

# Conducting visitor travel survey for a TOD – case study from South East Queensland

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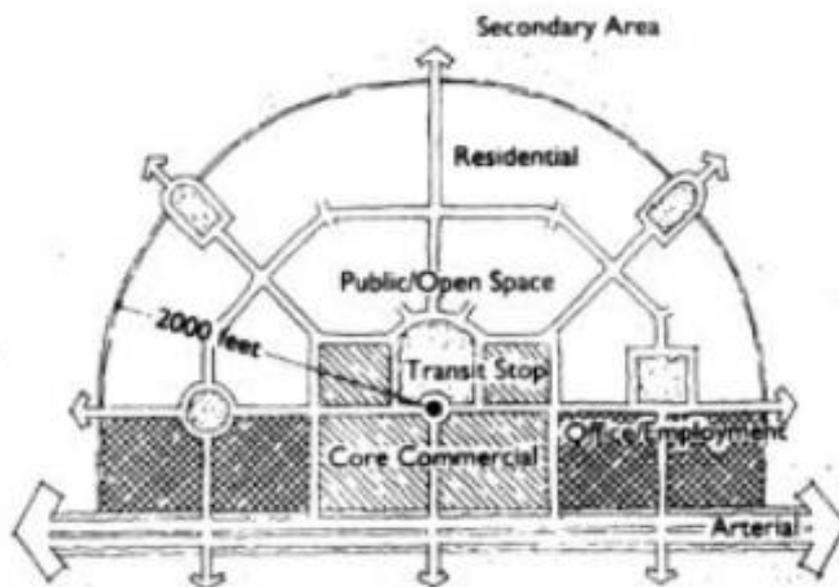
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## 1 An overview of Transit Oriented Developments

Transit oriented developments (TODs) or transit precincts have become important due to the need to facilitate sustainable living in urban areas. TODs are assumed to be a solution for overcoming transportation problems of congestion, travel delays and pollution. To achieve an efficient design with self containment, TODs are typically designed for mixed land uses, are positioned in close proximity to a major transit station, and incorporate public open space. The major transit station is supposed to promote transit trips, while the public open space is assumed to encourage walking and cycling trips within a TOD. Figure 1 shows the typical layout of a TOD.

The mixed land uses at a TOD may consist of residential, commercial/retail, office, recreational and educational land uses. Due to integration of diverse land uses, various categories of people interact in a TOD. The mix of people using a TOD varies from school students to professionals, and residents. Different age groups have different household characteristics and hence show different travel characteristics. In a TOD, residential land use is a trip generator (or trip producer) while all other land uses are trip attractors. The other land uses attract trips from not only residents of the TOD (intra-zonal trips) but also from outside the TOD due to its atypical development characteristics. Hence, TODs seem to have higher internal trip rates and higher trip attraction rates relative to trip production rates, when compared with homogeneous land uses (Dock and Swenson, 2003; Steiner, 1998). However there have been limited travel demand modelling studies undertaken for TODs (for example: Cervero, 1996; Ewing *et al.*, 2001; Zegras, 2004; van de Coevering and Schwanen, 2006).



**Figure 1 – Transit Oriented Development**

*Source: Calthorpe (1993, page 56)*

Studying the travel pattern of person movements and vehicle movements within a TOD requires travel data for residents as well as visitors (that is, people who live outside the TOD). Such data helps to draw an overall picture of travel within a TOD and also aids in determining the trip generation rates for a TOD. This data can also be used to determine the amount of intra-zonal trip making. In a traditional household survey, travel data is collected for residents of the study area and no travel data is collected for visitors. For a TOD, visitors constitute a major share of trips; hence a travel survey for visitors is also required.

This paper presents the methodology used for surveying visitors (including an employees' survey and a shoppers' survey) undertaken to collect travel data at a case study TOD, together with preliminary analysis of the results.

## 2 Objective of this paper

The main objective of this study is to determine a suitable methodology for collecting travel data for visitors of a TOD and present the findings from preliminary data analysis of the case study TOD. This visitors' data will later be used for travel demand modelling purposes. This paper demonstrates the detailed methodology used for conducting travel surveys for a case study TOD and explains the observations made while conducting the travel surveys and alterations made to the proposed survey techniques adopted for pilot surveys. The findings from preliminary data analysis are also summarised to outline the travel behaviour of visitors of the case study TOD. This will be explained with the help of mode shares, trip length distribution, along with demographic details.

## 3 Review of survey methods

Travel surveys collect travel data at a personal level, and demographic and socio-economic data at a household level. The dataset includes information on travel characteristics like trip purpose, frequency, mode choice, trip cost, car occupancy, parking cost and travel time etc. (Goldenberg, 1988; Hess and Ong, 2002; Rajamani *et al.* 2003; Newmark *et al.* 2004); personal information on age, gender, employment status; and household and socio-economic characteristics like vehicle ownership, number of valid licensed drivers, average household income, dwelling type, location of residence etc. (Allen and Perincherry, 1996; Sun *et al.*, 1998; Hess and Ong, 2002; Newmark *et al.*, 2004).

Various survey instruments are deployed to conduct travel surveys and collect travel data. The various methods of conducting travel surveys include home / personal interviews, telephone surveys, mail back surveys, intercept surveys, observational surveys, internet based surveys and GPS surveys. The standard method of conducting most household surveys is a diary; with one of the most recent surveys using GPS assisted trip data collection (Stopher and Greaves, 2007).

Employee travel data are rarely collected solely for transportation planning purposes due to the large expenses involved. Hence secondary forms of data sets (e.g. census data) are generally used (Souleyrette *et al.*, 2001). In 1986, Zakaria described the development and findings of a mail back questionnaire survey sampled for 236,000 employees for the City Centre of Philadelphia. The survey included some questions related to the perception of employees about the quality of the public transport system, in addition to questions related to trip details and demographics. In another attempt to collect visitor travel data, Newmark *et al.* (2004) conducted personal interview surveys for shoppers of four fringe shopping malls in the Prague metropolitan area, Czech Republic. The survey compared trip frequency, shopping activity duration, and mode shares against age, gender, income, car ownership and household size.

While household travel surveys are commonly conducted to collect travel data, resulting in considerable knowledge about conducting such surveys, there is very little evidence available dealing with visitors' surveys. As a result there is very limited information available on conducting travel surveys for visitors.

#### 4 Description of the study area

Kelvin Grove Urban Village (KGUV), located approximately 2km north west of Brisbane's central business district (CBD) in South East Queensland, was selected as a case study TOD site. KGUV spans over 16.57 hectares of land area and to the best of the authors' knowledge is the first of its kind of development in Australia. The various land uses include residential (townhouses and apartments), commercial and retail, official and educational land uses. Details of the land uses are given in Table 1 and an overview of the KGUV is shown in Figure 2. KGUV has a university campus and a state high school located on its northern boundary. This site is expected to be fully developed by late 2009.

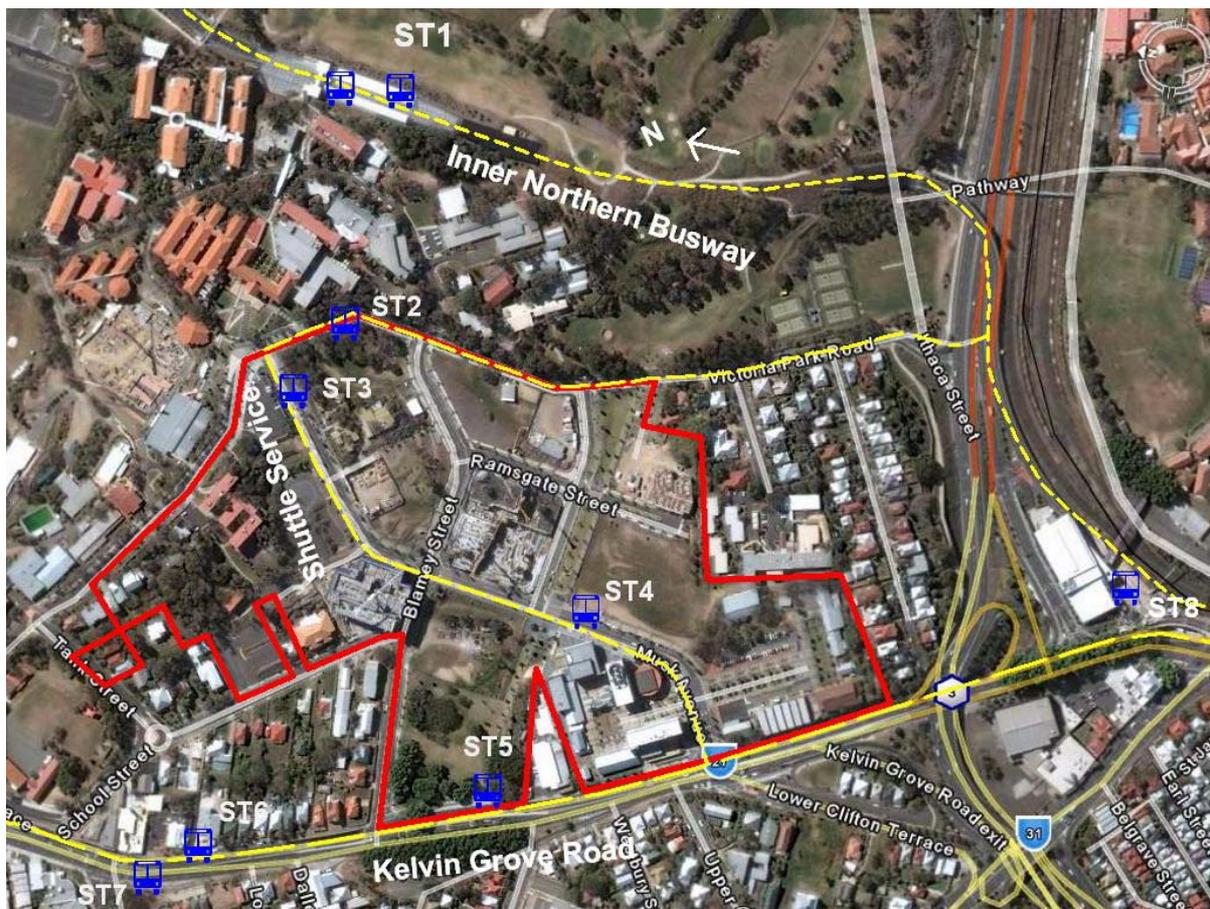


Figure 2 – Aerial view of Kelvin Grove Urban Village

Source: Google Earth

**Table 1 – Mixed land uses at Kelvin Grove Urban Village**

Land use	Size / area	Description
Residential	35,668 m <sup>2</sup>	1000 residential units including 200 affordable units, 455 beds of students accommodation and managed accommodation for older people
Educational	14,770 m <sup>2</sup>	QUT campus extension
Retail	(not available)	Centrally located shopping centre with street level shops
Commercial	3,878 m <sup>2</sup>	Commercial office facilities
Recreational	6,897 m <sup>2</sup>	Network of parks, theatre, sports complex
Mixed	11,995 m <sup>2</sup>	Mixed use area for residential, commercial and retail land use
	26,014 m <sup>2</sup>	Mixed use area for educational and commercial purposes

The main aspect considered for study site selection was the transportation facilities and proximity to the Brisbane CBD. The site is well connected to arterial roads and has an internal street network forming a grid pattern, with parks and open spaces promoting walking and cycling. KGUV does not have a major transit station at its centre; instead major public transport corridors run along east and west flank with an intercampus shuttle bus service running through its heart (Figure 2). KGUV is served by 16 bus services including nine express and very high frequency services. KGUV is close to two major busway stations (ST1 and ST8), four express bus stops (ST3, ST4, ST5, and ST7) and two local bus stops (ST2 and ST6); the locations of bus stops can be seen in Figure 2. After determining the quality of service for public transport availability according to a formal framework, it was observed that KGUV has overall good quality of public transport service (For further information about calculations of quality of service, please refer Muley *et al.*, 2007).

BCC (2000) stipulates car parking rates of minimum 3 spaces per 50m<sup>2</sup> GFA at ground floor level and 1 space per 30m<sup>2</sup> GFA above ground level for centre activities, 1 space for two staff and 1 space per 10 students at tertiary institutions and 1 space per 30m<sup>2</sup> GFA for offices. In KGUV the number of car spaces is restricted to 1 space per 30m<sup>2</sup> GFA for all non residential development. Usually, restricted parking facilities are provided at TODs to discourage drivers from driving their cars and to promote the use of sustainable modes of transport like walking, cycling and use of public transport.

In order to study the travel characteristics of visitors of this case study TOD, travel surveys were planned. It can be observed from Table 1 that KGUV has employees of a retail shopping centre, employees of educational land use, and students and shoppers as visitors of the area. The process and technique for conducting the survey for each visitor group is explained in the following section.

## 5 Methodology for conducting travel surveys

The step by step procedure followed in conducting the travel surveys for each type of visitor is explained with the help of flowchart shown in Figure 3. The first step for travel data collection involves selection of variables about which the information needs to be collected from the travel surveys. The variables were selected from existing literature and practical conditions of the study area. The selection of survey instrument and the design of survey questions were governed by these chosen variables. Sample size and the required target response rate were the main factors determining the type of survey instrument to be used.

Selection of an acceptable response rate was crucial as it controlled the decision of stopping or continuing the main surveys. After this step, the questionnaire survey form was designed in such a way that all questions were easy to understand by a lay person. Use of technical terms was avoided while designing questionnaire form to simplify the questions.

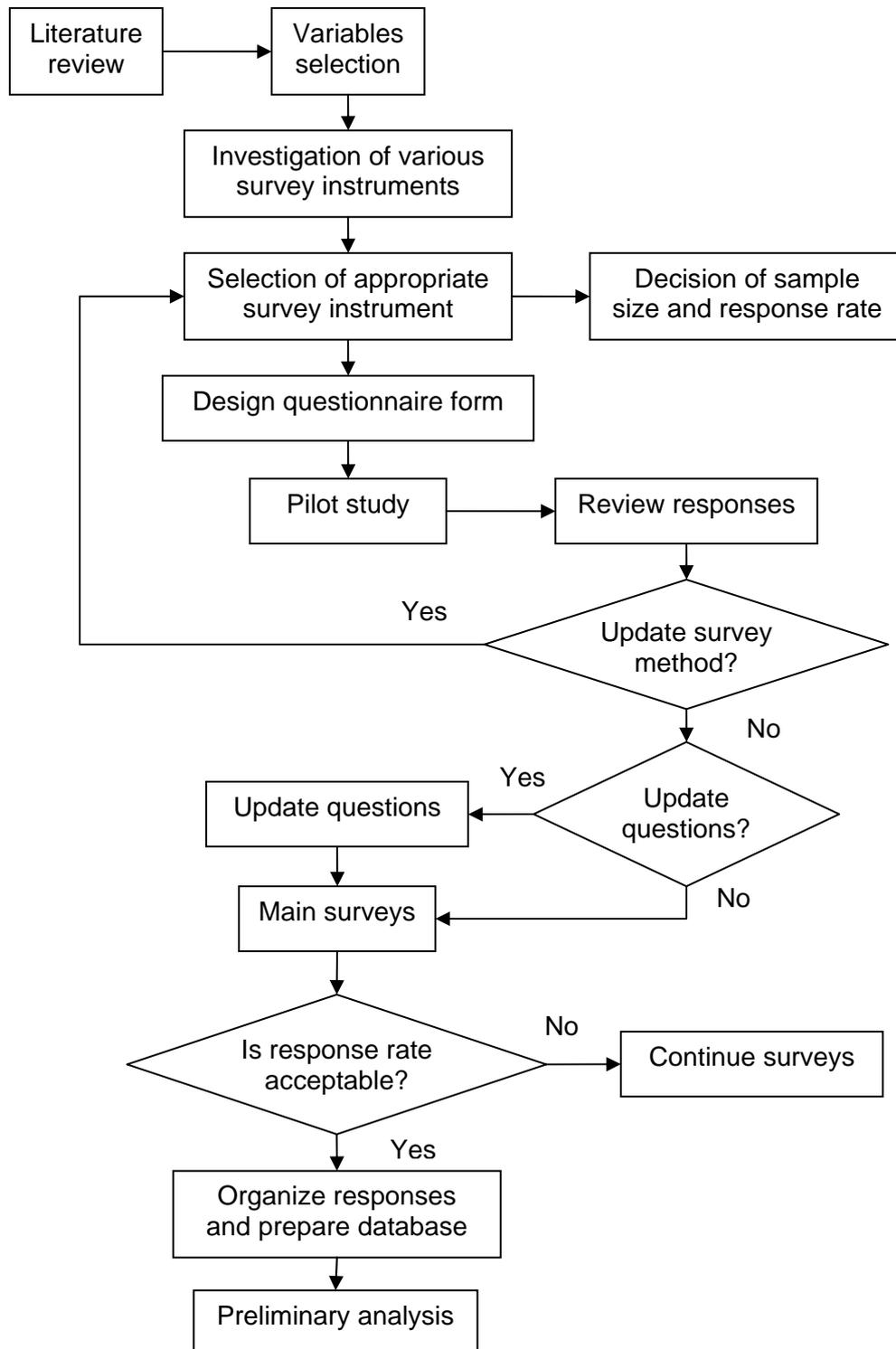


Figure 3 – Steps involved in the current data collection process

The survey questions and survey technique were tested for suitability before conducting the main travel surveys, by conducting pilot studies on a few respondents. Responses to the questions implied suitability of the survey technique and layout of the questions; where necessary changes to the survey instrument or the survey questions were made at this stage in order to improve the response rate and quality of responses.

After updating the questionnaire from the pilot study, the main surveys were conducted for people selected randomly in the selected category under study. Once the required response rate was achieved, the surveys were discontinued and all the collected responses were compiled and combined together for preliminary analysis. In subsequent stages of the research this travel data will be used for travel demand modelling. This process was repeated for all categories of visitors to the case study TOD.

## **6 Travel surveys for KGUV**

Travel surveys for visitors were carried out in three phases; the survey for shoppers, the survey for employees (professional employees and retail shop employees) and the survey for students. The details for the shoppers' survey and the employees' survey are discussed in this paper. The details of students' survey are not discussed as the survey is in progress. The employees at KGUV were divided into two groups depending on the type of employment they were engaged in. The two different groups were professional employees and employees at the retail shops working at the centrally located shopping centre in KGUV. The critical issues and observations while conducting the surveys are outlined in following subsections.

### **6.1 Selection of survey techniques**

An appropriate survey technique for each group of visitors was selected considering the data collection time and cost involved in conducting the surveys. A computer assisted personal interview (CAPI) survey was selected for collecting the travel data for shoppers. CAPI surveys were favoured because these have been shown elsewhere to provide a better response rate compared to the mail back questionnaire survey. Shoppers were also given an option of taking the survey forms with them with a reply paid envelope.

Different survey methods were adopted for the two types of employee groups. An internet based survey was chosen for the professional employees because it is less time consuming, more cost effective, and flexible for respondents. Also, all of the professional employees had work email addresses and good access to internet at their work places. By contrast, the employees at the shopping centre were surveyed using a CAPI survey. This method was chosen as these employees often did not have access to internet at their workplace, and their working hours were variable; hence it was necessary to contact them personally.

All the respondents of CAPI surveys were given a pocket pal guide, providing information about the bus timetables obtained from the transit agency TransLink as a reward for participating in the survey.

### **6.2 Design of questionnaire survey form**

A separate questionnaire survey was designed for each category of visitor. Most of the questions were multiple choice and stated in a layperson's language. While specifying possible responses, broad ranges were given instead of asking overly specific questions. For example, the age group of a respondent was asked instead of exact age. The respondents were given five choices of age groups to choose from (0–18 years, 18–30 years, 30–45 years, 45–65 years and 65 years and above). A copy of the questionnaire form can be obtained from Muley *et al.* (2008). The questionnaire form asked the following information:

- Mode of travel to work, mode choices (if available), mode specific questions (like parking fees, parking place, boarding and alighting stop location, public transport route number, transfer location, walking time to and from the stop) and reasons for choosing the selected mode of travel
- Perceptions of existing public transport at KGUV and any improvements the respondent considers are required to make existing public transport better
- Perceptions of KGUV
- Personal and household information (including age, gender, occupation, vehicle ownership, number of driving license holders, and size of household)

All the questionnaire forms were designed using web based survey design site called [www.surveymonkey.com](http://www.surveymonkey.com). It was estimated that each respondent would take approximately 10 to 15 minutes to complete the survey. Although a separate questionnaire survey was designed for each group of visitors, all the questionnaire forms collected the same travel data.

### **6.3 Process of conducting travel surveys (Review of proposed survey methods and their consequences)**

#### **6.3.1 Shoppers' survey**

Pilot surveys were conducted to test the methodology. A full questionnaire survey, which took 10 to 15 minutes to complete, was offered to shoppers, but it was found that they were always in a rush. Only 2 shoppers out of 15 agreed to participate in the survey, but after talking to them it was found that these two shoppers visited KGUV for the first time and they were not frequent visitors. Some people were reluctant to stop and hear about the survey. Hence the survey size needed to be reduced significantly for this group of subjects.

Only five questions were retained for the shoppers' survey, seeking information about their shopping trip. The answers were noted down in a tabular format, so as to reassure the shoppers that the survey would not take more than 1 or 2 minutes. Completing the responses in the table made the survey process faster and easier for interviewers as well. A good response rate of 72% was subsequently gained when this revised methodology was tested. Considering the good response rate and time required to conduct the survey, this methodology was used for the final survey.

#### **6.3.2 Professional employee survey**

A pilot survey was sent to 30 professional employees selected at random. The employees were working at the educational land use and the survey was sent to their personal email IDs. A response rate of 30% was obtained and the comments about the layout and design of the survey questionnaire indicated that there was no need for any changes. Hence the same methodology was adopted for conducting the main travel surveys.

#### **6.3.3 Retail shop employee survey**

Before conducting the main travel survey for employees at the retail shops, the survey methodology was tested on only 2 employees and the survey was shown to the owners / managers of all the shops to obtain permission to conduct the surveys. These two surveys took around 10 to 15 minutes to complete as expected. More employees were not surveyed for the pilot study as this is a small scale shopping centre with about 100 to 125 employees. It was then decided to proceed directly with the main survey.

When the main surveys commenced and the survey was conducted for all the employees, it was observed that some respondents took 30 to 45 minutes to complete the survey form as they were serving customers while the interview was in progress. After considering the time constraints on the respondents, some questions were removed as they took more time to answer, these being the rating scale questions related to the perceptions about public transport and KGUV and the reasons for choosing main mode of travel. The survey methodology was also modified to “pen and paper” based interviews instead of using “CAPI surveys”. This eliminated the time required to set up the laptop and gave flexibility to respondents (some respondents preferred to fill the survey on their own). This improved the data collection process, typically taking approximately 5 minutes to complete the survey.

## **7 Sample size and response rates**

Determination of sample size is an important step before conducting any kind of survey. Sample size is selected in such a way that it represents the average household characteristics of the study area. In this case, the size of the case study TOD is small; hence the travel surveys were given to all the people visiting the case study TOD. This offered the sample size as 100% of the population size, minimising coverage error and sampling error.

The number of responses and in turn the response rate depends on the sample size. Reasonable numbers of data sets were obtained for the main travel surveys after modifying the methodology. Employees of educational land use showed a response rate of about 10% while the response rate for employees of the retail shopping centre was approximately 31.2%. The response rate for shoppers’ survey was about 67.6%. The numbers of responses obtained were considered sufficient for travel characteristics determination; hence the surveys were ceased at this point.

## **8 Preliminary data analysis**

After conducting the main travel surveys for each category of visitor of the case study TOD, all travel data was compiled in Microsoft Excel spreadsheets. The preliminary analysis was performed using Microsoft Excel. The responses from the pilot study of employees were combined with responses obtained in full scale surveys and then analysis was conducted. The responses from the shoppers’ pilot survey were not included as they represent weekend data. This section lists details for mode share, trip length distribution and demographic information for each category of visitor. The trip length for each trip was calculated with the help of “home postcode” collected from respondents by using “Google maps” available at <http://www.maps.google.com.au>. Each trip length represents the actual road network distance (travelled by car) from the centrally located Village Centre to the home postcode centroid. The results for the shoppers’ survey and employees’ survey are discussed separately.

### **8.1 Analysis of shoppers’ travel data**

#### **8.1.1 Demographics**

A data set for 117 respondents to the quick interview shoppers’ survey was used for analysis. Figure 4 shows the distribution of age groups for KGUV shoppers. It can be seen that 73% of respondents are young adults (between 18 and 45 years). When asked about occupation, almost 60% respondents were students, and others are residents or visitors coming from the suburbs located in close vicinity to KGUV. The students of the educational land use on KGUV and from the school and university campuses located on the boundary of KGUV constitute a significant proportion of the shoppers.

Figure 5 shows the distribution of frequency of shopping trips for KGUV shoppers. A zero frequency of shopping trip includes the respondents who visited KGUV for the first or second time. A major share of respondents visited the shopping centre twice or thrice in a week. This indicates that students use the shopping centre for their convenience (day to day) shopping. The residents of KGUV made 3.5 trips a week; likely due to close proximity of the shopping centre. These trips contribute to internal trips which are mostly made by walking.

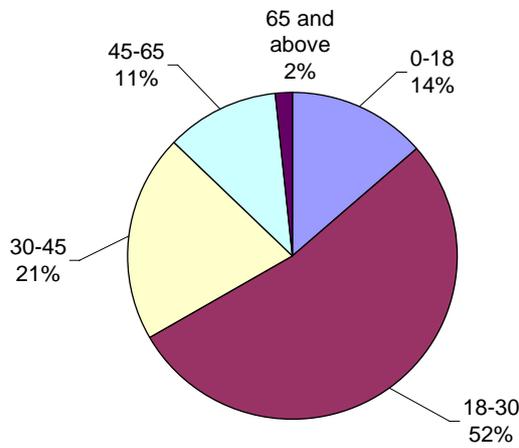


Figure 4 – Distribution of age groups

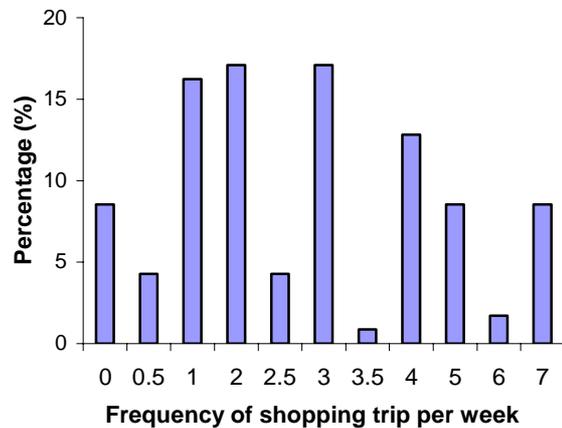


Figure 5 – Frequency of shopping trip

### 8.1.2 Mode share

Mode share is an important variable to be considered when assessing travel characteristics. Trip details about car occupancy and the public transport routes used were obtained from the respondents. The distribution of mode share for shoppers is shown with the help of a pie chart in Figure 6. The public transport trips include trips made by bus and train; no ferry trips were observed as there is no ferry terminal nearby KGUV. The mode share distribution shows that more than 70% of the shoppers travelled by sustainable modes of transport, including public transport, walking and cycling. This is a good indication of success of TOD in terms of transport mode share.

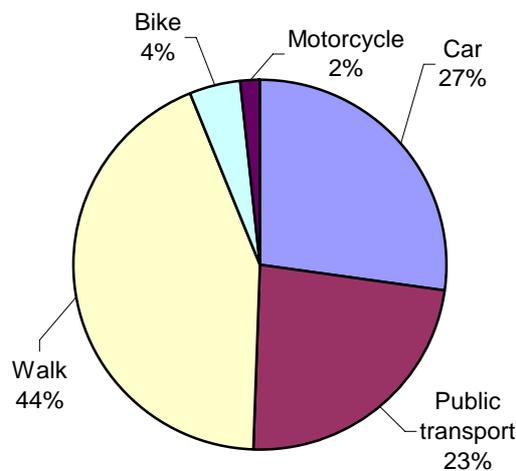


Figure 6 – Mode shares for KGUV shoppers

### 8.1.3 Trip length

The trip lengths for each shopping trip were calculated and are plotted in the trip length frequency distribution shown in Figure 7.

The average trip length was observed to be 7.6 km. About 17% of trips were internal trips and 83% trips were external trips. The minimum trip length was theoretically 0 km for internal trips and maximum trip length was 118 km. It can be interpreted from Figure 7 that most trips are from suburbs located in close proximity to KGUV.

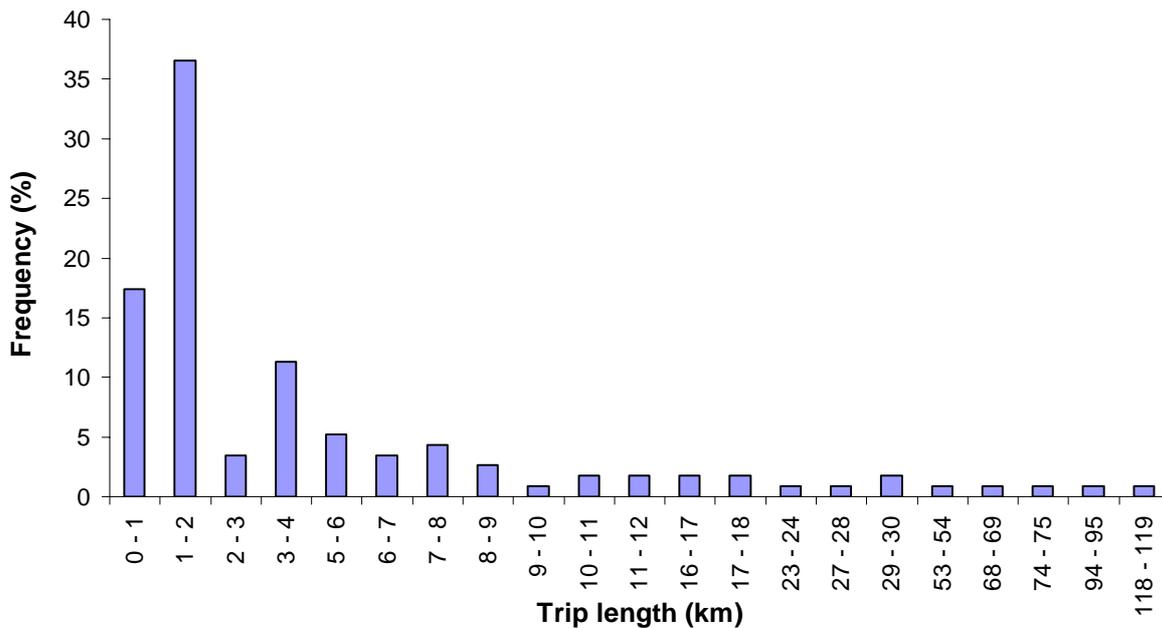


Figure 7 – Trip length frequency distribution for KGUV shoppers

## 8.2 Analysis of employee travel data

### 8.2.1 Demographics

The employee survey was carried out in two parts; a data set of 127 responses (10% of the population) was obtained for professional employees while 39 responses (31.2% of the population) were obtained for the retail shop employees. Table 2 lists some demographic characteristics of KGUV employees. It can be observed that the proportion of female workers is higher than that of male workers. The retail shops provide an employment opportunity to students studying in KGUV or the adjacent university. These work trips undertaken by students are most likely combined with their educational trip, hence can be counted as intra-zonal trips. The shopping centre has some street level family owned businesses; this gives the feeling of a village atmosphere and made the shopping centre more attractive. The proportion of driver’s licence holders is high for both categories of employees, but particularly so far the professional employees.

The distribution of age groups (in Figure 8) shows that the retail shop employees have more young workers. The difference in age groups can be related to the type of work as the retail shop employees do mostly hospitality or customer service and professional employees do research and education oriented work.

Figure 9 compares the frequency of work trips per week. Almost 31% of retail shop employees work on weekends and professional employees work typically five days a week.

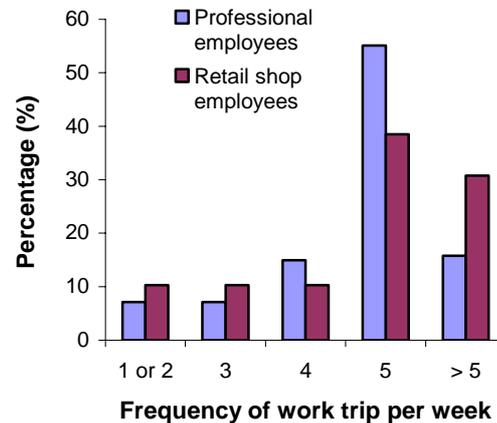
**Table 2 – Comparison of demographic characteristics for employees at KGUV**

Demographics	Professional employees	Retail shop employees
Male	37.4%	38.5%
Female	62.6%	61.5%
Employed full time	63.5%	53.8%
Employed part time	10.4%	7.7%
Employed part time and student full time	10.4%	25.6%
Self employed	0%	12.8%
Research students <sup>1</sup> full time	14.8%	0%
Employed full time and student part time	0.9%	0%
Valid driver’s licence holders	92.1%	84.6%

<sup>1</sup> Research students are treated as employees



**Figure 8 – Comparison of distribution of age groups**



**Figure 9 – Comparison of frequency of work trips per week**

**8.2.2 Mode share**

Figure 10 and Figure 11 show the distributions of mode shares for work travel for employees working at retail shops and at educational land uses (professional employees) respectively. The retail shop employees travelled by three modes of transport; car, public transport and walk only, with car comprising 60% of mode share. This high mode share for car travel is attributed to odd (late night or early morning) working hours and less frequent public transport or no public transport during off peak times (see Muley et al., 2007).

On the other hand, the professional employees travelled by many modes of transport with less than 50% by car, one third by public transport, and almost 20% by walking or cycling. The professional employees travelled typically during peak hours when public transport provision is best, which might be a reason for its higher mode share. Cycling was also a high mode share for this group, which is attributed to good quality access and trip-end facilities (such as showers and cycle lockers).

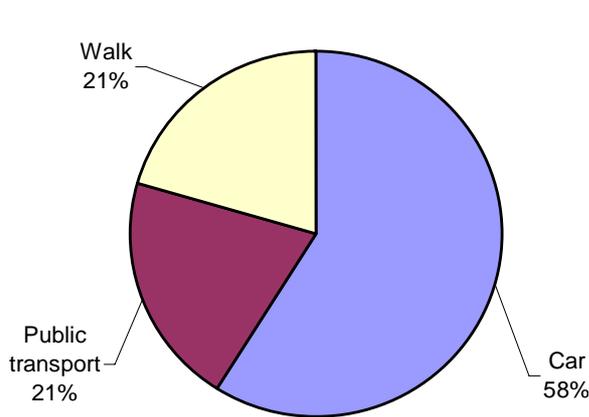


Figure 10 – Mode shares for retail shop employees

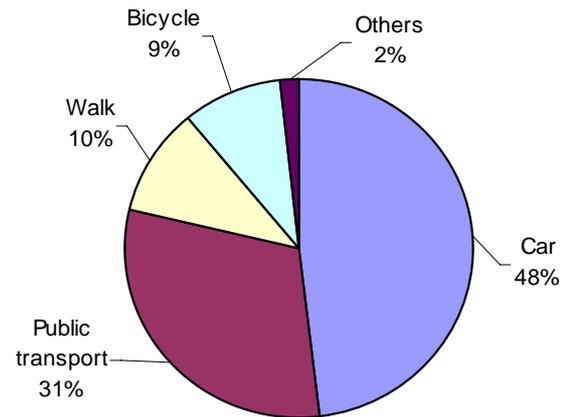


Figure 11 – Mode shares for professional employees

### 8.2.3 Trip length

Figure 12 shows trip length frequency distribution for professional employees. The trip length frequency distribution for retail shop employees is not shown due to the smaller sample size. Table 3 lists the maximum, minimum and average trip lengths for KGUV employees. Though the average trip length for both types of employees is similar, the maximum trip length varies more than two fold. The longer trip lengths for professional employees are attributed to the presence of specialised educational facilities (including a university extension comprising a research centre).

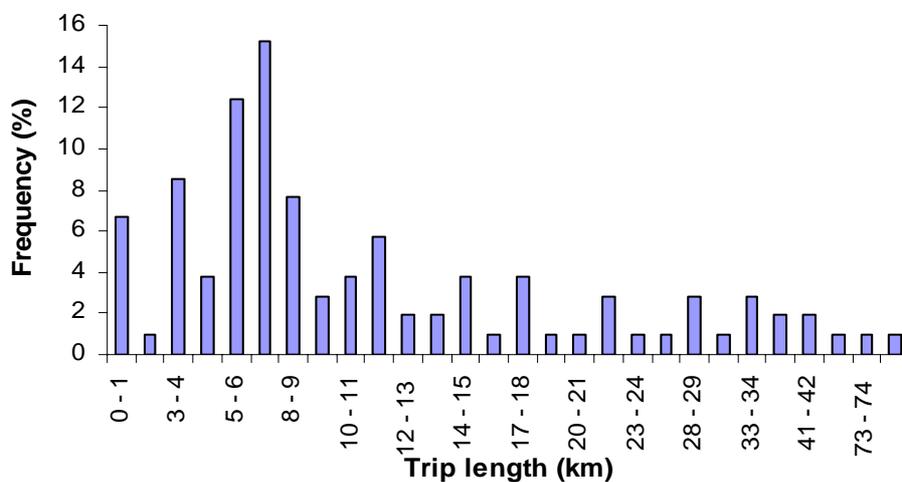


Figure 12 – Trip length frequency distribution for professional employees

Table 3 – Details of trip length for employees at KGUV

Trip Length	Professional employees	Retail shop employees
Minimum trip length	0.9km	0km
<b>Average trip length</b>	<b>13.2km</b>	<b>11.02km</b>
Maximum trip length	104km	44.2km

## 9 Transport issues related to TOD from respondents' perspectives

After analysing the perceptions and comments of shoppers and employees about the transport facilities at TOD, the following issues were noted:

- Respondents placed a strong emphasis on the frequency and reliability of public transport service to afford a mode shift from car to public transport. The travel time difference and the absence of a direct public transport link<sup>1</sup> were also pointed out as the main reasons for using personalised modes of transport. This indicates that for a TOD to be successful from a transport point of view, a good quality direct public transport service is required from various destinations, not only from the CBD.
- As this area lies near the CBD, some respondents suggested having a “loop service” (with minimum or no cost) running at a 15 minute interval from the CBD to KGUV which also connects the nearby Roma street railway station to make KGUV more attractive. (It is noted that, after this survey, TransLink implemented a high frequency bus service, Route 66, along the busway system between Kelvin Grove busway station to the east of KGUV, through the CBD via Roma Street railway station and on to the inner southeast suburb of Woolloongabba.)
- A suggestion was made to give pedestrians priority at intersections in KGUV to reduce the walking time and make walking more attractive.
- Demand for bike facilities indicated that a good bike path is needed not only in KGUV but also from home to the work place, as riding a bike on Brisbane’s roads was described as “scary”.
- A professional employee also suggested having strictly enforced parking restrictions on the local streets in KGUV with increased parking cost at the work place and incentives for employees who travel by sustainable modes of transport from the organisations to promote the more sustainable modes of transport.
- Shoppers suggested that the shopping centre should be an “all the time and one stop shop” and have more retail outlets aimed at young customers.
- One suggestion was to shift the residential area further away from commercial and retail area.

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<sup>1</sup> Brisbane has a hub and spoke public transport network with most services intersecting at the CBD. One often needs to change service, particularly for buses, to access a destination on the other side of the CBD. The imposition of a seat change has been reported to make public transport less attractive.

## 10 Conclusions

Visitor travel surveys were conducted for Kelvin Grove Urban Village (KGUV), as a case study Transit Oriented Development (TOD), to help in determining their travel characteristics.

### 10.1 Implementation of surveys

The observations and experiences from conducting the travel surveys are summarised below:

- Multiple choice questions were quicker for respondents to answer, compared to questions related to perceptions, which are usually designed on a rating scale.
- A shoppers' survey had to be designed as a quick response survey in order to maximise responses. A good response rate is likely to be obtained for a questionnaire of one A4 page sheet or questions listed in the form of a table.
- A pen and paper based survey was preferred over a computer based interview (CAPI) for employees at retail shops. A higher response rate was obtained for personal interview surveys compared to send back survey forms.
- An internet based survey was suitable for professional employees as in this case they had good access to internet at their workplace.
- Similar to the observation made by Shih and Fan (2008), the newest internet based survey technique obtained the lowest response rate for professional employees when compared to other survey techniques, which includes personal contact. The response rate for internet based surveys was found to be dependant mainly on the age, and the profession of the respondents.
- Personal contact was the best way to approach to the respondents, although this approach is time consuming and somewhat expensive.

### 10.2 Preliminary data analysis

The preliminary findings from the analysis of travel data of visitors at KGUV are listed below:

- More shoppers used the more sustainable modes of transport of walking, cycling and public transport (71% in total) compared to KGUV employees (42% of retail shop employees and 50% of professional employees). The Journey to Work data obtained in 2001 showed that 76.3% work trips were undertaken by car by Brisbane employees (Australian Bureau of Statistics, 2001 census data). The KGUV mode share values demonstrate sustainable travel choices when compared to the work trip values for Brisbane, lending support to the transportation claims of TODs.
- Students, KGUV residents and residents of nearby suburbs constituted a major share of shoppers. In many cases, this shopping trip was combined with a work trip, school trip or recreational trip performed by walking (44%) due to integrated land uses.
- Average trip lengths of 7.6 km, 13.2km and 11.02km were observed for shoppers, professional employees and employees at retail shops respectively. This indicates that KGUV attracts shoppers from nearby suburbs and employees from suburbs located farther afield. Higher values of trip lengths were observed for professional employees due to the specialised type of employment.

- The analysis of travel data survey indicated that only 8% of private car trips undertaken by professional employees were of less than 1km length, and no private car trips less than 1 km were made by shoppers and retail shop employees. The shoppers, retail shop employees and professional employees showed 50%, 15%, and 10% trips of less than 3 km. From analysis of SEQ travel surveys (QT, 2005) it is noted that in Brisbane 10% of private car trips are of less than 1km and 34% of private car trips are of less than 3km. All other percentages, excluding the shoppers' trips of less than 3km length, show positive signs towards reduced private car usage for the TOD, further supporting the sustainable transport claims of TOD.
- The distribution of frequency of shopping trips shows that there were more regular shoppers at the KGUV shopping centre, while the distribution of frequency of work trip shows that almost 31% retail shop employees work more than 5 days in a week and most professional employees work 5 days a week.
- The determination of travel characteristics of employees depend on the type of employment opportunities at a TOD and shopping trips depend on the scale of shopping centre.
- The main factors that appear to influence public transport mode choice include frequency, reliability, travel time and direct public transport connectivity.

### 10.3 Looking ahead

The travel data collected through this visitors' survey will be used for calibrating the travel demand model being developed for this TOD. First the focus will be on calculation of trip generation rates for each land use type and comparing with values used in traditional modelling. Later the focus will be shifted to trip distribution and mode choice modelling. It is proposed to calculate travel demand details like trip generation rate and trip distribution equations separately for each mode of travel using a spreadsheet tool being designed for analysing TODs.

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