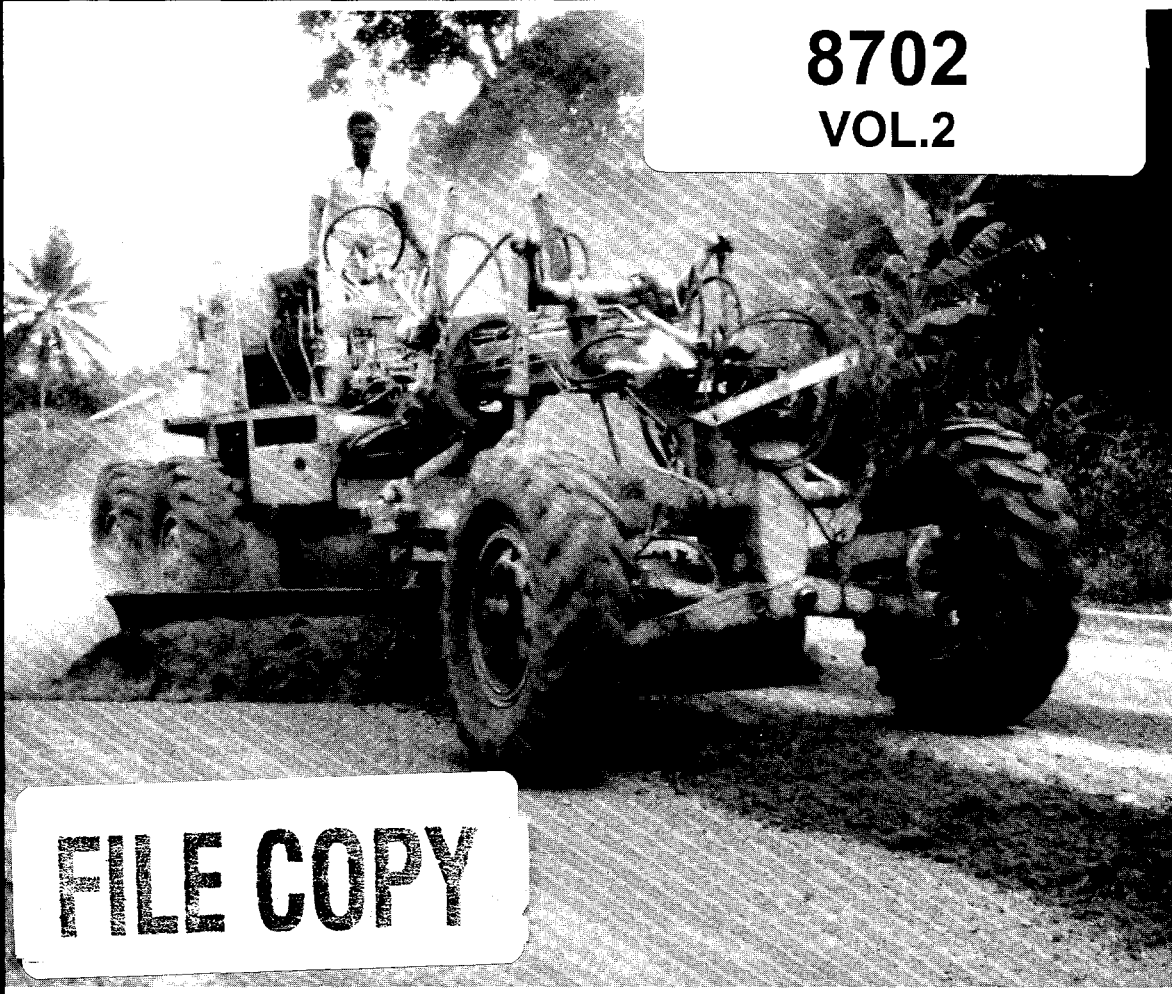


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VOL.2



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**ROAD MONITORING
FOR
MAINTENANCE MANAGEMENT**

VOLUME 2

damage catalogue for developing countries



WORLD BANK

PARIS 1990



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ROAD TRANSPORT RESEARCH

**ROAD MONITORING
FOR MAINTENANCE MANAGEMENT**

VOLUME 2

damage catalogue for developing countries

**REPORT PREPARED BY
AN OECD SCIENTIFIC EXPERT GROUP
IN CO-OPERATION WITH THE WORLD BANK**

The findings, interpretations, and recommendations in this study are the results of joint research by the OECD's Road Transport Research Programme and the World Bank. The report has been approved by the 23 governments participating in the Steering Committee of the OECD Road Transport Research Programme, i.e. all OECD Member governments except New Zealand. The report, however, does not necessarily reflect the views of the World Bank, its Board of Executive Directors, nor the countries they represent, other than those represented on the OECD RTR Steering Committee.

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Pursuant to article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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VOLUME 2

CATALOGUE DE DÉGRADATIONS
POUR LES PAYS EN DÉVELOPPEMENT

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FOREWORD

The OECD Road Transport Research Programme has two main fields of activity:

- The international co-operation in road and road transport research to provide scientific support for decisions by governments and international governmental organisations, and to assess future strategies concerning roads and road transport problems and the priority policy concerns of OECD Member countries;
- The information and documentation programme (IRRD -- International Road Research Documentation), a co-operative scheme that provides a mechanism for the systematic world-wide exchange of information on scientific literature and current research programmes.

In order to assist development aid agencies and highway administrations in third world countries, one of the priorities of the Programme's scientific and technical activities is on the maintenance management of road infrastructure and the evaluation of traffic safety measures and strategies in developing countries.

This report contains a Road Damage Catalogue which is an essential tool for quantifying maintenance needs in developing countries. It is a complement to a larger study on road condition surveys and inspections published separately. The "Road Monitoring Manual" and the "Damage Catalogue" should help in improving maintenance practice and cost effectiveness of road maintenance operations in developing countries.

DEDICATION

This work is dedicated to Per Fossberg of the World Bank and David Brooks of the Overseas Unit of the U.K. Transport and Road Research Laboratory, both of whom died in 1989, in recognition of their outstanding contribution to international co-operation and to advancing road technology and maintenance in the developing world.

ABSTRACT

IRRD No. 826026

The OECD Scientific Expert Group on "Pavement Monitoring Systems for Developing Countries" was created to prepare, in co-operation with the World Bank, a manual for road pavement inspection applicable to Third World countries' conditions. The booklet contains a catalogue of the various types of road deficiencies most commonly found in developing countries. First it covers damage to be rated in road condition surveys relative to: (1) road surfacings, (2) drainage, shoulders and road space, (3) road signs and furnitures, as well as (4) structures. Secondly, the catalogue covers damage to be rated in detailed visual inspections of both (1) unpaved and (2) paved roads. For each type of damage the catalogue contains a sheet presenting (1) a description and definition, illustrated by a photo, suitable inspection methods and rating criteria and (2) information on probable damage causes and factors and possible remedies. The catalogue is a complement to the full report on "Road Monitoring for Maintenance Management: A Manual for Developing Countries".

Subject classification: 60

Fields: Maintenance

Keywords: Surveillance, manual (book), highway, developing countries, data acquisition, data processing, surfacing, evenness, damage, inventory, apparatus (measuring), evaluation (assessment), deterioration, road network

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I. INTRODUCTION

To obtain evaluations as objective as possible and which are suitable for qualified personnel, it is mandatory to base visual inspections/surveys on a reference document such as a damage catalogue. The catalogue presented in this booklet comprises a number of sheets corresponding to those parameters which are evaluated and damage which most frequently occur in paved and unpaved roads. Figure 1 shows the position of the damage catalogue in the general scheme.

The proposed survey/inspection procedure includes two evaluation levels requiring a precise identification and quantification of principal defects. Although high output measuring equipment, such as the "Bump Integrator" or the "Longitudinal Profile Analyser" (APL) (see Annex D of the Manual), may be used for a quick inspection of the road system, this manual is based on visual surveys/ inspections, completed by simple measurements.

The damage is divided into that inspected during the Road Condition Survey (RCS) and that inspected during the Detailed Visual Inspection (DVI).

II. DAMAGE SHEETS

For each type of damage, the catalogue contains a sheet consisting of two parts:

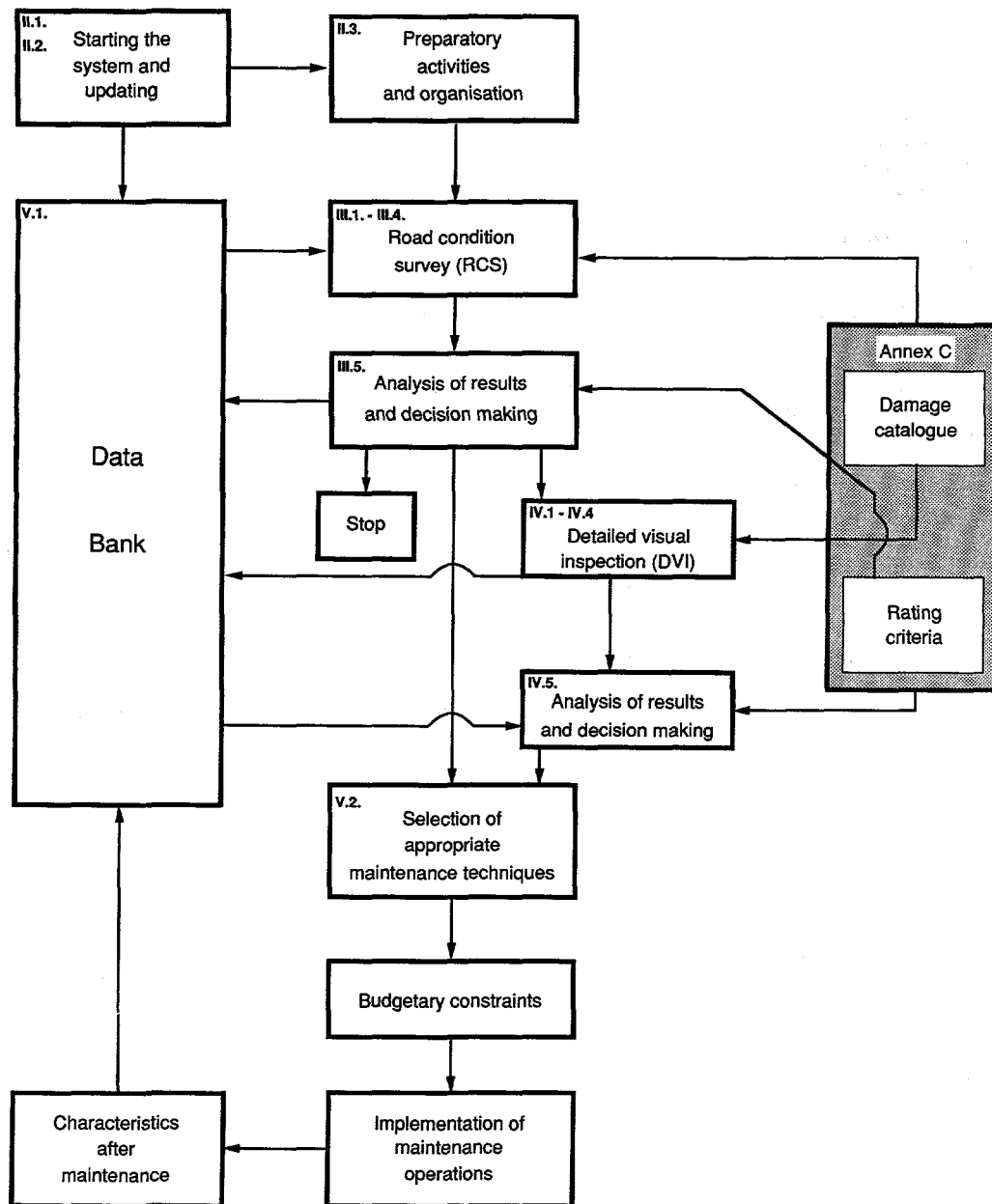
A. The first part contains information relative to surveys/inspections:

- A photo or illustration if possible of the damage in various stages;
- A detailed description of the damage;
- A description of inspection and/or proposed measurement methods;
- Quantitative criteria to record the extent and/or severity of the damage.

B. The second part contains the following information:

- Probable cause of the damage, preliminary symptoms and consequences, if no corrective maintenance actions are carried out;

Figure 1. POSITION OF THE DAMAGE CATALOGUE IN THE GENERAL SCHEME



- Factors affecting the development of the damage such as climate, traffic and materials;
- Proposed operations or remedies (divided into specific tasks), and taking into account the various causes leading to the present situation.

The last section is indicative only and the information given is summarised and incomplete. As such it should not be used by the maintenance department to define the maintenance activity to be undertaken. Other publications deal more specifically with maintenance and rehabilitation techniques and it is recommended to use these.

III. RATING OF DAMAGE

III.1. Road Condition Survey (RCS)

The classification of the carriageway or road surface condition is done on a five-point scale, based upon the criteria given in Annex B of the full Manual.

In addition to the damage affecting the road surfacing, the inspectors also evaluate the defects and damage of the drainage system and the area adjacent to the road (fill, etc.). This is done with a three-point rating system for roadside elements, road signs and furniture and structures in accordance with the description given on the relevant damage sheet.

The principles of this three-point system are that the values recorded for each element reflect the efficiency of routine and recurrent maintenance activities. The need for immediate intervention is based on considerations relating to road user safety and the stability of the road, embankment and structures. It is recorded in the "Remarks" section.

RATING CRITERIA

Value	Routine maintenance	Action
1	Satisfactory	Not necessary
2	To be checked	To be expected shortly
3	Not satisfactory	Necessary

III.2. Detailed Visual Inspection (DVI)

The rating of damage affecting the carriageway is based on two characteristics: extent and severity.

The extent may be defined as that part of the road affected by the damage.

For linear damage (rutting, edge distress, longitudinal cracks) the inspector estimates the length of the damage in proportion to the length of the sub-section.

For two-dimensional damage (corrugations, alligator cracking, peeling, bleeding, etc.) the inspector estimates the damaged area in proportion to the total area of the sub-section.

For both cases the proposed method distinguishes only three levels. These levels differ for the various types of defects and are given on the relevant sheet.

In this method, the severity of the damage is expressed as:

1. light;
2. moderate;
3. severe.

Purely superficial damage such as deposits of clay (CY) on unpaved roads or bleeding (BL) on paved roads cannot be quantified in terms of severity.

The significance of the damage is derived from a combination of the extent and severity. This is rated on a five-point scale established in matrices presented on the damage sheets. Apart from the defects CY and BL, all defects listed on Forms IV and V are assigned a value in accordance with the five-point rating scale. The defects CY and BL are assigned a value on the basis of their extent.

Note:

- It is of the utmost importance that the inspection teams have an intimate knowledge of the information contained in the damage catalogue.
- It is strongly recommended that, prior to actual inspection work, teams receive proper training related to the inspection programme (see Chapter VI of the full Manual).

SECTION 1

ROAD CONDITION SURVEY: ROAD PARAMETERS

Group	Type	No. of sheet	Rating levels	Section
Carriageway	Surface quality	-	5	Annex B
	Prevailing damage (if necessary)	-	-	3-4
Shoulders	Deformation	RCS 1	3	1
	Scour	RCS 2	3	
Side drains	Siltation	RCS 3	3	1
	Scour	RCS 4	3	
Road space	Debris/vegetation encroachment	RCS 5	3	1
	Obstacles	RCS 6	3	
Road signs & furniture; Road markings	Damaged and/or dirty, missing	RCS 7	3	1
Damage & defects to be repaired immediately	Various, to be mentioned under "Remarks"	-	-	3-4

The rating of the carriageway or road surface condition is based upon the criteria given in Annex B of the full report.

Figure 2. ROAD CONDITION SURVEY (RCS) FORM ("FORM II")

ROAD CONDITION SURVEY				ROAD DENOMINATION / CLASS:		Main Section No.	
				FROM:		Km:	
PAVED AND UNPAVED ROADS				TO:		Km:	
				Pavement type:		Pavement width: m	Section length: Km
OFFICE:		DISTRICT:		Summary (Avg. Condition)		Carriageway:	
Name of inspector:		Date:				Road side elements:	
Weather <input type="radio"/> Clear <input type="radio"/> Rainy		Carr.way: <input type="radio"/> Dry <input type="radio"/> Drying <input type="radio"/> Wet					

SUB-SECTION	○	○	○	○	○	○
Chainage of sub-section						

Roadside	L	R	L	R	L	R	L	R	L	R	L	R
Carriageway	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Prevailing damage												

Damage type	L	R	L	R	L	R	L	R	L	R	L	R
ROAD SIDE ELEMENTS	Shoulder	Deformation RCS1	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
		Scour RCS2	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Side drains	Siltation RCS3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	
	Scour RCS4	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	
Debris/Vegetation Encroachment RCS5	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Obstacles/Obstructions RCS6	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Average Condition (Others)	+ =		+ =		+ =		+ =		+ =		+ =	

ROADS/ SIGNS/ FURNITURE	L	R	L	R	L	R	L	R	L	R	L	R
Chainage												
Dirty RCS7	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Damaged RCS7	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
Missing RCS7	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3
	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3	1	2/3

REMARKS: _____

GROUP: SHOULDER TYPE: DEFORMATION



Rising shoulder due to spreading vegetation with localised road surface bumps.



Lowered shoulder due to erosion. Starting deformation of road surface edges.

DESCRIPTION:

The visual aspects may differ according to the type of deformation. Two cases are distinguished:
 Case a : the shoulder level is higher than the road surface level.
 Case b : the shoulder level is lower than the road surface level.

INSPECTION METHOD:

Visual recording and estimation of length of the deformed shoulder expressed as a percentage of the sub-section length.

RATING CRITERIA:

Value	Extent	Routine maintenance	Action
1	< 5 %	Satisfactory	Not required
2	5-50 %	To be checked	To be expected
3	> 50 %	Not satisfactory	Required immediately

GROUP: SHOULDER TYPE: DEFORMATION

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Case a:

- Accumulation of material from the road surface due to traffic and displacement by water
- Growth of grasses and bushes on unpaved shoulders
- Slope failures affecting the shoulder

Case b:

- Wear and deformation of shoulders caused by traffic and parking on shoulders in particular at soft spots and less compacted areas
- Strengthening of carriageway
- Slope failure of side drain due to erosion, water soaked embankment or embankment erosion
- Unforeseen settlement of embankment and subsequent damage of side drain and shoulder

REMARKS:

Following are the consequences of deformed shoulders:

Case a:

Ponding and infiltration of water on the side of the carriageway due to improper drainage of surface water; deformation of carriageway.

Case b:

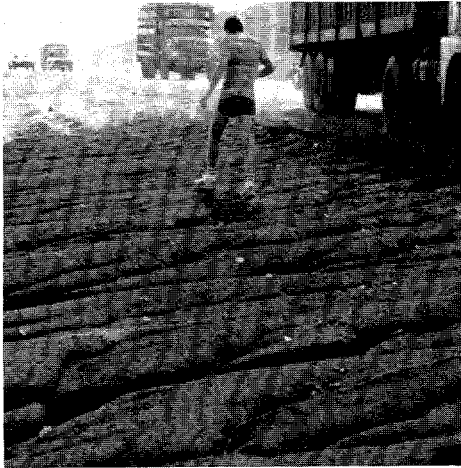
Ponding and infiltration of water on shoulders beside the carriageway. Deformation of carriageway; edge damage risks due to vehicle wheels. Dangerous for traffic.

In all cases rutting (PR 1b) and depressions (UR 3) will be generated.

POSSIBLE MAINTENANCE ACTIVITY:

- Reshape the shoulders to a lower level.
- Vegetation growth control.
- Protect slopes (in cut) against erosion.
- Refill shoulders.
- Make or repair outlets for side drains.
- Stop surface drainage over fill slopes and take protective measures against erosion.

GROUP: SHOULDER TYPE: SCOUR



Generalised erosion of shoulder



Erosion of shoulder and embankment

DESCRIPTION:

Two different types can be distinguished:

- a) Gullies perpendicular to the road axis cutting through the full width of the shoulder
- b) Longitudinal gullies, parallel to the road axis.

INSPECTION METHOD:

Visual recording and estimation of the eroded length expressed as a percentage of the sub-section length.

Value	Extent	RATING CRITERIA:	
		Routine maintenance	Action
1	< 5 %	Satisfactory	Not required
2	5-50 %	To be checked	To be expected
3	> 50 %	Not satisfactory	Required immediately

GROUP: SHOULDER

TYPE: SCOUR

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Erosion due to run-off of surface water.

The defect might be made worse by the flooding of the shoulder due to flooding of the side drain.

Main factors for the development of the defect are the erosive action of rain; the corresponding washing out of erodable soils; depends also on the topographical conditions.

The defect appears in particular on steep slopes, at curves in badly compacted materials and in easily erodable materials.

Gullies will be aligned along the steepest slope of the shoulder embankment.

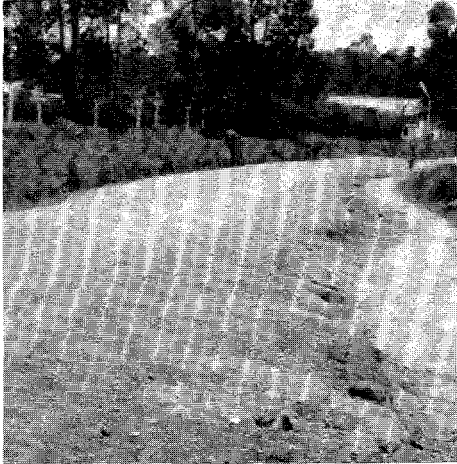
REMARKS:

Progressive scour deepens the gullies and the shoulder becomes unusable. This endangers the safety of the road users.

POSSIBLE MAINTENANCE ACTIVITY:

- 1-2. Reshape and relevel the shoulder.
3. In case of extensive erosion reshape the shoulder by adding well compacted erosion resistant material.

GROUP: SIDE DRAINS TYPE: SILTATION



Side drains filled up by fine particles due to erosion and water run-off.



Slope erosion resulting in ditch siltation.

DESCRIPTION:

Deposit of material in the side drains of the road causing a partial or completely blocked drainage system.

INSPECTION METHOD:

Visual recording and estimation of the total length of the affected drains as a percentage of the sub-section length.

RATING CRITERIA:

Value	Extent	Routine maintenance	Action
1	< 5 %	Satisfactory	Not required
2	5-50 %	To be checked	To be expected
3	> 50 %	Not satisfactory	Required immediately

GROUP: SIDE DRAINS TYPE: SILTATION

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- a) Presence of obstacles, resulting from:
- Side drain slope failure due to traffic action or cattle movement; or to erosion; or to cut slope failure;
 - Encroaching vegetation and accumulation of debris in drains.
- b) Bad drainage design:
- Too shallow longitudinal slope in the side drain;
 - Insufficient outlets to disperse the water.

REMARKS:

The consequences of the siltation are:

- Reduction of ditch cross-section and velocity of water;
- Increasing siltation and amounts of debris resulting in a complete obstruction of the ditch itself and the outlets;
- Ponding of water in the ditch, water penetration in base and sub-base course resulting in erosion;
- Reduction of bearing capacity of road shoulder.

POSSIBLE MAINTENANCE ACTIVITY:

- Cleaning up and reshaping of drains, control vegetation growth;
 - Cleaning up and repair of catchment basins;
 - Cleaning up and increasing number of outlets;
 - Eventual construction of interception ditches to improve erosion from slopes.
-

GROUP: SIDE DRAINS TYPE: SCOUR



Regressive erosion of a side drain.



Erosion of a turnout.

DESCRIPTION:

Erosion of bottom and sides of ditches:

- Direct erosion is occurring when soil particles are loosened and transported by water;
- Regressive erosion is occurring when a relatively flat terrain is followed (downstream) by a terrain with a steeper slope or more erodable materials.

INSPECTION METHOD:

Visual recording and estimation of the total length of the eroded drains as a percentage of the sub-section length.

RATING CRITERIA:

Value	Extent	RATING CRITERIA:	
		Routine maintenance	Action
1	< 5 %	Satisfactory	Not required
2	5-50 %	To be checked	To be expected
3	> 50 %	Not satisfactory	Required immediately

GROUP:	SIDE DRAINS	TYPE:	SCOUR
--------	-------------	-------	-------

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- Use of non cohesive materials which are not stabilized;
- Too steep longitudinal slope of drain;
- Drain too long (superior to critical length) insufficient number of outlets;
- Irregular longitudinal profile of drain; sudden change of slope; level of outlet too low.

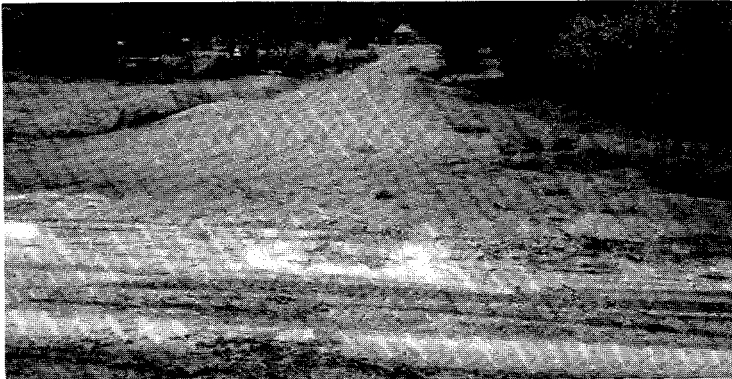
REMARKS:

Scour in the drain will result in the collapse of the drain in the first instance; rapidly the shoulder will follow and ultimately the carriageway itself will be endangered. Regressive erosion provokes a number of successive embankment collapses which endanger the road user and furthermore leads to major repair costs.

POSSIBLE MAINTENANCE ACTIVITY:

- Reshape and realign ditch;
 - Stabilise or protect bottom and side slopes of ditch in sensitive areas;
 - Reduce ditch length, construct more outlets;
 - Construct sedimentation dams.
-

GROUP: ROAD SPACE TYPE: DEBRIS/VEGETATION ENCROACHMENT



Dangerous crossroad due to
accumulating mud.

DESCRIPTION:

Obstruction of the carriageway which will hinder or endanger the traffic.

INSPECTION METHOD:

Visual recording and estimation of the severity of the obstruction.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	No major obstacles	Satisfactory	Not required
2	Necessary to slow down and bypass an obstacle. Major visibility reduction.	To be checked	To be expected
3	Total obstruction	Not satisfactory	Required immediately

GROUP: ROAD SPACE TYPE: DEBRIS/VEGETATION ENCROACHMENT

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Obstacles might result from:

- Sand encroachment following a storm or dune displacement;
- Vegetation encroachment due to insufficient maintenance of grasses and bushes alongside the road, or cut or fallen trees;
- Slope failures due to bad design or due to water penetration in slopes.

REMARKS:

Possible consequences:

- Reduction of visibility distances and increase of accident risks;
- Accumulation of material on the side of the carriageway blocking surface drainage;
- Increased surface deterioration due to trafficking of the resultant narrow carriageway;
- Enforced use of shoulders by vehicles.

POSSIBLE MAINTENANCE ACTIVITY:

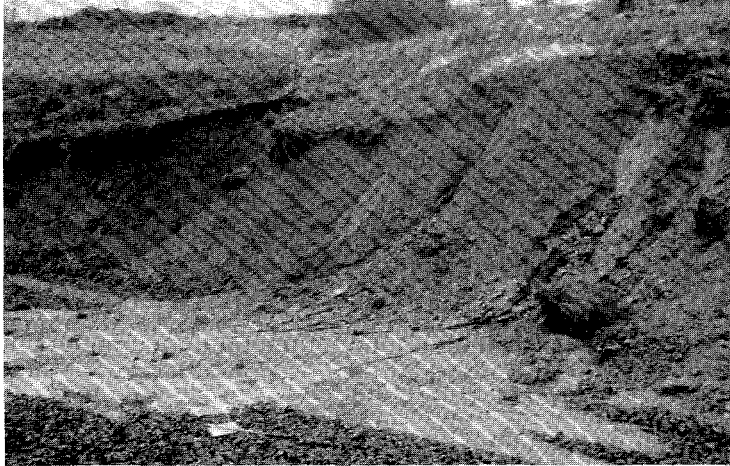
- Reduce vegetation growth, cleaning and grubbing of shoulders, cutting trees along the road alignment;
 - Clearing the roadway of vegetation and sand (dunes);
 - Repairing collapsed slopes.
-

GROUP:

ROAD SPACE

TYPE:

OBSTACLES/OBSTRUCTIONS



Obstructed carriageway due to
unstable side slope.

DESCRIPTION:

Obstruction of the carriageway which will hinder or endanger traffic flow.

INSPECTION METHOD:

Visual recording and estimation of severity and effect on traffic flow.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	No major obstacles	Satisfactory	Not required
2	Necessary to slow down and bypass an obstacle. Major visibility reduction.	To be checked	To be expected
3	Total obstruction	Not satisfactory	Required immediately

GROUP:	ROAD SPACE	TYPE:	OBSTACLES/OBSTRUCTIONS
--------	------------	-------	------------------------

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Obstacles may result from:

- Repair of vehicles (leaving behind tools or other items) on the road;
- Broken down vehicles;
- Rock fall.

REMARKS:

Possible consequences:

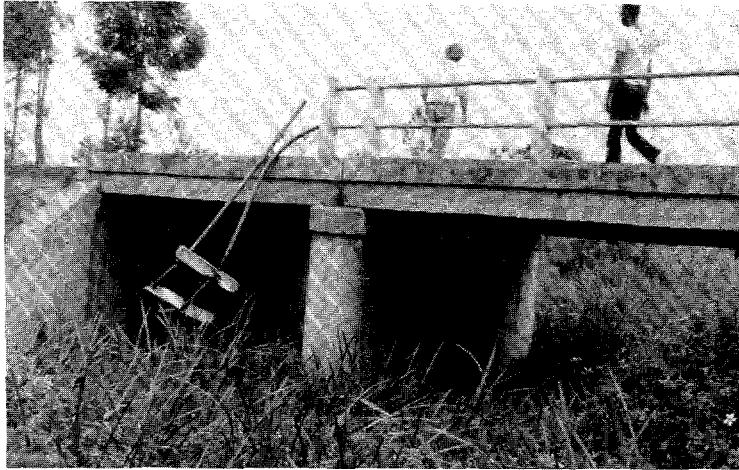
- Increase of accident risks to traffic;
- Enforced use of shoulders.

POSSIBLE MAINTENANCE ACTIVITY:

- Removal of obstacles from the carriageway;
 - Provision of appropriate traffic/warning signs when obstacle cannot immediately be removed.
-

GROUP: ROAD SIGNS
& FURNITURE
ROAD MARKING

TYPE: DAMAGED/MISSING



Accidental destruction of a bridge railing.

DESCRIPTION:

Damage to road signs, guard rails, paint markings, etc.; road signs, guardrails or markings are missing at critical places, e.g. road crossings or hair-pin curves, ravines, etc.

INSPECTION METHOD:

Record for each section all signs, furniture and markings and estimate the number of missing elements as a percentage of the total number. Describe the location and severity of damaged elements and implement immediate repairs or replacements.

RATING CRITERIA:

Value	Extent
1	< 10 %
2	10-25 %
3	> 25 %

GROUP:	ROAD SIGNS & FURNITURE ROAD MARKING	TYPE:	DAMAGED/MISSING
--------	---	-------	-----------------

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- Wear and tear by traffic;
- Damage from traffic accidents;
- Weather (corrosion);
- Vandalism.

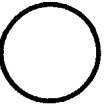
REMARKS:

Damaged signs and road furniture endanger traffic safety and should therefore be repaired quickly. (This may also apply to dirty road signs.) For road safety reasons, missing signs, road markings and furniture have to be replaced immediately.

POSSIBLE MAINTENANCE ACTIVITY:

- Repair or replacement of damaged (missing) elements;
 - Repainting of road markings.
-

Figure 3. SUMMARY OF ROAD CONDITION SURVEY RESULTS: AVERAGE CONDITION VALUE ("FORM IV")

ROAD CONDITION SURVEY (RCS)									OFFICE: _____		DISTRICT: _____		 PAGE
PAVED AND UNPAVED ROADS									Established by: _____				
									Date: _____				

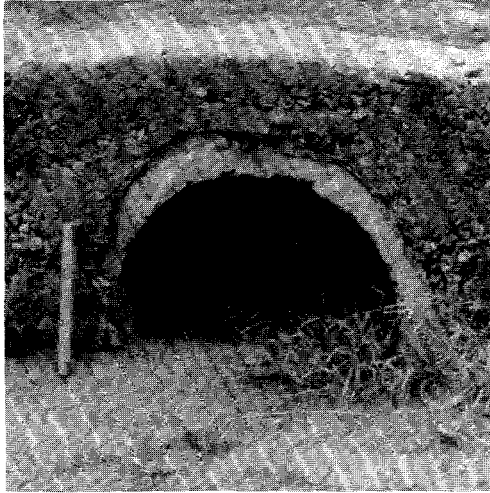
DESIGNATION OF ROAD SECTION									SURVEY DATA			
Road		Section No.	Identification Points (IP)			Section length		AADT	Avg. condition value			Notes / Remarks
Class	No.		I.P.	Designation	Km	Km	m		Carriageway	Road side elements	Road signs & Furniture	
1	2	3	4	5	6	7	8	9	11	12	13	14
			From		From							
			To		To							
			From		From							
			To		To							
			From		From							
			To		To							
			From		From							
			To		To							
			From		From							
			To		To							
			From		From							
			To		To							
			From		From							
			To		To							

SECTION 2

ROAD CONDITION SURVEY: STRUCTURES

Group	Type	No. of sheet	Rating levels
Culverts	Silted/blocked	RCS 8	3
	Scour	RCS 9	3
	Structural damage	RCS 10	3
Bridges	Silted/blocked	RCS 11	3
	Scour	RCS 12	3
	Structural damage	RCS 13	3

GROUP: CULVERTS TYPE: SILTED/BLOCKED



Partial obstruction due to progressive siltation.

DESCRIPTION:

This type of damage concerns the partial or complete obstruction of culverts by silt, natural debris or other material.

INSPECTION METHOD:

Visual inspection of all sub-section culverts and evaluation of functional conditions.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	Free flow	Satisfactory	Not required
2	Partial obstruction	To be checked	To be expected
3	Total obstruction	Not satisfactory	Required immediately

GROUP: CULVERTS TYPE: SILTED/BLOCKED

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Design faults:

- Invert level too low;
- Longitudinal slope too flat;
- Culvert pipe diameter incorrect.

During rainy seasons, soil/sand, small trees and vegetation in ground is carried away by the rain water and deposit in initial locations (entrance of culvert pipe, badly designed structures); this will lead to obstructions and subsequently flooding and inundation.

REMARKS:

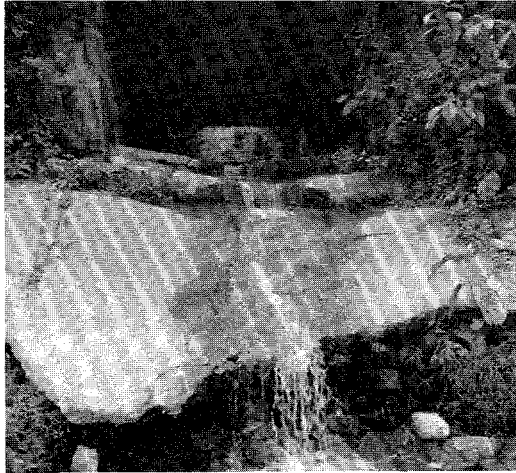
Lack of inspection and maintenance may have the following consequences:

- Submersion of embankment resulting in uncontrolled settlement of road shoulders;
- Ponding of water upstream of the structure resulting in slope failure;
- Inundation of complete culvert, shoulders and road.

POSSIBLE MAINTENANCE ACTIVITY:

- Preventative maintenance in dry season;
 - Cleaning of culverts especially entrance and mid-section of culvert pipes;
 - Construction of protective structures, against silt and debris upstream of culvert (mesh, deflecting devices, etc.);
 - Correction of culvert design errors.
-

GROUP: CULVERTS TYPE: SCOUR



Scour at the end
of the culvert.

DESCRIPTION:

This type of damage consists of the loss of materials from both ends of the culvert; eventually the whole structure might be undermined. Two types of erosion can take place downstream of the culvert depending on the initial gradient:

- Localised erosion with gully development;
- Regressive erosion with ravine development.

INSPECTION METHOD:

Visual inspection of all sub-section culverts and evaluation of severity of scour.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	Little or no erosion	Satisfactory	Not required
2	Substantial erosion without settlement of structure	To be checked	To be expected
3	Substantial erosion undermining the structure	Not satisfactory	Required immediately

GROUP: CULVERTS TYPE: SCOUR

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

The severity of the localised erosion and the damage caused by it depend upon the conditions at the downstream end of the culvert (flow, diameter, Froude parameter).

Regressive erosion with ravine development depends upon the stability of the free flow and the downstream outlet conditions of the culvert.

REMARKS:

The erosion will ultimately attack the embankment slopes and causes damage to the complete structure such as head and wingwalls and the culvert itself.

POSSIBLE MAINTENANCE ACTIVITY:

Design and implement protective erosion control and energy dissipating structures.

- Backfill of scoured areas with boulders or gabions;
- Installation of gabion protection, rock beds, etc.;
- Construction of concrete protection structures.

GROUP: CULVERTS TYPE: STRUCTURAL DAMAGE



Total destruction of a gully with collapse of the pavement

DESCRIPTION:

Two types of structural damage can be distinguished:

- Slight settlement with subsequent cracking in head walls, wing walls and the culvert structure;
- Pronounced uneven settlement, with the subsequent development of large cracks.

INSPECTION METHOD:

Visual inspection of all sub-section culverts and evaluation of severity of damage.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	Small or no damage	Satisfactory	Not required
2	Uneven settlement damaged inlet and outlets	To be checked	To be expected
3	Broken culvert (pipes), inlet and outlets	Not satisfactory	Required immediately

GROUP: CULVERTS TYPE: STRUCTURAL DAMAGE

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- Incorrect design;
- Diminished bearing capacity of foundation layers, settlement of soils under foundation;
- Erosive action around structure;
- Traffic may cause damage when insufficient cover is present.

REMARKS:

Lack of inspection and maintenance may have the following consequences:

- Minor damage : culvert is still functional;
- Major damage : obstruction of culvert, collapse of structure.

POSSIBLE MAINTENANCE ACTIVITY:

- Repair cracks;
 - Reconstruct inlet and outlet and other missing parts;
 - Reconstruct complete structure.
-

GROUP: BRIDGES TYPE: SILTED/BLOCKED



Accumulation of debris and vegetation below a bridge.



Shrubs which may lead to obstruction.

DESCRIPTION:

Depending on the nature of the structure, the following types of damage can be distinguished:

- Accumulation of soil or debris on the bridge deck and in the deck joints;
- Accumulation of floating debris against piers, abutments.

INSPECTION METHOD:

Visual inspection of all sub-section bridges and evaluation of severity of defect.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	Clean bridge deck, free flow under bridge	Satisfactory	Not required
2	Debris accumulation on and under bridge	To be checked	To be expected
3	Debris obstructing traffic flow and water flow	Not satisfactory	Required immediately

GROUP:	BRIDGES	TYPE:	SILTED/BLOCKED
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PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

During rainy seasons:

- Temporary inundation, flooding of bridge deck, malfunctioning of discharge facilities;
- Transport of floating debris in the river during periods of high flow; insufficient free flow under bridge.

Design deficiencies:

- Insufficient bridge width/span;
- Piers/abutments obstructing the flow of water.

REMARKS:

Lack of maintenance may have the following consequences:

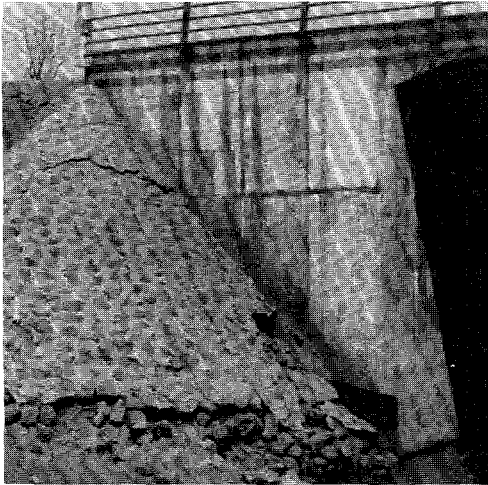
- Bridge deck : slippery surface endangering traffic;
- Joints : accumulation of dirt in joints will obstruct the free expansion of the deck;
- Abutments : obstruction of riverbed, reducing outflow, increasing velocity of water and scour risks.

POSSIBLE MAINTENANCE ACTIVITY:

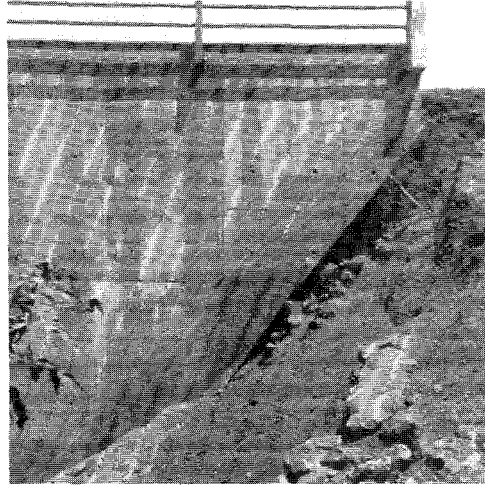
- Clean discharge facilities, repair immediately if not functional;
 - Clean joints;
 - Remove all floating dirt from piers and abutments;
 - If the bridge opening is obstructed regularly, consider widening.
-

GROUP: BRIDGES

TYPE: SCOUR



Sagging of abutment and paved side slopes resulting in structural damage.



Collapse of bridge embankment uncovering the wall of the abutment and undermining the pavement structure.

DESCRIPTION:

The following types of damage can be distinguished:

- Erosion of slopes and bedding;
- Undermining of the abutments and piers.

INSPECTION METHOD:

Visual inspection of all sub-section bridges and estimate of severity of damage. Inspect slopes, bedding, walls, rock beds, piers next to the bridge.

Value	Severity	RATING CRITERIA:	
		Routine maintenance	Action
1	Little or no erosion	Satisfactory	Not required
2	Erosion without major damage	To be checked	To be expected
3	Severe erosion endangering road and bridge	Not satisfactory	Required immediately

GROUP: BRIDGES TYPE: SCOUR

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- No discharge facilities for run off of surface water next to the bridge, infiltration of water between bridge and approach road, instability of slopes.
- Increase of flow velocity due to narrowing or obstruction of river bed.
- Piers/abutments not in line with flow of water.

REMARKS:

Lack of inspection and maintenance may have the following consequences:

- Slope failures, unstable abutments, ramps between approach road and bridge deck endangering traffic;
- Uneven settlement of foundations, collapse of bridge.

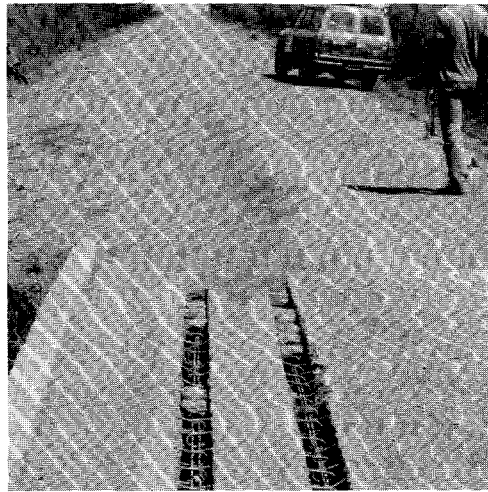
POSSIBLE MAINTENANCE ACTIVITY:

- Repair scoured slopes;
 - Protect eroded areas such as piers/abutments and slopes with boulders, gabions or retaining walls.
-

GROUP: BRIDGES TYPE: STRUCTURAL DAMAGE



Partial destruction of wooden bridge deck.



Exposure of steel reinforcement of bridge deck.

DESCRIPTION:

The following types of damage can be distinguished:

- Degradation of deck;
- Degradation of masonry joints;
- Cracking of abutments;
- Exposure of reinforcement steel.

INSPECTION METHOD:

Visual inspection of all sub-section bridges and estimate of severity of damage.

RATING CRITERIA:

Value	Severity	Routine maintenance	Action
1	Small or no damage	Satisfactory	Not required
2	Visible damage without risk to the bridge or traffic	To be checked	To be expected
3	Visible damage endangering the bridge and traffic	Not satisfactory	Required immediately

GROUP:	BRIDGES	TYPE:	STRUCTURAL DAMAGE
--------	---------	-------	-------------------

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Bridge deck : loosened bolts, anchor bolts, nails; wear and tear;
Abutments : aggressive water action on joints, weathering
action of climate (corrosive action), settlement
of foundation soils, increasing soil pressure;
Supports and joints : blockage due to dirt and corrosive action of
climate leading to damage to abutment and bridge
deck.

REMARKS:

Lack of inspection and maintenance may have the following consequences:

- Loss of bridge deck elements, damage to tyres and vehicles;
- Localised collapse of masonry, settlement of abutments, complete bridge collapse.

POSSIBLE MAINTENANCE ACTIVITY:

- Maintain and clear bridge deck and abutments;
 - Repair or replace deck;
 - Repair damaged masonry, protect degraded/corroded/cracked areas;
 - Rebuild bridge in the case of severe settlement or risk of collapse.
-

SECTION 3

DETAILED VISUAL INSPECTION OF UNPAVED ROADS

Type	No. of sheet	Code	Function affected	Rating levels
Rutting	DVI/UR 1	RU	Roughness/ Drainage	5
Corrugations	DVI/UR 2	CO	Roughness	5
Camber/crossfall	DVI/UR 3	CR	Drainage	5
Gravel thickness	DVI/UR 4	GR	Structure	5
Erosion gullies	DVI/UR 5	EG	Structure	5
Potholes	DVI/UR 6	PO	Structure	5
Clay	DVI/UR 7	CY	Safety	3

Figure 6. DETAILED VISUAL INSPECTION FORM FOR UNPAVED ROADS ("FORM VI")

DETAILED VISUAL INSPECTION (DVI)										UNPAVED ROADS																															
OFFICE:					DISTRICT:					ROAD DENOMINATION / CLASS:					Main Section No.																										
Name of inspector:					FROM I.P.:					Km:					TO I.P.:					Km:																					
Date:		Weather <input type="radio"/> Clear <input type="radio"/> Rainy			Carr.way: <input type="radio"/> Dry <input type="radio"/> Drying <input type="radio"/> Wet			Pavement type:					Pavement width: m					Section length: Km																							
SUB-SECTION										○		○		○		○		○																							
Roadside										L		R		L		R		L		R		L		R																	
Damage type - Cat										E		S		L		M		S		L		M		S		L		M		S											
Rutting - UR1										<10%		1		3		5		1		3		5		1		3		5		1		3		5							
										10-50%		2		4		5		2		4		5		2		4		5		2		4		5		2		4		5	
										>50%		3		5		5		3		5		5		3		5		5		3		5		5		3		5		5	
Corrugations - UR2										<10%		1		3		4		1		3		4		1		3		4		1		3		4		1		3		4	
										10-50%		2		3		5		2		3		5		2		3		5		2		3		5		2		3		5	
										>50%		3		4		5		3		4		5		3		4		5		3		4		5		3		4		5	
Loss of camber - UR3										<10%		1		3		4		1		3		4		1		3		4		1		3		4		1		3		4	
										10-50%		2		3		5		2		3		5		2		3		5		2		3		5		2		3		5	
										>50%		3		4		5		3		4		5		3		4		5		3		4		5		3		4		5	
Gravel thickness - UR4										<10%		1		3		5		1		3		5		1		3		5		1		3		5		1		3		5	
										10-50%		2		3		5		2		3		5		2		3		5		2		3		5		2		3		5	
										>50%		3		4		5		3		4		5		3		4		5		3		4		5		3		4		5	
Erosion gullies - UR5										<10%		1		3		5		1		3		5		1		3		5		1		3		5		1		3		5	
										10-50%		2		4		5		2		4		5		2		4		5		2		4		5		2		4		5	
										>50%		3		5		5		3		5		5		3		5		5		3		5		5		3		5		5	
Potholes - UR6										<5 (No./100m)		1		3		5		1		3		5		1		3		5		1		3		5		1		3		5	
										5-15		2		4		5		2		4		5		2		4		5		2		4		5		2		4		5	
										> 15		3		5		5		3		5		5		3		5		5		3		5		5		3		5		5	
Clay - UR7										< 5%		1		/		/		1		/		/		1		/		/		1		/		/		1		/		/	
										5-50%		2		/		/		2		/		/		2		/		/		2		/		/		2		/		/	
										>50%		3		/		/		3		/		/		3		/		/		3		/		/		3		/		/	
.....																																									

Remarks: _____

TYPE:

RUTTING

CODE: RU



Rutting in both lanes

Extent 3

Severity 2

Class 5

DESCRIPTION:

Permanent longitudinal deformations following the line of vehicle wheel paths. In extreme cases the cross-section of the road shows a w-profile.

INSPECTION METHOD:

Severity:

Place a 2 m straightedge across the ruts and measure with a wedge the depth of the ruts in mm. Measure all ruts observed over the width of the road; representative value is the highest value measured.

Extent:

Percentage of sub-section length.

RATING CRITERIA:

Extent	Evaluation	Severity	Extent	Class		
				Severity	1	2
1	< 10 %	< 20 mm	1	1	3	5
2	10-50 %	20-50 mm	2	2	4	5
3	> 50 %	> 50 mm	3	3	5	5

TYPE:

RUTTING

CODE: RU

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Resulting from wheel forces. Strongly influenced by traffic intensity, speed, loading or transverse distribution. The development of ruts is accelerated by heavy traffic and channelised traffic.

Climate:

Dry season: Lateral displacement of non-cohesive materials.
Rainy season: Liquifaction of surface material or stability loss of road embankment or supporting soils.

Materials:

Dry: Increased risk for non-cohesive materials (mainly sandy).
Humid: Increased risk for clayey materials and materials susceptible to water.

Others:

The presence of ruts may cause other damage to develop, such as longitudinal erosion gullies or potholes in weak spots in the surfacing.

REMARKS:

This damage has a bad effect on the safety of road users. Ruts prevent lateral movement of vehicles which accelerates rut development. In extreme cases the depth of ruts is such that the road becomes impassable.

POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required;
2. Dragging of surface course;
3. Dry grading or dragging;
4. Wet grading or regravelling of surface course;
5. Heavy grading or rehabilitation of road.

TYPE:

CORRUGATIONS

CODE: CO



Generalised corrugation.

Extent 3
Severity 3
Class 5

DESCRIPTION:

Shallow and evenly spaced ridges of surface material, transverse to road axis. These ridges extend over the entire width of the road; spacing varies between 500 and 1 000 mm depending on the average speed of vehicles.

INSPECTION METHOD:

Road condition survey:

Evident from within a vehicle either visually or by experiencing vibration.

Detailed visual inspection:

Measure by placing a 2 m straightedge across the top of the ridges; depth to be measured as well as distance between two successive ridges.

RATING CRITERIA:

Extent	Evaluation	Severity	Extent	Class Severity		
				1	2	3
1	< 10 %	< 20 mm	1	1	3	4
2	10-50 %	20-50 mm	2	2	3	5
3	> 50 %	> 50 mm	3	3	4	5

TYPE:

CORRUGATIONS

CODE: CO

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Lack of cohesion in the surface material and displacement by moving vehicles. The frequency (± 15 Hz) of the vibration of the suspended mass of vehicles combined with their speed determines the spacing of the ridges. The damage is occasioned by, and continues to develop through, existing irregularities in the surface.

Climate:

During the rainy season the ridge will also develop in the sub-base. The loss of coarse materials from the valleys will create weak spots leading to other damage.

The damage develops during the dry season when the material has little cohesion. The dryness and wind provide favourable conditions for the loss of fines.

Materials:

Materials most susceptible show little cohesion, a low plasticity index, contain particles larger than 5 mm and relatively few fines.

REMARKS:

This damage, one of the main sources of driver discomfort, is extremely harmful to vehicles. It is one of the main causes of increased vehicle operating costs.

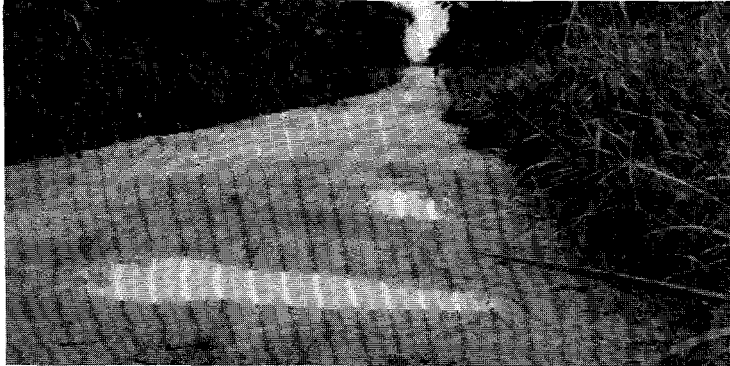
POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required;
2. Dragging of surface;
3. Dragging or light grading of surface;
4. Grading of surface;
5. Wet grading of surface.

TYPE:

CAMBER/CROSSFALL

CODE: CR



Loss of a crossfall,
water accumulating.

DESCRIPTION:

Distortion and deformation of the road cross-section. The ideal profile that should be maintained has a "roof" shape with transverse slopes of 3-4 % to permit the rapid flow of surface water off the road.

INSPECTION METHOD:

Severity:

The measurement can be performed rapidly with a straightedge equipped with a level tube and adapted to the required slope. The straightedge is placed transverse to the centreline; one end is placed on the centreline. The other end is raised by a height h (mm) to bring the straightedge to a level position, the gap between the underside of the straightedge and the road surface being a measure of the crossfall.

Extent:

Percentage of surface.

RATING CRITERIA:

Extent	Evaluation	Severity (h)	Extent	Class Severity		
				1	2	3
1	< 10 %	> 50 mm	1	1	3	4
2	10-50 %	20-50 mm	2	2	3	5
3	> 50 %	< 20 mm	3	3	4	5

TYPE:

CAMBER/CROSSFALL

CODE: CR

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- Wear by traffic;
- Differential settlement;
- Movement of materials.

REMARKS:

Defects in cross section reduce the removal of surface water thus weakening the road construction.

The formation of potholes and rutting will be accelerated.

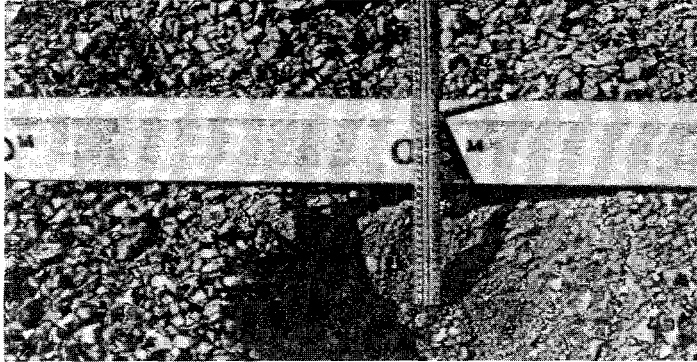
POSSIBLE MAINTENANCE ACTIVITY:

1. Continue the recurrent maintenance;
2. Dry grading; shorten the interval of operations;
3. Dry grading;
4. Wet grading or regravelling of surface course;
5. Regravelling of surface course or rehabilitation of road.

TYPE:

GRAVEL THICKNESS

CODE: GR



GR

Thickness between 15 and 20cm.

DESCRIPTION:

Thickness reduction of surface course.

Loss of surface material due to various causes including regrading and regravelling operations.

NOT RELEVANT FOR EARTH ROADS.

INSPECTION METHOD:

Severity is defined as the difference between the specified thickness and the measured thickness.

Road condition survey:

Monitor formation of ridges of material parallel to road axis. Extent expressed by % length affected.

Detailed visual inspection:

Measure every 500 m remaining thickness of surface course by digging hole to sub-base level (see picture above). Fill hole after measurement by replacing excavated material.

RATING CRITERIA:

Extent	Evaluation	Severity		Class Severity		
				1	2	3
1	< 10 %	< 10 mm		1	3	5
2	10-50 %	10-50 mm	Extent	2	2	3
3	> 50 %	> 50 mm		3	3	4

TYPE:

GRAVEL/THICKNESS

CODE: GR

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Is one of the main causes of loss of material. An ADT of about 140 vehicles leads to a loss of material of 10 to 30 mm per annum.

Climate:

Losses occur during all seasons, however rain will increase the loss of material. In the dry season this damage will also result in dust generated by traffic.

Materials:

Strongly dependent on type of material used for construction.

Others:

Combined action of all factors including maintenance, affects the pavement (or surface course). Development of damage depends on region, climate, materials used for road construction, traffic intensity, and topography.

REMARKS:

Road users safety is endangered by dust generated by traffic; dust reduces the visibility and is also a nuisance for people living adjacent to the road.

POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required;
2. Dragging of surface;
3. Dry grading of road surface;
4. Regravelling of surface course or wet grading;
5. Reconstruction of surface course.

TYPE:

EROSION GULLIES

CODE: EG



Longitudinal erosion gullies.

Extent 2
Severity 3
Class 5

DESCRIPTION:

The aspect is dependent upon the mode of development and the location.

Three main types are distinguished:

- 1) Scouring of side drains, following the slope of the formation level and affecting a section with steep slopes and bad compaction.
- 2) Longitudinal gulleys parallel to the road axis in the surface.
- 3) Gulleys transverse to the road axis cutting the road over its entire width.

INSPECTION METHOD:

Road condition survey:

Estimate and record the location of dangerous gullies.

Detailed visual inspection:

Place a 2 m straightedge across the gullies and measure their depth in mm with a tape or rule.

RATING CRITERIA:

Extent	Evaluation	Severity	Extent	Class Severity		
				1	2	3
1	< 10 %	< 20 mm	1	1	3	5
2	10-50 %	20-50 mm	2	2	4	5
3	> 50 %	> 50 mm	3	3	5	5

TYPE:

EROSION GULLIES

CODE: EG

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Traffic may create damage leading to erosion. Ruts develop into longitudinal gullies; corrugations may create perpendicular gullies.

Climate:

The severity of the erosion depends on the quantity and the velocity of the surface water to be removed.

Materials:

Badly compacted materials and materials likely to be affected by water.

Others:

Drainage and the quality of the surface courses are important. Damage occurs mainly in places where slopes are steep.

1. Side gullies : Resulting from normal discharge of water draining along the slope of the terrain through soft materials.
2. Longitudinal gullies : Poor cross-section; presence of ruts; improper maintenance of shoulders and deficiencies in drainage capacity.
3. Transverse gullies : Flooding of side drains; drainage of water along the natural slope of the terrain.

REMARKS:

Erosion develops quickly and can lead to total severance of the road. Deep gullies endanger the safety of road users.

POSSIBLE MAINTENANCE ACTIVITY:

- 1-2. Monitor drainage and cross-section of the road.
3. If prominent, grading or any other maintenance technique considered suitable for the damage leading to erosion gullies.
- 4-5. Extensive damage: regravelling or reconstruction of the road; if damage is localised fill gulley and restore road profile.

TYPE:

POTHOLES

CODE: PO



Pothole on dry roadway.

Extent 2
Severity 3
Class 5

DESCRIPTION:

In general bowl shaped holes caused by the loss of surface material.

INSPECTION METHOD:

Road condition survey:

Visual recording and estimation of extent; driving conditions; recording of deep potholes.

Detailed visual inspection:

Extent : Evaluation/assessment of number of potholes per 100 m of road length.

Severity : Place a straightedge over pothole and measure the depth of the hole.

RATING CRITERIA:

Extent No. per 100m	Evaluation Severity	Extent	Class Severity		
			1	2	3
1 < 5	< 20 mm	1	1	3	5
2 5-15	20-40 mm	2	2	4	5
3 > 15	> 40 mm	3	3	5	5

TYPE:

POTHOLES

CODE: PO

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Potholes develop in those areas where the subgrade is uneven or results from other damage (corrugations, rutting, erosion, gullies, etc.). Increased traffic will accelerate the development of potholes.

Climate:

Potholes start to develop in the wet season; water remains in them and soak the surface material, making it vulnerable to further damage. Once present, potholes will grow deeper and wider.

Materials:

Impermeable clayey soils prevent proper drainage of surface water and permit weak spots to develop into potholes.

Others:

This damage often results from neglected problems such as corrugations, rutting or drainage. Corrugations and rutting may cause the development of a series of potholes.

REMARKS:

Once potholes are present, they are to be repaired immediately since they worsen quickly. Potholes have an adverse effect on the safety and comfort of the road user.

POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required.
2. Fill potholes.
3. Fill potholes.
4. Grading or regravelling of surface.
5. Wet grading or regravelling of surface.

TYPE:

CLAY

CODE: CY



Road surface extensively covered
by clay.

Extent 3

DESCRIPTION:

Presence of clayey materials or fines in thin layers on top of the surface course. Shiny appearance during rainy season. Smooth appearance with cracks during dry weather.

INSPECTION METHOD:

Extent:

Estimation of percentage of surface affected.

RATING CRITERIA:

1. < 5 %
2. 5-50 %
3. > 50 %

TYPE:

CLAY

CODE: CY

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Loss of (gravel) base course.

Contamination of surface course by fines from lower courses.

During dry weather this type of damage may lead to other faults, similar to those appearing in paved roads, e.g. cracks, potholes, etc.

REMARKS:

Wet season: Surface can be dangerously slippery.

Dry season: Uneven appearance of surface can be a danger.

POSSIBLE MAINTENANCE ACTIVITY:

1-2. No maintenance required.

3. Regravelling of surface.

SECTION 4

DETAILED VISUAL INSPECTION OF PAVED ROADS

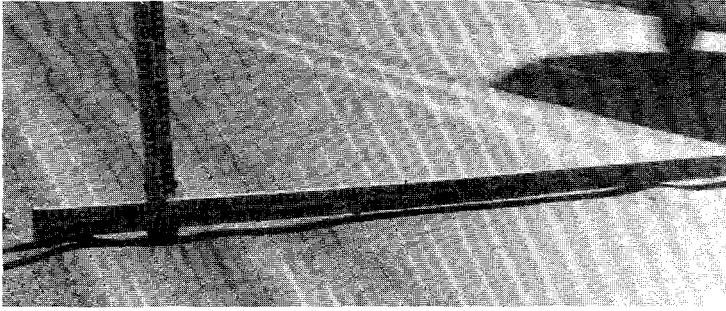
Type	No. of sheet	Code	Function affected	Rating levels
Rutting without cracks	DVI/PR 1a	RU	Structure/ Roughness/ Drainage	5
Rutting with cracks	DVI/PR 1b	RU/C	Structure/ Roughness/ Drainage	5
Corrugations	DVI/PR 2	CO	Carriageway	5
Depressions	DVI/PR 3	DP	Drainage	5
Transverse cracks	DVI/PR 4a	CT	Structure	5
Longitudinal cracks	DVI/PR 4b	CL	Structure	5
Alligator cracks	DVI/PR 4c	CA	Structure	5
Holes	DVI/PR 5	HO	Structure	5
Edge distress	DVI/PR 6	ED	Structure	5
Stripping/fretting/ ravelling	DVI/PR 7a	ST	Structure	5
Stripping/fretting/ ravelling of surface	DVI/PR 7b	ST/S	Structure	5
Bleeding	DVI/PR 8	BL	Safety	3

Figure 7. DETAILED VISUAL INSPECTION FORM FOR PAVED ROADS ("FORM VII")

DETAILED VISUAL INSPECTION (DVI)										PAVED ROADS																														
OFFICE:					DISTRICT:					ROAD DENOMINATION/ CLASS:					Main Section No.																									
Name of inspector:										FROM I.P.:					Km:																									
Date:		Weather o Clear o Rainy		Carr.way:		o Dry o Drying o Wet		TO I.P.:					Km:																											
					Pavement type:					Pavement width: m					Section length: Km																									
SUB-SECTION										○		○		○		○		○																						
Roadside										L		R		L		R		L		R																				
Damage type - Cat										E	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S											
Rutting - PR1										<10%	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5
										10-50%	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5
										>50%	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5
Corrugations - PR2										<10%	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4
										10-50%	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5
										>50%	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
Depressions - PR3										<10%	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4
										10-50%	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5
										>50%	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5
Transverse cracking - PR4a										<2 (No./100m)	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4
										2-15	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5
										>15	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
Longitudinal cracking - PR4b										<10%	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5
										10-50%	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5
										>50%	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5
Alligator cracking - PR4c										<10%	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5	1	4	5
										10-50%	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5
										>50%	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5
Holes - PR5										<5 (No./100m)	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5
										5-15	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
										>15	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5
Edge distress - PR6										<10%	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4	1	3	4
										10-50%	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5
										>50%	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
Stripping/ Fretting/ Ravelling - PR7a										<10%	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4
										10-50%	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	3	5
										>50%	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5
Stripping/Fretting/ Ravelling of surface - PR7b										<15%	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
										15-30%	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5	2	4	5
										>30%	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5	3	5	5
Bleeding - PR8										<5%	/	/	/	1	/	/	/	1	/	/	/	1	/	/	/	1	/	/	/	1	/	/	/	1	/	/	/	1	/	/
										5-50%	/	/	/	2	/	/	/	2	/	/	/	2	/	/	/	2	/	/	/	2	/	/	/	2	/	/	/	2	/	/
										>50%	/	/	/	3	/	/	/	3	/	/	/	3	/	/	/	3	/	/	/	3	/	/	/	3	/	/	/	3	/	/
Remarks:																																								

TYPE: RUTTING WITHOUT CRACKS

CODE: RU



Rutting without cracks due to heavy trucks with twin-wheels.

Extent 3
Severity 2
Class 5

DESCRIPTION:

More likely to occur in pavements with thick bituminous layers. Permanent depressions in the road surface affecting the road cross-section in the wheel paths. Generally over long distances. In some instances, ruts will be bordered by excess material displaced by the ruts.

INSPECTION METHOD:

Severity:

- Place 2 m straightedge over the wheel paths and measure the depth of the ruts;
- Take several measurements over the section or sub-section length;
- Take highest value measured as representative measure;
- Distance between measurements: 500 m in section, 100 m in sub-section.

Extent:

Percentage of length.

RATING CRITERIA:

Extent	Evaluation Severity		Class Severity			
			1	2	3	
1	< 10 %	< 20 mm	1	1	3	5
2	10-50 %	20-40 mm	Extent 2	2	4	5
3	> 50 %	> 40 mm	3	3	5	5

TYPE:

RUTTING WITHOUT CRACKS

CODE: RU

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Accumulation of irreversible deformation and/or lateral material displacement within the pavement layers.

Traffic:

Influence of axle load and traffic intensity is important. Low speeds are the most damaging. Narrow roads present higher risk as vehicles tend to follow the same wheel path. Double ruts can then be observed resulting from the action of dual tyres.

Climate:

High temperatures increase the risks of deformation in the bituminous layers.

Bituminous materials:

Wrong mix design; too much/too little bitumen; too many fines; poor interlock between aggregates; incorrect bitumen type; poor compaction.

REMARKS:

Damage will reduce lateral movement of vehicles thus increasing the development of existing ruts.

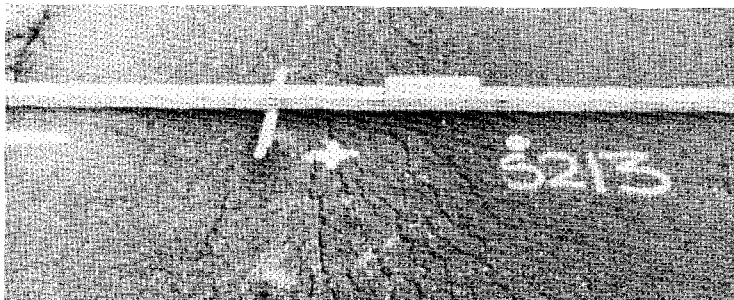
Presence of water in the ruts will endanger traffic through an increased risk of "aquaplaning".

POSSIBLE MAINTENANCE ACTIVITY:

Replace bituminous layers by materials of better composition.

TYPE: RUTTING WITH CRACKS

CODE: RU/C



Wheeltrack rutting and cracking.

Extent 3
Severity 2
Class 5

DESCRIPTION:

Concerns flexible pavements with thin layers of bituminous material. Permanent depressions in the road surface accompanied by cracks. Affects the road cross-section over the full length of the sub-section. This damage occurs especially in the wheel tracks and also along the edge of the road.

INSPECTION METHOD:

Severity:

- Place a 2 m straightedge across the wheel paths and measure the depth of the ruts;
- Take several measurements over the section or sub-section length;
- For the representative value take the highest value measured;
- Distance between measurements: 500 m in section, 100 m in sub-section.

Extent:

- Percentage of length.

RATING CRITERIA:

- To be rated in accordance with rating criteria for rutting and cracking;
- In this case rutting and cracking are both to be recorded on the DVI-form.

TYPE: RUTTING WITH CRACKS CODE: RU/C

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Inadequate pavement design.

Rigidity and thickness of top layers not appropriate to traffic and bearing capacity conditions.

Traffic:

Important influence of axle load and traffic intensity. Narrow roads present higher risk as vehicles tend to follow the same wheel paths.

Climate:

During rainy season increased moisture content in soil and foundation layers enhance the risk.

Proper drainage has to be maintained.

Materials:

High risks with clayey soils, lateritic soils, contaminated base courses or base courses containing too much fines.

REMARKS:

Damage will reduce lateral movement of vehicles thus increasing the development of existing ruts.

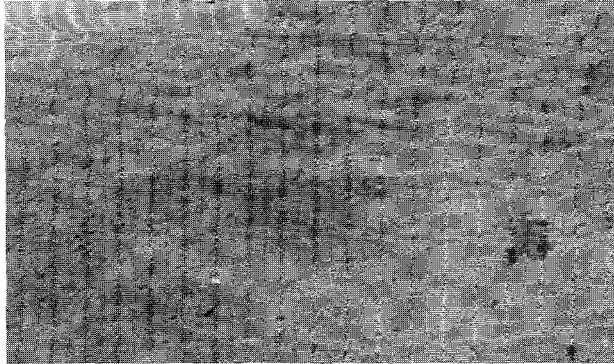
Presence of water in the ruts will endanger traffic through an increased risk of "aquaplaning".

POSSIBLE MAINTENANCE ACTIVITY:

- 1.
 - 2-3. Improve foundation by improving drainage; seal cracks.
 - 4-5. Improve foundation, reinforce pavement structure.
-

TYPE: CORRUGATIONS

CODE: CO



Transverse undulations
at intersection.

DESCRIPTION:

Shallow and evenly spaced ridges of surface material, perpendicular to the longitudinal road axis. Spacing of the ridges is often about 1 m; this type of damage is often localised.

INSPECTION METHOD:

Road condition survey:

Noticeable from within a vehicle either visually or by experiencing vibrations.

Detailed visual inspection:

Severity: Measurements with straightedge placed on the tops of the corrugations and determination of depth (h) with measuring wedge.

Extent: Affected area as a percentage of the total area.

RATING CRITERIA:

Extent	Evaluation	Severity (h)	Extent	Class Severity		
				1	2	3
1	< 10 %	< 20 mm	1	1	3	4
2	10-50 %	20-40 mm	2	2	3	5
3	> 50 %	> 40 mm	3	3	4	5

TYPE:

CORRUGATIONS

CODE: CO

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Corrugation occurs if one or more pavement layers start to flow, thus permitting movement of materials into the corrugated surface.

Traffic:

Tangential forces from wheels are the main cause of this type of damage, particularly where vehicles frequently stop or accelerate. Depressions may initiate the development of corrugations.

Climate:

High temperature increases the risk of such damage.

Wearing course design

Lack of adhesion between base and wearing course.

Materials:

Lack of stiffness in one of the layers due to improper construction, execution or design.

REMARKS:

POSSIBLE MAINTENANCE ACTIVITY:

- 1-2-3. No action required;
 - 4-5. Replace corrugated layers; choose mixtures with a better composition and quality.
-

TYPE: DEPRESSIONS

CODE: DP



Large depression with alligator cracking.

Extent 1
Severity 3
Class 4

DESCRIPTION:

Vertical settlement of the road surface, usually localised and circular in shape. Often the surface material is cracked.

INSPECTION METHOD:

Severity:

Place a 2 m straightedge over the affected area and measure the depth of the depression with a measuring wedge.

Extent:

Affected area as a percentage of the total area.

RATING CRITERIA:

Extent	Evaluation	Severity	Extent	Class		
				Severity	1	2
1	< 10 %	< 20 mm	1	1	3	4
2	10-50 %	20-40 mm	2	2	4	5
3	> 50 %	> 40 mm	3	3	5	5

TYPE: DEPRESSIONS

CODE: DP

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Settlement of lower layers and local loss of bearing capacity due to excessive moisture content within the pavement.

Traffic:

Heavy traffic is a major factor and worsens this damage rapidly.

Drainage:

Bad surface drainage : due to localised low spots. Run-off of surface water is not adequate. The water then penetrates into the foundation layers.

Bad lateral drainage : Water is ponding in sidedrains, raising the water table in the subgrade.

Climate:

Increased risks during rainy season.

Materials:

Clayey soils and clay contaminated subbase and base course materials.

REMARKS:

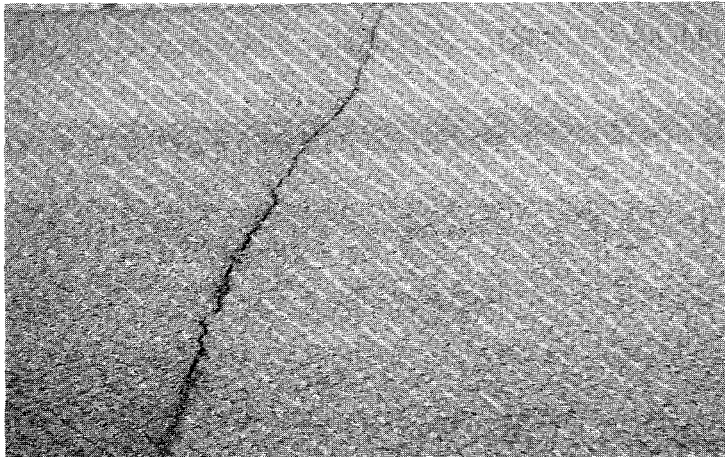
Once present, this type of damage worsens rapidly.

POSSIBLE MAINTENANCE ACTIVITY:

1. No action required.
 2. Maintain drains. Reinstate the surface course.
 3. Maintain drains. Reinstate the surface course.
 4. Maintain drains. Reinstate the surface course.
 5. Maintain drains. Remove the material in the affected area; replace by new base or subbase material and compact properly; reinstate the surface course.
-

TYPE: TRANSVERSE CRACKS

CODE: CT



Crack due to shrinking of base.

Severity 2

DESCRIPTION:

Rupture over the full width of the road.

INSPECTION METHOD:

Severity:

Measurement of width of crack in mm.

Extent:

Count all transverse cracks surpassing 1.5 m in length over a section of 100 m.

RATING CRITERIA:

Evaluation			Extent	Class Severity		
No.	per 100 m	Severity width		1	2	3
1	< 2	< 2 mm	1	1	3	4
2	2-15	2-10 mm	2	2	3	5
3	> 15	> 10 mm	3	3	4	5

TYPE: TRANSVERSE CRACKS

CODE: CT

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

- Inadequate joint construction.
- Lack of compaction of a road section.
- Reflection cracking from foundation layers.
- Structural discontinuity of pavement structure.

Climate:

During rainy season, water penetrates through the cracks to the underlying layers, thus weakening the sub-soil and leading to failure. Due to temperature variations, movement of the pavement layers will cause stresses at joints and in the foundation layers which will result in reflection cracking.

Materials:

Cement stabilized foundation materials (shrinkage cracks during drying process).
Lime stabilized foundation materials.

REMARKS:

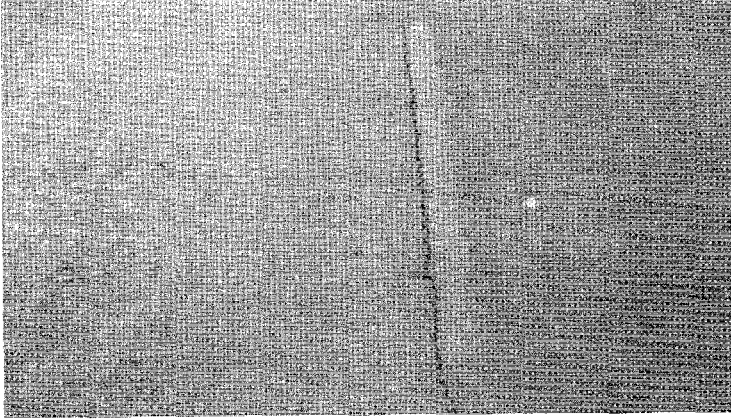
This type of damage may lead to other types when water infiltrates through the cracks into the sub-soil (settlement, alligator cracking, etc.).

POSSIBLE MAINTENANCE ACTIVITY:

- 1-2-3. Seal cracks.
- 4-5. Cut away wearing course and apply a new layer.

TYPE: LONGITUDINAL CRACKS

CODE: CL



Longitudinal cracking
on the centre line.

DESCRIPTION:

Crack or rupture parallel to the road axis (central or edge).

INSPECTION METHOD:

Severity:

Measurement of width of crack in mm.

Extent:

Evaluate percentage of section length affected by this type of damage.

RATING CRITERIA:

Extent	Evaluation Severity	Extent	Class Severity			
			1	2	3	
1 < 10 %	< 2 mm		1	1	3	5
2 10-50 %	2-10 mm	Extent	2	2	4	5
3 > 50 %	> 10 mm		3	3	5	5

TYPE: LONGIDUDINAL CRACKS

CODE: CL

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Different causes may be distinguished:

- Pavement fatigue (see also rutting accompanied by cracks); problems due to design;
- Opening of a longitudinal joint in the wearing course (construction fault);
- Reflection cracks where pavement has been widened; (uneven settlement of foundation or movement of longitudinal joints).

Traffic:

The influence of traffic will be important when the damage is concentrated in the wheel tracks.

Climate:

During the rainy season, weakening of sub-soil due to water infiltration. The variation in temperature will induce movement of materials and loss of interlock and adhesion of bitumen.

Materials:

Wearing course too fragile; bad mix design; low bearing capacity of foundation layers and soil.

REMARKS:

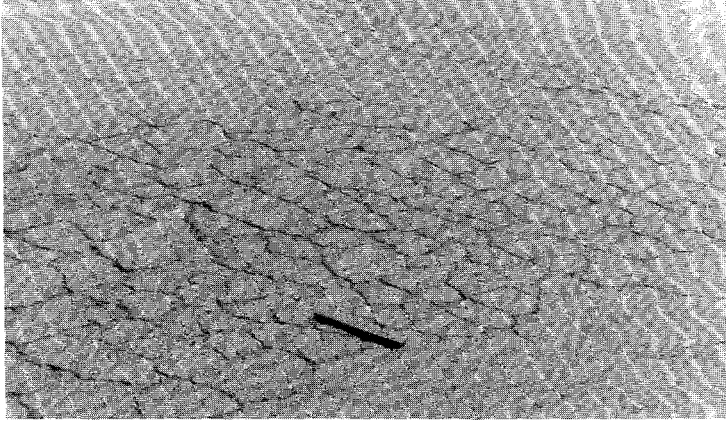
POSSIBLE MAINTENANCE ACTIVITY:

1-2-3. Seal cracks;

4-5. Cut away wearing course and construct a new layer or overlay.

TYPE: ALLIGATOR CRACKING

CODE: CA



Interconnected cracking.

DESCRIPTION:

Network of cracks in all directions, linked together; localised in the wheel tracks or over the full width of the road.

INSPECTION METHOD:

Severity: Measurement of width of crack in mm.

Extent: Detailed visual inspection: evaluate percentage of area affected.

RATING CRITERIA:

Extent	Evaluation Severity		Class Severity		
			1	2	3
1 < 10 %	< 2 mm	1	1	4	5
2 10-50 %	2-10 mm	Extent 2	2	5	5
3 > 50 %	> 10 mm	3	3	5	5

TYPE: ALLIGATOR CRACKING

CODE: CA

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Design:

-- Inadequate for traffic load; insufficient thickness of surface layers.
Pavement is at the end of its life; low bearing capacity of soil.

Traffic:

The damage appears in the first instance in the wheel tracks where the effects of traffic are greatest. If the base and subbase course are weak, this damage will be accompanied by deformation (see under "rutting with cracks").

Climate:

During the rainy season, weakening of sub-soil due to water infiltration. When the drainage is insufficient the damage will occur in the first instance in the outer wheel path of the road.

Materials:

Top layer: Too stiff relative to its thickness. Premature ageing of material.

Lower layers: Contaminated by clayey soils; clay or laterite soils.

REMARKS:

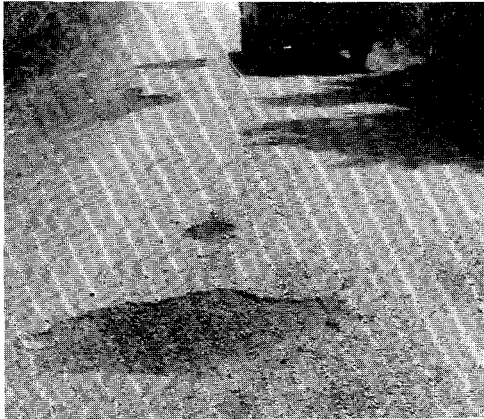
Ultimately alligator cracking will result in the formation of potholes.

POSSIBLE MAINTENANCE ACTIVITY:

1. None;
- 2-3. Superficial treatment, sealing;
- 4-5. Cut away and construct a new layer.

TYPE: HOLES

CODE: HO



Holes in wheeltracks.

Extent 1
Severity 3
Class 5

DESCRIPTION:

In general round holes caused by the loss of material in the top layer.

INSPECTION METHOD:

Road condition survey:

Visual recording and estimation of extent; driving conditions; localised deep holes.

Detailed visual inspection:

Severity: Place a straightedge over pothole and measure the depth of the hole with a tape or rule.

Extent: Counting the number of potholes per 100 m of road length.

RATING CRITERIA:

Extent No. per 100 m	Evaluation Severity		Class Severity		
			1	2	3
1	< 5	< 20 mm	1	3	5
2	5-15	20-40 mm	2	3	4
3	> 15	> 40 mm	3	4	5

TYPE: HOLES

CODE: HO

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Holes develop in those places where the subgrade is deformed or as a result of other damage (alligator cracking, settlements, etc.); increased traffic will accelerate the development of holes.

Climate:

Holes start to develop in the wet season; water remains in the depressions and soaks the foundation making it vulnerable to traffic. Once established potholes will continue to develop during all seasons.

Materials:

Wearing course material fragile or premature ageing of binder; clayey soils or contaminated foundations prevent proper drainage and encourage the development of holes.

Others:

This type of damage often results from neglected maintenance (surface treatment of road with alligator cracking).

REMARKS:

Once potholes are present, they are to be repaired immediately since they worsen quickly. Potholes have an adverse effect on the safety and comfort of the road user.

POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required;
2. Preventive maintenance of cracks (sealing);
3. Cut away bad material to obtain a patch with straightedges; fill with bituminous material and compact;
- 4-5. Cut away wearing course and apply a new bituminous layer.

Deep holes endangering traffic must be repaired immediately.

TYPE: EDGE DISTRESS

CODE: ED



Edge distress with shoulder deformation.

Extent 3
Severity 3
Class 5

DESCRIPTION:

Cracking and disintegration of the edges of the bituminous pavement.

INSPECTION METHOD:

Severity: Measure level differences.

Extent: Evaluate percentage of affected length.

RATING CRITERIA:

Extent	Evaluation Severity		Class Severity				
			1	2	3		
1	< 10 %	< 10 mm	1	1	3	4	
2	10-50 %	10-25 mm	Extent	2	2	3	5
3	> 50 %	> 25 mm		3	3	4	5

TYPE: EDGE DISTRESS

CODE: ED

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Traffic:

Due to narrow road width, vehicles are forced to use the edge of the road or the shoulder; settlement of shoulder due to parking of vehicles.

Construction:

Lack of support of shoulder; shoulder unstable and too low.

Materials:

Lack of adhesion in the surfacing ; lack of stiffness.

Climate:

Erosion will reduce shoulder level and progressively affect the surfacing.

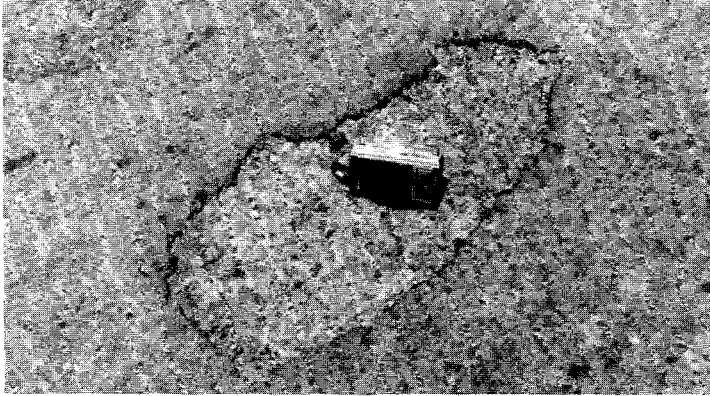
REMARKS:

This type of damage tends to worsen rapidly and may affect the safety of traffic.

POSSIBLE MAINTENANCE ACTIVITY:

1. No maintenance required;
2. Repair areas affected;
3. Reconstruct shoulder and edge of pavement;
4. Reconstruct shoulder and edge of pavement;
5. Reconstruct completely.

TYPE: STRIPPING/FRETTING/RAVELLING CODE: ST



Localised damage.

Extent 1
Severity 2
Class 2

DESCRIPTION:

Loss of areas of the surfacing.

INSPECTION METHOD:

Severity: Measure thickness of surfacing course affected in mm.

Extent: Evaluate percentage of area affected.

RATING CRITERIA:

Extent	Evaluation Severity	Extent	Class Severity		
			1	2	3
1	< 10 % < 10 mm	1	1	2	4
2	10-50 % 10-25 mm	2	1	3	5
3	> 50 % > 25 mm	3	2	5	5

TYPE: STRIPPING/FRETTING/RAVELLING CODE: ST

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Climate:

In the case of insufficient adhesion, infiltrating water (through cracks or porous surface layer will accumulate between the pavement layers and weaken the pavement structure.

Materials:

Insufficient thickness or stability of wearing course; lack of bond with lower layer.

REMARKS:

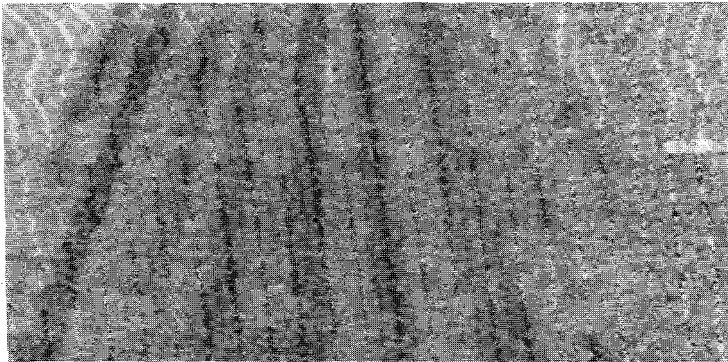
Lack of maintenance of this type of damage will result in the formation of potholes.

POSSIBLE MAINTENANCE ACTIVITY:

1. None;
 2. Localised repairs; surface treatment or sealing;
 - 4-5. Cut away wearing course and reconstruct.
-

TYPE: STRIPPING/FRETTING/RAVELLING OF SURFACE

CODE: ST/S



Longitudinal removal.

Extent 3

DESCRIPTION:

ONLY SURFACE DRESSINGS ARE CONCERNED

Removal of aggregates in longitudinal strips.

Pavement binder appears alternatively in thin and thick lines on the surface, parallel to road axis.

Removal of aggregates of a large surface area.

INSPECTION METHOD:

Severity: Evaluate percentage of a unit area (1 sq. m) affectedExtent: Evaluate percentage of the subsection affected.

RATING CRITERIA:

Extent	Evaluation	Severity	Extent	Class Severity		
				1	2	3
1	< 15 %	< 10 %	1	1	2	3
2	15-30 %	10-50 %	2	2	4	5
3	> 30 %	> 50 %	3	3	5	5

TYPE: STRIPPING/FRETTING/RAVELLING OF SURFACE

CODE: ST/S

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

During laying:

Bad spreading of binder (blocked, badly adjusted or aimed nozzles).
Bad adjustment in height of the spreading bar;
Bad binder/aggregate bond;
Bad aggregate gradation of the surface mix;
Bad spreading of aggregates.

REMARKS:

POSSIBLE MAINTENANCE ACTIVITY:

-- Renew treatment with better control of laying operation.

TYPE: BLEEDING

CODE: BL



Bleeding in wheeltracks.

Extent 3 right side
Extent 2 left side

DESCRIPTION:

Localised accumulation of bitumen at road surface, making the road appear black and shiny.

INSPECTION METHOD:

Extent: Evaluate percentage of surface area affected.

RATING CRITERIA:

Extent

- 1 < 5 %
 - 2 5-50 %
 - 3 > 50 %
-

TYPE: BLEEDING

CODE: BL

PROBABLE CAUSES AND FACTORS AFFECTING THE DEVELOPMENT OF THE DAMAGE:

Climate:

High temperature softens the binder and makes it more susceptible to damage (binder too soft or too susceptible to high temperatures).

Materials and construction execution

Excess bitumen in surface course; damage will occur generally in wheel paths.

Upward movement of bitumen from underlying tack coat or previous surface layer.

REMARKS:

Bleeding makes the road surface slippery.

POSSIBLE MAINTENANCE ACTIVITY:

1. No actions required.
2. Spread chippings or sand on the affected area.
3. Remove the affected layer and replace.

Figure 8. SUMMARY OF DETAILED VISUAL INSPECTION RESULTS: AVERAGE CONDITION VALUE ("FORM VIII")

DETAILED VISUAL INSPECTION (DVI)

OFFICE:	DISTRICT:	<div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center;"> PAGE </div>
Established by:		
Date:		

DESIGNATION OF ROAD SECTION									
Road		Section / Sub-section No.	Identification Points (IP)			Section length		AADT	
Class	No.		I.P.	Designation	Km	Km	m	Veh/day	
1	2	3	4	5	6	7	8	9	
			From		From				
			To		To				
			From		From				
			To		To				
			From		From				
			To		To				
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			To		To				
			From		From				
			To		To				
			From		From				
			To		To				

Visual inspection data																												Instrumental survey data		
Roadside	Unpaved roads													Paved roads											Avg. cond. value	IRI	Deflection	Skid resistance		
	Rutting	Corrugations	Loss of camber	Gravel thickness	Erosion gullies	Potholes	Clay	Rutting	Corrugations	Depressions	Tr/Long cracking	Alligator crack.	Holes	Edge distress	Stripping	Bleeding														
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32									
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