

2 CARTALINX OPERATION MANUAL

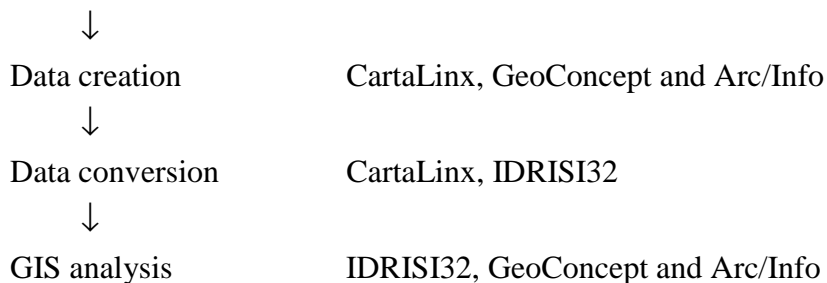
Usefulness of CartaLinx

GeoConcept is an GIS software that is useful with good operability in mapping data processing, but it is not so strong in the function of data topology (structuralization) that is necessary for various analytical processes in the GIS.

Arc/Info is powerful in the topology analyzing function, but its operation is not so simple and anyone can not handle it easily. In addition, its input function is inferior.

On the contrary, CartaLinx is used efficiently in IIMS in the following processes:

GIS/CAD data:



CartaLinx Operation Manual

1. Introduction

CartaLinx is the mapping software developed by Clarke University that is provided with basic functions necessary for GIS data input and editing. The software has the functions to process the topological data structure, relational database and data conversion and supports manually map editing and batch processing on the operation level.

The GIS processes polygons, Arcs and points in the mapping data structure. Unlike the CAD feature structure, the GIS data has a topological data structure that defines the spatial and joint relations between points, lines and polygons. This data structure is essential for GIS. In GIS it is necessary to comprehend the data structure rightly and create accurate data.

In using CartaLinx, it is necessary to input mapping data in consideration of the topological data structure of the GIS data. In the input and editing of mapping data, it is necessary to split a line or close it at the cross point. The data is defined as follows:

- A point is divided into a Node to configure an Arc and a Polygon Locator (called Centroid, Label Point).
- A line data (or Arc) consists of a start Node, a Vertex and an end Node.
- A polygon consists of several Arcs and it is essential that there is no error in the relation between the Nodes and Arcs in configuring a topology.

The IIMS has studied the introduction of this software in the spatial database and GIS data management for the purpose of a series of data management processes such as new data input, existing data editing and data conversions. The data handled in the IIMS is required to support various types of GIS that the related agencies possess and it is also essential to handle the data having a topological data structure.

CartaLinx Version 1.2 are released at present. But as the font package to support the French language is not available, the present version involves some bugs due to difference between the American and the European unit system and difference in the OS.

2 Features of the Software

(1) Data input functions

For new data input, four functions shown in Table-1 can be used:

Table-1 Data input functions

Data Input Item	Method
<ul style="list-style-type: none"> • Tablet digitizing • Raster digitizing • GPS digitizing • Existing data input 	<p>Data input by connecting a digitizer</p> <p>Data input using graphic images in the background</p> <p>Data input from GPS</p> <p>Input by data import</p>

(2) Editing function

In editing map features, Nodes, Arcs and polygons can be edited manually and automatically. The main editing functions are shown in Table-2. The software has its unique data structure to build the topology. The line break and polygon topology can be processed automatically by command.

Table-2 Editing functions

<p>Add, modify and delete new feature (Node, Arc, Polygon)</p> <ul style="list-style-type: none"> • Arc or polygon editing (Arc division at intersection, addition of a Node, and deletion of a pseudo Node, tying of Arcs (Node shift and snap), addition, deletion and shift of a Vertex) • Editing of features by batch processing (Automatic snap, automatic creation of intersections, automatic feature deletion (pseudo Node, duplicated Arcs, zero-length Arc, dangle Arc) • Map coordinate conversion • Feature editing and attribute editing using SQL • Use of relational database
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The database for feature management is supported by Microsoft Access in the standard format, and the data retrieval and feature editing using SQL can support the database compilation. In the relational database, the Text files and dBASE are supported as the method of conversion of attribute data with the external.

The map coordinate conversion can support the georeference using the Project commands. If the map coordinates are defined, map conversion to any arbitrary map coordinate system is also available. All the parameters for map coordinate conversion that can be handled by IDRISI32 can be used. The map images in IDRISI32 can be used directly by CartaLinX to structure the GIS data.

(3) The data import and export can be performed in the format shown in Table-3. These can be used as the data converter.

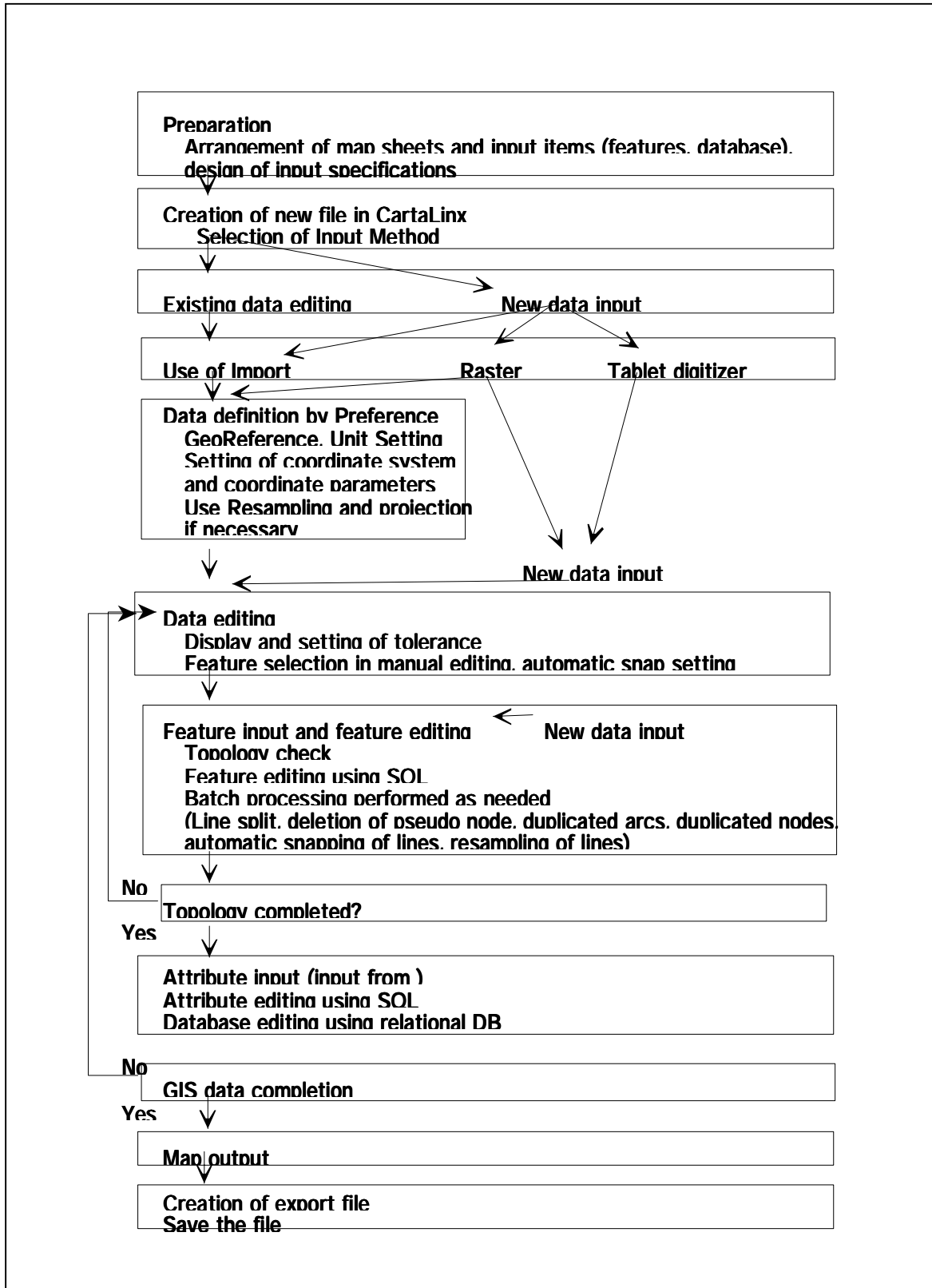
Table-3 Data conversion functions in CartaLinx

Format	Import	Export
IDRISI32	Ok	Ok
IDRISI16 (Version2)	Ok	Ok
Arc/Info Generate File	Ok	Ok
ArcView Shape File	Ok	Ok
MIF (MapInfo Inter exchange Format)	Ok	Ok
CartaLinx Layer Transfer Format	Ok	Ok
Delimited ASCII File	Ok	
SDTS (USGS Spatial Data Transfer Standard)	Ok	
British Ordinance Survey data	Ok	
AutoDesk World Drawing	Ok	

Format conversion to other data formats is available widely by using this software in conjunction with IDRISI32. However, some troubles may be caused if the MIF file is used. If the user understands the file structure rightly, the data structure can easily be edited by the use of an editor.

Map Input Flow

A general flow from feature input to output using CartaLinx is shown below.



1 File Creation in CartaLinx

1.1 Definition of File

(1) Creation of new file

Select “File → New Coverage → Blank Coverage” (Fig. 1.1 Selection of module)

Set up the mapping of Georeference by Preference. (Fig. 1.2 Georeference setting)

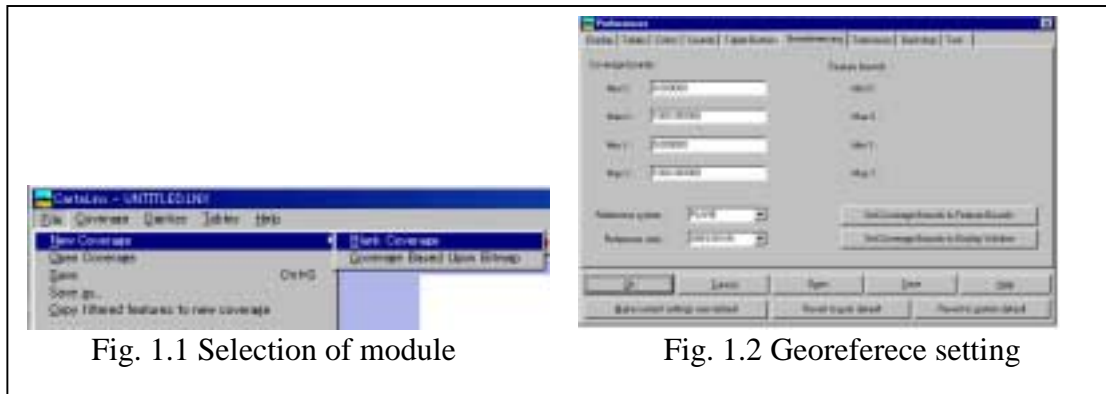


Fig. 1.1 Selection of module

Fig. 1.2 Georeference setting

The setting items is definitions of coordinate systems (decimal latitude and longitude, UTM,etc.) and mapping units (deg, m, km, feet, mile, etc.).

(2) Use of raster images

Select “File → New Coverage → Coverage based on Bitmap”

(Fig. 1.3 Selection of module)

Select the converted image in “File → Image Conversion as the input file” and control whether the data is displayed or not. (Fig. 1.4 Selection of raster images)

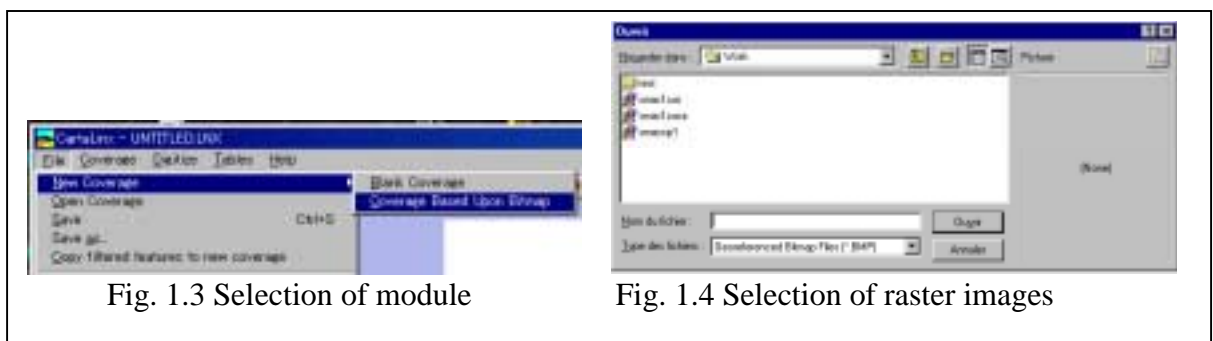


Fig. 1.3 Selection of module

Fig. 1.4 Selection of raster images

1.2 File Saving

Select “File → Save” or “File → Save As” and save Coverage.

(Fig. 1.5 Selection of module, and Fig. 1.6)

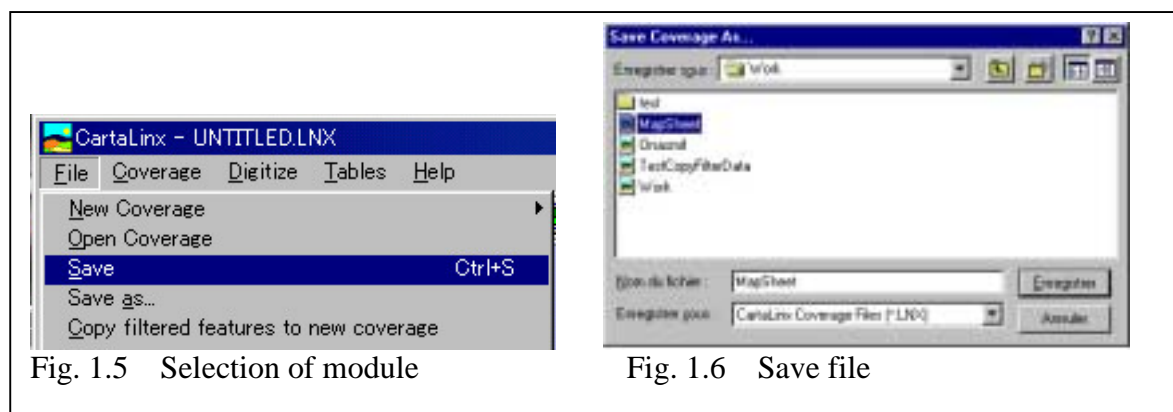


Fig. 1.5 Selection of module

Fig. 1.6 Save file

1.3 Import and Export of Feature Data

CartaLinx can be used as a converter to convert the data into the form in which the data can be entered under GeoConcept. Table 1.3 shows the data conversion function in CartaLinx.

Table-1.3 Data conversion functions

Format	Import	Export
IDRISI32	Ok	Ok
IDRISI16 (Version 2)	Ok	Ok
Arc/Info Generate File	Ok	Ok
ArcView Shape File	Ok	Ok
MIF(MapInfo Inter exchange Format)	Ok	Ok
CartaLinx Layer Transfer Format	Ok	Ok
Delimited ASCII File	Ok	
SDTS (USGS Spatial Data Transfer Standard)	Ok	
British Ordinance Survey data	Ok	
AutoDesk World Drawing	Ok	

In GeoConcept,

MIF file and SHP file can be imported directly to CartaLinx.

Other software data is imported via Arc/Info and IDRISI32.

SHP file is imported to CartaLinx by creating an Export file.

The Ungenerate file is imported to CartaLinx by creating an Ungenerate file for lines and points. A polygon is imported by creating individual Ungenerate files for lines and points (label points for a polygon). The database is exported to an external database file (text or MSAccess) and re-imported to CartaLinx.

DXF file is imported to the files created for individual layers and re-imported to CartaLinX in a usable format.

In the case of Export, it has the same functions as Import. In the same way as described above, the data is converted into the format exportable in Arc/Info and IDRISI32.

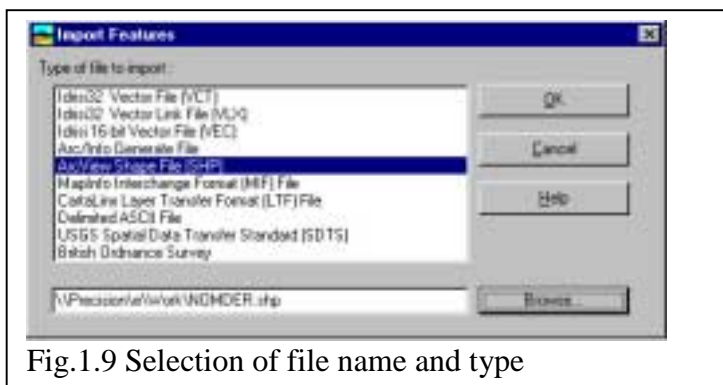
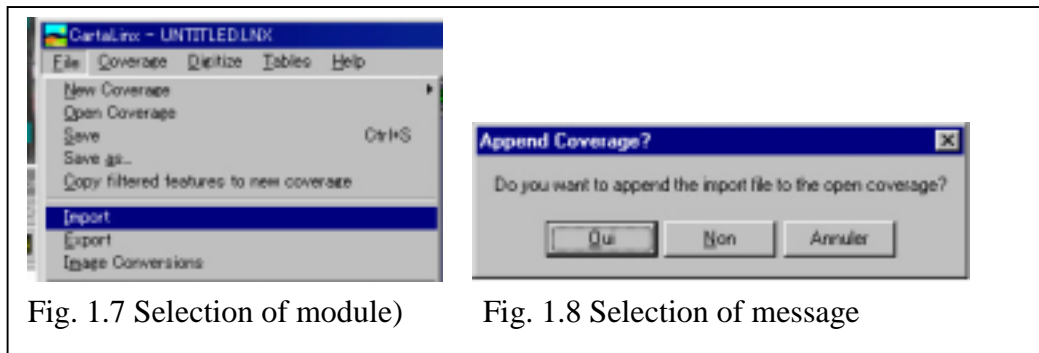
1.3.1 Import

Data import is made in the following steps:

Select “File → Import”. (Fig. 1.7 Selection of module)

Select “Y “ in Append Coverage. (Fig. 1.8 Selection of message)

Select a file type to be imported from ‘Type of file to import’ (Fig.1.9 Selection of file name).



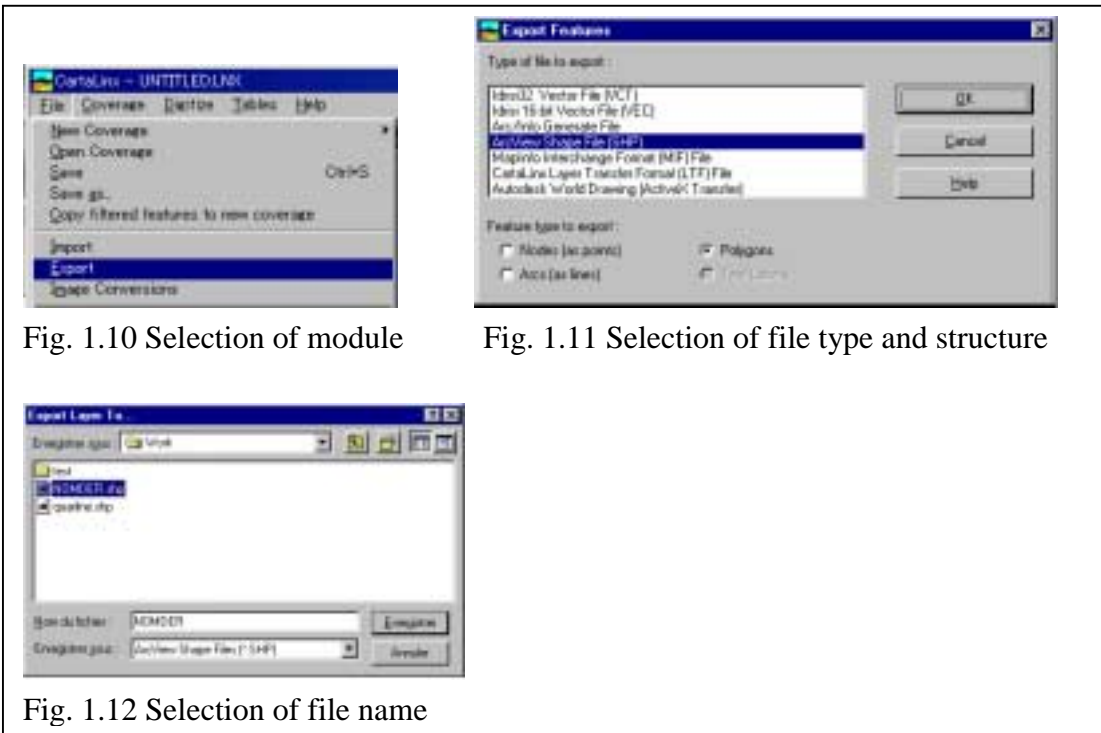
1.3.2 Export

Select “File → Export”. (Fig. 1.10 Selection of module)

Select a file type to be exported from ‘Type of file to export’. (Fig. 1.11 Selection of file type and structure)

Select a feature structure from ‘Feature Type to export’.

Input the file name. (Fig. 1.12 Selection of file name)



1.4 Image Conversion

Image Conversion is a function used for import of a raster image file. In IDRISI32, the image files can directly be used. The usable formats are as follows:

- IDRISI image format: Idrisi Raster (32 bits, 16 bits)
- Universe image format: TIFF, BMP, JPG, WMF, etc.

The IDRISI file directly provides the Georeference data. For the universe format, it is necessary to input Georeference data.

- Select “File → Image Conversion”. (Fig. 1.13 Selection of module)
- Select “Image to convert” on Browser. (Fig. 1.14 Selection of raster file)

For an IDRISI image, input the image file name to be saved. (Fig. 1.15 Input of file name)

For other images, select ‘Output of reference system’ and ‘Output reference units’ and input the Georeference information of coverage coordinate (X, Y) and the output file name.

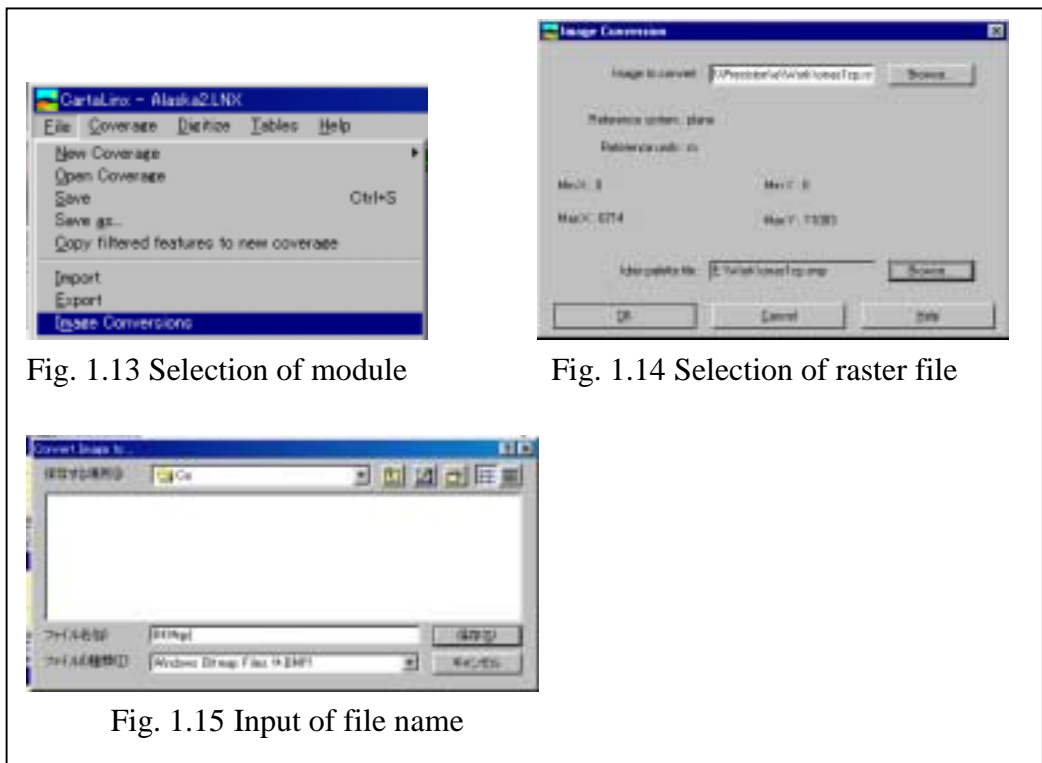


Fig. 1.13 Selection of module

Fig. 1.14 Selection of raster file

Fig. 1.15 Input of file name

1.5 Print Commands

The following commands are prepared for output of map sheets:

- (1) Printer Setup
Select a printer and paper.

- (2) Print Current Window
To fit page: Output the map sheet in the same scale as the window.
To described scale: Output the map sheet in the designated scale.

1.6 Copy Display Window

The map file on the display can be outputted in the 'Windows Meta File', 'Enhanced Windows Metafile' or 'Georeferenced BIT MAP'. (Fig. 1.17 Module of Copy Display Window)

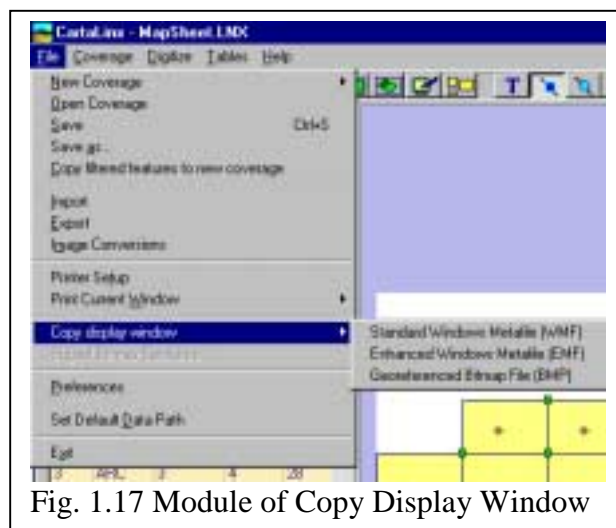


Fig. 1.17 Module of Copy Display Window

1.7 Preference

Preference is a module for setting the environment to manage the configuration in CartaLinx. The user clicks the tab and set a configuration by purpose. (Fig. 1.18 Menu of Preference)

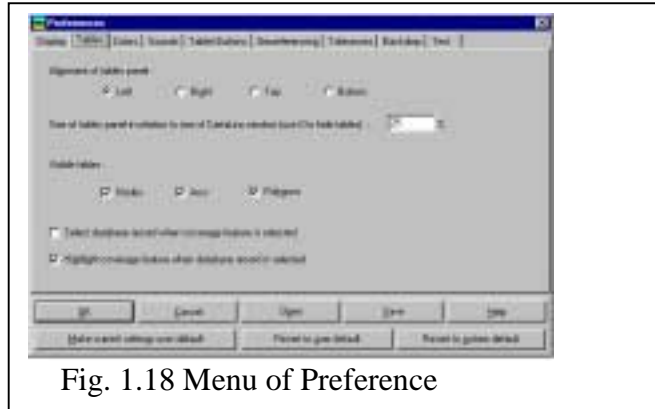


Fig. 1.18 Menu of Preference

1.8 Set Default Data Path

This command manages the working directory in the work file. (Fig. 1.19 SetDefault Data Path)

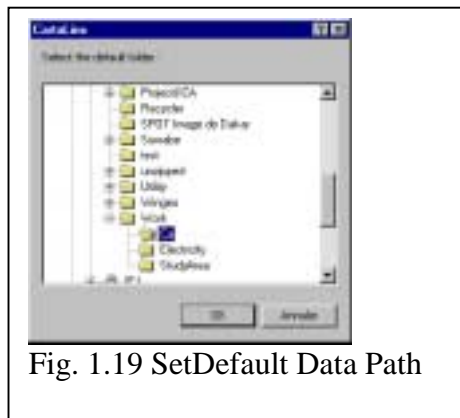


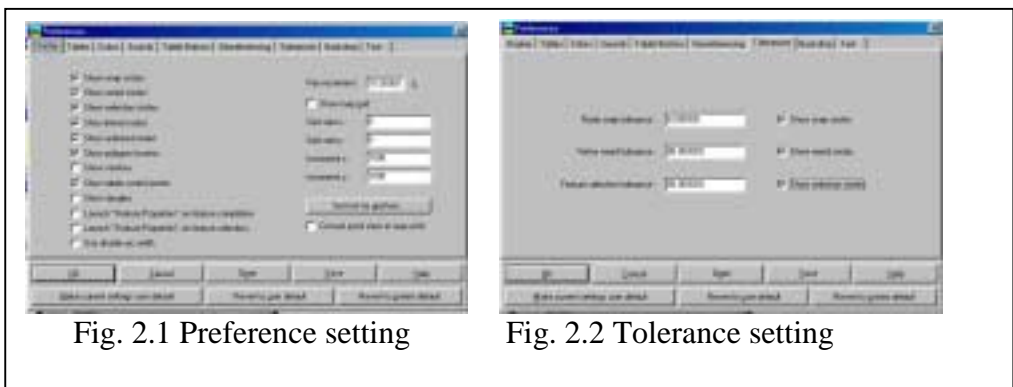
Fig. 1.19 SetDefault Data Path

2 Feature Input and Editing

2.1 Setup of Feature Operating Environment (Configuration Setup)

The parameters of the environment for feature editing are set up under the Preference commands. The user is required to change the setup commands flexibly depending upon the conditions of editing. The major setup items are as follows:

- Setting of feature display for Preference. (Fig. 2.1 Preference setting)
The display of Nodes and Vertices as symbols is set to on or off.
- Setting of tolerances (Fig. 2.2 Tolerance setting)



2.2 Feature Input 'Insert Existing Node'

Feature input should always be made in considering the topological structure of the GIS data. In digitization, the line segments should be closed at the intersection of lines.

An Arc is digitized from the start Node, a Vertex is inserted and is closed at the end Node. The line is closed at the intersection of the Arc. Therefore, it is the basic rule for Arc insertion to start from a Node and to end at another Node.

The feature data input operations such as data entry, window scaling and panning can be made efficiently using the menu for the right button or short-cut keys. (Fig. 2.3 Example of right button menu)

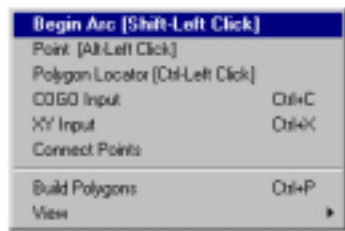


Fig. 2.3 Example of right button menu

The window view control can be executed by using the right button and short-cut keys. The zoom out is made by the use of PgUp and PgDn keys. The view can be panned by pushing the keys Alt and Arrow simultaneously. (Fig. 2.4 View control)

The feature input is made as follows:

(1) Arc input

Move the cursor to a point to be digitized and click the right button. (See Fig. 2.5.) Click 'Start Node' by the left button, or press shift and click the left button to input the first Node.

Digitize a line with a left button.

If an input error is found on the way, click the right button and select Undo, or key in "Ctrl-Z" to return to the previous data and reenter the data. (Fig. 2.5 Undo menu) At the end Node, click the right button and click Finish Arc with the left button. Or press shift and click the left button to close the line. (Fig. 2.6 Finish Arc)

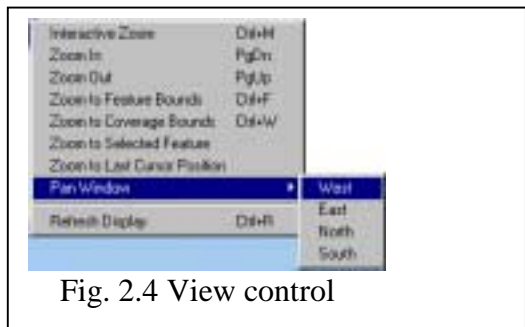


Fig. 2.4 View control

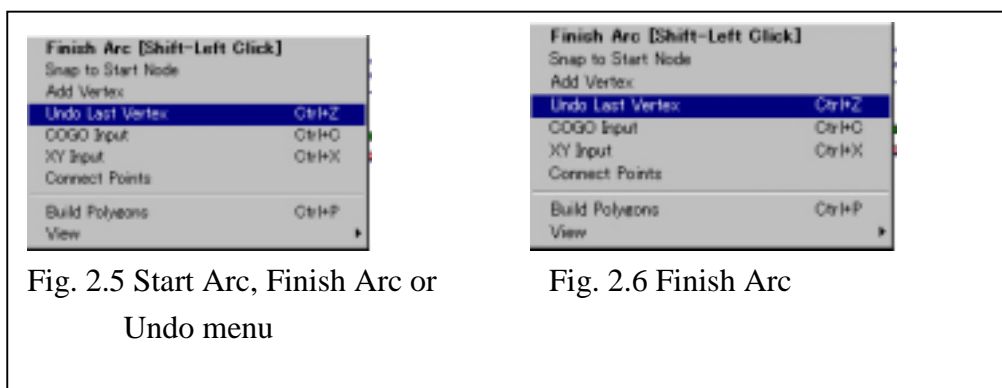


Fig. 2.5 Start Arc, Finish Arc or Undo menu

Fig. 2.6 Finish Arc

Then, repeat the input steps to acquire the next line.

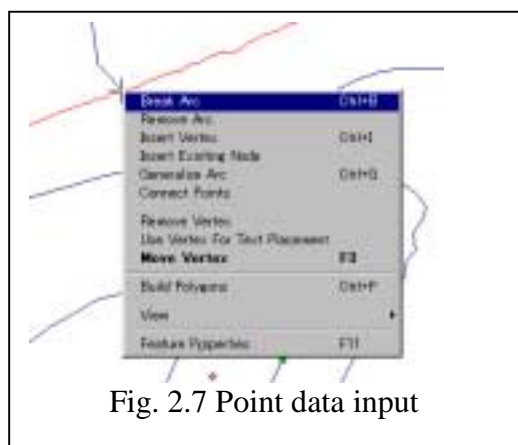
Move the cursor to the Node to be started, and click the right button. Then click the left button to select 'Start Node' or press shift and click the left button to start digitizing the line. Repeat the above operations for other lines.

(2) Digitize polygon

To digitize a polygon, repeat the above Arc input operations for data entry in considering the topological data structure.

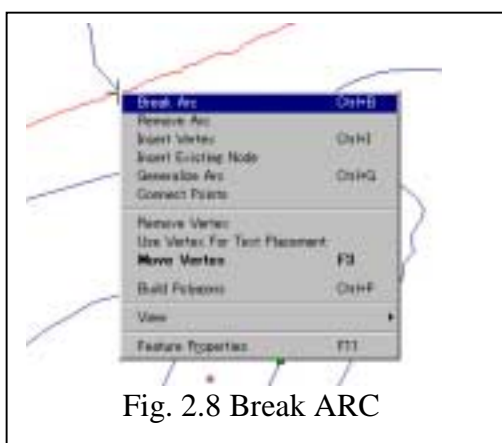
(3) Point or Polygon Locator

To insert a point (point or Polygon locator), move the mouse to a point to be inserted, click the right button and click the left button at the desired menu. Or key in data and insert it by clicking the left button. (Fig. 2.7 Point data input)



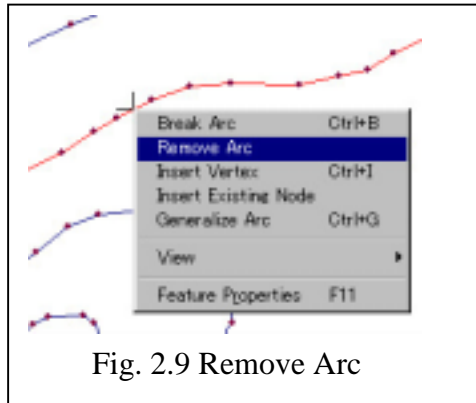
(4) Break Arc

For the Arcs that intersect, it is necessary to divide the line and put a Node at the intersection. To divide the Arc, click the left button of the mouse at the intersection a click the right button, or put the cursor at the intersection to tie the lines at one Node. (Fig. 2.8 Break Arc) Divide another intersecting line similarly.



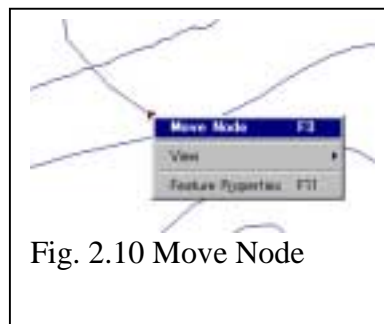
(5) Remove Arc

To delete an Arc, select the Arc and key in DEL key or click the right button and click the left button at Delete Arc. (Fig. 2.9 Remove Arc)



(6) Move Node and Tie Arcs

If the Arcs are digitized and not closed, tie these Arcs. If there is a Node at a point to which an Arc is moved, select the Node to which the Arc is moved. Press the function key of F3 or click the right button to select 'Move Node'. (Fig. 2.10 Move Node) Click the left button at the point to which the Node is moved. If a message is displayed on the window, click "OK".



If the Arc can not be tied, change the tolerance for feature selection or the tolerance for automatic snap and repeat the tying.

If there is no Node at a point to which an Arc is moved, click the right button at a point where a new Node is put for the moved Arc. (Fig. 2.11.) After confirming the message on the window, click the left button at the Node to be moved.

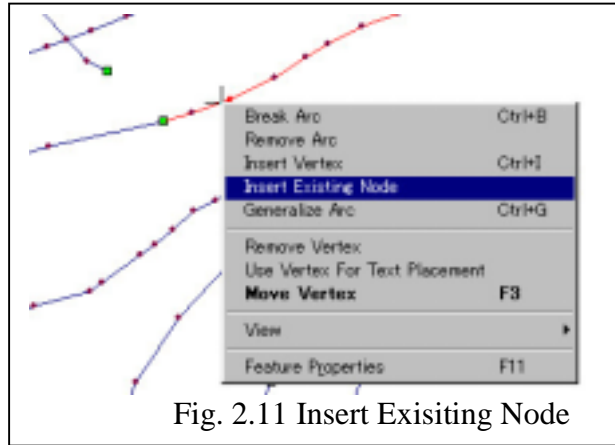


Fig. 2.11 Insert Existing Node

(7) Move, add and delete Vertex

Move Vertex: Same as in tying Arcs (Fig. 2.12 Move Vertex)

Add Vertex: Click the left button of the mouse at a point on which a Vertex is added and select an Arc. Present the menu view by clicking the right button and click the left button at Insert Vertex or push the “Ctrl-I” keys. (Fig. 2.13 Insert Vertex)

Remove Vertex: Click the left button of the mouse at a point on which a Vertex is added and select an Arc. Present the menu view by clicking the right button and click the left button at Remove Vertex or push the DEL key. (Fig. 2.14 Remove Vertex)

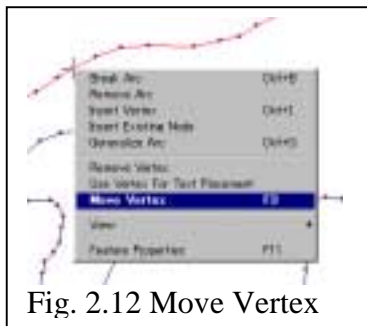


Fig. 2.12 Move Vertex

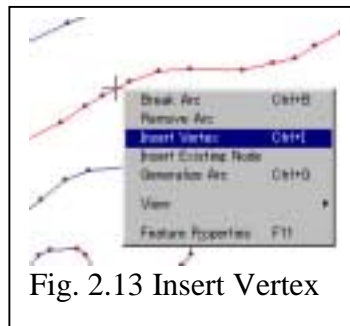


Fig. 2.13 Insert Vertex

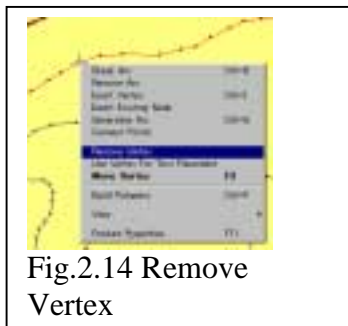


Fig.2.14 Remove Vertex

(8) Generalize Arc Vertexes

This command is to thin out the Vertexes automatically to constitute a digitized Arc. Select an option as necessary and execute this operation. (Fig. 2.15 Generalize, and Fig. 2.16 Selection of option and parameter input) For three options, refer to the Manual.

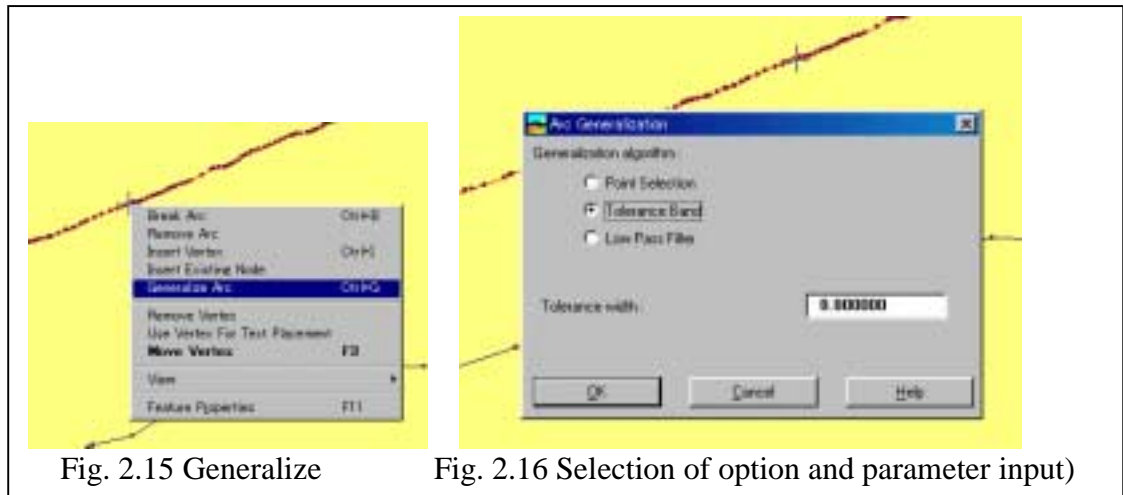


Fig. 2.15 Generalize

Fig. 2.16 Selection of option and parameter input)

(9) Feature attribute

For view and input of feature attributes, add the database field beforehand, and select a feature. Then, click F11 or the right button, and select Feature Property by clicking the left button. (Fig. 2.17 Selection of Feature Property) Click the attribute window and input data. (Fig. 2.18 Property Window)

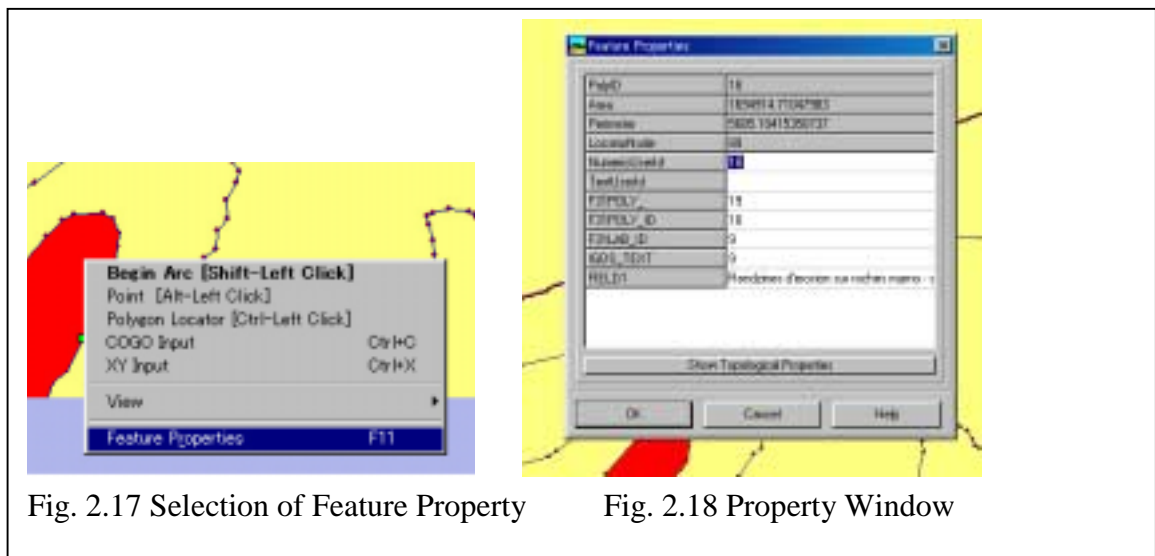


Fig. 2.17 Selection of Feature Property

Fig. 2.18 Property Window

3 Coverage Commands

Coverage commands are composed of modules for data input and editing. (See Fig. 3.1.) Main modules will be described below. For the details, refer to the Manual.

3.1 Append

This command is used to merge a coverage.

Enter the tolerance for the SNAP coverage. (Fig. 3.1 Input of tolerance)

Select the file name. (Fig. 3.2 Selection of coverage)

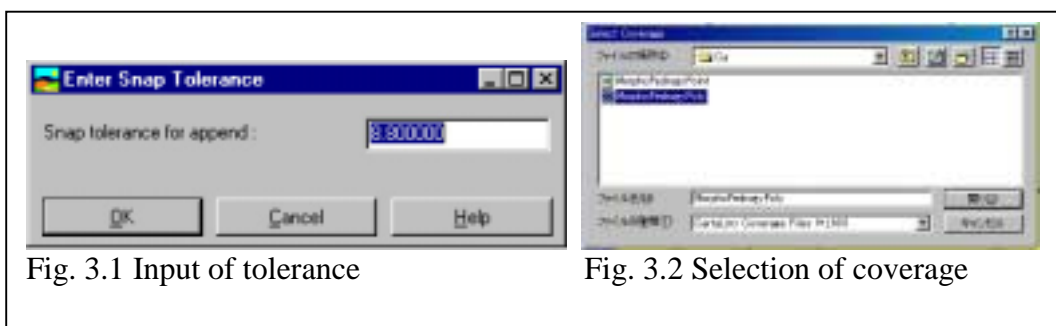


Fig. 3.1 Input of tolerance

Fig. 3.2 Selection of coverage

3.2 Arc Generalize

This module is used to optimize a line. (See Fig. 2.15 and Fig. 2.16.)

Select the optimum option. For the details, refer to the Manual.

3.3 Resample

This module is a geometric correction module that has the same function as the vector conversion module in IDRISI32.

If the Correspondence file is selected out of the files on view, file conversion is performed automatically. (Fig. 3.3 Resample) For creation of the Correspondence file, refer to the IDRISI32 Manual. (Fig. 3.4 Example of Correspondence file)

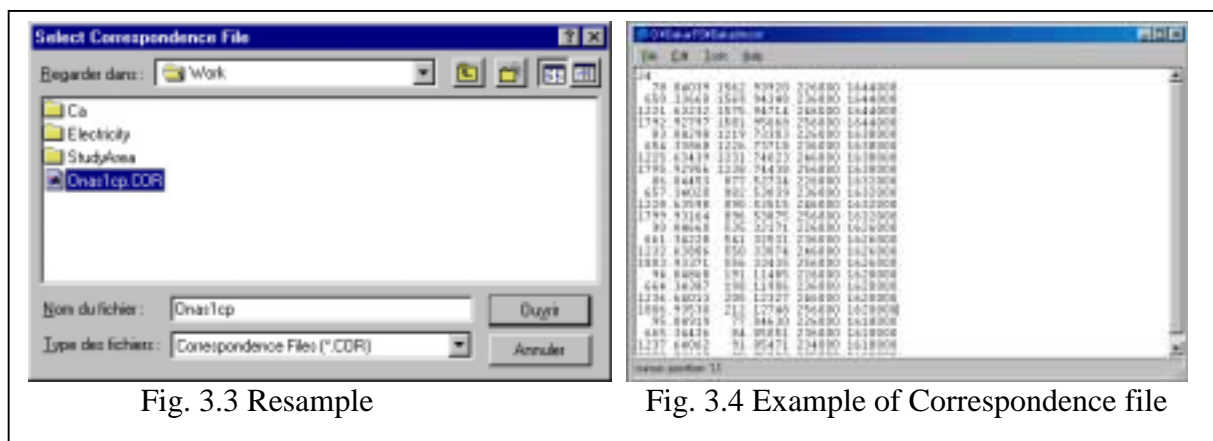


Fig. 3.3 Resample

Fig. 3.4 Example of Correspondence file

3.4 Project

This is a geometric correction module that has the same function as the vector conversion module in IDRISI32. The features having Georeference can automatically be converted in coordinates into a table prepared for the conversion of map projection. Input map projection. (Fig. 3.5 Change of map projection)

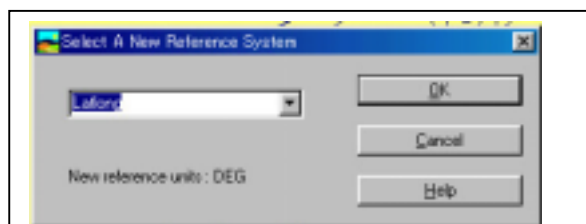


Fig. 3.5 Change of map projection

3.5 SNAP Module

This is a batch of commands to automatically snap the Nodes within a specified distance. Two modules are available.

- 1) Snap All Nodes
- 2) Snap All Nodes in Display Window

Input a tolerance for operation. (Fig. 3.6 Snap Tolerance)

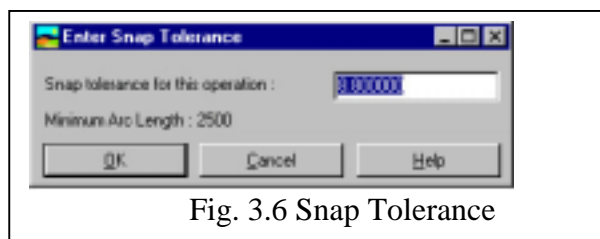


Fig. 3.6 Snap Tolerance

3.6 Intersection

This module is a batch of commands to perform automatic line snap and Node arrangement. The module is executed by the selection of a command automatically.

3.7 Remove PSEUDO Node (Remove Pseudo Node, Remove Pseudo Node in Window)

This module is a batch of commands to remove unnecessary Nodes. The module is executed by the selection of a command automatically.

3.8 Arc Editing Commands

This module is used to automatically remove a duplicated Arc, a Zero-Length Arc and a dangled Arc. Duplicated Arcs and Zero-Length Arcs are automatically executed by the selection of the module. Dangled Arcs within the user-designated coverage are automatically removed. (Fig. 3.7 Dangle Arc)

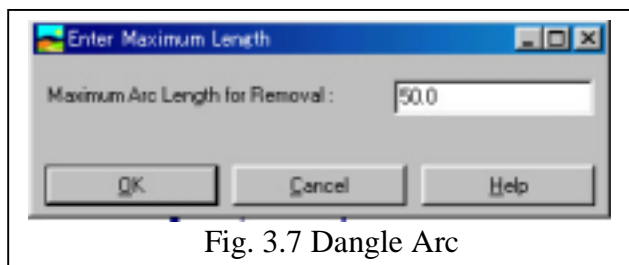


Fig. 3.7 Dangle Arc

3.9 Build Topology

This command is used to build a polygon data structure. By the selection of the module, a polygon topology is created automatically.

4 Digitize Commands

4.1 Input Device

This command is used to select a data input device by using a mouse, tablet digitizer and GPS. (Fig. 4.1 Input Device)

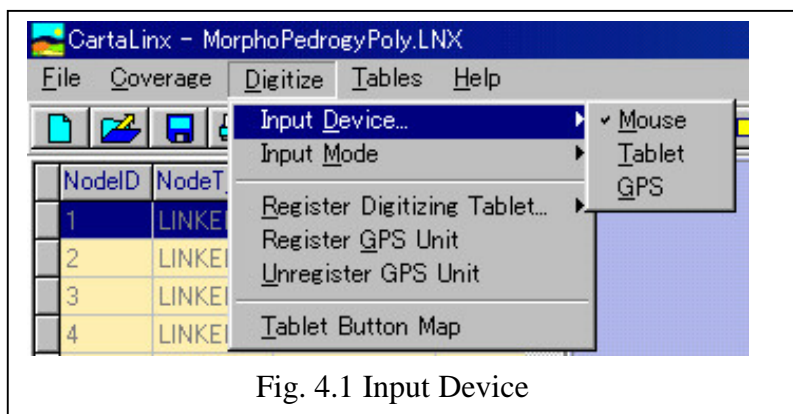


Fig. 4.1 Input Device

4.2 Input Mode

This command is to select a data input mode by 'Single Point' mode and 'Continuous' mode. (Fig. 4.2 Input Mode)

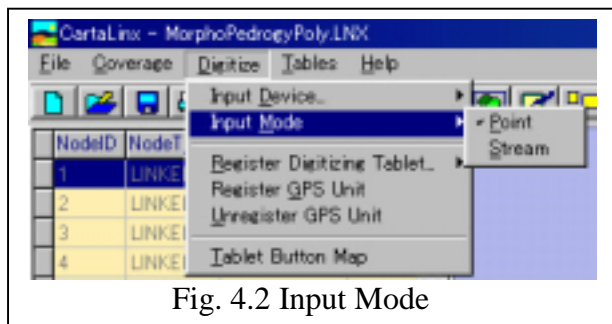


Fig. 4.2 Input Mode

4.3 Register Digitizer Table

This command is to execute map registration by a digitizer. (Fig. 4.3 Register Digitizer)

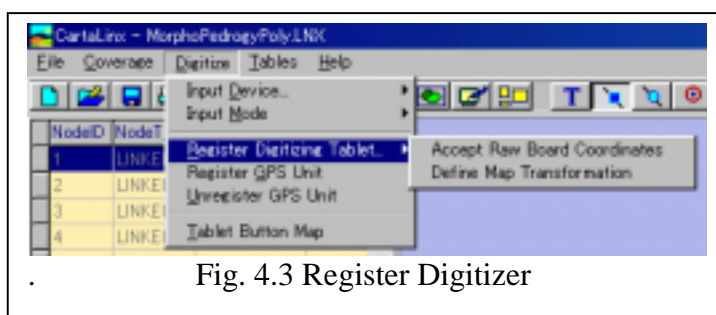


Fig. 4.3 Register Digitizer

(1) Accept Board Coordinate

This module is to input the reference point for a new map from a digitizer. Button 1 is used to input the reference point and button 2 is pushed to complete the registration.

(2) Define Map Transformation

This module is used to create a configuration file for each map sheet by key-in operation to the input map reference point and the map coordinates.

4.4 Tablet Button Map

This is a menu to set a digitizer by buttons. For details, refer to the Manual.

5 Tables Commands

These table commands are the modules to perform database attribute editing and feature editing by database operation.

5.1 Field Command

This is a module to add, delete and rename a field in the Node, Arc and polygon database.

(1) Add Field

A field is added in each feature of Node, Arc and polygon. (Fig. 5.1 Add Field)

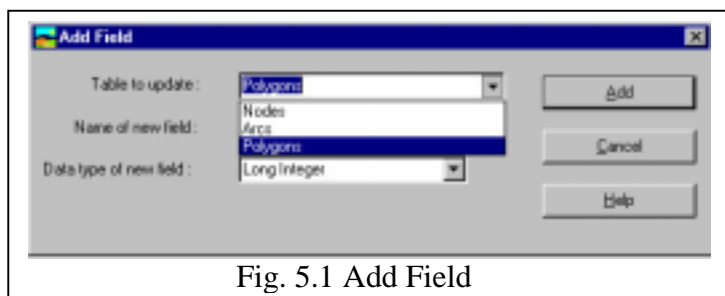


Fig. 5.1 Add Field

(2) Delete Field

A field is deleted in each feature of Node, Arc and polygon. (Fig. 5.2 Delete Field)

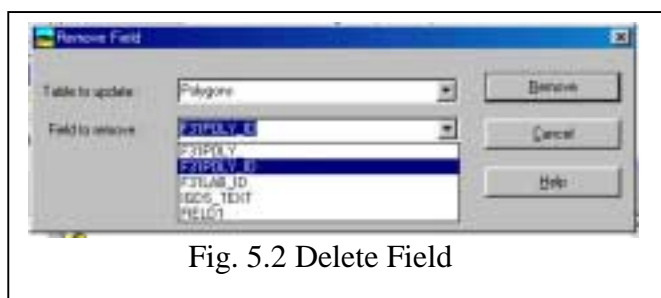


Fig. 5.2 Delete Field

(3) Rename Field

A field is renamed in each feature of Node, Arc and polygon. (Fig. 5.3 Rename Field)

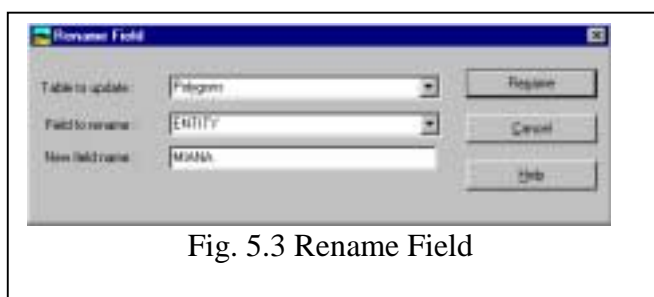


Fig. 5.3 Rename Field

5.2 Cross Table Transfer

This is a module to manage the feature attributes after change of a feature structure. For the details, refer to the Manual. (Fig. 5.4 Selection of Cross Table Transfer File)



Fig. 5.4 Selection of Cross Table Transfer File

<Example of feature correction using existing data>

(1) Import Features

- Import an externally created feature file in CartaLinx after selection of Export out of CartaLinx
- Correct data (editing of the feature and attribute)
- Process to check whether there is no error in the topology.
For a polygon, correct the feature until the topological structure is completely built.
- Import Arcs.
- Import Nodes (including Polygon Locator).

(2) Transfer polygon key fields to the polygon by 'Cross Table Transfer'.

- Save the feature attribute of the polygon in an external database (dBASE or TEXT)
- Add the polygon database and key field to the Node field and copy the polygon key field in the Point Locator.
- Execute the above steps using 'Cross Table Transfer'. (Polygon→Select Option of Polygon Locator)

(3) Create Export File for Polygon Label (Centroid)

Select a number ID of more than 0 (Polygon Locator) in Design Filter. Then, create the Export file. (Use Shape, MIF, or CartaLinx Layer Transfer Format.)

(4) Create Export File for Arc

Select Arc and Format from Export and export the feature.

As the file format, the mentioned (3) is recommended.

5.3 Table Operation

(1) Import External Table

A relational database is imported into CartaLinx.

Select a data type and the key field. (Fig. 5.5 Import External Table)

Then, select the name of data file to be imported and its key field and import the data. (Fig. 5.6 Selection of File Name)

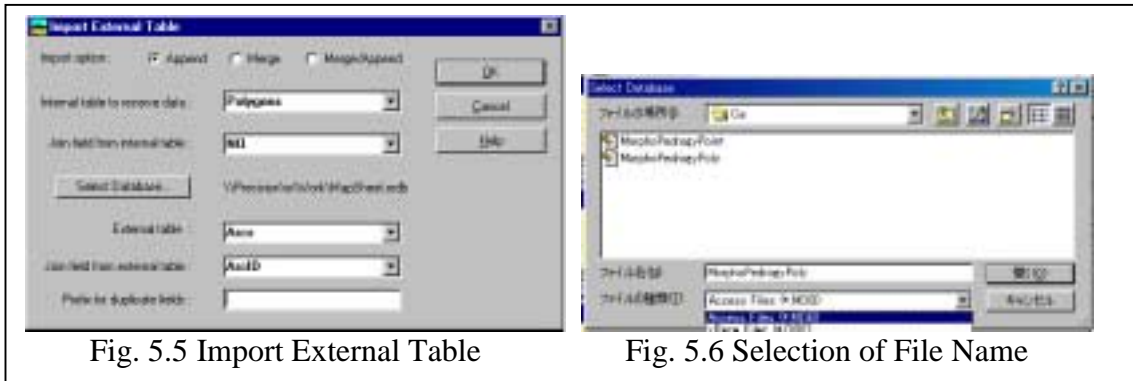


Fig. 5.5 Import External Table

Fig. 5.6 Selection of File Name

(2) Export Table

Export the attribute data to external data. (Fig. 5.7 Selection of Option and Fig. 5.8 Input of File)

The supported format is that of Xbase or text file.



Fig.5.7 Selection of option

Fig. 5.8 Input of File

5.4 Design Filter

Database and feature editing is performed by editing the statement text of SQL command. (Fig. 5.9) The user sets the feature type and the retrieval conditions, edits the statement of the retrieval conditions using the menu tab and executes the retrieval.

A feature selected by this command is temporarily saved in the clipboard, and the file can be saved using the command ‘Copy Filtered Features To New Coverage’.

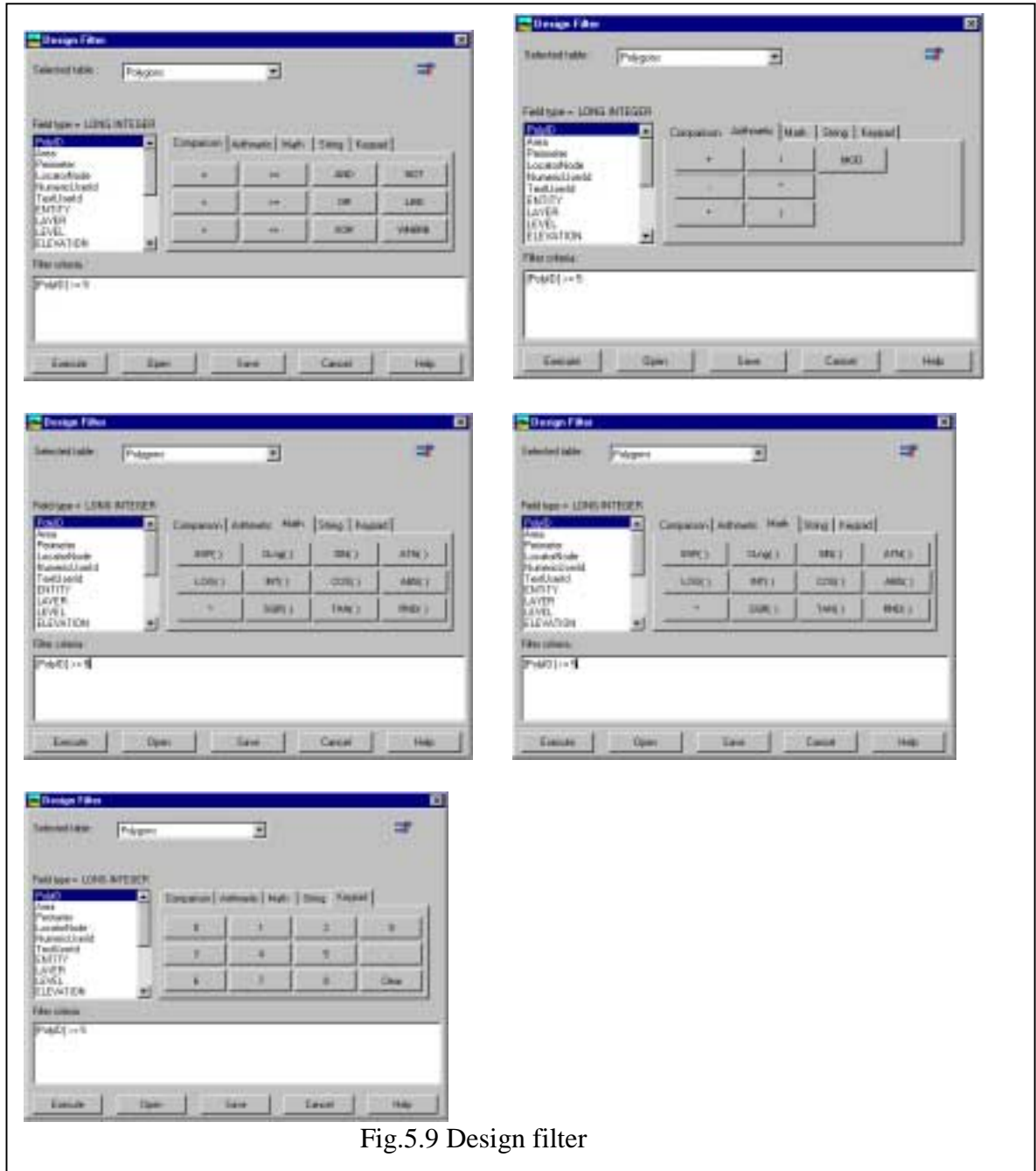


Fig.5.9 Design filter

5.5 Design Calculation

The attribute in the database field is operated. The attributes are controlled by the use of the calculations and the logic arithmetic and functions using the field(Fig.5.10).

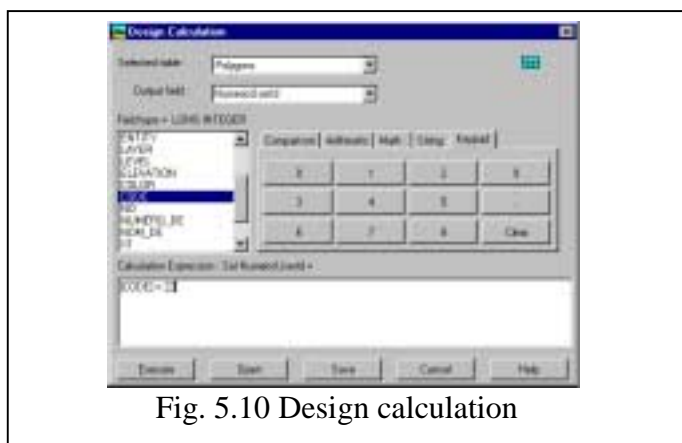


Fig. 5.10 Design calculation

5.6 Undo All Filter

The feature selected by 'Design Filter' is released.

5.7 Copy Filtered Features To New Coverage

The feature selected by 'Design Filter' is saved in a file. (Fig. 5.11 Copy Filtered Feature To New Coverage)

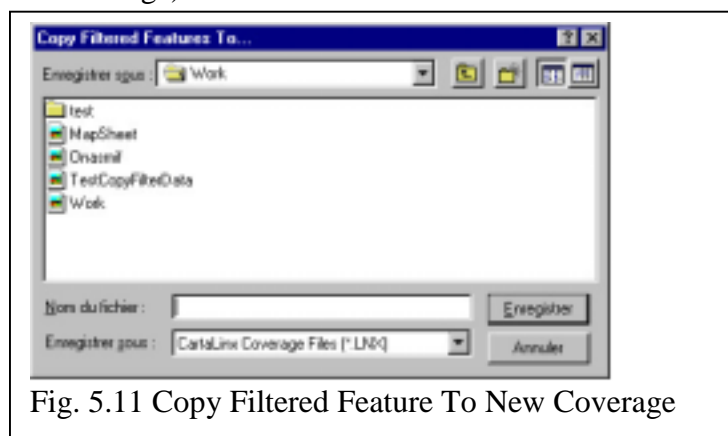


Fig. 5.11 Copy Filtered Feature To New Coverage

5.8 Option

An option as desired is set from the Preference menu.

6 HELP

In CartaLinx, the Help statement is described in detail in the Help file to ensure the user to fully understand the functions of the software. It is recommended that the Help file will be referred to for better understanding of the software functions, especially in order to clarify any unclear point during operation of any of the modules.

7 Literature

CartaLinx Reference Manual