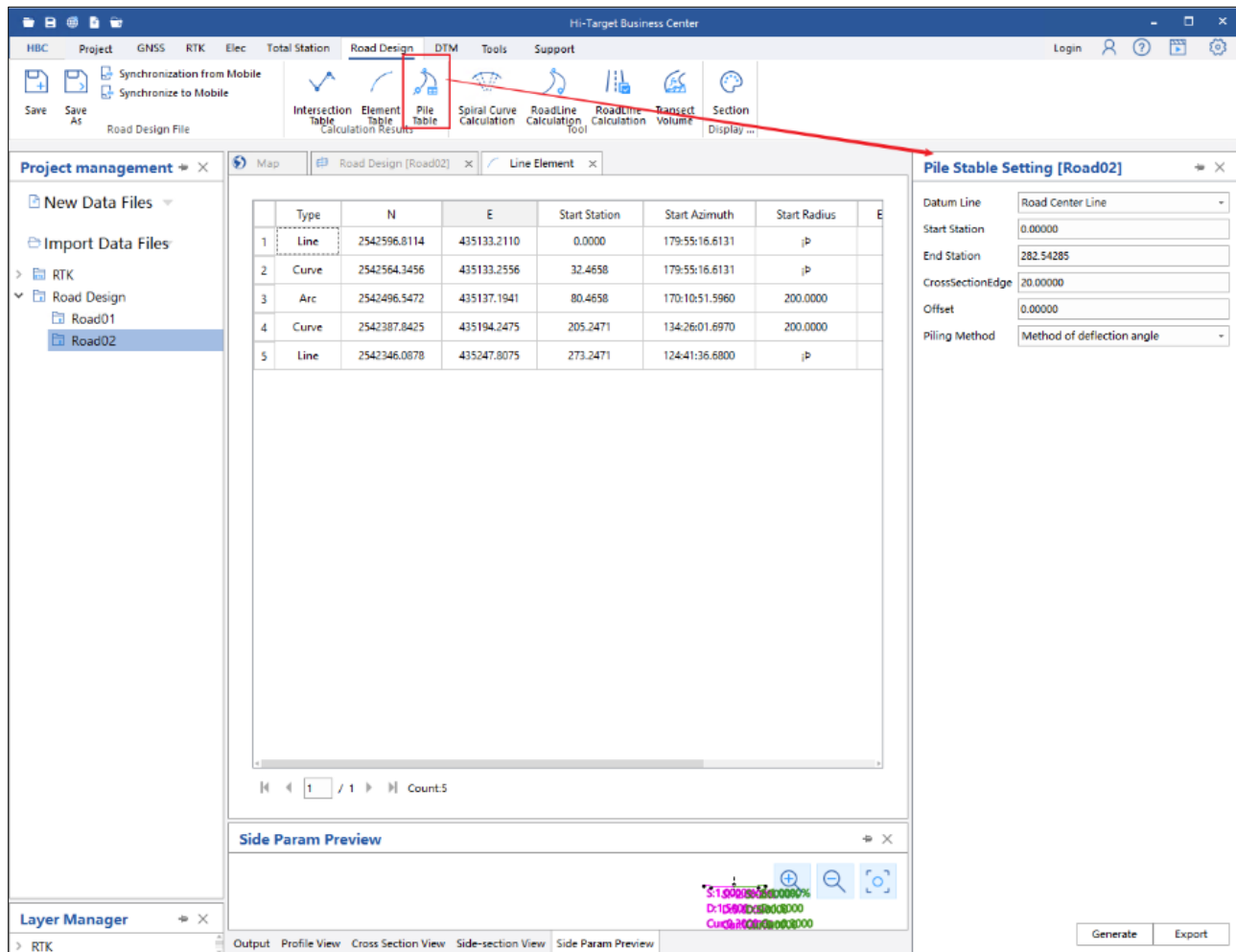


Figure 9-7-3 Pile by Pile

9.8 Tool

1.Retardation Calculation

Click on the [Retardation Calculation] icon in the toolbar under the [Road] module, the software pops up the jogging calculator panel on the right side of the software.

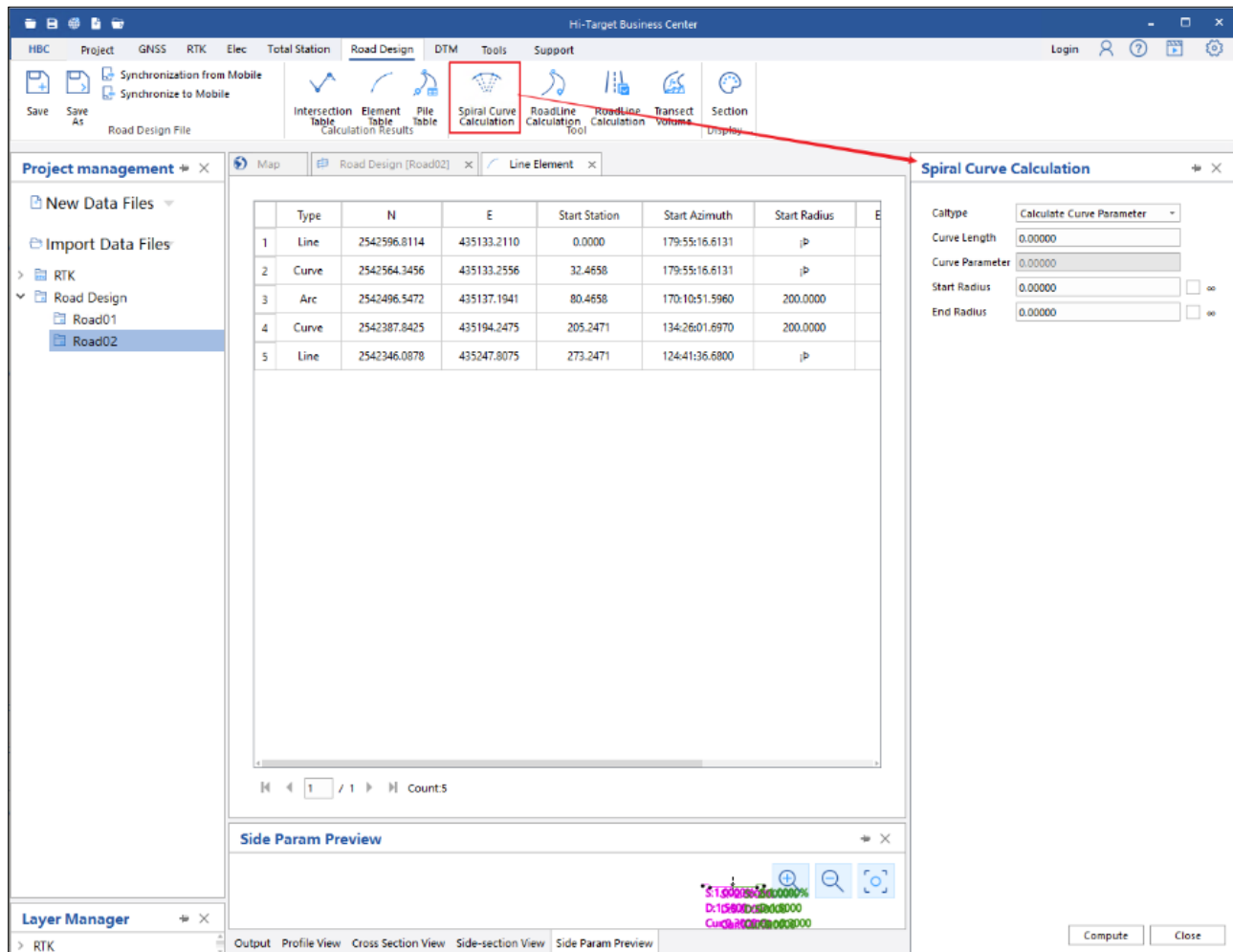


Figure 9-8-1 Retardation Calculation

In the slow curve calculation panel, click [Calculation type] drop-down box to select the type of calculation (1.Calculate curve parameters, 2.Calculate start radius, 3.Calculate end radius), and then fill in the corresponding parameter values for the calculation, if you want to calculate the start radius or end radius, you need to check [Start radius>End radius] or [Start radius]

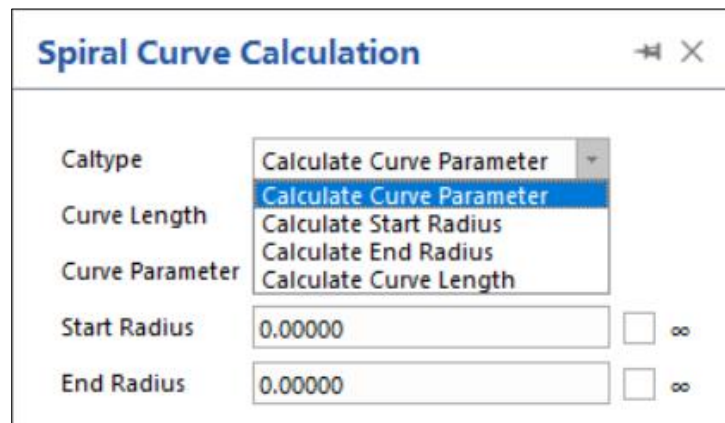


Figure 9-8-2 Retardation Calculation

2.Line Calculations

Click on the [line] icon in the toolbar under the [road] module, the software pops up the slow curve calculation panel on the right side.

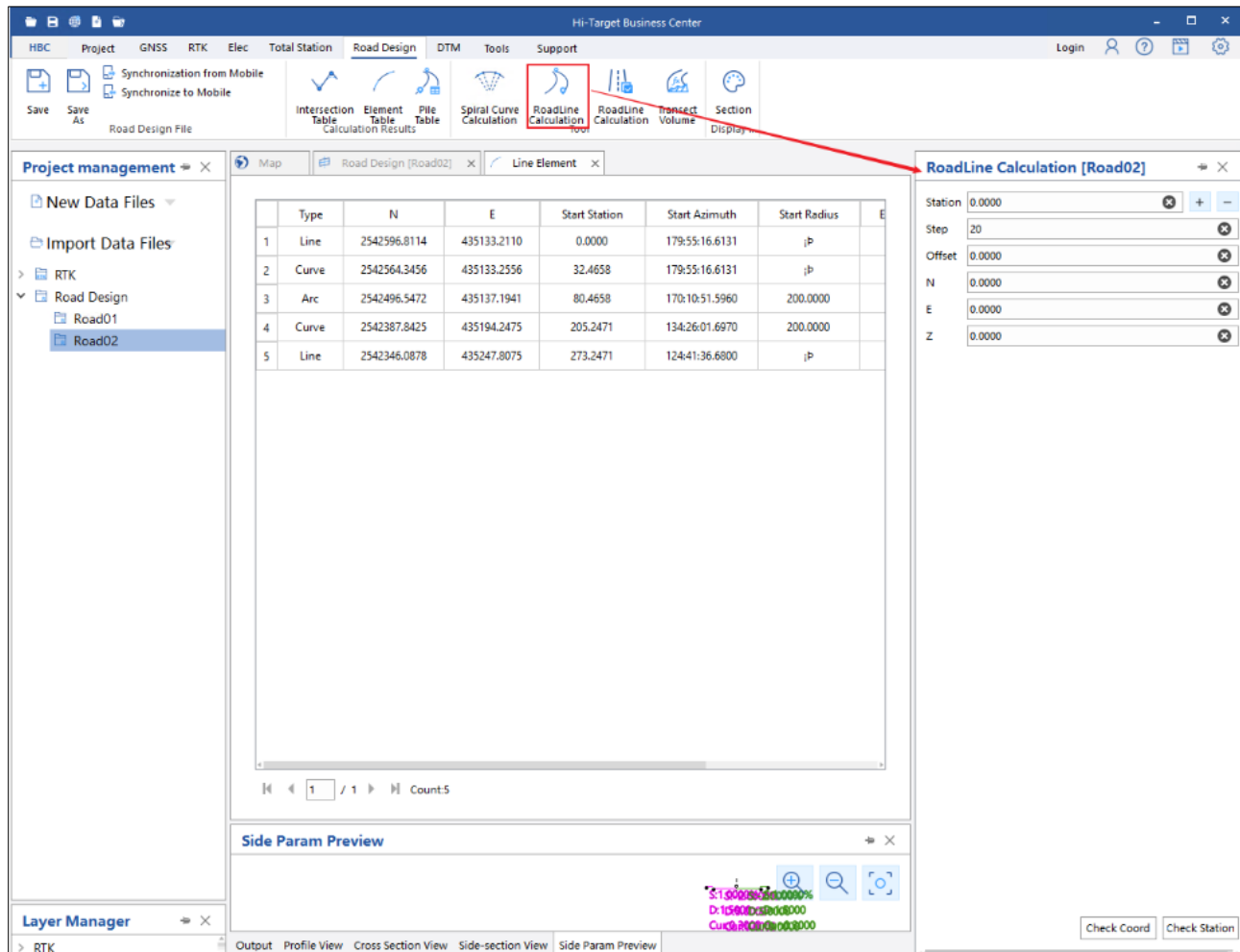


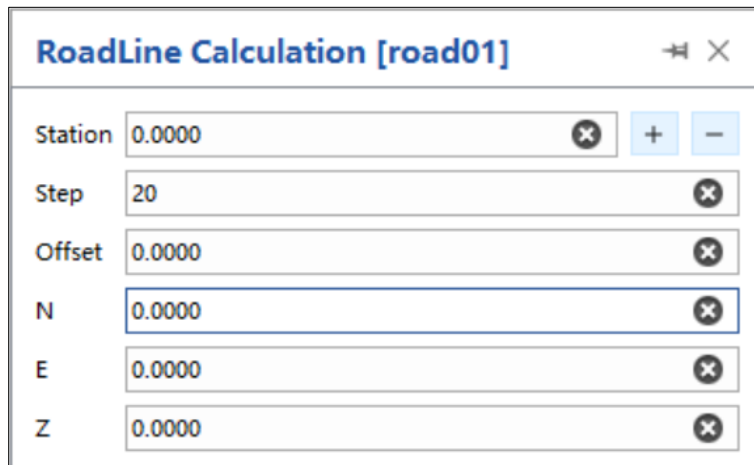
Figure 9-8-3 Line Calculations

(1) Check the Mileage

Enter the mileage value and offset of a point in the road, click [Check Mileage], the software displays the calculated N, E, Z coordinates and azimuth.

(2) Check the Coordinates

Enter the plane coordinates, click [Check Coordinates], and the software displays the calculated mileage value and offset.



RoadLine Calculation [road01]

Station	0.0000	✕	+	-
Step	20	✕		
Offset	0.0000	✕		
N	0.0000	✕		
E	0.0000	✕		
Z	0.0000	✕		

Figure 9-8-4 Line Calculations

3.Line Batch Inspection

Click the [Line Batch Check] icon in the toolbar under the [Road] module, and a batch calculation panel will pop up under the software, including two parts: 'Check Mileage' and 'Check Coordinates'.

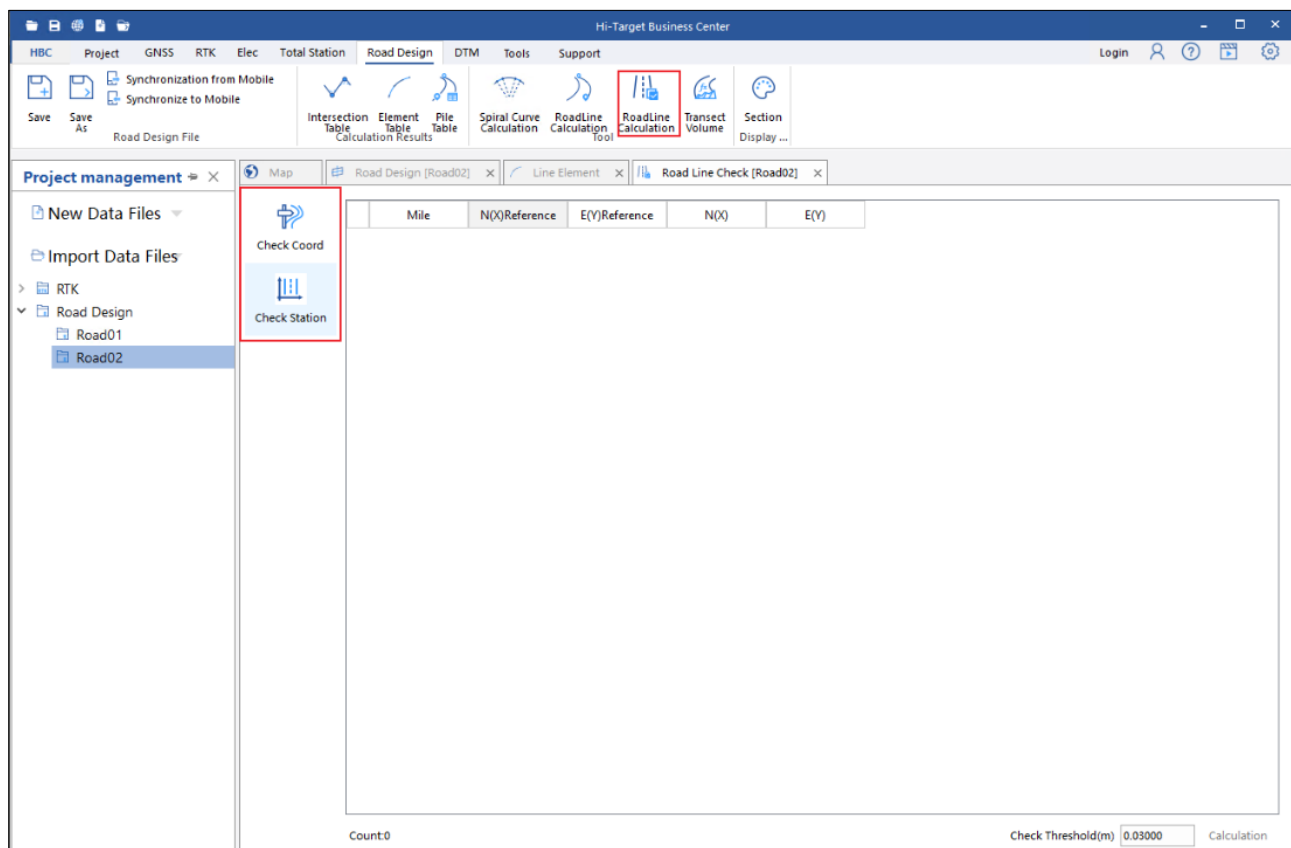
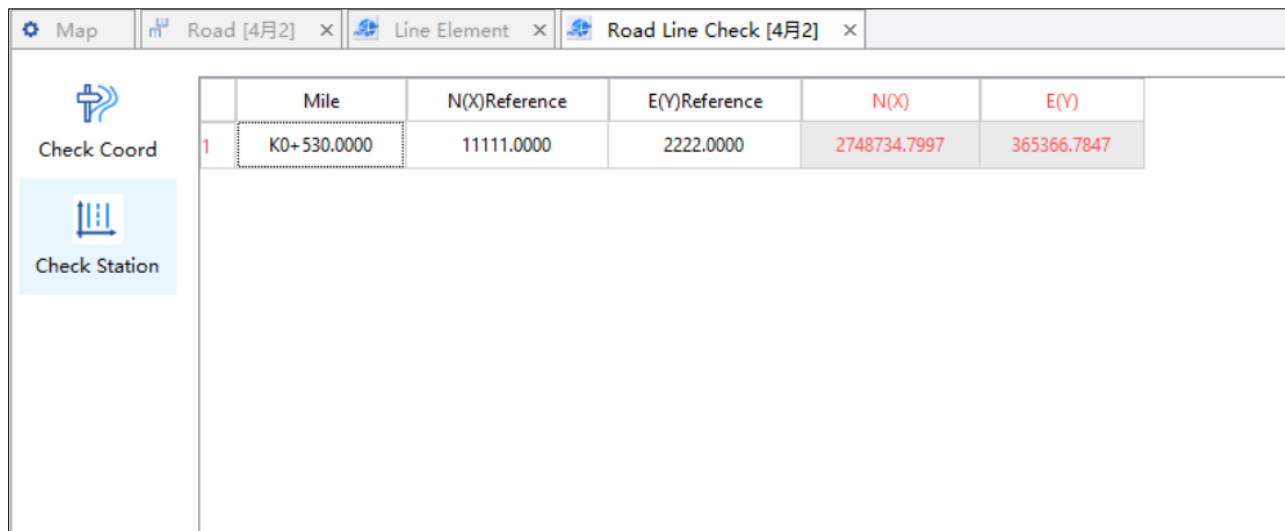


Figure 9-8-5 Line Batch Inspection

(1) Check Mileage

You can manually add or paste Excel table data by right-clicking, batch input mileage, N(X) reference value, E(Y) reference value N(E), E(Y), mileage reference value, click [Check mileage], the software displays The calculated N(E), E(Y), the default threshold is 0.03; the font of the calculated result exceeds the threshold range is displayed in red.

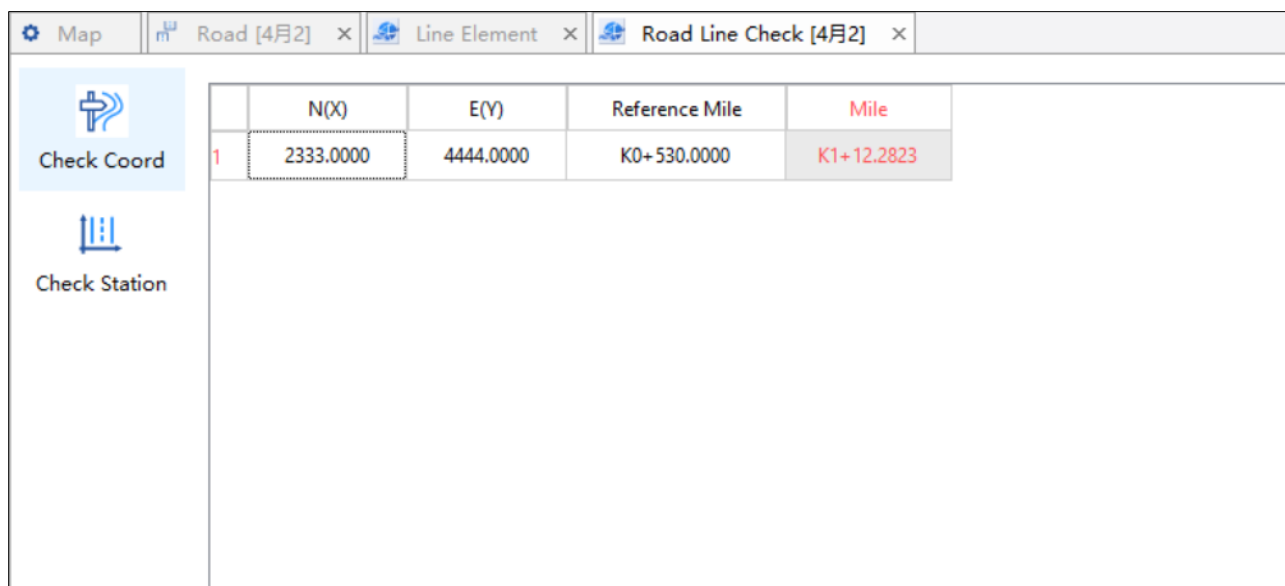


	Mile	N(X)Reference	E(Y)Reference	N(X)	E(Y)
1	K0+530.0000	11111.0000	2222.0000	2748734.7997	365366.7847

Figure 9-8-6 Check Mileage

(2) Check Coordinates

You can manually add or paste Excel table data by right-clicking, enter N(E), E(Y), mileage reference values in batches, click [Check Coordinates], the software displays the calculated mileage value, the default threshold is 0.05; the calculation result exceeds the threshold The range font is displayed in red.



	N(X)	E(Y)	Reference Mile	Mile
1	2333.0000	4444.0000	K0+530.0000	K1+12.2823

Figure 9-8-7 Check Coordinates

4. Transect Volume

Click the [Transect Volume] icon in the toolbar under the [road] module, and the cross section calculation panel will pop up on the right side of the software.

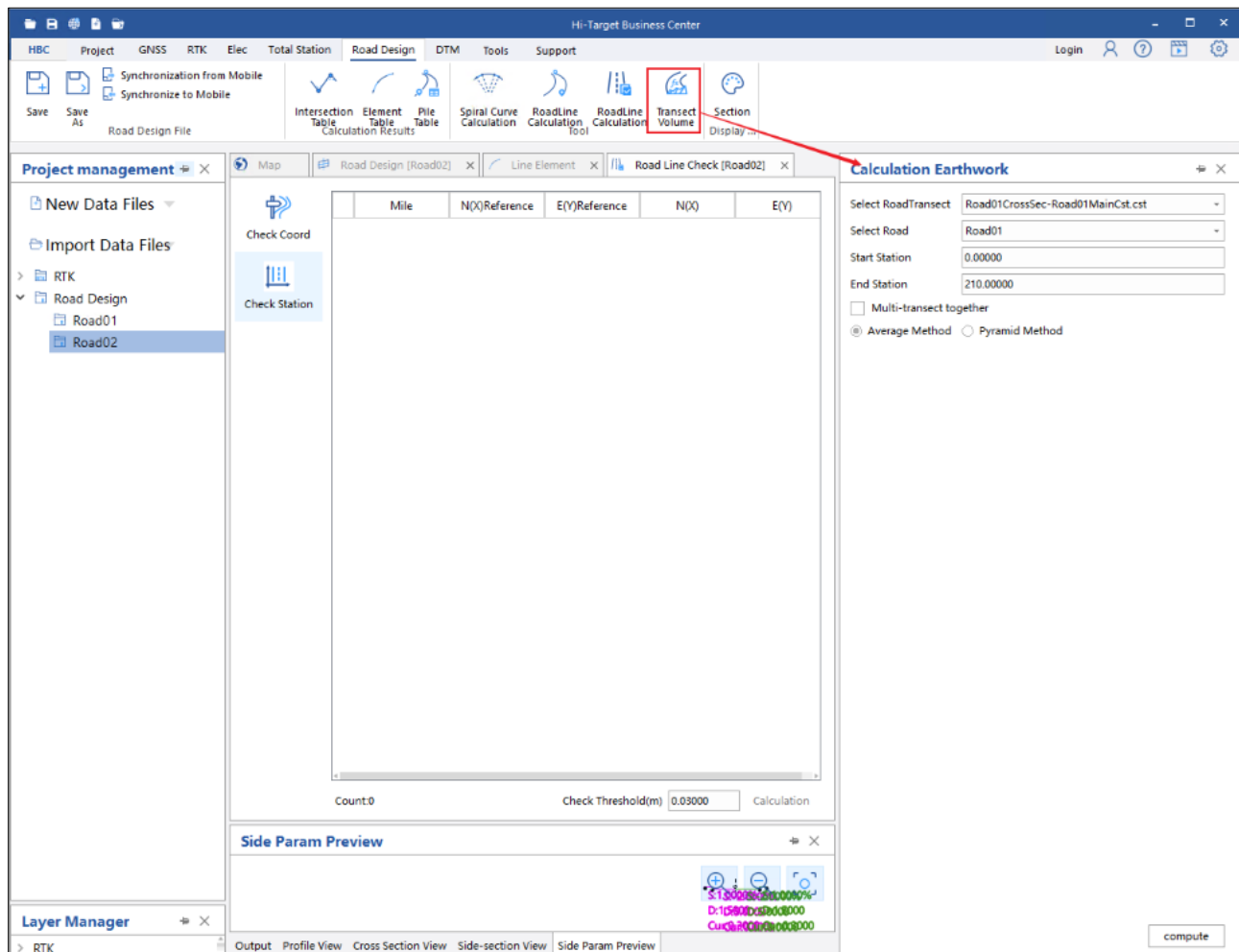


Figure 9-8-8 Transect Volume

Enter the data, click [compute], the calculation results are listed below.

※If the option of real-time mileage reduction is not checked, the cross-section points will be sorted in the order of mileage from small to large and offset from small to large; if the option of real-time mileage reduction is checked, the cross-section points will be sorted according to the real-time mileage from small to large. , The real-time offset is sorted from small to large; PS: check the real-time mileage reduction option, the cross-sectional tolerance is the reduction tolerance set by the user, and the real-time mileage reduction option is not checked, and the cross-sectional tolerance is 0.005.

Volume Calculation

Select RoadTransect

hdm-MainCst.cst

Select Road

test

Start Station

0.00000

End Station

40.00000

☒ Multi-transect together

Limit

5.00000

☒ Average Method
 ☐ Pyramid Method

Result

Dig Volume:

17094.23005

Fill Volume:

0.00000

Total Volume:

17094.23005

Graphics

Export

compute

Figure 9-8-9 Transect Volume

Click [Graphics], the main page will pop up the cross-section transect volume, fill and excavation line chart, click the point on the line chart, you can view the cross-sectional preview pictures of different mileage.

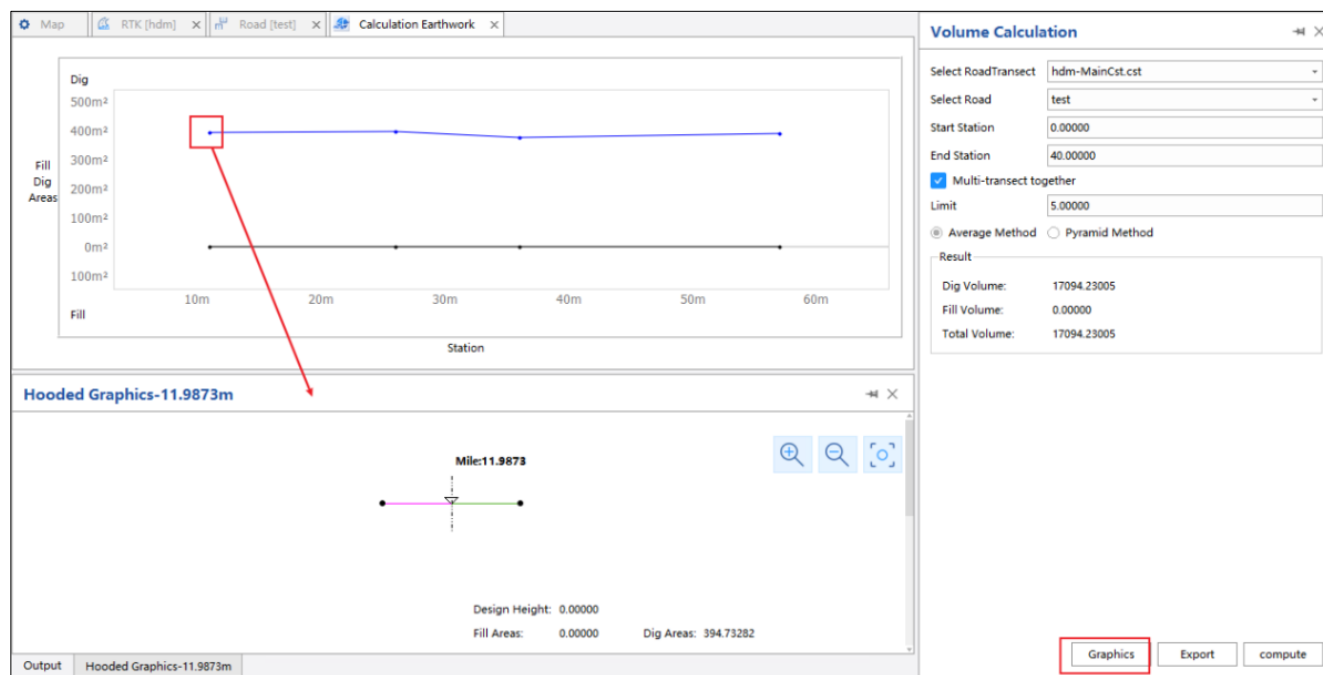


Figure 9-8-10 Transect Volume

Click [Export], select the path, enter the file name, you can export the cross-section earthwork calculation report and the dxf file (*.dxf).

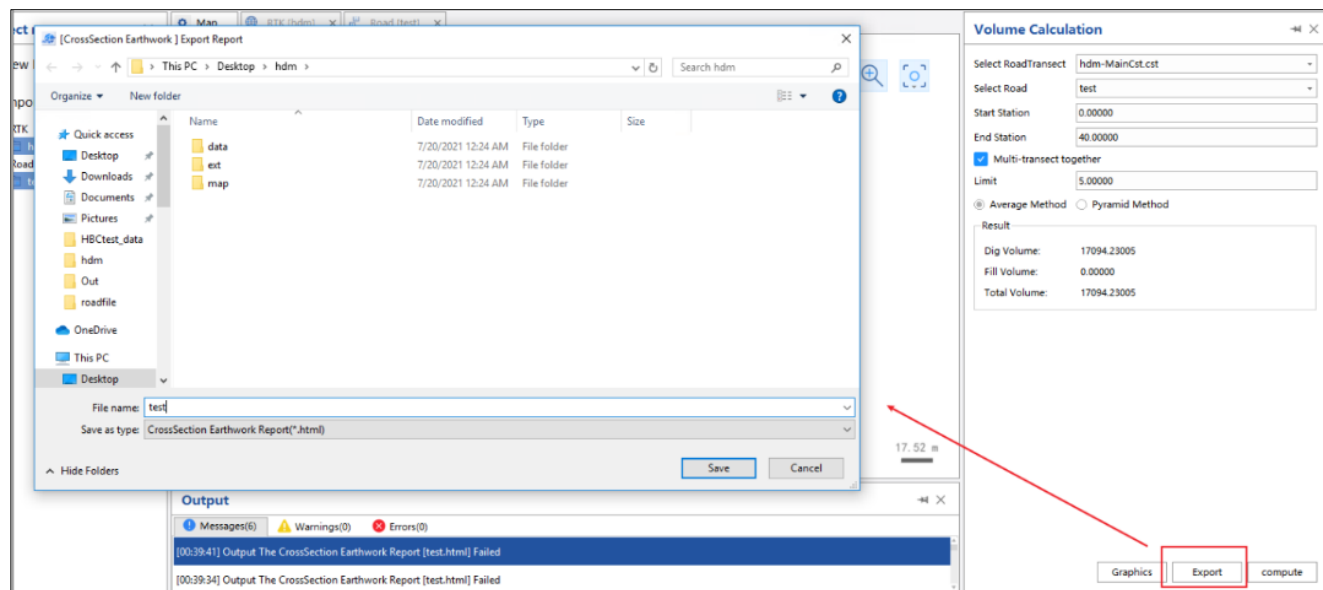


Figure 9-8-11 Transect Volume

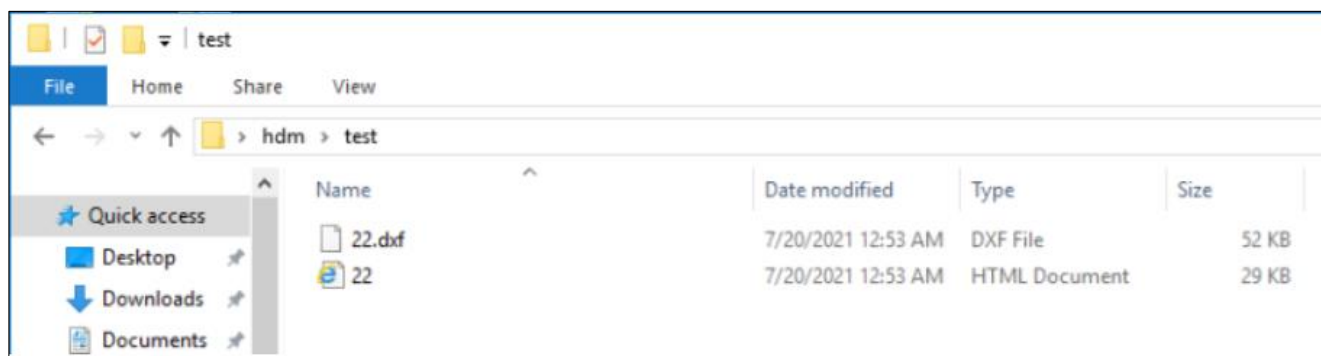


Figure 9-8-12 Transect Volume

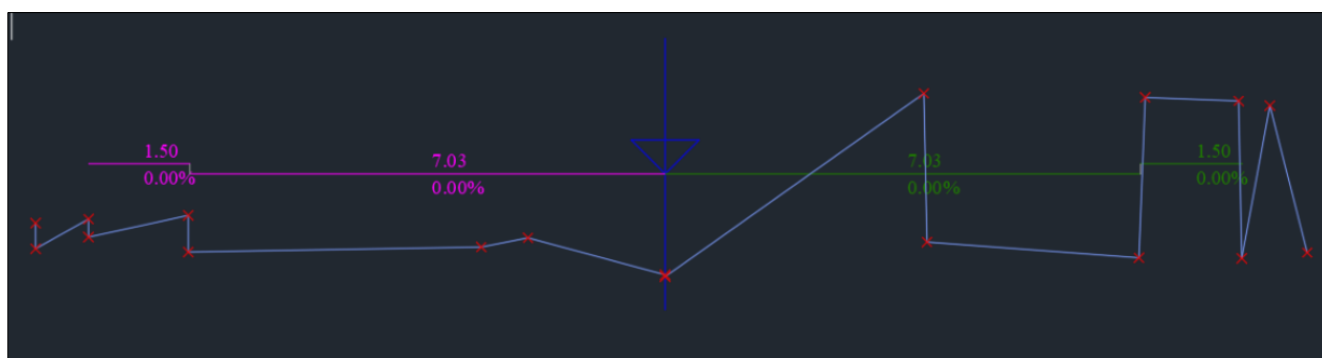


Figure 9-8-13 Transect Volume

※Transect Volume provides two methods: average method and pyramid method to calculate the amount of fill and excavation. Among them, using the average method to calculate the volume of earth and stone is simple and practical. It is a method often used on highways, but its accuracy is poor, and it is only used when the area of adjacent cross-sections is not much different. When the area of adjacent cross-sections differ greatly, it is more accurate to use the pyramid method.

9.9 Line Element

(1) Click the [line element] icon in the display configuration bar under the [Road Design] module, and the software pops up the line element color setting panel.

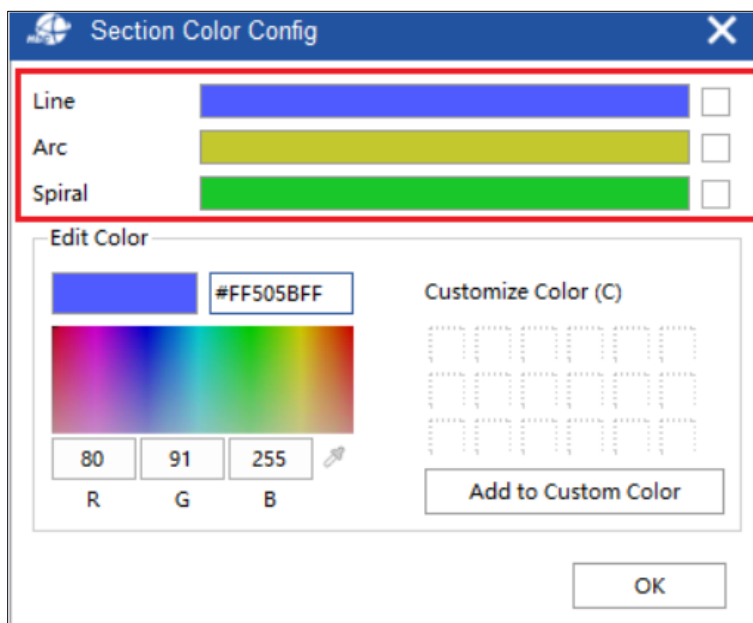


Figure 9-9-1 Line Element

You can set the color of straight line, arc and transition curve. Drag the straw to the color box to pick the color, and check the box on the left of the corresponding line element to complete the color setting of the corresponding line element.

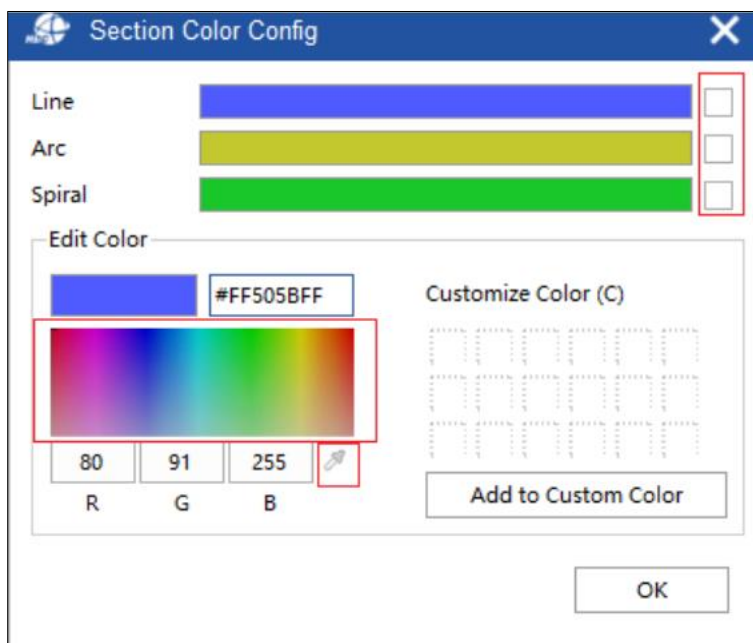


Figure 9-9-2 Line Element

After setting, click OK to change the line element color of the corresponding road on the map.



Figure 9-9-3 Line Element

(2) Add Custom Colors

Select the custom color box, drag the straw to the color box with the left mouse button to complete color selection, and click Add to custom color to complete the addition of custom color.

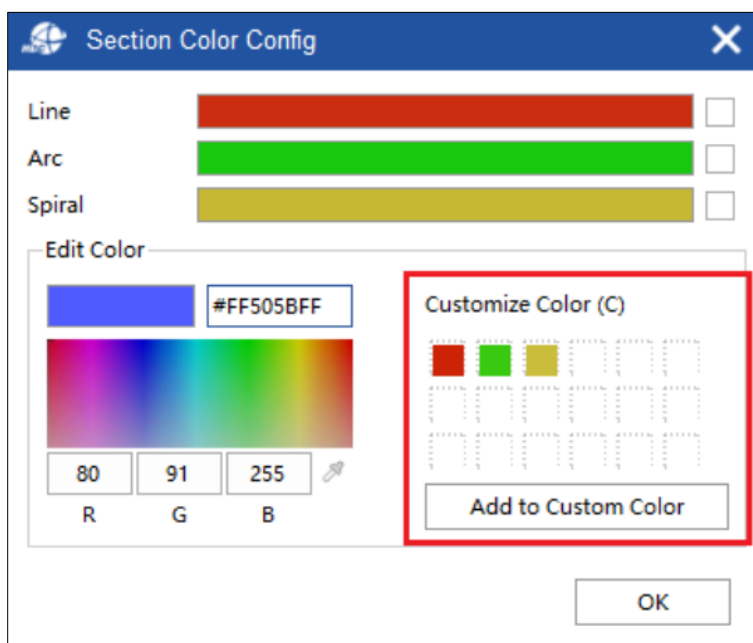


Figure 9-9-4 Add Custom Colors

(3) The color setting is completed by entering RGB values of different values. By inputting RGB values of different values, the color setting is completed. The value range of R, G and B is 0 ~ 255. The color setting can be completed by inputting corresponding values in the corresponding color box.

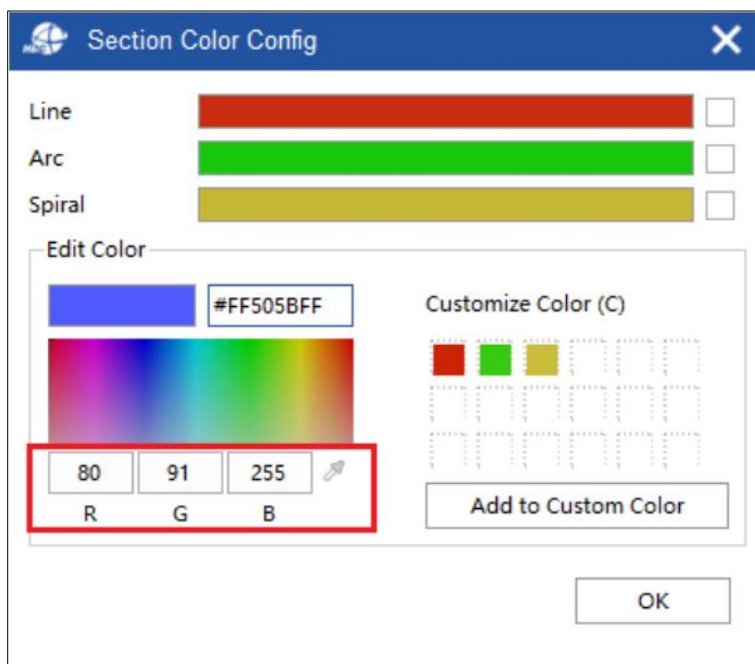


Figure 9-9-5 Add Custom Colors

Chapter 10

DTM

This chapter contains:

- Create
- Import
- Save
- Save As
- Synchronize
- DTM Data
- Check Surface Point
- Volume Calculation

10.1 Create

[Method 1] Click the 'New' button under 'Project' in the top menu bar of HBC software, select the 'DTM Files' option, and the software will pop up the Create DTM File dialog box.

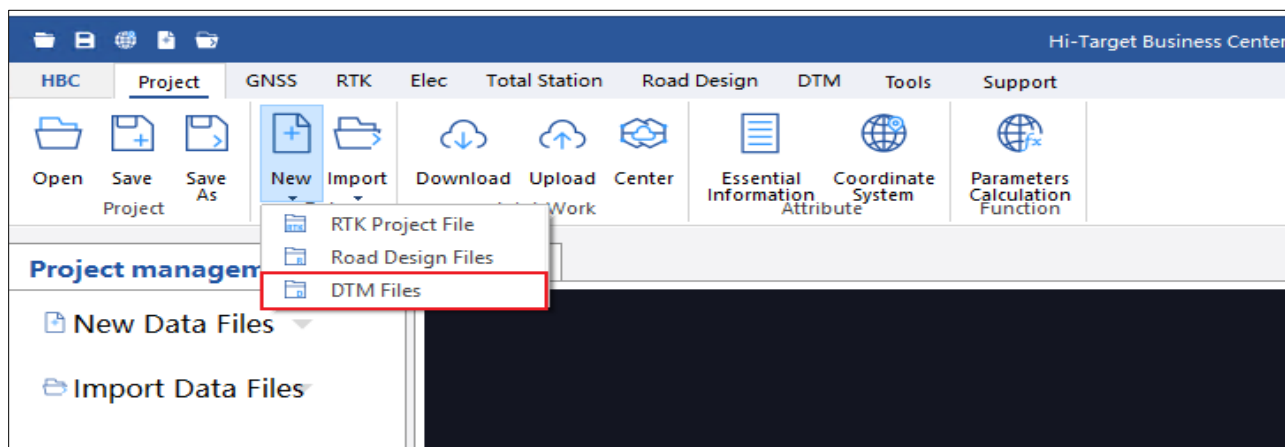


Figure 10-1-1 Method 1

[Method 2] Click 'New Data Files' under the Project Management dock window, select the 'DTM Files' option, and the software pops up the Create DTM File dialog box.

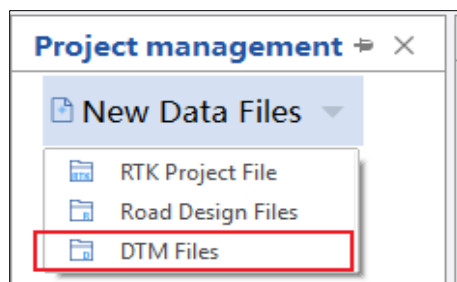


Figure 10-1-2 Method 2

[Method 3] Click the 'New' button on the top menu bar of the HBC software, select the 'DTM Files' option, and the software pops up a dialog box to create a DTM file.

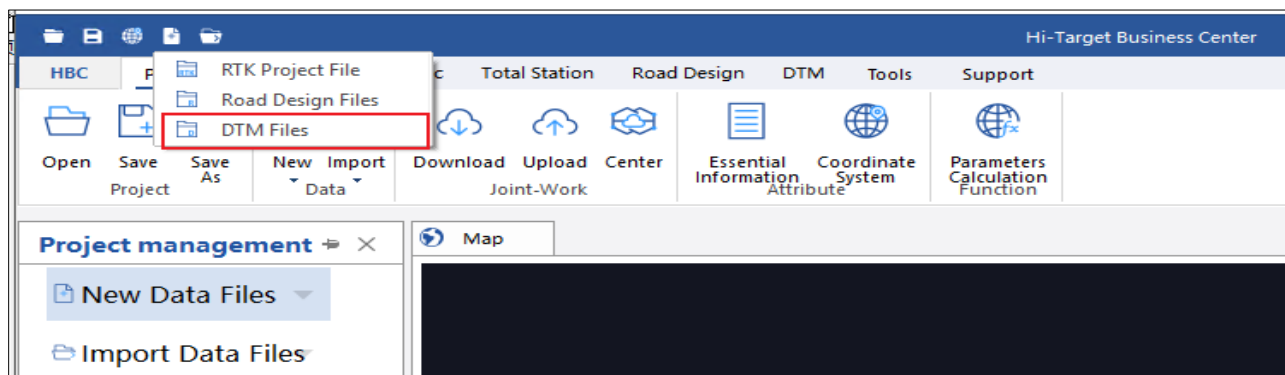


Figure 10-1-3 Method 3

[Method 4] In the new dialog box, select the *.tin file and the path to save the file. The default path is the desktop, and enter the file name, click 'Save', the software will automatically generate the xxx.tin file in the path selected by the user, and display it in the message window : The xxx.tin file is successfully created, and the new road file name is added under the road tree node on the left.

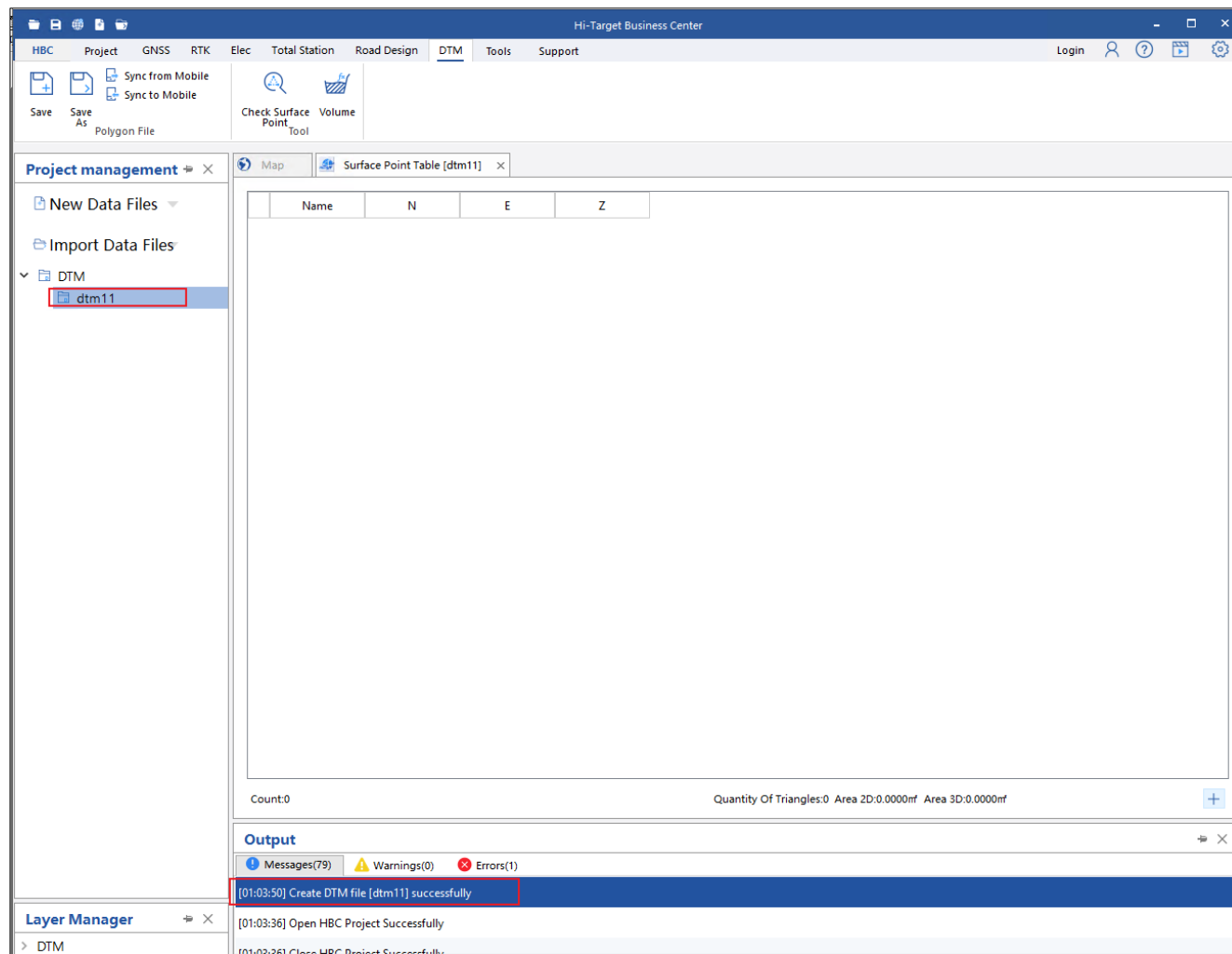


Figure 10-1-4 Method 4

10.2 Import

10.2.1 Import Surface File

1. Import DTM File

[Method 1] Click the 'Import' button under 'Project' on the top menu bar of the HBC software, select the 'DTM Files' option, and the software will pop up the Import DTM File dialog box.

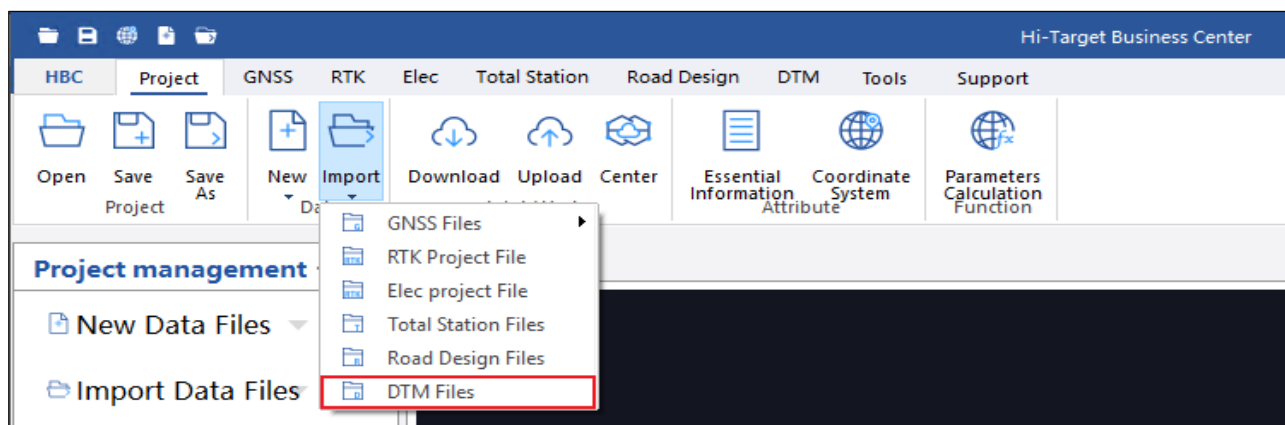


Figure 10-2-1 Method 1

[Method 2] Click 'Import Data Files' under the Project Management dock window, select the 'DTM Files' option, and the software pops up the Import DTM File dialog box.

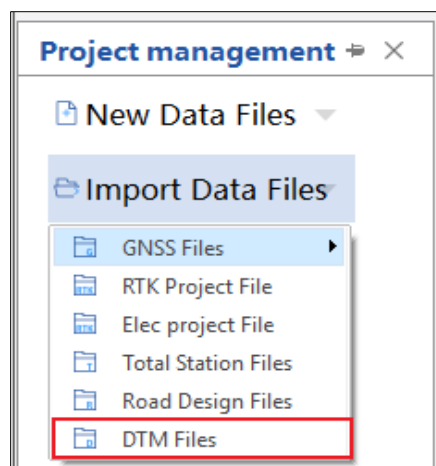


Figure 10-2-2 Method 2

[Method 3] Click the 'Import' button on the top menu bar of HBC software, select the 'DTM Files' option, and the software pops up the Import DTM File dialog box.

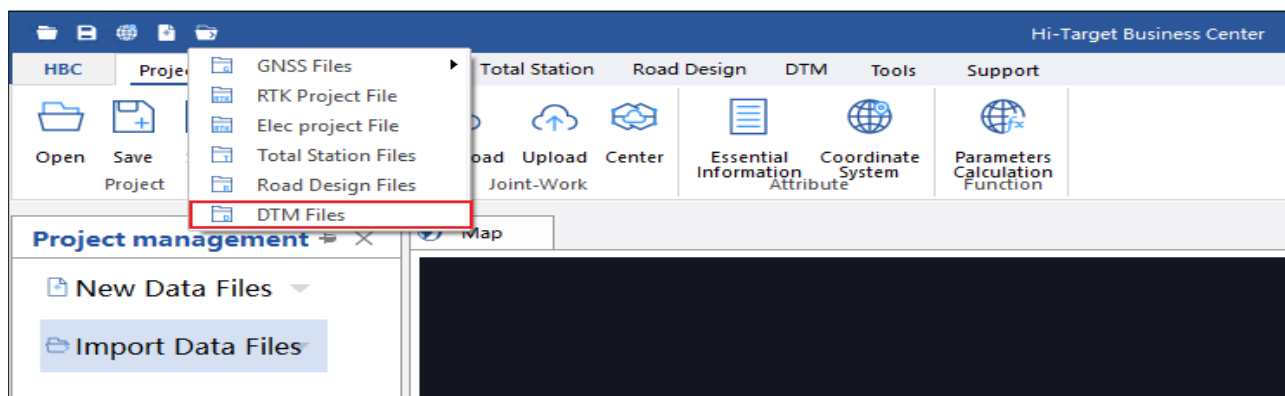


Figure 10-2-3 Method 3

2. Select the File

- Select the file path in the dialog box, select Hi-Target surface file (*.tin) or CASS surface file (*.sjw) or LandXml surface file (*.xml) or 3D coordinate data file (*.csv) in the file type drop-down box, click 'Import' or double-click the file to be loaded, the software automatically loads the surface file.
- If there is DTM data that has been manipulated (added or deleted or modification), it prompts "Current Surface File [XXX] Modified, Do You Need To Save Them?". Click 'Yes', the software saves the XXX file, click 'No', the software does not save the file.
- After successful loading, the open DTM file name will be added under the left DTM tree node. If the DTM file name already exists under the current project node, the DTM file will be selected directly.

10.2.2 Import 3D Coordinate Data File

- Click 'Import Data Files' under the project management dock window, select 'DTM Files' option, the software pops up the Import DTM File dialog box, select the 3D coordinate data file (*.csv).

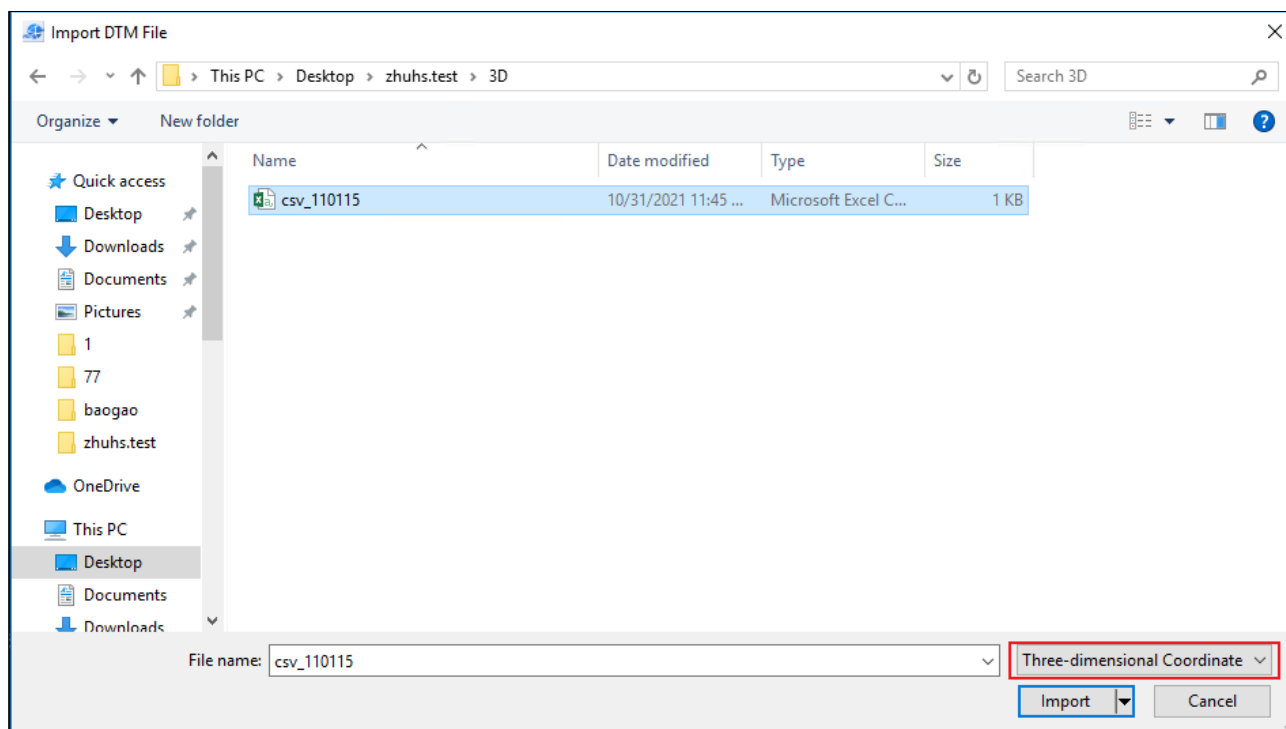


Figure 10-2-4 Select File

- If there is a DTM surface in the project, the software will prompt "apply to the current project".
- If you click 'Yes', the data from the 3D coordinate data file will be imported to the DTM project selected in the current project.
- If you click 'No', the software will generate a new DTM surface with the data from the 3D coordinate data file.

- The import of 3D coordinate data file (*.csv) is a custom format import, you need to set the import format, set the fields, and whether to include the file header and file consistency.

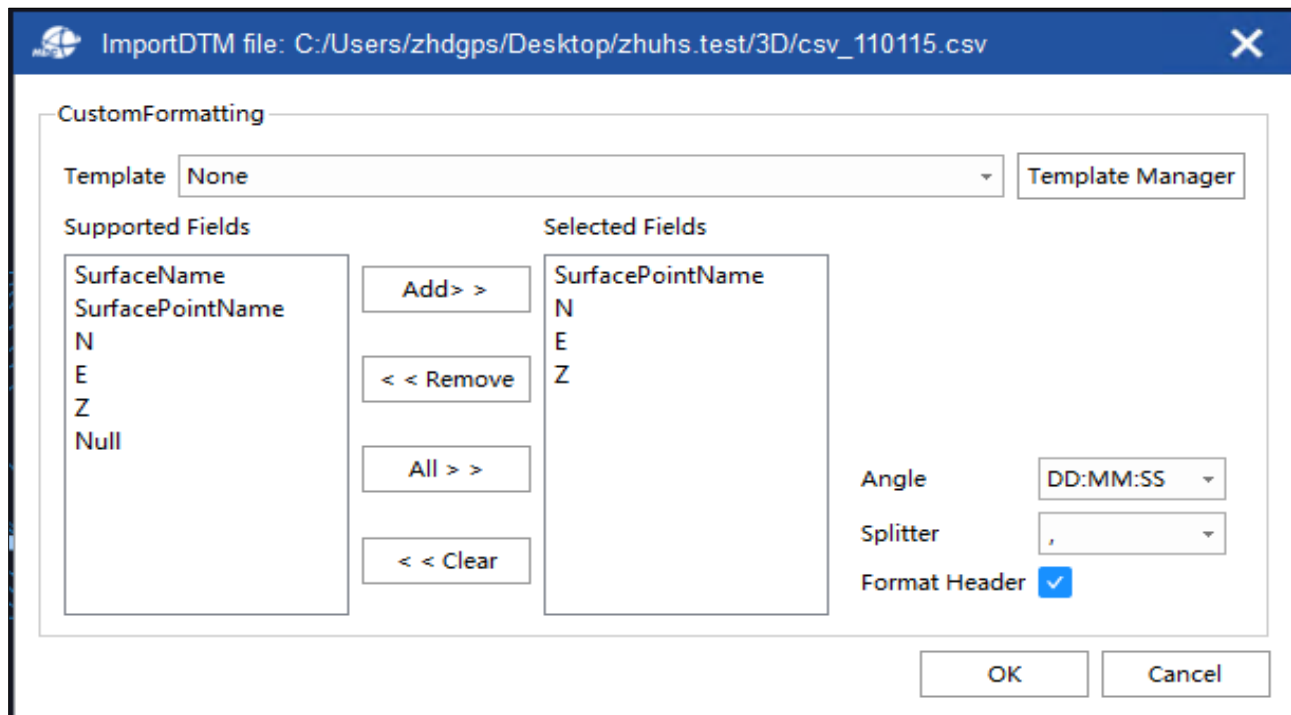


Figure 10-2-5 Custom Formatting

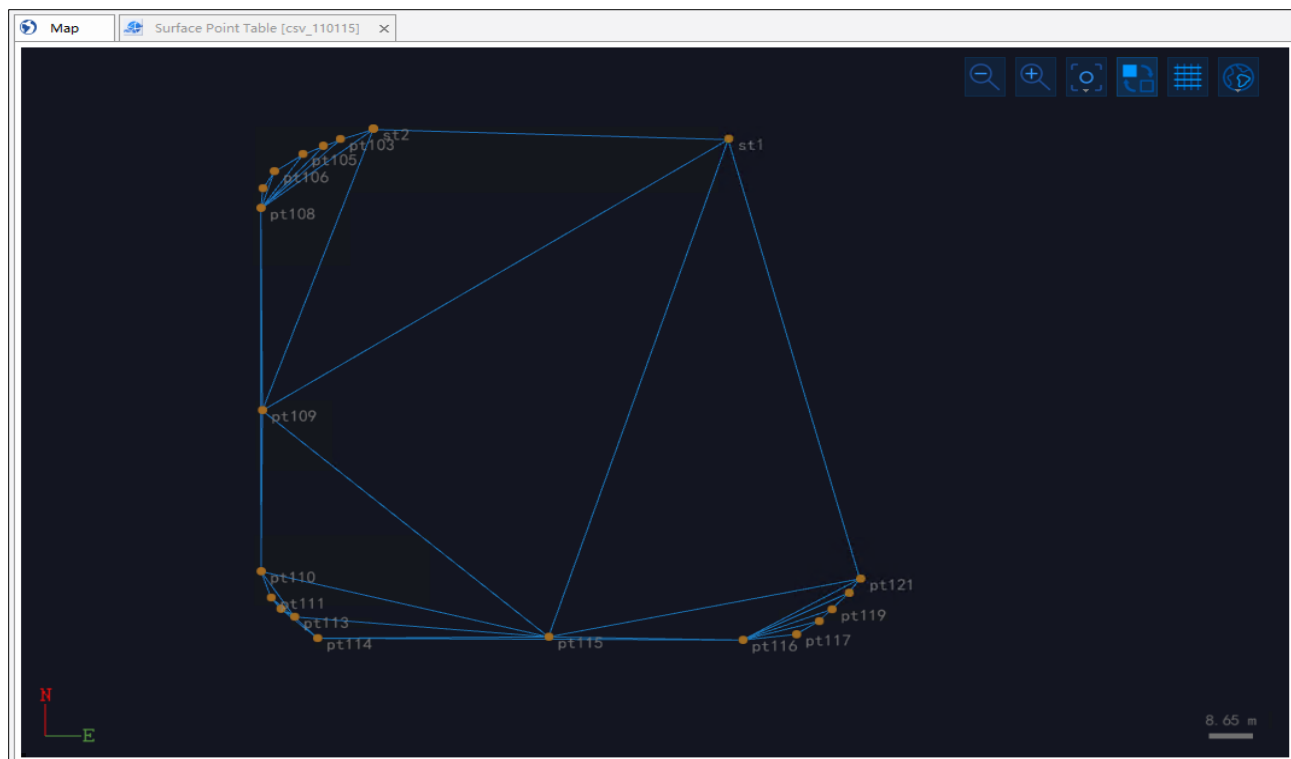


Figure 10-2-6 Import DTM File

10.3 Save

Click the 'Save' icon under 'DTM' in the top menu bar of HBC software, the current DTM file is saved successfully, and the software will display in the message window: "Save DTM file [xxx] successfully".

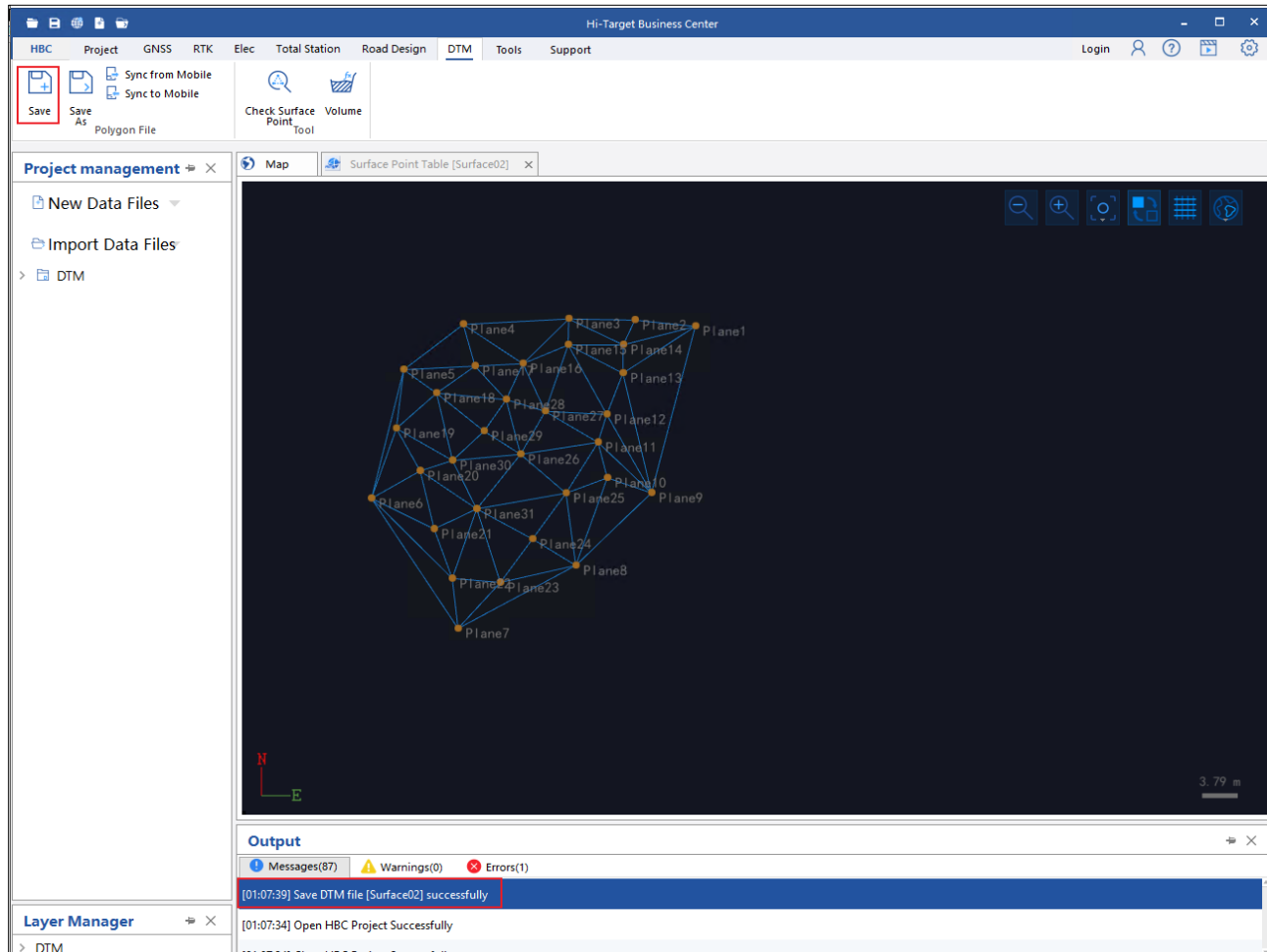


Figure 10-3-1 Save File

10.4 Save As

Click the 'Save As' icon under 'DTM' on the top menu bar of HBC software, the software will pop up a file selection box, select the path you need to save, enter the file name and click 'Save'. Can save as Hi-Target surface file (*.tin) and CASS surface file (*.sjw).

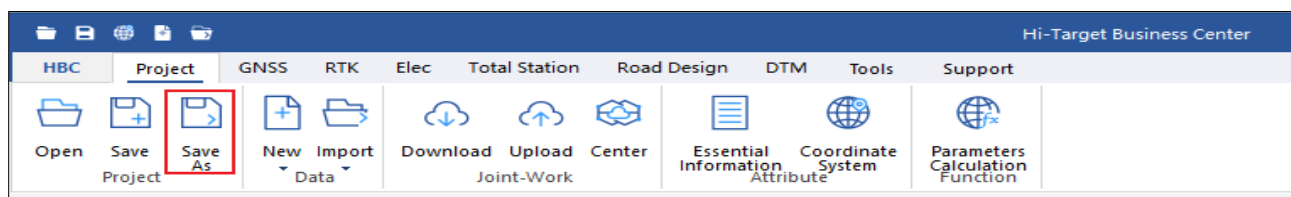


Figure 10-4-1 Save As

The software will save the data to the corresponding selected path, at the same time, the original file path of the current project record is switched to the saved path, and the message bar at the bottom of the software prompts "Save surface file [xxx] successfully".

10.5 Synchronize

After finishing DTM project editing, users can synchronize DTM project data with mobile via the 'Sync from Mobile' 'Sync to Mobile' button on the top bar.

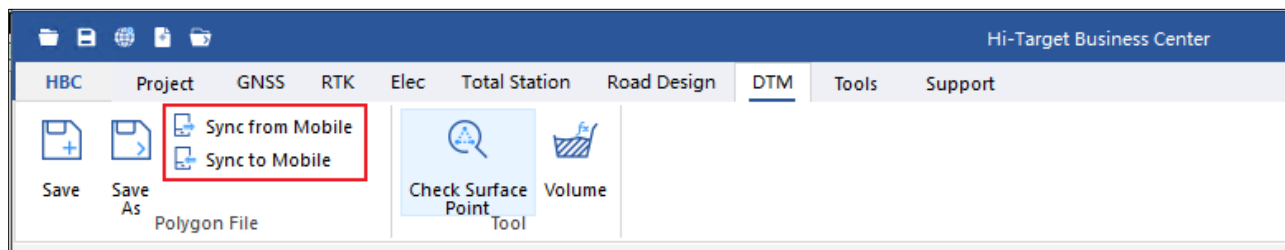


Figure 10-5-1 Synchronize

10.5.1 Synchronize from Mobile

1. Enter the Address and Port

After the mobile terminal software enables the FTP function, click the 'Synchronize From Mobile' button on the top bar, enter the address and port information (select the user name and password according to the mobile terminal configuration), and click connect.

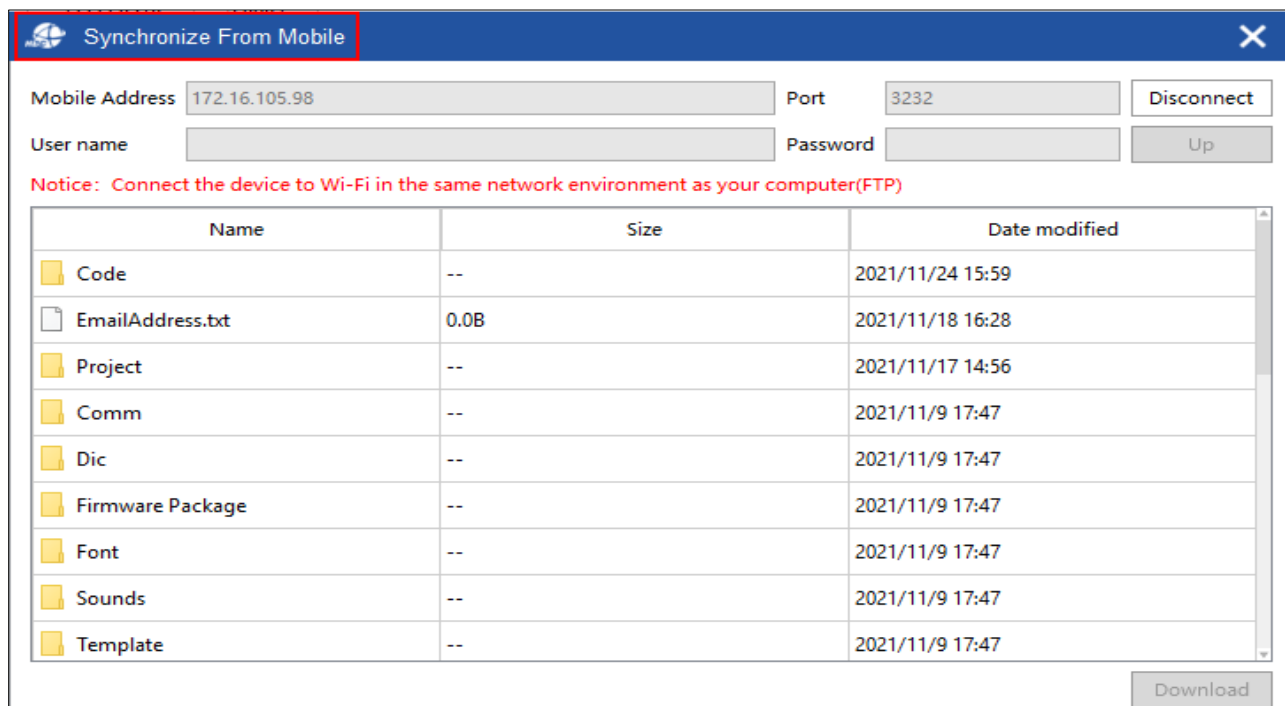


Figure 10-5-2 Enter the Address and Port

2. Synchronize Mobile Projects

After successful connection, select the corresponding DTM project folder and click the 'Download' button to open the mobile project synchronously.

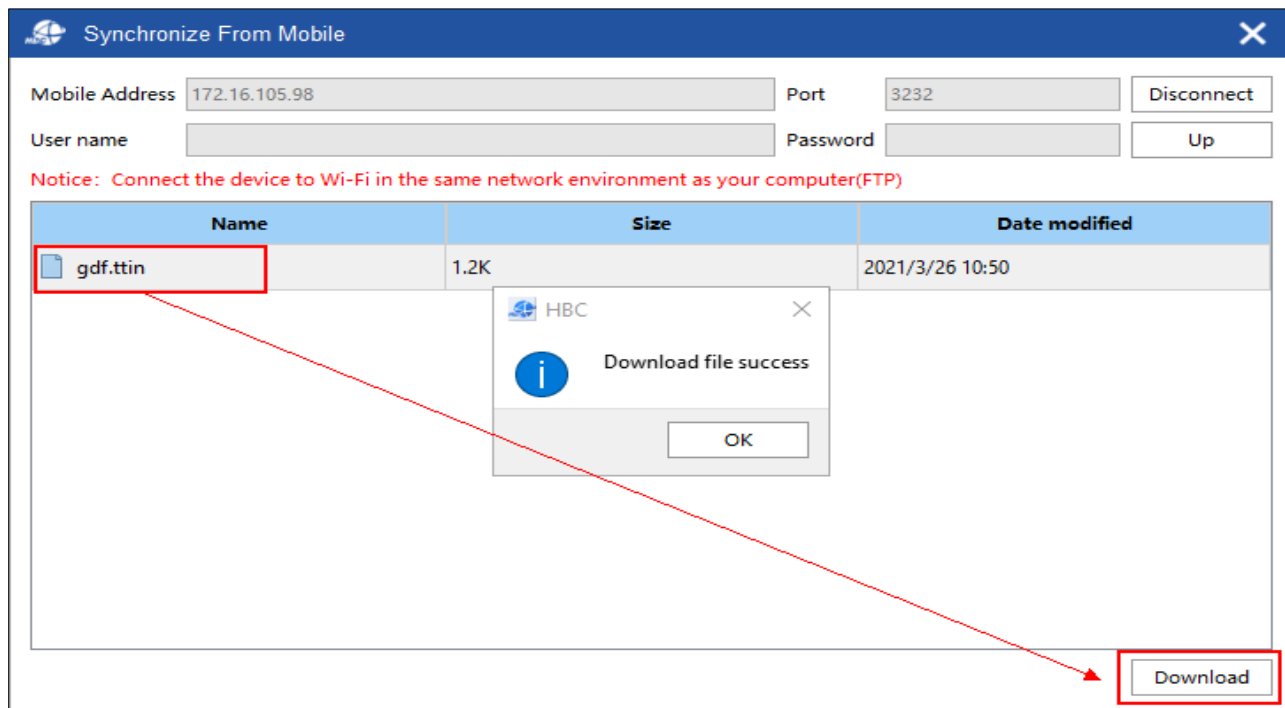


Figure 10-5-3 Download

10.5.2 Synchronize to Mobile

- After the mobile terminal software enables the FTP function, click the 'Synchronize To Mobile' button on the top bar, enter the address and port information (select the user name and password according to the mobile terminal configuration), and click connect.
- After successful connection, select the target folder and click the 'Start Synchronize' button to synchronize the current DTM project to the mobile terminal.

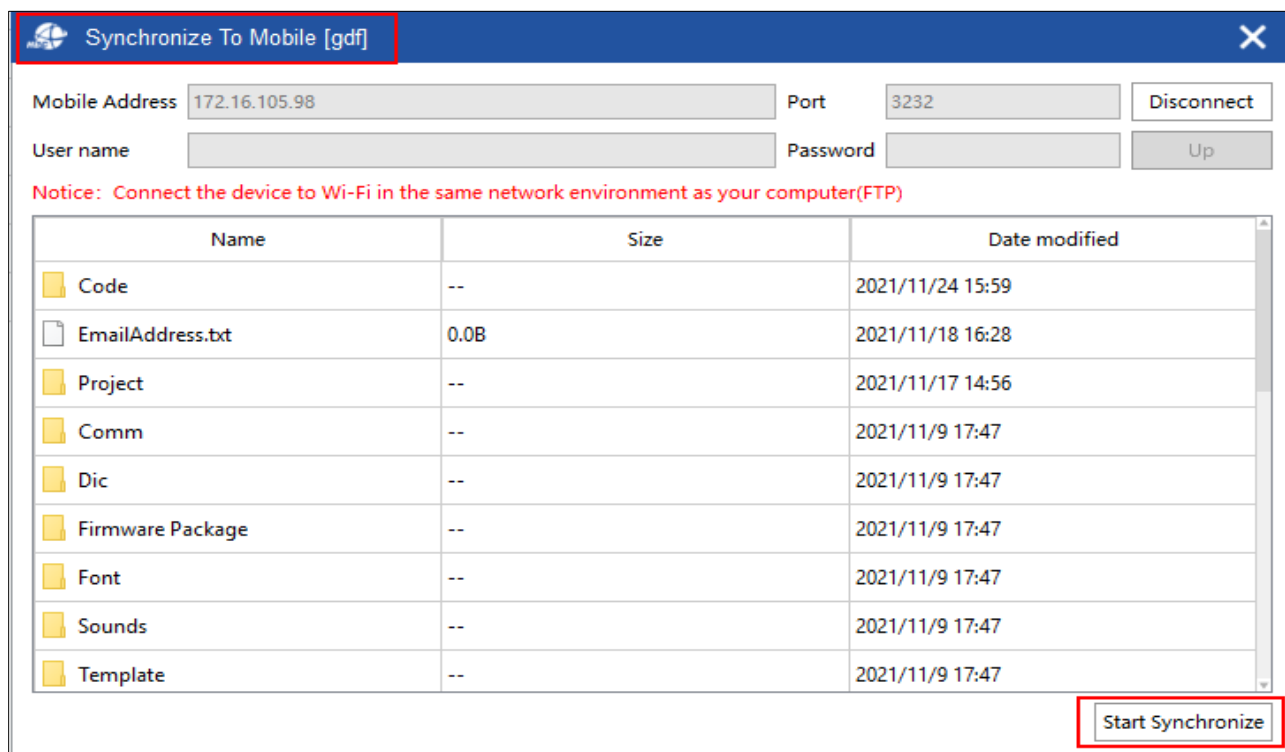


Figure 10-5-4 Connect

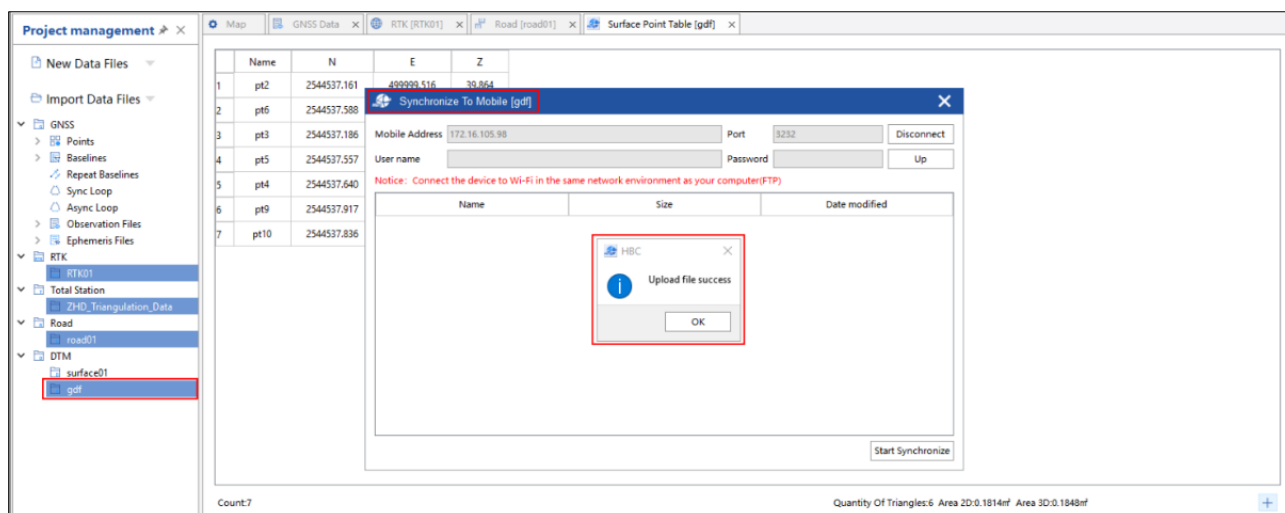


Figure 10-5-5 Start Synchronization

10.6 DTM Data

10.6.1 Data Deletion and Viewing

After creating or opening a DTM project, a DTM data editing list will pop up. Users can right-click on any row of data in the coordinate point list.

	Name	N	E	Z	
1	Plane1	2542664.638	435317.894	10.37	+ Add
2	Plane2	2542665.339	435311.952	10.23	↻ Refresh F5
3	Plane3	2542665.501	435305.449	10.27	🗑 Delete Del
4	Plane4	2542664.951	435295.078	10.29	🧹 Clear
5	Plane5	2542660.056	435289.200	10.42	📋 Copy Ctrl+C
6	Plane6	2542646.095	435285.966	10.203	📄 Paste Ctrl+V
7	Plane7	2542631.925	435294.423	9.964	
8	Plane8	2542638.725	435306.032	10.385	
9	Plane9	2542646.575	435313.502	10.181	
10	Plane10	2542648.223	435309.170	10.227	
11	Plane11	2542652.080	435308.274	10.256	
12	Plane12	2542655.110	435309.153	10.202	
13	Plane13	2542659.582	435310.755	10.143	
14	Plane14	2542662.663	435310.803	10.274	
15	Plane15	2542662.678	435305.383	10.240	
16	Plane16	2542660.659	435300.924	10.276	
17	Plane17	2542660.415	435296.214	10.245	
18	Plane18	2542657.495	435292.414	10.279	
19	Plane19	2542653.678	435288.446	10.303	
20	Plane20	2542649.056	435290.771	10.106	

Count:31 Quantity Of Triangles:51 Area 2D:724.2894mf Area 3D:724.5117mf

Figure 10-6-1 DTM Data Editing List

- Click the 'Add' button to add a row of surface point data; at the same time, you can add data through the "Add (A)" button at the bottom.
- Click the 'Refresh' button to display all data.
- Click the 'Delete' button to delete the data.
- Click the 'Clear' button to clear all surface point data.
- Click the 'Copy' button to perform data copying.
- Click the 'Paste' button to paste the data.

10.6.2 Select the Collected Point Data to Add to the DTM Surface Point List

One or more RTK module coordinate points, stakeout points, control points, graph root data, and cross-section points can be selected and added to the DTM surface point list.

- Select one or more coordinate points, stakeout points, control points, graph root data, and cross-section points in the RTK module data list, right-click the 'Add DTM Points' menu item, and select the DTM surface you need to add to.

Map RTK [RTK02] Surface Point Table [face1]										
	Name	N	E	Z	B	L	H	Rounds	Ave Times	Description
1	mp1	2542846.9356	435191.2328	10.6043	22:59:00.50406N	113:22:04.59920E	10.6043	3	10	
2	mp2	2542875.4920	435170.5420	10.6711	22:59:01.42940N	113:22:03.86848E	10.6711	1		
3	mp3	2542882.1093	435159.9435	10.7169	22:59:01.64301N	113:22:03.49538E	10.7169	1		
4	mp4	2542883.4292	435137.5273	10.7046	22:59:01.68278N	113:22:02.70820E	10.7046	1		
5	mp5	2542883.4628	435127.2179	10.7071	22:59:01.68242N	113:22:02.34625E	10.7071	1	5	
6	mp6	2542882.7039	435092.6218	10.5950	22:59:01.65290N	113:22:01.13177E	10.5950	1	5	
7	mp7	2542877.5573	435060.1181	10.5191	22:59:01.48105N	113:21:59.99142E	10.5191	1	5	
8	mp8	2542875.6635	435030.6130	10.4667	22:59:01.41535N	113:21:58.95584E	10.4667	1	5	
9	mp9	2542875.8485	435011.9234	10.4466	22:59:01.41874N	113:21:58.29966E	10.4466	1	5	
10	mp10	2542880.0886	434978.5501	10.1550	22:59:01.55188N	113:21:57.12735E	10.1550	1	5	
11	mp11	2542873.8482	434946.2041	10.3452	22:59:01.34449N	113:21:55.99270E	10.3452	1	5	
12	mp12	2542873.5773	434917.9018	10.3202	22:59:01.33171N	113:21:54.99911E	10.3202	1	5	

Figure 10-6-2 Add DTM Points

Map RTK [RTK02] Surface Point Table [face1]				
	Name	N	E	Z
28	pt27	2542908.933	435360.127	-2.088
29	pt28	2542896.933	435360.127	-2.088
30	pt29	2542881.933	435360.127	-2.088
31	pt30	2542865.933	435360.127	-2.088
32	pt31	2542860.933	435360.127	-2.088
33	pt32	2542853.933	435360.127	-2.088
34	pt33	2542853.933	435336.127	-2.088
35	pt34	2542853.933	435303.127	-2.088
36	pt35	2542853.933	435276.127	-2.088
37	pt36	2542853.933	435249.127	-2.088
38	pt37	2542853.933	435228.127	-2.088
39	pt38	2542853.933	435219.127	-2.088
40	pt39	2542853.933	435207.127	-2.088
41	pt40	2542853.933	435198.127	-2.088
42	pt41	2542853.933	435186.127	-2.088
43	pt42	2542853.933	435177.127	-2.088
44	pt43	2542853.933	435168.127	-2.088
45	mp1	2542846.936	435191.233	10.604
46	mp2	2542875.492	435170.542	10.671
47	mp3	2542882.109	435159.944	10.717

Figure 10-6-3 Add DTM Points

- Select an RTK module coordinate point, stakeout point, control point, graph root data, cross-section point in the map, right-hover the 'Add DTM Points' menu item, and select the DTM surface to be added to.

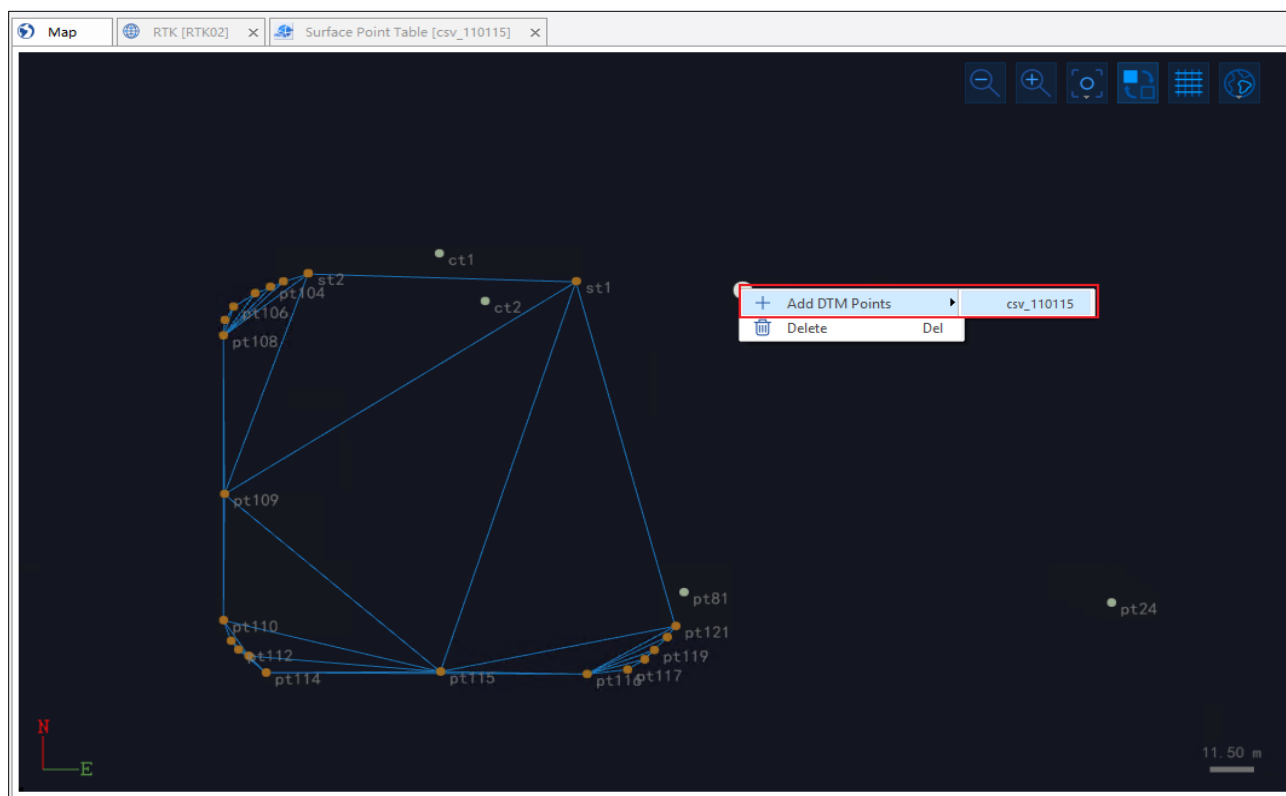


Figure 10-6-4 Add DTM Points



Figure 10-6-5 Add DTM Points

Note: 1. The right-click shortcut menu will only have the menu item 'Add DTM Points' when DTM surface exists; 2. If the added point data duplicates the point name in the DTM surface point list, the added point data will be renamed in the form of "Point Name_N".

10.6.3 Results Display

After editing the data, the results of the data can be displayed in real time, including the number of triangular meshes, the 2D total area, and the 3D total area.

Map GNSS Data RTK [RTK01] Road [road01] Surface Point Table [surface01]				
	Name	N	E	Z
1	dtm1	2542809.566	435206.657	10.143
2	dtm2	2542807.249	435200.985	10.185
3	dtm3	2542799.614	435194.916	10.184
4	dtm4	2542792.822	435192.303	10.166
5	dtm5	2542786.774	435194.867	10.257
6	dtm6	2542778.471	435194.899	10.313
7	dtm7	2542765.286	435194.751	10.295
8	dtm8	2542753.477	435200.682	10.425
9	dtm9	2542743.845	435206.049	10.462
10	dtm10	2542744.869	435213.993	10.481
11	dtm11	2542755.300	435207.571	10.562
12	dtm12	2542771.426	435206.966	10.528
13	dtm13	2542784.141	435208.002	10.376
14	dtm14	2542784.068	435213.524	10.308
15	dtm15	2542788.113	435230.749	9.768
16	dtm16	2542791.326	435236.946	12.370
17	dtm17	2542792.204	435246.688	10.930

Count:39

Quantity Of Triangles:60 Area 2D:9141.1669m² Area 3D:9285.8918m²

Figure 10-6-6 Results display

10.7 Check Surface Point

Performing Checks

Calculate the elevation of the input point, if the point is not in the surface it will not be calculated and prompt that the point is not in the design surface; if the point is in the surface, then the corresponding elevation will be calculated.

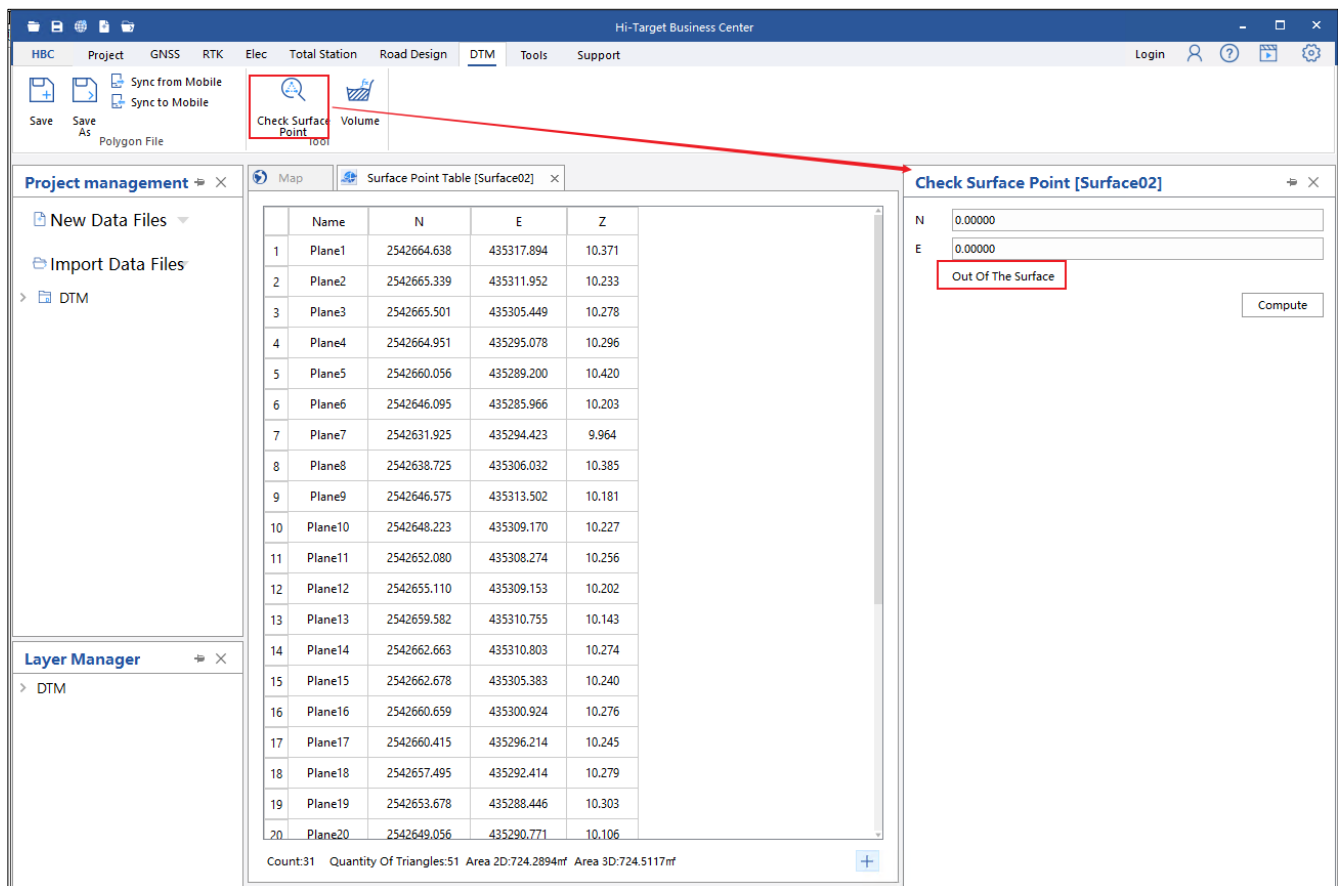


Figure 10-7-1 the Point Is Not in the Design Surface

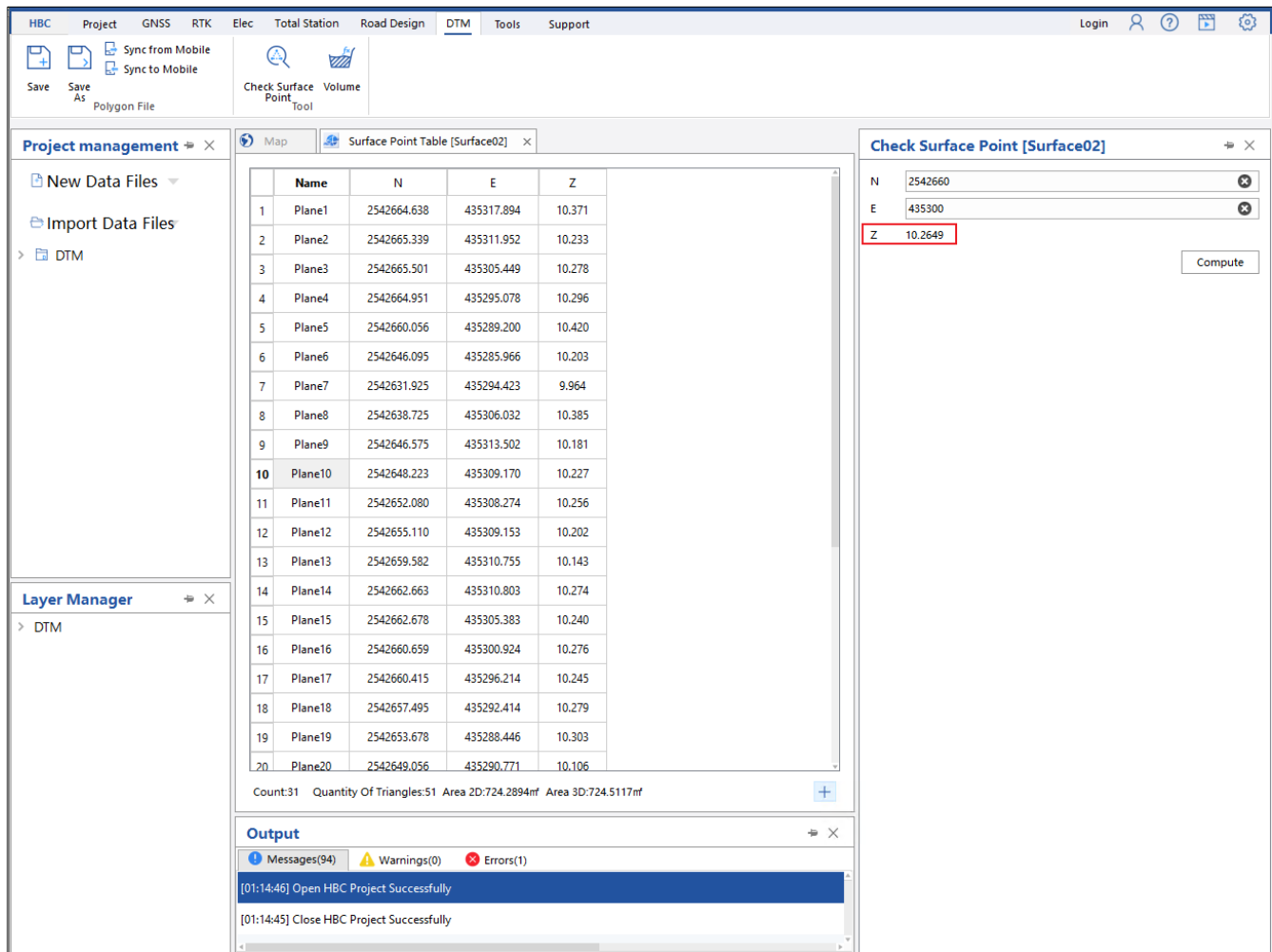


Figure 10-7-2 the Point Is in the Surface

10.8 Volume Calculation

Calculate the volume, 2D perimeter, 3D perimeter and area of the DTM between two DTM surfaces/one DTM surface and the predetermined elevation, the soil calculation interface is as follows.

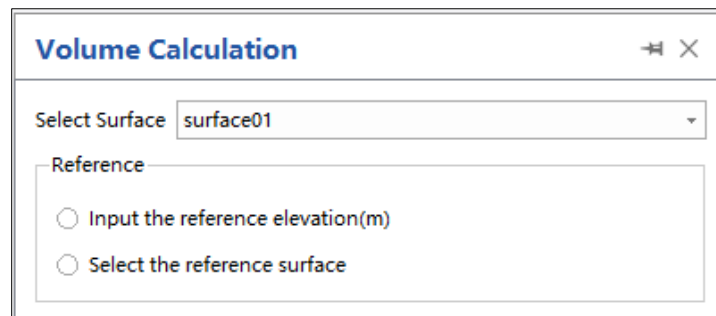


Figure 10-8-1 the Soil Calculation Interface

‘Select Surface’: Select an actual face from the drop-down list.

‘Input the reference elevation(m)’: After checking, the selected reference elevation and selected surface are used for earthwork calculation, and the target height of filling/ excavation needs to be input.

‘Select the reference surface’: After checking it, the selected reference surface and selected surface will be used for earthwork calculation.

After selecting different calculation methods, click Calculate to view the information of earth calculation, measuring surface, excavation area and fill area in the result interface, and click ‘Export’ button to export the earthwork result report as *.html, *.txt, *.docx files.

Volume Calculation

Select Surface

surface01

Reference

☒ Input the reference elevation(m)

10

☐ Select the reference surface

Result

The Result Of The Reference Hight And Surface

Surface	surface01
Reference hight(m)	10.0000
Use time(ms)	33
Cut(m³)	11759.1180
Fill(m³)	21.3724
Surface:	surface01
Area(2D:m²)	9141.1669
Area(3D:m²)	9285.8918
Perimeter(2D:m)	367.3701
Perimeter(3D:m)	367.4308
Cut area(m²)	
Area(2D:m²)	8864.5356
Area(3D:m²)	9008.4367
Fill area(m²)	
Area(2D:m²)	276.6314
Area(3D:m²)	277.4550

Export

compute

Figure 10-8-2 the Earthwork Results

"Area (2D:m²)": The area projected onto the horizontal plane.

"Area (3D: m²)": The area projected to the inclined reference plane.

"Perimeter(2D:m)": The polygonal length of the face (2D) from the start point to the current measurement point.

"Perimeter(3D:m)": The polygonal length of the face (3D) from the start point to the current measurement point.

The earthwork result report (*.html), earthwork result report (*.txt), earthwork result report (*.csv), earthwork result report (*.doc) format earthwork calculation result report can be exported.

Note: Exporting earth calculation report, the last page of the report adds a 90° top-view rendering of fill and excavation; among them, green for fill and red for excavation; there is no rendering of fill and excavation in earthwork result report (*.txt), earthwork result report (*.csv).

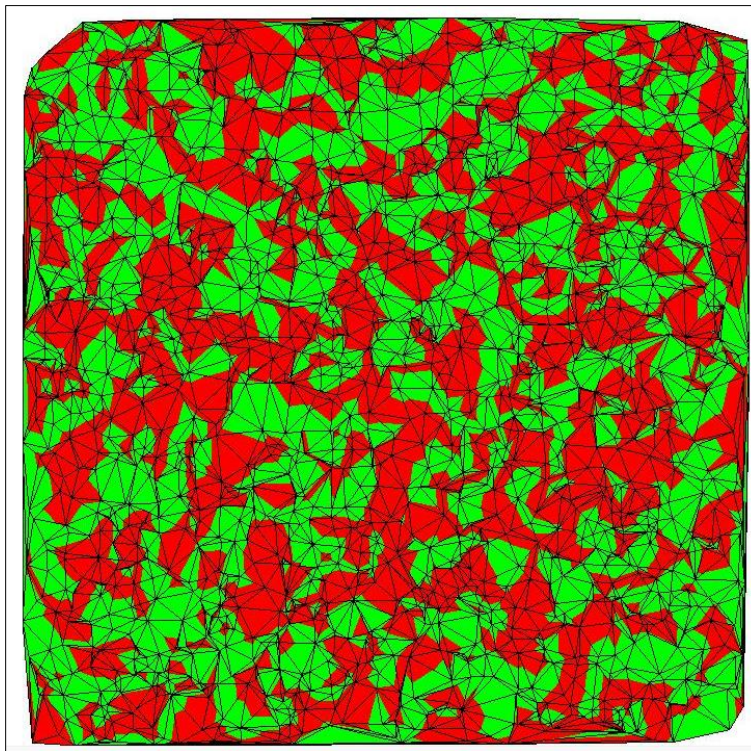


Figure 10-8-3 A 90° Top-view Rendering of Fill and Excavation

Chapter 11

Tools

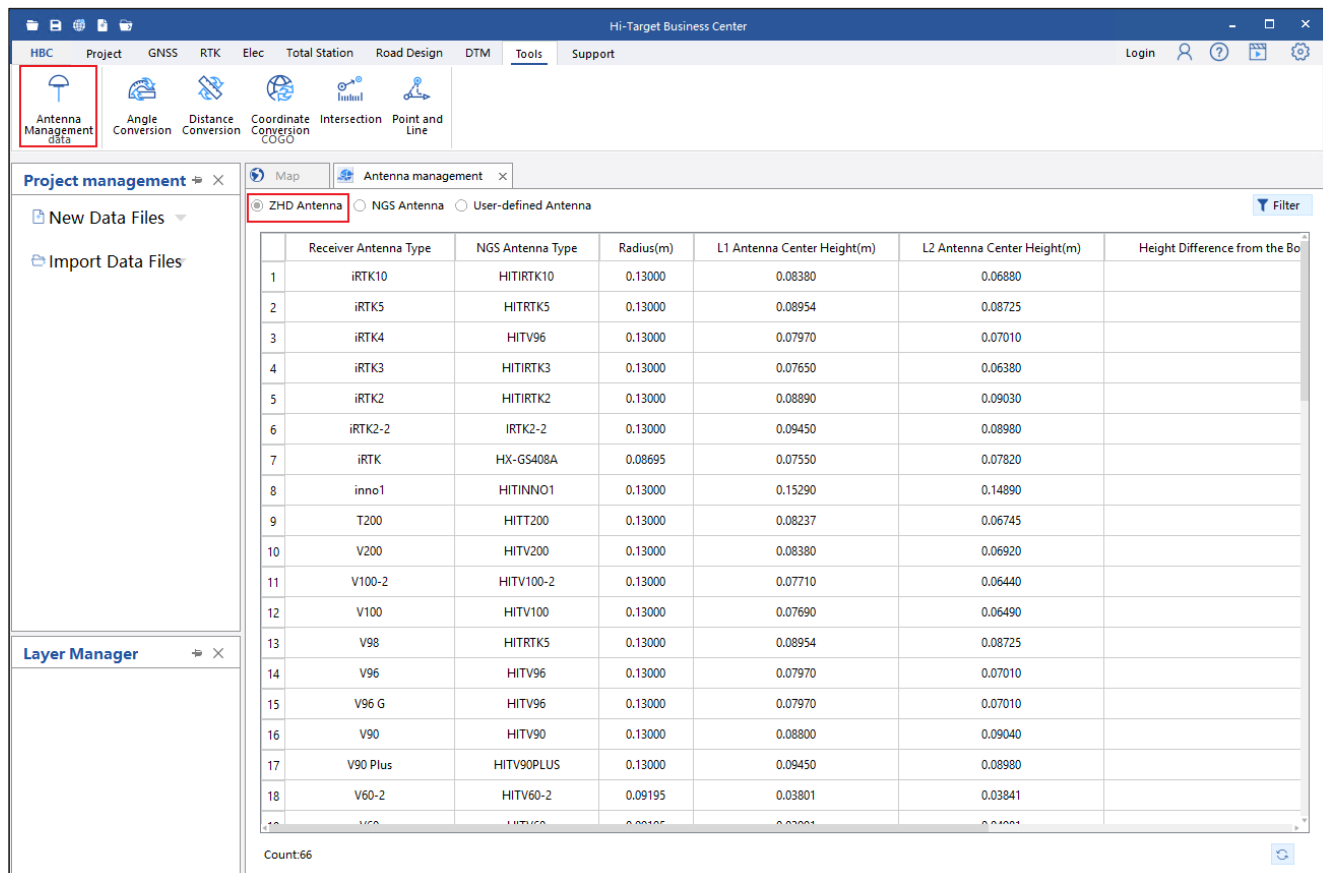
This chapter contains:

- Antenna Management
- Angle Conversion
- Distance Conversion
- Coordinate Conversion
- Intersection
- Point and Line

11.1 Antenna Management

11.1.1 ZHD Antenna

Select 'ZHD Antenna' to view the data of antenna types belonging to Hi-Target.



The screenshot shows the Hi-Target Business Center software interface. The 'Antenna Management' section is active, and the 'ZHD Antenna' radio button is selected. The table below displays the data for various antenna types.

	Receiver Antenna Type	NGS Antenna Type	Radius(m)	L1 Antenna Center Height(m)	L2 Antenna Center Height(m)	Height Difference from the Bo
1	iRTK10	HITIRTK10	0.13000	0.08380	0.06880	
2	iRTK5	HITRTK5	0.13000	0.08954	0.08725	
3	iRTK4	HITV96	0.13000	0.07970	0.07010	
4	iRTK3	HITIRTK3	0.13000	0.07650	0.06380	
5	iRTK2	HITIRTK2	0.13000	0.08890	0.09030	
6	iRTK2-2	IRTK2-2	0.13000	0.09450	0.08980	
7	iRTK	HX-GS408A	0.08695	0.07550	0.07820	
8	inno1	HITINNO1	0.13000	0.15290	0.14890	
9	T200	HITT200	0.13000	0.08237	0.06745	
10	V200	HITV200	0.13000	0.08380	0.06920	
11	V100-2	HITV100-2	0.13000	0.07710	0.06440	
12	V100	HITV100	0.13000	0.07690	0.06490	
13	V98	HITRTK5	0.13000	0.08954	0.08725	
14	V96	HITV96	0.13000	0.07970	0.07010	
15	V96 G	HITV96	0.13000	0.07970	0.07010	
16	V90	HITV90	0.13000	0.08800	0.09040	
17	V90 Plus	HITV90PLUS	0.13000	0.09450	0.08980	
18	V60-2	HITV60-2	0.09195	0.03801	0.03841	
19	V60	HITV60	0.09195	0.03801	0.03841	

Count:66

Figure 11-1-1 ZHD Antenna

Click the 'Refresh' button at the bottom right corner to get the latest antenna data from the official website of Hi-Target.

Map Antenna management x

③ ZHD Antenna ① NGS Antenna ② User-defined Antenna Filter

	Receiver Antenna Type	NGS Antenna Type	Radius(m)	L1 Antenna Center Height(m)	L2 Antenna Center Height(m)	Height Difference from the Bottom from the Bottom to the Measured Position(m)	Description
1	iRTK10	HITRTK10	0.13000	0.08380	0.06880	0.00000	GNSS Antenna
2	iRTK5	HITRTK5	0.13000	0.08954	0.08725	0.00000	GNSS Antenna
3	iRTK4	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
4	iRTK3	HITRTK3	0.13000	0.07650	0.06380	0.00000	GNSS Antenna
5	iRTK2	HITRTK2	0.13000	0.08890	0.09030	0.00000	GNSS Antenna
6	IRTk2-2	IRTk2-2	0.13000	0.09450	0.08980	0.00000	GNSS Antenna
7	iRTK	HX-GS408A	0.08695	0.07550	0.07820	0.03510	GNSS Antenna
8	inno1	HITINNO1	0.13000	0.15290	0.14890	0.00000	GNSS Antenna
9	V200	HITV200	0.13000	0.08380	0.06920	0.00000	GNSS Antenna
10	V100-2	HITV100-2	0.13000	0.07710	0.06440	0.00000	GNSS Antenna
11	V100	HITV100	0.13000	0.07690	0.06490	0.00000	GNSS Antenna
12	V98	HITRTK5	0.13000	0.08954	0.08725	0.00000	GNSS Antenna
13	V96	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
14	V96 G	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
15	V90	HITV90	0.13000	0.08800	0.09040	0.00000	GNSS Antenna
16	V90 Plus	HITV90PLUS	0.13000	0.09450	0.08980	0.00000	GNSS Antenna
17	V60-2	HITV60-2	0.09195	0.03801	0.03841	0.05639	GNSS Antenna
18	V60	HITV60	0.09195	0.03991	0.04981	0.05639	GNSS Antenna
19	V50	HITV30	0.08695	0.07550	0.07820	0.03510	GNSS Antenna

Count:64

Figure 11-1-2 Get the Latest Antenna Data

Click the 'Filter' button in the upper right corner to filter by form field.

Map Antenna management x

③ ZHD Antenna ① NGS Antenna ② User-defined Antenna Filter

	Receiver Antenna Type	NGS Antenna Type	Radius(m)	L1 Antenna Center Height(m)	L2 Antenna Center Height(m)	Height Difference from the Bottom from the Bottom to the Measured Position(m)	Description
1	iRTK10	HITRTK10	0.13000	0.08380	0.06880	0.00000	GNSS Antenna
2	iRTK5	HITRTK5	0.13000	0.08954	0.08725	0.00000	GNSS Antenna
3	iRTK4	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
4	iRTK3	HITRTK3	0.13000	0.07650	0.06380	0.00000	GNSS Antenna
5	iRTK2	HITRTK2	0.13000	0.08890	0.09030	0.00000	GNSS Antenna
6	IRTk2-2	IRTk2-2	0.13000	0.09450	0.08980	0.00000	GNSS Antenna
8	inno1	HITINNO1	0.13000	0.15290	0.14890	0.00000	GNSS Antenna
9	V200	HITV200	0.13000	0.08380	0.06920	0.00000	GNSS Antenna
10	V100-2	HITV100-2	0.13000	0.07710	0.06440	0.00000	GNSS Antenna
11	V100	HITV100	0.13000	0.07690	0.06490	0.00000	GNSS Antenna
12	V98	HITRTK5	0.13000	0.08954	0.08725	0.00000	GNSS Antenna
13	V96	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
14	V96 G	HITV96	0.13000	0.07970	0.07010	0.00000	GNSS Antenna
15	V90	HITV90	0.13000	0.08800	0.09040	0.00000	GNSS Antenna
16	V90 Plus	HITV90PLUS	0.13000	0.09450	0.08980	0.00000	GNSS Antenna
20	V30 Plus	HITV30PLUS	0.13000	0.09850	0.08730	0.00000	GNSS Antenna
24	A30	HITA30	0.13000	0.08360	0.06960	0.00000	GNSS Antenna
25	A20	HITA20	0.13000	0.07660	0.06430	0.00000	GNSS Antenna
26	A16	HITRTK5	0.13000	0.08954	0.08725	0.00000	GNSS Antenna

Count:64

Figure 11-1-3 Filter

11.1.2 NGS Antenna

Select 'NGS Antenna' to view the antenna type data published by NGS official website.

Map Antenna management X

☐ ZHD Antenna ☒ NGS Antenna ☐ User-defined Antenna Filter

	NGS Antenna Type	Manufacturer	L1 Phase Center Offset(East)[mm]	L1 Phase Center Offset(North)[mm]	L1 Phase Center Offset(Vertical)[mm]	L2 Phase Center Offset(East)[mm]	L2 Phase Center Offset(North)[mm]
1	3COAG35 NONE	3CORETEL	2.36000	-0.23000	58.24000	1.21000	1.34000
2	3COAG35H NONE	3CORETEL	2.96000	-2.23000	56.14000	2.21000	-0.26000
3	3COAT-703 NONE	3CORETEL	2.06000	0.27000	53.34000	-0.59000	-1.56000
4	3COAT-705 NONE	3CORETEL	1.76000	-0.83000	52.84000	-0.99000	-0.16000
5	3COAT901 NONE	3CORETEL	2.26000	-0.93000	56.24000	1.11000	0.74000
6	3COAT903 NONE	3CORETEL	1.26000	-1.33000	58.04000	1.41000	0.64000
7	3COAT905 NONE	3CORETEL	3.06000	-1.13000	58.64000	0.71000	0.44000
8	3COAT906 NONE	3CORETEL	1.86000	1.17000	59.44000	0.81000	1.44000
9	3S-02-TSADM NONE	3S Navigation Inc	2.36000	3.07000	254.34000	0.51000	3.54000
10	3S-02-TSATE NONE	3S Navigation Inc	0.66000	-0.53000	152.84000	-0.29000	-0.66000
11	ACC123CGNSSA_XN NONE	Antcom Corporation	4.96000	-0.53000	70.24000	1.71000	0.64000
12	ACC2G1215A_XT_1 NONE	Antcom Corporation	1.76000	1.07000	3.94000	2.71000	2.24000
13	ACC3G1215A_XT_1 NONE	Antcom Corporation	-0.54000	1.07000	3.14000	1.01000	3.74000
14	ACC4G1215A_XT1 NONE	Antcom Corporation	0.16000	1.67000	7.84000	1.61000	-3.16000
15	ACC4G1215A_XT_1 NONE	Antcom Corporation	-2.34000	1.47000	4.94000	-1.09000	0.04000
16	ACC5G1215A_XT1 NONE	Antcom Corporation	0.26000	-1.63000	30.14000	0.11000	-5.66000
17	ACC5G1215A_XT1 NONE	Antcom Corporation	0.86000	-2.53000	29.74000	-1.69000	-5.26000
18	ACC72CGNSSA NONE	Antcom Corporation	2.86000	-0.73000	49.04000	-0.09000	-1.26000
19	ACC72CGNSSA_XT_1 NONE	Antcom Corporation	1.66000	0.17000	61.14000	1.06000	1.66000

Count:835 Refresh

Figure 11-1-4 NGS Antenna

Click the 'Refresh' button at the bottom right corner to get the latest antenna data from the official website of NGS official website.

Map Antenna management X

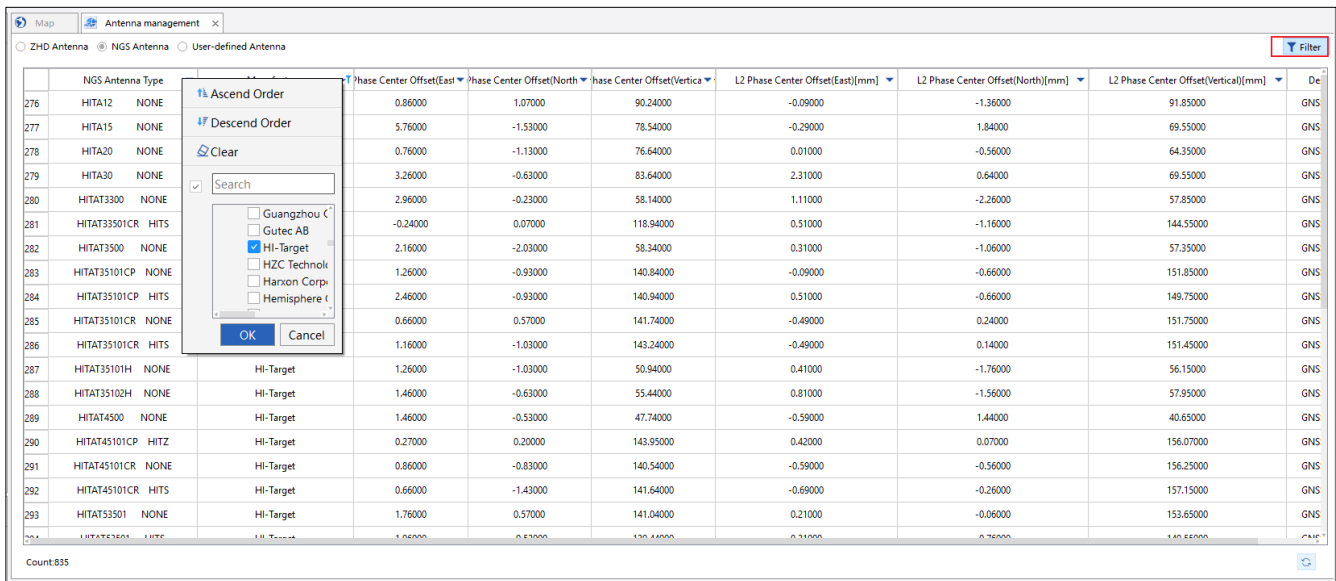
☐ ZHD Antenna ☒ NGS Antenna ☐ User-defined Antenna Filter

	NGS Antenna Type	Manufacturer	L1 Phase Center Offset(East)[mm]	L1 Phase Center Offset(North)[mm]	L1 Phase Center Offset(Vertical)[mm]	L2 Phase Center Offset(East)[mm]	L2 Phase Center Offset(North)[mm]
1	3COAG35 NONE	3CORETEL	2.36000	-0.23000	58.24000	1.21000	1.34000
2	3COAG35H NONE	3CORETEL	2.96000	-2.23000	56.14000	2.21000	-0.26000
3	3COAT-703 NONE	3CORETEL	2.06000	0.27000	53.34000	-0.59000	-1.56000
4	3COAT-705 NONE	3CORETEL	1.76000	-0.83000	52.84000	-0.99000	-0.16000
5	3COAT901 NONE	3CORETEL	2.26000	-0.93000	56.24000	1.11000	0.74000
6	3COAT903 NONE	3CORETEL	1.26000	-1.33000	58.04000	1.41000	0.64000
7	3COAT905 NONE	3CORETEL	3.06000	-1.13000	58.64000	0.71000	0.44000
8	3COAT906 NONE	3CORETEL	1.86000	1.17000	59.44000	0.81000	1.44000
9	3S-02-TSADM NONE	3S Navigation Inc	2.36000	3.07000	254.34000	0.51000	3.54000
10	3S-02-TSATE NONE	3S Navigation Inc	0.66000	-0.53000	152.84000	-0.29000	-0.66000
11	ACC123CGNSSA_XN NONE	Antcom Corporation	4.96000	-0.53000	70.24000	1.71000	0.64000
12	ACC2G1215A_XT_1 NONE	Antcom Corporation	1.76000	1.07000	3.94000	2.71000	2.24000
13	ACC3G1215A_XT_1 NONE	Antcom Corporation	-0.54000	1.07000	3.14000	1.01000	3.74000
14	ACC4G1215A_XT1 NONE	Antcom Corporation	0.16000	1.67000	7.84000	1.61000	-3.16000
15	ACC4G1215A_XT_1 NONE	Antcom Corporation	-2.34000	1.47000	4.94000	-1.09000	0.04000
16	ACC5G1215A_XT1 NONE	Antcom Corporation	0.26000	-1.63000	30.14000	0.11000	-5.66000
17	ACC5G1215A_XT1 NONE	Antcom Corporation	0.86000	-2.53000	29.74000	-1.69000	-5.26000
18	ACC72CGNSSA NONE	Antcom Corporation	2.86000	-0.73000	49.04000	-0.09000	-1.26000
19	ACC72CGNSSA_XT_1 NONE	Antcom Corporation	1.66000	0.17000	61.14000	1.06000	1.66000

Count:835 Refresh

Figure 11-1-5 Get the Latest Antenna Data

Click the 'Filter' button in the upper right corner to filter by form field.



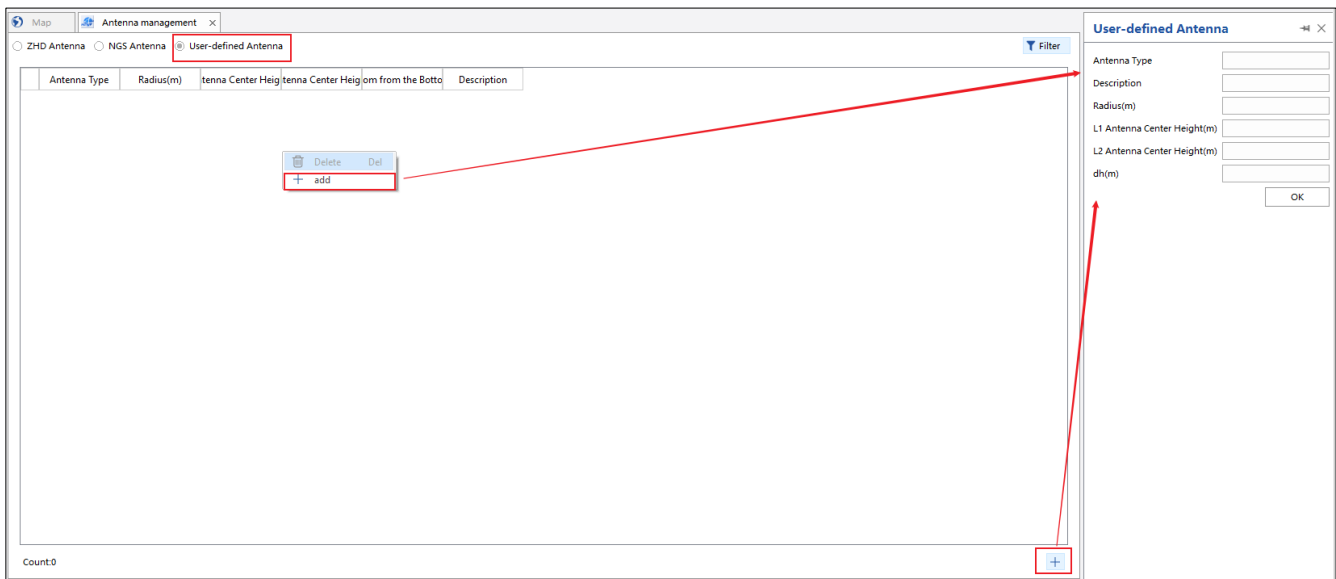
The screenshot shows the 'Antenna management' window with the 'User-defined Antenna' tab selected. A context menu is open over the table, showing options like 'Ascend Order', 'Descend Order', and 'Search'. The table lists various antenna types and their corresponding phase center offsets.

NGS Antenna Type	Phase Center Offset(East)	Phase Center Offset(North)	Phase Center Offset(Vertical)	L2 Phase Center Offset(East)(mm)	L2 Phase Center Offset(North)(mm)	L2 Phase Center Offset(Vertical)(mm)	De
276 HITAI2 NONE	0.86000	1.07000	90.24000	-0.09000	-1.36000	91.85000	GNS
277 HITAI5 NONE	5.76000	-1.53000	78.54000	-0.29000	1.84000	69.55000	GNS
278 HITAI20 NONE	0.76000	-1.13000	76.64000	0.01000	-0.56000	64.35000	GNS
279 HITAI30 NONE	3.26000	-0.63000	83.64000	2.31000	0.64000	69.55000	GNS
280 HITAT3300 NONE	2.96000	-0.23000	58.14000	1.11000	-2.26000	57.85000	GNS
281 HITAT33501CR HITS	-0.24000	0.07000	118.94000	0.51000	-1.16000	144.55000	GNS
282 HITAT3500 NONE	2.16000	-2.03000	58.34000	0.31000	-1.06000	57.35000	GNS
283 HITAT35101CP NONE	1.26000	-0.93000	140.84000	-0.09000	-0.66000	151.85000	GNS
284 HITAT35101CR HITS	2.46000	-0.93000	140.94000	0.51000	-0.66000	149.75000	GNS
285 HITAT35101CR NONE	0.66000	0.57000	141.74000	-0.49000	0.24000	151.75000	GNS
286 HITAT35101CR HITS	1.16000	-1.03000	143.24000	-0.49000	0.14000	151.45000	GNS
287 HITAT35101H NONE	1.26000	-1.03000	50.94000	0.41000	-1.76000	56.15000	GNS
288 HITAT35102H NONE	1.46000	-0.63000	55.44000	0.81000	-1.56000	57.95000	GNS
289 HITAT4500 NONE	1.46000	-0.53000	47.74000	-0.59000	1.44000	40.65000	GNS
290 HITAT45101CP HITZ	0.27000	0.20000	143.95000	0.42000	0.07000	156.07000	GNS
291 HITAT45101CR NONE	0.86000	-0.83000	140.54000	-0.59000	-0.56000	156.25000	GNS
292 HITAT45101CR HITS	0.66000	-1.43000	141.64000	-0.69000	-0.26000	157.15000	GNS
293 HITAT53501 NONE	1.76000	0.57000	141.04000	0.21000	-0.06000	153.65000	GNS

Figure 11-1-6 Filter

11.1.3 User-defined Antenna

Select 'User-defined Antenna', right click 'Add' or click 'Add' button at the bottom right corner, you can add custom antenna type data manually.



The screenshot shows the 'User-defined Antenna' dialog box. The 'Add' button is highlighted with a red box and a red arrow pointing to it. The dialog box contains fields for 'Antenna Type', 'Description', 'Radius(m)', 'L1 Antenna Center Height(m)', 'L2 Antenna Center Height(m)', and 'dh(m)'. The 'Add' button is located at the bottom right of the dialog box.

Figure 11-1-7 Add Custom Antenna Type Data Manually

Right-click 'Add' to pop up the custom antenna list, enter the antenna type, description, L1 antenna center height (m), L2 antenna center height (m), and the height difference data from the bottom to the measurement point, and then click 'OK', to complete the addition.

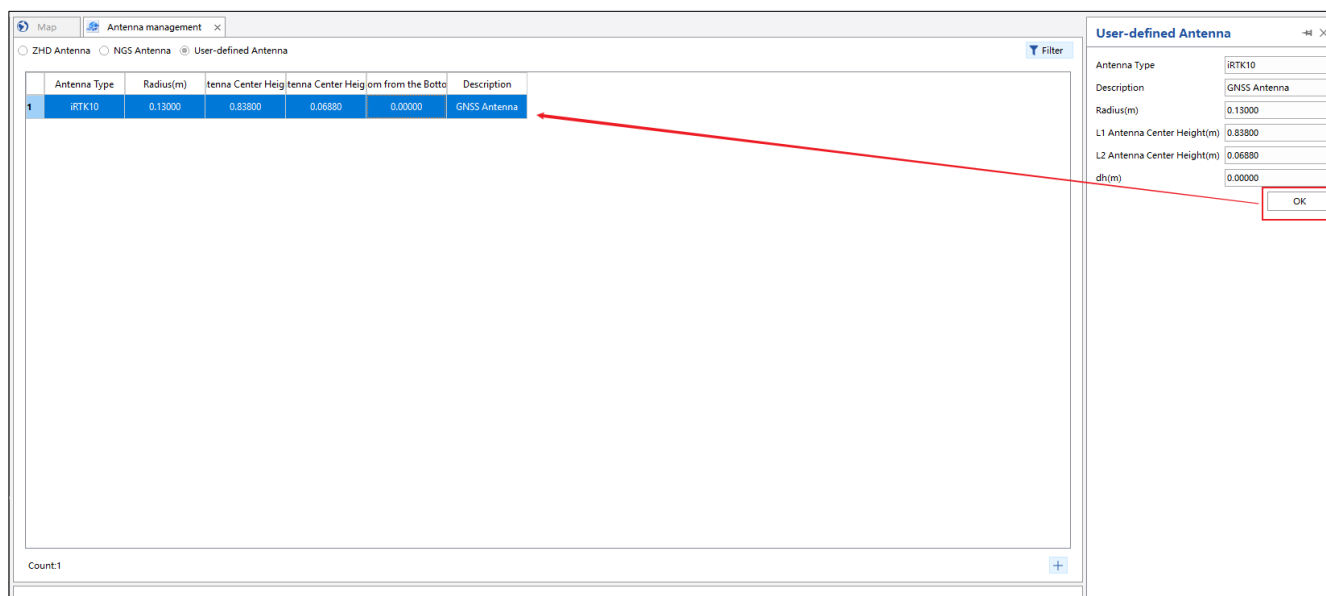


Figure 11-1-8 Add Custom Antenna Type Data Manually

To delete the custom antenna data, select the corresponding antenna and right-click 'Delete'.

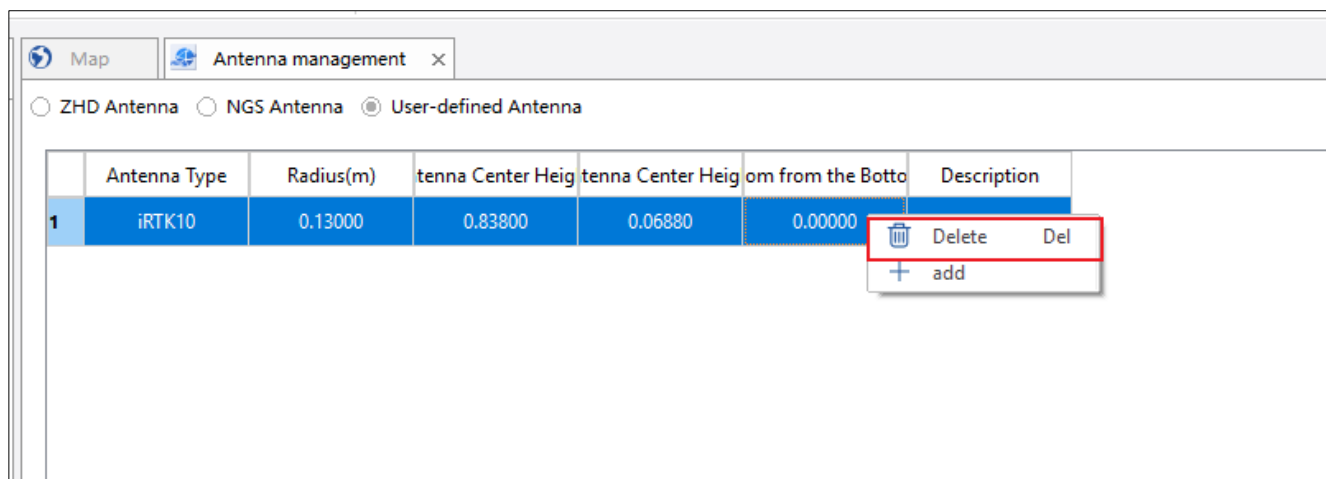


Figure 11-1-9 Delete the Custom Antenna Data

Click the 'Filter' button in the upper right corner to filter by form field.

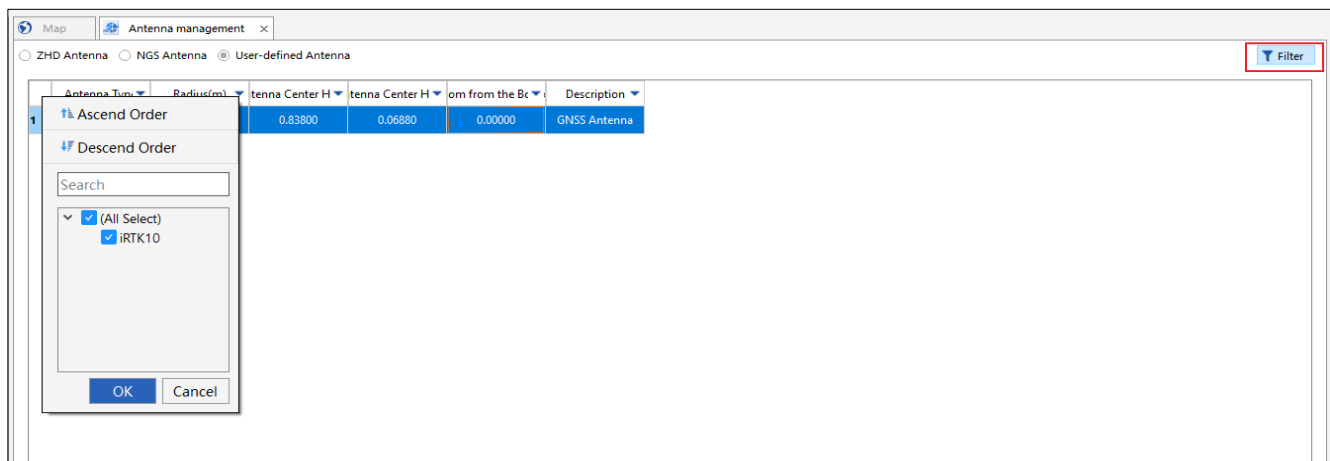


Figure 11-1-10 Filter

11.2 Angle Conversion

Click 'Tools' – 'Angle Conversion' to pop up the Angle Conversion column panel.

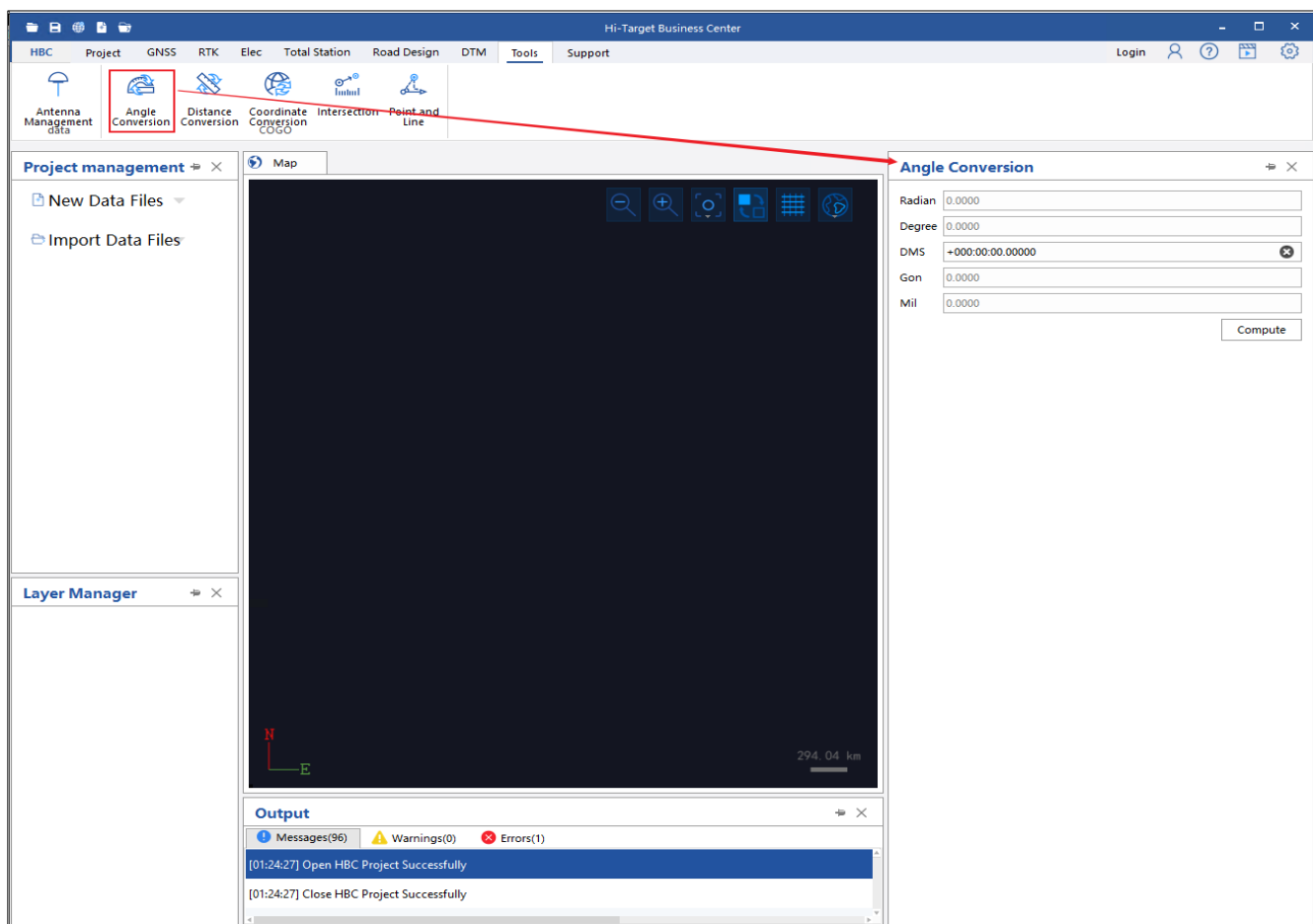
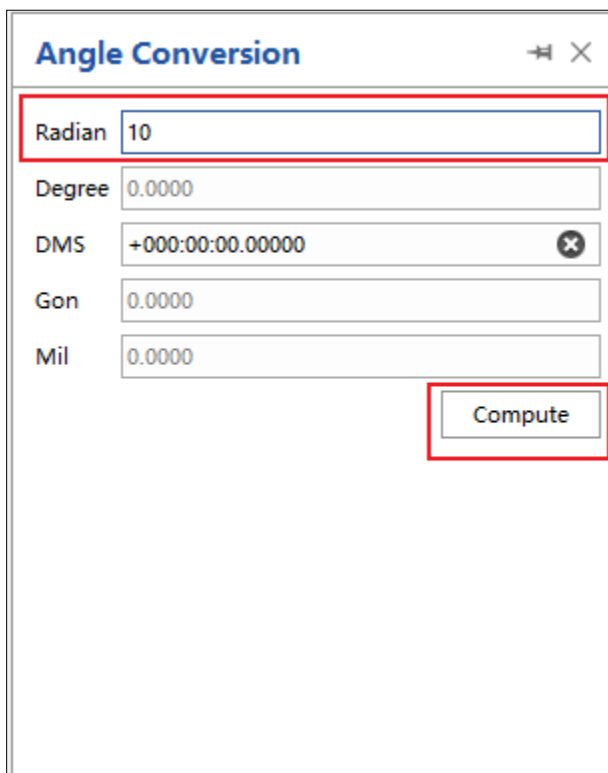


Figure 11-2-1 Angle Conversion

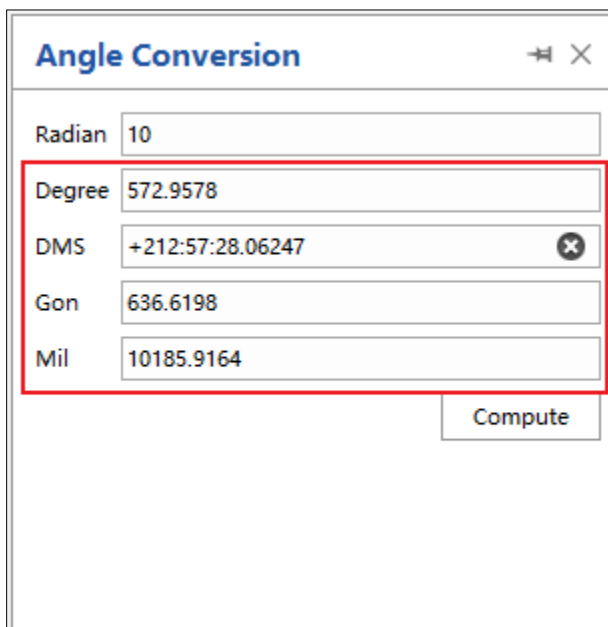
Support angle conversion between radians, degrees, degrees minutes and seconds, gauges and mils. Enter one of the data and click 'Compute' to calculate the remaining four angles.



The dialog box titled "Angle Conversion" contains five input fields and a "Compute" button. The "Radian" field is highlighted with a red box and contains the value "10". The other fields are "Degree" (0.0000), "DMS" (+000:00:00.00000), "Gon" (0.0000), and "Mil" (0.0000). The "Compute" button is also highlighted with a red box.

Unit	Value
Radian	10
Degree	0.0000
DMS	+000:00:00.00000
Gon	0.0000
Mil	0.0000

Figure 11-2-2 Angle Conversion



The dialog box titled "Angle Conversion" shows the same input fields as Figure 11-2-2, but now all fields are populated with calculated values. A red box highlights the "Degree", "DMS", "Gon", and "Mil" fields. The "Radian" field remains "10". The "Compute" button is still present.

Unit	Value
Radian	10
Degree	572.9578
DMS	+212:57:28.06247
Gon	636.6198
Mil	10185.9164

Figure 11-2-3 Angle Conversion

11.3 Distance Conversion

Click 'Tools' – 'Distance Conversion' to pop up the Distance Conversion column panel.

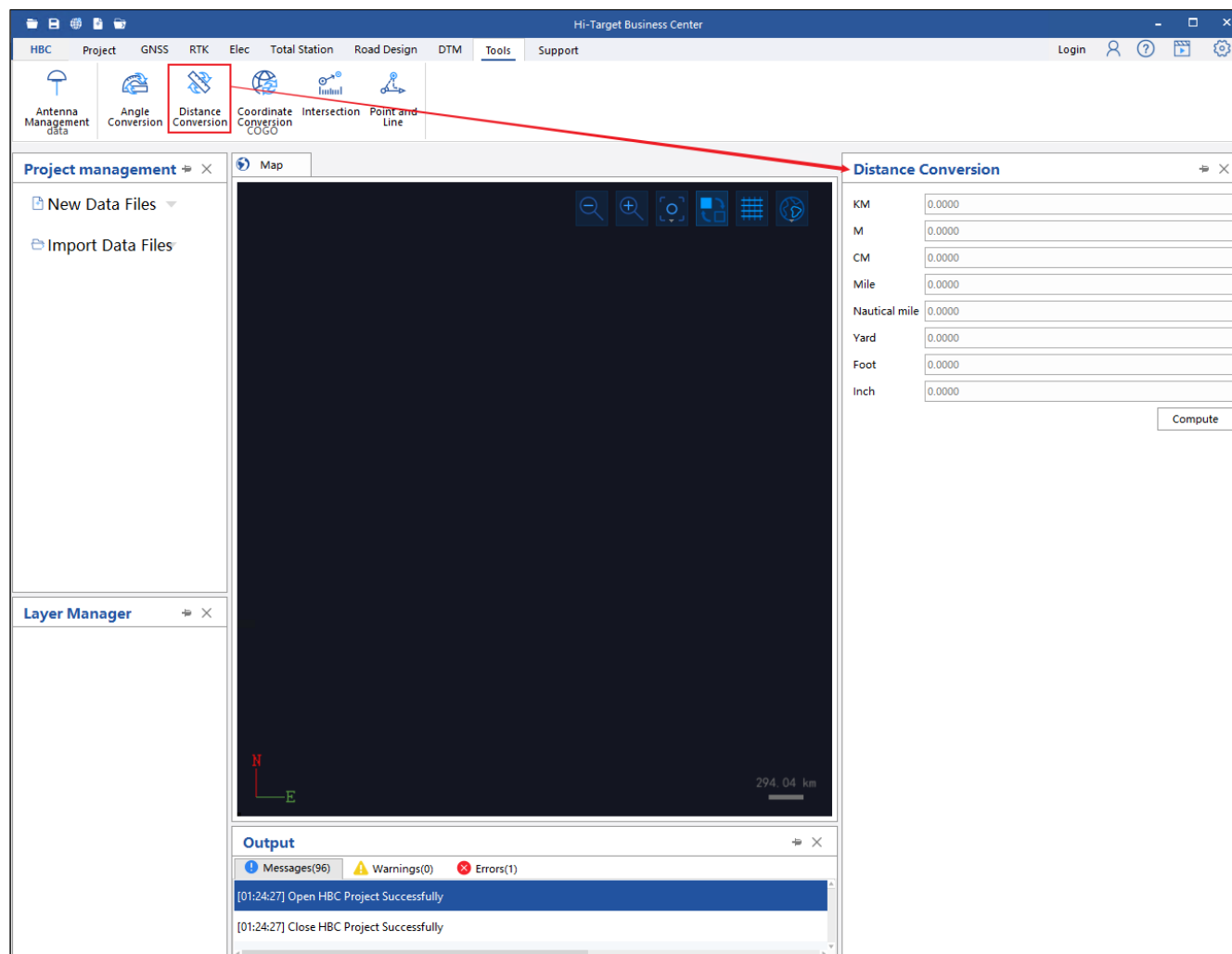
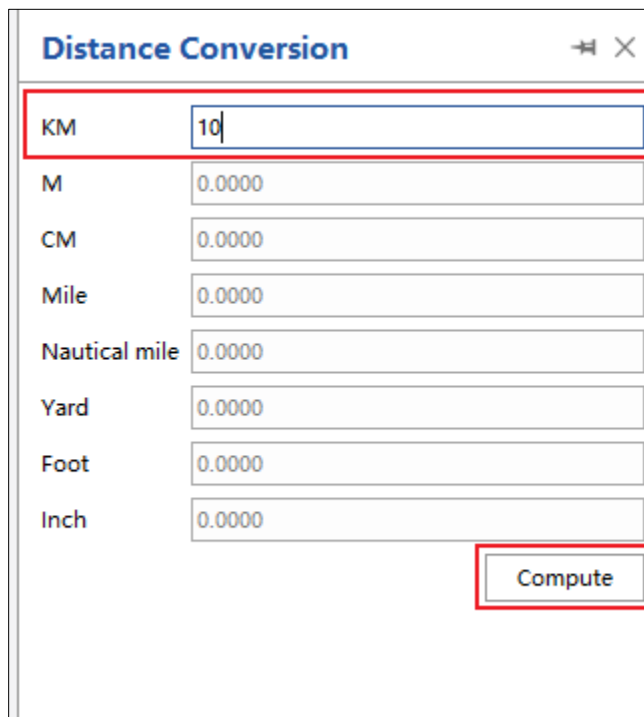


Figure 11-3-1 Distance Conversion

Support distance conversion between kilometers, meters, centimeters, miles, nautical miles, yards, feet and inches. Enter one of the data and click 'Compute' to calculate the remaining seven distances.

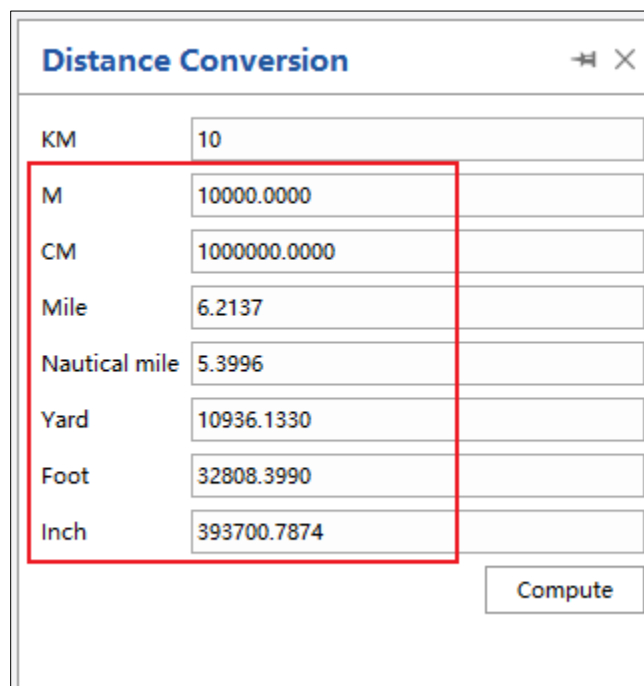


Distance Conversion

KM	10
M	0.0000
CM	0.0000
Mile	0.0000
Nautical mile	0.0000
Yard	0.0000
Foot	0.0000
Inch	0.0000

Compute

Figure 11-3-2 Distance Conversion



Distance Conversion

KM	10
M	10000.0000
CM	1000000.0000
Mile	6.2137
Nautical mile	5.3996
Yard	10936.1330
Foot	32808.3990
Inch	393700.7874

Compute

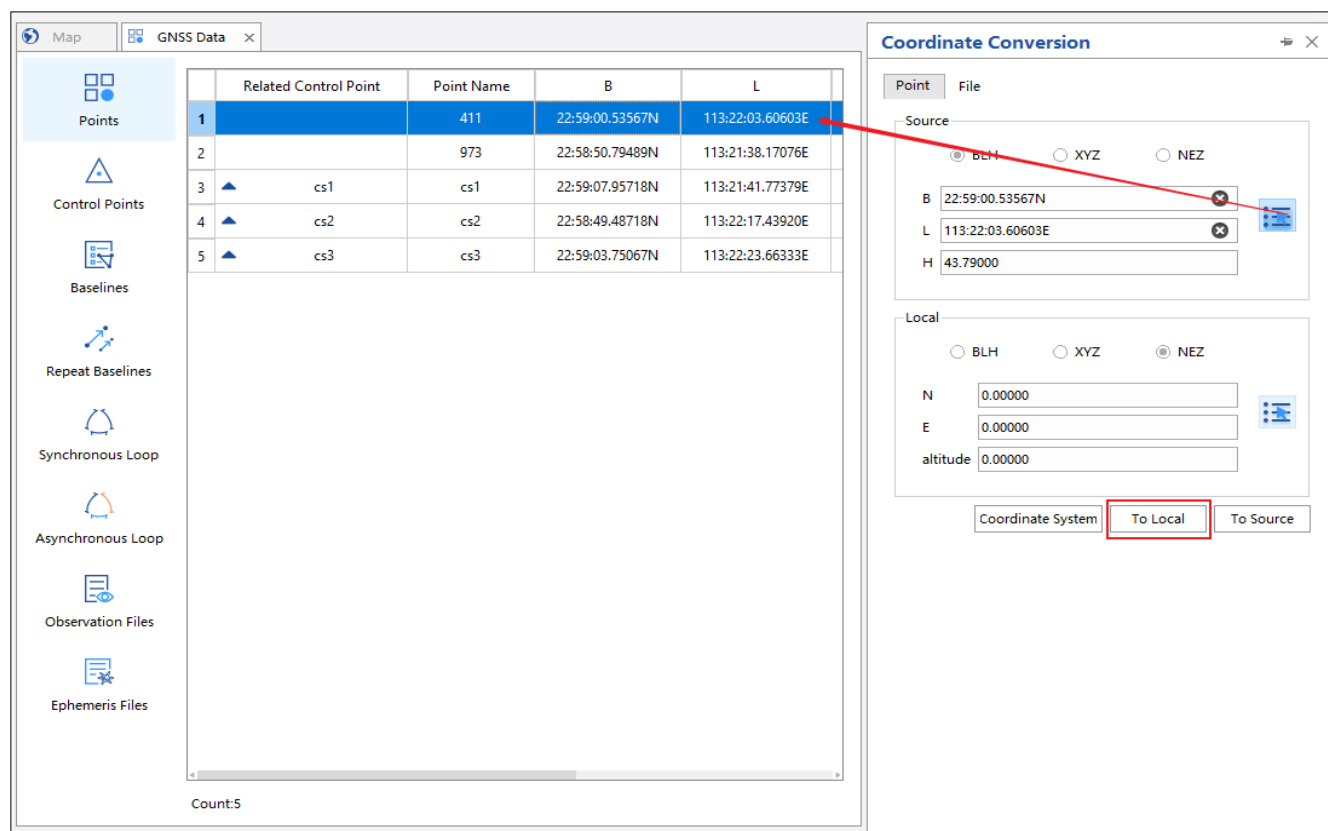
Figure 11-3-3 Distance Conversion

11.4 Coordinate Conversion

It supports the conversion between longitude, latitude and ellipsoid height (BLH), spatial rectangular coordinate (XYZ), plane coordinate and leveling elevation (NEZ).

11.4.1 Single Point Coordinate Conversion

The coordinate data can be input manually, or the data can be input by selecting points from the list. Input the coordinate data in the source ellipsoid, and click 'To Local' to calculate the coordinate data of the target ellipsoid.

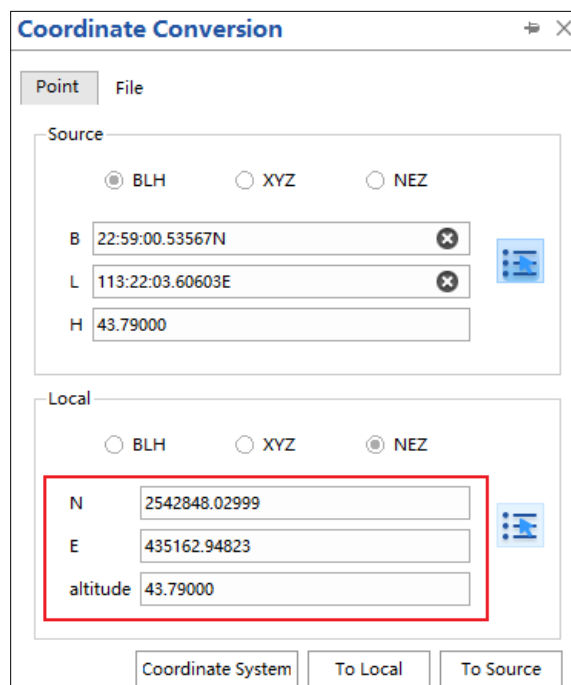


The screenshot displays the Hi-Target Business Center software interface. On the left, a sidebar contains icons for Map, GNSS Data, Points, Control Points, Baselines, Repeat Baselines, Synchronous Loop, Asynchronous Loop, Observation Files, and Ephemeris Files. The main window shows a table with the following data:

	Related Control Point	Point Name	B	L
1		411	22:59:00.53567N	113:22:03.60603E
2		973	22:58:50.79489N	113:21:38.17076E
3	▲	cs1	22:59:07.95718N	113:21:41.77379E
4	▲	cs2	22:58:49.48718N	113:22:17.43920E
5	▲	cs3	22:59:03.75067N	113:22:23.66333E

Below the table, it indicates 'Count:5'. On the right, the 'Coordinate Conversion' dialog box is open. It has two tabs: 'Point' and 'File'. The 'Point' tab is active, showing 'Source' and 'Local' sections. The 'Source' section has radio buttons for BLH, XYZ, and NEZ, with BLH selected. Below are input fields for B (22:59:00.53567N), L (113:22:03.60603E), and H (43.79000). The 'Local' section has radio buttons for BLH, XYZ, and NEZ, with NEZ selected. Below are input fields for N (0.00000), E (0.00000), and altitude (0.00000). At the bottom, there are three buttons: 'Coordinate System', 'To Local' (highlighted with a red box), and 'To Source'. A red arrow points from the 'To Local' button in the dialog box to the coordinate data in the table.

Figure 11-4-1 Input the Coordinate Data



Coordinate Conversion

Point File

Source

☒ BLH ☐ XYZ ☐ NEZ

B 22:59:00.53567N

L 113:22:03.60603E

H 43.79000

Local

☐ BLH ☐ XYZ ☒ NEZ

N 2542848.02999

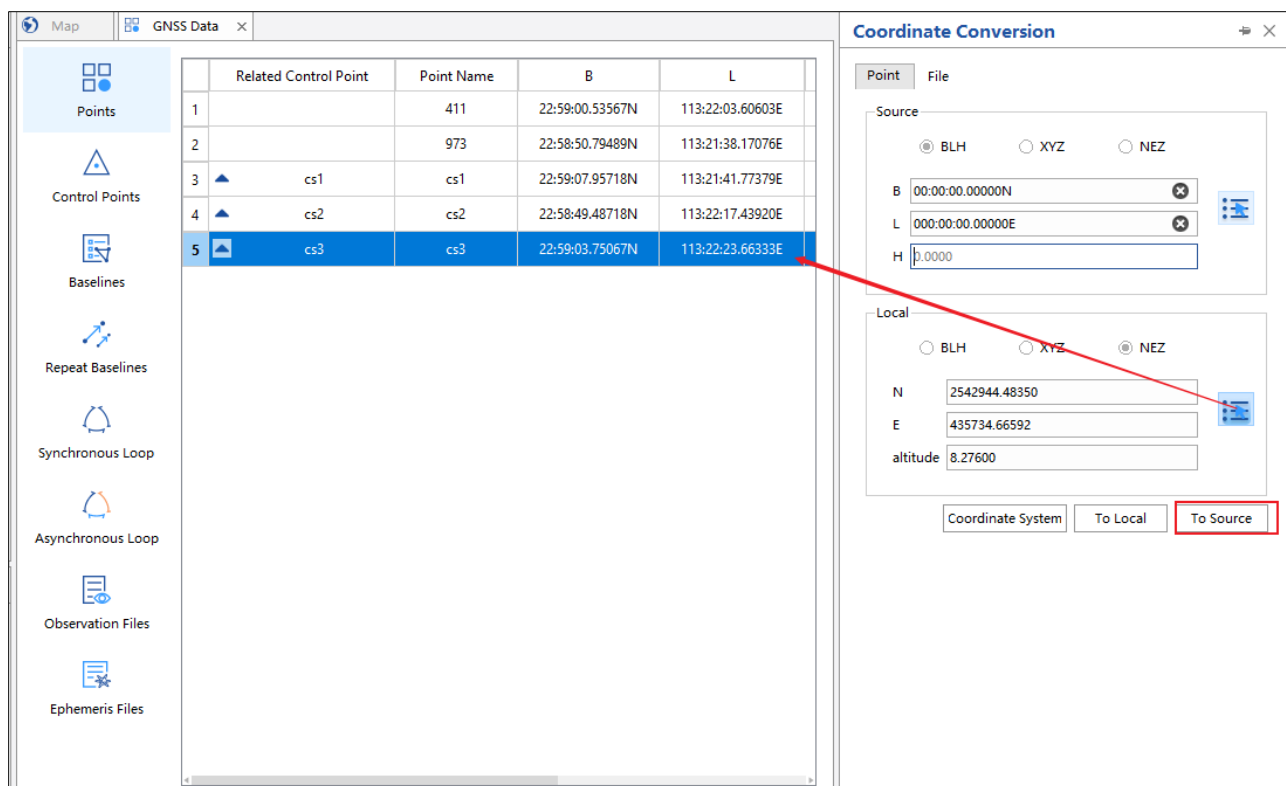
E 435162.94823

altitude 43.79000

Coordinate System To Local To Source

Figure 11-4-2 to Local

Input the coordinate data in the source ellipsoid, and click 'To Source' to calculate the coordinate data of the target ellipsoid.



Map GNSS Data

Points

Control Points

Baselines

Repeat Baselines

Synchronous Loop

Asynchronous Loop

Observation Files

Ephemeris Files

	Related Control Point	Point Name	B	L
1		411	22:59:00.53567N	113:22:03.60603E
2		973	22:58:50.79489N	113:21:38.17076E
3	▲	cs1	22:59:07.95718N	113:21:41.77379E
4	▲	cs2	22:58:49.48718N	113:22:17.43920E
5	▲	cs3	22:59:03.75067N	113:22:23.66333E

Coordinate Conversion

Point File

Source

☒ BLH ☐ XYZ ☐ NEZ

B 00:00:00.00000N

L 000:00:00.00000E

H 0.0000

Local

☐ BLH ☐ XYZ ☒ NEZ

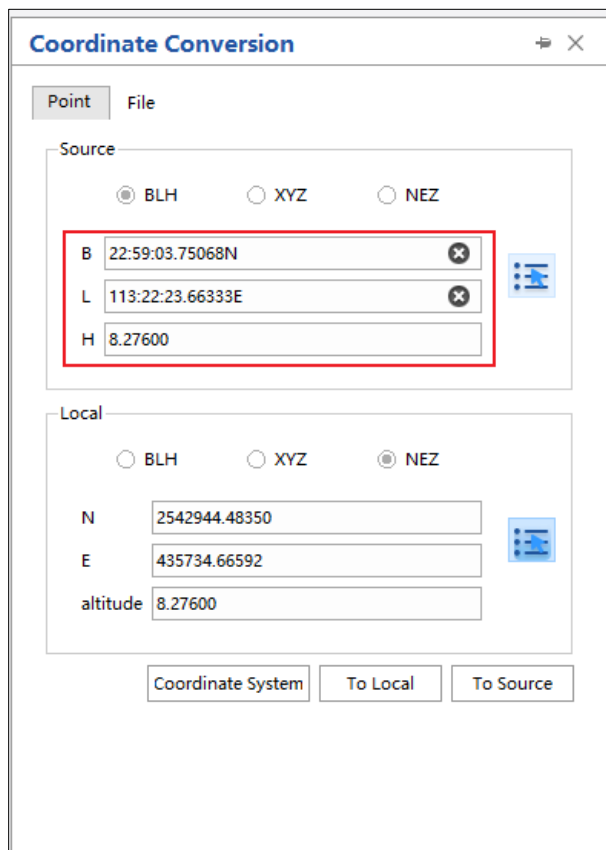
N 2542944.48350

E 435734.66592

altitude 8.27600

Coordinate System To Local To Source

Figure 11-4-3 Input the Coordinate Data



Coordinate Conversion

Point File

Source

☒ BLH ☐ XYZ ☐ NEZ

B 22:59:03.75068N

L 113:22:23.66333E

H 8.27600

Local

☐ BLH ☐ XYZ ☒ NEZ

N 2542944.48350

E 435734.66592

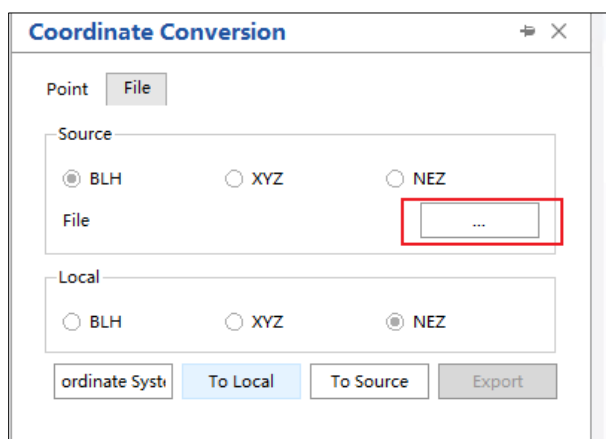
altitude 8.27600

Coordinate System To Local To Source

Figure 11-4-4 to Source

11.4.2 File Conversion

In the coordinates to be converted, select the coordinate type, then click '...', the file selector will pop up, select the corresponding file, and set the custom format settings. After the file is successfully imported, "ok" will be displayed on the right side of the "file" with the converted coordinates.



Coordinate Conversion

Point File

Source

☒ BLH ☐ XYZ ☐ NEZ

File ...

Local

☐ BLH ☐ XYZ ☒ NEZ

Coordinate System To Local To Source Export

Figure 11-4-5 Click '...'

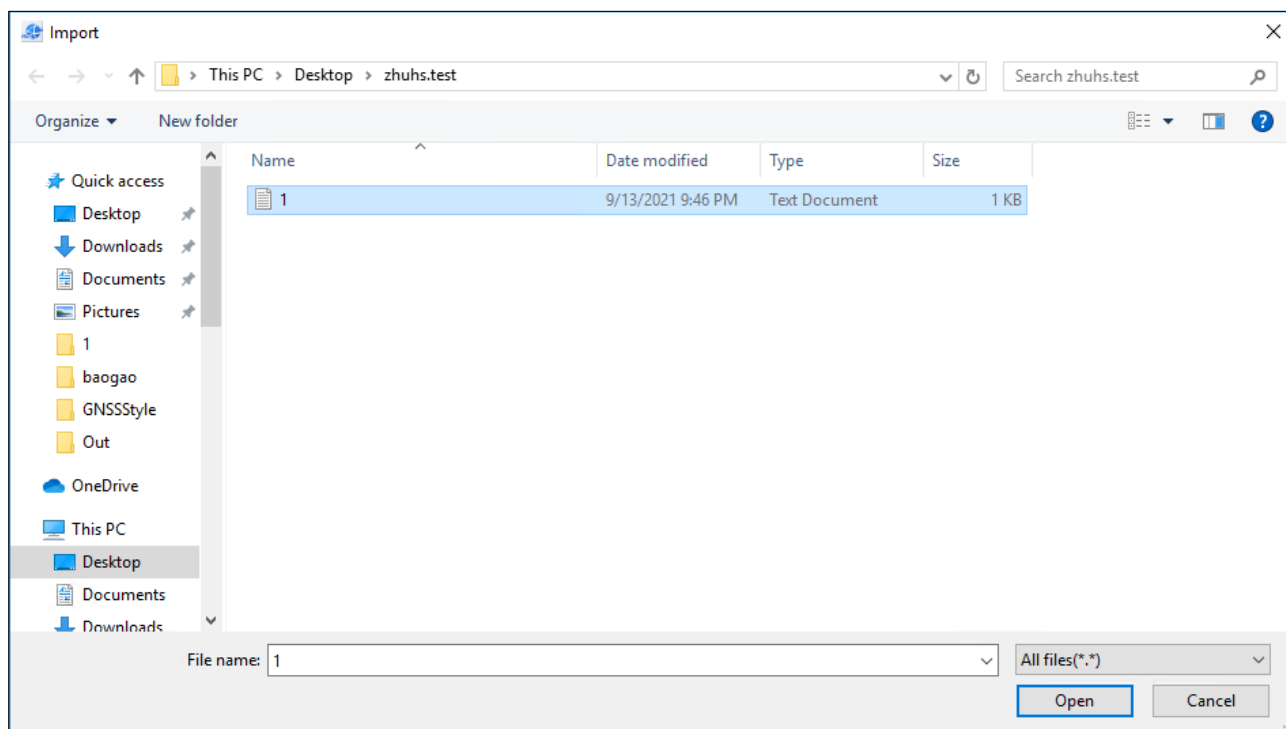


Figure 11-4-6 Select the Corresponding File

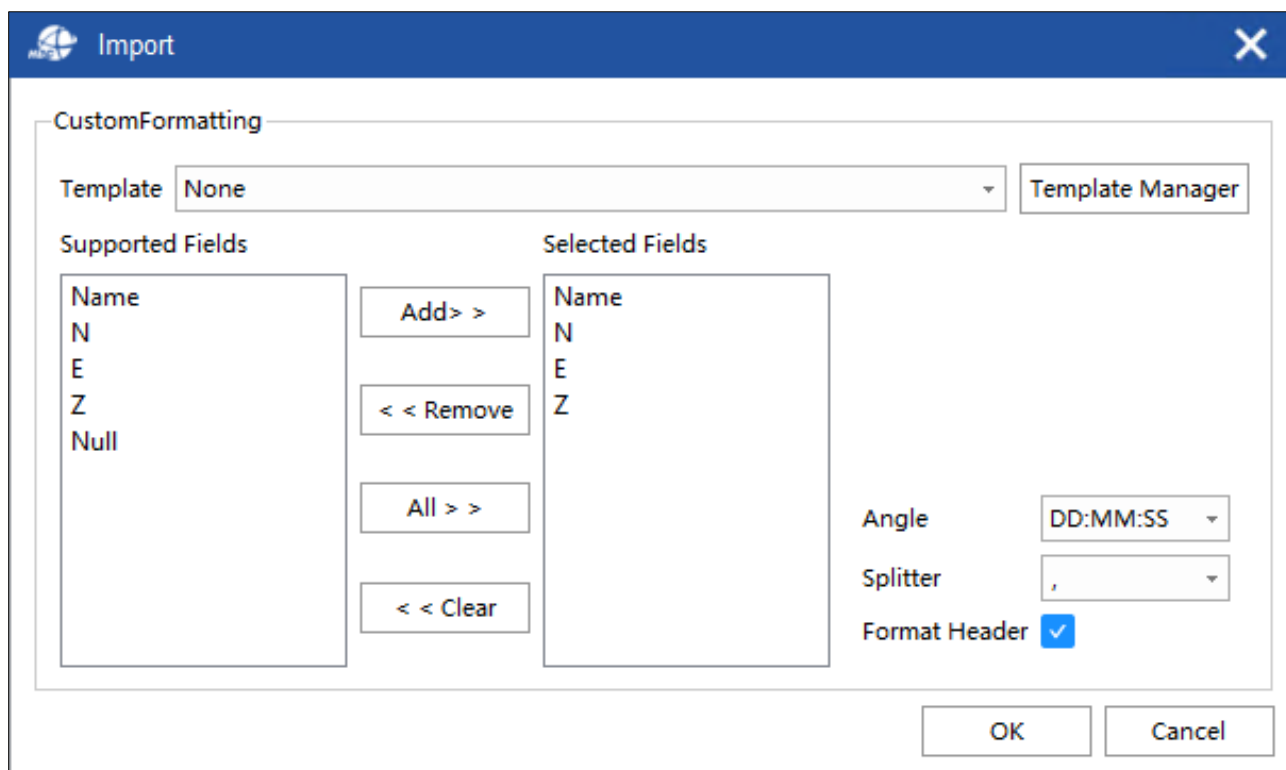


Figure 11-4-7 Set the Custom Format Settings

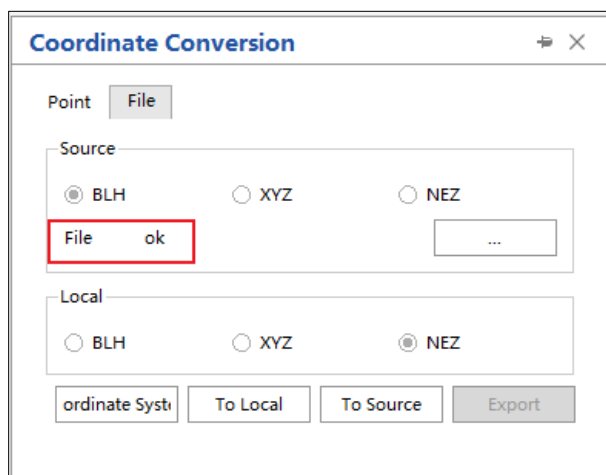


Figure 11-4-8 the File Is Successfully Imported

Click 'To Local/To Source', and the converted coordinate data will be displayed in the conversion result, click 'Export', set the corresponding export format settings as required, and click 'OK' to export the coordinate file after the converted coordinates.

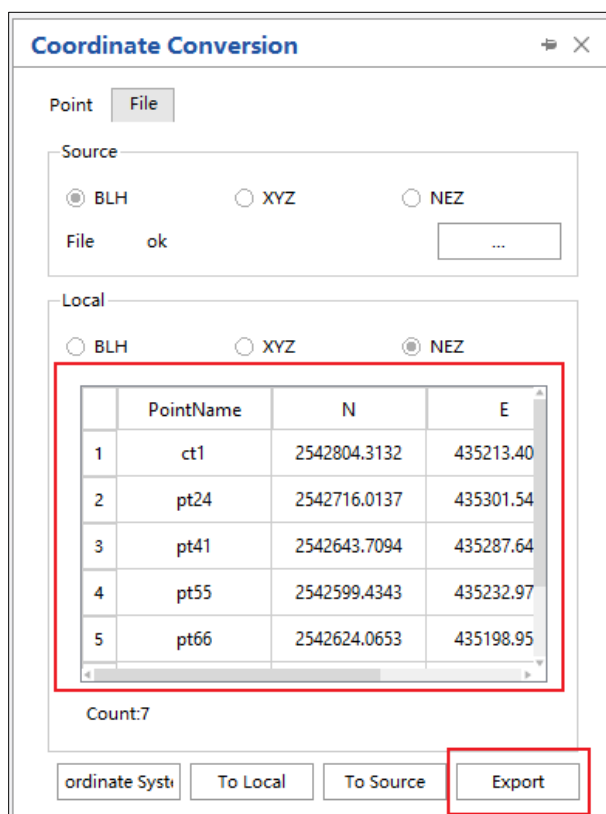


Figure 11-4-9 the Converted Coordinate Data

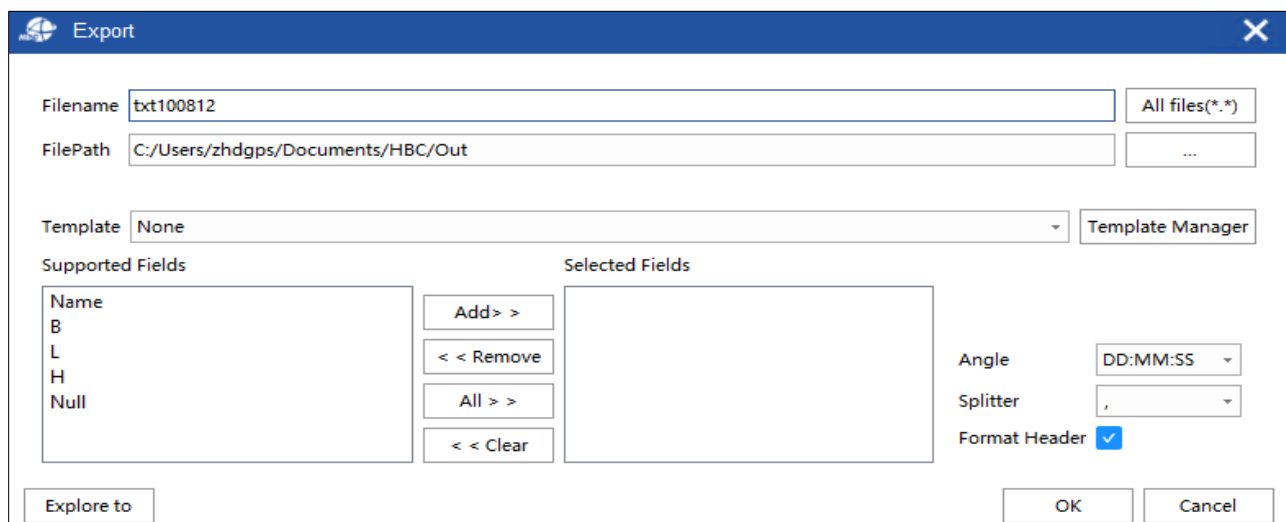


Figure 11-4-10 Export

11.5 Intersection

Click 'Tools' – 'Intersection' to pop up the Intersection column panel.

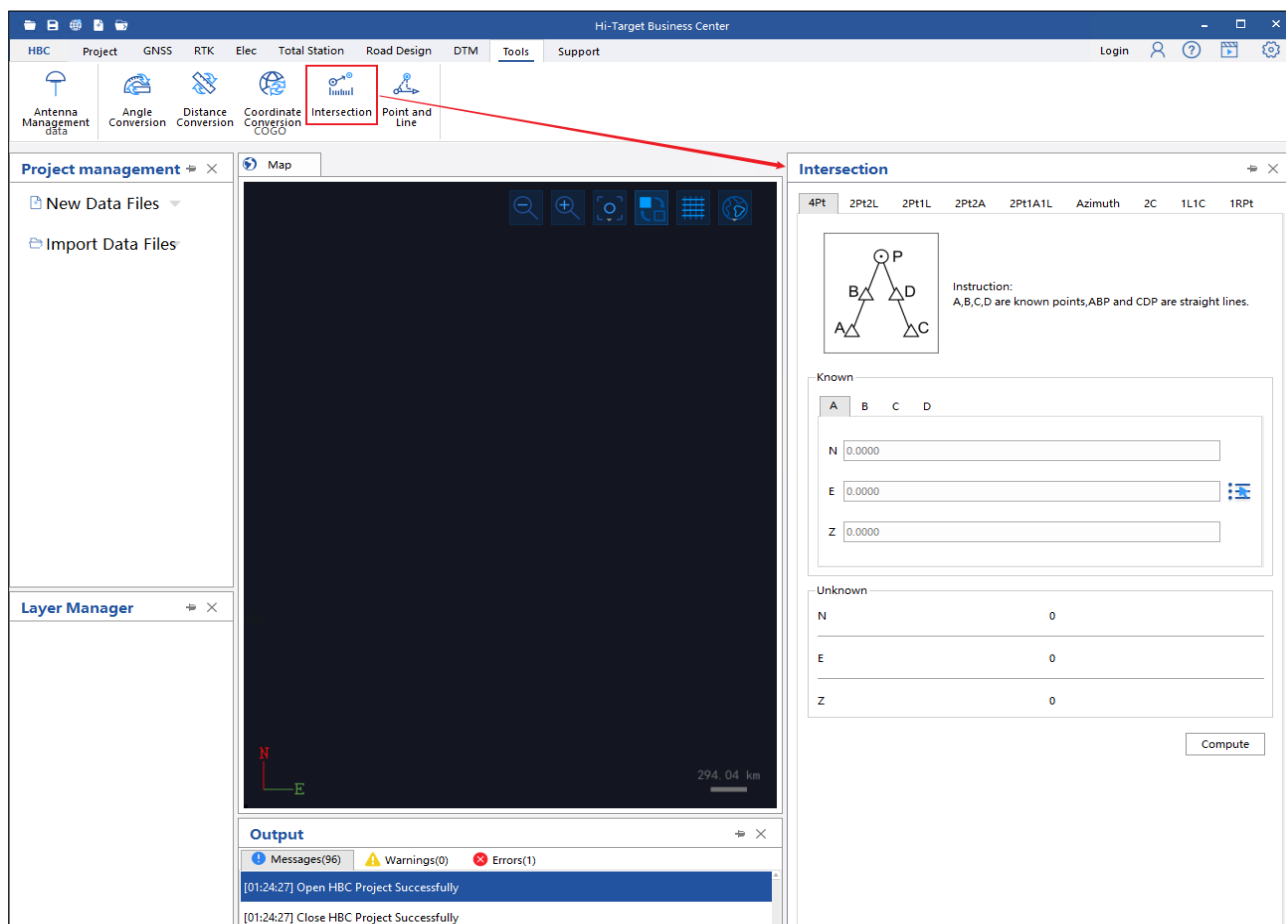
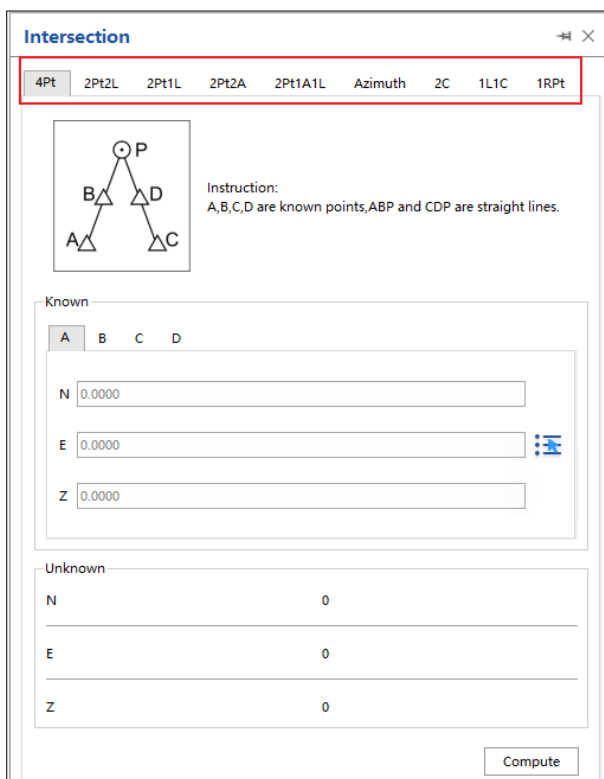


Figure 11-5-1 Intersection

Support four points known, two points and two lines, two points and one line, two points and two angles, two points and line angles, eccentric points, two circles intersecting, line and circle intersecting, and circular arc taking point measurement.



Intersection

4Pt 2Pt2L 2Pt1L 2Pt2A 2Pt1A1L Azimuth 2C 1L1C 1RPt

Instruction:
A,B,C,D are known points,ABP and CDP are straight lines.

Known

A	B	C	D
N	0.0000		
E	0.0000		
Z	0.0000		

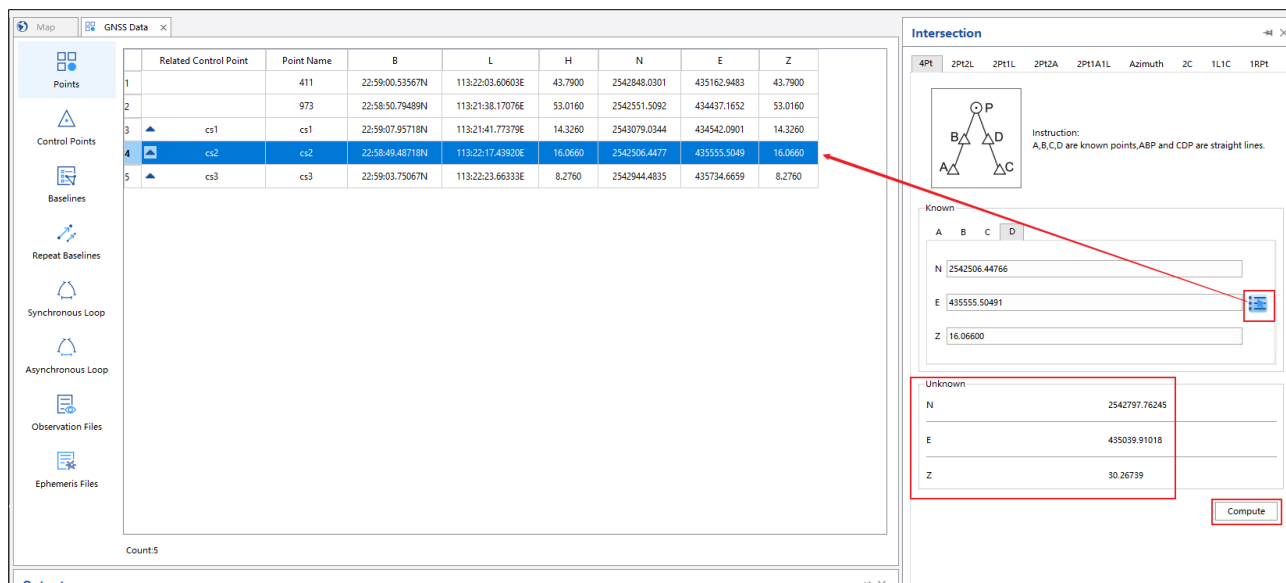
Unknown

N	0
E	0
Z	0

Compute

Figure 11-5-2 Intersection

Enter the corresponding coordinate data in the known points, you can enter the data manually or select points from the list, and then click Calculate to calculate the NEZ coordinates of the point to be found.



Related Control Point	Point Name	B	L	H	N	E	Z
1	411	22:59:00.53567N	113:22:03.60603E	43.7900	2542848.0301	435162.9483	43.7900
2	973	22:58:50.79489N	113:21:38.17076E	53.0160	2542551.5092	434437.1652	53.0160
3	cs1	22:59:07.95718N	113:21:41.77379E	14.3260	2543079.0344	434542.0901	14.3260
4	cs2	22:58:49.48718N	113:22:17.43920E	16.0660	2542506.4477	435555.5049	16.0660
5	cs3	22:59:03.75067N	113:22:23.66333E	8.2760	2542944.4835	435734.6659	8.2760

Intersection

4Pt 2Pt2L 2Pt1L 2Pt2A 2Pt1A1L Azimuth 2C 1L1C 1RPt

Instruction:
A,B,C,D are known points,ABP and CDP are straight lines.

Known

A	B	C	D
N	2542506.44766		
E	435555.50491		
Z	16.06600		

Unknown

N	2542797.76245
E	435039.91018
Z	30.26739

Compute

Figure 11-5-3 Calculate the NEZ Coordinates

11.6 Point and Line

Click 'Tools' – 'Point and Line' to pop up the Point and Line column panel.

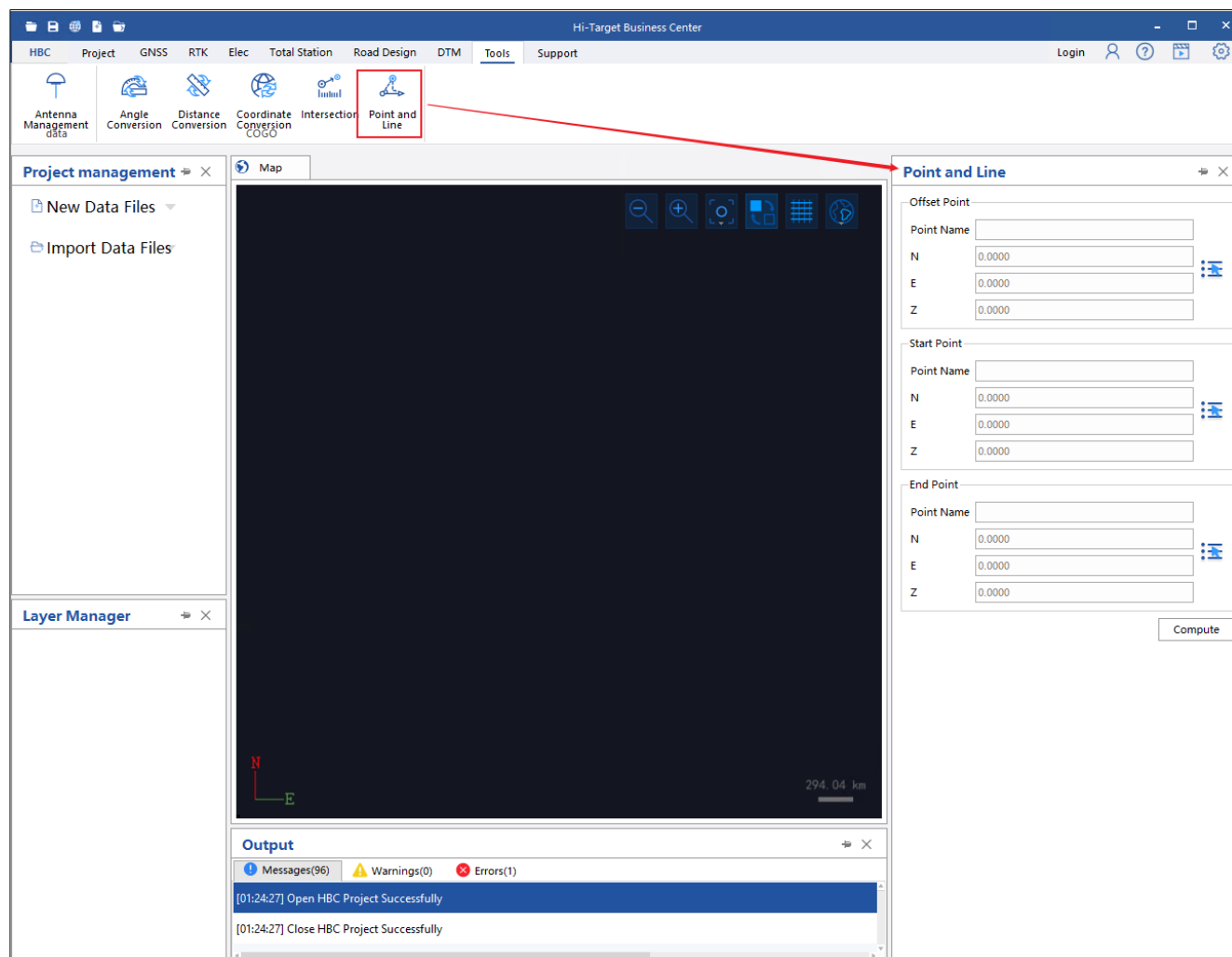
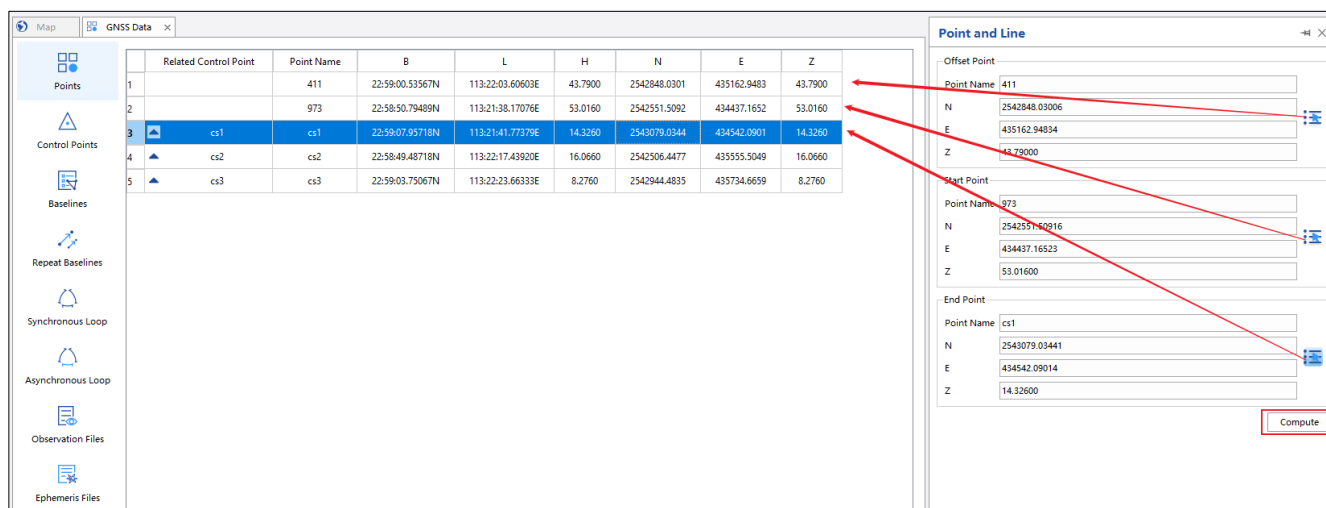


Figure 11-6-1 the Point and Line Column Panel

Input the coordinates of the selected point, line start point, and line end point manually or through the list of selected points; then click 'Compute' to display the calculation result in the area below the column panel.



The screenshot shows the 'GNSS Data' tab with a table of control points. The 'Point and Line' dialog box is open, showing the 'Offset Point', 'Start Point', and 'End Point' sections. Red arrows indicate the data flow from the table to the dialog fields.

	Related Control Point	Point Name	B	L	H	N	E	Z
1		411	22:59:00.53567N	113:22:03.60603E	43.7900	2542848.0301	435162.9483	43.7900
2		973	22:58:50.79489N	113:21:38.17076E	53.0160	2542551.5092	434437.1652	53.0160
3	cs1	cs1	22:59:07.95718N	113:21:41.77379E	14.3260	2543079.0344	434542.0901	14.3260
4	cs2	cs2	22:58:49.48718N	113:22:17.43920E	16.0660	2542506.4477	435555.5049	16.0660
5	cs3	cs3	22:59:03.75067N	113:22:23.66333E	8.2760	2542944.4835	435734.6659	8.2760

Point and Line

Offset Point

Point Name: 411

N: 2542848.03006

E: 435162.94834

Z: 43.79000

Start Point

Point Name: 973

N: 2542551.50916

E: 434437.16523

Z: 53.01600

End Point

Point Name: cs1

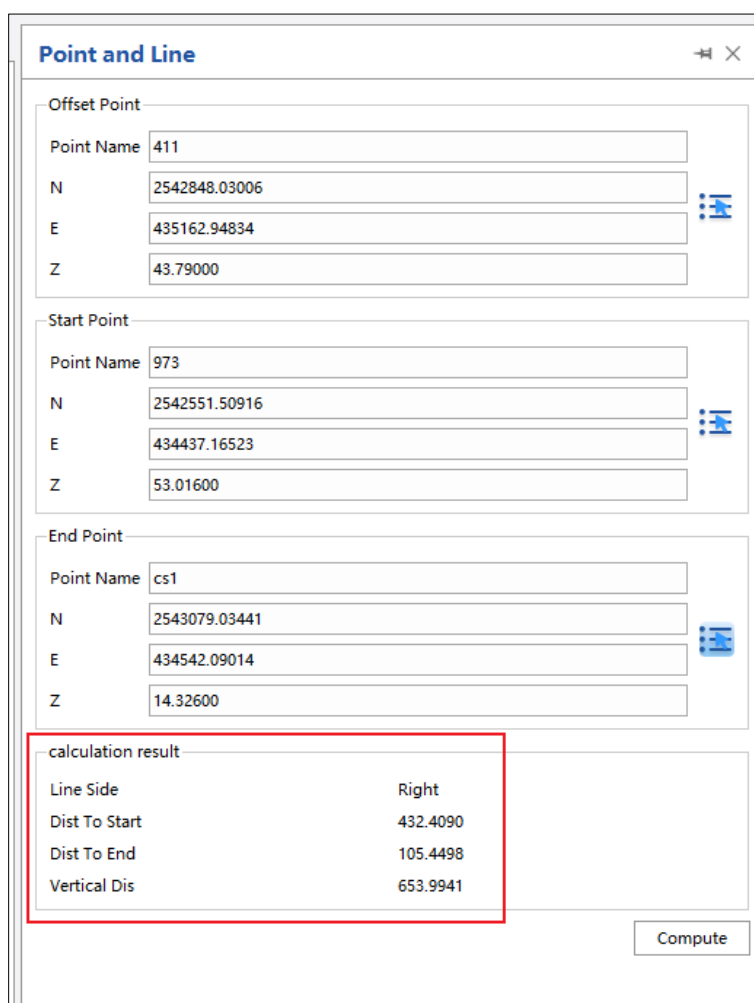
N: 2543079.03441

E: 434542.09014

Z: 14.32600

Compute

Figure 11-6-2 Compute



The screenshot shows the 'Point and Line' dialog box with the 'Calculation Result' section highlighted. The 'Compute' button is visible at the bottom right.

Point and Line

Offset Point

Point Name: 411

N: 2542848.03006

E: 435162.94834

Z: 43.79000

Start Point

Point Name: 973

N: 2542551.50916

E: 434437.16523

Z: 53.01600

End Point

Point Name: cs1

N: 2543079.03441

E: 434542.09014

Z: 14.32600

Calculation Result

Line Side	Right
Dist To Start	432.4090
Dist To End	105.4498
Vertical Dis	653.9941

Compute

Figure 11-6-3 the Calculation Result

Chapter 12

Support

This chapter contains:

- Register
- Model Info
- Help
- Video
- About
- Check Update

12.1 Register

12.1.1 Open the Software Registration Interface

The software registration interface will pop up automatically when the advanced modules 'GNSS PPK Solve' and 'Single BeiDou Solve' are not registered, or click 'Register' under 'Support' after opening the software, the software registration interface is as follows.



Figure 12-1-1 Register

The software will automatically generate a serial number based on the computer configuration information, enter the registration code or license file obtained from this serial number.

If you do not use the advanced 'GNSS PPK Solve' and 'Single BeiDou Solve' modules, you can enter the software directly by clicking the 'Cancel' button.

12.1.2 Click 'Register' to Complete the Advanced Module Registration

Note: New users will have a one-month trial period by default after the installation of the software, during which users can use the functions of the advanced modules.

12.2 Model Info

Click 'Support' – 'Model Info' to pop up the module information window. Display the license status and expiration date of each module of the basic module; display the license status and expiration date of the 'GNSS PPK Solve' and 'Single BeiDou Solve' modules of the advanced module.

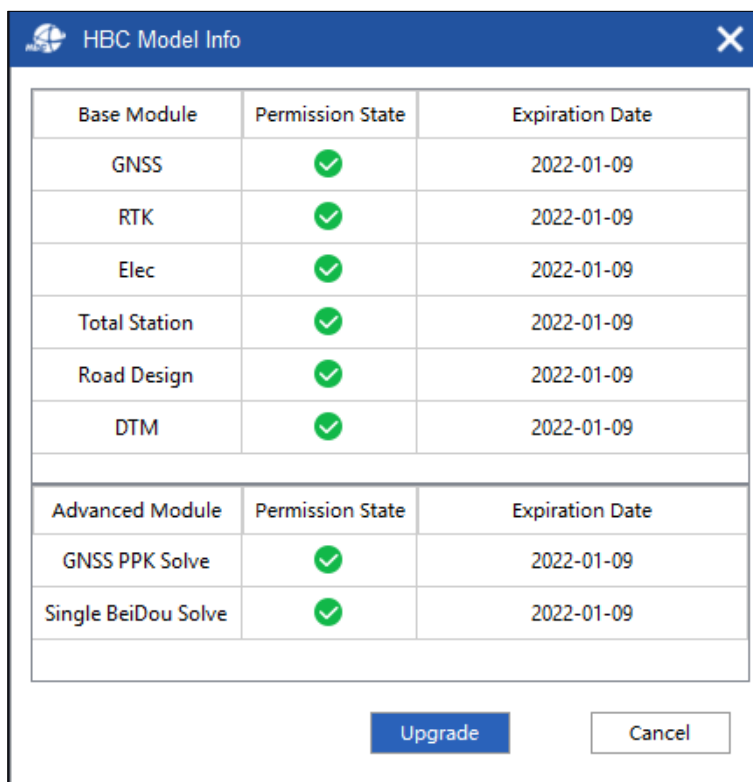


Figure 12-2-1 HBC Model Info

Click 'Upgrade', a registration window will pop up, after completing the registration, the module information will be refreshed automatically.

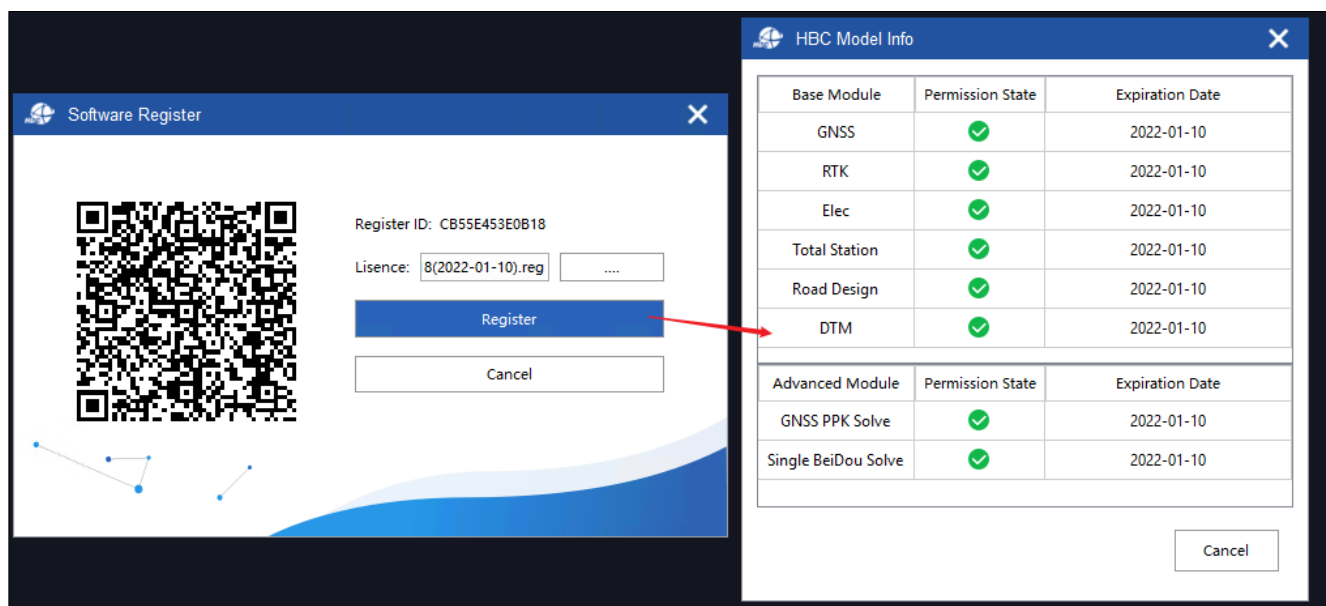


Figure 12-2-2 the Module Information

12.3 Help

Click 'Support'-'Help' or the 'Help' button in the upper right corner to pop up the help document.

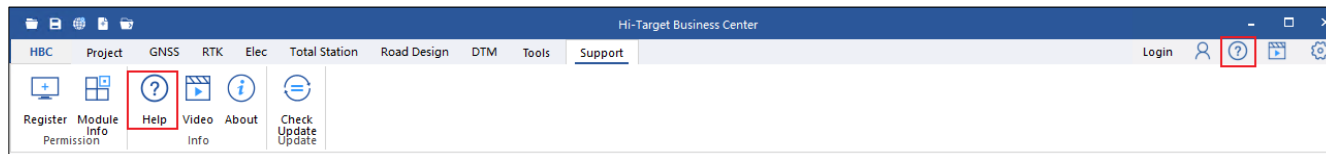


Figure 12-3-1 Help

12.4 Video

Watch the Operation Video Online

Click 'Support' – 'Video', or click the shortcut button in the upper right corner of the software to enter the video interface.

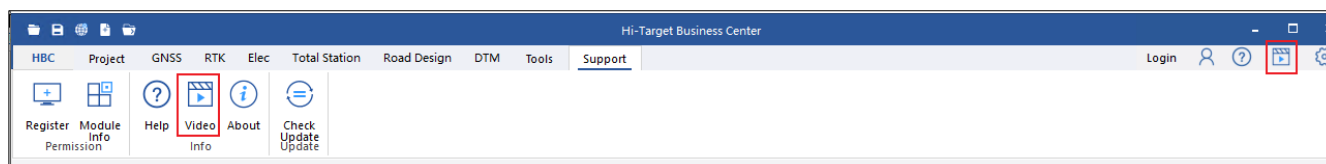


Figure 12-4-1 Enter the Video Interface

You can also directly enter the operation video page through the link:

https://www.youtube.com/watch?v=m2AfdpgXdXs&list=PLu7JRIOyik0oVri_bIYasY-5a-LzjmJzX

Select the corresponding modules and videos to watch and learn according to your needs.

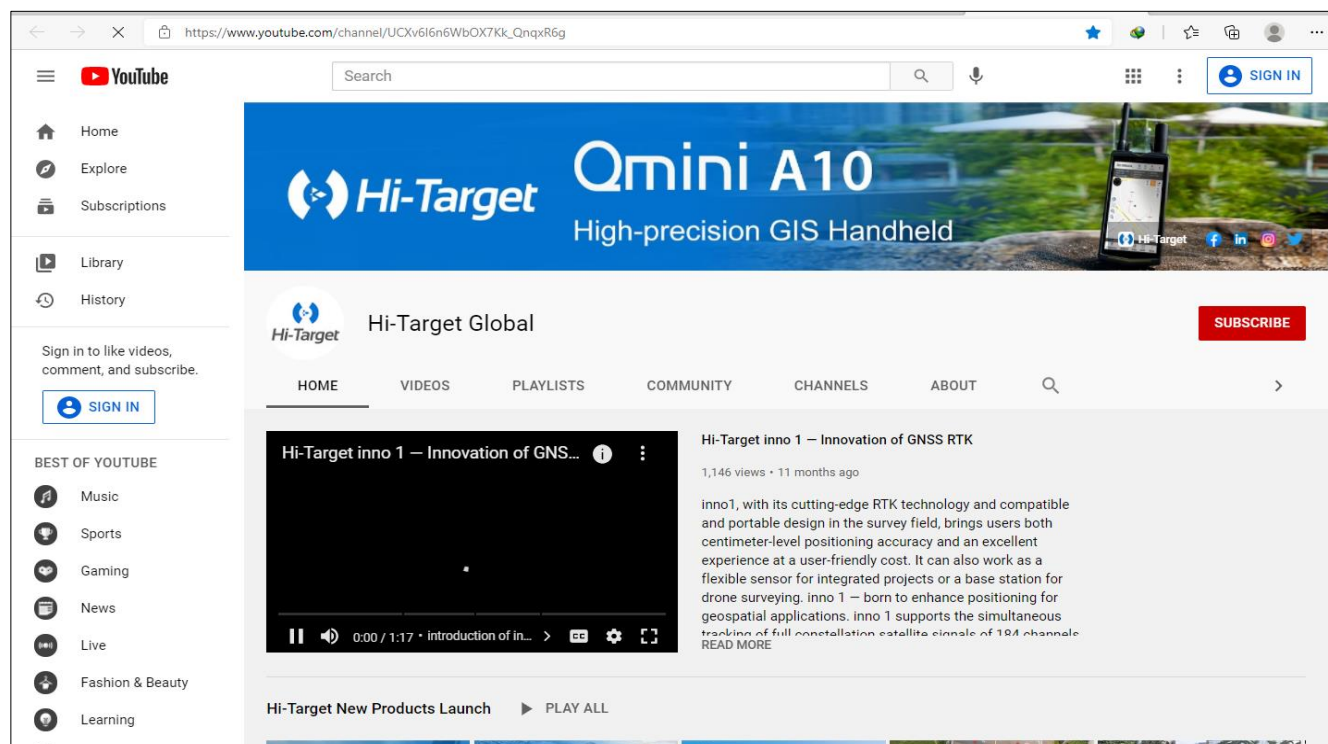


Figure 12-4-2 YouTube Video Address

12.5 About

Click 'Support' – 'About', the About window will pop up, and you can view the current version and the version update time.



Figure 12-5-1 About

12.6 Check Update

Click 'Support' – 'Check Update', the Check for Updates window will pop up, check "When the software starts, you are prompted for an update", click 'OK', then when the new version is updated, it will automatically prompt whether to update.

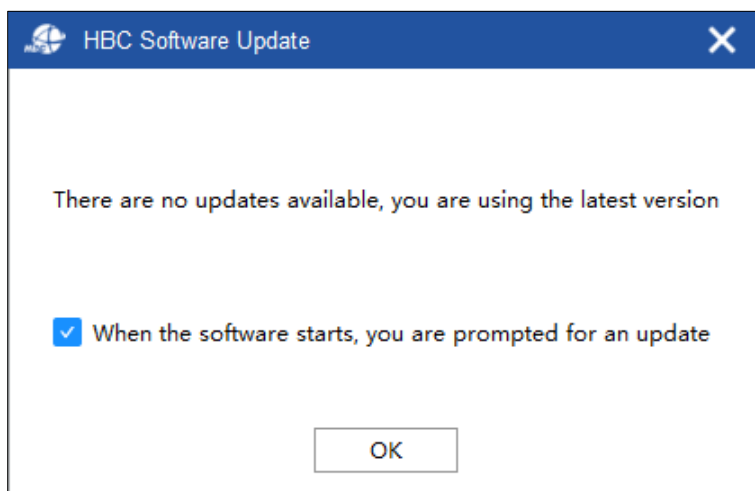


Figure 12-6-1 Check Update

Chapter 13

Other

This chapter contains:

- Layer Management
- Online Map
- File Editor Tool
- Online Update
- Software Setting

13.1 Layer Management

The layer management interface is located in the lower left corner of the left menu bar.

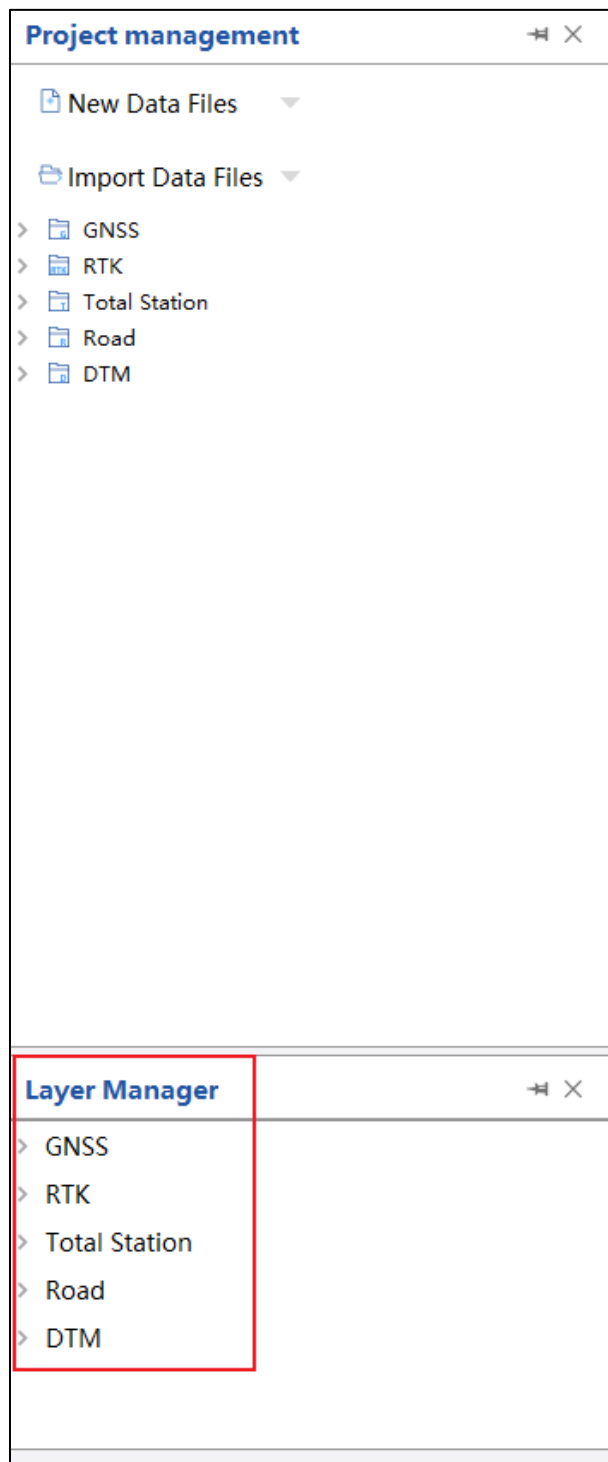


Figure 13-1-1 Layer Management

13.1.1 Layer Composition

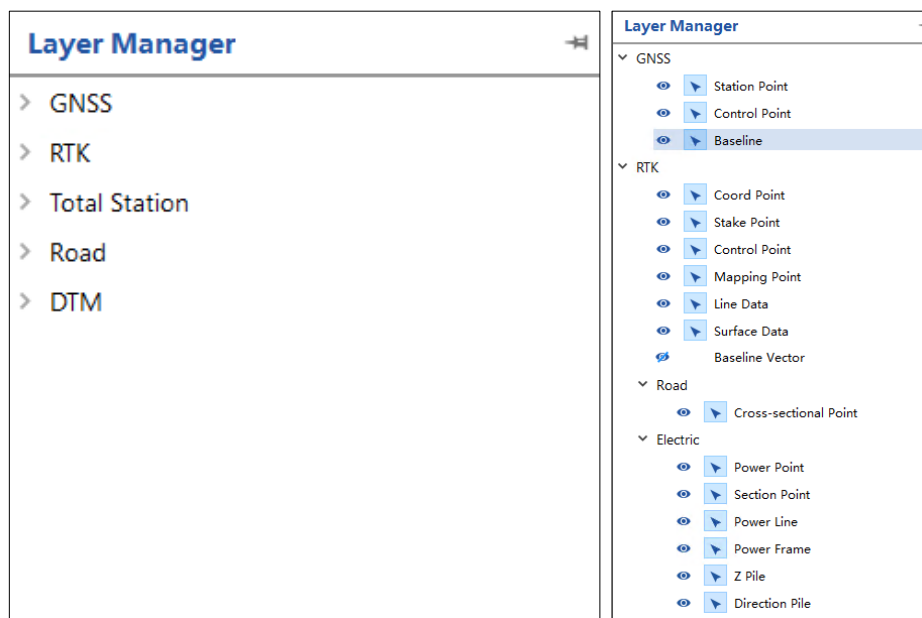


Figure 13-1-2 Layer Composition

Note: Except for route auxiliary points, structures, and road side stakes layers, the other layers (including GNSS, RTK, total station, road, DTM, and drawing modules) can be right-clicked [Optional], edit the layer; the layer can control whether to display, "move up", "move down" to adjust the priority of the layer, and "zoom to this layer" to quickly locate the layer.

13.1.2 GNSS Layer Management

GNSS module includes two layers: station point and baseline

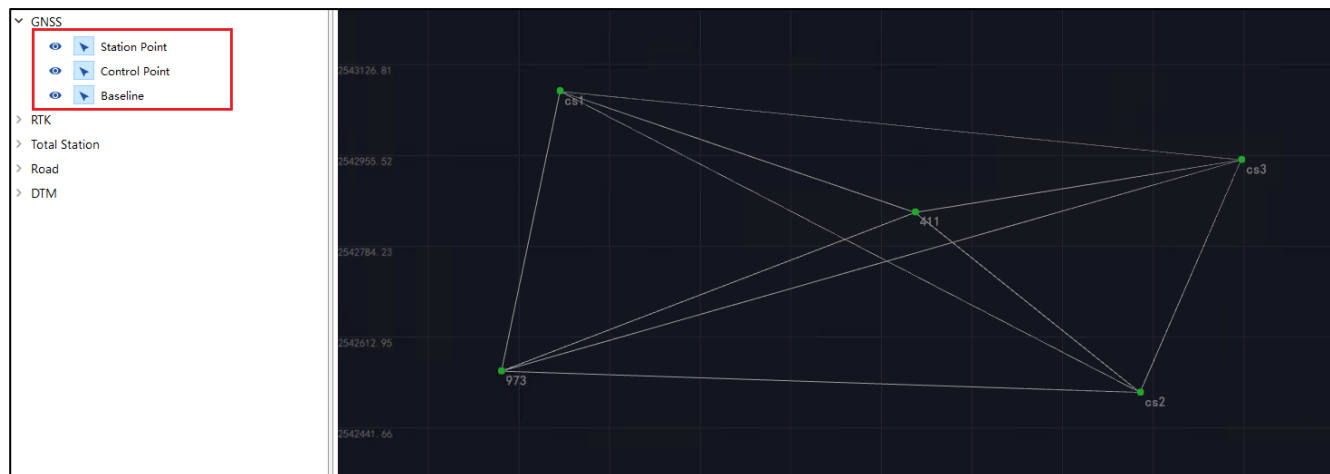


Figure 13-1-3 GNSS Layer Management

P.S. You can click the "eye" button or right-click the layer to set whether the layer is displayed; zoom to the layer to quickly locate the layer position.

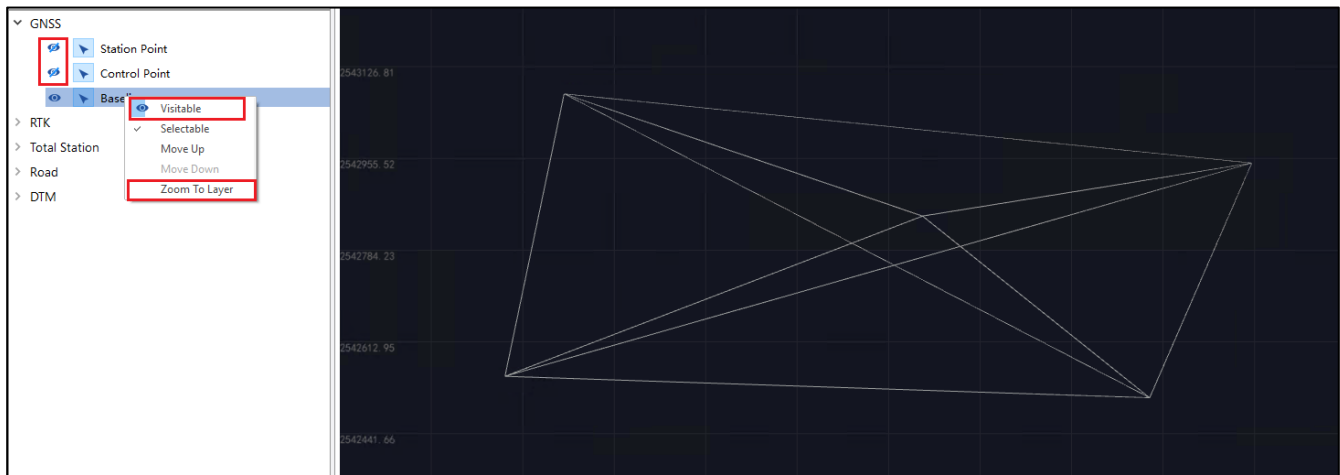


Figure 13-1-4 GNSS Layer Management

13.1.3 RTK Layer Management

RTK module includes coord points, stake points, control points, mapping points, line/surface data, base station vectors (base station vectors are closed by default); road module: cross-sectional points.

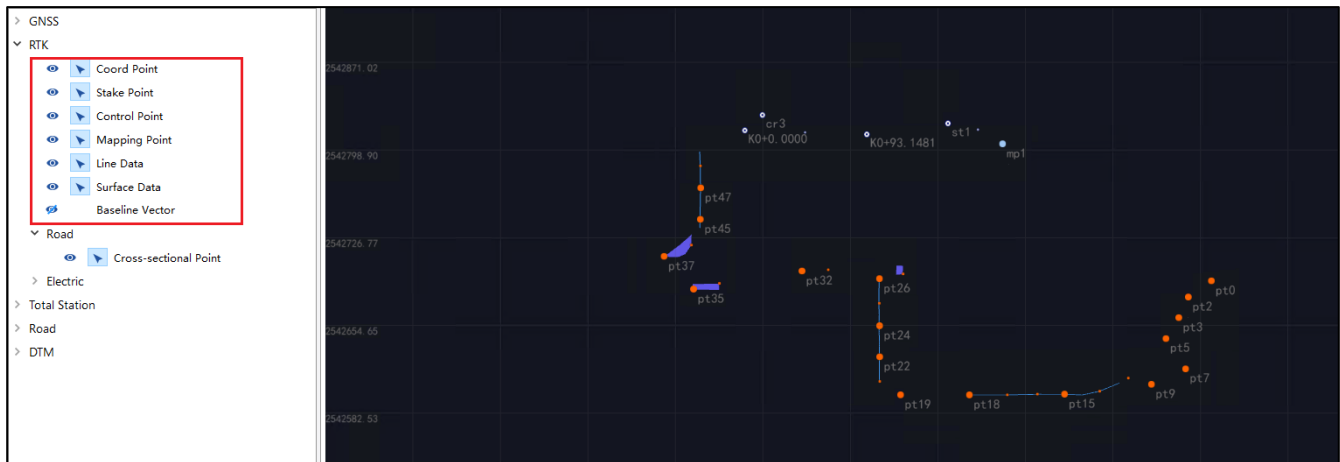


Figure 13-1-4 RTK Layer Management

You can click the "eye" button or right-click the layer to set whether the layer is displayed; zoom to the layer to quickly locate the layer position.

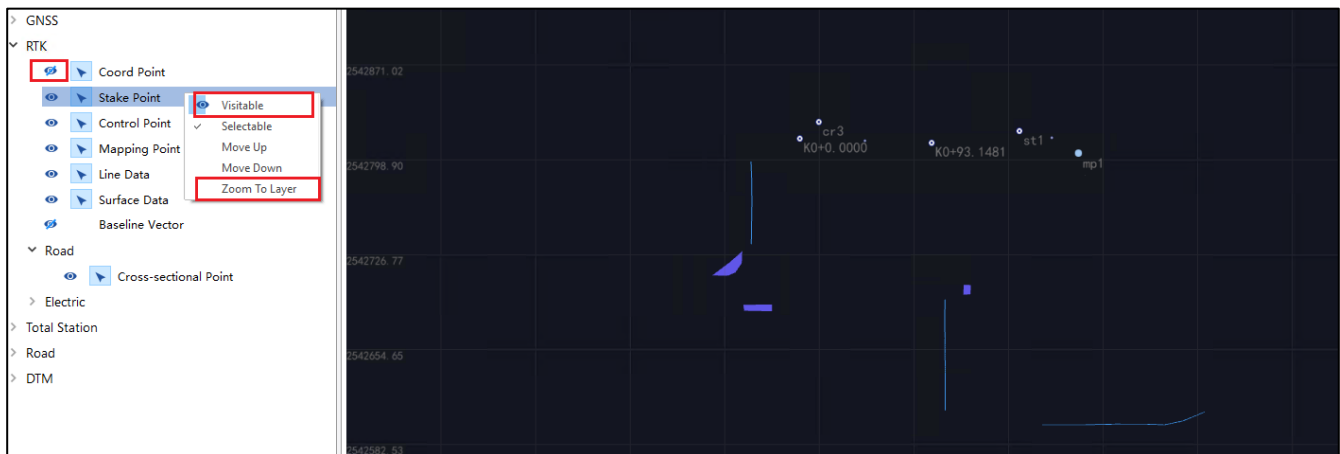


Figure 13-1-5 RTK Layer Management

13.1.4 Electricity Layer Management

Import the electric RTK project, the map can display power points, cross-section points, power lines, poles, towers, direction piles, Z piles; hide the power point display, and at the same time do not display Z piles and direction piles on the map.



Figure 13-1-6 Electricity Layer Management

13.1.5 Total Station Layer Management

The total station module includes observed points and shape lines.



Figure 13-1-7 Total Station Layer Management

※You can click the "eye" button or right-click the layer to set whether the layer is displayed; zoom to the layer to quickly locate the layer position.

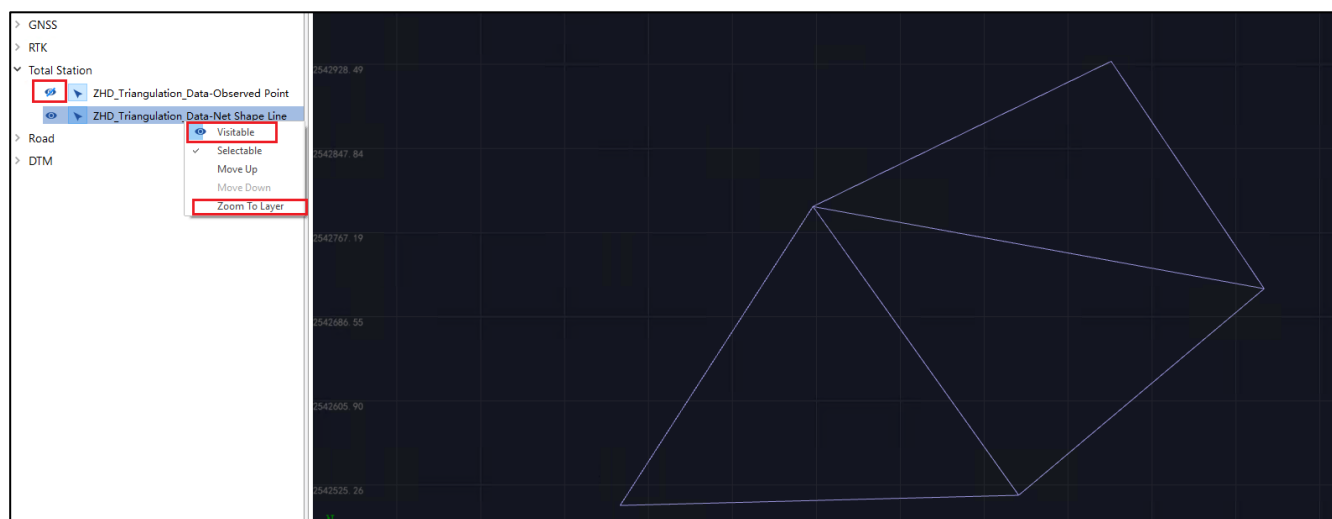


Figure 13-1-8 Total Station Layer Management

13.1.6 Road Layer Management

The road module includes road auxiliary points, construction, pile side lines, and the road as a whole.

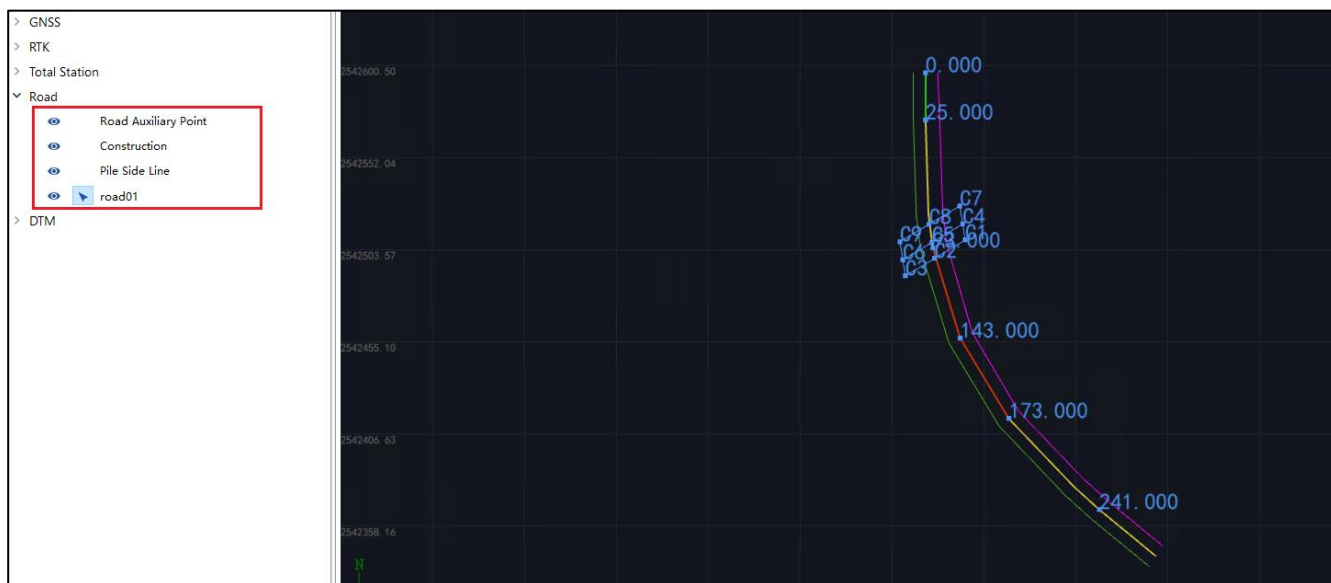


Figure 13-1-9 Road Layer Management

※You can click the "eye" button or right-click the layer to set whether the layer is displayed; zoom to the layer to quickly locate the layer position.



Figure 13-1-10 Road Layer Management

13.1.7 DTM Layer Management

DTM module includes file layers.



Figure 13-1-11 DTM Layer Management

※You can click the "eye" button or right-click the layer to set whether the layer is displayed; zoom to the layer to quickly locate the layer position.

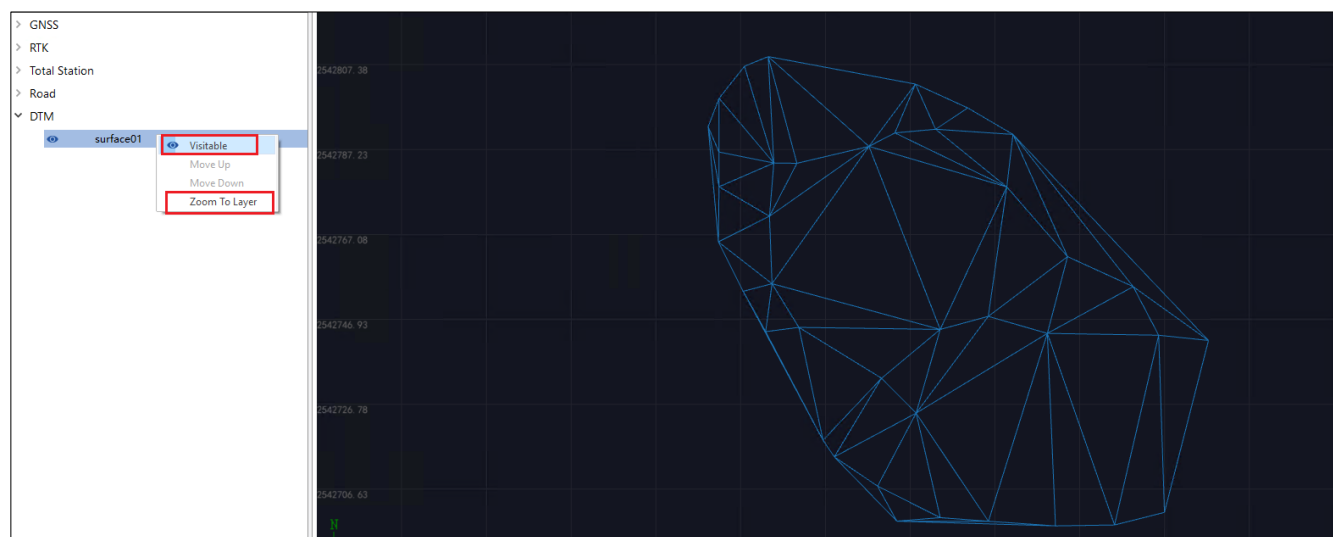


Figure 13-1-12 DTM Layer Management

13.1.8 Switch Map

1. Click the button in the upper right corner of the software window to switch the map background to black / white.

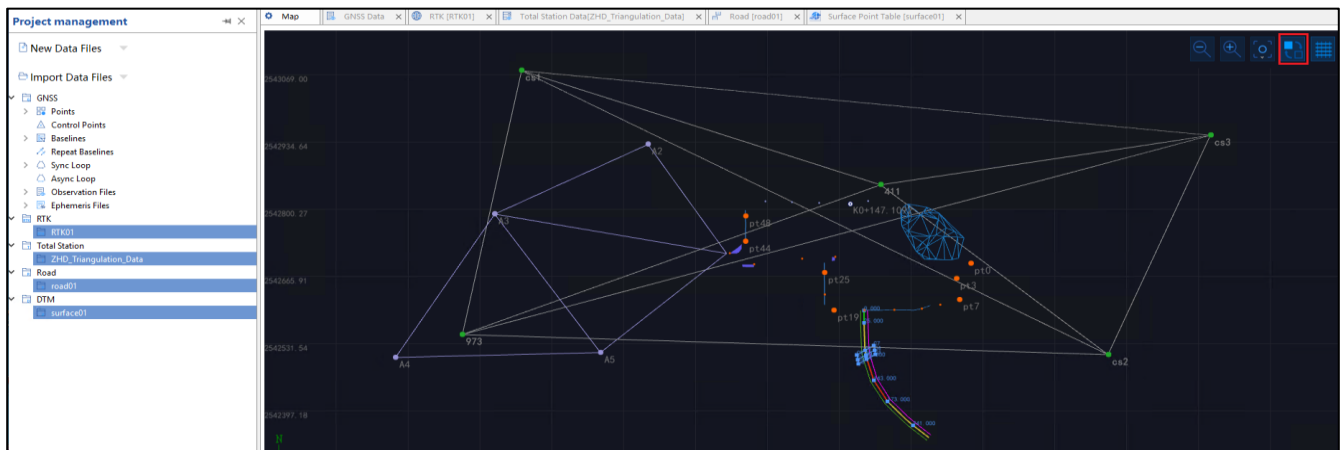


Figure 13-1-13 Switch Map

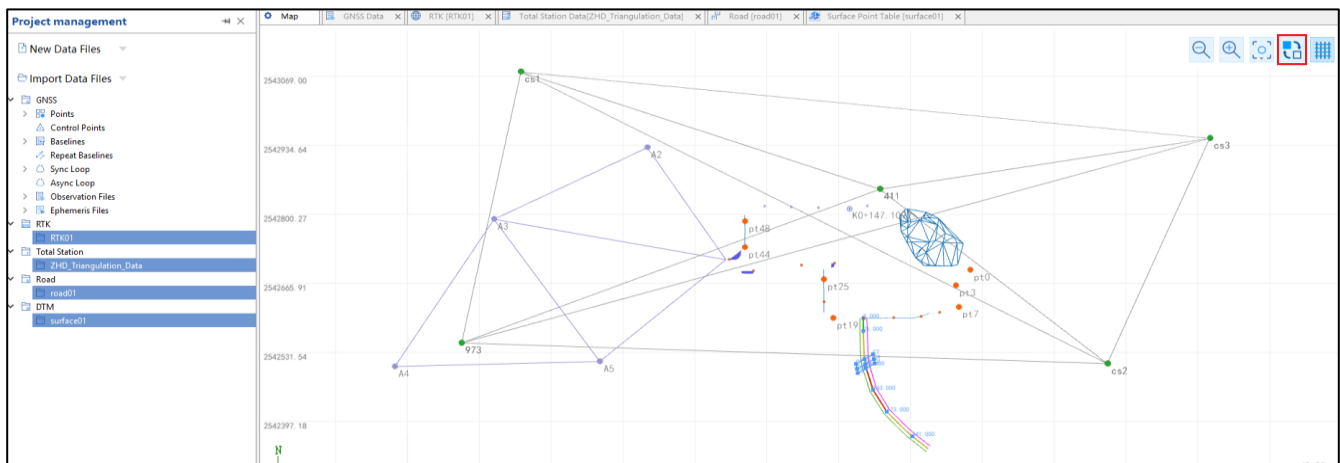


Figure 13-1-14 Switch Map

2. Click the button in the upper right corner of the software window to switch whether there is a grid in the map background.

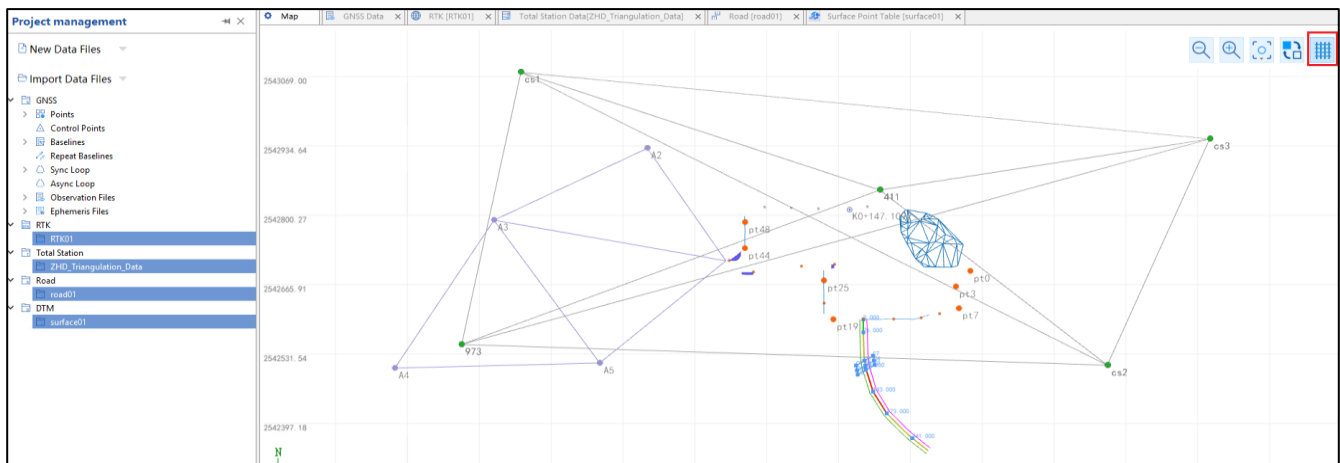


Figure 13-1-15 Switch Map

13.2 Online Map

At present, HBC supports "online map" and "online satellite map".

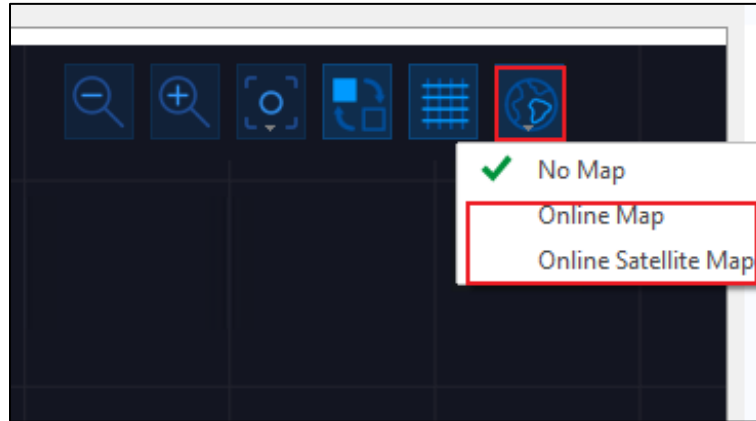


Figure 13-2-1 Switch Map

13.2.1 Online Map

Click the map button and select "online map".



Figure 13-2-2 Switch Map

You can zoom in and out to view detailed map information.

13.2.2 Online Satellite Map

Click the map button and select "online satellite map".

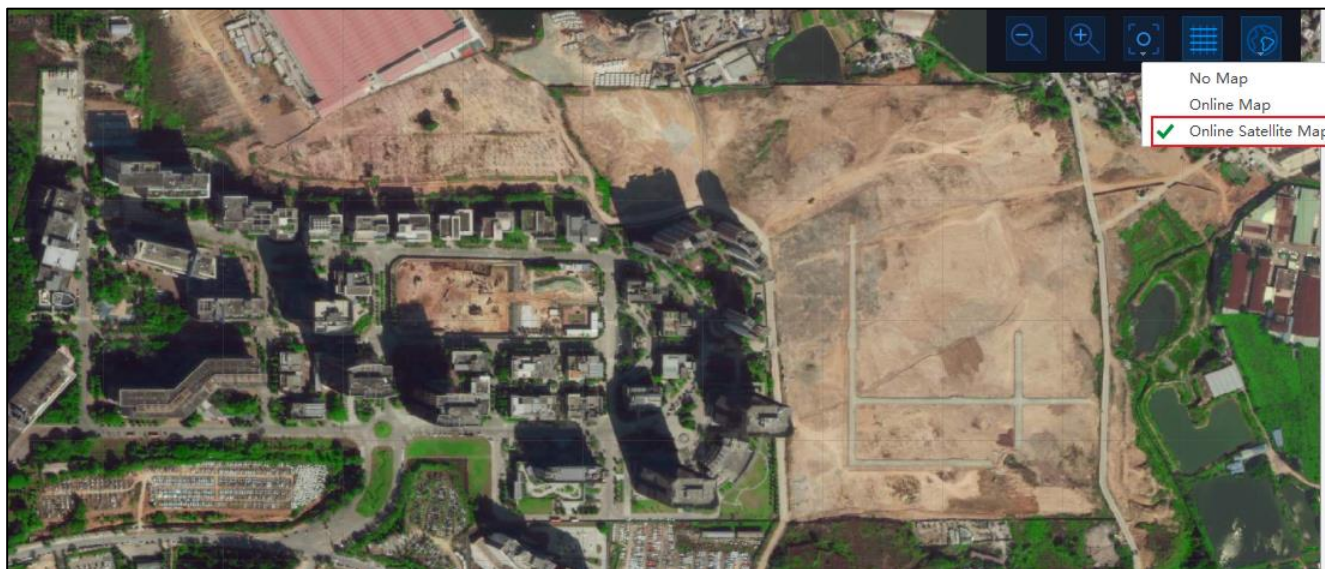


Figure 13-2-3 Switch Map

You can zoom in and out to view detailed map information.

13.3 File Editor Tool

13.3.1 Modify Site Name

Double-click the GNS observation file with the left mouse button to modify the site name of the file, up to 4 characters in length.

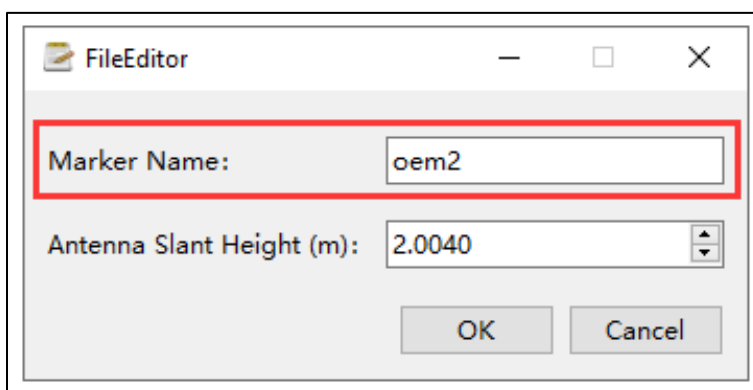


Figure 13-3-1 Modify Site Name

13.3.2 Modify Antenna Height

Double-click the GNS observation file with the left mouse button to modify the antenna height.

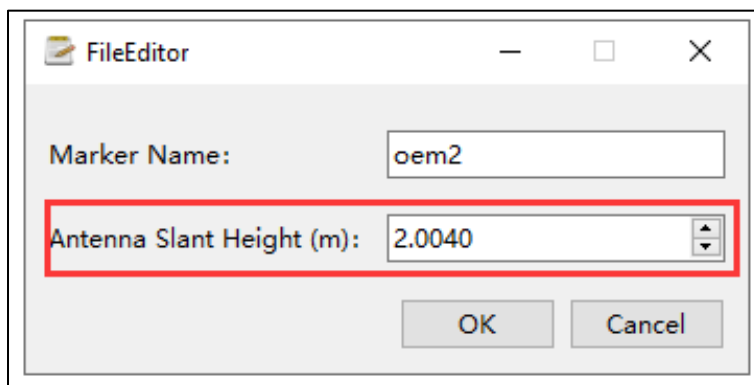


Figure 13-3-2 Modify Antenna Height

13.4 Online Update

13.4.1 Upgrade Popup

When there is a new version, open HBC, and an upgrade pop-up window will pop up, including the version upgrade content and download method.

Note: When you click [Ignore], except for manual update, this version update will no longer be displayed in the pop-up window.

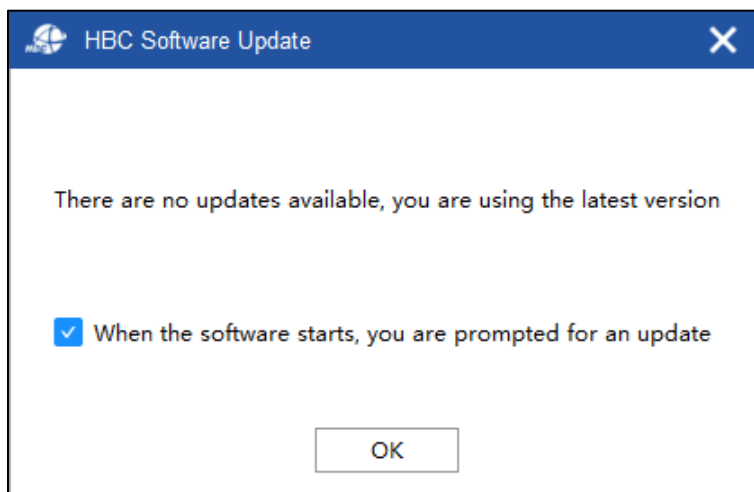


Figure 13-4-1 Upgrade Popup

13.4.2 Manual Update

Click [Support]-[Check for Update], and the upgrade pop-up window will pop up.

13.5 Software Settings

Click the "setting" button in the upper right corner of the software to pop up the software setting window.

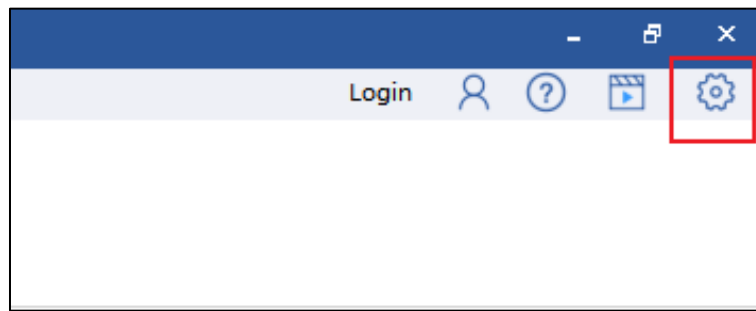


Figure 13-5-1 Software Settings

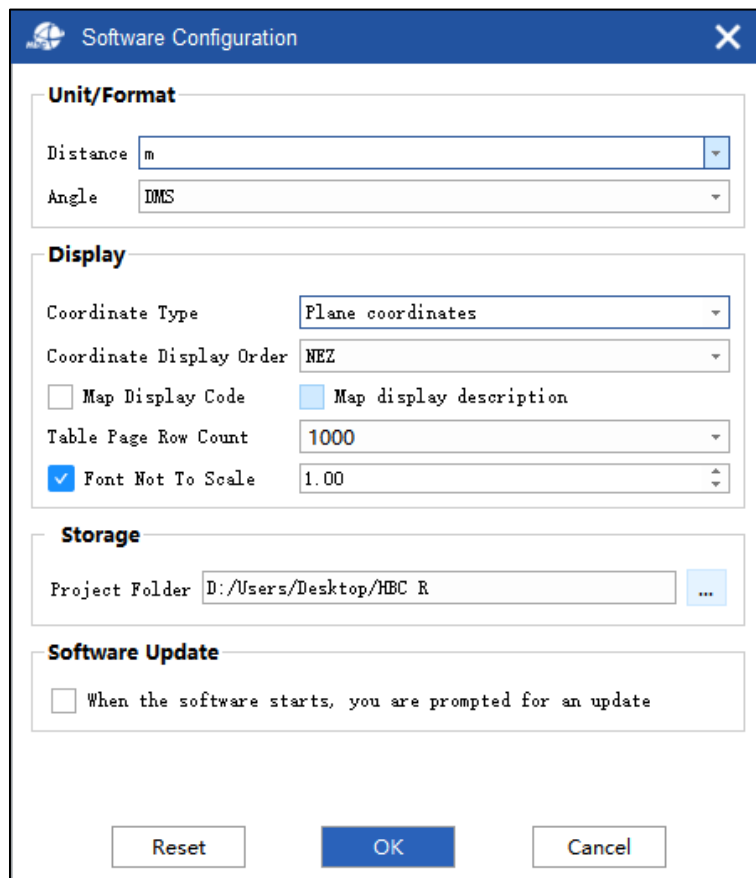


Figure 13-5-2 Software Settings

The unit / format, display, storage location and software update can be set.

13.5.1 Unit / Format

Distance unit and angle unit can be set.

The types of distance units are m, U.S. foot and foot.

The types of angle units are DMS, Gon, mil, DD:MM.MMMM.

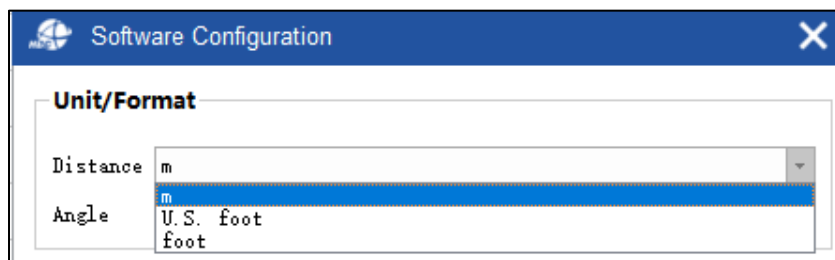


Figure 13-5-3 Unit / Format

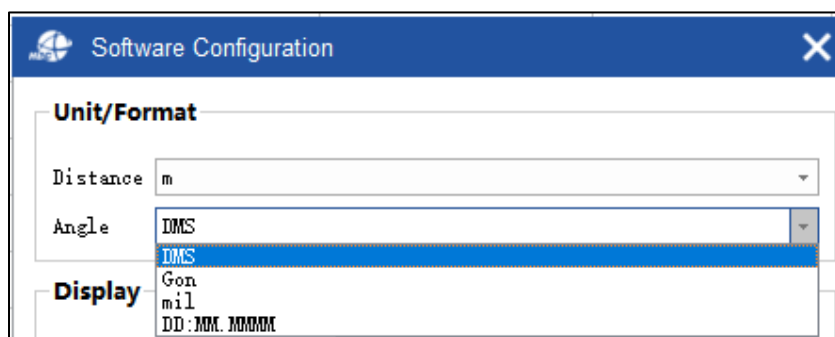


Figure 13-5-4 Unit / Format

13.5.2 Display

Coordinate type, coordinate display order, map display, number of lines per page of table and text can be set without scale.

Coordinate types include geodetic coordinates and plane coordinates.

The coordinate display order can be set to NEZ,NZE,ENZ,EZN,ZNE,ZEN.

Map display can set map display code and map display description.

The number of rows per page of the table can set the number of rows per page of list data in the software.

The text does not follow the scale. You can set the scale according to your preference.

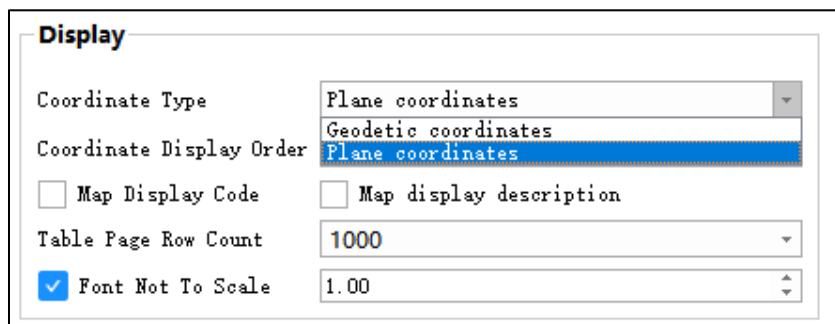


Figure 13-5-5 Display

Display

Coordinate Type
Plane coordinates

Coordinate Display Order
NEZ

☐ Map Display Code

Table Page Row Count

☒ Font Not To Scale

NEZ
NZE
ENZ
EZN
ZNE
ZEN

Figure 13-5-6 Display

13.5.3 Storage Location

You can set the file path to save the new project.

13.5.4 Software Update

When checked, the software will automatically prompt whether to update when the software is started.

Chapter 14

The Appendix

This chapter contains:

- Terminology Notes
- RINEX Format Description

14.1 Terminology Notes

14.1.1 IGS

International GPS Service (IGS), based on the global ground-based GPS continuous operation station, is an example of GPS continuous operation network and comprehensive service system. It provides GPS users with various free information, such as GPS precise ephemeris, fast ephemeris, forecast ephemeris, IGS station coordinates and their motion rate, phase and pseudorange data of GPS signals received by IGS stations, and earth rotation rate. It supports countless scientific projects in geodesy and geodynamics, including ionosphere, meteorology, reference frames, precise time transfer, high-resolution Estimate of Earth's rotation rate and its changes, and crustal movement. DORIS in France and PRARE in Germany are also considering the establishment of similar international organizations to make sure such space geodetic observation system are more efficient, automated, accurate and reliable.

14.1.2 Ambiguity

The unknown integer number of cycles of the reconstructed carrier phase contained in an unbroken set of measurements from a single satellite pass at a single receiver.

14.1.3 Baseline

The length of the three-dimensional vector between a pair of stations for which simultaneous GPS data has been collected and processed with differential techniques.

14.1.4 Broadcast Ephemeris

Satellite orbital parameters obtained by demodulation in a message published by a satellite.

14.1.5 SNR (Signal-to-noise Ratio)

The ratio of signal power to noise power at an endpoint.

14.1.6 Cycle Slip

A phenomenon under the interference, the loop jumps from a balance point for several cycle and stabilizes at a new equilibrium point, causing the integer period of phase to produce an error.

14.1.7 Carrier Wave

A radio wave having at least one characteristic (e.g., frequency, amplitude, phase) which may be varied from a known reference value by modulation.

14.1.8 C/A Code

The Coarse/Acquisition GPS code modulated on the GPS L1 signal. This code is a sequence of 1203 pseudorandom binary biphase modulations on the GPS carrier at a chipping rate of 1.023 MHz, thus having a code repetition period of one millisecond.

14.1.9 Difference Measurement

GPS measurements can be differenced across receivers, across satellites and across time. Although many combinations are possible, the present convention for GPS phase measurement differencing is to perform the differences in the above order: first across receivers, second across satellites and third across time.

-Single difference measurement (across receivers) is the instantaneous difference in phase of a received signal, measured by two receivers simultaneously observing one satellite.

-Double difference measurement (across receivers and satellites) is obtained by differencing the single difference for one satellite with respect to the corresponding single difference for a chosen reference satellite.

-Triple difference measurement (across receivers, satellites and time) is the difference between a double difference at one epoch of time and the same double difference at another epoch of time.

14.1.10 Difference Positioning

Determination of relative coordinates between two or more receivers which are simultaneously tracking the same GPS signals.

14.1.11 Geometric Dilution of Precision

In dynamic positioning, a factor describing the contribution of satellite geometry position to error. Expression: σ_{GDOP} . Where Q is the matrix factor of the instantaneous dynamic position solution (depending on the location of the receiver and satellite). □

Table 14-1-1 Everal Standard Terms in GPS

Name	Meaning
GDOP	4-D geometric factor
PDOP	3-D coordinate geometric factor
HDOP	2-D coordinate geometric factor
VDOP	Elevation geometric factor
TDOP	Clock difference factor 1:40,000
HTDOP	Elevation and clock difference geometric factor

14.1.12 Dynamic Positioning

A method determining the coordinate of the moving rover changed with time.

Each measurement result is obtained from a single data sample and calculated in real time.

14.1.13 Eccentricity

$$e = \sqrt{\frac{a^2 - b^2}{b^2}}$$

a: semi-major axis

b: semi-minor axis.

14.1.14 Ellipsoid

In geodesy, a mathematical figure formed by revolving an ellipse about its minor axis. Two quantities define an ellipsoid; these are usually given as the length of the semi-major axis a and the flattening

$$f = \frac{1}{a}(a - b)$$

14.1.15 Ephemeris

The energetic parameters of the position of a celestial body with time.

14.1.16 Flattening

Relating to Ellipsoids

$$f = \frac{1}{a}(a - b) = 1 - \sqrt{1 - e^2}$$

a: semi-major axis; b: semi-minor axis.; e: eccentricity

14.1.17 Geoid

The particular equipotential surface which coincides with mean sea level, and which may be imagined to extend through the continents. This surface is always perpendicular to the direction of the force of gravity.

14.1.18 Ionosphere Delay

A wave propagating through the ionosphere (which is a non-homogeneous and dispersive medium) experiences delay. Phase delay depends on electron content and affects carrier signals. Group delay depends on dispersion in the ionosphere as well and affects signal modulation (codes). The phase and group delay are of the same magnitude but opposite sign.

14.1.19 L-band

The radio frequency band extending from 390 MHz to 1550 MHz.

14.1.20 Multipath Error

A positioning error resulting from interference between radio waves which have travelled between the transmitter and the receiver by two paths of different electrical lengths.

14.1.21 Observing Session

A period of time for collecting GPS data simultaneously using more than two receivers.

14.1.22 Pseudo Range

A measure of the apparent signal propagation time from the satellite to the receiver antenna, scaled into distance by the speed of light. The apparent propagation time is the difference between the time of signal reception (measured in the receiver time frame) and the time of emission (measured in the satellite time frame).

14.1.23 Receiver Channel

The Radio, Mixing and Intermediate frequency channel in the GPS receiver which can receive and track the two carrier frequency signals of the satellite.

14.1.24 Satellite Configuration

The state of the satellite constellation at a specific time, relative to a specific user or set of users.

14.1.25 Static Position

The measurement of point position without taking into account the motion of the receiver.

14.1.26 Universal Time

Local solar mean time at Greenwich Meridian.

UT: Abbreviation for universal time UT0.UT0: As deduced directly from observation of stars.UT1: UT0 corrected for polar motion.UT2: UT1 corrected for seasonal variations in the Earth's rotation rate.UTC: Universal Time Coordinated; uniform atomic time system kept very close to UT2 by offsets.

14.1.27 Interval

The process of taking a continuous variable value at periodic intervals.

14.1.28 Condition of Observation

The geometric figure and trajectory of the satellite constellation.

14.2 RINEX Format Description

14.2.1 Observation Data File

This file contains header blocks and data blocks. Figure 9-2-1 lists the header blocks for this file and figure 9-2-2 lists the data blocks for this file. Here are just a few of the nouns in the observations.

1. Time: Refers to measuring time which signal arrives at the receiver
2. Pseudo range: Measurement of the apparent signal propagation time from the satellite to the receiver antenna, scaled into distance by the speed of light. In RINEX, there are three kinds of pseudo range observations: C1 is L1's C/A code, P1 is L1's P code and P2 is L2's P code. Because of the AS policy, many receivers cannot get the P code of L2, instead of that, adopting the related technology to find out the Y2-Y1 time delay to eliminate ionosphere influence. In this case, in RINEX, the time delay between C/A code and Y2-Y1 is converted to the synthesized P2 code.
3. Phase: It is a small value over the entire week of the beat frequency at the L1 and L2 frequencies. When the square technique extracts the phase, it is a small value in half a week and must be converted to an entire week.
4. Doppler: The receiver uses a specific processing software to record the Doppler value D1 and D2 and take Hz as the unit.

In all above records, the three observations must be consistent in time. If the external frequency standard is used to correct and set the time error correction number as τ , the following measurements are as follows:

$$\begin{aligned}\rho(\text{corr}) &= \rho(\text{recv}) - c \times \tau \\ T(\text{corr}) &= T(\text{recv}) - \tau \\ L1(\text{corr}) &= L1(\text{recv}) - F \times \tau\end{aligned}$$

Table 14-2-1 Description of Navigation File Header Block

Header Name 61~80Columns	Description	Format
RINEX VERSION/TYPE	Version format(2) File type O——Observation data Positioning system G——GPS R——GLONASS M——MIXED	16, 14X A1, 19X A1, 19X
PGM / RUN BY / DATE	Name of file outline Name of file institution Date of document creation	A20, A20, A20
COMMENT	Comments	A60
MARKER NAME	The name of measuring point	A60
MARKER NUMBER	The number of measuring point	A20
OBSERVER / AGENCY	Name or agency of the observer	A20, A40
REC# / TYPE / VERS	Receiver number, model and software version	3A20
ANT# / TYPE	Number and type of antenna	2A20
APPROX POSITION XYZ	Approximate position XYZ	3F14.4
ANTENNA: DELTA H/E/N	Antenna height H Eastward eccentricity of antenna E Westward eccentricity of antenna N	3F14.4
WAVELENGTH FACT L1/2	Wavelength factors of L1/L2 1: Integer ambiguity 2: Semi-cycle ambiguity 0: L1 Single frequency	2I6

	Number of tracking satellites (maximum 7, more than 7 duplicate records) PRN Satellite number	I6 7(3X,A1,12)
# / TYPES OF OBSERV	The number of different observation types in the file Definition of observation type: L1, L2: L1, L2phase observations(cycle) C1:C/A pseudo range measurements of L1 (m) P1, P2:L1, L2 P code pseudo range measurement (m) D1, D2:Doppler pseudo range measurement of L1 and L2 (Hz) T1, T2: The integral Doppler observation of meridian instrument (cycle) After the implementation of AS, L2 and P2 are changed.	I6 9(4X,A2)
INTERVAL	Interval of observation (s)	I6
TIME OF FIRST OBS	Starting time of observation(year,month,day,hour, minute, second) Time system: GPS=GPS time system GLO=UTC time system Default value in GPS/GLONASS: GPS=plain GPS file GLO=plain GLONASS file	5I6, F12.6 6X, A3
TIME OF LAST OBS	Ending time of observation (year,month,day,hour,minute, second)	5I6, F12.6 6X,A3

	Time system: GPS=GPS time system GLO=UTC time system Default value in GPS/GLONASS: GPS=plain GPS file GLO=plain GLONASS file	
LEAP SECONDS	In GPS/GLONASS, the slip second from January 6, 1980,	I6
#OF SATELLITES	The observation numbers of satellite contained in the document	I6
PRN / # OF OBS	The satellite number. If more than 9 observables are measured, repeat the record	3X, A1 ,I2,9I6 6X, 9I6
END OF HEADER	Header block terminator	60X

Table 14-2-2 Description of Data Block of Observation File

Observation Record	Description	Format
EPOCH /SAT Or EVENT FLAG	Epoch: year, month, day, hour, minute,second Epoch sign 0: Normal 1: Interruption of epoch ≥1: Epoch flag The number of satellites in the current calendar The satellite number in the current epoch, if there are more than 12, then another line(A1, I2) Receiver clock(s) If there are more than 12 satellites, records continuously; If Epoch flag>1 then Epoch sign: 2: Start moving the antenna	5I3, F11.7 I3, I3 I2(A1, I2) F12.9 32X,12(A1, I2)

	3: Placed at a new point, the end of the moving 4 : Header information 5: Exception (the epoch is too large) 6: The record of cycle slip The satellite numbers are recorded in both signs 2 and 5.	
OBSERVATIONS	Observation date LLI Signal strength The above data for each satellite is recorded in EPOCH/SAT. If more than 5 observations (80 byte),continue the next record. Observations: Phase: expressed as integer Pseudo range: expressed as meter Indicates that the measurement is lost LLI: Indicates the satellite lock status (0~7) Normal Default value AS exists Signalintensity 1: Minimum signal intensity 5:Moderate signal intensity 9:Maximum signal intensity 0:Do not consider	m (F14.3,I1,I1)

14.2.2 Navigation Data File

The satellite ephemeris is broadcast navigation message taken from the satellite, which is the basic data for calculating the ground position.

In the navigation message, the number of orbits, the satellite clock parameter, etc. are included. In order to accelerate the calculation of the ground point, the satellite sends the broadcast navigation message once per second, while the broadcast navigation message update every hour. So, each observation only needs to record a set of broadcast navigation messages. Figure 9-2-3 and figure 9-2-4 list the navigation file header block and data block, representatively.

Table 14-2-3 Description of Navigation File Header Block

Header Name	Description	Format
61~80 Columns		
RINEX VERSION / TYPE	Version format(2) File type (N——navigation data)	I6, 14X, A1, 19X
PGM / RUN BY / DATE	Name of file outline Name of file institution Date of document creation	A20 A20 A20
COMMENT	Comments	A60
TON ALPHA	Ionosphere parameters A0—A3	2X, 4D12.4
ION BETA	Ionosphere parameters B0—B3	2X, 4D12.4
DELTA-UTC	almanac parameters for calculating UTC time	
A0,A1,T,W	A0,A1: Calculate the parameter of time correction T : Reference time of UTC data W : Reference weeks of UTC	
LEAP SECONDS	Time variation due to leap seconds	I6
END OF HEADER	Header block terminator	60X

Table 14-2-4 Description of Navigation File Header Block

Observation Record	Description	Format
PRN /EPOCH / SV CLK	PRN Satellite number Epoch: TOC——Time of clock Year (two digits); Month; Day; Hour; Minute; Second. Satellite clock error (S) Satellite clock drift (s/s) Rate of satellite clock drift (s/s ²)	5I3, F11.7 I3, I3 I2(A1, I2) F12.9 32X,12(A1,I2)
BROADCAST ORBIT-1	IODE Expiry date of ephemeris data Crs (m) Δn (rad/s) MO (rad)	3X, 4D19.12
BROADCAST ORBIT-2	Cuc (rad) e flattening Cus (rad) $\sqrt{A}(\sqrt{m})$	
BROADCAST ORBIT-3	Toe time of ephemeris Cic (rad) Ω (rad) Cis (rad)	3X,4D19.12

BROADCAST ORBIT-4	I (rad) Crc (m) Ω (rad) Ω dot (rad/m)	3X,4D19.12
BROADCAST ORBIT-5	Idot (rad/s) L2 TOE L2 P Data label	3X,4D19.12
BROADCAST ORBIT-6	Satellite precision (m) Mobile Station Based (MSB) TGD (S) IDOC Expiry date of clock data	3X,4D19.12
BROADCAST ORBIT-6	Message sending time (GPS week seconds - counting from the Z of the word HOW)	3X,4D19.12

