Traffic standards and guidelines
2004/2005 survey

RSS 24
Stop and Give Way controls at intersections

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Land Transport NZ
Ikiiki Whenua Aotearoa

Survey of traffic standards and guidelines

Land Transport New Zealand is a Crown entity with the objective of allocating resources and undertaking its functions in a way that contributes to an integrated, safe, responsive and sustainable land transport system. Part of its function is to promote safe transport on land in New Zealand and to audit the performance of approved organisations.

To support this objective, the regional engineering sections of Land Transport New Zealand 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
- provide a national summary of the adoption 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 – road controlling authorities are asked to complete a questionnaire and interview, which look at the systems and procedures the road controlling authority has in place to deliver on a standard.
- Part 2 – a field survey is used to measure, where possible, the actual delivery from the user's viewpoint. In essence, this provides a snapshot of road safety delivery at the date of the survey.

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

I believe the findings are valuable and can be used to improve road safety in New Zealand.

Please contact the nearest office of Land Transport New Zealand if you would like further information or assistance with implementing traffic standards or guidelines.

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Summary

Introduction

- Surveys were undertaken between March and May 2005 to investigate policies and practices for Stop and Give Way controls at intersections and for crash reduction studies in a sample of road controlling authorities (RCAs).
- This report describes the procedures and presents the results for the intersection control survey. A companion report, RSS 23 *Crash reduction studies and monitoring*, details the results of the survey on crash reduction studies.

Methodology

- Land Transport New Zealand (Land Transport NZ) interviewed staff in 31 road RCAs about their policies and practices, after they had received a questionnaire in advance to help prepare responses.
- The surveyors, together with RCA staff, then inspected and noted details of a representative number of controlled intersections.

Results of interviews

- Almost every RCA (97 percent) stated they used Transit New Zealand and Land Transport NZ's *Manual of traffic signs and markings* (MOTSAM), the Land Transport Safety Authority (LTSA) document RTS 1 *Guidelines for the implementation of traffic control at crossroads* (1990) and *Land Transport Rule: Traffic Control Devices 2004* (TCD Rule) to determine the appropriate control to install and the manner of installation.
- Nearly half the RCAs (45 percent) had a local policy or guideline to help determine which intersection control to install.
- All RCA staff stated they had no remaining uncontrolled crossroads and all were trying to eliminate uncontrolled crossroads, including six where the surveyors encountered uncontrolled crossroads.
- Almost all RCAs (97 percent) stated they installed additional safety features (commonly throat islands with additional control signs) as a result of a poor crash record, complaints from the public or Police or other reasons.
- Most RCAs (54 percent) also had formal policies on installing duplicate control signs on the right hand side of the road or on a throat island.
- Almost all RCAs (90 percent) used contractors to inspect and maintain control signs and also used contractors or council staff to inspect and maintain visibility at intersections.
- No RCAs reported programmes of reviewing intersection controls for compliance with MOTSAM or RTS 1 criteria but most (58 percent) reported reviewing them after complaints or requests from the public or Police or on the basis of crash records.
- Most RCAs (52 percent) required pre-approved plans for control of intersections in new developments or subdivisions and some (23 percent) carried out inspections after construction.

Summary, continued

Results of interview, continued

- Some RCAs (23 percent) had policies for upgrading intersection controls to roundabouts or traffic signals.
- Almost all RCAs (81 percent) had formal procedures in place for installing intersection controls and a similar number had a register of controls that had been installed.

Results of field surveys

- 546 intersection approaches were surveyed, of which 360 were Give Way controlled and 185 Stop controlled. One was uncontrolled but should had a Give Way control
- Using MOTSAM and RTS 1 criteria, 63 percent of the Give Way controlled approaches should have been Stop controlled and 19 percent of the Stop controlled approaches should have been Give Way controlled.
- At rural sites, 50 percent of Give Way signs and 36 percent of Stop signs were smaller, urban-sized signs.
- There was insufficient visibility of the control sign on 36 approaches (seven percent) but only nine of these approaches were recorded as having an advance warning or a low speed approach.
- Only 59 percent of control signs complied with the MOTSAM requirement that they be located no more than nine metres from the through road.
- Only 25 percent of old style Give Way markings and 45 percent of old style Stop markings in rural areas complied with the size requirements in MOTSAM.
- 80 percent of Stop markings did not comply with the legal requirement to be within 10 metres of the limit line.
- 74 percent of Give Way markings did not comply with the previous legal requirement in the *Traffic Regulations 1976* (to be within 10 metres of the limit line) but complied with the new legal requirement of 20 metres in the TCD Rule.
- At 29 percent of urban intersections and 57 percent of rural intersections with new style Give Way markings, the triangle symbol did not comply with the requirement to be within 20 metres of the limit line.
- There were throat islands (with or without additional control signs) installed at 72 (13 percent) of the intersection approaches in the survey.

Discussion

- There was a mix of new and old style markings found in the survey because it was conducted in the months immediately following the TCD Rule coming in to force (on 27 February 2005.)
- Compliance with MOTSAM and RTS 1 was found to be poor and it was of particular concern that 29 percent of the new triangle markings in urban areas and 57 percent in rural areas did not comply with the legal requirement that they be located within 20 metres of the limit line.
- The overall findings were consistent with previous surveys that found on-road practice commonly did not meet the relevant standards to install and maintain traffic control devices

Summary, continued

Best practice

Elements of best practice observed or recommended from the survey results are:

- MOTSAM, the TCD Rule, and RTS 1 remain the appropriate documents to use to determine which controls to install and how to install them
- maintenance and inspection procedures should systematically consider all aspects of traffic control devices – appropriateness of control, legality and compliance of installation with standards, size and condition, visibility, etc
- RCAs should systematically review controls based on MOTSAM and RTS 1 criteria and to determine the need for additional safety features (such as throat islands and duplicated signs)
- pre-approved plans showing the appropriate controls at intersections should be required for all new or subdivisional developments
- formal, documented procedures and delegations are to be used to install or change intersection controls. A register of these actions should be developed and maintained.

Recommendations

The survey showed there is very poor on-road compliance with the stated standards and guidelines. Therefore:

- the proposed Traffic Control Devices Management Group (to review the content and format of MOTSAM) should research and review all the standards and guidelines relevant to this issue, especially:
  - the criteria for installing Stop control versus Give Way controls (especially at T intersections)
  - the sizes of markings and their distances from the limit lines
  - the requirement that control signs be located within nine metres of the through road.
- Land Transport NZ should report these findings to all RCAs, signs contractors and the New Zealand Road Markers' Federation to ensure they are aware of the correct standards and guidelines and to provide advice on corrective action where necessary
- RCAs should adopt all the elements of best practice documented in the above section.

Introduction

Between March and May 2005 the regional offices of Land Transport NZ conducted surveys of two roading or road safety issues in a sample of RCAs. The two areas surveyed were:

- Stop and Give Way controls at intersections
- crash reduction studies and monitoring.

This report describes the procedures and presents the results for the survey of intersection controls.

Purpose of the survey

The purpose of the survey was to:

- establish the criteria, standards and guidelines used by RCAs to control movements at intersections
- determine what programmes are used to review the appropriateness of intersection types and controls
- obtain a snapshot of sightlines at a variety of intersection control types
- measure on-road practices against legal marking and signing requirements
- identify issues and guidance that could be improved.

Methodology

Sample selection

A sample of 31 RCAs were chosen for the surveys. This included 28 territorial local authorities and three regional offices of Transit New Zealand (Transit NZ). The sample was weighted towards authorities not included in the previous 2003/2004 Land Transport Safety Authority (LTSA) surveys.

The table in appendix 1 lists the 31 RCAs included in the surveys.

Interview surveys

Interview surveys were conducted with representatives of each of the 31 RCAs. Questionnaires were sent in advance to allow time to research answers where necessary. Questions were centred on the standards, guidelines, programmes and practices used for the provision of Stop and Give Way controls at intersections.

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

Field surveys

Field surveys were conducted in all of the 31 RCAs. Staff or representatives from each RCA were encouraged to accompany the surveyors. The field surveys aimed to determine the extent to which samples of Stop and Give Way controlled intersections on the RCA network complied with:

- visibility requirements set down in either the MOTSAM or any other guidelines adopted by a specific local authority
- signing and marking requirements set down in MOTSAM or TCD Rule.

Results of the interview surveys

Criteria to determine control type

MOTSAM and the LTSA document RTS 1 *Guidelines for the implementation of traffic control at crossroads* (1990) provide guidance on criteria to determine if an intersection should be controlled as a Stop, Give Way or an uncontrolled type. The advice contained in MOTSAM for the use of Stop controls mirrors that in RTS 1. Austroads' *Guide to traffic engineering practice* and Australian Standard AS 1742.2 also provide guidance on when Stop and Give Way controls should be used.

Opportunity was provided for RCAs to demonstrate if local guidelines had been prepared to meet specific local needs rather than using the general national guidelines.

As a national guideline:

- 29 of the 31 RCAs (94 percent) used MOTSAM or RTS 1
- four RCAs (13 percent) used or referred to the Austroads guidelines. One RCA used Austroads exclusively, while the other three use it alongside MOTSAM and/or RTS 1
- one RCA (three percent) did not use any particular criteria to determine intersection control type.

As a local guideline:

- 17 RCAs (55 percent) noted that they did not have a separate local policy or did not respond to the question
- 14 RCAs (45 percent) had a local policy or set of guidelines to help determine intersection controls.

Of the 14 RCAs who had a local policy, only one had a current policy on the criteria for deciding between Stop and Give Way controls. The other policies related to which approaches to an intersection should be controlled eg, all side road approaches to designated arterial roads. Road hierarchy, traffic volumes, local engineering codes of practices and crash statistics all were used to determine which approach to an intersection should be controlled. It was noted that such local practices were sometimes referred to within the RCA's safety management system.

Results of the interview surveys, continued

Criteria to determine control type, continued

RCAs were also asked if they had any uncontrolled crossroads. All stated they did not have any uncontrolled crossroads. However, the surveyors encountered uncontrolled crossroads in six authorities (all in the South Island). Of these:

- three RCAs stated that they were eliminating uncontrolled crossroads
- one RCA noted that all crossroads in larger towns are controlled but not all small townships were fully controlled
- one RCA stated it had some uncontrolled crossroads, typically on low volume rural roads
- there were uncontrolled crossroads within a new subdivision of one RCA.

The likely scenario is that all surveyed RCAs were trying to eliminate uncontrolled crossroads but there are still uncontrolled crossroads in existence that RCA staff are not aware of.

Installation of signs and markings

As a standard for the method of installing traffic control road markings and signs at Give Way and Stop controlled intersections:

- 30 RCAs (97 percent) stated they used MOTSAM
- 13 of these RCAs (42 percent) noted that they also now used the TCD Rule
- one RCA (three percent) relied on advice from independent consultants.

Installation of additional features

Certain circumstances dictate that additional measures such as throat islands or no stopping lines should be installed at intersections. Only one RCA stated they did not have a policy of installing additional features. The other RCAs each used a number of different methods to determine whether additional features should be added:

- 18 RCAs (58 percent) used crash data or crash reduction studies
- 12 RCAs (39 percent) installed additional features on the basis of site inspections
- nine RCAs (29 percent) believed additional features should be added after public consultation or after complaints or concerns from the public
- eight RCAs (26 percent) used their engineering judgement or received advice from consultants on whether to install additional features.

Corner cutting by drivers making turning manoeuvres (four RCAs) and inadequate sightlines (three RCAs) were also noted as reasons justifying additional features.

RCAs were asked what criteria they used to determine whether to install repeater signs on the right hand side of the road or on a throat island at Stop and Give Way controlled intersections:

- four RCAs (13 percent) used a combination of factors including traffic volume, hierarchy, site geometry and visibility

Results of the interview surveys, continued

Installation of additional features, continued

- four RCAs (13 percent) reported visibility as the sole criterion to determine the use of repeater signs
- two RCAs (six percent) used geometry alone to determine the use of repeater signs
- two RCAs (six percent) used crash records alone
- two RCAs (six percent) used a site inspection to determine signing needs
- two RCAs (six percent) installed additional signs only if they had problems with vandalism or damage to signs
- one RCA (3 percent) used poor conformance by users as the reason to install additional signs
- seven RCAs (23 percent) had informal policies to provide additional signs where throat islands had been installed (for some other reason)
- seven RCAs (23 percent) said they had no policy at all, did not install additional signs or asked their consultants.

In order to ensure there are no other signs attached to Stop and Give Way signs:

- 23 RCAs (74 percent) employed contractors to inspect and conduct audits
- four RCAs (13 percent) said that they had no inspection procedures but removed any informal signs whenever they come across them
- four RCAs (13 percent) said they had no problems with informal signs.

Maintenance/ inspection procedures

RCAs were asked what maintenance and inspection procedures they had for Stop and Give Way signs and for visibility splays.

For Stop and Give Way signs:

- 28 RCAs (90 percent) had contracts with contractors to maintain and inspect signs
- two RCAs (six percent) inspected signs themselves on a cyclic basis
- one RCA (three percent) relied on their vegetation control contract for sign inspections.

Some authorities also noted they received reports from the public on signs that needed maintaining.

For visibility splays:

- 19 RCAs (61 percent) said requirements were included in their maintenance contracts
- nine RCAs (29 percent) said they were inspected, but did not say who by, whether contractors or employees within the authority
- two RCAs (six percent) said they had no visibility problems
- one RCA (three percent) relied on public complaints to alert them to problems.

Results of the interview surveys, continued

Maintenance/ inspection procedures, continued

To determine how effective these arrangements were, RCAs were asked to score their arrangement out of five, one indicating a very poor arrangement, and five indicating an excellent arrangement. The mean average score was 3.5.

- One RCA (three percent) scored their arrangement one out of five (very poor).
- 14 RCAs (45 percent) scored their arrangement three out of five (acceptable).
- 12 RCAs (39 percent) scored their arrangement four out of five (acceptable to excellent).
- Three RCAs (10 percent) scored their arrangement five out of five (excellent).

The contract in one RCA had not been running long enough for them to provide an answer.

Review programme

RCAs were asked how intersections were reviewed to see if the existing controls were still appropriate. In urban areas:

- 17 RCAs (55 percent) reviewed intersections using crash reports, with 13 of these also using public complaints and suggestions
- 18 RCAs (58 percent), including the 13 above used the public to make complaints and suggestions
- six RCAs (19 percent) said they employed consultants to inspect controls, of which three of these relied solely on the consultants
- five RCAs (16 percent) relied on staff knowledge and observations and occasional ad hoc checks, of which two didn't use any other review method
- four RCAs (13 percent) depended on the police to notify them of any issues, with all four also using other review programmes such as public complaints or crash reports
- one RCA (three percent) said it had not reviewed any intersections.

Intersections in rural areas were reviewed by the following methods to see if existing controls were still appropriate.

- 16 RCAs (52 percent) reviewed controls using crash reports.
- 15 RCAs (48 percent) relied on public complaints and suggestions, of which 12 also reviewed intersection controls using crash reports.
- Seven RCAs (23 percent) employed consultants to inspect controls.
- Six RCAs (19 percent) relied on staff knowledge and observations and occasional ad hoc checks.
- Five RCAs (16 percent) relied on staff knowledge and observations, with three of these authorities relying solely on this procedure.
- One RCA (three percent) said it had not reviewed any intersections.

Results of the interview surveys, continued

Controls on new/ subdivision roads

RCAs were asked how they ensure their standards and procedures are applied on new or subdivision roads.

- 16 RCAs (52 percent) ensured that their standards and procedures were applied on new/subdivision roads by pre-approving plans.
- Seven RCAs (23 percent) said they inspected the completed works, four of which also pre-approved plans as standard procedure.
- Five RCAs (19 percent) said they adhered to the code of practice (NZS 4404), two of which also pre-approved plans as standard procedure.
- Two RCAs (six percent) said that the council development engineer was responsible for overseeing adherence to standards and procedures.
- Two RCAs (six percent) said they did not ensure standards were observed.
- One RCA (three percent) said that Transit NZ was responsible for ensuring standards and procedures were applied.

Upgraded controls

RCAs were asked whether they had a policy to investigate upgrading priority controlled intersections to roundabouts or traffic signals. In total:

- 23 RCAs (74 percent) did not have a stated formal policy although three of these did have an informal policy. Of the 20 RCAs who did not have any policy, none intended to create one
- seven RCAs (23 percent) did have a stated formal policy. These policies included:
  - annual public consultation to prepare the LTCCP
  - investigations based on traffic volumes and crash reduction studies
  - determination by economic benefit
  - roundabout policy from a consultant's report
  - monitoring unsignalled intersections using NZS5431 procedure.
- one RCA (three percent) did not consider upgrading any intersections.

Formal adoption of controls

RCAs were asked whether they had procedures in place to formally ratify intersection controls.

- 25 RCAs (81 percent) had procedures in place to formally ratify intersection controls.
- Six RCAs (19 percent) did not have procedures in place.

Of the 25 RCAs that did have procedures in place:

- 12 RCAs (48 percent) had delegated responsibility to the road asset manager, regional manager, engineers, staff or the operations and maintenance co-ordinator
- eight RCAs (32 percent) relied on a council resolution
- two RCAs (eight percent) ratified intersection controls through community boards, although one of these also ratified controls through council resolution
- two RCAs (eight percent) ratified intersection controls through traffic bylaws
- two RCAs (eight percent) delegated responsibility to consultants.

Results of the interview surveys, continued

Register of controls

In total, 25 RCAs (81 percent) had an inventory register that recorded what controls there were at intersections and identified sign types and locations.

Of these:

- 20 RCAs (65 percent) used RAMM as their inventory
- three RCAs (10 percent) used SAM (Sign Asset Management)
- one RCA (three percent) used CONFIRM
- one RCA (three percent) used bylaws as an inventory register.

Of those who responded to the question, three authorities said that this inventory register was introduced in response to RSS 4 *Stop and Give Way controls at intersections,* while 10 authorities said it was not. Of the six authorities who did not have an inventory register, just one was planning to create one.

Traffic Control Devices Rule 2004

All 31 of the RCAs questioned were aware of the changes to the TCD Rule in relation to Stop and Give Way controls. When asked if they had a programme for upgrading signs and markings to comply with the TCD Rule:

- 29 RCAs (94 percent) did have a programme in place
- two RCAs (six percent) did not have a programme in place.

Use of controls at level crossings

Two-thirds of RCAs had views and concerns about the use of Stop and Give Way controls at level crossings. The views and concerns, as expressed, were:

- there should be a minimum distance between a crossing and a main road
- all level crossing controls should be converted to stop as a minimum
- signal control is preferred for level crossings
- some controls are unnecessary when there is little rail traffic
- there is insufficient protection for road users
- driver complacency
- the *Rail Corridor Act* is not clear as to who takes responsibility for installing level crossing controls
- railways don't do enough maintenance
- there should be a rule of thumb approach rather than formulae
- strobe lights are a good investment at all level crossings
- concern about buses stopping at level crossings and the danger of rear-end/overtaking crashes
- there is a need for guidance on controls for crossings with limited visibility and only occasional rail use.

Results of the interview surveys, continued

Comments on intersection controls

Finally, RCAs were asked if they had any general comments about Stop and Give Way controlled intersections, or if they had suggestions on ways Land Transport NZ could be of assistance on this issue. The views from the 13 RCAs that responded were:

- people ignoring Stop signs ie, driving through without stopping. A device or measure is needed to slow people down
- the left turn/give way rule needs to be changed
- there is an issue with sign manufacturers pressuring RCAs to use high specification signs
- the standards to install Stop signs on quiet urban streets should be relaxed
- there is a need for TV advertisements to show people how to behave at Stop signs/Give Way signs/roundabouts
- a single limit line is not as good as a double limit line
- there is inconsistency in changing from painted words for Give Way controls to a triangle but retaining the use of a word for Stop controls
- vandalism is a problem with signs being removed
- Land Transport NZ should come up with a package for new roading managers to get them up to speed with relevant issues
- T junctions should be Give Way controlled unless visibility is severely restricted
- there is concern about the value of the new Give Way markings. They're either going to create clutter or it will cost a lot to remove the old ones.

Results of the field surveys

Survey sample

Field surveys were undertaken on a sample of Stop and Give way controlled intersections. Staff or representatives from each RCA were encouraged to accompany the surveyors. In total, 546 approaches were surveyed at 326 sites (227 urban, 99 rural) in the 31 RCAs. The 326 sites consisted of both T intersections and crossroads, with crossroads treated as two separate approaches. 432 approaches (79 percent) were at crossroads or multi-leg intersections and 114 approaches (21 percent) were at T intersections.

There were various speed limits for the through roads to the intersections:

- 65 percent of surveyed intersections had a through road speed limit of 50 km/h
- 30 percent had a speed limit of 100 km/h
- three percent had a limit of 70 km/h
- 0.3 percent had a limit of 80 km/h
- 0.6 percent had a limit of 60 km/h.

Of these through roads:

- 39 percent were arterial roads, of which half had a speed limit of 100 km/h and half had a speed limit of 50 km/h
- 32 percent were collector roads of which 70 percent had a speed limit of 50 km/h. A further 23 percent of collector roads had a speed limit of 100 km/h
- 29 percent were local roads of which 89 percent had a speed limit of 50 km/h and 11 percent had a speed limit of 100 km/h.

There was only one crossroads in the sample where controlled approaches had a higher classification in the hierarchy than the through road.

Compliance with criteria for control type

Of the 546 approaches, 360 were controlled by Give Way signs and 185 were controlled by a Stop command. One was uncontrolled but should have had a Give Way control.

All the approaches were evaluated (using the criteria in MOTSAM and RTS 1) to determine whether the installed control was the correct control. The specific criteria used when evaluating intersection control type were:

- Stop signs should be installed on an intersection approach if lack of visibility makes it unsafe to approach the intersection at speeds greater than 10 km/h
- Give Way signs should be installed on all crossroad approaches that do not have visibility constraints requiring the installation of Stop signs, or are controlled by other methods.

Results of the field surveys, continued

Compliance with criteria for control type, continued

The Give Way controlled approaches were evaluated as to whether the intersection required a Stop control. Of the Give Way controlled approaches, 63 percent required Stop controls according to these criteria and were therefore signed incorrectly. 37 percent did not require a Stop control according to the criteria and were therefore signed correctly. At T intersection approaches, 37 percent of Give Way controls should have been Stop controls and at crossroads, 68 percent of Give Way controls should have been Stop controls.

Of the Stop controlled approaches, 19 percent were signed incorrectly and did not require the Stop control. The remaining 81 percent of approaches were signed correctly. 26 percent of the Stop controls at T intersections and 18 percent of the Stop controls at crossroads had the wrong control.

Size of signs

The TCD Rule specifies minimum sizes for Give Way and Stop signs.

- For Give Way signs, the minimum size is an equilateral triangle with sides 865 mm long.
- For Stop signs, the minimum size is an octagon 675 mm wide.

MOTSAM provides the standards and guidelines for the sizes of Give Way and Stop signs to be used in practice on New Zealand roads.

For Give Way signs in urban areas (70 km/h or less), the signs should be a triangle with sides 865 mm long. This results in a sign 750 mm high (urban size). For areas where signs are erected on divided roads or where approaching speeds exceed 50 km/h, larger signs of 900 mm x 1040 mm (rural size) should be used. In rural areas, the normal size of signs is 900 mm x 1040 mm (rural size). Where approach speeds are 100 km/h or greater, larger signs of 1200 mm x 1385 mm should be used (extra large size).

Stop signs in urban areas should be 675 mm x 675 mm (urban size). However, 845 mm x 845 mm signs (rural size) should be used on divided roads or where approach operating speeds exceed 50 km/h. In rural areas the normal size of signs should be 845 mm x 845 mm. However the 1015 mm x 1015 mm (extra large) size should be erected on divided roads or major roads where approach operating speeds are 100 km/h or greater.

The actual size of Give Way signs varied:

- on 50 km/h approaches, 97 percent of the 261 surveyed signs were urban size and the remainder rural size
- on 70 km/h approaches all four signs measured were urban size
- on 80 km/h approaches three of seven signs were urban size and the remainder were rural size
- on 100 km/h approaches, 50 percent of the 86 signs were urban size, 43 percent were rural size and the remaining four signs were extra large size.

Results of the field surveys, continued

Size of signs, continued

The size of Stop signs also varied:

- on 50 km/h approaches, 80 percent of the 123 surveyed signs were urban size, 19 percent rural size and one sign was extra large size
- on 70 km/h approaches, one of the five signs measured was urban size and the remaining four were rural size
- on 80 km/h approaches one of four signs was urban size, one was rural size and the other two were extra large size
- on 100 km/h approaches, 36 percent of the 50 signs were urban size, 56 percent were rural size and the remaining four signs were extra large size.

Approach visibility and advance warnings

Stop and Give Way signs should be visible from 60 metres away at approach speeds of 50 km/h or less. For approach speeds more than 50 km/h, the visibility distance should be 120 metres. Of the surveyed sites:

- 94 percent of signs were visible from a sufficient distance
- 36 signs (seven percent) were not sufficiently visible.

At 19 of the 546 approaches surveyed, approach visibility was not recorded.

Of the 36 approaches where the control sign was not sufficiently visible only:

- six approaches (17 percent) were recorded as having a Stop Ahead or Give Way Ahead sign, and
- three approaches (eight percent) had low speed approaches and therefore did not need to satisfy the visibility criteria.

There were Stop Ahead or Give Way Ahead signs recorded on 17 other approaches (three percent) where the visibility criteria were met.

Offset of signs from the through road

According to MOTSAM, control signs should be located less than nine metres from the edge of the through road. Control signs on all approaches were checked for compliance with this requirement.

In total, the offset of only 59 percent of control signs complied with the requirement. 56 percent of these non-complying signs were in 50 km/h areas (compared with 65 percent of approaches in the sample.) Considering a common reason for control signs failing to meet the requirement are the large corner radii at rural intersections, an unexpectedly large proportion of non-complying signs were in urban areas.

Results of the field surveys, continued

Style of markings

All markings were surveyed as to whether they were old or new style markings. New style markings were introduced by the TCD Rule and are characterised by:

- a triangle symbol in place of words for Give Way markings (although words may still be used), and
- a single limit line in place of double limit lines at both Stop and Give Way controlled approaches.

Of the 185 Stop controlled approaches:

- 140 (76 percent) had old style Stop markings
- 36 (19 percent) had new style Stop markings
- eight (four percent) had no markings at all, and
- one had only a new limit line.

At four of the approaches with no markings it was noted that there was sufficient length of seal on the approach to install the full markings.

Of the 360 Give Way controlled approaches:

- 239 (66 percent) had old style Give Way markings
- 88 (24 percent) had new style Give Way markings
- 18 (five percent) had no markings at all
- 10 (three percent) had only old style limit lines
- four (one percent) had only a new style limit line, and
- one had only old style words and no limit line.

At three of the approaches with no markings, it was noted there was sufficient length of seal to install the full markings.

Results of the field surveys, continued

Road marking dimensions

The TCD Rule includes the legal requirements for road markings on Stop and Give Way controlled approaches. These are:

- on Stop controlled approaches the word 'Stop' must be marked in letters not less than 2.4 metres high in urban areas or 3.6 metres in rural areas
- on Give Way controlled approaches a triangle symbol must be marked not less than 2.5 metres high, or
- where they previously existed, the words 'Way' and 'Give' may be maintained on the roadway in letters a minimum of 2.0 metres high.

MOTSAM recommendations differ from these in that:

- on Give Way controlled approaches the triangle symbol should be not less than 4.0 metres high in urban areas or 6.1 metres high in rural areas
- on Give Way controlled approaches with words, the letters should be not less than 2.4 metres high in urban areas or 3.6 metres high in rural areas.

The dimensions of all road markings on the surveyed approaches were measured against both the legal requirements and the MOTSAM recommendations. The term 'approximately' in this section of the report means 'within 0.1 metres'. This allows for a margin of error in taking the measurements. The results were as follows.

Of the 195 urban approaches with old style Give Way markings:

- all complied with legal requirements by having words with letters that were at least 2.0 metres high
- 25 (13 percent) had letters that were between 2.0 metres and 2.4 metres high and therefore complied with legal requirements but not with MOTSAM
- 166 (85 percent) had letters approximately 2.4 metres high and therefore complied with legal requirements and MOTSAM
- one had lettering 3.8 metres high and therefore complied with legal requirements and MOTSAM.
- three had no words.

Of the 60 rural approaches with old style Give Way markings:

- two (three percent) had words with letters that were less than 2.0 metres high and therefore did not comply with legal requirements
- 31 (52 percent) had words with lettering between 2.0 metres and 3.6 metres high and therefore complied with legal requirements but not MOTSAM
- 15 (25 percent) had lettering approximately 3.6 metres high and therefore complied with legal requirements and MOTSAM
- 12 (20 percent) had no words.

Results of the field surveys, continued

Road marking dimensions, continued

Of the 69 urban approaches with new style Give Way marking:

- 34 (49 percent) had triangle symbols approximately 2.5 metres high and therefore complied with legal requirements but not with MOTSAM
- eight (13 percent) had triangle symbols that were between 3.0 metres and 4.0 metres high and therefore also complied with legal requirements but not with MOTSAM
- 17 (25 percent) had triangle symbols approximately 4.0 metres high and therefore complied with both legal requirements and MOTSAM
- six (nine percent) had words approximately 2.4 metres high remarked instead of triangle symbols and therefore complied with legal requirements and MOTSAM
- one had a triangle symbol approximately 6.0 metres high and therefore complied with legal requirements and MOTSAM
- three had no triangle symbol or words.

Of the 24 rural approaches with new style Give Way markings:

- one had a triangle symbol that was 2.0 metres high and therefore did not comply with legal requirements
- 10 (42 percent) had a triangle symbol approximately 2.5 metres high and therefore complied with legal requirements but not with MOTSAM
- six (25 percent) had triangle approximately 4.0 metres high which complied with legal requirements but only with the urban size recommended in MOTSAM
- four (17 percent) had triangle symbols approximately 6.0 metres high and therefore complied with both legal requirements and MOTSAM
- three had no triangle symbol.

Of the 107 urban approaches with old style Stop markings:

- nine (eight percent) had lettering less than 2.4 metres high and therefore did not comply with legal requirements
- 93 (87 percent) had lettering approximately 2.5 metres high and therefore complied with legal requirements and MOTSAM
- the remaining five (five percent) had lettering between 3.0 metres and 3.4 metres high and therefore complied with legal requirements and MOTSAM.

Of the 42 rural approaches with old style Stop markings:

- 15 (36 percent) had lettering between 2.5 metres and 3.6 metres high and therefore did not comply with legal requirements
- 19 (45 percent) had lettering approximately 3.6 metres high and therefore complied with legal requirements and MOTSAM
- the remaining eight (five percent) had no lettering.

Results of the field surveys, continued

Road marking dimensions, continued

Lettering on all 23 urban approaches with new style Stop markings was approximately 2.5 metres high and therefore complied with legal requirements and MOTSAM.

Of the 13 rural approaches with new style Stop markings:

- 10 (77 percent) had lettering approximately 2.5 metres high and therefore did not comply with either legal requirements or MOTSAM
- three (23 percent) had lettering approximately 3.6 metres high and therefore complied with legal requirements and MOTSAM.

Road marking locations

The TCD Rule requires the road markings on Stop and Give Way controlled approaches to be in the following locations:

- on Stop controlled approaches, the word 'Stop' must be marked with the base of the letters not more than 10 metres from the limit line
- on Give Way controlled approaches, a triangle symbol must be marked not more than 20 metres before the limit line, or
- where they previously existed, the words 'Way' and 'Give' may be maintained on the roadway with the base of 'Way' not more than 20 metres from the limit line and the base of 'Give' not more than 25 metres from the base of 'Way'.

MOTSAM recommendations differ from these in that:

- the triangle symbol should be at least 2.0 metres away from the limit line
- on Give Way controlled approaches with words, the base of the word 'Way' should be within 10 metres of the limit line in urban and rural areas and the base of the word 'Give' should be within 25 metres of the limit line in urban areas and 35 metres of the limit line in rural areas.

The locations of markings on all surveyed approaches were measured for compliance with both the legal requirements and the MOTSAM recommendations.

Of the 195 urban approaches with old style Give Way markings:

- all complied with the legal requirement to have the word 'Way' within 20 metres of the limit line
- 140 (72 percent) did not comply with the MOTSAM requirement to have the word 'Way' within 10 metres of the limit line
- one did not comply with the legal requirement for the word 'Give' to be no more than 25 metres in advance of the word 'Way'
- 106 (54 percent) did not comply with the MOTSAM requirement that the word 'Give' be within 25 metres of the limit line (and a further 19 did not have this measurement recorded).

Results of the field surveys, continued

Road marking locations, continued

Of the 48 rural approaches with old style Give Way markings and words on the road:

- all complied with the legal requirement to have the word 'Way' within 20 metres of the limit line
- 42 (88 percent) did not comply with the MOTSAM requirement to have the word 'Way' within 10 metres of the limit line
- six (13 percent) did not comply with the legal requirement that the word 'Give' be within 25 metres of the word 'Way' and a further nine did not have this measurement recorded
- 13 (27 percent) did not comply with the MOTSAM requirement that the word 'Give' be within 35 metres of the limit line. Again, there were nine approaches that did not have this measurement recorded.

Of the 69 urban approaches with new style Give Way marking:

- 20 (29 percent) did not comply with the legal requirement to have the triangle symbol within 20 metres of the limit line (although 12 of these were within 21 metres)
- all complied with the MOTSAM requirement to have the triangle symbol at least 2.0 metres from the limit line.

Of the 21 rural approaches with new style Give Way markings and a triangle symbol marked:

- 12 (57 percent) did not comply with the legal requirement to have the triangle symbol within 20 metres of the limit line (although five of these were within 21 metres)
- all complied with the MOTSAM requirement to have the triangle symbol at least 2.0 metres from the limit line.

Of the 107 urban approaches with old style Stop markings:

- 90 (84 percent) did not comply with the legal and MOTSAM requirement that the word 'Stop' be marked within 10 metres of the limit line.

Of the 39 rural approaches with old style Stop markings and the word 'Stop' marked:

- 23 (59 percent) did not comply with the legal and MOTSAM requirement that the word 'Stop' be marked within 10 metres of the limit line.

Of the 23 urban approaches with new style Stop markings:

- 21 (91 percent) did not comply with the legal and MOTSAM requirement that the word 'Stop' be marked within 10 metres of the limit line.

Of the 13 rural approaches with new style Stop markings:

- 11 (85 percent) did not comply with the legal and MOTSAM requirement that the word 'Stop' be marked within 10 metres of the limit line.

Results of the field surveys, continued

Additional features

Additional features were surveyed and noted for each intersection. There were many different additional features, but the most numerous were throat islands with or without repeater signs. Of the surveyed intersections:

- 31 urban approaches with Give Way controls (12 percent) had throat islands although at 12 of these there was no record of an additional control sign
- four rural approaches with Give Way controls (four percent) had throat islands although at two of these there was no record of an additional control sign
- 28 urban approaches with Stop controls (22 percent) had throat islands although at two of these there was no record of an additional control sign
- nine rural approaches with Stop controls (17 percent) had throat islands although at three of these there was no record of an additional control sign.

Other additional features found in the survey include:

- six approaches with kerb build-outs
- four approaches with raised platforms and kerb build-outs
- two approaches with central hatching and kerb build-outs
- two approaches with additional Stop control signs on the right hand side of the road (both at the same intersection)
- one approach with a painted island
- one approach with a speed hump.

Discussion

General

The surveys were carried out in the months immediately after the TCD Rule came into effect. Therefore, RCAs were still in the process of implementing new markings as specified in the Rule and there was a mix of new and old style markings.

Although not questioned directly on the subject, no authority was taking the opportunity to review the appropriateness of intersection controls against MOTSAM or RTS 1 criteria before installing the new style of markings.

Almost every authority questioned claimed to use MOTSAM, RTS 1 and the new TCD Rule to determine the appropriate control to install and how to install the signs and markings. However, in practice the adherence to these documents was particularly poor. For example:

- 63 percent of Give Way controlled and 19 percent of Stop controlled approaches were signed wrongly
- 50 percent of Give Way and 36 percent of Stop signs at rural intersections were too small
- 41 percent of Stop and Give Way signs were too far away from the intersection
- only 25 percent of old style Give Way markings and 45 percent of old style Stop markings in rural areas complied with the size requirements in MOTSAM
- 80 percent of Stop markings did not comply with legal requirements to be within 10 metres of the limit lines.

It is also worth recording that 74 percent of Give Way markings would not have complied with the previous legal requirement in the *Traffic Regulations 1976* to be within 10 metres of the limit line. They only comply with the legal requirement in the TCD Rule because the distance was relaxed to 20 metres in the Rule.

Of even more concern was the number of new markings being installed to comply with the TCD Rule that were not being installed correctly. For example:

- only 27 percent of triangle symbols installed on urban approaches with Give Way controls and 17 percent on rural approaches met the MOTSAM size recommendations (although all met the legal requirements)
- 29 percent of triangle symbols installed in urban areas and 57 percent installed in rural areas did not meet the legal requirement of being within 20 metres of the limit line.

The width of the new limit lines were not measured as part of the survey but in some instances the surveyors noted the lines were less than the 300 mm wide that the TCD Rule requires them to be.

The table in appendix 1 gives a good idea of how few intersection approaches comply fully with MOTSAM and the TCD Rule based on the measurements taken as part of the surveys.

Discussion, continued

General, continued

These findings are consistent with those in most of these road safety surveys in earlier years – that measures and devices being installed on the roads commonly don't meet the standards and guidelines that staff of the RCA state they are meeting. That this is still occurring when implementing new standards at a time when systems and procedures are reportedly in place to prevent it happening is a good reason to review these systems and procedures to ensure standards are being met. It is also surprising that all but one RCA rated their maintenance and inspection procedures as 'acceptable' or better.

Resurfacing of roads provides an opportunity to correct markings that do not conform fully to MOTSAM and the TCD Rule. RCAs intending to take this opportunity will need to insert a clause into their sealing contracts and provide illustrations of the correct markings for the resealing contractor to ensure that existing markings are not tagged on the ground for re-marking. Instead the markings are to be applied as shown on the plan. If, as is usual, re-marking is carried out by a separate markings contractor, the plan will need to be issued to them with clear instructions to carry out the work.

Perhaps the most obvious indicator of the deficiencies in inspection procedures is the number of uncontrolled crossroads encountered by the surveyors given that all RCAs stated they had no remaining uncontrolled crossroads.

Despite stating they used MOTSAM or RTS 1 to determine which type of control to install, no authority used visibility criteria (as in those documents) as a basis to review whether existing controls were appropriate. The majority used crash records and complaints or suggestions from the public, police or staff members.

Best practice

Elements of best practice observed or resulting from the surveys were:

- MOTSAM, the TCD Rule, and RTS 1 remain the appropriate documents to use to determine which controls to install and how to install them
- maintenance and inspection procedures systematically consider all aspects of traffic control devices eg, appropriateness of control, legality and compliance of installation with standards, size and condition and visibility
- RCAs should systematically review controls based on MOTSAM and RTS 1 criteria and to determine the need for additional safety features (such as throat islands and duplicated signs)
- pre-approved plans showing the appropriate controls at intersections are required for all new or subdivisional developments
- contracts are worded and procedures implemented to ensure that the appropriate markings are correctly installed after resurfacing works rather than the previous markings simply being reinstalled
- formal, documented procedures and delegations are used to install or change intersection controls and a register is kept of these actions.

Discussion, continued

Recommendations

The survey showed there is very poor on-road compliance with the stated standards and guidelines. Therefore:

- the proposed Traffic Control Devices Management Group (to review the content and format of MOTSAM) should research and review all the standards and guidelines relevant to this issue, especially:
  - the criteria for installing Stop control v Give Way controls (especially at T intersections)
  - the sizes of markings and their distances from the limit lines
  - the requirement that control signs be located within 9.0 metres of the through road
- Land Transport NZ should report these findings to all RCAs, signs contractors and the New Zealand Road Markers' Federation to ensure they are aware of the correct standards and guidelines, and provide advice on corrective action where necessary
- RCAs are recommended to specifically issue instructions and plans for the correct markings to be applied at intersections when these are resurfaced
- RCAs are recommended to adopt all the elements of best practice documented in the above section.

Appendix 1

Summary of field surveys by road controlling authority.

RCA	Total surveyed approaches with old markings		Total surveyed approaches with new markings		Approaches complying totally with MOTSAM and TCD Rule			
	Urban	Rural	Urban	Rural	Urban – old	Rural – old	Urban – new	Rural – new
Kaipara District	2	-	7	4	1	-	2	0
Rodney District	3	6	1	-	0	0	0	-
Waitakere City	3	2	1	-	2	0	0	-
Franklin District	6	5	1	-	1	1	0	-
Thames - Coro District	8	2	1	-	0	0	1	-
Waipa District	7	3	-	4	0	0	-	0
Taupo District	3	3	4	2	0	0	0	0
Tauranga District	14	-	6	-	1	-	2	-
Kawerau District	8	-	-	-	0	-	-	-
Opotiki District	12	3	-	-	0	0	-	-
Hastings District	11	2	3	3	0	0	0	0
Napier City	20	-	-	-	1	-	-	-
Kapiti Coast District	19	-	1	-	0	-	0	-
Porirua City	20	-	-	-	1	-	-	-
New Plymouth District	21	4	-	-	2	0	-	-
Palmerston North City	12	4	1	-	1	0	0	-
Hutt City	24	-	4	-	1	-	0	-
Nelson City	22	-	1	-	3	-	1	-
Buller District	-	-	12	2	-	-	2	0
Grey District	6	1	6	1	0	0	2	0
Westland District	-	-	12	6	-	-	3	0
Mackenzie District	10	4	-	-	0	0	-	-
Waimate District	9	16	7	-	0	0	1	-
Qtown - Lakes District	9	5	3	3	1	0	0	0
Central Otago District	12	3	-	-	0	0	-	-
Dunedin City	12	1	-	11	0	0	-	0
Gore District	-	2	12	9	-	0	1	0
Invercargill City	10	6	6	-	1	0	1	-
TNZ Auckland	4	11	1	1	1	0	0	0
TNZ Napier	10	5	-	-	0	1	-	-
TNZ Christchurch	8	13	2	-	0	1	0	-
TOTALS	315	101	92	46	17	3	16	0

Appendix 2

Stop and Give Way controls at intersections questionnaire Road controlling authority: Person(s) replying to questionnaire Position in organisation: Contact phone no.: Date: Interviewer:	
Questions	**Prompts**
1 Which criteria does your Authority use to determine if an intersection should be controlled as a Stop, Give Way or is uncontrolled? Please detail/ list: (a) National guidelines (b) Local guidelines Does the Authority have any uncontrolled crossroads?	• This may be captured in the safety management system documentation. • Sightlines/conspicuity. • Are parked cars included in sightline measurements? • Traffic volumes. • Crash records/ CRS. • Public/politics. • Were procedures altered in response to RSS 4? • RTS 1 • If yes – why?
2 Which guidelines or standards does your Authority use when installing traffic control road markings and signs at intersections? (a) For Give Way controls (b) For Stop controls	• eg, MOTSAM, Austroads. • signs – location and size • markings - where are measurements taken to/from • TCD Rule • If own guidelines developed what was the reason?
3 How do you determine if additional features should be added?	• splitter islands • no stopping lines • CRS/crash records

Questions	**Prompts**
4 (a) What, if any, criteria do you use to determine the use of repeater signs on the right hand side of the road or throat island at Stop and Give Way controlled intersections? (b) How do you ensure that Stop and Give Way signs are stand alone and that no other signs are attached to these, apart from those specified in MOTSAM?	• Route hierarchy • Traffic volumes • Visual clutter from buildings/other signs particularly in urban areas
5 What maintenance/inspection procedures do you have for (a) Stop and Give Way signs (b) Visibility splays How effective are these agreements/ arrangements? (Assess on a scale of 1 to 5)	• Vegetation control. • Vegetation growth at specific times during the year. • Cleaning of signs • Does the Council have a formal policy? Documentation? Scale 1=very poor 3=acceptable 5=excellent
6 How are intersections reviewed to see if the existing controls are still appropriate? (a) In urban areas: (b) In rural areas:	• Crash reduction studies, project or existing road safety audits. • How often? • Under what circumstances?
7 How do you ensure your standards and procedures are applied on new/subdivision roads?	
8 Do you have a policy to investigate upgrading priority controlled intersections to roundabouts or traffic signals? (a) If yes, what is the criteria/policy? (b) If no, are you planning to create one?	
9 Does your Authority have procedures in place to formally ratify intersection controls? If so please detail.	• Is it known it is a legal requirement? • If delegated to officers to what level? • Arrangement at intersection with SH.

Questions		Prompts
10	Do you have an inventory register that records what controls there are at intersections and does it identify sign types and locations. If yes, what system(s) are you using? Was it introduced in response to RSS 4? If not, are you planning to create one?	• RAMM? • What type of database?
11	Are you aware of the changes in the Traffic Control Devices Rule in relation to Stop and Give Way controls? Do you have a programme for upgrading signs and markings to comply with the TCD Rule?	• Limit lines and give way symbol • Symbols not words • 4 or more legs • Level Xing wording
12	Do you have any views/concerns about the use of Stop and Give Way controls at level crossings?	
13	Do you have any general comments about Stop and Give Way controlled intersections, or suggestions on ways that Land Transport NZ could be of assistance on this issue?	

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
RSS 21	*Traffic calming*	2004
RSS 22	*Road markings*	2004
RSS 23	*Crash reduction studies and monitoring*	2005
RSS 24	*Stop and Give Way controls at intersections*	2005

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