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Shared Space Evaluation: O'Connell Street, Auckland

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Abstract

This paper presents an analysis of O'Connell Street after its transformation to a shared pedestrian and vehicle street in 2014. Both quantitative and qualitative performance measures were collected and analysed in general accordance with a multifaceted evaluation framework developed in a collaborative research study of the University of Auckland and Auckland Transport. Quantitatively, vehicle speed (and volume) data were obtained from automatic tube counts in order to observe their changing characteristics over a 24-hour period. Qualitatively, on-street surveys of pedestrian perception were undertaken to measure how well the street performed against the five assessment criteria of Placemaking, Pedestrian focus, Vehicle behaviour change, Economic impetus and Safety for all users.

While the results from the qualitative analysis of the five performance measures confirmed that the 'after' shared space environment performed positively and better than the 'before' scenario, this study identified a need to address increased vehicle speeds, and to improve user perception towards driver behaviour to successfully operate shared spaces.

1. Introduction

1.1 Background

There has been a surge in practice and literature of the use of the term 'Shared Space' and its applications in the past decade. This has been predominantly influenced by the work of a European Shared Space project and the UK's Department for Transport studies (Karndacharuk, Wilson & Dunn, 2013b). However, the concept of road user integration that forms an integrated part of the shared space principles is not new, with the broad philosophical perspective tracing back to the introduction of 'environmental areas' in the Traffic in Towns (Ministry of Transport, 1963) and residential shared streets in the Netherlands (Woonerf) in the late 1960s (Hass-Klau, 1990). In a comprehensive review of the origin and evolution of shared space concepts (Karndacharuk, Wilson & Dunn, 2014a), shared streets can be distinguished from calmed streets such as living streets (Bain, Gray & Rodgers, 2012), self-explaining roads (Mackie et al, 2013) and complete streets (Kingsbury, Lowry & Dixon, 2011) based on the segregation between vehicles and pedestrians.

A shared space has been defined in this study as *"a public local street or intersection that is intended and designed to be used by pedestrians and vehicles in a consistently low-speed environment with no obvious physical segregation between various road users in order to create a sense of place, and facilitate multi-functions"* (Karndacharuk, Wilson & Dunn, 2014a, p.215). In New Zealand, a shared space is legally recognised as a Shared Zone under the Land Transport (Road User Rule), which is defined as *"a length of roadway intended to be used by pedestrians and vehicles"*. The interaction between different users is controlled 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.

A number of streets in Auckland's Central Business District (CBD) have been operating as shared zones since 2011, including those in Elliot, Lorne and Fort Street areas. In a 2013 collaborative study between the University of Auckland and Auckland Transport, O'Connell Street, which was then a conventional street, was employed as a control site to provide a baseline for comparison of qualitative results (Karndacharuk, 2014). The street was converted to a shared space in 2014 (Auckland Council, 2015).

1.2 Objective and scope

The main objective of this paper is to assess the performance of O'Connell Street after its shared zone transformation by undertaking a 'before and after' analysis. The impact of the improvements has been measured based on a multi-faceted evaluation criteria with a focus on the qualitative aspects of the evaluation framework. To this end, this paper will:

- Cover the key changes in O'Connell Street in its transformation to a shared zone;
- Examine the shared space evaluation criteria, and detail a survey methodology employed; and
- Present and discuss the survey results.

O'Connell Street is a one-way, northbound street, located between Shortland Street to the north and Freyberg Place and Chancery Street to the south, in the Auckland CBD.

2. O'Connell St shared zone transformation

Conventional O'Connell Street previously incorporated a single lane of a 3m wide carriageway with parking bays and 1.2m-2m wide footpaths on either side, along with speed humps and a pedestrian crossing at its intersection with Vulcan Lane (pedestrian street). In keeping with Auckland Transport's design principles for Shared Zones (Karndacharuk, 2013), key design changes undertaken as part of the conversion to a shared street included:

- Removal of kerbs and vertical deflection devices, and provision of a level surface of similar paving materials and colours across the entire road reserve.
- Provision of street furniture including benches, trees and allowance for outdoor dining. This was implemented not only to reduce vehicular dominance and act as passive traffic calming, but also to informally define various zones (e.g. for through traffic and short-term parking).
- Signage and access design at the entry and exit points to the zone in order to signify a change to and from the conventional roads on the either side, thus requiring pedestrians and motorists to share the space.
- Minimum use of other traffic control devices (e.g. road marking) within the zone.
- Provision of a 1.8m wide safe zone on either side. The safe zone free of vehicles is delineated by a 600mm wide tactile delineator strip, primarily for the visually impaired.

The environments of O'Connell St before and after the transformation are shown in Figure 1.

Similar to other shared zones in the CBD, O'Connell Street is generally linear in design where street furniture, drainage channels and tactile delineator strips define the edge of the vehicular trafficable area.

3. Shared space evaluation framework

The methodological framework for this study was developed to evaluate the performance of the multiple aspects of public shared streets (Karndacharuk, Wilson & Dunn, 2013a). Acknowledging the context-sensitive nature and self-explanatory design, the overall

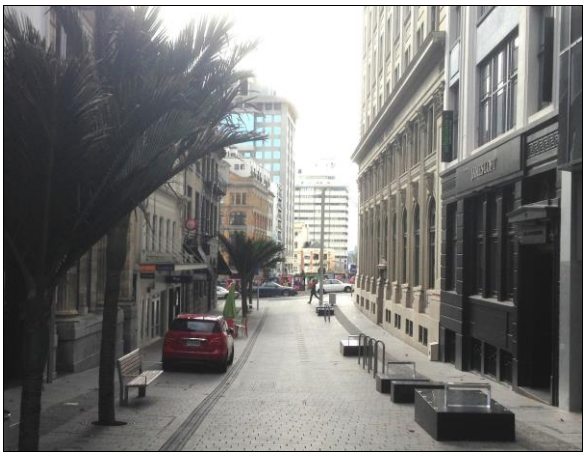
performance criteria (variables) chosen were based on the following five objectives of a shared space in terms of how successful the public space performs its functions of place, mobility and access (Karndacharuk, Wilson & Tse, 2011).

- **Placemaking**: the quality of the street environment and its attractiveness to pedestrians to spend time within the space
- **Pedestrian Focus**: an environment with improved pedestrian priority to enable pedestrians to freely roam the street
- **Vehicle Behaviour Change**: street design to reduce the dominance and priority of the motor vehicle and driver within the space
- **Economic Impetus**: a street space that complements surrounding land uses, particularly economic activities in an activity centre
- **Safety for All Road Users**: a safer environment for all users, including the elderly, the disabled and children.

Figure 1 Before and after street environments

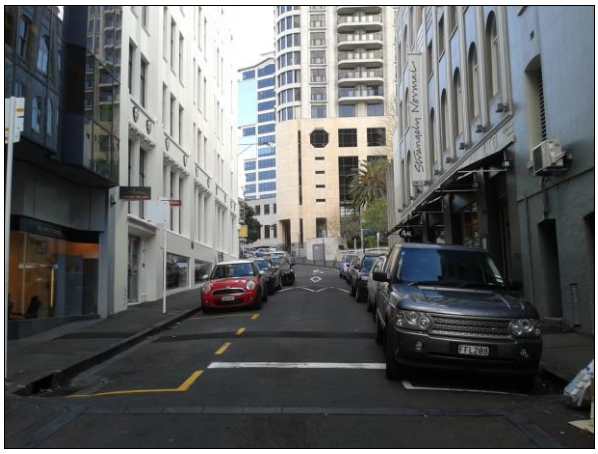
Before

After



(a) Looking north towards Shortland Street

Before



After

(b) Looking south towards Courthouse Lane

In addition to considering quantitative performance measures such as speed and volume data, the framework incorporates a qualitative evaluation of user perceptions. The primary method of collecting the qualitative data was an on-street perception survey, including a

questionnaire of the five performance measures. The perception of the road users towards the shared space objectives is a direct indicator of how well the space is servicing end users. Conversely, the measurement of these subjective values reveals from a road users perspective how successful the street space is in accomplishing each objective.

4. Study methodology of on-street perception survey

4.1 Questionnaire and rating scale

The perception survey was developed with a goal to measure the degree to which a shared street meets the five established objectives. In accordance with the previous work, the questionnaire was carefully developed to capture the perceptions of road users towards the study area, together with variables that were expected to influence the user perceptions.[1]

As shown in Figure 2, the following five statements were developed to measure the road users' opinions towards the five performance criteria. To minimise the halo effect where the respondent's overall impression of an object being evaluated (i.e. a shared street) influences a particular attribute of the object (Hutchinson, 1964), the survey questions and statements were designed with an aim for accuracy and exactness in definitions.

Place:	*I like spending time in this street*
Pedestrian:	*I can freely move around on the street*
Vehicle:	*Driver behaviour is appropriate in this street*
Economic:	*This street complements the economic activity*
Safety:	*I feel safe and secure in this street*

The survey design of the performance questions incorporated a 6-point Likert rating scale, ranging from 'Strongly Disagree' at the value of '-3' to 'Strongly Agree' at the value of '3'. As suggested by Bradburn, Sudman & Wansink (2004), each response point along the continuum was defined with a clear and accurate label to minimise incongruous and unreliable responses. A mid-point to express a neutral position was intentionally excluded in order for the participants to be more thoughtful about their opinions on each declarative statement while enabling a choice, either positively or negatively, to be made. It is, nevertheless, acknowledged that without a mid-point on the Likert scale an inherent bias is introduced due to the fact that the participants may genuinely be indifferent to the survey questions and were forced to decide towards a slightly 'negative' or slightly 'positive' response.

Moreover, the participants were asked to indicate, out of the five criteria, the most and the least important aspects. Two additional open-ended questions were included to investigate their perceived area for further improvement as well as any positive aspects of the street environment. Finally, the demographic and personal questions (including frequency of visit, age range, gender and ethnicity) were placed at the end of the survey questionnaire to enable a stronger focus on the main survey questions because the respondents tend to be more attentive at the start of a survey.

4.2 Data collection process

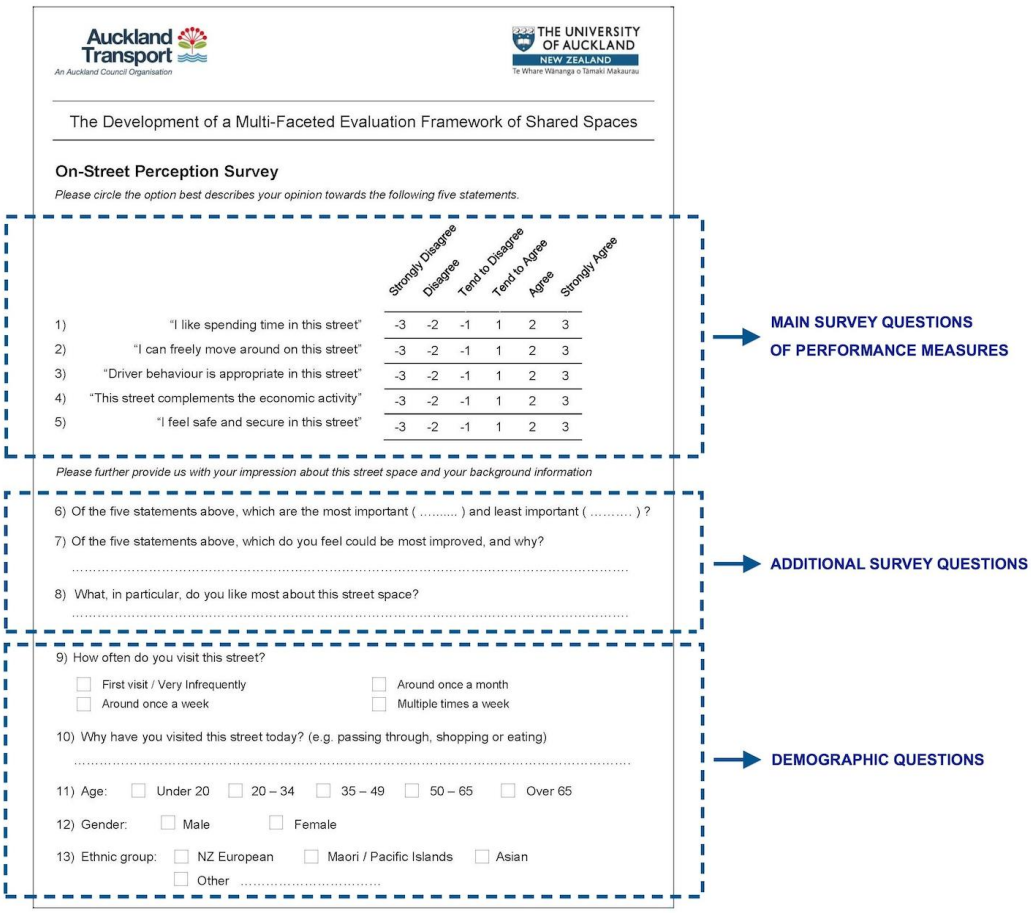
For general consistency with previous research (Karndacharuk, Wilson & Dunn, 2014b) and to better understand any temporal variations in space use and performance, the on-street

[1] Given that the research involved human participants, the design of the on-street survey and expert interview process was reviewed and approved by the University of Auckland Human Participants Ethics Committee. A Participant Information Sheet, incorporated in the ethics approval, provided the participants with the information on research purposes, survey procedures, intended use of the results, the confidentiality and anonymity of the responses and researchers' contact details.

perception surveys were conducted on Tuesday, Thursday and Saturday for weekday and weekend samples, and during peak activity periods of 7-9am, 11am-2pm and 4-6pm.

A total of 227 survey responses were collected in May 2015 and used for analysis for the 'after' scenario. For the 'before' scenario, 40 responses were collected in August 2013 as part of the pervious study (Karndacharuk, 2014).

Figure 2: On-street perception survey questionnaire



Auckland Transport
An Auckland Council Organisation

THE UNIVERSITY OF AUCKLAND NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

The Development of a Multi-Faceted Evaluation Framework of Shared Spaces

On-Street Perception Survey

Please circle the option best describes your opinion towards the following five statements.

		Strongly Disagree	Disagree	Tend to Disagree	Tend to Agree	Agree	Strongly Agree
1)	"I like spending time in this street"	-3	-2	-1	1	2	3
2)	"I can freely move around on this street"	-3	-2	-1	1	2	3
3)	"Driver behaviour is appropriate in this street"	-3	-2	-1	1	2	3
4)	"This street complements the economic activity"	-3	-2	-1	1	2	3
5)	"I feel safe and secure in this street"	-3	-2	-1	1	2	3

MAIN SURVEY QUESTIONS OF PERFORMANCE MEASURES

Please further provide us with your impression about this street space and your background information

6) Of the five statements above, which are the most important (.....) and least important (.....) ?

7) Of the five statements above, which do you feel could be most improved, and why?

.....

8) What, in particular, do you like most about this street space?

.....

ADDITIONAL SURVEY QUESTIONS

9) How often do you visit this street?

☐ First visit / Very Infrequently ☐ Around once a month
☐ Around once a week ☐ Multiple times a week

10) Why have you visited this street today? (e.g. passing through, shopping or eating)

.....

11) Age: ☐ Under 20 ☐ 20 – 34 ☐ 35 – 49 ☐ 50 – 65 ☐ Over 65

12) Gender: ☐ Male ☐ Female

13) Ethnic group: ☐ NZ European ☐ Maori / Pacific Islands ☐ Asian
☐ Other .....

DEMOGRAPHIC QUESTIONS

4.2.1 Survey Procedure

To ensure proper and consistent implementation by surveyors, survey procedures and instructions were established. Firstly, surveyors were required to be familiar with the survey objectives and how the objectives fitted within the overall evaluation framework of shared spaces so as to be able to clarify any questions raised by the participant. Secondly, each survey session was conducted in pairs with one surveyor at each end of the surveying area during the identified peak periods. Next, the surveyors approached the 5th pedestrian that walked into the study area from their side in order to prevent sampling bias. If willing to participate, the pedestrian was provided with the ethically approved survey sheet, and asked to fill out the questionnaire. Surveyors noted the survey period, weather conditions and any other observations that may influence the survey outcome.

4.2.2 Survey Participant Characteristics

Table 1 summarises the demographic information of the participants. For benchmarking purposes, the 2013 census data (Statistics NZ, 2014) is also included in the table. While the gender and age group data were based on the Auckland Central residents, the available census data for the ethnic groups were pertaining to the (wider) Auckland Region. A skew

was observed towards male participants (62%) in the survey. Almost 90% were between 20 and 65 years old with the largest age group of 20-34 years (41%).

The majority of participants were Europeans (62%). Asians, and Maori (indigenous people of New Zealand) / Pacific Islanders comprised 10% and 2% respectively. People of 'other' ethnicities comprised a significant group (26%). When compared to the census data of the Auckland Region population, the ethnic profiles of the participants sampled from the CBD sites had a much lower portion of Maori / Pacific Islanders and a greater diversity in 'other' ethnicities. Hence, the sample shows a different ethnic composition as the CBD is a multi-cultural city centre and a gateway to tourism.

Table 1 Demographic characteristics of perception survey participants.

Participant Characteristic	Study Area (%)		2013 Census (%)
	Before	After	
No. of participants	40	227	
Gender			
Male	22 (55.0)	141 (62.1)	(52.0)
Female	18 (45.0)	86 (37.9)	(48.0)
Age group			
Under 20	1 (2.5)	16 (7.0)	(12.4)
20-34	28 (70.0)	93 (41.0)	(56.0)
35-49	4 (10.0)	55 (24.2)	(15.2)
50-65	7 (17.5)	51 (22.5)	(11.6)
Over 65	0 (0)	12 (5.3)	(4.8)
Ethnic group			
European	22 (55.0)	140 (61.7)	(56.4)
Maori / Pacific Islands	0 (0)	5 (2.2)	(19.8)
Asian	11 (27.5)	22 (9.7)	(22.0)
Other ethnicity	7 (17.5)	60 (26.4)	(1.7)
Frequency of visit			
First visit / infrequently	8 (20.0)	32 (14.1)	
Once a month	5 (12.5)	31 (13.7)	
Once a week	8 (20.0)	22 (9.7)	
Multiple times a week	19 (47.5)	142 (62.6)	
Purpose of visit			
Passing through	28 (70.0)	165 (72.7)	
Dwelling / accessing adjacent land use	12 (30.0)	62 (27.3)	

Note: Percentages may not add due to rounding

Most respondents (63%) were regular visitors to the street sites and the surrounding areas with multiple visits per week. 73% of the participants travelled through the street without a prior intention to stop in and around the street, reflecting the dominating Movement function.

4.3 Data analysis

Given the main goal of this perception survey study was to qualitatively measure and evaluate how well a road space served the user perception of the five performance criteria, the effectiveness of a shared street can be expressed as an average value of users' subjective perception ratings. The three main measures of central tendency of Mean, Median and Mode were calculated. Given that the Likert scale produces ordinal survey data, the mean and standard deviation were not appropriate for the analysis of the ordinal sample data.

The primary numerical value that represents the key performance of a shared space towards each qualitative performance aspect is the median, termed 'Median Perception Rating' (MPR) in this study. By plotting the cumulative proportion of survey responses against each rating scale category, the MPR value can be determined (Karndacharuk, 2014).

5. Results and discussion

While the qualitative data collection process of the on-street perception surveys is comprehensively discussed in Section 4, the quantitative data of vehicle speed and volume statistics were obtained from automated traffic counters undertaken in 2005 and 2014 for the 'before' and 'after' shared zone implementation, respectively. Results of the quantitative and qualitative analysis are presented as follows.

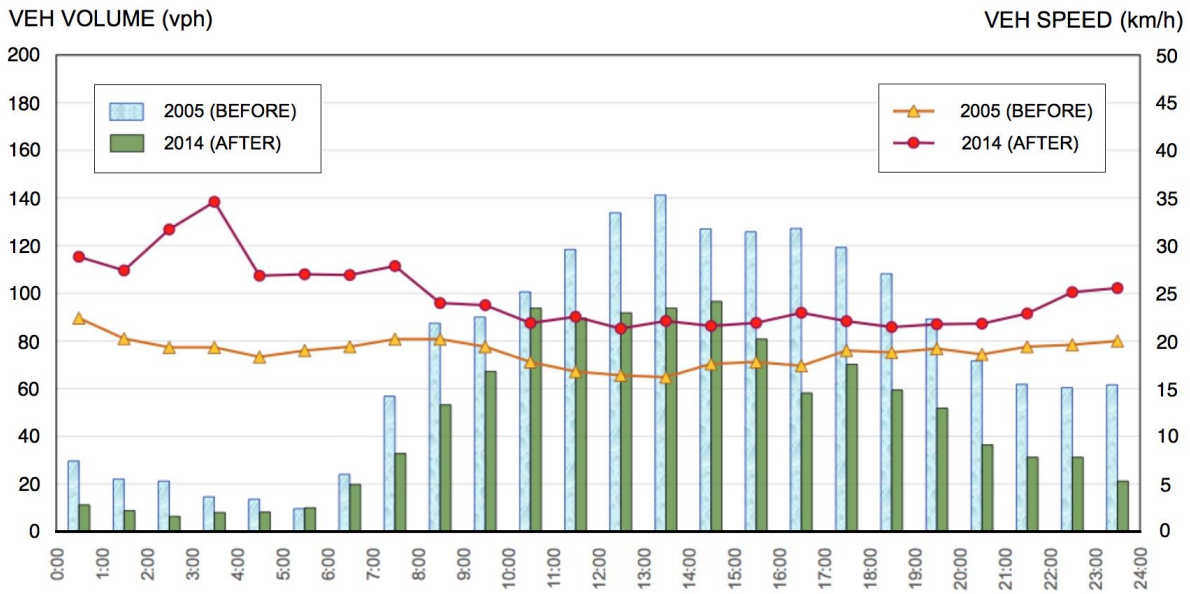
5.1 Quantitative data of vehicle volume and speed

The Annual Average Daily Traffic (AADT) of the before scenario was approximately 1,800 vehicles. The AADT reduced to some 1,100 vehicles after the shared zone upgrade. It is noted again that O'Connell Street is a one-way, northbound street.

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

85th percentile speeds of the before and after scenarios are illustrated in Figure 3. While the speed profiles over a 24-hour period are similar, there has been a general increase in the speeds since the implementation of the shared zone. Whereas in 2005 speeds were in the range of 16-23km/h, this seems to have increased to be in the 21-35km/h range in 2014. Albeit not entirely, the speeds on O'Connell Street were generally within the recommended 30km/h limit for safe pedestrian and vehicle interactions.

Figure 3: Vehicle speed (85th percentile) and volume before and after shared zone upgrade



It is possible that the reduction in vehicle volumes could potentially have an effect on the increase in speeds. However this can only be proven if the street environment remains unchanged.

Street furniture has a significant role in encouraging slower speed. Karndacharuk, Peake & Wilson (2014) note that streetscape elements should be used as traffic calming by way of defining a restricted vehicular path through the zone, preferably with some lateral shift to limit straight sections of the street and to break up sight lines.

As noted in Section 2, the shared zones in the CBD are largely linear in design and O'Connell Street is no exception. Previously, the street had a single trafficable lane of 3m, vertical deflection devices (speed humps and a raised pedestrian crossing) and parked vehicles on either side. They contributed to creating significant side friction. These characteristics (particularly the vertical deflection devices) were removed and replaced by a wider 4.2m trafficable lane and a level surface. Side friction that encourages a lower speed was provided mainly by street furniture (trees, benches, and outdoor dining). It is therefore apparent that street furniture design in the O'Connell Street Shared Zone is a less imposing visual mass for motorists, with fewer vertical and lateral constraints than before the shared zone upgrade. This perception of a less physically constrained environment, coupled with a largely linear design may have contributed to an increase in speeds.

Research shows that there is a high correlation between pedestrian and vehicle interaction and vehicle speeds. The higher the number of interactions, the lower the mean speed (Karndacharuk, Wilson and Dunn, 2014b). Pedestrian density was not measured in this study; nonetheless it can be inferred from Figure 3 and earlier discussions that periods of highest pedestrian activity coincide with periods of lowest recorded speeds. Reliance on pedestrian interaction to lower speeds means that speeds may not be sufficiently moderated when pedestrian movements are low (i.e. during off-peak times and especially at night). As pedestrians in shared zones are given a higher level of priority over vehicles, consistently low vehicle speeds are considered essential in reducing the risk of crash severity (Karndacharuk, Peake and Wilson, 2014). The importance of design features that consistently lower speeds independent of high or low pedestrian activity periods is thus again emphasised.

5.2 Qualitative data of on-street perception survey

Table 2 summarises the perception survey results of the five performance measures, including the Median Perception Ratings (MPR), mean values and the distribution of the response. The rating values of different survey periods are also presented for the after implementation scenario.

It is observed from the table that there are measurable improvements of the user perception towards the street environment across all variables with the most notable MPR increase of the Economic criterion. The results for each performance measure are discussed as follows.

5.2.1 Placemaking

The increase of the overall MPR values from 0.23 to 1.64 for the Place criterion is significant. The MPR and mean perception values in the morning and mid-day periods were slightly higher than those in the weekday afternoon and Saturday periods, reflecting business and commercial activities on the street, especially for many cafes that are closed after 3pm on weekdays. This is also evident on the proportion of the highest perception ratings of 3 that were predominant (39.2%) in the mid-day weekday period. Overall in the after scenario, only 5% of the responses were in the negative zone (-3 to -1). In other words, 95% of respondents recorded a positive perception towards the placemaking measure of the street.

Table 2 Median Perception Rating (MPR) and distribution of responses

Performance Measure				Mean	MPR	Distribution of Responses (%)					
						-3	-2	-1	1	2	3
Place	Before	Overall		0.53	**0.23**	2.5	17.5	12.5	30.0	35.0	2.5
	After	Weekday	7-9am	2.17	**1.72**	0.0	2.1	4.2	4.2	54.2	35.4
			11am-2pm	2.10	**1.73**	0.0	1.0	4.9	16.7	38.2	39.2
			4-6pm	1.94	**1.51**	0.0	2.1	2.1	17.0	57.4	21.3
		Weekend	Sat	1.97	**1.51**	0.0	0.0	3.3	20.0	53.3	23.3
		Overall		2.06	**1.64**	0.0	1.3	4.0	14.5	47.6	32.6
Pedestrian	Before	Overall		0.75	**1.06**	0.0	17.5	17.5	12.5	42.5	10.0
	After	Weekday	7-9am	1.98	**1.59**	0.0	2.1	6.3	12.5	50.0	29.2
			11am-2pm	1.94	**1.62**	1.0	4.0	3.0	18.8	38.6	34.7
			4-6pm	2.09	**1.74**	0.0	4.3	2.1	12.8	42.6	38.3
		Weekend	Sat	2.27	**1.83**	0.0	0.0	0.0	15.4	42.3	42.3
		Overall		2.02	**1.66**	0.4	3.1	3.1	15.9	42.0	35.4
Vehicle	Before	Overall		0.80	**0.23**	0.0	5.0	25.0	32.5	30.0	7.5
	After	Weekday	7-9am	.87	**0.90**	8.5	8.5	10.6	25.5	36.2	10.6
			11am-2pm	1.07	**0.86**	5.1	7.1	13.1	29.3	33.3	12.1
			4-6pm	1.45	**1.33**	2.1	8.5	6.4	19.1	44.7	19.1
		Weekend	Sat	1.46	**1.24**	5.0	10.0	10.0	20.0	45.0	10.0
		Overall		1.16	**0.97**	5.0	10.0	10.9	25.3	36.2	12.7
Economic	Before	Overall		-0.18	**-1.00**	7.5	27.5	15.0	27.5	20.0	2.5
	After	Weekday	7-9am	2.26	**1.68**	0.0	0.0	0.0	21.3	42.6	36.2
			11am-2pm	2.11	**1.84**	1.0	0.0	4.0	10.9	41.6	42.6
			4-6pm	2.11	**1.54**	0.0	0.0	2.2	26.1	41.3	30.4
		Weekend	Sat	1.73	**1.24**	0.0	5.6	5.6	27.8	50.0	11.1
		Overall		2.09	**1.68**	0.4	0.4	2.7	17.9	43.3	35.3
Safety	Before	Overall		1.58	**1.32**	0.0	.0	12.5	22.5	47.5	17.5
	After	Weekday	7-9am	1.83	**1.50**	0.0	8.3	6.3	16.7	39.6	29.2
			11am-2pm	1.92	**1.71**	1.0	2.9	4.9	15.7	37.3	38.2
			4-6pm	1.89	**1.64**	0.0	2.1	4.3	25.5	29.8	38.3
		Weekend	Sat	2.13	**1.58**	0.0	0.0	7.1	14.3	50.0	28.6
		Overall		1.93	**1.63**	0.4	4.0	5.7	18.1	36.1	35.7

5.2.2 Pedestrian focus

The increase of the overall MPR value from 1.06 to 1.66 reveals an improvement on the perceived pedestrian amenity and level of service of the street. In the after scenario, only 6% of the responses were in the negative zone, (-3 to -1) of which none had a rating of -3. In other words, 94% of respondents positively perceived this Pedestrian Focus criterion. It is also noted that the positive experience was highest during the Saturday peak.

The provision of a level surface across that enables easier movement of pedestrians across the street has certainly contributed to the positive perception. The implementation of the shared zone evidently provides a less physically constrained environment for pedestrians, especially when the footpath width in the before scenario was as narrow as 1.2m.

5.2.3 Vehicle behaviour change

Even though there was an improvement in the overall MPR values from 0.23 to 0.97, the 'after' perception values toward the Vehicle criterion were the lowest when compared to those of other performance criteria. This is reflected in the highest proportion (26%) of negative scores, especially during the mid-day period.

The relatively high proportion of negative perception towards driver behaviour in the street can be considered in the context of the upward trend observed in vehicle operating speeds as discussed in Section 5.1. It is possible that more positive perception can be achieved by design interventions with an aim to create a consistently low speed environment in the shared zone.

From the additional survey questions, 48% of the respondents cited driver behaviour as the one aspect that they would like to see most improved. A number of them requested the implementation of a speed limit. It is noted that the majority of shared zones in Auckland do not have a posted speed limit and therefore the prevailing speed limit applies. It is intended that the environment in which motorists are travelling will encourage lower speeds. New Zealand's operational principles suggest that a 10km/h design speed (and posted speed limit) should be used as shared zones are intended to be pedestrian oriented and therefore walking speed is desirable.

5.2.4 Economic impetus

The overall MPR increase from -1.00 to 1.68 is the most significant improvement due to the shared zone implementation. The lowest MPR score of 1.24 was recorded for the Saturday survey period, which was when office blocks and cafés are closed. This seems to be a correlation between pedestrian activities on the street and how economic success is perceived. It is, nevertheless, noted that the majority of the respondents considered this aspect to be least important variable within the street environment.

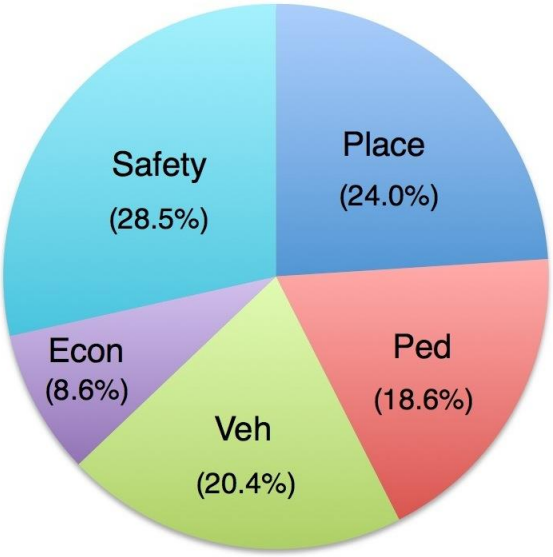
Before the shared zone upgrade, the parking and traffic lanes on O'Connell Street coupled with sections of relatively narrow footpaths may have acted as a barrier to overall activation of street frontage, thereby contributing to the negative scores. Previous research suggests that land-use frontage activation contributes to increased pedestrian activity and density and improvement on both movements along and across the street (Karndacharuk, Wilson & Dunn, 2013a). If active frontage is considered a proxy for economic activity, the improved visibility of active edges on O'Connell Street after the shared zone implementation seems to have contributed to the significant increase in positive perception of the Economic criterion.

5.2.5 Safety for all road users

The overall MPR values change from the before (1.32) to the after (1.63) scenario with 90% of the responses were within the positive range. Similar to the Place, Pedestrian and Economic criteria in the survey results, the shared zone was perceived positively.

As shown in Figure 4, the Safety criterion (28.5%) was perceived to be the most important aspect, followed by the Place (24.0%), Vehicle (20.4%), Pedestrian (18.6%) and Economic (8.6%) criteria. Considering the first two criteria of Safety and Place, it is possible that one is a proxy of the other. In other words, would someone like spending time in this street if they did not feel safe? If they like spending time in this street, does this imply that they consider it safe?

Figure 4: Most important aspect ranked by respondents



It was also observed during the surveys that the participant's experience of personal safety, which was not necessarily related to the street design, sometimes contributed to how the Safety criterion was rated. For instance, one respondent spoke of being harassed within the street at 2am by an intoxicated person. Given that most respondents (73%) used the street for Movement function (as shown in Table 1), O'Connell Street is considered primarily a leg on their commute to / from a destination within the CBD. The relative high importance given to the Safety aspect by respondents could therefore potentially reflect the importance of personal safety of the respondents' commuting route.

5.3 Overall remarks

The results of an increase perception scores from the surveys indicated that the users of the O'Connell Street shared zone largely perceive it in a positive light. Notwithstanding this, the issue of the increase in vehicular speeds whereby the significant proportion of survey participants identified the 'Vehicle behaviour change' objective as an area for improvement is considered one of the important findings of this paper.

These should be considered in light of Auckland Transport's, operational design principles for new or modified shared space schemes (Karndacharuk, 2013). The principles aim to provide details of fundamental aspects that should exist in the shared space environment to maximise the potential of the space operating successfully. The key design principles generally encompass the following:

1. The design should be context-sensitive, taking into account the surrounding land use and the complementary street functions of economic, social, cultural, historical and environmental amenity.
2. The scheme should attempt to limit vehicular dominance, volumes, and speed. Based on the walking speed criteria, the recommended design speed is 10 km/h.
3. The design should be self-explaining to reduce the need for traffic control devices. Such devices should be used sparingly or avoided within the zone.
4. Street furniture (e.g. trees, lighting and art works) should be used to define the various zones within the shared space and act as traffic calming measures.
5. Designs will typically consist of a level surface continuous with similar paving materials and colours across the road reserve.

6. The entry and exit points to the zone should be clearly marked. A gateway treatment should be implemented at the zone transition.
7. Any scheme should be accompanied by extensive education of the public to inform what is expected of them when using a shared space.

With the exception of point 7, the design of O'Connell Street was based on, and in theory addressed, all of the principles above. As discussed in Section 5.1, the linear design and lack of visual mass and / or side road friction may have contributed to an increase in the vehicle speed. The importance of a design to consistently achieve low speeds, commensurate with the recommended design speed of 10km/h, is therefore emphasised. This raises the question of whether the aforementioned design principles should be refined to be more explicit in their direction of design details (e.g. discouragement of linear and unrestrained design for vehicle zones).

5.3.1 Interconnectivity of performance criteria

When further considering the ranking of the most important aspects as perceived by users, it can be observed that none of the aspects are completely independent of the other. One criterion can be considered a proxy measure of another. Therefore, a positive perception of one measure could generally positively influence perception of another. For example, if a person does not feel safe (Safety), would they spend time in that street (Place)? If driver behaviour is not appropriate (Vehicle), would they feel positive about moving freely through the space (Pedestrian)? If there is a low economic activity within the street (Economic), would you like to spend time there (Place), and would that have a corresponding effect on driver behaviour (Vehicle)?

Conversely, as generally being observed in O'Connell Street, if a shared zone is generally performing well, a positive result should be observed across all the perception criteria. Given that all attributes scored positively, but with a perception that vehicle behaviour and speeds could be improved, it also indicates that designing a shared zone is a matter of delicate balance where a single design aspect (e.g. provision of visually appealing and open street environment) could result in both a benefit (positive Pedestrian and Place perception) and a dis-benefit (negative Vehicle perception due to increased vehicle speed in a less physically constrained environment).

5.4 Limitations

Besides having the small sample (40) of the before survey data, this study did not capture pedestrian volume data in both the before and after scenarios, and therefore it was not clear what proportion of the pedestrian population the sample size (227) represents. Additionally, pedestrian density statistics were not available for analysis. As there is a correlation between high pedestrian density and lower mean speed, this would have provided context for both the quantitative analysis of speed data, and also in the analysis of the Economic performance criteria.

Furthermore, surveyors also observed that the questionnaire design of the Economic variable in the survey form was difficult to understand by the participants. Given the inter-connectedness of the perception criteria, future survey design should be modified to make the question statement more relevant to the layperson's interpretation. Multiple questions for each of the criteria may help extracting greater information about the underlying components of the shared space that users found valuable.

6. Conclusion

The qualitative evaluation of the performance of the O'Connell Street based on a before and after analysis indicates that the space was to a large extent perceived positively by its users. The shared zone transformation particularly succeeded in improving the user perception of the 'Placemaking and Economic impetus' objectives as indicated by the significant improvement of the Median Perception Rating (MPR) values. The 'Safety for all road users' criterion was considered to be the most important aspect of the shared street, by the largest proportion of respondents (28.5%) whereas the 'Economic' aspect was considered to be the least important by the average user (8.6%).

While the overall MPR of the four criteria in the after scenario was in a similar range (1.63-1.68), the 'Vehicle behaviour change' criterion had the lowest overall MPR of 0.97. This corresponds to the survey result where driver behaviour was considered the key aspect that needed to be improved the most. Additionally, quantitative evaluation revealed an increase in vehicle speeds with the implementation of the shared zone, with this possibly attributable to a linear design and a general reduction in visual mass and/or side friction.

It is therefore important to reinforce a low speed environment of shared zones. Lower operating speeds should be achieved through design rather than reliance on pedestrian densities and activities. A linear design with less physical constraints on drivers could be discouraged more explicitly in design guidelines for shared spaces.

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