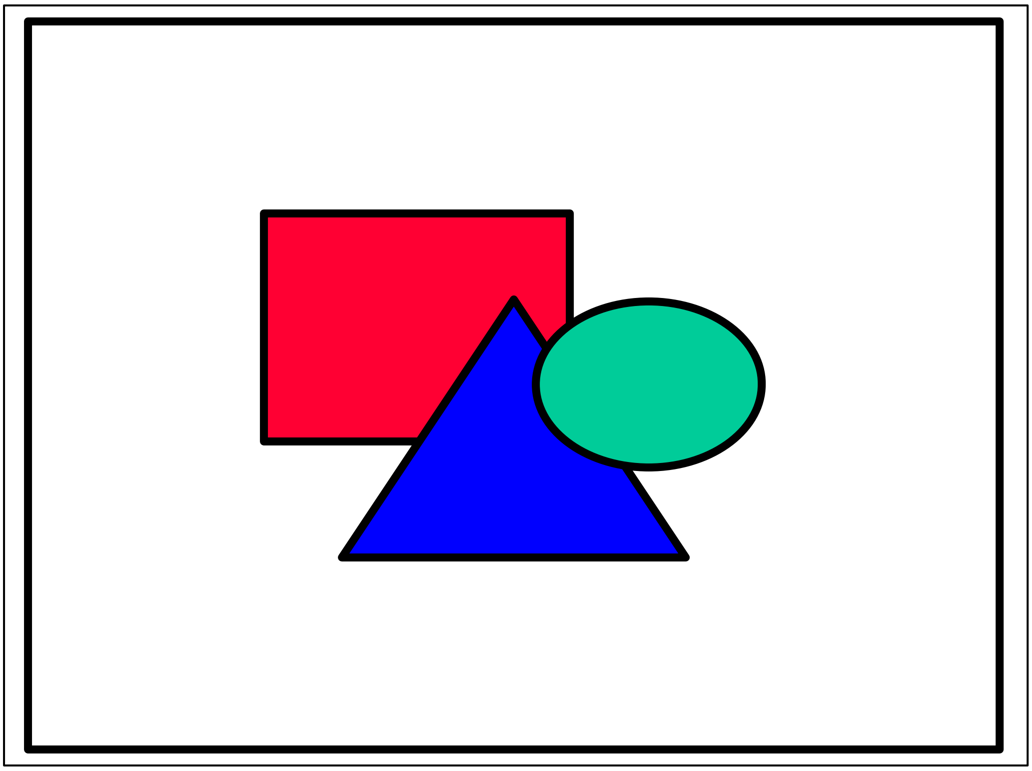
Traffic Standards and Guidelines
2000/2001 Survey

RSS 15

Roadside Hazard Management

LAND transport safety AUTHORITY



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Survey of Traffic Standards and Guidelines

The Land Transport Safety Authority (LTSA) is the government agency 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.

William McCook,
General Manager, Operations

Executive Summary

Introduction

- Interview surveys were conducted during 2001 with 30 road controlling authorities (RCAs) to investigate procedures and policies for two safety areas – road hierarchies and roadside hazard management.
- This report details the results of the surveys of roadside hazard management. A companion report details the results of the surveys of road hierarchies.
- Field surveys on roadside hazard management were conducted on a sample of new roads and at crash sites to:
  - measure on-road practices of roadside hazard management on new or reconstructed roads,
  - examine the site characteristics and types of treatments used at sites of collisions with poles, trees or guardrail ends, and
  - provide a national summary of results and report to interested parties.

Interview Findings

- Respondents referred to a wide variety of national and local standards and policies used for roadside hazard management with 15 (50%) of them, plus Transit New Zealand, reporting their own specific standards or policies.
- Similarly, they reported procedures ranging from a full safety audit process to “no programme or method” to manage roadside hazards on new roads. Consequently, the estimates of the proportion of new roads that met the desired standards ranged from 100% to “a low percentage.”
- For existing roads and streets only about a third of authorities reported proactive procedures (such as on-going monitoring and reporting, safety audits or systematic audits of roadside hazards) for identifying or treating roadside hazards. Most relied on a combination of public feedback, informal drive-overs and traffic crash reports.
- Utility poles and trees (in that order) were reportedly the most difficult roadside hazards to deal with in urban areas with ditches, poles and trees (in that order) the most difficult in rural areas.
- Nearly all authorities reported using W-section guardrail with only one or two using wire rope barrier, New Jersey barrier, or earth bunding.

- Authorities reported a wide range of local agreements and relationships with utility companies on the installation of poles on the road reserve. About half these were reported to be successful to some degree.
- Respondents reported a similar variety of attitudes to roadside tree planting with about a third advising that aesthetics took precedence over safety in their authority.
- The most common comment, made by 13 respondents, on the LTSA's role, was that the Land Transport Safety Authority (LTSA) should publish a good practice guide on roadside hazard management.

Field Survey Results

- The results of the field surveys of new or reconstructed roads showed an awareness of roadside hazard management issues and reasonable compliance with good practice.
- The three main areas of concern (which were also identified as such in the interviews) from the field surveys of new roads were:
  - the lack of ability to deal with utility poles on the roadside,
  - the construction of drains or non-recoverable slopes along the roadside, and
  - planting trees along the roadside (especially on arterials and collectors) for aesthetic reasons.
- The number of sites of collisions with roadside hazards that had been effectively treated was disappointingly low in both urban and rural areas. This was especially so for the sites of fatal collisions. Overall 75-80% of sites either had nothing done or a damaged pole or tree had been replaced in the same location.
- The survey of crash sites has provided some information on the characteristics of these sites, however control data is needed to make definitive statements on how to prioritise sites for proactive treatment.
- Based on the crash site surveys, the following observations can be made:
  - Utility poles currently present a greater risk than trees on arterials and collectors in urban areas while trees are a greater risk on local streets. To a lesser extent this is also true in rural areas.
  - Trees and utility poles on the outside of curves, within 50 metres of the midpoint of the curve in urban areas and between 20 metres and 100 metres from midpoint of the curve in rural areas should be given priority for treatment. At the very least they could be moved from the outside of the curve to the inside.

- Removing trees and poles from within 3 metres of the kerb or seal edge in urban areas with 20 metre-wide road reserves could dramatically reduce the number of collisions with roadside objects since very few vehicles collide with objects behind boundary fences.

Recommendations

- Definitive and up to date national policies and standards, backed by central government agencies, are needed for roadside hazard management to ensure consistency in practices, to ensure access to funding and to empower road controlling authorities to use safety objectives to manage their roadsides.
- LTSA encourages all road controlling authorities to send staff to Transit New Zealand's Highway Safety Features Workshops to ensure they have an appreciation and knowledge of roadside hazards and how to treat them.
- Road controlling authorities need to be more proactive and systematic in:
  - (a) ensuring that clear zones are maintained on new and reconstructed roads, particularly taking the opportunity to underground existing utilities,
  - (b) balancing safety requirements with pavement maintenance needs when determining shoulder slopes on new or reconstructed rural roads,
  - (c) implementing effective programmes to identify and treat existing roadside hazards, especially undergrounding of utilities, and
  - (d) ensuring that no new hazards, particularly trees, are added to the roadside.
- Procedures need to be put in place nationally so there is consultation between the utility company and the road controlling authority before a pole is replaced after a crash to ensure that opportunities for removing or relocating that pole and adjacent poles are exploited.
- Control data should be collected to add to the information gathered in this survey on the sites of collisions with poles and trees to give clear guidance on prioritising the proactive treatment of these roadside hazards.

Contents

1. Introduction

During April to August 2001 the Regional Offices of the Land Transport Safety Authority (LTSA) conducted surveys of two roading or road safety issues in road controlling authorities (RCAs).

The two areas surveyed were:

- road hierarchies in all RCAs, and
- roadside hazard management (in 30 RCAs).

This report describes the procedures for the roadside hazard management surveys and presents the results.

2. Purpose of the Surveys

The purpose of the surveys was to:

- Establish what standards and guidelines were being used by RCAs.
- Measure on-road practices of roadside hazard management on new or reconstructed roads.
- Describe programmes and methods used to identify and treat existing roadside hazards.
- Examine the site characteristics and types of treatments used at sites of collisions with poles, trees or guardrail ends.
- Provide a national summary of results and report to interested parties.

3. Methodology

3.1 Sample Selection

A sample of 30 RCAs was chosen for inclusion in the surveys. This included 28 territorial local authorities and two regional offices of Transit New Zealand (TNZ). The sample was weighted towards authorities not included in the 1999/2000 LTSA surveys.

Appendix 1 lists the 30 RCAs included in the surveys. The list also shows the number of sites included in the field surveys in each RCA.

3.2 Interview Surveys

Interview surveys were conducted with representatives in each authority. Survey forms were sent in advance to allow time to research answers if necessary. Questions centred on the standards, guidelines, programmes and practices used for the roadside hazard management.

The questions in the Roadside Hazard Management Questionnaire used for the Interview Surveys are shown in Appendix 2.

3.3 Field Surveys

Field surveys for each RCA consisted of:

- up to ten sections of new or reconstructed roads, plus
- up to ten urban sites of collisions with a pole, tree or guardrail end, plus
- up to ten rural sites of collisions with a pole, tree or guardrail end.

Copies of the survey forms used for the field surveys are in Appendix 3.

4. Results of the Interview Surveys

4.1 Staff Responsible for Roadside Hazard Management

For the thirty authorities in the sample, the staff responsible for each of the stages in the process of roadside hazard management were as follows.

- Determining what types of hazards required safety treatments:
    - management in 11 authorities,
    - roading or engineering staff in 11 authorities, and
    - consultants in 8 authorities.

- Deciding on the standards to be used for managing roadside hazards:
  - management in 15 authorities,
  - roading or engineering staff in 7 authorities,
  - consultants in 5 authorities,
  - the Council in 2 authorities, and
  - nobody in one authority.
- Determining or administering any programme to treat roadside hazards:
  - management in 12 authorities,
  - roading or engineering staff in 10 authorities,
  - consultants in 5 authorities, and
  - the remaining three authorities had no programme.
- Determining what treatment should be used to address particular roadside hazards:
  - management in 8 authorities,
  - roading or engineering staff in 12 authorities,
  - consultants in 9 authorities, and
  - contractors in one authority.

("Management" in the responses to these questions was typically a Roading Manager or an Asset Manager.)

4.2 Policies and Standards Documents on Roadside Hazard Management

This question asked which documents authorities used that were specific to their authority. However, many respondents also stated which national or common standards and guidelines they used, specifically:

- Transit New Zealand/Ministry of Transport *Guidelines for Planting for Road Safety*, August 1991
- Transit New Zealand/Land Transport Safety Authority *Manual of Traffic Signs and Markings*,
- AUSTROADS *Rural Road Design*, 1993
- Land Transport Safety Authority's Road and Traffic Standards Guidelines,
- National Roads Board *Guide to Geometric Standards for Rural Roads*, 1985

- New Zealand Standard NZS 4404-1981 *Code of Practice for Urban Land Subdivision*, 1981

No authority mentioned the Australian/New Zealand Standard AS/NZS 1158.1.3:1997 *Road Lighting* which gives extensive information on the safe location of lighting columns relative to roadways. The information in the document could also be applied to utility poles and trees in the absence of any other standards.

Thirteen of the 30 authorities (43%) stated they had no documentation on roadside hazard management specific to themselves. The two TNZ offices used the range of TNZ documents. Of the remaining 15 authorities:

- 7 stated they had engineering standards or a code of practice,
- 5 stated they had policy documents (on tree planting, street opening, or maintenance),
- 2 had permit systems (for road reserve control, or fencing control), and
- 1 had a safety management system.

4.3 Programmes to Monitor New/Reconstructed Roads

Programmes or methods reported by authorities for ensuring that new or reconstructed roads met their required standards for roadside hazards were:

- 14 carried out a full audit process,
- 8 carried out random audits or drive-overs by staff,
- 6 relied on staff doing or checking plans,
- 4 relied on compliance with a district plan or code of practice,
- 1 checked Council projects only, not private developers' projects,
- 1 used only routine maintenance inspections, and
- 4 had no reported programme or method.

4.4 New/Reconstructed Roads Complying with Standards

Estimations by respondents of the proportion of new or reconstructed urban streets meeting their required standards were:

- 9 thought 100% met the standards,

- 1 estimated 100% if power poles were excluded,
- 2 estimated 80%
- 1 estimated 70%
- 2 estimated a low percentage,
- 6 made no estimate,
- 9 could not reply (because they had no new urban streets, for example)

Estimates by respondents of the proportion of new or reconstructed rural roads meeting their required standards were:

- 11 thought 100% met the standards,
- 1 estimated 100% if power poles were excluded,
- 2 estimated 90%,
- 1 estimated 80%,
- 2 estimated 70%,
- 1 estimated 50%,
- 1 authority estimated a low percentage,
- 6 made no estimate,
- 5 could not reply (because they had no new rural roads, for example)

4.5 Most Problematic Roadside Hazards

On urban streets, the most difficult roadside hazards to treat were identified as:

- poles by 20 respondents,
- trees by 12 respondents,
- culverts by 1 respondent, and
- narrow road reserves by 1 respondent.

Note that 6 respondents gave no answer and some gave more than one answer. Typically, the cost of treating poles was given as the reason why they were the most problematic hazard. Trees were a problem because of public or political pressure to plant more trees or not to remove existing trees.

On rural roads, the most difficult roadside hazards to treat were identified as:

- ditches or water tables by 9 respondents,
- poles by 9 respondents,
- trees by 7 respondents,
- achieving clear zone widths by 5 respondents,
- culverts by 3 respondents,
- guardrails by 3 respondents,
- bridge ends by 2 respondents, and
- rural mailboxes by 1 respondent.

Note that 5 respondents gave no answer and some gave more than one answer. Typically, the cost of treating ditches or water tables was given as the reason why they were the most problematic hazard in rural areas.

4.6 Adequacy of Standards for Roadside Hazard Management

When asked whether they thought that the standards their authorities used for roadside hazard management were adequate:

- 7 respondents said they didn't use any standards,
- 6 respondents said their standards were adequate,
- 2 respondents said their standards were adequate but hard to maintain,
- 5 respondents said their standards were adequate but unachievable,
- 7 respondents said their standards needed improvement, and
- 3 respondents said they needed more formal standards.

Two of the 7 respondents reporting that their standards needed improvement said they were about to implement a safety management system.

4.7 Identifying Roadside Hazards on Existing Roads

Respondents generally reported more than one programme or method for identifying roadside hazards on existing roads. Specifically:

- 21 used public complaints or feedback,
- 16 used random or informal drive-overs,
- 16 used traffic crash reports,
- 7 used crash reduction studies,
- 5 used on-going monitoring and reporting by field staff,
- 5 used routine inspections by maintenance contractors,
- 4 used safety audit procedures,
- 2 carried out systematic audits of roadside hazards, and
- 2 used information from the police.

Note from these results that only about one third of the RCAs used proactive procedures (that is, on-going monitoring and reporting, safety audits or systematic audits of roadside hazards) for identifying roadside hazards on existing roads.

4.8 Programmes for Treating Roadside Hazards on Existing Roads

Many authorities reported more than one programme for treating roadside hazards on existing roads. The programmes reported were:

- 16 treated hazards as part of their minor safety programme,
- 9 had no programme but treated hazards as they were identified,
- 4 used crash reduction studies,
- 3 had a programme for undergrounding electricity or telephone lines,
- 3 had a bridge safety management programme, and
- 2 had a targeted safety audit programme.

Each of the following programmes or methods were reported once:

- regular liaison with service authorities to identify opportunities,
- treating all identified hazards on the carriageway,

- guardrailing bridges,
- guardrailing any identified site,
- writing to residents asking for their feedback,
- tree removal programme, and
- identifying and treating hazardous culverts.

Again, a minority of road controlling authorities had a proactive programme for treating roadside hazards.

4.9 Priorities for Treatment on Existing Roads

The following methods were reported for prioritising the treatment of roadside hazards:

- 9 authorities had no programme but treated hazards as they were identified,
- 7 authorities treated major routes first, then identified blackspots,
- 6 authorities gave priority to the hazards that were perceived to be the greatest risk,
- 4 authorities gave priority to those on roads with the highest traffic volumes,
- 2 authorities treated those identified in crash reduction studies first, and
- 3 authorities treated known blackspots first.

Other methods of prioritising that were each reported once were:

- treat hazards that were identified by the public first,
- treat hazards in the order listed in a specific ranking system,
- treat bridges first,
- guardrailing and blackspots first,
- treat any that can be treated from different funding sources, and
- treat any hazards that can be done as part of the capital works programme.

4.10 Most Common Treatments for Roadside Hazards

Respondents stated that the countermeasures most often used to treat particular types of roadside hazards were:

- Ditches/drains - delineate the obstacle, do nothing.
- Bridges - install guardrail, install delineation.
- Utility Poles - delineate the obstacle.
- Lighting Columns - install a breakaway or frangible device.
- Guardrails/Barriers - install approved guardrail terminal.
- Roadside Planting - remove the obstacle.
- Signs and Supports - relocate or install frangible support.
- Shoulders/Slopes - install delineation.
- Driveway Culverts - do nothing.
- Trees - remove the obstacle.
- Rural Mailboxes - do nothing, or relocate the obstacle.

4.11 Criteria for Installation of Guardrails or Sight Barriers

Reported criteria for determining whether to install guardrail or sight barriers in a given situation were:

- 16 authorities used a risk assessment or safety audit of the situation,
- 8 authorities looked at the crash history and contributing factors,
- 3 authorities always installed sight rails as a first step,
- 1 authority used the AUSTROADS guideline for new roads,
- 1 authority only considered guardrails at bridge ends, and
- 1 authority was developing a methodology to prioritise.

4.12 Types of Guardrails or Sight Barriers Used

The types of guardrails being used by the authorities in the sample were:

- 28 had installed W-section guardrail,
- 13 had installed timber sight rails,
- 2 always installed timber sight rails before W-section guardrail,
- 2 had installed New Jersey barrier,
- 2 had installed wire rope barrier,
- 1 had installed Fleet barrier, and
- 1 had installed earth bunding (between closely-spaced accessways.)

4.13 Criteria for Selecting Guardrails or Sight Barriers

The most common criteria quoted for choosing between different types of guardrail or barrier were:

- 6 authorities would only consider W-Section guardrail ,
- 3 authorities based the choice on the severity of the hazard,
- 3 authorities used cost considerations, and
- 2 authorities used AS/NZS 3845.

A number of other criteria were cited including what worked in the past, matching site and cost, degree of risk, aesthetics, TNZ specifications, and the risk to motorcyclists or cyclists.

4.14 Programmes for Upgrading Guardrails to Current Standards

Eighteen of the thirty authorities reported no programme for upgrading their guardrails. Of the other respondents:

- 4 had unspecified programmes for upgrading,
- 2 had completed upgrading,
- 2 were prioritising upgrades based on crash history,
- 1 was upgrading one major route only,
- 1 had a hierarchy-based upgrading programme,
- 1 was doing single lane bridges then other bridges, and
- 1 was developing a programme.

4.15 Proportion of Guardrails meeting Current Standards

Respondents estimated that the proportion of all their guardrails meeting the current standards for end-treatments was as follows.

- 2 said all their guardrails met current standards.
- 2 said a high percentage met the current standards.
- 3 said about half met the current standards.
- 6 said a low percent met current standards.
- 6 said none met current standards.

In addition, six respondents didn't know the proportion, two didn't know the standards, and three said that all their end-treatments were BCTs which they were happy with.

4.16 Agreements between Road Controlling Authorities and Utility Companies

Respondents reported the following agreements or arrangements between road controlling authorities and utility companies:

- 11 authorities reported no formal arrangements or agreements,
- 3 authorities reported "good arrangements" with power companies but not with telephone companies.
- 3 respondents said that utility companies must supply plans of their proposed installations to the road controlling authority.
- 2 reported bi-annual co-ordination workshops.
- 2 reported on-going discussion and liaison with utility companies.
- 2 reported agreements for utility companies to relocate or underground when poles need replacing.
- 2 reported they had a code of practice for all new work.
- 2 reported joint undergrounding programmes.
- 2 reported joint funding arrangements.
- 2 reported that the road controlling authority could decide when and where poles were moved.
- 1 reported that all new telephone services were undergrounded.
- 1 reported an agreement with the power company to delineate poles.
- 1 reported that their district plan required undergrounding.

4.17 Effectiveness of Agreements between Road Controlling Authorities and Utility Companies

Descriptions of how successful the above agreements or arrangements with utility companies were in addressing road safety issues were:

- 7 authorities said they were "very effective."
- 2 authorities said they were "effective on new roads."
- 5 authorities said they were "helpful."
- 2 authorities said they were "slightly effective."
- 4 authorities said they were "ineffective."

In addition, 8 authorities gave no answer and 2 authorities said they didn't know how effective the arrangements were.

4.18 Road Controlling Authority Policies on Roadside Tree Planting

Numerous different policies on roadside tree planting were reported. Some authorities reported more than one principle or policy. The most common principles reported were:

- aesthetics take precedence over safety (8 authorities)
- safety takes precedence over aesthetics (6 authorities)
- plantings must comply with a traffic safety standard (4 authorities)
- plantings must be approved by a staff engineer (3 authorities)
- policy is based on aesthetics but considers safety (2 authorities)

A number of other principles were each reported once:

- sight lines must be retained,
- trees must be "appropriate to the road,"
- lateral clearance depends on tree type,
- no restrictions related to road class,
- trees must be kept clear of the seal,
- no trees may be planted on the roadside, and
- don't have any branches below driver eye height.

Six authorities reported that they used the TNZ/Ministry of Transport *Guidelines for Planting for Road Safety*, 1991.

4.19 Comments on LTSA Role in Roadside Hazard Management

The most common comment, made by 13 respondents, on the LTSA's role, was that the LTSA should publish a good practice guide on roadside hazard management.

Other comments, each made by one or two respondents, were that the LTSA should:

- disseminate good ideas from other councils to deal with roadside hazard management issues,
- co-ordinate a national approach to utility companies to address the problem of roadside poles,
- advocate for more funding or a changed funding mechanism,
- be an independent arbiter to get roadside trees removed,
- help modify the Electricity Act to give more recognition to road safety,
- produce a good practice guide specifically for low volume roads rather than State highways,
- make road controlling authorities aware of hazards within the carriageway as well as alongside it,
- look for potential mass actions that could qualify for funding, and
- provide more input to address the problems of rural mailboxes and roadside poles.

5. Results of the Field Surveys of New or Reconstructed Roads

5.1 Introduction

The table in Appendix 1 shows the number of sections of new or reconstructed roads or streets surveyed in each RCA.

The sections of road in the survey were not chosen randomly. In some cases they were the only sections able to be found in the RCA, while others were generally those that could be conveniently visited during the field surveys of crash sites.

In total, 55 sections of new or reconstructed roads or streets were surveyed. Twenty eight of these sections were urban streets and 27 were rural roads.

Of the urban streets:

- 4 (14%) were arterials,
- 7 (25%) were collectors, and
- 17 (61%) were local roads.

Of the rural roads:

- 16 (59%) were arterials,
- 4 (15%) were collectors, and
- 7 (26%) were local roads.

The surveys involved compiling an inventory of all the roadside hazards found on the road reserve on each of the sections of road to give an overall estimate of the density and lateral clearance of the different types of hazards. Traffic signs were all assumed to be frangible (unless they obviously weren't) and were therefore excluded from the survey. Lighting columns were included in the results with an indication of whether or not they were frangible.

The clear zones on these sections of road were not checked against any standard. The wide variety of standards or policies used and the fact that the surveyors did not sight many of them made this impractical. One appropriate national standard to use to check all sites against would have been AS/NZS 1158.1.3:1997 *Road Lighting* but no authorities mentioned that they used this standard.

5.2 Roadside Hazards on New/Reconstructed Urban Streets

5.2.1 Urban Arterial Streets

The following roadside hazards were found on the road reserves of the 4 new urban arterial streets surveyed:

"Spot" Hazards

- 1 had three utility poles between 3.0 m and 6.0 m from the kerb on a 900 m long section,
- all had (frangible or breakaway) lighting columns at offsets of 1.0 m, 1.9 m, 2.5 m and 4.0 m behind the kerb,

- 2 had rows of trees planted 1.5 m and 3.0 m behind the kerb, 40 m and 10 m apart respectively,
- 1 had a transformer 2.5 m behind the kerb,
- 1 had four hazardous letterboxes between 2.0 m and 2.5 m behind the kerb on a 900 m long section, and

Longitudinal Hazards

- 1 had an upright cliff 3 m behind the kerb over 15% of its length.

Generally, roadside hazards were managed effectively on these arterials. The main concern with these results was the two new sections of road with rows of trees planted so close to the carriageway, given that they were arterial routes.

5.2.2 Urban Collector Streets

The following roadside hazards were found on the road reserves of the 7 new urban collector streets surveyed:

"Spot" Hazards

- 2 had rows of existing utility poles at 2.0 m and 5.0 m behind the kerb, respectively,
- 5 had rows of lighting columns at 2.0 m, 2.0 m, 2.5 m and 3.0 m behind the kerb while one offset was not recorded. The columns in the row 2.5 m behind the kerb were not frangible.
- 2 had rows of trees planted, one 3.5 m behind the kerb and 40 m apart, and one 6.5 m behind the kerb at 10 m apart,
- 1 had a transformer 5 m behind the kerb,

Longitudinal Hazards

- 1 had an upright cliff right on the kerbline over 60% of its length, and
- 1 had a drain right on the kerbline over its entire length.

Again, roadside hazards were managed effectively except for the one row of non-frangible lighting columns that had been installed and the rows of trees that had been planted, albeit further behind the kerb than those on the arterials. Also, when reconstructing the streets, the rows of utility poles could have been undergrounded and the drain piped while the opportunity was available.

5.2.3 Urban Local Streets

The following roadside hazards were found on the road reserves of the 17 new urban local streets surveyed:

"Spot" Hazards

- 2 rows of existing utility poles, 0.5 m and 3.1 m behind the kerb and an isolated utility pole 1 m behind the kerb,
- 1 new row of utility poles 5.0 m behind the kerb,
- 10 new rows of frangible lighting columns, eight between 0.5 m and 1.0.m, one at 1.7 m and one at 2.0 m behind the kerb,
- 10 new rows of planted trees (between 10 m and 40 m apart), four at 1.2 m or less, five between 2.0 m and 2.5 m, and one at 4.0 m behind the kerb,
- 2 transformers, 1.1 m and 4.5 m behind the kerb,
- 1 decorative structure 0.3 m behind the kerb,

Longitudinal Hazards

- 1 had a drain 1.5 m behind the kerbline over 70% of its length, and
- 1 had kerbs protruding into the carriageway (as part of threshold treatments) over 7% of its length.

Many, if not most of these streets were low-speed residential streets. While tree planting was again prevalent on these streets it may have been quite appropriate and contributed to the low-speed nature of the streets. It is again unfortunate that utility poles were not undergrounded and the drain piped at the time of construction or reconstruction. In all cases the surveyors recommended these treatments.

5.3 Roadside Hazards on New/Reconstructed Rural Roads

5.3.1 Rural Arterial Roads

Nine of the 16 sections of new or reconstructed rural arterial roads surveyed were State highways in TNZ's Christchurch Region. Lateral offsets on these rural arterials are all given from the edgelines (except where noted.) The following roadside hazards were found on the road reserves of the 16 sections:

Utility Poles

- 8 had existing or relocated rows of utility poles at offsets from the edgeline of 1.0 m, 2.0 m, 3.0 m, 4.0 m (three), 5.0 m and 6.0 m,

- 7 others had isolated utility poles between 2.0 m and 6.0 m from the edgeline,

Trees

- 2 had newly planted rows of trees on the roadside – one row 1.5 m behind the kerb, and one 6.0 m from the edgeline.
- 5 others had isolated, existing trees between 2.5 m and 5.0 m from the edgeline,

Culverts

- 8 had unprotected culverts (four of them new) at offsets of 0.6 m, 1.0 m, 1.5 m, 2.5 m, 3.0 m (two), 5.0 m and 6.0 m from the edgeline,

Other "Spot" Hazards

- 3 had vertical driveway headwalls approximately 3.0 m from the edgeline,
- 2 had substantial mailboxes 3.0 m from the edgeline,
- 1 had a large rock 4.0 m from the edgeline,
- 1 had a large advertising sign 5.0 m from the edgeline,

Longitudinal Hazards

- 9 had a drain or water table along the roadside, six of these within 3.0 m of the edgeline and ranging from 15% to 100% of the length of the section,
- 1 (in a national park) had native bush over 20% of its length and as close as 2.0 m from the edgeline,
- 2 had a cliff within 1.5 m of the edgeline, and
- 2 had an unprotected, non-recoverable slope within 3.0 m of the edgeline and extending for 20-25% of the length of the section.

The roadside hazards found on rural arterials reflect respondents' statements about the most difficult hazards to deal with. That is, surveyors found utility poles, trees and roadside drains were the most common hazards. Unprotected culverts also featured prominently.

Again, it is unfortunate that utility poles could not be removed as part of the works especially when some of the rows of poles had been relocated.

The continued planting of rows of trees on the roadside is disappointing since they have been shown to be hazards when they grow.

5.3.2 Rural Collector Roads

The following roadside hazards were found on the road reserves of the 4 new rural collector roads surveyed:

"Spot" Hazards

- 1 had a tree 5.5 m from the edgeline,
- 1 had a series of unprotected culverts 1.0 m from the edgeline,
- 1 had an unprotected headwall 1.5 m from the edgeline,
- 1 had a substantial mailbox 2.0 m from the edge of the carriageway,
- 1 had a transformer 4.9 m from the edgeline,

Longitudinal Hazards

- all had drains or water tables, 1.0 m, 1.9 m, 2.0 m and 5.5 m from the carriageway edge, for 25-100% of their length, and
- 1 had a cliff 1.9m from the carriageway edge for 60% of its length.

The prevalence of roadside drains was again noticeable, as was the relative absence of utility poles and trees from these roads. One factor in this may be that all these roads were in the North Island compared to the high proportion of the rural arterials that were on the Canterbury plains.

5.3.3 Rural Local Roads

Rural local roads do not generally have edgelines therefore all lateral offsets here are from the seal edge. The following roadside hazards were found on the road reserves of the 7 new rural local roads surveyed:

"Spot " Hazards

- 1 had a row of utility poles 5.3 m from the seal edge,
- 3 had isolated poles 1.2 m , 1.5 m, and 3.0 m from the edge of the carriageway,
- 2 had unprotected culverts 0.5 m and around 2.5 m respectively from the seal edge on either side,
- 2 had series of hazardous mailboxes 0.5 m and 1.0 m from the seal edge and one had an isolated mailbox 1.7 m from the seal edge,
- 2 each had an unprotected headwall 1.0 m and 3.0 m from the seal edge, respectively,

Longitudinal Hazards

- 5 had open drains 0.0 m, 0.7 m, 1.0 m (twice) and 1.3 m from the seal edge, three of them for the whole length of the section and the others for 25% and 33% of the length,

- 1 had a cliff 2.0 m from the seal edge for 1% of its length, and
- 2 had non-recoverable slopes 0.0 m and 0.7 m from the seal edge for 35% and 50% of the length of the section.

Drains again featured as the major hazard on these roads with hazardous mailboxes also more prominent than on other road classes.

6. Results of the Field Surveys of Crash Sites

6.1 Introduction

The table in Appendix 1 shows the numbers of hazards at the urban and rural crash sites surveyed in each RCA.

The crash sites in the survey were all sites of collisions with utility poles, trees or guardrails. Urban sites were defined using a 30 metre radius and rural sites by a 60 metre radius. The sites were not chosen randomly. The objective was to visit the crash sites that were most likely to have been treated with a crash countermeasure.

Therefore, priority was given to sites with:

- two or more hazards that had been hit,
- multiple collisions with a particular hazard,
- the most severe collisions, then
- collisions occurring between 1996 and 2000.

In total, 216 sites were surveyed, together accounting for collisions with 245 different hazards. The surveyors recorded the main characteristics of the hazards and the crash sites and any countermeasures known or apparent to them that had been undertaken to reduce the risk or consequences of further crashes. As with the survey of new roads, the crash sites and treatments were not measured against any standards or policies.

Data in Section 6 is presented relative to each object struck. For example, if three different poles were struck within a 30 metre-radius site, the site characteristics are included in the results for each pole separately, not just once for the site. If one pole was struck twice the results for that pole are included only once.

Table 1 shows the types of hazards that were struck in urban and rural areas.

Table 1 Hazard Types, Urban and Rural Sites

Hazard Type	Urban Number	Urban Percent	Rural Number	Rural Percent
Utility Pole	79	57%	49	46%
Lighting Column	12	9%	2	2%
Planted Tree	40	29%	27	25%
Self-sown Tree	5	4%	21	20%
Guardrail	1	1%	4	4%
Sight Rail	1	1%	4	4%
Total	138	101%	107	101%

6.2 Crash Site Characteristics

6.2.1 Street Classification and Collision Severity

Tables 2 and 3 cross-tabulate the street classifications at the urban and rural sites with the severity of the most severe collision with each object in the study period (1996-2000):

- Urban Sites

Table 2 Street Classification and Collision Severity, Urban Sites

Collision Severity	Arterial	Collector	Local
Fatal	3	5	2
Injury	36	37	24
Non-Injury	3	8	20
Total	42	50	46

Collisions with the hazards being studied at urban sites were reasonably evenly spread between the different street classes but tended to be less severe on local streets. Looking at the types of hazards struck by street class shows:

- on arterials, 64% were poles and 17% were trees,
- on collectors, 66% were poles and 30% were trees, and
- on local streets, 41% were poles and 50% were trees.

- Rural Sites

Table 3 Street Classification and Collision Severity, Rural Sites

Collision Severity	Arterial	Collector	Local
Fatal	11	3	4
Injury	50	13	19
Non-Injury	3	2	2
Total	64	18	25

Collisions with the hazards being studied at rural sites were mainly on the arterial routes but tended to be similar severity on each road class. Looking at the types of hazards struck by road class shows:

- on arterials, 50% were poles and 38% were trees,
- on collectors, 44% were poles and 56% were trees, and
- on local streets, 39% were poles and 52% were trees.

6.2.2 Street Curvature at the Crash Sites

Surveyors' subjective assessments of the street curvature at the urban and rural crash sites were:

Table 4 Street Curvature, Urban and Rural Sites

Curvature	Urban Number	Urban Percent	Rural Number	Rural Percent
Straight	59	43%	28	26%
Easy Left-Hand Curve	6	4%	13	12%
Easy Right-Hand Curve	15	11%	22	21%
Moderate Left-Hand Curve	8	6%	15	14%
Mod. Right-Hand Curve	17	12%	17	16%
Sharp Left-Hand Curve	11	8%	5	5%
Sharp Right-Hand Curve	14	10%	5	5%
Roundabout	8	6%	2	2%
Total	138	100%	107	101%

Rural crash sites were much less likely to be on a straight than urban crash sites and much more likely to be on easy or moderate curves.

6.2.3 Distance of Crash Site from Curve

All of the 75 urban crash sites (including roundabouts) where a driver lost control on a curve in the street were at or beyond the midpoint of the curve. There were 78 rural crash sites (including roundabouts) where a driver lost control on a curve. Table 5 shows the distances of the crash sites along the road from the midpoint of the curve for both urban and rural sites:

Table 5 Distance of Crash Site from Curve, Urban and Rural Sites

Distance of Crash Site from Curve	Urban Number	Urban Percent	Rural Number	Rural Percent
Before the Midpoint	-	-	6	8%
At the Midpoint	5	7%	4	5%
20m or Less Beyond Midpt	19	25%	6	8%
21m - 50m Beyond Midpt	34	45%	23	30%
51m - 100m Beyond Midpt	13	17%	25	32%
> 100m Beyond Midpt	4	5%	14	18%
Total	75	99%	78	101%

For urban sites, relating the degree of curvature to the distance of the crash site from the curve midpoint shows:

- Two of the crashes at the midpoint were at roundabouts and the other three were on easy right-hand curves.
- All the crashes on easy right-hand curves were within 50 metres of the curve midpoint.
- Crashes on easy left-hand curves tended to be further past the midpoint, with three of six crashes being more than 100 metres away.
- Crashes on sharp curves were almost all within 50 metres of the midpoint. On sharp right hand curves nearly half were within 20 metres.

At rural sites, relating the degree of curvature to the distance of the crash site from the curve midpoint shows:

- The six crashes before the midpoint of the curve were all on easy or moderate curves and are consistent with the type of crash where the driver falls asleep and keeps going in a straight line.
- As expected, crashes on sharp curves are generally closer to the midpoint than those on easier curves.

6.2.4 Orientation of Hazard Relative to Direction of Travel

- Urban Sites

Of the 138 objects struck at urban sites, 2 were on the central island of a roundabout, 2 at the head of a "T" intersection and 2 on a median. The orientation of the remaining 132 objects relative to the direction of travel and the curvature of the road were:

Table 6 Orientation Relative to Direction of Travel, Urban Sites

Curvature	Strt	Easy Left	Easy Right	Mod. Left	Mod. Right	Sharp Left	Sharp Right	R-about
Left Side	40	1	14	2	13	3	13	5
Right Side	16	5	1	6	4	8	-	1

In total, 91 (66%) of the hazards struck were on the left side of the road and 41 (30%) on the right side.

- Rural Sites

Of the 107 objects struck at rural sites, 2 were at the head of a "T" intersection and 3 had been hit from both directions. The orientation of the remaining 102 objects relative to the direction of travel and the curvature of the road were:

Table 7 Orientation Relative to Direction of Travel, Rural Sites

Curvature	Strt	Easy Left	Easy Right	Mod. Left	Mod. Right	Sharp Left	Sharp Right	R-about
Left Side	13	6	15	5	14	-	3	2
Right Side	11	7	7	9	3	5	2	-

In total, 58 (54%) of the hazards struck were on the left side of the road and 44 (41%) on the right side. This is a more even spread than for urban streets.

Another notable feature of these results for rural roads is that there is a more even spread between the left and right sides of the road for most types of curvature compared to urban streets.

6.2.5 Lateral Offset of Hazards

- Urban Sites

The distribution of the lateral offsets (measured from the kerb or seal edge) of the objects struck at the urban sites was:

Table 7 Lateral Offset of Hazards, Urban Sites

Lateral Offset	0 m-1.0 m	1.1 m-2.0 m	2.1 m-3.0 m	3.1 m-4.0 m	4.1 m-5.0 m	5.1 m-7.0 m	7.1 m-9.0 m	>9 m	Off-road
No. of Objects	48	39	9	11	14	5	2	4	6
%	35%	28%	7%	8%	10%	4%	1%	3%	4%

Overall at urban sites, 70% of the hazards struck were within 3.0 m of the kerb or seal edge. Only 6 objects (4%) were struck which were clearly beyond the boundary of the road reserve (off-road) and these may have been little more than 3.0 m from the kerb given the typical cross section for urban road reserves. The remaining 26% of objects were therefore located either where there was a wide berm or unfenced land alongside the road.

- Rural Sites

The distribution of the lateral offsets (measured from the edgeline or seal edge) of the objects struck at rural sites was:

Table 8 Lateral Offset of Hazards, Rural Sites

Lateral Offset	0 m-1.0 m	1.1 m-2.0 m	2.1 m-3.0 m	3.1 m-4.0 m	4.1 m-5.0 m	5.1 m-7.0 m	7.1 m-9.0 m	>9 m	Off-road
No. of Objects	6	14	9	17	19	10	4	5	22
%	6%	13%	9%	16%	18%	9%	4%	5%	21%

Only 28% of the hazards struck were within 3.0 m of the edgeline or seal edge compared to 70% on urban streets. However, 21% of objects struck were clearly beyond the boundary of the road reserve (off-road) compared to 4% in urban areas.

6.2.6 Road Surface at the Crash Sites

Table 9 shows the different road surface types that surveyors recorded at the crash sites.

While over 80% of the surface types recorded were chip seal, there was no data recorded for the road network in general so no conclusions can be drawn about the prevalence of any particular surface type at the crash sites.

Table 9 Road Surface at Crash Sites, Urban and Rural Sites

Road Surface	Urban Number	Urban Percent	Rural Number	Rural Percent
Asphaltic Concrete	24	17%	5	5%
Chip Seal	112	81%	92	86%
Gravel	2	1%	8	8%
Not Recorded	-	-	2	2%
Total	138	99%	107	101%

6.2.7 Shoulder Type at the Crash Sites

The types of shoulders recorded at the crash sites are shown in Table 10.

Table 10 Shoulder Type at Crash Sites, Urban and Rural Sites

Shoulder Type	Urban Number	Urban Percent	Rural Number	Rural Percent
Kerb	94	68%	4	4%
Grass Shoulder	19	14%	35	33%
Sealed Shoulder	13	9%	33	31%
Gravel Shoulder	9	7%	28	26%
No Shoulder	2	1%	3	3%
Not Recorded	1	1%	4	4%
Total	138	100%	107	101%

As stated in Section 6.2.5, 70% of the hazards struck at urban sites were within 3.0 m of the kerb or seal edge. When the sites are distinguished by shoulder type the results show:

- Where there was kerb, 81% of hazards struck were within 3.0 m of the kerb.
- Where there was a grass shoulder and no kerb, only 32% of the objects struck were within 3.0 m of the seal edge.

At rural sites there was no such clear relationship between the lateral offsets of the hazards and the different shoulder types.

6.2.8 Slope from Kerb or Seal Edge to Hazard at the Crash Sites

Table 11 shows the slopes to the hazard from the seal edge or kerb at both urban and rural sites.

Table 11 Slopes to the Hazards at Crash Sites, Urban and Rural Sites

Amount of Slope	Urban Number	Urban Percent	Rural Number	Rural Percent
Between 30% down and 100% down	3	2%	10	9%
Between 15% down and 30% down	2	2%	21	20%
Between 10% down and 15% down	5	4%	10	9%
Between Flat and 10% down	15	11%	8	8%
Flat	98	71%	41	38%
From Flat to 10% up	6	4%	6	6%
More than 10% up	8	6%	7	7%
Not Recorded	1	1%	4	4%
Total	138	100%	107	101%

The results show no clear relationship at either urban or rural sites between the lateral offsets of the hazards struck and the slope from the road to the hazard.

6.3 Urban Crash Site Treatments

Overall, surveyors were disappointed at the number of urban crash sites where there had been action to treat the hazards that had been hit. Of the 138 hazards hit, 90 (65%) had had nothing done to treat them and a further 14 (10%) had had the pole or tree replaced by another. A summary of the most substantial treatments recorded following the crashes at the remaining sites was:

- 12 sites (9%) had the hazard removed,
- 5 sites (4%) had the hazard relocated further from the street,
- 3 sites (2%) had measures (such as replacing a non-frangible pole with a breakaway one) to reduce the impact in the event of a crash,
- 3 sites (2%) had a guardrail installed to redirect errant vehicles, and
- 11 sites (8%) had delineation installed.

Of the 12 hazards that were removed, 5 were utility poles, 5 were planted trees, and 2 were lighting columns. Of the 14 hazards replaced with another, 11 were utility poles.

Notwithstanding that the most common treatment observed was "do nothing", the treatments that had been installed are consistent with the interview responses. Of the sites that had been treated, the most common treatment found for pole sites was to install delineation (8 out of 19 sites) and the most common treatment for trees was to remove them (5 out of 7 sites.)

However, the findings were at odds with the principle of the survey that visiting the sites of the most severe crashes would be more likely to produce a higher proportion of treated sites. Of the ten fatal crash sites, six had nothing done, three had the pole or tree replaced by another, and only one had the hazard removed – in this case a tree that was cut down by the relatives of the deceased.

At 24 of the 138 sites, surveyors considered that the hazard was worse at the time of the survey than at the time of the crash. This would mainly be because trees had grown bigger or more substantial utility poles had been installed to replace broken poles.

6.4 Rural Crash Site Treatments

Overall, surveyors also found an even lower proportion of hazards that had been treated at rural crash sites than at urban sites. Of the 107 hazards hit, 81 (76%) had had nothing done to treat them and a further 5 sites (5%) had had a damaged utility pole replaced by another pole. A summary of the most substantial treatments recorded following the crashes at the remaining sites was:

- 2 sites (2%) had the hazard removed (1 utility pole and 1 tree),
- 2 sites (2%) had the hazard relocated,
- 7 sites (7%) had a guardrail installed to redirect errant vehicles,
- 9 sites (8%) had delineation installed, and
- 1 site had nothing recorded.

In total, 17 sites (16%) had delineation installed since the crashes. Eight of these sites therefore had other, more substantial, treatments installed as well.

Again, the likelihood of treatments being installed did not increase at sites with more severe collisions. Only three of 18 fatal crash sites had any sort of treatment carried out – two had delineation installed and one had a support pole removed after it was struck.

7. Discussion

Respondents in the interview part of this survey referred to a wide variety of national and local standards and policies used for roadside hazard management. Similarly, they reported a wide variety of procedures in dealing with the issue, both on new roads and existing roads. For new roads, these ranged from a full safety audit process to "no programme or method." Consequently, the estimates of the proportion of new roads that met the desired standards ranged from 100% to "a low percentage".

For existing roads and streets only about a third of authorities reported proactive procedures for identifying or treating roadside hazards. One authority reported that they circularised the public asking for information on roadside hazards. Other authorities with limited professional resources could usefully employ this technique, although it should not replace systematic inspections.

Authorities reported a range of agreements and relationships with utility companies on the installation of poles on the road reserve. While about half the respondents said that these were successful from a safety viewpoint, the field surveys clearly showed that there is little co-ordination between the parties to remove or relocate utility poles when they need replacement after a crash. Many of the poles that had been removed were as a result of an undergrounding unrelated to the crash. The high cost of undergrounding pole installations and the current funding mechanisms also make it very difficult to justify on safety grounds.

Respondents reported a similar variety of attitudes to roadside tree planting with about a third advising that aesthetics took precedence over safety in their authority. This indicates a clear need for LTSA and other national bodies to:

- produce clear and up to date safety policies and standards, and
- try and change awareness and attitudes on this issue so trees are planted without compromising safety.

The results of the field surveys of new or reconstructed roads showed an awareness of roadside hazard management issues and reasonable compliance with good practice. The three main areas of concern from the field surveys (which were also identified as such in the interviews) were:

- the lack of ability to deal with utility poles on the roadside,
- the construction of drains or steep slopes along the roadside, and
- planting trees along the roadside (especially on arterials and collectors) for aesthetic reasons.

The latter two of these issues should be easier to control since they are "in-house" for most authorities.

Despite the majority of respondents in the interview surveys reporting that they treated hazards as they were identified or at known blackspots, the number of sites of collisions with roadside hazards that had been effectively treated was disappointingly low in both urban and rural areas. This was especially so for the sites of fatal collisions.

The survey of crash sites has provided some information on the characteristics of these sites, but control data is needed to make definitive statements on how to prioritise sites for proactive treatment.

However, the following statements can be made with some confidence:

- Utility poles currently present a greater risk than trees on arterials and collectors in urban areas while trees are a greater risk on local streets. To a lesser extent this is also true in rural areas.
- Trees and utility poles on the outside of curves, within 50 metres of the midpoint of the curve in urban areas and between 20 metres and 100 metres from midpoint of the curve in rural areas should be given priority for treatment. At the very least they could be moved from the outside of the curve to the inside.
- Removing trees and poles from within 3 metres of the kerb or seal edge in urban areas with 20 metre-wide road reserves could dramatically reduce the number of collisions with roadside objects since very few vehicles collide with objects behind boundary fences.

It is clear from the comments made about the LTSA's role and from the wide range of standards and practices reported in interviews that there is a need for well-recognised and up to date national policies and standards in the area of roadside hazard management. Such standards should help overcome the difficulties that road controlling authorities have in implementing their own policies and in maintaining hazard-free roadsides.

TNZ is currently updating the TNZ/Ministry of Transport *Guidelines for Planting for Road Safety*, 1991 and this, together with the relevant parts of TNZ's draft *State Highway Geometric Design Manual* and Australia/New Zealand Standard AS/NZS 1158.1.3:1997 *Road Lighting* need to be more widely promoted with RCAs.

8. Recommendations

- Definitive and up to date national policies and standards, backed by central government agencies, are needed for roadside hazard management to ensure consistency in practices, to ensure access to funding and to empower road controlling authorities to use safety objectives to manage their roadsides.
- LTSA encourages all road controlling authorities to send staff to Transit New Zealand's Highway Safety Features Workshops to ensure they have an appreciation and knowledge of roadside hazards.
- Road controlling authorities need to be more proactive and systematic in:
  - ensuring that clear zones are maintained on new and reconstructed roads, particularly taking the opportunity to underground existing utilities,
  - balancing safety requirements with pavement maintenance needs when determining shoulder slopes on new or reconstructed rural roads,
  - implementing effective programmes to identify and treat existing roadside hazards, especially undergrounding of utilities, and
  - ensuring that no new hazards, particularly trees, are added to the roadside.
- Procedures need to be put in place nationally so that there is consultation between the utility company and the road controlling authority before a pole is replaced after a crash, so that opportunities for removing or relocating that pole and adjacent poles are exploited.
- Control data should be collected to add to the information gathered in this survey on the sites of collisions with poles and trees to give clear guidance on prioritising the proactive treatment of these roadside hazards.

Appendix 1 Road Controlling Authorities Surveyed.

Road Controlling Authority (RCA)	Number of Sections of New Road Surveyed	Number of Urban Hazards Surveyed	Number of Rural Hazards Surveyed
Whangarei District	4	6	5
Kaipara District	4	4	5
Rodney District	6	4	6
Waitakere City	2	7	4
Manukau City	2	5	5
Hauraki District	1	6	3
Otorohanga District	-	5	1
Waitomo District	-	5	-
Rotorua District	-	5	4
Wairoa District	-	9	4
Ruapehu District	-	-	-
Wanganui District	-	-	-
Horowhenua District	4	6	8
Upper Hutt City	6	7	
Carterton District	2	2	8
South Wairarapa Dist.	3	4	5
Marlborough District	2	8	5
Buller District	1	1	
Grey District	2	6	6
Westland District	-	1	2
Christchurch City	4	16	7
Mackenzie District	-	-	-
Waimate District	-	1	2
Central Otago District	1	3	4
Queenstown-Lakes Dist	1	5	2
Dunedin City	1	8	4
Gore District	-	3	3
Invercargill City	-	6	3
TNZ Wanganui	-	-	-
TNZ Christchurch	9	5	11
Total Numbers	**55**	**138**	**107**

Appendix 2 Roadside Hazard Management Questionnaire

Road Controlling Authority: ______________________________________

Person(s) Replying to Questionnaire: ________________________________

Position in Organisation: ______________________________________

Contact Phone No.: ______________________________________

Date ______________________________________

Interviewer: ______________________________________

For this questionnaire, roadside hazards are defined as physical features on or near the roadway that could cause vehicle roll-over or injury to vehicle occupants through an impact with them. Roadside hazards here do not include visibility restrictions.

1. Who, in your authority:

   (a) decides what is a roadside hazard and what is not when determining whether a safety treatment is needed
   (b) decides on the standards to be used for managing roadside hazards,
   (c) determines or administers any programme to treat roadside hazards,
   (d) determines what treatment should be used to alleviate particular roadside hazards?

2. What documentation (specific to your authority) does your authority have to state which standards, policies or guidelines are used to manage roadside hazards?

3. What sort of programme or method does your authority use to check whether newly constructed or upgraded roads meet the standards, policies or guidelines for roadside hazard management?

4. On what proportion of your new or upgraded roads do you estimate you have fully met the standards?
   (a) In urban areas:
   (b) In rural areas:

5. Which standards or safety treatments do you have the most difficulty achieving, and why?
   (a) In urban areas:
   (b) In rural areas:

6. Do you consider the standards your authority uses to be adequate, or could they be improved? If so, how?

7. (a) How does your authority identify roadside hazards or necessary treatments on <u>existing roads</u> (in urban and rural areas)?
   (b) What types of roadside hazards do you try and identify?

8. (a) What programme(s) does your authority have in place for treating roadside hazards on existing roads?
   (b) What priorities does your authority have for treating roadside hazards? What is the basis for these priorities?

9. What types of treatments would your authority <u>most often</u> use to improve safety where a hazard caused by each of the following has been identified? Circle one or more letters corresponding to the treatments in the right hand column. (Attach a separate sheet if it is necessary to add explanation.)

Use the hierarchy of treatments:

A. remove the obstacle
B. relocate where it is less likely to be struck
C. reduce the impact severity (with a breakaway device)
D. redirect the vehicle (with guardrail, crash cushion or improved road surface)
E. delineate the obstacle.
F. Nothing.

(a) ditches/drains	A	B	C	D	E	F
(b) bridges	A	B	C	D	E	F
(c) utility poles	A	B	C	D	E	F
(d) lighting columns	A	B	C	D	E	F
(e) guardrails/barriers	A	B	C	D	E	F
(f) roadside planting	A	B	C	D	E	F
(g) signs & supports	A	B	C	D	E	F
(h) shoulders/slopes	A	B	C	D	E	F
(i) driveway culverts	A	B	C	D	E	F
(j) trees	A	B	C	D	E	F
(k) rural mailboxes	A	B	C	D	E	F
(l) others (specify)	A	B	C	D	E	F
(m)	A	B	C	D	E	F

10. (a) How do you determine whether to install guardrail or barrier in a given situation? (Attach documentation if that is easier.)
    (b) What types of guardrail or barrier have you used?
    (c) When installing guardrail, how do you decide which type of guardrail or barrier to install?
    (d) What sort of programme do you have for upgrading guardrail or barrier end-treatments to current standards?
    (e) What proportion of your end-treatments meet current standards?

11. (a) What on-going agreements/arrangements are in place between utility companies in your authority to minimize the danger to road users from roadside hazards (especially poles)?
    (b) How effective are these agreements/arrangements in minimizing or reducing the danger to road users?
    (c) Please describe any such agreement/arrangement that you know of which has been effective in minimizing or reducing a roadside hazard.

12. (a) If your authority plants trees on the roadside for aesthetic reasons, please describe (or attach details of) the policy for such plantings.

13. Do you have any general comments about roadside hazard management, or suggestions on ways the LTSA could be of assistance on this issue?

Thank you very much for taking the time to complete this questionnaire.

Appendix 3 Field Sheets for Roadside Hazard Management Survey

Existing Roads (Crash Sites)

Road Controlling Authority………………………………Photo No………

Surveyors: …………………………………….. Date........………………

Crash Site Information

(from the perspective of the driver approaching before their crash)

Road:……………………………………………….. ……...….m N S E W

Side Road: ………..…………………………..Speed Limit:……………………..

Class of Street or Road:………………………...*(Arterial, Collector, Local, etc.)*

Road Curvature (circle one): ***1**. Straight **2**. Easy left **3**. Easy right **4**. Moderate left **5**. Moderate right **6**. Sharp left **7**. Sharp right**8**. Roundabout*

Hazard Type (circle one)*: **1**. Power or Telephone Pole **2**. Lighting Column **3**. Planted Tree **4**. Self-Sown Tree **5**. Guardrail End **6**. Barrier End **7**. Two or more of these*

Hazard is on (circle one): ***1**. Left side **2**. Right side **3**. In the roadway **4**. Mixture*

No. of collisions with hazard (1996-2000): Fatal ….. Injury ……Non-Injury ….

Sketch of site:

Show & dimension: Roadway (esp. traffic lanes and shoulder), median, roadside hazards.

Complete a copy of this page for each pole, tree or guardrail end struck at the site. Again, consider the site from the perspective of the driver approaching before their crash.

	Before First Crash in Sample	At Time of This Survey
Hazard Type (from list on first page)		
Has the hazard been removed? (Circle one)		Yes No
Has the hazard got worse? (e.g. tree grown, pole bigger)		Yes No
If road is curved note distance along road before or after curve midpoint to hazard.		
Distance from kerb, edgeline or edge of seal (state which) to hazard.		
New guardrail end treatment or breakaway pole installed?	Yes No State what:	Yes No State what:
Surface material of road - AC, chip seal, friction course,gravel		
Shoulder type (sealed, gravel) and width.		
Average slope** from edge of road to hazard (e.g. 1 in 5 up)		
Guardrail or crash cushion installed?	Yes No State what:	Yes No State what:
Delineation or reflectorisation installed?	Yes No State what:	Yes No State what:

** - the most important aspect of this is to know whether the slope is recoverable.

<u>Remedial Work that Has (or Hasn't) Been Done</u>

Look for treatments from the hierarchy:

A. remove the obstacle
B. relocate where it is less likely to be struck
C. reduce the impact severity (with a breakaway device)
D. redirect the vehicle (with guardrail, crash cushion, or improved road surface)
E. delineate the obstacle.
F. Nothing.

(**Describe any remedial treatments that have been installed.** If there has been more than one crash with one of these hazards at the site, comment on any known treatments implemented after each crash, including any before 1996.)

New Roads

Road Controlling Authority………………………………Photo No.………

Surveyors: ………………. ………………. Date.......………………….

Street/Road Location Information

Road:……………………………………….. New or Reconstructed? ………

from ………m N S E W Side Road: ………..………………………………

to ………m N S E W Side Road: ………..………………………………

Speed Limit:…………Class of Street or Road: ……………………………
(Arterial, Collector, Local, etc.)

Direction of Travel: ……………………….
No. of known collisions with hazards (from CAS or other knowledge):

Period: ……………………….. Fatal ……….. Injury ………Non-Injury …….
(e.g. 1996-2000)

Sketch of Typical Roadway Cross Section:

Show & dimension: Roadway (esp. traffic lanes and shoulder), median, roadside hazards.

Inventory of Roadside Hazards (at Time of this Survey)

Type of Hazard	Distance along Road from Start	Length of Hazard	Distance from kerb, edgeline or seal edge	LH side, RH side or median?	Frangible, Breakaway Young Tree or Protected (F, B, Y or P)*	Was the hazard there before the road?**	If treatment needed, is there an obvious practical remedy?	What type of remedy? (from list A to F) ***

* - enter nothing if none of these apply. Frangible objects (such as W section guardrail or folded steel lighting columns) are designed to bend rather than break off.

** - or the road reconstruction

*** - treatments from the hierarchy:

G. remove the obstacle
H. relocate where it is less likely to be struck
I. reduce the impact severity (with a breakaway device)
J. redirect the vehicle (with guardrail, crash cushion, or improved road surface)
K. delineate the obstacle.
L. Nothing.

Other Comments

Road Safety Survey Series

RSS 1	Traffic Signal Light Output	1995/96
RSS 2	Street Lighting	1995/96
RSS 3	Treatment of Slip Lanes at Traffic Signals	1995/96
RSS 4	Stop and Give Way controls at Intersections	1996/97
RSS 5	Advisory Speed Signs	1996/97
RSS 6	Pedestrian Crossings	1996/97
RSS 7	Temporary Speed Limits	1998
RSS 8	Traffic Control at Road Works	1998
RSS 9	Safety Management Systems	1998
RSS 10	Skid Resistance	1999
RSS 11	Pedestrian Platforms	1999
RSS 12	Floodlighting Pedestrian Crossings	1999
RSS 13	No Passing Lines	2000
RSS 14	Roundabouts	2000
RSS 15	Roadside Hazard Management	2001
RSS 16	Road Hierarchies	2001

These reports are available on the LTSA website at www.ltsa.govt.nz or may be purchased from the Regional Engineer, Land Transport Safety Authority in Auckland (Private Bag 92-515), Wellington (PO Box 27-249) or Christchurch (PO Box 13-364) at a cost of $10 each including GST.