สำนักงานวิทยทรัพยากร จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER V

FIELD DATA COLLECTION

This chapter provides procedural guidelines for field data collection. Experimental results will be presented with details, involving 5 sections: Location Referencing Point (LRP) feature, Road Inventory, Road Condition, Bridge Inventory, and Bridge Condition. The system named Inspection Roadway Inventory System (IRIS) provides a touch-screen interface on a PDA (Personal Digital Assistant) to record the information of roadway inventory and conditions.

5.1 Field Data Collection

Mapping elements on roadway inventory was one of the objectives of this study as part of the field test of the digital data capture technique. The mapping practice was carried out in Road Number 13N in Lao PDR from Vientiane to Laungprabang province with the length about 400 kilometers. The initial intention was to carry out a set of road inventory element on the mapping. Elements on road mapping for roadway inventory were carried out to create a point feature as well as roads and bridges databases.

According to the methodology of Linear Location Referencing System (LRS), all of samples are recorded from Lao PDR (National Rd No 13N) and all selected links are recorded twice, one for road inventory and the other for road condition. The procedures are as follows:

(1) Create point feature and setup the LRP and bridge maker on the based map. Input general attributes data for point feature and setup LRP symbology. In this research, two types of attributes data are recorded i.e. roadway inventory and other road element conditions.

(2) Record the general road inventory attributes data such as road id, link id, segment id, surface types, number of lane, lane width, etc. along the roadway (1,000 meters/segment). In addition, if applicable, record bridge inventory and bridge condition data at the same time.

(3) Record road condition attributes data such as pavement, side drain, culvert, slope, road furniture, and right of way (ROW). The score rating methodology is used to evaluate road element conditions along the roadway (200 meters/segment).

(4) Capture the environment of road elements by digital camera.

For the above tasks, road inventory and road condition were recorded for a 10 km portion of the national road (Rd No 13N).

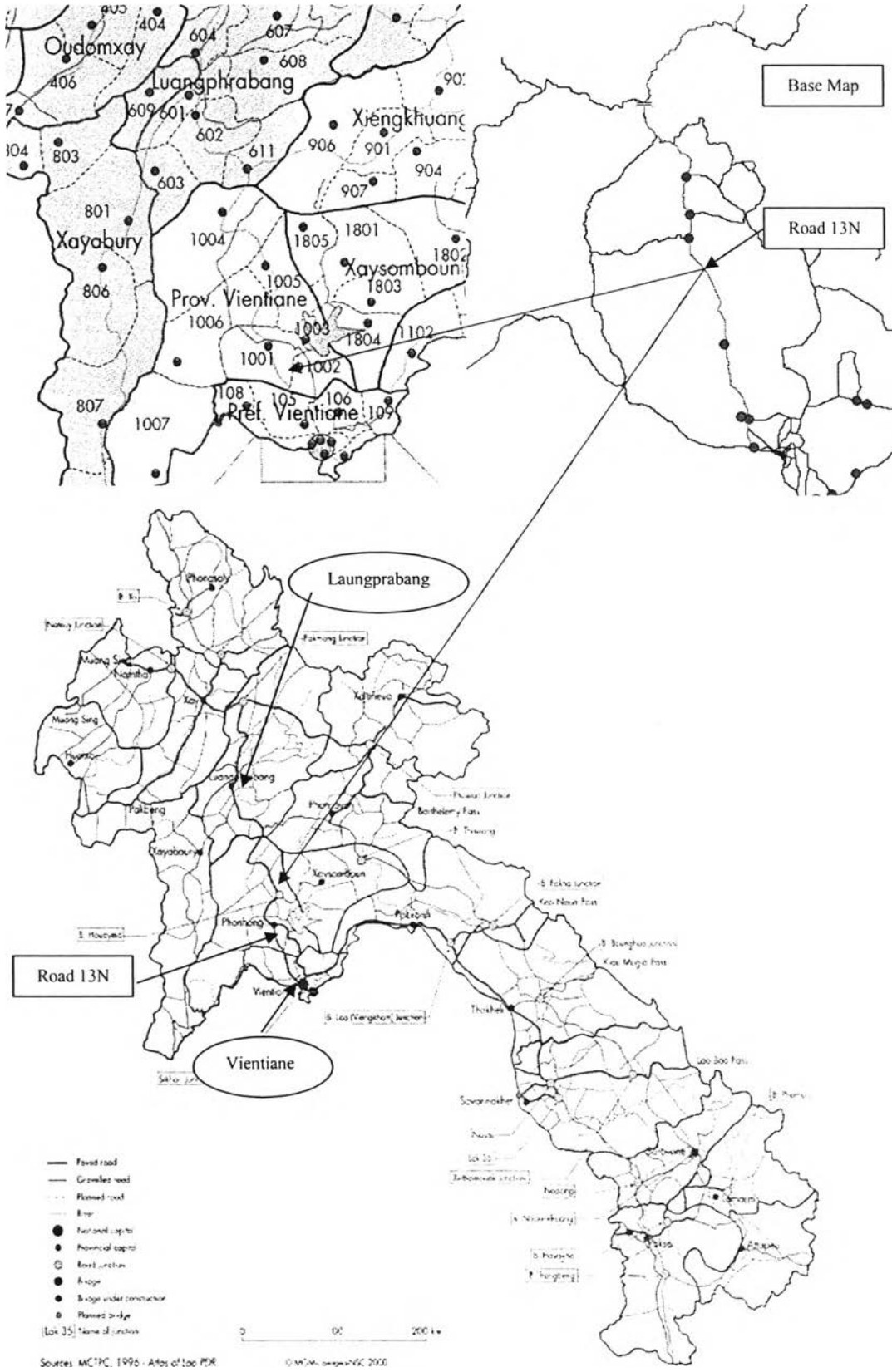


Figure 5.1 Location of Field Data Collection on Road No 13N in Lao PDR

Source: http://www.seasite.niu.edu/Lao/Lao_maps/provinceslarge.htm

5.2 Data Collection Procedure

5.2.1 Before Data Collection

Procedures for data collection can be summarized as follows.

(1) Before going to field location, all equipment must be checked. Make sure that they function properly for field data inspection.

(2) Started ArcPad on the PDA. Two types of data collection are considered: road inventory and road condition.

(3) Load Laos road inventory map layer, tap the Open Map icon, then choose the Laos road inventory map, tap add layer and add all layers that were created, choose the layer that is related to the data types being collected.

(4) Connect GPS receiver to ArcPad. Tap GPS icon to receive the current position from the GPS receiver.

(5) In this case, the road inventory in the Laos road inventory map was chosen. On the national road network, one segment is used for every 1,000 meters along the roadway.

(6) Record by tapping the select icon and select the road segment on the map.Tap attribute icon and edit form will display information for the road inventory recorded.

(7) An optional digital camera to capture the views of roadway inventories and their surrounding right-of-way environment.

5.2.2 Post Processing

(1) After each day of data collection, data should be transferred to a computer

(2) Files that need to be transferred from the ArcPad application folder on the PDA are: RoadInventory.dbf, RoadInventory.shp, and RoadInventory.shx. These files contain the road inventory attribute and location data collected.

(3) Before returning to the field for a new data collection, a clean (with no data) set of the above three files must be copied to replace the same files in the ArcPad application folder.

(4) At least one backup copy of all data collected should be made and stored in a separate location outside the office building that houses the computer.

(5) If pictures are collected, they should be transferred to the same subfolder as that forRoadInventory.dbf, RoadInventory.shp, and RoadInventory.shx for a particular shift.

(6) At the end of the data collection, data from all subfolders must be combined to create an integrated layer of road inventory and road condition for the whole road inventory system.

It is important to make sure that pictures in the subfolder are for the same road condition recorded in the three shapefiles in the subfolder. Accordingly, the inspector must decide whether to transfer both attribute files and picture files after each shift, not one or the other.

5.3 Data Collection Plan

5.3.1 Data Collection Time

(1) Roadway inventories can be collected during the daylight hours on any day of the year.

(2) Unless a water-proof PDA is used, data collection under rainy condition should be avoided.

(3) Data collection on weekends generally offers the benefit of faster data collection and better safety.

(4) Field data collection started from November, 24- 28, 2005 from Vientiane capital city to Laungprabang Province.

5.3.2 Mode of Travel

For safety during data collection, a van was used because it is considered to be the most convenience and comfortable mode of transportation for traveling from one segment to the next segment.

5.3.3 Initial Field Survey

Before the actual field data collection, it is important that an initial field survey (pilot survey) is conducted to obtain field condition and design the data collection plan that best suited to the study.

The Road No 13N in Lao PDR route was selected because of its varieties in roadway conditions. It was expected that these varying conditions would give an idea of the mobile inspection and installation characteristics for a variety of road environments.

5.4 Data Entry on the National Road (Rd No 13N)

5.4.1 Location Referencing Point

Location referencing points (LRP) are established based on route positions along the road, which can be found by surveyors (km posts, culverts, junctions, electric poles, temples, fuelling stations and bridges). LRPs should be identified to the accuracy of ±2.5 meters or better.

5.4.2 Point Feature Data

The reference of point features can be intersection, end of segment, and post km on the left or right. The point feature symbology will be set on the base map. The point feature form will appear for inputting the attribute of the point feature into the page detail form. Table 5.1 presents the location referencing point data and Figures 5.2 to 5.3 illustrate the point feature and LRP setup forms, as well as the attributes and geographic forms.

Table 5.1 Location Referencing Point Data

General information about point feature survey							
Point feature ID	Road ID	Link ID	Survey ID	Surveyor	Province	District	Date
32	13N	DA	1	khao	Vientiane	Sikhod	23/11/2548
LRP setup							
Link Start	Link End	PF offset	PF types	Photos	PF attribute	Symbology	Geography
0+0000	4+0000	4.000 m	culvert	picture	attributes	Symbol value	X=24899 Y=19898

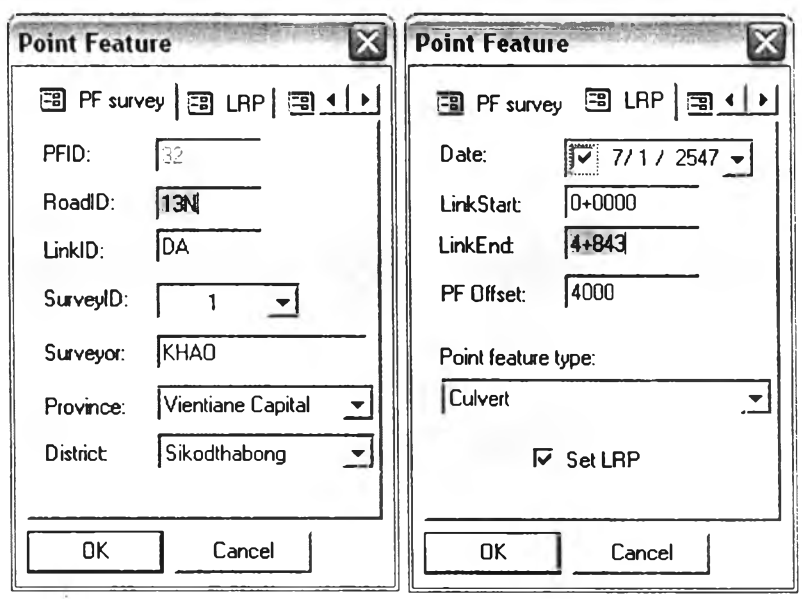


Figure 5.2 Point Feature and LRP Setup Forms

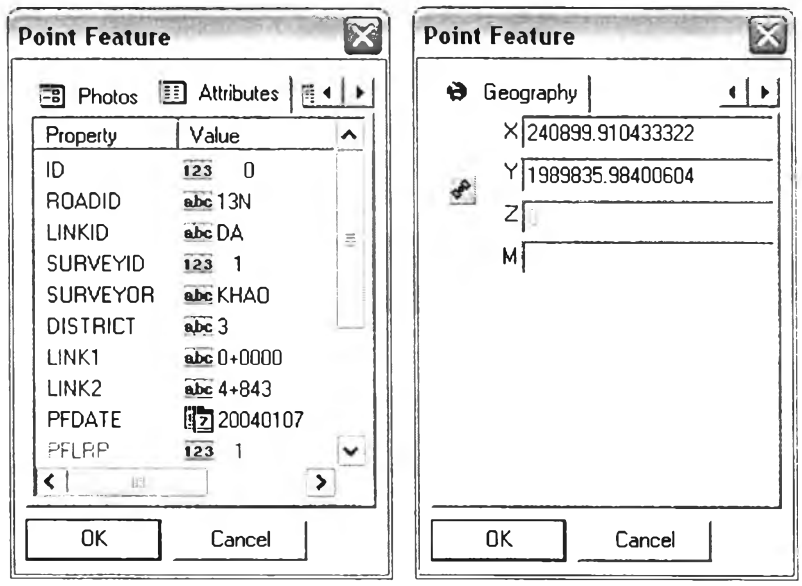


Figure 5.3 Attributes and Geographic Forms

5.4.3 Road Inventory

Road Inventory data such as statistic data will be recorded at every 1,000 meters per segment. A registration can continue as long as the attribute does not change. When reaching a new LRP the registration is reset. The details of the road inventory are shown in the Table 5.2. Figures 5.4 through 5.7 shows examples of corresponding forms.

Table 5.2 Road Inventory Data

General Information of road inventory							
Rd ID	Link ID	Node ID	Segment ID	Province	District	Survey ID	Station start
13N	F	6	1	Veintiane	Vangvieng	1	40+000
General Information of road inventory							
Station end	LRP Start	LRP end	Direction	Date-Inspection	Inspector	Rd No	Road Class
40+4000	11	12	VT-VV	23/11/2548	khao	13N	National
Attributes of road inventory data							
No lanes	Lane width	Surface type	Surface width	Shoulder type	Shoulder width	topology	Description
2 lanes	3. 50 m	Surface treatment	7.00 m	Hard	0. 5m	Flat; if <5m/km	If have

Road inventory History data							
Constraint	Access level	Road project	Road budget	Constructed year	Reconstruct year	Constructed by	Geography
None	Open all years	ADB	Financial	1940	1978	French	X=1234 Y=2345

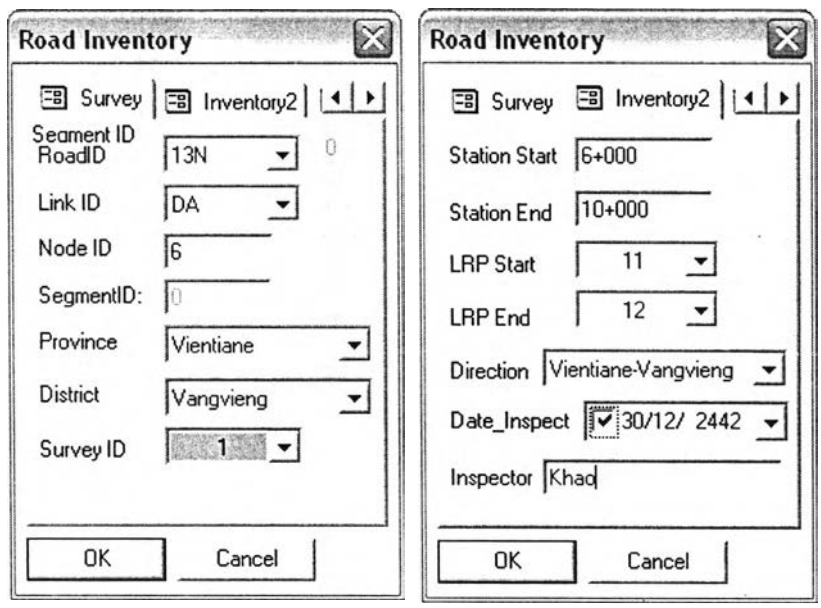


Figure 5.4 General Information Road Inventory Forms

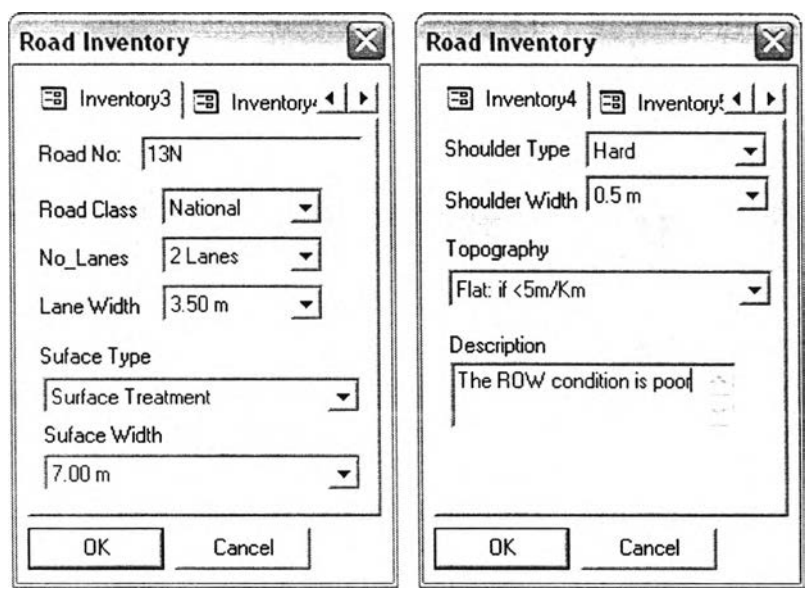


Figure 5.5 Road Inventory Data Forms

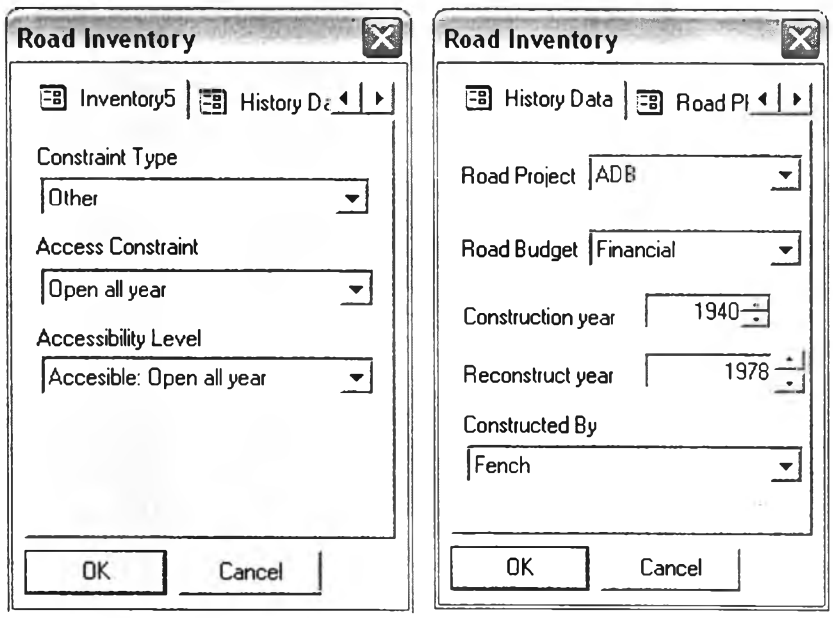


Figure 5.6 Road History Data Forms

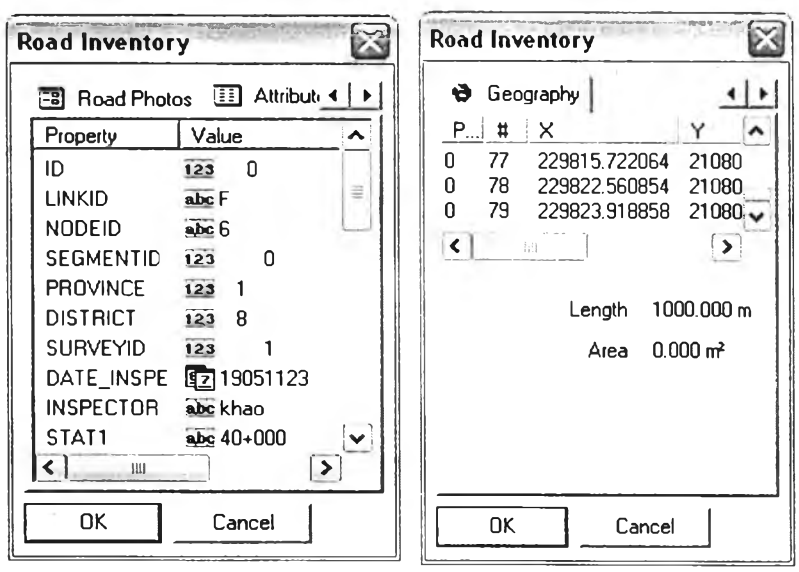


Figure 5.7 Attributes and Geographic Forms

5.4.4 Road Condition

Road Condition data, such as road elements and pavement surface condition, is collected in terms of segments, typically 200 meter intervals. The detail of the road element and road condition survey is shown in Table 5.3.

Table 5.3 Attribute of Road Condition Survey Data

General Information							
Rd ID	Link ID	Segment ID	Station1	Station2	LRP1	LRP2	Survey ID
13N	DA	1	6+200	6+400	1	2	1
Road Element							
Inspection date	Inspector	Pavement	Shoulder	Side drain	Culvert	Slope	Rd furniture
23/11/2548	khao	Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor
Accessibility							
ROW	Access constrain	Constrain types	Access Level	Road collapse	Culvert collapse	Land slide	Road soft
Pavement Condition							
Flushing	Patching	Reveling	Cracking	Potholes	Distegra	Evaluated	Total defect
Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor	Major/ Minor	Good/ Poor/ Bad	40,786
Shoulder, Side Drain and Culvert Condition							
Drop-off	Traverse Erosion	Poor crossfall	vegetation	Drainage needed	Blocked	Eroded	Silted/ blocked
Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting
Slope, Road Furniture, and Right of Way Condition							
Inlet/ outlet	Pipe damage	Slip-uphill	Slip-downhill	Erosion	Guardrail	Sign	Marking
Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting
R-O-W, Attribute and Geography							
Short grass	Long Grass	Bushes	Trees	Description	Symbology	Attribute condition	Geography
Condition Ratting	Condition Ratting	Condition Ratting	Condition Ratting	If have	Symbol value		X=1234 Y=2345

5.4.5 Road Pavement Condition

Figures 5.8 through 5.12 illustrate examples of data input for road pavement conditions.

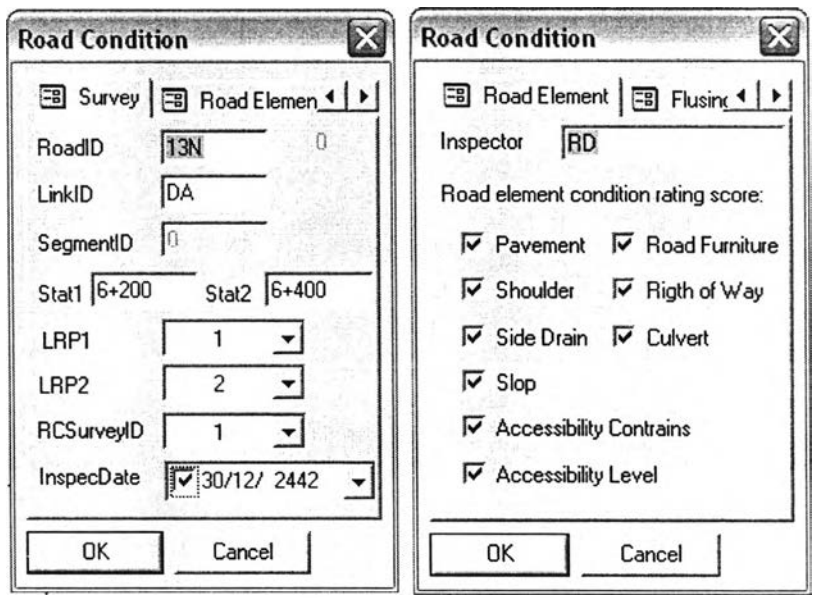


Figure 5.8 Survey and Road Elements Forms

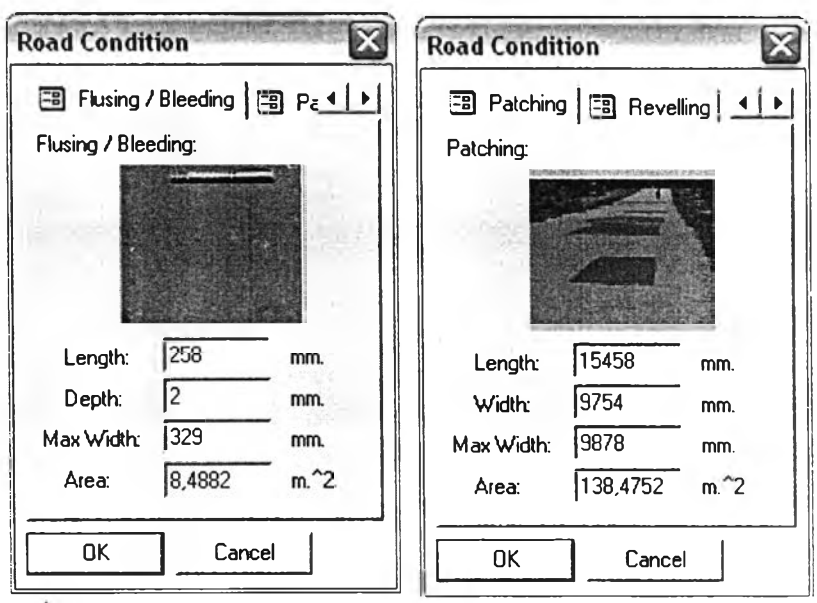


Figure 5.9 Flushing and Reveling Forms

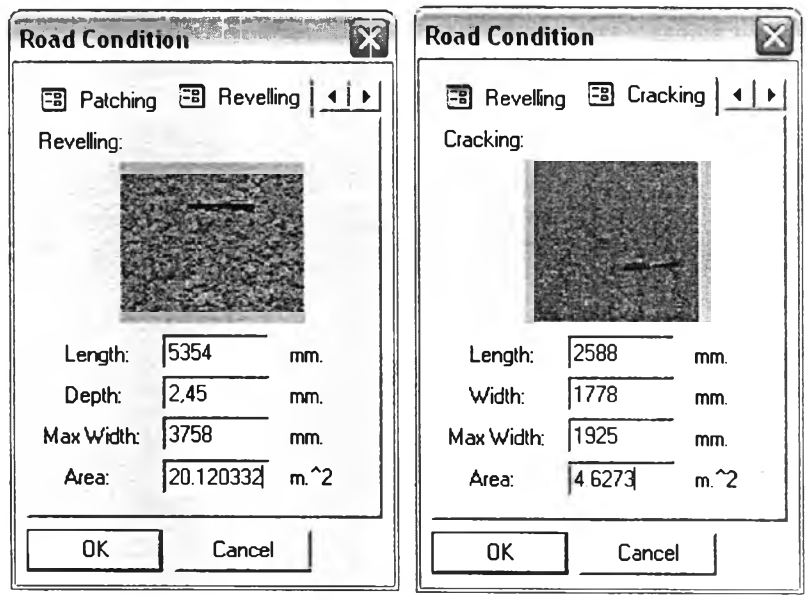


Figure 5.10 Patching and Cracking Forms

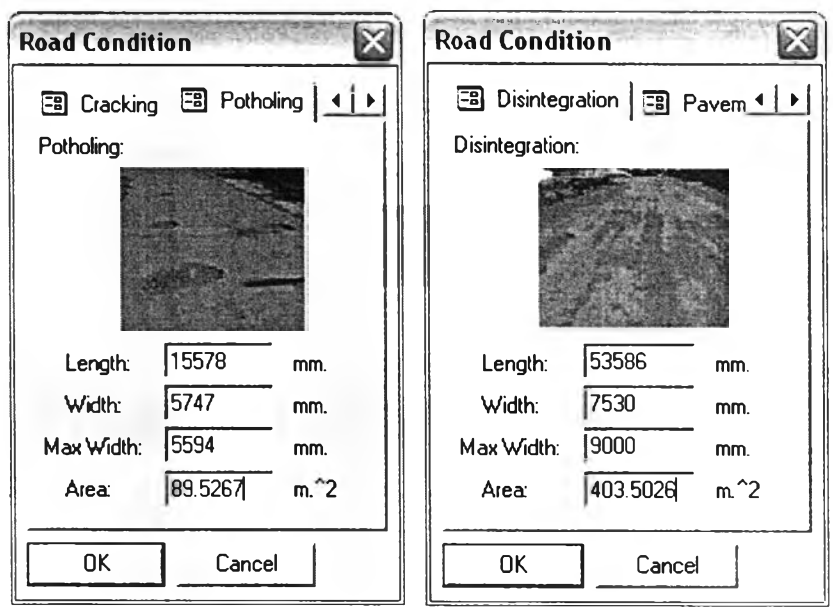


Figure 5.11 Potholing and Disintegration Forms

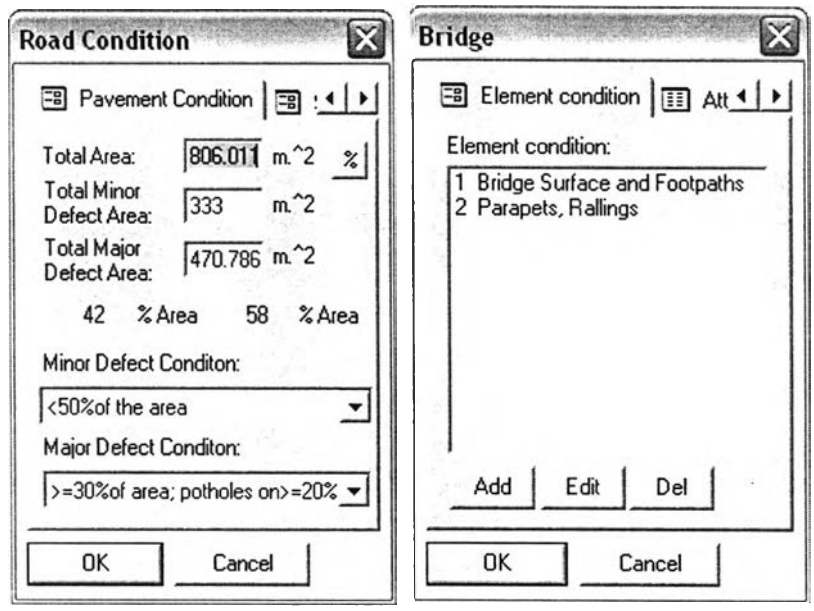


Figure 5.12 Pavement Condition and Editing Data Form

5.4.6 Road Element Condition

Road Element condition consists of shoulder, side drain, culvert, slope, road furniture, and right of way. All of road elements can be recorded together with pavement condition defect. Figures 5.13 through 5.16 illustrate examples of data input for road pavement conditions.

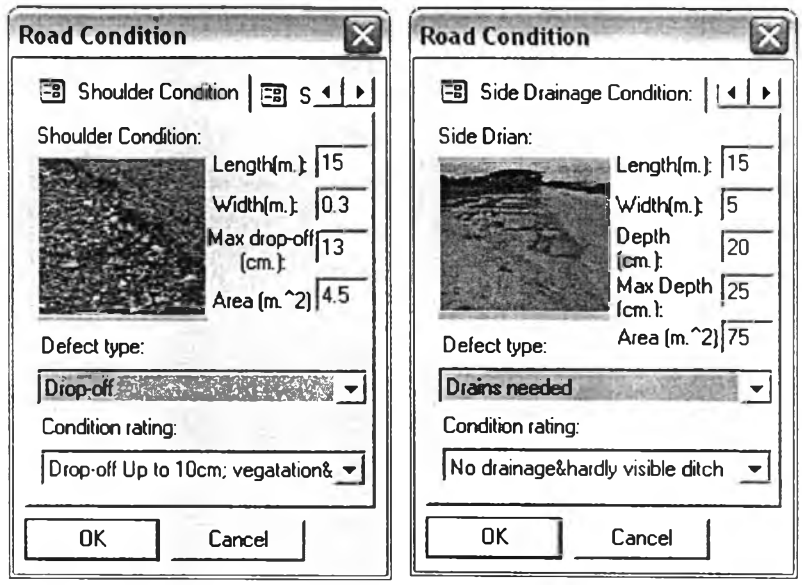


Figure 5.13 Shoulder and Side Drainage Condition Forms

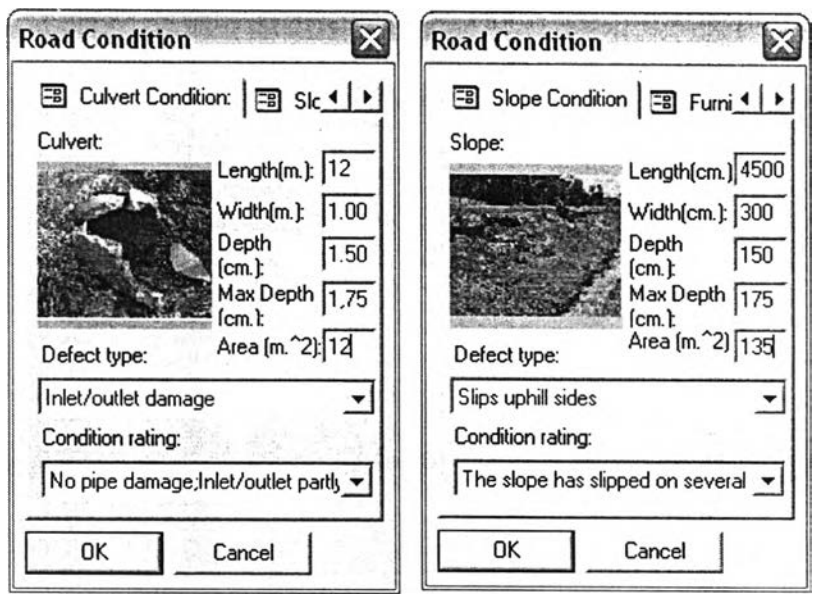


Figure 5.14 Culvert and Slope Condition Forms

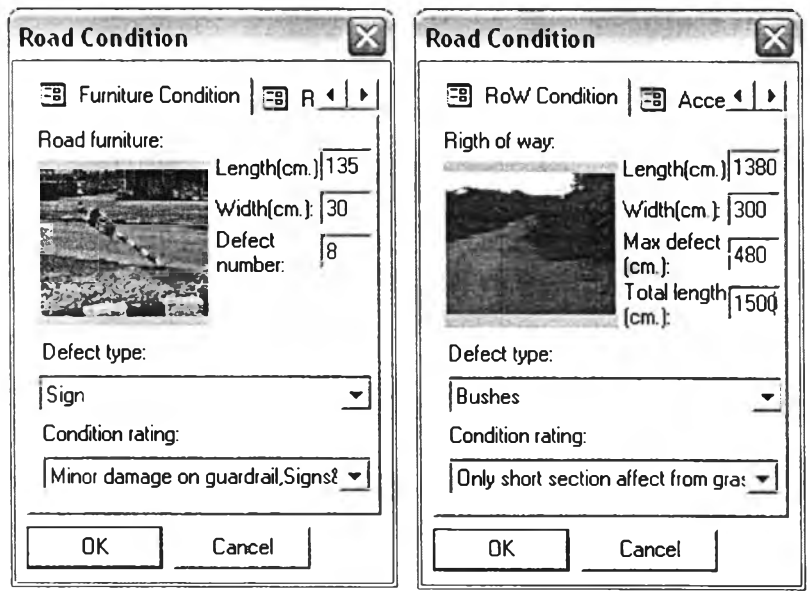


Figure 5.15 Road Furniture and ROW Condition Forms

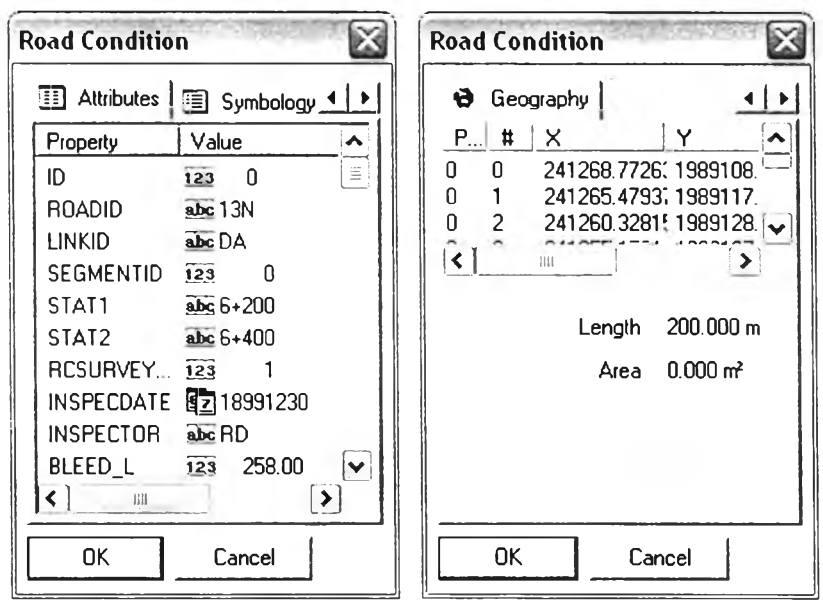


Figure 5.16 Attributes and Geographic Forms

5.4.7 Bridge Inventory and Condition

Bridge inventory and bridge condition can be recorded together from the bridge inventory and condition form. Table 5.4 shows an example of bridge inventory and condition taken during the field data collection. Figures 5.17 through 5.22 illustrate examples of data input for road pavement conditions.

Tables 5.4 Bridge Inventory and Bridge Condition

General Information							
Rd ID	Link ID	Survey ID	Date	Inspector	Bridge Number	Bridge ID	Station Start
13N	DA	1		Bridge	2	3	94+000
General Information							
River name	Bridge Name	Bridge types	Number of span	Bailey Design	Wearing surface		
Nam Lik	Nam Lik	Bailey	0	Double	Asphalt		
Bridge Dimension							
Width (m)	Length (m)	Min.span length	Max.span length	Max.load post	Max.load assess	Construct year	Reconst year
6	100	30	40	40	25	1940	1978
Bridge Elements							
Bridge surface	Parapet bridge	Guardrail on bridge	Drainage on bridge	Expansion joint	Super structure	Abutments	Embank ment
Bridge Elements							
Pier	Bearing	River bed	Other	Donor	Description	Photo paths	Remark
Bridge Condition							
Rd ID	Link ID	Bridge ID	Station Star	Segment ID	Inspection Date	Inspector Name	Inspecti on
13N	DA	3	54 + 000	1	27/11/2548	Khao	Bridge
Weather condition							
Temp	Weather	Next inspection	Remark	Photo	Element condition	Attributes	Geogra phic
34'C	cold	2007	T beam design	Bridge picture	Add/Edit/ Del	Properly Value	X=2179 Y=2062

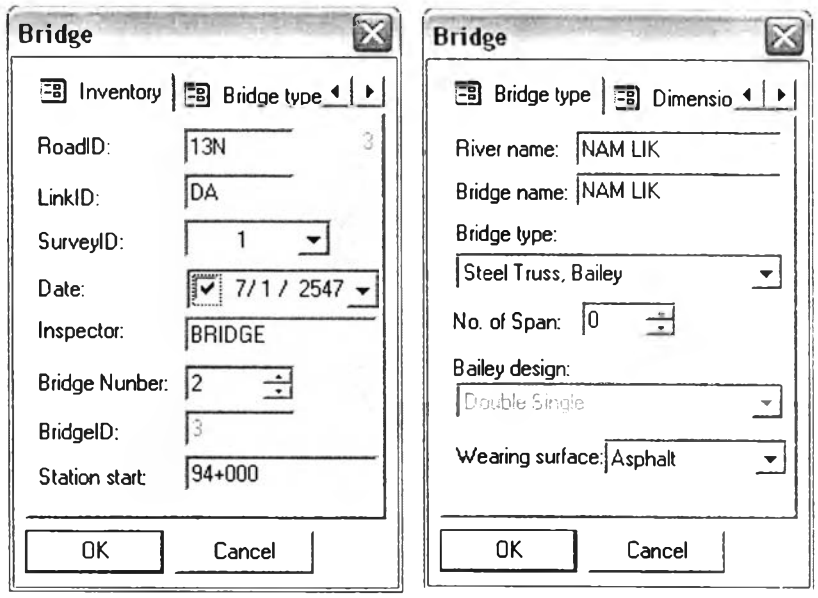


Figure 5.17 General Information Bridge Forms

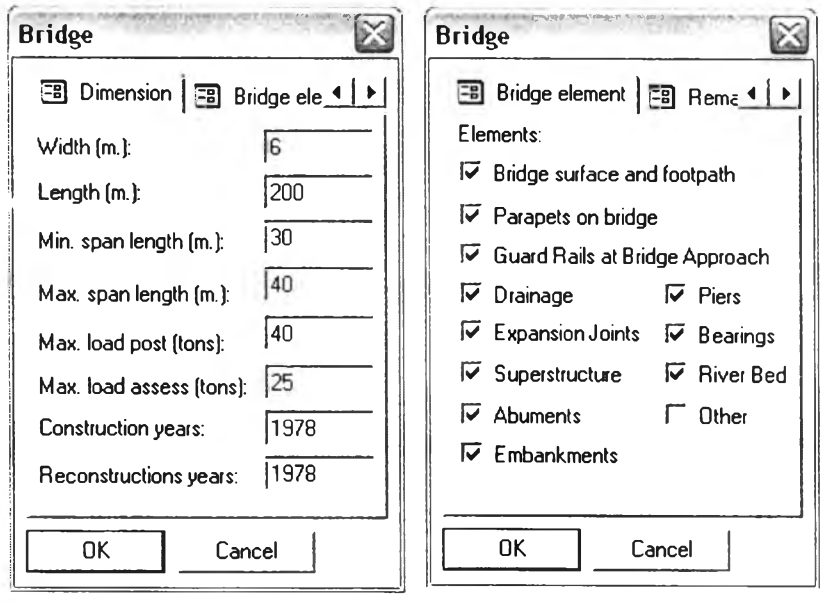


Figure 5.18 Dimension and Bridge Elements Forms

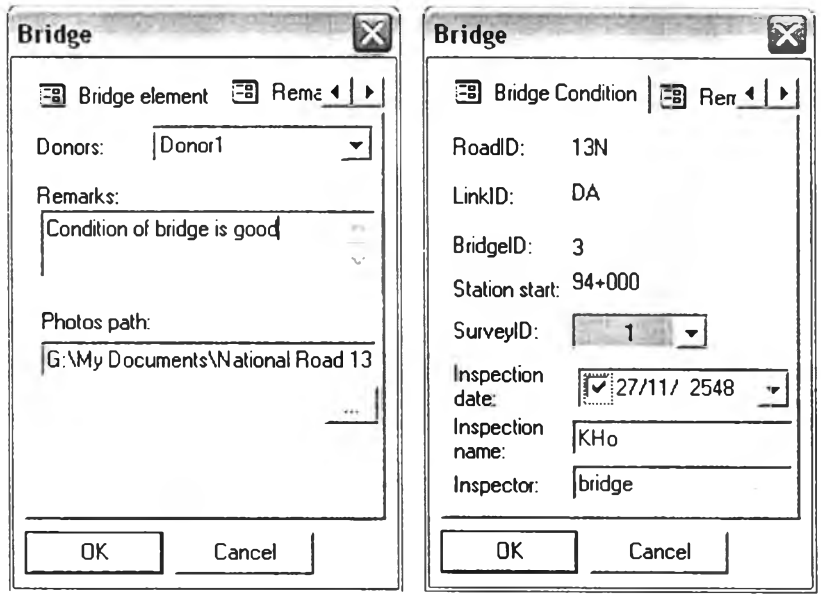


Figure 5.19 Bridge Condition Forms

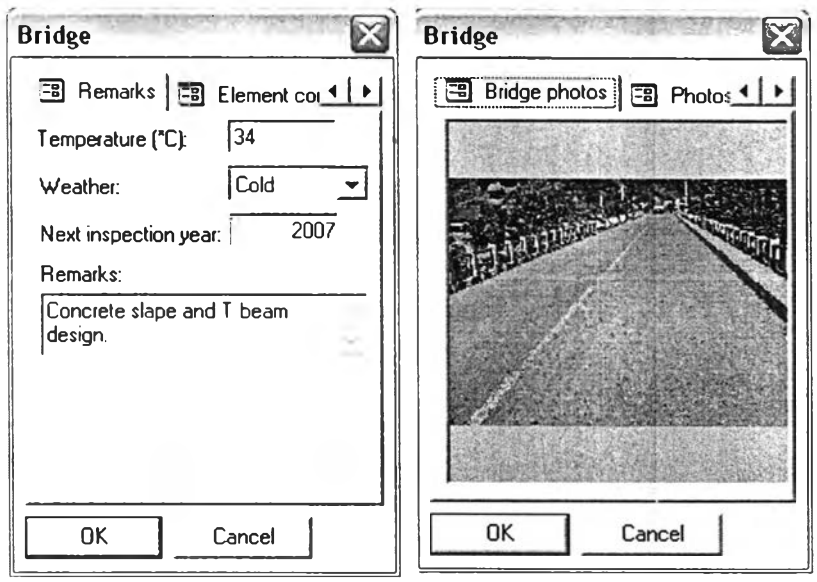


Figure 5.20 Bridge Photo and Remark Forms

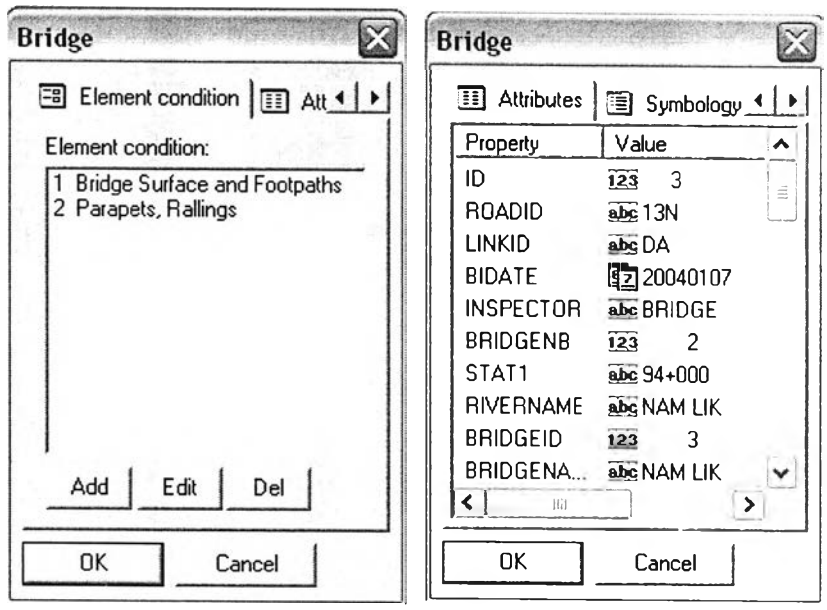


Figure 5.21 Elements Condition and Attributes Forms

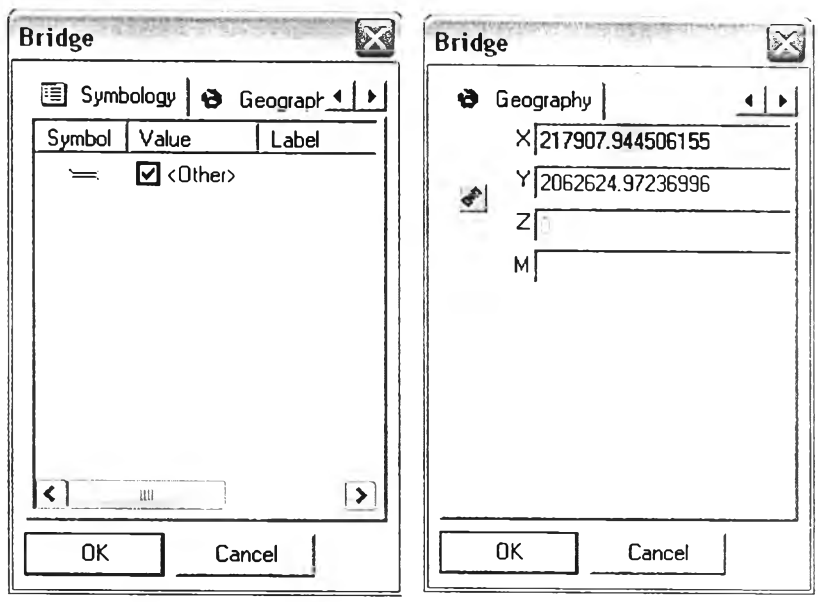
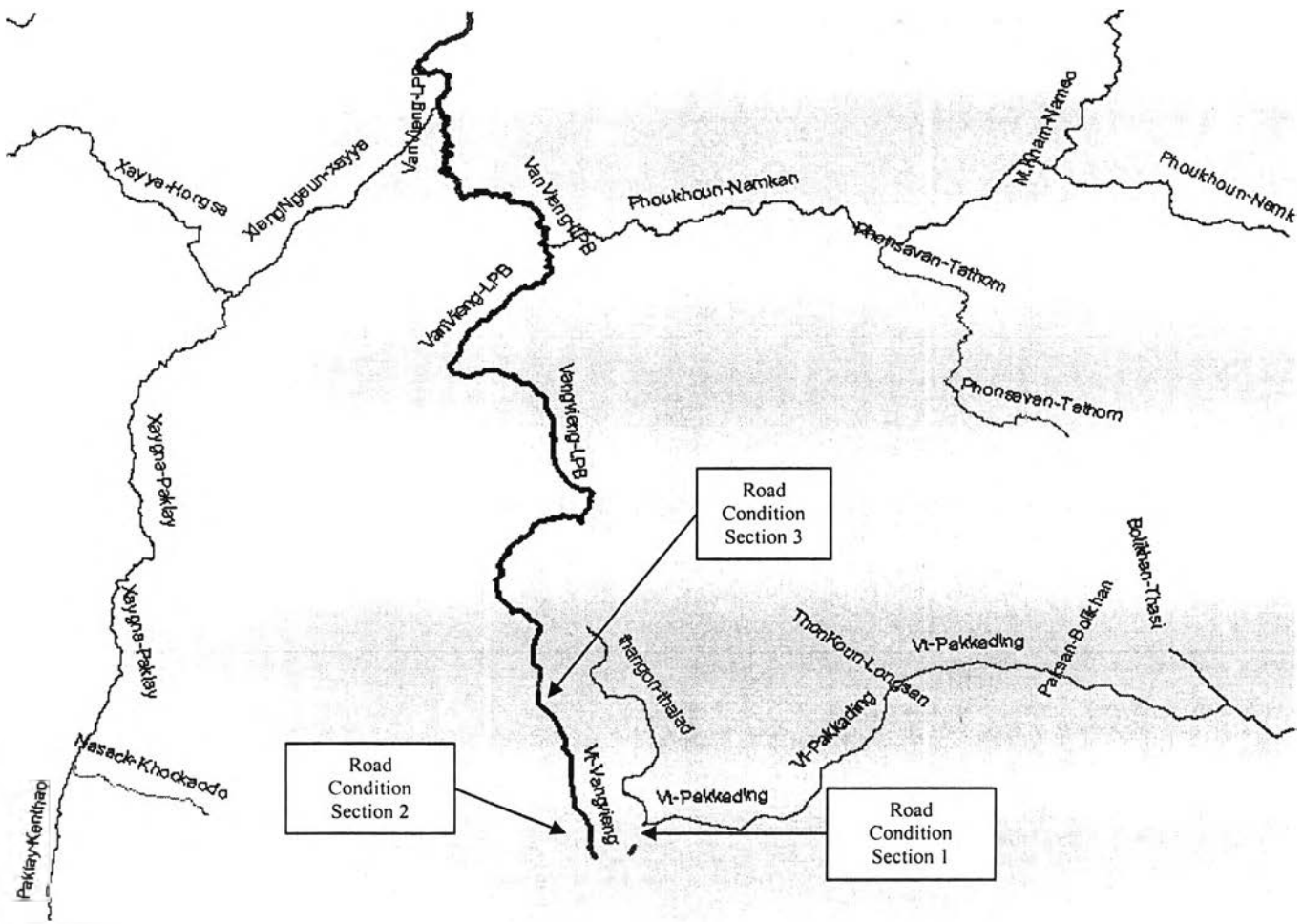


Figure 5.22 Symbology and Geographic Forms


Xayya-Hongsa
XiengNgeun-xayya
VanVieng-LPB
VanVieng-LPB
Phoukhoun-Namkan
M.Kham-Namso
Phoukhoun-Namk
Phonsavan-Tathom
Phonsavan-Tathom
VanVieng-LPB
Vangvieng-LPB
Xaygna-Paklay
Xaygna-Paklay
Nasack-Khockaodo
Paklay-Kenthao
Road Condition Section 3
Road Condition Section 2
Road Condition Section 1
thangon-thalad
Vt-Vangvieng
Vt-Pakkading
Vt-Pakkading
ThonKoun-Longsan
Vt-Pakkading
Paksan-Bolikhan
Bolikhan-Thasi

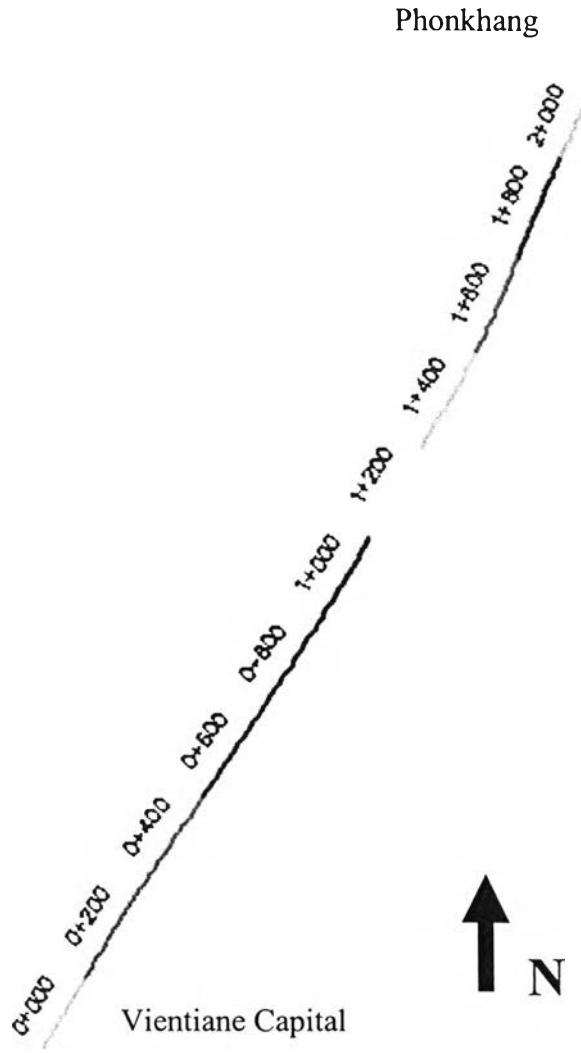


Figure 5.24 Section 1 Road Condition in Vientiane Capital to Phonkang

Table 5.5 Road Condition Defect

Road_No	Stat_start	Sta_end	MN_Area	MJ_Area	MN_cond	MJ_cond
13N	0+000	0+200	0.00	0.00	1	0
!3N	0+200	0+400	0.00	0.00	0	0
13N	0+400	0+600	0.00	0.00	0	0
13N	0+600	0+800	0.00	0.00	1	0
13N	0+800	1+000	0.00	0.00	1	0
13N	1+000	1+200	0.00	0.00	1	0
13N	1+200	1+400	0.00	0.00	1	0
13N	1+400	1+600	0.00	0.00	1	0
13N	1+600	1+800	0.00	0.00	1	0
13N	1+800	2+000	0.00	0.00	1	0

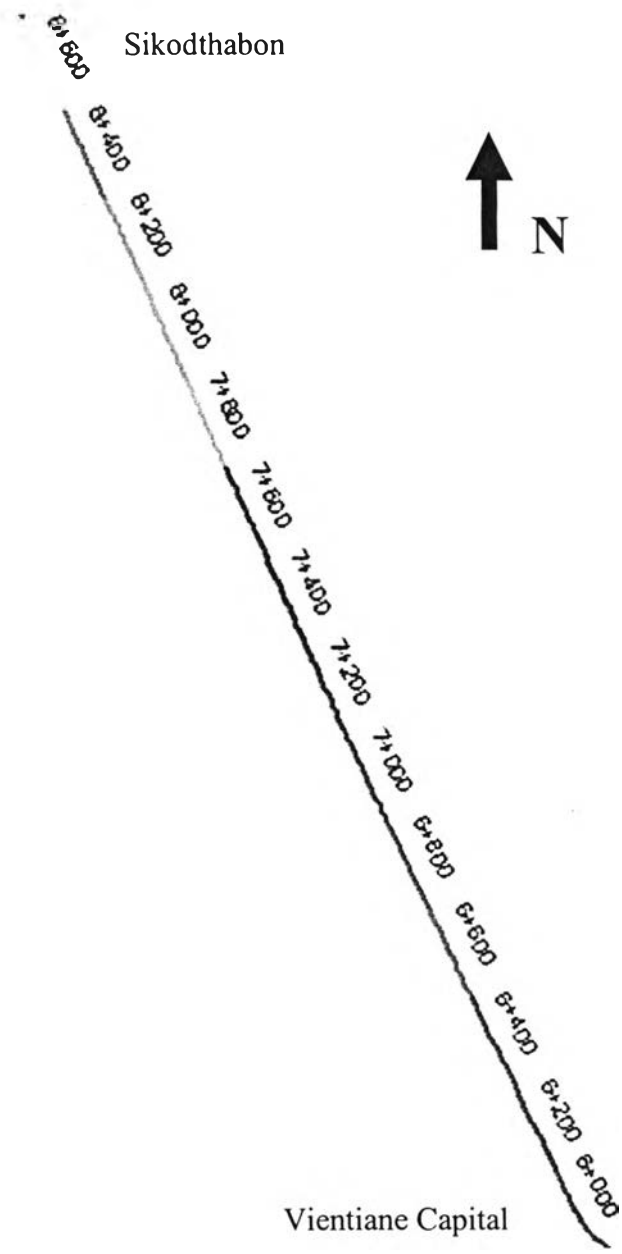


Figure 5.25 Section 2 Road Condition from Vientiane Capital to Sikodthabong District

Table 5.6 Road Condition Defect

Road_No	Stat_start	Sta_end	MN_Area	MJ_Area	MN_cond	MJ_cond
13N	6+000	6+200	30.05	75.40	3	3
!3N	6+200	6+400	57.98	25.34	4	2
13N	6+400	6+600	6.79	24.58	3	4
13N	6+600	6+800	22.06	4.46	4	3
13N	6+800	7+000	0.00	3.67	0	0
13N	7+000	7+200	0.00	0.00	0	0
13N	7+200	7+400	7.01	7.25	3	3
13N	7+400	7+600	20.06	6.92	4	3
13N	7+600	7+800	12.68	20.77	2	2
13N	7+800	8+000	18.53	19.35	2	2
13N	8+000	8+200	22.62	14.83	2	2
13N	8+200	8+400	21.12	18.80	2	2
13N	8+400	8+600	0.00	0.00	0	0
13N	8+600	8+800	0.00	0.00	1	0
13N	8+800	9+000	0.00	0.00	1	0
13N	9+000	9+200	0.00	0.00	1	0
13N	9+200	9+400	0.00	0.00	1	0
13N	9+400	9+600	0.00	0.00	1	0
13N	9+600	9+800	0.00	0.00	1	0
13N	9+800	10+000	0.00	0.00	1	0
13N	10+000	10+200	0.00	0.00	1	0
13N	10+200	10+400	0.00	0.00	1	0

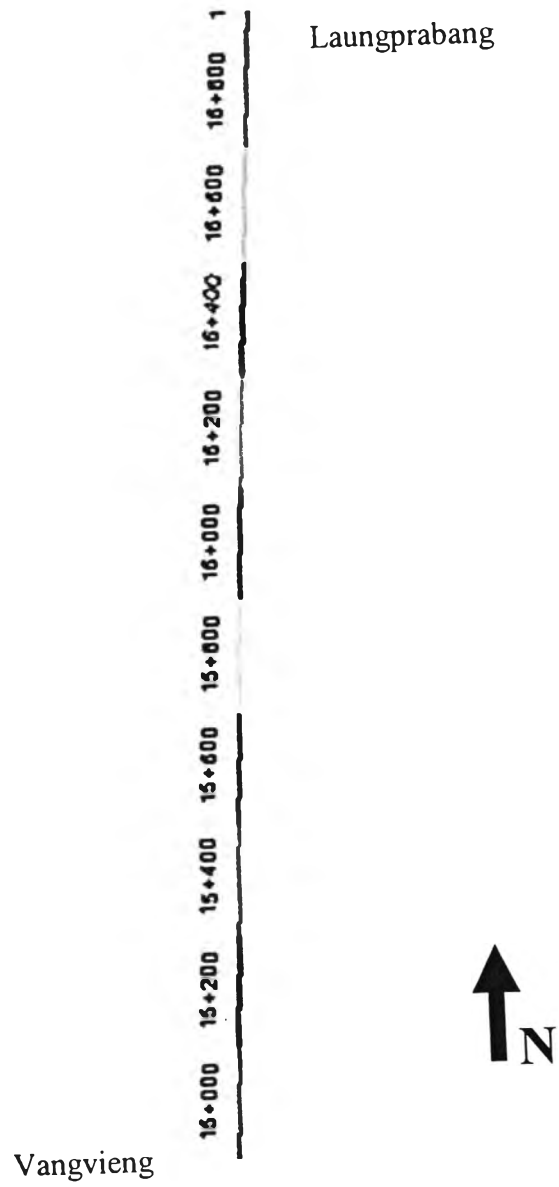


Figure 5.26 Section 3 Road Condition from Vangvieng to Laungprabang

Table 5.7 Road Condition Defect

Road_No	Stat_start	Sta_end	MN_Area	MJ_Area	MN_cond	MJ_cond
13N	15+000	15+200	36.01	19.07	4	2
13N	15+200	15+400	25.20	18.03	2	2
13N	15+400	15+600	21.75	14.56	2	1
13N	15+600	15+800	23.51	18.38	2	2
13N	15+800	15+000	23.57	18.49	2	2
13N	16+000	16+200	16.70	19.76	2	2
13N	16+200	16+400	36.96	25.96	2	2
13N	16+400	16+600	34.31	31.99	2	2
13N	16+600	16+800	32.87	12.93	2	2
13N	16+800	17+000	28.30	17.42	2	2
13N	17+000	17+200	29.52	24.34	2	2
13N	17+200	17+400	15.24	27.95	2	2
13N	17+400	17+600	25.67	22.61	2	2
13N	17+600	17+800	30.97	25.54	2	2
13N	18+800	18+000	20.41	27.20	2	2
13N	18+000	18+200	34.43	35.52	2	2
13N	18+200	18+400	12.57	30.10	2	2
13N	18+400	18+600	20.61	30.45	2	2
13N	18+600	18+800	27.57	26.59	2	2
13N	18+800	19+000	22.52	29.28	2	2
13N	19+000	19+200	22.33	23.94	2	2
13N	19+200	19+400	18.52	28.72	2	2
13N	19+400	19+600	21.31	22.18	2	2
13N	19+600	19+800	27.34	28.76	2	2
13N	19+800	20+000	26.15	32.77	2	2
13N	20+000	20+200	20.02	28.94	2	2

For the full detail attributes data collection tables of road inventory and condition in each section you can see on the appendices in the last part of this thesis.