Traffic Standards and Guidelines
1999 Survey

RSS 10

Skid Resistance

LAND transport safety AUTHORITY

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Survey of Traffic Standards and Guidelines

The Land Transport Safety Authority (LTSA) is a stand-alone authority responsible for promoting safety in Land Transport at reasonable cost. Part of its function is to "monitor adherence to safety standards within the land transport system".

To support this objective the regional engineering sections of the Land Transport Safety Authority undertake a survey programme that assesses the implementation effectiveness of various safety standards by road-controlling authorities.

The purpose of these surveys is to:

- assist and advise road controlling authorities on the implementation of selected traffic standards and guidelines that affect traffic safety;
- measure the uptake of standards and guidelines by road controlling authorities;
- provide a national summary of the uptake and compliance with standards and guidelines and report findings to road controlling authorities and other interested parties; and
- identify changes to improve standards, guidelines or traffic rules.

The surveys are usually carried out in two parts:

- Part 1 uses a questionnaire to look at the systems and procedures a road controlling authority has in place to deliver on the standard.
- Part 2 uses a field survey to measure where possible the actual delivery from the users viewpoint. It essentially provides a snapshot of road safety delivery at the date of the survey.

This report presents the national results of the latest of these surveys

I believe you will find the information of value and will be able to use it to improve road safety in New Zealand.

Please contact the Regional Engineer at the LTSA's Auckland, Wellington or Christchurch Office if you would like further information or assistance with implementing traffic standards or guidelines.

Rob Martyn,
General Manager, Operations

Executive Summary

Introduction

- Interview surveys were conducted during April and May 1999 with a sample of 31 road controlling authorities (RCAs) to investigate procedures and programmes for three safety areas – skid resistance, pedestrian platforms and floodlighting of pedestrian crossings.

- Field surveys were undertaken at a number of pedestrian platform sites and floodlit pedestrian crossings but were not undertaken for skid resistance.

- This report details the results of the interview survey of skid resistance. Companion reports detail the results of the other two surveys.

Results

- Ten (32%) of the surveyed RCAs had programmes for regular skid resistance testing, and 6 (20%) tested on an ad hoc basis. While the remaining 15 (48%) of the RCAs surveyed had not undertaken any skid resistance testing four had plans to test in future.

- Twenty-two (71%) of the RCAs had not adopted a policy for skid resistance investigatory levels.

- Twenty-three (74%) of the RCAs had specifications for constructing pavements with an appropriate level of skid resistance. Twenty-two of the 23 named Transit New Zealand's *M/6 Specification for Sealing Chip*. However, only 15 (48%) of the RCAs always specified minimum levels of Polished Stone Value for aggregate.

- Sixteen (52%) of the RCAs had a policy on the minimum skid resistance of road markings all naming Transit New Zealand's M/7 : 1998 *Specification for Road Marking paint* as their policy. Fourteen (45%) had no policy, and one RCA was unsure.

Discussion

- Approximately half of the RCAs were undertaking any skid resistance testing. RCAs are likely to be unaware of sites with low skid resistance however, apart from one, all were using other avenues such as complaints, crash records, and visual inspections to identify sites where skid resistance may be a problem.

- Only around one third of RCAs used skid resistance test results in determining reseal programmes. Virtually all used visual inspections and seal ages.

- Many RCAs did not specify the properties of aggregate being used in new pavements. Most claimed to have a good knowledge of the aggregates in use in their area but this would not include detail on the level of microtexture skid resistance.

- Most RCAs have recognised the need for monitoring of skid resistance, but have considered that testing was previously not economic. With Transit New Zealand now bringing the SCRIM machine into the country each year, many RCAs are accepting that it is economic to have the SCRIM machine include a selection of roads on their network.

Recommendations

- Where economic, skid resistance measurements should be undertaken and used to help determine reseal programmes.

- To be pro-active in identifying deficiencies, RCAs should undertake skid resistance measurements and monitoring.

- RCAs should adopt realistic investigatory levels of skid resistance.

- RCAs should develop a programme to prioritise the improvement of skid resistance at locations where the skid resistance is below investigatory levels.

- RCAs should use all sources of available data to identify locations where skid resistance may be a problem.

- RCAs should use specifications to ensure that pavements are constructed with the appropriate level of skid resistance. RCAs should also specify in their contract documentation, the minimum acceptable Polished Stone Value of aggregate.

- RCAs should specify in their contract documentation, the minimum acceptable skid resistance of road markings.

- RCAs should ensure that appropriate drainage treatments are used to minimise the retention of surface water.

Contents

1. Introduction

During April and May 1999 the Regional Offices of the Land Transport Safety Authority (LTSA) conducted surveys of three safety areas in 31 road controlling authorities (RCA). The 31 RCAs included three regional offices of Transit New Zealand and 28 territorial local authorities.

The three safety areas surveyed were:

- Skid resistance (interview surveys only)
- Pedestrian platforms (interview and field surveys)
- Floodlighting pedestrian crossings (interview and field surveys)

This report describes the procedures for the skid resistance surveys and presents the results.

2. Purpose of the Surveys

The purpose of the surveys was to:

- Establish what standards and guidelines RCAs used
- Measure performance against current standards and guidelines
- Provide a national summary of results and report to interested parties
- Identify any justifiable changes to standards, guidelines, or traffic rules

3. Methodology

3.1 Sample Selection

A sample of 31 RCAs was chosen for inclusion in the surveys. This included 28 territorial local authorities and three regional offices of Transit New Zealand. The sample was weighted towards authorities not included in the LTSA's survey the previous year.

3.2 Interview Surveys

Interview surveys were conducted with representatives of each authority. Survey forms were sent in advance to allow time to research answers if necessary. Questions centred on the standards and guidelines used for determining if skid resistance was appropriate.

The Skid Resistance Questionnaire is attached as Appendix 1.

3.3 Field Surveys

No field surveys were carried out on this topic.

4. Results

4.1 Interview Surveys

4.1.1 Determining Reseal Programmes

Authorities were asked what factors were considered in determining reseal programmes. The factors identified were:
- Seal ages 94% (29) of respondents
- Visual inspections 90% (28)
- Skid resistance testing 32% (10)

Among "other" factors identified were:

- RAMM algorithm or RAMM condition rating 58% (18)
- Maintenance Savings 13% (4)
- Crash data 6% (2)
- Roughness surveys 6% (2)

4.1.2 Skid Resistance Testing

The testing cycle and numbers of authorities following each regime were as follows:

- Regular testing 32% (10)
- Ad hoc or irregular testing 19% (6)
- No testing 48% (15)

The three Transit New Zealand regions undertook regular skid resistance testing on all roads within their jurisdictions. The remaining thirteen RCAs which had undertaken skid resistance testing only tested a sample of roads.

The sample was selected using the following information:
- Traffic volumes or road hierarchy 29% (9)
- "Problem sites" e.g. flushing observed 13% (4)

- Crash history 6% (2)
- High speed routes 6% (2)
- Seal ages 3% (1)
- Aggregate types 3% (1)

Four of the fifteen authorities not undertaking skid resistance testing had plans to undertake SCRIM testing in future whenever the SCRIM machine was in the country.

The testing devices used by authorities were as follows:

- SCRIM 35% (14)
- British Pendulum Tester 29% (9)
- Grip Tester 16% (5)
- Mu Meter 3% (1)

4.1.3 <u>Investigatory Skid Resistance Levels</u>

Investigatory skid resistance levels are pre-determined values below which skid resistance may be a problem. The values are used in conjunction with field test results to indicate when skid resistance may be deficient and intervention will be required. They can also be used in conjunction with field test results to assist authorities in prioritising the resurfacing programme. There will normally be a range of investigatory levels as friction demand will vary according to site.

RCAs were asked if they had adopted any investigatory levels, either formally or informally, and what they were. Most (71% or 22) had not adopted a policy for investigatory levels. Nine (29%) had adopted a policy for investigatory levels nominating Transit New Zealand's *TNZ T/10 : 1998 Specification for Skid Resistance deficiency investigation and treatment selection* (TNZ T/10).

The values of the investigatory levels of skid resistance or sideways force coefficient (SFC) contained in TNZ T/10 : 1998 are given in appendix 2:

Of the nine RCAs which had adopted this policy:

- eight believed they could reasonably estimate the proportion of their road network with skid resistance (sideways force co-efficient) below the investigatory levels.

- eight had a programme to improve skid resistance at locations where skid resistance is below the investigatory levels.

The nine authorities were asked what constraints they had encountered to improving skid resistance at locations that fall below investigatory levels. The following issues were identified.

- Funding (5)
- Technical issues (1)

4.1.4 Specifications for Ensuring Pavements are Constructed with the Appropriate Skid Resistance

Specifications used to ensure pavements were constructed with the appropriate level of skid resistance were as follows:

- 22 (71%) of the RCAs used TNZ M/6 Specification for Sealing Chip
- 7 (23%) had no specifications
- 4 (13%) follow up sand circle tests (this test indicates macrotexture only)
- 1 (3%) *Bituminous Sealing Manual, Table 2.1* (1)

The concerning aspect here is that 23% (7) RCAs had minimal control over the skid resistance of chip being applied to roads within their jurisdiction. Also, two of the four RCAs that specified follow up sand circle tests had no mechanism to ensure microtexture requirements were met.

Polished Stone Value (PSV) is a figure derived from a laboratory test that indicates the resistance of a stone to polishing. It is an important factor in predicting skid resistance. The extent of polishing is strongly affected by the volume of commercial vehicles per day. Polished stone is linked with lowered skid resistance.

Asked whether they specified the PSV of aggregate used in their area the responses were as follows:

- 15 (48%) always specified PSV
- 14 (45%) did not specify PSV
- 2 (7%) sometimes specified PSV (e.g when skid resistance was being addressed

The minimum values of PSV specified by TNZ M/6 Notes : May 1993 are shown in Appendix 2

The RCAs were asked if they used high PSV aggregate. Most did not although most were aware of the availability of high PSV aggregate. Six had used calcined bauxite and two had used blast furnace slag.

4.1.5 Alternatives to Testing to Identify Potential Sites of Low Skid Resistance

Authorities were asked what avenues other than skid resistance testing were used to identify potential sites of low skid resistance. All identified some sources of information including:

- Police reporting or crash records 84% (26)
- Road user reports or complaints 77% (24)
- Crash reduction studies 55% (17)
- LTSA *Road Safety Reports* 45%(14)
- Inspections 16% (5)
- Local reporting of crashes 10% (3)

4.1.6 Drainage Improvements

The presence of surface water is an important factor in skid resistance. Authorities were asked to identify what methods, apart from the usual considerations of crossfall and shoulder grading, they had used to improve surface drainage. The following methods were identified:

- porous pavement material e.g. “friction course” 45% (14)
- surface grooving 23% (7)
- water blasting of porous pavements 10% (3)
- increased crossfall 10% (3)
- coarser chip 6% (2)
- seal smoothing to repair low spots 6% (2)
- texturise surface 3% (1)
- reseal 3% (1)
- reconstruct 3% (1)

4.1.7 Skid Resistance of Road Markings

Sixteen (52%) RCAs authorities had a policy on the skid resistance of road markings naming Transit New Zealand's *TNZ M/7* 1998 *Specification for Road Marking Paint.* This specifies a minimum skid resistance of 30 BPN (British Pendulum Number).

Of the other RCAs fourteen had no policy, and one was unsure.

5. Discussion

- Only around half of the road controlling authorities surveyed are undertaking any skid resistance testing. The concerning aspect of this is that many RCAs may be unaware of sites with low skid resistance problem. However, it is encouraging to note that all apart from one RCA are using other avenues such as complaints, crash records, and visual inspections to identify sites where skid resistance may be a problem.

- Only around one third of RCAs used skid resistance test results in determining reseal programmes. Virtually all used visual inspections and seal ages.

- Many RCAs do not specify the properties of aggregate being used in new pavements, however most claimed to have a good knowledge of the aggregates in use in their area. This is concerning, as the aggregate being used may not have the required level of microtexture skid resistance.

- Most RCAs have recognised the need for monitoring of skid resistance, but have considered that testing was previously not economic. With Transit New Zealand now bringing the SCRIM machine into the country each year, many RCAs are accepting that it is economic to have the SCRIM machine include a selection of roads on their network.

6. Recommendations

- Where economic, skid resistance measurements should be undertaken and used to help determine reseal programmes.

- To be pro-active in identifying deficiencies, RCAs should undertake skid resistance measurements and monitoring.

- RCAs should adopt realistic investigatory levels of skid resistance.

- RCAs should develop a programme to prioritise the improvement of skid resistance at locations where the skid resistance is below investigatory levels.

- RCAs should use all sources of available data to identify locations where skid resistance may be a problem.

- RCAs should use specifications to ensure that pavements are constructed with the appropriate level of skid resistance. RCAs should also specify in their contract documentation, the minimum acceptable Polished Stone Value of aggregate.

- RCAs should specify in their contract documentation the minimum acceptable skid resistance of road markings in their contract documentation.

- RCAs should ensure that appropriate drainage treatments are used to minimise the retention of surface water.

Appendix 1

Skid Resistance Questionnaire, 1999

Road Controlling Authority

____

Person(s) Interviewed

____

Contact Phone No. ___________________________

Date ____________________

Interviewer ______________________________________

QUESTIONS
1. Who determines the reseal programme within your authority?
2. How is the reseal programme determined? ☐ Seal ages ☐ Visual inspections ☐ Skid resistance testing ☐ Other _____________
3. Does your authority undertake skid resistance measurements? ☐ Yes ☐ No
4. If skid resistance measurements are not undertaken by your authority, do you have any plans to monitor skid resistance in future? ☐ Yes ☐ No
5. If skid resistance measurements are undertaken by your authority; • What is the testing cycle? • Are all roads in your authority surveyed or only a sample? If only a sample are surveyed, how are the sites chosen? • What measuring devices are used? e.g. SCRIM, Grip Tester, British Pendulum Tester. • What adjustments are made to the measured values for the (major) effect of

seasonal variation in skid resistance?
6. Has your authority formally or informally adopted any investigatory levels for skid resistance (sideways force co-efficient or SFC)? ☐ Yes ☐ No If yes, what policy is adopted and what are the values of the investigatory levels?
7. What proportion of your road network has skid resistance (sideways force co-efficient or SFC) below the investigatory levels? Does your authority have a programme to improve skid resistance at these locations? ☐ Yes ☐No What constraints has your authority encountered to improving skid resistance at locations that fall below investigatory levels?
8. What specifications are used by your authority to ensure pavements are constructed with the appropriate level of skid resistance? Does your authority specify the Polished Stone Value (PSV) for aggregate? ☐ Yes ☐ No If so, what are the values specified? Does your authority make use of high PSV aggregate. ☐ Yes ☐ No If so, what materials are they, and when and where are they used?
9. Does your authority use other avenues (other than skid resistance testing) to identify potential sites of low skid resistance? e.g. Police reports, Crash Reduction Studies, Road Safety Reports, road user complaints.
10. What methods has your authority used to improve surface drainage? e.g. surface grooving, use of porous pavements, water blasting of porous pavements.
11. Does your authority have any policy on skid resistance of road markings? ☐ Yes ☐ No If so, what is the policy and what minimum value of skid resistance is specified?
12. Can the LTSA provide assistance in any way?

Appendix 2

Polished Stone Value requirements from TNZ M/6 Specification for Sealing Chip Notes

Category No.	Site Description	PSV of Aggregate Traffic in Heavy Commercial Vehicles per Lane per Day					
		<250	1000	1750	2500	3250	4000
1	Railway level crossings Approach to traffic lights Approach to pedestrian crossings Roundabouts.	55	60	65	70	75	75
2	Bends < 250m radius Gradients steeper than 10% > 50m length	50	55	60	65	70	75
3	Approaches to road junctions Gradients 5–10% > 50m length	45	50	55	60	65	70
4	Undivided carriageway	40	45	50	55	60	65
5	Divided carriageway Motorway	35	40	45	50	55	60

Investigatory Skid Resistance Levels from TNZ T/10:1998 Specification for Skid Resistance Deficiency Investigation and Treatment Selection

Site Category	Site Definition	Investigatory Level (SFC)*	Demand Category
1	Approaches to railway level crossings, traffic lights, pedestrian crossings, roundabouts.	0.55	High Demand
2	Curve < 250m radius Down gradients > 10%	0.50	High Demand
3	Approaches to road junctions Down gradients 5 – 10% Motorway junction area	0.45	High Demand
4	Undivided carriageways (event - free)	0.40	Low Demand
5	Divided carriageways (event - free)	0.35	Low Demand

*SFC = Sideways Force Coefficient

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These reports may be purchased from the Regional Engineer, Land Transport Safety Authority in Auckland (Private Bag 106-602), Wellington (PO Box 27-249) or Christchurch (PO Box 13-364) at a cost of $10 each including GST.