Guidelines for service stations

RTS 13

Disclaimer

March 1996
Reprinted June 1998, September 2001

Land Transport Safety Authority
PO Box 2840
Wellington
Telephone 04 494 8600
Fascimile 04 494 8601

ISSN: 1170-5337
ISBN: 0-478-20623-2

Contents

Preface

The safe design of service stations and driveways can prevent crashes and save lives. Over the five year period from 1990-1994, 387 reported injury crashes at service stations resulted in four deaths, 103 serious injuries and 364 minor injuries. There were also 876 reported non-injury crashes.

Historically the document *Standard for service stations 1983*, and its predecessors, were developed because the then Ministry of Transport was able to influence the siting of driveways and pumps at service stations through the licensing process that existed.

In May 1988, the deregulation of the motor spirits industry enabled oil companies to own and operate any number of service stations, as well as to set retail prices for the sale of fuel.

The continuance of this document was brought about by requests from local authorities, road controlling authorities, engineers and planners. Many of the principles in this guideline have been used throughout New Zealand and have obtained a wide acceptance at a working level by those in the industry, as well as being embodied in many local authority district schemes and plans. Local authorities who are preparing or reviewing their district plans under the *Resource Management Act 1991* may wish to refer to this guideline to evaluate and control any adverse effects that such developments could have on the natural and physical resources of New Zealand.

I would like to thank all those who contributed to the compilation of this document and commend to you the widespread use of this guideline.

Reg Barrett
Director, Land Transport Safety

1. Introduction

Some characteristics of service stations changed considerably following the 1988 deregulation of the motor spirits industry.

The trend has been to develop large efficient operations on arterial routes and at intersections.

The more recent designs incorporate large forecourts, carwashes, drive-in banking facilities, and retail areas with convenience stores.

The result is that the modern service station is a significant attraction for motorists, cyclists and pedestrians.

The aim of this guideline is to provide a document that can help engineers and planners enhance the road safety environment adjacent to the modern service station. The guideline also takes into account the *Resource Management Act 1991* and the changes that have occurred with service stations over recent years.

Although this guideline has evolved from the former Standard for Service Stations 1983, many of the principles outlined in this document may also be appropriate for assessing the impacts of some other land uses, particularly those that exhibit moderate to high traffic generation.

This guideline has been formulated using the following:

- fundamental traffic engineering principles
- Australian practice and guidelines
- crash data
- a survey of service stations at intersections
- feedback on the draft guideline
- the experience and opinions of a working group comprised of members from the traffic engineering and town planning professions (see Acknowledgements).

2. Traffic engineering principles and crash data

2.1 Fundamental traffic engineering principles

An understanding of fundamental traffic engineering principles is necessary to ensure safe roading design. Some of the more important principles are:

- reducing the number of conflict points
- separating the points of conflict
- controlling vehicle speeds
- defining vehicle paths.

The types of manoeuvres likely to occur at the driveway of a service station need to be known to ensure safe design. The most common manoeuvres are merging, diverging and crossing. Weaving manoeuvres may occur at some sites.

Every two-way driveway has nine conflict points (three merge, three diverge, three crossing), therefore midblock sites typically have 18 conflict points (two driveways) and intersection sites typically have 27 conflict points (three driveways). The conversion of driveways to *entry only* or *exit only* reduces the number of conflict points from 18 to eight and 27 to 12 in midblock and intersection sites respectively.

By implementing traffic management techniques such as one-way driveways, solid islands and solid medians, the number of conflict points can be reduced.

The conflict points associated with a service station driveway should be separated from the conflict points of an adjacent intersection.

This will separate the motorist's decision points and better define vehicle paths at, and adjacent to, intersections.

2.1 Australian literature

A literature review undertaken by the working group researched the following topics:

- policies and guidelines for service stations
- policies and guidelines for driveway locations.

The main points of interest regarding driveway location are summarised in Appendix 1.

2.3 Crash data and service station survey

The national reported service station injury crash data for the 1990-1994 five year period are analysed in Appendix 2.

Table 2.1 summarises the injury crash data by urban/rural, intersection/midblock and manoeuvre. Right turn manoeuvres (in and out) comprise the majority of the data.

Manoeuvres classified as unknown are those that cannot be readily identified as left or right turn (in or out) without a full examination of the original traffic crash reports.

Table 2.1: Percentage of service station injury crashes by urban/rural, intersection/midblock and manoeuvre (1990-1994)

	Urban		Rural	
Manoeuvre	Intersection	Midblock	Intersection	Midblock
Left turn (in)	10	1	0	0
Left turn (out)	5	6	6	0
Right turn (in)	41	54	56	50
Right turn (out)	24	33	20	25
Unknown	20	6	18	25
Total	**100**	**100**	**100**	**100**

A survey of 61 service stations located at intersections in urban speed environments (=< 70 km/h) was undertaken by the Land Transport Safety Authority (LTSA) (see Appendix 3 for an explanation and analysis of this survey).

The survey is limited because the database is not extensive (61 service stations, 28 crashes) and it would have been impracticable to obtain traffic flows on driveways (exposure).

The results from this survey suggest that driveway proximity to an intersection is not a clearly identifiable problem.

2.4 Linking fundamental traffic engineering principles, Australian literature and crash data

There has been criticism of the document *Standard for service stations 1983* (1) regarding the issue of service stations at intersections; in particular the requirement that no driveway should be located within 30 metres of an intersection carrying more than 1,000 vph.

Results from the service station survey suggest that many crashes occur independently of the distance from an intersection (a crash may be as likely to occur at 29 metres as at 31 metres). Therefore, the location of driveways at distances greater than 30 metres from intersections does not guarantee safety.

This guideline emphasises the use of traffic management techniques to address potential crash manoeuvres, rather than imposing an arbitrary distance from intersections.

The user of this guideline requires sound engineering judgement to ensure that the most effective combination of traffic management techniques is used at each site under consideration. The guideline recommends traffic management techniques to improve the negative road safety impacts. This approach is more aligned to the purpose and principles of the *Resource Management Act*.

3. Safety issues and recommended traffic management techniques in the urban speed environment

3.1 Summary of traffic management techniques

The main traffic management techniques used to increase safety at service stations are:

- solid medians
- flush medians
- increasing kerbside lane width
- locating driveways clear of queues
- traffic signs and markings
- stopping restrictions

3.1.1 Solid medians

The installation of a solid median may be the most effective technique for reducing crashes at both intersection and midblock service station sites.

Median divided arterial roads can achieve a crash reduction of approximately 23 percent (Jackett [2]). Sound engineering judgement is required when assessing the benefits of using isolated sections of a solid median.

Solid medians prevent right turn manoeuvres which comprise at least 65 percent of intersection crash data and 87 percent of midblock crash data.

Intersection and midblock capacity are often improved as solid medians prevent right turning traffic from obstructing through traffic.

Solid medians should be designed to minimise the occurrence of hazardous manoeuvres, e.g. u-turns at the end of the median. This may require extending the median to a point where turns can be safely accommodated. Consideration may need to be given to the consequences of restricting access to other neighbouring properties.

The desirable minimum width of a solid median is 1.8 metres (to provide refuge for pedestrians), although in many situations a greater width will be required in order to enhance pedestrian safety or accommodate traffic signals.

Refer to *Guide to traffic engineering practice, Part 5* section 5.10.2 and *Part 13* section 3.4.1 (3).

3.1.2 Flush medians

The use of a flush median will improve some safety and operational issues, but is not as effective as a solid median in addressing the major safety problem, i.e. right turn crashes.

Flush medians can achieve a midblock crash reduction of approximately 15 percent (Jackett [2]).

For exiting right turning vehicles, a flush median may assist the driver to select a suitable gap by effectively breaking the manoeuvre into two parts.

A flush median addresses most rear end/right turn-in crashes, but right turn crashes resulting from obscured visibility, e.g. visibility obscured by intersection queues or multi-lane traffic flows, are not fully addressed by a flush median.

The documents RTS 4 *Guidelines for flush medians* [4] and *Manual of traffic signs and markings, Part II Markings* [5] should be consulted for layout requirements.

3.1.3 Increasing kerbside lane width

Increasing the kerbside lane width can reduce left turn-in and left turn-out conflicts by providing more space on the road for turning manoeuvres to take place. Safety is enhanced by ensuring that the relative speed between through traffic and turning traffic is low. This may be achieved by lowering speed and/or the angle of conflict.

In some situations, on-street parking will not be allowed so that the visibility requirements set out in section 5.1 can be achieved. In this case, the extra space on the road can be utilised to give increased kerbside lane width.

On urban state highways, the provision of appropriate acceleration and deceleration lanes may be necessary. The Transit New Zealand document *Highway planning under the Resource Management Act 1991* [6] should be consulted.

3.1.4 Locating driveways clear of queued traffic

Right turn-in and right turn-out crashes are often attributed to obscured visibility, e.g. queued traffic at intersections. Some traffic management techniques applied in isolation, e.g. flush medians, cannot fully address right turn safety issues. However, the crash problem could be improved by combining several techniques, such as installing a flush median and locating driveways clear of queued traffic on the approach leg.

In some situations, the installation of a flush median in conjunction with locating driveways clear of queued traffic will address right turn crashes. However, at sites where traffic queues extend beyond the site boundary, the most effective technique is the installation of a solid median to physically prevent right turns. Sound engineering judgement is required on a site by site basis.

3.2 Safety issues and recommended traffic management techniques

When assessing the road safety issues arising from entry and exit manoeuvres at service stations in the urban speed environment, the practitioner should use table 3.2 to:

- highlight the major safety issues and problems associated with entry and exit manoeuvres
- examine why the safety issues and problems exist
- examine the effect that the safety issues and problems have on road safety and road operating characteristics
- identify the appropriate traffic management techniques to be used to improve the safety issues and problems.

Sound engineering judgement will be needed to ensure that the traffic management technique chosen is appropriate.

Table 3.2: Safety issues and recommended traffic management techniques for service stations in urban speed environments

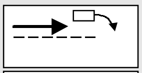
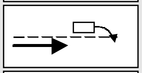
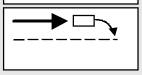
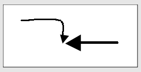
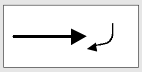
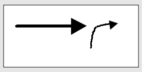
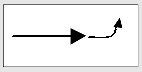
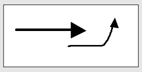
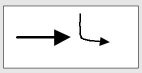
Manoeuvre	Crash type	% of crashes Inter-section	% of crashes Mid-block	Issues and problems	Why problem exists	Effect
Right turn-in	  	41	54	delay/safety	• deceleration • gap selection	• rear end crashes • delays motorists entering station and through traffic • reduced capacity on frontage road
				obscured visibility/ delay/safety	• queued traffic • multi-lane flows • gap selection	• right turn/right side crashes • delay to motorists entering station
Right turn-out		24	33	obscured visibility/ delay/safety	• queued traffic • multi-lane flows • gap selection	• right turn/right side crashes • delay to motorists exiting station
						• right turn/right side crashes • delay to motorists exiting station
Left turn-in	 	10	1	delay/safety	• deceleration to enter driveway	• delay to through traffic • rear end crashes • reduced road capacity
Left turn-out		5	6	delay/safety	• motorists exiting station accelerating to operating speed • gap selection	• delay to through traffic • left turn/left side crashes

Table 3.2 continued

Prominent causal factors	Recommended traffic management technique (by road hierarchy)			
	Arterial	Distributor	Collector	Local
• failure to signal • following too close • attention diverted	• solid median	• solid median	• flush median	• centreline
• visibility limited by other traffic • misjudged distance, size, position or speed of traffic	• solid median • locate driveway clear of queues	• solid median • locate driveway clear of queues	• flush median • locate driveway clear of queues	• centreline
• visibility limited by other traffic • misjudged distance, size, position or speed of traffic	• solid median • locate driveway clear of queues	• solid median • locate driveway clear of queues	• flush median • locate driveway clear of queues	• centreline
• failure to signal • following too close • attention diverted street parking	• widen kerbside lane • ban adjacent street parking	• widen kerbside lane • ban adjacent street parking	• widen kerbside lane	• centreline
• misjudged distance, size, position or speed of traffic • failure to check adequately	• widen kerbside lane • ban adjacent street parking	• widen kerbside lane • ban adjacent street parking	• widen kerbside lane	• centreline

3.3 Locating driveways clear of intersection corners

To avoid conflict between pedestrians and traffic at intersection corners and to separate driveway and intersection conflict points, driveways should not be located:

- within 4.5 metres of the tangent point of corner curves, or
- within 9 metres of the kerbing prolongation, whichever is the greater.

The distance measured from the kerbing prolongation is shown in Table 3.3 for various intersection angles and corner radii.

To separate driveway and intersection conflict points at T intersections, no driveway should be located at the head of the T, unless the service station driveway is controlled by traffic signals at the intersection, or unless the number of conflict points are reduced by using traffic management techniques, such as a seagull island.

Refer to Appendix 4 for the sketch and formulae used to calculate the minimum distances shown in Table 3.3.

Table 3.3: Minimum distance of driveway from intersection

Intersection angle	Corner radius (m)						
(degrees)	5	7.5	10	12.5	15	17.5	20
10	62	90	119	147	176	205	233
20	33	47	61	75	90	104	118
30	23	33	42	51	61	70	79
40	18	25	32	39	46	53	59
50	15	21	26	31	37	42	47
60	13	18	22	26	31	35	39
70	12	15	19	22	26	30	33
80	11	13	16	19	22	25	28
90	10	12	15	17	20	22	25
100	**9**	11	13	15	17	19	21
110	**9**	10	12	13	15	17	19
120	**9**	9	10	12	13	15	16
130	**9**	**9**	9	10	12	13	14
140	**9**	**9**	**9**	9	10	11	12
150	**9**	**9**	**9**	**9**	**9**	9	10
160	**9**	**9**	**9**	**9**	**9**	**9**	**9**
170	**9**	**9**	**9**	**9**	**9**	**9**	**9**

4. Safety issues and recommended traffic management techniques in the rural speed environment

4.1 Rural state highways

Crashes at service stations in the high speed environment (> 70 km/h) comprise 14 percent of the national reported service station injury crash data.

In keeping with the nature of the business, most service stations in the high speed environment are located on state highways in order to serve reasonable traffic volumes. Of the 54 crashes in the rural speed environment (Table 2.2, Appendix 2), 50 occurred on state highways and 4 on non-state highway roads.

The requirements of the Transit New Zealand document *Highway planning under the Resource Management Act 1991* [6] should be complied with for service stations situated on state highways.

4.2 Crash data

Right turn crashes are the major problem. The main points of interest are:

4.2.1 Midblock sites

- small crash data set (four reported injury crashes)
- right turn manoeuvres comprise 75 percent of the midblock crash data as follows:
  (a) right turn-in/rear end (GC, GD, GE)* = 25%
  (b) right turn-in/left side (LB) = 25%
  (c) right turn-out/right side (JA) = 25%

* See Appendix 5 for crash types.

4.2.2 Intersection sites

Right turn manoeuvres comprise at least 75 percent of intersection crash data as follows:

- right turn-in/rear end (GC, GD, GE) = 30%
- right turn-in/left side (LB) = 26%
- right turn-out/right side (JA) = 14%
- right turn-out/left side (KB) = 6%
- left turn manoeuvres comprise 6 percent of intersection crash data, i.e. left turn-out/right side (KA) = 6%

4.3 Traffic management techniques in the rural speed environment

4.3.1 Midblock sites

It is essential to provide adequate lane width adjacent to service stations so that:

- vehicles entering and exiting can decelerate and accelerate without adversely affecting the free flow of traffic on the frontage road
- through traffic can safely manoeuvre past vehicles entering or exiting the site.

The Transit New Zealand document *Highway Planning under the Resource Management Act 1991* [6] discusses the requirements for vehicle orientated commercial activities such as service stations situated on state highways.

In order to achieve adequate lane width, localised road widening may be required adjacent to service stations and truckstops situated on rural state highways. This typically involves widening of the sealed shoulder to 2.5 metres.

At some sites the merits of auxiliary lanes (acceleration, deceleration and right turn treatments) will need to be considered, based on the volumes of through traffic and traffic attracted to the site.

4.3.2 Intersection sites

For service stations located at a state highway intersection, it may be preferable to locate all driveways on the side road. This enables entering and exiting vehicles to use the merge and diverge tapers and right turn bay provided as standard intersection treatment. Refer to *Manual of Traffic Signs and Markings*, Part II Markings [5] Section 3.16.

For service stations proposed at intersections with little existing road marking treatment, the provision of merge, diverge and right turn bay markings at the side road should be undertaken to improve the safety issues of motorists entering and exiting the development.

5. General road safety considerations

5.1 Visibility

The provision of adequate visibility at service station driveways in both the horizontal and vertical planes is fundamental to safe design.

The document RTS 6 *Guidelines for visibility at driveways* [7] should be consulted. Extracts from this document are shown in Appendix 6.

Some of the more common situations which may cause visibility problems at service stations include:

- parked vehicles
- landscaping, fences or walls at property boundaries
- vehicle mounted advertising signs
- portable advertising signs on footpaths or grass berms
- signs adjacent to driveways, e.g. directional signs
- signs close to intersections or curves in the roadway.

Signs are discussed in Section 5.3.

Structures within the service station site such as fences and walls should be erected at a height so that visibility requirements discussed in Appendix 6 are satisfied. Generally, this will require a height of one metre or less. The use of a low nib wall, grass berm, or low growing/low maintenance species of plants are recommended near the property boundary (they serve to define the position of driveways) to prevent vehicles encroaching onto footpaths along site boundaries. They also enhance the environmental amenity of the development.

In some urban areas there will be a lot of competition for the available road space, and there may often be pressure to site activities, such as bus stops, adjacent to service station driveways.

This requirement may be accommodated with consideration to the following:

- permanent structures, e.g. bus shelter, should not impinge on visibility requirements
- the number of buses stopping should be infrequent so that visibility is not affected (this requires consideration of bus routes, timetables and in-service headways)
- passengers waiting for buses may become a safety hazard when there are too many of them and this could obscure a driver's visibility.

In all cases, the interaction between the development, frontage road, traffic and pedestrians is site specific. Therefore, each site should be assessed on its own merits using sound engineering judgement.

Consultation between the developer and the appropriate local authority or road controlling authority will be required where items within the road reserve, e.g. trees, bus shelters, car parking, impinge on the visibility requirements of a driveway.

5.2 Pedestrians

While table 2.1 (Appendix 2) shows that pedestrian/motor vehicle conflicts are not a major problem, an interaction exists between motor vehicles and pedestrians at the driveway/footpath interface and it requires careful consideration.

The following classification system using three categories should be considered to assess the suitability of a site for a service station:

Category 1: Less than 150 pedestrians/hour

Suitable for a service station. At low pedestrian flows, motor vehicles may dominate the driveway/ footway interface so that pedestrians are forced to give way. Driveways should be designed to reinforce the motorist's obligation to give way to pedestrians. Driveway widths can be maximised if required.

Category 2: 150 – 500 pedestrians/hour

Generally suitable for a service station. Special consideration should be given to ensure pedestrian amenity is maintained. For example, the number of driveways on frontage roads and driveway widths should be minimised where possible.

Category 3: Greater than 500 pedestrians/hour

Generally unsuitable for service stations. High pedestrian flows may cause delays, frustration and on-road queuing problems to motorists wishing to access the site. In some circumstances a service station development may be feasible at high pedestrian flows, provided there is adequate space for vehicles entering the development to safely wait on the roadway while giving way to pedestrians.

The categories shown have been formulated by members of the working group. Sound engineering judgement and consideration of the following are required:

- type of pedestrians, e.g. young children, the older pedestrian
- pedestrian environment, e.g. central business district, residential, commercial, rural etc.
- rare or occasional events, e.g. crowds attending concerts, fixtures, rallies etc.
- frequency and duration of pedestrian flows.

In many areas, the modern service station has superseded the corner dairy, with about a quarter of all sales being non-fuel related. Surveys have also shown that 12.5 percent of all sales are to pedestrians (Hunter [8]).

Consideration also needs to be given to the interaction between cyclists and motor vehicles where cycle lanes exist or where cycling is a prominent mode of transport. The peak hour for service station traffic generation and cycle flow need to be established in order to quantify the relationship that exists. It is possible that the two peak hours may not be coincidental.

5.3 Signs

The presence of some advertising signs at service stations may compromise road safety in the following ways:

- by directly distracting or confusing motorists
- by presenting a physical obstruction to vehicles moving on or off the carriageway
- by obstructing visibility (advertising or traffic signs).

To achieve advertising which is safe and effective from a road safety point of view, the document RTS 7 *Advertising signs and road safety: design and location guidelines* [9] should be consulted.

Driveways intended for one-way use should only display legend (ENTRY or EXIT) or directional arrow signs to convey the preferred direction of traffic movement. Such signs should be compatible with the intended traffic movements as defined by traffic management schemes on the adjacent roads. (In some cases signs may need to be visible from only one direction.)

5.4 Driveway angle and width

5.4.1 Driveway angle

For pedestrian safety and operational reasons, e.g. visibility, the angle between the driveway and the frontage road (kerb) should be in the range of 70 degrees to 90 degrees. A study by Richardson (10) confirms that vehicle design may limit the drivers field of vision and that a minimum acute angle of about 70 degrees is desirable. Driveways at an angle less than 70 degrees are more acceptable where access is made from a divided road or one-way roadway, with full consideration given to pedestrian movements and vehicle entry speeds.

Driveways located on urban arterial roads and rural roads may require the consideration of widening kerbside lane width. They may also require the provision of acceleration and deceleration lanes where driveway manoeuvres will significantly affect roadway capacity and operating speeds. (Refer Sections 3.1.3 and 4.3.)

5.4.2 Driveway width

Large driveway widths may allow vehicle entry and exit manoeuvres to be undertaken with more ease but increase a pedestrian's exposure to conflict.

The design vehicle, driveway type, e.g. one-way, two-way, and traffic generation are some of the factors affecting driveway width. The width should be restrictive enough to discourage parallel exiting manoeuvres which can result in visibility restrictions and conflicts.

The radius (or splay) at the roadway edge will be site specific and determined from the swept paths of the appropriate design vehicle. On any road, all vehicles should be able to undertake their turning manoeuvres without crossing the road centreline, and preferably without encroaching into adjacent lanes on a multi-lane roadway, with the exception of the occasional bulk filling tanker.

It may be preferable that bulk filling tankers do not use any driveway intended for one-way use. (This is because use by tankers may require widening to a maximum of 9 metres, under which circumstances the driveway is likely to be used as a two-way driveway by other vehicles.)

The recommended dimensions shown in Table 5.2 should be measured at the road boundary (the legal boundary between the service station site and the road reserve).

Table 5.2: Recommended driveway width

Movement	Minimum width (m)	Maximum width (m)
One-way	3.5	5.0
Two-way	6.0	9.0

Where a bulk filling tanker requires access via a one-way driveway, a greater maximum width may be required (to a maximum of 9 metres).

5.5 Internal layout

5.5.1 Parking

Where appropriate, consideration should be given to provide parking to the following:

- employees
- vehicles being serviced
- convenience store customers (non-petrol purchasers)
- fast food/restaurant customers
- storage at car wash, air hose etc.

All parking (or storage) should be clearly marked and located such that there is no obstruction to the sale of motor vehicle fuels, or conflicts between patrons and the facilities mentioned above.

Car wash structures should be placed so as to provide storage for several cars proceeding to the wash. Car wash manoeuvres should not conflict with driveway manoeuvres.

The parking requirements for the various site activities should be added together to determine the maximum space needed. If the parking requirements are calculated on an hourly basis for the various site activities it may be possible to demonstrate that the peak times do not coincide, thereby reducing total space required.

It is apparent that service stations do serve a role as the corner dairy in many situations (Hunter [8]), therefore, adequate parking should be provided.

5.5.2 Bulk tank filling

The operation of bulk tank filling should take place from within the service station site and without obstruction to driveways and adjacent footpaths.

Tanker access to bulk filling positions should be sited so that tankers can enter and exit the site in a forward direction. Section 5.4 discusses driveway widths and angles.

To mitigate the potential for on-site conflicts between pedestrians or motorists and bulk filling tankers, the on-site route should be designed to avoid the necessity for reverse manoeuvres.

It is acknowledged that some tankers may experience difficulty using a 9 metre driveway. However, the benefits of obtaining an orderly entry and exit manoeuvre by light vehicle users offsets the infrequent use by bulk tankers.

5.5.3 Pump locations

It is reasonable to expect some queuing for service at petrol pumps. However, if the arrival rate of customers exceeds the service rate then queue lengths and delays may become excessive, or alternatively customers may purchase fuel elsewhere.

Because traffic generation and expected queuing characteristics are site specific, it is not the intention of this document to propose ideal queuing disciplines or service layouts.

It is desirable that queuing vehicles do not block any driveway because this may cause a conflict between entering vehicles and traffic on the frontage road, or obstruct pedestrian flows on footpaths. To facilitate this requirement no pump should be located within 7 metres of any point on a driveway. This allows one vehicle to queue behind another that is being served.

The pump layout must not enable vehicles to be served from outside the site, i.e. the road reserve. This may be achieved by:

- locating pumps 4.5 metres or greater from the boundary
- installing grass berms, landscaping or low nib walls.

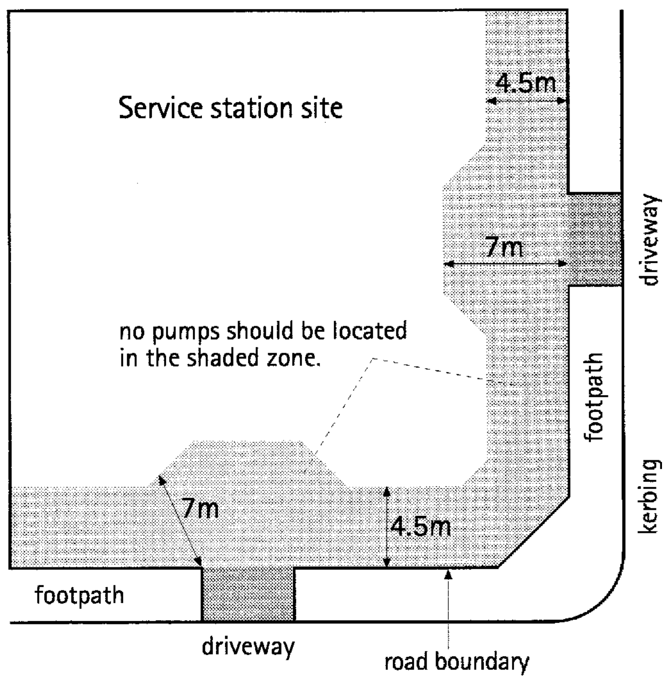
Consideration must be given to any future road widening which could alter road boundaries.

Figure 5.1 shows areas within the site where it is not advisable to locate petrol pumps.

To achieve easy entry and exit from the station, turns with an inside radius of less than 4.5 metres should not be used. For a 4.5 metre radius turn, a path width of 4.5 metres should be provided to ensure that there is sufficient width for a vehicle to traverse between the pumps and any kerb, nib wall or landscaping etc.

For turns of 7.5 metre inside radii (and greater) a minimum path width of 3.5 metres should be provided. When the station is to provide for any large vehicles such as buses, trucks and tankers, the minimum inside turning radii required is 7.5 metres with a path width of 4.5 metres.

Figure 5.1: Pump location



6. Truckstops

Truckstops are self-service stations dispensing diesel fuel only, typically by way of a card reader system. Truckstops differ from service stations in a number of important ways:

- vehicles are mostly heavy vehicles, with some large vans or diesel powered cars
- traffic generation is typically lower than that for service stations; however, the mean service time at truck stops is longer due to the larger fuel capacity of heavy vehicles
- heavy vehicles are the predominate vehicle using the site, therefore, driveway widths may be increased to 12 metres to facilitate entry and exit manoeuvres. This provision should not increase pedestrian exposure due to the fact that truckstops should typically be sited at areas of low pedestrian flow, as required by many local authority district schemes and plans
- heavy vehicles have a maximum legal length of 20 metres, therefore, fuel pumps should be positioned so that other vehicles may enter the driveway while another vehicle (up to 20 metres long) is being serviced. This may require the pump to be positioned about 24 metres clear of any point on a driveway, depending on site design. In addition, no pump should be positioned within 4.5 metres of any road boundary (which is not a driveway)
- due to the difference between heavy vehicle and light vehicle acceleration rates, those sites that generate heavy vehicles cause frontage road traffic to slow down more, while the heavy vehicles accelerate to operating speed.

Truckstops may require special consideration for acceleration lanes so that operational safety and capacity of frontage roads are not adversely affected.

A safety hazard can occur at sites where heavy vehicles undertake right-turn exit manoeuvres across a multi-lane road. In addition, capacity may be affected when heavy vehicles undertake right turn-in manoeuvres as they require a longer gap in the traffic stream than light vehicles for safe completion of the manoeuvre.

In some situations traffic management techniques such as a flush median should be implemented to improve safety and decrease delays to frontage road traffic.

This guideline acknowledges that other land use developments may generate more heavy vehicles than a truckstop, and the rationale used for addressing the safety issues at truckstops should also be applied to other heavy vehicle generating developments.

References

(1) Ministry of Transport (1983) *Standard for service stations*, Wellington.

(2) Jackett, M.J. (1993) *Accident rates on urban routes - 1992 update*, IPENZ Transactions Vol. 20, November 1993.

(3) Austroads *Guide to traffic engineering practice,* Part 5: Intersections at grade, (1988) and Part 13: Pedestrians (1995), Sydney.

(4) Land Transport (1991) RTS 4 *Guidelines for flush medians*, Wellington.

(5) Transit New Zealand (1994) *Manual of traffic signs and markings*, Part II Markings, Wellington.

(6) Transit New Zealand (1994) *Highway planning under the Resource Management Act 1991*, Wellington.

(7) Land Transport Safety Authority (1993) RTS 6 *Guidelines for visibility at driveways*, Wellington.

(8) Hunter, D.J. (1992) *New generation service station attraction*, Proceedings of Annual Conference 1992, IPENZ.

(9) Land Transport Safety Authority (1993) RTS 7 *Advertising signs and road safety: design and location guidelines*, Wellington.

(10) Richardson, A.J. (1979) *Vehicle characteristics - effect on traffic design,* Traffic Engineering Practice, Department of Civil Engineering, Monash University, Melbourne.

(11) Traffic Authority of NSW (1984) *Policies, guidelines and procedures for traffic generating developments*, Sydney.

(12) Vicroads (1986) *Service station entrance and exits*; Standard Drawing SD613, Kew.

(13) Main Roads (1987) *Interim policy manual for driveways in urban areas*, Perth.

(14) Queensland Department of Transport (1993) *Metropolitan North Development Assessment Guide - Draft*, Brisbane.

(15) Land Transport Safety Authority (1993) *Accident print-out and interpretation*, Wellington.

Acknowledgements

This guideline was compiled by a working group comprised of:

Graeme Bean	Land Transport Safety Authority (convenor)
Peter Kippenberger	Land Transport Safety Authority
Murray Noone	Land Transport Safety Authority
John Burgess	Consultant (Auckland)
John Chivers	Consultant (Wellington)
Russell Dickson	Consultant (Auckland)
Rachel Harward	Transit New Zealand (Auckland)
Murray Parker	Auckland City Council
Anatole Sergejew	Consultant (Auckland)
Garth Vipond	Manukau City Council

The group gratefully acknowledge comments on the draft document from:

Peter Evans	Transit New Zealand (Auckland)

Appendix 1: Australian literature

A literature review undertaken by the working group searched for policies and guidelines for service stations and driveway locations. The main points of interest regarding driveway location are summarised below:

New South Wales (Traffic Authority of NSW [11])

Minimum distance of driveway from signalised intersection (prolongation of property boundary) is 25m, or 100m at the intersection of two major roads, increase beyond 100m if necessary to clear normal queue lengths.

Minimum distance of 12m from limit lines at stop or give way controlled intersections.

Driveways serving a large amount of traffic should not be located where right turning traffic entering the facility would obstruct through traffic.

Victoria (Vicroads [12])

Minimum distance of driveway from a standard intersection corner truncation is 7.5m (equivalent to about 13.5m measured from the prolongation of the property boundary).

For channelised intersections, minimum of 14m measured from the nose of left turn splitter island.

Western Australia (Main roads [13])

Defines a standard corner property truncation (isosceles triangle with 8.48m base). For an unsignalised right angle intersection the minimum is about 9.5m (from the prolongation of property boundaries).

For signalised intersections the minimum is 25m from the standard truncation (about 31m from property boundary prolongation).

Queensland (Queensland Department of Transport [14])

Minimum distance of 25m from tangent point of corner curve for signalised intersections (about 30m from property boundary prolongation for 10m corner curve and 5m verge). Increase if necessary to clear normal queue lengths.

Appendix 2: Analysis of crash data

2.1 National crash data

An analysis of the Land Transport Safety Authority crash database for all New Zealand shows 387 reported injury crashes in the five year period 1990 - 1994 coded as entering or leaving a service station, i.e. 962 (15).

Table 2.1 shows the number and percentage of injury crashes at service stations by crash type. Appendix 5 shows the manoeuvres that comprise the various crash types.

Table 2.1: Service station injury crash types

Crash type	Number of crashes	Percentage of crashes
Overtaking	34	9
Straight road - lost control/head on	5	1
Curved road - lost control/head on	7	2
Rear end/obstruction	93	24
Intersection type	236	61
Pedestrian	11	3
Miscellaneous	1	0
Total	**387**	**100**

The main points of interest are:

- the 387 reported injury crashes resulted in 4 deaths, 103 serious injuries and 364 minor injuries
- crash numbers peak in the period of 4.00pm - 6.00pm and comprise 25 percent of the data
- motorcycles are involved in 30 percent of service station injury crashes whereas they comprise 15 percent of all New Zealand reported injury crashes.

2.2 Segregation of the national crash data

In order to study the characteristics of crashes by speed environment (urban/rural) and location (intersection/midblock), the data was grouped as shown in Table 2.2.

Table 22: Service station injury crash data by speed environment and location

Location/speed environment	Intersection	Midblock	Total
Urban (≤ 70 km/h)	266 (≤ 70 m)	67(> 70 m)	333
Rural (> 70 km/h)	50 (≤ 210 m)	4 (> 210 m)	54
Total crashes	**316**	**71**	**387**

Tables 2.3 - 2.6 show the percentage of injury crashes by manoeuvre for the four groups in table 2.2, the numbers shown in brackets represent the number of reported injury crashes. The manoeuvres chosen are those that allow data to be grouped as entering or exiting, and left turning or right turning. Each group has a manoeuvre called miscellaneous, which represents crash data for which movements cannot be readily identified without an in-depth analysis of traffic crash reports (TCRs).

Table 2.3: Percentage of urban intersection service station crashes, by manoeuvre

Urban intersection data				
	Entering		Exiting	
Manoeuvre	Left turn-in	Right turn-in	Left turn-out	Right turn-out
GA	5 (12)			
GB	5 (13)			
GC		1 (3)		
GD		13 (34)		
GE		3 (8)		
JA				20 (52)
KA			5 (14)	
KB				4 (11)
LB		24 (65)		
Misc.	20 (54)			
Turn totals	10 (25)	41 (110)	5 (14)	24 (63)
Total	100 (266)			

Table 2.4: Percentage of urban midblock service station crashes, by manoeuvre

Urban midblock data				
	Entering		Exiting	
Manoeuvre	Left turn-in	Right turn-in	Left turn-out	Right turn-out
GA	1 (1)			
GB	0 (0)			
GC		0 (0)		
GD		21 (14)		
GE		14 (9)		
JA				27 (18)
KA			6 (4)	
KB				6 (4)
LB		19 (13)		
Misc.	6 (4)			
Turn totals	1 (1)	54 (36)	6 (4)	33 (22)
Total	100 (67)			

Table 2.5: Percentage of rural intersection service station crashes, by manoeuvre

Rural intersection data				
	Entering		Exiting	
Manoeuvre	Left turn-in	Right turn-in	Left turn-out	Right turn-out
GA	0 (0)			
GB	0 (0)			
GC		6 (3)		
GD		18 (9)		
GE		6 (3)		
JA				14 (7)
KA			6 (3)	
KB				6 (3)
LB		26 (13)		
Misc.	18 (9)			
Turn totals	0 (0)	56 (28)	6 (3)	20 (10)
Total	100 (50)			

Table 2.6: Percentage of rural midblock service station crashes, by manoeuvre

Rural midblock data				
	Entering		Exiting	
Manoeuvre	Left turn-in	Right turn-in	Left turn-out	Right turn-out
GA	0 (0)			
GB	0 (0)			
GC		0 (0)		
GD		25 (1)		
GE		0 (0)		
JA				25 (1)
KA			0 (0)	
KB				0 (0)
LB		25 (1)		
Misc.	25 (1)			
Turn totals	0 (0)	50 (2)	0 (0)	25 (1)
Total	100 (4)			

Appendix 3: Service station survey

The Land Transport Safety Authority conducted a study of 61 service stations located at intersections as shown in table 3.1.

Table 3.1: Service station survey sites

Location	No. of sites	Sites with crashes	Injury crashes	Crash period
Auckland	21	8	10	87-91
Wellington	21	3	4	88-92
Christchurch	19	12	15	88-92
Total	61	23	28	

The sites were chosen randomly and included 29 T-intersections, 25 X-intersections, four roundabouts, two Y-intersections and one multi-leg intersection.

The details recorded on the site visits included: lane, footpath and driveway widths, petrol pump layouts, corner curve radius, intersection control, distance of driveway from intersection, general road geometrics (e.g. lane markings, channelisation) and details of goods and services offered by the service station.

A search of the Land Transport Safety Authority crash database was undertaken for a five year period at each site as shown in table 3.1.

The reported injury crash data was superimposed on the appropriate site sketches and the crashes grouped as follows:

- Approach Leg: 9 JA, 3 LB, 2 misc.
- Departing Leg: 3 JA, 7 LB, 4 misc.

Refer to Appendix 5.

The following comments are drawn from the site sketches and traffic crash reports:

A. Approach Leg

1. For six JA crashes the common characteristics were:
   - all exiting right turning vehicles passed through a gap left by queued traffic
   - all collided with a vehicle legally travelling along the lane marked as right turn only
   - all were signalised intersections with no median on approach leg
   - independent of distance from intersections (5, 20, 30, 40, 50, 60m).
2. One additional JA crash had all the above characteristics except the collision occurred in a shared through - right turn lane (19m).
3. One JA crash, car exiting did not see cyclist (23m).
4. One JA crash, car exiting did not see a second car following the first (4m).
5. Two LB crashes at the same site, both with motorcycle as key (through) vehicle that was not seen by right turn-in vehicle (52m).
6. One LB crash where key vehicle in kerbside lane was obscured by a vehicle in the median lane (through vehicles were in motion) (13m).
7. One MC crash resulted when a vehicle at a set of traffic lights reversed into the path of another vehicle undertaking a right turn-in (11m).
8. One GD crash resulted when a truck driver (following a car off a roundabout) checked rear vision mirror and failed to see the car undertaking a right turn-in (15m).

B. Departing leg

1. Three JA crashes, two involved motorcycle as key (through) vehicle (both signalised intersections) (30, 37, 49m).
2. Six LB crashes involved a motorcycle as the key (through) vehicle. In four situations the motorcycle was obscured by stationary vehicles (queuing for upstream signals or right turns). In one situation the motorcycle passed through a set of traffic lights on an amber light, and in another situation visibility was reduced by the sun (4, 4, 13, 16, 28, 39m).
3. One LB crash, right turn entry collided with through car that was obscured by traffic queuing for adjacent staggered T (37m).
4. One KA crash, motorcycle as key (through) vehicle (49m).
5. One DA crash, wrong pedal, loss control right turn-out and collided with stationary car at intersection (16m).
6. One NA conflict, pedestrian standing on roadway centreline not seen by right turn-out vehicle (31m).

For convenience, four categories were used to classify the distance between the driveway and intersection (prolongation of kerbing) namely: 0 - 9.9, 10 - 19.9, 20 - 29.9, > 30m.

Frontage roads were classified as main or side (based on traffic volume) or as an approach leg or departure leg. Intersection control, median type, number of lanes and presence of a right turn bay were recorded.

Table 3.2 shows the criteria table and gives definitions of the terms used.

Table 3.3 shows an example of the database for ten service station sites in the Auckland survey. A zero indicates the presence of an access in a particular distance category and a number (e.g. one) indicates the presence of an access and that an accident (or accidents) has occurred at that access.

The graphs that follow Table 3.3 have been produced by choosing various criteria and include the following:

- all data used and results grouped into main and side road
- approach leg on main road
- departure leg on main road
- traffic signal data used and results grouped into main and side road
- all data used and results grouped into approach and departure legs
- traffic signal data used and results grouped into approach and departure legs.

Table 3.2: Criteria table for service station survey database

code	position	control	median	lanes	RT bay
(i)	(ii)	(iii)	(iv)	(v)	(vi)

Definitions

(i) code: specific station I.D., e.g. A19 is Auckland sample station number 19

(ii) position: A = station located on the approach to the intersection, D = station located on the departure from the intersection

(iii) control: type of control at intersection (TS = traffic signals, GW = give way, S = stop, R = roundabout, Nil = uncontrolled)

(iv) median: median type on the main road (S = solid, F = flush, N = none)

(v) lanes: number of lanes on the main road

(vi) RT bay: Y = right turn bay on the main road

Note: A blank criteria table will extract and present all the data from the database.

Table 2.3: Service station survey database (sample)

					Main road crashes								Side road crashes							
					Nearest driveway to int.				Furthest d/way from int.				Nearest driveway to int.				Furthest d/way from int.			
Code	Position control	Median (F/S/N)	Lanes	RT bay	0–9m	10–19m	20–29m	30+	0–9m	10–19m	20–29m	30+	0–9m	10–19m	20–29m	30+	0–9m	10–19m	20–29m	30+
A01	D TS	N	4				0					1								
A02	A NIL	N	2		1						0									
A03	D TS	N	4	Y			1					0								
A04	A TS	N	3											0						0
A05	D GW	N	3	Y	0							0		0						
A06	D TS	N	2		0								0							
A07	A NIL	N	4			1								0						
A08	D TS	N	3			0						0	0							
A09	D TS	S	4	Y	0							0		1						
A10	D GW	N	2	Y		0						2				0				

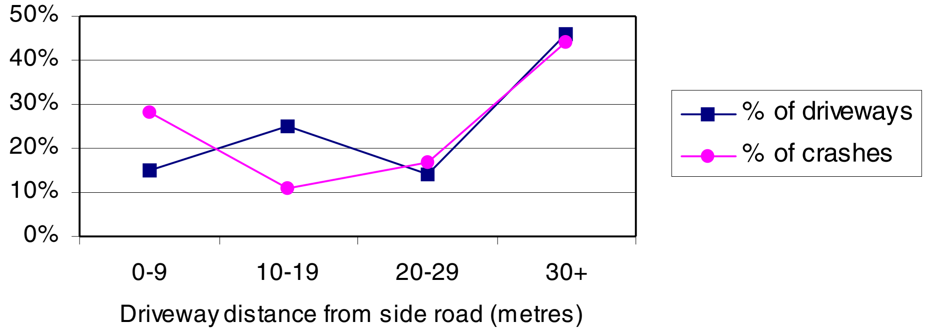
Criteria table for service station survey database

code	position	control	median	lanes	RT bay

	Results for the main road				Results for the side road			
	0-9m	10-19m	20-29m	30+	0-9m	10-19m	20-29m	30+
No. of driveways	14	23	13	42	12	20	12	24
% of driveways	15%	25%	14%	46%	18%	29%	18%	35%
No. of crashes	5	2	3	8	0	4	2	4
% of crashes	28%	11%	17%	44%	0%	40%	20%	40%
Crashes/driveway	0.36	0.09	0.23	0.19	0.00	0.20	0.17	0.17

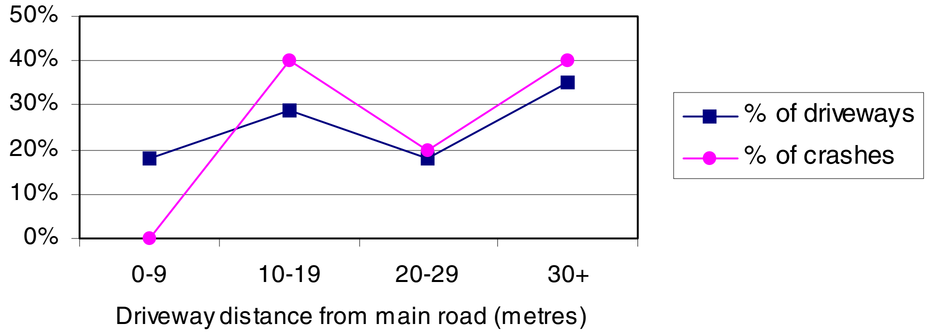
Location of driveway versus crashes

Main road accesses



Location of driveway versus crashes

Side road accesses



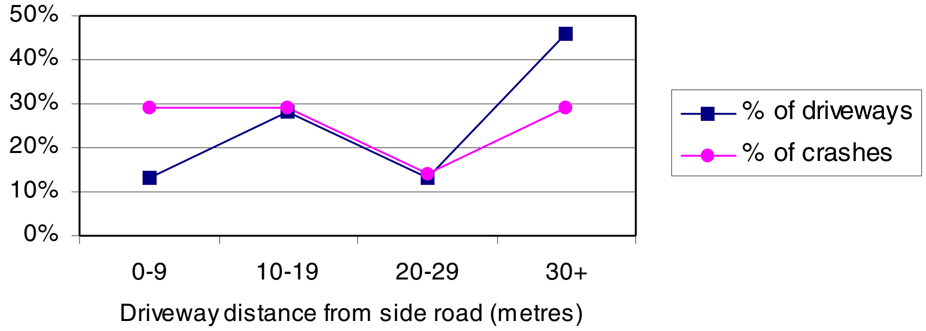
Criteria table for service station survey database

code	position	control	median	lanes	RT bay
	A				

	Results for the main road				Results for the side road			
	0-9m	10-19m	20-29m	30+	0-9m	10-19m	20-29m	30+
No. of driveways	5	11	5	18	2	12	5	11
% of driveways	13%	28%	13%	46%	7%	40%	17%	37%
No. of crashes	2	2	1	2	0	2	0	1
% of crashes	29%	29%	14%	29%	0%	67%	0%	33%
Crashes/driveway	0.40	0.18	0.20	0.11	0.00	0.17	0.00	0.09

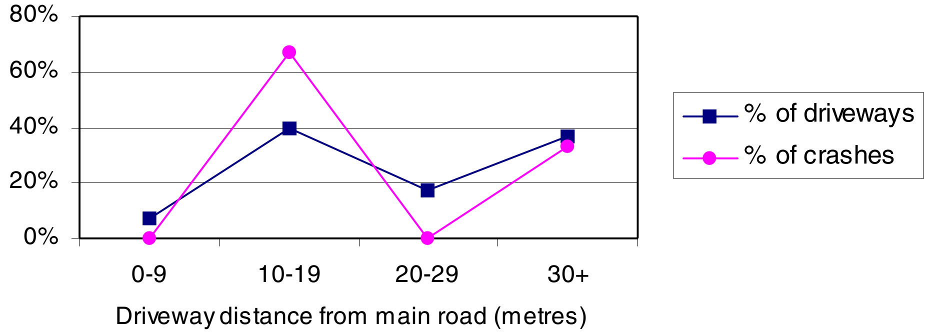
Location of driveway versus crashes

Main road accesses



Location of driveway versus crashes

Side road accesses



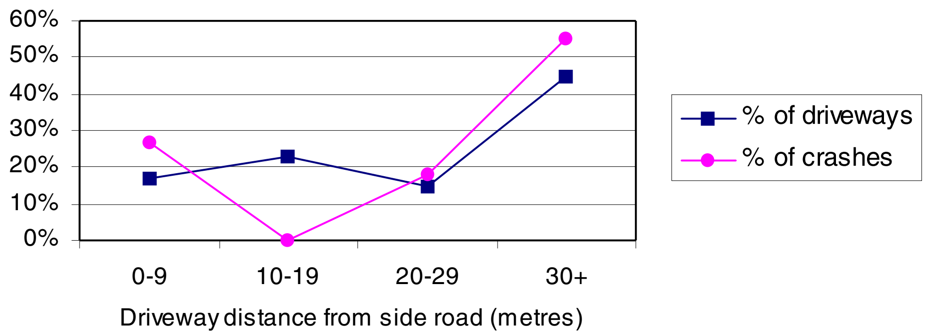
Criteria table for service station survey database

code	position	control	median	lanes	RT bay
	D				

	Results for the main road				Results for the side road			
	0-9m	10-19m	20-29m	30+	0-9m	10-19m	20-29m	30+
No. of driveways	9	12	8	24	10	8	7	13
% of driveways	17%	23%	15%	45%	26%	21%	18%	34%
No. of crashes	3	0	2	6	0	2	2	3
% of crashes	27%	0%	18%	55%	0%	29%	29%	43%
Crashes/driveway	0.33	0.00	0.25	0.25	0.00	0.25	0.29	0.23

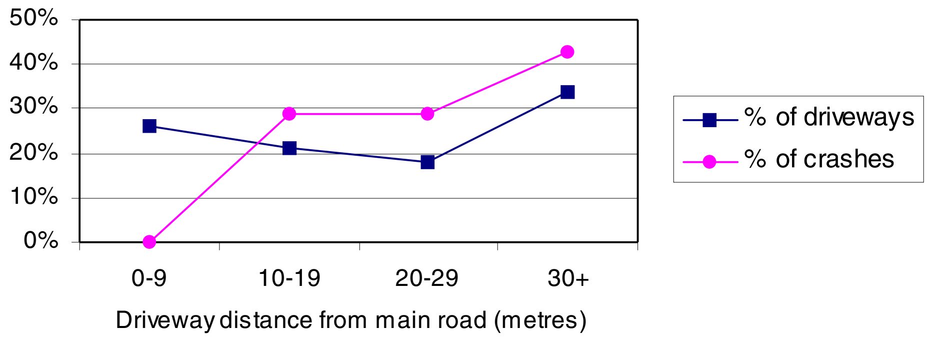
Location of driveway versus crashes

Main road accesses



Location of driveway versus crashes

Side road accesses



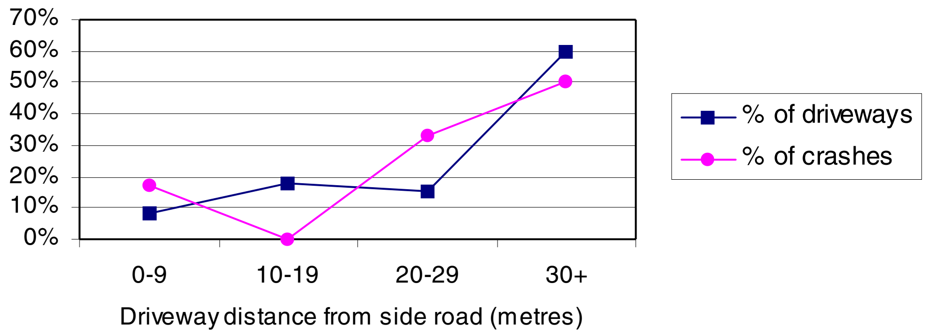
Criteria table for service station survey database

code	position	control	median	lanes	RT bay
		TS			

	Results for the main road				Results for the side road			
	0-9m	10-19m	20-29m	30+	0-9m	10-19m	20-29m	30+
No. of driveways	3	7	6	24	2	9	4	14
% of driveways	8%	18%	15%	60%	7%	31%	14%	48%
No. of crashes	1	0	2	3	0	3	2	4
% of crashes	17%	0%	33%	50%	0%	33%	22%	44%
Crashes/driveway	0.33	0.00	0.33	0.13	0.00	0.33	0.50	0.29

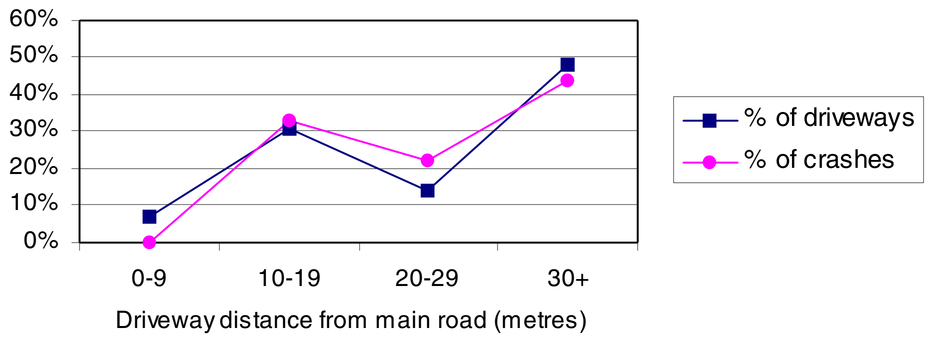
Location of driveway versus crashes

Main road accesses



Location of driveway versus crashes

Side road accesses

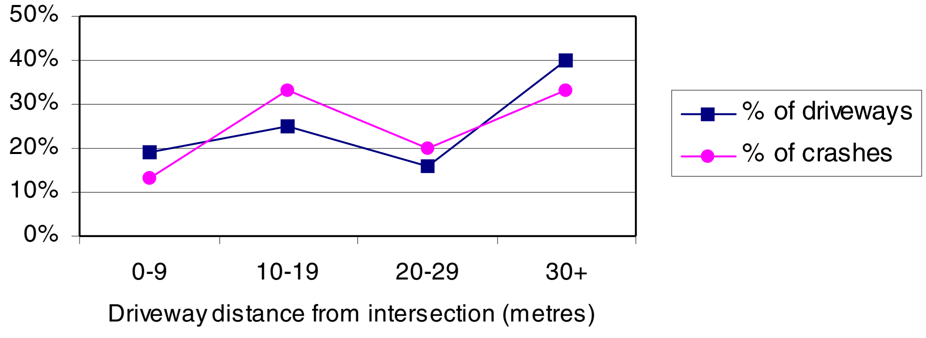


All approaches and all departures

	Results for the main road				Results for the side road			
	0–9m	10–19m	20–29m	30+	0–9m	10–19m	20–29m	30+
No. of driveways	15	19	12	31	11	24	13	35
% of driveways	19%	25%	16%	40%	13%	29%	16%	42%
No. of crashes	2	5	3	5	3	2	2	7
% of crashes	13%	33%	20%	33%	21%	14%	14%	50%
Crashes/driveway	0.13	0.26	0.25	0.16	0.27	0.08	0.15	0.20

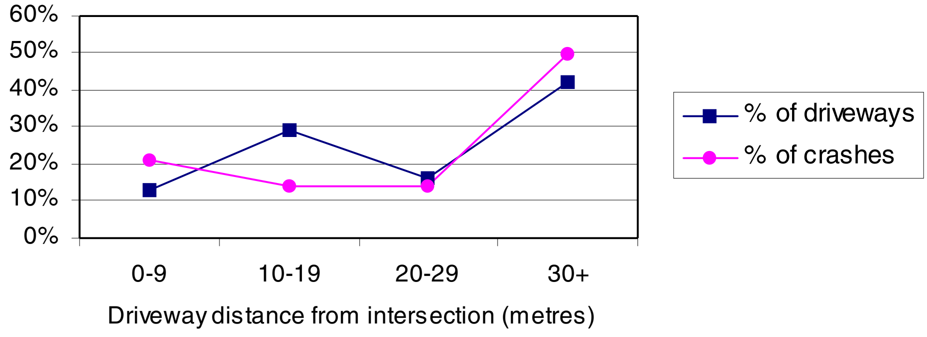
Location of driveway versus crashes

All approach data



Location of driveway versus crashes

All departure data

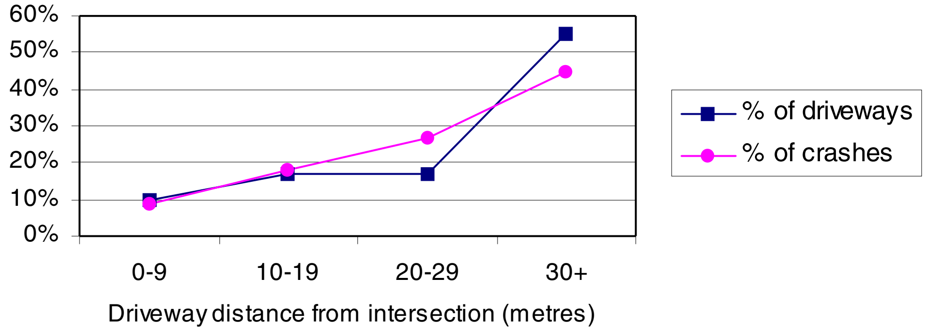


All approaches and all departures at traffic signals

	Results for the main road				Results for the side road			
	0–9m	10–19m	20–29m	30+	0–9m	10–19m	20–29m	30+
No. of driveways	3	5	5	16	2	11	5	22
% of driveways	10%	17%	17%	55%	5%	28%	13%	55%
No. of crashes	1	2	3	5	0	1	1	2
% of crashes	9%	18%	27%	45%	0%	25%	25%	50%
Crashes/driveway	0.33	0.40	0.60	0.31	0.00	0.09	0.20	0.09

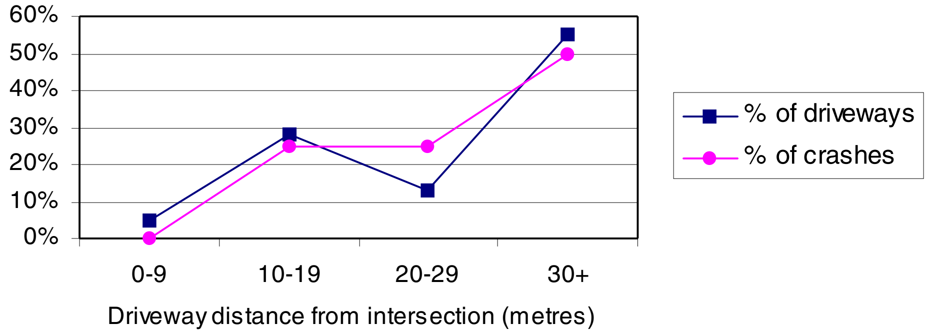
Location of driveway versus crashes

All approaches to signalised intersections



Location of driveway versus crashes

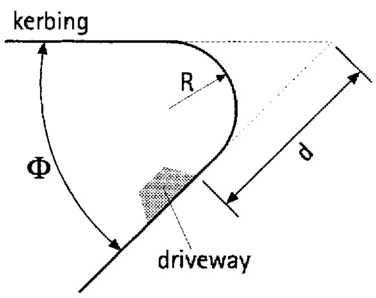
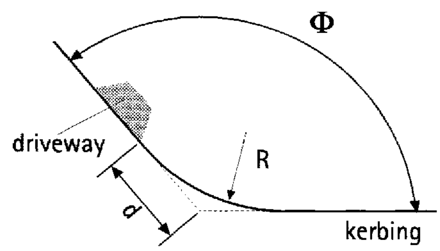
All departures from signalised intersections



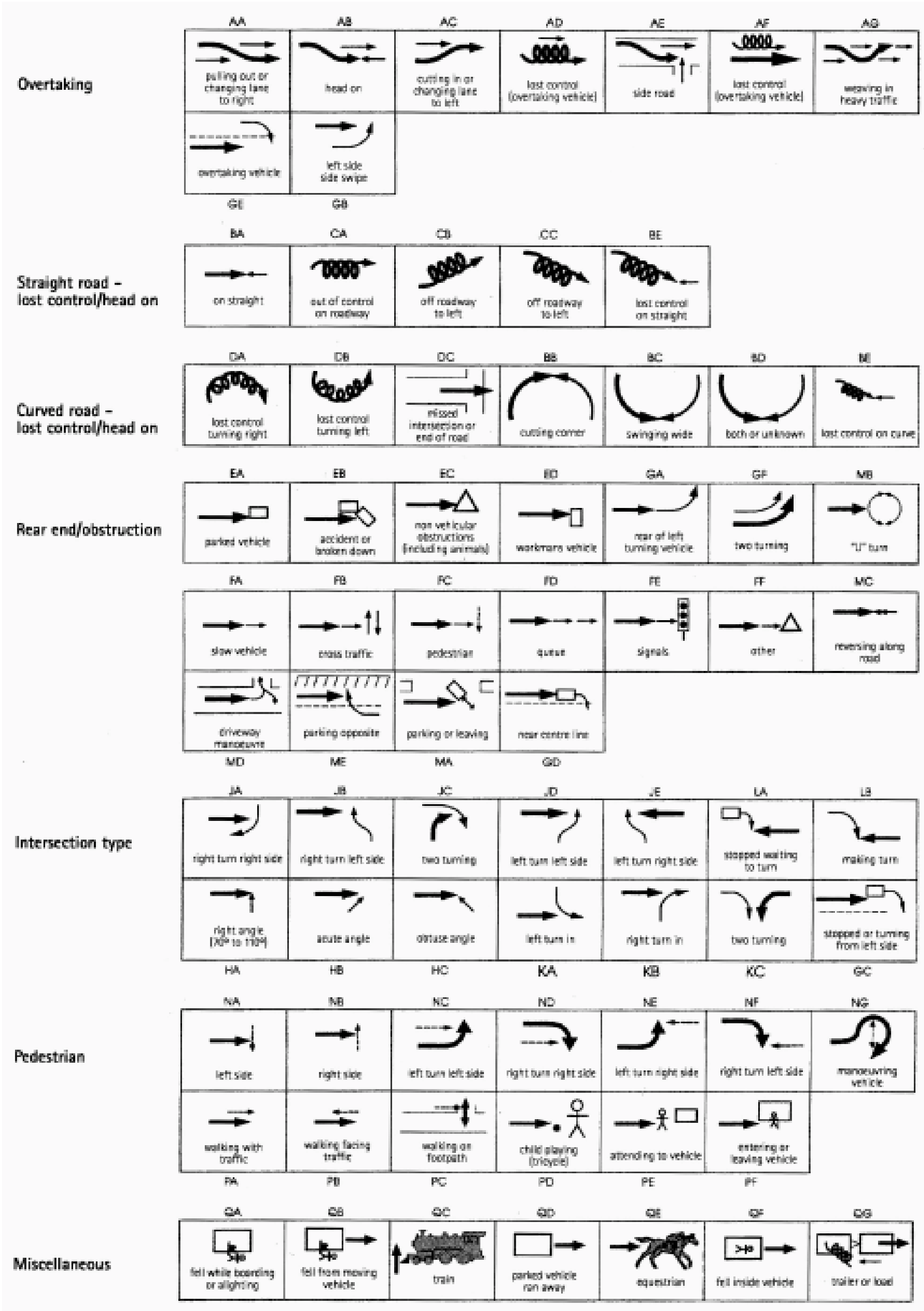
Appendix 4: Driveway distance formula

Table 4.1 shows the formulae used to calculate the minimum distance a driveway should be from an intersection (prolongation of kerbing).

Table 4.1: Minimum distance of driveway from intersection

Angle(Φ) < 90°	90° ≤ Angle(Φ) ≤180°
$d = [R/(\tan\Phi/2)] + 4.5m$ OR 9m, whichever is the greater	$d = [R.\tan(90-(\Phi/2))] + 4.5m$ OR 9m, whichever is the greater
 	

Appendix 5: Crash types



Appendix 6: Visibility

The following extracts regarding visibility are taken from RTS 6 - *Guidelines for visibility at driveways* [7].

6.1 Sight distance

Table 6.1: Sight distances

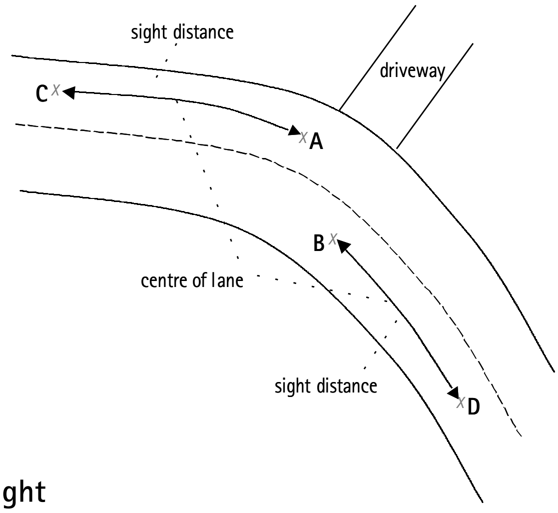
		Minimum sight distance (metres)**		
		Frontage road classification		
		Local	Collector	Arterial
Driveway classifications	**Operating speed (km/h)***			
Low volume	40	30	35	70
Up to 200 vehicle manoeuvres per day	50	40	45	90
	60	55	65	115
	70	85	85	140
	80	105	105	175
	90	130	130	210
	100	160	160	250
	110	190	190	290
	120	230	230	330
High volume	40	30	70	70
More than 200 vehicle manoeuvres per day	50	40	90	90
	60	55	115	115
	70	85	140	140
	80	105	175	175
	90	130	210	210
	100	160	250	250
	110	190	290	290
	120	230	330	330

* Operating speed = 85th percentile speed on frontage road. This can be taken as the speed limit plus 15% if survey data are not available.

** Distances are based on the Approach Sight Distance and Safe Intersection Sight Distance tables in Austroads, *Intersections at Grade* [4] assuming reaction times of 1.5 seconds on local roads with operating speeds up to 60 km/h, and 2.0 seconds for all other speeds and all collector and arterial roads.

Sight distance is measured along the vehicle path shown in Figure 6.1.

Figure 6.1: Sight distance measurement

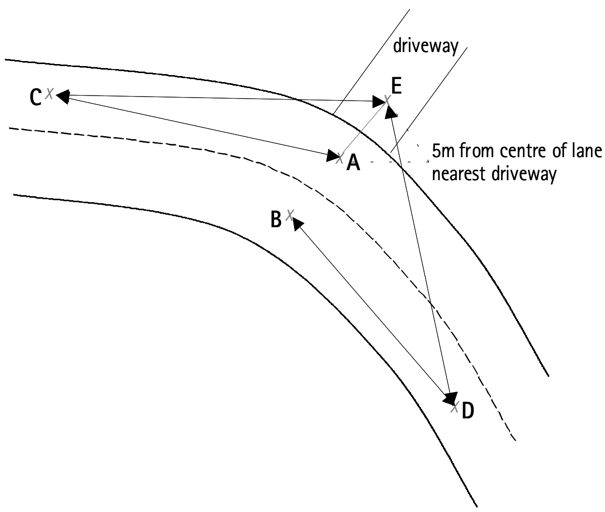


6.2 Lines of clear sight

There should be lines of clear sight from driver's eye height to driver's eye height (1.15 metres above ground level) along the lines detailed below and shown in Figure 6.2.

- Lines AC and BD - All driveways, all roads
- Lines EC and ED (no permanent obstructions, exclude parked vehicles which may obstruct these sight lines occasionally)
  - High volume driveway, collector road
  - Low volume driveway, arterial road in urban area
- Lines EC and ED (no obstructions, parked vehicles not excluded)
  - Low volume driveway, arterial road in rural area
  - High volume driveway, arterial road.

Figure 6.2: Lines of clear sight



Points A, B, C and D are as shown in Figure 6.2, with points C and D established by measuring the sight distance from Table 6.1 along the centre of the appropriate lane from points A and B.

The procedure of establishing adequate sight distance and lines of clear sight should be undertaken for all driveways at the service station site.

RTS 6 - *Guidelines for visibility at driveways* [7] should be consulted if an in-depth knowledge of the design principles for visibility at driveways is required.

Appendix 7: Glossary of terms

Driveway	A means of vehicle access between the roadway and the service station site, e.g. footpath crossover.
Flush median	A flush median is an area of white diagonal lines normally painted down the middle of the road. The area is bounded by approximately parallel longitudinal white lines. Flush medians are used to separate opposing lanes of traffic and provide a place for vehicles that are waiting to turn right, are waiting to merge with traffic, or provide pedestrian refuge areas.
Head of the T	The length of the road boundary opposite the side road of a T-shaped intersection. The extended road boundaries of the side road determine the length of the head of the T.
Intersection	The area outlined by extensions of the road boundaries where two or more roads intersect.
Intersection site	A site with crashes located 70m or less from an intersection in an urban speed environment ($\leq$ 70 km/h) and 210m or less in a rural speed environment (> 70 km/h).
Road boundary	The legal boundary between the road reserve and adjoining land use, e.g. a service station.
Road reserve	The entire area of legal road, including roadway, footpath and berms (grassed area between roadway and footpath).
Roadway	The portion of the road reserve used by vehicles. It includes traffic lanes, parking lanes and metal shoulders, but not footpaths or berms.
Rural	Speed environment > 70 km/h.
Solid median	A traffic island (raised above the roadway surface) used to channel and to separate different streams of traffic on the roadway or to provide refuge for pedestrians crossing the roadway.
Urban	Speed environment $\leq$ 70 km/h.
VPH	Vehicles per hour. The number of vehicles passing a fixed point on a roadway per hour.

Road and Traffic Guideline publications

The following Road and Traffic Guidelines are available:

RTS 1	Guidelines for the implementation of traffic control at crossroads (1990)
RTS 2	Guidelines for street name signs (1990)
RTS 3	Guidelines for establishing rural selling places (1992)
RTS 4	Guidelines for flush medians (1991)
RTS 5	Guidelines for rural road marking and delineation (1992)
RTS 6	Guidelines for visibility at driveways (1993)
RTS 7	Advertising signs and road safety: design and location guidelines (1993)
RTS 8	Guidelines for safe kerbline protection (1993)
RTS 9	Guidelines for the signing and layout of slip lanes (1994)
RTS 11	Urban roadside barriers and alternative treatments (1995)
RTS 13	Guidelines for service stations (1995)
RTS 14	Guidelines for installing pedestrian facilities for people with visual impairment (1997)
RTS 17	Guidelines for setting speed limits (1995)

The Guidelines may be purchased from:

Land Transport Safety Authority, Head Office (PO Box 2840, Wellington) or Regional Offices in: Auckland, (Private Bag 106 602), Wellington (PO Box 27 249) and Christchurch (PO Box 13 364).