2. Display Digitizing

① Check whether reseau marks and index marks on four corners properly coincide.

② [Table]—[Raster]—[Adjust Image style]—Adjust brightness and contrast of raster data (interpretation manuscript)

- Contrast   20-40
- Brightness   60-80

③ Saving table
- Save tables at the end of step or stop work in the middle of step.

2-1. Road
- Make sure to place node at road crossing, such, T shaped, Y shaped crossing and so on. For coordinates coincidences turn on the snap mode at mentioned crossing.

2-2. Railway
- Input with nodes, the same as in roads. Coordinates should coincide at railways crossing.

2-3. Canal and River
- Input with nodes, the same as in roads. Coordinates should coincide at canal crossing.
- Clip sandbank like as a doughnut, in case sandbank is in river, input as a Region. (See II-4-7)
- Digitize along the center of river double line of interpretation manuscript by using Input menu. Execute buffering in MapInfo standard function for converting line data to Region data in order to express double lined river. Input single line river after double line river input. Single lined river is joined with buffered double lined River. (See II-4-5)

2-4. Residential blocks and Houses
- Features 14-2 and 16 are input as line objects. (See II-4-1)
- Feature 14-1 is input to Region as maximum area without separating by road. (See Figure 5)
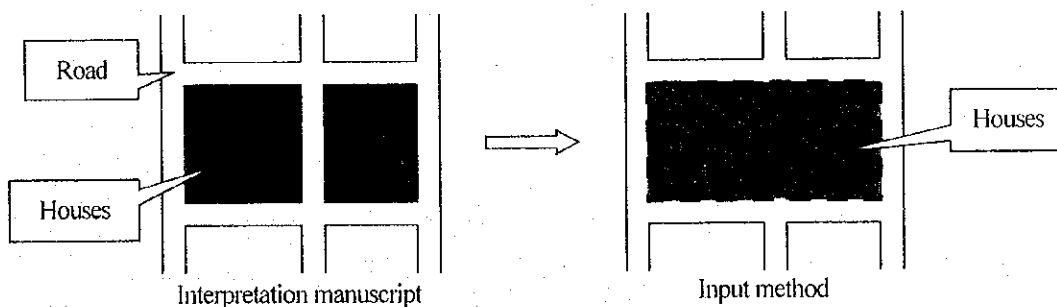

Figure 5. Input Procedure of Feature 14-1

2-5. Facilities of Manufacture, Industry, Agriculture, Society and Culture
  - Input symbol of object or express at the scale of interpretation manuscript data.

2-6. Vegetation
  - In case one Region is included into the other, input the outer Region by cutting out the inner Region with one stroke like as doughnut shape. (See Figure 6. and II-4-7 Input procedure of including Region)
  - At a boundary of vegetation, input with snap mode and use shift key not to cross boundary line.
  -- On interpretation manuscript there are some vegetation symbols without feature numbers except vegetation Regions. Find corresponding symbols from Input menu and input to the same place.

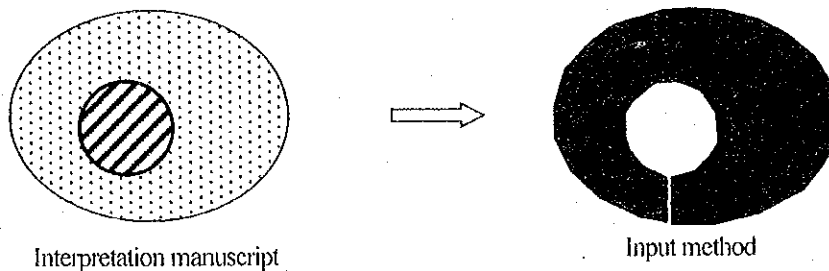Interpretation manuscript   Input method

Figure 6. Input method of including Regions

3. Input Procedure for Each Map Symbol

3-1. Residential Area (Feature no.9 – 20)
  Input map symbols, except symbols of Table 18, according to numbers on interpretation manuscripts.

Table 18. Input procedure of residential area

Feature number	Number on Input menu	Input procedure
9-1 9-2 9-3 9-4	9-1 9-2 9-3	- Input the Input menu number coinciding the feature number. - Input 9-4 as 9-3. - Execute rectangular correction automatically.
11	11-1 11-2	- 11-1 expresses outline of features and 11-2 expresses black painted symbol of features of the smallest size. - Input 11-1 after input 11-2.
12	12	- Input the same as individual houses.
14-1	14-1	- Input maximum area without separating by road.
14-2	14-2	- Input, clicking three times (See Table 7. Input procedure of 14-2 and 16)
16-1 16-2	16	- Input the same as 14-2. (See Table 7. Input procedure of 14-2 and 16)

3-2. Facilities for Manufacture, Industry, Agriculture, Society and Culture (Feature no. 36-89)
  Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 19.

Table 19. Input procedure of facilities

Feature number	Number on Input menu	Input procedure
64	64	- Input the same feature outline as in interpretation manuscript. - Produce the smallest size of symbol automatically according to the input size.
74	74-1 74-2	- Input the same feature outline as in interpretation manuscript. - Produce the smallest size of symbol automatically according to the input size.
88	88	- Input outline of the feature anticlockwise, the same as in interpretation manuscript. Pay attention to the direction of embankment.

3-3. Railway (Feature no. 90-102)

Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 20.

Table 20. Input procedure of Railway

Feature number	Number on Input menu	Input procedure
90	90-1 90-2	- 90-1 expresses a single-track line and 90-2 expresses a double-track line. Input according to the expression of interpretation manuscript.
96-1 96-2 96-3	96 (9-2)	- Point center of the building at first point and drag to the direction of the building. Input least sized symbol inside the station building with 9-2 after input 96.
97-1	97-1 (9-1)	- Point center of the building at first point and drag to the direction of the building. Input least sized symbol inside the building with 9-1 after input 97-1.
98-1	98-1	- Point center of the building at first point and drag to the direction of the building.
98-2	98-2	- Input the same as interpretation manuscript. End stop line of railway is automatically generated at the end of railway.
98-4	98-4	- Input with three clicks. At the first click select the desired line to generate symbols, and point the place where to put symbols at the second and third clicks.
100-1	100-1	- Input with three clicks. Specify the bridge length with first and second click. (Click the center of bridge) Specify the bridge width at third click. - Produce the smallest size symbol automatically according to the input size.
100-2	100	- Input with three clicks. Select the object to generate embankment by the first click. Specify the area for embankment by the second and the third clicks. See input procedure for road embankment.
100-3	100	- Input the same as interpretation manuscript. Pay attention to the direction of embankment.

3-4. Road (Feature no. 105-128)

Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 21.
Digitize along the center of the road.

Table 21. Input procedure of Road

Feature number	Number on Input menu	Input procedure
108	108-1 108-2	- Select feature numbers according to the expression of interpretation manuscript, because feature numbers are not described in detail at interpretation manuscript. - Digitize along the center of the road.
116	116	- Input with three clicks. Select the road by first click. Click start and end point by second and third click, and select road style on opened dialogue. Suitable embankment width will be generated along the road automatically. - Embankment without feature number input with 116. Pay attention to the input range of embankment symbol.
118	118	- Point center of interchange at the first point and drag to specified direction.
122	122	- Input with three clicks. Specify length of the bridge by first and second click, and specify width of the bridge by third click. Input along the center of the bridge.
128	128	- Input at the change point of road type. - Click the road after selection of 128 in Input menu. Selection of one of neighboring roads inputs borderline of the road. - Road borderline is to be input even if roads are without feature number.

3-5. Water part (Feature no. 129-185)

Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 22.

Table 22. Input procedure of water part

Feature number	Number on Input menu	Input procedure
129 130-3	129 130	- Input the Input menu number coinciding the feature number and digitize the same as interpretation manuscript. - In case the symbol number of 129, 130-3 with vegetation symbol, input with the number on the additional Input menu.
134-1	134 134	- Input ticker part of 134-1 as 134 at the merged point with 134-2. Input other part as 134. - First, input 134-2 for buffering to make Region. Then, input 134-1.
134-2	134	- Input 134 with digitizing along the center of 134-2. - Make buffering after digitizing.
None	134	- Digitize cay of scale river without vegetation symbol number as 134 following the interpretation manuscript. Input vegetation at the place with vegetation number.
135-1	135 135	- Digitize a wide part of single lined river as 135. Digitize other parts as 135.
135-2	135	- Digitize the center of 135-2 on the interpretation manuscript as 135. Make buffering after input.
145	145	- Digitize the center of 145 on the interpretation manuscript as 145. Make buffering after input.
152-2	152-2	- Digitize along the center of double-lined river. Make buffering after input.

156	156-1	- Input bridge at the double-lined road as 156-1. - Input with three clicks. Select the road with the first click and indicate both sides of culvert as the second and the third click. Select road type on the dialogue and execute.
	156-2	- Input bridge at the single-lined road and railway as 156-2. - Input with three clicks. Select the railway or single-lined road with the first click and indicate both sides of culvert as second and third click. Dialogue will not be required.
157	157	- Input with two clicks. Click both sides of bridge. - Input along the centerline of bridge.
158	158	- Input with three clicks. Point both sides of bridge with the first and second click and specify bridge width from center to the side edge with the third click. - Input along the centerline of bridge.
162	162	- Input with three clicks. Refer to 158.
167-1	167-1	- Input with three clicks. Refer to 158.
171	171	- Refer to input procedure of 171 on II-4-3 Input menu.
172	172	- Input with three clicks. Refer to 158.

3-6. Topographic features (Feature no. 213-222)

Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 23.

Table 23. Input procedure of Topographic features

Feature number	Number on Input menu	Input procedure
214-1	214 214	- Digitize the widening part of single lined dried riverbed as 214. Digitize other parts as 214. - After buffering of 214-2, digitize 214-1 with adjoining to buffered 214-2.
214-2	214	- Digitize with indicated Input menu following the interpretation manuscript. Execute buffering after digitizing.
214-4	214	- Digitize with indicated Input menu following the interpretation manuscript. - Pay attention to the direction of embankment.

3-7. Vegetation (Feature no. 238-286)

Input map symbols according to the numbers on interpretation manuscripts, except symbols of Table 24.

Vegetation regions without branch number are input with the same vegetation Input menu number. Refer to the table regarding symbols with branch number.

In case two vegetation symbol numbers are expressed in one vegetation region, input these numbers with additional Input menu but not with vegetation Input menu.

Table 24. Input procedure of Vegetation

Feature number	Number on Input menu	Input procedure
238	238	- Feature number is not expressed in interpretation manuscript. - Refer to input procedure of vegetation boundary.

3-8. Additional map symbols

Input map symbols according to interpretation manuscripts, except symbols of Table. 25

There are no feature numbers for Additional map symbols, because they are not originated in Kazakstan. The following map symbols are added to original map symbols for necessity of producing Digital Map.

Table 25. Input procedure of Additional Input menu

Input menu item	Input Procedure
Blank area	- To facilitate procedure input vegetation region without vegetation symbol number at previously blank area in order to input vegetation spread widely on the sheet, at the end of the procedure - Input the same as interpretation manuscript.
Street (0.6mm)	- Input 16-1 as street (0.6mm).
Street (0.3mm)	- Input 16-1 as street (0.3mm).
Runway	- Input runway the same as interpretation manuscript.

4. Special Instructions for Input Items

4-1. Input procedures of 14-2 and 16

① Confirm input of roads (In Input menu features are automatically generated parallel to road.)
② Select corresponding feature number on Input menu.
③ First, select parallel road to built-up area. Next, specify length of build up area with the second and the third click. Finally, double click to execute the program.
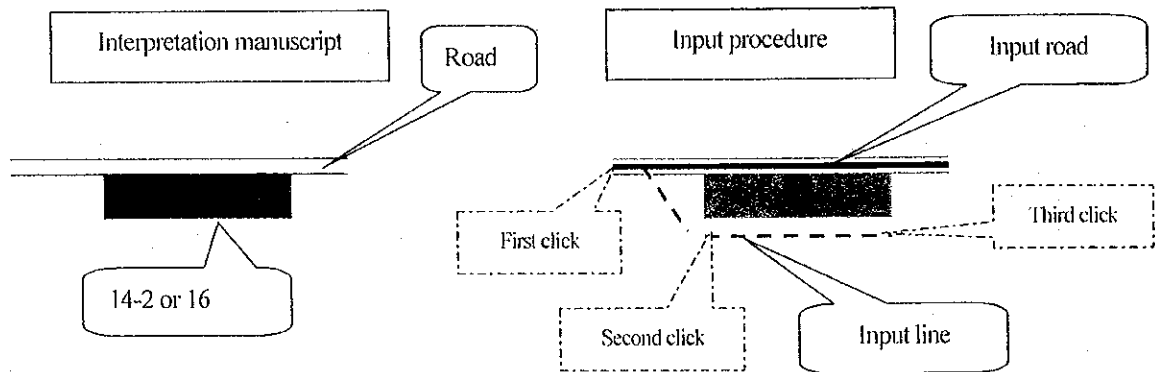

Figure 7. Input Menu Procedure, Numbers 14-2 and 16

④   Select road style at opened dialogue. (See Figure 8.)
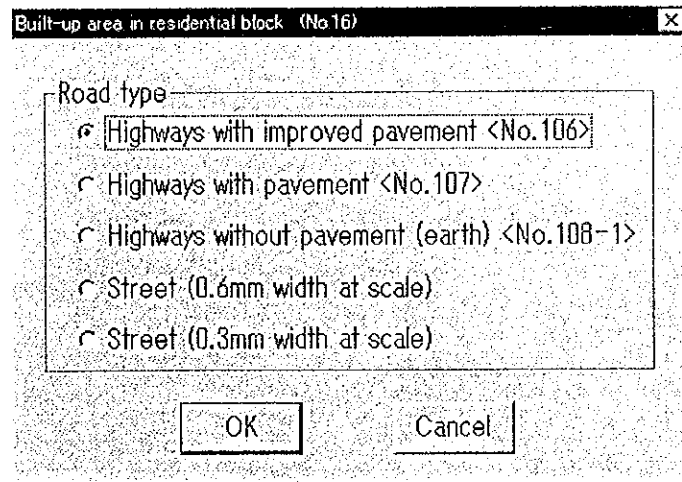
Figure 8. Dialogue of Residential Block Area

The second and the third clicks can be as on figure 9, because distance width from road depends on selection at dialogue. Second and third click points have no influence.

A single line will be generated along the road line (See Figure 10). This line will not be always generated outside of built-up area.
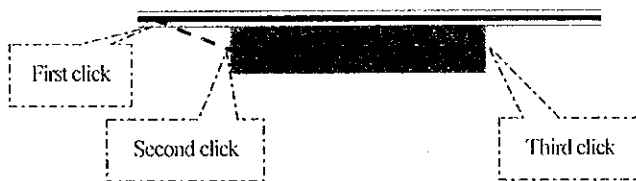
Figure 9. Input Method

Figure 10. Expression of Built-up Area

[Input procedure at the corner]

In case built-up area is to be generated along a street corner, the same procedure as for straight road is being carried out. It is not necessary to make additional click at the corner, because built-up area will not be expressed correctly if input is made with cut at the corner. (See Figure 11)
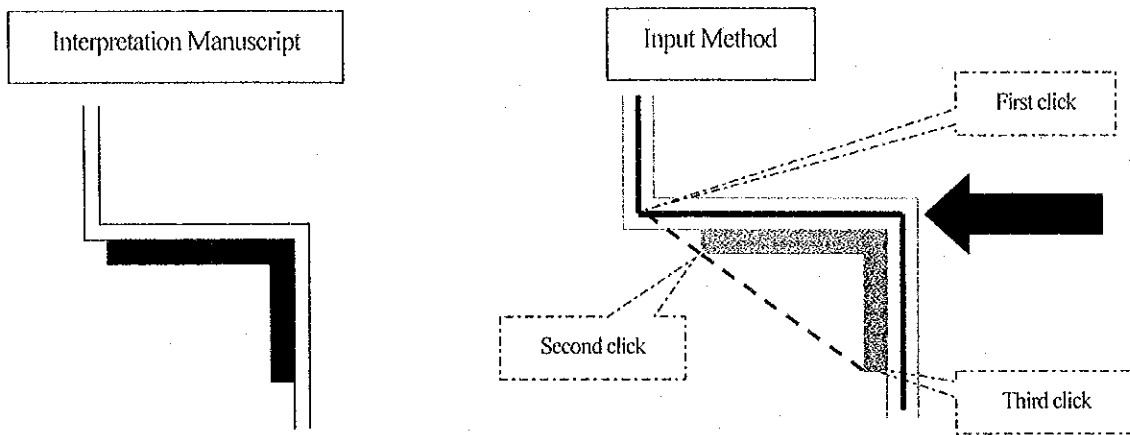
Figure 11. Input Method at a Corner

[Input procedure of block type built-up area]
　　Adjust each input built-up area lines. (See Figure 12)

[Interpretation Manuscript①]
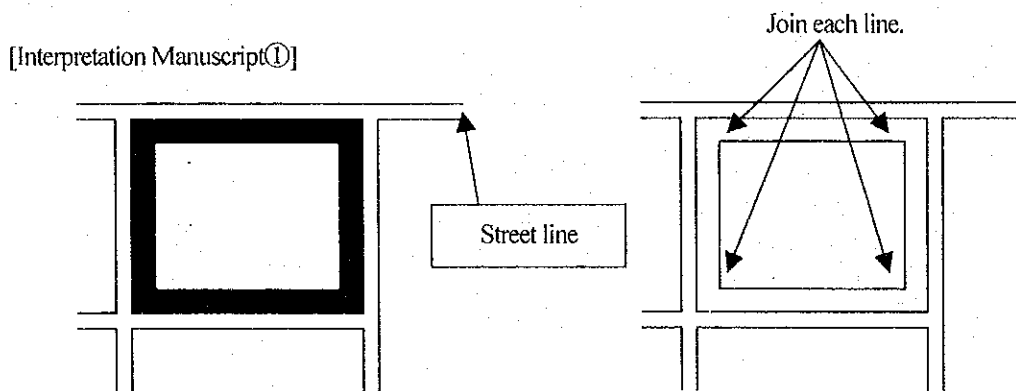
Produce built-up area line along the street by using Input menu number14-2. After that, join each line with joining command.

[Interpretation Manuscript②]
In case, built-up area is not completely surrounded by streets.
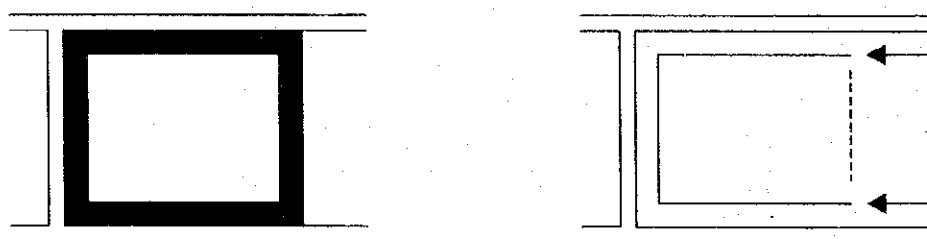
Figure 12. Join Procedure of Feature No. 14-02 and 16

Produce built-up area line along a street as solid line. Join at arrow symbol place with a modifying command.

4-2. Input procedure of embankment along a road
On interpretation manuscript digitize a road line along road center without discontinuing on an embankment along the road. Specify the area of embankment using the same procedure (Select the road with the first click and specify the area with the second and the third clicks.) as Feature no. 171 (River with embankment on one side or both sides). Select road type at dialogue to produce one side of the embankment. In case there are embankments on both sides of a road, the same procedure is taken to opposite side of the road.

[Note 1] In case embankment is along both sides and at the same place of the road, input the area as same as possible. Expressions of embankment shall be arranged properly by input same place. (See Figure 13)

Input perpendicularly.
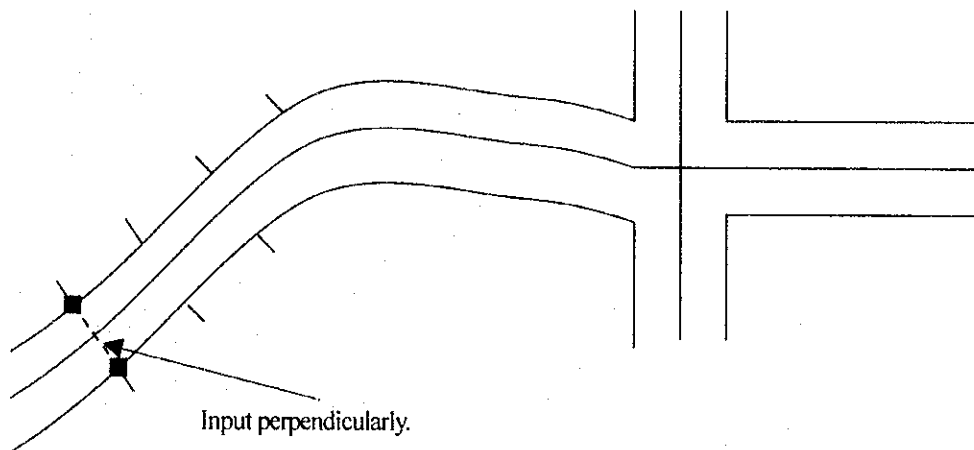
Figure 13. Input Procedure of Embankment along the Road

[Note 2] If a road ends, input embankment as on Figure 14, joining embankments.
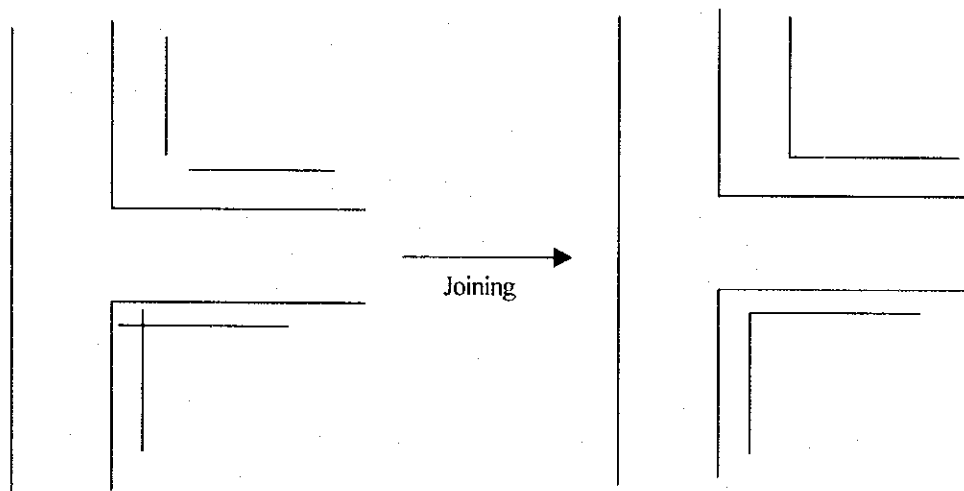
Joining

Figure 14 Joining of Embankment

Make the same procedure for embankment along the railway.

4-3. Input procedure for feature no. 171

    ①   Digitize along the center of canal with 145 or 152-1 according to numbers color on interpretation manuscript. (Input 145 in case numbers are blue, and input 152-1 in case numbers are brown.)

    ②   Input embankments along the canal at one side or both sides with 171, according to interpretation manuscript. Input procedure: Input with three clicks. Select canal with the first click, and specify the area with the second and the third clicks.

    ③   After input of embankment, make buffer to line 145, expressed with numbers 171, blue color. The radius is 30 meter and the Smoothness is 12 segments per circle at the buffering. Buffering patterns are shown in Table 26.

Table 26. Buffering Patterns of 171

Input menu number	Fill				Boundary				Weight
	Pattern	Foreground color			Style	Color			Point
		Red	Green	Blue		Red	Green	Blue	
171　(Blue)	2	208	224	255	1	0	85	255	0.1

4-4. Input procedure of Bridge

For bridge with feature number on interpretation manuscript, input coincident number from Input menu. In case feature numbers are not expressed, input 157 or 158 from Input menu.

Feature number 157 expresses least sized symbol bridge and 158 expresses at scaled symbol bridge. Input 158 in case bridge size on interpretation manuscript is larger than least sized symbol.

In case there are culverts without feature numbers, judge from the situation whether those are passing under road or railway, and then input.

4-5. Buffering

Attention :

    - After making buffer, delete the remaining original line. (See Figure 15)

    - Input single line after double line input. If single line is input already, end of the line should be joined to double line. (See Figure 15)

    - Radius and curve value in buffering are as in Table 27.

Table 27. Settings of Radius and Smoothness

Radius (Meter)	Smoothness (Segment per circle)
30	12

Delete original input line. Under normal condition, original line is hidden behind produced buffering surface.

Join single line to produced buffering surface.
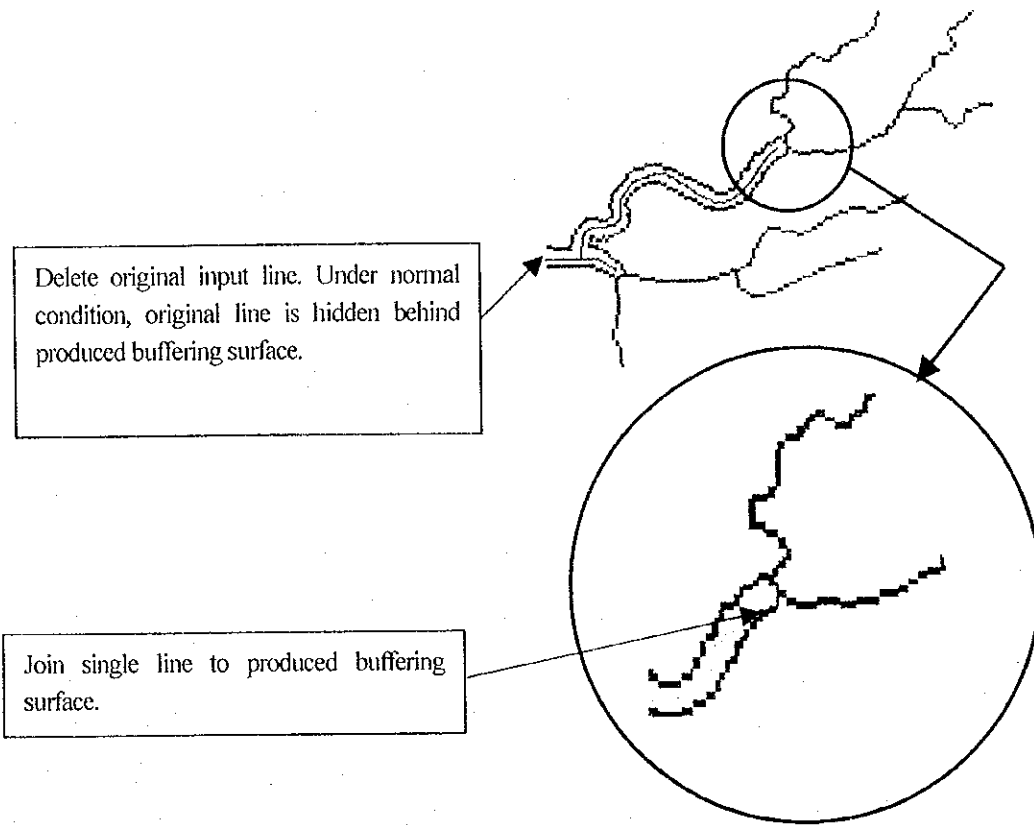
Figure 15. Buffering

4-6. Union and Division of objects

    Attention:

        - For correct symbolization data structure "Polygon number 1" must be used. Therefore, pay attention to data structure at union and division of objects.

4-7. Input procedure for including Region (Cutting out as spherical shape)
    This procedure is used when one Region is included into other Region. (See Figure 16.)
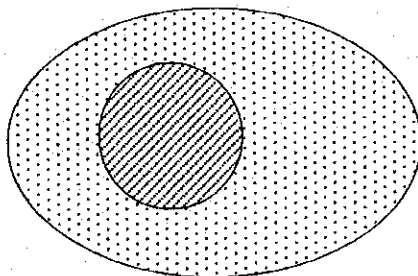
Figure 16.
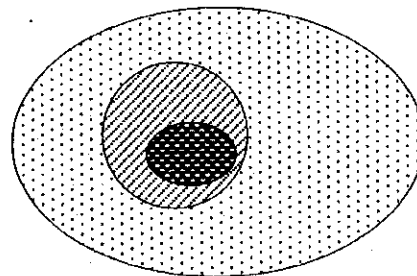
Region, which needs Spherical cut out

Figure 16-2

[Input procedure]
① Input inside Region. (It is easy to cut out like as doughnut shape with a snap function, at following step.) In case several Regions are included, cut out all included Regions first.
② Input outside Region. Digitize inside Region with a hollow like a doughnut shape, to protect inside Region from included outside Region. Start from one of the nodes and digitize with snap function. (See Figure 17)

- In case several Regions are piled as on Figure 16-2, input from inside Region to outside Region. Use doughnut type cut for all Regions except the most inside Region.

Interpretation manuscript   Input procedure

Node connection at this point is needed
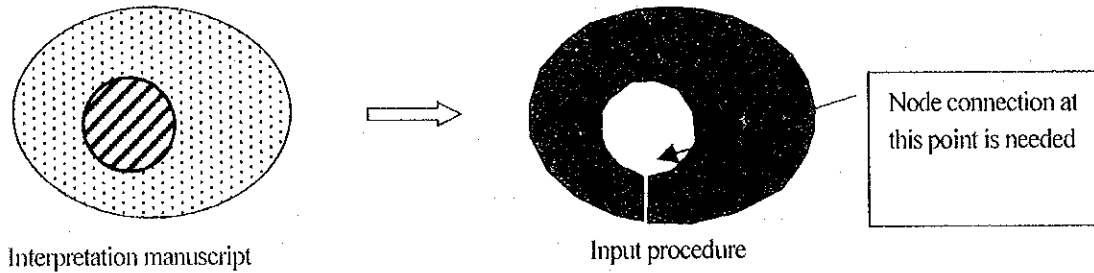
Figure 17. Input procedure of included Regions

5. Styles of Each Map Symbols after Buffer Creation

Styles of each map symbols after buffer creation are:

Table 28. Styles of Buffering

Feature number	Input menu number	Fill				Boundary				Weight
		Pattern	Foreground color			Style	Color			Point
			Red	Green	Blue		Red	Green	Blue	
134-2	134-3	2	208	224	255	2	0	85	255	0.2
135-2	135-3	2	0	85	255	7	0	0	255	0.4
145	145	2	208	224	255	2	0	85	255	0.1
152-2	152-2	2	255	255	255	68	128	0	0	0.4
171 (Blue)	171	2	208	224	255	2	0	85	255	0.1
214-2	214-3	2	255	255	255	8	128	0	0	0.4

* Background color of Fill are 255, 255, 255 for Red, Green, Blue for all map symbols.

III. Digital Mapping of 1/200,000 Scale Topographic Framework Map

1. Input

Attention:
- Symbol numbers shall be adapted to symbol specifications of 1-100,000.
- Lines near neat line shall be extended to a neat line on attached sheet frame DGN file by using "extend element to intersection" command.
- Crossings between railways, roads and canals should be joined. Join is done by node connecting or using "extend element to intersection" command.
- Feature number 96 (station building), 118 (inter change) and (index contour value) are input with an angle.
- Cay in feature number 129 and 130-3 is input with 129 and 130 at Input menu. After input of shoreline and cay, input auxiliary lines at additional Input menu. (Refer III-5-1. Input procedure of Region)

2. Input Procedure

2-1. Digitize on display

① Prepare new DGN file for digitizing at the operational directory. Change DGN file name to "Sheet name + a .dgn".
- Prepare base DGN file for copying (seed .dgn) in advance.

② Open DGN file for digitizing at I/RASC. Attach index mark DGN file and sheet frame DGN file as an attached file.

③ (At I/RASC) $\boxed{\text{File}}$—$\boxed{\text{Open}}$—Open interpretation manuscript. Adjust brightness of opened interpretation manuscript to conspicuous input lines. $\boxed{\text{Contrast}}$—$\boxed{\text{Contrast/Brightness}}$—Open Contrast Brightness dialogue and input the following values.
- Contrast ...... -25
- Brightness ...... -25

④ Load Input menu (KZINP) and start digitalization.

2-2. Use of Input menu

- $\boxed{\text{MicroStation utility}}$—$\boxed{\text{MDL application}}$—Load KZINP. (It can be loaded by input from keyboard. Input "mdl l kzinp").
- Input menu is arranged by categories. Open tools by clicking the icon of desired category. Input with Input menu number, which is coincident to the number on interpretation manuscript.
- All features are input by line.

2-3. Input scale

Proper scale for input is as in Table.
At delicate curving place, input with larger scale.

Table 29. Proper Scale for Input

Items	Scale
Railway	5-7
Road	5-7
Water Part	15-18
Residential Area	10-12
Symbol	10
Auxiliary line	15-18

3. Input Procedure for Each Map Symbol

3-1. Residential area

Table 30. Input Procedure for Residential Area

Feature number	Number on Input menu	Input procedure
14-1 14-2	14-1 14-2	- Input the same as interpretation manuscript. - Join properly so that no error will occur at converting to Region data.

3-2. Facilities for Manufacture, Industry, Agriculture, Society and Culture

Table 31. Input Procedures for Facilities of Manufacture, Industry, Agriculture, Society and Culture

Feature number	Number on Input menu	Input procedure
55	55	- Input the same as interpretation manuscript.

3-3.Railway

Table 32. Input Procedure for Railway

Feature number	Number on Input menu	Input procedure
90-1 90-2	90-1 90-2	- Input the same as interpretation manuscript with the coincident number.
96	96	- Least sized symbol of the station building. - Input with two clicks. Point center of the building at the first point and drag to the direction of the building.

3-4. Road

Table 33. Input Procedure for Road

Feature number	Number on Input menu	Input procedure
105 106 107 108 110 111	105 106 107 108 110 111	- Input the same as interpretation manuscript with the coincident number.
118	118	- Input with two clicks. Refer to input procedure of 96-2.

3-5. Water part

Table 34. Input procedure for Water part

Feature number	Number on Input menu	Input procedure
129 130	129 130	- Input the same as interpretation manuscript with the coincident number. - Input with surrounding area. - Convert to Region data after input.
134-1	134	- Digitize a wide part of single lined river, which join to 134 as 134. Digitize other parts as 134.
134-2	134	- Double lined river is expressed as Region data. Therefore, digitize along both river shores expressed on interpretation manuscript, and do not digitize along the center of a river. Pay attention to join input lines at the end of double line river so that no error occur at converting to Region data - Convert to Region data after input.
134-3	134	- Input the same as interpretation manuscript with indicated Input menu. - Input with surrounding area, and convert to Region data. - Convert to Region data after input.
None	134	- No numbers are expressed on cay at the interpretation manuscript, because there are no map symbols to express cay at the Kazakstan map symbols specification. - Input 134-5 with cay surrounding area, if there is a cay in river. - Convert to Region data after input.
135-1	135	- Refer to the input procedure of 134-1.
135-2	135	- Refer to the input procedure of 134-2. - Convert to Region data after input.
143	143-1 143-2	- 143-1 expresses the mainstream of canal and 143-2 expresses a branch stream of canal. Judge from the situation and input 134-1 and 134-2, not according to the width of canal.
144	144	- Input the same as interpretation manuscript.
145	145	- Refer to the input procedure of 134-2. - Convert to Region data after input.
146	146	- Input the same as interpretation manuscript. - Convert to Region data after input.

3-6. Topographic features

Table 35. Input Procedure of Topographic Features

Feature number	Number on Input menu	Input procedure
213-1 213-2 213-3 213-4	213-1 213-2 213-3 213-4	- Input the same as interpretation manuscript with indicated Input menu.
213-6	213-6	- Input the same as interpretation manuscript with indicated Input menu.
215-1 215-2	215-1 215-2	- Input the same as interpretation manuscript with indicated Input menu.

3-7. Additional map symbols

Table 36. Input Procedure for Additional Map Symbols

Feature number	Number on Input menu	Input procedure
None	None (Auxiliary lines)	- At converting to Region data, input auxiliary lines to express Region properly. Refer input procedure to Region.

4. Input Inspection

Plot out input DGN file with the attached interpretation manuscript and Sheet frame DGN file. Plot each interpretation manuscript of 1/100.000 scale. Inspect plotted out sheets by eye for overlapping of input lines to interpretation lines. Correct lines, in case there is discrepancy more than one line thickness.

5. Input Procedure for Map Symbols

5-1. Input procedure for Region

Objects, to be converted to Region data after being input as line data, must be input as closed area. In case data is not closed properly it is detected as error data at conversion to Region data. Input line data is to be overlapped, in case Region data is adjusting.
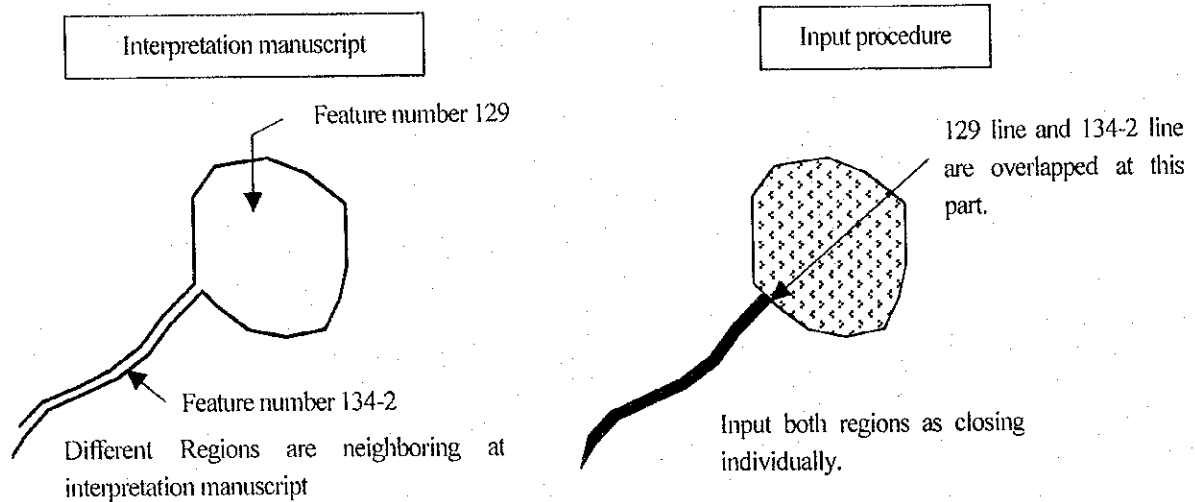
Figure 18. Input Procedure for Neighboring Regions

In case other Regions are included in the Region, input auxiliary line to create doughnut shape. In case of figure 19, without auxiliary line, cay will be hidden behind the river.

Interpretation manuscript	Input procedure

Feature number 134-3

Feature number 134-3

Cay

Cay

Auxiliary line

Other Regions are included in the Region.

Input auxiliary line to create doughnut shape.
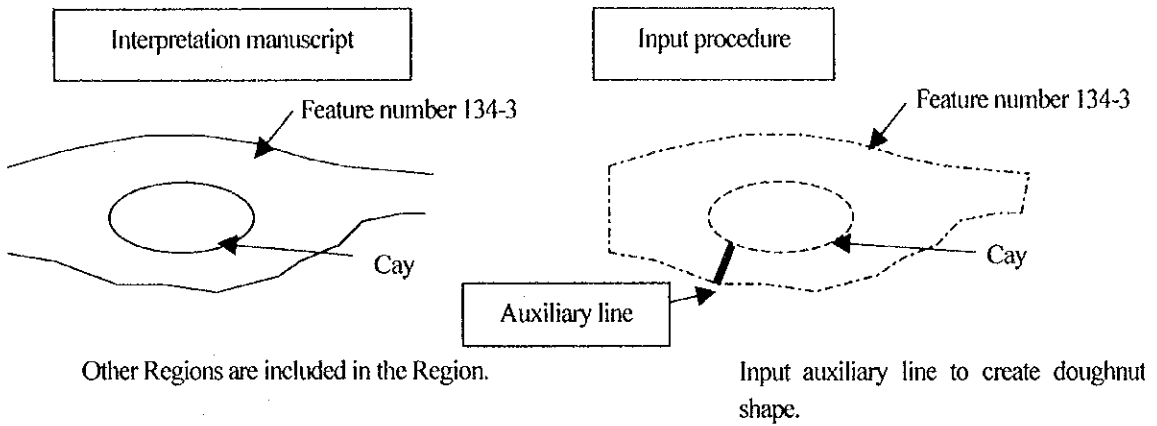
Figure 119. Input Procedure for Doughnut type Region

5-2. Input procedure for double lined river

Input double lined river as shown on figure 20 to create Region. Close the end of line.

Interpretation manuscript	Input procedure
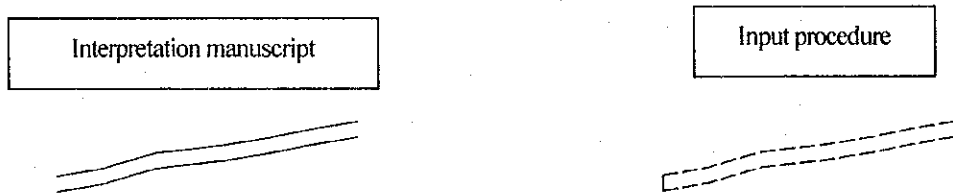
Figure 20. Input Procedure for Double Lined River

In case single lined river is joining to double lined river, input is as on figure 21.
Join properly at agjoining part.

Interpretation manuscript	Input procedure

134-1   134-2   134-3

Feature numbers

134-1
134-2   134-3   134-4

Input menu numbers

Figure 21. Input Procedure for Rivers

IV. Relief Inspection

1. Work Procedure

Figure 22 shows workflow and procedure (used software).

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                        ┌─────────────────────────────────┐
                        │      Digitized Relief Data       │
                        └─────────────────────────────────┘
                           │                         │
                           ▼                         ▼
        ┌──────────────────────────┐   ┌──────────────────────────────┐
        │ Inspection of Figure shape│   │ Data conversion to MIF, MID format│
        │ (MapInfo, Eye inspection) │   │         (MapInfo)             │
        └──────────────────────────┘   └──────────────────────────────┘
                                                    │
                                                    ▼
                                        ┌──────────────────────────────┐
                                        │ Inspection of Orientation residual│
                                        │          (SETCK)              │
                                        └──────────────────────────────┘
```

```
┌──────────────────────────────┐         ┌──────────────────────────────┐
│ Data conversion to Two-dimensional DGN│ │ Data conversion to            │
│ data                          │         │ Three-dimensional DGN data    │
│ (pl2dgn)                      │         │ (pl2dgn)                      │
└──────────────────────────────┘         └──────────────────────────────┘
              │                              │                    │
              ▼                              ▼                    ▼
┌──────────────────────────────┐   ┌─────────────────┐  ┌──────────────────┐
│ Transformation to            │   │ Revision of Relief│ │ Transformation to │
│ Kazakstan coordinates        │   │ (dgn2con)        │  │ TM coordinates    │
│ (shiftxyz)                   │   └─────────────────┘  │ (shiftxyz)        │
└──────────────────────────────┘           │           └──────────────────┘
              │                             ▼                    │
┌──────────────────────────────┐   ┌─────────────────┐  ┌──────────────────┐
│ Inspection of feature adjoining│  │ Height Inspection│ │ DXF conversion for│
│ (edcon)                       │   │ (Eye inspection)│  │ Geometric correction│
└──────────────────────────────┘   └─────────────────┘  │ (MicroStation)    │
              │                                          └──────────────────┘
┌──────────────────────────────┐
│ Inspection of sheet adjoining │
│ (edcon)                       │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Transformation to            │
│ TM coordinates                │
│ (shiftxyz)                    │
└──────────────────────────────┘
```
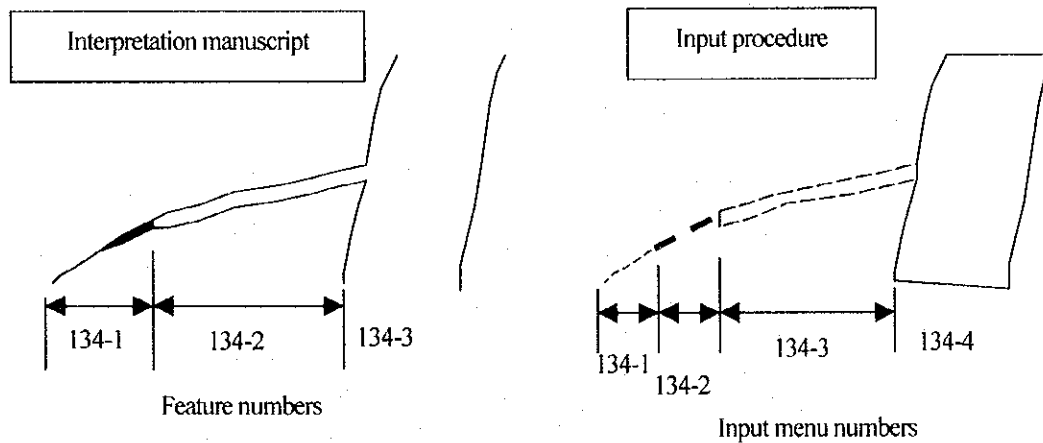
```
                ┌──────────────────────────────┐
                │ Adjustment of Inspection results│
                │        (MicroStation)         │
                └──────────────────────────────┘
                                │
                                ▼
                ┌──────────────────────────────┐
                │ DXF conversion of Inspection results│
                │        (MicroStation)         │
                └──────────────────────────────┘
                                │
                                ▼
                ┌──────────────────────────────┐
                │ MapInfo conversion of Inspection results│
                │          (MapInfo)            │
                └──────────────────────────────┘
```

Figure 22. Work flow

2. Work Procedure for Relief Inspection

Item	Work method	Expression of inspect result
Inspection of Feature shape	Print out digitized relief data together with rasterized relief data by MapInfo.	Mark circle at the place with large discrepancy, and input to digitized contour line file (two-dimensional).
Inspection of Orientation result	Create comparison table of orientation result and sheet index coordinates.	Place circle at the place, where orientation residual is more than two pixels.
Height Inspection	Plot out digitized contour line (three-dimensional) and revise contour line together with the original.	Create error height contour line file by deleting correct contour lines in digitized contour line file (two-dimensional) with the help of plotted out sheet.
EDCON	Execute joining between features and neat lines with thresh holding value 0.	Delete error circle on corrected contour line by eye inspection. Plot out the result and inspect contour height on flat area. In case of error contour line, move the level.
ELEDEL	Delete corrected features from DGN inspecting file.	
MapInfo data for inspection	Convert data to MapInfo data format through DXF format.	Send MapInfo inspection file and instruct correction.
CONT_CHK	Change digitized contour line style to correct contour line style.	

3. Forms of Error Marks

Items	Levels	Type	Color	Radius
Contour lines (2D)	21-35	Line	White	—
Revision contour lines (3D)	31-35	Line	Green (Index contour) Red (Intermediate contour)	—
Feature shape and coordinates	55	Circle	Blue	Variable
Feature type (color, line weight, etc.)	56	Circle and Line	Purple	5mm
Joining between features Joining to neat line	57	Circle	Red	5mm
Joining between neighboring sheets	58	Circle	Orange	5mm
Contour height	59	Line and Circle	Light blue	As the occasion
Garbage data	54	Circle	Green	Variable

4. Flowchart of Relief Digitizing

MapInfo data

DXF file

Files for data conversion

MapInfo data

Send to Kazakstan for inspection result

MapInfo inspection data

Two-dimensional DGN data (MapInfo inspection data)

ELEDEL

JOINT

EDCON

Data adjustment

Inspection of sheet adjoining

Inspection of feature adjoining

Plot out

Three-dimensional DGN data

Inspection of height

Revision

Mif, Mid

Sheet record

Print out

Inspection of Orientation result

Plot out in one sheet

Inspection of shape

MapInfo data

Land Cover Classification

Contents

Land Cover Classification of SPOT XI Image by PCI Software

Supervised and unsupervised classification can be done by Image Works. In this project, said classifications were adopted to first and second image analysis respectively.

The processing flow is:

```
                        ┌─────────────────────────┐
                        │       Image Works       │
                        └─────────────────────────┘

                          ┌───────────────────┐
                          │  Image Data (PIX)  │
                          └───────────────────┘
                              ↙           ↘

   ┌──────────────────┐                      ┌──────────────────┐
   │   Supervised     │                      │   Unsupervised   │
   │  Classification  │                      │  Classification  │
   └──────────────────┘                      └──────────────────┘

   ┌──────────────────────┐                  ┌──────────────────────┐
   │ Add output and       │                  │  Add output channel  │
   │ training channel     │                  └──────────────────────┘
   └──────────────────────┘                             ⇩
             ⇩                                ┌──────────────────────┐
   ┌──────────────────────┐                  │   Session setting    │
   │   Session setting    │                  └──────────────────────┘
   └──────────────────────┘                             ⇩
             ⇩                                ┌──────────────────────┐
   ┌──────────────────────┐                  │      Classify        │
   │  Edit training data  │                  └──────────────────────┘
   └──────────────────────┘                             ⇩
             ⇩                                ┌──────────────────────┐
   ┌──────────────────────┐                  │   Class labeling     │
   │ Check preview image  │                  └──────────────────────┘
   └──────────────────────┘                             ⇩
             ⇩                                ┌──────────────────────┐
   ┌──────────────────────┐                  │     Aggregation      │
   │      Classify        │                  └──────────────────────┘
   └──────────────────────┘                             ⇩
             ⇩                                ┌──────────────────────┐
   ┌──────────────────────┐                  │       Result         │
   │       Result         │                  └──────────────────────┘
   └──────────────────────┘
```
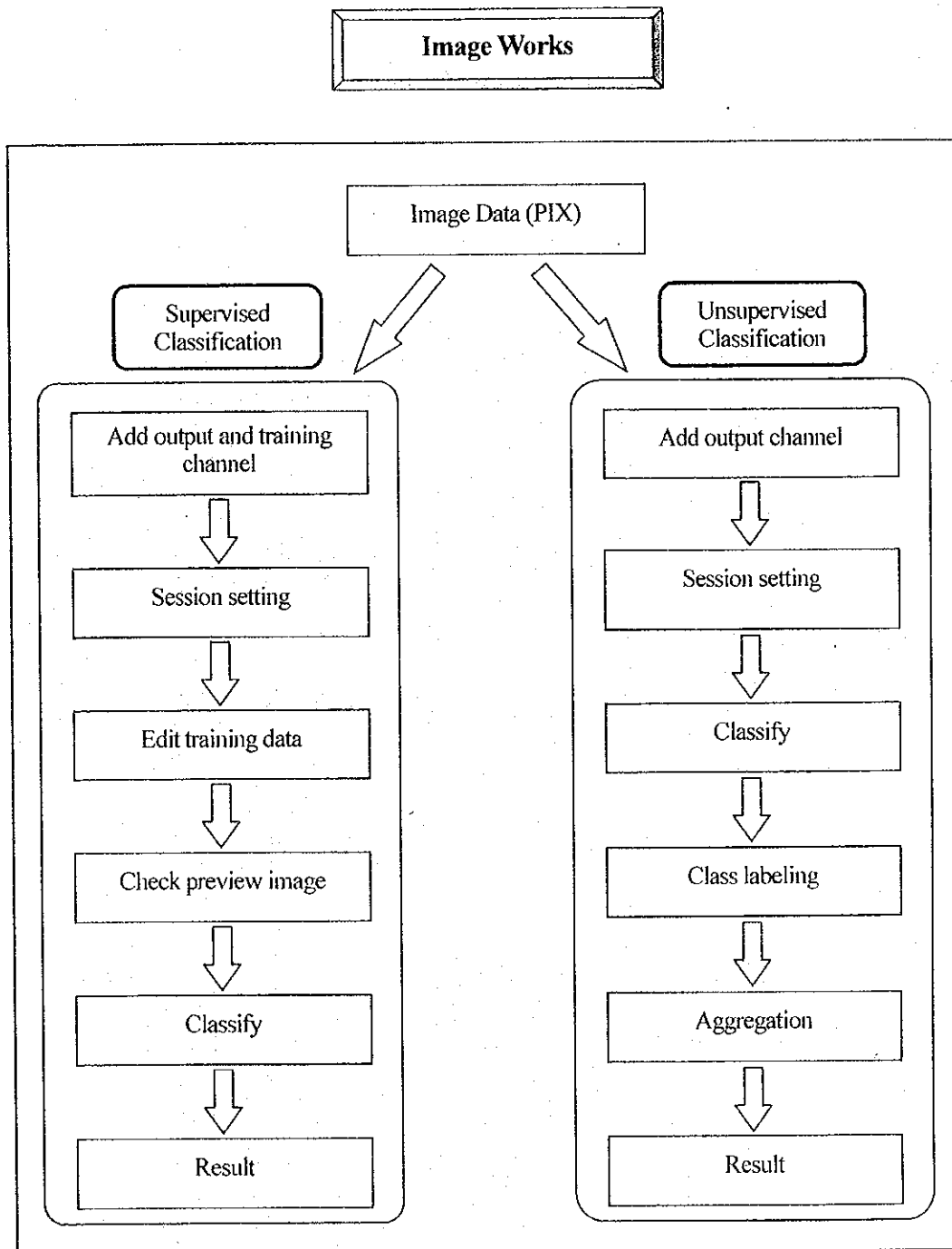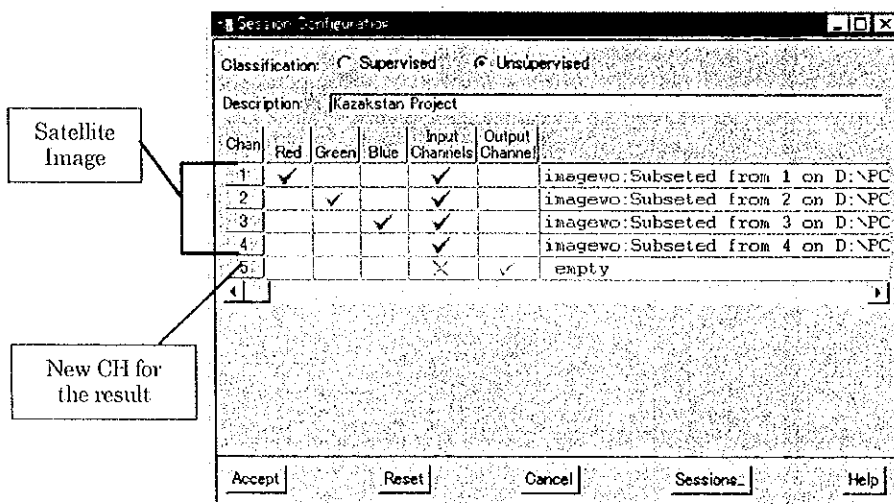
1. Unsupervised Classification

It is necessary to add new image channel for saving result image before executing classification. One 8-bit channel should be added on unsupervised classification.
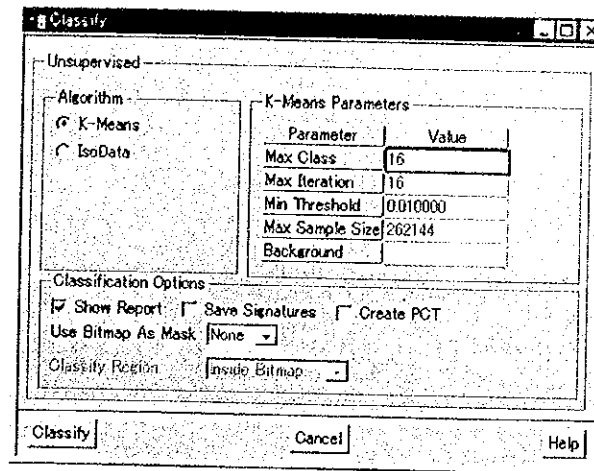
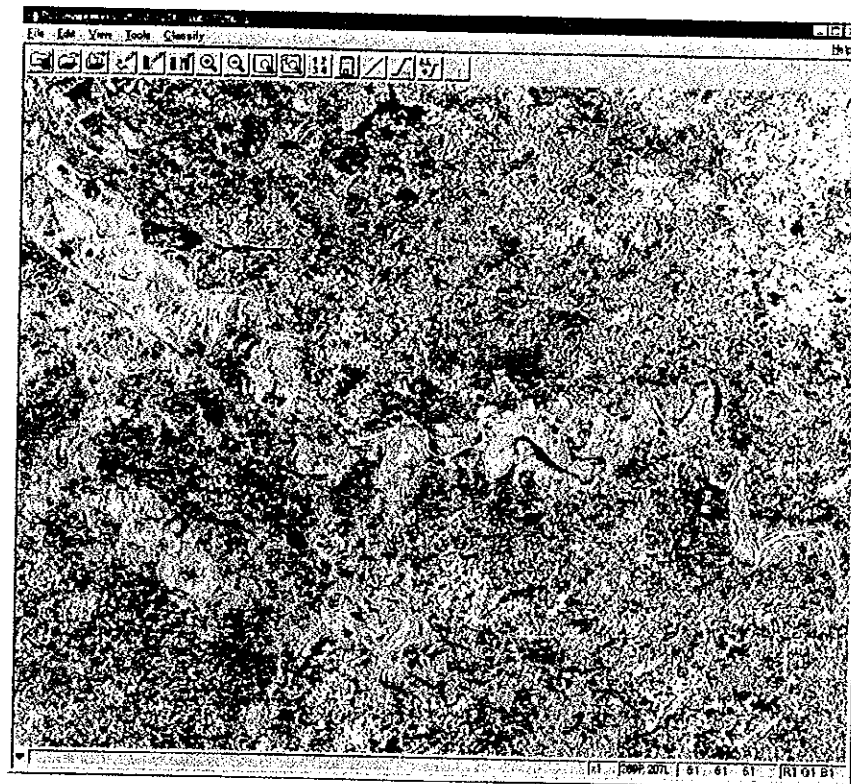Select 'Sessions...' under the 'Classify' menu of Image Works, and choose PIX file to classify.
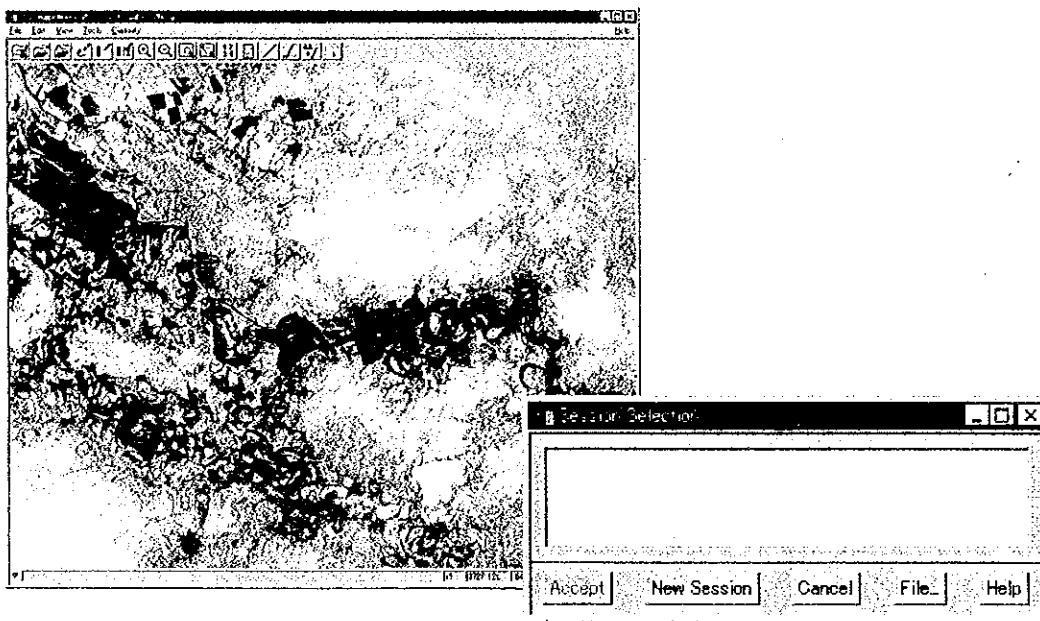
Click on the 'New Session' button on the 'Session Selection' panel.

'Session Configuration' panel appears. Make sure that 'Unsupervised' is checked. Define which channel is used for display and classification.

Press 'Classify' button to perform the classification after selecting algorithm and associated parameters.

The result image will automatically appears In Image Works window. This image is stored in selected channel in 'Session Configuration' panel. When the classification is finished, class labelling enables the image to reflect the land cover as it is. 'Class Labelling' panel can be invoked under the 'classify' menu.

2. Supervised Classification

It is necessary to add two 8-bit image channels before executing classification on the supervised classification. Press the 'New Session' button on the 'Session Selection' panel in the same way as unsupervised classification. Select 'Supervised' on the 'Session Configuration' panel.
Define which channel is used for display, input ,output and training data.
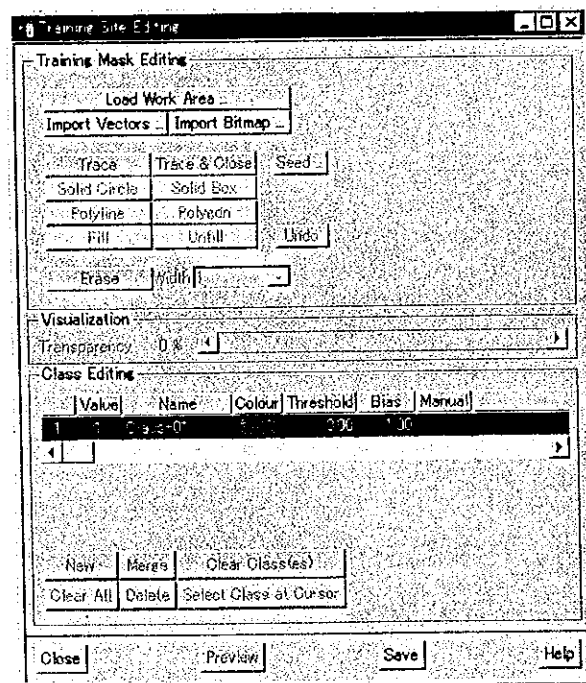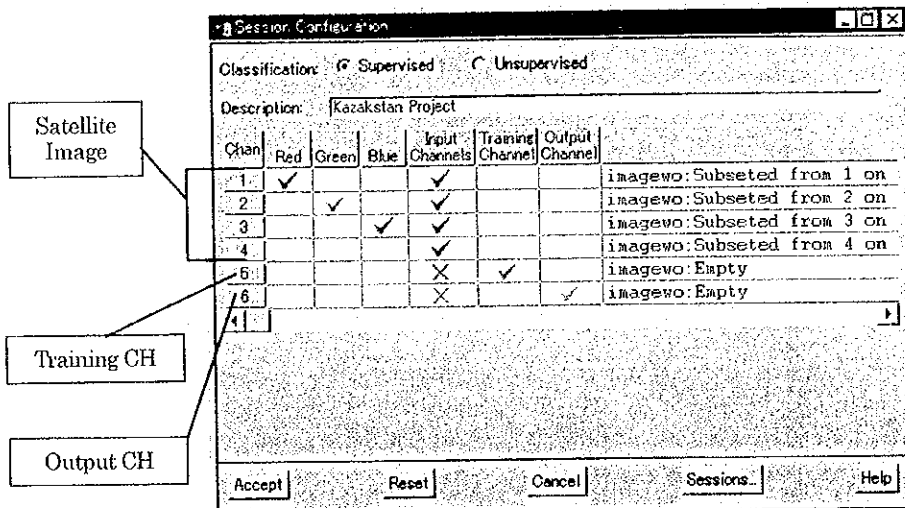
Press 'Load Work Area ...' button, and define area to get training data. After this, editing tools will be activated.
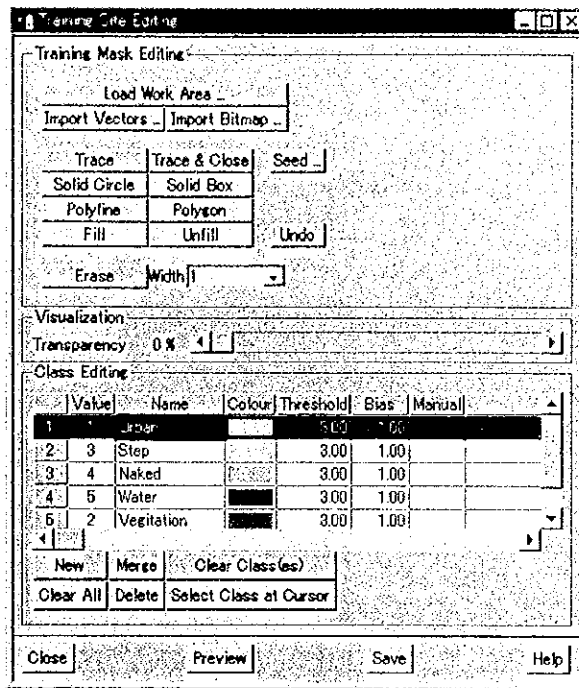
Add new class, and define name and colour of the class. Collect training data on the image according to ground-truth to the scene or previously prepared maps etc.
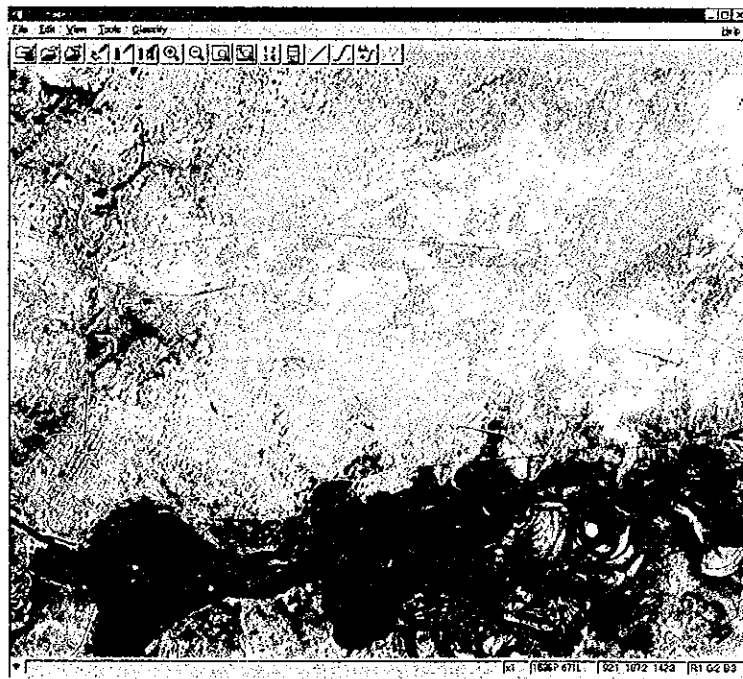
Signature Statistics

	Value	Name	Colour	Threshold	Bias	Manual
1	1	Urban		3.00	1.00	
2	2	Vegitation		3.00	1.00	
3	3	Step		3.00	1.00	
4	4	Naked		3.00	1.00	

General | Matrices

Channel	Mean	Std Dev
1	139.357	9.07593
2	100.5	6.65207
3	110.571	5.24696
4	75.3571	8.19937

Samples: 14

Import

Close | Separability | Save Report | New Panel

Scatter Plot

Channel 1 versus Channel 3

Scale
6000
4000
2000
0

Control Area

X [1] Y [3]   Colour ⊙ Grey ⊙ Pseudo
Sample ⊙ Entire File   ⊙ Selected Classes

	Value	Name	Colour	Plot Mean	Plot Ellipse	Descripti
1	1	Urban				
2	2	Vegitation				
3	3	Step				
4	4	Naked				
5	5	Water				

Close | Hide Controls | Show All | Graph Controls | Help

Signature Separability

Bhattacharrya Distance | Transformed Divergence

⊙ Matrix   ⊙ Sorted List

Separability Measure: Bhattacharrya Distance
Average Separability: 1.954182
Minimum Separability: 1.768063
Maximum Separability: 2.000000
Signature pair with
Minimum Separability: (Step,Naked)

Name	Urban	Vegitation	Step	Naked
Vegitation	2.000000			
Step	1.931778	1.851478		
Naked	1.990604	2.000000	1.768063	
Water	2.000000	2.000000	2.000000	2.000000

Close | Save Report | Help

Assessing statistics and separability among classes, training data should be adjusted properly. These tools are invoked from 'classify' menu.
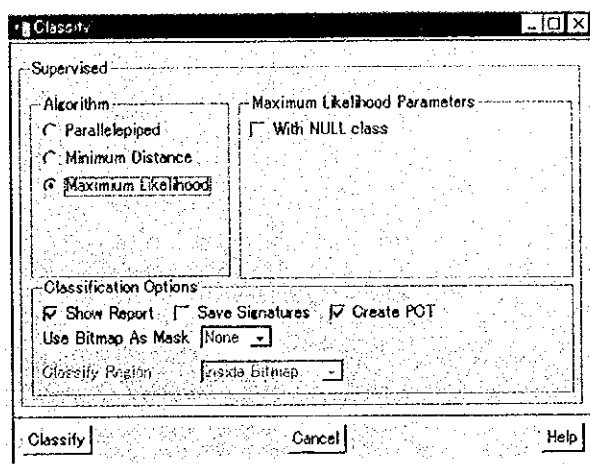
After defining the training areas, select 'Classify...' under the 'Classify' menu. Set the parameters according to selected algorithm on the 'Classify' setting panel. Press 'Classify' button to perform the classification.
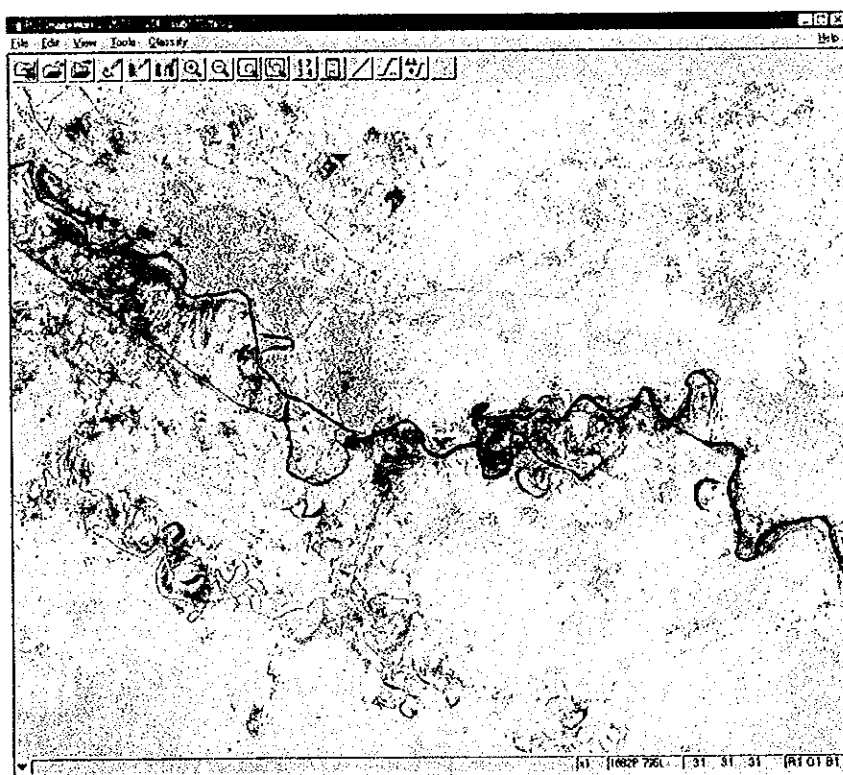
The result image will automatically appear in Image Works window. This image is stored in selected channel in 'Session Configuration' panel. Once the result image is exported to TIFF format, it can be used by MapInfo or other softwares.