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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
Manila

OCT 24 2019

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NO. 120)
Series of 2019) 10.28.19

SUBJECT: Updating of the Road Network Definition and Inventory Update Manual and Visual Road Condition Assessment Manual Under the Road and Bridge Information Application (RBIA)

In order to maintain the integrity and reliability of the Department's Road and Bridge Information Application (RBIA) Database System and with the objective of providing detailed instructions to RBIA users with regards to the conduct of Road Condition (RoCond) assessment and collection and maintenance of road inventory data, the following updated manuals are hereby prescribed for implementation by all DPWH Regional Offices and District Engineering Offices:

1. Road Network Definition and Inventory Update Manual 2019 Version 5
2. Visual Road Condition Assessment Manual 2019 Version 2

The aforementioned technical manuals are revised to accommodate actual road configurations and scenarios on RoCond assessment with updated site validation procedures, as well as, procedures and guidelines on updating the road inventory data in the RBIA.

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Secretary

4.1.5/NRAE/RJLM/ROP/EMF

Department of Public Works and Highways
Office of the Secretary
WIN9Q46463

Republic of the Philippines
Department of Public Works and Highways

Road Network Definition and Inventory Update Manual

October 2019

Version 5

Revision Register

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver 1/ Rev 0		First Release of the Document		June 2003
Ver 2./ Rev 1.0	General	All figures re-drawn	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	General	IPRSD Replaced with SD	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	General	Update of RBIA screenshots	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	General	Captions of workflows entitled "Workflow for Managing the LRS" updated to fit the content	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Figure 1	Update of the document map	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 2.2	List of functional classifications added	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 2.6 Sub-paragraph v	Wheelpath XSP Level measurements have been removed as these are not used in RBIA.	Edwin M. Fortes	Feb 2014
Ver 2/ Rev 1.0	Section 4.1.4	3rd paragraph: third bullet point removed	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.1.4	Paragraph added: "*In the event of a road conversion it will occasionally be necessary to install a complete new set of kilometer posts. In this situation the District and Region office must consult with IPRSD to determine the appropriate direction of the particular road prior to the installation of the posts (i.e. the direction of increasing chainage).*"	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.2.2, Figure 9	Steps 7 and 11 updated to remove mentions of video and specialized condition surveys.	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.2.2	Paragraph added: "*Note that Bridge Inventory Updates are to be carried out in accordance with the procedures detailed in the Bridge Inspection manual. That document provides the necessary forms required for this purpose.*"	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.3.2, Figure 13	Steps 7 and 11 updated to remove mentions of video and specialized condition surveys. Step 10 added: "*Use updated standalone database (District)*"	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.3.3, Figure 15	Figure and text Removed, reference to Figure 13 added	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.3.4, Figure 17	Figure and text Removed, reference to Figure 13 added	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.3.4, Sub-section: Action in the RBIA	"*If the road conversion necessitates the creation of a new Road Name*" removed in second bullet point	Edwin M. Fortes	Oct 2013

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver 2/ Rev 1.0	Section 4.5.3, subsection "Workflow"	"*Figure 18 indicates that the initial step is for a proponent to request the creation of a road*" replaced with "*Figure 18 indicates that the initial step is for a proponent to request to change district boundary of a national road*"	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Section 4.5	Section " *4.5 Procedure for Addressing Data Discrepancies*" added	Edwin M. Fortes	Oct 2013
Ver 2/ Rev 1.0	Appendix K	Appendix K " *Photographs of Existing National Roads with Delineated Carriageway, Shoulders, Sidewalks, Number of Lanes, Directional Flow of Traffic, etc.* " added	Edwin M. Fortes	Feb 2014
Ver 2 Rev 1.0	Appendix F	Appendix F Deleted “Causeways” and Added “Terrain” to Inventory Update Sheet	Edwin M. Fortes	Mar 2014
Ver 2 Rev 1.0	Appendix G	Appendix G Deleted “Vertical Sight Distance” and Added “Spillways” definitions	Edwin M. Fortes	Mar 2014
Ver 3/ Rev 1.0	Section 4.2.2	Section *“4.2.2 Systems Review before updating LRS and Inventory Data”* added	Edwin M. Fortes	Sep 2016
Ver 3/ Rev 1.0	Appendix G	Appendix G Updated to include definition for “Chainage”	Edwin M. Fortes	Sep 2016
Ver 4 Rev 1.0	Section 4.2.2	Revised 1st paragraph of Section *“4.2.2 Systems Review before updating LRS and Inventory Data”*	Edwin M. Fortes	Nov 2016
	Section 4.3.2	Revised steps for Splitting and Merging Sections		
Ver 4 Rev 2.0	Section 2.2	Revise Functional Classifications	Edwin M. Fortes	Nov 2016
	Section 4.1.5	Revised tolerance limits for measured lengths		
	Appendix F	Added AMCRP to and removed Gravel and Earth from Pavement Type; added more lookup codes for Roadside Structure; added Curb & Gutter item; modified Inventory Update Sheet		
	Appendix G	Added more items to Roadside Structure; added Curb & Gutter		

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver 5 Rev 1.0	Section 4.1.7	Updated figure and paragraph added: *"However, the affected LRPs should be reinstalled proportionately along the new alignment."*	Edwin M. Fortes	Oct 2019
	Section 4.2.2	Section *"4.2.2 Concepts in the Maintenance and Updating of RBIA and Locational Reference Points"* added		
	Section 4.3.2	Section "*4.2.3 Guidelines in the Physical Installation/Re-installation of the LRPs in the Field" added*		
	Section 4.3	Figures of different cases redrawn		

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GLOSSARY OF TERMS

BQS	Bureau of Quality and Safety
Cross Section	Cross-sectional Positions (Cross Section's)
DPD	Development Planning Division of Planning Services
DPWH	Department of Public Works and Highways
GIS	Geographic Information System
LRP	Locational Reference Point
LRM	Locational Referencing Method
LRS	Locational Referencing System
MYPS	Multi Year Programming and Scheduling Application
RBIA	Road and Bridge Information Application
RTIA	Road Traffic Information Application
SD	Statistics Division of Planning Services
TED	Traffic Engineering Division

1 Introduction

1.1 About this Manual

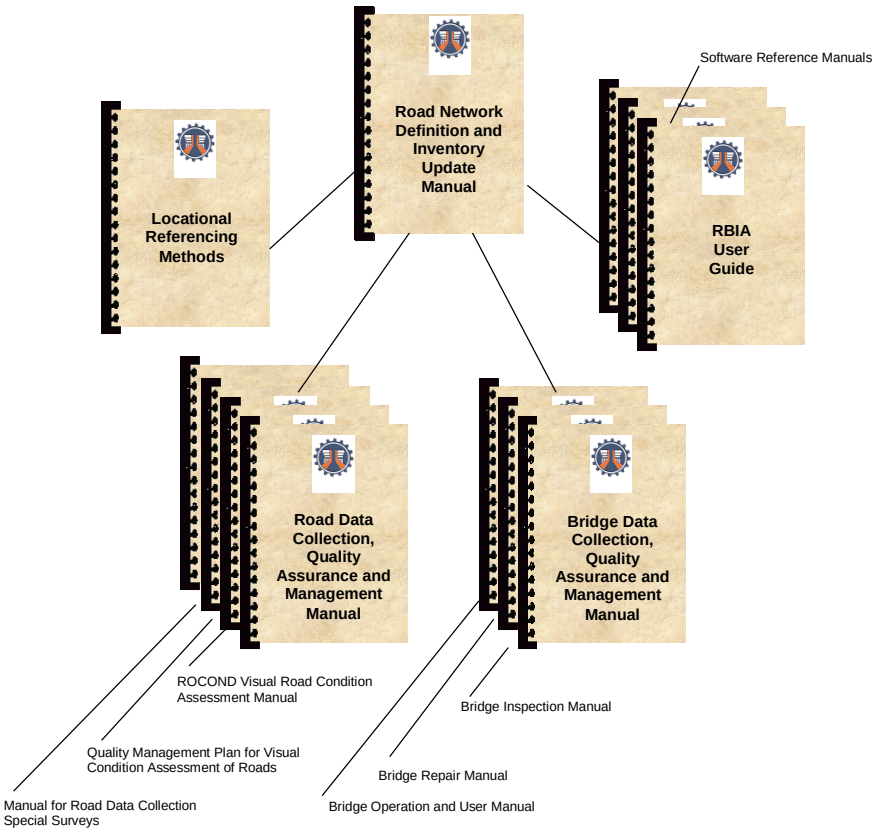
This manual provides procedures for managing and maintaining the DPWH Locational Referencing System and the Road Inventory. It is organized in the following sections:

- Definition of Network Entities - the National Highway network modeled using these 'building blocks';
- Locational Referencing Methods - the ways in which the location on a road is indicated in terms of the network entities;
- Procedures - how to go about creating/defining the network entities and deal with changes that occur to the network.

In addition, this manual addresses how changes that occur to the network and associated road inventory information get reflected in the Road and Bridge Information Applications (RBIA), the Department's computerized repository for road and bridge related data.

Other RBIA related manuals and guides, and their usage is shown in Figure 1.

Figure 1
Document Map



1.2 What is a Locational Referencing System?

In order to share road-related data among many users, a consistent Locational Referencing System (LRS) is required. Simply, it must answer the question “Where is it?” in a language that everybody can understand.

The LRS is a set of office and field procedures that includes techniques for recording, maintaining, and retrieving location information. It must be meticulously maintained to allow independent sets of data, whether computerized or manual, to be related to each other.

The LRS is not a computer system. Rather, the Road and Bridge Information Applications (RBIA) is the computer application that fully embraces the LRS.

2 Definitions

2.1 Introduction

This Chapter serves as an introduction to the network entities of the LRS and illustrates how they are used to model the road network. The details describing the situations under which these entities are created and how they are updated are later found as procedures in Chapter 4.

The DPWH LRS defines the road network using the following entities and definitions[1]:

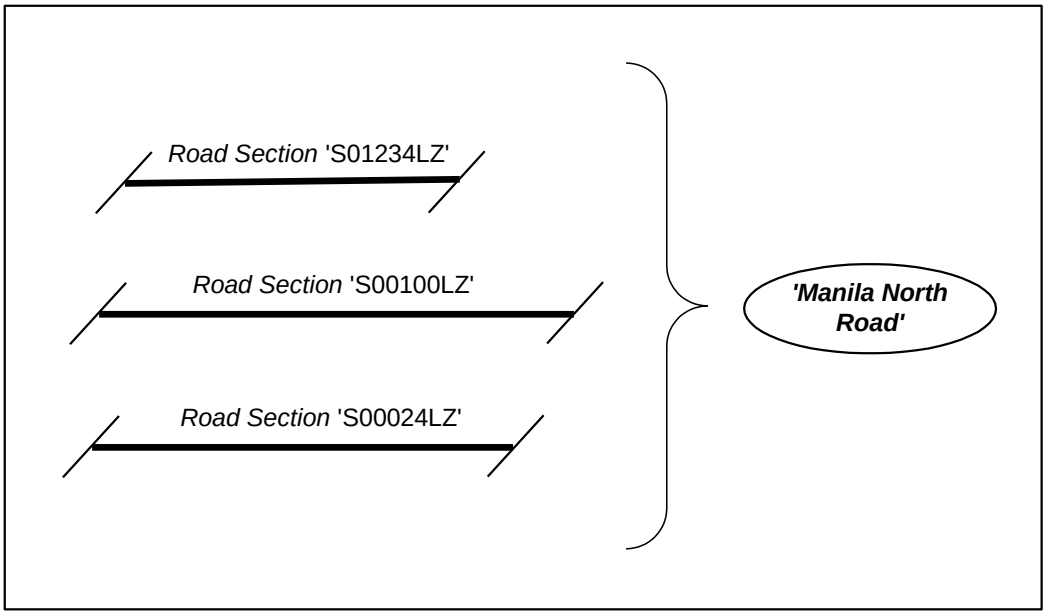
- Road Names
- Road Sections
- Nodes
- Locational Reference Points (LRP's)
- Cross-sectional Positions (Cross Section's)

2.2 Road Names

A Road Name (e.g.'Manila North Road') is simply a grouping of Road Sections.

Each Road Name is associated with a Road ID (e.g. 'R00122LZ') and a Functional Classification. There are three types of Functional Classifications:

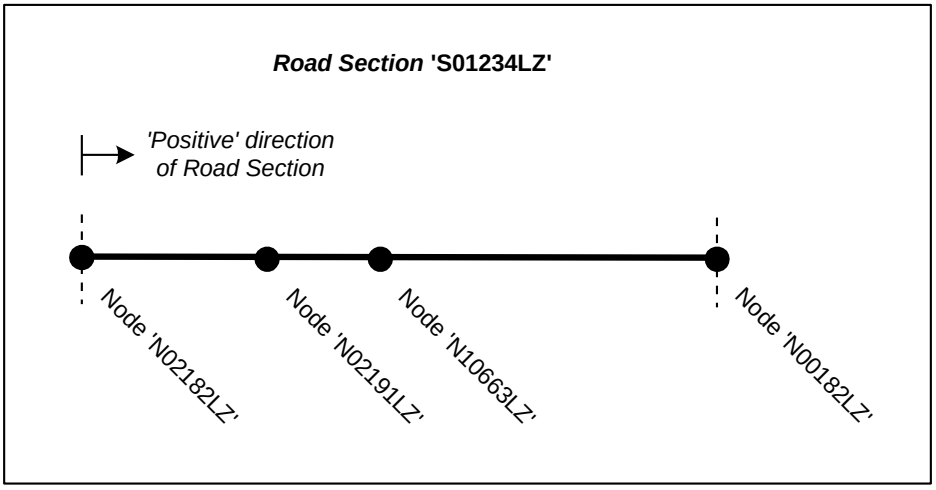
- Primary Road
- Secondary Road
- Tertiary Road



[1] As part of the LRS, multimedia files in the form of videos and photographs of these entities are available and they can be invoked from the RBIA. Samples are found in Appendix A.

2.3 Road Sections

A Road Section is a linear representation of a road's centerline and has a defined length and direction (the positive direction is always the direction of increasing kilometer posts/stationing). It is associated with one Road Name.



Each Road Section is associated with a 'Start' Node and an 'End' Node, and may also contain 'Intermediate' Nodes. In the figure above:

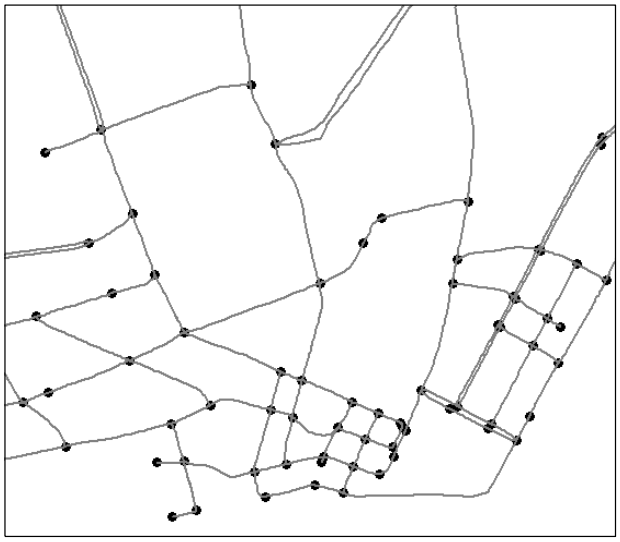
- N02182LZ is the start Node
- N00182LZ is the end Node
- N02191LZ and N10663LZ are intermediate Nodes

Each Road Section is created to be as long as possible, provided that:

- It is a contiguous length of road without any breaks or forks;
- Does not cross Engineering District[2] boundaries

[2] Area established for allocation and administration by DPWH of engineered works.

2.4 Nodes



Nodes are connectivity elements defined and associated with locations along Road Sections in the following instances:

- Junction between all National Roads;
- Junction between National Road and other roads (e.g. provincial, municipal roads);
- Start and End of a road;
- Administrative boundary.

2.5 Locational Reference Points (LRP's)

A Locational Reference Point (LRP) is a permanent physical feature on or adjacent to the carriageway, whose location along the Road Section is known.

An LRP may be one of several different types of features found along a road (see Chapter 4.1.4), but they are in most cases kilometer posts.

LRPs act as intermediate reference points when a location is addressed using the 'LRP + Displacement' Locational Referencing Method (described in Chapter 3.1).

Nodes are also LRPs.

2.6 Cross Section

Cross Section is used to specify the lateral location on the roadway (e.g. left shoulder, right shoulder).

Cross Sections are grouped as Cross Section Levels, where each level is associated with varying levels of detail in Cross Sections. The use of which Cross Section Level depends on how detailed this location information is collected and stored.

In the LRS, five Cross Section Levels are defined and the Cross Sections contained in each are as follows:

i) 'All' Cross Section Level

This Cross Section Level contains only one Cross Section called:

- All

"All" is used when the definition of the lateral location on the roadway is not relevant (e.g. for the definition of the environment). However in this case, usually, no cross-sectional position is defined.

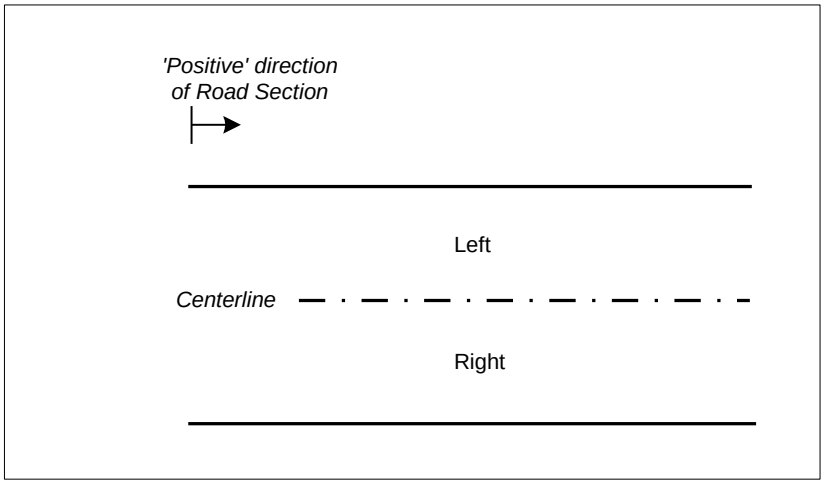
ii) 'Left/Right' Cross Section Level

This Cross Section Level contains two Cross Section's:

- Left
- Right

These Cross Section's break down the roadway into 'left' and 'right' sides, relative to the direction of the Road Section as illustrated in Figure 2.

Figure 2
'Left/Right' Cross Section Level



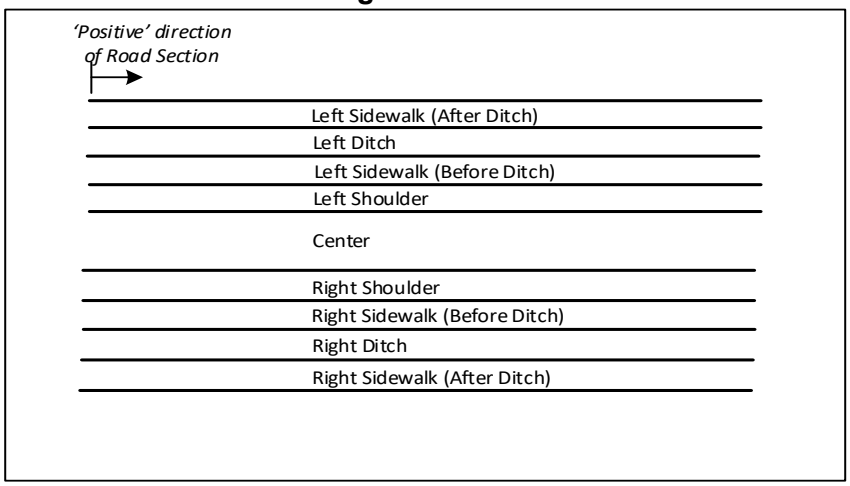
iii) 'Left/Center/Right' Cross Section Level

This Cross Section Level contains the following Cross Section's to describe the various components of a roadway:

- Left Sidewalk
- Left Ditch
- Left Shoulder
- Carriageway
- Right Shoulder
- Right Ditch
- Right Sidewalk

These Cross Section's give the next level of detail in describing the roadway. Again, the 'left' and 'right' is referenced against the direction of the road section. Figure 3 illustrates the model.

Figure 3
Left/Center/Right' Cross Section Model



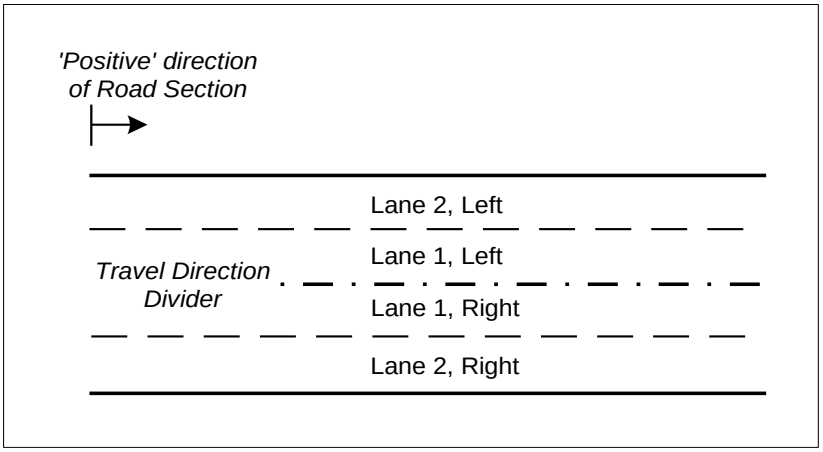
iv) 'Lanes' Cross Section Level

This level of Cross Section detail considers only the carriageway and breaks it down to the lanes:

- Lane 6, Left
- Lane 5, Left
- Lane 4, Left
- Lane 3, Left
- Lane 2, Left
- Lane 1, Left
- Lane 1, Right
- Lane 2, Right
- Lane 3, Right
- Lane 4, Right
- Lane 5, Right
- Lane 6, Right

This model allows for the description of a road section with up to six lanes on either side of the centerline. The lane numbers start from the line that divides the traffic, and the 'left' and 'right' is with reference to the positive direction of the road section. An example of this model on a 4-lane road is illustrated in Figure 4.

Figure 4
'Lanes' Cross Section Model



3 Locational Referencing Methods (LRM)

3.1 Linear Location Referencing

Once the network entities are defined, the locations of road inventory and condition information are described using 'linear location referencing'. Figure 5 illustrates such observations being referenced along a Road Section.

Users in the field communicate their location using a Locational Referencing Method (LRM). In order to do so, it is required that they:

- Know which Road Section they are on;
- Know which is the defined 'positive' direction of the Road Section;
- Can find and identify a reference location along the Road Section (either the start or LRP);
- Have means to measure or estimate the distance along the road centerline from the reference point.

In the LRS, either one of two methods may be used to indicate the location of something along a Road Section:

- As a distance from the start of the Road Section;
- As a distance, indicated as either in the positive or negative direction, relative to a Node on the Road Section ('LRP + Displacement' method).

Figure 6 illustrates how things on the road can be located using the 'LRP+Displacement' LRM, where displacements may be given as either a positive or negative number relative to the positive direction of the Road Section.

Figure 5
Locations Referenced against a Road Section

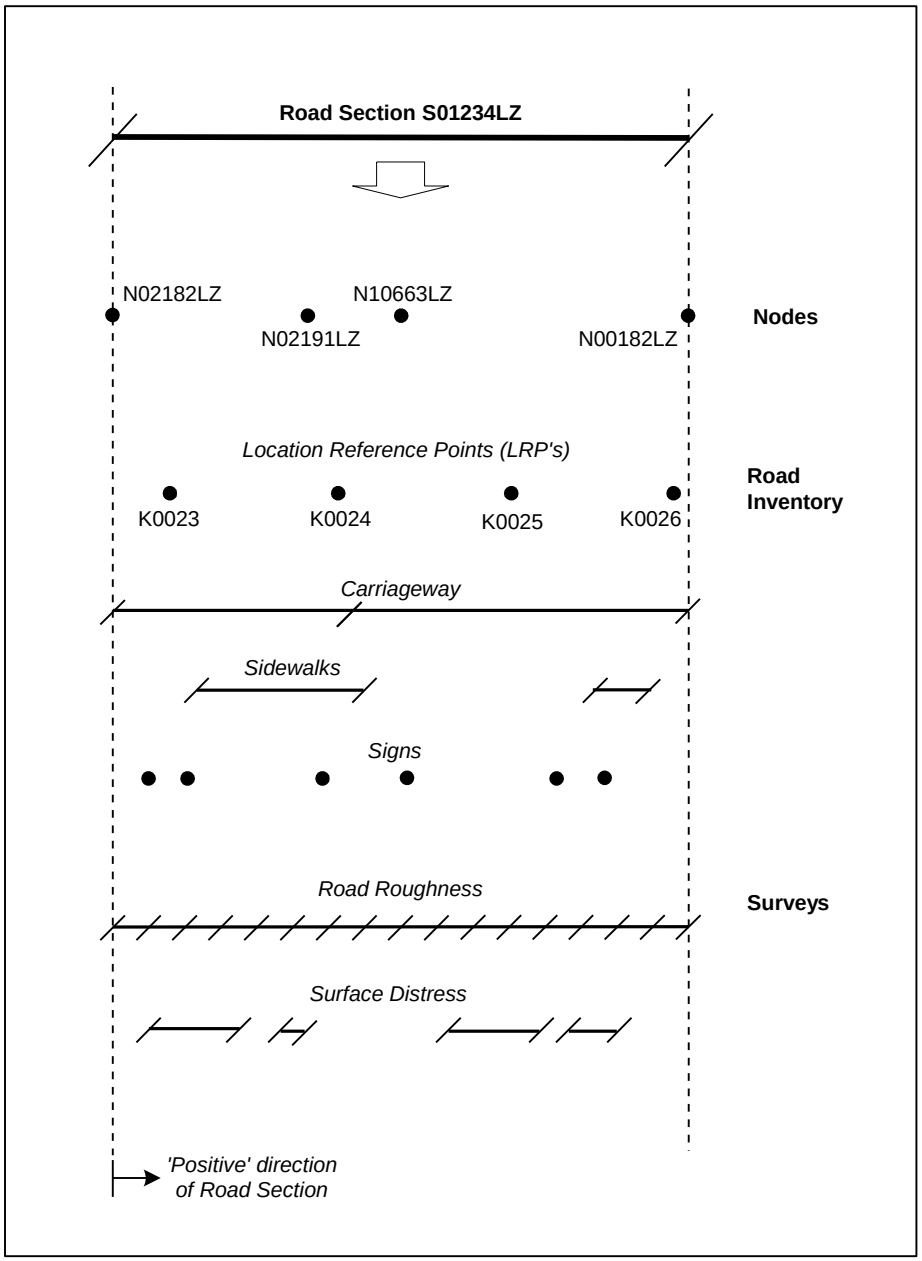
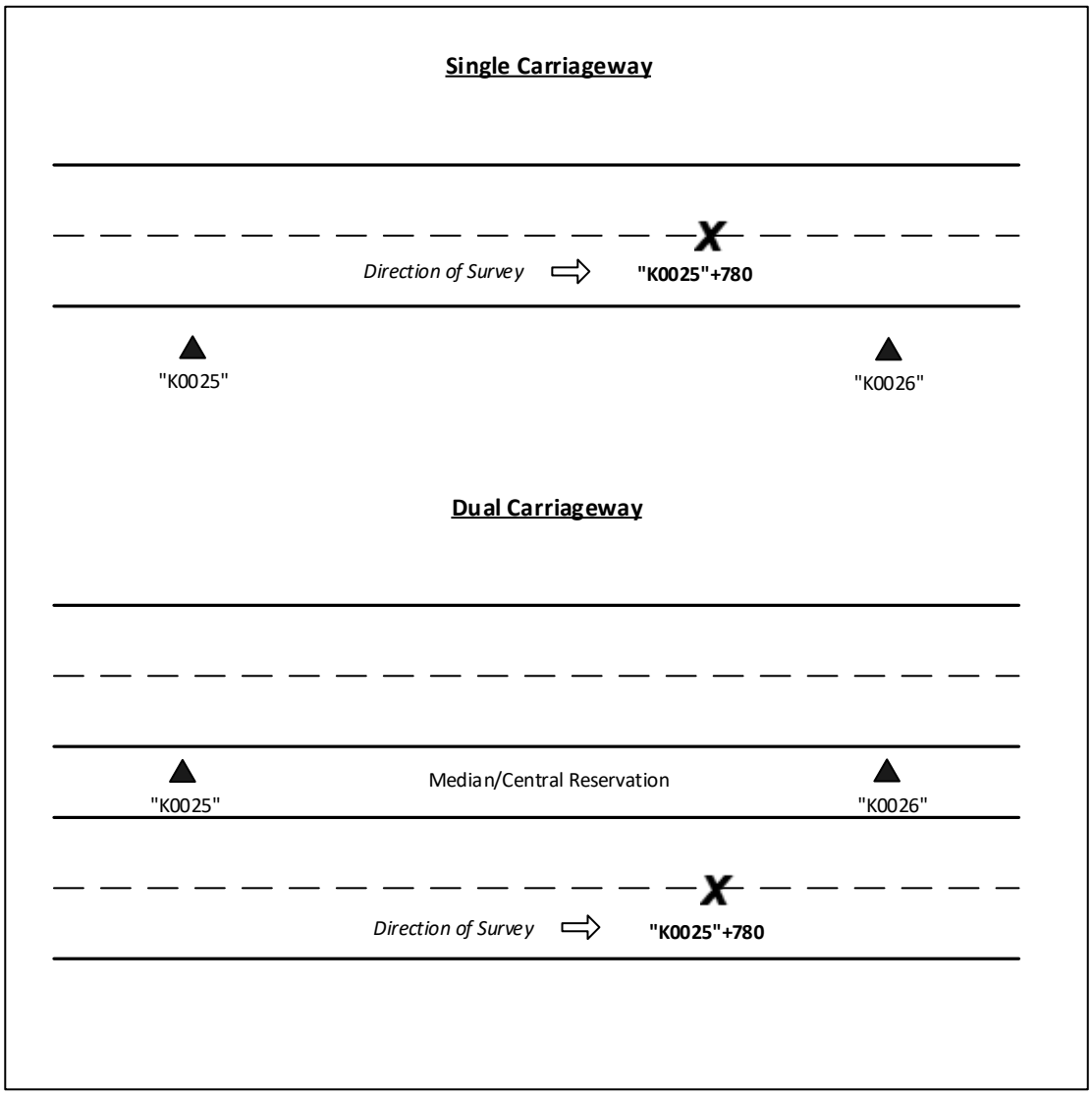


Figure 6
'LRP + Displacement' Locational Referencing Method



Use of the 'LRP + Displacement' method requires that the user in the field is equipped with a list of Road Sections along with valid Nodes that can be used for referencing against. This information is available as 'Road Network Reference' reports that are periodically produced through the RBIA for the users in the field (See Appendix B).

Figure 7 gives an example of a Road Section where a condition survey was carried out. It contains two LRPs that can be used for location referencing. Table 1 illustrates the two different methods of location referencing.

Figure 7
Example of Survey along a Section

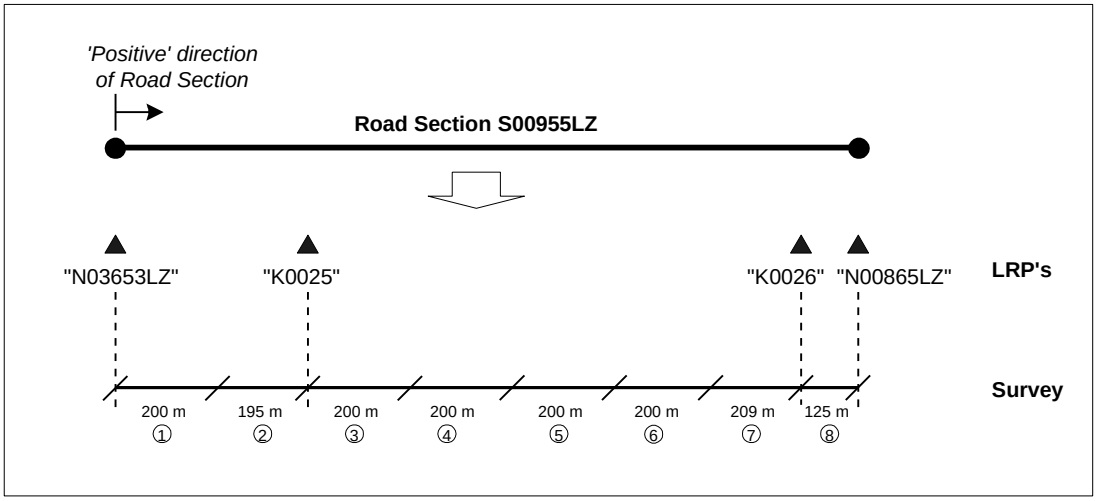


Table 1
Survey Data Locations using Different LRM's

	i) Relative to Start of Road Section		ii) 'LRP + Displacement' Method							
	(m)		From		To			Survey Data		
Road Section ID	From	To	LRP/Node	Displacement	LRP/Node	Displacement	Length (m)	Cracking	Potholing	Ravelling
S00955LZ	0	200	"N03653LZ"	0	"N03653LZ"	200	200	(Data record 1)		
S00955LZ	200	395	"N03653LZ"	200	"N03653LZ"	395	195	(Data record 2)		
S00955LZ	395	595	"K0025"	0	"K0025"	200	200	(Data record 3)		
S00955LZ	595	795	"K0025"	200	"K0025"	400	200	(Data record 4)		
S00955LZ	795	995	"K0025"	400	"K0025"	600	200	(Data record 5)		
S00955LZ	995	1,195	"K0025"	600	"K0025"	800	200	(Data record 6)		
S00955LZ	1,195	1,404	"K0025"	800	"K0025"	1,009	209	(Data record 7)		
S00955LZ	1,404	1,529	"K0026"	0	"K0026"	125	125	(Data record 8)		

3.2 Use of Cross-sectional Positions

As another dimension to linear referencing, Cross-sectional Positions (Cross Section's) are used to indicate the lateral position on the roadway, and Chapter 2.6 had defined the various Cross Section's that are available in the LRS.

If locations are recorded on a roadway while facing the positive direction of the road Section (i.e. while traveling in the direction of increasing kilometer posts), the 'left' and 'right' directions observed by the surveyor are consistent with that of the models defined in the LRS.

However, if the survey is carried out while facing the opposite direction to that of the Road Section, special care is necessary to ensure that the 'left' and 'right' observed get assigned against the correct respective lateral locations of the model. Such guidelines on the use of Cross Section's are given in Appendix C.

4 Procedures

4.1 Rules for Defining LRS Entities

4.1.1 Road Names

Each Road Name (e.g. 'Manila North Road') is unique and is associated with a unique Road ID. The Road ID coding scheme is as follows:

- The code is composed of 8 characters;
- The first character is always “R”;
- The last two characters comprise the code used to represent the island on which the road is located. For example, “LZ” represents Luzon, and “MN” represents Mindanao. See Appendix D for list of island codes;
- The middle 5 characters are numbers, unique for the island and includes leading zeros, if appropriate;
- Example of a Road ID is “R00034LZ” or “R01090MN”.

4.1.2 Bridge

Each Bridge is assigned a unique Bridge ID for identification. The coding convention is as follows:

- The code is composed of 8 characters;
- The first character is always “B”;
- The last two characters comprise the code used to represent the island on which the Bridge is located. For example, “LZ” represents Luzon, and “MN” represents Mindanao. See Appendix D for list of island codes;
- The middle 5 characters are numbers, unique for the island and includes leading zeros, if appropriate;
- Example of a Bridge ID is “B00521LZ” or “B01033MN”.

4.1.3 Causeway and Spillway

Coding convention for causeways and spillways is the same as bridges (see section 4.1.2).

4.1.4 Culvert

Each Culvert is assigned a unique Culvert ID for identification. The coding convention is as follows:

- The code is composed of 8 characters;
- The first character is always “C”;
- The last two characters comprise the code used to represent the island on which the Culvert is located. For example, “LZ” represents Luzon, and “MN” represents Mindanao. See Appendix D for list of island codes;
- The middle 5 characters are numbers, unique for the island and includes leading zeros, if appropriate;
- Example of a Culvert ID is “C00521LZ” or “C01033MN”.

4.1.5 Road Sections

Each Road Section is assigned a unique Section ID for identification. The coding convention is as follows:

- The code is composed of 8 characters;

- The first character is always “S”;
- The last two characters comprise the code used to represent the island on which the Road Section is located. For example, “LZ” represents Luzon, and “MN” represents Mindanao. See Appendix D for list of island codes;
- The middle 5 characters are numbers, unique for the island and includes leading zeros, if appropriate;
- Example of a Section ID is “S00521LZ” or “S01033MN”.

Once defined, each Road Section is assigned to a DPWH Engineering District office, which is responsible for its maintenance.

Length of a Road Section

One of the key attributes of a section is its length, which is normally measured using a calibrated odometer on a vehicle. This measurement is done once, during the initial survey to define the road network, and is not repeated unless it becomes apparent that it had not been measured accurately or was erroneous.

Subsequent measurements of length along a Road Section will never exactly match the defined length for various practical reasons, such as not being possible to travel the exact same wheelpath each time, use of different distance measuring instruments, etc.

Once created and stored in the RBIA, the Road Section length is taken as being the true centerline length and never changes. Locations recorded by subsequent surveys referenced against the Road Section are adjusted to fit the defined Road Section length, either by using the 'rubber-banding' functionality of the RBIA software, where locations are adjusted to fit the defined lengths, or by resetting the differences between recorded vs. defined lengths at intermediate reference locations (LRP's).

Tolerance limits are set against the difference between measured length vs. the defined length. If the difference is found to exceed the tolerance limit, for straight road (+/-1%) and for winding road (+/-2%), then an investigation is required to determine whether the survey had measured the locations incorrectly or perhaps the defined Road Section length had been wrong in the first place.

Should the latter be the case, it is usually necessary to end-date the Road Section and create a new version (associated data may be copied from the old to the new Road Section for any unaffected segments).

In some cases, where it is known that it had simply been a matter of having used an inaccurate distance measuring device during the original survey defining the Road Section length, it may be possible to adjust the defined length of the Road Section.

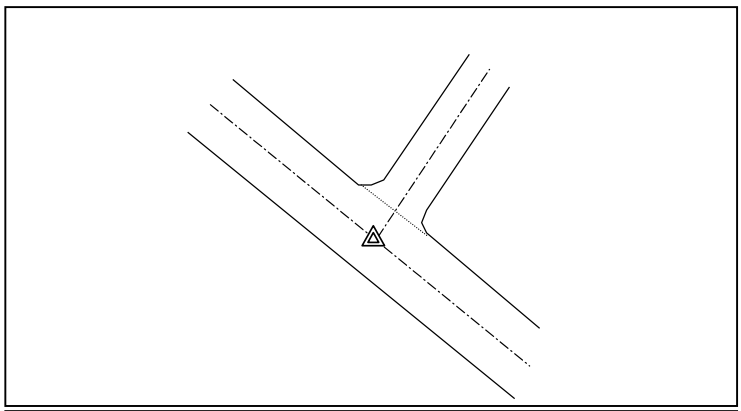
4.1.6 Nodes

Each Node is assigned a unique Node ID for identification. The coding convention is as follows:

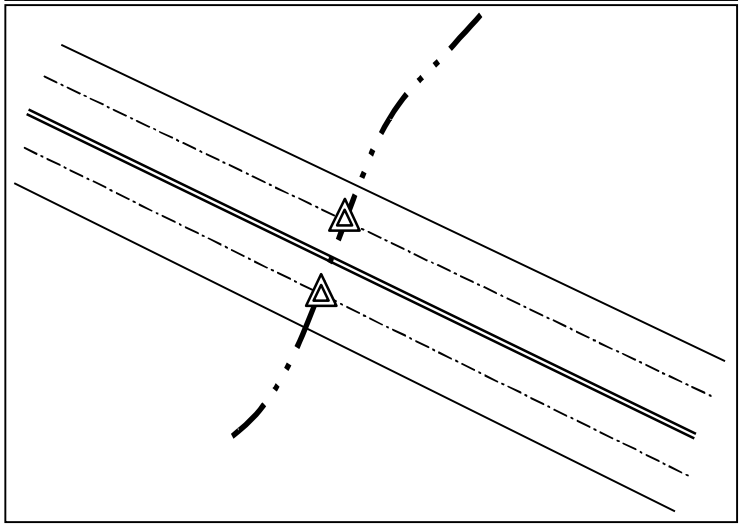
- The code is composed of 8 characters;
- The first character is always “N”;
- The last two characters comprise the code used to represent the island on which the Node is located. For example, “LZ” represents Luzon, and “MN” represents Mindanao. See Appendix D for list of island codes;
- The middle 5 characters are numbers, unique for the island and includes leading zeros, if appropriate;
- Example of a Node ID is “N00122LZ” or “N02601MN”.

Placement of Nodes

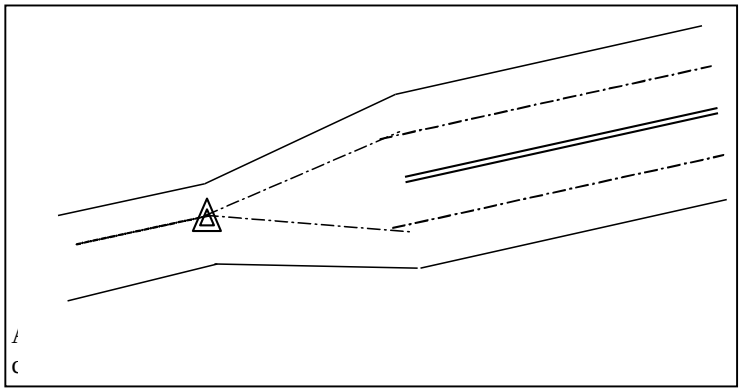
Nodes are defined at all National Road junctions, junctions between National Roads and other roads such as provincial road or municipal road, starts and ends of roads and administrative boundaries. The following rules are intended to clarify where Nodes should be positioned for the most common types of situations encountered on the network. A dual carriageway is defined by the presence of a central reservation, i.e. an area which separates opposing lanes of traffic. It may contain planted trees, a median barrier or be simply paved.



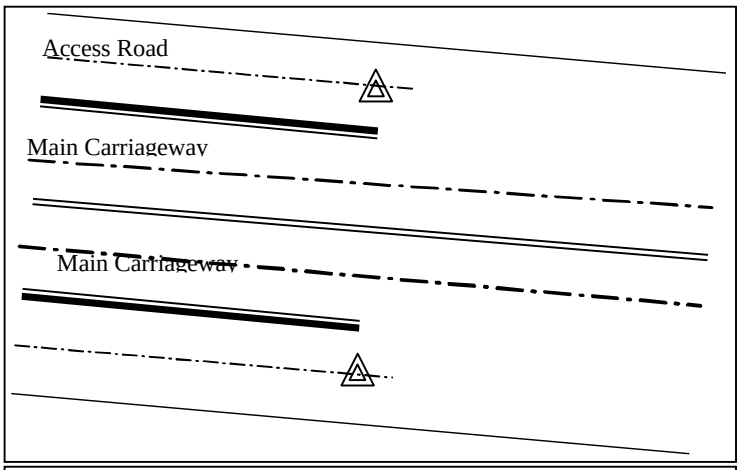
Where two or more single carriageway roads join at a single point, the junction Node is positioned where the centerlines cross.



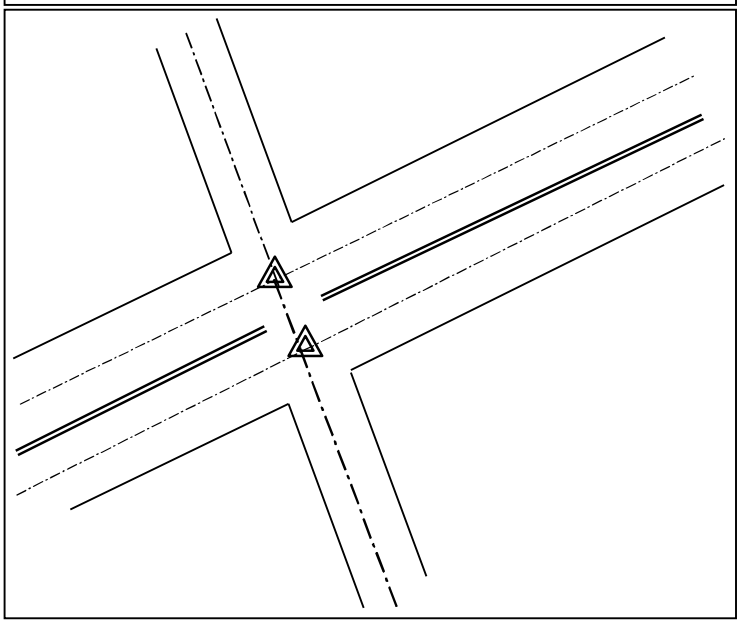
A Node is placed wherever a road crosses a Region, District, Province or Municipal boundary. In a dual carriageway (with central reservation), a Node should be positioned in each carriageway since each carriageway is an independent road section.



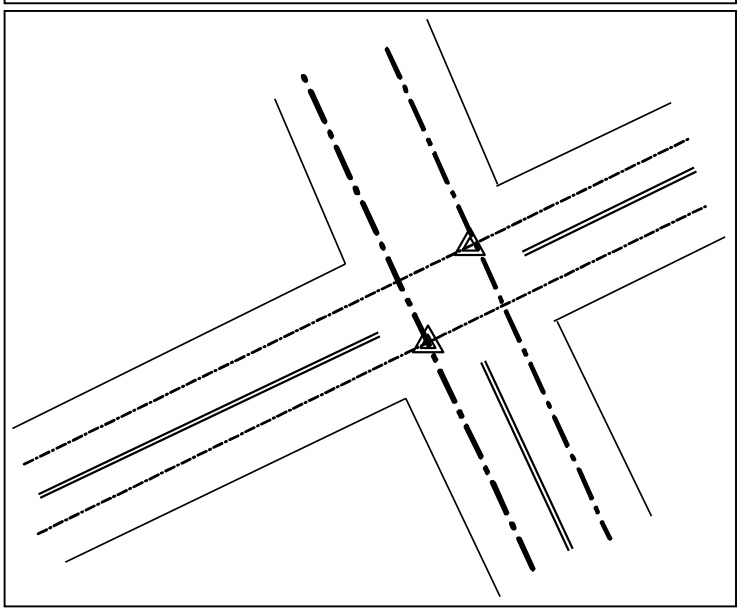
Wherever a road splits from a single carriageway to a dual carriageway, a Node should be positioned at the point where the carriageway begins to be divided by the curb of the central reservation. Additional Nodes are not required for each of the two carriageways.



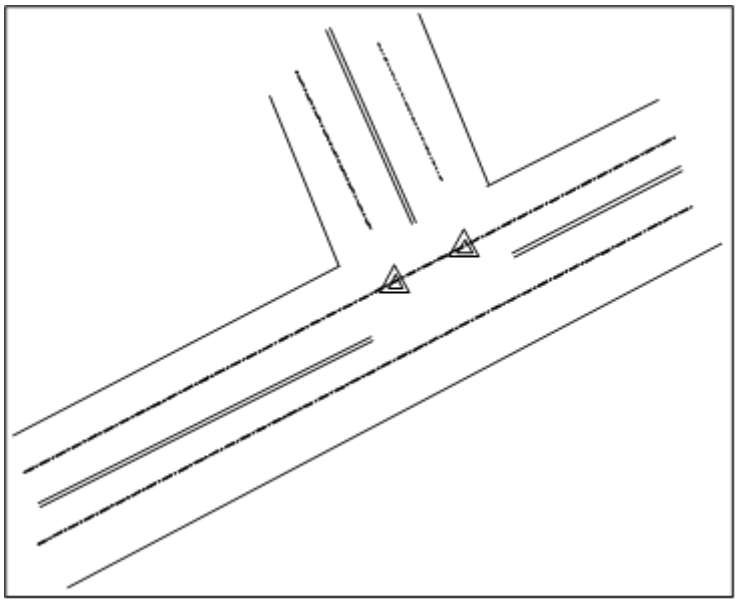
Whenever one of the carriageways of a dual carriageway is divided for an access road, one Node should be positioned at the point perpendicular to the centerline at the point where the access road and carriageway are divided. There is not a need for a Node in the main carriageway.



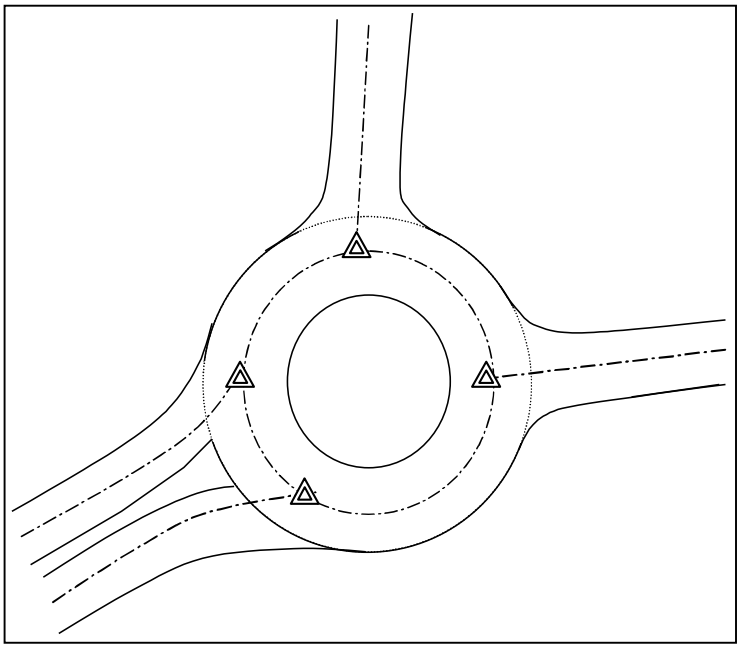
Where a single carriageway intersects a dual carriageway, a Node is positioned in each of the carriageways.



Where a dual carriageway crosses another dual carriageway, one Node is positioned at the intersection of each carriageway.



Where a dual carriageway intersects another dual carriageway but does not cross, a Node is positioned at the intersection of the carriageway for the intersecting carriageways and a Node is positioned in the opposite carriageway. If the carriageway on the opposite side of the intersection is a single carriageway the same procedure is followed.



Where an intersection is a roundabout design, the positioning of Nodes will be as follows:

a. For single carriageway road, a Node will be positioned were the carriageway intersects the carriageway of the roundabout;

b. For dual carriageway road, a Node will be positioned were each carriageway intersects the carriageway of the roundabout.

These rules are intended to clarify the determination of Node positions for the most common situations on the network. There may be complex junctions were the determination of the appropriate Node position is not as clear. In these special cases, the RBIA Section of the SD will establish the Node positions that will best represent the network.

4.1.7 LRP's

The key attribute of an LRP is that it is easily recognizable and uniquely identifiable in the field. It may be one of the following different types of features found along a road:

- Administrative Boundary Marker
- Building
- Bridge
- Culvert
- Kilometer Marker Post
- Other Post (i.e. not a kilometer marker post)

- Railroad Crossing
- Road Sign
- Turn Left (in positive direction of section)
- Turn Right (in positive direction of section)

The 'code' for a location reference point is the actual description of the LRP. Accordingly, the LRP descriptions within a Road Section must be unique. The following are the guidelines for the LRP descriptions:

- Kilometer posts are given a 'K' prefix to indicate that it is a kilometer post. This is followed by the number indicated on the kilometer post, shown as four digits, padded as necessary. Examples include '"K0023", "K0024", "K0025", etc.;
- LRP's are usually kilometer posts, but could also be for example, bridges.

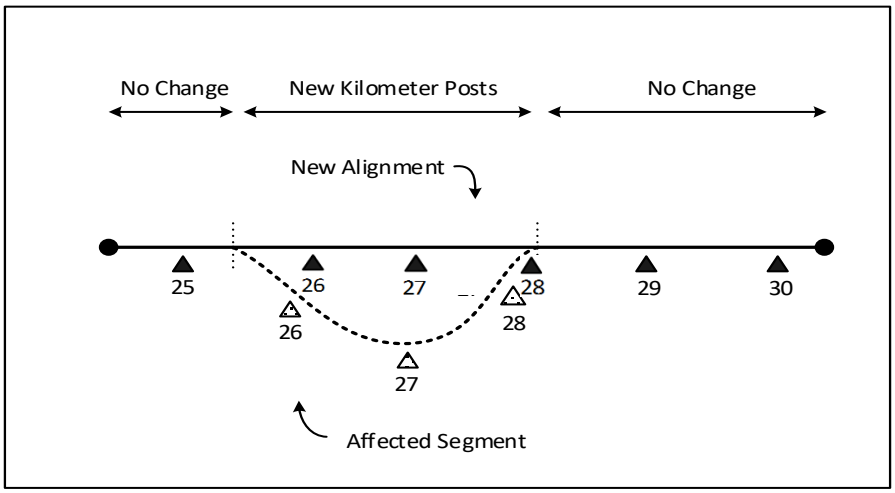
A single rail track crossing a road section at approximately 90 degrees can be used as a LRP. However when multiple tracks cross a road, the first or the last track crossed (in terms of the defined positive direction of the Road Section) should be specified. Also, if the track crossing is at such an oblique angle to the road that the crossing extends over several meters or more in the linear direction of the road, then such a crossing may be inappropriate as an LRP.

Placement/numbering of Kilometer Posts

All Kilometer posts have been accurately surveyed with their positions recorded in the RBIA. Therefore to maintain the integrity of the LRS information in the RBIA, it is very important that LRP's remain as permanent as possible in the field, and accordingly, kilometer posts must never be moved or relabeled without consulting the RBIA Section of the Statistics Division (SD).

The two major instances that require new kilometer posts to be installed include:

- road realignment
- road conversion



In the event of a road realignment resulting in change of overall length of a road, the kilometer posts associated with the unaffected part of the road downstream of the realignment must be left as is.

However, the affected LRPs should be reinstalled proportionately along the new alignment.

In the event of a road conversion it will occasionally be necessary to install a complete new set of kilometer posts. In this situation the District and Region office must consult with SD to determine the appropriate direction of the particular road prior to the installation of the posts (i.e. the direction of increasing chainage).

4.2 LRS and Inventory Data Update Procedures

4.2.1 General

The primary responsibility for updating the network definition is assigned to the SD of Planning Service, but the Regional and District offices have a support function in the maintenance of this information. The responsibilities for updating the LRS network information are as follows:

Central Office Planning Service:

- Establish national road network;
- Assigning network entities;
- Assign Road Sections to the appropriate DPWH office of responsibility for maintenance;
- Review network definitions for updates as necessary;
- Enter the revised data into the RBIA software.

Regional and District Planning and Design Division Offices:

- Provide Central Office Planning Service information concerning any changes to the network such as the completion of construction on a new road or the conversion of a road to DPWH responsibility;
- Provide Central Office Planning Service information concerning any revisions to existing Node or Road Section definitions such as a change to a junction layout;
- Verify any revisions to the network definition as correct.

4.2.2 Concepts in the Maintenance and Updating of RBIA Data and Locational Referencing Points

General Concepts

The maintenance and updating of the RBIA Data and the LRPs revolve around the following concepts and principles:

a. RBIA Data should reflect inventory features of actual ground inventory elements consistent with RBIA theories and procedures.
b. Ground locations of road sections (including length) and LRPs should reflect RBIA Data.
c. LRP Data should be upheld and maintained in the RBIA at all cost except for instances specified in Section 4.2.3.
d. Field distance measurements allows for a (+/-) 1% tolerance compared to RBIA posted measurements. The said allowance is applicable on differences in measurements, between field validation and RBIA data, on distances between LRPs and overall length of each road section. However, repositioning of the LRPs will depend on the analysis and evaluation of the result of field validation.

Guidelines on the Retention and Updating of Records in the RBIA

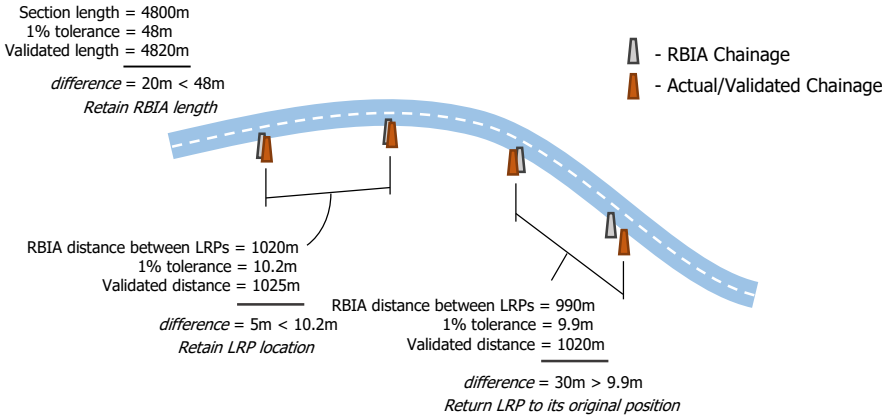
A. **Road Section Length** refers as the defined length measured at the centerline of the road beginning at the start node up to the end node of the road section.

Generally, actual field locations must be a reflection of all RBIA lodged information. Likewise, during field validation activities, field measurements on road section length that incurred a difference within the allowable tolerance shall adopt and maintain RBIA data. However, updating of records in the RBIA is deemed necessary based on the following cases:

Case 1: When there is no change in the road alignment

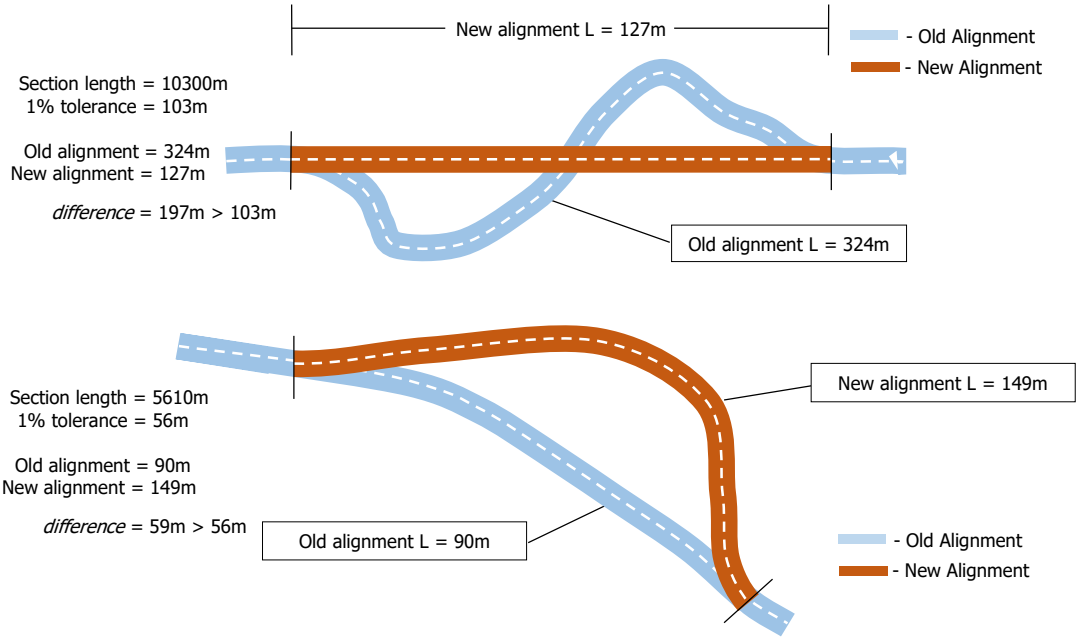
If the result of field validation is within the allowable tolerance of (+/-) 1 % of the total road section length and actual chainage of the corresponding LRPs against the RBIA, then retain the RBIA length and LRPs.

However, if the result of field validation is within the allowable tolerance of (+/-) 1 % of the total road section length against the RBIA but the actual chainage of the corresponding LRPs have been found displaced/moved exceeding the allowable tolerance, then retain the RBIA length but LRPs should be returned to their original position.



Case 2: When there is/are changes/corrections in the road alignment as per project implementation of road widening/upgrading, rehabilitation, reconstruction, construction of bridges on new alignment, road cut/road slip that needs new alignment, etc.

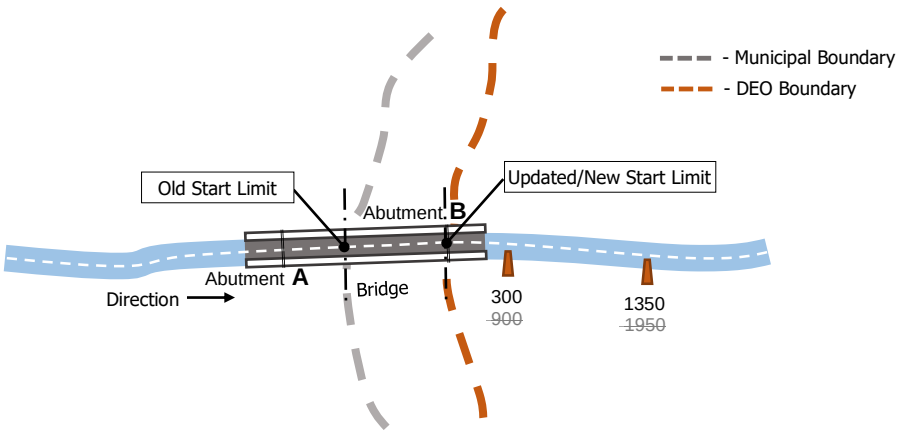
If the results of field validation is greater than the allowable tolerance of (+/-) 1% of the total road section against the RBIA and the affected LRPs also exceeded the said limit, then adopt the validation length and LRPs if they were no longer appropriate to be returned at their original positions. However, if the difference in length is within the said limit, then Case 1 applies.



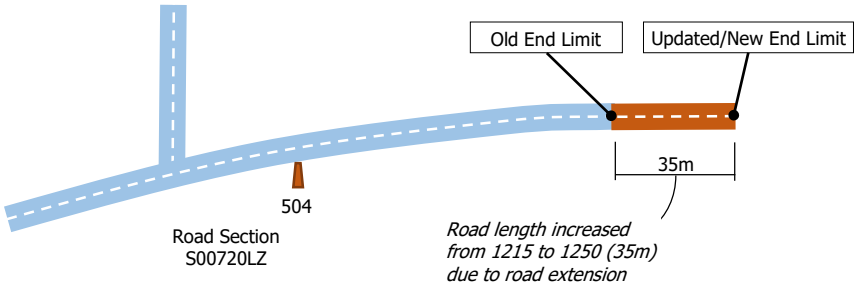
Case 3: When there are changes in the Start or End Limit of the road section or both

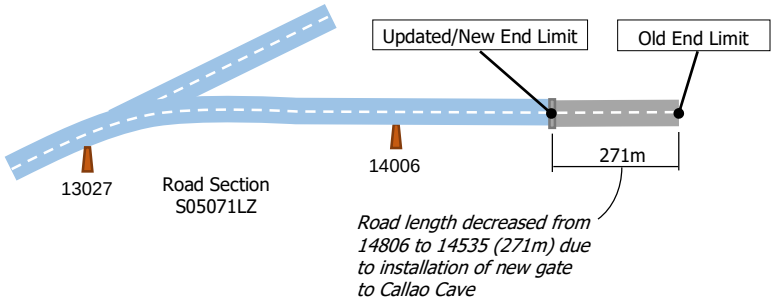
If there are changes in the start and end limits or both due to settled boundary issues, corrections in the start/end of the previous survey, etc., then adopt the adjusted road section lengths. In the case of LRPs;

a) If adjustment incurred at the start of the road section only, then the Chainages of LRPs in the RBIA should be adjusted. No need to repositioning.

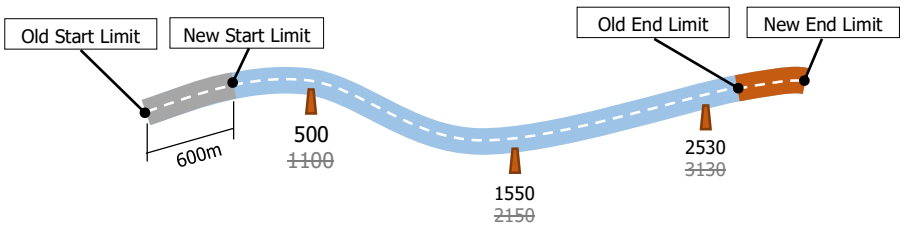


b) If adjustment incurred at the end of road section only, then the Chainages of LRPs in the RBIA remain.



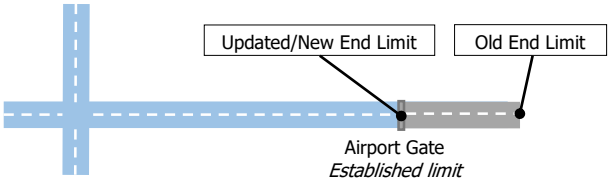


c) If adjustment incurred at the start and end of road section only, then the Chainages of LRPs in the RBIA shall be adjusted. No need for physically repositioning the LRPs.

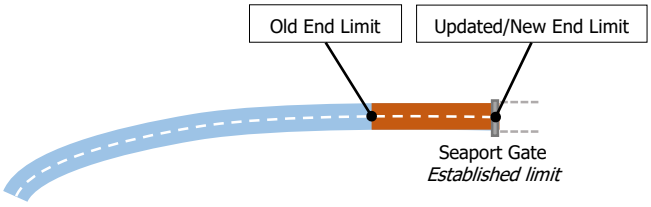


Case 4: When there is road section that was deficient or exceeded the road section limit (No adjoining road section or end of national road established at the gate of Airport, Seaport, National Parks, etc.)

a) Road sections that exceed the road section limit should be cut at the established end limit.

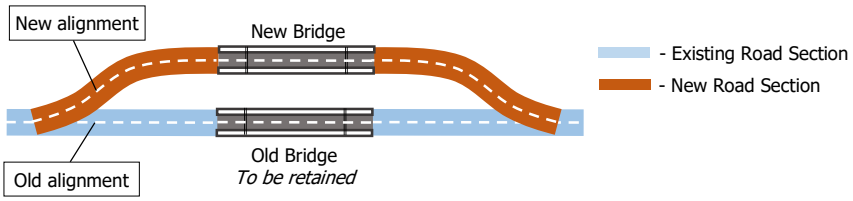


b) Road sections with deficient length should be adjusted up to the established end limit.



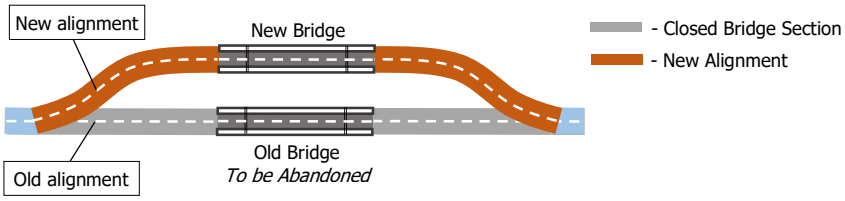
Case 5: When a new bridge is constructed on a new alignment and parallel to the existing bridge, the former bridge needs to be retained as part of the existing road section

Then consider the new bridge alignment as a separate road section with assigned Section Id, while, no changes will be done on the original alignment.



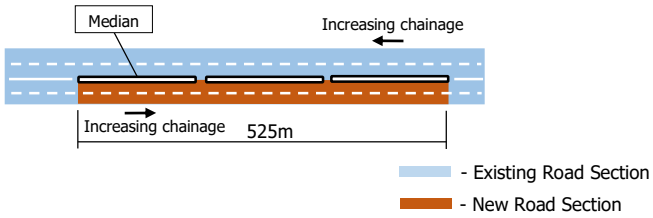
Case 6: When a new bridge is constructed on a new alignment parallel to the existing bridge, the former will no longer be utilized or closed to vehicular traffic

If length increased/decreased, adopt the new bridge alignment and adjust the Chainages of affected road elements including LRPs.



Case 7: Modification of Roadway Configuration from Single Carriageway into Dual Carriageway

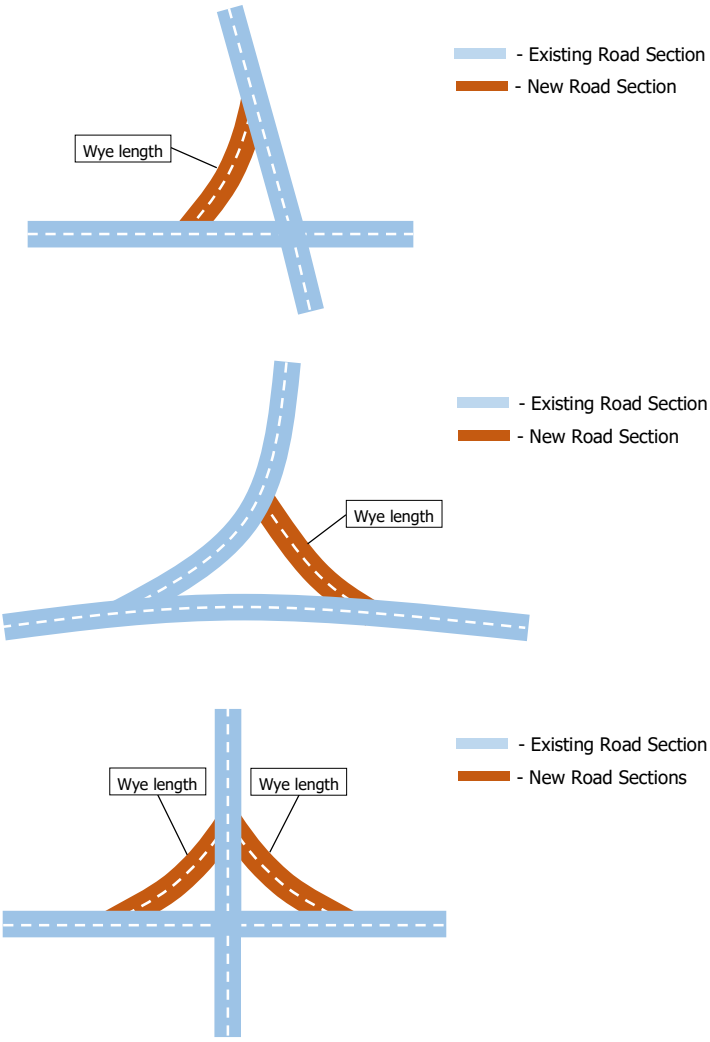
If there is portion of the road with median constructed at the center of the carriageway of at least five hundred (500) meters, then this should be considered as dual carriageway. The two opposing lane directions should be designated with separate road section Ids.



Case 8: Wye length

A wye length is a triangular joining arrangement which allows traffic to travel in a certain direction. This triangular junction allows flexibility for the traveler to reach their destination without having to pass through the main junction.

Wye lengths are considered a separate road section, hence, are assigned a separate road section Ids.



B. **Locational Referencing Points (LRPs)** are fixed known reference points usually kilometer post placed at the right side position of the road in the positive direction.

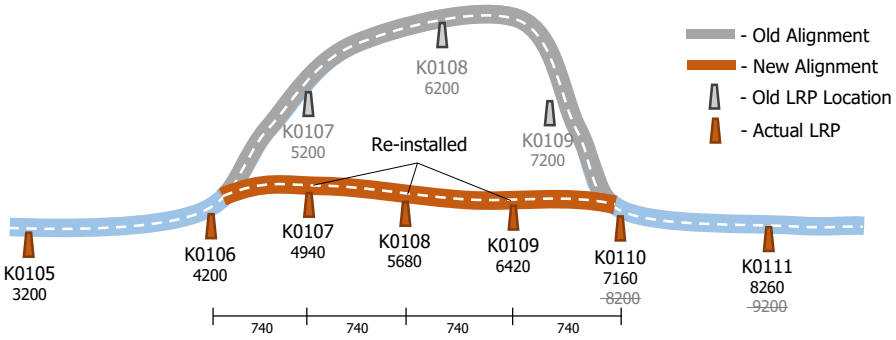
The LRPs should be positioned as much as possible as indicated and posted in the RBIA. However, movement/repositioning of the LRPs cannot be avoided at times due to the dynamics of the road brought about by continuous improvements within the network.

a. Retention of LRPs:

1. When measurements between LRPs reached within the (+/-) 1% allowable tolerance, retain the current actual ground location whilst maintaining the RBIA posted positioning. However, when distance measurements between succeeding LRPs exceeds the (+/-) 1% allowable tolerance, the actual ground LRP should be uprooted and re-installed per original RBIA positioning.
2. Missing LRPs that are currently established in the RBIA should be physically installed using RBIA positioning.

b. Updating of Chainages of LRPs in the RBIA:

1. When there is a road realignment resulting to shortening or lengthening of the existing centerline geometry.
2. When existing road is reconstructed such that the nodes associated with the sections or the lengths of sections are revised.
3. When there is a change in the location of the start of road section, a corresponding movement in the location/chainages of the LRPs follow. The RBIA should be updated when said changes occurs.
4. For newly converted local roads into national roads, LRPs should be established at 1,000m interval above ground prior to uploading in the RBIA (To be uploaded in the RBIA).
5. Road sections with existing LRPs in the field but not yet established in the RBIA should be updated in the RBIA.
6. Road sections with missing LRPs that are not yet established in the RBIA should be updated physically at 1000m interval (as applicable) and similarly updated in the RBIA.
7. Creation of new DEO/reapportionment of Legislative District resulting to redefining of boundary limits, the affected road section must be separated, and its corresponding LRPs should be adjusted accordingly.
8. In case of road realignment resulting in increase/decrease in length, the affected LRPs should be reinstalled proportionately along the new alignment.



C. **Inventory Elements**

1. Updating of records of inventory elements occur continuously, whenever there are changes in the actual road features.
2. For on-going projects, updating of inventory occurs when there is at least 50% of continuous physical length of the project that has been completed and within 30 days after the completion of the project.

4.2.3 Guidelines in the Physical Installation/Re-installation of the LRPs in the Field

Following the institutionalization of the RBIA and the LRS through then D.O. 54, series of 2004, as amended by D.O. 124, s. 2016,

On 15 March 2019, D.O. 31, s. 2019 was issued instructing the replacement of all currently installed LRPs/road markers, with newly designed and constructed LRPs/road markers, for uniformity in design and physical features, and general public information.

However, in order to ensure that the newly designed and constructed markers are placed and re-installed consistent with RBIA positioning, the following guidelines and procedures should be followed prior to physical installation to wit:

1. Locational Reference Points (LRPs) shall be installed on all primary, secondary and tertiary national roads following a standard design and specification across the entire road network.
2. The locational positioning of said LRPs are administered and managed by the Statistics Division, Planning Service (SD, PS).
3. LRPs must never be moved or relabeled without consulting the Road and Bridge Information Administration (RBIA) Section of the SD, PS.
4. Replacement of all RBIA positioned LRPs by newly constructed road markers/LRPs, should not be physically re-installed and restored without prior field validation and confirmation of its relative RBIA location/positioning by the SD, PS before and after its installation.
5. For newly converted local roads and road segments (gap portion of a subject national road) integrated into the national road network, LRP locations should be established at least 1,000m interval by the SD, PS and to be installed by the concerned DEOs.
6. Any changes in the position/location of the LRPs in the field shall be subjected for consultation and approval by the SD, PS.

Detailed procedures in the management of the LRS and inventory data are described in the form of 'Case Studies' in Chapter 4.3.

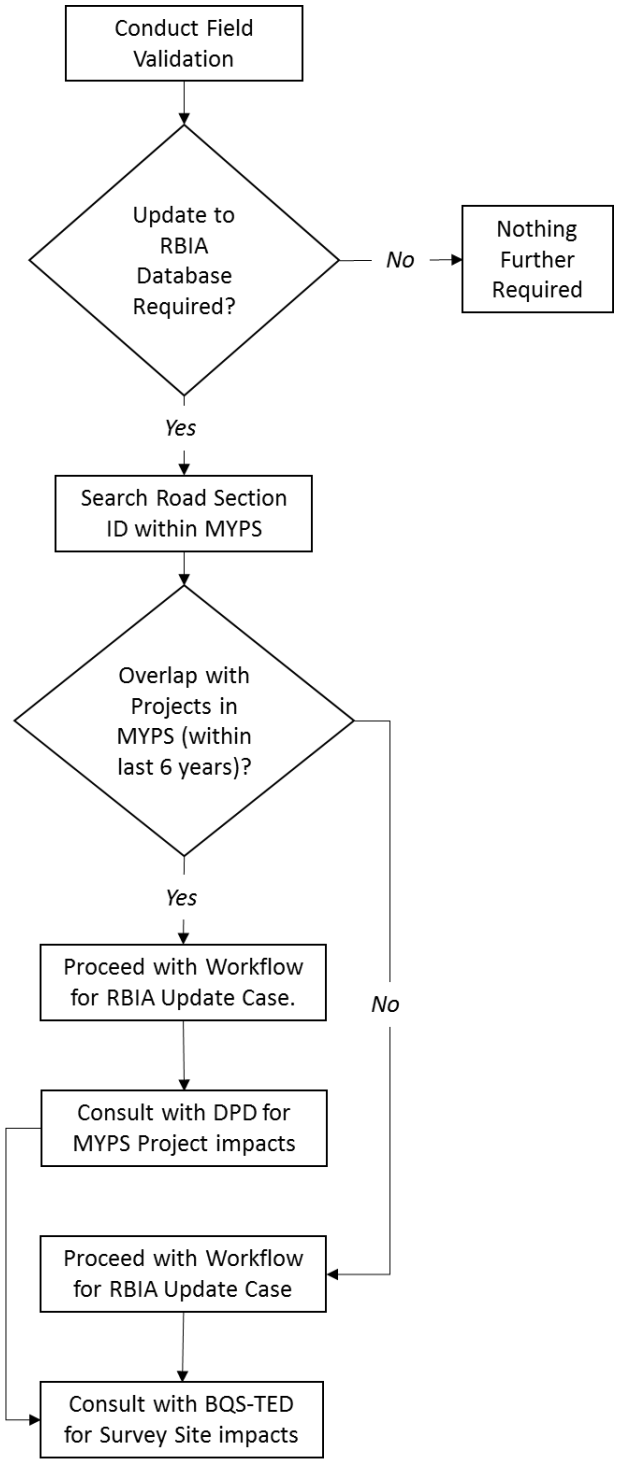
4.2.4 Systems Review before Updating LRS and Inventory Data

The DPWH LRS and Inventory Data contained in the RBIA should be consistent with all other systems in the Department. Prior to applying updates to the RBIA, a review of location related Projects in the Multi Year Programming and Scheduling (MYPS) application should be undertaken.

The workflow in Figure 8 provides guidance in reviewing MYPS prior to implementing any changes in the RBIA.

Workflow

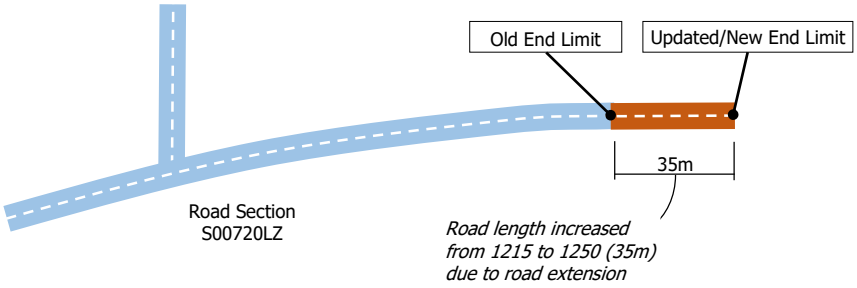
Figure 8 Update to RBIA Workflow



	Responsible	Details
Conduct Field Validation		
Update to RBIA Database Required?	SD RBIA Section	1. Confirm that either an inconsistency exists or there is a genuine need to update the RBIA. Changes should only be applied where necessary.
Search Road Section ID within MYPS	SD RBIA Section	2. Search MYPS to identify any Projects that are relevant to the Current or Future Road Section IDs
Overlap with Projects in MYPS (within last 6 years)?	SD RBIA Section	3. Confirm if there are any relevant Projects within the last six (6) years. See case study below for conducting a search of MYPS
Proceed with Workflow for RBIA Update Case.	SD RBIA Section	4a. Where updates to RBIA are required, follow the workflows outlined in Section 4.2.5 and 4.3.
Consult with DPD for MYPS Project impacts	SD RBIA Section	5. Provide DPD a brief memorandum outlining updates to Section ID and chainages.
Proceed with Workflow for RBIA Update Case	SD RBIA Section	4b. Where updates to RBIA are required, follow the workflows outlined in Section 4.2.5 and 4.3.
Consult with BQS-TED for Survey Site impacts	SD RBIA Section	6. Consult with Bureau of Quality and Safety Traffic Engineering Division (BQS-TED) for Traffic Survey Site impacts.

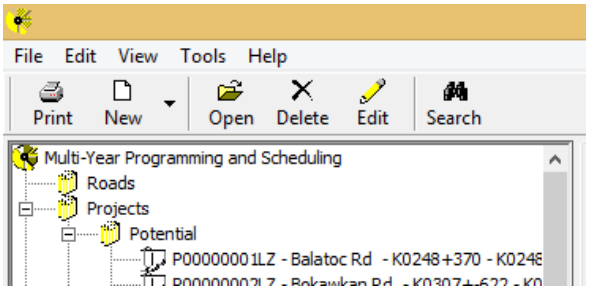
Case Study One: Extending Road Section

In the case study below, it is proposed to extend the length of Section S00720LZ by 35m.

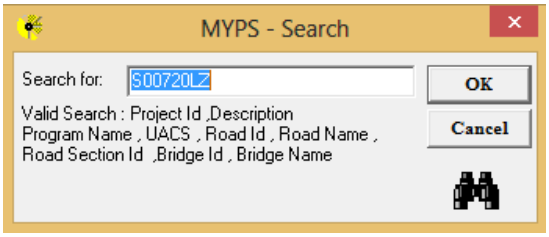


Step 1: Confirm that an update to the RBIA is required.
End limit is incorrect and should be updated within RBIA.

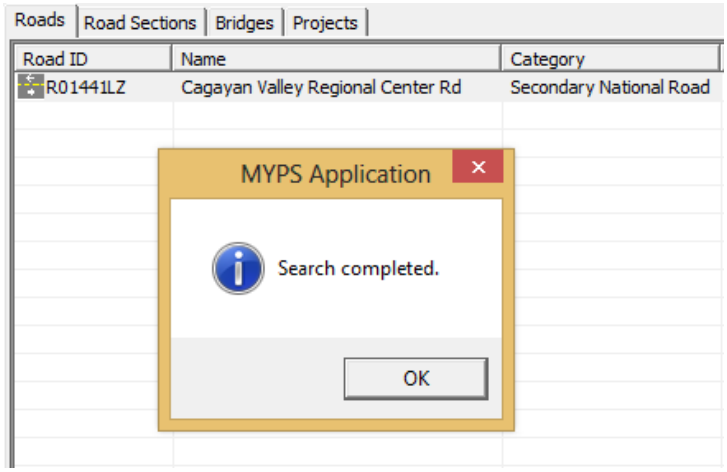
Step 2: Search Road Section ID within MYPS
Open MYPS and click on the '*Search*' button.



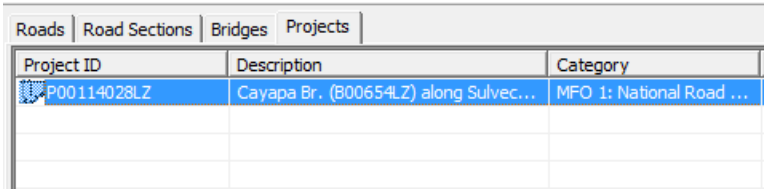
Enter the corresponding Road Section ID and press '*OK*'.



The search is completed and results are indicated within the *Contents Pane*.

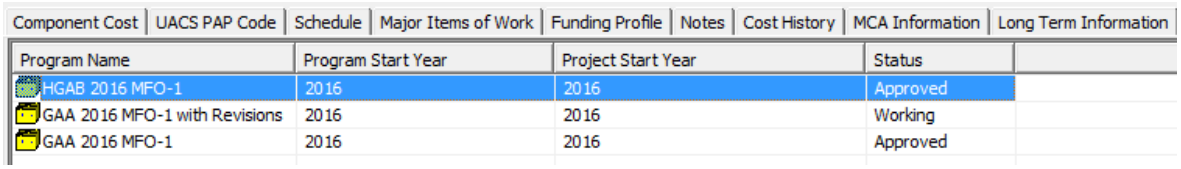


Selecting the '*Projects*' tab, indicates all the Projects that are related to the Road Section ID.



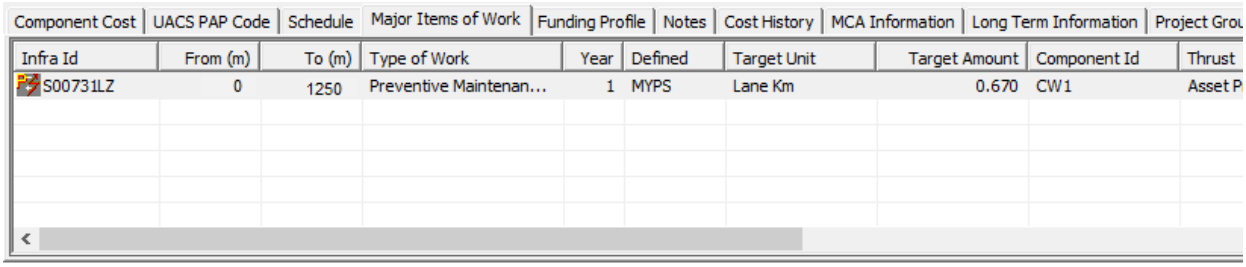
Step 3: Check for overlapping Projects within MYPS (within the last six years)
SD shall now view any relevant Project results to determine if it is within the last six years.

By double clicking on the Project, the details are displayed on the screen. The Program Information tab lists all Programs that the Project is linked to.



As shown in the Details Pane above, the Project is within a 2016 Program, therefore it is a Project within the last six years.

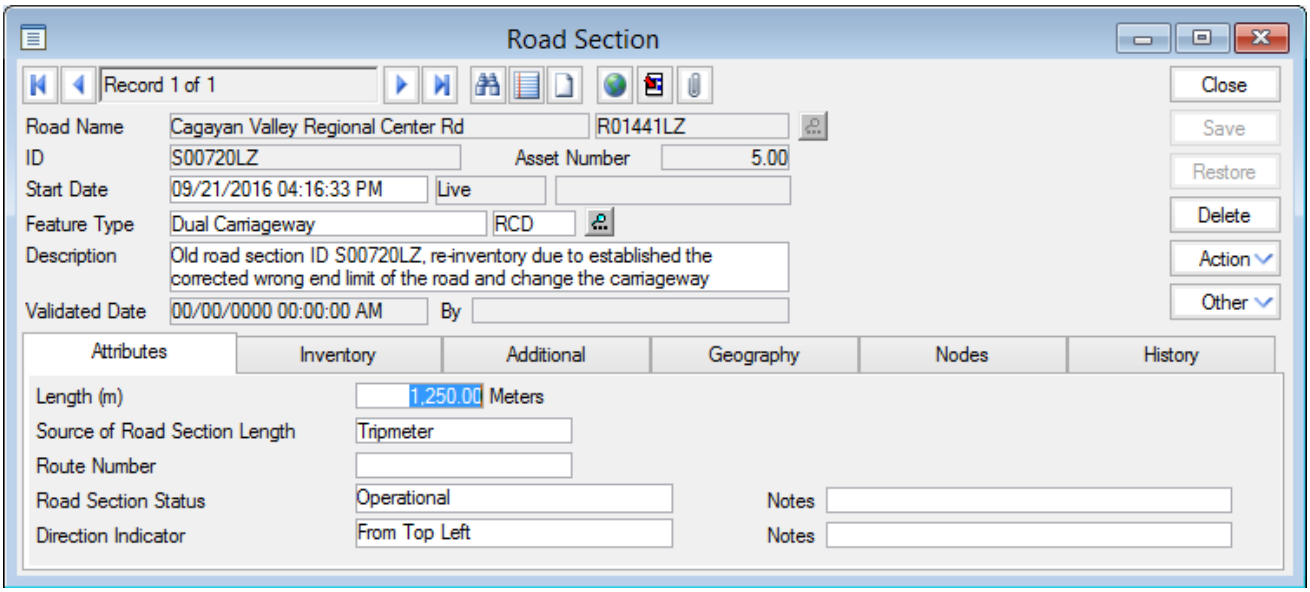
The chainages of the Project are then reviewed for any overlap with the proposed RBIA Update.



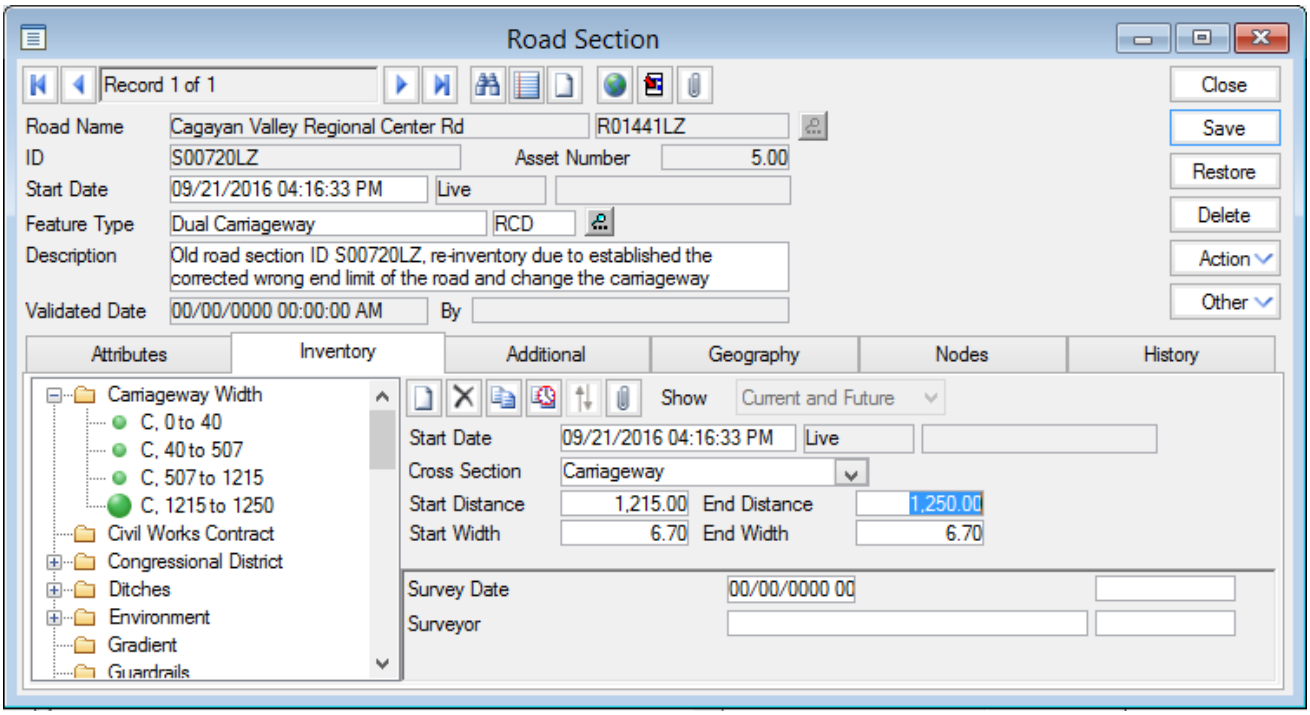
A review of chainages, as indicated above, shows that a Project overlaps with the updated Section.

Note: If the project is greater than six years old, SD shall proceed with the update to the RBIA, consulting with BQS-TED (Step 6) to determine if there are any survey site impacts.

Step 4: Update RBIA as per Data Update Workflow
SD proceed to update RBIA as per the RBIA Data Update Workflow in Section 4.2.5. In this case, the *Attributes* tab is updated with the revised length.



As the Section is being extended, the *Inventory* and *Nodes* are simply updated to suit the increased length.



<u>Step 5: Consult with DPD for MYPS Project impacts (only if overlapping Project is within last six years)</u>

SD shall prepare a brief memorandum for issue to DPD outlining the update to the RBIA and corresponding Section IDs and chainages.

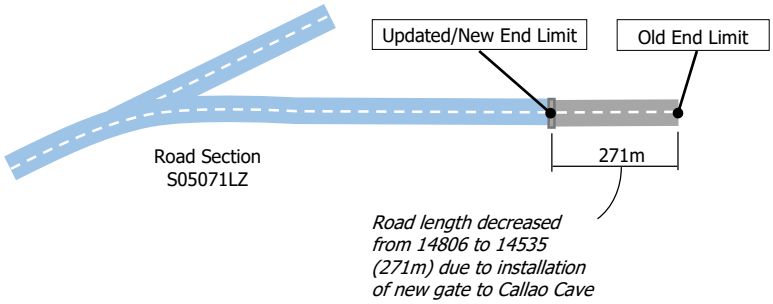
<u>Step 6: Consult with BQS-TED for Traffic Survey Site impacts</u>

In all cases that an update to the RBIA database is required, the SD shall consult with BQS-TED for potential survey site impacts.

SD shall provide a brief memorandum to BQS-TED outlining the required update to the Road Section, to facilitate any changes required to the RTIA data.

Case Study Two: Shortening Road Section

In the case study below, it is proposed to reduce the length of Section S05071LZ by 271m.



Step 1: Confirm that an update to the RBIA is required.

End limit is incorrect and should be updated within RBIA.

Step 2: Search Road Section ID within MYPS

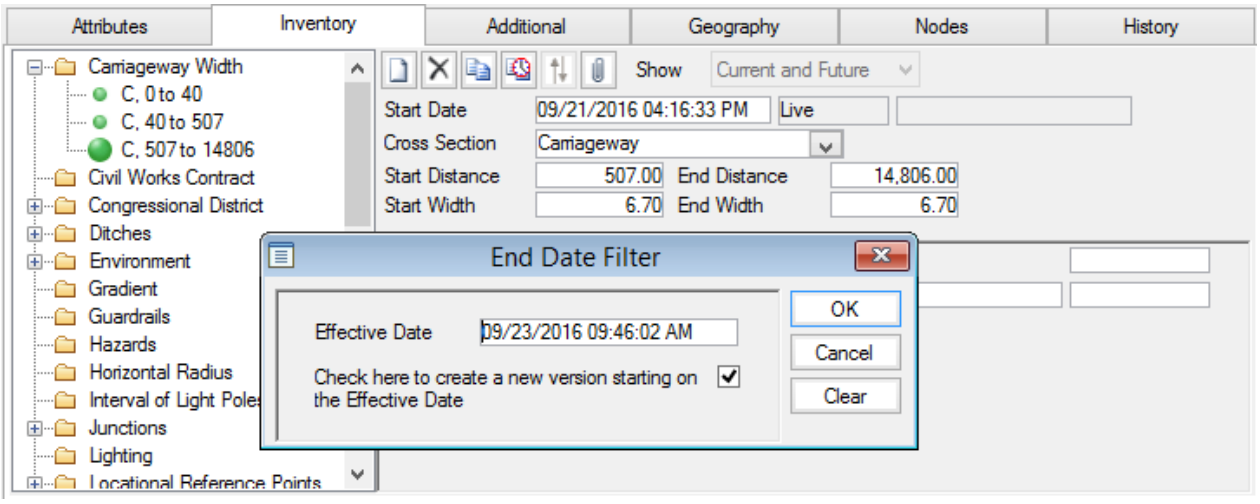
Following the same steps as Case Study One, the Road Section ID is searched in MYPS.

Step 3: Check for overlapping Projects within MYPS (within the last six years)

The search in MYPS indicates a relevant Project, however the chainages of the update do not overlap with the Project.

Step 4: Update RBIA as per Data Update Workflow

SD proceed to update RBIA as per the RBIA Data Update Workflow in Section 4.2.5. In this case, the *Attributes* tab is updated with the revised length. As the Section is being reduced, the *Inventory* items are end dated for the revised length and *Nodes* updated to suit.



Step 5: Consult with DPD for MYPS Project impacts (only if overlapping Project is within last six years)

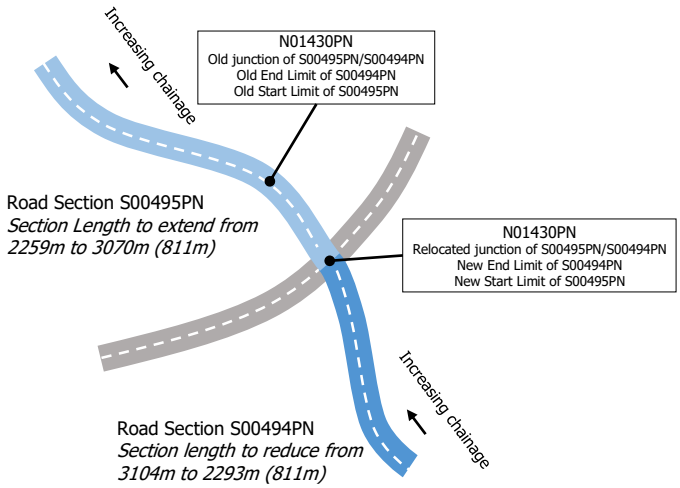
Consultation with DPD is not required, as Project chainages do not overlap with RBIA Update.

Step 6: Consult with BQS-TED for Traffic Survey Site impacts

Following the same steps as Case Study One, SD shall consult with BQS-TED.

Case Study 3: Update Junction Point

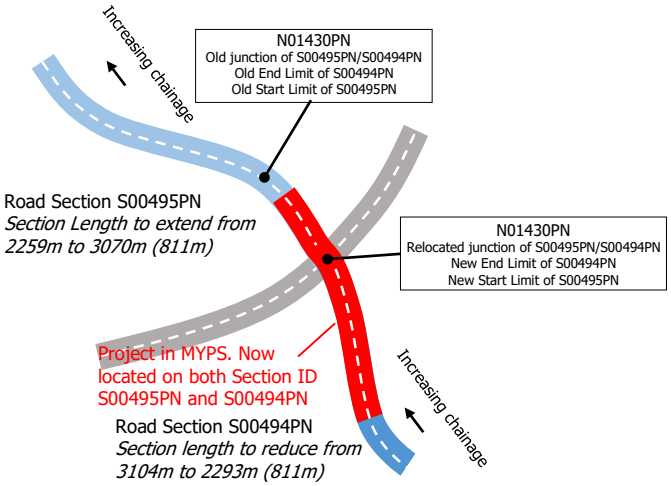
In the case study below, it is proposed to update the junction of Section S00495PN and S00494PN.



Step 1: Confirm that an update to the RBIA is required.
Junction point is inconsistent with GIS and should be updated within RBIA.

Step 2: Search Road Section ID within MYPS
Following the same steps as Case Study One, the Road Section ID is searched in MYPS.

Step 3: Check for overlapping Projects within MYPS (within the last six years)
The search in MYPS indicates a relevant Project in MYPS on Section ID S00494PN. On review of the chainages of the Project and the new junction point, the Project would now be located within both Section IDs. This update must be communicated with DPD as outlined in Step 5.



Step 4: Update RBIA as per Data Update Workflow
SD proceed to update RBIA as per the RBIA Data Update Workflow in Section 4.2.5. In this case, S00494PN shall be reduced in length by updating the *Attributes* and end dating the items in the *Inventory*.
Section S00495PN is increased in length by updating the *Attributes* and updating the items in the *Inventory* to suit.

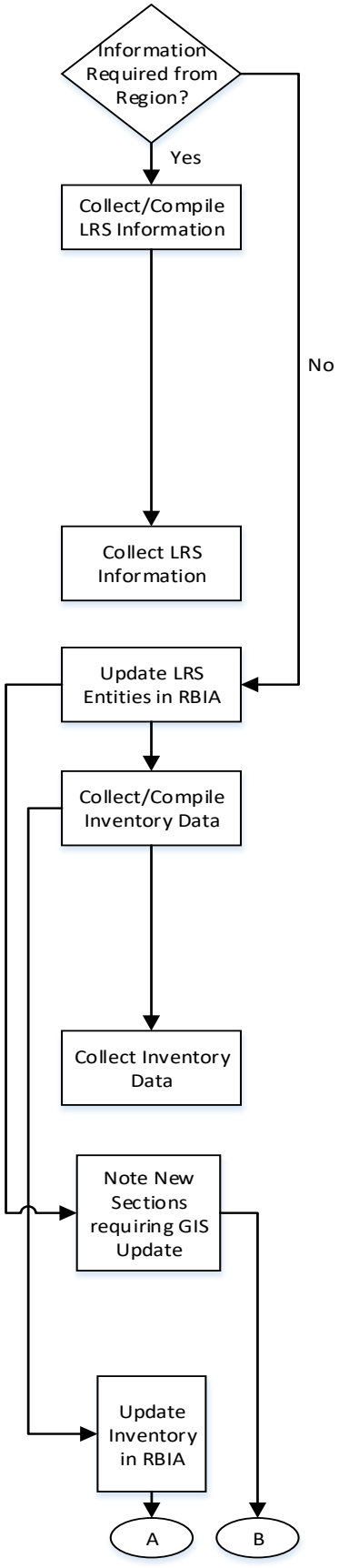
Step 5: Consult with DPD for MYPS Project impacts (only if overlapping Project is within last six years)
SD shall prepare a brief memorandum for issue to DPD outlining the Road Section IDs that are now relevant to the Project in MYPS. The memorandum shall include a simple figure indicating the Section IDs, and details of the change.

Step 6: Consult with BQS-TED for Traffic Survey Site impacts
Following the same steps as Case Study One, SD shall consult with BQS-TED.

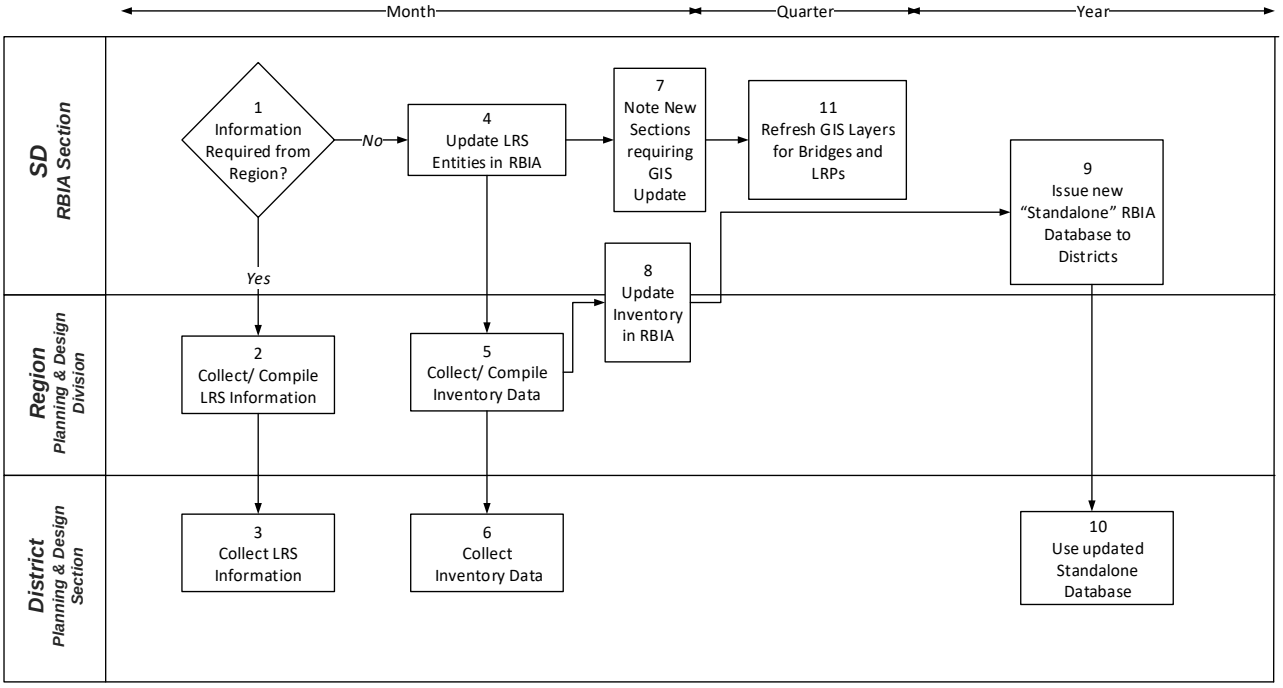
4.2.5 LRS and Inventory Data Update Workflow

In the event of a change in LRS information, Figure 9 illustrates the typical workflow in updating the associated LRS and inventory data in the RBIA.

Figure 9 Network Definition & Inventory Update Workflow Caused by Change to Network

Process Flow	Responsible	Details
	SD RBIA Section	1. SD determines whether or not information is required from the Region.
	REGION Planning and Design Division	2. If Information is requested by SD, the Regional Planning and Design Division Office Must submit and 'LRS and Road Inventory Update Sheet' to the SD. The completed sheet must contain sufficient detail, including existing data, to enable SD to determine the extent of the revision and the appropriate revisions to the location referencing data. An example of such update sheet and instructions are found in Appendix E.
	DISTRICT Planning and Design Section	3. The Regional Office may request the District Office to collect any necessary data.
	SD RBIA Section	4. The RBIA Team Leader of SD update the LRS information in the RBIA.
	REGION Planning and Design Division	5. If any inventory information is requested by SD, the Regional Planning and Design Division Office compiles the data using the same "LRS and Road Inventory Update Sheet'. (The road inventory information is collected using 'Instructions for Road Inventory Update Sheet as found in Appendix F.)
	DISTRICT Planning and Design Section	6. The Regional Office may request the District Office to collect any necessary data.
	SD RBIA Section	7. Information requirements for the Geographic Information System (GIS), are noted for inclusion in the annual data collection activities for these items.
	SD RBIA Section	8. The SD acquires any necessary inventory data necessary from the Region/Districts and makes the updates to the RBIA. It is noted, however, that, under normal circumstances, inventory updates that do not involve changes to the LRS information are made directly by the Region.

Process Flow	Responsible	Details
A Issue new "Standalone" RBIA Database to Districts	SD RBIA Section	9. The updated LRS and inventory information are periodically disseminated to the District Offices via distribution of updated standalone (read-only) versions of the RBIA database.
Use updated Standalone Database	DISTRICT Planning and Design Section	10. The District Offices then produce updated 'Road Network Reference Reports' for the users in the field (Appendix B).
B Refresh GIS Layers for Bridges and LRP's	SD RBIA Section	11. The RBIA Team Leader of SD extract and publish new GIS layers for bridges and LRPs. For detailed procedures for this step refer to the RBIA/GIS Procedure Manual.

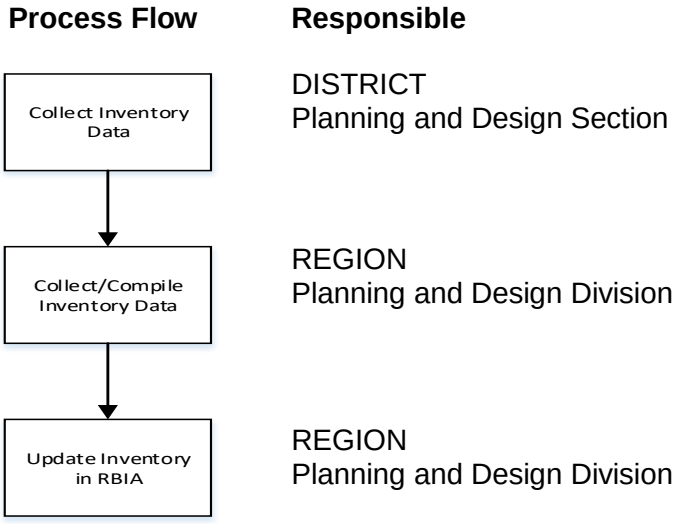


The workflow is triggered with the identification that a change has occurred to the network that impacts the location referencing information, and this can occur at any level of the organization.

The responsibility for identification of a change to the network shall be the Planning and Design Division of the Regional Office. The District Planning and Design Section may have a supporting role in this task. It is also possible that Central Planning Service may become aware of a change that impacts the location referencing data, for example from a Department Order that creates a new Engineering District Office. If Central Planning Service is aware of any change that may impact the location referencing data, they should contact the Regional Office and request the necessary information be submitted as soon as possible.

As mentioned earlier, inventory updates to the RBIA that do not involve changes to the LRS information are made directly by the Regional Office (both data collection and the entry into RBIA), and a much simpler workflow for this process is illustrated in **Figure 10**.

Figure 10 Inventory Update Workflow Caused by Change only in Inventory



Note that Bridge Inventory Updates are to be carried out in accordance with the procedures detailed in the Bridge Inspection manual. That document provides the necessary forms required for this purpose.

4.3 LRS/Inventory Update Case Studies

4.3.1 New or Change in Road Name

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of road names within the Alias Road Name field.

Definition

Road Name: A title representing the direction and/or location of a road.

Attributes Stored in RBIA: Road ID
Road Name
Alias Road Name
Functional Classification

Standards: RBIA to be updated within 1 month of receipt of Department Order/Memorandum Circular

Currency of Data: Changes to be available in RBIA (networked) within 1 month

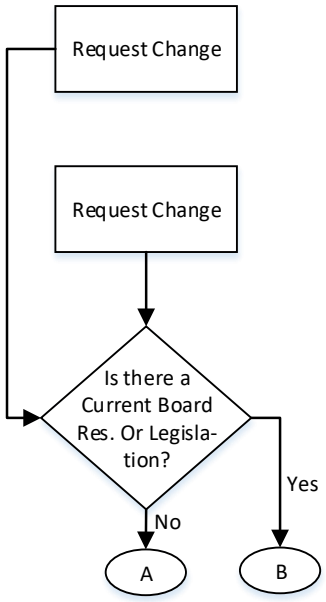
Data Stewards

Planning Service - SD, RBIA Section

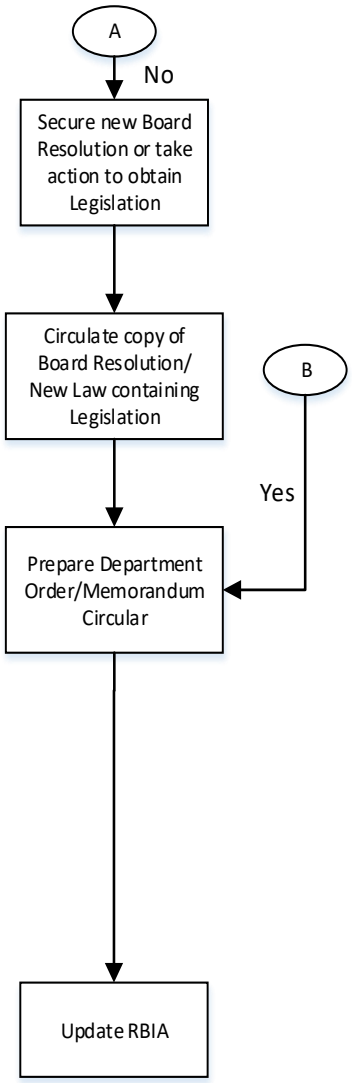
Users

Planning Service (PS)
Bureau of Maintenance (BOM)
Regional Office Planning & Design Division

Figure 11
Workflow for Updating Road Names



Process Flow	Responsible	Details
Request Change	SD RBIA Section	1. Receipt of Information that an inconsistency in Road Name exists. Or:
Request Change	Proponents	2. Receipt of a request from a proponent to change a Road Name.
Is there a Current Board Res. Or Legisla-tion?	SD RBIA Section	3. Confirm that either that an inconsistency does exist or there is a genuine need to change a Road Name by checking Board Resolutions or Legislation. If the particular Road Name has not been created through a board resolution or Legislation then it will be necessary to notify the DPWH Secretary. This process should include referring the proposed road name change to the National Historical Institute for concurrence.

Process Flow	Responsible	Details
	DPWH Secretary DPWH Secretary SD RBIA Section SD RBIA Section	4. Authorization by Board Resolution / Legislation for creation or amendment of a Road Name. 5. Circulate Board Resolution / Legislation to SD. 6. Where the Road Name is decreed by legislation a Department Order shall be prepared to have the Road Name recognized as the official name. Where a Board Resolutions decrees the Road Name, a Memorandum Circular shall be prepared to inform DPWH offices of the change. 7. Update the RBIA and email Users to inform of change. Shall also consult with BQS-TED to determine any impacts on Survey Sites.

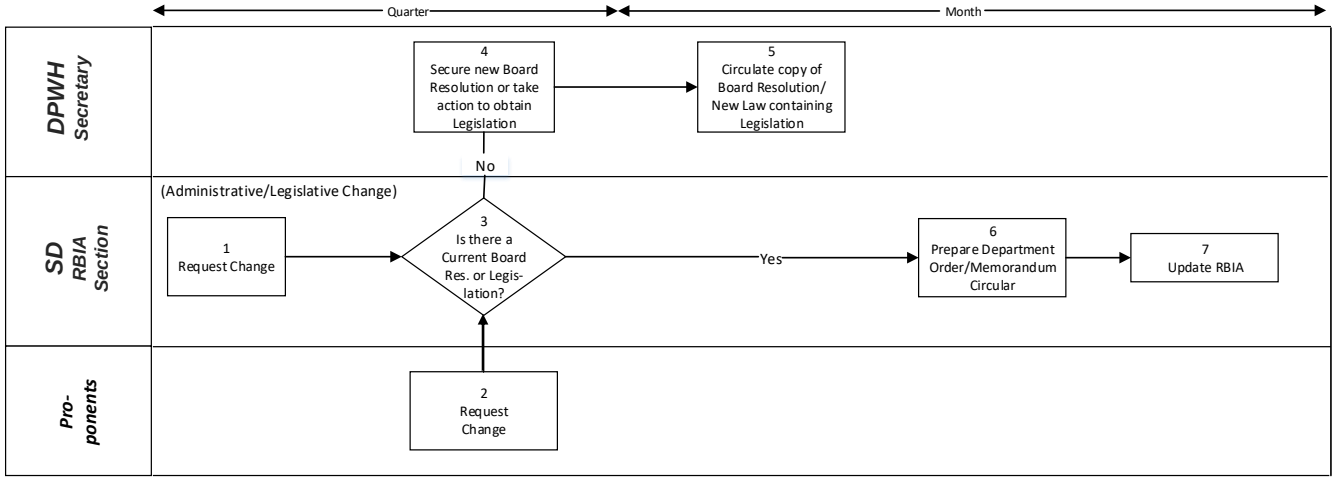
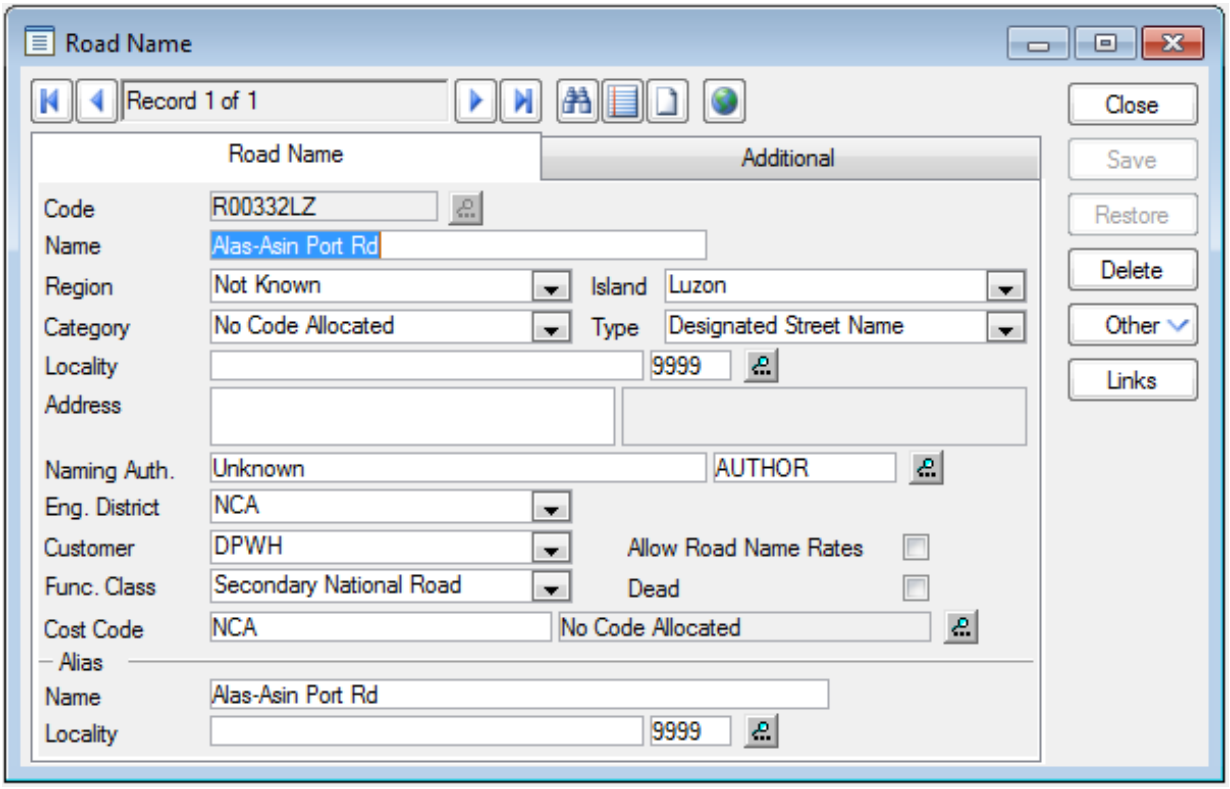


Figure 11 indicates that the initial step is for Users to notify SD of any identified inconsistency in Road Name. Alternatively a proponent makes a request to SD to have a name changed. This process commences upon SD receiving notification of the requested change.

Actions in the RBIA

9. Log in to RBIA with appropriate user privileges (permission to edit/add from 'Road Names' form).



10. Use the 'Road Name' form to make the necessary changes.

(Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.3.2 Realignment of Road

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of network definition and inventory information.

Definition

Realignment of Road: A new portion of road on a changed alignment.

Attributes Stored in RBIA:
Road Name
Road ID
Start Date
End Date
Road Section ID
Feature Type
Description
Length
Carriageway Configuration
Source of Road Section Length
Road Section Status
Engineering District

Standards: RBIA to be updated with location and inventory information within one month of receipt of Final Acceptance Report.

Currency of Data: Changes to be available in RBIA (networked) within 1 month of receipt of Final Acceptance Report.

Data Stewards

Planning Service - SD, LRS & GIS Section

Users

Planning Service (PS)
Bureau of Maintenance (BOM)
Regional Office Planning & Design Division
District Offices

Workflow

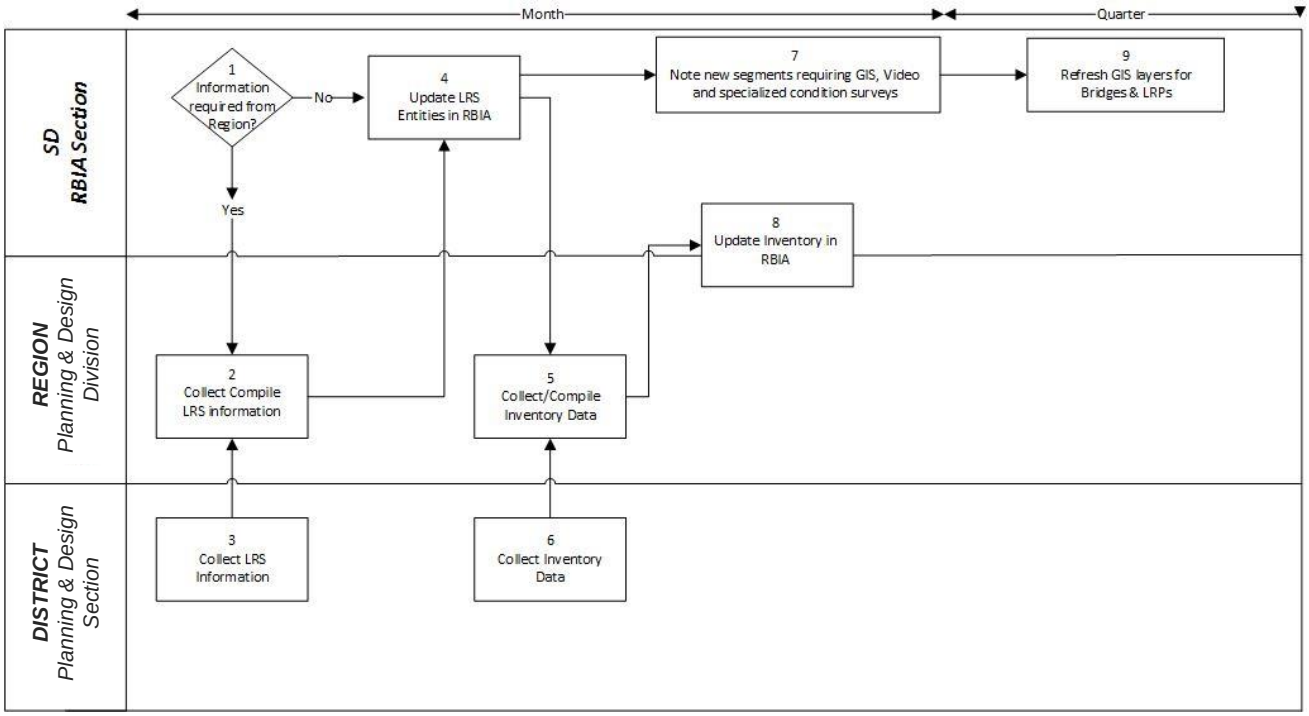
Figure 12
Workflow for Managing the Realignment of a Road

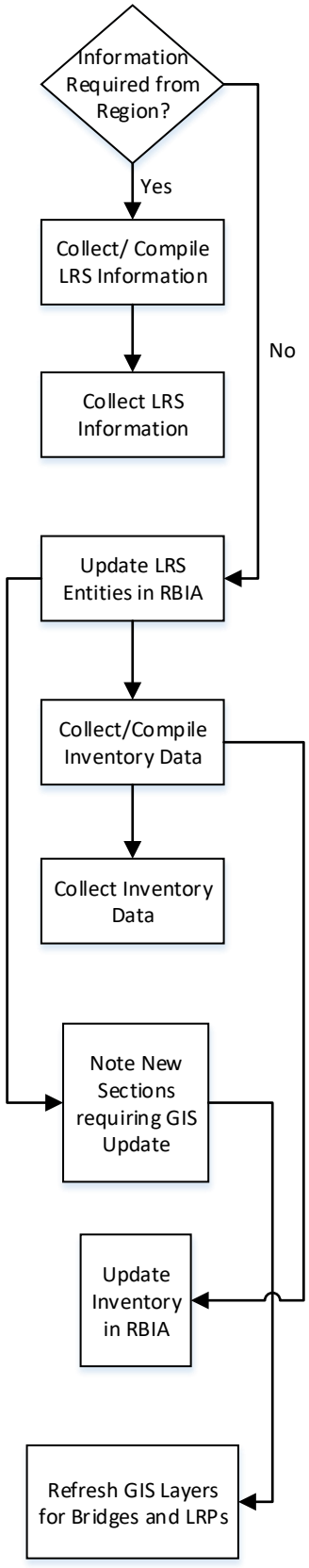
Process Flow	Responsible	Details
Submit copy Final Acceptance Report	Implementing Office	1. Receipt of signed copy of Final Acceptance Report by SD (Sample in Appendix H).
Update RBIA	SD RBIA Section	2. Update the RBIA and email Users to inform of change.

Figure 12 indicates that the initial step is for the Implementing Office to provide SD of the Final Acceptance Report for newly constructed works that result in realignment.

Workflow for RBIA Update of LRS and Inventory

Figure 13
Workflow for RBIA Update of LRS and Inventory

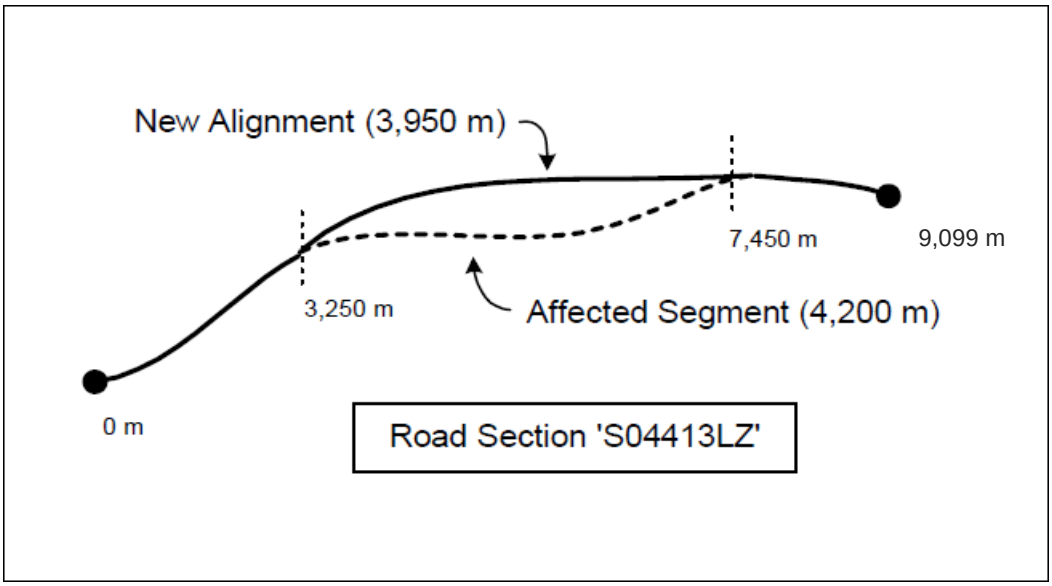


Process Flow	Responsible	Details
	SD RBIA Section	1. Determining need for information / data from Regions.
	REGION Planning and Design Division	2. Collecting LRS and Inventory information onto LRS and Inventory Update Form (note that this may be combined with step 3,5 & 6).
	DISTRICT Planning and Design Section	3. As per step 2.
	SD RBIA Section	4. Creating new sections in RBIA and update LRS information.
	REGION Planning and Design Division	5. As per step 2.
	DISTRICT Planning and Design Section	6. As per step 2.
	SD RBIA Section	7. Note segments that require GIS data. These need to be recorded and scheduled accordingly.
	SD RBIA Section	8. Updating the RBIA for Inventory Data.
	SD RBIA Section	9. Extract and publish new GIS layers for bridges and LRPs. For detailed procedures for this step refer to the RBIA/GIS Procedures Manual.

Actions in the RBIA

Use 'LRS and Inventory Update Sheet' provided by the Regional Office to visualize the new configuration.

Consider the following example:

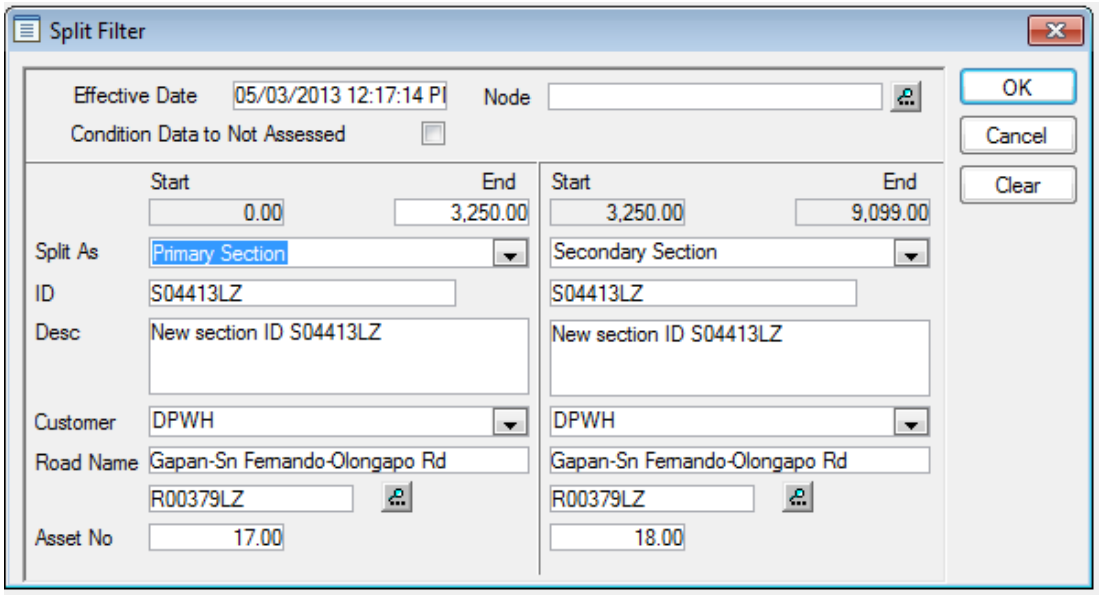


For the example above, the following steps shall be followed;

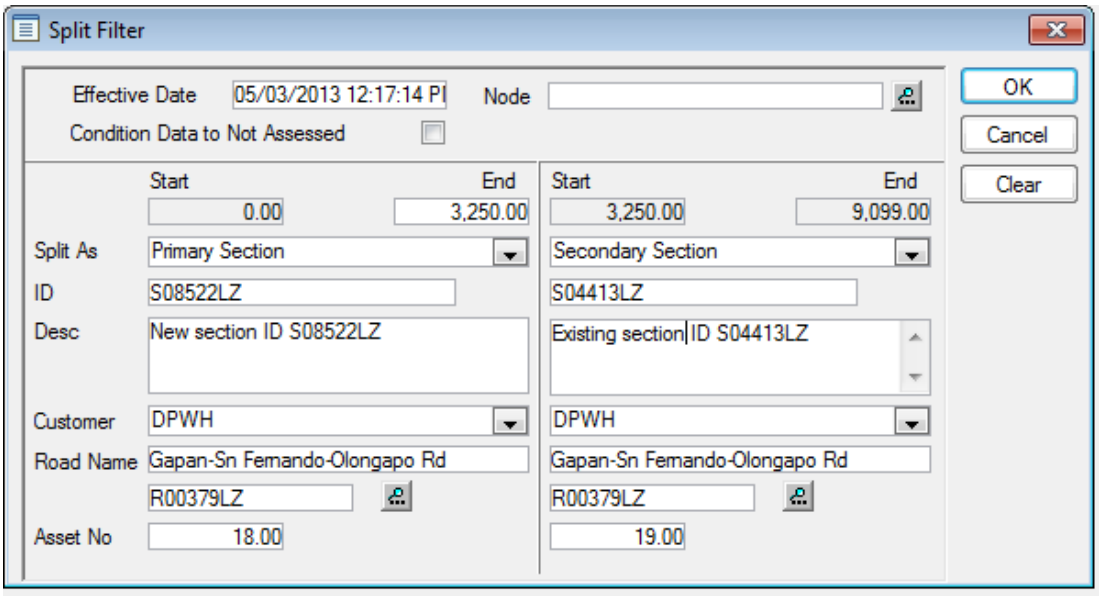
- Split road section at 3,250m
- Split road section at 7,450m (now 4,200m)
- End date the mid-section
- Create a new section to replace the end dated mid-section
- Merge the three newly created road sections, with total length of 8,849m

The steps are covered in further detail below.

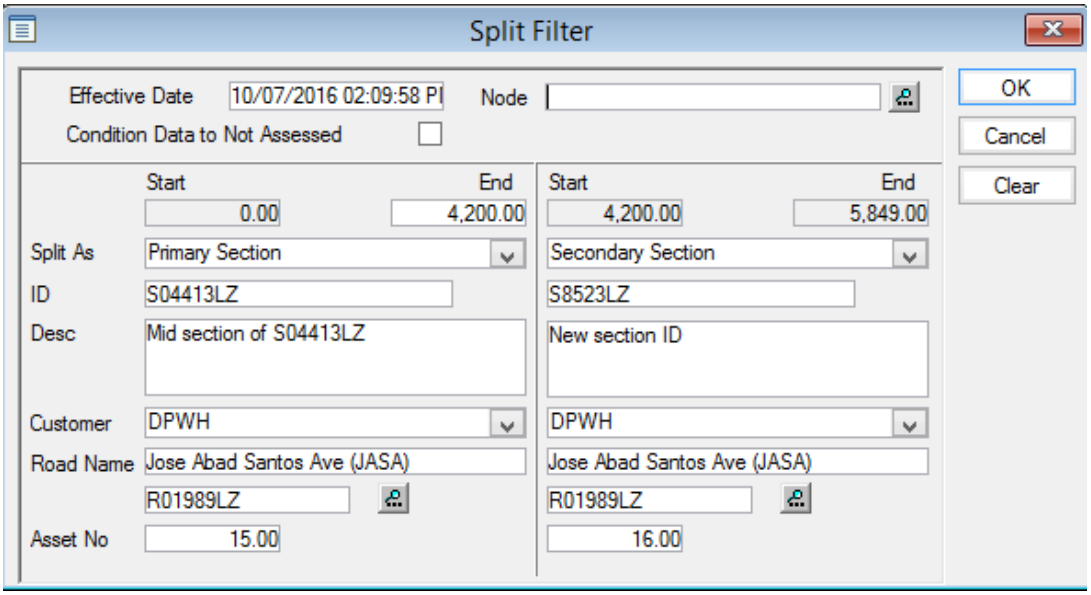
1. Log in to RBIA with appropriate user privileges (permission to perform various actions in 'Road Section' form).



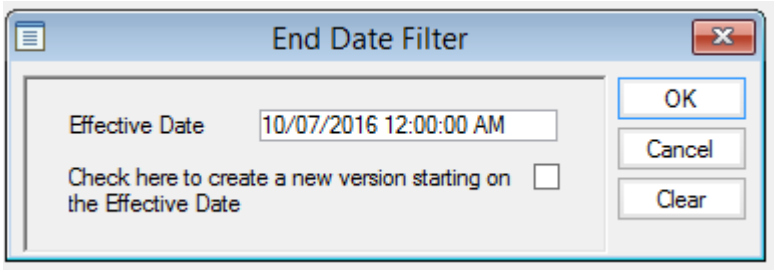
2. 'Split' affected Road Section S04413LZ at 3,250m.



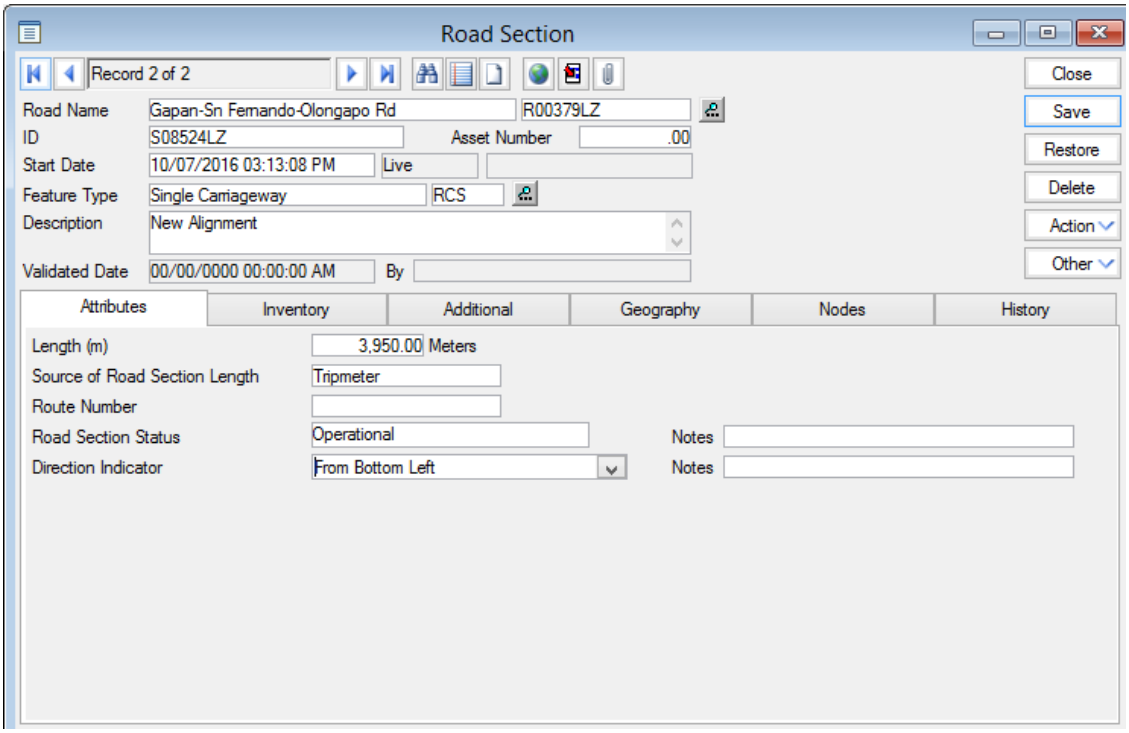
3. 'Split' newly created Secondary Section at 4,200m



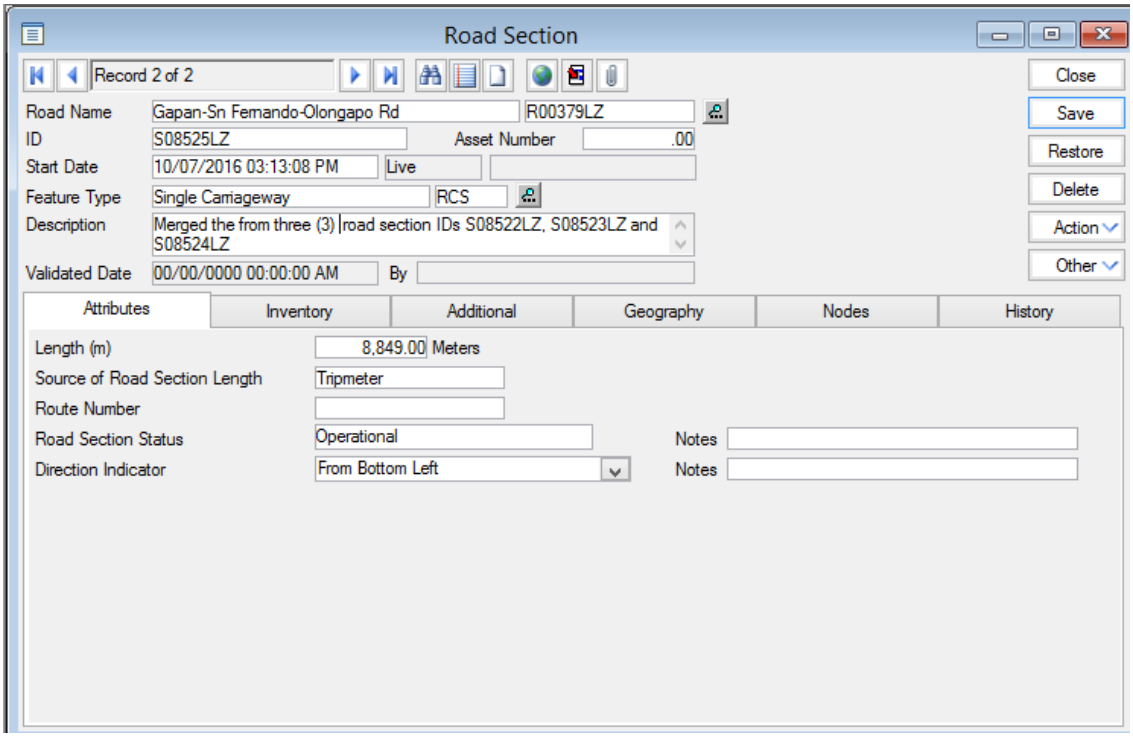
4. 'End Date' mid section S04413LZ. Ensure that "Check here to create a new version starting on the Effective Date" is ticked.



5. Create a new section ID for new alignment of 3,950m.



6. Merge the three newly created road section IDs with new total length of 8,849m.



(Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.3.3 Road Conversion

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of network definition.

Definition

Road Conversion:	A road that has been either upgraded from a provincial/local authority to National Status or downgraded from National status to a provincial/local authority.
Attributes Stored in RBIA:	Road ID Road Name Road Section ID Description Start Date End Date Length Feature Type Engineering District Carriageway Configuration
Standards:	To be updated within one month of receipt of Department Order
Currency of Data:	Changes to be available in RBIA (networked) within 1 month

Data Stewards

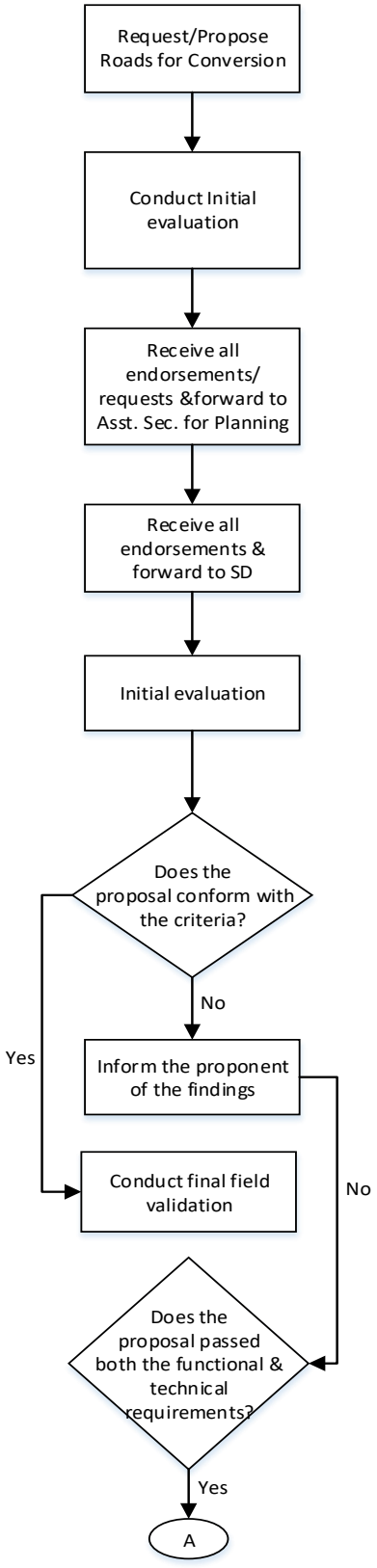
Planning Service - SD, LRS & GIS Section

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning and Design Division
District Offices

Workflow

Figure 14
Workflow for Managing a Road Conversion

Process Flow	Responsible	Details
	District Planning and Design Section Region Planning and Design Division DPWH Secretary Assistant Secretary for Planning and PPP SD Road Classification and Statistics Section SD RBIA Section SD RBIA Section SD RBIA Section Secretary	1. Receipt of request for conversion. 2. The Regional Office then conduct initial evaluation and endorse a request for conversion to the Secretary. 5. Road Classification and Statistics Section of DPWH conduct initial evaluation using available data with the DPWH Road Functional Classification Criteria. 8. SD Conducts final field validation and evaluation then submit a report and recommendation to the Office of the Secretary.

Process Flow	Responsible	Details
A		
Submit required supporting documents	Region Planning and Design Division	10. Regional Offices submit required supporting documents and satisfy DPWH criteria & technical requirements for eventual conversion.
Prepare Memorandum/ Recommendation to the Secretary with draft D.O. for approval	SD RBIA Section	
Road is converted	IMS	12. Approved Department Order is automatically posted at the DPWH web page.

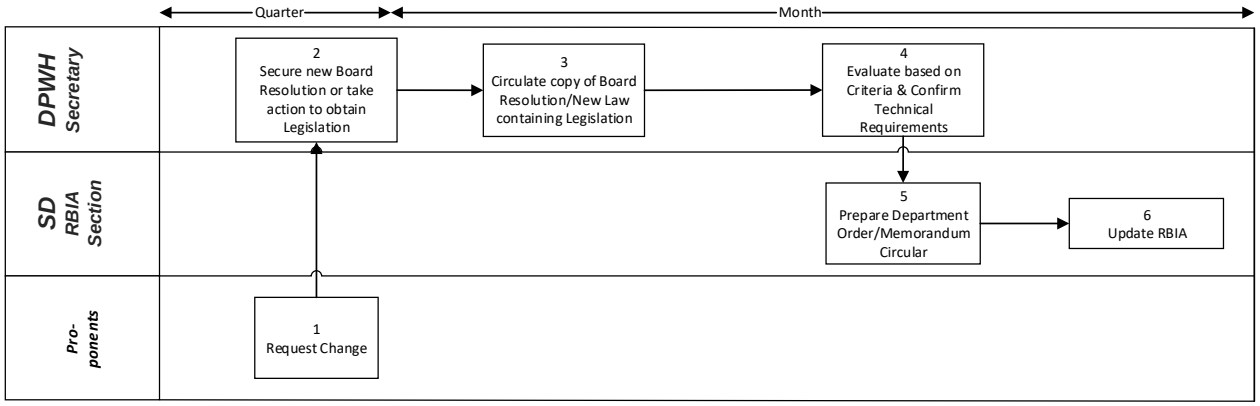


Figure 14 indicates that the initial step is for a proponent to request a road conversion. The works steps involved include:

1. Receipt of request for conversion.
2. Securing a new Board Resolution or taking action for new legislation to be created.
3. Circulating the new Board Resolution or legislation.
4. Evaluating the criteria and technical requirements of the subject road for national road status.
5. Where the Road Conversion is decreed by legislation a Department Order shall be prepared to have the road's status recognized. Where a Board Resolution decrees the Road Conversion, a Memorandum Circular shall be prepared to inform DPWH offices of the change.
6. Update RBIA

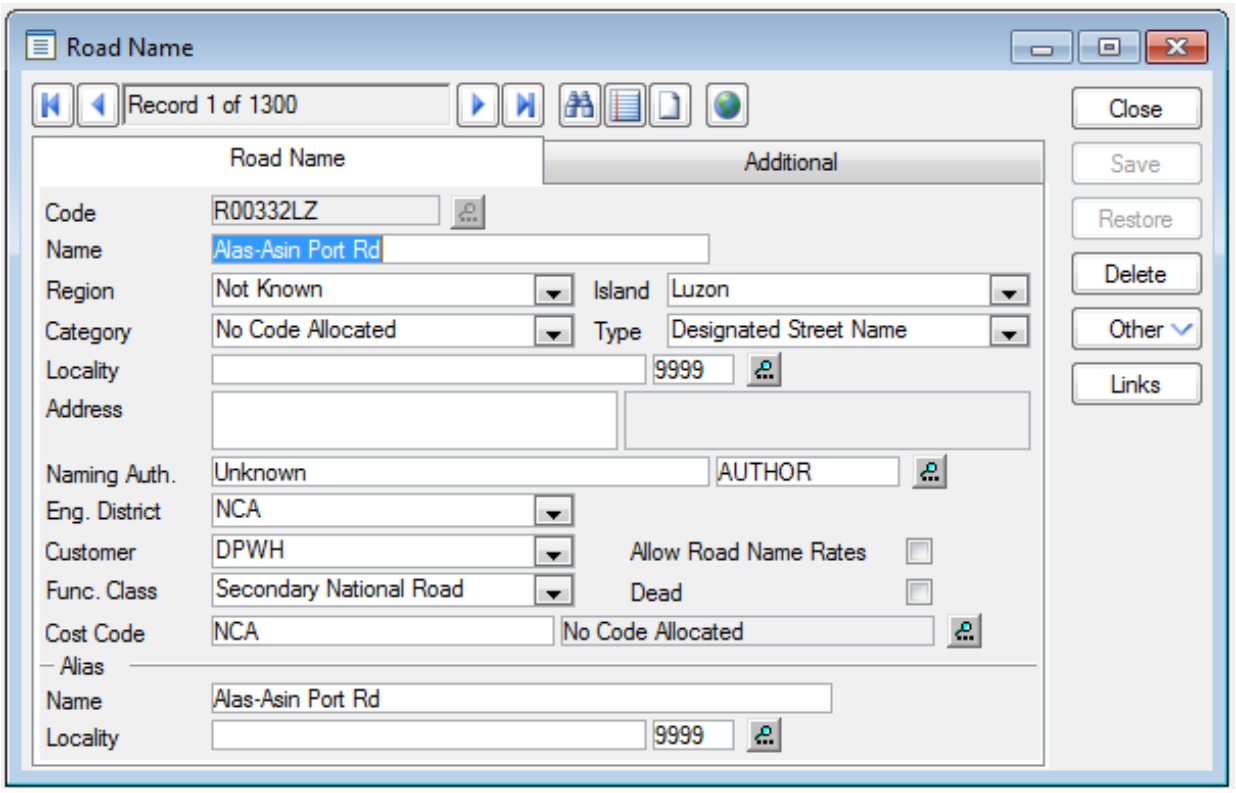
Workflow for RBIA Update of LRS and Inventory

Refer to Figure 13

Actions in the RBIA

1. Log in to RBIA with appropriate user privileges (permission to perform various actions in the 'Road Name' and Road Section' forms'.

2. If the road conversion necessitates the creation of a new Road Name, use the 'Road Names' form to add the new Road Name.



3. Open the 'Road Sections' form and create as many new Road Sections necessary representing the converted road. Also from this form, populate the road inventory information.

(Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.3.4 Creation of New Roads

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of network definition.

Definition

Road: A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Attributes Stored in RBIA:
Road ID
Road Name
Road Section ID
Description
Start Date
End Date
Length
Feature Type
Engineering District
Carriageway Configuration

Standards: To be updated within one month of receipt of Department Order

Currency of Data: Changes to be available in RBIA (networked) within 1 month

Data Stewards

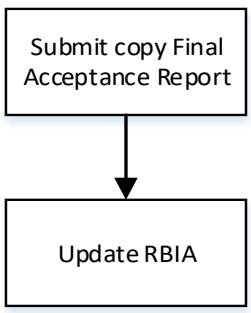
Planning Service - SD, LRS & GIS Section

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning & Design Division
District Offices

Workflow

Figure 15
Workflow for Managing the Creation of New Roads



Process Flow	Responsible	Details
Submit copy Final Acceptance Report	Implementing Office	1. Upon completion of construction, the submission of the Final Acceptance Report to SD.
Update RBIA	SD RBIA Section	2. Update RBIA.

Figure 15 indicates that the initial step is for a proponent to request the creation of a road.

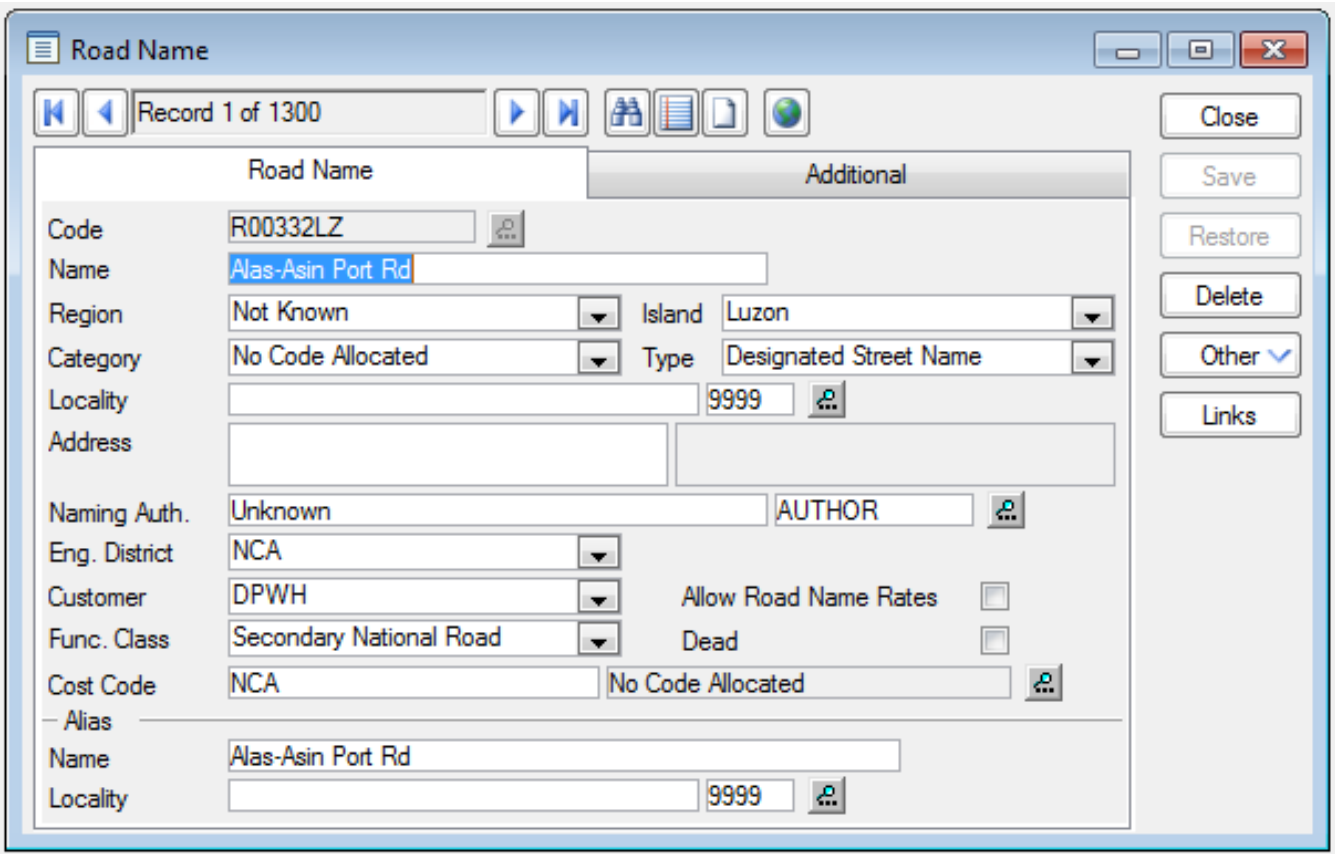
Workflow for RBIA Update of LRS and Inventory

Refer to Figure 13

Actions in the RBIA

1. Log in to RBIA with appropriate user privileges (permission to perform various actions in the 'Road Name' and Road Section' forms').

2. Use the 'Road Name' form to add the new Road Name.



3. Open the 'Road Section' form and create as many new Road Sections necessary representing the new road. Also from this form, populate the road inventory information. (Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.3.5 Change in District Boundary

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of network definition.

Definition

District Boundary: Dividing line of an area established, as a subdivision of a Region, for allocation and administration by DPWH of engineered works.

Attributes Stored in RBIA: Road Section ID
Description

Start Date
End Date
Length
Engineering District

Standards: To be updated within one month of receipt of Department Order

Currency of Data: Changes to be available in RBIA (networked) within 1 month

Data Stewards

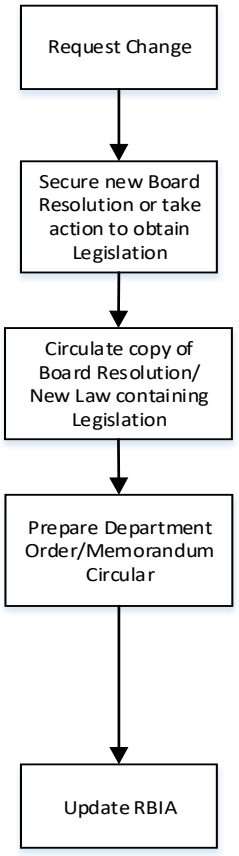
Planning Service - SD, LRS & GIS Section

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning & Design Division
District Offices

Workflow for Managing the LRS

Figure 16
Workflow for Managing District Boundary Changes



Process Flow	Responsible	Details
Request Change	Proponents	1. Receipt of request to change District Boundary on a national road. The proponent for this type of change would typically be the House of Representatives.
Secure new Board Resolution or take action to obtain Legislation	DPWH Secretary	2. Securing a new Board Resolution or taking action for new legislation to be created.
Circulate copy of Board Resolution/ New Law containing Legislation	DPWH Secretary	3. Circulating the new Board Resolution or legislation.
Prepare Department Order/Memorandum Circular	SD RBIA Section	4. Where the District Boundary is changed through legislation a Department Order shall be prepared. Where a Board Resolution decrees the boundary changes, a Memorandum Circular shall be prepared to inform DPWH offices of the change.
Update RBIA	SD RBIA Section	5. Update RBIA.

** Board Resolutions may result from consultations with Local Government, Congress, National Historical Institute, etc.*

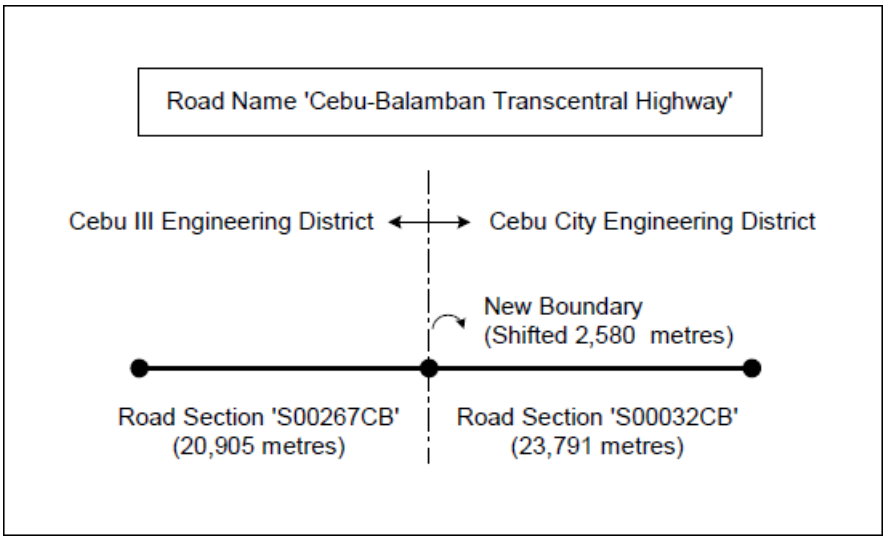
Figure 16 indicates that the initial step is for a proponent to request to change district boundary on a national road.

Actions in the RBIA

If a new Engineering District or Sub-District office is created, the LRS data must be updated to reflect the assignment of the Road Sections to the new offices. In such cases, this will be a reassignment of a Road Section from one office to another. In cases where a District has been split into two, it may be necessary to create a new Node at the boundary (if one does not exist) and split an existing Road Section into two.

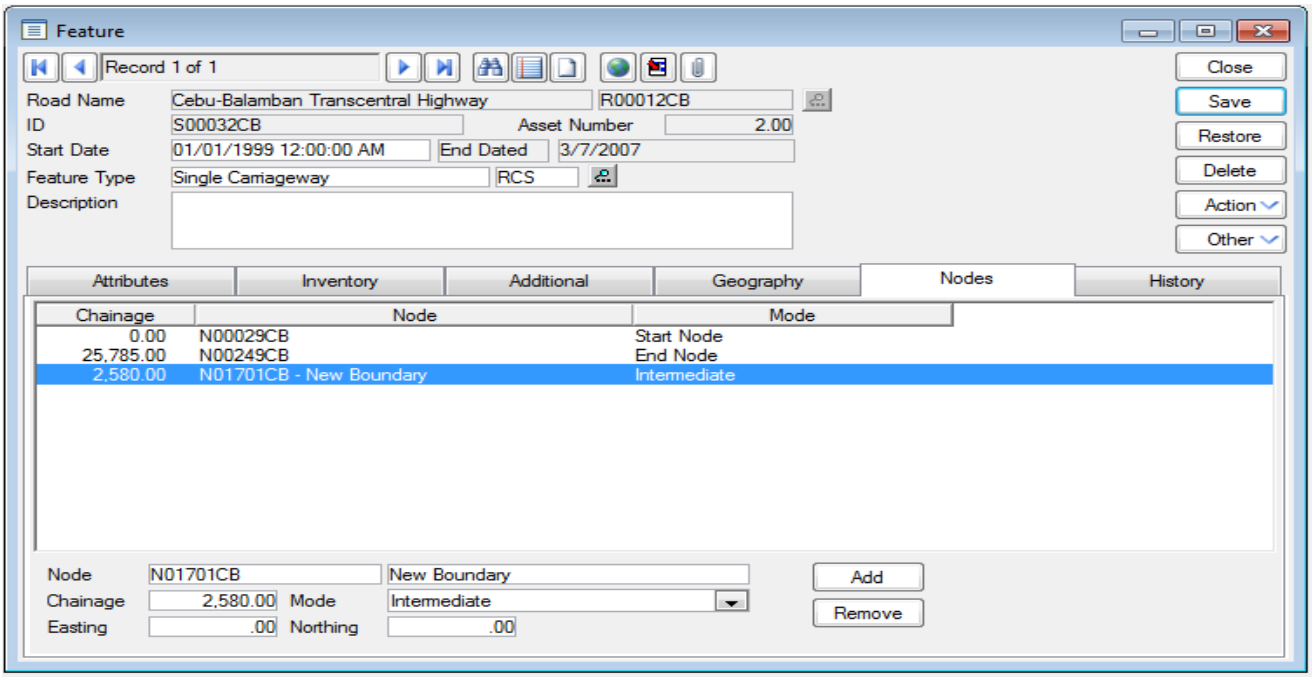
1. Use 'LRS And Inventory Update Sheet' provided by the Regional Office to visualize the new configuration.

   Consider the following example:

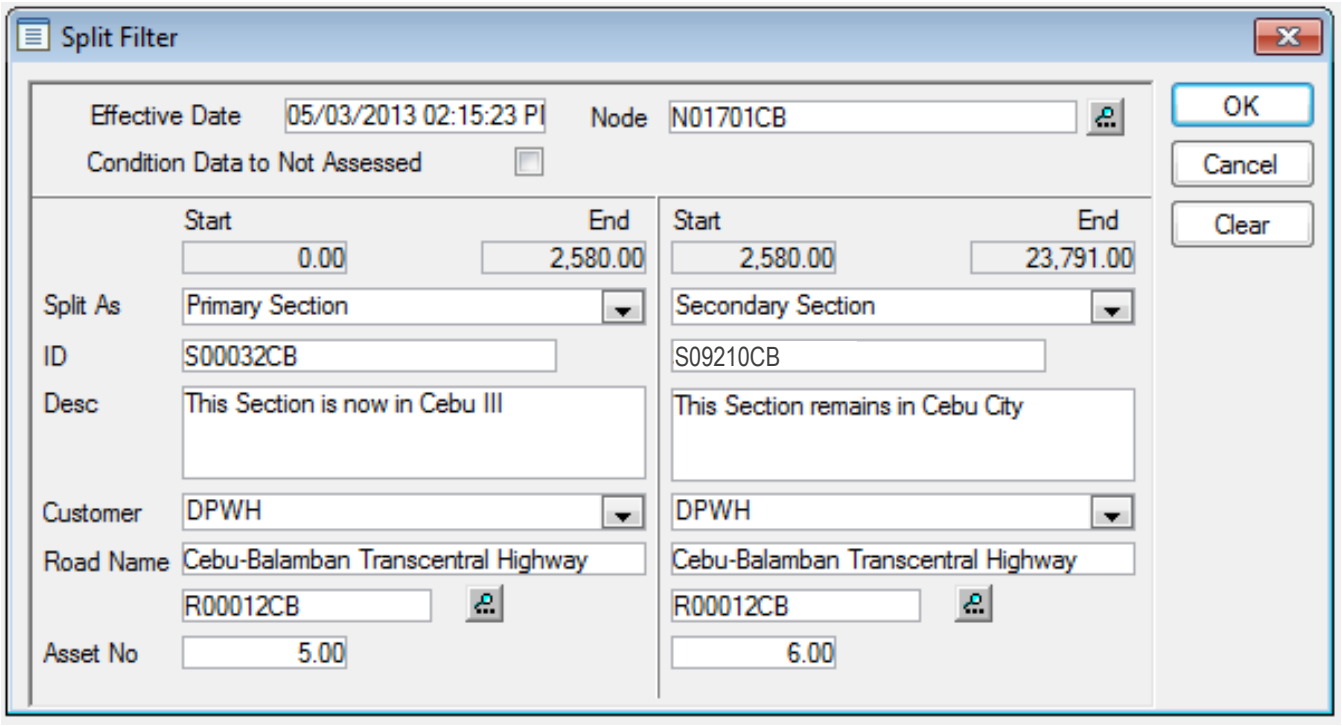


2. Log in to RBIA with appropriate user privileges (permission to perform various actions in 'Road Section' form).

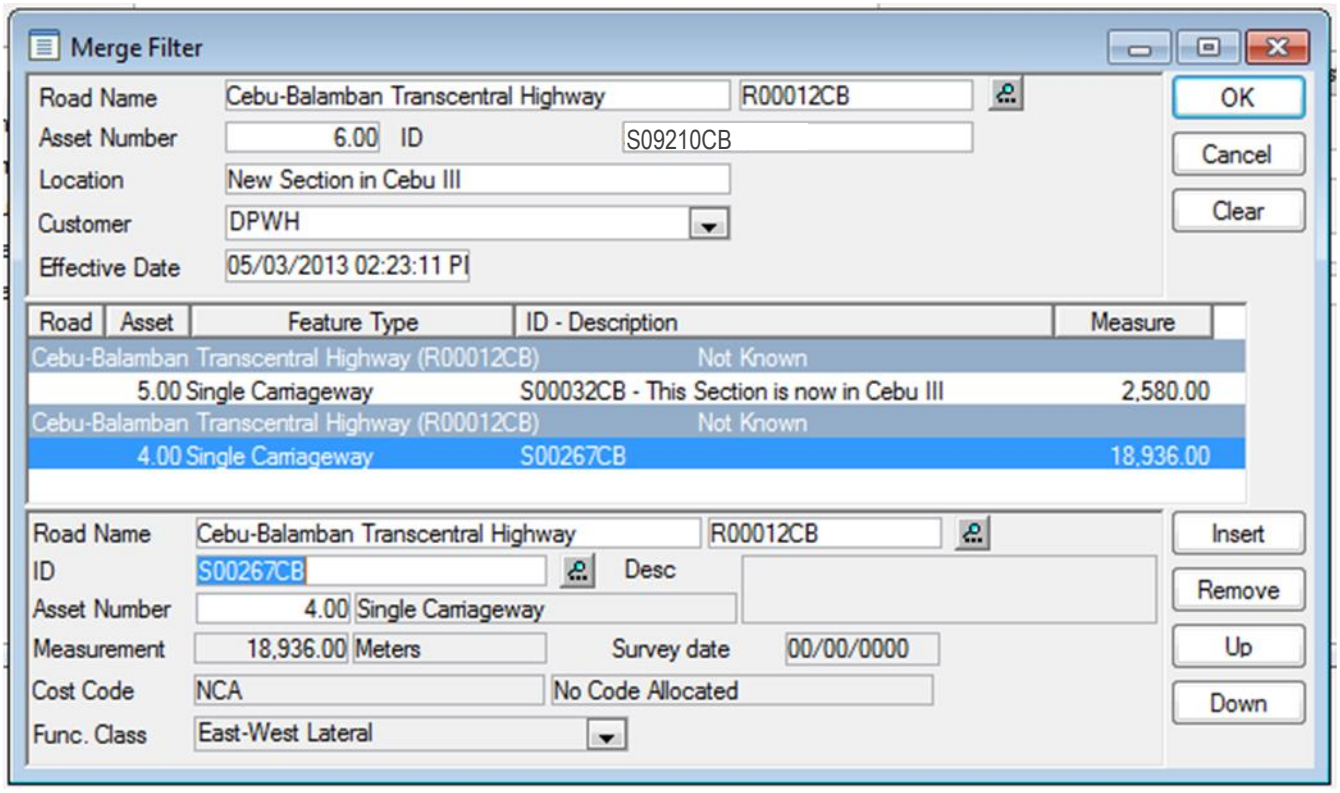
3. Create Node and add to Road Section ‘S00032CB’ at 2,580m



4. Split Road Sections S00032CB at this Node.



5. Merge Road Section S00267CB with the newly create Primary Section of S00032CB (2,850m) to create new Section S09210CB.



** Note: all element types must be checked (i.e. not just those shown above)*

(Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.3.6 Reassignment of Engineering Districts between Regions

Policies

The Road and Bridge Information Applications (RBIA) is the definitive source of network definition.

Definition

Engineering District:	An area established, as a subdivision of a Region, for allocation and administration by DPWH of engineered works. An Engineering District is composed of municipalities.
Attributes Stored in RBIA:	Engineering District Region
Standards:	To be updated within one month of receipt of Department Order
Currency of Data:	Changes to be available in RBIA (networked) within 1 month of receipt of Department Order.

Data Stewards

Planning Service - SD, RBIA Section

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning & Design Division
District Offices

Workflow for Managing the LRS

Figure 17
Workflow for Managing the Reassignment of Engineering Districts between Regions

Process Flow	Responsible	Details
Prepare Department Order/ Memorandum Circular	DPWH Secretary	1. Where the District is reassigned through legislation a Department Order shall be prepared. Where a Board Resolution decrees the change, a Memorandum Circular shall be prepared to inform DPWH offices of the change.
Update RBIA	SD RBIA Section	2. Update RBIA.

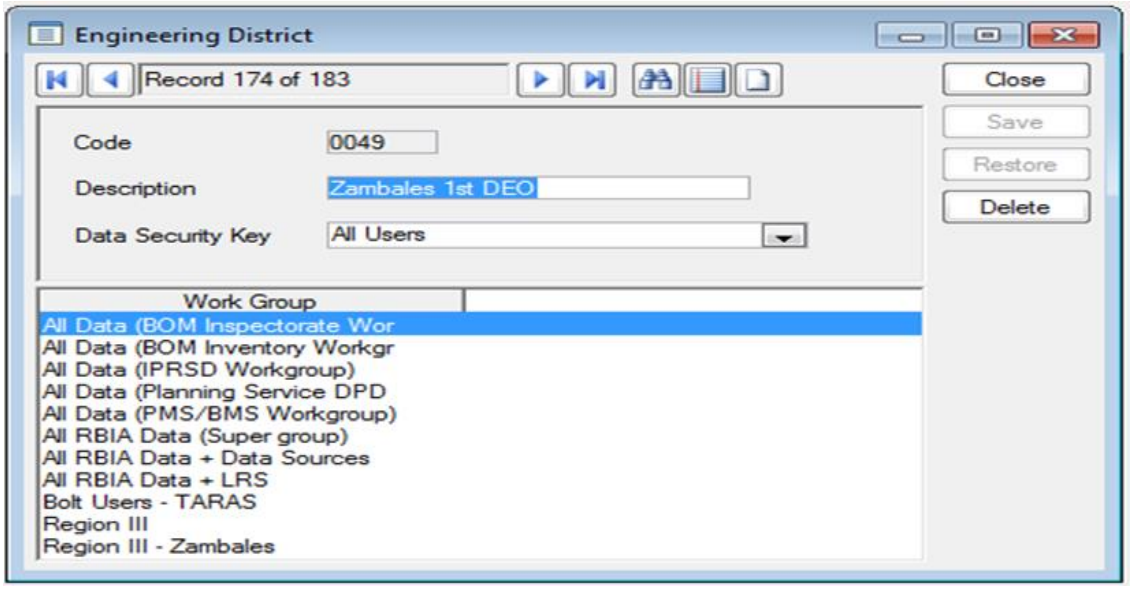
Figure 17 indicates that the initial step is for a proponent to request the reassignment of Districts to different Region(s) of a road.

Actions in the RBIA

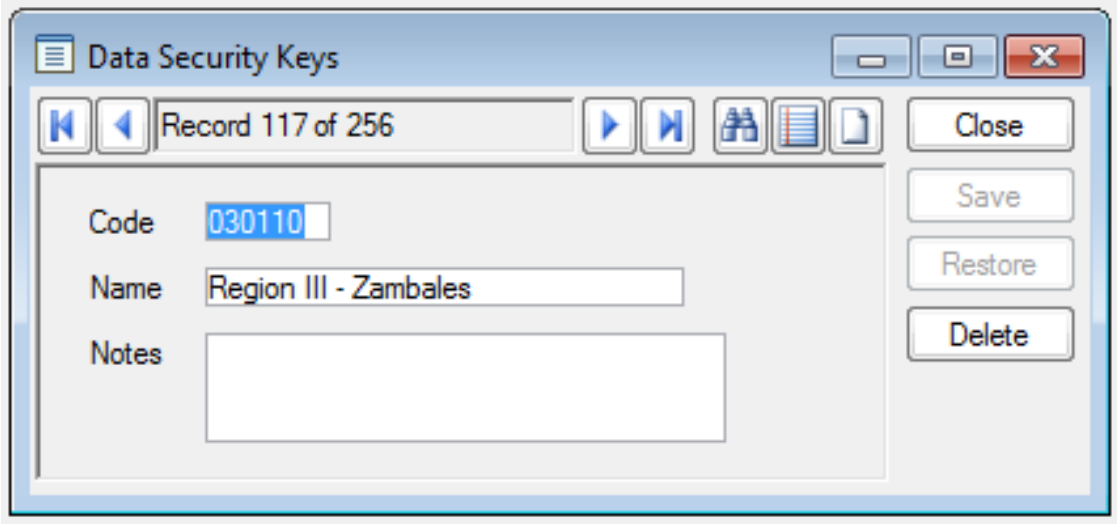
Consider an example where Zambales Engineering District is assigned from Region III to I. Because each Road Section is associated with an Engineering District and the latter is used for purposes of data security, edits to various lookup tables are required.

1. Log in to RBIA with appropriate user privileges (permission to perform various actions in the 'Engineering District', 'Data Security Keys', 'Data Security Groups' and 'Road Sections' forms).

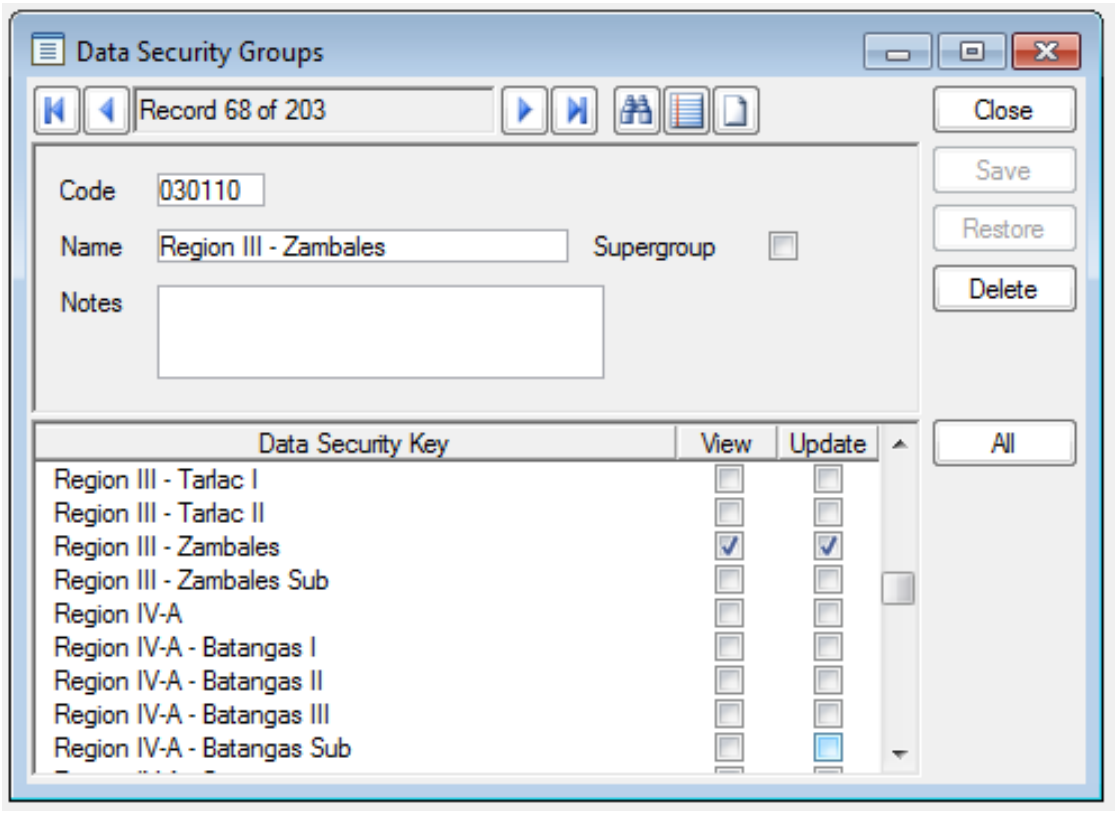
2. Use the 'Engineering District' form to make any appropriate changes to the affected Engineering District lookup to reflect the change in the Region that it belongs to.



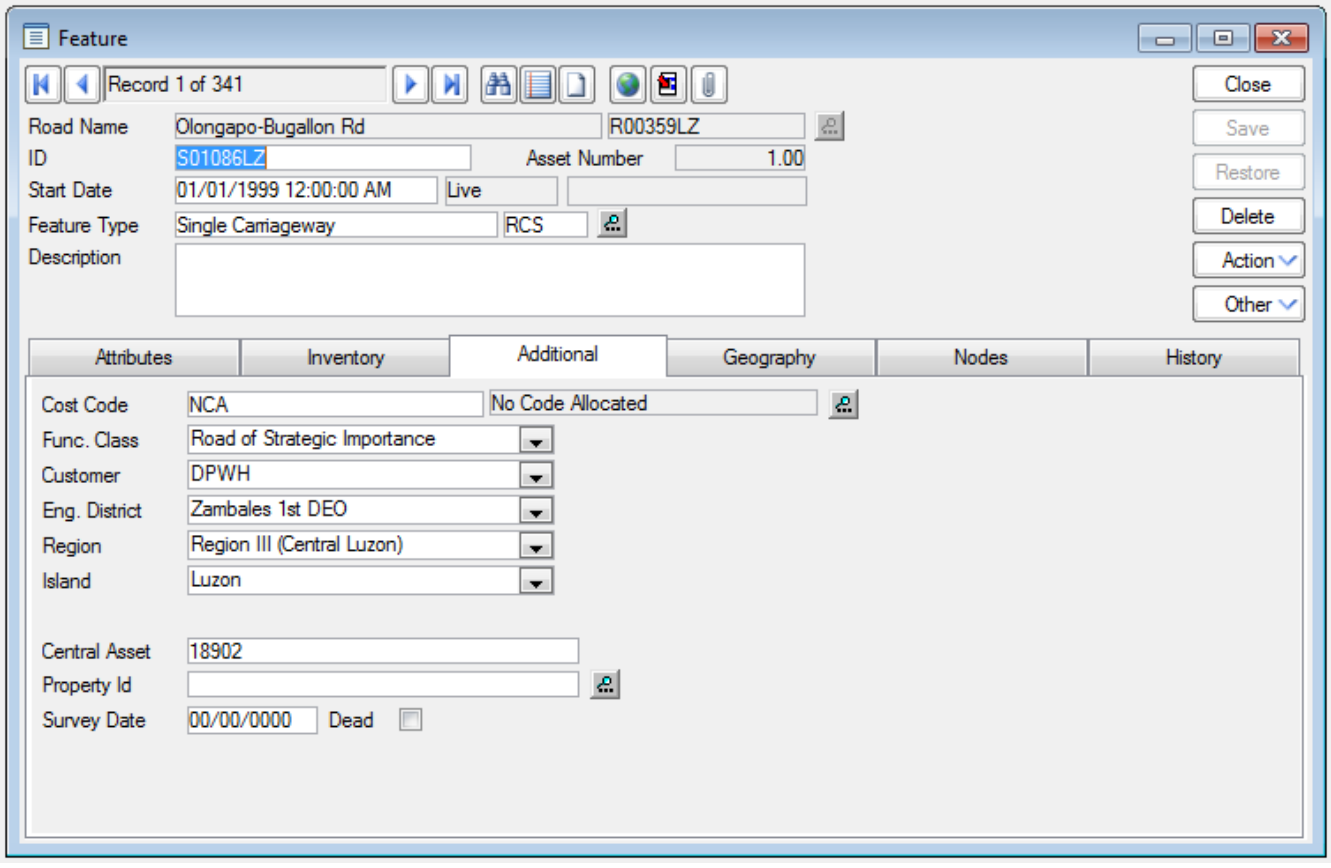
3. Use the 'Data Security Keys' form to make any appropriate changes to the affected Data Security Key lookup associated with the Engineering District.



4. Use the 'Data Security Groups' form to assign the affected Data Security Key to the proper Region.



5. Use the 'Feature' form, filtering on those Road Sections and structures belonging to the affected engineering District, to update the 'Region' against the Feature.



Alternatively, if you have permission to make bulk updates to feature attributes, use the ’Allocate Feature Additional Data’ utility to make changes to the 'Region' against Features.

(Refer to 'RBIA User Guide' for help in performing basic operations in the RBIA software.)

4.4 Procedure for Quality Assurance of LRS and Inventory Data

Policies

The road and bridge inventory data shall be of an appropriate quality that is verifiable by statistical procedures.

Definition

Quality Assurance:	Ensuring data maintained within RBIA is of appropriate quality[3] to satisfy user requirements.
Attributes Stored in RBIA:	All LRS network entities All Inventory elements
Standards:	To be verified as being within 95% confidence levels.
Currency of Data:	Changes to be available in RBIA (networked) within 1 month of notification.

Data Stewards

Data Quality Coordinator - Planning Service - SD

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning and Design Division
District Offices

Workflow

[3] Not all inventory elements are of the same importance to all users. Hence the accuracy to which inventory elements are recorded must take into account the uses of the information. To assist with decisions regarding required accuracy, a matrix of "Inventory Elements Versus Typical User” has been included in Appendix I.

Figure 18 Workflow for Quality Assurance

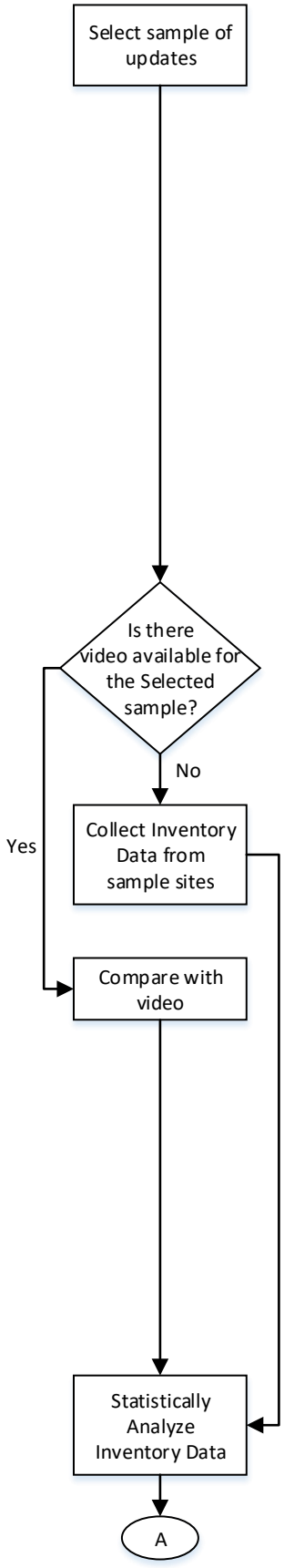
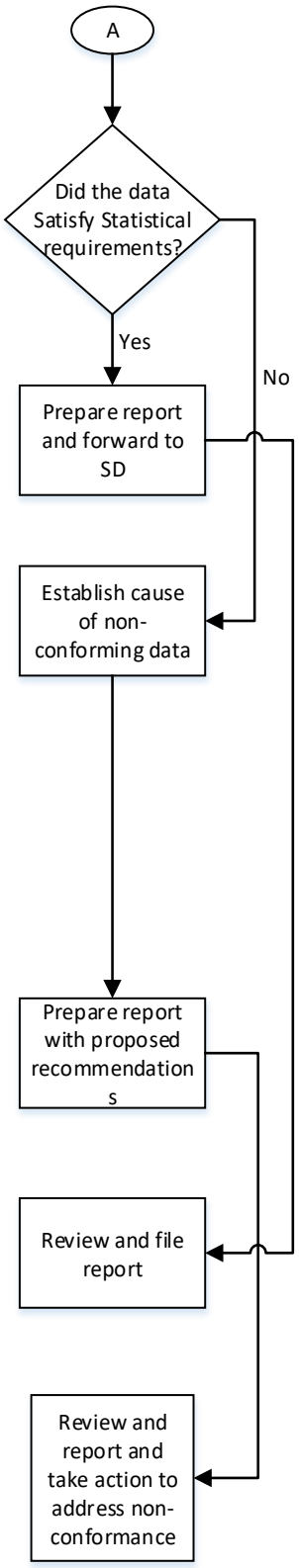
Process Flow	Responsible	Details
	REGION Planning and Design Division Data Quality Coordinator	1. Select random sample of sites for analysis from the list of inventory updates carried out in the previous 12 month period. The number of sample sites may be established from Table 2.
	REGION Planning and Design Division Data Quality Coordinator	2. Check RBIA for existence of video images for the sample sites.
	DISTRICT Planning and Design Section	3. If no video is available then arrange for inventory surveys with District Offices.
	REGION Planning and Design Division Data Quality Coordinator	4. If video is available compare inventory update sample. Since video only records surface inventory items checking shall be restricted to the following items: a) Carriageway Width (see App. F) b) Number of Lanes (see App. F) c) Pavement Type d) Shoulders e) Guardrail f) Road Markings
	REGION Planning and Design Division Data Quality Coordinator	5. Analyze data by the following method: ▪ Count the number of inventory items that have been updated (x). ▪ Count the number of inventory items which have identical records (y). ▪ Divide (x)/(y). In the example form shown in Fig.21 the number of inventory items being updated (x) = 7, and the number having an identical record from the video (y) = 5. Therefore the result is 71%.

Table 2 Minimum No. of Road Inventory Updates to be Reviewed

No. of inventory updates during the year	No. of inventory updates that need to be reviewed
100	50
200	65
300	70
400	75
500	80
750	85
1000	85



	(In addition, comparative District-by-District checks on selected inventory items should be conducted to identify possible inconsistencies in the data. An example of such comparison is shown in Fig.19. The information for these summary reports will come from the RBIA but may require manual compilation and summarizing using, for example, a spreadsheet application.)
REGION Planning and Design Division Data Quality Coordinator	6. Establish value of (x)/(y). If the result is less than 90% (fail) then proceed to step 8. If it is greater than 90% (pass) proceed to step 7.
REGION Planning and Design Division Data Quality Coordinator	7. Prepare report and forward to SD for review.
REGION Planning and Design Division Data Quality Coordinator	8. Establish cause of non-conformance. This may involve any or all of the following actions: ▪ Interviewing the inventory inspectors. ▪ Confirming that the re-inspected data has been carried out in exactly the same location of the original inspection ▪ Reviewing inventory methods of measurement ▪ Reviewing inventory definitions ▪ Reviewing training methods ▪ Provision of training for inventory inspectors.
REGION Maintenance Division Data Quality Coordinator	9. Prepare report with recommendations of appropriate corrective actions identified in step 8.
SD Data Quality Team Leader	10. Review and file report.
SD Data Quality Team Leader	11. Review report and take action to address non-conformances. This may involve taking action on a nationwide basis where definitions or described methods of measurement are found to be deficient.

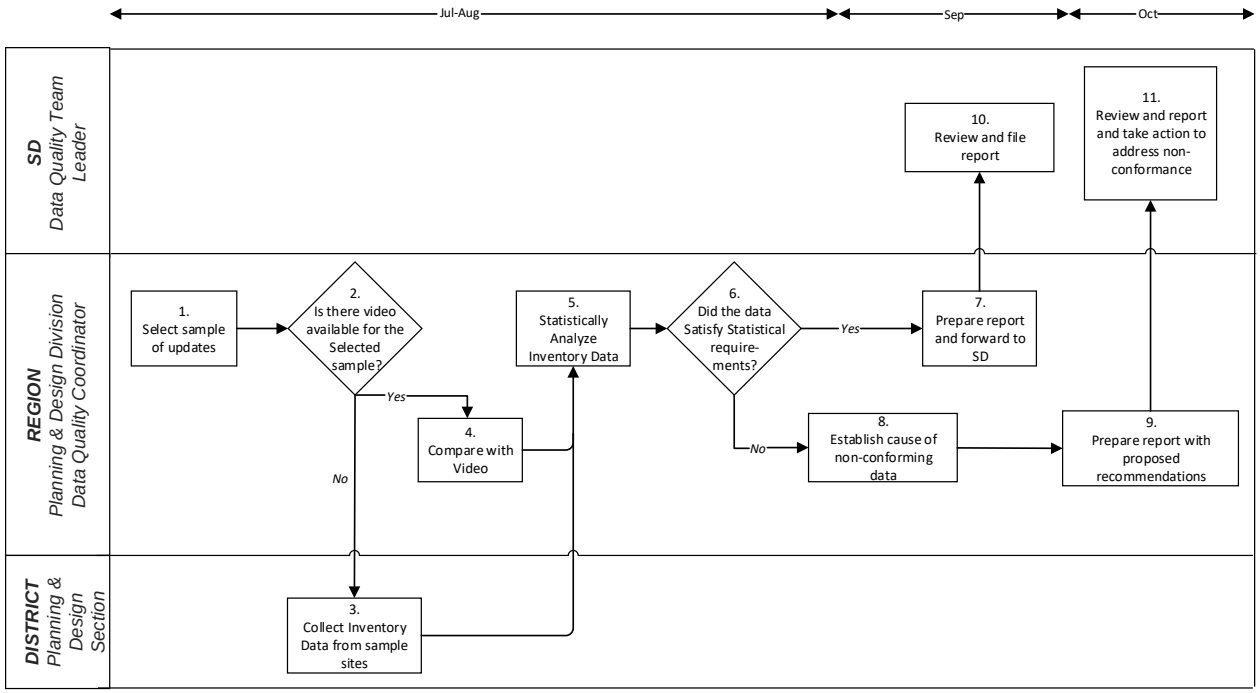


Figure 18 indicates that the initial step is for a random sample sites to be selected for analysis. This process commences with interrogation of the RBIA to identify inventory updates from previous 12 month period.

The steps for comparing the video and inventory data involve recording and inspecting data records using the form shown in Figure 19. While this form is particular to checking carriageway width, other forms for checking the other items are provided in Appendix J.

Figure 19 Sample Video and Inventory Data Check Sheet

Carriageway width - video checks

Region: XXX **District:** ZZZ

Section: S00567YY

Recorded Data			VIDEO			
Width	**From**	**To**	**Width (Est.)**	**From**	**To**	**COMMENTS**
6	45+678	46+327	6	45+678	46+327	
6.1	46+327	46+899	6.1	46+327	46+899	
7.5	46+899	47+543	6.5	46+899	47+543	error in width
6.1	47+543	48+311	6.1	47+543	48+311	
5	48+311	50+870	5	48+311	49+870	incorrect chainage
6.7	50+870	51+391	6.7	49+870	51+391	
6.1	51+391	55+415	6.1	51+391	55+415	

The guidelines for comparing the video and inventory data are as follows:

a) Carriageway Width, b) Number of Lanes and c) Pavement Type are to be checked using the following method. The steps include:

- Identifying where there is a change in the width, number of lanes or pavement type in the inventory database by forwarding the video to approximately 100m before

the position where the inventory data shows any change and stepping through the video a frame at a time until the change is noticed.

- On the Video / Inventory Cross-Checking check sheet (Appendix J) recording the position, estimated width when obvious errors are identified from the video, incorrect number of lanes or incorrect pavement type.

d) Shoulders are to be checked for the type of shoulder, the width of the shoulder and the position of any change. Since the width of the shoulder is difficult to judge from the video it is only to be checked for obvious errors. The position of any change is to be confirmed using the same method as described for items (a), (b) and (c) above.

e) Guardrail is to be checked by observing the entire video. Some guardrail will not be visible due to traffic or sharp bends in the road. In such cases the inventory data must be presumed correct. Record the start, end and side positions for the guardrail.

f) Road markings are to be checked by viewing the entire video. Record the km position and the type of marking (Paint, stud or no marking). There may be an overlap where there are paint markings and studs at the same position.

Figure 20 Sample Inventory Summary Report[4]

Summary Statistics for Selected Inventory Items **Page 1 of 1**

Data that deviates significantly from the average may indicate that inventory data is not complete. Further analysis on a road by road basis may be required to reveal specific deficiencies

Inventory Items: **Culverts, Guardrail, Signs**
Region: **Region III**
Report Date: **March 20, 2013**

District	Road Length (km)	Culverts No.	Culverts per km	Guardrail meters	Guardrail per km	Signs No.	Signs per km
Bataan I	118.1	378	3.2	533	4.5	321	2.7
Bataan II	138.1	768	5.6	290	2.1	971	7.0
Bulacan I	123.2	1,540	12.5	1,005	8.2	641	5.2
Bulacan II	136.1	340	2.5	1,068	7.8	972	7.1
Nueva Ecija I	209.8	1,630	7.8	1,261	6.0	1,190	5.7
Nueva Ecija II	230.4	1,877	8.1	714	3.1	1,427	6.2
Pampanga I	128.6	708	5.5	897	7.0	360	2.8
Pampanga II	58.3	412	7.1	508	8.7	99	1.7
Pampanga Sub	37.7	251	6.7	50	1.3	203	5.4
Tarlac	150.2	225	1.5	590	3.9	999	6.7
Tarlac Sub	52.6	414	7.9	453	8.6	279	5.3
Zambales	127.8	795	6.2	272	2.1	138	1.1
Zambales Sub	49.6	285	5.7	371	7.5	200	4.0
Total	1,560.4	9,624	6.2	8,012	5.1	7,801	5.0

Report Generated by: D. B. Manalac

[4] Note that other useful reports may include comparisons of: pavement types for shoulders and carriageway, carriageway widths and functional classification, etc. Inconsistencies in this type of information may reveal requirements for updating data.

4.5 Procedure for Addressing Data Discrepancies

Policies

The road and bridge inventory data shall be of an appropriate quality that is verifiable by statistical procedures.

Definition

Data Discrepancy:	Data that is inconsistent with related information.
Attributes Stored in RBIA:	All LRS network entities All Inventory elements
Standards:	Data to be verified as being within 95% confidence levels.
Currency of Data:	Changes to be available in RBIA (networked) within 1 month of notification.

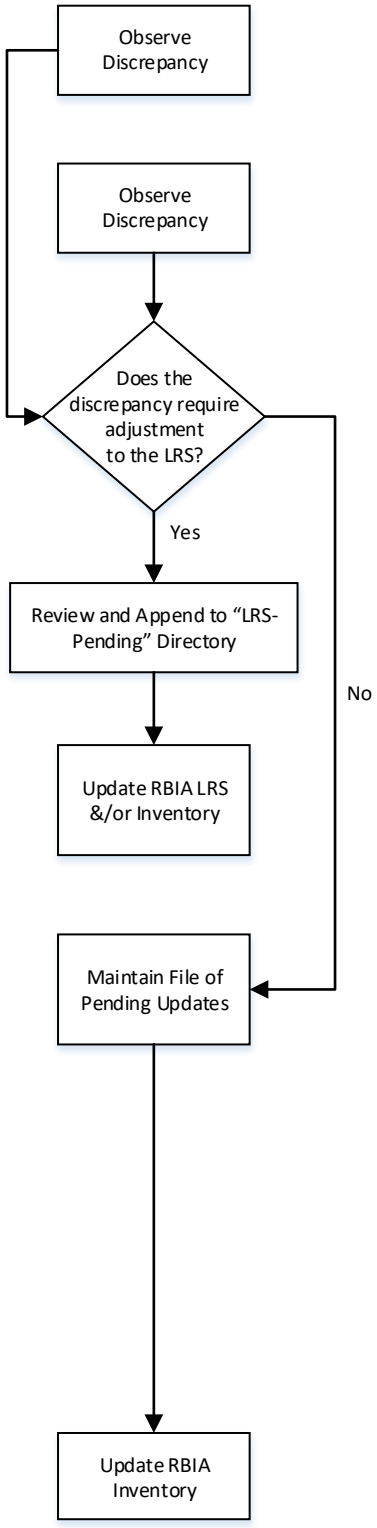
Data Stewards

Data Quality Coordinator - Planning Service - SD

Users

Bureau of Maintenance (BOM)
Planning Service (PS)
Regional Office Planning and Design Division
District Offices

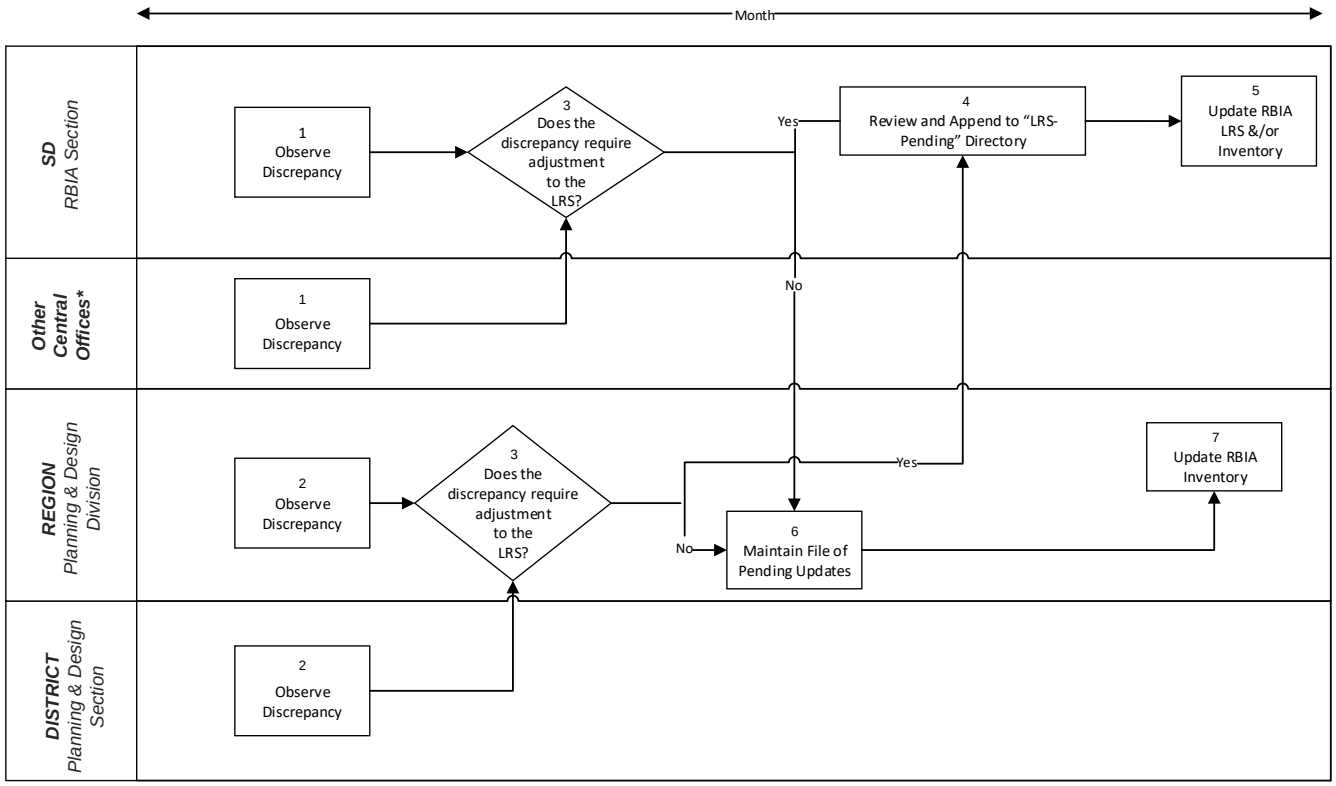
Figure 21
Workflow for Addressing Data Discrepancies



Process Flow	Responsible	Details
Observe Discrepancy	SD / Other Central Offices*	1. Observation of discrepancy.
Observe Discrepancy	Region / District	2. Observation of discrepancy.
Does the discrepancy require adjustment to the LRS?	SD / REGION	3. Review the discrepancy and determine whether an update to the LRS is required.
Review and Append to "LRS-Pending" Directory	SD	4. Review the discrepancy and record on the "LRS Pending" directory on the network.
Update RBIA LRS &/or Inventory	SD	5. Update the RBIA.
Maintain File of Pending Updates	REGION	6. The LRS&GIS Section of SD shall maintain a file of pending updates. These must be removed this directory by appending new discrepancies as necessary. As each is addressed through RBIA updates they shall be removed. Similarly, in the Regions, the RBIA Region Coordinator shall maintain a file of pending updates. These must be removed from the file as soon as they are addressed through RBIA update procedures.
Update RBIA Inventory	SD / REGION	7. Update the RBIA.

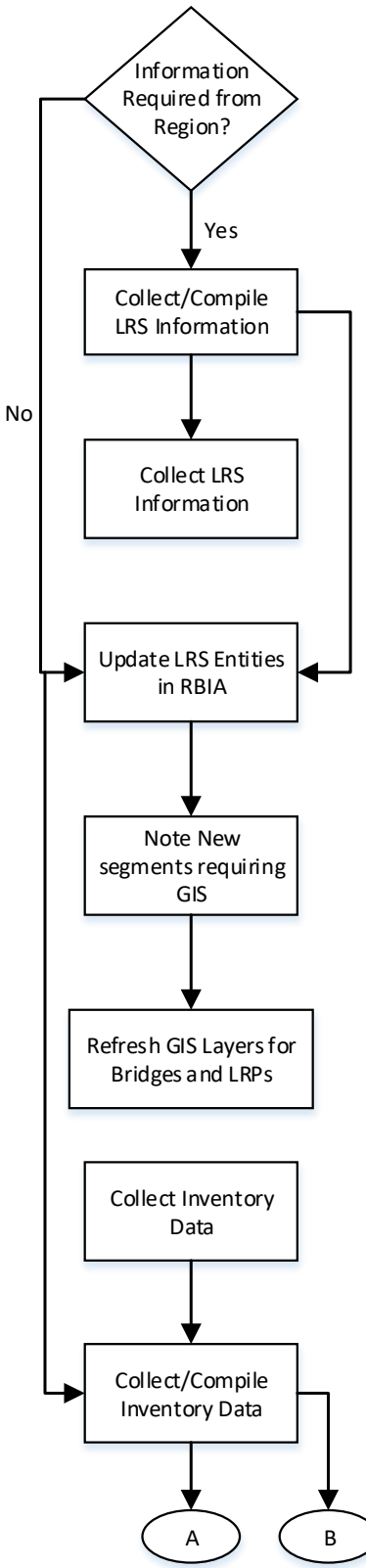
* *Includes PMO's and Other DPWH Offices*

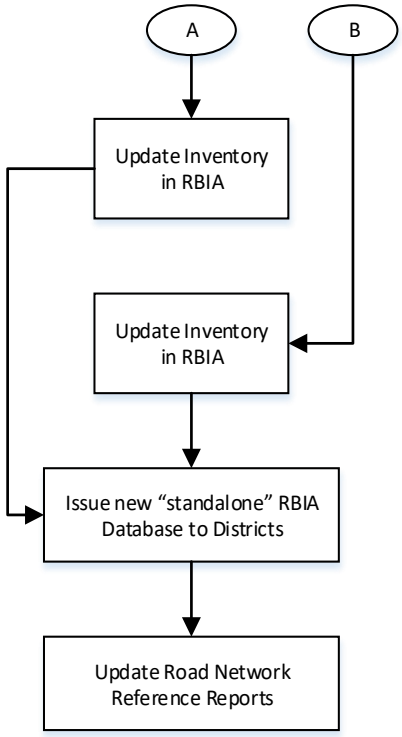
Figure 21 indicates that the initial step is for discrepancies to be identified from any office. These may be of many and varying forms and hence the action required will depend on the nature of the discrepancy.


Month
SD
RBIA Section
Other Central Offices*
REGION
Planning & Design Division
DISTRICT
Planning & Design Section
1
Observe Discrepancy
3
Does the discrepancy require adjustment to the LRS?
Yes
4
Review and Append to "LRS-Pending" Directory
5
Update RBIA LRS &/or Inventory
No
1
Observe Discrepancy
2
Observe Discrepancy
3
Does the discrepancy require adjustment to the LRS?
Yes
7
Update RBIA Inventory
No
6
Maintain File of Pending Updates
2
Observe Discrepancy

Workflow for RBIA Update of LRS and Inventory

Figure 22
Workflow for RBIA Update of LRS and Inventory for Addressing Data Discrepancies

Process Flow	Responsible	Details
	SD RBIA Section	1. Determining need for information / data from Regions.
	REGION Planning and Design Division	2. Collecting LRS and Inventory information onto LRS and Inventory Update Form (note that this may be combines with step3, 5 & 6).
	DISTRICT Planning and Design Section	3. As per step 2.
	SD RBIA Section	4. Creating new sections in RBIA and update LRS information.
	SD RBIA Section	5. Note segments that require GIS data, video and/or specialized condition surveys. These need to be recorded and scheduled accordingly.
	SD RBIA Section	6. Extract and publish new GIS layers for bridges and LRPs. For detailed procedures for this step refer to the RBIA/GIS Procedures Manual
	DISTRICT Planning and Design Section	7. As per step 2.
	REGION Planning and Design Division	8. As per step 2.



SD RBIA Section	9. Updating the RBIA for Inventory Data.
REGION Planning and Design Division	10. As per step 8.
SD RBIA Section	11. The updated LRS & inventory information are periodically disseminated to the District Offices via distribution of a report generated from the DEP Report Check Template Data Source.
DISTRICT Planning and Design Section	12. The District Offices then produce updated 'Road Network Reference Reports' for the users in the field (Appendix B).

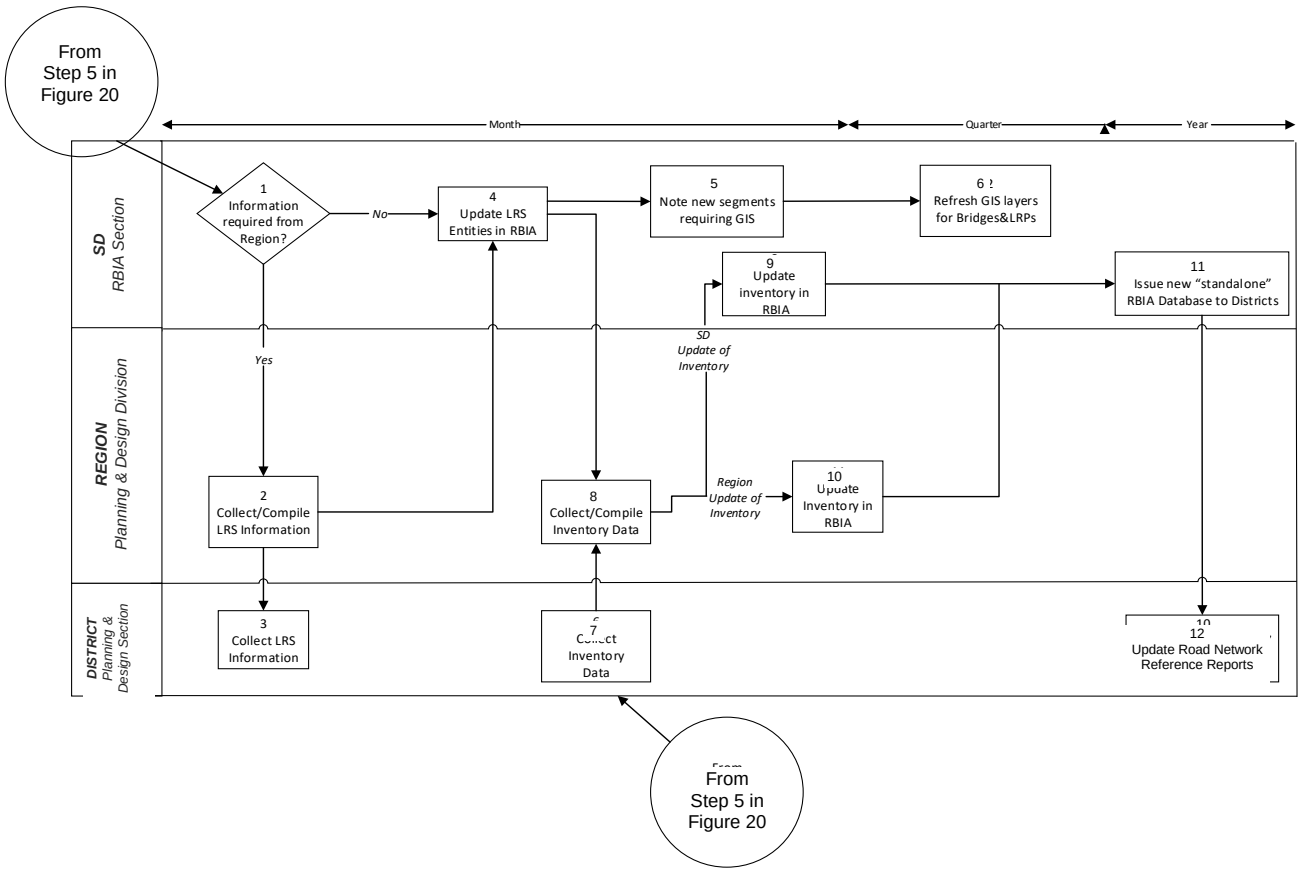


Figure 22 demonstrates the workflow required to update the RBIA.

INDEX

Appendix A

Sample LRS Videos and Photographs

Appendix A
Sample LRS Videos and Photographs

i) Videos

ii) LRP Photographs

Kilometer Post

Barangay Boundary

Bridge (Low-chainage Abutment)

Turn Right

Bus Shelter

iii) Node Photographs

Appendix B

Sample Road Network Reference Report

Republic of the Philippines
Department of Public Works and Highways

Road Network Reference

(List of Road Sections & Locational Reference Points)

Region III - Tarlac District

Key Map

Region III - Tarlac District

Road Sections List

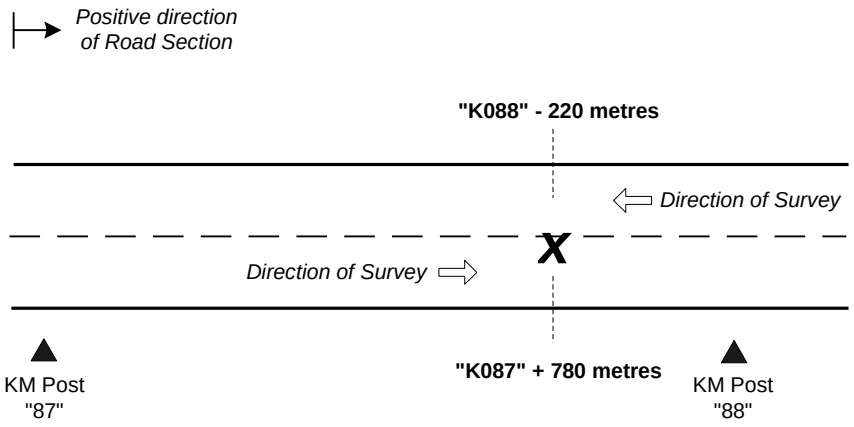
Region III - Tarlac District

Locational Reference Points Report

Region III - Tarlac District

"LRP + Displacement" Locational Referencing Method

"LRP + Displacement" Locational Referencing Method



Using the 'LRP + Displacement' location referencing method, an event on the road is referenced as the distance measured relative to a location reference point (LRP).

The distance may be positive or negative, relative to the positive direction of the road section.

Appendix C

Guidelines on use of XSP's

Appendix C
Guidelines on use of Cross Sections

Discussions in linear location referencing often consider the Road Section as being modeled as a line. It is also possible to further specify where, laterally on the roadway, an event occurs, by using Cross Sections.

Chapter 2.6 had described the various levels of Cross Sections that are available in the LRS. For most purposes, the use of one of the first three Cross Section Levels should be adequate. It must be remembered that as more detailed the Cross Section definitions become, the more complicated and potentially confusing it will be to the users. One must ask the question 'How will this information be used?' when deciding on the level of detail.

i) 'All' Cross Section Level

The 'All' Cross Section would be used to describe events where the cross-sectional position on the roadway is not an issue. Examples of some inventory items using this Cross Section Level include 'Right of Way Width', 'Terrain', etc.

ii) 'Left/Right' Cross Section Level

This level is used to indicate the location of an event as simply being either on the left or right-hand side of the roadway. Examples include 'Signs', 'Kilometer Posts', etc.

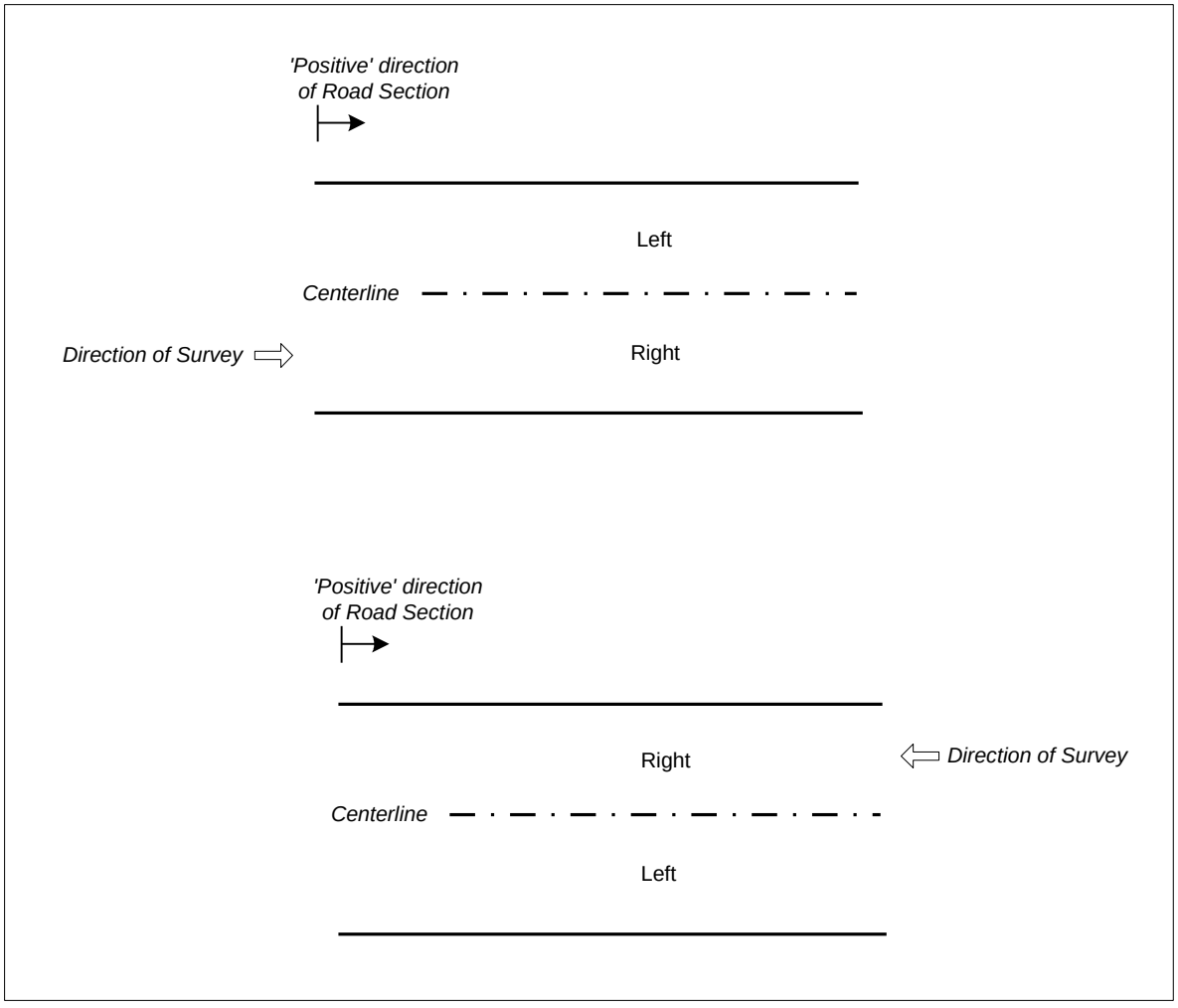
Whenever using Cross Sections, special care must be given to indicating what is 'left' and 'right' if the survey is carried out in the opposite direction to that of the Road Section.

If the data is to be entered manually into the RBIA, one must ensure manually that the 'left' and 'right' recorded by the surveyor corresponds to the same locations in the Cross Section model. To avoid the possible confusion, such surveys should be carried out only in the positive direction of the Road Section if possible.

If the data is to be imported, and the data had been collected in the opposite direction to the Road Section, the RBIA software is able to 'flip' the locations around back-to-front and left-to-right to fit the proper locations against the section. In doing so, it recognizes that what was observed as 'left' to the surveyor is actually 'right' in the model.

Figure 1 shows how cross-sectional positions are to be recorded if the data will be imported in electronic format to the RBIA. It can be seen that, when doing the survey, what is recorded as the 'left' and 'right' hand side is what the surveyor observed while facing the direction of the survey, regardless of whether or not it was surveyed in the opposite direction to the Road Section.

Figure 1
'Left/Right' Cross Sections Observed During Survey

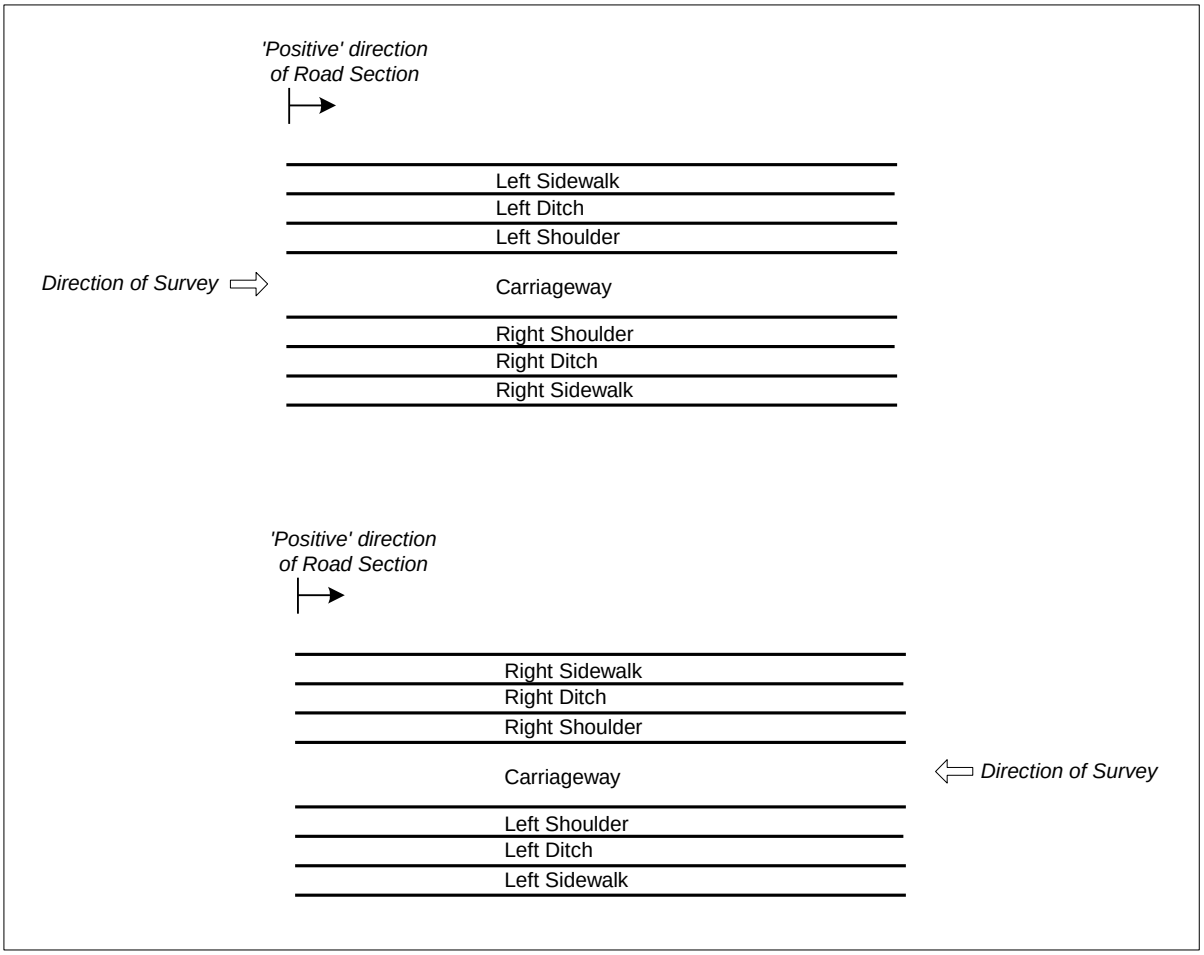


iii) ‘Left/Center/Right’ Cross Section Level

In this Cross Section model, the carriageway portion is considered in its entirety, where there is no need to break it down into lanes. Examples include ‘Surface Type’, ‘Number of Lanes’, ‘Carriageway Width’, and surface condition data if knowing the lane location of the defects is not important. If, say, the shoulder condition was recorded, the appropriate Cross Section would need to be indicated.

As with the previous Cross Section model, care must be taken in defining what is ‘left’ and ‘right’ if the survey is carried out in the opposite direction. If the data is to be imported, the ‘left’ and ‘right’, again, should be what was observed by the surveyor while facing the direction of the survey (Figure 2).

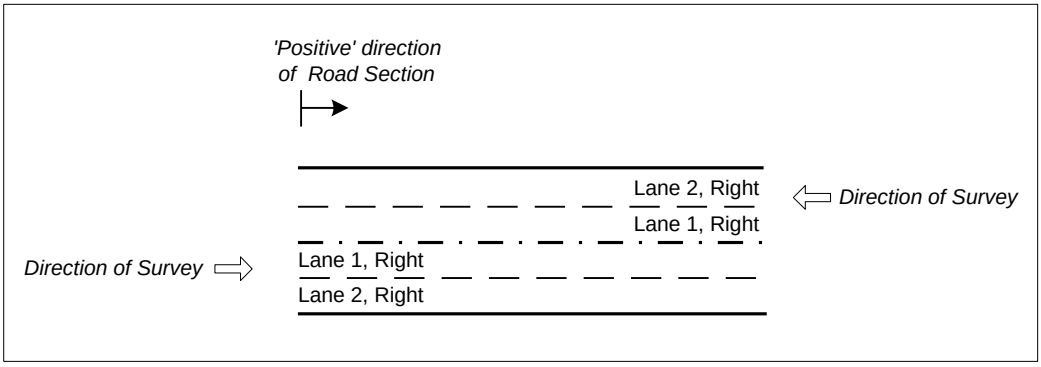
Figure 2
‘Left/Center/Right’ Cross Sections Observed During Survey



iv) 'Lanes' Cross Section Level

Again, if the data is to be imported, the 'left' and 'right' is what was observed by the surveyor while facing the direction of the survey (Figure 3). In this case, it can be seen that the lane Cross Sections measured by the surveyor will always refer to the 'right' side of the line dividing travel direction.

Figure 3
'Lanes' Cross Sections Observed During Survey



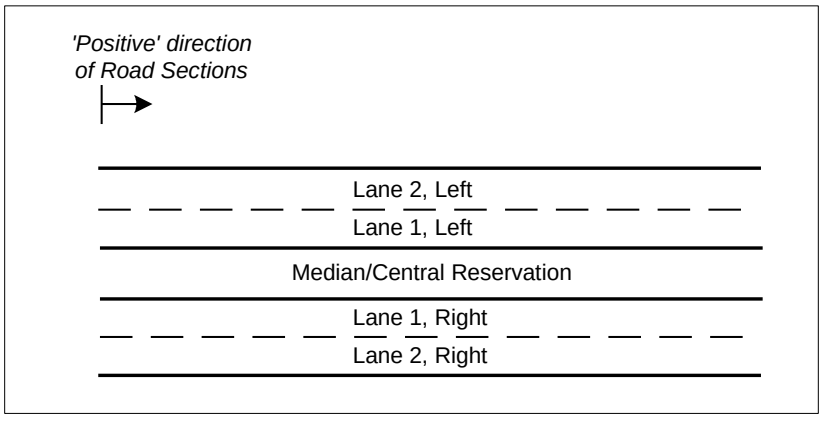
Special Consideration for Dual Carriageways & One-way Roads

The discussions on Cross Sections had assumed a Road Section of single carriageway configuration carrying traffic in two directions. However, in a dual carriageway system, each carriageway is treated as a separate Road Section with the traffic flowing one-way on each.

For the 'Lanes' Cross Section Levels that break down the carriageway into lanes, the question then becomes where is the travel direction divider for each of the two carriageways to describe 'left' and 'right'? In this case, the central reservation between the two carriageways is used as the dividing line to determine the left and right. This is illustrated in Figure 4. It also follows that on any one-way traffic system, whether it be single or dual carriageway configuration:

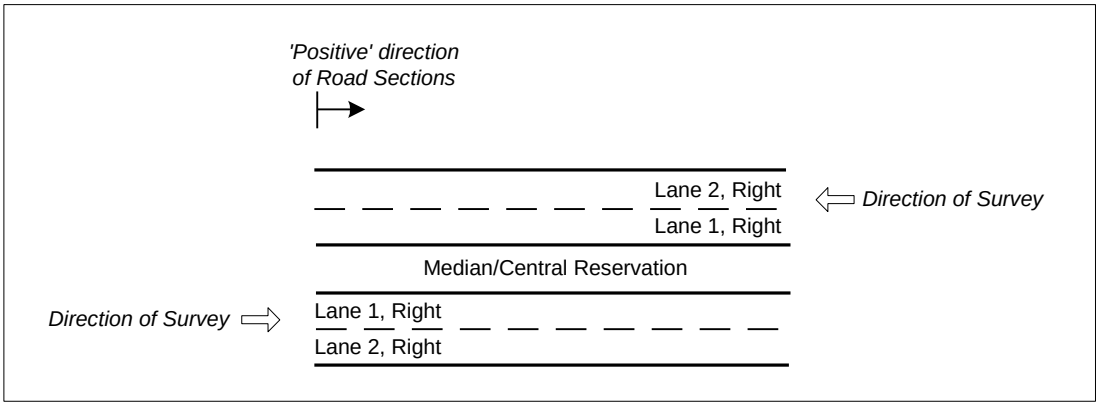
- If direction of traffic is the same as that of the Road Section, all lanes in the model will be on the 'right' side, numbered from left to right;
- If the direction of traffic is opposite to that of the Road Section, all lanes in the model will be on the 'left' side, numbered from right to left.

Figure 4
'Lanes' Cross Section Model, Dual Carriageways



It can be seen in Figure 5 that for the surveyor on any one-way road, every lane is recorded as being on the ‘right’ side and are numbered from left to right.

Figure 5
‘Lanes’ Cross Sections Observed During Survey, Dual Carriageways



Finally, it should be noted that in the case of a dual carriageway configuration, any inventory item located in between the two carriageways (e.g. the median/central reservation, light posts) is assigned against only one of the two Road Sections so as to avoid double counting. In the RBIA, such inventory records are assigned to the Road Section on which the traffic is traveled in the same direction as that of the direction of Road Section (increasing kilometer post numbers). This rule then follows that they will always be associated with the left-hand side Cross Section on that Road Section.

Appendix D

LRS Island Codes

Appendix D
LRS Island Codes

Island Code	Island Name	Island Group
AB	Alabat	LUZ
BH	Bohol	VIS
BL	Basilan	MIN
BN	Batanes	LUZ
BR	Biliran	VIS
BU	Burias	LUZ
CA	Cabra	VIS
CB	Cebu	VIS
CD	Corregidor	LUZ
CG	Camiguin	MIN
CN	Catanduanes	LUZ
CR	Coron	VIS
DG	Dinagat	MIN
GL	Golo	VIS
GR	Guimaras	VIS
IY	Itbayat	LUZ
LB	Lubang	VIS
LP	Lapu-Lapu	VIS
LT	Leyte	VIS
LZ	Luzon	LUZ
MN	Mindanao	MIN
MP	Mapon	MIN
MQ	Marinduque	VIS
MR	Mindoro	VIS
MT	Masbate	LUZ
NR	Negros	VIS
PN	Panay	VIS
PW	Palawan	VIS
RB	Romblon	VIS
SA	Sapa-Sapa	MIN
SB	Secubong	MIN
SD	Samal	MIN
SG	Siargao	MIN
SJ	Siquijor	VIS
SK	Sitangkai	MIN
SL	Sulu	MIN
SM	Samar	VIS
ST	Sabtang	LUZ
SY	Sibuyan	VIS
TB	Tandubas	MIN
TC	Ticao	LUZ
TL	Tablas	VIS
TW	Tawi-Tawi	MIN

Appendix E

Instructions for
LRS and Road Inventory Update Sheet

Instructions for LRS and Road Inventory Update Sheet

General

The 'LRS and Inventory Update Sheet' is to be completed in the event of any change to the road network definition in the DPWH Locational Referencing System (LRS).

Some common examples of such events that may cause changes to the LRS road network definition include:

- New or change in road name;
- Realignment of road;
- Road conversions;
- Creation of new roads;
- Change in district boundary;
- Placement of kilometer posts.

Updates required to the LRS information are against the following LRS entities and their attributes:

- Road Name
  - Name of the road/route;
  - Road ID;
  - Functional classification.

- Road Section
  - Road Section ID;
  - the Road Name to which it belongs;
  - Length;
  - Direction;
  - Engineering District.

- Node
  - Node ID
  - Location

- Locational Reference Point (LRP)
  - LRP Description (e.g. kilometer post number)
  - Location

In addition to the changes in road network definition, any affected road inventory information is also recorded using the form.

Sections 1 and 2 of the form specifically deal with changes to LRS entities only.

Sections 3, 4 and 5 of the form specifically deal with road inventory data only, as per 'Instructions for Road Inventory Update Sheet' found in the Road Network Definition & Inventory Updates Manual (Appendix F).

Instructions on Completing Section 1

This section is to be completed by the Regional Office Planning and Design Division to identify and describe the changes that have occurred to the road network. (Attach additional sheets if necessary.)

Date

Date on which the sheet is being prepared.

Region

Affected Region(s) in which the changes take place.

District

Affected Engineering District(s) in which the changes take place.

Name of Inspector

Name of person completing the sheet.

Nature of Change to Network

Indicate the nature of changes by ticking as many boxes as necessary.

Affected LRS Road Sections

List the Road Section(s) that are affected by the change. If a certain portion of a Road Section is affected, indicate the 'from' and 'to' locations and the length between those two points.

Sketch of Road Configuration

Draw a sketch of the situation. Details must include existing Road Section numbers, Nodes, kilometer posts, configuration of carriageways (and clearly indicate where carriageway is divided), and Engineering District boundaries (where they are crossed).

Attach additional sheets containing sketches as necessary.

Instructions on Completing Section 2

This section is to be completed by the LRS & GIS Team Leader of Infrastructure Planning, Research, and Statistics Division (IPRSD) of Central Office Planning Service. (Attach additional sheets if necessary.)

Based on the information received from the Regional Office (**Section 1**), he/she makes the appropriate changes to the LRS road network definitions and updates the RBIA.

He/she also illustrates the changes being made in the form of a sketch, either by annotating the original sketch from the Region or by attaching a new separate sketch.

Distance Measuring Requirements

On this section of the form all distances shall be measured using a vehicle fitted with a distance-measuring instrument (DMI) having the following specification:

- Reading resolution of 0.01 meter or less;
- Accuracy of ± 0.1% of the measured distance.

The DMI should be calibrated prior to use. This involves driving the equipment vehicle over an accurately measured test section to calculate a distance scale factor. This scale factor is usually calculated automatically in the DMI calibration software. The DMI will also require checking if the wheel or tire is replaced during field operations.

Prior to the calibration test run, the survey vehicle should be driven at normal highway speeds to achieve a standard operating temperature and all data acquisition systems and equipment must be operating correctly. The test section should be at least 500m in length and be located on a low traffic, straight, level paved road in good condition. The true length of the section, in a marked wheelpath, must be measured with a calibrated steel tape or accurate laser survey equipment.

Three runs are required to ensure accurate calibration and the required accuracy should be +/- 0.1%.

Road Names

In the event of just a change in name or Functional Classification of an existing Road Name, tick the 'Edit' box and complete the Road name, Road ID and Functional Classification fields. (The Road ID of an existing Road Name should not change under normal circumstances.)

In the event of a new Road Name being created, tick the 'Create' box and complete the required Road Name, Road ID, and Functional Classification fields.

In the event of a Road Name being removed from the LRS, tick the 'Delete' box and complete the Road Name, Road Id, and Functional Classification fields describing the Road Name being removed.

Road Sections

If an existing Road Section is assigned in its entirety to either a different Road Name or Engineering District, tick the 'Edit' box and complete the required details. (For existing Road

Sections, the Road Section ID, Length and Start Date should not change under normal circumstances.)

Either create or end-date Road Sections as necessary by ticking the appropriate box and completing the required details.

Nodes

Either create or end-date Nodes as necessary by ticking the appropriate box and completing the required details.

Locational Reference Points

Either create or end-date Locational Reference Points as necessary by ticking the appropriate box and completing the required details.

Name, Signature, Date

The LRS & GIS Team Leader then dates and signs the sheet to indicate that the changes to the network entities as described have been reflected in the RBIA.

Instructions on Completing Sections 3 to 5

These sections are completed by an inspector from any appropriate office (Central, Regional, or District) to record any updated road inventory information against the latest LRS network definition as described in **Section 2**.

These sheets are completed in accordance with the 'Instructions for Road Inventory Update Sheet' found in Appendix F of this manual.

The completed sheets are dated and signed by the inspector and then returned to the IPRSD for entry into the RBIA. The person entering into the RBIA finally dates and signs the sheets to indicate that the changes to inventory as described have been reflected in the RBIA.

Department of Public Works and Highways

LRS and Road Inventory Update Sheet

(Note: This form to be used only when LRS adjustments are required in the RBIA.)

1

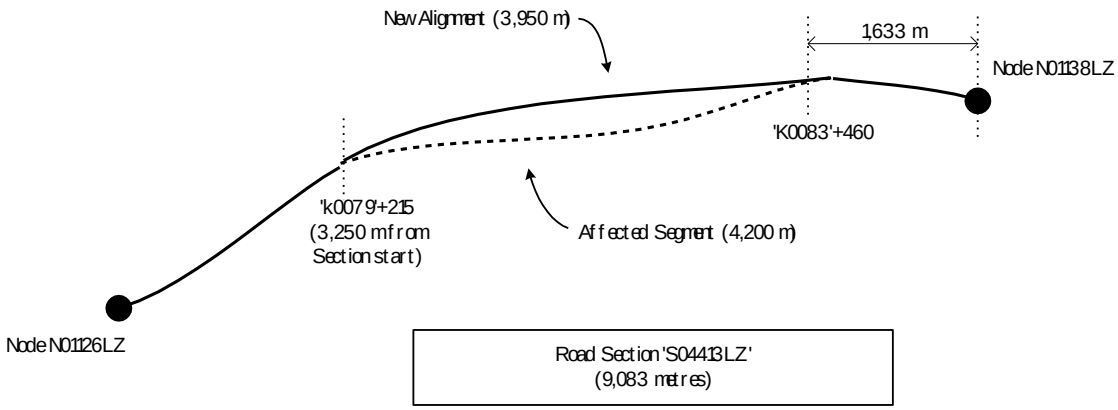
Date	February 3, 2002	Nature of change to road network: (Tick as many as necessary)	☐ New construction/road conversion ☐ Removal from network ☑ Realignment ☐ Placement of Kilometer Posts ☐ Other: _____
Region	3		
District	Tarlac		
Name of Inspector	Roman Perez		

Affected Existing LRS Road Sections (if any):

Section ID	Road Name	Location (LRP/Node + Displacement) From	Location (LRP/Node + Displacement) To	Length (m)
1. S04413LZ	Gapan-Sn Fernando-Olongapo	K0079 + 215	K0083 + 460	4,200
2.		+	+	
3.		+	+	
4.		+	+	
5.		+	+	

(Attach additional sheet if necessary.)

Sketch of Road Configuration[1]



to be completed by Regional Office

[1] Sketch must show both existing and new situations. Details must include existing Road Section numbers, Nodes, kilometer posts, configuration of carriageways (and clearly indicate where carriageway is divided), and Engineering District boundaries (where they are crossed).

Department of Public Works and Highways

LRS and Road Inventory Update Sheet

2

List of Changes to Network Entities [2]

1) Road Names

Action (Tick one)	Road Name	Road ID	Functional Classification
☐ Create ☐ Delete ☐ Edit			
☐ Create ☐ Delete ☐ Edit			

2) Road Sections

Action (Tick one)	Road Section ID	Road Name	Length (meters)	Engineering District	Start or End Date
☐ Create ☒ End-Date ☐ Edit	S04413LZ	Gapan-Sn Fernando-Olongapo	9,083.0	Pampanga II	02/12/03
☒ Create ☐ End-Date ☐ Edit	S08522LZ	Gapan-Sn Fernando-Olongapo	8,833.0	Pampanga II	02/12/03

3) Nodes

Action (Tick one)	Node ID	Road Section ID	Distance from Start (m)	Start or End Date
☐ Create ☐ End-Date				
☐ Create ☐ End-Date				
☐ Create ☐ End-Date				

4) Locational Reference Points

Action (Tick one)	LRP Description	Road Section ID	Distance from Start (m)	Start or End Date
☒ Create ☐ End-Date	K0080	S08522LZ	4,036	02/12/03
☒ Create ☐ End-Date	K0081	S08522LZ	5,041	02/12/03
☒ Create ☐ End-Date	K0082	S08522LZ	6,038	02/12/03
☒ Create ☐ End-Date	K0083	S08522LZ	7,029	02/12/03

(Attach additional sheet if necessary.)

I certify that the above network entities have either been end-dated or accurately created to the extent that there are no inconsistencies between old and new data.

Name: Signature: Date:

to be completed by IPRSD

[2] Annotate on sketch by Region or attach separate sketch.

3

Department of Public Works and Highways

LRS and Road Inventory Update Sheet **(**to be completed by Inventory Inspector)

Date: _____

Region: _____ District: _____ Inspector: _____

Road Section No: ._____ Road Name: _____

Inventory Type	Item					
Start Location		4,036m	5,041m	6,038m	7,029m	
Locational Reference Points	LRP Description	K0080	K0081	K0082	K0083	
	LRP Type	KM	KM	KM	KM	
	LRP Location					
Start Location						
Congressional Dist.	Congressional District					
Start Location						
Environment	Environment					
Start Location						
Junctions	Junction Type					
	Junction Name					
Start Location						
Place Name	Place Name					
Start Location						
Right of Way	Right of Way Width					
Start Location		K0079+215	K0083+171			
Carriageway Width	Carriageway Width	6.2				
Start Location		K0079+215	K0083+171			
Number of Lanes	Number of Lanes	2				
Start Location		K0079+215	K0083+171			
Pavement Type	Surface Type	A				
	Pavement Type					
	Yr. Of Last Surfacing					
	(Re)construction Year	2002				
Start Location						
Pavement Thickness	Most Recent Surface Thickness	50				
	Previous Surface Thickness	250				
	Slab Thickness	-				
Start Location		K0079+300	K0079+700			
Median	Median Type	D				
	Median Width	0.5				

Sheet ____ of ____

Department of Public Works and Highways

LRS and Road Inventory Update Sheet (to be completed by Inventory Inspector)

4

Inventory Type	Item					
Start Location						
Bridges	Bridge Type					
	Bridge Name					
	Bridge Length					
Start Location						
Culverts	Culvert Type					
	Culvert Size					
	Culvert No. Pipes/Chan.					
	Culvert Name					
	Culvert Drainage Cond.					
Start Location						
Causeway	Causeway ID					
	Type of Causeway					
	Barrel Type					
	Barrel Size					
	No. of Barrels					
	Overall causeway length					
Start Location						
Spillway	Road Name					
	Spillway ID					
	Type of Spillway					
	Ford overall length					
Start Location		K0079+215	K0081+200	K0083+171		
Left Shoulders	Shoulder Type	A	G			
	Shoulder Width	0.3	0.5			
Start Location		K0079+215	K0081+200	K0083+171		
Right Shoulders	Shoulder Type	A	G			
	Shoulder Width	0.3	0.5			
Start Location						
Left Side Slope	Side Slope Type					
	Side Slope Angle					
Start Location						
Right Side Slope	Side Slope Type					
	Side Slope Angle					
Start Location						
Left Sidewalks	Sidewalk Surface Type					
	Sidewalk Width					
Start Location						

4

Department of Public Works and Highways

LRS and Road Inventory Update Sheet **(**to be completed by Inventory Inspector)

Inventory Type	Item					
Right Sidewalks	Sidewalk Surface Type					
	Sidewalk Width					
Start Location		K0079+215	K0080+100	K0081+200	K0083+171	
Left Ditches	Drainage Type	UN	SD	UN		
	Drainage Size	S	S	M		
Start Location		K0080+300	K0082+000			
Right Ditches	Drainage Type	UN				
	Drainage Size	S				
Start Location						
Left Signs	Sign Type					
	Sign Size					

Sheet ____ of ____

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

5

LRS and Road Inventory Update Sheet **(**to be completed by Inventory Inspector)

Inventory Type	Item					
Start Location						
Right Signs	Sign Type					
	Sign Size					
Start Location						
Left Lighting	Safety Devices					
Start Location						
Right Lighting	Safety Devices					
Start Location						
Left Guardrails	Guardrail Type					
Start Location						
Right Guardrails	Guardrail Type					
Start Location						
Markings	Centerline Markings					
Start Location						
Hazards	Hazard Threat					
	Hazard Risk					
Start Location						
Roadside Friction	Roadside Friction					
Start Location						
Roadside Structures	Roadside Structure Type					
Start Location						
Horizontal Radius	Horizontal Radius of Curve					
Start Location						
Vertical Sight	Restricted Vertical Sight Dist.					
Start Location						
Gradient	Pavement Gradient					
Start Location						
Terrain	Terrain Type					

	Name	Signature	Date
Inventory Inspector			
District Engineer			
Regional Engineer			

I certify that the RBIA has been updated in accordance with the above inventory record.

Name:_____ Signature:_____ Date:_____

Sheet ____ of ____

Appendix F

Instructions for
Road Inventory Update Sheet

Instructions for Road Inventory Update Sheet

1.0 Location Referencing

Locations of all data must be specified in adherence to the DPWH Locational Referencing System (LRS). For inventory updates this entails data being referenced against a Road Section, and positioned by distance along the Road Section using the 'LRP + Displacement' method.

Furthermore, all inventory data records shall be recorded as surveyed while traveling in the positive direction of the Road Section.

Details on the LRS and LRM's are found in the Road Network Definition & Inventory Update Manual.

2.0 Distance Measuring Requirements

All distances shall be measured using a measuring wheel with minimum specifications:

- 5km range
- 1cm graduation

Note that in situations that require an LRS update (e.g. road conversion, road realignment, etc) the LRPs and section lengths must be measured with a calibrated odometer. Refer to Appendix E for details.

3.0 Definitions

Definition of terms used in the LRS and Road/Bridge inventory are found in the Road Network Definition & Inventory Update Manual (Appendix G).

4.0 Recording Parameters of Inventory Items

General

Complete the date and location information at the top of the survey form to describe the road being surveyed.

Separate forms are to be used for each Road Section.

The bottom part of the form is to be dated and signed by the Inspector and approved by the District and Regional Engineers. It is further dated and signed by the person entering the information into the RBIA.

Congressional District

Item: Congressional District

The limits of congressional districts shall be recorded at the start of each Road Section and at each change along it.

Environment

Item: Environment

The road environment shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
UM	Urban (Metropolitan) – population greater than 500,000
UN	Urban (Non-Metropolitan) – population between 10,000 and 500,000 and density greater than 500 people per square kilometer
R	Rural

Junctions

The presence of any type of public road junction shall be recorded. The chainage shall be measured at the mid-point of the road joining the Road Section being surveyed.

Item: Junction Type

For every Junction being recorded shall be classified as being one of the following types:

Code	Description
L	Junction Left
R	Junction Right
C	Cross

Item: Junction Name

For every junction being recorded, record the text description of the junction.

Place Name

Item: Place Name

The names of any cities, municipality or barangays where displayed on a sign or arch shall be recorded.

Right of Way

Item: Right of Way Width

This shall be determined from office records. A width value to an accuracy of ±1 m and chainage shall be inserted at the commencement of the survey and at each change of width.

Carriageway Width

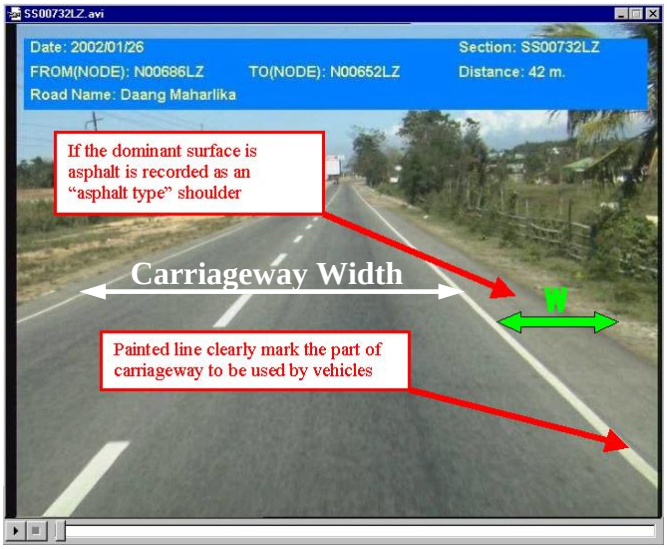
Item: Carriageway Width

The Width of the carriageway shall be recorded at the start of each Road Section and at each change along it.

The width of the carriageway shall be measured to an accuracy of ±0.5 m using either a tape measure or a measuring wheel. This information may be available from office records but it should also be checked on site. The carriageway width shall be re-measured at intervals no greater than 100 m along the alignment.

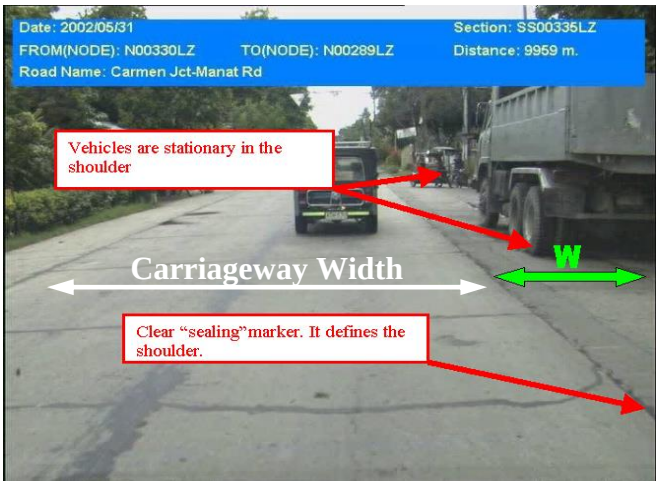
To distinguish between the edge of carriageway and the shoulder the following guidelines shall be used:

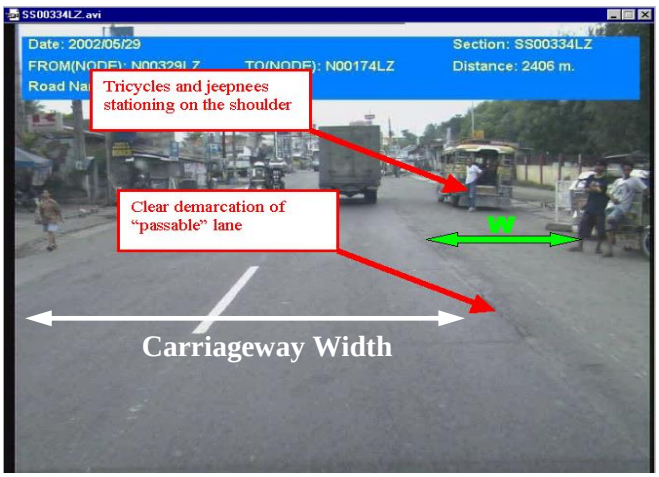
- Painted continuous markings on the edge of the road shall delineate between the carriageway and the shoulder.

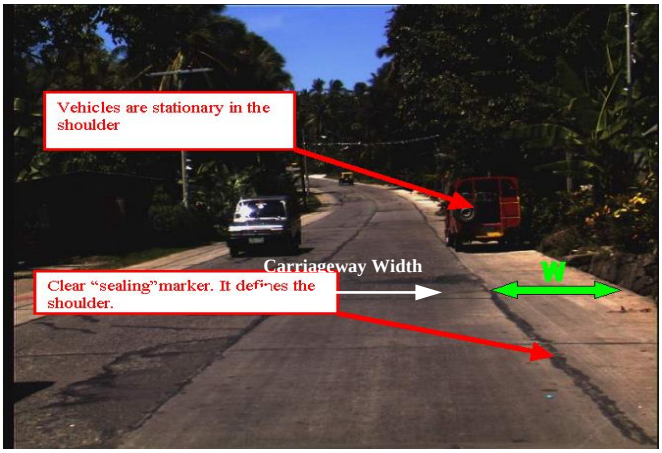


- When no painted marking is provided or visible, the carriageway width shall comprise the entire paved width.

- When there is no visible marking, but there is a clear change of pavement (i.e. in terms of its use) for widths of less than 3m, that width beyond the pavement change shall be recorded as “shoulder”.







For more references see Appendix K

On unsealed roads the average trafficked width shall be recorded as the carriageway width. This shall be judged from observation of the distance between the most extreme wheelpaths on the road.

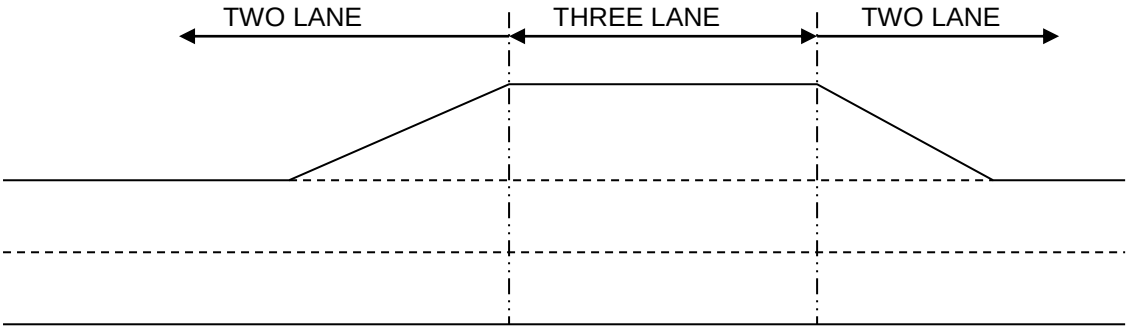
For more references see Appendix K.

Number of Lanes

Item: Number of Lanes

The number of lanes shall be recorded at the start of each Road Section and at each change along it. The method of determining the start and end points for each lane shall be in accordance with the principle described below:

- With marking: The number of lane should be recorded in accordance with the road marking, irrespective of the resulting lane width.
- With no marking (on 2-directional roads):
  - If the carriageway width is greater than 6.1 m, the number of lanes is recorded as the carriageway width divided by 3.05 (rounded to lower integer).
  - If the carriageway width is inferior to 6.1 m, the number of lanes is recorded as 1.
  - The lane width is carriageway width/2.



Pavement Type

Item: Surface Type

The surface type of the road shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
C	Concrete
A	Asphalt
S	Surface Treatment
G	Gravel
E	Earth

The dominant surface material shall be deemed the “Surface Type”.

Item: Pavement Type

The pavement type of the road shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
AMGB	Asphalt Mix on Granular Base
AMAB	Asphalt Mix on Asphalt Base (i.e. Bitumen Stabilized Base)
AMAP	Asphalt Mix on Asphalt Pavement
AMSB	Asphalt Mix on Stabilized Base
AMCP	Asphalt Mix on Concrete Pavement
STGB	Surface Treatment on Granular Base
STAB	Surface Treatment on Asphalt Base
STAP	Surface Treatment on Asphalt Pavement
STSB	Surface Treatment on Stabilized Base
STCP	Surface Treatment on Concrete Pavement
JPCD	Jointed Plain Concrete with Dowel
JPC0	Jointed Plain Concrete without Dowel
JRCP	Jointed Reinforced Concrete Pavement
CRCP	Continuous Reinforced Concrete Pavement
G	Gravel
E	Earth

Item: Year of Last Surfacing

The year of last surfacing shall be recorded at the start of each Road Section and at each change along it.

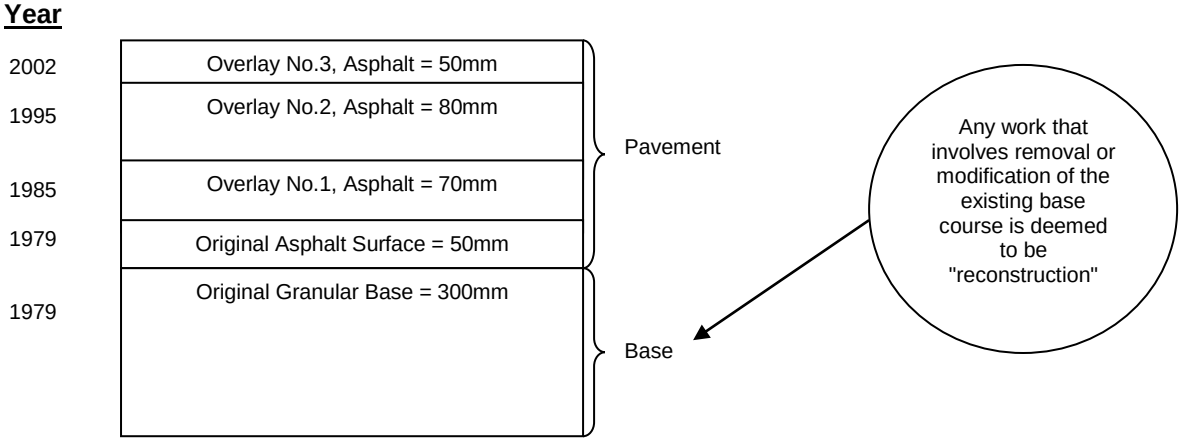
Note that for gravel pavements, the year of last surfacing is the year that gravel was last added to the pavement. I.e. Last Regravelling

Item: (Re) construction Year

The year of pavement construction or reconstruction shall be recorded at the start of each Road Section and at each change along it. Reconstruction shall be deemed to include any treatment that involves reworking of the existing base course (or portion thereof). Refer to figure F-1 for guidance on identification of base course layer.

Note that for gravel pavements, the year of reconstruction year shall be the same as the year of last surfacing (i.e. the year that gravel was last added to the pavement).

Figure F-1



Pavement Thicknesses

Item: Most Recent Surface Thickness

The most recent surface thickness of the road (asphalt pavement only) shall be recorded at the start of each Road Section and at each change along it. It shall be recorded as a number between 10-200 mm.

Thickness will normally be obtained from construction or rehabilitation records. Occasionally it may be necessary to excavate a trial pit or core the pavement to determine the thickness.

In the example shown in Figure F-1, the most recent surface thickness = 150mm (overlay year 2002)

Note that for concrete pavements (i.e. no asphalt surfacing), the surface thickness is the concrete thickness.

Item: Previous Surface Thickness

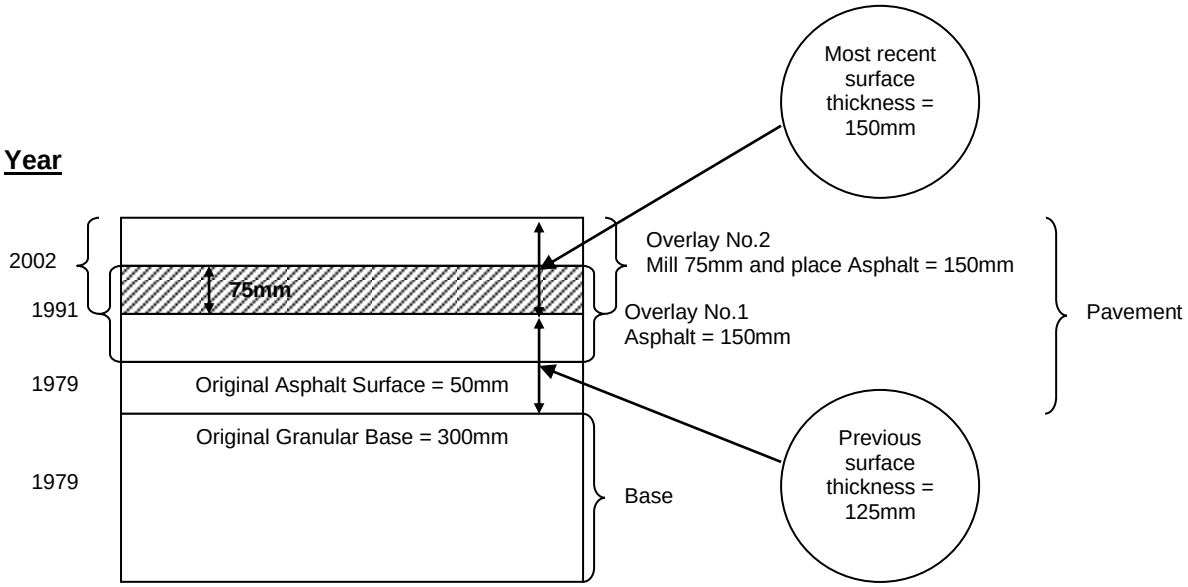
The previous surface thickness shall be recorded at the start of each Road Section and at each change along it. It shall be recorded as a number between 20-1,000 mm.

In the example shown in Figure F-1, the previous surface thickness = 200mm (80mm+70mm+50mm)

In the example shown in Figure F-2, the most recent surface thickness = 150mm (overlay year 2002) and the previous surface thickness = 125mm (75mm+50mm)

Note that for concrete pavements (i.e. no asphalt surfacing) the previous surface thickness is 0mm.

Figure F-2
Surface Thickness for Asphalt Pavements



Pavement Strength

The Pavement Strength of the road (asphalt surface only) shall be recorded at the start of each Road Section and at each change along it. It shall be recorded as a number from the following pick list.

Pavement Strength will normally be obtained from construction or rehabilitation records. Occasionally it may be necessary to excavate a trial pit or core the pavement to test the material for CBR value.

	Layer	Effective Thickness (mm)	Computed SNP		
			Low 3<CBR<=7	Medium 7<CBR<=15	High CBR>15
1	Asphalt Mix	(= 50	1.9	2.3	2.9
	Base	(=100			
	Subbase	0			
2	Asphalt Mix	(= 50	2.5	2.8	3.4
	Base	101-200			
	Subbase	0			
3	Asphalt Mix	(= 50	2.4	2.7	3.3
	Base	(=100			
	Subbase	(=100			
4	Asphalt Mix	(= 50	2.8	3.1	3.7
	Base	(=100			
	Subbase	101-200			
5	Asphalt Mix	(= 50	3.2	3.6	4.2
	Base	(=100			
	Subbase	201-300			
6	Asphalt Mix	(= 50	3.4	3.7	4.3
	Base	101-200			
	Subbase	101-200			
7	Asphalt Mix	(= 50	3.8	4.1	4.7
	Base	101-200			
	Subbase	201-300			
8	Asphalt Mix	(= 50	4.1	4.4	5.0
	Base	) 200			
	Subbase	201-300			
9	Asphalt Mix	75	2.8	3.1	3.7
	Base	(=100			
	Subbase	(=100			
10	Asphalt Mix	75	3.2	3.5	4.1
	Base	(=100			
	Subbase	101-200			
11	Asphalt Mix	75	3.6	4.0	4.5
	Base	(=100			
	Subbase	201-300			
12	Asphalt Mix	75	3.7	4.1	4.7
	Base	101-200			
	Subbase	101-200			

	Layer	Effective Thickness (mm)	Computed SNP		
			Low 3<CBR<=7	Medium 7<CBR<=15	High CBR>15
13	Asphalt Mix	75	4.2	4.5	5.1
	Base	101-200			
	Subbase	201-300			
14	Asphalt Mix	75	4.5	4.8	5.4
	Base	101-200			
	Subbase	201-300			
15	Asphalt Mix	100	3.2	3.5	4.1
	Base	(=100			
	Subbase	(=100			
16	Asphalt Mix	100	3.6	3.9	4.5
	Base	(=100			
	Subbase	101-200			
17	Asphalt Mix	100	4.0	4.3	4.9
	Base	(=100			
	Subbase	201-300			
18	Asphalt Mix	100	4.1	4.5	5.1
	Base	101-200			
	Subbase	101-200			
19	Asphalt Mix	100	4.6	4.9	5.5
	Base	101-200			
	Subbase	201-300			
20	Asphalt Mix	100	4.8	5.2	5.8
	Base	) 200			
	Subbase	201-300			

SNP - Adjusted Structural Number

Item: Slab Thickness

The slab thickness of the road (concrete pavement only) shall be recorded at the start of each Road Section and at each change along it. It shall be recorded as a number between 50-1,000 mm.

Thickness will normally be obtained from construction or rehabilitation records. Occasionally it may be necessary to excavate a trial pit or core the pavement to determine the thickness.

Median

Item: Median Type

The type of the median shall be recorded at each occurrence using the following codes:

Code	Description
D	Depressed
R	Raised
F	Flush

For dual carriageway roads the median shall be recorded against the carriageway with traffic flow in the direction of increasing chainage as shown by kilometer posts. Care must be taken to ensure that the median is only recorded against the one carriageway.

Breaks in the median shall result in them being recorded as separate medians.

Item: Median Width

The width of the median shall be recorded at the each occurrence.

The width of the median shall be measured to an accuracy of ±0.5 m using either a tape measure or a measuring wheel. This information may be available from office records but it should also be checked on site. The median width shall be re-measured at intervals no greater than 100 m along the alignment.

Culverts

All the features of the culvert or culvert group will be assigned to the chainage of the center of the culvert or group.

Item: Number of Barrels

The number of barrels shall be recorded (1-50).

Item: Barrel Length

Length of the barrel shall be recorded as a number between 1-30 meters.

Item: Barrel Diameter

The barrel diameter shall be recorded as a number between 0.2 and 2.0 meters.

Item: Culvert Type

The type of culvert shall be recorded using the following codes:

Code	Description
P	Pipe
B	Box
A	Arch
O	Other

Item: Barrel Material

The type of barrel material shall be recorded using the following codes:

Code	Description
C	Concrete
S	Steel

T	Timber
M	Masonry
O	Other

Item: Head Wall Material

The type of head wall material shall be recorded using the following codes:

Code	Description
C	Concrete
S	Steel
T	Timber
M	Masonry
O	Other

Item: Invert Type

The type of invert shall be recorded using the following codes:

Code	Description
S	Stone Pitching
C	Concrete
G	Gabion
O	Other
N	None

Spillway

Item: Road Name

The name of the road should be recorded

Item: Spillway Type.

The type of spillway shall be recorded using the following codes:

Code	Description
SWC	Spillway Concrete
SWG	Spillway Grouted Rock
SWM	Spillway Mattresses
SWNA	Spillway Not Specified
SWO	Spillway Other
SWR	Spillway Rip Rap

Item: Ford Overall Length

The length of the ford should be recorded.

Item: Scour/Bank Protection

The type of scour/bank protection should be recorded using the following categories:

Concrete

Mattress
Rip Rap
Grouted Rock
Other

Shoulders (Left & Right)

Item: Shoulder Type

The type of the shoulder shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
N	None
C	Concrete
A	Asphalt (surface dressing or premix)
G	Gravel
E	Earth

Note that shoulder type shall be determined based on the dominant material type present (i.e. for 50% or more of the width).

Item: Shoulder Width

The width of the shoulder shall be recorded at the start of each Road Section and at each change along it.

The width of the shoulder shall be measured to an accuracy of ±0.5 m using either a tape measure or a measuring wheel. This information may be available from office records but it should also be checked on site. The width of shoulders shall be re-measured at intervals no greater than 100 m along the alignment.

The diagrams provided under “Carriageway Width” clearly describe how the shoulder may be delineated from the carriageway for measurement purposes.

Side Slope (Left & Right)

Item: Side Slope Type

The type of the side slope shall be recorded at each occurrence of an embankment or cutting using the following codes:

Code	Description
E	Embankment (Edge of surfacing > 0.3m of ground level)
C	Cutting (Edge of surfacing < 0.3m of ground level)

Item: Side Slope Angle

The slope angle of the side slope shall be recorded for each occurrence using the following codes:

Code	Description
SH	Flat (< 5 deg)
MD	Medium (5 to 30 deg)

ST	Steep (> 30 deg)

The slope angles of the ditches may be estimated. When these estimates lie close to the slope range limits they should be checked by either a 1m long spirit level and triangular templates or an inclinometer such as an Abney level. The slope angle shall be re-measured at intervals no greater than 100m.

This information may be available from design or record drawings but it should also be checked on site.

Sidewalks (Left & Right)

Details are only required in urban areas and at bridges.

Item: Sidewalk Surface Type

The type of the sidewalk shall be recorded at each occurrence using the following codes:

Code	Description
N	None
C	Concrete
A	Asphalt
E	Earth

Item: Sidewalk Width

The width of the sidewalk shall be recorded at each occurrence.

The width of the sidewalk shall be measured to an accuracy of ±0.5 m using either a tape measure or a measuring wheel. This information may be available from office records but it should also be checked on site. The width of sidewalk shall be re-measured at intervals no greater than 50m along the alignment.

Ditches (Left & Right)

Item: Drainage Type

The type of the drainage shall be recorded at each occurrence using the following codes:

Code	Description
UN	Unlined ditch
LO	Lined open ditch
LC	Lined covered Ditch
SD	Storm drain

Item: Drainage Size

The size of the drainage shall be recorded each occurrence. The following codes shall be used to denote the depth of the ditches:

Code	Description

S	Shallow (<0.5m)
M	Medium (0.5 to 1.5m)
D	Deep (>1.5m)

The depths of the ditches may be estimated. When these estimates lie close to the depth range criteria they should be checked by tape measurement to an accuracy of ±0.1 m. The ditch depths shall be re-measured at intervals no greater than 100m.

Terrain

Item: Terrain Type

Terrain type shall be denoted by one of the following codes:

Code	Description
F	Flat
R	Rolling
M	Mountainous

Signs (Left & Right)

Each occurrence of DPWH signs shall be recorded.

Item: Sign Type

The type of sign shall be denoted by one of the following codes:

Code	Description
R	Regulatory
I	Information
G	Guidance

Item: Sign Size

The size of the sign shall be denoted by one of the following codes.

Code	Description
S	< 0.6m (largest dimension)
M	0.6 to 2.0m (largest dimension)
L	>2.0m (largest dimension)

Generally it should be possible to estimate sizes but a tape measure should be used in cases of doubt.

Lighting (Left & Right)

Item: Lighting

Any existence of road lighting shall be recorded using the following codes:

Code	Description
E	Exists

Guardrails (Left & Right)

Item: Guardrail Type

Any existence of guardrails shall be recorded using the following codes:

Code	Description
S	Steel
W	Wall
T	Temporary (Wood)

Markings

Item: Centerline Markings

Pavement markings shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
N	None
P	Painted
S	Studs

Hazards

Hazards to the road usage involves a considerable degree of judgment. Determining the appropriate codes will probably be beyond the scope of normal inventory personnel and will require knowledge of past events and advice from engineering geologists or hydrologists.

Item: Hazard Threat

Hazard treats shall be recorded at each occurrence using the following codes:

Code	Description
L	Landslip
F	Flood
E	Erosion

Item: Hazard Risk

Hazard risks shall be recorded at each occurrence using the following codes:

Code	Description
L	Low
M	Medium
H	High

Roadside Friction

Item: Roadside Friction

Roadside fiction shall be recorded at the start of each Road Section and at each change along it using the following codes:

Code	Description
N	None
L	Light
M	Medium
H	Heavy

The following definitions will be used:

None	Few or no houses along the carriageway
Light	Houses and/or road intersections along or close to the road, 100-200 meters between objects. Pedestrians and other slow moving traffic observed occasionally
Medium	Scattered roadside development, 50-100 meters between buildings and/or road intersections. Pedestrians and other slow moving traffic observed frequently.
Heavy	Continuous roadside development, less than 50 meters between buildings and/or road intersections. Pedestrians and other slow moving traffic tends to disrupt the motor vehicle traffic and reduce travel speed to under 35 km/hr even at low traffic densities.

Roadside Structures (Left & Right)

Item: Roadside Structure Type

The presence of roadside structures shall be recorded at each occurrence using the following codes:

Code	Description
R	Retaining wall
S	Obstruction
P	Parking

1

Department of Public Works and Highways

Road Inventory Update Sheet

Date: _____

Region: _____ District: _____ Inspector: _____

Road Section No: ._____ Road Name: _____

Inventory Type	Item					
Start Location						
Congressional Dist.	Congressional District					
Start Location						
Environment	Environment					
Start Location						
Junctions	Junction Type					
	Junction Name					
Start Location						
Place Name	Place Name					
Start Location						
Right of Way	Right of Way Width					
Start Location						
Carriageway Width	Carriageway Width					
Start Location						
Number of Lanes	Number of Lanes					
Start Location						
Pavement Type	Surface Type					
	Pavement Type					
	Yr. of Last Surfacing					
	(Re)construction Year					
Start Location						
Pavement Thickness	Most Recent Surface Thickness					
	Previous Surface Thickness					
	Slab Thickness					
Start Location						
Median	Median Type					
	Median Width					

Sheet ____ of ____

Department of Public Works and Highways

Road Inventory Update Sheet

2

Inventory Type	Item					
Start Location						
Bridges	Bridge Type					
	Bridge Name					
	Bridge Length					
Start Location						
Culverts	Culvert Type					
	Culvert Size					
	Culvert No. Pipes/Chan.					
	Culvert Name					
	Culvert Drainage Cond.					
Start Location						
Spillway	Road Name					
	Spillway ID					
	Type of Spillway					
	Ford overall length					
Start Location						
Left Shoulders	Shoulder Type					
	Shoulder Width					
Start Location						
Right Shoulders	Shoulder Type					
	Shoulder Width					
Start Location						
Left Side Slope	Side Slope Type					
	Side Slope Angle					
Start Location						
Right Side Slope	Side Slope Type					
	Side Slope Angle					
Start Location						
Left Sidewalks	Sidewalk Surface Type					
	Sidewalk Width					
Start Location						
Right Sidewalks	Sidewalk Surface Type					
	Sidewalk Width					

Sheet ____ of ____

3

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

Road Inventory Update Sheet

Inventory Type	Item					
Start Location						
Left Ditches	Drainage Type					
	Drainage Size					
Start Location						
Right Ditches	Drainage Type					
	Drainage Size					
Start Location						
Left Signs	Sign Type					
	Sign Size					
Start Location						
Right Signs	Sign Type					
	Sign Size					
Start Location						
Terrain	Type					
Start Location						
Left Lighting	Safety Devices					
Start Location						
Right Lighting	Safety Devices					
Start Location						
Left Guardrails	Guardrail Type					
Start Location						
Right Guardrails	Guardrail Type					
Start Location						
Markings	Centerline Markings					
Start Location						
Hazards	Hazard Threat					
	Hazard Risk					
Start Location						
Roadside Friction	Roadside Friction					
Start Location						
Roadside Structures	Roadside Structure Type					

	Name	Signature	Date
Inventory Inspector			
District Engineer			
Regional Engineer			

I certify that the RBIA has been updated in accordance with the above inventory record.

Name:_____ Signature:_____ Date:_____

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

Road Inventory Update Sheet

3

Sheet ____ of ____

Appendix G

Definition of LRS and Inventory Terms

Appendix G
Definition of LRS and Inventory Terms

i) Locational Referencing System (LRS)

Term	Definition
Engineering District	An area established - as a subdivision of a Region - for allocation and administration by DPWH of engineered works. An Engineering District is composed of municipalities.
Chainage	A length measured from a reference point. Usually measured in meters.
Locational Referencing Point (LRP)	Kilometer Marker Post, Bridge, or other relatively permanent feature that is used by DPWH to act as base datum or a marker for the relative positioning of other features.
Locational Referencing System	A method and technique for precisely determining positions of objects along a road network, in terms of a common base. Features are positioned on uniquely identified road sections, in terms of distance between nodes. The LRS serves the query: "**Where** on the road network is it?"
Node	A point representing the location of a road intersection, the beginning or ending location of a section or a place where a road crosses an administrative boundary.
Road	A general term denoting a public way for purposes of vehicular traffic, including the entire area within the road right-of-way.
Road Section	A part of a road centerline connecting significant (distinct and identifiable) nodes.

ii) Road & Bridge Inventory

Bridge	A structure carrying road traffic over a road, waterway or other feature, with a clear span measure along the centerline between the inside faces of supports over 3.0 meters. A bridge may have an independent deck supported on separate piers or abutments, or may have a deck constructed integral with the supports and may include a structure with a continuous floor (e.g. a box culvert). A bridge shall also include a stream crossing where a spillway, overflow or no structure exists, and where a bridge is required.
Carriageway	That part of the highway constructed for use by vehicular traffic.

ii) Road & Bridge Inventory (Cont'd)

Channel	A drainage feature to allow runoff of surface water from a road carriageway. It usually runs along the edge of a paved carriageway, and is adjacent to, or in place of, a curb.	
Cross Sectional Position (XSP)	Location of an object or feature as measured on an axis that is perpendicular to the centerline of a highway. The location of such object may be measured as distance in units from the centerline.	
Culvert	A structure, in the form of large pipes or an enclosed channel, for conveying storm water runoff or utility lines across a road – below road level.	
Ditch	An artificial open channel or waterway constructed through earth or rock for the purpose of carrying water.	See note below *
Guard Rail	A safety barrier to keep vehicles from leaving the road, or from crossing over into lanes intended for traffic flowing in the opposite direction.	
Natural Hazard	A physical fault or condition presenting risk - including failure of roadway, and potential for accident to vehicular traffic. Examples include soil or material erosion, and landslide.	
Junction	A general term denoting the area where two or more roads join or cross, including all the roadways provided for accommodation of through, cross and turning movements, together with grade separations and ramps, if any.	See note below *
Kilometer Marker Post	An object on the roadside, placed to indicate position on the road network in terms of distance from a start node - and which post in turn provides a reference for the relative positioning of other objects on a road section.	
Lane	A part of the roadway delimited by linear markings or signs for use by a single line of traffic. The minimum width for a lane is 3.05 m (see Department Order 22, 21/02/2013)	
Lighting	Illumination along the road designed to provide better visibility for road users.	
Median	The portion of a divided highway separating travelled ways for traffic in opposite directions.	See note below *

ii) Road & Bridge Inventory (Cont'd)

Parking Area	A surface or structure set aside from traffic lanes, and used for short-term storage of static vehicles.	
Pavement	The constructed all-weather surface of a road, including parking and auxiliary lanes but excluding shoulders. That part of a roadway having a constructed surface for the facilitation of vehicular traffic.	See note below *
Retaining Wall	A structure intended to stabilize a positively inclined slope or cutting above a highway. Positively inclined means sloping up or standing nearly vertical relative to the road surface.	
Roadway	The portion of a road or highway, including shoulders, for vehicular use.	See note below *
Road Right-of-Way	An area of landtake for a highway – as defined by lines offset from the centerline and / or cadastral boundaries- in order to provide visibility and space for utilities.	
Road Markings	Paint or studs on the carriageway or shoulder to control traffic. These markings either supplement information on road signs, or serve independently to indicate certain regulations or hazardous conditions.	See note below *
Roadside Friction	Development adjacent to the road carriageway affecting road capacity.	
Roadside Structure	Retaining Wall, Obstruction, or Parking Area beside the road.	
Safety Device	Guard Rails or Lighting designed to improve road safety for road users, normally positioned at or near points of hazard.	See note below *
Shoulder	The portion of the roadway contiguous with the travelled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface course. That portion of a roadway between the outer edge of the paired surface and the curb or the inside edge of the ditch or gutter or original ground surface. The minimum width for a shoulder is 1.50 m (see Department Order 22, 21/02/2013).	
Spillway	A passage for surplus water running over an obstruction such as a dam or an engineered ford across a river or stream.	

ii) Road & Bridge Inventory (Cont'd)

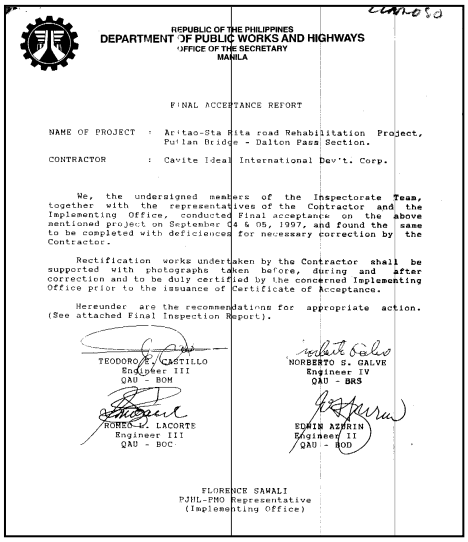
Road Sign	An object or device located to convey information to road users – through exposure to view. Four major sign types include: directional, regulatory, warning, and informational.
Side Slope	A negatively inclined (sloping downward) area or surface where the carriageway has been raised above existing ground level using earth or rock construction. Negatively inclined means relative to the road surface.
Sidewalk	Part of the Right-of-Way, usually adjacent to the carriageway that is specifically reserved for pedestrian movement.
Surface Type	An indicator of the kind of material used to compose the wearing course of a carriageway.
Terrain	A composite of elevation, relief, landform, drainage pattern, and land cover along or within a road corridor.

***** Note on Source – All definitions with asterisk from DPWH Blue Book

Appendix H

Sample Final Acceptance Report

Appendix H
Sample Final Acceptance Report



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

FINAL ACCEPTANCE REPORT

NAME OF PROJECT : Aritao-Sta Rita road Rehabilitation Project, Putlan Bridge - Dalton Pass Section.

CONTRACTOR : Cavite Ideal International Dev't. Corp.

We, the undersigned members of the Inspectorate Team, together with the representatives of the Contractor and the Implementing Office, conducted Final acceptance on the above mentioned project on September 04 & 05, 1997, and found the same to be completed with deficiences for necessary correction by the Contractor.

Rectification works undertaken by the Contractor shall be supported with photographs taken before, during and after correction and to be duly certified by the concerned Implementing Office prior to the issuance of Certificate of Acceptance.

Hereunder are the recommendations for appropriate action. (See attached Final Inspection Report).

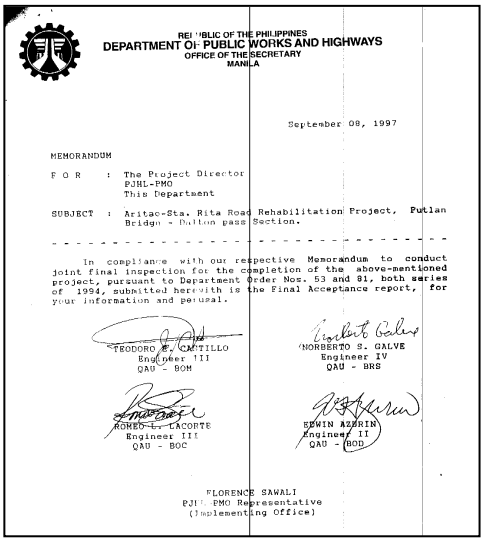
TEODORO E. CASTILLO
Engineer III
QAU - BOM

NORBERTO S. GALVE
Engineer IV
QAU - BRS

ROMEO E. LACORTE
Engineer III
QAU - BOC

EDWIN AZURIN
Engineer II
QAU - BOD

FLORENCE SAWALI
PJHL-PMO Representative
(Implementing Office)



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

September 08, 1997

MEMORANDUM

F O R : The Project Director
PJHL-PMO
This Department

SUBJECT : Aritao-Sta. Rita Road Rehabilitation Project, Putlan Bridge - Putlan pass Section.

In compliance with our respective Memorandum to conduct joint final inspection for the completion of the above-mentioned project, pursuant to Department Order Nos. 53 and 81, both series of 1994, submitted herewith is the Final Acceptance report, for your information and perusal.

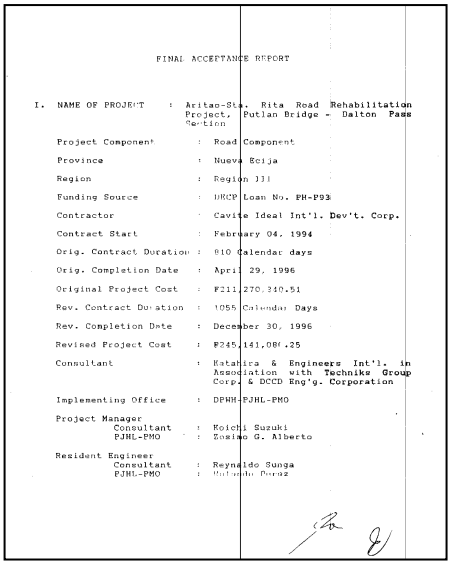
TEODORO E. CASTILLO
Engineer III
QAU - BOM

NORBERTO S. GALVE
Engineer IV
QAU - BRS

ROMEO E. LACORTE
Engineer III
QAU - BOC

EDWIN AZURIN
Engineer II
QAU - BOD

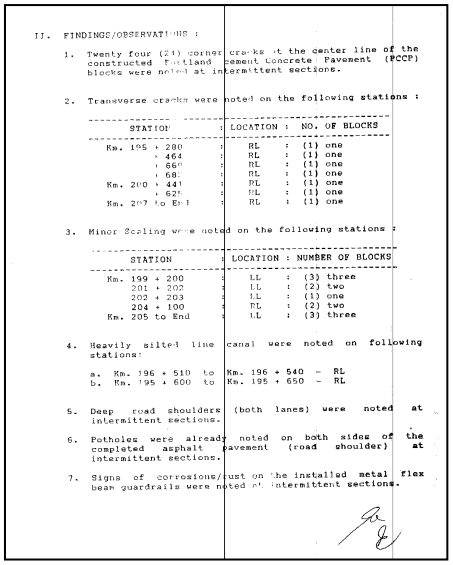
FLORENCE SAWALI
PJHL-PMO Representative
(Implementing Office)



FINAL ACCEPTANCE REPORT

I. NAME OF PROJECT : Aritao-Sta. Rita Road Rehabilitation Project, Putlan Bridge - Dalton Pass Section

Project Component	:	Road Component
Province	:	Nueva Ecija
Region	:	Region III
Funding Source	:	OKCF Loan No. PH-P93
Contractor	:	Cavite Ideal Int'l. Dev't. Corp.
Contract Start	:	February 04, 1994
Orig. Contract Duration	:	810 Calendar days
Orig. Completion Date	:	April 29, 1996
Original Project Cost	:	₱211,270,310.51
Rev. Contract Duration	:	1055 Calendar Days
Rev. Completion Date	:	December 30, 1996
Revised Project Cost	:	₱245,141,087.25
Consultant	:	Katahira & Engineers Int'l. in Association with Techniks Group Corp. & DCCD Eng'g. Corporation
Implementing Office	:	DPWH-PJHL-PMO
Project Manager		
Consultant	:	Koichi Suzuki
PJHL-PMO	:	Zosimo G. Alberto
Resident Engineer		
Consultant	:	Reynaldo Sunga
PJHL-PMO	:	Rolando Perez



II. FINDINGS/OBSERVATIONS :

1. Twenty four (24) corner cracks at the center line of the constructed Portland Cement Concrete Pavement (PCCP) blocks were noted at intermittent sections.

2. Transverse cracks were noted on the following stations :

STATION	LOCATION	NO. OF BLOCKS
Km. 195 + 280	RL	(1) one
" 464	RL	(1) one
" 660	RL	(1) one
" 68[illegible]	RL	(1) one
Km. 200 + 441	RL	(1) one
" 62[illegible]	RL	(1) one
Km. 207 to End	RL	(1) one

3. Minor Scaling were noted on the following stations :

STATION	LOCATION	NUMBER OF BLOCKS
Km. 199 + 200	LL	(3) three
201 + 202	LL	(2) two
202 + 203	LL	(1) one
204 + 100	RL	(2) two
Km. 205 to End	LL	(3) three

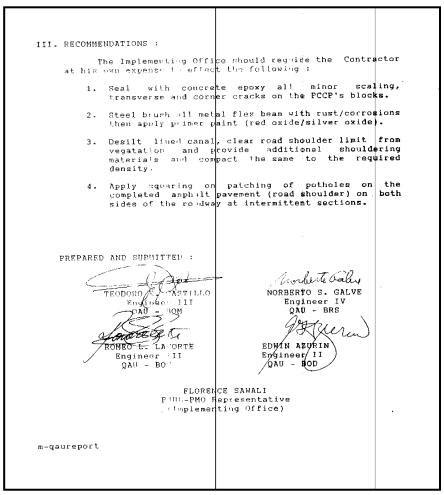
4. Heavily silted line canal were noted on following stations:

a. Km. 196 + 510 to Km. 196 + 540 - RL
b. Km. 195 + 600 to Km. 195 + 650 - RL

5. Deep road shoulders (both lanes) were noted at intermittent sections.

6. Potholes were already noted on both sides of the completed asphalt pavement (road shoulder) at intermittent sections.

7. Signs of corrosions/rust on the installed metal flex beam guardrails were noted at intermittent sections.



III. RECOMMENDATIONS :

The Implementing Office should require the Contractor at his own expense to effect the following :

1. Seal with concrete epoxy all minor scaling, transverse and corner cracks on the PCCP's blocks.

2. Steel brush all metal flex beam with rust/corrosions then apply primer paint (red oxide/silver oxide).

3. Desilt lined canal, clear road shoulder limit from vegatation and provide additional shouldering materials and compact the same to the required density.

4. Apply squaring on patching of potholes on the completed asphalt pavement (road shoulder) on both sides of the roadway at intermittent sections.

PREPARED AND SUBMITTED :

TEODORO E. CASTILLO
Engineer III
QAU - BOM

NORBERTO S. GALVE
Engineer IV
QAU - BRS

ROMEO E. LACORTE
Engineer III
QAU - BOC

EDWIN AZURIN
Engineer II
QAU - BOD

FLORENCE SAWALI
PJHL-PMO Representative
(Implementing Office)

m-qaureport

Appendix I

Inventory Elements and Typical User Matrix

Appendix I
Inventory Elements and Typical User Matrix

Inventory Element Type	Inventory Item	Planning Service	Bureau of Maintenance	Bureau of Design	Bureau of Construction	Bureau of Research & Standards	Project Management Offices	Region Offices	District Offices	Count
Locational Ref. Pts	LRP Description	☐	☐	☐	☐	☐	☐	☐	☐	8
	LRP Type	☐	☐	☐	☐	☐	☐	☐	☐	8
	LRP Location	☐	☐	☐	☐	☐	☐	☐	☐	8
Junctions	Junction Type	☐	☐	☐	☐	☐	☐	☐	☐	8
	Junction Name	☐	☐	☐	☐	☐	☐	☐	☐	8
Place Name	Place Name	☐	☐	☐	☐	☐	☐	☐	☐	8
Right of Way	Right of Way Width	☐		☐				☐	☐	4
Carriageway Width	Carriageway Width	☐	☐	☐	☐	☐	☐	☐	☐	8
Number of Lanes	Number of Lanes	☐	☐	☐	☐	☐	☐	☐	☐	8
Pavement Type	Pavement Type	☐	☐	☐	☐	☐	☐	☐	☐	8
Pavement Thicknesses	Surface Thickness	☐	☐	☐		☐	☐	☐	☐	7
	Pavement Depth	☐	☐	☐		☐	☐	☐	☐	7
	Slab Thickness	☐	☐	☐		☐	☐	☐	☐	7
Median	Median Type		☐	☐				☐	☐	4
	Median Width		☐	☐				☐	☐	4
Culverts	Number of Barrels	☐	☐	☐	☐			☐	☐	6
	Barrel Length	☐	☐	☐	☐			☐	☐	6
	Barrel Diameter	☐	☐	☐	☐			☐	☐	6
	Culvert Type	☐	☐	☐	☐			☐	☐	6
	Barrel Material	☐	☐	☐	☐			☐	☐	6
	Head Wall Material				☐				☐	2
	Invert Type				☐				☐	2
	Apron Type				☐				☐	2
	Type of Slope				☐				☐	2

Inventory Element Type	Inventory Item	Planning Service	Bureau of Maintenance	Bureau of Design	Bureau of Construction	Bureau of Research & Standards	Project Management Offices	Region Offices	District Offices	Count
Shoulders	Shoulder Type	☐	☐	☐	☐			☐	☐	6
	Shoulder Width	☐	☐	☐	☐			☐	☐	6
Side Slope	Side Slope Type			☐				☐	☐	3
	Side Slope Angle			☐				☐	☐	3
Sidewalks	Sidewalk Surface Type		☐	☐				☐	☐	4
	Sidewalk Width		☐	☐				☐	☐	4
Ditches	Drainage Type		☐	☐				☐	☐	4
	Drainage Size		☐	☐				☐	☐	4
Signs	Sign Type		☐					☐		2
	Sign Size		☐					☐		2
Lighting	Lighting		☐					☐	☐	3
Guardrails	Guardrail Type		☐					☐	☐	3
Markings	Centerline Markings		☐					☐	☐	3
Hazards	Hazard Threat		☐					☐		2
	Hazard Risk		☐					☐		2
Roadside Friction	Roadside Friction	☐								1
Roadside Structures	Roadside Structure Type							☐	☐	2
Horizontal Radius	Horizontal Radius of Curve	☐		☐						2
Vertical Sight	Restricted Vertical Sight Dist.	☐		☐				☐		3
Gradient	Pavement Gradient	☐		☐						2
Terrain	Terrain Type	☐		☐						2

Appendix J
Video and Inventory
Checking Sheets

Carriageway width - video checks

Region: _____ **District:** _____

Section: _____

Recorded Data			VIDEO			
Width	From	To	Width (Est.)	From	To	COMMENTS

Number of lanes - video checks

Region: ____________________ **District:** ____________________

Section: ____________________

Recorded Data			VIDEO			
Lanes	From	To	Lanes	From	To	COMMENTS

Pavement type - video checks

Region: ____________________ **District:** ____________________

Section: ____________________

Recorded Data			VIDEO			
Type	From	To	Type	From	To	COMMENTS

Shoulders - video checks

Region: ________________ **District:** ________________

Section: ________________

Recorded Data				VIDEO				
Type	XSP	From	To	Type	XSP	From	To	COMMENTS

Guardrail - video checks

Region: ____________________ **District:** ____________________

Section: ____________________

Recorded Data			VIDEO			
XSP	From	To	XSP	From	To	COMMENTS

Road Markings - video checks

Region: ____________________ **District:** ______________________

Section: ____________________

Recorded Data			VIDEO			
Type	From	To	Type	From	To	COMMENTS

Appendix K

Photographs of Existing National Roads with Delineated Carriageway, Shoulders, Sidewalks, Number of Lanes, Directional Flow of Traffic, etc.

Photographs of Existing National Roads with Delineated Carriageway, Shoulders, Sidewalks, Number of Lanes, Directional Flow of Traffic, etc.

Surface Type:

1. Asphalt

2. Concrete

3. Combination of Concrete & Asphalt (Multi-Surface Type)

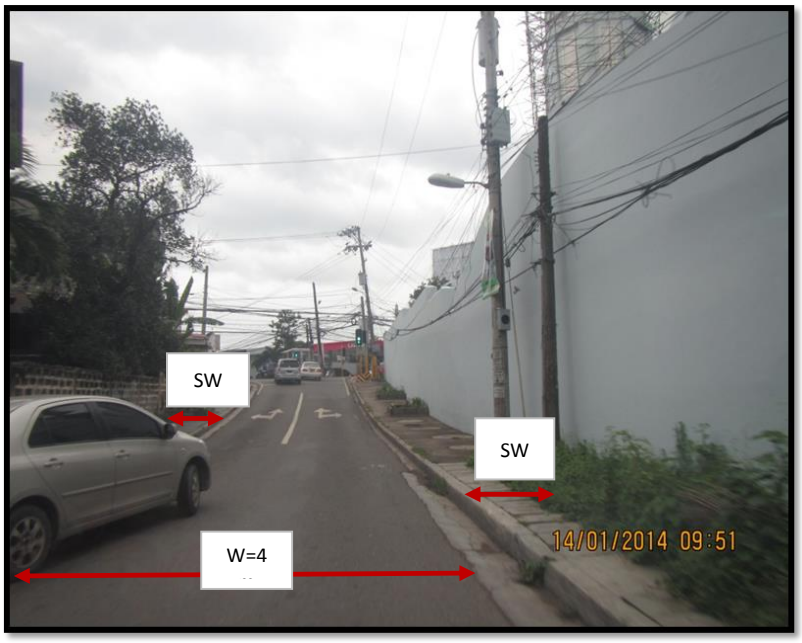
4. Gravel

ASPHALT

ASPHALT (W = 3.5m)
1-Lane, 1-Way, No Markings, No Shoulder, No Sidewalk

ASPHALT (W = 6.70m)
2-Lanes, 2-Way, No Markings with Paved Shoulder

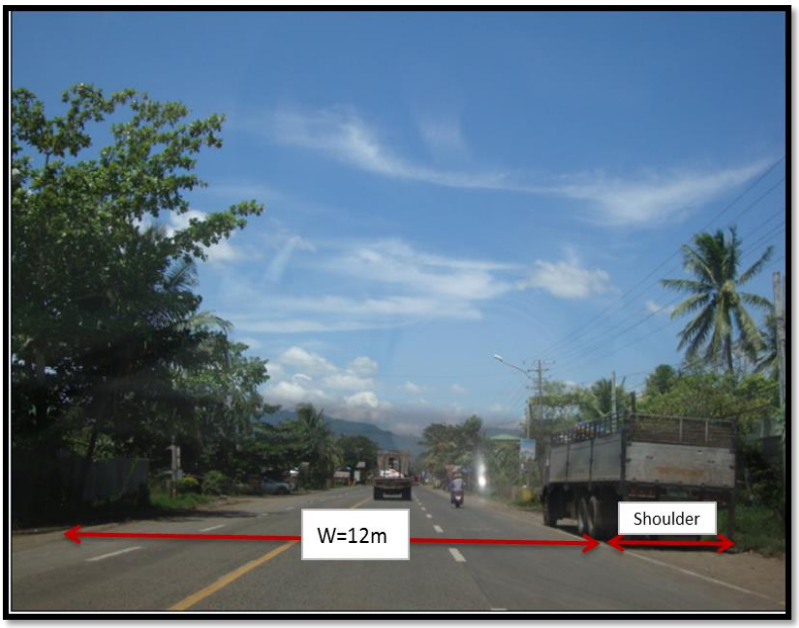
ASPHALT (W = 4m)
2-Lanes (Sub-Standard), 1-Way, without Markings,
No Shoulder/Sidewalk, with Curb and Gutter



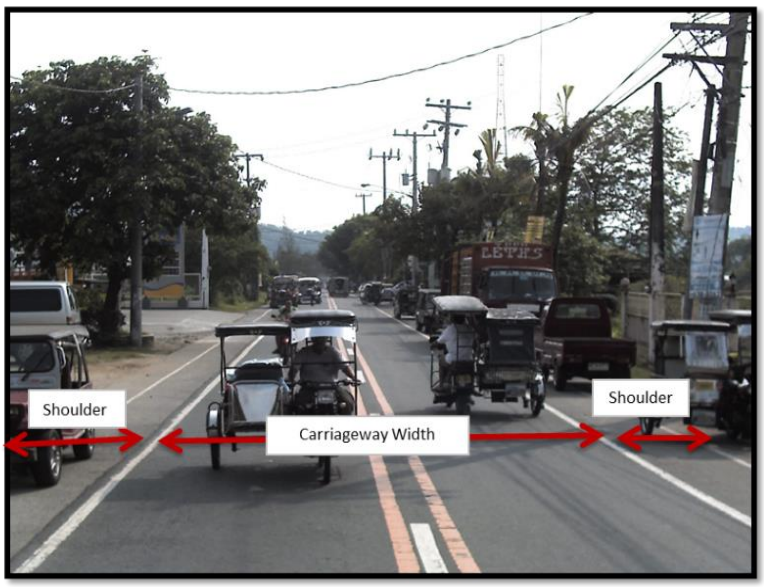
.

ASPHALT (W = 4m)
2-Lanes (Sub-Standard), 1-Way, Incomplete Markings
No Shoulder, with Sidewalk, with Curb and Gutter and Ditch

ASPHALT (W = 12m)
4-Lanes, 2-Way, Incomplete Markings, No Shoulder, No Sidewalk



ASPHALT (W = 12m)
4-Lanes, 2-Way, with Markings, with Shoulder at Right Side, No Shoulder at Left Side



ASPHALT (W = 6.10m)
2-Lanes, 2-Way, with Paved Shoulders, with Markings

ASPHALT (W = 6.10m)
2-Lanes, 2-Way, No Shoulder on Both Sides, with Side Walk at Right Side

ASPHALT (W = 14.80m)
4-Lanes (with Markings), No Shoulder, with Right Sidewalk
Dual Carriageway (One-Way)

ASPHALT (W = 14.80m)
4-Lanes (with Markings), No Shoulder, with Right Sidewalk
Dual Carriageway (One-Way)

CONCRETE

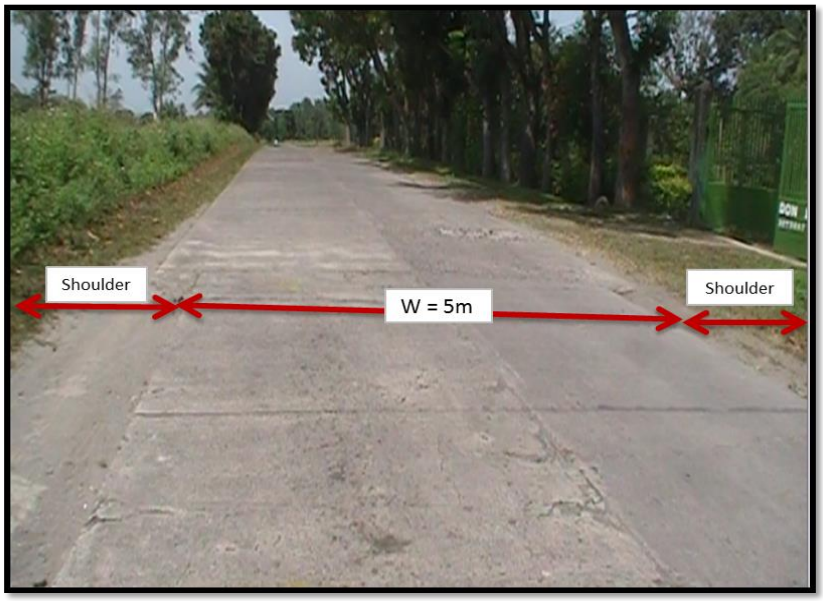
CONRETE (W = 3.05m)
1-Lane, 2-Way, No Markings, with Shoulder at Left & Right Side

CONCRETE (W = 4.0m)
2-Lanes (Sub-Standard), 2-Way, No Markings, without Shoulder at Left & Right Side

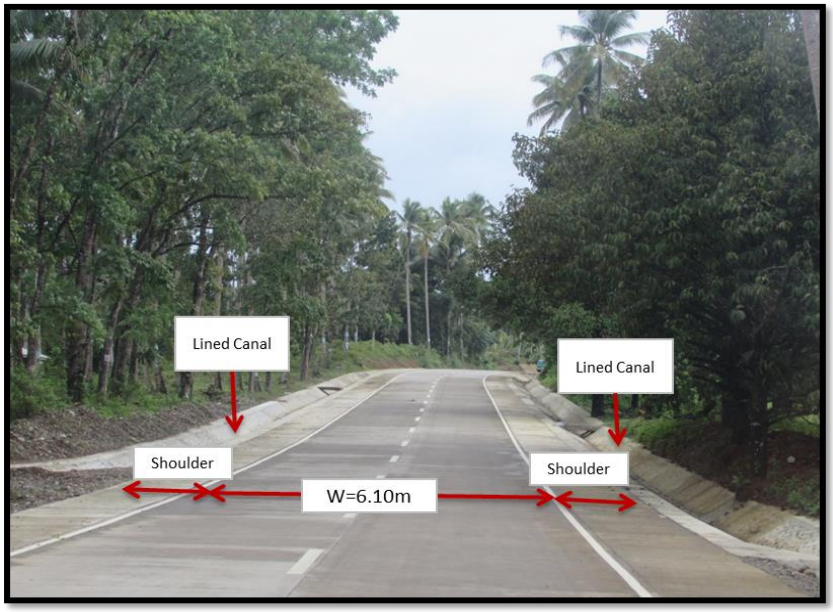
CONCRETE (W = 3m)
1-Lane (Sub-Standard), 2-Way, without Markings, with Shoulder at Right Side,
No Shoulder at Left Side

CONCRETE (W = 3m)
1-Lane (Sub-Standard), 2-Way, without Markings, with Shoulder at Left Side,
No Shoulder at Right Side

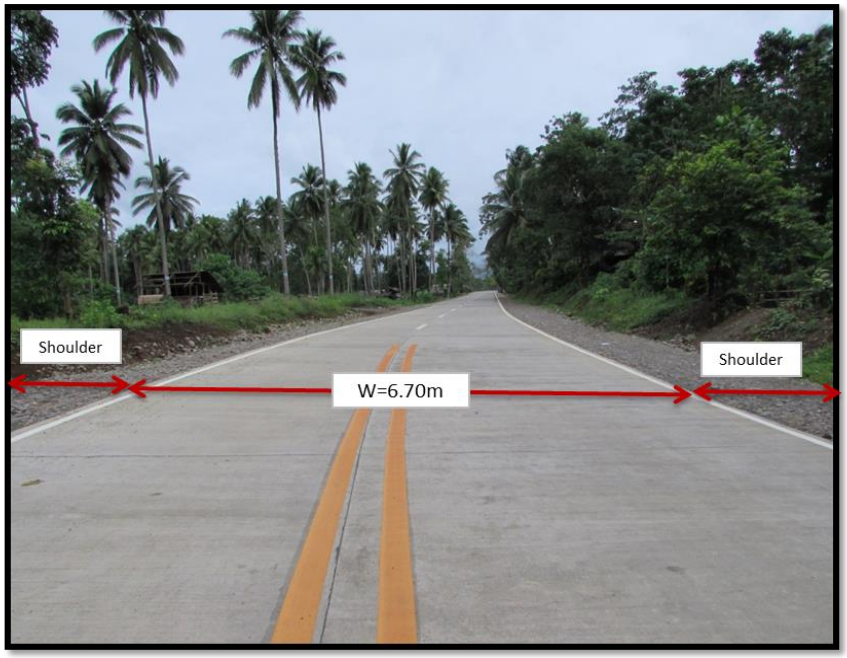
CONCRETE (W = 3m)
2-Lanes (Sub-Standard), 2-Way, without Markings, with Shoulder (Left/Right)



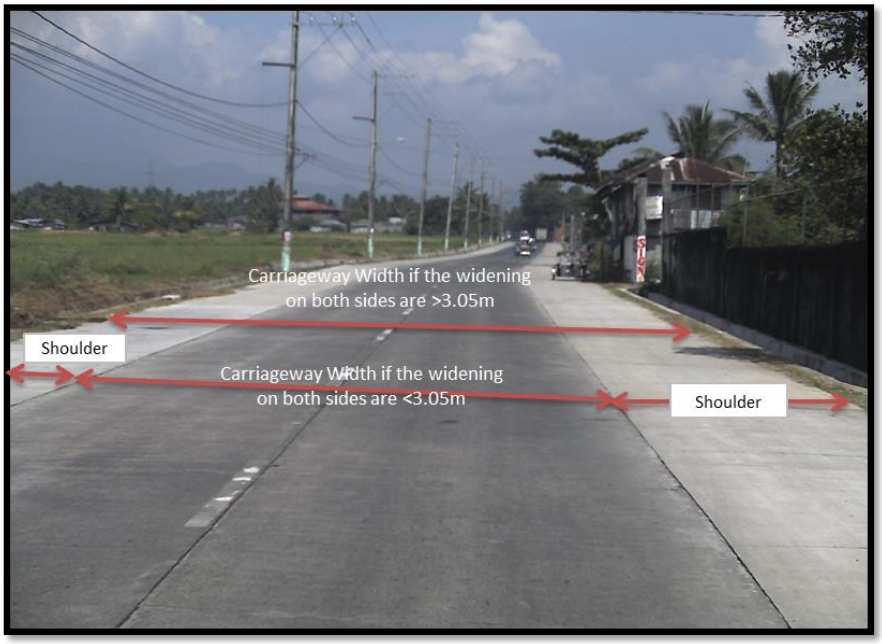
CONCRETE (W = 5m)
2-Lanes (Sub-Standard), 2-Way, without Markings, with Shoulder (Left/Right)



CONCRETE (W = 6.10m)
2-Lanes, 2-Way, with Markings, with Paved Shoulder and Lined Canal on Both Sides



CONCRETE (W = 6.70m)
2-Lanes, 2-Way, with Markings, with Gravel Shoulder on Both Sides



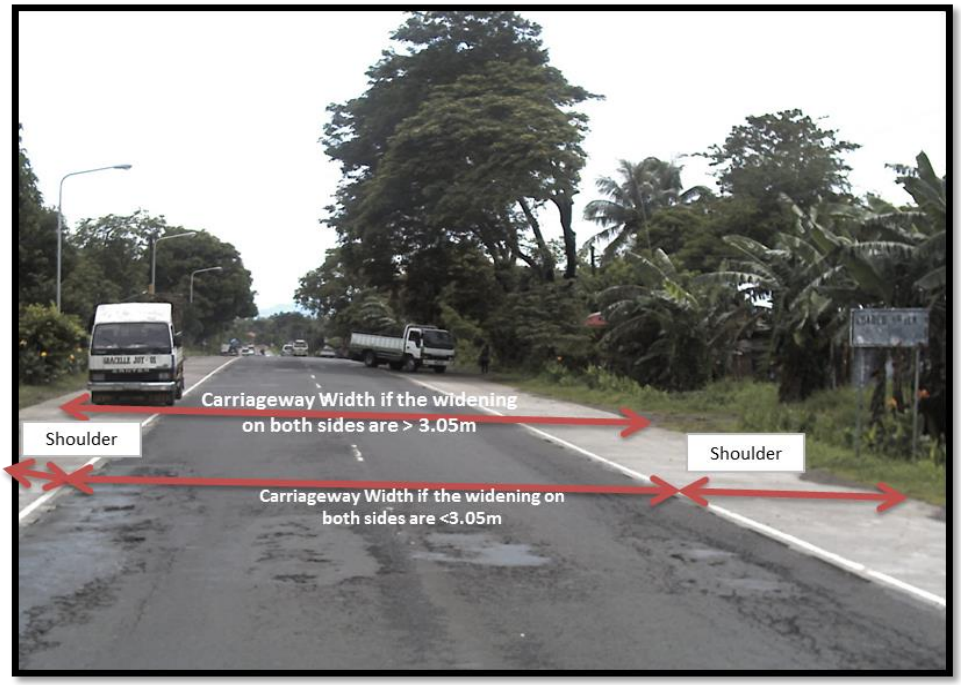
CONCRETE WITH CONCRETE WIDENING ON BOTH SIDES (No Markings)
2-Lanes if the Width of Widening is Less than 3.05m
4-Lanes if the Width of Widening is at Least 3. 05m

CONCRETE WITH CONCRETE WIDENING ON BOTH SIDES (No Markings)
2-Lanes if the Width of Widening is Less than 3.05m
4-Lanes if the Width of Widening is at Least 3.05m

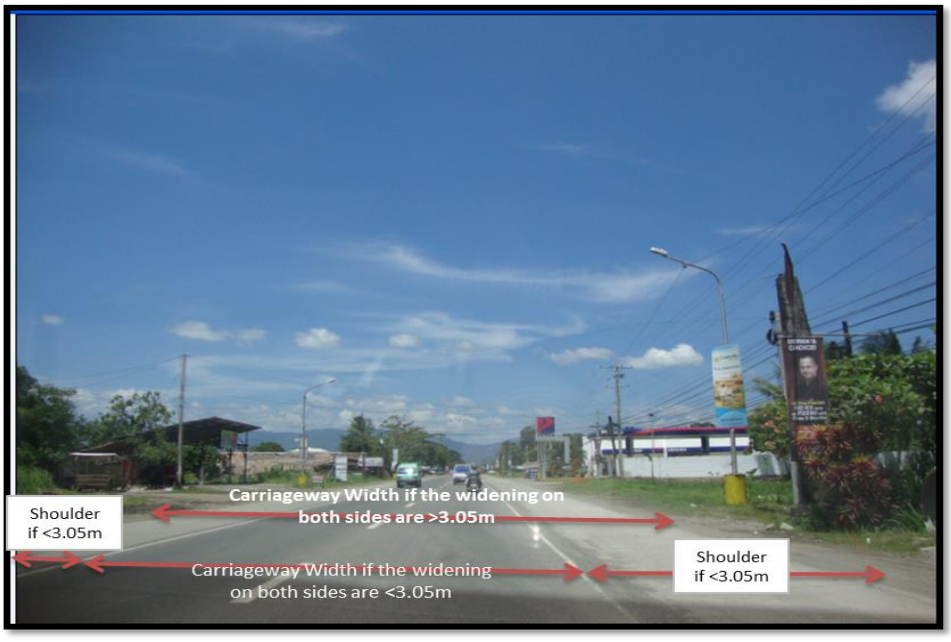
MULTI-SURFACE TYPE

ASPHALT & CONCRETE (W = 12.40M)
4-Lanes (Asphalt-2 Inner Lanes, Conrete-2 Outer Lanes), 2-Way, with Markings, without Shoulder on Both Sides, with Sidewalk at Left Side

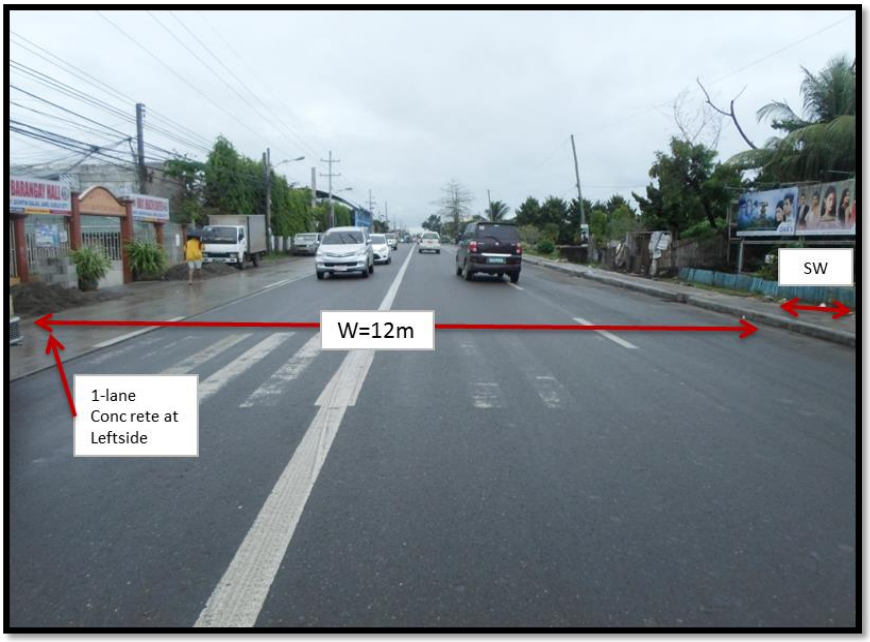
ASPHALT & CONCRETE (W = 12.40m)
4-Lanes (Asphalt-2 Inner Lanes, Concrete-2 Outer Lanes), 2-Way, with Markings, Without Shoulder and Sidewalk on Both Sides



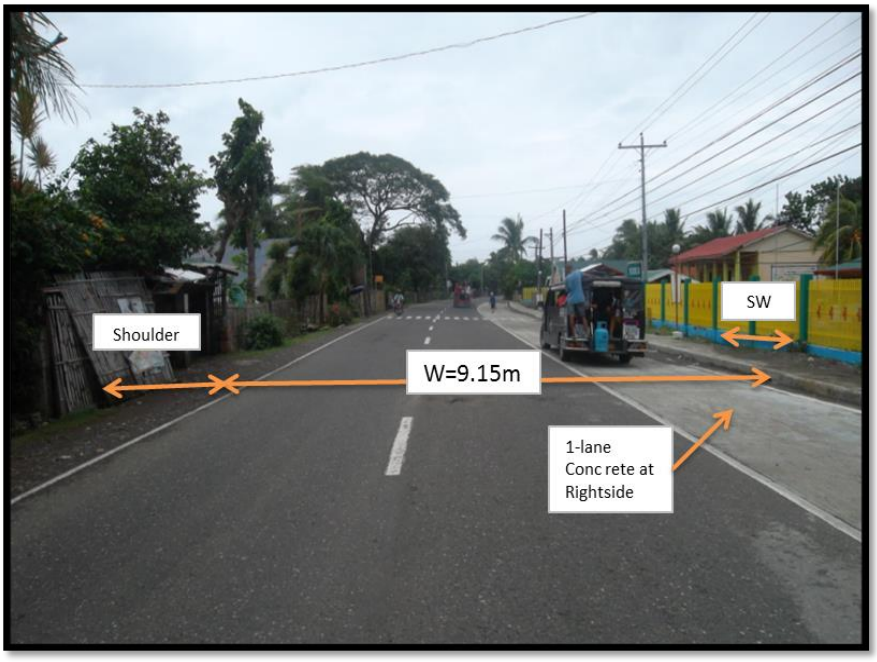
ASPHALT WITH CONCRETE WIDENING ON BOTH SIDES (No Edge Markings)
2-Lanes if the Width of Widening is Less than 3.05
4-Lanes if the Width of Widening is at Least 3.05



ASPHALT WITH CONCRETE WIDENING ON BOTH SIDES (No Edge Markings)
2-Lanes if the Width of Widening is Less than 3.05m
4-Lanes if the Width of Widening is at Least 3.05m



ASPHALT & CONCRETE (W = 12m)
4-Lanes (3 Lanes-Asphalt, 1 Lane-Concrete), 2-Way, with Markings
No Shoulder, with Sidewalk at Right Side



ASPHALT & CONCRETE (W = 9.15m)
3-Lanes (2 Lanes-Asphalt, 1 Lane-Concrete), 2-Way, with Markings
with Shoulder at Left Side, with Sidewalk at Right Side

GRAVEL

GRAVEL ROADS (W = > 4.0m)
2-Lanes, 2-Way, No Shoulders

GRAVEL ROADS (W < 4.0m)
1-Lane, 2-Way, No Shoulders

ROCOND

VISUAL ROAD CONDITION ASSESSMENT MANUAL
PHILIPPINE 2019 VERSION No. 2

Revision Register

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver.1 / Rev 0		Draft ROCOND Visual Condition Assessment Manual	Peter Knee	May 2013
Ver.1 / Rev 1	B paragraph 10	Rewording	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Figure 1, page 3	Reorganisation of the Activity Flowchart	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Table 1, page 3	Reassignment of responsibilities	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	C.2.1, page 4	Reference to availability of fund removed	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Figure 2, page 6	Clarification of sections with no assessment	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	C.6.1, 11), page 11	Correction of Form title	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Table 3, page 12	"Bridge more than 50 m", "Not assessable due to traffic", "Urban metropolitan area" removed from pick list of raters comments	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	C.8, paragraph 60, page 13	List of safety equipment updated	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Form Page 15	Title of form updated, "DEO" and "Region" moved at the top of the front, "accomplished by" replaced by "certified by" and "submitted by" replaced by "approved by". "Form 1" inserted in the header	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Form page 16	Field added for "Vegetation Control", "Thickness of rutting" replaced by "depth of rutting", surface failure removed from pothole field. "Form2" added in the header	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Page 17, 19 and 20	Paragraph about Vegetation control added	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Form page 18	Fields for other items redesigned, and field for "vegetation control" added. "Form 3" added in the header	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	Form page 20	Field for "vegetation control" added. "Form 4" added in the header	Edwin M. Fortes	Dec 2013
Ver.1 / Rev 1	E. Condition rating (pages 22 to 58)	Typos/punctuation corrected Formulae inserted Page 39: "50m gauging length" replaced by 1st ten slabs. Description about Vegetation control added page 59.	Edwin M. Fortes	Dec 2013
2014 Ver.1		Addition of ISO workflow diagrams and ISO form numbers	Edwin M. Fortes	June 2014
Ver. 1 / Rev 2	G. ROCOND Data Evaluation (pages 64 to 66)	Addition of Section on RoCond Data Evaluation	Edwin M. Fortes	Sep 2014

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver. 2 / Rev 1	A.1, Phar. 1, page 1	Length of the Philippine National Road Network updated based on 2018 DPWH Atlas	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	A.1, Phar. 2, page 1	Classifications of National Roads (Primary, Secondary and Tertiary) updated	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.2.4, page 6	Revision of Rating Segments	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.2.4.1 Segmenting Procedures (pages 6 to 10)	Additional Sub-section - C.2.4.1 Segmenting Procedures with illustrations/figures	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.2.4.2 Other RoCond Assessment Procedures (pages 10 to 14)	Additional Sub-section - C.2.4.2 Other RoCond Assessment Procedures with illustrations/figures	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.3 RoCond Joint Validation Procedures (page 15)	Additional Section - C.3 RoCond Joint Validation Procedures	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.4.2 Labeling of Lanes (pages 16 to 17)	Additional Sub-section - C.2.4.2 Labeling of Lanes with illustrations/figures	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	C.5.1, Phar 1, page 18	Updated the Procedure on Gauging Length Position	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	D. Survey Forms (pages 24 to 31)	Updated the Visual Road Condition Assessment Forms	Edwin M. Fortes	Sep 2019
Ver. 2 / Rev 1	G page 74	Asphalt and Concrete VCI Formula corrected	Edwin M. Fortes	Sep 2019

Contents

Abbreviations and Acronyms

DES	Data Entry System
DPWH	Department of Public Works and Highways
LRP	Locational Reference Point
LRS	Locational Referencing System
RBIA	Road and Bridge Information Applications
RoCond	Road Condition Survey
SD	Statistics Division

A. INTRODUCTION

The Philippine Road Network

The Philippines has a road network of about 210,528 kilometers of which 32,932.71 kilometers (at 15th October 2018) are classified as National roads under the management of the Department of Public Works and Highways (DPWH). The remaining roads are classified as local roads under the management of Local Government Units concerned.

The existing National roads are classified into: Primary, Secondary and Tertiary Roads. These roads have varying surface types: Concrete, Asphalt, Gravel or Earth and their condition is reported in terms of Good, Fair, Poor or Bad for reporting to DPWH management.

National Road Network Management by DPWH

The DPWH Planning Process draws upon a number of types of data to determine works programs and strategies. These include the road and bridge inventory, traffic, road user/vehicle operating costs and condition data. All these need to be maintained to suitable quality level and kept up to date to play an effective role in formulating work programs that reflect the needs of the road users, and for monitoring and reporting the condition of national roads and bridges to the public. Good quality data enables planners to make better planning decisions, allocate funds efficiently, and ultimately improve the management of the road network.

Management of all the National road network data feeding the planning process is a key function of the Infrastructure Planning Research and Statistics Division (SD) of Planning Service. All processes are fully documented and supported with software applications that facilitate effective and efficient storage, updating and retrieval of data throughout DPWH.

The Road and Bridge Information Application (RBIA) was established as the official repository of road and bridge data in DPWH in Department Order No. 54 of series 2004, through which SD are allocated responsibility for maintaining the data integrity. All road inventory and condition data is stored and managed in the RBIA.

The Development of Visual Road Condition Assessment Manual

This manual was developed to guide engineers in monitoring the condition and evaluating the distresses in the existing road network. It was originally introduced to DPWH in 2004 from the ROCOND 90 manual of the Road and Traffic Authority of New South Wales, Australia. It has continued to be refined since that time, with many versions introducing changes to rating methods that are better suited to Philippines Conditions.

These changes have been introduced by taking into account issues and concerns raised by the raters from the field. Some of these relate to the procedure and method of measurements, and most importantly improving the safety and comfort of the rater.

Related Documents

A suite of procedure manuals and documents are available to support all aspects of road and bridge data management. Three in particular relate to the ROCOND visual condition rating process:

- Road Data Collection, Quality Assurance and Management Manual;
- Quality Management Plan for Visual Condition Assessment of Roads;
- Road Network Definition and Inventory Update Manual.

B. GENERAL APPROACH

The procedures in this manual give specific technical survey methods for assessing road condition across a number of parameters. The data from the condition surveys may be used in a variety of ways for "road condition reporting". This includes:

- Measurement and recording of condition throughout the road network;
- Describing the condition of the road at the time of the rating;
- Providing a sequence of recorded condition that can be analysed to indicate performance trends; and
- Providing condition data for analysis in the Pavement Management System, Routine Maintenance Management System, and eventually for budgeting in the Multi-Year Programming System.

The procedures are designed for use by field technical personnel. A team of at least two is required to complete the condition survey and should include the trained RBIA District Coordinators. An experienced team can rate a minimum of 10 km and up to 20 km of 2-lane flexible pavement road per day depending on traffic, road and weather conditions (time of survey is from 6AM to 9AM, and from 3 PM to 6PM).

The assessment and measurement of road conditions follow one of two formats. Some items (side drains and shoulders) are rated on a one-dimensional scale of 1 to 4 (or 5) or in terms of percentage of affected area, utilizing ***condition descriptions*** with some simple dimensions. Defects for concrete and asphalt are rated on a two-dimensional scale covering the ***severity and extent of distress*** exhibited. Severity levels are banded in either 2 or 3 levels, and extent is measured in terms of the percentage of area affected by the particular distress.

Roads are inspected and condition reported for defined segments that are of same surface type generally between two kilometer posts or at least 50m in length (or 10 slabs) for paved roads and less for gravel roads. The inspection procedure caters for different pavement types and/or surface condition. Some items are necessarily evaluated by sampling. The rating ascribed to each item is deemed to report the average condition of the whole segment at the time of rating.

Organizational Responsibilities

The organizational arrangements for conducting ROCOND surveys are detailed in the Road Data Collection, Quality Assurance and Management Manual.

The RBIA Regional Coordinators supervise and monitor the survey, and validate the condition data submitted by the raters from the District Offices. Quality Control/Field validation will be conducted by the RBIA Regional Coordinators and SD. Procedures are provided in the Quality Management Plan for Visual Condition Assessment of Roads.

Data encoding is done by the designated RBIA District Coordinators through the DES (Data Entry System) computer application. Output files from the DES are to be submitted to the RBIA Regional Coordinator together with a hard copy of the pre-printed forms or field survey forms with the corresponding ROCOND Section Assessment Summary Form. Procedures for the steps involved are provided in the Quality Management Plan for Visual Condition Assessment of Roads.

Figure 1 shows the ROCOND activity flow chart and Table 1 shows the ROCOND implementation schedule.

Figure 1
Activity Flowchart

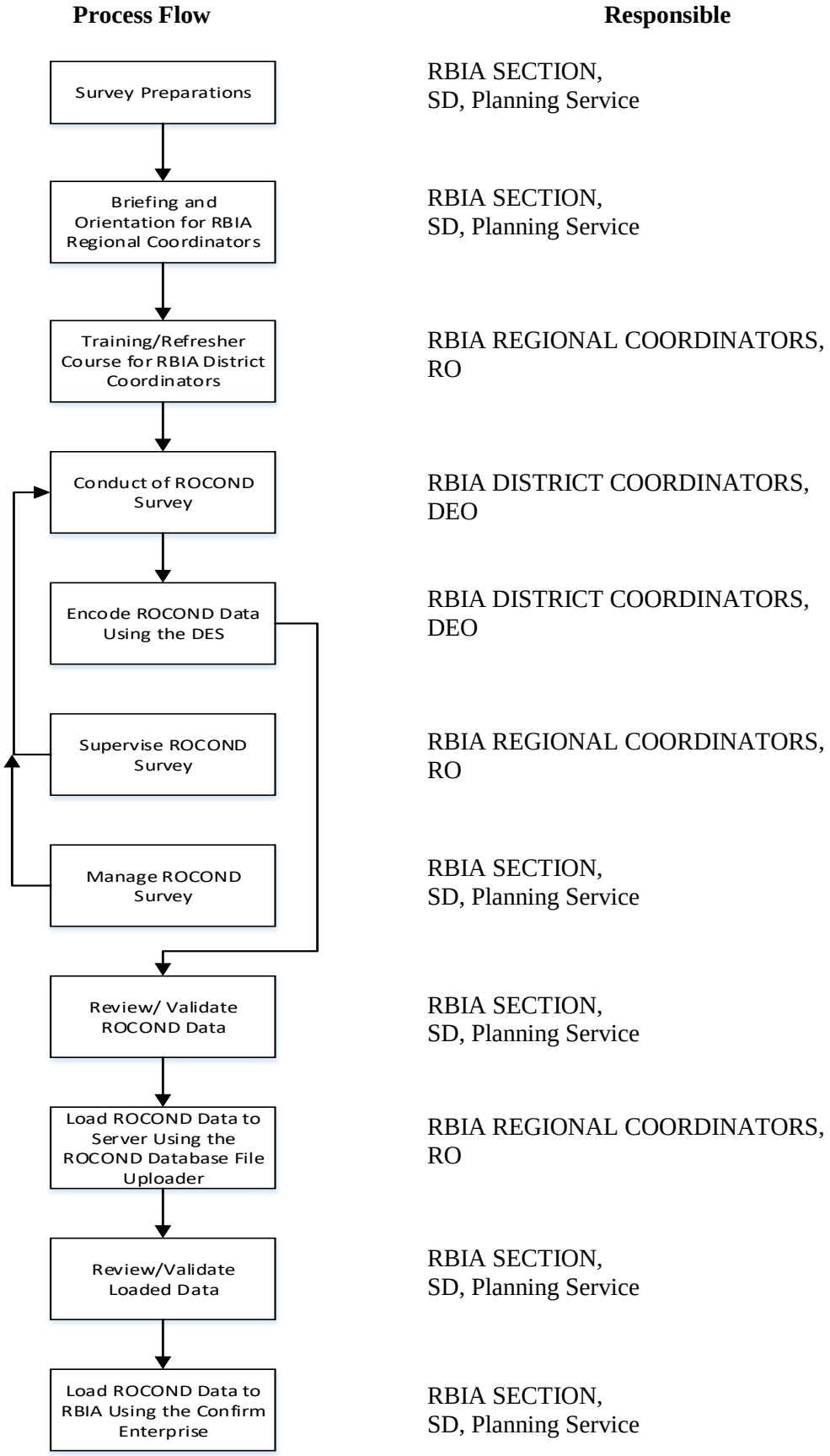


Table 1
Implementation Schedule

ACTIVITIES		SCHEDULE											
		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
I. RESPONSIBILITY OF RBIA SECTION, SD, PLANNING SERVICE													
1.	Prepare Survey requirements (funds, manual, forms, survey tools/equipment)												
2.	Coordinate with RO in preparation for the survey (preparation of program, etc.)												
3.	Conduct briefing/orientation for RBIA Regional Coordinators in Central Office												
4.	Monitor the conduct of ROCOND Survey												
5.	Review and Validate ROCOND Data												
6.	Import the uploaded data in the server into the RBIA database												
7.	Make the ROCOND data available for analysis and utilization												
II. RESPONSIBILITY OF RBIA REGIONAL COORDINATORS													
1.	Conduct training/refresher course for RBIA District Coordinators in the Region												
2.	Coordinate with RBIA Team in preparation for the conduct of ROCOND Survey												
3.	Attend briefing/orientation in Central Office by RBIA Team												
4.	Supervise the Conduct of ROCOND Survey												
5.	Review and validate ROCOND data												
6.	Upload the encoded data in the DES into the server												
III. RESPONSIBILITY OF RBIA DISTRICT COORDINATORS													
1.	Attend the training/refresher course by RBIA and RBIA Regional Coordinators												
2.	Prepare materials, equipment and other requirements for the survey												
3.	Conduct the ROCOND Survey												
4.	Input the ROCOND data into the DES												
5.	Submit the accomplished survey forms and the DES to the RBIA Regional Coordinators												
6.	Assist the validating team in the field assessment												

C. INSPECTION METHODS AND PROCEDURES

C.1 GENERAL

This manual for Visual Road Condition rating is designed only for roads with either a "rural" or "non-metropolitan urban" environment and is aimed to assist in the rating of current road conditions in a uniform and consistent manner. It provides definitive methods for assessing each pavement distress type to a standard suitable for network level surveys.

The raters are the designated RBIA District Coordinators who are trained in the proper methods and procedures of inspection. Raters should have experience in road maintenance, construction or material testing to facilitate a common and consistent approach to road condition assessment.

Where the condition of any item constitutes a hazardous situation at a particular location, the matter should be reported immediately to the relevant authority for urgent attention.

C.2 SURVEY PREPARATIONS

All ROCOND activities including preparations are mandated to the Planning Service through the RBIA Team of SD with coordination with the Regional Offices through the RBIA Regional Coordinators from the Maintenance Division (MD) or Planning and Design Division (PDD).

C.2.1 Scheduling

ROCOND surveys are scheduled to be done annually during the first quarter of the year so that the data will be available in time for use by other systems for analysis in preparation for the budget for the succeeding year. The typical schedule for the conduct of ROCOND survey is as shown in **Error! Reference source not found.**.

C.2.2 Training and Orientation

The raters, who are the designated RBIA District Coordinators, are required to complete ROCOND training and orientation by the RBIA Team of SD, and completely understand the proper methods and procedures of inspection and the criteria and guidelines for the evaluation of road distresses. They will be provided with inspection manuals, tools and equipment including funds for the rental of inspection vehicle and allowances. Details are provided in the Quality Management Plan for Visual Condition Assessment of Roads.

The Regional RBIA Coordinators should attend the annual briefing and orientation on ROCOND in the Central Office by the RBIA Team of Planning Service. They should also participate as the resource person in the conduct of ROCOND training in the Region for RBIA District Coordinators.

C.2.3 Preparations for ROCOND Survey

Detailed procedures for the ROCOND surveys are provided in the Road Data Collection, Quality Assurance and Management Manual. A summary of the key actions include:

SD

- Prepare ROCOND survey report of previous year and review the recorded distresses and established segments for each road section;
- Coordinate with the RBIA Regional Coordinators for the schedule of surveys and requirements;
- Prepare Survey Forms in pre-printed and blank forms: 1 sheet for Concrete, 1 sheet for Asphalt, and 1 sheet for Gravel/Earth. The number of forms will depend on the number of road segments to be assessed;

District Office

- Establish a Survey Team composed of the RBIA District Coordinator (rater) as the leader, an assistant in measuring the distresses, a laborer who will conduct the traffic and mark the established segment and gauging points, and a driver. In District with limited personnel, a Team can be composed of only the rater and the assistant.
- Prepare the equipment and safety gadgets enumerated in section C.9**.**

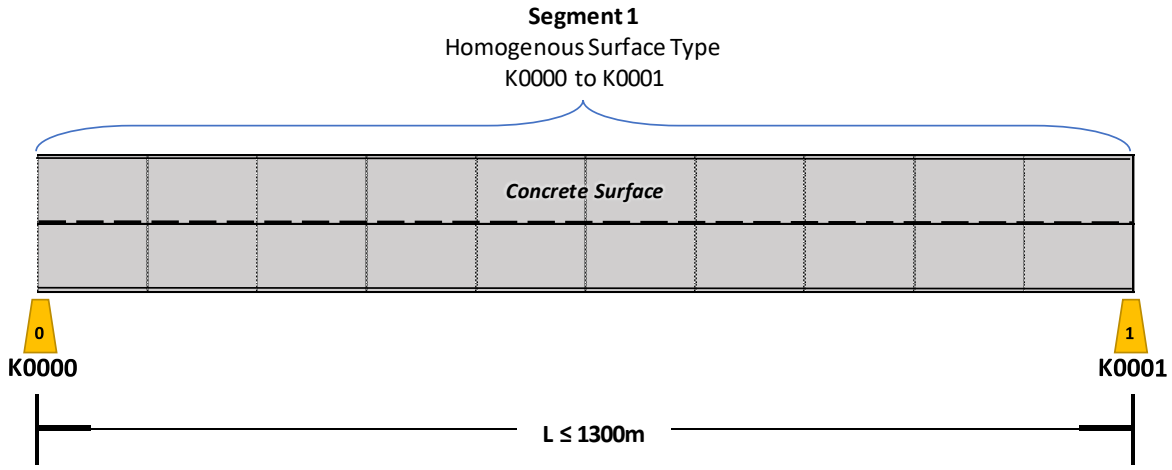
C.2.4 Rating Segments

The varying conditions of the existing national road network of the Philippines requires proper cutting of road segments, which is usually cut based on their homogenous surface types and conditions. The importance of determining the proper cutting of road segments is to separate segments with varying road features (e.g. change in number of lanes, surface types, bridges, etc.) and conditions (good, fair, poor and bad) along its stretch.

The visual road condition data collected annually reflect the changing conditions of the road network. Hence, RoCond data is an essential part of the Pavement Management System (PMS) to analyze appropriate work programs for proper maintenance and future improvements.

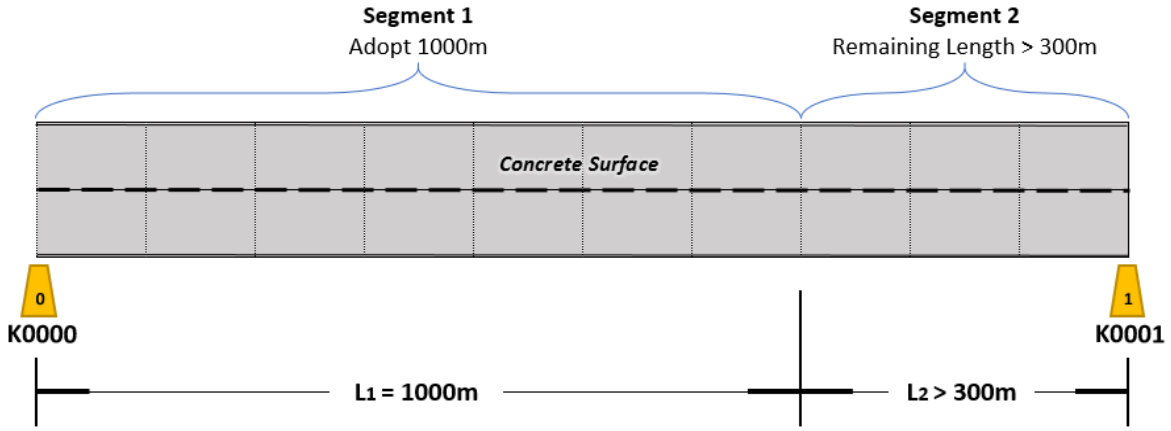
C.2.4.1 Segmenting Procedures

The general rule of the application of the RoCond rating system requires ***the assessment of segments designated as between consecutive kilometer posts of homogenous surface types but should not exceed 1300m, as illustrated below:***

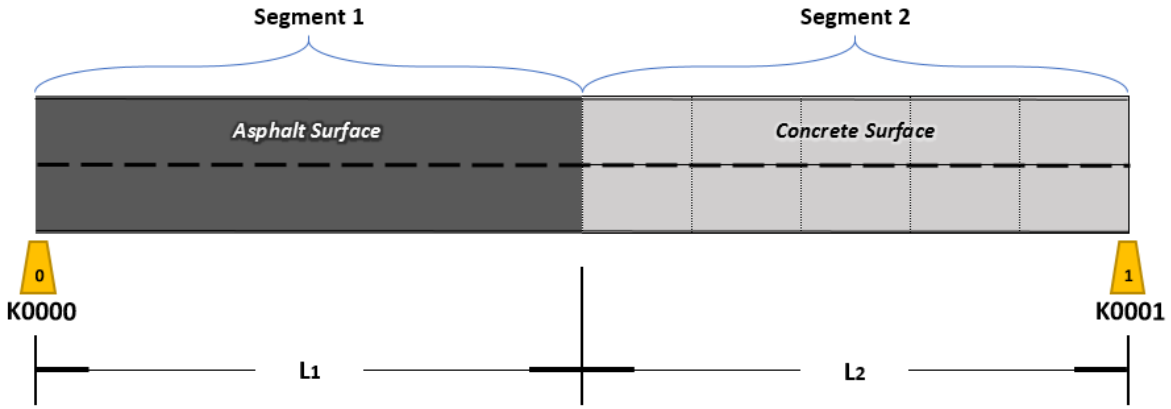


However, hereunder are the various conditions to consider in cutting a road segment, as follows:

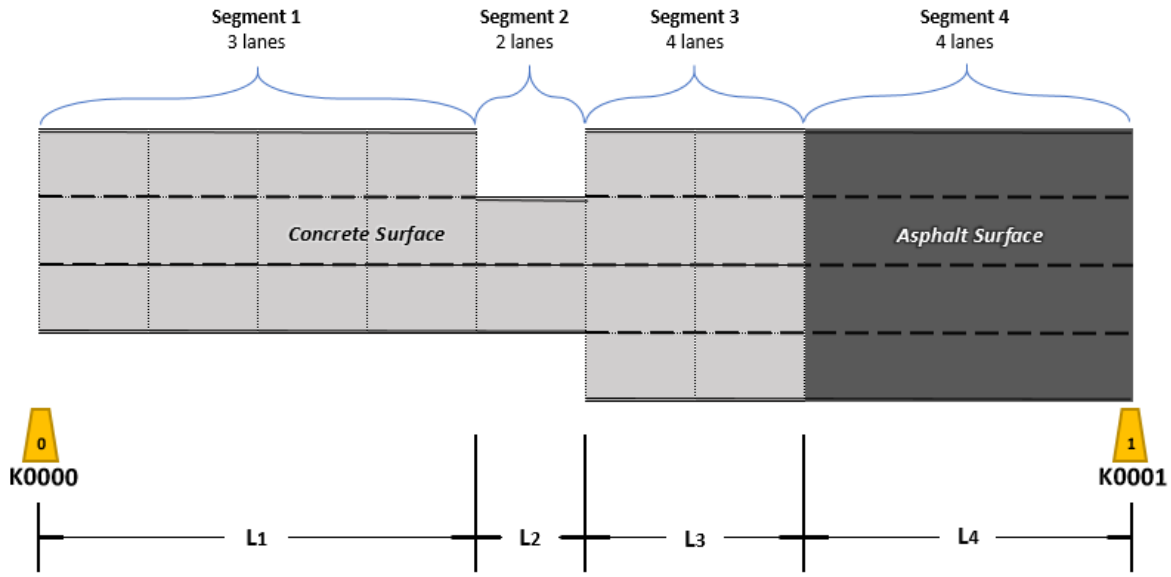
a. If the distance between two (2) consecutive kilometer posts **exceeds 1300m** of homogenous surface type, adopt the 1000-meter rating segment and the remaining length should be considered as another segment.



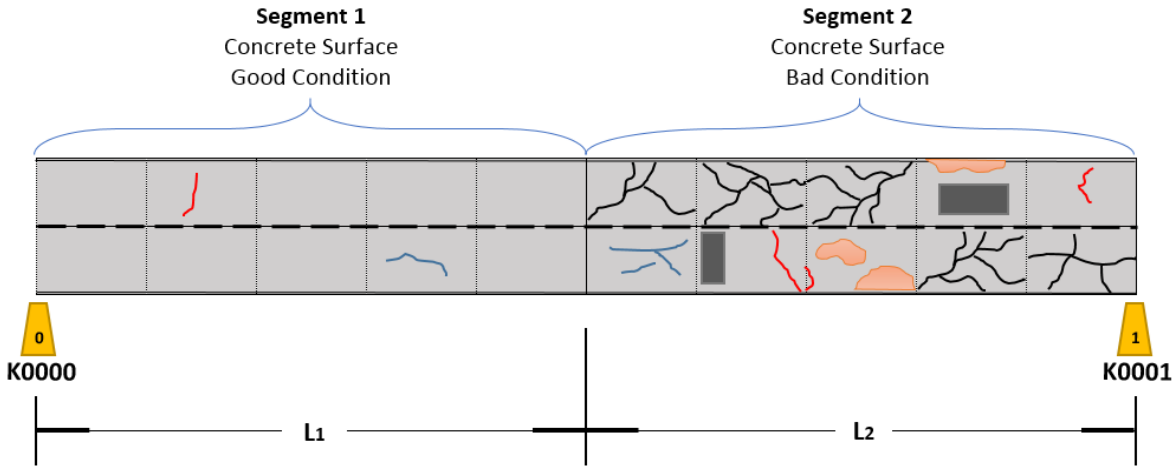
b. Whenever there is a change in the surface type.



c. Whenever there is a change in the number of lanes.

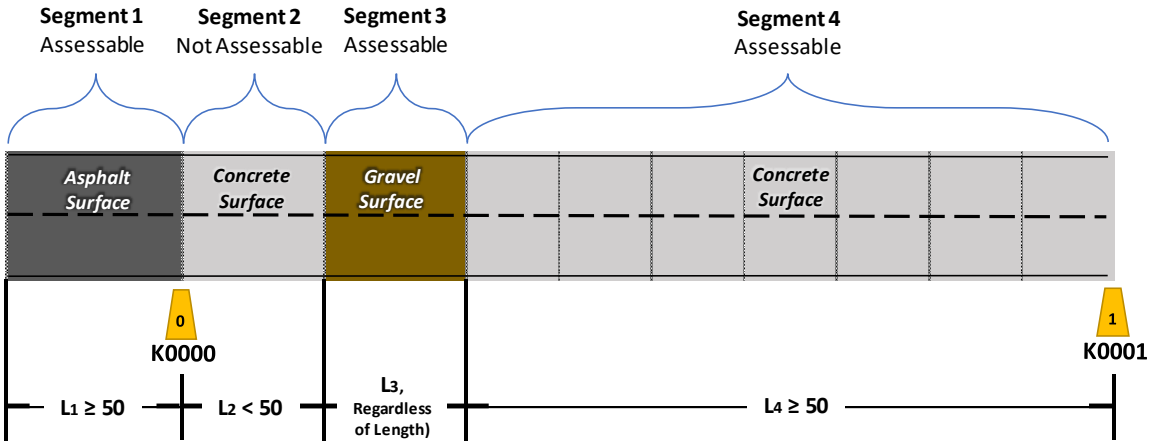


d. Whenever there is a distinct change in the condition of the pavement.

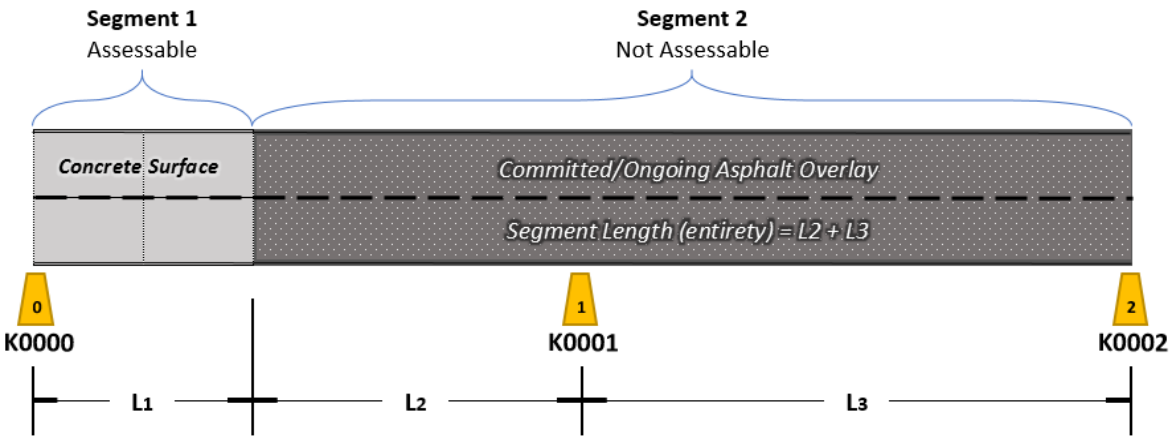


** Bad Condition applies to roads with Base failures/Potholes and Shattered Slabs.*

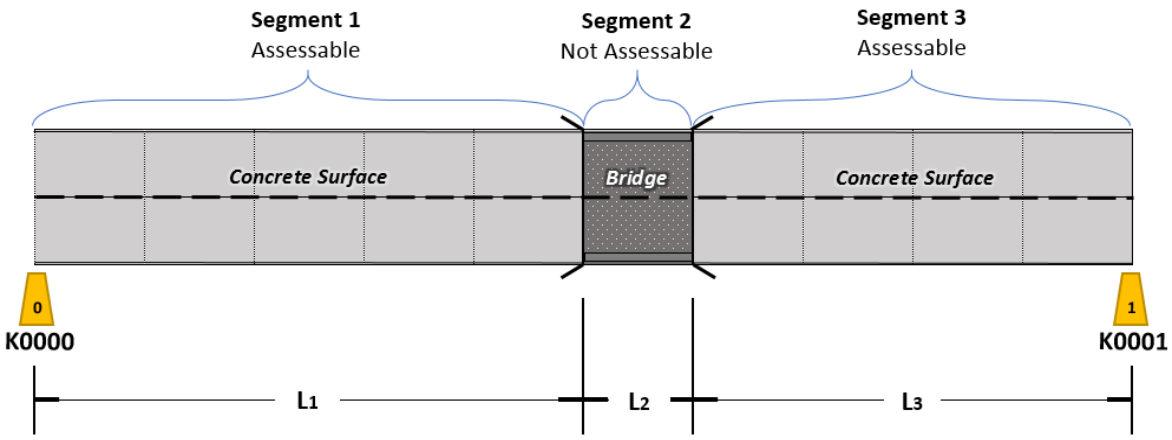
e. Only segments with lengths that are equal or greater than 50m are considered assessable except for gravel/earth segments which are assessed regardless of length.

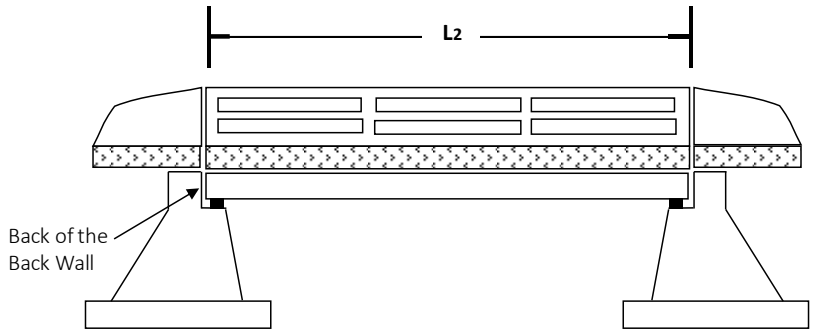


f. Committed or ongoing projects within the carriageway (e.g. Rehabilitation of Paved Road, Concrete Reblocking, Asphalt Overlay, etc.) are considered not assessable segment and should be **segmented in its entirety** (regardless of length).

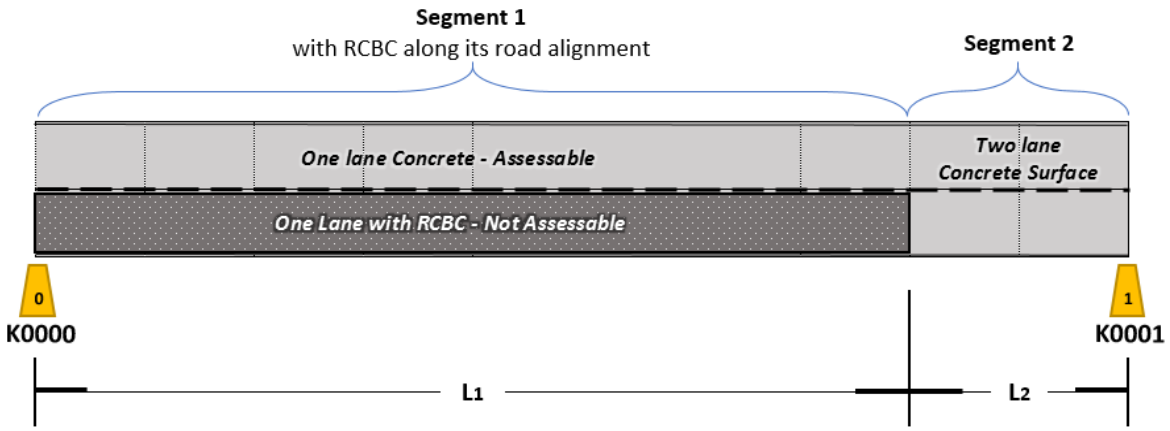


g. Bridges regardless of length, are considered not assessable segment (should always be cut). The limit or length of bridge is measured at the back of the back wall of both abutments.

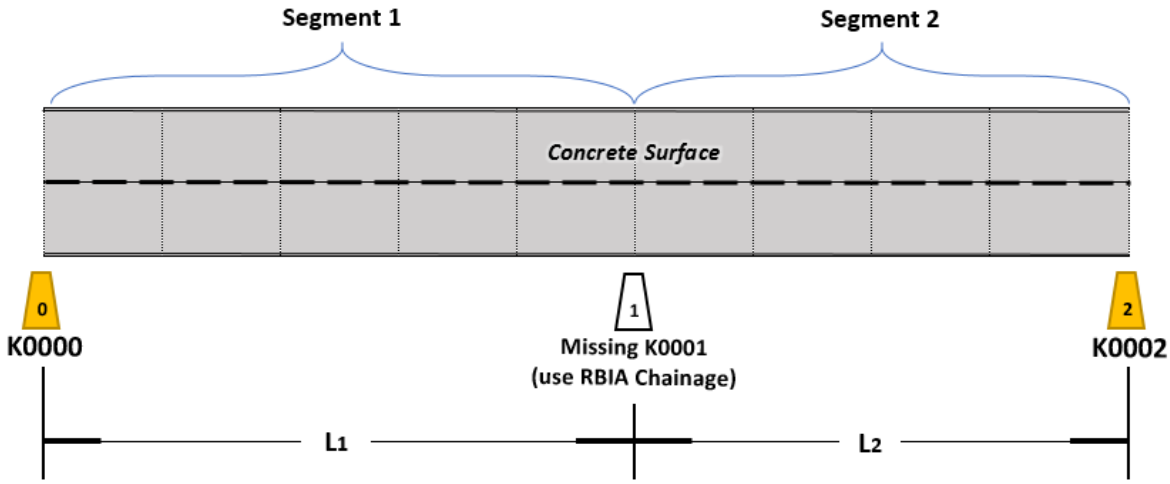




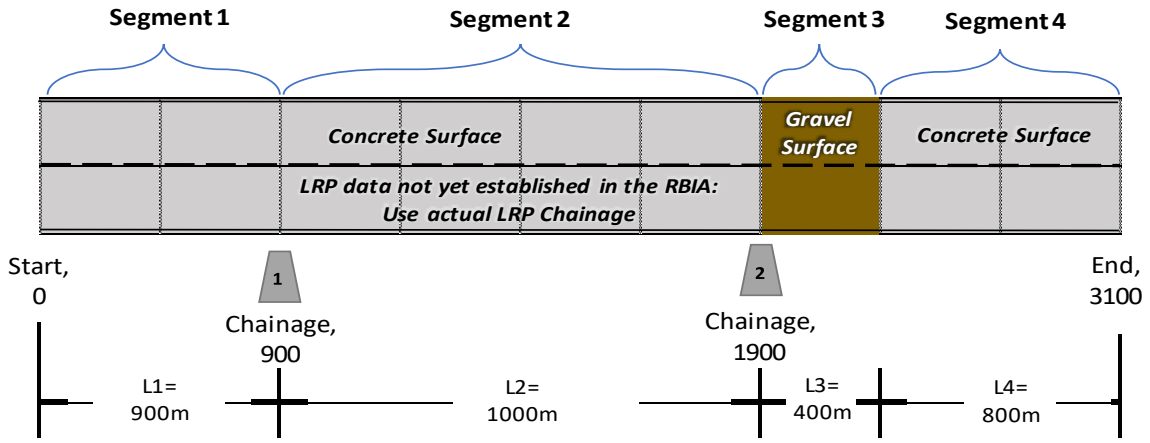
h. If the RCBC is constructed along the road alignment and being used as part of the carriageway/riding surface (not overlaid), then, this should be cut as separate segment and rated only the assessable portion and indicate in the Comments Field the lane that the RCBC is traversing.



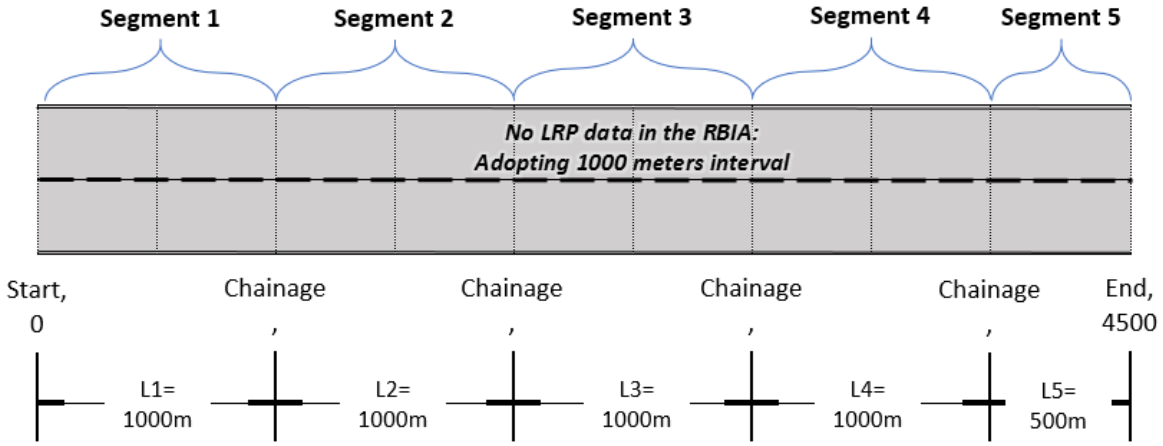
i. If there are missing LRPs on a road that is already established in the RBIA, adopt the chainage in the RBIA.



j. For LRPs that are physically existing in the field but not yet established in the RBIA, follow the subsequent rating segment procedures and use the actual Chainage of the LRP.

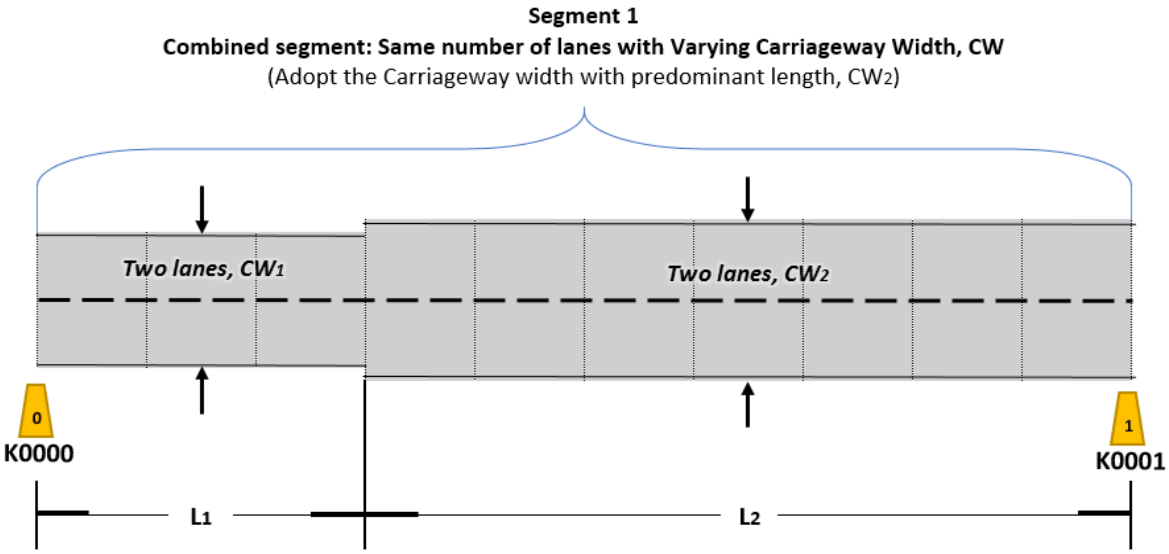


k. If the road does not have any existing LRP both in the field, adopt 1000-meter rating interval (for homogeneous surface type).

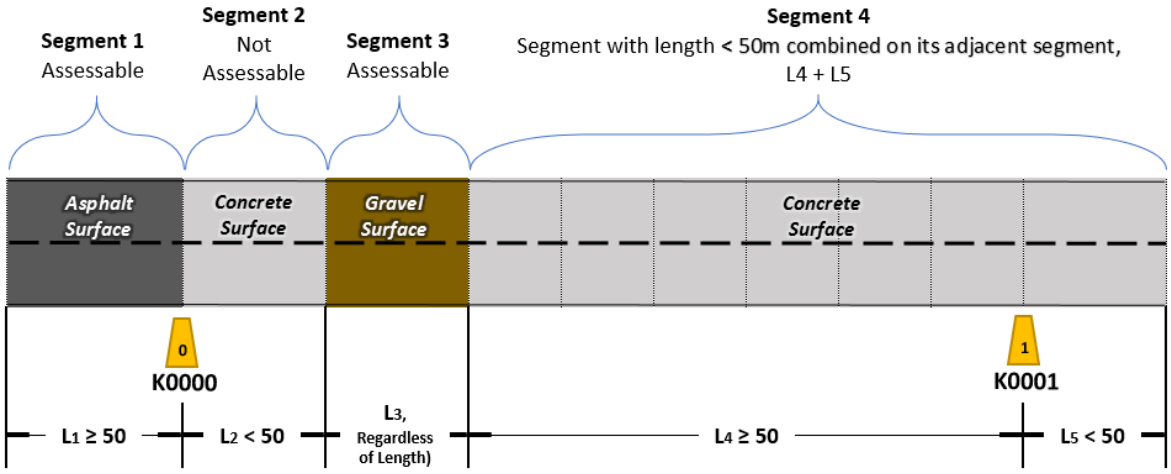


C.2.4.2 Other RoCond Assessment Procedures

a. Rating segments with the same number of lanes but have a varying carriageway width could be combined (if there is no distinct change in condition), however, use the carriageway width of the predominant length (in the DES Form).

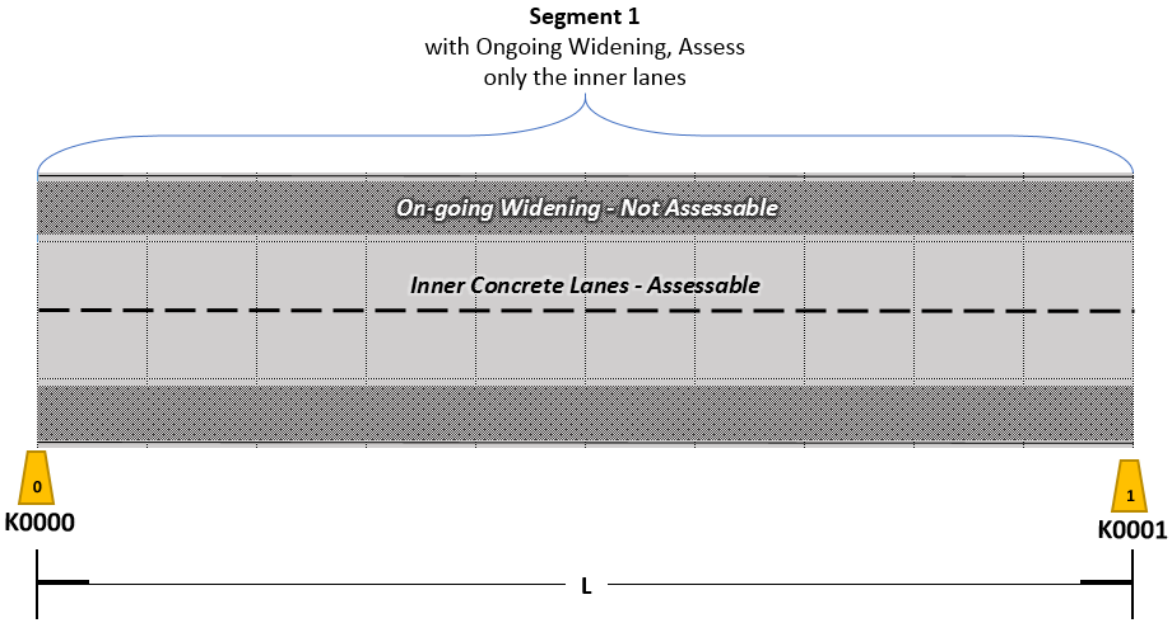


b. To minimize the number of Not Assessable segments, pavements with less than 50m in length which has the same surface type **before or after a kilometer post** could be added to the adjacent segment.



c. Unaffected portion of on-going projects (e.g. Road Widening, Asphalt Overlay along inner lanes, etc.) should be assessed.

Case 1: With On-going Widening

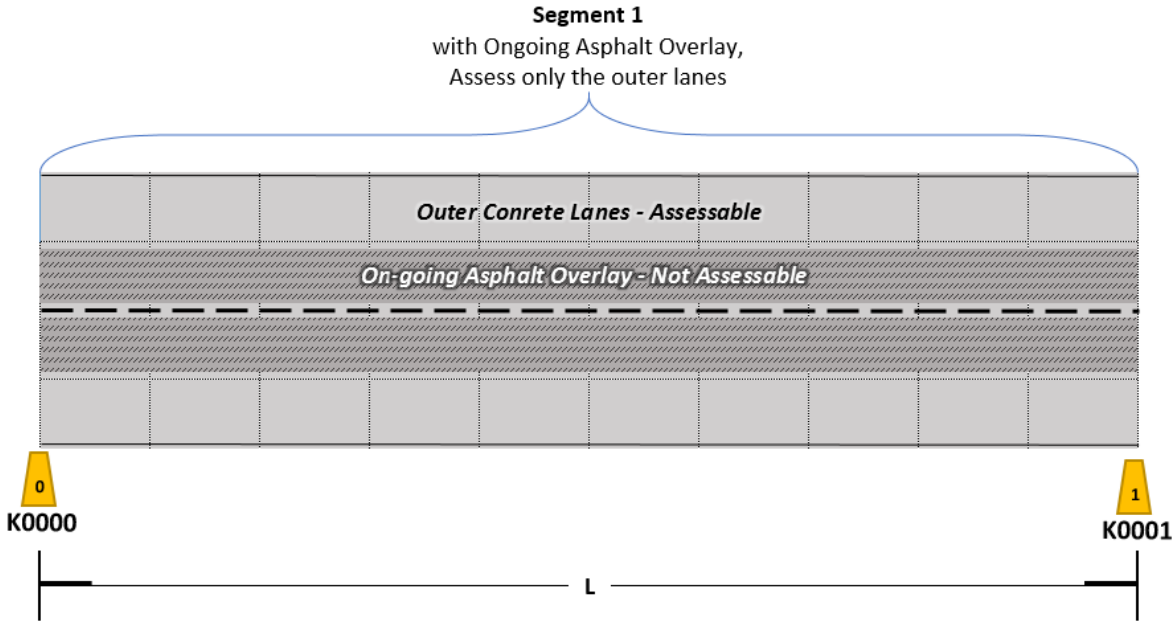


Surface Type Assessed: Concrete

Lanes Assessed: 2-Lanes (Lanes 2 and 3)

** Also indicate in the Comments field the scope of the on-going project and the affected lane/s*

Case 2: With On-going Asphalt Overlay

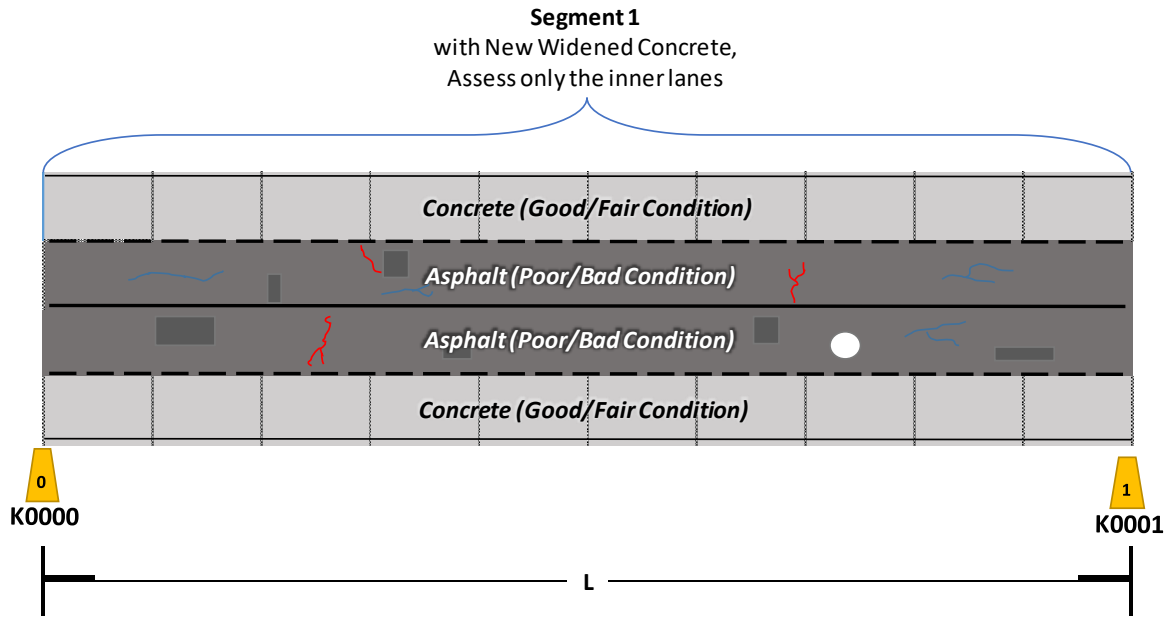


Surface Type Assessed: Concrete

Lanes Assessed: 2-Lanes (Lanes 1 and 4)

** Also indicate in the Comments field the scope of the on-going project and the affected lane/s*

d. Rating segments that have a **multi-surface type** should not be assessed throughout the whole carriageway. The rater must decide which surface type should be assessed (preferably the surface type with worse condition) and its corresponding number of lanes.

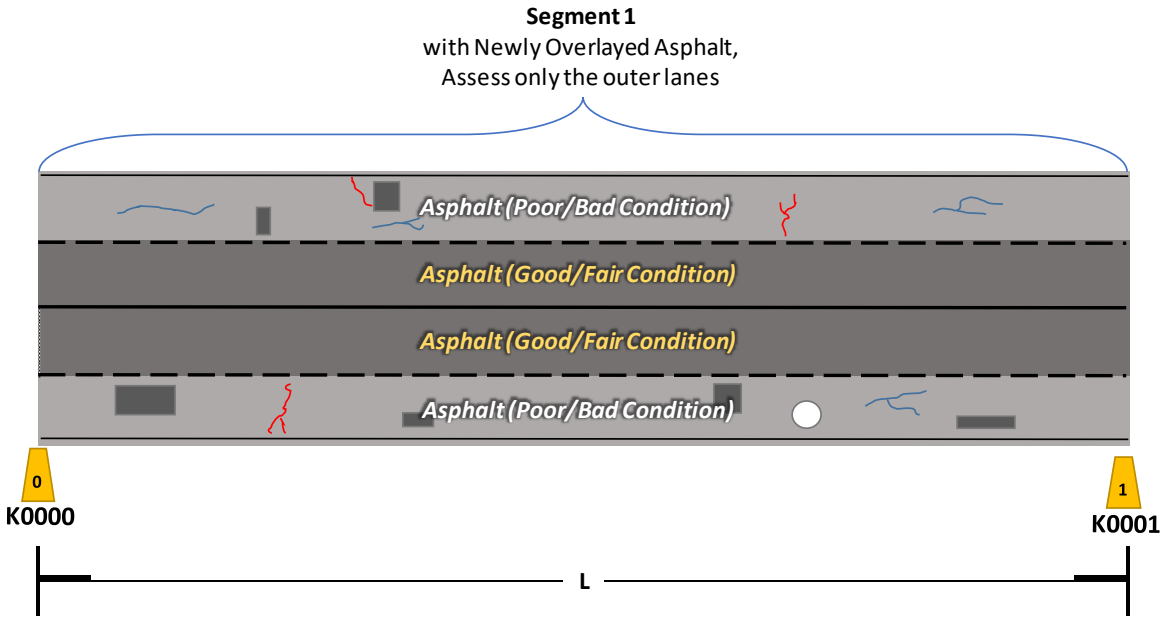


Surface Type Assessed: Asphalt

Lanes Assessed: 2-Lanes (Lanes 2 and 3)

** Also indicate in the Comments field the lanes assessed*

e. Rating segments with newly overlayed/rehabilitated pavement that do not cover the whole carriageway can result to a **distinct difference in condition between the lanes**. The rater must assess the lanes unaffected by the project.



Surface Type Assessed: Asphalt

Lanes Assessed: 2-Lanes (Lanes 1 and 4)

** Also indicate in the Comments field the lanes assessed*

Shown below is the sample interface of the updated RoCond DES which included a drop down pick list to select the lanes to be assessed to adopt the previously discussed. Only the selected lanes will be shown for data entry.

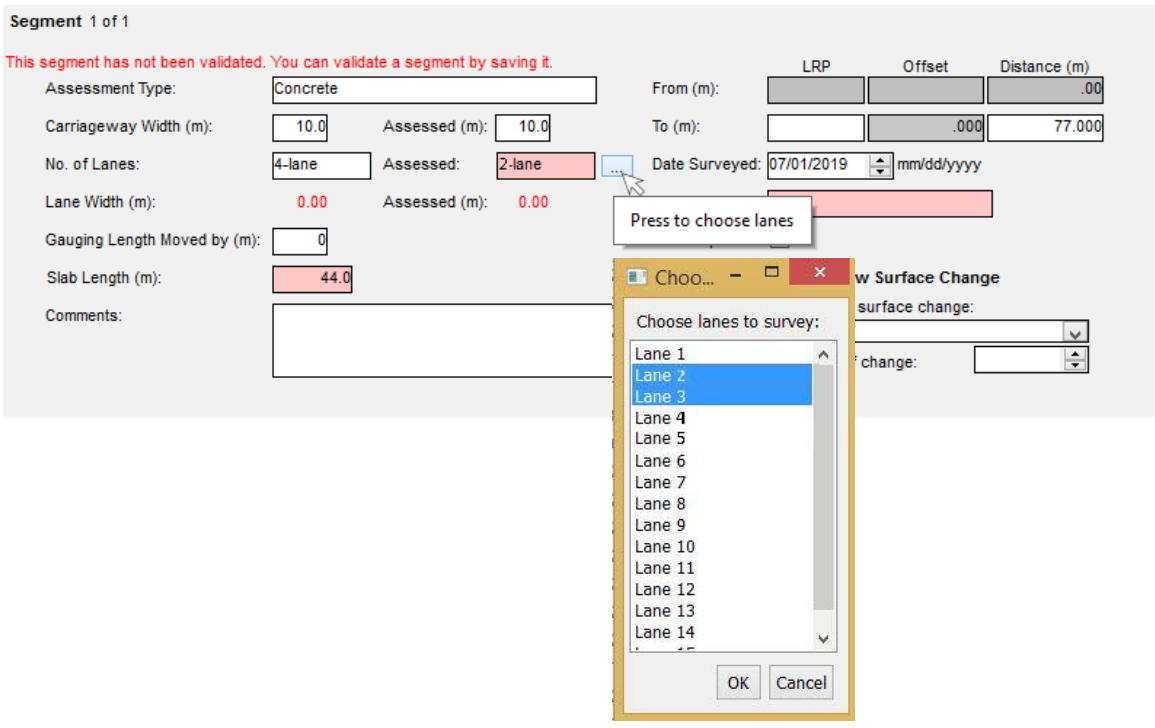
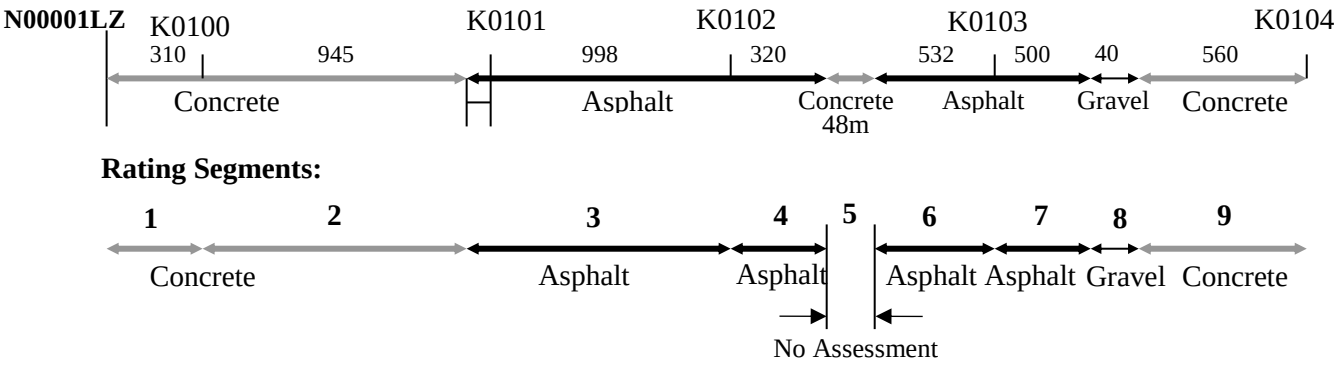


Figure 2
Typical Examples of Road Segments

Start

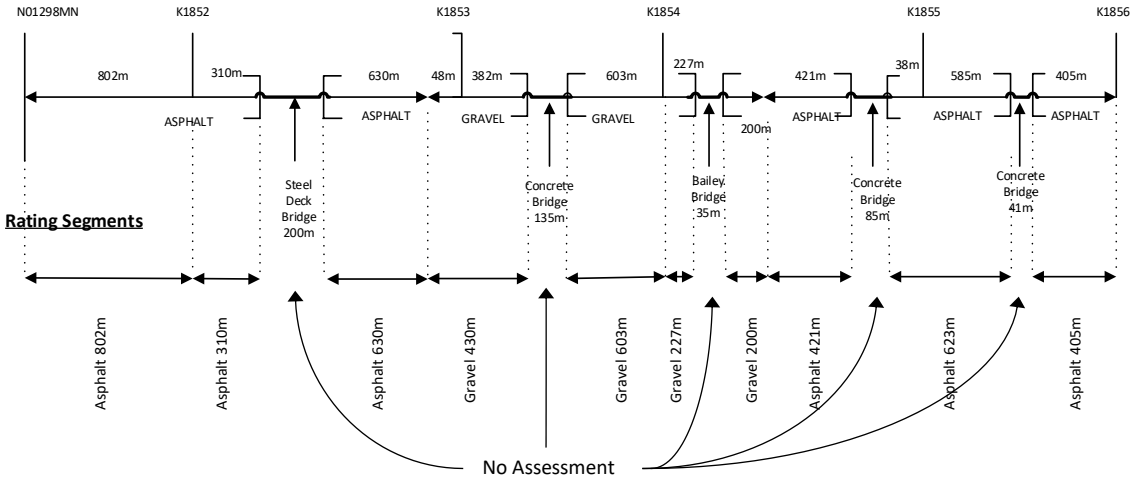
Example 1 - LRPs and Surface Type



Rating Segments:

Segment No	START	END	LENGTH	ASSESSMENT TYPE
1	K0100-310	K0100+000	310	Concrete
2	K0100+000	K0100+945	945	Concrete
3	K0100+945	K0102+000	1044	Asphalt
4	K0102+000	K0102+320	320	Asphalt
5	K0102+320	K0102+368	48	No Assessment
6	K0102+368	K0103+000	532	Asphalt
7	K0103+000	K0103+500	500	Asphalt
8	K0103+500	K0103+540	40	Gravel
9	K0103+540	K0104+000	560	Concrete

Example 2 - LRPs, Bridges and Surface Type



C.3 ROCOND JOINT VALIDATION PROCEDURES

RoCond Field validation is conducted jointly by RBIA staff from Planning Service and Regional Offices.

The random field validation should be carried out annually from May to August of each year. The validation will be conducted randomly and should cover at least 15% of the total paved road (15% for asphalt and 15% concrete) for each DEOs.

If the noted flaws in the assessment of defects (Shattered slabs, patches, asphalt wearing surface, etc.) for asphalt and concrete exceeds the 10% tolerance, the said defects must be re-assessed in the entirety of the DEOs road network.

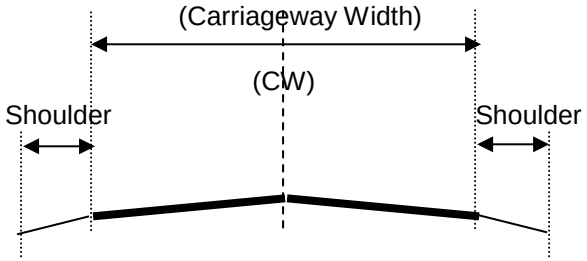
C.4 CONDITION ASSESSMENT

C.4.1 Carriageway Width

Due to the nature of road construction, the pavement type is usually uniform across its width. However, carriageway widths will vary. Carriageway Width (CW) is the width of surfacing designed to carry traffic and is used in computations for calculating the area affected by various pavement distress types. For the purposes of this methodology it is to be measured at the start point of the 50m gauging length.

Carriageway width is to be determined as illustrated in Figure 3. Other situations may also occur that require interpretation. Guidance on these is provided in the "Instruction for Road Inventory Update Sheet (Appendix F)". These other situations usually occur where there are no edge lines and there are excessively wide shoulders. Where there is a combination of asphalt and concrete surface type, record only the carriageway width of the surface type being assessed.

Figure 3
Carriageway Width



C.4.2 Labeling of Lanes

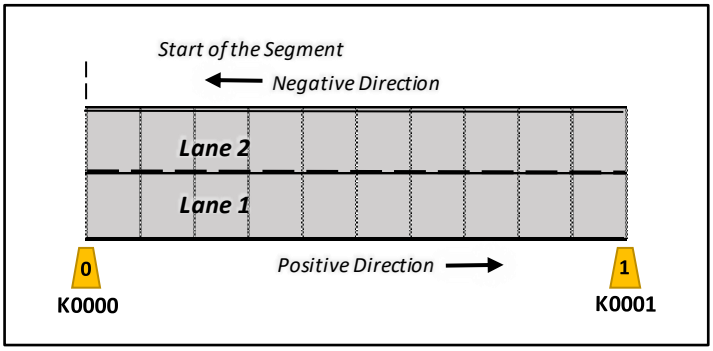
A lane is defined as part of a road carriageway that is marked by painted lines purposely for a single line of vehicles.

Proper numbering of lanes in the carriageway is important to indicate the actual location of the defects being assessed. The numbering of lanes starts at the rightmost lane of the road in positive direction and continuously marked towards the left side until the last lane of the carriageway.

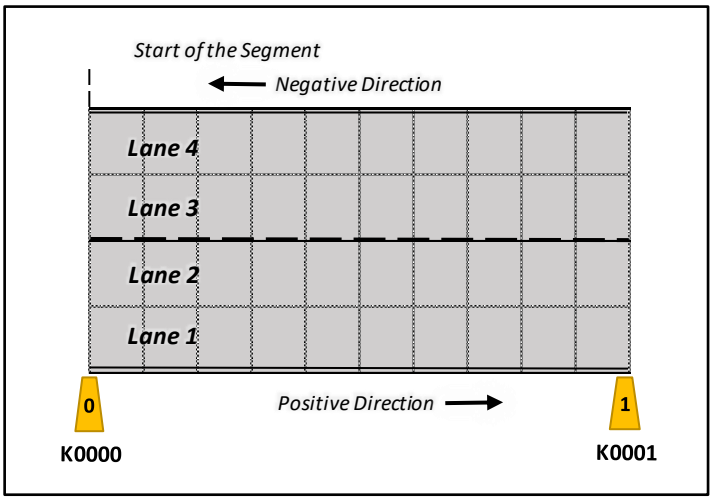
However, roads with dual carriageway configuration are assessed on both direction since they have a separate section Ids and are lane labeled as follows:

a. Single carriageway

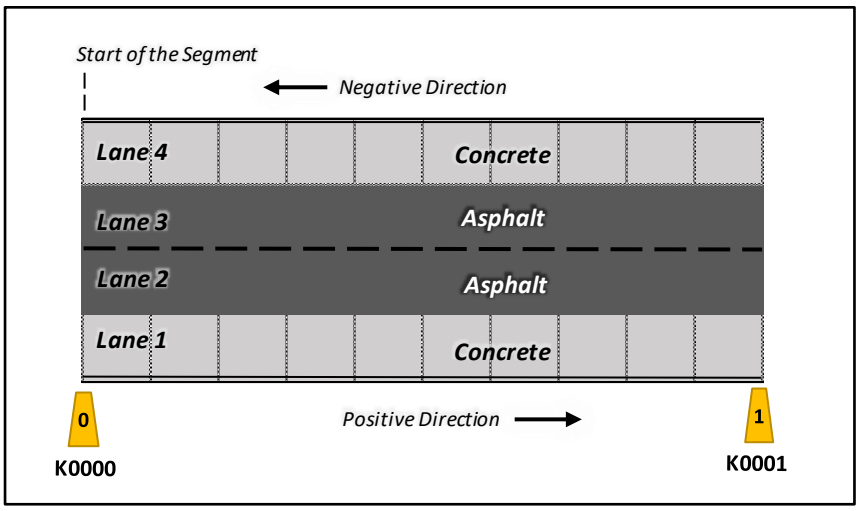
Two lanes



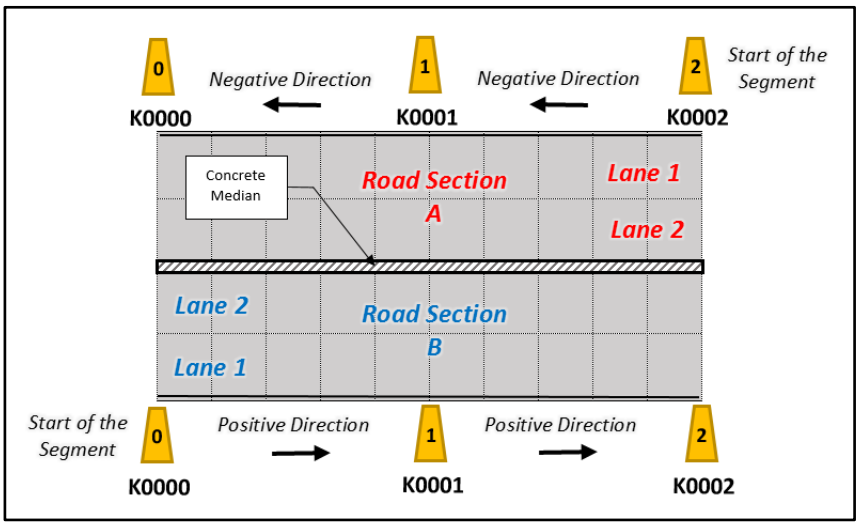
Multiple lanes



Multi-lanes with multi-surface types



b. Dual carriageway



C.4.3 Distress Types and Rating Methods

Once the segments have been selected as described in section C.2.4, the rating process can begin. On a two-lane road, some items are rated over the segment's total carriageway area, while other items are rated over a 50 meter gauging length for flexible pavements (asphalt), or the first 10 slabs for rigid pavement (concrete) both measured from the beginning of the segment to be rated. A summary of the distress types rated by the two methods is detailed in Table 2.

Table 2
Distress Types Rating Method

Surface Type	Distress Type	Method of Measurement
Flexible Pavement (Asphalt)	Rutting	Measured over the 50-meter gauging length (2-lanes)
	Edge Break	Measured over the whole segment
	Patches	Measured over the whole segment

Surface Type	Distress Type	Method of Measurement
	Potholes/Base Failures	Measured over the whole segment
	Surface Failures	Measured over the whole segment
	Wearing Surface	Measured over the whole segment
	Cracking	Measured over the whole segment
	Road Cut/Slip	Measured over the whole segment
Rigid Pavement (Concrete)	Joint Faulting	Measured over the 1st 10 slabs (1-lane only)
	Joint Spalling	Measured over the 1st 10 slabs (1-lane only)
	Joint Sealant Deterioration	Measured over the 1st 10 slabs (1-lane only)
	Shattered Slabs	Measured over the whole segment
	Wearing Surface	Measured over the whole segment
	Cracking	Measured over the whole segment
	Road Cut/Slip	Measured over the whole segment
Unsealed Pavement (Gravel/Earth)	Gravel Thickness	Measured over the whole segment
	Material Quality	Measured over the whole segment
	Crown Shape	Measured over the whole segment
	Roadside Drainage	Measured over the whole segment
	Road Cut/Slip	Measured over the whole segment
Other Items	Drainage (Side Drains)	Measured over the whole segment
	Sealed Shoulders	Measured over the whole segment
	Unsealed Shoulders	Measured over the whole segment

C.5 GAUGING LENGTH

C.5.1 Flexible Pavement

The 50m gauging length for flexible pavement (asphalt) is to be located between 0m and 50m from the start of the segment in the direction of increasing chainage. The position of the gauging length can be moved temporarily from 0m if this occurs at an intersection, there is on-going road works, or if there are other obstructions (patches, surface treatment) influencing the ability to perform the measurement. Where possible, the position of the gauging length should remain the same as in the previous year. If the gauging length is not positioned at the start of the segment, then the new gauging length location must be recorded in the comments field. However, the gauging length should be returned to its original position at the start of the rating segment once the reason for moving no longer exists or has been corrected. This is to ensure that positions are kept constant so that yearly measurements are comparable.

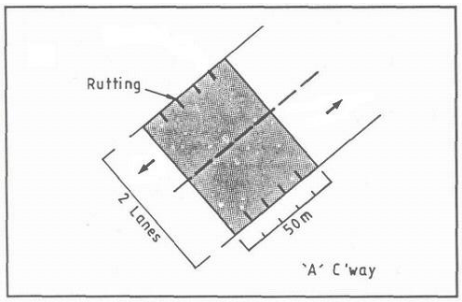
Rutting is the only type of distress in flexible pavement that is measured over the 50m gauging length. On multi-lane roads, only the outer two lanes are rated for rutting. The inner lanes can be used in cases where the road has been widened and the inner lanes have many more defects than the outer lanes. Refer to

Figure 4, Figure 5 and Figure 6.

On divided carriageways (that are recorded as separate sections), each carriageway is treated as a separate road and assessed accordingly. The outer lanes are again rated for rutting. Refer to

Figure 7.

Figure 4
Two Lane Road Gauging Length



On multilane rural roads, (flexible pavements) only the outer two lanes are rated for rutting. The inner lanes can be used in cases where the road has been widened and the inner lanes have many more defects than the outer lanes.

Figure 5
Four Lane Road Gauging Length

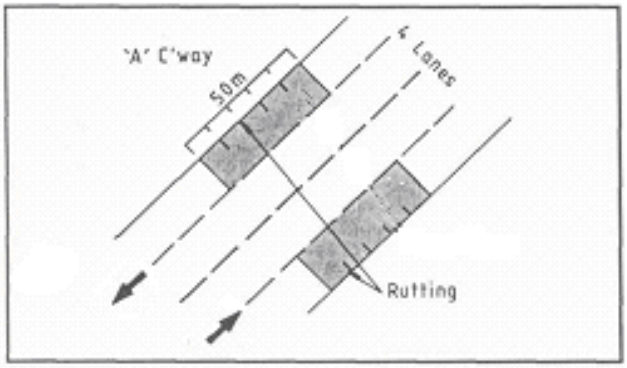
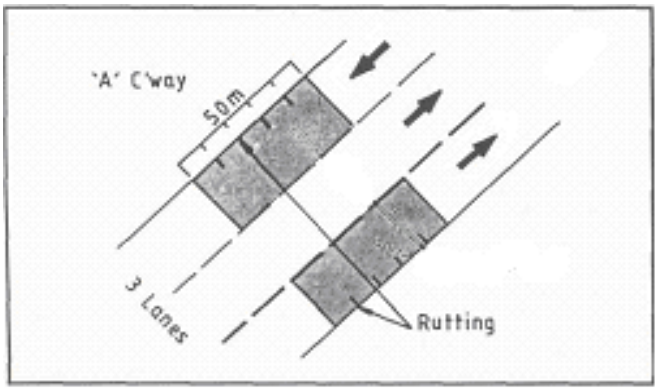
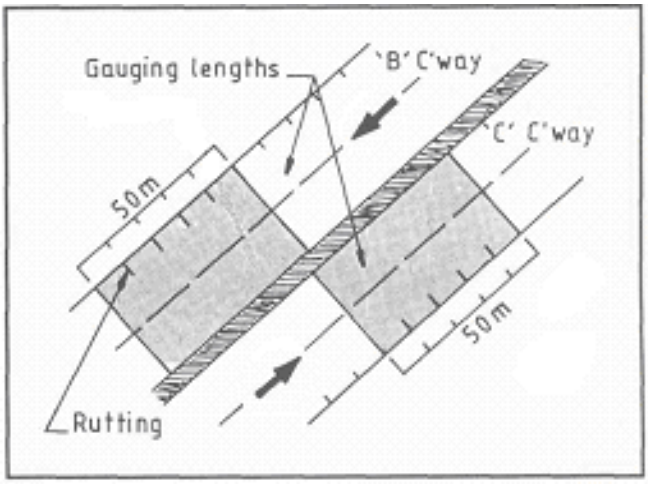


Figure 6
Three Lane Road Gauging Length



On divided carriageways (that are recorded as separate sections) each carriageway is treated as a separate road and assessed accordingly. The outer two lanes are again rated for rutting.

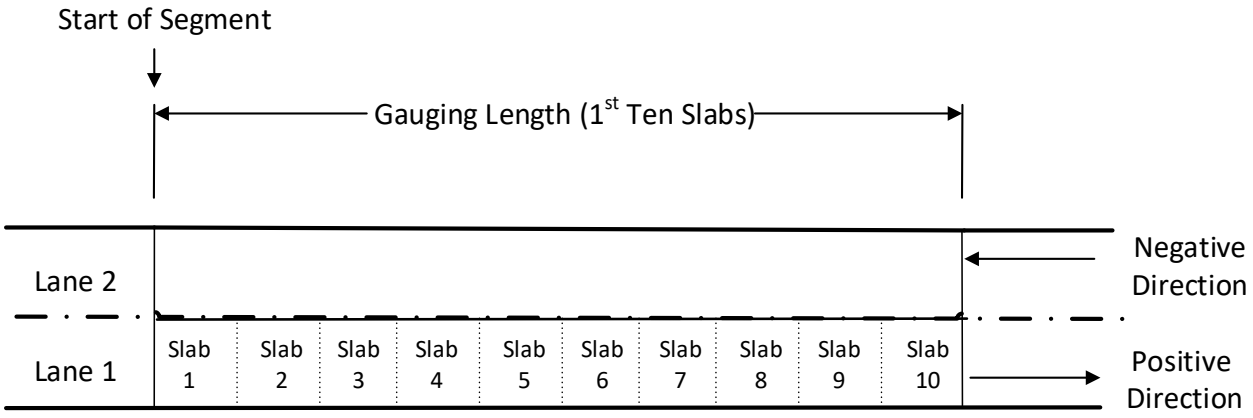
Figure 7
Divided Carriageway Gauging Length



C.5.2 Rigid Pavement

For rigid pavement roads (concrete), regardless of the number of lanes, the gauging length is the first 10 slabs applied only on a SINGLE lane in the direction of increasing chainage. It can be assessed on the side of the road with decreasing chainage if that side of the road is in an inferior condition, possibly due to heavier traffic. The three distress types that are rated over the gauging length of first 10 slabs of road segment are: joint faulting, joint spalling, and joint sealant. The location of gauging length of first 10 slabs should follow the provisions for flexible pavement in Section C.5 and should only be moved in subsequent condition surveys if obstructions exist. Figure 8 indicates the typical arrangement for locating the gauging length for Rigid Pavements.

Figure 8
Two Lane Rigid Pavement Road



C.6 LOCATING SEGMENTS ON THE ROAD

The location of start and end points for each rating segment is described by reference to the nearest kilometer post. As shown in the sample pre-printed condition assessment form in ***Section D***, the distance of the start and end point of the survey is clearly marked at the top of the form. In situations where there is less than 1 km of continuous pavement with the same surface type between two kilometer posts there may be more than one form to complete (one of each pavement length that is greater than 50m or 10 concrete slabs in length).

In certain cases where there are no kilometer posts, the start and end points of each kilometer will have to be determined from Location Reference Reports and measuring distance from the nearest node. In this situation the rating segments should be greater than 50m but not more than 1000m. More information on the Locational Referencing System (LRS) is provided in the "Road Network and Inventory Update Manual". The locations of the start and end point of each segment are to be determined using the same principles as described in section C.2.4. It is suggested that each rater obtain a hard copy of a report from the RBIA detailing the locations of surface types, as this can be used to assist with identifying the start and end points of segments in the field. Other RBIA reports that provide location details of nodes and bridges may be also useful for this purpose.

Any field discrepancies in location information should be checked and referred to SD for re-survey and updating of the LRS.

C.7 PROCEDURE FOR RATING

C.7.1 General Survey Procedure

The rater should follow the general procedure for the conducting of the ROCOND survey as follows:

1) The RBIA District Coordinator should brief the Survey Team on the proper methods and procedures.
2) Prepare the Survey Forms to be accomplished for each day based on the program.
3) Check the tools, equipment and other materials to be used.
4) At all times during the survey, be aware of moving vehicles and always observe safety procedures.
5) At the site, locate the location of the start of the segment to be assessed based on the information in the pre-printed forms.
6) Measure the distances of sections/points to be assessed within the segment length as follows:
    a) Gauging length for flexible pavement: every 10m from the start of segment for a distance of 50m
    b) Gauging length for rigid pavement: every slab starting from the start of the segment for the first 10 slabs
    c) Every 100m from the start of segment for the entire length of segment for all types
7) Mark the measured distances with paint along the edge of the pavement or other adjacent permanent references in increasing chainage. These markings will be the basis of the next surveys to avoid re-measurement of distances and to shorten the duration of survey.
8) On foot, observe and look for defects.
9) Stop at every location of road distress. Measure the affected area and assess the severity of damage.
10) Have the accomplished forms for each day compiled properly for encoding.
11) After encoding, submit the hard copies and electronic copy together with the duly signed standard ROCOND Assessment (Form 1) to the Regional Office.

C.7.2 Condition Rating Procedure

The individual segments are assessed by walking over segment`s total carriageway area. Information is recorded on the appropriate field worksheet (***Section D***) for input into the Data Entry System.

For newly constructed/rehabilitated/overlaid, unsealed roads and/or roads with few defects, it is recommended that the condition of items be assessed on one side of the roadway at a time. The side being travelled should be

the one assessed and the opposite on the return pass. This enables more accurate condition assessment, calculation of affected areas and is safer.

It is suggested that initially, a number of passes be undertaken to assess the condition of items rated over the total carriageway area of segment. However, with experience and depending upon pavement condition and traffic volumes, most segments can be properly rated with a single pass in each direction.

The items rated in this way are indicated in Table 2. The total carriageway area of the segment over which the above items are rated is defined as the carriageway width (as measured at the start point) times the length of the segment.

When the two lane 50 meter (for flexible pavement) or first 10 slabs (for rigid pavement) gauging length is selected, information is gathered on the field worksheet for input into the DES.

The two lane 50 meter (for flexible pavement) or first 10 slab (for rigid pavement) gauging length is then marked and the items within this length are assessed. These items include: rutting for flexible pavement, and joint sealant, joint faulting and joint spalling for rigid pavement.

This information is recorded on the appropriate field worksheet for output into the DES. This system carries out the necessary computations and the import files for loading into RBIA.

Any relevant comments a rater wishes to make should be written at the bottom of the survey form. Comments are to be recorded into the DES under the categories shown in Table 3. Where no specific category matches the comment, it is to be recorded as "Others".

Table 3
Pick List of Categories for Raters Comments

Committed project for funding*	Newly overlayed/reconstructed
Continually reinforced concrete	Ongoing Construction*
Faulting outside the gauging length	Proposed project*
Inaccessible due to road cut	Rutting outside the gauging length
Inaccessible due to safety reason	Segment less than 50 meters
Inaccessible due to slides	Bridge
Urban Metropolitan Area	Others

Even if the segment is not assessable, it is required to have an assessment form indicating the location details, existing surface type and the reasons why the segment is not assessable in the raters comment.

This information is useful for the RBIA Regional Coordinators in the Regional Offices and should be noted during the processing of data.

C.8 CONDITION RATING FORMS

There are three different types of ***visual condition assessment forms*** developed for ROCOND surveys. The type to be used is dependent upon the type of road surface since each type has different attributes to be assessed. There are condition rating forms for each of Asphalt, Concrete, and Gravel/Earth pavements.

The number of forms to be used depends upon the number of segments to be assessed. One form is to be used for each segment and may be either pre-printed or blank.

Pre-printed forms provide a guide and details of the segments to be rated, based upon current data available in the RBIA. Blank forms are to be used where pre-printed forms are unavailable. This may arise to a number of reasons including:

- A section needs to be cut/split or merged;
- Roads are converted from local authorities and the inventory data in the RBIA has not yet been updated;
- Kilometer posts are not available for location referencing;
- Pavement type differs from that of the pre-printed form (which occurs when the inventory in the RBIA is not up to date);

It is recommended that blank copies of the forms be prepared for the surveys so that ample supply are available when the raters are in the field doing the surveys. Blank forms are provided in section D.

C.9 EQUIPMENT

A number of equipment items, some specialized, are required during the course of assessing various items. These items include:

- Straight Edge, 1.2m long
- Measuring Wedge
- Rule in mm
- Crack Width Scale
- Measuring Wheel
- Spray Paint (or other appropriate road marking materials, eg. Chalk)

Raters should purchase or manufacture all equipment. No supplies will be available from Central Office but funds will be provided for the purpose. Dimensioned drawings to assist in making the straight edge, measuring wedge and crack width scale are shown in section F.

Safety Equipment and Gear should include:

- Safety Vests
- Cones
- Appropriate Advance Warning Signs
- Proper shoes
- Headgear
- Sunblock
- Water

***Note**: A traffic controller may be required in some sections where there is difficult alignment or high traffic volumes.*

D. SURVEY FORMS

61. The following forms are included:

SD_RC_001A	RoCond Assessment
SD_RC_002A	Visual Road Condition Assessment Form – Asphalt Pavement
SD_RC_003A	Visual Road Condition Assessment Form – Concrete Pavement
SD_RC_004A	Visual Road Condition Assessment Form – Gravel / Earth

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

ROCOND Assessment

REGION	
DEO	

ROAD SECTION	
SECTION ID	
SECTION LENGTH	

LOCATION	
ROAD ID	
ROAD NAME	

NUMBER OF SEGMENTS BY SURFACE TYPE		
ASPHALT	FLEXIBLE PAVEMENT	
CONCRETE	RIGID PAVEMENT	
GRAVEL/EARTH	UNSEALED PAVEMENT	

DATE OF SURVEY	

CERTIFIED CORRECT

RBIA DISTRICT COORDINATOR
SIGNATURE OVER PRINTED NAME

APPROVED BY

DISTRICT ENGINEER
SIGNATURE OVER PRINTED NAME

Department of Public Works and Highways
ROAD AND BRIDGE INFORMATION APPLICATION

Date of Survey
Rater

VISUAL ROAD CONDITION ASSESSMENT FORM - ASPHALT PAVEMENT

Region		District Office	
Road ID		Road Name	
Section ID		Section Length	meters

ROAD SEGMENT TO BE ASSESSED

From KM		Segment Length (m)			For New Surface Alteration
Chainage		Carriageway Width (m)	.	Assessed (m)	.	Surface Change Is:	
To KM		Lane Width (m)	.	Assessed (m)	.		
Chainage		No. of Lanes		Assessed		Yr of Surface Change:	

RUTTING: Thickness of rutting for every 10m of the first 50m of segment length

ROAD SLIP/CUT

Direction		Position 10m	20m	30m	40m	50m
Positive	Outer Wheel Path (mm)					
	Inner Wheel Path (mm)					
Negative	Inner Wheel Path (mm)					
	Outer Wheel Path (mm)					

OTHER ITEMS

Condition		
Drains		
Unsealed Shoulder		
Sealed Shoulder		

EVALUATED DEFECTS FOR EVERY 100 METERS OF SEGMENT LENGTH

Severity of Defects	Length of Defects (in meters) for evary 100m of segment length: 100m	200m	300m	400m	500m	600m	700m	800m	900m	1000m	1100m	1200m	1300m
EDGE BREAK: Length of edge break in meters for every 100m of segment length													
Width S													
Width M													
Width L													
Severity (S/M/L)													
PATCHES: Length of patches in meters for every 100m of segment length													
Width (meters) 0.5													
Width (meters) 1.0													
Width (meters) 1.5													
Width (meters) 2.0													
1-Lane Wide													
POTHOLES: Number of equiv. potholes (Area X 4) for every 100m													
Number													
SURFACE FAILURES: Number of surface failures (Area X 4) for every 100m													
Number													
WEARING SURFACE: Length of wearing surface for a specified width for every 100m of segment length													
0.50m Wide													
1.00m Wide													
1.50m Wide													
2.00m Wide													
1-Lane Wide													
Severity (M/S)													
LONGITUDINAL CRACKING: Length in meters with assumed affected width of 0.50m													
0.50m nominal width													
Severity (N/W)													
CROCODILE CRACKING: Length in meters by width or entire lane													
0.50m Wide													
1.00m Wide													
1.50m Wide													
2.00m Wide													
1-Lane Wide													
Severity (M/S)													
TRANSVERSE CRACKING: Length in meters with assumed affected width of 0.50m													
0.50m nominal width													
Severity (N/W)													

RATER'S COMMENT:

The following procedure should be followed in accomplishing the form:

Rutting. The depth of rutting in mm is recorded for every 10m of the 50m gauging length equivalent to 5 locations in 4 points across the road: the outer and inner wheel paths of increasing chainage, and the inner and outer wheel paths of decreasing chainage. Refer to ***page 40***.

Edge Break. The length of edge break in meters and severity of distress (S-small, M-medium, L-large) are recorded for every 100m of the road segment being assessed (generally 10 sub-segments between kilometer posts). Refer to ***page 44***.

Patches. The length of patches in meters is recorded for the corresponding width of 0.5m, 1.0m, 1.5m, or 2.0m for every 100m of segment length. Only successfully executed permanent repair (i.e. providing a surface condition equivalent to the surrounding pavement surface) should be recorded. Refer to ***page 34***.

Potholes and **Surface Failures**. The number of potholes, base failures and surface failures (a number has an area equivalent to 0.5mx0.5m or 0.25 sq. meter) is recorded for every 100m of segment length. Refer to ***page 35***.

Wearing Surface. The length of wearing surface in meters and severity of distress (M-minor, S-severe) are recorded for the corresponding width of 0.5m, 1.0m, 1.5m, 2.0m or the whole lane width for every 100m of segment length. Refer to ***page 42***.

Cracking. The length of cracking in meters and severity of distress (N-narrow, W-wide) are recorded for the corresponding width (transverse or longitudinal cracking-0.5m, crocodile cracking-0.5m, 1.0m, 1.5m, 2.0m or the whole lane) for every 100m of segment length. Refer to ***page 38***.

RoadSlip/Cut. This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box. Refer to ***page28***.

Other Items (Drains, Unsealed Shoulder & Sealed Shoulder). The rating in the scale of 1 to 5 are recorded for every 100m of the segment length, the average (rounded off to the nearest whole number) are recorded as the final rating of the segment. Refer to ***pages 65, 67 and 68***.

Vegetation Control. The number of vegetation controls required in the scale of 0 to 3 are recorded for every 100m of the segment length, the average (rounded off to the nearest whole number) are recorded as the final rating of the segment. ***Refer to page 59.***

Rater's comment shall be supplied as indicated in Table 3 in ***Section C.7.2*** at the bottom of the form.

The carriageway and lane width, date of survey and the name of the rater should be properly indicated at the top portion of the sheet. The description of the road and segments are indicated in the location details also seen at the top portion of the pre-printed forms. These forms are to be provided by the RBIA Regional Coordinators. Sample forms (pre-printed and blank sheet) in actual size are shown in section D.

Department of Public Works and Highways
ROAD AND BRIDGE INFORMATION APPLICATION
VISUAL ROAD CONDITION ASSESSMENT FORM - CONCRETE PAVEMENT

Date of Survey
Rater

Region		**District Office**	
Road ID		**Road Name**	
Section ID		**Section Length**	*meters*

ROAD SEGMENT TO BE ASSESSED

From KM		Segment Length (m)				**For New Surface Alteration**	
Chainage		Carriageway Width (m)	.	Assessed (m)	.	Surface Change Is:	
To KM		Lane Width (m)	.	Assessed (m)	.		
Chainage		No. of Lanes		Assessed		Year of Surface Change:	

REPRESENTATIVE ROAD LENGTH FOR THE WHOLE SEGMENT - FIRST 10 JOINTS

JOINT NO.	*Dimension* SLAB		*Defects* FAULTING			SPALLING		SEALANT
	Length (m)	Width (m)	Readings (mm)			Width (mm)	Length (m)	Detertn (m)
1				&				
2				&				
3				&				
4				&				
5				&				
6				&				
7				&				
8				&				
9				&				
10				&				

ROAD CUT/SLIP

OTHER ITEMS

Drains

Unsealed Shoulder

Sealed Shoulder

EVALUATED DEFECTS FOR EVERY 100 METERS OF ROAD LENGTH FOR THE WHOLE SEGMENT

Severity of Defects	*Length of Defects (in meters) for evary 100m of segment length*												
	100m	200m	300m	400m	500m	600m	700m	800m	900m	1000m	1100m	1200m	1300m
SHATTERED SLAB: Number of shattered slab for every 100m length of the segment													
Lane 1													
Lane 2													
Lane 3													
Lane 4													
Lane 5													
Lane 6													
Lane 7													
Lane 8													
Lane 9													
Lane 10													
SCALING: Length of scaling in meters by width in terms of no. of lanes (max. of 100m length for every lane)													
Lane 1													
Lane 2													
Lane 3													
Lane 4													
Lane 5													
Lane 6													
Lane 7													
Lane 8													
Lane 9													
Lane 10													
Severity (M/S)													
LONGITUDINAL CRACKING: Length in meters with assumed affected width of 0.50m													
0.50m nominal width													
Severity (N/W)													
MULTIPLE CRACKING: Length in meters by width or entire lane													
Lane 1													
Lane 2													
Lane 3													
Lane 4													
Lane 5													
Lane 6													
Lane 7													
Lane 8													
Lane 9													
Lane 10													
Severity (N)													
TRANSVERSE CRACKING: Length in meters with assumed affected width of 0.50m													
0.50m nominal width													
Severity (N/W)													
TOTAL CRACKED SLAB: Number of slab with cracks excluding Shattered slab for every 100m of segment length													
Number													

RATER'S COMMENT:

The following procedure should be followed in accomplishing the form:

Shattered Slab. The number of shattered slabs is recorded for the corresponding lane every 100m of segment length. Refer to ***page 54***.

Joint Faulting. The depths of faulting in mm at the outer and inner sides of transverse joint are recorded for the first 10 slabs (gauging length) of the. Refer to ***page 48***.

Joint Spalling. The width in mm and length in meters of spalling at longitudinal and transverse joints are recorded for the first 10 slabs (gauging length) of the segment. Refer to ***page 50***

Joint Sealant. The length of transverse and longitudinal joints in meters with sealant deterioration are summed up and recorded for the first 10 slabs (gauging length) of the segment. Refer to ***page 46***.

Wearing Surface. The length of wearing surface defects in meters and severity of distress (M-minor, S-severe) are recorded for the corresponding lane every 100m of segment length. Refer to ***page 56.***

Cracking. The length of cracking in meters and severity of distress (N-narrow, W-wide) are recorded for the corresponding width (transverse or longitudinal cracking-0.5m, multiple cracking - for every lane, for every 100m of segment length. Refer to ***page 52***.

RoadSlip/Cut. This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box. Refer to ***page 55***.

Other Items (Drains, Unsealed Shoulder & Sealed Shoulder). The rating in the scale of 1 to 5 are recorded for every 100m of the segment length, the average (rounded off to the nearest whole number) are recorded as the final rating of the segment. Refer to ***pages 65, 67 and 68***.

Vegetation Control. The number of vegetation controls required in the scale of 0 to 3 are recorded for every 100m of the segment length, the average (rounded off to the nearest whole number) are recorded as the final rating of the segment. ***Refer to page 59.***

Rater's comment shall be supplied as indicated in Table 3 in ***Section C.7.2*** at the bottom of the form.

Other information to be supplied are the same with that for flexible pavement.

Department of Public Works and Highways
ROAD AND BRIDGE INFORMATION APPLICATION

VISUAL ROAD CONDITION ASSESSMENT FORM - GRAVEL/EARTH

Date of Survey
Rater

Region		**District Office**	
Road ID		**Road Name**	
Section ID		**Section Length**	meters

ROAD SEGMENT TO BE ASSESSED

From KM		**Segment Length**	meters	**For New Surface Alteration**	
Chainage		**Carriageway Width**	meters	**Surface Change Is:**	
To KM		**Lane Width**	meters		
Chainage		**No. of Lanes**		**Year of Surface Change:**	

Gravel ☐ **Earth** ☐

ROAD SLIP/CUT ☐

ITEMS FOR ASSESSMENT	CONDITION	*Condition Rating of Items (1,2,3 or 4) for every 100m*												Overall Rating
		100	200	300	400	500	600	700	800	900	100	1100	1200	1300	
Gravel Thickness	**1** *>100mm*														
	2 *>=50mm<100mm*														
	3 *>=25mm<50mm*														
	4 *<25mm*														
Material Quality	**1** *Good*														
	2 *Fair*														
	3 *Poor*														
	4 *Bad*														
Crown Shape	**1** *Good*														
	2 *Flat*														
	3 *Uneven*														
	4 *Very Uneven*														
Roadside Drainage	**1** *Good*														
	2 *Fair*														
	3 *Poor*														
	4 *Bad*														

RATER'S COMMENT:

The following procedure should be followed in accomplishing the form:

Gravel Thickness. The thickness of gravel surfacing is assessed for every 100m of segment length and the average (rounded off to whole number) for the whole segment is recorded. Refer to ***page 59***.

Material Quality. The quality of gravel surfacing is assessed for every 100m of segment length and the average (rounded off to whole number) for the whole segment is recorded. Refer to ***page 60***.

Crown Shape. The shape of the crown of the carriageway of gravel surfacing is assessed for every 100m of segment length and the average (rounded off to whole number) for the whole segment is recorded. Refer to ***page 61***.

Roadside Drainage. The ability to drain water away from the carriageway of the road of gravel surfacing is assessed for every 100m of segment length and the average (rounded off to whole number) for the whole segment is recorded. Refer to ***page 62***.

Vegetation Control. The number of vegetation controls required in the scale of 0 to 3 are recorded for every 100m of the segment length, the average (rounded off to the nearest whole number) are recorded as the final rating of the segment. ***Refer to page 59.***

RoadSlip/Cut. This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box. Refer to ***page 63***.

Check appropriate box if surface type is gravel or earth.

Rater's comment shall be supplied as indicated in Table 3 in ***Section C.7.2*** at the bottom of the form.

Other information to be supplied are the same with that for flexible and rigid pavement.

E. CONDITION RATING

Note:
Representative 50 Meter Gauging Length

On a rural road, a two lane 50 meter gauging length is selected to rate the flexible item 'Rutting'.
All other items are assessed over the segment's total carriageway area.

PAVEMENT (FLEXIBLE)

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment of 400m, there are 3 patches, all 0.5m wide and measuring 1.5, 3.0 and 1.0m in length. There are 5 patches in the fourth 100m segment, two with a width of 0.5m or less and a length of 0.5 and 1.0m. Another two patches 1.5 m wide with lengths of 3.0 and 4.0m long. These patches will be recorded as follows:

width	Length (m)									
	100	200	300	400	500	600	700	800	900	1000
0.5	5.5			1.5						
1.0										
1.5				7.0						
2.0										

Example: A cracked patch which is rated as cracking and not patching followed by a successful patch which is rated as a patch

PATCHES

(Flexible Pavement)

Assessed over total area of segment

DEFINITION

For rating purposes, a patch is defined as a successfully executed permanent repair. It provides a surface condition equivalent to the surrounding pavement surface and provides a waterproof seal over its surface and around its perimeter. Any Defects found within a patch should be recorded under the applicable item. E.g. a patch that is cracked should not be rated as a patch but the cracks should be rated as cracks or a patch that is disintegrating should be rated as wearing surface or surface failures unless the disintegration penetrates into the unbound layer, in which case it should be rated as a pothole.

PURPOSE

If a road repair has been successful there may be no pavement defects to rate in that segment of road. A new road also has no defects. That there are no defects to rate may imply that the road is brand new. However, we know that if the road has been repaired, it is probably older and more likely to fail again than a brand new road. We therefore rate even the successful patches as a way of gaining some understanding of the likely life of the remainder of the pavement in that segment. Thus there is no limit to the size of a patch. Patches of all sizes should be rated.

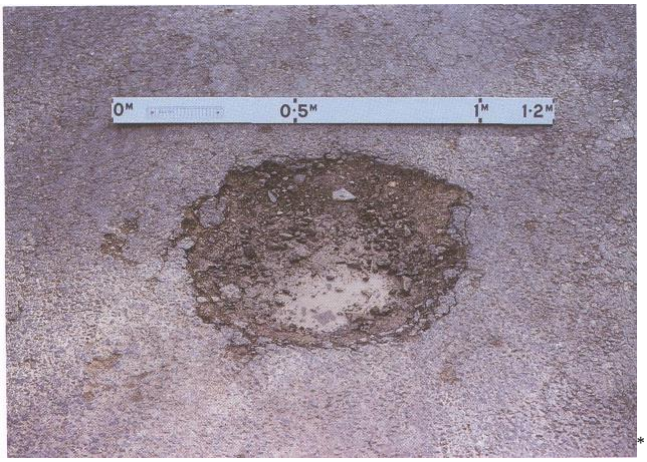
METHOD

This item is assessed over the total carriageway area of the segment. (Refer to Section C.7.2).

Patching is rated according to the areas affected within the carriageway area over the total carriageway area and expressed as a percentage.

MEASUREMENT

The length of patching per width band is rated and recorded every 100m lengths.



*

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment there are 2 potholes, both 0.5m wide and measuring 0.5 and 1.0m in length. There is 1 pothole in the third 100m segment, measuring 1.5m by 4m. These number of potholes will be recorded as follows:

Number of Potholes									
100	200	300	400	500	600	700	800	900	1000
3		24							

POTHOLES

(Flexible Pavement)

Assessed over total area of segment

DEFINITION

Holes of various shapes and sizes in the pavement surface. For rating purposes, severe cracking with base failure/settlement/depression (unbound layer) shall also be considered as potholes. Crocodile cracking around potholes should be assessed under Potholes. Road Slip or Cut are not considered as Potholes but are marked in the applicable check box.

A successfully patched area is not a pothole. (See the item "Patches (Flexible Pavement)" on page 34).

PURPOSE

Many of the potholes rated in this item will be fixed in a matter of weeks and as such, are of little value to the long-term determination of maintenance strategies. However, the measurement of these potholes in a road gives a good indication of the general condition of the pavement and future deterioration.

METHOD

This item is assessed over the total carriageway area of the segment. (Refer to "Procedure For Rating" in section C.7.2).

Potholes are rated according to the number of potholes, recorded according to the diameter of the potholes within the carriageway area over the total length of the segment.

MEASUREMENT

The number of potholes is rated per 100m lengths. **One (1) pothole is equivalent to 0.25 m^2.**

* *Pictures from: A guide to the Visual Assessment of Pavement Condition, Austroads, 1987*

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment there are 2 surface failures, both 0.5m wide and measuring 0.5 and 1.0m in length. There is 1 surface failure in the third 100m segment, measuring 2m by 1m. These surface failures will be recorded as follows:

Number of Surface Failures									
100	200	300	400	500	600	700	800	900	1000
3		8							

Example: Surface Failure due to wearing course deterioration

Example: Surface Failure due to delamination

SURFACE FAILURES

(Flexible Pavement)

Assessed over total area of segment

DEFINITION

Surface Failures, are loss of a discrete and large area of the wearing course layer. These Failures can be caused by wearing course deterioration, surface delamination or mechanical damage. Surface delamination frequently occurs in asphalt that has been overlaid on a concrete pavement Usually there is a clear delineation of the wearing course and the concrete layer below.

A successfully patched area is not a surface failure. (See the item "Patches (Flexible Pavement)" on page 34).

PURPOSE

Many of the surface failures rated in this item will be fixed in a matter of weeks and as such, are of little value to the long-term determination of maintenance strategies. However, the measurement of these surface failures in a road gives a good indication of the general health of the surface.

METHOD

This item is assessed over the total carriageway area of the segment and is rated using the same methodology as used when assessing Potholes. (Refer to "Procedure For Rating" in section C.7.2)

Surface Failures are rated according to the number of surface failures, recorded according to the diameter of the surface failures rounded to the nearest 0.5m within the carriageway area over the total length of the segment.

MEASUREMENT

The number of surface failures is rated per 100m lengths. **One (1) surface failure is equivalent to 0.25 m^2 .**

† *Pictures from: A guide to the Visual Assessment of Pavement Condition, Austroads, 1987*

ROAD SLIP/CUT

(Flexible Pavement)

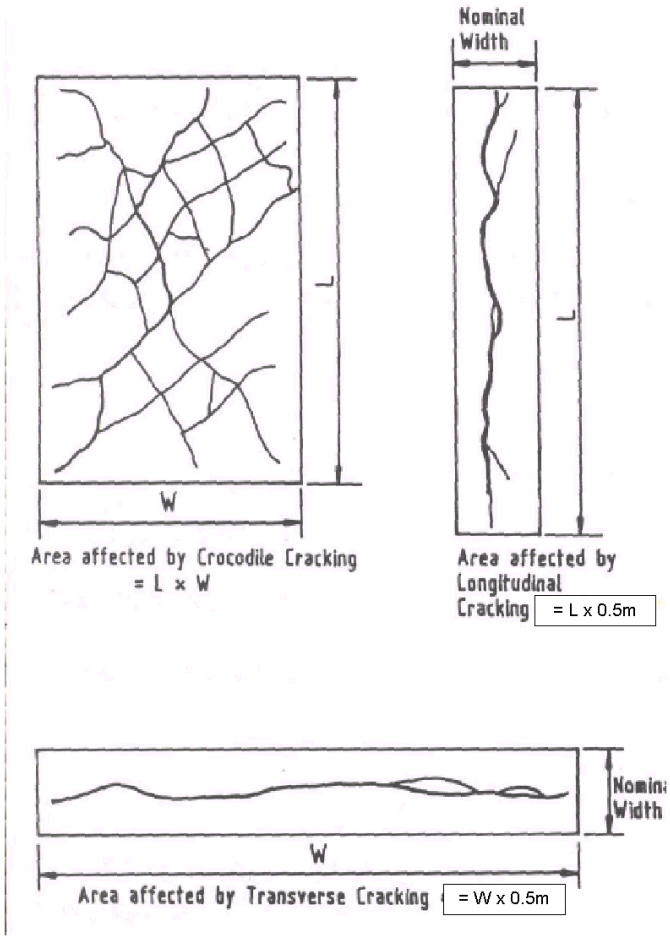
Assessed over total area of segment

DEFINITION
Road Slip/Cut is a serious problem due to slope failure and requires immediate attention.

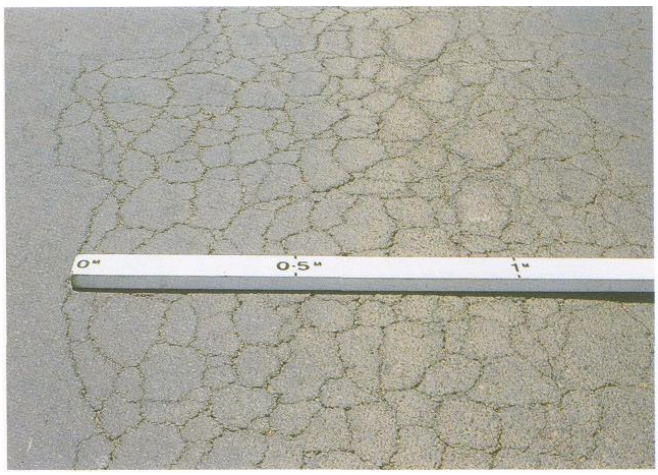
PURPOSE
Road Slip/Cut should be fixed in a matter of weeks and as such, is of little value to the long-term determination of maintenance strategies. This item is not included in the Visual Condition Index (VCI) calculations but is included as a warning that immediate attention is required.

METHOD
This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box if there are any Road Slip/Cut present irrespective of the number of occurrences per segment.

Note: The affected area of cracking at a location is defined to be rectangular in shape and dependent upon the extremities of the cracking. The affected area for single longitudinal cracking is calculated as the product of the length and a width of 0.5 m. If branching or meandering of the crack affects a more extensive width, then the affected width is used in the calculation. Similarly, the width of the area affected by transverse cracks is taken as 0.5 m unless more extensive. These calculations are done within the DES. The sketch illustrates this concept.



Crocodile, Longitudinal and Transverse Cracking



Example: Crocodile Cracking

PAVEMENT CRACKING

(Flexible Pavement)

Assessed over total area of segment

DEFINITION

Cracking is the indicator of surface failure in flexible pavements. (Localized cracking around potholes should be assessed under "Potholes (Flexible Pavement)" in section 0.)

Note: This pavement rating item includes all forms of cracking in flexible pavements. Identification of cracking requires careful examination of the pavement while on foot. It cannot be adequately recognized from a moving or stationary vehicle**. Temperature cracks are not considered cracks but reflection cracks are rated as cracks. Cracks that are well sealed are still considered cracks with only narrow severity.**

PURPOSE

Road pavements are designed assuming that the moisture content will remain constant. However, if the road surface is cracked, moisture will enter the pavement and the design assumptions will be void. The deterioration of a road is accelerated if the road is cracked. Cracking is one of the most frequent forms of distress and one of the most significant. It is therefore important to measure the cracking of a road.

A pavement management system is designed to allow a manager to plan the long term management of a road. Cracking is one of the most significant early signs of long term pavement distress. A detailed examination is required if the early signs of cracking are to be detected.

METHOD

This item is rated over the entire segment length. (Refer to "Procedure For Rating" in section C.7.2).

Pavement cracking in the selected lane is inspected on foot and rated according to:

- the **type** of cracking.
- **the severity** of distress as indicated by crack width; and
- **the length** of distress as indicated, this is converted to extent(%) by the data entry spreadsheet.

Severity of cracking is rated according to the predominant average crack width as measured with the Crack Width Scale (see section 0) and using the Flexible Pavement Marks.

Extent of cracking is calculated by the DES according to the total area of cracking within the segment over the total area of the segment and expressed as a percentage.

Example:

The following cracks were found in the segment:

In the first 100m, Longitudinal cracks of 4.0m (N), Crocodile cracks with a width of 0.5m and length of 3.5m (N), width of 2.0m and length of 1.0m (N) and Transverse cracks of 4.0m (N).

In the second 100m, Longitudinal cracks of 2.0m (W), Crocodile cracks with a width of 1.0m and length of 1.5m (W) and the full lane width for 12.0m (Wide).

In the third and fourth 100m's only two Longitudinal cracks were found 1.5m (N) and 3.0m (W) respectively.

These cracks will be recorded on the form as shown in the following table.

Cracking Flexible Pavement										
		Length and Severity								
		100	200	300	400	500	600	700	800	900
Longitudinal	0.5m wide	4.0	2.0	1.5	3.0					
	Severity	N	W	N	W					
Crocodile	Width	Length and Severity								
		100	200	300	400	500	600	700	800	900
	0.5	3.5								
	1.0		1.5							
	1.5									
	2.0	1.0								
	Lane		12.0							
	Severity	N	W							
Transverse	0.5m wide	4.0								
	Severity	N								

TYPE

The cracking is recorded on the form according to the type of crack.

Longitudinal Cracking: This is cracking running longitudinally along the pavement. It may be wandering in plan to some extent but is approximately parallel to the road centerline and does not exhibit strongly developed transverse branches.

Transverse Cracking: This is cracking running transversely across the pavement. The length of such cracks should exceed 0.6 m in order to be significant for rating purposes.

Crocodile Cracking: This is cracking consisting of interconnected or interlaced cracks forming a series of small polygons resembling a crocodile hide.

SEVERITY

The severity of distress is:

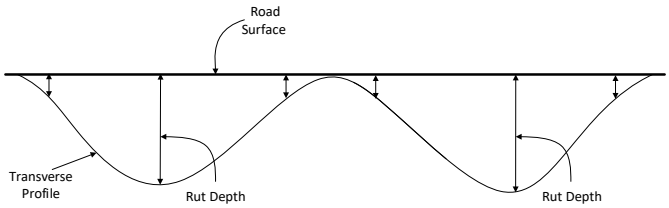
Narrow 'N' ≤ 3 mm average crack width
Wide 'W' > 3 mm average crack width

The severity is the predominant severity.

EXTENT

The length of cracks is recorded in meters for Longitudinal and Transverse cracks. The length of Crocodile cracks is recorded in meters per band width.

Straight Edge and Measuring Wedge



PAVEMENT RUTTING

(Flexible Pavement)

Assessed within 50 meter gauging length

DEFINITION

Rutting is defined as a longitudinal depression that forms in the wheel paths of a road under traffic loading.
Rut depth is defined as the maximum surface level variation measured from an imaginary line between two points on the surface at a spacing of 1.2 m (measured using a 1.2 m straight edge and a wedge - see illustration). Measurements are taken on the inner and outer wheel paths.

PURPOSE

Rutting is one of the principal ways in which a road fails. Measuring rutting gives a direct indication of the structural condition of the road. A rutted road will usually require a major treatment. Because rutting is such an important indicator of condition, ROCOND identifies the early stages of rutting so that future maintenance work can be anticipated.

METHOD

This item is rated within the 50 meter gauging length.

Measurements are taken at locations 10,20,30,40 and 50 m in the inner and outer wheel paths of each lane rated in the gauging length. (Refer to "Procedure For Rating" in section C.7.2).

Twenty rut measurements are recorded. However only those measurements equal to or greater than 5mm are used in the calculations.

The severity of rutting is calculated in the DES according to the average rut depth for both inner and outer wheel paths. This is the sum of the readings ≥ 5mm over the number of readings ≥ 5mm.

The extent of this distress is also calculated by the DES.

When measuring rut depth, use of the wedge minimizes measurement error and time required to take the measurement. This practice also reduces fatigue and enhances safety. The rutting portion of the wedge and the rutting side of the straight edge are painted the same color to avoid confusion with the faulting measurement procedure. A wedge is illustrated on the previous page. A dimensioned drawing of a wedge and a template to locate the scribed measurement marks are shown in section F. Ensure that readings are taken using the "RUTTING - FLEXIBLE PAVEMENT" scale.

Example: Two Lane Rural Road (Assessed within two lane 50 m gauging length)

Positive direction		**Negative direction**	
Outer Wheel Path (mm)	Inner Wheel Path (mm)	Inner Wheel Path (mm)	Outer Wheel Path (mm)
5	4	10	12
7	5	8	14
3	0	4	8
9	4	4	4
4	2	0	6

DISTRESS SCALES

SEVERITY

The severity of rutting is calculated according to the average rut depth for both inner and outer wheel paths. This is the sum of the readings ≥ 5mm over the number of readings ≥ 5mm. It is recorded to one decimal place in units of millimeters.

EXTENT

The extent is calculated by the DES as the percentage of the area with rutting ≥ 5mm in depth and is recorded to one decimal place as shown in the example opposite.

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment there are flushing in both wheelpaths each 0.5m wide and 70m long, in the third and fourth 100m segments there is raveling the entire length and lane width. The wearing surface will be recorded as follows:

width	Length (m)									
	100	200	300	400	500	600	700	800	900	1000
0.5	140									
1.0										
1.5										
2.0										
Lanes			100	100						
Severity	M		S	S						

Example: Wearing Coarse severe – coarse texture

WEARING SURFACE (RAVELLING/FLUSHING/ POLISHING)

Assessed over total area of segment

DEFINITION

This is a distress that only occurs on flexible pavements. The wearing surface item typically occurs in the wheel path.

The smoothness of the surface is the condition rated. Smoothness is due to excessive bitumen, stone wear, stone deterioration or stone loss depending on the type of surface and will lead to surface deterioration and an unsafe traveling surface.

Flushing/Bleeding: - is the occurrence of excessive bitumen at the surface of an Asphalt Concrete pavement.

METHOD

This item is assessed over the total carriageway area of the segment. (Refer to "Procedure For Rating" in section C.7.2).

Although initially assessed from a slow moving vehicle, closer inspection of the suspected affected areas is required. A simple test should be carried out on each affected area, after alighting from the vehicle, to determine whether wearing surface distress is actually present. A hand feel test is a convenient method to assess the degree of distress.

MEASUREMENT

The length of wearing coarse defect per width band is rated per 100m lengths. This item is rated in the same way that patching is rated.

SEVERITY

The severity of distress is:

Minor 'M' = Surface still relatively smooth with only some loss of fine aggregate or in the case of bleeding there are some signs of excess binder

Severe 'S' = Surface rough or pitted with both fine and coarse aggregate lost or in the case of bleeding the surface is covered with excess binder with skid resistance poor

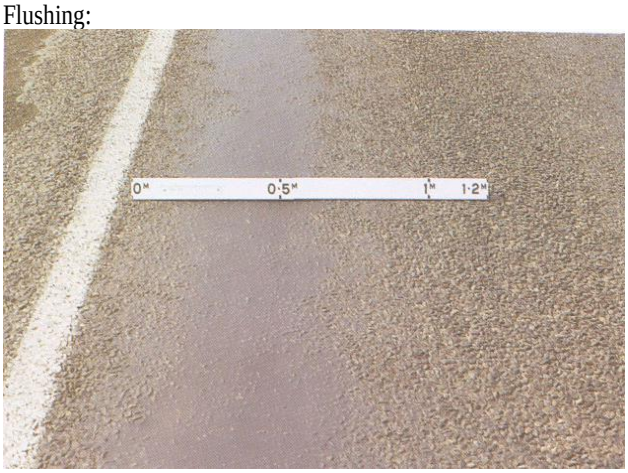
The severity is the predominant severity.

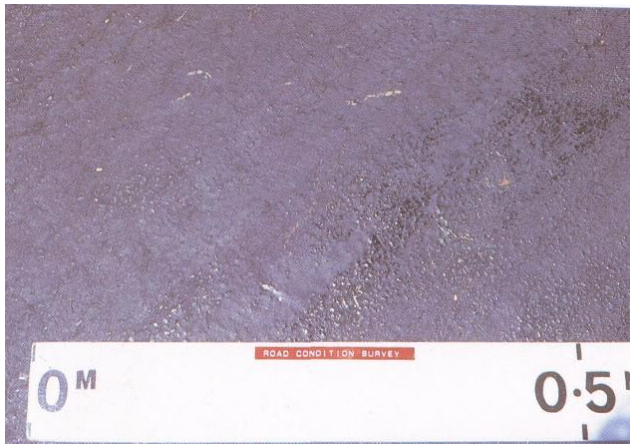
Examples:

‡ *Pictures from: A guide to the Visual Assessment of Pavement Condition, Austroads, 1987*

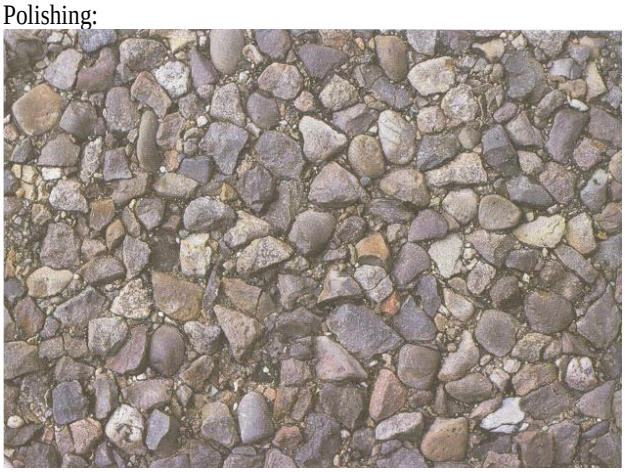
Ravelling:

Flushing:





Polishing:



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§ *Pictures from: A guide to the Visual Assessment of Pavement Condition, Austroads, 1987*

Example: (Assessed over total edge length of segment)

On a segment that is 560m long there is slight edge break over the entire length on the left side of the segment and severe edge break for the first 100m on the right side of the segment and moderate edge break for 20m in the third 100m on the right hand side. The first 100m has 100m of Slight and 100m of Large edge break, this will be recorded as 200m of Large edge break as there is no predominant severity so the more extreme is recorded. In the third 100m there is 100m of slight edge break and 20m of Extreme edge break therefore Slight is the predominate severity with a total length of 120m.

	00	200	300	400	500	600	700	800	900	1000
Length	200	100	120	100	100	60				
Severity	L	S	S	S	S	S				

EDGE BREAK (HORIZONTAL)

Assessed over total edge length of segment

DEFINITION

Horizontal Edge Break is defined as fretting along the edge of a seal or asphalt concrete surfacing and is associated with rutting or erosion of the shoulder in the vicinity of the edge of bitumen.

METHOD

This component is assessed for both edges for full segment being rated and is assessed from the vehicle.

Significant edge break is taken as a loss of seal exceeding 20 mm in width. Edge break less than 20 mm is not considered in the assessment. Edge break extending into the wheel path is not rated as edge break but rated as a pothole if the unbound layer has been exposed.

Severity is rated as the predominant severity distress occurring along the segment.

Extent of edge break is calculated by the DES as the total edge length displaying significant (>20 mm) edge break (i.e. the length of Slight, Moderate and Large edge break as measured on both sides of the road equals the "total length of edge break") over the total length of edges and expressed as a percentage.

DISTRESS SCALES

SEVERITY

The severity of distress is:

Slight	'S' =	20 - <75 mm average width of fretting
Moderate	'M' =	75 - 200 mm average width of fretting
Large	'L' =	> 200 mm average width of fretting

The severity is the predominant severity.

EXTENT

The extent of the distress is calculated by the DES.

PAVEMENT (RIGID)

Notes:

Representative Single Lane Gauging Length (1st ten slabs)

There are three rigid pavement items to be assessed within the gauging length of the 1st ten slabs. Joint Sealant, Faulting and Spalling are rated over ten joints starting at the beginning of the gauging length and proceeding until ten joints or cracks are assessed.

Localized Surface Defects shall be assessed over the entire segment.

All rigid pavement items apart from Local Surface Defects must be rated on foot for detailed inspection. Conditions cannot be adequately assessed from a vehicle.

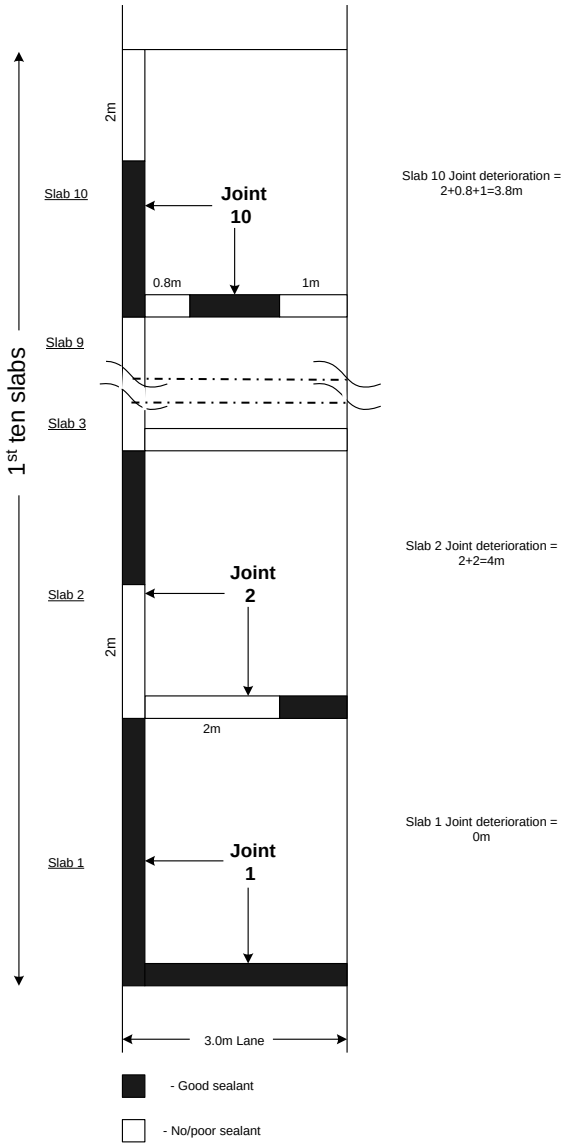
Rigid Pavements Overlaid With Asphalt Concrete

In many situations rigid pavements (i.e. concrete pavements) are covered (surfaced) with asphalt concrete (asphalt). Where this has occurred, the pavement should be rated according to the predominant surfacing type (e.g. if the surface area of asphalt is greater than the concrete surface area, then the segment should be rated as a Flexible Pavement).

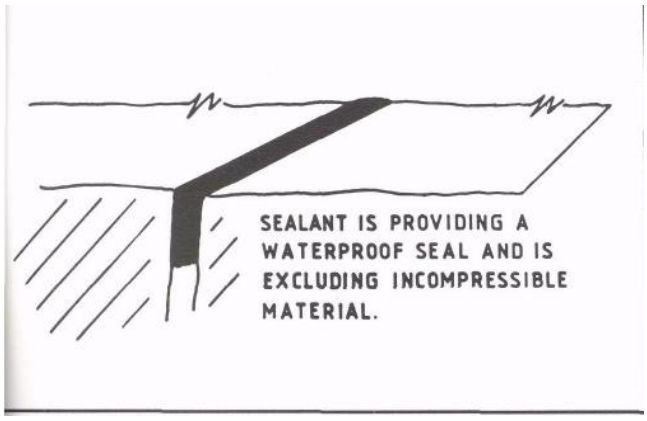
In situations where the segment is rated as a Rigid Pavement but asphalt partially covers the surface and the item's condition cannot be assessed, this should be recorded under the Rater’s comments. If possible the gauging length position must be selected on a portion of the segment where there is no asphalt concrete covering the concrete.

In each case, it must be determined whether the condition of an item can be properly assessed as to its ability to perform the function required of it. For example, joint sealant distress is a concern because it may allow water and/or incompressible material into the joint creating long-term problems. However, if the joint is covered with asphalt concrete, the true condition of the joint sealant cannot be determined and it is therefore "not assessable".

The impact of asphalt concrete cover is addressed in each item rating discussion.



Sealant in Transverse Joints



Sealed Joint - Good Condition

JOINT SEALANT DISTRESS

(Rigid Pavement)

Assessed within the 1st ten slabs

DEFINITION

An elastic joint sealant should be present in all sawn or preformed joints in concrete pavements. Joint sealants can be factory-molded sealants that are compressed and inserted into a prepared joint. Joint sealants can also be poured or gunned into the joint when supplied in the fluid state. The function of the joint sealant is to allow movement whilst excluding the lodgement of water and incompressible materials such as sand and silt in the joint.

METHOD

This item is rated within the selected single lane 1st ten slabs of the gauging length. (Refer to "Procedure For Rating" in section C.7.2).

Ten slabs within the gauging length are inspected on foot to allow assessment of the extent of joint sealant deterioration that is representative of all lanes. The transverse joint at the start of the slab and the adjacent longitudinal joint is considered. The extent of the deterioration is based on the amount of joint length showing loss or extrusion of the sealant over the total length of joints and is calculated by the DES.

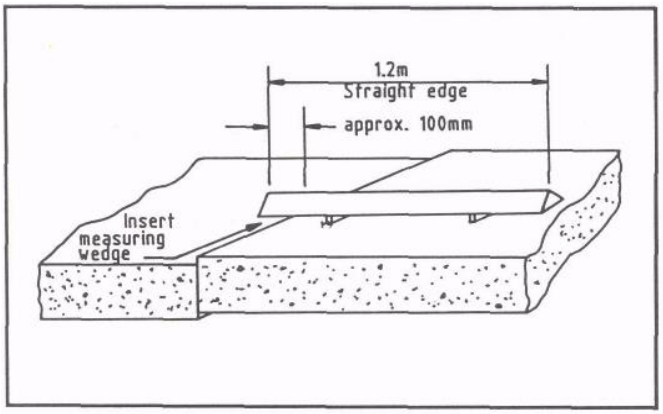
Where the rigid pavement joint is covered by an asphalt concrete overlay, the condition of the underlying pavement cannot be assessed and this should be recorded under the Rater's comments. However, the gauging length can be moved to assess the defects.

In the case of continuously reinforced concrete, which has no joints, the joint sealant deterioration should be rated as 0.

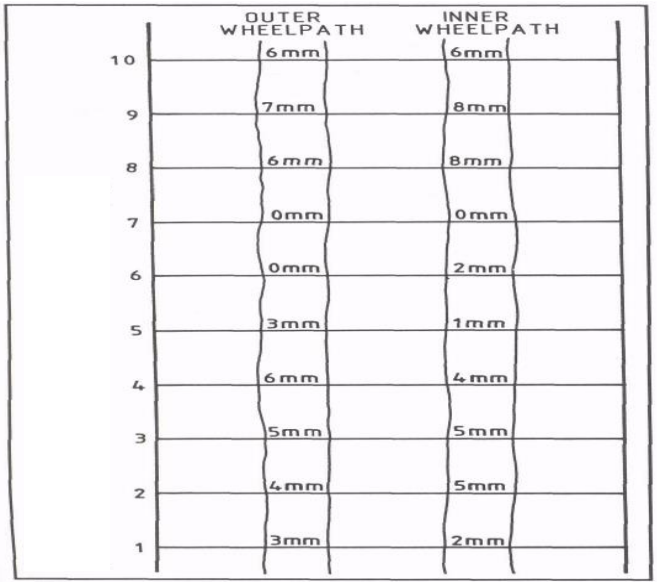
Example:(Assessed within single lane over the 1st 10 slabs - See diagram "Sealant in Joints")

MEASUREMENT

The length of deteriorated joint are recorded to one decimal place for each joint as shown in the example opposite. The length of deteriorated joint sealant cannot exceed the length of both transverse and longitudinal joints. The total length of the joints is not recorded, as this is equal to the lane width and slab length.



Measurement of Step Height



Faulting at Transverse Joints

FAULTING AT TRANSVERSE JOINTS

(Rigid Pavement)

Assessed over 1st ten transverse joints

DEFINITION

Joint faulting is defined as a difference in the levels of abutting concrete slabs at a transverse joint. This assessment is concerned with faulting at transverse joints (including planned cracks). Faulting at unplanned cracks and longitudinal joints should be reported separately in the comments field on the field worksheet.

METHOD

This item is rated over ten joints within the selected single lane beginning at the start of the segment. (Refer to "Procedure For Rating" in section C.7.2).

The "fault" is measured as the vertical displacement at each joint as indicated by a 1.2 m straight edge with 10 mm feet which is placed on the elevated slab with approximately 100 mm projecting over the lower slab as illustrated. The 10 mm feet are designed to allow for irregularities such as shoving of the asphalt at the joint or extrusion of the joint sealant thus not giving a flat surface from which to measure. The measurement is taken using the Measuring Wedge and reading from the 'FAULTING - RIGID PAVEMENT" scale which is painted the same color as the Faulting portion of the straight edge. The Measuring Wedge is used as close to the step as possible to avoid any local surface variations.

Two measurements, one in each wheel path, are made at each transverse joint of the lane within the single lane 50 m gauging length. If a joint is not stepped in one of the wheel paths, a measurement of "0" mm is recorded.

There will always be 20 measurements obtained from 2 wheel paths at 10 joints.

Where the joints are covered by an asphalt concrete overlay, the condition of the underlying pavement cannot be assessed and this should be recorded under the Rater's comments. However, assessment can be moved to assess the defects.

In the case of continuously reinforced concrete, which has no joints, the Faulting should be rated as 0.

Example: (Assessed over 1st ten transverse joints - See diagram "Faulting at Transverse Joints")

	Measurements		Average
Joint 1	3 mm	2 mm	2.5 mm
Joint 2	4 mm	5 mm	4.5 mm
Joint 3	5 mm	5 mm	5.0 mm
Joint 4	6 mm	4 mm	5.0 mm
Joint 5	3 mm	1 mm	2.0 mm
Joint 6	0 mm	2 mm	1.0 mm
Joint 7	0 mm	0 mm	0.0 mm
Joint 8	6 mm	8 mm	7.0 mm
Joint 9	7 mm	8 mm	7.5 mm
Joint 10	6 mm	6 mm	6.0 mm
	40 mm	+ 36 mm	= 76.0 mm

Where the overlaid asphalt is faulted, and reflects the condition of the underlying pavement, it should be rated and coded using the normal method.

Where the rigid pavement is covered by an asphalt overlay that is in good condition, the underlying pavement cannot be assessed and this should be recorded under the Rater's comments.

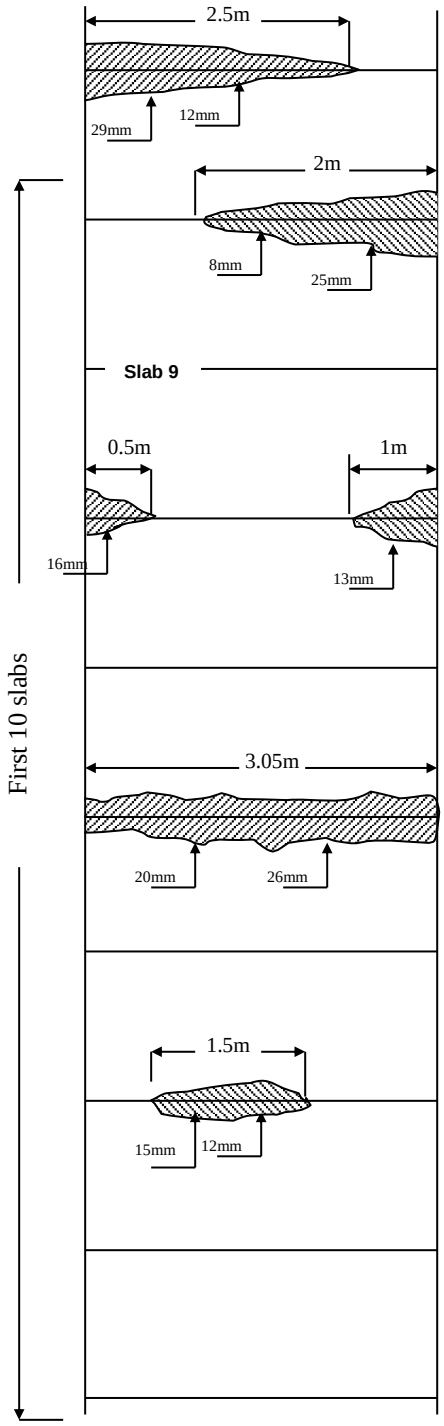
DISTRESS SCALES

SEVERITY

The severity of faulting is recorded as the step height over the first ten slabs and is recorded in units of millimeters as shown in the example opposite

EXTENT

The extent is calculated by the DES as the percentage of the joints with an average faulting ≥ 3mm in depth and is recorded to one decimal place.



Spalling at Joints

SPALLING AT JOINTS

(Rigid Pavement)

Assessed over 1st ten slabs

DEFINITION

Spalling is defined as the mark left of chipped-off concrete at joints. Breaking and chipping of discrete pieces of concrete. Spalling is measured at both the Transverse and Longitudinal joints. Spalling does not usually extend vertically through the whole slab thickness but tends to intersect a joint at an angle. Cracking at joints is not considered spalling but rated under the cracking item. The minor Spalling caused by the removal of forms during construction is not considered as Spalling for the purpose of these surveys. Any Spalling with a width of less than 10mm excluding the joint width will not be rated.

METHOD

This item is rated over ten joints within the selected single lane beginning at the start of the 50 meter gauging length. (Refer to "Procedure For Rating" in section C.7.2).

Two width measurements must be taken for each of the ten joints. A measurement is taken at the 1/3 point and 2/3 point along the length of the spalling, where there is only one length of spalling on the joint. Where spalling appears at both ends of the joint, on each side of an un-spalled length, a width measurement is taken at the center points along the length of the two spalls. If there are more than two areas of Spalling on a single slab then the average width of all the spalls must be recorded in both width columns. When a joint is not spalled, two width measurements of "0" mm are to be recorded.

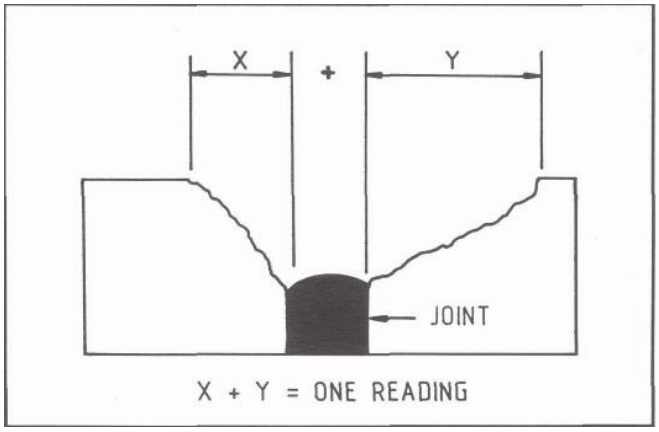
There will always be 20 width measurements obtained from 10 transverse joints.

When measuring the width of spalling at joints, the width of the joint gap is not included. When assessing Longitudinal joints only the Spalling in the lane being assessed is considered. See diagram on following page.

The length of spalling at each joint is recorded in meters. Where two or more lengths of spalling occur on the one joint, all lengths are combined. At any joint with no spalling, a length of "0" m is recorded for the "extent" calculation. For each joint both width measurements and the length measurement must be 0 or all three measurements must be greater than 0.

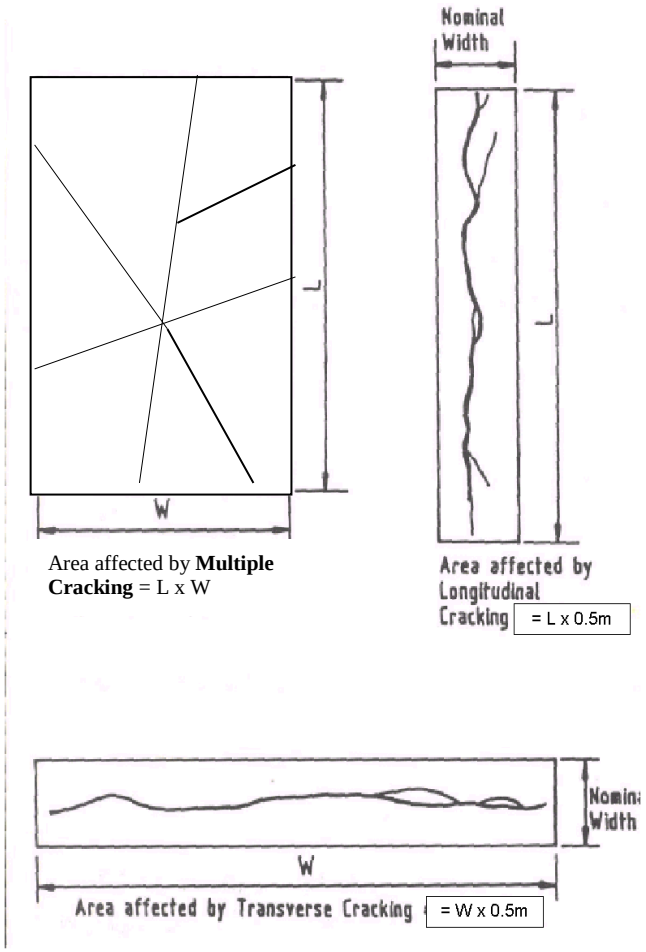
Where the joints are covered by an asphalt concrete overlay, the condition of the underlying pavement cannot be assessed and this should be recorded under the Rater's comments. However, assessment can be moved to assess the defects.

In the case of continuously reinforced concrete, which has no joints, the joint spalling should be rated as 0.



Spalling as Measured at Joint

The affected area of cracking at a location is defined to be rectangular in shape and dependent upon the extremities of the cracking. The affected area for single longitudinal cracking is calculated as the product of the length and a width of 0.5 m. If branching or meandering of the crack affects a more extensive width, then the affected width is used in the calculation. Similarly, the width of the area affected by transverse cracks is taken as 0.5 m unless more extensive. These calculations are done within the DES. The sketch illustrates this concept.



Multiple, Longitudinal and Transverse Cracking

PAVEMENT CRACKING

(Rigid Pavement)

Assessed over total area of segment

DEFINITION

Cracking is an indicator of rigid pavement breakup. The severity of cracking is determined by the crack width but hairline cracks are deemed not significant and are disregarded. Slabs that are considered shattered shall not be rated under cracking.

This pavement rating item includes all forms of cracking in rigid pavements. Identification of cracking requires careful examination of the pavement while on foot. It cannot be adequately recognized from a moving or stationary vehicle.

METHOD

This item is rated over the entire length of the segment. (Refer to "Procedure For Rating" in section C.7.2).

Pavement cracking over the whole segment is inspected on foot to allow assessment of severity and extent of cracking according to the defined scales. **Temperature cracks are not considered cracks but reflection cracks are rated as cracks. Cracks that are well sealed are still considered cracks with only narrow severity.**

Severity of cracking is rated according to the predominant average crack width as measured with the Crack Width Scale (see section 0) and using the Rigid Pavement marks.

If a segment has 6 lanes with multiple then the measurements will need to be recorded on separate pages.

The number of Cracked Slabs is also recorded on the form (excluding Shattered Slabs – see page 54).

In the case of continuously reinforced concrete the cracked areas must be rated as equivalent cracked slabs. Every 4.5m cracked per lane width is equivalent to one cracked slab.

Photos of Multiple Cracks

;

Example:

The following cracks were found;

In the first 100m - Longitudinal cracks of 3.0m (narrow), Multiple cracks in lane 1 and length of 9.0m and another in lane 4 and 4.5m long both with a narrow severity.

In the second 100m - Longitudinal cracks of 2.0m (Wide), Multiple cracks in lane 2 and 18.0m long with a severity of narrow.

In the third 100m - Longitudinal cracks 1.5m long (Narrow) and Transverse cracks 2.0m long (narrow).

In the fourth 100m - Longitudinal cracks 3.0m long (Wide) and Transverse cracks 2.0m long (narrow).

These cracks will be recorded on the form as shown in the following table.

Cracking Concrete Pavement										
Longitudinal	Length	3.0	2.0	1.5	3.0					
	Severity	N	W	N	W					
Multiple	Width	Length and Severity								
		100	200	300	400	500	600	700	800	900
	Lane 1	9.0								
	Lane 2		18.0							
	Lane 3									
	Lane 4	4.5								
	Severity	N	N							
Transverse	Length			2.0						
	Severity			N						
Number of Cracked Slabs		4	5	2	1					

DISTRESS SCALES

Note: Wherever a condition has an "Extent" of 0%, no code is entered for "Severity".

SEVERITY

The severity of distress is:

Narrow 'N' ≤ 3 mm average crack width

Wide 'W' > 3 mm average crack width

The severity is the predominant severity.

EXTENT

The length of cracks is recorded in meters for Longitudinal and Transverse cracks. The length of Multiple cracks is recorded in meters per band width.

The percentage of slabs cracked is calculated by the DES.

SHATTERED SLABS

(Rigid Pavement)

Assessed over total area of segment

DEFINITION

Shattered slabs are slabs that are badly cracked or disintegrating. **Slabs are normally considered shattered if a slab is damaged to an extent where it needs to be re-blocked. Shattered slabs may have only one (1) severe crack but with base failure and/or settlement/displacement**. Slab damage caused by a Road Slip or Cut is not to be rated under this item. A shattered slab covered with a seal may be assessed under this item.

METHOD

This item is assessed over the total carriageway area of the segment. (Refer to "Procedure For Rating" in section C.7.2).

Shattered slabs are rated according to the number of slabs affected within the carriageway area **for each lane** over the total length of the section.

MEASUREMENT

This item is a count of failed slabs. In the case of continuously reinforced concrete the shattered areas must be rated as equivalent shattered slabs. Every 4.5m shattered per lane width is equivalent to one shattered slab.

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment there are 2 shattered slabs in lane 1, 3 shattered slabs in lane 3 and 1 shattered slab in lane 4. In the second 100m segment there are no shattered slabs. There are 4 shattered slabs in lane 2 in the third 100m segment. These shattered slabs will be recorded as follows:

	Number of Slabs									
	100 200	200	300	400	500	600	700	800	900	1000
Lane 1	2									
Lane 2			4							
Lane 3	3									
Lane 4	1									

ROAD SLIP/CUT

(Rigid Pavement)

Assessed over total area of segment

DEFINITION
Road Slip/Cut is a serious problem due to slope failure and requires immediate attention.

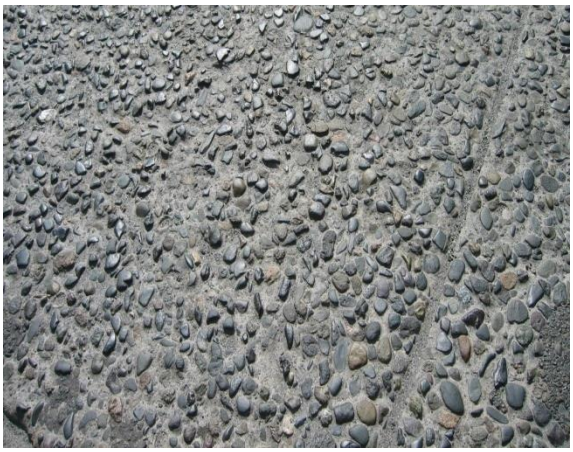
PURPOSE
Road Slip/Cut should be fixed in a matter of weeks and as such, is of little value to the long-term determination of maintenance strategies. This item is not included in the VCI calculations but is included as a warning that immediate attention is required.

METHOD
This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box if there are any Road Slip/Cut present irrespective of the number of occurrences per segment.

Example: (Assessed over total carriageway area of segment)

In the first 100m of a segment there is 70m of minor scaling in lane 1, in the second 100m there is 20m of minor scaling in Lane 1 & lane 2 and in the fourth 100m segment there is 80m severe scaling in lane 4. The scaling will be recorded as follows:

Width	Length (m)									
	100	200	300	400	500	600	700	800	900	
Lane 1	70	20								
Lane 2		20								
Lane 3										
Lane 4				80						
Severity	M	M		S						



Example: Severe Scaling – rough texture

Examples:

Scalling:

WEARING SURFACE

Assessed over total area of segment

DEFINITION

This is a distress that only occurs on rigid pavements.

Scaling and Polishing are the disintegration or loss of concrete from the surface of the pavement. Initially only fine aggregate and mortar is lost but large aggregate is also lost when the defect becomes more severe. Scaling and Polishing are caused by poor quality concrete, improper finishing techniques or traffic abrasion.

Map cracking, temperature cracks and pop-outs can also be rated for wearing surface defects with minor severity.

METHOD

This item is assessed over the total carriageway area of the segment. (Refer to "Procedure For Rating" in section C.7.2).

Although initially assessed from a slow moving vehicle, closer inspection of the suspected affected areas might be required.

MEASUREMENT

The length of scaling defect per width band is rated per 100m lengths. If a segment has 6 lanes with Scaling then this is recorded in each lanes.

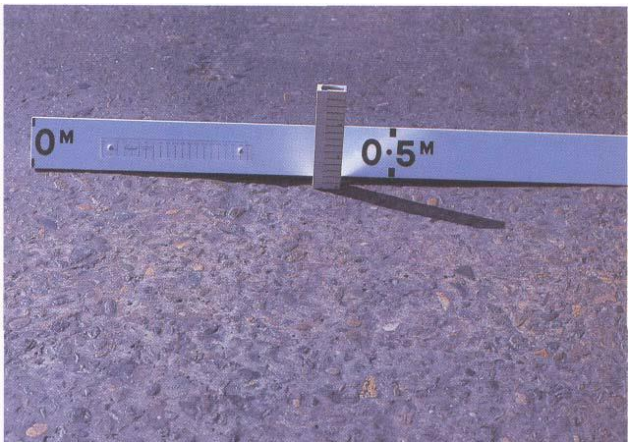
SEVERITY

The severity of distress is:

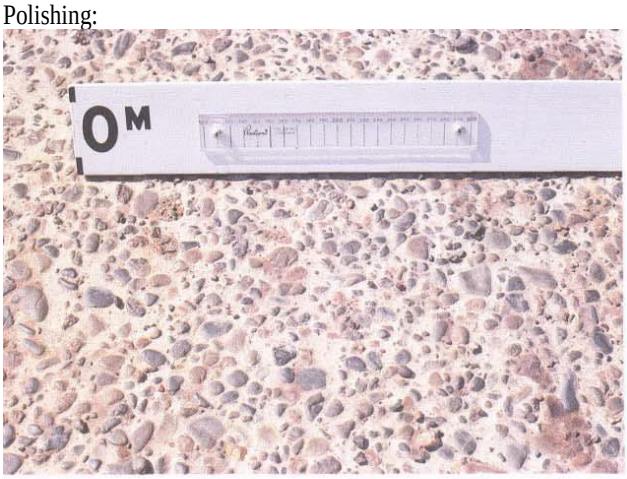
Minor 'M' = Surface still relatively smooth with only some loss of fine aggregate

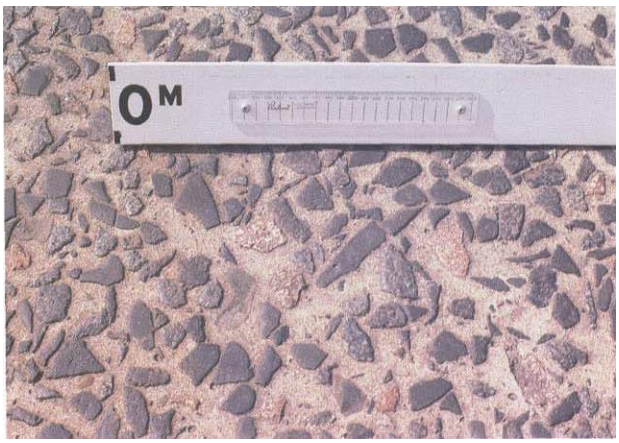
Severe 'S' = Surface rough or pitted with both fine and coarse aggregate lost

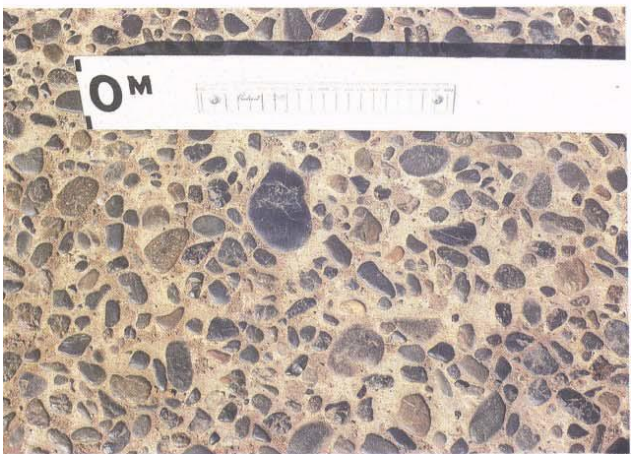
The severity is the predominant severity.



Polishing:







[5]

[5] *Pictures from: A guide to the Visual Assessment of Pavement Condition, Austroads, 1987*

UNSEALED ROADS

Rating of unsealed roads is to be assessed in conjunction with an experienced maintenance supervisor familiar with the particular road's history of performance and deterioration characteristics.

Unsealed roads are to be rated under five separate condition items. The items are Gravel Thickness, Gravel Quality, Crown Shape, Drainage and Road Slip/Cut.

Both Gravel roads and Earth roads are considered Unsealed Roads. Earth roads are formed only and have no imported material. Gravel roads are both formed and surfaced with an imported material and are rated on both formation and pavement condition items.

- Gravel thickness in the wheel path is taken at regular sample representative locations at points approximately 500 meters apart along the segment length.
- Quality of materials refers to the type, suitability and effectiveness of material present on the surface. (% of fines, loose stones.)
- Crown Shape is determined to be the height of the center of the road above the edge of the road.
- Roadside Drainage refers to the ability of water to drain away from the road.

UNSEALED ROADS

Note:

Appropriate Condition Score

The chosen condition rating should reflect the predominant condition over the total segment length.

GRAVEL THICKNESS

Assessed over total length of segment

DEFINITION

This component applies only to unsealed roads that are surfaced with an imported material i.e. gravel roads. If the road has not been surfaced with imported gravel then the road is an earth road and the gravel thickness is 0mm and rated with a condition score of 4.

METHOD

To determine the thickness closer inspection (exit vehicle) at regular representative intervals (500m) is necessary. This inspection may involve digging test holes in the pavement wheelpath.

The condition score is the number against the condition description which best describes the predominant condition of gravel thickness existing over the total segment length. If there are isolated areas that vary from the rest of the segment then these can be noted under “Raters Comments”.

CONDITION SCORE

1

Sufficient Gravel - Depth of gravel > 100mm

2

Isolated sub-grade exposure (<25%) - Depth of gravel 50 > 100mm

3

Moderate Sub grade exposure (25-75%) - Depth of gravel 25 > 50mm

4

Extensive Sub-grade exposure (>75%) - Depth of gravel 0 > 25mm

Note:

Appropriate Condition Score

The chosen condition rating should reflect the predominant condition over the total segment length.

MATERIAL QUALITY

Assessed over total length of segment

DEFINITION

If an unsealed road has been surfaced with in imported gravel then this gravel quality is rated along with any sub-grade that has been exposed, in the case of an earth road the in situ material is rated.

METHOD

To determine the material quality closer inspection (exit vehicle) at regular representative intervals (500m) is necessary.

The condition score is the number against the condition description which best describes the predominant condition of material quality existing over the total segment length. If there are isolated areas that vary from the rest of the segment then these can be noted under "Raters Comments".

CONDITION SCORE

1

Good Material Quality – even size distribution with sufficient plasticity to bind the material – no significant oversize material (>50mm is considered oversize)

2

Fair Material Quality – loose material or stones clearly visible (Poor grading and/or Plasticity too low)

3

Poor Material Quality – Poor particle size distribution with excessive oversize material - Plasticity high enough to cause slipperiness or low enough to cause excessive loose material resulting in loss of traction

4

Bad Material Quality – Poorly distributed range of particle sizes – Zero or excessive plasticity – safety hazard – Excessive oversize

Note:

Appropriate Condition Score

The chosen condition rating should reflect the predominant condition over the total segment length.

CROWN SHAPE

Assessed over total length of segment

DEFINITION

Crown Shape is determined to be the height of the center of the road above the edge of the road. This determines the ability of the road to shed water from it surface.

METHOD

The height difference between the center of the road and the edge of the road is estimated and not actually measured. If there are isolated areas that vary from the rest of the segment then these can be noted under "Raters Comments".

CONDITION SCORE

1

Good Camber – >2% crossfall – no significant ponding

2

Flat Camber – crossfall mostly <2% - some unevenness

3

Uneven Camber – No crossfall – Depressions common and drainage impeded

4

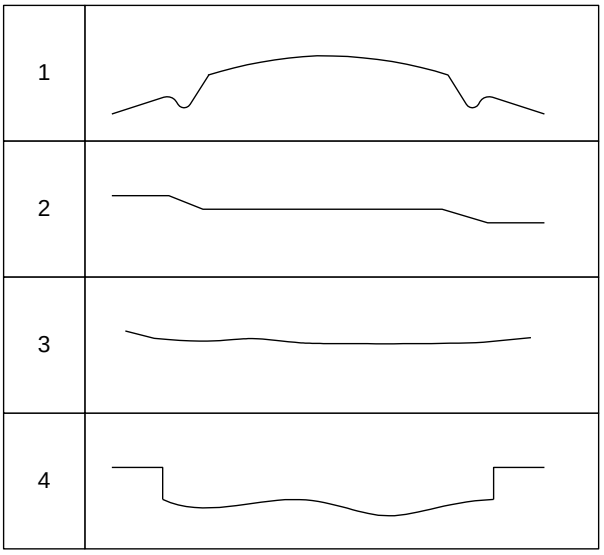
Very Uneven Camber – Extensive Ponding – Water tends to flow on the road

Note:

Appropriate Condition Score

The chosen condition rating should reflect the predominant condition over the total segment length.

The following diagram gives a graphic example for the different ratings.



ROADSIDE DRAINAGE

Assessed over total length of segment

DEFINITION

Roadside drainage is determined to be the height of the side of the road above the side drains or adjacent ground level. This item determines the ability of the roadside drainage to remove water away from the side of the road. This can be done by means of side drains, turn out drains or by having side slopes which lead the water away from the road

METHOD

The condition score is the number against the condition description which best describes the predominant condition of drainage existing over the total segment length. If there are isolated areas that vary from the rest of the segment then these can be noted under “Raters Comments”.

CONDITION SCORE

1

Good - Road edge well above side drains/ground level – well defined side drains or sufficient side slopes to drain water

2

Fair - Road edge level with side drains/ground level – ineffective side drains – water can cross the road in many places

3

Poor - Road edge slightly below ground level – no side drains or totally blocked side drains – some ponding of water

4

Bad - Road edge well below ground level – road serving as a drain to surrounding areas

ROAD SLIP/CUT

(Unsealed Pavement)

Assessed over total area of segment

DEFINITION
Road Slip/Cut is a serious problem due to slope failure and requires immediate attention.

PURPOSE
Road Slip/Cut should be fixed in a matter of weeks and as such, is of little value to the long-term determination of maintenance strategies. This item is not included in the VCI calculations but is included as a warning that immediate attention is required.

METHOD
This item is assessed over the total carriageway area of the segment and is rated simply by checking the supplied box if there are any Road Slip/Cut present irrespective of the number of occurrences per segment.

DRAINAGE

All of the items covered in Section E.4 to Section E.5 are OTHER ITEMS. These items are assessed from a slow moving vehicle and the existing conditions on both sides of the road are observed in each direction over the total length of the segment.

When returning to the selected 50 meter gauging length, the items may be inspected more closely if necessary. The average condition of the items is assessed and rated according to the condition descriptions. The appropriate condition score is then assigned.

OTHER ITEMS are assessed and rated from a maintenance perspective. They are rated to determine the need for maintenance treatments that will prolong the pavement lifespan. The consequential effect is an improved and better maintained road which enhances road user safety.

These hazardous conditions should be reported as soon as possible to the relevant authority for action to be taken.

SIDE DRAINS

Assessed over total length of segment

DEFINITION
Side drains provide for drainage of the road pavement and shoulder and condition is rated according to their ability to collect and discharge water runoff.

METHOD
The total length of provided drain on both edges of the road is inspected over the length of the segment.

The condition score is the number against the condition description which best describes the average condition of side drains existing over the total segment length.

This item is of importance for the determination of the needs in routine maintenance.

CONDITION SCORE

1
Adequate shape and depth.
Negligible scour, siltation or vegetation.
Correct Longitudinal grade.

2
Pavement runoff not affected
Obstruction (siltation, vegetation, scour) <30mm in drain waterway

3
Slight obstruction 30 < 50mm to runoff entering drain
Obstruction (siltation, vegetation, scour) 30 < 50mm in drain waterway.

4
Moderate obstruction 50 < 100mm to runoff entering drain
Obstruction (siltation, vegetation, scour) 50 < 100mm in drain waterway

5
Extreme Obstruction >100mm to runoff entering drain
Obstruction (siltation, vegetation, scour) >100mm in drain waterway

Note:

Special Considerations

Unsealed shoulders are not rated if the seal extends for more than 0.5 meter outside a painted edge line. Where this occurs, the road is deemed to have a sealed shoulder and this sealed shoulder is rated accordingly.

Occasionally a segment will have an unsealed shoulder on one side and a sealed shoulder on the other or have a sealed shoulder in the beginning of the segment and an unsealed shoulder at the end of the segment. In these circumstances, both the unsealed and sealed shoulder is rated. Comments regarding the length or position of shoulders can be recorded in the comments field. The purpose of a shoulder is to provide support to the carriageway area on which the traffic is designed to run. A poor shoulder condition contributes to the break down in structural condition of the designed carriageway area.

Therefore shoulders are rated on their pavement support role not their safety aspect.

SHOULDERS

UNSEALED SHOULDERS

Assessed over total length of segment

DEFINITION
Unsealed shoulders provide a hard and safe surface for occasional use by vehicles and to provide for drainage of surface runoff.

METHOD
The total length of unsealed shoulder on both edges of the road is inspected over the length of the segment.

The condition score is the number against the condition description which best describes the average condition of unsealed shoulders existing over the total segment length.

CONDITION SCORE

1
Adequate crossfall for drainage - Compact gravel - No loose stones - No scouring

2
No restriction to surface runoff - Minor scouring <25mm - Loose stones <30% of shoulder area -Adequate crossfall

3
Slight restriction to surface runoff - Scouring 25 < 40mm - Soft patches <10% of area - Loose stones covering >30% of area - Inadequate crossfall

4
Moderate restriction to surface runoff - Scouring 40 <80mm - Soft patches 10 < 50% of area - Inadequate or exaggerated crossfall - Loose stones 30 < 50% area

5
Major restriction to surface runoff - Scouring >80mm - Soft patches > 50% of area - Loose stones > 50% area - Inadequate or exaggerated crossfall

SEALED, ASPHALT SURFACED AND CONCRETE SHOULDERS

Assessed over total length of segment

DEFINITION

A sealed shoulder is only rated if it has a width of 0.5m or greater. Defective areas may be potholed, unsuccessfully patched, deformed, faulty or stripped.

METHOD

For this item, the total length of shoulder on both edges of the road is inspected over the length of the segment.
It is the surfaced area within the first two meters outside the painted edge line that is assessed to determine average condition. Shoulders are generally constructed up to a maximum of 2m width, beyond 2m is classified as parking.

If the condition score varies greatly between left and right shoulders (in the direction of increasing chainage), a separate score for each shoulder is required in the field worksheet comment field, i.e. left shoulder - 2, right shoulder – 5. Only the worst score is recorded under Sealed Shoulder. (See note in section 0 concerning the combination of sealed and unsealed shoulders.)

The condition score is the number against the condition description which best describes the average condition of sealed shoulders existing over the total segment length.

CONDITION SCORE

1
Defective area 0 - <2% , (defective area/area of the shoulder x 100)

2
Defective area 2 - <5%

3
Defective area 5 - <15%

4
Defective area 15 - 25%

5
Defective area > 25%

VEGETATION CONTROL

Assessed over total length of segment

DEFINITION

Vegetation control is generally defined as all works required to control and maintain vegetation within the road reserve. Vegetation include all plant life growing within the right of way, including but not limited to grass, weeds, scrub, shrubs, trees and overhanging branches.

Areas in which vegetation control are required include: unsealed shoulders, traffic islands, medians, areas for sight distance, side drains, embankments, side slopes.

METHOD

For this item, the yearly requirements in terms of vegetation controls on both edges of the road are estimated over the length of the segment.

The condition score is therefore the number of vegetation controls required for maintaining the vegetation of the segment in excellent condition.

CONTROL SCORE

0

No vegetation control required over the segment length

1

One Vegetation control required: e.g. grass cutting/mowing on unpaved shoulders; grass cutting on side drains; trimming of side slopes; or cutting of overhanging branches on ROW

2

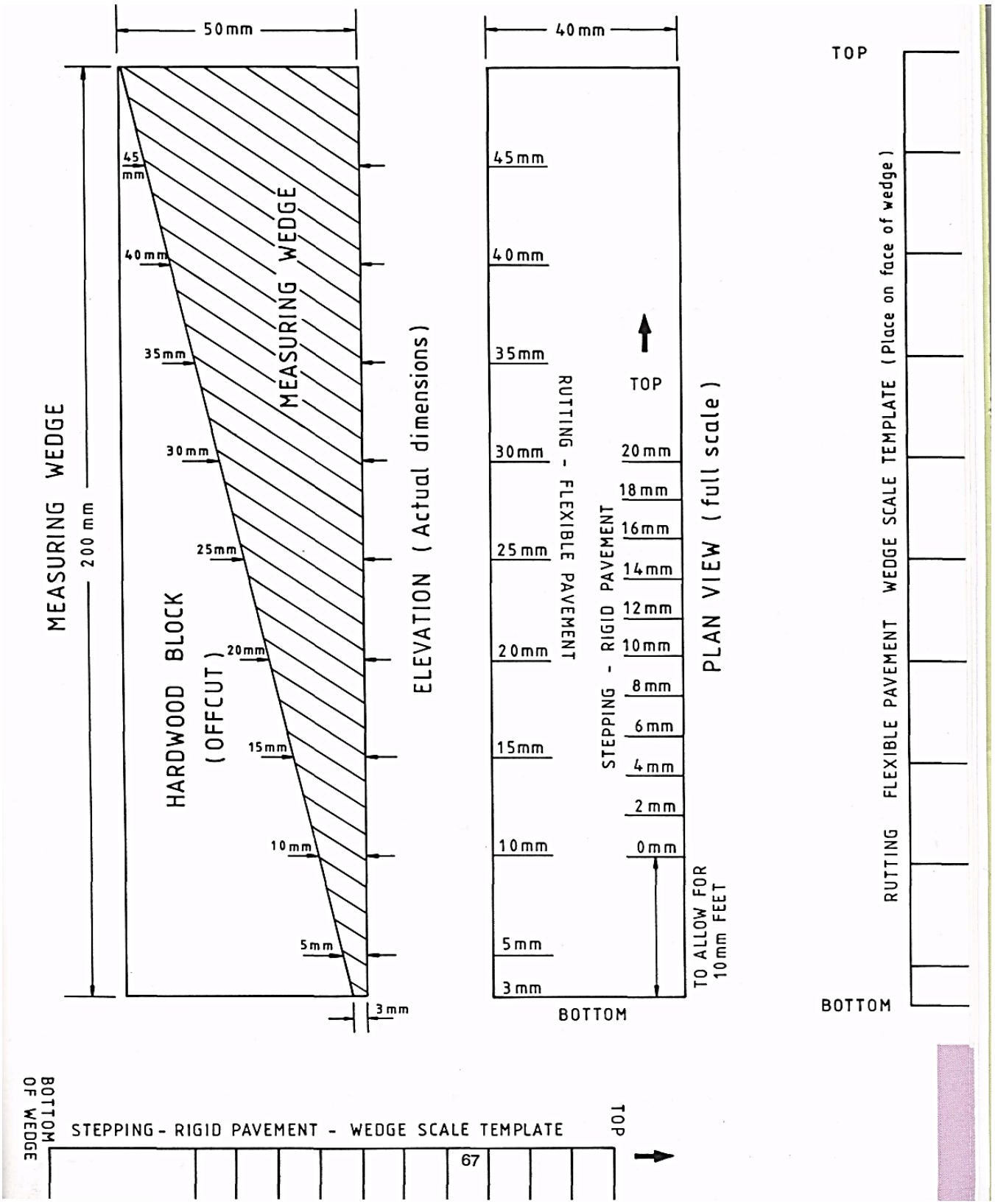
Two vegetation controls required

3

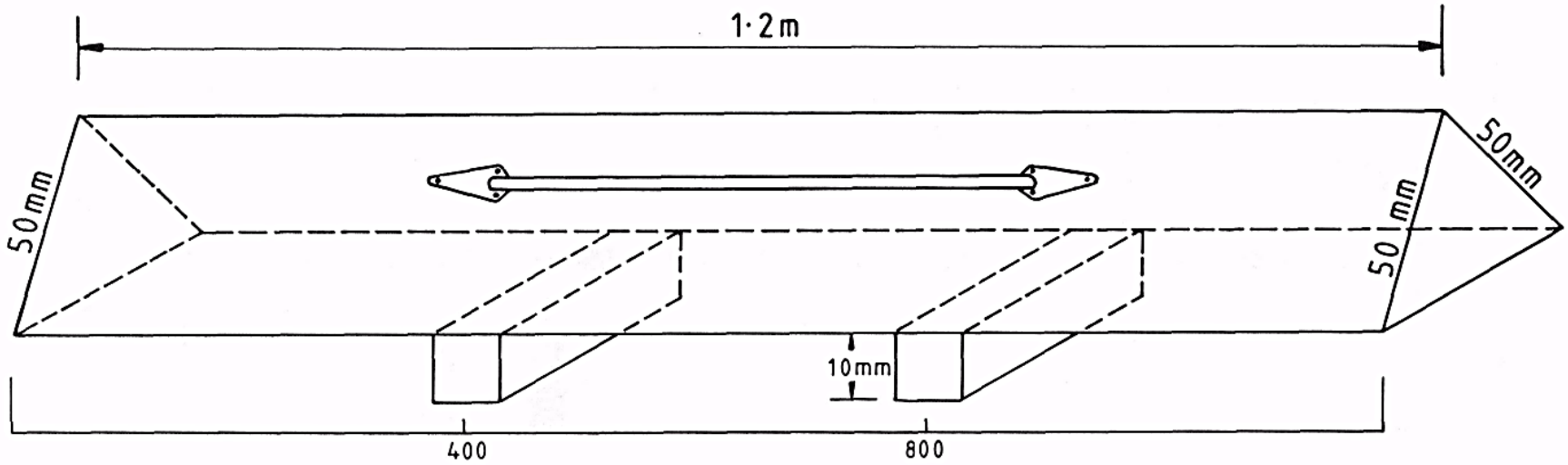
Three or more vegetation controls required

F. EQUIPMENT, DRAWING & TEMPLATES

STRAIGHT EDGE (1.2M) AND WEDGE

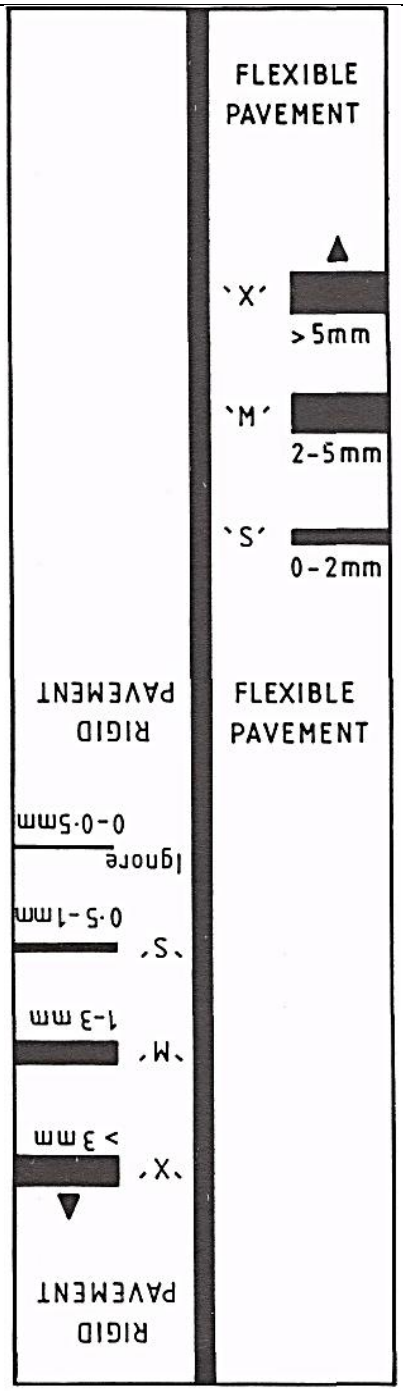


STRAIGHT EDGE



- Measuring beam must be exactly 1.2m long
- It should be constructed from hardwood timber offcuts
- For measuring stepping on Rigid Pavements it is recommended that two 10mm high feet be attached at the 400mm and 800mm points on one face to allow for AC overlay shoving or joint extrusion. The feet must not protrude from the sides of the face. The Rigid Pavement Wedge is then used to measure the stepping at transverse joints.
- A handle may be added for convenience of carrying, ensuring that one side remains flat when laid on the surface.

TEMPLATE FOR CRACK WIDTH SCALE



- Test the crack gap by working from narrowest to widest mark width
- Align bottom of mark with one side of crack
- The first mark wide enough to cover .the crack gap will show the correct "severity" code
- Ensure correct pavement type scale is used
- These are full scale drawings and should not be altered or reduced
- It is recommended that this be copied and pasted to a sheet of cardboard for durability

G.ROCOND DATA EVALUATION

Introduction

The Visual Condition Index (VCI) formula computes all the different road defects collected with RoCond into a single factor, ranging from 0 to 1, for each pavement type (concrete, asphalt and gravelearth). The formula applies different weight factors to road distresses in order to take into account their respective impact on the pavement condition.

The VCI is one of the Key Performance Indicators (KPI) used to assess the effectiveness of the asset preservation process. Therefore, its formula should remain unchanged to allow for the analysis of pavement condition over time.

While the VCI provides a very convenient tool to estimate the condition of a road segment, and more generally of the entire national network, the VCI should not be used as a single decision factor to determine maintenance options, in substitution of HDM-4 or of a multi-criteria analysis including other key inputs such as traffic, available budget and history of maintenance. It should also not be used in isolation as a determining factor to validate project proposals for rehabilitation, reconstruction or overlay. These decisions should be based on analysis of the most relevant defects.

Asphalt VCI Formula

Each Distress has a Weight Factor (Wf) as shown in Table 4. The first step in the calculation is to determine a weighted value for each distress. Edge Break, Wearing Surface and Cracking have additional severity ratings, which must also be considered. Edge Break severity is rated as Large, medium or small, the rating must be multiplied by 3 for large, 2 for medium and 1 for small extent before the weight factor can be applied.

Wearing Surface has separate weight factors for Minor and Severe Wearing Surface. Cracking has separate weight factors depending on the type and severity of the crack.

Table 4
Distress weight factors for Asphalt VCI

Distress	Weight factor
Cracking - Crocodile - Narrow	3.5
Cracking - Crocodile - Wide	5.9
Cracking - Transverse - Wide	5.5
Cracking - Transverse - Narrow	3.3
Edge Break (large)	1.25
Edge Break (medium)	0.82
Edge Break (small)	0.41
Patching	1.25
Potholes (number)	0.36
Surface Failures	0.18
Rutting (RDM)	4
Wearing Surface - Minor	0.55
Wearing Surface - Severe	1.2

Each segment can have only one type of cracking. The first part of the formula determines the sum of the weighted distresses.

With SDWf the sum of weighted distresses:

SDWf=(Cracking*Wf)+(Edge Break*Wf)+(Patching*1.25)+(Potholes*0.36)+(Surface Failures*0.18)+(Rutting RDM*4)+(Wearing Surface defects*Wf)

[1] Choose the relevant weight factor for cracking dependant on the type and severity
[2] Choose the relevant weight factor for Edge Break dependent on the severity
[3] Choose the relevant weight factor for Wearing Surface dependant on the severity

The final step is to calculate the VCI.

VCI=MAX(0,(100*(1-SQRT(1-((100-(MIN(300,SDWF)/3))100)^2))))

Concrete VCI Formula

Each Distress has a Weight Factor (Wf) as shown in Table 5. The first step in the calculation is to determine a weighted value for each distress. Scaling has separate weight factors for Minor and Severe Wearing Surface.

Cracking has separate weight factors depending on the type and severity of the crack.

Table 5
Distress weight factors for Concrete VCI

Distress	Weight factor
Cracking - Multiple – Narrow	3.6
Cracking - Transverse – Wide	5.5
Cracking - Transverse – Narrow	3.5
Spalling (spalling severity)	3
Faulting (faulting average)	4.2
Shattered Slabs (number)	1.36
Scaling – Severe	1.2
Scaling – Minor	0.55
Joint Sealant Deterioration	0.13

Each segment can have only one type of cracking. The first part of the formula determines the sum of the weighted distresses. With SDWf as the sum of weighted distress:

SDWf = (Cracking*Wf)+(Spalling*3) +(Faulting*4.2)+(Shattered Slabs*1.36)+(Joint Sealant*0.13)+(Scaling*Wf)

[1] Choose the relevant weight factor for cracking dependant on the type and severity
[2] Choose the relevant weight factor for scaling dependant on the severity

The final step is to calculate the VCI.

VCI=MAX(0,(100*(1-SQRT(1-((100-(MIN(300,SDWF)/3))100)^2))))

Gravel VCI Formula

Each Distress has a Weight Factor (Wf) as shown in Table 6. The first step in the calculation is to determine a weighted value for each distress. The formula is exactly the same for Earth roads.

Table 6
Distress weight factors for Gravel VCI

Distress	Weight factor
Gravel Thickness	10
Gravel Quality	12
Crown Shape	8
Drainage from Road	6

The first part of the formula determines the sum of the weighted distresses.

SDWf(Sum of weighted distress) = (Gravel Thickness*10)+(Gravel Quality*12) +(Crown Shape*8)+(Drainage from Road*6)

The final step is to calculate the VCI.

VCI=MAX(1,(100-(SDWf-SWf))

Where SWf is the sum of the weight factors (36)

Segment Condition

The VCI value determines the condition of the segment assessed **(*see*** Table 7 ***below*)**.

Table 7
VCI Categories

VCI Ranges	Condition Rating
1 – 20	Bad
20.1 – 40	Poor
40.1 – 70	Fair
70.1 – 100	Good

Road Condition with Recommended Treatment Measures

The road rating/condition with the corresponding general condition and treatment measures is shown in Table 8 below:

Table 8
Road Condition with Recommended Treatment Measures

Road Condition	Treatment Measures
GOOD	Little or no maintenance required (routine maintenance)
FAIR	Needs some partial/full depth repairs (preventive maintenance)
POOR	Needs extensive full depth repairs, some full slab replacement/Rehabilitation
BAD	Needs to rebuilt pavement (Total Reconstruction)