

Map Symbolization

Symbolization Manual for Microstation (1/5,000 map)

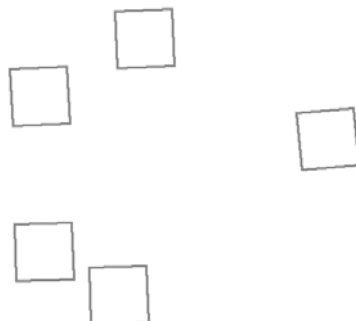
<Objective>

Symbolize 1/5,000 map by using “Microstation” software.

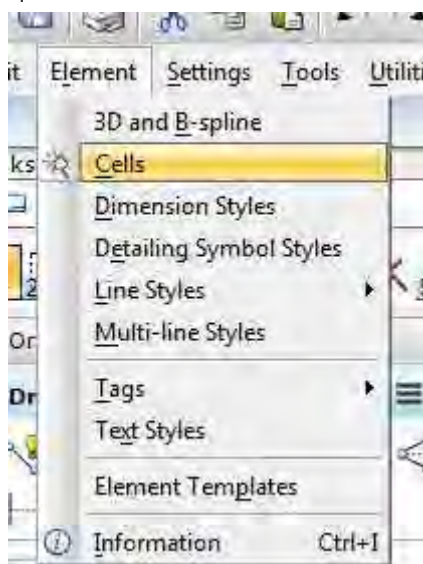
1. Symbolization of point (for Cell)

1.1 Make a simple cell

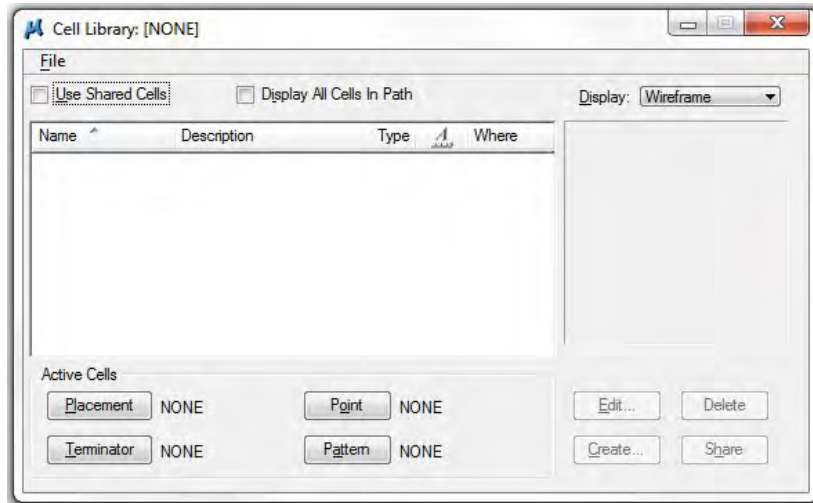
Level 3005- petit bâtiment



To make a .cell file, select **Element | Cells**.

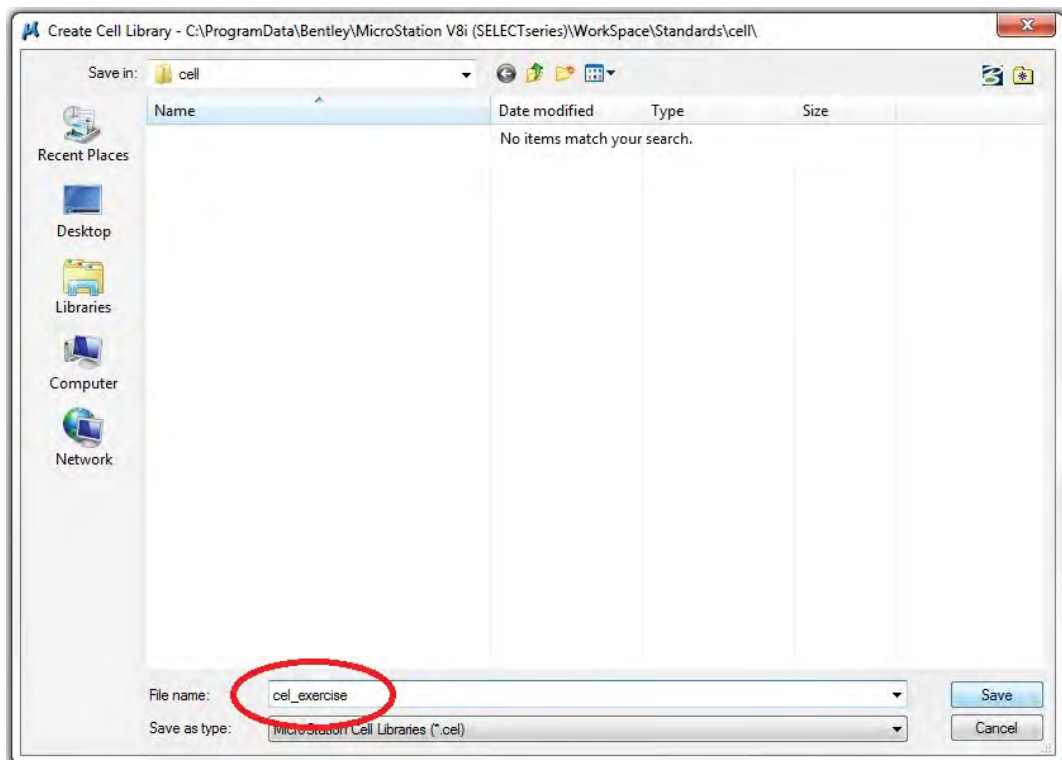


The “Cell Library” window opens.



And select **File | New**

“Create Cell Library window” opens.

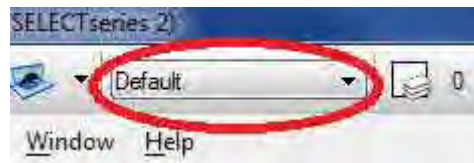


Input File name “cel_exercise” and click Save.



“cel_exercise.cel” file will be made and opens.

Change active level. And set active level “Default”.

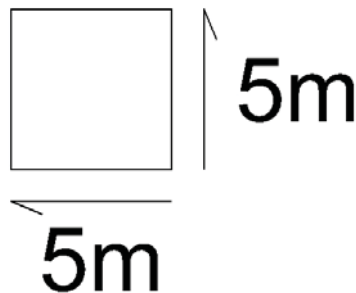


Make cell in “Default” level is better.

The cell can use in all levels.

If you make cell in other level, the cell cannot use another levels.

Then start to make “petit bâtiment” cell.



Work in true scale in MicroStation, expressed 1mm on the paper map.

Next, you have to give this cell’s origin point.

This “Habitat précaire” symbol’s origin point should be center of the square.



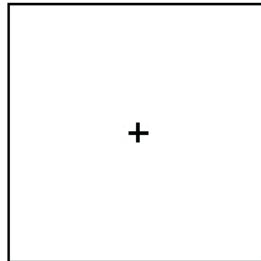
Click Define Cell Origin



Snap Mode --- Center Snap

And move your cursor to near by the object.

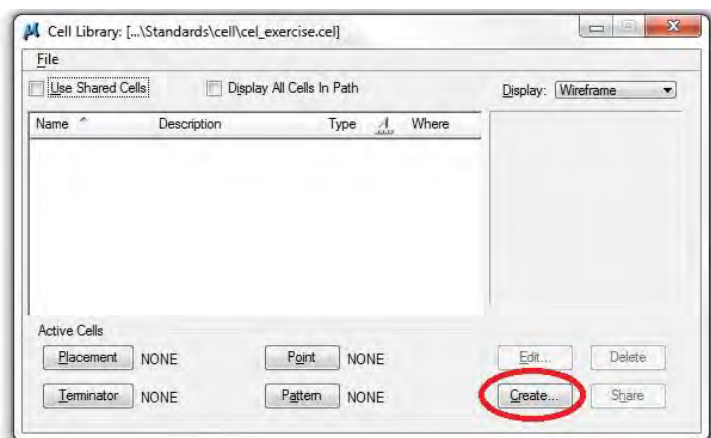
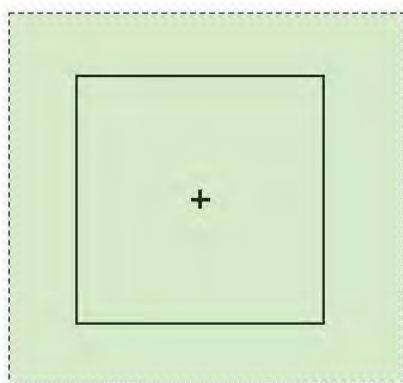
Snap sign will appear center of the object, and then click.



This is the cell's origin point.

And place fence around the object.

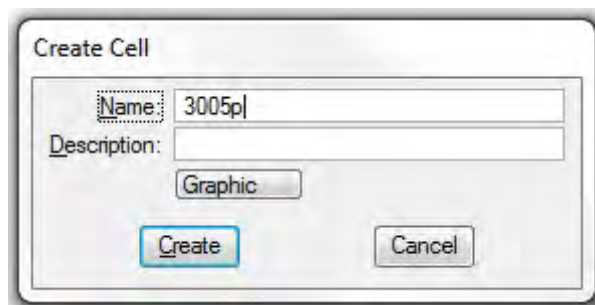
Then "Cell Library" window's "Create" button will be active.



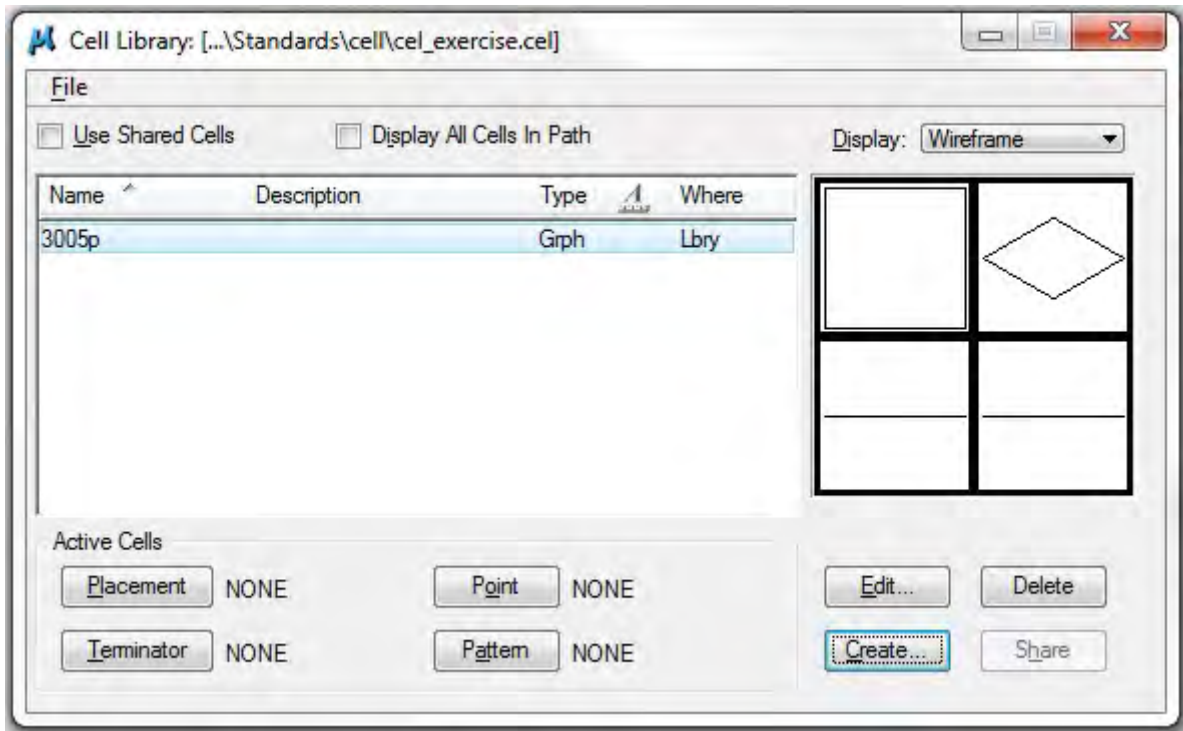
And click the "Create" button.

The "Create New Cell" window will be open and input the cell name "3005p".

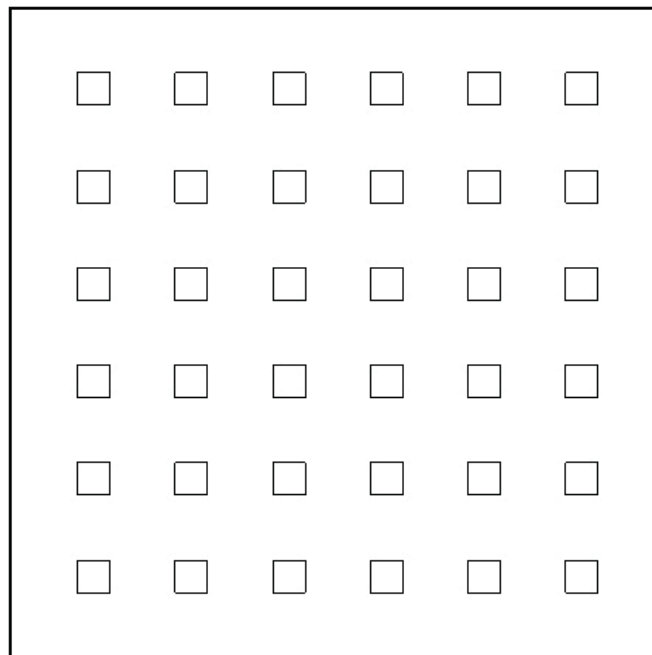
And click "Create".



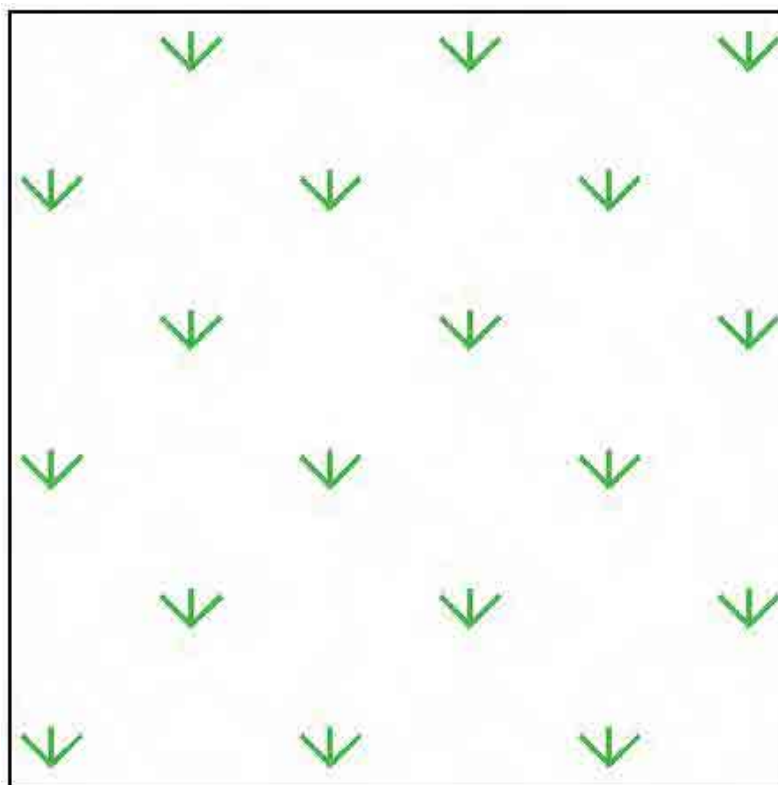
3005p cell will be appeared in the "Cell Library" window, and will be made in your ".cel" file.



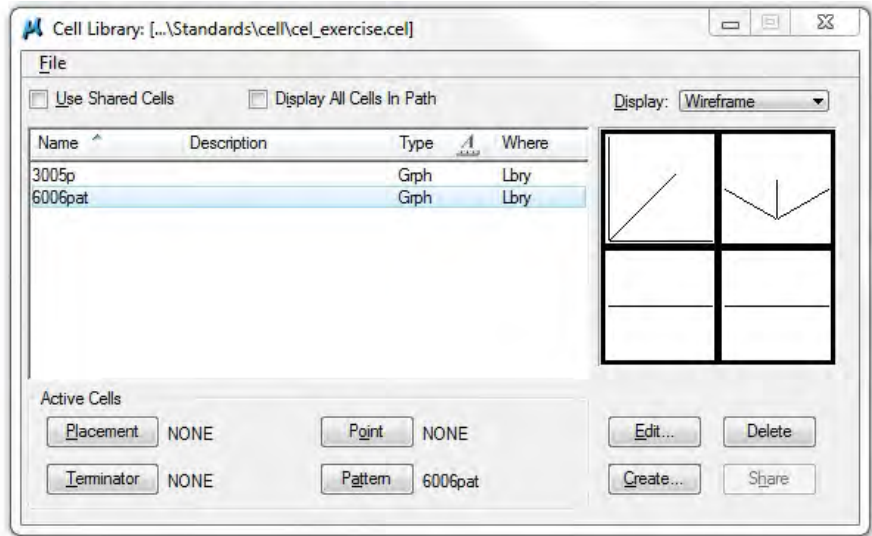
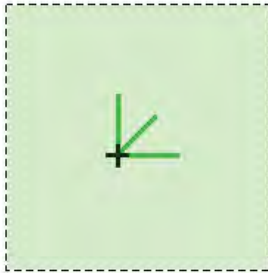
1.2 Make a pattern



You can arrange patterned cells in polygon area.

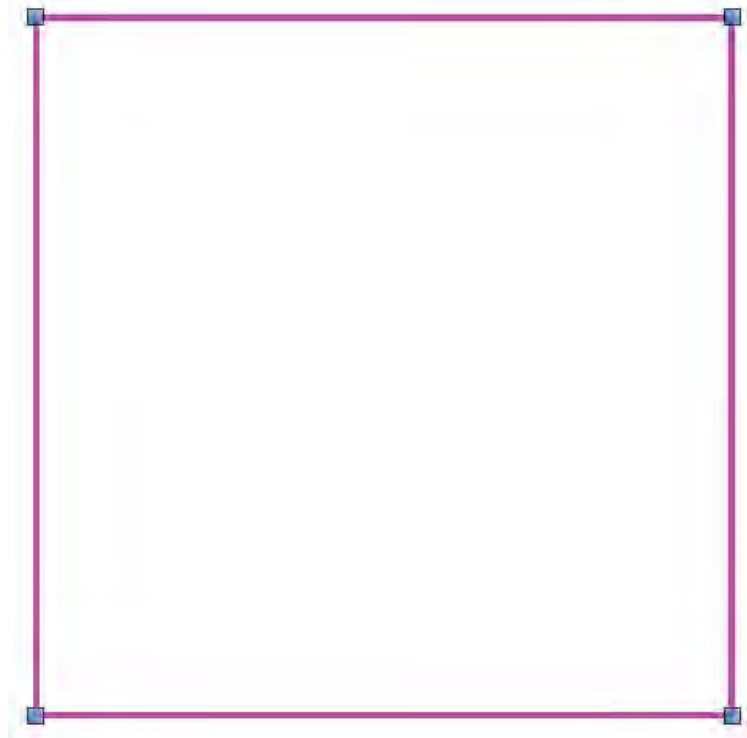


Place oblique pattern



Previously, make a -45° rotated cell.

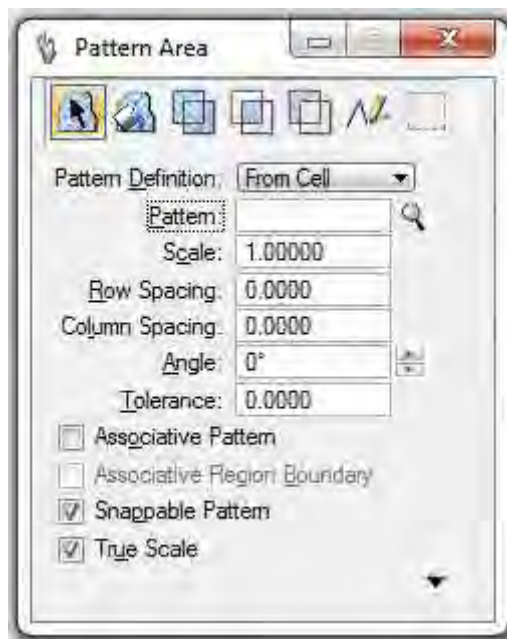
Choose shape object



Click "Pattern Area" button



The “Pattern Area” window will open



Input the name of cell into Pattern's text box

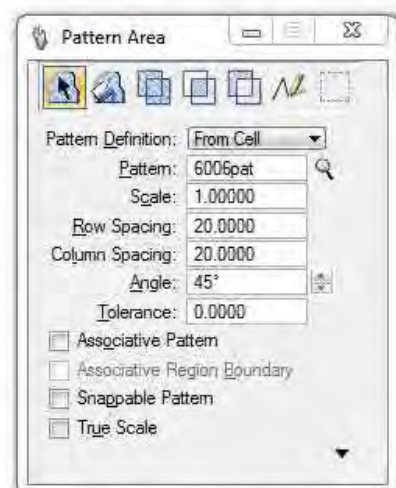
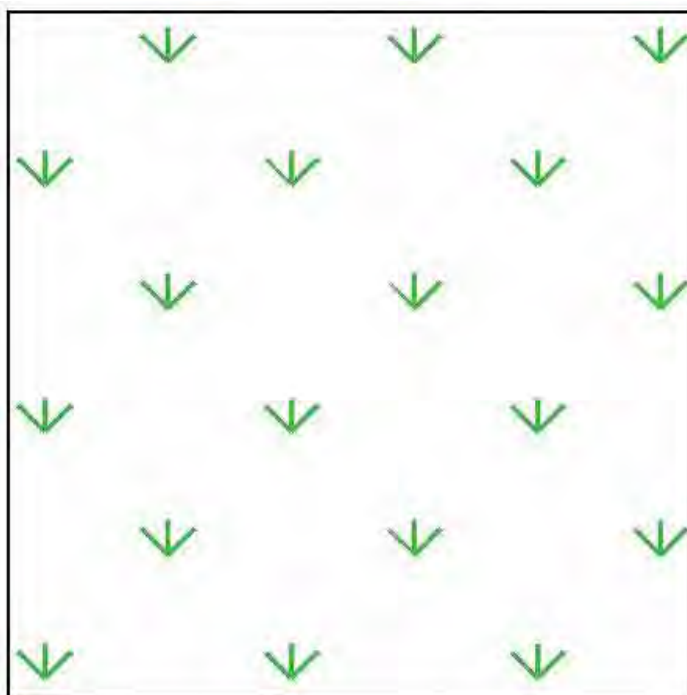
Change Scale 0 to 1

Row Spacing --- 20

Column Spacing --- 20

Angle --- 45

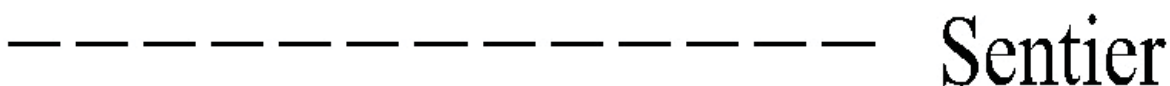
And click somewhere in View1



2. Symbolizing of line

2.1 Normal line

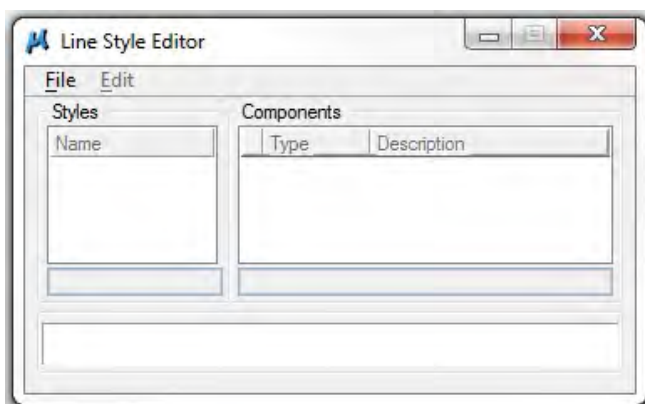
Layer 2009 “Sentier” line



This line consists of the pattern of 15m dash and 5m gap.

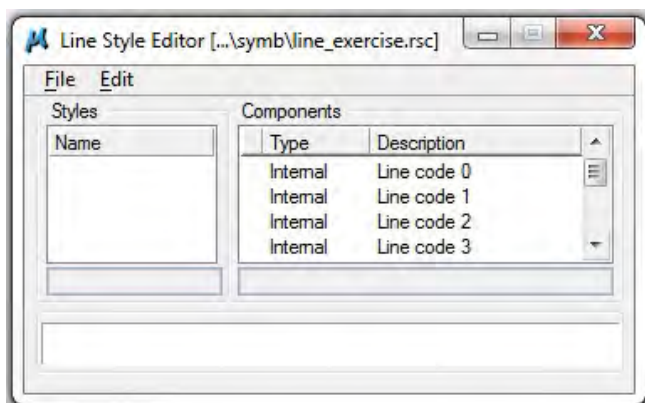


Element | Line Styles | Edit

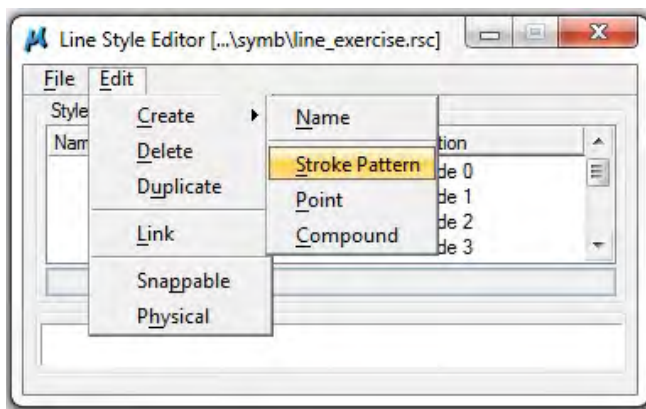


File | New

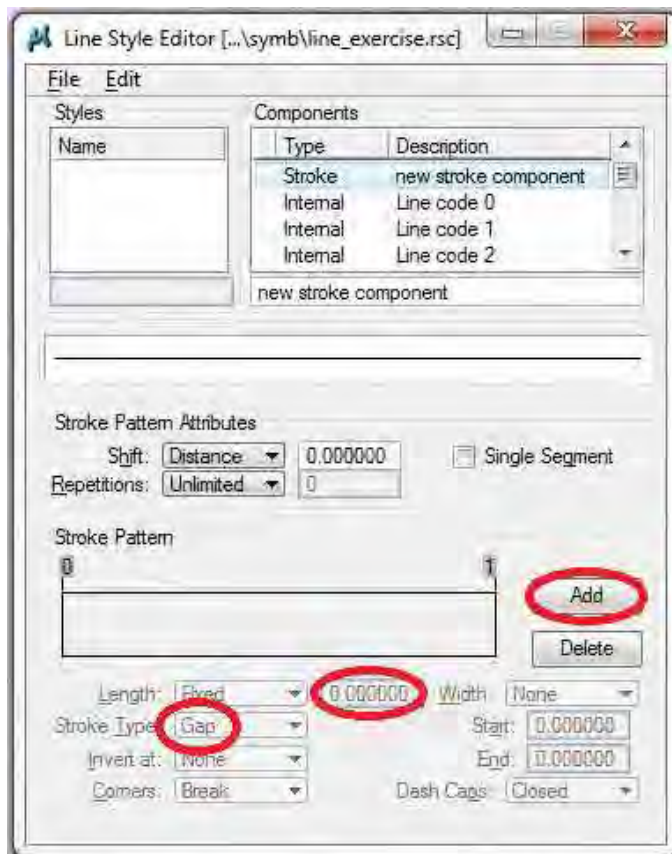
Input “line_exercise” and click OK.

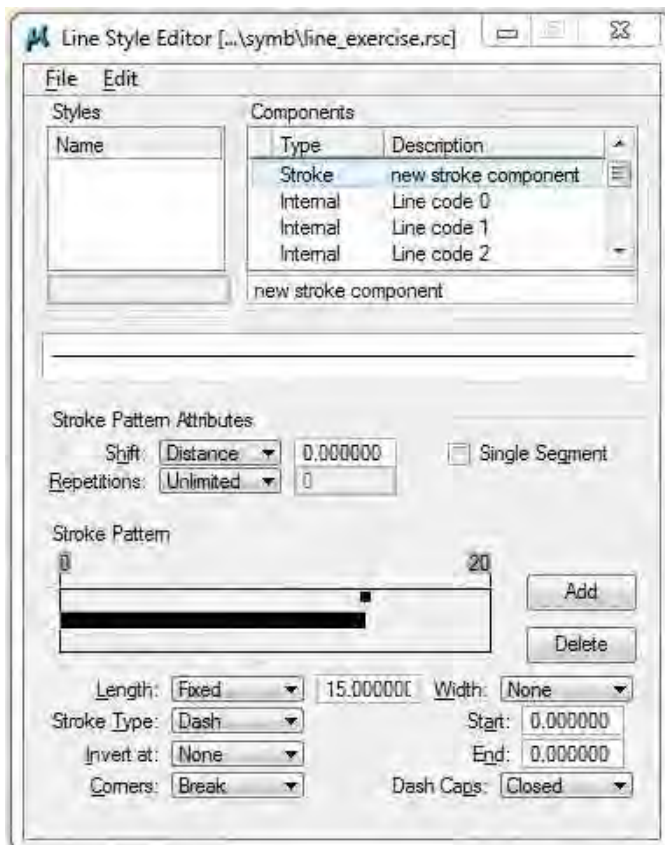


Edit | Create | Stroke Pattern

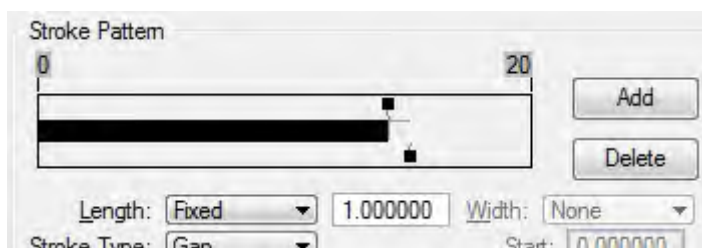


Click “Add” button, enter “Length” text box “15” and change Stroke Type “Gap” to “Dash”.

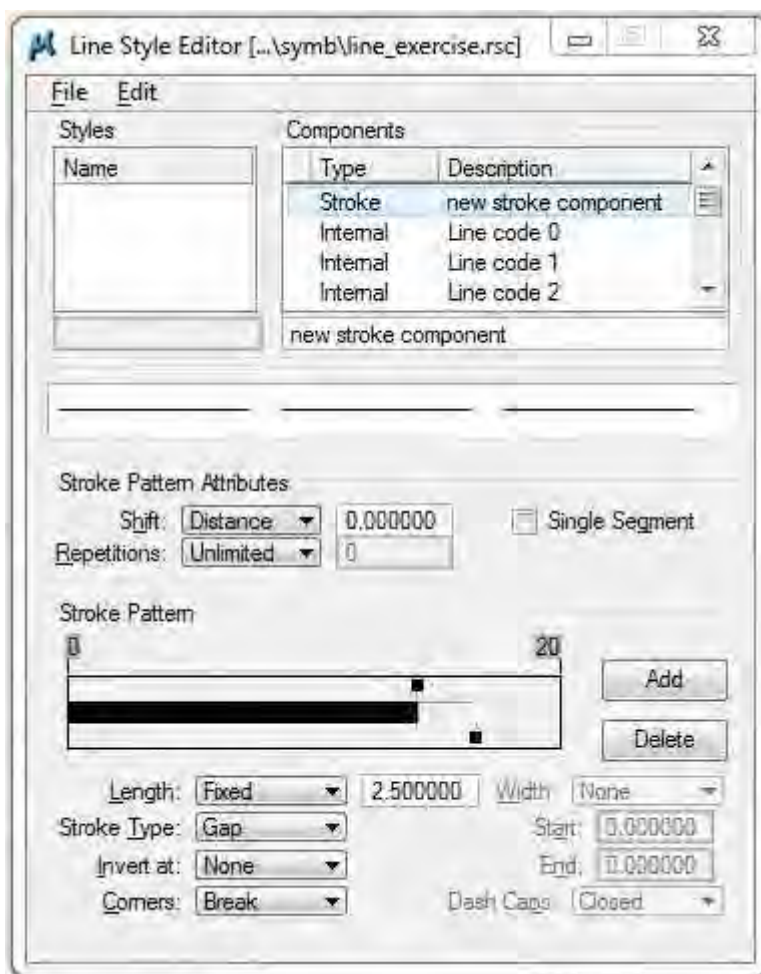




Click “Add” button and click at new appeared square part.



And enter “Length” text box “2.5”.

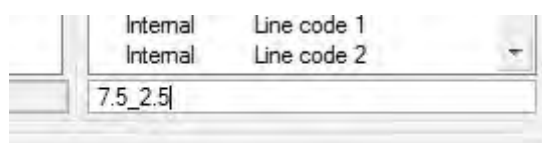


The line pattern was made.

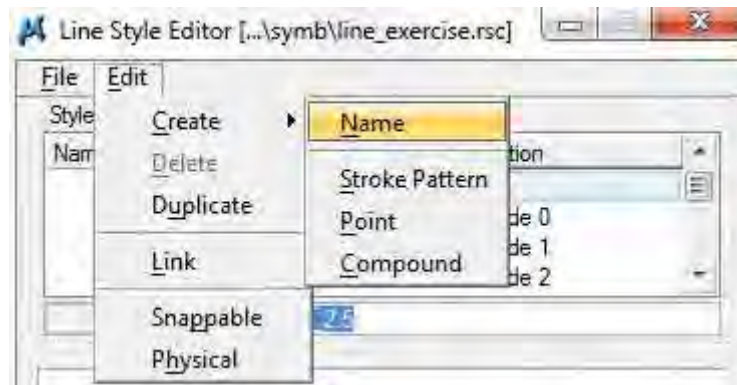
Then give a name to this line.

Delete “new stroke component” and input description,

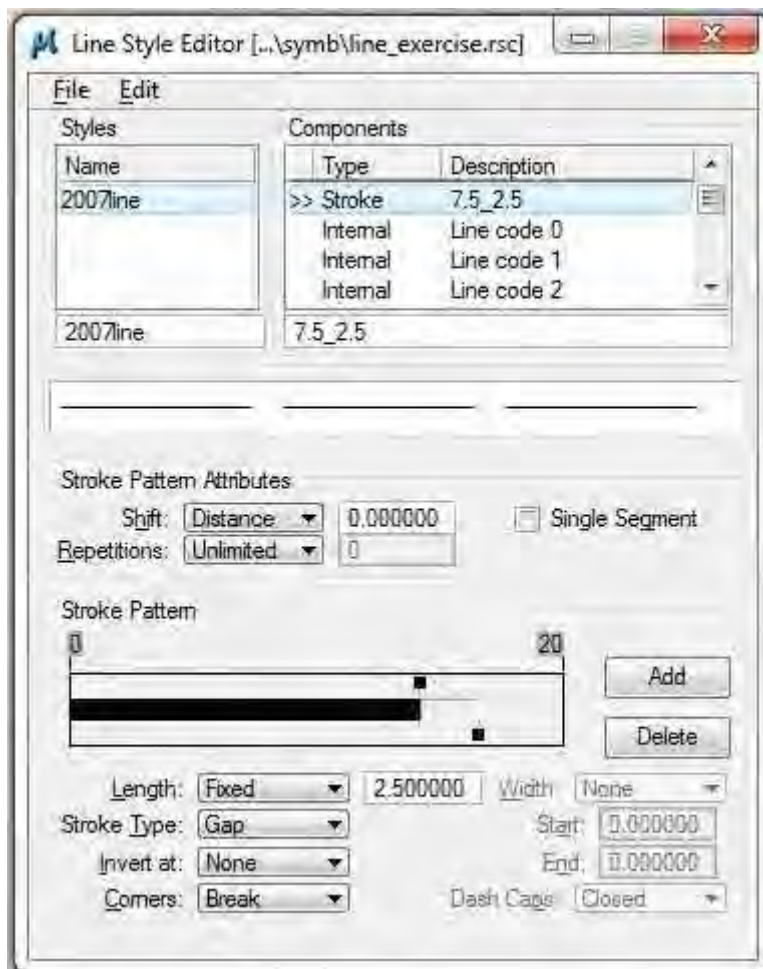
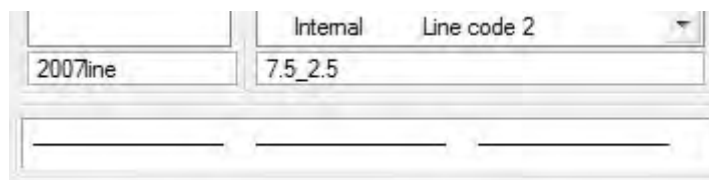
Ex. “7.5_2.5”



And Edit | Create | Name



Delete "unnamed" and input "2007line"

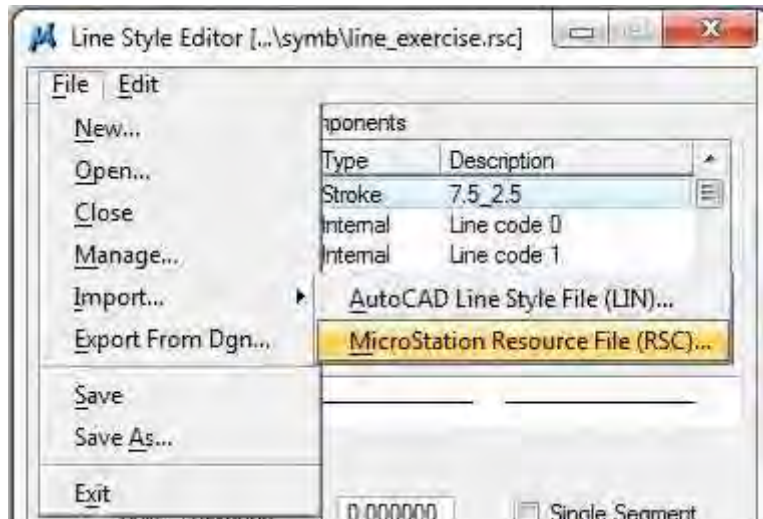


Now you have to save this file, **File | Save** in this window.

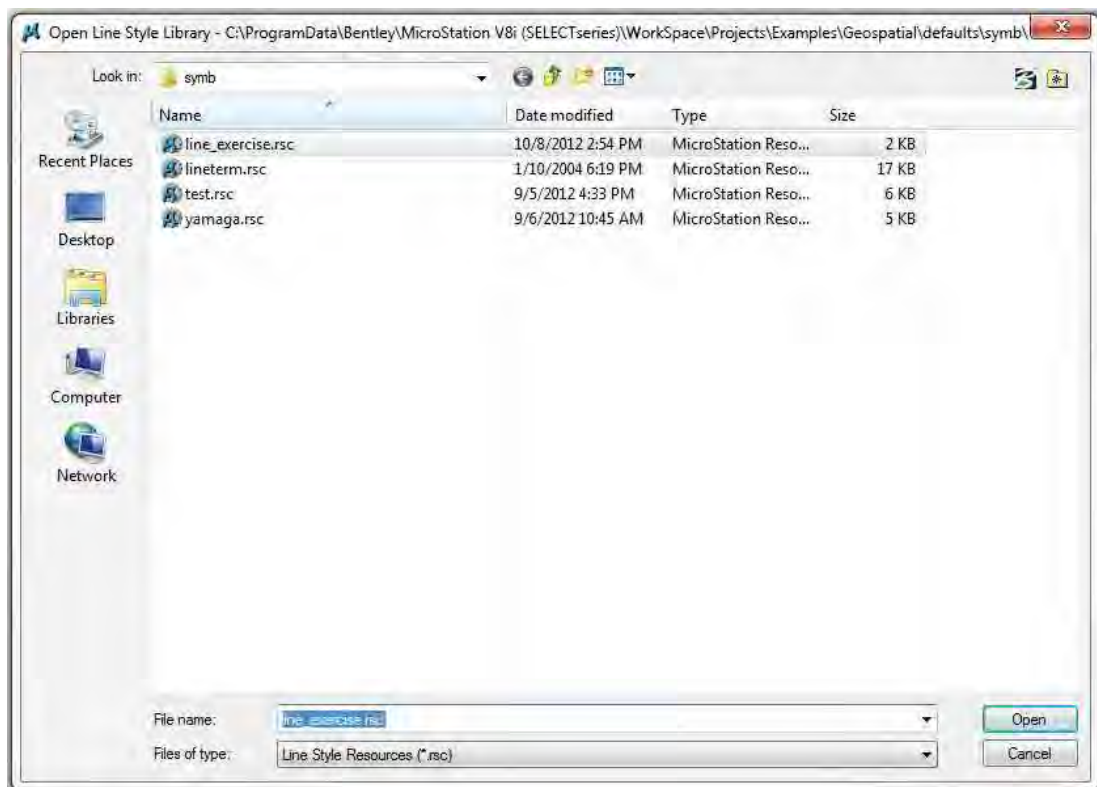
But this line can not use in DGN file yet.

Then you have to import this line style information from this file into DGN.

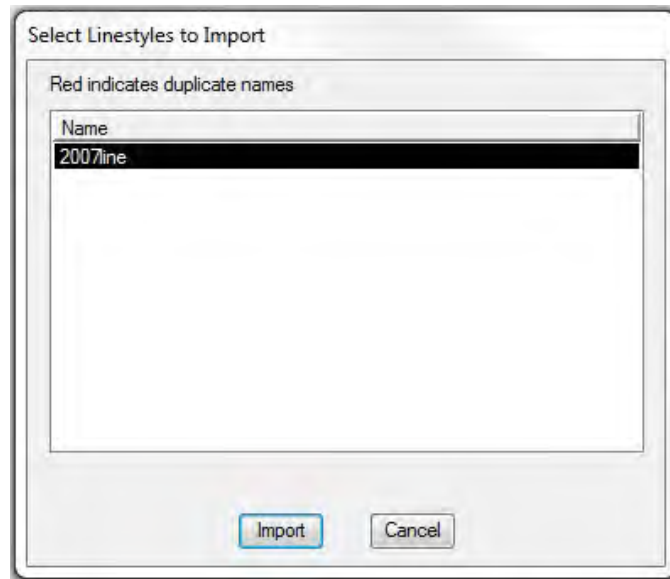
File | Import | MicroStation Resource File (RSC)...



Select “line_exercise.rsc” and click “open”

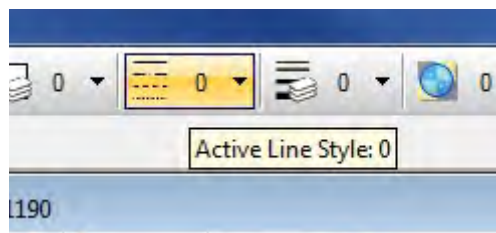


Select this line and click “Import” button.



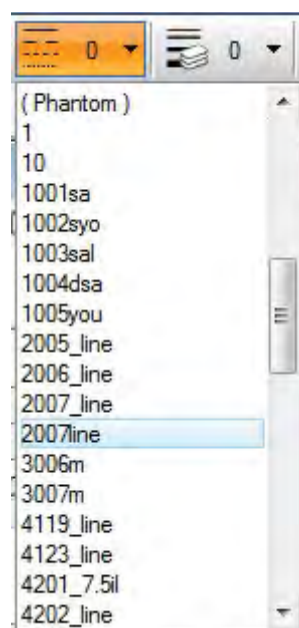
Then you can use this line style in your DGN.

Click Active Line Style button,



scroll...

And select this line style. Then you can use this line in your DGN.

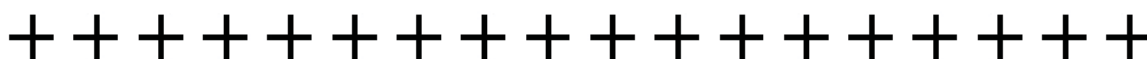


2.2 Complex line

“Frontière” line used in level 1001.

LEGENDE

Frontière	—————	BUJUMBURA *****
Limite de province	—————	GITEGA - - - - -



This line consists of patterned line (5m dash and 2.5m gap) and 5m length tick.

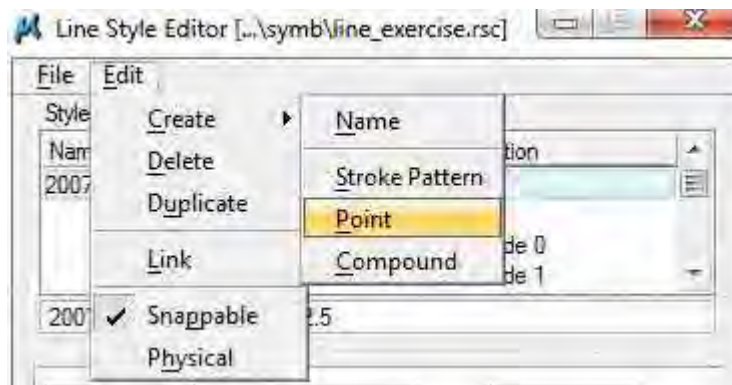


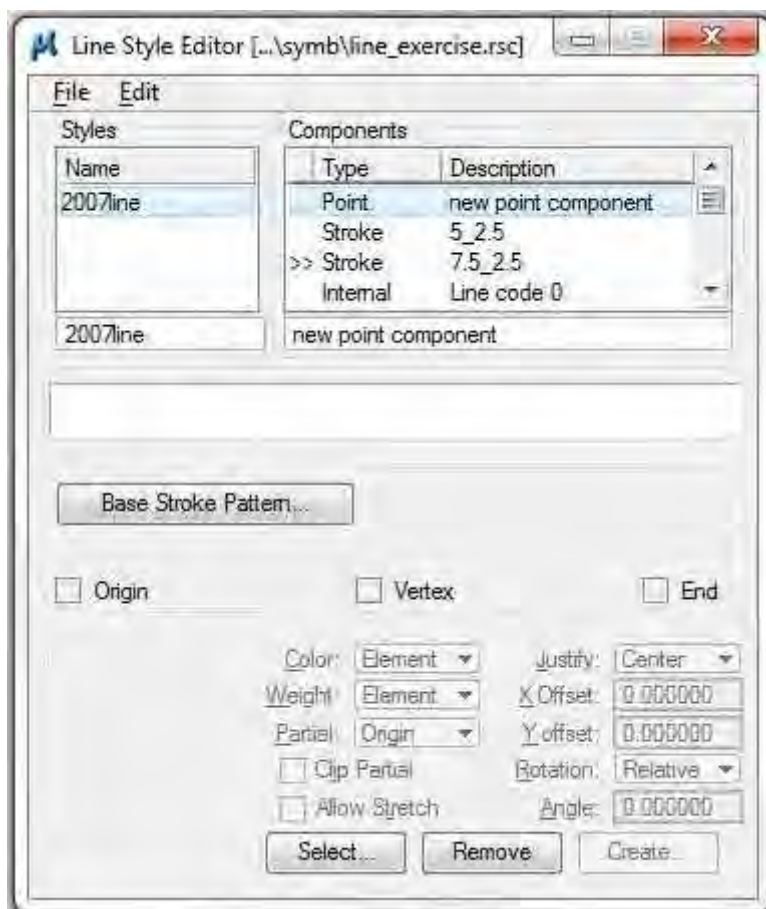
First, make 5-2.5 line.

In the “Line Style Editor” window, **Edit | Create | Stroke Pattern**

Add 5m dash, add 2.5m gap, and input description ex.”5-2.5”.

Next, in the “Line Style Editor” window, **Edit | Create | Point**





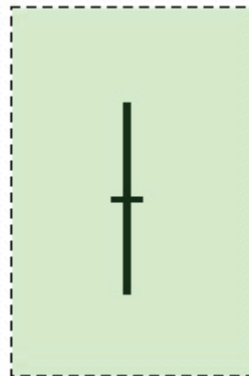
The "Line Style Editor" window will change
And in the View1 window, write 5m vertical line,



Give the origin point of this line, use “Define Cell Origin”

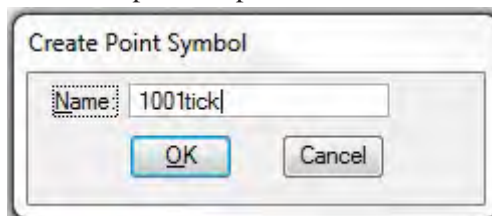


And place fence around it.

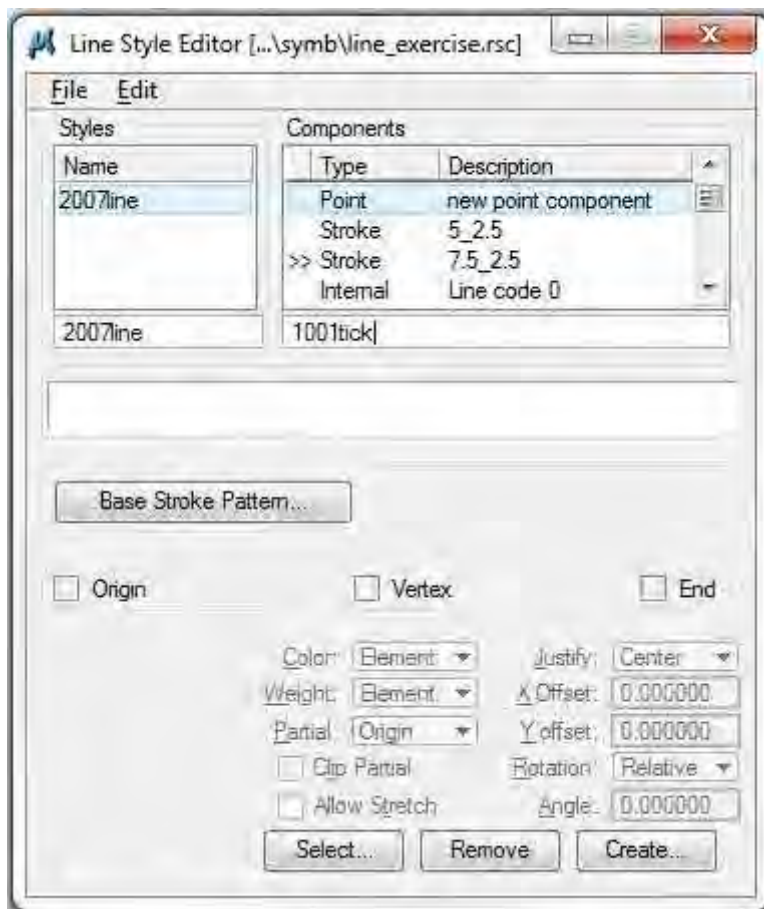


In the “Line Style Editor” window, “Create...” button will active, and click it.

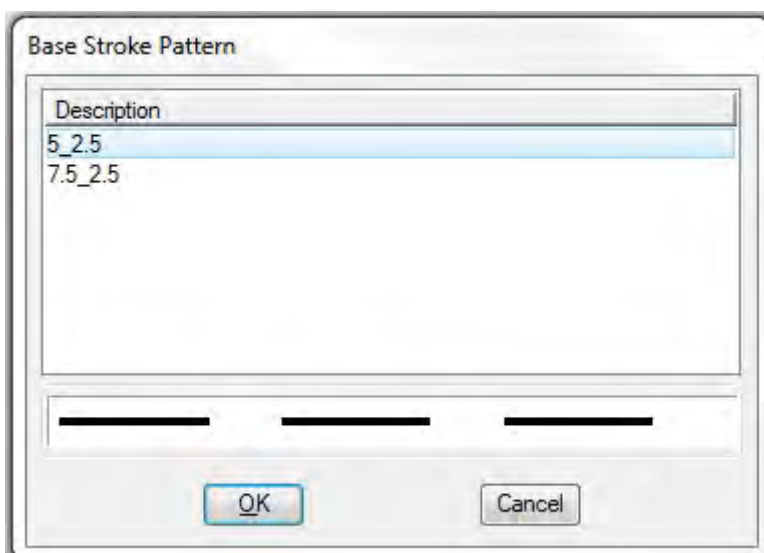
The “Create Point Symbol” window will open. Input a name as “1001tick”, and click “OK”.

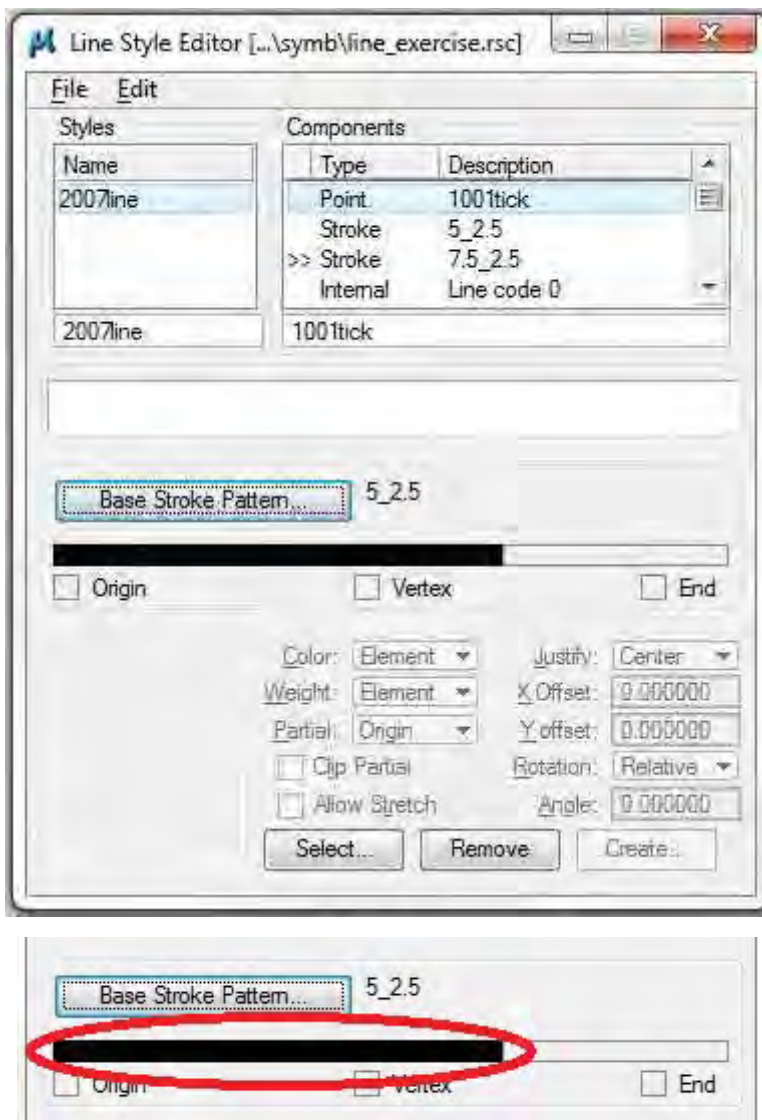


Input description as "1001tick".



Next, click "Base Stroke Pattern" button, choose "5_2.5", and "OK".



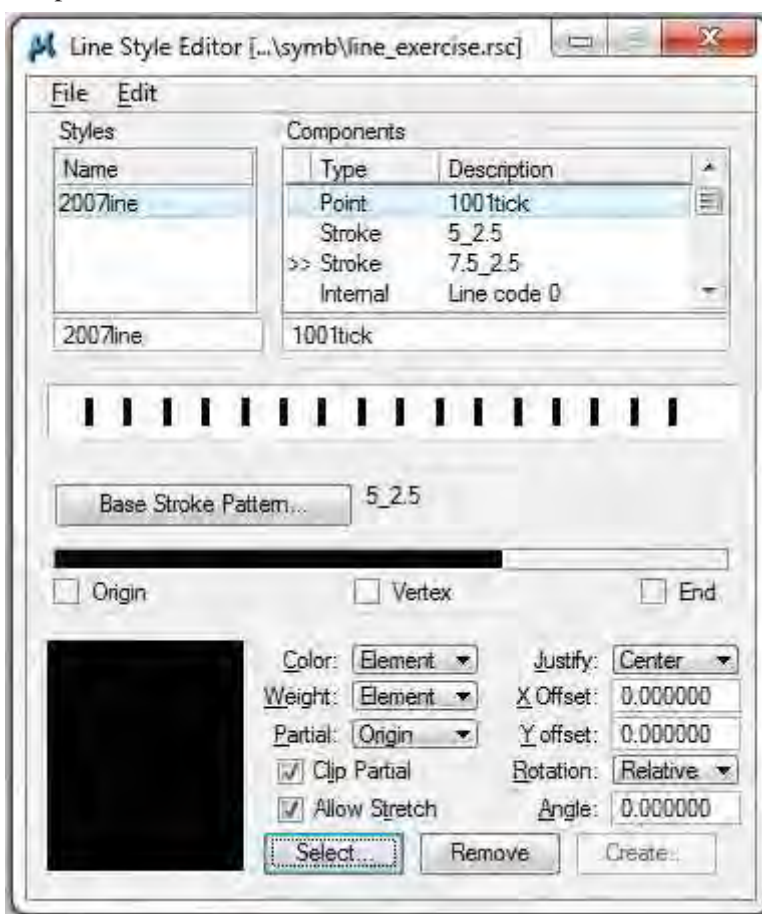


Click "Dash" part of the line, because this tick should be attach to that part.
And click "Select" button.

Select “1001tick” and click “OK”.

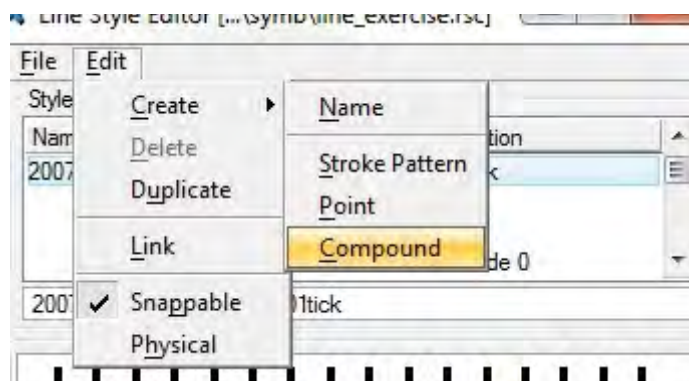


Then stroke “5_2.5” and point “1001tick” were made.

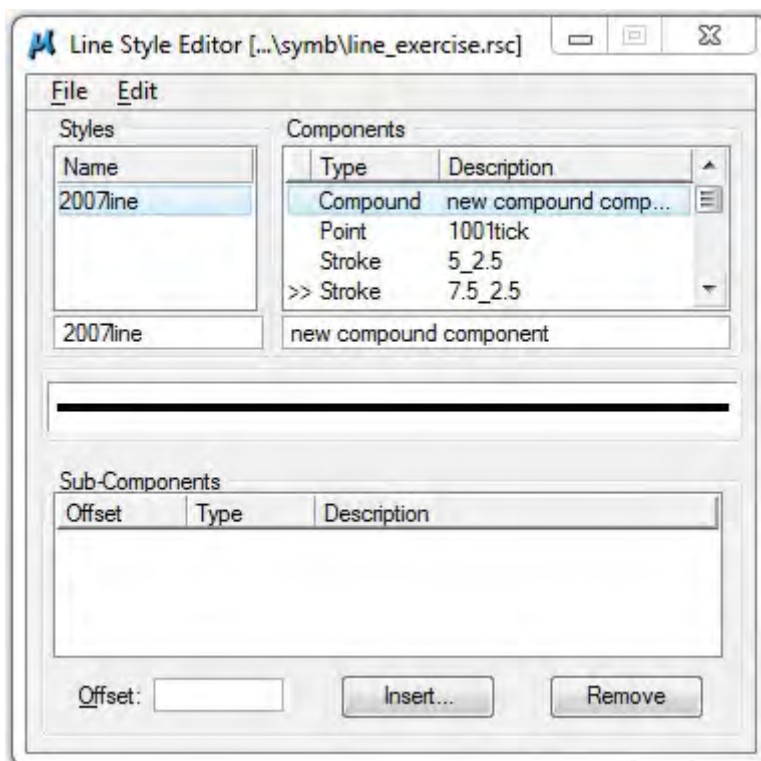


Next, compound these components.

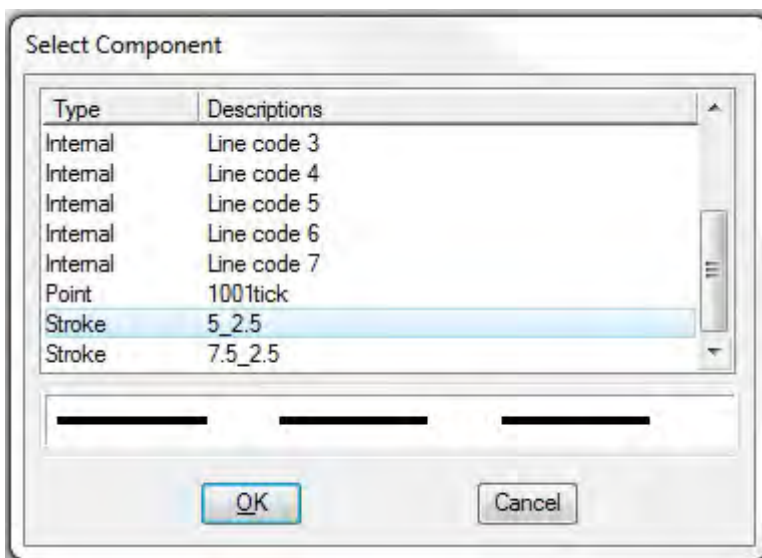
Edit | Create | Compound



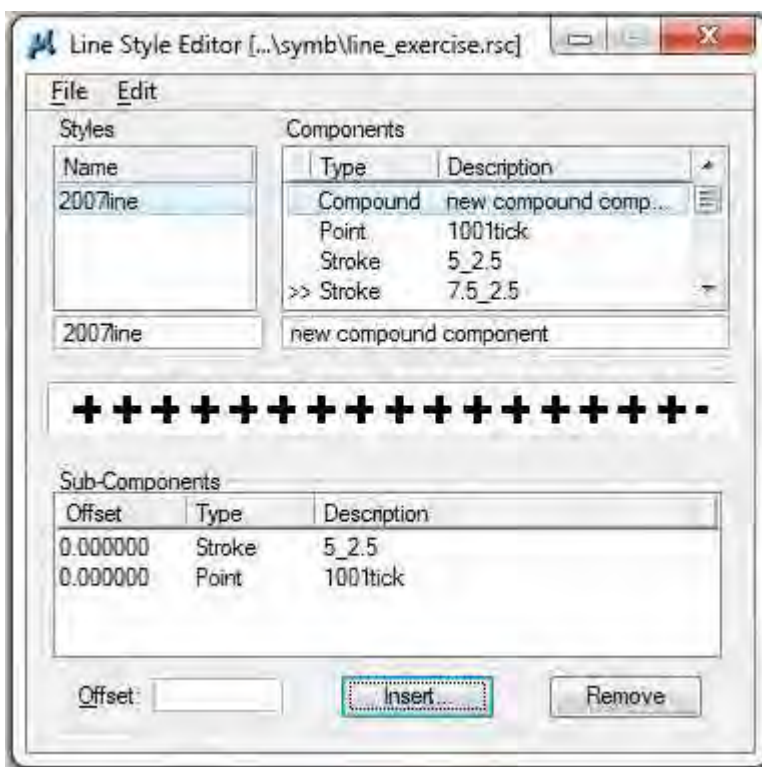
And click “Insert...” button.



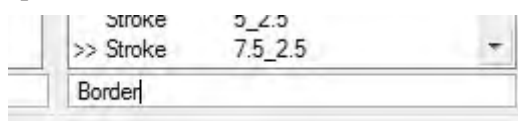
Select "Stroke 5_2.5" and click "OK".



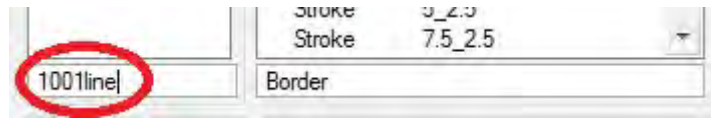
Click "Insert..." again, and select "Point 7106tick".



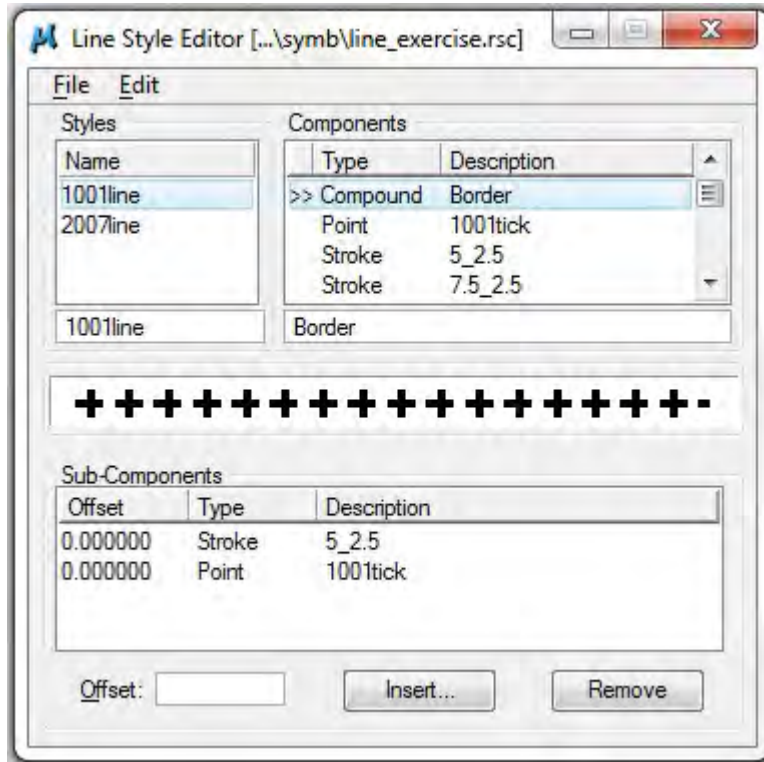
Change description. For example, "Border".



And **Edit | Create | Name**. Input “7106line”.



And select **File | Save** in this window.

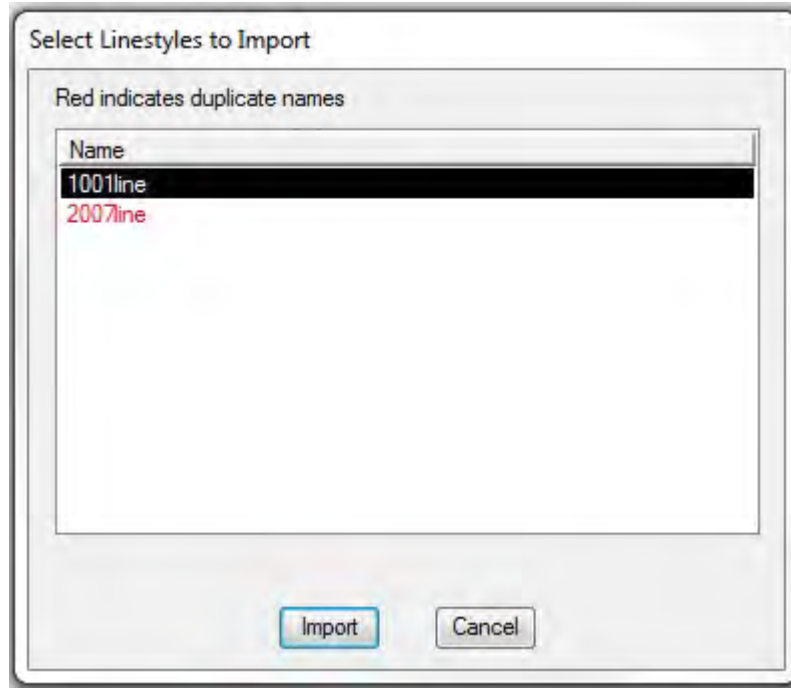


Import this line from this “.rsc” file into DGN again.

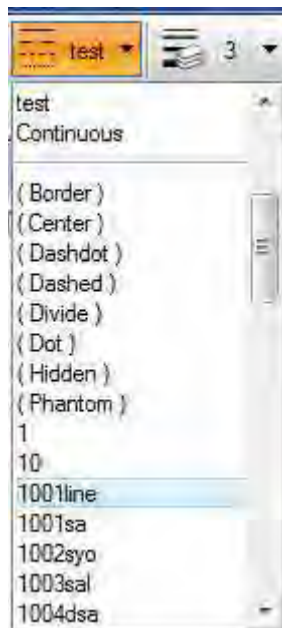
File | Import | MicroStation Resource File (RSC)

Select this file and open

Select “1001line” and click “Import”.



Red colored “2007line” has already imported, and not necessary to select it this time.

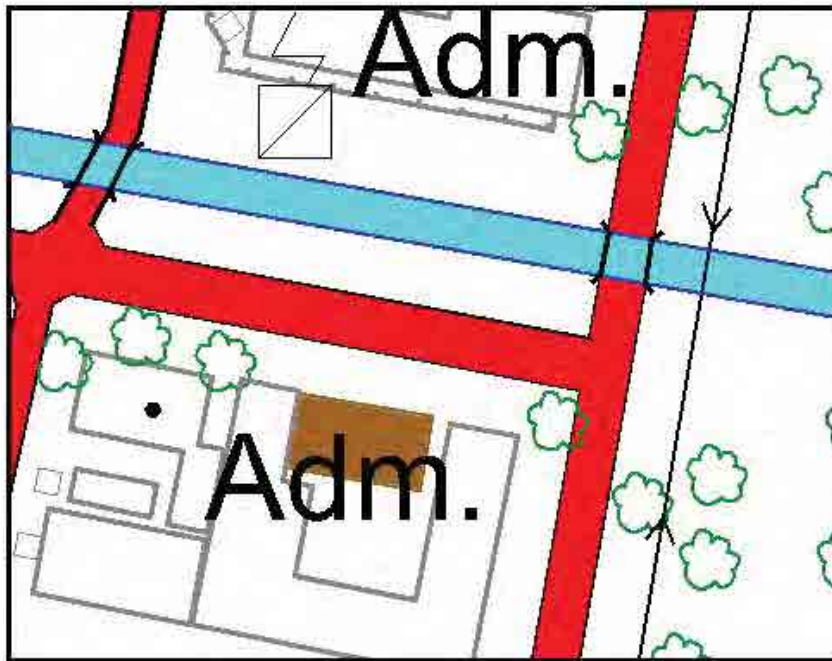


Then you can use this line style in your DGN file.

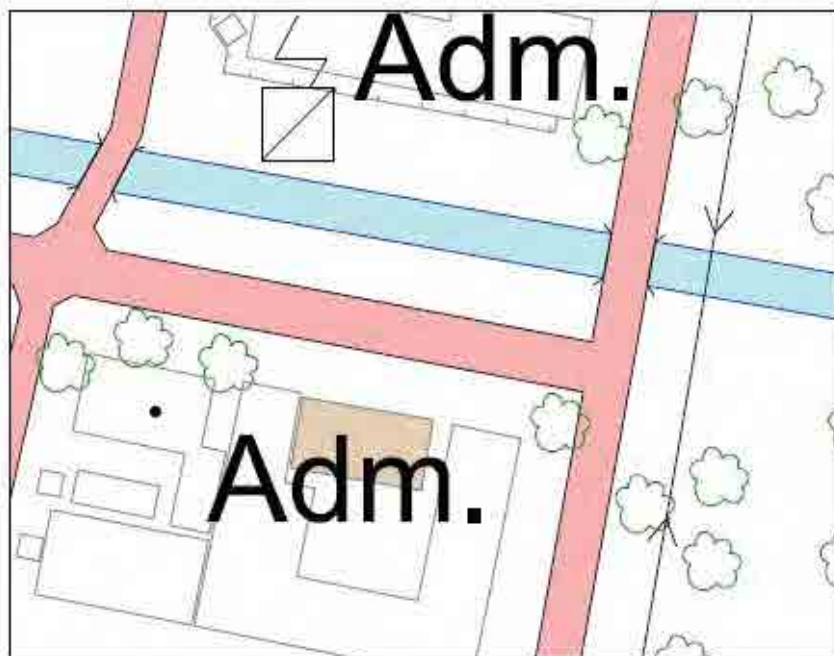
3. Create a Table file

3.1 Table file

If this DGN file is printed out without doing anything else, it will be hard to read the printed map as shown below.



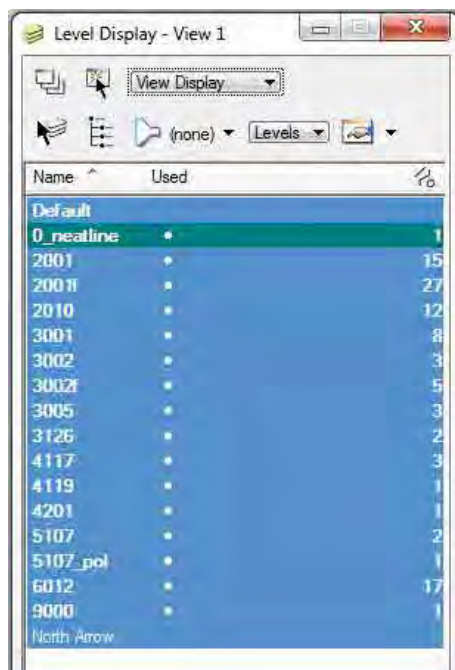
Then you have to fix some setting using table file.



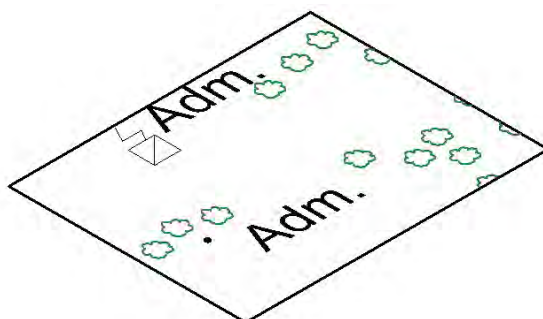
In this case, it is necessary to change the level order, color and line weight of the table file

3.2 Level order

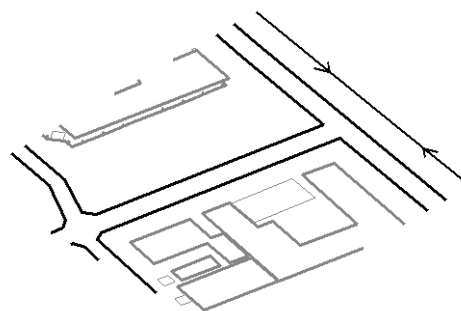
This DGN data uses 16 levels.



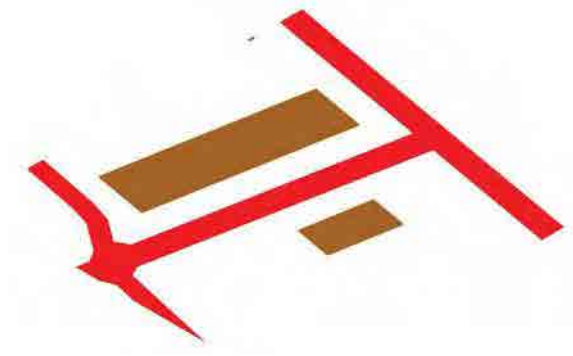
First, divide these levels into three groups.



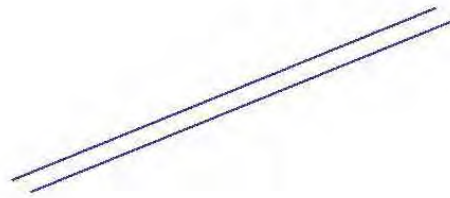
- 1). Order1(level: 0_neatline, 3126, 4117 6012, 9000)



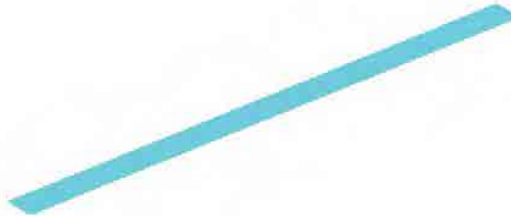
- 2). Order2(level: 2001, 3001, 3002, 3005, 4119, 4201)



3). Order3(level: 2002f, 3002f)

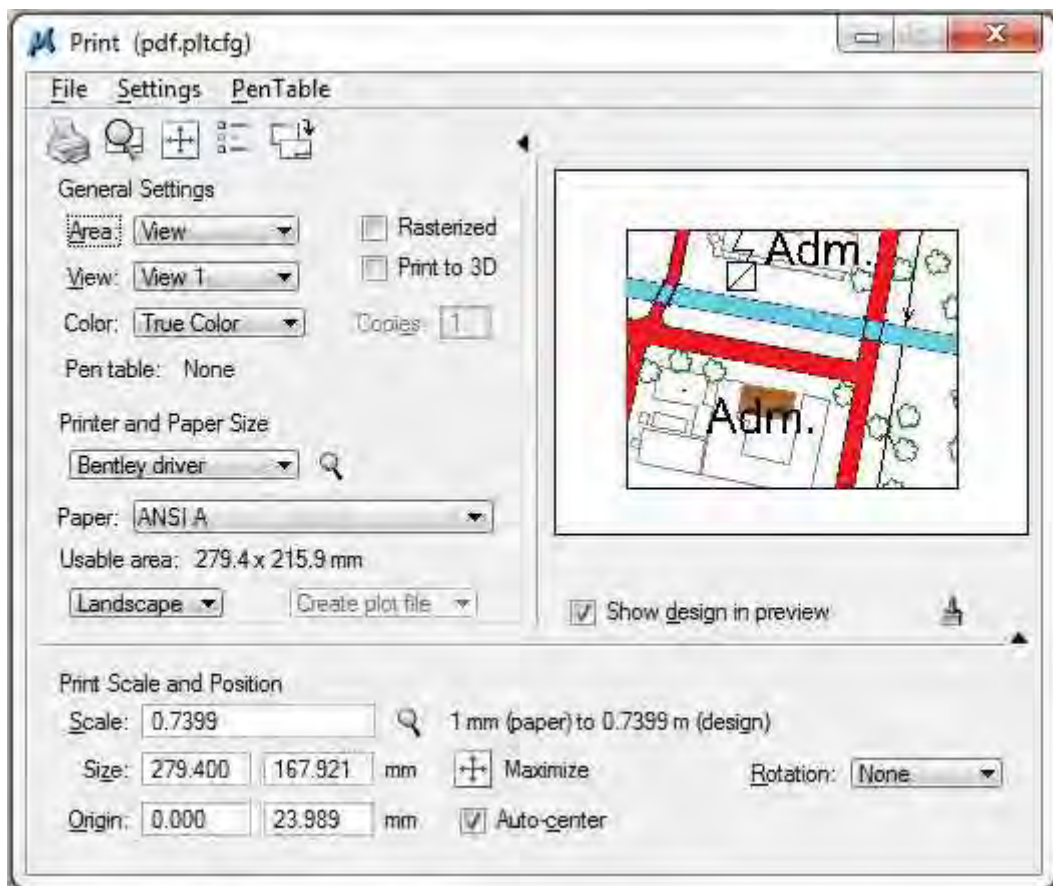


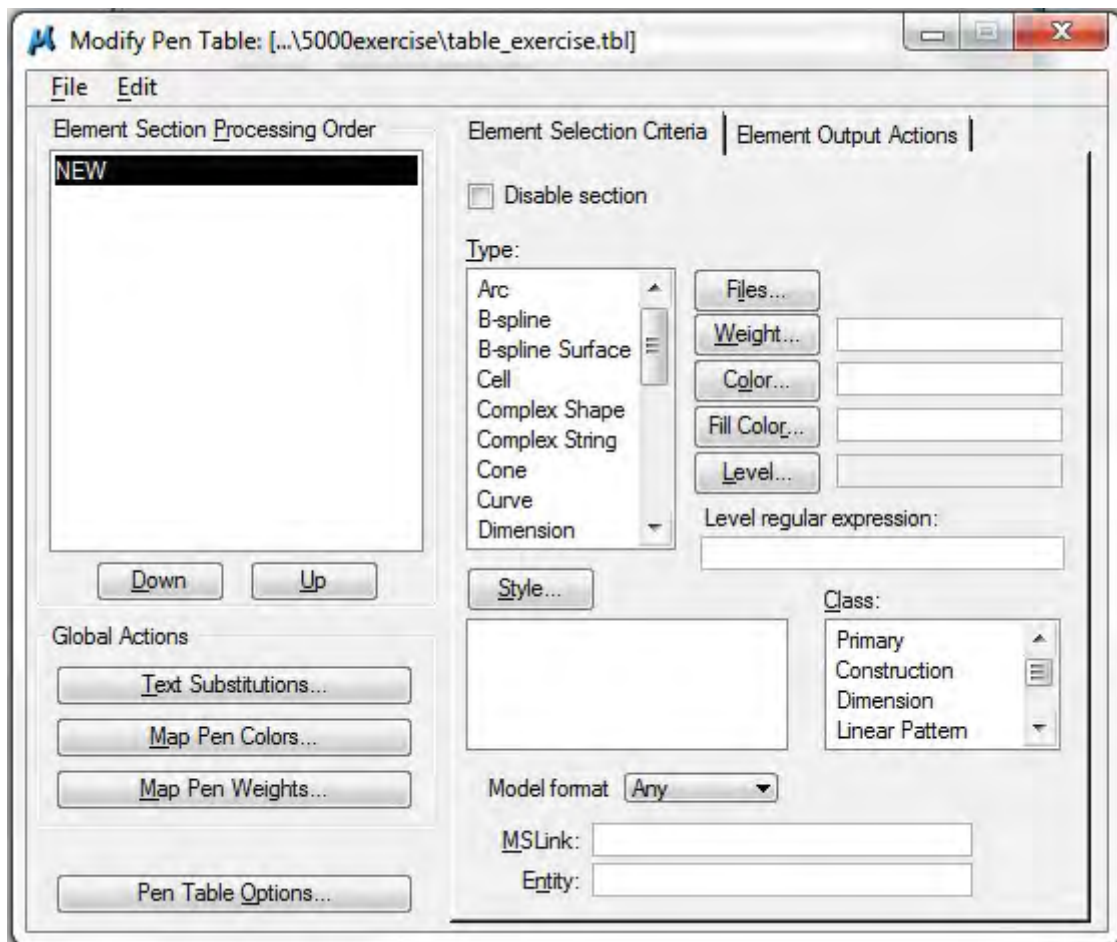
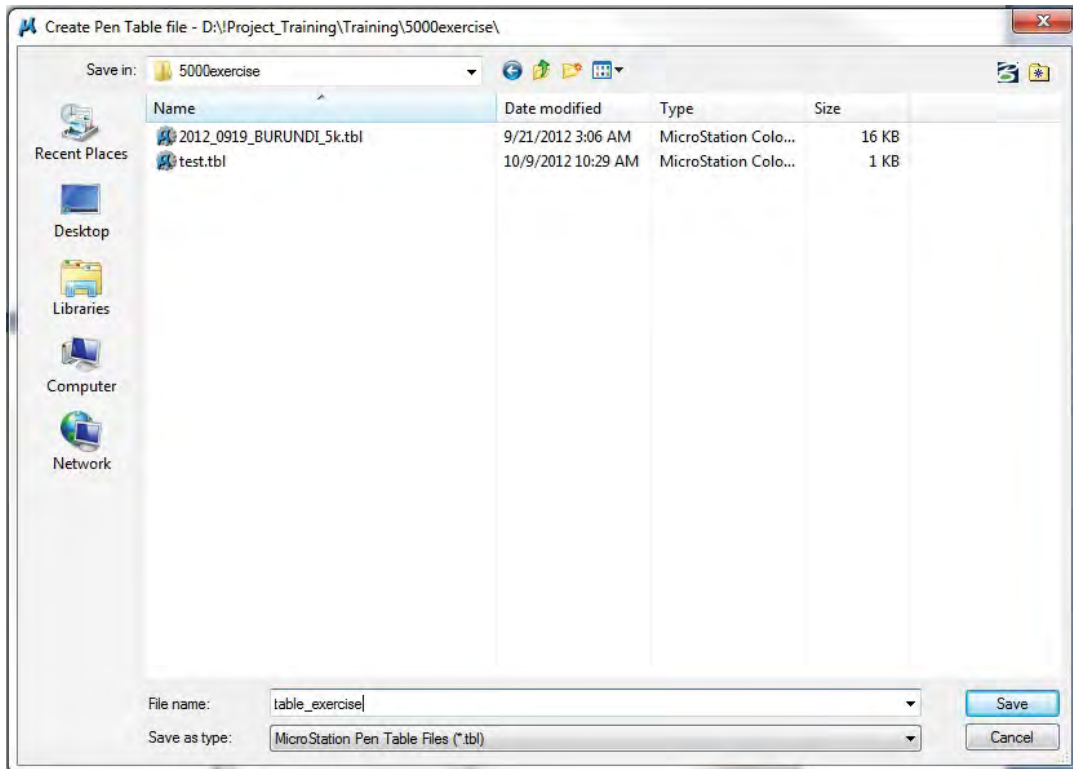
4). Order4(5107)

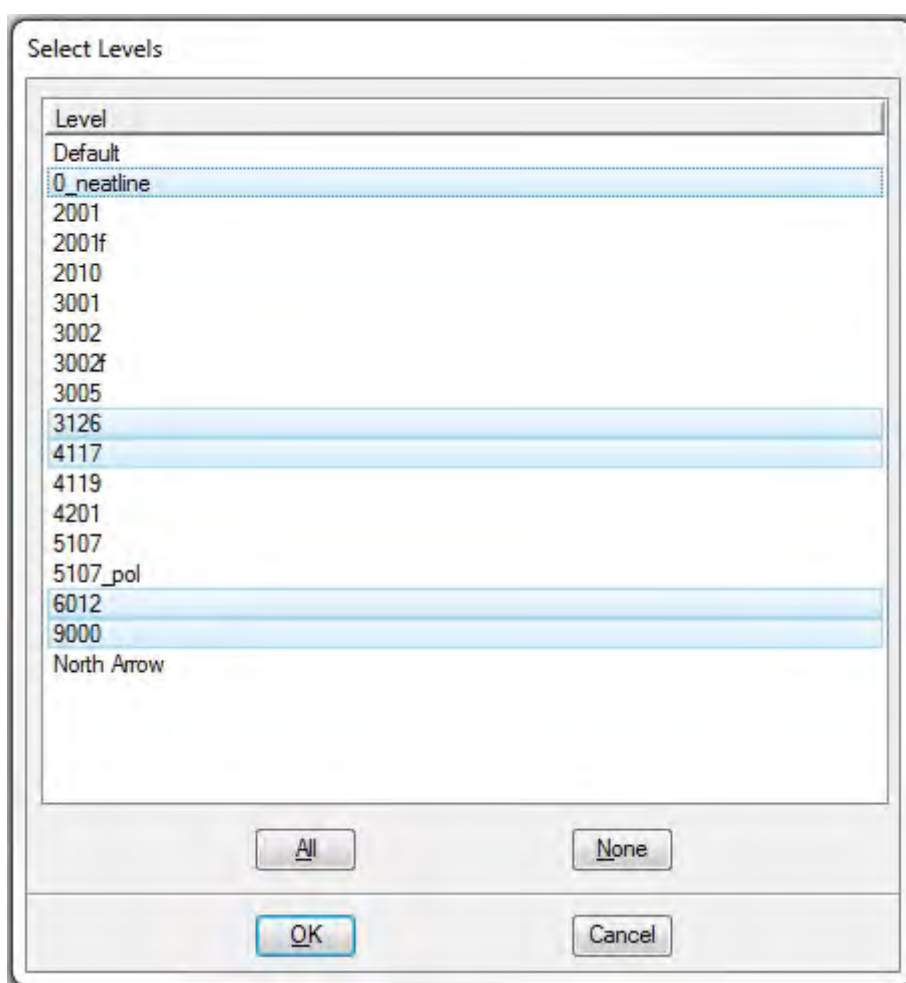
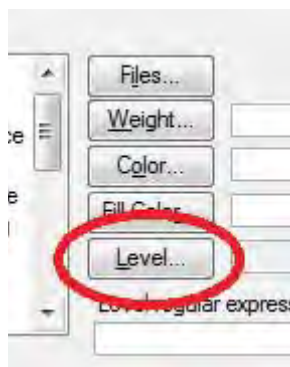


5). Order5(5107_pol)

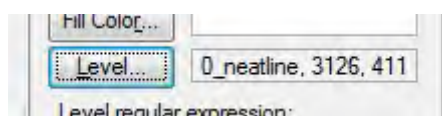
File | Print





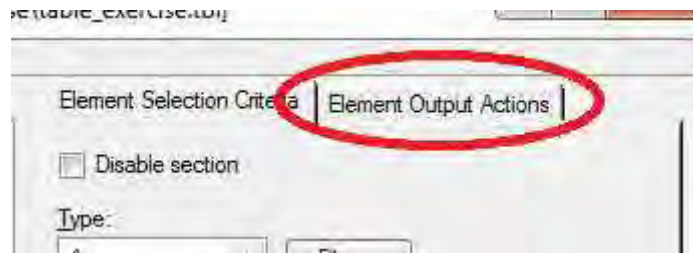


Select levels (level: 0_neatline, 3126, 4117, 6012, 9000), and click “OK”.

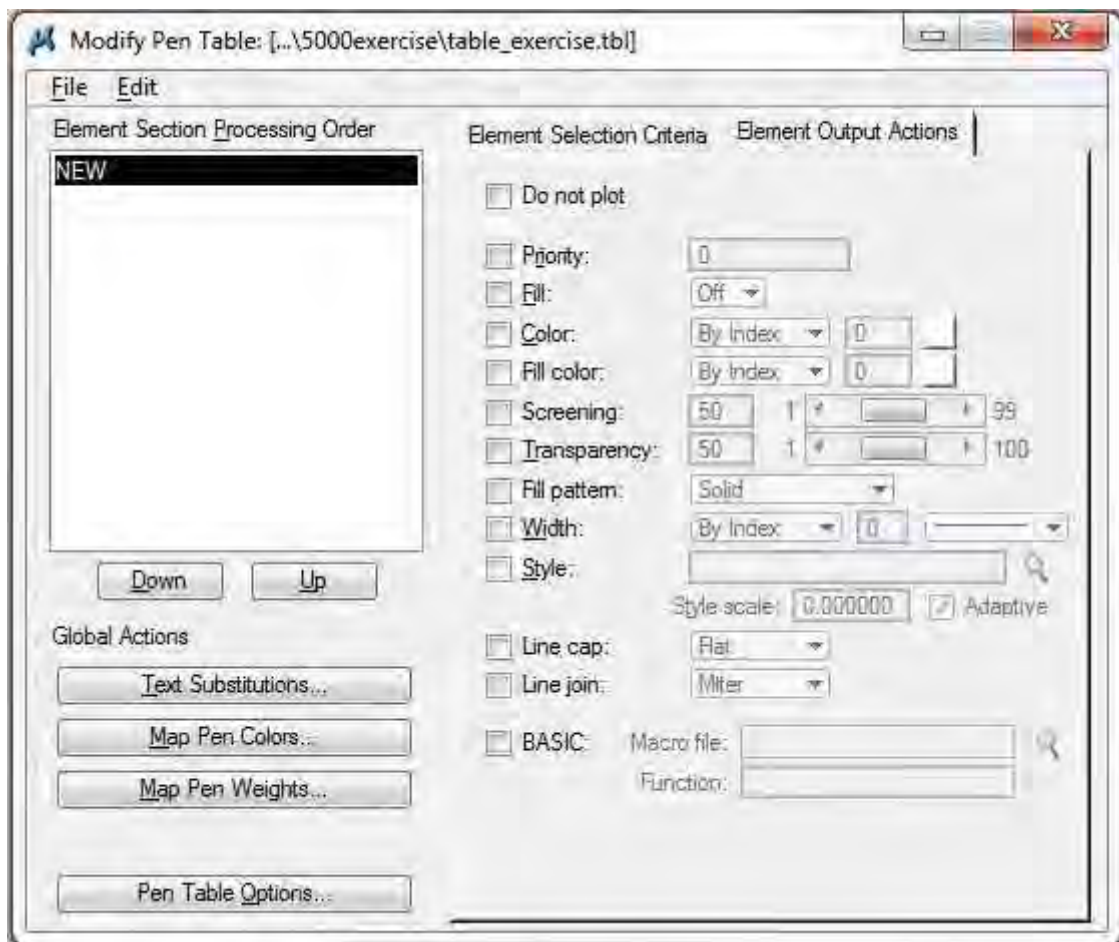


Selected level name will appear in the right side of level button.

Click the “Element Output Actions” tab.



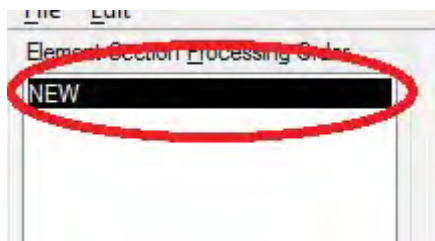
Check “Priority”’s check box and input “5” in text box.



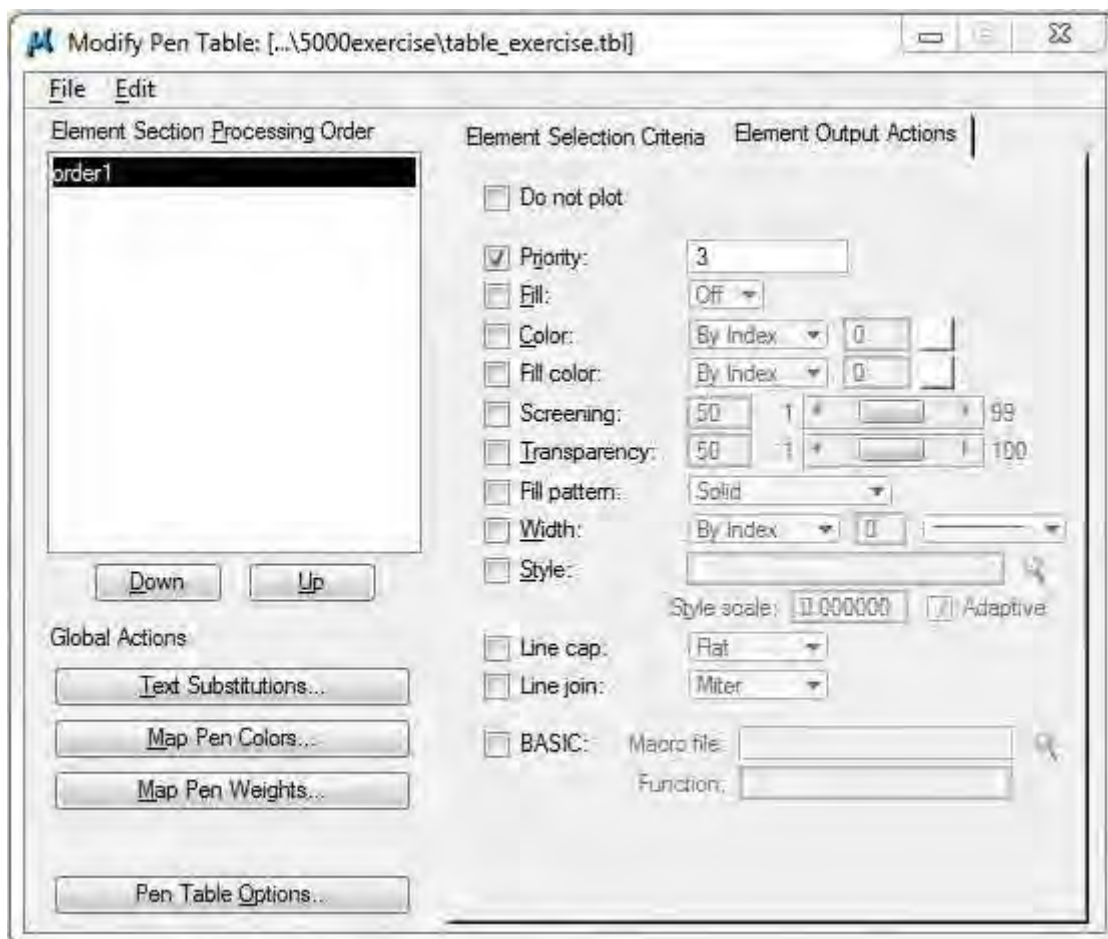
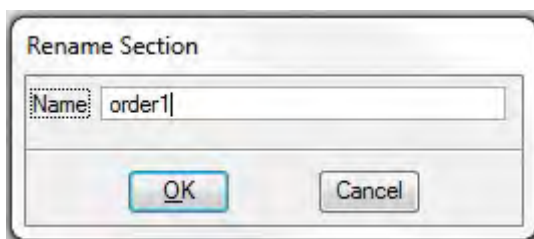
Order depends on this number.

Large numbered group will express above and small numbered group will be below.

And change the name of this group, double click “NEW”.



And input “order1” and click “OK”.

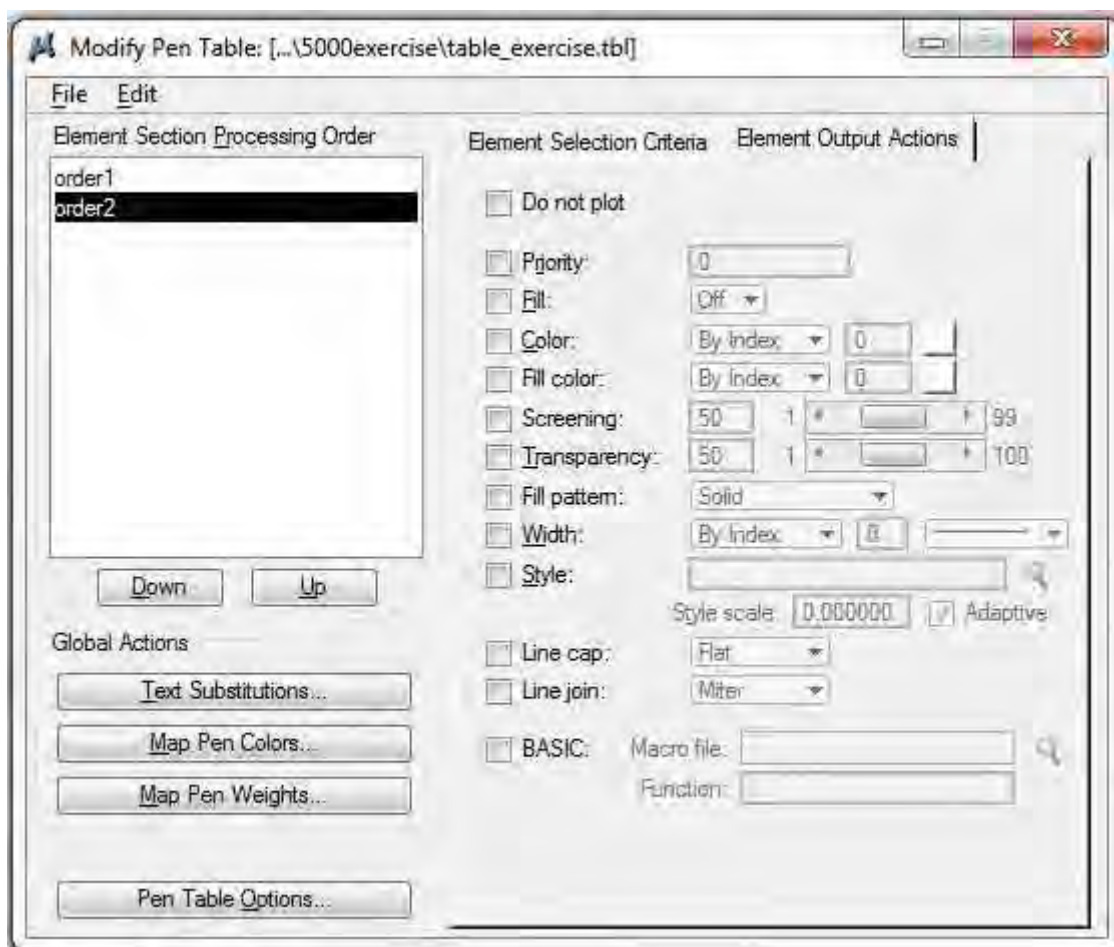
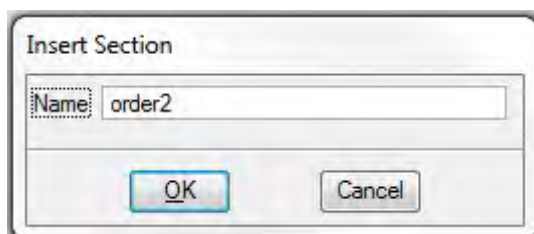


Next, make “order2” level group.

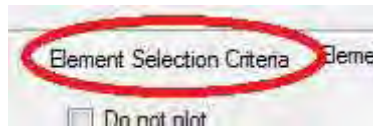
Edit | Insert New Section Below...



Input "order2" and "OK".



Click “Element Selection Criteria” tab.



Click “Level...”.

Select levels (2001, 3001, 3002, 3005, 4119, 4201) and click “OK”.

Click “Element Output Actions” tab.

Check “Priority” and input “4”.

Next, make “order3”.

Edit | Insert New Section Below .

Input “order3” and “OK”.

Click the “Element Selection Criteria” tab.

Click “Level...”.

Select levels (2001f, 3003f) and “OK”.

Click the “Element Output Actions” tab.

Check “Priority” and input “3”.

Next, make “order4”.

Edit | Insert New Section Below .

Input “order3” and “OK”.

Click the “Element Selection Criteria” tab.

Click “Level...”.

Select levels (5107) and “OK”.

Click the “Element Output Actions” tab.

Check “Priority” and input “2”.

Finally, make “order5”.

Edit | Insert New Section Below .

Input “order3” and “OK”.

Click the “Element Selection Criteria” tab.

Click “Level...”.

Select levels (5107_pol) and “OK”.

Click the “Element Output Actions” tab.

Check “Priority” and input “1”.

Levels dividing process is over.

3.3 Change color

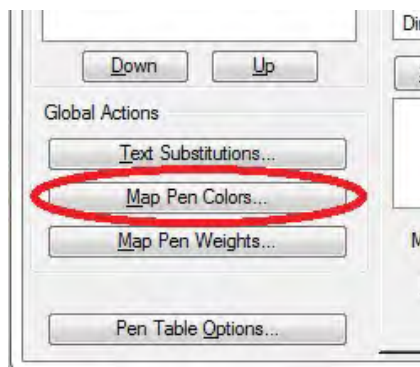
This DGN uses 7 colors.

Name	Description	Color	Line Style	Weight	Cap Style	Join Style	Check
Default		0	Continuous	1			✓
0_neatline		0	0	2			✓
2001		0	Continuous	2			✓
2001f		3	Continuous	0			✓
2010		0	Continuous	2			✓
3001		128	Continuous	2			✓
3002		128	Continuous	0			✓
3002f		102	0	2			✓
3005		128	Continuous	0			✓
3126		0	Continuous	1			✓
4117		0	Continuous	1			✓
4119		0	4119_line	1			✓
4201		128	4201_7.5il	2			✓
5107		1	Continuous	1			✓
5107_pol		7	Continuous	0			✓
6012		114	Continuous	1			✓
9000		0	0	2			✓
North Arrow		0	0	0			✓

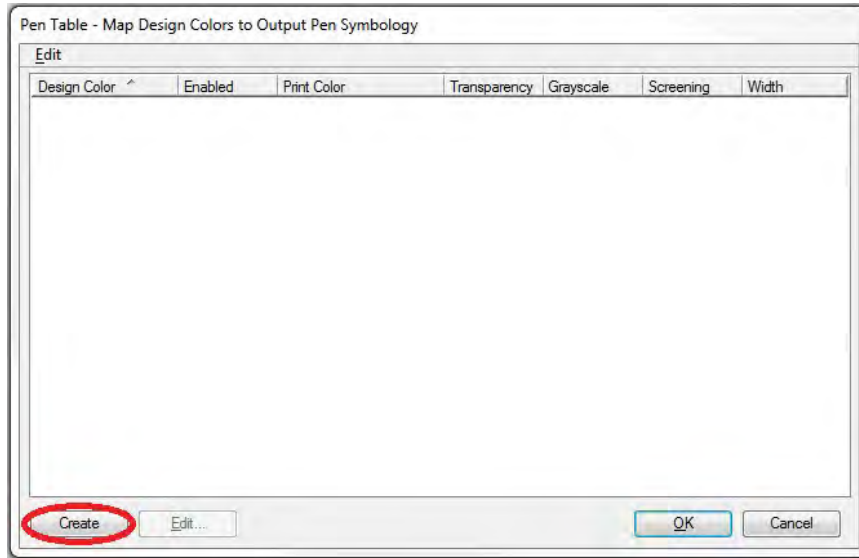
This table file changes road's color (level 2001f), building's color (level 3002f) and water color (5107_pol) into pale color.

Road (2001f) uses color No.3, building (3002f) uses No.102 and water (5107_pol) uses color No.7.

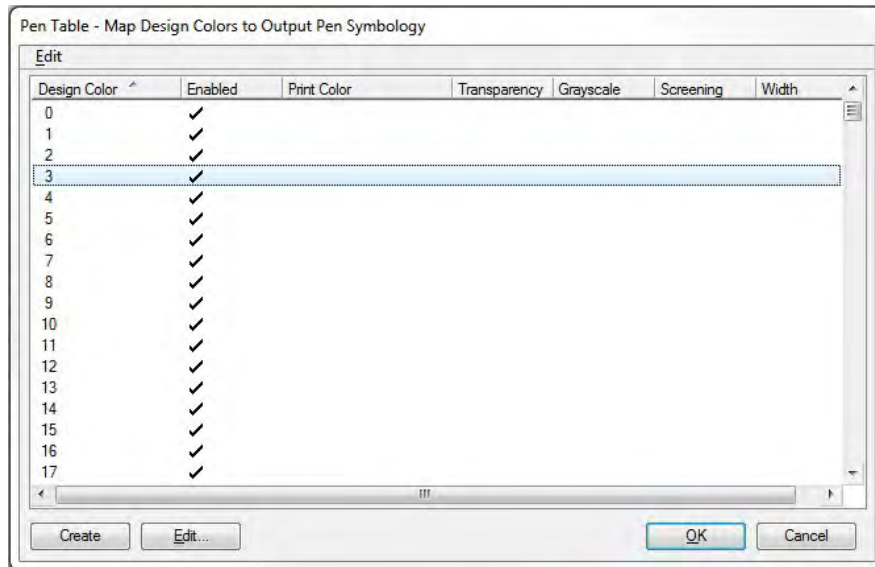
In the Modify Pen Table window, click "Map Pen Colors..." button.



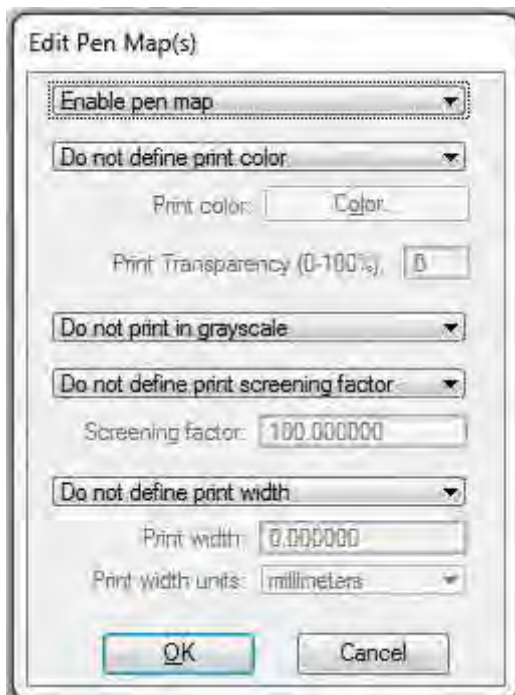
Click on "Create" button.



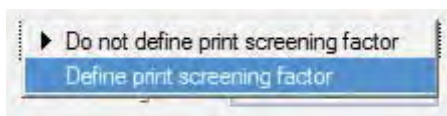
Double click on "3".



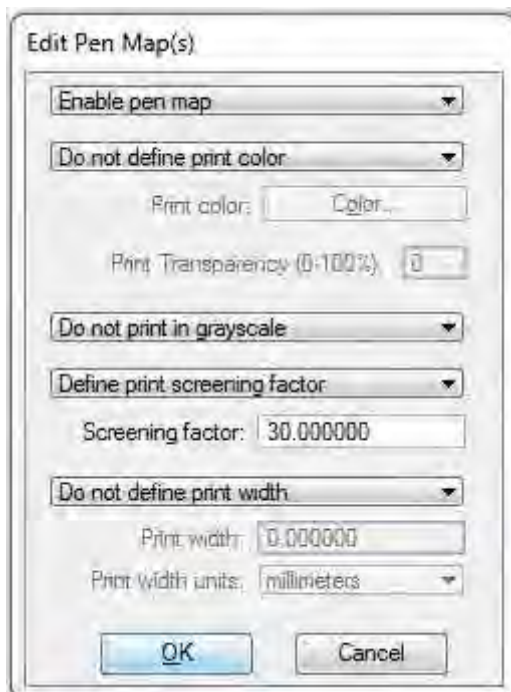
The "Edit Pen Map(s)" window will open.

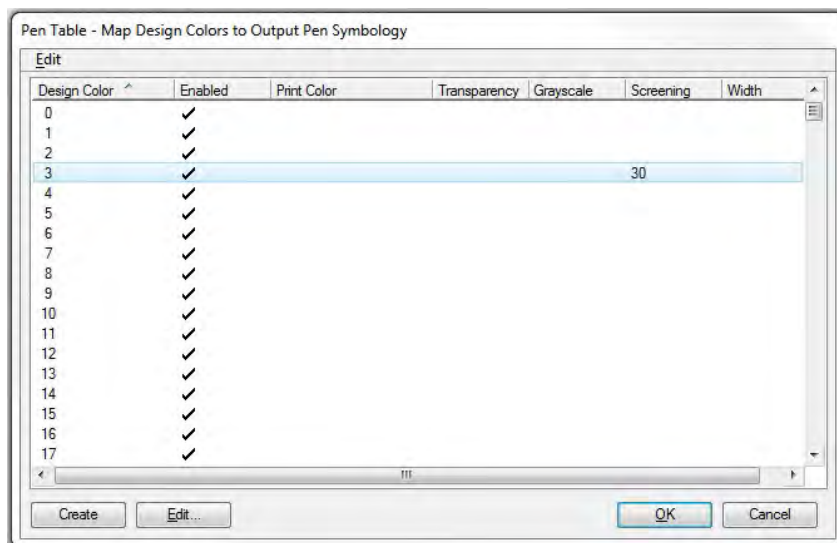


Click “Do not define print screening factor” and select “Define print screening factor”.



Change “Screening factor” value into 30 and “OK”.



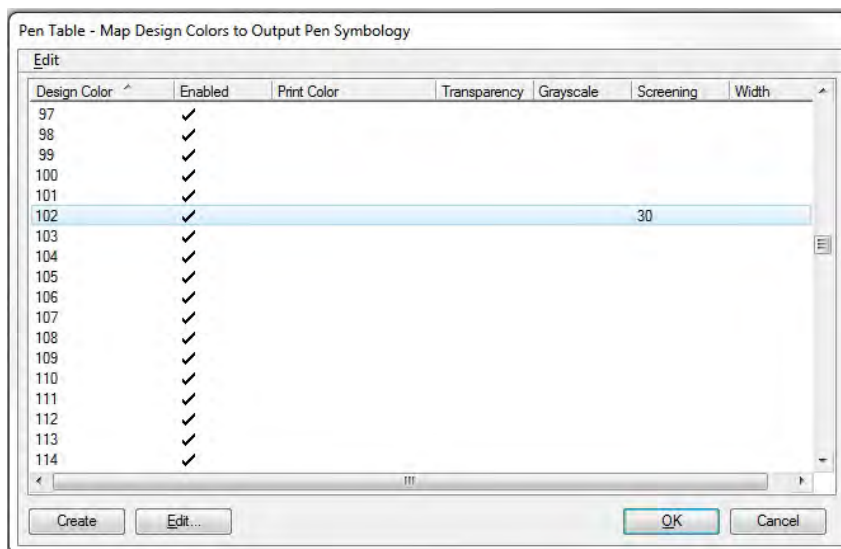


Next, change building color.

Double click on “102”

Click “Do not define print screening factor” and select “Define print screening factor”.

Change “Screening factor” value into 30 and “OK”.



Finally, change water color.

Double click on “7”.

Click “Do not define print screening factor” and select “Define print screening factor”.

Change “Screening factor” value into 30 and “OK”.

Color setting is complete, click “OK” in the “Pen Table” window.

3.4 Change line weight

Name	Description				
Default		0	Continuous	1	✓
0_neatline		0	0	2	✓
2001		0	Continuous	2	✓
2001f		3	Continuous	0	✓
2010		0	Continuous	2	✓
3001		128	Continuous	2	✓
3002		128	Continuous	0	✓
3002f		102	0	2	✓
3005		128	Continuous	0	✓
3126		0	Continuous	1	✓
4117		0	Continuous	1	✓
4119		0	4119_line	1	✓
4201		128	4201_7.5il	2	✓
5107		1	Continuous	1	✓
5107_pol		7	Continuous	0	✓
6012		114	Continuous	1	✓
9000		0	0	2	✓
North Arrow		0	0	0	✓

This DGN uses 3 types of line weight (0, 1, 2).

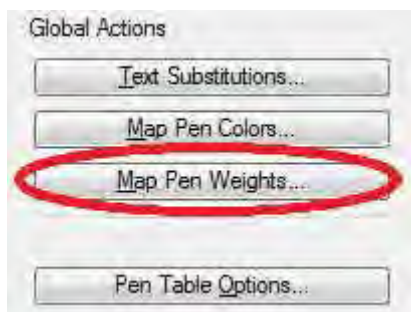
This table file defines width of these lines.

Weight 0 → 0.1mm

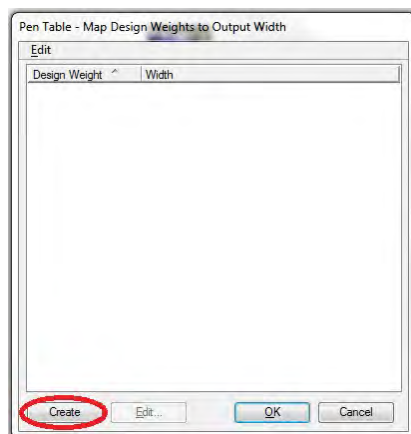
1 → 0.15 mm

3 → 0.2mm

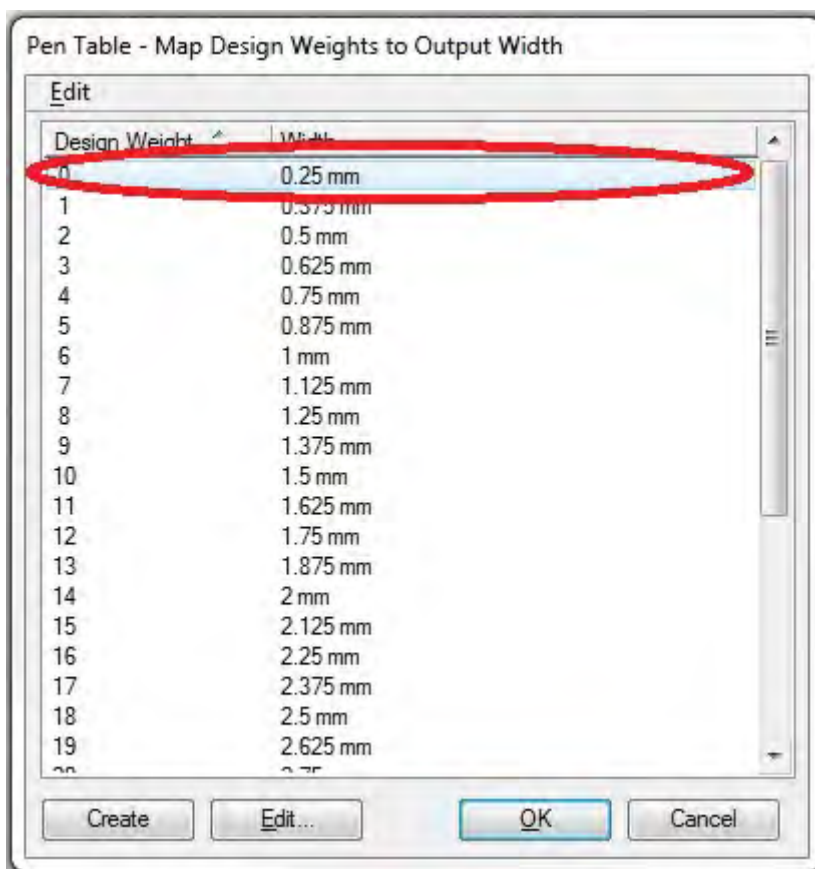
Click “Map Pen Weights...” button.



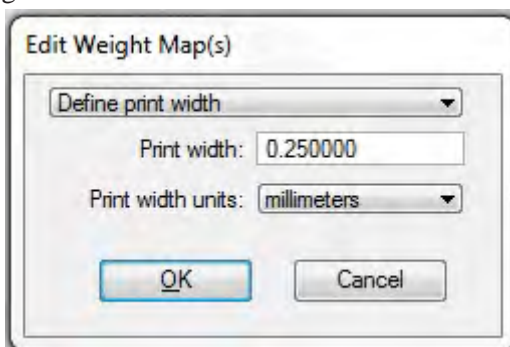
Click “Create” button.



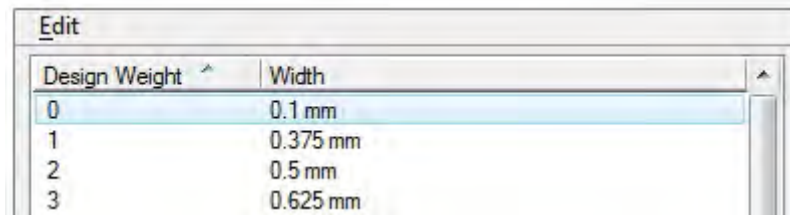
Double click on “0”.



This window will appear, change the value of Print width “0.1” and click “OK”.



Print width of Weight “0” will change.

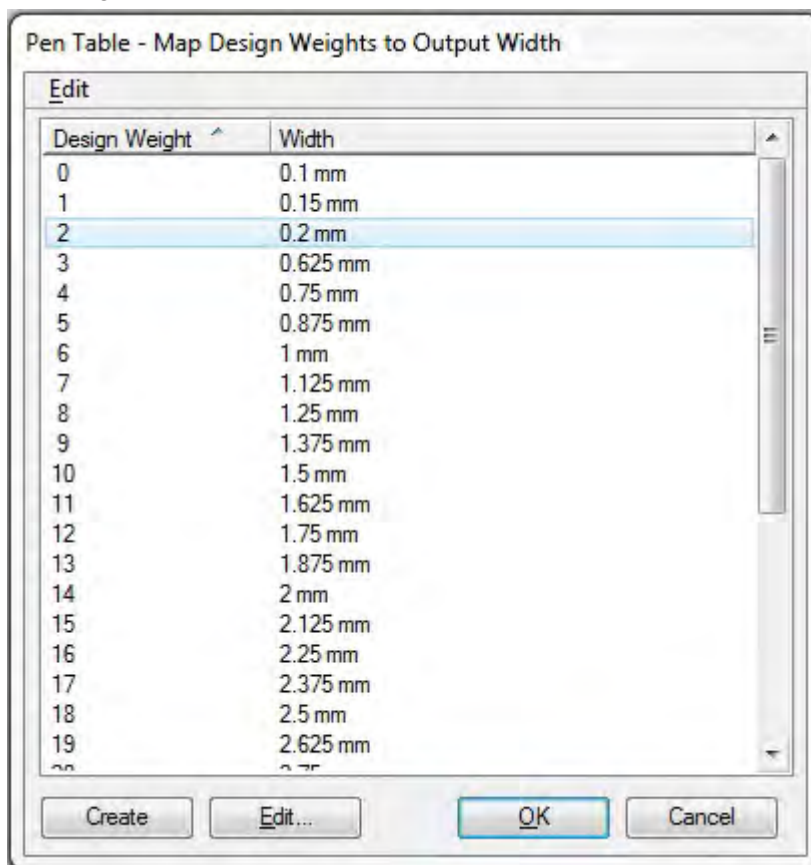


Design Weight	Width
0	0.1 mm
1	0.375 mm
2	0.5 mm
3	0.625 mm

Change the value of “1” “2” in the same way.

Double click on “1”, change value into “0.15”, and “OK”.

Double click on “3”, change value into “0.2”, and “OK”.



Design Weight	Width
0	0.1 mm
1	0.15 mm
2	0.2 mm
3	0.625 mm
4	0.75 mm
5	0.875 mm
6	1 mm
7	1.125 mm
8	1.25 mm
9	1.375 mm
10	1.5 mm
11	1.625 mm
12	1.75 mm
13	1.875 mm
14	2 mm
15	2.125 mm
16	2.25 mm
17	2.375 mm
18	2.5 mm
19	2.625 mm

Click “OK” button in the “Pen Table” window.

File | Save in the “Modify Pen Table” window, then finish.

Symbolization Manual for Illustrator (1/25,000 map)

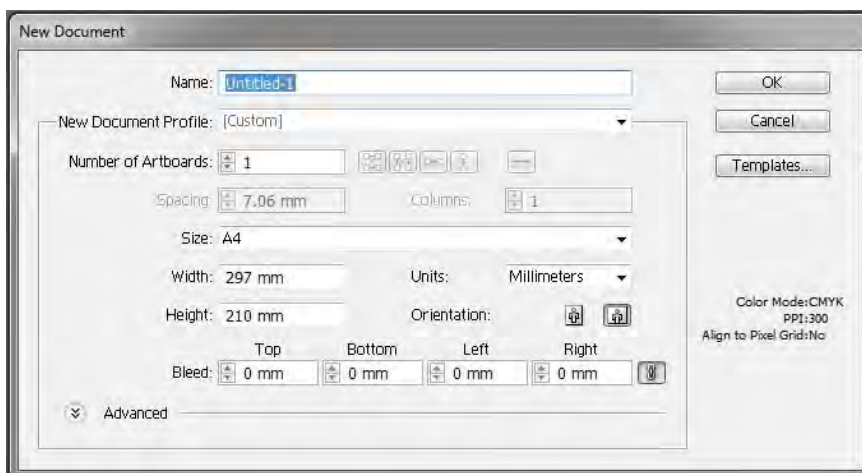
<Objective>

Symbolize 1/25,000 map by using “Illustrator” software.

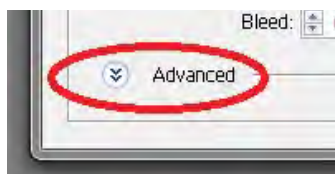
1. Setting up the work area

1.1 Open a new file

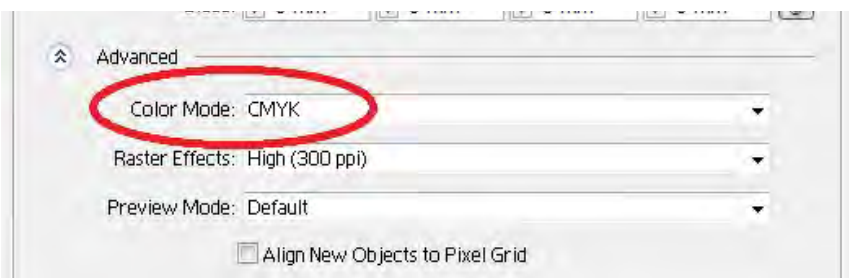
- 1) Choose File > New, and then enter a name in the Name text box.



- 2) Click the Advanced button,



and select the CMYK color mode.



- 3) If necessary, specify a height and width for the artboard.

1.2 Change the size of the Artboard

1). Choose File > Document Setup. Then choose Artboard from the pop-up menu at the top left of the Document Setup dialog box.

2). Do one of the following:

Choose a preset size from the Size pop-up menu.

Choose Custom from the Size pop-up menu, and enter the dimensions you want in the text boxes, up to 227 inches by 227 inches. You can change the units in the document (and therefore of the artboard size) by choosing a different unit from the Edit > Preferences > Units... dialog box

3). Click OK.



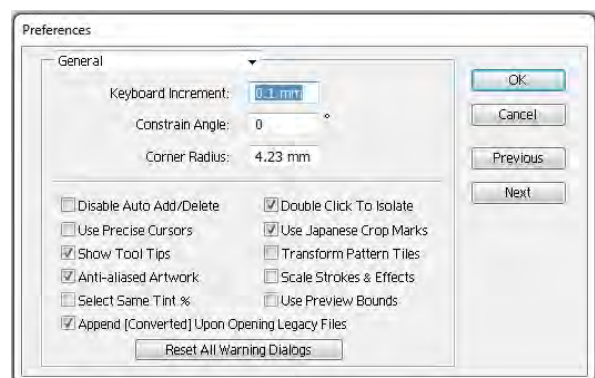
2. Setting up map unit and working environment

1). General

Choose Edit > Preferences > General

In the Keyboard Increment text box, enter the distance you want each press of an arrow key to move a selection, and then click OK.

Check the Japanese Crop Marks. It is shown Japanese crop marks on the map



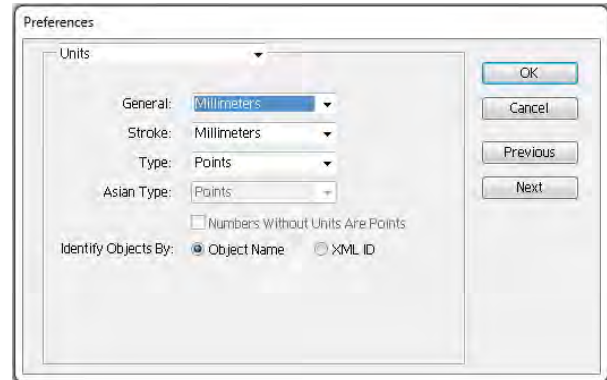
2). Unit...

Choose Edit > Preferences > Units...

Choose Millimeters from popup menu of General

Choose Millimeters from popup menu of Stroke

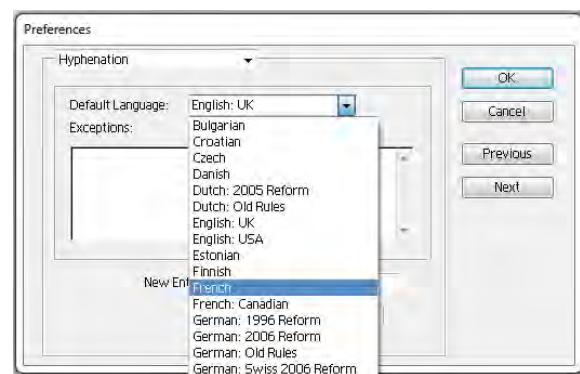
Choose Points from popup menu of Type



3). Hyphenation options:

Choose Edit > Preferences > Hyphenation

If desired, choose the language in which the hyphenation rules apply (to French) from the Languages pop-up menu. When you select a different language, the rules for hyphenating words change to match that language's rules.



4). Guides and Grid

Choose Edit > Preferences > Guides & Grid

Set options for guides and the grid:

For Color, choose a color for guides, or the grid, or both. If you choose Other, click the color box, choose a color from the color picker, and click OK.

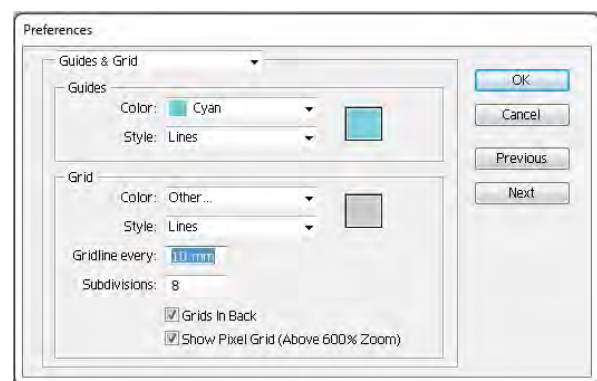
For Style, choose a display option for guides, or the grid, or both.

For Gridline Every, enter a new value (and unit of measure if necessary) for the spacing of primary gridlines.

For Subdivisions, enter a value to subdivide the grid.

For Grids in Back, select the option to display the grid behind all artwork; deselect the option to display the grid in front of all artwork.

Click OK.



3. Setting colors

It supposes to decide colors to use for offset printing. If it uses five colors as black, blue, green, café and chocolate, examples following:

3.1 Black and White

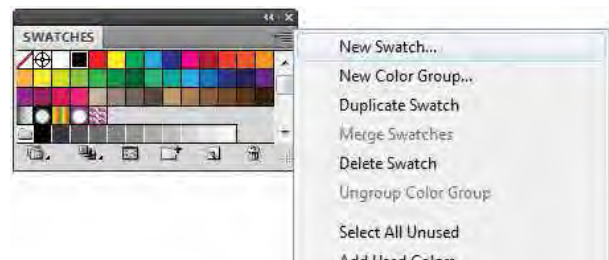
White use CMYK 0 %, Black use C=0 M=0 Y=0 K=100%. Both of Black and White exist in Swatches Palette in default.

3.2 Spot colors

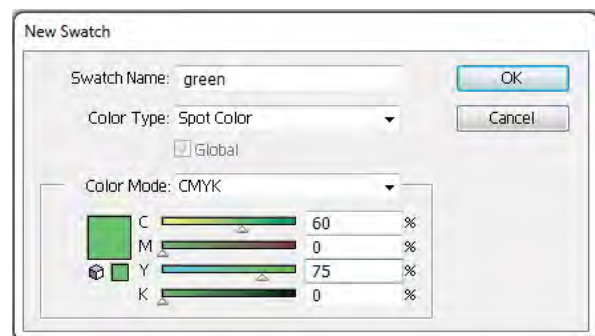
Color of blue, green, café and chocolate will be made as following:

Incase of green:

1) Open Swatches palette: Choose window > Swatches. Click allow button at the top right of Swatches palette, and then choose New swatches.



2) Enter “green” in Swatch Name text box, Choose “Spot Color” from pop up menu of Color Type, Choose “CMYK” from pop up menu of Color Model. Then put number of % into text box as example C = 60, M = 0, Y = 75 and K = 0. Click OK.



4. Symbolizations

4.1 Line features

1) Simple line

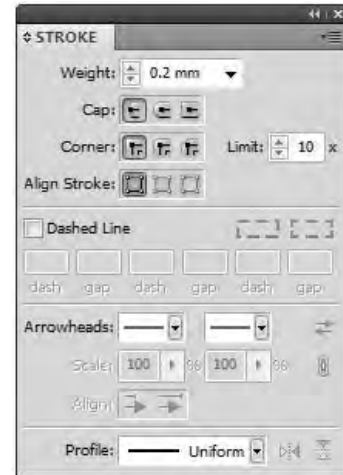
(1) The simple line made by one color as Principal contour (layer 7102):

A) Apply line weight:

Select contour with any selection tool.

Show stroke: Choose window > Stroke.

Fill in 0.2mm in text box of Weight
Choose Cap and Corner as image.

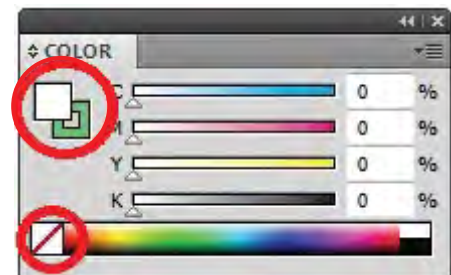


B) Apply color:

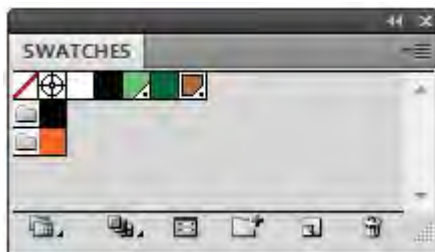
Select contour with any selection tool.

Show color palette: Choose window > Color.

Choose fill  and click none  Choose stroke 



Then choose Sepia from Swatches palette.



(2) The line made by dash as intermediate contour (layer 7103):



A) Applying line weight same as (1). Then check Dashed line.

Enter distance of dash and gap as example dash 2.5mm, gap 0.5mm.



B) Line Color should be applied with color palette as (1)

(3) Row of trees (layer 6011)

A) Apply line weight 0.5mm to enter the weight text box.

Select Round Cap. Then check Dashed line. Enter distance of dash and gap as dash 0mm, gap 1mm.



B) Line Color should be applied green with color palette as (1).



interest: Copy above line and past in front: Choose Edit > past in front. Then apply line weight 0.4mm, Cap, dash and gap same as above. Apply line color CMYK 0.

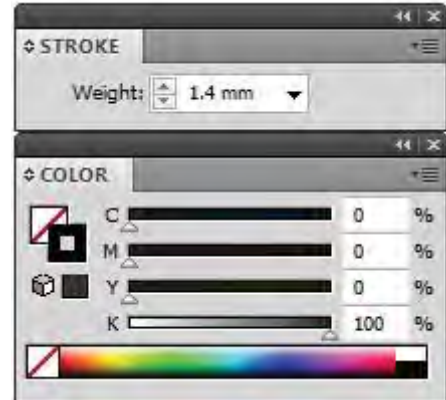


2) Lines made by multicolor

- (1) Divided national road, with median strip.
(layer 2001)

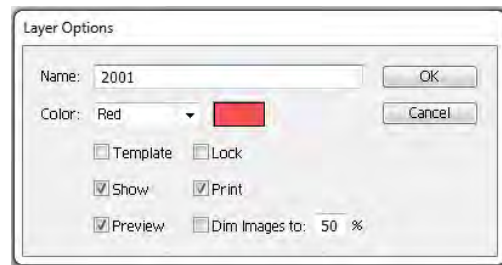


- A) Select a line with any selection tool. Then apply [line weight](#) 1.1mm, [stroke color](#) K 100% CMYK color model.

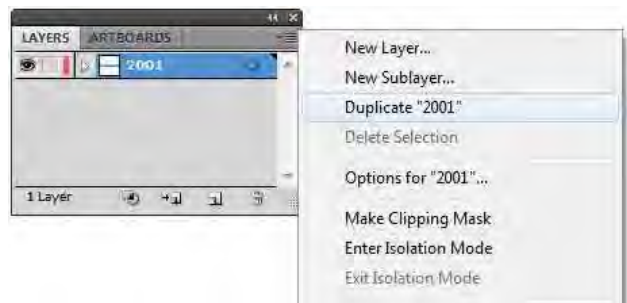


- B) Modify layer name: Double click layer or select layer, and then click the button at top right of layers box, then choose “Option for...”.

Layer Options box appears. Enter new name in the text box of Name. Click OK.

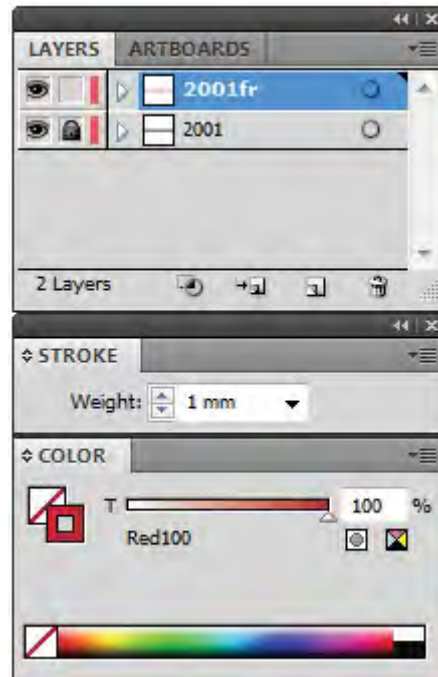


- C) Make new layer (2001fr) with duplicate layer of 2001: Select layer 2001, and then click the button at top right of layers box, then choose “Duplicate 2001”. “2001 copy” Layer will appear. And change Layer name “2001fr”.



- D) Applying line weight and stroke color for layer 201f: Select the objects of 201f with any selection tool(you can select all objects at once if many objects inside of same layer: Choose > select > All)

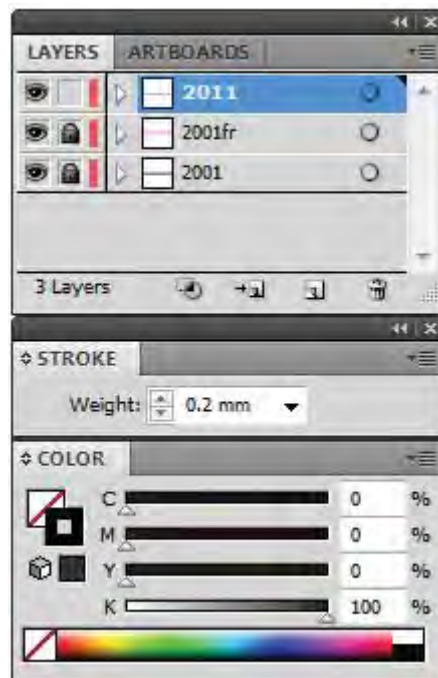
Enter 0.6mm in the text box of weight, apply stroke color café 100%.



- E) Make new layer (2011) with duplicate layer of 2001fr: Same method as above method

- F) Applying line weight and stroke color for layer 201c: Same method as above method

Line weight 0.2mm, Stroke color K 100%



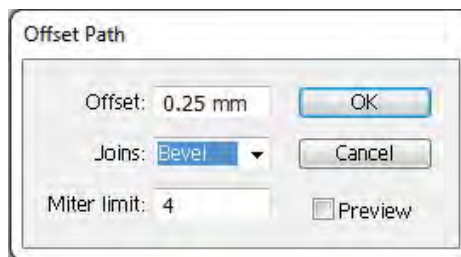
3) Lines made by offset line

Minimum symbol of Fence (layer 4201):

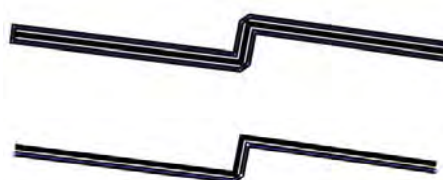
A) Select a line of Fence to use any selection tool. Apply line weight 0.2mm and stroke color K100.



B) Select a line of Fence to use any selection tool. Choose Object > Path > Offset Path. Offset Path dialog box will appear. enter offset distance 0.25mm (half of tick length) in the Offset text box. Choose “Bevel” from Joins pop-up menu. Click OK.



C) Cut above line made by offset path to use Scissors tool. Then delete one line you don't need.



D) Select the line remained with above method. Apply line weight 0.5mm(tick length). Enter each distance in the dash and gap text box. (dash 0.2mm, gap 4.8mm)

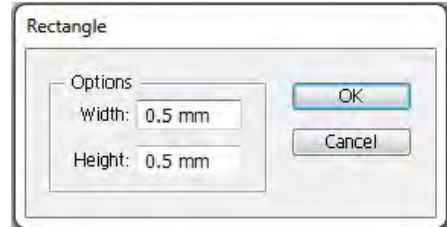
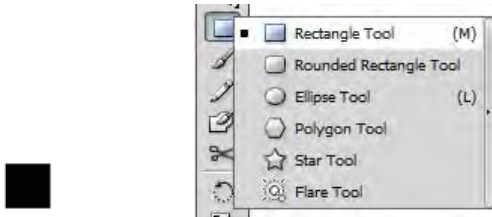


4.2 Point features

1) Simple symbols

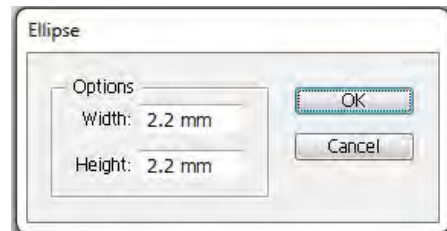
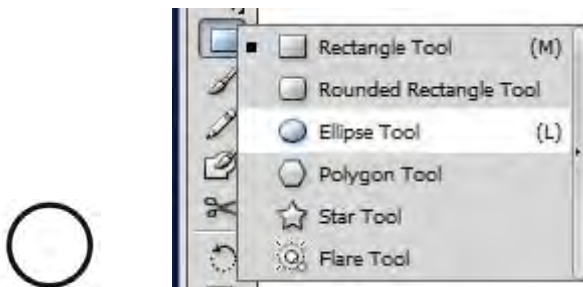
(1) Small building (layer 3002)

A) Select Rectangle tool. Click any place you need to draw on the document. Enter 0.5mm in the Width text box and Height text box. Click OK. Then apply fill color K 100.

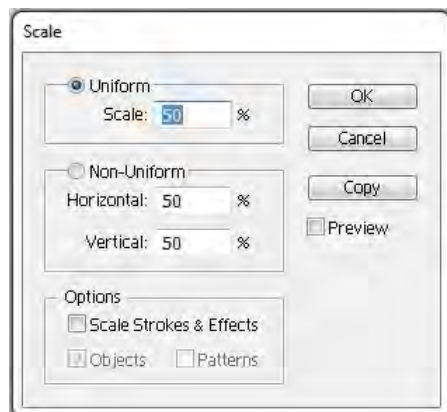


(2) Provincial Office (layer 3112)

B) Select Ellipse tool. Click any place you need to draw on the document. Enter 2.2 mm in the Width text box and Height text box. Click OK. Then apply [stroke color K 100](#), [fill none](#), [line weight 0.1mm](#).



C) Select above object to use selection tool. Then Choose Object > Transform > Scale. And then check Uniform and enter 20% (20% for 1mm = 0.2mm). Click Copy. [Apply fill color](#) K 100. Select both of objects. Choose Object > Group.

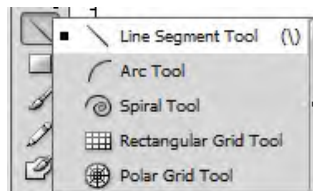


2) Symbols made in combination with simple figures

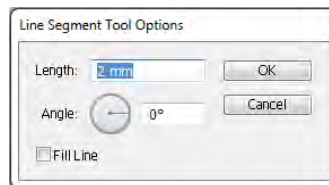
(1) Catholic Church (layer 3104)

A) Draw the square 1.75mm x 1.75mm .(See 4.2.1).(1). [Apply line weight](#) 0.15mm, [stroke color](#) K 100.

B) Select Line Segment Tool,



Click any place you need to draw on artboard.

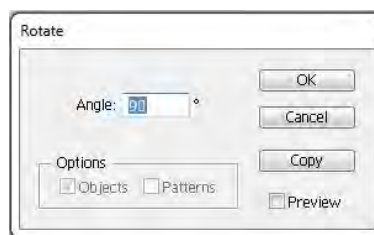


Enter Length 2mm, Angle 0.

[Apply line weight](#) 0.1mm, [stroke color](#) K 100.



C) Select the line to use selection tool. Choose Object > Transform > Rotate or double click Rotate tool. And then enter 90 in the Angle text box. Click Copy.



D) Fix the cross and the square. Finally apply [group](#) all of object.



4.3 Polygon feature

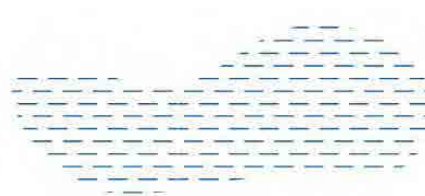
- A) Draw any polygon to use any tool. Then you can apply [line color](#), [fill color](#), [line weight](#), and line type. If you need to apply pattern for fill: Choose Window > Swatches. Then choose any pattern from pattern Palette.



Polygon to use dash line

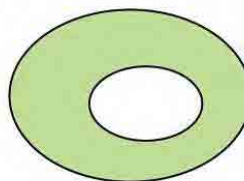
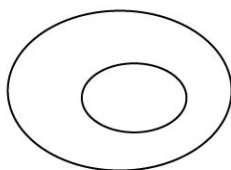


Polygon fill with green



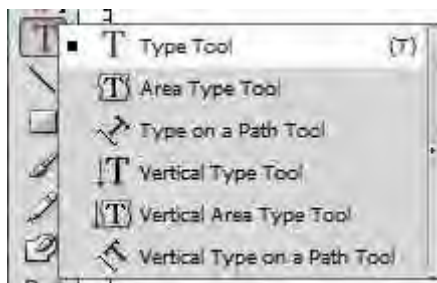
Polygon fill with pattern

- B) Exclude doughnut polygon if necessary: Select both of polygons, then exclude with choose Object > Compound Path > Make.



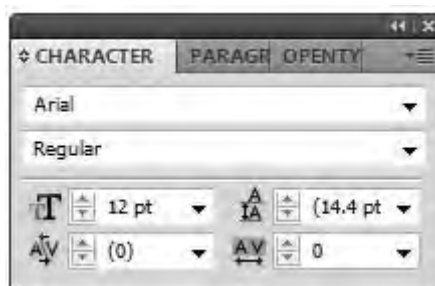
4.4 Text

- 1) Horizontal or Vertical text
 - A) Select Type tool,



click any place you need to type. And then type.

- B) Select above text to use any selection tool. Show character box: Choose window > Type > Character. Then you can change font, size and etc.. if necessary.



Apply text color to use fill color.

- C) If you need to shift baseline of text: Select text you need to shift to drag with text tool. Then chose point from baseline shift pop-up menu.

2) Text along a river

- A) Select river line. Then move with Alt key as along the river. One more line appears as along the river. Apply color as none fill and none stroke.



- B) Select the line with Path type tool. Then type name of river. You can arrange font, size and tracking space to use character box if necessary.

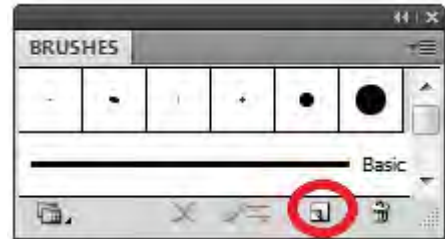


5. Records of Symbols and Patterns

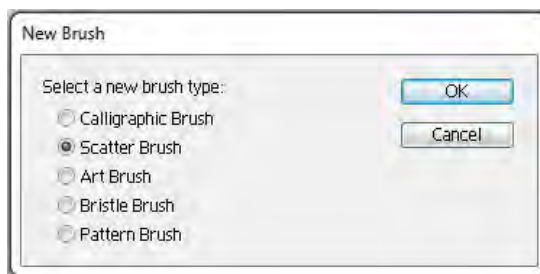
We cannot make symbols and pattern one by one in the process of map symbolization. If you already made the symbols, you need to store some place. It is explanation how to store the Symbols and Patterns.

5.1 Point symbols

- A) Select the object you need to store. Then show brush:
Choose window > Brushes. Then click the button at top right of Brushes box. And then select New Brush.

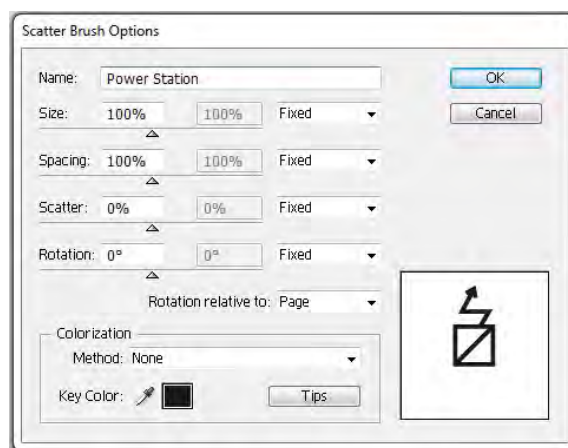


- B) Check New Scatter Brush.



- C) Then enter name of symbol in the name text box. Set each box as below:

Size 100 % Fixed, Spacing 1 % Fixed, Scatter 0 % Fixed, Rotation 0 % Fixed, Rotation relative to Page.



- D) Then click OK.

- E) If you need edit Brush object as isolated object, you can change brush object to isolated object as below:

Select the brush object. Then Choose Object > Expand appearance.

5.2 Pattern

Follow these general guidelines for constructing pattern tiles:

As you create your pattern tile, zoom in on the artwork to align elements more accurately, and then zoom out from the artwork for the final selection..

For greatest efficiency in previewing and printing, a fill pattern tile should be about 1/2 inch to 1 inch square.

The more complex the pattern, the smaller should be the selection used to create it; however, the smaller the selection (and the pattern tile it creates), the more copies are needed to create the pattern. Thus, a 1-inch-square tile is more efficient than a 1/4-inch-square tile. If you are creating a simple pattern, you can include multiple copies of the object within the selection intended for the pattern tile.

To create simple line patterns, layer stroked lines of varying widths and colors, and place an unfilled, unstroked bounding box behind the lines to create a pattern tile.

To make an organic or textural pattern appear irregular, vary the tile artwork subtly for a more realistic effect. You can use the Roughen effect to control variations.

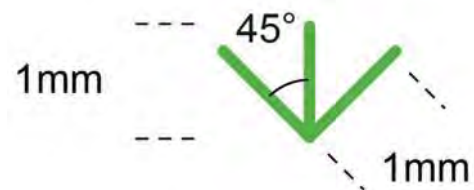
To ensure smooth tiling, close paths before defining the pattern.

Enlarge your artwork view and check for flaws before defining a pattern.

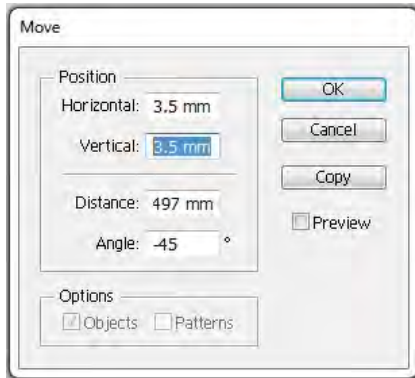
If you draw a bounding box around the artwork, make sure that the box is a rectangle, that it is the backmost object of the tile, and that it is unfilled and unstroked. To have Illustrator use this bounding box for a brush pattern, make sure that nothing protrudes from it.

Example: Farming land (layer 6006)

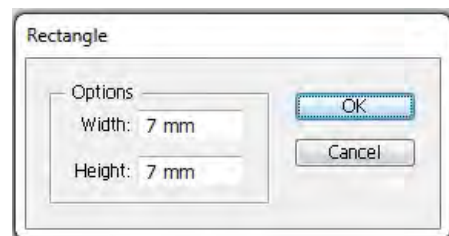
A) Make symbol: Draw three lines to use [Line segment tool](#) as below: 1mm in length. Angle are 45°, 90° and 135°. Then apply stroke weight 0.1mm, stroke color green100.



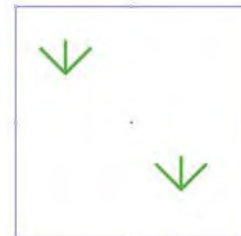
- B) Select above object. Then choose Object > Transform > move. and then enter 3.5mm in the Horizontal textbox and Vertical text box. Click Copy.



- C) Make pattern bounding box: Select Rectangle tool, then enter the distance in each text box as below: Width 7mm, means two times of horizontal and vertical distance between a symbol and a symbol. Then click OK. Then apply none fill and none stroke color.

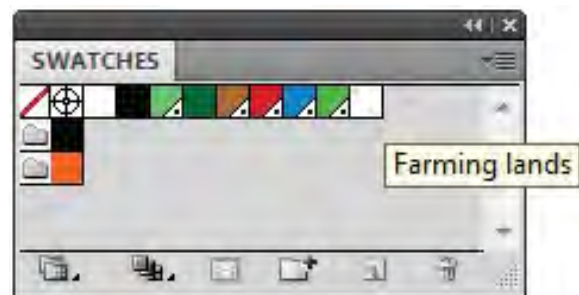
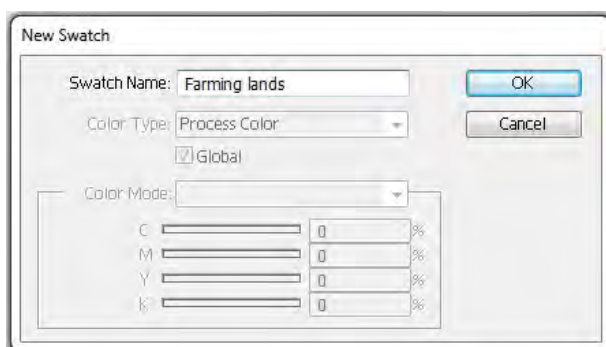


- D) Move this bounding box at surround these symbols.



- E) Select Bounding box. Then Choose Object > Arrange > Send to Back.

- F) Select all of symbols and bounding box . Then Choose Edit > Define Pattern. Enter Name of pattern in the Swatch Name text box. Click OK. It will be stored in Swatches palette.



Structuration

Manual for Data Structurization

<Objectives>

This manual presents detail regarding points covered during the training on GIS data structurization. Along with manual regarding functions in ArcGIS Software and GIS data structurization, this also includes the GIS Models (application) created by trainees.

Session 1: Introduction of Geographic Information System (GIS)

Basically, main aim of this lecture is to introduce Geographic Information System (GIS) and its principle concept. The topics included are:

- 1.1 What is GIS
- 1.2 Component of GIS
- 1.3 Application of GIS
- 1.4 GIS Data and GIS Database

=====

1.1 What is GIS

GIS is information system for input, store, retrieve, manipulate, analyze and output geospatial data to support decision/ planning/ management of natural and man made phenomena. It is integrated hardware, software, and data to achieve the targeted goals. The user can view, surf, make query and visualize getting pattern, trend and other similar relationship in the data and making output in the desirable format, such as maps, reports and chart and figures.

The GIS can be used, basically, with three concepts namely (i) Database Concepts (ii) Map Concepts and (iii) Modeling and Application Tool Development Concept. There is another concept, which might be termed as holistic concept, where all three are combined in one.

1.2 Component of GIS

Principally GIS is having four components

- Data input: collect and process geospatial data from various existing source, such as maps, remote sensing imagery, geo-statistical data and so on. Usually collection is through scanning, digitizing, keyboard entry.
- Data storage and access: collate and organize collected data provide access for efficient retrieval and updating.
- Data processing, analysis and manipulation: system allows performing simulation and modeling, simple geo-spatial and geo-temporal change detection, manipulating data to support decision making process, etc.
- Results and output: simple display and printing either stored data or resulted output from analysis either map, figure, tabular or report format.

Many software programs can handle spatial data or display maps. GIS is separated from these programs in that it is capable of performing spatial analyses. In other words, GIS is able to readily solve spatial questions or problems by using geo-referenced data (e.g., latitude, longitude).

These four components are combined together (figure below) by the user to achieve the target goal.

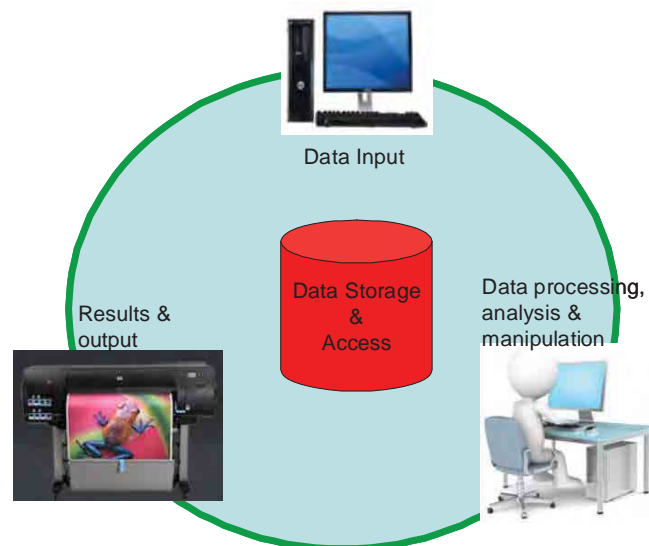


Figure1-1: Component of GIS

1.3 Application of GIS

There and wide range of application of GIS in several field or disciplines. It can be applied in any field where spatial reference is deemed necessary. In the real world, there are several events and phenomena are happening around us, which has some thing to do with geophysical and socioeconomic factors. Most of them are directly related with either one or all of them while indirectly with other. If we have to list out some of the fields, where GIS is widely used, it can be as follows:

- Regional planning and Natural Resources Management, including forest
- Land use and city planning
- Logistics, public service and utility management and planning
- Tracking and monitoring
- Assessment management
- Disaster management and mitigation plan
- Decision Support System and Applications
-

1.4 GIS Data and GIS Database

1.4.1 What is GIS Data and GIS Database

GIS data refers to data that stores information on locations and description of Geographic features. The two sets of GIS data may differ in terms of spatial and/or attribute information, scale at which these have been created (i.e. detailness of containing information), creation date, Map projection system, standard followed, and so on. Thus, such variations sometimes make retrieval, overlaying onto other GIS data and analysis inefficient and even difficult.

On the other hand, **GIS database** being created by considering all these related issues; it facilitates efficient storage and possible analysis, and retrieval by many users.

1.4.2 Types of GIS Data

Data can be classified while taking various concepts/methods in account, such as:

- i) Raster and Vector
- ii) Spatial and Non-spatial
- iii) Primary and Secondary
- iv) Geophysical, Geopolitical and Socioeconomic
- v)

There are basically two main methods of storing data in GIS, namely vector and raster. Depending upon the nature of map features, point, line and polygon are used to define them. Both vector and raster format can be used to store these features, but with different level of accuracy. Vector, which stores map features using vertices, is more accurate and mostly used for legal boundaries (for example land boundaries in urban area, national boundaries, etc.) and network analysis. On the other hand raster, which store map feature using generalized regular shaped grid, is less accurate than that of vector and mostly preferred for digital terrain model, remote sensing, natural resources (Rainfall distribution Map for example), statistical analysis, simulation and modeling etc.

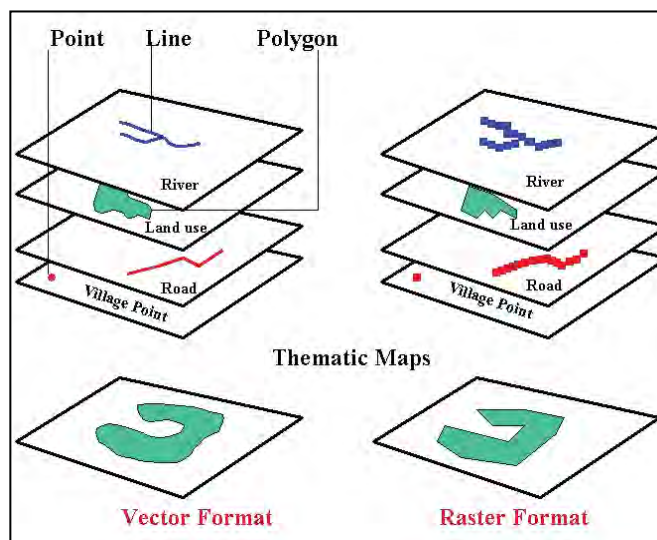


Fig.1-2: Illustration of Types of GIS Data

Geographic data comes in various forms, for example village points, Road network line, country land use features and so on. For better data query and analysis, GIS database has been designed to store geographical data in thematic form in most of the cases. A thematic geographic data is specific to single

item, for example a Forest Reserve and Wildlife National Parks, Road network map of the country, village location map, etc. Diagrammatic illustration in Figure 1-2 shows different data types used in GIS.

1.4.3 Format of GIS Data

“Format” refers to the File format and there are varieties of possible file formats which can store GIS Data. In fact, each Software supporting the display and processing of GIS data has generally its own native file format. For example, Software named “MapInfo” has file extension as *.mif*; Erdas Imagine has native format as *.img*. Other raster file formats are *.tif*, *.jpg*, and so on, and vector file formats are *.dxf*, *.dgn*, *.shp* (*ESRI ArcGIS shape file format*) etc.

Under this Study, ArcGIS has been procured. In ArcGIS, Shape file is one of the spatial data formats, which can be worked with and edit. Shape file is simple with, non topological format that store both the geometric location and attribute information of geographic features. To store the information a shape file has three or more files with specific file extensions that need to be stored in the same workspace. Some of these files are as follows, first three are required ones:

- i) *.shp*—This is the main file that stores the feature geometry.
- ii) *.shx*—This is index file that stores the index of the feature geometry.
- iii) *.dbf*—This is dBASE table that stores the attribute information of features.
- iv) *.sbn* and *.sbx*—These files store the spatial index of the features.
- v) *.prj*—This stores the coordinate system information. Used by ArcGIS.
- vi) *.xml*—Metadata for ArcGIS—This stores information about the shape file.

1.4.4 GIS Database

1.4.4.1 Standardization of Data Format for GIS Database

Before creating GIS database, some of the points such as types data file formats, projection systems, topology rules, nomenclature, unit of analysis, etc. need to be decided. Following the decided criteria makes the GIS database a good one, which can solve many issues for possible GIS analysis. With the procurement of ArcGIS, the file formats which can be worked with this Software are being planned for this project.

1.4.4.2 Data Sources for GIS Database

Basically, there are two types of data sources:

- **Primary:** The data which is created first hand using source data such as Satellite imagery, Aerial photograph, or Survey.
- **Secondary:** If the source of created data is the available existing data, which was created by other agency. Sometimes, such existing data might have been created long time ago.

This Study will generate bulk of data from primary source. Moreover, to develop GIS models, some GIS data from Secondary source will also be developed /used.

1.4.4.3 Nomenclature and Coding

All the GIS data layers generated under this Project will have code assigned, refer to Specification of Topographic data acquisition (1:5,000 and 1:25,000) for this Project.

1.4.4.4 Databook and Metadata

Databook and metadata are the integral part of GIS Database. Without it, it is very difficult; sometimes even impossible; to use the data for meaningful GIS analysis. Example of Databook is illustrated below. The metadata is defined as information on the data or data of the GIS data. Metadata will be presented in different lecture.

In many cases, data book table may be coded, for example instead of defining column as “Road” it might be as “RD”. In such case it should be defined what is the meaning of “RD” as note. Also, the location of the file (directory and sub-directory) and explanation of the name of file (brief description of file about what this data is) should also be included in data book. If detailed metadata is embedded with data, then data book might not be necessary.

Table 1-1: Sample of Databook

S.No	Data Name	Data Folder	Type
1	school_pnt	\\burundi_gis\point_shp	Point
2	river_lin	\\burundi_gis\line_shp	Line
3	road_lin	\\burundi_gis\line_shp	Line
4	hospital_pnt	\\burundi_gis\point_shp	Point
5	lake_pol	\\burundi_gis\poly_shp	Polygon
6	----		----

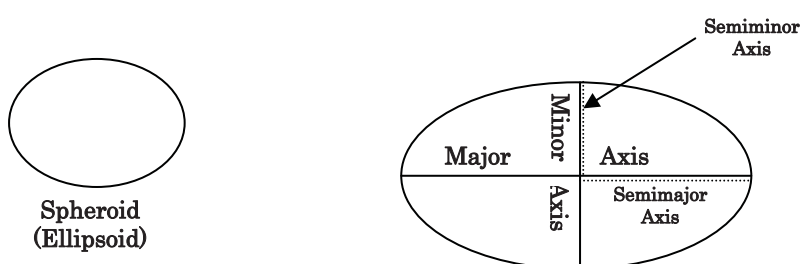
1.4.5 Map Projection System of Data

1.4.5.1 Introduction of Map Projection

All objects have a specific geographic location in a map, which enables them to be located on or near the earth's surface. To describe this, a framework for defining real-world locations is required. Latitude-longitude is one such framework, which is used globally and is often called as Geographic coordinate system. This measures of the angles (in degrees) from the center of the earth to a point on the earth's surface. Latitude angles are measured in a north-south direction with the equator as at the angle of 0. Similarly, Longitude measures angles in an east-west direction with Greenwich line at the angle of 0.

Another is a planar or Cartesian coordinate system derived from the global framework. This is also referred as Projected coordinate system. Unlike Geographic coordinate system, this coordinate system is defined on a flat, two-dimensional surface. Since the Earth surface is three-dimensional, it needs to be transformed to create a flat map sheet. This mathematical transformation is commonly referred to as a **Map Projection**. However, such transformation creates distortions in some aspect of distance, area, shape, or direction. These limitations are tackled by using map projections that fit with the intended geographic location. Thus, the map projection (along with Spheroid and Datum), become important parameters in defining the coordinate system for GIS data and map.

- **Spheroid:** It is based on Ellipsoid, which is defined by either the semi-major axis, 'a' and the semi-minor axis, 'b', or by 'a' and the flattening.



The flattening is the difference in length between the two axes expressed as a fraction or a decimal. The flattening, f , is:

$$f = (a - b) / a$$

The flattening is a small value, so usually the quantity $1/f$ is used instead.

- **Datum:** It defines the position of the spheroid relative to the center of the earth.

1.4.5.2 Map Projection for this Project (*The Study on Establishing Digital Topographic Database for Bujumbura City, Republic of Burundi*)

1. The projection system

Horizontal Datum:

Projection: Burundi Local

Spheroid: WGS84

Datum: WGS84

Central Meridian: 30.0000

Latitude of Origin: 0.00000

False Easting: 500,000m

False Northing: 10,000,000m

Scale Factor at Central Meridian: 0.9999

Vertical Datum: Burundi local existing Bench mark

1.4.6 Introduction on Data Integration and Analysis

In general, spatial analysis remains one of purposes of creating GIS data. And, for this integration of one feature with others or features of between map sheets are generally required. So, for the better integration of GIS data, there are number of points that we need to consider while preparing GIS data for integration.

Some of these are:

- All data should have same map projection.
- As far as possible, all the features should have been created at same scale otherwise their scale difference better be kept narrow.
- Though it may be very difficult to create the all the required dataset first hand, before including the existing data, it should be judged whether it will be matched with the other dataset or not.

Session 2: Introduction of ArcGIS

This session has been prepared with the two fold of objectives, which are included in following two topics:

- 2.1 General Introduction of ESRI products
- 2.2 Overview the Capabilities of ArcGIS software

2.1 General introduction of ESRI products

ArcGIS provides a scalable framework for implementing GIS for a single user or many users on desktops, in servers, over the Web, and in the field. ArcGIS is an integrated family of GIS software products for building a complete GIS. It consists of four primary frameworks for deploying GIS:

- **ArcGIS Desktop**—An integrated suite of professional GIS applications. Most users recognize this as three products: ArcView, ArcEditor, and ArcInfo.
- **Server GIS**—ArcIMS, ArcGIS Server, and ArcGIS Image Server.
- **Mobile GIS**—ArcPad and ArcGIS Mobile for field computing.
- **ESRI Developer Network (EDN)**—Embeddable software components for developers to extend GIS desktops, build custom GIS applications, add custom GIS services and web applications, and for creating mobile solutions.



Fig. 2-1 ArcGIS Software (Source: www.esri.com)

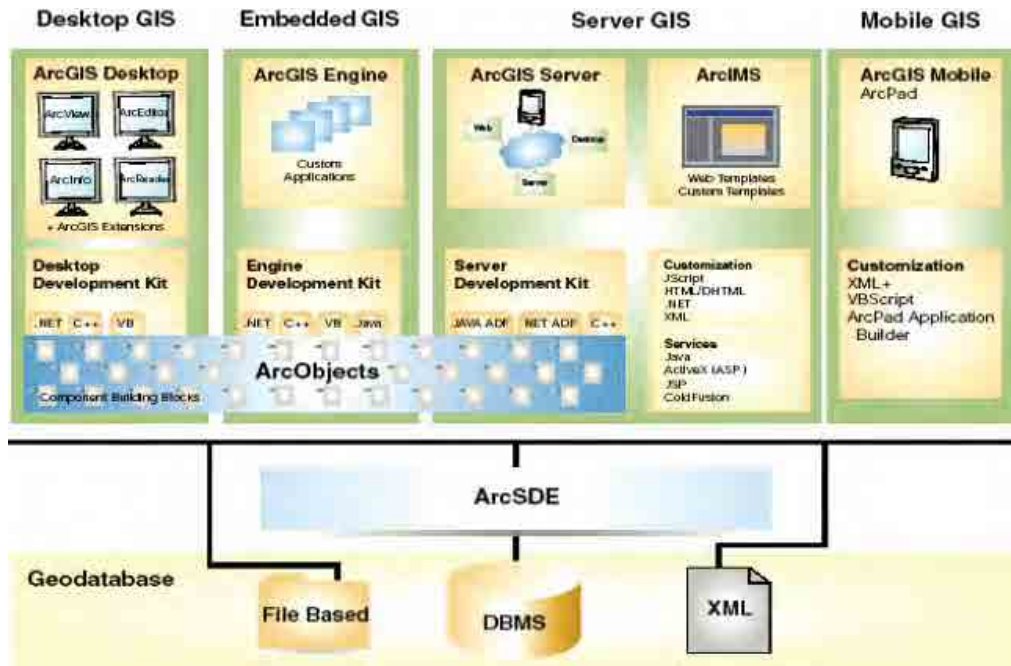


Fig. 2-2 ArcGIS – comprehensive GIS Software (Source: www.esri.com)

➤ **ArcGIS Desktop:**

ArcView: Comprehensive mapping, data use and mapping, data use and analysis tools; simple analysis tools; simple editing and editing and Geoprocessing

ArcEditor: ArcView + advanced editing

ArcInfo: ArcEditor+ advanced geoprocessing + Workstation ArcInfo

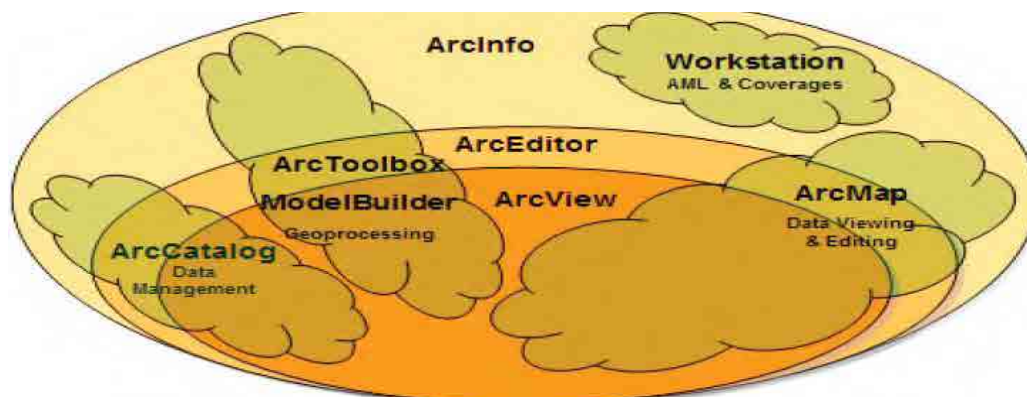


Fig.2-3 ArcGIS desktop components (Source: www.esri.com)

➤ **ESRI Extensions for ArcGIS**

Most commonly used Extensions are listed below

ArcGIS 3D Analyst Three-dimensional visualization and analysis. Includes ArcGlobe and ArcScene applications. Also includes terrain data management and geo-processing tools.

ArcGIS Spatial Analyst Includes a broad range of powerful raster modeling and analysis features that allow you to create, query, map, and analyze cell-based raster data. ArcGIS Spatial Analyst also allows integrated raster–vector analysis. Adds more than 200 tools to the ArcGIS geoprocessing framework.

Allows you to perform advanced routing and network analysis. Supports:

ArcGIS Network Analyst

- Drive-time analysis
- Point-to-point routing
- Route directions
- Service area definition
- Shortest path
- Optimum route
- Closest facility
- Origin–Destination

➤ **Mobile System:**

ArcPad:

- View/Edit existing GIS data, including imagery.
- Query your data, identify and locate features.
- Measure distance, area, and bearings.
- Navigate and “digitize” with your GPS.
- Extract, convert, and project your existing data using ArcGIS Desktop or ArcView

➤ **Database Support:**

ArcSDE:

- High performance
- Extremely large data volumes
- Integrated long transactions and versions
- Supports all GIS Data (vector, raster, survey, terrain, metadata, etc.)

- Supports leading RDBMS consistently
- Scales to many users and databases

➤ **Licensing:**

Single use license—one per user, best one per user, best for disconnected use, such as on laptops for disconnected use and handheld units.

Concurrent use license—a number of licenses on a server for anyone to use through the network. Also called floating licenses.

Other—such as server, server-client bundle, development-deployment bundle, etc.

2.2 Overview the Capabilities of ArcGIS Software

- Mapping & Visualization
 - Data Frames
 - Table of Content
 - Legends
- Data Management
 - Define a shape file's coordinate system
 - Generate a coverage's topology
 - Add an attribute to a table
 - Create a relationship class that defines the relationships between the features in coverage and attributes in INFO tables
 - viewing and editing metadata
 - Browsing 3D Data and Globe view
 - Browse and find geographic information
 - Record, view, and manage metadata
 - Define, export, and import geo-database data models and datasets
 - Search for and discover GIS data on local networks and the Web
 - Create and manage the schemas of geo-databases
 - Administer ArcSDE geodatabases
 - Administer an ArcGIS server
- Editing and data compilation
 - Data collection involves entering new data into your GIS
 - Data integration involves transforming data and maintaining its integrity.
 - Editing the features
 - Editing the attribute table

- Spatial adjustments
- Geo-processing
 - Analysis like buffer, clip
 - Conversion like shape to raster, shape to geo database
 - Geo-coding
 - Data Management tools
 - Spatial analyst
 - 3D analyst
 - Projection

- 3D Analyst

The ArcGIS 3D Analyst extension provides tools for three-dimensional (3D) visualization, analysis, and surface generation. With 3D Analyst, users can:

- View a surface from multiple viewpoints.
- Query a surface.
- Create realistic perspective imaging.
- Examine the visual impact of building new structures.
- Analyze atmospheric, surface, and subsurface pollution dispersion.
- Visualize the income distribution in their community.

Session 3: Menu and Functions in ArcCatalog

ArcCatalog helps by providing an integrated and unified view of all the data files, databases, and ArcGIS documents available to ArcGIS users. Geographic datasets often consist of a set of files, rather than a single file. When listed in Windows Explorer, the datasets appear as a list of system folders and files, whereas ArcCatalog displays and manages the datasets as single entities. This program allows connecting the data source locations, browsing through workspaces, examining or exploring the data, managing data, tables and metadata, and searching for data and maps.

In this session, following points have been mainly covered:

- 3.1 Over viewing the menus in ArcCatalog
- 3.2 Previewing the GIS data
- 3.3 Checking Properties of GIS Data
- 3.4 Checking and Creating/Editing Metadata

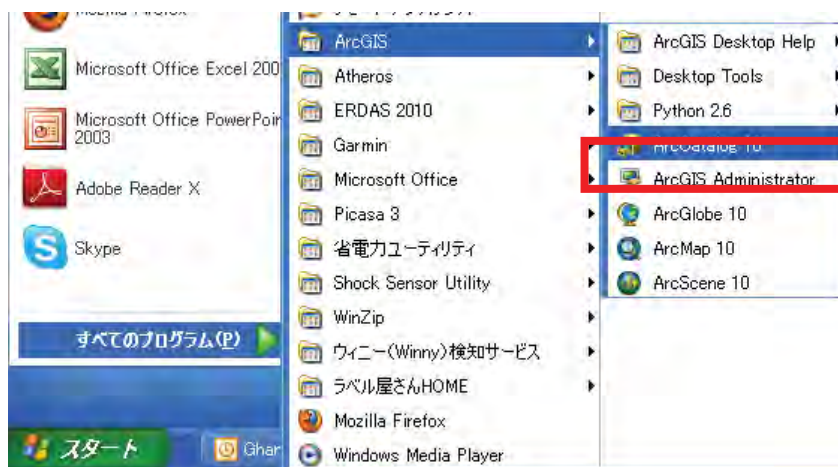
Followings data are placed under folder */training_data*:

- Ortho-rectified Aerial Photo (one map sheet) as *tif* file
- Road network data as line *shape* file.
- Map sheet index as polygon *shape* file

- Practice followings:

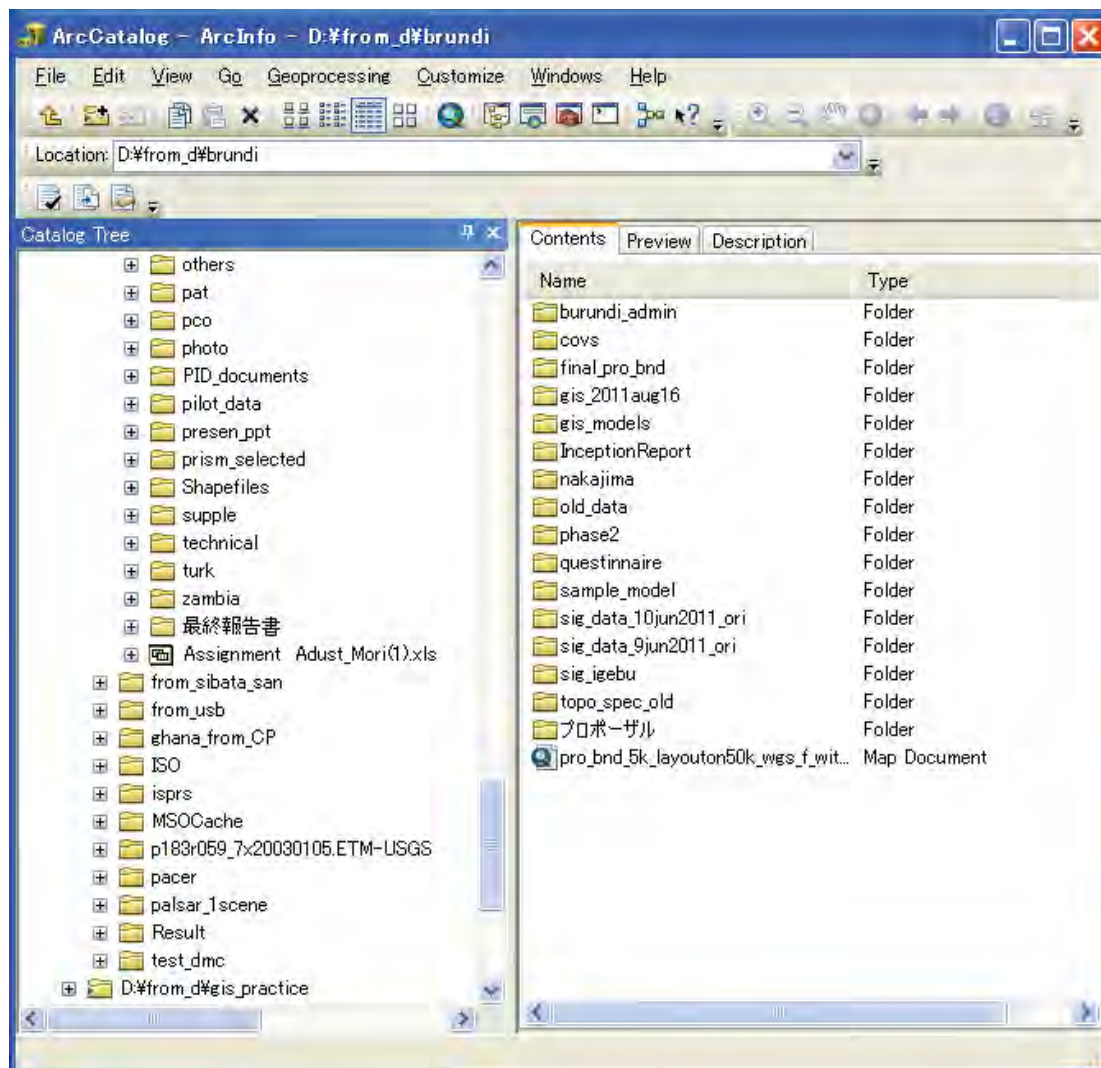
3.1 Over viewing the menus in ArcCatalog

- i) Open “ArcCatalog” component of ArcGIS as shown below:



Note: You can also open it by first opening the “ArcMap” and then clicking “ArcCatalog” Icon located at the Tool Bar.

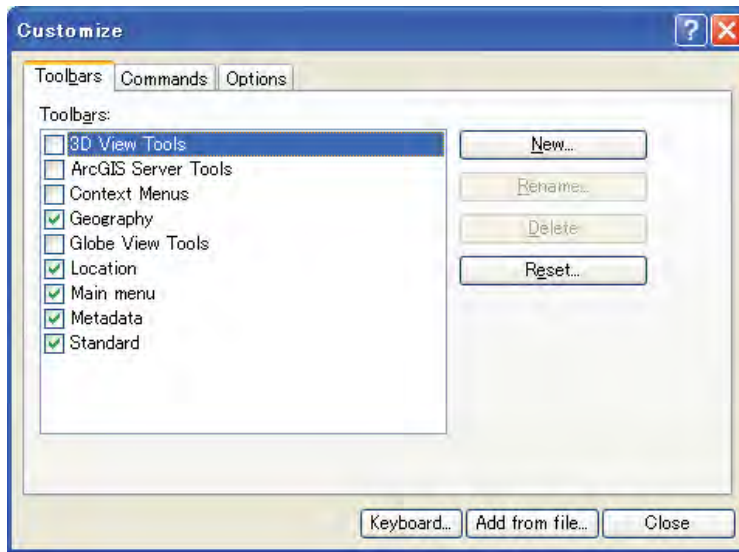
- ii) “ArcCatalog” program will open, for instance as below:



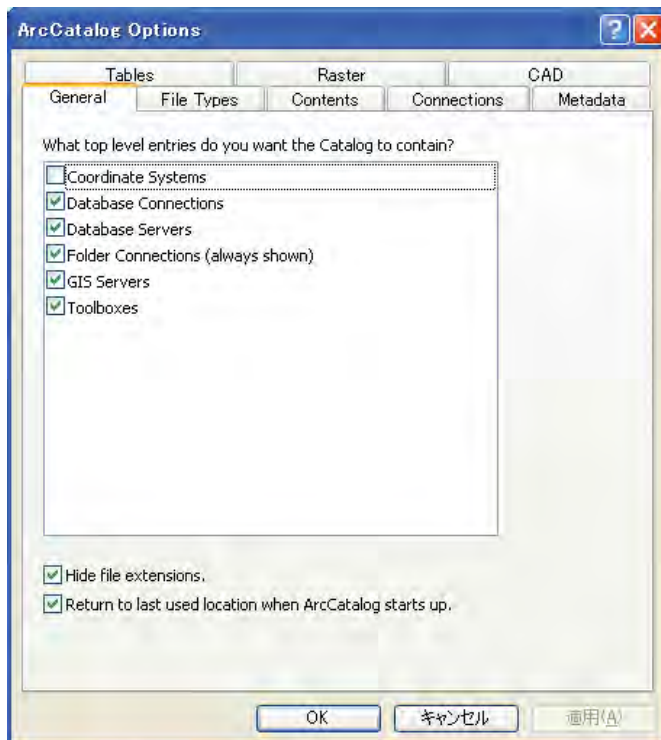
iii) As visible from above window, “ArcCatalog” has Toolbar with some active Icons and this is Standard Toolbar.

iv) “ArcCatalog” has main Menu like “File”, “Edit”, “View”, “Go”, “Geoprocessing”, “Customize”, “Windows”, and “Help” and each one has Pull down menu with various functions. Try to be familiar with the these functions including followings:

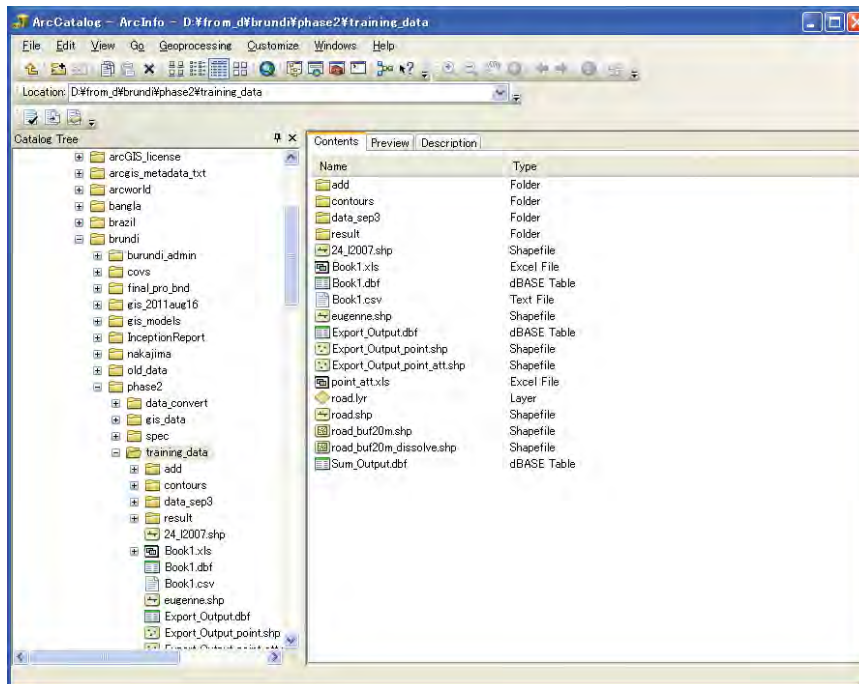
- **New** - (under “File” Menu), Creating New Folder, Shapefile, etc.
- **Connecting folder**- (under “File” Menu), Connecting new folder to ArcCatalog
- **Customize Mode** – (Under “Customize” Menu), Displaying and removing Toolbars, Commands, This window will be like below:



- **ArcCatalog Options-** To display window as below and see various setting options for display, etc. (Under “Customize” Menu)

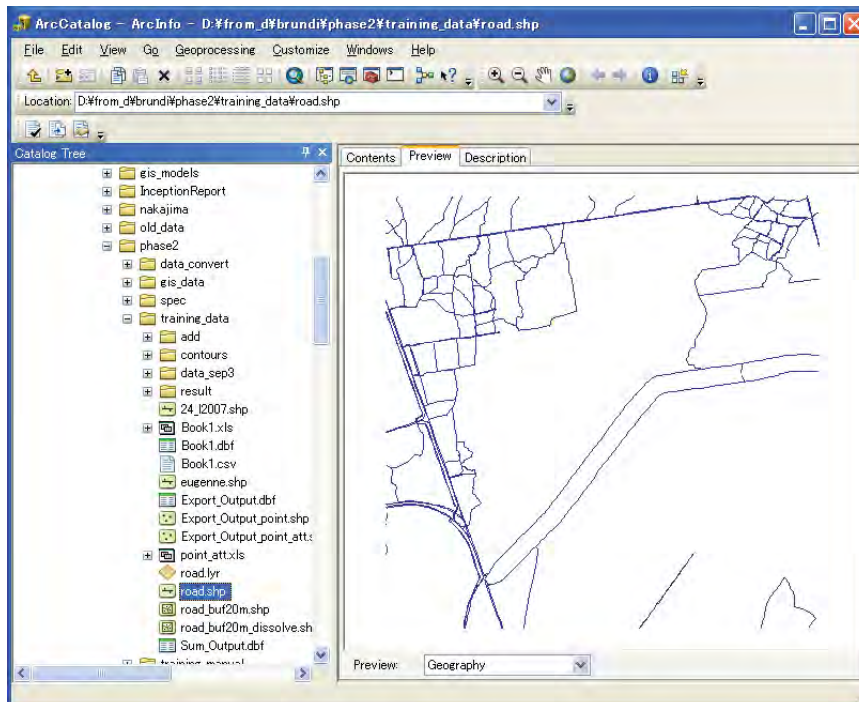


- v) Then, try to search the folder containing the exercise data by going to that directory from the left side of window that displays the folder structure. Double Click on the folder containing the GIS data, it will display the name of files in the Map displaying window as shown below:

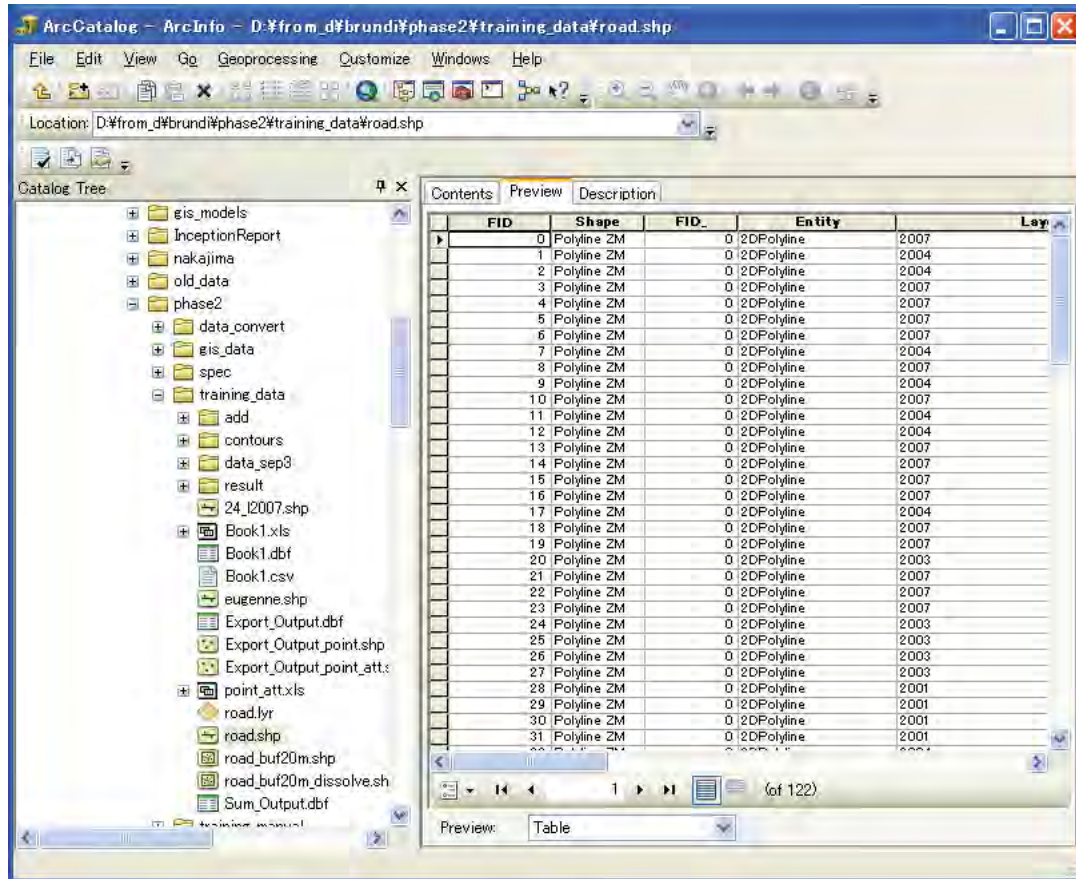


3.2 Previewing the GIS data

- vi) In the above window, click on one data, for instance, *road.shp* and then click Preview, it will display the Geography as below:

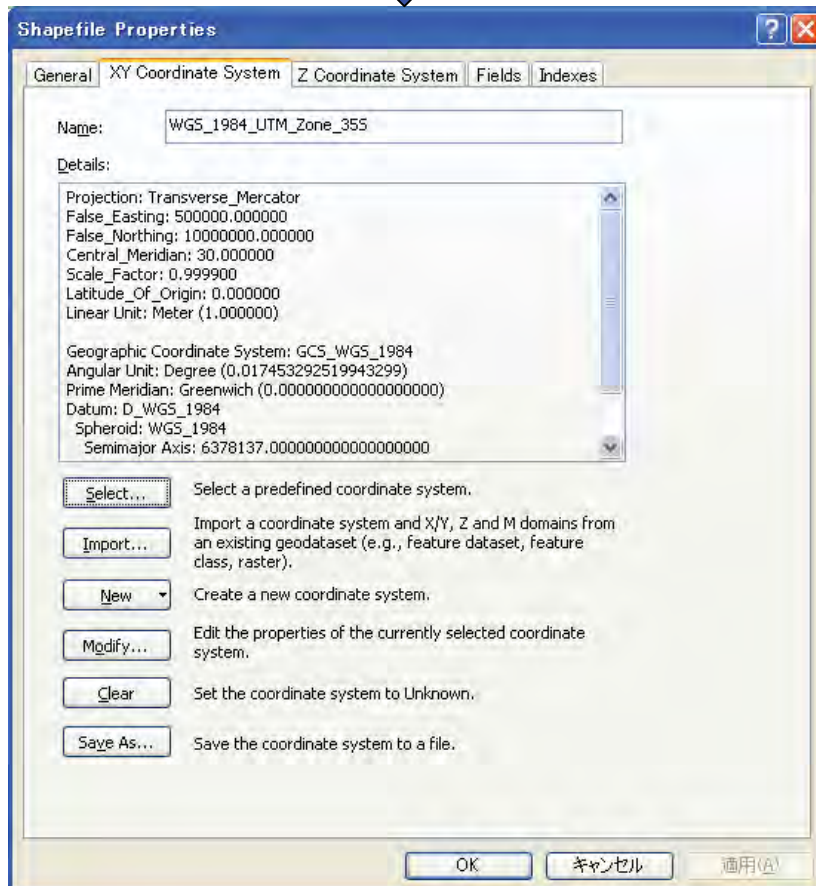
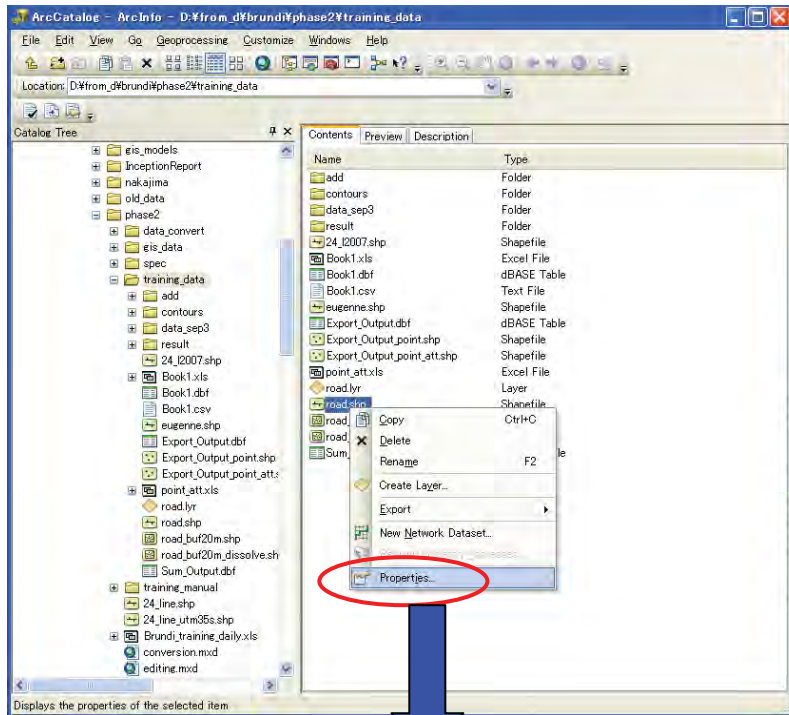


- vii) Click the Pull down option located right side of “Geography”, and select “Table”, it will display the Table of this GIS file as below:



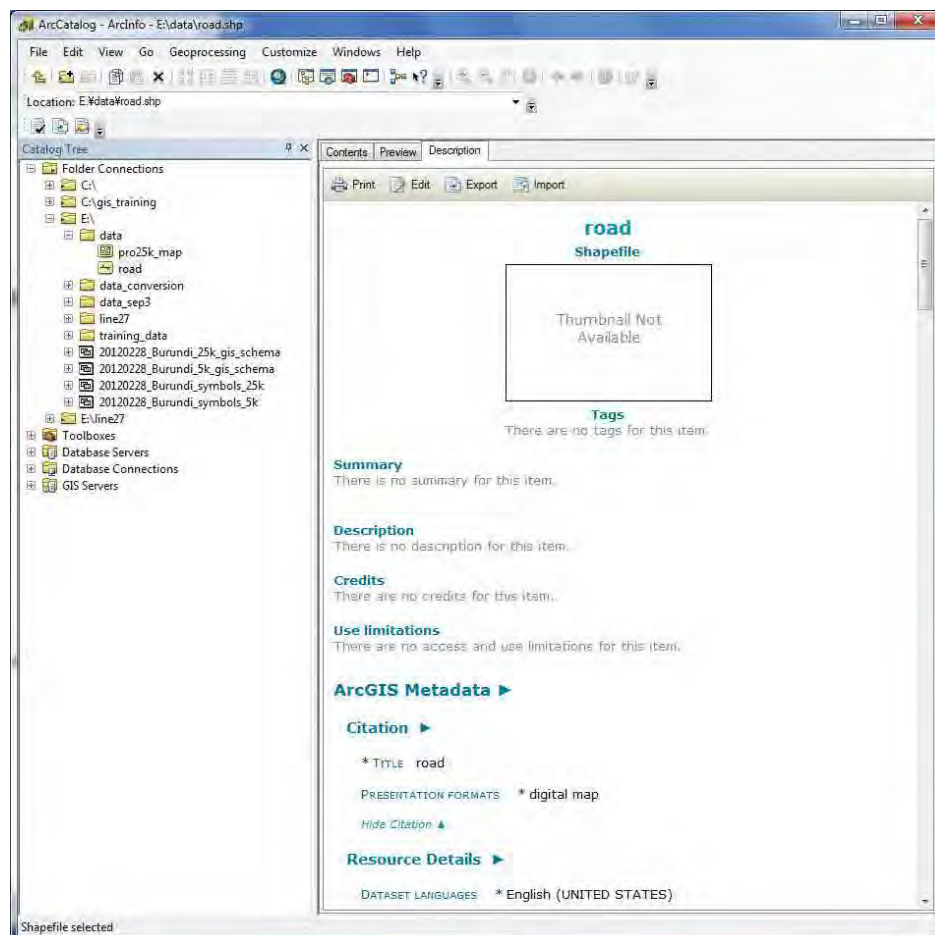
3.3 Checking Properties of GIS Data

- viii) Now, Right click on the *road.shp*, and then click on the “Properties”. It will display “**Shapefile Properties**” window containing the Menu; ‘General’, ‘XY Coordinate System’, ‘Z Coordinate System’, ‘Fields’, ‘Indexes’ will appear. Click on Menu ‘XY Coordinate System’ to display its XY coordinate system as below:



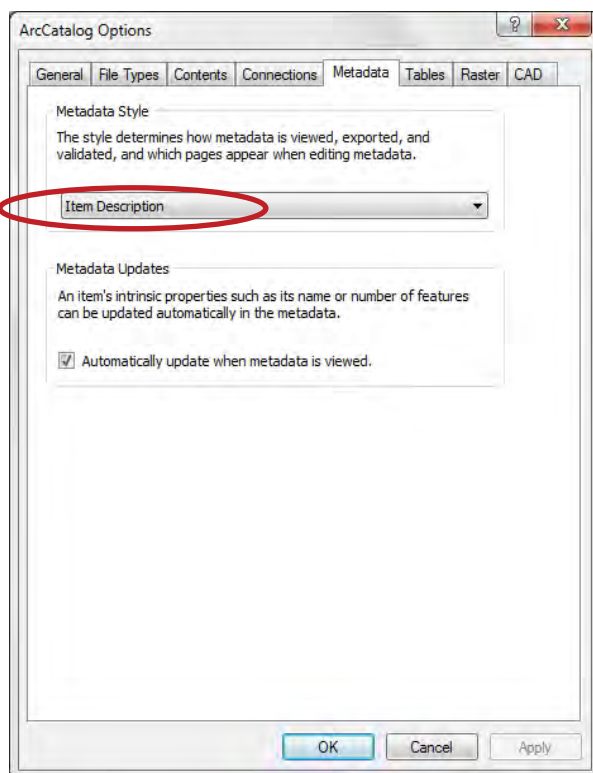
3.4 Checking and Creating/Editing Metadata

- ix) To check for Metadata, click “Description” to see the associated Metadata, which may be empty if yet to create, for instance as below:

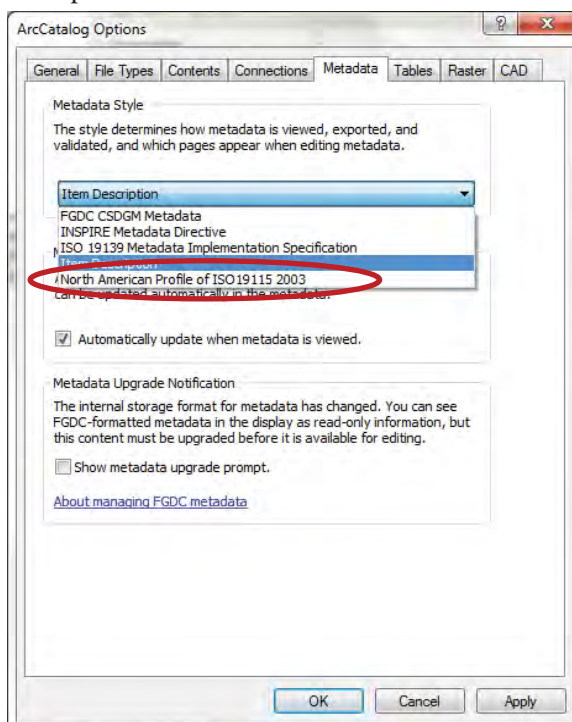


➤ Practice: Create Metadata for road.shp

- 1) From the ArcCatalog, click **Customize** on the toolbar and then click **ArcCatalog Options**. It will display the empty metadata as above.
- 2) “ArcCatalog Options” dialogue appears. Click on **Metadata** Tab, it will display the **Metadata Style**.

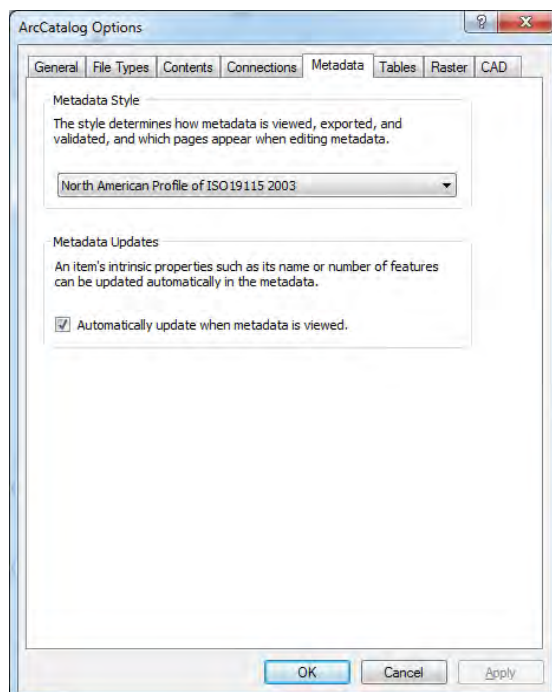


Now, click on Pull down menu, then you will see following Four types of Metadata Styles. These differ in their description.

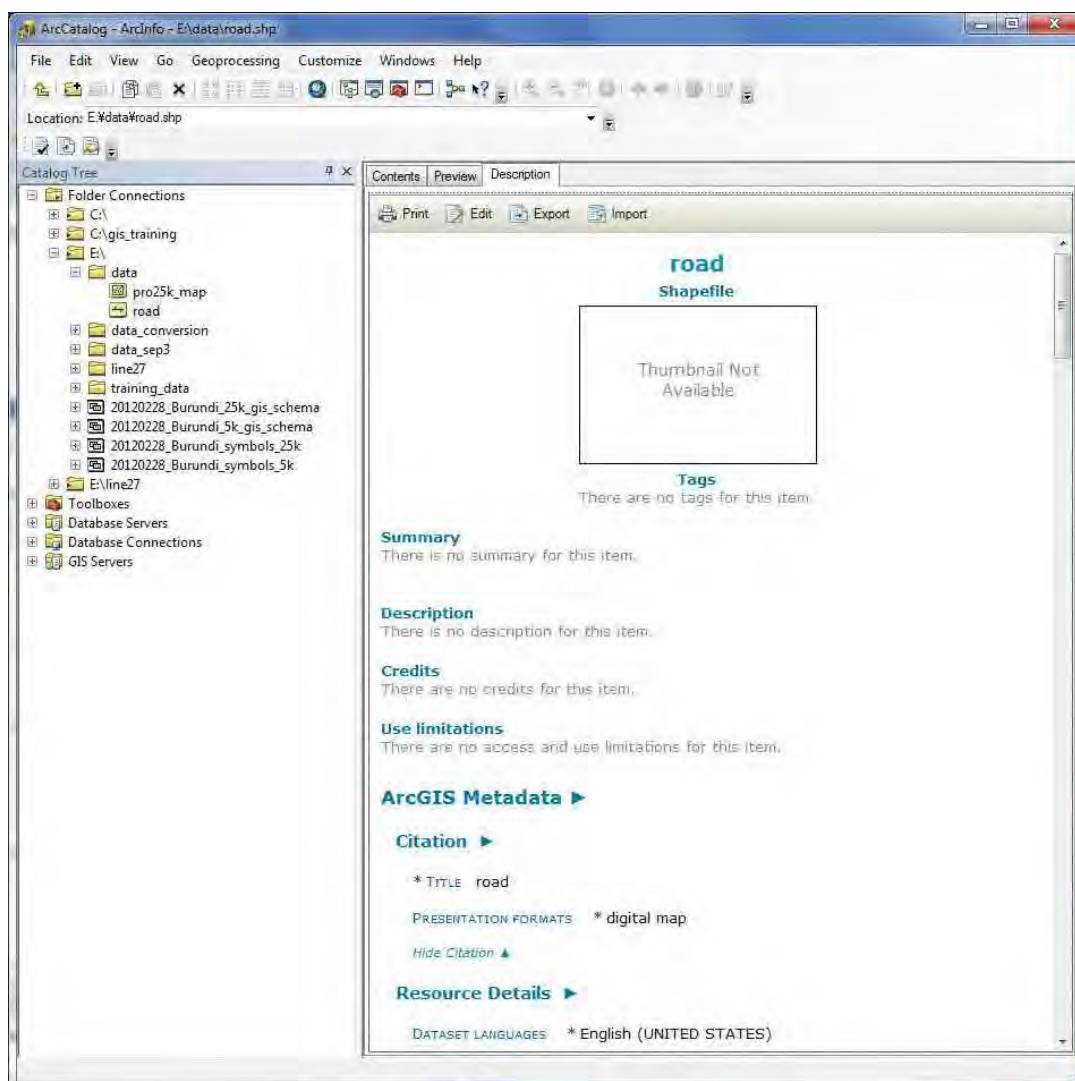


- A metadata style identifies the metadata standard or profile to be followed. It controls how you view the metadata and also the pages that appear for editing metadata in the Description tab.
 1. **FGDC CSDGM Metadata:** This lets you view and edit metadata following the Content Standard for Digital Geospatial Metadata (CSDGM) guidelines; export metadata in the XML format associated with this standard, and validate it using the CSDGM XML DTD.
 2. **INSPIRE Metadata Directive:** This style lets you view and edit a complete ISO 19139 metadata document that adheres to the INSPIRE Implementing Rules, export metadata in the ISO 19139 format, and validate it using the ISO 19139 XML Schemas.
 3. **ISO 19139 Metadata Implementation Specification:** This style lets you view and edit a complete metadata document that complies with ISO standard 19139, *Geographic information — Metadata — XML schema implementation*, export metadata in this format, and validate it using the standard's XML Schemas.
 4. **Item Description:** This is the default style. It lets you view and edit a brief description of an item that can be searched in ArcGIS and published to ArcGIS Online.
 5. **North American Profile of ISO 19115 2003:** This style lets you view and edit a complete metadata document that complies with *North American Profile of ISO 19115:2003 – Geographic information – Metadata*, export metadata in this format, and validate it using the ISO 19139 XML Schemas.

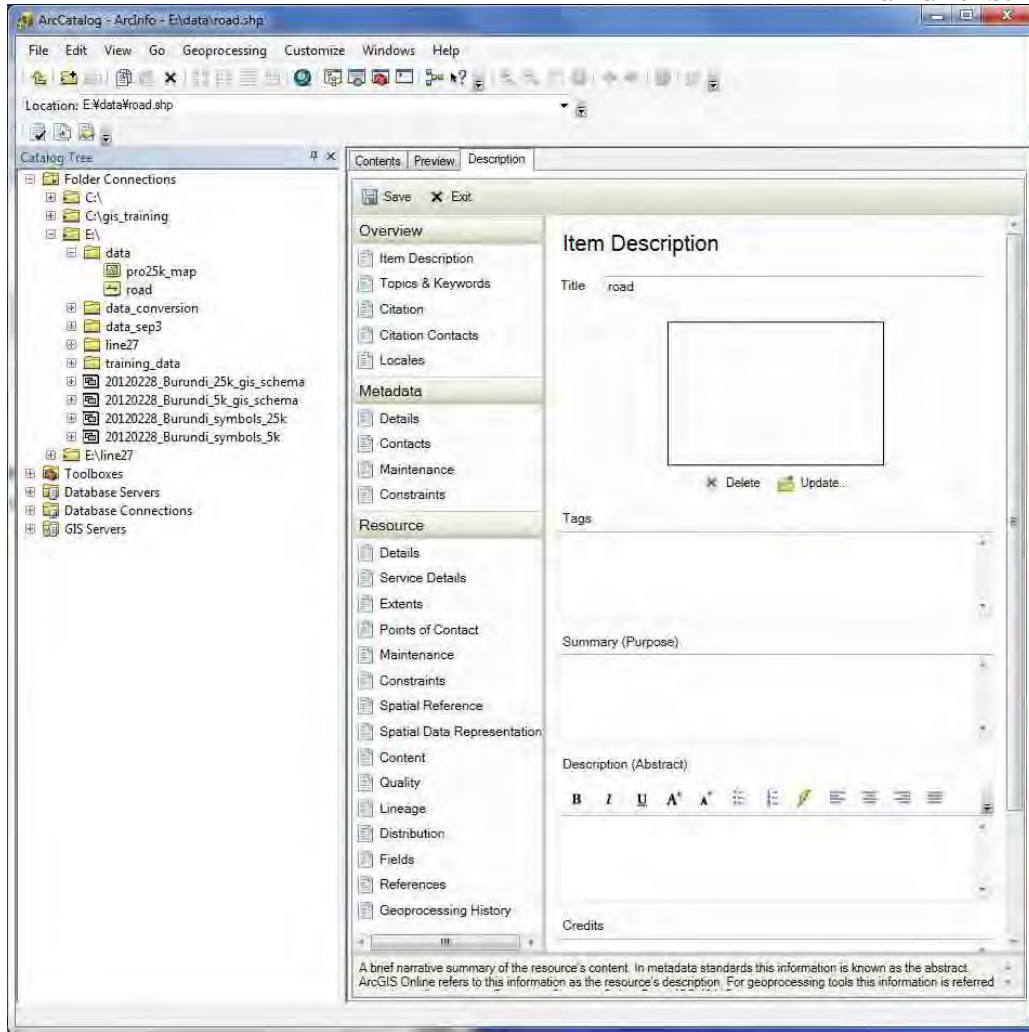
- 3) In “ArcCatalog Option” dialogue, select **North American Profile of ISO191152003** and click **apply** and **OK**.



- 4) Under “Description”, menus such as ‘Print’, ‘Edit’, ‘Validate’, ‘Export’, and ‘Import will appear.



- 5) Click the ‘Edit’ Tab in the above window, it will display the window like below. Description Items such as, **Update**, **Title**, **Tags**, **Summary**, **Description**, and **Credits** will appear in the window.



- 6) Complete those parameters and click **Save**. Thus, finally, it will have the Metadata containing all the input descriptions. For instance, as below:

Metadata Sample (Page 1 of 5)

Buja_Road

Shapefile

Thumbnail Not Available

Tags
There are no tags for this item.

Summary
There is no summary for this item.

Description
There is no description for this item.

Credits
There are no credits for this item.

Use limitations
There are no access and use limitations for this item.

ArcGIS Metadata ▶

Citation ▶

- * TITLE Buja_Road
- PRESENTATION FORMATS * digital map

Hide Citation ▲

Resource Details ▶

- DATASET LANGUAGES * English (UNITED STATES)

Metadata Sample (Page 2of5)

SPATIAL REPRESENTATION TYPE * vector

* PROCESSING ENVIRONMENT Microsoft Windows 7 Version 6.1 (Build 7601) Service Pack 1; ESRI
ArcGIS 10.0.3.3600

ARCGIS ITEM PROPERTIES

* NAME Buja_Road
* SIZE 0.002
* LOCATION file:///\\JICA03-PC\C\$\gis_training\eugene\Buja_Road.shp
* ACCESS PROTOCOL Local Area Network
* CONTENT TYPE Downloadable Data

[Hide Resource Details ▲](#)

Extents ►

EXTENT

GEOGRAPHIC EXTENT

BOUNDING RECTANGLE

EXTENT TYPE Extent used for searching
* WEST LONGITUDE 29.324990
* EAST LONGITUDE 29.350015
* NORTH LATITUDE -3.306068
* SOUTH LATITUDE -3.324993
* EXTENT CONTAINS THE RESOURCE Yes

EXTENT IN THE ITEM'S COORDINATE SYSTEM

* WEST LONGITUDE 424989.614605
* EAST LONGITUDE 427769.262109
* SOUTH LATITUDE 9632350.195700
* NORTH LATITUDE 9634440.937382
* EXTENT CONTAINS THE RESOURCE Yes

[Hide Extents ▲](#)

Spatial Reference ►

ARCGIS COORDINATE SYSTEM

* TYPE Projected
* GEOGRAPHIC COORDINATE REFERENCE GCS_WGS_1984
* PROJECTION WGS_1984_UTM_Zone_35S
* COORDINATE REFERENCE DETAILS
PROJECTED COORDINATE SYSTEM
X ORIGIN -5122600
Y ORIGIN -1100
XY SCALE 450310428.58990461

Metadata Sample (Page 3of5)

```
Z ORIGIN -100000
Z SCALE 10000
M ORIGIN -100000
M SCALE 10000
XY TOLERANCE 0.001
Z TOLERANCE 0.001
M TOLERANCE 0.001
HIGH PRECISION true
WELL-KNOWN TEXT PROJCS["WGS_1984_UTM_Zone_35S",GEOGCS
["GCS_WGS_1984",DATUM["D_WGS_1984",SPHEROID
["WGS_1984",6378137.0,298.257223563]],PRIMEM["Greenwich",0.0],UNIT
["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER
["False_Easting",500000.0],PARAMETER["False_Northing",1000000.0],PARAMETER
["Central_Meridian",30.0],PARAMETER["Scale_Factor",0.9999],PARAMETER
["Latitude_Of_Origin",0.0],UNIT["Meter",1.0]]
```

REFERENCE SYSTEM IDENTIFIER

* VALUE 0

[Hide Spatial Reference ▲](#)

Spatial Data Properties ►

VECTOR ►

* LEVEL OF TOPOLOGY FOR THIS DATASET geometry only

GEOMETRIC OBJECTS

FEATURE CLASS NAME Buja_Road

* OBJECT TYPE composite

* OBJECT COUNT 4

[Hide Vector ▲](#)

ARCGIS FEATURE CLASS PROPERTIES ►

* FEATURE TYPE Simple

* GEOMETRY TYPE Polyline

* HAS TOPOLOGY FALSE

* FEATURE COUNT 4

* SPATIAL INDEX TRUE

* LINEAR REFERENCING FALSE

[Hide ArcGIS Feature Class Properties ▲](#)

Metadata Sample (Page 4of5)

[Hide Spatial Data Properties ▲](#)

Distribution ▶

DISTRIBUTION FORMAT

* FORMAT NAME Shapefile

TRANSFER OPTIONS

* TRANSFER SIZE 0.002

[Hide Distribution ▲](#)

Fields and Subtypes ▶

DETAILS FOR OBJECT Buja_Road ▶

* TYPE Feature Class

* ROW COUNT 4

FIELD FID ▶

* ALIAS FID

* DATA TYPE OID

* WIDTH 4

* PRECISION 0

* SCALE 0

* FIELD DESCRIPTION

Internal feature number.

* DESCRIPTION SOURCE

ESRI

* DESCRIPTION OF VALUES Sequential unique whole numbers that are automatically generated.

[Hide Field FID ▲](#)

FIELD Shape ▶

* ALIAS Shape

* DATA TYPE Geometry

* WIDTH 0

* PRECISION 0

* SCALE 0

* FIELD DESCRIPTION

Metadata Sample (Page 5of5)

Feature geometry.

* DESCRIPTION SOURCE
ESRI

* DESCRIPTION OF VALUES Coordinates defining the features.

[Hide Field Shape ▲](#)

FIELD Id ►

* ALIAS Id
* DATA TYPE Integer
* WIDTH 6
* PRECISION 6
* SCALE 0

[Hide Field Id ▲](#)

[Hide Details for object Buja_Road ▲](#)

[Hide Fields and Subtypes ▲](#)

Metadata Details ►

* METADATA LANGUAGE English (UNITED STATES)
* METADATA CHARACTER SET utf8 - 8 bit UCS Transfer Format

SCOPE OF THE DATA DESCRIBED BY THE METADATA * dataset
SCOPE NAME * dataset

* LAST UPDATE 2012-09-10

ARCgis METADATA PROPERTIES

METADATA FORMAT ArcGIS 1.0
METADATA STYLE North American Profile of ISO19115 2003

CREATED IN ARCgis 2012-09-10T09:35:43
LAST MODIFIED IN ARCgis 2012-09-10T09:35:43

AUTOMATIC UPDATES

HAVE BEEN PERFORMED Yes
LAST UPDATE 2012-09-10T09:35:43

[Hide Metadata Details ▲](#)

Session 4: Menu and Functions in ArcMap

ArcMap is the central application used in ArcGIS. This allows displaying and exploring the datasets, assigning symbols, and creating map layouts for printing or publication. ArcMap is also used to create and edit datasets.

ArcMap presents geographic information as a collection of layers and other elements in a map. As shown below, the list of added layer is displayed in “**Data Frame Window**” and their graphic is displayed in “**Map Display Window**”

Following Points have been covered in the Practice

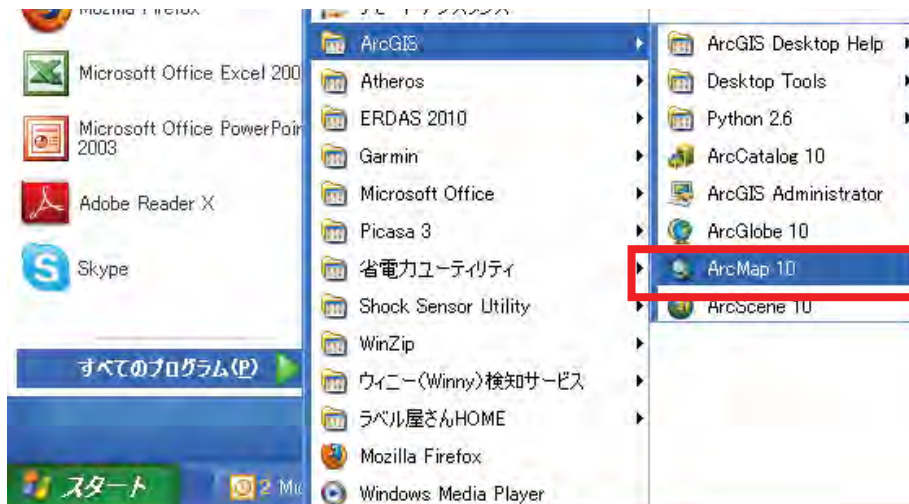
- 4.1 Displaying ArcToolBox, Tool Bars, Extensions
- 4.2 Adding the File
- 4.3 Layer Properties
- 4.4 Displaying Tabular Data
- 4.5 Displaying Data Frame Properties
- 4.6 Data View / Layout View
- 4.7 Add XY Data
- 4.8 Save as Layer File
- 4.9 Right click in the Map Display Window
- 4.10 Joining and Relating the Tables
- 4.11 Saving the Geographic Data
- 4.12 Saving the Project File

Followings data are placed under folder */training_data*:

- Ortho-rectified Aerial Photo (one map sheet) as *tif* file
- Road network data as line *shape* file (*road.shp*).
- Buffered road with 20m as polygon shape file (*road_buf20m.shp*)
- Excel file with XY coordinates (*book1.xls*)

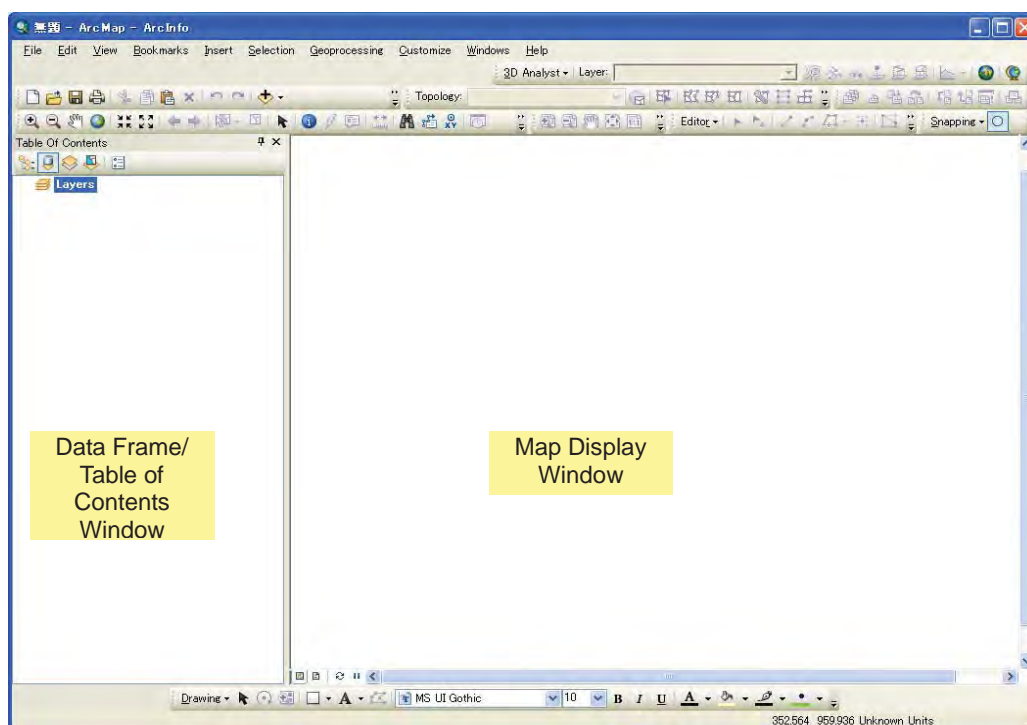
Follow following steps for the Practice:

- i) Open “ArcMap” component of ArcGIS as shown below:



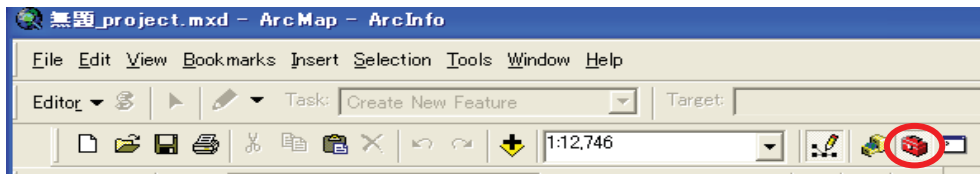
Note: You can also open it by first opening the “ArcCatalog” and then clicking “ArcMap” Icon located at the Tool Bar.

- ii) It will display the ArcMap-ArcInfo window as below. Left part is called ‘Data Frame (or Table of Contents) Window’ where the list of added data appears, and right side is called ‘Map Display Window’ where the added GIS data are displayed.

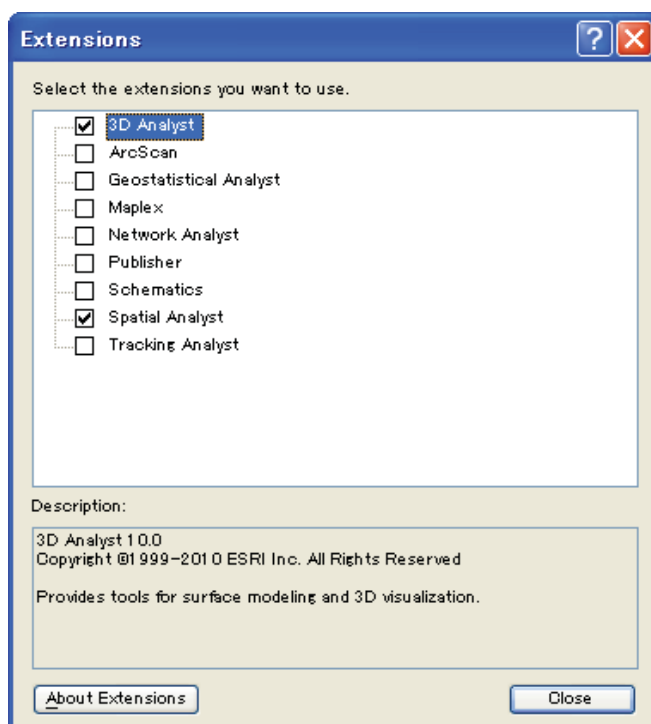


4.1 Displaying ArcToolBox, Tool Bars, Extensions

- **To display ArcToolBox:** Click the following marked Tab. It can be also opened by clicking this Tab from 'Geoprocessing' Menu.




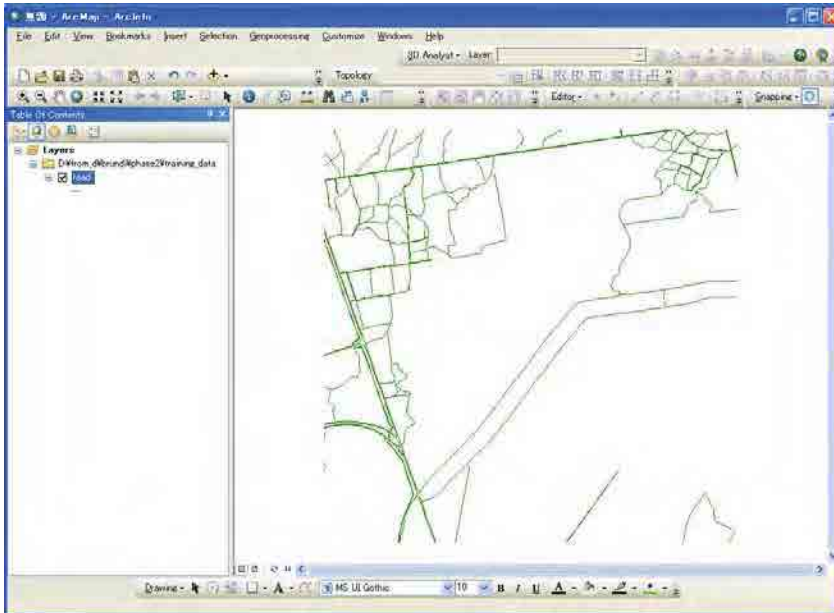
- **To display Tool Bars:** Right click the cursor after keeping it right to the Menu Bar (in the Grey area), and then check on the desired Tool Bar to display. It can be also checked on by clicking on the 'Customize' menu and then clicking the 'Toolbars' and selecting the desired Toolbar.
- The list of ArcGIS Extension can be displayed by clicking 'Customize' menu and then clicking 'Extensions...' Tab, Check the desired extension, for instance as below:



Note: if license is not available is will display failure message.

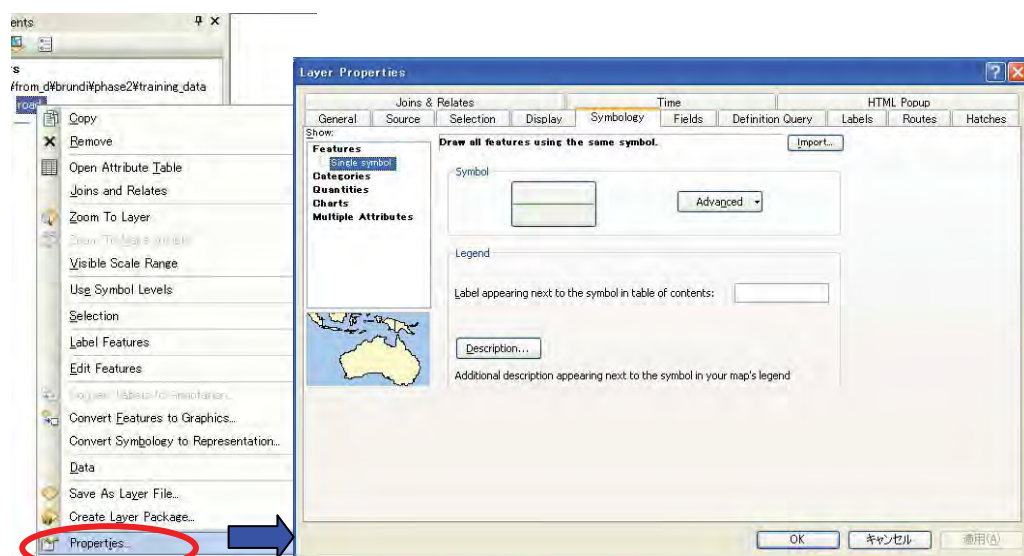
4.2 Adding File

- Click the Add Data  button (located in the Standard Tool Bar or in the 'File' Menu) to add the file.



4.3 Layer Properties

- Right click by putting the cursor onto the layer whose property is to display. And then click on the "Properties..." function, to display the "Layer Properties" window. This has various options for setting Symbol, Labels and others.



- **Practice:** Various functions under the Menu, including those under ‘Symbology’, ‘Labels’, ‘Selection’.

4.4 Displaying Tabular Data

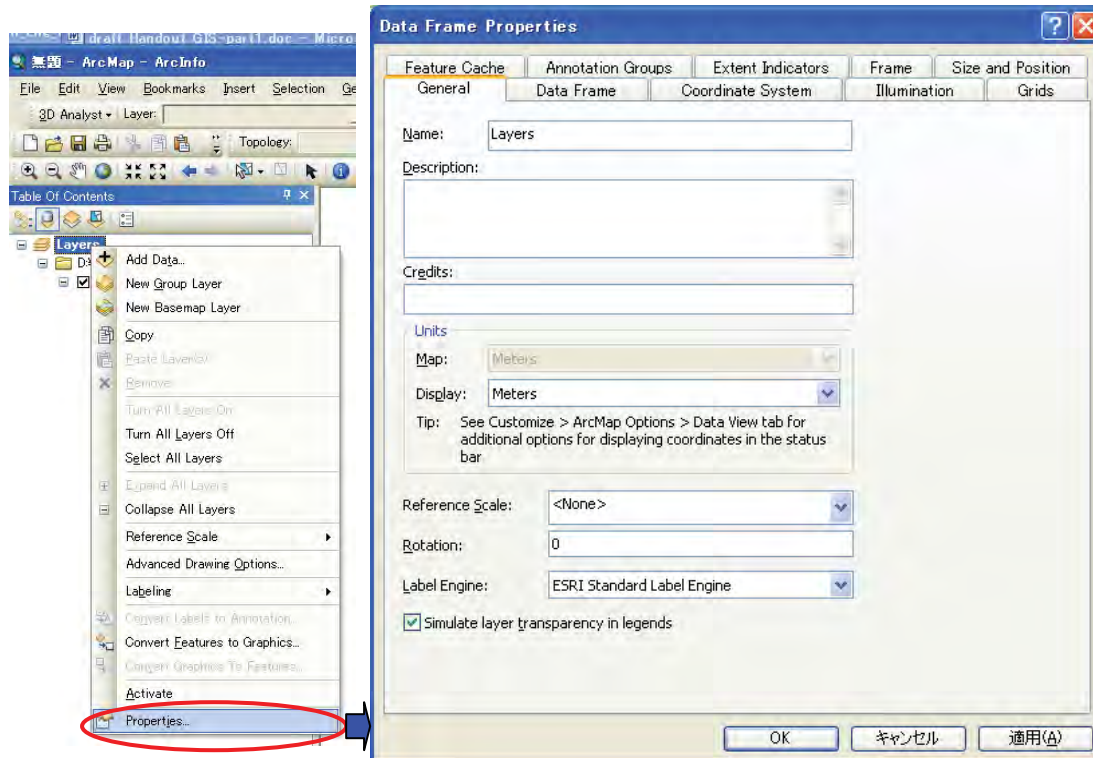
FID	Shape	FID_2	Entity	Layer	Color	Linetype	Elevation	LineWt	RefName	length	code	length_1
0	Polyline ZM	0	2DPolyline	2007	1	L2007	785.85096	15		75.52	1	0
1	Polyline ZM	0	2DPolyline	2004	22	Continuous	785.081326	20		219.63	1	0
2	Polyline ZM	0	2DPolyline	2004	22	Continuous	784.753163	20		172.11	1	0
3	Polyline ZM	0	2DPolyline	2007	1	L2007	784.651323	15		36.49	1	0
4	Polyline ZM	0	2DPolyline	2007	1	L2007	783.01653	15		4.67	1	0
5	Polyline ZM	0	2DPolyline	2007	1	L2007	782.334135	15		69.29	1	0
6	Polyline ZM	0	2DPolyline	2007	1	L2007	783.01653	15		56.03	1	0
7	Polyline ZM	0	2DPolyline	2004	22	Continuous	789.207845	20		181.31	1	0
8	Polyline ZM	0	2DPolyline	2007	1	L2007	788.284047	15		124.89	1	0
9	Polyline ZM	0	2DPolyline	2004	22	Continuous	788.589847	20		292.53	1	0
10	Polyline ZM	0	2DPolyline	2007	1	L2007	784.525561	15		2689.85	1	0
11	Polyline ZM	0	2DPolyline	2004	22	Continuous	785.721598	20		389.85	1	0
12	Polyline ZM	0	2DPolyline	2004	22	Continuous	786.046071	20		393.08	1	0
13	Polyline ZM	0	2DPolyline	2007	1	L2007	786.849124	15		273.53	1	0
14	Polyline ZM	0	2DPolyline	2007	1	L2007	789.701802	15		330.54	1	0
15	Polyline ZM	0	2DPolyline	2007	1	L2007	783.782869	15		215.37	1	0
16	Polyline ZM	0	2DPolyline	2007	1	L2007	789.485837	15		191.76	1	0
17	Polyline ZM	0	2DPolyline	2004	22	Continuous	786.000075	20		330.7	1	0
18	Polyline ZM	0	2DPolyline	2007	1	L2007	785.106128	15		199.45	1	0
19	Polyline ZM	0	2DPolyline	2007	1	L2007	791.663264	15		57.46	1	0
20	Polyline ZM	0	2DPolyline	2003	22	Continuous	789.671982	20		387.44	1	0
21	Polyline ZM	0	2DPolyline	2007	1	L2007	783.203178	15		534.06	1	0
22	Polyline ZM	0	2DPolyline	2007	1	L2007	783.95094	15		230.53	1	0
23	Polyline ZM	0	2DPolyline	2007	1	L2007	790.126643	15		3.38	1	0
24	Polyline ZM	0	2DPolyline	2003	22	Continuous	792.009722	20		563.39	1	0
25	Polyline ZM	0	2DPolyline	2003	22	Continuous	789.981913	20		147.23	1	0
26	Polyline ZM	0	2DPolyline	2003	22	Continuous	789.703759	20		2063.72	1	0
27	Polyline ZM	0	2DPolyline	2003	22	Continuous	790.221335	20		315.35	1	0
28	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.950918	30		232.25	1	0
29	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.948135	30		173.57	1	0
30	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.57235	30		200.34	1	0
31	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.336546	30		949.33	1	0
32	Polyline ZM	0	2DPolyline	2004	22	Continuous	791.133257	20		2733.31	1	0
33	Polyline ZM	0	2DPolyline	2001	7	Continuous	782.502046	30		75.21	1	0
34	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.658666	30		835.35	1	0
35	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.658666	30		209.73	1	0
36	Polyline ZM	0	2DPolyline	2001	7	Continuous	783.336546	30		213.09	1	0

Rig

ht click by putting the cursor onto the layer whose property is to display. And then click on the “Open Attribute Table” function, to display the “Layer Properties” window.

4.5 Displaying Data Frame Properties

- Right click on the “Layers” in the “Data Frame Window”, and then click “Properties”, it will display “Data frame Properties” with various display setting options. It can also be displayed by clicking “View” Menu and then “Data Frame Properties...” Tab.



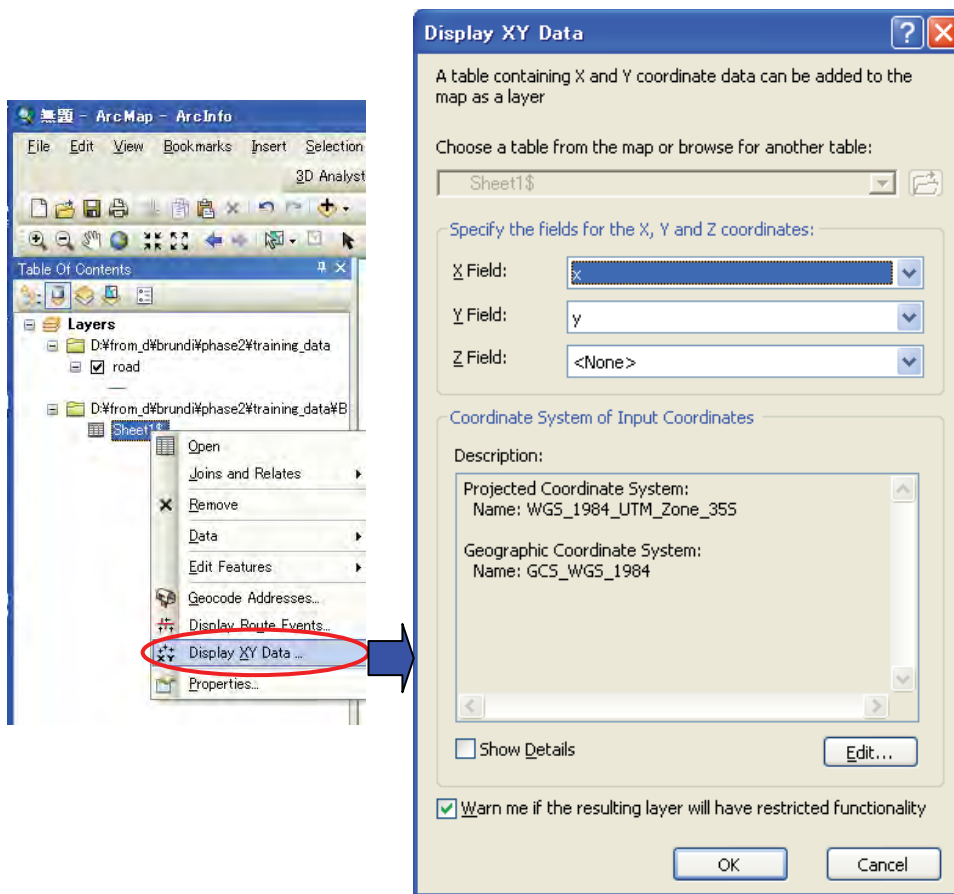
- **Practice:** In 'Data Frame Properties' window, set the parameters; such as under 'General', 'Data Frame', 'Coordinate System' and notice the effects.

4.6 Data View / Layout View

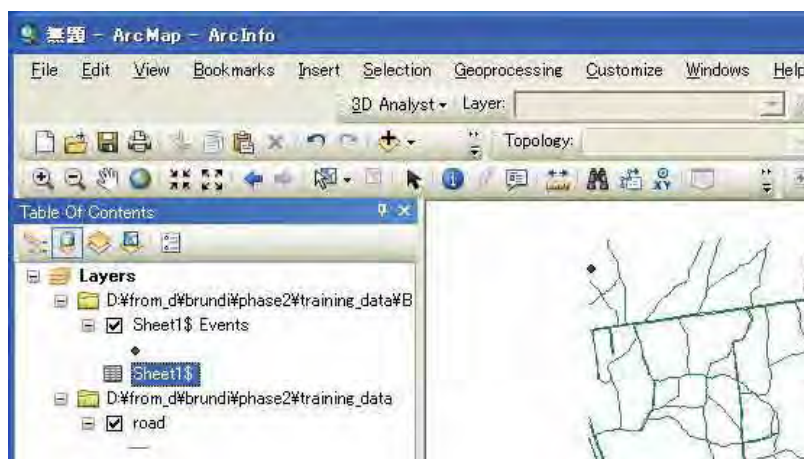
- Click on "View" Menu and then select 'Data View' or 'Layout view' to see the data in either environment.

4.7 Add XY Data

- After adding the table data with XY coordinates columns in the 'Data Frame Window', Right click on the File name in the 'Data Frame Window and then click 'Display XY Data.'.

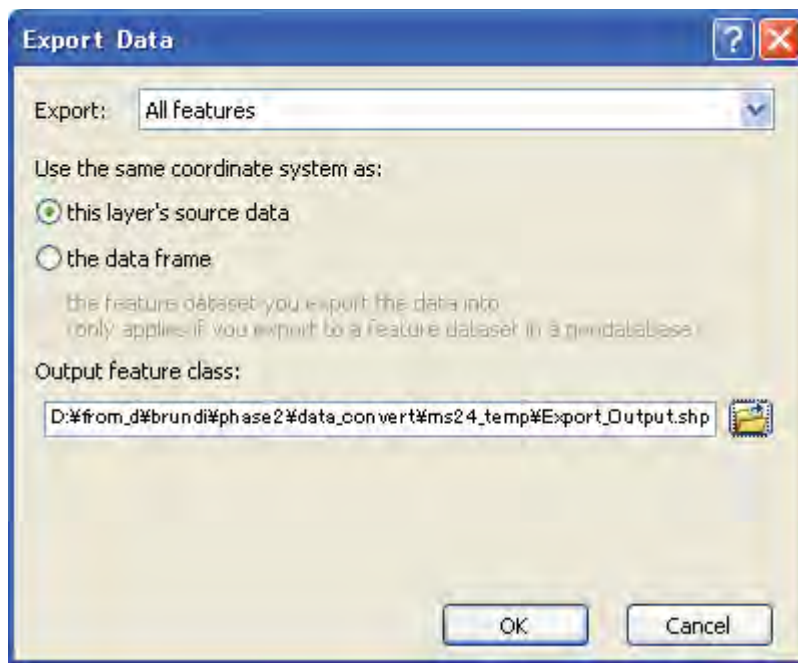


- It will display the 'Display XY Data' window. Choose right Field for X and Y and also set the Coordinate System by clicking 'Edit' Tab. Lastly, click 'OK' tab.
- It will display the created Point shape file of above XY data, for instance "sheet1\$ Events" as below:



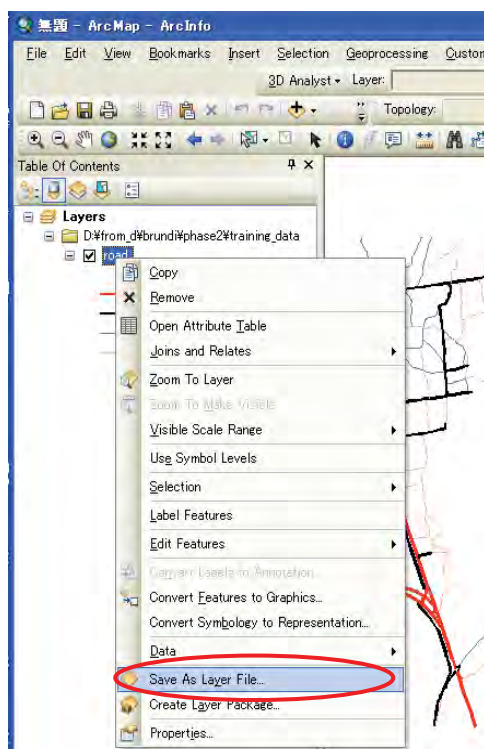
*Note: This displayed shape file is temporary one and **must be saved** for future use.*

- To save the above created point shape file, Right click on File name (in above case, “sheet1\$ Events”) and then click on “Data” and then, “Export Data”. Input the ‘Output File name’ and click OK Tab.



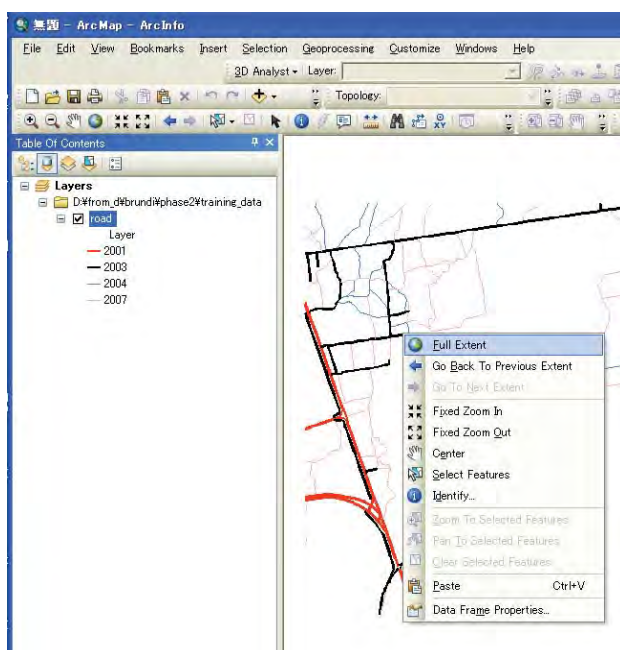
4.8 Save as Layer File

- In order to save a set of displayed symbol to apply to other shape file having similar categories (or to same shape file when displayed next time), Right click on the layer and then click on ‘Save As Layer File’.



Note: To apply the saved layer file to the desired shape file, it needs to be imported during applying symbol that file.

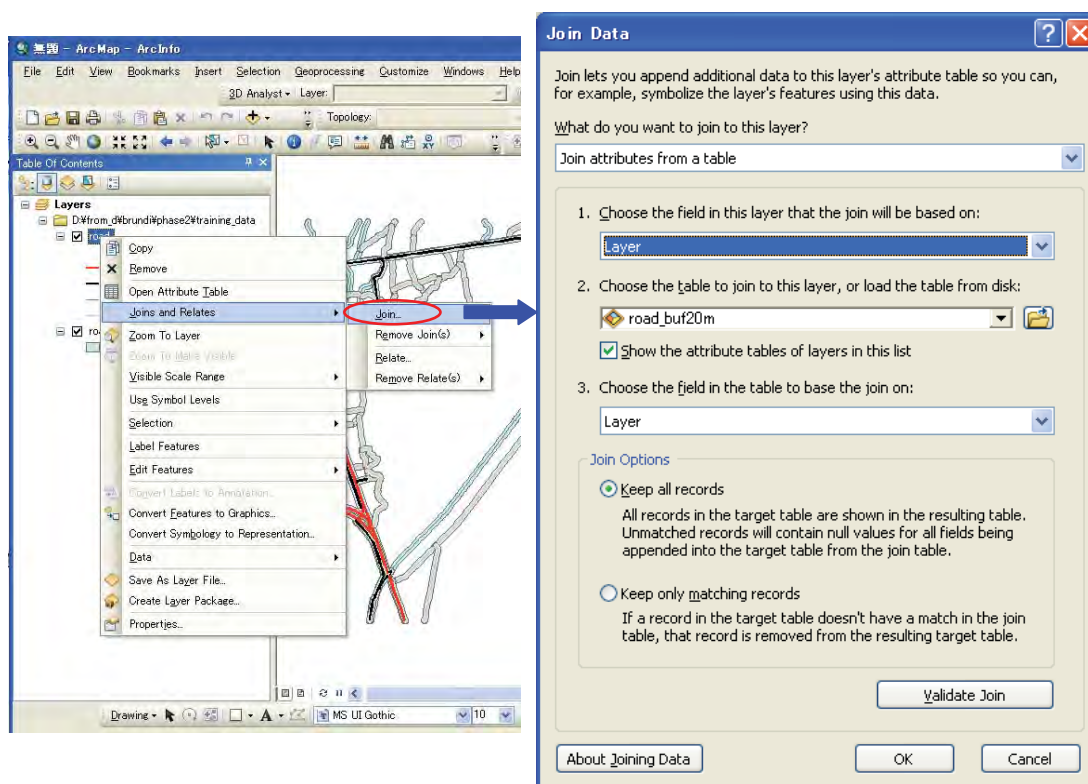
4.9 Right Click in the Map Display Window



- To use some of functions such as displaying full extent, Zoom In/out, Identify, and others, Right click by keeping cursor in the 'Map Display Window'.

4.10 Joining and Relating the Tables

- Joining or relating two tables is done by Right clicking on the data layer in the 'Data Frame Window' and then clicking on the 'Joins and Relates' Tab, and then select either 'Join' or 'Relates', for instance selecting 'Join' as shown below.

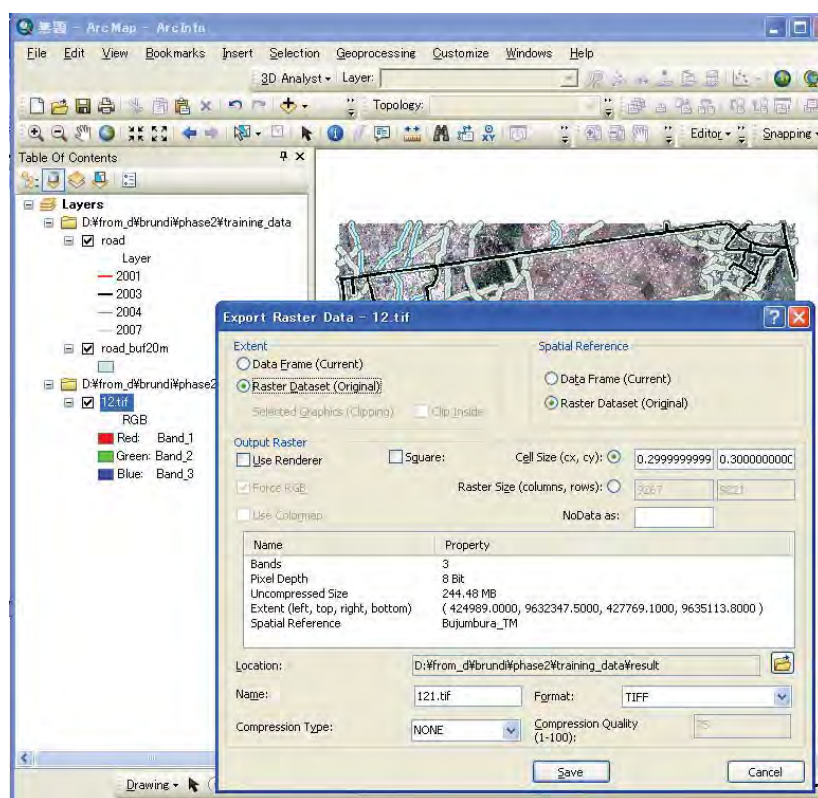


- Select the joining Field for the both Tables and then click OK Tab.
- It will join the table from the dataset to the targeted one. For instance, in this case, the table of road_buf20m will be joined to road.

Note: Such join is temporary one and for permanent joining, the dataset need to Save as new file name by Right clicking on the file name and then clicking 'Data' and then 'Export Data' (as done in point 7).

4.11 Saving the Geographic Data

- Saving the vector dataset is same as described in Point 7). And, to save Raster file, clicking on 'Export Tab will display the window shown in next page. In this window, select the desired options, and lastly click on 'Save' Tab.



4.12 Saving the Project File

- To save the setting of displayed file, click "File" Menu and then click on 'Save' Tab to save it as MXD file.

Session 5: Menu and Functions for Tables

ArcGIS contains various Functions for addition and modification of Tabular Data. The training included practicing the Menus and function related to Tables, such as following points:

5.3 Going through Menus and sub-menu

5.4 Select, De-select, and Export data

5.5 Adding the field

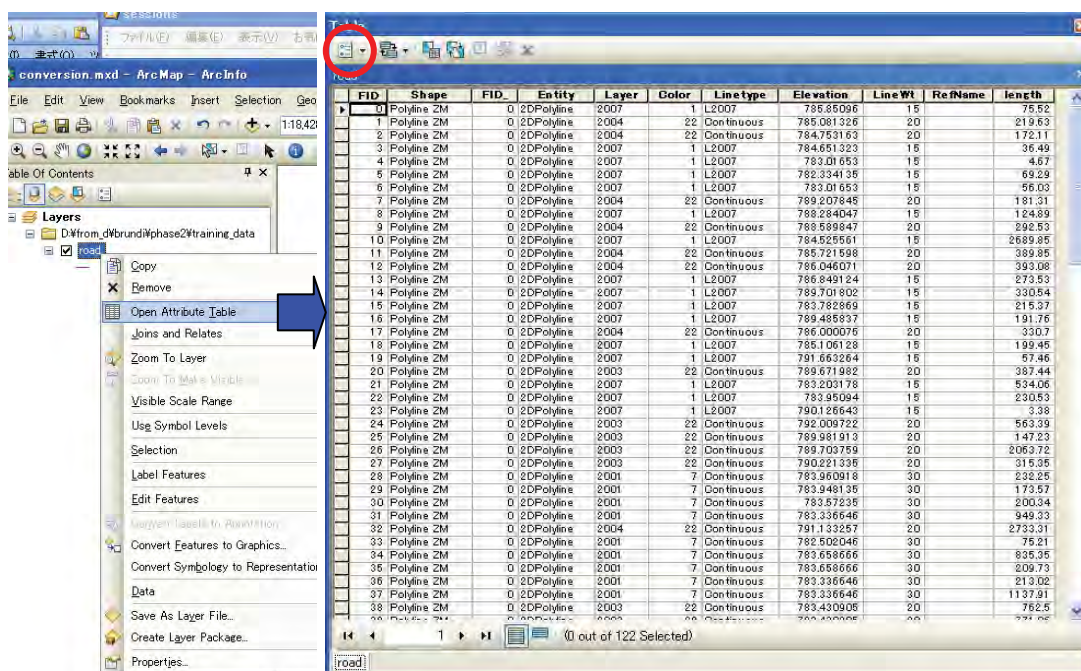
Followings data are under folder */training_data*:

- Road network data as line *shape* file.
- Map sheet index as polygon *shape* file

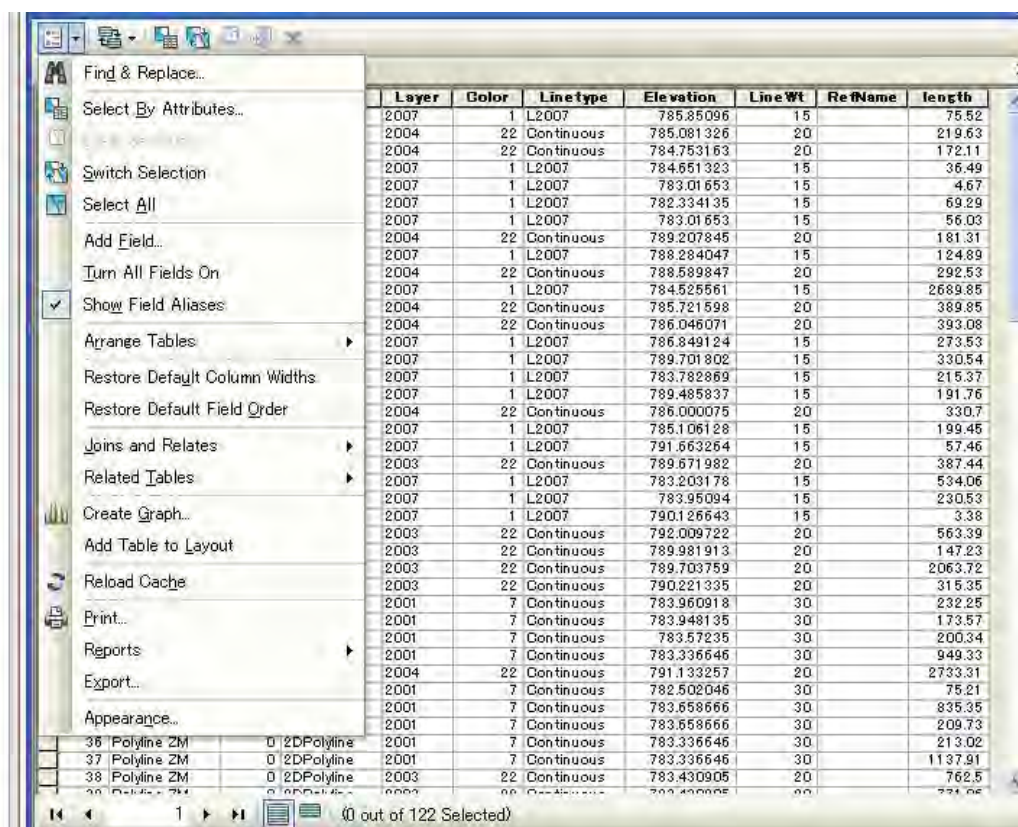
■ Follow following Steps as Practice:

5.1 Going through Menus and sub-menu

- i) Open ArcMap and Add Line shape file, *road.shp*.
- ii) Now, Right click on the File name in the “Table of Contents” and click on “Open Attribute Table”, it will display the Table as below.



- iii) Click on the Pull down menu of the ‘Options Menu’ located at the left side of Toolbar, a range of functional menu will appear.

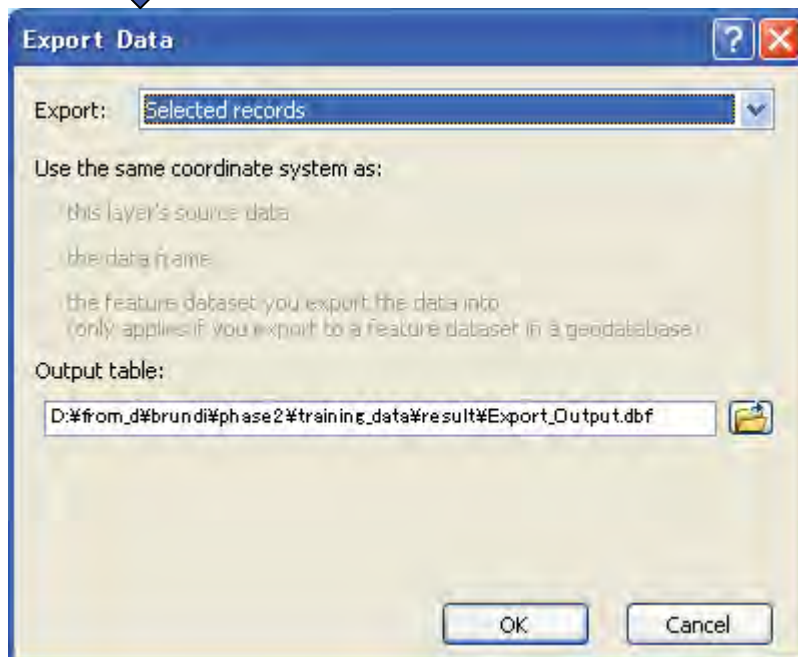
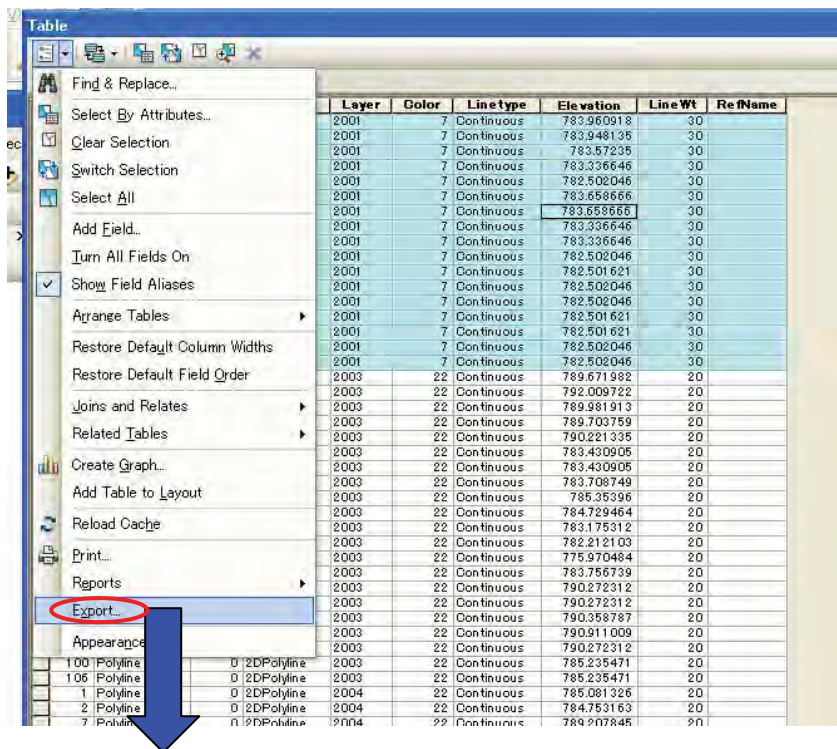


5.2 Select, De-select, and Export Data

- Selection can be done just by clicking the mouse on the left side of desired Case (Row) and then clicking the other along with Ctrl (Control) or Shift Key as required.

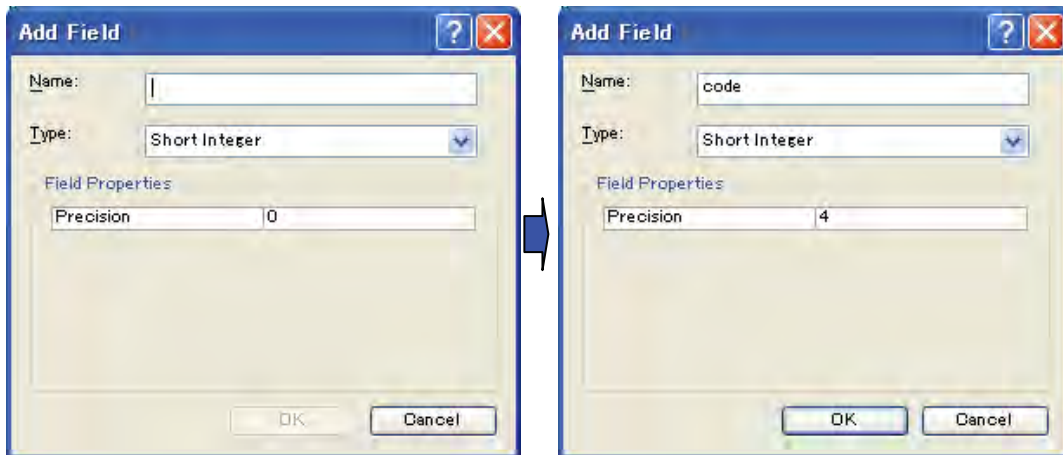
Note: Also, the Cases (Rows) can be selected using ‘Select by Attributes’ function.

- To export the selected Cases (Rows) of Tabular Dataset, click on Pull down menu of ‘Options Menu’ and then click on ‘Export’ and after assigning File name under desired folder, lastly click ‘OK’ Tab.



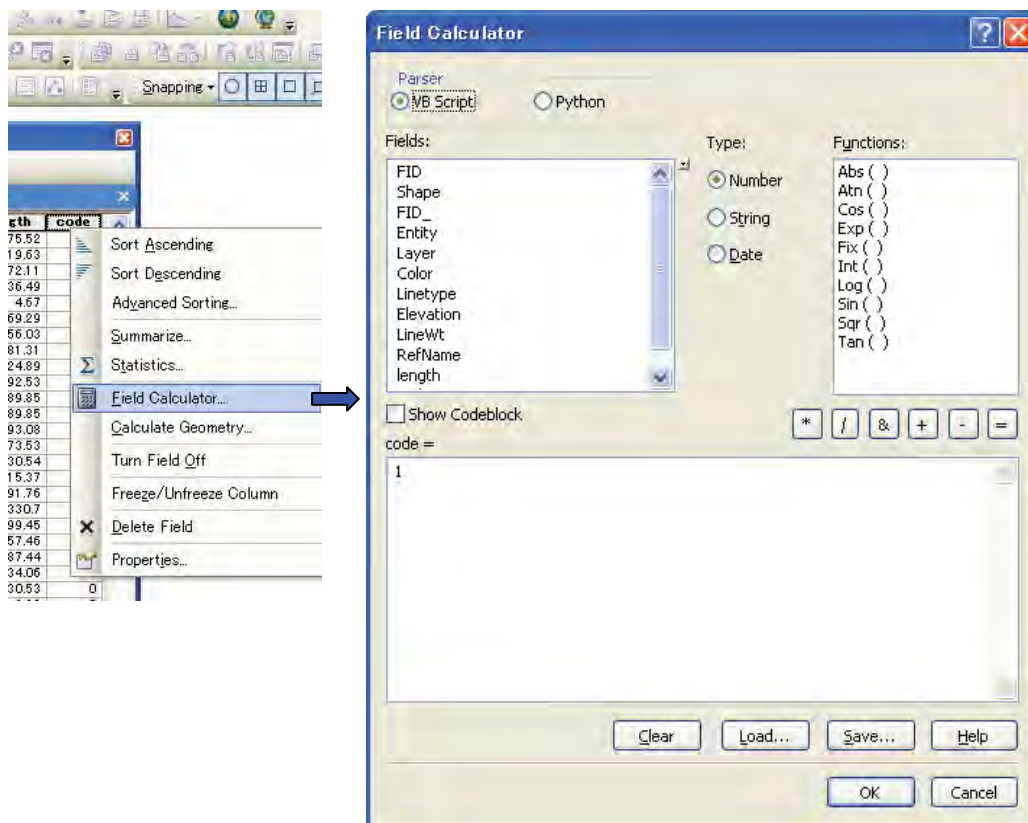
5.3 Adding the Field

- The addition of Field can be done only outside of Editing environment. For this, Click the 'Add Field', it will display following window. Input the Field Name and Type with Field Properties and click OK Tab. It will add the field 'code' in the Table.



- Now click Right on the 'code' field, it will display vertical menu as below. Click on 'Field Calculator' to display the window and input the desired data (for instance, 1 has been input below), and click OK Tab.

Note: to input the data to specific Case (Row), need to select before Right clicking on the Field.



- To delete the field, click “Delete Field” and then “Yes” Tab as confirmation.
- In case of ‘Length’, ‘Perimeter’, and ‘Area’ field, click on ‘Calculate Geometry’ function.

- Practice: The functions under ‘Options Menu’; especially:
 - Selecting and Clearing the selection, and Exporting the selected data
 - Add a field
 - Add the field ‘length’ (or ‘area’ / ‘perimeter’ in case of Polygon shape file)

Session 6: Familiarizing with Important Functions in ArcToolBox

ArcToolBox contains varieties of functions for analyzing the GIS data including conversion. Following points/functions in this session:


- 6.1 Introduction of ArcToolBox
- 6.2 Projection and Transformation
- 6.3 Feature Conversion
- 6.4 Contour to TIN, TIN to Raster
- 6.5 Clipping
- 6.6 Buffering
- 6.7 Dissolving

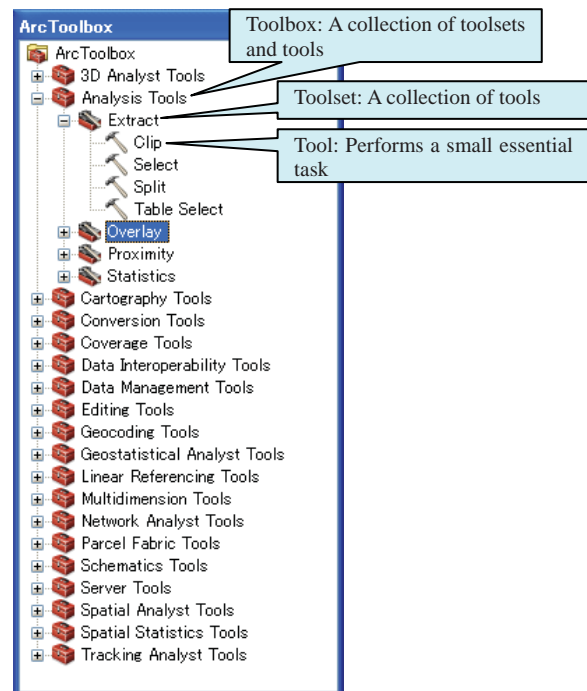
- **Data for this Exercise:**

Followings data are placed under folder */Data_for_Exercise:*

- Ortho-rectified Aerial Photo (one map sheet) as tiff file
 - Road network data as line shape file (*road.shp*).
 - Contour line data as line shape file (*contour27.shp*)
 - Boundary for clipping as shape file (*clip_pol.shp*)
-
-

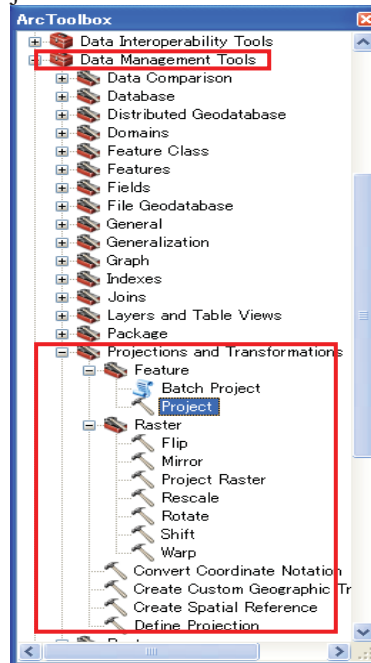
6.1 Introduction of ArcToolBox

- The ArcToolbox window is the central place to find, manage, and execute geoprocessing tools.
- The ArcToolbox window contains toolboxes, which in turn contain tools and toolsets (a toolset is just an organizational device, like a system folder).
- The ArcToolBox window can be displayed from both ArcMap and ArcCatalog. Click on ArcToolbox Window button  on the **Standard** toolbar.



6.2 Projection and Transformation

- ArcToolBox has number of tools related to Projection and Transformation.
- To display these tools, open ArcToolBox window – click “Data Management Tools”- then click “Projections and Transformations” (As marked below).
- Separate Tools are available for Feature (Vector) and Raster Dataset, with ‘Create Custom Geographic Transformation’ and ‘Define Projection’ tools common to both datasets.



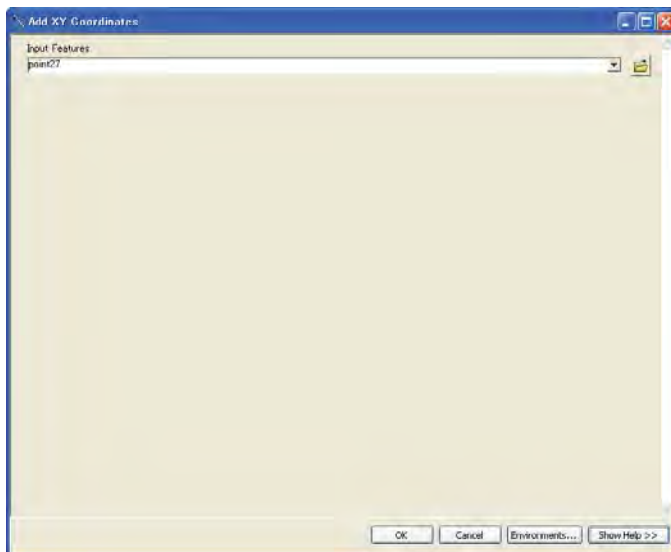
- **Practice:** Apply “Project” function to *road.shp* (to change to other projection system, such as Geographic Coordinate Systems).

6.3 Feature Conversion:

- The Tools to convert one type of Feature to another such as from Line to Polygon or vice versa, and so on, can be reached by clicking “Data Management Tools” and then “Features” as marked in side figure.

➤ **Practice: Add XY Coordinates to Point shape file (point27.shp).**

- Click ArcToolBox - Data Management Tools - Features - Add XY Coordinates
- Assign *point27.shp* as Input features (as below) and then click OK Tab.

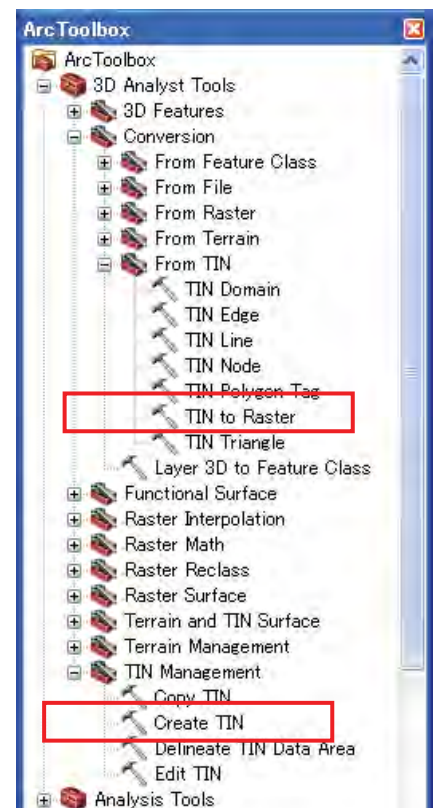


6.4 Contour to TIN, TIN to Raster

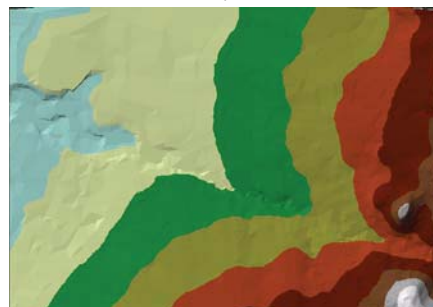
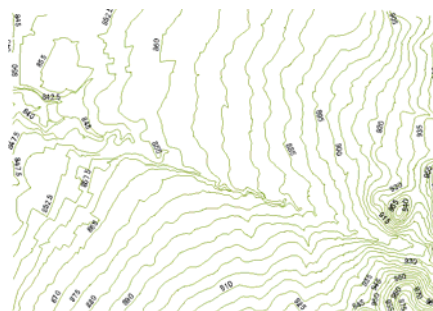
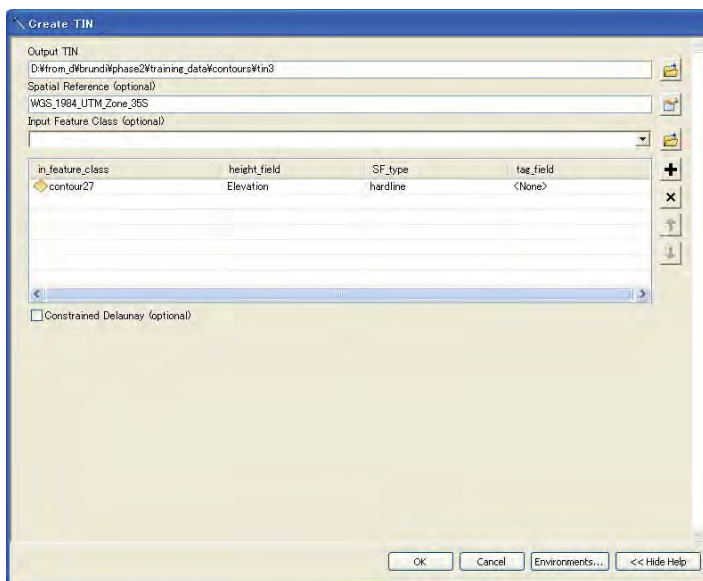
- Triangulated irregular network (TIN) is created from input vector data, which represents different surface features. You can add vector data using both the Create TIN and Edit TIN tools.
- These functions are available under “3D Analyst Tools” Toolbox.
- Use the Create TIN geoprocessing tool to construct a new TIN on disk. Once the TIN is created on disk, use the Create TIN geoprocessing tool to add additional vector data to the new TIN.

➤ **Practice: Convert the contour data (*contour27.shp*) to TIN and then from TIN to Raster.**

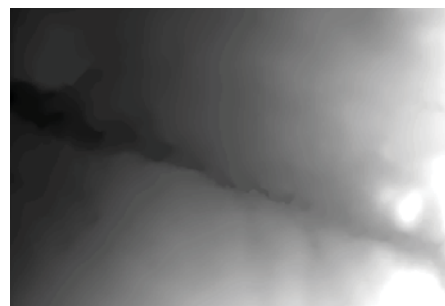
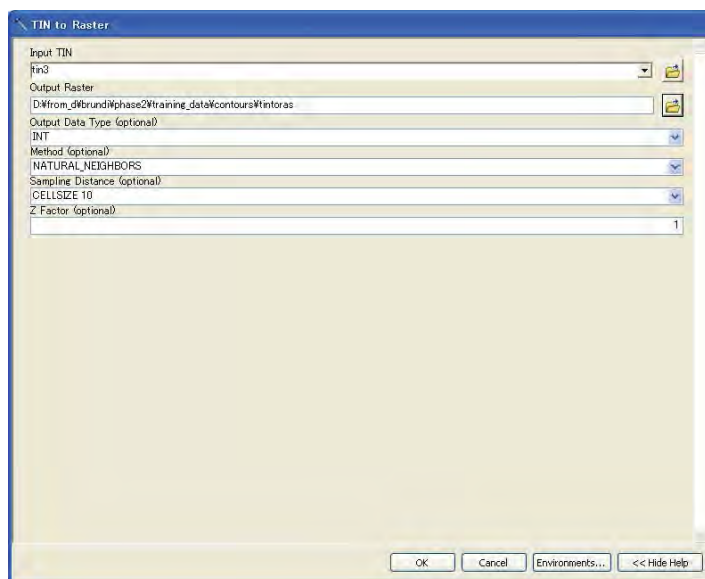
- **To convert contour lines to TIN:** ArcToolBox - 3D Analyst Tools – TIN Management – Create TIN



Manual for Structurization



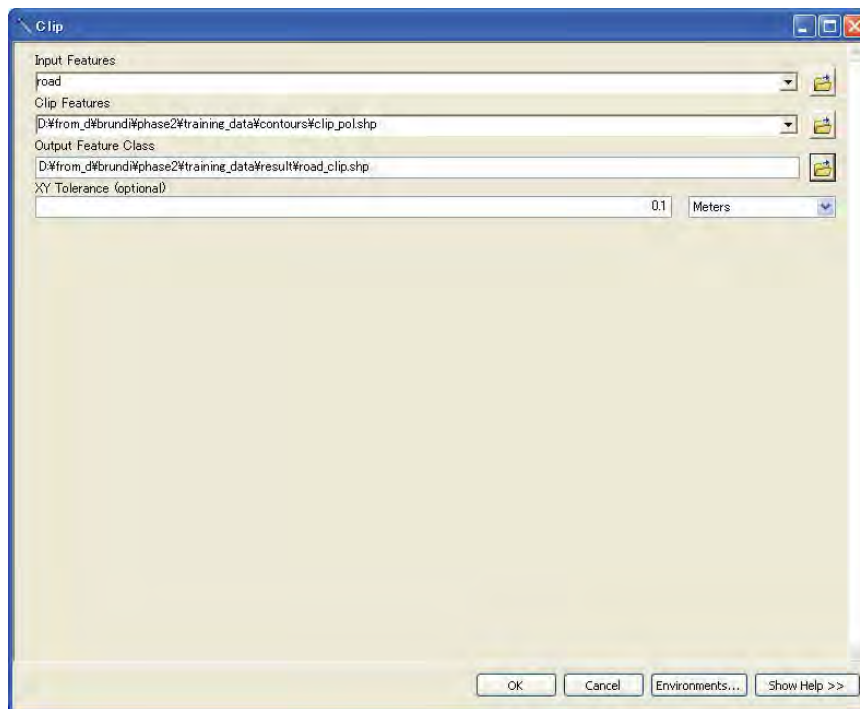
- To convert TIN to Raster: ArcToolBox - 3D Analyst Tools – Conversion – From TIN
- TIN to Raster



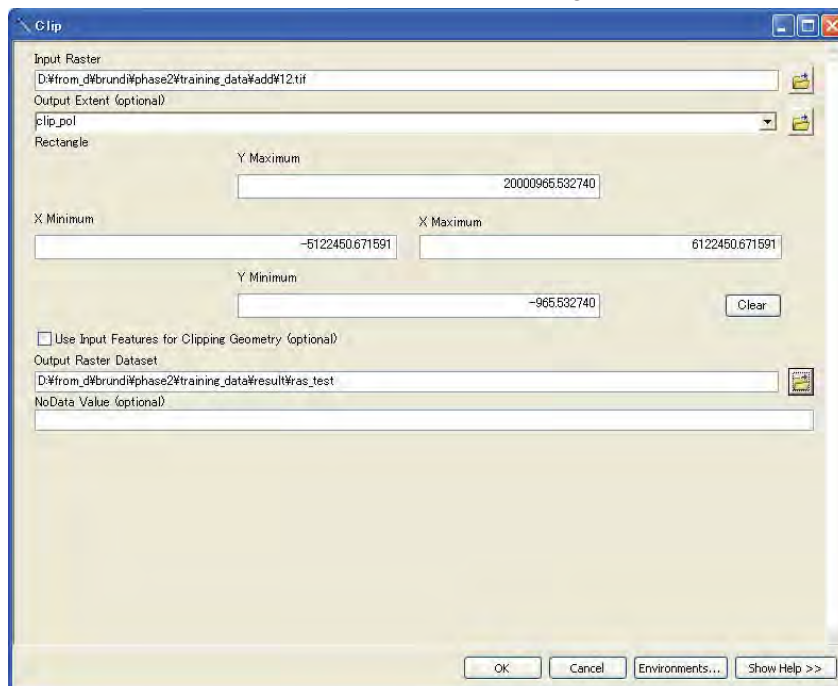
6.5 Clipping

➤ **Practice: clip the road data using clip_pol.shp**

- **For Clipping Feature: ArcToolBox - Analysis Tools – Extract – Clip**

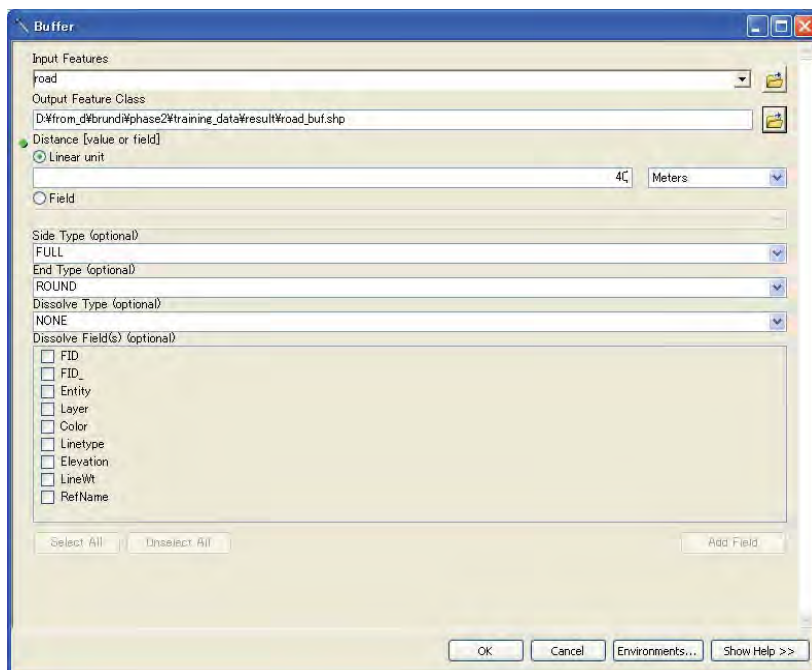


- **For Clipping Raster: ArcToolbox - Data Management Tools – Raster - Raster Processing - Clip**



6.6 Buffering

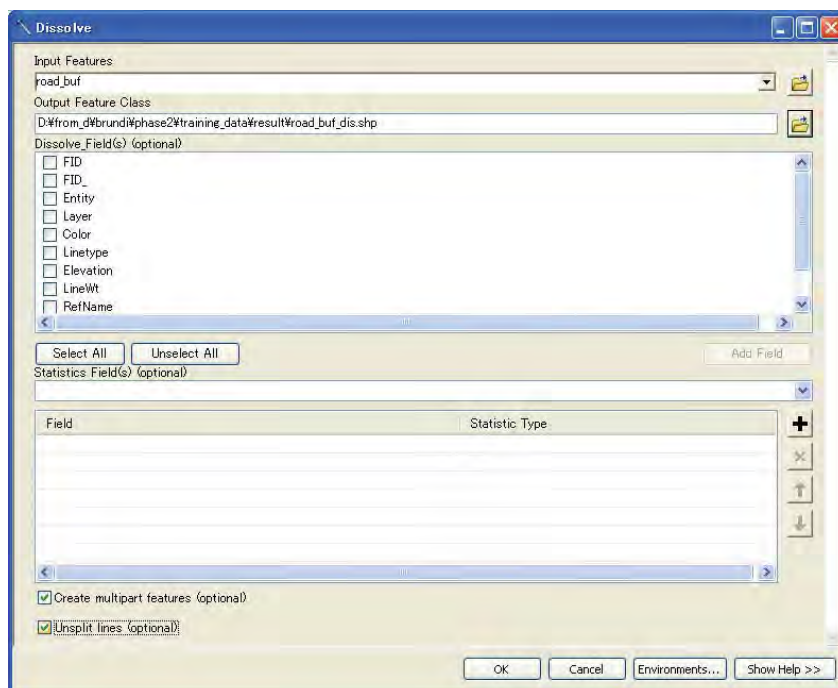
- **For Buffering:** ArcToolbox - Analysis Tools – Proximity - Buffer



- **Practice:** Buffer the road data (road.shp) with a threshold.

6.7 Dissolving

- **To Dissolve:** ArcToolbox – Data Management Tools – Generalization - Clip



- **Practice: Dissolve the earlier created Road buffer result.**

- =====
- **Practice: Considering that Local Government wants to categorize the land based on the distance from road and for this three threshold values are, say 20m, 40m, and 50m. Develop the land categorization.**

- Buffer the road with these criteria separately followed by dissolve.
- Then, combine the whole area and these all 3 results in sequence showing 4 categories using “Update” function (ArcToolBox – Analysis Tools – Overlay – Update).

Session 7: Data Query

This session includes ways of building logical queries in ArcGIS and extracting the selected features or attributes to new file.

The topics included are:

- 7.1 What is Data Query
- 7.2 Building Logical Query to Select Features
- 7.3 Exporting the selected Features to new file.

Followings data are placed under folder /training_data:

- Line features data as shape file (*line27.shp*)
- Road data as shape file (*road.shp*)

7.1 What is Data Query

Searching for required information by applying logical operators and mathematical expression is usually desirable for very simple to complex types of data analysis and modeling. For instance, a simple expression is presented as below:

"Layer" = '3005'

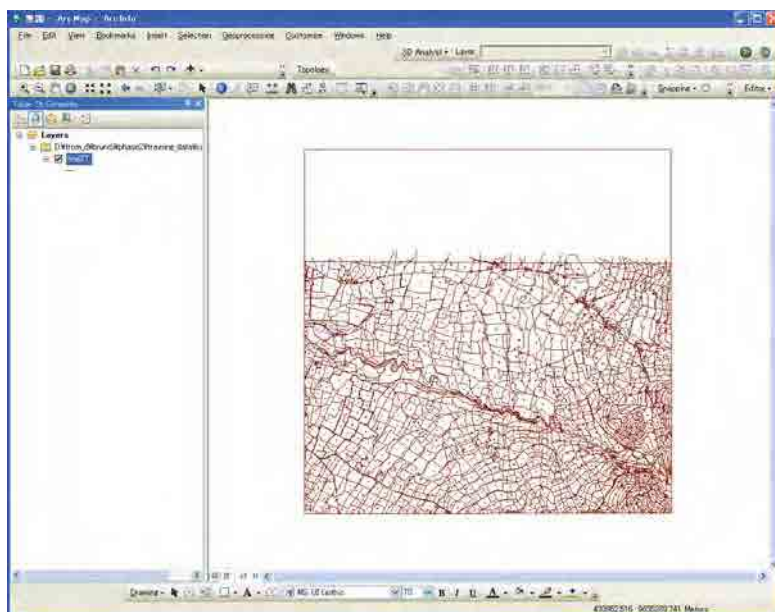
7.2 Building Logical Query to Select Features

While querying the data, one has to provide correct expression using logical criteria as wrongly built query might result into data which is not the same that user is looking for.

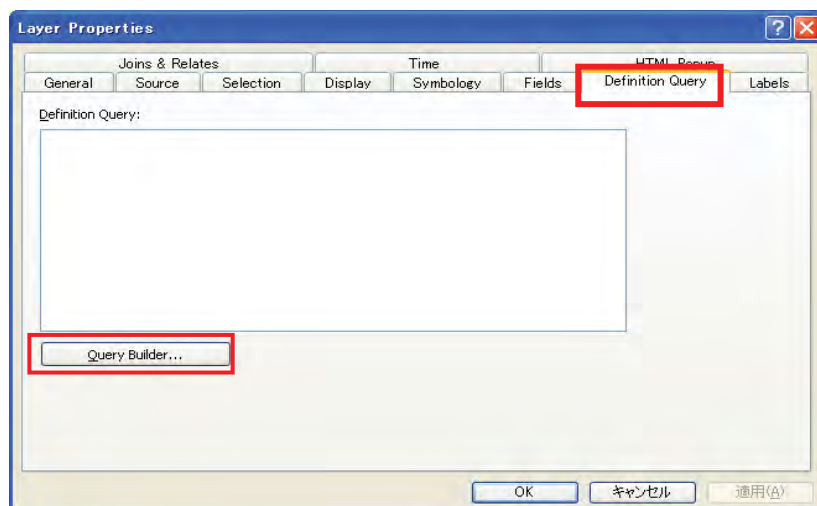
For this, In ArcGIS, the most common operators such as “And”, “Or”, “Not”, are available Also one can use mathematical operators.

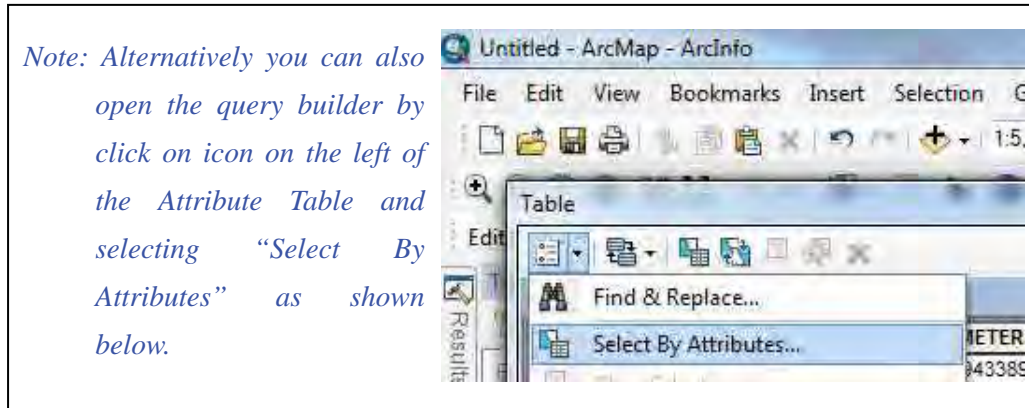
Follow following steps for the practice:

- x) Open “ArcMap” and Add Data for instance, *line27.shp*.

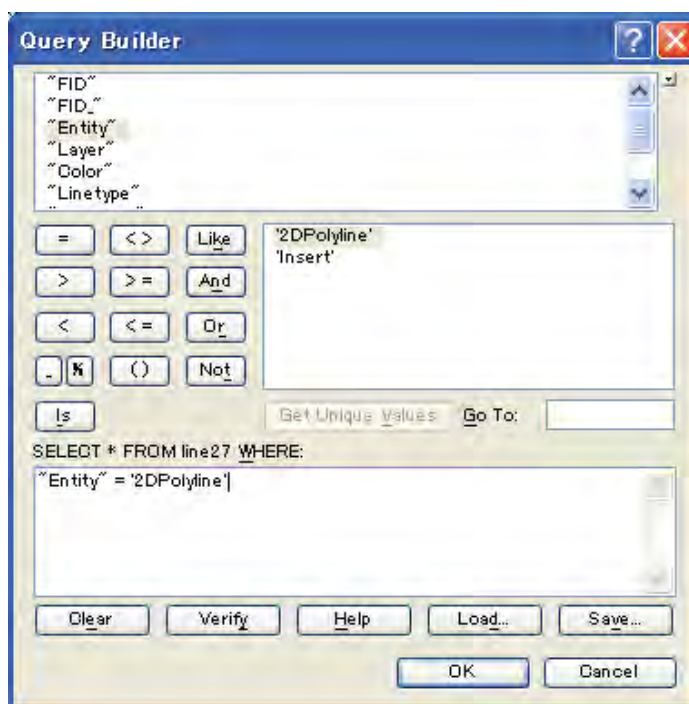


- xi) Click (Right) on the layer in “Table of Contents” and click “Properties”. And then click on “Definition Query” in the window it will appear as follows:

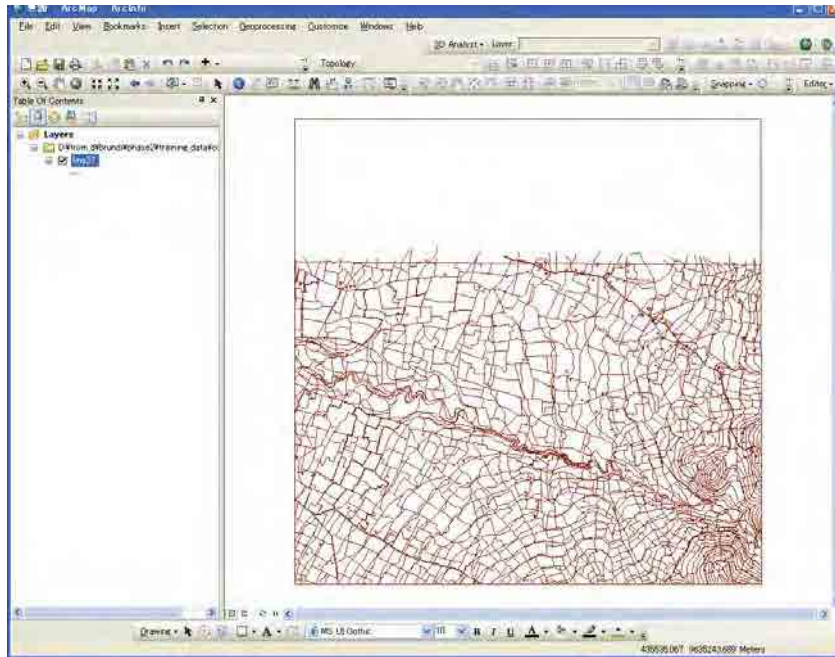




- xii) Click on “Select By Attributes”. The “Select By Attributes” window will appear. Click on “Entity” Item and then click on “Get Unique Values” button, it will display the values of this Item as ‘2DPolyline’ and ‘Insert’. Now, click twice on “Entity” Item, then once on “=”, then twice on , ‘2DPolyline’, and lastly click on “OK” Tab.



- xiii) It will display only the lines with “Entity” = ‘2DPolyline’, as shown below.



xiv) Now open the Attribute Table of this file, you will find only the record that meets this criteria.

FID	Shape *	FID_	Entity	Layer	Color	Line type	Elevation	Line Wt	Ref Nan
177	Polyline 2M	0	2DPolyline	area	1	Continuous	855	25	
1150	Polyline 2M	0	2DPolyline	71 02	2	Continuous	835	15	
1237	Polyline 2M	0	2DPolyline	9999	7	Continuous	0	25	
1238	Polyline 2M	0	2DPolyline	71 02	2	Continuous	855	15	
1241	Polyline 2M	0	2DPolyline	71 01	6	Continuous	925	15	
1242	Polyline 2M	0	2DPolyline	71 02	2	Continuous	920	15	
1243	Polyline 2M	0	2DPolyline	71 02	2	Continuous	905	15	
1244	Polyline 2M	0	2DPolyline	71 02	2	Continuous	930	15	
1245	Polyline 2M	0	2DPolyline	71 02	2	Continuous	935	15	
1246	Polyline 2M	0	2DPolyline	71 02	2	Continuous	940	15	
1247	Polyline 2M	0	2DPolyline	71 02	2	Continuous	865	15	
1248	Polyline 2M	0	2DPolyline	71 02	2	Continuous	855	15	
1249	Polyline 2M	0	2DPolyline	71 03	30	L71 03	852.5	15	
1250	Polyline 2M	0	2DPolyline	71 02	2	Continuous	940	15	
1251	Polyline 2M	0	2DPolyline	71 02	2	Continuous	935	15	
1252	Polyline 2M	0	2DPolyline	71 03	30	L71 03	842.5	15	
1253	Polyline 2M	0	2DPolyline	71 02	2	Continuous	845	15	
1254	Polyline 2M	0	2DPolyline	71 02	2	Continuous	840	15	
1255	Polyline 2M	0	2DPolyline	71 03	30	L71 03	852.5	15	
1956	Polyline 2M	0	2DPolyline	71 01	6	Continuous	075	15	

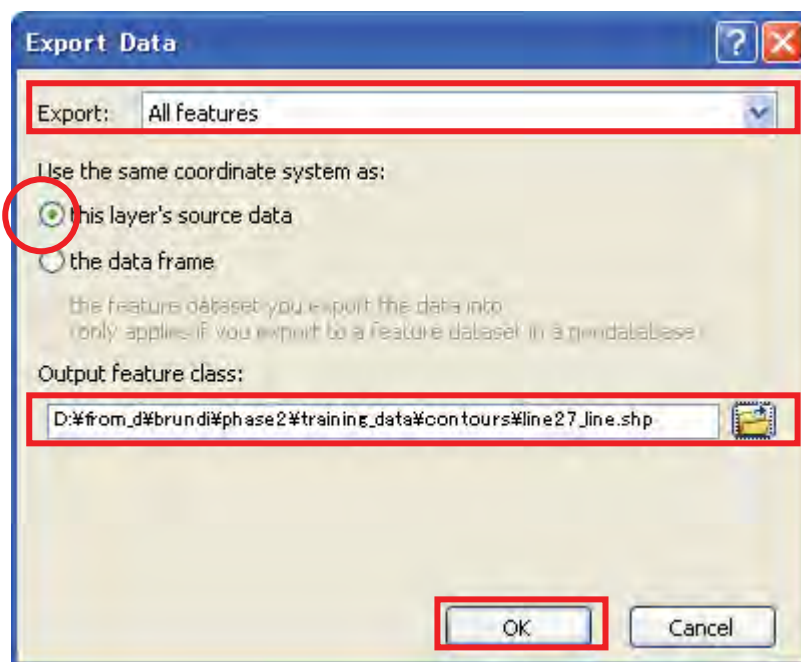
- **Practice:** Similarly, try to develop other query and observe the result (for instance, using “Entity” as ‘2DPolyline’ and desired “Layer”). You can also try by displaying the Road data.
- **Practice:** Make same logical Query from table and export the selected data.

7.3 Exporting the Selected Features to New File

Data selected with query expression can be exported in to new file creating new dataset. Such action is also used some times to create new datasets.

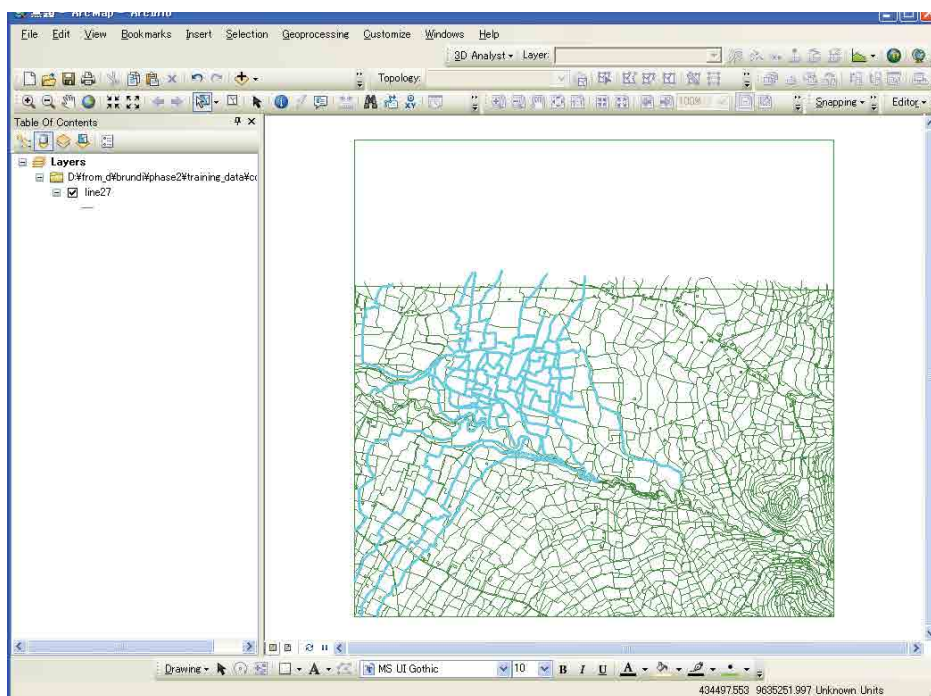
To export the above selected lines to new file:

- i) Right click on the layer in “Table of Contents”, then Right click on the layer then choose on “Data”, and then on “Export”. “Export Data” window will appear and in this:
 - set “Export” option as “All Features”
 - Check on “This layer’s Source Data” to preserve the coordinate system.
 - Input the Output file name under desired folder.
 - Lastly, click “OK”.

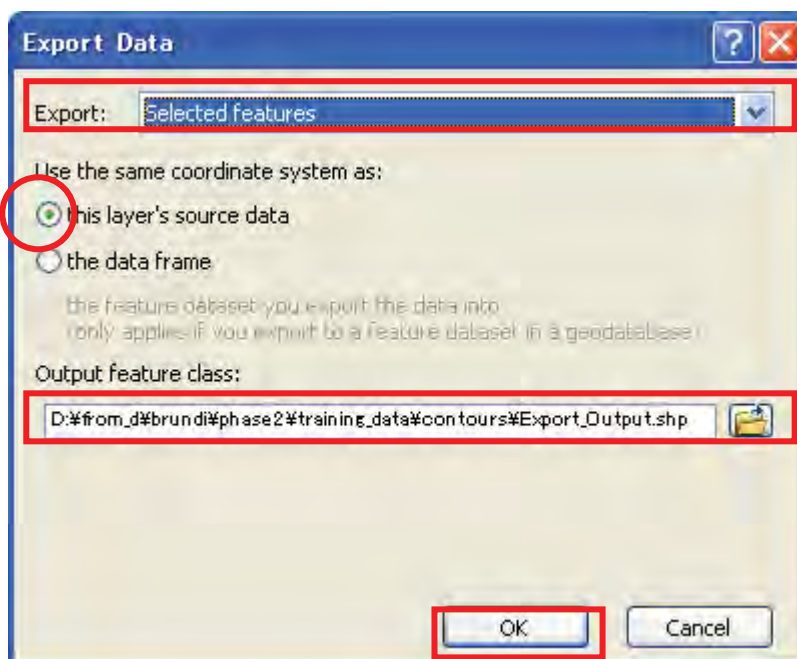


- Open the newly created file and view the result.

Note: If you know which features are to be exported to new file, one simple way to export those features are by just selecting by “Select Features by clicking (using “Select by Rectangle” Tab) or Dragging a box” Icon located in the Toolbar. This will highlight the selected features, for instance, as follows:



Then you follow repeat step i), but this time, “Selected features” need to select as the “Export” option as shown in window below:



After saving to new file, open and view the result.

- **Practice:** Alternatively select the desired features from Attribute Table and export in same way as mentioned above.

Session 8: Creating and Extracting New Data Layers

This session includes ways of creating new dataset and inputting data in GIS.

The topics included are:

8.1 Creating New Datasets

8.2 Inputting Data

- Data for this Exercise:

Followings data are under folder */training_data*:

➤ *Ortho-photo of map sheet 24 as Tiff file*

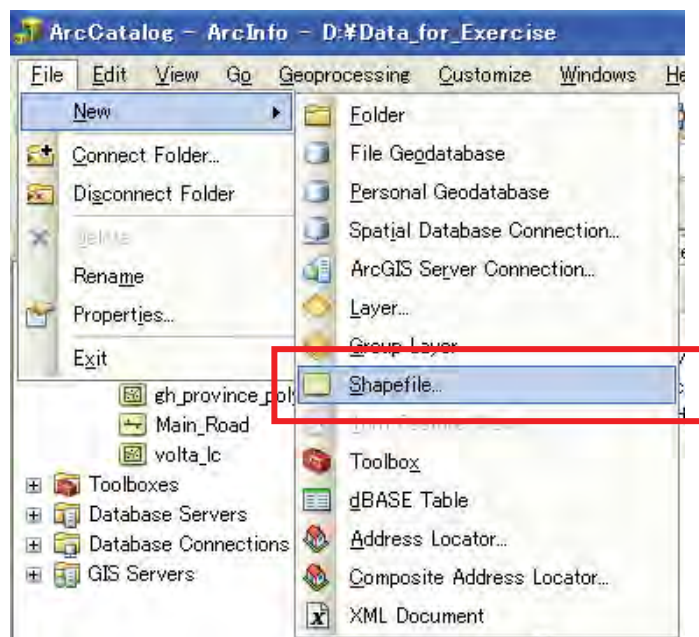
8.1 Creating New Datasets

Some ways of creating new datasets have already been introduced. Here creating empty shape file, will be practiced along with some digitizing features like point, line and polygons.

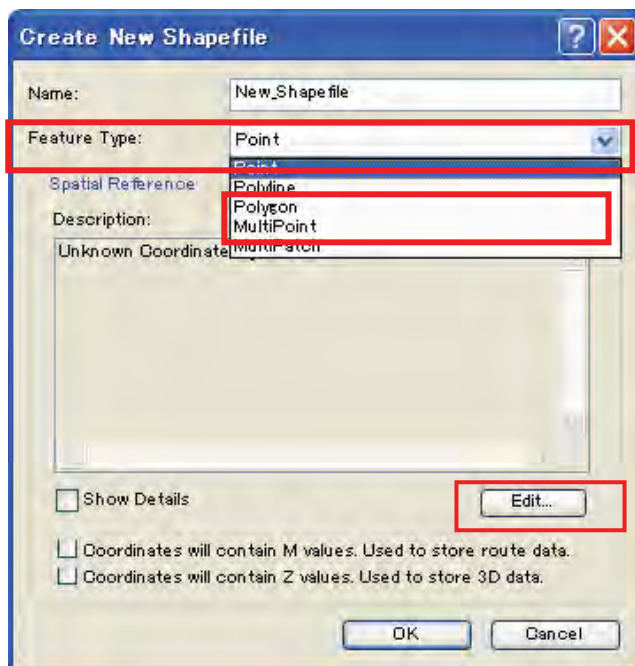
Empty Shape File: There has been some occasion where, we need to create empty Shape File. Such file is the layer without any geographic feature, but having definition like projection system, etc.

In this practice, you will create shape files with Feature type as Point, Line, and/or Polygon.

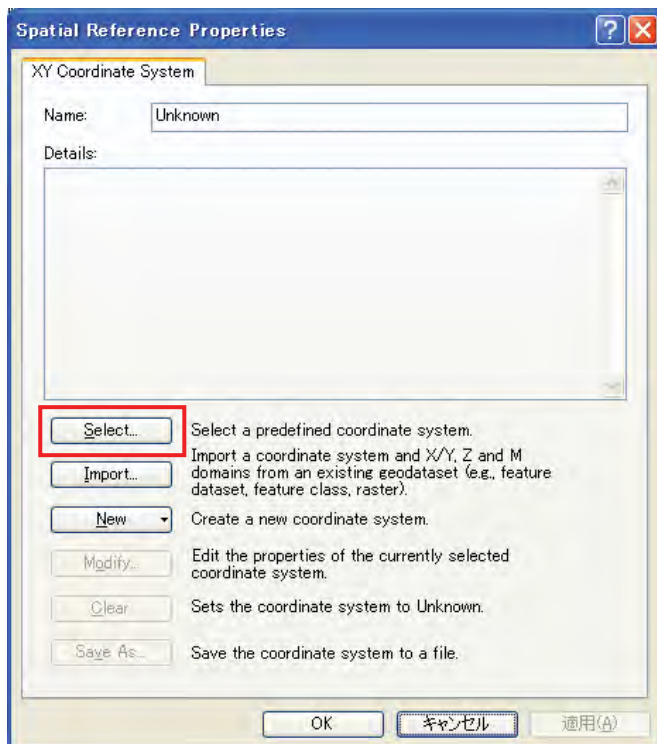
- i) Open ArcCatalog, enter in the folder where you want to create new Data layer. Then, Click 'File' -> 'New' -> 'Shapefile' Menu.



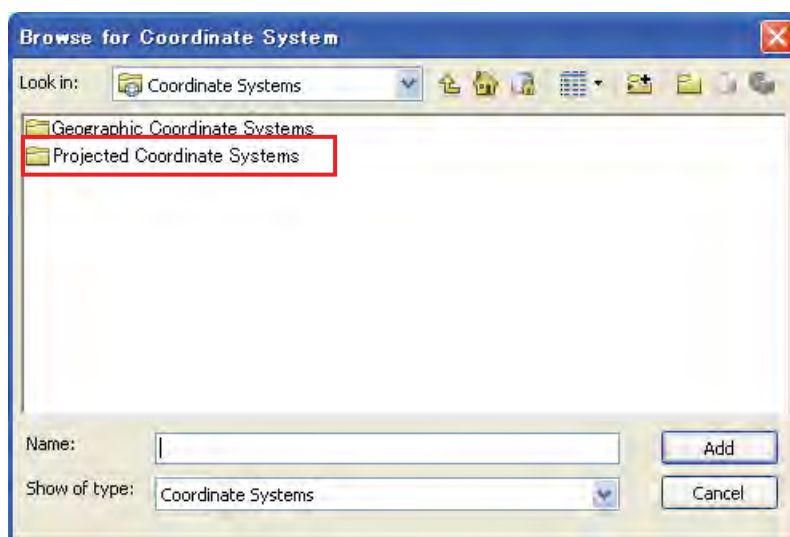
ii) Following window will appear. Assign "Name", "Feature Type" for instance, Point. Then click "Edit" to set the Projection system.

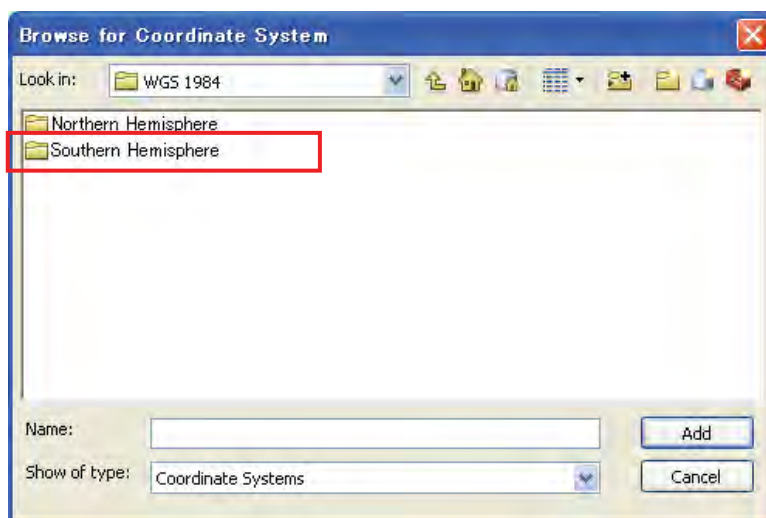
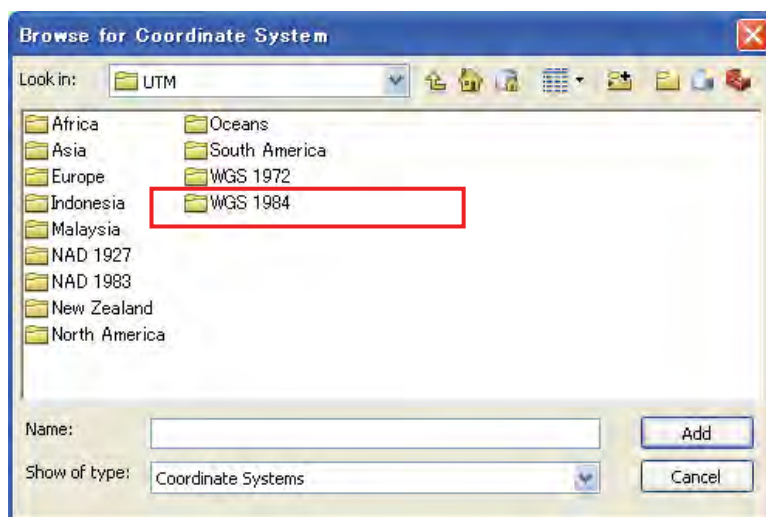
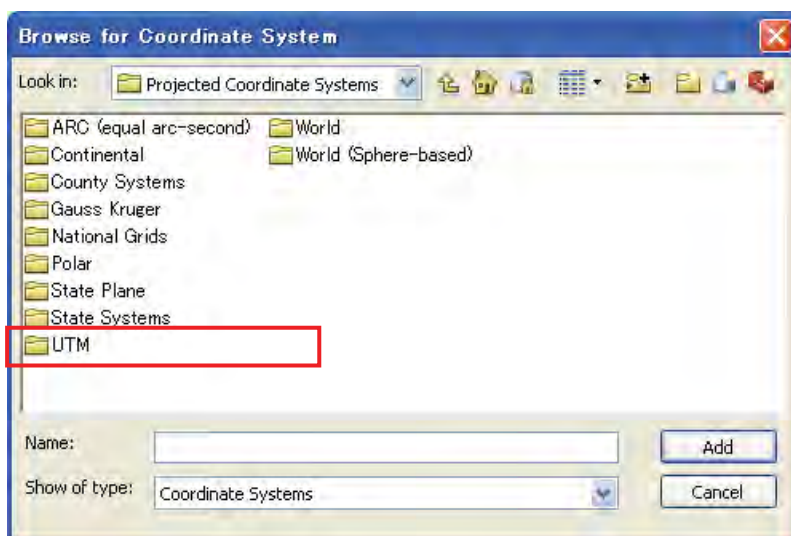


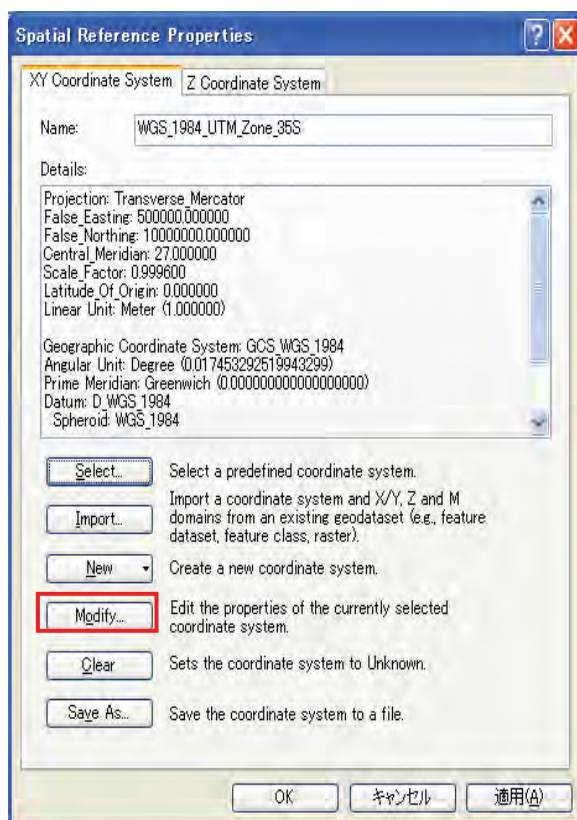
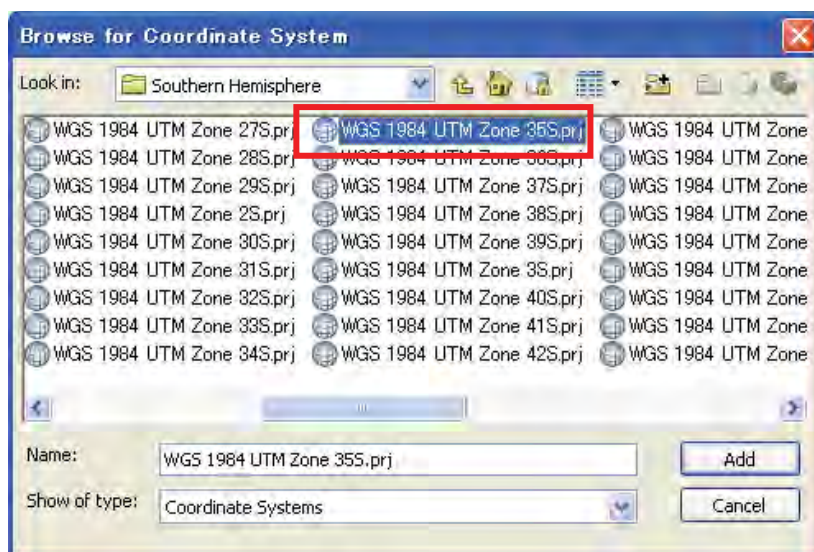
Following window will display.



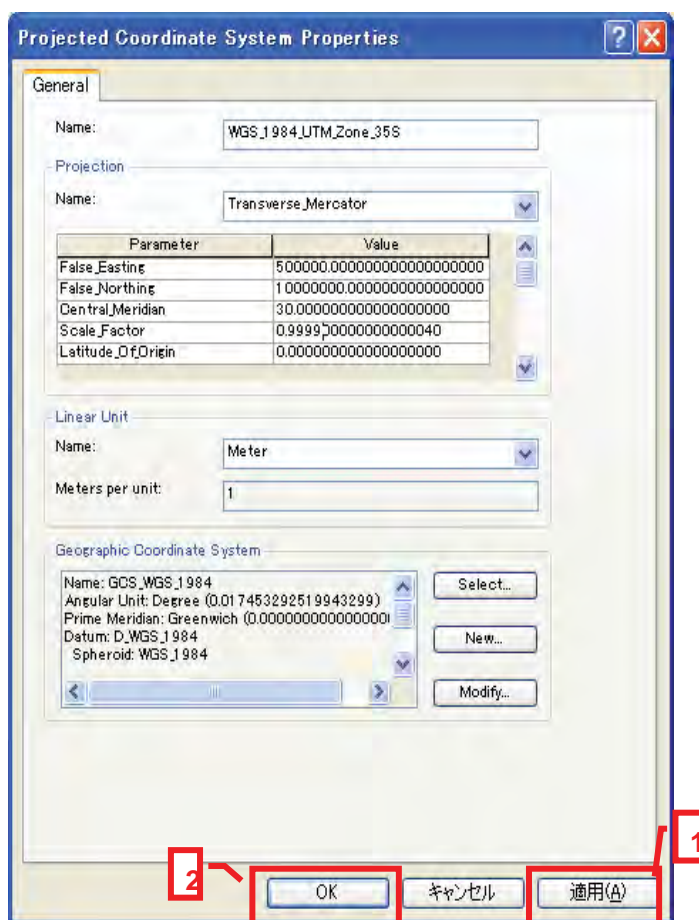
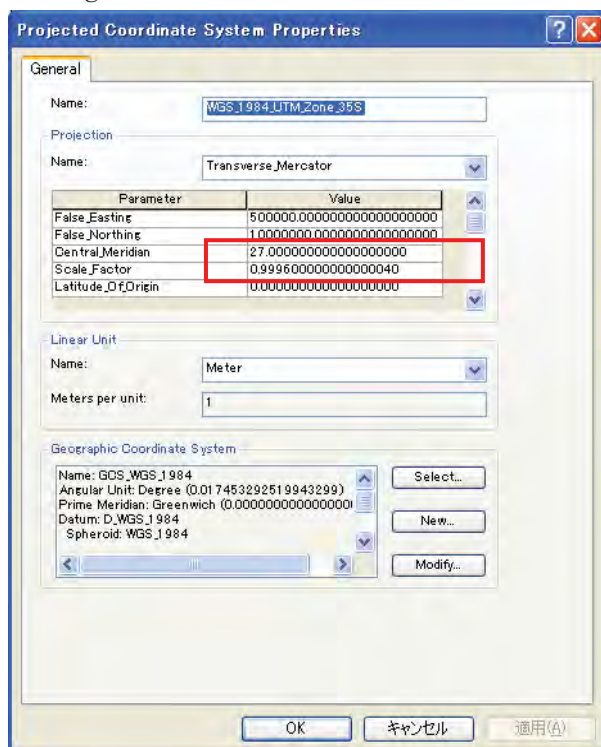
iii) Click “Select” in the above window to select the Projection system. For this, go to Projected Coordinate Systems and select Projection for this Project.





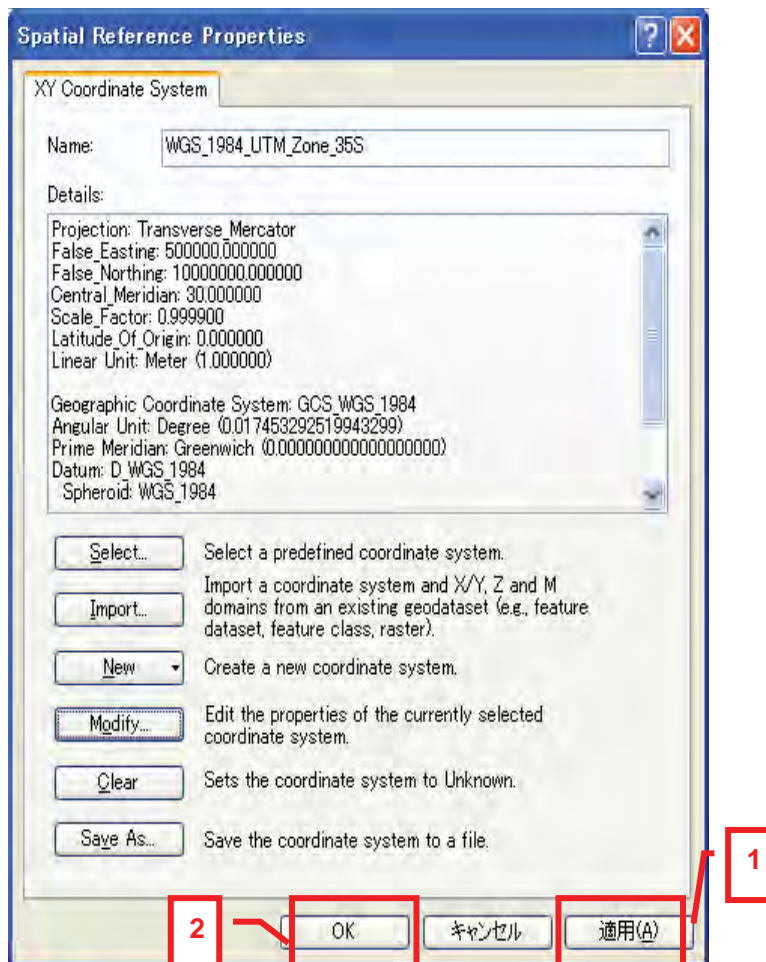


Change Central Meridian to 30.000 and Scale factor to 0.9999.

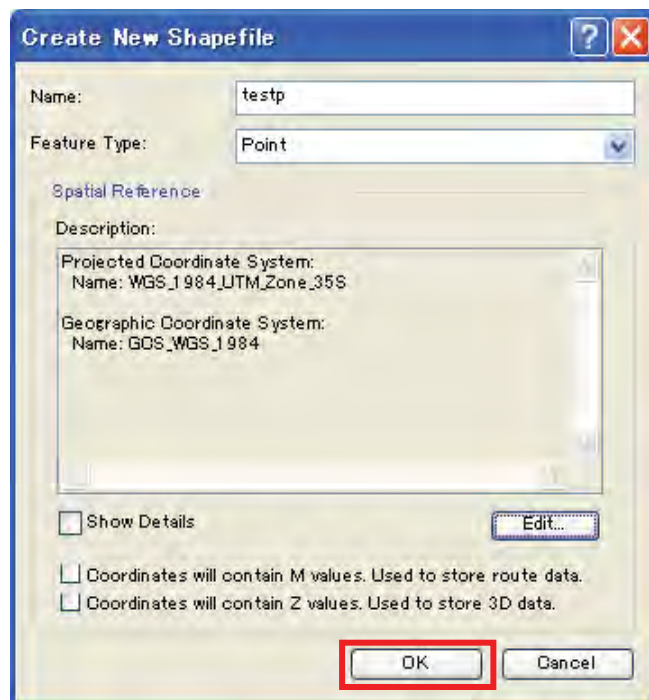


Click “Apply” and then “OK” Tab in “Projected Coordinate System Properties” window

- iv) Then, click ‘Apply’ in ‘Spatial Reference Properties’, and lastly click “OK”. The selected projection parameter will be displayed as below.



- v) Click “OK” in the below like window.



- vi) This will create empty Shapefile named *New_shapefile_pnt*. Similarly, practice to Shapefile with “Feature Type” as Line and Shapefile with “Feature Type” as Polygon.

➤ **Practice: Create Line shape file and Polygon Shape file in the same way**

8.2 Inputting Data

Empty shape file can also be used for inputting desirable data. For example, the empty shape file is opened and selected data from exiting layer can be copied, and pasted and saved to the empty shape file. In addition to this, the data can be input from the primary source data by digitizing.

Practice the inputting small building as point data, road as line data, and Land parcel as polygon data from existing Ortho-photo. Follow following steps for this Exercise:

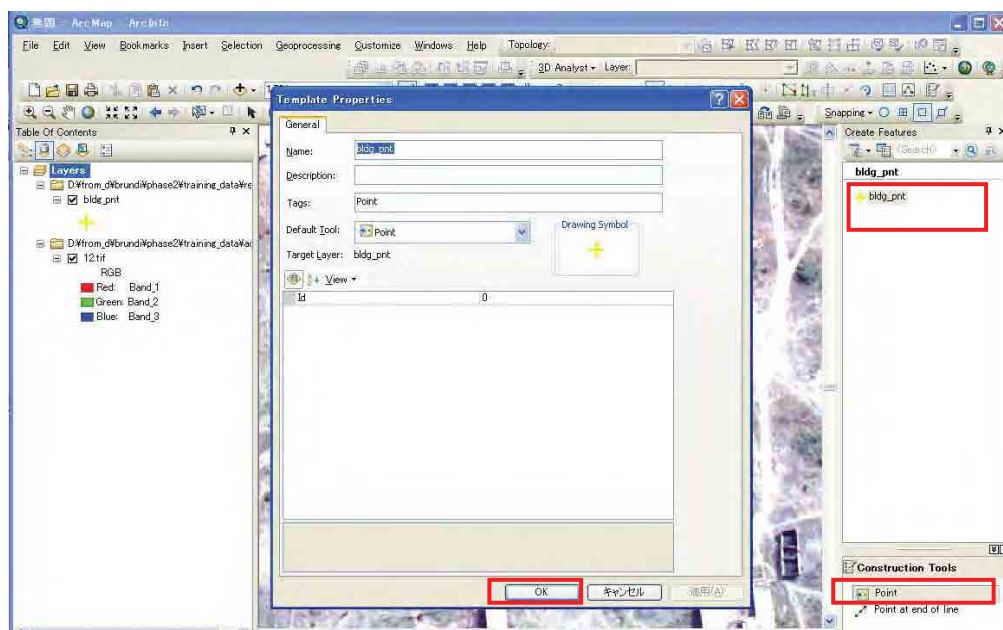
To input Data follow following steps:

- i) Open “ArcMap” then add Ortho-photo (Map sheet 24).
- ii) Add the created Point Shapefile (empty) to digitize small building locations.
- iii) Now, click “Editor” Pull down menu from the “Editor” Toolbar and click “Start editing” and then click

“OK” Tab in the appearing window. The Icons in the “Editor” Toolbar becomes active and change Task to “Create New Feature” as shown below:

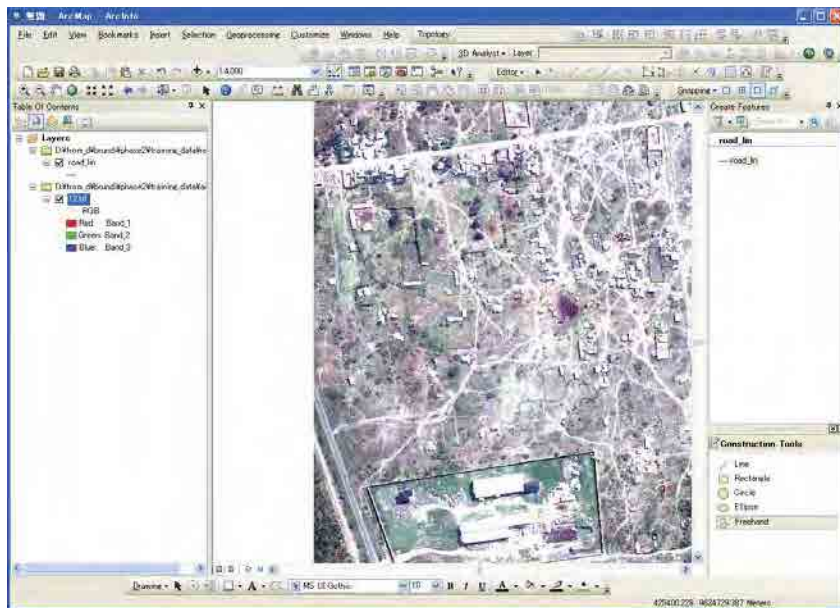
- iv) Click “Editor” and select “Start Editing”, then, “Create Features” dialogue tool appears on the right side of “ArcMap” window. In this Dialog tool, double click on “bldg_pnt”, it will display “Template Properties” dialog inside the Map window and “Construction Tools” with “Point” tool below the “Create Features” dialog, as shown below.

Click “OK” Tab in “Template Properties” dialog to remove it.

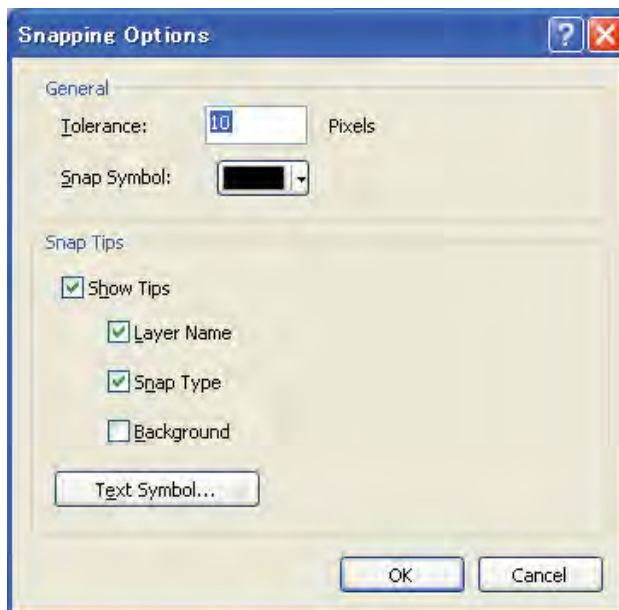




- v) First “Zoom In” the Ortho photo and find the small building locations. Then, click the “Point” Tab in “Construction Tools” and click at the center of small building. In same way, go on adding the other small buildings location as point.
- vi) To select the desired ones, click “Edit Tool” and click “Delete” button from keyboard if desired to delete.
- vii) To save the input work click “Save Edits” from “Editor” pull down menu and to stop the Editing, click “Stop Edits” from “Editor” pull down menu.
- viii) In the same way, practice to input Road in the Shapefile with data type as Polyline and Block boundary in the Shapefile with data type as Polygon.

- **Inputting Road as Line:** *The environment of start of road_lin.shp will look like as below:*

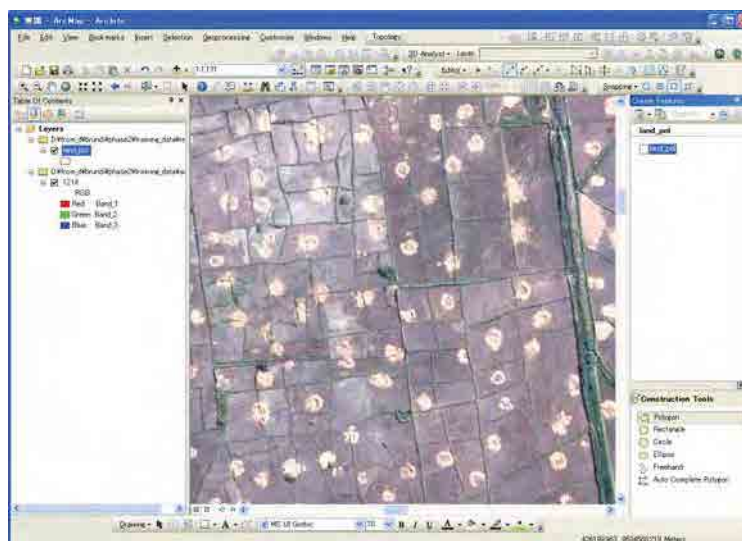


- *Set Snapping distance before start of digitizing, such as below:*



- *In general, “Line” or “Freehand” will required to use to input road. Double click will end the inputting of a road section.*
- *Use the Extend tool  on the Advanced Editing toolbar*
- *Use the Trim tool  on the Advanced Editing toolbar*

- **Land Parcel as Polygon:** *The environment of start of road_lin.shp will look like as below:*



- *Set Snapping distance before start of digitizing, such as mentioned earlier.*
- *Use auto complete polygon tool to digitize adjacent polygon.*

Session 9: Viewing Layers of this Project and Creation of Schema for GIS Database

There are about 169 types (for 1:5,000 scale maps) and about 156 types (for 1:25,000 scale maps) of layers used to compile the Topographic Maps of this Project. All layers need to go through layers to determine about the way for their grouping so that the schema for GIS database can be created.

In general, there is not rigid rule for how many layers or which layers need to be included in a group (put in one Shapefile). However, it is kept in mind that the layers with similar data types can only be grouped together. Thus, a polygon layer can be grouped with polygon or line layer with line or point layer with point. Furthermore, the layers of similar categories would be better grouped together. For instance, polygon layer of vegetation category better be grouped with the polygon layers of same category. Contour layers having elevation information better be treated separately. Considering these points, Table below presents a possible way for grouping the 169 layers (of 1: 5,000 scale maps) into 23 Shape files and 156 layers (of 1:25,000 scale maps) into 21 shape files.

Session 10: Converting CAD Data to Shapefile

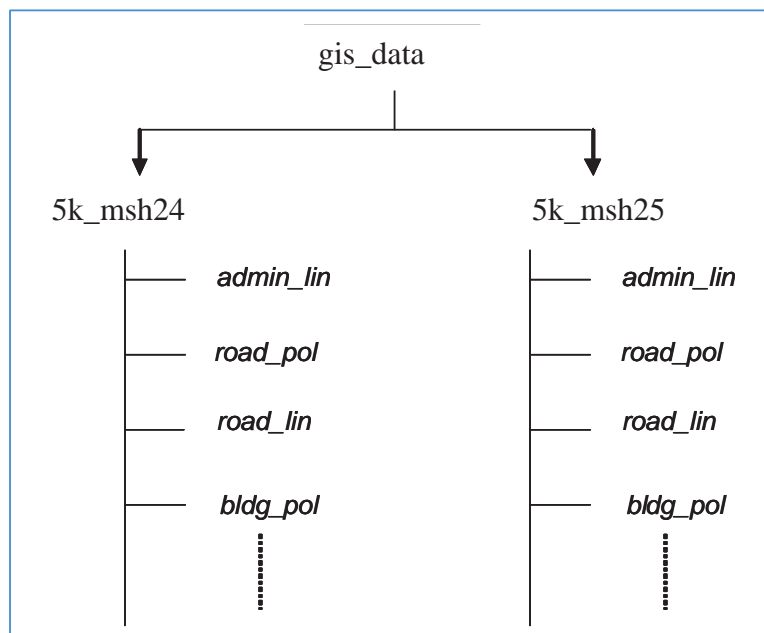
This includes the exercise on steps of converting the CAD data of this Project into Shapefile.

Data for the Practice: CAD data of map sheets 24, 25, 26, 27 as *dwg* file (*24.dwg*, *25.dwg*, *26.dwg*, and *27.dwg*).

There are, two ways of conversion are presented below, with some of steps in 2nd being modified. Follow the following steps:

Procedure I:

- 1) Over viewing of the GIS layer of JICA Project (that mentioned in **Session 9**)
- 2) Formulation of Files and their structure considering following points:
 - Arrangement of layers into shape files
 - Naming of shape files
 - Creation of Folder/ File Structure, for instance as presented below:



3) Creating Shape files with following schema; For example:

i) Shape file - *road_pol.shp*



A screenshot of a software window titled 'Table' showing the schema for a shapefile named 'road_pol'. The table has the following columns: FID, Shape *, code, layer_des, perimeter, area, and remark. The 'Shape *' column is highlighted in blue. Below the table, there are navigation icons and a status bar indicating '(0 out of 0 Selected)'. The file name 'road_pol!' is visible in the bottom-left corner of the window.

FID	Shape *	code	layer_des	perimeter	area	remark
-----	---------	------	-----------	-----------	------	--------

ii) For shape file - *road_lin.shp*



A screenshot of a software window titled 'Table' showing the schema for a shapefile named 'road_lin'. The table has the following columns: FID, Shape *, code, layer_des, length, and remark. The 'Shape *' column is highlighted in blue. Below the table, there are navigation icons and a status bar indicating '(0 out of 0 Selected)'. The file name 'road_lin!' is visible in the bottom-left corner of the window.

FID	Shape *	code	layer_des	length	remark
-----	---------	------	-----------	--------	--------

iii) For Shape file - *bldg_pnt.shp*



A screenshot of a software window titled 'Table' showing the schema for a shapefile named 'road_pnt'. The table has the following columns: FID, Shape *, code, layer_des, and remark. The 'Shape *' column is highlighted in blue. Below the table, there are navigation icons and a status bar indicating '(0 out of 0 Selected)'. The file name 'road_pnt!' is visible in the bottom-left corner of the window.

FID	Shape *	code	layer_des	remark
-----	---------	------	-----------	--------

iv) For Shape file - *cont_lin.shp*



A screenshot of a software window titled 'Table' showing the schema for a shapefile named 'contl_lin'. The table has the following columns: FID, Shape *, code, layer_des, elevation, length, and remark. The 'Shape *' column is highlighted in blue. Below the table, there are navigation icons and a status bar indicating '(0 out of 0 Selected)'. The file name 'contl_lin!' is visible in the bottom-left corner of the window.

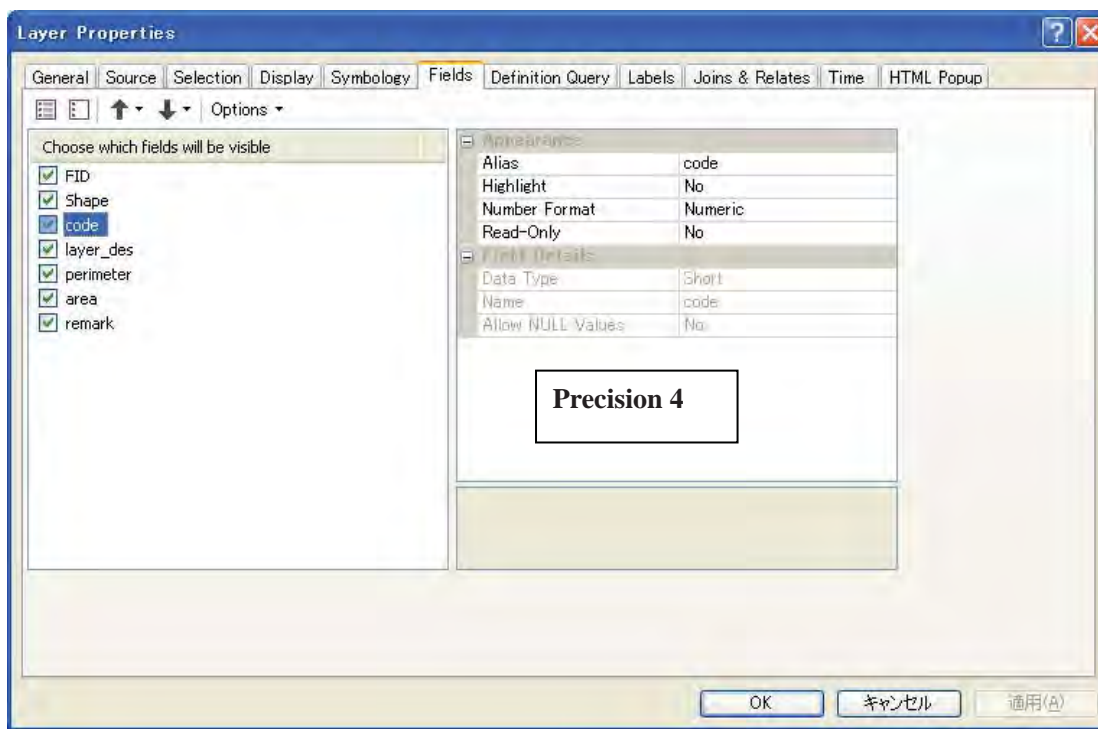
FID	Shape *	code	layer_des	elevation	length	remark
-----	---------	------	-----------	-----------	--------	--------

v) For Shape file - *contl_pnt.shp*

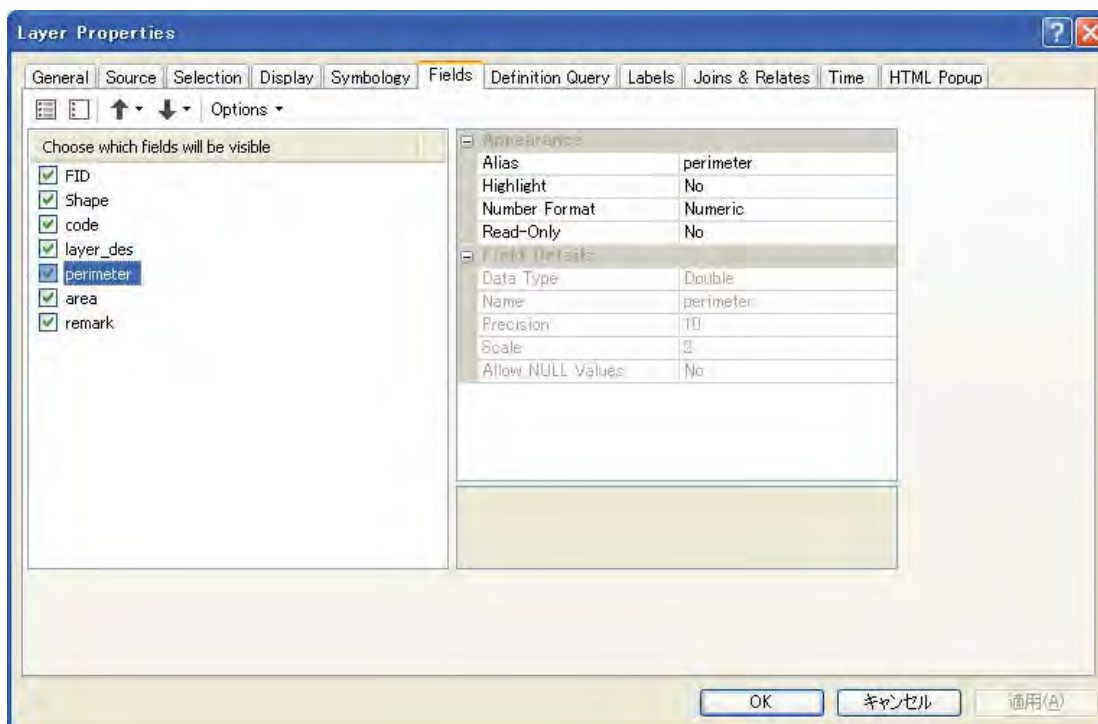


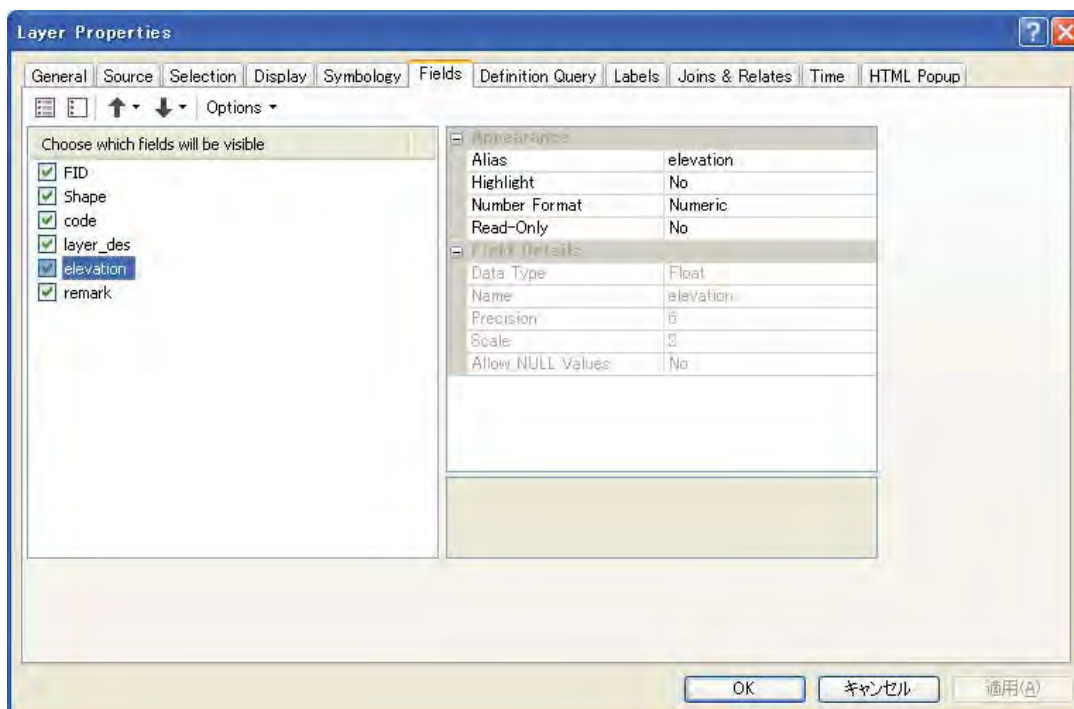
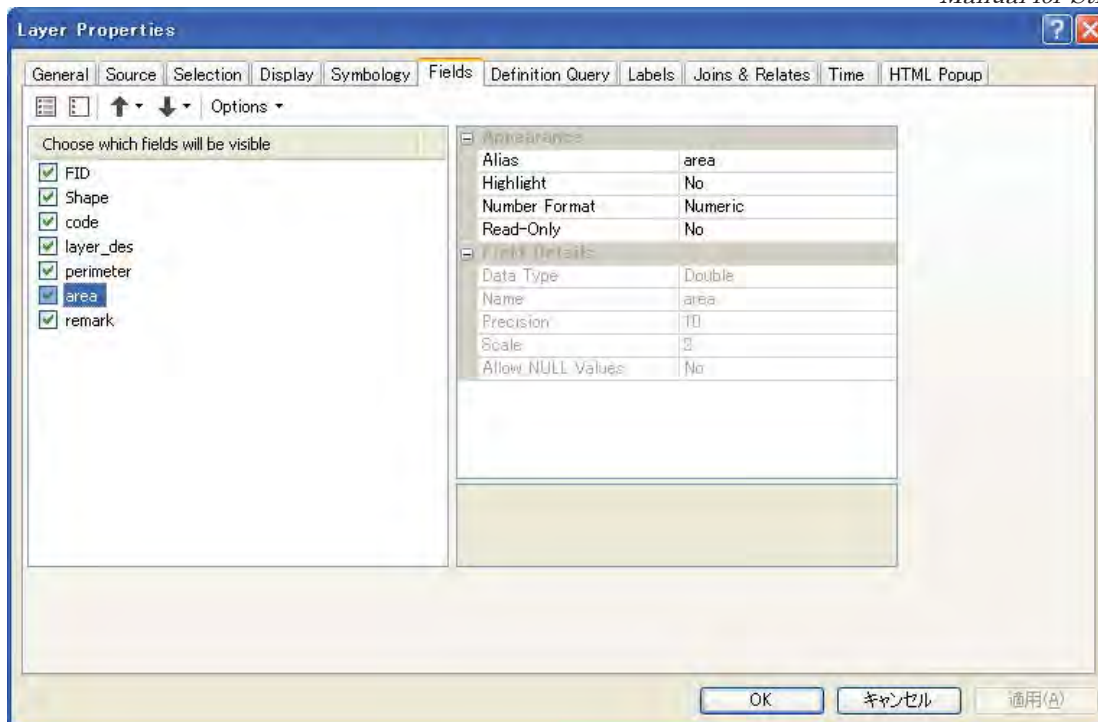
A screenshot of a software window titled 'Table' showing the schema for a shapefile named 'contp_pnt'. The table has the following columns: FID, Shape *, code, layer_des, elevation, and remark. The 'Shape *' column is highlighted in blue. Below the table, there are navigation icons and a status bar indicating '(0 out of 0 Selected)'. The file name 'contp_pnt!' is visible in the bottom-left corner of the window.

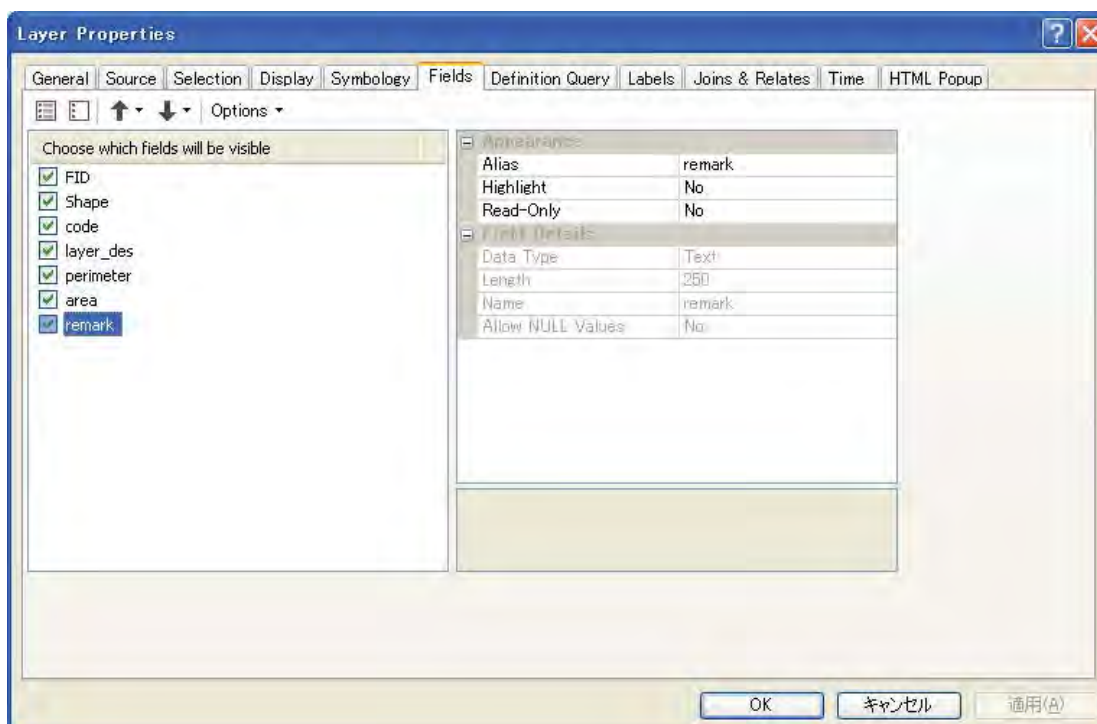
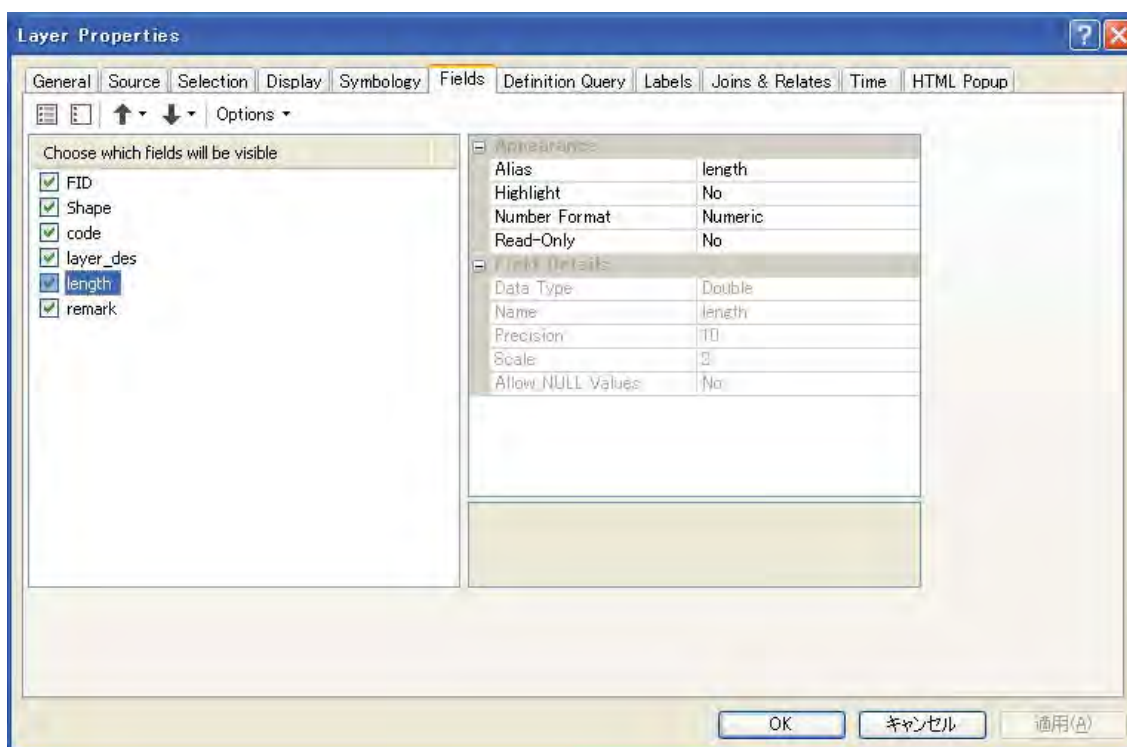
FID	Shape *	code	layer_des	elevation	remark
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Description of included fields:







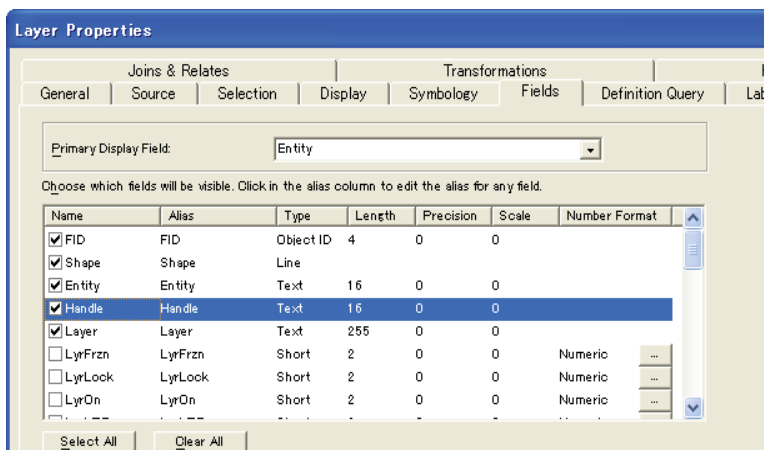
- Create above five (5) shape files with columns other than FID and Shape similar to as mentioned.
- Define Projection as designated for this JICA Project.
- Then copy the file to similar one and rename it as desired.

- Thus, create whole set of shape files for one map sheet.
- Copy the whole set of shape files to another map sheet.

4) Displaying CAD file and preparing it for conversion.

- Display CAD file.
- Check the layers off by displaying “Layer Properties” window and then clicking “Fields” menu.

Note: As the field ‘Elevation’ is required for contour line and control points data, need to check on this field, too.



- Save the above file to a temporary shape file (for working purpose) by selecting “Data” and then “Data Export” in the “Data Frame Window”.
- Define projection of this Shape file.
- Display this new shape file. Add the required columns as in schema of point 3) in the same sequence.
- Transfer / calculate the attribute data in the created column.

5) Transferring data to required shape files:

- Display the required empty shape file.
- Select the required layers in the temporary created shape file.
- Start Editor and first copy the layers from temporary shape file. Then paste to empty file.
- “Save edits” and then “Stop editing”. Thus required shape file will have data.
- In the same way repeat this procedure to save other required layers to other Shapefile.

This will complete the conversion process.

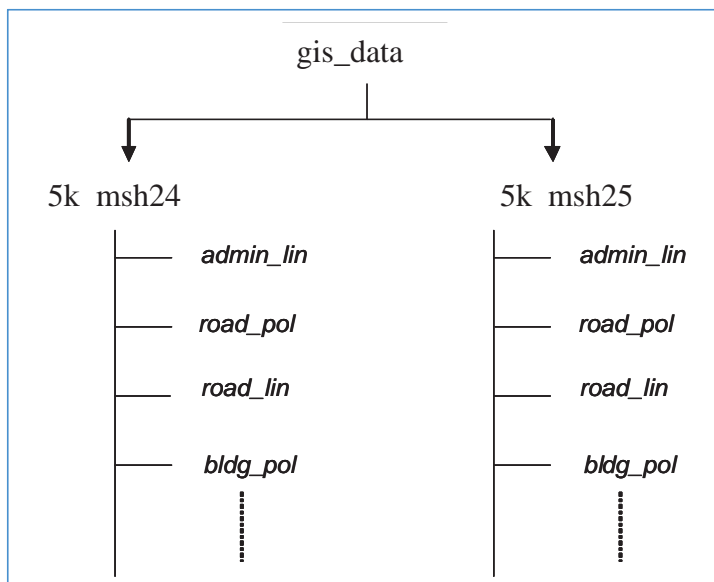
Procedure II (An Alternative Way for Conversion):

Instead of creating empty shape file, after creating the temporary (intermediate) Shapefile with all the required columns, the desired layers can be selected using ‘Definition Query’. This is included in this alternative Procedure.

1) Over viewing of the GIS layer of JICA Project (that mentioned in **Session 9.**)

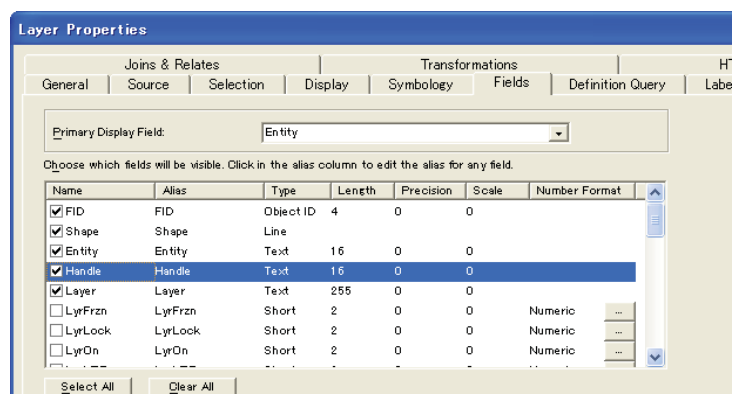
2) Formulation of Files and their structure considering following points:

- Arrangement of layers into shape files (for instance, as in Table 9.1 and Table 9.2)
- Naming of shape files (for instance, as in Table 9.1 and Table 9.2)
- Creation of Folder/ File Structure, for instance as presented below:

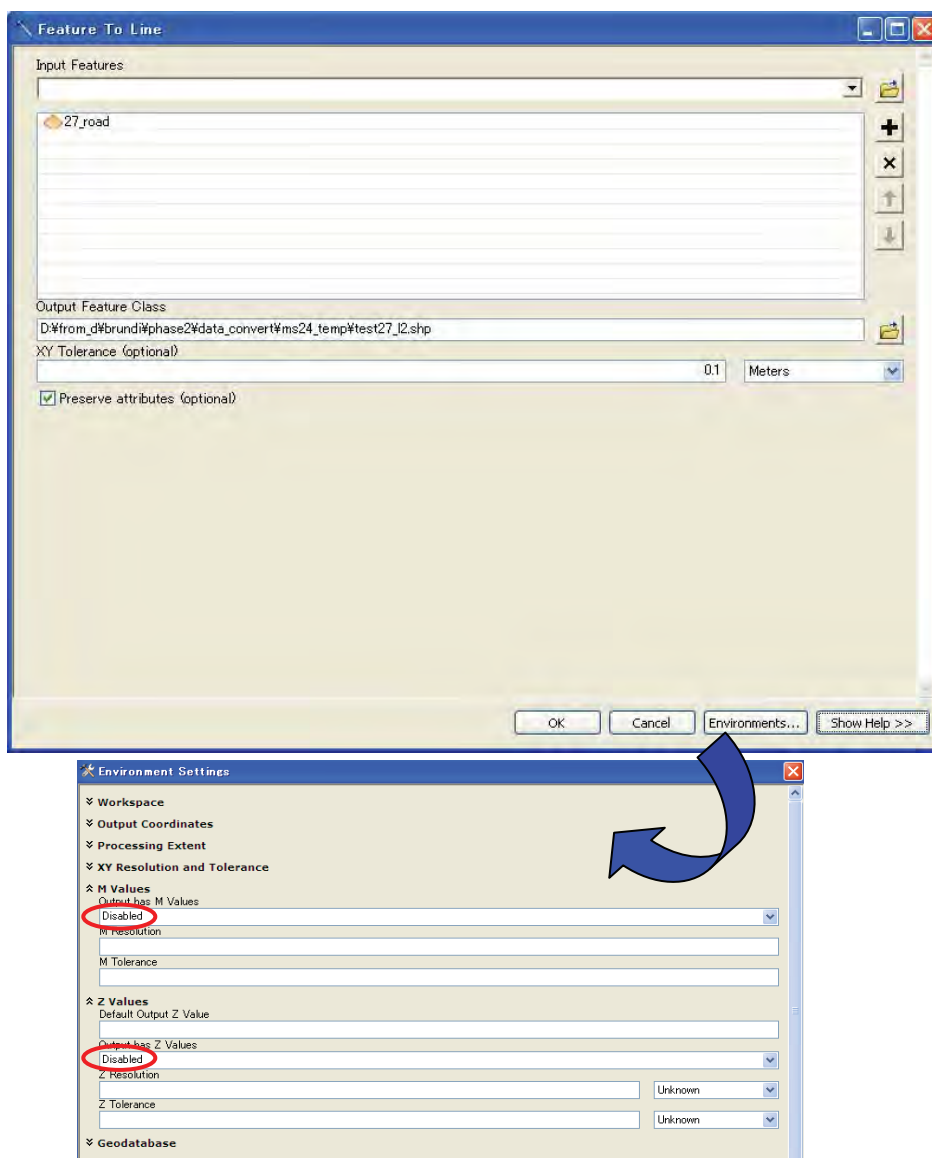


1) Displaying CAD file and preparing it for conversion.

- Display CAD file; Point / Polyline / Polygon
- Check the layers off by displaying “Layer Properties” window and then clicking “Fields” menu and ‘Check off’ the undesirable Fields. **(Keep the fields such as, FID, Shape, Layer, Identity, Handle, Color, and Elevation Checked On).**



- Export the data to Save As new Shapefile.
- Define the Projection of this Project
- **Convert Polyline ZM to Polyline:** For this click ArctoolsBox – Data Management Tools – Features – Feature to Line (if the above saved Shapefile is Line Feature). Similarly, need to choose Feature if Shapefile is Point and Feature to Polygon if Shapefile is Polygon. Disable Z and M values in the environment as shown below.



- Add the required Columns as follows:
 - For Point feature: Code, Layer_des, Elevation, Remark
 - For Line feature: Code, Layer_des, Elevation, Length, Remark.
 - For Polygon Feature: Code, Layer_des, Perimeter, Area, Remark
- Now, check off the other fields other than above plus FID and Shape.
- Select the features using 'Definition Query' in 'Layer Properties' and then Export to save to the designated Shape File name.