South Africa

COTO

Committee of Transport Officials

# TMH 9

# MANUAL FOR VISUAL ASSESSMENT OF ROAD PAVEMENTS
# PART E: UNPAVED ROADS

**Committee Draft Final**

**May 2016**

**Committee of Transport Officials**

# TECHNICAL METHODS FOR HIGHWAYS

## TMH 9

# MANUAL FOR VISUAL ASSESSMENT OF ROAD PAVEMENTS
## Part E: Unpaved Roads

**Committee Draft Final**
**May 2016**

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## Compiled under auspices of the:

Roads Coordinating Body (RCB)
Committee of Transport Officials (COTO)
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## Synopsis

TMH 9 provides the procedures for the visual assessment of the condition of roads. Assessment procedures and requirements for road segment information data are specified. Different distress types are classified and detailed descriptions of degree of distress (including photographic plates illustrating condition) for each of the distress types are given. TMH 9 is a companion document to TMH 22 on Road Asset Management Systems.

## Withdrawal of previous publication:

This publication replaces the previous Draft TMH9 “Standard Visual Assessment Manual for Flexible Pavements” published in 1992, and previous Draft TMH12 “Standard Visual Assessment Manual for Flexible Pavements” published in 2007. These previous publication is effectively withdrawn with the publication of this document.

## Technical Methods for Highways:

The Technical Methods for Highways consists of a series of publications in which methods are prescribed for use on various aspects related to highway engineering. The documents are primarily aimed at ensuring the use of uniform methods throughout South Africa, and use thereof is compulsory.

Users of the documents must ensure that the latest editions or versions of the document are used. When a document is referred to in other documents, the reference should be to the latest edition or version of the document.

Any comments on the document will be welcomed and should be forwarded to coto@nra.co.za for consideration in future revisions.

## Document Versions

**Working Draft (WD).** When a COTO subcommittee identifies the need for the revision of existing, or the drafting of new Technical Recommendations for Highways (TRH) or Technical Methods for Highways (TMH) documents, a workgroup of experts is appointed by the COTO subcommittee to develop the document. This document is referred to as a Working Draft (WD). Successive working drafts may be generated, with the last being referred to as Working Draft Final (WDF). Working Drafts (WD) have no legal standing.

**Committee Draft (CD).** The Working Draft Final (WDF) document is converted to a Committee Draft (CD) and is submitted to the COTO subcommittee for consensus building and comments. Successive committee drafts may be generated during the process. When approved by the subcommittee, the document is submitted to the Roads Coordinating Body (RCB) members for further consensus building and comments. Additional committee drafts may be generated, with the last being referred to as Committee Draft Final (CDF). Committee Drafts (CD) have no legal standing.

**Draft Standard (DS).** The Committee Draft Final (CDF) document is converted to a Draft Standard (DS) and submitted by the Roads Coordinating Body (RCB) to COTO for approval as a draft standard. This Draft Standard is implemented in Industry for a period of two (2) years, during which written comments may be submitted to the COTO subcommittee. Draft Standards (DS) have full legal standing.

**Final Standard (FS).** After the two-year period, comments received are reviewed and where appropriate, incorporated by the COTO subcommittee. The document is converted to a Final Standard (FS) and submitted by the Roads Coordinating Body (RCB) to COTO for approval as a final standard. This Final Standard is implemented in industry for a period of five (5) years, after which it may again be reviewed. Final Standards (FS) have full legal standing.

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# PART E. UNPAVED ROAD ASSESSMENT

## E.1. Introduction

General guidelines for the assessment of all types of roads are described in Part A of this manual. Part E focuses on guidelines pertaining specifically to the visual condition assessment of unpaved roads.

Unpaved roads can be categorised into three types:

- Tracks
- Earth roads
- Gravel roads (formed roads with imported gravel wearing course)

| Tracks | Earth | Gravel |
|---|---|---|
|  |  |  |

**Figure E.1: Types of unpaved roads**

Regular assessment of the unpaved road network is required for strategic and tactical planning purposes within the Unpaved Road Management System (URMS).

This manual provides the standard requirements and guidelines for the visual assessment of Earth and Gravel roads.

Information particularly relevant to unpaved roads is categorised into:

- Engineering assessment (material properties)
- Engineering assessment (surface distress)
- Functional assessment

## E.2. General information

### E.2.1. Assessment Procedure

In addition to the relevant procedures discussed in Part A (Section A.5.1), certain aspects pertain specifically to unpaved roads. Visual assessments on unpaved roads should preferably be carried out in the dry season, as many of the important defects are not easily identified when the road is wet. During network level assessments (can also be applied to project level assessments), the assessors should drive at a speed not exceeding 40 km/h when gathering data and should include at least one stop on each segment for a closer assessment of the material quality, layer thickness and general performance.

The assessment of defects is generally restricted to the trafficked portions of the road and excludes the shoulders and windrows left during blading.

### E.2.2. Moisture Condition

The moisture condition affects the visual assessment of properties such as dust, corrugations, loose material and skid resistance. It is therefore necessary to estimate the moisture condition for later use if there are queries regarding the influence of any of these properties.

Assessment of the condition is limited to a subjective rating of wet, moist (damp) or dry taking the consequences into account (e.g. the road will not be wet if dustiness is significant).

### E.2.3. Traffic

Traffic volumes per road link are normally obtained through counting stations at intersections as part of a formal traffic counting program. However, if such a program does not exist, the following guideline could be used to estimate the daily traffic volume.

**Table E.1: Traffic volume categories**

| Category | Traffic range per day | Traffic range per hour |
|---|---|---|
| Very Low | 0 – 20 vpd | 0 – 2 vph |
| Low | 20 – 50 vpd | 2 – 9 vph |
| Medium | 50 – 100 vpd | 9 – 21 vph |
| Heavy | 100 – 200 vpd | 21 – 46 vph |
| Very Heavy | > 200 vpd | > 46 vph |

## E.3. Engineering assessment (material properties)

The gravel wearing course and subgrade material properties are assessed in terms of their quality and quantity. The subgrade properties are important for circumstances when the gravel wearing course is lost, resulting the need to know the ability of the in-situ material to be maintained with a motor grader and to carry the load.

### E.3.1. Gravel Quality and Influencing Factors

The performance of an unpaved road depends primarily on the quality of the gravel used to construct the wearing course. The properties contributing to good gravel are particle size distribution and cohesion. The gravel should have a range of particle sizes ranging from very fine up to about 40 mm in order to provide a strong framework of stones interlocked by a tight matrix of fines. An excessive number of large stones results in poor riding quality and difficulties with maintenance. The fines need to have some plasticity to provide cohesion when dry. However, plasticity should not be so high that the road becomes slippery and impassable when wet. Gravel quality is assessed according to Table E.2.

**Table E.2: Visual assessment of gravel quality**

| Degree | Description |
|---|---|
| 1 | Evenly distributed range of particle sizes and sufficient plasticity that the material will leave a shiny streak when scratched with a pick. No significant cracking, ravelling and/or excessive oversize |
| 2 | Minor ravelling or cracking and/or minimal oversize material |
| 3 | Cracking, loose material or stones clearly visible |
| 4 | Poor particle size distribution with excessive oversize. Plasticity high enough to cause slipperiness. Ravelling is sufficient to cause loss of traction. |
| 5 | Poorly distributed range of particle sizes and/or zero or excessive plasticity. Cracking and/or quantity of loose material/stones are significant and affect safety of road user. Excessive oversize. |

The factors influencing the rating must also be recorded. The following factors can be marked:

- Excessive oversize stones and/or loose gravel
- Excessive clay and/or silt (i.e. plasticity too high)
- Excessive loose gravel or sand – loose with insufficient fines (i.e. plasticity too low)

## GRAVEL QUALITY

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

No significant cracking, ravelling and/or excessive oversize

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Cracking, loose material or stones clearly visible

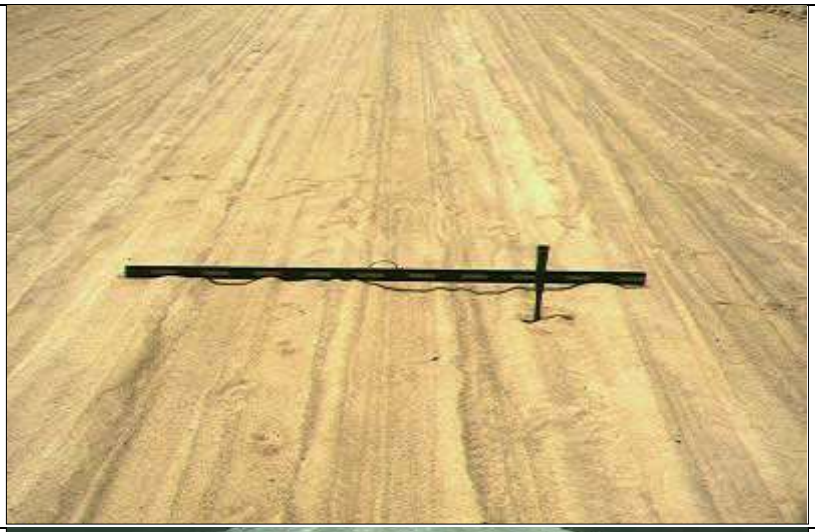
5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Cracking and/or quantity of loose material/stones are significant and affect safety of road user.

## GRAVEL QUALITY – INFLUENCING FACTORS

Excessive clay



Loose sand

Excessive oversize

### E.3.2. Gravel properties

Evaluation of the gravel quality (to perform well as a wearing course) provides valuable information to estimate specific properties for utilisation in performance models and/or to highlight the need for remedial action. These material properties are best obtained from laboratory test results. The minimum requirement is to classify the materials in terms of their appropriateness to carry the load and to provide a good and maintainable wearing course. Information regarding material properties is:

#### Maximum Size

Maximum size refers to the maximum stone size of the wearing course material visible on the surface of the road. The material size categories that are typically used are: > 50mm, 25 – 50mm, 13 – 25mm, and < 13mm.

#### Grading

Grading refers to the material classification, i.e. is it a coarse, medium or fine graded material.

#### Plasticity

An assessment of the plasticity of the material is made. This is an indication of the amount of clay in the gravel.

**Table E.3: Estimate plasticity**

| Estimate | Cohesiveness of the material | Typical PI Range |
|---|---|---|
| Low | Non-cohesive (sandy) | 0-6 |
| Medium | Intermediate cohesion | 6-12 |
| High | Cohesive (clayey) | >12 |

### E.3.3. Gravel quantity

#### Wearing course layer thickness

The gravel layer thickness is categorised into 5 layer thickness categories. This represents the assessor's general appreciation of the average layer thickness of the segment. Gravel quantity can be visually assessed using Table E.4.

**Table E.4: Visual assessment of gravel quantity/ layer thickness**

| Description | Thickness Category (mm) |
|---|---|
| Good shape, and no stone protrusion | >125 |
| No exposures of subgrade, but some stone protrusion | 100 – 125 |
| Significant stone protrusion, loose coarse material and/or isolated subgrade exposure | 50 – 100 |
| More than isolated exposure of the subgrade | 25 - 50 |
| Extensive exposure of the subgrade | 0 |

When visually assessing gravel thickness, adequate cover of material over pipe drains and culverts can be a good indicator, bearing in mind that all culverts/pipes should have sufficient cover to protect the structures from traffic loads. Exposure of pipe drains, culverts and bedrock indicates neglect of the road and inadequate gravel cover. The same applies to stone exposure. If it is assumed that the surface of the road was level after compaction, the height of stones above the surrounding road surface will give an indication of the amount of gravel that has been lost.

When the imported gravel wearing course material is lost, but the exposed subgrade material appears to be performing adequately, the gravel quantity should still be rated as “none”. For purposes of identifying “Spot gravelling” projects, it is important to distinguish between “Isolated” and “extensive” exposures.

If more accurate gravel quantity information is required, the actual layer thickness is measured by making small holes in the wheel tracks. A minimum of three (3) thickness measurements and a maximum of seven (7) are recorded for every segment. Where segments are less than 5 km in length, the test holes are spaced evenly. The measured thickness should be representative of the layer thickness over the interval. The measured gravel thickness in holes is recorded to the nearest 5mm. If the layer thickness exceeds 200 mm, the thickness is recorded as 200 mm. For earth roads the thickness is recorded as 0 mm.

**Note:** Please see TMH 22 for calculation of representative gravel thickness.

| GRAVEL QUANTITY | |
|---|---|
|  | > 125 mm<br>Good shape and no stone protrusion |
|  | 50 – 100 mm<br>Significant stone protrusion over some of road – most covered with gravel |
|  | 25 - 50 mm<br>More than isolated subgrade exposure (stony subgrade) |

### E.3.4. Exposed subgrade

The in-situ sub-grade material is often unsuitable as a wearing course and results in accessibility problems and shear failures. In flat areas, drainage of water away from the road will be retarded or even impeded. Exposed subgrade is assessed as shown on the assessment form.

Exposed sub-grade is assessed according to Table E.5.

**Table E.5: Exposed subgrade: Description of classes**

| Rating | Description |
|---|---|
| None | No exposure of the sub-grade to traffic |
| Isolated | Exposure only occasionally e.g. steep grades, rock outcrops in cuttings |
| Frequent | More than isolated but <20% of the road has exposure of sub-grade |
| Continuous | Extensive sub-grade exposed to traffic |

### E.3.5. Subgrade quality

Subgrade quality refers to the strength of the sub-grade or additional layers supporting the wearing course. The quality of the subgrade is assessed as below.

**Table E.6: Description of subgrade quality**

| Subgrade quality | Description |
|---|---|
| Good | Adequate strength under all conditions |
| Moderate | Material that will deform to some extent under wet conditions |
| Poor | Material that is impassable when wet. If assessed as poor, the cause must be indicated on the assessment form. |

| EXPOSED SUBGRADE | |
|---|---|
|  | None |
|  | Frequent |
|  | Continuous |

## E.4. Engineering assessment (surface distress)

Assessment will follow the requirements for degree and extent 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 necessary. The definitions for these two categories are described in Part A, section A.2.2.

### E.4.1. Potholes

Potholes are round or elongated depressions in the road surface. The potholes, which affect vehicles the most, are those between 250 and 1 500mm in diameter with a depth of more than 50 to 75 mm.

The descriptions of degrees of potholing are given in Table E.7.

**Table E.7: Degrees of potholing**

| Degree | Description |
|---|---|
| 1 | Depressions just visible. Cannot be felt in the vehicle (< 20mm) |
| 3 | Larger potholes affecting safety – 20 - 50mm deep |
| 5 | Large, dangerous potholes requiring evasive action - > 75mm deep |

## POTHOLES

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

Just visible (<20 mm)

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

20 – 50 mm deep

5

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

> 75 mm deep

### E.4.2. Corrugations

Corrugations can be either “loose” or “fixed”. Loose corrugations consist of parallel alternating crests of loose, fine-sandy material and troughs of compacted material at right angles to the direction of travel. Fixed corrugations on the other hand consist of compacted crests and troughs of hard, fine sandy-gravel material. Loose corrugations are easily removed by blading, whereas fixed corrugations need cutting or even tining with the grader before the material is re-spread.

Corrugations should be scraped with a geological pick to determine whether they are loose or fixed. The severity of corrugations is best assessed from within a moving vehicle at the modal speed of the typical vehicle on the road. The descriptions of degrees of corrugation are given in Table E.8.

**Table E.8: Degrees of corrugation**

| Degree | Description |
|---|---|
| 1 | Visible, but not felt or heard in a light vehicle |
| 3 | Can be felt and heard – speed reduction necessary |
| 5 | Drivers select a different path and drive very slowly. Safety is affected |

## CORRUGATIONS

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

Not felt or heard in a light vehicle

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

Can be felt and heard – speed reduction necessary

5

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

Vehicles select a different part of the road and drive very slowly

### E.4.3. Rutting

Ruts are parallel depressions of the surface in the wheel paths. They generally form as a result of loss of gravel from the wearing course by traffic abrasion and less commonly by deformation (compaction) of the subgrade and compaction of the wearing course.

Ruts are assessed in terms of their capacity to retain water using a visual estimate of their average depth. If greater accuracy is required, (e.g. for investigation or research purposes) a 2.0m straightedge and wedge should be used.

The descriptions of degrees of rutting are given in Table E.9.

**Table E.9: Degree of rutting**

| Degree | Description |
|---|---|
| 1 | Rutting is just visible |
| 3 | Rutting between 20 – 40 mm deep |
| 5 | Rutting >60 mm deep affecting directional stability of a vehicle |

## RUTTING

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Just visible

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

20 – 40 mm deep

5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

> 60 mm deep

### E.4.4. Loose Material

Loose material (finer than 26mm) is formed by the ravelling of the wearing course gravel under traffic. This may be distributed over the full width of the road but more frequently, it is concentrated in windrows between the wheel tracks, or alongside the travelled portion of the road

Loose material is assessed by estimating or measuring its thickness. This is achieved by scraping "paths" through the material to the hard surface with a geological pick and estimating the thickness or measuring it with a straightedge and wedge. The descriptions of degrees of loose material are given in Table E.10.

**Table E.10: Degrees of loose material**

| Degree | Description |
|---|---|
| 1 | Just visible (< 20 mm) |
| 3 | Loose material 20 – 40 mm thick |
| 5 | Loose material > 60 mm thick |

**Note:** Traffic associated loose material is usually limited to windrows, whilst maintenance associated loose material is usually distributed across the road. However, traffic induced windrows should not be confused with windrows left by the grader operator as a source of material for future blading operations. These windrows are usually on the very edge of the road and not along the wheel paths.

## LOOSE MATERIAL

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

Just visible

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

Loose material is 20 – 40 mm thick

5

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

Loose material is > 60 mm thick

### E.4.5. Stoniness

Stoniness is the relative percentage of material embedded in the road that is larger than a recommended maximum size (usually 37.5mm).

The descriptions of degrees of stoniness are given in Table E.11 (embedded stones) and Table E.12 (loose stones). Dedicated roughness measuring equipment can also be used to determine the road roughness if this level of detail is required.

**Table E.11: Degrees of embedded stoniness**

| Degree | Description |
|---|---|
| 1 | Seen, but not felt or heard in a light vehicle. |
| 3 | Speed reduction necessary. Stone protrusion approximately 40 mm. |
| 5 | Vehicles avoid protruding stones or drive slowly (>60 mm). Very difficult to blade. |

## STONINESS – FIXED/ EMBEDDED

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Seen but not felt or heard in a light vehicle

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Speed reduction necessary

5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Vehicles avoid or drive slowly

**Table E.12: Degrees of loose stoniness**

| Degree Rating | Description |
|---|---|
| 1 | Few loose stones 25 – 50mm. Driver can change lanes safely |
| 3 | Many loose stones 25 - 50mm or few loose stones > 50mm. Stones influence driver's actions when changing lanes. |
| 5 | Windrows of loose stones 25 – 50mm or many loose stones >50mm. Any lateral movement of the vehicle poses a significant safety hazard. |

## STONINESS – LOOSE

1

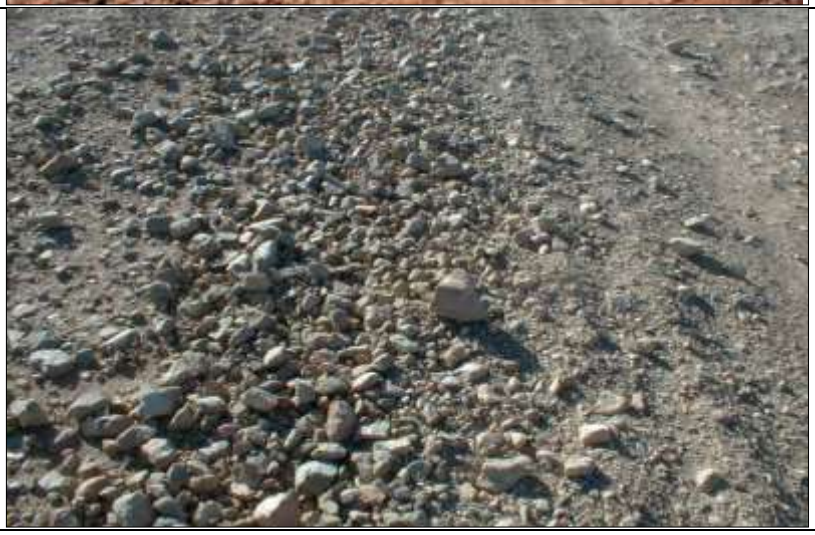
| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Few loose stones 25 – 50mm. Driver can change lanes safely

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Many loose stones 25 - 50mm or few loose stones > 50mm. Stones influence driver's actions when changing lanes.



5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Windrows of loose stones 25 – 50mm or many loose stones >50mm. Any lateral movement of the vehicle poses a significant safety hazard.

### E.4.6. Erosion

Erosion or scour is the loss of surfacing material caused by the flow of water over the road.

The result of erosion is run-off channels which, when occurring transversely, result in extreme roughness and dangerous driving conditions, and when occurring longitudinally (on grades), form deep “ruts”.

Transverse or diagonal erosion channels can be quantified by their depth and width. However, they are best assessed in terms of their effect on riding quality. Longitudinal erosion channels are assessed in a similar way to ruts by visual estimation or measuring depth with a 2.0 m straight edge and wedge. The descriptions of degrees of transverse and longitudinal erosion are given in Table E.13 and Table E.14.

**Table E.13: Degrees of transverse and diagonal erosion**

| Degree Rating | Description |
|---|---|
| 1 | Minor evidence of water damage. |
| 3 | Can be felt and heard – speed reduction necessary.<br>Channels 30mm deep x 75mm wide. |
| 5 | Vehicles drive very slowly and attempt to avoid them.<br>Channels 60mm deep x 250mm wide |

## EROSION – TRANSVERSE

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Minor evidence of water damage

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Can be felt and heard – speed reduction necessary – channels 30 mm deep x 75 mm wide

5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Vehicles drive very slowly and avoid erosion channels – channels > 60 mm deep x 250 mm wide

**Table E.14: Degrees of longitudinal erosion**

| Degree Rating | Description |
|---|---|
| 1 | Evidence of water damage |
| 3 | Channels 20 – 40 mm deep |
| 5 | Channels >60 mm deep |

## EROSION - LONGITUDINAL

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

Evidence of water damage

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

20 – 40 mm deep

5

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

> 60 mm deep

## E.5. Functional performance parameters

Functional performance parameters, impacting on the road user safety and costs are:

- Road roughness (riding quality)
- Trafficability

  **Note:** Although accessibility is often affected by insufficient cross drainage and road levels, this information cannot easily be obtained from normal visual assessments, as described in this document
- Safety as affected by :
  - Skid resistance/ slipperiness
  - Dust
  - Drifts/ drainage/ wash-aways

Factors influencing the performance of the road itself include:

- Road shape defined as “Drainage on the road”
- Road level and effective side drainage

### E.5.1. Road roughness

The roughness of the road is probably the major performance parameter affecting driver and passenger comfort and safety. Road roughness is best quantified using one of the many items of equipment dedicated to roughness evaluation. However, for the purposes of network assessment, it is usually acceptable to assess the road roughness visually.

Road roughness is most easily rated as a function of the perceived comfortable and safe driving speed unaffected by geometric constraints or road width. This is estimated by travelling on short sections at a comfortable speed (Table E.15).

**Table E.15: Assessment of Roughness (riding quality)**

| Degree Rating | Estimated comfortable/safe speed |
|---|---|
| 1 | Excess of 100 km/h |
| 2 | Between 80 and 100 km/h |
| 3 | Between 60 and 80 km/h |
| 4 | Between 40 and 60 km/h |
| 5 | Less than 40 km/h |

Roughness is usually measured in conjunction with an assessment of the parameters that influence it. Certain pavement defects are the direct result of deficiencies in the material properties. These factors influencing road roughness are:

- Deformation
- Potholes
- Stoniness
- Rock outcrops
- Corrugations
- Ruts
- Erosion

## ROUGHNESS

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Travel speed in excess of 100 km/h

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Travel speed between 60 and 80 km/h

5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Travel speed less than 40 km/h

| ROUGHNESS – INFLUENCING FACTORS | |
|---|---|
|  | Corrugation |
|  | Loose material |
|  | Stoniness |

| ROUGHNESS – INFLUENCING FACTORS | |
|---|---|
|  | Potholes |
|  | Deformation |
|  | Erosion |

### E.5.2. Trafficability/ passability

Trafficability (or passability) is the capacity of a normal saloon car to negotiate the road without losing traction or without excessive use of low gears. The terms trafficability and passability are used interchangeably throughout this document. However, impassability should not be confused with the inability to overtake in dusty conditions.

One of the mechanisms affecting trafficability is the loss of traction between the tyres and the road resulting from the low shear strength of the material. This results in churning of the material and sinking of the vehicle into the weak layer. Sandy materials are more prone to impassability when dry, while clayey materials are strong when dry, but often become impassable when wet. Impassable conditions may result from continued trafficking of slippery roads.

Other situations affecting trafficability typically experienced are:

- Steep grades
- Rocky terrain
- Vegetation encroachment
- Insufficient cross drainage provision/ dangerous drifts/ wash-aways

Assessment of trafficability is done according to the guidelines in Table E.16.

**Table E.16: Assessment of trafficability**

| Degree Rating | Description |
|---|---|
| 1 | Easy access at constant speed. |
| 3 | Speed reduction required at isolated positions to prevent damage to vehicle. |
| 5 | Impossible to access with normal saloon car. |

In case of wet weather problems, impassability is difficult to assess unless the assessor actually experiences the condition at its worst.

**Note:** Evidence of earlier wet condition impassable conditions often remains after the event. This includes:

- Deep depressions and evidence of potholes
- Detouring on the shoulders and verges to avoid wet areas
- Spurious material used to fill depressions and to provide temporary traction (often includes vegetation)

| **TRAFFICABILITY** | |
|---|---|
|  | 4<br>1 2 3 X 5<br>Steep and Rocky – Not accessible with normal saloon car |
|  | 5<br>1 2 3 4 X<br>High risk of inaccessibility with normal vehicle |
|  | Very Poor<br>1 2 3 4 X<br>Almost impossible to access with normal saloon car |

### E.5.3. Safety

Apart from providing access to the road user, safety to the travelling public is considered one of the most important goals of a road authority. Even though the level of service provided on different categories of roads might not be the same, identification of hazardous situations are considered essential for proper management of a road network.

Typical road condition problems related to safety include:

- Dust
- Skid resistance
- Slipperiness
- Drainage problems resulting in standing water or wash-aways

Assessment of safety is based on the risk of serious accidents occurring due to one or a combination of situations of the road surface, the geometry, drainage provision and the road reserve.

**Table E.17: Degrees of safety**

| Degree Rating | Description |
|---|---|
| 1 | No obvious risk situations |
| 2 | Minor risk situations |
| 3 | Risk situations causing discomfort |
| 4 | Significant speed reduction required to avoid serious consequences |
| 5 | Dangerous situations that could lead to severe consequences regardless of speed |

Some guidelines and problem situations are provided to assist the assessor in assessing this item.

**Dust**

Dust is undesirable from a number of points of view including safety (loss of visibility), economic (accelerated gravel loss as a result of the loss of fines), comfort of vehicle occupants, health (respiratory diseases), vehicle damage (filters and exposed moving parts), damage to road side vegetation (crops) and environmental impact (air pollution). Dust is generally considered unacceptable by the travelling public when the vehicle generating the dust cannot be seen by a following vehicle.

Dustiness should be rated in the rear view mirror while travelling at 60 km/h. Wind speed and lighting conditions (position of the sun) can influence rating in this way and should be taken into consideration. In assessing the dustiness of a road, the moisture condition at the time of assessment plays a major role.

| SAFETY DUE TO DUST | | | | | | |
|---|---|---|---|---|---|---|
|  | 1 | | | | | |
| | X | 2 | 3 | 4 | 5 | |
| | No loss of visibility | | | | | |
|  | 4 | | | | | |
| | 1 | 2 | 3 | X | 5 | |
| | Significant loss of visibility | | | | | |

**Slipperiness (wet conditions)**

Slipperiness is the loss of traction caused by an accumulation of excessively fine or plastic material on the surface of the wearing course in wet conditions.

Potential unsafe situations could be identified as follows:

- Smooth clayey surface with few protruding gravel particles.
- Significant cracking evident in the dry material.
- Evidence of tyre impressions remaining on the road surface.
- Evidence of compaction and shearing under traffic.

<table>
<tr><th colspan="2">SAFETY DUE TO SLIPPERINESS</th></tr>
<tr><td rowspan="3">  </td><td>1</td></tr>
<tr><td>X | 2 | 3 | 4 | 5</td></tr>
<tr><td></td></tr>
<tr><td rowspan="3">  </td><td>5</td></tr>
<tr><td>1 | 2 | 3 | 4 | X</td></tr>
<tr><td>Evidence of compaction and shearing under traffic.</td></tr>
</table>

**Skid resistance (dry conditions)**

Skid resistance is caused by an excess of loose, fine gravel (typically between 2 and 15mm in diameter) that accumulates on the road surface through ravelling under traffic or poor blading practices during dry conditions. This behaves like a layer of ball bearings and the skid resistance is reduced to practically zero. This is especially a problem on corners and at intersections.

Potential unsafe situations could be identified as follows:

- Presence of layer of fine gravel (2-15 mm) over the width of the road.
- Loss of directional control when braking.

**SAFETY DUE TO SKID RESISTANCE**

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

No loose material

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

Presence of layer of loose material

**Safety problems due to poor drainage and wash-aways**

Excessive water on the road can cause wash-aways or ponding of large quantities of water in poorly drained areas. Wash-aways can lead to loss of the road surfacing and road width. Ponding of water in areas of poor road geometry can lead to the ”surprise element” and unsafe conditions.

## SAFETY DUE TO DRAINAGE AND WASHAWAYS

| 3 | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

Drainage and geometry

| 4 | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | X | 5 |

Erosion/ wash-away on side of roadway

| 5 | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

Erosion/ wash-away in roadway

### E.5.4. Drainage on the road (profile/shape)

The profile (shape) of a road has a major impact on the drainage from the road. Roads with good profile tend to shed water rapidly, avoiding the development of potholes and potentially impassable conditions. Where the profile is flat, water tends to pond in localised depressions resulting in softening of the wearing course and the development of potholes and other defects.

The road profile is assessed according to Table E.18 and illustrated in Figure E.2. It should be noted that on grades, the impact of the transverse profile becomes less dominant than the actual grade.

**Table E.18: Visual assessment of transverse profile**

| Degree Rating | Description |
|---|---|
| 1 | Very good shape, Well-formed camber (about 3 – 5%) |
| 2 | Good shape. Good camber (about 3%) |
| 3 | Flat. Some unevenness with camber mostly less than 2%. |
| 4 | Uneven. Obvious development of irregularities that will impede drainage and form depressions |
| 5 | Very uneven. Development of severe irregularities impeding drainage and likely to cause extensive localised ponding. Water tends to flow to the centre of the road or individual lanes |

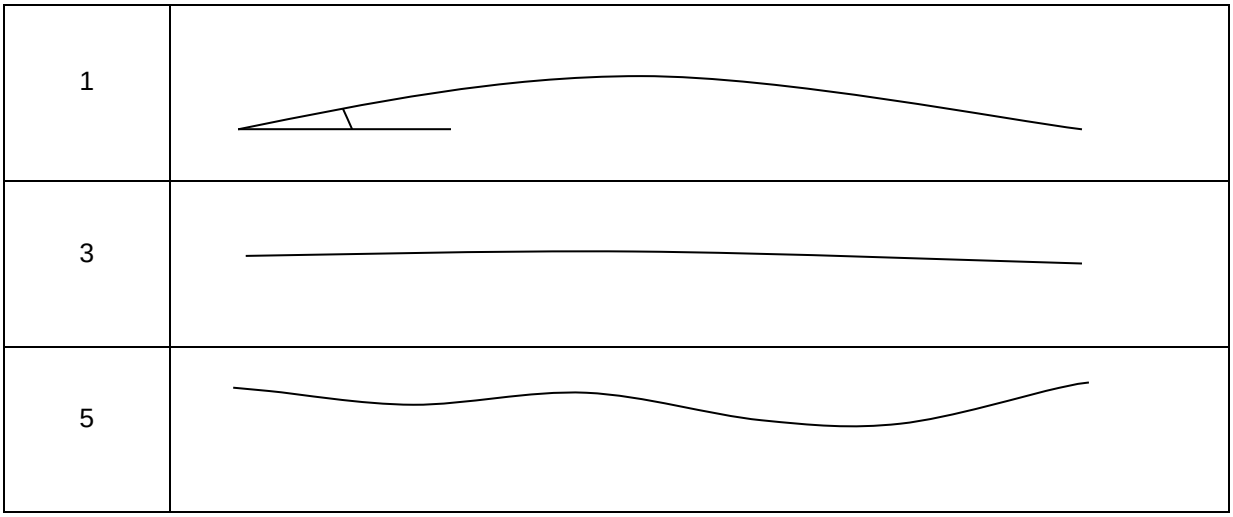



**Figure E.2: Transverse profile illustration**

## TRANSVERSE PROFILE (Drainage of the road)

1

| X | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Very good shape

3

| 1 | 2 | X | 4 | 5 |
|---|---|---|---|---|

Flat

5

| 1 | 2 | 3 | 4 | X |
|---|---|---|---|---|

Very uneven

*Provision is made on the assessment form to highlight the main cause/s of a degree 4 (Poor) or 5 (Very Poor) assessment, i.e. windrows, rutting, and road shape and/or road level.

### E.5.5. Drainage from the road (side of the road)

There is obviously a strong interrelationship between the road profile discussed previously (drainage on the road) and drainage from the road. However, the mentioned profile relates more directly to the capacity of the road to shed water without causing erosion, while drainage from the road relates more closely to the impact of standing water on both the wearing course and underlying road structure. Effective operation of adequate side drains is the predominant aspect to be considered during this rating. This includes removal of water from the zone of influence adjacent to the road as well as erosion effects associated with shoulders and undercutting of the road.

Drainage from the road is assessed according to Table E.19 and illustrated in Figure E.3. The descriptors are essentially applicable to roads in flat or slightly sloping terrain. Where grades are steeper, roads assessed as degrees 4 and 5 will act as drainage courses during periods of intensive rainfall leading to severe erosion.

**Table E.19: Visual assessment of drainage/road formation**

| Rating | Description |
|---|---|
| 1 | Well above ground level. Edges of road are at least 300mm above natural ground level with effective side drains. |
| 2 | Slightly above ground level. Road is between 50 and 300mm above natural ground level. Side drains are present. Stormwater could cross in isolated places. |
| 3 | Level with ground. Road is generally at ground level with ineffective side drains. Stormwater could cross in most places. |
| 4 | Slightly beneath ground level. Isolated areas of the road are below natural ground level. No side drains are present and localised ponding of water will occur. |
| 5 | Canal. Road is the lowest point and serves to drain the entire area. |

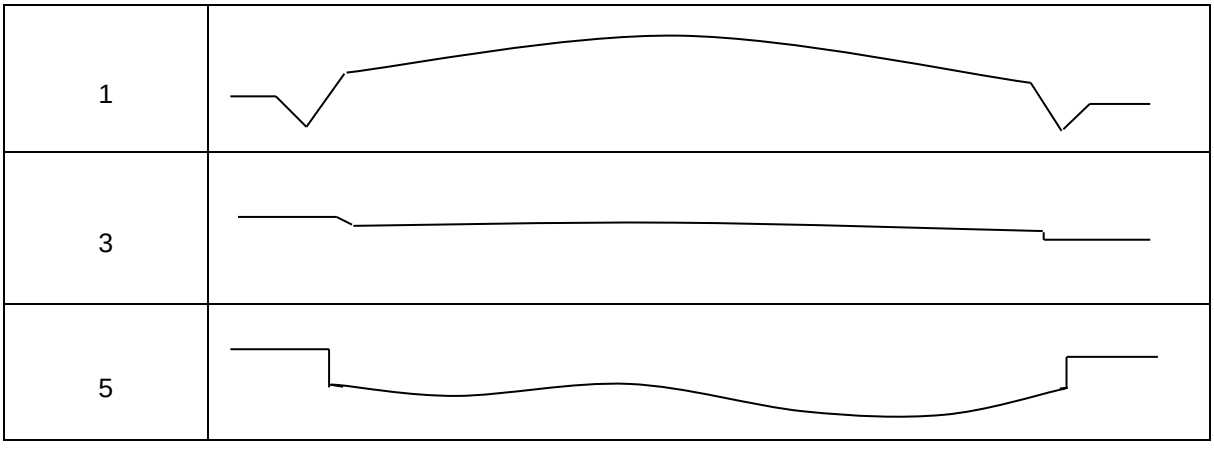



**Figure E.3: Illustration of drainage from the road**

*Provision is made on the assessment form to highlight the main cause/s of a degree 4 (Poor) or 5 (Very Poor) assessment rating i.e. culvert inlets, side drains, mitre drains and/or road level.

## DRAINAGE FROM THE ROAD (On side)

1

| | | | | |
|---|---|---|---|---|
| X | 2 | 3 | 4 | 5 |

Well above ground

3

| | | | | |
|---|---|---|---|---|
| 1 | 2 | X | 4 | 5 |

Level with ground

5

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | X |

Canal

## E.7. Summary

### E.7.1. Overall condition of the pavement

This section defines the summarised overall pavement condition to be recorded by the assessor. The general rating for the condition of the pavement is not used in data processing, but provides checks for the verification of the condition assessment data.

The description of the overall condition of the pavement is given in Table E.20.

**Table E.20: Description of Degrees of Overall Condition of Pavement**

| Degree | Description |
|---|---|
| 1 | Very few or no defects. Degree of defects less than 2. |
| 2 | Few defects. Degree of structural defects mostly less than 3 |
| 3 | A few defects of degree 3 is occurring locally or seldom. |
| 4 | General occurrence of defects with degree 3. |
| 5 | Many defects. The degree of the majority of structural defects is above 3 and the extent is predominantly general to extensive. |

### E.7.2. Comments and other problems

Certain items requiring possible maintenance measures that are not recorded under standard defects should be noted on the assessment form.

## E.8. Assessment form

# VISUAL ASSESSMENT : UNPAVED ROADS

South Africa COTO Committee of Transport Officials

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ROAD AUTHORITY : | | ROUTE CLASS : | 1 | 2 | 3 | 4 | 5 |
| REGION / SUBURB : | | TRAFFIC : | VL | L | M | H | VH |
| ROAD NO / STREET NAME : | | GRADIENT : | Flat | | Med | | Steep |
| SEGMENT (FROM) : | | TERRAIN : | Flat | | Rolling | | Mount |
| SEGMENT (TO) : | | ROAD TYPE | Gravel | | Earth | | Track |
| | | MOIST | Wet | | Moist | | Dry |

SEGMENT DIMENSIONS : LENGTH _____ m WIDTH _____ m

## MATERIAL INFORMATION / GRAVEL PROPERTIES

| | | | | | |
|---|---|---|---|---|---|
| MATERIAL QUALITY | 1 | 2 | 2 | 4 | 5 |
| Problem | | oversize | clay/silt | loose gravel | loose sand |
| MAXIMUM SIZE | < 13 mm | 13 - 25 mm | 25 - 50 mm | > 50 mm | |
| GRADING | Coarse | Medium | Fine | | |
| ESTIMATED 'PI' | Low | Medium | High | | |
| LAYER THICKNESS | > 125mm | 100 - 125mm | 50 - 100 mm | 25 - 50mm | < 25mm |
| EXPOSURED SUBGRADE | none | isolated | frequent | continious | |
| SUBGRADE QUALITY | | Good | Moderate | Poor | |
| Problem | | | wet | clay/mud | sand |

## SURFACE DISTRESS / ENGINEERING ASSESSMENT

| | DEGREE | | | | | EXTENT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MINOR | | WARNING | | SEVERE | ISOLATED | | | | EXTENSIVE |
| | 0 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| POTHOLES | | | | | | | | | | | |
| CORRUGATIONS | | | | | | | | | | | |
| RUTTING | | | | | | | | | | | |
| LOOSE MATERIAL | | | | | | | | | | | |
| STONINESS : FIXED | | | | | | | | | | | |
| : LOOSE | | | | | | | | | | | |
| EROSION : TRANSVERSE | | | | | | | | | | | |
| : LONGITUDINAL | | | | | | | | | | | |

## FUNCTIONAL ASSESSMENT

| | | | | | | |
|---|---|---|---|---|---|---|
| ROUGHNESS | | 1 | 2 | 2 | 4 | 5 |
| Problem | deformation potholes | stoniness | rock outcrop | corrugations | rutting | rut/erosion |
| TRAFFICIBILITY | | 1 | 2 | 2 | 4 | 5 |
| Problem | loose mat | clay | rocky | vegetation | steep | drainage |
| SAFETY | | 1 | 2 | 2 | 4 | 5 |
| Problem | | | Dust | skid resist | slipperiness | drainage |
| DRAINAGE : ON THE ROAD | | 1 | 2 | 2 | 4 | 5 |
| Problem | | | windrows | rutting | road shape | road level |
| DRAINAGE : SIDE OF THE ROAD | | 1 | 2 | 2 | 4 | 5 |
| Problem | | | culvert inlets | side drains | mitre drains | road level |

## SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| OVERALL PAVEMENT CONDITION | 1 | 2 | 2 | 4 | 5 |

COMMENTS:

ASSESSOR : _____ DATE : _____