Technical Note 4

Subject: How should GWRC manage and design Park and Ride?

Project: Park and Ride Strategy

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1. Introduction

Greater Wellington Regional Council (GWRC) commissioned MRCagney to provide inputs into a Park and Ride Strategy (PaRS) for the Wellington Region, which will guide how GWRC invests in and manages Park and Ride in the Wellington Region over the next 30 years. In three separate technical notes, we:

- Discuss **why** GWRC invests in Park and Ride (Technical Note 1);

- Evaluate **when** Park and Ride is an appropriate intervention (Technical Note 2); and

- Identify **where** Park and Ride should be located to maximise benefits (Technical Note 3).

In this, the fourth technical note, we consider the question of **how** GWRC should manage and design new and existing Park and Ride facilities to maximise benefits. This yields a set of recommendations to guide how GWRC should develop and manage Park and Ride facilities.

The following sections of this technical note are structured as follows:

- Section 2 reviews the academic and technical literature that evaluates various approaches to managing Park and Ride facilities;

- Section 3 assesses Park and Ride management practices used in a number of cities;

- Section 4 outlines a proposed approach for Park and Ride management in Wellington, based on the above analysis;

- Section 5 outlines principles for effective design of Park and Ride facilities that can be applied in various contexts; and

- Section 6 concludes.

2. Review of the literature on managing Park and Ride facilities

We begin with a review of the academic and technical literature on Park and Ride management. The purpose of this literature review is to examine how other cities manage their Park and Ride facilities. It identifies alternative options for Park and Ride management and provides information to assess them against the PaRS principles and sub-principles for Demand Management outlined in Technical Note 1.

Park and Ride management includes several broad 'themes' of policies that are intended to address several distinct but related issues. These include parking enforcement, policies to manage excess demand at Park and Ride facilities, policies to guarantee access for particular types of users, policies to manage 'spillover' of parking demand into surrounding residential or commercial areas, and technical solutions for implementing pricing and/or other restrictions.

Our literature review suggests that there are seven policy 'themes' that are in common use:

- General enforcement of terms and conditions at Park and Ride facilities;

- Restricting Park and Ride to public transport users;

- Preferential parking, i.e. reserving spaces for carpooling, car share, and electric vehicles;

- Short-stay Park and Ride spaces;

- Pricing Park and Ride;

- Managing spillover parking from Park and Ride facilities; and

- The use of parking hardware, mobile applications, or other technologies to enforce or manage facilities.

In the following sub-sections, we review the evidence on these policies, focusing on how they affect Park and Ride usage behaviour, station access mode choice, whole-of-trip mode choice, and patronage.

2.1 Enforcement of parking terms and conditions

Even if Park and Ride facilities are not priced or actively managed to prioritise certain users, general enforcement of terms and conditions may be a useful way of managing the adverse effects of excess occupancy. These adverse effects may include people parking on landscaped areas or footpaths, blocking accessways, blocking other users from safely exiting their spaces ('double-parking'), using the facility as convenient, free, all-day parking (but not using public transport), or leaving vehicles in Park and Ride lots overnight.

Enforcement options include:

- Posting terms and conditions of use at Park and Ride facilities – in New Zealand, this is a necessary prerequisite for any enforcement action;

- Issuing warnings to infringing users as a 'softer' reminder to change behaviour;

- Ticketing infringing users to discourage 'unsavoury' parking activities; and/or

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- Towing infringing users who are posing a risk to safety or inconveniencing other users, e.g. by blocking accessways, double-parking, or using the facilities for purposes other than accessing rapid transport (at least on weekdays).

TCRP 192[1] recommends that agencies be specific and intentional about permitted uses of the Park and Ride facility, and that active management of rules or regulations is important. The report suggest that agencies do the following:

- Set rules (ensuring rules are compliant with local or national regulations);

- Display rules (on-site signage and online at a minimum);

- Enforce rules (on-site inspection, ticketing, towing, etc.); and

- Modify rules as needed.

Monitoring and enforcement of terms and conditions is viewed as a good practice even in situations where parking is not priced or reserved for specific users. However, transport agencies typically do not publish information on enforcement, which makes it challenging to identify where and how Park and Ride enforcement is undertaken.

Parking enforcement is likely to be done on an 'as needs' basis. At high-demand facilities with a high risk of parking infringements, there may be ongoing or regular enforcement. At other facilities, enforcement may be intermittent or targeted towards addressing complaints from users.

2.2 Restricting parking to public transport users

In addition to enforcing basic parking terms and conditions, Park and Ride facilities may be managed to restrict access to public transport users. The aim of this policy is to manage excess occupancy arising from the use of facilities by non-commuters, and hence to ensure that Park and Ride facilities deliver the intended benefits of enabling higher public transport use and reducing peak-time congestion.

In order to restrict access to public transport users, it is necessary to implement a validation and enforcement system. For instance, Park and Ride users in San Francisco's BART system are required to register their space after entering stations.

Restricting Park and Ride facilities to public transport users can be desirable during weekdays, when facilities are expected to be available for commuters. However, there may be benefits to opening up facilities for other users during evenings and weekends, as this can support access to surrounding land uses, eg shopping centres.

TCRP Report 153 (Guidelines for Providing Access to Public Transportation Systems)[2] offers the following guidelines on access to Park and Ride by a range of users. It does not necessarily advocate for restricting Park and Ride to public transport users only:

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1 Ibid at 38

2 Transportation Research Board (2012) Guidelines for Providing Access to Public Transportation Stations, Transit Cooperative Research Program Report 153

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- Design parking to be shared with other users, where appropriate. For example, residential or entertainment uses may be able to use station parking on evenings and weekends;

- Park and Ride facilities to be open either 24 hours per day or, alternatively, just during the hours that the rapid transit service operates (e.g., 5 a.m. to midnight) if users are to be restricted;

- Gating or control is necessary where parking fees are collected and where facilities are sometimes closed. New technologies, such as parking apps and automatic numberplate recognition, can provide a cost-effective alternative in some cases; and

- The use of pay-by-space in Park and Ride, where riders pay for and register their specific space inside the station itself. This means of charging for parking helps to ensure that parking is used only by public transport riders.

An earlier US planning and design guideline recommended that Park and Rides should[3]:

- Establish a strict enforcement policy of ticketing or removing unauthorised users of the Park and Ride facility, based on local trespass laws;

- Provide fencing and pathway bollards to control vehicle and pedestrian access;

- Assure that all pedestrian and driveway access to the Park and Ride lot can be controlled to minimise or eliminate unauthorised activity; and

- Consider providing on-site security patrol during peak and off-peak periods.

A recent technical document published by the Calgary Transportation Department supports shared parking opportunities to reduce both the cost and space consumed by parking facilities.[4] Malls, churches, and community centres were identified as places where peak parking demand occurs during evenings and weekends, and hence where there may be some opportunities to share with commuter parking. In terms of restricting parking, Calgary currently uses reserved parking permits, with the potential for cameras at the entrance to aid enforcement.

2.3 Preferential parking

Preferential parking is used to encourage certain behaviours (e.g. carpooling or use of an alternative fuel vehicle), or to provide convenience to some types of users (e.g. people with disabilities, pregnant women, people with small children). Preferential parking is typically provided in a more desirable location within the car park. For the purposes of this study, we consider preferential parking to include carpooling, car share, and electric vehicles.[5] However, it could also cover other types of users.

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3 Spillar, R.J. (1997) Park-and-Ride Planning and Design Guidelines. Parsons Brinckerhoff Inc., New York

4 Calgary Transportation Department (2016) A review of Calgary Transit Park and Ride, Calgary City Council, Canada

5 Electric vehicles can have significant social and environmental benefits due to the fact that they reduce emissions relative to petrol or diesel vehicles. However, providing preferential access to electric vehicles would encourage people to travel shorter distances in electric vehicles and longer distances in petrol / diesel vehicles. As a result, preferential access for electric vehicles

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There is relatively little literature on preferential parking at Park and Ride locations. However, various public transport guidelines make suggestions on where to position parking spaces for such transport modes within a Park and Ride, including *TCRP Report 153 (Guidelines for Providing Access to Public Transportation Systems)*, which states that:

- Reserved spaces for car sharing services should be located in high-profile locations, in areas that are closer to station entrances than most of the at-large parking spaces.

2.4 Short-stay park and ride

Park and Ride facilities may be managed to encourage short-stay trips, for instance by setting time limits on some spaces. This may be done to encourage increased turnover of spaces throughout the day and hence higher patronage impacts per space.

There is relatively little literature on the provision of short-stay Park and Ride spaces. However, we observe that reserving spaces for midday trips may undermine the aim of encouraging peak commuter trips to switch from road to public transport. Midday periods typically have lower road congestion than the commuter peak, meaning that there are lower benefits from encouraging people to use Park and Ride during these periods.

Dijk and Parkhurst (2014)[6] reported that the city of Oxford in the UK introduced parking charges to its bus-based Park and Rides as a response to public spending cuts and to limit very long-stay parking by vacationers. However, this policy was focused on preventing multi-day stays rather than encouraging short-stay trips during the day.

TCRP Report 153 (Guidelines for Providing Access to Public Transportation Systems) recommends providing reserved space for midday riders, in addition to areas set aside for drop-offs, pick-ups, and taxi stands. These should be as close as practical to the station entrance without interfering with feeder bus operations, which typically have higher priority.[7]

As these examples suggest, pricing policies may encourage short-stay trips by increasing the availability of parking even after the morning peak. Certain methods of implementing pricing may also encourage midday use. For instance, in Calgary and the San Francisco Bay Area, unused monthly reserved parking spots are available to anyone after 10.00 am, which facilitates short-stay and casual parking outside of peak times.

An alternative approach to encouraging short-stay Park and Ride trips is to apply time limits to some spaces. Some of Auckland's Park and Rides set aside spaces for short-stay parking, typically P120 or P180. However, it is unclear if these time restrictions are enforced.

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at Park and Ride facilities may not be the best way of improving vehicle emissions – policies to achieve a significant mode shift to public transport and policies to reduce average travel distances are likely to have a larger effect.

6 Dijk, M. and Parkhurst, G. (2014) Understanding the mobility-transformative qualities of urban park and ride polices in the UK and the Netherlands. International Journal of Automotive Technology and Management, 14 (3/4). pp. 246-270.

7 Ibid at 2

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2.5 Pricing Park and Ride

Several academic papers analyse the effects of Park and Ride pricing on user preferences for accessing a public transport station. Pricing Park and Ride facilities is a common response to high levels of occupancy, as it may encourage some people to access stations via other modes. These studies rely upon surveys and models on cities or regions such as Perth, the San Francisco Bay Area, and Vancouver.

In Perth, an intercept survey was carried out on Park and Ride users to identify factors that influenced choice of Park and Ride station location, including, distance, availability of free or paid parking, availability of bicycle lockers, and time of day.[8]

The study was conducted in 2012 before the roll-out of the flat AUD$2 (NZ$2.10) tariff for all of Perth's Park and Rides in 2014. Respondents stated that the availability of secure and paid parking bays had a greater positive effect on station choice than free Park and Ride supply.[9] While this study does not delve into the reasons for this particular finding, our Technical Note 2 reported media coverage on pricing helping to reduce demand for Park and Ride, increasing availability later in the day, and discouraging use by non-public transport users, which may explain the positive influence of pricing on station choice.[10]

In Vancouver, a study was carried out to investigate the effect of increasing parking charges at Park and Ride stations on mode choice for current users. The study surveyed users at 14 of the busiest Park and Ride stations in Vancouver.[11] The survey data was used to model station access mode choice in response to increases in pricing at Park and Ride stations.

Modelling indicated that increasing parking charges at Vancouver Park and Ride stations was more likely to cause current Park and Ride users to switch to using public transport for their entire journey (e.g. by catching connecting services) or accessing stations directly by walking or cycling, rather than causing them to drive the entire journey.

A survey of Park and Rider users in the San Francisco Bay Area of California, USA was conducted to determine the demographic profile of users, their commuting habits, and their views toward facilities and pricing at Park and Rides.[12] Users reported a willingness to pay USD$1 (NZ$1.40) to USD$2 for Park and Ride where tangible improvements to a Park and Ride facility were implemented, such as added security, lighting, shelters, and toilets. Furthermore, surveyed users were willing to pay more in the range of USD$3 to USD$4 for a guaranteed reserved space.

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8 Olaru, D., Smith, B., Xia, J. & Lin, T. (2014) Travellers' Attitudes Towards Park-and-Ride (PnR) and Choice of PnR Station: Evidence from Perth, Western Australia, Procedia - Social and Behavioral Sciences, 162, 101-110.

9 Ibid at 8

10 https://thewest.com.au/news/wa/paid-parking-eases-jams-at-train-stations-ng-ya-382766

11 Habib, K.N., Mahmoud, M.S. & Coleman, J. (2013). Effect of Parking Charges at Transit Stations on Park-and-Ride Mode Choice. Transportation Research Record, 2351, 163-170.

12 Shirgaokar, M. & Deakin, E. (2005). Study of Park-and-Ride Facilities and Their Use in the San Francisco Bay Area of California. Transportation Research Record, 1927, 46-54.

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In a more recent study on the San Francisco Bay Area's Bay Area Rapid Transit (BART) system, researchers investigated Park and Ride users' responses to Park and Ride price changes.[13] Users at two stations were surveyed; MacArthur, which previously had free parking; and West Oakland, whose daily parking tariff increased from USD$1 to USD$5.

Researchers observed the following changes in user behaviour after price changes[14]:

- Arrival times at Park and Rides were spread more evenly. At West Oakland, the period of 4:00 to 6:00 a.m. lost 29% share of arrivals, whereas the next three one-hour periods each gained significantly. At MacArthur, demand from the peak period of 7:00 to 8:00 a.m. was shifted to the 8:00 to 9:00 a.m. period.

- At West Oakland, the number of users who reported using private car parks near the station increased. This may be explained by the surveyed group never having previously used the private car parks as they were more expensive.

- At MacArthur, users claimed they parked on the street less following the introduction of paid parking. One possible explanation is that people who used to park on the street some of the time no longer did because of the better availability of Park and Ride parking due to the pricing.

The researchers also held smaller discussion groups with some survey respondents. This indicated that 95% of respondents reported using BART the same amount compared to before the introduction of daily tariffs. Additionally, daily tariffs were preferred over monthly reserved permits as they are more affordable and flexible.[15]

Lastly, a survey of public transport users in Seattle, Washington canvassed users' attitudes towards pricing and other management strategies in response to high demand at its Park and Rides and concerns over commuter parking spillover onto commercial or residential streets.[16] Only 28% of surveyed users reported that they were willing to pay for existing parking spaces. However, when asked if they would support pricing if it could guarantee a parking space, nearly half of the surveyed users were in the affirmative.[17]

2.6 Managing spillover parking from Park and Ride facilities

Park and Ride spillover refers to commuter drivers who park their cars on nearby streets or private off-street parking lots due to the facility being full, or to avoid paying parking charges. A review of the literature highlights parking spillover as a potential concern in some contexts and some techniques to address it.

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13 Syed, S., Golub, A. & Deakin, E. (2005). Response of Regional Rail Park-and-Ride Users to Parking Price Changes. Systemwide Results and a Detailed Study of Two Stations. Transportation Research Record, 1927, 46-54.

14 Ibid at 13

15 Ibid at 13

16 Stieffenhofer, K.E., Barton, M. and Gayah, V., 2016. Assessing Park-and-Ride Efficiency and User Reactions to Parking Management Strategies. Journal of Public Transportation, 19(4), p.5

17 Ibid at 16

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Schiller and Kenworthy (2011) note that the protection of residential neighbourhoods from spillover parking and undesirable traffic is often given as a justification for Park and Ride provision. They suggest that parking management techniques such as residential parking permits and timely enforcement could assist in managing spillover parking without the need to expand Park and Ride provision.[18]

In a study of the development of the Light Rail system in Denver, Colorado, USA, Truong and Marshall (2014) reported that extra spaces were often added to planned Park and Rides to address concerns of spillover parking into adjacent residential areas that arise in consultation with the community and political leaders.[19] Despite this approach, this study noted that at one busy Light Rail station without Park and Ride (Louisiana/Pearl Station), the spillover parking issue was solved by restricting parking to residents during certain hours, rather than by developing new parking spaces.[20]

In Calgary, the public transport agency recognised that spillover parking would occur in the absence of parking controls in areas adjacent to stations and/or Park and Rides. Rather than recommending any particular parking control for nearby streets, it instead recommended allowing all parking spaces at Park and Rides with high demand to be subject to a priced reservation system. The objective of this system was to ensure that commuters had a space to park and to reduce spillover and/or illegal parking.[21]

In the European context, Park and Ride tends to be viewed as a 'last resort' option for managing transit-generated parking demand, with resident parking schemes, paid parking, time restrictions or even the prohibition of street parking to commuters seen as management responses that are prioritised before Park and Ride capacity is added.[22]

2.7 The use of parking hardware, mobile applications, or other technologies

Historically, parking management had to be done 'manually': in order to manage occupancy and enforce parking terms and conditions, facility owners relied upon some combination of:

- Infrastructure such as boom gates at facility entrances / exits to require users to pay upon entering or leaving;

- Payment machines where users can pay for parking or validate free parking;

- On-site staff who could monitor and enforce conditions; and / or

- Intermittent / targeted monitoring and enforcement of parking conditions.

18 Schiller, P. and Kenworthy, J., 2011. Walk to transit or drive to transit?. In Proceedings of Walk 21 Conference (pp. 1-14). Walk 21.

19 Truong, L. and Marshall, W., 2014. Are Park-and-Rides Saving the Environment or Just Saving Parking Costs? Case Study of Denver, Colorado, Light Rail System. Transportation Research Record: Journal of the Transportation Research Board, 2419, pp.109-117

20 Ibid at 19

21 Ibid at 4

22 Dijk, M. and Montalvo, C., 2011. Policy frames of Park-and-Ride in Europe. Journal of Transport Geography, 19(6), pp.1106-1119.

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These technologies and techniques can be prohibitively costly for small facilities or facilities where parking prices are low.

However, in recent years, there have been significant changes to parking management technologies and techniques. These can potentially reduce the cost that agencies bear to manage parking facilities and allow users to pay for or validate parking, while increasing the convenience and accessibility of parking for users. Some new technologies that are increasingly common include:

- 'Smart parking' systems that use sensors or automated numberplate recognition via cameras to identify whether spaces are occupied;

- Real-time information for parking wardens, e.g. from mobile apps or internet-connected sensors and parking machines, to help guide enforcement;

- Real-time information for parking users, such as electronic signs on approach roads to inform users about the number of free spaces at parking facilities;

- Payment systems that offer cash, credit card / EFTPOS, and payment via public transport smartcards – for instance, in Wellington, many parking meters accept payment via Snapper card;

- Mobile apps that enable users to reserve spaces in advance, pay for spaces without needing to find a meter, and extend their stay without returning to their car. In New Zealand, mobile apps have been developed by both transport agencies (e.g. AT Park) and private providers (e.g. Parkable).

'Smart parking' systems present a way to better manage demand. However, due to the rapidly emerging nature of these technologies there is limited research on how they are used for Park and Ride. Several papers examined the outcomes of a 'smart parking' trial at Rockridge BART station in Oakland, California, but we note that these studies predate more recent developments in mobile apps.[23] [24]

The Rockridge BART smart parking trial occurred between 2005 and 2006 for 50 Park and Ride parking spaces and involved:

- Real-time displays on an adjacent commute corridor into downtown Oakland and San Francisco that showed the availability of Park and Ride spaces; and

- An intelligent reservation and payment system to check parking availability and to reserve a space via telephone, mobile phone or online. This could be done *en route* or at home.

Smart parking participants were surveyed, finding that:

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23 Rodier, C. & Shaheen, S. (2006). Transit-Based Smart Parking in the U.S.: Behavioral Analysis of San Francisco Bay Area Field Test. Institute of Transportation Studies, UC Davis, Institute of Transportation Studies, Working Paper Series.

24 Shaheen, S. & Kemmerer, C. (2008). Smart Parking Linked to Transit. Lessons Learned from Field test in San Francisco Bay Area of California. Transportation Research Record, 2063, 73-80.

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- Smart parking encouraged 31% of respondents to use BART instead of driving alone to their on-site work location and 13% to divert to BART from carpooling, although 51% would still have used BART without smart parking (e.g. parking normally);

- There was an average increase of 5.5 more BART trips per month for work trips per surveyed user;

- Smart parking encouraged some users (14%) to access the BART station by car who previously would have taken the bus or walked;

- Decreased commute times were observed for respondents who regularly used smart parking to travel to work, from 43,700 to 40,400 minutes per month. This translates to an average commute time of 47.5 minutes with smart parking, versus 50 minutes without smart parking; and

- The average respondent reduced their monthly vehicle kilometres travelled by almost 16 km, reflecting the net effect of mode shifts.

2.8 Summary

Our review of the academic and technical literature on Park and Ride management has explored a range of different approaches, which could be implemented individually or in conjunction with each other. These management approaches can be used to address several distinct issues:

- Parking enforcement at Park and Ride facilities: This appeared to be good practice to ensure that parking facilities are used according to terms and conditions. Enforcement can be used to address some challenges associated with excess occupancy, such as people parking on landscaped areas or footpaths, blocking accessways, or double-parking and blocking other users in. However, the exact details of enforcement vary between facilities.

- Managing excess demand at Park and Ride facilities: Pricing Park and Ride facilities is the most commonly-implemented approach for doing this. However, other methods can be used to address site-specific issues, such as limiting access to public transport users during the daily commuter period.

- Guaranteeing access for particular types of trips or users: In some cases, Park and Ride spaces may be set aside for short-stay trips, user groups that face specific accessibility issues (e.g. people with disabilities or pregnant women), or behaviours that the transport agency is seeking to encourage (e.g. electric vehicle ownership). However, these management policies are likely to require focused enforcement to ensure that spaces are used appropriately. Furthermore, these options may not contribute directly to strategic objectives for Park and Ride.

- Managing 'spillover' of parking demand into surrounding residential or commercial areas: This can be done by implementing parking management policies in nearby areas, which may include residential parking permit schemes, time limits, or other policies.

- Technical solutions for implementing pricing and/or other restrictions: These are often required in order to implement the policies above, e.g. to enable monitoring of

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compliance with pricing policies. However, even if pricing is not in place policies like real-time information on the availability of spaces may be valuable for users. We note that parking management technologies are rapidly evolving. Mobile apps and automated numberplate recognition are likely to lower the cost of management and enforcement in the future, making it feasible to manage parking in more locations.

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3. Management Practices in Other Cities

Following the review of the academic and technical literature on Park and Ride management, this section explores how these management techniques are applied in ten peer cities around the world. These peer cities include cities that have previously been discussed in Technical Note 2, as well as several additional cities that are relevant to the Wellington regional context. This discussion repeats some information on Park and Ride pricing / management in Calgary, Ottawa, Auckland, South East Queensland and Perth.

3.1 Calgary

Calgary presently prices 50% of parking spaces at all of its Park and Rides through a monthly lease system at a price of CAD$85 (about NZ$90) per month, while the remaining 50% of spaces are free. After 10.00 am, unused monthly Park and Ride spaces are available for use by other commuters.[25] Reserved spaces can be booked via an online payment system. Additionally, Calgary City Council's Park and Ride policy also seeks to explore other ways to price Park and Ride, including:

- Different monthly reserve prices in different car parks;

- The amount of car parking allocated to monthly reserve parking;

- A daily Park and Ride tariff option;

- Options to reserve parking spaces in advance; and

- A means to charge higher tariffs for Park and Ride to people who do not live in Calgary.

Although these alternative pricing techniques have been explored, they are not currently in effect.

Some of Calgary's Park and Rides have set aside parking spaces for 4-hour maximum parking and mobility parking. A large number of the Park and Rides have 'plug-ins', which is not related to electric vehicle charging but instead is a heating system for car engines when the outside temperature falls below -20 degrees.

3.2 Ottawa

Ottawa adopts pricing as a management tool at a selected number of stations with high Park and Ride demand, where commuters can pay for monthly passes for guaranteed reserved spaces for CAD$57 per month. At a selected number of Park and Rides, pre-paid permits are also required for CAD$25.75 per month for all parking spaces, but these permits are available only for monthly pass holders. At Park and Rides with lower demand, parking is free.

Advanced parking technology does not appear to be used in Ottawa as permits need to be booked in advance via telephone.

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25 Ibid at 4

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Aside from priced Park and Ride, Ottawa does not set aside spaces for short-stay parking, carpooling, or electric vehicles; however, mobility carparks are provided. Monthly permits are not available for non-commuters.

3.3 Vancouver

Vancouver has 18 Park and Rides across its various public transport systems and prices 11 of these stations, with tariffs varying from CAD$2 to CAD$3.75 per day. Other Park and Rides are free of charge. Vancouver has adopted innovative parking payment technology, with users able to pay for their parking using a mobile app at nine Park and Rides owned by TransLink, Vancouver's public transport agency.[26]

Vancouver also sets aside spaces for car share vehicles at eight of its Park and Rides across two different companies, and spaces for carpooling at three of its Park and Rides. The carpooling spaces are still subject to the posted tariffs. Vancouver also rents out Park and Ride spaces to businesses needing to use the car parks outside of peak operating hours.

Vancouver also encourages shared parking by allowing businesses to rent some spaces at Park and Ride facilities.

3.4 Auckland

Although the *Auckland Transport Parking Strategy*[27] makes explicit reference, through Policy 13A, to the use of pricing to manage demand and encourage travellers to access stations by other means where alternative options are available, pricing does not apply to any of Auckland Transport's Park and Rides except for Waiheke Island. This has contributed to high levels of occupancy and facilities that fill up prior to the morning commuter peak. Ongoing development of the Park and Ride Programme Business Case and the 2018 version of the Regional Public Transport Plan may further articulate the Park and Ride locations suitable for pricing.[28]

Because Park and Rides are free, there is no payment system associated with Park and Ride and there are no physical access controls to restrict users. Notwithstanding the absence of physical access controls, signs at Park and Rides indicate that parking is for public transport users only. The enforcement of this policy is limited, as CCTV and patrols are not available at all stations. The *Auckland Transport Code of Practice* recommends all car parks should be fenced and equipped with CCTV.

A small number of stations, such as Papakura, Ōrakei, and Manurewa, set aside parking spaces for short-stay (P120 or P180) parking. No parking spaces are set aside carpooling, car share or electric vehicles in any of Auckland Transport's Park and Rides. Mobility parking is provided at Auckland Transport controlled Park and Ride facilities.

Management of spillover parking is addressed by Auckland Transport's *Parking Strategy*[29]. This strategy sets a number of 'intervention triggers' that identify when new parking management

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26 The remaining two paid Park and Rides are not owned by TransLink.

27 https://at.govt.nz/media/1119147/Auckland-Transport-Parking-Strategy-May-2015.pdf

28 MRCagney is currently assisting with these planning processes.

29 Ibid 27

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methods will be introduced, or existing methods tightened, to address issues with excess occupancy. These triggers are shown in Figure 3-1 below.

Issue	Trigger Point	Response
Demand pressure in currently unrestricted areas	Demand for on-street parking regularly exceeds 85% at peak times.	• Introduce time restrictions suitable to local demand or paid parking to encourage turnover of spaces; or • Establish new residential parking schemes
Demand pressure in residential areas	Parking demand regularly exceeds 85% of available supply in residential areas at peak times where off-street parking options are constrained (e.g. heritage zones, or areas where off-street parking constraints apply).	• Introduce or alter time restrictions (suited to local demand) to encourage turnover of spaces (with resident parking permit schemes where appropriate); or • Establish new residential parking schemes; or • Introduce paid parking areas to manage the high demand.
Demand pressure in areas with time restrictions	Occupancy levels for time-restricted spaces regularly exceed 85% at peak times.	• Investigate opportunities to reduce the time restriction and/or introduce additional time restrictions on adjacent streets; or • Introduce paid parking with no time limits and use demand responsive pricing
Demand pressure in areas with paid parking	Occupancy rates for paid parking in on-street spaces regularly exceed 85% at peak times.	• Increase parking charges, in line with Policy 1C • Consider provision of additional off-street paid parking consistent with the investment criteria.

Figure 3-1: On-street Parking Intervention Triggers. Source: Auckland Transport Parking Strategy

In brief, application of the intervention triggers means that excessive parking demand (i.e. regularly exceeding 85% occupancy at peak times, defined to mean the average of the four highest occupied hours in a day) in a street with unrestricted parking would trigger the introduction of time restrictions or residential parking schemes. This would apply to streets near Park and Ride experiencing spillover.

On streets where time restrictions or paid parking are already applied, excessive parking demand would trigger the introduction of priced parking or increased tariffs on existing paid parking.

In Auckland, these triggers have been applied in some Park and Ride locations and on city fringe streets that have been used as 'hide and ride' commuter parking for commuters who wish to park as close to the city centre for free or to get a one-zone bus or train fare. This includes Albany[30] where pricing at NZD$1 per hour will be introduced later in 2018 to address Park and Ride spillover from the nearby Albany Busway Station. Likewise, residential parking zones are

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30 https://at.govt.nz/about-us/have-your-say/north-auckland-consultations/albany-paid-parking-zone/

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used in city fringe areas such as Mt Eden[31], where the heritage nature of many of the properties means residents rely on on-street parking.

As evidenced by the experience in Auckland, a comprehensive regionwide parking management strategy can address parking spillover from Park and Ride using the same framework as for managing on-street parking in general.

3.5 Brisbane (South East Queensland)

The *South East Queensland Park 'n' Ride Strategy 2014* recommends the use of pricing to actively manage high demand in Park and Rides throughout the region and to prioritise customers who have a genuine need and willingness to pay for parking. However, at this point all Park and Rides in the region remain free.

No other management techniques have been used in South East Queensland, as it is not evident that spaces are set aside for carpooling, car share, electric vehicles or short-stay parking based on publicly available information.

In terms of parking restrictions, signage at Park and Rides indicates parking spaces are reserved for travellers at a particular station. A vehicle may be parked at a Park and Ride from first until last service. Vehicles that are parked overnight will be flagged for enforcement, which may include ticketing or towing of infringing vehicles.

3.6 Perth

Perth's public transport agency, TransPerth, implements a flat daily tariff of AUD$2 for all of its Park and Rides on weekdays. This can be paid by cash for pay and display or via a registered smartcard (the same as that used to board public transport) that is linked to a car's numberplate. Parking is free of charge on Saturday and Sunday.

As all Park and Rides are priced, TransPerth has a policy that Park and Rides are for passengers only. This policy is enforced by parking wardens who can issue AUD$50 fines for non-payment.

Some of Perth's Park and Rides have short-stay spaces for 'kiss and ride' trips with a maximum duration of 15 minutes. These spaces are subject to the same daily tariff between 9 am to 3.30 pm, and between 6.30 pm and 5 am, even though parking is limited to 15 minutes. No other parking spaces are set aside for carpooling, electric vehicles or car share; however, mobility parking is provided.

3.7 San Francisco Bay Area (Bay Area Rapid Transit and other systems)

The San Francisco Bay Area employs a range of parking management techniques and technologies to manage Park and Ride usage for its BART system.

All BART stations are priced, with varying daily tariffs that can be paid with cash or public transport cards. Monthly or daily reserved parking is also available at many BART stations with

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31 https://at.govt.nz/driving-parking/parking-permits/resident-parking-permits/residential-parking-zones/

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an online booking and payment system. BART's policy is to adjust parking prices every six months by USD$0.50 if a facility is over 95% occupied, up to a USD$3 daily fee maximum at all locations except West Oakland.[32]

BART is currently running an electric vehicle charging pilot programme at its Warm Springs/South Fremont Station, where electric vehicles can be charged for free at a select number of parking spaces. These spaces must be reserved online beforehand under the daily permitting system.

BART also runs a Park and Ride Carpooling/Ridesharing system at a selected number of stations. Commuters who carpool using the 'Scoop' ridesharing application 'Scoop', can access a guaranteed Park and Ride space in permit parking lots. Selected stations also have (priced) spaces allocated for traditional carpooling, where each member of the carpool must hold a 'carpool permit' that can be applied for. There is no guarantee of a carpool space through this system.

On BART's website, each station that has a Park and Ride lists its estimated 'fill time', which indicates the time at which the Park and Ride is typically full.

Besides BART's Park and Rides, the San Francisco Bay Area's bus and light rail systems also have Park and Rides, but these are unpriced and managed using different methods.

3.8 United Kingdom

Various cities in the UK of a comparable size to the constituent cities of the Wellington Region employ Park and Ride, particularly at bus stations. We explore the management techniques used in these cities in addition to the Park and Rides' relationship with public bus services.

3.8.1 Oxford

Oxford City Council and Oxford County Council manage five bus-based Park and Rides within their jurisdiction, including one with an interchange to a train station on the national rail network. At each of these Park and Rides, which are located at the city's periphery, riders can travel on frequent (15-minutes or better) peak bus services into Oxford City Centre, with lower headways (30 minutes) during the interpeak.

In terms of Park and Ride management and restriction, all Park and Rides are priced at a tariff of around £2 (NZD$3.90) per day and £10 per week, with the ability to purchase monthly (£30), quarterly (£85) and annual (£300) permits. Daily tariffs can be paid using a mobile application, over the phone, or with cash at an on-site machine, whereas permits can be paid online. As all Park and Ride facilities are priced, they are effectively restricted to commuters only. Real-time Park and Ride availability is also able to be viewed online.

In addition to paying for parking, there is also an option to combine the bus fare with the parking tariff for a cost of £6.80 that includes return bus travel for two adults and up to three children, which must be paid by cash or card at the ticket machines.

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32 It is unclear whether BART has a policy for reducing fares in response to low demand.

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At four of the five Park and Rides, provision has been made for a small number of parking spaces equipped with electric vehicle charge points, with priced parking but free charging. There is no provision for carpooling, short-stays or car share, except to say that the combined bus and parking fare may incentivise carpooling.

Oxford also provides bicycle parking facilities at two Park and Rides. Unlike in the Netherlands, where many users access stations via bicycle, these facilities are marketed towards commuters driving to the Park and Ride with a bicycle attached to the car, and then cycling towards the city centre for the last leg of the journey, which takes approximately 15 minutes.

3.8.2 Cambridge

Cambridgeshire County Council manages five bus-based Park and Rides. At each of these Park and Rides, which are located at the city's periphery, riders can travel on frequent all-day (15-minutes or better) bus services into Cambridge City Centre.

In terms of Park and Ride management and restriction, all Park and Rides are priced at a tariff of £1 per day and £5 per week, with the ability for credit card auto-payment linked to a car's number plate for regular users.

Daily tariffs can be paid using a mobile application, online, or with cash at an on-site machine, whereas auto-payment can be set up online. As all Park and Rides are priced, these are restricted to commuters only. While there are no fare products which combine the bus fare and parking tariff in Cambridge, there is the option to buy a return bus fare from the parking ticket machines.

At four of the five Park and Rides, provision has been made for a small number of parking spaces equipped with electric vehicle charge points, with priced parking but free charging. There is no provision for carpooling or car share, but parking is free for up to one hour to encourage short-stay trips and kiss-and-ride.

3.8.3 Sheffield

Sheffield manages eight Park and Ride facilities for its tram and bus networks. Four facilities are priced, of which three have a compulsory bundled pricing mechanism where a traveller must pay for a combined tram and parking fare from a ticket machine. The remaining Park and Ride site has a flat £1 daily tariff for parking. Connecting trams and buses typically have 10-minute headways during the daytime. The priced Park and Rides act as a means to restrict users, and while the free Park and Rides are meant for commuters only, the policy would need to be enforced via patrols.

Aside from the bundled pricing mechanism employed by Sheffield, the city does not use any other management techniques, with no dedicated spaces for electric vehicles, carpool or car share at its Park and Rides.

3.9 Summary

Our review identifies a diverse range of techniques used to manage Park and Ride. Common techniques include:

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- Enforcement of existing rules to ensure that Park and Ride spaces are intended for public transport users only and that parking should be in designated parking spaces only;

- Pricing to manage parking demand,

- Provision of a small amount of short-stay parking or customers arriving after the morning peak, including for 'kiss and ride',

- Real-time information technologies, and

- Setting aside parking spaces to encourage more efficient and environmentally-friendly travel options.

After the "first step" of enforcing existing rules at Park and Rides, pricing is the most common method to manage Park and Ride demand. Park and Ride facilities are routinely priced in the San Francisco Bay Area, Perth, Vancouver, Ottawa, Calgary, and the UK cities we reviewed. However, Brisbane and Auckland do not yet price their Park and Ride facilities. A range of price structures are used, including daily tariffs, weekly tariffs, or long-term permits. Hourly prices are uncommon given the all-day nature and purpose of Park and Ride. Payment systems are also varied and include cash, credit card or smartcard at a machine, mobile applications, online, telephone, and bundling with the public transport fare.

Explicit policies to restrict Park and Ride spaces to public transport users appear to be uncommon. Pricing is likely to serve as a de facto means to restrict users to public transport users only, as others would be less willing to pay for the parking tariff. Likewise, bundling parking charges with PT tickets reinforces the intention that Park and Ride is for PT users.

Some cities choose to allocate spaces for short-stay users or for other preferential purposes. We note that dedicating spaces may provide access for casual users (short-stay parking) or incentivises certain behaviours (preferential parking). Before implementing this technique, one should determine if this aligns with other desired transport outcomes. Use of these approaches is likely to require further monitoring and enforcement.

The use of technology to track occupancy and publish real-time data on the availability of Park and Ride spaces is common. This is not only useful for morning peak travellers but is also useful for interpeak travellers to check if spaces are available. Technology also enables new payment options, such as online booking or payment via mobile apps, and can assist with enforcement. Even if monitoring technology like parking space sensors or licence plate recognition through CCTV is not used, simple approaches like publishing typical fill times on a quarterly basis can provide users with valuable information.

Lastly, traditional parking demand management techniques can be deployed to avoid or mitigate concerns associated with spillover from Park and Ride facilities. Auckland's approach appears to be best practice, in that they treat spillover parking like any other occurrence of excessive parking demand. Auckland Transport administers a graduated management regime, with a series of clear intervention triggers on what to do, which include time-restricted parking, pricing or residential parking schemes on affected streets. However, implementing this approach requires coordination between the agencies managing different parking resources.

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4. Management Strategies

The previous two sections identified a range of approaches for managing Park and Ride facilities and reviewed evidence on the effects of these policies. We now consider how these approaches may be applied in the Wellington Region. The management approach proposed in this section draws upon the body of knowledge explored throughout this Technical Note and complies with the 'Demand Management' principles outlined in Technical Note 1.

To reiterate, these principles note that Park and Ride should be managed such that:

- Available Park and Ride capacity is well-used to support public transport;

- Park and Ride is prioritised for people with a genuine need to drive to rapid public transport;

- Users make an appropriate contribution to the costs of Park and Ride; and

- Spillover parking is appropriately mitigated and managed.

The assessment in this section considers a range of options and describes the rationale for the proposed approach.

4.1 Policies to manage excess Park and Ride occupancy levels

Analysis of Wellington Park and Ride occupancy in Technical Note 1 indicates that many, although not all, facilities fill up during or prior to the commuter peak. This limits their availability for trips at other times and creates a potential rationale to apply demand management policies in locations experiencing excessive occupancy.

There are three relevant considerations when choosing how to implement demand management policies:

- The degree to which pricing and non-pricing policies are relevant to Park and Ride facilities;

- How the role of pricing is construed and communicated to the public; and

- How spillover parking issues are addressed.

We discuss these considerations briefly before outlining a recommended approach.

4.1.1 The relevance of pricing and non-pricing demand management policies

As outlined in Auckland Transport's *Parking Strategy*, on-street parking management can be done using a 'graduated' approach, stepping up from unrestricted parking to residential permit parking to time-limited parking to priced parking as occupancy levels increase.

Unlike on-street parking, it is difficult to manage Park and Ride though graduated mechanisms like time limits or access restrictions. This reflects the fact that Park and Ride mainly serves commuter demand and hence time limits or other restrictions may render it unattractive altogether. Therefore, the two main mechanisms available to manage excess occupancy at Park and Ride facilities are:

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- Posting terms and conditions of use at Park and Ride facilities and enforcing them using the methods identified in Section 2.1; and

- Pricing Park and Ride facilities to manage excess occupancy issues that cannot be addressed via enforcement. Choices about how to price Park and Ride facilities include:

    o *Whether* to price facilities in the first place. In places with low occupancy levels and few issues with people being able to find a space at an appropriate time, pricing may not be necessary.

    o *How much* to charge users at Park and Ride facilities where pricing is applied. A low daily price may be appropriate in some locations but not others, reflecting lower levels of demand.

A related question is whether to provide weekly or monthly passes in addition to daily rate parking. In general, users are charged a premium for monthly passes, reflecting the higher certainty they offer for being able to find a space.[33] In order to be attractive for users, it would be necessary to reserve spaces for monthly pass users, and monitor these spaces to ensure that unauthorised users were not accessing them. If facilities are already being monitored for enforcement of terms and conditions and to ensure that users pay for access, then this may be an attractive option. However, it is likely to be difficult to administer as a standalone scheme.

In light of this discussion, we recommend a graduated enforcement and management approach at Park and Ride facilities. This graduated approach is influenced by steps taken by the *Auckland Transport Parking Strategy*, the pricing review system adopted by BART, and the hierarchy of management measures in Dijk and Montalvo (2011)[34]. This would include the following key elements:

- As a first step, posting terms and conditions of access at Park and Ride facilities to ensure that users are aware of access restrictions and good practices when using facilities.

- Second, where there is evidence of excess occupancy leading to unsafe or unsavoury parking practices such as parking on landscaped areas or footpaths, blocking accessways, or double-parking, conduct targeted enforcement, starting with written warnings to offending users and progressing to ticketing infringing users and (in egregious cases) towing infringers.

- Third, where occupancy levels continue to exceed target levels (see Section 4.1.5 below), Park and Ride facilities introduce pricing in order to manage excess demand. Prices should start at a relatively low level and be incrementally increased (or decreased) periodically in response to evidence that occupancy is above (or below) the target band. Consideration should be given to whether parking charges are cost-effective to collect – i.e. the aim should be for pricing to 'pay its way'.

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33 A monthly Park and Ride pass could be aligned to existing monthly passes on the rail network. However, the introduction of integrated fares and ticketing may alter these payment options.
34 Ibid at 22

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- Fourth, over time, this policy is likely to result in different prices (including some facilities that continue to be un-priced) for different Park and Ride facilities, reflecting different levels of demand and different costs of management. This is a 'horses for courses' pricing policy that ensures that management policies are targeted to sites where they are most in need.

We note that GWRC is introducing free bus transfers in zones 4 to 14 for users of rail monthly passes. A key objective of this policy is to relieve demand on Park and Ride by providing cheaper access to our feeder buses. Changes to parking enforcement and management could be progressed in parallel.

Broader opportunities for better managing Park and Ride capacity to match peak road network and Park and Ride demand will arise when GWRC introduces electronic fares and ticketing on trains, planned for 2020. Park and Ride users could be required to have public transport cards to access Park and Ride during weekdays (or at weekends and holidays as well, if required). Parking pricing could then be matched according to whether users also use public transport, allowing for premium parking rates to be charged if Park and Ride users are not also using public transport.

4.1.2 The role of pricing

There is a distinction between pricing to manage demand and pricing to raise revenues to fund Park and Ride provision. GWRC should be aware of the difference between these objectives and endeavour to clearly communicate the approach they are following.

In the first case, pricing is used as a tool to address documented demand pressures that arise at both new and existing Park and Ride facilities. This could be used in conjunction with other management techniques such as coupon parking or monthly leases. In this case, it is important to communicate that:

- Pricing is being implemented in order to address observed issues with excessive occupancy; and

- Users will experience benefits as a result of increased ease of finding a parking space, which will offset higher prices for many users.

In the second case, pricing is used as a tool to fund new Park and Ride facilities. In this case, the focus will largely be on introducing pricing where needed to fund or partly fund expansions, although pricing could still be introduced at existing facilities to cover the costs associated with on-going maintenance. In this case, it is important to communicate that:

- Pricing is being implemented in order to increase the availability of Park and Ride facilities or improve the quality of existing facilities; and

- Users will experience benefits from increased availability of Park and Ride facilities.

These objectives are not necessarily in conflict with each other. Often, both objectives matter to some degree. In these cases, it is important to ensure that overlapping objectives are clearly communicated in order to avoid confusion about the rationale for the policy.

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4.1.3 Dealing with spillover

Where there is a substantial risk of exacerbating spillover parking by managing demand at Park and Ride facilities, it is necessary to consider demand management strategies for surrounding residential or town centre streets. This is particularly important in situations where Park and Ride facilities are located in relatively dense residential or commercial areas where on-street parking is already highly occupied. However, it may be less relevant in places with lower-density land uses that generate less parking demand.

We therefore recommend a graduated and co-ordinated approach to manage both Park and Ride facilities and adjacent on-street parking. In doing so, we acknowledge that management of on-street facilities falls outside of GWRC's jurisdiction and will require coordination with local councils.

4.1.4 Proposed demand management approach

Table 4-1 sets out a proposed graduated approach to managing demand at Park and Ride facilities. This sets out intervention points for responding to specific issues around excess occupancy and spillover parking and suggests specific policy responses.

The following sub-section briefly discusses principles for two important elements of this graduated approach:

- How to identify an appropriate 'target' occupancy level for Park and Ride facilities; and

- How to incrementally adjust prices.

Table 4-1: Proposed graduated Park and Ride demand management strategy

Issue	Intervention Point	Response	Alignment with Sub-Principle
Park and Ride Demand Management			
Park and Ride facilities are full, and people are engaging in unsafe or unsavoury parking practices	Park and Ride regularly exceeds the target occupancy level (95%) at the time that public transport users would have to reach the station in order to arrive at Wellington Station by 09.00 am There is evidence of people parking on landscaped areas or footpaths, blocking accessways, or double-parking	Post terms and conditions at the facility Issue warnings to infringing users Ticket infringing users, after warnings are issued Tow infringing users in cases of severe issues	Available Park and Ride capacity is well-used to support public transport Park and Ride is prioritised for people with a genuine need to drive to rapid public transport

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Unpriced Park and Ride facilities are full, and commuters cannot find a parking space	Park and Ride regularly exceeds the target occupancy level (95%) at the time that public transport users would have to reach the station in order to arrive at Wellington Station by 09.00 am	Introduce a low (~$1/day) daily parking tariff to manage parking demand to an occupancy at around the target occupancy level before 09.00 am, ensuring that a small share of spaces are available throughout the day.[35]	Available Park and Ride capacity is well-used to support public transport Users make an appropriate contribution to the costs of Park and Ride Park and Ride is prioritised for people with a genuine need to drive to rapid public transport
Priced Park and Ride facilities are full, and commuters cannot find a parking space	Park and Ride regularly exceeds the target occupancy level at the time that public transport users would have to reach the station in order to arrive at Wellington Station by 09.00 am	Incrementally adjust parking tariffs to manage parking demand at around the target occupancy level before 09.00 am, ensuring that a small share of spaces is available throughout the day. Consider additional provision of Park and Ride parking, especially if parking charges are likely to cover the costs of provision.	Available Park and Ride capacity is well-used to support public transport Park and Ride is prioritised for people with a genuine need to drive to rapid public transport
Spillover Parking Demand Management			
Streets near a Park and Ride experience parking demand pressures	Streets regularly exceed a target average peak occupancy level (85%) during the midday period or other peak period	Introduce P120 time restrictions, with the ability to pay for coupons to park for longer periods (e.g. Wellington City Council's coupon parking scheme).	Spillover parking is appropriately mitigated and managed.

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35 Utilisation should be monitored, and prices adjusted – up or down – to ensure optimal utilisation.

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Streets near a Park and Ride experience parking demand pressures, despite time restrictions and coupon scheme	Streets in the local area regularly exceed a target average peak occupancy level	Introduce hourly parking tariffs, with the ability to pay for coupons to park for longer periods. (e.g. Wellington City Council's coupon parking scheme).	Spillover parking is appropriately mitigated and managed.

4.1.5 Target occupancy levels and incremental price adjustments

When implementing this approach, we recommend that GWRC should define and publicly communicate:

- Target occupancy levels for Park and Ride facilities at the end of the morning commuter peak period: These occupancy levels should be set to (a) provide Park and Ride users with certainty of finding a space, provided that they are willing to pay for it, and (b) ensure that a small number of spaces is available in inter-peak times.

- Policies for incrementally adjusting prices in response to excessively high or low occupancy: These policies should provide clarity about how much prices will adjust, either up or down, in response to emerging information.

For on-street parking, which tends to attract a higher proportion of short-stay or casual users, a target occupancy level of 85% is frequently used. For instance, Auckland Transport's *Parking Strategy* targets 85% occupancy, with an acceptable range of 70-90%. Occupancies below this level indicate a parking resource that is underutilised and hence not supporting surrounding land uses. Occupancies above this level indicate that users are likely to face challenges finding a space, leading to localised congestion as people circle the block to find a park. This band can be used as a guide for identifying the need to manage on-street parking near Park and Ride facilities.

A higher target is appropriate for Park and Ride facilities, which are targeted towards long-stay users that arrive during the peak, rather than casual users that arrive throughout the day. Consequently, we suggest a higher occupancy target of around 95% at the time that public transport users would have to reach the station in order to arrive at Wellington Station by 9.00am. This occupancy target, which is in use in the San Francisco BART system, indicates that around one in every 20 spaces is still available at the end of the morning commuter peak. This will ensure that users who arrive during peak times are generally able to find a space, while some spaces are available for midday users.

As this is a higher occupancy target than for other parking resources, we suggest an occupancy target band of 80-95%. Occupancy levels at or above the upper end of this band would justify a price response.

The **recommended approach to pricing Park and Ride** would be to:

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- Set a target occupancy level of 95% (with a target band of 80-95%) at the time that public transport users would have to arrive at the station in order to arrive at Wellington Station by 9.00 am (noting that this arrival time will vary by station)

- Implement pricing, or lift prices, at facilities where regular (eg monthly, quarterly or biannual) monitoring indicates that occupancies exceed the target band at 9.00am. Note that new technologies that provide more regular timely on occupancy may enable price adjustments on a more regular basis.

- Reduce prices at facilities where regular (e.g. quarterly or biannual) monitoring indicates that occupancies fall below the target band at the monitoring time.

- Set prices according to the following general principles:

  o Where pricing is newly introduced, it should start at a low daily rate, eg $1 to $2 per day

  o When occupancies exceed the target band, prices should be adjusted upwards, but by no more than (say) $0.50 to $1 per day at a time

  o When occupancies fall below the target band, prices should be adjusted downwards, but by no more than (say) $0.20 to $0.50 per day at a time.

The aim of this approach is to ensure that users have a reasonable degree of certainty about prices in the short run, avoiding sudden 'price shocks' while still providing for adjustment in response to high demand.

Where there is a risk of parking spillover onto local streets or nearby private parking lots, we recommend working with city or district councils to implement policies to address the adverse effects of spillover. The **recommended approach to managing spillover parking** is to:

- Set a target occupancy level of 85% (with a target band of 70-90%) for on-street parking during the four peak hours

- Monitor occupancy levels, either on a periodic or 'as needs' basis, to ensure that there are no significant issues with excess occupancy

- When occupancy levels consistently exceed the target band, adopt a graduated approach to managing this excess demand. This would encompass the following key steps:

  o Begin by implementing P120 time limits to discourage long-stay commuter parking, while offering a coupon permit parking system for local residents or workers who may be affected (a la Wellington City Council's existing coupon parking scheme).

  o Implement hourly pricing only where time limits prove insufficient to address excess occupancy issues.

These steps would have to be implemented by city or district councils in their role as road controlling authorities. We note that the general principles we outline here are relevant to on-street parking management in general. There are likely to be additional benefits from a

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consistent, clear and regionwide approach to parking demand management, inclusive of Park and Ride.

4.2 Payment Systems

In order to implement Park and Ride pricing, potential payment systems need to be explored. Our review of management practices in comparable cities showed that cities used a diverse mix of payment systems to pay for Park and Ride. These include cash and credit card at parking meters, public transport smart card, mobile applications, online, and via telephone, with many different options available to customers.

A similar approach should be adopted for the Wellington Region as it provides flexibility to customers who may prefer different payment methods. Presently in Wellington City, motorists can already pay for on-street parking using Snapper, mobile applications, cash or credit card, and this mix of payment systems is also seen throughout New Zealand. Therefore, for future priced Park and Rides in Wellington, the following payment systems should be available at a minimum, as they will cover most of the payment means made by New Zealanders:

- mobile phone application;

- existing public transport smartcard options; and

- debit and credit card (with near-field communication technology).

We note that the public transport smartcard payment option will require delivery of the proposed next-generation fares and ticketing system scheduled for 2020, as Snapper is not available on the rail system. Hence, we suggest deploying existing methods and technologies first, rather than investing in a new payment system now, to avoid precluding integration with a future integrated fare and ticketing system.

4.3 Preferential Parking

While some of the studied cities set aside some spaces within their Park and Rides for electric vehicle charging, carpooling, and car share, it is not clear from publicly available information what their objectives for setting aside such spaces are.

Given the local challenges of Park and Ride demand pressures, community expectations for increased Park and Ride provision, concerns about GWRC's ongoing level of investment in Park and Ride and the need to view Park and Ride as one of many means of station access, any proposal to set aside spaces should align with the underlying principles of the PaRS.

Accordingly, in Table 4-2 we assess the degree to which alternative preferential parking options align with the PaRS Demand Management principles.

Our key suggestion is that setting aside Park and Ride spaces for carpooling spaces and short-stay spaces aligns with the PaRS sub-principles on Demand Management, while spaces for electric vehicles and car shares do not. We therefore **recommend further consideration of providing carpooling spaces and short-stay spaces**, but not spaces for electric vehicles and car shares.

A key consideration for further investigation is that, if carpooling spaces are given preference, enforcement issues may arise. Attention should be given to exploring the use of mobile

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applications to regulate carpooling, such as the use of the 'Scoop' mobile application at BART stations whereby carpoolers using this application have access to a guaranteed parking space. In this way, there is more accountability with vehicle registration and the number of users using the carpool when linked with a mobile application.

In terms of short-stay Park and Ride parking, GWRC could consider setting aside a small share of parking spaces for short-stay use and place them as close as possible to the station platforms.[36] This is in line with the recommendations of the TCRP Report 153 to offer convenience to casual users. Once again, monitoring and enforcement would be required.

Table 4-2: Alignment of Preferential Parking options with Demand Management sub-principles

Electric Vehicles	Carpooling	Car Share	Short-Stay
Sub-principle: Available Park and Ride capacity is well-used to support public transport			
Capacity-wise electric vehicles are like any other private vehicle. Therefore, providing special spaces does not necessarily increase passenger occupancy and does not lead to an increase in patronage. Setting aside spaces for electric vehicle drivers, who presently make up a small proportion of the national vehicle fleet, means spaces cannot be used by most other drivers.	Carpooling increases the passenger occupancy of a vehicle, which increases the rate of public transport passengers per Park and Ride parking space. Therefore, carpooling spaces have the potential to support public transport patronage growth, if it can be demonstrated that the carpooling spaces will be well-utilised, leading to a net passenger gain verses a normal parking space.	Car share schemes make it easier to drive around a city without owning a car but are just like any other vehicle. These vehicles do not necessarily increase passenger occupancy levels and may not lead to an increase in patronage. Setting aside spaces for car share vehicles, which presently make up a small proportion of the national vehicle fleet, means spaces cannot be used by most other drivers.	Short-stay parking allows casual commuters to make short trips on the rapid transit network. Setting aside spaces for short-stay parking may lead to an increase in parking turnover each day, which boosts associated trips at the public transport station.
Not aligned with sub-principle	Aligned with sub-principle	Not aligned with sub-principle	Aligned with sub-principle
Sub-principle: Park and Ride is prioritised for people with a genuine need to drive to rapid public transport			
Drivers of electric vehicles do not necessarily equate to people who have a	Passengers in a carpool do not necessarily have a genuine need to drive to the station. There is no	Drivers of car share cars do not necessarily have a genuine need to drive to the station.	Commuters who require only short-stay parking do not necessarily have a genuine need to drive

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[36] Consistent with the above discussion of occupancy targets for Park and Ride facilities, we recommend that no more than 5% of spaces be reserved for short-stay use during mid-day periods. For instance, a potential approach would be to provide short-stay spaces at a diminishing rate for larger facilities, eg:

- 1 to 20 carparks: no less than 1 space
- 21 to 50 carparks: no less than 2 spaces
- Every additional 50 carparks: no less than 1

So a 100 space car park would have at least 3 short-stay spaces.

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genuine need to drive to the station. Setting aside electric vehicle spaces consequently removes parking spaces for people who have a genuine need but do not own an electric vehicle.	connection between carpool membership and having limited or no alternative station access modes.	Setting aside car share spaces consequently removes parking spaces for people who have a genuine need but are not members of a car share scheme.	to the station. There is no connection between short-stay parking users and having limited or no alternative station access modes.
Not aligned with sub-principle	Not aligned with sub-principle	Not aligned with sub-principle	Not aligned with sub-principle

Sub-principle: Users make an appropriate contribution to the costs of Park and Ride

Drivers of electric vehicles, as with all other vehicles, would be expected to pay for parking at priced Park and Rides.	Carpooling has the potential to increase the number of passengers per Park and Ride space, making investments into the capex and opex of Park and Ride more cost-effective. Users would have the opportunity to share costs associated with parking and could lead to an increase in carpooling.	Car share companies would be expected to pay for occupying parking spaces at Park and Rides.	Short-stay parking users could be charged at an hourly tariff that is lower than the daily tariff. Alternatively, if short-stay parking is free, any increase in parking turnover and associated public transport trips would make Park and Ride investment more cost-effective on a trips-per-space basis.
Aligned with sub-principle	Aligned with sub-principle	Aligned with sub-principle	Aligned with sub-principle

Sub-principle: Spillover parking is appropriately mitigated and managed.

Setting aside electric vehicle spaces removes parking spaces for most drivers who own conventional motor vehicles. This may exacerbate the issue of parking spillover as other drivers may be forced to park outside of the Park and Ride.	Carpooling has the potential to increase the number of passengers per Park and Ride space, which reduces parking space demand and mitigates against parking spillover.	Setting aside car share spaces removes parking spaces for most drivers who own conventional motor vehicles, which may exacerbate the issue of parking spillover as other drivers may be forced to park outside of the Park and Ride.	Short-stay parking has the potential to increase the number of passenger trips per Park and Ride space, which reduces parking space demand and mitigates against parking spillover.
Not aligned with sub-principle	Aligned with sub-principle	Not aligned with sub-principle	Aligned with sub-principle

Overall alignment with Demand Management Principle

In view of the assessment above, setting aside Park and Ride spaces for electric vehicles **does not align** with the Demand Management Principle.	In view of the assessment above, setting aside Park and Ride spaces for carpooling **aligns** with the Demand Management Principle.	In view of the assessment above, setting aside Park and Ride spaces for car share **does not align** with the Demand Management Principle.	In view of the assessment above, setting aside Park and Ride spaces for short-stay parking **aligns** with the Demand Management Principle.

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Not recommended	Recommended	Not recommended	Recommended

We have not specifically identified accessible / mobility parking as a form of preferential parking, as we consider the provision of these types of spaces to be a standard practice. New Zealand Standard 4121 (NZS 4121) provides guidance on the provision of mobility car parks[37]. Table 4-3 outlines the number of accessible car park spaces recommended by NZS 4121. We note that this is guidance, and each site should be evaluated on a case-by-case basis. GWRC may wish to confirm if accessible / mobility car parks exist within the current Park and Ride supply and consider accommodating accessible car parks in future expansions or upgrades.

Table 4-3: NZS 4121 Guidance on Accessible Parking Provision

Total number of car parks	Number of accessible car park spaces
1 -20	Not less than 1
21 - 50	Not less than 2
For every additional 50 car parks or part of a car park	Not less than 1

4.4 Restricting access to public transport users

The academic and technical literature on Park and Ride user restrictions provides limited guidance on this topic. Anecdotal evidence suggests that Park and Ride spaces are sometimes taken up for other purposes. For example, when a Park and Ride is located close to a retail or commercial centre, visitors to these establishments may utilise Park and Ride spaces. This may diminish the effectiveness of Park and Ride for increasing public transport use and mitigating peak period road congestion.

However, during weekends and evenings Park and Ride spaces can also be shared for other uses without diminishing their effectiveness. As a result, it may be desirable to restrict access to public transport during working days, while opening up facilities for other uses at other times.

Enforcing restrictions may be costly and difficult. The main options for restricting access to public transport users are monitoring turnover in the area and fining violators, or requiring people to validate with evidence of fare payment, e.g. via public transport smartcards. If necessary, regular parking warden patrols can be used for enforcement.

As a result, if GWRC is seeking to restrict access to public transport users, the best approach may be to:

- Post terms and conditions that specify when facilities are restricted to public transport users and when they are available for other uses

- Align any significant enforcement action with the introduction of pricing to manage excess occupancy issues, noting that priced facilities will have to be managed to some degree and that pricing may be a sufficient deterrent for non-public transport users.

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37 https://www.standards.govt.nz/assets/Publication-files/NZS4121-2001.pdf

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5. Principles for effective design of Park and Ride facilities

Technical Note 1 established a set of principles related to effective design for Park and Ride facilities. These principles note that Park and Ride should prioritise design to:

- Integrate with local transport networks;

- Enhance safety, security, and amenity;

- Minimise adverse environmental effects;

- Accommodate active modes and emerging transport technologies, such as ride-share; and

- Support future land use development (both on the site and in the wider vicinity).

This section briefly reviews best practices for designing Park and Ride facilities. The principles outlined here can be applied to sites in various locations.

In addition, we note that these principles have implications for how Park and Ride facilities are managed. If high occupancy levels result in some people engaging in unsafe or unsavoury parking practices such as parking on landscaped areas or footpaths, blocking accessways, or blocking other users in their spaces, then enforcement may be required to ensure that facilities are safe and attractive for users.

5.1 Design Best Practices for Park and Ride Facilities

5.1.1   Park and Ride Design

The Transit Cooperative Research Program (TCRP) has published a guidebook for planning and managing Park and Ride[38] which includes details for design and implementation considerations. This report observes that there are many things that must be considered in terms of design, ranging from the surrounding land uses to whether the site is owned or leased to site amenities.

The report notes that Park and Ride facilities should fit appropriately within the surrounding area, but that specific elements will likely vary based on the public transport modes served, demand, and site constraints. However, there are common design considerations that should be addressed, including:

- Parking infrastructure (i.e. surface lot, structure, underground, on-street, etc.)

- Type of parking required (i.e. mobility, time restricted, kiss and ride, bicycle etc.)

- Parking amenities (i.e. covered parking, electric vehicle charging stations, etc.)

- Passenger amenities (i.e. waiting areas, rubbish bins, restrooms, vending machines, etc.)

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38 Transit Cooperative Research Program (2017) TCRP Research Report 192 – Decision-Making Toolbox to Plan and Manage Park-and-Ride Facilities for Public Transportation.

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- Vehicle and access variables (i.e. access points to the facility, access within the facility, travel time information, etc.)

- Wayfinding signage and markers

- Urban and landscaping design elements

- Safety and security systems

- Electrical systems and utilities

The report also acknowledges that the state of transport is changing, and therefore Park and Ride facilities should be flexible in their design. This includes provision for more first-mile / last mile amenities, and ability to adapt or integrate with possible future land use plans.

5.1.2 Crime Prevention through Environmental Design

Crime Prevention through Environmental Design (CPTED) employs design and effective use of the built environment to reduce incidence or fear of crime.[39] CPTED can reduce criminal opportunity and improve quality of life for transport facility users. CPTED has four key principles related to surveillance, access management, territorial reinforcement, and quality environments. In New Zealand, seven national guidelines for CPTED have been developed, which are:

1. **Access: Safe movement and connections** – places with well-defined routes, spaces, and entrances that provide for convenient and safe movement without compromising security.

2. **Surveillance and sightlines: See and be seen** – places where all publicly accessible spaces are overlooked, and clear sightlines and good lighting provide maximum visibility.

3. **Layout: Clear and logical orientation** – places laid out to discourage crime, enhance perception of safety and help orientation and way-finding.

4. **Activity mix: Eyes on the street** – places where the level of human activity is appropriate to the location and creates a reduced risk of crime and a sense of safety at all times by promoting a compatible mix of uses and increased use of public spaces.

5. **Sense of ownership: Showing a space is cared for** – places that promote a sense of ownership, respect, territorial responsibility and community.

6. **Quality environments: Well designed, managed and maintained environments** – places that provide a quality environment and are designed with management and maintenance in mind to discourage crime and promote community safety in the present and future.

7. **Physical protection: Using active security measures** – places that include necessary, well designed security features and elements.

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39 https://justice.govt.nz/assets/Documents/Publications/cpted-part-1.pdf

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CPTED principles and guidelines should serve as a foundation for the design of Park and Ride facilities in Wellington.

5.1.3   Facility safety and security

While CPTED principles should be applied where possible, Park and Ride facilities may not benefit from continuous passive surveillance due to their location vis-à-vis other land uses. In Chapter 9 of *The Implementation and Effectiveness of Transport Demand Management Measures: An International Perspective*, Stuart Meek observes that[40]:

> *"It is important… to consider perceptions of safety and security as remote P&R sites do not often benefit from the 'natural surveillance' of busy town centre parking facilities. Although security is enhanced by CCTV systems, lighting and on-site security staff for example, it can also be incorporated into site design if considered in the planning stages, through fencing or the overall design of the site".*

As a result, on-site security measures at Park and Ride sites should also encompass other measures such as CCTV systems, good lighting, on-site security staff in areas with documented crime or personal safety issues and fencing and overall site design.

5.1.4   Environmentally Sensitive Design

Because Park and Ride facilities often include vast amounts of impervious surface area, they should be designed in a manner that avoids, reduces, or mitigates negative environmental effects. We note that the quantity and quality of stormwater runoff is potential adverse environmental effect associated with surface carparks.

Stormwater management techniques may vary by individual council. We note Wellington City Council's Water Sensitive Urban Design (WSUD) approach as a best practice.[41] WSUD relies on processes of natural systems and adapts them to the urban environment, thus integrating green and grey infrastructure to manage stormwater. Figure 5-1 shows how the WSUD approach incorporates swales, retention ponds, rain gardens, and permeable paving into carpark design.

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40 Meek, S. (2016) Park and Ride In: Ison, S. and Rye. T. eds. The Implementation and Effectiveness of Transport Demand Management Measures: An International Perspective. London: Routledge

41 https://wellington.govt.nz/~/media/services/environment-and-waste/environment/files/wsud-guide.pdf

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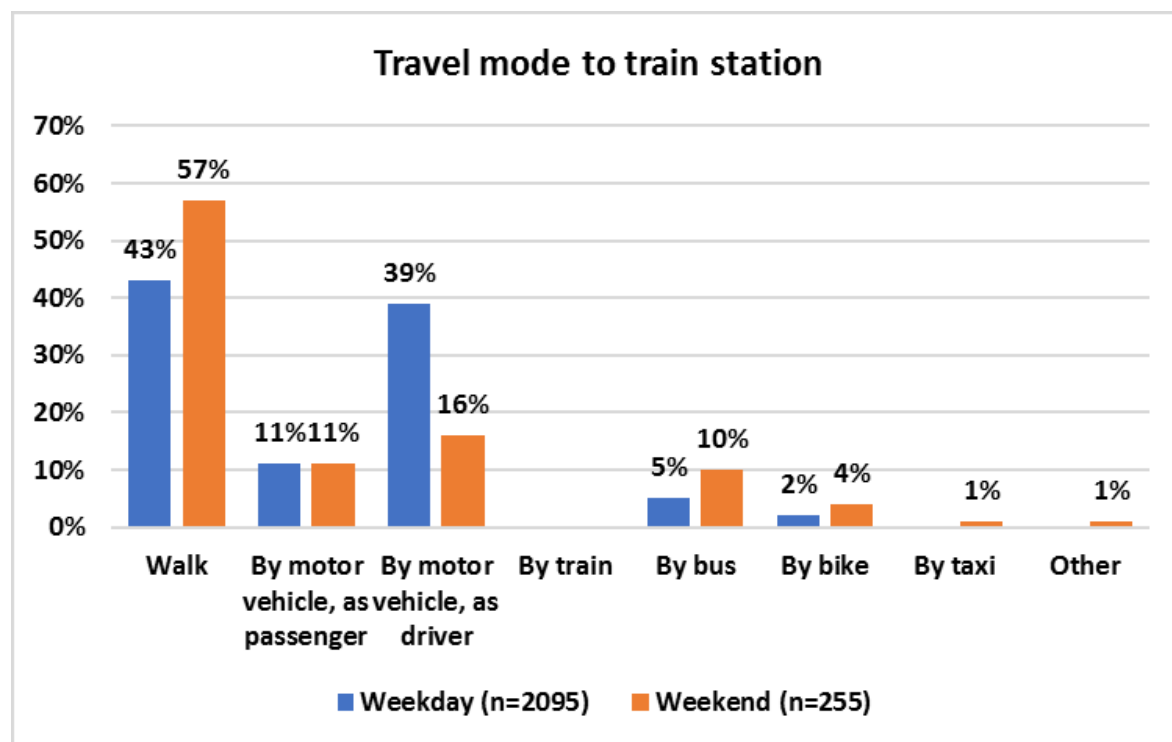*Figure 5-1: WSUD examples (source: Wellington City Council)*

5.1.5 Multimodal Integration

Park and Ride facilities represent just one of several modes of access to rapid transit stations. While Technical Note 2 discussed various modes of access, we feel it is worth reiterating here with respect to effective design.

Transit stations are inherently pedestrian oriented spaces. The 2017 Rail Survey undertaken by GWRC revealed that 43% of the weekday survey respondents accessed the station by walking[42]. Figure 5-2 shows the survey responses for the train station mode of access for weekday and weekends.

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42 GWRC 2017 Rail Survey, December 2017.

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Figure 5-2: Rail Survey Access Mode Unexpanded Results (source: GWRC 2017 Rail Survey)

As a result, it is essential that stations and surrounding areas should be designed in a manner that enables people to walk, cycle, or efficiently transfer from feeder bus services to stations. While car access is important, it should not reduce the convenience of other access modes.
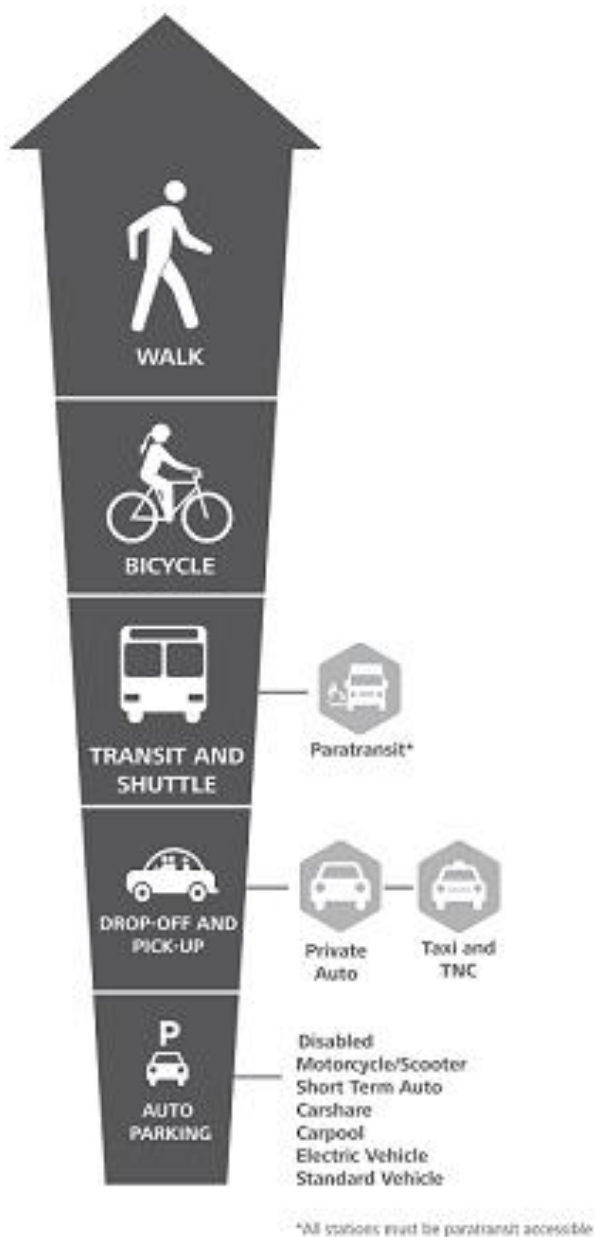
Metrolinx[43] , Bay Area Rapid Transit[44], and Auckland Transport[45] have developed a station access hierarchy approach like the one illustrated in Figure 5-3. Park and Ride sits at the bottom of this hierarchy, indicating that Park and Ride facilities should not be designed in a way that precludes other modes of access or reduces the convenience for users who access the station by other means.

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43 http://www.metrolinx.com/en/regionalplanning/projectevaluation/studies/GO_Rail_Station_Access_Plan_EN.pdf

44 https://www.bart.gov/about/planning/access

45 https://at.govt.nz/media/310975/ATCOP_Section_21_Public_Transport_Rail.pdf

Figure 5-3: Station Access Hierarchy. Source: https://www.bart.gov/about/planning/access

5.2 Design Considerations for New and Upgraded Facilities

Drawing from the range of best practices, we suggest a checklist of design considerations that should be incorporated when delivering new or upgraded Park and Ride facilities. Table 5-1 describes desired outcomes and relevant design considerations that align to the Effective Design sub-principles.

The purpose of this checklist is to ensure that sites deliver Effective Design outcomes with respect to safety, environmental effects, aesthetics, functionality, and future-proofing.

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Table 5-1: Effective Design Considerations

Effective Design Sub-principle	Desired Outcome	Rationale	Design Considerations
Integrate with local transport networks	The Park and Ride provides safe, comfortable, and convenient access for pedestrians, cyclists, and buses, both entering and exiting from the site, and within the site.	To ensure the design of the Park and Ride is safe for vulnerable road users to access, to minimise the Park and Ride's adverse traffic effects on the road network, and to ensure bus operations are accommodated.	• Avoid queuing onto the road • Avoid conflict at access points • Avoid generating high traffic volumes onto local roads or areas with high pedestrian amenity • Integration with walking and cycling networks • Integration with bus operations
Enhance safety, security and amenity	The Park and Ride is designed in accordance with CPTED principles and is supported by lighting and security measures.	To provide a safe and secure environment for Park and Ride and public transport users, to prevent crime, and to integrate the Park and Ride with its surrounding environment	• Lighting • CCTV • Passive surveillance • CPTED Design • Active frontage
Minimise adverse environmental effects	The Park and Ride incorporates environmentally sensitive design and stormwater management measures.	To minimise the impacts of Park and Ride on the local stormwater network capacity, minimise the contamination of stormwater, and reduce the risk of flooding. To provide natural screening of the Park and Ride, which minimises its adverse visual effects on the surrounding environment. To ensure lighting and noise from the Park and Ride are appropriate in the context of the surrounds.	• Maximum impervious area • Green stormwater infrastructure considered • Stormwater treatment, detention, and/or retention included • Planting and other landscaping included • Light spill and noise mitigation measures
Accommodate active modes and emerging transport technologies, such as ride-share	The Park and Ride includes areas that allow access by users using emerging transport technologies.	These elements have been selected to ensure Park and Rides cater for existing and newly emerging transport technologies, which provide additional methods for station access.	• Drop off/pick up zones for kiss and ride and ride share • Carpool parking spaces • Bicycle parking/storage • Docked/dockless bicycle parking areas
Support future land use development (both on site and in the wider vicinity)	The Park and Ride is designed with future land use in mind. Higher-value land uses feature facilities that are temporary and can be easily repurposed in the future.	Adopting flexible land use planning rules on the land for Park and Ride, and its surrounds, ensures that the land is not limited to parking purposes and can be redeveloped for other uses without planning constraints.	• Infrastructure permanence reflects possible future land use - i.e. higher value land uses have more temporary infrastructure; lower value land uses could have more permanent infrastructure • Site design is flexible and can accommodate other uses

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6. Conclusion

This Technical Note explores how Park and Ride facilities should be designed and managed to maximise the benefits they deliver for the transport system.

First, it outlines a recommended set of enforcement and management policies that GWRC can adopt to ensure that the region's Park and Ride facilities:

- Support the public transport system;

- Give priority to users with a genuine need to drive to the station;

- Generate revenue to cover costs; and

- Reduce the impacts associated with spillover parking.

Our key recommendation is that GWRC should adopt the graduated enforcement and management approach outlined in Table 4-1. This approach 'checks all the boxes' related to the PaRS demand management principles.

A second recommended action for managing Park and Ride facilities is to investigate payment system options for implementing Park and Ride pricing. Payment systems should be relatively cheap to implement and accessible to users while avoiding precluding integration with a future integrated fare and ticketing system.

A third management recommendation is to develop a monitoring and enforcement strategy to ensure that Park and Ride facilities are being used appropriately (enforcement) and that pricing is achieving desired outcomes (monitoring).

A fourth management recommendation, we suggest that GWRC consider designating a limited number of car parks for short-stay and carpool users to encourage sharing between users.

Finally, this Technical Note outlines a checklist of design considerations that should be incorporated into new and existing Park and Ride facilities. By using these approaches to design, Wellington's Park and Ride facilities can deliver high amenity, improve safety and comfort, and mitigate negative environmental effects.

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