TECHNICAL PAPER

SHARED SPACE PERFORMANCE EVALUATION: QUANTITATIVE ANALYSIS OF PRE-IMPLEMENTATION DATA

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ABSTRACT

This paper discusses Shared Spaces within the New Zealand context and presents a literature review, including the consideration of the distinct 'Place' function of the urban transport corridor. The concept also aims to significantly enhance pedestrian priority and amenity while reducing the dominance of motor vehicles within the road space in appropriate locations.

The scope of research includes 'before and after' case studies of the shared space projects in Elliott, Lorne and Fort Street areas in the Auckland Central Business District (CBD). A data collection process has been developed to quantitatively capture the existing and future road environments, including pedestrian and vehicle activity within the road corridor. This paper will discuss the key performance indicators that have been developed, and presents early outcomes of the data analysis based on the 'before' quantitative data.

This study collaboration between the University of Auckland and Auckland Transport (which is an Auckland Council controlled organisation) seeks to provide research-based evidence of how a shared space performs, and is expected to form the basis of design guidelines and a methodological framework to assess and evaluate the performance and perception of shared space schemes both internationally and in New Zealand.

INTRODUCTION

This paper presents an analysis of the development of a performance evaluation framework for shared spaces projects in a New Zealand context based upon data collected on the existing street context before shared space improvements are constructed. The study is part of a doctoral research programme undertaken at the University of Auckland in collaboration with Auckland Transport, which is an Auckland Council controlled organisation.

The quantitative measures of shared space, including pedestrian and traffic data are explored in order to establish the pre-implementation baseline in evaluating the effectiveness of shared space projects in the Auckland CBD.

SHARED SPACE CONCEPT

A review of literature reveals a large variance in the understanding of shared spaces and subsequent implications and applications of such concepts. This is reflected by a lack of clear definition of the term 'Shared Space' by and in contrast, the many similar words used in current terminology, that include shared street, simplified street, naked street, complete street, civilised street, single surface and de-cluttering (AkCC, 2009).

The Shared Space concept is considered to have originated from and evolved out of the Home Zone concept (*Woonerf* or *Woonerven* in Dutch, Quimby and Castle, 2006). Home Zones are residential streets in which the road space is shared between all users by making them places for people with the wider needs of residents in mind (IHIE, 2002). Some similar concepts that give an emphasis on residential and community interaction while diminishing traffic mobility function are 'liveable neighbourhood', 'living streets', 'self-explaining road' and Local Area Traffic Management (LATM).

A public space in the context of a shared space is an area situated exclusively within the road reserve. It differs from the term 'public realm', commonly used in Urban Design and Landscape Architecture disciplines because the 'public realm' definition can also include open spaces, town centres and parks outside of the road reserve.

A shared space in its broadest definition is a way of thinking with the vision to improve the quality of public space based on the integration of various forms of human activity (Shared Space, 2005). It involves not only transport engineering and urban design techniques on public spaces, but also planning, public consultation, and decision-making processes to seek improvements in interrelated areas of safety, congestion, spatial quality, sense of place, economic prosperity and community involvement.

The Shared Space concept brings about a new notion that is divergent but adds to current approaches of traffic engineering practice and management in built environments. These new and more traditional contexts are outlined and discussed in the following paragraphs.

Place Function for Urban Public Streets

The use and design of the public (road) space in towns and cities has been increasingly scrutinised by the public, particularly by urban designers and by planners. This is evident in New Zealand by the development and signatories to the Ministry for the Environment's Urban Design Protocol (MfE, 2005). Nevertheless, such space is statutorily defined as 'road' in the legislation e.g. Land Transport and Local Government Acts to ensure the public have the basic right of travelling from one place to another.

In traffic engineering and transport planning, the dominant function of movement or mobility is principally related to the efficiency of motor vehicle based traffic. The other conflicting function in road hierarchies is accessibility, which again largely describes the ability of vehicles to access adjacent land use activities. These two main competing functions gave rise to two distinct types of 'designed' street in an urban environment; traffic routes serving primarily mobility, and local streets serving primarily property access. Streets that served more equal mobility and access functions in the past have often resulted in design compromises, which have led to poor safety records.

Other functions such as environmental amenity and social aspects that include pedestrians have been considered in road / street design, but with the objective to contribute to the overall function of the abutting land use and surrounding areas rather than to create a place for social interaction and street activities.

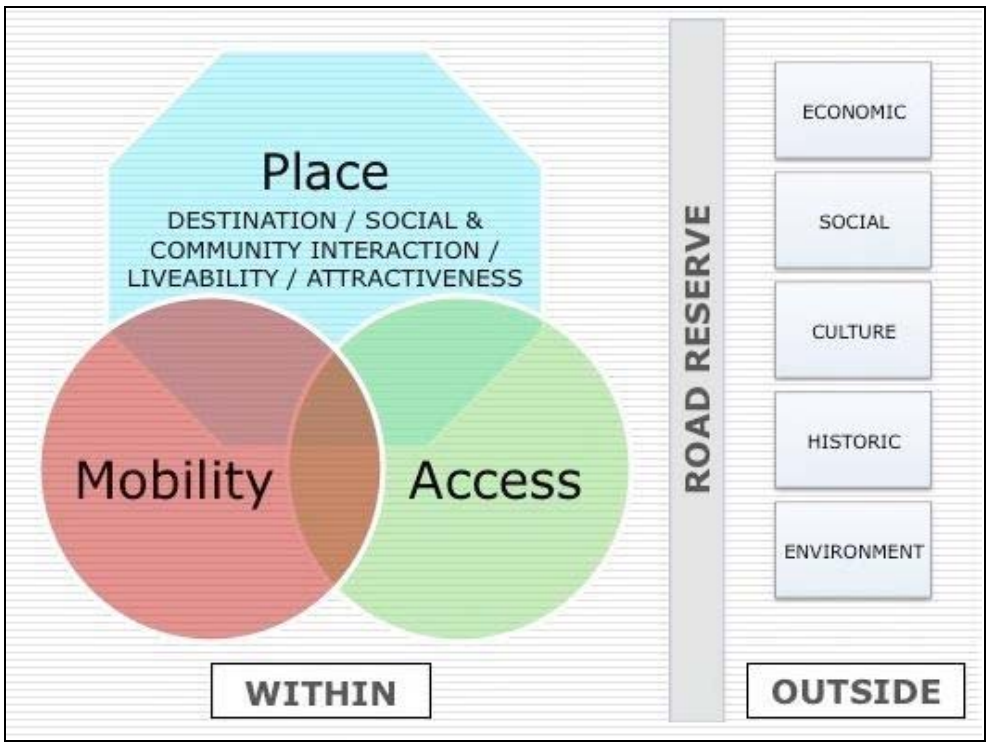

Figure 1 Introduction of Place function within urban road space

As depicted in Figure 1, an additional third 'Place' function is introduced for shared spaces within the public road corridor along with the two more conventional functions of 'Mobility' and 'Access'. The diagram also recognises supplementary functions towards the surrounding area and landuse activities outside the road reserve such as economic, social, cultural, historic and environmental amenity. Considering in the planning and design phases all these functions holistically distinguishes one street from others by its unique features, and highlights the street as the most basic unit of a neighbourhood or community.

Clearly, this three-function system cannot be applied to all streets in an urban area, due to the fact that transforming a typical street to a destination or a place requires active roadside frontage in sympathy with its context of adjacent land uses (via the supplementary functions for the area outside the road reserve). This design approach encourages a wider range of pedestrian and community activities, and thereby allows users to spend more time within the road space.

Approach to Reduce Vehicle Dominance

When occupying a space within a standard flexible or rigid carriageway, it is effortless for a driver in a vehicle to feel authoritative, or dominant over other space users, such as pedestrians or cyclists. This commentary is as well applied to a street that has been treated with speed and traffic management techniques such as Local Area Traffic Management (LATM) measures to calm down the traffic.

The underlying assumption for road and street design where the priority is functionally designed for motor vehicles is that motorists are accustomed to being dominant in the road space and therefore pay less attention to other road users. This is principally because conventional traffic engineering approaches have in some areas focused too much on the planning and designing of the road space for motor vehicles at the expense of other users.

As discussed previously, the goal of a shared space is to integrate a wider range of human activities in a quality 'place' where users can interact, even between driver and pedestrian. Accordingly, where there are various competing needs (especially in urban public realms where access and living / recreational / retail activities of non vehicle users are more important than through traffic functions), these priorities and design aspects should change to an environment where the vehicles are perceived and designed to be a guest in the environment.

When there are street pedestrian activities, the speed disparity between motor vehicles and other low speed 'living, working and eating' space users is one of the most important factors in determining the success and safety of a shared space. On the other hand, when there is little activity, a vehicle is still expected to behave cautiously, perhaps with higher speeds, but in anticipation of other vulnerable users. It is worth highlighting that unlike LATM, which uses horizontal / vertical physical devices to slow vehicles down, shared spaces should emphasise a level, unique, attractive and complex environment that introduces uncertainty in priority for motorists thereby reducing the dominance of motor vehicles within the space.

In this way, a shared space is a self-regulating and self-explaining street that reinforces the behavioural response of low speed and caution for all road users.

Road Design for Better Space Sharing

So far it is established that a shared space is a road corridor in a built-up environment that is designed to create a public space predominantly for pedestrian activity, and to deliberately by design reduce the dominance of vehicles.

To achieve these objectives, the design aspect of the shared space involves the minimisation, or frequently the absence of, the use of traffic regulations and control devices such as signage, road marking and demarcation. The lateral cross-section is designed to be relatively flat without an obvious vertical elevation difference (i.e. kerb) to separate the carriageway from the footpath. It is important to carefully consider the placement of street furniture for planting and outdoor activity such as dining and seating.

According to the Land Transport (Road User) Rule, a shared space is declared a Shared Zone, which means a length of roadway intended to be used by pedestrians and vehicles. The interaction between pedestrians and vehicles in an equitable manner is outlined as follows:

- 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.
- A pedestrian in a shared zone must not unduly impede the passage of any vehicle in the shared zone.

Slightly different to the above definition, the New Zealand Transport Agency's Pedestrian Design and Planning Guide (NZTA, 2009) describes a shared zone as a residential or retail street that has been designed to give priority to residents and pedestrians while significantly reducing the dominance of motorised vehicles.

A significant physical difference for shared spaces in comparison to the standard road and street design guidelines and principles is the re-introduction of a level surface, which is often recognised as a 'status quo' condition of a street before the invention of motored vehicles. Without the vertical elevation difference between the footpath and carriageway by the removal of kerbs, a level surface immediately highlights the need for the space to be 'shared' among all users. Another important design aspect is the minimisation of regulatory signs and marking, which are employed to traditionally define priority and behaviour of the space users as well as legal accountability from an enforcement perspective in urban areas.

Depicted in Figure 2 below, the space within the road reserve of shared spaces in the Auckland CBD projects has been deliberately designated into two major zones; Shared Zones and Accessible Routes. The Shared Zone is provided for all types of users and activities whereas the Accessible Route of minimum 1.8m in width on both sides of the street is provided for more vulnerable users, particularly visually impaired pedestrians. It is proposed to demarcate the two zones by a 300mm wide tactile delineator band in order to warn the visually impaired about the possibility of moving vehicles outside the Accessible Route.

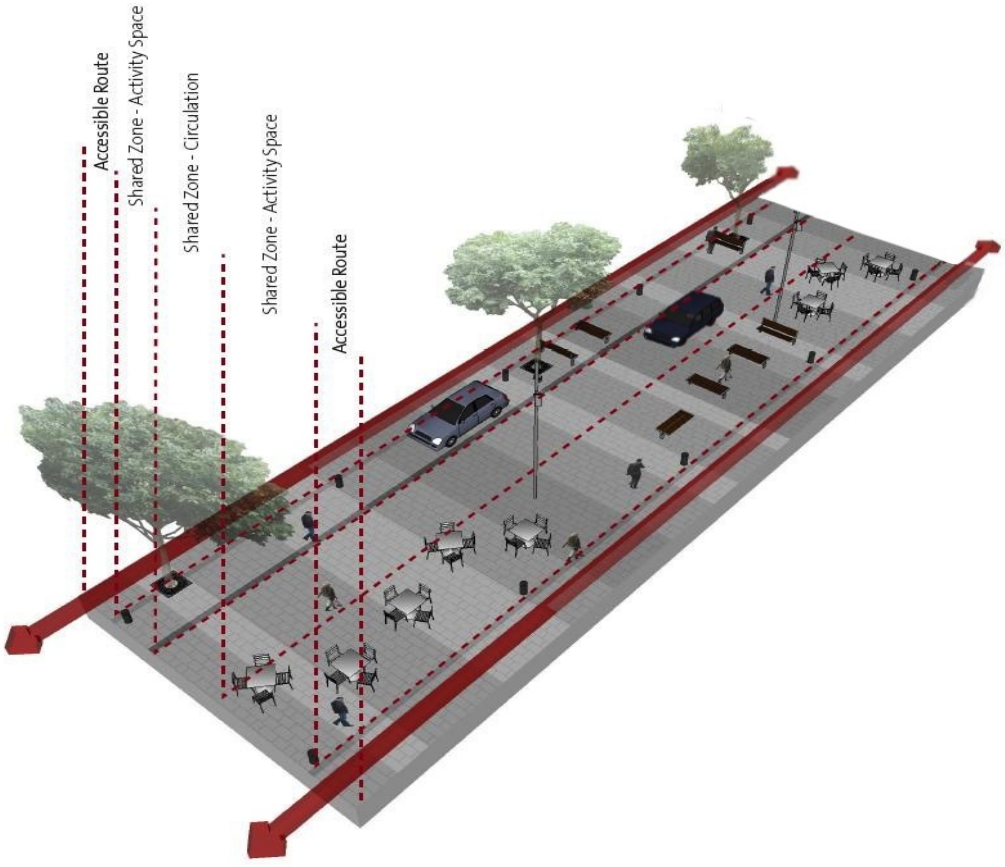

Figure 2 Spatial allocation of shared spaces in Auckland CBD

This design demonstrates the shift of user segregation from the conventional split of pedestrians (using footpath) and vehicles (travelling on carriageway) to a separation of those who are reluctant to share the space with motor vehicles such as the blind, the visually and mobility impaired, the elderly and young children (using the Accessible Route) and other space users, including drivers in motor vehicles.

PERFORMANCE EVALUATION RESEARCH STUDY

Auckland Council (previously Auckland City Council) has recently embraced the Shared Space concept by drawing on urban design experience and knowledge from Europe, particularly the United Kingdom. With support from Auckland Transport, the Council controlled organisation, this doctoral research study set out to investigate the performance and perception of shared spaces in New Zealand by developing a methodological framework that can be used to evaluate the effectiveness of shared space.

Research Objectives and Motivation

A review of the literature, relevant studies and publications reveals that little has been undertaken to thoroughly monitor and measure the effectiveness of shared spaces, especially the comparison between 'before and after' implementation data. This research on the performance evaluation of shared space schemes using both quantitative and qualitative research methodologies addresses this knowledge gap.

The goal of the research is to provide research-based evidence of how a shared space performs and to develop design guidelines and a performance evaluation framework. Subsequently the research objectives can be outlined as follows:

- To compile and review national and international literature in relation to shared spaces, including design and planning for built environments, road design, safety and traffic engineering;
- To identify relevant Key Performance Indicators (KPIs);
- To develop the methodology to quantitatively and qualitatively collect data and evaluate shared spaces;
- To collect relevant quantitative traffic, landuse and user data (e.g. vehicular traffic counts, speeds, pedestrian, cyclist flows, commercial and social activity, utilisation etc) for pre and post implementation analysis;
- To analyse and compare selected pre and post implementation data to determine the impacts of the scheme in different land use environments.

The motivation for the research is to develop an evaluation framework to enable the measurement of social, economic and engineering factors that determine where shared spaces are effective and where they are not.

Research Scope and Methodology

This study has initially focused on the data collection and evaluation of the shared space projects in Auckland City with an expectation to expand the scope to cover the entire Auckland region given that the previous Auckland City Council has been amalgamated with other local and regional councils to form a single Auckland Council for the region. The current scope consists of the following case studies in the Auckland City CBD area:

a. Elliott Street (between Victoria Street West and Wellesley Street West)
b. Lorne Street (between Wellesley Street East and Rutland Street)
c. Fort Street (Stage 1 between Queen Street and Commerce Street)

The Rugby World Cup 2011 international event is considered a catalyst for the above projects as part of a wider CBD transformation exercise. The outcome of this research will assist the Council in using a methodological framework to evaluate the needs and benefits of other planned shared space projects after the Rugby World Cup.

A data collection strategy for both the 'before' and 'after' periods was developed that uses network cameras to observe the fluctuation of user demand and their interaction with the space based on various time periods of the day, week and weather conditions. This will provide a quantitative performance measure of the activities involving pedestrian, cyclist and motor vehicles. Furthermore, it is proposed to implement a web-based perception survey to provide a qualitative measure of shared space performance.

Shared Space Objectives and Performance Indicators

As discussed earlier, the performance of a shared space can be determined based on how successful the public space performs its functions of Place, Mobility and Access. In general accordance with what was suggested in a report prepared for the UK Department for Transport (Reid et al, 2009), the following key objectives of shared space are established along with relevant performance indicators.

1. Placemaking – the street should provide better use of public space via a lively quality of the environment that attracts users to spend time within the space. It is also reflected in a wider range of street activities. The performance indicators include time spent in the area or user dwell time (which is a possible measure to indicate that the zone is an origin/destination rather than a through route), use of facilities provided, type of activity occurring (e.g. eating, chatting etc) and user perceptions.
2. Pedestrian Focus – this objective involves an environment with improving pedestrian priority and the ability to walk along and across as well as freely roam the street. The performance indicators include pedestrian flows, number and density of pedestrians, safety and user perceptions.
3. Economic Impetus – a road space that complements the operation and prosperity of the surrounding businesses. The performance indicators include property and leasing values, retail occupancy rates and user perceptions.
4. Vehicle Behaviour Change – a goal is to reduce the current dominance of the motor vehicle and the driver in the environment. This change of priority should enable the measurement of the vehicle driver feeling more like a guest within the environment. The performance indicators include traffic volume and speed reductions, travel time increase through the zone and observed sharing behaviour. The traffic data on the surrounding road network will also be measured to determine the impact of a shared space on the surrounding environment as it cannot be taken in isolation.
5. Safety for All Users – shared spaces are to provide a safer environment for all users, including cyclists, the elderly and children. The performance indicators include crash history, injury severity and costs, user demography and perceptions.

The perception of the uses of the shared space is a common performance indicator for all of the aforementioned objectives as the perceived value of such space is a direct indication of how well the space is serving the users. This measure reflects how successful it is in accomplishing each objective.

Data Acquisition using Video Survey

A number of network cameras have been used to continuously record the 'before' data period of pedestrian and vehicle activity for a two-week period for the three sites as follows:

a. Elliott Street area between 20 September and 4 October 2010;
b. Lorne Street area between 17 November and 1 December 2010;
c. Fort Street area between 25 August and 8 September 2010.

The 'after' period data will be collected after the re-construction of the streets to shared spaces has been completed in June 2011 at the relatively same time periods as for the 2010 'before' data. As this 'after' period will be during the Rugby World Cup (RWC) event with significant increases in expected visitors to Auckland, a second 'after' period survey will be undertaken in 2012 to determine more 'normal' changes in behaviour outside the effects of a major event. A 'controlled street' site with no change throughout the before and after periods will also be observed to measure any differences in effects of the RWC event.

It is imperative to ensure that the placement and setup of the cameras result in the movements and interaction of space users being appropriately captured. As illustrated in Figure 3 using the Elliott street area site for example, four cameras were placed on the fire escape outside the Smith & Caughey's building. All cameras were connected to a central box, which contains a network switch and a 12-volt power hub. The data being recorded is transferred to a computer with a minimum of 1TB hard disk stored in a secure and dry place i.e. inside the building. To minimise the risk of electric failure from outdoor weather, a power adaptor is utilised to convert power supply from standard 230V to 12V for the outside cables.

Additionally, during the time of the camera recording, a traffic count survey using tube counters was implemented on Elliott and Darby Streets to obtain the vehicular based traffic speed, volume and composition data.

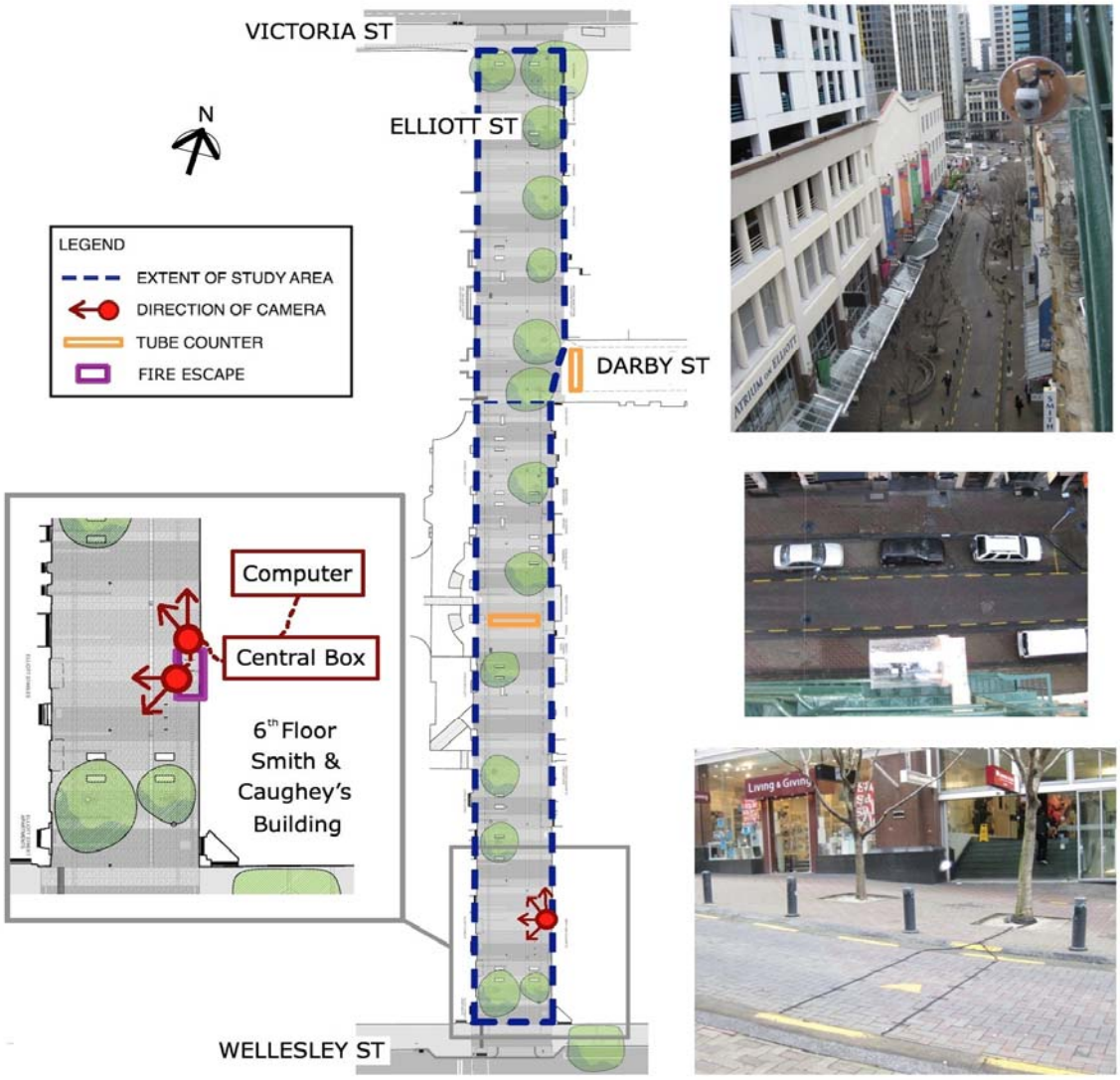

Figure 3 Data collection of Elliott Street area

Other Performance Evaluation Data Collection

In addition to the main method of quantitative data collection using the video survey, a web-based perception survey is being developed to qualitatively measure the ability of the road space configuration to serve the users with respect to the five objectives of shared space.

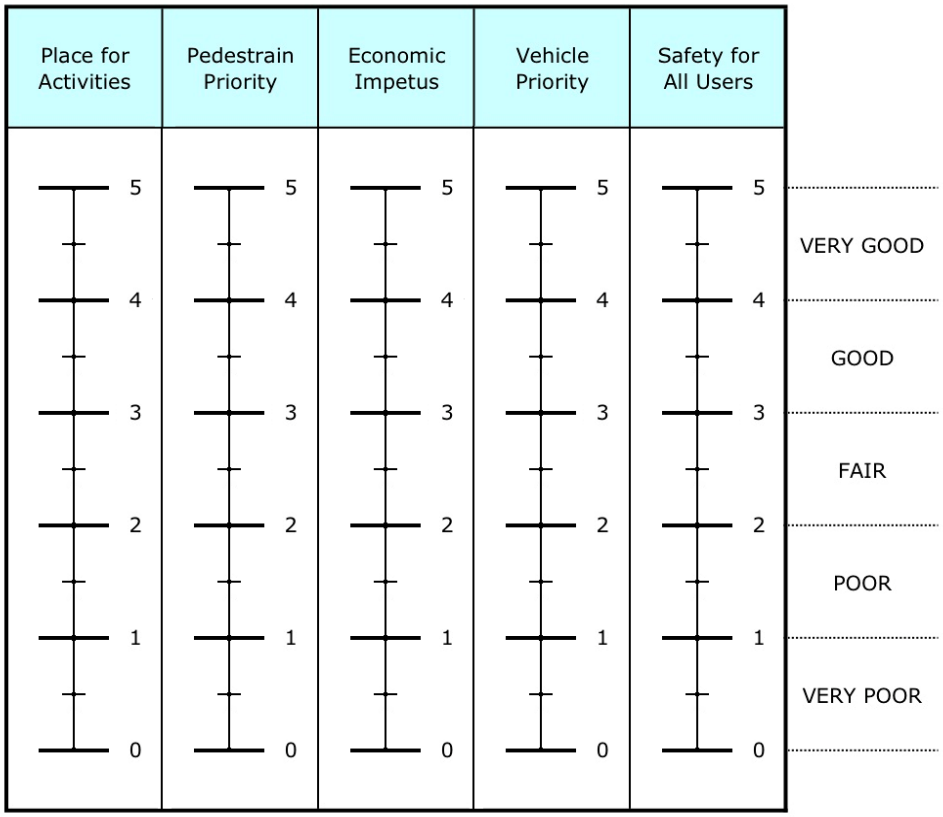

Figure 4 Proposed perception rating scales

It is proposed to utilise in the web-based survey a continuous scale of 0-5, representing very poor, poor, fair, good and very good respectively to capture the perception of shared space users toward the five variables that reflect the five objectives of shared spaces, including place for activities, pedestrian priority, economic impetus, vehicle priority and safety for all users. A similar 0-5 rating scale has been used for other purposes in measuring serviceability or ride quality of road sections (Karndacharuk, 2004). Figure 4 above shows a preliminary version of the perception rating scales. This survey will be filled in by a randomly selected group to represent the general public after they have viewed a common video of the street environment in the 'before' and 'after' shared space street configurations.

Furthermore, with the five identified objectives of shared spaces and respective performance indicators, it is proposed to capture economic data (e.g. property value per floor area) of the neighbouring businesses and properties, crash history using NZTA's Crash Analysis System (CAS) and safety incidents based on Council's database.

Additional to the network cameras and traffic tube counts, which only collect the traffic data within the space, it is planned to utilise traffic volume data from SCATS (Sydney Coordinated Adaptive Traffic System) to monitor any changes to the traffic volumes in the local road network at surrounding intersections.

QUANTITATIVE ANALYSIS OF BEFORE DATA

This section first considers the existing street and neighbouring environments of all study areas in order to better understand how each street is currently being used, and to acknowledge the spatial and physical characteristics as well as the surrounding landuse. In this paper, the Elliott Street study area has been selected to demonstrate how the quantitative analysis is being conducted using the 'before' data from the video surveys and traffic tube counts. Finally, a comparison of the pre-implementation data of the three case studies is shown and discussed.

Street Characteristics

All of the three sites are located in the Queen Street Valley Precinct designated under the Operative District Plan (AkCC, 2005). The precinct consists of the most intensive retail activities and a significant portion of commercial offices, thereby having the highest level of pedestrian activity within the Auckland region. The diversity of architectural character of the buildings (e.g. ages, style, levels of detail and height), and the streetscape contribute to a sense of "place". The street characteristics of each study area, exclusively within the road reserve, can be summarised in Table 1 below.

Table 1 Street characteristic summary for the three study areas

Study Area		Street Characteristic								
Street	Sub-section	Classification	Corridor		Vehicular Traffic			Pedestrian Traffic	
			Width (m)	Length (m)	Traffic Operation	Carriageway Width (m)	On-Street Parking	Footpath Width (m)	Extra Ped Facility
Elliott	Elliott St Nth	Local Rd	14.2	60	One-way NB	10	Vehicle	2.4	-
	Elliott St Sth	Local Rd	14.2	130	One-way NB	4-8	Vehicle	3.6	Verandah, seating & waiting area
Lorne	Lorne St	Local Rd	17.6	100	One-way NB	7-11	Veh & motorbike	3	Verandah & waiting area
Fort	Jean Batten Pl	Collector Rd	12.4	40	One-way NB	4	Prevented	4	-
	Fort St	Collector Rd	20	90	Two-way	12	Veh, taxi & police	4	Verandah
	Fort Lane	Local Rd	6	100	One-way NB	6	Veh & motorbike	-	-

Elliott and Fort Street areas are further divided into sub-sections in order to recognise their unique existing provisions for vehicular and pedestrian traffic. The street classification is based on the current road classification hierarchy under the Central Area District Plan.

It is observed that the inner city streets of Jean Batten Place and Fort Lane have more narrow road reserve widths than the standard guidelines in the District Plan in accordance with its classification i.e. minimum of 17m and 14m for Collector and Local roads respectively. With the 6m-corridor width on the Fort Lane section, pedestrians currently share the space with other users such as cars and service trucks. Unlike other spaces, the Jean Batten Place section does not accommodate on-street parking, which is evident by the presence of broken yellow lines or the no stopping at all times restriction.

Additionally, all road sections, except Fort Street have a one-way traffic operation, which was historically introduced to primarily accommodate the Mobility function of vehicular traffic in these areas. Although the one-way arrangement could be seen to significantly contribute to the vehicle dominance within the (road) space, there is another key contributing factor that is the use of the private land abutting the street and how it actively interacts with the public space. This is further explored in the following section.

Adjacent Landuse with Active Frontage

Table 2 gives a summary of the adjacent landuse activities along with the frontage measurement for both day and night time periods. Active frontages / edges can be defined in a number of ways. In this research it is defined as a distance along a property 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. There must be at least one pedestrian access off the street for each property.

Table 2 Adjacent landuse and frontage summary for the three study areas

Study Area		Adjacent Landuse				
Street	Sub-section	Overall Frontage (m)	Daytime (6am-6pm)		Nighttime	
			Active Edge (m)	Activity	Active Edge (m)	Activity
Elliott	Elliott St Nth	125	30 (24%)	Retail, takeaway & pulbic parking	5 (4%)	Takeaway & public parking
	Elliott St Sth	245	220 (90%)	Retail, café, restaurant, takeaway & hotel	55 (22%)	Café, restaurant, hotel & bar
Lorne	Lorne St	180	80 (44%)	Library, café, restaurant & unused theatre	10 (6%)	Restaurant & bar
Fort	Jean Batten Pl	80	40 (50%)	Retail	0 (0%)	-
	Fort St	165	135 (82%)	Retail, café, takeaway, convenience store, backpacker & police	50 (30%)	Takeaway, convenience store, backpacker
	Fort Lane	200	15 (8%)	Retail, café, restaurant & public parking	25 (13%)	Restaurant & bar

Only sections of Elliot Street South and Fort Street have active frontage greater than 80% of the overall frontage length, reflecting the diversity of adjacent landuse activities on the streets in comparison to the others. Furthermore, the active frontage of the Fort Lane section at night is larger than that of the daytime, which is because of the bar and night club activities.

The relationship between the active frontage of the adjacent landuse and the pedestrian and vehicular data is further discussed in the following sections.

Pedestrian and Vehicle Data Analysis

The 'before' video survey data of pedestrian activity was examined for every 15-minute interval over a 24-hour period. The pedestrian data is classified into two different groups; one is Pedestrian Movement (PM) and the other Pedestrian Occupancy (PO). The PM group represents the pedestrians who walk along and across the space for transport movement functions (i.e. Mobility and Access) whereas the PO group includes people who spend time within the shared space, and generally use the space for the 'Place' function. A review of a 10-second period immediately before and after the 15-minute snapshot is required to clearly differentiate the two groups.

Using the Elliott Street case study as an example of the data analysis process, Figure 5 below illustrates the results of the pedestrian and vehicle data analysis for a typical day on 27 September 2010 in good weather conditions. The pedestrian density is a ratio of the pedestrian numbers (p) relative to the area (m^2) allocated for pedestrians (e.g. footpath, seating and waiting area). Subsequent analysis will look into the pedestrian density taken into account the whole road space of the shared spaces.

Unlike the pedestrian volume, which is a 'snapshot' of the number of pedestrians at a particular time in every 15-minute period, the volume of vehicles shown at the bottom of Figure 5 is the accumulated number of vehicles within a 15-minute period. Also, the 85th percentile vehicle speed is employed to represent a speed at which the majority of vehicular traffic is travelling through the road space.

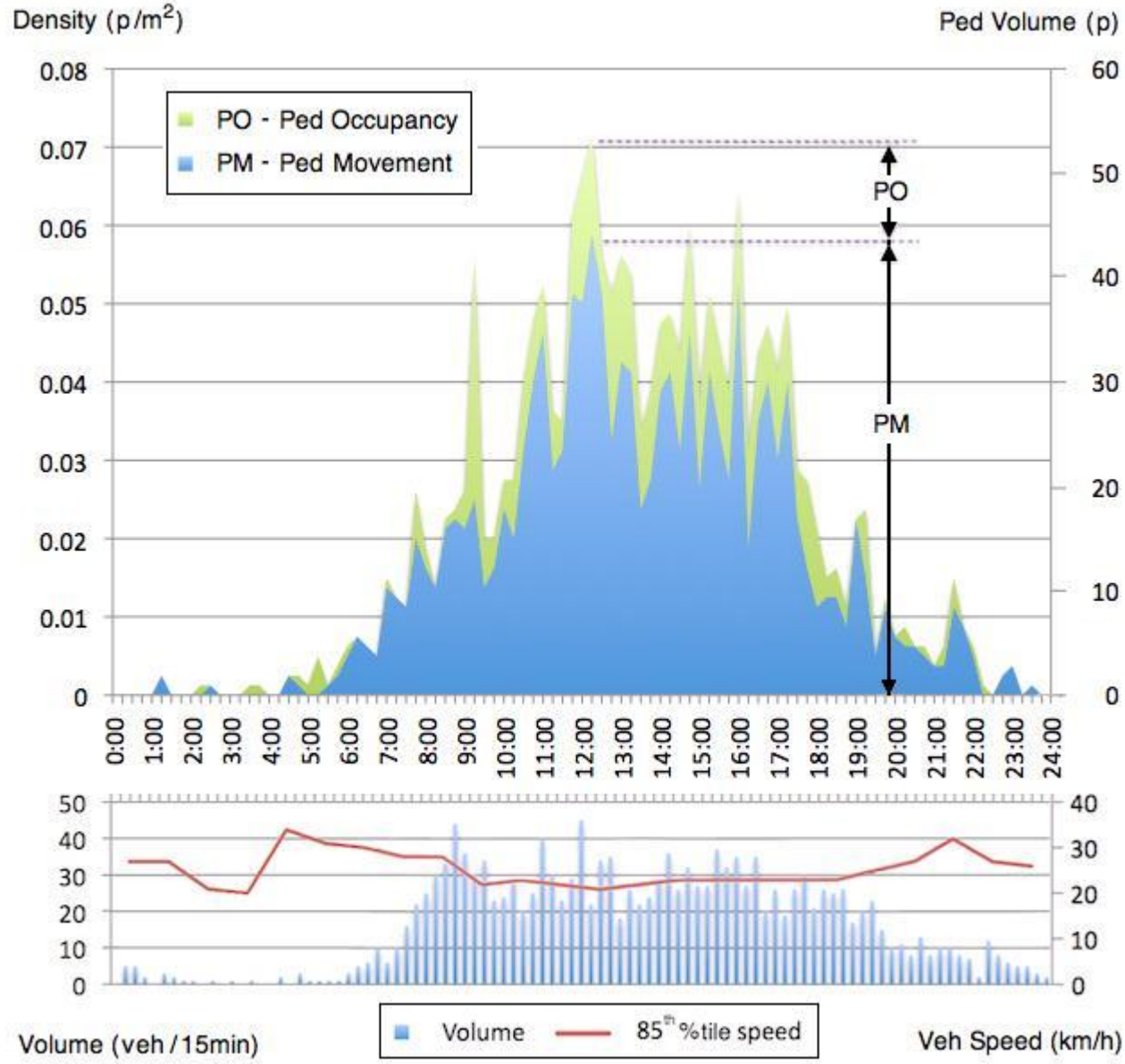

Figure 5 Result of 'before' data analysis for Elliott Street area

The pedestrian traffic volume and the corresponding density peaked at 12.15pm, which reflects the high demand of the space for transport functions during the typical business lunchtime period. However, it was 9.15am when the Occupancy portion outweighed the amount of pedestrian using the space for Movement functions (at a split of 56/44 for PO and PM respectively). It is observed from the video footage that the seating and waiting areas are well utilised for social street activities during these peak hour periods.

The overall percentage of Occupancy pedestrian traffic out of the 24-hour total was 22%, which is indicated by the green area of Occupancy in the upper graph. It is anticipated that with the implementation of the Shared Space concept to enhance the 'Place' amenity, the Occupancy proportion will increase significantly, especially during the day.

For the vehicular traffic, the 15-minute one-way northbound traffic volume (based on the tube counters) was similar to the pedestrian profile, reaching a highest peak at lunchtime with a similar morning peak at 8.45am. The five-day average daily one-way traffic was 1,800 vehicles per day with a peak of 150 vehicles per hour. This is reasonably typical for a local one-way street in a built-up CBD area; even though based on the surrounding landuse

catchment the majority of the vehicular traffic currently uses the street as a thoroughfare rather than to access the adjacent landuse (which is the primary function of a local road).

It is interesting to note that the current 85th percentile speed over the 24-hour period is 26 km/h given that it is a relatively short, one-way street with a posted speed limit of 50 km/h. It also has a relatively low traffic volume, and the majority of the street has no stopping at all time restrictions. Additionally, the peaked pedestrian density of 0.07 p/m^2 (or pedestrian space of 14.3 m^2/p at LOS A) is very low based on the theoretical capacity in accordance with Highway Capacity Manual's pedestrian Level of Service assessment (TRB, 2000).

Without any vertical speed calming devices such as speed humps, the vehicular travelling speeds are naturally suppressed by the existing use of unique paving surfaces as well as the diverse adjacent landuse activities with active frontages. The very good level of active edges on the Elliott Street South section during daytime periods generates frequent demand for crossing movements for pedestrians, and in turn evidently reduces vehicle speeds.

Before Pedestrian Data Comparison

Figure 6 below depicts the early 'before' data comparison for the three case study streets during the daytime period between 6am and 6pm in normalised density. The normalised density is a number of pedestrians averaged over the 15-min snapshots before and after a particular time per square metre of allocated pedestrian area within the road reserve. The average normalised density for Elliott, Lorne and Fort Street areas are 0.039, 0.023 and 0.020 p/m^2 respectively.

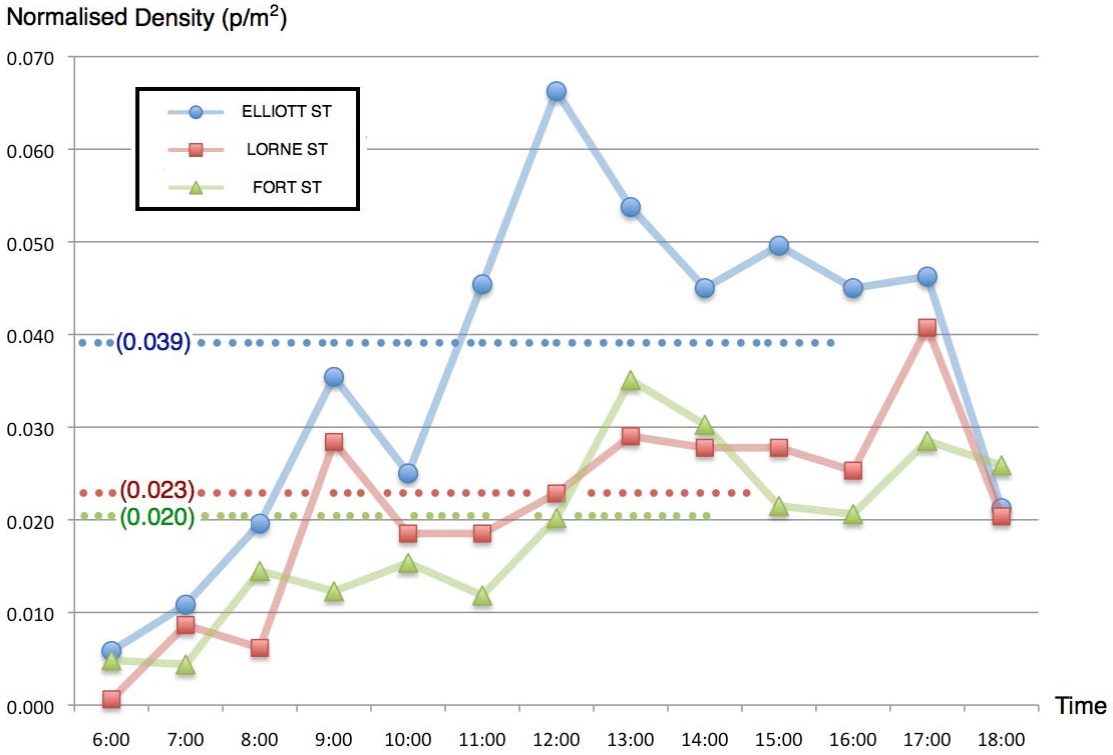

Figure 6 Preliminary comparison of pre-implementation pedestrian data

As discussed earlier for the density profile and the adjacent landuse, the Elliott Street area has a much stronger and active frontage with an average of 68% in comparison to Lorne Street and Fort Street of 44% and 43% respectively. The 68% average for the Elliott Street is calculated by dividing the total active edge (30m+220m) with the total frontage (125m+245m) as per the data shown in Table 2.

Based on the pedestrian data comparison to date, the level of active landuse frontages has, as would be expected for a vitalised CBD area, a high correlation with the amount of pedestrians within the street corridor.

CONCLUSION AND NEXT STEPS

The understanding of Shared Space in the New Zealand context is at an early stage in the adoption of international experience for the current schemes in Auckland City. A shared space is legally defined and sign posted as a Shared Zone.

This doctoral research study at the University of Auckland sets out to investigate the performance of shared spaces by establishing the performance measures / indicators and experimental methodology to adequately evaluate their performance. The acquisition of pre-implementation quantitative data is complete for the three locations of Elliott, Lorne and Fort Street areas in the CBD.

The quantitative 'before' data analysis has established a procedure to measure the performance of shared spaces by inspecting the pedestrian and vehicular activity. Based on the data analysis of the Elliott Street case study, the 'Place' amenity of a street can be quantified by looking at the number of pedestrians occupying the space in comparison to moving thought the road space. The data comparison of the three case studies reveals a strong relationship between the amount of pedestrians using the street and the extent of active frontage of the surrounding landuse.

Further research tasks involve implementing web-based perception surveys based on videos undertaken before and after implementation. A correlation will be investigated between quantitative values (e.g. volume and density of users, crash and economic data) and qualitative perception values. Moreover, a comparison between pre and post construction data is anticipated to provide a methodological framework to evaluate the performance of such schemes that allocates the majority of urban road space for an additional 'Place' function in favour of non-motorists.

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