

FINAL REPORT

R98 Development of Speed Management Activities Guideline

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Summary

The purpose of this project was to develop a guideline about the use of speed management activities. The purpose of this guideline is to provide a comprehensive resource for organisations, councils, districts, or authorities engaged in or seeking information about these activities. It is designed to effectively manage speed limits, whether they are already in place or being newly established.

This guideline document intends to provide the most up to date information to result in a consistent application of activities across Queensland. It is important to note that the guideline is not to be regarded as a standard.

The purpose of speed management activities is to support and encourage the lowering of vehicle speeds to levels compatible with the recommended speed limit and, consequently, within the parameters set by the risk assessed speed limit. Speed management activities set out in the guideline are broadly categorised as:

- engineering (e.g. traffic calming devices, active warning signs, portable warning signs)
- enforcement (e.g. mobile speed cameras, point-to-point speed cameras)
- education (e.g. community-based behaviour change initiatives).

Ensuring vehicle speeds are within acceptable ranges is expected to result in the following benefits:

- reductions in casualty crashes
- reductions in the severity of crashes
- an increase in the credibility of speed limits, leading to voluntary compliance.

This guideline provides a toolbox of speed management activities to assist practitioners in selecting and recommending appropriate measures.

It should be noted that the guideline does not provide technical specifications or design-specific procedures, and practitioners should therefore refer to their local design guideline.

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1. Introduction

1.1 Background

The *Queensland Manual for Uniform Traffic Control Devices* (MUTCD) Part 4: Speed Controls was most recently revised in November 2022 and the *Queensland Road Safety Technical User Volumes – Guide to Speed Management* (QRSTUV – GSM) was also published in November 2022. An earlier revision of the MUTCD Part 4 in 2018 contained a revised speed limit review process that placed increased emphasis on the risks present in road environments, including crash and infrastructure risks.

The speed limit review process recommends ‘speed management activities’ to support speed limits where the speed data speed limit (SDSL) – the speed limit based on vehicle speeds – is greater than the risk assessed speed limit (RASL) – the speed limit based on the function of the road and the risks to road users. The purpose of the speed management activities is to support and encourage the lowering of vehicle speeds to levels compatible with the recommended speed limit and, consequently, within the parameters set by the RASL. Ensuring vehicle speeds are within acceptable ranges through speed management activities is expected to result in the following benefits:

- reductions in all crashes
- reductions in the severity of crashes
- an increase in the credibility of speed limits, leading to greater voluntary compliance.

Speed management activities are broadly categorised as:

- engineering (e.g. traffic calming devices, active warning signs, portable warning signs)
- enforcement (e.g. mobile speed cameras, point-to-point speed cameras, police presence)
- education (e.g. community-based behaviour change initiatives).

A guideline document on speed management activities was requested by several road authorities during the speed limit review workshops held in 2020. Accordingly, the guideline will be available for all Queensland road authorities.

Previous versions of the MUTCD Part 4 and *Traffic and Road Use Management Manual Volume 2: Road Safety Part 3: Speed Limits and Speed Management* (superseded) did not provide guidance for speed management activities. While it is acknowledged that there are a number of existing resources providing some guidance for the 3 speed management activity categories, there is no single point of reference and the information available varies. Additionally, many of the existing resources are compartmentalised to one of the 3 categories and do not demonstrate how they could be used collaboratively. Further, the Department of Transport and Main Roads (TMR) could enhance uniform results throughout Queensland’s roads by establishing a centralised guidance source. This can ensure the delivery of consistent and efficient communication regarding changes in speed limits across jurisdictions in the state.

There are four Safe System pillars: safer vehicles, safer speeds, safer roads and safer road users. Speed management activities are part of the safer roads component of the Safe System framework which is adopted by TMR to manage road safety on its network. This indicates that speed management activities are an important part of TMR’s approach to road safety and are likely to be included in its initiatives and programs to promote safe driving behaviours, reduce speed-related crashes and improve road infrastructures to support safer speeds. The guideline provided should be applicable to all road infrastructure managers, including local government authorities, who are responsible for managing road safety within their respective jurisdictions.

1.2 Project Objectives

The objective of this project was to develop comprehensive guidance to assist practitioners in selecting effective speed management activities to accompany the outcome of a speed limit review that has identified motorists are travelling at speeds that are higher than the assessed risk-based speed limit. The guidance will allow practitioners to consistently select fit for purpose speed management activities to reduce speeds to match an existing speed limit, or a new speed limit.

1.3 Project Scope

The scope of the project included the following:

- Identify suitable and effective speed management activities for each of the three categories (engineering, enforcement and education) from existing domestic and international guidance and case studies.
- Identify regularly used speed management activities in Queensland, and emerging speed management activities that may be suitable for use in Queensland.
- Consult with local governments and TMR Program Delivery and Operations (PDO) Regions, and Customer Services Branch (CSB) Regions to identify the effectiveness of speed management activities implemented and regularly used to date in Queensland, as well as any that they believe may be effective and could be trialled.
- Identify suitable speed management activities for Queensland in consultation with officers who are either members of a Speed Management Committee (SMC) or represent organisations with a role in road safety.
- Develop a guideline for the selection and application of speed management activities. This guideline would complement TMR documents. The guideline is to be provided in the project report.

1.4 Project Methodology

The project methodology is provided in Table 1.1.

Table 1.1: Project methodology

Task no. / title	Task description
1. Literature review and consultation	A literature review of domestic and international guidance relating to suitable and effective speed management activities in each of the 3 categories (engineering, enforcement, education), including: • expected speed reductions (substantiate) • indicative crash reductions • estimate the associated cost of speed management activities • provide case studies (if available) • review any materials provided by TMR and the speed management committee. Workshop consultation with officers who are either members of an SMC, or represent organisations with a role in road safety to identify: • the effectiveness of speed management activities implemented to date in Queensland • emerging speed management activities that are believed may be effective and could be trialled • scenarios they are regularly presented with.
2. Identify suitable speed management activities	Synthesis of suitable speed management activities identified in Task 1. • Synthesis of suitable speed management activities as identified in the literature review and consultation process. This includes identifying the potential benefits of each activity and case studies if available. • Workshop with TMR to identify speed management activities to be included in the guideline.
3. Development of draft speed management activities guideline	Development of draft speed management activities guideline using the final short list of suitable speed management activities from Task 1 and Task 2. • Develop a table of contents and guideline structure for review and discussion with TMR. Continue to draft the guideline using an agreed option. • Draft the speed management activities guideline:

Task no. / title	Task description
	– this includes the speed management activities by the engineering, enforcement and education categories and the various road classes and associated functions on the state and local government roads as identified in QRSTUV GSM (2022).
4. Draft report and guideline	Compile the draft project report which will document the project findings, decisions, and outputs. The final speed management activities guideline is to be provided in the report.
5. Final report	Compile feedback and recommendations from TMR to document the final project findings, decisions, and outputs. The final speed management activities guideline will be provided within the report.

2. Literature Review and Consultation

The focus of the literature review was to identify information which can be used to develop practitioner guideline for determining suitable, effective, and evidence-based speed management activities in each of the 3 categories of engineering, enforcement and education.

In order to identify relevant research, a literature review was conducted using the resources of ARRB's MG Lay Library. These resources included the library's own comprehensive collection of technical land transport literature and information retrieval specialists with extensive experience in the transport field, as well as access to the collections and expertise of other transport-related libraries throughout Australia and internationally.

Used specifically in this literature search were the Australian Transport Index (ATRI) and Transportation Research Information Documentation (TRID) databases. The use of these databases ensured wide coverage of research material within the subject area from both national and international sources.

In total, over 100 research and speed management activity guideline publications were reviewed to identify relevant information.

2.1 Engineering Measures

Engineering speed management activities primarily include treatments that involve re-engineering the road to encourage slower speeds, or those that make the road and its environment more forgiving or self-explaining. Many of these treatments have the effect of either making it feel uncomfortable to drive in excess of the posted speed (e.g. deflection devices) or offer more visual guidance to encourage drivers to slow down. A brief description of these measures is provided below.

2.1.1 Vertical Deflection Devices

Vertical deflection devices are a physical feature of the roadway that force vertical changes in the travel path of a vehicle, specifically for the purpose of slowing vehicles. The resulting effect is a reduction in vehicle speeds as drivers attempt to avoid discomfort when driving over the deflection device. The devices include road humps, raised platforms and road cushions.

When considering the installation of vertical deflection devices as a speed management treatment, it is important to keep in mind that certain factors may need to be considered and mitigated to implement the treatment. These factors can include:

- The possibility of increased traffic noise during braking and acceleration, as well as the vertical displacement of vehicles. Additionally, road humps may be uncomfortable for some vehicle passengers and cyclists (Bendtsen & Larson 2001).
- Traffic may be diverted to other surrounding streets (Austroads 2020).
- The devices may not be suitable for streets with insufficient lighting, speed limits over 60 km/h, streets with bends or crests (lacking sight distance), on bus or designated cycle routes, streets with high commercial traffic, or areas where emergency vehicle access may be hindered, or property access significantly impacted (Austroads 2020).

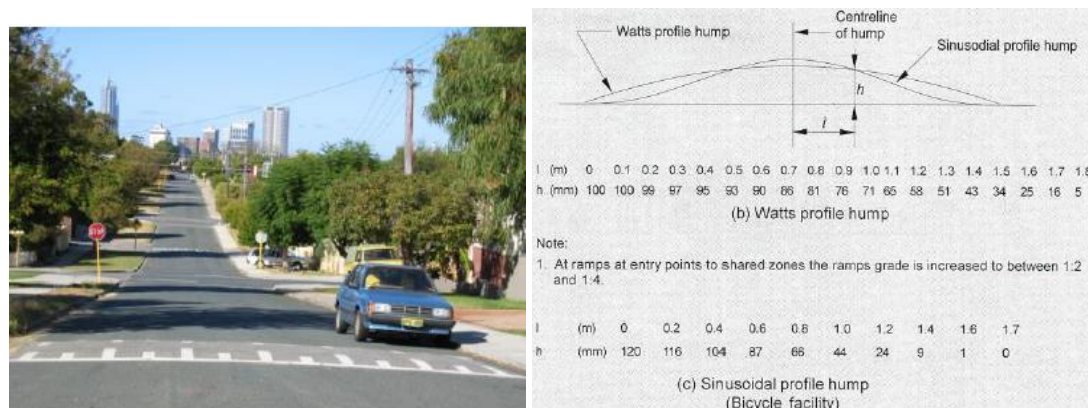
Road Humps

A road hump is one of the most commonly used local street speed management devices. It is a traffic calming device in the form of a raised curved profile extending across the roadway used to control and reduce vehicle speeds in low-speed urban environment, reducing crash risk and lowering crash severity.

Various designs are available for different speed environments; however, they are typically 70 to 120 mm high with a total length of 3 to 4 m (Austroads 2020).

Austroads (2020) further highlights the 2 main types used in Australasia, including the sinusoidal profile hump (more sympathetic to cyclists) and the Watts profile hump (greater effect on drivers) (Figure 2.1).

Figure 2.1: Example and typical dimensions of speed humps



Source: Austroads (2020).

The following findings were made for road humps as a speed management activity:

- Expected speed reduction post treatment installation
 - Austroads (2009) suggests that road humps produce an 85th percentile speed reduction of 45% at the treatment and 21% at the midpoint between treatments (local road).
 - VicRoads (2017) suggests a mean speed reduction of around 30% in the immediate vicinity of the road humps. The largest speed reduction benefits are achieved through regularly spaced humps (of 80 to 120 m) over local streets.
- Indicative crash reduction post treatment installation
 - Jurewicz (2009) suggests a casualty crash reduction factor of 71% (scheme-wide). It should be noted that this value is a UK-based figure that refers to all crashes and was not adjusted for regression to the mean.
 - Zein et al. (1997) suggests a crash reduction factor of 75% post treatment.
 - WHO (2008) reported a 61% reduction in fatal crashes at various sites in China.
- Approximate cost of installation
 - IRAP (2010) specified the cost of road hump as medium to high.
 - VicRoads (2017) estimated road humps to be a medium cost rating.
- Case studies
 - WHO (2008) examined the effectiveness of installing road humps on 63 minor roads that intersected with a 40 km main road and found that this intervention resulted in a substantial 61% reduction in the total number of fatalities from 2003 to 2004 (unclear about the distance between the road hump and the intersection). This highlighted the potential benefits of using speed reduction measures like road humps in reducing road fatalities.
 - Brindle (1995) investigated the speed impacts post the installation of various road humps in 60 km/h posted speed areas across Australia, recording the findings shown in Table 2.1.

Table 2.1: Speed reduction at hump or between humps post treatment

Location	Mean speed reduction at hump	85 th Percentile speed reduction at hump	Mean speed reduction between humps	85 th Percentile speed reduction between humps
Hawthorn, Victoria	14-31% (from 56-63 km/h to 32-42 km/h)	11-37% (from 63-75 km/h to 38-52 km/h)	9-19% (from 61-65 km/h to 46-52 km/h)	(not available)
Corio, Victoria (Case A)	49% (from 45 km/h to 23 km/h)	45% (from 53 km/h to 29 km/h)	26% (from 46 km/h to 34 km/h)	26% (from 54 km/h to 40 km/h)
Corio, Victoria (Case B)	52% (from 42 km/h to 20 km/h)	47% (from 49 km/h to 26) km/h	22% (from 46 km/h to 36 km/h)	21% (from 53 km/h to 42 km/h)
Stirling, Western Australia	75% (from 60 km/h to 15 km/h)	68% (from 65 km/h to 21 km/h)	40% (from 63 km/h to 38 km/h)	33% (from 70 km/h to 45 km/h)

The application of road humps compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Raised mid-block platforms

Similar to road humps, raised platforms (or raised tables) fulfil a similar purpose but are designed with a flat-top profile compared to a curved profile. They are normally 75 to 100 mm high and typically include a 2 to 6 m long platform ramped up from the normal level of the street (Austroads 2020). These long platforms are more suited for comfort of passengers in long wheel based vehicles. Raised mid-block platforms can also be enhanced with a pedestrian (zebra) crossing placed on a flat top road hump (wombat crossing), ensuring the safety and convenience of pedestrians. This pedestrian-oriented measure is not limited to mid-block platforms but also extends to intersections.

Examples of some raised mid-block platforms are shown in Figure 2.2.

Figure 2.2: Examples of raised mid-block platforms



Source: Left Austroads (2020), right VicRoads (2017).

The following findings were made for raised mid-block platforms as a speed management activity:

- Expected speed reduction post treatment installation
 - Austroads (2009) suggests that raised platforms can produce an 85th percentile speed reduction of 24% at the treatment site.
 - VicRoads (2017) suggests that raised platforms have been found to be effective in reducing average vehicle speeds by around 25% in 40 km/h zones in the immediate vicinity of the device. The largest speed reduction benefits can be achieved through regularly spaced platforms (of 80 to 120 m) over local streets.
 - Jurewicz (2009) suggests a 45% reduction in the 85th percentile speeds at the treatment site.

- Hawley et al. (1993) reported a 26% reduction (from 66 km/h to 49 km/h) in the 85th percentile speeds between road humps across 7 study sites in Australia.
- Hawley et al. (1993) reported an average reduction of 34–43% in 85th percentile speeds across 5 study sites with raised mid-block platforms with wombat crossings in New South Wales.
- Austroads (2011) reported a 22% reduction in the 85th percentile speeds and 21% reduction in the mean speeds on an urban local road intersection in New South Wales.
- Indicative crash reduction post treatment installation
 - Jurewicz (2009) suggests a casualty crash reduction factor of 71% (scheme-wide) based on before-and-after crashes at the raised platform treatment site.
 - Makwasha and Turner (2017) reported a 63% casualty reduction at sites (posted between 50 to 60 km/h) with mid-block platforms.
- Approximate cost of installation
 - VicRoads (2017) estimated the cost of raised platforms to be a medium cost rating.
- Case studies
 - Makwasha and Turner (2017) studied 8 raised mid-block platforms (2 sites with 50 km/h posted speed limits and 6 sites with 60 km/h posted speed limits) at various locations across New South Wales, Victoria and Queensland. The study found an indicative 63% casualty crash reduction at sites with mid-block platforms.
 - Hawley et al. (1993) analysed the speed reduction associated with installations of platforms in Australia. Across the 7 study sites, the initial average 85th percentile speed between platforms was 66 km/h. After the platforms were installed, the speed dropped to 49 km/h, a 26% reduction. The study also found that the speed across the platform was lower with higher ramp gradients and with shorter platform lengths.
 - A series of wombat crossings were trialled in NSW from 1991 to 1992. At the 5 study sites, the 85th percentile speed was 34–43% lower at the device after the installation of wombat crossings compared to a 10–12% reduction at the control sites (Hawley et al. 1993).
 - Austroads (2011) studied raised intersection platforms as part of a before and-after case study review at a site on an urban local road (platforms installed on all legs of a T-intersection) in New South Wales. With a posted speed limit of 50 km/h annual average daily traffic (AADT) approximately 6,000 vehicles per day (vpd), a 7–13 km/h (22%) reduction in the 85th percentile speeds was observed (from 58 to 45 km/h). A 10 km/h (21%) reduction from 48 to 38 km/h was observed in the mean site speeds as a result of the treatment.

The application of raised mid-block platforms compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Raised intersection platforms

Although primarily used as a mid-block treatment, raised platforms can also be applied at intersections on either local or arterial roads. Austroads (2004) defines a raised intersection platform as, ‘a raised flat section of roadway extending across the apron of an intersection ramped up from the normal level of the street’. They can also be painted or paved to raise driver awareness of the intersection; this is particularly common in Europe, especially in the Netherlands.

Examples of some raised intersection platforms are shown in Figure 2.3.

Figure 2.3 Examples of raised intersection platforms



Source: VicRoads (2019).

The following findings were made for raised intersection platforms as a speed management activity:

- Expected speed reduction post treatment installation
 - Austroads (2016a) suggests that raised intersection platforms can produce a 3 km/h reduction in the mean speeds and an 8 km/h reduction in the 85th percentile speeds.
 - Austroads (2011) reported a 1.1 km/h (2%) reduction in the 85th percentile speeds on an urban local road intersection in New Zealand.
 - Watkins (2000) reported a 20% reduction in 85th percentile speeds at 2 sites in Cambridge, USA.
 - Makwasha and Turner (2017) reported that raised intersections resulted in an 8 km/h reduction in 85th percentile speeds at sites with a posted speed limit of 60 km/h in Australia.
- Indicative crash reduction post treatment installation
 - Austroads (2016a) suggests that raised intersection platforms can produce a crash reduction of 40% at the treatment site.
 - Van der Dussen (2002) reported that raised intersection platforms reduced crashes by 70% in the Netherlands.
 - Makwasha & Turner (2017) reported a 55% casualty crash reduction at sites with raised intersection platforms.
- Approximate cost of installation
 - VicRoads (2017) suggests raised platforms to be a medium cost rating.
 - Austroads (2016a) suggests raised platforms to be a medium-to-high cost rating.
- Case studies
 - Austroads (2011) studied raised intersection platforms as part of a before-and-after case study review at a site on an urban local road in Hamilton, New Zealand. With a posted speed limit of 50 km/h (AADT 3,000–3,500 vpd), a 1.1 km/h (2%) reduction (from 60.9 km/h to 59.8 km/h) in the 85th percentile speeds was observed.
 - Van der Dussen (2002) studied the effectiveness of raised platforms at 10 intersections in Gelderland (Netherlands) with traffic volumes of 3,000–6,000 per day. The study concluded that raised platforms reduced the number of crashes by 70%. The platforms were especially effective at reducing the severity of crashes, with casualty crashes reduced by 80%, while property damage only crashes were 60% lower.
 - Watkins (2000) assessed the effectiveness of raised intersections at 2 locations in Cambridge, Massachusetts (USA). The results showed a 5 mph (8 km/h) and 4 mph (6.4 km/h) reduction in 85th percentile speeds at the 2 sites (AADT across sites 4,400 and 8,100 vpd).
 - Makwasha and Turner (2017) studied 8 raised intersection platforms (2 sites with 50 km/h posted speed limits and 6 sites with 60 km/h posted speed limits) at various locations across New South

Wales, Victoria and Queensland. The study found an indicative 55% casualty crash reduction in priority-controlled intersections. Furthermore, raised intersections lowered 85th percentile speeds by 8 km/h.

The application of raised intersection platforms compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Road Cushions

Road cushions are a form of road hump that occupies only a part of the roadway (Austroads 2020). It is designed to be more sympathetic to cyclists, buses and commercial vehicles than a standard full-width road hump.

When used in series along a street, they regulate speeds over the entire length of the street (Austroads 2020).

Examples of some road cushions are shown in Figure 2.4.

The following findings were made for road cushions as a speed management activity:

- Expected speed reduction post treatment installation
 - Austroads (2009) reported a 27% reduction in 85th percentile vehicle speeds in the vicinity of road cushions.
 - VicRoads (2017) suggests a speed reduction of up to 20% when spaced at appropriate intervals, with average travel speeds normally ranging from 25 km/h to 30 km/h over the cushions.
 - Layfield and Parry (1998) reported that speed cushions reduced mean speeds by 42% and 85th percentile speeds by 39% on average across over 300 road cushion sites.
- Indicative crash reduction
 - Austroads (2009) estimates a casualty crash reduction factor of 60% (scheme-wide). This value was estimated from the reduction in speed and other relevant studies rather than crash data.
 - Layfield and Parry (1998) estimates a crash reduction factor of 60%.
- Approximate cost
 - Austroads (2020) estimated road cushions as a relatively low-cost treatment to install and maintain.
 - VicRoads (2017) estimated road cushions as a low-to-medium cost treatment to install and maintain.
- Case studies
 - Speed cushions were initially introduced in Germany where cushions (1,840 mm wide base width, 50 mm high, and having 1:5 gradients) were reported to be effective at maintaining vehicle speeds to approximately 20 mph (32 km/h) (Pharaoh 1992).

Figure 2.4: Examples of road cushions



City of Gold Coast, Queensland



City of Banyule, Victoria



City of Banyule, Victoria



City of Marion, South Australia

Source: Austroads (2020).

- Layfield and Parry (1998) reported on a study of 34 local authority highway schemes within excess of 300 cushions, the majority on roads with 30 mph (48.3 km/h) speed limits. The study found that mean speeds reduced from 48.3 km/h at the cushion to 27.8 km/h following the installation of the cushions. The 85th percentile speeds reduced from 57.3 km/h at the cushion to 34.9 km/h following the installation of the cushions.

The application of road cushions compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

2.1.2 Horizontal Deflection Devices

The purpose of horizontal deflection devices is to change the horizontal course or path of a vehicle as a result of a physical feature of the roadway, primarily to assist in reducing vehicle speeds.

In this section, two types of horizontal deflection devices are considered:

- slow points
- centre blister treatments.

One of the limitations of horizontal deflection devices includes the presence of sufficient road width that could accommodate their installation.

Slow Points

Slow points (also known as angled slow points or chicanes) are a series of kerb extensions on alternating or opposite sides of a roadway, which narrow and/or angle the roadway (Austroads 2020). They are intended to reduce vehicle speeds, predominantly on local streets.

There are two main types of slow points: one-lane and two-lane, with the latter formed by building out the kerb on alternative sides of a single carriageway road to narrow the road and deflect the path of through traffic. A one-lane slow point functions similarly to a two-lane slow point. However, in a one-lane slow point, buildouts obstruct the carriageway, forcing the traffic to reduce to a single lane and the opposing traffic stream is required to stop and give way.

Examples of slow points are shown in Figure 2.5.

Figure 2.5: Examples of slow points



Source: Left (one lane), right (two lane) (Austroads 2020).

The following findings were made for slow points as a speed management activity:

- Expected speed reduction

- Austroads (2009) suggests slow points produce an 85th percentile speed reduction of up to 34% at the treatment.
 - Jurewicz (2009) suggests a 27% reduction (two lane) and 34% reduction (one lane) in the 85th percentile speeds at the treatment site.
 - Corkle et al. (2001) suggests a 14% reduction (one lane) in the 85th percentile speed (scheme-wide) based on 5 schemes found in US literature reviews.
 - Sayer et al. (1998) reported that one-lane slow points (at the treatment site) are capable of producing a 36% reduction in mean speeds and a 34% reduction in 85th percentile speeds, compared to a 33% reduction in mean speeds and a 32% reduction in 85th percentile speeds between sites in the UK.
 - Sayer et al. (1998) reported that two-lane slow points (at the treatment site) are capable of producing a 30% reduction in mean speeds and a 25% reduction in 85th percentile speeds, compared to a 16% reduction in mean speeds and a 15% reduction in 85th percentile speeds between sites in the UK.
 - Cusack et al. (1998) reported that two-lane slow points were capable of producing a 27% reduction in 85th percentile speeds and a 33% reduction in the mean speed at the treatment site in Australia.
 - Austroads (2020) also notes that the effectiveness of slow points can be increased when used in combination with lane narrowings, median treatments, centre blister islands and threshold treatments.
- Indicative crash reduction
 - According to Sayer et al. (1998), casualty crashes decreased by 61% as a result of 12 one-lane slow point schemes and by 51% as a result of 5 two-lane slow point schemes (with known before-and-after casualty data).
- Case studies
 - Sayer et al. (1998) undertook a detailed study in the UK on the implementation of one and two-lane slow points on roads with posted speeds of 30 mph (48 km/h). The following results were documented for the reduction in speed:
 - One-lane slow points: At the treatment site, a 34% reduction in the 85th percentile speed and a 36% reduction in the mean speed was found. Between treatments, there was a 32% reduction in the 85th percentile speed and a 33% reduction in the mean speed.
 - Two-lane slow points: At the treatment site, a 25% reduction in the 85th percentile speed and a 30% reduction in the mean speed was found. Between treatments, there was a 15% reduction in the 85th percentile speed and a 16% reduction in the mean speed.
 - Cusack et al. (1998) undertook field trials in Australia based on 4 sites (built-up areas with 50 km/h speed) with two-lane slow points, with results tested for statistical significance. The results indicated a 27% reduction in the 85th percentile speeds and a 33% reduction in the mean speed at the treatment site.

Some of the application and implementation difficulties and/or unintended consequences of the treatment identified in Austroads (2020) to consider include:

- The treatment is only applicable to roads where traffic volumes are low (not more than 1,000 vehicles per day), otherwise congestion and crash risk may increase.
- Route limitations make this treatment inappropriate on bus or cyclist routes, streets with a high connective role in the local street network, where on street parking is in short supply, routes required for emergency facilities (e.g. hospitals) or if the road is used by a high number of commercial vehicles.

- With one-lane devices, confrontations between opposing drivers may occur when arriving simultaneously and it may be unclear who should give way.
- Design must cater for ongoing maintenance of landscaping to prevent reduced visibility.

The application of slow points compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Centre Blister Treatments

A centre blister is a concrete island positioned at the centreline (median) of a street that has a wide oval plan shape that narrows the lanes, diverts the angle of traffic flow into and out of the device, and can be used to provide pedestrians with a refuge (Austroads 2020). This treatment is similar to a two-lane slow point, however, it involves an oblong traffic island placed in the centre of the two-way carriageway to create a symmetrical horizontal deflection for both lanes (Austroads 2009). Predominantly used to reduce vehicle speeds in local streets, centre blisters can also facilitate the movement of buses and commercial traffic.

Some examples of slow points are shown in Figure 2.6.

The following findings were made for centre blisters as a speed management activity:

- Expected speed reduction
 - Jurewicz (2009) suggests a 24% reduction in the 85th percentile speeds at the treatment site.
 - Austroads (2009) reported a 14% reduction in average speeds across several centre blister sites (with posted speeds of 50 km/h) in Victoria.
 - Hawley et al. (1993) reported a 38–44% reduction in the 85th percentile speeds across 2 arterial road sites in New South Wales.
 - Forbes and Gill (1999) reported a 9% decrease in 85th percentile speeds at a site (posted speed limit of 50 km/h) in America.
 - Austroads (2020) notes that the effectiveness of centre blisters can be increased when used in series or placed together with lane narrowings, threshold treatments, or other forms of slow point.
- Indicative crash reduction
 - In the absence of published evidence, an approximate theoretical crash reduction factor of 18% is estimated by ARRB using guidance from Nilsson (1984).
- Case studies
 - Austroads (2009) reported that at 9 centre blister sites (all with a posted speed of 50 km/h) across Melbourne resulted in an average speed reduction of 8 km/h, or 14%. The zone of influence of the centre blisters was 60 to 80 m on the approach and 70 to 100 m on the departure (Figure 2.7).

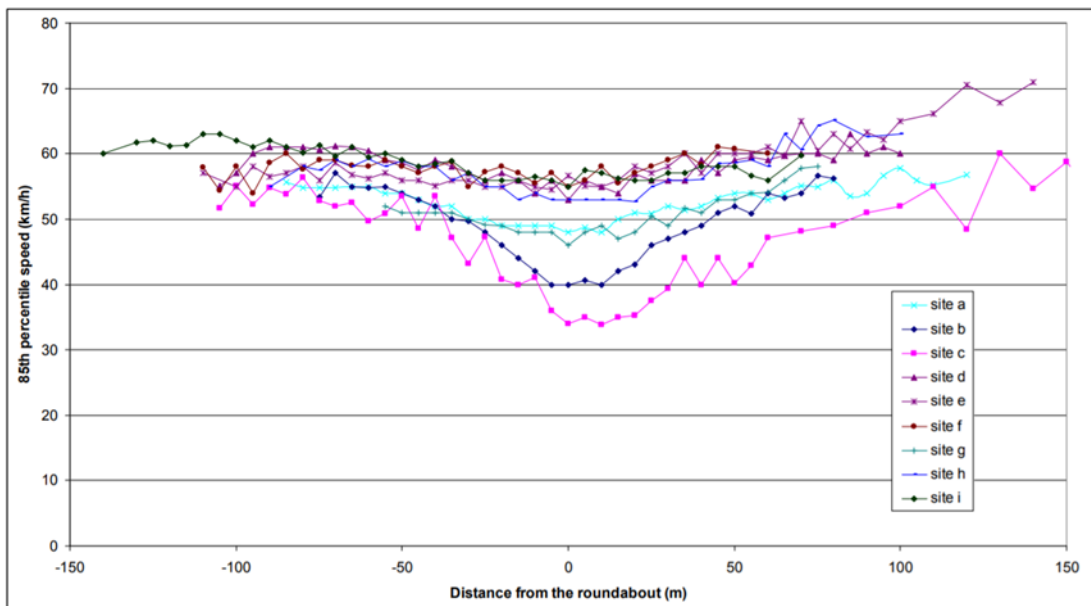
Figure 2.6: Examples of centre blister treatments



Source: Austroads (2020)

- Hawley et al. (1993) found that in 2 sites located on sub-arterial roads in New South Wales, the 85th percentile speeds reduced to between 38% and 44%. For example, from before speeds of 70 km/h to an after speed of 43 km/h (Willoughby site, 50 km/h posted speed) and before speeds of 75 km/h down to an after speed of 62 km/h (Bankstown site, 40 km/h posted speed).
- Forbes and Gill (1999) reported that following the installation of centre blister treatments at a site (known as speed control medians in America), with a 50 km/h speed limit and 85th percentile speeds of up to 70 km/h pre-treatment, the mean speed dropped by 9% from 54 km/h to 49.3 km/h (statistically significant).

Figure 2.7: Centre blister islands - 85th percentile speed profiles for 9 trial sites across Melbourne



Source: Austroads (2009).

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- road geometry needs to be wide enough to accommodate island installation
- The potential for property access to be restricted resulting in drivers performing U-turn manoeuvres.

The application of centre blister treatments compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

2.1.3 Signage

Signage for speed management can be divided into static signs and feedback signs. Static signs remain stationary and provide a fixed message to drivers, while feedback signs provide information based on driver behaviour. Effective use of signage can help reduce speeds and improve safety.

Static Signage

Repeater regulatory speed limit signs

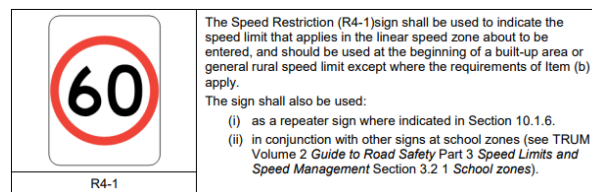
The purpose of a speed limit sign is to indicate to drivers the maximum legal vehicle speed permitted under normal driving conditions on the street section or in the area where the sign is installed (Austroads 2020). Examples of speed limit signs are given in the Queensland MUTCD Part 4 (TMR 2019), AS 1742.1 – 2014 and AS 1742.2 – 2009 (Figure 2.8).

To enhance compliance with speed limits on roadways, the implementation of repeater regulatory signs can be used as an effective speed management measure. Additionally, the inclusion of pavement markings can complement regulatory speed limit signs, further emphasising the posted speed limit.

The following findings were made for the presence of repeater regulatory speed limit signs as a speed management activity:

- Expected speed reduction post treatment installation
 - Mackie (1998) suggests that the use of static signs only has a small effect on the expected reduction in speed, with a 3.1 to 3.7% reduction in mean speeds and a 2 to 3.9% reduction in 85th percentile speeds.
 - Ullman and Rose (2005) reported a 16% reduction in average speed from 55 to 46 mph (88.5 to 74 km/h).
 - Austroads (2016a) suggests a mean speed reduction of up to 4 km/h.
 - Stephan et al. (2007) reported that repeater signs were capable of producing a net mean speed reduction of 1.59 to 3.63 km/h in the Melbourne CBD (posted speed of 50 km/h).
 - In addition to speed limit signs, US Department of Transportation (2017) indicates there is a reduction of 1% in the 85th percentile speeds on rural roads for the presence of speed limit pavement markings.
- Approximate cost of installation
 - Austroads (2016a) suggests that repeater regulatory speed limit signs would serve as a low-cost treatment.
- Case studies
 - Mackie (1998) undertook a study in the UK to monitor sites in Kent (semi-urban) and Humberside (rural) to assess the effect on speed of 20 mph (32 km/h) zones after having installed reinforcing static signage. The results were as follows:
 - mean speeds: 3.7% reduction from 26.7 to 25.7 mph (43 to 41.4 km/h) (Kent), 3.1% reduction from 28.3 to 27.4 mph (45.5 to 44.1 km/h) (Humberside)
 - 85th percentile speeds: 3.9% reduction from 33.3 to 32.0 mph (53.6 to 51.5 km/h) (Kent), 2% reduction from 34.7 to 34 mph (55.8 to 54.7 km/h) (Humberside).
 - Rose and Ullman (2003) used speed limit display signs in a study in Texas at permanent locations to evaluate their effectiveness in reducing speeds at speed-sensitive locations. The installation of a permanent speed limit sign at the entry of a school zone (posted speed limit of 55 mph (88.5 km/h)) led to a 9 mph (15 km/h) reduction in the average speed.

Figure 2.8: Example of a regulatory speed limit sign



Source: Department of Transport and Main Roads (2019).

- Stephan et al. (2007) reported on the installation of repeater speed signs on 2 50 km/h posted speed routes (Lonsdale Street and Exhibition Street) in Melbourne CBD and a before-and-after study. The results indicated a minimum net mean speed reduction of 1.59 km/h during the day on weekends and a maximum net mean speed reduction of 3.63 km/h on weekend nights.
- Prescott et al.(1990) investigated the effects of using 70 mph (112.7 km/h) repeater signs along a 20-mile (32.2 kilometres) motorway section in Yorkshire, England. Over a two-year period, the study found that additional signing had no significant effect on the travel speed of motorists.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Where the zoned speed may be different from the speed that drivers might expect by virtue of street lighting or roadside environment, consideration should be given to more frequent installation of repeater signs (TMR 2022a).
- The treatment may increase clutter and add to roadside hazards which could reduce the credibility of signage if drivers are overwhelmed by the increased stimuli (Austroads 2016a).

The application of repeater regulatory speed limit signs compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

‘New speed limit’ signs

The implementation of new speed limits, particularly lower limits, often takes drivers some time to adjust to the new limit. To facilitate a smooth transition to the new limit, signage can be used.

An example of the signs is shown in Figure 2.9.

The new speed limit signs have been applied in Victoria and are only displayed as a temporary measure no longer than 3 months (TMR 2022). Although no evaluation studies have been undertaken on the effectiveness of the signs, they are still warranted as an appropriate speed management activity.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Consultation with enforcement stakeholders.
- Effective when observed travel speed is higher than the risk-assessed speed limit.

The application of the signs compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Figure 2.9: Example of new speed limit ahead sign



TC2353

Source: Queensland MUTCD Part 4: Speed Controls (2022).

Black-link signage

In Queensland, high crash risk zones or black links target high-risk road sections with a history of crashes. They aim to improve road safety through targeted interventions and infrastructure improvements.

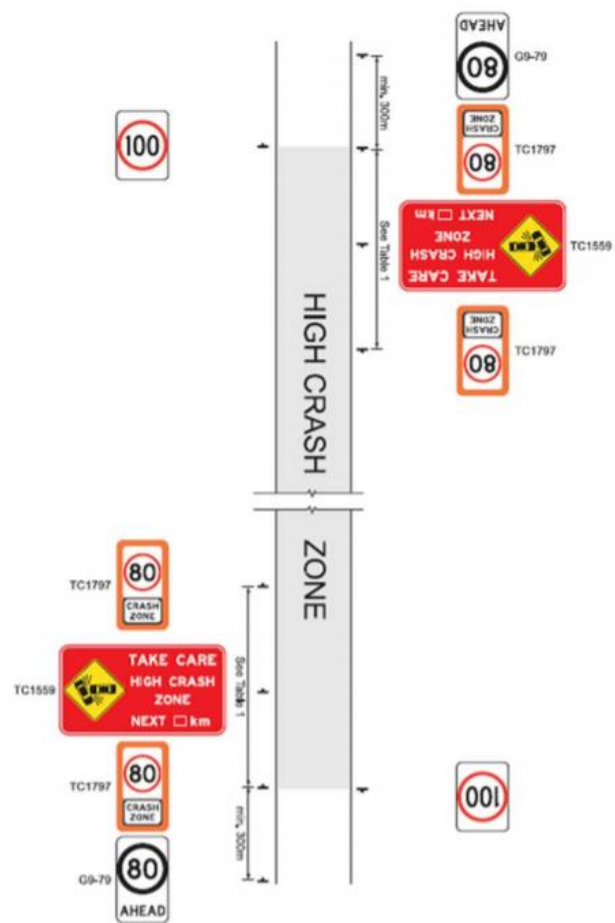
As outlined in Section 3.1.13 of the MUTCD Part 4, to ensure that drivers are able to differentiate between the speed environment in the reduced speed zones and a regular speed zone, specific signage can be installed to warn drivers that they are entering a speed zone where the speed limit has been reduced due to the poor safety performance of the section of road (TMR 2022a).

In order to support a reduction in the need for enforcement and a regulatory speed reduction in these areas, black link signage (Figure 2.10) can be used as a speed management activity.

The following findings were made for the installation of black link signage as a speed management activity:

- Expected speed reduction post treatment installation
 - Edgar and Tripathi (2011) reported a 7 to 12 km/h reduction in the 85th percentile speeds (speeds ranging from 105 km/h to 91 km/h).
- Indicative crash reduction post treatment installation
 - Edgar and Tripathi (2011) reported a 16% reduction in total crashes compared to the before five-year average.
 - Edgar and Tripathi (2011) reported an 11% reduction in fatal and serious injury (FSI) crashes compared to the before five-year average.
- Case studies
 - An evaluation undertaken by Edgar and Tripathi (2011) from December 2008 to April 2009 examined the effectiveness of the speed reduction (from 100 to 90 km/h) and high visual impact sign design in reducing speeds at 5 black link sites (AADT > 2,000 and speed limit of 80 km/h or greater) across Queensland. The study identified that significant speed and crash reductions were observed as a result of the speed management activities.

Figure 2.10: Example of typical signage layout for high crash zones (black links)



Source: TMR (2022a).

It should be noted that the treatment is typically adopted on higher-order roads with high vehicle volumes.

The application of black link signage compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Feedback Signs

While feedback signs are basically a form of vehicle-activated sign, they have been included in this section given they are most typically used to encourage greater levels of compliance, thereby reducing the need for enforcement (Austroads 2016a).

Radar or similar technology is deployed to measure the speed of an approaching vehicle and its speed is displayed (Austroads 2016a).

Various examples of feedback signage often include radar speed signs and speed-activated warning signs.

Radar Speed Signs

Radar speed signs aim to promote safety through increasing driver awareness of their travelling speed and to achieve better adherence to the speed limit in locations with identified or suspected speed issues. Examples of some of the radar speed signs (including pole mounted and mobile trailers) are shown in Figure 2.11.

Figure 2.11: Examples of radar speed signs



Source: Left - Burke (2015), right - Voxon (2020).

The following findings were made for radar speed signs as a speed management activity:

- Expected speed reduction post treatment installation
 - Burke (2015) reported an average speed reduction of 13% and an 85th percentile speed reduction of 10% across various speed zones and road hierarchies (i.e. from 40 to 70 km/h).
 - Wall et al. (2010) assessed speed advisory devices on rural roads in NSW and indicated reductions in the mean speed of around 14%, while compliance with the speed limit increased from around 50% to almost 90%.
- Approximate cost of installation
 - Burke (2015) indicated that the cost of installing a portable warning sign was approximately A\$13,000.

- Case studies

- Brisbane City Council's Portable Warning Signs Program evaluated by Burke (2015) included the installation of 26 portable speed warning signs being moved about 175 times around Brisbane. The program to the study date has shown an average speed reduction of 9.5 km/h after passing the signs displayed across various speed zones (including 40 to 70 km/h). Average speed reduction for all vehicles was approximately 5.2 km/h. The visual reminder has delivered a significant reduction in motorists travelling above the speed limit from 22.1% of 25.1 million vehicles to 8.7%
- In the study, 2 signs were also unmoved for a period of at least 23 weeks. It was found that the static signs were also effective in reducing speeds over a longer period.
- A mean speed reduction from 55 to 48 km/h (13%) was observed over the 23 weeks.
- An 85th percentile speed reduction from 59 to 54 km/h (10%) was observed over the 23 weeks.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider from the Brisbane City Council trial include:

- While the portable speed warning signs are not an enforcement tool, data from the signs was provided to the Queensland Police Service to help identify speeding hot spots.
- Practical challenges were predominantly to do with finding appropriate locations for the signs, with many streets being too short to be useful or lacking physical space to install the sign.

The application of radar speed signs compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Vehicle Activated Signs

Vehicle activated signs (VAS) are electronic signs that display a message when approached by a driver exceeding a speed threshold (NZ Transport Agency 2016). They are often used to warn drivers of an upcoming hazard (e.g. bend, crossroad, worksite, crash site) or where there are unpredictable weather conditions (e.g. fog). VAS are often applied at sites where standard reflectorised warning signs have been tried and have been found to not sufficiently warn drivers to reduce their speeds enough to safely negotiate a hazard.

Examples of speed-activated warning signs are shown in Figure 2.12.

The following findings were made for speed-activated warning signs as a speed management activity:

- Expected speed reduction post treatment
 - Winnett and Wheeler (2002) suggests a speed reduction of up to 11 km/h on approach to curves.
 - Mabbott and Cairney (2002) suggests a reduction in the mean speed in the order of 3.5 to 8 km/h is possible.
 - Austroads (2016a) suggests a reduction of 10 km/h in 85th percentile speeds (rural).

Figure 2.12: Examples of vehicle-activated signs



Source: Top – TMR (2021), bottom – NZ Transport Agency (2016).

- Makwasha and Turner (2014) reported a mean speed reduction of 3% for curve warning VASs and 4% for speed roundel VASs. They further reported an 85th percentile speed reduction of 6.4% for curve warning VASs and 5.4% for speed roundel VASs (rural roads).
- Indicative crash reduction post treatment
 - NZ Transport Agency (2016) suggests a 35% reduction in all crashes.
 - Charlton and Baas (2006) reported an 11% reduction in crashes with the use of dynamic or active signs.
- Approximate cost of treatment
 - Austroads (2016a) suggests that VASs would be a medium cost treatment.
 - Austroads (2014) suggests that VASs would be a medium cost treatment.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Vandalism of the signs can be a problem (NZ Transport Agency 2016).
- Where power supplies are difficult to access in remote areas, alternative power supplies (e.g. solar power) can be more expensive (NZ Transport Agency 2016).
- Can be used in combination with gateway treatments to create an effective transition zone between high and low-speed environments.
- Do not perform well on roads with (TMR 2016):
 - high volumes (i.e. AADT > 20,000 vehicles per day)
 - speed limit of 100 km/h or greater
 - more than 2 lanes in each direction
 - on approaches to hazards with vertical or horizontal curves or gradients
 - areas with a dense canopy of trees
 - roads with limited forward visibility
 - an overtaking lane is present.

The application of vehicle activated signs compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

2.1.4 Perceptual Countermeasures

Lane Narrowings

Lane narrowings are applied to the trafficable carriageway to reduce speeds, improve delineation and to minimise pedestrian crossing distances and therefore exposure to conflict (Austroads 2020). Reducing the width of existing vehicle lanes by marking wider edge lines, striped shoulders and central flush medians or wide centrelines can help to manage speed, reinforce the appropriate road category, and provide recovery space (NZ Transport Agency 2016).

Wider roads can lead to faster driving because they are perceived as safer, while narrower pavements tend to slow traffic. Line marking, such as wide centreline treatment can be used to narrow the perceived lane width and reduce speeds.

Examples of lane narrowing treatments are shown in Figure 2.13.

Figure 2.13: Examples of lane narrowings



Source: Left - NZ Transport Agency (2016), Right - Krammes (2009).

The following findings were made for lane-narrowing treatments as a speed management activity:

- Expected speed reduction post treatment
 - In a survey of visual lane narrowing treatments (cross-hatching and edge lines), the average reduction in mean speeds was 11 km/h (Charlton & Baas 2006).
 - A study by Heimbach et al. (1983) suggests that the narrowing of a lane by 0.3 m would tend to reduce speeds by approximately 1 km/h.
 - Harvey (1992) suggests that by narrowing the road, the result would be a speed reduction from a range of average speeds of 45 to 65 km/h (before treatment) to 40 to 55 km/h (post treatment) for a 50 km/h posted speed limit.
 - Distefano and Leonardi (2017) reported a 35 to 40% reduction in mean speeds.
- Approximate cost
 - Austroads (2014) suggests that lane narrowing would be a low to medium cost depending on the narrowing method used.
- Case studies
 - A study by Distefano and Leonardi (2017) in Italian urban speed environments (posted speed of 40 km/h), found a 35 to 40% speed reduction as a result of lane narrowing from 8 to 3.1 m. This led to an average 17 km/h reduction in the 85th percentile speeds and an average speed reduction of 16 km/h along the road section.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Often the treatment is not appropriate to use with the kerbside lane required for traffic, in locations with limited sight distance, in streets without adequate lighting or where the narrowing is such that it will pose a difficulty to buses and cyclists on fixed routes (Austroads 2020).
- The effectiveness of lane narrowings or kerb extensions can be increased (Austroads 2020) when used in combination with:
 - median treatments including splitter islands
 - flat-top road humps, wombat crossings, or raised pavements
 - road humps or cushions.

- Disadvantages of the treatment might include increased conflict between vehicles and cyclists (more squeeze points), less effective than many other horizontal displacement devices in reducing speeds, might encourage illegal overtaking and it may increase congestion (Austroads 2020).
- The width may be better utilised in a wider shoulder or as a wide centreline. The types of road uses and road functions need to be discussed as part of the application of these types of treatments to ensure safety is not compromised for any road users i.e. narrower lane width may be more appropriate in high pedestrian and cycle volume areas compared to rural routes with a high percentage of heavy vehicles (NZ Transport Agency 2016).

The application of lane narrowing compared to other speed management activities identified is summarised in Table 2.6.

Converging Chevron Linemarking Patterns

The converging chevron pattern is characterised by a series of chevrons on the pavement surface that are placed progressively closer (Yang et al. 2019). The intent of this treatment is to create the illusion that drivers are travelling faster than they really are and to foster the impression that the traffic lanes are narrowing.

An example of converging chevron linemarking patterns is shown in Figure 2.14.

The following findings were made for converging chevron linemarking patterns as a speed management activity:

- Expected speed reduction post treatment

In Wisconsin, Drakopoulos and Vergou (2003) evaluated the effect of converging chevron treatments and showed reductions in both the mean speeds of 15 mph (25 km/h) and 17 mph (28 km/h) in the 85th percentile speeds. This represented a 32% decrease in the 85th percentile speeds.

- Hunter et al. (2010) reported a 1 to 2 mph (1.6 to 3.2 km/h) reduction in both mean and 85th percentile speeds.

Figure 2.14: Example of converging chevron patterns



Source: Yang et al (2019).

- Indicative crash reduction post treatment

- Griffin and Reinhardt (1996) looked at patterns of converging chevrons on pavements in Japan and concluded that the chevron patterns may reduce crashes by as much as 25 to 50%.

- Case studies

- Hunter et al. (2010) in Atlanta, Georgia investigated the effectiveness of chevron markings in reducing vehicle speeds on two-lane freeway-to-freeway directional ramps. The analysis indicates that chevrons have a minimal effect on vehicle speeds, with drivers adjusting back to their previous speeds as they acclimatise to the treatment. The effect of the treatments on speed tended to be most pronounced immediately after the chevron implementation. However, by the 9th month after implementation the magnitude of the effect dropped to under 1 to 2 mph (1.6 to 3.2 km/h) for the mean speed and most vehicle speed percentiles.

It should be noted that chevron markings are often applied to higher speed environments where they are more effective in reducing speed.

Transverse lines, bars or optical speed bars

Transverse lines, bars or optical speed bars consist of intermittent pavement markings (either flush or raised) that extend across traffic lanes. Transverse lines can be used to alert drivers of a high crash risk area located on or as a warning to reduce their speed.

Examples of transverse lines, bars or optical speed bars are shown in Figure 2.15.

The following findings were made for transverse lines as a speed management activity:

- Expected speed reduction post treatment
 - VicRoads (2017) noted that the evidence for speed reduction for transverse lines (with rumble strips) is inconclusive, however some studies have shown reductions in mean speeds of 5–12%.
 - It also noted that flush transverse lines have a limited physical influence on travel speeds, however, they are largely seen as a perceptual countermeasure to warn drivers to slow down.
- Indicative crash reduction post treatment
 - Austroads (2016b) noted a 20% reduction in casualty crashes and a 30% reduction in FSI crashes post treatment.
- Approximate cost
 - VicRoads (2017) noted that the treatment has a relatively low cost rating.

Source: VicRoads (2017).



Some of the application and implementation difficulties and/or unintended consequences of the treatment identified in VicRoads (2017) to consider include:

- When using raised transverse lines, consideration needs to be given to the noise pollution in local streets as well as the ability of cyclists to be able to bypass them.
- Common practice is to reduce the spacing between successive transverse lines in the direction of travel in order to create a perceptual impression that a driver is speeding, encouraging drivers to respond by reducing their speeds.
- Site-specific installations should ensure that transverse lines have adequate skid resistance (particularly for motorcyclists), to reduce a skid resistance differential with the pavement surface.
- Pavement markings are subject to traffic wear and can require regular maintenance to ensure lines remain highly visible.
- Line visibility may be greatly affected in dark or wet conditions.
- The markings have commonly been used as a gateway treatment to rural townships.

The application of transverse lines compared to other speed management activities identified is summarised in Table 2.6.

Urban Landscaping

Various forms of landscaping can be used to alter drivers' perception of the road environment in order to influence vehicle speeds by creating a feeling of being in more of an enclosed space (Westerman et al. 1993). Some examples might include kerb extensions (reducing effective lane width) or tree planting of strips adjacent to the roadway (to create a canopy over the roadway).

An example of urban landscaping is shown in Figure 2.16.

The effectiveness of landscaping will vary for different types of treatments. VicRoads (2017) noted that the treatment has a medium cost rating.

Some of the application and implementation difficulties and/or unintended consequences of the treatment identified in VicRoads (2017) to consider include:

- Maintenance of any natural urban landscaping includes ensuring appropriate clearances for operational and safety reasons.
- Care should be taken to ensure that obstacles close to the road do not increase crash risks and continue to uphold a forgiving road environment for drivers.
- Landscaping should not impede any sight distances, pedestrian visibility or obstruct any surrounding services (e.g. underground, overhead).

Figure 2.16: Example of urban landscaping



Source: VicRoads (2017).

The application of urban landscaping compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Shared Space – lower speed zones

Shared spaces or naked roads are an urban design concept where the priority for users is shifted from vehicles towards pedestrians and cyclists, complemented by a speed limit reduction. This treatment is more common in areas where 'place' as a function is more important than the through traffic.

For example, cycle streets (CSs) are local access roads that are part of the principal cycle network and designed to encourage bicycle use. They are typically used in low volume and low speed environments, particularly on local residential streets. CSs are a mixed traffic environment and allow bicycle riders to use the centre of the road while drivers use the rough textured edges. A narrow service road along an arterial road can also be designed as a CS, accommodating access functions for vehicles while serving as a through function for bicycle traffic (TMR 2018). While shared spaces can be achieved in different ways, the general concept involves removing conventional road management systems such as traffic signals and signs, kerbs, barriers and line markings (Austroads 2016a).

Examples of a shared space and a shared zone sign are shown in Figure 2.17.

Figure 2.17: Example of a shared space and shared zone sign



Source: NZ Transport Agency (2016).

The following findings were made for shared spaces or naked roads as a speed management activity:

- Expected speed reduction post treatment
 - Austroads (2016b) notes that there are mixed results for this treatment, although some studies show up to a 13 km/h reduction in mean and 85th percentile speed.
 - Department of Transport (2012) reported a 27–35% reduction in 85th percentile speeds in Bendigo, Victoria.
 - Webster and Mackie (1996) reported a 15 km/h reduction in mean speeds across all UK trial sites.
- Indicative crash reduction post treatment
 - Austroads (2016b) notes that there are mixed results for this treatment with some studies showing safety improvements, while others report increases in risk, particularly for vulnerable roads users. Some studies show a 49% reduction in casualty crashes, crash modification factor (CMF) 0.51.
 - Webster and Mackie (1996) reported a 60–70% reduction in crashes across all UK trial sites.
- Case studies
 - A shared space installed by the City of Greater Bendigo in the town centre (Department of Transport 2012) at the intersection of Bull Street and Hargreaves Street resulted in average 85th percentile speeds reducing from 40 km/h to between 26 to 29 km/h.
 - Webster and Mackie (1996) found that using 20 mph (32.2 km/h) zones in the UK led to a reduction of 60% in injury crashes, 70% in fatal crashes and over a 9 mph (about 14.5 km/h) reduction in average speeds across all areas. Public acceptance surveys were carried out and the results showed residents were generally in favour of the schemes.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Spaces are normally designed for operational speeds of 10 to 15 km/h, however, can be posted up to 30 km/h (NZ Transport Agency 2016).
- Various implementation issues are also of concern (Austroads 2016a):
 - Shared space applications depend on the area-specific traffic and spatial problems.
 - They require substantial re-design of road and pedestrian space to create a distinct environment.
 - There could be confusion with who has priority.
 - This treatment can present some problems for the visually and hearing impaired.

- From an application standpoint as well, shared spaces are typically applied in high pedestrian volume areas, including strip shopping centres and they should not be considered as a treatment for roads with traffic volumes of more than 15,000 vehicles per day (Austroads 2016a).

The application of shared spaces (lower speed zones) compared to other speed management activities identified is summarised in Table 2.6.

Raised Retroreflective Pavement Markers (RRPMs) - inside edgeline

Some practitioners in the workshop consultation (Section 2.5) identified that the installation of RRPMs on the inside of the edgeline had been effective as a speed management activity. This had a similar effect as narrowing the lane width.

Examples of RRPMs on the inside of the edgeline are shown in Figure 2.18.

Figure 2.18: Examples of RRPMs (inside edgeline)



Source: Google Maps 2020, image, map data, Google, CA, USA.

The following findings were made for RRPMs (inside edgeline) as a speed management activity:

- Approximate cost
 - Cairns Regional Council reported that the treatment was a relatively low-cost option in the workshop consultation (Section 2.5).
- Case studies
 - Cairns Regional Council reported in the workshop that it had used the treatment and had received positive feedback from drivers and particularly the cyclist community. The cost was noted as being relatively low and effective in reducing mid-block speeds, however no evaluation study has been undertaken to date.

It should be noted in regard to maintenance that the rate of replacement is the same as RRPMs which have been placed on centreline treatments.

The application of RRPMs (inside edgeline) compared to other speed management activities identified is summarised in Table 2.6.

2.1.5 Other Roadside Environment Treatments

Gateway treatments

Gateway treatments predominantly involve the use of signs with other techniques to create a threshold or gateway between high and low speed environments.

Examples of gateway treatments are shown in Figure 2.19.

Figure 2.19: Examples of gateway treatments



Source: Austroads (2016b).

There was no available literature on the effectiveness of gateway treatments on urban roads. Consequently, the following findings for rural roads are provided as an indicative measure.

- Expected speed reduction post treatment
 - Austroads (2016b) suggests that for rural sites, a reduction of up to a 25 km/h in the 85th percentile speed and up to 15 km/h in the mean speed could be achieved.
 - American Traffic Safety Services Association (2016) reported a 1.6–11.2 km/h reduction in mean speeds and a 1.6–14.4 km/h in 85th percentile speeds as a result of coloured surface gateway treatments in a rural town in Iowa.
- Indicative crash reduction post treatment
 - Austroads (2016b) suggests that for rural sites, the following could be achieved:
 - 25% reduction in casualty crashes
 - 35% reduction in casualty crashes if pinch point used
 - 40% reduction in FSI crashes if pinch point is used.
 - Charlton and Baas (2006) suggests a 15 to 27% reduction in crashes if high visibility and physical features are used for a gateway treatment (the left image in Figure 2.19). An 11 to 20% reduction in crashes would be expected through using visual narrowing treatments as a gateway treatment (the right image in Figure 2.19).
 - Taylor and Wheeler (2000) reported a 43% reduction in fatal and serious accidents on interurban roads in British villages.
 - Austroads (2014) suggest that for rural sites, a crash reduction of 35% would be expected.
- Case studies
 - Taylor and Wheeler (2000) evaluated the effects of 56 traffic-calming schemes in British villages on main interurban roads where the speed on the approach to the villages was typically 90 km/h. It was found that the schemes with only gateway measures resulted in a reduction in fatal and serious crashes within the villages of 43%; the number of minor crashes increased by 5%.
 - American Traffic Safety Services Association (2016) evaluated coloured gateways with 35 mph (56.3 km/h) speed limit markers on the entrances to a small community in Iowa to slow vehicles entering the town from a 55 mph (88.5 km/h) speed limit outside the town. Overall, the treatments produced statistically significant reductions in the mean speed ranging from 1 to 7 mph (1.6 to 11.3 km/h) and reductions in 85th percentile speed ranging from 1 to 9 mph (1.6 to 14.5 km/h).

Consideration should also be given to some of the application and implementation difficulties and/or unintended consequences of the treatment (Austroads 2016a), including:

- Gateway treatments need to be located at the point where development commences to be most effective.
- The treatments should be backed up by changes in the environment (e.g. use of painted medians) after the threshold to maintain the speed reductions.
- Introduction of street furniture may introduce hazards for errant vehicles.
- Care should be taken so that the gateway does not have a negative effect on skid resistance, presenting an additional risk, particularly for motorcyclists.
- There may be maintenance issues associated with this treatment.
- Gateway treatments are only suitable for transition zones or where there are clear changes in traffic conditions and the speed environment (e.g. entry to a shopping strip).
- The speed reduction produced by a gateway treatment may dissipate within 250 m if there are no downstream changes in the road conditions, such as decreases in road width or an increase in urban density (Charlton & Baas 2006).

The application of gateway treatments compared to other speed management activities identified is summarised in Table 2.6.

Pavement texturing and colouring

Pavement texturing and surface colouring is a common treatment used to emphasise a traffic calming feature or to warn drivers to reduce their operating speed. It involves the use of paving materials such as bricks, cobbles, concrete pavers, or other materials that create variation in colour and texture to highlight the road section.

Often these surfaces might include words, numerals and symbols that are marked on the pavements to provide guidance, warning or regulatory messages to drivers and can be designed in accordance with Queensland MUTCD Part 2.

Examples of pavement texturing and colouring are shown in Figure 2.20.

Figure 2.20: Examples of pavement texturing and colouring



Source: Left - NZ Transport Agency (2016), Right - Krammes (2009).

The following findings were made for pavement texturing and colouring as a speed management activity:

- Expected speed reduction post treatment
 - Taylor et al. (2002) found that using colour bands incorporating a slow marking was found to be effective in reducing mean speeds by 6 mph (10 km/h) on a driving simulator on a 60 mph (100 km/h) road.

- Krammes and Sheldahl (2009) reported a 57% reduction in vehicles speeding 24 km/h over the posted speed limit. A 2% speed reduction was found in the 85th percentile speeds.
 - Hallmark et al. (2008) reported an average speed reduction of 8 km/h using painted speed reinforcement.
 - Nogueira and Mennis (2019) reported that paved bricks reduced mean speeds by approximately 13% and granite blocks reduced average speeds by approximately 31% compared to asphalt-paved city streets in the USA.
 - Jones and Lutes (2016) reported a 30% decrease in mean speeds following a brick installation project in Florida.
 - Te Velde (1985) found an average speed reduction of 5% when road segments transitioned from smooth to rough surfaces but found no immediate increase in speed when roads transitioned from rough to smooth surfaces.
- Case studies
 - Krammer and Sheldahl (2013) found in Iowa that there were significant drops in the average speed of vehicles by installing painted speed reinforcement. The largest reduction in speed of 57% was seen in cars travelling over 15 mph (24.1 km/h) over the speed limit. The study further noted a 2% speed reduction in the 85th percentile speed.
 - Hallmark et al. (2008) found evidence that with increased AADT, the effectiveness of painted speed reinforcement increased drastically. The study revealed that on average, there was a 5 mph (8 km/h) reduction in speed, but this reduction doubled to 9 mph (14.5 km/h) when the AADT increased. This suggests that by encouraging a small number of drivers to slow down, it can have a ripple effect on the rest of the vehicles, resulting in a general reduction in speed.
 - Nogueira and Mennis (2019) studied the effect of brick and granite block paving materials in reducing speeds on 18 city roads in the USA, mostly with posted speeds of approximately 40 km/h. Results suggest that paved bricks reduced average speeds by approximately 5 km/h (13%) and granite blocks reduced average speeds by approximately 11 km/h (31%), compared to asphalt-paved city streets.
 - Jones and Lutes (2016) found that in Florida the average speed dropped from 41 to 29 mph (66 to 46.7 km/h) (30% decrease) following a brick installation project in 1996.

It should be noted that the effectiveness of the original colour coating can degrade over time, requiring ongoing maintenance (NZ Transport Agency 2016).

The application of pavement texturing and colouring compared to other speed management activities identified is summarised in Table 2.6.

2.2 Enforcement Measures

Enforcement is an important measure to encourage drivers to obey the road rules and comply with the speed limits. The Queensland Camera Detected Offence Program (CDOP) includes various camera-based traffic enforcement methods, including speed cameras (fixed, mobile, point-to-point and combined red light and speed cameras). Additionally, feedback advisory signs (including portable warning signs and speed-activated warning signs, see Section 2.1.3) and various penalties (including demerit points, licence suspension, enforcement tolerances and speed compliance incentives) have been incorporated to target the reduction of vehicle speeds and crashes. Use of these mechanisms will continue to influence driver behaviour.

2.2.1 Cameras and Radar

Fixed speed cameras

Fixed speed cameras are permanently installed at high-risk locations, the aim being to reduce vehicle speeds and subsequently fatal and serious injury crashes. Their effectiveness has been assessed both nationally and internationally (Elvik & Vaa 2009; Gains et al. 2004; Diamantopoulou & Corben 2002). They have been found to reduce vehicle speeds, the proportion of drivers exceeding the speed limit, and the number of crashes.

An example of fixed speed cameras is shown in Figure 2.21.

The following findings were made for fixed speed cameras as a speed management activity:

- Expected speed reduction post treatment
 - Gains et al. (2005) suggests an average speed reduction of 6% at new sites with the reductions being greater at sites with speed limits of 30 or 40 mph or (50 to 65 km/h) (7%) compared to sites with higher speed limits (3%). Excessive speed fell by 91% at fixed camera speed sites.
 - PA Consulting (2001) suggests a 71% reduction in the total proportion of vehicles speeding.
 - ARRB Transport Research (2005) reported a 6 km/h reduction in mean speeds and a 4 to 20% reduction in 85th percentile speeds across urban and rural trial sites in NSW.
 - Diamantopoulou and Corben (2002) reported a 3.4% reduction in vehicle speeds at a Melbourne trial site (posted speed limit of 80 km/h).
- Indicative crash reduction post treatment
 - Gains et al. (2005) suggests a crash reduction of 42% with respect to FSI crashes.
 - PA Consulting (2001) suggests a 35% reduction in casualty crashes and a 47% reduction in serious casualty crashes.
 - Elvik and Vaa (2004) reports on a meta-analysis of the combined results of 10 individual, methodologically sound studies in the period 1984–96. In urban areas a 28% crash reduction was found and in rural areas a 16% crash reduction on roads that were equipped with fixed speed cameras.
 - Transport for NSW (2015) reported an average reduction of 38% in injury crashes.
 - ARRB Transport Research (2005) reported a 23% reduction in casualty crashes across rural and urban trial sites in NSW.
- Case studies
 - Transport for NSW (2015) found that, overall, when comparing 5 years of crash data before and after the fixed speed cameras were installed there had been a:
 - 38% reduction in the number of injury crashes
 - 91% reduction in fatalities
 - 42% reduction in injuries.

Figure 2.21: Example of fixed speed cameras



Source: ARRB Transport Research (2005).

- ARRB Transport Research (2005) undertook a before-and-after assessment of speed and casualty reductions at 28 sites in rural and urban NSW as a result of the implementation of fixed speed cameras. The data showed a reduction in mean speed of around 6 km/h after both 12 and 24 months, with the 85th percentile speed dropping by between 4 to 20% over the 2-year study. There were large reductions in the percentage of drivers exceeding the speed limit by 10, 20 and 30 km/h, however there were small increases in the proportion of speeding drivers along adjacent lengths of road. Along the study routes, casualty crashes reduced by 23% and fatal crashes by nearly 90%.
- Diamantopoulou and Corben (2002) found average vehicle speeds dropped by 3.4% in the Domain Tunnel in Melbourne. It was concluded that the cameras significantly reduced the proportion of drivers exceeding the 80 km/h speed limit and the incidence of extreme speeding (> 30 km/h over the limit).
- Elvik and Vaa (2009), Gains et al. (2004) and Mountain et al. (2004) have also indicated reductions in speed and the incidence and severity of crashes. The crash reductions ranged between 22% and 28% for all urban crashes.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Using camera fines to improve road safety through education, safer practices, rehabilitating persons who have been injured in road crashes, and enhancing infrastructure and technologies on state-controlled roads (Department of Transport and Main Roads 2023).
- Some members of the public may view speed cameras as a means to generate funds (Soole et al. 2010).

The application of fixed speed cameras compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Mobile speed cameras

Mobile speed cameras are similar to fixed speed cameras, but they can be moved from location to location (e.g. on a trailer), allowing speed enforcement to be targeted given specific conditions. Trailer speed cameras are often used in areas that are not safe or practical for a mobile speed camera vehicle. These cameras are often used in high-risk locations, including high-speed road corridors, road work areas and school zones. The unpredictability of their location also contributes to speed reductions.

An example of a trailer speed camera is shown in Figure 2.22.

The following findings were made for mobile speed cameras as a speed management activity:

- Expected speed reduction post treatment
 - Anderson and Edgar (2001) reported 85th percentile speed reductions on urban arterial roads in the ACT, and that the number of drivers more than 10 km/h above the speed limit was 59% lower at the speed camera sites.
 - Gunarta and Kerr (2005) reported a 2.2 km/h speed reduction in mean speeds (in a posted 50 km/h zone) in Christchurch.
 - De Pauw et al. (2014) reported a 2.3 km/h reduction in mean speeds in urban areas and a 1.6 km/h reduction in mean speeds in rural areas.
- Indicative crash reduction post treatment

Figure 2.22: Example of mobile speed cameras



Source: Austroads (2016a).

- Newstead and Cameron (2003) found a 45% reduction in the number of fatal crashes within 2 km of speed camera sites and significant reductions in other crash types, across a state-wide program.
 - Anderson and Edgar (2001) notes a 36% reduction in FSI crashes at sites with mobile speed cameras.
 - Bobevski et al. (2004) suggests that on average, a 1% increase in mobile speed camera hours is significantly associated with a 0.09% decrease in casualty crash frequency.
 - Goldenbeld and van Schagen (2005) reported a 21% reduction in casualty crashes on 80 to 100 km/h rural roads in the Netherlands.
 - Gunarta and Kerr (2005) reported a 6–12% reduction in crashes in a Christchurch study.
 - Chen et al. (2000) reported an 11–25% reduction in crashes in a Canadian study.
 - Gains et al. (2004) reported a 15% reduction in crashes in a UK study.
 - Jones et al. (2007) reported a 19% (all crashes) and 44% (FSI crashes) reduction in a study in rural England.
 - Newstead et al. (2018) indicates that mobile speed cameras, which are a part of the Camera Detected Offence Program (CDOP) technology, are responsible for monitoring the highest number of crashes in Queensland. These cameras have been found to have a significant impact on reducing casualty crashes, with state-wide reductions estimated at 13% in 2016, and the reduction in serious casualty crashes estimated at 15%.
- Case studies
 - A Netherlands covert mobile speed camera study (1998–2002) of vehicles travelling on 80 and 100 km/h rural roads, with enforcement levels ranging from approximately 5,500 hours in 1998 to 14,500 hours in 2001. Over the five-year period, a 21% reduction in both all casualty crashes and serious casualties was estimated (Goldenbeld & van Schagen 2005).
 - A Christchurch overt mobile speed camera study was undertaken at various sites across the city for roads with a posted speed limit of 50 km/h. Speed cameras were found to reduce mean speeds by about 2.2 km/h. The study estimated a reduction in casualty crashes of approximately 6% and fatal crashes of approximately 12% in the area surrounding the camera sites (Gunarta & Kerr 2005).
 - In Canada, Chen et al. (2000) assessed the effects of mobile cameras at major rural roads and reported a reduction of 25% in daytime speed-related crashes, 11% in daytime serious injuries and 17% in daytime fatalities.
 - In the UK, Gains et al. (2004) reported on the results of an evaluation study of the British Safety Camera Program. Mobile speed enforcement in rural areas resulted in a 15% reduction in the number of injury crashes.
 - Jones et al. (2007) assessed the impact on crash and casualty numbers from the introduction of mobile speed cameras in rural Norfolk, England. Crash data was collected for 2 years before and after the introduction of the cameras. Across the entire program (including streets with and without cameras) overall crashes decreased by 1% and crashes involving fatal or serious injuries declined by 9% on roads where cameras were not placed. At mobile speed camera sites, crashes decreased by 19% and fatal and serious injury crashes decreased by 44%.
 - A four-year evaluation of mobile speed camera sites in London showed a 1.4 mph (2.3 km/h) reduction in average speed in urban areas and a 1 mph (1.6 km/h) reduction in average speed on rural roads. In the year ending in March 2004, it was estimated that between 150 and 400 FSI crashes on urban roads and between 90 and 120 FSI crashes on rural roads were prevented (De Pauw et al. 2014).

Some of the application and implementation difficulties and/or unintended consequences of the treatment identified in ARRB (2019) to consider include:

- Unmarked and unsigned deployments should be present at most sites in order to enforce to road users that they can be caught and punished anywhere and anytime.

- Overt deployments at specific sites could result in a halo effect, resulting in site-specific deterrence rather than general network-wide deterrence.
- Signage should not be placed in advance of mobile speed cameras as it allows drivers to adjust speed in advance of the site, decreasing the certainty of punishment.
- Site selection should be based on crash risk (see Section 2.2.2).
- Once sites have been selected, a random deployment schedule should be adopted using a computer algorithm or statistical analysis to ensure the selection is truly random.

The application of mobile speed cameras compared to other speed management activities identified is summarised in Table 2.6.

Point-to-point speed cameras

Point-to-point speed cameras use pairs of cameras to determine an average speed along a known distance between them. A number of cameras are mounted at staged intervals along a particular route and are linked to measure the time taken to travel between at least 2 given points. The distance between the 2 sites may vary from as low as 300 metres to many kilometres and an enforcement threshold may be implemented in a similar manner to mobile or fixed speed camera operations (Cameron & Delaney 2006).

An example of a point-to-point speed camera operation is shown in Figure 2.23.

Figure 2.23: Example of point-to-point speed cameras



Source: Austroads (2016a).

The following findings were made for point-to-point speed cameras as a speed management activity:

- Expected speed reduction post treatment
 - Speed Check Services (2010) reported a 22% reduction in 85th percentile speeds in an English study.
 - Stoelhorst (2008) reported a mean speed reduction of 15–20 km/h from a speed limit of 100 km/h in a Dutch study.
- Indicative crash reduction post treatment
 - Austroads (2012) suggests that FSI crashes typically had reduced by 35 to 85% following the introduction of point-to-point speed limit enforcement.
 - Høy (2015) undertook an evaluation in Norway, suggesting that point-to-point camera enforcement reduces deaths and serious injuries by 49%.
- Approximate cost of implementing point-to-point speed cameras
 - In South Australia, Department of Planning, Transport and Infrastructure (DPTI) have a reported budget of A\$1.75 million (over a two-year period) allocated for the development and implementation of infrastructure, system hardware and development of back office software. Moreover, South Australian Police (SAPol) have been allocated an additional A\$500 000 for software development for the purpose of updating their systems to be capable for digital enforcement technology (Lynch, 2010).
 - An early estimate given in 2003 for the cost of the Victorian system was A\$2 million, however the final specifications changed significantly in the years preceding its full implementation in 2007 (Cameron 2008).

- Case studies
 - Speed Check Services (2010) carried out a study in Northampton, England on a road with a 50 mph (80.5 km/h) posted speed limit. Comparing 3 years prior to 3 years post installation it found that 85th percentile speeds reduced from 58 mph (93 km/h) to 45 mph (72 km/h).
 - A study carried out in Rotterdam, Netherlands on a road with a posted speed of 80 km/h found that free-flow average speeds reduced by 15 to 20 km/h; average speed reduced from 100 to 80 km/h for passenger vehicles and 90 to 80 km/h for heavy vehicles; speed variation and 85th percentile speeds also reduced (exact amounts not detailed); offence rates reduced from 4.6 to 0.6% (weekday) and 0.9% (weekend) – estimated traffic volume of 124,000 vehicles per day (Stoelhorst 2008).

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Concerns are regularly expressed regarding the privacy and security of data stored by point-to-point systems (Orozova-Bekkevold et al. 2007). These concerns include ensuring the security of stored data, particularly at roadside processors.
- Synchronisation of clocks used in point-to-point enforcement systems has been flagged as an issue (Austroads 2012).
- There are concerns with the accuracy of video data accurately capturing number plates (Austroads 2012).
- Keenan (2002) notes that a significant proportion of drivers often alter their speed behaviour close to the installations, suddenly applying their brakes prior to the camera and then accelerating immediately after, often resulting in inflated crash statistics.

The application of point-point speed cameras compared to other speed management activities identified is summarised in Table 2.6.

Combined red light and speed cameras

Combined red light and speed cameras are located at intersections to detect both red light and speeding offences; drivers can also be fined for both offences if speeding through a red light. They are typically placed at intersections where speed-related crashes have occurred.

Examples of combined red light and speed cameras are shown in Figure 2.24.

Figure 2.24: Examples of combined red light and speed cameras



Source: NRMA (n.d.).

The following findings were made for combined red light and speed cameras as a speed management activity:

- Indicative crash reduction post treatment
 - NSW Road Traffic Authority estimated a casualty crash reduction of 30% at sites with combined red light and speed cameras (NRMA n.d.).

- Studies of combined red-light and speed cameras are limited. Using proper controls, a study of combined red light and speed cameras in Edmonton, Canada, found significant reductions in total crashes (25%), angle crashes (33%), and rear-end crashes (11%) (Contini & El-Basyouny 2016).
- Cameron and Delaney (2006) reported a 47% reduction in casualty crashes in a Victorian study.
- Case studies
 - Newstead and Cameron (2003) analysed the crash effects of 87 signed fixed digital speed and red-light cameras. When only the crashes involving vehicles travelling from the approach intersection leg where the camera was placed are considered, the estimated casualty crash reduction was 47% compared with a 26% casualty crash reduction when all approach legs of the intersections are considered.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Concerns with the accuracy of video data collected have been raised.
- Typical combined red light and speed cameras only capture data on one leg of the intersection, however at major road intersections, speeding can often occur on multiple legs. In Germany, multi-leg combined red light and speed cameras are used to capture multiple intersection legs (Vitronic 2020).

The application of combined red light and speed cameras compared to other speed management activities identified is summarised in Table 2.6.

2.2.2 Police Presence

Patrol movements

Where camera-based operations cannot be introduced in the short term, effective compliance can be achieved (particularly in urban areas) with police patrol movements (including handheld radar or laser devices) and interception strategies. These include:

- regular patrols (including both overt and covert vehicles)
- targeted re-routing of patrol movements to high-risk streets (i.e. based on crash and speed history).

The perception of speed enforcement is a much stronger behavioural influence than messages about the injury risk of speeding (WHO 2008). In some countries, being detected by police and charged with an offence is more likely than having a serious crash, therefore, to the individual, the risk of being caught and penalised is more likely to influence the choice to speed than fear of a crash (WHO 2008).

Deterrence is most effective when potential offenders perceive a high likelihood of punishment and believe it will be swift and severe (Davey & Freeman 2011). Therefore, the variability and predictability of patrol movements can be an effective speed management activity.

Radar and laser speed measuring devices are generally accurate to within ± 3 km/h and ± 2 km/h respectively. Various speed check enforcement methods can include:

- radar checks from inconspicuous police cars
- radar checks from a hidden tripod outside a police car
- laser gun (with stopping of the offender)
- other (surveillance, video car, laser camera).

Figure 2.25: Examples of radar (left) and laser (right) equipment



Source: WHO (2008)

Examples of radar and laser equipment are shown in Figure 2.25.

The following findings were made for radar and laser equipment as a speed management activity:

- Expected speed reduction post treatment
 - Goldenbeld and van Shagen (2005) reported a 4.8% reduction in mean speeds on rural roads (posted speeds between 80 to 100 km/h) in a Dutch study.
 - Vaa (1997) reported a mean speed reduction of 0.9–4.8 km/h in a Norwegian study on semi-rural roads (posted speeds of 60–80 km/h).
 - Chen et al. (2000) reported a 2.8 km/h mean speed reduction using photo radar (rural sites).
- Indicative crash reduction post treatment
 - Goldenbeld and van Shagen (2005) reported a 21% reduction in casualty crashes in a Dutch study.
 - Diamantopoulou & Cameron (2002) reported a 71.3% reduction in incident crashes in a Victorian study.
 - Chen et al. (2000) reported an overall crash reduction of 16% as a result of the use of photo radar.
- Case studies
 - A study by Goldenbeld and van Schagen (2005) on rural roads in the Netherlands (posted speeds between 80 and 100 km/h) involved radar and laser speed checks across 116 km of road. The findings over the five-year testing period included:
 - On the 80 km/h posted speed roads, the mean speed was found to drop from 82.6 to 78.6 km/h, compared to the non-enforced roads which recorded a minor average speed reduction from 83.1 to 81.5 km/h.
 - There was an estimated reduction of 21% in both the number of injury crashes and the number of serious casualties. This was based on a comparison between the number of crashes and casualties during the enforcement project (5 years) and the 8 preceding years on the enforced roads and at all other roads outside urban areas in the same region.
 - A study by Diamantopoulou and Cameron (2002) covering the years 1992 to 1997 throughout rural Victoria evaluated the use of mobile radar, covert patrol cars using mobile radar and mixed overt and covert cars using mobile radar (73 radars in total) on roads with posted speed limits of 100 km/h. A net reduction of 71.3% was found for injury crashes occurring on the same day or up to 4 days after the enforcement was present. The effect was strongest (a net 73.9% reduction) on the day when a mix of overt and covert enforcement was in use.
 - A study by Chen et al. (2000) in rural British Columbia on a 22 km highway corridor investigated the use of photo radar at 12 locations along the corridor from 1995 to 1998. A mean speed reduction of 2.8 km/h was found at a monitoring site 2 km from the treatment area. A crash reduction of 14% was expected at the treatment locations, 19% at the non-treatment location, and an overall reduction of 16% along the study corridor as a whole.

- A study by Vaa (1997) in Oslo (Norway) along a 35 km stretch of semi-rural roads with mainly 80 km/h posted speed limits (short sections of 60 km/h when travelling through populated communities) was undertaken over a 16-week period in 1991. Five police patrols using stationary speed enforcement with observation units (mainly in unmarked hidden cars) measuring speed by radar or laser gun and 'stop' units using marked visible police cars undertook the enforcement. An average of 9 hours of enforcement was used on a daily basis. Average speeds were reduced by 0.9 to 4.8 km/h in both speed limit zones for all times of the day. The proportion of speeding drivers was reduced by 10% in both speed limit zones.

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Unmarked and unsigned deployments should be present at most sites to enforce to road users that they can be caught and punished anywhere and anytime (ARRB 2019).
- Overt deployments at specific sites could result in a halo effect, resulting in site-specific deterrence rather than general network-wide deterrence (ARRB 2019).

The application of patrol movements compared to other speed management activities identified is summarised in Table 2.6.

Multi-purpose bays

In order for Queensland Police Service (QPS) to undertake safe enforcement of the network, multi-purpose bays have historically been used to help police in intercepting vehicles when necessary. An increased police presence facilitates more opportunities to influence driver behaviour and detect high-risk road users, particularly on narrow roads.

The identification of high-risk locations that might warrant a multi-purpose bay could be achieved through using historical road crash data. For example, QPS identified that motorcyclists constituted 20 to 25% of all road fatalities in recent years, many of which occurred on narrow winding roads that were difficult for police to undertake static enforcement due to the lack of multi-purpose bays (TMR & QPS 2017). TMR subsequently identified 14 of the state's highest-risk motorcycle routes and constructed 46 multi-purpose bays along the roads to enable a heightened police presence to influence road user behaviour.

Figure 2.26: Example of multi-purpose bay



Source: Department of Transport and Main Roads.

An example of multi-purpose bays as shown in Figure 2.26.

The application of multi-purpose bays compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

2.2.3 Penalties

In order to maximise the effectiveness of engineering features and enforcement policies, authorities impose penalties on drivers who are caught speeding. The penalties can include monetary fines, the loss of demerit points, impounding vehicles and cancelling licences (Austroads 2016a). The literature available on the

potential speed and crash reduction following a change in penalties enforced is limited, with only a few case studies available.

Demerit points

Doubling of demerit penalties for speeding offences in NSW (WHO 2008). In 1999, during a trial period that spanned 45 days and focused on promoting awareness of the penalties and implementing stricter enforcement measures, several outcomes were observed:

- decrease of between 27 to 34% in fatal crashes
- reductions in traffic infringements
- estimated \$1 million worth of additional media support
- high levels of community awareness and support.

The application of demerit points compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Licence suspension

A study in Poland found that licence suspension for 3 months for exceeding the 50 km/h speed limit in an urban area led to a 20% reduction in crashes, a 30.2% reduction in fatalities, a 20.7% reduction in injuries and an 11.9% reduction in speed offences (Global Road Safety Partnership 2019).

The application of licence suspension compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Enforcement tolerance (or threshold speed)

The enforcement tolerance (otherwise known as threshold speed) is the trigger speed at which cameras are set or the enforcement level applied by on-road policing (WHO 2008). The literature available on the potential speed and crash reduction is limited, with only a few case studies exploring the impacts.

The European Conference of Ministers of Transport (2006) stated that since the introduction of tougher enforcement tolerances in Victoria, there had been a 43% reduction in fatalities in metropolitan Melbourne from 2001 to 2003 across all road user categories.

Reduced tolerance levels of 3 to 5 km/h in 2 urban sites in Sweden from 1986 to 1987 resulted in a drop in the mean speed by 0.8 to 1.2 km/h (around 2%) compared to the uncontrolled sites (Cameron et al. 2003).

New Zealand enforced a flat 10 km/h enforcement threshold across all roads in July 2000. There was a 50% reduction in the proportion of vehicles detected exceeding the 10 km/h tolerance at camera sites in the first 6 weeks following the introduction of the speed tolerance. The proportion of drivers travelling over 110 km/h on rural roads fell from levels of 24 to 26% during 1997–99, to 20% in 2000, 15% in 2001 and 10% in 2002 (Cameron et al. 2003).

The application of an enforcement tolerance compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Vehicle Impoundment

Vehicle impoundment is a countermeasure that is used in all Australian jurisdictions to combat high range and repeat speed offenders (Watson 2020). Vehicles which are impounded are held in a storage facility for a pre-determined time based on the legislation in the jurisdiction, but this could vary from 2 days to several months.

Vehicle impoundment is a common tool which has been used in the USA for over 20 years (Centers for Disease Control and Prevention 2015). The research on the effectiveness of impoundment in reducing recidivism varies.

A Californian study undertaken in 1994–95 found that repeat offenders who had their vehicle impounded had 22% fewer driving convictions and 38% fewer crashes (DeYoung 1999). However, other studies in the USA have found relatively little impact of impoundment or could not isolate the effectiveness of impoundment from other treatments (DeYoung 2000; Beirness et al. 1997).

A study was undertaken in Victoria using a two-stage approach to investigate the effectiveness of impoundment in reducing speed-related reoffending rates (Watson et al. 2020). Stage 1 (48-hour impoundment) included all offenders with an eligible offence between 1 July 2006 and 30 June 2011, with Stage 2 (30-day impoundment) including all offenders with an eligible offence between 1 July 2011 and 31 December 2014. The results were as follows:

- During Stage 1, there were 11,048 offenders with an impoundment offence, of these, 4,323 (39%) had their vehicle impounded
 - Those who had their vehicle impounded had lower offence rates (between 15 and 51%) compared with offenders who did not have their vehicle impounded.
- During Stage 2, there were 6,392 offenders with at least one eligible offence of which 2,922 had their vehicle impounded
 - Those who had their vehicle impounded had lower offence rates (between 16 and 55%) compared with offenders who did not have their vehicle impounded.

In late 2013, QPS launched an education campaign called '*Go too far, loose your car*' (including television, radio, print and digital advertising) which aimed to educate the public about the introduction of anti-hooning laws (QPS 2020). Although an evaluation study was not undertaken on the effectiveness of the joint campaign, it is an example of how enforcement and education can be used in conjunction with each other.

The application of vehicle impoundment compared to other speed management activities identified is summarised in Table 2.6.

Speed compliance incentives

Some countries have introduced incentives for drivers to comply with speed limits, with the potential benefit of improved public acceptance of tougher speed enforcement.

Free Licence Schemes

One scheme that was in operation in Victoria, Australia, provided a 30% rebate on licence renewal for drivers with no offences (for any road laws) in the prior 3 years (WHO 2008). Currently in Victoria, a free licence scheme has been adopted to reward young drivers who maintain a good driving record while on their probationary licence (VicRoads 2021).

A similar system is also used in Tasmania, under the 'offence free reward' where drivers who have progressed through their provisional licences can manually apply for a fee refund on their P1 and P2 licences if they have received no offences during their provisional licence stages (Department of State Growth 2021). In December 2020, this system will transition to drivers automatically receiving the refund under the 'safer driver reward', with no need to manually apply any more.

The literature available for estimating potential speed and crash reductions as a result of the initiative is limited, with only some European studies showing some promise.

In a study in Sweden, drivers had a speed violation rate of 14% pre-trial, and this rate reduced to 8% post-trial (Hultkrantz & Lindberg 2011). On the other hand, a larger behaviour change was observed in a trial in Denmark, which found that drivers who were compensated with large rewards (€700 euros, 2012 prices), reduced their rate of speeding by nearly 80% compared to those who were not financially rewarded (Lahrmann et al. 2012).

In the Netherlands, a trial was carried out with 62 drivers driving rented cars fitted with electronic equipment to notify them about whether or not they were speeding (i.e. a green light would come on for speed compliance, and a yellow or red light for non-compliance). Points were awarded for complying with the speed limit, which could then be gained and exchanged for gifts. The program focused on both speeding and close following. Before the trial, an average of 66% of all kilometres were driven at the correct speed. During the trial, this increased to 86%, but fell to 70% after the trial. Once the trial had finished, however, a substantial part of the effects disappeared, although some of the participants persisted in their improved behaviour (Belonitor 2005).

The application of free licence schemes compared to other speed management activities identified is summarised in Table 2.6.

Speed Lottery

The idea of a speed lottery has been successfully trialled in Stockholm, Sweden. Using existing speed-capture technologies, the camera photographs all drivers passing by, those who speed are issued a fine, those who comply with the speed limit are then entered into a lottery (funded by the speed camera fines) and are rewarded for travelling at safe speeds.

The study was undertaken in 2010 by the Swedish National Society for Road Safety and included over 24,000 cars that had passed the cameras. The trial reported a reduction in the mean speed from 32 to 25 km/h.

An example of the device used in Sweden is provided in Figure 2.27.

From a system-wide economic standpoint however, this treatment may not be entirely feasible. Elvik (2014) undertook an economic evaluation and cost-benefit analysis of incentive systems with rewards for compliance with speed limits. The prevention of a fatality was valued at 3.46 million Euros (2009 prices); however, the benefits were found to be smaller than the costs for all versions of the reward system and all groups of drivers.

The application of a speed lottery compared to other speed management activities identified is summarised in Table 2.4 to Table 2.6.

Figure 2.27: Example of speed lottery camera



Source: Arakawa and Matsuda (2016).

2.3 Education Measures

Education and training programs help to communicate the risk of speeding to all roads users as well as targeting specific road user groups. They play a key role in bridging the gap between current practice in speed management and speed zone setting and the adoption of Safe System speeds.

Blume et al. (2000) argue that when used in combination with engineering and enforcement activities to inform the public of the dangers of speeding, educational campaigns improved speed reduction at specific sites. Sasser et al. (2005) further supports this, indicating that combining specific public education campaigns with visible speed enforcement can result in measurable reductions in speed-related crashes. Overall, it is widely acknowledged that mass media and public education initiatives have played a critical role in the significant positive changes witnessed in community attitudes to road safety and road user behaviours (Wakefield et al 2010).

The literature reviewed for educational speed management activities and the effect they may have on directly reducing speed and crashes is difficult to document for various reasons. This may be due to the difficulties surrounding measuring tangible effects that are directly tied to an education speed management activity, but also because many educational initiatives that are used often follow the introduction of either engineering or enforcement activities. As a result, the effectiveness of educational campaigns is typically determined based on the degree of message acceptance or persuasiveness (i.e. ability to achieve attitudinal, intention and/or behavioural change). However, just because the effects are sometimes hard to prove, it does not mean that educational speed management activities are a waste of money or effort.

Subsequently, this section focuses on case study examples of educational programs or campaigns that have been used both domestically and internationally.

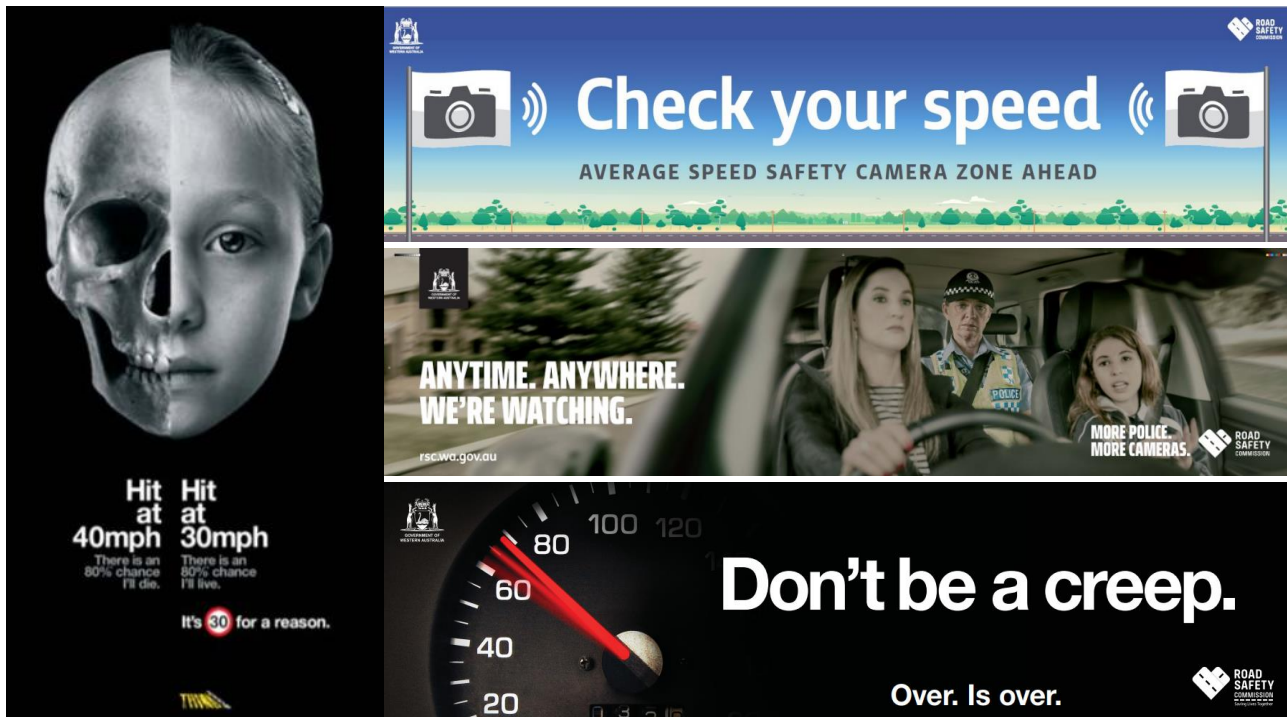
2.3.1 Marketing Campaigns

A marketing campaign in the context of speed management is a mass communication medium used to educate large audiences about issues relating to speed (often seen in the form of television, radio or billboard advertisements). The marketing campaigns considered include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).

While dramatically conveying the sometimes-devastating harm of a speed-related road crash usually does not change individual driver behaviour, it can serve as a call to action or emotional plea, to draw public attention to an issue.

Examples of various mass public marketing campaigns are shown in Figure 2.28.

Figure 2.28: Examples of marketing campaigns



Source: OECD (2006), Government of Western Australia (2023).

The following findings were made for marketing campaigns as a speed management activity:

- Expected speed reduction post treatment
 - Elliott (1993) conducted a meta-analysis to examine both successful and unsuccessful advertising campaigns (87 international campaigns across various communication mediums), reporting that the average mass media campaign will achieve approximate improvements in road safety of 6% (in the relevant outcome). Elliott argues that mass media and education have a direct influence on behaviours and attitudes, as well as an indirect influence through signposting and awareness raising functions in conjunction with enforcement.
 - Mackie (1998) suggests that up to 3 mph (4.8 km/h) reductions in mean speeds have been achieved through public awareness campaigns.
 - Vaa and Phillips (2009) undertook a meta-analysis of the effects of road safety campaigns in the Campaigns and Awareness Raising Strategies in Traffic Safety project in Brussels, showing that overall, speed campaigns resulted in a 16% reduction in speeding. Local campaigns combined with enforcement efforts were found to be more effective than mass media campaigns (i.e. using television, radio and newspaper as the communication media).
 - Woolley et al. (2001) reported a 0.31 km/h mean speed reduction in a South Australian speed-related publicity experiment.
- Indicative crash reduction post treatment
 - Delhomme (1999) analysed a total of 21 countries, with a specific focus on Europe. The evaluation encompassed 265 assessments from 17 different countries, all of which were published between 1980 and 1997. In examining all media campaign types it was found that a road safety media campaign will reduce crashes by an average of 8.5% during a campaign and 14.8% after the campaign is completed. Campaigns addressing the issue of speed were found to reduce crashes by an average of 16.9% during the campaign. There were insufficient data to determine the effect of speed-related campaigns after their completion.

- Land Transport Safety Authority (1994) reported a 10–24% reduction in casualty crashes in a New Zealand advertising campaign focused on speeding and drink driving.
- Approximate cost of treatment
 - CARRS-Q in 2013 estimated that the median production costs for television road safety advertisements ranged from A\$10,000 (simple talking head advertisement) to \$450,000 (cinema verité type executions featuring graphic crash scenes).
 - Grey Advertising (responsible for the ‘little bit dead’ campaign run in Victoria) developed and implemented a communication strategy with the following media budget: 70% television, 14% press, 7% radio, 5% outdoor, 2% Sky Channel and 2% cinema advertising (Delaney et al. 2004). The overall budget is not available.
- Case studies (mass public marketing)
 - A supplementary road safety package (Land Transport Safety Authority 1994) was introduced to assist the New Zealand government in meeting the National Road Safety Plan goals regarding reduced fatalities (targeted at speeding and drink driving behaviour). It was found that the campaign was associated with a 10% reduction in serious casualties during 1995–96 and a 24% reduction during 1996–97.
 - A South Australia speed-related publicity experiment (1998–2001) aimed to study the impact of advertising while enforcement efforts were fixed. Television and radio advertising focused on well-established principles of deterrence against speeding, the consequences of crashing, and information about the relationship between speeding and crashing. Data revealed a 0.31 km/h reduction in both the mean speed and 95th percentile speed. An estimated casualty reduction of 1.4% was also found (Woolley et al. 2001).
- Case studies (local campaigns)
 - An Icelandic study (Jonsson 2005) showed that an intensive speed reduction campaign without additional supportive measures (e.g. changes in enforcement or engineering efforts) had no significant effect on speed distributions on the main highways.
 - Delhomme et al. (1999) reported that road safety campaigns are more effective when they are carried out at a local level.
 - Lourens et al. (1991) evaluated 3 local information campaigns in the Netherlands aimed at reducing driving speed in residential areas, improving drivers’ observational behaviour and increasing the subjective risk of drivers of running into a child. Looking at both reported and actual speed, they found indications that the information campaigns had a positive effect, although this had been difficult to demonstrate statistically.
 - Judd (2012) highlights a proactive local program within the Town of Bassendean (Western Australia) that involved encouraging drivers to slow down in local streets through the use of various communication mediums, including speed display trailers, additional speed zone signs, rubbish bin stickers, speed cameras and information pamphlets. The results of this campaign were not recorded.

TMR (2019) describes a *Speed Limit Reduction – Communication Toolkit* to support speed limit reductions (from 50 to 40 km/h) in local-government-controlled CBDs. Although an evaluation of its effectiveness was not undertaken, it included detailed example templates for communicating the decision to reduce the speed limit (2 to 4 weeks before the change) and communicating the commencement of the speed limit change. Cairns Regional Council adopted the toolkit and used various communication mediums (Figure 2.29) including:

- email
- fact sheets

- posters
- media statements
- community service announcement via local radio stations
- social media posts
- variable message signs.

Figure 2.29: Examples of local communication toolkit items from Cairns Regional Council



Source: TMR (2019).

Some of the application and implementation difficulties and/or unintended consequences of the treatment to consider include:

- Communication medium – multiple modes of communication (i.e. not just television) should be considered, factoring in various language barriers (WHO 2008).

- Target audience – campaigns should be targeted towards a specific audience (i.e. based on crash data statistics) and messages should be clear, consistent and simple (NZ Transport Agency 2016).
- Content of message – various characteristics including response efficacy, threat relevance, type of emotional appeal and the ordering of the message are important in creating a successful campaign (CARRS-Q 2013)
 - Negative fear-based messages, as opposed to positive approaches, have been favoured in the road safety advertising context and this practice has continued despite support for the greater use and, at least trialling, of positive approaches in road safety advertising (Lewis et al. 2009).
- Localised information dissemination – many traditional campaigns often target certain groups within the population nationally; however, these campaigns would also have the potential to be applied locally to address a road link or community-based speed compliance issue (when engineering or enforcement measures are often not available or applicable).
- Some countries (e.g. UK, France and New Zealand), developed a code where car manufacturers agreed to not base their advertising campaigns on the speed properties of their vehicles (European Conference of Ministers of Transport 1989).

The application of marketing campaigns compared to other speed management activities identified is summarised in Table 2.6.

Variable Message Signs

Variable message signs (VMSs) are used to dynamically display advisory information or speeds under different road conditions. Compared to speed-activated warning signs, these signs are continually updated with new information about the road conditions to inform drivers with real-time data, including an amended speed limit.

They could be used as a transitioning activity to support a change in the speed limit or to display educational messages such as ‘adhere to speed limit’ or ‘slow down – police patrolling’.

An example of a variable message sign is shown in Figure 2.30.

Figure 2.30: Example of variable message sign

The following findings were made for variable message signs as a speed management activity:

- Expected speed reduction post treatment
 - Cooper and Sawyer (2005) reported a mean speed reduction of 2.9 km/h.
 - Erke et al. (2005) reported a mean speed reduction of 4.7–6 km/h.
- Indicative crash reduction post treatment
 - A study undertaken by the Michigan Department of Transportation reported that variable message signs (known as dynamic message signs in America) were likely to reduce 16% of crashes on freeways (Oh et al. 2015).
- Case studies
 - Cooper and Sawyer (2005) undertook a study from 1990 to 1992 using fog VMSs on motorways in London, with about 20,000 vehicles were involved in the study. Twelve VMSs displayed the word ‘fog’ when the visibility was reduced to less than 250 m. Compared to days when there was no fog recorded, there was a significant speed decrease of 2.9 km/h on average.



Source: Coats Hire (2023).

- Erke et al. (2005) undertook a study in Norway to investigate the effects of variable message signs on driver behaviour at 2 sites. The signs changed every quarter of an hour between 10:30 pm and 12 at night to display either a blank or text message. One of the observations was that at both test sites, the average speeds were reduced by 4.7 to 6 km/h.

When evaluating the treatment, it is important to consider certain challenges and unintended outcomes that may arise during its application and implementation. These include:

- The perceived credibility of the messages is crucial for driver acceptance. Steinhoff et al. (2002) reported lower speed compliance levels when the difference between the prescribed speed limit displayed on the VMS and the actual traffic situation was large.
- Warning drivers of an upcoming VMS reduces the probability of missing the message (Nygardhs & Helmers 2007).

The application of variable message signs compared to other speed management activities identified is summarised in Table 2.6.

2.3.2 Targeted Education

Targeted education initiatives in the context of speed management are intended to address a speed-related issue at a particular location e.g. speeding along a local road corridor in industrial areas. Traditionally, these initiatives may have also been used for regional and state purposes, such as TMR's road safety. However, there is also an opportunity to be more effective through targeting local audience e.g. school children or workplace employees.

School-based education

Most road safety education and training takes place informally, being often driven by family and outside the school itself. Although parents and other adults in a child's circle have a responsibility to set a good example, this might not always be the case, which presents an opportunity for formal education about speeding to serve as a speed management activity.

The 2 main age categories in schools include primary and secondary students. The majority of educational efforts for primary school children in the past have focused on children not becoming the victims of crashes, particularly as they likely are not in a position to influence the speed of vehicles (Delaney et al. 2003). For example, the Safe Routes to School program in Victoria focused on staying safe when travelling to and from school, designed to reduce children's involvements in road crashes through educating them about things like looking both ways before crossing the road or using a helmet when riding a bike.

Secondary school children on the other hand, begin to reach the age at which they are allowed to participate more and here schools can play a much greater role in educating students about speeding. Children can play an important role in making parents more accountable for driving at speeds over the posted speed limit (OECD 2006).

OECD (2006) recommended that the effects of speed could be better integrated into subjects within the school curriculum, such as physics (e.g. braking distance, impact speed, g-forces), chemistry (exhaust emissions), and human science (e.g. reaction time, resistance of the human body to impacts). However, there need to be sufficient links with reality, i.e. the effects of speed on crashes, crash severity, quality of air in residential areas, for the realities of road safety to not be forgotten.

OECD (2006) also highlights that although children do not have a direct role in traffic, they may still be able to strongly influence the driving behaviour of their parents. For example, c to vehicle occupants (e.g. children in the back seat), children who are made aware at school of the concerns about speeding would be in a position to alert their parents if they start driving over the speed limit.

As an example, the Northern Territory Government (2011) has compiled a booklet (*Guidelines for Road Safety Around Schools*) of information that can be used to help local governments and schools educate children about road safety. Some of the recommendations for areas which have identified a speeding problem include:

- raise awareness of speeding in community newspapers and school council circulars
- an assembly item about the dangers of speeding by students.

Currently in Queensland, RACQ (2021) offers a range of complimentary educational initiatives targeted to different age groups (e.g., primary, secondary, older individuals, parents). These programs involve RACQ staff visiting schools throughout the state to educate students about the significance of road safety. However, there is currently no specific program exclusively focused on addressing the issue of speeding, especially designed for younger age groups.

The application of school children's education compared to other speed management activities identified is summarised in Table 2.6.

Workplace education

Education about speeding in the workplace is often targeted at employees who work within the freight industry (e.g. truck drivers). Although they are more likely to be driving as part of their work, there is also a significant proportion of the population that drives to and from work every day, creating an opportunity for employers to become involved in raising awareness about speeding.

For example, between 1989 and 1992, road crashes accounted for about half of work-related deaths in Australia, with 541 people killed while they were working and 628 killed while they were commuting to and from work (Road Safety Council 1998).

In an effort to address this, Road Safety Council (1998) suggests that across Australia, road safety and workplace safety authorities should focus on core elements of any successful company road safety plan (regardless of the industry), specifically:

- recognising positive and negative staff driving performance by having staff incentives and disincentives
- supporting training, education and development programs that promote safe driving.

Activities recommended in Road Safety Council (1998) to support these elements included having a system that:

- enables members of the public to comment on the driving performance of employees (e.g. phone numbers on the back of vehicles)
- recognises and rewards the good driving performance of staff, done in front of their peers and publicises achievements throughout the company
- links any overall staff incentive or reward system for road safety to the actual reduction in crash rates achieved
- identifies poor driving performance (i.e. speeding)
- imposes some form of penalty for drivers and/or their section or department (e.g. loss of bonus for not wearing a seat belt; vehicle repair costs allocated against divisional budgets).

A year-long study on employee education programs was undertaken by Gregersen et al.(1996) at a large Swedish telephone company Televerket using over 900 drivers from the company. The experiment was set up with the following groups:

- One group of drivers was involved in a driver training course teaching limitations as well as skills and including 'commentary driving' to influence perceptions and behaviour.

- A second group was exposed to a range of educational information (pamphlets, seasonal driving tips, pamphlets and videos).
- The third group involved small local groups of 8 to 15 drivers meeting 3 times to discuss safety problems and solutions under the guidance of trained facilitators.
- The fourth group was promised monetary rewards for safe driving. A set amount was promised, and variable (depending on crash severity) deductions made throughout the year for any crashes. The drivers were given the money at the end of the year to spend how they wished.
- The fifth group were the control group and were not exposed to any training or information and were not even aware that they were a control group.

There was no reduction in crashes among the second group (information) and the control group. All other groups showed reductions in crash rate. The discussion group showed the largest reduction, followed by the driver training group and the monetary reward group. It is believed the group discussion was effective because drivers made personal decisions about their driving. The discussion group process was the least expensive and the driver training the costliest.

The application of workplace education compared to other speed management activities identified is summarised in Table 2.6.

2.4 Case Studies – Multiple Activities

Although many case studies explored the isolated effect of a single speed management activity, many instances noted the effects of multiple activities either within the same or across multiple categories (i.e. engineering, enforcement and/or education) being used simultaneously. Often applying only one speed management activity in isolation might not produce a strong or sustainable effect.

All relevant case studies identified as having multiple speed management activities are detailed in Table 2.2.

Table 2.2: Summary of case studies using multiple speed management activities

Reference	Background information	Description of activities	Speed reduction (% or km/h)	Crash reduction (%)
Gordon (2011)	- UK Mixed Priority Routes Demonstration Project focused on developing and implementing schemes that reduced casualty numbers, while providing wider safety benefits throughout streets with high levels of traffic and mixed people and land use. - Aim: to facilitate the implementation of a number of trial schemes, monitor the effects and provide a good practice guide to assist practitioners in developing such schemes in the future. - Trial used 10 case studies representative of areas across England, all of which had existing safety problems, with annual casualties ranging from 10 to 73 across all sites.	The following treatments were applied on local road types (ranging from urban to rural) with a posted speed of 20 mph (32 km/h): Engineering: road humps, raised mid-block platforms, shared spaces Enforcement: n/a Education: n/a	Across the 4 sites with a raised platform or speed hump, a 5–19% reduction in the 85th percentile speeds and average speed reductions of 5–17% were found.	Across the 4 sites with a raised platform or speed hump, a casualty crash reduction up to 41% was found. Whole package of treatments resulted in a 60% reduction in casualty crashes.
OECD (2006)	- In 2002, road safety was announced as one of the President's top priorities in France, resulting in the road safety action plan which focused predominantly on enforcement. - Program targeting driver behaviour, infrastructure and vehicle initiatives was rolled out over 3 years, involving several ministries within France.	The following treatments were applied on various roads in a range of areas across different speed limits: Engineering: n/a Enforcement: fixed cameras, demerit points Education: workplace education, school children education	Over 3 years from 2002, the average speed on French roads decreased by 5%.	Over 3 years, the number of fatalities decreased by over 30%.
VicRoads (2019)	- T-intersection at Kidman Avenue and the Surf Coast Highway (Belmont, Victoria) saw 6 collisions involved in road trauma from 2008 to 2012. - The method trialled stemmed from an intersection design in the Netherlands.	The following treatments were applied on a local road with a posted speed of 60 km/h: Engineering: raised intersection platforms, traffic lights, speed limit reduction from 70 to 60 km/h. Enforcement: n/a Education: n/a	A reduction of 34% in the mean speeds and a reduction of 21% in the 85th percentile speeds.	Estimated combined treatment crash reduction of 30%.

Reference	Background information	Description of activities	Speed reduction (% or km/h)	Crash reduction (%)
				
OECD (2006)	• <i>Arrive alive!</i>, Victoria's road safety strategy 2002–2007 focused on reducing annual fatalities and series injuries from road crashes by 20%, with a key focus on addressing speeding.	The following treatments were applied on various roads with posted speed limits including 60, 70 and 80 km/h: Engineering: n/a Enforcement: mobile speed cameras, radar and laser equipment, flashless cameras, reduced enforcement tolerance, tougher penalties for speeding, speed detection equipment, combined red light and speed cameras Education: n/a	Improved speed compliance in 60, 70 and 80 km/h zones. In 2005, for the first time, average travel speeds in these zones were below the legal speed limit. However, 15% of motorists in these zones still travelled at speeds above the limit.	During the first 4 years of the program, there was a 16% reduction in fatalities and approximately an 8% reduction in serious injuries.

Reference	Background information	Description of activities	Speed reduction (% or km/h)	Crash reduction (%)
Cameron et al. (2003)	- The study aimed to assess whether there was any interaction between the impact of mobile covert speed camera enforcement and the impact of extensive mass media road safety campaigns focusing on speed-related topics. - Victoria police varied levels of speed camera activity in 4 Melbourne districts while various advertisements were displayed. - Interaction between enforcement and publicity was not statistically significant.	The following treatments were applied on various urban road types with varying posted speed limits: Engineering: n/a Enforcement: mobile speed cameras Education: marketing campaign	Not known.	Reductions in crash frequency were associated with increasing levels of speed camera ticketing, and there was a statistically significant 41% reduction in fatal crashes associated with very high camera activity. High publicity awareness was associated with a 12% reduction in crash frequency, but publicity appeared to be unrelated to crash severity.
Delaney et al. (2004)	- Evaluation of moving mobile radar for speed enforcement accompanied by a Transport Accident Commission (TAC) television advertisement on mobile radar enforcement in Victoria - A total of 73 moving mobile radar devices were used by the police in Victoria	The following treatments were applied on various urban and rural road types with varying posted speed limits: Engineering: n/a Enforcement: mobile radar equipment Education: marketing campaign	Not known.	A net 28% reduction in casualty crashes was found. The residual effect was found to be strongest one to four days after the enforcement was present.

Some of the application and implementation difficulties and/or unintended consequences of some of the programs with multiple treatments to consider include:

- Delaney et al. (2004) highlighted that publicity supporting mobile radar enforcement produces stronger effects when it is specific to the enforcement rather than when it encompasses all speed-related themes.
- Jonsson (2005) showed that an intensive speed reduction campaign without additional supportive measures (e.g. changes in enforcement or engineering) had no significant effect on speed distributions on the main highways in an Icelandic study.

As shown in Table 2.2, the multiple treatments can reduce speeding at both a site and network level, however, the effects are more likely to be larger in medium to high-risk areas (i.e. high crash or infrastructure risk). Currently there is no guidance available to aid practitioners in determining:

- when to adopt multiple speed management activities
- the number of activities that should be used
- what the optimal combination of activities might be to derive the greatest effect.

Section 4 provides information for practitioners to select which and how many speed management activities should be used.

2.5 Workshop Consultation

A workshop was held by the project team to engage officers who are either members of a Speed Management Committee (SMC), or represent organisations with a role in road safety and TMR Engineering and Technology (speed and community engagement experts) about their experiences with speed management activities in Queensland. This included identification of the following issues:

- scenarios they are regularly presented with (that require the use of speed management activities) (Section 2.5.1)
- the effectiveness of speed management activities implemented to date in Queensland (Section 2.5.2) including any treatment within the following categories
 - engineering
 - enforcement
 - education
 - multiple treatments
- emerging speed management activities (Section 2.5.3) that are believed to be effective and could be trialled (including new ideas or activities trialled both domestically or internationally)
- any other local considerations (Section 2.5.4) that need to be accounted for when selecting speed management activities in Queensland.

Following the workshop, a survey was emailed to all participants to provide any further insights on the key issues. A summary of the workshop and survey responses is provided in Section 2.5.1 to Section 2.5.4.

2.5.1 Identification of Common Scenarios

The participants identified a number of scenarios they were regularly presented with requiring speed management activities, including the following:

- Scenario 1: High-speed rural roads that contain long mid-block sections, typically including a narrow formation width, narrow shoulder and low traffic volumes (i.e. high-speed geometry).
- Scenario 2: Urban city precincts with high pedestrian mixture (i.e. inner city, large events).

- Scenario 3: High-volume roads (e.g. highways) with COVID-impacted traffic conditions (reduced fleet platooning effects) contributing to increases in speeding with less vehicles on the road.
- Scenario 4: Roadwork sites.
- Scenario 5: Rural township entry with town lengths > 500 m and low posted speeds.
- Scenario 6: Intersections, particularly with high-speed environments prior to entry.
- Scenario 7: Foreshore areas with increased pedestrian activities, with wide roads and the time of day acting as contributing factors.

The scenarios outlined above are addressed by the suite of speed management activities proposed in Section 3.

2.5.2 Effectiveness of Speed Management Activities in Queensland

Participants identified a large variety of speed management activities they had experienced within Queensland, many of which confirmed the findings in Sections 2.1 to 2.4.

On the other hand, other activities discussed in workshop are summarised in Table 2.3.

A summary of the workshop findings is provided in Appendix A.

Table 2.3: Effectiveness of speed management activities in Queensland – workshop findings

Category	Speed management activity	Effectiveness in Queensland
Engineering	RRPMs (placed next to the edgeline on the inside of the traffic lane)	Narrows effective width, low maintenance requirements and positive feedback from cyclists.
Enforcement	Shared speed and crash databases (targeted enforcement)	Effective in reducing recurring behavioural speeding in local areas.
	Multi-purpose bays	Assist police with enforcement efforts.
	Patrol movements	Effective in reducing recurring behavioural speeding in local areas.
Education	Variable message signs	Effective, however somewhat costly.
	Media releases using social media	Large presence has been effective in targeting social media users. Case study examples were provided.

2.5.3 Emerging Speed Management Activities

Participants from workshop identified some emerging speed management activities that are either already underway in other regions of the state or require substantial coordination among speed management stakeholders. These activities involve new or recently developed approaches, strategies, or interventions within the field of speed management. They are considered emerging because they have not been widely established or adopted like conventional speed management methods. Importantly, some of these activities involve the integration of multiple approaches to effectively tackle speed-related issues. These integrated approaches include:

- Centralised speed database (mixed treatment) – sharing of traffic speed data collected between QPS, TMR and local councils to allow each party to target high-speed areas accordingly.
- State-wide speed-lottery scheme (mixed treatment) – involves drivers ‘randomly’ winning money for driving below the speed limit, with the aim of putting a positive spin on behaviour change (i.e. not viewed as revenue raising especially if funded by camera detected fines).

Although these activities are not primary speed management activities, they could be considered as secondary or supportive activities that could be trialled in Queensland.

2.5.4 Other Considerations

Other issues raised by participants regarding speed management activities in Queensland included:

- Implications of COVID-19 – a sudden reduction in traffic volumes may render some speed management activities redundant or less effective.
- Inconsistency of treatments – a lack of standardised guidance has meant that the current activities in place across the state do not provide a consistent road user experience.
- Lack of guidance on education measures (specifically) – multiple participants noted the lack of guidance for communication strategies, education programs and initiatives even though communication is considered one of the most important aspects of lowering speeds.
- No legal mandate to undertake speed limit reviews – which could result in a reduced uptake of speed management activity guidance for users.

2.6 Summary of Review Findings

A literature review (Sections 2.1 to 2.4) and a workshop with practitioners in the field (Section 2.5) were undertaken to assess current domestic and international guidance and experience relating to suitable and effective speed management activities in each of the 3 categories (engineering, enforcement, education), with a focus on:

- expected speed reductions
- indicative crash reductions
- approximate associated cost
- case studies.

Gaps were identified from both the literature review and workshop consultation, including:

- missing information on the speed reduction, crash reduction or costs of various treatments
- centralised guideline on information provided for practitioners to determine the selection of appropriate speed management activities (specifically within the education category), including how to select multiple treatments
- guidance on how to determine the appropriateness of a speed management activity as a function of the road environment and road hierarchy.

A summary of the findings of the speed management activities are detailed in Table 2.6. It should be noted that education measures are grouped together as the effects of specific activities (e.g. radio, television, billboard) were not able to be isolated from each other.

Table 2.4: Summary of speed management activities – engineering

Impact criteria	Vertical deflection devices				Horizontal deflection devices		Static signage			Feedback signs		Perceptual countermeasures						Other	
	Road humps	Raised mid-block platforms	Raised intersection platforms	Road cushions	Slow points	Centre blister treatments	Repeater regulatory speed limit signs	New speed limit signs	Black link signage	Radar speed signs	Vehicle activated signs	Lane narrowings	Converging chevron linemarking patterns	Transverse lines, bars or optical speed bars	Urban landscaping	Shared spaces	RRPMs (inside of edgeline)	Gateway treatments	Pavement texturing & colouring
Mean speed reduction (km/h or %)	14-75%	21-25%	3 km/h	20-42%	16-36%	14%	3-16%	Unknown	Unknown	13-14%	3-4%	11-40%	1.6-25 km/h	5-12%	Unknown	33%	Unknown	1.6-15 km/h	5-57%
85th Percentile speed reduction (km/h or %)	11-68%	22-45%	2-20%	27-39%	14-34%	9-44%	2-4%	Unknown	6-11%	10%	5-6%	Unknown	32%	Unknown	Unknown	27-35%	Unknown	1.6-25 km/h	2%
Crash reduction	61-75%	63-71%	40-70%	60%	51-61%	18%	Unknown	Unknown	11-16%	Unknown	11-35%	20-90%	25-50%	Unknown	Unknown	49-70%	Unknown	11-43%	Unknown
Installation cost	Medium	Medium	Medium	Medium	Unknown	Medium	Low	Unknown	Unknown	Low	Medium	Medium	Unknown	Low	Medium	Unknown	Low	Unknown	Unknown

Table 2.5: Summary of speed management activities - enforcement

Impact criteria	Cameras and radar				Police presence			Penalties					
	Fixed speed cameras	Mobile speed cameras	Point-to-point speed cameras	Combined red light and speed cameras	Patrol movements	Multi-purpose bays	Shared speed/crash database	Demerit points	Licence suspension	Enforcement suspension	Vehicle impoundment	Free licence scheme	Speed lottery
Mean speed reduction (km/h or %)	3-71%	1.7-3.2 km/h	11-20%	Unknown	5%	Unknown	Unknown	Unknown	12%	2-50%	Unknown	6-80%	22%
85th Percentile speed Reduction (km/h or %)	4-20%	59%	22%	Unknown	16-71%	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Crash reduction	16-97%	6-45%	35-85%	25-47%	14-73%	Unknown	Unknown	27-34%	20%	43%	38%	Unknown	Unknown
Installation cost	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

Table 2.6: Summary of speed management activities - education

Impact criteria	Social media	Television advertisements	Billboards	Local press / news	Letterbox drops	Fact sheets / posters	Variable message signs	Rubbish bin stickers
Mean speed reduction (km/h or %)	0.8-1.2 km/h	Unknown	7 km/h	6-16%	Unknown	Unknown	2.9 - 6 km/h	Unknown
85th Percentile speed reduction (km/h or %)	Unknown	Unknown	Unknown	0.31 km/h	Unknown	Unknown	Unknown	Unknown
Crash reduction	43%	Unknown	Unknown	1.4-43%	Unknown	Unknown	16%	Unknown
Installation cost	Unknown	Unknown	Unknown	Low	Unknown	Unknown	Unknown	Unknown

3. Short List of Speed Management Activities

The literature review and workshop findings presented in Section 2 identified a total of 49 speed management activities.

The workshop confirmed many of the findings in the literature review and no major contradictions were identified. Any additional speed management activities mentioned in the workshop that had not been identified previously were added to the literature review.

3.1 Summary of Speed Management Activities identified

A summary of all the speed management activities identified in the literature review (in black text) and workshop consultation (in blue text) is outlined in Table 3.1.

Table 3.1: Summary of speed management activities for engineering, enforcement and education

Engineering	Enforcement	Education
• Vertical deflection devices – road humps – Raised mid-block platforms – Raised intersection platforms – Road cushions • Horizontal deflection devices – Slow points – Centre blister treatments • Static signage – Repeater regulatory speed limit signs – “New speed limit” signs – Black link signage • Feedback signs – Radar speed signs – Vehicle activated signs • Perceptual countermeasures – Lane narrowings – Converging chevron linemarking patterns – Transverse lines, bars, or optical speed bars – Urban landscaping – Shared spaces – RRPMS (inside of edgeline) • Other – Gateway treatments – Pavement texturing and colouring	• Cameras and radar – fixed speed cameras – Mobile speed cameras (includes vans and trailers) – Point-to-point speed cameras – Combined red light and speed cameras • Police presence – Patrol movements – Multi-purpose bays – Shared speed and crash database (targeted enforcement)	• Social media targeted by location and demographic factors • Television advertisements • Billboards • Local press/news • Letterbox drops • Fact sheets/posters • Variable message signs • Rubbish bin stickers

The speed management activities summarised in Table 3.2 were also identified in the literature review. However, the activities have been deemed not suitable for application to a road, link or local area that may form part of a speed management activity, as recommended in the TMR AS1742.4 Supplement. The activities have been included in the table, as their consideration could result in speed management at a state, region or district network level.

Table 3.2: Summary of speed management activities not applicable to local area level

Engineering	Enforcement	Education
The treatments as per Table 3.1. can be applied on a broader scale.	Broader speed management activities (outside the scope of this project) • Penalties and incentives – monetary / fines – Demerit points – Licence suspension – Enforcement tolerance – Vehicle impoundment – Speed compliance incentives – Free licence scheme – Speed lottery incentive	Broader speed management activities (outside the scope of this project) • Marketing campaigns • Targeted education – school-based education – School subject matter integration – School assembly item – School newspaper/newsletter – Educational programs (e.g. RACQ, QPS) – Workplace education – Training and development programs – Streamlined public feedback – In-vehicle speed monitoring, including staff incentives and disincentives – Regular driver safety group discussions

3.2 TMR Feedback

A discussion on the summary of all the speed management activities (Section 3.1) revealed that while most of the identified activities would directly impact specific roads, there were also some activities that would have an indirect effect.

Although the measures with an indirect effect were not suitable for inclusion in the speed limit review guideline, they still play a role in promoting long-term changes in driver behaviour and infrastructure that could ultimately help reduce local speeding problems.

Therefore, even though these measures were not included in the guideline developed in Section 4, they present an opportunity for further investigation in future research.

3.2.1 Workshop Consultation Feedback

An additional workshop was held to discuss the findings from Section 2 and Section 3.1.

The following were identified as areas of concern that need to be addressed in the final guideline:

- Guideline scope – the purpose of the speed management activities needs to highlight the intended timeline for how long the treatments are needed to be effective, and whether they are intended to be a permanent or temporary measure.
- Appropriateness of treatments at different road hierarchy levels or speed environments – although it is clear that some speed management activities are only intended for certain environments (e.g. speed bumps on a local street), the guideline needs to clearly outline the suitability of treatments in different road and/or speed environments.

Furthermore, survey feedback was collected on the final list of speed management activities with questions targeting indicative effectiveness ratings of various activities. The results are integrated into the guideline in Section 4.

3.3 Short-listing of Speed Management Activities

The process of short-listing suitable speed management activities considered the following:

- availability of information regarding effectiveness
- precedent case studies
- scope considerations
- appropriateness of activities in Queensland
- feedback from TMR and workshop consultation.

As a result, the following activities were not considered in the short list:

- penalties and incentives (including fines, demerit points, licence suspension, enforcement tolerances, vehicle impoundment and speed compliance incentives)
- targeted education (including school children and workplace education initiatives).

The activities selected to be included in the guideline are detailed in Table 3.3, a total of 34 being considered.

Table 3.3: Selected speed management activities

Engineering	Enforcement	Education
• Vertical deflection devices – Road humps – Raised mid-block platforms – Raised intersection platforms – Road cushions • Horizontal deflection devices – Slow points – Centre blister treatments • Static signage – Repeater regulatory speed limit signs – ‘New speed limit’ signs – Black link signage • Feedback signs – Radar speed signs – Vehicle activated signs • Perceptual countermeasures – Lane narrowings – Converging chevron linemarking patterns – Transverse lines, bars or optical speed bars – Urban landscaping – Shared spaces – RRPMS (inside of edgeline) • Other – Gateway treatments – Pavement texturing and colouring	• Cameras and radar – Fixed speed cameras – Mobile speed cameras (includes vans and trailers) – Point-to-point speed cameras – Combined red light and speed cameras • Police presence – Patrol movements – Multi-purpose bays	• Social media • Television advertisements • Billboards • Local press/news • Fact sheets/posters • Variable message signs • Rubbish bin stickers

Note: Mixed treatments combining multiple speed management activities were not included.

4. Speed Management Activities Guideline

The contents of this section are provided as Draft Guidance for TMR to integrate into their existing documents, or publish as a standalone document. Alternatively, the guidance can be published as a NACOE Guide.

The purpose of the Speed Management Activities Guidelines resulting from this report is to provide a single point of reference for any organisation, council, district, or authority involved with, or seeking information about speed management treatments and activities. The guideline is applicable to both existing and newly established speed limits. By providing the latest information, the guidelines promote uniformity in the implementation of activities throughout Queensland. It is important to understand that this guideline is not intended to be treated as a standard.

Queensland Road Safety Technical User Volumes – Guide to Speed Management (QRSTUV GSM) contains guidelines for the speed limit review process. This Guideline will provide guidance for the practitioners to select and recommend speed management activities to complement the Speed Limit Review process (TMR 2022a, 2022b).

4.1 Purpose of the Guideline

The Speed Management Activities Guideline has been prepared to assist road managers or consultants to select suitable and effective speed management treatments and activities (hereinafter referred to as speed management activities) on the Queensland state and local government road network.

This Guideline is provided to assist practitioners with the selection and implementation of speed management activities to reduce vehicle operating speeds to speed limit determined by the risk-based speed limit assessment process identified in the Department of Transport and Main Roads (TMR) Queensland Manual of Uniform Traffic Control Devices: Part 4: Speed Controls.

This Guideline is not limited in use; however, it is intended to be used to support the outcome of a Speed Limit Review. Some examples of when the guideline can be used to support a Speed Limit Review outcome include when:

- a new speed limit is to be implemented and the existing operating speeds indicate the speed limit reduction alone may not reduce operating speeds,
- an existing speed limit should be retained, however the operating speeds exceed the speed limit.

This Guideline provides a speed management activity selection matrix to assist practitioners to identify activities to reduce operating speeds, and apply these consistently across the Queensland road network. A detailed summary of each possible activity to determine the suitability for a location when considering the local context of that road or section of road. Technical specifications or design-specific guidance is not provided, practitioners should refer to specifications and guidance provided by the relevant road manager.

The speed management activities provided in the guideline are classified into the following categories:

- engineering (e.g. traffic calming devices, active warning signs, portable warning signs)
- enforcement (e.g. mobile speed cameras, point-to-point speed cameras)
- education (e.g. community-based behaviour change initiatives).

The implementation of speed management activities are intended to result in the following benefits:

- reductions in casualty crashes
- reductions in the severity of crashes,

- an increase in the credibility of speed limits, leading to voluntary compliance.

4.2 Application of the Guideline

The selection of a suitable Speed Management Activity is not warrant based only, the context of the site (e.g. traffic mix (bus or heavy vehicle route, commuting peaks), roadside land use (residential, commercial, industrial etc), on road or off road cycle paths, proximity to schools or bus stops, pedestrian crossing provisions etc.) should also be considered.

The speed management activity selection matrix (Speed Management Activities Selection Matrix

Table 4.1) is provided as a guide for the selection of speed management activities by road classification and posted speed limit. The matrix also provides an indication of how effective each activity is in reducing speed, improving safety and the general acceptance by the community.

Using the speed management activity selection matrix (Speed Management Activities Selection Matrix

Table 4.1) a practitioner should identify one or more Speed Management Activity that is complimentary to the site context, and effective in mitigating the possible cause of the higher operating speeds.

Each speed management activity shortlisted as being suitable should be reviewed in detail using the information provided in Section 4.4 where the activities by the 3 main speed management categories: engineering (Section 4.4.1), enforcement (Section 4.4.2) and education (Section 4.4.3).

Any speed management activity/ies that are implemented should be monitored to evaluate their effectiveness in reducing operating speeds to the target/acceptable speeds.

A summary of the application of this guideline is as follows:

1. A speeding issue has been identified via a speed limit review as per the Department of Transport and Main Roads (TMR) Queensland Manual of Uniform Traffic Control Devices: Part 4: Speed Controls (TMR 2022a) and *Queensland Road Safety Technical User Volumes (QRSTUV) – Guide to Speed Management* (TMR 2022b) to determine that operating speeds are higher than the acceptable range.
2. Select suitable speed management activity/ies using the speed management activity selection matrix (Speed Management Activities Selection Matrix
3. Table 4.1)
4. Review the information for the selected activity/ies in Section 4.4. Use the reference in Speed Management Activities Selection Matrix
5. Table 4.1 to find the applicable table in Section 4.4.
6. Plan and implement any activity as per the governing road authority, or relevant government agencies policies and processes.
7. Monitor and evaluate the operating speeds to determine the effectiveness of the implemented speed management activity/ies as per Section 4.5.

4.3 Speed Management Activities Selection Matrix

Table 4.1: Speed Management Activity Selection Matrix

		Engineering																		Enforcement						Education									
		Vertical deflection devices				Horizontal deflection devices		Static signage			Feedback signs		Perceptual countermeasures						Other		Cameras and radar				Police presence			Communication mediums							
Reference		VD1	VD2	VD3	VD4	HD1	HD2	SS1	SS2	SS3	FS1	FS2	PC1	PC2	PC3	PC4	PC5	PC6	O1	O2	CR1	CR2	CR3	CR4	PP1	PP2	PP3	CM1	CM2	CM3	CM4	CM5	CM6	CM7	
Treatment/Activity		Road humps	Raised mid-block platforms	Raised intersection platforms	Road cushions	Slow points	Centre blister treatments	Repeater regulatory speed limit signs	New speed limit signs	Black link signage	Radar speed signs	Vehicle activated signs	Lane narrowing	Converging chevron linemarking patterns	Transverse lines, bars or optical speed bars	Urban landscaping	Shared spaces	RRPMs (inside of edge line)	Gateway treatments	Pavement texturing & colouring	Fixed speed cameras	Mobile speed cameras	Point-to-point speed cameras	Combined red light and speed cameras	General patrol movements	Speed enforcement patrol movements	Multi-purpose bays	Targeted social media	Television advertisements	Billboards	Local press / news	Fact sheets / posters	Variable message signs	Rubbish bin stickers	
Access / local street		✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	
Collector street		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Trunk collector road		✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Sub-arterial, arterial road		✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	
Motorway, freeway, expressway		✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗
Posted speed limit (km/h)	10	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✗	
	20	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	
	30	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	
	40	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	
	50	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	60	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	70	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	80	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	90	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗
	100	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗
110+	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	
Effectiveness of speed management activity	Speed reduction																																		
	Safety improvement																																		
	Community acceptance																																		

Legend:

Effectiveness of speed management activity	High	Medium	Low	Not Reported
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4.4 Speed Management Activity Options

4.4.1 Engineering

Vertical Deflection Devices

<i>VD1: Road Humps</i>		
Description	A road hump is a traffic calming device in the form of a raised curved profile extending across the roadway used to control and reduce vehicle speeds in low-speed urban environment, reducing crash risk and lowering crash severity.  Source: Austroads (2020)	
Speed reduction	High	Studies have reported a 14–75% reduction in the mean speeds, and an 11–68% reduction in 85th percentile speeds post the implementation of road humps (Austroads 20,20, Brindle 1995 VicRoads 2017.).
Safety improvement	High	Studies have reported a 61–75% reduction in expected crashes (Zein et al. 1997, Jurewicz 2009, Makwasha & Turner 2017, WHO 2008).
Community acceptance	Low	Main complaints include: Noise pollution for local residents, accessibility restrictions from cyclists and inadequate accessibility for emergency vehicles, buses and other heavy vehicles (Austroads 2020, Bendtsen & Larson 2001)
Implementation	- Various designs are available for different speed environments; however, they are typically 70 to 120 mm high with a total length of 3 to 4 m (Austroads 2020). - Two main types used in Australasia, including the sinusoidal profile hump (more sympathetic to cyclists) and the Watts profile hump (greater effect on drivers).	
Considerations	- Traffic noise level may increase just before and after the device due to braking, acceleration and the vertical displacement of vehicles, road humps may also be uncomfortable for vehicle passengers and cyclists (Bendtsen & Larson 2001). - Risk of traffic being diverted to other surrounding streets (Austroads 2020). - Treatment not applicable on streets without adequate lighting, speeds over 60 km/h, streets with bends or crests (insufficient sight distance), on bus or designated cycle routes, streets with high commercial traffic, where emergency vehicle access may be impeded, or property access is significantly affected (Austroads 2020).	
Further guidance	See Appendix B, MUTCD Part 13 - Local Area Traffic Management (TMR 2003).	
References and other sources	Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Bendtsen, H & Larson, L 2001, <i>Noise by humps on roads</i>, Denmark Transport, Forskning, Lyngby, Denmark. Brindle, R 1995, <i>Living with Traffic: Twenty-Seven contributions to the art and practice of traffic calming 1979-1992</i>, ARRB Transport Research Ltd, Special Report No. 53, Melbourne, Australia. Department of Transport & Main Roads 2003, <i>Queensland Manual of Uniform Traffic Control Devices – Part 13: Local Area Traffic Management</i>, TMR, Brisbane, Queensland. IRAP 2010, <i>Speed management techniques aimed at persuading drivers to adopt safe speeds include police enforcement, driver education, speed limits and engineering treatments</i>, Road Safety Toolkit, Australia. Jurewicz, C 2009, <i>Impact of LATM Treatments on Speed and Safety</i>, Road & Transport Research Journal, 18(4), 14–22. http://search.proquest.com/docview/743234313/ Makwasha, T & Turner, B 2017, <i>Safety of raised platforms on urban roads</i>, Journal of the Australasian College of Road Safety, 28(2), pp.20–27. VicRoads 2017, <i>Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines</i>, 1st Edition, Victoria State Government, Victoria, Australia. WHO 2008, <i>Safety Management – A road safety manual for decision-makers and practitioners</i>, Global Road Safety Partnership, Geneva. Zein, SR, Geddes, E, Hemsing, S & Johnson, S 1997, 'Safety benefits of traffic calming', Transportation Research Record, no. 1578, pp. 3–10.	

VD2: Raised mid-block platforms

Description	Similar to road humps, raised platforms (or raised tables) fulfil a similar purpose but are designed with a flat-top profile compared to a curved profile.  Source: Austroads (2020)	
Speed reduction	Medium	Studies have reported a 21–25% reduction in mean speeds, and a 22–45% reduction in 85 th percentile speeds post implementation (Austroads 2009, VicRoads 2017, Jurewicz 2009, Hawley et al. 1993, Austroads 2011).
Safety improvement	High	Studies have reported a 63–71% reduction in expected crashes (Jurewicz 2009, Makwasha & Turner 2017).
Community acceptance	Low	Main complaints include: Noise pollution for local residents, accessibility restrictions from cyclists and inadequate accessibility for emergency vehicles, buses and other heavy vehicles (Austroads 2020, Bendtsen & Larson 2001).
Implementation	- They are normally 75–100 mm high and typically include a 2 to 6 m long platform ramped up from the normal level of the street (Austroads 2020). - Wombat crossings are also commonly installed on top of raised mid-block platforms to facilitate safe pedestrian movement.	
Considerations	- Traffic noise level may increase just before and after the device due to braking, acceleration and the vertical displacement of vehicles, road humps may also be uncomfortable for vehicle passengers and cyclists (Bendtsen & Larson 2001). - Risk of traffic being diverted to other surrounding streets (Austroads 2020). - Treatment not applicable on streets without adequate lighting, speeds over 60 km/h, streets with bends or crests (insufficient sight distance), on bus or designated cycle routes, streets with high commercial traffic, where emergency vehicle access may be impeded, or property access is significantly affected (Austroads 2020).	
Further guidance	See Road Design Note (RDN 03-07) (VicRoads 2019) and AP-R514-16 (Austroads 2016a) for further design guidance.	
References	Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Bendtsen, H & Larson, L 2001, <i>Noise by humps on roads</i>, Denmark Transport, Forskning, Lyngby, Denmark. Brindle, R 1995, <i>Living with Traffic: Twenty-Seven contributions to the art and practice of traffic calming 1979-1992</i>, ARRB Transport Research Ltd, Special Report No. 53, Melbourne, Australia. Department of Transport & Main Roads 2003, <i>Queensland Manual of Uniform Traffic Control Devices – Part 13: Local Area Traffic Management</i>, TMR, Brisbane, Queensland. IRAP 2010, <i>Speed management techniques aimed at persuading drivers to adopt safe speeds include police enforcement, driver education, speed limits and engineering treatments</i>, Road Safety Toolkit, Australia. Jurewicz, C 2009, <i>Impact of LATM Treatments on Speed and Safety</i>, Road & Transport Research Journal, 18(4), 14–22. http://search.proquest.com/docview/743234313/ Makwasha, T & Turner, B 2017, <i>Safety of raised platforms on urban roads</i>, Journal of the Australasian College of Road Safety, 28(2), pp.20–27. VicRoads 2017, <i>Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines</i>, 1st Edition, Victoria State Government, Victoria, Australia. VicRoads 2019, <i>Raised Safety Platforms (RSPs)</i>, RDN 03-07, VicRoads, Melbourne, Australia. WHO 2008, <i>Safety Management – A road safety manual for decision-makers and practitioners</i>, Global Road Safety Partnership, Geneva. Zein, SR, Geddes, E, Hemsing, S & Johnson, S 1997, 'Safety benefits of traffic calming', Transportation Research Record, no. 1578, pp. 3–10.	

VD3: Raised Intersection Platforms

Description	Although primarily used as a mid-block treatment, raised platforms can also be applied at intersections on either local or arterial roads. Austroads (2004) defines a raised intersection platform as 'a raised flat section of roadway extending across the apron of an intersection ramped up from the normal level of the street'.		 Source: VicRoads (2019)
Speed reduction	Medium	Studies have reported a 3 km/h reduction in mean speeds and a 2-20% reduction in 85 th percentile speeds post implementation (Austroads 2011, 2016a, Watkins 2000, Makwasha & Turner 2017).	
Safety improvement	High	Studies have reported a 40-70% reduction in expected crashes (Austroads 2014, Van der Dussen 2002 Makwasha & Turner 2017).	
Community acceptance	Low	Main complaints include: Noise pollution for local residents, accessibility restrictions from cyclists and inadequate accessibility for emergency vehicles, buses and other heavy vehicles (Bendtsen & Larson 2001, Austroads 2020).	
Implementation	- Typically installed on roads with a maximum posted speed limit of 60 km/h. - They can also be painted or paved to raise driver awareness of the intersection, this is particularly common in Europe, especially in the Netherlands.		
Considerations	- Traffic noise level may increase just before and after the device due to braking, acceleration and the vertical displacement of vehicles, road humps may also be uncomfortable for vehicle passengers and cyclists (Bendtsen & Larson 2001). - Risk of traffic being diverted to other surrounding streets (Austroads 2020). - Treatment not applicable on streets without adequate lighting, speeds over 60 km/h, streets with bends or crests (insufficient sight distance), on bus or designated cycle routes, streets with high commercial traffic, where emergency vehicle access may be impeded, or property access is significantly affected (Austroads 2020).		
Further guidance	See Road Design Note (RDN 03-07) (VicRoads 2019) and AP-R514-16 (Austroads 2016a) for further design guidance.		
References	Austroads 2011, <i>Safe intersection approach treatments and safe speeds through intersections: phase 2</i>, AP-R385-11, Austroads, Sydney, NSW. Austroads 2014, <i>Methods for Reducing Speeds on Rural Roads: Compendium of Good Practice</i>, AP-R449-14, Austroads, Sydney, NSW. Austroads 2016a, <i>Achieving safe system speeds on urban arterial roads: compendium of good practice</i>, AP-R514-16, Austroads, Sydney, NSW. Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Bendtsen, H & Larson, L 2001, <i>Noise by humps on roads</i>, Denmark Transport, Forskning, Lyngby, Denmark. Makwasha, T & Turner, B 2017, <i>Safety of raised platforms on urban roads</i>, Journal of the Australasian College of Road Safety, 28(2), pp.20–27. Van der Dussen, P 2002, Verhoogde plateaus effectief en goedkoop bij terugdringen aantal ongevallen, [in English Raised plateaus effective and cheap in reducing number of crashes], Wegen, vol. 76, no. 8, pp. 18-20. VicRoads 2019, <i>Raised Safety Platforms (RSPs)</i>, RDN 03-07, VicRoads, Melbourne, Australia. Watkins, K 2000, Cambridge's traffic calming program: pedestrians are the focus, ITE 2000 annual meeting and exhibit, Nashville, Tennessee, Institute of Transportation Engineers, Washington, DC, USA.		

VD4: Road Cushions

Description	A road cushion as another form of road hump that occupies only a part of the roadway (Austroads 2020). It is designed to be more sympathetic to cyclists, buses and commercial vehicles than a standard full-width road hump.		 Source: VicRoads (2019)
Speed reduction	Medium	Studies have reported a 20-42% reduction in mean speeds and a 27-39% reduction in 85 th percentile speeds post implementation (Austroads 2009, VicRoads 2017, Pharaoh 1992, Layfield & Parry 1998).	
Safety improvement	High	Studies have reported a 60% reduction in expected crashes (Austroads 2009, Layfield & Perry 1998).	
Community acceptance	Low	Main complaints include: Noise pollution for local residents, accessibility restrictions from cyclists and inadequate accessibility for emergency vehicles, buses and other heavy vehicles (Bendtsen & Larson 2001, Austroads 2020).	
Implementation	Typically installed in a series over an entire street, as they have the ability to regulate speed over its entire length (Austroads 2020).		
Considerations	- Traffic noise level may increase just before and after the device due to braking, acceleration and the vertical displacement of vehicles, road humps may also be uncomfortable for vehicle passengers and cyclists (Bendtsen & Larson 2001). - Risk of traffic being diverted to other surrounding streets (Austroads 2020). - Treatment not applicable on streets without adequate lighting, speeds over 60 km/h, streets with bends or crests (insufficient sight distance), on bus or designated cycle routes, streets with high commercial traffic, where emergency vehicle access may be impeded, or property access is significantly affected (Austroads 2020).		
Further guidance	See Road Design Note (RDN 03-07) (VicRoads 2019) and AP-R514-16 (Austroads 2016a) for further design guidance.		
References	Austroads 2009, <i>Impact of LATM treatments on speed and safety</i>, AP-T123-09, Austroads, Sydney, NSW. Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Bendtsen, H & Larson, L 2001, <i>Noise by humps on roads</i>, Denmark Transport, Forskning, Lyngby, Denmark. Layfield, R & Parry, D 1998, <i>Traffic calming – speed cushion schemes</i>, Transport Research Laboratory, Berkshire, England. Pharaoh, T 1992, Case Study: Herne, Germany, Urban Transport International, pp. 26. VicRoads 2019, <i>Raised Safety Platforms (RSPs)</i>, RDN 03-07, VicRoads, Melbourne, Australia.		

Horizontal deflection devices

HD1: Slow Points

Description	Slow points (also known as angled slow points or chicanes) are a series of kerb extensions on alternating or opposite sides of a roadway, which narrow and/or angle the roadway (Austroads 2020). They are intended to reduce vehicle speeds, predominantly on local streets.		 Source: Austroads (2020)
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Speed reduction	Medium	Studies have reported a 16-36% reduction in mean speeds and a 14-34% reduction in 85 th percentile speeds post implementation (Austroads 2009, 2020, Jurewicz 2009, Corkle et al. 2001, Sayer et al. 1998, Cusack et al. 1996).
Safety improvement	High	Studies have reported a 51-61% reduction in expected crashes (Sayer et al. 1998).
Community acceptance		No studies available.
Implementation	Treatment is only applicable to roads where traffic volumes are low (not more than 1,000 vehicles per day), otherwise congestion and crash risk may increase (Austroads 2020).	
Considerations	- Route limitations make this treatment inappropriate on bus or cyclist routes, streets with a high connective role in the local street network, where on-street parking is in short supply, routes required for emergency facilities (e.g. hospitals) or if the road is used by a high number of commercial vehicles (Austroads 2020). - With one-lane devices, confrontations between opposing drivers may occur when arriving simultaneously and it may be unclear who should give way (Austroads 2020). - Design must cater for ongoing maintenance of landscaping to prevent reduced visibility (Austroads 2020).	
Further guidance	See AGTM08-20 (Austroads (2020) for further design guidance.	
References	Austroads 2009, <i>Impact of LATM treatments on speed and safety</i>, AP-T123-09, Austroads, Sydney, NSW. Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Corkle, J, Giese, JL & Marti, MM 2001, <i>Investigating the effectiveness of traffic calming strategies on driver behavior, traffic flow and speed</i>, final report, MN/RC-2002-02, Minnesota, Department of Transportation, St Paul, MN, USA. Cusack, SG, Brindle, RE & Lydon, M 1998, 'Speed control device evaluation: angled slow points', contract report CR OC6517-2, ARRB Transport Research, Vermont South, Victoria. Jurewicz, C 2009, <i>Impact of LATM Treatments on Speed and Safety</i>, Road & Transport Research Journal, 18(4), 14–22. http://search.proquest.com/docview/743234313/ Sayer, IA, Parry, DI & Barker, JK 1998, <i>Traffic calming: an assessment of selected on-road chicane schemes</i>, report no.313, Transport Research Laboratory (TRL), Crowthorne, Berks., UK.	

HD2: Centre Blister Treatments

Description	A centre blister is a concrete island positioned at the centreline (median) of a street that has a wide oval plan shape that narrows the lanes, diverts the angle of traffic flow into and out of the device, and can be used to provide pedestrians with a refuge (Austroads 2020).		 Source: Austroads (2020)
Speed reduction	Medium	Studies have reported a 14% reduction in mean speeds and a 9-44% reduction in 85 th percentile speeds post implementation (Jurewicz 2009, Austroads 2009, 2020, Hawley et al. 1993, Forbes & Gill 1999).	
Safety improvement	Medium	Studies have reported an 18% reduction in expected crashes (Nilsson 1984).	
Community acceptance		No studies available.	
Implementation	- Road geometry needs to be wide enough to accommodate island installation. - Treatment is only appropriate on streets with posted speed limits equal to or less than 60 km/h.		
Considerations	Potential for property access to be restricted resulting in drivers performing U-turn manoeuvres.		

Further guidance	See AGTM08-20 (Austroads (2020) for further design guidance.
References	Austroads 2009, <i>Impact of LATM treatments on speed and safety</i>, AP-T123-09, Austroads, Sydney, NSW. Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Forbes, G & Gill, T 1999, "Arterial Speed Calming- Mohawk Road case study" in Urban Street Symposium - Transportation Research Board, Dallas, Texas, June 28-30, pp. 1 2/1-7. Hawley, L, Henson, C, Hulse, A & Brindle, R, 1993, Towards traffic calming: a practitioners' manual of implemented local area traffic management and blackspot devices, Report no. CR 126, Federal Office of Road Safety, Canberra, ACT. Jurewicz, C 2009, <i>Impact of LATM Treatments on Speed and Safety</i>, Road & Transport Research Journal, 18(4), 14–22. http://search.proquest.com/docview/743234313/. Nilsson, G 1984, <i>Speeds, accident rates and personal injury consequences for different road types</i>, report no. 277, Swedish National Road and Transport Research Institute, Linköping, Sweden.

Static Signage

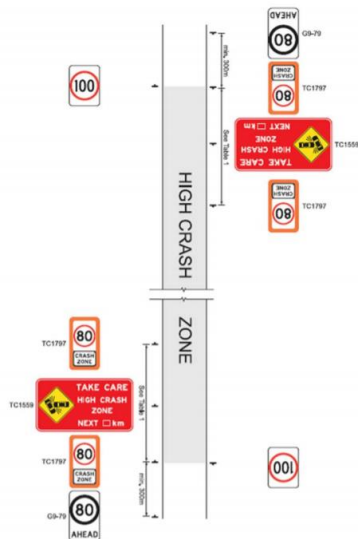
SSI: Repeater Regulatory Speed Limit signs		
Description	The purpose of a speed limit sign is to indicate to drivers the maximum legal vehicle speed permitted under normal driving conditions on the street section or in the area where the sign is installed (Austroads 2020).	 The Speed Restriction (R4-1) sign shall be used to indicate the speed limit that applies in the linear speed zone about to be entered, and should be used at the beginning of a built-up area or general rural speed limit except where the requirements of Item (b) apply. The sign shall also be used: (i) as a repeater sign where indicated in Section 10.1.6. (ii) in conjunction with other signs at school zones (see TRUM Volume 2 <i>Guide to Road Safety Part 3 Speed Limits and Speed Management Section 3.2.1 School zones</i>). Source: TMR MUTCD Part 4: Speed Controls (2019)
Speed reduction	Low	Studies have reported a 3-16% reduction in mean speeds and a 2-4% reduction in 85 th percentile speeds post implementation (Austroads 2016a, Mackie 1998, Ullman & Rose 2005, Stephan et al. 2007).
Safety improvement		No studies recorded.
Community acceptance		No studies available.
Implementation	Applicable in all linear speed zones, except for the general urban speed limit and 50 km/h local streets where the default speed limit applies (TMR 2022a).	
Considerations	- May increase clutter and add to roadside hazards which could reduce the credibility of signage if drivers are overwhelmed by the increased stimuli (Austroads 2016a). - Where the zoned speed may be different from the speed which drivers might expect by virtue of street lighting or roadside environment, consideration should be given to more frequent installation of repeater signs (TMR 2022a).	
Further guidance	See Section 3.1.6, MUTCD Part 4 (TMR 2022a), AS 1742.1-2014 and AS 1742.2-2009 for further design guidance.	
References	Austroads 2016a, <i>Achieving safe system speeds on urban arterial roads: compendium of good practice</i>, AP-R514-16, Austroads, Sydney, NSW. Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Department of Transport & Main Roads 2022a, Queensland Manual of Uniform Traffic Control Devices – Part 4: Speed Controls, TMR, Brisbane, Queensland. Mackie, A 1998, <i>Urban speed management methods</i>, Transport Research Laboratory, Berkshire, England. Stephan, K, Lenne, M & Corben, B 2007, 'Reduction of travel speeds in the Melbourne CBD after installation of repeater speed signs: results of a controlled before-after study', <i>Australasian road safety research policing education conference, 2007, Melbourne, Victoria, Australia</i>, The Meeting Planners, Collingwood, Vic, 9 pp.	

Ullman, G & Rose, E, 2005, Evaluation of Dynamic Speed Display Signs, Transportation Research Record, 1918(1918), pp.92–97.

SS2: 'New speed limit' signs

Description	The implementation of new speed limits, particularly lower limits, often takes drivers some time to adjust to the new limit. To facilitate a smooth transition, signage displaying 'new speed limit ahead' or 'new limit' can be used.		 TC2353 Source: Queensland MUTCD Part 4: Speed Controls (2022)
Speed reduction	Low	No formal studies have been conducted, however, have proven to be effective in Victoria when observed travel speed is higher than the risk- assessed speed limit. .	
Safety improvement	Low	No formal studies have been conducted.	
Community acceptance	Low	No formal studies have been conducted.	
Implementation	The new speed limit signs are used in Victoria and are only displayed as a temporary measure over a period of one to two months (VicRoads 2017).		
Considerations	Providing warning of a new speed limit could reduce the credibility of speed enforcement efforts.		
Further guidance	See Section 4.5, Traffic Engineering Manual – Speed Zoning Guidelines (Volume 3) (VicRoads 2017) for further design guidance.		
References	VicRoads 2017, <i>Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines</i> , 1 st Edition, Victoria State Government, Victoria, Australia.		

SS3: Black link signage

Description	In Queensland, high-crash risk zones or black links are sections of road identified across the state as having a history of speeding and subsequently speed-related crashes. To ensure drivers are able to differentiate between the speed environment in the reduced speed zones and the environment in a regular speed zone, signage can be installed to warn drivers that they are entering a speed zone where the speed limit has been reduced due to the poor safety performance of the section of road (TMR 2022a).		 Source: TMR (2022a)
Speed reduction	Medium	Studies have reported a 7-12 km/h reduction in the 85 th percentile speeds (Edgar & Tripathi 2011).	
Safety improvement	Medium	Studies have reported an 11-16% reduction in expected crashes (Edgar & Tripathi 2011).	

Community acceptance		No formal studies have been conducted.
Implementation	Treatment is typically adopted on higher-order roads with high vehicle volumes.	
Considerations	-	
Further guidance	See Section 3.1.13, Queensland Manual of Uniform Traffic Control Devices – Part 4 (TMR 2022a) for further design guidance.	
References	Department of Transport & Main Roads 2022a, Queensland Manual of Uniform Traffic Control Devices – Part 4: Speed Controls, TMR, Brisbane, Queensland. Edgar, N & Tripathi, S 2011, 'Queensland's Experience with Speed Limit Reductions on Black Links', 2011 Australasian Road Safety Conference, Perth, Western Australia, Australia.	

Feedback Signs

<i>FS1: Radar Speed Signs</i>		
Description	Radar speed signs aim to promote safety through increasing driver awareness of their travelling speed and to achieve better adherence to the speed limit in locations with identified or suspected speed issues.	 Source: Burke (2015)
Speed reduction	Medium	Studies have reported a 13-14% reduction in mean speeds and a 10% reduction in 85 th percentile speeds across various speed zones and road hierarchies (Burke 2015, Wall et al. 2010).
Safety improvement		No formal studies have been conducted.
Community acceptance		No formal studies have been conducted.
Implementation	Data from the signs can be provided to the Queensland Police Service to help identify speeding hot spots (Burke 2015).	
Considerations	Road must be long enough and have enough physical space to install the sign (Burke 2015).	
Further guidance	-	
References	Burke, A 2015, 'Effectiveness of portable speed warning signs', 2015 Australasian Road Safety Conference, Gold Coast, Queensland, Australia. Wall, J, Job RFS, Boland P, Cuenca V, Creef, K, Beck J & Saffron D 2010, 'The NSW intelligent speed adaptation trial', NSW Centre for Road Safety, Roads and Traffic Authority, Sydney, NSW.	

FS2: Vehicle Activated Signs

Description	Vehicle activated signs (VAS) are electronic signs that display a message when approached by a driver exceeding a speed threshold (NZ Transport Agency 2016).		
Source: NZ Transport Agency (2016)			
Speed reduction	Low	Studies have reported a 3-4% reduction in mean speeds and a 5-6% reduction in 85 th percentile speed (Mabbott & Cairney 2002, Winnett & Wheeler 2002, Austroads 2016a, Makwasha & Turner 2014).	
Safety improvement	Medium	Studies have reported an 11-35% reduction in expected crashes (NZ Transport Agency 2016, Charlton & Baas 2006).	
Community acceptance		No formal studies have been conducted.	
Implementation	- Does not perform well on roads with (TMR 2016): - high volume (i.e. AADT > 20,000 vehicles per day) - speed limit of 100 km/h or greater - more than 2 lanes in each direction - on approaches to hazards with vertical or horizontal curves or gradients - areas with dense canopy of trees - roads with limited forward visibility - overtaking lane is present. - Able to be adopted in combination with a gateway treatment.		
Considerations	- Vandalism of signs (NZ Transport Agency 2016). - Where power supplies are difficult to access in remote areas, alternative power supplies can be more expensive (NZ Transport Agency 2016).		
Further guidance	See Technical Note 160 – Vehicle Activated Signs (TMR 2016) for further design guidance.		
References	Austroads 2016a, <i>Achieving safe system speeds on urban arterial roads: compendium of good practice</i>, AP-R514-16, Austroads, Sydney, NSW. Mabbott, N & Cairney, P 2002, 'Courtesy travel speed advisory systems', <i>Road safety research, policing and education conference</i>, 2002, Adelaide, South Australia, Transport SA, Adelaide, SA, pp. 147-55. Makwasha, T & Turner, B 2014, <i>Evaluation vehicle activated signs on rural roads</i>, Paper presented at the 26th ARRB Conference, Sydney, Australia. NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i>, New Zealand Government, New Zealand TMR 2016, Technical Note 160 – Vehicle Activated Signs (VAS), Department of Transport & Main Roads, Brisbane, Queensland. Winnett, MA & Wheeler, AH 2002, <i>Vehicle Activated Signs—A Large Scale Evaluation</i>. TRL548, Road Safety Division, Department for Transport, Wokingham, Berkshire.		

Perceptual Countermeasures

<i>PCI: Lane Narrowings</i>		
Description	Lane narrowings involve treatment of the trafficable carriageway to reduce speeds, improve delineation and to minimise pedestrian crossing distances (and therefore exposure to conflict) (Austroads 2020).  Source: NZ Transport Agency (2016)	
Speed reduction	Medium	Studies have reported an 11-40% reduction in mean speeds. (Charlton & Bass 2006, Distefano & Leonardi 2017, Harvey 1992, Heimbach 1983).
Safety improvement		No formal studies have been conducted.
Community acceptance		No formal studies have been conducted.
Implementation	- Often the treatment is not appropriate to use when the kerbside lane is required for traffic, in locations with limited sight distance, in streets without adequate lighting or where the narrowing is such that it will pose a difficulty to buses and cyclists on fixed routes (Austroads 2020). - The effectiveness of lane narrowings can be increased when used with median treatments, flat-top road humps, or other forms of slow point (Austroads 2020).	
Considerations	- Increased conflict between vehicles and cyclists, less effective than many other horizontal displacement devices in reducing speeds, might encourage illegal overtaking and it may aid in increasing congestion (Austroads 2020). - The road uses and road functions need to be discussed as part of the application of these types of treatments to ensure safety is not compromised for any road users (NZ Transport Agency 2016).	
Further guidance	See Guide to Traffic Management Part 8: Local Street Management (Austroads 2020) for further design guidance.	
References	Austroads 2020, <i>Guide to Traffic Management Part 8: Local Street Management</i>, 3rd Edition, Austroads, Sydney, NSW. Charlton, S & Baas, P 2006, <i>Speed change management for New Zealand roads</i>, Land Transport New Zealand Research Report 300, p.144. Distefano, N & Leonardi, S 2017, Effects of speed table, chicane and road narrowing on vehicle speeds in urban areas, New Horizons 2017 Conference, Italy. Harvey, T 1992, <i>A Review of Current Traffic Calming Techniques</i>, Institute for Transport Studies, University of Leeds, Leeds, UK. Heimbach, C et al, 1983, "Some Partial Consequences of Reduced Traffic Lane Widths on Urban Arterials", Transportation Research Record 923, Transportation Research Board. NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i>, New Zealand Government, New Zealand	

PC2: Converging Chevron Linemarking Patterns		
Description	The converging chevron pattern is characterised by a series of chevrons on the pavement surface that are placed progressively closer (Yang et al. 2019). The intent of this treatment is to create the illusion that drivers are travelling faster than they are and to foster the impression that the traffic lanes are narrowing.  Source: Yang et al. (2019)	
Speed reduction	Low	Studies have found a reduction in mean speeds between 1.6 to 25 km/h, and between a 1.6 to 28 km/h reduction in 85 th percentile speeds (Drakopoulos & Vergou 2003, Hunter et al. 2010)
Safety improvement	Medium	Studies have reported a 25-50% reduction in expected crashes (Griffin & Reinhardt 1996).
Community acceptance		No formal studies have been conducted.
Implementation	Studies have indicated that chevrons have a minimal effect on vehicle speeds with drivers adjusting back to their previous speeds as they acclimatise to the treatments. The effect on speed tended to be most pronounced immediately after the chevron implementation. However, by the 9th month after implementation the magnitude of the effect dropped to under 1 to 2 mph (1.6 to 3.2 km/h) for the mean speed and most vehicle speed percentiles.	
Considerations	Chevron markings are often applied to higher-speed environments to be more effective in reducing speed.	
Further guidance	-	
References	Drakopoulos, A & Vergou, G 2003, 'An evaluation of the converging chevron pavement marking pattern installation on interstate 94 at the Mitchell Interchange South-to-West ramp in Milwaukee County, Wisconsin', 2003, Marquette University. Griffin, L, & Reinhardt, R 1996, A review of two innovative pavement patterns that have been developed to reduce traffic speeds and crashes, Washington, DC: AAA Foundation for Traffic Safety. Hunter et al. 2010, Evaluation of Effectiveness of Converging Chevron Pavement Markings in Reducing Speed on Freeway Ramps, Transportation Research Record, 2149(1), pp.50–58. Yang, Y. et al. 2019, Evaluation effects of two types of freeway deceleration markings in China. PLoS ONE, 14(8).	

PC3: Transverse lines, bars or optical speed bars		
Description	Transverse lines, bars or optical speed bars consist of intermittent pavement markings (either flushed or raised) that extend across traffic lanes. Transverse lines can be used to alert drivers of a high crash risk location or as a warning to reduce their speed.  Source: VicRoads (2017)	
Speed reduction	Low	Studies have reported a reduction of 5-12% in mean speeds (VicRoads 2017).
Safety improvement	Medium	Studies have shown a 20-30% reduction in expected casualty crashes (VicRoads 2017).

Community acceptance		No formal studies have been conducted.
Implementation	- Common practice to reduce the spacing between successive transverse lines in the direction of travel in order to create a perceptual impression that a driver is speeding, encouraging drivers to respond by reducing their speeds (VicRoads 2017). - Commonly used as a gateway treatment to rural townships (VicRoads 2017).	
Considerations	- Potential noise pollution in local streets and the ability for cyclists to be able to bypass them (VicRoads 2017). - Site-specific installations should ensure that transverse lines have adequate skid resistance (particularly for motorcyclists), to reduce a skid resistance differential with the pavement surface (VicRoads 2017). - Pavement markings are subject to traffic wear and can require regular maintenance to ensure lines remain highly visible (VicRoads 2017). - Line visibility may be greatly affected in dark or wet conditions (VicRoads 2017).	
Further guidance	See Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines (VicRoads 2017) for further design guidance.	
References	VicRoads 2017, <i>Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines</i> , 1 st Edition, Victoria State Government, Victoria, Australia.	

PC4: Urban Landscaping		
Description	Various forms of landscaping can be used to alter a driver's perception of the road environment in order to influence vehicle speeds by creating the feelings of being in more of an enclosed space (Westerman et al. 1993).	 Source: VicRoads (2017)
Speed reduction		No formal studies have been conducted.
Safety improvement		No formal studies have been conducted.
Community acceptance		No formal studies have been conducted.
Implementation	- Care should be taken to ensure that obstacles close to the road do not increase crash risks and continue to provide a forgiving road environment for drivers (VicRoads 2017). - Landscaping should not impede any sight distances, pedestrian visibility or obstruct any surrounding services (e.g. underground, overhead) (VicRoads 2017).	
Considerations	Maintenance of any natural urban landscaping, this includes ensuring appropriate clearances for operational and safety reasons (VicRoads 2017).	
Further guidance	-	
References	VicRoads 2017, <i>Traffic Engineering Manual: Volume 3 – Additional Network Standards & Guidelines</i> , 1 st Edition, Victoria State Government, Victoria, Australia.	

	Westerman, H, Black, J, Brindle, R, Lukovich, T & Sheffield, D 1993, A Practitioner's Guide to Managing the Road Environment of Traffic Routes Through Commercial Centres, Federal Office of Road Safety and the Roads and Traffic Authority, NSW, Australia.
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<i>PC5: Shared Spaces</i>		
Description	Shared spaces or naked roads are an urban design concept where the priority for users is shifted from vehicles towards pedestrians and cyclists, complemented by a speed limit reduction. This treatment is more common in areas where 'place' as a function is more important than the through traffic. While shared spaces can be achieved in different ways, the general concept involves removing conventional road management systems such as traffic signals and signs, kerbs, barriers and line markings (Austroads 2016a).	 Source: NZ Transport Agency (2016)
Speed reduction	Medium	Studies have reported a 13-15 km/h mean speed reduction and a 27-35% reduction in 85 th percentile speeds (Austroads 2016a, Department of Transport 2012, Webster & Mackie 1996).
Safety improvement	High	Studies have reported an expected 49-70% reduction in crashes (Austroads 2016a, Webster & Mackie 1996).
Community acceptance		No formal studies have been conducted.
Implementation	- Implementation issues of concern include (Austroads 2016a): - Shared space applications depend on the area-specific traffic and spatial problems. - They require substantial re-design of road and pedestrian space to create a distinct environment. - There could be confusion with who has priority. - This treatment can present some problems for the visually and hearing impaired. - Spaces are normally designed for operational speeds of 10 to 15 km/h, however, can be posted up to 30 km/h (NZ Transport Agency 2016).	
Considerations	Shared spaces are typically applied in high pedestrian volume areas, including strip shopping centres and they should not be considered as a treatment for roads with traffic volumes of more than 15,000 vehicles per day (Austroads 2016a).	
Further guidance	-	
References	Austroads 2016a, <i>Achieving safe system speeds on urban arterial roads: compendium of good practice</i>, AP-R514-16, Austroads, Sydney, NSW. Department of Transport 2012, 'Bendigo town centre: creating shared space to improve pedestrian safety', Department of Transport Victoria, Melbourne, Victoria. NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i>, New Zealand Government, New Zealand. Webster, D & Mackie, A 1996, Review of Traffic Calming Schemes in 20 mph Zones, Transport Research Laboratory Report 215, Crowthorne, UK.	

<i>PC6: RRPMs (inside of edgeline)</i>		
Description	Some practitioners have identified that the installation of RRPMs on the inside of the edgeline has been effective as a speed management activity. This had a similar effect as narrowing the lane width.  Source: Google Maps 2020, image, map data, Google, CA, USA.	
Speed reduction	Low	No formal studies have been conducted but Cairns Regional Council has found it effective in reducing mid-block speeds.
Safety improvement	Low	No formal studies have been conducted but Cairns Regional Council has received positive feedback from drivers and cyclists.
Community acceptance	Low	No formal studies have been conducted but Cairns Regional Council has received positive feedback from drivers and cyclists.
Implementation	-	
Considerations	Maintenance – the rate of replacement is the same as for RRPMs which have been placed on centreline treatments.	
Further guidance	-	
References	-	

Other

<i>O1: Gateway Treatments</i>		
Description	Gateway treatments predominantly involve the use of signs with other techniques to create a threshold or gateway between high and low-speed environments.  Source: Austroads (2016b)	
Speed reduction	Low	Studies have found a 1.6-15 km/h mean speed reduction and a 1.6-25 km/h speed reduction in the 85 th percentile speed (American Traffic Safety Services Association 2016, Austroads 2016a).
Safety improvement	Medium	Studies have found an 11-43% reduction in expected crashes (Austroads 2014, 2016, Charlton & Bass 2006, Taylor & Wheeler 2000).
Community acceptance		No formal studies have been conducted.
Implementation	- Gateway treatments needs to be located at the point where development commences to be most effective. - Should be backed up by changes in the environment (e.g. use of painted medians) after the threshold to maintain the speed reductions. - Gateway treatments are only suitable for transition zones or where there are clear changes in traffic conditions and the speed environment (e.g. entry to a shopping strip).	

Considerations	- Street furniture may introduce hazards for errant vehicles. - Care should be taken so that the gateway does not have a negative effect on skid resistance, presenting an additional risk, particularly for motorcyclists. - Speed reduction produced by a gateway treatment may dissipate within 250 m if there are no downstream changes in the road conditions, such as decreases in road width or an increase in urban density (Charlton & Baas 2006).
Further guidance	-
References	American Traffic Safety Services Association 2016, Innovative Safety Solutions with Pavement Marking and Delineation, Fredericksburg, Virginia. Austrroads 2014, <i>Methods for Reducing Speeds on Rural Roads: Compendium of Good Practice</i>, AP-R449-14, Austrroads, Sydney, NSW. Austrroads 2016a, <i>Achieving safe system speeds on urban arterial roads: compendium of good practice</i>, AP-R514-16, Austrroads, Sydney, NSW. Charlton, S & Baas, P 2006, <i>Speed change management for New Zealand roads</i>, Land Transport New Zealand Research Report 300, p.144. Taylor, M & Wheeler, A, 2000, Accident reductions resulting from village traffic calming. In: Demand management and safety systems; proceedings of seminar J, Cambridge 11-13 September 2000, p. 165-174.

O2: Pavement texturing and colouring

Description	Pavement texturing and surface colouring is a common treatment used to emphasise a traffic calming feature or to warn drivers to reduce their operating speed. The use of paving materials such as bricks, cobbles, concrete pavers, or other materials that create variation in colour and texture reinforces the identity of the area as a traffic-restricted zone.		
Source: NZ Transport Agency (2016)			
Speed reduction	Low	Studies have found a reduction of 5-57% in the mean speed and a 2% reduction in the 85 th percentile speed (Jones & Lutes 2016, Krammer & Sheldahl 2013, Nogueira & Mennis 2019, Te Velde 1985).	
Safety improvement		No formal studies have been conducted.	
Community acceptance		No formal studies have been conducted.	
Implementation	-		
Considerations	• Effectiveness of the original colour coating can degrade over time, requiring ongoing maintenance (NZ Transport Agency 2016). • More expensive to maintain than standard surfacing (NZ Transport Agency 2016).		
Further guidance	-		
References	Jones, K & Lutes, S 2016, Why we should preserve brick streets, webpage, Lafayette, Indiana, viewed 24 August 2020, < https://highlandparklafayette.com/wp-content/uploads/Preserving-Lafayettes-Brick-Streets.pdf >. Krammes R & Sheldahl E 2009, "Traffic Calming on Main Roads Through Rural Communities" Federal Highway Administration TechBrief, University of Iowa.		

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4.4.2 Enforcement

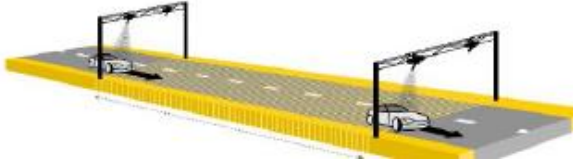
Cameras and Radar

<i>CR1: Fixed speed cameras</i>		
Description	Fixed speed cameras are permanently installed at high-risk locations, the aim being to reduce vehicle speeds and subsequently fatal and serious injury crashes. The effectiveness of fixed speed cameras has been assessed both nationally and internationally (Elvik & Vaa 2009, Gains et al. 2004, Diamantopoulou & Corben 2002).	 Source: ARRB Transport Research (2005)
Speed reduction	Low	Studies have found a 3.4-7% reduction in mean speeds and a 4-20% reduction in 85 th percentile speeds (Gains et al. 2005, ARRB Transport Research 2005, Diamantopoulou & Corben 2002).
Safety improvement	Medium	Studies have found a 16-97% reduction in expected crashes (ARRB Group 2005, Blackburn & Glance 1984, Elvik & Vaa 2004, Gains et al. 2005, PA Consulting 2001, Transport for NSW 2015).
Community acceptance		No formal studies have been conducted.
Implementation	-	
Considerations	Some members of the public may view speed cameras as revenue raising.	
Further guidance	-	
References	ARRB Transport Research 2005, <i>Evaluation report: evaluation of the fixed digital speed camera program in NSW</i>, Roads and Traffic Authority, Sydney, NSW. Diamantopoulou, K & Corben, B 2002, 'The impact of speed camera technology on speed limit compliance in multi-lane tunnels', Road safety research, policing and education conference, 2002, Adelaide, South Australia, Transport SA, Adelaide, SA, pp. 79-84. Elvik, R & Vaa, T 2009, <i>The handbook of road safety measures</i>, 2nd edn, Elsevier, Oxford, UK. Gains, A, Nordstrom, M, Heydecker, B & Shrewsbury, J 2005, <i>The national safety camera programme: four-year evaluation report</i>, London: P A Consulting Group and University College London. PA Consulting, 2001, <i>Cost Recovery System for traffic safety cameras - First year report: Executive Summary</i>, Report prepared for DTLR Road Safety Division, U.K. Transport NSW 2015, <i>Annual NSW Speed Camera Performance Review 2015</i>, Transport New South Wales Centre of Road Safety, NSW Government, NSW.	

CR2: Mobile speed cameras

Description	Mobile speed cameras are similar to fixed speed cameras but they can be moved from location to location (e.g. by trailer), allowing speed enforcement to be targeted given specific conditions. They are often used in areas that are not safe or practical for a mobile speed camera vehicle. The cameras are used in high-risk locations, including high-speed road corridors, roadwork areas and school zones. The unpredictability of their location also contributes to speed reductions.	
	 Source: Austroads (2016a)	
Speed reduction	Low	Studies have found a 1.6-2.3 km/h reduction in mean speeds (Gunarta & Kerr 2005, De Pauw et al. 2014).
Safety improvement	Medium	Studies have found a 6-45% reduction in expected crashes (Newstead & Cameron 2003, Anderson & Edgar 2011, Bobevski et al. 2004, Goldenbeld & van Schagen 2005, Gunarta & Kerr 2005, Chen et al. 2000, Gains et al. 2004, Jones et al. 2007).
Community acceptance		No formal studies have been conducted.
Implementation	- Unmarked and unsigned deployments should be used at most sites in order to enforce to road users that they can be caught and punished anywhere and anytime (ARRB 2019). - Over deployments at specific sites could result in a halo effect, resulting in site-specific deterrence rather than general network-wide deterrence (ARRB 2019).	
Considerations	- Signage should not be placed in advance of mobile speed cameras as it allows drivers to adjust speed in advance of the site, decreasing the certainty of punishment (ARRB 2019). - Site selection should be based on crash risk. - Once sites have been selected, a random deployment schedule should be adopted using a computer algorithm or statistical analysis to ensure selection is truly random (ARRB 2019).	
Further guidance	-	
References	Anderson, R & Edgar, AW 2001, 'Mobile speed cameras in the ACT: slashing speeds and cutting crashes', <i>Road safety research, policing and education conference, 2001, Melbourne, Victoria</i>, Monash University Conference Management Office, Clayton, Vic, 5 pp. ARRB 2019, A review on Better Practice for Mobile Speed Camera Programs in Other Jurisdictions, Australian Road Research Board, Brisbane, Queensland. Bobevski, I, Hosking, S, Oxley, P, & Cameron, M 2004, Evaluation of speed enforcement initiatives in Victoria, 2000-2002, Draft final report, Monash University Accident Research Centre. Chen, G, Wilson, J, Meckle, W & Cooper, P 2000, Evaluation of photo radar program in British Columbia, <i>Accident Analysis Prevention</i>. 32, 517– 526. De Pauw, E., Daniels, S., Brijs, T., Hermans, E., Wets, G. 2014. <i>An evaluation of the traffic safety effect of fixed speed cameras</i>. <i>Safety Science</i>, 62, 168–174. Gains, A, Heydecker, B, Shrewsbury, J & Robertson, S 2004, <i>The national safety camera programme: three-year evaluation report</i>, prepared by PA Consulting Group for Department for Transport, DfT, London, UK. Goldenbeld, C & van Schagen, I 2005, The effects of speed enforcement with mobile radar on speed and accidents: an evaluation study on rural roads in the Dutch province Friesland. <i>Accident Analysis and Prevention</i>, Vol. 27, pp. 1135-1144. Gunarta, S & Kerr, G 2005, Speed impact of mobile speed cameras in Christchurch, <i>Road and Transport Research</i>, Vol. 14, No.2. Jones, A., Sauerzaph, V. & Haynes, R. 2007, <i>The effects of mobile speed camera introduction on road traffic crashes and casualties in a rural county in England</i>, <i>Journal of Safety Research</i> 39 (2008) 101–110.	

CR3: Point-to-point cameras

Description	Point-to-point speed cameras use pairs of cameras to determine an average speed along a known distance between them. A number of cameras are mounted at staged intervals along a particular route and are linked to measure the time taken to travel between at least 2 given points. The distance between 2 camera sites may vary from as low as 300 metres up to many kilometres and an enforcement threshold may be implemented in a similar manner to mobile or fixed speed camera operations (Cameron & Delaney 2006).		 Source: Austroads (2016a)
Speed reduction	Medium	Studies have found a 15-20% reduction in mean speed and a 22% reduction in 85 th percentile speeds. (Speed Check Services 2010, Stoelhorst 2008).	
Safety improvement	High	Studies have found a 35-85% reduction in expected crashes (Austroads 2012, Hoyer 2015).	
Community acceptance		No formal studies have been conducted.	
Implementation		- Synchronisation of clocks used in point-to-point enforcement systems has been flagged as an issue (Austroads 2012). - Keenan (2002) notes that a significant proportion of drivers often manipulate their speed behaviour in close vicinity to the installations, suddenly applying their brakes prior to the camera and then accelerating immediately after, often resulting in inflated crash statistics.	
Considerations		- Concerns are regularly expressed regarding the privacy and security of data stored by point-to-point systems (Orozova-Bekkevold et al. 2007). These concerns include ensuring the security of stored data, particularly at roadside processors. - Concerns with the accuracy of video data accurately capturing number plates (Austroads 2012).	
Further guidance		-	
References		Austroads 2012, <i>Point-to-point speed enforcement</i>, AP-R415-12, Austroads, Sydney, NSW. Cameron, M & Delaney, A 2006, <i>Development of Strategies for Best Practice in Speed Enforcement in Western Australia</i>, Melbourne: Monash University Accident Research Centre. Keenan, D 2002, Speed cameras: The true effect on behaviour, <i>Traffic Engineering and Control</i>, 43, 154-160. Orozova-Bekkevold, I Martinez, M & Akkermans, L 2007, <i>Needs and Objectives of the EC Regarding TLE Data in the Light of Data Availability and the Technical Aspects of Data Collection and Exchange: Working Paper 12: Police Enforcement Policy and Programmes on European Roads</i>. Speed Check Services 2010, <i>Average Speed Enforcement Solutions: Safer, Smoother, Greener, Fairer</i>, London: Speed Check Services. Stoelhorst, H 2008, <i>Reduced speed limits for local air quality and traffic efficiency</i>, Paper presented at the 7th European Congress and Exhibition on Intelligent Transport Systems and Services, Geneva, Switzerland.	

CR4: Combined red light and speed cameras		
Description	Combined red light and speed cameras are located at intersections to detect both red light and speeding offences; drivers can also be fined for both offences if they speed through a red light. They are typically placed at intersections where speed-related crashes have occurred.	 Source: NRMA (n.d.)
Speed reduction		No formal studies have been conducted.
Safety improvement	Medium	Studies have found an 11-47% reduction in expected crashes. (NRMA n.d., Contini & El-Basyouny 2016, Cameron & Delaney 2006).
Community acceptance		No formal studies have been conducted.
Implementation	Typical combined red light and speed cameras only capture data on one leg of the intersection, however at major road intersections, speeding can often occur on multiple legs. In Germany, multi-leg combined red light and speed cameras are used to capture multiple intersection legs (Vitronic 2020).	
Considerations	Concerns with the accuracy of video data collected have been raised.	
Further guidance	-	
References	Contini, L & El-Basyouny, K 2016, Lesson learned from the application of intersection safety devices in Edmonton, <i>Accident Analysis & Prevention</i>, 94, pp. 127-134. NRMA n.d., <i>Shedding light on red light speed cameras</i>, webpage, Brisbane, Australia, viewed 21 August 2020, <https://www.mynrma.com.au/cars-and-driving/driver-training-and-licences/resources/shedding-light-on-red-light-speed-cameras>. Vitronic 2020, <i>POLISCAN RED+SPEED: Perfect Symbiosis for Monitoring Traffic Light Intersections</i>, webpage, Wiesbaden, Germany, viewed 21 August 2020, <https://www.vitronic.com/traffic-technology/applications/traffic-enforcement/red-light-enforcement/poliscan-red-speed.html>.	

Police Presence

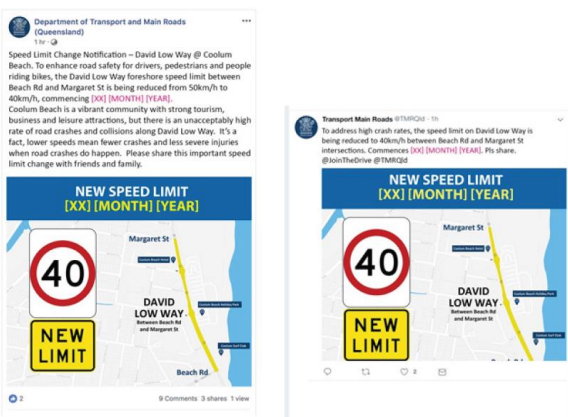
PP1 and PP2: Police Patrol Movements		
Description	Where camera-based operations cannot be introduced in the short term, effective compliance can be achieved (particularly in urban areas) with police patrol movements (including hand held radar or laser devices) and relevant interception strategies. This includes: - regular patrols (including both overt and covert vehicles) - targeted re-routing of patrol movements on high-risk streets (i.e. based on crash, speed history).	 Source: WHO (2008)
Speed reduction	Low	Studies have found a 5% reduction in mean speeds (Goldenbeld & van Shagen 2005).
Safety improvement	Medium	Studies have found a 16–71.3% reduction in expected crashes. (Chen et al. 2020, Diamantopoulou & Cameron 2002, Goldenbeld & van Shagen 2005).

Community acceptance		No formal studies have been conducted.
Implementation	Unmarked and unsigned deployments should be used at most sites to enforce to road users that they can be caught and punished anywhere and anytime (ARRB 2019).	
Considerations	Overt deployments at specific sites could result in a halo effect, resulting in site-specific deterrence rather than general network-wide deterrence (ARRB 2019).	
Further guidance	QPS Traffic Manual: Chapter 6 (Speed Detection)	
References	ARRB 2019, A review on Better Practice for Mobile Speed Camera Programs in Other Jurisdictions, Australian Road Research Board, Brisbane, Queensland. Chen, G, Wilson, J, Meckle, W & Cooper, P 2000, Evaluation of photo radar program in British Columbia, Accident Analysis Prevention. 32, 517– 526. Diamantopoulou, K & Cameron, M 2002, An evaluation of the effectiveness of overt and covert speed enforcement achieved through mobile radar operations, Report no 187, Monash University Accident Research Centre (MUARC), Victoria, Australia. Goldenbeld, C & van Schagen, I 2005, The effects of speed enforcement with mobile radar on speed and accidents: an evaluation study on rural roads in the Dutch province Friesland. Accident Analysis and Prevention, Vol. 27, pp. 1135-1144.	

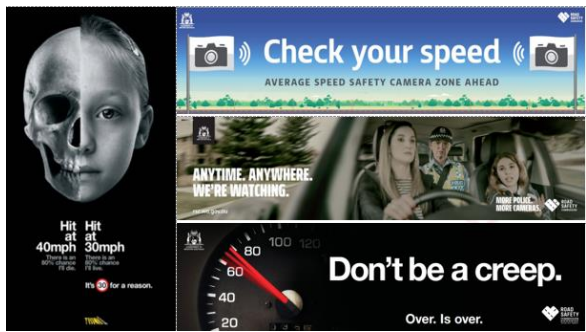
PP3: Multi-purpose bays

Description	In order for police to undertake safe enforcement of the network, multi-purpose bays have historically been used to help them with intercepting vehicles when necessary. An increased police presence facilitates more opportunities to influence driver behaviour and detect highrisk road users, particularly on narrow roads.	
	Source: Department of Transport and Main Roads	
Speed reduction		No formal studies have been conducted.
Safety improvement		No formal studies have been conducted.
Community acceptance		No formal studies have been conducted.

4.4.3 Education

CMI: Social Media		
Description	A marketing campaign in the context of speed management is used to educate large audiences about issues relating to speed (often seen in the form of social media, television, radio or billboard advertisements). They can include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).	
	 Source: TMR Speed Limit Reduction Communications Toolkit (2019)	
Speed reduction	Low	Mackie (1998) suggests that up to a 3 mph (4.8 km/h) reduction in mean speeds has been achieved through public awareness campaigns. Vaa and Phillips (2009) reported that in Brussels, speed campaigns resulted in a 16% reduction in speeding. Woolley et al. (2001) reported a 0.31 km/h mean speed reduction in a South Australian speed-related publicity experiment.
Safety improvement	Low	Elliott (1993) reported that the average mass media campaign will provide improvements in road safety of approximately 6%.
Community acceptance		No formal studies have been conducted.
Implementation	TMR (2019) provides direction about a wide range of options including: Phase one (communicating the decision to reduce a speed limit): - Stakeholder email detailing the upcoming change - Fact sheet about new speed limit - Poster outlining the change - Draft media statement for road authority - Draft community service announcement for local radio stations - Content and imagery for Facebook and Twitter posts - Wording for variable message signs. Phase two (communicating the commencement of the speed limit change): - Draft media statement - Draft community service announcement for local radio stations - Content and imagery for Facebook and Twitter posts - Wording for variable message signs.	
Considerations	- Target audience – campaigns should be targeted towards a specific audience (i.e. based on crash data statistics) and messages should be clear, consistent and simple (NZ Transport Agency 2016). - Content of message – characteristics including response efficacy, threat relevance, type of emotional appeal and the ordering of the message are important in creating a successful campaign.	
Further guidance	Department of Transport and Main Roads Land Transport Safety Branch, tmr.speed@tmr.qld.gov.au	
References	Elliott, B 1993, A meta-analysis of road safety mass media campaigns, unpublished report. Mackie, A 1998, <i>Urban speed management methods</i>, Transport Research Laboratory, Berkshire, England.	

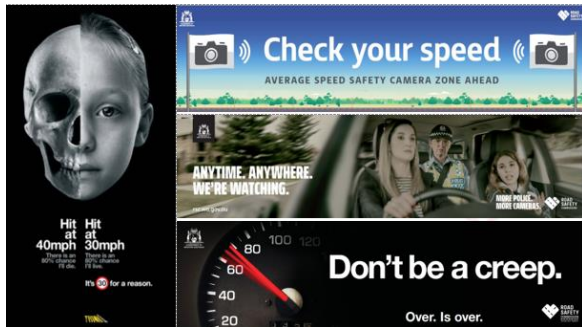
	NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i>, New Zealand Government, New Zealand. Vaa, T & Phillips, R 2009, <i>Campaigns and Awareness Raising Strategies in Traffic Safety (CAST)</i>, Deliverable 1.3: Results of meta-analysis: effects of road safety campaigns, European Commission, Directorate-General for Transport and Energy, Brussels. Woolley, J, Dyson, C, & Taylor, M 2001, <i>The South Australian road safety Media Evaluation Study - final report</i>. Adelaide: Report to Safety Strategy, Transport SA. Transport Systems Centre, University of South Australia.
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<i>CM2: Television advertisements</i>		
Description	A marketing campaign in the context of speed management is used to educate large audiences about issues relating to speed (often seen in the form of television, radio or billboard advertisements). Marketing campaigns can include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).  Source: OECD (2006), Government of Western Australia (2023)	
Speed reduction	Low	The South Australia speed-related publicity experiment (1998-2001) aimed to study the effects of advertising on speeding. TV and radio ads focused on deterring speeding, highlighting crash consequences, and educating about the relationship between speed and crashes. Results showed a decrease of 0.31 km/h in both the mean speed and 85 th percentile speed. (Woolley et al. 2001).
Safety improvement	Low	An estimated casualty reduction of 1.4% was also found (Woolley et al. 2001).
Community acceptance		No formal studies have been conducted.
Implementation	CARRS-Q in 2013 estimated that the median production costs for television road safety advertisements ranged from A\$10,000 (simple talking head advertisement) to \$450,000 (cinema verité type executions featuring graphic crash scenes).	
Considerations	- Target audience – campaigns should be targeted towards a specific audience (i.e. based on crash data statistics) and messages should be clear, consistent and simple (NZ Transport Agency 2016). - Content of message – characteristics including response efficacy, threat relevance, type of emotional appeal and the ordering of the message are important in creating a successful campaign.	
Further guidance	Department of Transport and Main Roads Land Transport Safety Branch, tmr.speed@tmr.qld.gov.au	
References	NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i>, New Zealand Government, New Zealand. Woolley, J, Dyson, C, & Taylor, M 2001, <i>The South Australian road safety Media Evaluation Study - final report</i>. Adelaide: Report to Safety Strategy, Transport SA. Transport Systems Centre, University of South Australia.	

CM3: Billboards

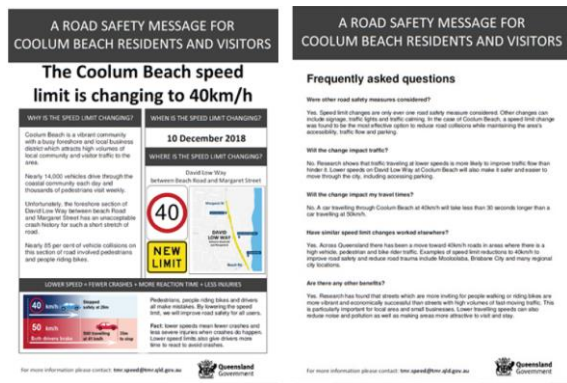
Description	A marketing campaign in the context of speed management is a mass communication medium used to educate large audiences about issues relating to speed (often seen in the form of television, radio or billboard advertisements). Marketing campaigns considered include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).		 Source: myPolice Maryborough (2013)
Speed reduction	Low	Refer to CM1 Social Media.	
Safety improvement	Low	Refer to CM1 Social Media.	
Community acceptance		No formal studies have been conducted.	
Implementation	Billboards need to comply with the framework for the specific area. TMR has a policy for the management of roadside advertising which includes the Roadside Advertising Manual (https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Roadside-advertising-manual).		
Considerations	- Communication medium – multiple modes of communication should be considered, factoring in various language barriers (WHO 2008). - Target audience – campaigns should be targeted towards a specific audience (i.e. based on crash data statistics) and messages should be clear, consistent, and simple (NZ Transport Agency 2016).		
Further guidance	Department of Transport and Main Roads Land Transport Safety Branch, tmr.speed@tmr.qld.gov.au Department of Transport and Main Roads Roadside Advertising Manual, tmr.qld.gov.au/business-industry/Technical-standards-publications/Roadside-advertising-manual		
References	NZ Transport Agency 2016, <i>Speed management guide – Volume 2: toolbox – how to implement treatments and activities</i> , New Zealand Government, New Zealand. WHO 2008, <i>Safety Management – A road safety manual for decision-makers and practitioners</i> , Global Road Safety Partnership, Geneva.		

CM4: Local press / news

Description	A marketing campaign in the context of speed management is a mass communication medium used to educate large audiences about issues relating to speed (often seen in the form of television, radio or billboard advertisements). Marketing campaigns considered include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).		 Source: OECD (2006), Government of Western Australia (2023)
Speed reduction	Low	Refer to CM1 Social Media.	
Safety improvement	Low	Refer to CM1 Social Media.	
Community acceptance		No formal studies have been conducted.	

Implementation	A Speed Limit Reduction – Communications Toolkit has been developed for TMR (2019). This toolkit provides direction about a wide range of options to include. The list includes: Phase one (communicating the decision to reduce a speed limit): - Stakeholder email detailing the upcoming change - Fact sheet about new speed limit - Poster outlining the change <u>Draft media statement for road authority</u> <u>Draft Community Service Announcement for local radio stations</u> - Content and imagery for Facebook and Twitter posts - Wording for Variable Message Signs Phase two (communicating the commencement of the speed limit change): <u>Draft media statement</u> <u>Draft Community Service Announcement for local radio stations</u> - Content and imagery for Facebook and Twitter posts - Wording for Variable Message Signs
Considerations	- Communication medium – multiple modes of communication (i.e. not just television) should be considered, factoring in various language barriers (WHO 2008). - Content of message – various characteristics including response efficacy, threat relevance, type of emotional appeal and the ordering of the message are important in creating a successful campaign.
Further guidance	Department of Transport and Main Roads (DTMR) Land Transport Safety Branch, tmr.speed@tmr.qld.gov.au
References	WHO 2008, Safety Management – A road safety manual for decision-makers and practitioners, Global Road Safety Partnership, Geneva.

CM5: Fact sheets / posters

Description	A marketing campaign in the context of speed management is a mass communication medium used to educate large audiences about issues relating to speed (often seen in the form of television, radio or billboard advertisements). Marketing campaigns considered include mass public campaigns (i.e. state and national level) as well as local initiatives (i.e. specific street or suburb).		
Speed reduction	Low	Refer to CM1 Social Media.	
Safety improvement	Low	Refer to CM1 Social Media.	
Community acceptance		No formal studies have been conducted.	
Implementation	A Speed Limit Reduction – Communications Toolkit has been developed for TMR (2019). This toolkit provides direction about a wide range of options to include. The list includes: Phase one (communicating the decision to reduce a speed limit): - Stakeholder email detailing the upcoming change <u>Fact sheet about new speed limit</u> - Poster outlining the change - Draft media statement for road authority - Draft Community Service Announcement for local radio stations - Content and imagery for Facebook and Twitter posts		

	• Wording for Variable Message Signs Phase two (communicating the commencement of the speed limit change): • Draft media statement • Draft Community Service Announcement for local radio stations • Content and imagery for Facebook and Twitter posts • Wording for Variable Message Signs
Considerations	• Communication medium – multiple modes of communication (i.e. not just television) should be considered, factoring in various language barriers (WHO 2008). • Content of message – various characteristics including response efficacy, threat relevance, type of emotional appeal and the ordering of the message are important in creating a successful campaign.
Further guidance	Department of Transport and Main Roads (DTMR) Land Transport Safety Branch, tmr.speed@tmr.qld.gov.au
References	Communication medium – multiple modes of communication (i.e. not just television) should be considered, factoring in various language barriers (WHO 2008).

<i>CM6: Variable message signs</i>		
Description	Variable message signs (VMSs) are used to dynamically display advisory information or speeds under different conditions. Compared to speed-activated warning signs, variable message signs are continually updated with new information about the road environment conditions to inform drivers with real-time data; this includes an amended speed limit under the conditions.	 Source: Coates Hire (2020)
Speed reduction	Low	Studies have found a reduction of 2.9–6 km/h in mean speed (Cooper & Sawyer 2005, Erke et al. 2005).
Safety improvement	Medium	Studies have found a reduction of 16% in expected crash rates (Oh et al. 2015).
Community acceptance		No formal studies have been conducted.
Implementation	• The perceived credibility of VMS messages is crucial for driver acceptance. Steinhoff et al. (2002) reported lower speed compliance levels when the difference between the prescribed speed limit displayed on the VMS and the actual traffic situation was large. • Warning drivers of an upcoming VMS reduces the probability of missing the upcoming message (Nygardhs & Helmers 2007).	
Considerations	-	
Further guidance	-	
References	Cooper, B & Sawyer, H 2005, Assessment of M25 Automatic Fog-Warning System – Final Report, Federal Highway Administration, Washington D.C., United States of America. Erke, A, Hagman, R & Sagberg, F 2005, Trafikkinformasjon og bilføreres oppmerksomhet – En undersøkelse av hvordan tavler med variabel tekst påvirker kjøreatferd. Transportøkonomisk institutt. TØI rapport 799/2005. Oslo, Norway. Oh, Jun-Seok, et al. 2015, <i>Costs and Benefits of MDOT Intelligent Transportation System Deployments</i>, Western Michigan University, Kalamazoo, Michigan.	

Steinhoff, C et al. 2002, Problematik präventiver Schaltungen von Streckenbeeinflussungsanlagen. Forschung Strassenbau und Strassenverkehrstechnik, Heft 853. Bonn: Bundesministerium für Verkehr, Bau- und Wohnungswesen.

Nygaardhs, S & Helmers, G 2007, VMS – Variable Message Signs: A literature review, VIT, Linköping, Sweden.

CM7: Rubbish bin stickers

Description	Rubbish bin stickers have a visual impact, which is different from conventional figures and numbers in terms of road safety messages. They can form part of a marketing campaign to target road safety. They have the added benefit of being locally applied and therefore create an impact on neighbourhood streets, as more than 30% of crashes occur on these types of streets. (https://www.nowtolove.com.au/news/local-news/wheelie-bin-stickers-to-save-childrens-lives-13727).	
	 Source: ABC News (2016)  Source: WALGA Roadwise Program (https://www.roadwise.asn.au/bin-stickers.aspx)	
Speed reduction		No formal studies have been conducted.
Safety improvement		No formal studies have been conducted.
Community acceptance	High	Western Australian Local Government Association (WALGA) Roadwise Program, includes the participation of 50 local governments which placed more than 225,000 stickers on wheelie bins across Western Australia (https://www.roadwise.asn.au/bin-stickers.aspx).
Implementation	The Australian Road Safety Foundation has designed a sticker that can be purchased (website: https://arsf.com.au/lifesaving-wheelie-bin-stickers/).	
Considerations	The stickers are only visible on bin collection days, which prevents motorists from becoming complacent when they see the stickers too often.	
Further guidance	WALGA Roadwise Program - https://www.roadwise.asn.au/bin-stickers.aspx Australian Road Safety Foundation - https://arsf.com.au/lifesaving-wheelie-bin-stickers/	
References	-	

4.5 Review and Monitor

A speed management activity/ies should be monitored and evaluated to identify its effectiveness.

The evaluation will determine the level of effectiveness and identify if the speeds have been reduced, remain the same as or have increased when compared to the operating speeds pre-implementation.

From the review of available literature, it is evident that jurisdictions either do not capture sufficient data to monitor the effectiveness of speed management activities over time, or they do not publish this data externally. Consequently, there is currently no process for documenting the effectiveness of speed management activities in Queensland.

Operating speeds should be monitored for a 3 month period after implementation. The data should be used to undertake a Speed Data Speed Limit analysis as per *QRSTUV – Guide to Speed Management* (TMR 2022b) and compare the outcome to the results of this analysis pre-implementation and the speed data test ranges (Table 4.2).

Table 4.2: Operating speed data test ranges

Criteria	Existing speed limit (km/h)								
	40	50	60	70	80	90	100	110	
Mean speed	32–43	41–53	49–63	59–72	69–80	79–89	89–97	99–106	
Upper limit of 15 km/h pace	36–49	46–59	56–69	66–79	76–89	86–98	96–106	105–114	
Percentage within pace	> 60	> 60	> 60		> 60	> 60	> 60	Urban > 54 Rural > 45	> 40

Source: TMR (2022b).

If speeds are reduced to the appropriate levels, then no further action is required (apart from any maintenance activities).

If the speeds are unchanged or have increased, alternative speed management activities should be explored.

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Appendix A Consultation

A consultation workshop was held in October 2020 by the project team to engage the Speed Management Committee (TMR districts, councils and Queensland Police Service) and TMR Engineering and Technology (speed and community engagement experts) about their experiences with speed management activities in Queensland.

The workshop minutes are provided in **Error! Not a valid bookmark self-reference.** A.1. An overview of the survey sent out to all participants is outlined in Figure A.1.

Table A.1: Consultation workshop minutes

Agenda topic	Workshop discussion
- Identify scenarios they are regularly presented with (ones that requires the use of speed management activities). - Scenario information includes the road type, posted speed limit and information regarding what is contributing to the speed limit being exceeded (e.g. road attributes such as width, alignment, type OR road user groups e.g. vehicle class, age demographic, time of day etc).	- Scenario 1: High speed rural roads (speed data shows vehicles travelling 90-100 km/h in 80 km/h posted speed zones) that contain long mid-block sections. Typical cross-section includes a 6-7 m formation width, small shoulder formation accompanied by low traffic volumes - Typical challenge – community acceptance, particularly in rural areas when dealing with locals. - Scenario 2: Urban city precincts with high pedestrian mixture with typical posted speeds of 50 km/h. - Scenario 3: COVID-impacted traffic conditions have seen a reduction in fleet platooning effects (particularly on highways or in high-volume areas), contributing to increases in speeding with less vehicles on the road. - Scenario 4: Roadwork environments, vehicles are still speeding in constrained areas or on roads with high-speed geometry. - Scenario 5: Rural township entry with town lengths > 500 m and posted speeds of 60 km/h (vehicles typically travelling at 80 km/h). - Scenario 6: Large events at key locations with high pedestrian volumes (e.g. stadiums, children's sporting events, festivals, fetes etc.) are lacking local traffic management (more guidance required). - Scenario 7: Intersections and roundabouts – typically areas with high vehicle/pedestrian conflict points. Particularly intersections/roundabouts with high-speed environments prior to entry. - Scenario 8: Foreshore areas with increased pedestrian activities, with wide roads and time of day acting as contributing factors.
- Identify the effectiveness of speed management activities implemented to date in Queensland; this would include any treatment within the following categories: - engineering - enforcement - education. Inclusive of when multiple treatments have been used. - This will be an open discussion. Inclusive of when multiple treatments have been used.	Engineering - Reverse curves – costly, alignment changes can be challenging to integrate into the rest of the network. - Vertical and horizontal deflection devices (local streets) such as raised platforms – negative community and key stakeholder feedback (noise, acceleration/deceleration and seen as 'revenue raising'), issues with limited service or heavy vehicle access. - Alternative – speed awareness signs instead have worked well. Communities more open to education/mixed treatments. Lower speeds in congested areas are a more effective treatment. - RRPMs (placed in middle of traffic lane) – narrows the effective width of the traffic lane → note that no community consultation was used for this treatment, however it wasn't an issue - Maintenance – same level of maintenance regardless of placement on the road - Positive community feedback – especially from cyclists - Appropriate speed environment – 70/80 km/h. - Shared road environment (single-lane roundabouts) – signage/linemarking highlights shared paths for both vehicles and cyclists (compared to dedicated cyclist lane through the roundabout). Speed reduction has been found in practice. - Portable vehicle activated signs (European design) – signs displaying green smiley face or red frown face (speeding) found to be more effective than only displaying speed as a number. - Speed and curve warning signage – targeted at speed reduction in high-speed rural roundabouts (80 km/h <) have aided in reducing entry speeds. - Speed limits – permanent regulatory speed reduction to 30 km/h at roundabouts on council roads. Reduction to 40 km/h in CBD areas. - SAMs signage – supports both engineering/enforcement outcomes. Resulted in general decrease in 85th percentile speeds across the network. Data collected from signs can identify times of poor compliance. Concerns regarding accuracy of data collected raised, improvement would be beneficial. - Reduced lane width using linemarking – particularly on local roads as a conceptual measure. - Raised priority crossings (particularly on side roads) – to reduce speed at conflict points - Some negative community feedback with raised platform compliance. - Coloured surface painting – mostly on roundabout approaches. - Compact roundabouts – with vertical deflection on the approach.

Agenda topic	Workshop discussion
	Enforcement • Range of enforcement strategies used by QPS: – Covert and marked vehicles – Trailer enforcement presence effective – In car systems (mobile speed cameras) – returning to the same locations has helped with reductions in speed over time – Fixed speed cameras – target areas based on crash history – Handheld devices (radar) – Variable message signs/highly visible signage (e.g. driving to conditions) – Variable speed limits – challenging to enforce when these regularly change (quarantine period), some engineers contact QPS a month in advance of a speed limit change to assist with the enforcement process – Portable platforms – Combined red light and speed cameras – have worked well in QLD – Point-to-point cameras – more accepted. • Speed limit signs – opportunity for increased reflectivity in the background (improved visibility) • Increased enforcement efforts at roadworks sites have proved effective • Importance of community explanation – adding complementary signage in high-risk crash areas, black spots etc • Impact of social media – raises more awareness about speeding. Greater community acceptance of enforcement efforts when it is communicated to them prior to rolling out enforcement activities. • Difficulties highlighted with targeting high-risk individual drivers who continue to speed on the roads • Provision of target speed enforcement data to QPS (i.e. highlighting time of day where speeding is most problematic) has been effective in reducing recurring behavioural speed in local areas • Provision of safe enforcement areas (e.g. turning bays) helps with enforcement efforts Education • Vehicle mounted signs – costly, used for communicating changes in speed (i.e. not always used), most effective after about a week, only used over short time durations • Community engagement plan (for speed limit reduction in Cairns case study) – dedicated communication engagement plan with community, worked with key stakeholders, issuing without infringement (QPS intercepting and educating), developed a free toolkit for local governments, • Emphasised the difference between education, marketing and community engagement – highlighted the need to be conscious of the right people sharing the right information. • Media releases via social media – large presence has been effective in targeting social media portion of the community • Education campaigns – community feedback has generally been positive for campaigns that support road safety/speed management • School safety committees (run by Transport Safety Officers) – great feedback into engineering safer school zone areas • QPS education programs at schools – effective in bridging the gap between enforcement and education. • Letterbox drops and local media – highlighting importance of safety and safer speeds prior to use of VMSs
• Identify aspirational speed management activities that are believed to be effective and could be trialled. – Including new ideas or activities trialled elsewhere (both domestically or internationally).	• Mixed treatments - local government traffic advisor committees as a whole of government (WOG) and community champion forum to collect information to target enforcement efforts • Community interactions – creating a streamlined communication system for community members to provide feedback on initiatives • Publicly available speed limit data – to help drivers be more aware of their speeds, could be cheaper than VMSs and more appropriated with the rise of automated vehicles. • Sharing data between 3E parties (e.g. QPS, TMR, councils) – e.g. sharing traffic speed data • Speed lottery idea – win money if you're driving below the speed limit, could put a positive spin on behaviour change. Many are unaware that Camera Detected Offence Program (CDOP) revenue is spent on road safety education and road safety projects only. • Variable speed limits (for rural intersections) • Raised intersection platforms

Agenda topic	Workshop discussion
• General discussion – Any other local considerations that need to be accounted for when selecting speed management activities in Queensland?	• COVID implications – decreased congestion has resulted in an increased number of people speeding. • Concerns raised about the inconsistency of treatments across the network and the need for more standardised guidance for speed management activities • Limited state/national funding for speed management activities – some opportunity for local government and state government to collaborate and co-fund initiatives (e.g. speed cameras) • Lack of guidance surrounding communication strategies and methods noted by multiple attendees (even though communication is one of the most important aspects of achieving desired outcomes) • Currently no mandate for regions/councils to conduct speed limit reviews and implement them using speed management activities – potential to incorporate this into future policy • Desire to educate senior managers in TMR and politicians about the influence of speed limit on safety and crash outcomes to get more people on board with speed limit recommendations or the actioning of speed management activities • The Speed Management Committee is a group of four main stakeholders (QPS, TMR PDO, LGAs and TMR Road Safety). SMCs are set up in most regions and hold regular meetings to discuss Speed Limit Review recommendations made by LGAs and TMR PDO. The committee considers strategies that balance the three Es – engineering, education and enforcement. After discussion and endorsement by representatives from these stakeholders, changes in speed limits are implemented by respective road authorities.

Figure A.1: Workshop consultation survey



**Speed Management
Activities Workshop
Consultation - Survey**

SHAPING OUR
TRANSPORT FUTURE

Please answer the questions below

Thank you for attending this workshop today, we greatly appreciate your feedback and contribution to improving how we can improve the process of management speed in QLD!

Please take a few moments to complete the following survey either during the workshop or afterwards, this will help the project team in gaining a more wholistic understanding of the current processes that are being used and steer the direction of future guidance publications.

All answers will remain confidential, the data only be used by the project team.

OK

*** 1. Workshop Attendee Information**

Your Name *	
Your Organisation *	
Email Address	
Contact Number	

2. Agenda Item 1

In your experience, can you identify typical/regular scenarios where speed management activities are required?

Scenario information includes the road type, posted speed limit and information regarding what is contributing to the speed limit being exceeded e.g. road attributes such as width, alignment, type. OR road user groups e.g. vehicle class, age demographic, time of day etc

3. Agenda Item 2

Can you identify the effectiveness of any engineering speed management activities implemented to date in QLD?

Effectiveness of activities might include: trial results, speed reductions, crash reductions, community feedback, treatment costs etc

4. Agenda Item 2

Can you identify the effectiveness of any enforcement speed management activities implemented to date in QLD?

Effectiveness of activities might include: trial results, speed reductions, crash reductions, community feedback, treatment costs etc

5. Agenda Item 2

Can you identify the effectiveness of any education speed management activities implemented to date in QLD?

Effectiveness of activities might include: trial results, speed reductions, crash reductions, community feedback, treatment costs etc

6. Agenda Item 2

Can you identify the effectiveness of any mixed speed management activities (i.e. multiple activities used within or across multiple categories from the 3 E's) implemented to date in QLD?

Effectiveness of activities might include: trial results, speed reductions, crash reductions, community feedback, treatment costs etc

7. Agenda Item 3

Are there any aspirational speed management activities that are believed to be effective and that you think could benefit from a trial in QLD?

Including new ideas or activities trialed elsewhere (both domestically or internationally).

8. Agenda Item 4

Are there any other local considerations that need to be accounted for when selecting speed management activities in QLD?

9. Agenda Item 4

Any further questions or comments you'd like to ask/inform the project team of?

Table A.3: Consultation Workshop 1 Discussion

ITEM	TOPIC	Discussion	Action items	Assigned to	Due date	Complete
0	Meeting opening, identify project scope and deliverables.	N/A				
1	- Identify scenarios they are regularly presented with (ones that requires the use of speed management activities). - Scenario information includes the road type, posted speed limit and information regarding what is contributing to the speed limit being exceeded (e.g. road attributes such as width, alignment, type OR road user groups e.g. vehicle class, age demographic, time of day etc.	- Scenario 1: High-speed rural roads (speed data shows vehicles travelling 90-100 km/h in 80 km/h posted speed zones) that contain long mid-block sections. Typical cross-section includes a 6-7 m formation width, small shoulder formation accompanied by low traffic volumes - Typical challenge – community acceptance, particularly in rural areas when dealing with locals. - Scenario 2: Urban city precincts with high pedestrian mixture with typical posted speeds of 50 km/h. - Scenario 3: COVID-impacted traffic conditions have seen a reduction in fleet platooning effects (particularly on highways or in high-volume areas), contributing to increases in speeding with less vehicles on the road. - Scenario 4: Roadwork environments, vehicles are still speeding in constrained areas or on roads with high-speed geometry. - Scenario 5: Rural township entry with town lengths > 500 m and posted speeds of 60 km/h (vehicles typically travelling at 80 km/h). - Scenario 6: Large events at key locations with high pedestrian volumes (e.g. stadiums, children's sporting events, festivals, fetes etc) are lacking local traffic management (more guidance required). - Scenario 7: Intersections and roundabouts – typically areas with high vehicle/pedestrian conflict points. Particularly intersections/roundabouts with high-speed environments prior to entry. - Scenario 8: Foreshore areas with increased pedestrian activities, with wide roads and time of day acting as contributing factors.				
2	- Identify the effectiveness of speed management activities implemented to date in Queensland this would include any treatment within the following categories: - engineering - enforcement - education Inclusive of when multiple treatments have been used <i>This will be an open discussion. Inclusive of when multiple treatments have been used.</i>	Engineering - Reverse curves – costly, alignment changes can be challenging to integrate into the rest of the network. - Vertical and horizontal deflection devices (local streets) such as raised platforms – negative community and key stakeholder feedback (noise, acceleration/deceleration and seen as 'revenue raising'), issues with limited service or heavy vehicle access - Alternative – speed awareness signs instead have worked well. Communities more open to education/mixed treatments. Lower speeds in congested areas are a more effective treatment. - RRPMs (placed in middle of traffic lane) – narrows the effective width of the traffic lane - Maintenance – same level of maintenance regardless of placement on the road.				

ITEM	TOPIC	Discussion	Action items	Assigned to	Due date	Complete
		– Positive community feedback – especially from cyclists – Appropriate speed environment – 70/80 km/h. • Shared road environment (single-lane roundabouts) – signage/linemarking highlights shared paths for both vehicles and cyclists (compared to dedicated cyclist lane through the roundabout). Speed reduction has been found in practice. • Portable vehicle activated signs (European design) – signs displaying green smiley face or red frown face (speeding) found to be more effective than only displaying speed as a number. • Speed and curve warning signage – targeted at speed reduction in high-speed rural roundabouts (80 km/h <) has aided in reducing entry speeds. • Speed limits – permanent regulatory speed reduction to 30 km/h at roundabouts on council roads. Reduction to 40 km/h in CBD areas. • SAMs signage – supports both engineering/enforcement outcomes. Resulted in general decrease in 85th percentile speeds across the network. Data collected from signs can identify times of poor compliance. Concerns regarding accuracy of data collected raised, improvement would be beneficial. • Reduced lane width using linemarking – particularly on local roads as a conceptual measure. • Raised priority crossings (particularly on side roads) – to reduce speed at conflict points – Some negative community feedback with raised platform compliance • Coloured surface painting – mostly on roundabout approaches • Compact roundabouts – with vertical deflection on the approach Enforcement • Range of enforcement strategies used by QPS: – Covert and marked vehicles – Trailer enforcement presence effective – In-car systems (mobile speed cameras) – returning to the same locations has helped with reductions in speed over time – Fixed speed cameras – target areas based on crash history – Handheld devices (radar) – Variable message signs/highly visible signage (e.g. driving to conditions) – Variable speed limits – challenging to enforce when these regularly change (quarantine period), some engineers contact QPS a month in advance of a speed limit change to assist with the enforcement process – Portable platforms – Combined red light and speed cameras – have worked well in QLD – Point-to-point cameras – more accepted				

ITEM	TOPIC	Discussion	Action items	Assigned to	Due date	Complete
		• Speed limit signs – opportunity for increased reflectivity in the background (improved visibility) • Increased enforcement efforts at roadworks sites have proved effective • Importance of community explanation – adding complementary signage in high-risk crash areas, black spots etc • Impact of social media – raises more awareness about speeding. Greater community acceptance of enforcement efforts when it is communicated to them prior to rolling out enforcement activities. • Difficulties highlighted with targeting high-risk individual drivers who continue to speed on the roads • Provision of target speed enforcement data to QPS (i.e. highlighting time of day where speeding is most problematic) has been effective in reducing recurring behavioural speed in local areas • Provision of safe enforcement areas (e.g. turning bays) helps with enforcement efforts Education • Vehicle mounted signs – costly, used for communicating changes in speed (i.e. not always used), most effective after about a week, only used over short time durations • Community engagement plan (for speed limit reduction in Cairns case study) – dedicated communication engagement plan with community, worked with key stakeholders, issuing without infringement (QPS intercepting and educating), developed a free toolkit for local governments, • Emphasised the difference between education, marketing and community engagement – highlighted the need to be conscious of the right people sharing the right information. • Media releases via social media – large presence has been effective in targeting social media portion of the community • Education campaigns – community feedback has generally been positive for campaigns that support road safety/speed management • School safety committees (run by Transport Safety Officers) – great feedback into engineering safer school zone areas • QPS education programs at schools – effective in bridging the gap between enforcement and education. • Letterbox drops and local media – highlighting importance of safety and safer speeds prior to use of VMSs				

ITEM	TOPIC	Discussion	Action items	Assigned to	Due date	Complete
3	- Identify aspirational speed management activities that are believed to be effective and could be trialled. - Including new ideas or activities trialled elsewhere (both domestically or internationally).	- Mixed treatments – local government traffic advisor committees as a WOG and community champion forum to collect information to target enforcement efforts - Community interactions – creating a streamlined communication system for community members to provide feedback on initiatives - Publicly available speed limit data – to help drivers be more aware of their speeds, could be cheaper than VMSs and more appropriated with the rise of automated vehicles. - Sharing data between 3E parties (e.g. QPS, TMR, councils) – e.g. sharing traffic speed data - Speed lottery idea – win money if you're driving below the speed limit, could put a positive spin on behaviour change (i.e. not viewed as revenue raising especially if funded by camera detected fines). Many are unaware that revenue is spent on road safety education and road safety projects only. - Variable speed limits (for rural intersections) - Raised intersection platforms				
A4	- General discussion - Any other local considerations that need to be accounted for when selecting speed management activities in Queensland?	- COVID implications – decreased congestion has resulted in an increased number of people speeding. - Concerns raised about the inconsistency of treatments across the network and the need for more standardised guidance for speed management activities - Limited state/national funding for speed management activities – some opportunity for local government and state government to collaborate and co-fund initiatives (e.g. speed cameras) - Lack of guidance surrounding communication strategies and methods noted by multiple attendees (even though communication is one of the most important aspects of achieving desired outcomes) - Currently no mandate for regions/councils to conduct speed limit reviews and implement them using speed management activities – potential to incorporate this into future policy - Desire to educate senior managers in TMR and politicians about the influence of speed limit on safety and crash outcomes to get more people on board with speed limit recommendations or the actioning of speed management activities				
5	Review of action items and close out meeting.	N/A	Survey monkey link to be sent out to all attendees post meeting.	Brooke/Paul	28/10/20	Yes

Figure A.1: Workshop 2 – Consultation presentation

WORKSHOP 2 - CONSULTATION



NACOE
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ASSET CENTRE
OF EXCELLENCE

R98 – Speed Management Activities Guideline

ARRB Project Leader: David Milling
ARRB Quality Manager: Joseph Affum
TMR Project Manager: Paul Gottke

AN INITIATIVE BY:  SHAPING OUR
TRANSPORT
FUTURE  **Queensland**
Government

Introductions

TMR Project Manager: Paul Gottke
A/Principal Engineer, Safer Roads

ARRB Project Leader: David Milling
Team Leader, Transport Safety

ARRB Project Assistant: Brooke Young
Graduate, Transport Safety



 **NACOE**
NATIONAL
ASSET CENTRE
OF EXCELLENCE

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TRANSPORT
FUTURE  **Queensland**
Government

Project background

- The Queensland Manual for Uniform Traffic Control Devices (MUTCD) Part 4: Speed Controls – requires speed limit review process recommends the use of ‘[speed management activities](#)’ (SMAs)– however there is no standardised guidance to support practitioners in actioning these.
- This project seeks to develop comprehensive Speed Management Activities Guidance to assist practitioners in selecting effective ‘speed management activities’ within the categories of engineering, enforcement and education for the various road classes and associated functions on the [State](#) and [Local Government](#) roads on the QLD network.

Engineering	Enforcement	Education
• Traffic calming devices • Active warning signs • Portable warning signs, etc	• Mobile speed cameras • Point to point speed cameras • Penalties	• Community based behaviour change initiatives • School education programs

AN INITIATIVE BY:  

Scope

Identify suitable and effective speed management activities for the 3 E's

- [Engineering](#),
- [Enforcement](#),
- [Education](#).

Develop a Guideline for the selection and application of speed management activities.

- This guideline would complement the TMR supplement to AS1742.4.

Today's Agenda

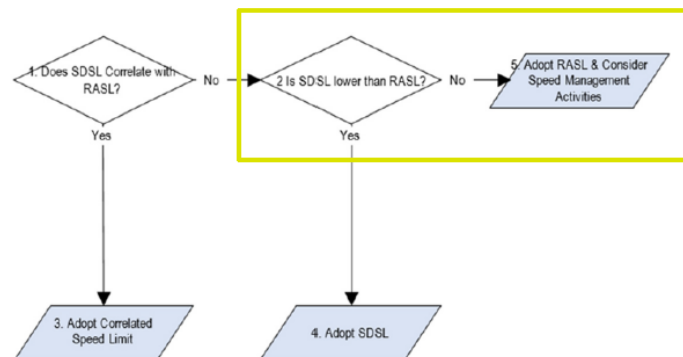
Agenda Item	Time	Schedule
1 Project progress updates since Workshop 1	10 mins	2:10 pm – 2:20 pm
2 Discuss synthesised list of speed management activities identified, including the following; • Engineering (25 mins) 2:20pm – 2:45pm • Enforcement (25 mins) 2:45pm – 3:10pm • <i>Break (5 mins)</i> 3:10pm – 3:15pm • Education (25 mins) 3:15pm – 3:40pm	80 mins	2:20 pm – 3:40 pm (with 5 min break)
3 Discussion of speed management activity selection process flowchart	10 mins	3:40 pm - 3:50 pm
4 General discussion / review of action items and closeout meeting	10 mins	3:50 pm - 4:00 pm

Setting the Scene

The focus of introducing Speed management Activities is when:

- Speed Data Speed Limit (SDSL) is **greater** than the Risk Assessed Speed Limit (RASL) **at a given site (localised)**

Speed Limit Review Process (Section 5.1)



Source: Figure 6 from MUTCD Part 4 (TMR 2019)

Online feedback survey

<https://www.surveymonkey.com/r/SMAworkshop2>

1. Workshop Attendee Information

Your Name	
Your Organisation	
Email Address	
Contact Number	

2. Agenda Item 2

Of the synthesised list of engineering speed management activities proposed for the new guidance, are you able to provide an indicative estimate of it's effectiveness (i.e. low, medium, high) in Queensland?

Deflection devices

	Road humps	Raised mid-block platforms	Raised intersection platforms	Road Cushions	Slow points	Centre blister treatments
Speed reduction						
Safety improvement						
Community feedback						

Drop down list options (i.e. low, medium and high)

Other (please specify)

Drag out textbook for more room



AN INITIATIVE BY:



Project progress updates since Workshop 1 2.10 – 2.20 pm

- Workshop consultation, survey and TMR feedback
 - Focus of this guidance is site specific speed management activities, acknowledging that network-based treatments could have a localised effect (out of scope)
 - Acknowledgment of some
 - missing data about speed / crash / cost effectiveness
 - Missing guidance about treatment appropriateness for different road environments / hierarchies



Agenda Item **1** 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities

2.20 – 3.40 pm

- Discuss the synthesised list of speed management activities based on treatments identified in the literature review, workshop 1 feedback and TMR feedback this would include any treatment within the following categories:
 - Engineering (25 mins),
 - Enforcement (25 mins),
 - Education (25 mins),

[Next Slide](#)



Agenda Item



AN INITIATIVE BY:



Synthesised list of speed management activities (engineering)

2.20 – 2.45 pm

- Discuss the synthesised list of **engineering** speed management activities identified for potential use in Queensland



City of Gold Coast, Queensland



City of Banyule, Victoria



City of Banyule, Victoria



City of Marion, South Australia

Source: Austroads (2020)



Agenda Item



AN INITIATIVE BY:



Your opinion on potential total effectiveness

Speed reduction (e.g. reduction in mean or 85th percentile speeds)

Safety improvement (e.g. reduction in crashes)

Community feedback (e.g. effect on noise, vehicles operations)

Please provide specific comments in the feedback box.

Of the synthesised list of [engineering](#) speed management activities proposed for the new guidance, are you able to provide an indicative estimate of it's effectiveness (i.e. low, medium, high) in Queensland?

Deflection devices

	Road humps	Raised mid-block platforms	Raised intersection platforms	Road Cushions	Slow points	Centre blister treatments
Speed reduction						
Safety improvement						
Community feedback						

Other (please specify)



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (engineering)

2.20 – 2.45 pm

Vertical deflection devices	Horizontal deflection devices	Static Signage	Feedback signs	Perceptual countermeasures	Other
– Road humps – Raised mid-block platforms – Raised intersection platforms – Road cushions	– Slow points – Centre blister treatments	– Repeater regulatory speed limit signs – "New speed" limit signs – Black link signage	– Radar Speed Signs – Vehicle activated signs	– Lane narrowings – Converging chevron linemarking patterns – Transverse lines, bars or optical speed bars – Urban Landscaping – Shared spaces – RRPMS (inside of edgeline)	– Gateway treatments – Pavement texturing and colouring



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (engineering)

2.20 – 2.45 pm

Impact criteria	Vertical Deflection Devices				Horizontal Deflection Devices		Static signage			Feedback signs		Perceptual countermeasures							Other	
	Road humps	Raised mid-block platforms	Raised intersection platforms	Road Cushions	Slow Points	Centre Blister Treatments	Repeater regulatory speed limit signs	New Speed Limit Signs	Black link signage	Radar Speed Signs	Vehicle Activated Signs	Lane narrowings	Converging chevron linemarking patterns	Transverse lines, bars or optical speed bars	Urban landscaping	Shared spaces	RRPMs (inside of edgeline)	Gateway Treatments	Pavement texturing & colouring	
Mean Speed reduction (km/h or %)	14-75%	21-25%	3 km/h	20-42%	16-36%	14%	3-16%	Unknown	Unknown	13-14%	3-4%	11-40%	1.6-25 km/h	5-12%	Unknown	33%	Unknown	1.6-15 km/h	5-57%	
85th Percentile Speed Reduction (km/h or %)	11-68%	22-45%	2-20%	27-39%	14-34%	9-44%	2-4%	Unknown	6-11%	10%	5-6%	Unknown	32%	Unknown	Unknown	27-35%	Unknown	1.6-25 km/h	2%	
Crash reduction	61-75%	63-71%	40-70%	60%	51-61%	18%	Unknown	Unknown	11-16%	Unknown	11-35%	20-90%	25-50%	Unknown	Unknown	49-70%	Unknown	11-43%	Unknown	
Installation cost	Medium	Medium	Medium	Medium	Unknown	Medium	Low	Unknown	Unknown	Low	Medium	Medium	Unknown	Low	Medium	Unknown	Low	Unknown	Unknown	



Agenda Item 1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (enforcement)

2.45 – 3.10 pm

Discuss the synthesised list of **enforcement** speed management activities identified for potential use in Queensland



Source: Top left - ARRB (2005), Top right - WHO (2008), Bottom - Austroads (2016)



Agenda Item 1 2 3 4

AN INITIATIVE BY:



Your opinion on potential total effectiveness

Speed reduction (e.g. reduction in mean or 85th percentile speeds)

Safety improvement (e.g. reduction in crashes)

Community feedback (e.g. effect on noise, vehicles operations)

Please provide specific comments in the feedback box

5. Agenda Item 2

Of the synthesised list of enforcement speed management activities proposed for the new guidance, are you able to provide an indicative estimate of its effectiveness (i.e. low, medium, high) in Queensland?

Cameras & radar

	Fixed speed cameras	Mobile speed cameras	Point-to-point speed cameras	Combined red light and speed cameras
Speed reduction				
Safety improvement				
Installation cost				

Other (please specify)



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (enforcement)

2.45 – 3.10 pm

Cameras & Radar	Police Presence
- Fixed speed cameras - Mobile speed cameras (includes vans & trailers) - Point-to-point speed cameras - Combined red light and speed cameras	'General duties' Patrol movements 'Speed Enforcement' Patrol movements - Enforcement bays - Shared speed/crash database to identify target locations for Police



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (enforcement)

2.45 – 3.10 pm

Impact criteria	Cameras & Radar				Police presence				Penalties					
	Fixed speed cameras	Mobile speed cameras	Point-to-point speed cameras	Combined red light and speed cameras	'General' Patrol movements	'Speed enforcement' patrol movements	Enforcement Bays	Shared speed/crash database	Demerit points	Licence suspension	Enforcement suspension	Vehicle impoundment	Free licence scheme	Speed lottery
Mean Speed reduction (km/h or %)	3-71%	1.7-3.2 km/h	11-20%	Unknown	5%	5%	Unknown	Unknown	Unknown	12%	2-50%	Unknown	6-80%	22%
85th Percentile Speed Reduction (km/h or %)	4-20%	59%	22%	Unknown	16-71%	16-71%	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Crash reduction	16-97%	6-45%	35-85%	25-47%	14-73%	14-73%	Unknown	Unknown	27-34%	20%	43%	38%	Unknown	Unknown
Installation cost	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown



Agenda Item

1 2 3 4

Out of scope

AN INITIATIVE BY:



IMPROVING OUR TRANSPORT FUTURE



Break

3.10 – 3.15 pm



Time for a 5 min break!



AN INITIATIVE BY:



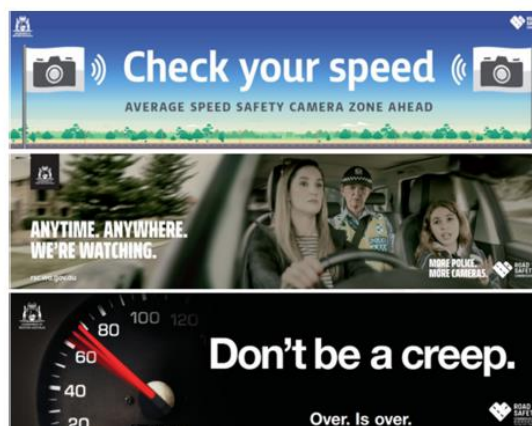
IMPROVING OUR TRANSPORT FUTURE



Synthesised list of speed management activities (education)

3.15 – 3.40 pm

Discuss the synthesised list of **educational** speed management activities identified for potential use in Queensland



Source: Government of Western Australia (2020)



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Your opinion on potential total effectiveness

Speed reduction (e.g. reduction in mean or 85th percentile speeds)

Safety improvement (e.g. reduction in crashes)

Community feedback (e.g. effect on noise, vehicles operations)

Please provide specific comments in the feedback box

7. Agenda Item 2

Of the synthesised list of **education** speed management activities proposed for the new guidance, are you able to provide an indicative estimate of its effectiveness (i.e. low, medium, high) in Queensland?

Communication mediums

	Social media	Television advertisements	Billboards	Local news/press	Letterbox drops	Fact sheets / posters	Variable message signs
Speed reduction							
Safety improvement							
Community feedback							

Other (please specify)



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (education)

3.15 – 3.40 pm

Communication mediums

- Targeted Social media (i.e. by location and demographic)
- Television advertisements (i.e. running in specific locations)
- Billboards (on subject road)
- Local press / news
- Letter box drops (on subject road)
- Fact sheets / posters (on subject road)
- Variable message signs (on subject road)
- Rubbish bin stickers (on subject road)

Slide One – [xx]km/h speed limit coming soon



Slide Two – [xx] km/h from [xx] [MONTH]



Version 2

Slide One – Speed limit changing soon



Slide Two – [xx] km/h from [xx] [MONTH]



Images: Variable message signs example (left), social media targeting demographic / geographic areas (right)



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Synthesised list of speed management activities (education)

3.15 – 3.40 pm

Impact criteria	Targeted Social Media	Television advertisements	Billboards	Local press / news	Letterbox drops	Fact sheets / posters	Variable message signs	Rubbish bin stickers
Mean Speed reduction (km/h or %)	0.8-1.2 km/h	Unknown	7 km/h	6-16%	Unknown	Unknown	2.9 - 6 km/h	Unknown
85th Percentile Speed Reduction (km/h or %)	Unknown	Unknown	Unknown	0.31 km/h	Unknown	Unknown	Unknown	Unknown
Crash reduction	43%	Unknown	Unknown	1.4-43%	Unknown	Unknown	16%	Unknown
Installation cost	Unknown	Unknown	Unknown	Low	Unknown	Unknown	Unknown	Unknown



Agenda Item

1 2 3 4

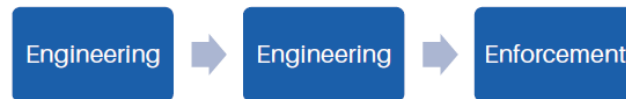
AN INITIATIVE BY:



Agenda Item 3.

3.40 – 3.50 pm

A structured approach to the 3 E's



Multiple E's to work in parallel?



Agenda Item

1 2 3 4

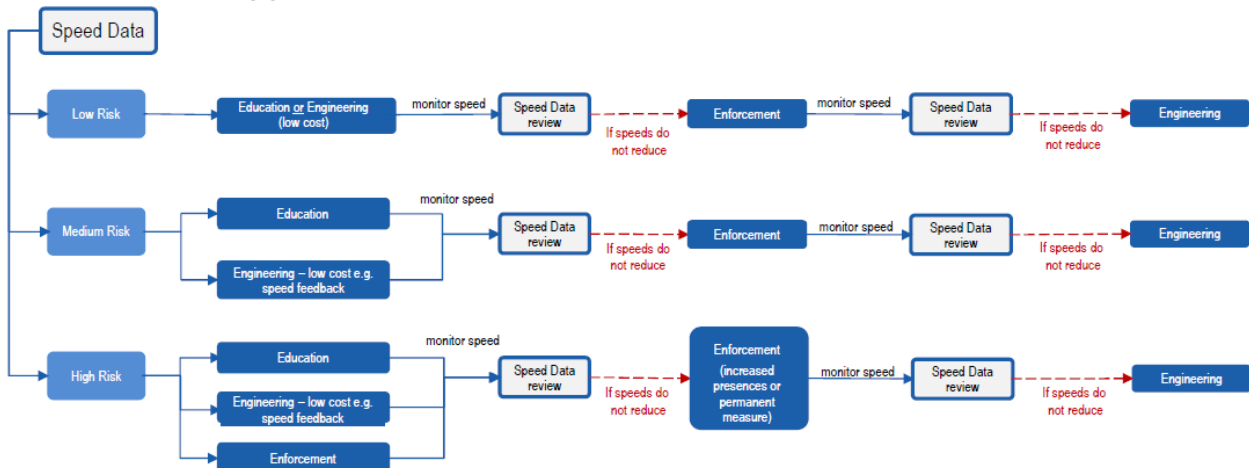
AN INITIATIVE BY:



Discussion of speed management activity selection process flowchart

3.40 – 3.50 pm

A structured approach to the 3 E's



Agenda Item

1 2 3 4

AN INITIATIVE BY:



Discussion of speed management activity selection process flowchart

3.40 – 3.50 pm

Table 5.2.2 – Speed data test ranges

Criteria	Existing Speed Limit (km/h)							
	40	50	60	70	80	90	100	110
Mean speed	32–43	41–53	49–63	59–72	69–80	79–89	89–97	99–106
Upper limit of 15 km/h pace	36–49	46–59	56–69	66–79	76–89	86–98	96–106	105–114
Percentage within pace	>60	>60	>60	>60	>60	>60	Urban >54 Rural >45	>40

Table 5.2.3 – Suggested speed limit from speed data analysis

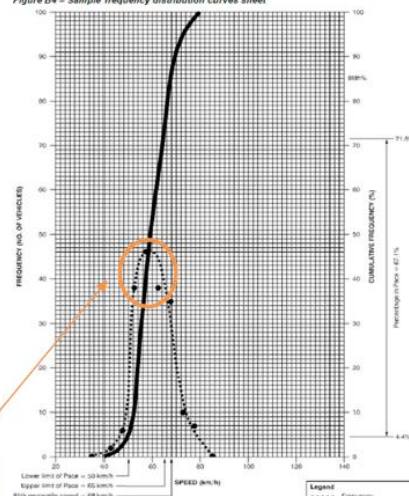
Upper limit of the 15 km/h pace	59	60–66	67–76	77–86	87–96	97–105	>105
Suggested SDSL	50	60	70	80	90	100	110

- Low Risk = 1 of the criteria not satisfied
 Medium Risk = 2 of the criterion not satisfied
 High Risk = 3 of the criterion not satisfied

???

15 km/h pace range

Figure B4 – Sample frequency distribution curves sheet



Agenda Item 1 2 3 4

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INSPIRING OUR TRANSPORT FUTURE



Queensland Government

General discussion / review of action items and closeout meeting

3.50 – 4.00 pm

- Any other general comments about today's workshop?
- Any further questions about the project?



Agenda Item 1 2 3 4

AN INITIATIVE BY:



INSPIRING OUR TRANSPORT FUTURE



Queensland Government

Meeting Close

- Review of action items
- Questions or general inquiries – see contact details below

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