Indoor Navigation

In recent years, indoor navigation is a kind of navigation mode becomes more and more popular. Navigation applications have been shifted from outdoors to indoors, which helps users to reach the indoor destination quickly. Indoor navigation can be used as the super entrance to "the last kilometer of map navigation", which is gradually playing its commercial value in recent years.

SuperMap iMobile has accumulated abundant experience in the navigation field. Traditional navigation, industry navigation functions have been widely used. Based on this, SuperMap iMobile 8C(2017) introduced 2D indoor navigation function. SuperMap iMobile 9D extends the indoor navigation from 2D to 3D, which enhances the navigation experience of users.

Following functions are provided by SuperMap iMobile for indoor navigation.

- Indoor map display (two-dimensional, three-dimensional)
- Indoor floor switch
- Indoor cross-floor, multi point path planning
- Indoor analog navigation, real navigation
- Navigation voice broadcast

This paper will introduce the indoor navigation function of SuperMap iMobile in details from the following aspects: indoor navigation data production, indoor positioning technology, indoor navigation and indoor navigation solution.

Data Preparation

Tool used for data preparation is SuperMap iDesktop V9.0.

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2.1 2D Indoor Map

2.1.1 Navigation Map Composition

A two-dimensional indoor map for SuperMap iMobile indoor navigation engine includes the following contents:

- Indoor data Source: Contains indoor map source data, navigation path data, floor association attribute table.
  - Indoor map source data, that is, indoor raw data, mainly used on the map for display. Take shopping malls for example, staircases, toilets, shops, ATMs and so on are included.
  - Navigation path data: Indoor data, including path data (line dataset), which can be used for for navigation after the topology network.
  - Floor association attribute table: Store floor association relation, which is the basis of the normal operation of navigation. The table needs to be made manually.
- Bounds data source: Used to control the display and hiding of floor controls. The bounds data source name is "bounds" (the name is not modifiable), containing a region dataset named "building" (the name is not modifiable). The dataset contains only one polygon object and the shape and size of the polygon are similar or identical to the shape and size of the inddor map.
- Outdoor data source (optional): Contains a variety of outdoor data, such as roads, points of interest, etc.. It is used to produce indoor and outdoor integration map to achieve display effect from outside to indoor.
- Map: After a variety of style settings and thematic processing, maps will used to show in the program.

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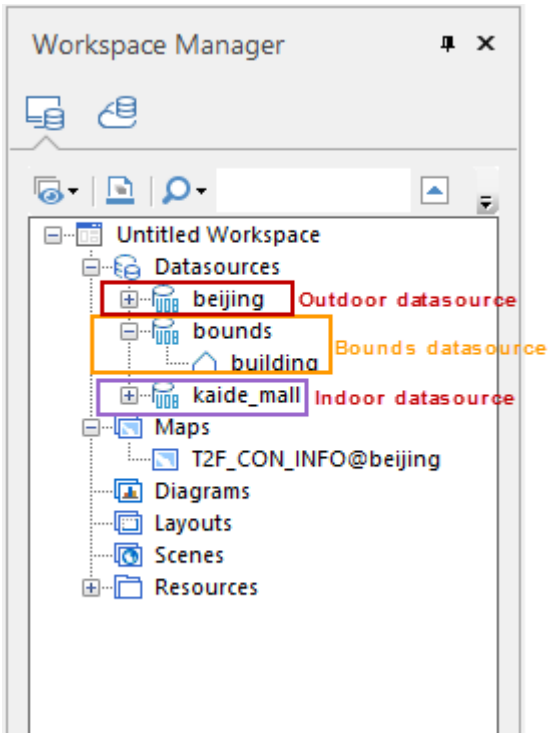

Figure 1 2D Indoor Map Data Structure

2.1.2 Map Display and Data Preparation

2.1.2.1 Import Dataset

Import the original data into the import data source before preparing the data.

Operations:

step 1: Create a datasource. Workspace Manager--Right click Datasource--New File Datasource, enter datasource name and storage path.

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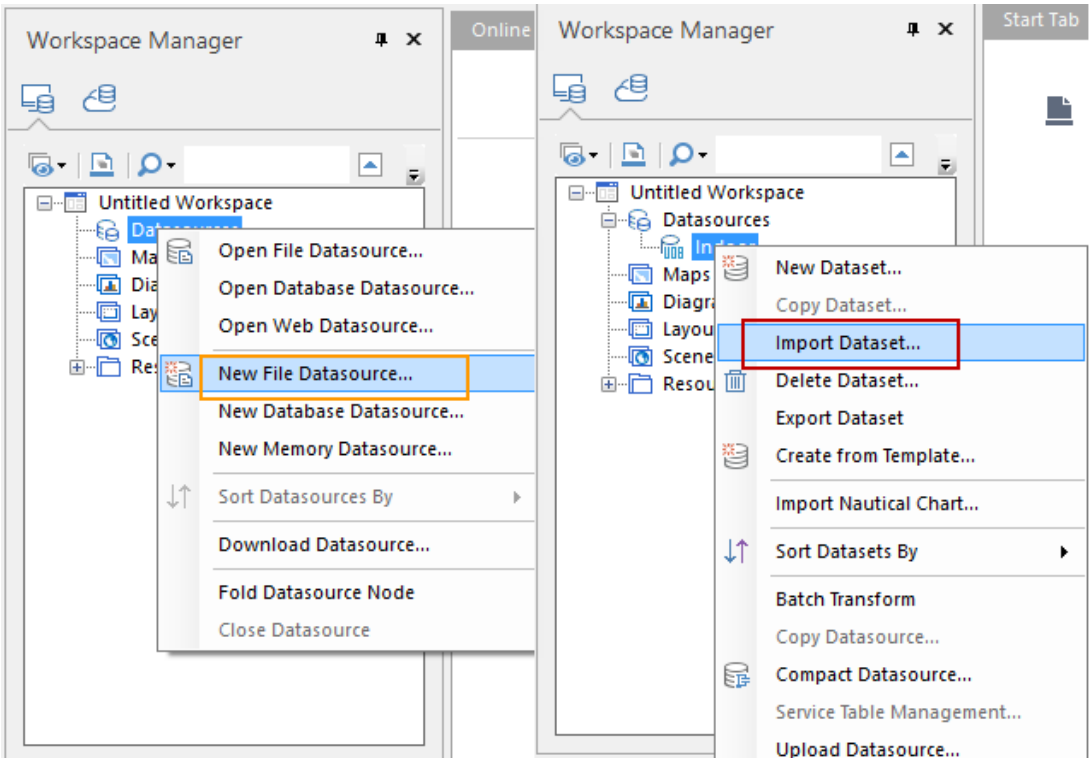

Figure 2 Create new datasource (left) and import dataset (right)

Step 2: Import the dataset Workspace Manager--Right click the datasource created in the 1st step--Import Dataset, and add files for datasets via the Add File button.

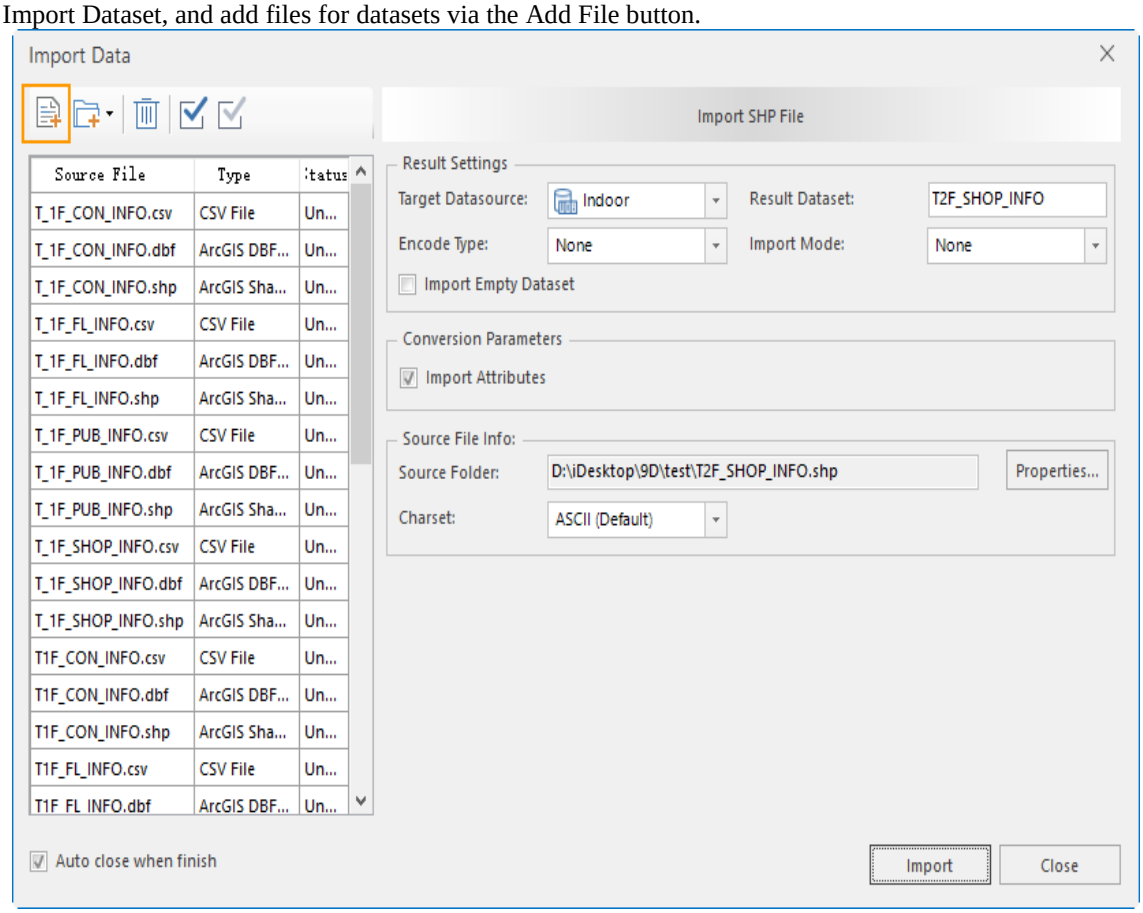

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Figure 3 Add file

2.1.2.2 Layer Grouping

Organize data as layer groups, and each layer group contains all the data for one floor.

Operations:

Step 1: Create layer groups: Manage data for one floor in one layer group.

Layer Manager--New Group, New Root Group, create layer groups. (You need to add the dataset to the Map window before you can see the New Root Group button)

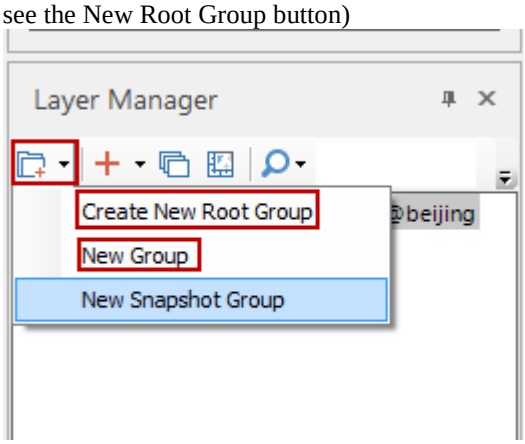

Figure 4 New Root Group

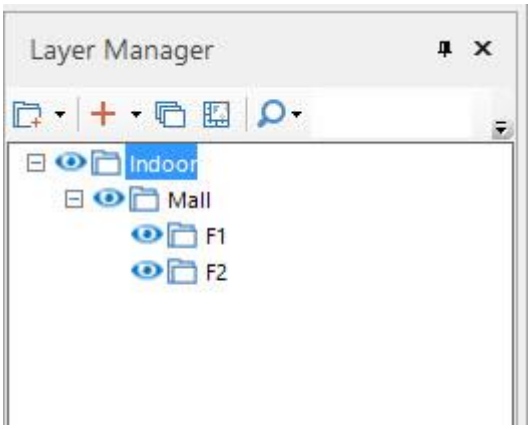

Figure 5 Sample for creating root group

Step 2: Add the indoor dataset to the current map and place it under the appropriate group.

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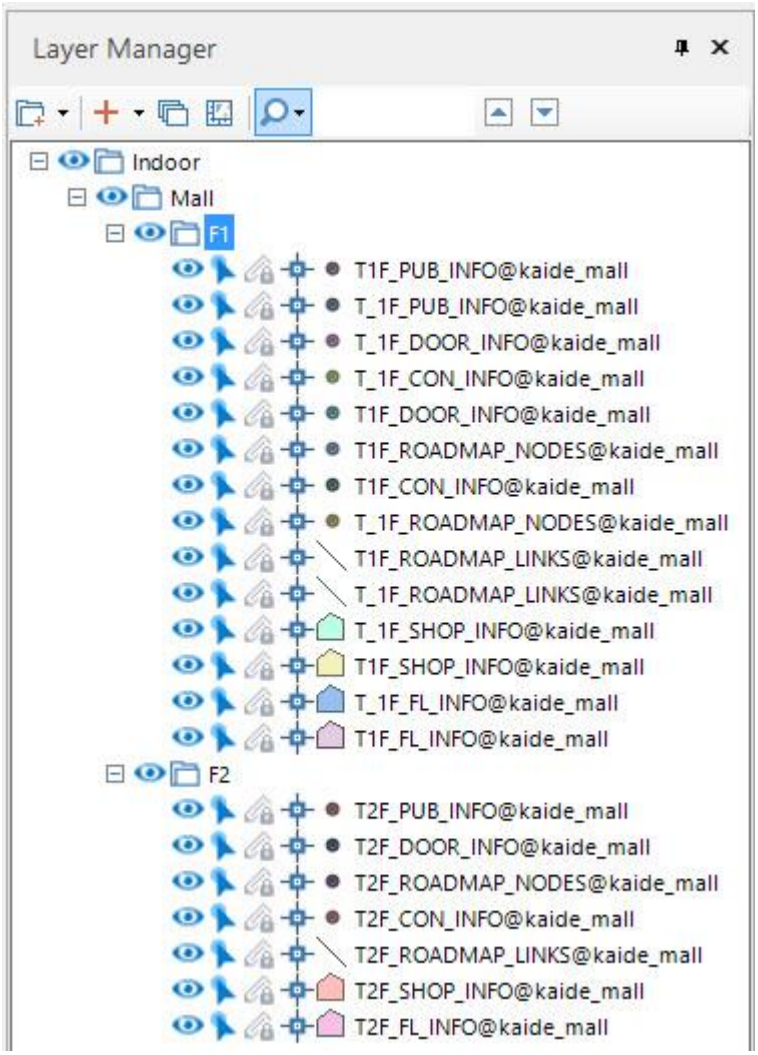

Figure 6 Layer structure sample

2.1.2.3 Region Dataset Preparation

Region Data Attributes: The region data must contain the following attributes, which cannot be changed:

Floor ID	The attribute field name is called "**FL_ID**" (the name cannot be changed). It will be used for floor display, path analysis, and navigation. Each floor has an ID, and the floor IDs for all the features on the same floor are the same.
Type	Used to make unique value thematic map, which displays in different colors depending on the type. You can set the value of a type based on different attributes of the object. Take shopping malls for example, shops, elevators, toilets can be set to different types.

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Name	Used to make the label thematic map, and display the name on the maps.

Table 1 Attributes must be contained in the region dataset

Step 1: Add attribute items: If the dataset does not contain the above attributes, you need to manually add the content.

On the region dataset where you want to add the attributes, right click, select Attributes--Attribute Table, open the list of attributes as shown below, and use 

to add the attribute items. You need to click Apply to take effect.

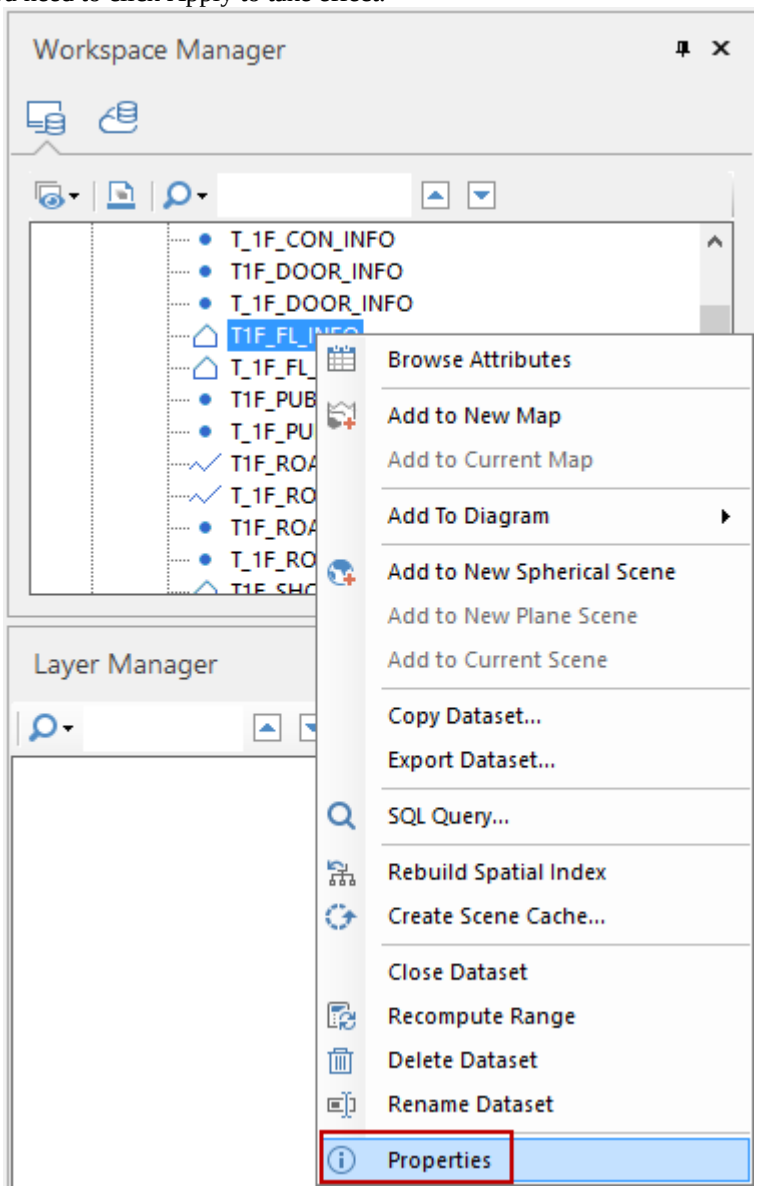

Figure 7 Open attribute table for operations

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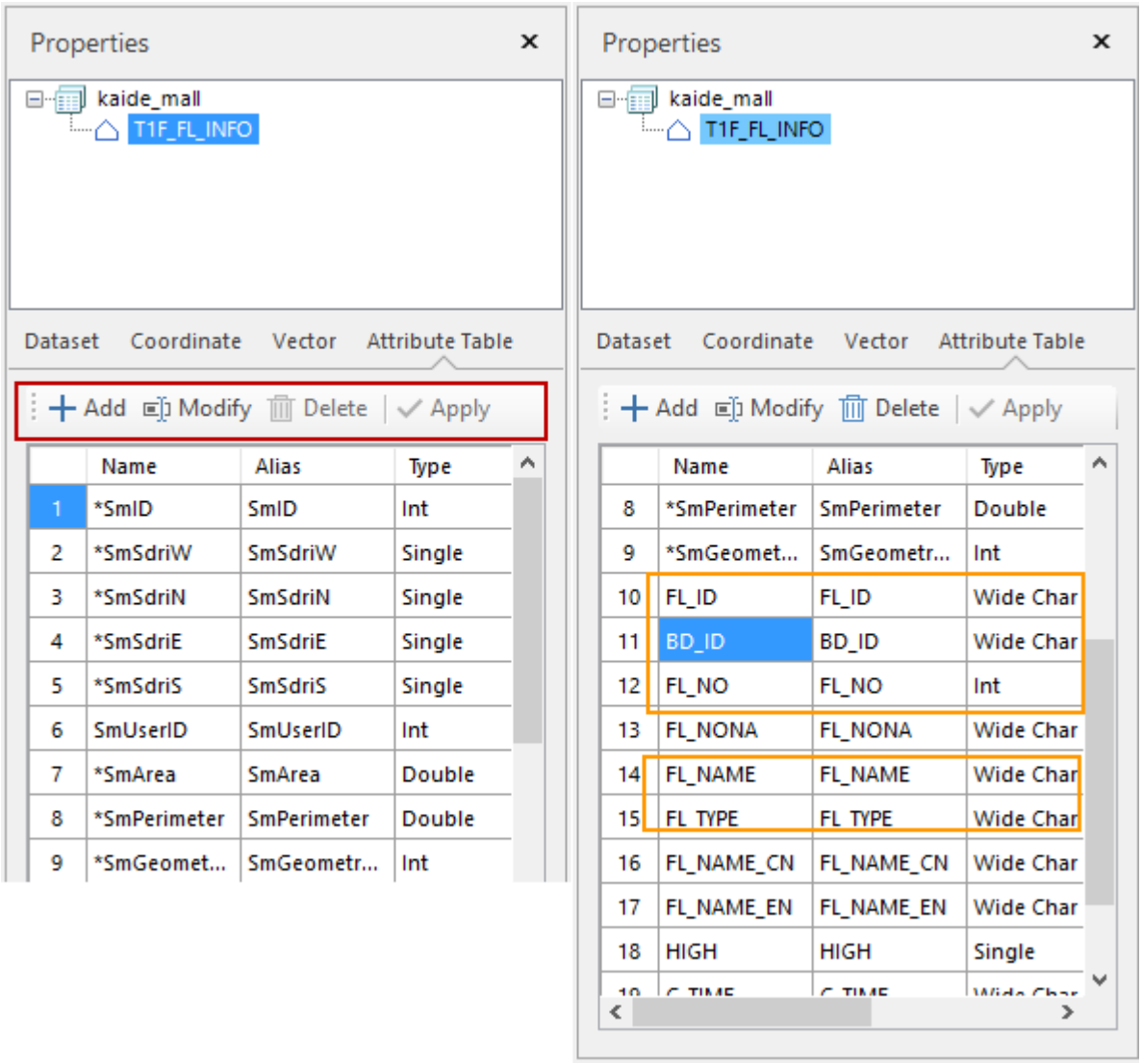

Figure 8 Attribute list (left), attribute adding results (right)

Step 2: Add attribute values: When the attribute item is added, you can add the corresponding attribute to each object in the dataset.

On the above-mentioned dataset, right-click, select Browse Attributes, open the attribute table of the dataset as shown below, double-click an item in the property sheet (item with * cannot be edited) and edit the attribute.

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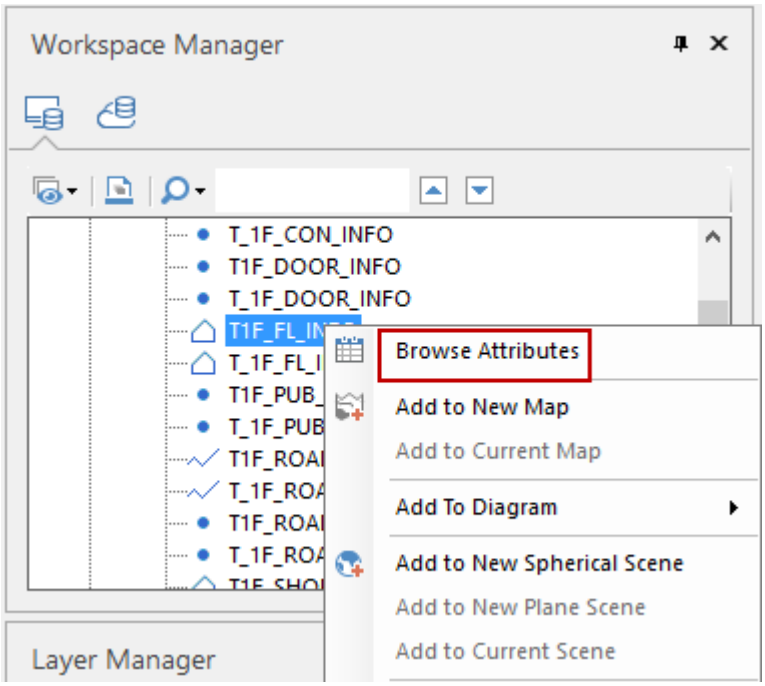

Figure 9 Open attribute table for operations

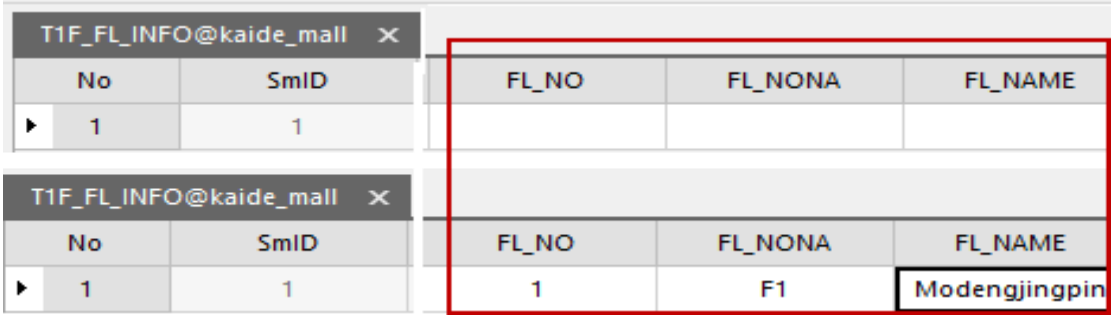

Figure 10 Attribute table structure (top), sample for adding attributes (bottom)

Step 3: Create unique value thematic map, which displays objects in different colors depending on the types.

In the Layer manager, select the region dataset layer, right-click, select "Create Thematic Map"--"Unique Values Map"--"Default", the following "Thematic Map" setting interface will display. Select expression. You can select appropriate colors via color ramps, or open Fill Symbol Selector via Styles button for color settings.

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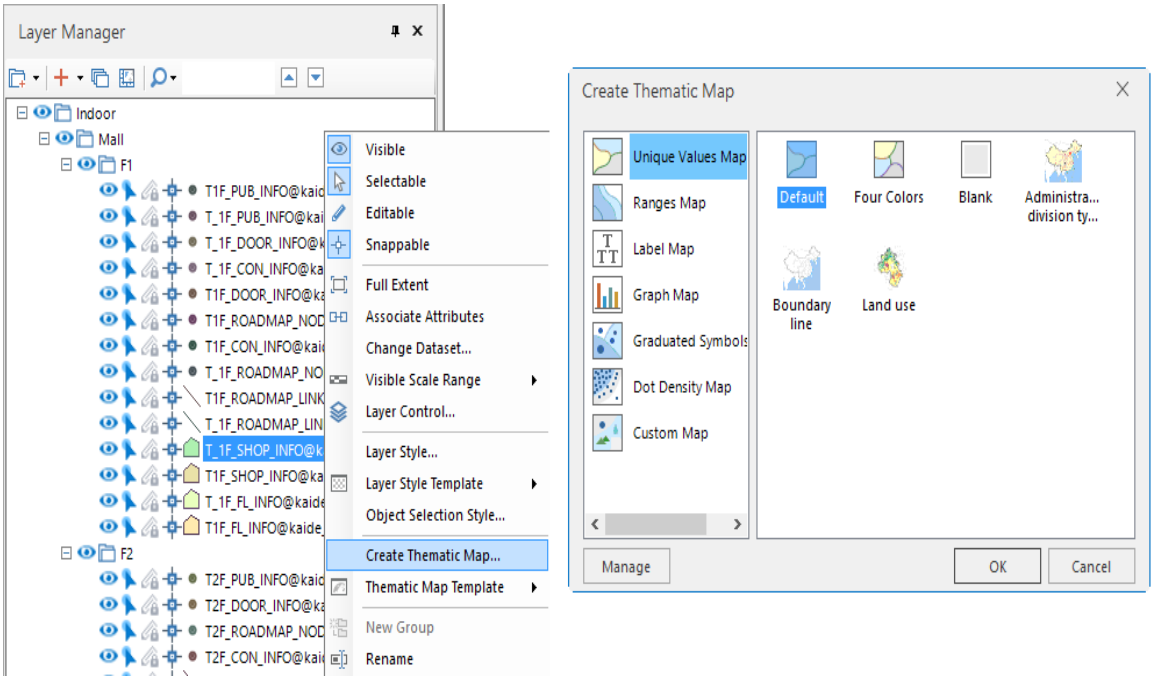

Figure 11 Operations for setting unique values map

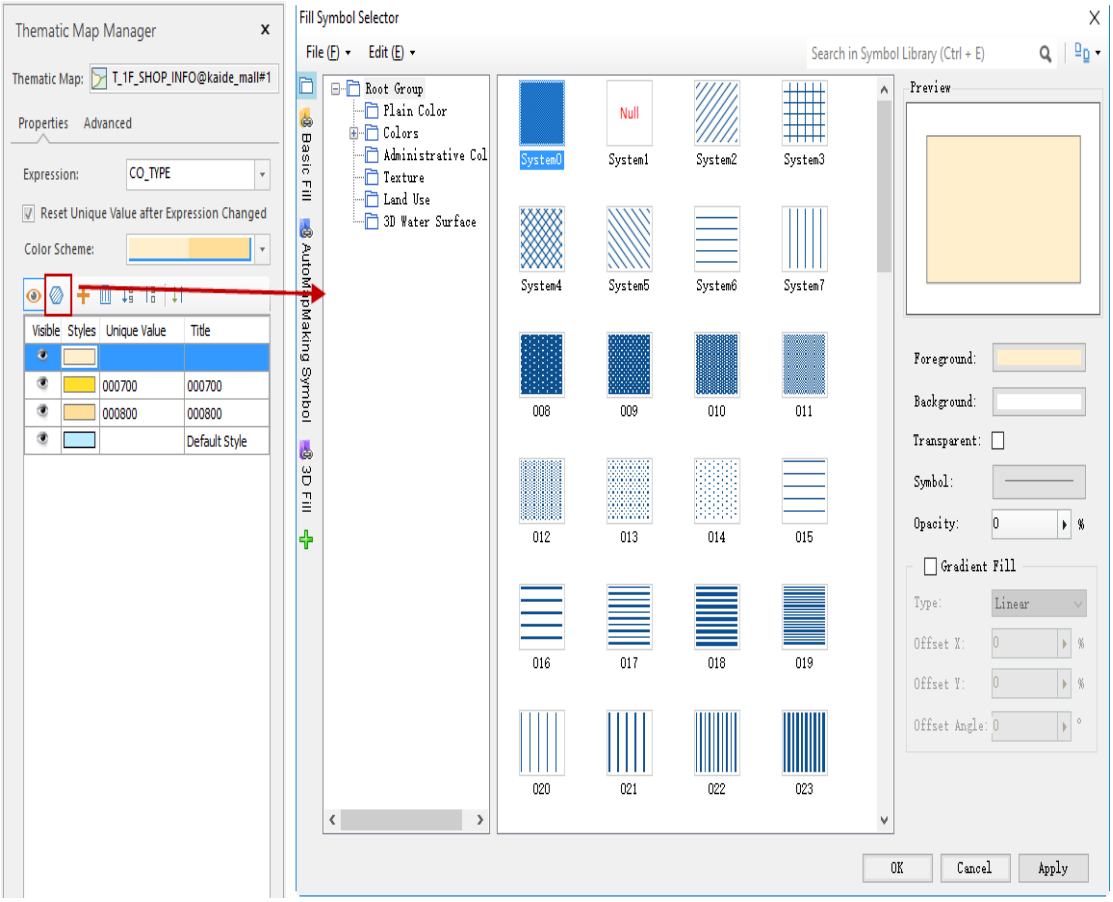

Figure 12 Settings for unique values map

Step 4: Create lable map and display names as labels.

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In the Layer manager, select the region dataset layer, right-click, select "Create Thematic Map"--"Label Map"--"Default", the following "Thematic Map" setting interface will display. Select expression, and set on the Properties, Styles, Advanced tabs.

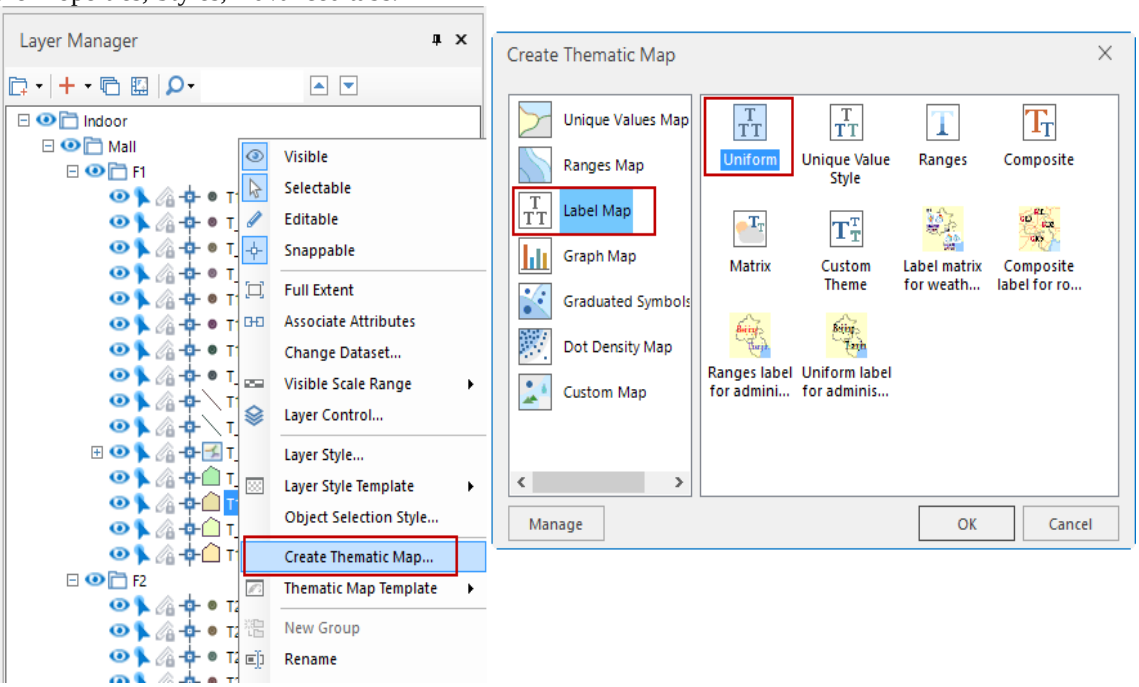

Figure 13 Operations for setting label maps

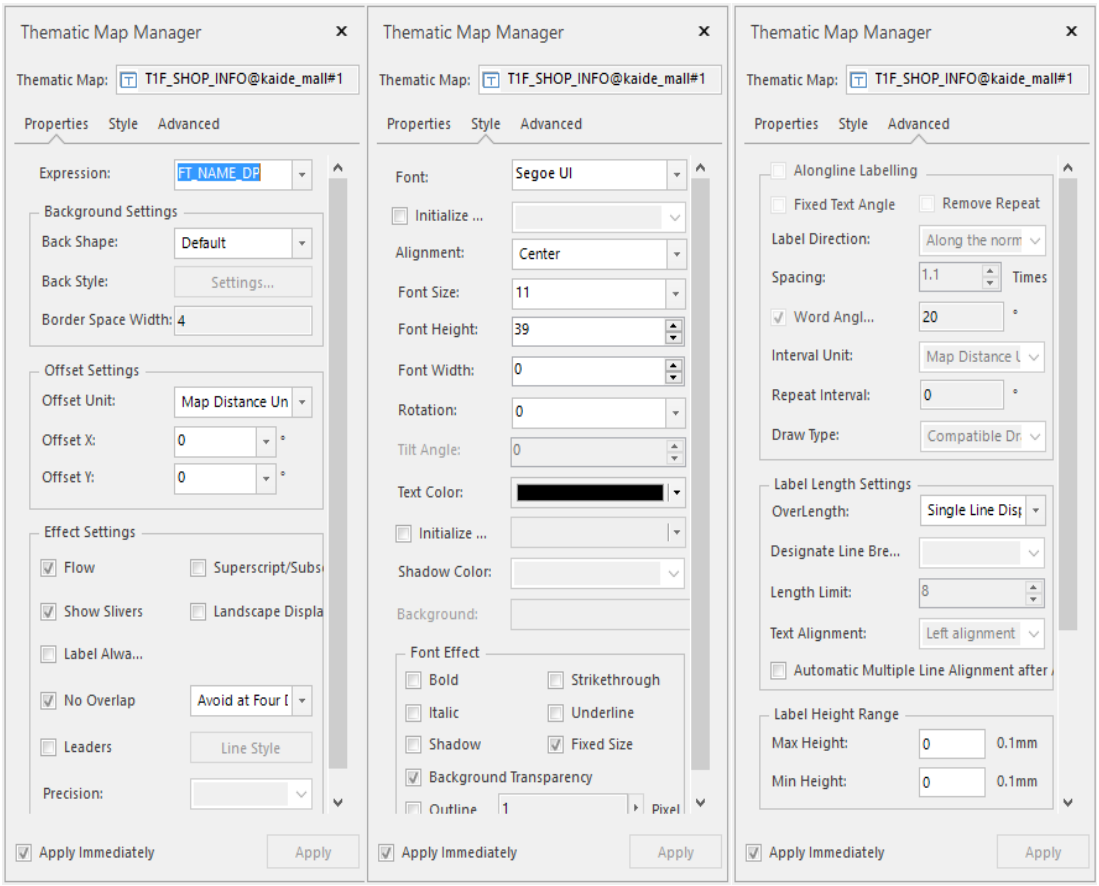

Figure 14 Settings for label maps

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2.1.2.4 Point Data Preparation

Step 1: Add attribute items: The method is the same as the adding attribute items for region datasets. You can add attribute items following steps below.

Floor ID	The attribute field name is called "**FL_ID**" (the name cannot be changed). It will be used for floor display, path analysis, and navigation. Each floor has an ID, and the floor IDs for all the features on the same floor are the same.
Type	Used to make unique value thematic map, which displays in different colors depending on the type. You can set the value of a type based on different attributes of the object. Take shopping malls for example, shops, elevators, toilets can be set to different types.
Name	Used to make the label thematic map, and display the name on the maps.

Table 2 Attributes must be contained in the point dataset

In addition to the above attribute items, staircases (including escalators, ladders, straight ladders, etc.) must also contain the following attribute items because of the navigation involved.

Staircase ID	The attribute field name is " **FT_ID**", and each layer of stairs has an ID value. Even if parts of straight ladder on have different IDs.
Staircase Type	The "Type" in the table above. In the staircase attributes, the name of the attribute item must be "**FT_TYPE**".
Floor Arrived	The attribute field name is "**TO_CON**", in the form of "#Floor Arrived#ID of the next floor". For example, if you have arrived at the staircase with the ID 138690310200334 on the 2nd floor, the attribute value is " #2#138690310200334". Each staircase only needs to correspond to the upper stair. For example, for floor 1, the attribute of this field is 2. For the top level, this attribute can be empty.

Table 3 Attributes must be contained in the staircase data

Attribute items are added with the same region data's attribute items, please refer to the steps of of adding attribute items for region dataset.

Step 2: Add attribute values The method is the same as the adding attribute values for region datasets. You can add attribute values following steps below.

Step 3: Create unique value thematic map, which displays objects in different colors depending on the types.

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In the following interface, set up properties for unique values maps. You can open Maker Style Selector via the Styles button to select appropriate market styles.

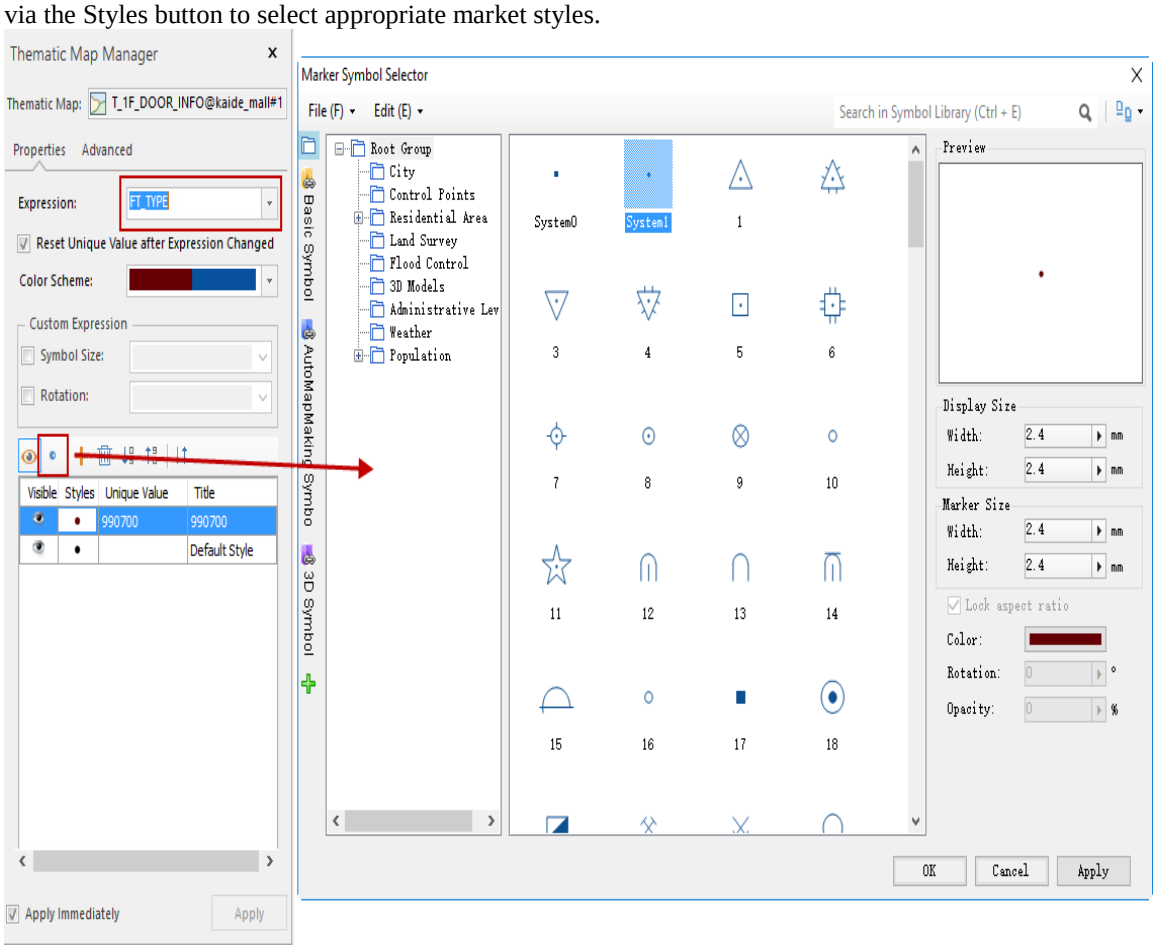

Figure 15 Operations for setting marker symbols

If marker styles in the Marker Style Selector cannot meet your requirements, you can choose to Import Symbol Library (import .sym files), Import Raster File (import .jpg, .png, .bmp, .ico pictures) to import desired symbols.

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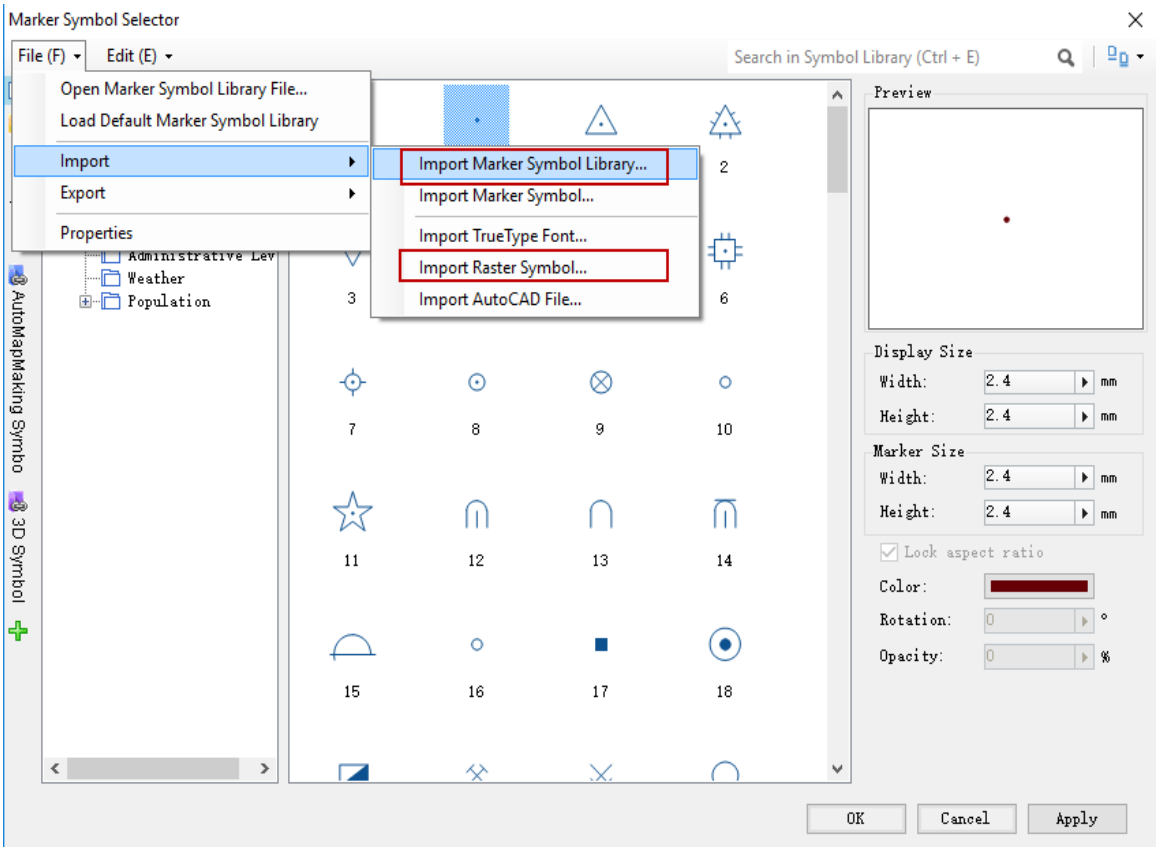

Figure 16 Import Symbols

Steps 4: Create label thematic map: The method is the same as creating label map for region dataset.

2.1.2.5 Save Map and Workspace

According to the above method, the data of each floor is processed. When finished,set one floor visible. The original layer used for creating the thematic map can be removed or hide.

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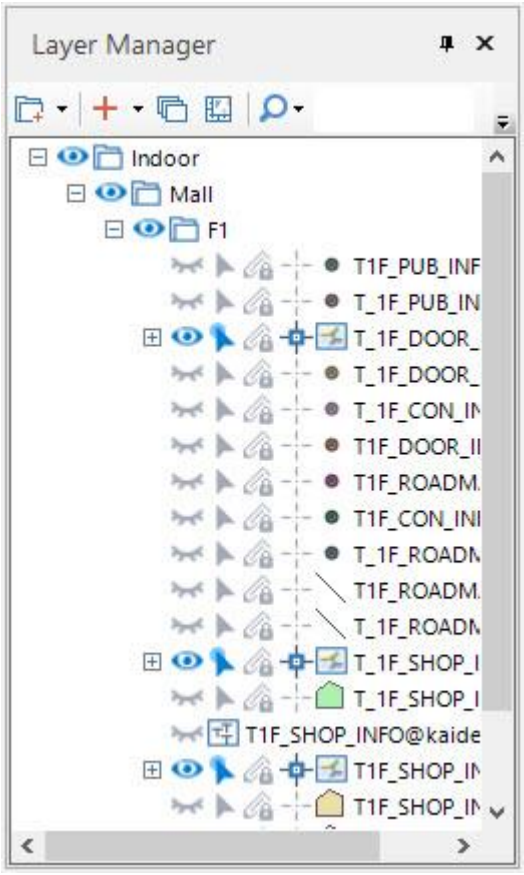

Figure 17 Sample for data processing results

Click "Start"--"Workspace"--"Save". In the window for saving the map, enter the map name and save the map. Save the workspace by entering the workspace name and storage location in the window for saving the workspace.

Tip: To prevent data loss, you can save it from time to time during data production.

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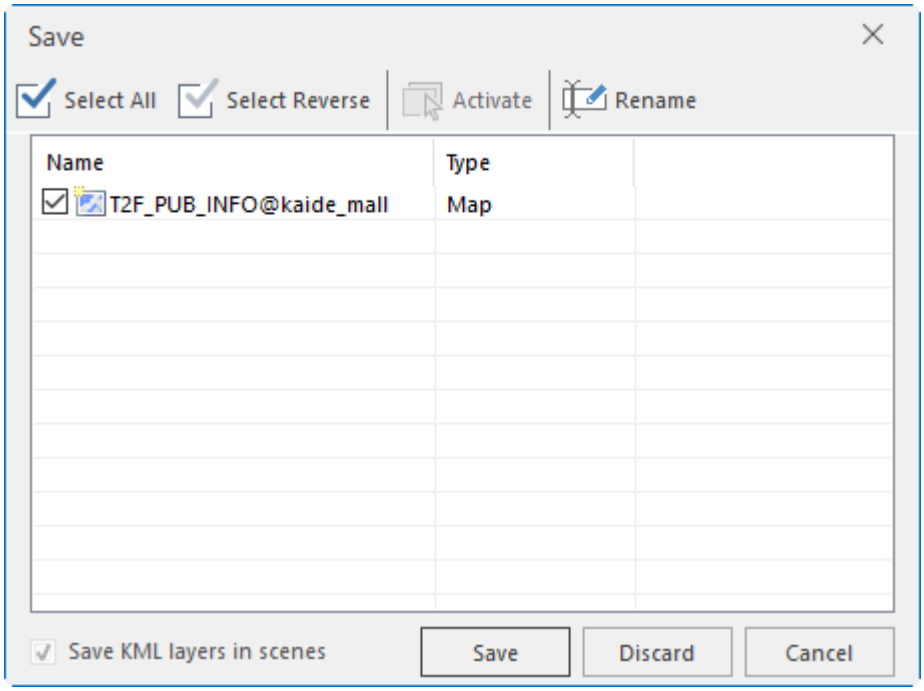

Figure 18 Save the map

2.1.3 Navigation Path Data Preparation

The raw indoor data needs to include path data stored in line datasets. You need to construct road network based on the path data for navigation. It is not necessary to add the road network to the map.

Click "Traffic Analysis"--"Network by Topology"--"Structure 2D Network", open the "Build Network Dataset" dialog box, select the dataset for the topology network, set the dataset name, click "OK" to complete the topology network.

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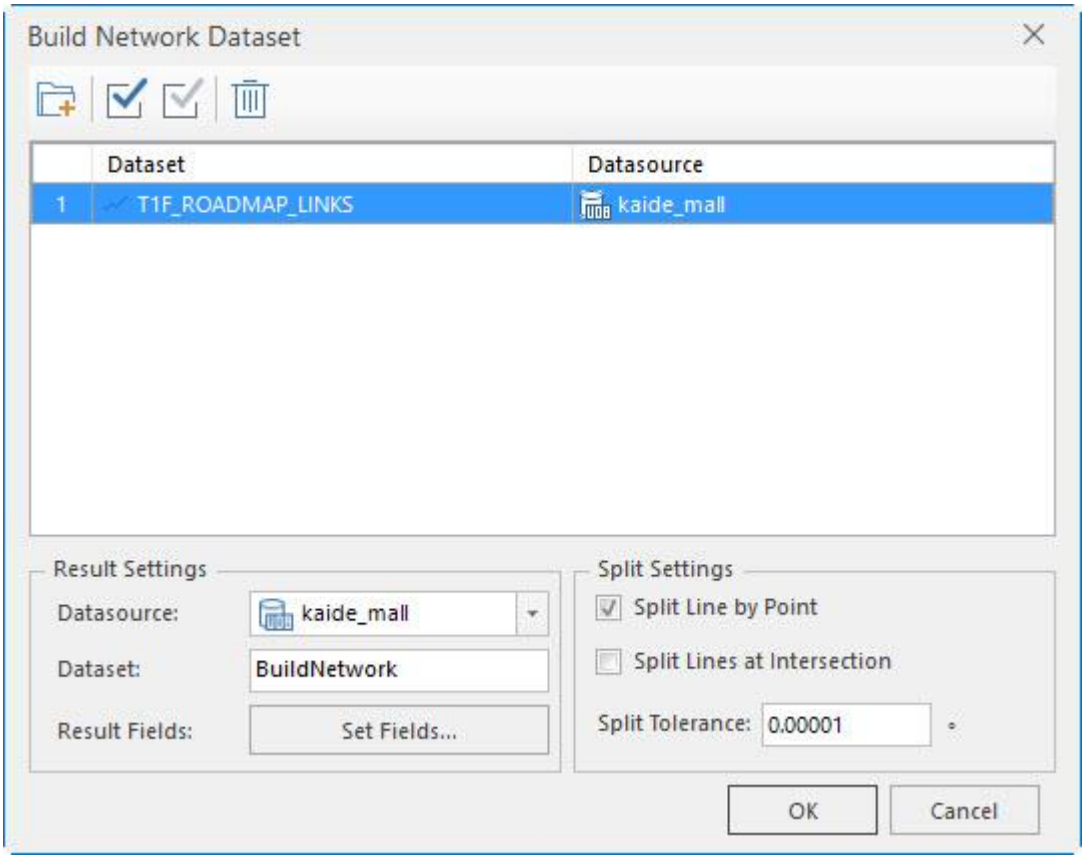

Figure 19 Construct 2D network dataset

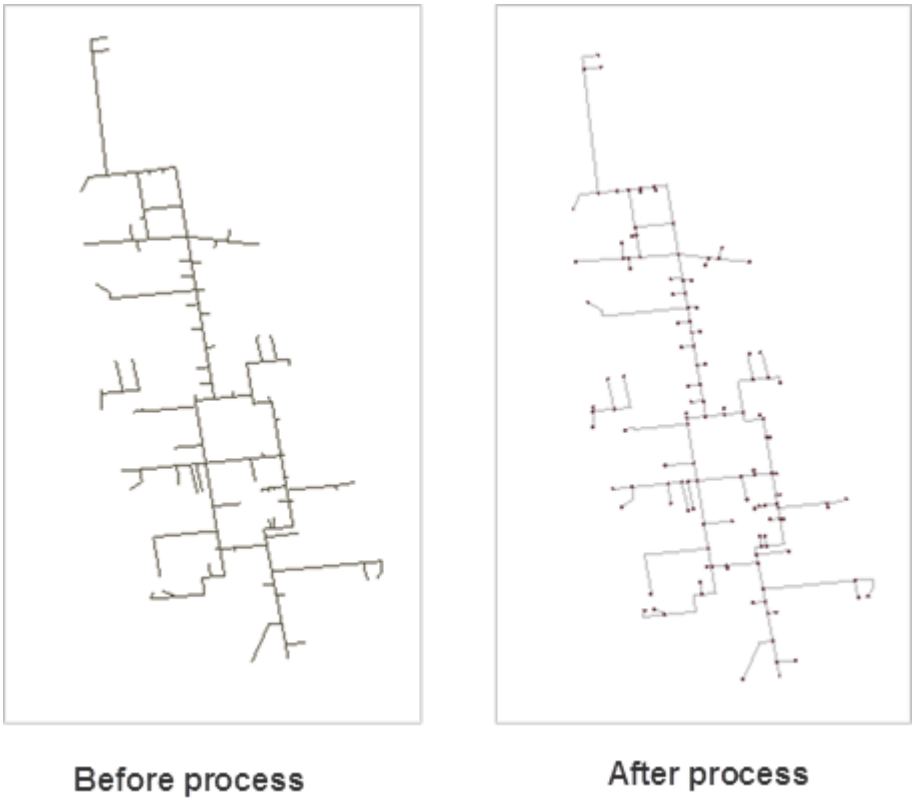

Figure 20 Comparison before and after constructing topology

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2.1.4 Bounds Data Preparation

The size of the bounds data should be the same or slightly larger than the indoor bounds to control the display of floor controls. The bounds data is a datasource named “bounds” (fixed name, cannot be changed) containing a region dataset named “ building” (fixed name, cannot be changed). The region dataset contains only one polygon.

Operations:

Step 1: Create a datasource: The datasource name is “ bounds”, and the storage path is the same as the path of the indoor datasource.

Right click Workspace Manager--Datasource, and click New File Datasource.

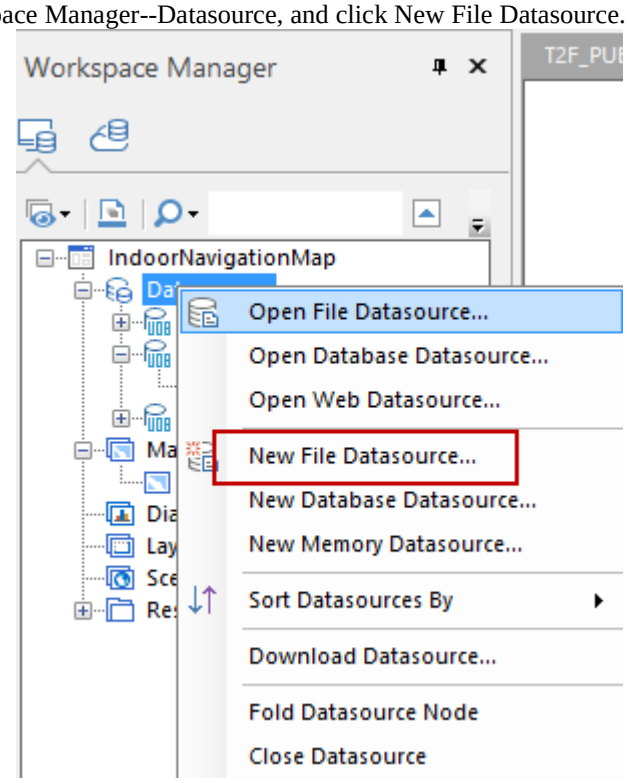

Figure 21 Create new datasource

Step 2: Create a region dataset Datset name is “building”. The dataset is a region dataset.

Right click Workspace Manager--The bounds datasource, and click New File Datasource.

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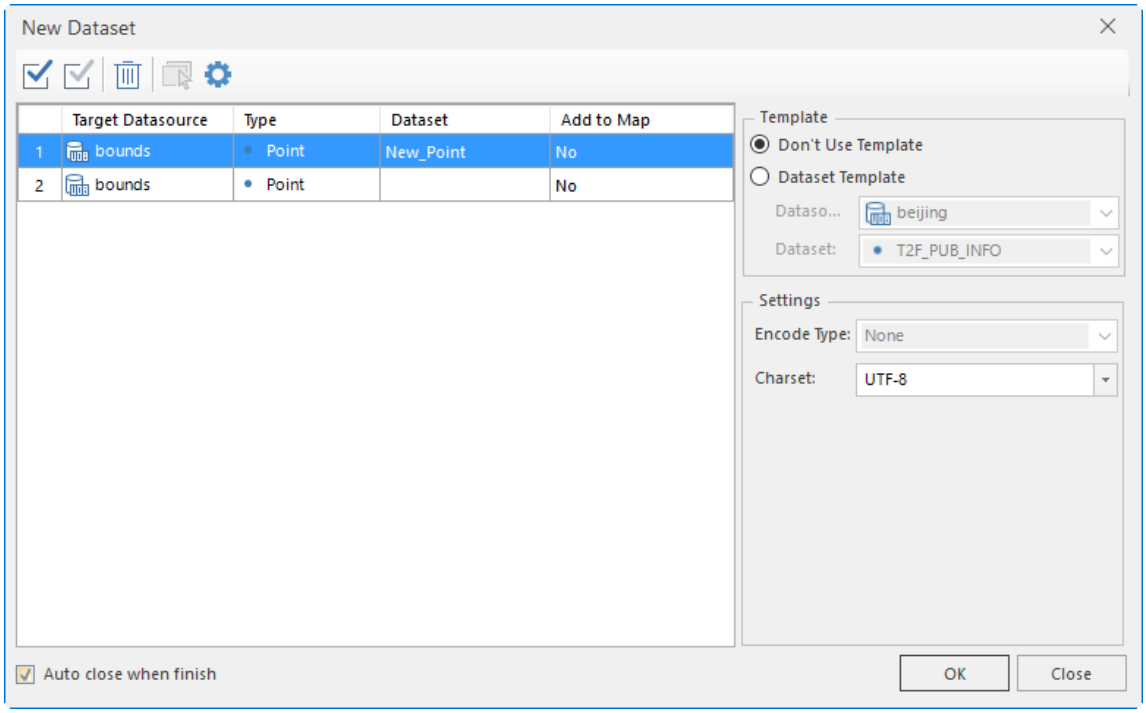

Figure 22 Create a region dataset

Step 3: Add a region object The number of polygons can only be 1, the size of the polygon should be the same as or slightly larger than the indoor map area, and the location should be the same as the indoor data.

1 Add dataset to map: Add the dataset to the map window by double-clicking the "building" dataset or right click on the dataset and click Add to New Map.

2 Set the dataset editable: In the Layer Manager, click the third button (the editable button) before the "building" dataset, or right click the dataset and select "Editable" to set the dataset to editable mode.

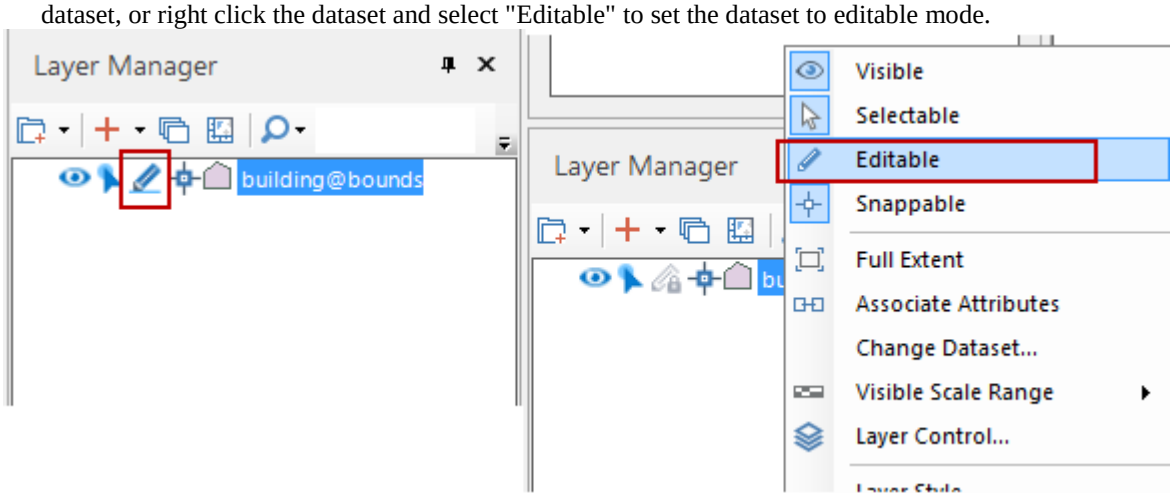

Figure 23 Two methods to set the layer editable

3 Drawing a region object: You can draw region objects in the building dataset following the steps below:

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Object Operations--Draw Objects--Region

If the original indoor data contains a region dataset that is similar to the entire indoor area, you can copy and save the dataset into the building dataset.

In Workspace Manager, right click the dataset to be copied, click Copy Dataset to open the dialog box for copying the dataset, where you can set the target datasource ”bounds“ and the name of the result dataset ”building“.

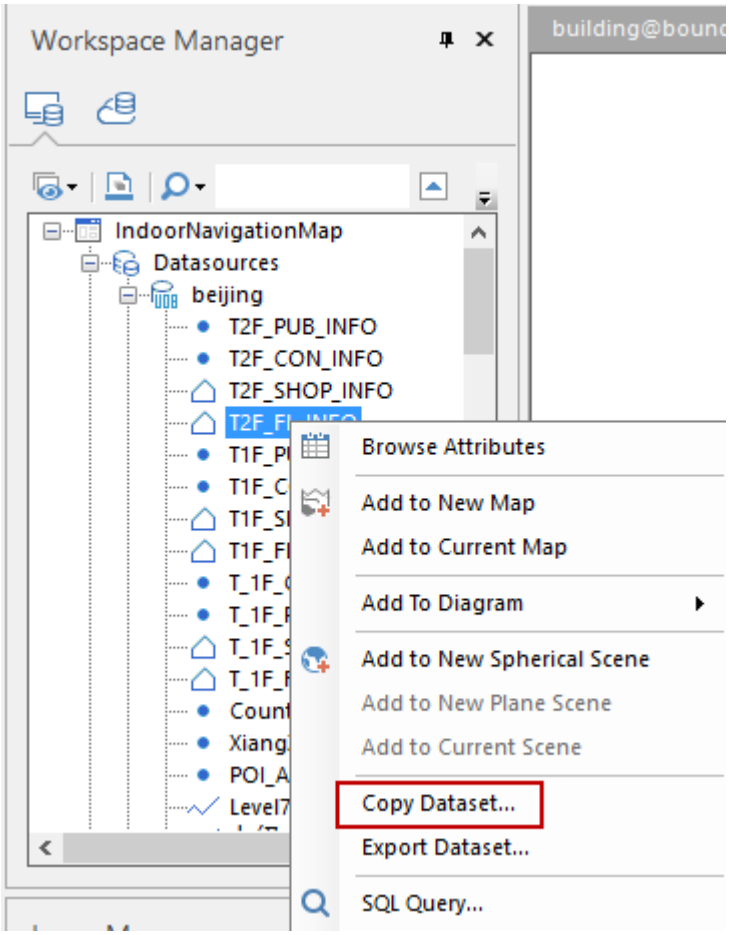

Figure 24 Copy dataset

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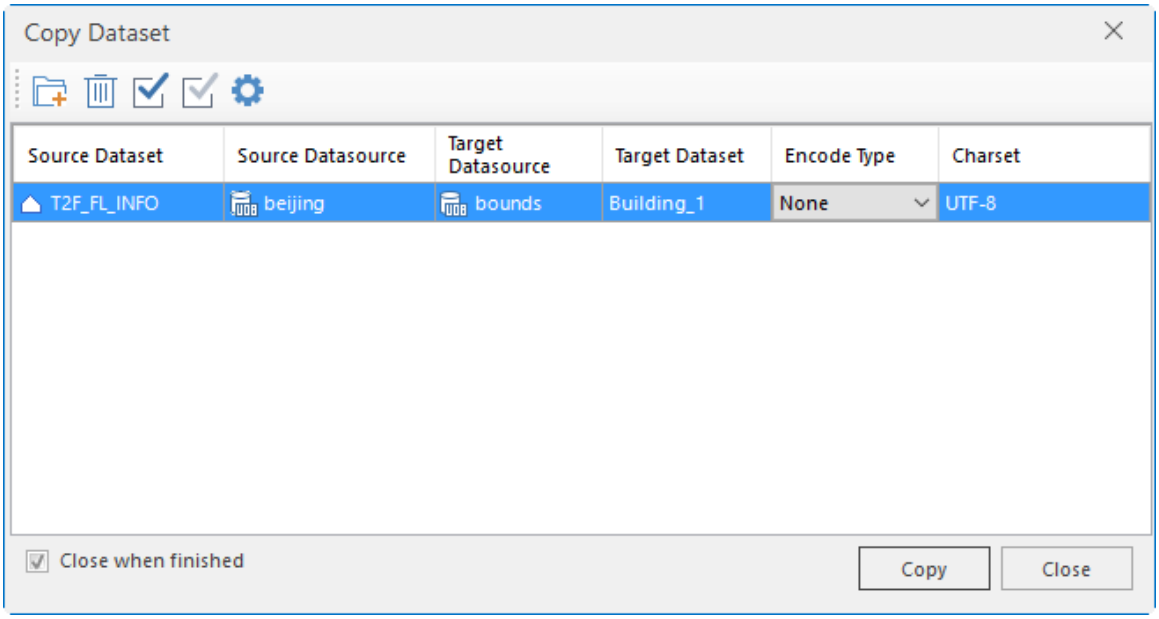

Figure 25 The dialog box for copying dataset

Step 4: Add attribute items. You need to add two fields LinkName“ and “ LinkDataSource” (the names are fixed and cannot be changed) for the building dataset.

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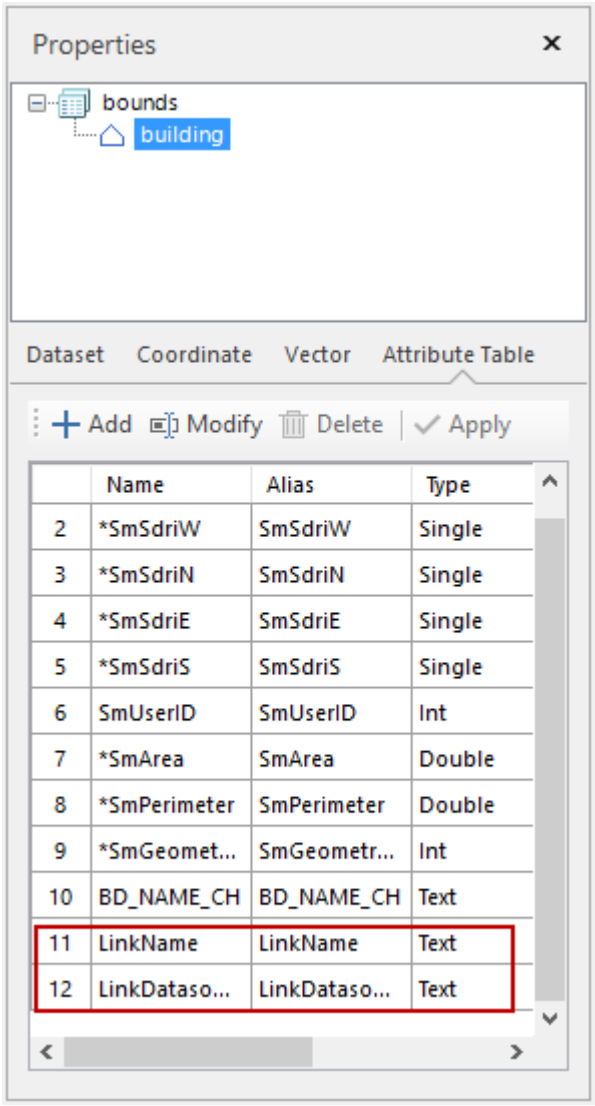

Figure 26 Add LinkName“ and “ LinkDataSource” fields

Step 5: Add attribute values

No	SmID	SmSdriW	SmSdriN	SmSdriE	SmSdriS	SmUserID	SmArea	SmPerimeter	SmGeometrySize	BD_NAME_CH	LinkName
1	2	116.352188	39.94286	116.353378	39.940731	0	12303.761831	597.976601	1816	KaideMall	LayerGroup#

Figure 27 Addvalues for LinkName“ and “ LinkDataSource” fields

The value of LinkName comes from the the upper level of the floor group in Layer Manager. You can get the value by right-clicking on the group, select Layer Properties, and get the value of the layer name in the Layer Properties window.

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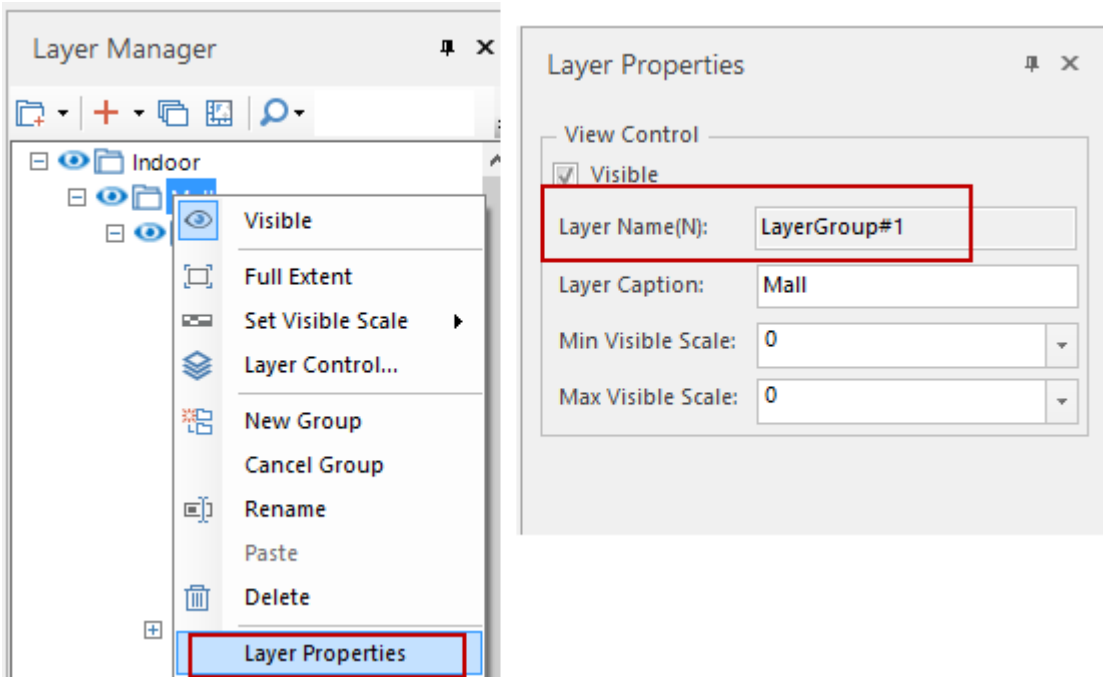
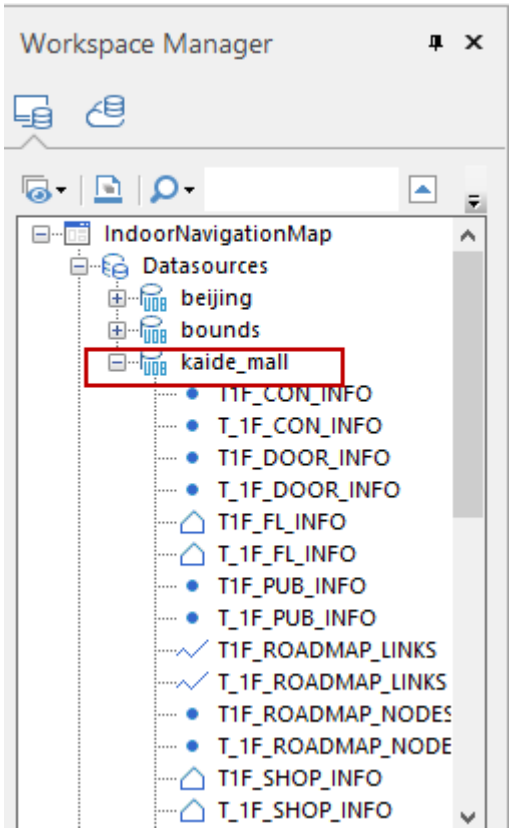


Fgiure 28 ”LinkName“ How to get attribute value

The value of LinkDataSource is the name of the datasource where the original navigation data is.



Fgiure 29 “LinkDataSource” How to get attribute value

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2.1.5 Attribute Data Preparation

The attribute dataset plays a critical role in navigation, and it must contain the following data items:

Layer Name	The name of the attribute field is "**LayerName**", which means the name of each floor in Layer Manager.
Floor ID	The name of the attribute field is "**FL_ID**", which is the same as the ID added for features of each floor.
Path File Name	The name of the attribute field is "**NetworkName**", which means the name of the dataset where the path data for each floor is.
Floor Name	The name of the attribute field is "**FloorName**", which is used for name display during floor switch.
Floor Index	The name of the attribute field is "**FloorIndex**", which means the index value for each floor.

Table 4 Attributes must be contained in the attribute dataset

Operations:

Step 1: Create the attribute dataset and store the dataset in the datasource where the original indoor data is. The name of the dataset is " FloorRelationTable" (cannot be changed).

Right click Workspace Manager--The datasource where the orginal data is, and click New Dataset.

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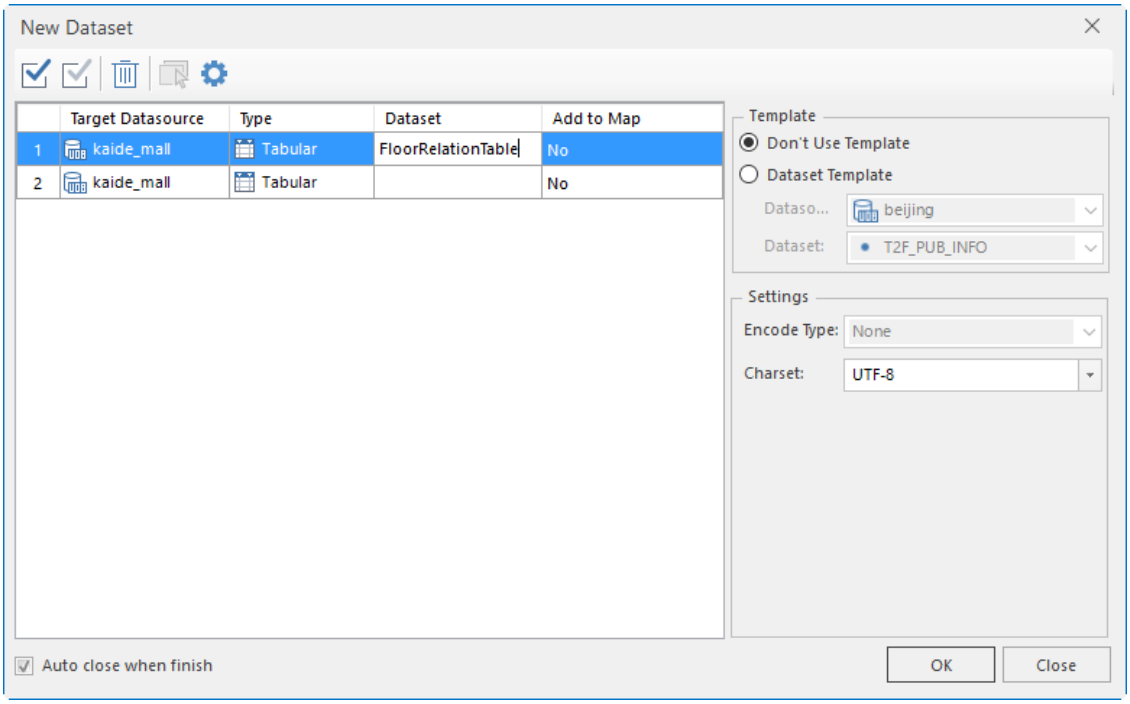

Figure 30 Create attribute table

Step 2: Add attribute items

On the FloorRelationTable dataset where you want to add the attribute items, right click, select Attributes--Attribute Table, open the list of attributes as shown below, and use 

to add the attribute items. Note: Attribute fields cannot repeat. Click Apply to take effect.

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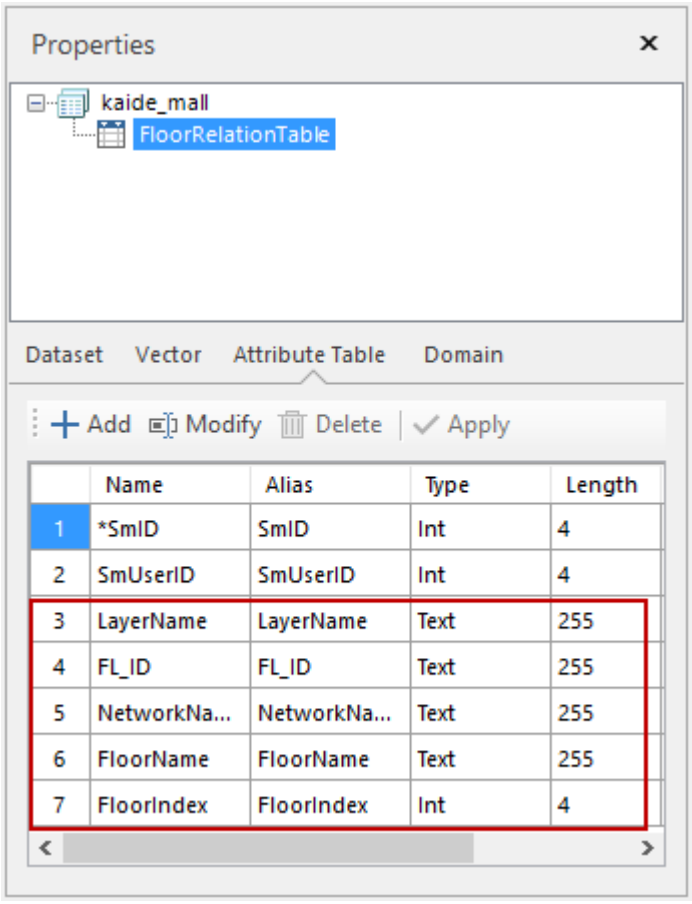

	Name	Alias	Type	Length
1	*SmID	SmID	Int	4
2	SmUserID	SmUserID	Int	4
3	LayerName	LayerName	Text	255
4	FL_ID	FL_ID	Text	255
5	NetworkNa...	NetworkNa...	Text	255
6	FloorName	FloorName	Text	255
7	FloorIndex	FloorIndex	Int	4

Figure 31 Add attribute items

Step 3: Add attribute values

On the FloorRelationTable dataset, right-click, select Browse Attributes, open the attribute table of the dataset as shown below, double-click an item in the property sheet and edit the attribute.

No	SmID	SmUserID	LayerName	FL_ID	NetworkName	FloorName	FloorIndex
1	1	0	LayerGroup#8	138690100100...	T_1F_Network	B1	-1
2	2	0	LayerGroup#3	138690110100...	T1F_Network	F1	1
3	3	0	LayerGroup#4	138690110200...	T2F_Network	F2	2

Figure 32 “FloorRelationTable” Add attributes

LayerName value that corresponds to the layer name for each floor in the layer manager.

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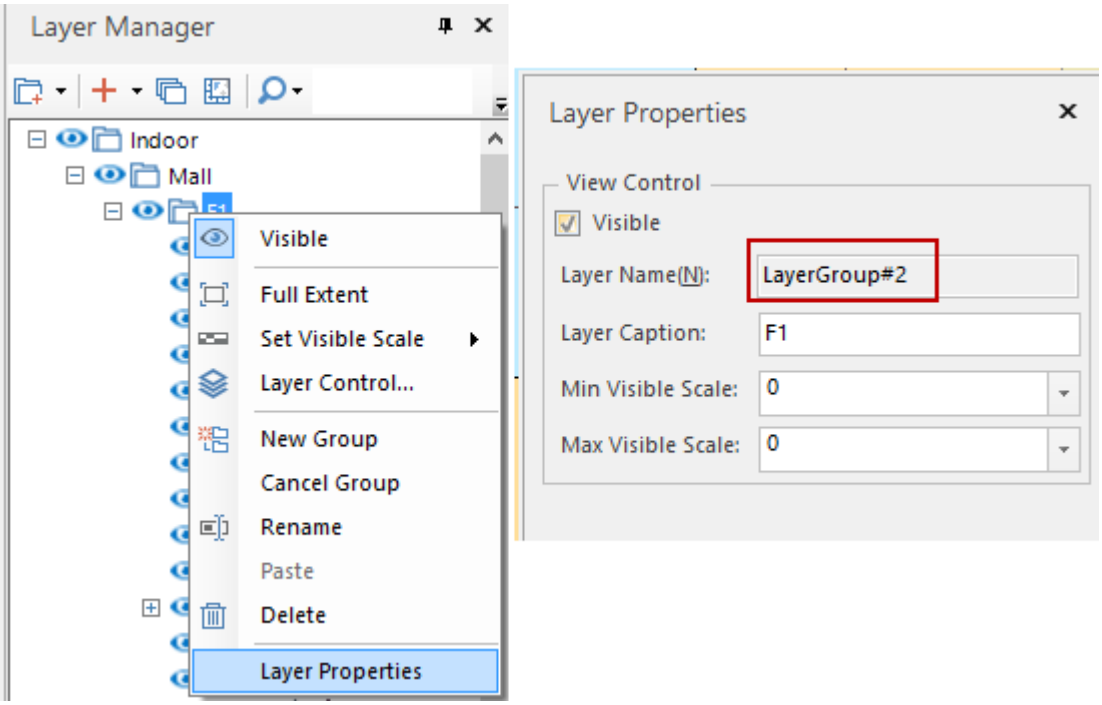

Figure 33 " The method to get layer name

FL_ID value: Floor ID. The floor ID for objects in each floor is the same.

NetworkName value is the name of the path navigation data for the floor.

Add: 6/F, Building 107, No. A10, Jiuxianqiao North Road, Chaoyang District, Beijing, 100015, CHINA, 100015
E-mail: request@supermap.com Website: www.supermap.com

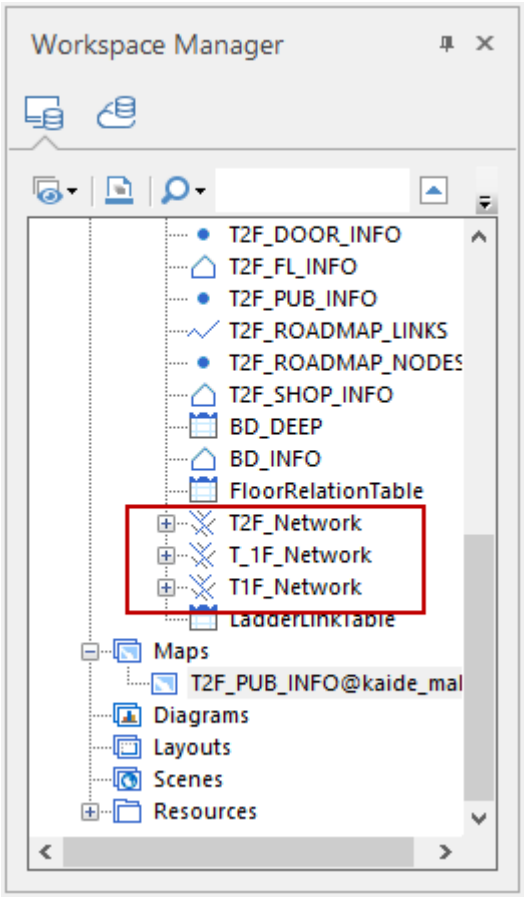

Figure 34 " The method to get path file name

FloorName value that is the floor name value displayed in the floor operator control on mobile devices.

FloorIndex value is the floor index. For example, the value for the ground floor is-1, the value for the 1st floor is 1, and the value for the 2nd floor is 2.

2.1.6 Line Symbol Library Settings

The navigation path drawn on mobile devices after path analysis can be set through the line symbol library.

In Workspace Manager, right click Resources, click Line Symbol Library to open the Line Symbol Library dialog box, select Import, click Import Line Symbol... to import .lsl file.

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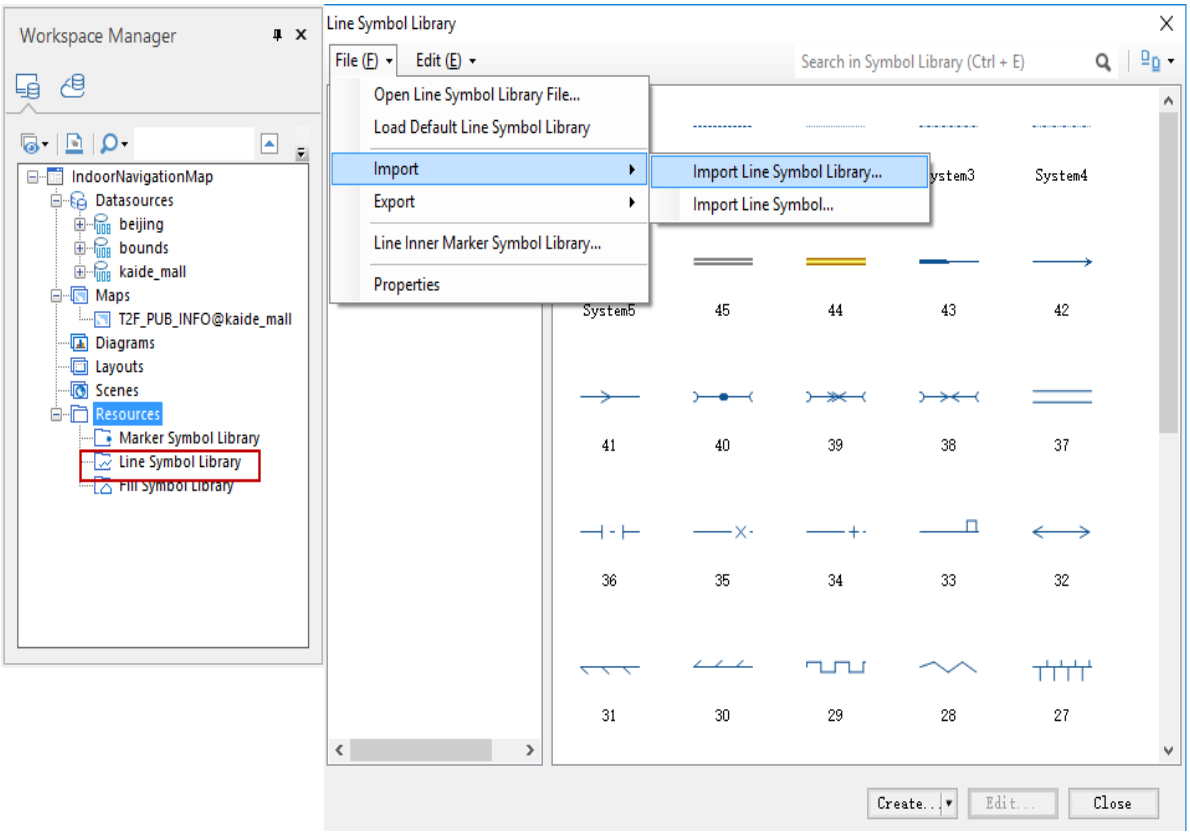

Figure 35 Import line symbol library

Or, you can edit line symbols in the Line Symbol Editor that displays when you click Edit->New Symbol->New 2D Symbol.

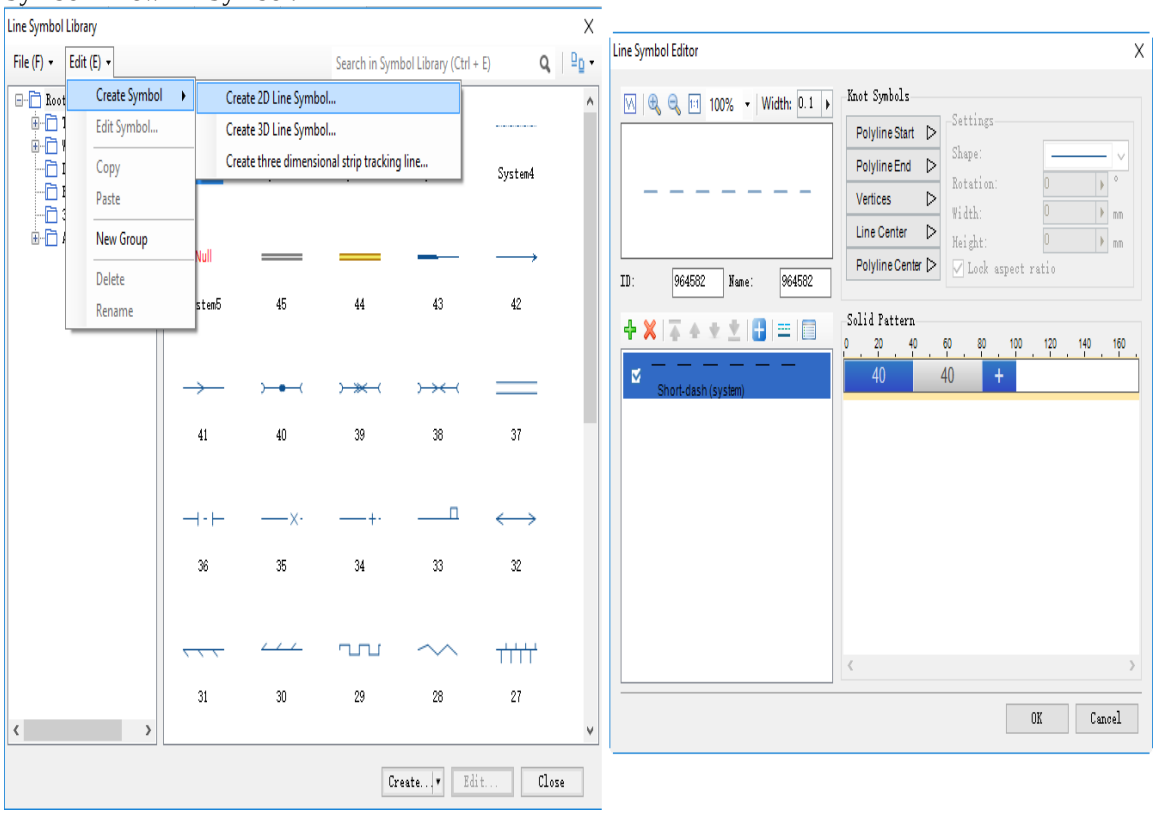

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Figure 36 Edit line symbol

2.1.7 Outdoor Map Data (Optional)

After the completion of the indoor data, the city map data can be superimposed as a base map, and the indoor and outdoor data can be integrated for usage. The production of outdoor data will not be introduced here.

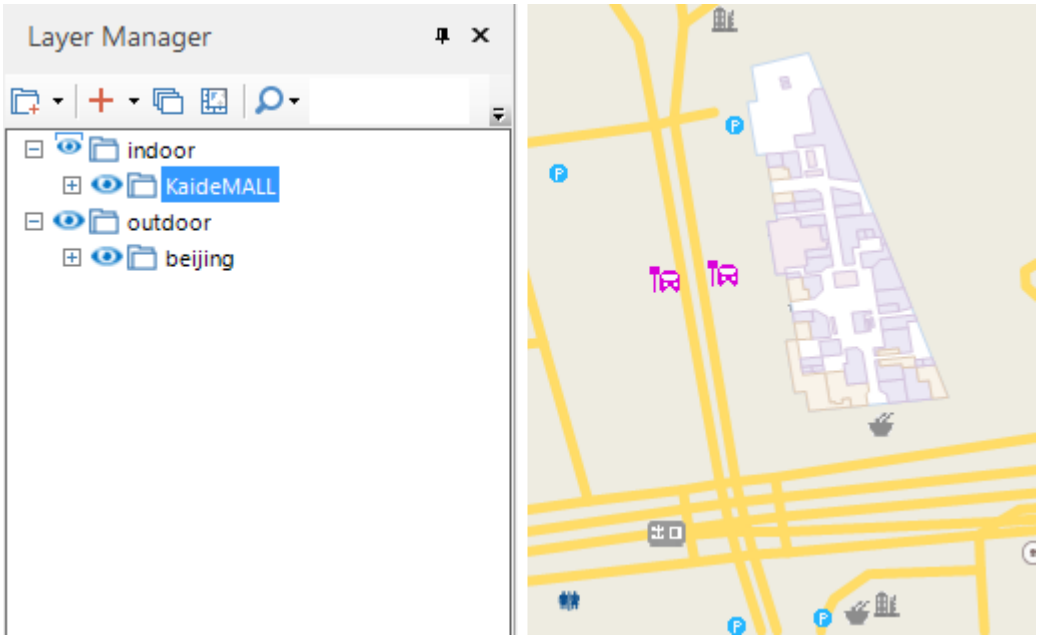

Figure 37 Integration of indoor and outdoor data

2.2 3D Indoor Map

2.2.1 Map Display and Data Preparation

2.2.2.1 Import Dataset

Import the original data into the import data source before preparing the data.

Operations:

step 1: Create a datasource. Workspace Manager--Right click Datasource--New File Datasource, enter datasource name and storage path.

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Step 2: Import the dataset Workspace Manager--Right click the datasource created in the 1st step—

Import Dataset, and add files for datasets via the Add File button.

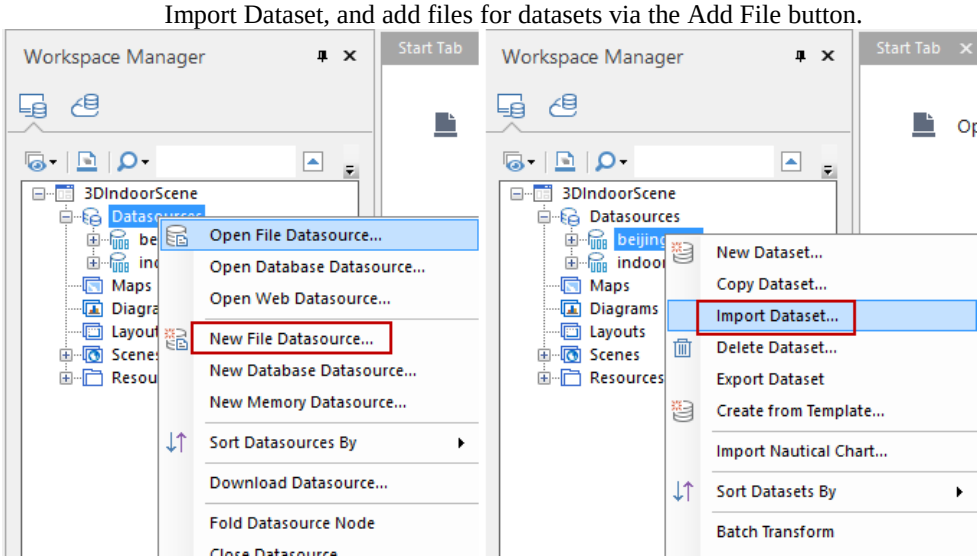

Figure 38 Create new datasource (left) and import dataset (right)

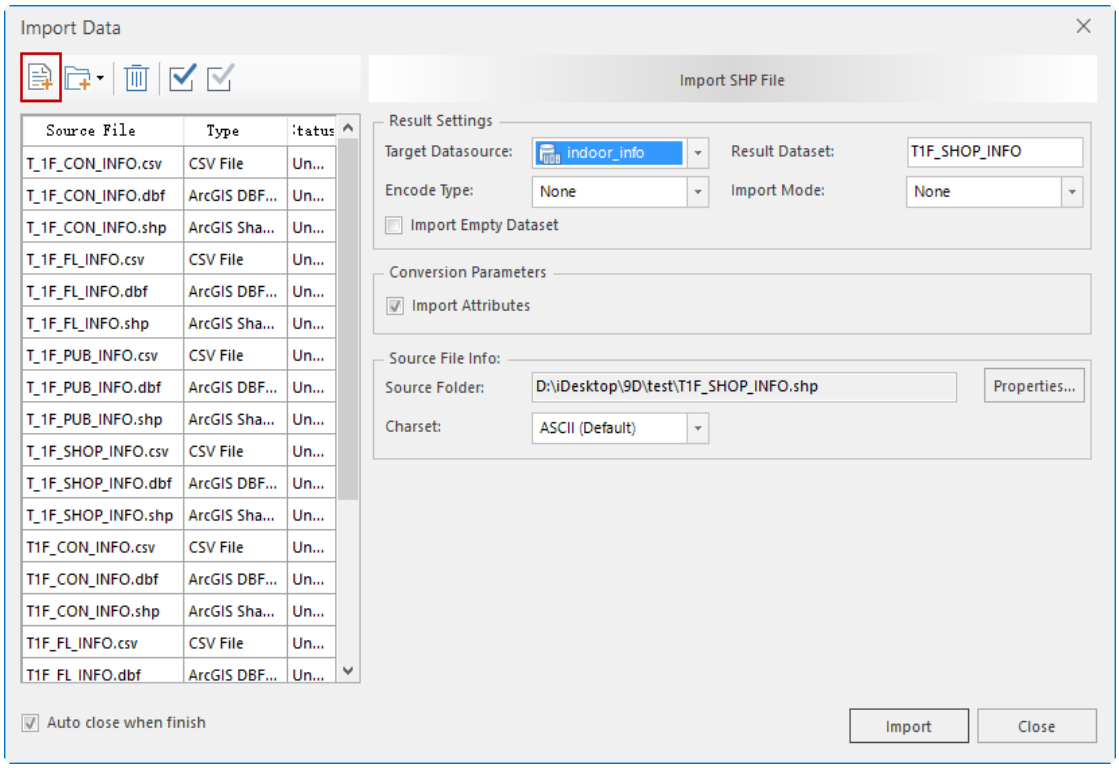

Figure 39 Add file

2.2.1.2 Create Spherical Scene

Right click Scenes in Workspace Manager, click New Spherical Scene to create a new scene. You will see the Layer Manager as follows:

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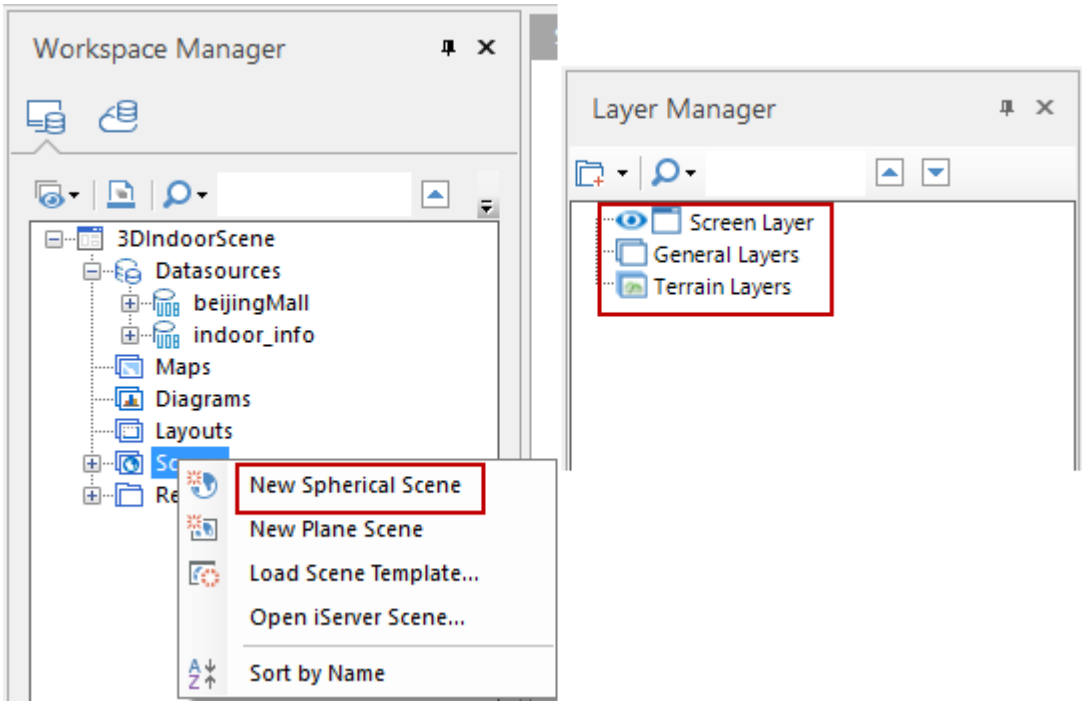

Figure 40 Create scene (left), results after creation (right)

After the spherical scene is created, add the dataset imported from the previous process to the current scene by dragging or right-clicking "Add to Current Scene". When finished, if you cannot find the layer you have added, select the layer in the layer manager, and right click quickly navigate to this layer.

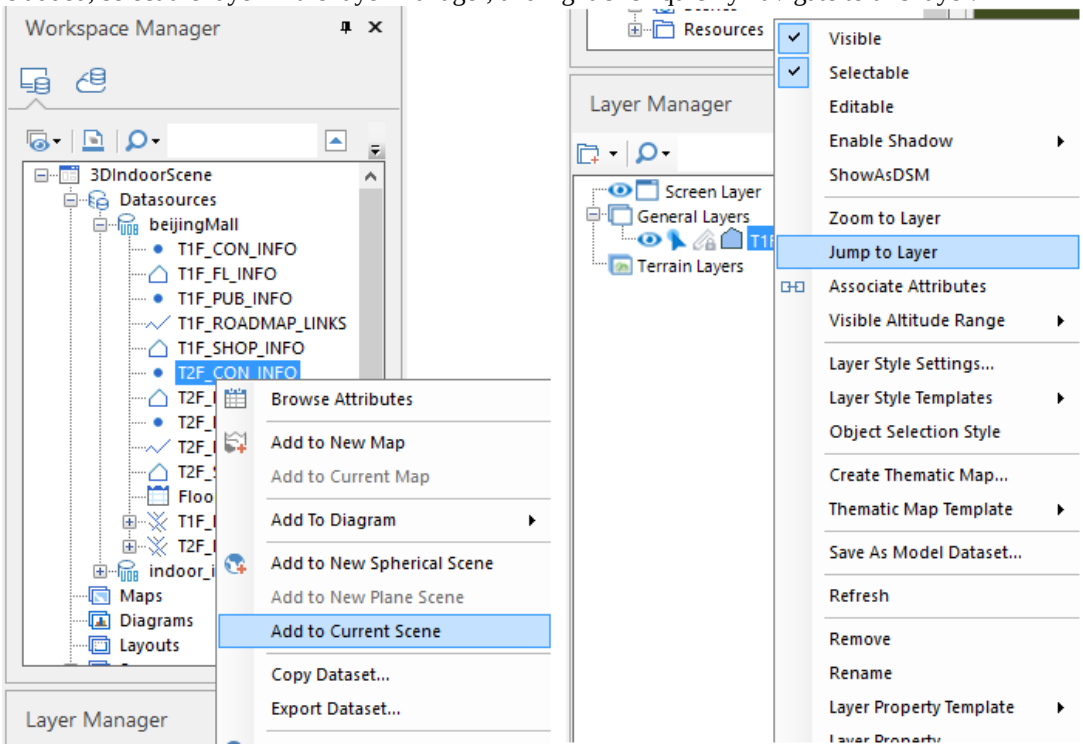

Figure 41 Add a layer to a scene (left), navigate to layer (right)

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2.2.1.3 Region Dataset Preparation

Region Data Attributes: The region data must contain the following attributes:

Floor ID	The attribute field name is called "**FL_ID**" (the name cannot be changed). It will be used for floor display, path analysis, and navigation. Each floor has an ID, and the floor IDs for all the features on the same floor are the same.
Type	Used to make unique value thematic map, which displays in different colors depending on the type. You can set the value of a type based on different attributes of the object. Take shopping malls for example, shops, elevators, toilets can be set to different types.
Name	Used to make the label thematic map, and display the name on the maps.

Table 5 Attributes must be contained in the region dataset

Step 1: Add attribute items: If the dataset does not contain the above attributes, you need to manually add the content.

On the region dataset where you want to add the attributes, right click, select Attributes--Attribute Table, open the list of attributes as shown below, and add the attribute items. You need to click Apply to take effect.

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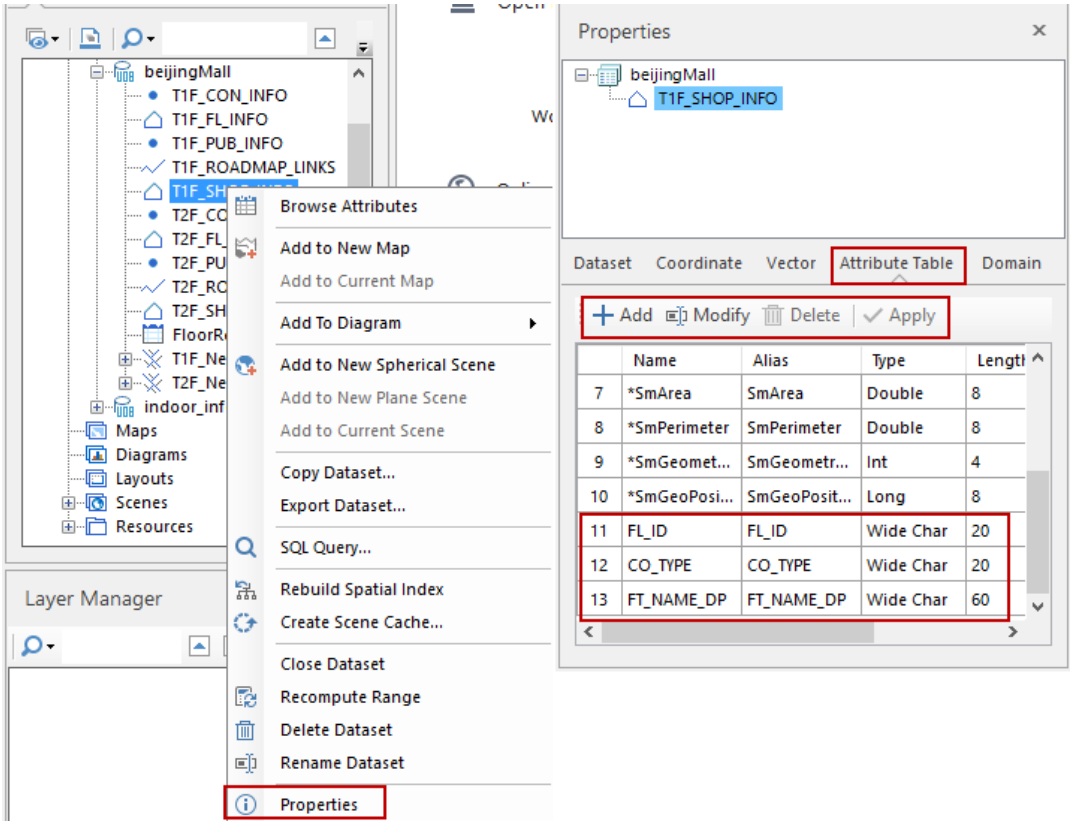

Figure 42 Open attribute list (left), attribute adding results (right)

Step 2: Add attribute values: When the attribute item is added, you can add the corresponding attribute to each object in the dataset.

On the above-mentioned dataset, right-click, select Browse Attributes, open the attribute table of the dataset as shown below, double-click an item in the property sheet (item with * cannot be edited) and edit the attribute.

Add: 6/F, Building 107, No. A10, Jiuxianqiao North Road, Chaoyang District, Beijing, 100015, CHINA, 100015
E-mail: request@supermap.com Website: www.supermap.com

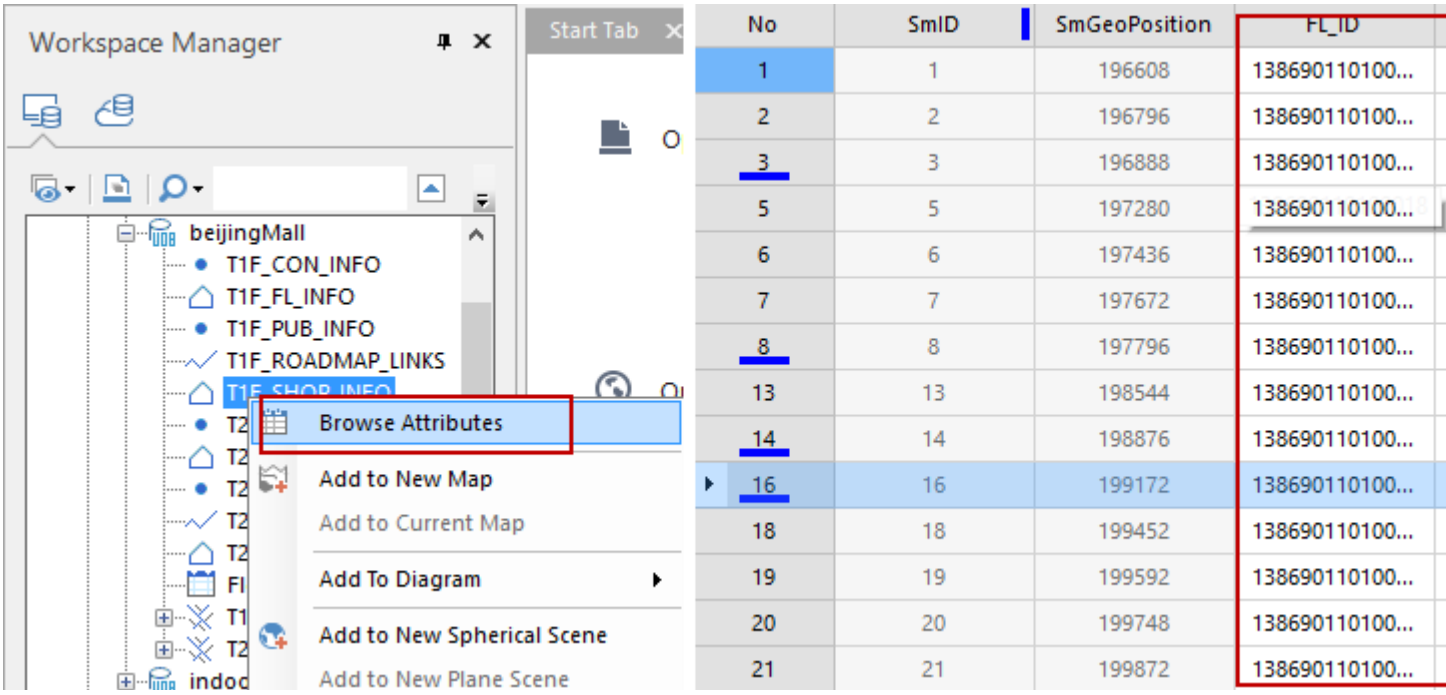

Figure 43 Add attribute values

Step 3: Create unique value thematic map, which displays objects in different colors depending on the types.

In the Layer manager, select the region dataset layer, right-click, select "Create Thematic Map"--"Unique Values Map"--"Default", the following "Thematic Map" setting interface will display. Select expression. You can select appropriate colors via color ramps, or open Fill Symbol Selector via Styles button for color settings.

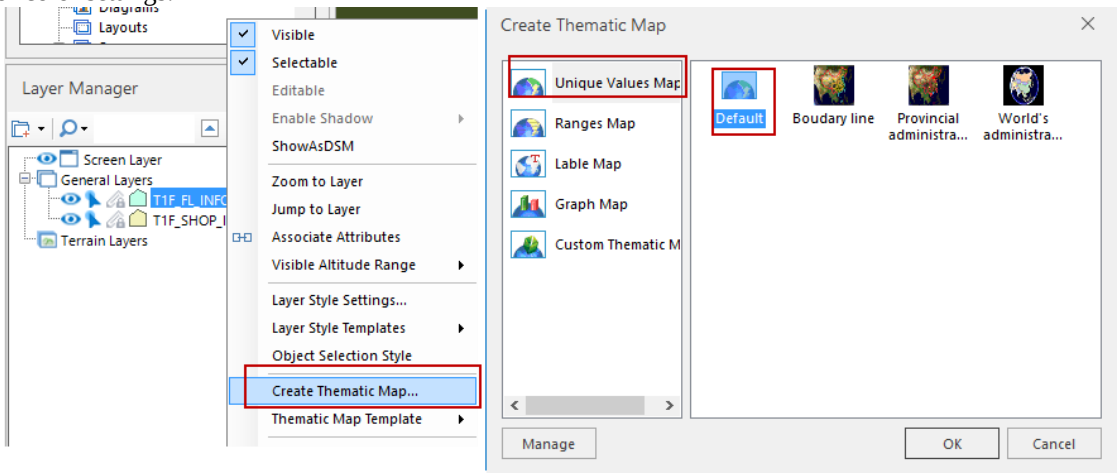

Figure 44 Create unique values map

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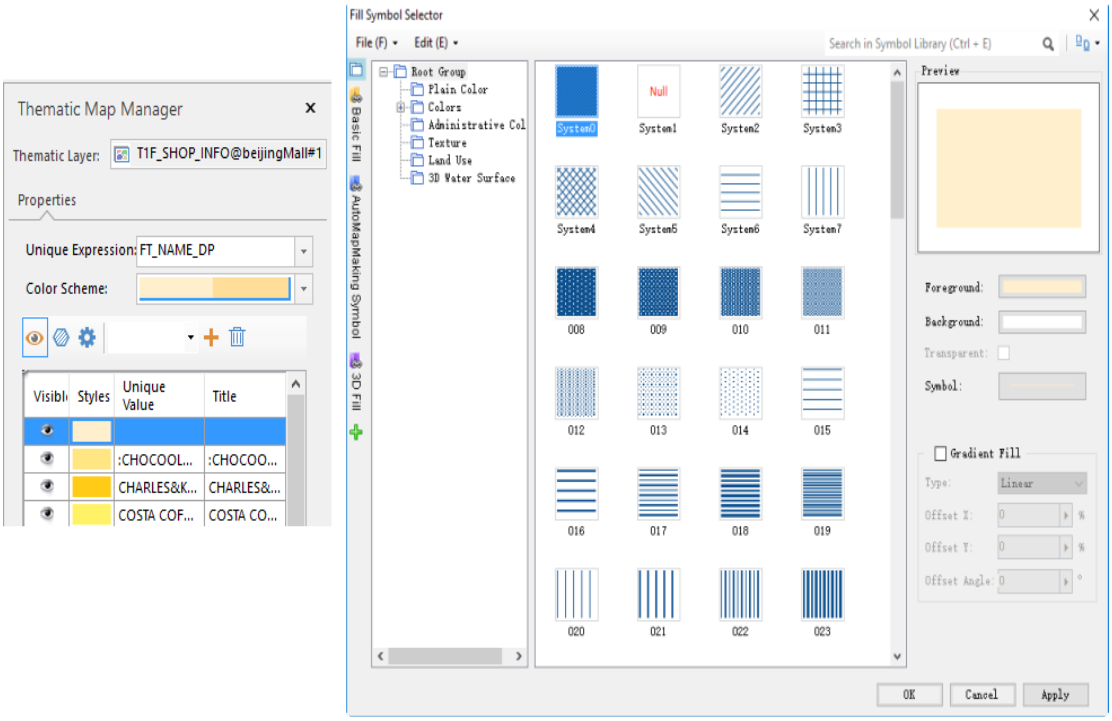

Figure 45 Settings for label maps

When finished, you can convert it into 3D.

In Layer Manager, select the thematic layer, you will find altitude modes via Style Settings-->Stretch Settings. Absolute, Bottom Elevation and Stretch Elevation are available for your choice. Note that here the bottom elevation of this layer equals the sum of the bottom elevation and stretch elevation of the next layer.

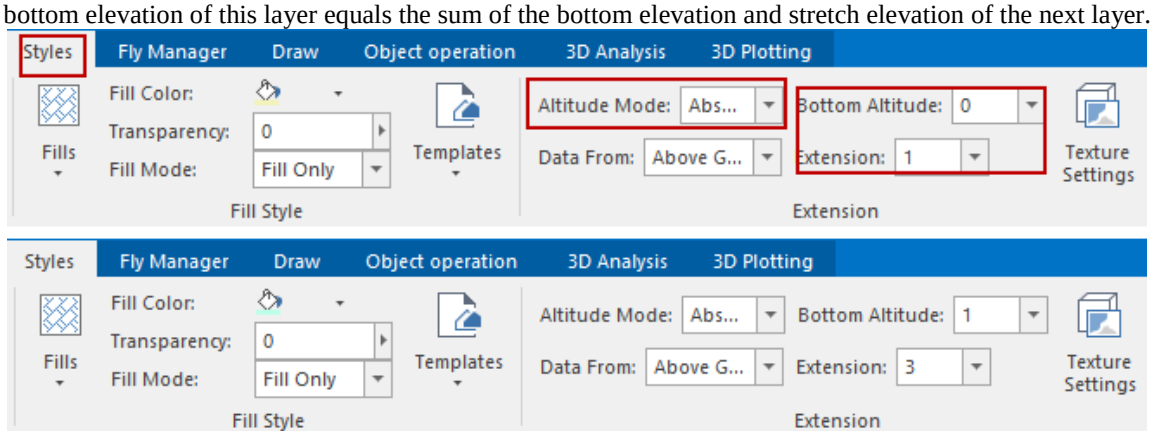

Figure 46 Stretch reference of the 1st layer (top), stretch reference of the 2nd layer (bottom)

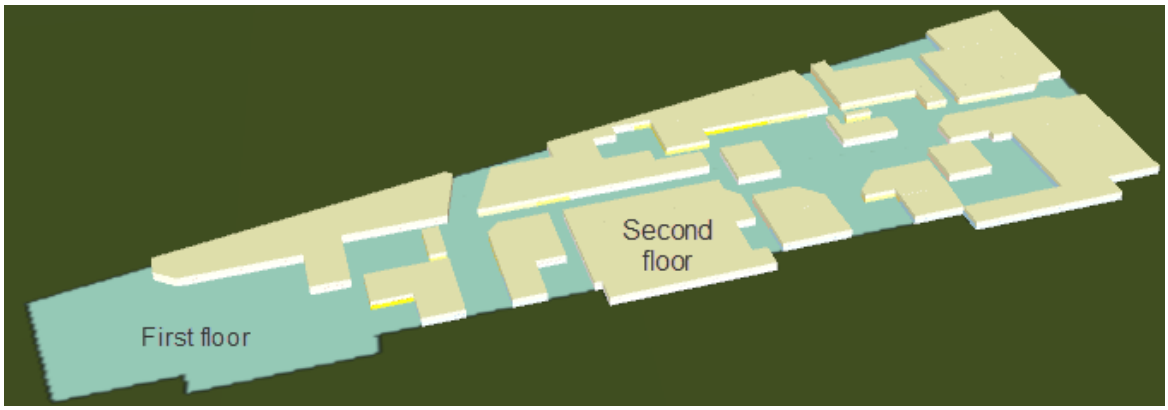

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Figure 47 Effects after stretch

Step 4: Create lable map and display names as labels.

In the Layer manager, select the region dataset layer, right-click, select "Create Thematic Map"--"Label Map"--"Default", the following "Thematic Map" setting interface will display. Select express and set for it.

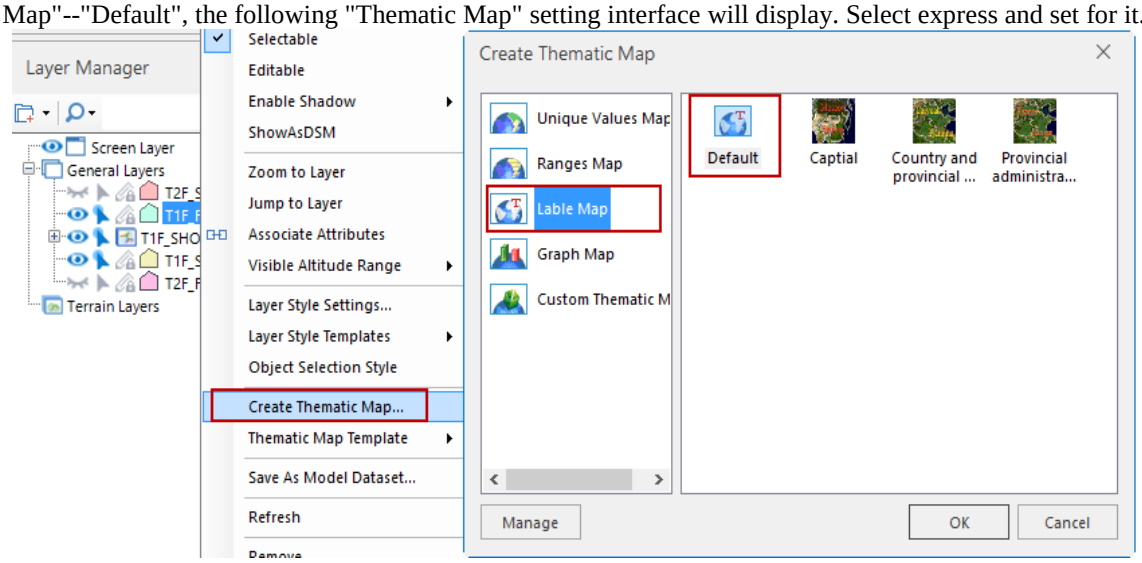

Figure 48 Create label maps

When you finish creating label map, you still need to perform stretch settings. Note that the Bottom Elevation and Stretch Elevation are the same with that of the corresponding label map.

2.2.1.4 Point Data Preparation

Step 1: Add attribute items: The method is the same as the adding attribute items for region datasets. You can add attribute items following steps below.

Floor ID	The attribute field name is called "**FL_ID**" (the name cannot be changed). It will be used for floor display, path analysis, and navigation. Each floor has an ID, and the floor IDs for all the features on the same floor are the same.
Type	Used to make unique value thematic map, which displays in different colors depending on the type. You can set the value of a type based on different attributes of the object. Take shopping malls for example, shops, elevators, toilets can be set to different types.
Name	Used to make the label thematic map, and display the name on the maps.

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Table 6 Attributes must be contained in the point dataset

In addition to the above attribute items, staircases (including escalators, ladders, straight ladders, etc.) must also contain the following attribute items because of the navigation involved.

Staircase ID	The attribute field name is " **FT_ID**", and each layer of stairs has an ID value. Even if parts of straight ladder on have different IDs.
Staircase Type	The "Type" in the table above. In the staircase attributes, the name of the attribute item must be "**FT_TYPE**".
Floor Arrived	The attribute field name is "**TO_CON**", in the form of "#Floor Arrived#ID of the next floor". For example, if you have arrived at the staircase with the ID 138690310200334 on the 2nd floor, the attribute value is " #2#138690310200334". Each staircase only needs to correspond to the upper stair. For example, for floor 1, the attribute of this field is 2. For the top level, this attribute can be empty.

Table 7 Attributes must be contained in the staircase data

Attribute items are added with the same region data's attribute items, please refer to the steps of of adding attribute items for region dataset.

Step 2: Add attribute values The method is the same as the adding attribute values for region datasets. You can add attribute values following steps below.

2.2.1.5 Save Map and Workspace

Process data for each layer according to the method above.

Figure 49 Effects for 3D scene

Click "Start"--"Workspace"--"Save". In the window for saving the map, enter the map name and save the map. Save the workspace by entering the workspace name and storage location in the window for saving the workspace.

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Tip: To prevent data loss, you can save it from time to time during data production.

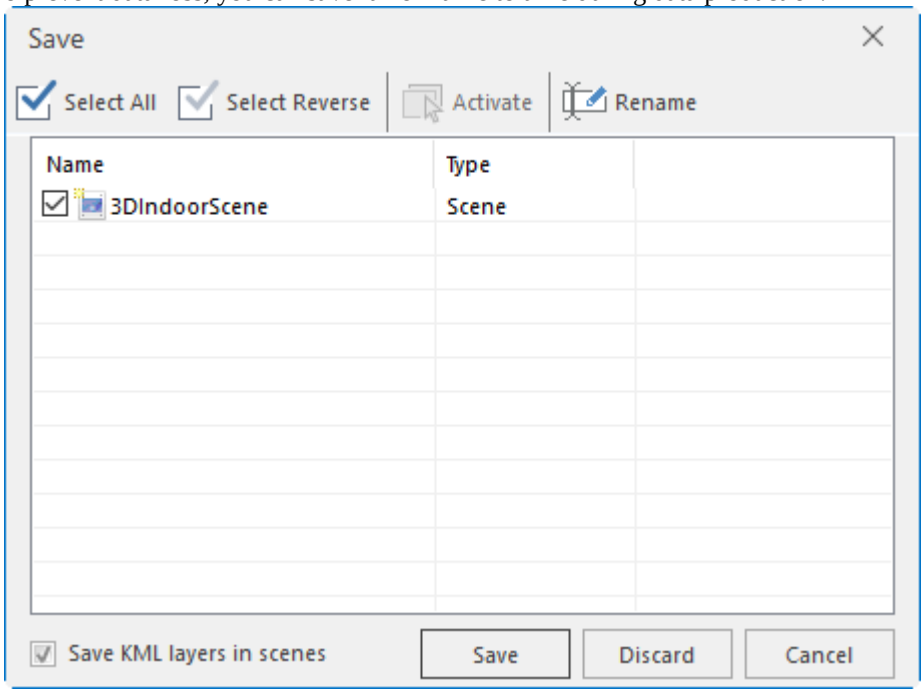

Figure 50 Save 3D scene

2.2.2 Navigation Path Data Preparation

The raw indoor data needs to include path data stored in line datasets. You need to construct road network based on the path data for navigation. It is not necessary to add the road network to the map.

Click "Network Analysis"--"Construct Network on Topology"--"Construct 2D Network", open the "Construct 2D Network Dataset" dialog box, select the dataset for the topology network, set the dataset name, click "OK" to complete the topology network.

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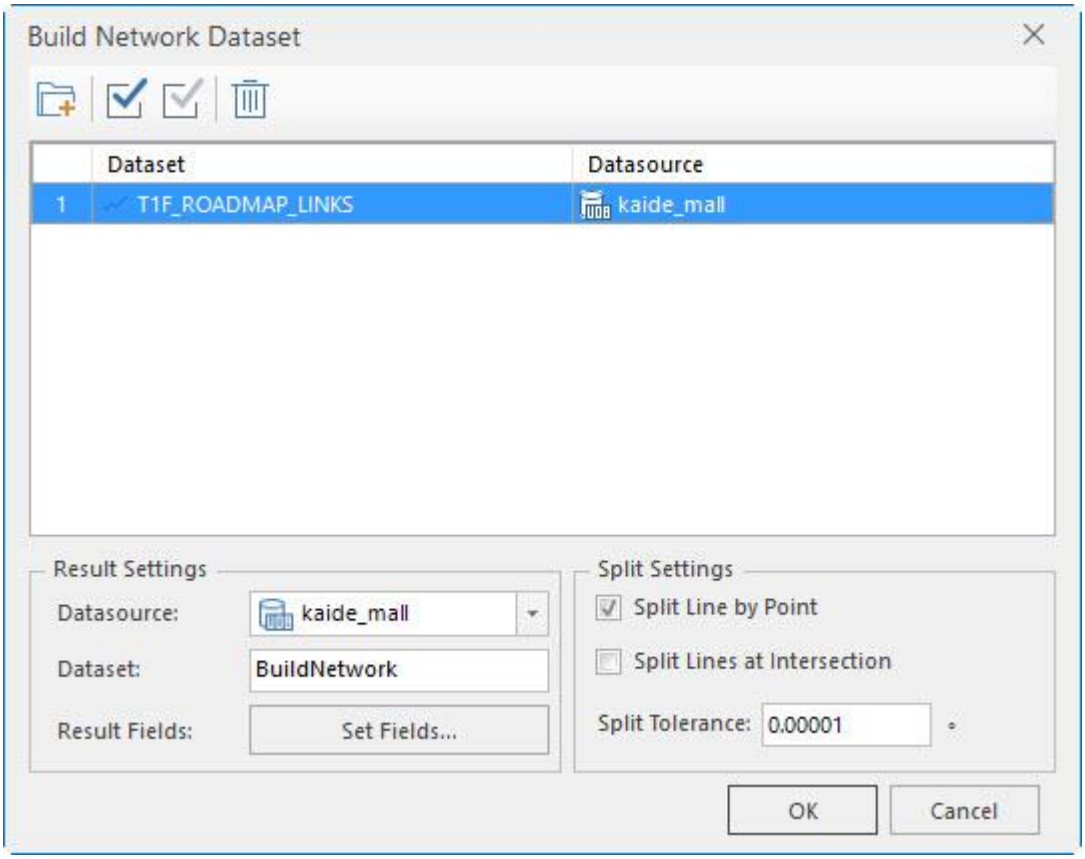

Figure 51 Construct 2D network dataset

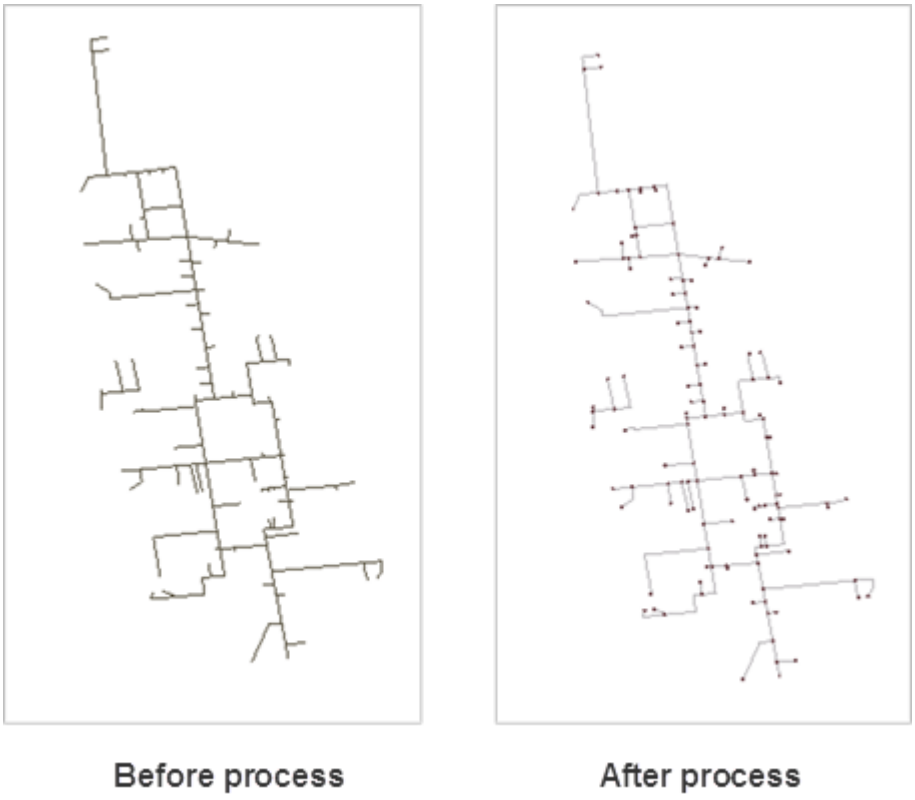

Figure 52 Comparison before and after constructing topology

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2.2.3 Attribute Data Preparation

The attribute dataset plays a critical role in navigation, and it must contain the following data items:

Floor ID	The name of the attribute field is "**FL_ID**", which is the same as the ID added for features of each floor.
Path File Name	The name of the attribute field is "**NetworkName**", which means the name of the dataset where the path data for each floor is.
Floor Name	The name of the attribute field is "**FloorName**", which is used for name display during floor switch.
Floor Index	The name of the attribute field is "**FloorIndex**", which means the index value for each floor.
Elevation	The name of the attribute field is "**Height**", which means the elevation for each floor.

Table 8 Attributes must be contained in the attribute dataset

Operations:

Step 1: Create the attribute dataset and store the dataset in the datasource where the original indoor data is. The name of the dataset is " FloorRelationTable" (cannot be changed).

Right click Workspace Manager--The datasource where the orginal data is, and click New Dataset.

Add: 6/F, Building 107, No. A10, Jiuxianqiao North Road, Chaoyang District, Beijing, 100015, CHINA, 100015
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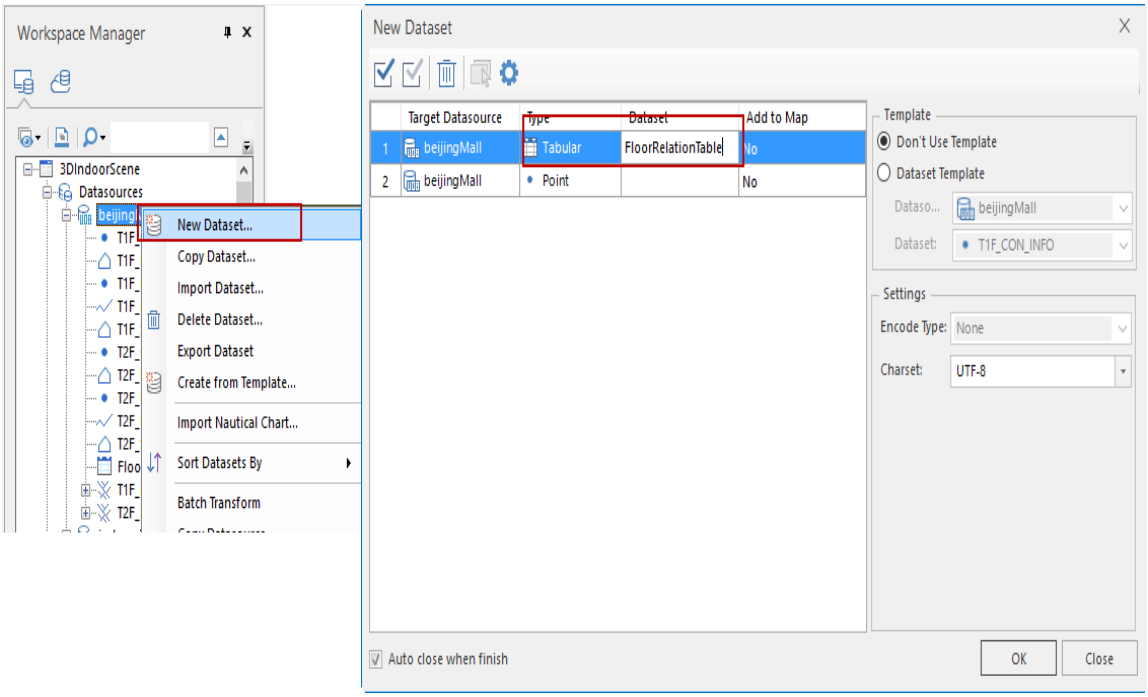

Figure 53 Create attribute table

Step 2: Add attribute items

On the FloorRelationTable dataset where you want to add the attribute items, right click, select Attributes--Attribute Table, open the list of attributes as shown below, and use 

to add the attribute items. Note: Attribute fields cannot repeat. Click Apply to take effect.

Add: 6/F, Building 107, No. A10, Jiuxianqiao North Road, Chaoyang District, Beijing, 100015, CHINA, 100015
E-mail: request@supermap.com Website: www.supermap.com

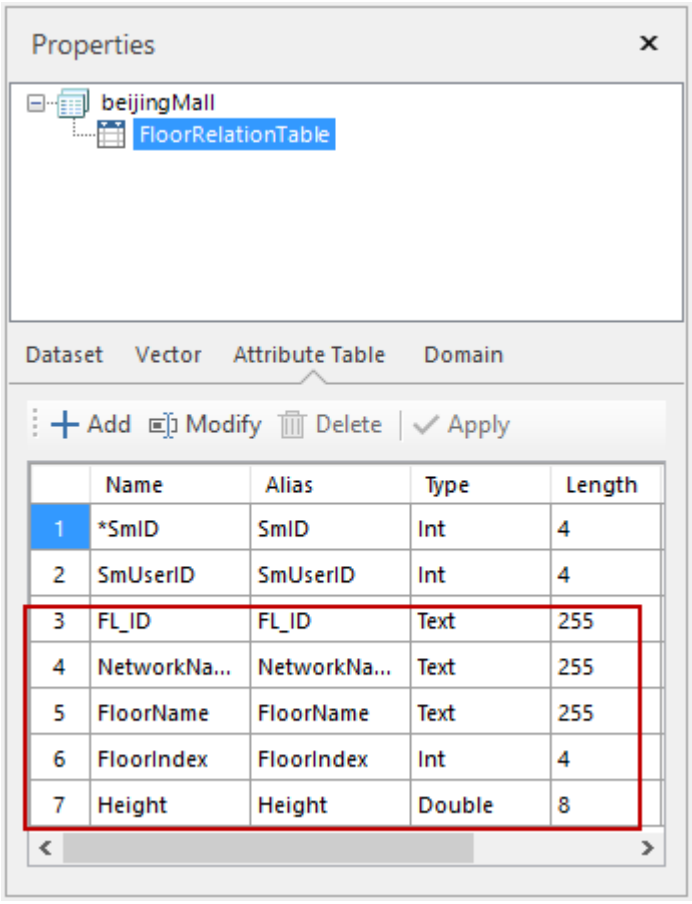

Figure 54 Add attribute items

Step 3: Add attribute values

On the FloorRelationTable dataset, right-click, select Browse Attributes, open the attribute table of the dataset as shown below, double-click an item in the property sheet and edit the attribute.

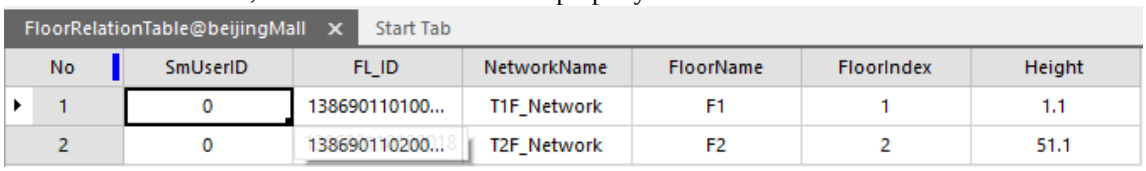

Figure 55 “FloorRelationTable” Add attributes

FL_ID value: Floor ID. The floor ID for objects in each floor is the same.

NetworkName value is the name of the path navigation data for the floor.

Add: 6/F, Building 107, No. A10, Jiuxianqiao North Road, Chaoyang District, Beijing, 100015, CHINA, 100015
E-mail: request@supermap.com Website: www.supermap.com

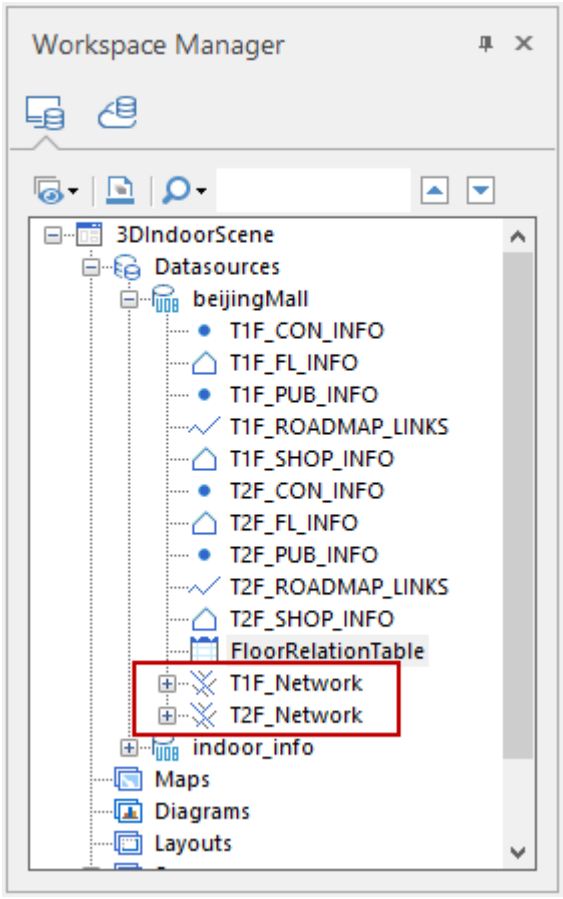

Figure 56 " The method to get path file name

FloorName value that is the floor name value displayed in the floor operator control on mobile devices.

FloorIndex value is the floor index. For example, the value for the ground floor is-1, the value for the 1st floor is 1, and the value for the 2nd floor is 2.

Height value: Floor elevation. The method to acquire it is to calculate the sum "Bottom Elevation" + "Stretch Elevation" + 0.1. To ensure the proper display of analysis results, here we add 0.1 to the final results.

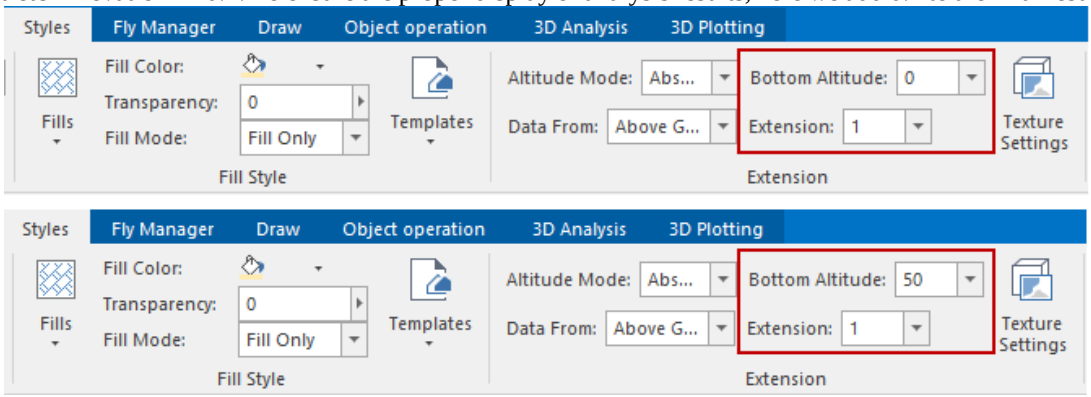

Figure 57 how to get "Elevation"

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2.2.4 Camera Properties

The camera data is used to save the camera location when switching floors. The data source name is “indoor_info” (fixed name, cannot be changed), the dataset name is "CameraInfo” (fixed name, cannot be changed), and the type is attribute dataset.

step 1: Create a datasource.

Workspace Manager--Right click Datasource--New File Datasource, enter datasource name “ indoor_info”.

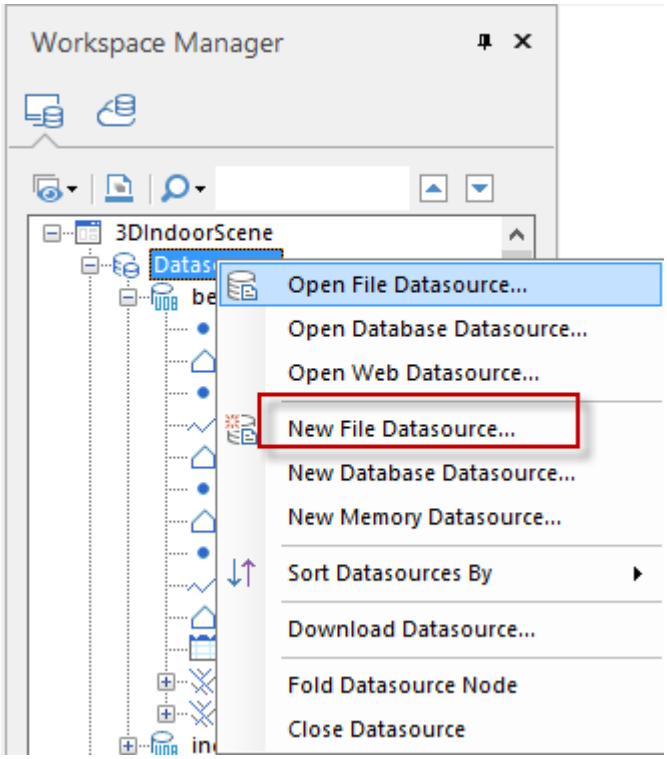

Figure 58 Create new datasource

step 2: Create a dataset.

The name of the dataset is “ CameraInfo”. The dataset is an attribute dataset.

Right click Workspace Manager--The indoor_infodatasource, and click New Dataset.

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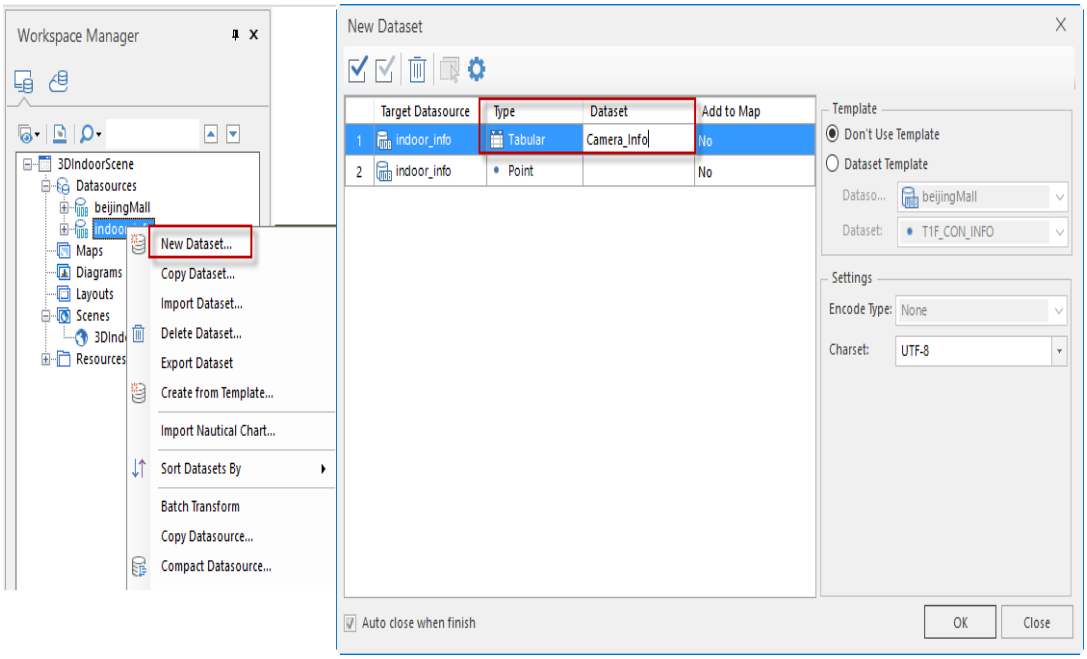

Figure 59 Create attribute table

Step 3: Create attribute items.

Attribute items contain following contents:

Longitude	**Longitude**
Latitude	**Latitude**
Altitude	**Altitude**
Heading	**Heading**
Tilt	**Tilt**
Floor Index	**FloorIndex**
Floor Name	**FloorName**

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Floor ID	**FloorID**

Table 9 Attribute items for camera parameters

On the CameraInfo dataset where you want to add the attribute items, right click, select Attributes--Attribute Table, open the list of attributes as shown below, and use 

to add the attribute items. Note: Attribute fields cannot repeat. Click Apply to take effect.

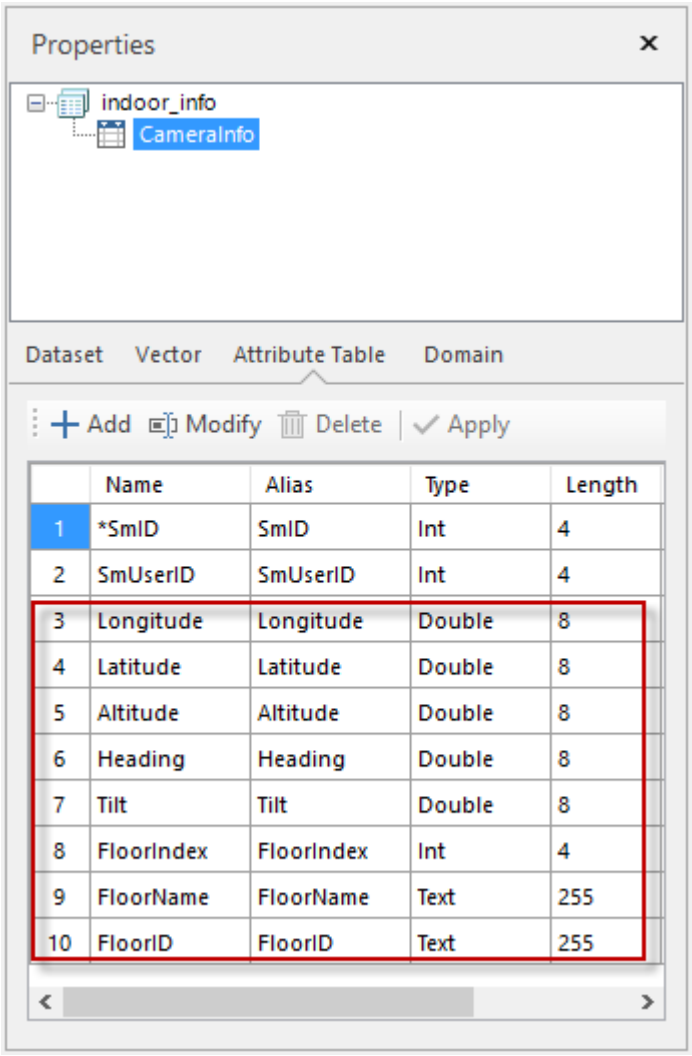

Figure 60 CameraInfo" attribute items

Step 4: Add attribute values

On the CameraInfo dataset, right-click, select Browse Attributes, open the attribute table of the dataset as shown below, double-click an item in the property sheet and edit the attribute.

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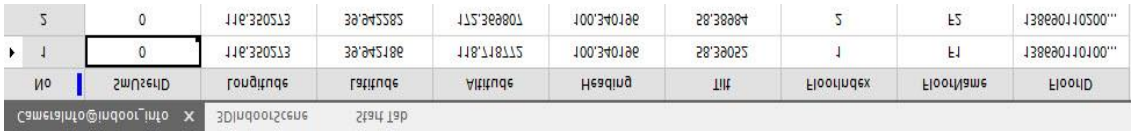
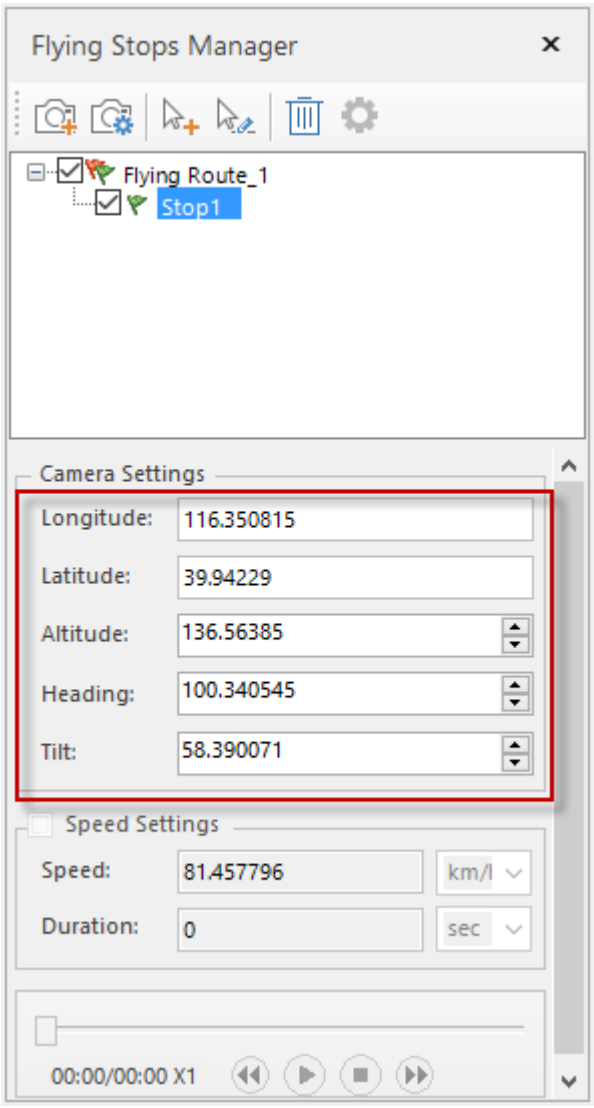


Figure 61 Effects of adding attribute values

Longitude, Latitude, Altitude, Heading, Tilt are camera parameters. Open the scene, adjust each floor to the location of the window center. You can get corresponding parameters via creating a new flying route. Open the Flying Stops Manager via Fly Manager-->Flying Route-->New, and create new flying route through the button.



Fgiure 62 Get camera parameters

FloorIndex value is the floor index. For example, the value for the ground floor is-1, the value for the 1st floor is 1, and the value for the 2nd floor is 2.

FloorName value that is the floor name value displayed in the floor operator control on mobile devices.

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FloorID value: Floor ID. The floor ID for objects in each floor is the same.

2.2.5 Cache Data Preparation

To ensure higher performance of 3D scene on mobile devices, cache will be employed.

Step 1: Create 3D cache

In Workspace Manager, right click in the current scene and click Create Cache.

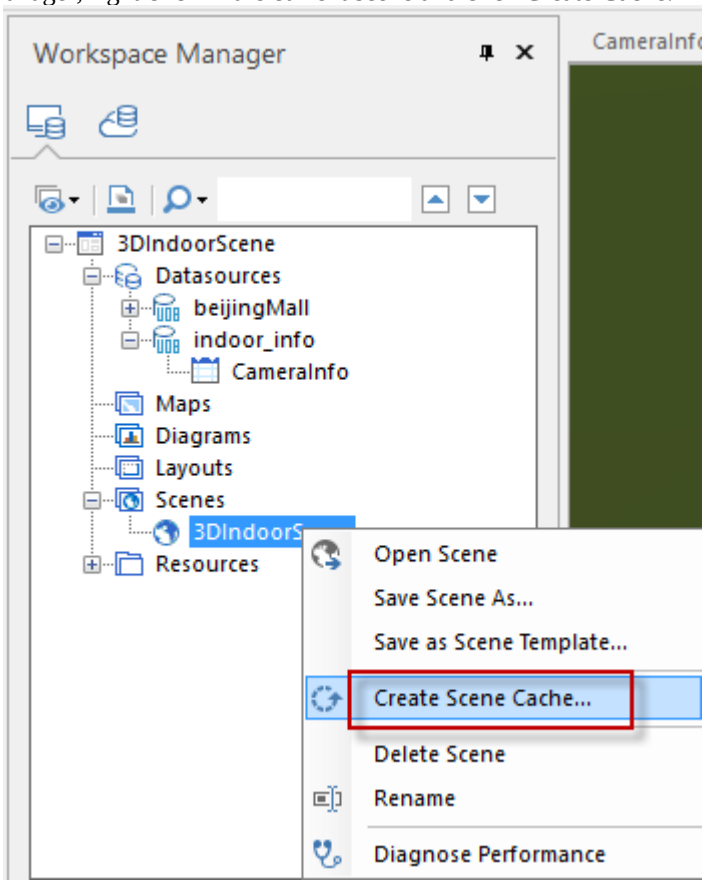

Figure 63 Create scene cache

Following prompts may appear during the process, you can click Yes.

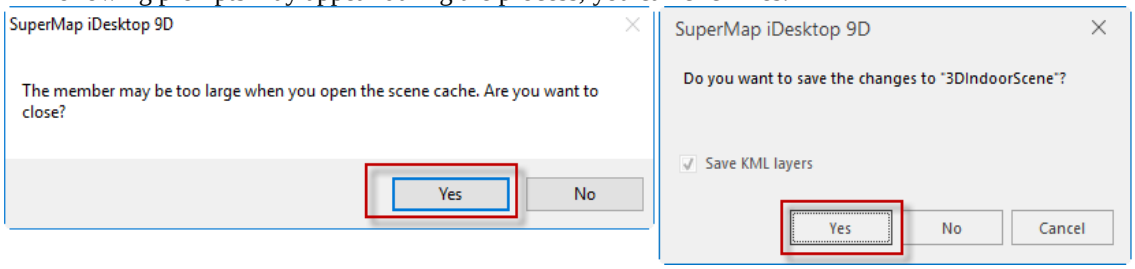

Figure 64 Prompts during creating cache

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In the Generate Scene Cache dialog box, select all dataset via  , select cache type (the Android device uses the option "Android series device" and iOS devices use the "iOS series Device").

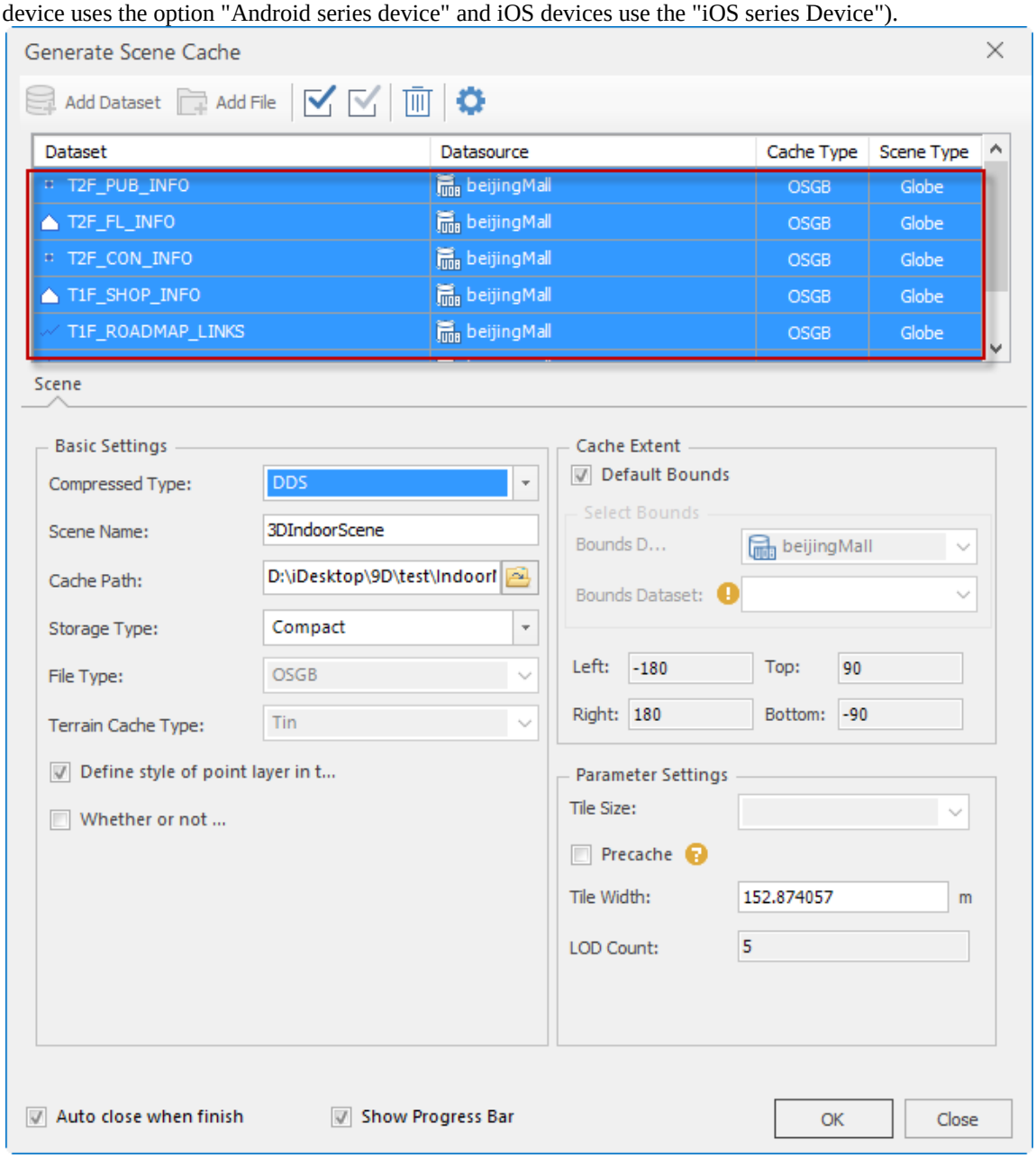

Figure 65 Settings for creating scene cache

Step 2: Adjust data structure again

1) Close the current workspace.

2) After creating the scene cache, a new workspace will be generated. Open the new workspace.

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3) Copy the datasource where the orgional navigation data is located and the “indoor_info” to the folder of the workspace.

4) Open the two datasources via Workspace Manager-->Datasources-->Open File Datasource.

5) Save the workspace via Start-->Workspace-->Save.

Till now, you have finished data preparation for 3D indoor navigation.

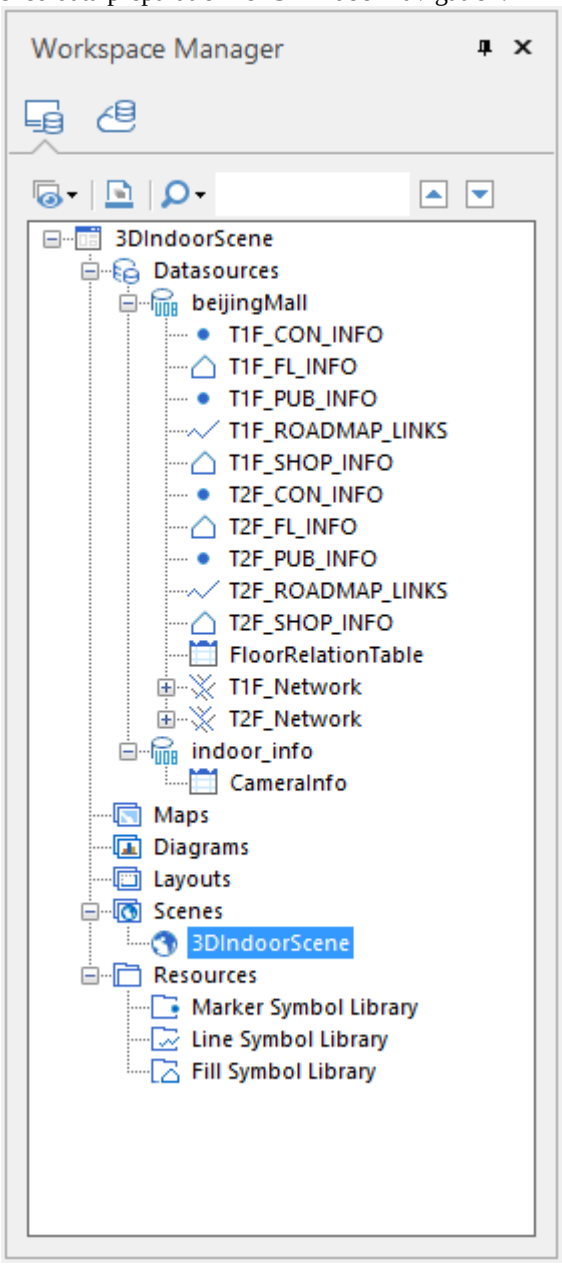

Figure 66 Indoor 3D navigation data structure

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3.1 2D indoor navigation

3.1.1 Step 1: Loading map

```
//Sets license path
Environment.setLicensePath(sdcard + "/SuperMap/license/");
//Only when Environment  is initialized, the component functions can be called.
Environment.initialization(this);
setContentView(R.layout.activity_main);
//Open workspace
m_wokspace = new Workspace();
WorkspaceConnectionInfo info = new WorkspaceConnectionInfo();
info.setServer(sdcard+"/SampleData/IndoorNavigationData/beijing.smwu");
info.setType(WorkspaceType.SMWU);
m_wokspace.open(info);
//Associate map display control with workspace
m_mapView = (MapView)findViewById(R.id.Map_view);
m_mapControl =  m_mapView.getMapControl();
m_mapControl.getMap().setWorkspace(m_wokspace);
//Open map in workspace. Parameter 0 represents first map
String mapName = m_wokspace.getMaps().get(0);
m_mapControl.getMap().open(mapName);
//Set the drawing mode as full screen., Point, text and common layers display at the same time.
m_mapControl.getMap().setFullScreenDrawModel(true);
//Refresh map
m_mapControl.getMap().refresh();
```

Note:

1) You can reference online help or development guide for project creation and environment configuration to do indoor navigation with the libraries com.supermap.analyst.jar and com.supermap.navigation.jar should be added.

2) Please view online help or development guide for the way of applying for permission.

3) Set path of permission and data as the circumstances may require.

3.1.2 Step 2: Initialization of navigation module

```
//Get navigation module
m_NavigationEx = m_mapControl.getNavigation3();
m_floorListView = (FloorListView)findViewById(R.id.floor_list_view);
//Set MapControl associated with floor view</span
m_floorListView.linkMapControl(m_mapControl);
```


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3.1.3 Step 3: Add navigation point

Add startting point.

```
m_NavigationEx.setStartPoint(pt.getX(), pt.getY(), mCurrentFloorID);
```

Add end point.

```
m_NavigationEx.setDestinationPoint(pt.getX(), pt.getY(), mCurrentFloorID);
```

Add path point (one or more) when starting point and end point have been added.

```
m_NavigationEx.addWayPoint(pt.getX(), pt.getY(), mCurrentFloorID);
```

3.1.4 Step 4: Path anlysis

```
//Determine whether indoor map has been opened
String currentFloorID = m_floorListView.getCurrentFloorId();
if (currentFloorID == null) {
    Toast.makeText(m_mapControl.getContext(), "Please open indoor map first", Toast.LENGTH_SHORT).show();
    return;
}
//Determine whether loading indoor map datasource is successful
Datasource datasource = m_floorListView.getIndoorDatasource();
if (datasource == null) {
    Toast.makeText(m_mapControl.getContext(), "Failed to load indoor map datasource",
Toast.LENGTH_SHORT).show();
    return;
}
//Set datasource where indoor map locates
m_NavigationEx.setDatasource(datasource);
//Path analysis
boolean bResult = m_NavigationEx.routeAnalyst();
if(bResult){
    Toast.makeText(m_mapControl.getContext(), "Analyzing successfully", Toast.LENGTH_SHORT).show();
}
else{
    Toast.makeText(m_mapControl.getContext(), "Failed to analyze",Toast.LENGTH_SHORT).show();
    return;
}
```

3.1.5 Step 5: Navigating

```
//Start to navigate  0: real navigation, 1: simulate navigation ,2: cruising ,3: pedestrian navigation/span>
if(!m_NavigationEx.startGuide(1)){
    Toast.makeText(m_mapControl.getContext(), "Failed to start navigation", Toast.LENGTH_SHORT).show();
    return;
}
```

Detail reference sample code is provided in product packet (Non-green version), the path is ../SampleCode/SampleCode_ADT(SampleCode_AndroidStudio)/IndoorNavi, for downloading and reference.

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3.2 3D indoor navigation

3.2.1 Step 1: Loading map and initializing navigation module

```
String sdcard =
android.os.Environment.getExternalStorageDirectory().getAbsolutePath().toString();
Environment.setLicensePath(sdcard + "/SuperMap/license/");//Set license path
Environment.initialization(this);    //Only when Environment has been initialized, the component
function can be called
setContentView(R.layout.activity_main);

//Open workspace
m_workspace = new Workspace();
WorkspaceConnectionInfo info = new WorkspaceConnectionInfo();
info.setServer(sdcard+"/SampleData/3DIndoor scene/3DIndoor scene.sxwu");
info.setType(WorkspaceType.SXWU);
boolean result = m_workspace.open(info);
if (!result) {
    System.out.println("Failed to open workspace");
    return;
}
m_sceneView= (SceneView)findViewById(R.id.scene_control);
m_sceneControl= m_sceneView.getSceneControl();
//Scene control intialization callback listener
m_sceneControl.sceneControlInitedComplete(new SceneControlInitedCallBackListenner() {

    @Override
    public void onSuccess(String arg0) {

        //Open scene
        m_scene = m_sceneControl.getScene();
        m_scene.setWorkspace(m_workspace);
        String mapName = m_workspace.getScenes().get(0);
       m_scene.open(mapName);

        m_navigation3D = m_sceneView.getNavigation();        //Get navigation module
        m_sceneControl.setNavigationControlVisible(true);    //Set navigation bar visible

        //InitializeFloorList
        m_floorListView3D = (FloorListView3D)findViewById(R.id.floor_list_view_3d);
        m_floorListView3D.setVisibility(View.VISIBLE);
        m_floorListView3D.linkScenepControl(m_sceneControl, m_workspace);
        m_floorListView3D.setNavigation3D(m_navigation3D);
        //Set datasource where indoor map
locates                          m_navigation3D.setDatasource(m_workspace.getDatasources().g
et("beijingMall"));
       //Set 3D scene controls
        m_navigation3D.setSceneControl(m_sceneControl);
        //Set GestureDetector(Used for users to add navigation point through gestures.)
        m_sceneControl.setGestureDetector(new
GestureDetector(m_sceneControl.getContext(), mSceneGestrueListener));
        //Add navigation guide information and update listener
        m_navigation3D.addNaviInfoListener(new NaviListener() {
            @Override
            public void onStopNavi() {//Callback when navigation is stopped
                //Close navigation when it is finished
```


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```
                m_naviState = NAVI_STATE.STATE_NULL;
                m_navigation3D.cleanPath();
                System.out.println("Navigation stopped");
            }
            @Override
            public void onStartNavi() {//Callback after starting navigation
            }
            @Override
            public void onPlayNaviMessage(String message) {//Play information of navigation
            }
            @Override
            public void onNaviInfoUpdate(NaviInfo naviInfo) {//Callback when navigation guide
information updated
           }
            @Override
            public void onAdjustFailure() {//Callback when matching roads is failed
            }
            @Override
            public void onAarrivedDestination() {//Callback when getting to desination
                //Close navigation when getting to destination
                m_naviState = NAVI_STATE.STATE_NULL;
                m_navigation3D.cleanPath();
                System.out.println("Getting to destination");
            }
        });
    }
});
```

3.2.2 Step 2: Add navigation point

Add starting point.

```
m_navigation3D.setStartPoint(pt3d.getX(), pt3d.getY(), pt3d.getZ());
```

Add end point

```
m_navigation3D.setDestinationPoint(pt3d.getX(), pt3d.getY(), pt3d.getZ());
```

Add path point(one or more) when a starting point and an end point have been added.

```
m_navigation3D.addWayPoint(pt3d.getX(), pt3d.getY(), pt3d.getZ());
```

3.2.3 Step 3: Path analysis

```
m_navigation3D.routeAnalyst();
```

3.2.4 Step 4: Navigating

```
m_navigation3D.startGuide(1);
```

Detail reference sample code is provided in product packet (Non-green version), the path is `../SampleCode/SampleCode_ADT(SampleCode_AndroidStudio)/IndoorNavigation3D`, for downloading and reference.

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