Traffic standards and guidelines
2001/2002 survey

RSS 19
Traffic signs

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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 effectiveness of the implementation 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
- identify changes to improve standards, guidelines or traffic rules.

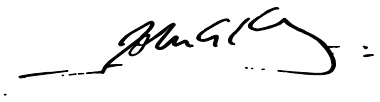
The surveys are usually carried out in two parts:

- 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 user's 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 nearest regional office of the LTSA if you would like further information or assistance with implementing traffic standards or guidelines.



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Executive summary

Introduction

- Surveys were conducted jointly with Transfund New Zealand during 2002 to investigate policies and practices for four safety areas – stock crossing facilities, vehicle entrances, amenity surfacings and traffic signs.
- This report describes the procedures and presents the results for the traffic sign surveys. A companion report details the results of the surveys on the other topics.

Methodology

- Staff in 30 road controlling authorities (RCAs) were interviewed face-to-face about their policies and practices by Land Transport Safety Authority (LTSA) and Transfund staff, after receiving a questionnaire in advance to prepare responses.
- The surveyors, together with council staff, then inspected and noted details of a representative, on-road sample of regulatory signs, permanent warning signs, chevrons and bridge end markers. An average of 140–150 signs were surveyed in urban and rural areas in each authority.

Interview results

- All but two RCAs had a database of information on their signs inventory and most updated it monthly.
- Only 20% of the RCAs reported a formal policy on the provision of traffic signs and few had systematic policies or procedures specifically aimed at managing their signs asset.
- 19 of the 30 RCAs conducted some night inspections of signs.
- There was no consistency in the class of retro-reflective sheeting specified by RCAs with one RCA using nothing but Class 2 sheeting through to another specifying a range of three different classes for different circumstances.
- Generally, only half to two thirds of the authorities had any procedures for checking signs maintenance standards, visibility of signs, cleanliness of signs, retro-reflectivity or correct mounting positions.
- 90% of the RCAs rated the performance of their signs contractor as acceptable or better and all were happy with the implementation of their temporary traffic management plans.
- 11 of the RCAs had experienced problems with the manufacture of signs but all were relatively minor and easily remedied.

Field survey results

- A total of 3,920 signs were surveyed plus 284 which should have been present but were not. Of these, 1,548 were in urban areas and 2,656 in rural areas.
- Of the signs actually present, 403 (10.3%) were completely or partially hidden from the view of approaching motorists, usually by vegetation.
- Many signs were smaller than recommended, notably more than half of all rural Stop and Give Way signs.
- 60% of the signs in urban areas were either too close to the kerb or projecting over the roadway and one in eight bridge end markers was too far away from the roadway to adequately define the trafficable width.
- 23% of the signs were mounted lower than the minimum recommended height including 40% of rural permanent warning signs.
- Nearly 30% of urban Stop and Give Way signs and nearly two thirds of these signs in rural areas were further from the intersection than recommended by the *Manual of Traffic Signs and Markings*.
- Just over half of all the signs surveyed were in good condition or better and about 15% were either missing or needed replacement.
- Just over 40% of all signs surveyed were adequate in all respects (including condition, size, location, visibility and message).

Discussion

- Signs that were not damaged were lasting much longer than their guaranteed life with more than 80% of signs over 10 years old of all retro-reflective classes still in serviceable condition. (This conclusion is based on a subjective daytime assessment.)
- RCAs who reported formal procedures for checking different aspects of their traffic signs had no better standard of signing than others who reported only informal procedures or no procedures at all. The conclusion is that any formal checks must be detailed and purpose-based.
- Overall, RCAs with a dedicated signs contractor or a contractor with specialist signs staff had a higher standard of signs maintenance and a higher level of satisfaction with their contractor than those where the signs contract was part of the network maintenance contract. However, this observation is not uniform across all authorities.

Best practice

The surveyors consider that best practice for traffic signs management includes the following elements:

- recording all traffic signs in a database. RAMM is the most readily available and, if used, all available fields should be entered
- requiring and ensuring signs are marked with the date of installation and that this information is recorded in the database
- continuing regular cyclic inspection regimes (monthly or otherwise) to verify contractual claims
- using MOTSAM or a customised version of the policies in MOTSAM to ensure signs are installed consistently in terms of their format and the situations where they are provided.
- progressively checking all signs conform to MOTSAM or the alternate policy especially to identify locations where necessary signs are missing or have never been installed
- carrying out systematic safety audits as an independent review of installations, checking particularly for correctness, coherence and consistency of sign installations. The field sheets used for this survey could be used for this purpose
- employing contractors that are able to bring relevant specialist expertise to sign maintenance and staff who have sufficient knowledge and experience of signs maintenance to effectively manage the contract
- undertaking systematic night inspections to cover the network at least every two years to check the class of retro-reflective sheeting on each sign is appropriate and the performance is adequate.

Recommendations

- RCAs should adopt and implement any of the elements of best practice above that they do not already have in place.
- A study needs to be undertaken to determine the best class of retro-reflective sheeting to use on signs in different circumstances and national guidelines produced as a result.
- Sign height specifications would be better stated relative to the road surface rather than the base of the signpost.
- The requirement in the *Manual of Traffic Signs and Markings* that RG 5 Stop signs and RG 6 Give Way signs be less than nine metres from the main roadway at an intersection should be reviewed.

1 Introduction

During October to December 2002 the regional offices of the Land Transport Safety Authority (LTSA), jointly with Transfund New Zealand (Transfund) conducted surveys of four roading or road safety issues in a sample of road controlling authorities (RCAs).

The four areas surveyed were:

- stock crossings and stock underpasses
- vehicle entrances
- amenity carriageway surfacings
- traffic signs.

This report describes the procedures and presents the results for the survey of traffic signs.

2 Purposes of the survey

The purposes of the survey were to:

- establish what standards and guidelines are being used by RCAs for the provision of traffic signs
- determine what programmes are used to identify deficiencies and to upgrade or replace traffic signs
- measure on-road practices against current standards and guidelines specifically for regulatory (RG) signs, permanent warning (PW) signs, bridge end markers (BEMs) and chevrons as a representative sample of all traffic signs
- obtain a 'snapshot' of the specifications and state of traffic signs on the road network in New Zealand
- identify and report on 'best practice' for the management of traffic signs
- identify issues that could be improved upon in the provision and maintenance of traffic signs and recommend appropriate remedial action.

3 Methodology

3.1 Sample selection

A sample of 30 RCAs was chosen for the survey, all of them territorial local authorities (TLAs). The sample was weighted towards authorities not included in the 2001/2002 LTSA surveys.

The table in Appendix 1 lists the 30 RCAs included in the surveys.

3.2 Interview surveys

Interview surveys were conducted with representatives of each of the 30 RCAs. Survey forms were sent in advance to allow time to research answers where necessary. Questions were centred around the standards, guidelines, programmes and practices used for the provision of traffic signs.

The questionnaire used for the interview surveys is shown in Appendix 2.

3.3 Field surveys

Field surveys were conducted in all 30 RCAs and staff or representatives from each were encouraged to accompany the surveyors. For practical reasons the survey was limited to:

- regulatory (RG) signs
- permanent warning (PW) signs
- chevrons
- bridge end markers (BEMs).

These sign types were also assumed to provide a reasonably representative sample of the total population of traffic signs for the purpose of the survey.

A small number of other signs were included in the survey because they were in regulatory format and should have been permanent warning signs or vice versa.

Usually four urban and four rural routes were chosen in each RCA that either had a noticeably high crash rate or were likely to have a good representation of these sign types along them. The numbers of each type of sign surveyed in each RCA are shown in the table in Appendix 1.

The surveyors mostly walked the urban routes and on rural routes got out of the survey vehicle to closely inspect each sign. To try and ensure consistency, the same surveyor inspected and assessed the signs in all 30 RCAs. Mostly, the same surveyor transferred assessments to the survey form for all 30 RCAs. There were some changes to the survey method in heavy rain or when other people helped record results.

For most routes, urban and rural, the surveyors aimed to fill in one of the survey forms or record details of all signs on the route if a form could not be filled. This gave an average sample of around 140–150 signs in each RCA.

A copy of the survey form used for the field survey is shown in Appendix 3.

4 Results of the interview surveys

4.1 Inventories of traffic signs

Most of the 30 RCAs in the survey used the Road Assessment and Maintenance Management (RAMM) database to store information about their traffic signs. The types of inventories reported by respondents were:

- no signs inventory or database – 2 RCAs (7%)
- their own in-house database – 4 RCAs (13%)
- use of RAMM but unable to specify which fields were entered – 3 RCAs (10%)
- use of RAMM but entered only some of the available fields – 18 RCAs (60%)
- use of RAMM, entering all available fields – 3 RCAs (10%).

Specifically, 12 RCAs (40%) stated they entered the age or installation date of signs.

Twenty-three RCAs (77%) said they updated their inventory every month based on their contractor's monthly claim. Two of these also carried out a six-monthly audit of these updates. The other methods of updating the inventories included:

- no procedure – 2 RCAs (7%)
- annual or less frequent update – 2 RCAs (7%)
- updated as part of a performance-based contract – 1 RCA (3%)
- relying on the contractor or consultant – 1 RCA (3%)
- updated informally by council staff – 1 RCA (3%).

By way of comparison, in the 2002 LTSA surveys, only 35 percent of RCAs using RAMM for signs inventory said they updated data monthly or more frequently. This is reported in LTSA RSS 18 Data Collection 2002.

4.2 Overall policies for providing traffic signs

Most RCAs had no formal overall policies or strategies for providing traffic signs on their network. Two RCAs (7%) had no policy at all and a further 21 (70%) had no formal policy. Only one RCA reported a systematic programme for replacement of traffic signs and a further six (20%) reported a formal policy as part of an asset management plan.

4.3 Procedures to ensure adequate visibility of signs

A variety of procedures were used to check that adequate visibility of traffic signs was achieved and maintained. These were:

- no check or no formal procedure – 8 RCAs (27%)
- reliance on the contractor to keep sightlines clear – 8 RCAs (27%)
- regular inspections of the maintenance contract – 5 RCAs (17%)
- formal performance criteria had to be met by the contractor – 2 RCAs (7%)
- joint contractor/network manager inspections every six months – 2 RCAs (7%)
- check signs at time of installation – 2 RCAs (7%)

- standard procedure to measure all signs – 1 RCA (3%)
- annual audit of part of the network – 1 RCA (3%)
- specific one-off surveys – 1 RCA (3%).

One RCA used a public complaints procedure in addition to regular inspections of the maintenance contract.

4.4 Policies on the replacement of traffic signs

RCAs reported using the following policies or procedures to determine when to replace traffic signs:

- inspections-based programme – 5 RCAs (17%)
- only act on reports of damaged signs – 7 RCAs (23%)
- annual inspection – 3 RCAs (10%)
- rely on contractor – 4 RCAs (13%)
- no formal policy – 11 RCAs (37%).

Most of those RCAs reporting 'no formal policy' replaced signs when casual observation found them to be damaged or the legend faded.

4.5 Procedures to check overall coherence and consistency of traffic signs

When asked about procedures they used to check whether signs on their network were installed consistently and in line with drivers' expectations, reported procedures were:

- no procedures – 12 RCAs (40%)
- occasional audit – 6 RCAs (20%)
- cyclic inspections – 7 RCAs (23%)
- rely on the contractor – 2 RCAs (7%)
- safety audits – 2 RCAs (7%)
- night inspections – 1 RCA (3%)

Such checks are important to ensure that all necessary signs are installed in compliance with guidelines or standards. Many RCAs carried out these checks more frequently on main routes than on other routes. The frequencies for conducting these checks on main routes were:

- monthly – 11 RCAs (37%)
- three-monthly – 2 RCAs (7%)
- six-monthly – 3 RCAs (10%)
- annually or less – 3 RCAs (10%)

- irregularly – 4 RCAs (13%)
- no checks – 7 RCAs (23%).

One of the RCAs conducting monthly checks also stated they conducted other checks at random.

If such checks are conducted for the specific purpose of checking sign coherence and consistency there should be no need to do them more frequently than annually. However, the anomaly is noted that only seven RCAs said they carried out no checks in answer to this question while 12 RCAs said they had no procedures for doing such checks. A conclusion is that the checks referred to in the answer on frequency were not for this specific purpose.

4.6 Quality control and quality assurance schemes

Nearly all RCAs had specified a quality control or quality assurance scheme in their signs contract. The specifications used were:

- contractor under a performance-based contract – 1 RCA (3%)
- contractor had their own QA scheme – 9 RCAs (30%)
- Transit New Zealand Report TQS1 Quality system for road construction, road maintenance and structures, physical works contracts having a high QA level – 7 RCAs (23%)
- Transit New Zealand Report TQS2 Quality system for road construction, road maintenance and structures, physical works contracts having a normal QA level – 2 RCAs (7%)
- Transit New Zealand Specification Q/03 ‘Normal QA Level Contracts’, 1995 – 1 RCA (3%)
- modified Transit NZ specification – 2 RCAs (7%)
- pictorial standards included in contract specification – 1 RCA (3%)
- none specified – 6 RCAs (20%)
- no answer – 1 RCA (3%)

The surveyors noted that some contractors were using their own QA schemes that were more demanding than the quality control specified in the contract documents.

4.7 Night inspections of traffic signs

The frequencies of night inspections reported by RCAs were:

- monthly – 1 RCA (3%)
- six-monthly – 4 RCAs (13%)
- annually or less – 11 RCAs (37%)
- rely on contractor – 3 RCAs (10%)

- no night inspections – 10 RCAs (33%)
- no answer – 1 RCA (3%)

Two RCAs reported doing random night inspections in addition to the scheduled inspections. Six authorities reported they did night inspections on main routes only.

4.8 Procedures for inspecting sign maintenance standards

The range of procedures reported for checking the adequacy of maintenance of traffic signs was:

- contractor validates under performance-based contract – 1 RCA (3%)
- cyclic inspections with two teams swapping areas – 1 RCA (3%)
- joint inspections by contractor and network manager – 4 RCAs (13%)
- cyclic and random inspections – 2 RCAs (7%)
- network manager audits work monthly – 10 RCAs (33%)
- three formal inspections per annum – 1 RCA (3%)
- annual inspections by day and night – 1 RCA (3%)
- no formal procedure – 10 RCAs (33%).

4.9 Classes of retro-reflective sheeting used

A slight majority of RCAs specified different classes of retro-reflective sheeting for different types of signs Typically in these RCAs a higher grade of retro-reflectorisation was specified for regulatory signs than for other signs. Two RCAs reported using Enhanced Class 1 sheeting on all warning signs for vulnerable road users. The numbers of RCAs specifying different types of sheeting were:

- Class 2 – 1 RCA (3%)
- Class 1 – 9 RCAs (30%)
- Class 1 or Class 2 – 10 RCAs (33%)
- Class 1 or Enhanced Class 1 – 6 RCAs (20%)
- all Classes depending on circumstances – 1 RCA (3%)
- no policy or policy not known – 3 RCAs (10%).

4.10 Procedures to check drivers' sightlines are not obscured by vegetation

This question was more specific than the question covered in Section 4.3 and the responses from some RCAs were quite different from those in Section 4.3. Responses were:

- performance specification and audit regime – 2 RCAs (7%)

- cyclic inspections (other than monthly) – 3 RCAs (10%)
- audited monthly – 9 RCAs (30%)
- random inspections – 1 RCAs (3%)
- checked annually – 1 RCA (3%)
- rely on contractor – 4 RCAs (13%)
- no formal inspections – 10 RCAs (33%).

One of the authorities conducting other than monthly inspections used two teams swapping areas to encourage continuous improvement.

4.11 Specifications for cleaning traffic signs

Seven RCAs (23%) reported they had no requirements in their contracts for signs to be cleaned. The requirements for the other RCAs were:

- 1 RCA (3%) had a performance-based contract and audit regime
- 4 RCAs (13%) required cleaning only after a need was identified
- 3 RCAs (10%) used the TNZ C/20 specification
- 15 RCAs (50%) specified in their contracts 'that signs must be kept clean' or had a similar requirement.

4.12 Procedures to check cleaning of traffic signs

Reported procedures for checking that signs had been cleaned were largely as informal as the specifications for cleaning. They were:

- 1 RCA (3%) had a performance-based contract and audit regime
- 8 RCAs (27%) checked as part of their monthly audit of the contract
- 1 RCA (3%) conducted cyclic inspections
- 3 RCAs (10%) carried out random inspections
- 17 RCAs (57%) had no formal inspections.

4.13 Procedures to check retro-reflectivity of traffic signs

Equipment to properly check the retro-reflective sheeting on signs is costly, time consuming to use and not readily available in New Zealand. It is, therefore, not surprising that no RCAs specified or conducted objective testing of their signs in the field. Only three RCAs specified anything to do with retro-reflectivity in their signs contract, one of these referring to Clause 1.13 in the Transit New Zealand/Land Transport Safety Authority *Manual of Traffic Signs and Markings*, 1998 (MOTSAM.) The subjective procedures used to check retro-reflectivity were:

- visual night inspections – 3 RCAs (10%)
- annual winter inspections – 1 RCA (3%)

- rely on the network management consultant – 3 RCAs (10%)
- check that reflective class on new signs is correct – 1 RCA (3%)
- rely on casual observations – 3 RCAs (10%)
- no formal procedure – 19 RCAs (63%).

4.14 Procedures to check mounting of traffic signs

MOTSAM gives requirements for mounting traffic signs in terms of their height, lateral offset and longitudinal offset. RCAs were asked about the procedures they use to check that signs are mounted in accordance with these (or other) requirements. Their responses on the type of procedures were:

- 1 RCA (3%) had a performance-based contract and audit regime
- 8 RCAs (27%) conducted both monthly and random inspections
- 1 RCA (3%) checked all new signs and conducted six-monthly audits
- 4 RCAs (13%) relied on their network management consultant to do any checking
- 7 RCAs (23%) relied on casual observation
- 4 RCAs (13%) relied on their contractor
- 5 RCAs (17%) had no procedure.

The frequency of these inspections were:

- 13 RCAs (43%) conducted monthly checks
- 2 RCAs (7%) conducted six-monthly checks
- 5 RCAs (17%) were unsystematic in programming checks
- 10 RCAs (33%) had no checking procedure.

4.15 Level of satisfaction with signs maintenance contractor

RCAs were asked to rank their level of satisfaction with their signs contractor on a five point scale. Some RCAs chose intermediate points on the scale but the responses were:

- Excellent – 1 RCA (3%)
- Good – 11 RCAs (37%)
- Acceptable to good – 4 RCAs (13%)
- Acceptable – 11 RCAs (37%)
- Poor to acceptable – 1 RCA (3%)
- Poor – 1 RCA (3%)
- Very poor – none.

One RCA provided no answer since their contractor had only been contracted for a month. There was generally a good level of satisfaction with signs contractors with 90% rating their contractor's performance 'acceptable' or better.

4.16 Traffic management requirements for signs maintenance contractor

In view of the changing requirements for temporary traffic management at the time of the surveys, RCAs were asked which specifications they had adopted for their signs maintenance contract. Responses were:

- Transit New Zealand *Code of Practice for Temporary Traffic Management*, 2002 (CoPTTM) – 6 RCAs (20%)
- CoPTTM and Transit New Zealand *Working on the Road: A Handbook for Temporary Traffic Control and Safety at Roadwork Sites*, 1993 (WOTR) – 1 RCA (3%)
- Transit New Zealand *Specification G1 Temporary Traffic Control*, 1996 and Transit New Zealand *Temporary Traffic Control for High Capacity Highways Manual*, Auckland – 1 RCA (3%)
- approved traffic management plan – 2 RCAs (7%)
- Transit New Zealand *Specification G1 Temporary Traffic Control*, 1996 – 7 RCAs (23%)
- WOTR – 8 RCAs (27%)
- Transit New Zealand *Specification G1 Temporary Traffic Control*, 1996 and WOTR – 4 RCAs (13%)
- CoPTTM and Transit New Zealand *Specification G1 Temporary Traffic Control*, 1996 – 1 RCA (3%).

Note that Transit New Zealand *Specification G1 Temporary Traffic Control*, 1996, WOTR and Transit New Zealand *Temporary Traffic Control for High Capacity Highways Manual* have all been superseded by CoPTTM. However, continued use of the requirements in these documents was often because contracts had been in place before the release of CoPTTM.

4.17 Satisfaction with traffic management by signs maintenance contractor

Overall, RCAs were relatively happy with the way their signs contractors were implementing their temporary traffic management plans. Again on a five-point scale, there was a fairly narrow range of responses:

- Good performance – 9 RCAs (30%)
- Acceptable to good performance – 6 RCAs (20%)
- Acceptable performance – 15 RCAs (50%)

4.18 Quality problems with traffic signs

Eleven (37%) of the 30 RCAs questioned stated they had experienced problems with the quality of signs supplied to them. Generally though, problems were minor and were not on-going. Examples of the types of problems reported were:

- damage during transport
- spelling errors or poor alignment of the text on the sign face
- screen printed legend fading too fast (3 RCAs)
- wrong colour or class of retro-reflective sheeting (2 RCAs)
- direction arrow missing from the legend
- delamination of Class 1 sheeting
- inability of a sign mounting system to withstand wind loads (2 RCAs).

Remedies to these problems mostly involved replacement of defective signs by the supplier. Other remedial actions reported were:

- change of supplier
- using vinyl overlay instead of screen printing for the legend
- better control and checking of incoming stock.

5 Results of the field surveys

5.1 Survey sample

In total, 3,920 traffic signs were surveyed in the 30 RCAs and a further 284 signs were recorded as ‘absent’. That is, the sign was missing from the post or, in the opinion of the surveyors, should have been installed for legal or practical reasons. For practical reasons the survey was limited to:

- regulatory (RG) signs
- permanent warning (PW) signs
- chevrons
- bridge end markers (BEMs).

A small number of other signs included in the survey were regulatory format and should have been permanent warning signs or vice versa.

Usually four urban and four rural routes were chosen in each RCA that either had a noticeably high crash rate or were likely to have a good representation of these sign types along them. The number of each type of sign surveyed in each RCA is shown in the table in Appendix 1.

A total of 1,548 signs were surveyed in urban areas and 2,656 in rural areas (including those recorded as absent.)

For each sign in the survey, the following characteristics were recorded:

- sign type (using the code number from MOTSAM)
- age (subjective estimate if not recorded on the sign itself)
- class of retro-reflectivity
- what obstruction was limiting visibility of the sign, if applicable
- size
- colour (only noted if it was clearly the wrong colour)
- whether the lettering/symbol was correct
- lateral offset
- orientation (relative to approaching traffic)
- height
- condition (subjective assessment)
- longitudinal offset (for RG-5 Stop and RG-6 Give Way signs only)
- other comments, if applicable.

5.2 Age distribution of signs

Newer traffic signs (typically less than about 10 years old) commonly have their date of installation etched on them or punched on a manufacturer's sticker. For such signs, the age of the sign (from installation date) was recorded, usually to the nearest year. The ages of other signs were assessed subjectively on the scale 'new, newish, oldish, old, very old'.

Figures 1 and 2 show the two age distributions recorded.

Figure 1. Age distribution of signs of known age (all RCAs)

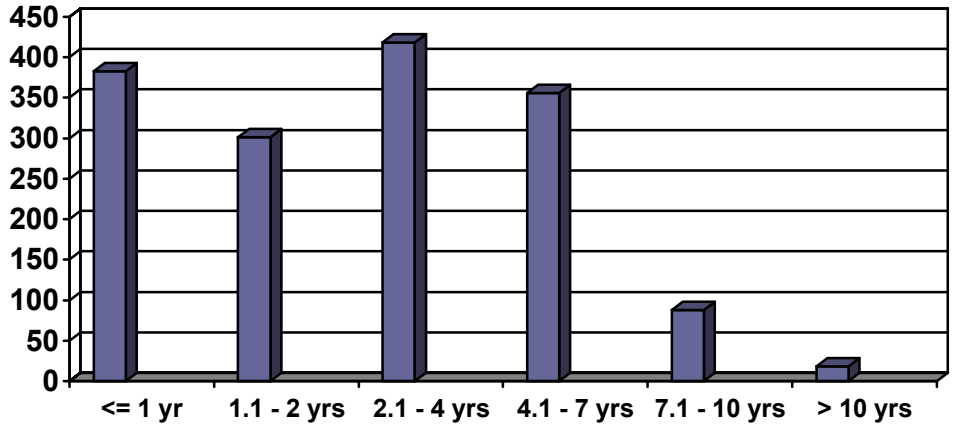
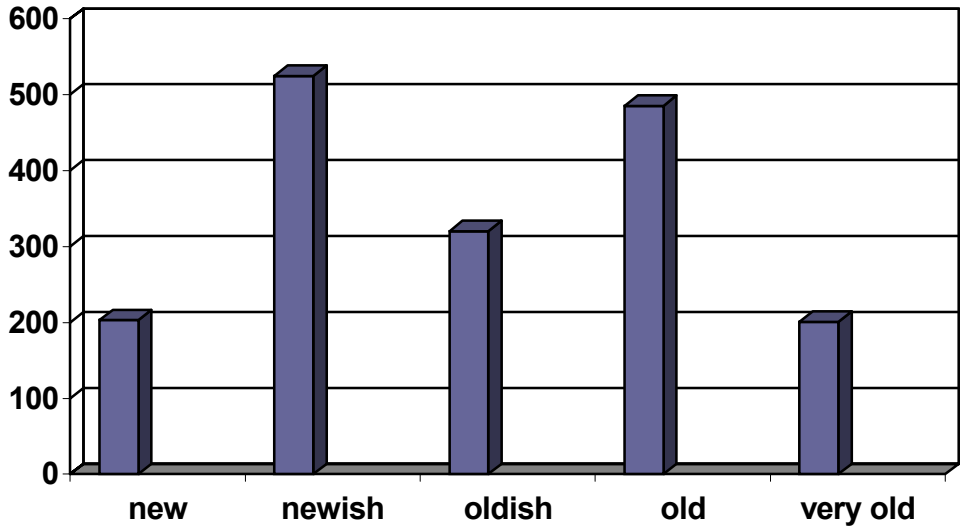


Figure 2. Age distribution of signs (subjective) (all RCAs)



5.3 Retro-reflective classes of signs

Figure 3. Retro-reflective class by sign type

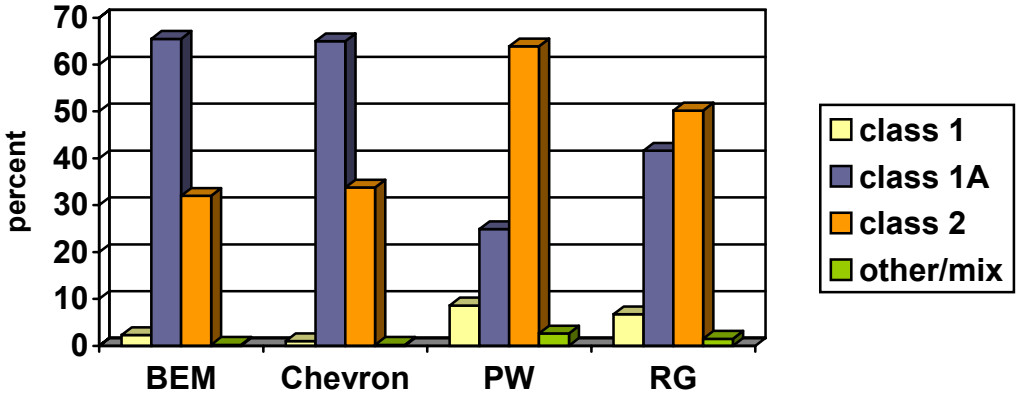


Figure 3 shows the retro-reflective class by sign type for all signs in the survey sample. Note that Class 1A also includes signs with Enhanced Class 1 in this figure.

5.4 Items obscuring traffic signs

Overall, 403 signs in the sample of 3,920 (10.3%) were completely or partially hidden from approaching motorists by an obstruction of some sort. The most common types of obstruction were:

- long grass/weeds/wild flowers – 81 cases
- curve in the road – 72 cases
- planted tree or shrub on road reserve – 62 cases
- planted tree or shrub on private land – 43 cases
- guard rail or sight rail – 31 cases
- self-sown tree or shrub on road reserve – 29 cases
- crest in the road – 22 cases
- other traffic sign – 20 cases
- wild tree or shrub on private land – 15 cases.

Most (55–60%) of the signs hidden by unavoidable obstructions such as a crest or curve in the road were regulatory signs. Where the longitudinal position of these signs could not be changed, the installation of an advance warning sign can mitigate for the lack of visibility.

However, of real concern is the number of cases where the RCA has caused the visibility obstruction by their own actions such as planting trees or locating guard rails or other traffic signs poorly in relation to one another. Other cases result from lack of action by RCAs such as control of grass (often coupled with signs that are mounted too low) and other vegetation on the road reserve.

5.5 Sizes of traffic signs

Sign sizes were checked against the sizes recommended in MOTSAM. Although none of the authorities surveyed stated they used MOTSAM to determine their sign sizes, many stated that their signs contracts referred to MOTSAM when asked what their overall policies were on provision of signs.

Overall, in urban areas:

- 13 signs (0.8%) were smaller than recommended. (nine of these were chevrons.)
- 274 signs (19.0%) were larger than recommended.

In rural areas:

- 482 signs (19.4%) were smaller than recommended. (247 of these were regulatory signs, 178 permanent warning signs and 57 were chevrons)
- 62 signs (2.5%) were larger than recommended.

In rural areas, 57.9% of RG 5 Stop signs and 55.8% of RG 6 Give Way signs were smaller than recommended by MOTSAM

There is evidence that many RCAs who installed undersize signs in the past are now installing signs complying with MOTSAM sizes as the older signs need replacing. (Using the subjective distribution of sign ages, only 11.0% of signs assessed as new or newish were too small compared with 22.5% of signs assessed as oldish, old or very old).

5.6 Colour of chevron signs

The colour of all chevron signs in the sample was recorded. The distribution of colours observed was:

- 226 (61.1%) were silver or white on black
- 98 (26.5%) were yellow on black
- 46 (12.4%) were black on yellow.

While changes in the specifications for the colour of chevron boards is partly responsible for the observed differences in colours, comparing observed colours with the recorded ages of chevrons showed that some authorities are continuing to install silver on black or yellow on black chevrons. Only 38 of 79 chevrons (48.1%) recorded as new or less than one year old were recorded as black on yellow, the current MOTSAM standard.

5.7 Symbols/messages on signs

Fifty-two of the 3,920 signs surveyed (1.3%) were recorded as having the wrong symbol or the symbol/message missing from the sign. By far the most common fault recorded was the wrong road layout shown on a permanent warning sign (35 occurrences.)

5.8 Lateral offset of signs

Broadly, the edge of any traffic sign nearest the road should be at least the following minimum distances away from the kerb or edge of the shoulder (for unkerbed roads:

- 300 mm from a non-mountable kerb
- 500 mm from a mountable kerb
- 600 mm from the edge of the shoulder (in urban and rural areas).

Lateral offsets of chevrons were not recorded in the survey. For BEMs, surveyors only recorded whether they defined the trafficable width or whether they were too far from the roadway. Of the lateral offsets recorded:

- 24 signs (1.6%) in rural areas with no kerb had no clearance or projected over the shoulder
- 101 signs (6.8%) in rural areas with no kerb had less than 600mm clearance from the shoulder
- 316 signs (24.3%) in urban areas with a kerb had no clearance or projected over the roadway.

- 466 signs (35.9%) in urban areas with a kerb had less than 300mm clearance from the kerb
- 66 of these 466 signs in urban areas were RG 17 or RG 17.1 Keep Left signs
- 98 of 786 BEMs (12.5%) were too far away from the carriageway to adequately define the trafficable width.

5.9 Orientation of signs

While most traffic signs of the types being surveyed should be turned about five degrees away from a driver's line of sight, notes were made where signs were leaning or the horizontal angle differed markedly from five degrees.

The results showed 188 of the 3920 (4.8%) of signs in the survey were badly oriented in relation to approaching traffic. The most common problems observed were:

- 137 signs were on a significant lean
- 14 signs were turned too far away from the road
- 13 signs were turned too far towards the road
- 11 signs were parallel to the road
- 13 signs were otherwise wrongly oriented.

5.10 Height of signs

Other than certain sign types (eg Keep Left signs, BEMs, chevrons) MOTSAM recommends the lowest sign on a given post should be the following minimum height above the base of the post:

- 1.5 metres in rural areas and for general use
- 2.0 metres in urban areas, except for
- 2.5 metres above a footpath.

Out of the total of 2,836 permanent warning and regulatory signs in the sample (excluding those noted above), 654 (23.1%) were mounted lower than MOTSAM recommendations. Those signs that were too low were:

- 381 rural permanent warning signs (39.8%)
- 106 rural regulatory signs (21.5%)
- 82 urban permanent warning signs (18.2%)
- 85 urban regulatory signs (9.1%).

However, of these, 94 rural and 22 urban signs were subjectively judged to be at an appropriate height despite not meeting MOTSAM requirements. Reasons for this include:

- the triangular shape of RG 6 Give Way signs means they can be mounted lower than 2.5 metres above a footpath where they are more visible to motorists without posing a hazard to pedestrians
- where a signpost is mounted above the road surface it would be more appropriate to measure the height of the sign above the road rather than above the base of the post
- the nature of the approach to some sign sites makes it necessary to mount the sign lower than MOTSAM recommendations in order for it to be seen.

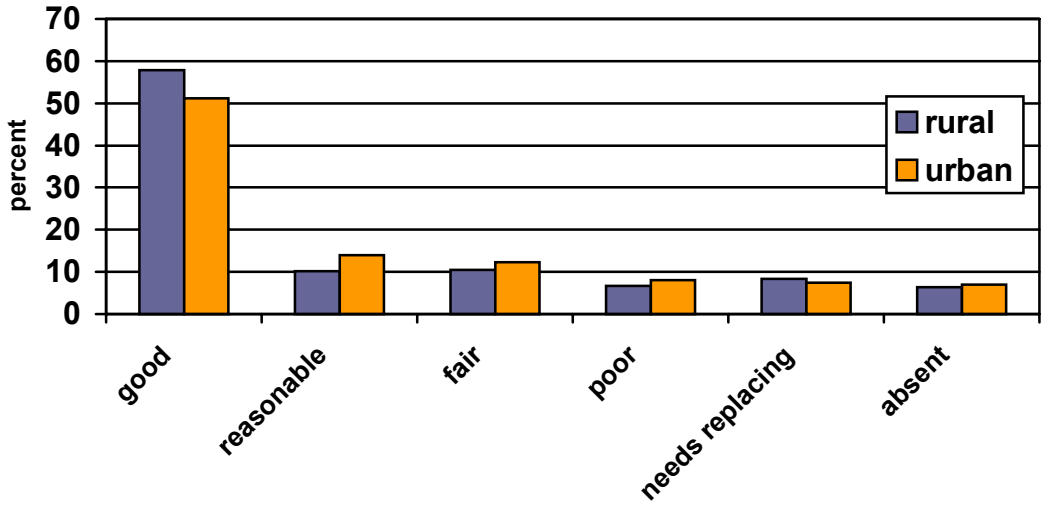
5.11 Longitudinal offset of Stop and Give Way signs

The surveyors recorded the longitudinal offset (ie the distance from the sign to the edge of the main roadway at the intersection) of 548 RG 5 Stop and RG 6 Give Way signs. The results showed that 211 of these (38.5%) had a longitudinal offset greater than the nine metres maximum stated in MOTSAM. Of these, 98 were in rural areas (63.6% of rural RG 5 or RG 6 signs recorded) and 113 were in urban areas (28.7% of urban RG 5 or RG 6 signs recorded).

5.12 Condition of signs

The condition of all signs surveyed was subjectively assessed in daylight. The same surveyor did this for the duration of the survey to try and ensure some consistency. Assessments were based on the scale 'good, reasonable, fair, poor, needs replacing, absent'. Figure 4 shows the distribution of sign condition for rural and urban areas separately.

Figure 4. Condition of signs by area



The table in Appendix 4 shows the distribution of assessed sign condition for the signs surveyed in each local authority.

The surveyors considered signs other than those classified as 'needs replacing' and those that were missing or absent were still serving their purpose.

5.13 Other observations about signs

A total of 519 signs from the sample of 3,920 signs (13.2%) surveyed had some other comment noted about them. The most common of these observations were:

- 98 (2.4%) were damaged (usually by vehicle impact)
- 95 (2.4%) were buckled
- 86 (2.2%) were noticeably dirty
- 49 (1.3%) had graffiti on them
- 46 (1.2%) had significant lichen growth on them
- 35 (0.9%) had the supplementary sign missing
- 32 (0.8%) had a buckled supplementary sign
- 20 (0.5%) had bullet holes in them.

5.14 Type of signs absent

Of the 284 signs the surveyors considered should have been present but weren't:

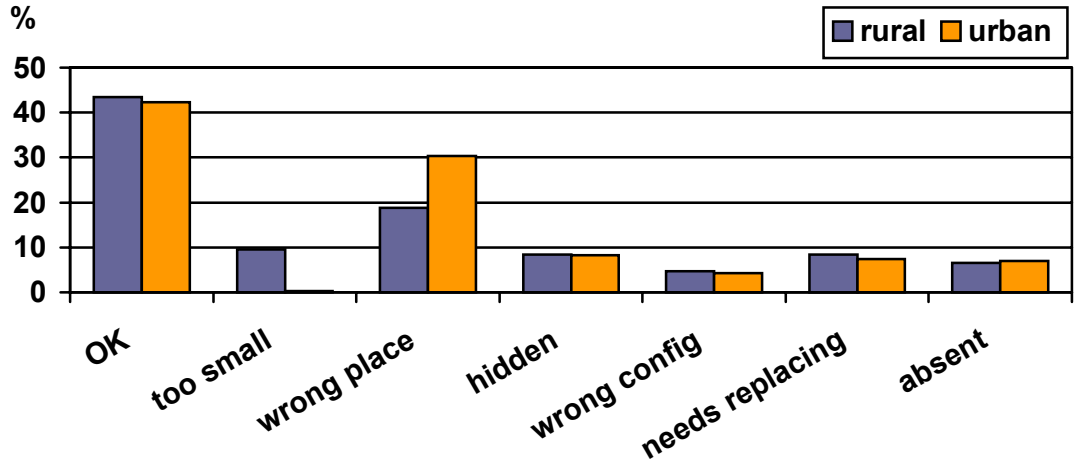
- 40 were BEMs
- 28 were chevrons
- 140 were permanent warning signs
- 74 were regulatory signs
- 2 were other signs.

These numbers include signs that were missing off their post as well as those that had apparently never been installed.

5.15 Overall state of signs

Each sign surveyed was assessed for its overall state in relation to its condition, whether it was in the right place, the right sign, etc. Figure 5 shows the distribution of the overall state of the signs by area.

Figure 5. Overall state of signs (all RCAs)



The table in Appendix 5 shows the overall state of the signs surveyed in each road controlling authority.

For the purpose of this analysis, these attributes have been put in a hierarchy from 'absent' to 'OK'. A sign with more than one of these things wrong has been included under the 'worst' of its attributes. For example, a sign that was too small and needed replacing would be included under 'needs replacing'. The order of these attributes in the hierarchy is intended to reflect how well a sign was doing its job. For individual cases it is arguable that the attributes should be in a different order.

It is also worth noting that the most common reason for recording a sign as being in the 'wrong place' was if it was mounted too low.

6. Discussion

6.1 Age distribution of the signs inventory

It is worth noting here that many of the signs that had the manufacturer's stickers on them had not had their installation date punched in the sticker. The surveyors estimate that around half of the signs that were judged to be less than about 10 years old did not have their installation date on them in any form.

Cross-tabulating each of the actual and subjective age distributions (shown in Figures 1 and 2 in Section 5.2) with the assessed sign condition separately for Class 1 and Class 2 signs enables an indicative composite age distribution for the whole sample to be determined. The cross-tabulations are shown in Tables A6.1 and A6.2 in Appendix 6 and the distribution is shown in Figure 6.

Figure 6. Age distribution of signs (composite) (all RCAs)

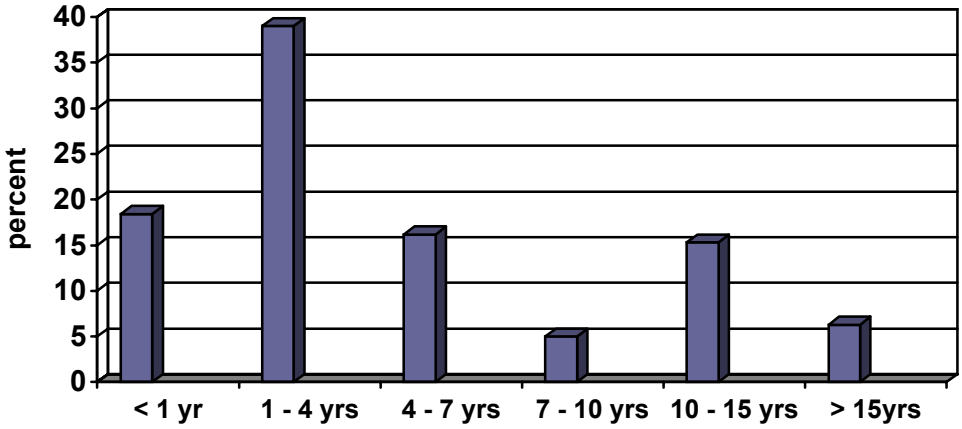


Figure 6, the indicative composite age distribution for all the signs that had their age recorded, shows something over 20% of the signs surveyed may have been more than 10 years old. Only one authority was surveyed that was trying to implement a policy of replacing all their traffic seven years for Class 2 sign. Figure 7 shows that high proportions of signs with both classes of retro-reflective sheeting would still be in serviceable condition after these ages. Figure 8 shows the same information for the subjective age distribution. Again, in these figures and Figure 9, Enhanced Class 1 signs are included with Class 1A signs.

Only 3 of the 82 Class 2 signs more than seven years old were rated as 'needs replacing'. Only two Class 1 signs were found that were known to be over 10 years old and these were rated 'OK' and 'fair'.

Figure 7. Signs rated in serviceable condition by age (known ages only)

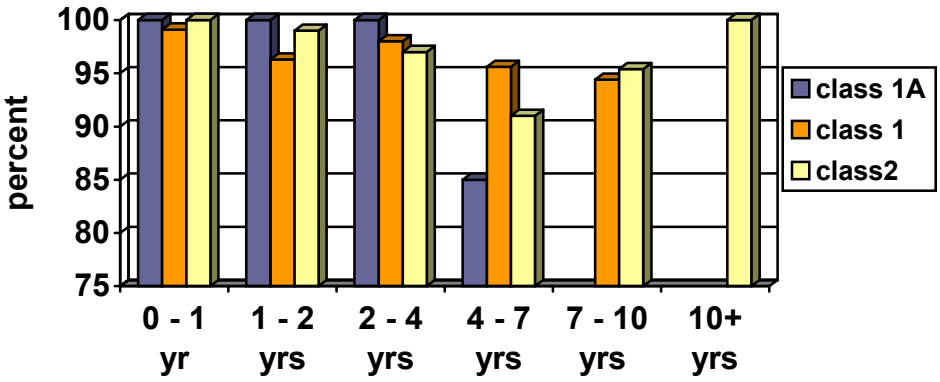
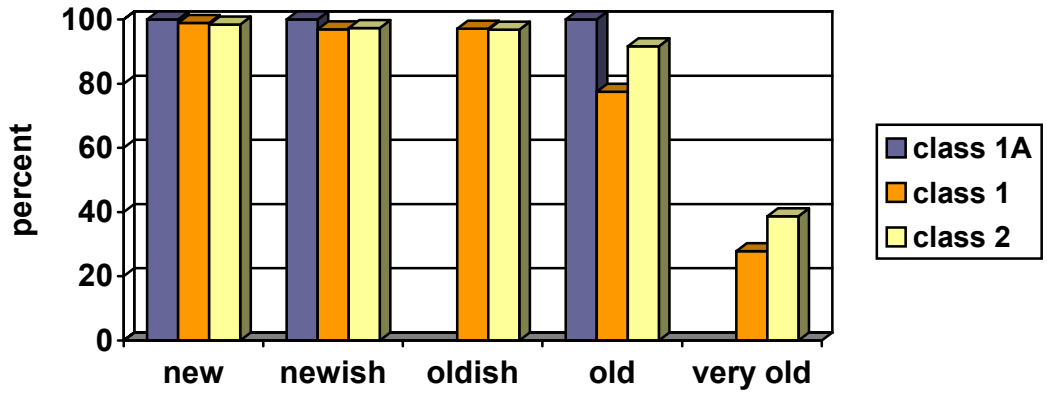


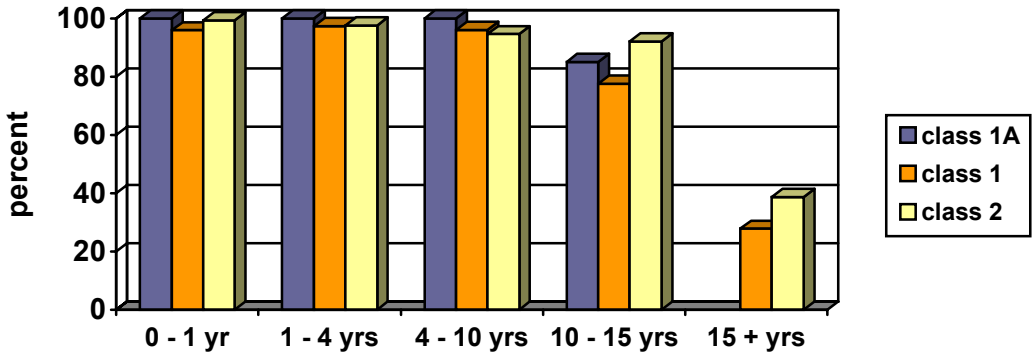
Figure 8. Signs rated in serviceable condition by age (subjective ages)



The apparent anomalies in the Figure 7 are due to small samples. However, it was apparent that Class 2 reflective sheeting remained in serviceable condition longer than Class 1 sheeting. This seemed in part because Class 1 sheeting deteriorated where it had been cut, causing water and dirt to enter the cells, promoting lichen growth and delamination.

Although ratings of condition were subjective, the longevity of Class 2 sheeting shows up clearly in Figure 9 which uses the indicative age distribution from Figure 6.

Figure 9. Signs rated in serviceable condition by age (indicative age distribution)



All staff interviewed were asked to estimate the proportion of their signs that needed replacement due to vandalism or theft. While the responses were not recorded as part of the survey, estimates were consistently around 30% or one third of all replacements.

6.2 Programmes for checking and inspection of signs

RCAs reported various methods and frequencies for inspecting their networks to determine the need for maintenance or replacement of signs. Specifically, they reported on procedures and programmes to check:

- adequacy of sightlines to signs
- whether vegetation is hiding signs
- night-time effectiveness of signs
- effectiveness of maintenance and cleaning of signs
- mounting heights and locations of signs.

Cross-tabulating some of the results from this survey allows an evaluation of the relative success of each of the methods used towards achieving effective signs. Some very interesting results show up.

6.2.1 Sightlines to Signs

RCAs were asked what procedures they used to check that sightlines to signs were adequate. Grouped responses together with the proportions of signs that were completely or partly hidden by something other than a crest or curve in the road (which would generally have an advance warning) were:

- no formal procedure (8 authorities) – 7.0% of signs hidden
- rely on contractor (8 authorities) – 5.9% of signs hidden
- formal procedures (14 authorities) – 8.3% of signs hidden.

The formal procedures reported, the number of authorities reporting them and the resulting proportions of hidden signs were:

- cyclic inspections of maintenance contract (5 RCAs) – 8.5% hidden
- check at time of installation (2 RCAs) – 5.3% hidden
- six monthly joint check by consultant and contractor (2 RCAs) – 9.1% hidden
- contractor required to meet audited performance criteria (2 RCAs) – 13.7% hidden
- ‘standard procedure to measure all signs’ (1 RCA) – 12.3% hidden
- annual audit of part of the network (1 RCA) – 1.9% hidden
- specific one-off surveys (every few years) (1 RCA) – 6.8% hidden.

Most of these reported procedures involved inspections or audits that covered a number of different issues simultaneously. It is clear from these results that the procedures are not generally effective in maintaining adequate sightlines to signs.

6.2.2 Vegetation hiding signs

RCAs were asked what procedures they used to check that sightlines to signs were not obscured by vegetation. Grouped responses together with the proportions of signs that were completely or partly hidden specifically by vegetation were:

- no formal procedure (10 RCAs) – 3.3% of signs hidden
- rely on contractor (4 RCAs) – 6.0% of signs hidden

- formal procedures (16 RCAs) – 6.6% of signs hidden.

Again, the formal procedures reported, the number of authorities reporting them and the resulting proportions of hidden signs were:

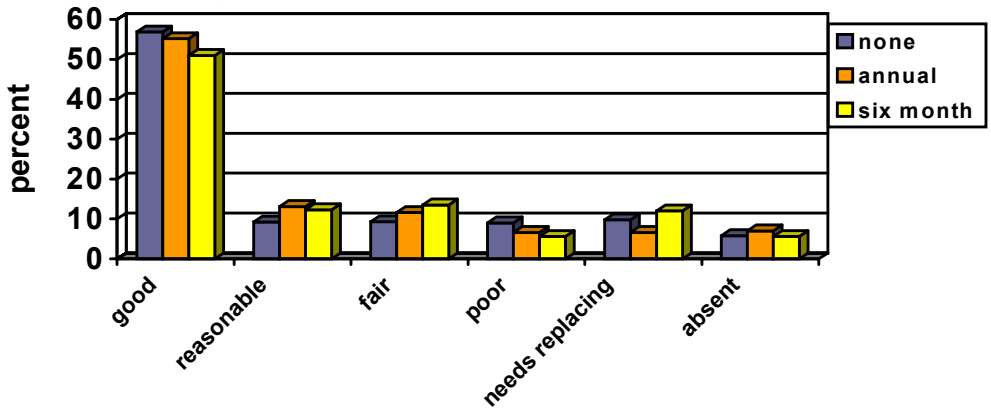
- monthly inspections of maintenance contract (9 RCAs) – 7.3% hidden
- cyclic inspections (other than monthly) (3 RCAs) – 5.4% hidden
- contractor required to meet audited performance criteria (2 RCAs) –5.9% hidden
- annual audit of the network (1 RCA) – 8.7% hidden
- random inspections (1 RCA) – 3.7% hidden.

As in Section 6.2.1 it is apparent that the reported formal procedures are not effective in ensuring that signs are not hidden by vegetation. Similar comments apply regarding the need to ensure that all aspects of signs are actually inspected and checked off.

6.2.3 Night inspection of signs

The most common frequencies RCAs reported for night-time inspections of signs were annually (12 RCAs), none (11 RCAs), or six-monthly (3 RCAs). Figure 10 relates the frequency of night-time surveys to the subjective condition of signs as recorded during the survey.

Figure 10. Condition of signs by frequency of night-time inspections



As Figure 10 shows, there was little difference in the condition of signs for the different frequencies of inspections.

6.2.4 Checking adequacy of maintenance by contractors

RCAs reported a number of methods for checking that their contractor was adequately maintaining signs on the road. These methods, together with the proportion of signs in the survey that were adequate in all respects were:

- no formal checking procedure (11 RCAs) – 43.6% OK overall

- audit (a sample of) work monthly (9 RCAs) – 40.6% OK overall
- cyclic audits plus random inspections (2 RCAs) – 47.9% OK overall
- joint cyclic inspections by consultant and contractor (2 RCAs) – 43.5% OK overall
- six-monthly inspections of contractor's work (2 RCAs) – 37.1% OK overall.

While the above results show little variation (and therefore again show that the regular audits being done have little effect), two of the other four authorities stood out with their results. One that had annual day and night inspections had 63.8% of signs adequate in all respects. The other, where the contractor was required to validate that they had met their performance criteria (ie self-regulation), achieved 27.8% of signs adequate in all respects.

6.2.5 Checking adequacy of cleaning by contractors

Reported procedures for checking that signs have been adequately cleaned together with the proportion of signs recorded as 'dirty' in the survey were:

- no formal procedures (15 RCAs) – 2.0% of signs dirty
- monthly audits (9 RCAs) – 2.2% of signs dirty
- random inspections (3 RCAs) – 1.5% of signs dirty
- regular inspections (less than monthly) (2 RCAs) – 1.0% of signs dirty
- contractor meets performance specification (1 RCA) – 6.1% of signs dirty.

Again, there is no evidence that scheduled inspections are any more effective than informal inspections. There is a suggestion that self-regulation by the contractor in the one RCA is not effective.

6.2.6 Checking mounting heights and locations

The effects of RCAs using different procedures to check mounting heights and lateral offsets of signs against MOTSAM requirements was reflected by the overall proportion of signs in the sample found to be incorrectly placed. These were:

- no procedures (3 RCAs) – 18.7% of signs wrong
- rely on contractor (3 RCAs) – 15.1% of signs wrong
- casual observation (7 RCAs) – 28.5% of signs wrong
- audits by consultant/network manager (4 RCAs) – 26.4% of signs wrong
- check at installation (2 RCAs) – 27.2% of signs wrong
- monthly plus random audits (8 RCAs) – 21.0% of signs wrong
- contractor meets performance specifications (3 RCAs) – 17.0% of signs wrong.

Again, there is no evidence that reported regular inspections and audits are any more effective at ensuring signs are mounted correctly than doing nothing or using casual observation. If anything, the procedures being used are less effective.

6.2.7 Overall effectiveness of procedures for checking the standard of signs

The results reported in the preceding sections show clearly that, in general, the formal procedures being reported are having no more effect, often less effect, on the standard of signs on the road than informal procedures or no procedures at all. The survey reported in this document shows that a thorough and systematic procedure can identify deficiencies, which can then be rectified. Possible ways to ensure that inspection and audit procedures are effective in maintaining the desired standard of signs include:

- doing a purpose-based inspection rather than one to check that a contractor has done work that is being paid for
- ensuring inspections are conducted by knowledgeable and experienced people
- ensuring inspections are dedicated to inspecting signs alone and not cover a multitude of issues at the same time
- using a checklist of characteristics for each sign, possibly based on the field sheets used for this survey
- conducting the inspections at appropriate intervals
- conducting follow-up field inspections to ensure that necessary work has been done correctly.

6.3 Type of signs maintenance contract

The points immediately above emphasise the importance of having experienced and knowledgeable people looking after traffic signs. Subjectively, the surveyors considered the standard of signs in authorities with specialist signs contractors was higher than in other authorities. Of the 30 RCAs surveyed:

- 10 had a specialist signs contractor
- one had their signs contract as part of their network maintenance contract but with a dedicated staff member to look after signs
- 19 had their signs contract as part of their network maintenance contract.

Looking at the overall state of signs in each of these groups (as in Section 5.15) shows:

- in RCAs with a separate signs contract, 46.7% of the signs were OK in every respect
- in the other RCAs, 41.0% of signs were OK in every respect.

(For the purpose of this analysis, the single authority where the contractor had a dedicated staff member for signs is included in the group with a separate signs contractor.)

RCAs participating in the survey were also asked to rank their satisfaction with the performance of their signs contractor. This enables an alternative analysis as shown in Figure 11.

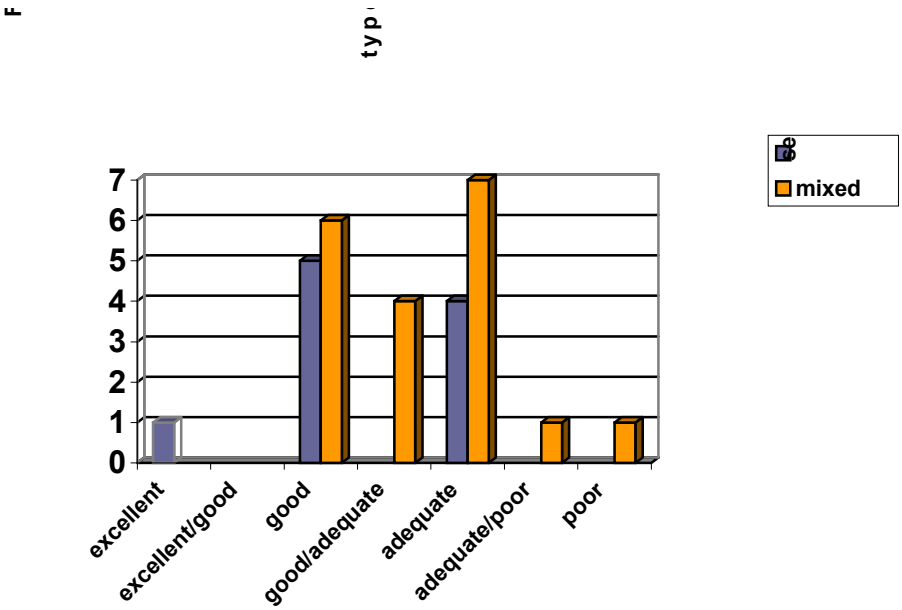


Figure 11 shows there is overall a higher level of satisfaction with the performance of signs contractors if the signs contract is separate from the network maintenance contract.

The combined results show a separate signs contractor is likely to produce better results than a contract as part of network maintenance (and the difference is statistically significant.) However, there is variation from one RCA to another and employing a separate signs contractor is not a guaranteed way to improve the standard of signs.

6.4 Appropriate class of retro-reflective sheeting

Slightly more than half the RCAs surveyed had a policy of specifying a different class of retro-reflective sheeting for different signs. Most of these specified a higher grade of sheeting on regulatory signs than on other signs. Two of them specified Class 1 except for vulnerable road user warnings where Enhanced Class 1 was specified.

There was no consistency between RCAs – neighbouring RCAs could have any one of three different classes of sheeting for the same sign in the same circumstances.

Although it was not part of the survey the surveyors also noted situations at night where retro-reflective sheeting appeared too bright for the circumstances, dazzling the approaching driver. Together, these observations suggest there is a need for more definitive guidelines on the appropriate class of sheeting to be used in different situations.

6.5 Longitudinal offset of Stop and Give Way signs

As noted in Section 5.11, 63.6% of rural RG 5 Stop or RG 6 Give Way signs and 28.7% of urban RG 5 Stop or RG 6 Give Way signs had a longitudinal offset greater than the

nine metres maximum stated in MOTSAM. In a large majority of cases the offset of these signs needed to exceed the MOTSAM requirement so they were in a position to be seen by approaching motorists. The MOTSAM requirement therefore needs to be reviewed.

6.6 Best practice for traffic signs management

There was variation in the standards of signing achieved by RCAs who reported using the same policies and practices. Those reporting procedures that would be expected to produce the best results were apparently not implementing the procedures effectively. It is therefore difficult to conclude which observed policies and practices constitute best practice. However, the surveyors consider elements of best practice include:

- recording all traffic signs in a database. RAMM is the most readily available and, if used, all available fields should be entered
- requiring and ensuring signs are marked with the date of installation and that this information is recorded in the database
- continuing regular cyclic inspection regimes (monthly or otherwise) to verify contractual claims
- using MOTSAM (or a customised version of the policies in MOTSAM) to ensure signs are installed consistently in terms of their format and the situations where they are provided
- progressively checking all signs conform to MOTSAM or the alternate policy especially to identify locations where necessary signs are missing or have never been installed
- carrying out systematic safety audits as an independent review of installations, checking particularly for correctness, coherence and consistency of sign installations. The field sheets used for this survey could be used for this purpose
- employing contractors that are able to bring relevant specialist expertise to sign maintenance and staff who have sufficient knowledge and experience of signs maintenance to effectively manage the contract
- undertaking systematic night inspections to cover the network at least every two years to check the class of retro-reflective sheeting on each sign is appropriate and the performance is adequate.

7. Recommendations

- RCAs should adopt and implement any of the elements of best practice in Section 6.6 that they do not already have in place.
- A study needs to be undertaken to determine the best class of retro-reflective sheeting to use on signs in different circumstances and national guidelines produced as a result.

- Sign height specifications would be better stated relative to the road surface rather than the base of the signpost.
- The requirement that RG 5 Stop signs and RG 6 Give Way signs be less than nine metres from the main roadway at an intersection should be reviewed.

Appendix 1 Sign types surveyed by a road controlling authority

Road controlling authority (RCA)	Urban					Rural					All
Sign type	BEM	Chev	PW	RG	Other	BEM	Chev	PW	RG	Other	
Buller District	-	1	18	39	-	21	6	18	23	-	126
Central Otago District	-	2	9	28	3	16	40	34	18	-	150
Cent. Hawkes Bay Dist.	-	-	19	33	-	38	18	27	20	1	156
Dunedin City	6	1	25	23	-	33	19	61	41	-	154
Franklin District	4	4	12	34	-	12	26	26	28	-	146
Gore District	-	2	6	34	-	14	23	64	45	-	146
Grey District	9	2	17	40	-	33	3	44	9	-	157
Horowhenua District	-	5	17	33	-	22	42	40	9	2	170
Invercargill City	-	1	17	37	-	12	15	23	8	-	102
Kaipara District	-	1	17	37	-	24	8	22	34	-	143
Mackenzie District	-	-	14	10	-	52	11	40	26	-	153
Marlborough District	-	3	25	47	-	44	14	58	67	4	187
Matamata-Piako District	2	3	23	22	1	20	7	22	12	-	112
Papakura District	-	2	15	37	-	7	34	32	18	1	146
Queenstown-Lakes Dist	1	4	6	32	-	12	44	29	18	-	146
Rangitikei District	-	-	7	23	-	10	17	18	14	-	89
Rodney District	8	8	20	34	1	8	18	34	18	-	149
South Taranaki District	4	1	25	46	2	18	6	37	24	-	163
South Waikato District	-	6	8	33	1	7	6	21	2	-	84
South Wairarapa Dist.	-	-	4	19	1	76	22	42	12	-	176
Tararua District	8	-	6	20	-	52	12	30	10	2	140
Tasman District	-	-	22	34	-	37	8	30	19	-	150
Upper Hutt City	-	4	24	24	-	12	14	33	8	-	119
Waikato District	-	-	11	27	-	4	13	48	18	-	121
Waimate District	-	-	4	25	-	44	11	34	30	-	148
Waitakere City	1	26	27	23	2	16	2	18	5	2	122
Wanganui District	-	5	12	37	-	8	10	48	15	-	135
Western BOP District	4	6	13	24	1	8	6	47	6	-	115
Westland District	-	-	8	18	-	72	4	12	31	-	145
Whakatane District	4	11	19	75	-	9	7	21	8	-	154
Total numbers	**51**	**98**	**450**	**937**	**12**	**735**	**460**	**957**	**492**	**12**	**4204**

Appendix 2 Audit of road environment – Questionnaire

Road controlling authority: _____

Person(s) replying to questionnaire: _____

Position in organisation: _____

Contact phone number: _____

Contact email: _____

Interviewer: _____ Date: _____

Council policy, design and control of externals

	Questions	Prompts
1	What form of inventory or database of traffic signs do you maintain? (State)	RAMM? Database? What database?
2	What policies do you have for the provision of traffic signs on your network? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
3	What procedures do you have to check that drivers' sightlines to traffic signs are in accordance with the *Manual of Traffic Signs and Markings*? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
4	What policy do you have for the replacement of existing traffic signs? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?

5	What procedures do you have to check conspicuity of traffic signs in relation to advertising signs? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
6	What controls do you have on roadside advertising signs? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
7	How effective are the controls you have on roadside advertising signs? (Assess on scale 1to 5)	Scale: 1=very poor. 3=acceptable. 5=excellent.
8	Are there any locations where you think advertising signs create a hazard? (State)	
9	Which part of the council's organisation is responsible for approving new vehicle entrances to private property? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
10	What liaison (formal and informal) is there between the different parts of the council's organisation in planning and approving new vehicle entrances to private property? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?

11	Who is responsible to see new vehicle entrances are built according to the approved plan? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
12	What do you do when new entrances are not built according to the approved plan? (State)	Does the Council have a formal policy? What documentation is there of it? What informal policy is there?
13	Does the council have a policy of encouraging or requiring old standard vehicle entrances to be upgraded? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
14	Does the council maintain an inventory of vehicle entrances to private property? (State)	Yes/No
15	If there is an inventory of vehicle entrances to private property, how is this updated? (State)	
16	If there is an inventory of vehicle entrances to private property, who is responsible for updating it? (State)	
17	Does the council have a formal policy for the construction and management of stock crossings at road level (eg dairy herds, deer)? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?

18	Does the council have a formal policy for the construction and management of stock underpasses? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
19	What are the major requirements of the council's policy? (State)	
20	Does the council maintain an inventory of stock crossings and/or underpasses of roads? (State)	Yes/No
21	If there is an inventory of stock crossings of roads, how is this updated? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
22	If there is an inventory of stock crossings of roads, who is responsible for updating it? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
23	Does the council have a policy on what warning devices farmers should use in conjunction with stock crossings? (State.)	(Yes/No)
24	What warning devices that stock crossings are in use does the council encourage farmers to use? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?

25	What warning devices that stock crossings are in use do farmers prefer to use? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
26	To what extent are warning devices used as intended? (Assess on scale 1 to 5)	Scale: 1=very poor. 3=acceptable. 5=excellent.
27	How effectively are stock warning devices used by farmers? (Assess on scale 1 to 5)	Scale: 1=very poor. 3=acceptable. 5=excellent.
28	What is the minimum length relative to the width of carriageways that the council will accept for a stock underpass? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
29	Where stock underpasses are narrower than the road boundary to boundary, what standard of protection does the council require to be built and maintained at the road level? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
30	When carriageway surfacings are chosen for amenity reasons rather than for technical reasons, what part of the council's organisation is responsible for planning and decision-making on amenity surfacings? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?

31	When carriageway surfacings are chosen for amenity reasons rather than for technical reasons, what liaison (formal and informal) is there between the different parts of the council's organisation in planning, installing and maintaining amenity surfacings? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
32	In the event of disagreements between the different parts of the council's organisation over amenity surfacings, how are these resolved? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
33	What types of amenity surfacings does your council apply to carriageways? (State)	Does the council have a formal policy? What documentation is there of it? What informal policy is there?
34	What changes in the local safety environment have occurred as a result of the use of amenity surfacings on carriageways? (Note: Statistical evidence of actual change is sought in the answer to this question.) (State)	

Maintenance contract and contractor

	Questions	Prompts
1	What procedures do you have to update and correct your inventory of traffic signs? (State)	What is written into your maintenance contract for this? How often is it done?
2	What procedures do you have to check the overall coherence and consistency of provision of traffic signs? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
3	How often do you perform these checks? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
4	What quality control or quality assurance scheme have you included in your traffic signs maintenance contract? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
5	What procedures have you for night inspections of traffic signs and markings? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
6	What inspections do you carry out to check the adequacy of maintenance of traffic signs? (State)	What is written into your maint. contract for this? What procedures outside the maintenance contract?
7	What standard of reflectivity do you specify for new or replacement traffic signs? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?

8	What procedures do you have to check that drivers' sightlines to traffic signs are not obscured by vegetation? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
9	What do you specify in your maintenance contract for the cleaning of traffic signs? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
10	What procedures do you have to check the cleanliness of traffic signs meets your specification requirements? (State)	What is written into your maint. contract for this? What procedures outside the maintenance contract?
11	What do you specify in your maintenance contract for the reflectivity of traffic signs? What procedures do you have to check this? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
12	What procedures do you have to check the mounting heights and locations of traffic signs with respect to the carriageway? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?

13	How often do you perform these checks? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
14	How well does your traffic signs contractor meet your specified requirements? (Assess on scale 1 to 5)	Scale: 1=very poor. 3=acceptable. 5=excellent.
15	What guideline do you require your traffic signs contractor to conform to in managing traffic at work sites? (State)	What is written into your maint. contract for this? What procedures outside the maint. contract?
16	How well does your traffic signs contractor manage traffic at his work sites in accordance with the specified guidelines? (Assess on scale 1 to 5)	Scale: 1=very poor. 3=acceptable. 5=excellent.
19	Have you experienced any quality problems with traffic signs? If so, what were the problems you encountered? (State)	
20	If so, how did you overcome the problems you encountered? (State)	
21	Would you like Transfund or LTSA to assist you with any problem that causes you concern? (State)	

Appendix 3 Field survey sheet.

Traffic Signs Standards and Maintenance Field Survey Sheet

SURVEYOR: ________________ LOCAL AUTHORITY: ____________________ ROAD: ______________________

SECTION: ____________________________ DIRECTION: ____________________CLASSIFICATION: _____________

CHECKING AGAINST WHAT DOCUMENT? (MOTSAM? Traffic Regs?): ____

Distance Along Road	Sign Type	Overall OK?	Age of Sign	Refl. Class	Reflect-ivity	Visibility limited by?	Overall Size OK?	Colour OK?	Letter/ Symbol Size	Lateral Offset	Orient -ation	Height	Cond-ition	Long. Offset	Other Comment

OVERALL COMMENTS:

Appendix 4 Condition of signs by road controlling authority

Sign state	OK	Reas.	Fair	Poor	Replace	Missing	Sample
Buller District	53%	18%	11%	4%	7%	7%	126
Central Otago District	61%	13%	12%	8%	1%	5%	150
Cent. Hawkes Bay Dist.	49%	14%	18%	6%	5%	8%	156
Dunedin City	66%	8%	5%	3%	3%	14%	154
Franklin District	71%	7%	7%	4%	2%	9%	146
Gore District	65%	4%	10%	7%	8%	6%	146
Grey District	60%	7%	14%	7%	9%	3%	157
Horowhenua District	61%	17%	5%	10%	6%	1%	170
Invercargill City	79%	-	4%	2%	8%	7%	102
Kaipara District	34%	18%	5%	15%	18%	11%	143
Mackenzie District	62%	7%	8%	9%	4%	11%	153
Marlborough District	43%	24%	10%	5%	12%	6%	187
Matamata-Piako District	71%	1%	13%	5%	8%	2%	112
Papakura District	48%	16%	9%	12%	10%	5%	146
Queenstown-Lakes Dist	73%	3%	7%	3%	10%	3%	146
Rangitikei District	52%	17%	11%	12%	2%	6%	89
Rodney District	48%	17%	17%	7%	7%	4%	149
South Taranaki District	57%	17%	9%	5%	6%	7%	163
South Waikato District	35%	2%	1%	32%	19%	11%	84
South Wairarapa Dist.	56%	10%	14%	3%	12%	5%	176
Tararua District	39%	24%	17%	7%	6%	6%	140
Tasman District	55%	13%	13%	7%	6%	11%	150
Upper Hutt City	50%	22%	12%	7%	4%	6%	119
Waikato District	51%	1%	19%	5%	16%	8%	121
Waimate District	53%	16%	15%	5%	10%	2%	148
Waitakere City	43%	12%	23%	13%	3%	7%	122
Wanganui District	50%	13%	12%	2%	3%	21%	135
Western BOP District	51%	1%	13%	10%	17%	8%	115
Westland District	51%	6%	13%	9%	17%	3%	145
Whakatane District	71%	8%	7%	4%	9%	2%	154
Totals	**55%**	**12%**	**11%**	**7%**	**8%**	**7%**	**4204**

Appendix 5 Overall state of signs by road controlling authority

Sign state	OK	Wrong Size	Wrong Place	Hidden	Wrong Config.	Needed Replace	Missing	Sample
Buller District	52%	12%	17%	3%	2%	7%	7%	126
Central Otago District	41%	9%	21%	13%	9%	1%	5%	150
Cent. Hawkes Bay Dist.	47%	1%	35%	3%	3%	5%	8%	156
Dunedin City	38%	12%	18%	8%	7%	3%	14%	154
Franklin District	49%	10%	21%	7%	2%	2%	9%	146
Gore District	30%	3%	32%	4%	16%	8%	7%	146
Grey District	58%	3%	17%	10%	-	9%	3%	157
Horowhenua District	52%	7%	26%	2%	7%	6%	1%	170
Invercargill City	44%	-	27%	2%	12%	8%	8%	102
Kaipara District	36%	8%	14%	6%	6%	18%	11%	143
Mackenzie District	29%	5%	43%	3%	7%	4%	11%	153
Marlborough District	41%	3%	26%	11%	1%	12%	6%	187
Matamata-Piako District	54%	4%	23%	8%	2%	8%	2%	112
Papakura District	39%	11%	15%	16%	4%	10%	5%	146
Queenstown-Lakes Dist	47%	6%	18%	8%	9%	10%	3%	146
Rangitikei District	51%	9%	30%	2%	-	2%	6%	89
Rodney District	64%	3%	11%	9%	2%	7%	4%	149
South Taranaki District	24%	8%	42%	10%	4%	6%	7%	163
South Waikato District	29%	6%	12%	8%	16%	19%	11%	84
South Wairarapa Dist.	57%	11%	9%	6%	2%	12%	5%	176
Tararua District	52%	3%	28%	3%	1%	6%	6%	140
Tasman District	43%	1%	30%	10%	2%	2%	11%	150
Upper Hutt City	46%	6%	22%	12%	4%	4%	6%	119
Waikato District	26%	3%	33%	9%	5%	16%	8%	121
Waimate District	18%	10%	37%	17%	7%	10%	2%	148
Waitakere City	43%	8%	15%	16%	7%	3%	7%	122
Wanganui District	45%	12%	11%	6%	2%	3%	21%	135
Western BOP District	28%	4%	19%	19%	4%	17%	8%	115
Westland District	43%	6%	25%	6%	1%	17%	3%	145
Whakatane District	60%	2%	12%	14%	1%	9%	3%	154
Totals	**43%**	**6%**	**23%**	**8%**	**5%**	**8%**	**7%**	**4204**

Appendix 6 Sign age distributions by sign condition for Class 1 and Class 2 signs

Table A 6.1. Class 1 signs

	OK	Reasonable	Fair	Poor	Needs replacing	Number of signs
0–1 yr	88.3%	5.9%	3.6%	1.4%	0.9%	222
1–2 yrs	78%	10.5%	4.7%	3.1%	3.7%	191
2–4 yrs	78.5%	8.1%	5.3%	6.9%	1.2%	246
4–7 yrs	60.2%	18.1%	12.7%	4.8%	4.2%	166
7–10 yrs	50%	33.3%	5.6%	5.6%	5.6%	18
>10 yrs	-	-	100%	-	-	1
New	95.6%	2.2%	1.1%	-	1.1%	91
Newish	84.6%	5.4%	2.7%	4.2%	3.1%	260
Oldish	42.9%	30%	11.4%	12.9%	2.9%	70
Old	33.8%	1.4%	26.8%	15.5%	22.5%	71
Very old	5.6%	5.6%		16.7%	72.2%	18

Table A 6.2: Class 2 signs

	OK	Reasonable	Fair	Poor	Needs replacing	Number of signs
0–1 yr	94.6%	1.1%	3.3%	1.1%	-	92
1–2 yrs	86.1%	3.8%	5.1%	3.8%	1.3%	79
2–4 yrs	72.6%	13.3%	5.9%	5.2%	3%	135
4–7 yrs	39.5%	19.2%	18%	14.4%	9%	167
7–10 yrs	40%	27.7%	18.5%	9.2%	4.6%	65
>10 yrs	11.8%	23.5%	17.6%	47.1%	-	17
New	93.5%	4.8%	-	-	1.6%	62
Newish	77.5%	13.8%	5%	0.9%	2.8%	218
Oldish	30%	37.7%	25.1%	4%	3.2%	247
Old	12.7%	25.4%	35.6%	17.8%	8.4%	393
Very old	2.2%	5%	7.2%	24.3%	61.3%	181

Combining the information in these two tables suggests that ‘new’ is roughly equivalent to ‘0–1 yrs’, ‘newish’ to ‘1–4 yrs’, ‘oldish’ to ‘4–10 yrs’, ‘old’ to ‘10–15 yrs’ and ‘very old’ to ‘>15 yrs’.

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
RSS 17	School crossing facilities	2002
RSS 18	Data collection	2002
RSS 19	Traffic signs	2003
RSS 20	Vehicle entrances, stock crossing facilities and amenity carriageway surfacings	2003

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