Road Condition Assessment Manual

Version 2: 2026

WALGA

Influence. Support. Expertise.

Acknowledgements

Acknowledgement of Traditional Owners

WALGA acknowledges the continuing connection of Aboriginal people to Country, culture and community. We embrace the vast Aboriginal cultural diversity throughout Western Australia, including Boorloo (Perth), on the land of the Whadjuk Nyoongar People, where WALGA is located and we acknowledge and pay respect to Elders past and present.

WALGA is committed to supporting the efforts of WA Local Governments to foster respectful partnerships and strengthen relationships with local Aboriginal communities.

Disclaimer

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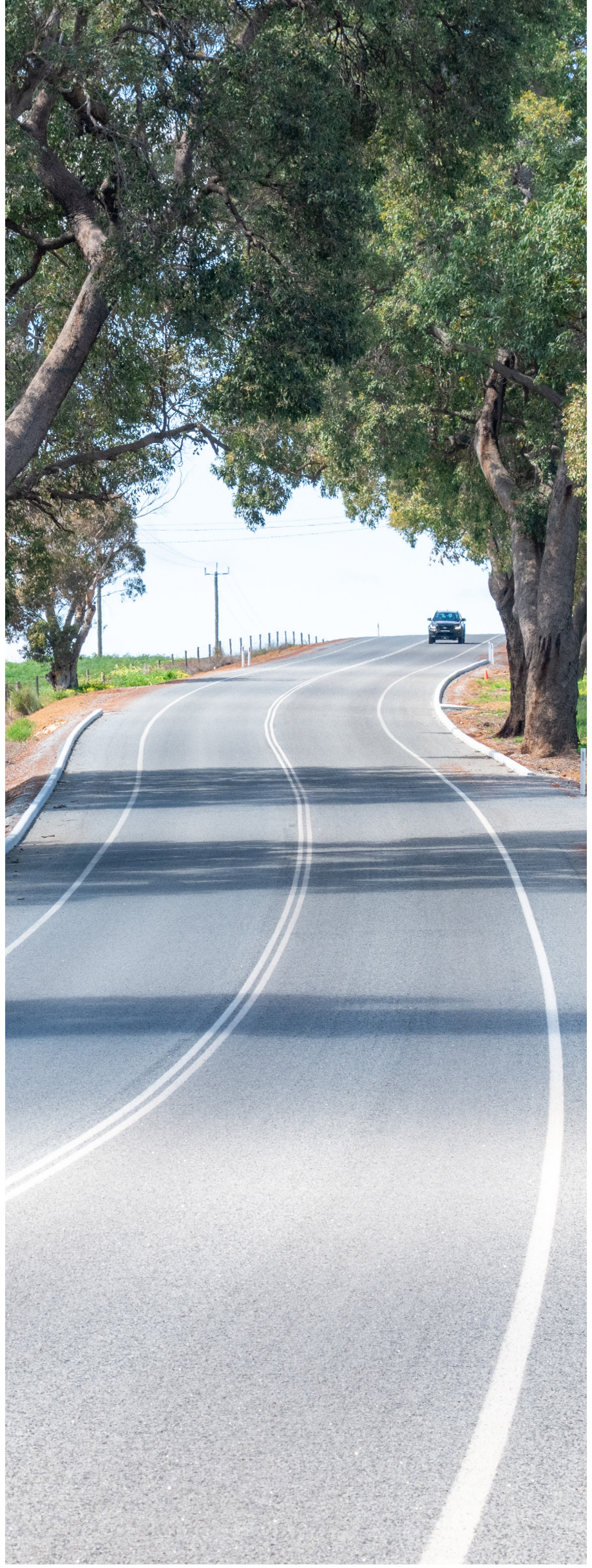

Version	Revision Date	Author	Summary of Changes
1	2016	WALGA/ARRB Group	This version represents the initial Manual
2	2026	WALGA/Civilse	Refer Appendix E for Summary of Changes

Foreword

This 2025 release (Version 2) of WALGA's Road Visual Condition Assessment Manual builds on the original 2016 edition prepared by ARRB, now NTRO. In January 2025, WALGA commissioned Civil Sciences & Engineering (CSE) to modernise and refine the Manual, incorporating feedback from Local Governments, advances in automated data collection technologies, updated rating bands, and improved quality assurance and inspector calibration guidance. All updates have been made while preserving compatibility with the ThinkProject / RAMM system and previously collected datasets.

Version 2 also introduces pavement roughness as a standalone condition category for sealed and unsealed roads. This allows a broader and more holistic network-level understanding of pavement performance.

Accurate, up-to-date condition data is the foundation of sound pavement asset management:

- Cost efficiency

  On high trafficked roads, keeping pavements in good condition with routine works is far cheaper over the lifecycle than allowing failure and then rebuilding. In many analyses, timely maintenance costs are on the order of one quarter of defer-and-rehabilitate strategies.

- Risk reduction

  Timely surface treatments (patching, crack sealing, resurfacing) preserve waterproofing and reduce structural failures, particularly on heavier-trafficked pavements.

- Informed decision-making

  Accurate condition data (inventory, severity, extent, and network usage) enables asset managers to:

  Target maintenance at the optimal time

  Optimise whole-of-life costs

  Support robust and condition-informed asset valuations

This Manual provides a consistent, network-level visual survey framework, a "snapshot" of pavement health across defined treatment lengths, to guide maintenance and capital works programming. It is not intended as a design guide for project-level investigations. For detailed treatment design, users should refer to:

- Austroads Guide to Pavement Technology Series (AGPT02, AGPT05)
- Main Roads WA Engineering Road Notes (ERN 9, ERN 16, ERN 19)
- IPWEA Practice Notes and other relevant guidance

The technical basis for the Road Condition Index (RCI), including revised rating alignment and composite index formulation, is documented in Appendix C.

Please direct any queries regarding data translation from Version 1, safety procedures, or scope of use to WALGA via infrastructure@walga.asn.au.

Acronyms

Acronym	Definition
AGAM	Austroads Guide to Asset Management
AGBT	Austroads Guide to Bridge Technology
AGPT	Austroads Guide to Pavement Technology
AGRD	Austroads Guide to Road Design
AGTM	Austroads Guide to Traffic Management
AI	Artificial Intelligence
ARRB	ARRB Group Ltd (Australian Road Research Board)
ASTM	American Society for Testing and Materials
CI	Composite Index
CSE	Civil Sciences and Engineering
DCI	Drainage Condition Index
DFG	Deflectograph
ERN	Engineering Road Note
FWD	Falling Weight Deflectometer
GPR	Ground Penetrating Radar
GPS	Global Positioning System
ICC	Intra-class Correlation
IPWEA	Institute of Public Works Engineering Australasia
IRI	International Roughness Index
IRIqc	Quarter-car IRI model
LG	Local Government
LG TRRIP	Local Government Transport Road Research and Innovation Program

Acronym	Definition
LiDAR	Light Detection and Ranging
LWD	Light Weight Deflectometer
MAE	Mean Absolute Error
MASW	Multichannel Analysis of Surface Waves
MRWA	Main Roads Western Australia
NAASRA	National Association of Australian State Road Authorities
NTRO	National Transport Research Organisation
PCI	Pavement Condition Index
PSPA	Portable Seismic Pavement Analyser
QA	Quality Assurance
QC	Quality Control
RAMM	ThinkProject Asset & Work Manager (formerly Road Assessment and Maintenance Management)
RCI	Road Condition Index
SCI	Surface Condition Index
SWMS	Safe Work Method Statement
TL	Treatment Length
TSD	Traffic Speed Deflectometer
UCI	Unsealed Condition Index
USW	Ultrasonic Surface Waves
WALGA	Western Australian Local Government Association

1. Introduction

1.1 Purpose

The purpose of this Manual is to provide Local Governments (LGs) and their contractors with a consistent, repeatable method for conducting network-level visual condition assessments of sealed and unsealed road pavements and paths. It focuses on:

- Defect identification and measurement: recording the severity and extent of surface distresses such as cracking, rutting, patches, potholes and surface deficiencies.
- Condition indices: standardising defect ratings into condition indices and combining into composites for sealed and unsealed networks to provide consistent, comparable outputs.
- Program support: utilising the indices to inform maintenance prioritisation and long-term planning at the network level.

This Manual is intended for:

- Asset managers in LG authorities who plan and budget road maintenance programs.
- Field survey teams and consultants who collect visual condition data.
- Data analysts who compile and interpret condition survey results within ThinkProject / RAMM or similar asset management systems.

This Manual supports the collect → process → report → program stages of the road asset management cycle shown in Figure 1-1, by defining how condition data are gathered, quality-assured and reported into indices for program planning.

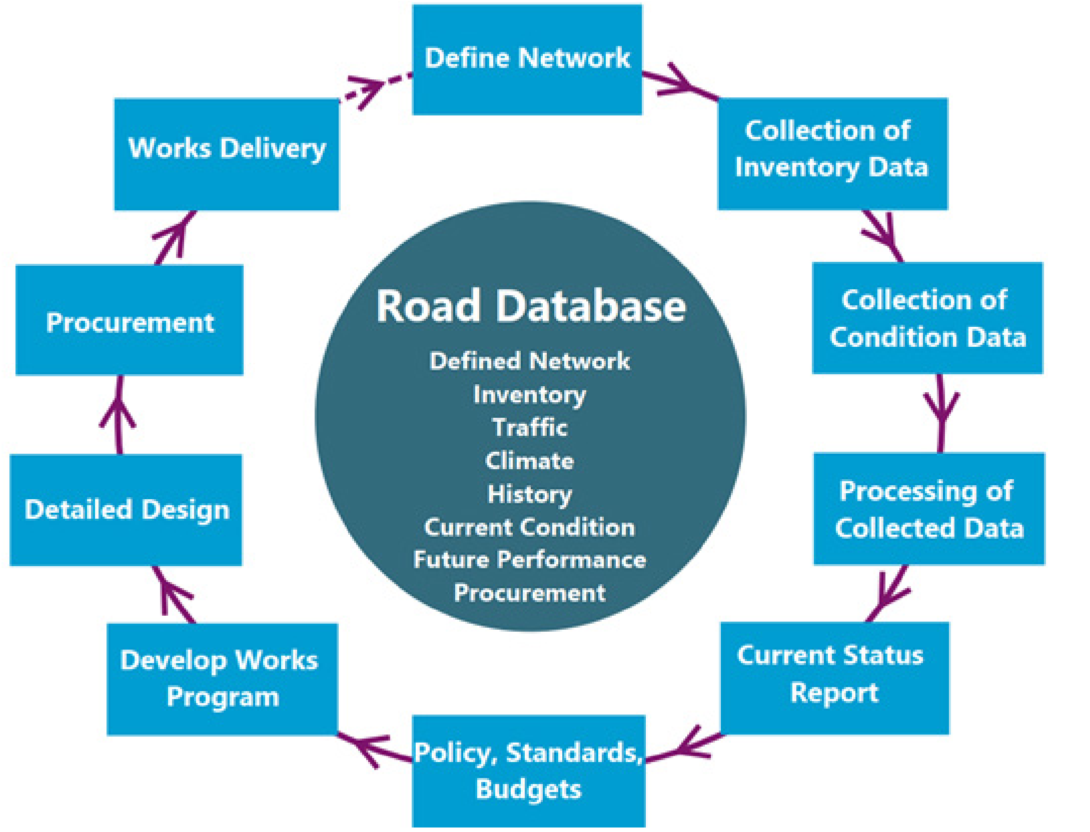

Figure 1-1: Overview of Road Asset Management Process. Adapted from (Austroads, 2009), AGAM05-09.

1.2 Scope

This Manual applies to the visual condition assessment of sealed and unsealed road pavements and paths across the Western Australian LG road network. It is intended for network-level assessments that support the prioritisation of maintenance and renewal activities and the development of long-term asset management strategies.

The road hierarchies covered include:

- Access Roads (A)
- Local Distributor (LD)
- District Distributor B (DB)
- District Distributor A (DA)
- Regional Distributor (RD)

Primary Distributor roads are excluded as these are the responsibility of Main Roads Western Australia (MRWA).

The Manual focuses on surface, pavement and drainage defects. Roughness may be included as a standalone dataset to complement program decisions. Data may be collected via manual visual assessment, video-based capture, or automated/AI-assisted methods (see Section 1.4).

The Manual does not cover the condition assessment of geometric features or ancillary roadside assets such as signs, lighting, barriers, drainage infrastructure, crossovers, pathside furniture or vegetation. These assets should be assessed using separate guidelines, where applicable.

This Manual is not a design guide for project-level investigations. For detailed engineering design, pavement rehabilitation strategies and structural testing, consult the documents listed in Section 1.7 Related Standards and Practice Notes.

1.3 Assessment Strategy

Assessment Types

This Manual supports two complementary network-level pathways. LGs may use either pathway alone or in combination. Both feed into asset systems for program planning and lifecycle decisions.

- Roughness assessment: objective ride-quality indicator from vehicle-mounted profilers, reported as International Roughness Index (IRI) (m/km). This is treated as a standalone dataset (see Section 2).
- Visual condition assessment: defect-by-defect ratings (severity/extent) converted to condition indices and combined into composites for sealed and unsealed networks (see Sections 3, 4 and Appendix C).

The appropriate pathway depends on asset type, survey resources and data availability. Roughness is most informative on higher-speed corridors, whilst visual condition is universal and supports defect-specific programming. Many councils use both to balance network-wide coverage and defect detail, as well as safety and cost.

The frequency of surveys will differ by LG depending on network size, traffic, risk and resources. A risk-based cycle is recommended, with typical frequencies as follows:

- Higher-order sealed roads: Every 2-3 years for visual condition plus annual or biennial roughness where practical.
- Lower-order sealed roads: Every 3-5 years for visual condition.
- Unsealed roads: Baseline every 4-5 years and after significant weather events. For high risk or critical links, reduce to 1-3 years.

Councils may shorten cycles where indices trend toward intervention levels or where safety, growth or vulnerability warrants earlier review.

Figure 1-2 summarises how the two assessment pathways map to the reported indices. IRI is a standalone dataset, while visual condition feeds the SCI (Surface), PCI (Pavement) and DCI (Drainage) for sealed roads, and the UCI for unsealed roads.

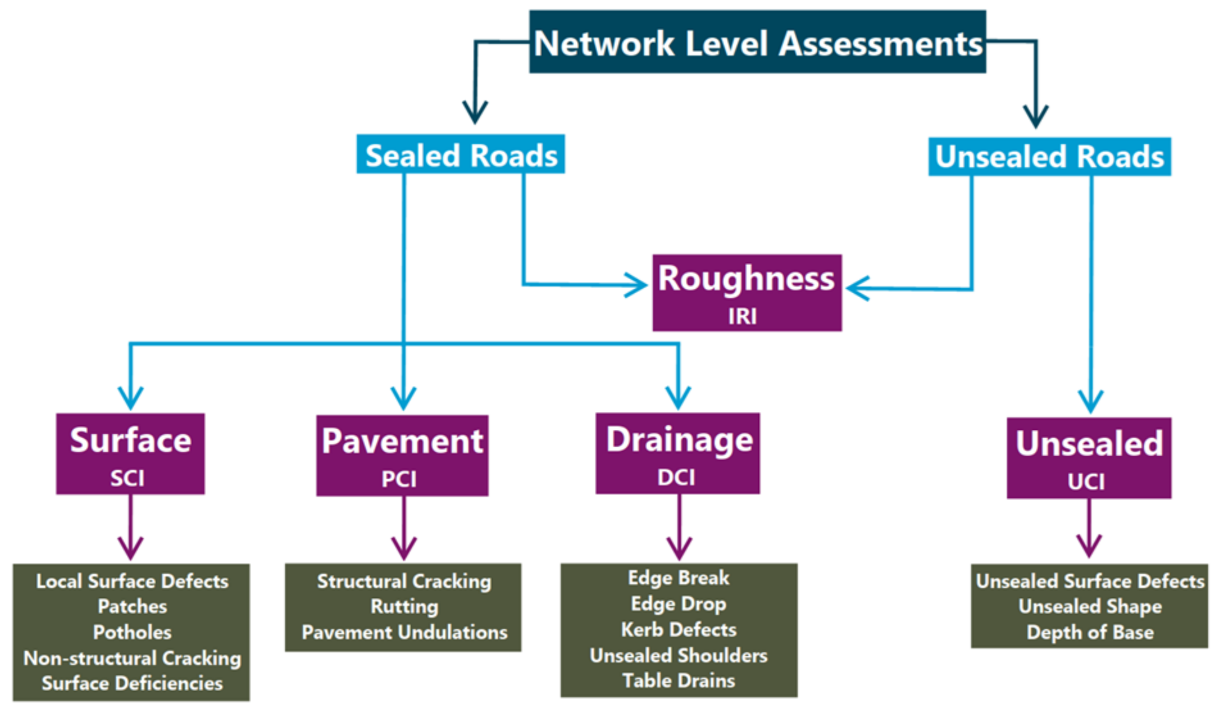

Figure 1-2: Network-level Assesment Framework

Fit for Purpose

Condition indices provide a consistent, network-level view of asset condition, but intervention decisions must also consider whether the pavement remains fit for purpose in its context. A pavement is fit for purpose when road users can travel at the intended operating speed safely, without unreasonable dis-comfort, and without damage to vehicles or mobility devices, surface water is managed, and the surface does not present obvious hazards.

The following aspects need to be considered when applying fit for purpose judgement:

- Context: Surface age or stable low-severity cracking may not impede service on low-speed, low-volume streets; monitoring and targeted crack sealing may be sufficient.
- Hierarchy-specific expectations: Trigger points for roughness and surface defects should reflect posted speed and function. In traffic-calmed or ≤50 km/h environments, isolated roughness or device-related profile changes may not justify treatment on index values alone unless they present a safety or accessibility risk.
- Risk-based escalation: Regardless of ratings/indices, intervene where hazards emerge or where trends show rapid deterioration.
- Transparency: When deferring works on a fit-for-purpose basis, record the rationale, evidence (inspection notes, complaints, crash data) and the planned monitoring interval.

1.4 Data Collection Methods

This Manual accommodates multiple capture methods. Surveys may use one or a combination, provided calibration and QA requirements (Section 1.6) are met.

Capture Methods

- Manual visual inspection

  Traditional walk or drive-through surveys using trained inspectors. Defects are recorded in the field on tablets or mobile devices which may be synced to ThinkProject/RAMM.

- Video based capture

  High-resolution dash or roof-mounted cameras collect forward/downward video that is reviewed in the office. This reduces field time, improves safety, and allows re-review where QC flags anomalies.

- Automated/Artificial Intelligence (AI) assisted survey tools

  Inertial laser profilometers, 3D scanning and computer-vision models can capture longitudinal profiles, rut depth, texture and cracking patterns. For roughness, the most common workflow is quarter-car simulation on profiler data to produce IRI (m/km), in accordance with AGAM/T001-16, (Austroads, 2016).

Minimum Metadata

Record, at a minimum: date/time, GPS location, direction of travel, road hierarchy, treatment-length ID, inspector or system ID, device/model and software/model version, and current calibration certificate/reference.

Equipment

Document the mounting configuration, sampling rates, speed window, lighting constraints and any warm-up or repeat-run requirements. Define triggers for re-calibration, such as hardware changes or abnormal QC findings. For IRI, retain repeatability evidence and quarter-car settings.

Artificial Intelligence Acceptance

The Manual supports the use of AI to assist or automate condition assessment, provided accuracy and repeatability are demonstrated and documented. There are two acceptance levels:

- Level 1 - Screening (human-in-the-loop): Use AI to pre-classify or pre-measure; people review and confirm critical calls. Select this level when AI is suitable for triage and work-ordering support.
- Level 2 - Decision-grade (direct use): Use AI outputs directly for index mapping and reporting. Select this level only when accuracy and repeatability are shown to be equivalent to trained human raters.

As guidance, Level 1 should demonstrate "good" agreement and reasonable numeric accuracy, Level 2 should demonstrate "strong" agreement, tighter numeric accuracy, and high repeatability. LGs may set local thresholds appropriate to risk and use case.

For either level, record a short validation note including:

- A hold-out test set representative of local conditions
- Comparison with adjudicated human ratings/measurements
- Summary accuracy and repeatability statistics
- Device/software/model version and date.

Typical metrics used are:

- Macro-F1 or weighted κ (kappa) for agreement on categorical ratings
- MAE (mean absolute error) for the size of numeric error (e.g., mm, %)
- ICC (intra-class correlation) for repeatability on repeat passes.

System Integration

The Manual is fully compatible with ThinkProject/RAMM and historic Version-1 datasets: (i) no changes are included that disrupt existing asset schemas; (ii) threshold adjustments are calibrated to allow translation of historic data; and (iii) Appendix C provides the operative condition/index tables and implementation guidance.

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Introduction

1.5 Treatment Lengths

Definition and Purpose

A treatment length (TL) is a continuous section of road segment that performs in a broadly uniform way and is expected to receive the same treatment across its full length (Road Efficiency Group (REG), 2018).

Treatment lengths are fundamental to how condition data is interpreted and how works are planned. They form the basic unit used to:

- assign defect ratings and condition indices,
- aggregate condition results across the network,
- develop forward works and renewal programs, and
- compare condition over time.

If treatment lengths are poorly defined, condition scores can be misleading, priorities distorted, and renewal decisions harder to justify. Consistent, well-defined treatment lengths are therefore critical to reliable condition assessment and defensible programming.

Default Segmentation

For most urban and semi-urban networks, a practical default approach is to define treatment lengths from intersection-to-intersection (Figure 1 3). This usually provides segments that are:

- easy to understand in the field,
- compatible with how works are delivered, and
- suitable for reporting and planning.

Local Governments should review these default lengths and refine them, where required to ensure each length is reasonably uniform in condition and construction.

Some asset systems offer automated or dynamic segmentation tools to assist with this process. These tools can be useful where high-quality, complete asset data is available, but they should not be assumed to be suitable for all networks. Where underlying inventory, surfacing history, or condition data is incomplete or inconsistent, automated segmentation can introduce errors. Manual review and local knowledge remain essential.

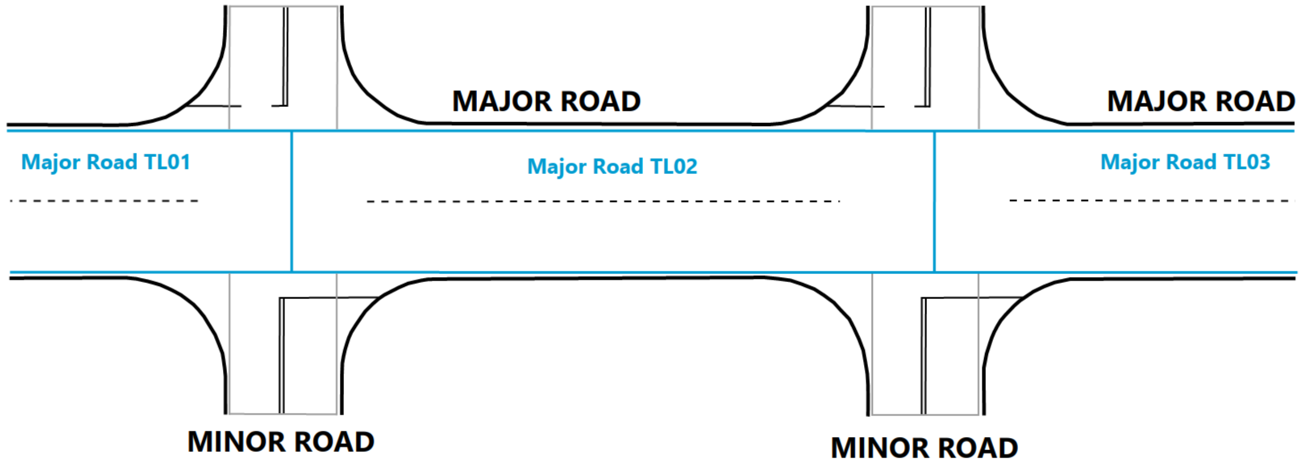

Figure 1-3: Typical Treatment Length Definition

Length Guidance

A treatment length should be split wherever there is a clear and sustained change in performance or asset characteristics. Common reasons include:

- a noticeable change in surface condition,
- a change in pavement structure or surfacing type,
- a significant change in carriageway width or number of lanes,
- a change in road environment (e.g. rural to urban),
- sections resurfaced or renewed at materially different times,
- major features such as roundabouts or long turning pockets where condition differs from the adjacent road.

As a guide:

- Urban roads: treatment lengths should generally align with intersections or cul-de-sacs, and be no longer than a practical resurfacing length.
- Rural roads: where condition is relatively uniform, contiguous lengths of approximately 500 m to 1 km are usually appropriate.

Very short lengths can lead to inefficient mobilisation and fragmented works. Very long lengths make it difficult to assign representative condition and can mask localised deterioration.

Intersections and Overlaps

Centreline geometry in asset databases can create small overlaps or duplicate slivers at intersections. Where these are insignificant, they may be ignored. Where they materially affect area or length calculations, the overlapping stubs should be isolated and excluded when defining treatment lengths.

Small localised features such as speed humps, pedestrian refuges, short sections of different paving, or service trenches do not automatically require a treatment length split unless they result in a sustained change in performance.

Documentation and Consistency

The rules used to define treatment lengths should be clearly documented and applied consistently across the network. This should include:

- the default segmentation approach,
- typical minimum and maximum lengths,
- common triggers for splitting lengths, and
- how exceptions are handled.

Clear documentation ensures that different users apply the same logic, and that condition scores remain comparable over time.

1.6 Quality Assurance

Framework

A robust Quality Assurance (QA) framework underpins every reliable condition survey. QA covers both the capture process and the integrity of the data itself. Quality Control (QC) refers to the checks and corrections applied to that data. Equally important is inspector calibration, ensuring that people interpreting and recording defects do so in a consistent, repeatable way across teams, seasons and technologies.

Planning

Before any survey begins, prepare a documented QA/QC plan that addresses:

- Data scope

  Define which fields and metadata will be collected.

- Validation and error identification

  Specify how anomalies will be detected, including at a minimum:

  Missing or duplicate records; improbable GPS/time; hierarchy mismatches.

  Out-of-range entries (e.g. extent > 100%).

  Precision: rounding to the nearest 5 units (where specified).

- Error handling and flagging

  Describe how questionable records will be flagged and who reviews them. Rules to include:

  Automatic checks at upload.

  Manual review of outliers.

- Trend/outlier checks against prior surveys
- Resolution Workflow

  Document the step-by-step process for fixing flagged data, including roles and responsibilities, version control and audit trails.

- Safe Work Method Statement (SWMS)

  Include or reference the SWMS covering field inspection activities to ensure data is collected safely and legally.

Inspector Calibration & Training

Consistent interpretation of surface defects is just as important as accurate measurements. Each Local Government should implement:

1. Induction & Training
   - A half-day workshop for new inspectors, covering: defect definitions, measurement techniques, software entry procedures and safety protocols.
   - Use the Manual's photographs as calibration benchmarks.
2. Calibration Exercises
   - Annual Cross-Audits: Two or more inspectors independently rate the same treatment lengths; any ratings differing by more than one band are reviewed together to resolve discrepancies.
   - Benchmark Surveys: Maintain a set of "gold-standard" calibration sites with known condition scores; revisit these at least annually.
3. Ongoing Refresher Sessions
   - An annual half-day "refresher" to review recent survey data, discuss challenging cases, and realign interpretations.
4. Documentation & Records
   - Log all training dates, attendance and calibration results.
   - Store calibration site data, notes, and any agreed rating adjustments for future reference.

Data Management & Continuous Improvement

- Centralised Database

  Upload all survey data (and QC flags) into the organisation's asset register or a dedicated condition database.

- Version Control

  Track revisions to both the QA/QC plan and the collected data so that any corrections are fully auditable.

- Post-survey QC and Reporting

  Validate rounding, check distributions by hierarchy, and spot-check length-weighted roll-ups from sub-segments to treatment lengths and sections. Where automated/AI-assisted outputs are used, retain device/model and software/model versions and apply the organisation's acceptance criteria.

- Periodic Review

  At least every three years, revisit QA/QC procedures and calibration methods to reflect new technologies and evolving best practice. Interim tweaks may be issued sooner if material quality issues are identified.

1.7 Related Standards, Guidelines and Practice Notes

This Manual is intended for network-wide assessment of sealed and unsealed road pavements and paths. It does not prescribe project-level design, structural testing, or the inspection/condition assessment of other assets or geometric features.

Where more detailed investigation, design or asset-specific guidance is required, refer to the primary standards, guidelines and practice notes below. These documents take precedence for project-level engineering and asset class–specific requirements.

Introduction

Table 1-1: Primary Standards, Guidelines and Practice Notes

Pavement Investigation and Treatment Design	
For rehabilitation design, resurfacing, strengthening, testing and forensic investigation	• AGPT Part 2: Pavement Structural Design • AGPT Part 5: Pavement Evaluation and Treatment Design • MRWA Engineering Road Note 16: Pavement Evaluation and Treatment Design • MRWA Engineering Road Note 19: Pavement Defect Investigation Guidelines
Other Road Corridor Assets	
For assets outside the scope of this Manual (drainage, utilities, lighting, parks-side elements, paths)	• IPWEA Practice Note 2: Footpaths and Cycleways • IPWEA Practice Note 5: Stormwater Drainage • IPWEA Practice Notes 10.1–10.6: Parks and Open Space Management • IPWEA Practice Note 11: Street Lighting • WALGA Guidelines and Specifications for Residential Crossovers
Traffic and Network Operations	
For signage, traffic calming, network operation and access management	• AGTM Part 4: Network Management • AGTM Part 8: Local Area Traffic Management • AGRD Part 3: Geometric Design • MRWA Signs and Lines Policy and Guidelines
Bridges	
For structures requiring visual inspection or structural condition assessment	• WALGA Bridge Inspection Framework – Level 1 • AGBT Part 7: Maintenance and Management of Existing Bridges • MRWA Routine Visual Inspection Guidelines for Bridges – Level 1 • MRWA Condition Assessment – Level 2: Detailed Visual Inspection Guidelines (Concrete, Steel and Timber Bridges)

Where differences arise, this Manual governs network-level visual condition assessment; project-specific standards govern design and construction.

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2. Roughness Assessment

2.1 Overview

Road roughness is a measure of the smoothness or ride quality of a road surface, typically expressed using the International Roughness Index (IRI) in units of m/km (Austroads, 2007). It reflects the deviation of the pavement surface from a true planar profile and has a significant impact on:

- Vehicle operating costs
- Ride comfort and safety
- Dynamic loading on pavements
- Public perception of road quality

Roughness is often considered a holistic indicator of pavement performance, particularly suitable for network-level assessments, and is used to flag sections that may require detailed, project-level investigation. It is applicable to both sealed and unsealed roads, with interpretation dependent on road class, speed environment, and traffic volumes.

Roughness in this Manual refers to IRI measured with vehicle-mounted inertial laser profilers, which combine laser height and accelerometer data to derive a longitudinal profile and compute IRI using a quarter-car filter. This is distinct from LiDAR/surface-scanning products, which do not produce standard IRI.

Customer research has shown that ride quality is one of the strongest influences on perceived road condition and satisfaction, supporting the use of IRI as a primary network-level screening indicator (O'Connor & Martin, 2020).

2.2 Purpose and Use

The intent of including roughness in this Manual is to:

- Provide a network-wide, objective measure of road surface condition.
- Support asset managers in prioritising resurfacing or maintenance.
- Complement visual condition assessments with quantitative data.

Roughness assessment is not mandatory, but highly recommended where suitable data collection methods are available. It is especially beneficial where automated surveys (e.g. profilometer vehicles) are already in use.

This section introduces condition rating bands for roughness by road class and surface type, intended as a guide only. Local authorities should apply engineering judgment when interpreting roughness data, considering factors such as traffic calming devices, geometry, speed limits, and public complaints.

2.3 Measurement Methodology

Current practice is to measure roughness using inertial laser profilometers, mounted to survey vehicles. These systems measure the longitudinal profile in both wheelpaths, simulating a standard vehicle's response using the ASTM E1926 Quarter-Car IRI Model (IRIqc) (Austroads, 2007).

Inertial laser profilers measure pavement profile independently of vehicle suspension, tyre pressure, and vehicle speed within the manufacturer's specified operating range. Unlike response-type road roughness measurement systems (RTRRMS), such as NAASRA meters, inertial profilers do not require operation at a constant speed. However, surveys should be conducted within the recommended speed range of the device. Heavy braking, rapid acceleration, or harsh manoeuvres that cause the host vehicle to pitch forward or backward should be avoided, as these can affect profile quality.

At very low operating speeds (typically below approximately 15 km/h), accelerometer signals may be dominated by noise, reducing profile accuracy. Surveys at sustained very low speeds should therefore be avoided where practicable.

Routine calibration, sensor alignment and verification are essential to maintain data quality.

Survey inputs:

- Speed basis: IRI is modelled at a reference speed of 80 km/h
- Measurement unit: m/km
- Reported value: Lane IRIqc (average of left and right wheelpath IRIs)

- Typical interval: 100 m reporting segments
- Quality control: Retain device/software/model and version in metadata, and document pre- and post-survey checks.

Historical roughness data in WA may also reference NAASRA counts/km[MB13.1][DG13.2]. For comparison purposes, the following conversion can be used (Prem, 1989):

NAASRA counts/km ≈ (26.49 × IRI) − 1.27

However, the standard for all new data should be IRI.

Note: IRI results may be influenced by localised features such as speed humps, intersections, driveways, patched trenches, bridge abutments, rail crossings, or surface transitions, particularly on lower-order roads. Care must be taken not to over-interpret high readings caused by such localised features. Where necessary, shorter reporting intervals (e.g. 10 m) may be used to better understand the influence of localised features and support informed interpretation.

2.4 Applicability

Sealed Roads: IRI is highly applicable for all sealed Distributor and Regional roads. On urban local distributors, it may be used with discretion. Urban access roads are excluded from IRI assessment due to low speeds, inconsistent geometry, and lack of practical benefit.

Unsealed Roads: While naturally rougher, unsealed roads benefit from roughness tracking to inform grading frequency. Thresholds are higher and more variable, depending on traffic volumes.

Roughness data should be used to:

- Flag sections for routine maintenance or resurfacing
- Support asset valuation and funding prioritisation
- Track pavement deterioration over time.

2.5 Condition Rating Bands

The tables below provide indicative condition bands for roughness, separated by surface type and road hierarchy. These values have been adapted for Western Australian local road conditions and intended as guidance only.

Table 2-1: *IRI Condition Ratings for Sealed Roads*

Road Type	Good	Fair	Poor
Regional Distributor	< 4.0	4.0 – 5.2	≥ 5.3
District Distributor A	< 4.0	4.0 – 5.2	≥ 5.3
District Distributor B	< 4.5	4.5 – 6.0	≥ 6.1
Local Distributor	< 5.0	5.0 – 6.4	≥ 6.5
Access Roads (Non-Built Up)	< 5.0	5.0 – 6.4	≥ 6.5

Note: These values represent typical expectations and are not absolute limits. For roads with speed humps or complex geometry, IRI should be interpreted with local context.

Table 2-2: *IRI Condition Ratings for Unsealed Roads*

Road Type	Good	Fair	Poor
Low Volume	< 5.0	5.0 – 10.0	> 10.0
High Volume	< 5.0	5.0 – 8.0	> 8.0

Roughness thresholds for unsealed roads are more lenient due to natural variability, but a consistent increase beyond these values indicates need for regrading.

Source: Adapted from (WALGA, 2016) roughness guidance, informed by Austroads investigation levels (Austroads, 2007; Martin, 2005) and modified to reflect WA local road conditions.

2.6 Interpretating Data

An IRI value exceeding the "Poor" threshold does not automatically mandate works, rather it should trigger site validation, possibly visual inspection, to determine cause and treatment need.

Common contributing defects include:

- Depressions, rutting, potholes
- Stripping, cracking, corrugation.

Judgement should consider:

- Consistency of high IRI across a section
- Presence of distress observed during visual survey
- Speed environment and safety concerns
- Surface type and road function.

2.7 Integration into Asset Management

Roughness is a key performance indicator in network-level pavement management, offering a quantifiable, repeatable, and objective measure of road condition. When integrated with visual condition data, it provides asset managers with a more complete picture of pavement health, especially where budget and resources limit the frequency of detailed inspections.

Roughness data supports asset management by:

- Prioritising intervention timing: Roads with high roughness (but limited visible distress) may be candidates for early resurfacing to restore ride quality.
- Tracking deterioration trends: IRI values collected cyclically (e.g. biennially) help estimate the rate of surface decline over time.
- Valuation and depreciation: IRI can be used in condition-based depreciation models for fair value reporting.
- Targeting different treatments:
  - High IRI + no structural defects → Functional overlay / regrading.
  - High IRI + structural distress → Full pavement rehabilitation.

Where both roughness and defect-based condition indices (PCI, SCI, DCI) are available, the indices may be viewed in conjunction, with likely actions outlined Table 2-3.

Table 2-3: *Guidance on Combined Index Actions*

Scenario	Likely Action
Low PCI, High IRI	Surface treatment to restore ride comfort
High PCI, High IRI	Further investigation needed
Low PCI, Low IRI	Monitor – good condition overall
High PCI, Low IRI	Confirm with visual assessment – false positive possible

It is recommended that roughness be used as a screening tool to flag candidate sections for further review or capital works planning. It is not intended to replace visual assessment but to complement it, especially where automated data collection is already in use.

3. Sealed Roads

3.1 Local Surface Defects

Overview

Description

Local surface defects are isolated pavement issues that occur at discrete locations rather than uniformly across a treatment length. Typical manifestations include failed patches, localised rutting or cracking, short-wave deformations, and localised shoving or corrugations. While local in extent, these defects reduce ride quality and can accelerate adjacent pavement deterioration if not treated.

Typical Forms

Table 3-1 has descriptions and possible causes of typical local surface defects.

Table 3-1: *Types of Local Surface Defects*

Defect Type	Description	Possible Causes
Failed Patch	Reinstated area where the original surface was replaced but has settled, cracked, or sits proud/low.	• Inadequate preparation • Poor materials or compaction • Premature trafficking • Utility reinstatement settlement
Localised Rutting or Cracking	Small, confined rutting or cracking that does not match network rutting / cracking patterns.	• Isolated structural weakness • Substandard patching or areas of reduced pavement thickness • Localised subgrade failure or utility-related subsidence
Pavement Deformation	Local dips or non-intentional humps that create short-wave roughness; may be outside wheel paths.	• Differential settlement • Subgrade consolidation or expansive soil volume changes • Tree root uplift or trench reinstatement settlement
Localised shoving or corrugations	Closely spaced waves or ridges, often in braking/turning zones.	• Inadequate bond between layers • Weak asphalt mix or reinstated patches in traffic stress zones • Braking/turning forces or invasive tree roots

Failed Patch

Localised Rutting

Pavement Deformation

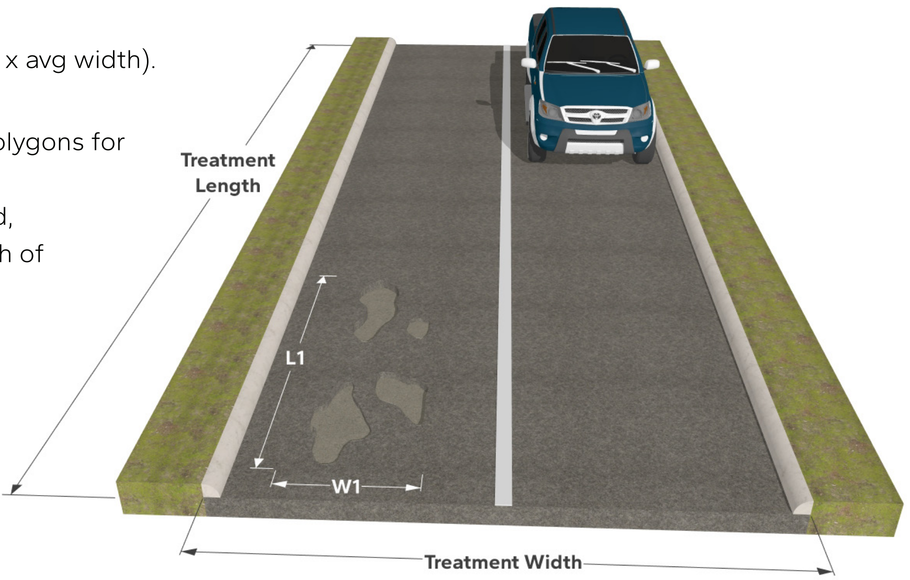
Localised Shoving

Method of Measurement

What to measure: the percentage of treatment area affected by local surface defects.

Procedure:

1. Determine treatment area (length x avg width).
2. Determine the area affected:
   Field or video capture: trace polygons for each defect area.
   If only dimensions are recorded, compute area as length × width of each defect.
3. Express the area affected as a percentage of the total treatment area to the nearest 5%.
4. Assign a rating according to Table 3-2.



Rating

Table 3-2: *Local Surface Defect Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	0% < Area Affected ≤ 5%
3	5% < Area Affected ≤ 10%
4	10% < Area Affected ≤ 20%
5	Area Affected > 20%

Additional Notes

- Include all discrete local defects within the treatment length, regardless of position across the carriageway.
- Extensive, uniform issues should be rated under the relevant primary category instead, for example Rutting, Cracking, or Pavement Undulations.

Sealed Roads

3.2 Pavement Undulations

Overview

Description

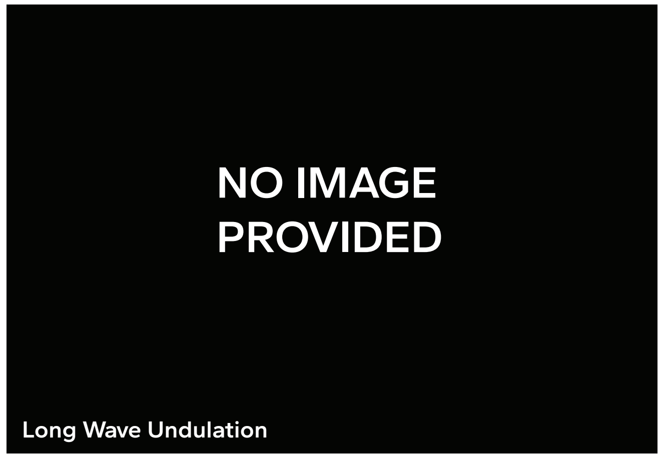
Pavement undulations are areas with elevations lower or higher than the surrounding surface that create long-wave or irregular depressions and uplift. They may be isolated or widespread, and in some cases present over an entire treatment length. Unlike rutting, these deformations are not confined to wheel paths and are often linked to subgrade movement or differential settlement rather than traffic load alone.

Typical Forms

Table 3-3 has descriptions and possible causes of typical pavement undulations.

Table 3-3: *Types of Pavement Undulations*

Defect Type	Description	Possible Causes
Long-wave undulations	Broad, gentle sagging or heaving over several metres that gives a "wavy" ride. Often on compressible foundations; uniform, repeating wave pattern.	• Inadequate use of wick drains and preloading to compress soft soils • Subgrade settlement due to long-term consolidation • Poor construction control during earthworks or embankment preparation
Irregular depressions and uplift	Localised bowls, humps or dish-shaped areas with abrupt transitions.	• Inadequate pavement thickness or compaction • Isolated zones of poor-quality subgrade • Ground movement due to geology, embankment instability, or moisture change • Tree root subsidence or heave • Decay of organic matter left during construction



Long Wave Undulation

Irregular Depressions

Method of Measurement

Pavement undulations are assessed in terms of both severity (impact on ride quality) and extent (length effected).

Severity

What to assess: the effect on ride quality and safety.

Procedure:

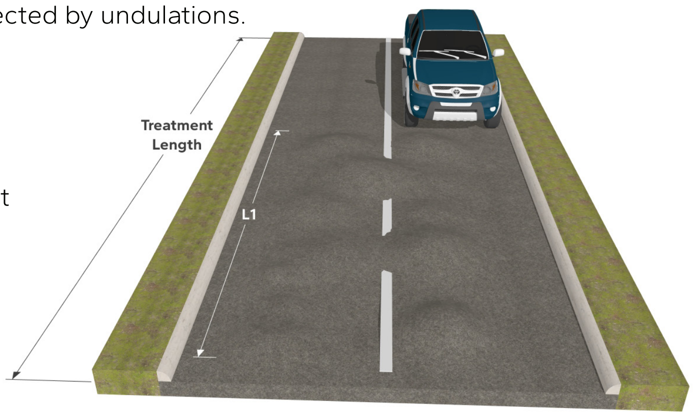
- Drive-through assessment: Drive the treatment length at the posted speed and observe:
  - The degree of vehicle bounce or oscillation.
  - Changes in comfort level and need to reduce speed.
  - Any concerns relating to vehicle control or safety.
- Video-based assessment: Review calibrated forward-facing video at an appropriate playback speed. Note visible pitch and heave, steering corrections and any speed-advisory signage.
- Automated assessment: Use profile-based roughness and wavelength indicators to corroborate field observations.
- Assign a rating according to Table 3-4.

Extent

What to measure: the percentage of treatment area affected by undulations.

Procedure:

1. Determine treatment length.
2. Delineate each undulation zone between where the surface departs from the general grade and where it returns. Sum mapped lengths.
3. Express the length affected as a percentage of the total treatment length to the nearest 5%.
4. Assign a rating according to Table 3-5.



Rating

Severity

Table 3-4: Pavement Undulation Severity Rating

Rating	Description
0	Not Applicable
1	Slight unevenness, ride still comfortable at posted speed.
3	Noticeable undulation, affects ride quality, motorists may reduce speed.
5	Very poor ride, uncomfortable and potentially unsafe, hazard signage needed.

Extent

Table 3-5: Pavement Undulation Extent Rating

Rating	Description
0	Not Applicable
1	No length affected
2	0% < Length Affected ≤ 5%
3	5% < Length Affected ≤ 10%
4	10% < Length Affected ≤ 20%
5	Length Affected > 20%

Additional Notes

- Use this section for long-wave or irregular shape changes that affect ride quality across a discernible area. Short-wave, highly localised deformations are rated under Local Surface Defects.
- Where automated roughness is available, record the IRI in the comments as supporting information. Severity is still assigned by observed ride effect and mapped extent in this section.
- Low-speed or confined areas: if you cannot drive at or near the posted speed, assess severity using visual amplitude and wavelength, straightedge or string-line checks, and driver feedback at the maximum safe speed. Document the assessment speed. Do not include vertical traffic-calming devices or utility covers.
- If undulations vary across the segment, assign severity based on the worst-affected area and note any variation in the comments. Only consider re-segmenting where the ride quality changes abruptly and a single rating would misrepresent the condition.

3.3 Patches

Overview

Description

Patches refers to discrete reinstated sections of pavement surface that address prior surface or structural failures or follow service trenching. A successful patch restores waterproofing and a reasonable surface profile and is typically an intermediate treatment ahead of future resurfacing or rehabilitation.

This category excludes:

- Large resurfaced areas that span most or all of a lane width or are part of planned capital works. Treat these as resurfacing or renewal, not patching.
- Failed patches showing cracking, distortion or differential settlement. Record these under Local Surface Defects. If the basecourse is exposed, it must be recorded as a pothole under Section 3.4.

Typical Forms

- Expedient patches: Small, irregular shapes placed rapidly to restore function.
- Repair patches: More regular, straight-sided shapes with proper dig-out and reinstatement, applied as intermediate treatments.
- Utility reinstatement patches: Trench or pit reinstatements after service works.

Possible Causes

- Correction of isolated surface or structural pavement failures.
- Reinstatements following utility excavations or trenching.
- Emergency or short-term repairs following adverse weather or asset damage.
- Substandard construction practices or inadequate compaction.


Expedient Patch

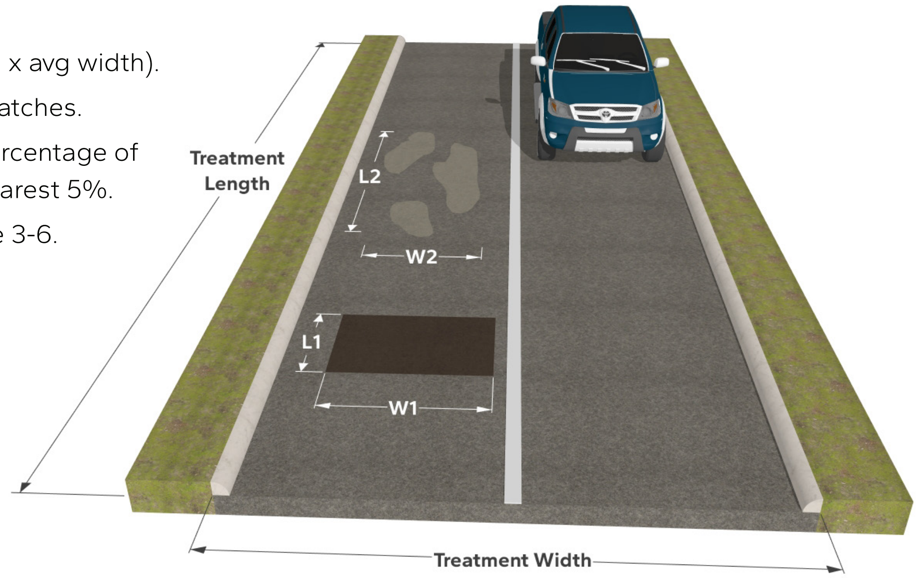

Repair Patch

Method of Measurement

What to measure: the percentage of treatment area affected by patches.

Procedure:

1. Determine treatment area (length x avg width).
2. Determine the area affected by patches.
3. Express the area affected as a percentage of the total treatment area to the nearest 5%.
4. Assign a rating according to Table 3-6.



Rating

***Table 3-6:** Patching Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	0% < Area Affected ≤ 5%
3	5% < Area Affected ≤ 10%
4	10% < Area Affected ≤ 20%
5	Area Affected > 20%

Additional Notes

- Record only successful patches here. Treat any failed patches under Local Surface Defects.
- If patch density is very high and concentrated in one zone, consider whether re-segmentation of the treatment length would provide a fairer representation of condition.

3.4 Potholes

Overview

Description

Potholes are circular or irregular holes in the pavement surface caused by the loss of surfacing material under traffic. They typically form when water enters through cracks or poorly drained shoulders, weakens the pavement, and is then pressurised under wheel loads, dislodging material and creating a void. Ravelling or stripping can expose underlying layers and accelerate pothole development. Untreated defects such as extensive cracking, failed patches, or rutting often precede potholes.

Typical Characteristics

- Circular or irregular plan shape with a distinct edge.
- Below surrounding surface level, into base material.
- May contain loose aggregate, water, or debris.

Possible Causes

- Inadequate drainage or edge break allowing water ingress.
- Low pavement strength or moisture-susceptible base/subgrade.
- Poor compaction or construction defects.
- Delayed maintenance of cracks, failed patches or rutting.
- Progression of surfacing defects that expose the basecourse such as ravelling or cracking at joints.

Circular Pothole

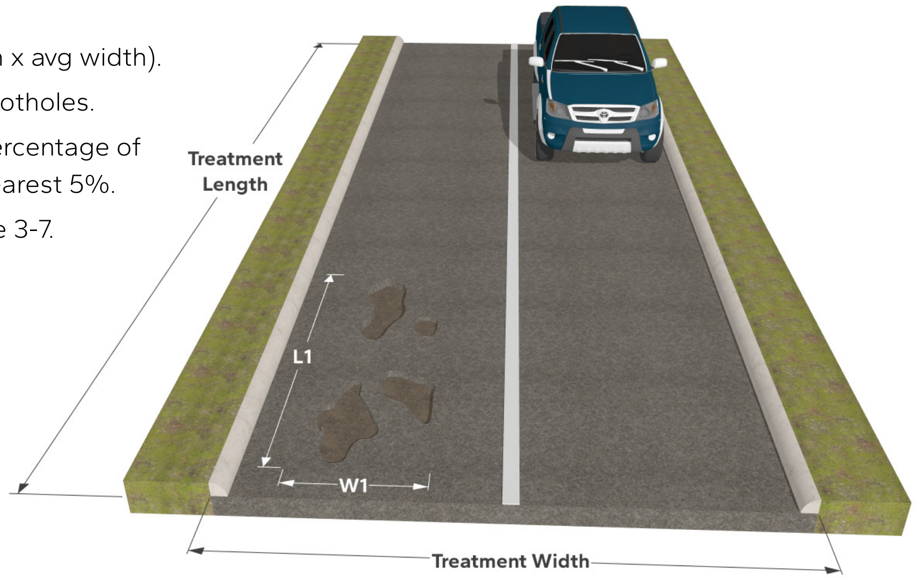
Irregular Shaped Pothole

Method of Measurement

What to measure: the percentage of treatment area affected by potholes.

Procedure:

1. Determine treatment area (length x avg width).
2. Determine the area affected by potholes.
3. Express the area affected as a percentage of the total treatment area to the nearest 5%.
4. Assign a rating according to Table 3-7.



Rating

Table 3-7: Potholes Rating

Rating	Description
0	Not Applicable
1	No Area Affected
2	0% < Area Affected ≤ 5%
3	5% < Area Affected ≤ 10%
4	10% < Area Affected ≤ 20%
5	Area Affected > 20%

Additional Notes

- Differentiate potholes from delamination. A pothole is loss of surfacing material with broken edges and a bowl-shaped depression. Delamination is loss of bond where an intact layer has detached, often shallow with sharp plate edges. Record delamination under Surface Deficiencies, not as potholes.
- Where pothole density is high in a short segment, consider whether re-segmenting the treatment length would provide a fairer representation.
- If potholes are water-filled, estimate plan area from the rim and edge definition.

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3.5 Rutting

Overview

Description

Rutting is longitudinal deformation in the wheel path of a pavement. It results from densification of pavement layers (including the subgrade) or plastic shear deformation of the upper layers. These depressions are typically at least four times longer than they are wide and can occasionally feature bulging of the surface adjacent to the rut. Rutting may occur in one or both wheel paths of a lane but is most often observed in the outer wheel path nearest the pavement edge.

Possible Causes

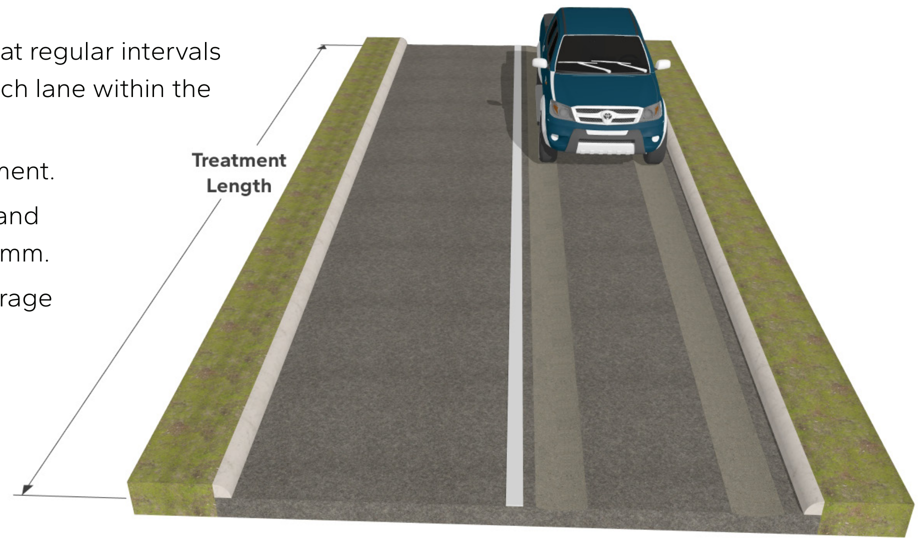
- Ingress of water through the surfacing or road edges into base, subbase and subgrade.
- Structural overloading and/or inadequate pavement thickness.
- Inadequate quality of pavement materials.
- Poor construction control, particularly compaction and drainage.
- Pavement at terminal condition.
- Channelised heavy vehicle loading or repeated wheel path trafficking.

Method of Measurement

What to measure: the rut depth along the treatment length. Extent is implicitly addressed through the regular interval measurement.

Procedure:

1. Identify and measure rut depths at regular intervals along the outer wheel path of each lane within the treatment length.
2. Record each rut depth measurement.
3. Calculate the average rut depth and record the value to the nearest 5mm.
4. Assign a rating based on the average rut depth according to Table 3-8.



Manual field-measured approaches are becoming less common. Remote or automated capture options typically include:

- Inertial laser profilers with transverse lasers: Vehicle-mounted profilers use accelerometers and laser height sensors to derive pavement profiles at traffic speed. When fitted with a transverse laser array, rut depth is computed from the cross-section.
- Mobile LiDAR/3D point cloud: 3D point clouds can be processed to extract transverse profiles and detect rutting. Published case studies report automated detection of ruts ≥ 25 mm with close agreement to profiler measurements.
- Video/computer vision only: Useful for screening and mapping but cannot reliably measure rut depth and should only inform qualitative cues unless supported by laser or LiDAR data.

Guidance on rut capture methods and accuracy requirements is based on the LG TRRIP Data Collection Technologies Report (Bartlett & De Silva, 2025).

Rating

Table 3-8: Rutting Rating

Rating	Description
0	Not Applicable
1	No Area Affected: Avg Depth < 5 mm
2	Low: 5 mm ≤ Avg Depth < 10 mm
3	Moderate: 10 mm ≤ Avg Depth < 20 mm
4	High: 20 mm ≤ Avg Depth < 30 mm
5	Extreme: Avg Depth ≥ 30 mm


Low Rutting


Moderate Rutting


High Rutting


Extreme Rutting

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Additional Notes

- Use a straightedge and wedge/depth gauge for ground-truth measurement where safe access is possible.
- Inertial laser profilers or LiDAR systems may be used to capture transverse profiles at traffic speed. Record the automated rut value in the comments to support the rating, noting the equipment and survey speed.
- Verify current calibration certificates for automated systems and ensure surveys are undertaken in dry conditions at steady speed. Where practical, confirm a sample of locations using manual spot checks as the reference.
- Maintain consistent spacing for rut measurements or sampling along the treatment length (e.g. every 10 m), unless agency requirements specify otherwise.
- If rut depth varies markedly within a segment, assign severity based on the worst-affected area and note the variation in comments. Only consider re-segmenting where the change is abrupt and a single rating would misrepresent ride quality.
- Differentiate rutting from localised shoving or corrugation. Short-wave, confined deformation should be rated under Local Surface Defects.

An example calculation of determining rutting rating from average depths is provided in Table 3-9.

Table 3-9: Example Rutting Calculation

Lane 1 Distance (m)	Rut Depth (mm)	Lane 2 Distance (m)	Rut Depth (mm)
0	19	0	20
10	8	10	12
20	11	20	9
30	12	30	16
40	17	40	14
Sum of rut depths		138 mm	
Number of measurements		10	
Average rut depth (nearest 5mm)		15 mm	
Rating		3	

3.6 Structural Cracking

Overview

Description

Structural cracking is traffic-load related distress that indicates loss of pavement structural capacity. It most often appears in the wheelpaths as longitudinal cracks that progress to interconnected "crocodile" patterns. Structural cracks allow water ingress, accelerate base failure, and typically require rehabilitation rather than surface-only treatments.

Where non-structural cracking shows pumping of fines or visible moisture movement under traffic, record it as structural cracking. Typical Forms:

- Early longitudinal fatigue in wheelpaths: single or paired longitudinal lines within the wheelpaths, often the first visible phase of load-related distress.
- Parallel longitudinal bands: two or more near-parallel cracks in the wheelpaths with short lateral connectors beginning to form polygons.
- Crocodile fatigue: dense, interconnected polygons, usually confined to wheelpaths; typical cell size less than 150 mm, up to 300 mm.
- Cracking coincident with rutting or shear: fatigue cracks accompanied by measurable rutting or adjacent bulging.
- Moisture or pumping indicators: wetness visible in the crack under load, ejected fines or paste deposits adjacent to the crack after traffic, dark staining or slurry trails.


Crocodile Fatigue Cracking


Parallel Longitudinal Cracking


Early Longitudinal Fatigue Cracking


Unstable Cracking with Pumping

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Possible Causes

Table 3-10: *Typical Causes of Structural Cracking*

Crack Type	Load-related fatigue / inadequate pavement strength	Weak or moisture-susceptible subgrade	Differential settlement / loss of support	Deep-seated reflection of joints/cracks	Shear forces (braking/turning)
Alligator / Fatigue	✓	✓			
Longitudinal (wheelpath)	✓	✓	✓		✓
Transverse (structural)	✓	✓		✓	
Slippage (shear)					✓
Reflection (structural)				✓	
Settlement / Subsidence		✓	✓		

Structural cracking indicates loss of structural capacity within the pavement or subgrade. It often originates from repeated loading, inadequate pavement thickness, moisture-related weakening of support layers, or differential movement. Structural cracking requires investigation and cannot be treated through surfacing alone.

Method of Measurement

Structural cracking is assessed in terms of both severity (crack width) and extent (area affected).

Severity

What to measure: average crack width in millimetres across the treatment length.

Procedure:

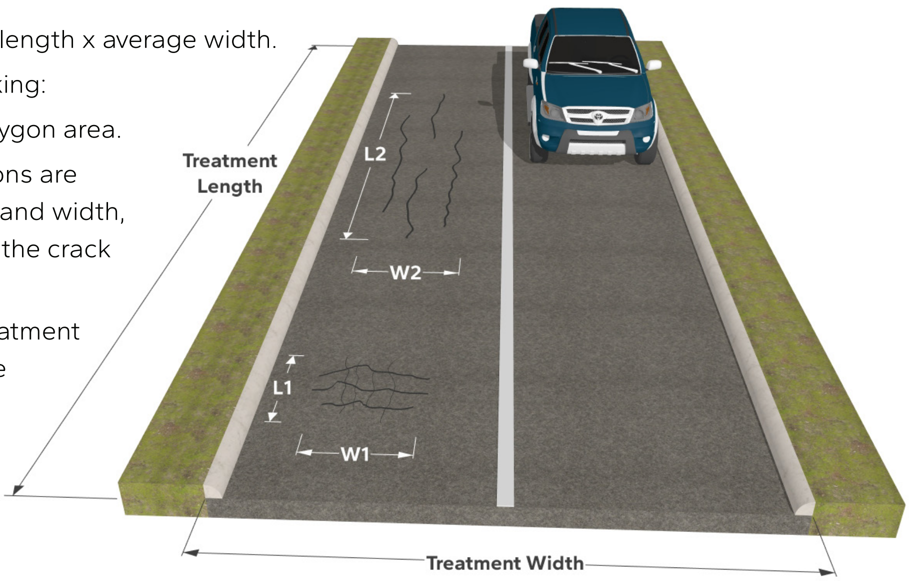
1. Select representative locations across the treatment length.
2. Measure crack width at regular intervals.
   - Manual: use crack gauge or ruler periodically for QA
   - Video: use calibrated imagery or on-screen scale
   - Automated: use algorithm output of physical width in millimetres.
3. Compute the arithmetic mean of measured widths for the treatment length and assign a rating according to Table 3-11.

Extent

What to measure: percent of treatment area affected by structural cracking.

Procedure:

1. Determine the treatment area as length x average width.
2. Measure areas of structural cracking:
   - Polygonal cracking: trace polygon area.
   - Linear cracking where polygons are impractical: apply a 0.50 m band width, taken as 0.25 m each side of the crack line.
3. Sum affected areas, divide by treatment area and express as a percentage of the total treatment area to the nearest 5%.
4. Assign a rating according to Table 3-12.



Rating

Severity

Table 3-11: *Structural Cracking Severity Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	Low: Avg Width < 2 mm
3	Moderate: 2 mm ≤ Avg Width < 4 mm
4	High: 4 mm ≤ Avg Width < 6 mm
5	Extreme: Avg Width ≥ 6 mm

Extent

Table 3-12: *Structural Cracking Extent Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	0% < Area Affected ≤ 5%
3	5% < Area Affected ≤ 10%
4	10% < Area Affected ≤ 20%
5	Area Affected > 20%

Additional Notes

- Where crack sealing is encountered, the following should be applied:

  Preparatory sealing prior to planned resurfacing: record severity 5 and extent as measured.

  Routine maintenance sealing: record severity 2 and extent as measured.

  If sealed cracks are still open or pumping, rate by measured width.

  If intent of crack sealing is unknown, record severity as 5.

  Record the crack seal intent metadata as Prep, Routine or Unknown for each treatment length to support the decision rules above.

3.7 Non-Structural Cracking

Overview

Description

Non-structural cracking is environmental or construction-related distress that is not driven by traffic loading. It commonly results from temperature and moisture changes, material shrinkage, reflection from underlying joints, or minor settlement. While non-structural cracks may not immediately reduce load capacity, they compromise waterproofing and can progress to structural failure if left untreated.

If any non-structural cracking exhibits pumping of fines or visible moisture movement under traffic, record it as Structural Cracking for this assessment.

Typical Forms

- Block cracking: Interconnected cracks forming a series of blocks approximately rectangular in shape. Typically distributed over a large area of pavement.
- Longitudinal cracking: Cracks running longitudinally along the pavement either singly or as a series of parallel cracks.
- Transverse cracking: Unconnected cracks running across the pavement.
- Diagonal cracking: Unconnected cracks running diagonally across the pavement.
- Meandering cracking: Unconnected irregular cracks, varying in line and direction; which usually occurs singly.
- Crescent cracking: Crescent, or half-moon-shaped, cracks often occurring in closely spaced parallel groups and commonly associated with turning vehicles and poor bond between surface and underlying pavement.


Block Cracking


Longitudinal Cracking


Traverse Cracking


Diagonal Cracking

Meandering Cracking

Crescent Cracking

Possible Causes

***Table 3-13:** Typical Causes of Non-Structural Cracking*

Crack Type	Reflection of underlying crack / joint	Poor construction	Shrinkage in basecourse	Poor bond between layers	Wearing course thickness / unsuitable mix	Braking / turning shear	Tree roots
Block	✓		✓				
Longitudinal	✓	✓					
Transverse	✓		✓				✓
Diagonal	✓	✓	✓				✓
Meandering	✓						✓
Crescent		✓		✓	✓	✓	

Method of Measurement

Non-structural cracking is assessed in terms of both severity (crack width) and extent (area affected).

Severity

What to measure: average crack width in millimetres across the treatment length.

Procedure:

1. Select representative locations across the treatment length.
2. Measure crack width at regular intervals.
   - Manual: use crack gauge or ruler periodically for QA
   - Video: use calibrated imagery or on-screen scale
   - Automated: use algorithm output of physical width in millimetres.
3. Compute the arithmetic mean of measured widths for the treatment length and assign a rating according to Table 3-14.

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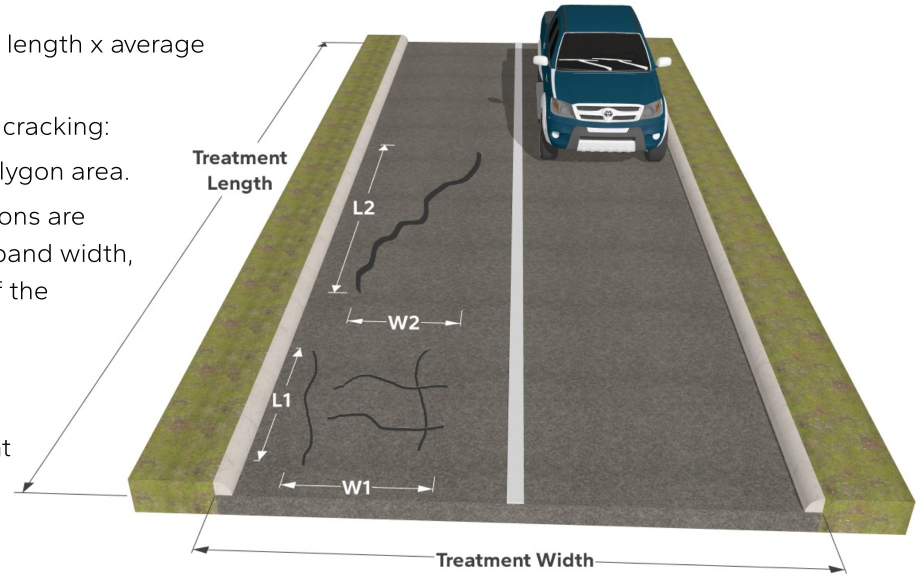
Extent

What to measure: percent of treatment area affected by non-structural cracking.

Procedure:

1. Determine the treatment area as length x average width.
2. Measure areas of non-structural cracking:
   - Polygonal cracking: trace polygon area.
   - Linear cracking where polygons are impractical: apply a 0.50 m band width, taken as 0.25 m each side of the crack line.
3. Sum affected areas, divide by treatment area and express as a percentage of the total treatment area to the nearest 5%.
4. Assign a rating according to Table 3-15.



Rating

Severity

***Table 3-14:** Non-Structural Cracking Severity Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	Low: Avg Width < 2 mm
3	Moderate: 2 mm ≤ Avg Width < 4 mm
4	High: 4 mm ≤ Avg Width < 6 mm
5	Extreme: Avg Width ≥ 6 mm

Extent

***Table 3-15:** Non-Structural Cracking Extent Rating*

Rating	Description
0	Not Applicable
1	No Area Affected
2	0% < Area Affected ≤ 10%
3	10% < Area Affected ≤ 20%
4	20% < Area Affected ≤ 30%
5	Area Affected > 30%

Additional Notes

- Cracking confined to failed patches or pothole perimeters is to be excluded (Refer to Section 3.1 for localised cracking).
- Where crack sealing is encountered, the procedures as outlined in Section 3.6: Additional Notes are applicable.

3.8 Surface Deficiencies

Overview

Description

Surface deficiencies are changes to the surfacing layer that reduce texture, waterproofing, or skid resistance. They are assessed on asphalt and sprayed seal surfaces.

Typical Forms

Table 3 16 has descriptions and possible causes of surface deficiencies.

Table 3-16: *Types of Surface Deficiencies*

Defect Type	Description	Possible Causes
Ravelling	Progressive surface disintegration with loss of binder and aggregate.	• Binder oxidation / hardening • Damage by fuel / chemicals • Poor or unsuitable mix design • Inadequate compaction, cold or wet construction
Stripping	Loss of aggregate on the surface (spray seal) or within the layer (asphalt).	• Low binder application rate • Poor binder to stone adhesion (dirty, dusty or wet aggregate) • Inadequate compaction, cold or wet construction • Moisture ingress via excessive voids or cracks
Flushing / Bleeding	Excess binder at the surface, low texture and potential tyre pick-up, often in wheelpaths; reduced skid resistance.	• Flushing in underlying layer (previous surfacing) • Excess rate of binder or prime application • Residue volatiles within the underlying prime • Aggregate punching into soft support • Incorrect selection of asphalt type
Polishing	Smoothing/rounding of aggregate in trafficked areas, reducing microtexture and skid resistance.	• Traffic abrasion on polish-susceptible aggregate • High traffic volumes and turning/braking shear • Marginal aggregate selection
Delamination	Loss of a discrete piece of the wearing course with a clear boundary to the layer below.	• Inadequate sweeping or priming/tack before overlay • Weak or loose layer under a seal • Water ingress through cracks breaking the bond • Fragments dislodged from block / crocodile cracking • Adhesion of binder to tyres • Inadequate asphalt thickness

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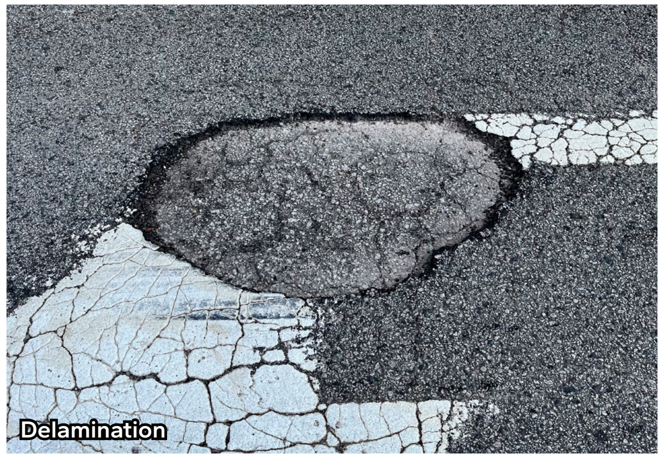

Method of Measurement

What to measure: percent of treatment area affected by all surface deficiencies combined.

Procedure:

1. Determine treatment area (length x avg width).
2. Determine the areas affected:
   - Field or video capture: trace polygons for each defect area.
   - If only dimensions are recorded, compute area as length × width of each defect.
3. Merge overlapping polygons of different deficiency types so they are not double counted.
4. Express the total area affected as a percentage of the total treatment area to the nearest 5%.
5. Assign a rating according to Table 3-17.

Exclusions

- Do not count minor ravelling where only fines loss is observed and the aggregate matrix remains intact with uniform texture.
- Do not count minor flushing where binder has only just risen and aggregate is still clearly visible with adequate macrotexture.

Rating

Table 3-17: Surface Deficiency Rating

Rating	Description
0	Not Applicable
1	No area affected
2	0% < Area Affected ≤ 10%
3	10% < Area Affected ≤ 20%
4	20% < Area Affected ≤ 30%
5	Area Affected > 30%

Additional Notes

- Record surfacing type (asphalt or sprayed seal) in metadata.
- Do not double-count areas recorded as potholes. If material loss forms a hole with depth and broken edges, record under Potholes; if loss is a thin layer with a clear bond line, record under Delamination here.
- Where deficiency coverage is very patchy, consider whether re-segmenting would provide a more homogeneous assessment.

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3.9 Edge Break

Overview

Description

Edge break is the lateral loss of sealed surface at the pavement edge, typically adjacent to an unsealed shoulder. It commonly occurs where the unsealed shoulder surface sits below the level of the adjacent seal, so the seal–shoulder interface is directly trafficked, causing abrasion and fretting of the pavement edge. Edge break may be local or continuous and is frequently observed on tight curves or where the edge is vulnerable to tyre wear and attrition.

Do not confuse edge break with edge drop off. Edge break is a horizontal loss of seal, whereas edge drop off is a vertical height difference between the seal and the shoulder (refer Section 3.10). Edge break is most relevant on roads without kerbs. Where continuous kerbing exists, this defect is generally not applicable.

Possible Causes

- Inadequate seal width or horizontal alignment that forces vehicles to traffic near the edge.
- Insufficient edge support or omission of a shoulder resheet following an overlay.
- Erosion of the shoulder by wind or water that focuses flow at the seal edge.
- Vegetation growth at the seal edge that disrupts the bond and promotes fretting.
- Concentrated traffic loading at the edge in narrow lanes or on curves or through vehicles traversing off the seal.
- Weak seal coat or loss of adhesion at the edge.
- Lack of routine shoulder maintenance.

Method of Measurement

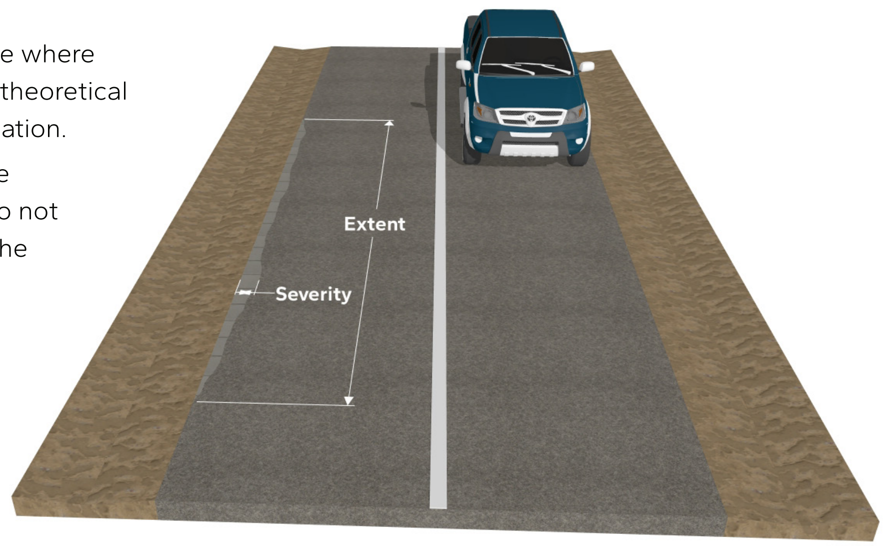
Edge break is assessed in terms of both severity (width) and extent (length affected). Both sides of the carriageway are to be considered.

Severity

What to measure: average edge break width (mm) occurring in the treatment length.

Procedure:

1. At regular intervals record each edge where break exists by measuring from the theoretical seal line to the most extreme indentation.
2. Calculate the arithmetic mean of the measured widths for both edges. Do not include segments with no break in the averaging set.
3. Assign a rating according to Table 3-18.



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Extent

What to measure: percent of edge length affected by edge break greater than 20 mm.

Procedure:

1. Measure the cumulative length along the left edge with edge break > 20 mm.
2. Measure the cumulative length along the right edge with edge break > 20 mm.
3. Express the total length affected as a percentage of the total treatment length to the nearest 5%.
4. Assign a rating according to Table 3-19.

If one side is kerbed or otherwise inapplicable, record that side as Not Applicable and base the percentage calculation on the applicable edge only, noting this in metadata.

Rating

Severity

Table 3-18: *Edge Break Severity Rating*

Rating	Description
0	Not Applicable
1	No Length Affected: Avg Width < 20 mm
2	Low: 20 mm ≤ Avg Width < 75 mm
3	Moderate: 75 mm ≤ Avg Width < 150 mm
4	High: 150 mm ≤ Avg Width < 250 mm
5	Extreme: Avg Width ≥ 250 mm


Low Edge Break


Moderate Edge Break


High Edge Break


Extreme Edge Break

Extent

Table 3-19: *Edge Break Extent Rating*

Rating	Description
0	Not Applicable
1	No Length Affected
2	0% < Length Affected ≤ 5%
3	5% < Length Affected ≤ 10%
4	10% < Length Affected ≤ 20%
5	Length Affected > 20%

Additional Notes

- Where edge drop off co-exists, rate both edge break and edge drop off separately.
- On kerbed sections, record edge break as "Not Applicable" and document the presence of kerb in metadata.

3.10 Edge Drop

Overview

Description

Edge drop off is the vertical height difference between the top of the sealed surface and the adjacent unsealed shoulder. It occurs where the shoulder sits lower than the seal, creating a lip at the seal–shoulder interface. This can degrade ride quality and create a safety hazard, particularly for motorcycles and when vehicles attempt recovery from the shoulder.

Do not confuse edge drop off (vertical step) with edge break (horizontal loss of seal at the edge, see Section 3.9). Edge drop off is most relevant on roads without continuous kerbs.

Possible Causes

- Resurfacing of the seal without shoulder resheeting, increasing the seal height above the shoulder.
- Shoulder erosion by wind, water or traffic.
- Inadequate shoulder material quality or compaction.
- Heavy traffic loading close to the edge on narrow pavements and curves.
- Lack of routine shoulder maintenance and reshaping.

Method of Measurement

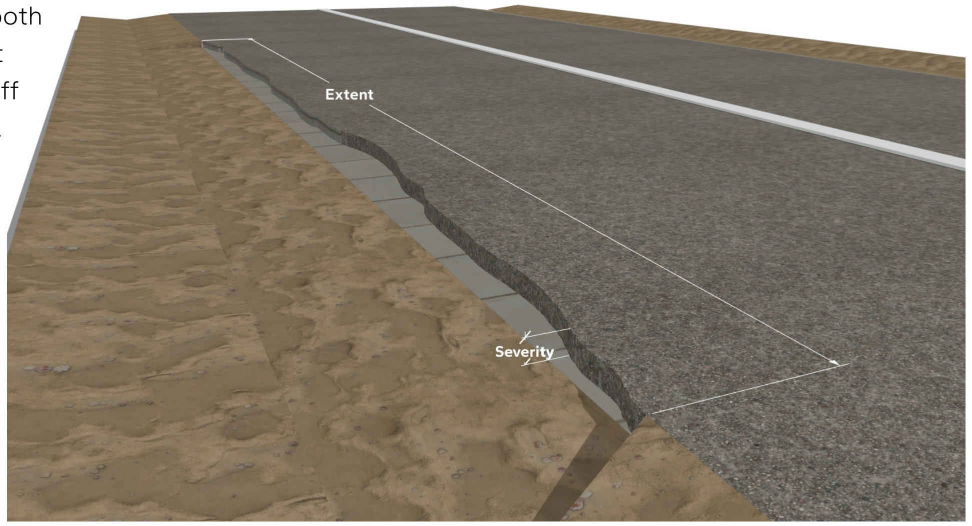
Edge drop off is assessed by severity (average height) and extent (percent of edge length affected). Measure both sides of the carriageway where applicable.

Severity

What to measure: average edge drop off height (mm) over the treatment length.

Procedure:

1. At regular intervals measure the vertical distance from the sealed surface to the shoulder surface at the edge.
2. Compile measurements for both edges where present. Do not include locations with drop off < 15 mm in the averaging set.
3. Calculate the arithmetic mean of the measured heights.
4. Assign a rating using Table 3-20.



Road Condition Assessment Manual

Sealed Roads

Extent

What to measure: percent of edge length affected by edge drop greater than 15 mm.

Procedure:

1. Measure the cumulative length along the left edge with edge drop > 15 mm.
2. Measure the cumulative length along the right edge with edge drop > 15 mm.
3. Express the total length affected as a percentage of the total treatment length to the nearest 5%.
4. Assign a rating using Table 3-21.

If one side is kerbed or otherwise inapplicable, record that side as Not Applicable and base the percentage calculation on the applicable edge only, noting this in metadata.

Rating

Severity

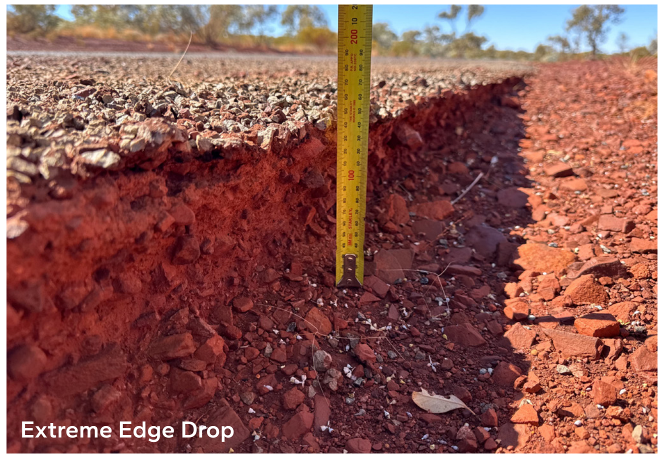
Table 3-20: *Edge Drop Severity Rating*

Rating	Description
0	Not Applicable
1	No Length Affected: Avg Drop < 15 mm
2	Low: 15 mm ≤ Avg Drop < 30 mm
3	Moderate: 30 mm ≤ Avg Drop < 50 mm
4	High: 50 mm ≤ Avg Drop < 75 mm
5	Extreme: Avg Drop ≥ 75 mm


Low Edge Drop


Moderate Edge Drop


High Edge Drop


Extreme Edge Drop

Road Condition Assessment Manual

Sealed Roads

Extent

Table 3-21: Edge Drop Extent Rating

Rating	Description
0	Not Applicable
1	No Length Affected
2	0% < Length Affected ≤ 5%
3	5% < Length Affected ≤ 10%
4	10% < Length Affected ≤ 20%
5	Length Affected > 20%

Additional Notes

- Rate edge break and edge drop off separately where both occur at the same locations.
- On kerbed sections, record edge drop off as "Not Applicable" and note the presence of kerb in metadata.

3.11 Kerb Defects

Overview

Description

Kerb defects are faults in the constructed kerb that reduce its ability to protect the pavement edge, collect and convey stormwater, delineate traffic, and provide a safe interface for road users. Typical defects include cracking, spalling, missing or dislodged units, horizontal or vertical misalignment, protrusions into the carriageway, and inadequate kerb height that allows water to bypass the channel.

Possible Causes

- Poor construction quality or insufficient reinforcement at joints.
- Inadequate provision for thermal movement and shrinkage.
- Vehicle strike, service authority works, or tree root action.
- Repeated asphalt overlays without channel adjustment leading to inadequate kerb height.
- Foundation settlement, erosion, or washout behind the kerb.

Method of Measurement

Kerb defects are rated by severity (functional impact) and extent (percent of kerb length affected). Assess both sides of the carriageway where kerbs are present.

Severity

What to assess: functional impact of the kerb on drainage, delineation, and user safety, considering both physical condition and height adequacy for drainage and containment.

Procedure:

1. Traverse the treatment length and assess the kerb's ability to perform its intended functions.
2. Consider defect types such as cracking, spalling, missing units, misalignment, protrusions, and inadequate kerb height relative to context and design intent. If conditions vary, base the severity on the predominate condition. Where different defect types coexist, take the worse (higher) severity.
3. Assign a single severity rating for the treatment length using Table 3-22.

Extent

What to measure: percent of kerb length within the treatment length where defects impact the kerb function.

Procedure:

1. Measure the cumulative length of defective kerbing on both sides.
2. Express the total defective length as a percentage of the total kerb length (both sides) to the nearest 5%.
3. Assign a rating using Table 3-23.

Rating

Severity

Table 3-22: Kerb Defect Severity Rating

Rating	Description
0	Not Applicable
1	Adequate – no or minimal impact on function.
2	Slight impact on function – minor cracking, small chips
3	Moderate impact on function – noticeable misalignment, cracking or settlement
4	High impact on function – sections missing or displaced
5	Severe impact on function – long sections missing or failed

Slight Kerb Defects

Moderate Kerb Defects

High Kerb Defects

Extreme Kerb Defects

Extent

Table 3-23: Kerb Defects Extent Rating

Rating	Description
0	Not Applicable
1	No length affected
2	0% < Length Affected ≤ 5%
3	5% < Length Affected ≤ 15%
4	15% < Length Affected ≤ 25%
5	Length Affected > 25%

Additional Notes

- Record kerb presence (both sides, one side, intermittent) in metadata. For intermittent kerb, base extent on the kerbed portions only and document the basis.
- Where resurfacing has raised the carriageway and reduced effective kerb height, reflect this in the severity rating even if the kerb structure is intact.
- Dropped kerbs at crossings or driveways that are built to purpose should not be marked inadequate solely due to reduced height. Rate them only if broken, settled, or misaligned in a way that compromises function.

3.12 Unsealed Shoulders

Overview

Description

Unsealed shoulders are the compacted, unsealed strips adjacent to the sealed carriageway that provide recovery space and help shed water from the pavement. Defects typically present as loss of shape or stability that affects safety or drainage, for example rutting, corrugations, excessive crossfall, softness or bogginess. Assess only the constructed shoulder width, not verge or table drains.

Do not double count: vertical steps at the seal edge are Edge Drop (see Section 3.10), loss of seal at the edge is Edge Break (see Section 3.9).

Possible Causes

- Infrequent grading/compaction; unsuitable material.
- Water tracking along the seal edge; poor drainage.
- Narrow pavements/curves concentrating traffic on the shoulder.
- Utility reinstatements or construction not restored to profile.
- Traffic traversing over or parking on the shoulder.

Method of Measurement

What to assess: the predominant functional condition of each shoulder across the treatment length (trafficability + drainage performance), considering rut depth, corrugation, crossfall adequacy, and material stability.

Procedure:

1. Traverse the treatment length and assess the shoulder's ability to perform its intended functions.
2. Consider defect types such as rutting / corrugation and crossfall adequacy.
3. Assign a single condition rating for the treatment length using Table 3-24.

Rating

Table 3-24: Unsealed Shoulder Condition Rating

Rating	Description
0	Not Applicable
1	Excellent – stable, compact, effective crossfall, no meaningful ruts/corrugations.
2	Good – shallow ruts or corrugations, crossfall generally effective
3	Fair – noticeable rutting / corrugations, sections with inadequate crossfall
4	Poor – deep ruts or corrugations, poor crossfall causing ponding/erosion
5	Very Poor – largely untrafficable/unsafe, very deep ruts, severe corrugations

Additional Notes

- If the condition between two sides differ by >1 rating, record the worst side and note "asymmetric" in metadata.
- If one side is sealed or absent, record "Not Applicable" and rate the applicable side only (note this in metadata).
- Record a simple extent qualifier in metadata: None / Isolated / Patchy / Continuous.
- If very recent grading clearly masks defects, record the current condition and note "recent grading" in metadata.

3.13 Table Drains

Overview

Description

Table drains are the longitudinal channels alongside the pavement that collect runoff from the carriageway and shoulders and convey it to outlets. A drain is considered inadequate when its capacity or continuity is reduced by siltation, vegetation, backfall, obstructions, or erosion that prevents effective flow and leads to ponding, scour, loss of shoulder stability or water tracking along the seal edge. Vegetation that slows high velocity water or stabilises erodible soils should be assessed before removal.

Do not confuse table drain condition with shoulder condition; assess only the constructed drain, not the verge or batters. On fully kerbed-and-pitted urban sections, table drains are generally Not Applicable.

Possible Causes

- Infrequent maintenance grading, desilting or vegetation control.
- Insufficient longitudinal fall or local backfall.
- Outlet or culvert blockage at driveways and cross-culverts.
- Poor tie-in at accesses or utility reinstatements.
- Sediment wash from adjacent land or unsealed shoulders.

Method of Measurement

What to assess: the typical operating condition of table drains on both sides of the treatment length, considering: shape and depth, continuity/fall to outlet, siltation/vegetation, scour/erosion, soft spots, and standing water.

Procedure:

1. Traverse both sides of the treatment length and measure defects as required.
2. Determine the typical condition for the length.
3. Assign a single condition rating for the treatment length using Table 3-25.

Rating

Table 3-25: *Table Drain Condition Rating*

Rating	Description
0	Not Applicable
1	Excellent – Adequate shape and depth; free-draining to outlet
2	Good – Minor local obstruction or build-up (< 30mm); generally free flow
3	Fair – Localised restriction; shallow siltation/vegetation or scour (30–50mm)
4	Poor – Significant restriction; obvious scour or siltation (50–80mm), soft patches
5	Very Poor – Major restriction; extensive scour (> 80mm) or heavy siltation/vegetation

Sealed Roads


Excellent Table Drains


Fair Table Drains


Very Poor Table Drains

Additional Notes

- If the condition between two sides differ by >1 rating, record the worst side and note “asymmetric” in metadata.
- If drains exist on one side only, rate that side and mark the other side N/A (0) in metadata.
- Culverts: record culvert presence and condition as metadata (inlet/outlet blockage: Clear / Partial / Blocked; structural condition if available).
- Aim to survey in a consistent season (ie pre-wet or post-wet) for comparability; note unusual recent weather in metadata.

Road Condition Assessment Manual

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4. Unsealed Roads

4.1 Unsealed Surface Defects

Overview

Description

This category covers surface-only issues on unsealed roads that affect ride, safety or dust but are not profile/crossfall problems. Typical defects include localised potholes, rutting, corrugations, excessive dust generation and poor/loose surface texture.

Overall shape/profile of unsealed roads is rated under Section 4.2: Unsealed Shape. Only surface defects are captured here.

Typical Forms

Table 4-1: *Typical Unsealed Surface Defects*

Defect Type	Description	Possible Causes
Potholes	Bowl-shaped hole caused by loss of surface material	• Incorrect preparation of the pavement • Structural deficiencies in the pavement material • Interaction between water and traffic • Poor construction control • Extended periods between maintenance grades
Rutting	Depressions along the wheel paths usually the length is at least 4 times longer than the width	• Inadequate pavement thickness • Structural deficiencies in the pavement material • Poor construction control • Trafficking of moisture sensitive pavements in wet conditions • Extended periods between maintenance grades
Corrugations	Closely spaced transverse ridges/trough, often in braking / acceleration zones and on climbs.	• Insufficient binding fines / low cohesion in wearing course material • Traffic-induced vibration • High speeds/traction changes • Inadequate grading/compaction • Extended periods between maintenance grades
Excess Dust	Visible plumes during traffic indicating loss of fines	• Dry and/ or windy conditions • Poor quality of wearing-course material, low plasticity and poor grading. • Lack of dust suppression. • Extended periods between maintenance grades
Poor Texture	Ravelled or segregated surface, loose aggregate	• Inadequate fines/plasticity of wearing course material • Poor mix/grading of wearing course material • Insufficient moisture/compaction.

Potholes

Rutting

Corrugations

Poor Texture

Method of Measurement

What to measure: the percentage of the treatment area affected by one or more unsealed surface defects (combined).

Procedure:

1. Determine treatment area (length x avg width).
2. Determine the areas affected:
   - Field or video capture: trace polygons for each defect area.
   - If only dimensions are recorded, compute area as length × width of each defect.
3. Merge overlapping polygons of different defect types so they are not double counted.
4. Express the total area affected as a percentage of the total treatment area to the nearest 5%.
5. Assign a rating according to Table 4-2.

Rating

Table 4-2: *Unsealed Surface Defects Rating*

Rating	Description
0	Not Applicable
1	No area affected
2	0% < Area Affected ≤ 10%
3	10% < Area Affected ≤ 20%
4	20% < Area Affected ≤ 40%
5	Area Affected > 40%

Additional Notes

- If there is a dominant defect type (Potholes / Corrugations / Dust / Rutting / Texture), record this in the metadata.
- Where a short segment contains hazardous concentrations (ie pothole clusters or severe corrugations), consider re-segmenting to isolate and rate that length separately.
- For dust, assess during normal operating speeds; consider only sections where a sustained plume is evident.
- For poor surface texture, exclude very minor loosening immediately after grading if the surface still presents adequate interlock.

Road Condition Assessment Manual

Unsealed Roads

4.2 Unsealed Shape

Overview

Description

Unsealed shape is the adequacy of the road's cross section and crown (and any superelevation on curves) to shed water off the running surface and provide for safe vehicle dynamics for traffic separation. Poor shape leads to ponding in wheel tracks, soft spots, rutting, corrugations and unsafe riding conditions. This item rates the functional shape, not surface defects or material depth (covered in Section 4.1 and 4.3 respectively).

Possible Causes

- Inadequate or infrequent grading / poor grader technique.
- High shoulders or retained windrows after maintenance.
- Continued cutting during maintenance grades leading to road depressed below plain level.
- Material loss or settlement in wheel tracks.
- Inappropriate or inconsistent camber/ superelevation on curves.

Method of Measurement

What to assess: the adequacy of the road shape to shed water across the treatment length. Rate the typical condition, influenced by the worst recurring locations.

Procedure:

1. Traverse the full treatment length focussing on:
   - Continuity and height of crown / crossfall across relative to the shoulder / drain
   - Evidence of ponding or water being trapped
   - Wheel-track ruts that hold water
   - Scouring / berms that block lateral flow
   - Excessive crossfall or inconsistent shape
2. Determine the typical condition for the length. Weight judgement by distance; short, isolated anomalies should not dominate the rating.
3. Assign a single condition rating for the treatment length using Table 4-3.

Rating

Table 4-3: Unsealed Shape Rating

Rating	Description
0	Not Applicable
1	Excellent – Adequate crossfall; crown ≥1m above drain; compact, minimal loose gravel.
2	Good – Adequate crossfall; crown 0.75–1.0m above adjacent drain.
3	Fair – Variable crossfall; slight drainage restriction; crown 0.5–0.75 m above drain.
4	Poor – Variable crossfall; slight drainage restriction; crown 0.25–0.5 m above drain or excessive crossfall or inconsistent shape affecting vehicle dynamics
5	Very Poor – Inadequate/excessive crossfall; poor material; crown 0.05–0.25m above drain. Severely inconsistent shape.

Excellent Unsealed Shape

Fair Unsealed Shape

Very Poor Unsealed Shape

Additional Notes

- Inspection after rain can help reveal ponding, but don't penalise short-lived puddles from isolated wheel impressions.
- Where there are no table drains, judge against the road's ability to discharge water safely to the roadside without pooling on the carriageway.
- Isolated locations with inadequate, excessive, or reversed crossfall, or where the drainage path is blocked shall be recorded in the metadata.

4.3 Depth of Base

Overview

Description

Depth of Base is the thickness of imported granular material above the natural subgrade on unsealed roads. Adequate depth is critical for all-weather access, resistance to rutting and corrugations, and to protect the subgrade from moisture. Where thickness is inadequate, the subgrade can break through in wheelpaths and rapid surface distress follows.

This defect applies only to gravel-surfaced unsealed roads (i.e. roads with an imported granular wearing course). For formed and unformed roads, where no imported gravel layer exists, Depth of Base is not applicable and shall be recorded as 0

Possible Causes

- Construction did not achieve the intended gravel thickness.
- Progressive loss of gravel due to traffic, grading, wind and water erosion.
- Contamination or dilution with fines reducing effective thickness.
- Local scouring at low points, culverts or tight curves.
- Increased heavy vehicle loading beyond design assumptions.

Method of Measurement

What to assess: the average granular base thickness within the treatment length, determined by measured or inferred indicators.

Procedure:

1. Traverse the full treatment length focussing on:
   - Height of formation
   - Presence of the subgrade or rock protrusions within the running lanes
   - Defects serving an indication of inadequate cover thickness over the subgrade
2. Determine the typical depth of base for the length. Weight judgement by distance; short, isolated anomalies should not dominate the rating.
3. Assign a single condition rating for the treatment length using Table 4-4.

Notes:

- Visual assessment is the primary method. Physical measurement may be used to complement visual observations.
- Physical measurement is typically by test pits or pavement dips, measuring from the surface to natural subgrade.
- Non-destructive options may be used where calibrated to physical depth:
  - GPR as the primary method for thickness profiling.
  - Seismic surface wave methods (USW/MASW/PSPA).
  - Deflection devices (LWD, FWD, TSD) do not measure thickness; they may assist only when a local correlation to pit-measured thickness has been established.
- Record the capture method and any calibration sites in the metadata.

Rating

Table 4-4: *Depth of Base Rating*

Rating	Description
0	Not Applicable
1	Very Thick - No protrusions (Indicative thickness ≥ 300mm)
2	Thick - Isolated minor protrusions (Indicative thickness 200-300mm)
3	Moderate - Scattered protrusions (Indicative thickness 100-200mm)
4	Thin - Frequent protrusions (Indicative thickness 50-100mm)
5	Very Thin - Significant or widespread protrusions (Indicative thickness < 50mm)

Very Thick Base

Moderate Base

Very Thin Base

Additional Notes

- Average thicknesses provided in Table 4 4 are indicative only. These numbers should be adjusted to align with local material properties and traffic.
- Ratings 1–5 apply only to gravel-surfaced roads. Formed and unformed roads shall be recorded as 0.
- Rate "5" where the subgrade is breaking through, even if some points exceed 50 mm.
- Do not double-count: distress from inadequate thickness should be captured separately under Unsealed Surface Defects and Unsealed Shape as applicable.

5. Paths

5.1 Overview

Footpath assets are rated with a single overall condition rating (1–5; 1 = very good, 5 = very poor). The rating reflects the worst defect affecting service. Sections can vary over short lengths; avoid overly small splits, use ≥ 20 m sections where practical and, where variability is high, rate the whole section at the worst applicable level.

- On-road footpaths: Paths running parallel to a road within the road reserve. Collect in the same direction as road data.
- Sectioning: A single footpath section runs between intersections. If condition or type changes within a block, split into smaller, homogeneous subsections of measured length.
- Adjacent verge paving: Where brick-paved verges adjoin concrete paths, rate the footpath only (verge paving is excluded from the footpath dataset).

5.2 Method of Measurement

- Assign one condition rating (1–5) per section based on the extent/severity of the worst defect that affects function.
- Where measurements are required, record to the nearest 5 mm for QA/consistency and apply the thresholds as stated below.

5.3 Rating

Bituminous Seal and Asphalt Footpaths

Condition rating of bituminous seal and asphalt footpaths are outlined in Table 5-1.

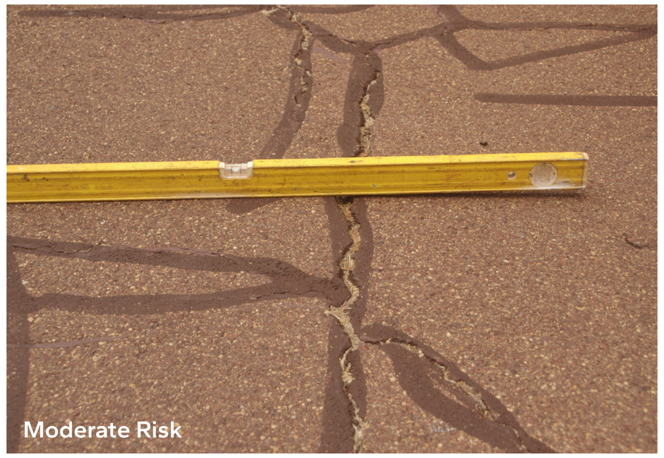
Paths

Table 5-1: Bituminous Seal and Asphalt Footpath Condition Rating

Condition Rating	Cracking / Deformation	Service structures level	Potholes / patches / edge	Public-injury risk
1	No cracks, no deformation	OK	No potholes / unsuccessful patches, no edge break	None
2	Slight cracking < 2 mm, slight deformation	< 5 mm	No potholes /unsuccessful patches, very slight edge break	Very low
3	Cracking 2–5 mm; minor deformation < 5 mm	5-10 mm	Isolated potholes / unsuccessful patches, slight edge break	Low
4	Cracking 5–10 mm, deformation 5–10 mm	10-15 mm	Small potholes/unsuccessful patches, moderate edge break	Medium
5	Cracking > 10 mm, deformation > 10 mm	> 15mm	Large potholes / unsuccessful patches, high level of broken edges	High


Very Low Risk


Low Risk


Moderate Risk


High Risk

Road Condition Assessment Manual

Paths

Slab Footpaths

Condition rating of slab footpaths are outlined in Table 5-2.

Table 5-2: Slab Footpath Condition Rating

Condition Rating	Slab condition	Joint spread	Displacement/ deformation	Service structures level	Public-injury risk
1	No broken/cracked slabs, uniform joints	-	< 5mm	OK	None
2	Slightly cracked slabs	< 10 mm	5-10 mm	< 5 mm	Very low
3	Cracked slabs	10-20 mm	10-15 mm	5-10 mm	Low
4	Badly cracked slabs	20-30 mm	15-20 mm	10-15 mm	Medium
5	Badly cracked/broken slabs	> 30 mm	> 20mm	> 15 mm	High


Very Low Risk


Low Risk


Moderate Risk


High Risk

In-situ Concrete Footpaths

Condition rating of in-situ concrete footpaths are outlined in Table 5-3.

***Table 5-3:** In-situ Concrete Footpath Condition Rating*

Condition Rating	Cracking / gaps	Displacement / faulting	Service structures level	Public-injury risk
1	No cracking, uniform gaps < 10 mm	-	OK	None
2	Slight cracking < 2 mm, uniform gaps 10–15 mm	< 5 mm	< 5 mm	Very low
3	Cracking present, non-uniform gaps 10–15 mm	5-10 mm	5-10 mm	Low
4	Cracking, broken/sinking sections, non-uniform gaps 15–20 mm	10-15 mm	10-15 mm	Medium
5	High level of cracking; broken/sinking sections, non-uniform gaps > 20 mm	> 15 mm	> 15 mm	High


Very Low Risk


Low Risk


Moderate Risk


High Risk

Brick and Interlocking Paved Footpaths

Condition rating of brick and interlocking paved footpaths are outlined in Table 5-4.

***Table 5-4:** Brick and Interlocking Paved Footpath Condition Rating*

Condition Rating	Paver condition / gaps	Displacement / deformation	Service structures level	Public-injury risk
1	No broken/cracked pavers, uniform gaps < 2 mm	-	OK	None
2	No broken/cracked pavers; uniform gaps < 5 mm	< 5 mm	< 5 mm	Very low
3	Edges chipped/cracked; uniform gaps < 5 mm	5-10 mm	5-10 mm	Low
4	Broken pavers; non-uniform gaps 5–10 mm	10-15 mm	10-15 mm	Medium
5	Broken pavers with sections missing, non-uniform gaps > 10 mm	> 15 mm	> 15 mm	High


Very Low Risk


Low Risk


Moderate Risk


High Risk

5.4 Additional Notes

- Section metadata: path type code, length, direction, location, and any adjacent verge-paving notes.
- Measurement convention: where applicable, round crack widths, displacement and level differences to the nearest 5 mm for QA, apply thresholds as written.

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Appendix A

Road Condition Assessment Rating Sheet

Appendix A: Road Condition Assessment Rating Sheet

Road Visual Condition Assessment Rating Sheet

ROAD NUMBER: ROAD NAME: DATE: SHEET OF

Treatment Length (*to be entered before conducting survey*)		Sealed Road																			Unsealed Road			Notes
Start (m)	End (m)	Local Surface Defects Extent	Pavement Undulations Degree	Pavement Undulations Extent	Patches Extent	Pothole Extent	Rutting Severity	Structural Cracking Severity	Structural Cracking Extent	Non Structural Cracking Severity	Non Structural Cracking Extent	Surface Deficiencies Extent	Edge break Severity	Edge break Extent	Edge drop off Severity	Edge drop off Extent	Kerb Severity	Kerb Extent	Unsealed Shoulders	Table Drains	Unsealed Surface Extent	Unsealed Shape	Depth of base	

Appendix B
Path Condition Assessment Rating Sheet

Appendix B: Path Condition Assessment Rating Sheet

Path Visual Condition Assessment Rating Sheet

Date:

Description		Path type (tick one type)		Rating (1 - 5)	Comment
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			
Path number		Bituminous seal & asphalt			
Path name		Slab			
Start (m)		In situ concrete			
End (m)		Brick paved & interlocking concrete			

Appendix C

Road Condition Indices

Appendix C: Road Condition Indices

Background

Road Condition Indices (RCIs) provide a consistent framework to evaluate, compare, and prioritise sealed and unsealed road assets. They support network-level decision-making, program development, and long-term financial planning by converting visual observations into standardised numerical indicators.

RCIs are based on the following principles:

- Common scale: All indices are normalised to a consistent condition scale (1–5), where higher values indicate progressively worse condition. A value of 0 applies where a defect is not applicable.
- Inputs and conversion: Indices are derived from defect ratings determined from the measured extent and severity/degree. Conversion tables and curves in this Appendix define how these defect ratings map to condition indices.
- Hierarchy sensitivity: Where justified, sealed-road curves reflect road hierarchy, with tighter thresholds for higher-order roads that carry greater speeds and volumes. A single curve is used where hierarchy has negligible influence.
- Data resolution: Applicable at defect site, treatment length, road section, or road length. Road-length results are length-weighted averages.
- Composite indices: Individual defect indices are combined to produce composite indices (SCI, PCI, DCI, and UCI) for sealed and unsealed roads. These composites support network screening and prioritisation rather than project-level design
- Alignment and validity: The method aligns with WALGA network condition practice and has been validated on WA local government datasets to ensure stability, repeatability, and compatibility with ThinkProject/RAMM workflows.

This Appendix builds upon the RCI framework originally developed for WALGA by (ARRB, 2016b) and documented in Version 1 of the Manual (WALGA, 2016). The methodology has been further refined for Version 2, including updated index curves, incorporation of an Unsealed Condition Index (UCI), and alignment with current WALGA defect assessment practices.

Composite Index Framework

Composite indices summarise related defects on the common 1–5 scale. Each composite is computed with the advanced maximum method, which emphasises the worst component so critical defects are not masked by averaging:

$$CI = MIN\left[5,\ MAX\,[All\ indices] + p \times \frac{\sum All\ indices - MAX\,[All\ indices]}{Number\ of\ Indices - 1}\right]$$

where:

- CI = composite index incorporating multiple defect indices
- p = influence factor (typically 0.1–0.3; use 0.1 by default)

Components marked 0 (Not Applicable) are excluded from the calculation. Round final values to one decimal place.

The influence factor p controls how much the other defect indices (besides the worst one) contribute to the composite index. A lower value places greater emphasis on the most severe defect, while a higher value allows secondary defects to influence the result more strongly. For Western Australian local roads, a value of p = 0.1 is recommended as it maintains sensitivity to the critical defect without overstating minor or isolated issues. Higher values (up to 0.3) may be appropriate only where agencies specifically want composite indices to reflect broader overall condition rather than dominant failure modes. Unless justified, p should remain at 0.1 for consistency across the network and alignment with prior WALGA practice.

Inputs to each component index are derived from defect ratings, which are determined from measured extent and, where relevant, severity. Class-specific thresholds apply where noted. Road-length results are produced by length-weighted averaging of treatment-length indices.

The composite indices used in this Manual are outlined in Table C-1.

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Table C-1: Composite Indices Overview

Composite Index	Network	Component Defects Included
SCI – Surface Condition Index	Sealed	Local Surface Defects, Patches, Potholes, Non-structural Cracking, Surface Deficiencies
PCI – Pavement Condition Index	Sealed	Structural Cracking, Rutting, Pavement Undulations
DCI – Drainage Condition Index	Sealed	Edge Break, Edge Drop, Kerb Defects, Unsealed Shoulders, Table Drains
UCI – Unsealed Condition Index	Unsealed	Unsealed Surface Defects, Unsealed Shape, Depth of Base

Figure C-1 shows the individual defects for each composite index.

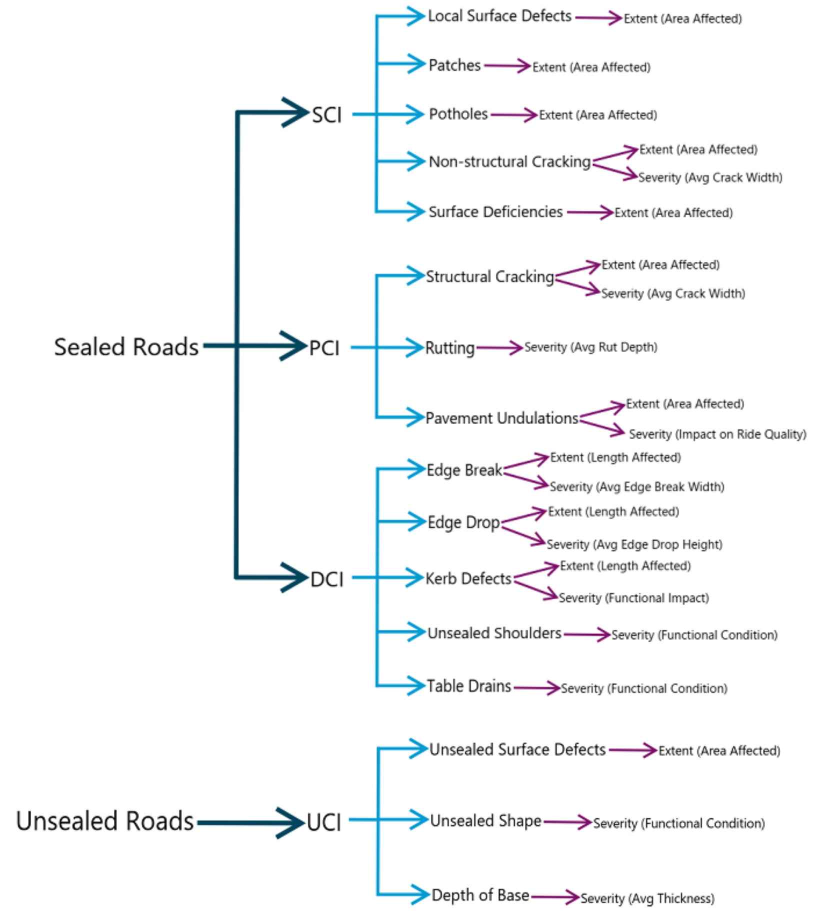

Figure C-1: Composite Index Formulation

Surface Condition Index

The Surface Condition Index (SCI) represents the functional condition of the sealed road surfacing. It captures visible surface distress that affects serviceability, appearance, skid resistance, moisture protection, and user experience. SCI does not measure structural capacity, that is handled under PCI. SCI is used for network-level screening, multi-year programming, and surfacing treatment selection.

Local Surface Defects

Local surface defects have a singular condition index:

- Extent (Area affected)

Table C-2 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-2.

Table C-2: *Local Surface Defects Condition Indices*

CI Band	Rating	Area Affected (%)	
		Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-5	0-2
2 ≤ CI < 3	Good	> 5-10	> 2-5
3 ≤ CI < 4	Fair	> 10-15	> 5-10
4 ≤ CI < 5	Poor	> 15-20	> 10-15
CI ≥ 5	Very Poor	> 20	> 15

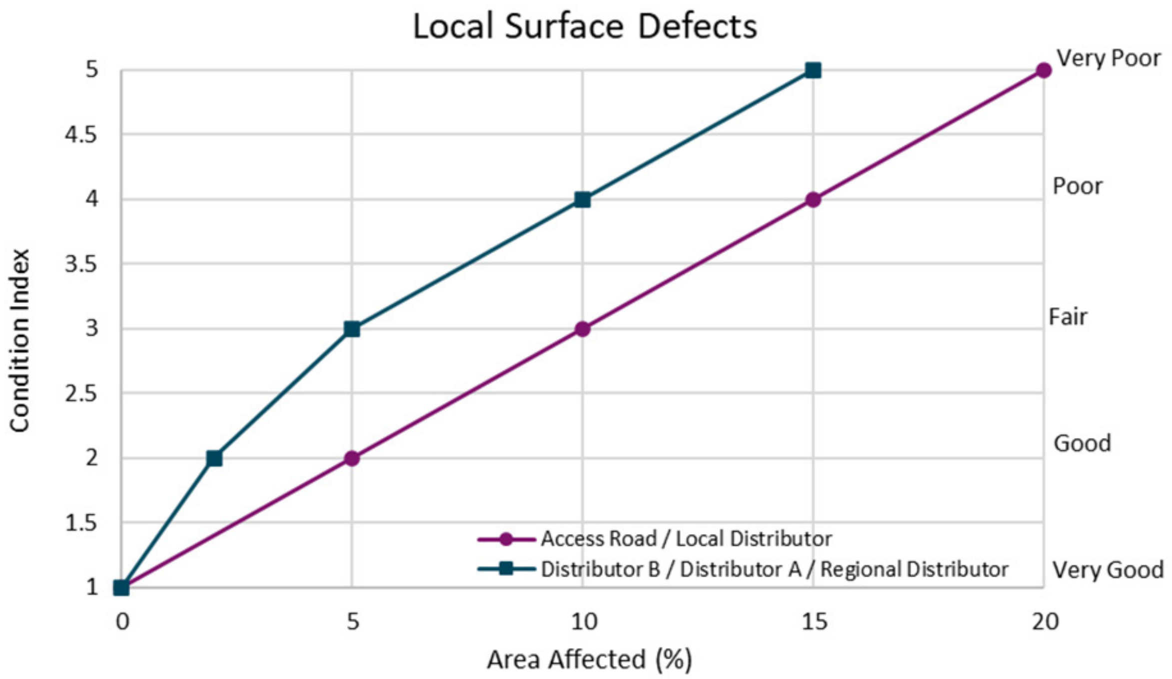

Figure C-2: Local Surface Defects Index Curves

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Patches

Patches have a singular condition index:

- Extent (Area affected)

Table C-3 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-3.

Table C-3: *Patches Condition Indices*

CI Band	Rating	Area Affected (%)	
		Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-5	0-2
2 ≤ CI < 3	Good	> 5-10	> 2-5
3 ≤ CI < 4	Fair	> 10-15	> 5-10
4 ≤ CI < 5	Poor	> 15-20	> 10-15
CI ≥ 5	Very Poor	> 20	> 15

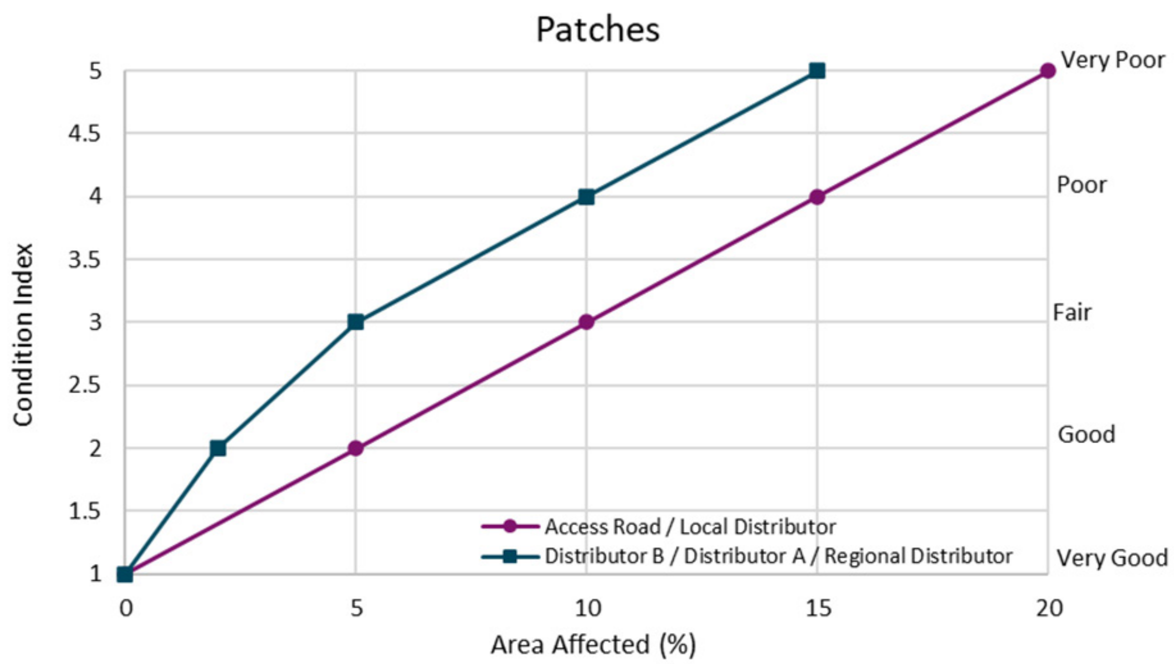

Figure C-3: Patches Index Curves

Potholes

Potholes have a singular condition index:

- Extent (Area affected)

Table C-4 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-4.

Table C-4: *Potholes Condition Indices*

CI Band	Rating	Area Affected (%)
		All Hierarchies
1 ≤ CI < 2	Very Good	0-2
2 ≤ CI < 3	Good	> 2-5
3 ≤ CI < 4	Fair	> 5-10
4 ≤ CI < 5	Poor	> 10-15
CI ≥ 5	Very Poor	> 15

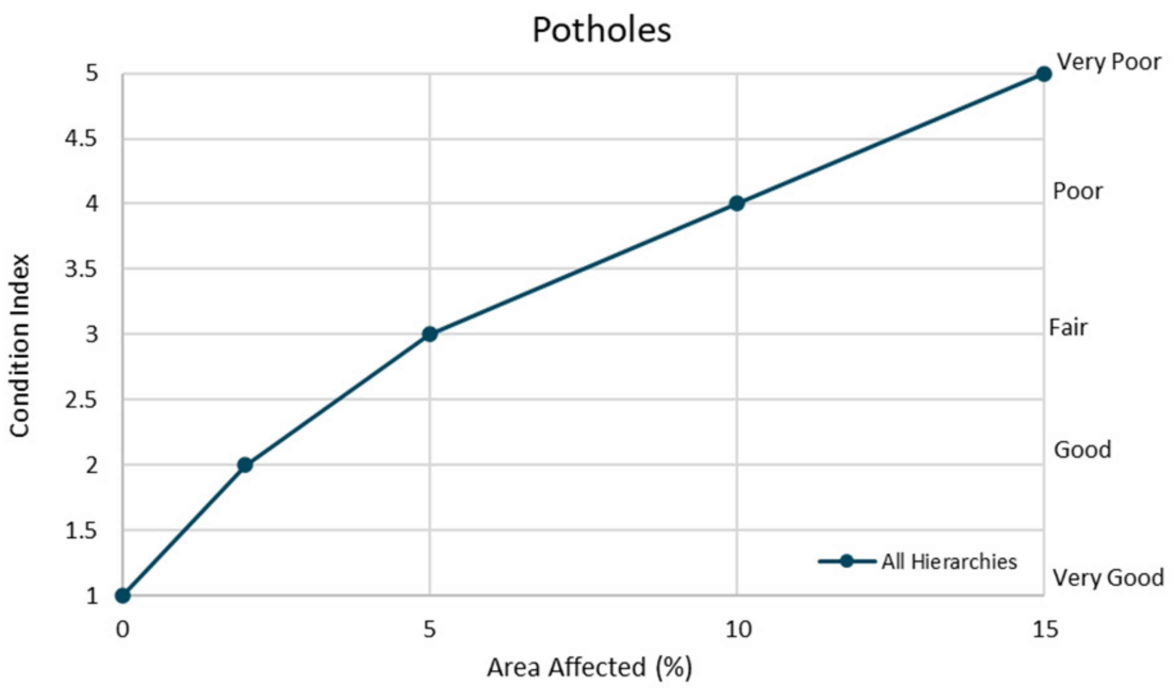

Figure C-4: Potholes Index Curves

Non-Structural Cracking

Non-structural cracking has two condition indices:

- Severity (Avg crack width)
- Extent (Area affected)

Table C-5 lists the severity and extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-5.

Table C-5: *Non-Structural Cracking Condition Indices*

CI Band	Rating	Avg Crack Width (mm)	Area Affected (%)	
		All Hierarchies	Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-1	0-12	0-8
2 ≤ CI < 3	Good	> 1-2	> 12-18	> 8-12
3 ≤ CI < 4	Fair	> 2-4	> 18-24	> 12-18
4 ≤ CI < 5	Poor	> 4-6	> 24-30	> 18-25
CI ≥ 5	Very Poor	> 6	> 30	> 25

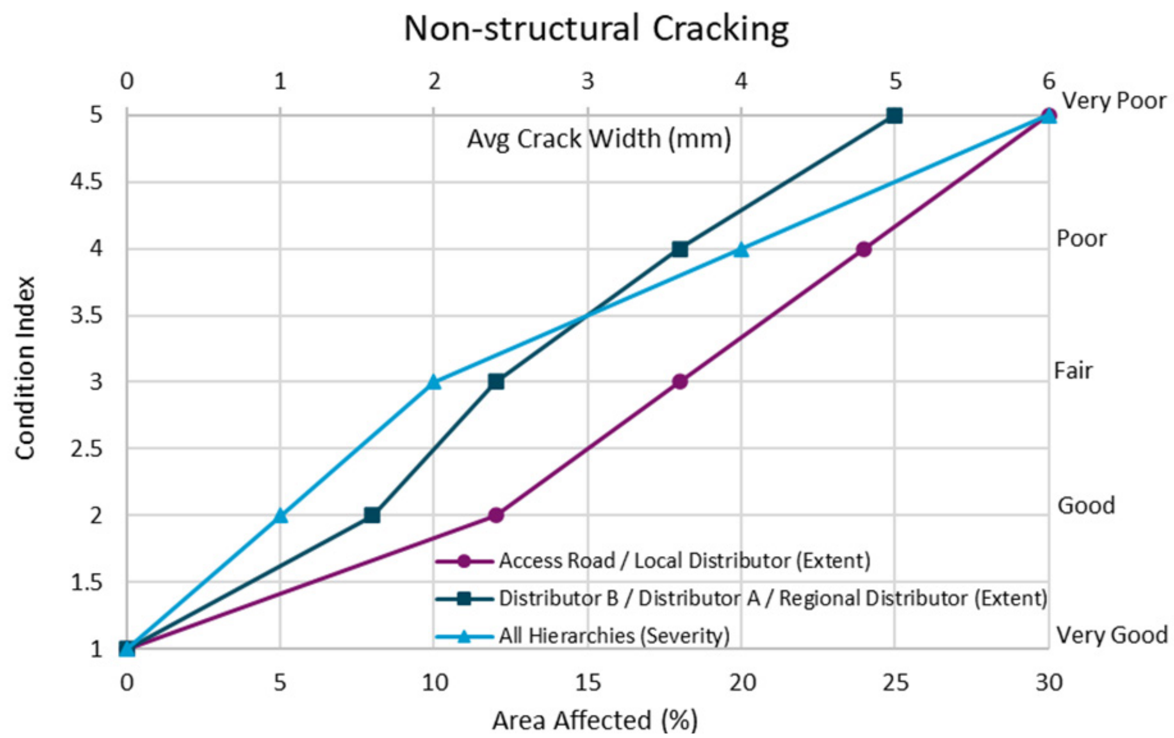

Figure C-5: Non-Structural Cracking Index Curves

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Surface Deficiencies

Surface deficiencies have a singular condition index:

- Extent (Area affected)

Table C-6 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-6.

***Table C-6:** Surface Deficiencies Condition Indices*

CI Band	Rating	Area Affected (%)	
		Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-12	0-8
2 ≤ CI < 3	Good	> 12-18	> 8-12
3 ≤ CI < 4	Fair	> 18-24	> 12-18
4 ≤ CI < 5	Poor	> 24-30	> 18-25
CI ≥ 5	Very Poor	> 30	> 25

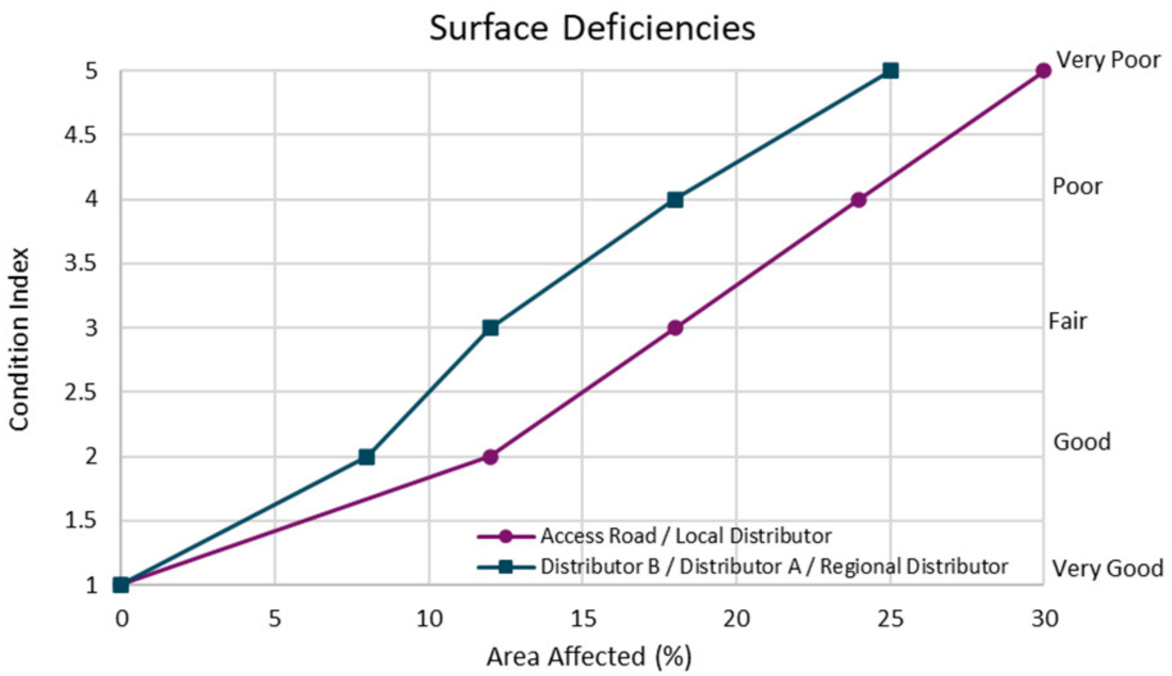

Figure C-6: Surface Deficiencies Index Curves

Pavement Condition Index

The Pavement (Structural) Condition Index (PCI) represents the structural condition of the sealed pavement layers beneath the surfacing. It reflects defects that indicate loss of strength, loss of support, or shape instability within the base or subgrade. PCI is used to identify sections requiring structural investigation, pavement rehabilitation, strengthening, or renewal. It does not measure surfacing performance, that is captured under SCI.

Structural Cracking

Structural cracking has two condition indices:

- Severity (Avg crack width)
- Extent (Area affected)

Table C-7 lists the severity and extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-7.

***Table C-7:** Structural Cracking Condition Indices*

CI Band	Rating	Avg Crack Width (mm)	Area Affected (%)	
		All Hierarchies	Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-1	0-8	0-6
2 ≤ CI < 3	Good	> 1-2	> 8-12	> 6-9
3 ≤ CI < 4	Fair	> 2-4	> 12-15	> 9-12
4 ≤ CI < 5	Poor	> 4-6	> 15-20	> 12-15
CI ≥ 5	Very Poor	> 6	> 20	> 15

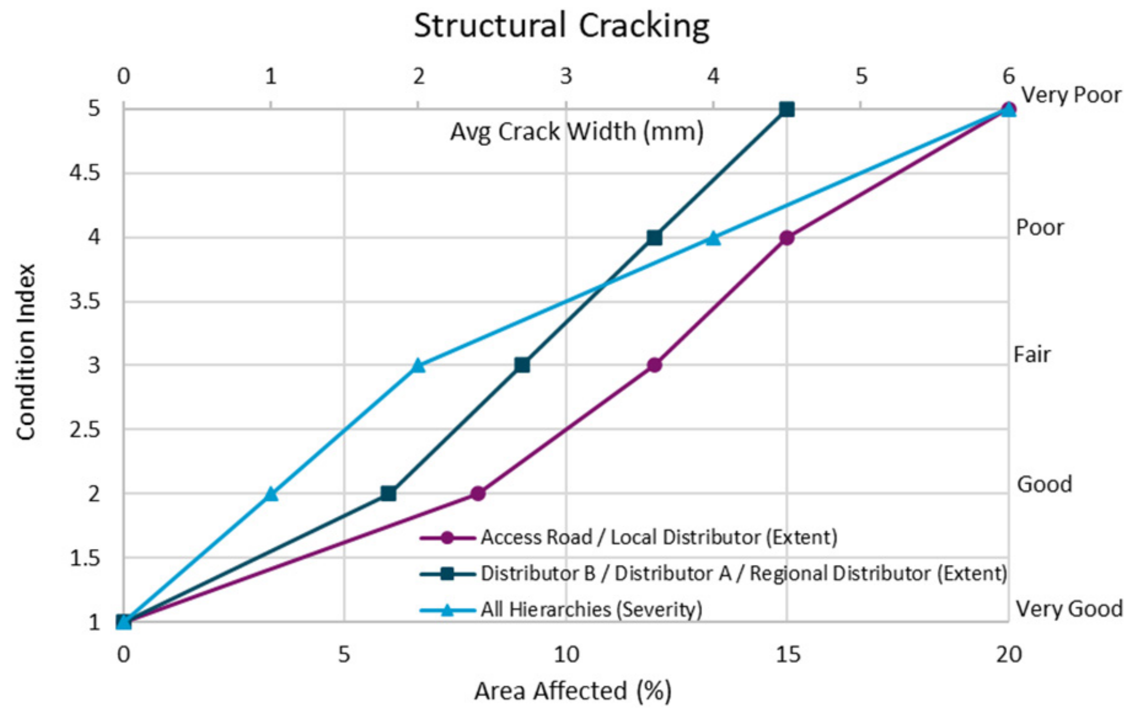

Figure C-7: Structural Cracking Index Curves

Appendix C: Road Condition Indices

Rutting

Rutting has a singular condition index:

- Severity (Avg rut depth)

Table C-8 lists the severity thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-8.

***Table C-8:** Rutting Condition Indices*

CI Band	Rating	Avg Rut Depth (mm)	
		Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-10	0-5
2 ≤ CI < 3	Good	> 10-15	> 5-10
3 ≤ CI < 4	Fair	> 15-20	> 10-15
4 ≤ CI < 5	Poor	> 20-25	> 15-20
CI ≥ 5	Very Poor	> 25	> 20

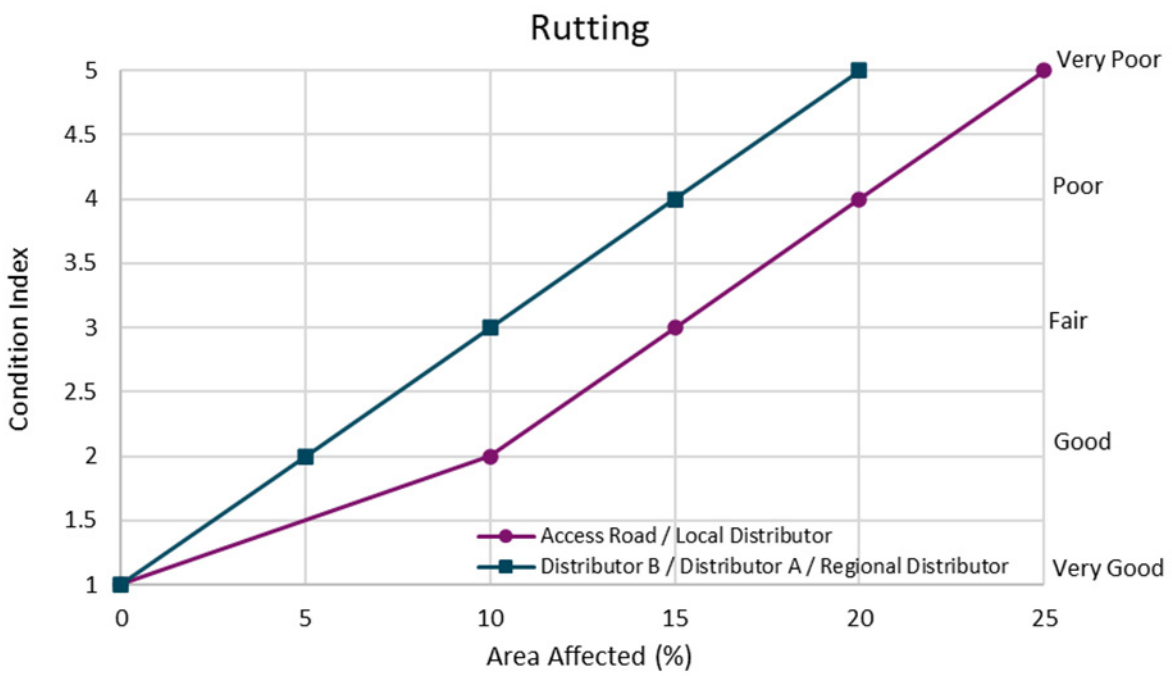

Figure C-8: Rutting Condition Index Curves

Appendix C: Road Condition Indices

Pavement Undulations

Pavement Undulations have two condition indices:

- Severity (Impact on ride quality)
- Extent (Length affected)

The severity is measured and recorded as a value of 1, 3, 5. No conversion is therefore applied as the measured rating is used directly to produce the index.

Table C-9 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-9.

***Table C-9:** Pavement Undulations Condition Indices*

CI Band	Rating	Length Affected (%)	
		Access Road / Local Distributor	Distributor B / Distributor A / Regional Distributor
1 ≤ CI < 2	Very Good	0-5	0-2
2 ≤ CI < 3	Good	> 5-10	> 2-5
3 ≤ CI < 4	Fair	> 10-15	> 5-10
4 ≤ CI < 5	Poor	> 15-20	> 10-15
CI ≥ 5	Very Poor	> 20	> 15

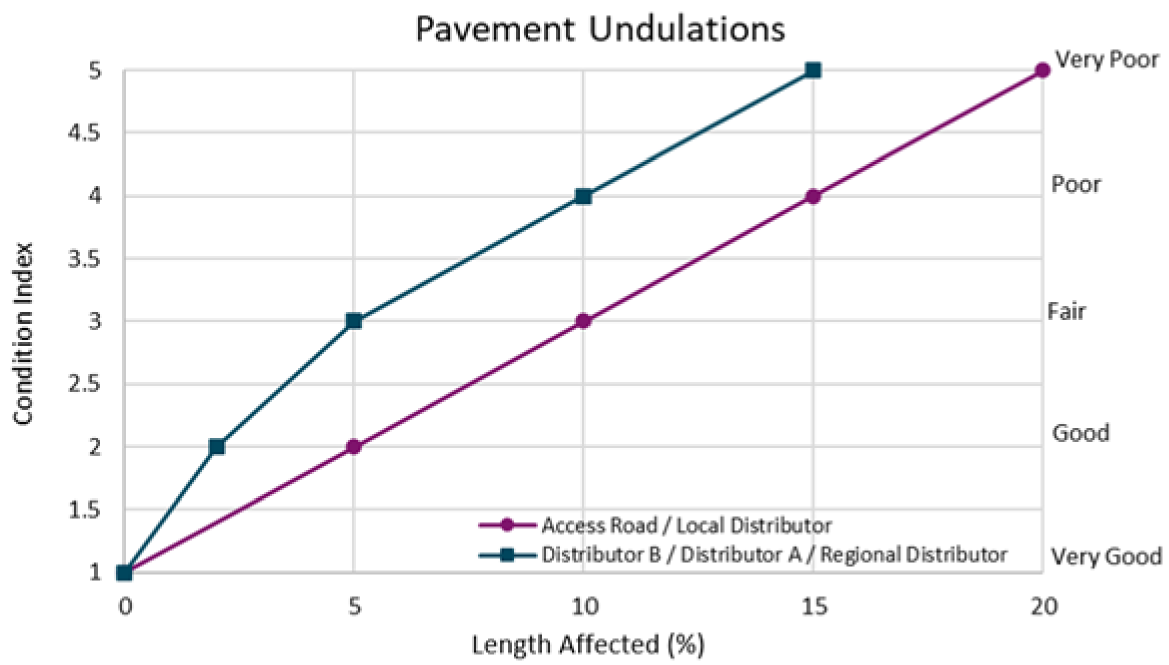

Figure C-9: Pavement Undulations Index Curves

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Drainage Condition Index

The Drainage Condition Index (DCI) represents the functional condition of drainage-related elements on sealed road networks. It reflects defects that affect surface runoff, edge support, moisture infiltration, and the long-term preservation of the pavement. DCI is used to identify sections where poor drainage is accelerating pavement deterioration or creating safety risks. It does not measure surface or pavement condition itself, that is captured under SCI and PCI.

Edge Break

Edge break has two condition indices:

- Severity (Avg edge break width)
- Extent (Length affected)

Table C-10 lists the severity and extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-10.

Table C-10: *Edge Break Condition Indices*

CI Band	Rating	Avg Edge Break Width (mm)		Length Affected (%)
		Access Road / Local Distributor / Distributor B / Distributor A	Regional Distributor	All Hierarchies
1 ≤ CI < 2	Very Good	0-25	0-15	0-5
2 ≤ CI < 3	Good	> 25-75	> 15-50	> 5-10
3 ≤ CI < 4	Fair	> 75-150	> 50-100	> 10-15
4 ≤ CI < 5	Poor	> 150-250	> 100-200	> 15-20
CI ≥ 5	Very Poor	> 250	> 200	> 20

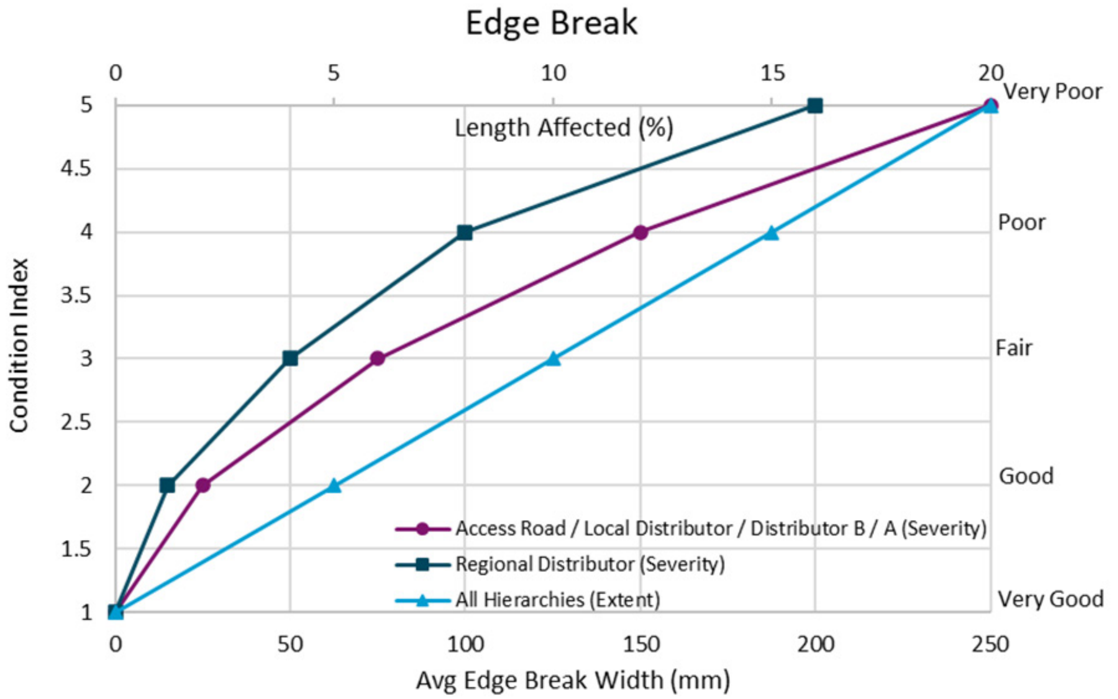

Figure C-10: Edge Break Index Curves

Edge Drop

Edge drop has two condition indices:

- Severity (Avg edge drop height)
- Extent (Length affected)

Table C-11 lists the severity and extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-11.

Table C-11: *Edge Drop Condition Indices*

CI Band	Rating	Avg Edge Drop Height (mm)	Length Affected (%)
		All Hierarchies	All Hierarchies
1 ≤ CI < 2	Very Good	0-15	0-5
2 ≤ CI < 3	Good	> 15-30	> 5-10
3 ≤ CI < 4	Fair	> 30-50	> 10-15
4 ≤ CI < 5	Poor	> 50-75	> 15-25
CI ≥ 5	Very Poor	> 75	> 25

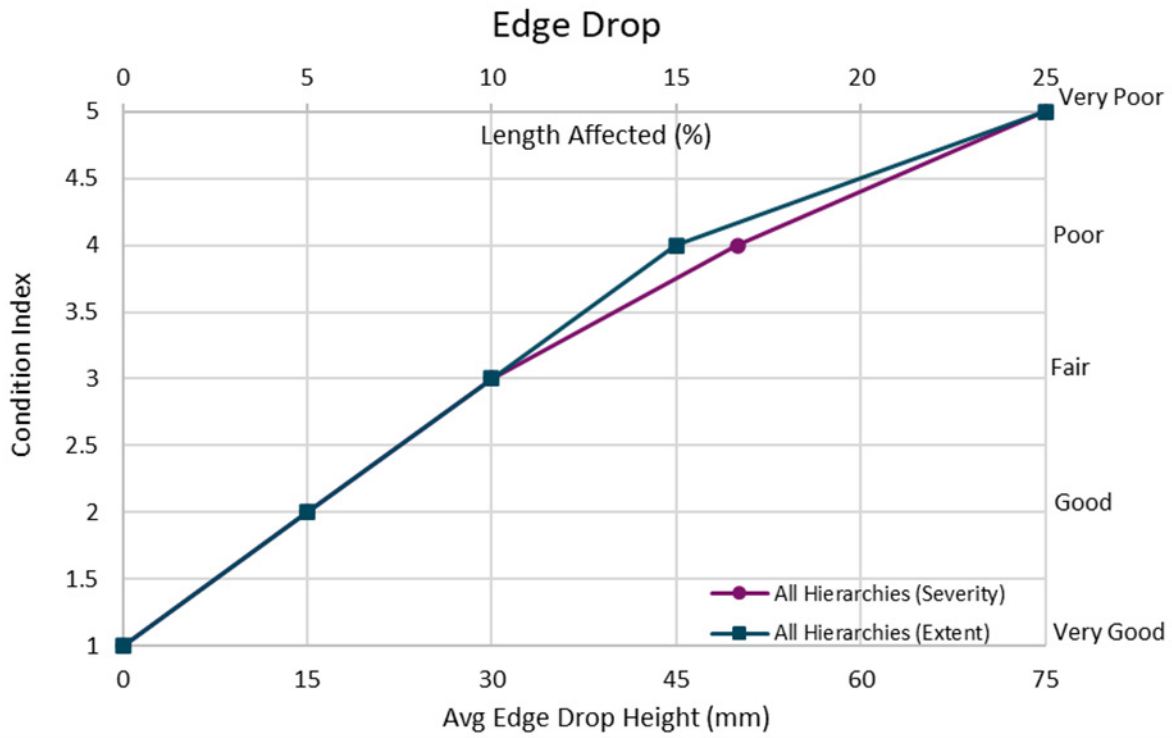

Figure C-11: Edge Drop Index Curves

Kerb Defects

Kerb defects have two condition indices:

- Severity (Functional impact)
- Extent (Length affected)

The functional impact is recorded as a rating of 1 to 5. It is not linked to road hierarchy and hence the rating is used directly as the condition index.

Table C-12 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-12.

Table C-12: *Kerb Defects Condition Indices*

CI Band	Rating	Functional Impact	Length Affected (%)
		All Hierarchies	All Hierarchies
1 ≤ CI < 2	Very Good	1-2	0-5
2 ≤ CI < 3	Good	> 2-3	> 5-10
3 ≤ CI < 4	Fair	> 3-4	> 10-15
4 ≤ CI < 5	Poor	> 4-5	> 15-25
CI ≥ 5	Very Poor	> 5	> 25

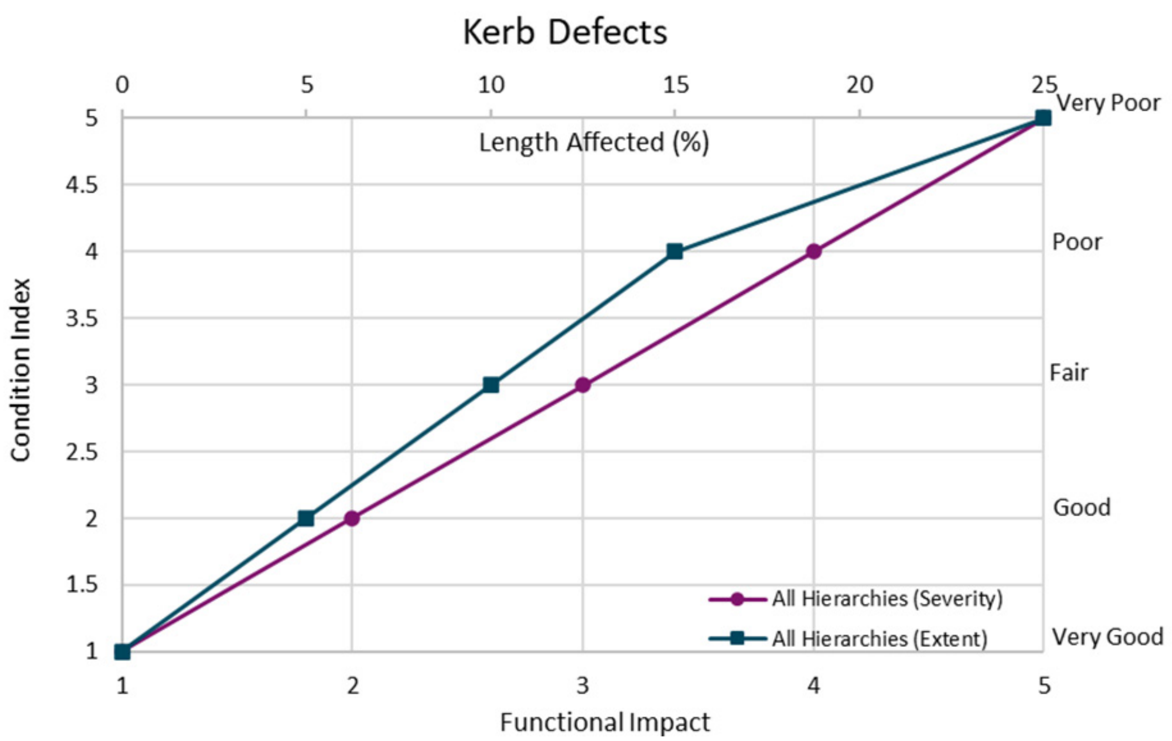

Figure C-12: Kerb Defect Index Curves

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Unsealed Shoulders

Unsealed shoulders have a singular condition index:

- Severity (Functional condition)

The functional condition is recorded as a rating of 1 to 5. It is not linked to road hierarchy and hence the rating is used directly as the condition index.

Table C-13 lists the severity thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-13.

Table C-13: *Unsealed Shoulders Condition Indices*

CI Band	Rating	Functional Condition
		All Hierarchies
1 ≤ CI < 2	Very Good	1-2
2 ≤ CI < 3	Good	> 2-3
3 ≤ CI < 4	Fair	> 3-4
4 ≤ CI < 5	Poor	> 4-5
CI ≥ 5	Very Poor	> 5

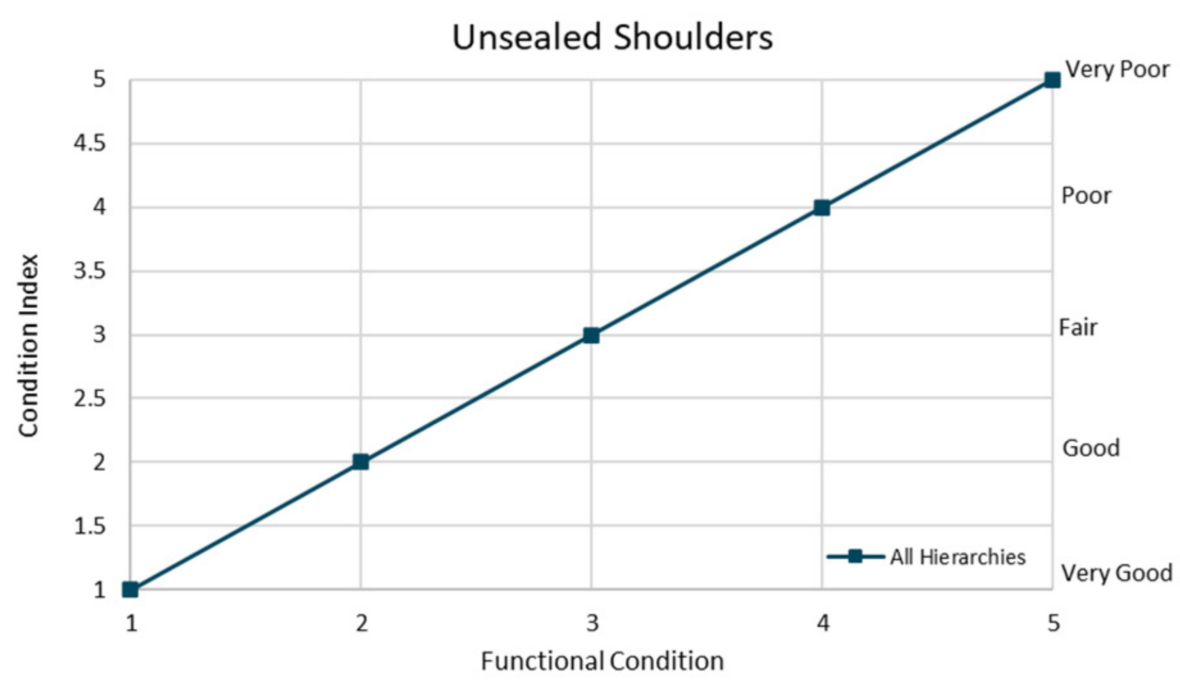

Figure C-13: Unsealed Shoulders Index Curves

Appendix C: Road Condition Indices

Table Drains

Table drains have a singular condition index:

- Severity (Functional condition)

The functional condition is recorded as a rating of 1 to 5. It is not linked to road hierarchy and hence the rating is used directly as the condition index.

Table C-14 lists the severity thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-14.

***Table C-14:** Table Drains Condition Indices*

CI Band	Rating	Functional Condition
		All Hierarchies
1 ≤ CI < 2	Very Good	1-2
2 ≤ CI < 3	Good	> 2-3
3 ≤ CI < 4	Fair	> 3-4
4 ≤ CI < 5	Poor	> 4-5
CI ≥ 5	Very Poor	> 5

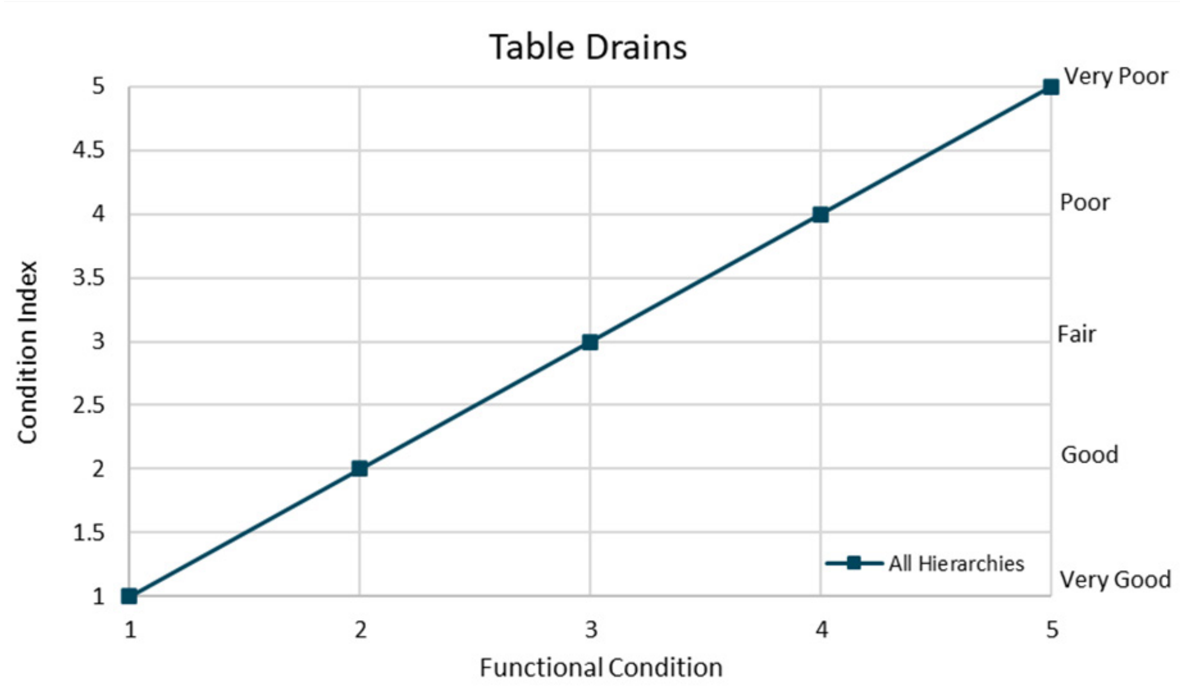

Figure C-14: Table Drains Index Curves

Appendix C: Road Condition Indices

Unsealed Condition Index

The Unsealed Condition Index (UCI) represents the functional condition of unsealed road segments. It reflects surfacing performance, shape, and depth factors that influence safety, ride quality, moisture control, and ongoing maintenance demand. UCI is used for network-level planning and to determine resheeting priorities, maintenance grading frequency, and long-term gravel re-sheet programs. It does not measure sealed-pavement defects, which are managed under SCI, PCI and DCI.

Unsealed Surface Defects

Unsealed surface defects have a singular condition index:

- Extent (Area affected)

Table C-15 lists the extent thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-15.

***Table C-15:** Unsealed Surface Defect Condition Indices*

CI Band	Rating	Area Affected (%)
		All Hierarchies
1 ≤ CI < 2	Very Good	0-10
2 ≤ CI < 3	Good	> 10-20
3 ≤ CI < 4	Fair	> 20-30
4 ≤ CI < 5	Poor	> 30-40
CI ≥ 5	Very Poor	> 40

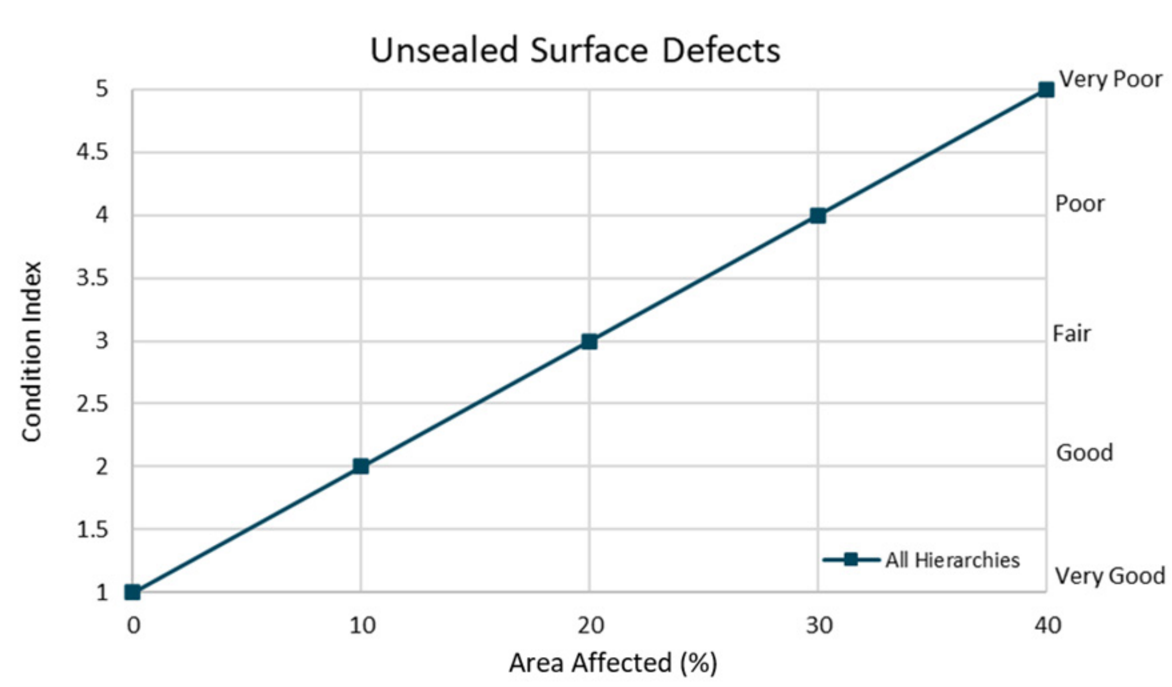

Figure C-15: Unsealed Surface Defect Index Curves

Unsealed Shape

Unsealed shape has a singular condition index:

- Severity (Functional condition)

The functional condition is recorded as a rating of 1 to 5. It is not linked to road hierarchy and hence the rating is used directly as the condition index.

Table C-16 lists the severity thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-16.

***Table C-16:** Unsealed Shape Condition Indices*

CI Band	Rating	Functional Condition
		All Hierarchies
1 ≤ CI < 2	Very Good	1-2
2 ≤ CI < 3	Good	> 2-3
3 ≤ CI < 4	Fair	> 3-4
4 ≤ CI < 5	Poor	> 4-5
CI ≥ 5	Very Poor	> 5

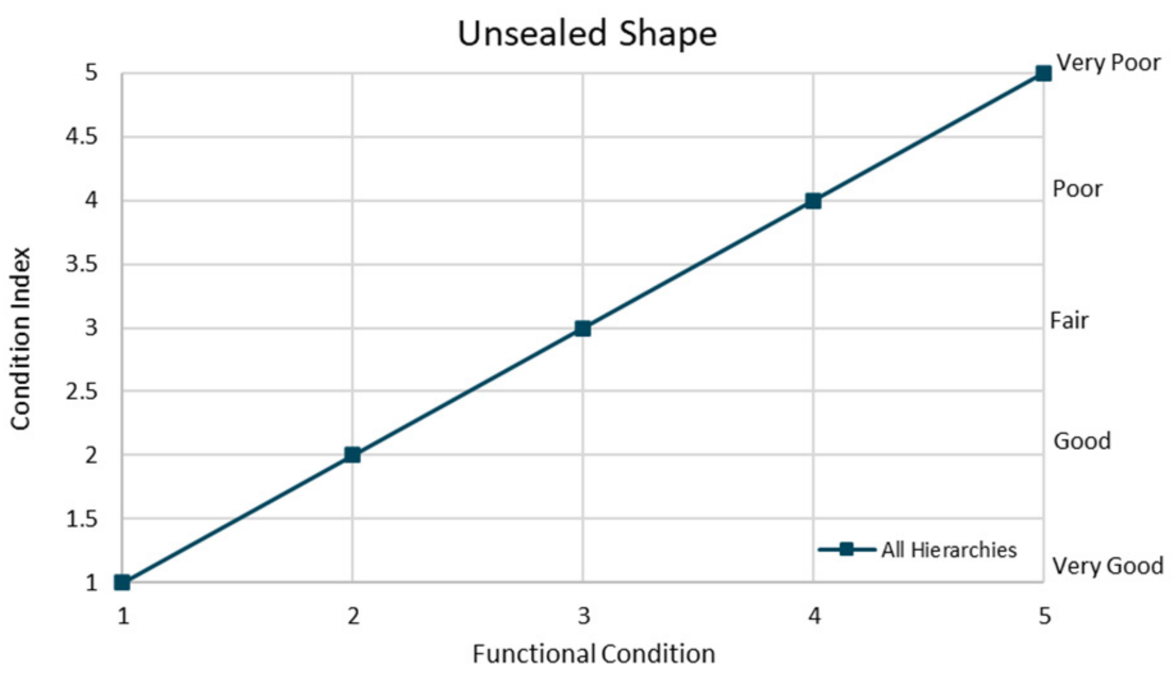

Figure C-16: Unsealed Shape Index Curves

Road Condition Assessment Manual

Appendix C: Road Condition Indices

Depth of Base

Depth of base has a singular condition index:

- Severity (Avg thickness)

Table C-17 lists the severity thresholds that define the condition index bands. The corresponding index curves are shown in Figure C-17.

***Table C-17:** Depth of Base Condition Indices*

CI Band	Rating	Avg Thickness (mm)
		All Hierarchies
1 ≤ CI < 2	Very Good	≥ 300
2 ≤ CI < 3	Good	> 200-300
3 ≤ CI < 4	Fair	> 100-200
4 ≤ CI < 5	Poor	> 50-100
CI ≥ 5	Very Poor	0 -50

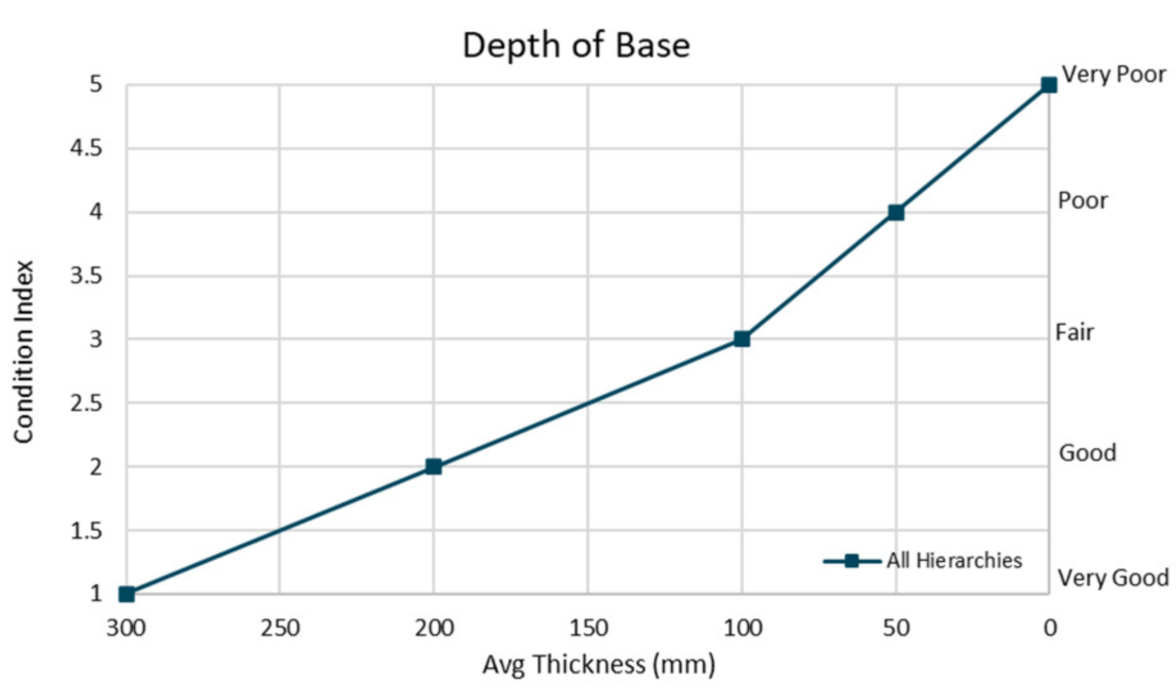

Figure C-17: Depth of Base Index Curves

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Appendix D

Worked Examples

Purpose

This Appendix provides worked numerical examples to demonstrate how individual defect observations are converted into defect indices and combined into the composite indices defined in Appendix C.

Where measured extent and severity/degree values are retained and available, these values may be used directly in the conversion to defect indices. Where measured values are not retained and only the defect rating is available, a single representative value is required for index calculation. In these cases, the upper bound of the applicable defect rating band is typically adopted, consistent with the methodology applied in Version 1 of the Manual. Where a change in conversion method is introduced, agencies should document the change and consider recalculating historical indices to maintain comparability.

The examples support training, auditing, and validation of automated workflows. Values shown are for illustration only.

Worked Example - Sealed Road

Road Hierarchy: Regional Distributor

Step 1: Data Collection

A 500m sealed treatment length was visually assessed. The recorded defect values, corresponding defect ratings, and the upper bound values adopted for index calculation are shown in Table D-1.

Table D-1: Recorded Defect Values

Defect Type	Defect Component	Recorded Values (Rounded)	Defect Rating	Upper Bound Value
Local Surface Defects	Area Affected	5%	2	5%
Patches	Area Affected	5%	2	5%
Potholes	Area Affected	0%	1	0%
Non-structural Cracking	Area Affected	20%	3	20%
	Avg Crack Width	3mm	3	4mm
Surface Deficiencies	Area Affected	10%	2	10%
Structural Cracking	Area Affected	5%	2	5%
	Avg Crack Width	2mm	3	4mm
Rutting	Avg Rut Depth	15mm	3	20mm
Pavement Undulations	Area Affected	5%	2	5%
	Impact on Ride Quality	3	3	3
Edge Break	Area Affected	10%	3	10%
	Avg Edge Break Width	50mm	2	75mm
Edge Drop	Area Affected	5%	2	5%
	Avg Edge Drop Height	20mm	2	30mm
Kerb Defects	Length Affected	NA	0	NA
	Functional Impact	NA	0	NA
Unsealed Shoulder	Functional Condition	2	2	2
Table Drains	Functional Condition	3	3	3

Step 2: Convert to Defect Indices

The defect ratings from Table D-1 are converted to Individual Defect Indices using the applicable Regional Distributor conversion curves in Appendix C. Where measured (recorded) values are retained, these may be used directly. In this example, the upper bound value of each defect rating band has been adopted as the representative input for index conversion.

The resulting indices are shown in Table D-2.

Table D-2: Defect Index Values

Composite	Defect Type	Defect Component	Defect Index
Surface	Local Surface Defects	Extent	3.0
	Patches	Extent	3.0
	Potholes	Extent	1.0
	Non-structural Cracking	Extent	4.3
		Severity	4.0
	Surface Deficiencies	Extent	2.5
Pavement	Structural Cracking	Extent	1.7
		Severity	4.0
	Rutting	Severity	5.0
	Pavement Undulations	Extent	3.0
		Severity	3.0
Drainage	Edge Break	Extent	3.0
		Severity	3.5
	Edge Drop	Extent	2.0
		Severity	3.0
	Kerb Defects	Extent	-
		Functional Impact	-
	Unsealed Shoulder	Severity	2.0
	Table Drains	Severity	3.0

Step 3: Calculate Composite Indices

The Surface (SCI), Pavement (PCI), and Drainage (DCI) Composite Indices are calculated using the Advanced Maximum Method:

$$CI = MIN\ [5,\ MAX\ [All\ indices] + p \times \frac{\sum All\ indices - MAX\ [All\ indices]}{Number\ of\ Indices - 1}$$

where:

- CI = composite index incorporating multiple defect indices
- p = influence factor (typically 0.1–0.3; use 0.1 by default)

Table D-3: SCI Calculations

Parameter	Value	
∑ All indices	17.8	
MAX [All indices]	4.3	A
Number of indices - 1	5	
$\frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	2.7	
$0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	0.27	B
$\text{MAX [All indices]} + 0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	4.57	A + B
MIN [5 or A + B]	4.6	
Surface Condition Index	**4.6**	

Table D-4: PCI Calculations

Parameter	Value	
∑ All indices	16.7	
MAX [All indices]	5	A
Number of indices - 1	4	
$\frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	2.9	
$0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	0.29	B
$\text{MAX [All indices]} + 0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	5.29	A + B
MIN [5 or A + B]	5.0	
Pavement Condition Index	**5.0**	

Table D-5: DCI Calculations

Parameter	Value	
∑ All indices	16.5	
MAX [All indices]	3.5	A
Number of indices - 1	5	
$\frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	2.6	
$0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	0.26	B
$\text{MAX [All indices]} + 0.1 \times \frac{\sum \text{All indices} - \text{MAX [All indices]}}{\text{Number of indices} - 1}$	3.76	A + B
MIN [5 or A + B]	3.8	
Drainage Condition Index	**3.8**	

Appendix D: Worked Examples

Step 4: Final Summary

Table D-6: Index Summary

Composite Index	Value	Condition Interpretation
SCI	4.6	Poor
PCI	5.0	Very Poor
DCI	3.8	Fair

Interpretation: Surface and pavement defects are the primary contributors, with drainage secondary. This should trigger project-level investigation to confirm root causes and determine whether the optimal treatment is resurfacing or structural strengthening, rather than inferring treatments from index values alone.

Worked Example - Unsealed Road

Road Hierarchy: Local Distributor

Step 1: Data Collection

An 800m unsealed treatment length was visually assessed. The recorded defect values, corresponding defect ratings, and the upper bound values adopted for index calculation are shown in Table D-7.

Table D-7: Recorded Defect Values

Defect Type	Defect Component	Recorded Values (Rounded)	Defect Rating	Upper Bound Value
Unsealed Surface Defects	Area Affected	15%	3	20%
Unsealed Shape	Functional Condition	2	2	2
Depth of Base	Avg Thickness	150mm	3	100mm

Step 2: Convert to Defect Indices

The defect ratings from Table D-7 are converted to Individual Defect Indices using the applicable Local Distributor conversion curves in Appendix C. Where measured (recorded) values are retained, these may be used directly. In this example, the upper bound value of each defect rating band has been adopted as the representative input for index conversion.

The resulting indices are shown in Table D-8.

Table D-8: Defect Index Values

Composite	Defect Type	Defect Component	Defect Index
Unsealed	Unsealed Surface Defects	Extent	3.0
	Unsealed Shape	Severity	2.0
	Depth of Base	Severity	3.0

Appendix D: Worked Examples

Step 3: Calculate Composite Indices

The Unsealed (UCI) Composite Index is calculated using the Advanced Maximum Method:

$$CI = MIN\ [5,\ MAX\ [All\ indices] + p \times \frac{\sum All\ indices - MAX\ [All\ indices]}{Number\ of\ Indices - 1}$$

where:

- CI = composite index incorporating multiple defect indices
- p = influence factor (typically 0.1–0.3; use 0.1 by default)

Table D-9: UCI Calculations

Parameter	Value	
∑ All indices	8.0	
MAX [All indices]	3.0	A
Number of indices - 1	2	
$\frac{\sum All\ indices - MAX\ [All\ indices]}{Number\ of\ indices - 1}$	2.50	
$0.1 \times \frac{\sum All\ indices - MAX\ [All\ indices]}{Number\ of\ indices - 1}$	0.25	B
$MAX\ [All\ indices] + 0.1 \times \frac{\sum All\ indices - MAX\ [All\ indices]}{Number\ of\ indices - 1}$	3.25	A + B
MIN [5 or A + B]	3.3	
Unsealed Condition Index	**3.3**	

Step 4: Final Summary

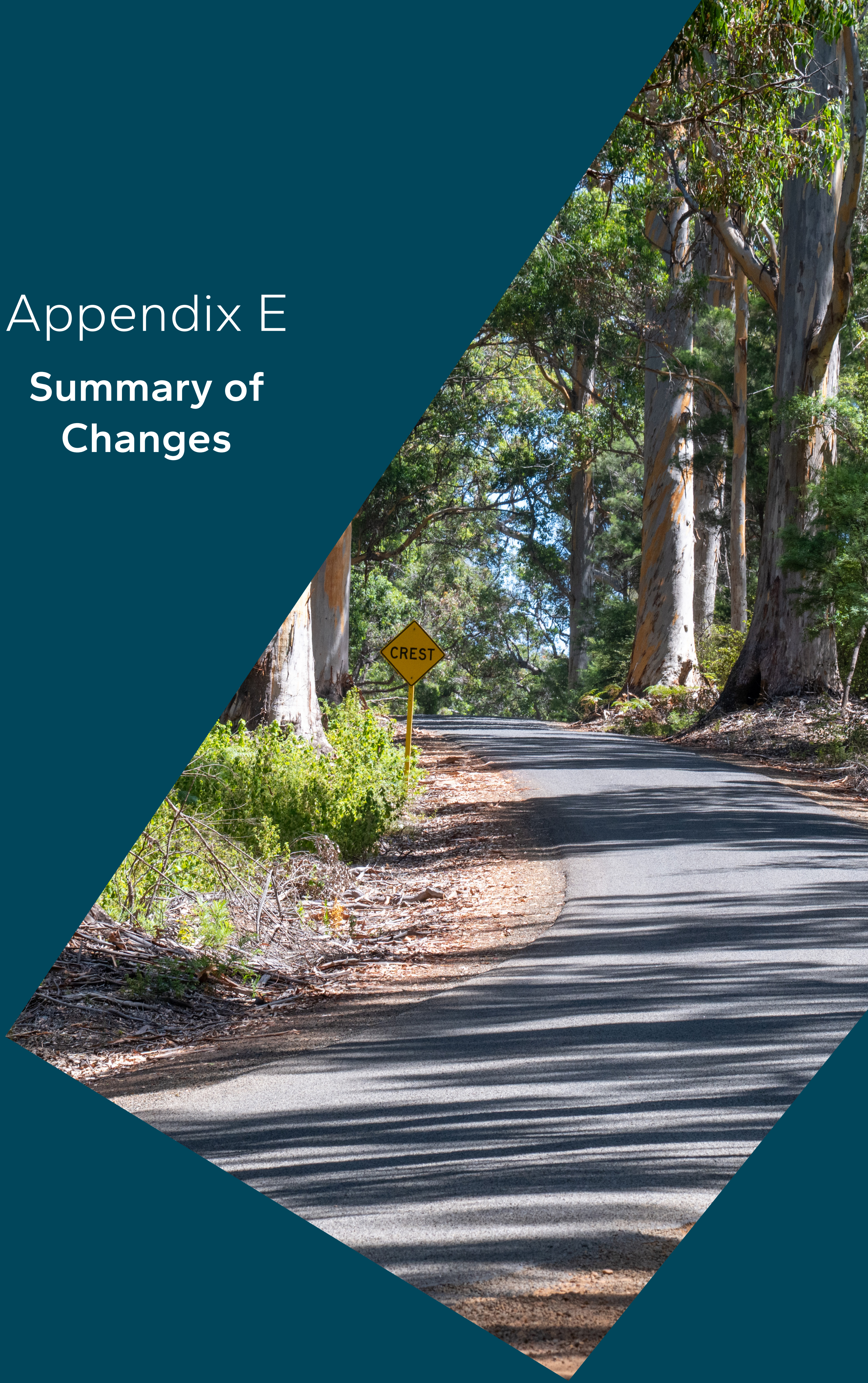
Table D-10: Index Summary

Composite Index	Value	Condition Interpretation
UCI	3.7	Fair

Interpretation: The condition is mainly driven by surface defects and base thickness, with shape contributing. Routine grading and resheeting should be programmed to restore surface quality and crossfall. Because unsealed performance is highly traffic- and moisture-sensitive, monitoring after regrading is recommended to confirm that shape and surface condition are being maintained between cycles.

Appendix E

Summary of Changes



Road Condition Assessment Manual

Appendix E: Summary of Changes

Appendix E: Summary of Changes

Key Update Area	Summary of Changes
Improved Structure and Usability	The manual has been reorganised and updated to improve clarity and usability for practitioners undertaking condition surveys. Key improvements include: • Clearer explanation of treatment lengths and network-level assessment processes • Addition of an Acronyms section and improved document navigation • Inclusion of a Related Standards and Practice Notes section • Updated figures and example imagery to support consistent interpretation of defects These changes improve the accessibility of the manual and support more consistent application by inspectors and asset managers.
Introduction of Pavement Roughness Assessment	Version 2 introduces pavement roughness (IRI) as a standalone network condition indicator for both sealed and unsealed roads. • Roughness can now be used alongside visual condition surveys to provide a broader understanding of pavement performance. • Guidance is provided on measurement methods, interpretation and integration into asset management systems. • Roughness is treated as a separate dataset and is not included within the combined defect indices. This change reflects current asset management practice and supports more holistic network condition assessment.
Recognition of Modern Data Collection Technologies	The manual has been updated to reflect current industry practices in road condition data collection. The manual now explicitly supports the following data collection methods: • Manual visual inspection • Video-based condition surveys • Automated survey technologies • AI-assisted defect identification and measurement Guidance is also provided on minimum metadata requirements, equipment configuration and system integration to ensure collected datasets remain consistent and traceable.
Guidance for AI-Assisted Condition Assessment	New guidance has been introduced for the use of artificial intelligence and automated condition assessment tools. Two levels of AI application are defined: • Level 1 – Screening: AI assists inspectors with identifying potential defects. • Level 2 – Decision-grade: AI outputs are used directly in condition assessment and reporting. Validation requirements and performance metrics are outlined to ensure automated methods achieve acceptable accuracy, repeatability and reliability before implementation.

Key Update Area	Summary of Changes
Improved Quality Assurance and Inspector Calibration Framework	Version 2 introduces a more structured Quality Assurance (QA) and Quality Control (QC) framework for condition surveys. Enhancements include: • Guidance on preparing QA/QC plans for condition surveys • Data validation and anomaly checking procedures • Formalised inspector calibration and training processes • Recommended cross-audit exercises to improve consistency between inspectors These improvements support more reliable and repeatable condition assessments across Local Governments.
Improved Defect Definitions and Recording Guidance	Several defect definitions and recording rules have been clarified to improve consistency during field surveys. Key updates include: • Clarification of the definition of patches and failed patches • Separation of structural and non-structural cracking into dedicated sections, reflecting their different implications for pavement performance. • Improved guidance on recording surface deficiencies, kerb defects and other surface distresses. These refinements help ensure defects are recorded consistently and interpreted correctly during condition surveys.
Refinement of Defect Rating Thresholds and Measurement Methods	Several defect rating thresholds and measurement approaches have been updated following review of survey data from multiple road networks. Examples include: • Updated rating bands for pavement undulations and surface deficiencies. • Adjustments to non-structural cracking extent ranges. • Updated approaches for assessing defects such as rutting and flushing to better reflect how they are observed in practice. These refinements improve the ability of condition ratings to differentiate between levels of deterioration observed in the field.
Improvements to Condition Index Calculations	Updates have been made to improve the accuracy, transparency and usability of the condition index calculations. Key improvements include: • Alignment of index calculation tables with revised defect rating thresholds. • Updated guidance on the influence factor (ß) used in composite index calculations. • Introduction of a dedicated Unsealed Condition Index (UCI) for unsealed roads. These changes strengthen the reliability of condition indices used to support maintenance planning and asset management decision-making.

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