

CONFERENCE PAPER

OPERATIONAL GUIDELINES AND PRINCIPLES FOR SHARED ZONES IN NEW ZEALAND

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ABSTRACT

Expectations are increasing for public road space to integrate pedestrian and social activity into the underlying transport functions. This has led to several shared space schemes within Auckland that re-designed the road reserve to provide a sense of place, enhance priority for pedestrians and encourage greater use of the road space rather than solely as a transport infrastructure asset.

While the terms 'Shared Space' and 'Home Zone' are applied to a shared pedestrian and vehicle street in mixed-use and residential areas, respectively, both concepts are declared a Shared Zone in the Land Transport (Road User) Rule.

Auckland Transport (AT) has identified the need to provide guidance to designers of shared spaces to ensure consistent public expectations. AT has reviewed existing and proposed shared zones in both activity centres and residential areas.

The paper will discuss outcomes from a University of Auckland research study into the operation of shared spaces. The paper will detail key design principles for the effective operation of shared spaces and home zones developed by AT for the Auckland Transport Code of Practice (ATCOP). The principles from this code of practice for shared zones can be applied to other New Zealand regions.

INTRODUCTION

There is increasing pressure for public road space to be utilised for more than just transportation functions. Roads are being seen as pieces of infrastructure that not only support the movement of people and goods, but in certain appropriate environments can create a sense of place where people can linger, participate in activities and which can better support the economic activities that the street services. Therefore, designers and planners are seeking ways that certain key streets can be more people focussed rather than vehicle centric.

Some urban streets in Auckland have undergone transformations in order to achieve a number of general aims. These typically include (Joyce, 2012; Karndacharuk, Wilson and Tse):

- Improving priority and amenity for pedestrians
- Creating a sense of place
- Reducing vehicle speeds and volumes
- Creating a place for activities to happen
- Provide opportunities for people to stop, sit, listen and linger
- Encourage the rejuvenation of streets to enhance economic activity.

In many areas in New Zealand and internationally such transformations have led to the creation of what has been described as 'Shared Space' and in New Zealand legally defined as a 'Shared Zone'. In Auckland, such schemes have generally been designed with a strong focus on urban design with opportunities for place-making and activities such as seating, outdoor dining are maximised. An assessment by Auckland Council (2012), concluded that these streets appear to have been effective with increased business activity, greater foot traffic and reduced vehicular traffic. Notwithstanding these findings, some operational issues have been identified that could limit achieving maximum success and that could result in safety risks.

To date, five schemes in the Auckland Central Business District (CBD) have been converted to shared spaces with a further space currently in construction and others in the design phase. In addition, there are other streets in the Auckland Region that have been or are planned as shared spaces. As there have been no specific guidelines to the design of shared spaces, this has led to those outside of the Auckland CBD utilising different design principles. As a result, concern has been raised that people moving from one space to another will not appreciate what is expected of them due to differing characteristics or behaviours of shared space users. This inconsistency potentially places road users at increased safety risk, and compromises the shared space objectives.

To address the identified operational issues and to provide design consistency between spaces so users have similar expectations and behaviours in each shared space, Auckland Transport has developed a set of operational principles to be used by designers. These provide overall guiding principles on the operation that still enable each shared space to have its own character. These principles for CBD shared spaces have been incorporated into the Auckland Transport Code of Practice (ATCOP), which at the time of writing is still in draft form.

This paper details some of the key research findings and observations behind the operational principles developed for the CBD shared spaces. These have been developed for the New Zealand context to specifically provide consistency across the Auckland Region, and, if adopted by other New Zealand local authorities, would provide consistency throughout the country.

The paper also provides commentary on shared spaces in the residential environment and some of the key challenges for these in New Zealand, as the CBD principles are unlikely to provide sufficient guidance for residential shared spaces, or what are often called Home Zones.

BACKGROUND

The concept of shared spaces is generally accepted to stem from the Netherlands where areas known as 'Woonerf' or 'residential neighbourhoods' were widely introduced in the 1970s. These streets were designed to reduce the dominance of motor vehicles and give back the street to other users such as pedestrians and cyclists (Karndacharuk, Wilson and Dunn, 2013b). As the name suggests, these measures were typically in residential streets.

Since that time, the principle has been extended to mixed-use streets in urban environments, and can be seen throughout Europe, US and internationally in a variety of forms.

There are various definitions and interpretations of what forms a shared space between different countries. In the United Kingdom a shared space is defined as "*A street or place designed to improve pedestrian movement and comfort by reducing the dominance of motor vehicles and enabling all users to share the space rather than follow the clearly defined rules implied by more conventional designs*" (Department for Transport, 2011). This implies shared spaces should enhance the ability for pedestrians to move around a space by removing traditional design features such as road markings and kerbs that may form an encumbrance or barrier to better use of the road space. Traditionally the focus has been on residential streets in the UK, but in recent years the principles have been extended into urban streets.

In Australia, shared spaces have different connotations in different jurisdictions. For instance in New South Wales, the legislation defines a Shared Zone around the speed limit over a length of road where appropriate signs are provided at the start and the end; a driver in a shared zone must give way to a pedestrian (New South Wales Government, 2013). Typically there is a posted speed limit of 10 km/h although this is treated as advisory.

In contrast, New Zealand defines shared spaces as 'Shared Zones' where user behaviours and interactions are set out in the Land Transport (Road User Rule) 2004 (New Zealand Government, 2004) as follows:

Rule 10.2 Shared Zone

- (1) A driver of a vehicle entering or proceeding along or through a shared zone must give way to a pedestrian who is in the shared zone.
- (2) A pedestrian in a shared zone must not unduly impede the passage of any vehicle in the shared zone.

This definition details the priorities between pedestrians and other vehicular traffic whilst also indicating that pedestrians also have a responsibility to be considerate when moving through the zone. In the Auckland region, the national rule is further supported by the Auckland Transport Bylaw (Auckland Transport, 2012) which states that in Shared Zones:

- Rule 13
- (1) Auckland Transport may by resolution specify any road to be a shared zone
 - (2) Except where Auckland Transport has by resolution specified otherwise, no person may stand or park a vehicle in a road specified as a shared zone.
 - (3) A person must not use a shared zone in a manner contrary to any restriction made by Auckland Transport.

The bylaw outlines an expectation that parking is generally only permitted in a shared zone by exception and that the road controlling authority has the power to implement any other restrictions that may be appropriate for that zone.

In Auckland, shared spaces have been implemented as shared zones primarily to enhance the urban environment and to re-dress the balance to people rather than vehicles. Streets have been transformed through the use of materials and design to provide an environment where pedestrians have greater amenity and priority with reduced vehicle volumes and speeds. A specific aim is to provide flexible space that may be used for a variety of purposes, but predominantly enables local businesses to maximise their offering with outdoor dining and seating opportunities.

In contrast to experience overseas where the forerunner of shared spaces has been in residential areas prior to reaching city or town centre areas, the New Zealand experience has predominantly been the reverse, with residential shared spaces only recently being proposed as part of new residential developments. This poses new challenges as to appropriate designs for residential areas in the New Zealand context.

OPERATIONAL PRINCIPLES

The urban shared spaces in Auckland have principally been developed from an urban design perspective. All have adopted a level surface across the road reserve to remove barriers to pedestrians moving around the space; traditional road markings and traffic signs have been minimised and street furniture and paving utilised to define areas. All these features need to inter-relate and work well together to achieve the desired outcomes.

For a shared space to be considered truly successful, it must not only deliver on anticipated outcomes (such as improved economic activity to businesses on the street or feeling of a sense of place), but also ensure consistently reduced vehicle speeds at all times of operation as a result of intuitive awareness of all users when entering a shared space.

The key operational issues of the existing Auckland urban shared spaces are discussed below, including previous research work that informed the development of a set of operational principles for urban shared spaces.

Traffic Speed

Traffic speed is considered to be the main operational factor that dictates whether a shared space is a success. Regardless of whether the street is well designed from a place making perspective, it is essential that traffic speeds are low so that people are able to feel safe and be safe when moving around or simply sitting and enjoying the space. Slow traffic speeds are necessary to enable pedestrians and motorists to interact and to effectively negotiate, via eye contact and body language, priorities within the trafficable areas of the shared space.

Safe Speed is one of the key pillars of the Safe Systems approach to implementing a safe road system (Ministry of Transport, 2010). The survivability of pedestrians in a crash with a vehicle has been shown to significantly increase at impact speeds of 30km/h or lower (World Health Organization, 2013). It is therefore essential that speeds are kept low in the shared space through effective design due to the high degree of pedestrian / vehicle interaction expected.

There is no legislative requirement for shared zones to have a low posted speed limit. The prevailing speed limit of the surrounding roads (typically 50km/h) is active within the space and therefore motorists would be legally able to travel at this speed limit. The shared spaces that have been implemented consequently rely on the design features of the shared space to encourage slower speeds.

For the urban shared spaces in Auckland, Table 1 presents the recorded mean and 85th percentile traffic speeds from 7 day automatic vehicle tube counts.

The table shows that there is a range of different vehicle speeds between the various shared spaces. The lowest speed on Darby Street is likely to be attributable to the short length of this road (approximately 75m). For Fort Street eastbound, the traffic counter was positioned only 15m from the intersection of Jean Batton Place hence vehicles have only limited opportunity to gain speed when entering the street before passing over the counter. This resulted in the speed being at the lower end of the range of recorded speeds and lower than the westbound movement.

Shared Zone	Annual Average Daily Traffic (AADT) ¹	Mean speed (km/h)	85 th percentile speed (km/h)	Posted speed limit (km/h)	Length of active frontage ² (H, M, L) ³	Pedestrian Activity ⁴ (H, M, L) ³
Darby Street	336	16.8	22.1	50	M	L
Elliott Street	999	17.3	23.0	10	M	H
Fort Street (Stage 1)	3043 (westbound) 1551 (eastbound)	17.5 (westbound) 15.8 (eastbound)	23.2 (westbound) 19.5 (eastbound)	50	M	M
Jean Batton Place	1949	17.3	22.2	50	L	M
Lorne Street	519	20.0	26.4	50	L	L
Totara Ave (2012 data)	2278	23.2	30.5	50	L	L

Table 1 Summary of survey vehicle speeds (2013) within shared space streets

All spaces were subject to a 50km/h speed limit with the exception of Elliott Street, which had a posted speed limit of 10km/h. Although, this may have been a factor in the reduced speed, interaction between pedestrians and motorists, as described below, also appears to have had a significant effect on the lower overall mean speed when compared to the other spaces such as Lorne Street and Totara Avenue.

Lorne Street and Totara Avenue are at the high end of the recorded speed range. Neither of these spaces have any notable activation of the street edges nor sufficient pedestrian-vehicle interaction to moderate speeds.

All spaces have similar characteristics in that they are generally linear in design with street furniture, drainage channels or paving defining the edge of the trafficable area, which exaggerates the linear design.

Research by Karndacharuk, Wilson and Dunn (2014) shows that there is a high correlation between pedestrian and vehicle interaction and vehicle speed as indicated in Figure 1. This figure presents the number of pedestrian-vehicle interactions for each survey hour against the mean speed for that hour.

¹ All roads are one way except Fort Street

² Proportion of distance along the street boundary that provides transparent frontage so that the activity generated within the property (e.g. building) can be visible from the street at relatively the same levels

³ H = High, M = Medium, L = Low

⁴ Pedestrian activity within the central vehicular trafficable areas, this may include pedestrian crossing movements or pedestrian movements along the trafficable area; pedestrian movements along the accessible zones adjacent to buildings outside the vehicular trafficable areas have been excluded

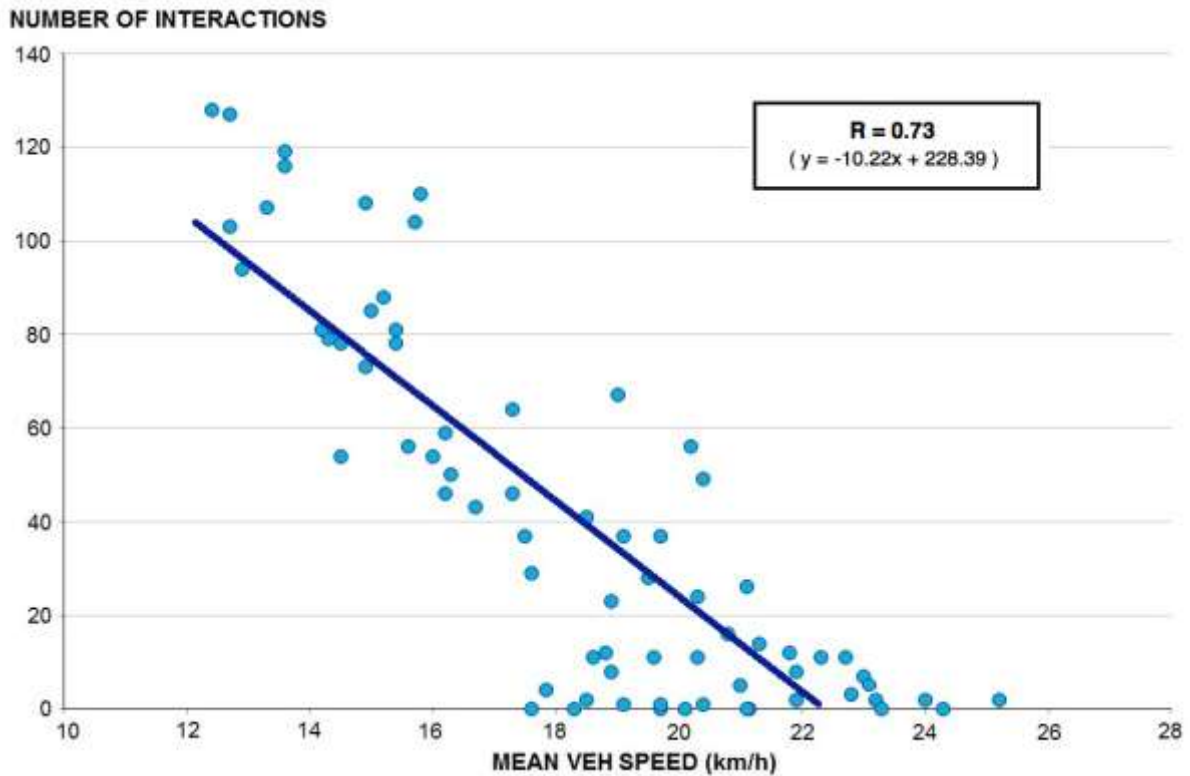


Figure 1 Pedestrian-vehicle interaction versus mean vehicle speed on Elliott Street
(Source: Karndacharuk, Wilson and Dunn, 2014, adapted by the authors)

Figure 1 represents three 24-hour periods and thus presents conditions throughout the day and night. It clearly shows that the higher the number of interactions the lower the mean speed. It can be inferred from this that if designers are too reliant on pedestrian interaction, speeds may not be sufficiently moderated when pedestrian movements are low (i.e. during off-peak times and especially at night); this relationship is also evidenced by the observed speeds and pedestrian activity summarised in Table 1.

This is further illustrated in Figure 2 which presents the relationship between the normalised pedestrian density of the whole corridor and the mean vehicle speeds for three of the shared streets in the CBD area for the main pedestrian activity times of 8am to 6pm.

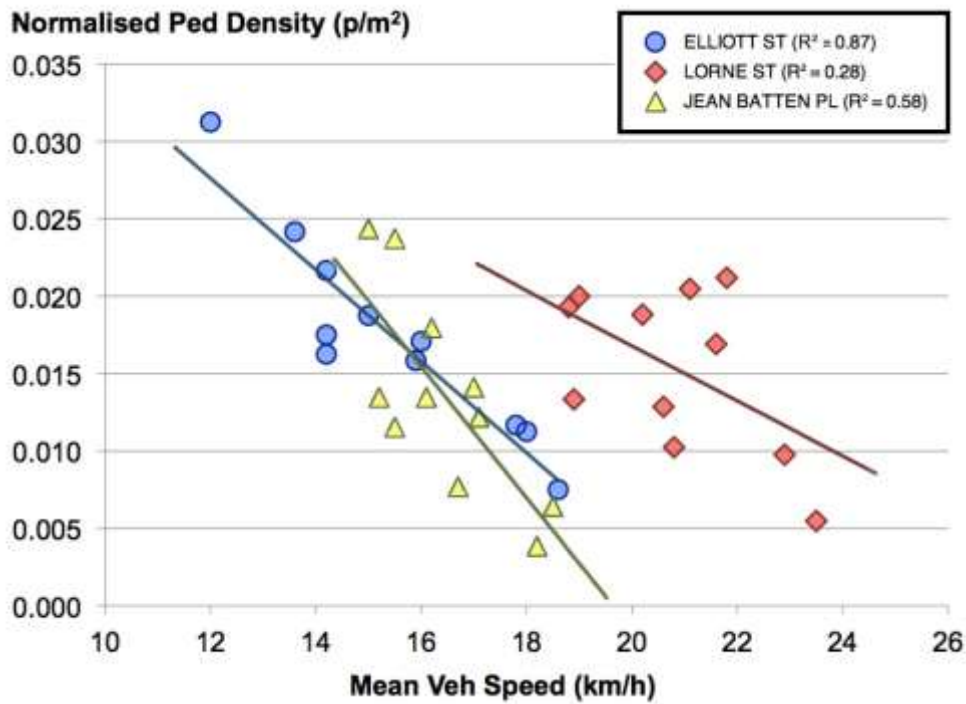


Figure 2 Normalised pedestrian density versus mean vehicle speed
(Source: Karndacharuk, Wilson and Dunn, 2013a, adapted by the authors)

For the three sites examined, this figure demonstrates that there is a stronger correlation between these two factors where pedestrian numbers are high, as on Elliott Street, compared to other streets where pedestrian numbers are low. In the case of these three streets, Elliott Street has significantly more activity along the frontage of the buildings lining the street than either Lorne Street or Jean Batten Place and hence the stronger influence of pedestrians on the vehicle speeds (Karndacharuk, Wilson and Dunn, 2013a).

A comparison of the distribution of vehicle speeds for the two highest speed streets (Lorne Street and Totara Avenue) and the lowest speed street (Elliott Street) is shown in Figure 3. This comparison shows that the majority of speeds (72%) for Elliott Street travel below 20km/h. In contrast, 53% of vehicles travel at speed less than 20km/h in Lorne Street and only 35% in Totara Avenue. Therefore, the resultant proportions of vehicles travelling at higher speeds (i.e. greater than 20km/h) is a particular concern with regards to the safety of the users of the shared space, as this will increase the severity of a crash between a vehicle and pedestrian. Notwithstanding the more favourable speeds for Elliott Street, there is still a significant proportion of motorists travelling above 20km/h. This may increase the propensity and severity of a vehicle-pedestrian crash as pedestrians may have an expectation that vehicles will be travelling at a slow speed.

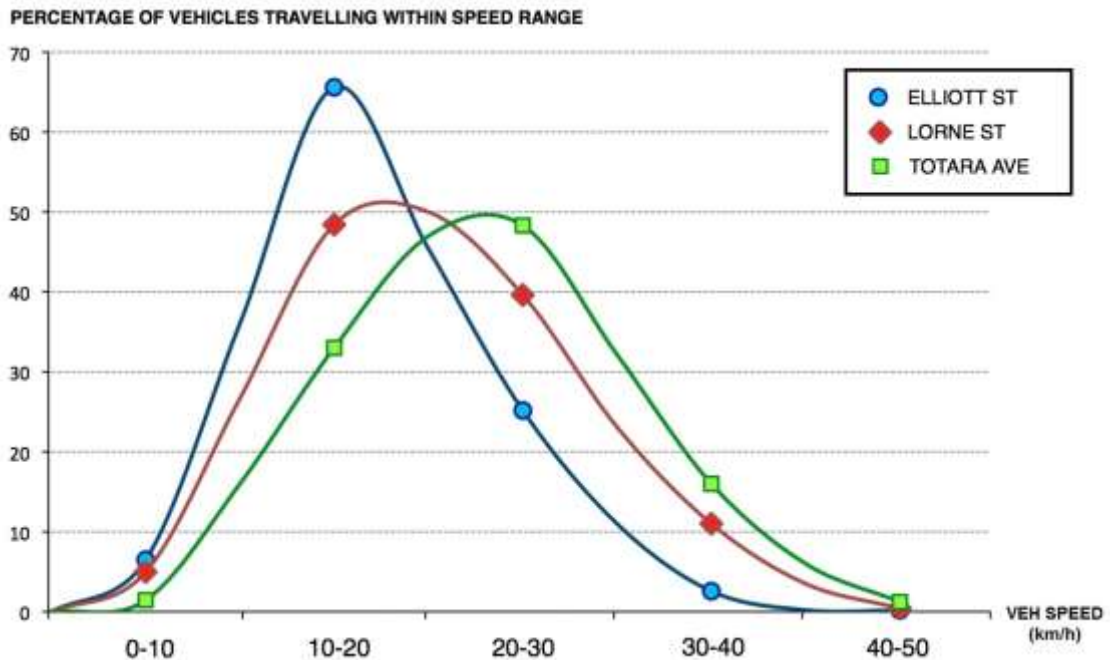


Figure 3 Comparison of distribution of vehicular speeds (2013) ⁵

The variability of the mean traffic speeds for each hour of the day for Elliott Street, Lorne Street and Totara Avenue are presented in Figure 4.

It can be seen in Figure 4 that the mean speed for Totara Avenue is generally consistent throughout the day at around 24km/h except for a short higher peak in the early hours of the morning. In contrast, both Elliott Street and Lorne Street show that speeds reduced during the day time; speeds are consistently below 20km/h in Elliott Street for 12 hours and Lorne Street 9 hours as indicated by the shaded areas in the figure. The main variable is the number of pedestrian-vehicle interactions. Totara Avenue has very low pedestrian movements across the space and hence little or no interaction within the vehicular trafficable zone. This leads to speeds being consistent throughout the whole 24 hour period. These figures complement the results shown in Figure 2 where speeds are most reduced during times of greatest pedestrian activity, particularly in Elliott Street.

⁵ Data for Totara Avenue is for 2012

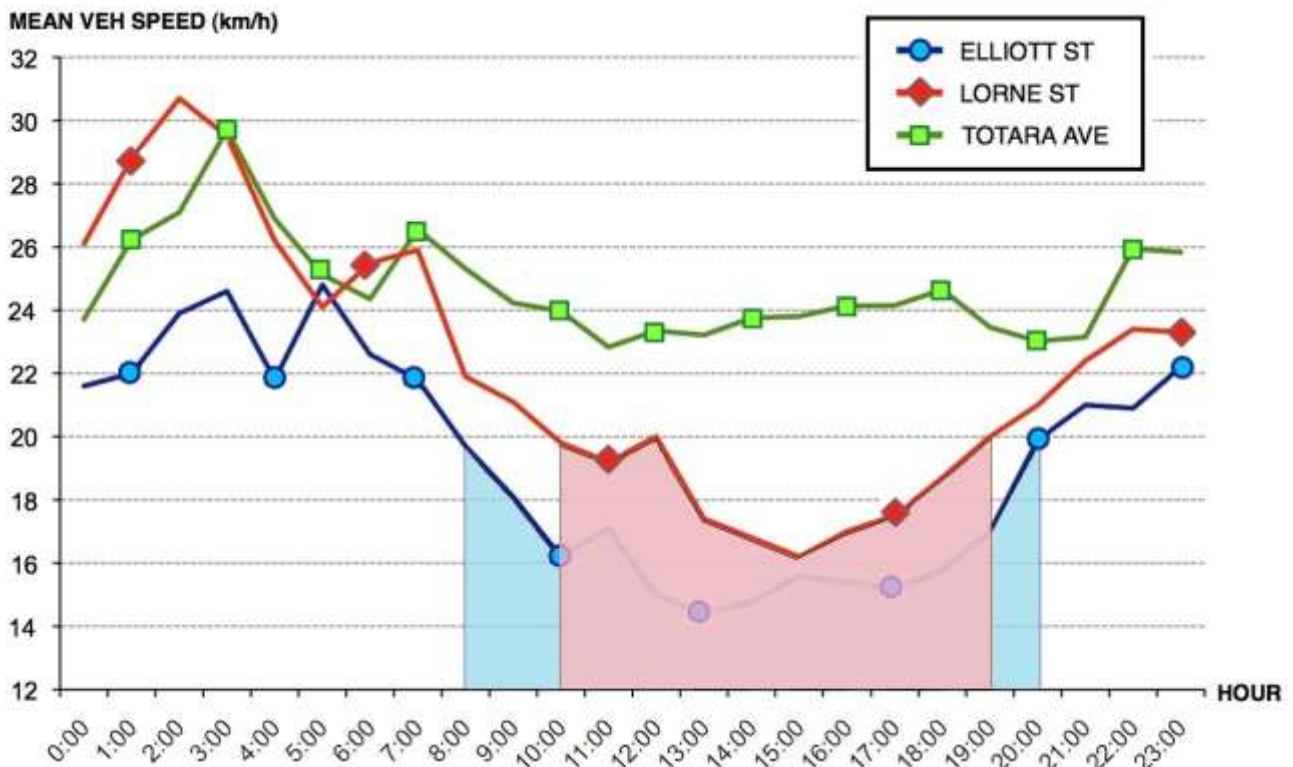


Figure 4 Mean speed distribution over 24 hour period (2013) ⁶

From the above analysis it can be surmised that the current design of the shared spaces goes some way to moderating vehicle speeds, with pedestrian-vehicle interaction further decreasing speed. However, the designs are not sufficiently able to keep speeds low (e.g. below 20km/h) without sufficient pedestrian-vehicle interaction. As pedestrians in shared zones are given a higher level of priority over vehicles, consistently low vehicle speeds are considered essential to reducing the risk of crash severity.

As a consequence, the operational design principles developed for shared zones seek to encourage designers to provide appropriate steps that would achieve consistently low vehicle speeds within shared zones. Key elements of the operational principles are around the suitability of the location as a shared zone and physical design elements to minimise speed.

As demonstrated by the research, pedestrian-vehicle interaction is one of the key factors in lowering vehicle speeds. Therefore, the design principles prompt designers to consider; to what extent a street has the potential to maximise the amount of active building frontage onto the street thereby maximising the pedestrian activity that depends upon the potential active frontage. The active frontage should not be located solely on one side of the street as it is important that there is both lateral pedestrian movement along the street as well as transverse movement across the street. Lorne Street represents a street where activity is only on one side and hence pedestrian movements across the street are low and therefore there is less effect on vehicle speeds.

If active frontage or pedestrian activity is likely to be low then designers need to consider whether the street is appropriate as a shared zone. Where it is known that future development will result in greater activity, then interim design measures should be incorporated that either encourage greater activity (such as vending stalls) or design elements that physically reduce vehicle speeds. Over reliance on pedestrian-vehicle interaction will result in higher vehicle speeds, particularly during times with low pedestrian activity. This is demonstrated in the above data for Totara Avenue above and for Elliott and Lorne Streets outside of the core pedestrian activity times. Therefore, in these situations, physical design measures are required to limit vehicle speeds.

⁶ Data for Totara Avenue is for 2012

The current shared zones in Auckland are generally linear in nature so motorists have a clear line of sight from one end of the street to the other. Street furniture is mostly in alignment and drainage channels further exacerbate the straightness of the road. Such features do little to deter some motorists from travelling faster than desirable. The operational design principles therefore encourage designers to break up this linearity by providing some lateral shift within the space so that motorists travel slower over the length of the street to negotiate the design features and so that the street does not appear to be straight.

The majority of shared zones in Auckland do not have a posted speed limit and therefore the prevailing speed limit applies. It is intended that the environment in which motorists are travelling will encourage slower speeds. International case studies have shown that a lower speed limit is often included in the design; in New South Wales, Australia a 10km/h limit is posted, whilst UK guidance suggests that a 20mph (approximately 30km/h) limit is used. The New Zealand operational principles suggest that a 10km/h design speed (and posted speed limit) be used. Shared zones are intended to be pedestrian orientated and therefore walking speed is desirable. Recognising that it would not be practical to post such a limit, the 10km/h speed is intended to emphasise to motorists that the shared zone is a low speed environment.

This approach is consistent with the Safe System approach which recognises that people make mistakes and that designers of the system have a responsibility for minimising the harm of these mistakes. Shared spaces encourage pedestrians and vehicles to use the same space which has the potential of increasing the risk of a crash. Therefore it is important that risks of harm, particularly serious or fatal injuries are minimised by designs that effectively ensure speeds are appropriately low.

Street Furniture Design

Street furniture within a shared zone is an integral part of the design. It is used to define the form of the zone and delineates areas to be used for different functions such as indicating limits of the vehicular trafficable areas, outdoor dining, seating and safe zones for pedestrians where it is intended that motorists do not drive. Often the furniture has multiple functions such as demarcating areas as well as performing a function in its own right (e.g. seat and street light).

The operation of the shared zones in the Auckland CBD areas has resulted in street furniture being frequently damaged by vehicles within the space, usually by manoeuvring vehicles reversing into areas to load or unload. It has been identified that this is largely due to the street furniture being of a low height (such as a bench) that is difficult for a motorist to observe out of the rear of a vehicle.

The design principles therefore require that street furniture be placed strategically to form clusters which have a larger visual mass for motorists to observe. Elements that have sufficient height to be seen by a driver should be used, for instance by having tall elements (e.g. trees and lighting columns) at each end of the cluster of furniture are also recommended.

As discussed previously, a key requirement is to reduce speed in the shared zone. Street furniture therefore has a significant role in encouraging slower speed. It should be used as a traffic calming measure by defining a path through the zone, preferably with some lateral shift to limit straight sections of the street and to break up long sight lines.

Pedestrian Priority

Historically, as motorcars proliferated, the design of city streets developed to provide delineation between vehicles and cars by creating footpaths separated from the carriageway by a vertical kerb. Research overseas (Department for Transport, 2011) has demonstrated that as the kerb height is reduced, pedestrians make greater use of the whole width of the carriageway. Such an approach would not be suitable in every location in the present vehicle dominated environment, but within shared zones that are intended to be low speed, low traffic volume areas, the removal of the kerb

to provide a level surface enables pedestrians to regain use of the whole space and assert a level of priority over motor vehicles.

The operational principles therefore support the use of a level surface over the full width of the road reserve. It is recommended that similar paving be used over the entire width to promote use of the whole space as pedestrian areas and to avoid indicating that only one or certain areas may be available to various users.

Awareness of Shared Zone

When entering into a shared zone it is essential that all users appreciate the change in the environment from a traditional street into a zone where different priorities apply. This is necessary so that users are aware of their obligations when using the space, to enhance safety and ensure that rules can be legally enforced.

Overseas shared zones are required to provide gateway signage on the entry (and exit) to the zone. In New Zealand, signs compliant to the relevant Traffic Control Devices Rule are provided on the entries and exits; however, in the Auckland schemes, these have been mounted high on street lighting poles and can be difficult to see by motorists turning into the zone from all approaches. Further, the signs are mounted out of the line of sight of pedestrians.

Therefore, the principles developed require that gateway treatments be provided at all transition points into the zone. These gateways must provide the legal signage of the requirements of the shared zone including any parking restrictions and must be erected to be visible to all users, including pedestrians. Entries into a shared zone from major pedestrian sources should make the change of zone clear so that users appropriately modify their behaviour.

Although signage is a minimum requirement which should be erected as a gateway feature, other visual cues within the zone should assist users in intuitively modifying their behaviour.

HOME ZONES

The research outlined in this paper is based upon shared zones in urban, commercial streets and the operational principles have been specifically developed for these circumstances. However, due to increasing pressure for greater intensity of housing particularly in Auckland, and the desire to provide a point of difference for new residential developments by creating a sense of place, developers are increasingly seeking to implement shared zones within residential areas. Although they have been commonly implemented in the European context and are the well known origin of the shared space principle (Woonerf), there are few appropriate New Zealand examples and currently, no specific guidelines have been developed for the New Zealand context.

Residential shared spaces have their unique challenges, particularly in regards to keeping speeds low, requirements for parking and maximising the ability for the space to be used effectively and safely by residents. The Operational Design Principles developed by Auckland Transport for the urban shared zones can be used as guiding principles for a shared zone in a residential street (Home Zone), however these need to be supplemented with further design guidelines to ensure appropriate outcomes that enable the home zone to operate autonomously. At the timing of writing this paper, supplementary guidelines are now in preparation.

CONCLUSION

In recent years, shared spaces have been constructed in a number of urban streets within the Auckland CBD and other Auckland suburbs. Whilst the CBD shared spaces have been deemed to be largely successful in the context of the economic returns for businesses and encouraging the redevelopment of streets, a number of operational issues and some inconsistency in the design approach between the CBD and suburban shared spaces have been identified.

To respond to these issues and to provide greater consistency between shared spaces in future schemes, Auckland Transport has developed a set of operational guideline principles. These principles have been incorporated into the Auckland Transport Code of Practice (ATCOP). The principles have been developed as a result of academic research into their operation and safety and as a result of site observations and monitoring by Auckland Transport.

The main influencing factor on the safety of shared spaces is traffic speed. This has a specific bearing on the usability of the space, potential for a crash and the severity of the crash. Given that the spaces are primarily designed to promote priority for pedestrians, the consequences of a crash are likely to be more severe in a shared space environment at higher speeds. It is therefore important that lower speeds are achieved through effective design. Based on research undertaken by Karndacharuk, Wilson and Dunn (2013a; 2014), it is evident that the current physical design of the existing shared spaces has had a limited effect on moderating traffic speeds and that there may be an over reliance on pedestrian-vehicle interaction to reduce vehicle speeds. Furthermore, when speeds are not consistently low, the consequence of a pedestrian-vehicle crash will be more severe as pedestrian activity reduces and vehicular speeds increase.

The operational principles seek to address this issue by encouraging designers to provide spaces that moderate speeds through physical design by strategic placement of street furniture; designs should not result in long straight sections of road that can encourage motorists to travel at higher than desirable speeds.

Damage to street furniture has been common in many of the shared spaces. This can be minimised through appropriate choice and placement of street furniture so that it can be more readily seen by motorists.

The operational principles have been developed to provide guidance for designers of shared spaces in Auckland. However, as they have been developed for the New Zealand context, it is recommended that they are considered for adoption by other local authorities across the country. This would help provide consistency in the design of shared spaces so that visitors from one area of the country will have clear expectations and understanding of a shared space in another location.

Auckland Transport is currently developing supplementary design guidelines for shared zones in residential areas (Home Zones) as whilst the general principles remain, these have different design and operational requirements than shared spaces in urban areas.

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ACKNOWLEDGEMENTS

The authors would like to thank Auckland Transport for their support. The views expressed in this paper are those of the authors and do not necessarily reflect the views of Auckland Transport.