MRCagney
BETTER TRANSPORT • BETTER PLACES • BETTER CHOICES

PO Box 3696, Shortland Street, Auckland 1010
Level 4, 12 O'Connell Street, Auckland 1010

www.mrcagney.com

T: +64 9 377 5590
F: +64 9 377 5591
E: auckland@mrcagney.com

MRCagney Pty Ltd
Company Number: 1317981

Technical Note 2

Subject: When is Park and Ride the most appropriate intervention?

Project: Park and Ride Strategy

Our file: NZ 2263	**Prepared by:** Anthony Leung and Stuart Donovan
Status: Final	**Date:** 5 June 2018

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);
- Identify ***where*** Park and Ride should be located to maximise benefits (Technical Note 3); and
- Consider ***how*** Park and Ride should be managed and designed to maximise benefits (Technical Note 4).

In this, the second technical note, we now consider the question of ***when*** Park and Ride is the most appropriate investment. Our approach, at this stage, is relatively high-level; it seeks to develop the strategic context that will guide more detailed technical work in later stages of this project, most notably using the objective and principles to evaluate potential investments.

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

- Section 2 reviews Park and Ride practices in a range of cities internationally and locally. It presents information on key Park and Ride statistics and performance indicators; the strategies they use to develop Park and Ride to access public transport; and their management and operation strategies;
- Section 3 considers a wide range of options that can be used to provide station access and compares their relative costs and benefits. This includes traditional options, such as walking, cycling, and connecting buses, as well emerging options such as bicycle sharing and ride-sharing. We also discuss interactions between modes;
- Section 4 presents a brief overview of emerging trends in customer expectations with regards to mobility, in general, and public transport, in particular. This includes a summary of Mobility as a Service, Mobility Hubs, and innovations in ticketing, all of which may affect customer expectations with regards to Park and Ride;

- Section 5 distils the information in preceding sections into a set of key assessment criteria for deciding on when Park and Ride is the most appropriate intervention for improving access to public transport. It also contains a proposed prioritisation framework for evaluating Park and Ride investment opportunities that are available to GWRC.
- In Section 6, we conclude with a discussion of some key areas where feedback is sought.

2. Park and Ride Practices

Here we seek to identify "best practice" with regards to Park and Ride investment and management. As the term 'best practice' is open to interpretation, and it is unlikely that one city can be identified that represents 'best practice' in all areas, we review several cities, including:

- Calgary;
- Ottawa;
- Auckland;
- Brisbane (South East Queensland); and
- Perth.

The subsequent sub-sections evaluate each of these cities. While these cities were selected because they have transport and land use patterns, planning regimes, and/or transport systems that are not too dissimilar from Wellington, the latter is unique in some key respects.

For each city, we will review and evaluate their:

- Park and Ride Key Performance Indicators (KPIs);
- Park and Ride development strategies, if they exist; and
- Park and Ride management strategies or operating initiatives, if they exist.

The learnings taken from this review form a useful platform for informing the rest of this technical note that addresses the question of when Park and Ride is the most appropriate intervention for station access.

2.1 Key Performance Indicators (KPIs)

We begin with tabulated summaries of the peer cities' Park and Ride KPIs in comparison to Wellington, before describing each of the cities' development and management strategies in separate sections. The KPIs to be presented include:

- Population and jobs (totals and density);
- Annual patronage (total and by mode);
- Number of park and ride car parks and spaces (total and by mode);
- Park and ride spaces per boardings;

- Average weekday customers by mode; and
- Park and ride spaces per average weekday customer.

The purpose of presenting these specific KPIs for each city is to show the significance of Park and Ride supply to each city's public transport patronage, whilst taking into consideration the population and employment situations of each city. The KPIs are presented in the following tables below.

Table 2-1: Total Park and Ride Provision by City

City	Public Transport Modes	Population	Population Density (km^2)	Jobs	Job Density (km^2)	Annual Patronage (Millions)	Annual Trips per capita	Public PnR Locations	Private PnR Locations	PnR Spaces	PnR spaces Per Million Boardings
Calgary	LRT, Bus	1,392,609	272.5	843,440	165	110	78.6	20	5	17,494	160
Ottawa	LRT, BRT, Bus	1,323,783	195.6	744,740	110	97.1	74.7	16	7	8,253	85
Auckland	Train, BRT, Bus, Ferry	1,657,200	335.4	755,400	152.9	90.3	60.2	25	3	4,602[1]	72
Brisbane (South East Queensland)	Train, BRT, LRT, Bus, Ferry	3,328,397	149	1,500,500	67.1	177.4	52.2	165	8[2]	28,752[3]	162
Perth	Train, Bus, Ferry	1,943,858	303	871,420	135.8	140.9	70.5	50	0	16,500	117
Wellington	Train, Bus, Ferry, Cable Car	469,400[4]	222.2	233,400	110.5	37.8	80.5	33	0	5,846	155

[1] Excludes private spaces in Takapuna, Albany, and Remuera, operated by Wilson Parking.

[2] These facilities are shared with private and community entities.

[3] Includes the two recently opened Park and Rides at Helensvale and Parkwood Stations as part of the G:link Stage 2 in December 2017.

[4] 2017 Statistics New Zealand Sub-national population estimate for Kapiti Coast District, Porirua City, Upper Hutt City, Lower Hutt City, and Wellington City only.

Table 2-2: Park and Ride spaces and number of customers by public transport system

City	Public Transport Systems	Annual patronage (millions)	Trips per capita per annum	Average Weekday Customers[5]	Park and Ride Spaces	PnR Spaces per average weekday customer
Calgary	LRT	Data not available		153,320	15,179	0.10
	Bus	Data not available		116,250	2,345	0.02
Ottawa	LRT	3.2	2.5	7,550	765	0.10
	BRT	65.6	50.5	105,000	7,480	0.07
Auckland	Train	20.3	13.5	32,505	2,126	0.07
	BRT	5.1	3.4	8,219	1,436	0.17
	Bus	58.7	36.7	93,970	0	0
	Ferry	6.1	4.1	9,812	1,040	0.11
Brisbane (South East Queensland)	Train	51.0	15.0	81,616	21,876	0.27
	Bus	111.7	32.9	178,720[6]	5,330[7]	0.03
	LRT	8.0	2.4	12,752	1,400	0.11[8]
	Ferry	6.7	2.0	10,752	147	0.01
Perth	Train	60.1	30.1	96,148	16,379	0.17
	Bus	80.0	40.0	128,027	156	0.001
	Ferry	0.748	0.4	2,393	0	0
Wellington	Train	13.1	27.9	25,098[9]	5,846	0.23
	Bus	24.4	52.1	78,200	0	0
	Ferry	0.195	0.4	626	0	0

[5] For all cities except for Calgary and Wellington, this is calculated by using this formula: (Annual patronage*0.8)/250/2) to estimate the average number of weekday customers.

[6] This figure includes all bus boardings as it was not possible to isolate patronage for the busway stations due to limitations with the most recent data set.

[7] Spaces for bus and BRT

[8] This statistic should be viewed with caution as the Gold Coast Light Rail's two new Park and Rides (part of the Stage 2 extension to Helensvale) were only open from December 2017, while the patronage numbers are from the 2016/17 financial year when the Park and Ride did not exist.

[9] Based on average weekday boardings in September 2017 reported by GWRC

As demonstrated by the preceding tables, the peer cities exhibit a wide range of Park and Ride performance in respect of the KPIs.

2.1.1 Calgary

In Calgary, the CTrain is supported by around 15,000 Park and Ride spaces across 26 car parks, and around 1,600 of these spaces are provided by private parking operators.[10] There are also around 2,500 additional Park and Ride spaces serving Calgary's bus network.

The supply of Park and Ride spaces as a percentage of the CTrain's average weekday customers as reported by the Calgary Transportation Department in 2016 is summarised in Table 2-2 above.[11] There are around 10 Park and Ride spaces per every 100 average weekday customers on the CTrain, and 2 park and ride spaces per every 100 average weekday customers for the bus.

If city centre CTrain stations are excluded, then Park and Ride supply as a percentage of average weekday patronage at **suburban** stations is around 15%.[12]

The patronage split for individual stations is shown in Figure 2-1 below (extracted from the source).

[10] Ibid

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

[12] Ibid at 10

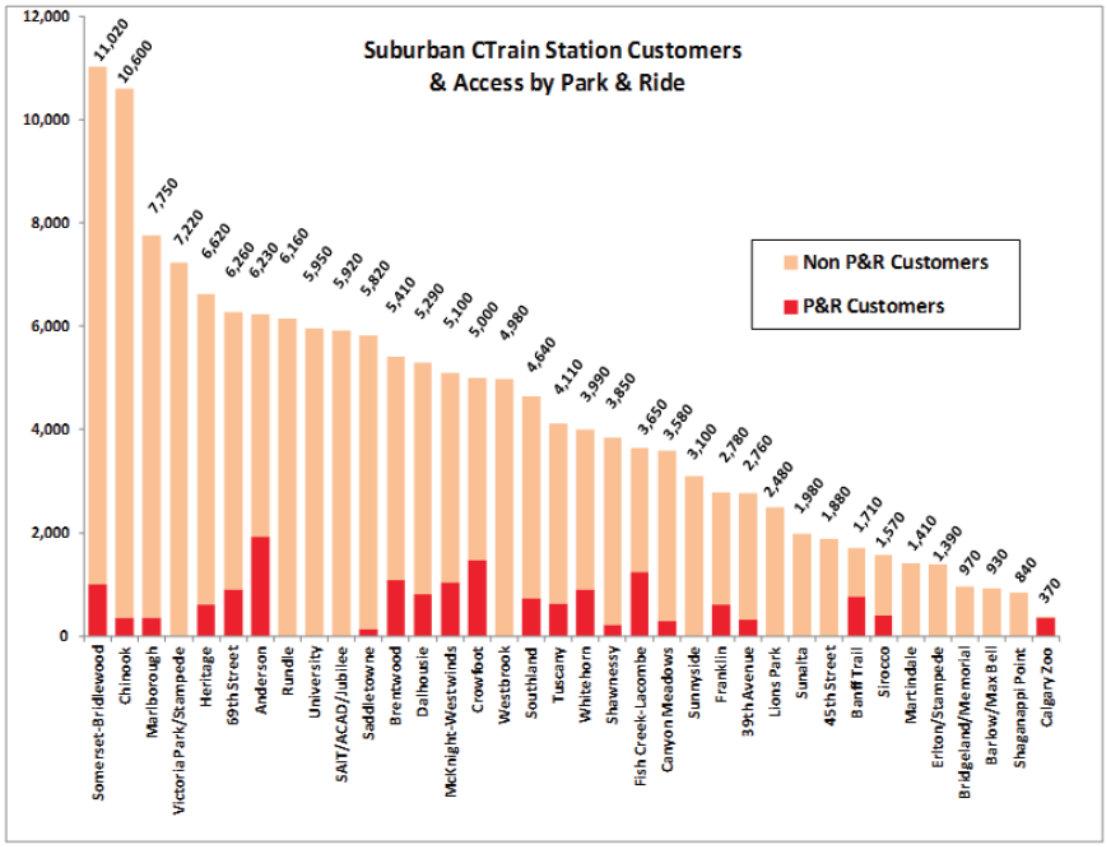

Figure 2-1: Suburban CTrain Station Customers and Access by Park and Ride. Source: Calgary Transportation Department (2016)

Based on Figure 2-1, the supply of Park and Ride spaces as a percentage of average weekday customers ranges from 2% to a maximum of 45%, with an average percentage of around 15%.

These statistics suggest that approximately 85% of passengers[13] access CTrain's suburban stations via other modes such as feeder bus, walking, cycling, or kiss and ride, which increases to 90% if all stations are considered. It is noted however that drivers and passengers who park on streets adjacent to a station are not included in these statistics. Nonetheless, it is still apparent that a clear majority of CTrain and bus passengers access the station by modes other than Park and Ride.

[13] While the graph shown in Figure 2-1 indicates "P&R Customers" we understand this to be in reference to Park and Ride supply. However, based on our experience, Park and Ride facilities are highly utilised and typically have auto-occupancy levels around 1 to 1.1 people per car. Therefore, absent more detailed surveying and data analysis, supply can serve as a proxy for customers.

2.1.2 Ottawa

Ottawa's public transport system is supported by around 8,200 Park and Ride spaces across 23 car parks, with seven of the Park and Rides provided by private parking operators.[14]

As evidenced by Table 2-2, Ottawa's Park and Ride inventory largely serves its BRT system rather than the O-Train (LRT), which has a greater reach in the city's suburban areas. The O-Train has only one station served by Park and Ride, a terminus station called Greenboro, which is also an interchange station for the Transitway.

Park and Ride spaces as a percentage of average weekday customers on the O-Train (although serving only one station) is 10%, while it is 7% for the Transitway (BRT), or 7% across both modes. Statistics on patronage at a station level, to determine the contribution to patronage by Park and Ride at only stations with Park and Ride, were unable to be located.

Access to LRT is likely to be predominantly done by modes other than car due to the absence of Park and Ride in all but one LRT station at Greenboro. These statistics also indicate that potentially up to 93% of passengers access the Ottawa's BRT stations via other modes such as feeder bus, walking, cycling, or kiss and ride. It is noted however that drivers and passengers who park on streets adjacent to a station are not included in these statistics. Nonetheless, it is still apparent that a clear majority of O-Train and Transitway passengers access the station by modes other than Park and Ride.

2.1.3 Auckland

While Auckland's Park and Ride KPIs are evident in Table 2-1 and Table 2-2, a more detailed level analysis is available for this city that looks at station-level Park and Ride indicators at only stations with Park and Ride.

In June 2017 Auckland Transport surveyed 22 of the 30 locations with formal Park and Ride in the region. The number of Park and Ride parking spaces as a percentage of average weekday customers across the surveyed stations with Park and Ride, is summarised in Table 2-3.

Table 2-3: Auckland's Park and Ride Performance Indicators

Mode	Average weekday customers[15])	Total PnR Spaces	PnR Spaces per average weekday customer
Busway	6,943	1,436	0.21
Ferry	4,706	1,040	0.22
Train	24,065	2,126	0.09
Total	**35,714**	**4,602**	**0.13**

[14] City of Ottawa (2013) Transportation Master Plan, City of Ottawa, Canada

[15] Boardings were recorded at a station level, rather than across the whole network. As such, boardings equal number of customers

As shown in Table 2-3, Park and Ride supply as a percentage of average weekday patronage at train stations with Park and Ride is only 9%, but this percentage is much greater for busway stations and ferry piers with Park and Ride.

These statistics suggest that around 90% of train passengers access train stations with Park and Ride by a variety of modes other than driving to the station, which is not surprising given the relative urban nature of Auckland's rail network and its proximity to established residential and employment areas. In terms of ferry, many of the piers with Park and Ride are located in isolated peri-urban locations such as Gulf Harbour or Beachlands, meaning driving to the pier is usually the only means of access for a large percentage of users, as reflected in Table 2-3. Busway access exhibits similar characteristics, as two of the three stations with Park and Ride at Albany and Hibiscus Coast are presently surrounded by large undeveloped land earmarked for residential and commercial purposes, so their relative isolation to established land uses is amenable to access by car.

2.1.4 Brisbane (South East Queensland)

South East Queensland's public transport system is supported by approximately 29,000 parking spaces, across more than 170 Park and Rides serving its train, bus and ferry networks, with the majority (around 22,000 spaces) serving the train stations.[16]

Table 2-1 and Table 2-2 present the most recent statistics on Park and Ride supply relative to annual boardings and average weekday customers on South East Queensland's public transport network. These tables show that South East Queensland has the highest number of Park and Ride spaces per million boardings among the peer cities, while there is significantly more Park and Ride spaces per average weekday customer for the train network compared to the other modes of bus, LRT and ferry. LRT in South East Queensland (G:Link in Gold Coast) has only had Park and Ride relatively recently, with the first two Park and Rides containing a capacity of 1,400 spaces opening in December 2017.

In 2014, the percentage of average weekday patronage on sampled weekdays across all train and busway stations with Park and Ride that is attributed to Park and Ride, was surveyed by TransLink and reported by MRCagney in 2014, and is shown in Table 2-4. Survey responses at ferry piers and regular bus stops with Park and Ride were not included in this dataset.

[16] MRCagney (2014). South East Queensland Park 'n' Ride Strategy 2014, MRCagney, Brisbane, Australia

Table 2-4: South East Queensland's Park and Ride performance indicators

Mode	Boardings (Customers[17])	Total PnR Spaces	Percentage PnR Users (based on survey responses, not number of spaces)
Busway	12,601	1,301	12%
Train	67,305	21,876	27%
Total	**79,906**	**23,177**	**24%**

As shown in Table 2-4, based on the 2014 survey, access to South East Queensland's busway stations via Park and Ride is relatively low compared to its train stations at 12% of station users, meaning the remainder of the users accessed the busway stations via other modes such as feeder buses, kiss and ride, or active transport. This result is expected given the busway network is largely located in the inner urban areas of Brisbane, where station access by means other than driving to the station is a more effective alternative. In contrast, the percentage of surveyed users accessing train stations via Park and Ride is much higher at 27%, reflecting the wide geographic spread of South East Queensland's train stations that encompass not only urban areas, but also peri-urban and rural areas to which access by car is often more effective than other modes.

2.1.5 Perth

Perth's public transport system is supported by around 16,500 Park and Ride spaces across 48 out of 70 train stations and two bus stations, with all but 156 spaces serving the rail network.[18] As such, there are around 17 Park and Ride spaces for every 100 average weekday customers on the train network, with only 0.1 spaces for every 100 average weekday bus customers.

These statistics suggest that potentially up to 83% of passengers access Perth's train stations via other modes such as feeder bus, walking, cycling, or kiss and ride. It is noted however that drivers and passengers who park on streets adjacent to a station are not included in these statistics. Nonetheless, it is still apparent that a clear majority of train passengers access the station by modes other than Park and Ride. Statistics on patronage at a station level, to determine the contribution to patronage by Park and Ride at only stations with Park and Ride, were unable to be located. Nonetheless, with 50 out of 70 train stations having Park and Ride, the statistics presented in Table 2-1 and Table 2-2 can be considered as reasonably representative of Park and Ride performance in Perth.

[17] Ibid at 15

[18] MRCagney (2014) Benchmarking park and ride policy in Auckland, MRCagney, Auckland

2.1.6 Wellington

Having examined the Park and Ride KPIs for the peer cities, attention turns to Wellington. Although Wellington has a much lower population, employment, and annual patronage compared to the peer cities, it has a comparatively high number of Park and Ride spaces per million annual boardings, second only to Calgary (Table 2-1).

Wellington's Park and Ride spaces are limited to its train network, and in relation to the number of customers, there are around 23 Park and Ride spaces for every 100 average weekday customers. This puts Wellington's train network in a similar situation to South East Queensland's train network, Auckland's BRT line, and Perth's train network, but there are fewer Park and Ride spaces per customer on Auckland's train network compared to that of Wellington. The Canadian peer cities exhibit substantially lower Park and Ride supply in relation to average weekday customers compared to Wellington.

As data is available for Wellington on KPIs at a station-level for stations with Park and Ride, these are also presented here. The 33 stations with Park and Rides recorded 25,980 boardings per average weekday in September 2017, which translates to 45 Park and Ride spaces per every 100 average weekday customers. The number of Park and Ride spaces in relation to average weekday customers in Wellington, at a detailed station-level for stations with Park and Ride, is significantly higher than the peer cities for which detailed station-level data is also available (Auckland and South East Queensland). For instance, Auckland's June 2017 survey showed 13 Park and Ride spaces per every 100 average weekday customers (Table 2-3), while South East Queensland's 2014 survey exhibited 24% of passengers using Park and Ride (Table 2-4).

2.2 Development and Management Strategies

The subsequent sections address how each of the peer cities approach the development and management of their Park and Ride, either through formal strategies, pricing, or otherwise.

2.2.1 Calgary

Park and Ride Development Strategy

As already reported in our first technical note, Calgary City Council's Park and Ride policy sets a 15% patronage target via Park and Ride as a formal strategy, which appears to have been realised in terms of the suburban stations and will be maintained as part of the policy. We are not convinced that there are merits of setting a formal target for Park and Ride access in this way, and would not recommend that GWRC adopt this practice.

The Park and Ride policy also allows private landowners to make their parking available to commuters by amending local planning regulations, to develop more Park and Rides at no financial cost to the city council. The policy makes it clear that station access should focus on the mode that provides the greatest possible customer catchment, and adopts a set of criteria for determining Park and Ride capacity based on the station catchment, nearby road capacity, and the character of nearby land uses. The policy also expresses a preference for Park and Rides to be located beyond a 5.0 km radius from the city centre, and a priority system that favours access to the CTrain by feeder bus, walking and cycling while keeping in mind the importance of Park and Ride for many customers.

Despite the small patronage contribution made by Park and Ride, Calgary Transit plans to introduce more Park and Rides as part of its project to build a new CTrain line called the Green Line, as well as Park and Rides for new terminus stations for extensions of existing lines.

Park and Ride Management Strategy

Calgary City Council's Park and Ride policy contains a strategy to manage Park and Ride. It recognises an oversupply of Park and Ride detracts from the city's goal to minimise car use, generate adverse traffic effects on residential streets and neighbourhoods, as well as undermine patronage on feeder buses to CTrain stations. This view is balanced by the recognition that too little parking may constrain patronage particularly where there are few other options for accessing the system, and the policy acknowledges the need to balance these two aspects. Accordingly, the policy has identified stations at which Park and Ride capacity should be reduced, and as noted above, identified areas for Park and Ride expansion to meet the 15% patronage target.

The policy contains a cursory overview of pricing as a management tool, and considers:

- Different monthly reserve prices in different car parks;
- The amount of the car park allocated to monthly reserve parking;
- A daily Park and Ride tariff;
- A means of putting parking spaces on hold without losing the reservation and the hours during which reserve parking has effect; and
- A means to charge higher tariffs for Park and Ride to people who do not live in Calgary.

At present, all Park and Rides feature pricing as a management tool, where 50% of spaces are reserved for monthly leases at CAD$85 per month, while the remainder are free. After 10.00 am, unused monthly Park and Ride spaces are available for use by other commuters.[19]

2.2.2 Ottawa

Park and Ride Development Strategy

Although there is no specific Park and Ride strategy authored by OC Transpo or the City of Ottawa, the city's *Transportation Master Plan 2013* [20] contains brief references to how and why it seeks to develop Park and Rides throughout the city.

Under an action entitled: *"Make rapid transit stations convenient, comfortable and accessible to all users including pedestrians and cyclists"* (Action 6-4), the plan recognises Park and Ride as an important feature at selected rapid transit stations to serve customers in urban areas who drive to public transport to meet other needs en route (e.g. childcare, shopping, appointments), as well as customers who live in the rural area. In this regard, it appears the City of Ottawa is

[19] Ibid at 10

[20] Ibid at 13

guided by the principle of extending rapid transit to customers who otherwise would not be able to access rapid transit, as reported in our first technical note.

The Plan views future Park and Rides as a way to encourage commuters to transfer to public transport at the city's peripheral areas, thereby minimising car travel across the urban area and towards the centre of Ottawa. To this effect, the Plan envisages seven new Park and Rides to accompany new Transitway and O-Train stations to be built in the future, mainly near the termini of planned LRT or BRT lines.

The object of providing Park and Ride for urban residents who drive to a station as the final destination after doing other activities en route is a new principle not seen in the first technical note's literature review, and perhaps reflects local travelling patterns not seen elsewhere.

Park and Ride Management Strategy

Although the *Transportation Master Plan 2013* contains brief references to the reasons why Park and Ride will be developed in Ottawa, the Plan does not include a management strategy. However, 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 reserved spaces at the Park and Rides for CAD$57 per month.

2.2.3 Auckland

Park and Ride Development Strategy

Auckland's strategy towards Park and Ride development is contained in the *Auckland Transport Parking Strategy*, which was previously reported in our first technical note. To reiterate, this strategy contains a series of guiding principles vis-à-vis Park and Ride development, including locating in sites with less effective feeder bus and active transport options, locating in sites that intercept commuter trips and which do not worsen local congestion, and developing in conjunction with other public transport improvements such as station upgrades.

Auckland Transport is currently developing a programme business case for Park and Ride in Auckland, with which MRCagney is involved. It is expected this programme business case will articulate in greater detail a planned programme of Park and Ride development based on a robust set of assessment criteria.

Park and Ride Management Strategy

With regard to Park and Ride management, the *Auckland Transport Parking Strategy* makes explicit reference to the use of pricing to manage demand, by encouraging travellers to access the station by other means where alternative options are available, which in turn, increases availability to travellers who have limited alternative access options and have a willingness to pay. Notwithstanding this strategy and the existing phenomena across Auckland's Park and Rides where they are full early in the morning peak, pricing does not apply to any of Auckland Transport's Park and Rides, except Waiheke Island. Pricing was previously used at Papakura Train Station under the jurisdiction of the former Papakura District Council. Ongoing development of the Park and Ride Programme Business Case and the 2018 version of the Regional Public Transport Plan, with which MRCagney is also assisting, may further articulate the Park and Ride locations suitable for pricing.

2.2.4 Brisbane (South East Queensland)

Park and Ride Development Strategy

South East Queensland's strategy towards Park and Ride development is contained in the *South East Queensland Park 'n' Ride Strategy 2014*, which was previously reported in our first technical note. To reiterate, this strategy contains a series of guiding principles vis-à-vis Park and Ride development, including locating in sites with limited feeder bus and active transport options, with low land values, and away from town centres and pedestrian areas, and locating in sites which do not worsen local congestion. The strategy also recommends avoiding Park and Ride development on sites with potential for dense mixed-use development, as this type of development can deliver significant patronage, economic value, and improve walkability to the station.

Park and Ride Management Strategy

The *South East Queensland Park 'n' Ride Strategy 2014* recommends the use of pricing, where necessary, to actively manage Park and Ride facilities, as reported in our first technical note. The purpose of using pricing as a management tool is to ensure the availability of some spaces throughout the day and to prioritise parking for customers with a genuine need and willingness to pay.

Other management measures contained in this strategy include:

- A network-wide or corridor-based Park and Ride cap:
    - Introduce a cap on Park and Ride numbers on certain corridors or network-wide. This would allow the removal of Park and Ride in certain locations where it is not considered appropriate and replaced at an alternative location on the corridor;
- Gating Park and Ride with access by goCard to prevent Park and Ride use by non-public transport users (e.g. in locations where the station is near other major attractions such as shopping centres); and
- Introducing parking restrictions on streets near a priced Park and Ride to avoid commuters parking for free on nearby streets.

2.2.5 Perth

Park and Ride Development Strategy

Although there is no specific Park and Ride strategy authored by TransPerth or Western Australia's Public Transport Authority, the Public Transport Authority's *Public Transport Plan – Transport @ 3.5 Million*[21] contains brief references to how and why it seeks to develop Park and Rides throughout the city, and examples of Park and Ride development projects to be developed in the near future.

[21] Western Australia Public Transport Authority (2016) Public Transport Plan – Transport @ 3.5 Million, Western Australia Public Transport Authority, Perth

This plan proposes that planned 'High Priority Public Transit Corridors', effectively bus corridors with planned bus priority measures that connect a high number of passengers to activity centres and train stations, will need to shoulder the largest share of additional patronage growth at train stations, along with increased levels of walking and cycling. This proposal recognises the fact that with both land and road space at a premium, there will be limited opportunities to increase the provision of Park and Ride, similar to the Wellington Region.

Nonetheless, this plan identifies prospective locations for new Park and Rides in areas that cannot be effectively accessed via the planned 'High Priority Public Transit Corridors', as well as the planned capacities for these Park and Rides.

Park and Ride Management Strategy

Although a formal Park and Ride Management Strategy was unable to be found for Perth, Perth is one of the few cities in Australasia that charges for using Park and Ride. In 2014, TransPerth implemented a flat all-day tariff of AUD$2 for all its Park and Rides, which can be paid by cash or unregistered smartcards for Pay and Display, or via a registered smartcard that is linked to a car's license plate, called SmartParker.

MRCagney is unaware of any publicly available post-implementation studies, but media reports have reported on a diverse range of reactions and outcomes following the implementation of pricing. These reports range from pricing helping to reduce the demand for Park and Ride, increasing availability later in the day, and discouraging use by non-public transport users[22], to reports indicating that it is now cheaper to drive due to the need to pay for Park and Ride[23]. The SmartParker has also been beset with problems related to issuing large quantities of fines that were eventually overturned, which was subsequently audited by Western Australia's Office of the Auditor General[24].

While it may still be too early to determine the success or otherwise of Perth's pricing approach, lessons can be taken from Perth's experience and applied to the Wellington Region.

2.2.6 Development and Management Summary

A summary of the pricing systems used in the peer cities, and whether formal Park and Ride development and management strategies exist, is provided in Table 2-5 below.

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

[23] http://www.abc.net.au/news/2017-09-12/why-are-people-avoiding-public-transport-in-perth/8893648

[24] https://audit.wa.gov.au/reports-and-publications/reports/information-systems-audit-report-22-june-2016/smartparker-public-transport-authority/

Table 2-5: Summary of parking charges, and development and management strategies

City	Location	Charge	Development and Management Strategy
Calgary	LRT	Unreserved (50% of spaces) – free Reserved (50% of spaces) – CAD$85 per month plus GST of 4%. After 10.00 am, unused monthly Park and Ride spaces are available for use by other commuters for free.	Yes
	Bus	Free	
Ottawa	BRT	At selected stations with high parking demand, spaces can be reserved (e.g. a guaranteed space) for CAD$58.50 per month. At selected stations with high demand, a permit is required to park there, but does not guarantee a space, for CAD$25.75 per month. The remaining stations are free.	No
	LRT	Only LRT station with Park and Ride is Greenboro Station. Here, parking is free, but a reserved space can be leased for CAD$58.50 per month.	
Auckland	Train	All public Park and Ride car parks are free. Private Park and Ride car park at Remuera Station operated by Wilsons costs $2 for 12 hours.	Yes
	BRT	All public Park and Ride car parks are free. Private Park and Ride car park at Albany Station and Takapuna operated by Wilsons range from $2-$4 for 12 hours.	
	Ferry	Free except for: • West Harbour on weekends ($5 per day); • Waiheke Island ($3-$6 per day, or $165 per month on a lease)	
Brisbane (South East Queensland)	Train	Free	Yes
	Bus	Free	
	LRT	Free	
	Ferry	Free	
Perth	Train	AUD$2 per day on weekdays only	No
Wellington	Train	Free	**To be developed**

2.3 Summary

As stated earlier, the Wellington Rail Network's Park and Ride performs similarly to Auckland's busway and ferry network, South East Queensland's train network, and Perth's train network. On the other hand, the percentage of public transport users using Park and Ride is considerably higher in Wellington than Calgary and Ottawa, as well as the other modes in the Australian cities.

We note the following key aspects that may explain these differences:

- **Transport and land use characteristics** – Wellington's Park and Ride tend to serve low density suburban, peri-urban, and rural areas, which are somewhat similar to Auckland's busway and ferry and South East Queensland's train network.
- **Park and ride management characteristics** – Like Auckland and South East Queensland, Wellington offers free Park and Ride. Unpriced Park and Ride may encourage a large number of commuters to drive to the station, instead of other options that may be available such as feeder buses and walking and cycling.

The percentage of GWRC-managed Park and Ride spaces per weekday boarding, by station and by line in the Wellington Region, is shown in Table 2-6.

Table 2-6: Average Weekday Patronage Attributed to Park and Ride

Line	Station	Number of Park and Ride Spaces	Average weekday boardings	Percentage of Park and Ride Spaces per Weekday Boarding
Hutt	Petone	448	1,534	29%
	Melling	187	524	36%
	Woburn	159	914	17%
	Waterloo	628	2,572	24%
	Naenae	24	565	4%
	Taita	120	1,350	9%
	Pomare	77	331	23%
	Manor Park	55	448	12%
	Silverstream	95	759	13%
	Trentham	127	956	13%
	Wallaceville	126	550	23%
	Upper Hutt	349	1,182	30%
	Subtotal	**2,395**	**11,684**	**20%**
Johnsonville	Crofton Downs	54	474	11%
	Ngaio	49	516	9%
	Khandallah	14	420	3%
	Raroa	45	652	7%
	Johnsonville	35	749	5%
	Subtotal	**197**	**2,811**	**7%**
Kapiti	Takapu Road	175	478	37%
	Redwood	147	544	27%
	Tawa	214	739	29%
	Porirua	811	2,775	29%
	Paremata	222	778	29%
	Mana	48	476	10%
	Plimmerton	107	601	18%
	Pukerua Bay	30	352	9%
	Paekakariki	79	460	17%
	Paraparaumu	527	1,711	31%
	Waikanae	377	1,286	29%
	Subtotal	**2,737**	**10,201**	**27%**
Wairarapa	Featherston	147	385	38%
	Woodside	98	151	65%
	Carterton	98	249	39%
	Solway	87	103	84%
	Masterton	87	397	22%
	Subtotal	**517**	**1,284**	**40%**

3. Comparison of Station Access Strategies

In this section, we discuss a range of station access strategies, including Park and Ride. The station access strategies we will compare include:

- Walking and cycling;
- Feeder bus;
- Drop-off;
- Land development near stations; and
- Park and Ride.

In the right circumstances, any of these station access strategies may be appropriate, to the degree that they respond to community expectations and align with Wellington's strategic land use and transport outcomes, as per the proposed objective for the PaRS.

Our discussions include a high-level comparison of the relative benefits and costs of the different station access modes, as well as how the various access modes relate to each other. The purpose of this comparison is to highlight the strengths and weaknesses of different strategies, and in particular where Park and Ride is the most appropriate intervention.

Each of these strategies are touched on in the subsequent sub-sections, followed by a summary table for comparative purposes. The order in which these strategies are discussed is deliberate, as it reflects a preferred station access hierarchy. This hierarchy prioritises walking and cycling as a primary means to access a station, over other modes of station access such as feeder bus, drop offs, land development, and followed at the end by Park and Ride. This hierarchy is reflected well in the following diagram from Bay Area Rapid Transit (BART) in the USA, although it excludes land development[25].

[25] While the figure excludes land development per se, land development is a key factor in the walking and cycling station access modes and is accounted for by these modes.

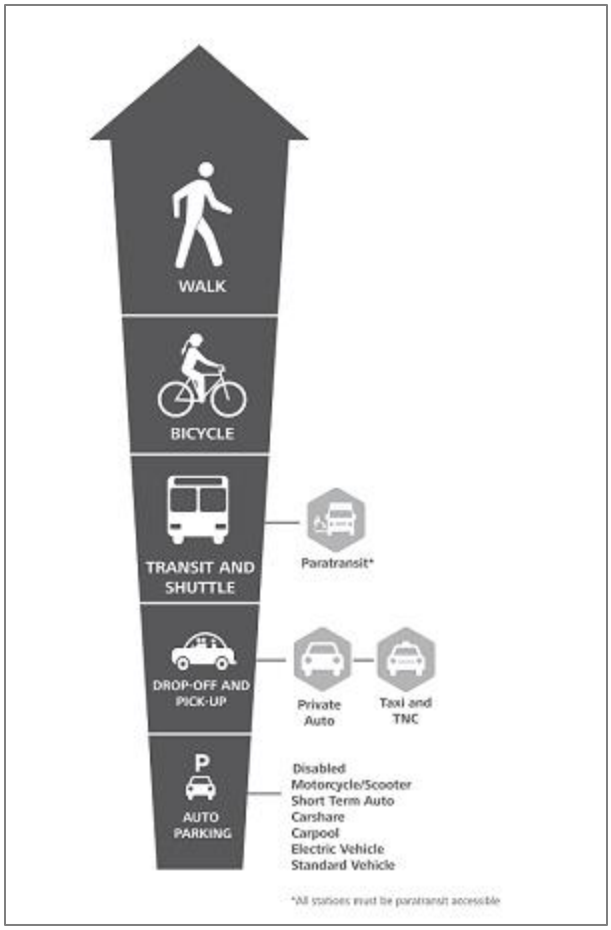

Figure 3-1: Example station access hierarchy. Source: https://www.bart.gov/about/planning/access

3.1 Walking and cycling

All public transport journeys involve walking or mobility assisted (e.g. wheelchair) legs. For this reason, pedestrian or mobility assisted access to stations receives the highest priority. This includes stations with large Park and Rides, such as those found in South East Queensland, where pedestrian access between the Park and Ride and station itself is given a high priority.

Other journeys may begin with bicycles or other small wheeled devices. In recent times the advent of electric bicycles, and general improvements in electric battery technology, has greatly expanded the ease with which people can travel by bicycle. In the Netherlands, electric bicycles now represent 25% of all bicycles sold.

From the perspective of the organisations responsible for funding public transport, such as GWRC and the NZ Transport Agency, walking and cycling typically represents the most cost-effective way that passengers can access public transport. Walking and cycling requires relatively low-cost infrastructure and imposes few external costs on others.

Investment in walking and cycling infrastructure around public transport stations could realise significant benefits, especially when the investment facilitates wider travel demands, such as travel to school and/or retail trips. Recent work carried out by MRCagney on the *Auckland*

Cycling Programme Business Case demonstrated that for every $1 invested in cycling, this would generate $2 to $4 in benefits for society such as the benefits cited above.

On the other hand, the degree to which people can walk and cycle is sensitive to the physical and cultural geography around stations, such as distance, topography, and urban form, especially density and street network connectivity. The upshot of this discussion is that the market for walking and cycling to public transport should be catered for wherever possible, while acknowledging that the size of the market may be constrained by the prevailing geography.

Economic benefits of increased walking and cycling include:

- Decongestion benefits,
- Health benefits of regular physical activity,
- Reduced environmental impacts,
- Improved safety from passive surveillance

The local socio-economic impacts of walking and cycling can, however, be much broader than this and include support for local retail and increased accessibility for people who may not be able to drive. When combined with wider improvements to the urban realm, walking and cycling can foster community interaction and a sense of place.

As demonstrated in our review of peer cities, most commuters access the station by modes other than Park and Ride. We suggest it is reasonable to assume most commuters walk to the station or stop, with smaller numbers cycling. This is especially true in the more established parts of larger cities. Consequently, in these areas it is important to invest to make walking and cycling as easy and safe as possible in the immediate catchment of the station.

The question remains at how far from a station should investment be targeted to improve walking and cycling conditions? Recent research from Auckland Council, showed median walking distances to train stations in urban areas ranged from around 550 m to 1.2 km, while median walking distances to busway stations ranged from 580 m to 2.7 km[26], although this research recognised the 2.7 km median walking distance at Albany Station as an outlier.

Furthermore, results from the 2017 Wellington Rail Survey showed that nearly one-quarter of rail customers using Park and Ride in Wellington drove less than 1 km to a station and 70% drove less than 3 km. Accordingly, targeting (for walking and cycling) customers living up to 3 km away from a station appears appropriate, and is applicable to the Wellington context given the many similarities between the Wellington and Auckland urban areas.

3.1.1 Bicycle share

The use of bicycle share for station access represents an emerging transport technology that has the potential to transform existing ways of travel to and from a station. Already in Auckland,

[26] Wilson, L (2013). Walkable catchments analysis at Auckland train and Northern Busway stations – 2013. Auckland Council technical report, TR2013/014

a private sector-led dockless bicycle sharing scheme has launched, and it would not be unreasonable to assume similar schemes will roll out in Wellington and other cities in New Zealand, given their proliferation through Australia and Asia.

Bicycle share, whether docked or dockless, has numerous benefits. It encourages participation in cycling by making bicycles ubiquitous throughout the city, making it easier to cycle everywhere around the city. In the context of station access, bicycle share solves the age-old problem for people travelling from/to locations that are too far to walk, but would be a very easy and short bicycle ride. Walking and cycling investments as detailed in Section 3.1 would complement the introduction of bicycle share.

In terms of costs, this is dependent on whether such a scheme is privately-led or involves public funds. Costs for the user are typically relatively affordable prices, with the scheme in Auckland priced at 25¢ per 15 minutes. Given the speed at which private dockless bicycle share schemes are developing in Asia, Australia and now in New Zealand, it seems prudent to await or work with companies behind these schemes to facilitate implementation in the Wellington Region.

While the proliferation of dockless bicycle share in recent years has been led by private enterprises at no financial cost to the city authorities, there are lingering questions over the financial viability of private-led schemes. Costs may also be incurred by the public sector in terms of managing the quantity and location of dockless bicycles within the road reserve, depending on how they are regulated.

For this reason, we note bicycle sharing as something to watch closely, even if widespread roll-out and up-take in Wellington may be a few years away yet. We also note that investment in conventional bicycle facilities, such as lanes and racks, will tend to support conventional bicycle use as well as increasing the market for bicycle share. We return to these issues in Section 4.

3.2 Feeder bus

Feeder buses are an effective way to transport large volumes of people who live beyond comfortable walking and cycling distances to and from public transport stations and who may not have access to private vehicles.

Public transport agencies in the peer cities that we reviewed, as well as Wellington, already operate feeder buses. Where feeder buses provide efficient connections to rapid transit, and when implemented in conjunction with integrated fares and appropriate levels of priority, feeder buses can be an attractive mode of access.

In terms of costs, feeder buses incur small capital costs associated with the construction of stops. On the other hand, feeder buses have high fixed costs and can have high costs per passenger if patronage is low. This may occur when the Park and Ride is not located where the buses can meet other travel demands, such as education and shopping trips.

Indeed, we note that most high-performing public transport networks do not operate highly specialised routes that service only one demand segment, but instead try to develop a network of lines that meet the needs of many different types of users. Such services may well connect to the Park and Ride, while at the same time connecting to other, unrelated origins and destinations.

We expect connecting bus services will be an effective mode of access to Park and Ride where:

- Park and Ride is priced at approximately 50 percent of its market value;
- There is an integrated fare system such that customers are not penalised for using buses to access trains and vice versa;
- Bus services can access the Park and Ride as well as other important destinations, such as schools and shops;
- There exists moderate to high demands in and around key corridors leading to the Park and Ride, which support a peak frequency of 20 minutes or better; and
- Transfers between bus and train are convenient and efficient compared to parking.

In the absence of these conditions, the provision of connecting bus services may simply serve to increase operating costs without associated increases in patronage and fare revenue.

In terms of benefits, connecting bus services can help reduce congestion on local road networks while alleviating demand for park and ride.

3.3 Drop-off

Short stay vehicle access for drop-offs represent an important method for accessing stations. "Drop-off" comes in two primary forms: (1) so-called "kiss and ride" and (2) on-demand services, such as taxis and ride-share. Accommodating drop-offs is important at all stations, especially those with limited ability to provide access by other means, such as Park and Ride, connecting bus services, and walking and cycling.

On-demand transport services are becoming more prevalent. Whereas taxis have traditionally filled the vehicle-for-hire role in most cities, they have – until recently – been prohibitively expensive for most forms of travel. The emergence of on-demand companies like Uber and Lyft have changed the vehicle-for-hire landscape, and reduced costs to the point that people are now using these services for a wide-variety of travel demands, including accessing public transport. As technology improves and is deployed, then we expect the demand for drop-off to increase substantially. This includes autonomous vehicles, potentially supported by on-demand ridesharing.[27] Such technologies are discussed in more detail in Section 4.

Drop-off is beneficial for station access in several ways. First, it allows access to the station by private vehicle, but does not require storage space for said vehicle. This can facilitate the drop-off of passengers whilst the driver continues their journey elsewhere, and expands access to the public transport system without incurring additional costs associated with parking. Secondly, it can fill a gap in station access during periods where feeder bus frequencies may be low or unavailable, e.g. at night. Likewise, it offers a viable alternative to driving to and parking at a Park and Ride for those who do not own a car or who do not wish to drive, and are outside of comfortable walking and cycling distances.

[27] Ridesharing refers to a transport service that is booked via a mobile application to take a passenger to their desired destination, whilst also picking up and dropping off other passengers who also wish to travel to other destinations along the same route. Such services are widespread overseas, such as UberPool or Lyft Line, and have emerged in New Zealand with a service called Savy launching in Queenstown.

With respect to costs, drop-off poses little direct financial costs to local authorities, except for the identification of an appropriate location. However, indirect costs may be imposed on local authorities where drop off, particularly on-demand for hire services directly competes with existing feeder buses, undermining the buses' viability and attractiveness, which lowers patronage and farebox recovery (to be addressed in Section 3.6.2). However, it is recognised that drop-offs could increase overall VKT as a passenger may get dropped off and picked up by a driver who otherwise may not have needed to make those two vehicle trips, which cumulatively, may cause localised congestion issues.

3.4 Land development near stations

The intensification of residential, commercial or mixed-use development through up-zoning via plan changes or District Plan reviews can enable more people to live and work in close walking distance to a station. In this way, land use development near a station increases the potential number of public transport users in proximity to a station, and can lift patronage.

Benefits of land development can include:

- Reduced congestion
- Increased patronage
- Revenue from proceeds of development

Land development near stations also incurs a range of potential costs and risks. Such developments may be controversial with the wider community, especially if it replaces Park and Ride. Nonetheless, we suggest that it may be beneficial option in some settings.

3.5 Park and Ride

Finally, we turn to Park and Ride. An overview of the potential benefits and costs of Park and Ride was provided in Sections 2.1 and 2.2 of our first technical note, and will not be repeated in full here. To summarise, Park and Ride's potential benefits include:

- Encouraging public transport patronage;
- Attracting long distance commuter car trips to public transport that would otherwise use motorways and arterial roads for most of their journey;
- Increasing the attractiveness of key public transport corridors and higher density centres in advance of connecting bus services;
- Facilitating multi-modal integration in lower density centres and/or topographically challenging areas where the scope for walk-up and connector bus services is limited;
- Providing access to public transport for individuals with mobility issues; and
- Reducing parking requirements at major centres.

In terms of potential costs, these are summarised from our first technical note as follows:

- The capital costs of providing parking, ranging from $5,000 to $40,000[28] per parking space, and the resultant subsidy per trip made per space (with costs around $5,000 to $10,000 likely in the Wellington context);
- The operational costs of Park and Ride, including maintenance (day-to-day plus long-term pavement rehabilitation), security, etc.;
- The potential undermining of other more cost-effective station access modes, such as walking and cycling, and feeder buses;
- The generation of additional driving and associated congestion for people who would have otherwise accessed the station by another mode; and
- The opportunity costs of using land near a station for Park and Ride, instead of land use development and the associated foregone patronage from a dense community of residents and workers near a station

3.6 Relationships between station access modes

As alluded to throughout the preceding sub-section, the varying station access modes have the potential to influence one another, depending on the quantum and mix of station access modes available in a city. We address the relationships at play here.

3.6.1 Park and Ride and feeder bus and walking and cycling

As documented in our first technical note, Park and Ride generates potential negative effects on the viability of feeder buses and the uptake of walking and cycling as station access modes. Experiences in Melbourne[29] and South East Queensland[30] show the potential for Park and Ride to attract people who would have otherwise accessed the station by bus or active transport, which not only reduces the net patronage gains from Park and Ride, but also reduces the attractiveness of existing feeder buses and walking and cycling.

The peer cities' experiences in this technical note demonstrated that most people access the station with modes other than Park and Ride. Therefore, increasing provision of Park and Ride without regard to the origins of a station's customer base is likely to draw passengers away from existing feeder buses and associated fare revenue, making such services costlier to run. It is also likely to draw people away from walking and cycling to a station, contributing to localised congestion and increases in VKT, which are contrary to the objective and principles proposed for the PaRS. For these reasons, it is necessary for Park and Ride management and investment to be appropriately targeted in accordance with the PaRS objective and principles, to ensure Park and Ride leads to net increases in patronage by serving only customer bases in lower density centres and/or topographically challenging areas where the scope for walking, cycling and connector bus services is limited.

[28] The upper limits of this range include sites with high land acquisition costs or facilities with multi-storey parking structures.

[29] Hamer, Paul. (2010). Analysing the Effectiveness of Park and Ride as a Generator of Public Transport Mode Shift. Road and Transport Research. 19.

[30] Ibid at 16

Bicycle share has the potential to replace Park and Ride trips, especially from passengers who drive only a short distance to a station. The convenience and ubiquity of established bicycle share schemes overseas have eliminated the 'first mile, last mile' problem for many potential public transport customers, by making the journey between home and station much quicker and appear closer, which make driving to and parking at a Park and Ride less necessary and attractive.

This relationship can be viewed as a positive development. Any potential bicycle scheme that matures in the Wellington Region will diversify the mix of access modes to stations, which may reduce the demand for Park and Ride, leading to savings for GWRC in terms of reduced Park and Ride development and management costs. It is considered that bicycle share would not undermine feeder buses, as buses serve passengers living a considerable distance away from a station, whose journey may not be attractive via bicycle.

3.6.2 Drop-off and feeder bus

Drop-off access, in the context of further market penetration of on-demand ridesharing seen around the world, poses potential challenges for existing feeder buses to stations. In cases where feeder buses take passengers on an infrequent route to a station (e.g. hourly, half-hourly, or peak-only), on-demand ridesharing may take advantage of the service gaps to take passengers to stations at the push of the screen on a mobile application. The corollary of this phenomenon is that over time, on-demand ridesharing increases in popularity and passengers favour this service over the infrequent feeder buses, especially if fares can be kept affordable through the partition of fares across the multiple passengers on a ride-sharing journey. Patronage on feeder buses may decline as a result of the competing on-demand ridesharing service, leading to potential fare revenue decreases and diminishing farebox recovery.

The potential undermining of feeder buses and associated fare revenue by drop-off access is therefore a concern of which GWRC should be mindful. For example, the new on-demand ridesharing service, Savy, in Queenstown offers $5 flat fares throughout Queenstown and peripheral centres such as Frankton, Kelvin Heights, and Arthur's Point. It would not be unreasonable to expect Savy to cannibalise patronage on new bus routes plying these peripheral centres due to their low all-day hourly frequency, despite the lower bus fare of $2. In the context of parking tariffs in central Queenstown, Savy may offer a time and price advantage over the new bus routes for many residents.

3.6.3 Land development and Park and Ride

Depending on the availability and ownership of land near a station, land development may replace land used for Park and Ride. Since the Park and Ride spaces were present before the land development, the reduction or removal of parking spaces may lead to spillover effects, especially if commuter habits remain unchanged. In the American context, it is not unusual for public transport agencies to impose 'one-for-one' parking replacement policies, and where there are limitations in available land or funding, this may pose difficult financial and political

challenges for a local authority where expensive underground or multi-storey parking structures are required to be built.[31]

It remains to be seen what the planning and political reaction would be toward the replacement of Park and Ride with land development in the Wellington or New Zealand context. For instance, Park and Rides may be linked to existing resource consents, so the reduction or removal thereof may trigger the need for resource consent variations, which invites potential planning and political uncertainties. Adverse transport effects would need to be assessed and mitigation measures proposed, which may involve the facilitation of the other station access modes discussed in this technical note, such as improving feeder bus access.

3.7 Summary

A summary of the high-level overview of benefits and costs of the station access modes discussed in this section is provided in Table 3-1 below.

Table 3-1: Summary of benefits and costs of station access modes

Type	Source	Walk / Cycle	Bus	Drop-off	Park and Ride
Benefits	PT Patronage	Some	Yes	Some	Variable
	Decongestion	Yes	Yes	Some	Variable
	Health	Yes	Some	No	No
	Environmental	Yes	Some	Some	No
	Future land development opportunity	No	No	No	Yes
Costs	Capital	Low	Medium	Medium	High
	Operating	Low	High	Low	Medium
	Opportunity	Low	Low	Low	High

Based on this summary of benefits and costs, we suggest that walking and cycling facilities are prioritised at all GWRC's major public transport stations and stops, along with drop-off facilities for private vehicles. The provision of connecting bus services and/or Park and Ride is, however, a decision that incurs higher costs and warrants more detailed consideration.

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

4. Emerging Trends in Customer Expectations

The way people use the transport system in the future is likely to be influenced by broader trends. Trends in technology, especially mobile communications and payments; on-demand transport services; and electric/autonomous vehicles, seem likely to affect customer expectations. At the same time, the social and environmental challenges associated with an ageing population and environmental degradation, such as climate change, are likely to bite.

Taken together, these technological changes and social/environmental challenges are often referred to as 'mega-trends'.[32] This simply captures the fact that their genesis and momentum originate beyond Wellington and indeed even New Zealand in many cases. Examples include:

- Customers expecting tailored and personalised services;
- Digitally enabled infrastructure;
- Digital connectivity between service providers, customers and infrastructure;
- Working and e-commerce trends that affect travel patterns and reduce travel demand;
- Climate change affecting transport system resilience;
- Energy efficiency and renewable energy are constantly advancing; and
- Urbanisation is redefining mass movement

The implication is that we cannot control the nature of these developments, even if we can choose our response. In this section, we speculate on what these mega-trends may mean for customer expectations with regards to Park and Ride. We emphasise the word "speculate"; whereas other aspects of our work is evidence based, this section is necessarily based on our judgements of what may happen in the future.

Our main expectation is that these mega-trends will disrupt not just traditional business models, such as premium airport public transport services, but also fundamentally re-shape the transport networks that underpin economic prosperity and social connections in our communities. The following sub-sections explore some of these potential impacts at a high level, namely Mobility as a Service, Mobility Hubs, and ticketing.

4.1 Mobility as a Service

In transport, megatrends are already changing our understanding of what mobility is and how it is delivered. The main trend in customer expectations is away from thinking in terms of planning how to link journeys in mono-modal transport systems, towards "mobility as a service".

[32] See ShapingSEQ for an informative discussion of these trends in the South East Queensland context.

The shift in managing 'transport' to managing 'mobility' moves beyond planning and delivering a single transport service. Instead, it requires a more retail-based model imbued with a 'family of services' philosophy. Five key trends are driving this shift:

- **Access rather than ownership:** Providing access to mobility rather than owning (and long-term commitment to) the means of mobility is revolutionising the transportation sector and facilitating new entrants to markets. The sharing economy is a recognised global phenomenon that has led to more means of connecting people to share opportunities such as ride sharing, car share, bike hire and so on.
- **User experience:** Transport is increasingly focused on improving the broader user experience rather than just service delivery. This shift reflects a growing awareness that passengers care about much more that service attributes, as well as the ability for users to more readily share information and feedback. Expectations and requirements have changed with a greater emphasis on flexibility, personalisation, and on-demand services. As new technology develops, and new business models emerge, the options that are available increase. We expect people's sensitivity to the user experience will also.
- **Technology:** Modern technologies are affecting the transport sector. It is now possible to integrate journey planning across several modes and to provide real time, accurate information, connected communication, and response. Tranzer is one relevant example, with which people can plan their journeys by public transport and on-demand services across the whole of the Netherlands and then pay using their phone. In the medium to long run, such products will cut into the demand for paper tickets and enable people to easily travel by public transport even when they are away from home.
- **Integration:** In most urban areas, most people already make use of several different forms of transport. Integration is already a key aspect of transport networks, and will become more critical in the future. Walking and cycling are key parts of the whole system. Furthermore, some modal choices are expanding (such as bike-sharing and car sharing) or the distinctions become blurred with services such as Uber. This trend requires a commitment to improving the standardisation with which data is delivered.
- **Big Data:** The ability for the public and private sector to manage access and the user experience, while integrating different services and modern technologies, rests on timely access to data. Standardised, open-source data platforms and aggregator applications, are the underlying enabler for many of these changes. This is indeed an area where public organisations, such as GWRC, have a role to play to ensure that the private sector can innovate efficiently while preserving individual privacy.

When one steps back and considers these five components together, the picture that emerges is one that is frequently described as "mobility as a service". We anticipate that customers will increasingly expect a transport system where planning, services, and payment systems are seamlessly integrated, regardless of the modes that are used for individual trip legs.

4.2 Mobility Hubs

As transport become increasingly integrated, public transport stations are expected to evolve into 'Mobility Hubs' and play a critical role in delivering a range of services. A Mobility Hub is a major transit station that integrates with surrounding modes of transport seamlessly, while also providing intensive opportunities to live, work, shop or enjoy other leisure activities.

Common characteristics of Mobility Hubs include:

- Multi-modal transport options with seamless transfers;
- High residential and employment densities and public facilities;
- Complementary services, such as childcare and parcel pick-up;
- Legibility and a strong sense of place;
- Pedestrian orientation; and
- Integrated technology.

In Toronto, Metrolinx has developed a network of 51 Mobility Hubs, which will be a critical component to the region's future transport system.[33] A 2016 update on their Mobility Hubs concept noted "many existing sites offer little more than vast parking lots, while others are easily accessible by many modes and are already vibrant places of activity and destinations in themselves."[34] This illustrates how stations, particularly those with existing Park and Ride can evolve to provide better outcomes from both an economic and patronage perspective.

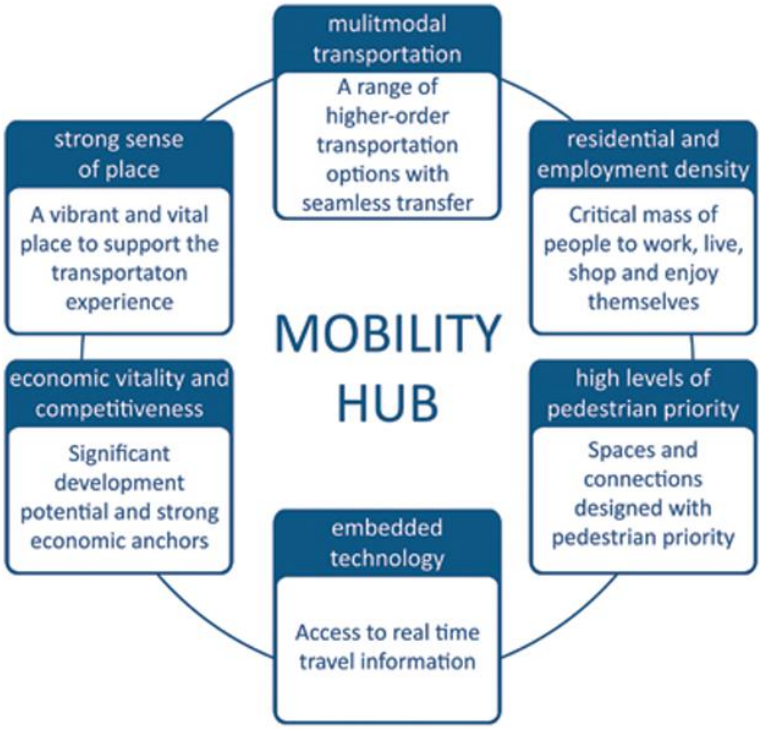

Figure 4-1: Mobility Hub summary. Source: www.metrolinx.com/en/regionalplanning/mobilityhubs

[33] Metrolinx, (2008) The Big Move 2008 Regional Transport Plan for the Greater Toronto and Hamilton Area

[34] Metrolinx, (2016) State of Mobility Hubs

Nascent mobility hubs have also begun to emerge in Auckland, with the emergence of 'Click and Collect' services at some of Auckland's public transport stations. Click and Collect provides a seamless online shopping experience by allowing public transport passengers to collect their e-shopping at their desired public transport station, which has benefits in terms of reducing personal vehicle trips to shops, and enhancing the public transport experience. We see this as merely the first step of a long journey of transforming Auckland's public transport stations into mobility hubs. Overall, we believe there are sufficient parallels between Toronto, Auckland, and Wellington in this regard. Therefore, GWRC may wish to anticipate these developments by including a policy to develop Mobility Hubs as an element of the PaRS, and we will seek to identify sites suitable for Mobility Hubs in our subsequent technical note that identifies ***where*** Park and Ride investment should occur.

4.3 Ticketing

Wellington's existing ticketing systems are in the process of being upgraded. This will remove the requirement for customers to use multiple payment methods for various parts of their journey. Arguably the lack of interoperability between different service providers is a key barrier to greater use (and implementation) of public transport services, and provides monetary and non-monetary incentives for people to use Park and Ride rather than connecting bus services.

Currently, different transport modes and operators still operate as 'silo' entities – this is most evident in the form of different fare structures, fare policies, service information and sales channels, which make a combination of different transport modes complicated at best.

As technology evolves, customers are increasingly expecting systems that are integrated and easy to use. Integrated smart cards, such as HOP in Auckland, are just the first step in this process. Key trends in ticketing include:

- The shift from card-based ticketing to account-based ticketing. In the present system, customer information and balance is stored on the card itself. In the future, all information will be stored in the back-end, whereas cards simply become one possible token for accessing public transport, along with phones; and
- The integration of payment systems, both across different providers and internationally. While Uber is perhaps the most well-known example, emerging services, such as Tranzer, offer the potential to plan, use, and pay for public transport using the same interface nationally and internationally.

What is GWRC's role in all of this? Well, achieving interoperability will require standardisation of systems and data, for example using APIs[35], such that private third-parties can sell tickets to services that are operated by GWRC. In the case of Tranzer, we note that users pay the cash ticket price plus a transaction fee, that is, it is a premium product. At the same time, public transport operators in the Netherlands continue to operate their smart card system in parallel, through which they can offer targeted discounts to more regular users. Hence, at this stage, we

[35] Application Programming Interface (API) is a computing term that refers to a set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.

envisage these developments will complement, rather than replace, existing ticketing systems. Nonetheless, while information and communications technologies can enable improvements across systems and between operators, but there remain significant legal, regulatory, economic, and political challenges to overcome. Furthermore, public decision-making processes often take longer than global innovation cycles. This is a challenge.

Opportunities to improve ticketing processes in Wellington exist. Furthermore, if future provision of Park and Ride is to include the option for pricing (which will be explored in a future technical note), then this should be integrated into ticketing and payment systems, as per Perth.

4.4 Summary

In the future, we expect that customers will expect a single multimodal transportation system that does not distinguish between transport modes. Users want to choose the most suitable means of transport for each trip (á la Mobility as a Service). Of course, in behind the scenes there still exists a role for GWRC to subsidise some modes (and price others) as a means of maximising the net social benefits of the transport choices that people make. Ultimately, however, most users do not care that public transport is subsidised and Uber is not, they simply want to be able to easily use either mode when it is most convenient and cost-effective for them.

5. Park and Ride Investment Prioritisation Framework

5.1 Investment Prioritisation

The question that remains is how to prioritise Park and Ride proposals over one another if multiple proposals are assessed to be broadly congruous with the proposed assessment criteria? The solution we propose is to adopt an investment prioritisation framework that seeks to rank Park and Ride proposals, and filters out the best-performing proposals among peers.

In Table 5-1 below, the prioritisation framework incorporates the PaRS principles and sub-principles as proposed in the first technical note that relate to investment in new Park and Ride, with the assessment criteria below sitting beneath these principles. A set of quantitative and qualitative indicators were selected as proxies that would assist with assessing which Park and Ride proposals align with a principle and meet the associated assessment criteria.

We note that because this technical note seeks to address the “when” question, the table focuses on the Strategic Location principles. The Effective Design and Demand Management principles will be addressed in the “where” and “how” technical notes. We envisage that the framework will be applied in a stepwise process.

Table 5-1: Investment Prioritisation Framework – Strategic Location

Principle	Sub-Principle	Assessment Criteria	Indicators contributing to assessment	Rationale for use of indicator and relationship to assessment criterion
Strategic Location	**1a. Expand access to the rapid public transport network**	The Park and Ride serves a new customer base which would otherwise be unable to effectively access the rapid transit station by walking, cycling, feeder bus, or other means.	Presence of residential areas beyond a 10-minute walking, 15-minute cycling, or 30-minute feeder bus catchment of a station	The catchments proposed represent a typical travel time that a commuter may be prepared to travel to reach a station, before transferring to a rapid transit service. The presence of residential areas beyond these travel time catchments indicate a Park and Ride may be able to serve these residential areas, thereby extending the reach of the rapid transit service.
	1b. Intercept car commuters as early as possible in advance of congested bottlenecks	The Park and Ride is situated to intercept travellers before reaching congested points on the network.	Travel demand model forecasts of volume to capacity ratios of existing and future transport networks	To realise the congestion and emissions benefits associated with Park and Ride, the facility should be located to intercept trips in advance of known locations with reoccurring congestion.
	1c. Represent an efficient transport investment	The Park and Ride generates a greater net increase in patronage compared to walking, cycling, feeder bus, or other access modes for every dollar invested into capital expenditure.	Benefit-cost ratio analysis of a hypothetical Park and Ride development compared to investing in other station access modes	It is prudent to ensure investment in Park and Ride represents the best use of money, and the same amount of investment could not generate greater patronage benefits and other benefits if invested in other station access modes.
		The benefit-cost ratios for Park and Rides are demonstrably higher than potential alternatives over the lifetime of the investment.		
		The land values near a rapid transit station are not conducive to developments that	Assessment of land values per square metre on land within 200 m of a station.	To minimise the opportunity costs of developing Park and Ride, and to ensure Park and Ride is the best possible use of the land.

Principle	Sub-Principle	Assessment Criteria	Indicators contributing to assessment	Rationale for use of indicator and relationship to assessment criterion
		provide better value for money than Park and Ride.		
		Land near a rapid transit station is zoned for low density land uses.	Assessment of development capacity on land within 200 m of a station, based on District Plan zoning and overlays	To minimise the opportunity costs of developing Park and Ride, and to ensure Park and Ride is the best possible use of the land.
	1d. Respond to community needs	The Park and Ride is situated in locations with sufficient community support.	Qualitative assessment of community requests for Park and Ride including, formal requests from the Local Council's transport committees, number of public submissions received, and articles in newspaper, etc.	To ensure Park and Ride at a particular location is compatible with the planning, transport, and community expectations as expressed by relevant input and consultation processes.

A yet-to-be-determined scoring or weighting system would be assigned to each of the 'indicators contributing to assessment', and a Park and Ride proposal's performance against these indicators would determine its overall score, which can be used for comparison with other proposals, allowing proposals to be ranked or prioritised over another. A minimum score or rank could also be defined, whereby any proposal that scores under the minimum could be disregarded. We invited input from the GWRC for feedback on the particulars of the scoring or weighting system, and the ways in which it would be applied.

6. Conclusion

This technical note explored the ways in which Park and Ride is provided in similar peer cities around the world, and assessed how Park and Ride provision in these cities compared to overall patronage outcomes in terms of the entire public transport network and by mode. The Park and Ride performance observed in the peer cities provided a useful benchmark against the Wellington Region's performance, to see where the region sits among its peers. We found that the Wellington Region's Park and Ride performance is more broadly aligned with the public transport systems in Auckland and South East Queensland. These regions equally provide vast quantities of unpriced Park and Ride to commuters, and with similar land use patterns surrounding stations with Park and Ride. Conversely, Park and Ride in the Wellington Region contributes to a much greater percentage of average weekly patronage than the other peer cities of Perth, Ottawa, and Calgary. This difference may be explained by a greater propensity to use other station access modes in those cities, as well as the adoption of Park and Ride pricing, which reduces parking demand and prioritises spaces for those with a willingness to pay.

In light of the differences in Park and Ride and patronage outcomes from our best practice peer cities review, we analysed the range of station access modes available to cities such as the Wellington Region, including Park and Ride, and assessed their relative costs and benefits at a high altitude. Benefits and advantages of each mode were illuminated, and the ways in which the provision of one mode may affect another were also highlighted. In particular, we noted the potential adverse relationships that may exist between:

- Park and Ride, and feeder buses and walking and cycling;
- Drop-off and feeder bus; and
- Land development and Park and Ride.

Likewise, we noted the need for these relationships to be managed.

Based on the learnings taken from the peer cities and the Wellington Region, the recognition of the relationships between the different station access modes, as well as the proposed PaRS objective and principles, we consequently developed an Investment Prioritisation Framework.

In our view, the purpose and function of the Investment Prioritisation Framework is a 'first-stage' evaluation of proposals for Park and Ride against these qualitative criteria, for a determination of whether Park and Ride is an appropriate intervention for station access to a particular rapid transit station in the Wellington Region. It is anticipated that each criterion must be used in the assessment, and a Park and Ride proposal must broadly be aligned with these criteria for it to be considered as an appropriate intervention.

In the context of limited funds that are available to GWRC to invest in Park and Ride or other station access modes, the framework also provides a mechanism to prioritise or rank qualifying proposals over one another. To this end, we developed the Investment Prioritisation Framework to include an associated quantitative or qualitative indicator, to allow a detailed evaluation of a Park and Ride proposal. A proposal's performance against the 'indicators contributing to assessment' would give rise to a score, allowing multiple proposals to be ranked, with the

highest scoring proposals expected to receive higher priority. A minimum score could also be set within this framework, where proposals scoring below the minimum would be disregarded.

This technical note's evaluation of ***when*** Park and Ride investment is appropriate subsequently leads to a discussion of ***where*** to invest Park and Ride in the Wellington Region, which will be discussed in the subsequent technical note.