

***Traffic Standards and Guidelines***  
1999/2000 Survey

***RSS 14***

**Roundabouts**



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## Survey of Traffic Standards and Guidelines

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

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

The purpose of these surveys is to:

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

The surveys are usually carried out in two parts:

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

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

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

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



William McCook,  
General Manager, Operations



## Executive Summary

### Introduction

- Interview surveys were conducted during April and May 2000 with 33 road controlling authorities (RCAs) to investigate procedures and policies for two safety areas – no passing lines and roundabouts.
- Field surveys were conducted at a sample of sites to obtain a 'snapshot' of the on-road situation relative to the standards, verify responses to the interview and to discuss problems or successes with RCA staff.
- This report details the results of the surveys of roundabouts. A companion report details the results of the surveys of no passing lines.

### Interview Findings

Most of the surveyed RCA staff considered roundabouts to be a good form of intersection control. Even some of those with no or few roundabouts favoured their use provided the appropriate traffic engineering criteria applied.

Of the 33 RCAs surveyed 24 had roundabouts with 349 roundabouts in total:

- two RCAs had more than 50 roundabouts,
- seven had between 11 and 50 roundabouts, and
- the remaining 15 had fewer than 11 roundabouts.

Most were in urban areas with only 19 roundabouts (5%) in rural areas.

Only the four Transit NZ Regional Offices had documented standards used for roundabout design. However all 24 RCAs stated they use, or expect their consultants to use, Austroads Part 6 as the guideline for roundabout design. Most also stated they use the Manual of Traffic Signs and Markings for signs and markings at roundabouts.

Traffic engineering criteria including traffic flows, crash history, land-use issues and economics (benefit/cost) are the commonly used criteria for deciding when and where to install roundabouts.

Generally, the RCAs recognised that roundabouts can cause problems for cyclists and pedestrians and considered their needs when assessing whether or not to install a roundabout. No ideal solutions have been found to accommodate cyclists and pedestrians at roundabouts.

Ten of the 24 RCAs had policies for undertaking safety audits on roundabout projects, with most undertaking formal safety audits and others carrying out more informal in-house safety checks.

### Field Survey Results

Field surveys were undertaken at 113 roundabouts, 4 in rural areas.

No roundabouts fully met the standards for all of the surveyed aspects.

Surveys of the 440 road approaches at the 113 roundabouts showed:

- two thirds did not satisfy the desirable sight triangle criteria in Austroads Part 6,
- 17% had inadequate deflection,
- 20% had inadequate visibility to the right from the limit lines,
- 11% did not have Give Way signs on the left,
- two roundabouts (2%) had no Give Way signs on any approach,
- one third did not have the legally required P28 'rotary junction' sign.

The surveys included 22 multi lane roundabouts. Most (16, or 73%) had lane arrows marked on one or more of the approaches although this is not recommended. Over half these multi lane roundabouts had Alberta style marking through the roundabout and just over a quarter had partial concentric markings.

Some RCAs have developed standard layouts and landscaping details to provide good consistency in the appearance of their roundabouts. Street name/chevron signs or standard chevrons are being well used to delineate roundabouts.

### Recommendations

- Road controlling authorities should document their standards and policies on the design and installation of roundabouts in accordance with safety management system principles.
- More guidance is needed on best design practice for local road roundabouts, small dome types and standard roundabouts on typical 14m wide roadways.

- Better dissemination of information is needed on best practices for signing, marking and landscaping roundabouts.
- The applicability of the sight triangle criterion for sight distance in Austroads Part 6 needs to be reviewed for urban roundabouts.
- The Traffic Regulations 1976 and legal issues with respect to signs, markings and driving rules at roundabouts need to be reviewed and simplified to promote consistent behaviour and environment at roundabouts.
- A single “Roundabout Give Way” sign to be used at the limit lines should be considered to replace both the P28 ‘rotary junction’ and Give Way signs.
- Further research is required to relate the safety performance of roundabouts to the design criteria and determine the most important design criteria or combinations of the criteria to achieve good balanced, safe roundabouts.
- RCAs should undertake safety inspections of their roundabouts to ensure all required signs and markings are installed and maintained and that adequate sight distances and deflection are achieved.





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## 1. Introduction

During April and May 2000 the Regional Offices of the Land Transport Safety Authority (LTSA) conducted surveys of two road safety issues in 33 road controlling authorities (RCAs).

The two safety areas surveyed were:

- no passing lines, and
- roundabouts

This report describes the procedures for the roundabouts surveys and presents the results.

Compliance was measured with respect to:

- Austroads *Guide to Traffic Engineering Practice, Part 6 – Roundabouts* (Austroads Part 6)
- Transit New Zealand/LTSA *Manual of Traffic Signs and Markings, Part II Markings* (MOTSAM)
- *Traffic Regulations 1976*

## 2. Purpose of the Surveys

The purpose of the surveys was to:

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

## 3. Methodology

### 3.1 Sample Selection

A sample of 33 RCAs was chosen for inclusion in the surveys. This included 29 territorial local authorities and four regional offices of Transit New Zealand (TNZ). The sample was weighted towards authorities not included in the 1999 LTSA surveys.

Appendix 1 lists the 33 RCAs included in the surveys. The list also shows the number of roundabouts surveyed in each RCA and a table summarising the

results of the field surveys. Nine of the 33 RCAs surveyed had no roundabouts.

### 3.2 Interview Surveys

Interview surveys were conducted with representatives in each authority. Survey forms were sent in advance to allow time to research answers if necessary. Questions centred on the standards and guidelines used for the design and installation of roundabouts.

The Roundabouts Questionnaire used for the Interview Surveys is in Appendix 2.

### 3.3 Field Surveys

Up to 10 randomly selected roundabouts were surveyed in the field for each RCA. Staff from the RCA were invited to take part. The field surveys evaluated the extent of compliance with Austroads Part 6, MOTSAM and the Traffic Regulations 1976.

A copy of the Roundabouts Survey Form used for the field surveys is in Appendix 3.

## **4 Results**

### 4.1 Interview Surveys

#### 4.1.1 Number of Roundabouts

The total number of roundabouts in the RCAs surveyed was 349. Nine of the 33 RCAs surveyed had no roundabouts and were therefore discounted from completion of the questionnaire form and subsequent analysis.

The number of roundabouts in each RCA is shown in Appendix 1.

#### 4.1.2 Types of Roundabouts

Information on the types and locations of the 349 roundabouts showed:

- 95% were on urban roads (speed limit < 80km/hr) with most (89%) in 50km/hr areas.
- 79% were single lane and 21% multi-lane roundabouts. Ten RCAs had multi-lane roundabouts.
- 71% had four road approaches, 24% had three approaches and 5% had five or more approaches.

- The numbers of each central island type were:
  - 64% (224) standard mountable kerb (8 with high walled islands)
  - 25% (85) collared or modified
  - 11% (40) minimum or dome (“fried egg”)

Appendix 4 Photographs 1 to 5 show examples of these types of central islands.

#### 4.1.3 Design Standards

All 24 RCAs with roundabouts noted they use Austroads, Part 6 as the design standard or guide. Several stated they used consultants for roundabout design and while they did not specify the use of Austroads Part 6 they generally used Austroads guides as their base design standards.

Most RCAs use MOTSAM for the signs and markings at roundabouts and Australian/New Zealand Standard AS/NZ 1158:1997 Road Lighting for lighting although some stated they did not specifically design lighting layouts at roundabouts.

Nine also use TNZ's *Roading Design Guideline RD2-Roundabouts*.

Nine also confirmed they use the Traffic Regulations 1976 as one of the design standards.

Nine listed other design guides such as vehicle tracking curves, in-house guidelines (based on experience), and policies on lane arrows and floodlighting.

#### 4.1.4 Design Criteria

Most RCAs had no formal criteria to decide when and where to install roundabouts but used general traffic engineering criteria. Traffic flows, crash history, land-use issues and economics (benefit/cost) were the criteria most often used.

Problems RCAs had experienced were:

- inadequate deflection to control speeds,
- inconsistent signage,
- visibility obstructions (by signs and/or landscaping),
- lane marking and lane use at multi-lane roundabouts,
- mountable kerbs too high on some collared islands,
- inadequate delineation of the edge of collars or of small dome roundabouts, and

- collar paving similar to nearby footpaths which encourages pedestrian use.

#### 4.1.5 Cyclists and Pedestrians

Provision for cyclists' and pedestrians' needs when installing roundabouts varied from no consideration (because of low volumes) to undertaking full movement counts and considering other design options if necessary. Most RCAs recognised that roundabouts can cause problems for cyclists and pedestrians. Other than providing alternative routes, no ideal design solutions had been found for cyclists who were generally expected to form part of the vehicular traffic stream at roundabouts.

Provisions made by RCAs for cyclists and pedestrians included:

- kerb cut downs on the splitter islands for pedestrians,
- control of speeds and provision of adequate lane widths for cyclists, and
- education of cyclists and encouragement of use of alternative routes to avoid roundabouts.

#### 4.1.6 Signs, Markings and Lanes

All RCAs interviewed stated they use Give Way signs at roundabouts and most (22 of the 24) stated they use the P28 'rotary junction' sign. Several RCAs suggested the Give Way sign at roundabouts be replaced with the Australian 'give way/rotary junction' sign.

Of the 10 RCAs with multi-lane roundabouts:

- 8 generally matched the number of entry, circulating and exit lanes.
- 3 use Alberta type lane markings, 3 a mixture of Alberta and partial concentric lane markings, 1 uses only partial concentric and 1 does not use lane markings. The other two had no policy on marking the lanes, each had only one multi-lane roundabout and generally preferred single lane roundabouts.

#### 4.1.7 Safety Audits

Ten of the 24 RCAs had policies to undertake safety audits for roundabout projects.

Most of these undertake formal safety audits at design and post-construction stages but others use more informal in-house safety checks.

#### 4.1.8 Other Features

- Splitter Islands  
All the RCAs stated they install splitter islands at roundabouts with perhaps some discretion for local road, small dome roundabouts. Several

stated they followed Austroads Part 6 which states splitter islands should be provided on all roundabouts on arterial and collector roads and are desirable on roundabouts on local roads.

- Skid Resistance

Six of the RCAs, including the 4 TNZ regional offices, stated they had policies on skid resistance at roundabouts. TNZ include approaches to roundabouts in their general skid resistance policy as site category 1 (Sideways Force Co-efficient 0.55).

Transverse grooving of dense asphalt concrete is used in Christchurch City but recent surveys suggest improvements from this are not significant. Longitudinal grooving is currently under investigation by Christchurch City.

- Signs and Landscaping

Features adopted by RCAs to enhance roundabouts and achieve consistency in their appearance include:

- chevron signs including use of single chevron boards or mini chevrons,
- street name chevrons on central island,
- quadrant layout of central island signs and landscaping (to overcome visibility problems),
- street name sign on splitter islands (for exiting traffic),
- use of collar-type roundabouts,
- landscaping central islands, and
- kerbside landscaping to help control pedestrian paths.

#### 4.1.9 Documentation

Only the four TNZ regional offices have documented in-house procedures for the design and installation of roundabouts. The other RCAs stated their procedures were not formally documented or that they had no procedures. Many use consultants to undertake roundabout designs and expected the consultants to use industry standards (e.g. Austroads, Part 6).

#### 4.1.10 General

General comments or suggestions on roundabouts included:

- The P28 'rotary junction' sign is insignificant and should be combined with a give way type sign at the roundabout.
- RCAs need better guidelines for roundabout designs on local roads and their use as part of LATM schemes.
- Roundabouts need more consistency for users (such as standard layouts, lane widths, marking etc)

- Legal issues and definitions of roundabouts need clarification and changes to achieve simple well understood driving rules and consistent driving behaviour at roundabouts.
- RCAs need better dissemination of data on roundabouts.

## 4.2 Field Surveys

Appendix 1 tabulates the number of roundabouts surveyed for each RCA and the results of surveys of:

- P28 'rotary junction' signs
- Give way signs on left
- Deflection
- Sight distance and visibility

### 4.2.1 Number of Roundabouts

Field surveys were conducted at 113 roundabouts.

In total these 113 roundabouts had 440 road approaches (24 had 3 approaches, 79 had four and 10 had five or more approaches). Most (92%) of the roundabouts surveyed were in 50km/h areas. Four were in 70km/h, 3 in 80km/h and 1 in 100km/h areas.

### 4.2.2 Deflection

Roundabouts should be designed so the speed of all vehicles is less than 50km/hr within the roundabout. The deflection criteria of Austroads Part 6 is that no vehicle path has a radius greater than 100 metres. For low speed, local road roundabouts the design speed is 25km/hr and deflection based on a path of 20 metres radius. Deflection can be achieved by the central island, offset approaches or the entry roadway alignment and splitter islands.

The field surveys noted how the deflection was achieved and compared the deflection or offset along a vehicle path against a table of deflections and distances equating to a 100 metre (or 20 metre) radius to assess the on-site deflection as "Clearly adequate," "Adequate," or "Inadequate".



The table below shows the results of the field surveys of deflection.

Deflection by	Deflection			Total
	Clearly adequate	Adequate	Inadequate	
Central island	51% (224)	13% (59)	13% (57)	<b>77% (340)</b>
Offset approaches	5% (22)	1.5% (6)	1.5% (6)	<b>8% (34)</b>
Entry alignment / splitter island	9% (38)	3.5% (16)	2.5% (12)	<b>15% (66)</b>
<b>Total</b>	<b>65% (284)</b>	<b>18% (81)</b>	<b>17% (75)</b>	<b>100% (440)</b>

#### 4.2.3 Sight Distance and Visibility Criteria

Figure 4.9 of Austroads Part 6 illustrates three sight distance criteria that influence the safety performance of a roundabout. These are:

- Criterion 1 (*to limit lines*) - to provide adequate stopping sight distance to the Give Way limit lines.
- Criterion 2 (*to right*) - to provide a driver stationary at the limit lines with a clear line of sight to traffic entering the roundabout from an approach immediately to the right for a distance at least equal to the critical gap acceptance travel time. This criterion also needs to be checked in respect to vehicles in the circulating carriageway (*to circulating*). For this survey critical gap acceptance time of 4 seconds was used giving a sight distance of 56 metres for 50km/hr or 28 metres for 25km/hr entry speeds.
- Criterion 3 (*sight triangle*) - a sight triangle which allows a driver slowed to 50km/hr (25km/hr) approaching a roundabout time to stop and avoid a vehicle driving through from the immediate right approach at 50km/hr (25km/hr).

For this survey, sight distances were assessed as being greater than or equal to the criteria ("Satisfied standard") or "Less than the standard." Measurements were made to help make the assessment but the actual sight distances were not recorded.

The table below shows shows the number and percentage of approaches that satisfied or were less than the sight distance standards.

Sight Distance Criteria	% (number) of Approaches that	
	Satisfied standard	Were less than standard
<b>1. to limit lines</b>	97% (425)	3% (15)
<b>2a. to right</b>	80% (351)	20% (89)
<b>2b. to circulating</b>	100% (439)	0% (1)
<b>3. sight triangle</b>	33% (146)	67% (294)

#### 4.2.4 Lanes

- Approach/Circulating/Departure Lanes

Austrroads Part 6 states that “Generally, the number of circulating lanes should be equal to the number of entry lanes and should match the number of departure lanes.”

Some roundabouts had left turn only approach lanes. These lanes were ignored when matching approach, circulating and departure lanes.

Twenty-two multi-lane roundabouts were surveyed. The number of approach, circulating and departure lanes were not matched at 9 (41%) of these roundabouts.

- Circulating Lane Markings

There is divided opinion on whether lane lines should be used to delineate circulating lanes on multi-lane roundabouts and, if used, what is the most appropriate form of lane marking to use.

The alternatives suggested in MOTSAM for multi-lane roundabouts are:

- No marking
- Partial concentric
- Alberta

Of the 22 multi-lane roundabouts surveyed, 18% (4) had no marking, 27% (6) had partial concentric markings and 55% (12) had Alberta markings.

- Lane Arrows

MOTSAM states “Due to conflicts with the Traffic Regulations, lane arrows are not generally recommended for multi-lane approaches to roundabouts as they may confuse priorities”.

Of the 22 multi-lane roundabouts surveyed 73% (16) had lane arrows on one or more approaches. These 22 roundabouts had a total of 87 road approaches, 75 of which had more than one lane. 57% (43) of these multi-lane approaches were marked with lane arrows.

The 16 roundabouts with lane arrows were in eight different RCAs, including three TNZ regions.

4.2.5 Signs (P28 'rotary junction' and Give Way signs)

All approaches to roundabouts must have a P28 'rotary junction' (MOTSAM PW8 sign) sign to satisfy the legislative requirements to give priority to the circulating traffic on the roundabout.

Regulation 2 of the *Traffic Regulations 1976* in the definition of "Intersection" states "...that at a roundabout or rotary junction the approaches to which are marked by signs in the form of sign P28..... a vehicle having entered the central circulating roadway from an approach roadway shall be deemed to enter separate intersections as it approaches each area where its intended path of travel may conflict with the path of travel of vehicles entering from other approach roadways." This effectively defines a roundabout as several intersections with traffic on the central circulating roadway having priority over traffic entering from an approach road.

Give Way signs and markings are detailed in MOTSAM for use on the approaches to roundabouts to clearly inform drivers of the requirement to give way.

The table below shows the results of the surveys of P28 'rotary junction' and Give Way signs.

	<b>Roundabouts (113)</b>	<b>Approaches (440)</b>
No P28 'rotary junction' sign	18% (20)	34% (149)
No Give Way signs	2% (2)	4% (16)
No Give Way on left		11% (49)
Give Way on left only		26% (116)
Give Way on left and splitter island		63% (275)
Give Way on splitter island only		8% (33)

Nearly all of the RCAs had at least one roundabout with an approach road with no P28 'rotary junction' sign. Some of these approaches had map style signs and some were at old roundabouts. Map signs are not "in the form of sign P28" as required by the *Traffic Regulations 1976* to legally define a rotary junction or roundabout.

One of the two roundabouts without any Give Way signs was a large diameter roundabout constructed as a town centre feature and intended to become a pedestrian area but the roads were never closed. The other was a new subdivision roundabout built by the developer.

#### 4.2.6 Other Surveyed Features

Other features of roundabouts were surveyed and the results are summarised below.

- Speed Control

For each approach, the surveyors subjectively assessed whether they thought the speed of vehicles through the roundabout was controlled mainly by the deflection or by visibility restrictions.

Deflection was considered to be the main factor controlling the vehicle speeds on 82% (342) of the 440 approaches.

- Splitter Islands

The table below shows the proportion and types of splitter islands at the roundabouts surveyed.

<b>Splitter Island types</b>	<b>Roundabouts (113)</b>	<b>Approaches (440)</b>
Raised	86% (97)	88% (386)
Flush	8% (8)	8% (34)
Some raised, some flush	4% (5)	N/A
None	2% (2)	4% (20)

- Central Islands

The types and diameter of central islands at the 113 roundabouts surveyed are shown in the table below.

<b>Central Island Type</b>	<b>Percent (number)</b>	<b>Range of diameter of island</b>
Standard	46% (52)	4.0 to 50 metres
Collar	39% (44)	6.5 to 29 metres
Dome	8% (9)	4.5 to 10 metres
Other	7% (8)	5.5 to 80 metres

The diameter of the central islands ranged from:

- 13 to 25 metres in 70km/h areas (4 roundabouts surveyed)
- 29 to 50 metres in 80km/h areas (3 roundabouts surveyed)
- 18 metres in 100km/h areas (1 roundabout surveyed)

- Central Island Signs and Vegetation

The table below shows the types of signs and vegetation on the central islands at the 113 roundabouts surveyed.

Description	Percent (number)	Comment
Street name/chevron sign	13% (15)	See photographs 1,2 & 3, Appendix 4
Standard chevron sign	44% (50)	See photograph 4 Appendix 4
Standard street name sign	8% (9)	
Other signs	14% (16)	
No signs	30% (34)	
No vegetation	23% (26)	
Low vegetation	65% (74)	Less than 500mm high
High vegetation	12% (13)	Trees of vegetation over 500mm high

- Features

Features noted at the roundabouts surveyed are shown in the photographs in Appendix 4. These include:

- Good examples of quadrant paving/landscaping and street name/chevron signs (photographs 1,2, and 3)
- Standard chevron signs on central island (photograph 4)
- Central island lighting (photograph 4)
- Dome (“fried egg”) roundabouts with flush splitter islands on local roads with other local area traffic management works (photograph 5)
- Good deflection by entry alignment and splitter islands (photographs 6 and 7)
- Old roundabouts as town centre features not to current standards (photographs 8 and 9)
- Various pedestrian crossing facilities near roundabouts (photographs 10,11, and 12)
- Poorly defined collar and ineffective collar (photograph 13)
- Badly located power poles near kerb on exit from roundabouts (photograph 14)

## 5 Discussion

Most of the RCA staff surveyed considered roundabouts to be a good form of intersection control. Even some of those with no or few roundabouts favoured their use provided the appropriate traffic engineering criteria applied. Several advised they considered better guidance and best practice details needed to be developed for local road and small dome-type roundabouts.

Surveys of the 440 road approaches at the 113 roundabouts showed two thirds did not satisfy the desirable sight triangle criteria from Austroads Part 6. Austroads notes that the desirable triangle may not be achievable in urban areas. Achieving the sight triangle could in fact encourage higher approach speeds and it is questionable that it is appropriate for urban roundabouts.

Deflection is one of the most important criteria for roundabouts and the surveys showed 17% of the approaches to roundabouts had inadequate deflection. Sight distance to the right from the limit lines is also an important criteria and 20% of the approaches surveyed had inadequate visibility to the right. These roundabouts need attention to correct these deficiencies.

A third of the approaches did not have the legally required P28 'rotary junction' sign. Some of these had map signs which, although indicating the presence of a roundabout ahead, do not comply with the Traffic Regulations 1976 which require a sign in the form of the P28 (MOTSAM PW 8) sign

A number of RCA staff commented that the P28 'rotary junction' sign was not conspicuous or appropriate. Using a combination "Roundabout Give Way" sign at the roundabout limit lines like the Australian example would be more meaningful and overcome the legal difficulties in the above situations.

Some RCAs have developed standard layouts and landscaping details to provide good consistency in the appearance of their roundabouts. Street name/chevron signs or standard chevrons are being well used to delineate roundabouts. Appendix 4 contains some photographs of a few of these.

## 6. Recommendations

- Road controlling authorities should document their standards and policies with respect to the design and installation of roundabouts in accordance with safety management system concepts.
- More guidance is needed on best design practice for local road roundabouts, small dome-types and standard roundabouts on typical 14m wide roadways.
- Better dissemination of information is needed on best practices for signing, marking and landscaping roundabouts.

- The applicability of the sight triangle criterion for sight distance in Austroads Part 6 needs to be reviewed for urban roundabouts.
- The Traffic Regulations 1976 and legal issues with respect to signs, markings and driving rules at roundabouts need to be reviewed and simplified to promote consistent behaviour and environment at roundabouts.
- A single “Roundabout Give Way” sign to be used at the limit lines should be considered to replace both the P28 ‘rotary junction’ and Give Way signs.
- Further research is required to relate the safety performance of roundabouts to the design criteria and determine the most important design criteria or combinations of the criteria to achieve good balanced, safe roundabouts.
- RCAs should undertake safety inspections of their roundabouts to ensure all required signs and markings are installed and maintained and that adequate sight distances and deflection are achieved.

**Appendix 1, Road Controlling Authorities Surveyed.**

<b>Road Controlling Authority (RCA)</b>	<b>Number of roundabouts in RCA area</b>	<b>Number of roundabouts surveyed</b>
Ashburton	3	3
Auckland	55	8
Banks Peninsula	0	0
Central Hawkes Bay	0	0
Christchurch	86	10
Clutha	0	0
Far North	3	2
Franklin	10	4
Gisborne	19	8
Hastings	35	6
Hurunui	1	1
Kapiti Coast	6	6
Mackenzie	0	0
Matamata Piako	0	0
Porirua	14	5
Rangitikei	2	2
Selwyn	4	3
South Waikato	8	4
Southland	0	0
Tararua	0	0
Tasman	5	2
Timaru	6	6
TNZ Auckland	9	7
TNZ Dunedin	11	6
TNZ Wanganui	6	2
TNZ Wellington	20	2
Waikato	6	4
Waimakariri	6	3
Waimate	0	0
Waipa	7	7
Waitaki	0	0
Western Bay Of Plenty	13	6
Whakatane	14	6
<b>Total Numbers</b>	<b>349</b>	<b>113</b>



The table below summarises for each RCA the deficiencies surveyed for

- P28 'rotary junction signs
- Give way signs on left
- Deflection
- Sight distance and visibility

Road Controlling Authority (RCA)	No. of roundabouts	No. of approaches	Percent of Approaches with						
			No P28 'rotary junction' sign	No Give Way on left	Inadequate deflection	Inadequate sight distance			
						To limit lines	To right	To circulating	Sight triangle
Ashburton	3	13	69%	46%	0%	0%	23%	0%	46%
Auckland	8	33	69%	46%	0%	0%	23%	0%	46%
Christchurch	10	38	13%	3%	21%	3%	26%	0%	84%
Far North	2	7	57%	14%	29%	0%	43%	0%	86%
Franklin	4	16	19%	0%	6%	0%	56%	0%	88%
Gisborne	8	31	3%	0%	39%	0%	10%	0%	71%
Hastings	6	25	40%	24%	32%	0%	40%	0%	68%
Hurunui	1	4	0%	0%	100%	0%	0%	0%	100%
Kapiti Coast	6	20	70%	45%	40%	5%	0%	0%	55%
Porirua	5	19	26%	5%	16%	5%	5%	0%	53%
Rangitikei	2	8	38%	0%	0%	0%	13%	0%	63%
Selwyn	3	13	8%	8%	15%	0%	8%	0%	77%
South Waikato	4	16	75%	0%	50%	0%	69%	0%	81%
Tasman	2	8	0%	50%	0%	0%	38%	0%	63%
Timaru	6	22	5%	5%	5%	0%	45%	0%	73%
TNZ Auckland	7	25	40%	0%	0%	24%	0%	0%	20%
TNZ Dunedin	6	23	39%	0%	0%	0%	0%	0%	91%
TNZ Wanganui	2	8	25%	25%	13%	13%	38%	0%	75%
TNZ Wellington	2	7	14%	14%	0%	0%	0%	0%	43%
Waikato	4	19	79%	11%	26%	0%	0%	0%	37%
Waimakariri	3	12	25%	8%	17%	0%	17%	0%	92%
Waipa	7	27	48%	26%	11%	0%	37%	0%	70%
Western BOP	6	24	46%	0%	0%	0%	0%	0%	58%
Whakatane	6	22	18%	0%	9%	5%	23%	0%	64%
<b>All RCAs</b>	<b>113</b>	<b>440</b>	<b>34%</b>	<b>11%</b>	<b>17%</b>	<b>3%</b>	<b>20%</b>	<b>0%</b>	<b>67%</b>

**Appendix 2, Roundabouts Questionnaire, 2000**

Road Controlling Authority

\_\_\_\_\_

Person(s) Interviewed

\_\_\_\_\_

Contact Phone No. \_\_\_\_\_ Date

\_\_\_\_\_

Interviewer \_\_\_\_\_

**QUESTIONS**

1. How many roundabouts are there under your jurisdiction? Total \_\_\_\_\_

- a) How many have
  - 5 or more approaches \_\_\_\_\_
  - 4 approaches \_\_\_\_\_
  - 3 approaches \_\_\_\_\_

- b) How many are
  - single lane roundabouts (single circulatory lane all quadrants) \_\_\_\_\_
  - multi lane roundabouts (> one lane in one or more quadrants) \_\_\_\_\_

- c) How many are on roads with a speed limit of
 

less than 50km/h	_____	50km/h	_____
60km/h	_____	70km/h	_____
80km/h	_____	100km/h	_____

- d) How many have central islands that are
 

standard /kerbed design	_____	collar / modified design	_____
minimum / dome design	_____	other	_____

(describe other \_\_\_\_\_)

2. What criteria do you use to decide when and where roundabouts are installed?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. How do you consider cyclist and pedestrian needs in your decision to install a roundabout and how do you take their needs into account in your designs?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Please describe issues and remedies that you are aware of for any of your roundabouts that have not worked in terms of safety or other factors?

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5. Do you have a policy for undertaking safety audits at roundabouts?  
Yes / No

- a) How many safety audits of your roundabouts have been undertaken at  
 Feasibility stage \_\_\_\_\_  
 Design stage \_\_\_\_\_  
 Post construction stage \_\_\_\_\_

Comments:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

6. What standard(s) do you use for : (tick as appropriate)

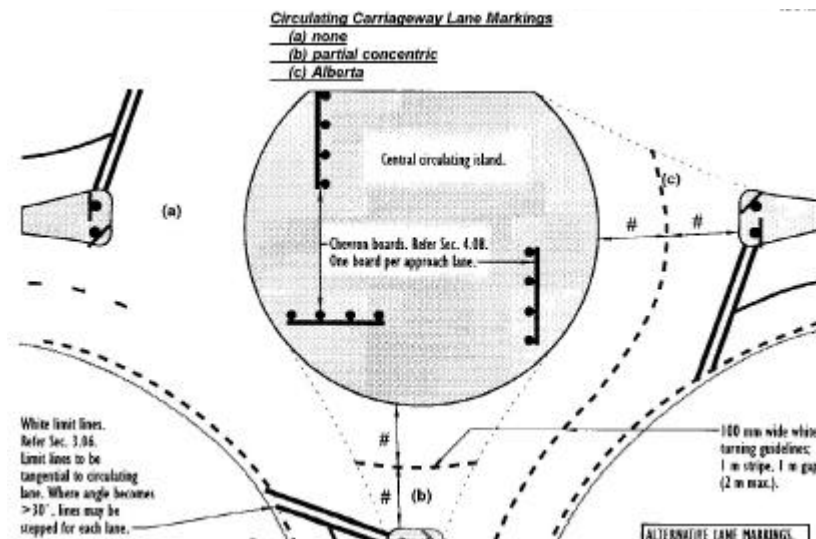
	Austrroads Part 6 Roundabouts	RD2 (TNZ)	AS/NZS 1158 (lighting)	Signs & Markings Manual	Traffic Regs	Other
a. Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Markings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

\_\_\_\_\_  
 \_\_\_\_\_

7. Describe any specific policies you have adopted for lane markings at roundabouts (eg use of lane arrows, use Alberta style markings – diagram follows)

\_\_\_\_\_  
 \_\_\_\_\_



8. Do you use PW 8 (roundabout) and/or RG6 (Give Way) signs at all roundabouts? PW8.....Yes / No RG6.....Yes / No

Comments:

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9. Do you have a policy to match the number of entry, circulating and departure lanes? Yes / No / Generally

Comments:

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---

10. What policies do you have for installing approach/splitter islands at roundabouts?

Describe:

---

---

---

11. Have you developed any standard features/details for your roundabouts? (e.g. Street name chevron signs on central island) Yes / No

Comments:

---

---

---

12. Have you adopted investigatory levels for skid resistance at roundabouts? Yes / No

a) Do you monitor skid resistance levels at roundabouts? Yes / No

b) Do you have any methods for achieving appropriate levels of skid resistance at roundabouts? Yes / No

Comments:

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13. Please list/describe any documented in-house procedures you have for the design and installation of roundabouts.

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14. Any general comments on roundabouts or suggestions in ways LTSA can help?

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**Appendix 3, Field Sheet for Roundabouts, 2000**

Road Controlling Authority \_\_\_\_\_ Site Number \_\_\_\_\_

Surveyors \_\_\_\_\_ Date \_\_\_\_\_

Location \_\_\_\_\_ Speed Limit \_\_\_\_\_  
\_\_\_\_\_ km/h

Photograph(s) \_\_\_\_\_

Sketch sketch roundabout in space on last page (optional)

1. Central Island Type a. Standard  b. Collared  c. Dome   
d. Other

2. Central Island Dimensions diameter if circular ..... \_\_\_\_\_ m  
Dimension sketch if not circular ---

3. Circulating carriageway width ..... \_\_\_\_\_ m  
If width varies record approach/width below (eg north/8m)  
\_\_\_\_\_/\_\_\_\_\_m \_\_\_\_\_/\_\_\_\_\_m \_\_\_\_\_/\_\_\_\_\_m  
\_\_\_\_\_/\_\_\_\_\_m

4. Circulating carriageway crossfall a. to central island  b. from island

5. Circulating carriageway lane markings  
a. none  b. partial concentric  c. Alberta   
d. other

6. Central Island Signs (Note that signs on approaches get recorded as item 16)

a. None  b. standard chevrons  c. Street Name plus chevron   
d. Street Name no chevron  e. direction (IDS)   
f. Other

7. Central Island Vegetation

- a. None (sealed/paved surface)     b. low planting (<500mm)   
c. High planting (trees etc)

8. Any significant features (describe)

---

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---

---

Complete one column in the following table for each approach  
(use Col. 1 for northern leg then work in clockwise direction)

	1	2	3	4	5
9. Road/street & direction					
10 Road Classification (Arterial/Collector/Local)	A C L	A C L	A C L	A C L	A C L
11 Number of approach lanes					
12 Lane markings (tick as appropriate)					
a. None	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Left Turn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Left turn / Straight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Straight ahead	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Straight / right turn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Right turn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13 Number of circulating lanes (for this approach)					
14 Number of departure lanes (on this approach)					
15 Left edge delineation					
a. Kerb, no egeline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Edgeline with RRPM's	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Edgeline no RRPM's	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(tick as appropriate)					
16 Signs (tick as appropriate)					
a. Rotary Junction (PW8)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Keep Left (RG17 Or 17.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Give Way on left	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Give Way on splitter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Diverge (PW5)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. ADS (Street/Guide) sign	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17 Splitter Island length (m) Raised or Flush					
18 Deflection of "through" path achieved by :-					
central island	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
offset approaches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
entry align/splitter island	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19 Estimate whether deflection is:-					
clearly adequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
adequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
definitely not adequate (see Additional Notes)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





## Appendix 4, Photographs



Photograph 1: Standard roundabout. Quadrant paving/landscaping for good visibility of street name/chevron sign.



Photograph 2: Collared roundabout. Quadrant paving/landscaping for good visibility of street name/chevron sign.



Photograph 3 : Good bold street name/chevron sign.  
Note cyclist using cut down on splitter island.



Photograph 4: Good collared roundabout with good deflection.  
Typical chevron sign.



Photograph 5: Dome roundabout on local roads with other traffic calming  
(note speed hump in background)  
Beware of vegetation growth obscuring signs



Photograph 6: Deflection by approach alignment.  
Service road to properties on the left.  
Note incorrect use of keep left RG17 sign.



Photograph 7: Deflection by approach alignment and splitter island.



Photograph 8 : Large central island roundabout. Island and speed humps force low operating speed. Constructed in 1980. Not to current standards but works well with low speeds.



Photograph 9 : Old roundabout with pedestrian paths through central island and inappropriate use of mandatory turn left sign.

Pedestrians *should not* be encouraged to use central island.



Photograph 10 : Paving removed from pedestrian crossing point to avoid matching paved collar.



Photograph 11 : Pedestrian crossing/platform on approach to small roundabout.



Photograph 12 : Pedestrian crossing point well back from roundabout.  
Note the give way signs for pedestrians.



Photograph 13 : Low poorly defined and ineffective collar.  
Traffic travels straight through over collar with no deflection.  
The primary Give Way should be on the left at full mounting height



Photograph 14 : Walled roundabout but badly located pole (with hazard marker) on exit.





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