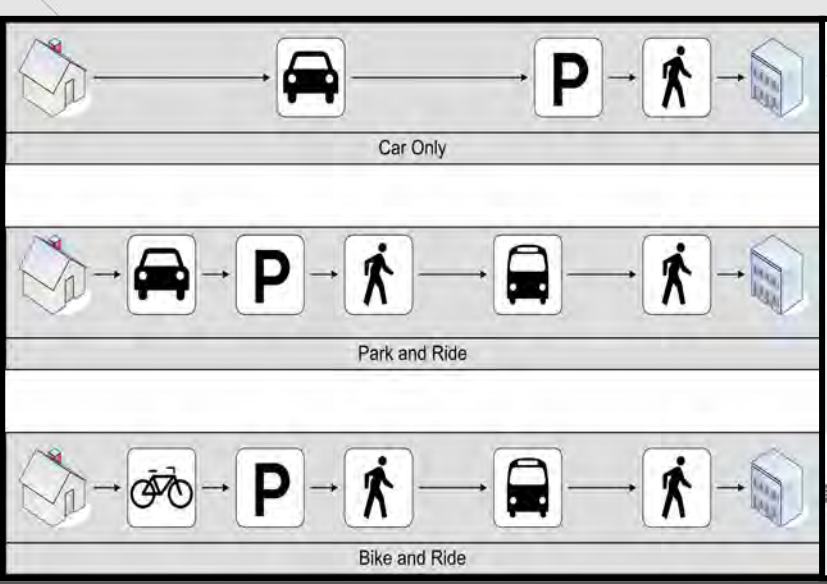

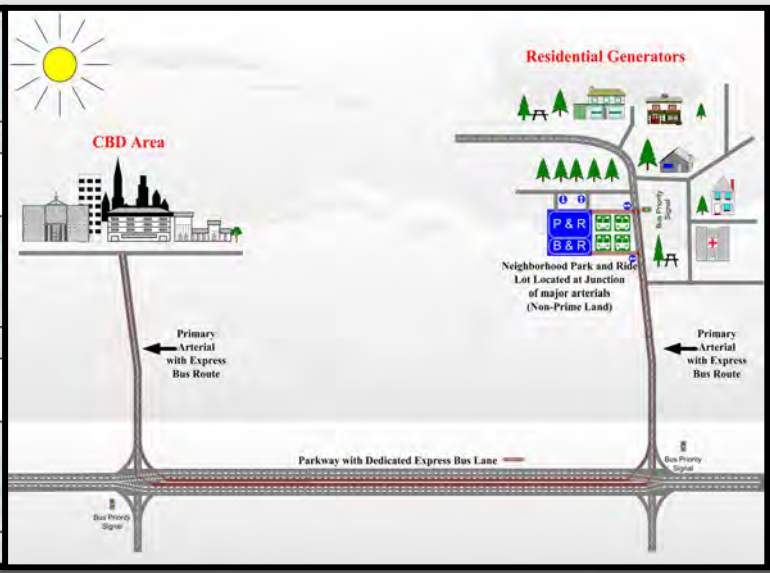

FINAL REPORT

Project: Park and Ride Strategy for the Australian Capital Territory
Reference: 3002128

Date: 5/11/2008

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Document / Report Control Form

Project Name: **Park and Ride Strategy for the Australian Capital Territory**

Project number: **3002128**

Report for: **Territory and Municipal Services**

PREPARATION, REVIEW AND AUTHORISATION

Revision #	Date	Prepared by	Reviewed by	Approved for Issue by
Draft Report	14/04/2008	Dr. Khaled Abbas Josh Everett Ahmed Al Sergany		
Draft Final Report	05/05/2008	Dr. Khaled Abbas Josh Everett Ahmed Al Sergany		
Final Report	25/05/2008	Dr. Khaled Abbas Ahmed Al Sergany		
Final Report Revision 1	05/11/2008	Dr. Khaled Abbas Ahmed Al Sergany	Dr. Jerome Catbagan Lindsay Jacobsen	Craig Sutton

ISSUE REGISTER

Distribution List	Date Issued	Number of Copies
TaMS	05/11/2008	1+CD
SMEC Canberra		

SMEC Australia Pty. Ltd.

2/14 Wormald Street
SYMONSTON ACT 2609

PO Box 1654 FYSHWICK ACT 2609

Tel: **(02) 6126 1900**
Fax: **(02) 6126 1966**
Email: **craig.sutton@smec.com.au**
WWW: **http://www.smec.com.au**

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Executive Summary

Introduction

A common policy response to the problems of increasing car use is to encourage drivers to switch to alternative transit modes. In this context, the ACT government has recognised the need to develop a sustainable transport plan. This was developed in 2004, and is intended to lead Canberra into a new era with a clear focus in managing transport demands, and attaining a sustainable future transport system, to ensure that Canberra remains valued by its citizens as a place to live and work.

SMEC understands that the main aim of this study is to develop a Park and Ride strategy for the ACT that supports ACTION's express bus service system and encourage a shift from car only trips to Park and Ride trips. Austroads defines Park and Ride as a service that enables car users to switch to public transport, at least for the last section of their journey, into the city or town centre, thereby reducing traffic delays over the most congested sections of the road network. Such a strategy is to be developed under the *ACT Sustainable Transport Plan* along with a strategic public transport network plan. A detailed methodology was developed by SMEC including inception and previous study reviews, Park and Ride site inspection and documentation, Park and Ride and car user surveys, site selection processes, business case development, developing and utilisation of a Park and Ride mode split model and finally developing a proposed ACT Park and Ride strategy.

Park and Ride facilities in the ACT

Park and Ride facilities in the ACT consist of allocated, surface parking spaces in car parks close to bus interchanges in the town centres, as well as surface parking spaces at a number of group centres. There are presently Park and Ride facilities located in town centres, providing approximately 200 spaces in total. The aim is to encourage transit use, so parking is generally free or significantly less expensive than in the City, which is the primary focus of the Park and Ride scheme in the ACT. Park and Ride services are operated by the public transport operator ACTION. Town centre interchange facilities are restricted to authorised vehicles displaying a valid Park and Ride permit, and remaining Park and Ride locations across Canberra do not require a permit.

Park and Ride and Car User Surveys

SMEC undertook a Park and Ride travel demand survey on behalf of TaMS. The survey was intended to provide a better understanding of the travel pattern of Park and Ride users in Canberra. Detailed results from the survey are presented in the body of the report.

SMEC also undertook a car user survey on behalf of TaMS. The main objective of this survey is to recognise characteristics of private car daily trips for commuters living in suburbs that are within the catchment areas of existing main Park and Ride facilities. Detailed results from this survey are presented in the body of the report.

Park and Ride Site Selection

One of the main objectives of this study is to select sites that can be utilised as future Park and Ride locations. In this context, SMEC developed a methodology to be followed for Park and Ride site selection. The proposed exercise involves a review of key current and future bus routes and services, identification of sites to be included for further analysis using pre-defined criteria, project group consultation, and scoping and ranking of proposed locations to develop a list of preferred sites. The study initially identified 41 potential sites, 10 of which were included for further scoping and 3 identified as dependent on future plans of introducing new bus interchanges and rapid bus services by 2031. The application of identified scoping criteria demonstrated the superiority of sites along Athllon drive in the south. The following tables show a listing of the proposed sites based on the scoping assessment.

Proposed Park and Ride Locations Over Short and Medium Term

Proposed Park and Ride Carpark Location	Identified by
Athllon Drive, near Mawson Drive	Project work group & SMEC
College Street, near Belconnen Pool / Leisure Centre	Project work group & SMEC
Jamieson	Project work group & SMEC
Athllon Drive, Rylah Crescent and Longmore Crescent	Project work group & SMEC
Exhibition Park	SMEC
Battye Street / AIS	SMEC
College Street and Kirinari Street	SMEC
Belconnen Way and Eastern Valley Way	SMEC
Yarra Glen and Carruthers Street	SMEC
Charnwood Shopping Centre	SMEC

Proposed Park and Ride Locations Over Long Term Based on Future Express Bus Routes

Proposed Park and Ride Carpark Location	Tentative Rank
Fyshwick	1
Gungahlin Drive, Gundaroo Drive	2
Erindale	3

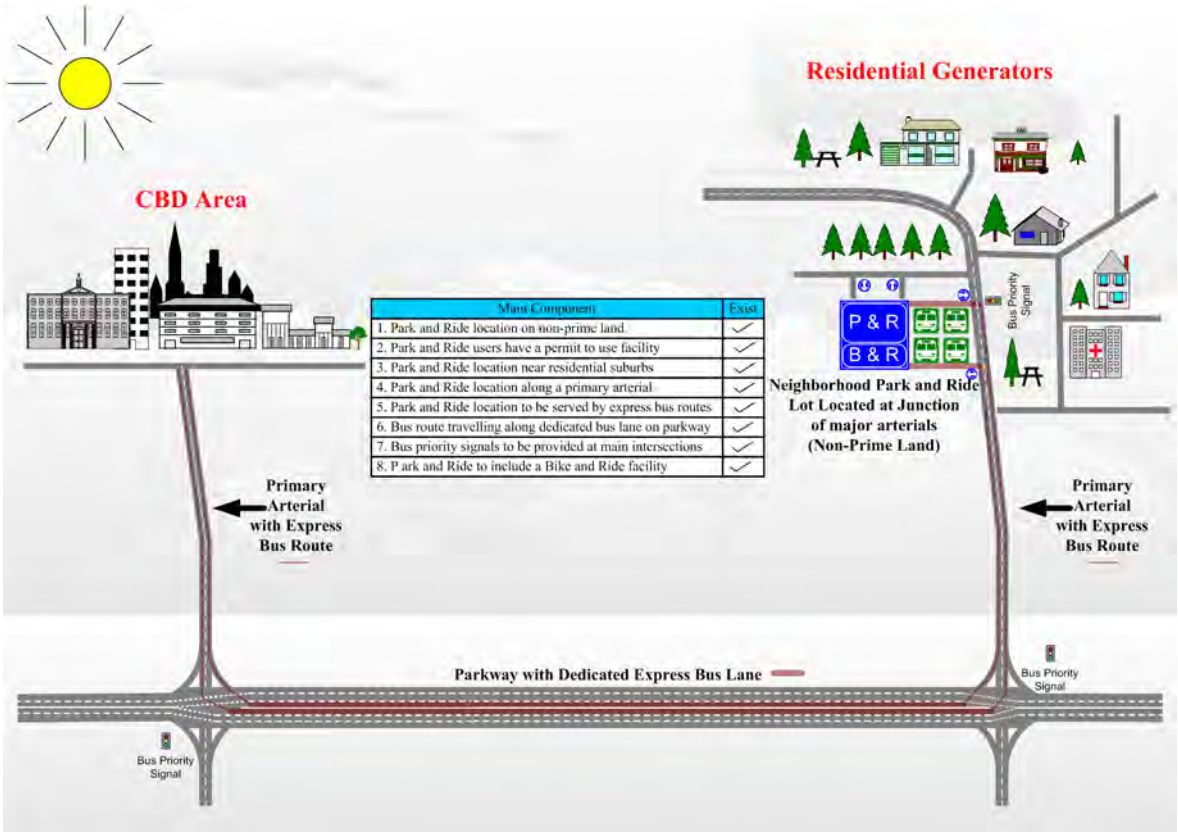
Business Case for a New Park and Ride Site in Canberra

It was decided to concentrate the scoping on the Mawson site along Athllon Drive. The Mawson Park and Ride option was compared to a car only option where a commuter conducts their entire trip by car. An analysis of the costs and benefits of each option was undertaken over a 15 year period (from 2010 to 2025). The business case is intended to show the expected costs, benefits and revenues as a result of developing a new Park and Ride facility. The Net Present Value (NPV), Benefit Cost Ratio (BCR), and Revenue Cost Ratio (RCR) are estimated for the Park and Ride Option versus the car only option. In this context, it was clear that the Park and Ride option can be considered economically and financially viable.

Develop Future Park and Ride Strategy

Based on the literature review, assessment and the insight gained by SMEC in the course of this study, SMEC developed a diagrammatic sketch that shows the generic components for a recommended Park and Ride system. These include:

- Park and Ride location to be on non-prime land
- Park and Ride users to have a permit to use the facility
- Park and Ride location to be near residential suburbs
- Park and Ride location to be highly visible along a primary arterial upstream of traffic congestion
- Park and Ride location to be served by express bus routes
- Bus route travelling along dedicated bus lanes on arterial roads for part of the journey
- Bus priority signals to be provided at main intersections
- Park and Ride to include a Bike and Ride facility



Main Components of the Recommended Park and Ride System

In order to attain a sustainable Park and Ride strategy framework for the ACT, several components must be developed in a complementary manner to allow their interaction in an organised and balanced fashion. This entails the selection of sustainable policies and measures. A Park and Ride strategy should be developed as part of an overall public transport, parking and road improvement program. Park and Ride facilities require funding, adequate public transport service and rideshare programs, and suitable incentives reducing inner-city traffic through early guidance to Park and Ride locations. Further, the ACT Government has acknowledged that the strategic management of parking demand and supply, including its pricing, is essential for achieving transport and land use goals. This is because parking affects the competitiveness and attractiveness of urban centres and influences people's travel choices.

Based on the local and international literature review as well as on SMEC experience and survey analysis, SMEC developed a strategy for Park and Ride in the ACT. The strategy is meant to clearly anticipate:

1. Targeted System
2. Achievement aspects
3. Implementation policies/measures
4. Implementation authority/organisation
5. Time Framework

The strategy is classified into two main components. The first is the Park and Ride and bus incentive policies and measures. This is mainly concerned with making the bus system an attractive mobility option for those who wish to travel. The second component is the car disincentive policies and measures. Disincentive measures use physical, regulatory and pricing restraints to discourage users of single occupancy vehicles and possibly induce them to shift to other Higher Occupancy Vehicle modes, in particular the public transport system.

The following tables detail the components of the developed strategy.

Table: Components of Park and Ride Strategy for ACT (Park and Ride and Bus Incentive Policies and Measures)

System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Park and Ride System	Park and Ride Distribution	▪ Adopt a system of ***several small*** Park and Ride facilities with potential for expansion. ▪ Distribute geographically across Canberra to avoid duplication of catchment areas. ▪ Focus on the following locations: - Along Belconnen Way and Ginninderra Drive providing service to Belconnen suburbs - Along Athllon Drive providing service to Tuggeranong suburbs - Along Canberra Avenue (Fyshwick vicinity) providing service to Queanbeyan suburbs - Along Flemington Road providing service to Gungahlin - At the airport providing service to the west of Canberra and the potential expected developments such as Kowen - Along Cotter Road providing service to the expected Molonglo development, east of Canberra	TaMS	Short & Medium Term
	Park and Ride Location	▪ Avoid town centre locations ▪ Avoid premium land locations (preferably low value land). ▪ Use existing parking facilities that are under-utilised during normal commuting times (e.g. at sports grounds). ▪ Park and Ride to optimise accumulation of transit passengers to allow users to make short, car-based trips to gain access to the transit network. ▪ Park and Ride location to intercept traffic from suburbs and to ensure that the bus trip component is 50% or more. The literature indicates that Park and Ride lots should be located 5-8 km from major destinations such as city or town centres ▪ Locate Park and Ride lots on the upstream side of the point of freeway congestion (or at least not after the point of congestion). ▪ Locate Park and Ride lots on frequent rapid bus services. ▪ Park and Ride locations to be visible from adjacent arterials. ▪ Park and Ride locations selected to provide good vehicle and non-motorised access. ▪ Locate Park and Ride lots within view of businesses or homes to provide a feeling of security and safety. ▪ Provide opportunities for joint uses – i.e. Park and Ride with retail and service outlets such as dry cleaning, groceries, day care centres, etc.		Short & Medium Term
	Park and Ride Pricing System	▪ Provide free parking for Park and Ride users at Park and Ride locations		Short Term

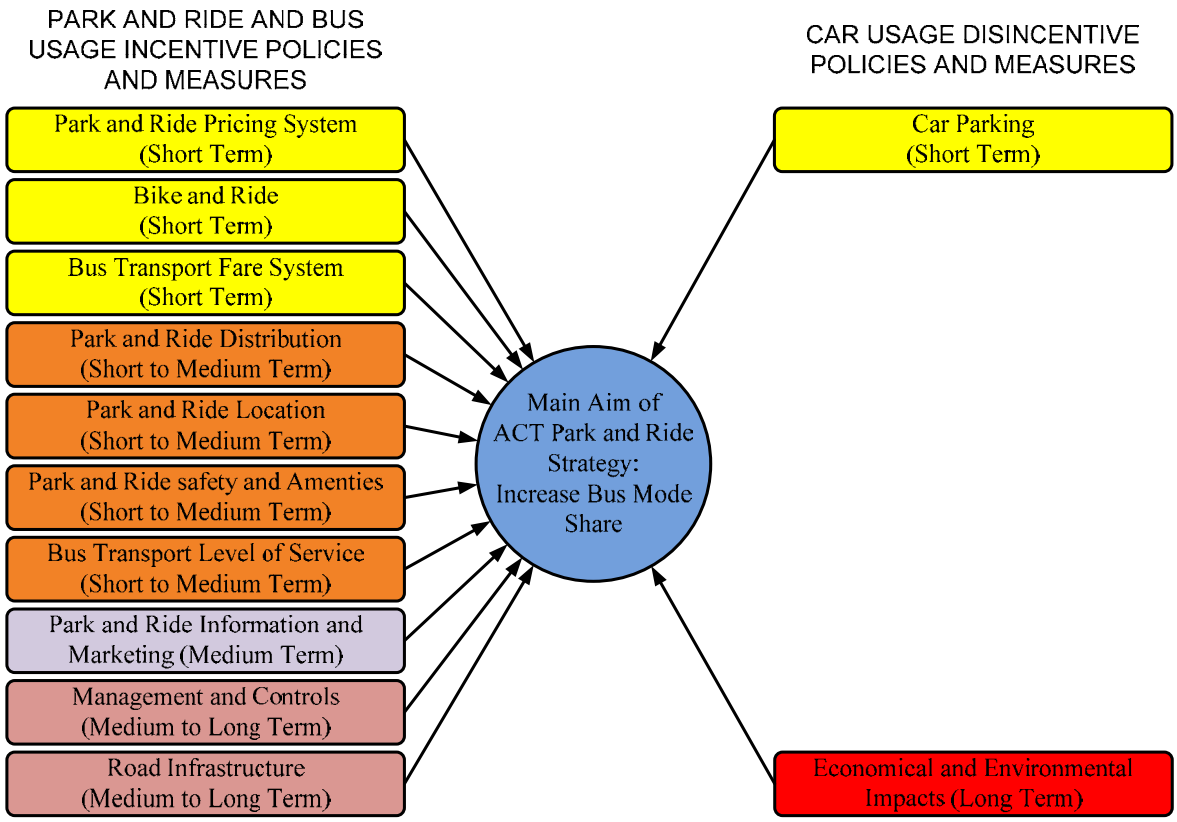
System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Park and Ride System	Park and Ride Safety & Amenities	▪ Locate the Park and Ride facility to be within a maximum walking distance of 150 meters* to the bus stop/terminal. ▪ Provide adequate light, landscape, and other amenities to make the site attractive ▪ Introduce commercial and social activities in Park and Ride vicinities to enhance personal safety and vehicle security. ▪ Install way-finding signs and include signage indicating telephone numbers for reporting problems. ▪ Provide additional facilities in Park and Ride locations such as litter bins, public toilets, public telephones, vending machines and taxi terminals. ▪ Install timetable display boards (preferably real-time timetables) ▪ Avoid road crossings or provide segregated or signalised pedestrian crossings.	TaMS	Short & Medium Term
	Bike and Ride	▪ Include bicycle storage lockers or other bicycle storage if demand exists.		Short term
	Park and Ride Information & Marketing	▪ Promotional campaigns for using Park and Ride systems. ▪ Employer incentive schemes for using Park and Ride systems. ▪ Provide drivers with accessible and up-to-date information on Park and Ride facility locations, space availability, and downstream roadway conditions.		Medium Term
Bus Transport System	Bus Transport Fare System	▪ Low and flexible fares for daily, weekly, monthly, and seasonal Park and Ride users.	ACTION	Short Term
	Bus Transport Level of Service	▪ Introduce more express services ▪ Span the service over an extended peak period ▪ Reduce number of intermediate stops. ▪ Provide high-level, express bus service during peak periods. ▪ Provide real-time information systems. ▪ Promote Park and Ride as part of an overall transit and ridership improvement program		Short & Medium Term
Road	Infrastructure	▪ Introduce more dedicated bus lanes for services connecting Park and Ride facilities to destinations. This should make the bus trips to/from Civic faster than using a car. ▪ Access to bus lanes for at least a portion of the bus trip to the final destination ▪ Access to dedicated bus lanes (busways) for at least a portion of the bus trip to the final destination	Roads ACT	Medium & Long Term
	Management and Control	▪ Introduce more bus signal pre-emption		Medium & Long Term

(*) Based on current main Park and Ride locations as well as on Guide to Land use and Public Transportation (Sno-Tran 1989)

Components of Park and Ride Strategy for ACT (Car Disincentive Policies and Measures)

System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Parking	Car Parking	▪ High parking fees in CBD and town centres. ▪ Parking spaces in CBD and town centres to be regulated. ▪ Parking costs at destination(s) served should be substantially higher than round trip bus fare so as to provide cost savings to users. Transit riders to destinations with abundant free parking will not use Park and Ride	TAMS	Short & Medium Term
Private Car	Economical and Environmental Impacts	▪ Introduce road pricing over the long term as a car usage disincentive measure. ▪ Increase taxes for car ownership.	ACT Government	Medium and Long Term

The main components of the strategy are summarised in the illustration below:



In conclusion SMEC recommends the following main actions:

Time Horizon	Actions
Short term	Identify and develop new Park and Ride locations on non prime land and taking into consideration all location aspects recommended in this report including expected express bus route services. Transfer current town centre Park and Ride facilities to other usage either as paid parking or as prime development areas
Medium term	Invest, improve and upgrade the Canberra public transport system to become competitive in cost and time with car usage. Make sure that all Park and Ride facilities are provided with express bus services. Limit city parking spaces, and increase parking fees (car usage disincentives)
Long term	Introduce further car usage disincentive measures such as central area road pricing

1 Introduction

1.1 Project Appreciation

Transport mobility and accessibility in urban areas are necessities for promoting sustainable economic growth and development. In many parts of the world, and particularly in urban areas, travel demand is growing at very fast rates. On the other hand, the provision of transport networks is constrained by limited funding. This growing demand accompanied by inadequacies of transport supply leads to several traffic related problems. These include traffic congestion causing delays, reduced road safety, substantial environmental impacts in terms of air and noise pollution and an increase in energy consumption.

The ACT has among the highest rates of private car ownership of any state or territory in Australia (ABS 2006 Motor Vehicle Census). Much of metropolitan Canberra was designed in the 1960s around a car-based transport and land use system with the expectation of a future trunk public transport system. Currently, cars provide the bulk of Canberra residents' accessibility needs, at 83% of work trips, with relatively low use of public transport, walking and cycling for work trips, at 7%, 4% and 2.3% respectively. Compared with the Australian average for trips to and from work, Canberra residents use their cars more, cycle more, walk about the same amount and use public transport less (ACT Sustainable Transport Plan 2005).

A common policy response to the problems of increasing car use is to encourage drivers to switch to alternative transport modes. To achieve a major shift from private to public transport will require massive investments to attain a comprehensively improved public transport system that provides incentives by offering commuters the right quality of service at the right price. This should be accompanied by targeted marketing campaigns. All things considered, this is intended to persuade people to choose public transport services instead of their cars.

In this context, the ACT government has recognised the need to develop a sustainable transport plan. This was developed in 2004. This is meant to lead Canberra to a new era with a clear focus in managing transport demands and attaining a sustainable future transport system to ensure that Canberra remains valued by its citizens as a place to live and work.

1.1.1 SMEC Conceptualisation of Sustainable Transport Plan

SMEC's definition of a sustainable transport system is one that meets society's economic and social needs by securing acceptable levels of accessibility and mobility. Such a system can be described as being efficient, safe, equitable, and satisfies users' requirements. It should be planned, designed, implemented, operated, maintained, managed and controlled such that it can provide adequate levels of service while minimising traffic problems such as congestion, waste in resource consumption, loss of life, personal injury, and degradation of the environment.

A sustainable transport plan seeks to develop a consolidated and integrated approach towards the management of transport and its impact on the local community and business environment. It will endeavour to find better ways of governing, managing and funding urban transport. SMEC developed Figure 1-1 as a conceptualisation of a sustainable transport plan generic mission statement. As shown in Figure 1-1, the demand for travel is a derived demand resulting from:

- Economic and social development
- Demographic (population) changes
- Land use type, patterns and growth
- Recreational activities
- Educational endeavours
- Vehicle and particularly private car ownership
- Level of utilization of private cars

The supply of transport constitutes both the modal and the network supply. Typical of many market oriented systems, the interaction of transport system demand and supply components results

in desirable outcomes of mobility, accessibility, economic development and social interaction as well as negative impacts including congestion, delays, accidents, environmental impacts (local and global) etc.

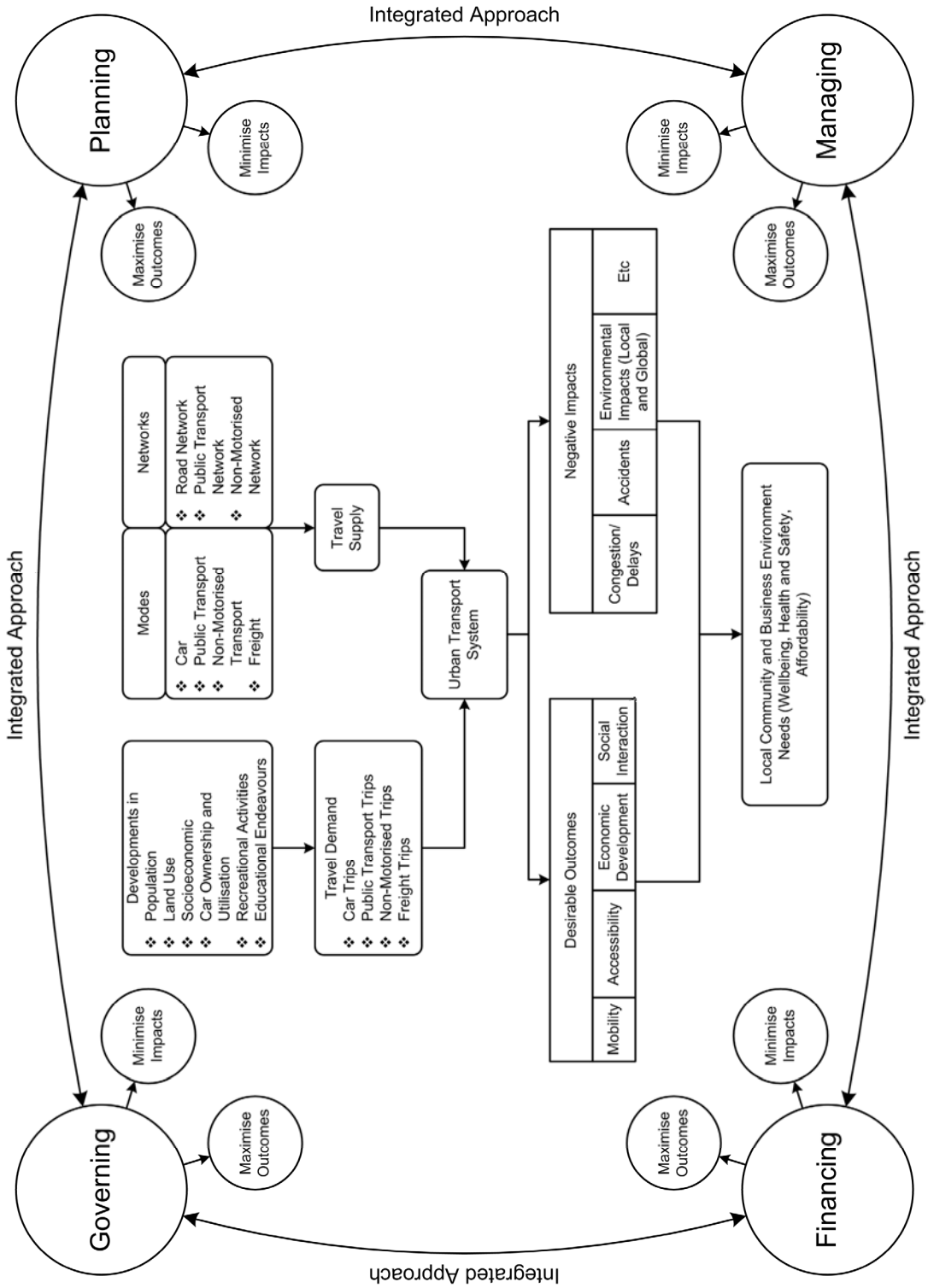


Figure 1-1: SMEC Conceptualisation of Sustainable Transport Plan

1.2 Study Objectives

SMEC understands that the main aim of the study is to develop a Park and Ride strategy for the ACT that will support ACTION's express bus service system and encourage a shift from car only trips to Park and Ride trips. Austroads defines Park and Ride as a service that enables car users to

switch to public transport, at least over the last section of their journeys into the city or town centre, thereby reducing traffic delays over the most congested sections of the road network.

The key objectives of this study are to:

- Review the Park and Ride literature as well as to document components and characteristics of the current Park and Ride system in ACT
- Identify travel preferences, perceptions and judgement of Park and Ride users as well as of car users.
- Identify the preferred locations of future Park and Ride facilities through the development and application of a set of area-specific and site-specific selection criteria.
- Identify the demand and size for potential Park and Ride facilities by application of an appropriate demand forecasting methodology.
- Recommend a Park and Ride strategy for the ACT consistent with the *ACT Sustainable Transport Plan*.

1.3 Scope of Work

According to the brief, the scope of work generally includes the development of a long-term plan for the Territory to provide Park and Ride facilities in support of increased use of sustainable transport modes (primarily combined car/public transport trips, but also considering opportunities for increasing other combined-mode trips such as bicycle/bus and car/bicycle). This plan will be based on a strategic examination of major issues, opportunities and challenges. SMEC will examine local circumstances, and will apply a thorough understanding of best practices to the identification and assessment of possible alternatives.

1.4 Methodology

A detailed methodology is presented in Figure 1-2. The figure shows that the methodology is composed of several components. These are as follows:

- Inception and studies review stage
- Park and Ride site inspection and documentation
- Park and Ride user survey
- Car user survey
- Site selection process
- Business case development
- Developing and utilisation of a Park and Ride versus car mode split model
- Developing a Park and Ride strategy for ACT

These eight components are discussed in detail in the following sections.

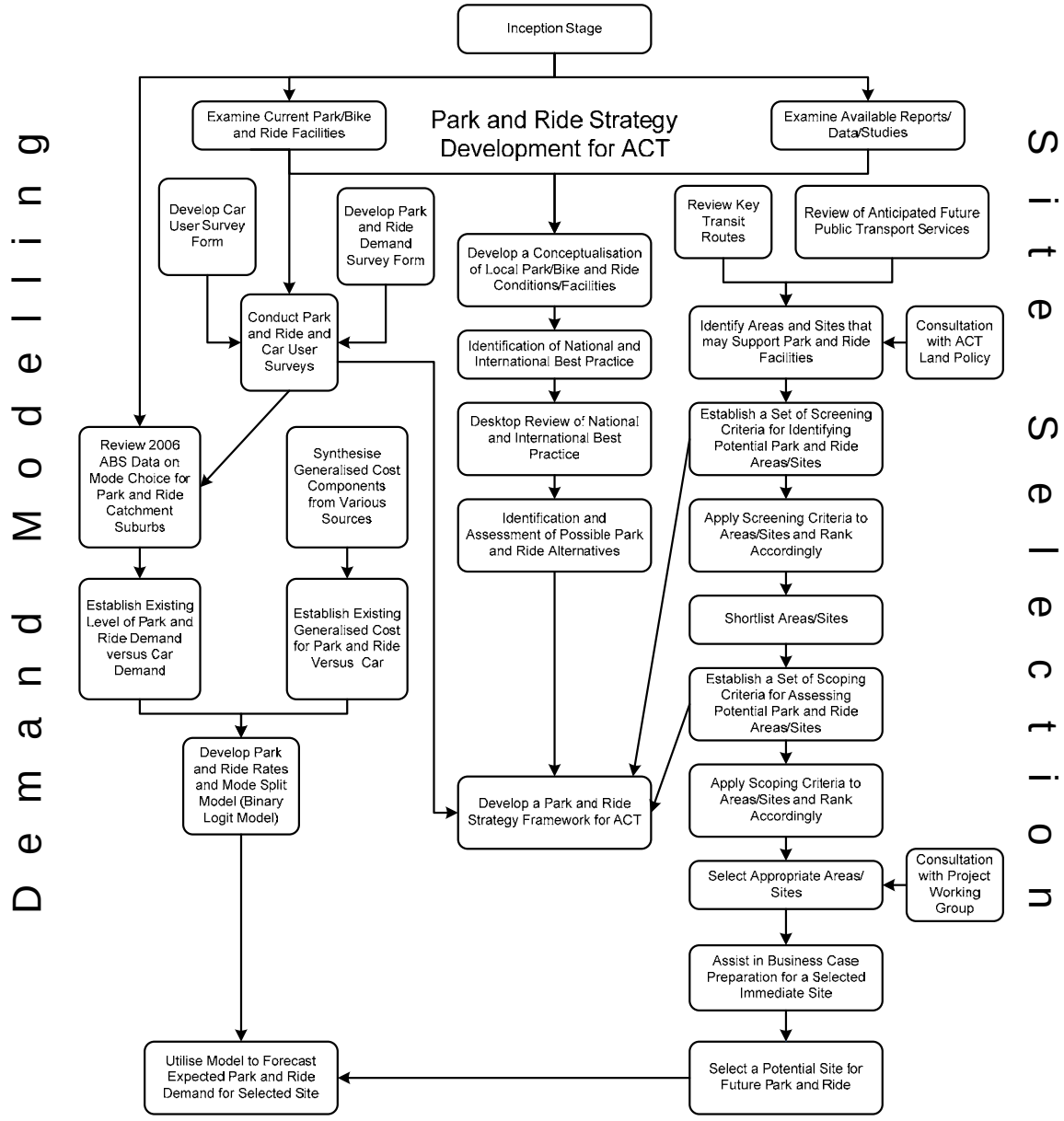


Figure 1-2: Proposed Detailed Study Methodology

2 Inception Stage and Studies Review

2.1 Inception Meeting

Once the study was commissioned, SMEC arranged for a meeting with the project team. The inception meeting was vital to enable a more in-depth insight and understanding of the requirements of the Park and Ride study. It was also important in refining the work plan to better suit the requirements of the client. A second inception meeting was also conducted to engage SMEC in preparing a business case for a selected potential Park and Ride site.

Inception meetings have enabled SMEC to gain additional information as well as obtain relevant data, reports, studies and maps. In addition, SMEC has requested other data and reports obtained from in-progress studies.

2.2 Review Local Reports and Studies

SMEC has reviewed all related studies of Park and Ride in the ACT which have been conducted during the past several years. A content analysis examination has been performed. This is meant to collate the most relevant policies, goals and recommended practices that are relevant to developing a Park and Ride strategy in the ACT.

A number of related plans and studies were previously conducted. SMEC notes the availability of these references on the internet. These have been thoroughly reviewed so as to utilise all data and information available. According to the RFT, a list of these studies and reports include:

- The ACT Sustainable Transport Plan
- The Draft ACT Parking Strategy, released for public comment on 1 March 2007
- The Public Transport Futures Feasibility Study
- Route maps and schedules for all public transport services presently operating in the ACT
- Information on existing Park and Ride locations.

2.2.1 ACT Sustainable Transport Plan

SMEC understands that this study should be conducted with consideration of the ACT Sustainable Transport Plan. This document, released in April 2004, provides the strategic framework to guide the development and implementation of a sustainable transport system in Canberra.

The Sustainable Transport Plan is part of The Canberra Plan, the overarching document that provides the overall vision and framework for action for Canberra. The aim of the Sustainable Transport Plan is to achieve an efficient, effective, equitable, safe and sustainable transport system for Canberra. Its objectives are as follows:

- Reduce the need for car-based travel.
- Shift the balance from cars towards greater use of walking, cycling and transit.
- Improve the efficiency and sustainability of the transport system.
- Make the best use of all travel modes and technologies.
- Reduce accidents, noise, air pollution and greenhouse gas emissions.
- Provide transport choices and address the transport needs of all sectors of the community.
- Protect the future by maintaining options, flexibility and robustness in the transport system.
- Integrate transport and land use planning and management.

The targets set in the Sustainable Transport Plan aim to increase the percentage of journey to work trips using sustainable transport modes to 20% by 2011 and 30% by 2026. As shown in Figure 2-1, this will be mainly achieved through a number of initiatives and supporting measures. The three main initiatives are:

- Public transport related,
- Land use related, and
- Non motorised transport related.

These initiatives are supported with a number of measures, including Park and Ride and Bike and Ride improvement measures.

The Sustainable Transport Plan identifies the implementation of Park and Ride facilities to support busways and key public transport routes as a key short term priority. While the Sustainable Transport Plan and supporting projects underline the importance of Park and Ride facilities as integral components of a multi-modal transportation system and a supportive measure in making public transport a viable alternative to the single occupant vehicle, there is presently no overriding set of goals and objectives for Park and Ride facilities.

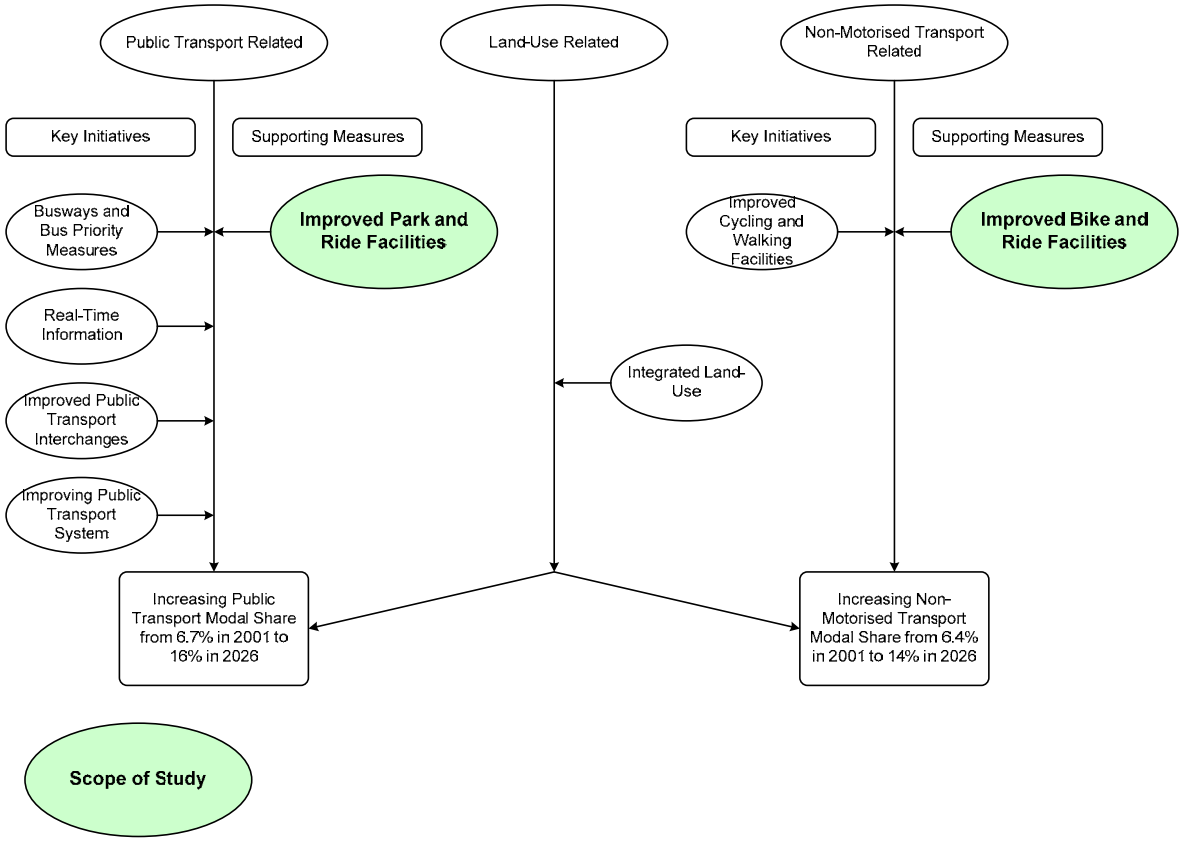


Figure 2-1: Key Initiatives and Supporting Measures of ACT Sustainable Transport Plan

Specific mode-share targets (walking, cycling, and public transport) have been developed as part of the Sustainable Transport Plan. Table 2-1, from the Sustainable Transport Plan, sets out the mode share targets. Consistent and supportive parking strategies are essential to achieving these mode share targets.

Table 2-1: Sustainable Transport Plan Mode-share Targets

Year	2001	2011	2026
Walking	4.1%	6%	7%
Cycling	2.3%	5%	7%
Public Transport	6.7%	9%	16%
Total	13.1%	20%	30%

2.2.2 Draft ACT Parking Strategy - March 2007

The draft ACT Parking Strategy notes that Park and Ride facilities aim to reduce the travel demand by people in cars seeking to travel to the major centres, thus reducing congestion on major roads and the effects of externalities associated with car travel. Another objective of a Park and Ride program is to maximise the length of journey undertaken by transit.

As part of the development of the draft strategy, a review was undertaken of existing and potential future Park and Ride locations, with a view to identifying new locations close to transit routes but outside town centres to maximise parking availability in town centres and minimise the distance people need to drive before taking transit services to reach their destinations.

The study identified opportunities for Park and Ride facilities to be established in public carparks near EPIC in Lyneham, and in carparks near Australian Institute of Sport in Bruce. Locations to be further examined include group centres, such as Kaleen, Kippax (Holt) and Southlands (Mawson) and other centres.

Suburban Park and Ride facilities that intercept car travellers relatively near their point of origin should be distinguished from commuter parking facilities that may be developed on the periphery of the city and/or the town centres. While it may be beneficial to locate some all-day parking facilities around the periphery of urban centres, a genuine Park and Ride facility should seek to maximise the length of journey undertaken by public transport rather than simply intercepting car drivers near the periphery of the city, town centres or other major employment locations such as Barton and Parkes.

2.2.3 ACT Territory and Municipal Services Public Transport Strategic Network Plan (July 2007)

Park and Ride facilities are important access options but they have a very specific market. A Park and Ride user is someone with access to a car, but with a reason not to drive it all the way to his/her destination. In denser and more congested urban areas such as Sydney or Melbourne, such users are common because driving into the urban core is both expensive and inconvenient. In Canberra, driving is relatively easy throughout the region even during the peak commute period, so for a person with a car, the primary reason to use the Park and Ride system instead of driving all the way is to reduce their vehicle operating and parking costs. Some may also be motivated by a desire to use their travel time in ways that they cannot do by driving. However, most people will not be motivated to bear the inconvenience of getting out of the car and onto a bus unless there is a clear financial benefit, given the lack of benefit in travel time.

The Park and Ride market is anticipated to vary substantially based on assumptions about the cost of driving, especially:

Parking costs

The increased development of the Civic area may cause parking costs to rise due to market forces, unless held down as a matter of public policy. In denser cities, high CBD parking costs are often prohibitive for daily commuters, and help to motivate the use of public transport, often via Park and Ride.

Fuel costs

A dramatic increase in the price of petrol – widely predicted in a range of scenarios – could change the costs of the daily commute to the point where many people on tight budgets would look at Park and Ride as a means of avoiding those costs.

With parking and fuel costs both low, Park and Ride utilisation is currently quite limited. There are currently three Park and Ride facilities within town centres. Because other parking in the same area is paid, these facilities require permits provided by ACTION to the customer on request.

Where possible, future Park and Ride planning should look for locations on the Frequent Rapid network. However, Park and Ride does not need to be at the same town centre stop as the bus interchange. In fact, more suitable sites for Park and Ride facilities are those with relatively low land values, usually outside town centres. The ideal location appears to be where the rapid service to the city is especially fast as it avoids the congestion near the interchange. In Woden, for example, a site at the northern edge of the Town Centre would provide customers a very fast trip into the City, while a site further south would require most trips to go through the inevitably slower operations around the Woden Interchange. Similar issues suggest a focus on locations east of Belconnen in Bruce, and south of Gungahlin along Flemington Road. In Tuggeranong, for example, it may be appropriate to look for new Park and Ride opportunities along Athllon Drive.

2.3 Review of International Park and Ride Studies

This section describes several significant international Park and Ride studies, with some discussions on how these are relevant to this study. This is meant to assist in framing an overall policy direction for Park and Ride facilities in the ACT. The main objective is to develop a comprehensive set of alternative policies, measures and actions that can be used in developing a sustainable Park and Ride system for Canberra.

2.3.1 MAG Park and Ride Site Selection Study

The Maricopa Association of Governments (MAG) is a council of governments in the metropolitan Phoenix area in the United States. In January 2000, it conducted the MAG Park and Ride Site Selection Study for the purpose of identifying potential Park and Ride lots that can easily integrate with the regional express bus system and the informal system of carpooling and vanpooling. The study was able to recommend design guidelines and criteria for lot development, management and operations plan for the lots, and programming and implementation strategies. (MAG Park-and-Ride Study Final Report, 2001)

The study was mainly conducted in two stages – the identification of ‘target areas’ for potential lots (generally within a five to six mile radius) along freeway corridors, and the evaluation of specific sites and recommendation of preferred sites within each target area. A number of criteria were defined to identify the target areas and to evaluate and prioritise the recommended target areas for short and long-term development. These criteria include the following:

- Spacing,
- Available land/capacity and potential for expansion,
- Land use compatibility/regulatory issues,
- Opportunities for joint use,
- Visibility of lot from the road,
- Availability of express bus service,
- Security,
- Vehicular access,
- Non-motorised access,
- Environmental considerations,

- Freeway proximity,
- Location relative to congestion on freeway,
- Access to HOV (high-occupancy vehicle) lanes and ramps,
- Cost,
- Cost effectiveness,
- Jurisdictional support,
- Community issues, and
- Demand.

The objectives of the MAG study are similar to those defined for the development of the ACT Park and Ride Strategy. Therefore, the processes involved and some of the established criteria may also be applied to the ACT.

2.3.2 Park and Ride (Convenient Parking for Transit Users) – TDM Encyclopaedia, Victoria Transport Policy Institute

The TDM (Transportation Demand Management) Encyclopaedia is an online information resource concerning transportation management strategies and is created and maintained by the Victoria Transport Policy Institute – an independent research organisation based in Victoria, British Columbia, Canada. This describes and discusses numerous TDM strategies, one of which is the Park and Ride system. It outlines how a Park and Ride facility should be developed, how they can help support ridesharing and public transit use, its impacts and benefits, its relationships with other TDM measures, and it also provides some examples and case studies of successful Park and Ride system implementations. (TDM Encyclopaedia, http://www.vtpi.org/tdm/tdm12.htm)

A summary of the significant findings, extracted from the review of this online document, is outlined as follows:

- Park and Ride facilities reduce urban traffic congestion and worksite parking demand by encouraging shifts to transit and ridesharing. The system tends to be most effective when traffic congestion and parking problems are worst.
- Although only a portion of road users utilise the Park and Ride system, all users can benefit from the reductions in traffic congestion, accidents and pollution.
- To be successful, Park and Ride facilities need significant government support through subsidies.
- A Park and Ride location is most appropriate at the fringe of large urban areas and is most effective as a support system for efforts to encourage transit and rideshare commuting. Excessive Park and Ride facilities may not be as effective around transit stations that want to focus on transit oriented development.

The SMEC team acquired considerable insight from the review of this reference and will use the knowledge gained to apply some of the suggestions and develop better policy recommendations.

2.3.3 Park and Ride Feasibility Study – Hamilton City Council

In 2005, the feasibility of operating a Park and Ride facility in Hamilton City was investigated under the initiative of Environment Waikato (EW) and the Hamilton City Council (HCC) in New Zealand. Key stakeholders and affected communities were consulted and generally supported the concept, with many feeling that investment should be more focused on the existing public transportation system. About a third of the respondents claimed to be likely to use the service when asked if they will support the Park and Ride system. (Park and Ride Feasibility Study, Hamilton City Council and Environment Waikato, 2005)

The following is an outline of some of the significant study conclusions found by SMEC, which were deemed useful for the development of the ACT Park and Ride Strategy:

- Park and Ride systems usually aim to intercept traffic from reaching identified congestion points or bottlenecks through the provision of parking facilities at the outskirts of the city centres and

express transit services connecting such facilities to the city centre. Therefore, the key elements of a successful Park and Ride operation are given as follows:

- ✓ Travel time better than or equal to that of the car (direct or express service)
- ✓ Reliable, frequent (10-minute desirable) bus service
- ✓ Parking policies that discourage commuter parking in the CBD
- ✓ Secure, convenient parking

- Park and Ride facilities can provide intangible benefits, such as enhancement of access and mobility, promotion of sustainability, and improvement of public health.
- The Park and Ride system is unlikely to be cost-effective within the assumed 20-year planning horizon, and should thus be supported by an efficient public transport system and appropriate CBD parking policies to be effective.

2.3.4 Park and Ride for Tompkins County

A White Paper was prepared in 2004 to present the concept of Park and Ride as a transportation system component in Tompkins County, New York in the United States. It described advantages and disadvantages of having a Park and Ride facility, mostly based on the experience of other urban areas, and discussed how Park and Ride strategies can be utilised in the county. It listed the primary goals of a Park and Ride system as the following:

1. To provide an alternative to car use through public transport,
2. To intensify vehicle occupancy in the congested urban area,
3. To offer a more economically efficient provision of parking capacity,
4. To improve journey quality for the motorist, and
5. To contribute to environmental objectives.

The summary of findings provided the SMEC team a number of ideas on what constitutes a successful Park and Ride operation. It listed characteristics of ideal Park and Ride lots and outlined factors for selection of suitable sites. These are as follows:

- Characteristics of Ideal Park and Ride Lots
  - ✓ High level of transit service, express buses/shuttles with 15-minute headways at most
  - ✓ Location within close proximity of main roadway links (i.e. highways and arterials)
  - ✓ Access to HOV or priority lanes for buses
  - ✓ Express transit service during peak hours
  - ✓ Visible from adjacent arterials (for marketing the site and user safety)
  - ✓ Parking costs at destinations served by the lot should be substantially higher than the cost of the Park and Ride facility parking fee and bus fare
  - ✓ Provides improved convenience and cost savings to users
  - ✓ Supported by a strong promotional campaign
- Park and Ride Facility Site Selection Factors
  - ✓ Availability of land for acquisition and/or use
  - ✓ Opportunity for shared utilisation with existing, adjacent land use activities
  - ✓ Joint development opportunities (i.e. building the Park and Ride facility simultaneously with another private or public development initiative)
  - ✓ Spacing (i.e. optimum coverage; do not build more facilities than needed)
  - ✓ Site accessibility from adjacent roadways
  - ✓ Location along major commute corridors
  - ✓ Location relative to congestion points
  - ✓ Non-motorised access

- ✓ Site visibility from neighbouring land uses
- ✓ Size of available land
- ✓ Transit service (e.g. existing, potential for new service, etc.)
- ✓ Development costs
- ✓ Proximity to amenities
- ✓ Land use compatibility
- ✓ Security concerns
- ✓ Potential design constraints (i.e. topography, site dimensions, etc.)
- ✓ Environmental considerations
- ✓ Jurisdictional support
- ✓ Community issues (i.e. level of community acceptance)

(De Aragon, 2004)

Consistent with the previously reviewed articles, the provision of reliable and convenient express transit services is always a vital component of a successful Park and Ride system. This is also true for the associated costs and user convenience, which are usually major determining factors on whether users will shift to transit when travelling to work. Potential Park and Ride users must be able to feel the benefits gained from using the system, not only physically but also financially.

2.3.5 Modal Integration of Bus and Car in UK Local Transport Policy

A study concerning the environmental impacts of Park and Ride facilities was reported in 2002, which described how strategic environmental consequences increased with the growth of short-range Park and Ride schemes, and suggested a suitable method to assess wider environmental, social and economic sustainability of Park and Ride proposals. This article was seen as important by the SMEC team as it provided some insight on potential environmental effects of implementing the Park and Ride system, especially on a much larger scale.

It was able to identify 'unintended effects' of Park and Ride schemes and concluded that:

- Provision of dedicated bus services usually results in net traffic interception within an urban area, but not always. If ever a traffic-reduction effect is actually experienced in the urban area will depend on whether the amount of change is greater than the change in traffic levels due to the current, local economic condition. It also depends on whether net effect of the local transport policy does not end up producing induced traffic due to the resulting available road space.
- Traffic is increased on the road network outside the urban area, mainly because of three reasons:
  - ✓ Users who previously parked in the city centre make detours to reach the Park and Ride facility,
  - ✓ Users switch modes from public transport, and
  - ✓ People travel more to the particular urban area because Park and Ride is a more attractive option in terms of cost.
- Taking the first two conclusions into account, existing literature suggest that traffic growth outside the urban area has been observed to be greater than the traffic reduction within the urban area.

Given these concerns on unexpected (negative) impacts of the Park and Ride system, a more strategic approach in evaluating such schemes was developed. This method, which they call the Strategic Environmental Assessment (SEA) approach, was deemed necessary by the authors to address the following objectives:

- ✓ To examine a proposal early so that it can be assessed along with other possible options that can meet the same transport objectives rather than evaluating alternative locations for the same proposal,
- ✓ To give sufficient spatial scale to the assessment, including the effects in rural areas and the global environment, and

- ✓ To introduce a temporal dimension, with particular consideration of the potential effects of additional sites and related planning development pressures.

(Parkhurst and Richardson, 2002)

The review of this particular article is simply meant to give an overview of potential negative effects that may come out of implementing a comprehensive Park and Ride system and a proposal to address such concerns. It should however be noted that the case being studied in this article is the Park and Ride system in the United Kingdom, which is relatively much more mature and much larger in scale than the one being proposed in the ACT. The described effects therefore, may just have a little chance of actually happening in Canberra. Investigating this further however, is no longer within the scope of developing the ACT Park and Ride Strategy and would certainly warrant additional research work to be conducted.

3 Survey of Current Park and Ride Facilities

3.1 Examine Current Park and Ride Facilities

Park and Ride facilities in the ACT consist of allocated, surface parking spaces in car parks close to bus interchanges in the town centres, as well as surface parking spaces at a number of group centres, with the aim of encouraging greater use of public transport. Parking is generally free or significantly less expensive than in the city, which is one of the main elements of Park and Ride schemes in the ACT. Suburban Park and Ride facilities can reduce the demand for car access to the city centre and thereby reduce the demand for all-day parking spaces in the city.

Park and Ride services are operated by the public transport operator ACTION. Facilities are restricted to authorised vehicles displaying a valid Park and Ride permit. There are presently Park and Ride facilities located in town centres, providing approximately 200 spaces in total. The usage of these facilities has been increasing over the course of the past several years.

ACTION offers monthly free Park and Ride permits to individuals who purchase certain multi-fare tickets; an adult monthly, four adult weekly or adult fare saver books of 10 tickets. These permits allow individuals to park for free at the following town centre locations:

- Adjacent to the Belconnen interchange, with access from Swanson Court
- Adjacent to the Woden interchange, with access from Matilda Street
- Adjacent to the Tuggeranong interchange, with access from Anketell Street

These Park and Ride permits must be used in conjunction with bus travel. However, there have been problems with people working in each of these centres misusing the permits. Town centre locations for Park and Ride are not the most efficient use for parking spaces, with a fair degree of misuse apparent. Some drivers find it cheaper to park in Park and Ride locations in the town centres and effectively gain bus passes or tickets as a bonus while walking to work locations nearby. This is inconsistent with the intentions of the existing Park and Ride scheme, and it also uses parking infrastructure at centres where there is high demand for parking (e.g. Woden Town Centre).

There are additional Park and Ride locations with Canberra that do not require a permit, located in the group centres identified in Table 3-1.

Table 3-1: Park and Ride Locations

Park and Ride Locations Requiring a Permit	Park and Ride Locations not Requiring a Permit
▪ Belconnen Interchange, access from Swanson Court. ▪ Woden Interchange, access from Matilda Street. ▪ Tuggeranong Interchange, access from Anketell Street.	Belconnen: ▪ Jamison Centre, access from Bowman Street. ▪ Charnwood Shopping Centre, access from Lhotsky Street. ▪ Kippax Centre, access from Hardwick Crescent. Woden: ▪ Curtin Shops, access from Carruthers Street. Tuggeranong: ▪ Kambah Village Shops, access from Marconi Crescent. ▪ Kambah Centre, access from O'Halloran circuit. ▪ Chisholm Shops, access from Bentham Street. ▪ Calwell Shops, access from Webber Street.

3.2 Inspection and Documentation of Park and Ride Facilities

SMEC has conducted inspection visits to understand and document the operation of the current Park and Ride system. This inspection has assisted in developing the Park and Ride demand survey as well as identifying issues that warrant further examination and comparison with best practice. The map in Figure 1-1 shows the current geographical distribution of the Park and Ride facilities in the ACT.

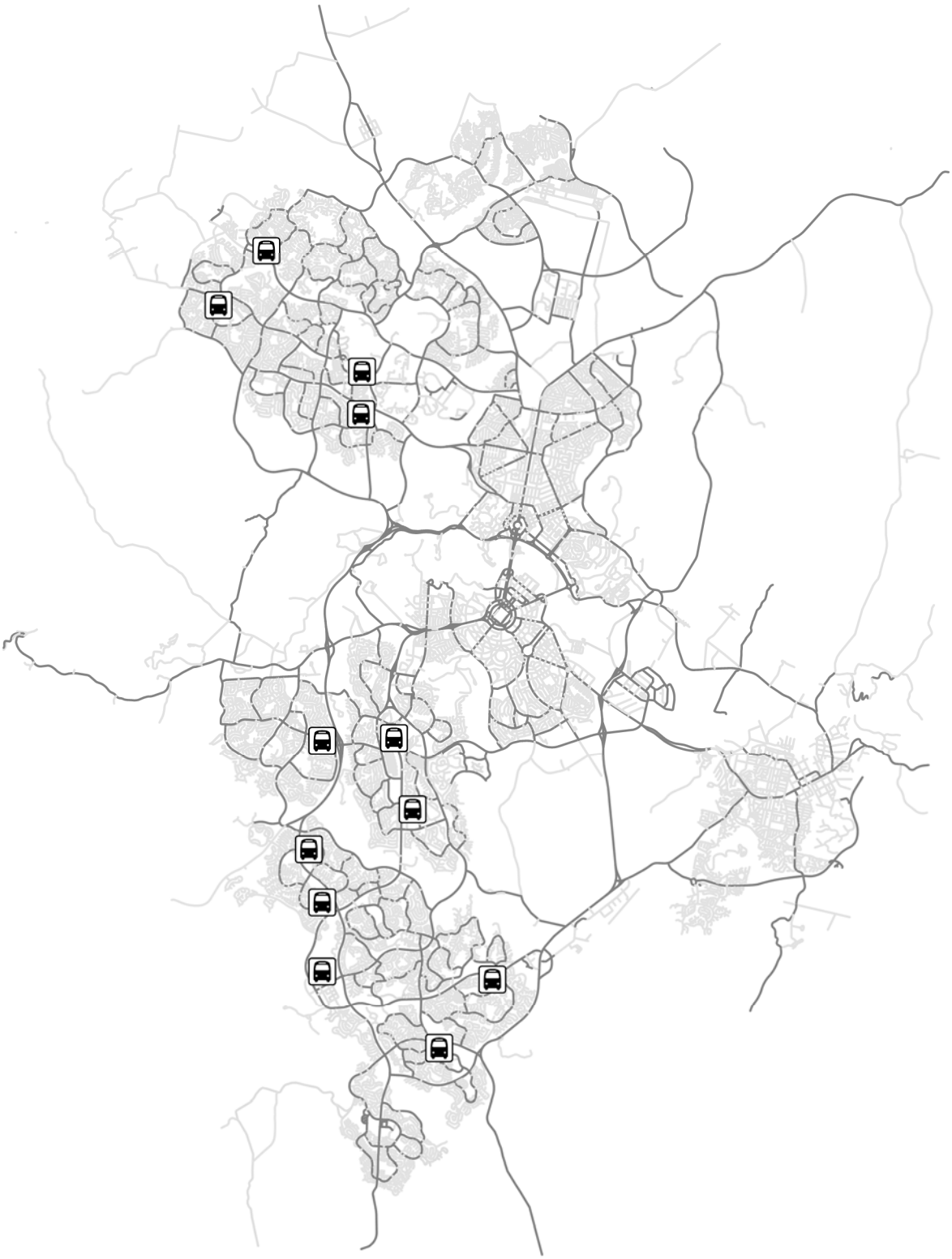


Figure 3-1: Park and Ride Locations

The SMEC team inspected the existing Park and Ride sites, took photographs and documented information about different Park and Ride components. The collected data are listed in Table 3-2, which include the capacity, peak hour demand, average distance to bus terminal and average walking time to bus terminal. Two other attributes were also calculated – the utilisation rate and the average distance from the three main permit based Park and Ride facilities to Civic.

The Woden facility has the highest capacity, followed by Tuggeranong and Belconnen. As previously noted, these three facilities require a permit. As the other facilities do not require a permit, it was difficult for SMEC to distinguish the Park and Ride users from other vehicles at these locations. Given this constraint, the average utilisation was calculated only for the three permit facilities and was found to have an approximate value of 89%.

The SMEC team measured the walking distance and time to reach the bus terminal. As shown in the table, all facilities are within 200 metres of the bus stop or interchange. On average it takes less than two minutes to walk from the parking area to the bus pick-up point.

Table 3-2: Park and Ride Inventory

Location	Available Parking Spaces	Occupied Parking Spaces	Utilisation Rate	Average Distance to Bus Terminal	Walking Time to Bus Terminal	Average Distance to Civic
Woden Interchange	138	120	0.87	50 m	< 1 min	10.5 km
Tuggeranong Interchange	32	28	0.88	60 m	< 1 min	20.5 km (via Woden)
Belconnen Interchange	30	30	1	200 m	< 2 min	8.4 km
Jamison Centre	Approximately 10 No permit required	10	0.83	60 m	< 1 min	
Kambah Centre	Approximately 60 No permit required	0	0	50 m	< 1 min	
Chisholm Shops	Approximately 50 No permit required	35	0.7	50 m	< 1 min	
Calwell Shops	Approximately 10 No permit required	7	0.7	50 m	< 1 min	
Charnwood	Approximately 100 No dedicated Park and Ride spaces	10	0.1	150 m	< 2 min	
Kippax Centre	Approximately 100 No dedicated Park and Ride spaces	50	0.5	200 m	< 2 min	
Curtin Shops	Approximately 100 No dedicated Park and Ride spaces	60	0.6	200 m	< 2 min	

The following figures show a number of photos taken within the Park and Ride facilities in an effort to document the components of such facilities as well as to identify any issues observed by SMEC.

3.2.1 Woden Interchange

The Woden Park and Ride facility is the biggest in Canberra and lies within a larger public car park. The Woden facility requires a permit for users between 07:30 and 05:30. The car entry and exit to this facility is via Matilda Street. The site is surrounded by office buildings, the Westfield retail centre, the Hellenic Club and the Woden Bus Interchange. The site has the potential to attract genuine Park and Ride users as well as other users who may have their final destination as the office space around the facility. The site also occupies prime land. Once parked, users either walk to the Woden bus terminal to catch a bus to the city or directly to their final destinations located in the surrounding buildings. A cycle path exists at the fringe of the parking area. In addition, a number of bike lockers are present to allow cycling or Bike and Ride as alternative modes of transport.

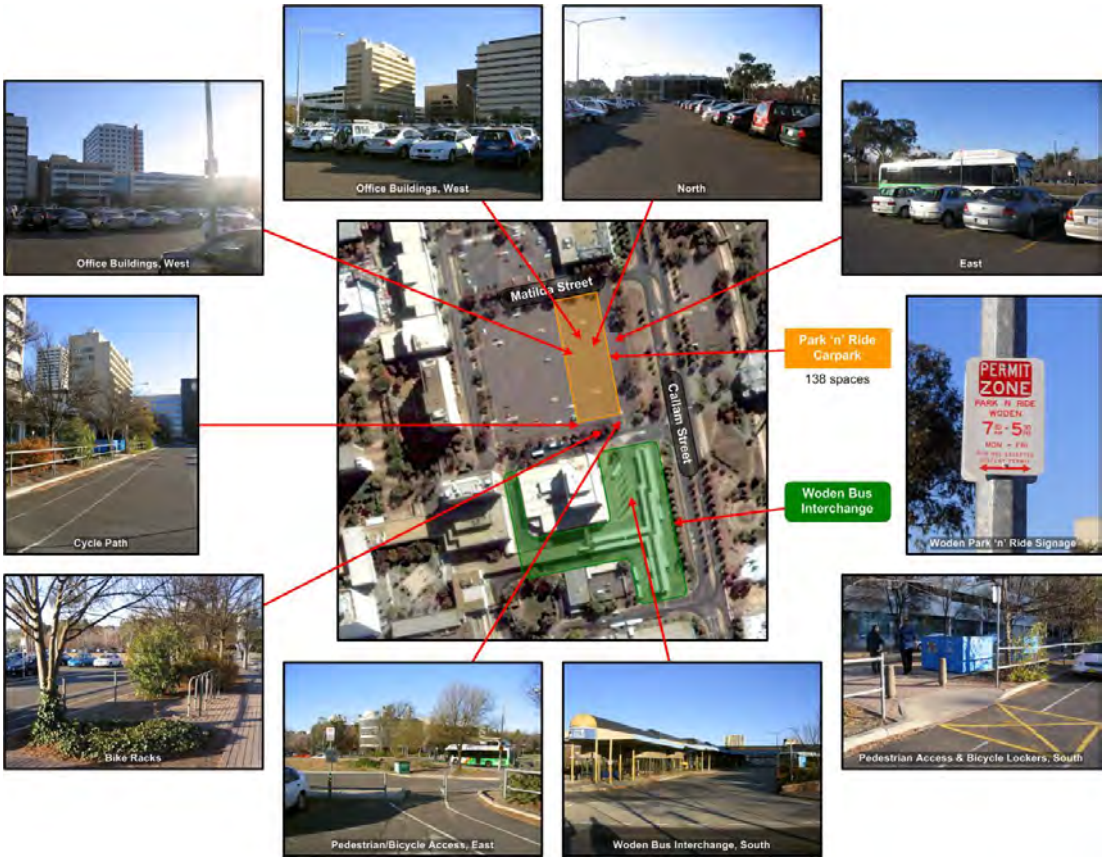


Figure 3-2: Woden Park and Ride Facility

3.2.2 Tuggeranong

The Tuggeranong Park and Ride facility is the second smallest permit-required facility in Canberra, only slightly larger than Belconnen, and also lies within a larger public car park. The Tuggeranong facility requires a permit for users between 07:30 and 10:00. The car entry and exit to this facility is from Anketell Street. The site is surrounded by office buildings, residential developments, the Hyperdome retail centre and Lake Tuggeranong College. More office space is currently being developed so the site has the potential to attract more users who may have these offices as their final destination rather than genuine Park and Ride users. The site also occupies prime land. Once parked, users either walk to the Tuggeranong Interchange to catch a bus to the city or alternatively walk directly to their final work destinations located in the surrounding buildings. A cycle path exists at the fringe of the parking area. Similar to the Woden facility, a number of bike lockers are also present to allow cycling or Bike and Ride as alternative modes of transport.

Figure 3-3: Tuggeranong Park and Ride Facility

3.2.3 Belconnen

The Belconnen Park and Ride facility is the smallest permit-required facility in Canberra, and also lies within a larger public car park. The facility requires a permit for users between 07:30 and 10:00. The car entry and exit to this facility is via Swanson Court. The site is surrounded by office buildings and is near the Westfield retail centre. Similarly to the Tuggeranong facility, more office buildings are currently being developed, so concerns about misuse of the Park and Ride system also exist here. The site also occupies prime land. Once parked, users either walk to the Belconnen Interchange to catch a bus to the city or alternatively walk directly to their final work destinations located in the surrounding buildings. A number of bike lockers are present to allow cycling or Bike and Ride as alternative modes of transport.

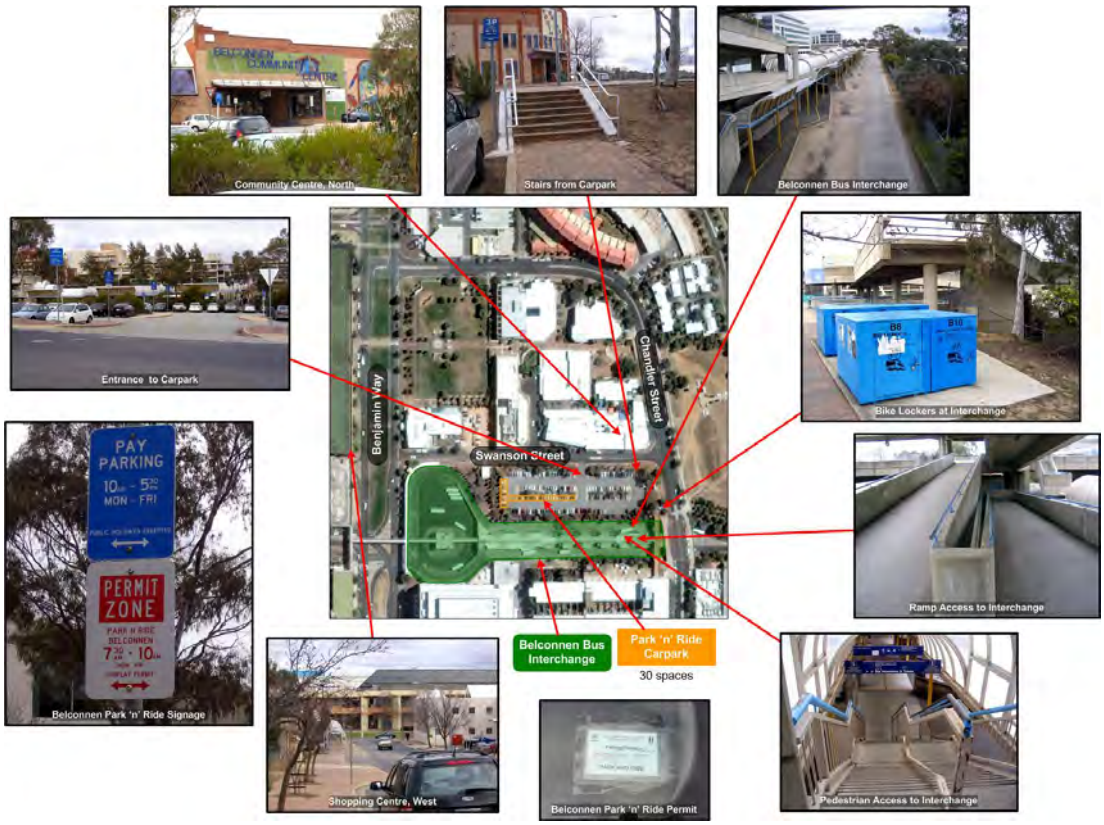


Figure 3-4: Belconnen Park and Ride Facility

3.2.4 Other Facilities

Figure 3-5 through to Figure 3-10 show the locations and photographs of the other Park and Ride facilities where permits are not required.

Figure 3-5: Charnwood Park and Ride Facility

Figure 3-6: Jamison Park and Ride Facility

Figure 3-7: Kambah Park and Ride Facility

Figure 3-8: Chisholm Park and Ride Facility

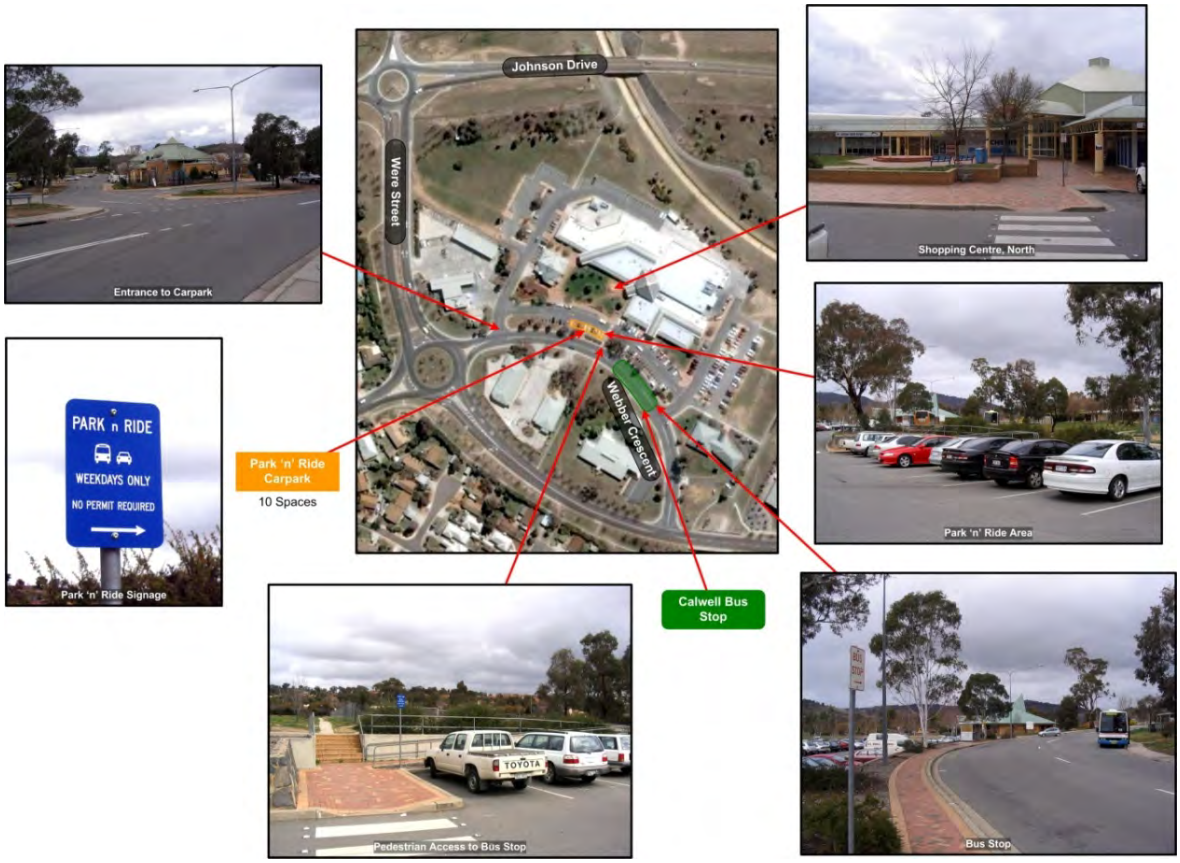


Figure 3-9: Calwell Park and Ride Facility

Figure 3-10: Brand Depot Park and Ride Facility

3.3 Examine Current Bike and Ride Facilities

To encourage combined bicycle/bus trips, a small number of bicycle parking lockers are provided (50 in total) at five locations – the four bus interchanges plus Gungahlin Town Centre, as shown in Figure 3-11. Utilisation rates vary by location but average 50%. In addition, it is not clear whether lockers are being used for combined bicycle/bus trips or as secure bicycle parking at destinations for bicycle-only trips.

The distribution of bicycle lockers by location is as follows:

1. City: 16 lockers at the bus interchange in Mort Street
2. Belconnen: 10 lockers at Chandler Street, south of Swanson Court
3. Woden A: 4 lockers at the eastern end of the footbridge over the bus interchange
4. Woden B: 8 lockers at the northern side of Bowes Street, west of Callam Street
5. Tuggeranong: 10 lockers at the southern side of Pitman Street, west of the bus interchange
6. Gungahlin: 2 lockers at the northern side of Hibberson Street, east of Gozzard Street

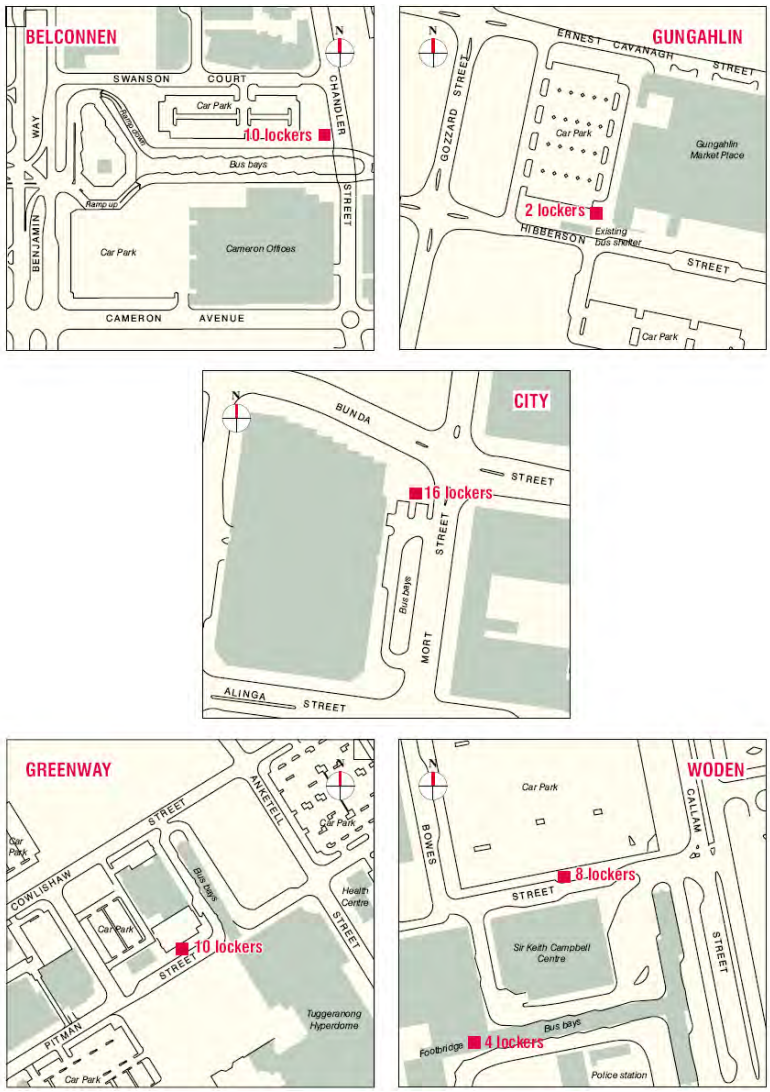


Figure 3-11: Bike Locker Locations (Source: Pedal Power)

These lockers are provided to protect bicycles from theft and vandalism, and they can also be used to store bicycle accessories such as helmets. Lockers are managed by Pedal Power for the ACT Government. The minimum rental period is 6 months with rental in blocks of six months, at a cost of $66 for six months or $110 for a year, GST inclusive. Figure 3-12 and Figure 3-13 present photos of bike lockers at/near main Park and Ride locations in Belconnen and Woden. Figure 3-14 shows the inside of a bike locker.

Figure 3-12 Bike Lockers at Belconnen Interchange, along Chandler Street south of Swanson Court

Figure 3-13 Bike Lockers at Woden Interchange, along the north side of Bowes Street west of Callam Street

Figure 3-14 The Inside of a Bike Locker (Source: Pedal Power)

4 Park and Ride Demand Survey

4.1 Park and Ride Travel Demand Survey

As part of this project SMEC conducted a Park and Ride travel demand survey on behalf of TaMS. The survey's objectives are the following:

- To provide a better understanding of the travel pattern of Park and Ride users in Canberra, and
- To assist in making more informed decisions on how to better plan the Park and Ride facilities in Canberra

Specifically, the survey's intention was to allow SMEC to:

- Establish socio economic characteristics of Park and Ride users,
- Establish time components of Park and Ride trips, and
- Identify factors encouraging/discouraging Park and Ride

SMEC proposed to adopt mail surveys as its preferred survey method. This method usually produces a higher response rate with people more likely to answer sensitive attitude and behaviour related questions as well as avoid biased answers. SMEC's previous experience has shown that postal questionnaires that offer potential incentives to respondents (such as a lottery with prize money) can produce a more representative sample size, generate better results as well as being easy to maintain for longitudinal surveys. If respondents wish to maintain their anonymity, then they can simply waive their participation in the lottery (for example) and leave their contact details blank.

The survey involved a simple short questionnaire that could be completed by Park and Ride respondents in the comfort of their homes and mailed back to SMEC. The survey included a number of structured questions that are useful in obtaining simple factual information, as respondents can choose from limited sets of options (see Appendix 1 for questionnaire details).

Stage 1: A package was prepared by the SMEC team including:

- A cover letter
- Instructions on how to complete the survey
- The survey form identified by the Park and Ride location for which the forms were distributed
- A reply paid envelope

Stage 2: Survey forms were distributed at the three permit based Park and Ride locations, during the PM peak period on a working day, while travellers are returning from work. This proved to be successful as Park and Ride users were approached personally with the questionnaire during a non-rush time. The purpose of the questionnaire was briefly explained and if the Park and Ride user wished to participate they were handed the aforementioned package.

Stage 3: Potential participants completed the questionnaires at their comfort and convenience, and mailed it back to SMEC.

Stage 4: Once received by SMEC the completed surveys were reviewed, validated and sorted.

Stage 5: Several checks were conducted to verify the logic of the data, its coding and entry. In this task, questionnaire data were entered and processed using an Excel spreadsheet.

Stage 6: This stage is mainly concerned with the descriptive analysis of questionnaire responses.

Figure 4-1 reflects the logistics of distribution of the Park and Ride demand survey, according to the methodology above.

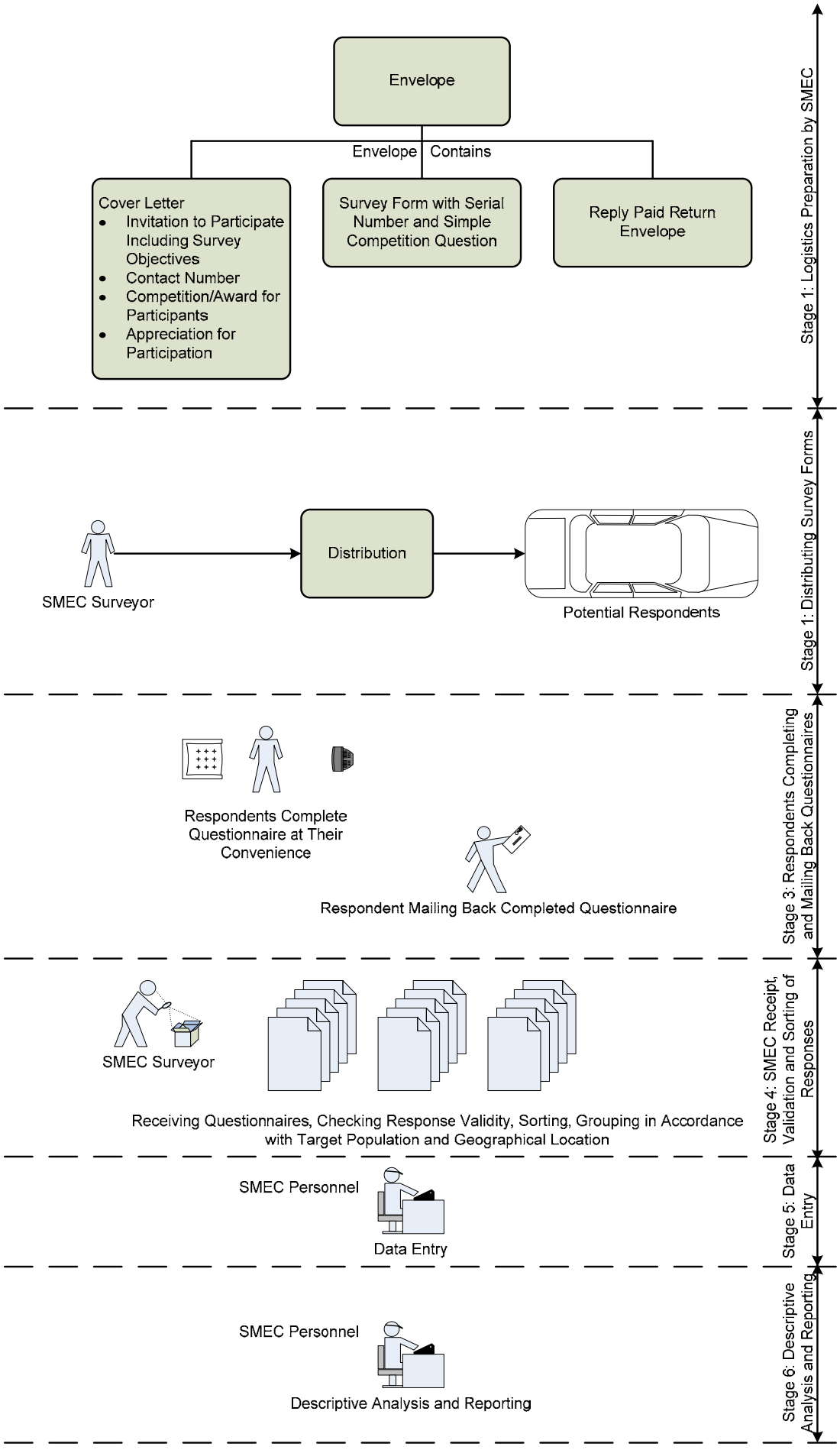


Figure 4-1: Mobilising and Conducting the Survey

4.2 Park and Ride Travel Demand Survey Sample

As shown in Table 4-1, the SMEC team attempted to distribute survey forms to all potential Park and Ride users. 62 completed questionnaires were received, and sample sizes differ between the facilities. The overall received sample is 38% of the demand at the time of the survey.

Table 4-1: Park and Ride Travel Demand Survey Sample Data

Location	Available Parking Spaces	Occupied Parking Spaces	Survey Forms Distributed	Completed Surveys Received	Sample Size
Woden Interchange	138	120	90	40	33%
Tuggeranong Interchange	32	28	21	16	57%
Belconnen Interchange	30	30	25	12	40%
Total	**200**	**178**	**136**	**68**	**38%**

Figure 4-2 shows the distribution of Park and Ride demand survey samples; 59% of the completed forms came from Woden Park and Ride users, while 23% came from Tuggeranong and 18% came from Belconnen.

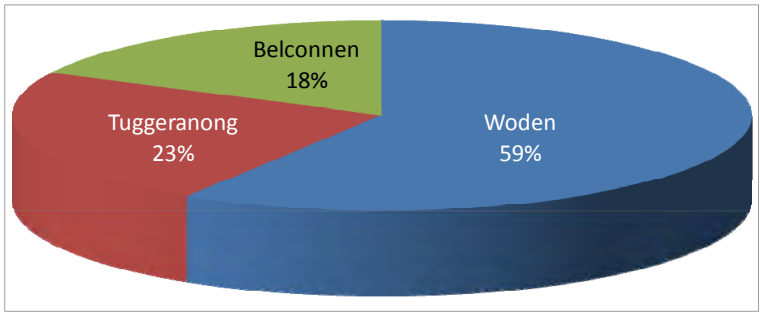


Figure 4-2: Received Park and Ride Travel Demand Survey Forms Sorted by Main Location

4.3 Park and Ride Demand Survey Results

The following section represents a descriptive analysis of all of the travel survey questions.

4.3.1 Suburb Origin of Park and Ride Facility

The potential demand origin by suburb for each Park and Ride facility is shown in Figure 4-3. The figure shows that there is relatively high usage by commuters from the suburbs of Gordon and Wanniassa. This is followed by residents of Monash, Kambah, and Isabella Plains.

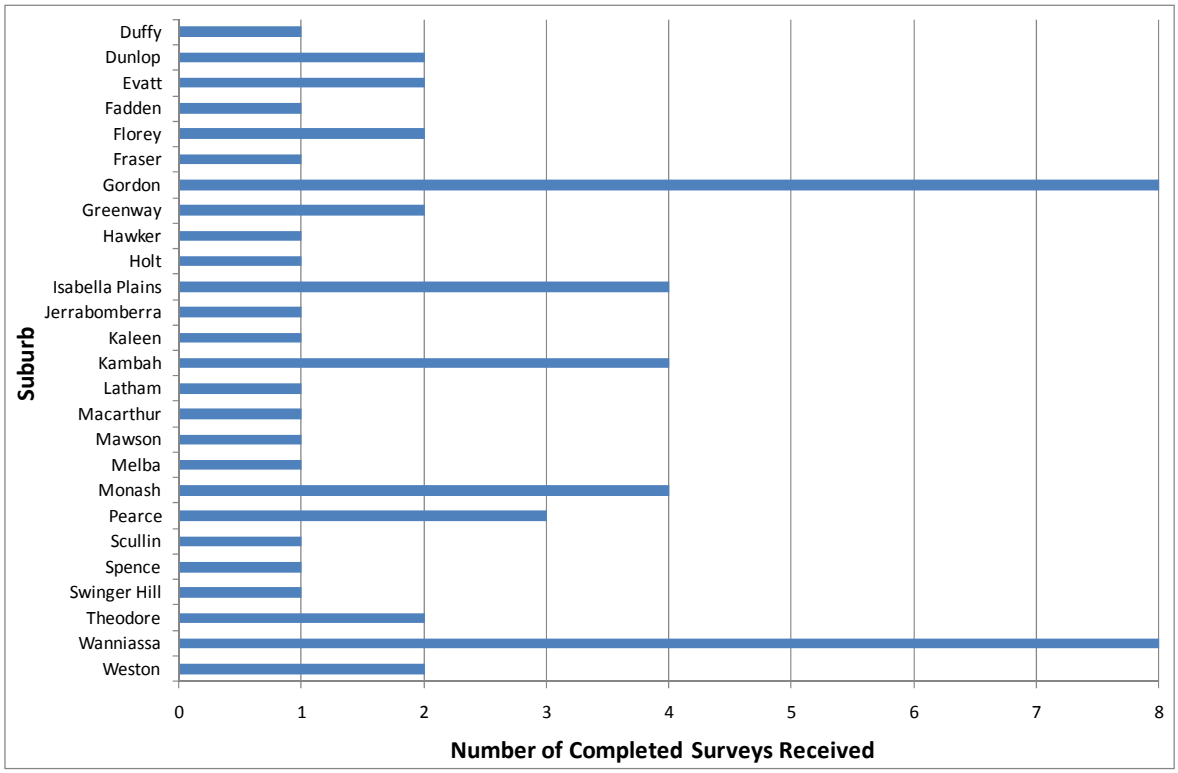


Figure 4-3: Suburb Origin of Park and Ride facility

4.3.2 Car Occupancy

Figure 4-4 shows the vehicle occupancy rates of Park and Ride users. The proportions of users travelling alone and those travelling with passengers are approximately equal.

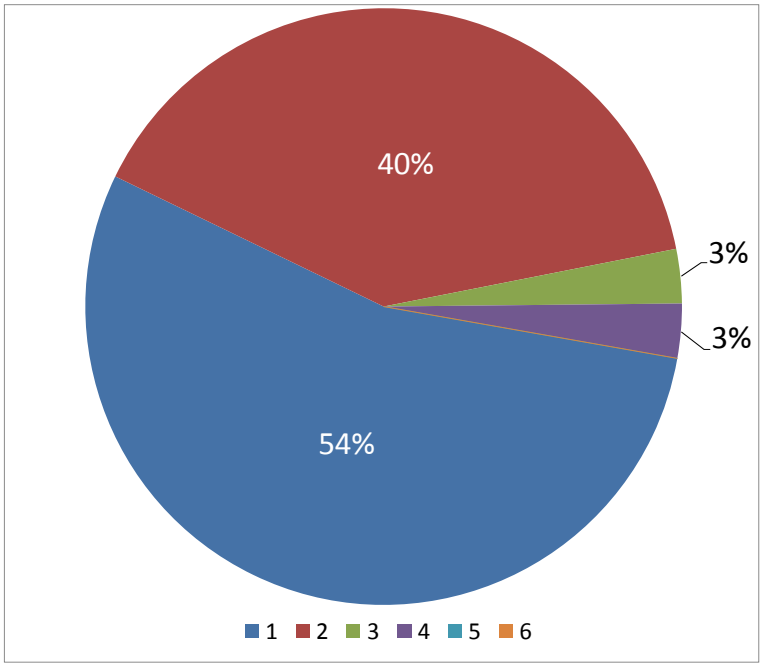


Figure 4-4: Car Occupancy of Park and Ride Commuters

4.3.3 Ease of Locating a Parking Space

Figure 4-5 illustrates that 93% of the respondents experienced no difficulty in locating an empty parking spot within the Park and Ride facilities.

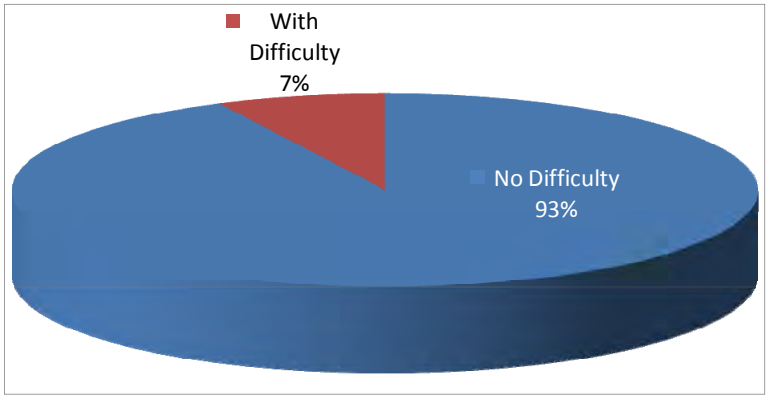


Figure 4-5: Ease of Locating Parking Spots within Park and Ride Facilities

4.3.4 Park and Ride Facility as the Final Destination

Figure 4-6 shows that only 1 respondent stated that the Park and Ride facility represents their final destination. SMEC notes that the real proportion may be higher as abusers of the system may be reluctant to admit to doing so especially if they indicate their name on the questionnaire.

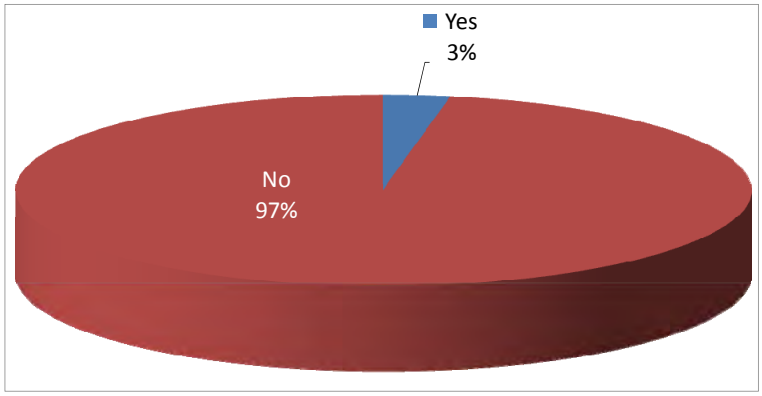


Figure 4-6: Park and Ride Facility as the Final Destination

4.3.5 Mode of Transport from Park and Ride Facility

The modes of transport used by Park and Ride users are illustrated in Figure 4-7. The overwhelming majority of users will take a bus to complete their journey, while only one respondent stated that they carpool from the Park and Ride facility to final destination. Cycle and Taxi were offered as options but there were no responses for these travel methods.

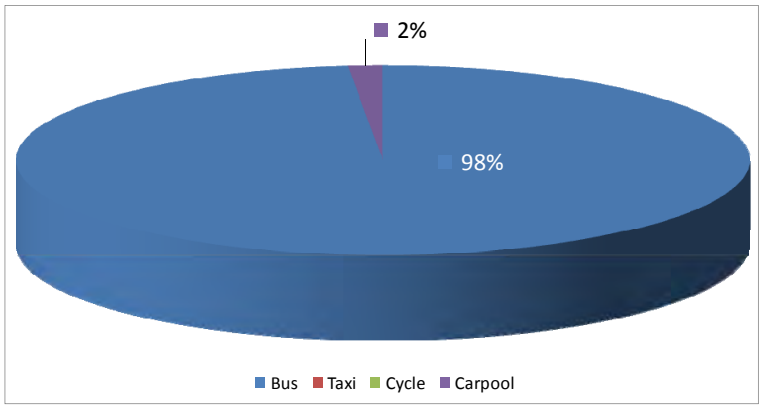


Figure 4-7: Mode of Transport from Park and Ride Facility

4.3.6 Change of Buses

All surveyed Park and Ride users stated that they do not change buses to reach their final destination.

4.3.7 Final Destination of Park and Ride Users

Figure 4-8 indicates that final destinations for Park and Ride users vary. The overwhelming majority of users are travelling to Civic, Russell, Barton and Parkes.

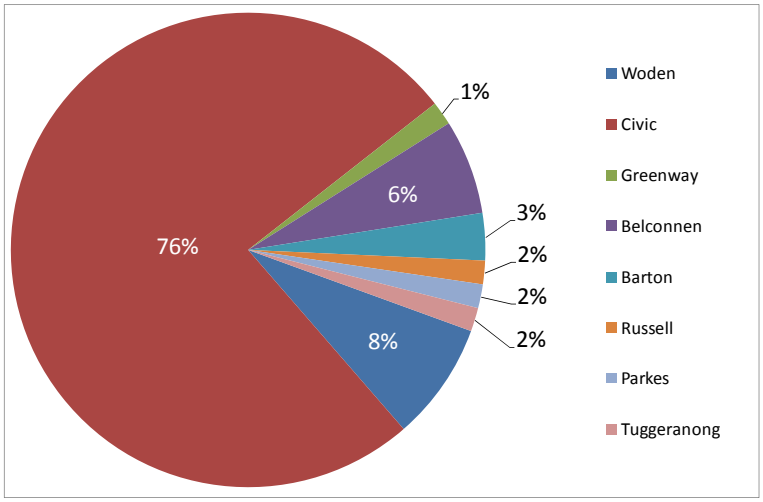


Figure 4-8: Final Destinations for Park and Ride Users

4.3.8 Trip Purpose

100% of the respondents stated that their trip purpose was for work.

4.3.9 Weekly Frequency of Trips Using Park and Ride Facilities

Figure 4-9 shows the frequency of trips conducted by commuters using the Park and Ride facilities. The overwhelming majority use the system for the whole week, which is consistent with the journey to work trip purpose.

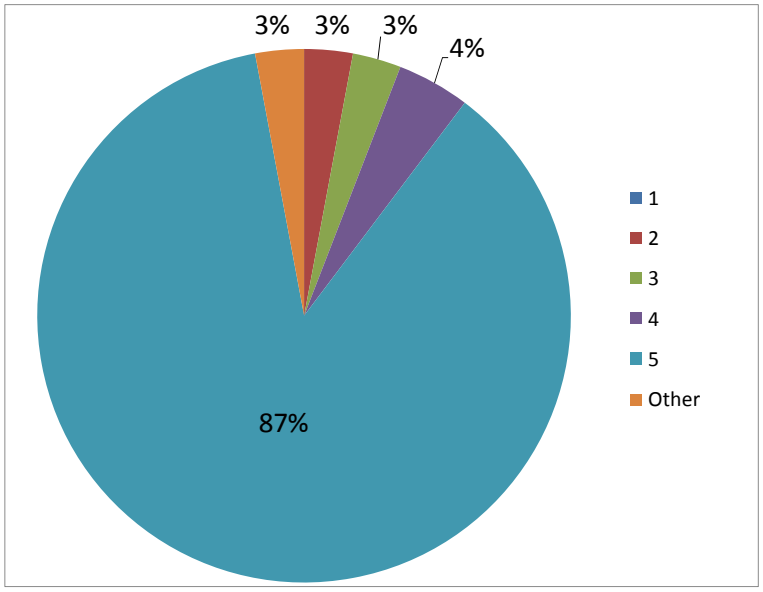


Figure 4-9: Weekly Frequency of Trips Using Park and Ride Facility

4.3.10 Period of Use of Park and Ride Facilities

Figure 4-10 shows the length of time for which respondents have been using the Park and Ride system. Exactly half of the surveyed users have begun using the system in the last year, which may identify the recent attractiveness of such a system being associated with increasing congestion, reduced parking supply in the city centre and higher fuel costs.

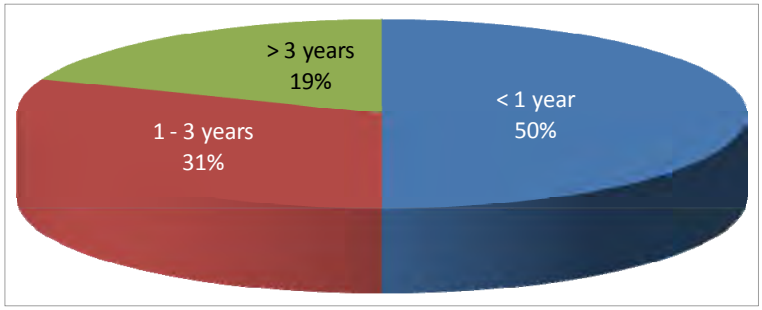


Figure 4-10: Period of use of Park and Ride Facility

4.3.11 Mode of Transport before Using Park and Ride Facilities

Figure 4-11 shows that the majority of respondents used their cars in their work trips before shifting to Park and Ride.

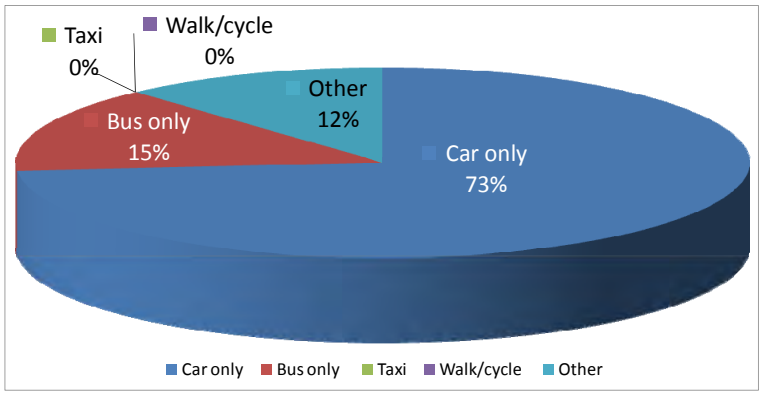


Figure 4-11: Mode of Transport before using Park and Ride Facility

4.3.12 Difficulties Encountered when Using Park and Ride Facilities

Figure 4-12 indicates that most of the respondents indicated that they do not encounter any difficulties during using the Park and Ride system.

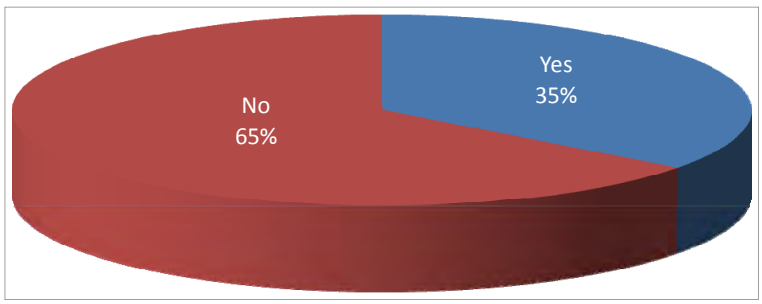


Figure 4-12: Difficulties Encountered when using Park and Ride Facility

Eight types of generic difficulties that may exist in any Park and Ride System were provided to respondents in an effort to elicit their ranking of the relative extent of these difficulties. Figure 4-13 shows the rank frequency distribution of these difficulties where rank 1 represents the greatest difficulty. The figure shows respondents perceive limited parking space at Park and Ride facilities as well as vehicle safety and security as potential difficulties. In addition, several respondents indicated other difficulties.

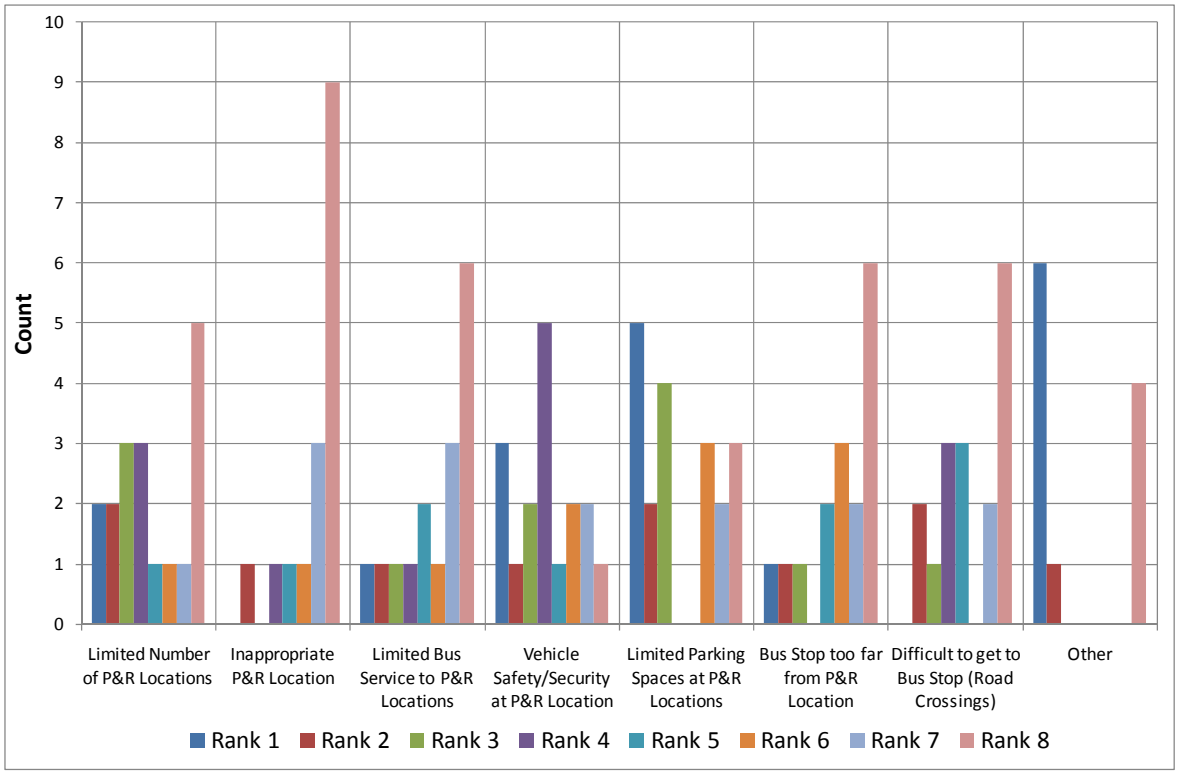


Figure 4-13: Ranking Difficulties Encountered in using the Park and Ride System

4.3.13 More Park and Ride Locations

Park and Ride users were asked whether they would like to see more Park and Ride locations, with the overwhelming majority answering yes.

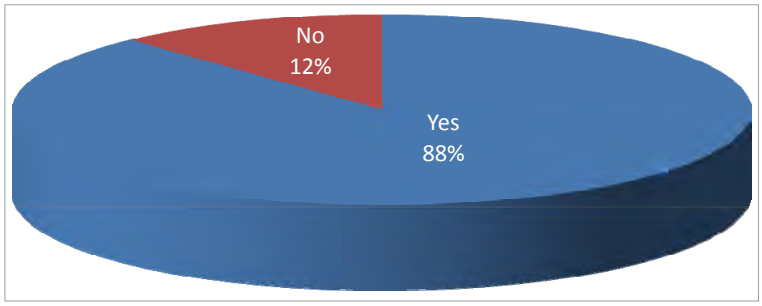


Figure 4-14: More Park and Ride Locations

4.3.14 Potential Park and Ride Locations

Five potential Park and Ride locations were suggested in the survey for ranking according to their perceived attractiveness. As shown in Figure 4-15, a new location on Athllon Drive was ranked highest by more than 50% of respondents.

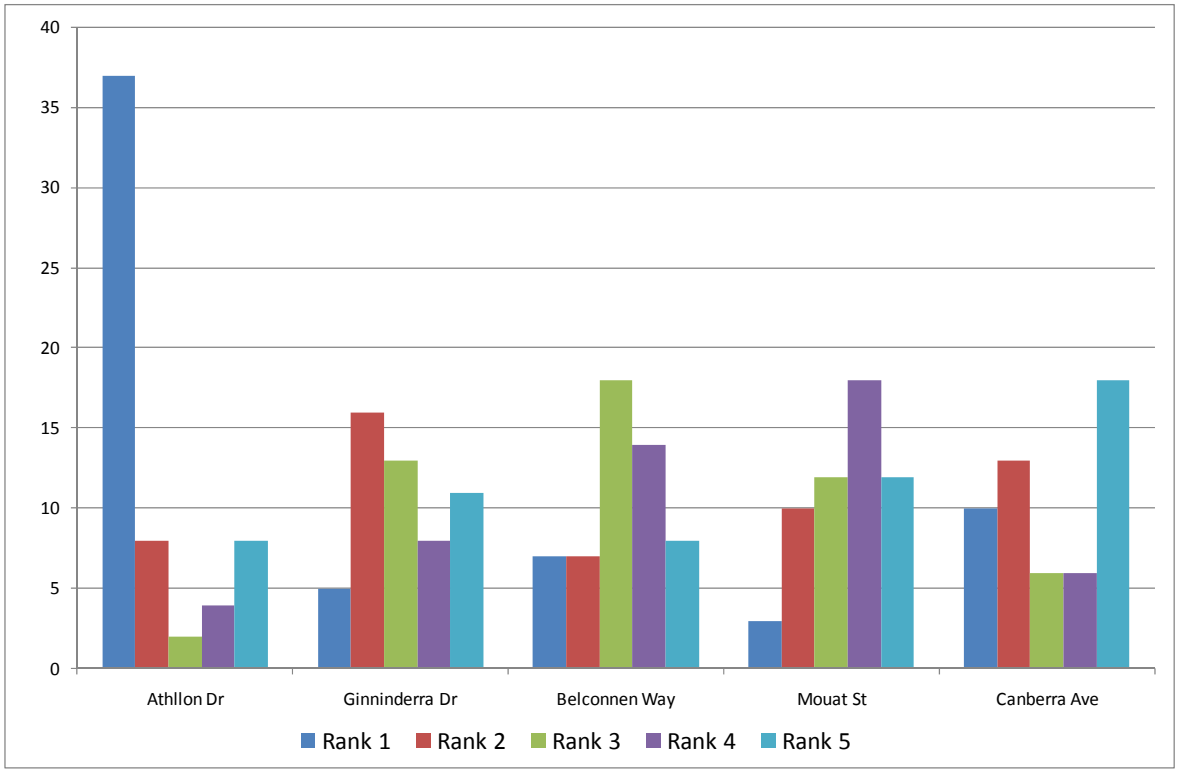


Figure 4-15: Ranking Preferred Location for New Park and Ride Facility Locations

4.3.15 Park and Ride Demand Survey Participants' Issues

Users were asked an open-ended, final question to provide suggestions for improvement of the Park and Ride system in Canberra. The majority of respondents (71%) raised a number of issues and suggestions. Figure 4-16 illustrates the issues that the Park and Ride demand survey participants identified. The figure shows that Park and Ride users identified the following major issues:

- Not enough buses (17%)
- Safety of cars and people (15%)
- Crowded buses (15%)
- Park and Ride facility not being used correctly (12%)
- Timing of bus services (10%)
- Too hard to collect passes (7%)
- *Other (16%)*

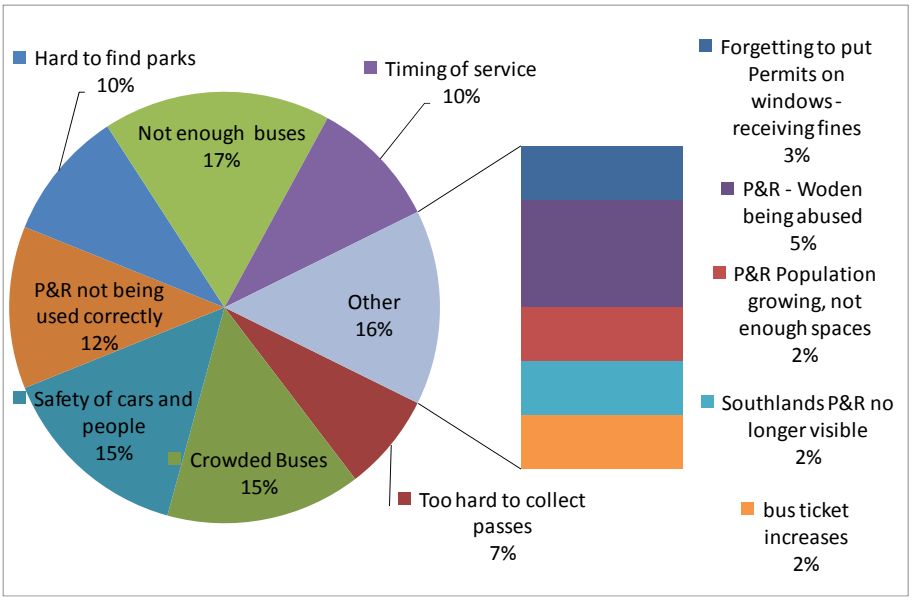


Figure 4-16: Issues Raised by Survey Participants

4.3.16 Park and Ride demand survey participants Suggestions

Figure 4-17 illustrates the suggestions for improving the system by users in their questionnaire response. The three most popular suggestions are *more parking spaces*, *more buses*", and *passes be issued for more or less than a month (more flexibility)*.

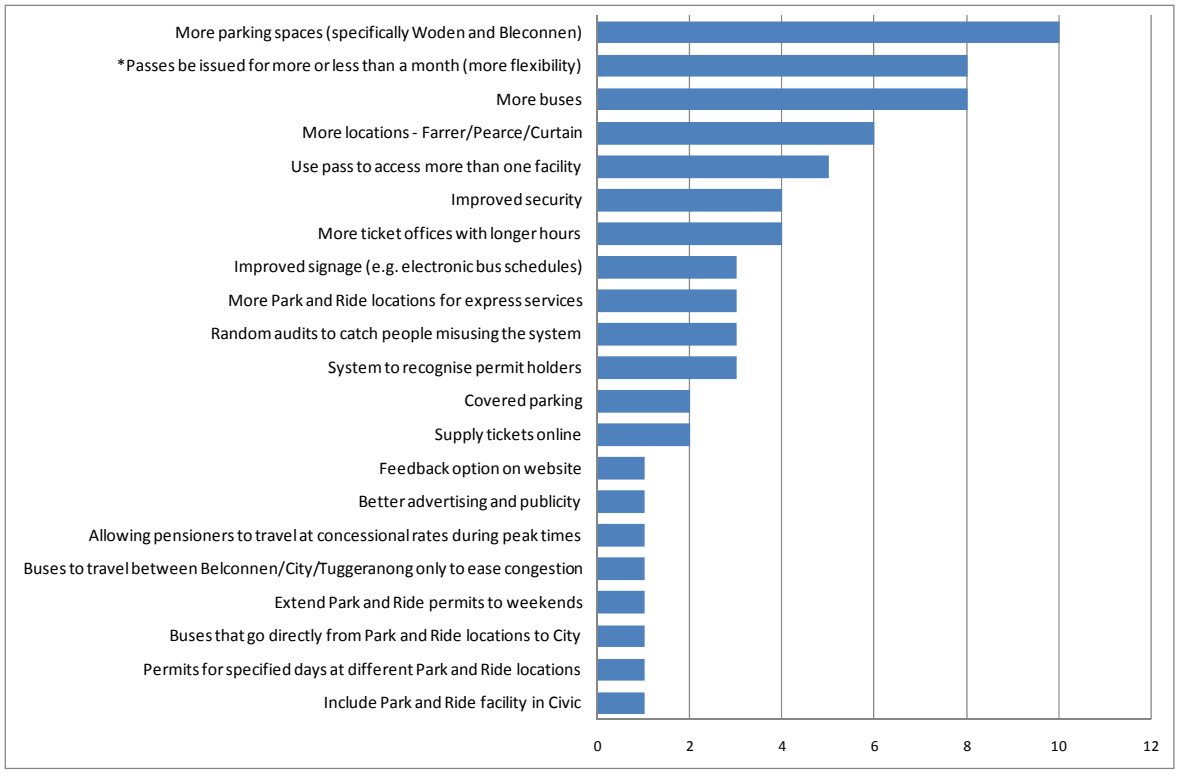


Figure 4-17: Suggestions by Participants to Improve the Park and Ride System

* The current system only issue passes on a monthly basis

4.3.17 Perceived Travel Time Components of Using Park and Ride

Figure 4-18 shows the cumulative frequency distribution for average total travel time on Park and Ride journeys. Total travel time includes the following components:

- Average facility access time
- Average travel time from facility to interchange
- Average waiting time for bus
- Average bus travel time
- Average travel time from bus to final destination

The average total travel time varies significantly between the facilities. The largest absolute variation occurs in the access time to the Park and Ride facility and the bus travel time. The average access times to the facilities are 9.79, 9.92 and 14.11 minutes for Tuggeranong, Belconnen and Woden respectively. Average bus travel time is shortest when coming from Woden interchange, at 19.26 minutes, while it is largest when coming from Tuggeranong Interchange at 30.14 minutes. The rest of the travel time components vary slightly among the three Park and Ride facilities.

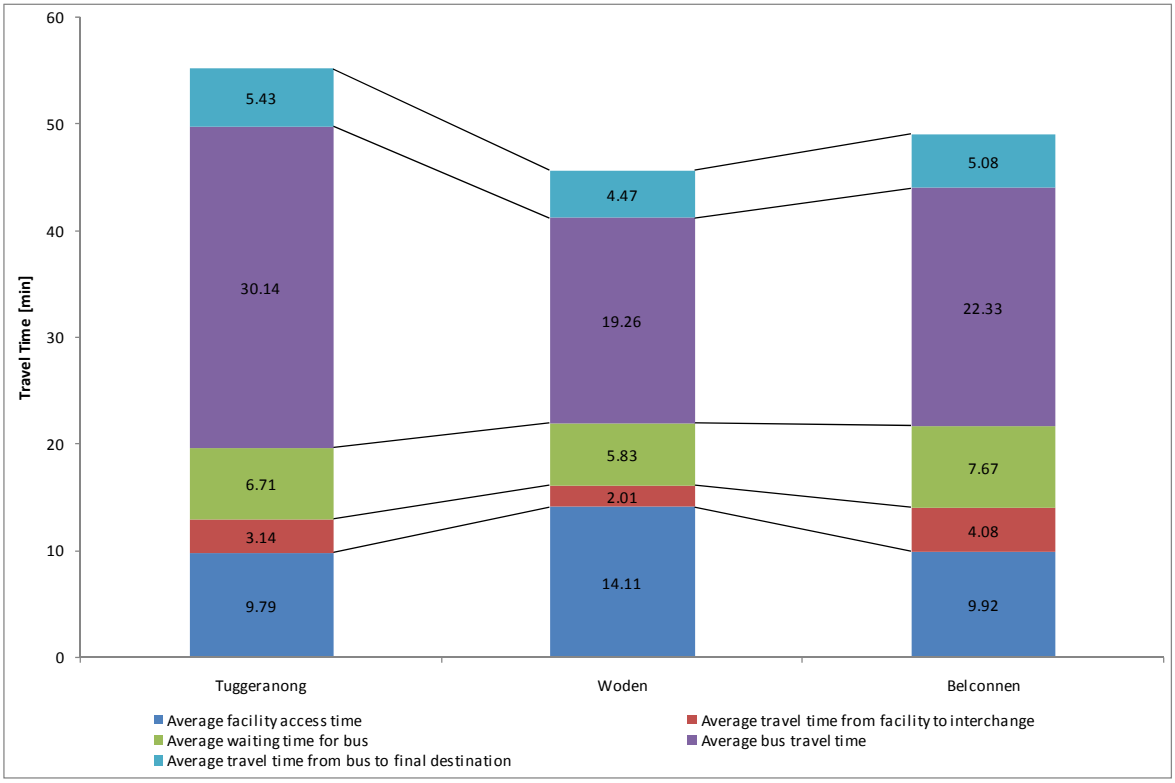


Figure 4-18: Cumulative Frequency Distribution of Travel Time Components for Park and Ride Users

4.3.18 Park and Ride Demand Survey Summary Conclusions

A summary of the main conclusions of the Park and Ride demand survey are as follows:

1. The system attracts a large number of commuters from the suburbs of Gordon and Wanniassa, followed by the suburbs of Monash, Kambah, and Isabella Plains.
2. Slightly more than half (54%) of the respondents travel to the Park and Ride facility on their own.
3. Almost all (93%) respondents find a parking spot easily within the facility.
4. Almost all (98%) respondents ride the bus for the longest component of their trips, and 2% of them use the Park and Ride facility to change to carpooling.
5. No respondents need to change buses to reach their final destinations.
6. Most (82%) respondents' final destinations are Civic, Russell, Barton and Parkes, followed by 8% for Woden, 6% for Belconnen and 4% for Tuggeranong.
7. All trips are for work.
8. Most (87%) respondents use the system 5 days a week.
9. Half of the respondents have been using the system for less than one year, with 31% between one and three years and 19% for more than three years.
10. Most (73%) respondents switched from using their cars.
11. Most (65%) respondents indicated that they do not encounter any difficulties during their use of the Park and Ride facilities. Difficulties that were encountered include limited parking availability, vehicle safety and security.
12. Most (88%) respondents would like more Park and Ride locations.
13. More than half of the respondents nominated Athllon Drive as the site of a possible future Park and Ride facility.
14. Potential issues that were identified include insufficient bus services, safety of vehicles and people, crowded buses as well as misuse of the Park and Ride system.
15. Potential improvements that were identified include more parking spaces, more buses and more flexibility in the permit system, e.g. for more or less than one month at a time.
16. Users of the Woden facility have the shortest average journey time from the bus interchange to work at 19 minutes, while it is longest for Tuggeranong users at 30 minutes on average.

5 Car User Travel Survey

5.1 Objectives

The main objective of this survey is to recognise characteristics of private car daily trips for commuters living in suburbs that are within the catchment areas of the existing main Park and Ride facilities. The secondary objective is to gain an understanding of the reasons for which commuters use private cars for their work trips, and what changes in the bus and the Park and Ride systems may instigate a modal shift from private car to bus and/or Park and Ride. The distributed car user travel survey form is included in Appendix 1.

5.2 Survey Process

The following represents the stages followed by SMEC to conduct the car user travel survey.

Stage 1: A package was prepared by the SMEC team including:

- A cover letter
- Two serially numbered survey forms
- Instructions on how to complete the survey
- Two reply paid envelopes

Stage 2: SMEC mailed out packages to households randomly selected from the White Pages (telephone directory).

Stage 3: Participants were asked to complete the questionnaires at their convenience and mail the completed forms back to SMEC.

Stage 4: Once received by SMEC the completed surveys were reviewed, validated and sorted.

Stage 5: The survey data was then entered into an Access database and processed using Excel. Several checks were conducted to verify the logic of the data, its coding and entry.

Stage 6: This stage is mainly concerned with the descriptive analysis of questionnaire responses.

Figure 5-1 reflects the logistics of distribution of the car user travel survey, according to the methodology above.

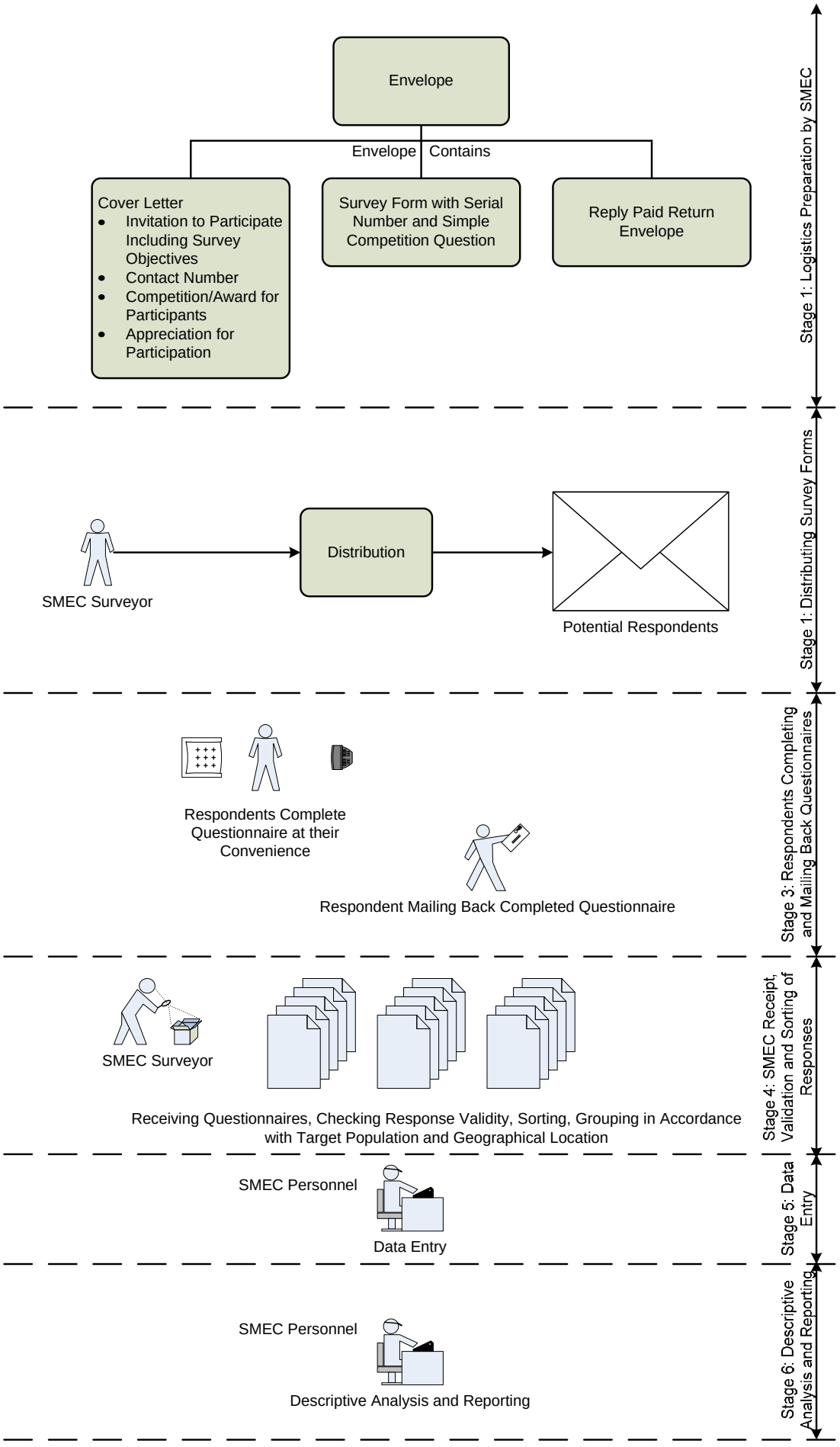


Figure 5-1: Mobilising and carrying out the Survey

5.3 Car User Travel Survey Sample

To obtain a representation of the behaviour of private car users in the Park and Ride catchment areas, the survey participants were chosen at random from the suburbs that were identified by the Park and Ride demand survey. Surveys forms were mailed to households in the suburbs shown in Figure 5-2.

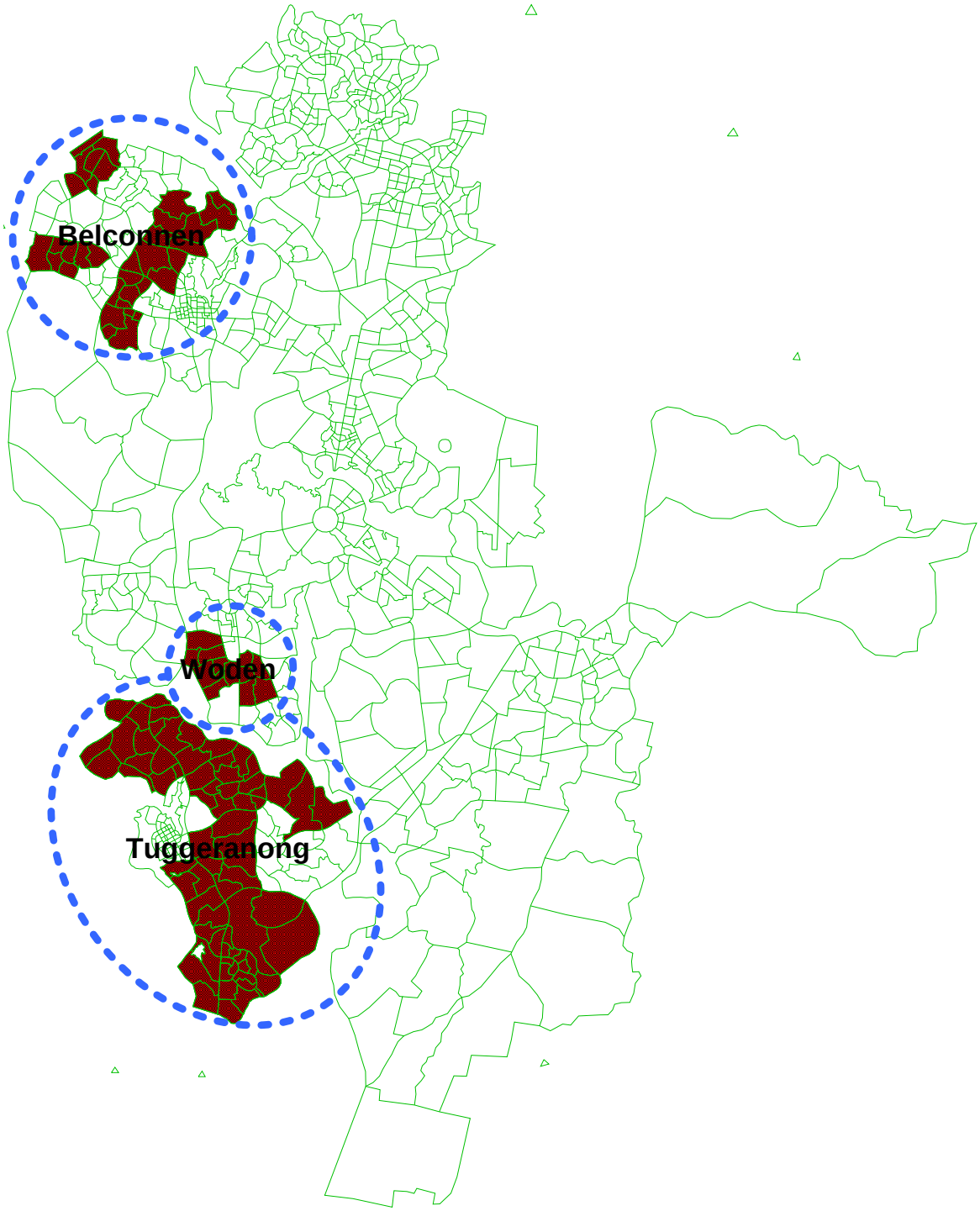


Figure 5-2: Locations of Suburbs to which Car User Travel Survey Forms were Mailed To

Previous experience suggested that the expected response rate from mail-out surveys is usually between 20% and 10% depending on the complexity of the questionnaire, the time of year it is conducted, the level of interest of respondents as well as whether respondents have recently been

subjected to other questionnaires. 1.9% of households within the identified suburbs, with residents of driving age (over 16 years), were contacted. The sample distribution is detailed in Table 5-1.

Table 5-1: Car User Travel Survey Sample Distribution

Area	Suburb	Population ≥ 16 Years	Forms Mailed
Belconnen	Dunlop	4,186	78
	Evatt	4,241	79
	Florey	3,938	74
	Hawker	2,362	44
	Holt	3,675	69
	Melba	2,530	47
	Scullin	2,203	41
	Sub-total	*23,135*	*432*
Tuggeranong Valley	Banks	3,391	63
	Bonython	2,509	47
	Calwell	4,210	79
	Conder	3,430	64
	Fadden	2,455	46
	Gordon	5,624	105
	Isabella Plains	3,122	58
	Kambah	12,189	227
	Macarthur	1,194	23
	Monash	4,351	81
	Theodore	2,814	53
	Wanniassa	6,146	115
	Sub-total	*51,435*	*961*
Woden Valley	Chifley	1,874	35
	Mawson	2,353	44
	Pearce	1,956	37
	Sub-total	*6,183*	*116*
	Total	**80,753**	**1,509**

Source (Population): 2006 ABS Census

Figure 5-3 indicates the distribution of returned car user travel survey forms.

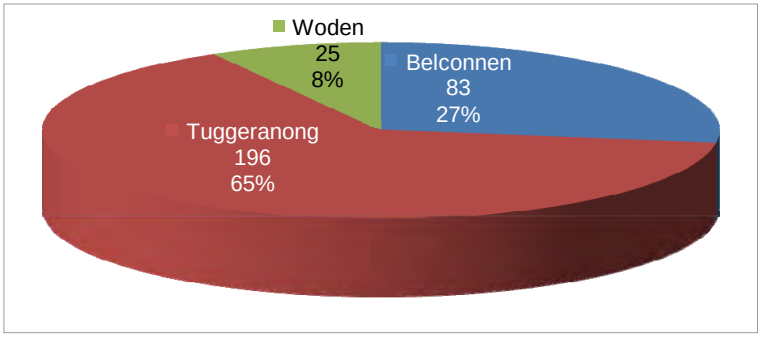


Figure 5-3: Sampling of Car User Travel Survey

5.4 Car User Travel Survey Response Rate

SMEC received 325 responses, from which 21 were excluded because of incomplete responses or ineligibility of the participant (e.g. not a private car user.) The overall average response rate was 21.54%, as shown in Table 5-2, or 20.15% after incomplete or ineligible responses were excluded. The proportion of accepted questionnaires for coding is similar (around 20%) for the three facilities, ruling out any possible geographical bias in the analysis.

Table 5-2: Response Rates for Car User Travel Survey

Area	Mailed	Received	Coded	Excluded	Coded/Mailed
Belconnen	432	325 (21.54%)	83	21	19.21%
Tuggeranong	961		196		20.40%
Woden	116		25		21.55%
Total	**1,509**	**325**	**304**	**21**	**20.15%**

5.4.1 Distribution of Survey Forms by Suburb

A comparison of the number of mailed out survey forms compared to the number of received completed forms for each suburb is shown in Figure 5-4.

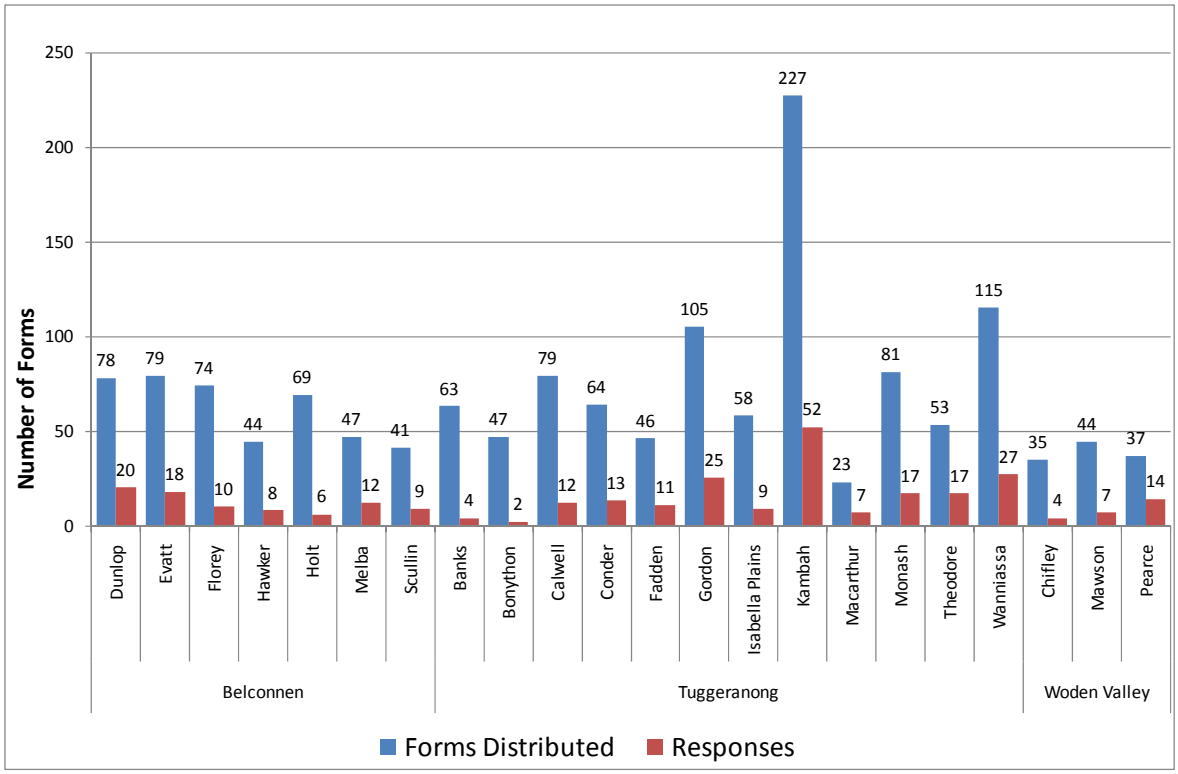


Figure 5-4: Distribution of Survey Forms Delivered and Received by Suburb

5.4.2 Data Entry

Once the received forms were validated and sorted, the information was entered into an Access database. A graphical entry interface was created to ease the data entry process and minimise errors. The collected data was then exported to Excel for analysis.

5.5 Car User Travel Survey Results

5.5.1 Number of Household Registered Private Cars

Figure 5-5 shows that more than half of the surveyed households own two registered private cars, while less than a quarter own only one.

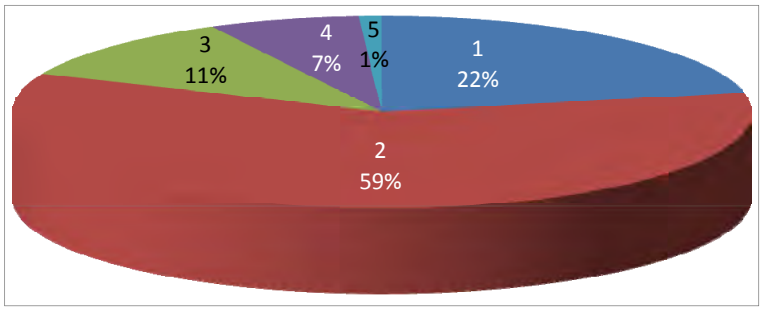


Figure 5-5: Number of Household Registered Private Cars

5.5.2 Private Car User Trip Purpose

Figure 5-6 shows that 63% of respondents indicated that their trip purpose is for work, followed by multi-purpose trips with 30%. No other specific trip type occurs more than 3% of the time.

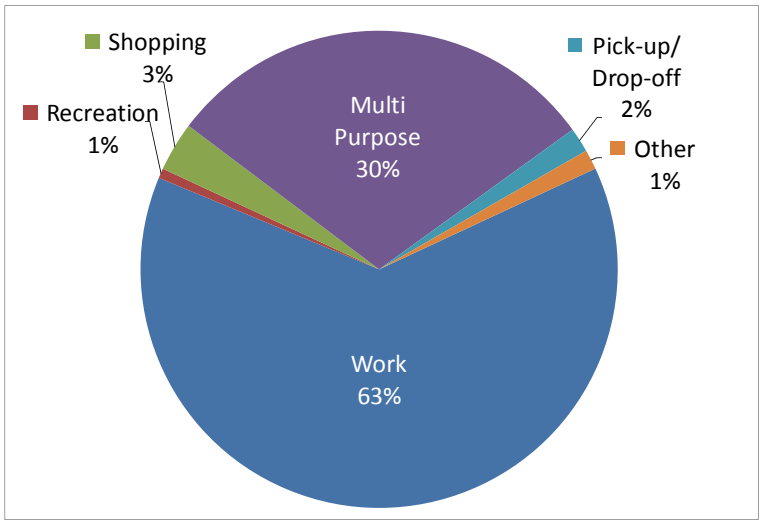


Figure 5-6: Private Car User Trip Purpose

5.5.3 Frequency of Trips by Private Car

Figure 5-7 shows the frequency of trips conducted by private car in an average week. More than three quarters of respondents travel five or more times in a week.

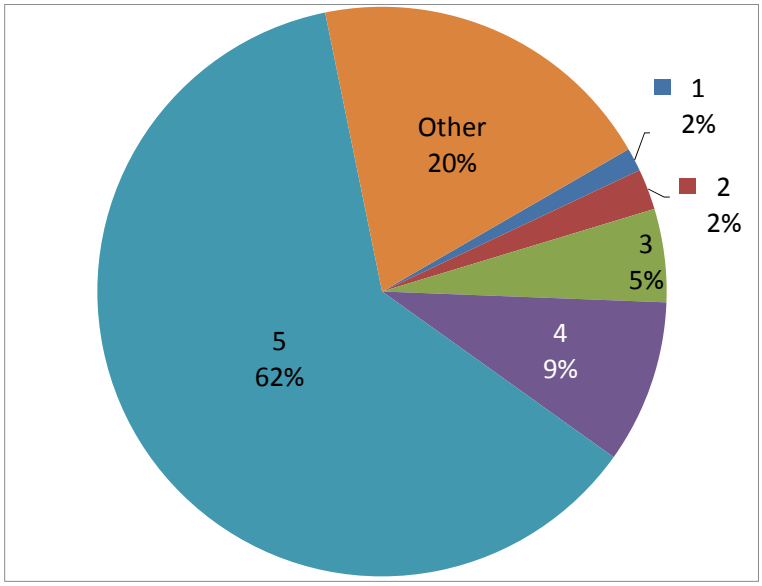


Figure 5-7: Weekly Frequency of Trips by Private Car

5.5.4 Private Car Occupancy Rates

Figure 5-8 shows the vehicle occupancy of private car users. The figure shows that two thirds of respondents travel on their own.

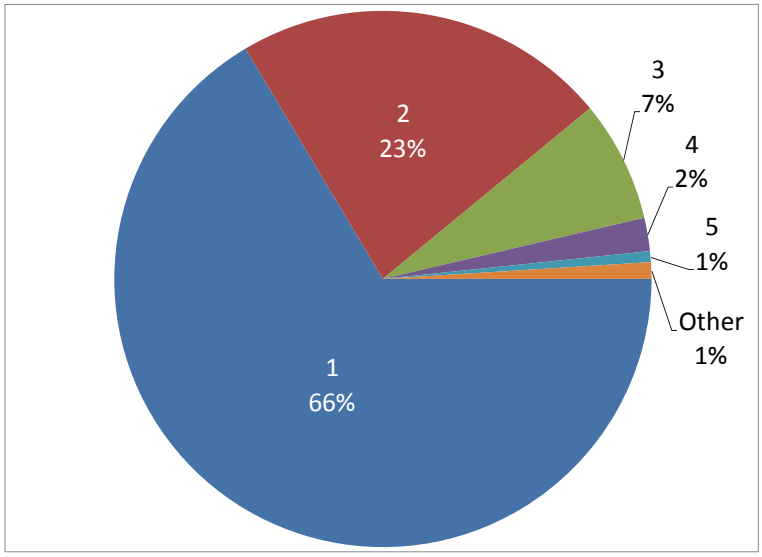


Figure 5-8: Car Average Occupancy

5.5.5 Private Car Average Travel Time by Suburb

Figure 5-9 shows the average in-car driving time per trip for all trip purposes. Significant variations in driving time were found across different suburbs.

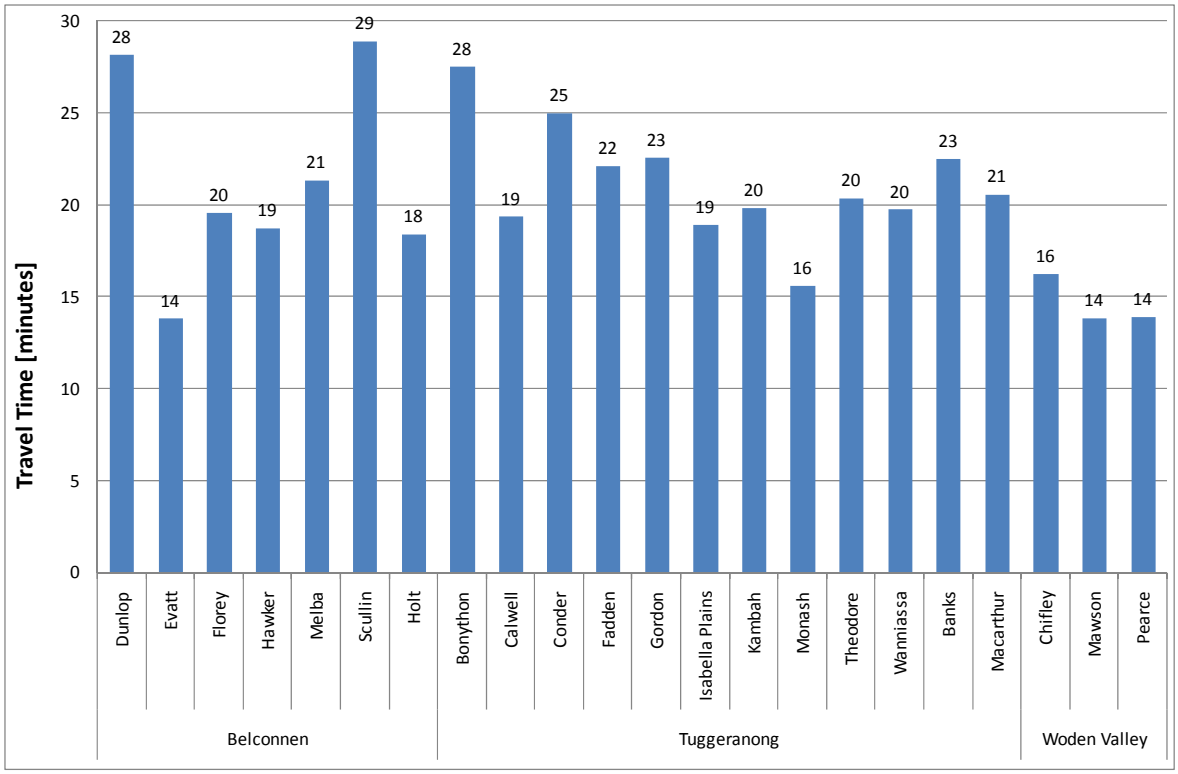


Figure 5-9: Average In-Car Driving Time by Suburb

5.5.6 Private Car Parking Facility Types

Figure 5-10 indicates that most private car users park off-street (surface parking), while almost a third make use of structured (i.e. multi-level) parking facilities. Only 12% park on-street.

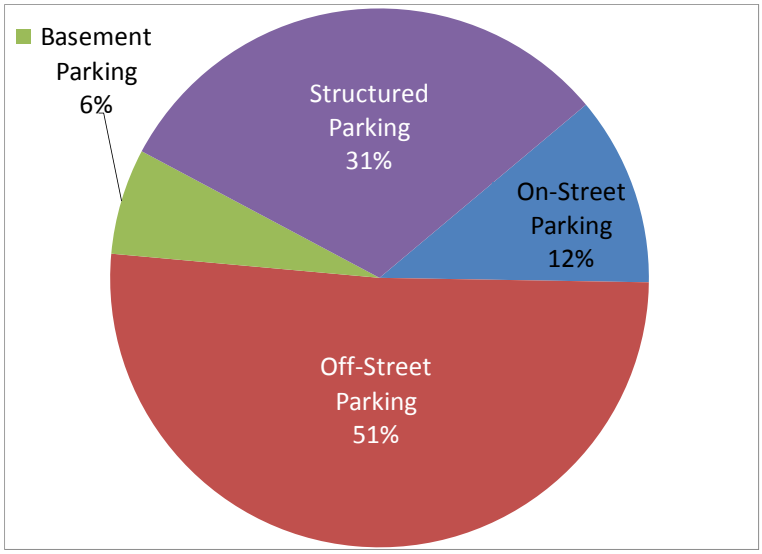


Figure 5-10: Private Car User Parking Type

5.5.7 Private Car Parking Fees

Figure 5-11 shows that most car users (61%) benefit from free parking.

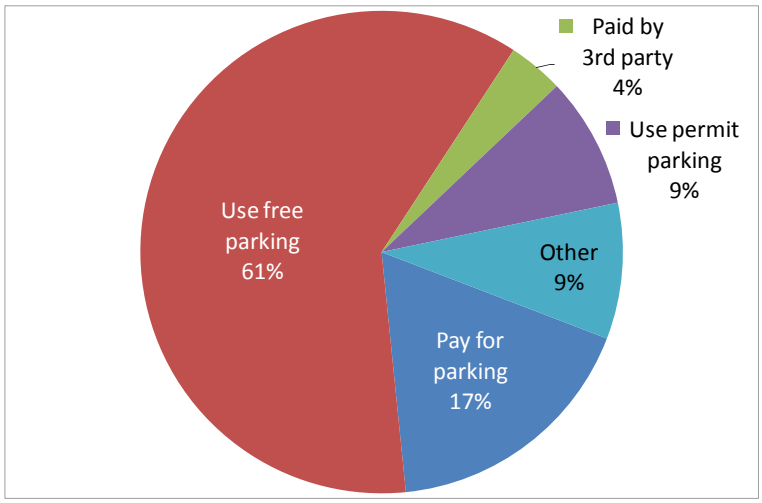


Figure 5-11: Types of Parking Fees

5.5.8 Ease of Locating a Parking Space

Figure 5-12 illustrates that two thirds of respondents find it easy to locate an empty parking space, while only 6% frequently have trouble doing so.

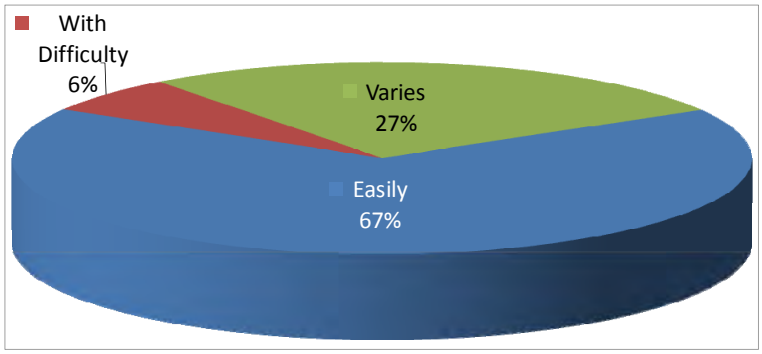


Figure 5-12: Ease of Locating a Parking Space

5.5.9 Private Car User Walking Time to Destination

Figure 5-13 shows the average walking times for private car users to their final destination after parking their car. Slight variations are apparent between different destinations, with North Canberra and Woden Valley having the longest walking times of about five minutes, and Belconnen and South Canberra having the shortest with less than three minutes.

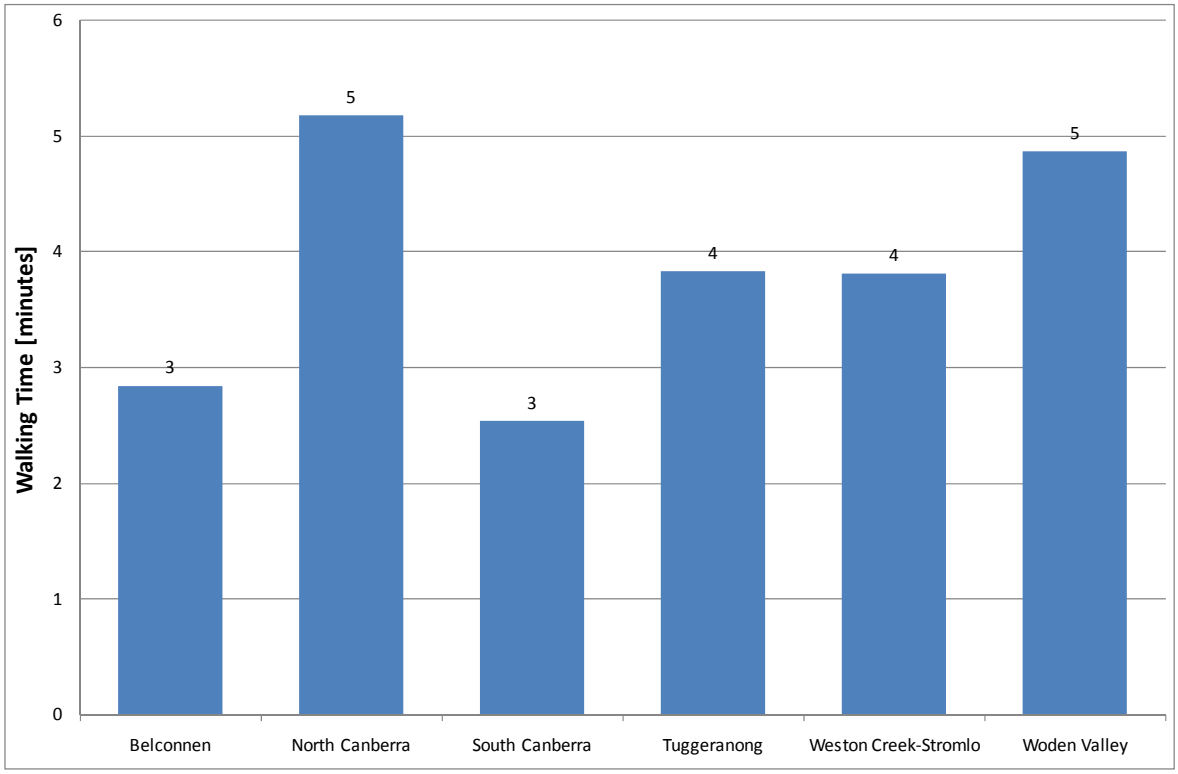


Figure 5-13: Average Walking Time from Parking Spot to Final Destination

5.5.10 Reasons for Choosing Private Car for Daily Trips

Ten generic reasons for choosing the private car as the primary mode of transport were listed to allow respondents to identify factors influencing their mode choice. Figure 5-14 shows the rank frequency distribution of these reasons where rank 1 represents the highest relative importance.

The figure shows that respondents perceive freedom from fixed schedules (*flexibility*) and speed (*faster than other methods*) as key reasons for choosing the private car to make daily trips. In addition, respondents indicated other reasons including:

1. No other transport available.
2. Bus not early enough (*note: some people need to travel very early in the morning*).
3. Disability.
4. Drop-off and pick-up children.

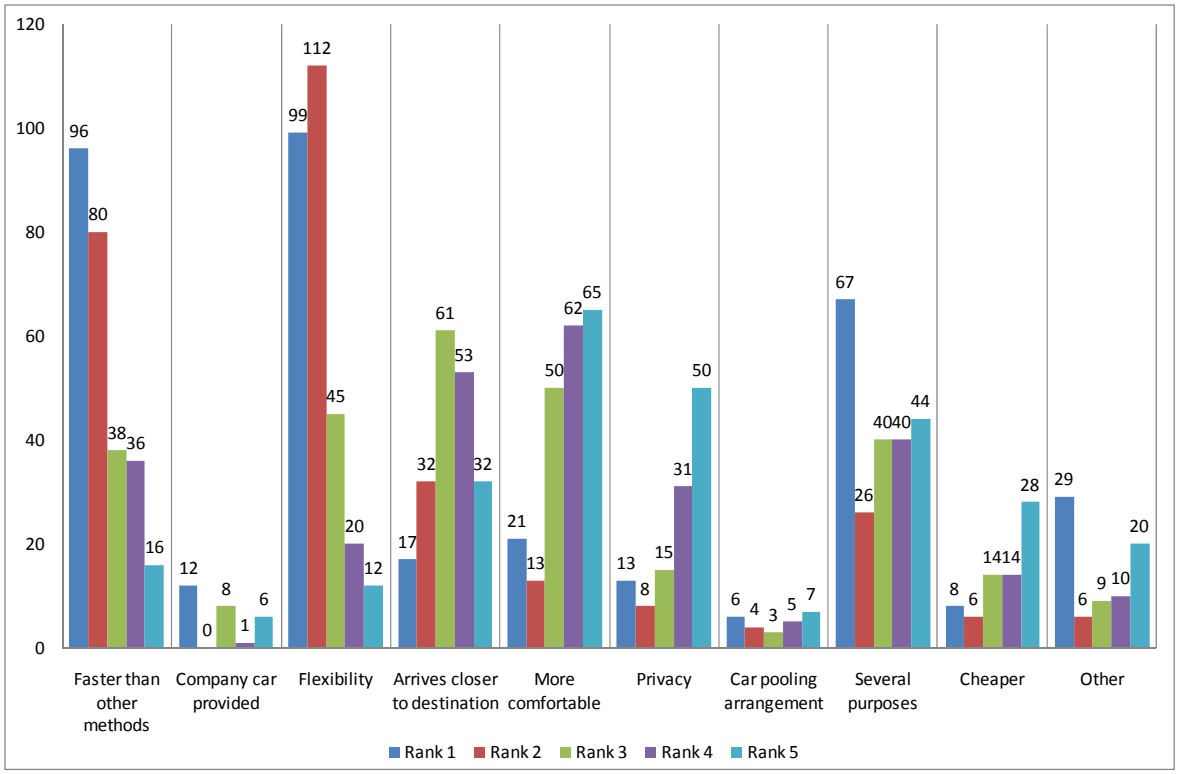


Figure 5-14: Reasons for Choosing Private Car for Daily Trips

5.5.11 Factors Encouraging Car Users to Shift to Public Transport

Ten generic factors that may encourage car users to shift to public transport to make their daily trips were suggested to allow respondents to identify under what conditions they may re-evaluate their decision to travel by car. Figure 5-15 shows the rank frequency distribution of these factors where rank 1 represents the most encouraging. The figure shows that respondents perceive *more direct bus routes* and *improved service frequency*, to be the most likely factors to influence their choice between private car and public buses for daily travel.

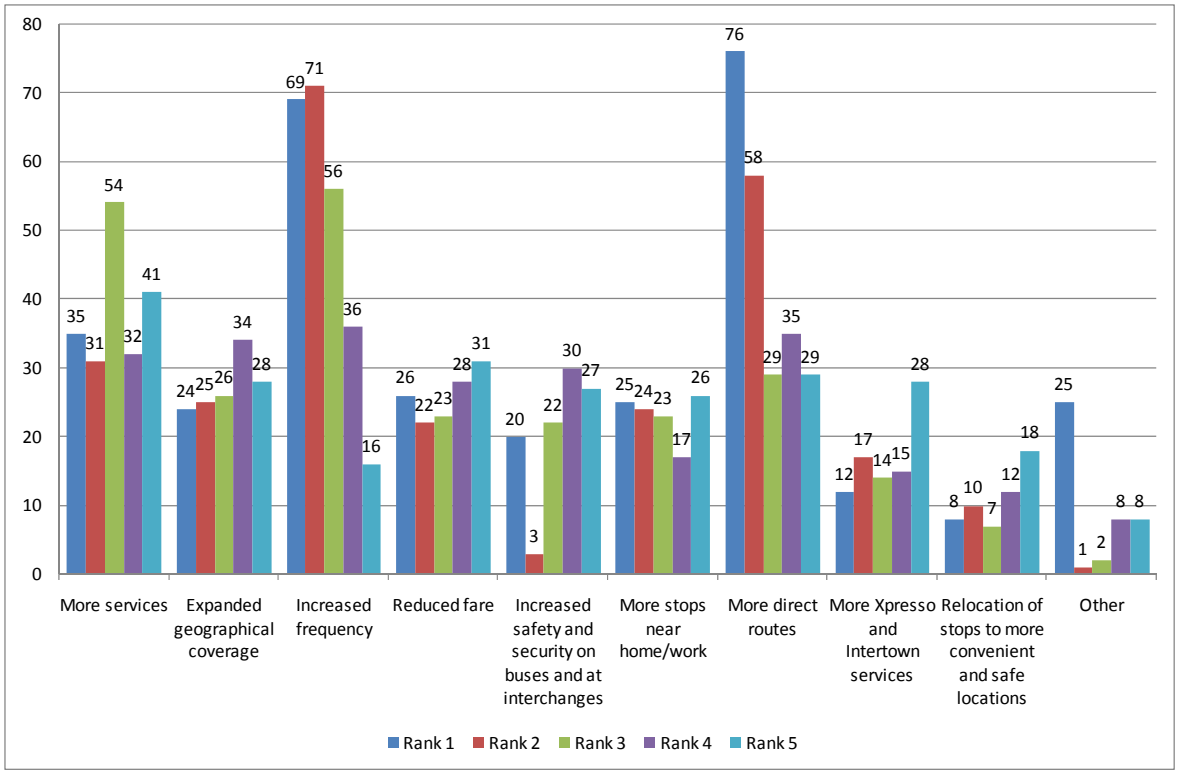


Figure 5-15: Factors Encouraging Use of Public Buses for Daily Trips

5.5.12 Park and Ride System Awareness

Figure 5-16 shows that 85% of respondents indicated that they are aware of the Park and Ride system in Canberra.

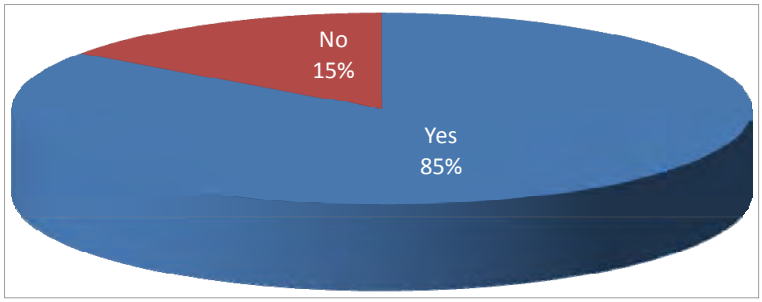


Figure 5-16: Park and Ride System Awareness

5.5.13 Factors Encouraging Car Users to use Park and Ride

Seven generic factors that may encourage car users to switch to Park and Ride for their daily trips were suggested to allow respondents to identify which of them are more likely to do so. Figure 5-17 shows the rank frequency distribution of these factors where rank 1 represents the most encouraging. The figure shows that respondents perceive *frequent bus service to Park and Ride locations* and *more Park and Ride locations* as the factors with most potential for encouraging greater use of the Park and Ride system for daily trips.

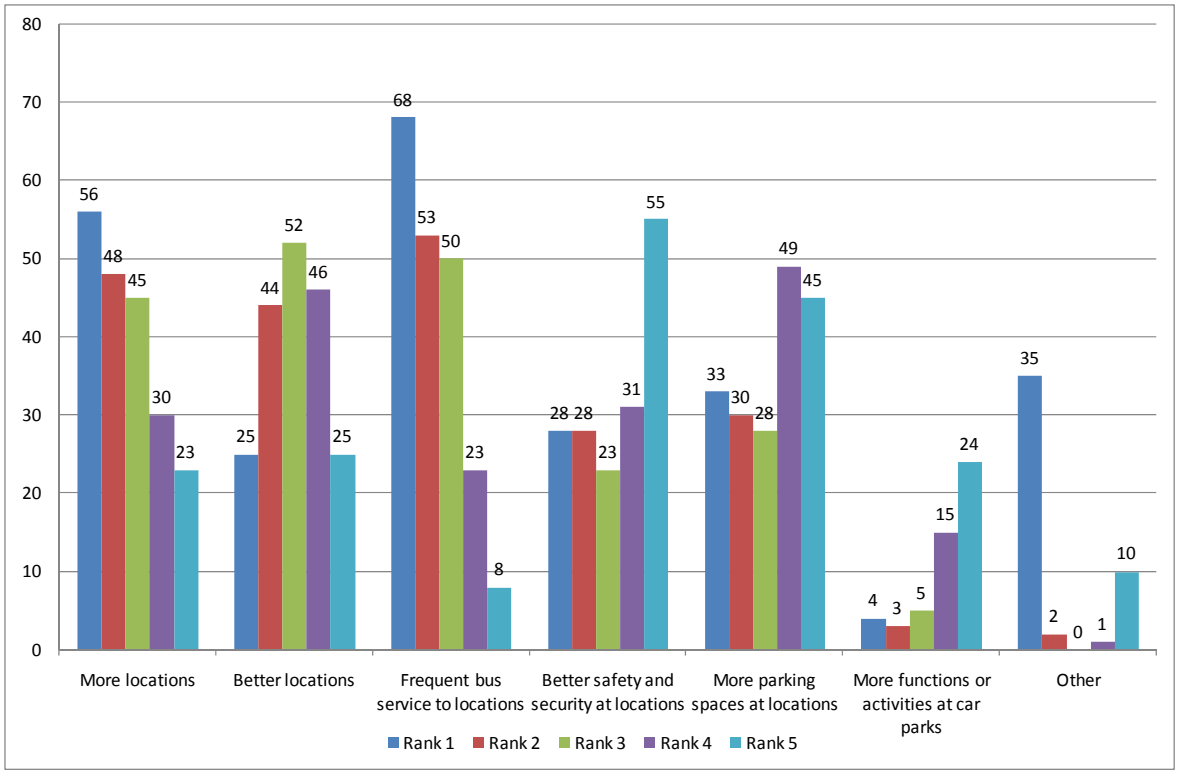


Figure 5-17: Factors Encouraging Use of Park and Ride System for Daily Trips

5.5.14 Duration of Private Car Use

Figure 5-18 shows the length of time for which survey respondents have used a private car as their primary transport mode. Almost all respondents have been using a private car for more than 3 years, while only 4% have been doing so for less than a year.

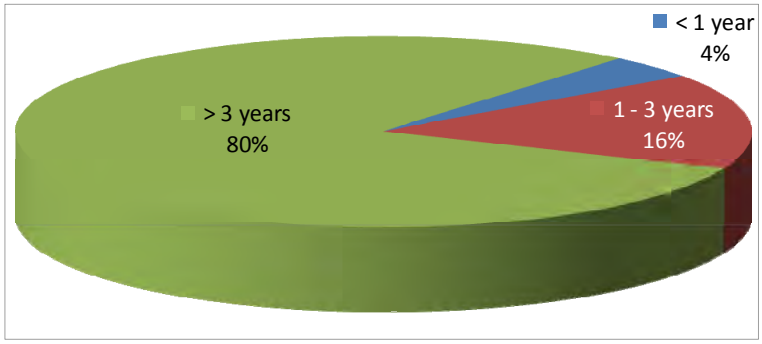


Figure 5-18: Duration of Private Car Use

5.5.15 Mode of Transport before Private Car

Figure 5-19 shows that the majority of respondents previously used buses, while 6% switched from Park and Ride to private car only. The former are presumably those that did not own cars before or did not have driving licences.

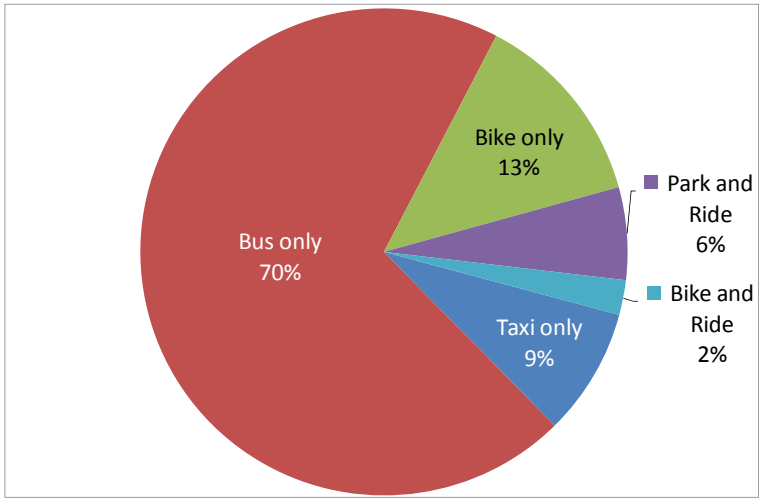


Figure 5-19: Mode of Transport before Using Private Car for Daily Trips

5.5.16 Car User Suggestions to Improve Bus System

Respondents were asked an open-ended question to state their suggestions on how to improve the bus system in Canberra. The majority of respondents (63%) provided at least one suggestion. Figure 5-20 illustrates the categories of suggestions for improving the bus system. The figure shows that the three most common suggestions are 1) *improve service frequency*, 2) *more buses*, and 3) *more direct routes*.

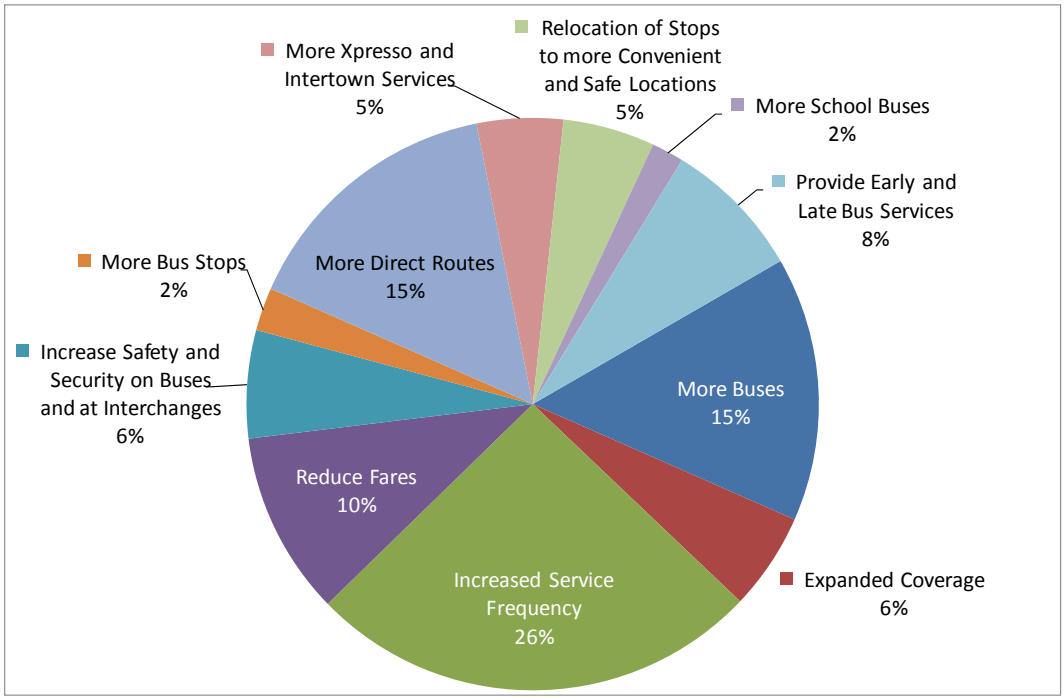


Figure 5-20: Car User Suggestions to Improve the Bus System

5.5.17 Car User Suggestions to Improve Park and Ride System

Respondents were asked an open-ended, final question to state their suggestions for improvement of the Park and Ride system in Canberra. Only 35% of respondents provided suggestions. Figure 5-21 illustrates the categories of suggestions made by the car user travel survey participants. The figure shows that the three most common suggestions are 1) *better safety and security at Park and Ride locations*, 2) *more Park and Ride locations*, and 3) *more frequent bus services*.

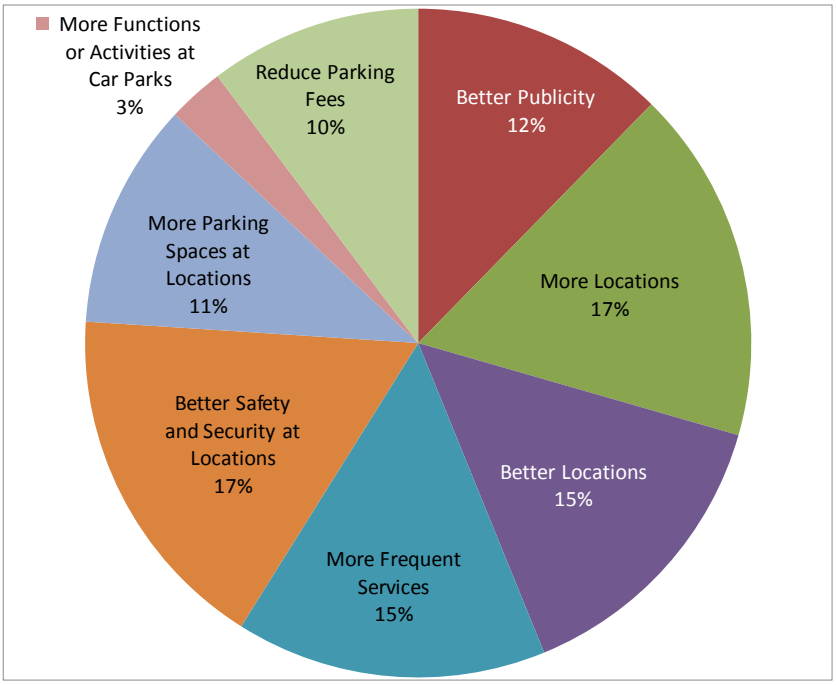


Figure 5-21: Car User Suggestions to Improve the Park and Ride System

5.5.18 Perceived Travel Time Components of Using Private Car

Figure 5-22 shows the cumulative frequency distribution of average total travel time for a private car user trip. This is composed of an average in-car travel time and average walking time from the parking space to their final destination.

Figure 5-22: Cumulative Frequency Distribution of Travel Time Components for Private Car Users

A time verification question was included in the survey form. This was meant to compare the total journey travel time to the cumulative travel time. Table 5-3 shows a comparison of the two. The table shows a slight variation between the two answers.

Table 5-3: Differences between calculated and stated total travel time of Car users (Minutes)

Area	Cumulative	Stated Total	Differences
Belconnen	25.90	24.68	1.22
Tuggeranong	24.20	22.39	1.81
Woden	18.97	14.67	4.30

5.5.19 Car User Travel Survey Summary Conclusions

A summary of the main conclusions drawn from the analysis of the car user survey are as follows:

1. 59% of respondents indicated that they have two registered cars, while, 22% have indicated that they have one car.
2. 63% of car users' daily trips are for work purposes.
3. 62% of car users make 5 daily trips in a week, while 9% of car users make 4 daily trips in a week.
4. Most of the respondents indicated that they use their cars alone for these trips (66%).
5. Average in-car driving time varies from 14 minutes for car users driving from Evatt, Mawson and Pearce suburbs to 29 minutes for car users driving from Scullin.
6. 51% of car users use off-street parking while 31% use structured car parking.
7. 61% of car users use free parking, while 17% personally pay for parking.
8. 67% of car users find parking spots easily, while, 6% find parking spots with difficulty.
9. Walking time of car users varies slightly according to destination areas, where the walking time varies from 3 minutes in Belconnen and South Canberra areas to 5 minutes in North Canberra and Woden Valley areas.
10. *Flexibility* (freedom from fixed schedules) and *faster than other methods* are potential reasons behind the choice of private car for daily trips.
11. *More direct routes* and *increased frequency* are potential factors that may encourage private car users to use the bus system for their daily trips.
12. 85% of car users are aware of the Park and Ride system in Canberra.
13. *Frequent bus service to Park and Ride locations* and *more Park and Ride locations* are potential factors that may encourage private car users to use the Park and Ride system in Canberra.
14. 80% of car users have used their private car for more than three years.
15. 70% of car users primarily used buses to make their daily trips before using their cars.
16. The main suggestions made by car users to improve the bus system were *improve service frequency*, *more buses*, and *more direct routes*.
17. The main suggestions made by car users to improve the Park and Ride system were *better safety and security at Park and Ride locations*, *more Park and Ride locations* and *more frequent services*.
18. The average total travel time varies in accordance with the trip origin area.

6 Selecting Potential Park and Ride Sites

6.1 Park and Ride Selection Process

6.2 Identify Park and Ride Location

One of the main objectives of this study is to identify potential sites for future Park and Ride facilities. SMEC developed the methodology shown in Figure 6-1 to be followed for this process. The proposed exercise involves a multi-criteria analysis, project group consultation and ranking of sites to identify the preferred site(s). The following sections will demonstrate in detail how SMEC applied this methodology.

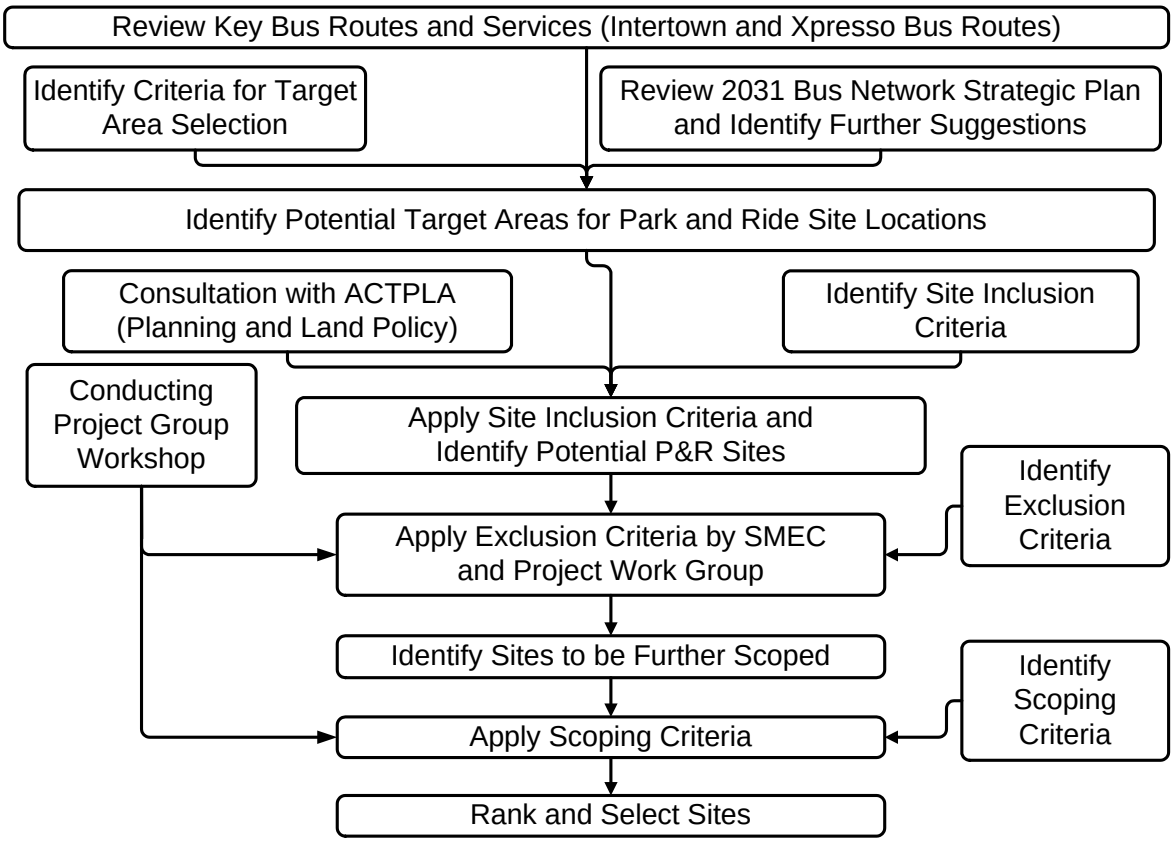


Figure 6-1: SMEC Methodology for Selection of Potential Park and Ride Sites

6.3 Review Key Bus Routes and Services

The literature review suggested that it is very difficult for the Park and Ride system to compete with the car-only mode choice unless premium bus services are available. Premium bus services mainly involve direct routes providing fast and frequent services with a minimum number of stops, and can also include dedicated bus lanes between the origin and the destination.

Currently, ACTION operates four main service types during weekday peak periods, namely:

- Ordinary services
- Xpresso services (introduced during the 2008 network and timetable changes)
- Intertown services
- 200 series (peak hour) bus routes as a shuttle during peak hours between employment centres in Civic, Barton, Campbell and Russell

A review of the ACTION *Authority Annual Report 2005-06* showed that adult patronage for 2005-06 was 5.865 million, an increase of 12.4% over 2004. This achievement is believed to be due in part to the popularity of the Xpresso bus services.

In this task, all Intertown and Xpresso bus service routes were identified and reviewed. The review is intended to identify potential target catchment areas, which are identified based on the following criteria:

- Location of the site with respect to existing Xpresso and Intertown routes
- Size of direct residential suburb catchment area
- Location and its effect on car and bus journey distances; ideally minimising the former while maximising the latter.
- Possibility for use of vacant land

Appendix 2 shows the application of this procedure for each of the Intertown and Xpresso routes. As a result, areas that hold potential for future Park and Ride locations were identified along existing key transit routes. Figure 6-2 shows the areas identified as potential locations marked as blue for the intertown common route between Belconnen and Tuggeranong via Civic and Woden. Figure 6-3 shows the updated Xpresso bus services with areas identified as potential Park and Ride locations marked as blue and orange circles. The blue circles mark the areas identified for the existing Xpresso bus services while the orange circles mark the Park and Ride areas identified for the Xpresso services. SMEC did not propose a Park and Ride location for the Xpresso route 737 as this route starts and ends in employment areas (City to Brindabella Business Park and Fairbairn Park).

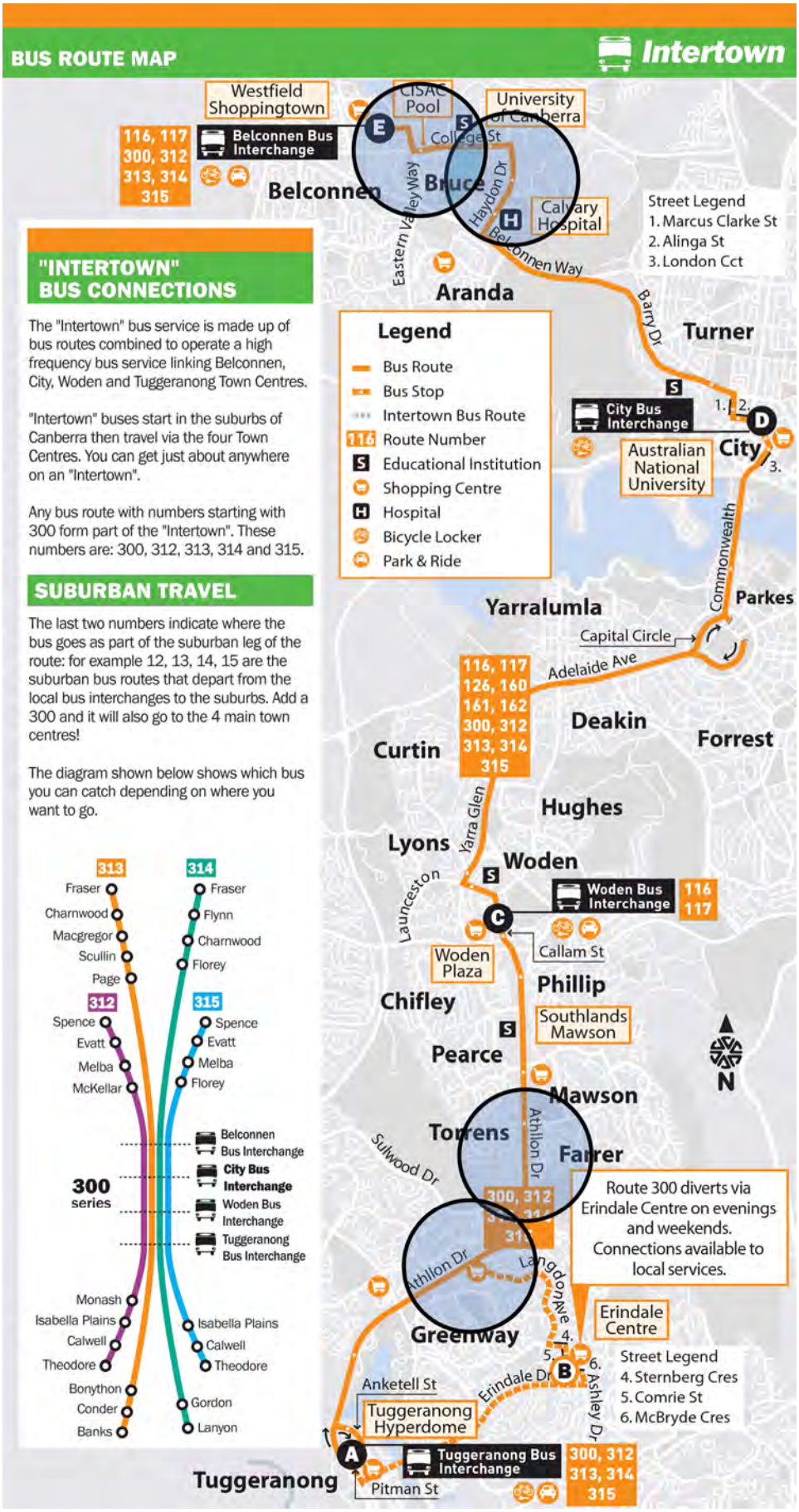


Figure 6-2: Potential Location Along Intertown Bus Routes

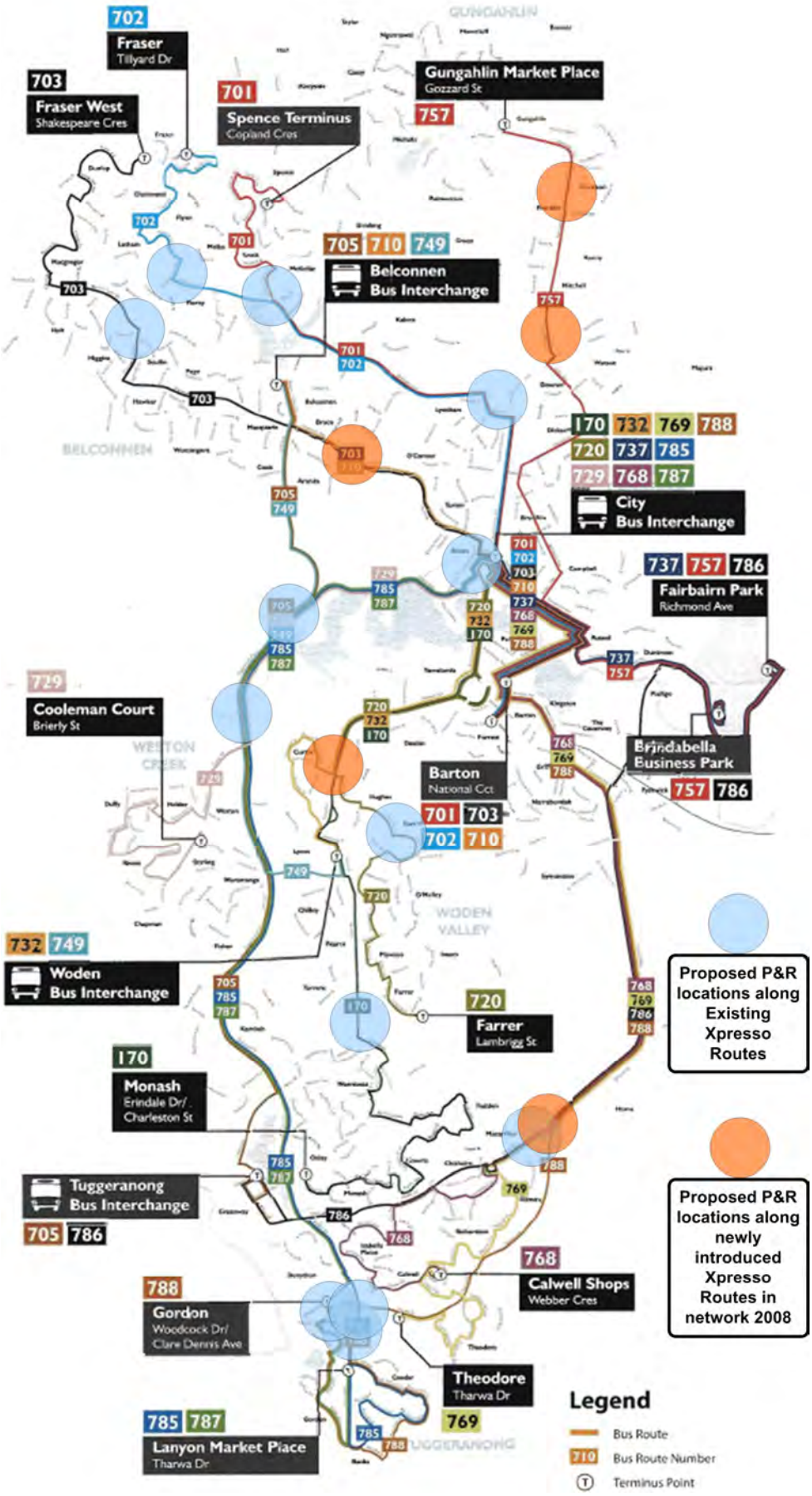


Figure 6-3: Potential Park and Ride Locations Along Xpresso Bus Routes

6.4 Review Future Bus Network Plans

In this step, a review of relevant bus projects (see Table 6-1) and the 2031 strategic bus network plan (see Figure 6-4) was conducted. Based on this review the rapid bus service routes and new interchange locations were identified. These include the Gungahlin, Fyshwick and Erindale interchanges.

It has been assumed that further rapid bus services will be required to cater for the expected developments such as Molonglo in the west and Kowen in the east as well as to provide more Intertown links to have a proper east-west and north-south bus network coverage (see Figure 6-5.)

Table 6-1: Priority Projects Identified in the Canberra Spatial Plan

PROJECT	DESCRIPTION
Belconnen to Civic busway	Construction of busway, bus priority measures and stops. This project will connect the major activity nodes along this key route.
Gungahlin to Civic busway	Construction of busways, bus priority measures and stations on Flemington Road and Northbourne Avenue. This will encourage land use development along the route and bus use by new residents of Gungahlin and Inner North Canberra.
Woden to Civic bus priority measures	Measures to improve bus priority and travel times along this key route.
Tuggeranong to Woden bus priority measures	Measures to improve bus priority and travel times along the route.

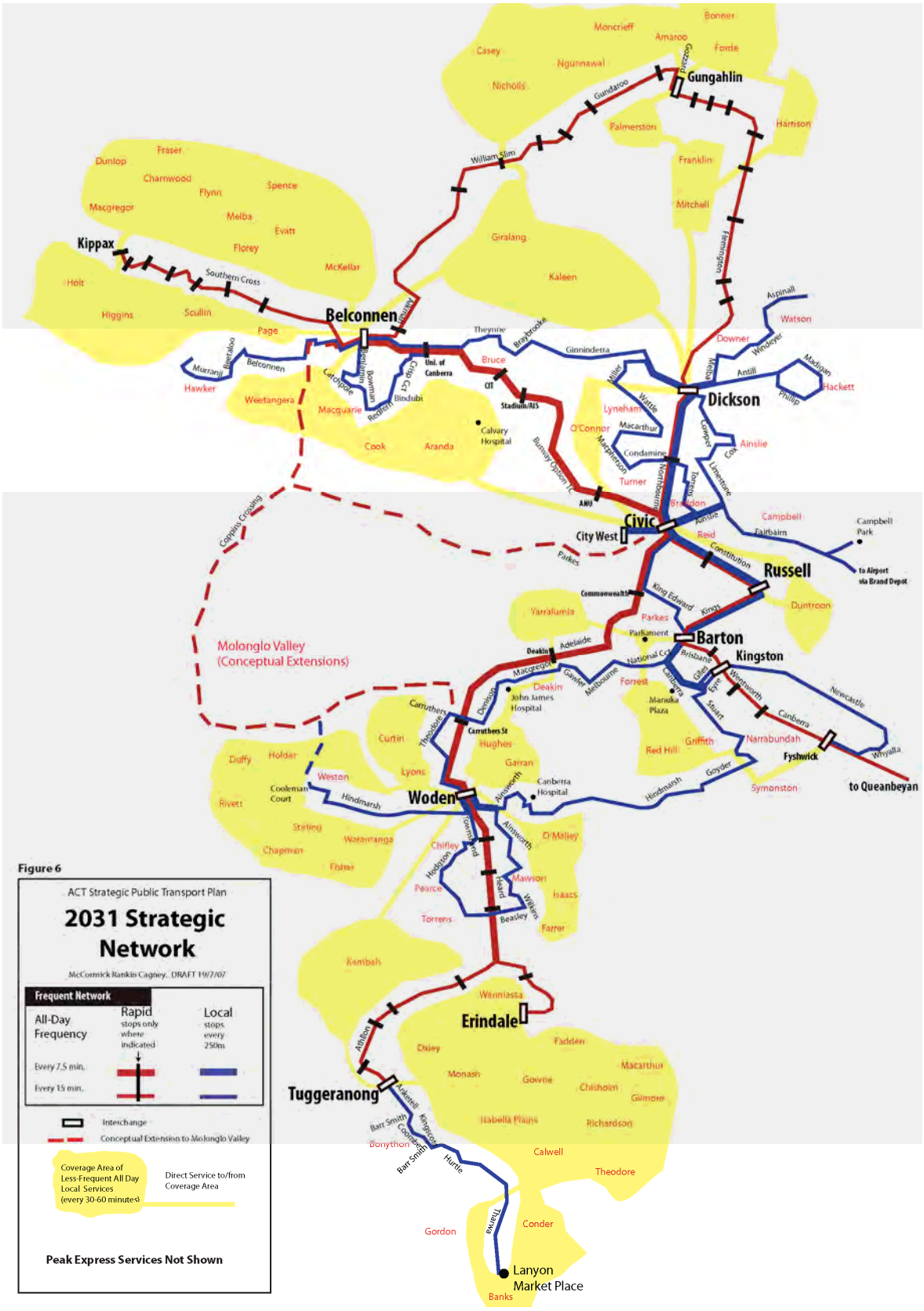


Figure 6-4: ACT Strategic Public Transport Plan Expected by 2031 (Source: Strategic Network Concept – 2007 McCormick Rankin Cagney)

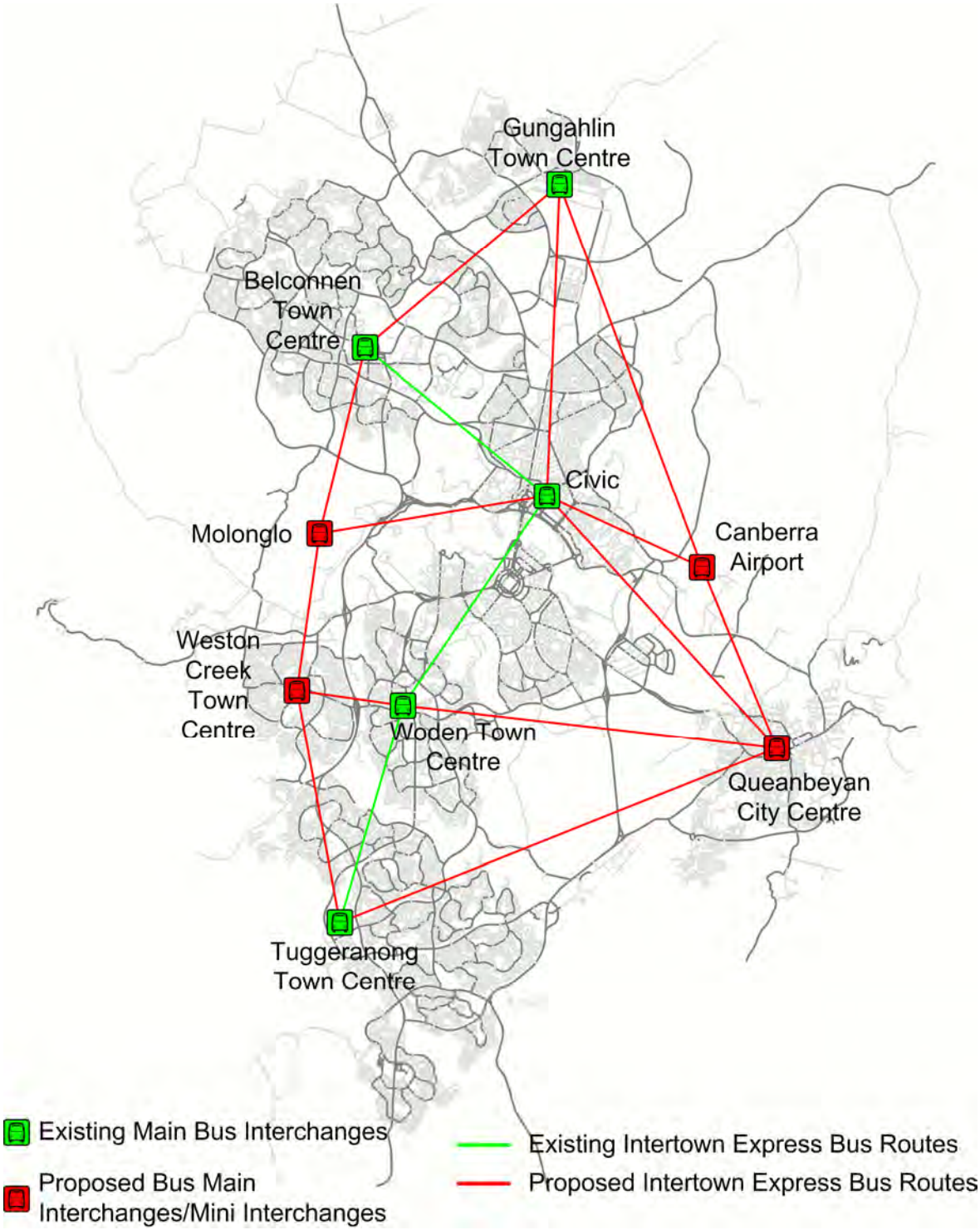


Figure 6-5: SMEC Expectation for Main Public Transport Routes Requirements by 2031

6.5 Identification of Sites to be Included for Further Evaluation

Several ACT studies have reported on issues impacting on the selection of Park and Ride facilities. The draft *ACT Parking Strategy*, released for public comment on 1 March 2007, indicates an intention to remove Park and Ride facilities from town centres to new locations closer to public transport routes, both to maximise parking opportunities within town centres and reduce the distance people need to drive before taking public transport services to reach their destinations.

Town centre locations for Park and Ride are not the most efficient use of available parking spaces, with a fair degree of misuse apparent. Some drivers find it cheaper to buy bus tickets and park in Park and Ride locations in the town centre in which they work, rather than pay for regular parking. This is inconsistent with the intentions of the existing Park and Ride scheme, and it also contributes

to the congestion of parking infrastructure at centres where there is already high demand for parking, e.g. Woden Town Centre.

The parking area adjacent to Belconnen Interchange will be removed with the future construction of the Cohen Street extension and associated far-side terminal bus system. The timing of this work is not presently known, and will be subject to government priorities and future funding availability. In a broader sense, consideration has generally been given to whether the use of large parcels of land within the town centres and larger group centres for Park and Ride is the most optimal use of this land, or alternatively whether providing parking close to locations where a range of bus routes intersect is a significant factor in attracting users to public transport.

In this task, an analysis is undertaken with a view to identifying new sites along transit routes (Intertown and Xpresso services) but outside town centres to maximise parking availability in town centres and minimise the distance people need to drive before taking transit services to reach their destinations. The outcome of this task will be the identification of sites that may support Park and Ride facilities. The following site inclusion criteria were selected and applied:

Availability of Xpresso or Intertown Bus Service during Peak Periods

As stated, the availability of Intertown or Xpresso bus services is considered to be the key factor in the selection of potential Park and Ride sites. A lack of such service between any potential area/site and a regional destination, such as Civic, eliminated the site.

Availability of Land and Ownership Status

This is based on consultation with ACTPLA planning and land policy to identify potential land sites within the selected target areas along the current Xpresso and Intertown services as well as along the future expected rapid bus services. ACTPLA planning and land policy identified sites that are within road reserves as well as other sites that can be used for Park and Ride. In addition, SMEC involved some of its experts in the identification of potential sites.

Concentration Centres and Generated Traffic

The review of population and employment concentration centres is crucial in understanding from where traffic is produced and to where it is attracted. Park and Ride sites were selected to intercept this line of movement at points that minimise the car-only journey distance and maximise the bus journey distance as part of the Park and Ride option.

Spacing

The target site capacity, when combined with the existing Park and Ride facilities, will constitute a system of public Park and Ride facilities serving the entire regional road network system. The average travel distance from the five main town centres to Civic was identified (see Table 6-2.) The table demonstrates that the average journey distance from a town centre to Civic is around 13 km. However, this is biased by the distance to Tuggeranong and Queanbeyan. The average, considering only Woden and Belconnen town centres, is approximately 9 km. SMEC assumed this distance to be the functional minimum for the bus journey component in a typical Park and Ride trip. However, this does not exclude locations that have other advantages and are closer to the city.

Table 6-2: Average Travel Distance to the City from Other Town Centres

Origin	Distance
Belconnen	8.4 km
Gungahlin	12.5 km
Queanbeyan	15.5 km
Woden	10.5 km
Tuggeranong (via Woden)	20.5 km

Appendix 3 shows the 41 sites that were identified based on the application of the previous site inclusion screening criteria. These are superimposed on a map of Canberra roads in Figure 6-6 along with a 9 km radius circle centred on Civic. This indicates that any Park and Ride locations outside of the circle can be considered acceptable in terms of the length of the bus journey component of a trip to Civic.

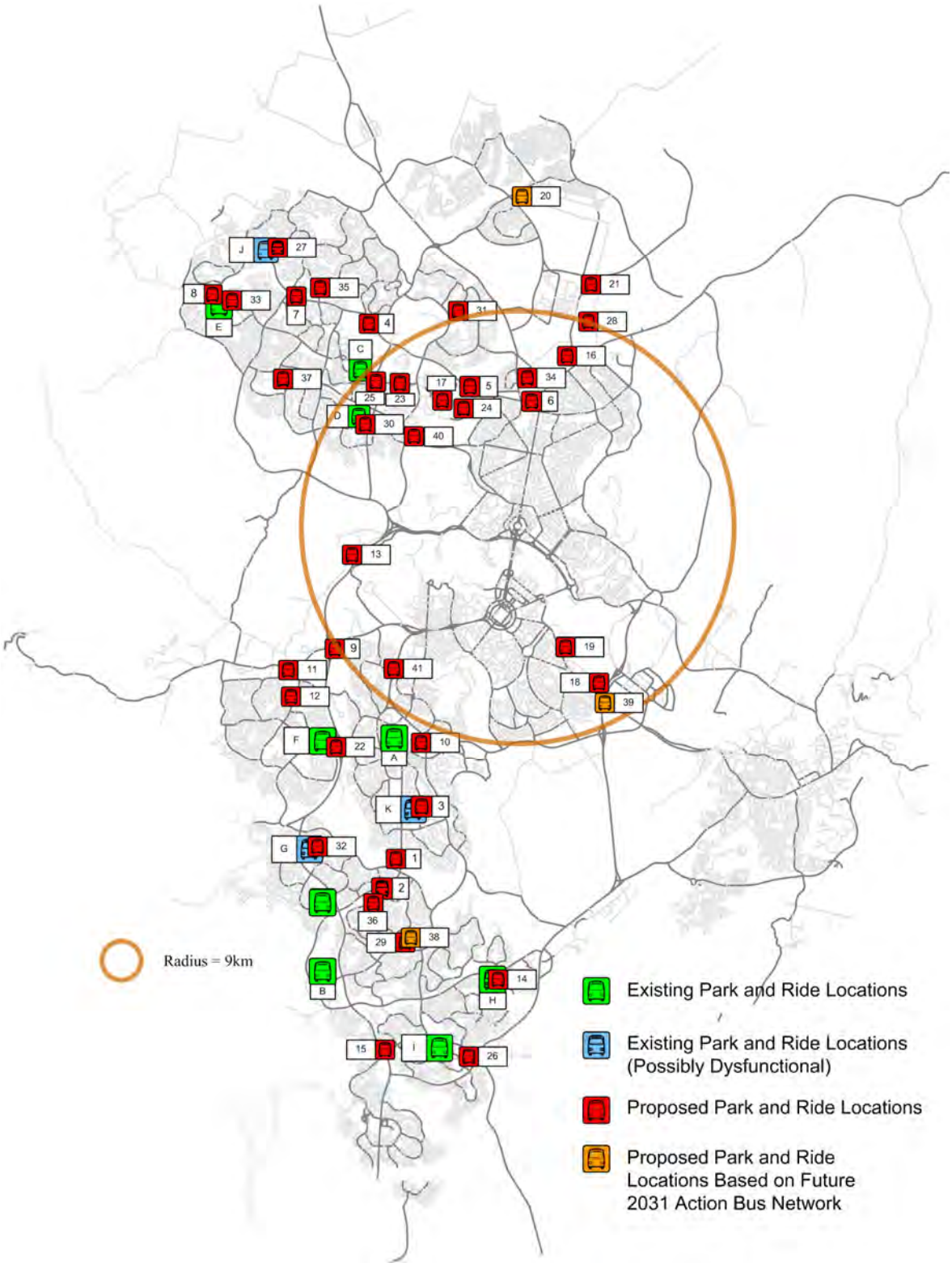


Figure 6-6: Existing and Proposed Park and Ride Site Locations

6.6 Identify Site Exclusion Criteria

SMEC identified a number of criteria such that if a site is vulnerable to one or more of these criteria, the site will be excluded for the short and medium term evaluation. Such exclusion criteria are as follows:

Seclusion, Safety and Security Issues

Identified areas that are perceived to be secluded with no neighbouring premises will be excluded. It was felt that issues regarding personal safety and vehicle security can arise in these sites. A lot perceived as dangerous will be avoided despite other favourable attributes. Park and Ride facilities may be perceived as locations for vehicle theft, vandalism and/or personal assault. The seclusion and safety criteria can be overcome by including other neighbouring facilities such as petrol stations, child care centre, dry cleaners etc.

Potential Constraints Including Drainage Zone

If a drainage zone exists within identified sites, the potential site will be excluded. It was felt that it is not favourable to have a Park and Ride site through which a drainage zone passes as there is a potential for site flooding.

Special Permission

A site requiring special permission from NCA is given lower priority than sites that can be utilised without such permission.

Community Issues

This pertains to the level of community concern related to the site. Sites that are not expected to have community opposition were rated higher than sites where community input indicates there may be some opposition.

Competition with Other Users

Contrary to their intended purpose some Park and Ride sites can potentially be attractive as a regular parking location at the destination. The potential for this competition between legitimate and illegitimate users was considered, and a reduced potential for this misuse was viewed as favourable.

6.7 Identify and Apply Site Exclusion Criteria (Flaw Analysis)

Appendix 3 shows the application of the inclusion and exclusion criteria to the 41 identified sites. As shown in Table 6-3, thirteen (13) sites remained of which ten (10) were included for further scoping while the remaining three (3) are dependent on the future plans for the introduction of new bus interchanges and rapid bus services by 2031.

Table 6-3: Status of Proposed Park and Ride Locations after Application of Exclusion Criteria

Ref. #		Proposed Park and Ride Carpark Location	Identified by
1	3	Athllon Drive North of Sulwood Drive	
2	1	Athllon Drive, Rylah Crescent and Longmore Crescent	Project Work Group & SMEC
3	1	Athllon Drive near Mawson Drive	Project Work Group & SMEC
4	3	Ginninderra Drive and William Slim Drive	
5	3	Ginninderra Drive, West of GDE	
6	3	Mouat Street west of Northbourne Avenue	
7	3	Ginninderra Drive and Kingsford Smith Drive	
8	3	Florey Drive and Southern Cross Drive	
9	3	Tuggeranong Parkway and Cotter Road interchange	

Ref. #		Proposed Park and Ride Carpark Location	Identified by
10	3	Yamba Drive near Canberra Hospital	
11	3	Dixon Drive and Streeton Drive	
12	3	Streeton Drive and Hilder Street	
13	3	Tuggeranong Parkway and Forest Drive Interchange	
14	3	Coyne Street and Hambidge Crescent	
15	3	Drakeford Drive and Tharwa Drive	
16	3	Flemington Road near Exhibition Park	SMEC
17	1	Battye Street near Australian Institute of Sport	SMEC
18	3	Canberra Avenue near Monaro Highway	
19	3	Wentworth Avenue and Cunningham Street	
20	2	Gungahlin Drive and Gundaroo Drive	
21	3	Flemington Road and future Wells Station Drive	
22	3	Hindmarsh Drive and Tuggeranong Parkway interchange	
23	1	College Street and Kirinari Street	SMEC
24	3	Australian Institute of Sport East Carpark	
25	1	College Street, near Belconnen pool and leisure centre	Project Work Group & SMEC
26	3	Calwell playing fields	
27	1	Charnwood Shopping Centre	SMEC
28	1	Exhibition Park	SMEC
29	3	Wanniassa Oval	
30	1	Jamieson	Project Work Group & SMEC
31	3	Kaleen Shopping Centre	
32	3	Kambah Village	
33	3	Kippax	
34	3	North Lyneham	
35	3	Melba playing fields	
36	3	Wanniassa playing fields	
37	3	Hawker shops	
38	2	Erindale	
39	2	Fyshwick	
40	1	Belconnen Way and Eastern Valley Way	SMEC
41	1	Yarra Glen and Carruthers Street	SMEC

Proposed for Detailed Scoping by Project work Group and/or SMEC

Proposed Park and Ride Location – Based on Future 2031 Action Bus Network

Proposed but not considered for detailed scoping Based on Exclusion Criteria

6.8 Identify Site Scoping Criteria

A set of more detailed criteria was developed and applied to rank the proposed locations to assist in the selection of sites for development. The criteria are:

Available Land Capacity of Park and Ride Sites and Potential for Expansion

This criterion is mainly concerned with the size of potential sites, particularly the site's ability to meet current and projected demand for the target area.

Walking Distance from Park and Ride Sites to Bus Interchange/Stop

This criterion is mainly concerned with minimising the walking distance of Park and Ride users to and from bus stops. This is also used to determine whether to maintain bus stops in their current locations or relocate them to more suitable positions.

Non-Motorised Access to Park and Ride Sites

This criterion is concerned with the ease of access to and from the Park and Ride sites for bicycle and pedestrian users. Sites with direct links for pedestrians and cyclists to adjacent neighbourhoods received the highest ratings. The availability of sites within cycling corridors (current and potential future accessibility by bicycle) is considered as important as this facilitates Bike and Ride.

Visibility and Proximity to Major Roads and Highways

The distance between a potential site and the nearest major road or highway was considered. Sites located in proximity to major roads or highways were deemed better sites as these facilitate buses joining main stream traffic.

Car Site Access

The potential to have a direct, adequately controlled access point for cars into and out of the Park and Ride facility.

Access to Bus Stops/Interchanges

The potential to have a direct, adequately controlled access point for users to and from the Park and Ride facility and to and from bus stop/interchange.

Vehicle Security and Personal Safety

Sites with high visibility from adjacent activities areas (e.g. commercial, residential) received higher ratings than sites that were more remote or less visible.

Expected Cost from Planning to Construction

Planning level cost estimates for site development include land costs, leasing costs, development costs, operation and maintenance costs and other significant costs. Sites in existing weekend or seasonal parking facilities as well as vacant and/or underdeveloped public ownership land were also rated higher than sites that need further design and construction. The availability of existing under-utilised surface parking areas that can partly or fully be used for Park and Ride was also considered an advantage for the particular site. Construction costs typically average several thousand dollars per parking space, which is usually lower than the costs of providing parking at city centres owing to lower land values.

Quality of Express Bus Service to the Site (Existing or Proposed Service)

Local bus services improved the ratings. The number of major destinations served directly, or by a single convenient connection was considered, along with the availability of midday and evening service, and the span and frequency of transit service.

Transit Catchment Area and Potential Demand

If the area around the parking area can contribute passengers to the transit service, the density and efficiency of the service is improved. The projected demand at the site, in terms of the number of stalls required, was based on travel model projections. Sites with the highest demand within the target area received the highest ratings.

6.9 Identify and Apply Site Exclusion and Scoping Criteria by Project Working Group

SMEC prepared a presentation on the study progress that was attended by a number of stakeholders and the project working group nominated by TaMS. This included representatives from TaMS (including Roads ACT), ACTPLA, ACTION, ACT Procurement Solutions and SMEC. SMEC outlined the study objectives, key issues, site location and evaluation exercise and the project progress.

Several issues arose from discussions after the presentation. These include:

- The potential for introduction of land use with Park and Ride facilities such as petrol stations
- Walking distance between car park and bus stop
- Frequency of bus services
- Introduction of flexible systems where Park and Ride permits can be issued for individual days of the week
- Supporting policies for improving Park and Ride are necessary, such as city parking policy and ACTION bus policy
- Safety and security (e.g. improved lighting at Park and Ride facilities)
- Locations near bus routes that can use dedicated bus lanes

After the presentation, attendees were divided into three groups. Each group consisted of three members from different departments. Each group was handed a set of A3 tables showing the included Park and Ride sites and the bus services to the site as well as a set of exclusion criteria and further scoping criteria. The first group was given nine sites in the area of Woden and Fyshwick to assess, while the second group was given 10 sites in the Tuggeranong area and the third group was given 10 sites in the Belconnen west area. Figure 6-7 shows the locations of the sites assessed in accordance with the area. Appendix 4 shows the working groups comments and their assessment of the included sites. These comments were further summarised by the group members in Table 6-4, *Note: Rankings of included locations were not provided.*

Table 6-5 and Table 6-6.

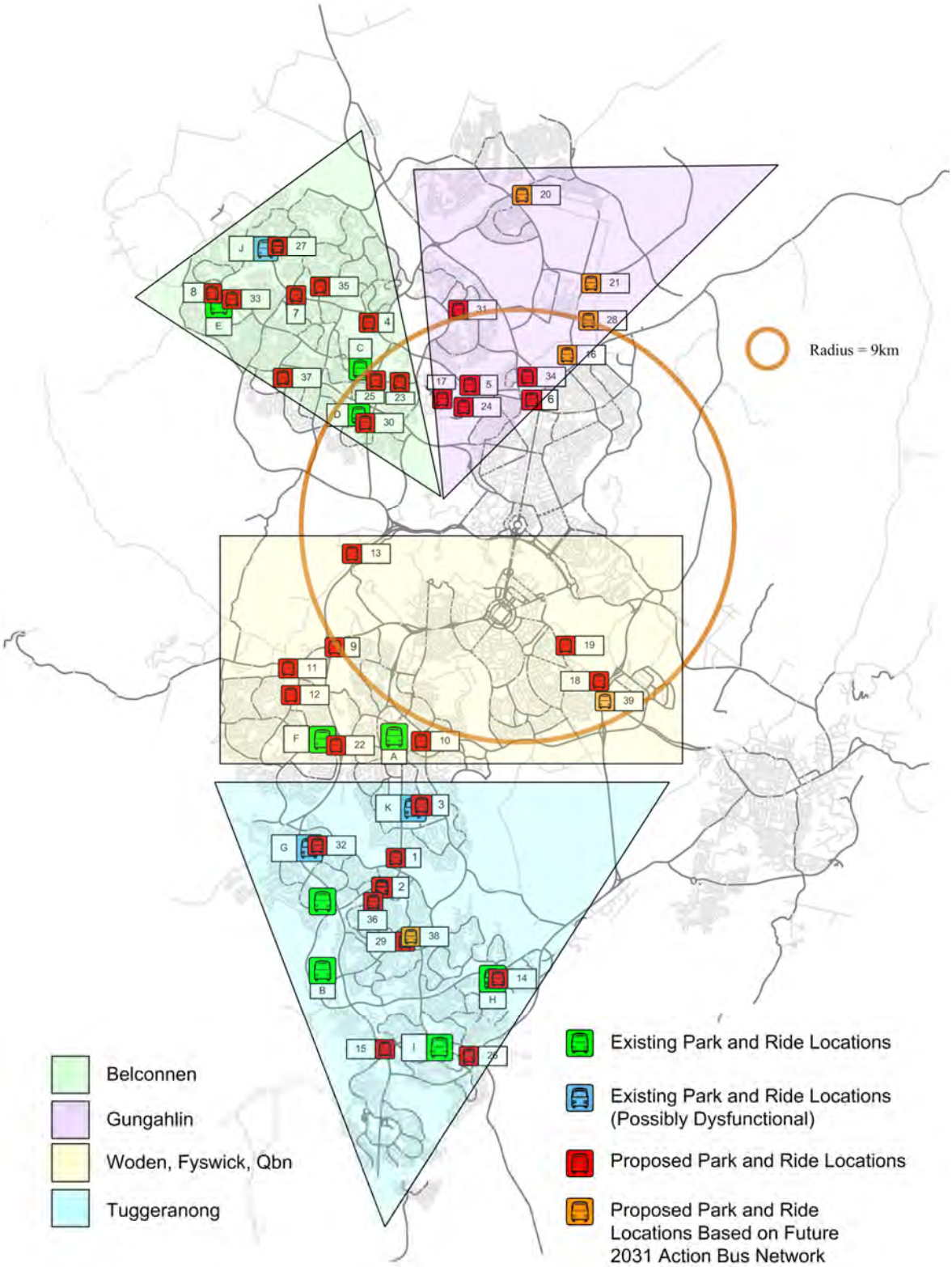


Figure 6-7: Sites Assessed by Project Working Group according to Location

*Note: This assessment was made before the introduction of new Xpresso routes in 2008

Table 6-4: Summary of Group Comments on Sites in Woden and Fyshwick

Location	Reason if Excluded	Rank if Included
Near Tuggeranong Parkway and Cotter Road interchange (9)	Security Too close to city	
Yamba Drive near Canberra Hospital (10)		√
Near Dixon Drive and Streeton Drive (11)		√
Near Streeton Dr and Hilder Street (12)	Security	
Near Tuggeranong Parkway and Forest Drive interchange (13)	Security Too close to city	
Near Canberra Avenue and Monaro Highway (18)	Security	
Near Wentworth Avenue and Cunningham Street (19)	High land value	
Near Hindmarsh Drive/Tuggeranong Parkway Interchange (22)	Security	
Fyshwick (39)		

Note: Rankings of included locations were not provided.

Table 6-5: Summary of Group Comments on Sites in Tuggeranong

Location	Reason if Excluded	Rank if Included
Athllon Drive North of Sulwood Drive (1)	Too secluded	
Athllon Drive, Rylah Crescent and Longmore Crescent near Langdon Avenue (2)		2
Athllon Drive near Mawson Drive (3)		1
Near Monaro Highway, Coyne Street and Hambidge Crescent (14)		4
Near Drakeford Drive and Tharwa Drive (15)		5
Calwell Playing Fields (26)	Too Secluded	
Wanniassa Oval (29)	Secluded	
Kambah Village (32)	Too secluded Too far from bus routes	
Wanniassa Playing Fields (36)	Too secluded	
Erindale Town Centre (38)		3

Table 6-6: Summary of Group Comments on Sites in Belconnen West

Location	Reason if Excluded	Rank if Included
Near Ginninderra Drive and William Slim Drive (4)	Significant safety issues	
Near Ginninderra Drive and Kingsford Smith Drive (7)	Significant safety issues	
Near Florey Drive and Southern Cross Drive (8)		√
Near College Street and Kirinari Street (23)	Safety issues Traffic congestion	
College Street near Belconnen pool and leisure centre (25)		√
Near Charnwood Shopping Centre (27)	Busy Poor access to Xpresso routes	
Jamison (30)		√
Kippax District Playing Fields (33)	Significant Safety issues	
Melba district playing fields (35)	Significant Safety issues	
Hawker Shopping Centre (37)		√

Note: Rankings of included locations were not provided.

6.10 Apply Site Scoping Criteria

The study initially identified 41 potential sites. Ten (10) of these were included for further scoping and three (3) were also included as being dependent on future plans to introduce new bus interchanges and rapid bus services by 2031. The application of identified scoping criteria by SMEC is depicted in Appendix 5. The scoping assessment table was completed based on the evaluation of short-listed sites considering the identified criteria and their relationships to each other.

The application of identified scoping criteria demonstrated the superiority of sites along Athllon drive in southern Canberra. Table 6-7 and Table 6-8 show short-lists of the proposed sites based on the scoping assessment in the short and medium term, and long term, respectively.

Table 6-7: Proposed Park and Ride Locations (Short and Medium Term)

Proposed Park and Ride Location	Identified by
Athllon Drive near Mawson Drive	Project work group & SMEC
College Street near Belconnen pool and leisure centre	Project work group & SMEC
Jamieson	Project work group & SMEC
Athllon Drive, Rylah Crescent and Longmore Crescent	Project work group & SMEC
Exhibition Park	SMEC
Battye Street near Australian Institute of Sport	SMEC
College Street and Kirinari Street	SMEC
Belconnen Way and Eastern Valley Way	SMEC
Yarra Glen and Carruthers Street	SMEC
Charnwood Shopping Centre	SMEC

Table 6-8: Proposed Park and Ride Locations (Long Term, based on Future Express Bus Routes)

Proposed Park and Ride Location	Identified by
Fyshwick	SMEC
Gungahlin Drive, Gundaroo Drive	SMEC
Erindale	SMEC & TAMS

It was decided to further concentrate the scoping on the two sites identified along Athllon Drive.

6.11 Apply Final Site Selection Criteria to Athllon Drive Sites

The SMEC team visited the two locations along Athllon Drive which demonstrated the potential to become Park and Ride facilities over the short term. A detailed criteria comparison of the two sites is shown in Table 6-9. The SMEC team felt that the site near Mawson Drive was superior provided that vehicle access points via Mawson Place and a vehicle crossing over the drainage channel are put in place. The site would yield approximately 2500m^2 and is highly visible from Athllon Drive. The potential for expansion also exists – Intertown and Xpresso bus services are stopping at existing bus stops, which are located in very near proximity to the proposed site. An existing signalised intersection provides the potential for safe crossing (see Figure 6-8).

Table 6-9: Detailed Comparison of Potential Athllon Drive Sites based on Scoping Criteria

		Potential Site	
			
Scoping Criteria	Description	Athllon Drive, Rylah Crescent and Longmore Crescent near Langdon Avenue SITE 3 or spare spaces in existing car park opposite service station	Athllon Drive near Mawson Drive
	Available land capacity of Park and Ride sites and potential for expansion	Potential for expansion exists	Potential for expansion exists
	Walking distance from Park and Ride sites to bus station/ terminal/ stop	Intertown routes pass the proposed Park and Ride facility but the nearest current stop is approx. 1900m away. A new stop would be required.	Existing bus stop shown at Athllon Dr – Mawson Dr intersection
	Non-motorised access to Park and Ride sites	Trunk cycleway adjacent	Trunk cycleway adjacent
	Visibility to major roads and highways	Athllon Drive	Athllon Drive

		Potential Site	
			
	Car site access	Existing access road	Existing access road
	Access to bus stops	Will need new bus stops on Athllon Drive	Existing bus stop shown at Athllon Dr – Mawson Dr intersection
	Vehicle security and personal safety	OK	OK
	Expected cost from planning to construction	Medium (bus bays for new bus stops) May be spare spaces in existing car park	Low; a bus stop already exists
	Quality of express bus service to the site (existing or proposed service)	Intertown	Intertown, 170, 720
	Transit catchment area and potential demand	Catchment of trips along Athllon Drive to Woden and Civic	Trips along Athllon Drive to Civic

Figure 6-8: Recommended Site for New Park and Ride Facility in the Short Term

7 Business Case for a New Park and Ride Site in Canberra

7.1 Introduction

While opportunities for new Park and Ride facilities have been identified as part of planning for the Belconnen to City Transit way (at Canberra Stadium) and the Gungahlin to City Transit way (Wells Station Drive/Flemington Road), no analysis has been carried out in a broader sense on projected demand, location or size of any new facilities within the Territory. In this study, SMEC assisted TaMS in developing a detailed business case for the identified and selected Mawson site including economic cost-benefit analysis as well as financial analysis. This was used to support the 2007/2008 budget bids prepared for this new Park and Ride location.

7.2 Methodology

In order to assess a potential Park and Ride option it must be compared to a car only option in which a commuter conducts their entire trip by car. An analysis of the costs and benefits of each option was undertaken over a 15 year period, from 2010 to 2025. The two considered options are:

Option 1

Around 60 car users continue to use their cars for all their daily AM and PM peak work journeys from/to their homes in the South of Canberra and to/from their work in the city

Option 2

Around 60 car users use their cars for a small part of their daily AM and PM peak work journeys from/to their homes in the South of Canberra and to/from the new Park and Ride facility and then walk to existing ACTION Bus stations to ride an Intertown or an Xpresso bus service to/from their work in the city. This also includes the conversion of 60 Park and Ride spaces in the Woden facility to pay parking

The Net Present Value (NPV) and Benefit Cost Ratio (BCR) are estimated for the Park and Ride option versus the car only option. The SMEC methodology for developing the business case for the potential Park and Ride site is detailed in Figure 7-1.

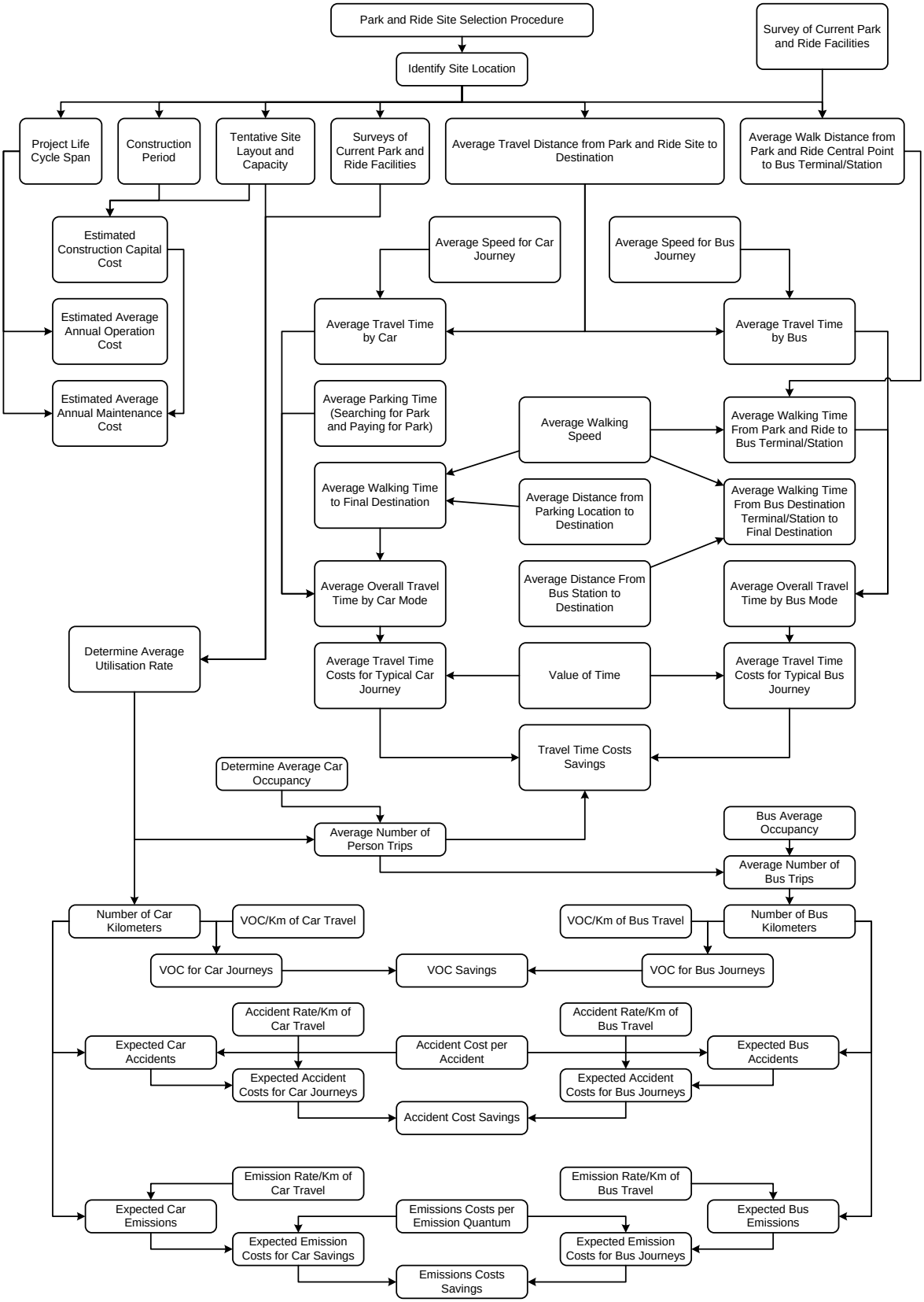


Figure 7-1: SMEC Detailed Methodology for Developing a Business Case for a Potential Park and Ride Facility

7.3 Description of Proposed Project

The proposed project involves building an open parking area with an approximate capacity of 70 car parking spaces and 15 bike racks. The new parking area, intended as a Park and Ride Facility, is located at the corner of Athllon Drive and Mawson Drive. This would also involve the conversion of the 60 existing Park and Ride spaces at Woden to pay parking. Pay parking is expected to be $11/day (this parking fee assumption was agreed upon after SMEC's consultation with TaMS).

Access to the parking area will be via Mawson Place. This will require the construction of a vehicle overpass to cross the drainage channel.

7.4 Estimated Whole-of-Life Cost of Project

The project construction is expected to be completed by 2010, with expected operation from opening to 2025. The project costs include:

- Construction cost of the designated parking area
- Construction cost of the access bridge
- Contingency cost at 30% contingency
- Costs of studies
- Design and supervision costs
- Cost for provision of 15 bike racks
- Promotion costs
- Procurement costs
- Operational and/or maintenance costs
- Other costs

7.4.1 Area of Park and Ride Facility and Access Bridge

The following assumptions and calculations are used in the computation of the Park and Ride and the access bridge construction costs.

- Width of Park and Ride facility = 50 meters (on-site wheel measurement)
- Length of Park and Ride facility = 50 meters (on-site wheel measurement)
- Area = 50m × 50m = 2500m²
- Area per parking space = 35.7 m² (Based on ACT Parking Standards)
- Expected number of parking spaces = $\frac{\text{Area}}{\text{Area per Car Space}} = \frac{2500\text{m}^2}{35.7\text{m}^2} = 70$
- Width of access bridge = 9 metres
- Span of access bridge = 9 metres
- Area of access bridge = 9m × 9m = 81m²

7.4.2 Expected Costs for Park and Ride Facility, Access Bridge and Bike Rack Provision

- Open parking space building cost per square metre = $73.54 (Provided by ACTPLA – Indec Consulting September 2006)
- Parking area construction cost = 2500m² × $73.54/m² = $183,850
- Small bridge structure building cost per square metre = $1,800 (Based on recent SMEC experience with Canberra Hospital new car park)
- Access bridge Construction cost = 81m² × $1,800/m² = $145,800
- Contingency cost at 30% contingency = 0.3 × ($183,850 + $145,800) = $98,895 (Based on recent SMEC experience with Canberra Hospital new car park)

- Feasibility studies = $16,000
- Design and supervision at 10% of construction costs including contingency = 0.1 × 1.3 × (183,850 + 145,800) = $42,854.50
- Cost for provision of 15 bike racks at $500 each = 15 × $500 = $7,500
- Promotion costs = $25,000
- Procurement costs = $10,000

7.4.3 Total Estimated Capital Costs of Project for Cost-Benefit Analysis

Capital construction costs and maintenance life costs were estimated and Table 7-1 shows the various capital cost components for developing the Park and Ride site in Mawson. These are just initial approximate estimates and will be subject to further calculations after the detailed design process. However, these provide cost approximations, which are considered appropriate for preliminary evaluation purposes. A simplified maintenance cost was also included in the analysis. The cyclic maintenance was assumed to occur every 5 years from the opening year (2008). The cyclic maintenance cost was estimated as 1% of the initial construction cost. As for the annual maintenance cost, it was estimated as 0.25% of the initial construction cost. No annual maintenance was assumed in case cyclic maintenance was applied.

Table 7-1: Capital Costs for Developing the Park and Ride Facility in Mawson

Cost Components	Cost
Feasibility	$16,000
Design and Supervision	$42,854
Construction (Parking)	$183,850
Construction (Bridge)	$145,800
Contingency (if any)	$98,895
Procurement Fees	$10,000
Promotion	$25,000
Total (excl. GST)	**$522,399**

7.5 Travel Demand and Supply Assumptions, Predictions and Characteristics

7.5.1 Park and Ride Supply and Expected Demand

As previously mentioned, the area of the identified site is expected to accommodate 70 cars. This area has the potential for expansion. The expected demand utilisation of the site is assumed to be equivalent to the current demand utilisation for Woden, Belconnen and Tuggeranong Park and Ride facilities, which is around 87%. The expected Park and Ride demand during the peak period is thus calculated as: 0.87 × 70 = 61.

7.5.2 Working Days

The following assumptions were made on the working days and peak hours to be included in the economic and the financial appraisals

- Number of days in a year = 365.24
- Proportion of working days = 5/7
- Number of public holidays = 9 days
- Number of working days = $365.24 \times 5/7 - 9 = 252$

- Two peak times were considered (AM and PM) to allow for return journeys. Therefore, the number of yearly peak periods considered are: 252 × 2 = 504 peak hours

7.5.3 Average Journey Distance

The following assumptions were made to identify average journey distances. These are based on the current location of the Park and Ride facilities and their proximity to Civic as well as the average catchment distance (i.e. maximum distance from the facility wherein car users can be reasonably expected to utilise the Park and Ride system) to/from the nearby suburbs.

- Average car journey distance origin to destination = 15 km
- Average car journey distance to Park and Ride facility = 5 km
- Average bus or car journey distance from Park and Ride facility to destination = 15 – 5 = 10 km

7.5.4 Average Journey Speeds

The speed limit in the ACT is 50 km/hr unless otherwise indicated. SMEC thus assumed 50 km/hr as the average speed during the peak period both for the car and the bus journeys.

- Average car journey speed origin to destination during peak hour ≈ 50 km/hr
- Average bus running speed origin to destination during peak hour ≈ 50 km/hr

7.5.5 Annual In-Vehicle Time (Car or Bus) (AIVT)

The annual in-vehicle time for a commuter travelling by bus or by car from the proposed Park and Ride location is calculated as follows.

AIVT = (number of working days × number of peak periods × expected demand) × (average journey distance / average journey speed) × 2 = 12249 hours

This will be used as the expected annual vehicle hours travelled (VHT) by the car option.

7.5.6 Park and Ride Users' Walking and Waiting Times

The following walking time assumptions are based on the current location of the bus stops along Athllon drive as well as the average walking time from the Civic bus stop to office destinations. The waiting time assumptions are based on examining the ACTION bus timetables for Xpresso and Intertown routes that travel along Athllon Drive to/from Civic.

- Average walking time to/from bus stop (outward journey) = 4 minutes
- Average walking time to/from bus stop (inward journey) = 4 minutes
- Annual walking time to bus stop = (number of working days × number of peaks × expected demand) × (average walking time to or from bus stop) / 60 = 2041 hours
- Average waiting time at bus stop = 2 minutes
- Annual waiting time at bus stop = (number of working days × number of peaks × expected demand) × (average waiting time at bus stop) / 60 = 1021 hours

7.5.7 Bus Running Characteristics and Annual Bus Travel Time

The following bus running characteristics were adopted based on reviewing ACTION timetables

- Number of bus stops from Mawson to City on Intertown routes = 8 including 7 intermediate bus stops and the Woden Bus Interchange
- Average bus stopping time at intermediate bus stops = 30 seconds
- Average bus stopping time at Woden Bus Interchange = 60 seconds
- Average total times at bus stops and interchange = 7 × 30 + 1 × 60 = 4 minutes 30 seconds
- Annual time at bus stops and terminals = number of working days × number of peaks × expected demand) × (average total time at bus stops and terminals) / 60 = 2306 hours

7.5.8 Annual Park and Ride User Journey Time

The annual expected Park and Ride journey times can be calculated as follows:

Annual Park and Ride user journey time = annual walking time to bus stop + annual waiting time at bus stop + annual in-vehicle time (car or bus) + annual time at bus stops and terminals = 2041 + 1021 + 12249 + 2306 = 17617 hours

This will be used as the expected annual vehicle hours travelled (VHT) if using the Park and Ride option.

7.5.9 Number of Buses versus Number of Cars

In case the Park and Ride facility is not developed, the expected demand of 61 commuters will continue to use their cars for the whole journey. This assumption is based on conservative average car occupancy of 1 person/car. SMEC reviewed the ACTION web site to identify the types of buses used for Xpresso and Intertown services as well as their capacities. Table 7-2 is a summary of extracted information regarding Average Bus Occupancy.

Table 7-2: Bus Capacity (Extracted from ACTION website)

Type of Bus for Intertown Services	Number	Capacity (Seated)	Capacity (Standing)
IRI Bus	20	46	31
Scania	54	45	17

SMEC adopted an average bus seated capacity of 45. In this context, the theoretical number of buses expected to accommodate the Park and Ride demand can be computed as follows:

Theoretical Number of Buses = (number of cars * average car occupancy) / average bus seated capacity = (61 × 1) / 45 = 1.35 (rounded to 2 buses)

7.6 Travel Related Costs- Economic Benefits

Several indicators of travel are required, namely the number of Vehicle Kilometres Travelled (VKT) as well as the number of Hours Travelled (VHT). These are used to estimate the travel cost components for each option and hence the relative benefits of the Park and Ride option versus the car-only option. For each of the two options, the following travel related costs were estimated:

Vehicle Operating Costs (VOC): This is dependent on the number of vehicle-kilometres travelled (VKT) as well as on the vehicle operating cost per km (VOC/km) obtained from the RTA Economic Analysis Manual

Time Costs (TC): This is dependent on the Vehicle-Hours Travelled (VHT) as well as on the vehicle composition, average vehicle occupancy and value of travel time obtained from the RTA Economic Analysis Manual

Accident Costs (AC): This is dependent on the VKT as well as on the accident rate per million vehicle-kilometres travelled (MVKT) obtained from the RTA Economic Analysis Manual

Environmental Externality Costs (EEC): This is dependent on the VKT and obtained from the RTA Economic Analysis Manual

The following sections detail the exact methodology used for estimating each of these costs:

7.6.1 Vehicle Operating Cost

Vehicle operating cost (VOC) is a function of kilometres travelled and the VOC rate per kilometre (VOC/km). According to the RTA Economic Analysis Manual, the VOC/km varies with the operating speed and the vehicle type.

Car Annual Travelled Kilometres (ATK) = number of working days × number of peak periods × expected demand × average journey distance from Park and Ride facility to destination × 2 = 614880 km/year

Bus Annual Travelled Kilometres (ATK) = number of working days × number of peaks × theoretical number of required buses × average journey distance from Park and Ride facility to destination × 2 = 20160 km/year

This study considered two vehicle types; private car and bus. The RTA model for calculating the VOC/km depending on the journey speed was adopted. This is included in Table 7-3. These models are based on the recently updated figures shown in the RTA manual's Appendix B: Economic Parameters for 2005.

Table 7-3: Vehicle Operating Costs (Extracted from RTA Manual)

Type of Cost	Cost (C)	Unit
RTA Vehicle Operation Cost (VOC) including Fuel Cost for Car	21.01	cents/km
RTA VOC including Fuel Cost for 2 axle four tyre (Bus)	34.73	cents/km

For each option, the VOC is a product of VKT and the appropriate C value, and is given by the equation:

$$VOC_{Option} = VKT_{Option} \times C_{Option}$$

7.6.2 Travel Time Costs

The VHT for each option is multiplied by the value of time to produce the travel time costs for each option. According to the RTA manual, the average hourly value for travel time (VOT) during peak and business hours is $11.05 based on December 2005 prices. Travel time cost (TTC) is calculated using the equation:

$$TTC_{option} = VHT_{(option)} \times VOT$$

7.6.3 Accident Costs

The expected number of accidents by type is a function of kilometres travelled. It is a known phenomenon that more travelling means a higher probability of getting involved in an accident. Average rates for accident occurrence were estimated based on the 2004 accident statistics. These are included in Table 7-4.

Table 7-4: Accident Rates per 100 Million Vehicle Kilometres

Type	Fatal Injury	Serious Injury	Other Injury	Property Damage
Car*	0.34	4.722222	13.26	260.1
Bus	0	0	0	60

(*) Accident rate/100 million vehicle km based on ACT 2004 accident statistics
(**) Adopted bus accident rate/100 million vehicle km based on TRRL studies

Table 7-5 also shows the cost of accidents as reported in the RTA manual.

Table 7-5: Accident Costs by Type*

Incident Type	Cost/Incident
Fatal Injury	$1,572,820
Serious Injury	$391,890
Other Injury	$15,930

(*) Source: RTA Economic Analysis Manual 2007

For each option, the accident cost (AC) is simply a summation of all the costs expected to be incurred as a result of occurrence of different types of accidents. The equation used to estimate this is given by:

$$AC_{option} = \frac{VKT_{(option)}}{100MVKT} \times (Rate_{(Fatal)} \times Cost_{(Fatal)} + Rate_{(S.Injury)} \times Cost_{(S.Injury)} + Rate_{(Injury)} \times Cost_{(Injury)} + Rate_{(PDO)} \times Cost_{(PDO)})$$

$$AC_{Car} = \frac{VKT_{(option)}}{100MVKT} \times (0.34 \times \$1{,}572{,}820 + 4.72 \times \$391{,}890 + 13.26 \times \$15{,}930 + 260.1 \times \$6{,}995)$$

7.6.4 Environmental Externalities Costs

SMEC also considered environmental factors for each option including:

- Noise Cost (Passenger Vehicles)
- Air Pollution Cost (Passenger Vehicles)
- Water Pollution Cost (Passenger Vehicles)
- Greenhouse Cost (Passenger Vehicles)
- Nature and landscape Cost (Passenger Vehicles)

Each of these costs was calculated as a function of kilometres travelled and environmental externality cost/veh-km (EEC). According to the RTA Economic Appraisal Manual, the EEC for each of the considered environmental externality is included in Table 7-6. These figures are again based on the recently updated Appendix B (Economic Parameters for 2005) of the RTA manual.

Table 7-6: Environmental Externality Costs for a Passenger Vehicle*

Type of Cost	Cost (EEC)	Unit
Noise	0.79c/km	cents/veh-km
Air Pollution	2.37c/km	cents/veh-km
Water Pollution	0.35c/km	cents/veh-km
Greenhouse	1.69c/km	cents/veh-km
Nature and Landscape	0.33c/km	cents/veh-km

(*) Source: RTA Economic Analysis Manual 2007

For each option, the environmental externality cost is a product of VKT and the appropriate environmental externality cost (EEC) value, given by:

$$EEC_{option} = VKT_{option} \times EEC_{(PassengerVehicle)}$$

7.6.5 Economic Benefits

The expected benefits for the considered park and Ride option were also estimated. This was mainly based on obtaining the savings of Option 2 as compared to Option 1, which has been considered as the base option for comparison. Savings include VOC savings, TTC savings, AC savings and EEC savings. The equation to estimate the benefits of implementing a Park and Ride facility is given by:

$$Benefits_{P\&R} = (VOC_{P\&R} - VOC_{Car}) + (TTC_{P\&R} - TTC_{Car}) + (AC_{P\&R} - AC_{Car}) + (EEC_{P\&R} - EEC_{Car})$$

7.7 Economic and Financial Analyses

Economic analysis covers a wide range of costs and benefits to the entire community, whilst financial analysis concentrates on the effects on the individual agency sponsoring the project. Table 7-7 presents the types of expected economic and financial benefits derived from this project.

Table 7-7: Table of Expected Economic and Financial Benefits

Quantifiable Economic Benefits	Quantifiable Financial Benefits	Other Benefits
Vehicle Operation Cost Savings	Bus Fare Revenue	Traders Commercial benefits at Mawson Shops
Accident Cost Savings (Fatal, Seriously Injured, Slightly Injured, Property Damage)	Pay parking Fees Revenue	Land and Property Value Increase as a result of New Park and Ride Facility
Environmental Externalities (Noise, Air and Water Pollution, Greenhouse, Nature and Landscape)	Bike Rack Rent Revenue	

Whole life economic and financial benefits of the two options are shown in Table 7-8 and Table 7-9. These are shown with no discounting. Detailed economic and financial appraisal outputs are shown in Appendix 6 showing cost savings and financial benefits resulting from Option 2.

Table 7-8: Cost-Benefit Table

Option	Costs ($'000)*			Benefits($'000)*			
	Capital Construction Costs	Annual Maintenance	Cyclic Maintenance	Vehicle Operating Cost Savings	Travel Time Savings	Accident Cost Savings	Environment Cost Savings
Option 1	-	-	-		$890.3		
Option 2	$530	$16	$16	$1,863.6		$405.8	$353.7

(*) These are costs and benefits over the 15 year life period of the options without discounting

Table 7-9: Cost-Revenue Table

Option	Costs ($'000)*			Revenue ($'000)*		
	Capital Construction	Annual Maintenance	Cyclic Maintenance	Bus Fare Revenue	Pay Parking Revenue	Bike Locker Rent Revenue
Option 1						
Option 2	$530	$16	$16	$1,202.3	$1,701.0	$29.7

(*) These are costs and revenue over the 15 year life period of the options without discounting

7.7.1 Benefit-Cost Ratio

In order to compare the costs and benefits of Option 2 relative to Option 1 over the evaluation period, the change in monetary values over time needs to be accounted for. This is achieved by discounting the annual costs and benefits of the project to the present year using a range of discount rates (4%, 7%, and 10%). The normal indicators of the worth of a project, the net present value (NPV) and the benefit-cost ratio (BCR) were estimated for each of these discount rates. The analysis results are summarised in Table 7-10.

Table 7-10: Results of Economic Analysis

Discount Rate	NPV ($'000)	BCR
4%	$703	2.32
7%	$540	2.04
10%	$303	1.61

If the discounted present value of the benefits exceeds the discounted present value of the costs, then the project is economically worthwhile. This is equivalent to saying that the net benefit (NPV of benefits – NPV of costs) must be positive. Another equivalent condition is that the ratio of the present value of the benefits to the present value of the costs (BCR) must be greater than one. It can be seen from Table 7-10 that Option 2 is producing positive NPVs as well as BCRs greater than 1. It is therefore clear that Option 2 can be considered as an economically viable option. Detailed spreadsheet output used to estimate the NPV and BCR is included in **Appendix 6.**

7.7.2 Revenue-Cost Ratio

Similarly, the present values of costs and revenues of Option 2 relative to Option 1 over the evaluation period were compared using the same discount rates (4%, 7%, and 10%). In addition to estimating the NPV, the revenue-cost ratio (RCR) was also calculated for each of the discount rates. These two indicators (NPV and RCR) were used to determine the financial viability of the proposed facility. The analysis results are summarised in Table 7-11.

Table 7-11: Results of Financial Analysis

Discount Rate	NPV (000)	RCR
4%	$1,559	3.93
7%	$1,273	3.46
10%	$857	2.73

A project is considered viable if the discounted present value of the revenues exceeds the discounted present value of the costs. In other words, the net revenue (NPV of revenues – NPV of costs) must be positive. Another positive indicator of a project's viability is a high value of RCR (NPV of revenues / NPV of costs), which should be greater than 1. From Table 7-11, it is shown that Option 2 is producing positive NPVs as well as RCRs greater than 1, which makes it a financially viable option. Detailed spreadsheet output used to estimate the NPV and RCR is included in **Appendix 6.**

7.7.3 Advantages and Disadvantages of Considered Options

This section will outline key advantages and disadvantages of the two considered options (see Table 7-12).

Table 7-12: Advantages and Disadvantages for Options

Option	Advantages	Disadvantages
Option 1	No new construction, maintenance or operation cost for a new Park and Ride facility Time savings for car journeys	More congestion on roads Higher accident probability More traffic noise, vehicle emissions, greenhouse emissions, etc. No potential for release of prime parking spaces, either in Woden town centre or in the city centre No potential for improving the public transport system No potential for extra revenue generation for ACTION buses No potential for extra revenue generation for commercial activities in Mawson centre (community benefit)
Option 2	Less congestion on roads Reduction of accident probability Less traffic noise, vehicle emissions, greenhouse emissions, etc Potential for release of prime parking spaces, either in Woden town centre or in the city centre Potential for improving the public transport system Potential for extra revenue generation for ACTION buses Potential for extra revenue generation for commercial activities in Mawson centre	Construction, maintenance and operation costs of the new Park and Ride facility No time savings for Park and Ride journeys

7.8 Expected Positive Outcomes

The following positive outcomes are expected if a Park and Ride facility is implemented in Mawson:

1. A new open parking area with a capacity of 70 cars
2. Better public transport system being supported by more Park and Ride facilities
3. A shift in modal share for a minimum of 60 car users from using their cars to travel to/from work and towards using the Park and Ride system, which involves using their cars for a small part of their journey, parking their cars in the new Park and Ride facility and riding one of the Intertown or Xpresso buses to their work destination in the city.
4. Economic cost savings in terms of:
   - Vehicle operating costs,
   - Accident costs, and
   - Environmental externalities costs including noise, air pollution, water pollution, greenhouse cost, nature and landscape costs.
5. Financial benefits in terms of:
   - ACTION bus revenue generated by Park and Ride users
   - ACTION revenue generated from bike locker rentals
   - Additional parking revenue resulting from the added parking space in Woden

7.8.1 Potential Beneficiaries and Impacts of the Proposed Park and Ride Facility

In this section, the impacts of the proposed Park and Ride facility on potential beneficiaries are identified (see Table 7-13). Potential beneficiaries include car drivers, bicycle associations, environmental groups, surrounding commercial areas, as well as ACTPLA, TaMS, ACTION and NCA.

Table 7-13: Impacts of the Proposed Park and Ride Facility

Stakeholder	Potential Impacts
Car Drivers	Less congestion and better options for alternative modes
ACTPLA, TaMS, NCA	Relieve traffic congestion off Athllon Drive, as well as other road network systems leading to/from city Less traffic accidents along these routes Assist in achieving the objectives and targets of the Sustainable Transport Plan
ACTION	Assist in achieving an improved and more integrated public transport system More customers and more revenue
Bicycle Associations	Provide an opportunity for the Bike and Ride system
Environmental Groups	Lessen the environmental impacts of the transport system –reductions in noise, air and water pollution, greenhouse emissions
Surrounding Commercial Areas	Provide the potential for more customers (Park and Ride users)

7.8.2 Implications of Not Implementing the Proposed Park and Ride Facility

The implications of not proceeding with the project are outlined in Table 7-14.

Table 7-14: Implications of Not Proceeding with the Project

Stakeholder	Potential Implications of Not Proceeding
Car Drivers	More traffic congestion along Athllon Drive, as well as other road network systems leading to/from city
ACTPLA, TaMS, NCA	More traffic congestion along Athllon Drive, as well as other road network systems leading to/from city. Athllon Drive is expected to be running at LOS D in 2021 AM peak. This is considered to be congested LOS by traffic standards that warrants intervention. Potential for more car accidents along these roads
ACTION	Loss of opportunity to achieve an improved and a more integrated public transport system Loss of opportunity to attract more customers and more revenue
Bicycle Associations	Loss of opportunity for the Bike and Ride system
Environmental Groups	Continue the worsening environmental impacts of the transport system – increases in noise, air and water pollution, greenhouse emissions
Surrounding Commercial Areas	Loss of opportunity to provide more customers (Park and Riders)

7.9 Conclusion

The methodology described in this chapter can be used to develop business cases for other suggested Park and Ride locations. The methodology is meant to show the expected costs, benefits and revenues as a result of developing a new Park and Ride facility. However, such benefits on their own only present small-scale improvements to the Canberra transport system. In order to bring about significant benefits and improvements, the existing public transport system in Canberra should be upgraded. This could be supported by a comprehensive Park and Ride system and these will jointly provide strong incentives for drivers to shift from cars to public transport. SMEC also expects that the success of these measures considerably depends on the introduction of more car usage disincentives such as high parking fees and road pricing.

8 Park and Ride Mode Split Modelling

Projection of future demand for the use of Park and Ride facilities is critical to both the selection of the facility location and the design of the site. This is based on the development of a mode choice model, which is used to analyse and predict the choices that individuals or groups of individuals make in selecting from the available transportation modes that are used for particular types of trips.

Mode choice decisions are based on three main factors – trip characteristics, traveller characteristics, and mode characteristics. Mode choice models can be developed using generalised travel costs to represent the total costs each user faces when choosing between modes.

The simplest form of mode choice model is to apply a fixed mode share to the total trip matrix, generating a vehicle trip matrix to be used in the traffic assignment. There may be one fixed share for the entire area, or it may vary for each origin-destination pair. The primary drawback to fixed share models is that they do not reflect the impact that mode attributes such as travel time, travel costs and income have on mode shares.

Therefore, discrete choice models, which predict the choices made by decision units from a set of discrete alternatives, are often used for mode choice analysis. There are a variety of functional forms that can be proposed for the explanation of discrete choice. The Multinomial Logit (MNL) model relates the probability that a decision unit (for example, individual, household, firm, etc.) chooses a given alternative from a set of alternatives to the utility of these alternatives.

8.1 Calibration of Binary Logit Mode Choice Model (Car Trips Versus Park and Ride Trips)

Mode choice models require a number of inputs, many of which are produced in earlier steps in the modelling process. Variables which are typically included are transit travel time (out-of-vehicle, in-vehicle, walk time, wait time), number of transfers, highway travel time, transit fare, auto costs, household income and/or auto ownership, household size, number of workers, etc.

In this study, SMEC calibrated a binary logit mode choice model (a special case of the MNL model) between car-only trips and Park and Ride trips, and another between car-only trips and Bike and Ride trips. The methodology for calibration is as follows (from Ortuzar & Willumsen 2004, pp. 207-208):

Let us assume that we have C_{ij}^{car} *and* $C_{ij}^{P\&R}$ *as the known part of the generalised cost function for each of the two modes. If we also have information about the proportion choosing each mode for each* (i, j) *pair* P_{ij}^{mode} *we can estimate the values of* λ *and* δ *using linear regression as follows. The modelled proportions* P *for each* (i, j) *pair, dropping the* (i, j) *indices for convenience are:*

$$P_{car} = \frac{1}{1+\exp\{-\lambda(C_{P\&R}+\delta-C_{car})\}}$$

$$P_{P\&R} = 1 - P_{car}$$

This gives:

$$P_{P\&R} = \frac{\exp\{-\lambda(C_{P\&R}+\delta-C_{car})\}}{1+\exp\{-\lambda(C_{P\&R}+\delta-C_{car})\}}$$

Therefore taking the ratio of both proportions and taking logarithms of both sides and rearranging yields:

$$\ln\left\{\frac{P_{car}}{(1-P_{car})}\right\} = \lambda\left(C_{P\&R} - C_{car}\right) + \lambda\delta$$

Where we have observed data for P and C and therefore the only unknowns are λ and δ. These values could be calibrated by linear regression with the term on the left-hand side of the previous equation acting as the dependent variable and $\left(C_{P\&R} - C_{car}\right)$ *as the independent one; then λ is the slope of the line and λδ is the intercept.*

Towards this end, SMEC utilised results of the Park and Ride survey as well as ABS data and other available data to calibrate a generalised cost function for Park and Ride trips as well as for car-only trips. This was followed by the calibration of a car versus Park and Ride binary logit mode split model. The intended mode split model is meant to show the proportion distribution between car-only trips and Park and Ride trips. SMEC will demonstrate the applicability of the developed mode split model to obtain the proportion of trips using cars only versus Park and Ride trips for the intended facility in Mawson.

Several steps were conducted and these are summarised in the following subsections.

8.2 Estimation of Mode Trip Generalised Cost Functions

Generalised cost functions (GCF) include the fare, in-vehicle travel time and waiting time costs. Travel time for public transport usage includes in-vehicle time, walk time at each end of the journey and when transferring between services, and wait time. For private modes, the travel time includes the in-vehicle time and additional terminal time which represents the final access/egress to the travel origin or destination. The out of pocket costs represent fares for the public transport user. For private modes, it includes toll fees and parking costs, which are assumed to be shared among the occupants of the vehicle.

A trip involves a number of cost components (see Figure 8-1) and these depend on the mode used. In this study, two main modes are considered – *car-only* and *Park and Ride*. The figure demonstrates the main trip components. Taking these into consideration, the generalised cost function (GCF) for each mode can be calculated as follows:

$$GCF_{car} = VOC_{car} + DTC_{car} + PC_{car} + TTC_{car-work}$$

$$GCF_{P\&R} = VOC_{car} + DTC_{car} + PC_{car} + TTC_{car-bus} + WTC_{bus} + DTC_{bus} + F_{bus} + TTC_{bus-work}$$

Where: VOC = Vehicle Operating Cost

DTC = Driving Time Cost (Value of Time)

PC = Parking Cost

TTC = Transfer Time Cost (Value of Time)

WTC = Waiting Time Cost (Value of Time)

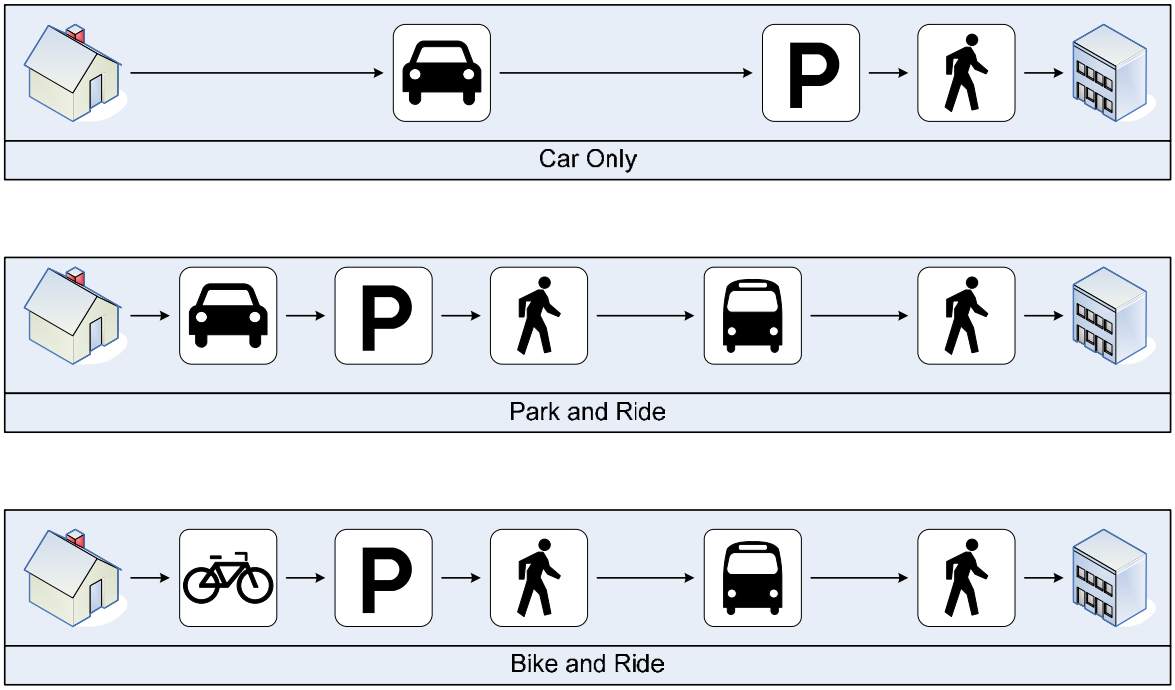


Figure 8-1: Components of Trip Costs

Cost information can be obtained from different sources. SMEC utilised the RTA Economic Analysis Manual as the basis for cost computation, where dollar costs associated with vehicle operating costs and time costs were taken.

8.2.1 Cost Data for Car Trips

Car-only trip costs were collected from various sources for each of the considered suburbs to complete the equation below:

$$GCF_{car} = VOC_{car} + DTC_{car} + PC_{car} + TTC_{car-work}$$

Where:

- VOC_{car} = *Journey Distance* × $UrbanVehicleOperatingCost/km_{Stop\ Start\ Model\ with\ Average\ Speed\ of\ 50km/hr}$
- Journey distance is the distance between suburb centroids and Civic. This was based on Google maps
- Urban vehicle operating cost/km for a stop start model with a used car having an average speed of 50 km/hr was taken from the RTA Economic Analysis Manual as $0.27/km.
- DTC_{car} = *Travel Time* × *Value of Time*
- Travel time was calculated based on the origin of the trip (identified either by address or by suburb) and the destination identified as Civic. This was based on Google maps.
- Value of time was taken as $16.99/hour of AM peak travel time.
- PC_{car} was assumed to be $8. This is a common cost for a day's parking in Civic.
- $TTC_{car\text{-}work}$ = *Transfer Time* × *Value of Time*
- Transfer time from the car parking lot to work was based on the results of the Park and Ride user survey carried out by SMEC.

8.2.2 Cost Data for Park and Ride Trips

Park and Ride trip costs were collected from various sources for each of the considered suburbs to complete the equation below:

$$GCF_{P\&R} = VOC_{car} + DTC_{car} + PC_{car} + TTC_{car-bus} + WTC_{bus} + DTC_{bus} + F_{bus} + TTC_{bus-work}$$

Where:

- VOC_{car} = *Journey Distance* × $UrbanVehicleOperatingCost/km_{Stop\ Start\ Model\ with\ Average\ Speed\ of\ 50km/hr}$
- $Journey\ Distance \times Urban\ Vehicle\ Operating\ Cost/km_{Stop\ Start\ Model\ with\ Average\ Speed\ of\ 50km/hr}$ Journey distance is the distance between suburb centroids and the nearest Park and Ride facility. This was based on Google maps
- Urban vehicle operating cost/km for a stop start model with a used car having an average speed of 50 km/hr was taken from the RTA Economic Analysis Manual as $0.27/km.
- DTC_{car} = *Travel Time* × *Value of Time* $Travel\ Time \times Value\ of\ Time$
- Travel time was calculated based on the origin of the trip (identified either by address or by suburb) and the destination identified as Civic. This was based on Google maps.
- PC_{car} was assumed to be free as there are no charges associated with parking in a Park and Ride facility
- $TTC_{car\text{-}bus\ terminal}$ = *Transfer Time* × *Value of Time* $Transfer\ Time \times Value\ of\ Time$
- Transfer time from the Park and Ride facility to the bus terminal was based on the results of the Park and Ride user survey carried out by SMEC.
- WTC_{bus} = $Waiting\ Time \times Value\ of\ Time$
- Waiting time was calculated based on the headway and standard deviation of buses using the equation $t^w = (h^2 + \sigma^2)/2h$, where h is the headway, σ is the deviation and t^w is the waiting time.
- DTC_{bus} = *Travel Time* × *Value of Time*
- Travel time in a bus was calculated using the bus timetables.
- F_{bus} was taken to be $2.20, which is the discounted cost for bulk ticket purchases (required to get a Park and Ride permit)
- $TTC_{bus\text{-}work}$ = *Transfer Time* × *Value of Time*
- Transfer time from the bus terminal to work was based on the results of the Park and Ride user survey carried out by SMEC.

Once the generalised cost components for each of the two considered modes for each suburb were calculated, the generalised cost data were ready for further processing. These data were used in combination with the mode choice probabilities to calibrate the mode split calibration using linear regression, subsequently producing mode split factors.

8.3 Preparation of Binary Logit Model Input Data

The data required for the calibration of the binary logit model is as follows:

1. Observed data for proportion of car-only trip makers and Park and Ride users for each suburb
2. Observed cost data for car-only trips for each suburb
3. Observed cost data for Park and Ride trips for each suburb.

It was necessary to set up a different model for each of the three existing Park and Ride locations in Belconnen, Woden and Tuggeranong. Separating the three areas is necessary because of the differences in generalised costs involved in travel to Civic. Each Park and Ride facility then needs all the data indicated above for each suburb attracted to that facility.

Observed data for the existing mode split (proportion of car users) is taken from the 2006 Australian Bureau of Statistics (ABS) Census. One of the questions in the census involves mode of

travel to work. Car users were identified as people who used only their car as a driver to travel to work. Park and Ride users were identified as people who travelled in a car as a driver in combination with travelling on a bus. Passengers were not included since the primary purpose of the model is to determine Park and Ride parking area usage.

8.3.1 Results of Binary Logit Model Calibration

The components of the linear regression model are shown in Table 8-1, Table 8-2 and Table 8-3.

Table 8-1: Belconnen Binary Logit Data

Zone	P_{car}	$P_{P\&R}$	C_{car} [minutes]	$C_{P\&R}$ [minutes]	$\ln \frac{P_{car}}{P_{PnR}}$
Dunlop	99.47%	0.53%	83.577	64.333	5.235
Evatt	99.51%	0.49%	74.038	56.889	5.316
Florey	99.65%	0.35%	76.205	54.649	5.653
Fraser	98.76%	1.24%	71.684	61.964	4.375
Holt	99.50%	0.50%	75.389	53.092	5.295
Kaleen	99.63%	0.37%	64.000	58.436	5.587
Latham	99.17%	0.83%	81.628	60.436	4.779
Melba	99.47%	0.53%	96.910	57.608	5.228
Spence	99.54%	0.46%	75.980	54.008	5.383

According to the ABS 2006 data, the previous table shows that for the Belconnen area, the average proportion of car users using their cars for the full journey is 99.41% while an average proportion of 0.59% use their cars as part of the Park and Ride trip.

From these data, it was found that $\lambda = -0.0055$ and $\delta = -926.9818$

Table 8-2: Woden Binary Logit Data

Zone	P_{car}	$P_{P\&R}$	C_{car} [minutes]	$C_{P\&R}$ [minutes]	$\ln \frac{P_{car}}{P_{PnR}}$
Banks	99.52%	0.48%	110.070	78.537	5.334
Bonython	99.43%	0.57%	87.568	71.883	5.161
Chapman	99.50%	0.50%	74.075	51.960	5.296
Chisholm	99.37%	0.63%	83.310	65.244	5.056
Conder	99.78%	0.22%	103.542	86.762	6.100
Duffy	99.52%	0.48%	70.654	49.920	5.339
Fadden	99.54%	0.46%	87.654	55.153	5.372
Gordon	99.56%	0.44%	99.680	63.099	5.412
Greenway	99.53%	0.47%	79.257	48.141	5.351
Isabella Plains	99.74%	0.26%	95.463	54.101	5.963
Kambah	99.56%	0.44%	79.799	54.423	5.421
Macarthur	98.66%	1.34%	78.975	61.432	4.299
Mawson	99.19%	0.81%	77.005	45.413	4.806
Monash	99.15%	0.85%	94.927	54.684	4.759
Pearce	99.21%	0.79%	70.419	42.765	4.828
Scullin	99.53%	0.47%	113.259	83.953	5.345
Theodore	99.81%	0.19%	103.733	73.018	6.243
Wanniassa	99.61%	0.39%	82.894	53.138	5.555
Weston	99.71%	0.29%	72.386	49.653	5.836

Again, based on the ABS 2006 data, Table 8-2 shows that for the Woden area, the average proportion of car users using their cars for the full journey is 99.47% while an average proportion of 0.53% use their cars as part of the Park and Ride trip.

Using the same process as the one done for the Belconnen facility, it was found that λ = -0.0074 and δ = -694.4324

Table 8-3: Tuggeranong Binary Logit Data

Zone	P_{car}	$P_{P\&R}$	C_{car} [minutes]	$C_{P\&R}$ [minutes]	$\ln \frac{P_{car}}{P_{PnR}}$
Banks	99.52%	0.48%	110.070	93.753	5.334
Calwell	99.43%	0.57%	103.590	81.661	5.158
Chifley	99.10%	0.90%	69.421	67.276	4.703
Gordon	99.56%	0.44%	99.680	79.290	5.412
Greenway	99.53%	0.47%	79.257	51.857	5.351
Isabella Plains	99.74%	0.26%	95.463	69.117	5.963
Monash	99.15%	0.85%	94.927	60.250	4.759
Theodore	99.81%	0.19%	103.733	76.934	6.243

For the Tuggeranong area, Table 8-3 shows that the average proportion of car users using their cars for the full journey is 99.48% while an average proportion of 0.52% use their cars as part of the Park and Ride trip.

From this data, we find that λ = -0.0186 and δ = -266.4516

8.4 Utilisation of Park and Ride Binary Logit Model

The calibrated model for Woden was used to forecast demand for the proposed Park and Ride facility in Mawson. Due to its location, it was assumed that the new facility would have the same catchment area as the existing Woden facility.

The car-only costs and Park and Ride costs were measured using the same methods as in the calibration with the number of car-only trips taken from the 2006 census. The probability of whole trips being made using the car only was calculated using the following equation.

$$P_{car} = \frac{1}{1 + e^{-\lambda(C_{P\&R} + \delta - C_{car})}}$$

Where:

- P_{car} is the probability of the trip being made by car only
- $C_{P\&R}$ is the generalised cost of the Park and Ride trip
- C_{car} is the generalised cost of the car trip
- δ is the cost penalty associated with Park and Ride trips where λ = -0.0074
- λ is the smoothing factor where δ = -694.4324

Table 8-4 shows the results for the prediction of the usage of a new Park and Ride facility in Mawson. It should be noted that the total number of Park and Ride trips also include the trips that are currently using the Woden Park and Ride facility.

Table 8-4: Utilisation of Binary Logit Model to Predict Demand for Mawson Park and Ride Facility

Suburb	C_{car} [minutes] (Model Input)	$C_{P\&R}$ [minutes] (Model Input)	Car Trips (Model Input)	P_{car} (Model Output)	$P_{P\&R}$ (Model Output)	Park and Ride Trips (Model Output)
Banks	111.643	85.837	1867	0.99518	0.00482	9
Bonython	87.569	71.386	1221	0.99482	0.00518	6
Chapman	74.075	65.277	998	0.99453	0.00547	5
Chisholm	83.310	64.842	2042	0.99491	0.00509	10
Conder	103.543	86.265	1785	0.99487	0.00513	9
Duffy	70.654	63.237	1042	0.99448	0.00552	6
Fadden	87.655	53.751	1292	0.99546	0.00454	6
Gordon	100.174	74.833	2914	0.99516	0.00484	14
Greenway	89.359	62.030	422	0.99523	0.00477	2
Isabella Plains	93.285	70.623	1556	0.99507	0.00493	8
Kambah	79.800	53.711	5656	0.99519	0.00481	27
Macarthur	78.975	61.221	663	0.99488	0.00512	3
Mawson	77.006	44.725	856	0.99540	0.0046	4
Monash	93.999	64.144	2100	0.99532	0.00468	10
Pearce	70.420	46.301	750	0.99512	0.00488	4
Scullin	113.259	100.605	839	0.99469	0.00531	4
Theodore	104.734	83.644	1544	0.99501	0.00499	8
Wanniassa	82.895	52.192	2846	0.99535	0.00465	13
Weston	72.387	62.970	1028	0.99456	0.00544	6
Total						155

Research conducted in the United States (Turnbull 1995) suggested a demand rate of 0.5% to 2% of the market area population for bus-based Park and Ride. It should also be noted that a demand rate (or attractiveness factor) of 0.7% was determined for the Western Australia bus-based Park and Ride system (Department of Transport 1998).

This means that there is a potential to increase the Park and Ride demand in Canberra from around 0.5% to 0.7% and probably even up to 2%.

9 Develop Future Park and Ride Strategy

9.1 Park and Ride Generic Components

Based on the literature review, facility assessments, user surveys and the overall insight gained by SMEC during the course of this study, a diagrammatic sketch was developed (illustrated in Figure 9-1), showing the generic components of an ideal Park and Ride system. These include:

- Park and Ride location to be on non-prime land
- Park and Ride users to have a permit to use the facility
- Park and Ride location to be near residential suburbs
- Park and Ride location to be highly visible along a primary arterial upstream of traffic congestion
- Park and Ride location to be served by express bus routes
- Bus route travelling along dedicated bus lanes on arterial roads for part of the journey
- Bus priority signals to be provided at main intersections
- Park and Ride to include a Bike and Ride facility.

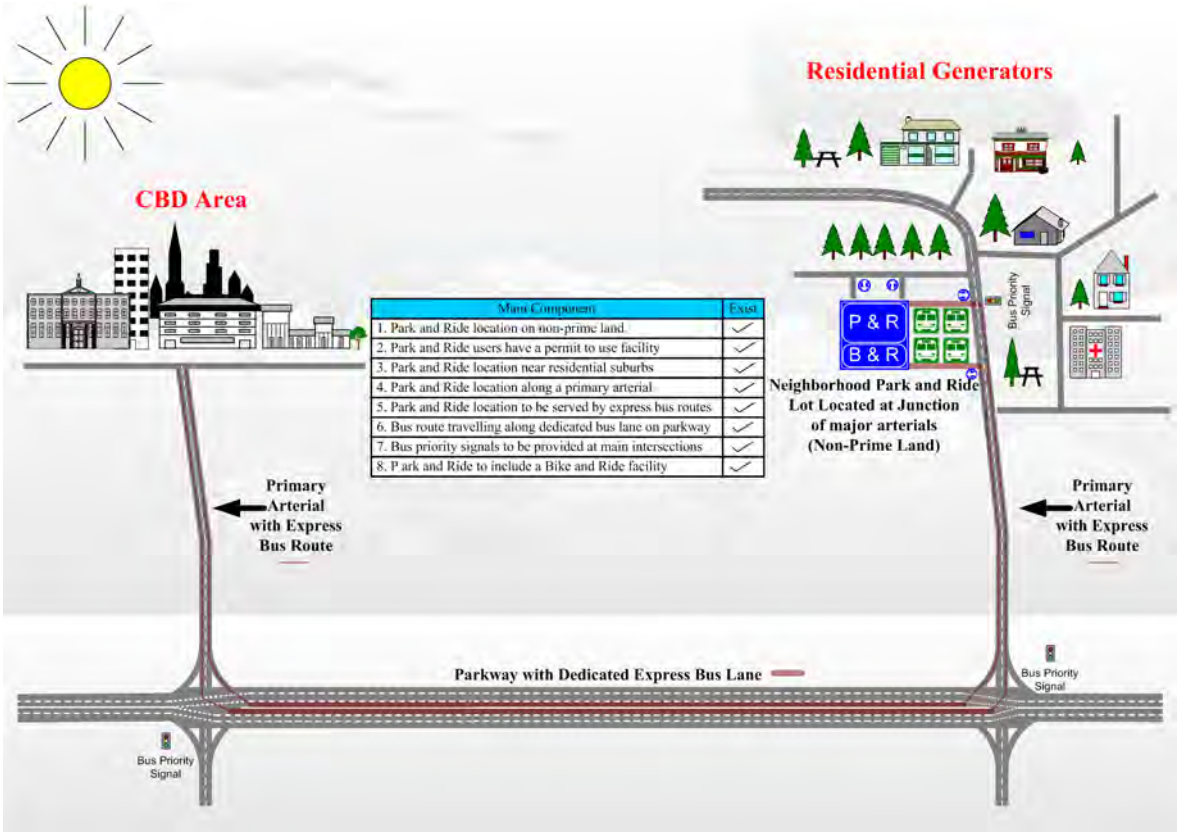
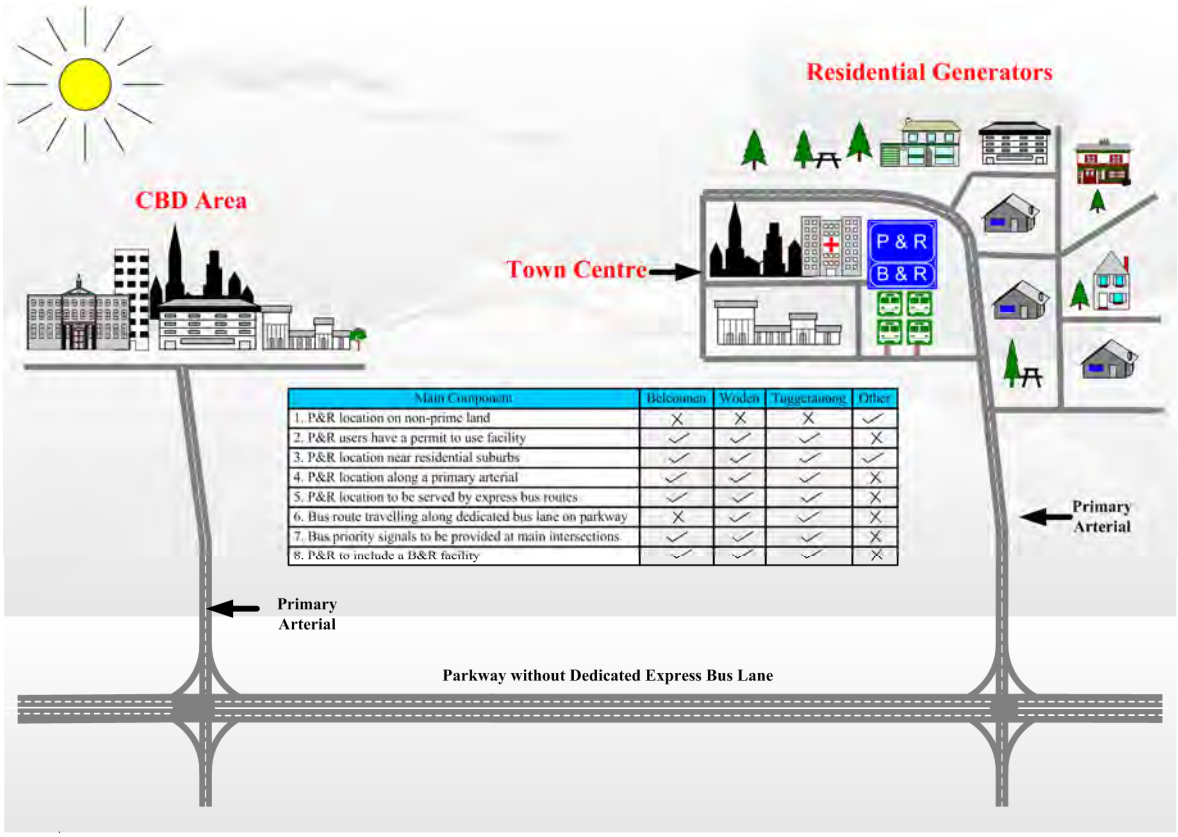


Figure 9-1: Main Components of the Recommended Park and Ride System

SMEC modified the previous generic diagram to show the existing Park and Ride system in Canberra and to identify the absence of some components (see Figure 9-2). The diagram shows that the three main Park and Ride locations in Woden, Tuggeranong and Belconnen town centres do not satisfy the first requirement as these are located on prime property that can be better utilised for development purposes. As for the rest of the Park and Ride facilities, the diagram shows that most lack a number of essential components, such as being along a primary arterial and being served by an express bus service.



Main Component	Belconnen	Woden	Tuggeranong	Other
1. P&R location on non-prime land	X	X	X	✓
2. P&R users have a permit to use facility	✓	✓	✓	X
3. P&R location near residential suburbs	✓	✓	✓	✓
4. P&R location along a primary arterial	✓	✓	✓	X
5. P&R location to be served by express bus routes	✓	✓	✓	X
6. Bus route travelling along dedicated bus lane on parkway	X	✓	✓	X
7. Bus priority signals to be provided at main intersections	✓	✓	✓	X
8. P&R to include a B&R facility	✓	✓	✓	X

Figure 9-2: Main Components of the Existing Park and Ride System

9.2 Park and Ride Strategy Framework for ACT

In order to attain a sustainable Park and Ride strategy framework for ACT, several components have to be developed in a complementary manner allowing their interaction in an organised and balanced fashion. This entails the selection of sustainable policies and measures. A Park and Ride strategy should be developed as part of an overall public transport, parking and road improvement program. Park and Ride facilities require funding, adequate public transport service and rideshare programs, and suitable incentives reducing inner-city traffic through early guidance to Park and Ride locations. Furthermore, the ACT Government has acknowledged that the strategic management of parking demand and supply, including its pricing, is essential for achieving transport and land use goals. Parking supply and its associated costs affect the competitiveness and attractiveness of urban centres and influence people's travel choices.

Based on the local and international literature review as well as on SMEC experience and survey analysis, a strategy for Park and Ride in the ACT was developed. The strategy is meant to clearly anticipate:

1. Targeted systems,
2. Achievement aspects,
3. Implementation policies/measures,
4. Implementation authority/organisation, and
5. Time framework

The strategy is classified into two main components. The first is the Park and Ride and bus incentive policies and measures. These are mainly concerned with making the bus system available and attractive for those who wish to travel. The second component is the car disincentive policies and measures. Disincentive measures use physical, regulatory and pricing restraints to discourage users of single occupancy vehicles and possibly induce them to shift to other high-occupancy vehicle modes, particularly the public transport system.

Table 9-1 and Table 9-2 detail the components of the developed strategy.

Table 9-1: Components of Park and Ride Strategy for the ACT (Park and Ride and Bus Incentive Policies and Measures)

System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Park and Ride System	Park and Ride Distribution	▪ Adopt a system of ***<u>several small</u>*** Park and Ride facilities with potential for expansion. ▪ Distribute geographically across Canberra to avoid duplication of catchment areas. ▪ Focus on the following locations: - Along Belconnen Way and Ginninderra Drive providing service to Belconnen suburbs - Along Athllon Drive providing service to Tuggeranong suburbs - Along Canberra Avenue (Fyshwick vicinity) providing service to Queanbeyan suburbs - Along Flemington Road providing service to Gungahlin - At the airport providing service to the west of Canberra and the potential expected developments such as Kowen - Along Cotter Road providing service to the expected Molonglo development, east of Canberra	TaMS	Short & Medium Term
	Park and Ride Location	▪ Avoid town centre locations ▪ Avoid premium land locations (preferably low value land). ▪ Use existing parking facilities that are under-utilised during normal commuting times (e.g. at sports grounds). ▪ Park and Ride to optimise accumulation of transit passengers to allow users to make short, car-based trips to gain access to the transit network. ▪ Park and Ride location to intercept traffic from suburbs and to ensure that the bus trip component is 50% or more. The literature indicates that Park and Ride lots should be located 5-8 km from major destinations such as city or town centres ▪ Locate Park and Ride lots on the upstream side of the point of freeway congestion (or at least not after the point of congestion). ▪ Locate Park and Ride lots on frequent rapid bus services. ▪ Park and Ride locations to be visible from adjacent arterials. ▪ Park and Ride locations selected to provide good vehicle and non-motorised access. ▪ Locate Park and Ride lots within view of businesses or homes to provide a feeling of security and safety. ▪ Provide opportunities for joint uses – i.e. Park and Ride with retail and service outlets such as dry cleaning, groceries, day care centres, etc.		Short & Medium Term
	Park and Ride Pricing System	▪ Provide free parking for Park and Ride users at Park and Ride locations		Short Term

System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Park and Ride System	Park and Ride Safety & Amenities	▪ Locate the Park and Ride facility to be within a maximum walking distance of 150 meters* to the bus stop/terminal. ▪ Provide adequate light, landscape, and other amenities to make the site attractive ▪ Introduce commercial and social activities in Park and Ride vicinities to enhance personal safety and vehicle security. ▪ Install way-finding signs and include signage indicating telephone numbers for reporting problems. ▪ Provide additional facilities in Park and Ride locations such as litter bins, public toilets, public telephones, vending machines and taxi terminals. ▪ Install timetable display boards (preferably real-time timetables) ▪ Avoid road crossings or provide segregated or signalised pedestrian crossings.	TaMS	Short & Medium Term
	Bike and Ride	▪ Include bicycle storage lockers or other bicycle storage if demand exists.		Short term
	Park and Ride Information & Marketing	▪ Promotional campaigns for using Park and Ride systems. ▪ Employer incentive schemes for using Park and Ride systems. ▪ Provide drivers with accessible and up-to-date information on Park and Ride facility locations, space availability, and downstream roadway conditions.		Medium Term
Bus Transport System	Bus Transport Fare System	▪ Low and flexible fares for daily, weekly, monthly, and seasonal Park and Ride users.	ACTION	Short Term
	Bus Transport Level of Service	▪ Introduce more express services ▪ Span the service over an extended peak period ▪ Reduce number of intermediate stops. ▪ Provide high-level, express bus service during peak periods. ▪ Provide real-time information systems. ▪ Promote Park and Ride as part of an overall transit and ridership improvement program		Short & Medium Term
Road	Infrastructure	▪ Introduce more dedicated bus lanes for services connecting Park and Ride facilities to destinations. This should make the bus trips to/from Civic faster than using a car. ▪ Access to bus lanes for at least a portion of the bus trip to the final destination ▪ Access to dedicated bus lanes for at least a portion of the bus trip to the final destination	Roads ACT	Medium & Long Term
	Management and Control	▪ Introduce more bus signal pre-emption		Medium & Long Term

(*) Based on current main Park and Ride locations as well as on Guide to Land use and Public Transportation Sno-Tran 1989

Table 9-2: Components of Park and Ride Strategy for ACT (Car Disincentive Policies and Measures)

System	Aspect	Implementation Policies and Measures	Implementation Authority	Time Framework
Parking	Car Parking	▪ High parking fees in CBD and town centres. ▪ Parking spaces in CBD and town centres to be regulated. ▪ Parking costs at destination(s) served should be substantially higher than round trip bus fare so as to provide cost savings to users. Transit riders to destinations with abundant free parking will not use the Park and Ride system.	TAMS	Short & Medium Term
Private Car	Economical and Environmental Impacts	▪ Introduce road pricing over the long-term as a car usage disincentive measure ▪ Increase taxes for car ownership.	ACT Government	Medium and Long Term

The main components of the strategy are summarised in the illustration below:

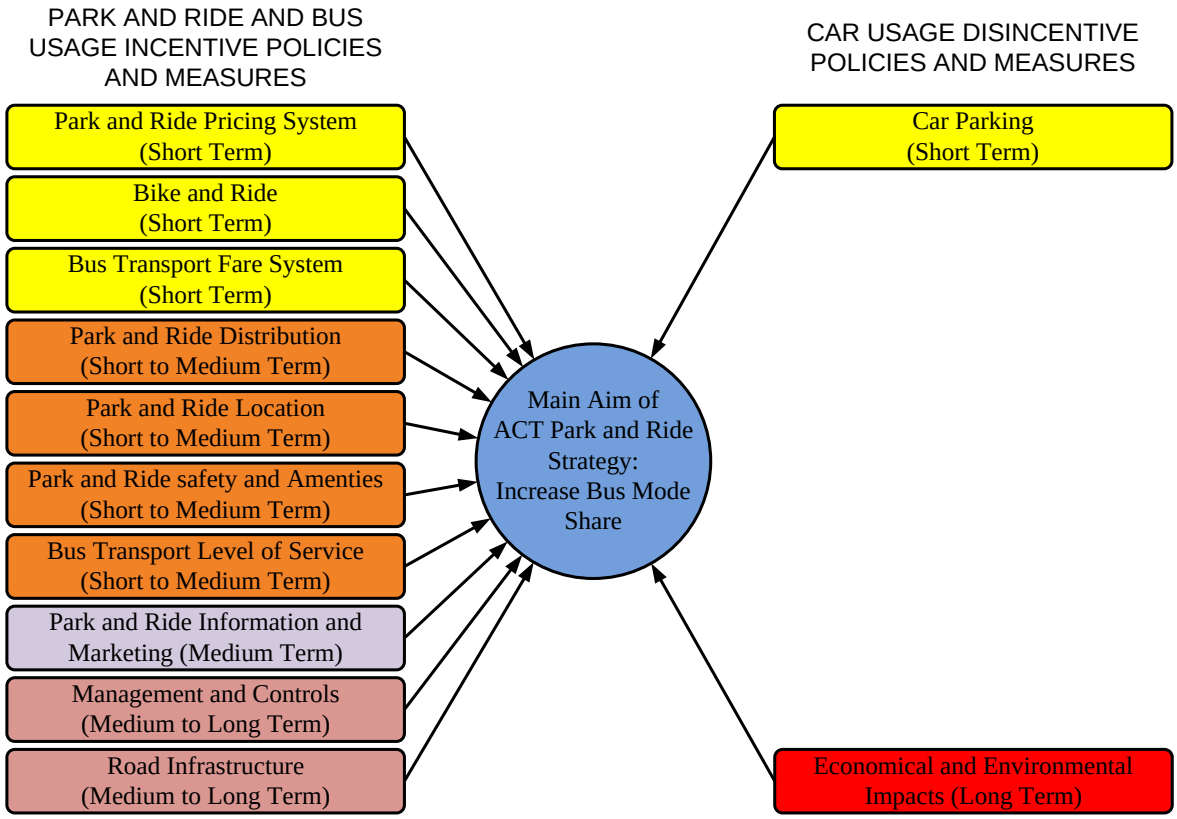


Figure 9-3: ACT Park and Ride Strategy

In conclusion SMEC recommends the following main actions:

Table 9-3: Recommended Main Actions

Time Horizon	Actions
Short term	Identify and develop new Park and Ride locations on non prime land and taking into consideration all location aspects recommended in this report including expected express bus route services. Transfer current town centre Park and Ride facilities to other usage either as paid parking or as prime development areas
Medium term	Invest, improve and upgrade the Canberra public transport system to become competitive in cost and time with car usage. Make sure that all Park and Ride facilities are provided with express bus services. Limit city parking spaces, and increase parking fees (car usage disincentives)
Long term	Introduce further car usage disincentive measures such as central area road pricing

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