Government of the People's Republic of Bangladesh
Ministry of Communications
Roads and Highways Department

PAVEMENT INVENTORY SURVEY MANUAL

MAY 2005

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APPENDICES

1. INTRODUCTION

Data collection is one task amongst many in the overall process of managing roads. It is an expensive and time-consuming task that needs to be properly planned and managed. It is essential that the data be:

- Relevant to the decisions that must be taken
- Affordable in terms of cost and human resources
- Collectable i.e. physically feasible and reasonably convenient

Above all, the data collection routines must be sustainable, i.e. 'doable' year after year.

When a new road is to be included in RMMS is it important to focus on the specific data required for identification of the road in the network subsidiary the data for the Planning and Programming. This data will consist of:

- Administrative data
- Network referencing data
- Inventory data
- Road condition data
- Traffic data

Obtaining the first two of these are basically desk exercises and will only require a reconnaissance survey to confirm the road network to be included. It will be necessary to establish the network referencing data prior to all the others, as no other data can be stored in the database until the road has been defined and labelled.

Inventory data does not change significantly with time and therefore does not have to be collected with regular intervals. It is anticipated that the collection could be a one-time activity for most inventory items with future changes derived from as-built drawings and contract construction and maintenance records at the time of completing project works.

In Roads and Highways Department (RHD) the HDM Circle has the responsibility to produce a road gazette every year containing the relevant information which describes the entire RHD road network.

The inventory of a road contains the following components:

- Road and Link Numbering
- Location Reference Point Survey
- Cross Section Inventory Survey
- Drainage Inventory Survey
- Construction/Maintenance Inventory Survey

This instruction manual has been prepared solely for use within RHD and describes the works that are being adopted for the Pavement Inventories.

This guide is accessible on the RHD Intranet.

2. ROAD NUMBERING

2.1 OBJECTIVE

A standard system of road numbering was introduce under the Road Master Plan (RMP) Project and subsequently adopted by RHD. This numbering system is the primarily reference system for recording information about RHD road network.

2.2 PROCEDURE

2.2.1 Road Number

Road occurrence is a set of sequentially connected Links.

Each Road is identified by a unique alpha digit name called a Road Name.

Road class, road function, road status and road name are constant from the start to the end of a Road. If any of these changes, then this is defined as another road.

The ***Class*** of road is the hierarchy of roads by physical standard related to traffic flow.

The ***Road Function*** is the allocation of a road by purpose as one of National, Regional or District Road.

The Status of a road is the hierarchy of roads which are defined as of importance at the national level, the provincial level, or the district levels.

The ***Road Name*** is the official name of the road as defined by the government office.

Three types of RHD road are recognised:

National Highways:

National highways connect the capital with Divisional HQs or sea ports or land ports.
National highways connect the capital with international borders.
A National Highway must branch of from another National Highway, National Highways cannot connect between Regional Highways or Zilla Roads.

N1 - N8	Major national routes.
N101 - N809	National routes of lesser importance, where the first number is the major national route and the second digit (chronological order) designates a serial number.

Regional Highways:

Regional highways connect the National highway network with District HQs or main river and land ports not connected by National Highways.
Regional highways connect District HQs.

	Regional Highways must branch of from National or Regional Highways, Regional Highways cannot connect between Zilla Roads.
R101 - R899	Where the first number is the national road number from which is branches of and the second two digits (chronological order) designates a serial number.

Zilla Roads:

	Zilla roads connect Upazilla HQs with the National/Regional road network (single shortest route). Zilla roads connect Upazilla HQs. Zilla roads branches of from National or Regional Highways or other Zilla roads.
Z1001 - Z8999	Where the first number is the national/regional road number from which is branches of and the next three digits (chronological order) designates the feeder road (serial number).

2.2.2 Link Number

A Link is the part of a road between two intersections on that road (of RHD roads).

Links are used exclusively for traffic purposes and not in connection with other types of data collection (except traffic counts) or in connection with locating maintenance works.

As all roads contain a link with the number 1, the link number therefore cannot be used as a unique identifier for a given link. A link number can only be used in combination with a road number (i.e. N1.5 where N1 is the road number and 5 is the link number).

The following are constant from the start to the end of a link:

Rule 1. The Number of Main Carriageway lanes is constant

Rule 2. The Link is either one way or two way traffic flow

Rule 3. Ramps and roundabouts are to be treated as single links unless the number of main carriageway lanes change, or the traffic flow change. In these cases the ramp or roundabout must be split and apportioned to more than one Link.

Rule 4. A link must start a Connecting LRP but might end at a Connecting LRP or an End LRP, except in the special case of a roundabout where the Link starts and ends at the same Connecting LRP. The link must be either split or extended in accordance with Rules 1. to 3.

Rule 5. If the length of a Link (between two LRPs) is less than approximately 200 meters, then the Link is not to be considered a separate Link but to be included in the shorter of the Links either before or after.

Each Link is given a serial number starting with 1, 2, 3 etc. from the beginning of the road and increasing in the direction (increasing chainage) of the road.

A unique serial number is given to each Link within each Road.

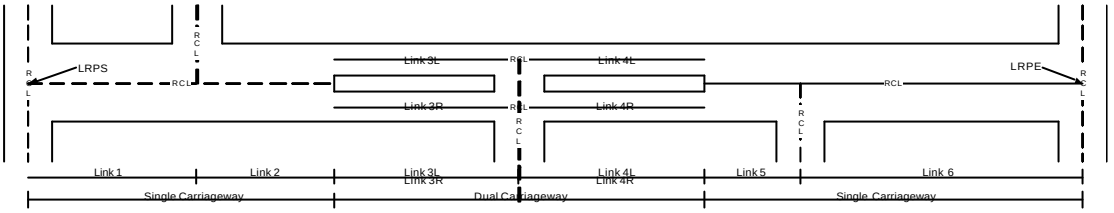
For example:

N1.1, N1.2, N1.3 etc

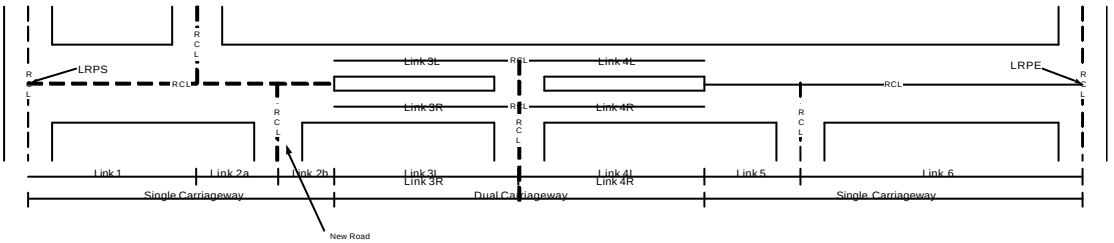
R101.1, R101.2, R101.3 etc

Z3015.1, Z3015.2, Z3015.3 etc.

Dual carriageways get the link extension L (left) and R (right) this distinguishes the individual sides in the RMMS and when the HDM carries out the planning and programming runs.



If a link has to be split because a new road joining the link then the following rule is to be used:



Link N1.2 is split into two new links given the following numbers: N1.2a and N1.2b.

Extension (for example .2a) for a split of links will be shown before the extension for dual carriageway (for example .2aL)

3. LOCATION REFERENCE POINTS

This chapter describes RMMS Location Referencing principles along with a number of other fundamental and important associated concepts.

3.1 OBJECTIVE

Location Referencing comprises the concepts and techniques used to define how the spatial and temporal position and events in the physical world are reflected within the computer system and vice versa.

Thus Location Referencing is the foundation on which the computerised model of the road is built and is the foundation of the RMMS.

The purpose of the Location Reference Point (LRP) Survey is to establish the location of LRPs, the distance between adjacent LRPs and the GPS coordinates for the LRPs that make up a road.

The RHD has adopted a LRP system based on Km stones, bridges etc. for referencing its roads.

3.2 PROCEDURE

The locations of Location Reference Points (LRPs) shall be established during the survey. In many instances these will be the existing km posts (**Primary** LRP) or, if km posts are missing, other fixed points (bridges etc. – **Secondary** LRP) adjacent to the carriageway.

Distance between LRP's shall be measured with 1 (one) meter accuracy and the location of each LRP measured by GPS (Longitude/Latitude). LRPs shall be clearly identified and located in a position which is easily visible, by future assessment teams.

The offset direction and the LRP numbers should increase in terms of increasing km post numbers (Chainage).

If there are no km posts on a road, the LRPs are defined as increasing from the start of the roads to the end of the road.

For storage in the Road Maintenance Management System (RMMS) all data items collected in the project should be referenced using the following tentative Location Referencing System (LRS):

1. Road Number;
2. Km Reference (chainage/distance measurement from start of the road);
3. GPS Co-ordinates

Table 3.1 Location Reference Objects

Event Feature	Location	GPS Coordinates	Description
Start of Road	Start Location of Road	Yes	What is road connected to Where it starts from Name of location (Junction, bazaar, city, etc.)
End of Road	End Location of Road Chainage from start of road	Yes	Where it ends Name of Location (Junction, bazaar, city, etc.)
Km Posts	Location of Km Posts	Yes	Chainage from start of road Chainage from start of link Chainage from last Km post Description of km post
Bridges	Chainage from start of road	Yes	Description of type of bridge Length of bridge Width of bridge
Culverts	Chainage from start of road	Yes	Description of type of culvert (pipe/box) Size of culvert
Ferry Ghat	Chainage from start of road	Yes	Width of river
Road Junctions (intersections) (L or R)	Chainage from start of road	Yes	Description of type of junction(intersection) (T-, Y-, X– junction)
Railway Crossing	Chainage from start of road	Yes	Number of tracks
Toll Plaza	Chainage from start of road	Yes	Length of toll plaza Width of toll plaza

Primary Location Reference Points are Km posts.

Km posts only (also missing) are given whole numbers such as:
LRP001
LRP002
LRP003
Etc.

A missing km post is assumed to be located 1,000m from the last km post.

Secondary Location Reference Points are all other referensable objects named in the above table.

Secondary LRPs (see above list) are identified by the LRP number plus an additional letter such as:
LRP001
LRP001a (for example the first structure located between LRP001 and LRP002)
LRP001b (for example an intersection located after the bridge (LRP001a) and between LRP001 and LRP002)
LRP002
LRP002a (for example an intersection located between LRP002 and LRP003)
LRP003

An example of a surveyed road is given in Appendix 1.

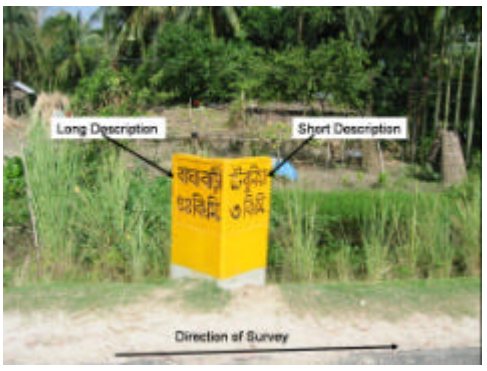
Structures with a total span of 10m or more are to be recorded as bridges and an LRP to be established at the start and end of the bridge. Start LRP of a bridge is where the abutment ends and the bridge/culvert begin, same for the end of the bridge, see picture below.

3.2.1 Description of Km posts

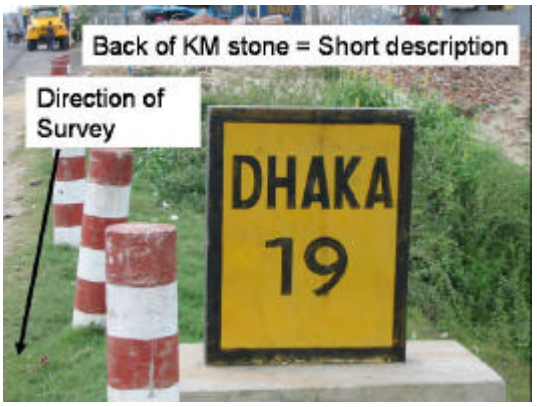
The LRP survey form held two fields for description of the Km posts.

A short description and a long description, the short description is mainly indicating the distance from the km post to the start of the road. The long description is indicating distances to the next city.

See picture below:




Front of KM stone = Long Description
CHITTAGONG
245
COMILLA
78
Direction of Survey


Back of KM stone = Short description
Direction of Survey
DHAKA
19

4. CROSS SECTION INVENTORY

4.1 OBJECTIVE

The first of the Network Level Surveys is the Cross-Section Survey. This survey should be a one-time survey of Cross-Section items on the network. It does not need to be repeated annually.

The data to be collected during this survey are continuous section data.

One of the objectives of carrying out Pavement Inventories is to measure the width of carriageway, shoulder, non-motorized lanes etc. which form part of the crest of the road.

4.2 PROCEDURE

There are two main types of road inventory data to be collected, each of which needs a different and individual data collection treatment. These are 'Section' or 'Continuous' data and 'Event' or 'Discrete' data.

Continuous / Section Data

This data type relates to data that can be termed continuous and has both a defined 'Start' and 'End' point to which a chainage can be given and which can be measured therefore in linear or square meters e.g. drainage ditch types, guard-rail and other fences, kerbs, shoulders, traffic lanes, verges, traffic markings, bus bays, bicycle lanes, foot patch etc. In addition to the chainage data it is normal practice to also provide a record of the offset from the centre-line so as to identify exactly the cross-section details of the road.

Discrete / Event Data

This data types relates to discrete event data that can be adequately described by a single chainage and an off-set from the centre-line. Such items are: - drainage outlets (catch-pits, outfalls, drop-inlets, gullies and slope drains etc.), road signs, stop-lines, pedestrian crossings, man-holes, railway level-crossings, roadway lighting poles, traffic signals, kilometre posts, guide posts, overbridges, overhead transmission lines, utility poles and the like.

All inventory data collection demands significant time and human resource inputs. It can only be done by manually recording the presence and location of each inventory item.

(a) The width of the pavement, shoulders and verge is measured to the nearest 10cm at the beginning of the road and recorded. Type of pavement and shoulders are also recorded

(b) The observation of cross section widths should be done on foot. If any element changes, the new width of each element in the cross section is measured (also these not changing) and data is recorded on the survey form together with the chainage in which the change takes place.

(c) If there is no change of item width in the cross section, observation can be continued to the end of the road.

The following types of Verges, Shoulders and Surface are normally found in Bangladesh:

Verge Types	Shoulder Types	Surface Types
1. None	1. None	1. None
2. Earth (ER)	2. Earth (ER)	2. Bituminous
	3. Bituminous (BIT)	3. HBB
	4. HBB	4. Earth (ER)
	5. Water Bound Macadam (WB)	5. Cement Concrete (CC)

Appendix 2 contains cross section inventory forms for single as well as dual carriageways.

5. DRAINAGE INVENTORY

5.1 OBJECTIVE

The drainage survey should be a one-time survey and is part of the road Cross-Section Inventory. It does not need to be repeated annually.

The data to be collected during this survey are continuous section data.

One of the objectives of carrying out Pavement Inventories is to measure the width of carriageway, shoulder, non-motorized lanes etc. which form part of the crest of the road.

5.2 PROCEDURE

All inventory data collection demands significant time and human resource inputs. It can only be done by manually recording the presence and location of each inventory item.

(a) The width of the drainage and the distance from centerline is measured to the nearest 10cm at the beginning of the road and recorded. Type of drainage are also recorded

(b) The observation of cross section widths should be done on foot. If any element changes, the new width and/or type of drainage is measured (also these not changing) and data is recorded on the survey form together with the chainage in which the change takes place.

(c) If there is no change of item width and/or type of drainage in the cross section, observation can be continued to the end of the road.

The following types of drainage are normally found in Bangladesh:
1. None
2. Earth plain
3. Rock plain
4. Grassed plain
5. Lined masonry
6. Lined pitchstone
7. Lined concrete

Appendix 3 contains cross section inventory forms for drainage survey.

6. PAVEMENT HISTORY

6.1 OBJECTIVE

The survey is intended to identify when and how the pavement was originally constructed and what maintenance has been carried out since.

6.2 PROCEDURE

The main sources from which relevant data can be obtained are:

- As-built drawings (indicating year of construction);
- Engineers, technicians and foremen with long service record; and
- Test pits and/or DCP testing

If the first two items are unavailable, the actual construction might have to come from test pits or from DCP testing.

The main part of the work can be carried out in the office going through the as-built drawings received from contractors over the years. Supplementary information can normally be obtained from engineers, technicians and foremen.

For roads where no information can be obtained from in-house records, information should be obtained from either test pits or from DCP testing – see separate Manual (DCP & Test Pits Survey Manual).

The pavement construction survey form to be used is shown in Appendix X

Appendices

APPENDIX 1
LOCATION REFERENCE POINT SURVEY FORM

Location Reference Point (LRP)

ROADS AND HIGHWAYS DEPARTMENT

Road no	Road Name	Date of Survey

LRP NO	Chainage	LRP Type	Referencable (Y/N)	Reference LRP	Offset from Ref LRP	Parpendicular distance from centre line (m)	Short description of LRP	Longitude	Latitude	Long Description and Remarks

LRP Types
1. Km Post
2. Cross Road
3. Side Road, Left
4. Side Road, right

LRP Types
5. Turn off, Left
6. Turn off, Right
7. Round About
8. Rail Road Crossing

LRP Types
9. Bridge
10. Culvert
11. Monument
12. Others

Surveyor

Name:

Signature:

Location Reference Point (LRP)

ROADS AND HIGHWAYS DEPARTMENT

Road no	Road Name	Date of Survey
N1	Dhaka - Chittagong - Teknaf	20 - 05 -2004

LRP NO	Chainage	LRP Type	Referencable (Y/N)	Reference LRP	Offset from Ref LRP	Parpendicular distance from centre line (m)	Short description of LRP	Longitude	Latitude	Long Description and Remarks
LRPS	0	12	Y	-	-	-	Start of Road	90.437969	23.709258	Roundabout .....
LRP001	0.985	1	Y	LRPS	0.985	7	Km Post 5	90.437969	23.709611	Chittagong 245, Comilla 78
LRP002	1.994	1	Y	LRP1	1.009	6.9	Km Post 6	90.471238	23.709643	Chittagong 244, Comilla 77
LRP003	2.994	1	N	-	1.000	0	Km Post 6, Missing			
LRP003a	3.567	4	N	LRP002	1.573	0	Sideroad Left side	90.460002	23.708123	D1234 to Asasuni
LRP004	4.001	1	Y	LRP002	2.007	7	Km Post 8	90.459875	23.707345	Chittagong 242, Comilla 75
LRP004a	4.599	3	N	LRP004	0.598	0	Sideroad Right Side	90.45789	23.702222	R207 to Kalaroa
LRP004b	4.756	9	N	LRP004	0.755	0	Bridge	90.451234	23.700043	Bridge over Jamuna
LRP005	5.005	1	Y	LRP005	1.004	6.8	Km Post 9	90.447632	23.694723	Chittagong 241, Comilla 74
LRP005a	5.607	4	N	LRP005	0.602	0	Sideroad Right Side	90.439993	23.693214	D1235 to Jessore
LRP006	5.998	1	Y	LRP005	0.993	6.8	Km Post 10	90.436789	23.691234	Chittagong 240, Comilla 73
LRPE	7.567	12	N	LRP006	-	0	End of Road	90.425678	23.683456	R208

LRP Types
1. Km Post
2. Cross Road
3. Side Road, Left
4. Side Road, right

LRP Types
5. Turn off, Left
6. Turn off, Right
7. Round About
8. Rail Road Crossing

LRP Types
9. Bridge
10. Culvert
11. Monument
12. Others

Surveyor

Name:

Signature:

APPENDIX 2
ROAD INVENTORY SURVEY FORMS

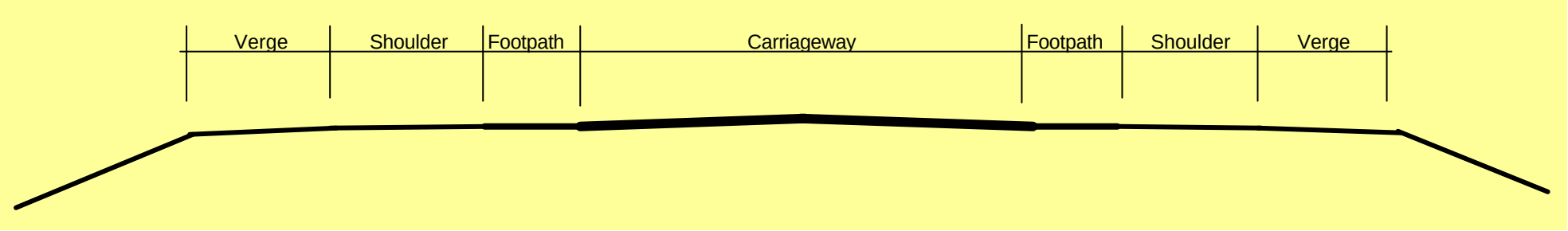
Road Inventory Survey (Single Carriageway)

ROADS AND HIGHWAYS DEPARTMENT

Road no | Road Name | Date of Survey

Start LRP+Offset(m) | End LRP+Offset(m)

Verge		Shoulder		Footpath	Carriageway		Footpath	Shoulder		Verge	
Width (m)	Type	Width (m)	Type	Width (m)	Surface Type	Width (m)	Width (m)	Width (m)	Type	Width (m)	Type



Verge Types
1. Earth (ER)

Shoulder Types
1. Earth (ER)
2. Bituminous (BIT)
3. HBB
4. Water Bound Macadam (WB)

Surface Types
1.Bituminous
2.HBB
3. Earth (ER)
4. Cement Concrete (CC)

Signature of the Surveyor

Road Inventory Survey (Dual Carriageway)

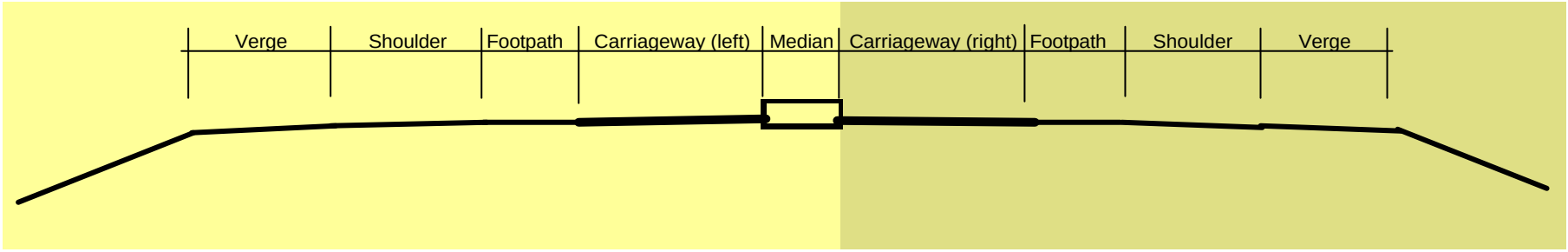
ROADS AND HIGHWAYS DEPARTMENT

Road no | Road Name | Date of Survey

Start LRP+Offset(m) | End LRP+Offset(m)

Carriageway (L/R):

Verge		Shoulder		Footpath	Carriageway		Median	Carriageway (right)		Footpath	Shoulder		Verge	
Width (m)	Type	Width (m)	Type	Width (m)	Surface Type	Width (m)	Width (m)	Surface Type	Width (m)	Width (m)	Width (m)	Type	Width (m)	Type



Verge Types
1. None
2. Earth (ER)

Shoulder Types
1. None
2. Earth (ER)
3. Bituminous (BIT)
4. HBB
5. Water Bound Macadam (WB)

Surface Types
1. None
2. Bituminous
3. HBB
4. Earth (ER)
5. Cement Concrete (CC)

Signature of the Surveyor

APPENDIX 3
DRAINAGE INVENTORY SURVEY FORM

Inventory of Drainage

ROADS AND HIGHWAYS DEPARTMENT

Road no	Road Name	Date of Survey

Start point		End point		Left side drain	Right side drain
LRP + offset(m)	Chainage	LRP + offset(m)	Chainage	Type	Type

Drain Types
1. None
2. Earth plain
3. Rock plain
4. Grassed plain

Drain Types
5. Lined masonry
6. Lined pitchstone
7. Lined concrete

Surveyor

Name:

Signature:

APPENDIX 4
HISTORY INVENTORY SURVEY FORM

PAVEMENT INVENTORY FORM

ROADS AND HIGHWAYS DEPARTMENT

Road No	Road Name	Date of Test
Test No	Location Ref Point (LRP)	Chainage from LRP

Layer no	Layer Name (Surf/Binder/Base/ Sub-base/Subgrade)	Layer Type	Layer Material Type	Thickness (mm)

Surface Types
1. Bituminous
2. HBB
3. Gravel
4. Earth
5. Cement Blocks
6. Cemet Concrete

Binder Types
1. None
2. Bituminous

Base Types
1. None
2. Granular
3. Bituminous
4. WBM
5. Stabilized

Sub-base Types
1. None
2. Granular
3. WBM
4. Stabilized

Material Type
1. Asphalt Concrete (AC)
2. Seal Coat (SC)
3.Bituminous Concretre (BC)
4. Water bound Macadam (WB)
5.HBB
6.Surface Treatment (DBST)
7.Surface Treatment (SBST)
8. Earth

Material Type
9. Gravel
10. Concrete
11. Sand
12. Sand Khoa

Surveyor