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Implementation Principles for 30 km/h Speed Limits and Zones

Auttapone Karndacharuk[1] and David McTiernan[2]

[1]*Roads and Maritime Services, New South Wales, Australia*
[2]*Australian Road Research Board, New South Wales, Australia*

Corresponding Author: Dr Aut Karndacharuk, 27 Argyle Street Parramatta NSW 2150, aut.karndacharuk@rms.nsw.gov.au and +61 429 580 107.

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Key Findings

- Implementation principles developed for an Australian state road agency;
- Emphasis on an area-wide 30 km/h practice for improved road safety and environment;
- Unlike New Zealand, Australia has limited experience in 30 km/h implementation;
- 30 km/h speed limit practice aligns well with the Safe System approach and principles.

Abstract

In the context of the Safe System approach for harm minimisation where fatal and serious injuries are not accepted as inevitable costs of mobility in any transport system, there is an increasing need to consider implementing speed limits within the biological tolerance of road users. The need to implement speed limits lower than 40 km/h in an urban area with high pedestrian movement and activity has been recognised by an Australian state road agency. Through a literature review, stakeholder consultation with road transport agencies in Australia and New Zealand and a Safe System analysis, this paper presents the development of guiding principles in implementing 30 km/h speed limits and zones in Australasia. The implementation principles have been developed to inform a revision of the existing speed zoning guidelines and its applications within the jurisdiction, which are also applicable elsewhere across Australasia and internationally.

Keywords

Speed Limit; Speed Zone; 30 km/h; Traffic Calming; Local Area Traffic Management; Speed Management

Introduction

In Australia, current practices and guidelines foster the implementation of a 40 km/h speed limit in high pedestrian activity areas and a 10 km/h limit in designated shared zones. While there are trials and pilot tests in the country, the use of area-wide 30 km/h speed limits are not generally accepted, partly due to regulatory barriers.

Internationally, particularly in Europe, a speed limit of 30 km/h (or 20 mph), by contrast, has long been employed as a measure to reduce vehicular dominance and for improving pedestrian safety and amenity. One early example developed in the 1970s was 'verkehrsberuhigung' (German for 'traffic calming'), which describes speed control measures such as 30 km/h speed zones to improve street environments (Brindle 1992).

In the context of the Safe System and harm minimisation approach where fatal and serious injuries (FSIs) are not accepted as inevitable costs of mobility in any transport system, there is an increasing need to consider implementing speed limits lower than 40 km/h in heavily pedestrianised areas. This situation has been recognised by a state-level transport agency in an Australian jurisdiction. This paper presents the results of a literature review of 30 km/h speed zone implementation and stakeholder consultation. The implementation principles have been prepared to inform a revision of the existing speed zoning guidelines and its applications within the jurisdiction, which are also applicable elsewhere across Australasia and internationally.

Methods

The research methodology included a review of the literature on the 30 km/h speed limits and zones, stakeholder consultation with Australian and New Zealand road transport agencies and a Safe System analysis. The focus of the review of published literature in relation to 30 km/h speed limit practice was on the guidance, policies and criteria for setting 30 km/h speed zones. The review findings, including a comprehensive list of 30 km/h speed limit schemes in various jurisdictions, are documented in Karndacharuk & McTiernan (2017).

Targeted stakeholder consultation with Australian and New Zealand road transport agencies was undertaken to obtain jurisdictional views and practice on the 30 km/h speed limit implementation, including views about the approach, lessons learnt from design and implementation experiences as well as key issues and lessons learnt. For the Safe System analysis, the objective was to identify the extent to which the 30 km/h speed zone implementation requirements align, and are consistent with, the Safe System approach and its pillars.

Discussion of Review Findings

This section offers a discussion of the literature review findings with an aim to inform a development of the guiding principles. It is noted that the speed limit of 20 mph (equivalent to approximately 32 km/h) is used interchangeably with 30 km/h in this paper. Additionally, the 30 km/h speed limits in many European countries are predominantly applied in a residential context rather than an area with high pedestrian activity.

Towards area-wide practice in both residential areas and activity centres

A shift from a linear or 'pockets' implementation towards an area-wide practice can be observed, especially in the UK and Europe, in both residential and mixed-use areas. The 30 km/h speed limit designation is an integrated part of the Netherlands' Sustainable Safety – the precursor to the Safe System approach. The 30 km/h zones are applied principally to urban local roads that serve the dominant access function while facilitating pedestrian and cycle movement as well as allowing stopping and parking of vehicles (Schermers 1999, Schermers & van Vliet 2001).

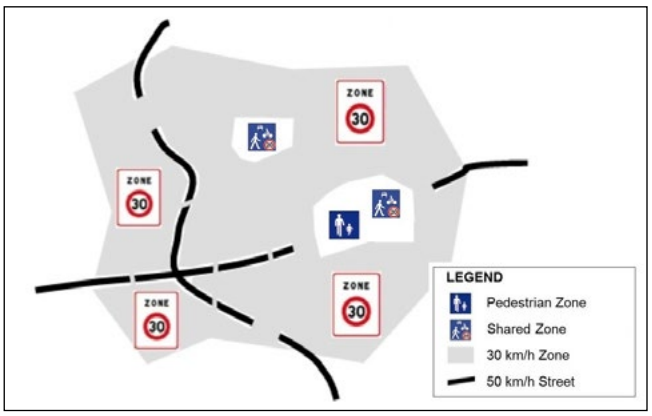

Figure 1. Area-wide 30 km/h speed zone implementation (Based on Nogues 2009)

The extent of an area-wide 30 km/h implementation in relation to linear 50 km/h traffic routes is shown in Figure 1. The 30 km/h zone can be applied to an entire activity centre boundary that incorporates pedestrian and shared zones (Nogues 2009).

Choices of implementation techniques using signs and traffic calming measures

The findings from the literature review reveals a wide range of implementation techniques from using either signs only, or traffic calming measures only, or a combination of both measures. Consistent with the Sustainable Safety concept (Austroads 2005) where speed limits often require engineering support to encourage compliance, many 30 km/h (or 20 mph) speed zones in the UK and Europe utilise both speed limit signs and traffic calming measures to limit high speeds, and reduce speed differences and vehicle conflicts.

The following sections discuss the two unique implementation techniques of signs only and self-explaining roads (traffic calming measures only).

Traffic Signs Only

Setting 30 km/h speed limits by using posted speed signs only has been evaluated by a number of jurisdictions. This method has a cost advantage when compared to the approach of constructing physical traffic calming measures. However, its main disadvantage is the effectiveness on the reduction of vehicle speeds and crashes.

Large-scale implementations of low speed limits using signs only were trialled and implemented in a number of towns and cities in the United Kingdom, including Bristol, Edinburgh, Oxford, Portsmouth and Warrington (20's Plenty for Us 2017). The UK study concluded that signed only speed limits are most appropriate for areas where vehicle speeds are already low (Department for Transport 2013). In many cases, a 30 km/h speed roundel road marking was also used as a repeater sign in addition to post-mounted speed signs to indicate the speed limit.

Signs-only speed limits were used in Alberta, Canada where the legal speed limits around school and playground zones were lowered from 50 km/h to 30 km/h in 2009 (Tay 2009). The Belgian government also lowered the speed limits in school zones to 30 km/h in Flanders (Dreesen & Nuyts 2007). However, the speed limits around school zones are not in full-time operation in Alberta, and only some are full-time in Flanders.

Traffic Calming Measures Only (Self-Explaining Roads)

The Woonerf concept was originally proposed in the Netherlands in the 1960s with the design emphasis on creating an environment in a residential area where

vulnerable users can safely share the street with motorists (Karndacharuk 2014). Road design features, including a level, shared surface, traffic calming measures and streetscape elements for pedestrian staying activities, are employed to urge the driver not to drive faster than walking speeds (Karndacharuk et al. 2014). Implemented in this fashion, Woonerf streets do not require sign-posted speed limits to explicitly remind the motorist of safe vehicle speeds.

A similar approach to the Woonerf is Self-Explaining Roads (SER). Also known as a naked street, the SER encourages the driver to adopt safe behaviour and speeds in response to the visual appearance of the roads (Mackie et al. 2013, Theeuwes & Godthelp 1995, Wegman et al. 2005). The SER approach can be applied across all road categories as long as the road design and user behaviour match the intended function and the look and feel of the roads are consistent within each road category.

In the Guide to Traffic Management (Austroads 2016b), the SER concept is recognised as psychological traffic calming within the local area traffic management (LATM) philosophy, where increased uncertainty by design helps drivers to slow down to negotiate the area and become more aware of the surrounding rather than simply moving through the road space.

Accordingly, McTiernan et al. (2015), suggested that the wider application of the SER approach should be considered in the Australasian context to support improved safety and self-regulation of speed by drivers. A trial of SER was undertaken in Auckland, New Zealand (Charlton et al. 2010). Two types of road hierarchy were chosen – local and collector roads. A 30 km/h design speed was applied to the local roads along with the design to reduce forward visibility and to incorporate improved landscaping, community spaces and threshold treatments. Road markings and signage were also removed.

Stakeholder Consultation

Consultation with Australasian transport agencies at both state and local levels was undertaken in August and September 2017 to obtain views and experience on 30 km/h speed limits and zones (Karndacharuk & McTiernan 2017). The task comprised a short email survey asking for feedback on:

- Design, planning and implementation experience
- Outcome and lessons learnt from an evaluation study
- Key issues/complaints, including community perceptions.

The majority of the consultation messages and requests for information were submitted to the road and traffic agencies using the contact details from their website or via an online customer contact form. A follow-up task of a telephone discussion and an examination of relevant documentation available on the agency's official websites was also conducted.

Table 1 presents the outcome of consultation with each of the Australian and New Zealand jurisdictions. None of the road transport authorities in Australia that responded to the survey requests opposed lowering the speed limit to 30 km/h in appropriate locations. Five Australian jurisdictions (i.e. ACT, NSW, Tasmania and Victoria and WA) have either planned or implemented 30 km/h speed zones. Collectively, the 30 km/h area has been or is being applied, albeit on a relatively small scale, to school zones, activity centre areas and residential streets in Australia.

In New Zealand, the majority of the 30 km/h speed zones are implemented on an area-wide basis. More importantly, all the NZ local government jurisdictions under investigation have prioritised the use of 30 km/h zones in the CBD and mixed-use areas.

Table 1. Consultation response from transport agencies in Australia and New Zealand

Jurisdiction	Feedback on 30 km/h Implementation		
	Response	**Experience**	**Discussion**
ACT	Yes	Yes	• As part of an Active Streets pilot program (ACT Government 2017), a 30 km/h speed limit was trialled at two primary schools (out of four schools under the pilot scheme). • The 30 km/h school zone was considered an infrastructure intervention to promote safe routes to school via active travel.
NSW	Yes	Yes	• The 30 km/h speed limit was applied on Druitt Street primarily in response to a fatal crash. The other 30 km/h zone within the boundary of the City of Sydney (2017) is in the Royal Botanic Garden. • The general consensus within RMS is that the 30km/h limit on Druitt Street is not successful as it appears anecdotally that most drivers are either unaware or choose to ignore the speed limit. • A trialled 30km/h limit is suggested in a street environment that is obviously different from the standard (higher speed) road environment in order for drivers to feel compelled (be that by geometry, traffic calming or carriageway widths) to drive in accordance with the lower speed limit.

Jurisdiction	Feedback on 30 km/h Implementation		
	Response	**Experience**	**Discussion**
NT	Yes	No	• Department of Infrastructure, Planning and Logistics is not aware of a 30 km/h implementation in the Northern Territory.
Qld	Yes	No	• Department of Transport and Main Roads support, in principle, the use of 30 km/h to improve road safety in an appropriate location. • At the time of writing, there was a plan to implement 30 km/h speed limits across the Brisbane CBD.
SA	No	No	• No response from Department of Planning, Transport and Infrastructure has been provided within the project timeframe.
Tas	Yes	Yes	• 30 km/h zones, forming part of a streetscape upgrade, have been implemented within the City of Hobart to support the Central Bus Interchange. • A 30 km/h speed limit was implemented in 2010 along Hobart waterfront at the Franklin Wharf under the responsibility of TasPorts. A crash data analysis of the before (2003-2009) and after (2011-2017) showed: - 39% reduction of total recorded crashes (from 69 to 42) - No serious and fatal injury post implementation whereas there was one serious injury crash in the before period.
Vic	Yes	Yes	• Yarra City Council (2017) is planning to implement a 12 month trial of area-wide 30 km/h speed limits on residential streets in Fitzroy and Collingwood. • Recognising the benefits of reducing speed limits to 40 km/h on all residential streets in Yarra, the 30 km/h trial forms part of Council's commitment to creating safer streets for all road users. • Based on the review and discussions with the UK's Nottingham City Council and the 20s Plenty for Us program, the following key findings are identified in a pre-trial evaluation (Fildes et al. 2017): - There is a need to carefully stage the introduction of a trial with on-going consultation with key stakeholders and community engagement to maximise its success. - Additional signage to be placed at critical threshold entry points along the trial boundary or where there is no change with new speed limit in order to alert local travellers of the trial in progress and to keep stressing the road safety message • VicRoads is in principle support the use of 30 km/h speed limits in Victoria. To ensure speed compliance, community support and acceptance is considered an important factor in the planning and implementation process.
WA	Yes	Yes	• A 30 km/h speed limit environment exists: - In the high pedestrian activity section of Oxford Street in Leederville and on the Cappuccino Strip (South Terrance) in Fremantle - Along the beach front roads between West Coast Highway and the sea at Scarborough Beach • Main Roads Western Australia further advised that more 30 km/h speed zones are being implemented under the Safe Active Streets (formally called Bike Boulevards) program.

Jurisdiction	Feedback on 30 km/h Implementation		
	Response	**Experience**	**Discussion**
NZ	Yes	Yes	• A 30 km/h speed limit environment was implemented in the following two locations in Auckland before 2010. - Queen St in Auckland CBD. The speed within the zone is largely controlled by congestion and the closely spaced signalised intersections. Traffic signal phasings are also set with generous time for pedestrian, which helps restraining traffic volumes and speeds. - Orewa Blvd in Orewa town centre. 30 km/h was originally implemented as a temporary speed limit. The design of the zone was styled similar to a shared zone with a texture, level surface (no kerb). There has been speed compliance issues due to the need to regain sufficient width for over dimension vehicles. • A recent area-wide 30 km/h zone is progressively being implemented in Wynyard Quarter and Viaduct Harbour on Auckland waterfront. Traffic calming measures (e.g. raised platform and special surfaces) are employed to support a credible low speed environment. • With the recent changes to the speed limit guidelines and legislation, Auckland Transport expect to roll out more 30 km/h areas in the next few years, particularly in the CBD and town centres across the region.
			• The majority of streets in the Christchurch CBD have a 30 km/h speed limit, which was imposed through the Recovery Plan post 2011 earthquake. A large proportion of the 30 km/h zones do not have the environmental controls (e.g. traffic calming) that were originally intended to occur at the same time as the 30 km/h implementation. • The average speed is in the order of 35-40 km/h even with traffic signal coordination for 30 km/h progression. • The 30 km/h speed limit has not been well received by the community, although much of the negativity was directed at a few roads due to their arterial nature and the lack of physical changes to the streets. • Christchurch City Council is of the view that regular repeater road markings, which were recently allowed through the change in NZ legislation, would support the 30 km/h operation (by improving conspicuity) along with self-enforcing traffic calming measures.
			• A 30 km/h limit was implemented in 2010 in the Hamilton CBD as part of streetscape improvement in order to improve pedestrian safety. The monitoring of speeds and safety performance showed the work was successful, which paved the way for more introduction in 2013.
			• Started in 2009, Wellington City Council has been progressively implementing 30 km/h limits in the CBD and shopping centres (16 location completed) to support pedestrian and cycling activity. The lower speed limit has been shown to reduce crash rates.

Safe System Analysis

The Safe System concept recognises that humans can only tolerate limited kinetic energy exchange before death or serious injury occurs. Safe System principles aim to manage the energy exchange via the four pillars of safe roads, safe speeds, safe vehicles and safe people to eliminate death and serious injury as a consequence of a road crash. A fifth pillar, involving emergency response and post-crash care is often cited internationally (Austroads 2016c). A Safe System analysis, shown in Table 2, considers the impact of the 30 km/h speed zone implementation against the five Safe System pillars.

Table 2. Safe System analysis of 30 km/h implementation

Safe System Pillar	Assessment Response
Safer roads and roadsides	• With an emphasis of reducing pedestrian deaths and serious injuries, roads and roadsides should be designed to incorporate traffic calming measures, especially in areas where existing speeds are much higher than 30 km/h, to gain compliance with lower speed limit. • Other street and urban design approaches such as provision for the disabled, appropriate lighting as well as Crime Prevention through Environmental Design should be considered in order to: - reduce the risk of crashes occurring, - lessen the severity of injury if a crash does occur - encourage safe behaviour by users
Safer vehicles	• The rapid development of emerging technologies of connected and autonomous vehicles (CAVs) provides an opportunity to promote the use of safer vehicles in crash avoidance and protection for both occupants and people outside the vehicle. • The deployment of CAVs and in-vehicle intelligent systems will assist in ensuring the compliance of 30 km/h speed limits and zones and enabling automated protective systems for vulnerable users when crash risk is elevated.
Safe road users	• In acknowledgment of the fact that people make mistakes and are vulnerable, lowering speed limits to 30 km/h in a highly pedestrianised area will reduce crash energies, and provide a factor of safety in terms of increased driver field of vision, driver's reaction time and breaking distance. • Education campaigns and stakeholder engagement should focus on: - reminding that a successful 30 km/h implementation is a shared responsibility of everyone, including road users. - encouraging safe, consistent and compliant behaviour through well-informed and educated road users. • Enforcement and sanctions are critical to effective implementation, particularly from the outset.
Safer speeds	• Based on the literature review findings, a maximum limit of 30 km/h should be applied principally in an area with high pedestrian activity to manage fatality and serious injury risks to more vulnerable road users. • Credible and consistent 30 km/h speed limit implementation is fundamental to encourage road users to obey and drive to conditions.
Post-crash response and trauma treatment	• The need for access by emergency and medical services should be taken into account during the planning, design and implementation of 30 km/h speed limits and zones.

Implementation Principles

The following guiding principles are proposed to be employed in the process of implementing a 30 km/h speed zone in order to maximise the potential for the zone to operate successfully by ensuring commonality and legibility for the end user. Table 3 shows 12 principles, which can generally be categorised into three groups to address the why, where and how of a potential implementation of 30 km/h as an appropriate, credible and enforceable speed management option.

Table 3. Principles for 30 km/h speed limit implementation

Principle		Discussion
The 'Why'		
1	Embrace the Safe System approach for harm minimisation.	• In a location with a large number of vulnerable road users and possible vehicle-pedestrian conflicts, a Safe System approach supports the use of speed limits no greater than 30 km/h to manage the potential for fatal and serious injury risk, especially for pedestrians. • A small reduction in mean speed can result in a substantial decrease in FSI crashes. • While a 40 km/h speed zone already provides a degree of support to the harm minimisation approach in high pedestrian activity areas, a 30 km/h environment, implemented in a consistent and credible manner, is expected to further reduce road trauma and social costs of FSIs.
2	Enable a more balanced approach through the creation of a 30 km/h speed environment by taking into account multi-modal and multi-functional objectives for the use of the same road space.	• Roads and speed environments are categorised based on the functions they perform in the context of an integrated road network and land use activities. • Lowering a speed environment from 40 to 30 km/h will improve the mobility and accessibility of non-motorised users as well as enhance environmental amenity within the network and of the surrounding land uses.
The 'Where'		
3	Prioritise a location with strategic place significance in the movement and place framework.	• The classification, taking into account factors such as road design and traffic volumes, is a key input into calculating safe and appropriate travel speeds. The role of road space as a destination (place function) is recognised in the Guide to Traffic Management (Austroads 2016a). • 30 km/h speed limits and zones can be prioritised based on this movement and place functions within the road network.
4	Target activity centres and selective residential areas with a high level presence of vulnerable road users.	• Based on the movement and place framework, the initial focus of employing 30 km/h limits can be activity centres and other high-risk urban areas with high volumes of pedestrians and other vulnerable road users.
The 'How'		
5	Focus on an area-wide implementation in homogeneous road sections.	• Regulatory signs are required at entry points to the designated area. • Attention must be paid to ensure these additional signs (and pavement markings) do not present new hazards to the environment (e.g. issue with skid resistance and impeding sight lines).
6	Employ traffic calming measures for speed management and control.	• Incorporating traffic calming in the 30 km/h implementation at the outset is critical for speed management, especially in an area with existing mean speeds significantly higher than 30 km/h. • While it is relatively costly to retrofit the existing higher-speed streets with traffic calming measures, the SER design of a new road network in greenfield areas can readily incorporate local area traffic management devices to self-regulate speeds.

Principle		Discussion
7	Utilise a mean speed as a primary measure of actual traffic speed for a road section.	• The conventional use of 85th percentile speed to determine speed limits is challenged by the arguments that: - Many drivers are ill equipped to judge road safety risks, and to determine appropriate speeds for the environment. - Many people tend to drive above the speed limit, which gradually increase the 85th percentile speed over time - Many individuals seek to drive faster than the average speed in effect to self-affirm their image of better than average drivers • Setting a speed limit based on a mean speed will achieve a safe distribution of speeds at a lower level than that of the 85th percentile speed. This is more suitable for a lower speed zone of 30 km/h where (vehicle) mobility is not a primary function. • The aim of the 30 km/h zone implementation and monitoring is to ensure a mean speed is appropriate to the prevailing road and traffic environment or otherwise additional traffic calming measures are required. • The use of mean operating speed as a primary measure is reflected in the UK's 2013 *Setting Local Speed Limits* circular and NZ's 2017 *Setting of Speed Limits* rule.
8	Consider residual crash risks associated with road, roadside and traffic characteristics.	• Lowing a speed limit to 30 km/h in itself reduces crash severity and likelihood. • Nonetheless, there are residual risks associated with the road environment (e.g. road geometry, roadside hazards, traffic volume, traffic mix and presence of vulnerable users) that may warrant additional measures to be included as part of a 30 km/h implementation.
9	Manage the impact of the 30 km/h implementation in school zones.	• There is no reason why the maximum speed environment for school zones should not be reduced to 30 km/h during school hours, except for major thoroughfares. • Key factors to be considered are default and full-time speed limits as well as speed management measures during school and non-school hours. • Lowing a general (default) urban speed limit from 50 km/h to 30 km/h would render a school zone designation redundant. • Any safety risk due to children's movement unpredictability can be addressed using the flashing lights as well as school zone signage and marking but as advisory measures instead of a specific enforceable zone. • In any case, legal traffic controls are still required to distinguish the 30 km/h speed environment from the underlying (higher) speed limit outside school hours.
10	Set technical criteria that are consistent with the requirements in the existing guidelines.	• The following criteria should be developed: - A minimum length to avoid too many changes of speed limit along a route or an area. - Repeater signs or markings to serve as an indicator of the speed limit and a reminder for drivers to check whether they are travelling at the maximum safe speed. - Specific provisions for temporary or part-time 30 km/h limits • Once the impact and performance of the 30 km/h implementation is fully understood, the existing criteria of the speed zoning guidelines may require an update to reflect contemporary practice. For example, if a SER design was proven to be successful in speed management, a requirement for regulatory signage may be relaxed.

Principle		Discussion
11	Establish an on-going evaluation and monitoring process.	• An on-going performance evaluation informs policies, guides the investigation of investment options, and assists in estimating the return on investment. • The speed limit review is an iterative process to keep up with a change in road and land-use environments.
12	Engage key stakeholders and communities for support.	• Community support and acceptance is fundamental in the success and compliance of any 30 km/h zone implementation. • Education and communication of the benefits of 30 km/h speed zones is also vital in gaining greater community acceptance.

Conclusions

Guiding principles for implementing 30 km/h speed limits and zones have been developed based on the outcome of a literature review, a consultation survey of Australasian practitioners in road transport agencies and a Safe System analysis of setting a 30 km/h speed limit for harm minimisation.

It is found that the 30 km/h speed limits and zones have been utilised widely in various international jurisdictions outside Australia and New Zealand. The 30 km/h practices identified employ speed management techniques of traffic calming measures, self-explaining roads and regulatory signage to influence safe travelling speeds within the designated 30 km/h zones.

Based on the philosophy of the Safe System approach, which reaffirms an absolute priority to avoid death and serious injury, 30 km/h has been recognised as a safe and appropriate speed limit in an area where there is a high level of vulnerable road users present and a potential for conflict with vehicle traffic. The evidence of 30 km/h practice in Australia and New Zealand highlights the area of focus for the 30 km/h implementation - that is, to prioritise the activity centre areas in an integrated area-wide approach.

Moving forward would require the integration of the principles into to the regulatory speed zoning guidelines to enable a broader introduction of 30 km/h limits and zones. In the longer term, an emphasis should be placed on having 30 km/h as a default urban speed limit in higher-order activity centres (town centres or denser) and designated residential areas serviced by the lowest order roads since there are the areas of greatest pedestrian activity.

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