Using Pedestrian Traffic as an Indicator of Urban Recovery: An Ongoing Case Study of Christchurch CBD

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1 INTRODUCTION

Pedestrian footfall numbers have received increased attention from policy-makers in recent years. This has been driven in part by concerns about the attractiveness of urban places for business, tourists and retail as increases in walking are found to benefit local economies (MoT, 2008; Sauter & Wedderburn, 2008). Interest has also increased from crime and security experts, as pedestrians provide natural surveillance and well-connected areas experience less crime. The health benefits of walking are a further reason for interest in measuring pedestrian activity.

We suggest that an additional reason for measuring pedestrian traffic is for tracking urban recovery after a natural hazard event such as the magnitude 7.1 earthquake that shook Christchurch in September 2010. Thriving retail areas are an integral part of vibrant and successful cities, and it is imperative that businesses in these areas continue to trade during the recovery phase. The fate of retail areas is heavily dependent on the number of potential customers visiting stores. Road, building, and footpath closures, as well as perceptions of personal risk, can reduce pedestrian traffic, and thus, business viability even when individual businesses escape direct damage themselves

2 AIM

The purpose of this ongoing study is to investigate the potential use of regular pedestrian counting as an indicator for business recovery, using the Christchurch CBD as a case study. Businesses will be surveyed to ascertain in what ways the earthquake and the subsequent rebuilding and repairs affected their turnover[1]. In doing this, the relationship between lower footfall and business vulnerability will be revealed, and the reliability of this possible indicator assessed.

3 BACKGROUND

3.1 Indicators For Business Recovery

Recovery after a natural hazard event is increasingly viewed as a dynamic process with no clear endpoint (Nigg, 1995). There is an urgent need for time- and cost-effective ways to track the recovery of business areas in the aftermath of natural disasters and other shock events, especially as statistical indicators for post-disaster recovery have received relatively little attention in the literature. Indeed, much of our knowledge associated with the recovery phase has been gained through one-off surveys or focused investigations of disaster-affected communities.

A large literature exists around the use of indicators, particularly focused on measuring changes in the environment. Indicators, when chosen carefully, can help to establish baselines, identify trends, predict problems, and assess options. Indicators should be based on information that is reliable, accessible, timely, and accurate. Comparability, simplicity, sensitivity, accessibility, transparency, and cost-effectiveness are all important aspects (Litman, 2007; Dale & Beyeler, 2001).

Indicators for making comparisons across disasters should meet the following criteria (a) be consistent in definition across countries, cultures and time periods; (b) data must be readily available; and (c) measurement should be standardised in order to make reasonable comparisons across space and time. The key requirement for comparisons within a specific disaster event is that indicator results can inform policy and decision-making in the affected community (Chang, 2010). The temporal dimension is also important as we are interested in how long it takes to reach a new normality and compare it to the pre-disaster normality.

3.2 Pedestrian Traffic

Pedestrian footfall counts provide an insight into the operation of a city and can also assist local and transport authorities in regard to traffic planning, safety analysis, retail forecasting, and urban design changes. Pedestrian footfalls are also linked to urban vitality, walkability, and property and rent costs (Chiaradi et al., 2009; Monheim, 1998). For retailers, the volume

[1] The large earthquake that took place on 22 February 2011 caused extensive damage to the CBD, and as a result the intended survey has been postponed.

of pedestrians visiting an area is important as it represents customer potential, with the greatest volume usually in the area of greatest concentration of department and large chain stores (Thomas & Bromley 2003). In contrast, locations that lack a retail 'anchor' and are no more than 50m away from areas of main pedestrian activity attract fewer shoppers. Timmermans and Van der Waerden (1992) present empirical evidence linking retail store performance and pedestrian route-choice behaviour. They find the viability of stores and retail areas to be largely dependent upon the pedestrian volumes in the vicinity.

Pedestrian volumes are site specific, vary by street/path type, weather conditions, and periodic cycles, and are influenced by the location of transport sources such as public transport and car parks (Aultman-Hall et al. 2009; Attaset et al. 2010; Clifton & Livi, 2005; Monheim, 1998). For these reasons, it is important to have baseline data for a number of sites against which to make comparisons. With increased interest in walking behaviour in recent years, new instruments and methods to assess walking have been developed, one of which is counting the number of pedestrians. Other techniques include analysis of walking behaviour, modelling pedestrian flows, and surveys of pedestrians to identify pedestrian demographics, trip purpose, and accessibility and attractiveness of the walking environment (Monheim, 1998; Sauter & Wedderburn, 2008).

3.3 Christchurch CBD

The September 2010 earthquake caused damage to unreinforced masonry buildings in Christchurch's CBD, resulting in ongoing road and footpath closures and the closure or displacement of businesses unable to occupy their premises. Anecdotal accounts describe many businesses experiencing a fall in revenue of more than 50% since the earthquake, with retailers particularly affected by shoppers avoiding the central city (Heather, 2000; Stewart, 2011).

The CBD was already under threat before the earthquake as it is losing business and retail activity to more suburban locations. In 2006 it was estimated that there was 260,000m^2 of retail floor space in the central city compared to 500,000m^2 in the remainder of Christchurch (CCC, 2006). More recent expansions of suburban malls will have widened this gap further, so that the traditional central shopping area is now in a highly competitive relationship with the city's decentralised suburban areas. Alongside the decentralisation of retail, other businesses have shifted outwards to new suburban office parks, and indeed anecdotal evidence suggests that as many as 10,000 office jobs have left the central city in the last 10 years (Macfie, 2010). As workers leave the CBD, so does their discretionary spending, deepening the problems facing retailers based in the central city. In response to these challenges, since the late 1990s Christchurch City Council has initiated a range of strategies intended to revitalise the central city (CCC, 2010).

4 METHODOLOGY

Students conducted manual pedestrian counts using tally counters at 12 sites throughout the CBD (see Figure 3), for two hours in the morning (10.30am-12.30pm) and two hours in the afternoon (1.00-3.00pm) on a midweek day in each of October, November, December 2010 and February 2011. In December and February, additional counts were undertaken between 4.00-6.00pm. Pedestrian counts were recorded every quarter hour over these periods, as is consistent with vehicle traffic studies. Our intention is to replicate our study a number of times for a year to monitor progress towards recovery and to reveal areas likely to be at risk of decline due to fewer potential customers. The sites were chosen based on the patterns of earthquake damage within the CBD, and to be comparable with sites used in an assessment of urban vitality in 2008 undertaken for the Christchurch City Council (Gehl Architects, 2009).

On each counting day, observations were made about the closures of streets, buildings and footpaths. Data collection on Wednesday 6 October occurred on a warm, sunny day within the school holiday period. The weather on Thursday 4 November was similarly warm and sunny, but did not fall within school holidays. On Wednesday 8 December the weather was overcast with a cold southerly wind. Warm and sunny weather was experienced on Thursday 10 February, which fell during the school term.

We are also assessing the feasibility of installing automated pedestrian counters at these 12 sites, and installed one Irisys passive infrared sensor at the beginning of December 2010. Because automated pedestrian counters only record pedestrians on one footpath, pedestrian numbers were recorded manually on one side of the road only, to allow future comparisons with data collected by automatic counters. This differs from the methodology employed by Gehl Architects, where data were collected on both footpaths at 34 sites throughout the city for 10 minutes every hour between 8.00am and midnight on a Tuesday and Wednesday in November 2008 during fine weather. Gehl's data were manipulated to determine an hourly total and an average per minute for each site. To allow comparisons between the Gehl data and our data, we halved the Gehl data at sites where both footpaths were open in 2010.

5 RESULTS AND DISCUSSION

The total number of pedestrians recorded at each site between 10.30am-12.30pm and 1.00-3.00pm on each of our counting days is shown in Figure 1. At two of the sites (Colombo St D and Sol Square) pedestrian numbers have altered little over the study period. Pedestrian numbers fell each month to December in 7 of the 11 sites, but numbers bounced back in February in all but two of these (High St and Worcester St B). The total number of pedestrians recorded at all sites fell each month between October and December, with 12.8% fewer pedestrians overall in November, and a further fall of 4.1% by December. In February, the total number of pedestrians counted at these times almost recovered to the October totals, being only 0.8% lower than the earlier number.

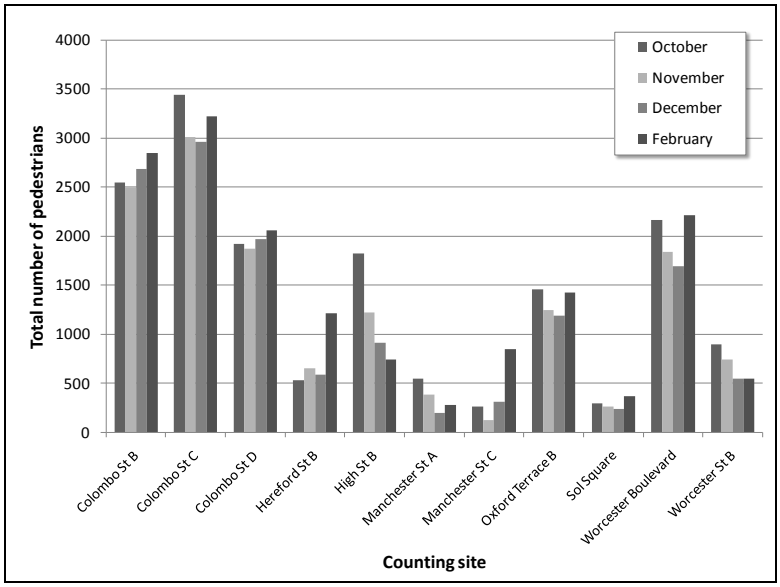

Figure 1: Total number of pedestrians recorded (10.30am-12.30pm and 1.00-3.00pm)

There are a number of possible explanations for the observed decrease in pedestrian numbers over the first three months. The higher total number of pedestrians observed in October may have been artificially high because this was the only survey undertaken during school holidays. For the December count, being three weeks before Christmas, we anticipated more pedestrians but the low numbers observed may be attributable to the unpleasant weather deterring shoppers (Aultman-Hall et al. 2009; Attaset et al. 2010). Similarly, the increase recorded in February may be in part due to fine weather. The full reopening of Manchester Street, part of which had been closed since September due to an unsafe building that had to be demolished, led to temporarily closed businesses in that area reopening by February, and this is likely to have resulted in more workers being in the CBD than in the preceding months.

When the share of pedestrians is compared between the sites, as shown in Figure 2 as a percentage of the total pedestrians recorded across all of these 11 sites, we observe that for the first 3 months Colombo Street, which had been relatively unaffected by the earthquake, increased its share of the CBD's pedestrians. The trend towards a greater proportion of pedestrians along Colombo St in the lead up to the Christmas period also reflects people's consumption habits as chain stores are concentrated in this area as is Ballentyne's department store. Colombo St's position changed in February, due largely to the increase in the numbers of people observed in Hereford St and Manchester St taking a greater share of the central city's pedestrians as businesses in this part of the city reopened. The High St and Worcester St B sites experienced a sustained fall in their share of pedestrians, and this is probably due to earlier road closures in Manchester St having initially funnelled pedestrians down the High St and Worcester St as they sought alternative walking routes in the city. As roads and pavements reopened, pedestrians returned to their usual routines and the numbers of pedestrians decreased in these streets over the following months.

Pedestrian numbers are lower than those recorded in 2008 for almost all sites aside from those on Worcester St. Of all times in the day, late afternoon pedestrian numbers are generally lower than those recorded in 2008. This may reflect fewer workers finishing work in the city around 5pm as some businesses closed or relocated after the earthquake. Pedestrian numbers on Colombo St are similar to those observed in 2008, though not in the late afternoon. Low numbers in the southern and eastern parts of the city appear to be related to the earthquake damage (especially on Manchester St) and the resultant cordons and business closures in place. Building, and therefore employer, closures may be impacting

pedestrian numbers in these areas, and road and pavement closures are probably diverting pedestrian traffic to the more central and western parts of the city. Also since 2008, the City Council, a major employer in the central city, has relocated its civic offices from Tuam Street to Worcester Boulevard, resulting in fewer people working in the south of the CBD.

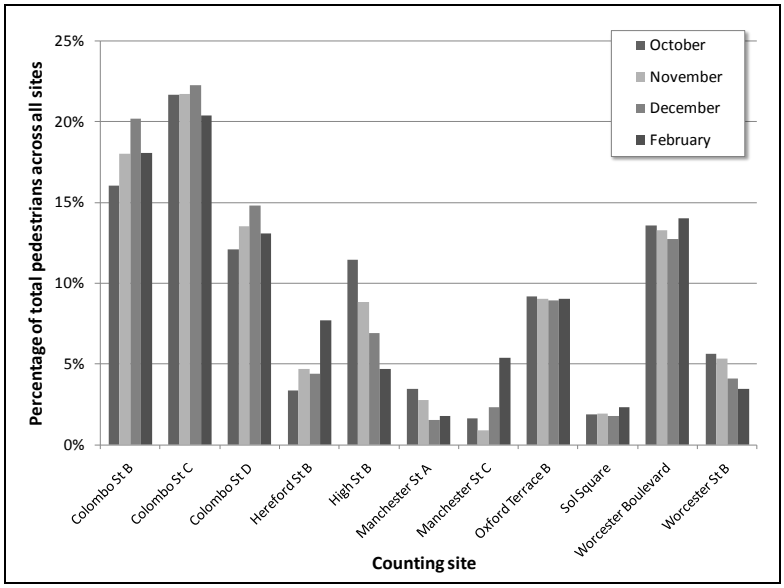

Figure 2: Share of pedestrians at each site as a percentage of the total pedestrians recorded

A clear pattern of areas in the CBD at risk of decline due to failing businesses is emerging from the data. The southern and eastern sides of the CBD, including our sites on Manchester St, eastern Hereford St, Sol Square, High St and southern Colombo St (see Figure 3), are experiencing declining footfalls that may threaten the viability of businesses that remained open after the earthquake (Timmermans & Van der Waerden, 1992). These findings support anecdotal accounts of businesses in the south and eastern parts of the city experiencing hardship since September's earthquake. At the same time, other sites to the north and west of the CBD appear to be experiencing reasonable and even high pedestrian numbers. This part of the city contains the cultural quarter running from Cathedral Square to the Arts Centre and Gallery. With less damage to buildings in this area than to the east, this part of the CBD had fewer road closures that might deter pedestrians. Retail is dominated by chain stores, and this area appears to have maintained its popularity with shoppers and tourists after the earthquake. The relocation of the civic offices is also likely to be manifest in the higher pedestrian numbers.

Figure 3: Map of Christchurch CBD, showing counting sites and possible level of risk

Cities are dynamic places and pedestrian numbers reflect the ebb and flow of city life. In small cities, like Christchurch, pedestrian numbers will change in response to changes in transport

and urban design, special events that draw people, and to businesses or large firms opening, closing or relocating. When monitoring progress towards recovery, it is important to be aware of these contextual issues in order to isolate progress at each site and the impacts that factors like street, building and footpath closures are having on businesses nearby. Pedestrian count data can draw attention to areas of concern, and complement more detailed business surveys which are harder to organise, can only be carried out infrequently, are expensive, and involve a time delay with regard to obtaining results and providing information for change.

Manual pedestrian counting is relatively cheap, simple to organise, and easy to replicate. It is a non-intrusive means of observational study that allows for the quick survey of sites and prompt analysis of data. The protocol for manual counting is simple, but the data collection must be rigorous to be comparable over time. This means that whilst subcontractors do not require special training, they must be provided with a clear protocol. Observation of surrounding conditions is also a key part of the methodology, as analysis of numbers without some context in terms of nearby damage, cordons and closures can be misinformed. Whilst the subcontractors were encouraged to note down any observations, it is difficult to interrogate them later.

In comparison with manual counting, automatic pedestrian counters can be counting day and night, seven days a week. This provides insight into spikes during holidays and special events. The initial capital costs are in the order of $1,500 plus installation, but in the long run automatic counters provide rich continuous data more cheaply than manual counters. Other considerations include the regular battery changing and data download that must be carried out onsite. In addition, the large volume of data takes longer to analyse than a manual count. One key disadvantage of automated counting over manual counting is that it is harder to investigate anomalies. For example, a person can observe a large crowd of tourists walking past and make note of this.

6 CONCLUSIONS

Regardless of the counting method, pedestrian numbers fulfil the majority of requirements of a good indicator as outlined by Litman (2007) and Dale and Beyeler (2001). When collected following a clear and consistent protocol, the information is accurate and comparable. Pedestrian counts are a simple, timely, and cost-effective measure. Our results demonstrate that pedestrian traffic is sensitive to changes, but that the transparency and reliability of the findings are dependent on knowledge about factors like weather conditions, the location of street in relation to amenities and services, footpath and building closures, and non-shock events like the relocation of large employers from one part of the city to another.

This study is ongoing, and we will continue to employ manual counting methods as well as automatic passive thermal counting units. From our results to date, we conclude that with adequate contextual information regular pedestrian counts could potentially be a useful indicator of business recovery after a shock event. By providing quantitative evidence, our findings in Christchurch suggest that pedestrian numbers can highlight areas at risk of decline due to businesses experiencing lower customer patronage (Timmermans & Van der Waerden, 1992). This promise will be assessed by surveying businesses, so that the relationship between footfall and turnover can be tested.

We acknowledge the limitations associated with counting pedestrians, but advocate pedestrian counting as a simple and cost-effective complement to anecdotal evidence and more thorough surveys. Pedestrian footfall data can also assist with urban design, traffic management, public safety and other local authority concerns. Thus, we encourage local authorities to adopt pedestrian counts as a matter of routine. In the unfortunate instance of a shock event, such data will act as baseline data against which to compare post-shock data and therefore inform decision-making on urban recovery. Regular monitoring can provide local authorities with timely and inexpensive information so demolition, repair and rebuilding projects can be managed in a way that minimises further disruption to trading.

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