

Shared Spaces – Auckland – A Safety and Operational Performance Study

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Abstract

In 2017 Traffic Engineering Solutions, Ltd (TES) undertook an operational safety review of Shared Spaces (spaces) in the Auckland CBD, New Zealand. These spaces are public streets intended to be shared by people and motorists. The aim of the study was to review the spaces with respect to their safety record and operational performance, and to consider how well the design elements within the spaces were performing to enable the safe and appropriate use of these areas. The study included site surveys and an international literature review.

The 5 Shared Spaces reviewed in this study were generally considered to be operating reasonably successfully. However, excessive traffic speeds (around 25km/h 85th%tile) and higher than desirable vehicle volumes (above 3,000 vehicles per day) were evident at two spaces.

Various measures have been recommended to reduce traffic speeds and volumes within the spaces. These measures would be expected to enhance safety and operational performance in the existing spaces, and should also be considered for future spaces.

Introduction

In 2017 Traffic Engineering Solutions Ltd (TES) undertook an operational safety review of several ‘Pedestrianised’ Shared Spaces (spaces) in the Auckland CBD, New Zealand. The aim of the study was to review the spaces with respect to their safety record and operational performance from a transportation and public perspective, and to consider how well the design elements within the spaces were performing to enable the safe and appropriate use of these areas.

Background

Shared Spaces are public streets or intersections that are intended to be shared by people and motorists in a consistent low-speed environment, with no obvious physical separation between the various road users. ‘People’ would include pedestrians, cyclists, and persons with mobility or vision impairment.

In Shared Spaces, traditional demarcations such as road-marking, signs and kerbs are replaced with a level paved surface and urban streetscape design, minimising separation between pedestrians and vehicles.

Spaces have been implemented in a number of streets in the Auckland CBD and West Auckland in recent years. There are currently eight Shared Spaces in Auckland: Elliott Street & Darby Street; Lorne Street; Fort Street (including Fort Lane and Jean Batten Place); Federal Street; O’Connell Street; Totara Avenue; McCrae Way; and Westgate Town Centre (Te Pumanawa Square). The first Shared Space (Elliott Street) was created in 2011.

The Transport (Road User) Rule 2004 defines the term Shared Zone¹ as: “A road that has been designed to slow traffic and give priority to pedestrians. Drivers give way to pedestrians who, in turn, should not impede traffic.”

ATCOP² describes Shared Spaces as: “Shared spaces within the public road space (as opposed to open space or private area) where all road users (including pedestrians, cyclists, vehicles and the disabled) are encouraged by design to legally interact, share and occupy the same public space”.

Furthermore, ATCOP states that Shared Spaces should “...attempt to limit vehicular dominance, volumes and speed. Traffic calming measures, such as lateral shifting of horizontal alignments, and street closures, can be employed to restrict vehicular movements and speeds. Based on the walking speed criteria, the recommended design speed should be 10 km/h”.

An Auckland Council bylaw prohibits parking within a Shared Space. Loading is permitted within a space, unless specifically restricted with appropriate signage. ATCOP recommends loading activities be restricted to time periods when pedestrian demand is lower.

Method

The study included an international literature review, and site observations, measurements, and surveys throughout an entire day at five Shared Spaces in the Auckland CBD. The site surveys/measurements included the following:

- Seven day speed and volume tube counts, with vehicle classification;
- Surveys over one entire weekday (7am to 11pm) at each space;
- Pedestrian volume counts, crossing movements, and dwell times;
- Pedestrian user surveys;
- Potential conflict (encounters) between pedestrians and motorists;
- Vehicle parking/loading;
- Design review;
- Road Safety Audit.

Shared Spaces – Key Design Features

Based on the layout of existing spaces in the Auckland CBD, and as noted by previous research (Carmine et al 2012)(Karndacharuk et al 2016), spaces in Auckland have generally been designed to exhibit the following key features:

- **Gateway Entry/Exit:** A paved surface and legal signage (Shared Zone) at the entry and exit, to clearly indicate the area encompassing the Shared Space. Generally, Shared Spaces have been designed to minimise legal signage and be self-explanatory for users;
- **Level Textured Surface:** Level block paving materials across the width of the street, with no kerb, encouraging pedestrians and motorists to share the space. It is generally accepted that textured block paving encourages slower vehicle speeds;
- **Accessible Zone:** A narrow area along both sides of the space (adjacent to building frontage), that is clutter free and provides enhanced amenity for pedestrians, particularly the visually- and mobility-impaired. The accessible zones also include textured paver navigational strips that define the accessible zone, and to guide visually-impaired pedestrians;
- **Activity Zone:** An area along the length of the space that accommodates fixtures, such as street furniture, lighting, seating, planter-boxes, art works, cycle stands, and loading areas. Ideally, street furniture near traffic or loading areas should have sufficient height and bulk to

¹ Shared Zone: Transport Rule 2004 uses the legal term Shared Zone, referred to in this report as Shared Space.

² ATCOP: Auckland Transport Code of Practice. This document provides quality standards to ensure that the function, condition and useful service life of transport assets are consistently achieved across the Auckland region.

- be clearly visible, with seating kept clear of direct traffic or vehicle manoeuvring areas; and
- **Trafficable Zone:** An area along the length of the space that caters for shared movement of vehicles and pedestrians. Crossing points for pedestrians are not necessary.

Shared Spaces – Desired Design Features

The main objectives of Auckland's spaces are to reduce vehicular dominance on a roadway and improve the street environment for pedestrians and community interaction. These goals are considered to be assisted by achieving the following design objectives:

- **Reduced Traffic Speeds:** Reduced vehicle speeds are an objective of Shared Spaces, and a key element to their successful operation. Safe Speed is one of the key pillars of the Safe Systems approach to implementing a safe road system (Ministry of Transport, 2010). Also, the survivability of pedestrians involved in a crash with a vehicle has been shown to increase significantly at impact speeds of 30km/h or lower (World Health Organisation, 2013). ATCOP recommends limiting vehicle speeds to 10km/h in Shared Spaces, though for most existing spaces in Auckland a speed limit of 50km/h applies. Relatively low traffic speeds (below 25km/h) are likely to reduce vehicular dominance, encourage street sharing, and reduce the likelihood and severity of any crashes;
- **Improved Safety:** Creating a safer environment should be an objective of all streetscape designs. However, measurements of safety should be based on reported crash statistics, and not on perceptions of risk. Indeed, an element of perceived risk can be promoted as a positive design aspect, as unpredictability and increased awareness of risk can help slow vehicle speeds, resulting in a more useable environment for pedestrians;
- **Reduced Traffic Volumes:** Relatively low traffic volumes are likely to reduce vehicular dominance and result in a more successful space. A space should operate in a manner similar to a Local Road, servicing adjacent properties only, with low amounts of 'through' traffic or public parking access. It may be acceptable to have higher traffic flows at peak commuter times, but lower traffic volumes throughout the remainder of the day are ideal when pedestrian volumes are higher. Traffic volumes of around 100 vehicles per hour or less would be ideal. Traffic volumes far in excess of 100 vehicles per hour throughout the day could create issues with respect to motorists dominating a space;
- **Increased Pedestrian Volumes:** Successful spaces generally have high numbers of non-motorists using the space, and thus spaces need to be located on pedestrian desire lines, and the surrounding land use should attract pedestrians. Food-based activities are considered particularly important for encouraging pedestrians to 'linger' within a Shared Space. Art works, monuments and seating can help create focal points that encourage pedestrians to 'linger' in an area. Also, night-time activities, such as late-night dining, or cinemas, are important for extending pedestrian activity into the night. Relatively high pedestrian volumes along and across a Shared Space throughout the day increases the likelihood of a space operating successfully. Hence the need for spaces to be implemented in town centres, along pedestrian desire lines, and adjacent to active building frontage;
- **Active Building Frontage:** Active building frontage throughout the day is required on both sides of a space, to encourage pedestrian movements within and across the space. Increased pedestrian movement causes increased pedestrian-vehicle interaction, which encourages slower vehicle speeds;
- **Trafficable Zone Lateral Shift:** Lateral shift of the trafficable zone is desirable to limit straight sections of street and break up long sight lines, thereby encouraging slower vehicle speeds. Research indicates that straight sections of circulation zone longer than 50 m should be avoided (RTA, 1987; Vic Roads, 2008). This can be achieved using street furniture;
- **Trafficable Zone Narrow Width:** A narrow traffic lane is likely to encourage slower vehicle speeds due to 'side friction' associated with roadside infrastructure. A width less

than 5.5 m for two-way flow could be ideal for encouraging slower vehicle speeds. Extrapolating this figure, a width of 4m or less would be considered suitable for a one-way Shared Space. Spaces can be narrowed using street furniture such as seating, landscaping, art works, monuments, tree canopies, street lighting, cycle stands, and on-street loading. However, if on-street loading is restricted at most time periods, then it is limited in effectiveness. The visual width of a carriageway can be further narrowed through the use of paving patterns; and

- **Loading / Parking:** Parking is prohibited in Auckland's spaces, but loading is permitted unless specifically restricted by signage. In Auckland spaces, 5 minute loading is permitted every day from 6am to 11am. Loading is a necessary service for properties along a space, and loading is not considered to have a significant adverse effect on spaces, especially if loading activities are restricted to time periods when pedestrian volumes are low.

The Key Design Features and Desired Design Features for a Shared Space are illustrated in Figure 1.

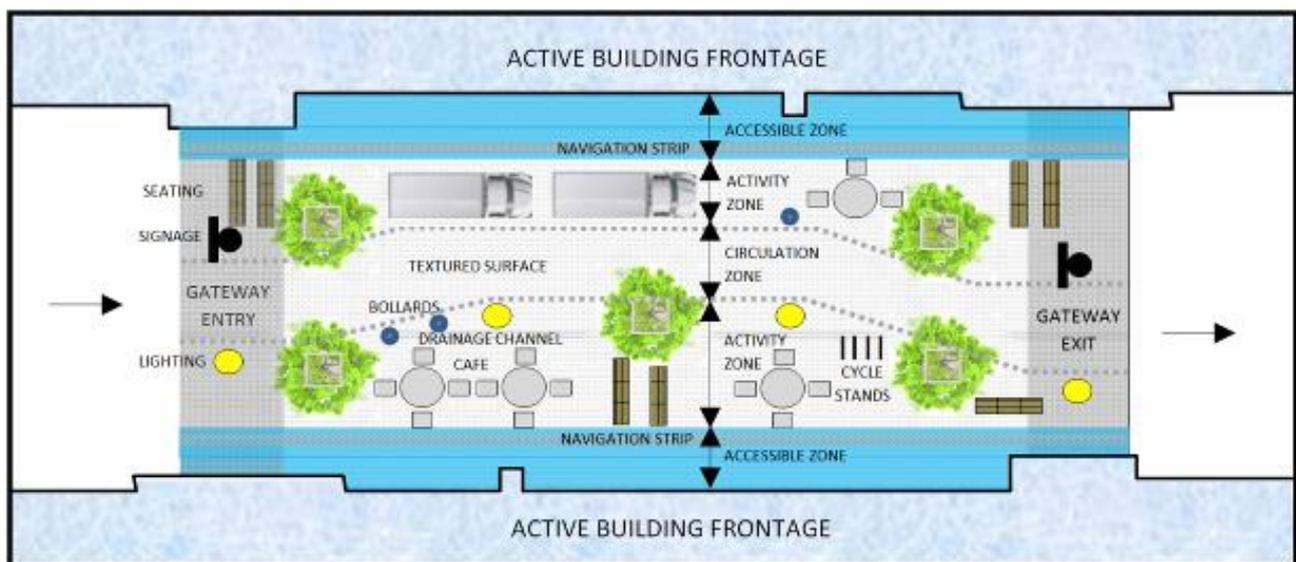


Figure 1: Key Design Features and Desired Design Features for a Shared Space

In relation to Figure 1, the following design attributes are worth noting:

- Lower traffic speeds are encouraged by the trafficable zone having lateral deflection, a narrow width, adequate 'side friction', and no adjacent drainage channel;
- Street furniture adjacent to the trafficable zone with high bulk/height is likely to increase 'side friction'. Large street furniture (such as trees) are effective at enhancing the space 'Gateways', and are robust at the rear of loading areas;
- The navigational strips are unobstructed, define the accessible zone, and are located within the accessible zone; and
- Pedestrian seating is not exposed to the trafficable zone or loading areas. Bollards provide added protection for seating, and prevent loading at inappropriate locations.

Auckland - Shared Space Comparison – Key Design Features

Shared Spaces in Auckland generally exhibit five key features: a Gateway, Textured Surfaces, an Accessible Zone, an Activity Zone, and a Trafficable Zone. Most of the spaces in Auckland provide all of these key features, with the following exceptions:

Fort Lane

Fort Lane does not provide an accessible zone or an activity zone. It is questionable whether Fort Lane is accurately defined as a Shared Space, as it effectively operates as a service lane. Pedestrian safety and amenity is likely to be compromised on Fort Lane by lack of provision for the zones. Consideration could be given to increasing amenity for pedestrians along the lane by providing some form of activity zone, with a ‘buffer’ between pedestrian and vehicles. However, pedestrian volumes and vehicle speeds are low along the lane, and the lane appears to have a satisfactory safety record.



Figure 2: Fort Lane – Lack of Accessible / Activity Zones

Darby Street

Darby Street does not provide an accessible zone or activity zone on its northern side. Again, it appears that these zones were not incorporated onto the northern side of this Shared Space due to its narrower width in comparison to most other Shared Spaces. However, it is noted that the existing activity/accessible/circulation zones on Darby Street are wider than necessary, and it may have been possible to accommodate some form of activity/accessible zone on the northern side of the space.

Lack of provision for these zones on the northern side of Darby Street reduces pedestrian amenity and safety, particularly for vision/mobility impaired pedestrians. Also, the wider than necessary circulation zone (6m) with limited ‘side friction’ may encourage higher vehicle speeds (an average 85th%tile of 22km/h was measured). It is noted that one reported minor-injury crash on Darby Street involved a vehicle colliding with a pedestrian. Furthermore, the Darby Street circulation zone operates immediately adjacent to the northern building frontage, which creates issues with respect to pedestrians entering/exiting doorways, and potential issues with vehicles colliding with the veranda overhang and associated signage.

Consideration should be given to introducing some form of accessible zone along the northern side of Darby Street, to (1) enhance amenity and safety for pedestrians, and (2) to reduce the circulation zone width and increase vehicle ‘side friction’, thus reducing vehicle speeds, and enhancing pedestrian safety.

Alternatively, consideration could be given to closing the Queen Street entrance to Darby Street to all traffic after 11am (when loading ceases to be permitted), creating a fully pedestrianised space. This would enhance pedestrian safety and amenity for most of the day. Also, it would address the

issue of Darby Street having no accessible zone on its northern side, and the trafficable zone being too wide particularly when no loading occurs.



Figure 3: Darby Street – Lack of Accessible / Activity Zones on Northern Side

Auckland - Shared Space Comparison – Desired Design Features

In terms of operational safety and efficiency, Shared Spaces are more likely to operate successfully if they exhibit most of the Desired Design Features, which are discussed as follows:

Traffic Speeds

Overseas research indicates that relatively low traffic speeds below 25km/h are likely to reduce vehicular dominance, encourage street sharing, and reduce the likelihood and severity of crashes (World Health Organisation, 2013). Based on overseas research and measured speeds on Auckland’s Shared Spaces, achieving a design speed of around 20km/h was considered reasonable, and likely to achieve successful outcomes in terms of operational safety and amenity.

Traffic speeds on all the spaces were measured to be 20km/h and above (85th%tile, 7-day tube counts). Four Shared Spaces had measured traffic speeds above 22km/h, which was considered excessive. Measures should be introduced to reduce traffic speeds on the Shared Spaces shown to have excessive speeds. This would reduce vehicle dominance and increase the frequency of motorists yielding to pedestrians, which would improve safety and amenity for pedestrians.

Traffic Volumes

Relatively low traffic volumes on a Shared Space (around or less than 100 veh/hr, or roughly 1,000 veh/day) are likely to reduce vehicle dominance on a Shared Space. The following is noted:

- Fort Lane, Darby Street, Elliott Street and O’Connell Street have relatively low traffic volumes (around 1,000 veh/day or less, based on 7-day tube counts);
- Jean Batten Place and Fort Street (east) have slightly higher traffic volumes (around 2,000 veh/day). These spaces were observed to operate satisfactorily; and
- Federal Street and Fort Street (west) have relatively high traffic volumes, at 3,444 and 4,914 veh/day, respectively. Pedestrian amenity and safety would be enhanced in these spaces if ‘through’ traffic could be discouraged.

Pedestrian Volumes

High pedestrian volumes reduce vehicle dominance in a Shared Space.

- Elliott Street, Jean Batten Place and Fort Street (west) had relatively high pedestrian

volumes (over 780 pedestrians/hr). High pedestrian volumes within these spaces help to create relatively successful spaces;

- Fort Street (east) has moderate pedestrian volume (540 pedestrians/hr), but the space is wide and lengthy, and pedestrian density appeared low;
- Darby Street has relatively low pedestrian volumes, at 384 pedestrians/hr. However, this space is relatively narrow, short, and has low traffic volumes, which compensates;
- Fort Lane has the lowest pedestrian volumes at 207 pedestrians/hr. This space has a narrow width and low traffic volumes, resulting in a space that has an adequate safety record, though provides low pedestrian amenity.

Active Building Frontage

Active building frontage is important for generating pedestrian activity and pedestrian crossing movements, which reduces vehicle dominance of a Shared Space.

- Fort Lane has very low activity building frontage. The lane operates reasonably satisfactorily, but operates as a service lane rather than a Shared Space;
- Federal Street has active building frontage along its northern section, but has low activity frontage along its southern section, where motorists dominate;
- Fort Street (east) has a modest level of building activity along its length, with several commercial buildings, vehicle accesses, and low turnover retail reducing pedestrian activity, particularly towards the eastern end, resulting in modest pedestrian volumes.

Lateral Shift

Trafficable zone lateral shift is effective at moderating vehicle speeds, and based on international research straight sections of Shared Space should be limited to around 50m lengths. None of the Shared Spaces have been provided with lateral shift, which is considered a significant design flaw, particularly in relation to spaces with long midblock lengths and wide trafficable zones. Both Fort Street (east) and Federal Street have no lateral shift, and are long, straight and wide. It is no coincidence that these spaces both exhibit excessive vehicle speeds (85th%tile speeds of 24km/h and 26km/h, respectively). Consideration should be given to introducing lateral shift to these Shared Spaces, and any other spaces with a vehicle speeding issue.

Drainage Channel

ATCOP advises against installing drainage channels alongside the trafficable zone of a Shared Space. This is because such a channel visually defines the edge of a traffic lane and may encourage higher vehicle speeds. Unfortunately, all the spaces have been designed with a drainage channel alongside the trafficable zone. Retrospectively, it would not appear economically feasible to correct this issue. However, if lateral shift were to be introduced to some of the spaces, then the drainage channel would no longer be aligned along the length of the trafficable zone.



Figure 4: Drainage Channel Alongside Trafficable Zone – Federal St and Fort St (east)

Trafficable Zone Side Friction

Trafficable zone ‘side friction’ encourages slower vehicle speeds. ‘Side friction’ is increased by having a narrow trafficable zone with permanent street furniture of sufficient height and bulk positioned close to the trafficable zone. Several spaces (Fort Street (east), Federal Street, Darby Street, Elliott Street, and O’Connell Street) appear to generate insufficient ‘side friction’, which is likely to be an aggravating factor with respect to higher vehicle speeds on these Shared Spaces.



Figure 5: Insufficient ‘side friction’ – Federal Street, Fort Street (east), and Darby Street

Pedestrians Walking Along Trafficable Zone

If a high proportion of pedestrians on a Shared Space walk along the trafficable zone, then it indicates that pedestrians are comfortable sharing the trafficable zone with traffic, which indicates a more successful space. The pedestrian utilisation of the trafficable zone was measured during an all-day survey. Darby Street and O’Connell Street had relatively high percentages of pedestrians walking along the trafficable zone (around 30%). This is mainly attributed to these Shared Spaces having low traffic volumes. Fort Street (east) and Federal Street had relatively low percentages of pedestrians walking along the trafficable zone (around 10%). This is attributed to these spaces having relatively high traffic volumes, high traffic speeds, and lower activity building frontage.

Pedestrians Yielding to Vehicles

A Shared Space is likely to operate more successfully if a high proportion of motorists are willing to yield to pedestrians, as required by the Transport (Road User) Rule for a Shared Space. During all-day surveys, yielding was observed and measured between motorists and pedestrians using the Shared Spaces.

In Fort Street (west), 63% of motorists yielded to pedestrians, as opposed to pedestrians yielding to motorists, or pedestrians and motorists yielding to each other. This favourable result could probably be attributed to high pedestrian volumes, slow vehicle speeds, and vehicle queuing.

Elliott Street had the lowest proportion of motorists yielding to pedestrians (28%), which may be a reflection of higher vehicle speeds. Also, the junction of Elliott Street and Darby Street encourages pedestrians to cross the Shared Space at a particular location, rather than wait for a gap in traffic while walking along the Shared Space, which increases need to yield.

All the other Shared Spaces had similar levels of motorists yielding to pedestrians (ranging from 35% to 44%), with the exact figures not being considered significant.

Large Vehicles

If large vehicles form a relatively high proportion of traffic in a Shared Space, then traffic is more likely to dominate the space, with negative consequences on pedestrian amenity and safety. Tube counts indicated the proportion of large vehicles to cars/vans using each space.

Fort Lane recorded a fairly high proportion of large vehicles (7%), which would be expected for a service lane. Since traffic volumes are very low on this space (207 veh/day), this result is not considered significant.

Federal Street recorded a fairly high proportion of large vehicles (7%), and since traffic volumes on Federal Street are relatively high (3,444 veh/day), this result is considered significant. In particular, large numbers of buses were observed using the space, usually associated with a casino and hotel. The high proportion of large vehicles using Federal Street is considered to contribute to Federal Street operating less successfully as a space.

Illegal Loading and Parking

High levels of illegal loading and parking are likely to result in a less successful space, as such vehicles reduce amenity for pedestrians, and can adversely affect road safety if parked over the accessible zone, or double parked over the trafficable zone.

Relatively high levels of illegal parking and loading were observed on Fort Street (east) and Federal Street, with legal loading/parking representing only 45% and 31% of observed demand, respectively. This may be a reflection of higher demand, more commercial activity, or less enforcement.

Measures should be considered to reduce illegal loading/parking, such as (i) increased enforcement; (ii) increased signage; and (iii) extended time periods for legal loading.

Public Perception of a Shared Space

The general public's perceived satisfaction with a Shared Space is an important indicator of how successfully a space operates. However, the subjective manner of data collection can easily introduce survey bias. The type of questions asked, the politeness of the enquiry, the exact location

of the enquiry, the profile of respondents, the time of day of survey, and the total number of surveys, could all generate bias. Overall, most of the Shared Spaces achieved similar results, varying from 62% to 64% satisfaction with the operation of the Shared Spaces.

Only one space (Federal Street) had a significantly different result, with only 48% of pedestrians indicating satisfaction with the Shared Space. This result correlates with Federal Street failing to meet many desired design criteria.

Road Safety

A primary indicator of the success of a Shared Space is if road safety has improved since introduction of the space. Since spaces usually divert traffic, on this basis alone they should reduce reported crashes. Furthermore, spaces should reduce traffic speeds, which usually results in decreased crash numbers and crash severity. Using the NZTA (New Zealand Transport Agency) CAS (Crash Analysis System) database, reported crash statistics were reviewed at each space over an equivalent time period, before and after installation.

Fort Street (west), Fort Lane, and Jean Batten Place as a combined Shared Space achieved a significant crash saving. Lower traffic speeds and less on-street parking are probably the main contributory factors in this result.

Elliott and Darby Streets space had a relatively neutral impact on reported crash statistics. Considering that this space diverted traffic elsewhere, a crash saving should have been achieved. Relatively high traffic speeds, and lack of accessible zone on the northern side of Darby Street may be aggravating factors.

O'Connell Street space had a neutral impact on crash statistics, with zero reported crashes for around 2 years before installation, and zero reported crashes after installation.

Crash severity has worsened on Fort Street (east) and Federal Street, although crash numbers have reduced somewhat. This is a poor result considering that the introduction of a Shared Space on these streets diverted traffic, particularly on Fort Street (east), where traffic volumes halved. Also, the Shared Spaces should have reduced vehicle speeds, with a reduction in crash numbers and crash severity. However, it is noted that the increase in crash severity in both cases was caused by a single serious injury crash reported on each Shared Space, which could be an isolated incident rather than an indicative crash pattern. Nevertheless, measures should be introduced to reduce vehicle speeds on Fort Street (east) and Federal Street, to help improve road safety on these spaces.

Conclusions

Overall, the Shared Spaces reviewed in this study were generally considered to be operating reasonably successfully in terms of safety and operational performance.

However, excessive traffic speeds (above 22km/hr) were evident at several spaces: Federal Street, O'Connell Street, Fort Street (east), and Elliott Street. Also, traffic volumes were higher than that desirable at two spaces: Fort Street (west) and Federal Street.

Excessive traffic speeds and volumes are a key factor adversely affecting pedestrian safety and amenity within a Shared Space. Reducing both traffic speeds and traffic volumes are important for achieving a fully successful outcome for a space.

Various measures were recommended to improve the operational performance and safety of the Auckland CBD Shared Spaces.

In general terms the key recommendations included:

- Introducing trafficable zone lateral shift;
- Narrowing the trafficable zone;
- Increasing trafficable zone side friction, by increasing the height and bulk of street furniture;
- Ensuring navigational strips are clear of street furniture;
- Positioning seating clear of traffic.

Details regarding the recommendations were documented in individual reports for each Shared Space, including a spreadsheet comparing and recommending solutions for all the Shared Spaces (TES, 2016).

In summary, the Key Design Features and Desired Design Features discussed in this report should be considered for inclusion within any proposed Shared Space.

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