# New Zealand Transport Agency
# Maintenance guidelines for local roads (2012)

## Contents

# 1. Introduction

## 1.1 Status and intent

These guidelines contain performance measures and target values that the New Zealand Transport Agency (NZTA) consider appropriate for asset managers to aim for when setting the level of maintenance on local roads. They were developed in consultation with all territorial local authorities and with a limited number of roading consultants and contractors and included in the 2008/9 Planning programming and funding manual. This is a reissue of that document with minor editorial changes. They will be listed in the NZTA's *Register of network standards and guidelines* with the status of guideline. It is anticipated that the Roading Efficiency Group will further refine this document.

## 1.2 Optimising maintenance

The NZTA wishes to fund the optimal level of maintenance considering both road user costs and the life-cycle costs to the roading agency. While the levels of maintenance associated with these guidelines are intended to align with current industry standards and our knowledge of road user expectations, they may not yet be optimal. The values attained in any network will be tempered by local economic, geological and climatic conditions. These guidelines will be refined with time where it can be shown that they do not align with the optimal.

## 1.3 Territorial local authority compliance

As with all NZTA guidelines, the target values specified indicate practice that is acceptable to the NZTA. Territorial local authorities (TLAs) may adopt different values to optimise environmental, economic, or resource utilisation impacts, but, as required by the NZTA's *Register process manual*, traceable justification of the decision to do so must be retained for audit purposes.

Where a TLA adopts a different, more expensive value, NZTA may limit its financial assistance to the cost of maintaining the network to the value specified here, unless specific agreement to financially assist a different value has been agreed with NZTA.

## 1.4 Format

The guidelines are grouped into three areas in order to clearly identify the objective of the measures defined:

- user satisfaction
- safety
- asset preservation.

## 1.5 Criteria

In developing these guidelines the NZTA has endeavoured to make them:

- sensible and easily understood
- simple to measure and thus not require a large inspection resource
- memorable, so that deficiencies are apparent

- the minimum number required to describe the outcomes desired
- economically sound in terms of long-term agency costs.

## 1.6 Method of measurement

The methods of measurement specified in these guidelines are:

- RAMM or dTIMS reports – standard reports generated by a TLA for their own asset management purposes
- visual inspection – in which faults are noted, usually from a moving vehicle, during the course of a periodic inspection by TLA or the NZTA's staff
- safety inspections – safety focused, periodic drive-over inspections, which are expected to form part of a TLA safety management system
- inspection programme – regular programmed inspections by a TLA of their load-bearing and drainage structures.

## 1.7 Road groups

The guidelines use a total 12 road groups; five urban; five rural; two for tracks. The NZTA considers this to be the least practical number for maintenance purposes. Any local authority that requires a more detailed breakdown can subdivide these groups provided they can be amalgamated for any reports that the NZTA may request.

## 1.8 Compatibility with contract specifications

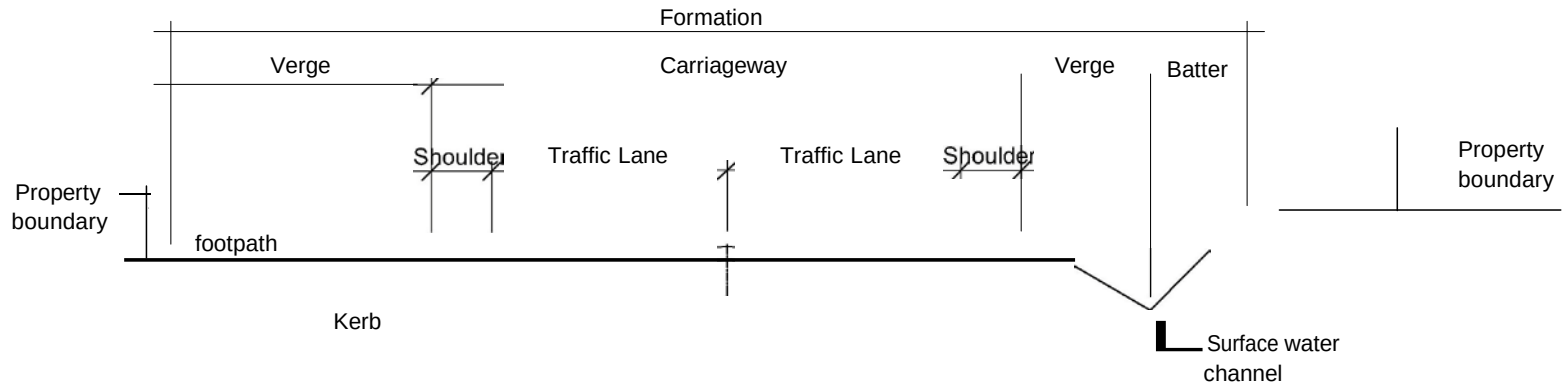
Because the guidelines are output based, they define the expected condition of any road section in the network at any time. If further deterioration is expected before the deficiency can be rectified, intervention levels must be set at a higher level to achieve compliance with these target values.

The guidelines show the National Land Transport Programme (NLTP) work categories related to each of the measures. This enables each of the measures to be readily translated into a basket of contract specification requirements to achieve the desired outcome.

## 1.9 Definition of terms

Figure 1 on the following page, showing a typical road cross-section, is provided in order to define the terms used in the guidelines for elements in the road reserve.

**Figure 1**

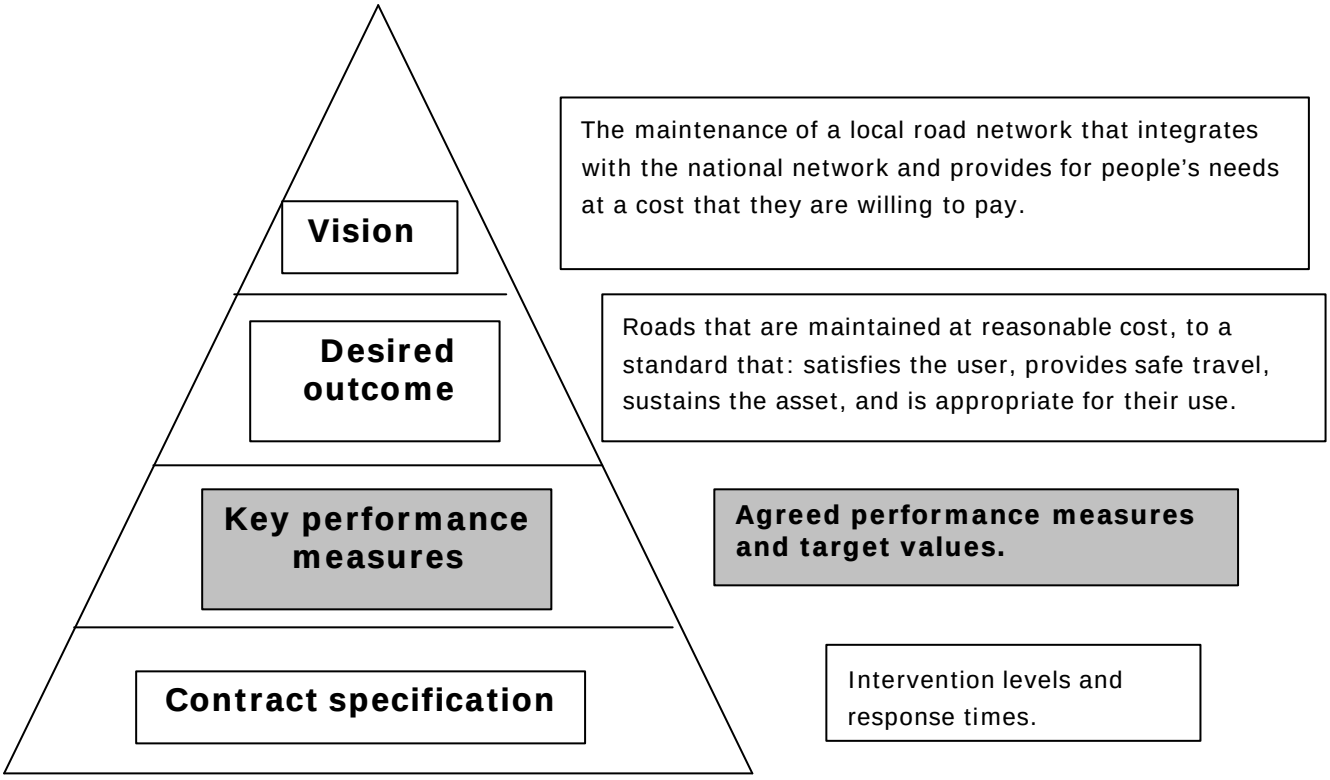



## TYPICAL ROAD CROSS SECTION

* **Dimensions of Clear Zones should be defined in the Local Authority Safety Management System for the network.**

## 1.10 Maintenance pyramid

This diagram shows the relationship between the NZTA's guidelines, outcomes and contract specifications.




## 1.11 Government Policy Statement on Land Transport Funding 2012/13-2021/22

The Government Policy Statement on Land Transport Funding (GPS) sets central government's outcomes and priorities for the land transport sector. The government has three focus areas that are the priorities for this GPS:

- Economic growth and productivity
- Value for money
- Road safety

The NZTA, when preparing the National Land Transport Programme, must take into account how road maintenance contributes to the outcomes sought in the GPS.

Territorial local authorities, being approved organisations, are reminded that the levels of service provided and maintenance practices used should help to meet the impacts identified in the GPS and the objectives of the Land Transport Management Act 2003.

## 2. NZTA road groups for maintenance guidelines

| Environment | Group name | Average annual daily traffic |
|---|---|---|
| Urban | A | >10,000 |
| | B | 5,000–10,000 |
| | C | 1,000–5,000 |
| | D | 200–1,000 |
| | E | <200 |
| | F | Available if required |
| Rural | A | Available for future use |
| | B | >5,000 |
| | C | 1,000–5,000 |
| | D | 200–1,000 |
| | E | 50–200 |
| | F | <50 |

**Adjustment factors** – optional, apply where desired to some or all measures

| Terrain type | % HCVs | Traffic type |
|---|---|---|
| Continuous flat and/or straight: Move up one group* | >15% HCVs: Move up one group. | >20% tourist traffic and/or major tourist destination: Move up one group. |
| Undulating: no adjustment | <3% HCVs: Move down one group. | |
| Steep and/or winding: Move down one group* | | |
| * Applicable to routes where average speeds change significantly, as a result of the consistent terrain type. | | |

| Additional road type | Group name | Traffic volume and type | Maintenance guidelines |
|---|---|---|---|
| Tracks | G | Recreational use, very low traffic volume, all year round access. | Safely passable by 4WD saloon vehicles at low speed. Minimal signage and marker posts. |
| | H | Recreational use, very low traffic volume, dry season access only. | Safely passable by 4WD saloon vehicles at low speed, in dry season. Minimal signage and marker posts. |

## 3. Maintenance guidelines

### ROAD USER SATISFACTION MEASURES

| Measures | Explanation | Method of measurement | Target values by road group | | Related NLTP work category |
|---|---|---|---|---|---|
| | | | Urban | Rural | |
| Maximum average roughness on sealed roads. | Average NAASRA roughness of all sealed roads in group. | RAMM roughness report. | A – 90<br>B – 100<br>C – 110<br>D – 120<br>E – 140 | B – 90<br>C – 100<br>D – 110<br>E – 120<br>F – 140 | Sealed pavement maintenance; Sealed road pavement rehabilitation; Resurfacing. |
| Maximum roughness on roughest sealed roads. | No more than 5% by length of roads in any group shall exceed the average roughness limits. | RAMM roughness report. | A – 120<br>B – 130<br>C – 140<br>D – 150<br>E – 170 | B – 110<br>C – 120<br>D – 130<br>E – 150<br>F – 180 | Sealed pavement maintenance; Sealed road pavement maintenance; Resurfacing. |
| Number of maintenance related **faults that are likely to affect driver behaviour,** eg requiring evasive action or reduction in speed. | Faults per one lane-km urban route/10 lane-km rural, such as:<br>- rutting/depressions<br>- shoving<br>- potholes<br>- corrugated length<br>- edgebreak (in lane)<br>- bleeding<br>- detritus (in lane)<br>- ponding water | Visual inspection for all faults. | A – 1<br>B – 2<br>C – 3<br>D – 3<br>E – 4 | B – 2<br>C – 4<br>D – 6<br>E – 8<br>F – 10 | Sealed pavement maintenance; Drainage maintenance; Associated improvements. |

## ROAD USER SATISFACTION MEASURES

| Measures | Explanation | Method of measurement | Target values by road group | | Related NLTP work category |
|---|---|---|---|---|---|
| | | | Urban | Rural | |
| Adequacy of destination and directional signs. | All route destinations clearly* sign-posted. | Visual inspection. | All – 100% | | Traffic services maintenance. |
| Visibility not restricted by dust. | Distance from source vehicle at which there is adequate visibility. | Visual inspection. | Unsealed roads: E – 50 m | | Unsealed pavement maintenance; Road metalling. |
| Corrugations on unsealed roads. | Proportion of road significantly corrugated. (Significantly corrugated is defined as sufficient to cause driver discomfort or reduction in vehicle speed.) | Visual inspection. | < 10% of length of section affected or <20 m at any location. | | Unsealed pavement maintenance; Road metalling. |
| Availability of road after emergency closure. | Access restored by detour within stated time or, roads reopened to at least a single lane for 20 minutes per hour. | | A – 1 hour<br>B – 4 hours<br>C – 4 hours<br>D – 8 hours<br>E – 12hours | B – 4 hours C – 8 hours D – 12hours | Network & asset management; Emergency works; Environmental maintenance; Operational traffic management. |
| Number of maintenance related hazards on cycleways requiring evasive action by rider. | Hazards per km, such as:<br>- detritus<br>- ponding water<br>- potholes<br>- broken glass | Visual inspection. | All cycleways – 4 | | Cyclepath maintenance. |

* 'Clearly' will be measured as compliance with industry standards for road groups (development of standards is intended as a separate exercise)

## SAFETY MEASURES

| Measures | Explanation | Method of measurement | Target values by road group | | Related NLTP work category |
|---|---|---|---|---|---|
| | | | Urban | Rural | |
| Adequate* provision, visibility and reflectivity of traffic services facilities for safe travel at normal day and night operating speeds on wet or dry road. | Deficient traffic services facilities, per 1 km urban/10 km rural route, such as:<br>- pavement markings,<br>- signs<br>- edge marker posts (EMPs)<br>- RRPMs | Safety inspection. % missing or ineffective on all road groups. | Regulatory signs/markings – 0%<br>Warning signs – 0%<br>EMPs – 3 on straight or 1 on curve<br>RRPMs – 20% | | Traffic services maintenance; Environmental maintenance. |
| Adequate skid resistance on all sealed roads. | No section with a skid resistance insufficient for location. | Visual inspection of suspect sites identified from desktop analysis (see Appendix A). | All road groups:<br>Number of wet weather (skid-related) crashes for the network trending down.<br>All sites identified without an adequate level of skid | | Resurfacing; Sealed pavement maintenance. |
| Loose gravel on unsealed roads. | Minimal loose gravel on carriageway. | Safety inspection. | Straights:<br>Maximum average depth <30 mm<br>Maximum windrow depth <60 mm<br>Curves:<br>Shape maintained to produce four wheel tracks, or no loose gravel. | | Unsealed pavement maintenance; Road metalling. |

* 'Adequate' will be measured as compliance with industry standards for road groups (development of standards is intended as a separate exercise).

## SAFETY MEASURES

| Measures | Explanation | Method of measurement | Target values by road group | | Related NLTP work category |
|---|---|---|---|---|---|
| | | | Urban | Rural | |
| Sight distance is not restricted by vegetation growth/trees. | Number of deficient locations per 1 km urban/10 km rural route. | Safety inspection. | A – 0<br>B – 0<br>C – 0<br>D – 1<br>E – 2 | B – 0<br>C – 0<br>D – 0<br>E – 3<br>F – NSV* | Environmental maintenance. |
| All traffic restraining devices are maintained in an effective operating condition. | Restraining devices, such as:<br>- bridge side rails<br>- guardrails<br>- wire rope barriers<br>- crash cushions | Safety inspection. | All – 100% | | Traffic services maintenance; Structures maintenance. |
| Where shoulders are provided they are maintained in a state that allows safe stopping or recovery by vehicles. | A vehicle wandering from the traffic lane to the shoulder at the 85%ile road speed shall be able to safely return to the traffic lane. | Safety inspection. | All – 100% | | Sealed pavement maintenance. |
| Roadside safety zones are maintained free of unauthorised obstructions. | Obstructions, such as:<br>- self-sown trees<br>- abandoned vehicles<br>- unauthorised advertising signs<br>- unauthorised storage | Safety inspection. | NSV | All – 100% | Routine drainage maintenance. Environmental maintenance. |
| Carriageway lanterns are maintained in an effective operational condition. | Maximum number of adjacent defective or non-operating lanterns. | Safety inspection. | A – 0<br>B – 2<br>C – 2<br>D – NSV<br>E – NSV | B – 2<br>C – 2 | Traffic services maintenance. |
| Traffic signals (incl. at rail crossings) operational at all times. | 100% of lanterns operational. | Safety inspection. | All – 100% | | Operational traffic management. |

*NSV = no specified value for this group.

## ASSET PRESERVATION MEASURES

| Measures | Explanation | Method of measurement | Target values by road group | | Related NLTP work category |
|---|---|---|---|---|---|
| | | | Urban | Rural | |
| Change in Pavement Integrity Index (PII) of sealed network. | Change over previous 3 years for each road group, and the predicted change over the next 10 years, resulting from the proposed works programme. | dTIMS report (current and predicted), historical levels from RAMM. | Each road group: +/- 5% | | Sealed road pavement rehabilitation; Sealed pavement maintenance. |
| The length of the sealed network overdue for resurfacing. | The aim is to reseal at the optimum time by a managed reduction in backlog. | RAMM remaining life report. | All reseals done in optimum year. | | Resurfacing. |
| Structural integrity of structures is not diminished by lack of maintenance. | Structures, such as:<br>- bridges<br>- retaining walls<br>- lighting columns. | Inspection programme. | All structures regularly inspected and faults remedied. | | Structures maintenance; Traffic service maintenance. |
| All bridge waterways clear of **significant** obstructions. | Significant obstructions such as:<br>– debris at piers. | Visual inspection. | At all times. | | Structures maintenance. |
| All drainage facilities functioning satisfactorily. | Drainage facilities, such as:<br>- culverts<br>- kerb and channel<br>- surface water channels<br>- sumps. | Inspection programme. | At all times. | | Routine drainage maintenance; Drainage renewals. |
| **Unsealed roads - Interim measure until better research/tools available:** | | | | | |
| Adequate pavement depth is maintained. | Adequate metal replacement is programmed. | Annual quantity of metal spread. | Metal spread is equal to estimated | | Unsealed pavement maintenance. |

# 4. Commentary

## 4.1 Road groups

The guidelines use a total of 12 road groups; five urban; five rural; two for tracks. The aim was to have the least practical number for maintenance purposes. There will be very few local authorities, if any, that use all of the groups. Six or seven groups will cover most networks. After discussions with focus group participants, the rural low volume categories split was set at 200vpd. Levels of service would be expected to change at 200 vpd rather than 500 vpd. This will also reflect more closely the split between unsealed and sealed roads.

## 4.2 Road user satisfaction measures

### 4.2.1 Maximum average roughness on sealed roads

Explanation of measure: The target value measures the maximum average NAASRA roughness count of all sealed roads in each road group.

NZTA considers that it is more meaningful to the road user and asset manager to specify a roughness for each road group rather than a smooth travel exposure rate or a weighted average for the total road length.

### 4.2.2 Maximum roughness on roughest sealed roads

Explanation of measure: No more than five percent by length of roads in any group shall exceed the average roughness limit as stated in the target values.

The length of road within any group will be relatively small, so the roughest five percent will be a very manageable and easily identified length.

### 4.2.3 Number of maintenance related faults that are likely to affect driver behaviour

Explanation of measure: The target values measure the number of faults per one lane-kilometre of urban streets or any 10 lane-kilometre route in rural areas.

Since this is a user satisfaction measure, only those faults that adversely affect the driver or the vehicle are of concern here. Other faults will be accounted for in safety and asset preservation measures. Implicit in this measure is the assumption that the urban (lower speed) user will tolerate 10 times as many faults/km as the rural (higher speed) user.

### 4.2.4 Adequacy of destination and directional signs

Explanation of measure: All route destinations are clearly sign-posted.

The expectation is that a driver will be able to travel along normal routes between significant locations and have the route clearly indicated at each intersection where a change from the through road is required.

### 4.2.5 Visibility not restricted by dust

Explanation of measure: The target value measures the distance from the source vehicle at which adequate visibility is restored.

The dust clouds created by passing vehicles can cause significant discomfort and environmental problems. Dust creates two forms of dissatisfaction to the driver:

- the irritation and discomfort to the body caused by the particles themselves
- the reduction in visibility caused by the air born particles.

It is the reduction in visibility that is the most easily measured, but addressing this will improve other effects. Although at low traffic volumes there is a very low risk of there being a third vehicle present, there is very high discomfort or unease caused by the perceived risk of a third vehicle being hidden in the cloud.

Because a following vehicle can adjust its speed to limit the impact of dust nuisance, the worst case is passing a vehicle travelling in the opposite direction. In that scenario at vehicle speeds of 70 km/h, a dust cloud of 50 m equates to approximately 1.3 seconds of inadequate visibility and 100 m to 2.6 seconds.

### 4.2.6 Corrugations on unsealed roads

Explanation of measure: The target value measures the proportion of any road section significantly corrugated.

Corrugations are defined as transverse undulations, closely and regularly spaced. They are caused by inadequate quality of base material for the prevailing climatic and traffic conditions. They most commonly occur in dry conditions and are aggravated by braking and by wheel spin on gradients and when accelerating.

Corrugations create dissatisfaction to the driver by:

- discomfort to the body
- affecting the ease of steering a vehicle in often critical situations, eg tight winding hilly roads or high-speed straight flat sections
- increase on vehicle wear
- damage to produce and freight during travel.

It appears that any series of corrugations causes dissatisfaction, with little relationship to length or depth. The appearance of corrugations does not always relate to traffic volumes although traffic behaviour can increase their severity.

### 4.2.7 Availability of road after emergency closure

Explanation of measure: The target value gives the maximum time to be taken to restore vehicle access by detour, or reopen roads to at least a single lane for 20 minutes per hour.

The expectation is that even after severe storm events, routes on major roads will be restored (or detours available) within hours, and on minor roads some form of access to property and service centres will be available within days.

### 4.2.8 Number of maintenance related hazards on cycleways requiring evasive action by rider

Explanation of measure: The target value measures hazards, per kilometre of cycleway, such as:

- detritus

- ponding water
- potholes
- broken glass.

Since this is a user satisfaction measure, only those maintenance related faults that create hazards or annoyance for the cyclist are of concern here.

## 4.3 Safety measures

### 4.3.1 Adequate provision, visibility and reflectivity of traffic services facilities for safe travel at normal day and night operating speeds on wet or dry road

Explanation of measure: The target values consider deficient traffic services facilities, per one kilometre of urban street or any 10 kilometre route in rural areas, grouped by type.

- signs – regulatory and warning
- edge marker posts (EMPs)
- RRPMs
- pavement markings.

The expectation is that all regulatory and warning signs will be in place and clearly visible at all times, but that some missing RRPMs, EMPs and ineffective pavement markings are acceptable.

### 4.3.2 Adequate skid resistance on all sealed roads

Explanation of measure: The target values are aimed to achieve no section of sealed road with a skid resistance insufficient for its location.

It is not the NZTA's intention to require extensive and costly survey and testing programmes by TLAs. Hence, quantitative skid resistant values have deliberately not been specified, nor have complete strategies for dealing with skid resistance. Strategic principles adopted by individual local authorities will depend largely on the resources available.

Instead, a simple procedure, for identifying hazardous sites and assessing their risk, followed by guidelines for deciding on appropriate action, has been included. Refer to Appendix A.

Crash studies undertaken in many countries have demonstrated the generic principle that crash rates increase as skid resistance falls. There is also convincing evidence that crash rates reduce following treatment to improve skid resistance. Therefore, analysis of the wet road crash rates is a valuable indicator of skid resistance levels.

Where reliable crash data is not available the other indicators are used alone.

### 4.3.3 Loose gravel on unsealed roads

Explanation of measure: It is desirable to attain a bound riding surface with minimal loose gravel. The target values measure the maximum depth of loose material across the carriageway.

Loose gravel is defined as unbound, fine or coarse material on the pavement surface. It can occur as a variable layer spread over the whole surface, or in narrow continuous mounds (windrows) between wheel tracks, or at the road edge.

This measure is not related to average daily traffic (ADT).

One of the worst situations associated with loose gravel is on bends that have restricted sight distance and poorly maintained superelevation. Vehicles are forced to follow two-wheel tracks on a single lane.

### 4.3.4 Sight distance is not restricted by vegetation growth / trees

Explanation of measure: The target values measure the number of deficient locations per one kilometre of urban streets or any 10 kilometre route in rural areas.

On reasonably busy roads, sight distance is not expected to be restricted by any vegetation.

### 4.3.5 All traffic restraining devices are maintained in an effective operating condition

Explanation of measure: Restraining devices considered under these guidelines include:

- bridge side rails
- guard rails
- wire rope barriers
- crash cushions

Where such devices have been provided it is expected that they will be maintained in a state fit for their purpose at all times.

### 4.3.6 Where shoulders are provided, they are maintained in a state that allows safe stopping or recovery by vehicles

Explanation of measure: A vehicle wandering from the traffic lane to the shoulder at the 85 percentile road speed should be able to safely return to the traffic lane.

It is recognised that few local roads have trafficable shoulders, but where they have been provided it is expected that they will be maintained in a state fit for their purpose. Refer to Figure 1 of these guidelines for a definition of a shoulder.

### 4.3.7 Roadside safety zones are maintained free of unauthorised obstructions

Explanation of measure: Obstructions on the roadside may be:

- self-sown trees
- abandoned cars
- unauthorised advertising signs
- unauthorised storage.

Refer to the NZTA's *Guidelines on Roadside Safety Zones* for a fuller explanation of the management of these zones.

Roadside safety zones are generally defined as the areas adjacent to the traffic lanes that are available for the recovery of vehicles that have left the carriageway or where drivers can bring vehicles to rest without personal injury. Where possible, the roadside safety zones should be free of all hazards.

### 4.3.8 Carriageway lanterns are maintained in an effective operational condition

Explanation of measure: The target value relates to the maximum number of adjacent defective or non-operating lanterns.

Over the entire network it is acceptable for there to be isolated ineffective lanterns, but the hazard will increase with increasing traffic volume and for urban Group A it is unacceptable to have any adjacent ineffective lanterns.

### 4.3.9 Traffic signals operational at all times

Explanation of measure: The target is to have all lanterns, including those at rail crossing signals, operational at all times.

## 4.4 Asset preservation measures

### 4.4.1 Change in the pavement integrity index (PII) of the sealed network

Explanation of measure: The target value measures the change over the previous three years for each road group, and the predicted change over the next 10 years, resulting from the proposed works programme.

Land Transport NZ has utilised a composite condition index rather than 'remaining useful life' values or calculations because of the variety of current methodologies utilised for the latter, and the issues that can arise due to these variations. The make-up of the index has been based on conditions that are already rated and stored in the RAMM database and the current RIMS dTIMS set-up. The primary reason for this is to maximise the use of what is already available, and minimise the need to collect further information.

The proposed composite condition index incorporates components that can indicate a pavement's health, namely:

- rutting (RDM)
- cracking (ACA)
- roughness (NAASRA or IRI)
- shoving (ASH)
- potholes and patches (ACP)

It is in a format consistent with the current Surface Integrity Index (SII) utilised in the RIMS dTIMS model.

If the number of sections contained within a road group is small, then the average of the group can be expected to vary by more than that of a large sample. This would be taken into account in any Land Transport NZ audits.

### 4.4.2 Length of the sealed network overdue for resurfacing

Explanation of measure: The aim is to reseal at the optimum time by a managed reduction in backlog.

While the target is to do all reseals at the optimum time it is recognised that operationally this will be modified to produce reseal lengths that minimise contract overheads and traffic disruption.

### 4.4.3 Structural integrity of structures is not diminished by lack of maintenance

Explanation of measure: Structures considered under this measure include:

- bridges
- retaining walls
- lighting columns

Asset managers should have an inspection programme in place with a frequency of inspections sufficient to ensure that the structural integrity is not compromised by lack of maintenance.

### 4.4.4 All bridges and waterways clear of significant obstructions at all times

Explanation of measure: The expectation is that no debris will be allowed to accumulate and significantly obstruct a waterway at a bridge.

### 4.4.5 All drainage facilities functioning satisfactorily

Explanation of measure: Drainage facilities considered under this measure include:

- culverts
- kerb and channel
- surface water channels
- sumps.

The flow of water through any drainage facility should not be impeded by debris or broken components.

### 4.4.6 Unsealed road pavements

Explanation of measure: The aim of this measure is that adequate pavement depth is maintained through a cyclic replacement programme.

This is an interim measure until better research/tools are available.

# Appendix A

## Method for the identification and programming of sites with insufficient skid resistance

### (a) Introduction

This guide primarily deals with methods to ensure that the road surface is able to provide a certain level of surface friction (skid resistance) through routine and reactive maintenance.

**Note**: The development of a mechanical testing regime through routine collection of data to identify, prioritise and programme sites where treatment may be required is outside the scope of this guide. Development of proactive methods using the routine collection of data on surface friction is, however, encouraged where resources permit.

The general process for identification and programming of sites with insufficient skid resistance is as follows:

1. Desktop study – analysis of data and identification of sites for investigation/remedial action.
2. Undertaking of site investigations.
3. Prioritising and programming required remedial actions.
4. Monitoring the success of remedial actions.

It is vital that findings of field investigations and information considered during this process, including desktop analysis, are formally recorded and retained. This will aid the development of a successful local strategy to minimise friction-related crashes, improve the network user safety and mitigate the risk of claims.

### (b) Desktop study

The purpose of the desktop study is to shortlist sites for a site investigation. The elements of a desktop study should include:

- a crash analysis to identify sites with an accident history. In particular, loss of control in wet-type accidents may indicate skid resistance at the site and needs to be investigated
- analysis of data from skid resistance surveys (if available)
- analysis of surfacing records to identify sites that may be polished. Seal age, PSV of chip and traffic volume should be considered
- analysis of RAMM condition data to determine surface condition. Factors such as low surface texture (flushing/bleeding) which may affect skid resistance should be considered
- other factors such as local knowledge, public complaints, sites with poor geometry, sites where surface water or ponding may be a problem etc.

### (c) Skid site investigations

Personnel with both asset management and road safety engineering experience should ideally undertake site investigations.

Once on site, identify factors (listed in the table below) influencing levels of skid resistance.

| Road surface | Road geometry | Other |
|---|---|---|
| Texture depth, bleeding, flushing.<br>Roughness.<br>Surface water drainage.<br>Surface contaminant ie mud, gravel, ice.<br>Variation in skid resistance.<br>Differences in wheel paths.<br>Unexpected change in skid resistance.<br>Degree of chip polishing*, seal age, PSV. | Gradient<br>Crossfall<br>Curvature<br>Design speed<br>Advisory speed | Traffic volume, % HCV.<br>Site definition ie junctions, traffic lights, roundabouts.<br>Risk issues, ie school, pedestrian crossing.<br>Maintenance schedule.<br>Modifications planned.<br>Hazards, eg warning signs, sight distance.<br>Isolated curves surprise effect.<br>Benefit/cost ratio of modifications. |

*Chip polishing (smoothing and rounding of the upper surface of the road stone) usually occurs in the wheel tracks. It can be partly identified by the relative appearance and feel of trafficked and untrafficked areas. Polished areas feel relatively smooth and will sometimes be noticeably shiny. The quantity of polishing cannot be quantified by observation. For sites suspected of polishing, mechanical testing can be used to quantify the degree of polishing. For small one-off sites mechanical test equipment such as 'Griptester' or British Pendulum is useful.

### (d) Possible programming outcomes of a site investigation

A. No action (eg it is found that the skid resistance when all factors are considered appears to be adequate or data is unrepresentative of the conditions found on the site at the time of the site investigation).

B. Continue to monitor the site (possibly while utilising 'slippery when wet' signs in accordance with local policy, where appropriate). This will generally be where crash data does not give rise to concern and where the road surface does not require maintenance as a result of other factors.

C. Consider further testing to determine if the surface has adequate skid resistance. For sites suspected of polishing, mechanical testing can be used to quantify the degree of polishing. For small one-off sites mechanical test equipment such as Griptester or British Pendulum is useful.

D. The listing of the site for remedial action to restore the surface skid resistance, eg reseal, resurface (for guidance on PSV calculation TNZ T10 site categories can be used), retexture, waterblasting, install appropriate signage/road marking/delineation etc.

### (e) Prioritisation of sites

Prioritisation of sites for treatment is likely to be affected by funding levels, exposure and site location. A suggested prioritisation system is given in the table overleaf.

| Site location [1] | AADT >5000 | AADT 200-5000 | AADT <200 [2] |
|---|---|---|---|
| Accident site (skid-related) | Highest priority | Highest priority | Highest priority |
| Approaches to:<br>• railway level-crossings<br>• traffic lights<br>• pedestrian crossings<br>• roundabouts<br>• top and give way intersections<br>• one-lane bridges | Highest priority | Medium priority | Lowest priority |
| Isolated curves < 250 radius and or steep down gradient >10% | Highest priority | Medium priority | Lowest priority |
| Uncontrolled approaches to intersections | Medium priority | Medium priority | Lowest priority |
| Event free – where no geometrical constraint, or situations where vehicles may be required to brake suddenly and may influence skid resistance requirements. | Lowest priority | Lowest priority | Lowest priority |

Notes:

1 Where the site location combines with other factors such as surface condition requiring maintenance, the priority should be raised to the next level.

2 Typical treatment options for 'lowest priority' are likely be of type 'B' on the previous page.

### (f) Monitoring

Monitoring of sites where remedial actions have been implemented to determine the adequate level of skid resistance is maintained, is also recommended. This could be done annually as part of the forward works programming.

### (g) Useful reference documentation

TNZ. Specifications for state highway skid resistance management (2012) *T/10* and TNZ *T/10 Notes*

NZTA. *Economic evaluation manual*

NZTA. *Road safety briefing notes* (annual reports)

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