Curtin University

Department of Urban and Regional Planning

Transit usage and car ownership in a Transit Oriented Development: A case study of Subi Centro, Perth, Western Australia

Presented to partially fulfil the requirements of Master of Urban and Regional Planning

Planning Dissertation 611

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November 5, 2010

School of Built Environment

Declaration

I, Steven Barlow, declare that this dissertation represents my own research and does not use the work of others except where cited within the text. The ideas, views and opinions expressed are mine personally and do not represent those of my employer or Curtin University of Technology.

Signed:

Date: November 5, 2010
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Abstract

Despite the increase in the cost of motoring over the past thirty years, the automobile remains a dominant force in Perth’s urban landscape. Reducing automobile travel is therefore seen as both a key part of many urban environmental initiatives and as part of a larger effort to restore neighbourhoods to friendlier and more attractive times. Transit oriented development (TOD) has become a key urban growth planning paradigm in Perth as it is acknowledged as a means to reduce the reliance on private vehicle travel whilst encouraging economic revitalisation, community diversity and travel alternatives. Because of the combination of accessibility and the potential for the concentration of urban activities, Perth’s inner city has been a favoured location for government sponsored TOD demonstration projects.

This dissertation discusses the rationale for, and the key principles of, TOD and explores how two of its key elements, namely reduced car ownership and increased transit usage, have fared in the Subiaco Redevelopment Authority’s Subi Centro TOD. An overview of the Subi Centro redevelopment, including a demographic analysis, provides the context for the research. An extensive review of national and international literature on TOD is undertaken followed by the presentation of the results of a survey of 51 Subi Centro residents. Information gathered from interviews with key staff members from the Subiaco Redevelopment Authority and the City of Subiaco has been used to supplement the findings of the resident survey.

Indicative evidence gathered suggests that the two key objectives of increased transit use and decreased car use and ownership by residents in Subi Centro have not been met. A number of key factors inhibiting the effectiveness of Subi Centro as a TOD were found, including the availability of free parking both in the station precinct and at residents’ workplaces; a lack of significant density around the train station; and the fact that a large proportion of residences are located on the outer extremity of the train station’s walkable catchment.

Recommendations stemming from the research include proposed policies on land assembly, TOD implementation, performance targets, infrastructure investment, parking controls and housing variety. Gaps found in the current understanding of the delivery, functioning and performance of TOD in the Perth context are also highlighted with recommendations made for future research.
1 Introduction

1.1 Overview

Policy makers and researchers around the world are showing increased interest in the relationship between land use, transport and sustainability with the interest being driven primarily by the understanding that conventional land use and transport planning is not sustainable (Falconer and Richardson 2010; Williams 2005). In the context of Perth, Western Australia (WA), conventional land use and transport planning has resulted in the city becoming characterised by low density, segregated land uses and car dependence (Falconer and Richardson 2010). As a response, the redevelopment of underutilised inner city areas, especially those with train stations, has been touted as a much needed step towards improving the sustainability of metropolitan Perth with international and Australian research indicating that higher population density, mixed land use and high quality transit provision results in significant shifts in travel behaviour (Cervero 1996; Newman and Kenworthy 1999). Despite having genuinely good intentions of reducing travel demand through planning, such policies have not had unequivocal support, either in the research community (Gordon and Richardson 1997; Troy 1996), at the local government authority (LGA) level, or amongst the general Perth metropolitan population with many plans for such redevelopments completely stymied or sufficiently watered down by local councils and/or resident groups.

Towards the end of the twentieth century, changing demographics, lengthening commutes and sterile urban development patterns prompted people to seek walkable neighbourhoods in locations close to central Perth, but the built environment was not able to meet the demands of the market. The deindustrialisation of Perth’s inner city opened up a significant amount of land in East Perth, Northbridge and Subiaco and the WA Government identified these sites as ideal locations for implementing a program of urban renewal through transit oriented development (TOD) in order to cater for the growing demand and to demonstrate to the private sector that these kinds of developments could be successful and profitable. In an effort to ensure that state planning objectives were achieved in these locations, the state government enacted legislation to create ‘redevelopment authorities’ tasked with revitalising the sites in accordance with sustainable development principles. Locations designated as ‘redevelopment areas’ were removed from the relevant LGA planning schemes and the power to plan, subdivide, develop and sell land within the
redevelopment areas was given to the relevant redevelopment authority. Upon completion of the redevelopment, the land is ‘normalised’, that is, returned to the relevant LGA.

The first of the redevelopment authorities created by the state government in 1991 was the East Perth Redevelopment Authority. The Subiaco Redevelopment Authority (SRA), which created the ‘Subi Centro’ TOD, followed in 1994. The redevelopments achieved by these authorities are widely regarded as being highly successful as they have transformed largely underutilised industrial and/or dilapidated working class residential areas into upscale residential and/or mixed use locations. In the process, they achieved their aim of changing the perceptions of the development industry and the general public about the value of mixed-use, medium-density development in Perth (Keys 2010). Despite the claimed success, there is some debate about whether they have fully achieved the benefits of TOD, especially with regard to the level of transit use and car ownership by residents, hence the purpose for this research.

1.2 Research aims and objectives

This dissertation focuses on the SRA’s Subi Centro TOD and will aim to determine if it has achieved its planned sustainable transport outcomes, primarily increased public transport use and reduced car use and ownership by residents. The key objectives associated with the research aim are as follows:

1. Provide an overview of the SRA and the Subi Centro development including key demographic characteristics;
2. Conduct a comprehensive review of literature relating to TOD in order to outline the rationale for, and principles of, TOD so as to contextualise the empirical research;
3. Identify the travel choices of Subi Centro residents by undertaking a resident survey and discuss the potential implications of these findings, if any;
4. Make policy recommendations for future TOD in Perth based on the findings of the research at Subi Centro; and
5. Make recommendations for further research where gaps in the current understanding have been identified.

The goal of this dissertation is not to question Subi Centro’s success in immensely improving the area’s aesthetic quality and in transforming a previously underutilised area into a highly valued and desirable location to live in, as evidenced by its extremely high median house price. Rather, the aim is to gather some sort of indicative evidence of Subi Centro residents’ level of transit use and car ownership and use and compare it with the average levels found in the surrounding Subiaco LGA, the Perth metropolitan area and with the findings from other TOD studies. The findings will provide the
basis for a discussion on whether the redevelopment has actually achieved two of its key objectives, which were to increase transit use and decrease car use and ownership.

1.3 Scope and study area

The scope of this dissertation will be limited both by geographic area and by research area. The geographic study area is defined by the boundary of the Subi Centro development (Figure 1) which is bounded by Salvado Road in the north, Haydn Bunton Drive in the east, Roberts Road and Hay Street in the south and Hart Lane and Jersey Street in the west.

![Figure 1. Subi Centro redevelopment area. Source: Subiaco Redevelopment Authority (2010).](image)

The research scope will be limited to focusing on the transport related elements of a TOD, primarily car and transit use; providing a demographic profile of the Subi Centro population; and identifying the level of public transport use and car ownership/use by Subi Centro residents.

1.4 Dissertation structure

This chapter provided an overview of the dissertation and the development of Subi Centro as a TOD. It also provides a brief summary of the historical development of Perth’s inner city area in order to put the Subi Centro development in context. Research aims and objectives were then stated along with a description of the scope and study area.
Chapter 2 provides a brief overview of the historical development of metropolitan Perth, describing how the city has developed to its current urban form. Subi Centro is described in more detail including a statistical/demographic analysis.

Chapter 3 presents a detailed review of national and international literature on TOD and provides an outline of the principle elements of TOD. The literature review also provides the basis for the formulation of the Subi Centro resident survey, the outline and results of which are presented in chapter 5.

The research methodology is discussed in chapter 4. It introduces and describes the case study analysis and presents the research strategy along with a description of each of the research instruments used. The chapter is completed with a discussion of the research rationale and the difficulties/problems encountered in undertaking the research.

Chapter 5 discusses the resident survey rationale, method, design and approach. The limitations of the survey are acknowledged and a summary of the results are presented under the categories of respondent information, public transport usage, shopping trips, journey to work, opinions and household information.

Significant findings of the various research components are discussed in chapter 6. Patterns of difference depending on residence location within Subi Centro are also examined as are the overall findings as they relate to the research objectives.

In chapter 7, the aims and objectives are reiterated and key conclusions are drawn from the research. Subsequently, key policy recommendations are outlined along with recommendations for future research in order to fill identified knowledge gaps.
2 The evolution of development in Perth

2.1 From settlement to present day

In the early stages of its development, Perth was densely settled and had a mix of land uses with a clear distinction between the city and the country. Transport was by foot, boat or animal power with short distances between homes, services and places of employment (Newman and Kenworthy 2006). Over time, the compact form of the city became associated with ‘undesirable’ land uses, congestion and pollution. In response, segregation rather than agglomeration was implemented by city officials towards the late 1800s and the establishment of the Fremantle-Perth-Guildford rail line in 1881 provided the initial corridors of development and allowed settlements to be sited a significant distance from the city centre whilst still affording residents reasonable access.

The introduction of tram services in 1899 led to the development of linear settlements along transit corridors away from the train line (Selwood 1979). The advent of the bus, and more importantly the widespread adoption of the automobile, as mode options meant that growth no longer needed to be coordinated around public transport lines and cars soon became symbolic of freedom, mobility and opportunity (Laird and Newman 2001). The movement away from the city centre was aided by road building and housing development on cheap, greenfield land on the city’s urban fringe. Public transport and later cars provided mobility potential however Falconer (2008) contends that affordable housing and easy access to finance for land purchase, combined with the desire for personal space away from the central city, gave reason to be mobile.

Perth’s current urban form and land use pattern is closely linked to its transport network which is largely based on mobility by private car, leaving relatively few housing options for those preferring a less driving intensive lifestyle (Curtis 2006). This, combined with increasing road traffic congestion, the impact of increased car generated emissions on people’s health and the environment, and the rising cost of petrol have caused the amenity of local neighbourhoods and the quality and extent of public transport to become high profile subjects in Perth in recent years.

2.2 Planning for sustainability

The rise of sustainable development as a planning imperative has seen the philosophy of separating land uses turn full circle, with planners advocating land use mixing and intensification at key nodes
as a means of providing for sustainable population growth, increasing vibrancy and reducing car dependence (Levinson and Krizek 2008; Newman and Kenworthy 1999). As a result, recent planning policies, strategies and guidelines for Perth, including the draft *Network City: community planning strategy for Perth and Peel* and its successor, released in August 2010, *Directions 2031 and beyond*, have focused on channelling high density, mixed use development around Perth’s established activity centres, many of which are located around rail stations, in order to create more sustainable urban development and associated transport patterns (WAPC 2004, 2010).

*Directions 2031 and beyond*, strives to make Perth more sustainable by transforming it into a ‘connected city’ which consists of fairly self sufficient communities (activity centres) arranged in corridors linked by a ‘movement network’ consisting of integrated public and private transport networks (WAPC 2010). To achieve this goal, *Directions 2031 and beyond* promotes the use of more sustainable modes of transport for local and regional travel; it sets a target of 47 per cent of new development to occur within the existing urban area by increasing residential densities; and it promotes the mixing of land uses at key activity nodes (WAPC 2010). Despite this planning paradigm being present in a number of guises for some time, a cursory analysis of Perth’s train station precincts reveals a deficiency of conforming development including insufficient densities, limited mixing of uses and limited accessibility. The implementation of ‘Redevelopment Authorities’ is therefore an attempt by the state government to combat this lack of sustainable, transit-oriented development in key locations.

2.3 The Subiaco Redevelopment Authority & Subi Centro

The *Subiaco Redevelopment Act 1994* provides the legislative framework for the Subi Centro redevelopment. It removed a designated area of land from the control of the local authority (the City of Subiaco) and established the SRA with planning and development control of the land. The Act gives the SRA the power to resume, plan, develop and sell land within its jurisdiction and makes it responsible for all aspects of the revitalisation, from master planning, to land development, investment attraction and community development (Subiaco Redevelopment Authority 2010). The model was very similar to that of the East Perth Redevelopment Authority which was established three years earlier and had started to achieve some notable results with regard to the redevelopment of underutilised inner city land. The SRA’s mandate was to build on the development success being achieved in East Perth and further Perth’s inner city revitalisation in Subiaco.
The SRA aimed to transform 80 hectares of former industrial land directly adjacent the Subiaco train station into a vibrant and sustainable medium to high density mixed use community. Land assembly for the project was facilitated by the majority of it being Crown land with 44 per cent being City of Subiaco endowment lands, 5 per cent in private ownership and the remainder being transport reserves and State Government owned land (Subiaco Redevelopment Authority 2010).

The Commonwealth Government provided around $30 million (1994 $) of funding under the now defunct Building Better Cities program and the WA Government contributed around $100 million (1994 $) which together allowed for the environmental remediation works and the sinking of a portion of the Perth to Fremantle railway line through the area (Subiaco Redevelopment Authority 2010). The railway sinking was the catalyst for renewal as it made available a large area of land for the project and laid the foundation for a TOD which could take advantage of existing public transport infrastructure. The central tenet of investing in sinking the rail line was to enable high levels of development and the high levels of development were to increase patronage of the public transport infrastructure.

The bulk of the Subi Centro development is located to the west of Subiaco train station with its outer edge well beyond the 800 metre walkable catchment of the station (Figure 2).
The redevelopment has been ongoing for almost 16 years and approximately 86 per cent has been completed. The areas shaded in green in Figure 3 are those that have been normalised. The remaining sites are still under the control of the SRA.

Figure 2. SRA area (orange) with 400m (red) and 800m (blue) catchments around Subiaco station. Source: Author.
2.3.1 Comparison of key demographic characteristics

2.3.1.1 Population size and density

At the last census in 2006, Subi Centro’s population was relatively small at around 1,500 people. Its average household size of 1.86 was slightly smaller than that for the Subiaco LGA and it was significantly smaller than the average household size in the Perth metropolitan area. Whilst Subi Centro’s density was almost double the average for Perth, it was actually slightly lower than the average for the Subiaco LGA despite being planned to be a higher density than surrounding areas. Subi Centro’s density was also well short of Newman and Kenworthy’s (2006) contention that the fundamental threshold of urban intensity needed to reduce automobile dependence is around 35-40 persons per hectare. This level of density also correlates with findings by Stead (2001) that travel is lowest in areas where population density is between 40 and 50 persons per hectare.

Table 1. Population size, household size and density 2006

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Household size</th>
<th>Density/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subi Centro</td>
<td>1,487</td>
<td>1.86</td>
<td>21.69</td>
</tr>
<tr>
<td>Subiaco LGA</td>
<td>16,379</td>
<td>2.0</td>
<td>23.79</td>
</tr>
<tr>
<td>Perth Metro</td>
<td>1,445,078</td>
<td>2.5</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Source: City of Subiaco (2010a) and ABS (2007).
2.3.1.2 Age

Subi Centro’s age structure was found to be dominated by two age groups, 18-34 year olds and people aged 60 years or over. The former age group consists of young adults living at home with parents, and young professionals who are either renting as a couple, living in a group share house or purchasing. The 60+ age group consists largely of retirees and those who have downsized from larger homes in areas further from the city centre. Subi Centro is also well located to medical facilities which are an attraction for the 60+ age demographic. The 0-17 age group in Subi Centro had the largest discrepancy compared to the Subiaco LGA and Perth metropolitan areas indicating a significant lack of families with children.

### Table 2. Age structure 2006

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Subi Centro</th>
<th>Subiaco LGA</th>
<th>Perth Metro</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-17</td>
<td>6.7</td>
<td>15.6</td>
<td>23.9</td>
</tr>
<tr>
<td>18-34</td>
<td>29.1</td>
<td>32.7</td>
<td>24.0</td>
</tr>
<tr>
<td>35-49</td>
<td>20.0</td>
<td>21.0</td>
<td>22.5</td>
</tr>
<tr>
<td>50-59</td>
<td>16.8</td>
<td>13.2</td>
<td>13.0</td>
</tr>
<tr>
<td>60+</td>
<td>27.3</td>
<td>17.5</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Source: City of Subiaco (2010a) and ABS (2007).

2.3.1.3 Individual and household incomes

Income figures specifically for Subi Centro were not able to be sourced but figures for the Subiaco LGA show an area of a higher socio-economic status than the Perth metropolitan area average, as both individual and household incomes are significantly higher (Table 3). Anecdotal evidence for Subi Centro suggests that its median weekly income would be even higher than that of the Subiaco LGA.

### Table 3. Median weekly individual and household incomes 2006

<table>
<thead>
<tr>
<th></th>
<th>Individual income</th>
<th>Household income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subi Centro</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Subiaco LGA</td>
<td>$646</td>
<td>$1,567</td>
</tr>
<tr>
<td>Perth Metro</td>
<td>$513</td>
<td>$1,192</td>
</tr>
</tbody>
</table>


2.3.1.4 Social mix through housing diversity

Until 2003, housing in Subi Centro catered almost exclusively to a high income demographic due to limited housing diversity, creating an elite enclave. In response to calls from the City of Subiaco for a more diverse social mix within Subi Centro, the SRA adopted a Housing Diversity Policy in October 2002 (City of Subiaco 2010b). The policy committed the SRA to actively seek to encourage a mix of affordable and social/community housing to accommodate the widest possible range of incomes. Under the policy, affordable housing in Subi Centro is provided either by the State Government (for
low-income and special needs groups), developed by the private sector as owner-occupied affordable housing through the SRA/Department of Housing Shared Equity Scheme, or delivered as affordable rental housing (Subiaco Redevelopment Authority 2010). A target of between 10 and 15 per cent of all housing units are to be affordable housing, with approximately half of these to be social or special needs housing.

Because land releases within Subi Centro did not include the delivery of affordable housing until 2003, the SRA estimates that the current rate of affordable housing in Subi Centro is only around 8 per cent, well below the target figure (Keys 2010).

**2.3.1.5 Housing tenure**

The proportion of residences owned outright in Subi Centro is similar to the average for the Subiaco LGA and Perth metropolitan area. The proportion being purchased is slightly higher than the average in the Subiaco LGA but significantly lower than the Perth metropolitan area whilst the proportion being rented is similar to that in the Perth metropolitan area but significantly less than in the Subiaco LGA. The ‘Other’ category shows the biggest discrepancy from the average for both the Subiaco LGA and Perth metropolitan area. No explanation as to what constitutes ‘Other’ was provided by the City of Subiaco Community Profile or the ABS Census table. One possible explanation could be a large number of house sitters or people living rent free however it is unlikely that this would account for all of the 13.4 per cent.

<table>
<thead>
<tr>
<th>Table 4. Housing tenure 2006</th>
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<tr>
<td></td>
</tr>
<tr>
<td>Owned</td>
</tr>
<tr>
<td>Being purchased</td>
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<tr>
<td>Rented</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Not stated</td>
</tr>
</tbody>
</table>


**2.3.1.6 Car ownership**

Subi Centro residents showed a high level of car ownership with only 4 per cent of households not owning a car. In comparison, the Perth metropolitan area average had almost double the proportion of no car households and the Subiaco LGA had almost four times the proportion of no car households. Subi Centro also had a much higher proportion of two car households than the
remainder of the Subiaco LGA and was on par with the Perth metropolitan average despite its significantly higher level of accessibility to local facilities and public transport.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>One</th>
<th>Two</th>
<th>Three +</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2006</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subi Centro</td>
<td>4%</td>
<td>48%</td>
<td>39%</td>
<td>9%</td>
</tr>
<tr>
<td>Subiaco LGA</td>
<td>15.4%</td>
<td>46.6%</td>
<td>29.7%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Perth Metro</td>
<td>7.4%</td>
<td>35.8%</td>
<td>39%</td>
<td>17.8%</td>
</tr>
</tbody>
</table>

Source: City of Subiaco (2010a), ABS (2007) and Subiaco Redevelopment Authority (2009).

### 2.3.1.7 Real estate values

Subi Centro has found extraordinary success in the marketplace as it has not only sold well, but real estate prices have increased dramatically. Figures solely for properties sold within Subi Centro were not able to be sourced, but to provide an indication as to the affluence of the area, the median house price in the suburb of Subiaco, of which Subi Centro makes up a sizeable proportion, at June 30, 2010 was $1.3 million compared with only $485,000 for the Perth metropolitan area at the same time (REIWA 2010).

![Figure 4. Subiaco vs. Perth metro region annual median house sale price](image)

*Median sale price covers 12 months to reference quarter.*

Source: Real Estate Institute of Western Australia (2010).
3 Literature review

3.1 Transit oriented development rationale

There is significant literature on the principles and practices of TOD (Cervero and Arrington 2008; Curtis 2005; Falconer and Richardson 2010; Hemily 2004; Levinson and Krizek 2008; Newman and Kenworthy 1996; Renne 2007). A central principle of TOD is the integration of mixed land uses with the transit network to produce relatively denser, mixed use development in precincts around transit stations (rail or bus) in order to ensure the fullest possible development potential is realised, car usage and ownership is reduced and that the public transport facilities are well utilised by residents, visitors and workers (Housing and Urban Research Institute Western Australia 2007). The public transport node is generally surrounded by a core or ‘inner radius’ of high density development and activity with a gradual reduction in density and activity up to an 800 metre radius, as shown in Figure 5.

![Figure 5. Schematic structure of TOD. Source: Falconer and Richardson (2010).](image)

A range of studies on the benefits of high density, mixed use development centred around rail stations have shown that improving transport accessibility at the neighbourhood level, primarily by orienting medium to high density mixed use development within 800 metres or ten minutes walk of major transit stops, reduces car-based travel by encouraging more local trip making via non-motorised modes and increases public transport patronage (Bannister 2005; Cervero 2005; Curtis
2006; Ewing 1997; Lansdell and Martin 2009; Levinson and Krizek 2008; Mees 1994; Naess 2005; Newman and Kenworthy 1996; Westerman 1998). This, combined with the desire to make cities and communities more sustainable has prompted governments the world over to enact planning policies and strategies aimed at achieving these outcomes in transit precincts, largely resulting in TOD.

3.2 Elements of TOD

Falconer and Richardson (2010) contend that whilst each TOD should be designed to fit the characteristics of the local area and take into account particular constraints, there are ten key elements that all TODs should have:

1. A walking scale.
   - To provide for a reduced dependency on cars within the TOD precinct. Indicated by reduced levels of car ownership and use.
2. An active and defined centre.
   - With a mix of land uses including destinations and activities that need to be accessed on a regular basis, both in the daytime and at night.
3. Quality streets and public places.
   - To create a sense of place within the public domain.
4. A diverse mix and a sufficient size.
   - Significantly denser than traditional suburban development with a mix of residential and other ‘destination’ uses, all within walking and cycling distance to a major transit stop.
5. A public transport hub.
   - An integrated and good quality public transport system that combines multiple transport modes with high public transport trip generating land uses located within walking distance of the transit stop.
6. Low speed car access.
   - Streets with good connectivity and traffic calming features to control vehicle traffic speeds.
7. An appropriate level of on-street car parking.
   - A reduced amount of land devoted to parking compared with conventional development.
8. Well located public off-street car parks.
   - Public car parks should be located at the periphery of the TOD or out of sight of the main activity areas.
9. An appropriate level of walking and cycling infrastructure.
   - A neighbourhood designed for cycling and walking, with adequate infrastructure and facilities and attractive street conditions.
10. Limited barriers to accessibility.
    - Active street frontages that promote vibrancy and safety with a permeable street network and robust buildings that may facilitate changing land uses over time. Avoid putting major roads with more than one lane of traffic in each direction through a TOD.
Whilst it is recognised that all of these elements or principles of TOD are interconnected, this dissertation will limit its focus to those elements which primarily influence the level of transit use and car ownership and use by residents in the Subi Centro TOD with the aim being to determine whether the claimed benefits, in relation to these particular elements, have in fact occurred.

3.3 The search for a sustainable urban form through TOD

Sustainable development seeks to create an urban environment which maximises economic development and social equity whilst minimising the impact of negative externalities upon the natural environment (Renne 2007). Despite the concept of sustainable development being clear, the formula for achieving a sustainable city is less clear. Authors from a range of disciplines including planning professionals, academics, economists, engineers, sociologists and governments have all weighed in to the debate on how a sustainable city is best achieved (Breheny 1996). Debate has focused on whether cities should follow a compact form of development (Nijkamp and Rienstra 1996; Newman and Kenworthy 1996) or a dispersed form (Gordon and Richardson 1997; Troy 1996). A compromise position has also been put forward proposing ‘decentralized concentration’ or a ‘polycentric’ form of development based around activity/transport nodes (Breheny 1996; Ewing 1997; Schwanen, Dijst, and Dieleman 2004). Recent arguments have stated that there are a number of approaches to city form rather than one universal model, outlining the impacts of and relationships between such concerns as travel behaviour, accessibility and the integration of land use and transport on city form and travel behaviour (Bannister 2005; Cervero 2005; Curtis 2008; Naess 2005; Newman and Kenworthy 2006).

3.3.1 Land use and transport integration

The literature investigating the influence of the integration of land use and transport on travel behaviour continues to expand rapidly. A number of areas have received considerable coverage, including the influence of population size, density, land use mix, local urban form, balance of jobs and housing and also wider socio-economic variables, such as the influence of income and household composition. The underlying theme of much of the research is to evaluate the potential contribution of integrating land uses with transport to reduce car based travel and within this, Hickman and Bannister (2005) identify three important concepts:
• Locating a mix of uses in close proximity to each other, thereby making multiple trip chaining possible;
• Reducing journey distances; and
• Encouraging a modal shift to public transport, walking and cycling.

3.3.1.1 Land use zoning and mixing

Grant (2002) states that congestion, pollution and generally poor urban conditions led to modern town planning in the early twentieth century with land use zoning one of the strategies used by planners to ensure ‘orderly urban development’. Zoning aimed to protect basic residential amenity by separating uses seen as incompatible in proximity. The rapid change in industrial practice and lifestyle preferences over the course of the twentieth century caused zoning to lose some of its relevance. Curtis (2005) claims that the pursuit of ‘orderly urban development’ in Perth through the practice of zoning has placed residences some distance from services, facilities and places of work, contributing to the heavy reliance on car travel and the creation of large expanses of dull, lifeless suburbs.

Mixed land uses, especially in the inner city, has therefore become part of a strategy for replacing disappearing light industrial uses in order to increase urban vitality. The rationale is that compatible uses tend not to create conflict and can help to create synergies. For instance, adding high density residential uses to commercial and office districts may prove compatible because residents who live near businesses may patronize or work in those businesses. Their presence could enliven the area after work hours, creating new business opportunities.

Grant (2002) claims that another benefit is that if people are able to live near places where they can shop, work, or play they could reduce car ownership and vehicle trips, increase pedestrian and transit use, and thus alleviate the environmental consequences associated with automobile use. This is confirmed by Cervero (1996) who found that having grocery stores and other consumer services within 100 metres of residences encouraged commuting by mass transit, walking and bicycling, controlling for such factors as residential densities and vehicle ownership levels. However, when retail shops are beyond 100 metres yet within 1,500 metres of residences, Cervero found that they tended to encourage auto-commuting, ostensibly because of the ability to efficiently link work and shop trips by car.
In WA, land use (re)integration has only recently been pursued as a policy imperative in an attempt to create vibrant, higher density mixed use neighbourhoods which are more people-friendly and sustainable. Directions 2031 and beyond’s solution is a more prominent role for activity centres and corridors with good neighbourhood design to encourage walking and cycling and reduce travel demand through the local provision and placement of a mix of facilities and services (WAPC 2010). An essential tenet is that activity centres be (re)developed to incorporate higher densities of both residential and employment uses and have a greater mix of uses. It is suggested that if centres are linked by a high quality public transport service, people will significantly reduce their use of automobiles for both commuting and non-work travel (WAPC 2010).

3.3.1.2 Reducing journey distances
Cervero (2005) contends that in the majority of cases, travel demand arises because people want to get to places. Where they go and how they get there depends on their resources; the transportation network in place; their access to a car, bus or rail system; the needs, demands or desires of their families; their demand for the goods that travel can access; the price of fuel, transit fares, etc (Crane 2000). Bannister (2005) suggests that if many destinations (work, education, shopping, etc) are located closer to points of origin (residences) and a greater choice of mode of travel is provided to people, then this would reduce the need to travel long distances, increase the probability of journeys being made by non-motorized modes and produce more efficient bi-directional travel flows. This link between land use and transport has also been identified by many other authors who promote the integration of the two in order to achieve greater levels of accessibility and ultimately, sustainability (Curtis 2006; Mees 1994; Westerman 1998).

3.3.1.3 Mode shift and density
Research by Cervero (1996) suggests that people are less likely to drive to work and more likely to use transit if there is a mix of land uses in the area, if nearby housing is of medium to high density, if they live close to the central city, if they have a short commute, and if they have few cars. The effects of higher densities and car ownership were the strongest of all with car ownership levels declining with neighbourhood density and the presence of non-residential land-uses in the area. This research is supported by Rickwood and Glazebrook (2009) who contend that local area density is, if not a causal factor, at least a useful proxy for predicting car ownership and mode choice. They found
3. Literature review

that the general spatial structure of the city and location within the city was an even more important factor.

Falconer and Richardson (2010) claim that residents of a TOD should use active modes more frequently for local trips, make more trips locally, make more regional trips by public transport and fewer trips by private motor vehicle overall than residents of conventional neighbourhoods because high residential densities clustered close to employment promote a critical population mass for walking, cycling and public transport. These same densities foster retail businesses aimed both at destination shopping and local residential requirements. Research on the effect of density on travel behaviour is somewhat mixed however, with some studies finding minimal (or no) effects of density after controlling for demographic effects (Crane and Crepeau 1998) while others find significant effects (Miller and Soberman 2003). It is therefore most likely that density as a single variable is not the causal factor affecting travel behaviour; it is more likely only one of several interacting factors.

3.3.2 Car dependency

Arrington and Cervero (2008) claim that TOD communities have a much lower car dependency than standard developments which is likely due to two major reasons: (1) residential self-selection, wherein for lifestyle reasons people consciously seek out housing near transit stops for the very reason they want to regularly take transit to work and other destinations; and (2) the presence of retail sited between residences and stations that promote ‘rail-pedestrian trip-chaining’; and car-shedding (i.e., the tendency to reduce car-ownership when residing in efficient, transit-served locations).

A study of TODs across California by Lund, Cervero, and Willson (2004) found that residents were up to five times more likely to commute via transit compared to conventional areas. Chatman (2006) found that residents and employees near train stations have a higher non-auto share of commuting and non-work travel which was mainly attributed to the level of convenience (or inconvenience) of using a car.

3.3.3 Car parking

TOD, particularly around train stations, provides an ideal opportunity to reduce standards for car parking provision for all land uses due to the presence of alternative transport options (Arrington
and Cervero 2008; Lansdell and Martin 2009). There are multiple benefits from less car parking, including more land available to revenue-generating land uses (Arrington and Cervero 2008), less fragmentation of urban form, less surface pavement resulting in more green space (Khan and Bajracharaya 2009), and a reduced reliance on private vehicles, creating a reduction in car ownership and use (Lansdell and Martin 2009).

Lansdell and Martin (2009) contend that the availability of parking within residential and commercial precincts is a fundamental factor which impacts upon mode choice and trip generation. This is confirmed by Crane and Crepeau (1998), who found that parking availability was positively associated with the proportion of car trips. Stead (2001) also found evidence to indicate a link between parking restraint and average travel distance per person with travel distance being lower in areas with parking restrictions. Despite this, Cervero and Arrington (2008), claim that the widest knowledge gaps on the effects of TOD on travel demand are in estimating vehicle trip generation rates. Therefore, most TODs include an amount of parking which does not take into account that a rail stop is nearby and as a result, their potential traffic reducing benefits are muted.

An example of relatively scarce parking supply for both residents and visitors leading to a high level of non-car transport can be found in the Boston central area. Lansdell and Martin (2009) explain that limited parking restricts both vehicle ownership and use, which combines with an efficient public transport and pedestrian network to dramatically decrease the utility of the car. A cap on the parking supply actively reinforces the need for public transport development to encourage the central area’s continued economic growth.

### 3.3.4 Accessibility

A transit patronage study in Toronto by Mees (1994) showed that good accessibility to an efficient public transport system will increase its mode share by more than population density alone. Lansdell and Martin (2009) take this concept further by claiming that to be successful, public transport associated with TODs must provide accessibility advantages over the private car with the uptake depending not only on accessibility ‘to’ the system but also ‘of’ the system, i.e. whether the system can efficiently reach employment precincts and other trip attractors in the region.
3.3.5 Demographics

Many studies have suggested that urban form affects individual travel patterns but Stead (2001) and Schwanen, Dijst, and Dieleman (2005) argue that socio demographics are equally, if not more, important. They contend that urban form impacts may not be equally important for all sectors of the population and the variation in socio-economic characteristics increases the difficulty in establishing the precise relationships between land-use characteristics and travel patterns. This adds complexity to the comparison of travel patterns in different areas. For example, Stead (2001) found that residents of higher socioeconomic status households travel further than residents of lower socioeconomic status households despite the built environment.

Kitamura, Mokhtarian, and Daidet (1997) suggest that relationships between travel outcomes and neighbourhood characteristics might be driven by often unmeasured, independent demographic characteristics and attitudes. Crane (2000) cites a number of researchers who have found that higher density communities have higher levels of transit use and lower automobile travel but Stead (2001) claims that the link between density and travel behaviour is not precisely clear because of the intervening relationship between density and the demographic characteristics of certain households. Disentangling the effect of urban design and land use from the effect of demographics is therefore crucial to discovering if residents in dense neighbourhoods travel less because their neighbourhood is dense or if dense neighbourhoods attract people who prefer not to travel by car.

3.4 Summary

The literature review has found that there is a general consensus amongst researchers that a well designed TOD can bring substantial benefits through lower car ownership and use, increased transit use and more walking and cycling for local trips when compared to conventional development. Whilst most TODs have taken different forms as a result of being designed to fit local characteristics, it has been found that there are a number of key features or elements that should be present in all TODs.

One of the main rationales for TOD is to achieve sustainability through land use mixing which reduces journey distances due to a greater number of uses being in close proximity; allows trip chaining to eliminate some trips; and encourages a mode shift to walking and cycling because more destinations are in close proximity to residences. These elements are made possible by increasing
the density of the central area of the TOD to provide the level of population required to support the greater number of uses in close proximity.

Even though a TOD may contain all of the necessary elements, success is still not guaranteed with the socio-economic status of the area’s residents shown to play a large part in the functioning of the TOD. Debate continues as to the level and extent of that influence with contrasting findings by different authors creating a knowledge gap.

As stated in section 1.2, the focus of this research is to determine if Subi Centro has achieved its planned sustainable transport outcomes, primarily increased public transport use and reduced car use and ownership by residents. This is considered to be important given that Subi Centro is regarded as a ‘premium’ development, so the primary data gathered will aid in determining if the socio-economic status of residents is having the biggest influence on travel patterns or whether there are other factors at play which are just as influential.
4 Research methodology

4.1 Rationale

Subi Centro is arguably Perth’s most highly regarded TOD with the SRA (2010, Subiaco Square) claiming on its website that it has delivered an integrated mixed use development with a range of social, economic and environmental benefits that:

“represents one of Australia’s best examples of transit oriented development”.

Despite these claims, few independent studies have been done in Subi Centro to actually determine its level of success in terms of sustainable transport (i.e. if the project has actually achieved increased train patronage, more walking and cycling and reduced car ownership and use). This knowledge ‘gap’ has provided the rationale for this research.

4.2 Case study analysis

As outlined in section 1.2, the research undertaken was guided by a general research proposal with a number of key objectives stemming from that overall proposal. Neuman (2006) suggests that this is an integral part of the development of a research project and should be used to guide the methodology design.

The methodological approach chosen for this research is a case study analysis of Subi Centro. A case study was chosen to give focus to the research and to provide a boundary whilst still allowing the exploration of issues both within and across the case (Punch 2005). Limiting the focus of the research solely to Subi Centro allowed for an in-depth understanding of the area and made the project feasible in the given timeframe. Analysis within the case study area was also limited to residents only as a more expansive analysis (visitors and workers) would have been too unwieldy and, according to Punch (2005), likely to have resulted in superficial perspectives if adequate resources weren’t available to undertake the extent of the research within the given timeframe.

The case study analysis aimed to identify one or more conclusions that could answer or explain the research question and associated objectives; identify areas for further research; and produce a number of policy recommendations which may be applied to other Perth TODs in order to help ensure that future TODs achieve planned outcomes.
4.3 Research strategy – mixed method research

A number of authors highlight the benefits of mixed method research, including Burns (2000), Neuman (2006), Richards and Morse (2007) and Thomas (2003). Creswell and Plano Clark (2007) claim that the complexity of research problems calls for answers beyond simple numbers in a quantitative sense or words in a qualitative sense. Therefore, a mixed method approach to the research has been followed, with both qualitative and quantitative methods employed as outlined in Table 6.

Table 6. Research tools used

<table>
<thead>
<tr>
<th>Research Instrument</th>
<th>Method</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>Site analysis</td>
<td>Mixed</td>
<td>Familiarisation with the built environment and layout of the study area to allow a rating to be made of each TOD element.</td>
</tr>
<tr>
<td>Statistical analysis</td>
<td>Quantitative</td>
<td>Gain an understanding of the demographic make-up of Subi Centro residents and their travel behaviour based on ABS figures. Compare and contrast with figures for residents in the remainder of the Subiaco LGA and the Perth metropolitan area.</td>
</tr>
<tr>
<td>Literature review</td>
<td>Qualitative</td>
<td>Determine what TOD is, what benefits it provides and what elements should be present in most TODs.</td>
</tr>
<tr>
<td>Resident survey</td>
<td>Quantitative</td>
<td>Measure magnitude of demand for car and transit use by residents along with attitudinal measurement and a basic demographic analysis.</td>
</tr>
<tr>
<td>Practitioner interviews</td>
<td>Qualitative</td>
<td>Insight into how Subi Centro was developed and any issues that have become apparent from a developer (SRA) and manager (City of Subiaco) perspective.</td>
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</table>

Mixed method research uses quantitative and qualitative methods to build on and validate each other (Creswell and Plano-Clarke 2007). In this sense, information gathered in the practitioner interviews has been used to further understand any trends picked up in the resident survey. The research methodology has been chosen to provide an overview of the general research question through statistical and thematic analysis of the key issues. Creswell and Plano Clark (2007) explain that this is the most common approach to mixing methods and is known as ‘triangulation design’. Its purpose is to obtain different but complementary data on the same topic in order to best understand the research problem and it has the benefit of seeing the general research question from different viewpoints. This design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data (Creswell and Plano-Clarke 2007).
There are strengths and limitations to both methods of research which are noted by a number of authors (Bell 1999; Burns 2000; Thomas 2003). The methodological justification for using both qualitative and quantitative methods is to capitalise on the strengths of each approach and at the same time compensate for the weaknesses of each.

4.3.1 Site analysis

By itself, a site analysis would provide limited value, but combined with the other research methods, it adds considerable understanding of the built environment in Subi Centro. Quantitative information in the form of field notes and photographs were taken in the conducting of site observations and these supplement the findings of the desk-top analysis which used web based data sources such as aerial photographs and maps. The main focus of the analysis was to rate how well each of Falconer and Richardson’s ten elements of TOD have been delivered in Subi Centro. The ratings are presented in section 6.1.

4.3.2 Resident survey

The resident survey that was undertaken is discussed in detail in chapter 5.

4.3.3 Practitioner interviews

Two interviews were conducted. The first was via telephone with Natalie Goode, the former Manager of Planning Services at the City of Subiaco. Despite recently departing the City of Subiaco to take up a position at the City of Fremantle, it was determined that Natalie was the best person to interview given her significant background knowledge and understanding of the development and its associated issues. The second interview was a one on one interview with Ryan Keys, the SRA’s Planning Manager.

Both interviews were semi-structured with a number of open-ended questions, whose wording and order could, and were, changed at will during the interview. It was felt that the lack of predetermined categories of analysis would allow a more in-depth exploration of a range of issues and perspectives with interviewees having the ability to provide their opinion and thoughts in their own terms without being forced into set responses (Patton 1990). According to Burns (2000), this approach is more flexible than structured interviews using closed ended questions as it permits a more valid response from the informant’s perception of reality. In order to ensure validity, interview
questions were carefully considered in order to extract the required information from the interviewees. There is a risk however that the interviewees only provided the perspective that they believed was wanted to be heard or they may have deliberately withheld information for various reasons (e.g. commercial, institutional or political).

The SRA interview focused on the process of TOD design including the development of plans for the integration of land uses with the transport infrastructure, car parking provision standards, anticipated demographic mix, residential densities and sustainable transport targets. The City of Subiaco interview explored more general concepts and issues with regard to the Subi Centro redevelopment including a discussion of any issues that had arisen from the revitalisation, such as the impacts of the new demographic mix on the local area and any noteworthy changes to local transport patterns.
5 Subi Centro resident survey

5.1 Rationale

A survey of 51 Subi Centro residents was undertaken in order to ascertain such things as their travel choices to get to, from and around the area and opinions on further development in the station precinct. A quantitative survey instrument (Appendix 1) was chosen as the main component of the research methodology because Thomas (2003) suggests that this would be useful in revealing the current status of a target variable within a particular entity (in this instance the travel behaviour of Subi Centro residents). Also important in the context of this time-limited project, Bell (1999) states that questionnaires are a good way of collecting certain types of information quickly and relatively cheaply.

The resident survey sought to elicit a range of behavioural and attitudinal data from Subi Centro residents and to interrogate the key themes identified in the literature review (e.g. that TOD residents drive less and take transit more). The survey also sought to determine whether travel behaviour in Subi Centro correlates with the findings of studies undertaken in other TODs. The surveys were designed to provide a useful snapshot of Subi Centro residents’ travel behaviour and to hopefully serve as a pilot for a possible broader travel behaviour survey covering a larger proportion of Subi Centro residents as well as workers and visitors in the area.

5.2 Methodology

The surveys collected demographic and socio-economic data at both a personal and household level. The dataset includes information on personal travel characteristics like trip purpose, frequency, mode choice, parking, etc; personal information on age, gender, average income, employment status; and household and socio-economic characteristics like vehicle ownership, number of licensed drivers, dwelling type, etc.

5.3 Survey design

Most questions are fixed alternative, multiple choice and were written to be easily understood. When constructing the response sets for the questions, careful attention was paid to ensure that the categories were accurate, exhaustive, mutually exclusive and uni-dimensional (Sarantakos 2005). The surveys were carefully designed with care taken in question-writing and sequencing in order to
increase legibility and consistency (Bell 1999). Hay (2005) states that a survey instrument will gain richer data when incorporating different styles of questions including closed questions, open questions and scaling techniques so all of these were included in the survey instrument.

Sensitivities with regard to certain personal information were also respected when specifying possible responses, with broad ranges given as options. For example, the age group of a respondent was asked instead of exact age and income brackets were used rather than an exact figure.

With regard to income, respondents were asked for individual income rather than household income so as not to distort the results when dealing with a group or shared house. For example, household income would provide an accurate indication when dealing with predominantly traditional family structures but would provide an inaccurate indication if there is a large number of group/shared houses. In this instance, a household figure of three modestly paid singles living together would give the appearance of a wealthier household than is actually the case.

5.4 Piloting

Frazer and Lawley (2000) state that piloting proposed questions is vital to ensuring a robust survey design and to increase its validity and reliability by allowing a determination of whether the answers will likely provide the information sought. The survey was piloted with six respondents which allowed for every question to be tested for relevance against the research objectives listed in section 1.2 and also for clarity and simplicity. Lessons learnt from the pilot include:

- The placement and wording of sensitive questions was adjusted.
- Question sequence was refined.
- Time constraints on some respondents meant that more time consuming questions were removed to ensure that the survey lasted less than ten minutes.
- The wording of some questions was altered to provide more clarity.

5.5 Sampling

Thomas (2003) states that surveys involve gathering information about the current status of some target variable within a particular collectivity, then reporting a summary of findings. In this instance, the target variable can be defined as travel behaviour and the collectivity is the case study area, Subi Centro. According to Burns (2000, 82):

“the concept of sampling involves taking a portion of the population, making observations on this smaller group and then generalising the findings to the larger population”.

Travel surveys can collect detailed information about travel patterns and preferences at both a personal and household level, but the expense of collection meant that only a very small subset of all residents within Subi Centro could be surveyed. As it wasn’t feasible to engage all residents, a sample that included a broad cross-section of the population was considered vital to reducing bias in the results and to ensure that a valid generalisation could be made. The sample needed to reasonably reflect the proportion or relative frequency of characteristics in the defined population (as determined by information from the ABS’s 2006 census data). ‘Stratified sampling’ was used to determine the make-up of respondents for this survey instrument. Neuman (2006, 231) describes stratified sampling as:

“a random sample in which the researcher first identifies a set of mutually exclusive and exhaustive categories, divides the sampling frame by the categories, and then uses random selection to select cases from each category”.

Burns (2000) claims that stratified sampling offers increased possibility of accuracy by ensuring all groups are represented in the sample in similar proportions as they are in the overall population. This has been achieved in this survey by reviewing census data about the characteristics of the Subi Centro population and then randomly selecting respondents who display a good balance of those characteristics. The characteristics taken into consideration when choosing respondents for the survey were:

- Age group;
- Gender;
- Employment status and type; and
- Income.

5.6 Approach

5.6.1 Administration

A total of three ‘cells’ in two different precincts within the study area as defined by the SRA scheme map (Figure 6) were surveyed: Precinct 4 Salvado Road in the north-west and the two ‘cells’ of Precinct 7 Price Street, the larger cell in the west and the smaller cell in the centre. A random intersection was chosen within each of the cells and a personally administered survey was conducted at roughly every third residence in a clockwise direction. The procedure was followed until eight surveys were conducted in each the two cells of Precinct 7 (16 in total) and 35 in Precinct 4 as it is the largest of the cells.
Precincts 4 and 7 were chosen as they are fully developed and contain primarily townhouse style residences, making them easy to get access to. Precincts 1 and 5 contain primarily gated buildings which are difficult to access and Precinct 2 has not yet been fully developed. Precinct 3 contains primarily office buildings (with some residential above) and Precinct 6 is open space. Precincts 8 and 9 are not yet developed.

5.6.2 Sample size

A stratified random sample of 51 Subi Centro residents aged 18 and above was completed. The sample size of any survey will have a direct effect on the validity of the results. As identified in Table 1 (section 2.3.1.1), there were 1,487 people living in Subi Centro in 2006. A conservative estimate of one per cent annual population growth since 2006 provides a 2010 population figure of 1,547. At the 95 per cent confidence level, this requires a sample size of 308 respondents to provide statistically
valid results at a confidence interval of 5. However, time and cost limitations have led to a revised sample size of 51 at a confidence interval of 13.5 (Creative Research Systems 2010). At the 95 percent confidence level, a sample of 51 does not provide conclusive data, but it does provide indicative trends that can offer a sound base for the qualitative research component and to draw some inferences/conclusions.

5.6.3 Timeframe
Eight resident surveys were conducted on a Thursday evening and 43 were conducted on a Saturday. All were conducted in the month of September 2010.

5.6.4 Analysis tool
To simplify the analysis of raw data, the survey was consecutively coded. Frazer and Lawley (2000) state that coding is vital for efficient analysis of the data, in order to understand trends, correlations and test hypotheses. Microsoft Excel was used to manage the data as its ability to sort data in lists allowed for flexible trend analysis.

5.7 Survey aims
The analysis of responses had the following aims:

1. To outline the ‘face value’ aggregate attitudes and travel behaviour of Subi Centro residents.
2. To highlight any differences in attitudes and behaviour from what would realistically be expected of someone living in a TOD location (according to the literature).
3. To identify, where possible, any change of attitude or behaviour since moving to Subi Centro.
4. To determine the level of transit use and car ownership of those surveyed.
5. To determine any differences in travel behaviour between the three residential cells surveyed.

5.8 Limitations
In addition to the sampling limitation noted in section 5.5, Muley, Bunker, and Ferreira (2008) state that in a traditional household survey, travel data is collected for residents of the study area and no travel data is collected for visitors or workers, but in a TOD, visitors and workers constitute a major share of trips, so these groups should also be surveyed. Given time and resource limitations, this has not been done in this research, but should be undertaken in the future. It is also reiterated that limited time and resources made it difficult to obtain a truly representative sample. Generalisations made from this research only relate to the subjects from which they were derived and this is a noted deficiency in the research.
5.9 Results

5.9.1 Respondent information

5.9.1.1 Age structure

A reasonably even spread of ages were surveyed with the 60+ age group being the most represented which is in keeping with the ABS figures presented in section 2.3.1.2. Of the 51 people surveyed, 33 were male and 18 were female and 41.2 per cent had lived in Subi Centro for more than five years.

![Figure 7. Breakdown of respondents by age and gender](image)

5.9.1.2 Employment status

Around 55 per cent of respondents worked full time with retirees the next largest category at 15.7 per cent.

![Figure 8. Employment status](image)
5.9.1.3 Income

The income bracket with the highest number of respondents was $0 - $49,999 (23.5 per cent) however only two of the twelve respondents in this category worked full time with the remainder either engaged in some form of study (university students living at home with parents), unemployed or retired. The next largest bracket was $150,000+ (21.6 per cent). In total, 47.1 per cent of those surveyed earned in excess of $100,000 per year and when only considering full time workers, this figure rises to 69.2 per cent.

Figure 9. Annual pre-tax income brackets of respondents

5.9.2 Public transport usage

5.9.2.1 By gender

Whilst almost 20 per cent of people surveyed used public transport at least five times per week, 27.5 per cent never used it and a further 13.7 per cent used it less than once a month. Men were found to be more regular users of public transport than women with 57.6 per cent of men surveyed using public transport at least once a week compared to only 22.2 per cent of women.

Figure 10. Respondent public transport use by gender
5.9.2.2 By age

People aged between 30 and 39 had the highest proportion of regular (at least once a week) public transport users at 62.5 per cent whilst the 60+ age group had the lowest proportion at 38.5 per cent. The 50-59 age group had the highest proportion of people that never used public transport at 44.4 per cent whilst the 60+ age group had the lowest proportion at 7.7 per cent. The 60+ age group had the highest proportion of occasional (one to three times a month) users at 53.8 per cent.

![Figure 11. Public transport use by age](image1)

5.9.2.3 By employment status

Respondents who were in full-time work travelled by public transport the least with 35.7 per cent never using it whereas 60.8 per cent of the remaining respondents used public transport at least once a week.

![Figure 12. Public transport use by employment status](image2)
5.9.2.4  By income

Lower income residents were only slightly more likely to take transit with 48.1 per cent of respondents that earned less than $100,000 per year stating that they used public transport at least once a week whilst 41.7 per cent of respondents that earned in excess of $100,000 per year said that they used public transport at least once a week.

5.9.3  Shopping trips

5.9.3.1  Nature of trip

47 of the 51 respondents surveyed did their regular/weekly shopping in Subiaco but more than two thirds said that they did that shopping as an individual trip rather than as a ‘chained’ trip (see 6.3.2).

![Figure 13. Nature of shopping trip](image)

5.9.3.2  Mode of travel

The primary mode of transport that people used to get to those shops was by driving with more than two thirds using this mode on most occasions and around a quarter regularly walking.

![Figure 14. Mode used for regular shopping trip in Subi Centro](image)
5.9.4 Journey to work

5.9.4.1 Distance travelled

Of the 41 respondents who worked or studied, three worked from home and almost half travelled less than five kilometres, with the majority employed in central Perth.

![Distance travelled](image1)

*Figure 15. Distance traveled to place of work or study*

5.9.4.2 Mode of travel

Of the 38 respondents that traveled to their place of work/study, 57.9 per cent traveled by private vehicle, 28.9 per cent took public transport and 10.5 per cent traveled by non motorised means.

![Mode](image2)

*Figure 16. Mode of travel to work/study*

A significant discrepancy is noted in the mode of travel when broken down by distance. Of the 20 people surveyed that travelled up to five kilometres to work, 40 per cent drove, 40 per cent took public transport and 20 per cent walked or cycled. Of the 18 people surveyed that travelled more
than five kilometres, 77.8 per cent drove, 16.7 per cent took public transport and 5.5 per cent took a taxi.

5.9.4.3 Parking
A total of 81.2 per cent of people that drove to work received free parking. When asked if they would use an alternative mode of travel if they had to pay for parking, half said they would or might and the other half said they would continue to drive. When broken down by distance, this result changes significantly with 85.7 per cent of people that drove less than five kilometres stating that they would or might take an alternative mode if they had to pay for parking. For those that travelled more than five kilometres, only 27.3 per cent stated that they would or might take an alternative mode if they had to pay for parking.

Of those that would continue to drive even if they had to pay for parking, 77.8 per cent travelled in excess of 10 kilometres to work and believed that taking public transport would take too long compared to driving as there was no direct public transport route.

5.9.5 Opinions

5.9.5.1 Station precinct development
The majority of respondents were neutral in their attitude to further development in the 400 metre radius of the Subiaco station precinct. Increased apartment/townhouse development received slightly more support than opposition, as did retail (though to a lesser extent), whilst people were slightly more opposed to further commercial/office development.
5.9.5.2 Transport

When asked for their thoughts on transport in Subi Centro, only two respondents thought that it wasn’t well served by public transport. Opinion was divided on the level of road traffic in the area with 47.1 per cent stating that it was a major issue, 11.8 per cent neutral and 41.2 per cent claiming that it wasn’t a major issue. Over 84 per cent of respondents thought that Subi Centro is easy to walk around; every respondent stated that they could easily walk to the train station from their place of residence; and over 90 per cent said that Subi Centro had good cycling facilities. When asked if one of the main reasons they lived in Subi Centro was to be close to the train station, only 31.4 per cent of respondents stated some level of agreement, with more respondents in strong disagreement (33.3 per cent). In total, 60.8 per cent stated some level of disagreement with the statement.

![Figure 17. Attitude to station precinct development](image)

When asked “what would make you drive less both within Subi Centro and when you travel outside the area”, only 17 respondents provided comment and nine of those said that they would drive less if there was an increased number of destinations in the metropolitan area serviced by public transport. Respondents commented that public transport was very good if you wanted to go
somewhere on or near a train line but it was difficult to travel anywhere else without a car. A few respondents stated that they would use public transport more if they had more time.

When asked if they had any suggestions to improve walking, cycling or public transport in Subi Centro, 19 respondents provided comment and the most common response was to provide a better pedestrian environment (five respondents). The next most common response (four respondents) was for more traffic calming followed by more and better cycle paths (three respondents).

5.9.6 Household information

5.9.6.1 Car use

In comparison with their last place of residence, 54.9 per cent of respondents stated that their household car use had reduced since moving to Subi Centro whilst 39.2 per cent estimated it to be about the same and almost 6 per cent said that it had increased.

![Figure 19. Household car use in Subi Centro compared to last residence](image)

It was also found that households with a greater number of cars had a higher incidence of driving to work. A total of 46.9 per cent of respondents that lived in a household with 2 or more cars drove to work whilst only 31.6 per cent of respondents from a one car household drove to work.
5.9.6.2 Housing tenure

Almost half of the respondents stated that their house was owned outright, which is almost double the proportion stated in the figures published by the City of Subiaco (2010a) shown in Table 4. The proportion of renters and mortgagers were reasonably consistent with the City of Subiaco figures.

![Figure 20. Subi Centro housing tenure](image)
6 Discussion of findings

6.1 Rating Subi Centro’s TOD elements

Falconer and Richardson’s (2010) ten elements of TOD (listed in section 3.2) were observed in Subi Centro in the site analysis and given a rating according to how well they had been delivered. As can be seen in Table 7, only two elements are considered to have been delivered well, six elements fairly and two elements poorly.

<table>
<thead>
<tr>
<th>Element</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A walking scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 An active and defined centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Quality streets and public places</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 A diverse mix and a sufficient size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 A public transport hub</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Low speed car access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 An appropriate level of on-street car parking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Well located public off-street car parks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 An appropriate level of walking and cycling infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Limited barriers to accessibility</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A good rating has been given to those elements that have been delivered well whilst a fair rating has been given to those elements that are either present but could be done better or have been done well in some areas but not at all in others.

Element 10 has been given a poor rating for two reasons. The first is because Roberts Road, which runs along the southern boundary of Subi Centro, is a high traffic road and it creates a physical barrier between the station precinct and Rokeby Road (the main retail street running through the original Subiaco town centre). The second is because the undeveloped Station Street Markets, AFC and Bosich sites (see Figure 3) act as a barrier to accessibility between the bulk of the residences and the station precinct, requiring people to either walk around them to access the station or walk through them and be subject to footpaths being cut off in some locations, forcing pedestrians onto
the road. Keys (2010) advised that the SRA is aware of this situation and it will be rectified once the development is fully complete.

The poor delivery of this element is likely to be a major contributor to the high levels of car use by Subi Centro residents, especially for local shopping trips. The lower than expected level of transit use is attributed to the long walk to the station from the outer edges of Subi Centro, combined with pedestrian severance; and also to the lack of destinations in the metropolitan area serviced by public transport (identified in 5.9.5.2).

6.2 Performance targets

The interview with Ryan Keys (2010) of the SRA confirmed suspicions that no specific target outcomes were set for Subi Centro with regard to reducing car use/ownership and increasing transit use, which Keys acknowledged as a shortcoming. In its 2008/09 Annual Report (Subiaco Redevelopment Authority 2009), the SRA reports on a number of Key Performance Indicators (KPIs) in order to determine the performance of the development. The KPIs for measuring sustainable transport in Subi Centro include:

- KPI 4A - measures public transport use.
- KPI 4Bi - measures car ownership.
- KPI 4Bii - measures method of travel to work.

Because no performance target was set for these KPIs, it is impossible to know if the development has achieved its objective of reducing car ownership and increasing public transport use. For example, for KPI 4A on page 23, the SRA provides a weekly passenger count figure for selected years at Subiaco station, claiming that:

“the increase in train passenger counts is reflective of greater public transport use in an area that is a well connected, Transit Orientated Development centre”.

The SRA’s figures are somewhat misleading as they include patrons attending football games at Subiaco Oval which distort the figures. The findings of the resident survey and peak period patronage figures in Table 8 (section 6.3.1) provide a more accurate account of station use by those that live in the area. These figures temper the SRA’s claim of a high level of public transport use which was acknowledged by Keys (2010) as a shortcoming that should be addressed by the SRA in future annual reports.
6.3 Travel behaviour

6.3.1 Public transport use

Being developed as a TOD, it would be reasonable to expect patronage of the train station by Subi Centro residents to be much higher than the average for Perth, somewhat higher than the Subiaco LGA and roughly on par with the levels found in the reviewed literature. However, the Subi Centro residents surveyed had a lower level of transit use when compared to figures for the Subiaco LGA and in the reviewed literature with less than 20 per cent of residents taking transit five or more times a week. Most notably, 27.5 per cent never took transit. Evidence to support the resident survey findings can be found in Table 8 which shows the patronage of Subiaco station for the 7am-9am peak period on an average weekday in March 2010. The patronage of Maylands station has been provided as a comparison as this station is currently being targeted for redevelopment into a TOD precinct but in contrast to Subiaco, only a very limited amount of development has occurred to date. Despite this, Table 8 shows the morning peak period patronage for Maylands is almost double that for Subiaco.

<table>
<thead>
<tr>
<th></th>
<th>Subiaco</th>
<th>Maylands</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00am - 7:59am</td>
<td>260</td>
<td>486</td>
</tr>
<tr>
<td>8:00am – 8:59am</td>
<td>212</td>
<td>356</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>472</strong></td>
<td><strong>842</strong></td>
</tr>
</tbody>
</table>

Source: Veaney (2010). Note: the data includes SmartRider initial and transfer boardings, cash initial boardings and estimated cash transfer boardings. PTA’s patronage business rules were applied to the cash sales.

The two stations are located a similar distance from Perth Station - Subiaco is 3.7 kilometres to the west on the Fremantle Line whilst Maylands is 4.5 kilometres to the north-east on the Midland Line. The area surrounding Subiaco station is denser than that surrounding Maylands station but this is balanced by Maylands station having slightly more car parking than at Subiaco. The main difference between the two is that unlike Subiaco, Maylands station does not have a feeder bus service. Given the similarities of the two areas, it would be reasonable to assume that Subiaco’s feeder bus service would provide it with a higher patronage figure than Maylands. However, Maylands’ higher patronage level is attributed to the significantly different demographic around Maylands which is discussed further in section 6.5.2.
6.3.2 Trip chaining

The literature review revealed that a benefit of TOD is the presence of retail sited between residences and train stations, providing the ability to ‘chain’ or link shopping trips with a walk trip to or from the station, thereby reducing the total number of trips made as well as the need to drive to the shops. The resident survey revealed that this is not happening in Subi Centro with more than two thirds of residents stating that they did their shopping as an individual trip and two thirds also stated that they drove to the shops despite living within walking distance. Two likely reasons have been identified to account for this situation. The first is because the residential precincts of Subi Centro that were surveyed were just that – residential only. No land use mixing occurs beyond the station precinct and these findings support Cervero’s (1996) assertion that shops located between 100 and 1,500 metres from residences encourage car use (see section 3.3.1.1).

The second reason is attributed to free parking. An underground car park adjacent the station has been established under the supermarket but parking for the first 90 minutes is free which encourages driving and is the likely explanation for the high proportion of car trips to undertake shopping by the residents surveyed (section 5.9.3.2) and why the trips are not part of a chained walk trip between the home and train station.

6.3.3 Journey to work

There are a number of reasons why people use different modes of transport to get to work. These include accessibility to affordable and effective public transport options; the number of cars available within a household; the travel distance to work; and the availability, and to a lesser extent cost, of parking. The survey results showed that commuting by modes of transport other than the car decreased as home-to-work distance increased. 60 per cent of those who travelled up to five kilometres to their place of work/study used a form of transport other than a private vehicle whilst only 16.7 per cent of those who travelled more than five kilometres took public transport, supporting Cervero’s (1996) assertion that people are less likely to drive to work if they have a short commute.

ABS census data on journey to work has been collected to supplement the information gathered by the resident surveys which has been further supplemented by information published in the SRA’s 2008/2009 Annual Report (Subiaco Redevelopment Authority 2009) and displayed in Table 9.
Census data for Subi Centro residents show a shift for work trips of 7.5 per cent away from private vehicle use and 0.6 per cent to public transport when compared to the Perth metropolitan area average. In comparison with the remainder of the Subiaco LGA, thereby largely eliminating income and geographical effects, private vehicle mode share is 12.6 per cent higher than the adjacent land area and public transport use is 6.3 per cent lower. This shows that despite the higher level of accessibility to transit, the proportion of Subi Centro residents that regularly use transit is lower than in the surrounding area.

Results from the resident survey contrast with the census data, as a much higher proportion of Subi Centro residents were found to take public transport to work, along with a much lower proportion taking private vehicles. This could be explained either by the fact that the survey was of a small number of residents and therefore statistically insignificant or it could be an indication that the travel behaviour of some residents is changing towards more sustainable options by making use of the infrastructure in place.

### 6.3.4 Bus services

Limitations on residents’ ability to travel to destinations (including workplaces) away from the train lines via non motorized modes of transport have highlighted a deficiency of local bus services for accessing these destinations. Residents indicated that the bus system is not well integrated with the train service and bus services do not service a number of desired destinations. Bus services in Subi Centro feed the train station and whilst this allows for good access along key spines such as Rokeby Road and Thomas Street, there remains an unmet need for connection to a wider network of destinations. Beyond the peak evening period, a lack of frequent transit services also means that...
travel to and from Subi Centro is car reliant with residents commenting on the difficulty of evening travel to destinations beyond walking distance. Such circumstances mean that for most residents, there remains an ongoing need to own a car despite living in a TOD.

6.4 Built environment

6.4.1 Parking

Subi Centro has been confronted with the issue of car parking in a location of high-value housing and businesses. Parking has been found to be a friction point both in residential and commercial areas with Goode (2010) believing that the problem stems from the predominant socio-economic group residing in the area:

“when you can afford to pay up to $2 million for a house, your friends aren’t likely to visit you by catching the train”.

This indicates potential for future difficulty managing parking in TODs that comprise mainly high-income households. Such high-value TODs are likely to occur in the inner and middle suburbs where high land values result in a mostly premium product offered to the market. The contradiction is that inner and middle suburb TODs are most suited to the lowest rate of car parking provision due to the possibility of higher densities and established transit links, services and facilities.

6.4.1.1 Residential

For an area well served by transit and close to a range of services and facilities, Subi Centro has a large amount of residential parking which supports multi car households. A number of residents even complained that there was not enough parking despite over 92 per cent of residences surveyed having two or more private parking spaces and the average was 2.1 private spaces per residence. This compares to a study of 17 TODs across four different cities in the United States by Cervero and Arrington (2008) which found that the average number of parking spaces per residence was 1.16.

Parking in Subi Centro’s residential streets is managed via a permit system whereby parked cars are required to display a permit in order to park contrary to signed restrictions. Households are issued with a residential parking permit for each household vehicle in excess of the number of on-site parking spaces at the residence. Each residence is also issued with two visitor parking permits. This system does little to discourage car ownership as it allows households to acquire more vehicles than
can be accommodated on-site in the knowledge that a residential parking permit will be provided free of charge for each vehicle in excess of on-site parking spaces.

![Figure 21. Typical residential street in Subi Centro](image)

Source: Author

Reduced parking standards are being implemented by the SRA in the Australian Fine China (AFC) site (Precinct 8 in Figure 6). Goode (2010) advised that this has been met with fierce opposition from local residents and the Subiaco Council on the grounds that it will increase traffic congestion in the local area and flood residential streets with parked cars due to the site’s location beyond the 400 metre radius of the train station (meaning residents are unlikely to walk to the train station); its proposed higher density compared to the remainder of Subi Centro; and the likely high socio-economic status of future residents (which are likely to have a high level of car ownership). Despite the objections, plans for the site have been approved and development has commenced.

6.4.1.2 Commercial

In addition to the free parking provided in the underground car park in the retail precinct, there is a reasonable amount of surface car parking in Subi Square (adjacent the station) which is in clear sight rather than being concealed (see Figures 22 and 23). This is detrimental to the amenity of the area as it separates the activity created within the station area from the commercial area. It is also contrary to Element 8 of Falconer and Richardson (2010) listed in section 3.2, which states that public car parks should be located out of sight of, or away from, main activity areas.
Figure 22. Surface car parking in Subi Square – aerial view.
Source: Near Map (2010).

Figure 23. Surface car parking in Subi Square – street view
Source: Author.

A study conducted by Holling (2008) found that businesses in Subi Centro’s station precinct were mostly of the opinion that the TOD had delivered little in terms of more pedestrians but had placed a strain on parking resources. Holling claims that businesses were opposed to reduced parking...
provision because the train station was not perceived to be an adequate trade-off for reduced car access (via less parking) as most businesses considered themselves to be in competition with suburban commercial precincts which are not subject to parking controls and therefore have free, ample car parking to attract customers.

Observations made in Subi Centro whilst undertaking this research determined that the perception of business owners as described by Holling (2008) is not without foundation. It was noted that there was only limited pedestrian movement between the train station and Subi Square as most pedestrians headed south towards the traditional Subiaco town centre. The station precinct and surrounds had considerable car traffic movement and the majority of pedestrian activity came from the underground car park and on-street parking areas, providing the reason for Subi Square businesses to be against parking reductions.

6.4.2 Density

The level of density around Subi Square is considered to be inefficient to generate adequate activity in the station precinct both for businesses and for train patronage. Keys (2010) explained that the SRA’s original intention was to develop the station precinct to a density rating of R100 in accordance with the Residential Design Codes (WAPC 2008). This was downgraded to R80 after the City of Subiaco was reluctant to support the higher density due to community concerns about parking, traffic, anti social behaviour, reduced real estate values, etc. Goode (2010) acknowledged that with hindsight, the City of Subiaco would now be more supportive of the R100 density around the train station as this is the most appropriate location for it.

In order to increase Subi Centro’s overall density and subsequently reduce car use and ownership and increase transit use, Keys (2010) advised that the SRA is developing Precinct 8, the AFC site, to a much higher density than the existing precincts. Both the City of Subiaco and many Subiaco residents strongly opposed the plans for much the same reasons as they opposed a similar level of density that was originally planned for the train station precinct. A key facet of their argument was that the densities proposed for the AFC site were out of proportion with the rest of Subi Centro and that future residents will not be able to reduce their car ownership as the site is too far from the train station for transit use to be a convenient and suitable alternative (Keys 2010). Ironically, they argued that this kind of density would have been better suited to the train station precinct.
AF opponents believed the site should be developed into townhouses with a similar density as that in the remainder of Subi Centro. Keys (2010) explained that the SRA’s view is that this approach would simply attract more of the same demographic and therefore the same trends of high car use and limited transit use would continue. By offering a completely different product to what is currently available in Subi Centro, the SRA hopes to attract a different demographic, one that is less averse to taking transit and reducing their car ownership and use.

6.5 Socio-economic characteristics

6.5.1 Income level and car ownership

The income results from the resident survey reaffirm the census data in section 2.3.1.3 showing that Subiaco, and in particular Subi Centro, is a high socio-economic status area. The literature review revealed that household income is one of the major influences on the number of cars per household which then influences the travel behaviour of residents despite the built environment. Arrington and Cervero’s (2008) finding that higher income households show a strong propensity for car ownership regardless of other factors isn’t entirely evident in Subi Centro, although it has been calculated on individual rather than household income which may have some effect.

The survey results show an average household car ownership rate in Subi Centro of 0.76 cars per person. For higher income respondents (those earning $100,000+ per year), the ratio was only 0.71. For lower income respondents (those earning less than $100,000 per year) the ratio was 0.80. Despite this slight discrepancy with the literature findings, Subi Centro’s average car ownership rate is still much higher than the average rate of 0.64 cars per person for the Perth metropolitan area (Australian Conservation Foundation 2010). This contrasts with Renne’s (2007) finding that TOD households exhibit lower car ownership in comparison to regional averages.

The SRA assumption that high levels of public transport use and corresponding lower levels of car use and car parking demand would occur in Subi Centro is at odds with the resident survey results indicating a higher level of car ownership than the Perth metropolitan area average. As identified in section 2.3.1.6, Subi Centro has a higher proportion of two car households and a lower proportion of no car households than the Subiaco LGA average. Clearly, there is a need in the longer term to reverse these trends, but given the high socio-economic status of residents, the relatively low
density of much of the development and the fact that a large proportion of residences are more than 800 metres from the train station, the high demand for car ownership and parking is likely to continue to exist without a behavioural change or other external influence (e.g. significantly increased fuel prices).

6.5.2 Social mix

The delay in the adoption by the SRA of a Housing Diversity Policy until late 2002 was largely due to Subi Centro residents’ opposition to social housing combined with the SRA’s desire to ensure Subi Centro’s economic (i.e. sales) success (Goode 2010). The SRA’s inaction on implementing a policy to address the lack of social mix within Subi Centro may have helped to increase real estate values, but it also helped to undermine its TOD credentials. For example, it could be argued that the lower income demographic that was kept out of the development would have likely owned fewer cars and been more regular users of transit. Evidence for this can be seen in Maylands (section 6.3.1) which has a much greater social mix than Subi Centro, including a much larger proportion of low to middle income households in the vicinity of the train station (Eastern Metropolitan Regional Council 2010).

6.5.3 Gender, age and employment status

The finding that men were more than twice as likely to be regular transit users than women is likely attributed to women’s concerns about safety, both on transit and whilst walking to and from it. This can be easily addressed by improving security and the perception of safety both on transit and in and around transit stations.

The 60+ age group had the highest proportion of occasional transit users which is attributed to the fact that a large proportion of this age group are no longer in full time work, thereby reducing their tendency to be regular transit users given they no longer have a need to commute on a daily basis. Most people surveyed in this age group stated that they tended to use transit for occasional trips into the central city to undertake ‘other’ shopping and for some social outings where convenient. The 60+ age group also had the lowest proportion of non-transit users which shows that seniors are amenable to taking transit, just more so on an occasional rather than regular basis. The PTA’s policy that permits pensioners to travel free on public transport between the hours of 9am and 3pm on weekdays may be also helping to influence that demographic to use transit.
6.6 Opinions

6.6.1 Residential self selection

There was some level of residential self selection apparent in Subi Centro but not to the extent expected. Of the 16 respondents that stated some level of agreement to moving to Subi Centro to be close to the train station, 15 of them said they took public transport at least once a week. However, over 60 per cent of all respondents stated that being close to a train station was not a major reason for moving to Subi Centro despite the development being planned and promoted as a TOD. Therefore, the findings in this research only partially correlate with Arrington and Cervero’s (2008) claims that people consciously seek out housing near transit stops for the very reason they want to regularly take transit to work and other destinations. This indicates that perhaps Subi Centro’s transit related features, aims and benefits weren’t adequately promoted to buyers by the SRA, despite Keys’ (2010) claims to the contrary.

Insufficient density in and immediately surrounding the station precinct is also likely to have played a part in reducing the appeal of the development to those wanting to locate near transit. Only a small proportion of the total number of residences in Subi Centro are within five minutes walk of the station precinct and the significant distance to the station has been found to be a major influence on the appeal of transit.

6.6.2 Further development

The residents surveyed were generally not happy about car dependence and liked the idea of TOD, but were not so keen on some of the elements of TOD. They seemed to harbour fears about density, traffic congestion and intense urban activity leading to reduced real estate values and amenity, along with increased crime and noise, supporting findings by Renne (2005). This was confirmed by Keys (2010) who commented that Subi Centro had suffered from the presence of households with suburban values in an urban setting:

“many people that came to live in Subi Centro had no problem buying into a higher density development due to anticipated financial benefits but they brought with them suburban intolerances to high levels of activity, mixed use and variety despite the development being promoted to purchasers as having these features”.
6.7 Influence of distance between station and residence

When reviewed at the precinct/cell level, noticeable differences in travel behaviour were evident which is attributed to the average distance of residences in each cell from the station/retail precinct. Precinct 7 central is the closest of the three cells surveyed to the station precinct at around 400 metres. Precinct 4 is an average of 700 metres away and Precinct 7 west is an average of 800 metres away (see Figures 2 and 6).

6.7.1 Demographics

All three cells showed similar traits regarding income however Precinct 4 had a higher proportion of full time workers (62.9 per cent) than the two cells of Precinct 7 (both 37.5 per cent). Given the findings in section 5.9.2.3, this may have some influence on travel behaviour however it is difficult to determine whether the influence is due to the employment status or the distance to the train station.

6.7.2 Public transport use

Public transport use was significantly higher in Precinct 7 central with 87.5 per cent of respondents using it at least once a week whilst 42.9 per cent of respondents in Precinct 4 used it at least once a week. Only 12.5 per cent of respondents in Precinct 7 west used it at least once a week. This revealed that the closer the residence was to the train station, the more likely the resident was to be a regular transit user.

6.7.3 Mode of travel to shops

In Precinct 7 central, half of the respondents regularly drove to the shops and the other half walked. In Precinct 4, 80 per cent drove and 20 per cent walked whilst in Precinct 7 west, 62.5 per cent drove and 37.5 per cent walked or cycled. This element wasn’t as clear cut as public transport use but there was still a positive influence of distance on car travel, i.e. the trend generally showed that the further the residence from the station/retail precinct, the more likely the resident was to travel there by car.

6.7.4 Residential self selection

Residents in Precinct 7 central were more likely to have chosen to live in Subi Centro to be close to the train station than residents in the other cells with 62.5 per cent stating some level of agreement when asked if one of the main reasons they moved to Subi Centro was to be close to the train station.
station. In Precinct 4, 25.7 per cent stated some level of agreement and in Precinct 7 west, 25 per cent stated some level of agreement. In keeping with findings in sections 6.7.2 and 6.7.3, residents who lived closer to the train station were more likely to have chosen to live in Subi Centro to be close to transit when compared to residents that lived in the outer areas of the development.

6.7.5 Car ownership
Residences closer to the train station showed a lower level of car ownership than those in outer areas of the TOD with the rate of car ownership in Precinct 7 central (0.75 cars per person) similar to that in Precinct 4 (0.73 per person). In Precinct 7 west, it was somewhat higher (0.89 per person). This indicates that a greater number of residents in areas closer to the train station may be substituting a second car for transit than those in outer areas of Subi Centro.
7 Conclusions and recommendations

7.1 Aims and objectives revisited

The aim of this dissertation was to determine if Subi Centro has achieved two of its planned sustainable transport outcomes, primarily increased transit use and reduced car use and ownership by its residents. The indicative evidence gathered and presented suggests that Subi Centro has not met these two key outcomes. This dissertation has also achieved three of its key objectives by:

1. Providing an overview of the SRA and the Subi Centro development including key demographic characteristics;
2. Conducting a comprehensive review of literature relating to TOD in order to outline the rationale for, and principles of, TOD so as to contextualise the empirical research;
3. Identifying the travel choices of Subi Centro residents and discussing the potential implications of these findings;

The final two objectives, making policy recommendations for future TOD in Perth based on the experience at Subi Centro and offering recommendations for further research, are presented in this chapter after a brief summary of the findings is listed.

7.2 Summary of findings

The key factors highlighted by this research which inhibit the effectiveness of Subi Centro as a TOD in terms of increased transit use and decreased car ownership and use are:

- The lack of a mix of uses within residential areas combined with unlimited parking in and around residences encourages car ownership and use.
- The availability of free parking in the immediate station/retail precinct encourages access by car.
- Free parking at workplaces makes driving more attractive than alternative modes.
- A lack of significant density around the train station has resulted in a lower level of pedestrian activity and transit use.
- The lack of continuity of development has negatively affected accessibility between the majority of residences and the station precinct (although this should improve once the development is fully complete).
- The large proportion of residences located more than 400 metres from the station/retail precinct has contributed to the low level of walking to access the station and shops and has also likely influenced the high level of car ownership and use.
- The limited coverage of the metropolitan public transport network combined with low frequencies has limited the ability of residents to reduce car ownership. This is a result of the low density, single use spatial structure of the city which limits transit’s effectiveness and necessitates car use.
- The predominantly affluent demographic was found to have some influence but not to the extent expected or found in other research. Higher income residents had slightly lower
transit use but they also had slightly lower car ownership so whilst an influence was present, it wasn’t as significant as distance from the station.

7.3 Conclusions

TOD has been an important part of urban policy in Perth since the early 1990s but it is not as prevalent as it could be or as effective as it should be and the resultant threat is that continued suburban sprawl with its commensurate impacts and costs will continue to dominate Perth. However, simply increasing the delivery of TODs should not be considered a panacea or saviour for city development. As has been shown by this analysis of Subi Centro, even the most highly acclaimed TOD in Perth has its shortfalls when it comes to achieving sustainable travel outcomes despite significant resources being put towards its planning and development. A number of interdependent factors have been found to influence travel behaviour in spite of the built environment.

Despite purporting to be transit-oriented, this research has discovered that Subi Centro has fallen short of the concept’s full potential, revealing itself more as a development that is simply near transit rather than a true integration of land use and transit. There remains a gap between the planned vision for what Subi Centro would achieve in terms of changing travel behaviour and improving economic activity and social amenity and what it has actually achieved to this point in time. Whilst the development is certainly better than what was there before, the findings of this research could lead people to view Subi Centro anywhere along the spectrum between being a reasonable first up effort at delivering an integrated TOD to simply being government subsidised sprawl, just in a slightly more compact and picturesque form as it has maintained a degree of security, predictability and tranquillity in its built environment rather than the true density, activity and mix found in many TODs around the world.

To be fair, Subi Centro cannot be expected to yield the same benefits now as what it may after it has been fully completed and had time to mature, but the point remains. Whilst not being overly favourable to the achievements of Subi Centro, the findings of this research do provide some optimism for the future success of TOD in Perth (and in Subiaco for that matter). The base infrastructure is in place, so it is simply a case of devising strategies to ensure it is more effectively utilised. Furthermore, if simple measures are introduced, such as paid parking at all workplaces and activity centres, the survey findings have shown that better outcomes would be achieved. A significant increase in the cost of travel would also see the benefits of TOD increase exponentially as
it would likely cause people to demand more housing in locations which allow them to meet the majority of their travel needs via alternative modes to the car.

### 7.4 Policy recommendations

Any policies that arise from this research need to be workable in the current Perth marketplace. The WA government should therefore adopt a balanced approach to strategic transport planning and policy making that stresses accessibility over mobility through planning for ‘people and places’ rather than ‘movement’. This approach is supported by Cervero (2005), Curtis (2006) and James (2008). Policies addressing land use solutions (locating different types of development relative to transport provision and vice versa); demand management (reducing the need for travel, especially by car); the promotion of alternative transport modes (walking, cycling and public transport); and the provision of housing and land uses suited to a range of incomes in order to maximise public transport patronage all need to be developed.

#### 7.4.1 Facilitate land amalgamation

Fragmented land ownership is one of the key obstacles to TOD. In order to capitalise on the significant opportunities that integrated development around transit stations presents, a policy which facilitates land amalgamation around transit stations should be developed. Although not explored in detail in this research, this could occur through a combination of such measures as:

- zoning policies which encourage site amalgamation (e.g. bonus development incentives, increasing plot ratios);
- facilitating site amalgamation via a convenor or facilitator for an area (this is sometimes led by government agencies in lieu of private sector integration);
- faster development approvals for amalgamated, good-quality TOD projects;
- infrastructure delivery programs, including transit investment that is integrated (and funded and committed) to delivery with increasing density in TOD locations; and
- financing incentives, where developer financing arrangements could be more amenable to amalgamated sites in TODs.

#### 7.4.2 Determine appropriate implementation model

The private sector is often reluctant to take on the risks and challenges associated with the assembly of fragmented landholdings, especially in established areas with lower land values. Therefore, some level of government support/involvement will likely be necessary to deliver future TODs. The redevelopment authority model has been successful in both East Perth and Subiaco largely due to high land values; significant government subsidy and land holdings; and rezoning from industrial to
7. Conclusions and recommendations

residential. Despite this success, a survey of 24 LGAs in the inner and middle suburbs of Perth by Renne (2005) revealed that most LGAs showed little support for redevelopment authorities as they weren’t convinced that the developer should also be the approving authority. The majority, 79 per cent, felt that public-private partnerships would be the most effective vehicle for delivering TODs in Perth as it would allow the statutory body to be kept separate from the implementation arm.

A policy should therefore be implemented which requires that each new TOD be matched to the most appropriate implementation model for the location. Due regard should be given to the land value, level of land ownership fragmentation, desired outcomes, etc before a decision on the most appropriate implementation model is made.

7.4.3 Set performance targets

Clearly defined and measurable performance criteria should be developed during the planning phase for all new TODs. This will allow a determination of their level of success in achieving sustainable transport outcomes. Performance targets should be set depending on the location of the TOD because performance targets for a TOD in the suburbs will not necessarily be the same as for a TOD in a central area.

7.4.4 Increase land use mix

Ensure a greater mixing of land uses throughout the TOD and avoid placing large clusters of residences more than 400 metres from high trip generating facilities such as transit stops and grocery stores in order to encourage residents to walk rather than drive.

7.4.5 Differentiate land use policies

It may be useful to develop land use policies aimed at different sectors of the population. The complex interplay of socio-demographic factors, physical elements and travel behaviour requires a sophisticated planning approach as straightforward relationships between urban form and travel behaviour cannot be assumed given heterogeneous urban populations. This strategy is supported by Stead (2001) and Schwanen, Dijst, and Dieleman (2005).

7.4.6 Develop a network of TODs

The development of TOD in Perth has been fragmentary and inadequate, leading to lower usage of public transport than envisaged due to the TOD generally being an isolated island of higher density
development within a mass of lower density, single use suburban sprawl. Lansdell and Martin (2009) claim that the high degree of synergy between transport and land use planning ensures that a lone higher density, mixed use development such as Subi Centro which is located amongst identical land uses will not provide sufficient mass and activity to dramatically shift the transport mode, even for its own residents.

Greater success would therefore be achieved by adopting a policy that promotes the development of TODs along corridors of compact, walkable, mixed use developments linked by high quality transit. This policy approach is supported by Rickwood and Glazebrook (2009) who argue that one dense precinct, or TOD, will have a limited local impact on travel behaviour but a network of TODs linked by efficient rapid transit can have cumulative (and significant) impacts.

**7.4.7 Invest in public transport infrastructure**

If TOD is to achieve the benefit most frequently attributed to it, namely reduced car use, then alternative transport modes must provide a suitable alternative to entice people out of their cars. This is achieved by improving the capacity, coverage, integration, frequency and efficiency of the public transport system. Sufficient investment in the network needs to be made by government and that investment needs to be supported by policies that promote the development of appropriate and supportive land uses which integrate with transit stops.

**7.4.8 Implement appropriate transportation pricing**

A policy requiring transportation pricing to incorporate the full set of costs (environmental, social and economic) is required. Appropriate pricing needs to be set such that consumer preferences for transport and location result in choices being made that are socially and environmentally acceptable. Hensher (1998) contends that this will, within a society of significant variations in individual wealth, produce a continuum of land use/travel bundles, accommodating the preferences of individuals for high density/low-travel requirements through to low density/high-travel requirements.

**7.4.9 Implement parking pricing and controls**

According to Shoup (2005), free parking distorts transportation choices and does little to discourage car use, thus diminishing the performance of TODs. By increasing the cost or restricting the capacity of parking in a given area, alternative transport modes will become by comparison, more attractive.
A policy that requires fair market prices to be charged for all non residential parking in the central precinct of a TOD should be implemented with revenue used to pay for improved services in the area. Hypothecating revenue to directly benefit the location from where it was generated will help to gain support for charges from the local community that might otherwise resist paying for parking. Evidence to support this can be found in central Perth where the Perth Parking Management Area (PPMA) has been established with a levy charged for every non-residential car bay and all revenue raised is to be spent on balanced transport projects within the PPMA (State of Western Australia 1999).

Policies controlling the level of residential parking in TODs must be improved as those implemented by the SRA have been shown to be ineffective. These need to be complemented by the implementation of controls and pricing on employee parking at all workplaces that are adequately served by transit. It has been shown that this strategy will achieve success in reducing the level of car use and subsequently increase the use of transit for the journey to work.

7.4.10 Increase TOD housing supply and variety

The high value of housing in Subi Centro is due to its proximity to the city, its uniqueness and its lack of variety. Little can be done to address the influence of location on the price of future TODs but much can be done to address uniqueness and variety. It is well known that when supply doesn’t match demand, prices rise, so if more TODs are built in Perth to satisfy growing demand, uniqueness will disappear and price growth will slow.

A policy should be implemented in new TODs that requires a variety of housing types and sizes to be built. This will result in the TOD containing housing at a range of different prices, which will attract people of varying ages, family types and income levels, adding to the demographic mix and helping to secure improved use of public transport and subsequent reduced levels of car ownership and use.

7.5 Recommended future research

The need for research that helps guide current and imminent planning initiatives has never been greater, as they will be steering Perth in a direction that, if poorly chosen, will result in a city with poor environmental and economic outcomes. Recommended areas for future research include:
7. Conclusions and recommendations

- The interaction of urban form (density, size, topography, etc) and socio-economic and cultural variables (household types, incomes, attitudes to travel, etc) as each have uneven impacts on different sectors of society. For example, Subi Centro’s more wealthy households are less constrained in their travel choices than households with lower incomes despite the built environment and this varying impact should be more widely researched so it can be addressed in policy.

- The political and institutional factors determining successful integration of urban transport solutions.

- How housing in Perth TODs can remain affordable in order to attract people on lower incomes who are generally more regular users of transit and own fewer cars.

- Appropriate parking standards (quantity and pricing) in Perth TODs to discourage high levels of car ownership.

- The right combination of land-use and non-land-use (e.g. pricing) initiatives for achieving mobility objectives.

- The effect of density and land-use mix on travel behaviour (especially non-work).

- Undertake a larger survey of Subi Centro residents to gain a more accurate picture of travel behaviour. Include visitors and workers in the survey.
References


Falconer, R. 2008. Living on the edge: Transport sustainability in Perth's liveable neighbourhoods, Department of Philosophy, Murdoch University, Perth


Housing and Urban Research Institute Western Australia. 2007. Housing in Railway Station Precincts: Some Empirical Evidence of Consumer Demand in Perth Western Australia. Perth. Planning and Transport Research Centre.


References


Appendices

Appendix 1 – Resident survey

Good morning/afternoon. My name is Steve Barlow and I am a Masters student at Curtin University and I am undertaking research for a thesis on the travel behaviour of Subi Centro residents. If you are over 18 and a resident of Subi Centro, I would be grateful if you could spare approximately ten minutes of your time to complete a questionnaire on this issue.

DETAILS OF PARTICIPATION

Participation in the research project by completing the questionnaire is completely voluntary. You may withdraw from the questionnaire at anytime without the risk of prejudice or any negative consequences.

Access to personal information in the completed survey will be restricted to the researcher and the research supervisor (see contact details). To make sure all of your responses are anonymous, this questionnaire does not have any way of identifying you.

CONTACT DETAILS

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Phone: 0431 964 159
Email: sbarlow78@yahoo.com.au
Supervisor: Dave Hedgcock
Phone: 9266 9057
Email: d.hedgcock@curtin.edu.au
Part 1 - About you

Q1. In which of the following age groups are you?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29</td>
<td>1</td>
</tr>
<tr>
<td>30-39</td>
<td>2</td>
</tr>
<tr>
<td>40-49</td>
<td>3</td>
</tr>
<tr>
<td>50-59</td>
<td>4</td>
</tr>
<tr>
<td>60+</td>
<td>5</td>
</tr>
</tbody>
</table>

Q2. Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
</tr>
</tbody>
</table>

Q3. Have you lived in Subi Centro for more than five years?

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
</tbody>
</table>

Q4. Which bracket best describes your annual pre-tax income?

<table>
<thead>
<tr>
<th>Income Bracket</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 - $49,999</td>
<td>1</td>
</tr>
<tr>
<td>$50,000 - $74,999</td>
<td>2</td>
</tr>
<tr>
<td>$75,000 - $99,999</td>
<td>3</td>
</tr>
<tr>
<td>$100,000 - $124,999</td>
<td>4</td>
</tr>
<tr>
<td>$125,000 - $150,000</td>
<td>5</td>
</tr>
<tr>
<td>$150,000 +</td>
<td>6</td>
</tr>
</tbody>
</table>

Part 2 – Public Transport

Q5. Generally speaking, how often do you use public transport?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 days per week or more</td>
<td>1</td>
</tr>
<tr>
<td>1-4 day(s) per week</td>
<td>2</td>
</tr>
<tr>
<td>1-3 day(s) per month</td>
<td>3</td>
</tr>
<tr>
<td>Less often</td>
<td>4</td>
</tr>
<tr>
<td>Never</td>
<td>5</td>
</tr>
</tbody>
</table>

Q6. When do you mainly travel on public transport?

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays</td>
<td>1</td>
</tr>
<tr>
<td>Weekends and public holidays</td>
<td>2</td>
</tr>
<tr>
<td>At all times</td>
<td>3</td>
</tr>
</tbody>
</table>

Q7. How long have you been consistently using public transport in Perth?

<table>
<thead>
<tr>
<th>Consistent Usage Period</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>1</td>
</tr>
<tr>
<td>1-5 years</td>
<td>2</td>
</tr>
<tr>
<td>More than 5 years</td>
<td>3</td>
</tr>
</tbody>
</table>

Q8. On the last public transport trip you made did you have...?

<table>
<thead>
<tr>
<th>Access to a Motor Vehicle</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>1</td>
</tr>
<tr>
<td>No access</td>
<td>2</td>
</tr>
</tbody>
</table>
Q9. For which of the following purposes do you take public transport more often than not?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work purposes</td>
<td>1</td>
</tr>
<tr>
<td>Grocery shopping</td>
<td>2</td>
</tr>
<tr>
<td>Other shopping</td>
<td>3</td>
</tr>
<tr>
<td>Social/leisure purposes</td>
<td>4</td>
</tr>
<tr>
<td>Personal business purposes</td>
<td>5</td>
</tr>
<tr>
<td>Study purposes</td>
<td>6</td>
</tr>
<tr>
<td>Medical appointments</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
</tbody>
</table>

Q10. Approximately how long does it take you to walk to your nearest regular public transport stop/station?

<table>
<thead>
<tr>
<th>Duration</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 minutes</td>
<td>1</td>
</tr>
<tr>
<td>5-10 minutes</td>
<td>2</td>
</tr>
<tr>
<td>10-15 minutes</td>
<td>3</td>
</tr>
<tr>
<td>More than 15 minutes</td>
<td>4</td>
</tr>
<tr>
<td>Don’t know</td>
<td>5</td>
</tr>
</tbody>
</table>

Part 3 – Shopping Trips

Q11. Do you do your regular/weekly shopping in Subiaco?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
</tbody>
</table>

Q11a. If yes, do you usually do this shopping:

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>In conjunction with another purpose (e.g. on your way to/from work)</td>
<td>1</td>
</tr>
<tr>
<td>As an individual trip</td>
<td>2</td>
</tr>
</tbody>
</table>

Q12. How do you usually travel to these shops? (if more than one mode is used, note the primary mode)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>1</td>
</tr>
<tr>
<td>Public transport</td>
<td>2</td>
</tr>
<tr>
<td>Walk</td>
<td>3</td>
</tr>
<tr>
<td>Cycle</td>
<td>4</td>
</tr>
<tr>
<td>Motorcycle/Scooter</td>
<td>5</td>
</tr>
<tr>
<td>Taxi</td>
<td>6</td>
</tr>
</tbody>
</table>

Part 4 - Work Trips

Q13. What best describes your current study or work commitments?

<table>
<thead>
<tr>
<th>Study:</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Time</td>
<td>1</td>
</tr>
<tr>
<td>Full Time</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work:</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Time</td>
<td>3</td>
</tr>
<tr>
<td>Part Time/Casual</td>
<td>4</td>
</tr>
<tr>
<td>Unemployed</td>
<td>5</td>
</tr>
<tr>
<td>Retired</td>
<td>6</td>
</tr>
</tbody>
</table>
**Q14. Approximately how far away from your home is your place of work/study?** *(if distance is not known, ask for the suburb)*

<table>
<thead>
<tr>
<th>Distance</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work from home</td>
<td>1 (skip to Q17)</td>
</tr>
<tr>
<td>0-5km</td>
<td>2</td>
</tr>
<tr>
<td>5-10km</td>
<td>3</td>
</tr>
<tr>
<td>10-20km</td>
<td>4</td>
</tr>
<tr>
<td>20km+</td>
<td>5</td>
</tr>
</tbody>
</table>

**Q15. How do you usually get to work/place of study?** *(if more than one mode is used, note the primary mode)*

<table>
<thead>
<tr>
<th>Mode</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car as driver</td>
<td>1</td>
</tr>
<tr>
<td>Car as passenger</td>
<td>2</td>
</tr>
<tr>
<td>Motorcycle/Scooter</td>
<td>3</td>
</tr>
<tr>
<td>Taxi</td>
<td>4 (skip to Q16)</td>
</tr>
<tr>
<td>Public Transport</td>
<td>5 (skip to Q16)</td>
</tr>
<tr>
<td>Cycle</td>
<td>6 (skip to Q16)</td>
</tr>
<tr>
<td>Walk</td>
<td>7 (skip to Q16)</td>
</tr>
</tbody>
</table>

**Q16. If you drive to your work/place of study, do you pay for parking?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
</tbody>
</table>

**Q16a. If no, would you use an alternative mode of transport if you had to pay for parking?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>Maybe</td>
<td>3</td>
</tr>
</tbody>
</table>

**Q17. Is your place of work/study within 1km or 10 mins walk of a public transport stop/station?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
</tbody>
</table>

**Part 5 – Your opinion**

**Q18. There should be more....**

<table>
<thead>
<tr>
<th>Development</th>
<th>Strongly oppose</th>
<th>Slightly oppose</th>
<th>Neutral</th>
<th>Slightly support</th>
<th>Strongly support</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Shopping/retail development in the Subiaco station precinct</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2 Commercial/office development in the Subiaco station precinct</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 Apartments/townhouses in the Subiaco station precinct</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q</th>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Slightly disagree</th>
<th>Neutral</th>
<th>Slightly agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subi Centro is well served by public transport</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Road traffic is not a major issue in Subi Centro</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Subi Centro is easy to walk around</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>I can easily walk to the train station from my house</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>One of the main reasons I live here is to be close to the train station</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Subi Centro has good cycling facilities</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Q20. What would make you drive less both within Subi Centro & when you travel outside the area?

__________________________________________________________________________________

__________________________________________________________________________________

Q21. Do you have a suggestion to improve walking, cycling or public transport in Subi Centro?

__________________________________________________________________________________

__________________________________________________________________________________

Part 6 - About your household

Q22. How many....

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults are there in your household?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children are there in your household?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cars are there in your household?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Bicycles are there in your household?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>People have a valid driver’s license in your household?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Q23. How many private/exclusive parking spaces are available to your household?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 space</td>
<td>1</td>
</tr>
<tr>
<td>2 spaces</td>
<td>2</td>
</tr>
<tr>
<td>3 spaces</td>
<td>3</td>
</tr>
<tr>
<td>4+ spaces</td>
<td>4</td>
</tr>
</tbody>
</table>
Q24. Since moving to Subi Centro from your last place of residence, is your household car use...?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>More</td>
<td>1</td>
</tr>
<tr>
<td>Less</td>
<td>2</td>
</tr>
<tr>
<td>About the same</td>
<td>3</td>
</tr>
</tbody>
</table>

Q25. Is this house or apartment...

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned and fully paid off by you or someone in this household?</td>
<td>1</td>
</tr>
<tr>
<td>Being paid for by a mortgage by you or someone in this household?</td>
<td>2</td>
</tr>
<tr>
<td>Rented by you or someone in this household?</td>
<td>3</td>
</tr>
<tr>
<td>Other, please describe:______________________________________________________________</td>
<td>4</td>
</tr>
</tbody>
</table>

Thank you for participating in this survey, your help is much appreciated.

Interviewer to note:

Which best describes the building where this home is located?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A one-family house detached from any other house</td>
<td>1</td>
</tr>
<tr>
<td>A one-family house attached to one or more houses</td>
<td>2</td>
</tr>
<tr>
<td>A building with 3 or 4 apartments</td>
<td>3</td>
</tr>
<tr>
<td>A building with 5 or more apartments</td>
<td>5</td>
</tr>
<tr>
<td>Other, please describe:______________________________________________________________</td>
<td>6</td>
</tr>
</tbody>
</table>

Street name:______________________________________________________________
Appendix 2 – Map of Subiaco LGA including ward areas

Source: City of Subiaco (2009)
Appendix 3 – Transperth train map

Source: Transperth (2010)