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Shared Space – Auckland – Operational Safety Study

Bruno Royce

Traffic Engineering Solutions Ltd, Auckland

Paper

INTRODUCTION

Traffic Engineering Solutions Ltd (TES) has undertaken an operational safety review of several 'Pedestrianised' Shared Spaces in the Auckland CBD, at the request of Auckland Transport. The aim of the study was to review Shared 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.

Individual reports were prepared for Federal Street, O'Connell Street, Elliott Street, Darby Street, Fort Street, Fort Lane, and Jean Batten Place, which are the Shared Spaces currently operational in central Auckland. This report compares the results obtained from observing and analysing these Shared Spaces, and summarises the results overall.

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.

Shared 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".

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.

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 10km/h”.

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

LOCATION AND LAYOUT

The location and layout of the subject Shared Spaces are illustrated in Figure 1.



Figure 1: Location and Layout of Auckland CBD Shared Spaces

SHARED SPACES – COMMON DESIGN ELEMENTS

Based on ATCOP and the layout of existing Shared Spaces in the Auckland CBD, Shared Spaces in Auckland have generally been designed to exhibit the following common features:

- **Gateway Treatment:** 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 designed to 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 the length of the Shared Space, on both sides of the Shared 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 Shared 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 be clearly visible, with seating kept clear of direct traffic or vehicle manoeuvring areas; and
- **Circulation Zone:** An area along the length of the Shared 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 Shared 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 Shared 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 Shared Space. A Shared 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 Shared Space;
- **Increased Pedestrian Volumes:** Successful Shared Spaces generally have high numbers of non-motorists using the space, and thus Shared 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 Shared Space operating successfully. Hence the need for Shared 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 Shared Space, to encourage pedestrian movements within and across the Shared Space. Increased pedestrian movement causes increased pedestrian-vehicle interaction, which encourages slower vehicle speeds;
- **Circulation Zone Lateral Shift:** Lateral shift of the circulation 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 greater than 50m in length should be avoided (RTA, 1987; Vic Roads, 2008). This can be achieved using street furniture;
- **Circulation Zone Narrow Width:** A narrow circulation lane is likely to encourage slower vehicle speeds due to 'side friction' associated with roadside infrastructure. A width less than 5.5m 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. Shared 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 Shared Spaces, but loading is permitted unless specifically restricted by signage. In Shared Spaces within Auckland, five minute loading is permitted every day from 6am to 11am. Loading is a necessary service for properties along a Shared Space, and loading is not considered to have a significant adverse effect on Shared Spaces, especially if loading activities are restricted to time periods when pedestrian volumes are low.

The Design Elements and ideal Design features for a Shared Space are illustrated in Figure 2:

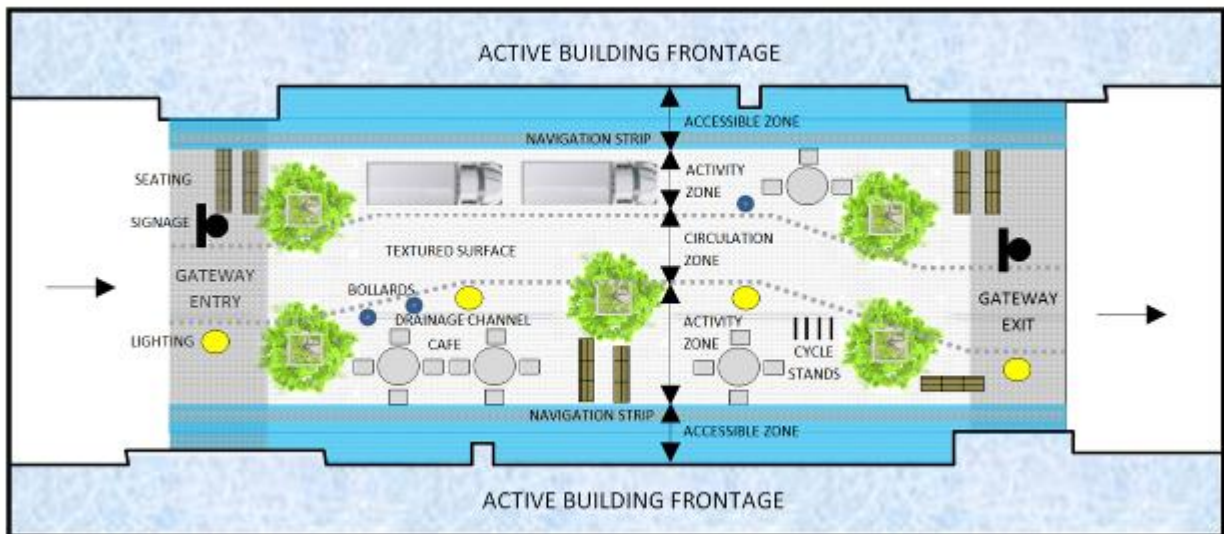


Figure 2: Design Elements and Ideal Design Features for a Shared Space

In relation to Figure 2, the following design attributes are worth noting:

- Lower traffic speeds are encouraged by the circulation zone having lateral deflection, a narrow width, adequate 'side friction', and no adjacent drainage channel;
- Street furniture adjacent to the circulation zone with high bulk/height is likely to increase 'side friction'. Large street furniture (such as trees) are effective at enhancing the Shared 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 circulation zone or loading areas. Bollards provide added protection for seating, and prevent loading at inappropriate locations.

SHARED SPACE COMPARISON – COMMON DESIGN ELEMENTS

Shared Spaces in Auckland generally exhibit five common design elements: a Gateway, Textured Surfaces, an Accessible Zone, an Activity Zone, and a Circulation Zone. Most of the Shared Spaces in Auckland provide all of the common design elements, with the following exceptions:

Fort Lane

Fort Lane does not provide an accessible zone or an activity zone. These zones were not incorporated into this Shared Space due to the lane's narrow width (5m). As a result of not including these zones, 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 3: 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 Shared 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 85thtile 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, 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 circulation zone being too wide particularly when no loading occurs.

Darby Street could be an ideal Shared Space to undertake a trial for closing a Shared Space to traffic after 11am. This is because it has no driveway accesses, has low traffic volumes, and its closure would not create a significant detour. Electronic bollards could close-off the Queen Street entrance at 11am, after which loading is no longer permitted. Any vehicles remaining in Darby Street after 11am could exit the Shared Space using Elliott Street. Furthermore, if closing Darby Street was successfully trialled, then consideration could be given to closing some other Shared Spaces, such as Jean Batten Place and O'Connell Street.



Figure 4: Darby Street – Lack of Accessible / Activity Zones on Northern Side

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

ATCOP recommends limiting vehicle speeds to 10km/h in Shared Spaces. However, 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 would be considered reasonable, and likely to achieve successful outcomes in terms of operational safety and amenity.

Traffic speeds on all the Shared 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. These spaces were Elliott Street (23km/h), Fort Street (east)(24km/h), O'Connell Street (25km/h), and Federal Street (26km/h).

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). This level of traffic volume does not appear to have a significant negative impact on the operation of these Shared Spaces; 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 Shared Spaces if 'through' traffic could be discouraged.

Pedestrian Volumes

High pedestrian volumes reduce vehicle dominance in a Shared Space. The following is relevant with respect to the Shared Spaces:

- Elliott Street, Jean Batten Place and Fort Street (west) have relatively high pedestrian volumes (over 780 pedestrians/hr). Although these Shared Spaces are deficient in terms of some Desired Design criteria, high pedestrian volumes within the Shared Spaces are likely to compensate and help create relatively successful Shared Spaces;
- Fort Street (east) has moderate pedestrian volume (540 pedestrians/hr), but the Shared Space is wide and lengthy, and pedestrian density appeared low;
- Darby Street has relatively low pedestrian volumes, at 384 pedestrians/hr. However, this Shared Space is relatively narrow, short, and has low traffic volumes, and these characteristics compensate;
- Fort Lane has the lowest pedestrian volumes at 207 pedestrians/hr. This Shared Space has a narrow width and low traffic volumes, resulting in a Shared 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. The following Shared Spaces have issues with building frontage:

- 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. If other design shortfalls on Federal Street could be addressed, then this could compensate for the section of low activity building frontage;
- 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. This results in modest pedestrian volumes and crossing movements. Again, addressing other design shortfalls could help to alleviate the issues created by modest activity building frontage.



Figure 5: Inactive Building Frontage: Fort Lane, Fort St (east), and Federal St

Lateral Shift

Circulation 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 Shared Spaces with long midblock lengths and wide circulation zones. Both Fort Street (east) and Federal Street have no lateral shift, and are long, straight and wide. It is no coincidence that these Shared Spaces both exhibit excessive vehicle speeds (85th percentile speeds of 24km/h and 26km/h, respectively). Consideration should be given to introducing lateral shift to these Shared Spaces, and any other Shared Spaces with a vehicle speeding issue.



Figure 6: No Lateral Shift Circulation Zone – Fort St (east) and Federal St

Drainage Channel

ATCOP advises against installing drainage channels alongside the circulation 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 Shared Spaces have been designed with a drainage channel alongside the circulation zone. Retrospectively, it would not appear economically feasible to correct this issue. However, if lateral shift were to be introduced to some of the Shared Spaces, then the drainage channel would no longer be aligned along the length of the circulation zone.

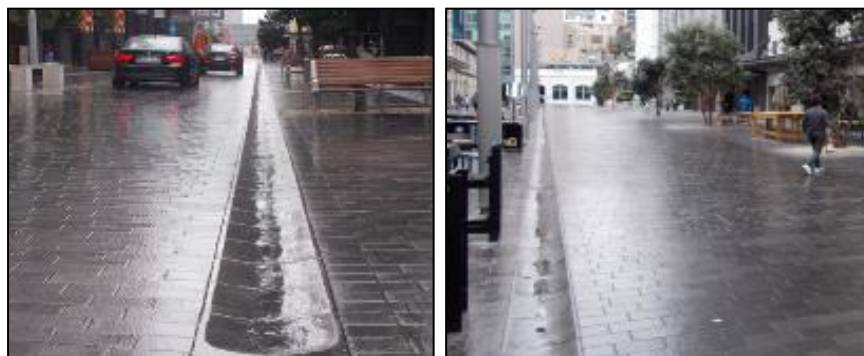


Figure 7: Drainage Channel Alongside Circulation Zone – Federal St and Fort St (east)

Circulation Zone Side Friction

Circulation zone ‘side friction’ encourages slower vehicle speeds. ‘Side friction’ is increased by having a narrow circulation zone with permanent street furniture of sufficient height and bulk positioned close to the circulation zone. Several Shared 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 8: Insufficient ‘side friction’ – Federal Street, Fort Street (east), and Darby Street

Pedestrians Walking Along Circulation Zone

If a high proportion of pedestrians on a Shared Space walk along the circulation zone, then it indicates that pedestrians are comfortable sharing the circulation zone with traffic, which indicates a more successful Shared Space. The pedestrian utilisation of the circulation zone was measured during an all-day survey.

Darby Street and O’Connell Street had relatively high percentages of pedestrians walking along the circulation 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 circulation zone (around 10%). This is attributed to these Shared 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.



Figure 9: Fort Street (west) - Pedestrian Crossing Through Vehicle Queue

Pedestrians Crossing the Shared Space

If a large number of pedestrians cross a Shared Space, then motorists are less likely to dominate a Shared Space. Thus, a Shared Space across many pedestrian desire lines, with crossing walkways and active building frontage, is more likely to operate successfully.

Pedestrian movements across the Shared Spaces were measured, but pedestrians were counted if they crossed the Shared Space in a fairly direct manner. Consequently, Shared Spaces across a pedestrian desire line, with junctions, crossing walkways, or locations where pedestrians need to cross abruptly, would have a higher quantity of pedestrians measured crossing the Shared Space. However, pedestrians crossing a Shared Space abruptly is not necessarily a positive attribute of a Shared Space.

In contrast, if pedestrians wandered along the Shared Space, and gradually crossed the Shared Space (in increments), this was not measured as a 'crossing'. This is because to measure such movements along the length of a Shared Space would require an origin / destination survey. Thus, pedestrians meandering across a Shared Space were not included in the 'crossing' survey, although such pedestrian movements would actually be considered ideal in a Shared Space. Hence, the survey measurements were not considered an accurate reflection of the pedestrian 'crossing' movements, and their impact on a Shared Space.

For example, Federal Street measured a high proportion of pedestrians crossing the street. However, this is not considered to indicate that Federal Street operates successfully, as pedestrians were not observed to meander across the circulation zone, and were observed to cross abruptly, mostly towards the northern end, often in-between vehicle queues.

Also, both Darby Street and Jean Batten Place had low percentages of pedestrians crossing the Shared Space. However, in reality, it is considered likely that most pedestrians using these Shared Spaces crossed the space, and that many pedestrians were not counted as 'crossing' because they meandered across the space, or they crossed in the vicinity of the Shared Space junction (Elliott Street / Fort Street (west)), both of which are not negative aspects.



Figure 10: Federal Street (L) (crossing quickly), and Darby Street (R) (wandering across)

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 Shared Space.

Jean Batten Place recorded the highest proportion of large vehicles (8%). However, site observations did not support this result, and large vehicles were not observed to be a problematic during site inspections. Also, all vehicles using Jean Batten Place are required to use Fort Street (west), which had a fairly low percentage of large vehicles (4%), thus the Jean Batten Place measurement does not appear significant.

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 Shared Space (207 veh/day), this result is also 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 Shared Space, usually associated with the Sky City Hotel/Casino. The high proportion of large vehicles using Federal Street is considered to contribute to Federal Street operating less successfully as a Shared Space.



Figure 11: Federal Street – Frequent Buses

Illegal Loading and Parking

High levels of illegal loading and parking are likely to result in a less successful Shared 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 circulation 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.



Figure 12: Federal St (L) and Fort St (east) (R) – Illegal Loading / Parking

Public Perception of a Shared Space

The general public's perceived satisfaction with a Shared Space is an important indicator of how successfully a Shared 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 Shared 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 Shared Space. Since Shared Spaces usually divert traffic, on this basis alone they should reduce reported crashes. Furthermore, Shared Spaces should reduce traffic speeds, which usually results in decreased crash numbers and crash severity. Reported crash statistics were reviewed at each Shared 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 Shared Space had a relatively neutral impact on reported crash statistics. Considering that this Shared 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 Shared 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 Shared 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 Shared Spaces: Federal Street, O'Connell Street, Fort Street (east), and Elliott Street. Also, traffic volumes were higher than that desirable at two Shared 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 Shared 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 circulation zone lateral shift;
- Narrowing the circulation zone;
- Increasing circulation 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 Common Design Elements and Desired Design Features discussed in this report should be considered for inclusion within any proposed Shared Space in New Zealand.

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