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Raters' Guideline for Visual Assessment of Low Volume Rural Road Pavements

Part B: Flexible Pavements

Final

Civil Design Solutions

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Cover photos: Types of distress on flexible road pavements

Quality assurance and review table

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Preface

Visual assessments of road conditions are used to determine Visual Condition Indices for various purposes. These include assessing maintenance and rehabilitation needs, prioritisation of projects in a decision support system, or for research purposes. Visual Condition indices are, in turn, used to monitor the changing condition of roads over time for maintenance management or research purposes. Therefore, the data that are recorded during the visual assessment must be collected in a systematic, repeatable, and consistent manner. This can be achieved by using the guidance provided in this document.

The suite of Raters' Guidelines comprises five parts. Part A provides general guidance on assessing the degree and extent of defects, field assessment procedures and quality assurance. Parts B to E provide detailed descriptions of the various distress types and guidance on assessing the degree of distress for Flexible Pavements, Concrete Pavements, Block Pavements and Unpaved Roads.

Key words

Performance Monitoring, Low Volume Roads, Design Standards

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Research for Community Access Partnership (ReCAP)

Safe and sustainable transport for rural communities

ReCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa and Asia. ReCAP comprises the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). These partnerships support knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The ReCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

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Acronyms, Initialisms, Units and Currencies

$	United States Dollar
AfCAP	Africa Community Access Partnership
AsCAP	Asia Community Access Partnership
CDS	Civil Design Solutions
GPS	Global Positioning System
LTPP	Long Term Pavement Performance
ReCAP	Research for Community Access Partnership
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
VCI	Visual Condition Index

B.1 Introduction

B.1.1 General

The principal aim of this guideline is to provide guidance for the visual assessment of the condition of flexible pavements as part of a Long-Term Pavement Performance (LTPP) monitoring programme. The guideline deals with the type of defects observed on flexible pavements (i.e., pavements that are surfaced with a bituminous bound layer such as an asphalt layer or a surface treatment). The assessment of flexible pavements follows the procedures for defining the degree and extent of defects, as discussed in Part A (sections A.2.2. and A.2.3). Although only three degrees of distress are illustrated in this document (Degree 1, 3 and 5), use should be made of degrees 2 and 4 where appropriate. The definitions for these two categories are described in Part A, section A.2.2.

The visual assessment for flexible pavements is divided into the following three categories:

- Engineering assessment (surfacing)
- Engineering assessment (structural)
- Functional assessment

Annex A includes a typical form for recording the visual assessment of flexible pavements.

The photographs included in this guideline are intended to assist the Rater to determine the degree of distress of typical defects. Users of the guidelines are encouraged to include their own photographs where one is missing or replace photographs with their own examples that more clearly portray the degree of distress in the local context.

B.1.2 Visual assessment items

The various items to be assessed are presented in Table B.1-1.

Table B.1-1: Visual assessment items

A. Surfacing Assessment	B. Structural Assessment	C. Functional Assessment

• Texture
• Voids
• Surfacing failures
• Surfacing patching
• Surfacing cracks
• Binder condition
• Aggregate loss
• Bleeding/flushing.
	• Cracks
	• Pumping
	• Deformation:
	  ○ Rutting
	  ○ Undulations
	  ○ Shoving
	• Patching
	• Potholes.
		• Roughness (Riding Quality)
		• Skid Resistance
		• Drainage
		• Shoulders
		• Edge Defects:
		  ○ Edge break
		  ○ Edge drop.

B.2 Surfacing Assessment

B.2.1 Texture

The texture depth depends on the aggregate size and the quantity of binder in the surfacing layer. The texture can be expressed as fine, fine-medium, medium-coarse or coarse, or if it varies across the width of the road, as varying (refer to Table B.2-1, Figure B.2-1 and Figure B.2-2).

Table B.2-1: Description of texture types

Texture Type	Description
Coarse	The surfacing has a coarse appearance, with coarse aggregate clearly visible, e.g., a new 13.2 mm single seal.
Medium	The road may have a smooth appearance. If present, the coarse aggregate is visible, but the surface does not appear coarse, because of fine aggregate between the coarse aggregate, e.g., normally a new 6.7 mm single seal or 13.2/6.7 mm double seal.
Fine	The surfacing is smooth and the coarse aggregate (if present) in the surfacing is not visible—for example, a sand seal, fine slurry seal or smooth asphalt.
Varying	This implies the variation of the texture in the cross-section of the road surface, e.g., the surface appears smooth in the wheel paths with a different texture elsewhere. If the texture is rated as varying, the different types of texture that are observed should also be noted.

Figure B.2-1: Visual assessment of degrees of texture (Slurry Seal, Double Seal, Single Seal)

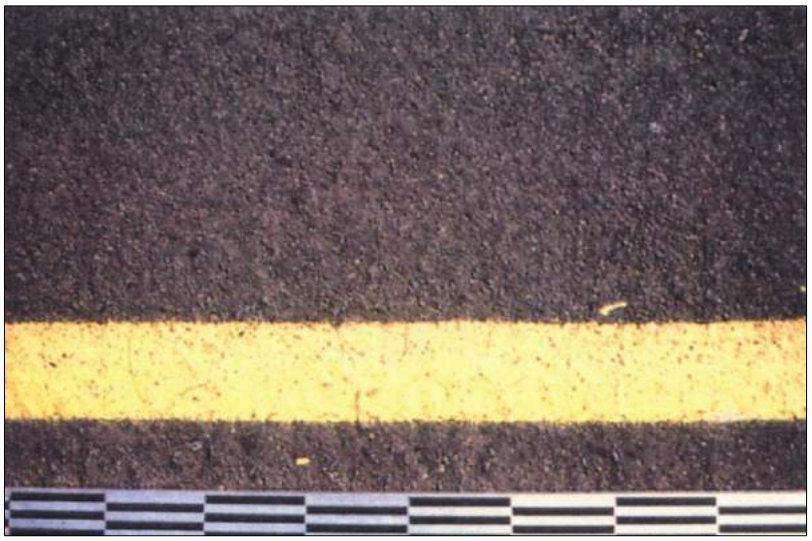
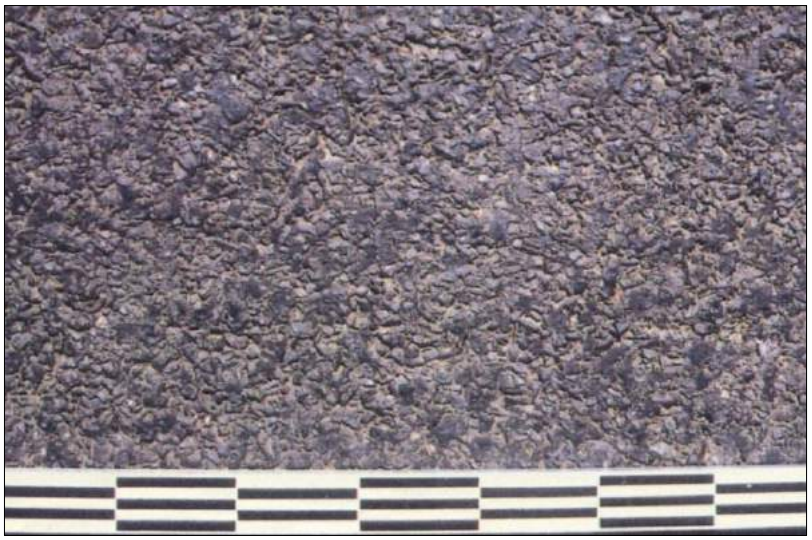
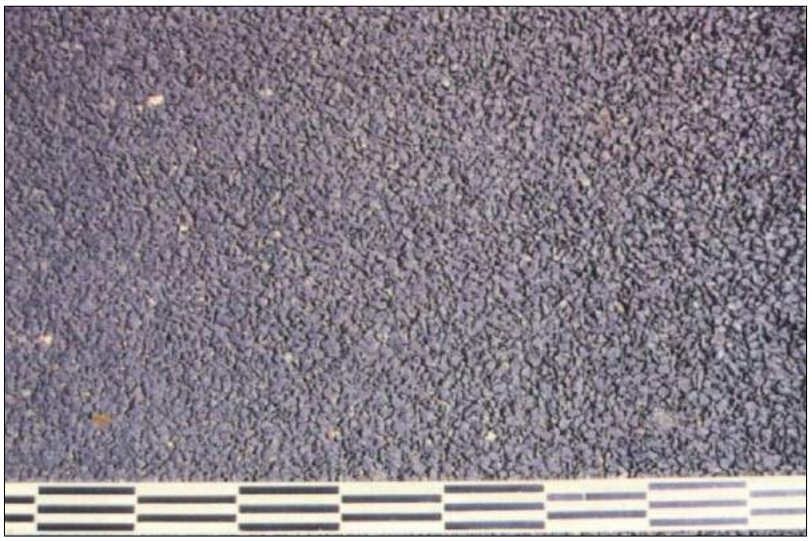
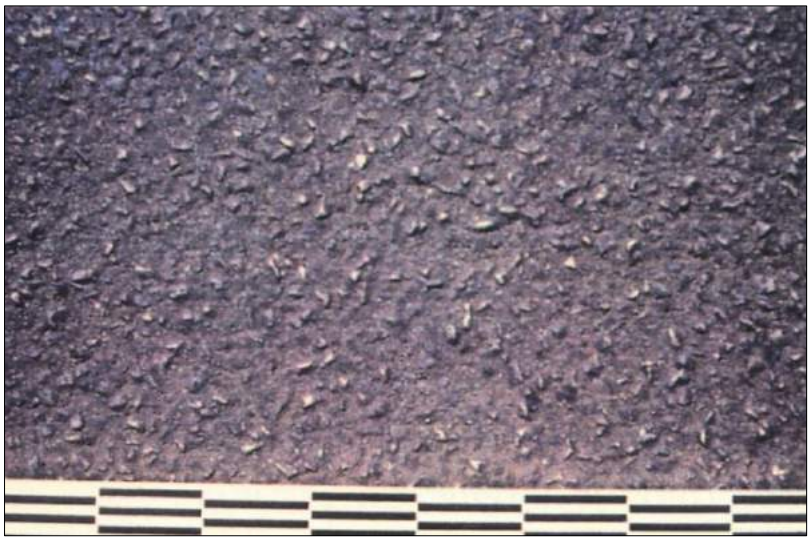
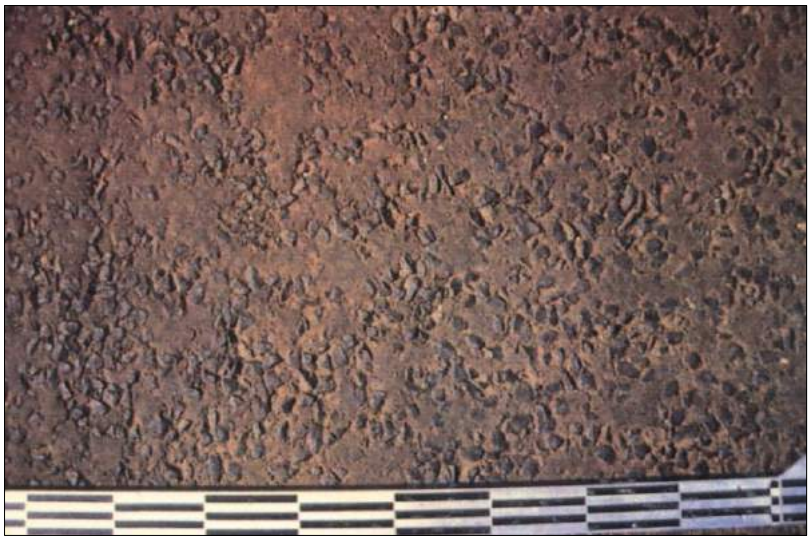
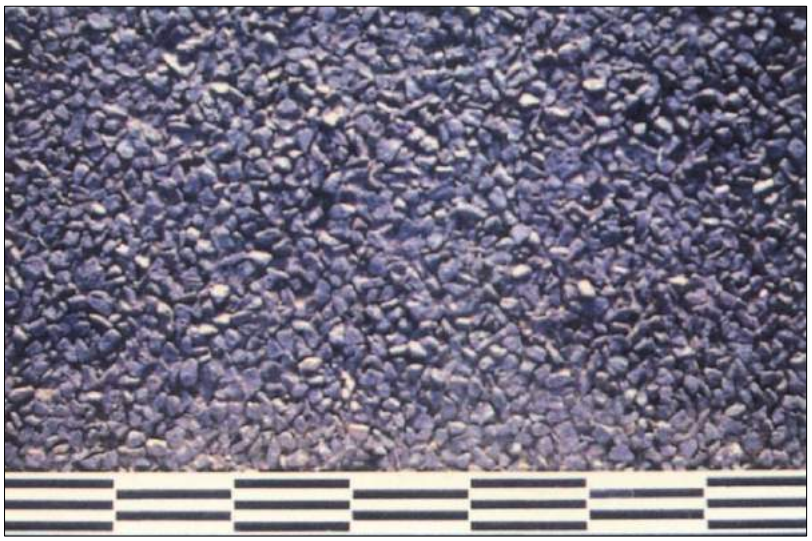
Surfacing: Texture	
	Fine
	Slurry seal
	Medium
	Double seal
	Medium
	6 mm or 9 mm single seal

Figure B.2-2: Visual assessment of degrees of texture (Cape Seal, Asphalt, Single Seal)

Surfacing: Texture	
	Medium
	Cape seal
	Medium
	Asphalt with rolled in chips
	Coarse
	13 mm single seal

B.2.2 Voids

The surface voids in a bituminous surfacing are related to the size of the aggregate, the "packing" of the aggregate and the quantity of binder used in the surfacing. The degree of void classification includes none, few, many and varying. "None" suggests that the surface is dense (or bleeding) and no voids are visible, "few" that some voids are visible and the surfacing is fairly dense, and "many" if the voids are visible, the surfacing is open, and aggregates are well proud of the binder. The surface is considered "varying" if there is a variation of the voids in the cross section of the road. The description of void classes is given in Table B.2-2 and is illustrated in Figure B.2-3 and Figure B.2-4.

Table B.2-2: Description of void classes

Void Classes	Description
None	The surfacing is dense (or bleeding) and no voids are visible.
Few	Some voids are visible, surfacing is fairly dense.
Many	Many voids are visible, surfacing is open. Aggregates are well proud of the binder.
Varying	This implies the variation of the voids in the cross-section of the road surface, e.g., the surface appears sealed in the wheel paths with many voids elsewhere. If the voids are rated as varying, the different degrees of voids that are observed should also be noted.

Figure B.2-3: Visual assessment of degrees of surfacing voids (Cape Seal, Slurry Seal, Asphalt)

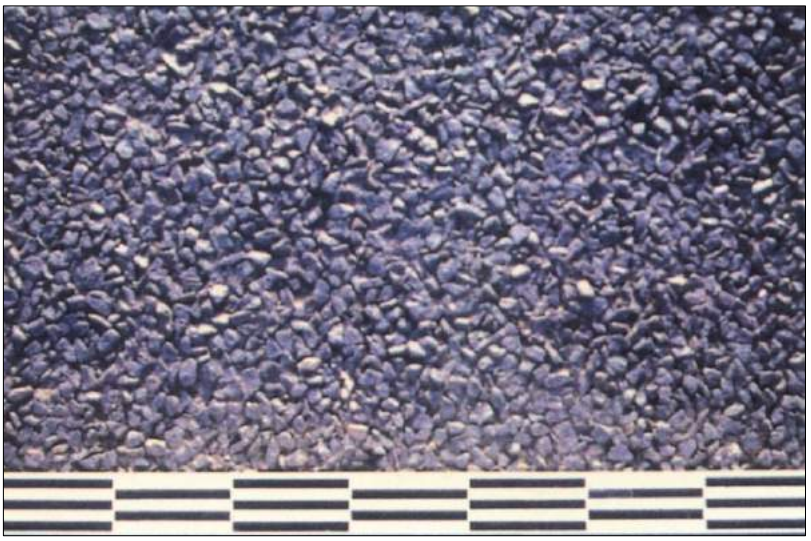
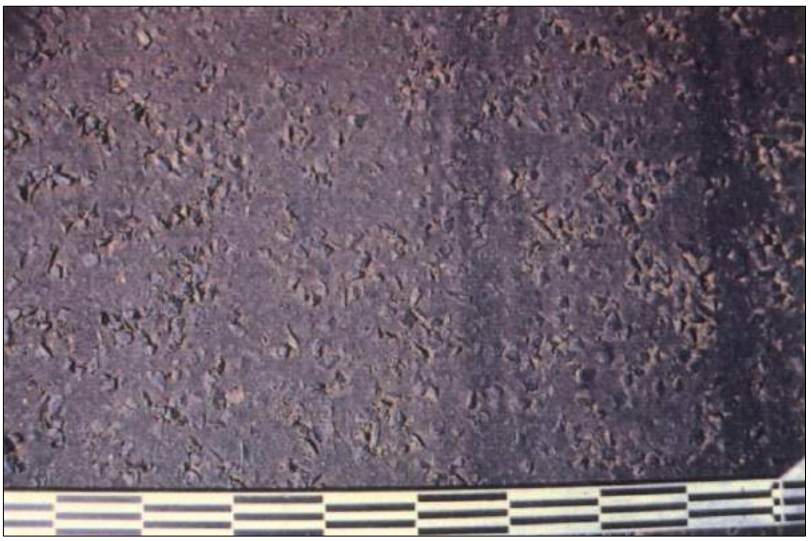
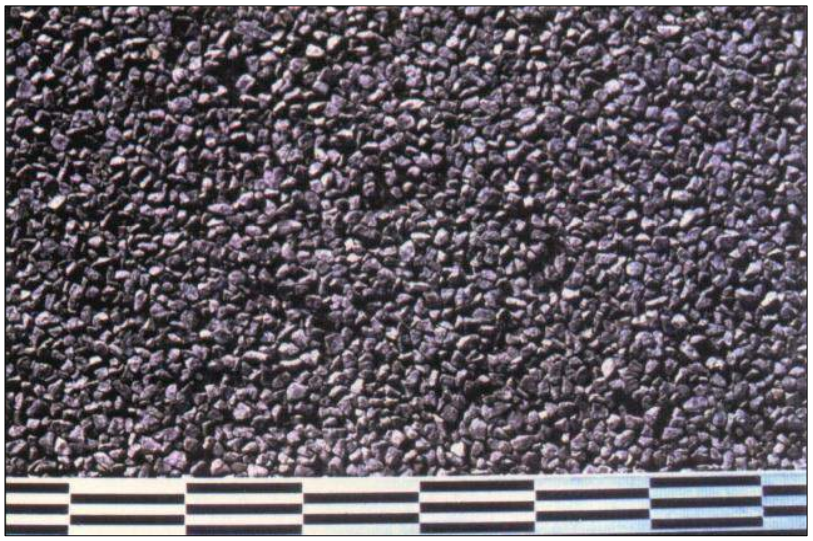
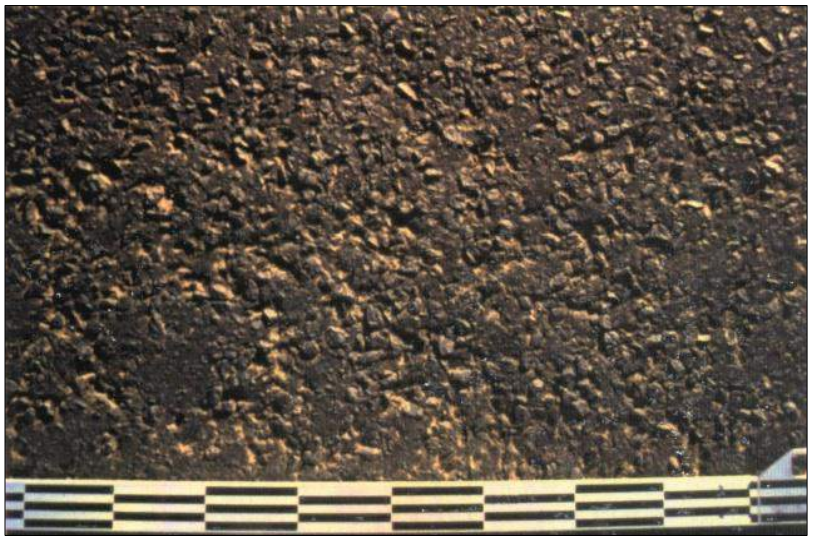
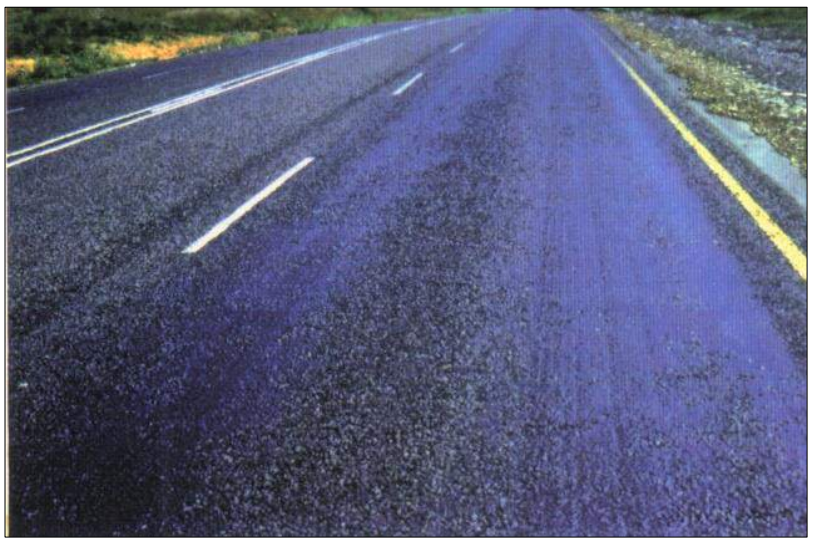
Surfacing: Voids	
	None
	Cape seal
	Few
	Slurry seal
	Few
	Asphalt

Figure B.2-4: Visual assessment of degrees of surfacing voids (Single Seal, Asphalt, Varying)

Surfacing: Voids	
	Many
	Single seal
	Many
	Asphalt
	Varying (none to many)

B.2.3 Surfacing failures

Surface failures typically include shallow, surface-related potholes caused by spalling around cracks, localised loss of surfacing due to poor bonding with the underlying layer and the disintegration of weak surfacing aggregates. In some countries distress to the surfacing may be due to salt damage. The degree of distress for failure is related mostly to the diameter or area, as given in Table B.2-3 and illustrated in Figure B.2-5. If the defect extends below the surfacing is it a structural failure and is considered separately (Section B.3).

Table B.2-3: Description of degrees of surfacing failure

Degree	Description
1	Failures difficult to discern from moving vehicle. Small areas of surfacing are lost (diameter < 50 mm).
3	Significant failure is visible from a moving vehicle (diameter ≈ 150 mm).
5	Failure occurs over large areas and/or secondary defects have developed owing to the failure (diameter > 300 mm).

Figure B.2-5: Visual assessment of degrees of surfacing failure

Surfacing Failures	
	1 X | 2 | 3 | 4 | 5 Small areas of surfacing are lost (diameter <50 mm), not easily visible from a moving vehicle
	3 1 | 2 | X | 3 | 4 Significant failure visible from a moving vehicle (diameter ≈ 150 mm)
	5 1 | 2 | 3 | 4 | X Occur over large areas, failures > 300 mm in diameter.

B.2.4 Surfacing patching

Surfacing patches can be described as minor patching. Patches in asphalt surfacing that are cut square or with distinct square edges are deemed structural. Geotextile patches are rated as surfacing patches.

If patches are observed outside the wheel paths, these should be assessed as surfacing patches. Patches occurring in the wheel paths should normally be assessed as structural defects as they are normally a result of crocodile cracking, deformation, and rutting. The description of surfacing patching classes is given in Table B.2-4 and is illustrated in Figure B.2-6.

Table B.2-4: Description of degrees of surface patching

Degree	Description
1	Patching difficult to discern from moving vehicle (diameter < 100 mm). Also: singular occurrence of significant patching.
3	Patches visible from moving vehicle (diameter ≈ 300 mm). Also: singular occurrence of large patches or concentration of small patches.
5	Patching occur over large areas (diameter > 500 mm). Also: concentration of significant patching.

Figure B.2-6: Visual assessment of degrees of surfacing patching

Surfacing Patching	
	1 X 2 3 4 5 Small areas of surfacing are patched (diameter < 100 mm).
	5 1 2 3 4 X Patching occur over large areas (diameter > 500 mm) or concentration of significant patching.

B.2.5 Surfacing Cracks

Surfacing cracks are caused mostly by shrinkage of the bituminous surfacing as a result of decreased binder volume. This occurs when the binder ages and loses its lighter oils and aromatics. These cracks are also sometimes referred to as map cracks, star cracks and amorphous cracks. They are more commonly found in dense surfacing such as sand seals, slurry seals, etc. and are more easily observable on finely textured surfaces.

The initial cracking consists of short longitudinal, diagonal, crescent-shaped and transverse cracks randomly spaced over the full road width. The severity of the cracking increases with ageing, to form a map pattern. In this state, secondary cracking induced by traffic around the shrinkage cracks is often evident. If maintenance is poor, the condition can deteriorate so that the basic pattern of shrinkage cracks is not obvious.

When surface treatments older than about eight years have areas of crocodile cracking over most of the road width, it is necessary to inspect less severely cracked areas for evidence of the characteristic map crack pattern resulting from binder shrinkage. Surfacing cracks are normally not confined to the wheel paths, as is the case with traffic associated crocodile cracks. This behavioural feature should be used to help distinguish this crack type from crocodile cracking. However, when in doubt, record the distress as crocodile cracking, which is a structural defect.

The description of the degrees of surfacing cracks is given in Table B.2-5 and is illustrated in Figure B.2-7.

Table B.2-5: Description of degrees of surfacing cracks

Degree	Description
1	Faint cracks. In some instances, small cracks appear in a star pattern.
3	Distinct cracks. Slight spalling may be visible. Easily observable when driving slowly. Emergence of a map crack pattern.
5	Open cracks with severe spalling. Map crack pattern complete.

Figure B.2-7: Visual assessment of degrees of surfacing cracks

Surfacing Cracks	
	1 X | 2 | 3 | 4 | 5 Faint cracks.
	3 1 | 2 | X | 3 | 4 Distinct cracks, easily observable from a slow-moving vehicle.
	5 1 | 2 | 3 | 4 | X Open cracks with severe spalling.

B.2.6 Aggregate loss

Aggregate loss (ravelling) is the progressive loss of the surfacing aggregate, usually as a result of traffic abrasion. Aggregate loss is mostly construction-related and occurs shortly after construction or during the first cold period/winter. The possible causes of aggregate loss include:

- Insufficient or dry binder.
- Poor binder to stone adhesion due to due to contaminated, dirty, or hydrophilic aggregates without effective precoating with adhesion agent aggregate adhesion.
- Aging or absorption of binder by porous aggregate.
- Aggregate deterioration (poor durability).
- Inadequate rolling before opening the surfacing to traffic.

Aggregate loss later in the life of surface layer may be related to the use of certain types of aggregate (for example white quartzite) that disintegrates over time, as seen in Figure B.2-8.

Figure B.2-8: Aggregate loss due to disintegration

In assessing the degree of aggregate loss, the following must be considered:

- A single surface treatment consists of one layer of single-size stone aggregate, and consequently, any aggregate loss exposes the underlying layer. In the case of multiple surface treatments, ravelling is characterised by loss of the fine aggregate on the surface, followed by loss of the larger aggregate in successively exposed layers. Asphalt surfacings consist of a mixture of aggregates of various sizes and often also include a final layer of pre-coated aggregate. Because of the different manifestations of the distress in different surfacings, the degree of aggregate loss is defined differently for each case. The type of surfacing inspected should, therefore, be accurately recorded.
- Tell-tale signs of aggregate loss can be seen on the side of the road. However, the aggregate at the side of the road may be evidence of previous aggregate loss (before the application of a diluted emulsion). The loss of excess aggregate (“over-chipping”), should not be regarded as aggregate loss. All aggregate loss, irrespective of activity, should be recorded under this item.

The description of degrees of aggregate loss is given in Table B.2-6 and is illustrated in Table B.2-7.

Table B.2-6: Description of degrees of aggregate loss for various types of surfacing

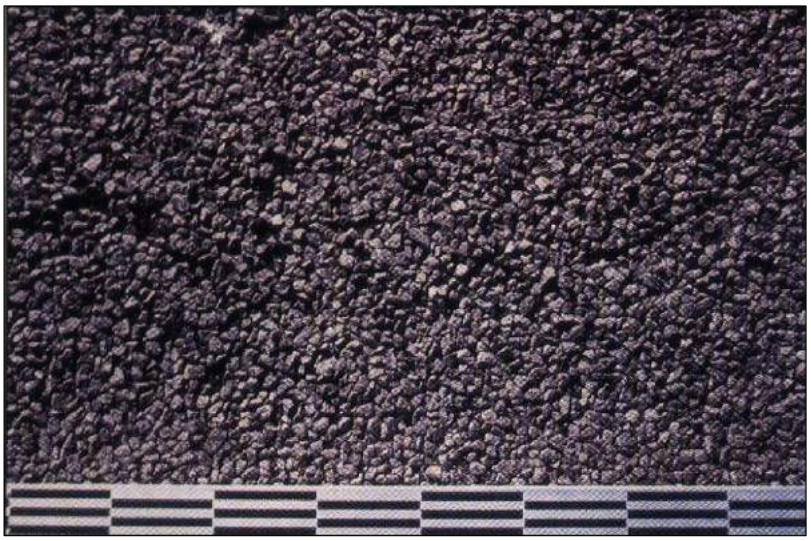
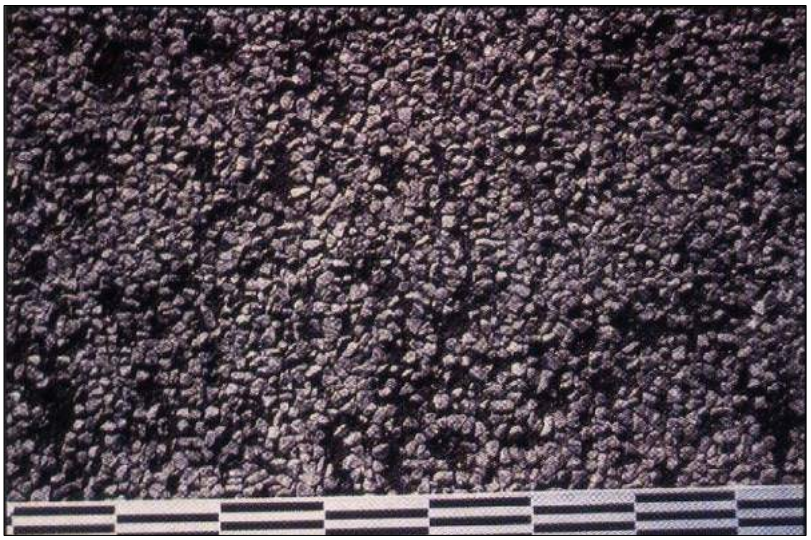
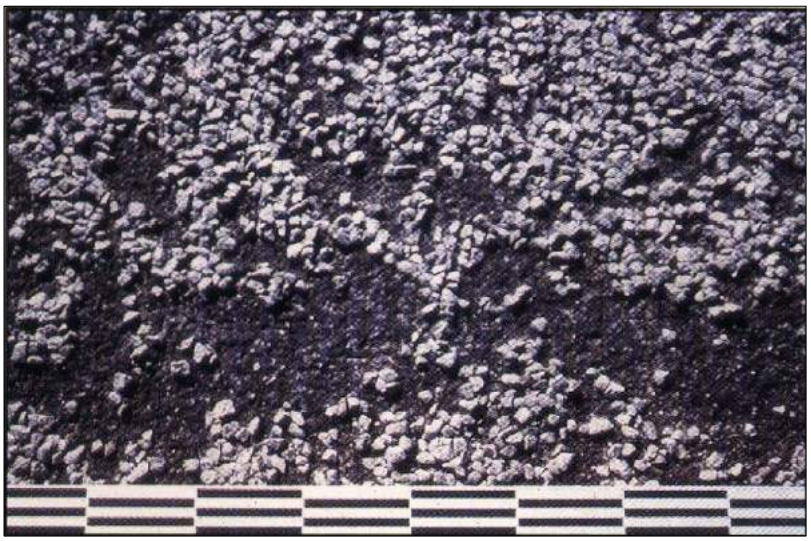
Degree	Description		
	Slurry Seals	Stone Seals	Asphalt Surfacing
1	Very little discernible loss of aggregates. Loss of individual aggregate visible on close in-spection. Difficult to discern from a vehicle.	Very little discernible loss of stone. Loss of individual stones visible on close inspection. Difficult to discern from a vehicle.	Very little discernible loss of aggregate or pre-coated chips. Difficult to discern from a vehicle.
3	Distinct aggregate loss in small areas, easily discernible from moving vehicle. Also, general pitted appearance through distinct but scattered loss of aggregate.	Distinct stone loss in small areas, or general pitted appearance through scattered loss of aggregate clusters, losing shoulder to shoulder matrix.	Distinct disintegration of asphalt layer in small areas and/or general loss of pre-coated chips. Distinct pitted appearance.
5	General loss of slurry in large patches.	General loss of stone from all layers in large areas.	General disintegration of total asphalt layer.

An assessment of the activity of the aggregate loss must be made. Aggregate loss is defined as active if there are signs that the loss is continuing at that time, for example, a fresh bitumen face where a stone has become dislodged from a seal. A close inspection of the surface should be carried out to determine if the aggregate loss is active. If the previous aggregate loss has subsequently been successfully treated with diluted emulsion, which appears to have stopped further aggregate loss, the aggregate loss should be rated as non-active. Therefore, if the aggregate loss has been rated, one of the two categories in Table B.2-7 must be indicated. If uncertain, the aggregate loss must be rated as active.

Table B.2-7: Indication of aggregate loss activity

Degree of Activity	Description
Active (A)	Aggregate loss is continuing
Non-Active (N)	No continuing aggregate loss

Figure B.2-9: Visual assessment of degrees of aggregate loss

Aggregate loss (chip and spray)	
	1 X 2 3 4 5 Loss of individual stones visible on close inspection.
	3 1 2 X 3 4 Distinct stone loss in small areas.
	5 1 2 3 4 X General loss of stone from all layers in large areas.

B.2.7 Binder condition (dry/brittle)

Binder Condition refers to the freshness and elasticity of the binder. The binders in surface treatments and asphalts become increasingly dry and brittle with time. The secondary defects of a dry binder condition are shrinkage cracks (surface cracks) and aggregate loss.

In surface treatments, with relatively thick films of binder, there is an initial loss of the lighter, more volatile oils and aromatics, and an increase in oxidation of the surface of the film. These oxidised products are partially water-soluble and also tend to shrink, exposing fresh surfaces after each rainfall, therefore allowing the oxidation to penetrate deeper into the binder film. In asphalts the binder film is thinner, but loss of oils and oxidation is restricted by the low voids in the mix.

To assess this defect, it is necessary to remove a chip or two from the surfacing between the wheel tracks and to test whether the binder is dry (lifeless) or not. The use of a screwdriver is recommended to remove aggregate from the surfacing. The colour of the binder on the removed chip also gives an indication of the brittleness. If the binder is dry, the colour will normally be dull and brownish and if the binder is 'lively', it will be bright black (Figure B.2-11). The defect must not only be assessed visually on the road surface, because the colour of the aggregate can be misleading, but an inspection of the shrinkage crack pattern can provide a clue to the binder condition (See Section B.3.2).

Note: Temperature can influence the brittleness of the binder. Conventional blinders normally appear hard and dry below road temperatures of about 20° C.

The description of degrees of binder condition is given in Table B.2-8.

Table B.2-8: Description of degrees of binder condition

Degree	Description
1	Binder not fresh but is sticky, and colour still bright black and/or very difficult to dislodge aggregate from seal. (No shrinkage cracks yet).
3	Binder appears dull (brownish), binder is brittle owing to hardening and/or aggregates can be dislodged from seal with relatively little effort. (Shrinkage cracks may have appeared in slurries or asphalt.)
5	Binder is dull (brown) and very brittle (not sticky at all), binder elasticity is very low and/or aggregate can be dislodged from seal without effort. (Except surface cracks in asphalt and slurries, and aggregate loss on stone seals.)

Figure B.2-10: Example of binder Degree 1

If the degree of binder condition is rated as > "0", then the extent should be rated as "5", unless there is a significant variation in binder condition over the length of the road segment.

B.2.8 Bleeding / flushing

Bleeding occurs when excess binder moves upwards relative to the aggregate, therefore reducing surface texture depth. The measurement of this form of distress is complicated by the pronounced difference in textures obtained in the different forms of newly laid surfacings (e.g., asphalt, gap-graded asphalt with pre-coated chips, etc.). A common scale for the degree of bleeding for all types is desirable and Table B.2-9, therefore, gives a description of the degree of bleeding with particular reference to the presence of excess binder. Figure B.2-11 illustrates the assessment of the degree of bleeding.

Table B.2-9: Description of degrees of bleeding

Degree	Description
1	Surfacing is slightly rich in excess binder. Stones well proud of binder.
3	Surfacing rich in excess binder. Smooth appearance, but stones visible in the binder.
5	Surfacing very rich in excess binder giving pavement surface a wet look. Film of excess binder covering all stones in wheel parts. Surface is tacky during hot weather, and/or wheel prints are visible in binder with possible pick-up of binder.

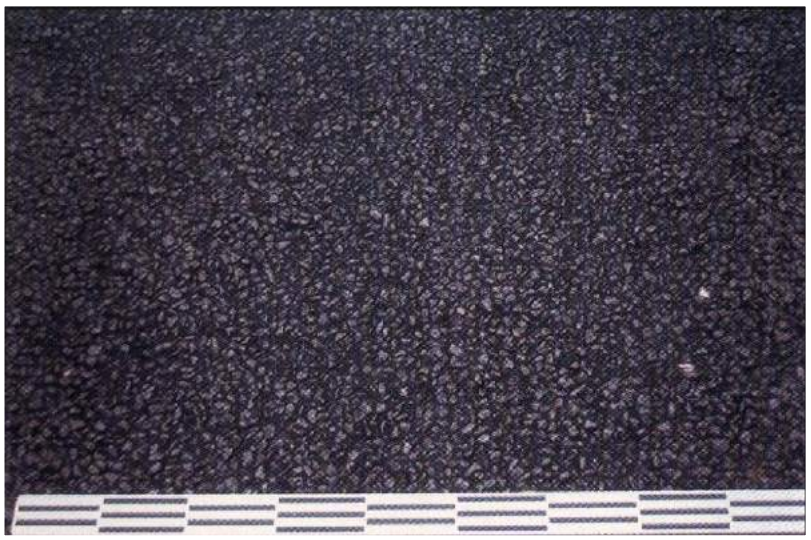
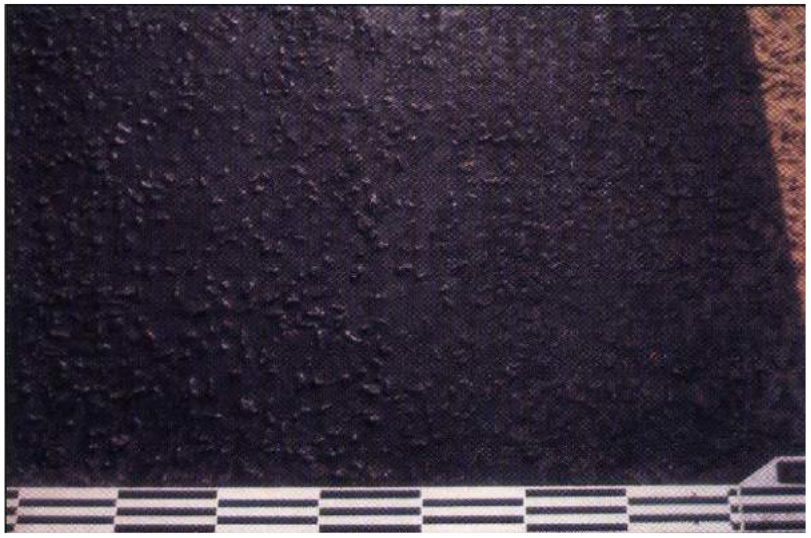
Possible causes of bleeding include:

- Excessive application of binder with respect to stone size.
- Penetration of aggregate into base (low strength base).
- Excessive prime coat being incorporated into the seal.
- In a double surface treatment (e.g., Double Surface Dressing or Cape Seal), the second layer of surfacing has been applied before the volatiles in the binder of the first layer have evaporated.

Degree 1 represents a texture depth that would be considered adequate for skid resistance of roads carrying high-speed traffic, whereas degree 5 indicates the worst possible condition for skid resistance for all roads.

The descriptions of visual appearance with regard to the depth between stones relate to surface seals. Densely-graded asphalt, for example, cannot obtain a condition described as Degree 1 in terms of depth between stones. It is also difficult to determine the extent to which a lack of texture in depth is due to actual distress (i.e. a deterioration), rather than to the way in which it was constructed. Usually, however, only degrees 3 to 5 are of practical interest for such surfacings.

Figure B.2-11: Visual assessment of degrees of bleeding/flushing

Bleeding/flushing	
	1 X 2 3 4 5 Surfacing is slightly rich in excess binder.
	3 1 2 X 3 4 Surfacing rich in excess binder. Smooth appearance, but stones visible in the binder.
	5 1 2 3 4 X Surfacing very rich in excess binder giving pavement surface a wet look.

B.3 Structural Assessment

B.3.1 General

This section provides guidelines for the evaluation of the current condition of the pavement structure as manifested through visible distress. This assessment will, together with the surfacing assessment, be used to determine the deficiencies and inadequacies of the pavement being monitored.

The defects are the result of deterioration of the strength of the pavement structure caused by, for example, a poor surfacing, ingress of water, traffic, climate, quality of material in pavement layers and the age of the pavement.

The following modes of distress which indicate the defects in the pavement structure are to be evaluated with regard to degree and extent:

- cracking;
- pumping;
- deformation;
- patching; and
- failures / potholing.

B.3.2 Cracks

Cracks are fissures resulting from partial or complete fractures of the pavement surface. Such cracking can occur in a variety of patterns, ranging from isolated single cracks to an interconnected pattern extending over the entire pavement surface.

The detrimental effects associated with the presence of cracks are manifold and include:

- loss of waterproofing of the pavement layers;
- loss of load-spreading ability of the cracked material;
- pumping and loss of fines from the base course;
- loss of riding quality through loss of surfacing; and
- loss of appearance.

The loss of load-spreading ability and waterproofing will usually lead to accelerated deterioration of the pavement condition. Factors which lead to cracking include:

- deformation;
- fatigue life of the surfacing exceeded;
- age embrittlement of the surfacing;
- reflection of cracking in underlying layers (longitudinal, block, traverse cracking);
- shrinkage; and
- poor construction joints

Crack patterns, alone or linked with deformation, are useful in assessing causes of pavement failure. As cracks promote water entry, they can be the primary cause of a range of secondary defects (e.g., deformation and potholes).

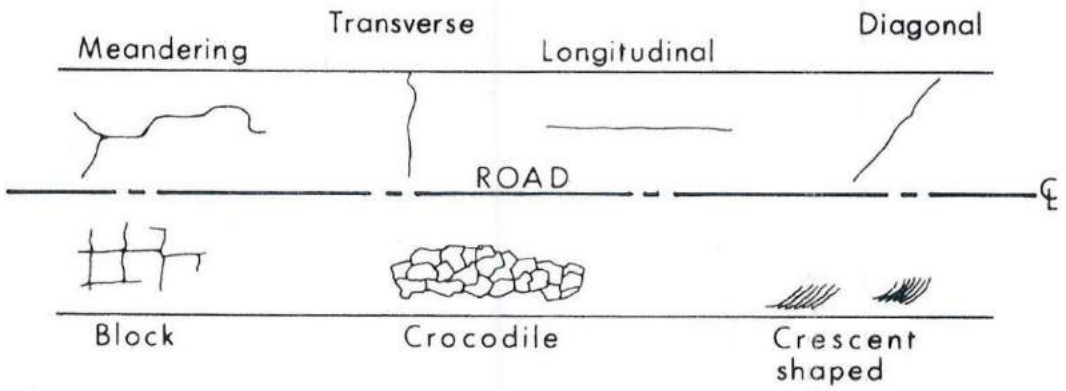
The crack types included in this section are:

- Block;
- Longitudinal;
- (Diagonal);
- Transverse; and
- Crocodile.

NOTE: If a crack is sealed, it is not rated as a crack, except if it has opened up again.

The general form of the various crack types is illustrated in Figure B.3-1.

Figure B.3-1: General form of crack types



B.3.2.1 Block cracks

Block cracks are interconnected cracks forming a series of blocks, approximately rectangular in shape. They are commonly distributed over the full pavement. Cell sizes are usually greater than 200 mm and can exceed 3000 mm.

Possible causes of block cracks in flexible pavements include:

- shrinkage and fatigue of underlying cemented materials;
- shrinkage cracks in asphalt surfacing owing to daily temperature cycles; and
- fatigue cracking in an embrittled bituminous wearing course.

The description of the degrees of block cracking is given in Table B.3-1 and is illustrated in Figure B.3-2.

Table B.3-1: Description of degrees of block cracks

Degree	Description
1	Faint cracks.
3	Distinct, open cracks (≈ 3 mm) with slight spalling, deformation, or secondary cracking at corners in the form of triangles.
5	Open cracks (> 3 mm) with significant spalling, secondary cracking or deformation evident around open cracks, or wide-open cracks (> 10 mm) with little or no secondary defects.

Figure B.3-2: Visual assessment of degree of block cracks

Block Cracks					
	1				
	X	2	3	4	5
	Unspalled cracks with mean width < 3mm				
	3				
	1	2	X	3	4
	Distinct, open (≈ 3 mm) with slight spalling.				
	5				
	1	2	3	4	X
	Open cracks (> 3 mm) with significant spalling, or wide open cracks (> 10 mm).				

B.3.2.2 Longitudinal cracks

These are linear cracks that occur longitudinally along the pavement. These cracks are not restricted to the wheel paths and are often located at discontinuities in the pavement structure such at the base/shoulder interface.

Table B.3-2: Description of degrees of longitudinal cracks

Degree	Description
1	Faint cracks.
3	Distinct, open cracks (≈ 3 mm) with slight spalling, deformation, or secondary cracking at corners in the form of triangles.
5	Open cracks (> 3 mm) with significant spalling, secondary cracking or deformation evident around open cracks, or wide, open cracks (> 10 mm) with little or no secondary defects.

Possible causes of longitudinal cracks include:

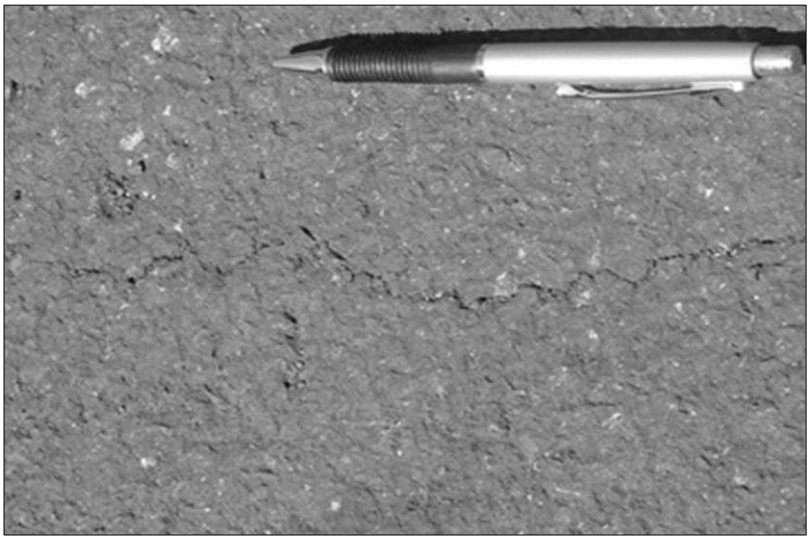
a) Occurring singly:

- Poor construction techniques (e.g., asphalt overlay construction joint).
- Differential movement in the case of pavement widening.

b) Occurring as a series of almost parallel cracks:

- Active clay subgrades.
- Differential settlement of subgrade, e.g., between cut and fill.
- Incipient slips for roads on slopes or loss of support due to adjacent deep excavation.

Figure B.3-3: Visual assessment of degree of longitudinal cracks

Longitudinal cracks	
	1 X 2 3 4 5 Faint.
	3 1 2 X 3 4 Distinct, open (≈ 3 mm) with slight spalling.
	5 1 2 3 4 X Open cracks (> 3 mm) with significant spalling, or wide open cracks (> 10 mm).

B.3.2.3 Transverse cracks

Transverse cracks are line cracks across the pavement. They are often the first manifestation of shrinkage in a cement stabilised base or sub-base but may also be a sign of active clay in the subgrade. Transverse cracks can also be a sign of temperature associated fatigue and seasonal effects. They are normally not related to structural problems, but further deterioration of the pavement may occur with the ingress of water through the cracks.

These cracks often also occur at drainage structures or where services have been installed subsequent to initial construction by the pavement layers.

Shrinkage cracks, which often appear in an asphalt surfacing layer (map pattern), should not be noted as transverse cracks, but as surfacing cracks.

The description of degrees of transverse cracks is given in Table B.3-3. Figure B.3-4 illustrates the assessment of degree of transverse cracks.

Table B.3-3: Description of degrees of transverse cracks

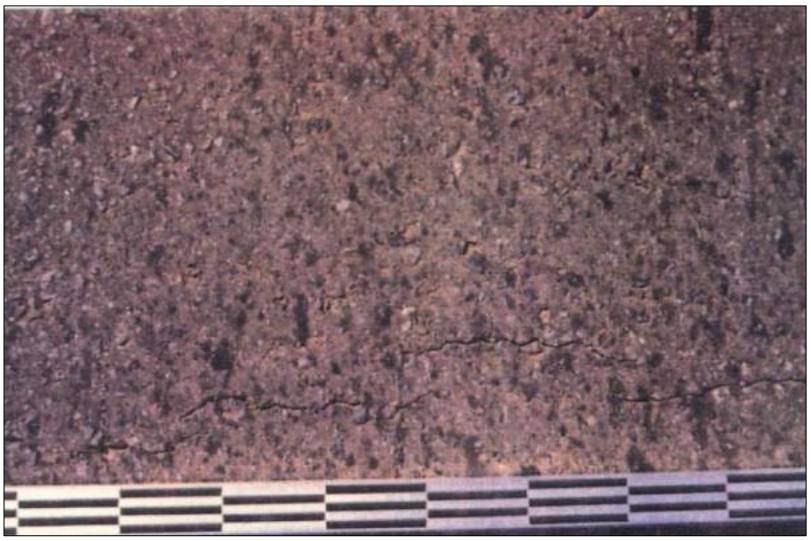
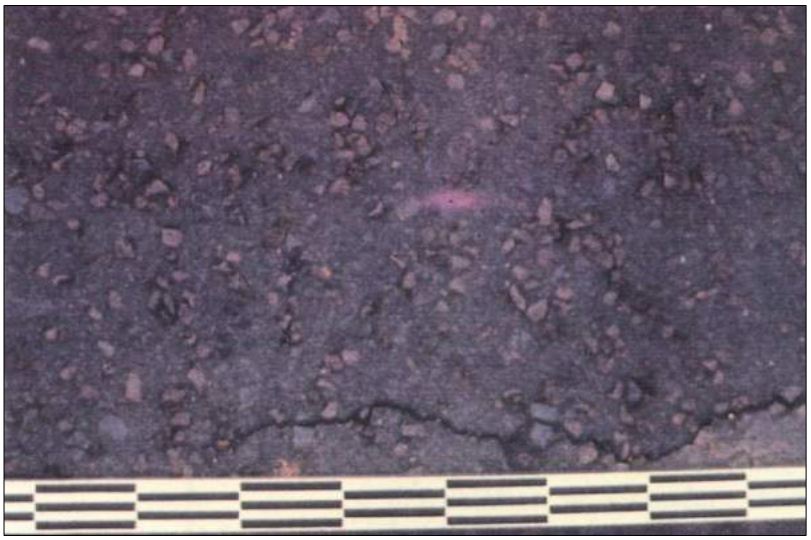
Degree	Description
1	Faint cracks.
3	Distinct, open cracks (≈ 3 mm) with slight spalling, deformation, or secondary cracking at corners in the form of triangles.
5	Open cracks (> 3 mm) with spalling, secondary cracking or deformation evident around open cracks, or wide open cracks (> 10 mm) with little or no secondary defects.

Short transverse cracks at the edge of the surfacing should be assessed separately from transverse cracks and recorded under edge defects.

Possible causes of transverse cracking include:

- Poor compaction and related settlement of the pavement structure at discontinuities, such as where services, e.g., culverts, have been installed.
- Reflection of stabilisation cracks from the base or sub-base.
- Shrinkage of natural gravels through drying or self-cementation.

Figure B.3-4: Visual assessment of degree of transverse cracks

Transverse cracks	
	1 X 2 3 4 5 Faint.
	3 1 2 X 3 4 Distinct, open (≈ 3 mm) with slight spalling.
	5 1 2 3 4 X Open cracks (> 3 mm) with significant spalling, or wide open cracks (> 10 mm).

B.3.2.4 Crocodile (fatigue) cracks

Crocodile cracking often appears as fine, irregular longitudinal cracks, often initially in isolated patches, which grow progressively closer and eventually interconnect to form the familiar crocodile pattern. The cracks will allow the ingress of water into the pavement, resulting in deformation of the cracked area and/or spalling of the edges. These, initially fine, irregular longitudinal cracks, should, however, be classified as longitudinal cracks for the purpose of the assessment. Crocodile cracking also occurs as secondary cracking around primary line cracks. Higher degrees (degree ≥ 3) of crocodile cracking are often accompanied by deformation and pumping. The description of the degrees of crocodile cracks is given in Table B.3-4, and Figure B.3-5 illustrates the assessment of the degree of crocodile cracks.

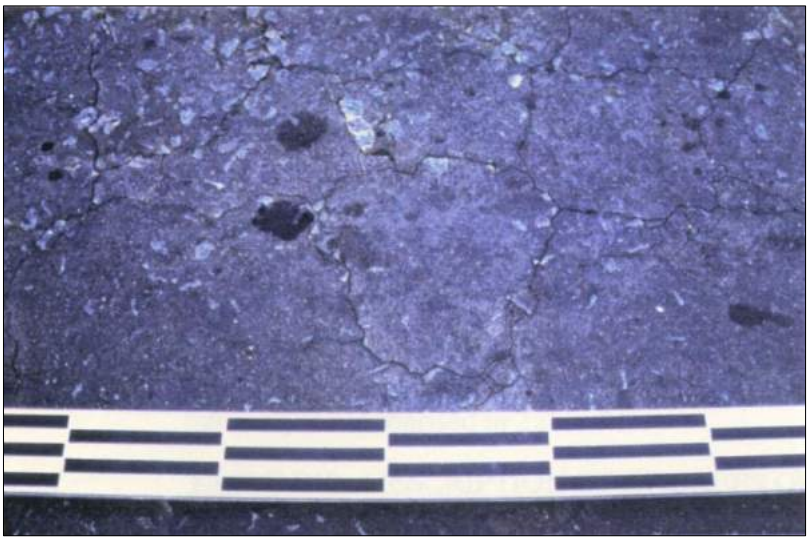
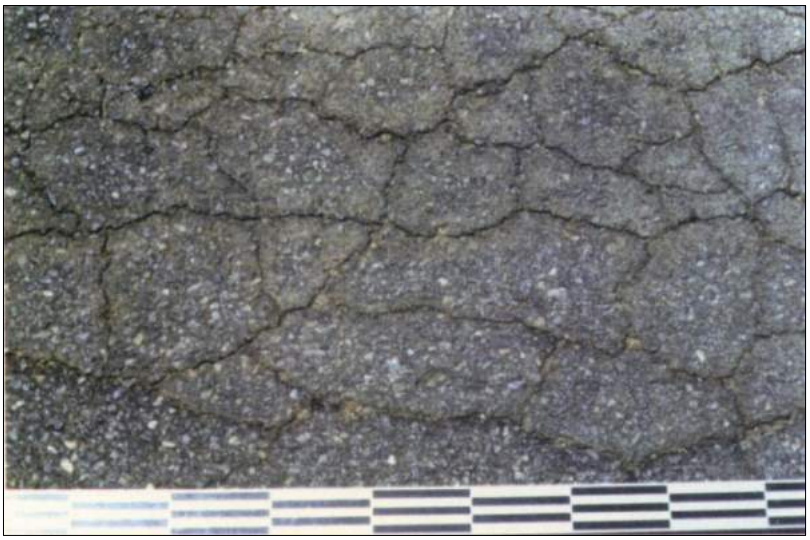
Table B.3-4: Description of degrees of crocodile cracks

Degree	Description
1	Faint cracks in wheel paths. Only visible on close inspection.
3	Distinct cracks (≈ 3 mm) with slight deformation/movement and/or pumping of cracked areas and/or slight spalling of the edges.
5	Open cracks (> 3 mm) with severe deformation/movement and/or severe pumping of cracked area and/or extensive spalling of edges. Crocodile cracking has spread outside the wheel paths. High density of crocodile crack pattern.

Possible causes of crocodile cracking include:

- Traffic induced fatigue failure of the surfacing or base due to:
    - inadequate pavement thickness;
    - low base stiffness; and/or
    - brittle surfacing.
- Saturated pavement or subgrade due to poor drainage, e.g., in the outer wheel track of the pavement adjacent to an unsealed shoulder.
- Poor bond of the bituminous surfacing to the road base.

Figure B.3-5: Visual assessment of degree of crocodile cracks

Crocodile cracks					
	1				
	X	2	3	4	5
	Faint.				
	3				
	1	2	X	3	4
	Distinct, open (≈ 3 mm) with slight deformation/movement and/or pumping.				
	5				
	1	2	3	4	X
	Open (> 3 mm) with severe deformation/movement and/or pumping.				

B.3.3 Pumping

Pumping occurs when active pore pressure under traffic loading causes fine material to be pumped from within the pavement to the surface, normally through existing cracks. Pumped out fines are visible along the cracks on the surfacing and there is usually a thin layer of fines next to the cracks which adhere to the surface layers.

Pumping of fines is affected by rainfall and cracks should, therefore, be inspected carefully for signs of pumping. The description of the degrees of pumping is given in Table B.3-5 and Figure B.3-6 illustrates the assessment of the degree of pumping.

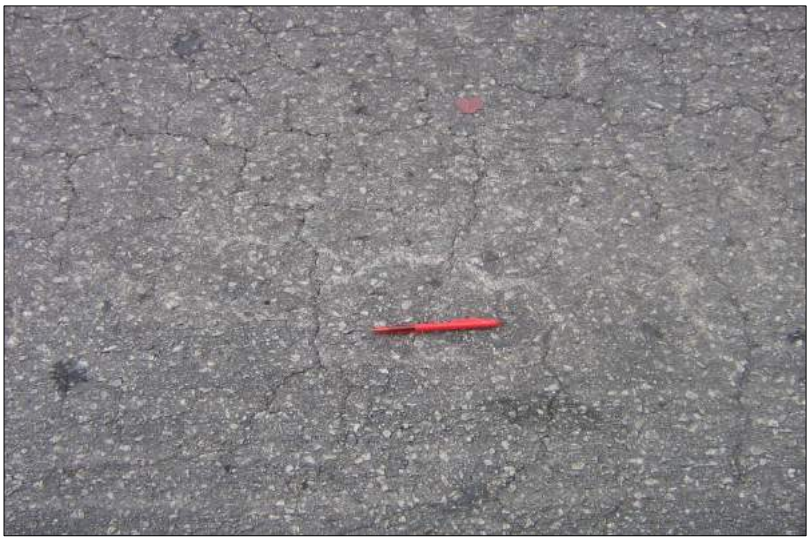
Table B.3-5: Description of degrees of pumping

Degree	Description
1	Pumping faintly visible on close inspection.
3	Pumping clearly visible from vehicle. Only slight or no deformation of road surface next to the crack.
5	Extensive deposits of fines alongside the cracks and/or severe deformation at cracks.

Possible causes of pumping include:

- Water infiltration into the pavement, e.g., because of a pervious or cracked surfacing and subsequent accumulation at the base/sub-base interface, e.g., due to a permeability inversion (relatively pervious base underlain by a relatively impervious sub-base).
- A high water-table.

Figure B.3-6: Visual assessment of degree of pumping

Pumping					
	1				
	X	2	3	4	5
	Faintly visible on close inspection.				
	3				
	1	2	X	3	4
	Clearly visible from vehicle. Only slight or no deformation.				
	5				
	1	2	3	4	X
	Extensive deposits of fines alongside the cracks.				

B.3.4 Deformation

Deformation is a change in the road surface profile. This is manifested as an area of the pavement having its surface either above or below that of the original level. The following types of deformation are assessed:

1. Rutting.
2. Undulation/settlement.
3. Shoving.

B.3.4.1 Rutting

Rutting results from compaction or shear deformation through the action of traffic and is limited to the wheel paths. When the rutting is fairly wide and even-shaped, the problem is normally in the lower pavement layers. When rutting is narrower and more sharply defined, the problem normally lies within the upper pavement layers. Rutting frequently occurs with crocodile cracking, especially for pavement structures with thin bituminous layers. A deviation of the yellow line could also assist in the identification of rutting.

The assessor is not expected to measure rut depths using a straight edge, but for calibration purposes rutting is defined as the maximum deviation measured under a 2 m straight edge placed transversely across the rut. The description of the degrees of rutting is given in Table B.3-6 and Figure B.3-7 illustrates the assessment of degree of rutting.

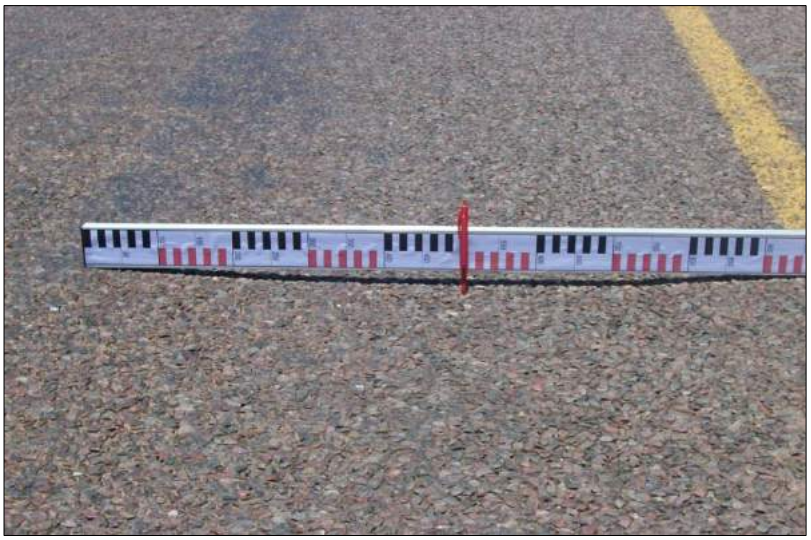
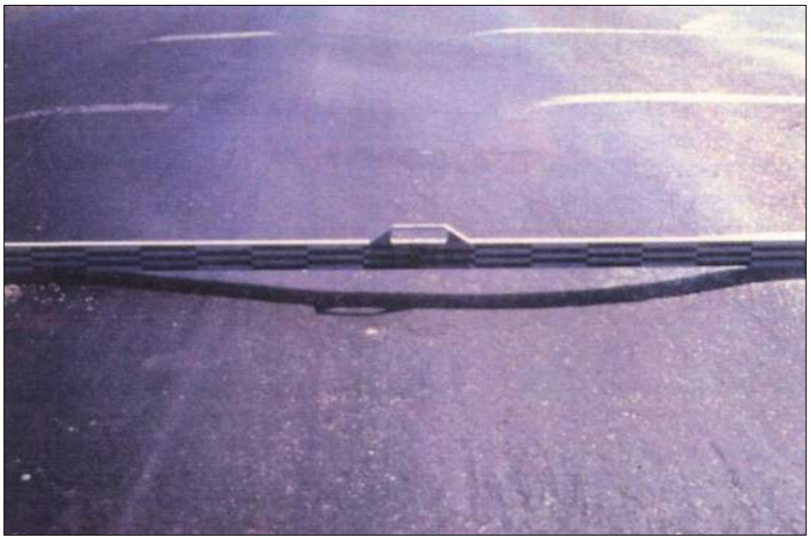
Table B.3-6: Description of degrees of rutting

Degree	Description
1	Difficult to discern unaided (< 5 mm)
3	Just discernible (≈ 10 – 15 mm)
5	Severe, dangerous. Very obvious from moving vehicle, even at high speed. May affect directional stability (> 30 mm).

Possible causes of rutting include:

- Insufficient compaction of subgrade.
- Insufficient compaction of pavement layers.
- Insufficient pavement strength and/or thickness.
- Shear failure of granular base and or sub-base.

Figure B.3-7: Visual assessment of degree of rutting

Rutting					
	1				
	X	2	3	4	5
	< 5 mm - not readily visible with the eye.				
	3				
	1	2	X	3	4
	≈ 10 – 15 mm.				
	5				
	1	2	3	4	X
	> 30 mm - obvious from moving vehicle, even at high speed.				

B.3.4.2 Undulation / settlement

Undulation is a smooth rising and falling of the surface profile of a road with a long wave type of amplitude. It is typically associated with the settlement (especially differential settlement) of embankments at intermittently located culverts and bridges. It is often associated with adverse foundation conditions, e.g. in-situ foundation materials with a slow rate of consolidation or heaving clays affected by changes in moisture conditions.

The degree of undulation is fairly subjective. Table B.3-7 serves as a guide to link the degree of undulations to the riding quality of the road and, therefore the safety of the road user. Although there is an overlap of this item with riding quality, the purpose of this rating is to highlight the presence of differential settlement, consolidation, or heaving related deformation. Figure B.3-8 illustrates the assessment of the degree of undulation.

NOTE: Unevenness caused by patches, potholes, corrugations, and failures should not be rated as undulation/ settlement. General unevenness of the road resulting from constructions or other minor problems should not be rated under this item but will be reflected in the riding quality measurement or rating.

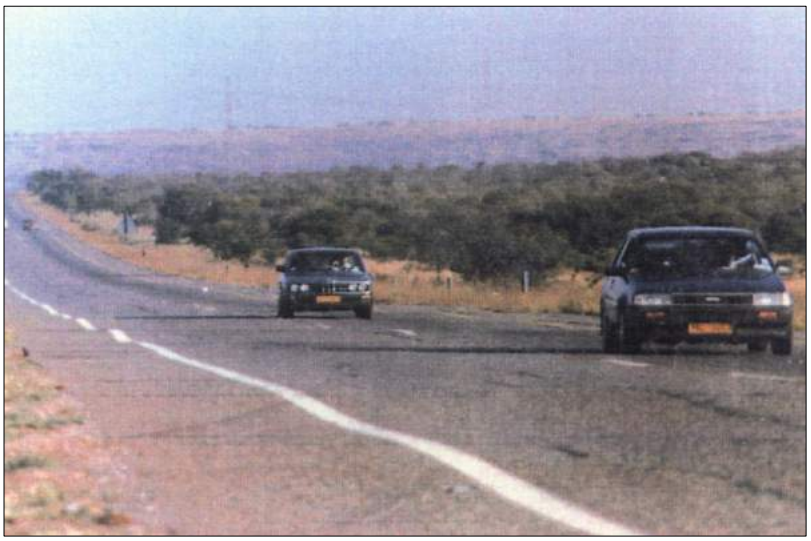
Table B.3-7: Description of degrees of undulation

Degree	Description
1	Undulations cause slight unevenness of road profile; ride is still smooth and comfortable.
3	Undulation is clearly visible and has an effect on riding quality. Motorists may have to reduce driving speed if extent is more than merely localised.
5	Ride very poor and very uncomfortable owing to undulations, road unsafe at normal speed limit. Speed restrictions may have been imposed.

Possible causes of undulation include:

- Consolidation of isolated areas of soft or poorly compacted subgrade or embankment materials.
- Differential settlement due to the instability of an embankment.

Figure B.3-8: Visual assessment of degree of undulation

Undulation	
	1 X | 2 | 3 | 4 | 5 Visible but not felt in a light vehicle.
	3 1 | 2 | X | 3 | 4 Can be felt – speed reduction necessary.
	5 1 | 2 | 3 | 4 | X Vehicles select a different path and drive very slowly.

B.3.4.3 Shoving

Shoving is the bulging of the road surface generally parallel to the direction of traffic and/or horizontal displacement of pavement and surfacing materials, mainly where braking or accelerating movements occur. Shoving appears as lateral displacement of the surfacing and base course. It is generally caused by a loss of shear strength in the base course (or sometimes underlying layers) usually as a result of deterioration of the layer materials (durability problems), excessive moisture in the layer or inadequate support from the road shoulder. Mounds tend to form towards the edge of the road adjacent to depressions in the wheel-paths.

Descriptions of degrees of shoving are given in Table B.3-8. Figure B.3-9illustrates the visual assessment of degrees of shoving failure.

Table B.3-8: Description of degrees of shoving

Degree	Description
1	Failure initiated. Minor depression (< 30 mm). Start of surface distress and shoving.
3	Failure developing. Visible depression (± 50 mm). Surfacing cracked and shoving with obvious mounding.
5	Severe failure with loss of surfacing and base material or severe depression (>90 mm), cracking of seal and significant shoving and mounding.

Note: Distress types within a failure (e.g. cracks and pumping) should not be rated separately. Edge breaking should not be rated as a failure unless it has been caused by loss of strength in the underlying layer.

Possible causes of shoving include:

- Inadequate strength in the surfacing and/or base.
- Inadequate pavement thickness.
- Lack of containment of the pavement edge.
- Excessive moisture in the pavement layer(s).
- Stop and start of vehicles at intersections or roundabouts.

Figure B.3-9: Visual assessment of degree of shoving

Structural Failure Shoving	
	1 X | 2 | 3 | 4 | 5 Minor depression (< 30 mm) with signs of shoving.
	3 1 | 2 | X | 3 | 4 Visible depression (± 50 mm). Surfacing cracked and shoving with mounding.
	5 1 | 2 | 3 | 4 | X Severe, loss of surfacing and base material or severe depression (> 90 mm) and shoving.

B.3.5 Patching

A patch is a repaired section of pavement where a portion of the pavement surface has been removed and replaced with similar material. The extent and frequency of patching can be a useful indicator of the structural adequacy of the pavement. Defects can occur within a patch or the patch can be a further defect where it is raised or depressed below the original level of the pavement surface.

The assessment of the average size of the patches can give an indication of the severity of the distress type that was repaired with the patch. The size of patches should be assessed in accordance with Table B.3-9. Distress types within a patch (e.g., cracking and pumping) should be rated separately. Figure B.3-10 illustrates the assessment of the degree of patching.

Table B.3-9: Description of size of patching

Degree	Size
1	< 0.5 m^2
3	≈ 2 m^2
5	> 10 m^2

Note: The following items are not regarded as structural patching:

- Rut filling.
- Repair work constructed with major plant using the following items as guidelines:
    - Width of repair work greater than the width of one lane; and/or
    - Length of repair work more than 50 metres.
- Service crossings (urban environment) are not regarded as patching.
- If a patch has failed, it should be assessed as a structural failure/pothole / cracking.

Possible causes of patching include:

- Loss/correction of the surfacing.
- Moisture entry to the base through a cracked surfacing.
- Load associated disintegration of the base.
- Reinstatement after excavation for the installation of services.

Figure B.3-10: Visual assessment of degree of patching

Patching	
	1 X | 2 | 3 | 4 | 5 Small areas of surfacing are patched < 0.5 m^2.
	3 1 | 2 | X | 3 | 4 Patches with total area ~ 2 m^2.
	5 1 | 2 | 3 | 4 | X Extensive areas of surfacing are patched > 10 m^2.

B.3.6 Potholes

Potholes refer to structural failures of a variable diameter that extend through the surface layer to a depth of > 25 mm into the base layer. They exclude surfacing failures owing to the loss of surfacing as described in Section B.2.4. They are defined as bowl-shaped depressions in the pavement surface resulting from the loss of surfacing and base course material. They are a secondary form of distress that develops from cracks caused by traffic action. Free water collecting in the hole and the underlying base accelerates the development of potholes.

The degree of potholing can generally be expressed by the diameter and depth of the potholes. The description of degrees for potholes is given in Table B.3-10. Figure B.3-11 illustrates the assessment of degree of potholes.

Where a pothole has been patched, it must be rated under “patching”.

Table B.3-10: Description of degrees of potholes

Degree	Description
1	< 250 mm diameter and < 25 mm deep.
3	Potholes > 250 mm diameter and depth > 50 mm.
5	Potholes > 500 mm diameter and of serious depth (> 75 mm) and/or severe secondary defects.

Note:

- Distress types within a failure (e.g., cracks and pumping) should not be rated separately.
- Edge break should not be rated as potholes unless it extends into a wheel track.

Possible causes of potholes include:

- Extreme loss of surfacing possibly due to traffic abrasion, and subsequent moisture ingress to the pavement.
- Load-associated disintegration of the base.
- Pickup of bituminous surfacing caused by binder adhesion to the tyres of the vehicle.
- Inadequate compaction adjacent to oversize aggregate in the base layer.

Figure B.3-11: Visual assessment of degree of potholes

Potholes	
	1 X 2 3 4 5 < 250 mm diameter and ~ 25 mm deep.
	3 1 2 X 3 4 > 250 mm diameter and > 50 mm deep.
	5 1 2 3 4 X > 500 mm diameter and > 75 mm deep

B.4 Functional Assessment

B.4.1 General

The functional requirements of a road reflect the service it provides to the road user. They are predominantly those that govern comfort, safety, and speed of travel.

The various functional features to be assessed are the riding quality, skid resistance, surface drainage, condition of the shoulders and edge breaking. In this section, they are assessed either on a five-point or a three-point scale (excluding edge breaking).

B.4.2 Roughness (riding quality)

The roughness of a pavement is defined as the general extent to which road users, through the medium of their vehicles, experience a ride that is smooth and comfortable, or bumpy and therefore unpleasant or perhaps unsafe. This is determined by the unevenness of the road profile (longitudinal deformation, rutting in wheel paths, etc.), the loss of surface or base layer material (potholes, extreme ravelling, etc.) and uneven patching. The description of degrees of riding quality is given in Table B.4-1.

Table B.4-1: Description of degrees of roughness

Degree	Description
Very Good (1)	Ride very smooth and very comfortable, no unevenness of the road profile, no rutting, ravelling or uneven patching.
Good (2)	Ride smooth and comfortable, slight unevenness of the road profile, slight rutting, ravelling or uneven patching.
Moderate (3)	Ride fairly smooth and slightly uncomfortable, intermittent moderate unevenness of the road profile, moderate rutting, ravelling or uneven patching.
Poor (4)	Ride poor and uncomfortable, frequent moderate unevenness of the road profile, frequent rutting, ravelling or uneven patching, comfortable driving speed below speed limit.
Very poor (5)	Ride very poor and very uncomfortable, extensive severe unevenness of the road profile, extensive rutting, ravelling or uneven patching, comfortable driving speed much lower than speed limit, road unsafe owing to severe unevenness.

Possible causes of roughness generation include localized depressions, ruts, potholes, patches, stripping, cracking, etc.

B.4.3 Skid Resistance

Skid resistance reflects the general ability of the road surface to prevent skidding when wet, in all manoeuvres generally executed by vehicles. The property that largely determines skid resistance is the surface texture. The two important characteristics of the surface texture are the surface texture depth and the hardness or roughness of the stones themselves.

The surfacing texture depth relates to the gaps between the stones protruding from the surface. The roughness of the stones can be qualitatively assessed by examining the stones and determining if they are rough and angular or smooth and rounded (polished by traffic action). The description of degrees of skid resistance is given in Table B.4-2.

Table B.4-2: Description of degrees of skid resistance

Degree	Description
Very good (1)	Skid resistance adequate for roads carrying high speed, traffic, surface texture coarse, many voids. Stones very rough, edges sharp to the touch. (Example: New 13 mm single seal).
Moderate (3)	Skid resistance intermittently inadequate for high speed traffic and/or surface texture medium to fine, few voids. Stones not very sharp or very rough to touch.
Very poor (5)	Skid, resistance inadequate for all traffic and/or texture fine, no void, film of binder covering all stones. Stones rounded and smooth to the touch. (Example: Severe bleeding and/or very smooth asphalt surface on curve or rolling terrain).

Note: Problems resulting in poor skid resistance can be indicated on the assessment form (if required), by marking the appropriate block(s), if provided on the form. These problems include:

- bleeding; and
- polished aggregates.

B.4.4 Surface Drainage

The surface drainage of a road is a measure of the general ability of the road to keep the riding surface clear of water. This is related to the speed at which water runs off during rain and to the extent of the ponding of water during and after rain. It is an important factor which affects the skid resistance and the volume of water sprayed on to other vehicles. The function of good surface drainage is also to keep the road surface clear of grit washed onto the road from the verges. Overall drainage, including side drains, should not be assessed as part of surface drainage. Surface drainage includes only the area up to 2 m from the outside yellow line (paved and unpaved shoulders).

The description of degrees of surface drainage is given in Table B.4-3.

Table B.4-3: Description of degrees of surface drainage

Degree	Description
Adequate (1)	No visible problem that could retard the run-off of water from the road and shoulders.
Inconsistent (3)	Problems exist that could lead to general slight ponding or severe localised ponding.
Inadequate (5)	Problems exist that could lead to widespread severe ponding in the wheel paths.

Problems leading to inadequate surface drainage can be indicated on the assessment form (if required), by marking the appropriate block(s). These problems include the following:

- Rutting: Water ponding in wheel path on relatively flat roads (see Figure B.4-1);
- Shoulders: Too high or overgrown, leading to ponding of water on the road; and
- Alignment: Horizontal or vertical alignment problem, for example, the bottom of a sag curve or inside of a super-elevated horizontal curve.

Figure B.4-1: Water ponding in wheel track

B.4.5 Unpaved Shoulders

The unpaved shoulder is rated in terms of the availability of the shoulder as a safe recovery area. Several problems might render the unpaved shoulder unsafe, for example:

- the erosion of the shoulder by water;
- wearing out by traffic;
- level differences between the edge of carriageway and shoulder;
- the width of the shoulder is too narrow;
- the cross-sectional slope of the shoulder is too steep; or
- sight distances are obstructed by vegetation.

These problems can be indicated on the assessment form by marking the appropriate block(s).

The description of the degrees of unpaved shoulder conditions is given in Table B.4-4.

Table B.4-4: Description of degree of unpaved shoulder conditions

Degree	Description
None	If the edge of the road is defined by a kerb or there are no shoulders e.g., in a mountain pass.
Safe (1)	Shoulder can be safely used as stopping area at the posted speed limit.
Inconsistent (3)	Problems may be expected if the shoulder is used as stopping area at the posted speed limit (routine maintenance required).
Unsafe (5)	Shoulder is unsafe to be used as stopping area at the posted speed limit.

B.4.6 Edge defects

Edge defects typically occur in the form of:

1) Edge break;
2) Short transverse cracks; and/or
3) Edge drop-off.

These defects occur along the interface of the pavement and the shoulder and are most significant where the shoulder is unsealed. The detrimental effects of these edge defects are more common on narrow roads due to traffic moving closer to the edges and include:

- Reduction of pavement width.
- Loss of quality of ride and possible loss of control of the vehicle.
- Channelling of water at the edge of the pavement leading to deformation of the shoulder and subsequent entry of water into the base.

B.4.6.1 Edge Break

Edge Break is the braking away of the surfacing at the edges of the pavement. The description of degrees of edge break and short transverse cracks is given in Table B.4-5. The assessment of degree of edge break is illustrated in Figure B.4-2.

Table B.4-5: Description of degrees of edge break

Degree	Description	
	Edge break	Short transverse cracks
1	< 50 mm	Faint
3	≈ 150 mm	Distinct (up to 3 mm)
5	> 300 mm Safety hazard to traffic	Open (> 3 mm) with spalling

Note: Edge breaking extending into the wheel path should be classified as potholing.

Possible causes of edge break include:

- Poor unpaved shoulder maintenance.
- Inadequate pavement width.
- Alignment which encourages drivers to travel on pavement edge.
- Loss of adhesion to base.
- Edge drop-off.

Figure B.4-2: Visual assessment of degree of edge break

Edge break	
	1 X 2 3 4 5 < 50 mm.
	3 1 2 X 3 4 ≈ 150 mm.
	5 1 2 3 4 X > 300 mm - safety hazard.

B.4.6.2 Edge Drop-off

Edge drop-off is the difference in elevation between the traffic lane and the outside shoulder. It occurs typically when the outside shoulder settles or erodes. It is not usually considered a defect of the drop-off is less than 25 mm.

The description of degrees of edge drop-off is given in Table B.4-6. The assessment of degree of edge drop off is illustrated in Figure B.4-2.

Table B.4-6: Description of degrees of edge break

Degree	Description	
	Edge drop-off	Height of drop-off
1	< 50 mm	Slight
3	≈ 75 mm	Moderate
5	> 300 mm Safety hazard to traffic	Severe

Figure B.4-3: Visual assessment of degree of drop-off

Drop-off	
	1 X 2 3 4 5 < 50 mm.
	3 1 2 X 3 4 ≈ 75 mm.
	5 1 2 3 4 X > 100 mm.

B.4.7 Overall condition of pavement

The description of the overall condition of the pavement is given in Table B.4-7. A general rating for the condition of the pavement is useful for data verification.

Table B.4-7: Description of degrees of overall condition of pavement

Degree	Description
Very good	Very few or no defects. Degree of defects < 3 (less than warning).
Good	Few defects. Degree of structural defects mostly less than warning.
Moderate	A few defects with degree of defects seldom severe. Extent is only local if degree is severe (excluding surfacing defects).
Poor	General occurrence of particular structural defects with degrees warning to severe.
Very poor	Many defects. The degree of the majority of structural defects is severe and the extent is predominantly general to extensive.

B.4.8 Other problems

Certain items that are not recorded under standard defects should be noted on the assessment form. These include problems such as service crossings (trenches), mechanical damage, mole damage or root damage, poor off-carriageway drainage or any other problems not listed on the form.

Off-carriageway drainage is assessed in terms of the Crown Height (h), which is the height of the crown of the road above the invert of the drain. This is one of the most significant factors affecting the performance of roads.

The classification of Crown Height is shown in Table B.4-8.

Table B.4-8: Classification of road drainage

Classification	Crown Height
Very good	h > 0.90 m
Good	0.75 m < h < 0.90 m
Moderate	0.60 m < h < 0.75 m
Poor	0.40 m < h < 0.60 m
Very poor	h < 0.40 m

B.5 Visual Condition Index

The overall pavement condition based on the visual assessment, can be described in different ways. Section B.4.7 provides a simple method for assessing the overall condition of the pavement. However, the ratings of the various condition aspects, as described in this guideline, can be used to calculate a Visual Condition Index (VCI), which is a less subjective measure of the condition. The formula for the VCI is:

$$VCI = 100\left(1 - C\sum_{i=1}^{n} F_i\right)$$

Where:

$$F_i = D_i \times E_i \times W_i$$

i = Visual assessment item number as specified on the condition assessment sheet

n = number of items

D_i = Degree rating of defect i

E_i = Extent rating for defect i

W_i = Weight for defect i

$$C = 1 \div \sum_{i=1}^{n} F_{i(max)}$$

$F_{i(max)}$ = F_i with D_i and E_i set at their maximum value (5).

VCI_{max} = 100

VCI_{min} = 0

The degree (D) and extent (E) of each defect are taken from the Visual Assessment Form (Annex A). Most of the defects are rated as 1 to 5 for degree and extent. For those defects that are not rated in this way the following applies:

- An extent of 5 is assumed for the functional assessment items (Roughness, Skid Resistance, Surface Drainage and Shoulders) for each panel being assessed.
- Roughness and skid resistance are rated as “very good”, “good”, “moderate”, “poor” and “very poor”, which are given a degree score of 1 to 5 accordingly.
- Surface drainage is assessed as “adequate”, “inconsistent” and “inadequate”, which are given a degree score of 1, 3 and 5.
- Shoulders are rated as “none”, “safe”, “inconsistent” and “unsafe” which are given a degree score of 0, 1, 3, and 5.
- An extent of 5 is assumed for Overall Pavement Condition.
- Overall Pavement Condition is rated as “very good”, “good”, “moderate”, “poor” and “very poor”, which are given a degree score of 1 to 5 accordingly.

“Surfacing texture” and “surfacing voids” are not included in the calculation of the VCI.

“Other problems” are not included in the calculation of the VCI.

Recommended weightings for flexible pavements are shown in Table B.5-1 and can be used for the calculation of the VCI. Each road agency should verify the weightings and modify them in accordance with their assessment of the importance of each defect.

Table B.5-1: Recommended weightings for calculation of the VCI

Parameter		Weighting (W)
Surfacing	Surfacing Failures	0.7
	Surface Patching	0.7
	Surfacing Cracks	0.7
	Aggregate Loss	0.7
	Binder Condition	0.7
	Bleeding/Flushing	0.7
Structural	Block Cracks	1.2
	Longitudinal Cracks	1.2
	Transverse Cracks	1.2
	Crocodile Cracks	1.2
	Pumping	1.2
	Rutting	2.0
	Undulations/Settlements	1.2
	Shoving	1.2
	Patching	1.2
	Potholes	1.2
Functional	Roughness	2.0
	Skid Resistance	1.0
	Surface Drainage	1.2
	Shoulders (Unpaved)	1.2
	Edge Break	0.7
	Short Transverse Cracks	0.7
	Edge Drop-Off	0.7
Overall pavement condition		Not included in VCI calculation

Based on the result of the VCI calculation, the road condition is categorised in accordance with the criteria in Table B.5-2.

Table B.5-2: Categorisation of road condition

Degree	Description
Very good	VCI = 85 – 100
Good	VCI = 70 – 85
Moderate	VCI = 50 – 70

Degree	Description
Poor	VCI = 30 – 50
Very poor	VCI = 0 – 30

B.6 Standard Forms

The Visual Assessment Form for flexible pavements is presented in Annex A. Typical results are given in Annex B and calculation of the VCI is shown in Annex C.

Annex A: Visual Assessment Form for Flexible Pavements

VISUAL ASSESSMENT : FLEXIBLE PAVEMENTS

ROAD AUTHORITY :

REGION / DISTRICT :

ROAD NO :

SEGMENT (FROM - TO) :

PANEL DIMENSIONS : LENGTH _____ m WIDTH _____ m

ROUTE CLASS :	1	2	3	4	5
TRAFFIC :	VL	L	M	H	VH
GRADIENT :	Flat		Med		Steep
TERRAIN :	Flat		Rolling		Mount

ENGINEERING ASSESSMENT

SURFACING

TEXTURE	COARSE	MEDIUM	FINE	VARYING
VOIDS	MANY	FEW	NONE	VARYING

CURRENT SURFACING :

	DEGREE					EXTENT				
	MINOR		WARNING		SEVERE	ISOLATED				EXTENSIVE
	0	1	2	3	4	5	1	2	3	4	5
SURFACING FAILURES											
SURFACING PATCHING											
SURFACING CRACKS											
AGGREGATE LOSS (A / N)											
BINDER CONDITION (DRY / BRITTLE)											
BLEEDING / FLUSHING											

STRUCTURAL

	DEGREE					EXTENT				
	MINOR		WARNING		SEVERE	ISOLATED				EXTENSIVE
	0	1	2	3	4	5	1	2	3	4	5
BLOCK CRACKS											
LONGITUDINAL CRACKS											
TRANSVERSE CRACKS											
CROCODILE CRACKS											
PUMPING											
RUTTING											
UNDULATIONS / SETTLEMENT											
SHOVING											
PATCHING											
POTHOLES											

FUNCTIONAL ASSESSMENT

ROUGHNESS	Very Good	Good	Moderate	Poor	Very Poor
Problem	potholes	patching	undulations	gen uneven	corrugations
SKID RESISTANCE	Very Good	Good	Moderate	Poor	Very Poor
Problem				bleeding	polished
SURFACE DRAINAGE		Adequate	Inconsistent		Inadequate
Problem		rutting	shoulders	alignment	side drains
SHOULDER (UNPAVED)	None	Safe	Inconsistent		Unsafe
Problem	eroded	overgrown	inclined	too high	too narrow

	0	1	2	3	4	5	1	2	3	4	5
EDGE BREAK											
SHORT TRANSVERSE CRACKS											
EDGE DROP-OFF											

SUMMARY

OVERALL PAVEMENT CONDITION	Very Good	Good	Moderate	Poor	Very Poor

COMMENTS:

OTHER PROBLEMS	service crossings	trees	moles	mechanical damage	Off-carriageway drainage

ASSESSOR : _____ DATE : _____

Annex B: Example of completed Visual Assessment Form

VISUAL ASSESSMENT : FLEXIBLE PAVEMENTS

ROAD AUTHORITY : MIS ROAD AGENCY
REGION / DISTRICT : MIS
ROAD NO : RR100
SEGMENT (FROM - TO) : km 2+200 to km 2+220
PANEL DIMENSIONS : LENGTH 20 m WIDTH 6.0 m

ROUTE CLASS : 1 | 2 | 3 | 4 | 5
TRAFFIC : VL | L | M | H | VH
GRADIENT : Flat | | Med | | Steep
TERRAIN : Flat | | Rolling | | Mount

ENGINEERING ASSESSMENT

SURFACING

CURRENT SURFACING :

TEXTURE: COARSE | MEDIUM | FINE | VARYING
VOIDS: MANY | FEW | NONE | VARYING

	DEGREE (MINOR / WARNING / SEVERE)					EXTENT (ISOLATED / EXTENSIVE)				
	0	1	2	3	4	5	1	2	3	4	5
SURFACING FAILURES		✓						✓			
SURFACING PATCHING			✓					✓			
SURFACING CRACKS				✓					✓		
AGGREGATE LOSS (A / N)	✓										
BINDER CONDITION (DRY / BRITTLE)		✓									✓
BLEEDING / FLUSHING	✓										

STRUCTURAL

	DEGREE (MINOR / WARNING / SEVERE)						EXTENT (ISOLATED / EXTENSIVE)				
	0	1	2	3	4	5	1	2	3	4	5
BLOCK CRACKS	✓										
LONGITUDINAL CRACKS			✓						✓		
TRANSVERSE CRACKS	✓										
CROCODILE CRACKS	✓										
PUMPING	✓										
RUTTING				✓							✓
UNDULATIONS / SETTLEMENT	✓										
SHOVING	✓										
PATCHING			✓					✓			
POTHOLES			✓				✓				

FUNCTIONAL ASSESSMENT

ROUGHNESS	Very Good	Good	Moderate	Poor	Very Poor
Problem	potholes	patching	undulations	gen uneven	corrugations
SKID RESISTANCE	Very Good	Good	Moderate	Poor	Very Poor
Problem				bleeding	polished
SURFACE DRAINAGE		Adequate	Inconsistent		Inadequate
Problem		rutting	shoulders	alignment	side drains
SHOULDER (UNPAVED)	None	Safe	Inconsistent		Unsafe
Problem	eroded	overgrown	inclined	too high	too narrow

	0	1	2	3	4	5	1	2	3	4	5
EDGE BREAK		✓						✓			
SHORT TRANSVERSE CRACKS	✓										
EDGE DROP-OFF			✓					✓			

SUMMARY

OVERALL PAVEMENT CONDITION	Very Good	Good	Moderate	Poor	Very Poor

COMMENTS: MAINTENANCE REQUIRED – POTHOLES

OTHER PROBLEMS	service crossings	trees	moles	mechanical damage	Off-carriageway drainage

ASSESSOR : BOND DATE : 20/07/2020

Annex C: Calculation of the VCI

MI5 trial sections — **Assessment Items**

Section No.	Panel No.	Type of Surfacing	Surfacing failures		Surface patching		Surfacing cracks		Aggregate loss		Binder condition		Bleeding/flushing		Block cracks		Longituduinal cracks		Transverse cracks		Crocodile cracks		Pumping		Rutting		Undulations/settlement		Shoving		Patching		Potholes		Roughness		Skid resistence		Surface drainage		Shoulder (unpaved)		Edge break		Short transverse cracks		Edge drop		Visual Condition Index
		Weighting	0.7		0.7		0.7		0.7		0.7		0.7		1.2		1.2		1.2		1.2		1.2		2.0		1.2		1.2		1.2		1.2		2.0		1.0		1.2		1.2		0.7		0.7		0.7		
			Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	Degree	Extent	
RR100	1	CMA laterite base	1	2	2	2	3	3	0	0	1	5	0	0	0	0	2	3	0	0	0	0	0	0	3	5	0	0	0	0	2	2	2	1	3	5	2	5	1	5			1	2	0	0	2	2	81.4
																																																	81.4
	Factor to ignore items not rated																																																
RR100	1	CMA laterite base	1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		0		1		1		1		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
0	0	0	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		
	Maximum value to be used as divisor																																																
RR100	1	CMA laterite base	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	5	5	5	5	5	5	582.5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0