Public Transport Interchanges and Stations

Public Transport Design Guidance

Waka Kotahi

1 November 2023

V1.0

WAKA KOTAHI
NZ TRANSPORT AGENCY

Te Kāwanatanga o Aotearoa
New Zealand Government

More information

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1. Introduction

The Public Transport Design Guidance series, of which this document is a part, supports road controlling authorities – regional and local councils, and public transport contracting authorities and consultants to deliver consistent and user-centric public transport infrastructure. Each topic in the series is a one-stop shop of best practice guidance for a specific topic within the context of Aotearoa New Zealand's regulatory and operating environments.[1]

The public transport interchanges and stations topic sets out sets out a principles-based process and advice for planning and designing public transport interchanges throughout Aotearoa New Zealand. This topic will be useful for:

- planning and delivering public transport services
- the master-planning of land use and infrastructure
- communicating the benefits of public transport infrastructure projects to the public
- finding ways to make public transport more attractive and drive growth in use.

This introduction sets out the scope of this topic, defines interchanges and stations, explains their role in meeting public transport objectives and outlines relevant legislation and related guidelines.

1.1. Scope

This topic identifies the main principles, priorities and considerations for the planning and design of public transport interchanges and stations. Key topics covered include:

- the types of users at interchanges and stations and their differing needs
- the interchange and station categories and their impact on design and planning
- optimising interchange and station locations for accessibility and convenience
- designing for people to support safety, security, accessibility, legibility, navigability
- designing for vehicles to provide an efficient, safe and effective facility
- managing conflicts and separating movement of people and vehicles
- implementation, including consenting and consultation processes
- designing for operation and maintenance activities
- case studies and examples from existing interchanges and stations.

While the guidance focuses on planning and designing the various elements that make an effective public transport interchange or station; it does not provide detailed direction on construction standards for interchanges or stations. Rather, the topic sets out a principles-based process for deciding what interchange or station facilities are required.

It is the role of planners and designers to investigate the requirements for each individual interchange or station and tailor solutions to address site-specific needs, considering each site's transport system and urban context.

1.2. What are public transport interchanges and stations?

A public transport station provides large scale access to public transport services with many users. Stations may serve a variety of routes or one high quality route. Many public transport stations also serve as interchanges where people can transfer between public transport services and routes.

Interchanges and stations may be used for joining the public transport network or for transferring or connecting passengers between routes. Interchanges and stations may also include other activities such as retail or offices. Bus stations, railway stations and ferry terminals are all covered by this guidance.

[1] The guidance topics are available from our website: Public transport design guidance.

The terms ‘interchange’ and ‘stations’ are often used interchangeably in New Zealand and internationally. In this guidance we sometimes say ‘interchange’ for simplicity but please take this to generally also include public transport stations that *do not* serve an interchange function but that *do* provide larger scale public transport access than an average bus stop.

Figure 1: Bus station at a public transport interchange in Auckland. Source: Waka Kotahi.

1.3. Why are interchanges and stations important?

Public transport interchanges give customers access to a wider public transport network. By linking services to form a network, more travel opportunities are unlocked. Interchanges and stations should allow easy, quick, and safe transfers to be made between services. They can also provide key links with walking, cycling and road networks.

Interchanges and stations have an important role in making public transport a more attractive choice. This has potential benefits for safety, public health, the environment, urban spaces, and economic prosperity.

Interchanges need to provide a smooth transition for customers, accommodate the needs of each transport mode and demonstrate good design. If transfers between transport services are made easier, quicker and more convenient, travel opportunities for existing and new customers will emerge that are better, more frequent and wider ranging, broadening customers’ travel horizons. Large scale public transport stations without interchange functions still serve as important gateways to the public transport network for a substantial number of users.

Figure 2: Interchange facilities at Wellington Railway Station for transferring from train or local bus to ferry shuttle. Source: Mark Edwards.

A public transport interchange or station has characteristics that support the achievement of broader objectives for public transport. Understanding how the objectives are interrelated and where trade-offs may be necessary is vital in creating a quality design.

Public transport should address the social, economic, and environmental needs of a community, providing customers with more active, sustainable, and appealing travel choices. The objectives of public transport are to:

- meet the increasing demand for travel by public transport.
- provide safer and more secure journeys.
- reduce car dependency by providing viable alternatives that are attractive and reliable.
- ease congestion and tackle climate change by promoting more sustainable modes.
- link neighbourhoods with each other and to employment, education, and other opportunities
- improve quality of life by improving air quality and reducing noise and other environmental harms
- act as a catalyst for socioeconomic and physical regeneration in local communities
- support future growth and generate revenue towards funding ongoing transport system operations.
- integrate facilities with local land use.
- enhance people's sense of place by creating more attractive buildings and public spaces.
- support the goals of the National Policy Statement on Urban Development 2020 by enabling the enhancement and densification of the urban environment
- enable everybody to have access to the transport system, by designing inclusively for all abilities and personal circumstances.

At the heart of a successful public transport interchange or station are key characteristics that contribute to the objectives and influence the design. These design priorities are discussed in **section 2.3.**

1.4. Relevant legislation

Legislation considered during the development of this guidance document includes the:

- Building Act 2004

- Health and Safety at Work Act 2015
- Land Transport Act 1998
- Land Transport (Road User) Rule 2004
- Land Transport Rule: Traffic Control Devices 2004
- Local Government Act 2002
- Public Works Act 1981
- Resource Management Act 1991.

1.5. Related guidelines

Key planning and design requirements are reflected in best practice guidelines such as those by:

- Auckland Transport – Public Transport Interchange Design Guidelines (2013)
- Waka Kotahi – Public transport design guidance (multiple topics)
- Austroads guidance and publications, especially the guide to traffic management series of publications
- Victoria State, Department of Transport – Public Transport: Guidelines for land use and development (2008)
- Australian Government, Department of Infrastructure and Regional Development – The Whole Journey (2017)
- New South Wales Government, Sydney Metro – Interchange Access Plan: Sydenham (2019)
- Government of Western Australia, Public Transport Authority – Bus Interchange Guidelines (2016)
- Transport for London – Interchange Best Practice Guidelines (2021).

2. Interchange and station fundamentals

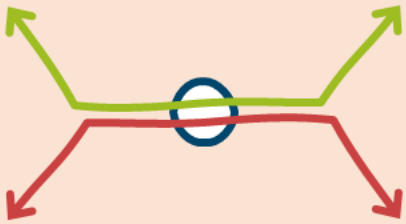
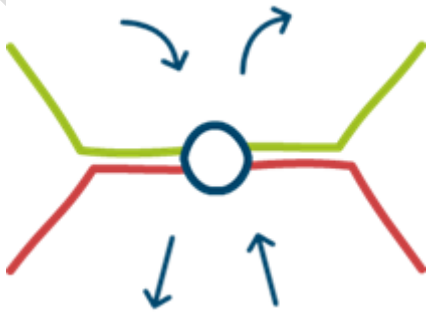
Guidance to support understanding of different users of interchanges, different interchange types and the critical priorities for planning and designing interchanges.

2.1. Users of interchanges

A public transport station or interchange layout is inherently driven by those who use and interact with it, so understanding their requirements is critical for a functional and fit-for-purpose design, including site choice, layout, and access. Users will differ for each interchange (as described in the table below), so their needs and the resultant design requirements should be assessed uniquely within the context of the specific interchange.

Everyone should expect a clean, efficient, accessible, reliable, safe, and legible facility.

Table 1: Different interchange user perspectives

Groups	Interaction with transport network	Description
Interchanging passengers		Interchanging passengers are moving between services at the interchange, making transfers or connections. They care most about how reliable, easy and comfortable the change is. These elements are affected by station legibility and wayfinding, the distance and quality of the walking environment between connecting platforms or stops, and the quality of the waiting areas and wider public transport interchange. As with most passengers, they are also concerned about service reliability, travel time and route diversions.
Passing-through passengers		Passing-through passengers are travelling through an interchange remaining on the same service. They care most about the time taken to travel through an interchange and the route the service uses. As with most passengers, they are also concerned about service reliability and travel time.
First/last mile passengers		First/last mile passengers are beginning or ending their trip at the interchange. They care most about having safe, direct and legible access to, from and within the interchange; clean, comfortable and safe waiting areas; and real-time information on services. As with most passengers, they are also concerned about service reliability and travel time.

Groups	Interaction with transport network	Description
Indirect users (passers-by)		Indirect users (or passers-by) are those using an interchange for a purpose not involving public transport. They are most concerned about how easy it is to move through the interchange, the quality (safety and attractiveness) of the urban realm, and the access to the amenities provided by the station or surrounding areas. A sub-class of indirect users specifically access an interchange to use its non-transport facilities such as toilets, information services or retail services.
Neighbours		Neighbours are the local businesses, residents or others in the areas close to or within the interchange. They are most concerned about the impacts (positive and negative) from public transport infrastructure and services. These impacts include noise, air quality, visual amenity, severance, opportunities for enhancing the built and natural environment, the volume of foot traffic, and the integration between land use and public transport.
Operators		Operators include vehicle drivers, maintenance staff, emergency services, interchange staff and retail staff. They are most concerned about the ease of undertaking their operational tasks, the location of, and access to, facilities for these tasks, their staff's safety and security when undertaking tasks, and the costs and timing or scheduling of operational tasks.

2.2. Categories of interchanges and stations

The categorisation on an interchange or station is important for planning and design. Interchanges and stations can be categorised by considering their function in the transport network, their scale and the interfacing land uses.

Interchanges and stations can be categorised in different ways, taking into consideration:

- their **function within the wider transport network** – that is, whether the interchange or station has a primarily public transport function or wider multimodal function in terms of trip patterns, services provided and location in the transport network.
- **interfacing land uses** – that is, whether the public transport interchange or station includes or is adjacent to a mix of residential, retail and employment land uses, whether there is a dominant land use, and what that form of land use is.
- **scale** – that is, how significant the public transport interchange or station activities are, considering the number of services provided, volume of passengers served, retail floorspace, volume of drop-off trips and the provision of Park & Ride facilities.

The categorisation of an interchange or station is important for understanding the relative importance of different design considerations and for making design decisions in a context of conflict requiring trade-offs and of limited space and resources.

Interchanges and stations can typically be classified into one of four categories, as shown in the following table.

Table 2: Interchange and station categories

Interchange category	Function	Interface	Scale
City Gateway	High	High	High
Destination Gateway	High	High–medium	High–medium
Local Gateway	Medium–low	Low	Medium–low
Dedicated Transport Hub	High–medium	Medium–low	High–medium

An interchange or station may span more than one category and may change category over time as its function, interfaces, or scale change. The four interchange and station categories are discussed in **sections 2.2.1 to 2.2.4** and, for simplicity, are largely just referred to as 'interchanges' rather than 'interchange or station' in this section.

2.2.1. City Gateway interchange

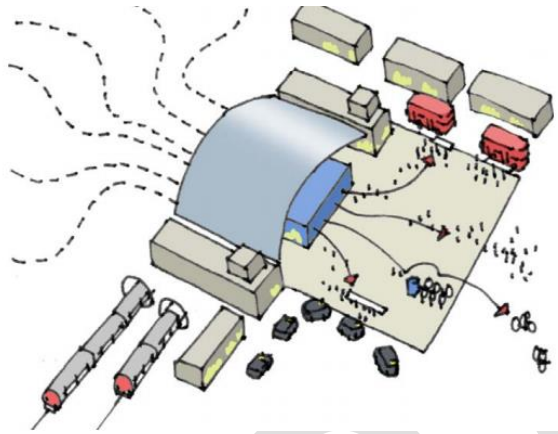


Figure 3: Schematic of a City Gateway interchange. Source: Transport for London, Station Public Realm Design Guidance (2015).

City Gateway interchanges are found in the heart of established urban settings with high-value, intensive and mixed land uses, and significant spatial constraints. They are likely to be major multimodal interchanges, with high frequency rail and/or other frequent services, and a very high volume of pedestrians.

The high value of land in these locations often supports vertical layering of transport with other land uses. Passenger journey efficiency is important due to the level of patronage (number of journeys). Travel activity may be up to 24 hours each day.

City Gateway interchanges are almost exclusively accessed by pedestrians and users of micromobility, public transport, Total Mobility, or other accessible pick-up and drop-off (PUDO) ways of travelling. A ride-share and taxi drop-off can be desirable in small volumes. Park & Ride is not desirable or viable due to high land values, impacts on more space-efficient modes, overall space constraints and the likelihood that these stations are predominantly journey destinations rather than trip generators.

These interchanges can be an ideal location for large-scale bicycle parking.

Table 3: Examples of City Gateway interchanges

Railway station	Bus station (off-street)	Bus interchange (on-street)
		
Figure 4: Wellington Railway Station. Source: KiwiRail.	*Figure 5: Christchurch Bus Interchange. Source: Aurecon.*	*Figure 6: Lower Albert Street Bus Interchange. Source: Auckland Transport.*

2.2.2. Destination Gateway interchange

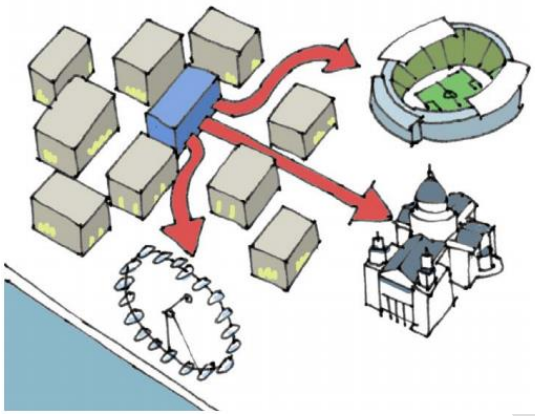


Figure 7: Schematic for a Destination Gateway interchange. Source: Transport for London, Station Public Realm Design Guidance (2015).

Destination Gateway interchanges are likely to be in or very near an established suburban setting that is a local hub with valuable, intensive, and mixed land uses in addition to high densities and spatially constrained environments. These interchanges or stations serve key destinations for the public such as town centres, hospitals, and universities. Some may be in growth or new master-plan locations, in which case understanding the long-term potential of the place and process of future urban change becomes significant.

A key feature of these interchanges is the mix of transport activities, including direct access to destinations as well as the ability to change between services and modes.

Travel activity may continue throughout much of the day as these interchanges serve key destinations that often have a mixed employment and residential profile and may generate a mix of trip attractor and generator characteristics. Traffic can negatively affect as well as support centres.

Park & Ride and PUDO (other than accessible parking and PUDO) are not usually appropriate for interchanges in major centres due to the need for efficient land use and the impact additional traffic can have on local congestion. These stations may be able to be fully integrated into or immediately alongside other land use developments.

Table 4: Examples of Destination gateway interchanges

Ferry terminal	Railway station	Bus interchange (on-street)
		
Figure 8: Devonport Ferry Terminal. Source: Auckland Transport.	*Figure 9: Ellerslie Station. Source: Auckland Transport.*	*Figure 10: Christchurch Hospital bus stops. Source: Christchurch City Council Newsline.*

2.2.3. Local Gateway interchange

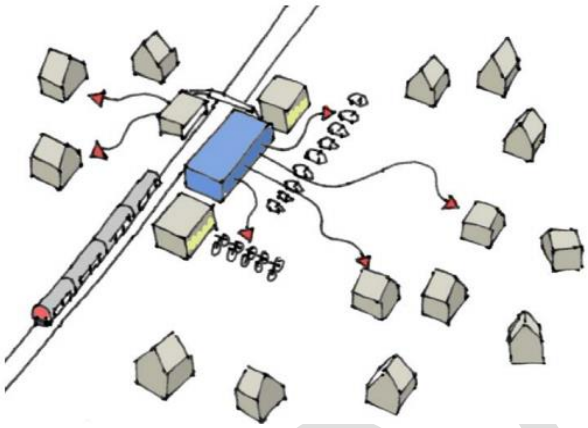


Figure 11: Schematic of the Local Gateway interchange. Source: Transport for London, Station Public Realm Design Guidance (2015).

Local Gateway interchanges are likely to be in a predominantly residential or employment context with limited retail, leisure, or hospitality activities. Spatial constraints will vary depending on location.

These interchanges or stations are less likely to be multimodal, but they may be if they are strategically located and provide a key node between different modes. They are likely to attract a broad range of access modes from walking and cycling to private vehicles.

Travel activity may drop significantly outside peak community hours, and 'last mile' travel choices become important. Park & Ride may be desirable if the interchange is located at a strategic node interfacing between the wider road network, urban periphery or rural context and the public transport network. Park & Ride provision must align with current and expected future local land uses and would be indicated only if surrounding land value and density is very low. Flexibility should be retained to repurpose any Park & Ride land for other uses as local land uses and values change. PUDO provision is generally desirable at Local Gateway interchanges.

Table 5: Examples of Local Gateway interchanges

Ferry terminal	Bus interchange (off-street)	Bus interchange (on-street)
		
Figure 12: Half Moon Bay Ferry Terminal. Source: Auckland Transport.	*Figure 13: Ōtara bus station. Source: Auckland Transport.*	*Figure 14: Kilbirnie bus hub. Source: Lorelei Schmitt.*

2.2.4. Dedicated Transport Hub

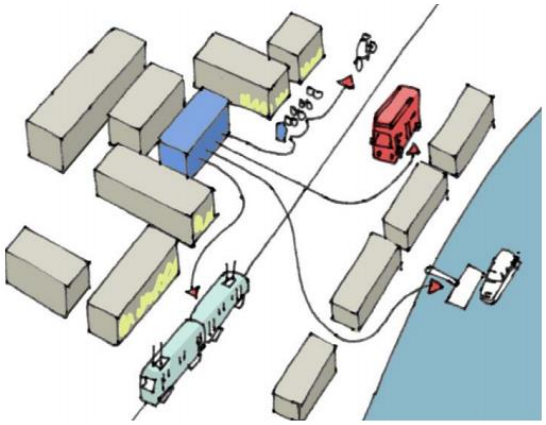


Figure 15: Schematic of a Dedicated Transport Hub. Source: Transport for London, Station Public Realm Design Guidance (2015).

Dedicated Transport Hubs are likely to be in areas with limited retail, education, leisure, or hospitality activities. Spatial constraints will vary depending on location.

These interchanges perform an important function in the transport network as they provide opportunities for people to access and transfer between a variety of public transport services. This often broadens the catchment of the network as a whole and is often seen with trunk and feeder transport networks.

These interchanges can be points along the network with forced transfers (for example, transferring from ferry to bus or from train to train). Because of this transfer function, a much higher volume of transfer passengers than any other users are likely. Specialist interchanges are likely to be multimodal, served by one or more high frequency routes.

Dedicated Transport Hubs can offer good potential for high-quality integration of public transport with surrounding land uses, due to people's ability to access many different public transport services. This allows the interchange to shift from a specialist to a destination function and provide opportunities for revitalising the surrounding urban landscape, connecting communities, and increasing land values. The design should provide flexibility for adaptation to suit an expected change in category.

A Dedicated Transport Hub may be suitable for Park & Ride, depending on current and expected future transport and land use factors. Park & Ride can be considered, provided the interchange location is unsuited to significant integration with other land uses, land values are low, and it does not interfere with public transport operations.

Table 6: Examples of Dedicated Transport Hubs

Railway station	Railway station	Bus interchange (off-street)
		
Figure 16: Waterloo Interchange. Source: Wellington Metro.	*Figure 17: Ōtāhuhu Station. Source: Auckland design manual.*	*Figure 18: Constellation Station. Source: Waka Kotahi.*

2.3. Design priorities

The seven planning and design priorities for designing new or upgraded public transport interchanges to meet the station objectives are as follows:

1. **Safety:** The safety of pedestrians and all public transport interchange users is protected, and risks are minimised.
2. **Enhances journeys:** The design and location of the public transport interchange encourages public transport use by providing for seamless transfers, connections and access using other transport modes. An attractive, secure and welcoming facility is provided that is accessible to all and compliant with all relevant legislation and standards.
3. **Operability:** The interchange provides facilities for the operation of public transport vehicles (that is, capacity for movements, loading and unloading, and driver amenities).
4. **Public realm integration:** The public transport interchange integrates seamlessly with and enhances surrounding land uses and streets.
5. **Sustainability:** The provision and operation of the public transport interchange does not cause disproportionate negative impacts on carbon emissions and local amenity, including pollution and flooding.
6. **Cost-effectiveness:** The costs of providing and operating the public transport interchange are optimised.
7. **Future-proofing:** The interchange is designed and located to be resilient in the face of reasonably foreseeable changes and to continue to deliver on these priorities throughout the facility's lifespan.

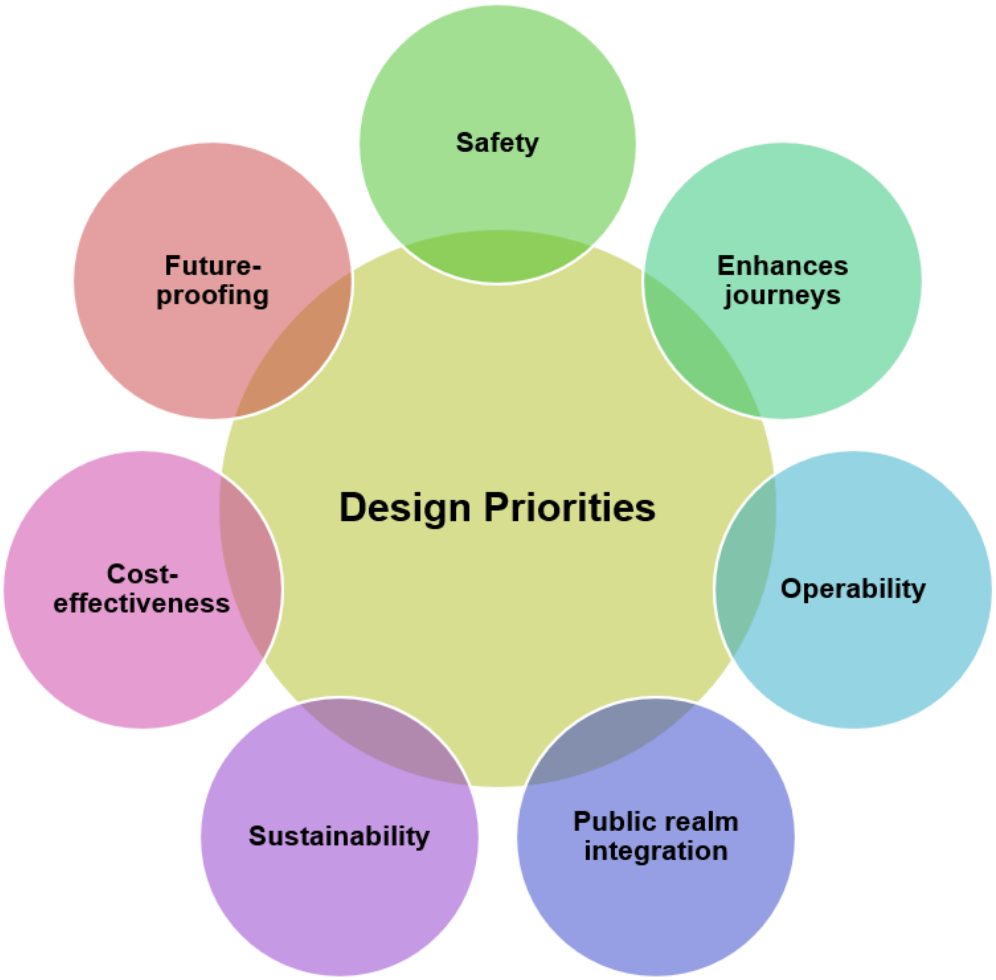


Figure 19: Design priorities

These priorities are discussed below.

2.3.1. Safety

The safety of users of the interchange or station is paramount. Safety includes not just road safety but the health and safety of those working in the interchange and the personal safety and security of people using the interchange.

Interchange design must contribute to Vision Zero, of an Aotearoa New Zealand where no one is killed or seriously injured on our roads.

We want everyone in Aotearoa to be able to get home safely every time and to feel comfortable choosing from a variety of safe travel options that support their personal health, accessibility for their families, and the environmental health of communities.

In 2019, the government released its 10-year road safety strategy, Road to Zero. It commits Aotearoa to Vision Zero and a target of a 40 percent reduction in deaths and serious injuries on our roads by 2030 (from 2018 levels).

A Safe System has people and their safety at the centre of transport planning and investment decisions. The influence of the transport system is pervasive, so its safety – or lack of safety – also affects a wide variety of social needs. Road safety – mobility without risk of death or injury – affects health, poverty, equity, the environment, employment, education, gender equality and community sustainability.

Road to Zero and the vision are underpinned by the Safe System and its principles. These principles inform how we design the network and how our decision making should reflect and contribute to four safety outcomes:

- Promote good choices, but plan for mistakes.

- Design for human vulnerability.
- Strengthen all parts of the road transport system.
- Recognise shared responsibility.

Interchange designers and planners must always consider Vision Zero and the application of the Safe System principles when designing and locating the interchange. It is not possible to eliminate all risks and potential conflicts, but it is critical to ensure potential conflict between moving vehicles and pedestrians and others outside vehicles is managed within the Safe System survivability threshold of 30km/h. This means a person outside a vehicle should not be in conflict with a vehicle travelling over 30km/h.

We strongly recommend an independent Safe System audit is undertaken during each planning and design phase for every public transport interchange or station.

Further information

- Safe System Audit Guidelines
- Road to Zero
- Road to Zero and Safe System

Health and safety at work is governed by the Health and Safety at Work Act 2015. WorkSafe provides guidance and standards in relation to the application of that Act to the workplace, in this case the interchange.

2.3.2. Enhances journeys

Travel efficiency and comfort are key drivers to promote public transport and make passengers feel they are engaged with a high-quality public transport system. By maximising passenger comfort and minimising travel time, the overall customer experience and attractiveness of public transport improves significantly.

Interchanges and stations are major interaction points people have with the public transport system and can have a significant impact on the comfort and convenience of their journey. Furthermore, the outward perception of the whole system is largely influenced by people's experience at this point. A poor perception of public transport is a known barrier to public transport uptake.

Interchanges and stations facilitate the movement of passengers:

- to and from public transport services
- from one mode of public transport to another (transfers)
- between services of the same mode (connections).

Providing access to and from the public transport network needs to consider a variety of modes (for example, walking, cycling or driving). Access is about more than just physical access. It includes the look and feel of the facility, information, wayfinding, branding, and how the interchange or station design and layout interacts with its surroundings.

The ability to transfer or connect provides passengers with wider access to destinations and more direct journeys and enables increased network utilisation. A well-designed interchange can increase awareness of the potential benefits of transferring by reducing barriers and making transferring easy and safe. For example, a benefit may be reduced actual or perceived waiting time.

Design and operational details are important, such as timetable co-ordination between connecting services and the layout of the interchange to reduce walking time between connecting services. Remember that not all public transport stops or stations need to be interchanges, and not all interchanges are used much as public transport stops. In addition, some transfers are forced on the user, for example, through geography such as a transfer from a ferry to a land-based mode.

Making sure interchanges and stations are easily accessible, safe and in a convenient location is important for making public transport usable by everyone, regardless of ability. If people experience or perceive transferring as difficult, they may choose not to use public transport for journeys requiring transfers or connections.

Remember that accessibility is not limited to physical access. Designers and planners also need to think of visual, hearing, sociocultural, economic and ethnicity (language) characteristics. We also need to think ahead and create an access legacy that will cope with future demand and concepts such as social distancing.

Interchange design, layout and operational practices need to reflect how the facilities may need to adapt to emerging modes and take maximum advantage of new and emerging technologies to better serve passenger movements. Considerations include:

- integration of ride-share and small passenger service vehicles when designing Park & Ride and PUDO facilities
- cycle access and associated facilities (including charging stations) to serve not only standard bikes, but micromobility devices such as e-scooters and e-bikes as well as larger bikes such as electric long-tail cargo bikes (which are quickly growing in popularity because they allow people to move children and goods easily by bicycle)
- other infrastructure such as bike-share and ride-share (car-share, PUDO and on-demand) services; noting that ride-share services are not suitable for every interchange and should be considered carefully in terms of ridership, system legibility and travel patterns.

Figure 20: Cycle parking at Constellation Bus Station. Source: Jacobs.

Public transport interchanges and stations need to provide appropriate facilities for the number and types of journeys being made, delivering a quality environment for people accessing public transport. These facilities include easy movement into, out of and through the interchange, information, shelter, safety and security, as well as additional amenities for ticketing, passenger comfort and convenience, as appropriate.

2.3.3. Operability

Public transport infrastructure and facilities should enable the transport network to operate efficiently. This efficiency should include the movement and loading of vehicles as well as the access and design of non-public infrastructure (that is, operational facilities such as a drivers' eating facilities, sign-on locations, lay-over facilities, and electric vehicle charging) and future growth flexibility. Operational facilities are an essential requirement and often depend on the frequency of services.

Consideration must be given to approach and departure routes for public transport vehicles operating on non-dedicated rights of way. Wherever possible, priority measures should be integrated with the design to facilitate easy and reliable movements to and from the interchange.

Detailed guidance on public transport priority is in Public Transport Design Guidance topic Priority and optimisation.

2.3.4. Public realm integration

The public realm forms the physical link between the station and the wider community. In this context, it is defined as the space between and around buildings, including streets that are accessible and useable by people. Elements of the public realm include land uses, building types and frontages, landmarks, streets, footpaths, landscaping, lighting and public art. Collectively, these elements give the public realm its identity and sense of place.

The One Network Framework is a tool that brings land use and transport together. The framework balances and integrates the intended strategic and local Place and Movement functions of the street network, as well as the levels of service for all transport modes.

Some interchanges or stations serve as a critical interface to towns, cities, or other places. This interface can support place-making and economic opportunities. An interchange should be designed to enhance the public realm in the local community, as well as the Place function of local streets. These enhancements can improve the perception of public transport, improve the level of confidence in the system, and contribute to increased patronage. The improvements can also reduce the negative environmental impact of an interchange on the community, provide better movement networks, and contribute to active and safe streets and public spaces.

A well-designed interchange integrates with the public realm to encourage movement, efficient use of space and area activation to improve the overall sense of place and local identity. A strong relationship between an interchange and the surrounding public realm will deliver a richer and more fulfilling environment and a more functional catchment with higher patronage, which will enhance local character and provide a clear and positive sense of place for its users.

2.3.5. Sustainability

Sustainability and the environmental impact of infrastructure design have always been important but have been brought increasingly into focus in recent years. Facilities supporting a public transport network should be designed to enhance and improve the local community. Well-designed public transport interchanges can contribute significant emissions reduction benefits by supporting a high-quality public transport system that encourages mode shift and reduced private vehicle usage. In addition, the design of interchanges should mitigate adverse environmental impacts and promote sustainable use, operation, and maintenance.

Sustainable design makes places more efficient, helps mitigate against climate change, adds value to a public transport interchange, and meets the needs of people who want to use the interchange now and in the future.

Sustainable features include:

- the use of natural light to reduce the need for artificial lighting and reduce light pollution.
- excellent insulation of indoor and heated areas.
- self-stopping escalators, which use less energy than always-running escalators.
- the use of lifecycle impact assessments to choose materials with lower overall impacts on the environment.
- the generation of on-site sustainable energy (for example, solar charging across large roof areas).
- natural ventilation to reduce the need for air conditioning.
- recyclable waste containers.
- safeguarding existing trees and green areas and providing landscaping opportunities for large trees to be planted.

- rain gardens to manage stormwater from large rainfall events.

Figure 21: Windows provide natural light and recycling bins are available at the Christchurch interchange. Source: Mark Edwards.

The interchange's presence in the landscape can be softened by the sympathetic use of materials and plantings and minimising aspects such as light spill. This can be done without compromising the function of the interchange and wider network.

Water management should minimise a new facility's impact, including managing run-off from necessary hard surfaces and buildings, minimise the consumption of piped water, and re-use wastewater.

Station design should also consider embodied emissions (that is, the emissions associated with the materials and construction activities). These emissions can be managed through a variety of techniques, including right sizing the quantity of materials used and using recycled or partially recycled materials or materials derived from sustainable sources.

For guidance about resource efficiency to support lower-emission choices, see the Highways Information Portal topic Resource efficiency and waste minimisation.

Mode of access to the station is also a critical factor in determining the facility's sustainability (see also **section 4.3**).

2.3.6. Cost-effectiveness

All public transport interchanges must be cost-effective in terms of their design. Cost-effectiveness is considered in the context of whole-of-life costs and benefits, encompassing initial construction and inspection, maintenance, operation, and replacement (where relevant). Considerations include:

- a fit-for-purpose design.
- a correctly scaled investment – the size and cost of a specific piece of infrastructure or facility should be in line with the expected investment benefits (economic, social, and environmental) and the spatial footprint should be considered for space-effectiveness and cost-effectiveness (for

example, a smaller interchange might have lower opportunity costs, better potential for land use integration, and shorter access and transfer distances).

- the construction materials to be used and their capital costs, maintenance costs, operational costs (such as electricity costs), and design life.
- flexibility for future adaptation (for example, costs could be saved if the facility is expanded 'just in time').
- operational efficiency for the public transport network.
- achievable synergies of value engineering with sustainable design.

2.3.7. Future-proofing

A public transport interchange will typically have a lifespan of several decades, so needs to be designed taking into consideration not just existing needs, but likely needs in the medium to long term. Rather than attempting to design for all current and likely future needs from the initial construction of the new facility, it is usually more common (and more cost-effective) to design for shorter-term needs but with flexibility for future expansion and upgrading in stages.

To understand longer-term needs, ask how the context for the interchange could change over time.

- How might public transport networks change? The interchange should be flexible enough to accommodate future service patterns and vehicle designs. These may require changes in the capacity provision for the number and size of vehicles, as well as provision of layover and driver amenities.
- How might passenger demand change? The interchange should provide for changing volumes, types and patterns of passenger demand. This may require changes in the capacity provision for passenger activities (including amenities and facilities for first and last mile access).
- How might the surrounding land use and urban form change? The interchange should be adaptable enough to continue to integrate with the public realm as it changes. This may require provision of new connections for access into, out of and through the interchange, as well as alignment with changing identity and place attributes of the area.
- How might the surrounding transport networks change? The design should provide flexibility to allow integration to be maintained with networks as they evolve; for example, by providing for new or upgraded accesses and facilities to optimise benefits from new walking and cycling routes.
- How might the interchange category change? If land uses and networks evolve, the interchange category may change, and the design would need to facilitate adaptation to meet the needs of the altered balance of passenger types and the new relationship with the urban form. For example, densification may change a Dedicated Transport Hub into a Destination Gateway and require Park & Ride to be repurposed to enhance the urban form.
- How might changes in technology affect the interchange? Changes in technology might change the operation of public transport vehicles, how people access the interchange, and their needs, such as for information, while using the interchange. For example, the ongoing introduction of battery electric vehicles should be considered in the design of facilities for operations and for first and last mile access.

3. Planning and design process

The effective planning, management and operation of interchanges is essential to realise positive outcomes for users and operators. Interchange design should be undertaken with a lifecycle approach, considering constructability, futureproofing and asset life extension, maintenance, repair, and decommissioning.

Planning and design development for an interchange should follow the Waka Kotahi business case approach.

Business case approach guidance

Interchange planning and design development should also follow relevant policies and standards. Detailed methodologies for planning and designing a public transport interchange are not covered in this guidance. However, important themes are highlighted below.

3.1. Location

A public transport interchange plays a critical role in the customer journey experience, so it is important to adopt a broad perspective when planning an interchange, including considering the station's location relative to the streetscape and urban realm.

The choice of station location should also consider expected future changes, as outlined in **section 2.3.7**. In many cases, the interchange location is part of a master planning or structure planning process.

Figure 22: Sunnynook Bus Station. Source: Jacobs.

Fundamentally, a public transport interchange should be in an accessible and convenient location. Factors that can influence interchange location are described in the table below.

Table 7: Factors that can influence interchange location.

Factor	Impact
Trip attractors or generators	Stations should be located close to major patronage generators and important community facilities such as schools, universities, employment areas, town centres, hospitals, and retail centres. Integration of public transport planning with land use planning enables public transport to be an attractive option for more trips, meaning increased demand and patronage. Locating a public transport interchange in an attractive location requires careful management of the resulting pedestrian movements in and around the interchange (see **section 3.3.3**).

Factor	Impact
Network	Interchanges should minimise deviation of main trunk routes and present as a transport hub to connecting services. Consider the routing of public transport services to an interchange and how route length and congestion may affect service reliability. Interchanges should avoid locations or layouts that mean a vehicle cannot enter or exit the interchange easily, especially in heavy traffic.
Connections	Interchanges should be located and arranged to make transfers between services and modes as comfortable and easy as possible.
Severance	Severance is an urban design term used to describe separation effects on a place caused by infrastructure preventing easy movement or restricting visual connections. Consider the scale and location of infrastructure and the public transport corridor and the effects on pedestrian, cycle and local vehicular movement as well as the long-term impacts on the quality, functionality and viability of centres, communities and local businesses.
Topography	Interchanges should be located (where possible) on or adjacent to a level section of road to maximise accessibility and safety for all passengers including those with mobility impairments. Consider topographical barriers such as hills and waterways when planning interchange locations.
Universal Access	Interchanges should be located and arranged, taking into consideration the needs of all users. This includes considering the specific access needs of disabled people and elderly people.
Walking, cycling and micromobility catchment	Interchanges should be positioned to maximise walking, cycling and micromobility catchments and support direct, clear and intuitive connections. Access to the interchange should be close to intersections and pedestrian-crossing facilities, linking with good-quality facilities such as wide footpaths. More information is in the Public Transport Design Guidance topic Getting to and from public transport.
Street environment	Interchanges should be located and arranged to avoid undue negative impacts on people travelling in the street environment and on the One Network Framework Movement function of the street. This includes considering road safety (including safe sight lines for drivers and driveway locations), the likelihood or magnitude of traffic delay (particularly if it would affect public transport services), footpath widths and interactions with cycleways. This factor is particularly influential for on-street facilities.
Safety of area	Interchanges are best located in easily visible and well-lit areas. The interchange design should also minimise opportunity for crime and increase perceptions of personal security.
Amenity	Consider the effects of the interchange on the qualities and characteristics of an area and on the One Network Framework Place function of interfacing streets. Explore opportunities to enhance local amenity, identity and functionality through interchange design.
Environmental impacts	Location choice should consider the impacts of public transport infrastructure and services on the surrounding areas (including noise, air quality and visual impacts).
Urban form potential	Benefits can be achieved by locating interchanges in areas with a higher potential for integration with current and/or future land uses. These locations will typically be highly walkable, with a higher density urban form to support public transport as a main mode of access.

The choice of interchange location is significantly affected by the category of interchange, as this affects the relative significance of the influencing factors:

- **City Gateway:** The importance of integrating the interchange into the surrounding land uses and street environment is particularly high and minimising severance is key. Walking and cycling access and transfer facilities are higher priorities than the network impacts of the location.
- **Destination Gateway:** Land use integration, access to attractors and generators, and the impacts on the street environment and local amenity are key considerations. First/last mile access and transfer facilities are prioritised.
- **Local Gateway:** A balanced consideration of the influencing factors is required.
- **Dedicated Transport Hub:** The public transport network and enablement of transfers has a higher priority in influencing the location than first/last mile access, although the potential for integration with land use is also a significant factor.

3.2. Consultation

Each Public Transport Authority or Territorial Authority has its own consultation policies and processes that need to be applied during the planning and design process. These policies and processes reflect legislation such as the Local Government Act 2002. Additionally, any resource consenting process may place additional consultation expectations on infrastructure projects. Interchange development requires and, more importantly, benefits from genuine consultation with stakeholders. More information on engagement and consultation can be found in *Public engagement guidelines (2016).*

Potential outcomes from high-quality consultation are:

- better-informed proposals and decisions.
- better co-ordination and use of resources.
- improved efficiency and effectiveness of delivery.
- identification of a broader range of options for consideration.
- design and facilities that align with community needs.
- enhanced opportunities for design to tell local stories, contribute to local identity, and support Māori design aspirations.
- greater public awareness of proposals and decisions.
- informed and empowered communities.
- improved relationships with communities.
- improved public acceptance (buy-in) of decisions.
- improved public perception of the organisation and trust in its actions
- greater public involvement and interest in democratic processes.

Potential consultees include:

- neighbouring land users and building owners.
- operators that will or may use the interchange.
- iwi
- local and central government entities
- emergency services
- existing users, in the case of an existing interchange
- representative user groups (bus drivers' union, taxi companies, walking and cycling groups, the Automobile Association, freight groups, disabled communities, community panels and local business communities)
- resident and community groups.

3.3. Design considerations

Design layouts for interchanges need to provide for all interchange users. User considerations can broadly be divided into design considerations for:

- passenger access, covering:
    - interchanging passengers
    - first/last mile passengers
    - indirect users (passers-by)
    - neighbours
- vehicle operations, covering:
    - public transport operators
    - interchanging passengers
    - first/last mile passengers
    - passing-through passengers.

How to manage conflicts between passenger access and vehicle operations is also an important consideration. The following sections summarise the key design considerations under each category.

3.3.1. Passenger access

Key design considerations for passenger access are:

- safety and security
- accessibility
- visibility
- legibility and wayfinding
- connectivity
- interface with transport networks and land use
- passenger activities and zones
- passenger facilities and amenities
- capacity.

These considerations are discussed in **section 4**.

3.3.2. Vehicle operation

Key design considerations for vehicle operations are:

- safety
- legibility
- efficiency
- operational facilities and amenity
- capacity.

These considerations are discussed in **section 5**.

3.3.3. Managing conflicts

A major risk to people in any interchange is interaction with moving vehicles. While such occurrences are rare, when they do occur the consequences can be serious. Therefore, it is important to design the layout of an interchange to avoid or control pedestrian–vehicle conflict in and around the facility. It is critical to design for people's desire lines, so interchange layout is intuitive, fit for purpose, and easy to use.

To confirm the adequacy of conflict management provisions, undertake a risk assessment and have an independent Safe System audit undertaken at the design stage in respect of expected pedestrian movements to and from the interchange and within the site, considering likely pedestrian desire lines.

Review the risk assessment and carry out a post-opening Safe System audit as soon as practicable once the public transport interchange is fully operational.

Conflict management techniques

Consider the three main conflict management techniques:

- **Interchange positioning:** Orient the public transport interchange to maximise pedestrian flows directly to adjacent developments, minimising the need for vehicles to cross pedestrian paths. Residual conflicts must be controlled.
- **Raise or lower vehicle movements:** If residual conflicts cannot be effectively controlled, consider vertical segregation to place vehicle movements above or below grade and avoid conflicts.
- **Raise or lower pedestrian movements:** If residual conflicts cannot be effectively controlled and it is unfeasible to displace vehicle movements, consider vertical segregation to place pedestrian movements above or below grade. Residual conflicts must be controlled.

Merits and drawbacks of vertical segregation

Vertical segregation of public transport interchanges compared with a fully at-grade approach can:

- optimise the land footprint.
- facilitate efficient operations.
- support integration with land use.
- enhance amenity.
- improve the customer experience for some users.
- reduce severance.
- improve safety.

However, vertical segregation compared with a fully at-grade approach can also:

- negative affect the experience of some users
- detract from amenity.
- be more expensive and difficult to maintain than a fully at-grade approach.

An interchange should be designed considering the specific parameters of the site, the functional requirements, and visual amenity in context with the surrounding community and urban fabric.

Advantages and disadvantages of each construction typology

The advantages and disadvantages of each construction typology are discussed below.

All movements at grade

Figure 23: All movements at grade Source: Waka Kotahi.

Interchanges designed to have all movements at grade typically have lower construction costs than grade-separated interchanges and can enable a higher level of equity of access and security.

Compared with a vertically segregated facility, at-grade facilities require a larger land footprint and high-quality integration with the urban form may be difficult to achieve. They may also require more controlled crossings, which can result in significant trade-offs between impacts on operational efficiency, safety, severance, and the customer experience.

This typology may be appropriate at bus and light rail transit facilities **if** the conflicts can be avoided or controlled satisfactorily. At rail and ferry facilities, all conflicts should be avoided.

Relocate vehicle movements

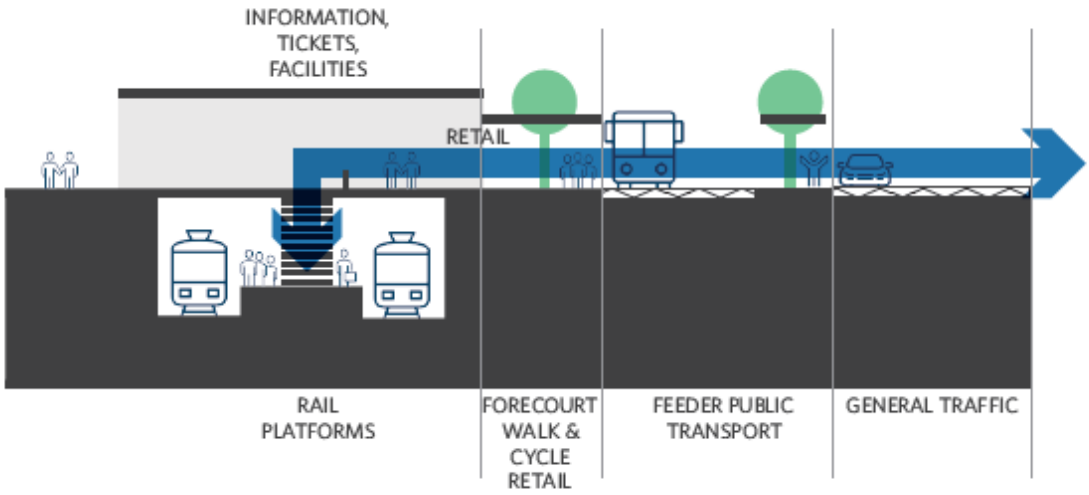


Figure 23: Sample layout for vehicle movements below grade. Source: Waka Kotahi Draft Rail Planning Station Case Study *(unpublished, 2020).*

Placing vehicle operations below or above grade allows for a smaller footprint and can increase operational efficiency and improve safety by eliminating or reducing mode conflict. This approach can also significantly reduce severance and enhance the customer experience by providing more intuitive, reliable, and direct links for people walking and cycling. In turn, it supports high-quality integration with the urban form.

However, construction costs for the required infrastructure can be much than higher at-grade infrastructure, with or without overbridges or underpasses. Equity of access can be challenging to provide, and platforms and platform access need careful design to provide a secure environment.

Placing vehicle operations below ground, rather than elevating them above ground, typically produces superior urban outcomes. Elevating public transport can remove functional severance by retaining easy movement links underneath but may retain qualitative severance if the movement links are unattractive. This may be undesirable in urban environments and could require considerable expenditure on constructing quality spaces under the elevated infrastructure.

Relocate pedestrian movements

Figure 24: Pedestrian overbridge, Akoranga Station. Source: Auckland Council.

Figure 25: Pedestrian underpass, Tretham Station. Source: YttriumShrew, CC BY-SA 4.0, https://creativecommons.org/licenses/by-sa/4.0, via Wikimedia Commons

Pedestrian overbridges and underpasses can allow for a smaller footprint and increased operational efficiency. They can also, albeit to a limited extent, reduce severance and enhance the customer experience by providing reliable walk times.

However, overbridges and underpasses can be barriers to neighbourhood cyclists and unattractive to public transport customers and neighbourhood pedestrians, due to requiring increased walk time. They can contribute to improved safety from mode conflict if combined with measures to prevent, discourage, or control customers and pedestrians avoiding the segregation to cross at grade. Overbridges and underpasses can be challenging to provide with natural surveillance for security. Integration of the segregated crossing with concourse facilities or surrounding land uses can provide a more secure environment that is attractive to customers and pedestrians.

Underpasses can be more challenging to deliver as high-quality and safe spaces than overbridges, due to limitations on providing natural light and surveillance. However, underpasses usually have a lower impact on the visual amenity of the area.

Control of residual pedestrian–vehicle conflict involves three actions:

- **Limiting vehicle speeds:** Vehicles should travel at a low speed through the interchange to minimise the risk and severity of an interaction with pedestrians. Speed restriction is implemented through driver training supported by signage and enforcement. Consideration can also be given to the use of speed-limiting devices.
- **Restricting pedestrian routes to a limited number of managed crossing points:** Pedestrian footpaths and walkways, where practicable, should always be as direct as possible to avoid the potential for pedestrians to take short cuts. Use legibility and wayfinding principles (see **section 4.2.5**) to guide pedestrians along safe routes to access all destinations. Ideally, footpaths and walkways should be covered or enclosed to encourage pedestrians to keep to the path,

particularly in poor weather. Barriers may be considered as part of the safety arrangements on road perimeters to help prevent unauthorised access to road areas. Consider appropriate positioning, height, and construction of any barriers relative to the risks posed.

- **Implementing controls on managed crossing points:** Pedestrian crossings should be designed and constructed to minimise potential serious harm should a pedestrian–vehicle conflict occurs. They should be clearly defined and recognisable to passengers and drivers alike by means of materials used, markings, configurations, signing and lighting.

Any potential pedestrian vehicle conflict needs to be managed to be within the Safe System tolerance level of 30km/h. Additional speed management controls may be required such as providing a raised platform at signalised and zebra crossings. Crossings should be positioned at an appropriate distance from vehicle loading and unloading zones to ensure a reasonable sight line for a pedestrian waiting at a crossing. Any pedestrian crossing should be at right angles to vehicle movements to avoid users having to turn their head more than 90 degrees to observe oncoming vehicles.

Refer to relevant design guidance, including the Pedestrian Network Guidance and RTS14: Guidelines, for facilities for blind and vision-impaired pedestrians. Consider providing audio information as well.

Further information

- Pedestrian network guidance
- *RTS 14: Guidelines for Facilities for Blind and Vision Impaired Pedestrians* (2015)

The following example from Panmure station illustrates some of these concepts.

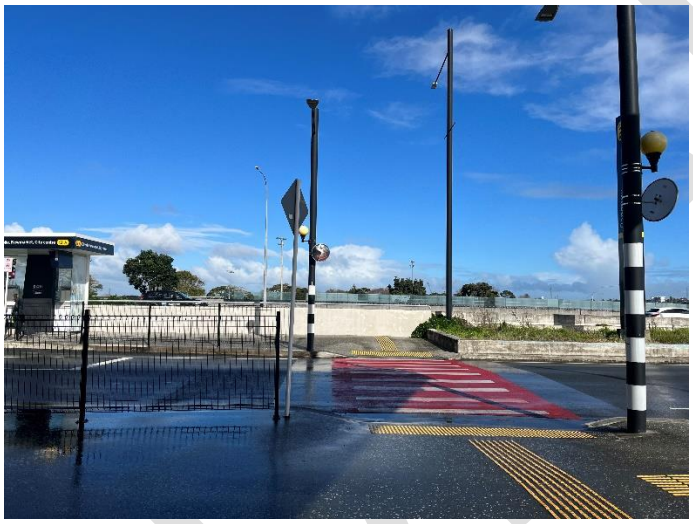


Figure 26: Pedestrian desire line not being met by infrastructure location. Source: Natalie Jones

Panmure Station

In this image of Panmure Station, the zebra crossing between the station and local bus stops is placed to the north of the stops. As many passengers want to directly cross to the bus stops (and may be under time pressure to do so) this does not align with pedestrian desire lines, which has led to a safety issue. A temporary barrier was used to dissuade unsafe crossing, and it has now been replaced by a rail. Alternative remedies included using hedging, which would have a higher urban design benefit, or moving the stop or crossing to better align with desire lines.

4. Designing for people

Planning and designing for people is essential for a successful public transport interchange or station. The needs of people vary, depending where they are on their journey as they move through the public transport network.

Public transport interchanges exist to serve their customers. Successful interchanges prioritise customer experience through station location and the design of spaces. The planning and design priorities identified in **section 2.3** mean a public transport interchange must meet four requirements:

- **Accessible:** An interchange should be easy to get to and use by all people of all abilities and skills. Ideally, it should be a step-free and obstacle-free environment.
- **Legible:** A legible environment makes navigation and movement easy, seamless and intuitive. Critical to this are direct and simple routes, supported by consistent and rationalised infrastructure, including good lighting, minimal street furniture, and standardised surfacing and material finishes.
- **Navigable:** Clear wayfinding means making it easy for people to navigate to, from and within a public transport interchange.
- **Permeable:** A permeable public transport interchange gives users choice and control of their movements within the facility and makes clear connections to existing routes, facilities, and destinations. A permeable interchange creates a more accessible, connected, and resilient transport system.

The planning and design of any public transport interchange must be based on current patterns of use (people transferring, connecting, boarding, and alighting), levels of demand and relevant conditions affecting passenger requirements, as well as potential future patterns of use. This requires consideration of planned and potential changes in the:

- density and mix of land use in the local area,
- volume and pattern of customer movement between destinations,
- nature of the public transport services operating in the interchange zone.

These changes may require modifying the capacity for passenger movement to and from the interchange by different modes, user movement through the interchange and passenger waiting areas. Change may also be necessary to facilities for waiting areas, ticketing, amenity, security and wayfinding.

4.1. Designing for everyone

4.1.1. Universal Design and Human-Centred Design

Universal Design is a holistic design philosophy to create environments, products, learning and education programmes, and systems that as many people as possible can use. In other words, it makes things more accessible, safer, and more convenient for everyone, regardless of age and ability. This design philosophy recognises design aspects for children, elderly adults, pregnant women, and people with luggage or push chairs.

Figure 27: Consider a range of mobility aids that people might be using. Source: Waka Kotahi.

Human Centred Design requires understanding why and how people access places, how they experience place and travel. This user-centric approach is key to good planning and design. Safe, attractive, efficient transport that has a positive interface with place is a universal desire.

Universal Design and Human Centred Design considers human factors – characteristics of people that determine how they interact with designs of products, services, and environments. People constantly interact with the built environment and rely on their available senses to do so. This means design should be considered from the following five points of view:

Interchange layout and detailed design needs to interact with users in a meaningful manner and in a way that is inclusive of all needs and skill levels. This consideration is relevant from large-scale design decisions such as for interchange layouts, walking distances and desire lines to detail such as the colour or symbols used on wayfinding signs and information boards.

Throughout the design process, projects should consider the three main categories of end users who each interact with the facility differently:

- Primary end users interact directly and regularly with the facility (for example, passengers and drivers).
- Secondary end users interact directly with the facility, the system and other users but are not the primary users (for example, cleaners and maintenance people).
- Tertiary end users interact indirectly with the facility (for example, controllers in an operations centre, asset managers or emergency services personnel).

Engage representatives from each group during the design process, as far as possible. This is particularly useful from an operations and maintenance perspective, as users' understanding of existing systems and lessons from other projects can be valuable and avoid repetition of previous mistakes. Applying human factors expertise and end user engagement is a useful approach to review and fine-tune designs.

4.1.2. Accessibility

Good interchange design creates an accessible environment for all members of the community. It is also critical to accommodate people travelling with prams, luggage, bicycles, and other common items. Accessibility considerations should not only consider mobility, but all activities associated with interchange users.

Figure 28: Provide accessibility for prams or other common items people may have with them. Source: Lorelei Schmitt.

Detailed design guidance on minimum requirements for provision of an accessible built environment is in standard NZS4121:2001 Design for Access and Mobility: Buildings and associated facilities. However, this standard covers minimum provision for mobility access only and further consideration is required to meet the aims of Universal Design.

Accessible interchange design requires consideration of the following:

- **Location and design:** The interchange should integrate well with surrounding land uses and enable access by disabled people. This will likely require accessible parking and PUDO.
- **Layout:** The interchange should provide safe and attractive routes that align with desire lines. These routes should be wide, even, unobstructed, and direct. Step-free access should be provided by appropriately graded ramps or lifts. Lift design needs to consider all users, including being of an appropriate size to accommodate large equipment such as mobility scooters and cargo bikes. Consider shade and shelter along walking routes and convenient and comfortable resting places along longer routes.
- **Boarding and alighting areas:** These areas should include comfortable waiting areas with seating. The design of bays, platforms and wharves should facilitate easy and seamless access for all.
- **Emergency procedures and safe egress routes:** These should be considered with all people in mind, including, for example, lifts being or becoming unavailable.
- **Good quality accessible information:** Information should enable all people to plan, choose and use the transport service they require. Service information should be made available in at least two different forms (for example, embossed characters or Braille) or by audible talking signs. Inductive loops should be indicated by a sign with the international symbol for inductive loops.
- **Wayfinding:** This should be intuitive, supported by clear signage, tonal contrasts, and use of tactile surfaces as appropriate. Accessible routes and facilities should be clearly signposted.
- **Tactile ground surface indicators** should be used to support wayfinding (directional tactile) and to warn those with vision impairments about hazards like train platforms, cycleway, and footpath edges (warning tactile).

  The bus stop section of the PTDG includes the most current guidance for bus stop tactile layouts. Guidance for use in other contexts is offered in: RTS14: Guidelines for facilities for blind and

vision impaired pedestrians may 2015 and standard NZS/AS 1428.4.1:2009 Design for Access and Mobility: Part 4.1 – Tactile ground surface indicators and also in the Pedestrian Network Guidance.

Note that as shown in the image below warning tactile is often deployed along the entire length of train platforms, though with appropriate setback. More recently a number of councils have opted to provide similar treatments at bus stops at busier bus interchanges which is being well-received by the visually impaired community.

- **Lighting and surfaces:** The interchange should have good lighting and slip-resistant surfaces.
- **Toilets:** Some passenger toilets should be easily accessible by disabled people and include changing places for disabled adults and facilities for people travelling with babies and young children.
- **Ticketing:** Ticketing facilities should account for the needs of all users.

We strongly recommend that an independent accessibility audit is undertaken during the planning and design stage of each public transport interchange.

Further information

- *Auditing Public Transport Accessibility in New Zealand*
- Changing Places, Fully accessible public bathrooms

Figure 29: Tactile ground surface indicators along the length of a train platform. Source: Jacobs.

4.2. Spatial design

Effective spatial design plays a significant role in the logic and quality of passenger movement. An interchange layout should be intuitive (self-explaining). Passenger movement and interchange legibility should be supported by, and not rely on, signage and wayfinding. For some interchanges, this

may not be easy to achieve (for example, where space is constrained). In these cases, particular care should be put into enhancing the connectivity between spaces and optimising legibility.

Within an interchange, the design of the physical area between different transport modes or components of the interchange facility are essential to a whole journey experience. By following good practice, the design will provide a seamless journey and clear transition for passengers using transport facilities and accommodate the needs of each mode.

As walking is the main mode for moving between modes, transition spaces can be an enjoyable environment with retail, greenery, artwork, and seating areas.

4.2.1. Passenger activities and interchange zones

Identification of the impacts interchange functions have on different public spaces within a public transport interchange is critical to planning and designing these spaces. The interchange comprises three connected spaces:

- **Decision spaces** are where the passenger decides what they will do next such as entrances and corridor intersections. These locations should have clear sight lines, clear signage and accessible transport information.
- **Movement spaces** connect decision spaces. Typically, they include corridors and paths reserved for passenger movement and connections to, from and between transport modes or the surrounding area. These spaces should provide clear, unobstructed routes.
- **Opportunity spaces** are those areas of the interchange zone outside the core decision and movement spaces. They accommodate cafés, retail entrances, retail displays, seating and landscaping.

The needs of a typical passenger as they pass through an interchange can be represented in the three key zones of an interchange:

- access and interchange zone
- facilities zone
- boarding and alighting zone.

Depending on the context, layout, scale and spatial constraints of an interchange, these zones may not be in physically separate areas. The extent and quantity of facilities within each zone can also vary.

The spatial organisation of an interchange should recognise the needs of all users. For example, passengers entering the interchange should be presented with the time of day, departure information, the means of obtaining a ticket, retail opportunities, the ticket gateline or card validator, and clear directions to the departure area.

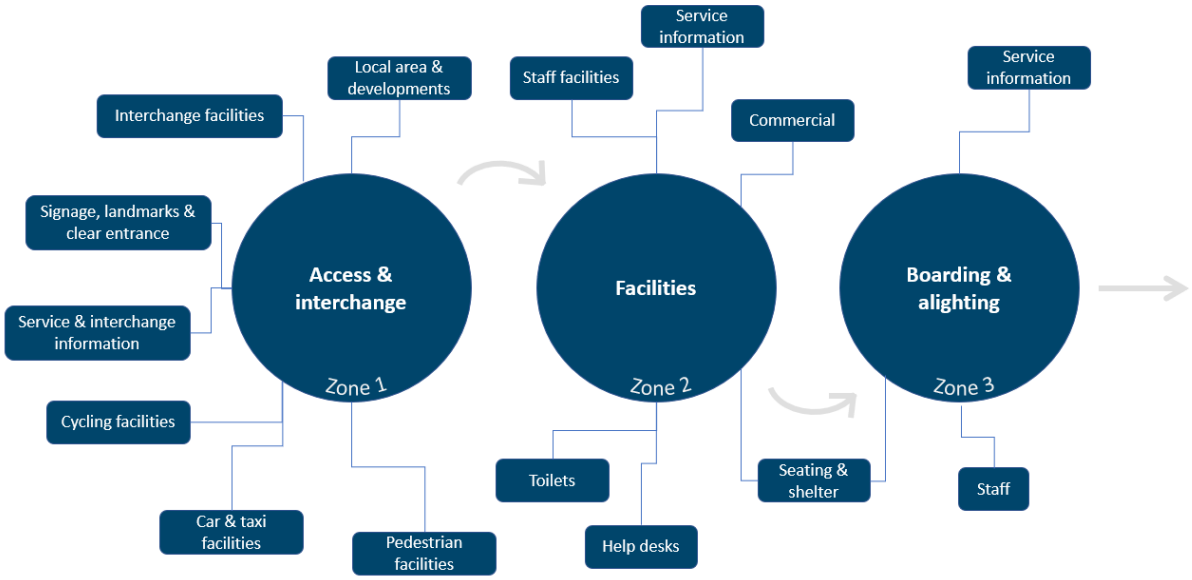


Figure 30: Three key interchange zones

The typical activities or facilities found in the three key zones are described in the table below.

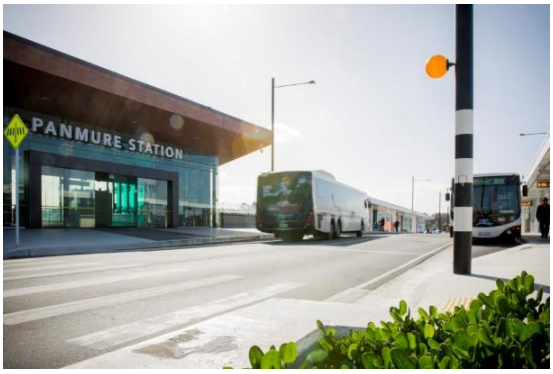
Table 8: Typical activities or facilities found in each of the three key zones.

Zone 1: Access and interchange
This zone acts as a gateway between the station and its surrounding environment. The arrival zone may include the street and approaching paths for cyclists and pedestrians, interchange stops, vehicle drop-off areas and pedestrian forecourt space. Safety, universal access, wayfinding, and amenity are key to a successful zone. Important requirements are: • clear, unobstructed routes, which should follow desire lines, to external destinations and to and from station facilities in Zone 2 • legible entrances • sufficient information to aid passengers accessing station facilities and transferring between services • facilities for first/last mile transport (for example, vehicle and cycle parking).
Zone 2: Facilities
This zone ensures the primary travel needs of passengers and station visitors are met. Facilities such as travel information, waiting areas, toilets, left luggage, retail, and food and beverage services should follow a logical grouping based on the needs of passengers. Waiting areas should be well lit and sheltered from the wind, rain, and sun. Passengers should feel comfortable and secure in waiting environments. In locations where temperatures may become especially high and there is little natural ventilation, air conditioning may be appropriate.

Zone 3: Boarding and alighting
This zone is primarily for entering and exiting vehicles. At this stage of a journey, passengers have the means to travel and should be well informed. All that remains is to ensure timely departure information is available and safe boarding and alighting is facilitated. For some interchanges (particularly rail) access between Zones 2 and 3 (platform) may be separated by automatic ticket gates. This separates the paid and unpaid areas of the concourse. Other interchanges may not separate these zones, and main waiting areas may be on platforms rather than with other interchange facilities. In some cases, interchange activity occurs within Zone 3 only (for example, changing between services at the same platform).

At some interchanges it may not be feasible or desirable for the interchange zones to be physically separated. This is illustrated in the following examples:

Distinct zones – Panmure Station

Zone 1: Access and interchange	
 *Figure 31: Panmure Station – access and interchange zone. Source: Auckland Council* Our Auckland.	Features of this zone include: • crossings and pavement support station walkability. • local stops, PUDO and Park & Ride facilities on the streets surrounding the interchange. • the station is clearly signposted for legibility. • a high-quality surrounding public realm. • interchange information visible at the entrance.
Zone 2: Facilities	
 *Figure 32: Panmure Station – facilities zone. Source: WSP.*	Features of this zone include: • a ticket booth, retail kiosk and toilet facilities available in the central concourse. • directional signage to platforms.
Zone 3: Boarding and alighting	
 *Figure 33: Panmure Station – boarding and alighting zone. Source: Beca and Auckland Transport.*	Features of this zone include: • a separate zone for boarding and alighting, which is commonly seen at larger interchanges and those with few spatial constraints. • seating on platforms. • ticketing machines available to top-up cards or purchase trips. • tagging poles for fare collection. • a help point clearly signposted in orange. • directional signage to the concourse. • real-time information is provided.

Combined boarding and alighting and facilities zones at Sunnynook Station

Zone 1: Access and interchange	
 *Figure 34: Sunnynook Station – access and Interchange zone. Source Aurecon.*	Features of this zone include: • cycle parking • PUDO and accessibility parking • local interchange stops on an adjacent street (not shown in the image) • clear signposting of the interchange (not shown in the image)
Boarding, Alighting and Facilities	
 *Figure 35: Sunnynook Station – combined boarding and alighting and facilities zones. Source Aurecon.*	Features of this zone include: • combined standard boarding and alighting and facilities zones, which is generally seen at smaller railway stations and some bus stations. • ticketing machines and interchange information available on the platform • seating and shelter with sufficient space for queuing, boarding, and alighting.

Indistinct zones – on-street facilities at the Lower Albert interchange

On-street interchange	
 *Figure 36: Lower Albert interchange. Source: Auckland Transport.*	Features of this zone include: • Access zones unnecessary as interchange is integrated with surrounding land uses – cycle parking may be provided, and car parking is rare. • Seating and shelter are placed with enough space to allow for pedestrian through movements behind and for queuing/boarding and alighting space in front. • Transport information is available within shelters (including real time information). • This is normally only seen at on-street interchanges and very small interchanges.

4.2.2. Capacity provision

Interchanges should be designed to accommodate expected passenger demand and to enable preparation of contingency and station management plans to accommodate growth beyond the life of the implementation project. Design should be based on a stated level of service as shown below:

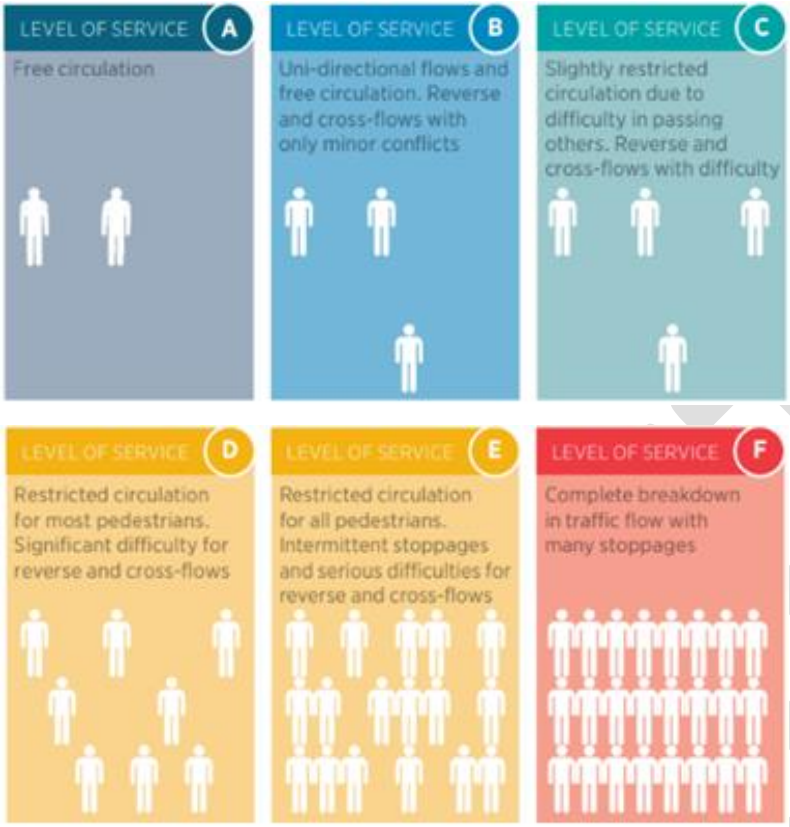


Figure 37: Levels of service for interchanges. Source: Auckland Transport Public Transport Interchange Design Guidelines *(2013).*

When planning or designing an interchange or station, designers should consider, in addition to current usage, various operational scenarios:

- future growth and travel patterns
- contingencies
- events such as:
    - service disruptions and the simultaneous arrival of passenger vehicles and the passenger surges this creates.
    - the breakdown of critical interchange elements such as escalators and lifts
- fire alarm and emergency evacuations, which often provide the critical passenger flows and infrastructure sizing for the safe design of an interchange.
- potential development opportunities or constraints associated with the environmental context for example, open spaces or interfaces with rivers and streams, surrounding or near the interchange.

The design, location, and layout of passenger facilities in an interchange have a significant impact on the customer experience of all interchange users. Facilities must be safe, accessible, and simple to use for people of all abilities and skills. Quality design should provide intuitive and user-friendly facilities that meet the needs of all passengers.

4.2.3. Visibility

Good visibility within, to and from an interchange is important to consider when designing an interchange that feels secure, is accessible and is easy to use. Within the interchange, this means providing clear sightlines along desire lines and using transparent materials and good lighting. It can

also mean positioning ticket offices, the operations room and even driver facilities within sight of as much of the public area as possible.

Visibility is an important component of other key design principles, namely wayfinding, safety and security and connectivity. Consider throughout interchange design, visibility:

- within the interchange (which enables passive security and wayfinding)
- to and from oncoming public transport services (which is required for legible and easy-to-use public transport) and so people can see service head signs
- of signage (which enables effective wayfinding).
- within the vehicle operations area, particularly between different stops, platforms, or wharves (which enables efficient interchange operations).

Figure 38: Bulls bus station supports clear visibility design principles. Source: Lorelei Schmitt

4.2.4. Safety and security

The safety and security of all users at an interchange is paramount in design – everyone using a public transport interchange, whether customers, drivers, staff or passers-by, should be able to do so without fear of injury or accident. Interchanges should be designed considering the need to reduce the safety risks of using, operating, and maintaining interchanges. These safety risks include those posed by mode conflict (see **section 3.3.3**), crime and other security issues or from hazards with potential for accidental harm.

Crime prevention through environmental design – strategies and design approaches

Crime prevention through environmental design (CPTED) is the application of design and built environment techniques to reduce the incidence and fear of crime. The core principles of CPTED are surveillance, access control, territorial reinforcement and maintenance, and quality environment. Application of these principles to interchange design can support the provision of safe and secure environments for all people in an interchange environment. The overall design influences the opportunity for crime and the fear of crime for users moving through the facility.

Consider the four overlapping CPTED strategies when designing an interchange:

- **Natural surveillance:** People are less likely to commit crime if they believe they are being watched. People will also likely feel safer if they think people can see them. Natural surveillance is a design concept directed primarily at keeping intruders easily observable (‘see and be seen’). This concept is promoted with features that maximise the visibility of people, parking areas and

building entrances; doors and windows that look out on to streets and parking areas; pedestrian-friendly footways and streets; front porches; and adequate night-time lighting.

- **Territorial reinforcement:** A clear definition of space enables users to feel a sense of territorial control while discouraging potential offenders from perceiving control within interchange areas. Physical design can create or extend a sphere of territorial influence to reinforce these areas of perceived control. Defining property lines and establishing clear boundaries between private spaces and public spaces can be achieved with features such as landscape plantings, pavement designs, gateway treatments and barriers.
- **Natural access control:** Preventing access to an area using natural access control methods increases an offender's perception of likely detection, so decreases the likelihood of crime to be committed. This is achieved by clearly defining approaches to areas within and surrounding an interchange facility to provide a natural indication of where people are allowed and not allowed.
- **Target hardening:** Features can be implemented to prohibit entry or access and make an interchange less attractive to target. Features include window locks, dead bolts for doors, interior door hinges, alarm systems and more active security measures such as on-site security guards.

The four strategies are incorporated into the following CPTED design approaches:

- Provide for safe movement through the interchange with:
  - entrances and exits to buildings that are safe and accessible without compromising security,
  - layouts that support legibility and avoid potentially confusing changes of direction or in height,
  - all areas having well-signed alternative routes or exits to avoid entrapment, and where potential entrapment spots cannot be designed out, signage that warns people.
- Provide good visibility in and around the interchange with:
  - views that are not obscured by obstructions that provide hiding places for potential offenders,
  - pedestrian tunnels and underpasses that have end-to-end visibility,
  - columns and other visual obstructions kept to minimum dimensions,
  - glazing used to maintain sightlines.
- Locate activities requiring additional security, such as payment facilities, at areas with high volumes of foot traffic and take advantage of natural surveillance within the safe area.
- Reinforce natural surveillance so passengers can see and be seen (for example, interfacing commercial and retail activity).
- Choose finishes to maximise the sense of spaciousness, light and airiness (and to avoid dead space and dark corners).
- Use good design and quality materials to create a busy and attractive space and ensure regular maintenance to keep places attractive and safe.
- Define space ownership clearly to limit vandalism, graffiti and antisocial behaviour and have a layout that does not create left-over spaces where ownership is unclear.
- Provide good quality lighting (see **section 4.4.5**).
- Consider using surveillance equipment as well as clearly visible and identifiable help points (see **section 4.4.4)**.

CTPED strategies and design approaches will not be relevant at all interchanges with options typically more limited at on-street facilities. Obtain site-specific advice from crime prevention professionals and incorporate it into final designs.

We recommend that an independent CPTED safety audit is undertaken during the planning and design of each public transport interchange.

Further information

- National Guidelines for Crime Prevention through Environmental Design in New Zealand: Part 1 – Seven qualities of safer places (2016)

Additional design areas to consider include:

- effective drainage design and use of non-slip surfaces
- fire safety infrastructure and access for emergency vehicles
- spatial layouts and infrastructure that enable rapid evacuation in an emergency
- spatial layouts that can facilitate and enable social (physical) distancing.

Safety and security for LGBTQIA+ people using public transport

The needs of all people, including the LGBTQIA+ [2] community, need to be considered in public spaces. Non-binary and trans people are particularly more likely than others to report being harassed or attacked while using public transport. Engagement with local LGBTQIA+ people to incorporate their experience and presence in their own way will help to design public space that can be welcoming to and for all people. Good design promotes inclusion without the need for excessive security or a police presence.

Further information

- Evidence about harassment and fear of attack while using public transport, from a 2018 survey: Counting Ourselves (2019)

4.2.5. Connectivity, Legibility, and Wayfinding

The main reason people use public transport interchanges is to move to, from or between public transport services. Interchanges should provide efficient connectivity to and between transport services by minimising interchange time and distance, reducing the risk of conflicts between modes and providing clear wayfinding. Consider also wider network connectivity and the role of the interchange in that wider network.

Wherever the public join or leave the public transport system, be that at a public transport interchange or an individual mode station or stop, a strong theme and brand should be apparent. Pay particular attention to how the public transport space interacts with the footpath and adjoining buildings.

[2] LGBTQIA+ stands for lesbian, gay, bisexual, transgender, queer (or questioning), intersex, and asexual with the plus (+) sign representing other gender identities and sexual orientations (such as gender-fluid, pansexual and non-binary).

Figure 39: Convenient and obvious wayfinding information. Source: Jacobs.

Figure 40: Wallaceville Station highlights the station name repeatedly, and with artistic touches, so it's clear from a variety of vantage points along the platform. Source: Lorelei Schmitt.

The legibility of public transport interchanges is critical if the public transport system is to be easy to use. Many factors contribute to legibility, including interchange space allocation, wayfinding, interchange layout and stop allocation. Network legibility is also important and is affected by various factors such as route numbering and naming, timetabling and network structure.

Consideration of how people will move into, away from and within an interchange is critical for efficient customer movement. Wayfinding in an interchange facilitates the most efficient customer movement to, from and in the facility and should be intuitive (self-explaining) to minimise the amount of signage required. Carefully chosen materials and lighting can support signage in providing legibility.

The following examples from Panmure Station and Manukau Bus Station illustrate some of these concepts using design shortcomings.

Figure 41: Panmure Station central concourse. Source: WSP.

Panmure Station

Panmure Station has escalators in four separate locations within the central concourse, and internal structures often block visibility to the escalators. The direction of the escalators is not obvious from the station layout, so must be marked to be more obvious and rely on multiple forms of wayfinding signage.

Figure 42: Manukau Bus Station – station arrangement leads passengers toward a dead end

Manukau Bus Station

The arrangement of the station and its waiting area naturally leads passengers to the end of the corridor shown (to what looks like a door at the end). However, there is no exit there, so passengers must walk back to the centre of the waiting area to find an exit.

Figure 43: Manukau Station rain protection does not match desire lines and obscures the train station name. Source: Duncan Rothwell

Manukau Bus Station

In the area between the Manukau Bus Station and the adjacent train station, the rain shelter is located to the side of the crossing and does not follow desire lines. As a result, it offers little to no useful protection for users. The pedestrian canopy between the two interchanges, although well intended to protect pedestrians from the weather, does not achieve this function. It also obscures the name of the train station and could negatively affect legibility.

Branding is vital in establishing public transport user loyalty, so should be repeated within the wayfinding in a public transport interchange.

The design considerations in the following table influence the legibility of an interchange.

Table 9: Legibility design considerations for interchanges

Subject area	Impact
Signage and wayfinding	Wayfinding signage and local area maps guide passengers to the interchange, from the interchange to other local points of interest and transport facilities (such as bus, ferry and taxi facilities), and within the interchange to services and facilities. Wayfinding can be reinforced using the built form and materials to enable intuitive navigation to important points of interest in and around the interchange. Where possible, buildings should be oriented to create sightlines to local landmarks or natural features to aid passenger orientation and wayfinding.
Information	Interchanges should convey sufficient information on the public transport serving the interchange and its facilities, as well as their operating times, to inform the unfamiliar traveller. This information must be easy to understand and accessible to all.
Branding and consistency	Strong branding reinforces user confidence in using interchanges by displaying a recognisable and unified identity. A consistent look and feel helps people to interact with public transport systems more successfully, quickly and predictably. Branding can be achieved for an area's public transport system and infrastructure by adopting common design themes, a common approach to spatial organisation, a common palette of materials, modular components, and common public realm elements.
Frontages and entrances (off-street facilities)	Interchange buildings should present, wherever possible, active frontages to surrounding pedestrian routes. Interchange entrances should be clearly identifiable from the roadside and surrounding areas.
Integration with the public realm	A public transport interchange often serves as a recognisable landmark with strong neighbourhood identity. Integrating interchanges with adjacent buildings, green infrastructure, consistent design features from the surrounding area, and existing networks (that is, legible integration with access paths, street connections and public transport routes) dramatically enhances the public realm.

Design principles used in the fields of road sign design and human factors design are applicable to wayfinding design, so should be used whenever possible. Consider the following:

- **Recognisable and consistent signage:** Three sign design principles (familiarity, compatibility, and standardisation) have been shown to influence users' comprehension of signs. Both familiarity and standardisation are enhanced through recognisable, consistent signage.
- **Wayfinding and traffic control devices:** These devices (for example, a road sign or road marking) should be differentiated, because the rules for the design and use of these two devices is different.
- **Clear information:** The following factors influence the ease by which people can comprehend icons:
    - familiarity – frequency of encounters
    - concreteness – depicting objects in the real world rather than in abstract forms
    - simplicity – amount of detail
    - meaningfulness – relevance or instructiveness
    - semantic closeness – the relatedness or closeness of the symbol to what it represents.

- **Clarity, conciseness and consistency:** Follow style rules for consistent formatting, use of grammar, fonts, colours, spacing, words per wayfinding board, and visual complicity (being easy to see).
- **Increase detail:** Wayfinding measures work in a hierarchical environment where more detail needs to be provided, the closer the person gets to the destination.

4.3. Access to the interchange

4.3.1. First and last mile

Travelling to and from public transport is crucial for each public transport journey. The parts of the journey where passengers travel from their origin to board public transport and travel to their destination after disembarking are known as the 'first and last mile'. These first and last mile connections are important for passengers to enjoy their public transport journeys and can be affected by:

- the distance between the origin or destination and the public transport stops or station
- the level of comfort and universal access along the connecting route
- the availability and attractiveness of alternative travel options (for example, taxi, feeder bus services and Park & Ride facilities)
- passengers' perceived or actual safety in accessing public transport.

Access should be provided by following the access hierarchy illustrated below. The hierarchy is an indicative guide to the proximity and level of amenity of first and last mile infrastructure for each mode and is a key component in planning the layout of a public transport interchange. Designers also need to recognise that sometimes certain modes need to be managed to maintain safety and operational efficiency.

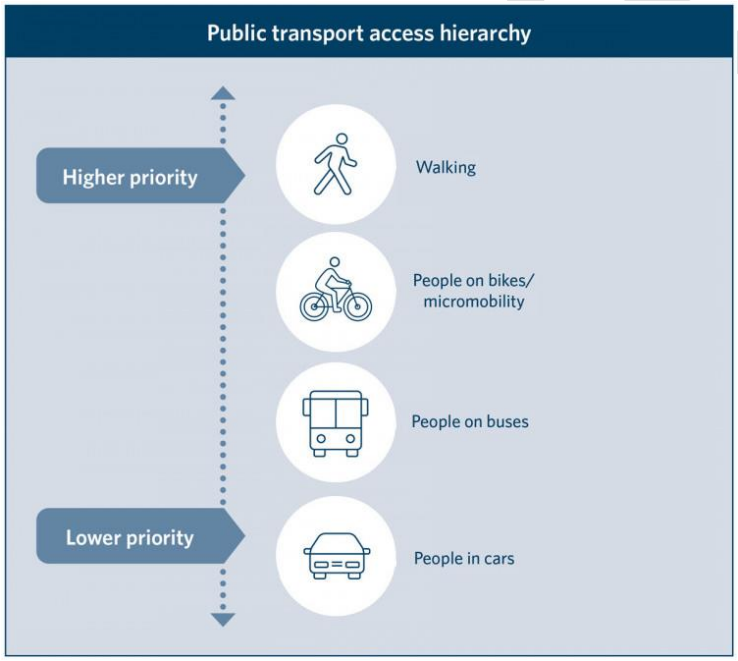


Figure 44: Public transport access hierarchy. Source: Waka Kotahi public transport design guidance.

The location and category of the interchange are also important considerations when designing for access.

At City Gateway and Destination Gateway interchanges, access for cars should generally be limited to PUDO by taxis and ride-shares and accessible parking. Facilities for general PUDO and Park & Ride at these interchanges is not recommended.

At Local Gateways and Dedicated Transport Hubs, PUDO can significantly increase access to the public transport network. Park & Ride can also be considered if it aligns with current and future aspirations for land use.

Further information is in the Public Transport Design Guidance topic Getting to and from public transport.

Provision for people using bikes:

Cycle parking can be provided in the many different ways as detailed in the Cycle Parking Planning and Design section of the Cycling Network Guidance.

Figure 45: Bicycle hoop parking by a light rail station in Boston. Source: Lorelei Schmitt.

Cycle facilities are often desirable to achieve a larger active mode catchment and enable greater overall access to the interchange. Appropriate facilities support convenient and safe access in and out of the interchange.

Cycling access can be supported by facilities for storage. These facilities should be located near the interchange station such that they are convenient and easy to navigate to. Consider provision near all entrances and concentrate near primary cycling access routes. Ensure cycle parking does not block pedestrian through routes. Storage facilities should cater for short-term and long-term parking and be contained and covered with appropriate restricted access and security (see **section 4.2.4**) so users feel safe using the storage. Facilities should provide for the needs of the types of cycles and micromobility devices expected to be stored (including cargo bikes, tricycles and e-bikes that can require more space or charging facilities than a standard bike).

The three main types of long-term cycle storage facilities are:

- **individual bike lockers**, which provide the most secure storage and suitable for low numbers of cyclists, but are more expensive on a per user basis, may be less space efficient and may not be fully utilised.
- **restricted access enclosures** can safely store many bikes simultaneously but involve each member of the collective group of bike users having a key to the enclosure.

- **larger storage facilities** cater for a large number of cycles and are generally implemented in areas with high demand, but they usually have only a medium level of security such as CCTV, as a large number of people have access.

Figure 46: Secure bike parking at Wellington Railway Station. Source: Lorelei Schmitt.

To determine an appropriate number and type of cycle parking or storage facilities, observe demand at existing interchanges. If you see people locking their bikes to street furniture such as sign posts, trees or fences or that use of formal bike parking is more than 80 percent, install additional cycle parking or storage.

For new interchanges, assume higher demand at rapid transit stations and terminus stations. Ideally include space for additional parking/storage to be constructed later, as needed. Consider that bikes are often left for long periods at terminus stations so higher quality security and weather protected facilities may be necessary.

For more information on cycle storage facilities, see Cycle Parking Planning and Design.

See also the Public Transport Design Guidance: Getting to and from public transport, specifically planning and design for People on bikes and micromobility.

Note that cyclists may bring their bikes on their public transport journey. People with bikes may also change between different services or modes. Therefore, interchange design should consider how a person with a cycle might enter and move within the interchange and access platforms. Consider also that modern bicycles may be longer, have wider handlebars, or be heavier than traditional bicycles.

Provision for people in motor vehicles

Vehicle access facilities must consider all levels of user ability and provision must be made for designated accessible parking and PUDO within an accessible distance of the main interchange entrance.

Provide motorbike parking separately to discourage use of the bike parking.

If a general PUDO facility is provided, locate it within a short walking distance of the main interchange entrance. Unless demand justifies a dedicated taxi rank, PUDO by taxi should occur within the PUDO facility.

Further information

- Cycle Parking Planning and Design
- Public Transport Design Guidance topic: Getting to and from public transport

4.3.2. Interface with land use

Land use and transport are mutually dependent disciplines, with multiple synergies with respect to location and design:

- **Location:** Best practice is for public transport interchanges to be co-located or as near as possible with existing centres and areas of higher density. Future centres and areas of high density should also be planned in locations where interchanges can best be integrated with them.
- **Design:** Best practice is for public transport interchanges to be highly integrated with adjacent land uses and street networks to facilitate easy access and promote the attractiveness of public transport.

Interchange location and design should realise synergies with the public realm and urban form, enabling opportunities for enhancement of local amenity, functionality, identity, and place-making. This can include design elements such as public art that acknowledge local history, heritage, and culture.

Local iwi should be consulted to determine whether the location has historical or cultural significance that could be highlighted and celebrated and realise story-telling opportunities.

Further guidance

Hononga ki te Iwi | our Māori engagement framework.

Location, access and land use mix and density are fundamental elements to consider when determining the benefits from increased integration of an interchange with local land use. International examples show that successful integration of public transport with the urban form requires:

- development towards a long-term vision
- medium to high density development, with the station as a central or focal point of an integrated mixed-use master plan
- good connections to reliable, fast and/or frequent public transport services, ideally across multiple modes
- walking, cycling and micromobility prioritised as access modes within a supportive public realm to minimise the need for car parking near the station
- high-quality design of station facilities, surrounding public realm and supporting developments that create a people-focused urban environment that is safe, legible, well connected, and attractive.

The integration of interchanges with land use is realised most fully in Transit-Oriented Development. This is a development located immediately next to a public transport interchange and that is planned and located to prioritise and maximise public transport as the main mode of access. It promotes a more compact urban form.

Further guidance

People, Places and Movement: Integrated Public Transport and Urban Form

4.4. Typical facilities

The types of facilities required at an interchange are unique to the location of each interchange and should reflect the type of services provided and demand from expected peak patronage. Amenity at each individual interchange should be functionality focused and driven from the perspective of the user.

Facilities need to consider the interchange category, alongside its location and level of demand:

- **City Gateway interchanges:** Facilities should be planned to accommodate the number of passengers using these interchanges. Detailed consideration should be given to the level of information provision required to support access by occasional passengers, visitors, and people making transfers and connections.
- **Destination Gateway interchanges:** These interchanges typically require a higher standard of information facility to help infrequent passengers. Review the primary attractors and generators

served to identify the need for specific facilities (for example, passengers travelling to a hospital are more likely to need seating).

- **Local Gateway interchanges:** Additional security facilities may be required to mitigate the impact of lower patronage levels on natural surveillance, particularly if evening usage is particularly low.
- **Dedicated Transport Hubs:** A high priority needs to be given to information provision to assist passengers making transfers and connections. Additional amenities may be needed if alternatives are not available locally (for example, toilets and retail services).

When designing an interchange, passenger facility considerations should include:

- waiting areas – shelter and seating.
- fares and ticketing – ticket machines and boarding and fare collection systems.
- signage and information – signage and information provision.
- security and safety – CCTV and help points.
- general amenity – other facilities such as lighting, toilets, and retail outlets.

These considerations are discussed in the following sections.

In addition, facilities should be considered for:

- Universal Access – ramps, lifts, and accessible facilities (refer section 4.1 Designing for everyone)
- first and last mile access – cycle storage and vehicle parking (refer section 4.3.1 First and last mile)

4.4.1. Waiting areas

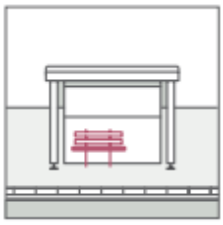


Figure 47: Schematic of a bus shelter with a seat

Shelter should be provided at all interchanges to afford passengers some protection while waiting to board services. Shelter can also assist safety by separating areas of conflicting use. Shelter design should balance reasonable amenity and comfort for users with robust and maintainable materials and designs.

Where the interchange configuration requires users to walk between services and modes, shelter from wind, sun and rain along the route is recommended, wherever possible.

Seating should be in waiting areas as close as possible to and in view of boarding points. Seating should be fixed and arranged in a manner that does not obstruct pedestrian flows or passenger access to information, while allowing space for wheelchairs, prams and luggage.

4.4.2. Fares and ticketing

Figure 48: On-board payment with Wellington's Snapper ticketing system. Source: Greater Wellington Regional Council.

Fare collection methods are usually decided and implemented on a regional, city or system-based level. The three main methods are as follows:

- **On-board payments:** Passengers board a service and make a cash payment, present their multi-trip pass or ticket to the driver or on-board fare collector, or present a smartcard to an electronic fare payment device to tag on and off.
- **Prepaid ticketing:** Fare collection occurs before boarding, typically at a ticket-vending machine, a staffed ticketing office or an electronic fare payment device. The passenger either pays a fare and receives a proof-of-payment or valid ticket for a given trip or possesses a tagged-on smartcard when boarding a service. This proof-of-payment must be shown to the driver or fare inspector on demand.
- **Barrier-type fare collection:** This form of pre-paid ticketing separates a 'free' or 'unpaid' area from a 'paid' area of the interchange using physical or virtual separation methods. Physical separation uses electronic fare gates, turnstiles, or fare collectors or inspectors who permit entry to the paid area. Virtual separation requires tagging on and off with a smartcard or pre-purchased tickets or proof-of-payment to gain entry to the paid zone.

Figure 49: Ticketing machine in Auckland. Source: Waka Kotahi.

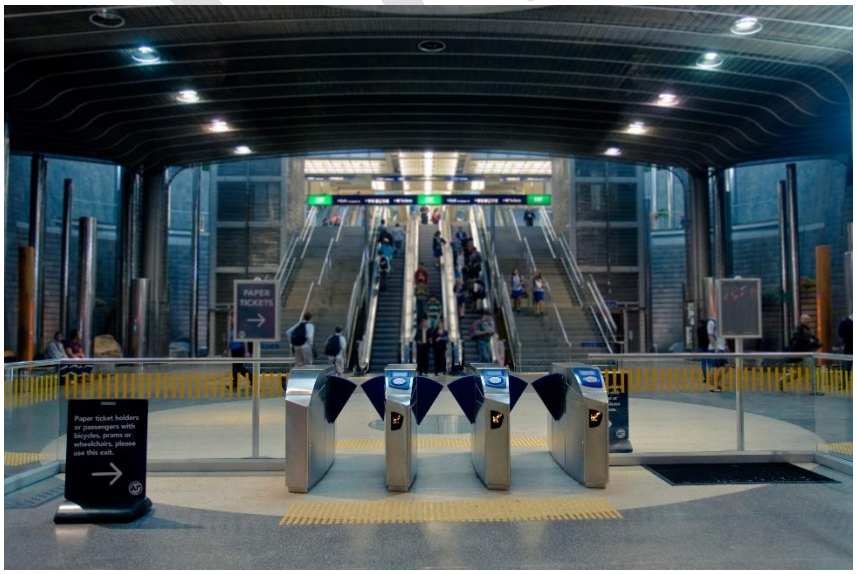


Figure 50: Barrier-type fare collection system, Source: Waka Kotahi

The fare collection method or system can affect the interchange layout and public transport operations. An interchange may need to support multiple fare-collection methods or integrate barrier-type fare collection with on-board collection. Collecting fares before boarding enables faster boarding, reduces dwell times and allows for greater person throughput. In addition, barrier-type fare collection significantly reduces fare evasion and promotes safety and security within the interchange.

However, to enable these pre-boarding methods of fare collection, additional infrastructure and facilities must be provided in the interchange. Therefore, the capital and operating costs of such facilities must be compared with the cost and operating efficiency, travel time and likely fare evasion rates of alternative methods.

Off-board fare-collection facilities should be positioned in such a way that they do not impede the circulation or flow of passengers – queue management principles must also be considered. Furthermore, the location and design of barrier-type systems must allow for the needs of passers-by – some interchanges require 24x7 through access for key links such as an overbridge or underpass.

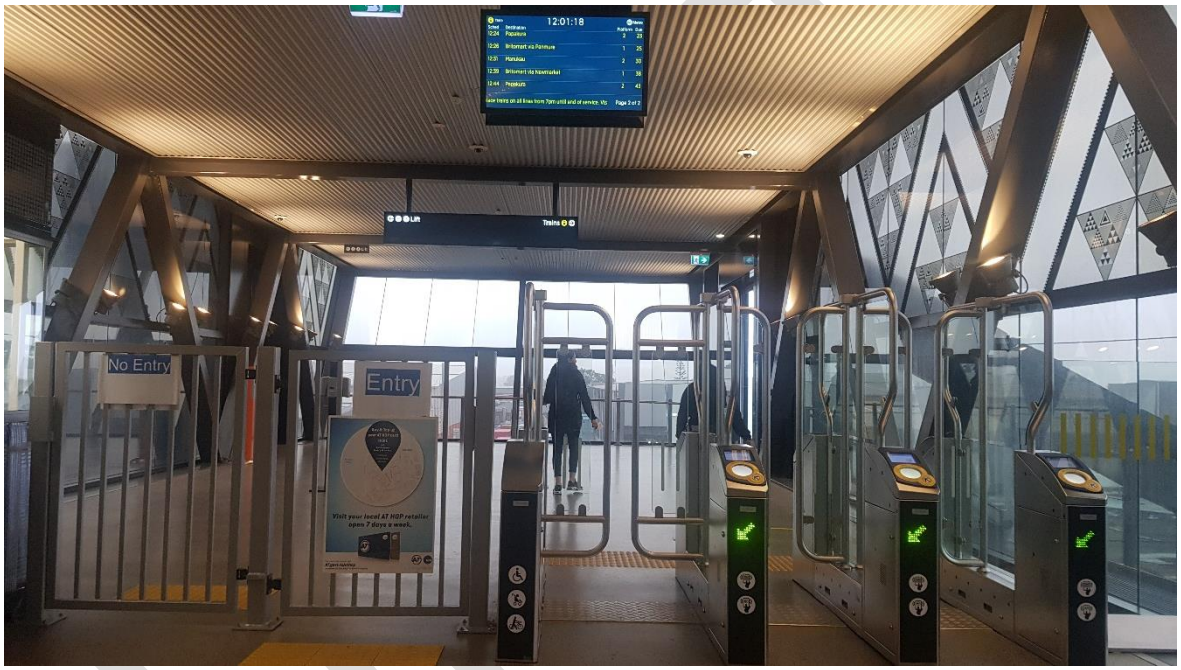


Figure 51: Electronic ticketing gates separate the 'free' or 'unpaid' and 'paid' areas. Source: Aurecon.

4.4.3. Signage and information

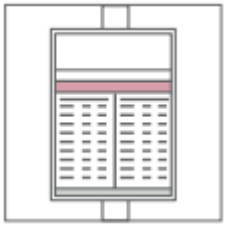


Figure 52: Schematic of a bus schedule sign

Wayfinding signage provides directions, and **service information** provides the 'what, where, when and how much' information that a customer may require to complete their public transport journey. Information is a fundamental requirement for a positive customer experience on public transport.

Public transport information should be easily available, clear, and easy to understand. To meet the needs of all interchange users, information should be delivered across a full range of media, including visual, audio, and tactile forms.

Signage needs to be easy to find if it is to serve its purpose and may be ceiling mounted, wall mounted, free standing, electronic or dynamic. The spatial design should account for the placement of displays, viewing distances, accumulation spaces and passenger circulation routes. Character heights of all directional signage and customer information displays should mean the written text is legible within the viewing cone established for each location.

To assist in passenger orientation for onward journeys in, from and within the interchange all information should be integrated with wayfinding strategies.

Refer: Connectivity, Legibility and wayfinding, section 4.2.5.

Consideration should be given to changing priorities for signage and information in each interchange zone as outlined in the table below.

Table 10: Priorities for signage and information by interchange zone

Zone 1: Access and interchange
High priority considerations • Interchange zone map and signpost. • Clearly legible and visible entry and exit points (off-street facilities). • 'No parking' signage for PUDO bays for people who need it (if provided) and clearly identified for use by passengers. • Directional signage to normal and emergency exits and lift access for people who need it. **Other considerations** • Interchange name sign, opening times and clock. • Directional signage to other transport modes. • Directional signage to local places of interest. • Local area maps with directions to points of interest in the area and that enable passengers to orient themselves with their surroundings.

Figure 53: Clear interchange sign name. Source: Auckland Transport

Figure 54: Directional signage near escalators at Henderson interchange. Source: Auckland Transport

Zone 2: Facilities

Information within an interchange facility or zone can serve multiple purposes, providing service information on the network operations, opening hours and the location of the interchange in the local area.

High priority considerations

- Signage outlining where service connections can be made and facilities (such as toilets and help points), provided in predictable locations.
- Maps showing interchange zones and public transport networks.
- Signage supporting orientations (for example, to the north or south, city bound).
- Fare and ticketing information that is easy for the passenger to find before boarding a service. Optimise the accessibility of this information by positioning it near thoroughfares or under shelter and aligned with desire lines.
- Information provided in large, clear print as well as audio and braille forms.
- Directional signage to normal and emergency exits and lift access for people who need it.

Other considerations

- Markings on footpaths to aid wayfinding.
- Public address systems.
- Help points, customer information desk and ticket kiosks that are positioned in easy to locate, logical and efficient areas and are identifiable to all users.
- Timetable information.
- Static and real-time information on arrivals and departures, provided centrally in the main area.

Figure 55: Signage to buses uses an icon and larger size font but information toward amenities is also offered. Source: Auckland Transport.

Figure 56: Timetable information and local area maps. Source: Auckland Transport.

Zone 3: Boarding and alighting

High priority considerations

- Real-time information that gives passengers confidence that they are using a high-quality public transport system. Real-time information should be positioned in the line of sight of a waiting customer looking towards the direction of the arriving public transport vehicle and should be unobstructed by canopies, shelters or other structures. The display should include a clock.
- Name signs for the interchange and each platform or stop.
- Directional signage to normal and emergency exits and lift access for people who need it

Figure 57: Real-time information display located so passengers can look at it and see the direction of the arriving bus. Source: Auckland Transport.

Figure 58: Clearly numbered platform stop. Source: Auckland Transport

4.4.4. Security and safety

Figure 59: Icon of a security camera

Interchange design should include **security cameras, designated waiting areas, help points and customer service staff** as appropriate for a safe and well-monitored environment.

Security camera systems should be visually discreet, be easy to maintain and provide surveillance to all public areas of the interchange environment. However, the cost of monitoring and complying with legal requirements can be significant. Signage informing people of the presence of security infrastructure within the interchange enhances personal safety and highlights the risk of detection to potential offenders.

Help and customer service zones should have customer service staff or fully accessible help phones and be visible, accessible, and easy to navigate towards.

4.4.5. General amenity

Figure 60: Icon for toilet facilities

It is desirable to include passenger and staff **toilet** facilities at interchanges.

The provision of public toilets located before ticket gates and toilets behind ticket gates should consider the predicted number of passengers, the availability and proximity of existing public toilets, and overall demand on the facility. Toilets located away from interchange zones must be sign-posted in predictable locations.

Water fountains and bottle taps should also be provided near toilet facilities. Separate toilet facilities may be required for drivers – see **section 0**.

Figure 61: Icon for retail kiosk

Retail outlets, mobile and temporary kiosks should be incorporated where possible as they can provide additional amenity and meet customer needs, enhancing the journey experience and providing customers with activity options while waiting. Integrated retail also enhances security, makes the interchange a more attractive and vibrant environment, and can financially support the operation of the public facility through lease payments. Appropriate retail, mobile and temporary kiosks and vending machines must be positioned in a manner that does not affect the safe function and operation of the interchange**.**

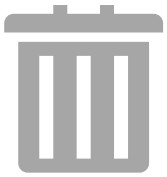


Figure 62: Icon of a rubbish bin

Waste collection bins for rubbish and recycling are a cost-effective method to keep the interchange zone clean and should be provided where possible, particularly at sites where food and drink vending machines and suppliers are on site.

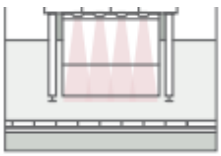


Figure 63: Icon of a shelter

Lighting at the interchange (and along walking and cycling routes accessing the interchange) plays a central role in creating comfortable, safe environments for customers, staff and other interchange users. By enabling passengers to see and be seen, lighting enhances their security and perceptions of personal safety and improves the public transport journey experience. Lighting can also be used to define routes between places and highlight important features and destinations without the need for additional infrastructure. Lighting from retail and other commercial outlets should not detract from these positive effects.

Maximise the availability of natural light, where possible, by using glazing or transparent materials on elevations and skylights. On-street facilities should also make use of existing street lighting and lighting from adjacent land uses.

Lighting at the interchange should:

- comply with Aotearoa New Zealand building standards and relevant codes.
- not distract or interfere with drivers of any vehicles.
- be consistent and high quality for visibility, visual comfort, understanding, safety, security, and adaptation, especially for visually impaired users.
- not produce sudden changes in lighting levels, excessive contrast, glare, dark spots, or pooling, and avoid potential for conflict with obstructions by avoiding highly reflective gloss finishes.
- use white light, where possible, to enhance face recognition and improved visibility.

Figure 64: Icon of a public wireless network

Provision of a **public wireless network and charging points** for personal devices delivers additional amenity and supports passenger access to information and online ticketing facilities. Internet access also helps people to feel safe because they can access help or support if needed (for example, in the case of service disruptions).

The enhancement of the passenger experience should be balanced against the ongoing cost of provision. Charging points should be located in passenger waiting areas, near seating, and covered by natural or electronic surveillance.

5. Designing for public transport vehicles

5.1. Design for bus operations

5.1.1. Requirements for bus operations

Interchanges should be resilient to changing conditions, both during the operational day and throughout the year. Designs must accommodate a variety of operational scenarios such as special events (for example, sporting events), changes to service, adverse weather conditions, and emergencies (for example, a medical event, fire or security threat).

Operational aspects to consider include:

- operational safety, which is essential.
- time spent waiting and transferring, which are the main reasons public transport customers are averse to moving between modes, so the interchange layout should configure vehicle operations to enable easy and intuitive passenger transfers.
- travel time impacts on both customer satisfaction and service operation costs, so the interchange layout should provide for direct vehicle access to platforms and layovers (if provided), without additional circulation time.
- vehicle specifications and design requirements (for example, tracking, platform dimensions and markers)
- route specifications and design requirements (for example, vehicle volumes per route, route directions and destinations, and differences between peak and off-peak volumes)
- reasonable allowance for growth in vehicle numbers and types, changes in vehicle types, service patterns and operations using the interchange in the future (for example, change from single to double-decker buses and from on-board to off-board ticketing).
- future-proofing or design for electric charging areas for public transport vehicles (see the Public Transport Design Guidance topic Battery electric bus charging).
- flexibility for responding to unexpected network changes and differing vehicle and passenger volumes.
- platform design that supports easy access on and off buses for passengers and drivers
- tow truck access for the removal of stranded vehicles.
- driver facilities that are sized and positioned adequately for their planned use (for example, for welfare breaks, rest, meal breaks, or handover and signing on or off) and occupancy, including future proofing.

At an on-street interchange, further considerations are relevant to designing for bus operations in a street environment. For further guidance, see the Public Transport Design Guidance topic Bus stop.

5.1.2. Operational safety

As noted earlier, the safety and security of all users at an interchange is of the greatest importance and safety must be embedded throughout interchange design. Safety considerations come in many forms from road safety to personal safety and security.

Significant safety risks can be posed by conflicts between modes (see section 3.3.3, Managing conflicts), which can be strongly influenced by operational layouts.

Key considerations are:

- designing to avoid or minimise frequency and severity of conflict between buses and direct passenger routes.
- having, as far as practical, all facilities on a single concourse, minimising the requirement for pedestrians to cross vehicle lanes
- minimising bus circulation within town and city centres to and from the bus station to minimise traffic congestion and potential pedestrian–vehicle conflict.

The risks posed by conflicts between buses and pedestrians and between buses can also be managed by considering:

- well-lit and well-signed operational areas.
- good demarcation between operational areas and customer areas.
- clear sightlines for drivers to allow for safe entry, stop, start, and exit.
- easy manoeuvres with a margin allowed for vehicle type variances.
- avoiding vehicle conflict areas or having appropriate controls in place.
- conflicts associated with reversing buses, which can be particularly challenging to control due to limitations of visibility – it is recommended that carefully selected and overlapping engineering controls and operating procedures are applied to the reversing of in-service buses and are enabled by planning and design.

5.1.3. Operational layout

Layout types – DIRO and DIDO

The two main types of bus station design are:

- drive in, reverse out (**DIRO**)
- drive in, drive out (**DIDO**).

Each type has advantages and disadvantages, and either may be appropriate, with design determined by local considerations. Neither design is mutually exclusive, a bus station might use a mixture of both types, although if this is the case, they are generally well separated. For example, at Hamilton Transport Centre, buses DIRO within the central area of the bus station and DIDO on the periphery.

DIRO layouts typically result in pedestrians and passengers moving directly between the main bus station concourse and the platforms. This means pedestrian desire lines can be managed to minimise the risk of vehicle–pedestrian conflict.

DIRO is also likely to limit the footprint of the bus station and allow the concentration of facilities and passengers in one securely managed concourse, without requiring vertical segregation. The design involves buses reversing on departure, and it is essential to address the potential for pedestrians to access the bus carriageway area with control measures and management policy and practice.

DIDO arrangements can have a risk of mode conflict given the propensity of crossing movements, particularly at larger bus stations with multiple passenger islands. The provision of separate islands can also lead to a dispersal of passengers, which reduces the benefits of centrally located facilities and increases the difficultly of providing security cover. These weaknesses of the DIDO layout can be significantly reduced by using vertical segregation to separate bus movements and platforms from main passenger movements and the concourse, but this is usually at a significant cost.

For further information on vertical segregation refer to section 3.3.3, Managing conflicts.

The drawing below summarises the interaction of vehicle manoeuvring lines, (in blue) with alighting passengers desire lines (in red) at a DIRO facility and a DIDO facility with multiple islands.

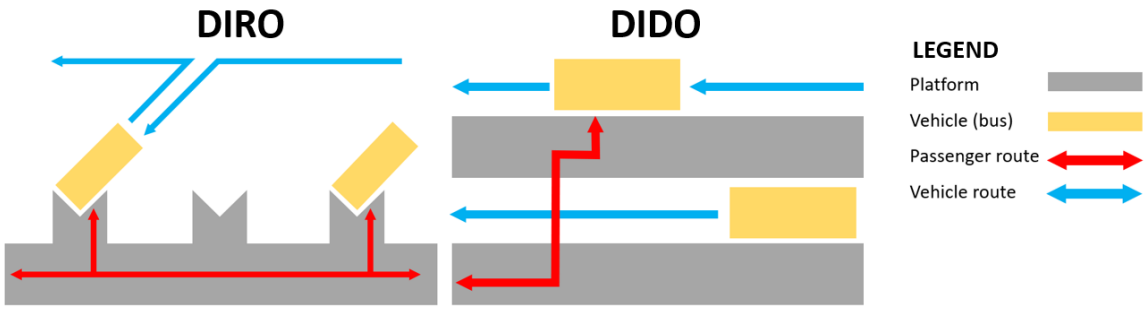


Figure 65: Interaction of vehicle manoeuvring lines (blue) and alighting passenger desire lines (red) at a drive in, reverse out (DIRO) and drive in, drive out (DIDO) facility.

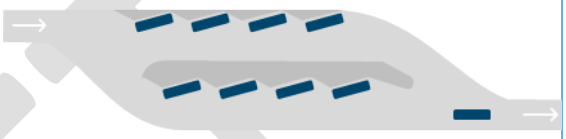
The main advantages and disadvantages of DIRO and DIDO layouts are summarised in the table below.

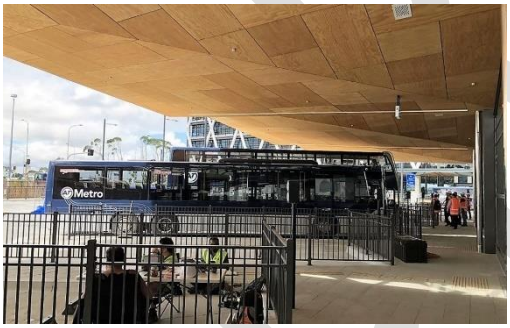
Table 11: Advantages and disadvantages of a drive in, reverse out (DIRO) and drive in, drive out (DIDO) facility.

DIRO	DIDO
Advantages	
• Requires smaller land footprint – more efficient use of space. • Supports management of passenger and pedestrian routes, segregation from vehicle movements and undercover passenger connections. • Is easier to design with a single concourse. • Is readily enclosed, providing full weather protection and improved security (can be closed outside operational hours) if a single concourse. • Enables central provision of all customer facilities and amenities if a single concourse.	• Avoids the riskier reversing manoeuvre (unless required in relation to layover). • Reduces the risk of passengers walking in drivers' blind spots while buses are reversing. • Reduces the risk of collision with infrastructure or vehicles due to parallel parking, without requiring strong management through operational policy and practice. • Requires less dwell time for buses manoeuvring on or off the stand.
Disadvantages	
• Requires buses to reverse on departure. • has increased risk of passenger death or injury, if passengers alighting from a bus enter the bus station apron where buses reverse instead of going to the concourse. • Has increased risk of bus collision with infrastructure or other vehicles due to reversing, so requires strong management through operational policy and practice (for example, give way to reversing buses, enter drive-through lane ASAP, and avoid two adjacent vehicles reversing simultaneously). • Increases dwell time for bus manoeuvring on and off the stand.	• Makes less efficient use of space – may require separate islands and for passenger facilities to be across a roadway. • Is more challenging for managing pedestrian routes, segregating passengers from vehicle movements, and providing undercover passenger connections. • Is harder to design with a single concourse. • is harder to enclose, exposing passengers to inclement weather and providing less security, if it has multiple islands. • Does not enable central provision of all customer facilities and amenities if it has multiple islands.

Platform layouts

Several platform layout permutations are possible for off-street and on-street bus interchanges, in terms of both the configuration of individual bus stopping bays and the arrangement of platforms within the interchange. Representative examples of potential layouts are discussed below.

Linear (drive in, drive out – DIDO)	Shallow sawtooth or forward-exit sawtooth (DIDO)
 *Figure 66: Linear DIDO platform. Source: Aurecon.*	 *Figure 67: Shallow sawtooth or forward-exit sawtooth DIDO at Dunedin interchange. Source: Glen Koorey.*
	
A linear DIDO layout is typically used for on-street bus stops and busway stations where buses stop for only short periods. Bus stops can be independent or interdependent. Independent stops require more space for buses to pull in and out. This design typically needs the most land area (particularly when independent stops are required).	A shallow sawtooth or forward-exit sawtooth DIDO layout uses shallow angled bays (around 30 degrees). It is not commonly used in Aotearoa New Zealand but is generally more land space efficient than parallel bays while allowing independent movement and not requiring reversing manoeuvres.

Deep sawtooth or reverse-exit sawtooth (drive in, reverse out – DIRO)	Drive-through (DIDO)
 *Figure 68: Deep sawtooth or reverse-exit sawtooth (DIRO) at Manukau Bus Station. Source: Auckland Transport.*	 *Figure 69: Drive-through set up (DIDO) in Tel Aviv. Source: Auckland Transport* Interchange Guidelines *(2013).*
	
A deep sawtooth or reverse-exit sawtooth (DIRO) layout is used at off-street facilities only. This design uses deep angled bays (45–60 degrees) and requires buses to drive in and reverse out. This design is used when buses are likely to occupy the stop for longer periods such as at a terminus. Design may or may not allow access from the rear door of the bus.	Drive-through (DIDO) platforms line up in a parallel arrangement. The use of multiple platforms reduces safety and security by spreading customers over many waiting areas and creating more bus–pedestrian conflict points. This design can also lead to greater bus–bus conflict.

Island (drive in, drive out – DIDO)

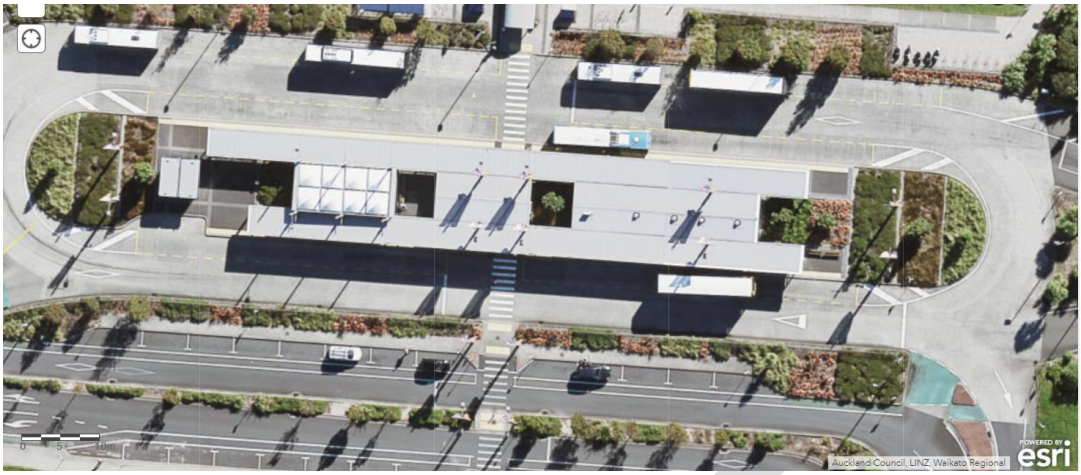


Figure 70: Island (DIDO) set up at Albany Bus Station.

The island (DIDO) layout is used at off-street facilities only. It arranges the platforms around a single island, which can be the main concourse. This design provides good operational flexibility and supports central facilities at the expense of space requirements and potential for pedestrian–bus conflict unless grade-separated access or a concourse is used.

Platform design

Vehicles should be able to align reliably and consistently close and parallel to the platform and stop where passengers expect. Failure to align the bus with the kerb properly means the driver has either had to stop too far away from the kerb or been forced to pull in or out at too sharp an angle. Either of these scenarios can have serious implications for safety and the bus being considered accessible.

Detailed guidance on bus stops and platforms is in the Public Transport Design Guidance topic Bus stop.

5.1.4. Stop allocation

Stop allocation is the process by which routes are allocated to stops for passengers to board and alight or for a layover. The most efficient and best suited bus stop allocation for an interchange requires a detailed understanding of schedules, route structure and passenger needs. This understanding allows stop allocation to deliver sufficient capacity, to accommodate late-running buses without causing congestion, and to support passenger understanding of the transport system.

Stop allocation considerations include:

- space requirements in interchanges.
- vehicle dwell times.
- system legibility for passengers.
- convenience and safety for passengers.
- interchange accessibility.

Conventional interchange planning practice

Conventional interchange planning practice allocates each bus route its own stop. This can maximise system legibility for passengers (who will always find their bus at the same stop) but can be an inefficient use of space with knock-on effects for passengers who experience reduced convenience and safety because of greater walking distances and more dispersed bus stops.

Shared-route bus stops

Planning for bus stops to be shared by routes can substantially reduce the overall size of the bus facility. This may mean several bus routes using a single stop at different times or bus stops with space for more than one bus to use them at the same time.

For system legibility and improved passenger access, bus stops should be organised by common corridors or streets and serve common destinations or geographic areas. It may also be appropriate to brand or communicate key common destinations the stop serves (for example, 'the hospital stop').

Lead-stop operation

Where passengers wait at platforms, they will generally collect and wait at the head of stop. Lead stop operation (where multiple services stop in order of arrival) can be challenging in relation to service recognition, where passengers might need to move to the appropriate location on the platform and hail the driver of a following bus.

The first bay is the 'main' bay for stops long enough to accommodate two or more buses, while the second, third and subsequent bays may be used only during a short peak period. This can be particularly challenging for disabled people, so consider accessibility implications throughout design. Where lead-stop operation is used, it is helpful if buses depart in the same sequence, rather than independently. This allows all customers to be seen by the following drivers who can stop a second time at the lead stop to pick up those customers.

Layover allocation needs

Layover location allocation needs to be considered in relation to bus stop allocation to minimise travel within the public transport interchange and ensure layover vehicles can physically access service stops.

Dynamic and semi-dynamic bus stop allocation systems

Dynamic and semi-dynamic bus stop allocation systems, such as those used in Christchurch and Perth Busport can further reduce bus stop space in terminals and interchanges. These systems use Intelligent Transport Systems to track bus movements and monitor bus stop occupancy to match arriving and departing buses to vacant stops.

For further information on Perth Busport refer to section 5.1.5:

Dynamic bay allocation case study – Perth Busport

Intelligent systems should be implemented in conjunction with appropriate real-time passenger information. Consideration of these systems should include accessibility implications, including the timely announcement of arrival platforms, which must account for the size of the interchange and consequent distances customers might have to move to reach those platforms.

5.1.5. Dynamic bay allocation case study – Perth Busport

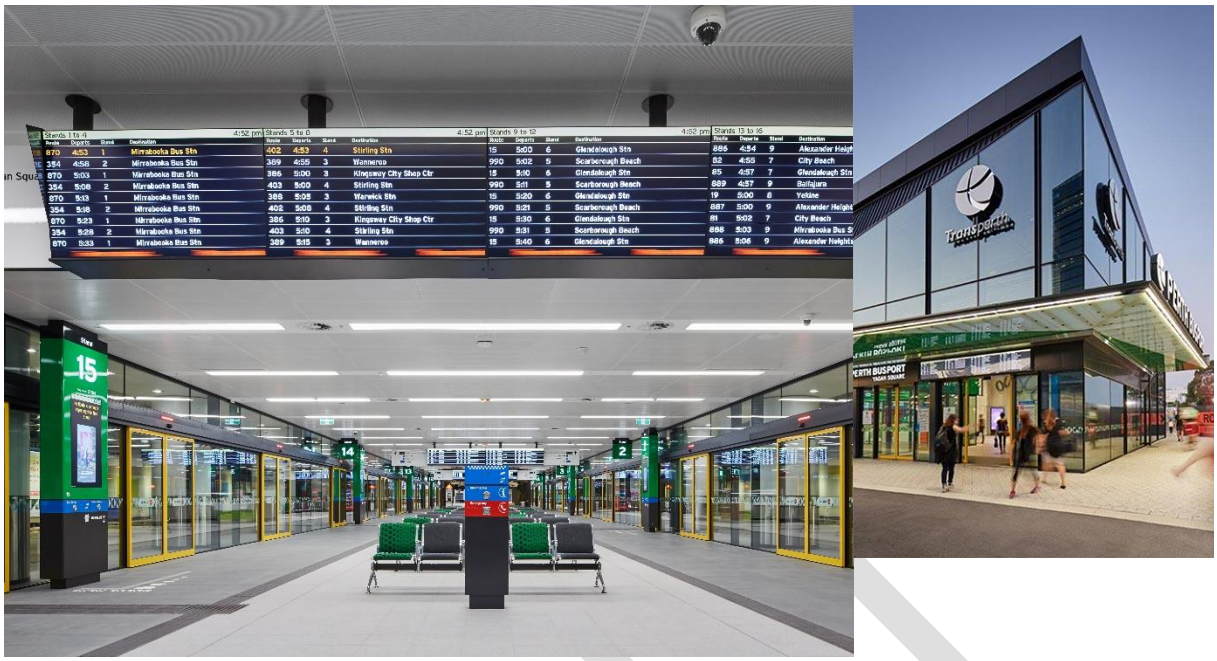


Figure 71: Perth's dynamic bus bay allocation. Source: GHD Woodhead.

Overview

Perth Busport is a major underground interchange that opened in 2016 and cost $217 million. Over 25,000 passengers and 1,300 buses use the facility each day. This interchange is Australia's first bus station using dynamic bay allocation. Dynamic bay management allowed designers to halve the required active and layover stops within the interchange. With 16 bays and 25 layover spaces, the interchange has been designed to operate up to 200 buses an hour.

Over 100 screens around the facility show passengers the bay their bus is departing from and when. Due to the novelty of the design in Australia, wayfinding is an important priority of the station.

System operation

Buses are not allocated on a totally random basis. Bus route groups are permanently assigned to groups of bays. This allows passengers to wait in the same general area for each trip.

Radio frequency identification (RFID) readers are installed at each bay as well as at each entry or exit along with a bay allocation display screen at each location. Each bus is fitted with a unique RFID tag so it can be identified at each location in the Busport. A wi-fi zone around and within the interchange allows buses to exchange trip detail information with the control centre and be appropriately identified and allocated.

- When a bus enters the interchange, an RFID reader at the entry detects it and a wi-fi connection is established. The system sends the bay allocation to the bus driver in the form of a message to the ticket machine and a display at the entry.
- The bus is sent to one of the 16 stands to set down passengers. Buses can set down at any bay.
- When the bus arrives to set down passengers, it is then allocated a layover space.
- When the bus is within a few minutes of its scheduled departure time, a message is sent to the driver telling them to request a departure bay.
- The driver then uses the ticket machine to request a departure bay and is allocated one of four bays in the relevant route group. At this point, confirmed bay allocation information is displayed to passengers on concourse displays and the display at the bay.

In addition to the digital system, a controller oversees bus operations. The controller plays a vital role in assisting drivers and helping them to follow system rules, ensuring passengers receive accurate information and identifying system issues so they can be resolved quickly.

Driver facilities

Facilities for driver amenity and layovers may include:

- driver and staff equipment (for example, cashboxes and ticketing supplies)
- driver parking
- toilets, break rooms and lockers
- layover parking for buses.

Four design priorities are as follows:

- The level of provision must be appropriate for both existing and future service frequency and operating patterns. Consider the interchange type and location. Layover provision is less likely to be a priority at City Gateway interchanges due to space constraints and the requirement for capacity for passengers and in-service operations.
- Layover parking should be located in a manner that supports safe access and usage, including following CPTED principles (discussed in **section 4.2.4**). Layover parking should be located to minimise 'dead running' from and to active platforms.
- Driver amenities should be located close to layover parking for easy access by drivers and without compromising passenger access through the interchange. Consider opportunities for land-use integration with mixed public facilities.
- Electric charging facility requirements, whether permanent charging installations or temporary arrangements, should be considered and engaged on with stakeholders.

Detailed guidance on facilities for layovers and driver amenity is in the Public Transport Design Guidance topic Bus layover and driver facilities.

5.2. Design guidance for rail, light rail transit and ferry operations

Guidance on design considerations for **rail operations** at stations is available from KiwiRail:

- *Standard E-ST-AE-0161: Traction Overhead Clearances: Electrical and mechanical* (2018)
- *Standard C-ST-PL-4109: Commuter Platform* (2018)
- *Standard T-ST-AM-5120: Track Geometry* (2017)
- *Standard T-ST-DE-5200: Track Design* (2019)
- *Standard T-ST-DE-5212: Track Standard Clearances* (2018)
- *T200: Track Handbook* (2017).

There is no domestic guidance on design considerations for **light rail transit operations** at interchanges. International guidance includes:

- Queensland Government, TransLink – Public Transport Infrastructure Manual
- New South Wales Government, Transport for New South Wales – T LR SS 90001 ST: Consistency through the Look and Feel of Light Rail Stops
- New South Wales Government, Transport For New South Wales – T LR RS 00100 ST: LRU 100 Series – Minimum Operating Standards For Light Rail Vehicles – General interface standards
- Yarra Trams – CE-021-ST-0039: Infrastructure – Tram stop platform design
- Yarra Trams – CE-021-ST-0035: Infrastructure – Tram track design.

For guidance on specific design considerations for **ferry operations** at interchanges, see Auckland Transport's Engineering Design Code: Ferry terminal design.

6. Implementing interchanges

6.1. Consenting

The consenting processes for implementing public transport interchanges and stations are specific to the policies and rules in each district plan and the applicable bylaws set by the local authority.

Public transport stations typically require resource consent and/or a designation, so it is recommended consenting requirements are considered during the site selection phase.

If a proposed station is likely to severely affect transport within an area, a Transport Impact Assessment should be undertaken with a view to understanding the implications of the proposal and how it fits in the wider strategy context, including the Government Policy Statements for transport or urban development and the Local or District Plan.

Building works, including the provision of shelters and other structures associated with a public transport interchange, usually require a building consent from the local council or building consent authority. Councils can allow exemptions from building consent requirements. For more information, see section 42A of the Building Act 2004.

Implementation of a public transport interchange or station may require the use of land belonging to private landowners. This requires:

- the land to be acquired through agreement or under the Public Works Act 1981, which gives the Crown statutory authority to acquire land for a public work); for more information on acquiring land, see Land Information New Zealand)
- a long-term lease to be agreed on the land required.

Land acquisition is typically the preferred approach, as it provides greater certainty of tenure for the interchange and minimises ongoing costs. However, leasing may be appropriate where the interchange is co-located with significant retail, residential and commercial activities.

6.2. Consultation procedures

Consultation with stakeholders and affected parties is recommended before any formal resource consent, notice of requirement or traffic resolution process. Consultation can enhance understanding of issues relevant to the site selection and design of a public transport interchange, which in turn can provide opportunities to incorporate measures to avoid or mitigate adverse effects.

Consultation can support the consenting process by building stakeholder support and addressing points of contention. It is best practice to start the consultation process early so design development can be informed by the information gathered and issues identified, thus minimising requirements for design rework.

Section 3.2 offers advice on key stakeholders and affected parties for a public transport interchange see:

Planning and design process: Consultation

Further guidance on consultation can be provided by a communications and engagement specialist.

7. Operations and maintenance

7.1. Operational requirements

The design of an interchange or station must consider operational requirements of the proposed infrastructure. Key considerations include operational efficiency, disruption management, servicing, commissioning, and upgrade projects.

Operational efficiency

The effective planning, management and operation of interchanges is essential to realise positive outcomes for users and operators. Operational efficiency requires consideration of service coordination, operating costs, integrated ticketing, journey reliability, maintenance, safety, and servicing. This means interchanges need to:

- be capable of being operated efficiently with minimum intervention under normal and disrupted operating conditions
- enable effective performance of operational roles needed for safety, customer experience, maintenance, and operational management purposes, including the provision of work areas and facilities for staff and drivers that are safe and secure
- be designed (considering the location of interchange, stop layout, layover bays and circulation paths) to allow efficient and reliable public transport service operations and incur reasonable operating costs
- be informed by end-user representatives throughout design, commissioning, and operation stages
- separate the main modes (pedestrians, cyclists, public transport, taxis and ride-shares, and private cars) to improve safety and efficiency by reducing potential conflicts
- allow routine activities such as maintenance, facility management, security patrols, inspections, and emergency services access to be undertaken easily and with minimal disruption to the operation of the interchange.

Figure 72: Bus layover area at Wellington Railway Station. Source: Unsplash, Elliot Blyth.

Disruption management

The design for a public transport interchange needs to consider how the interchange will operate during periods of service disruption. These disruptions include:

- poor service reliability, caused by such things as unusual levels of traffic, incidents on the network, weather, and network maintenance
- high demand for public transport caused by special events
- the temporary replacement of services (for example, buses replacing trains during track works or replacing ferries due to weather events)
- works directly affecting the passenger concourse, platforms, or wharves (for example, upgrades, refurbishment or emergency repair).

Figure 73: Temporary traffic management at Wellington Railway Station bus interchange. Source: Lorelei Schmitt.

The design response to the risk of disruption should be proportional to the regularity and impact of the disruption event on interchange users.

Design considerations for providing resilience include:

- additional capacity for public transport vehicles
- additional capacity for passenger waiting areas and movements
- provision for temporary access to the interchange by replacement modes
- provision for the use of temporary signage at the interchange to guide passengers, drivers and operations staff
- delivery of interchange layouts that support temporary traffic management.

Consideration should be given to how resilience can be incorporated into the design by enabling flexible operations. For example, bays at a railway station for deliveries could be designed and located to support use by rail replacement buses, when required.

Detailed guidance on managing disruption caused by works at or near bus stops is in the Public Transport Design Guidance topic Bus stops impacted by temporary traffic management.

Servicing

Consider how the interchange will be serviced. The design should provide clear access and stopping areas outside operational zones for:

- emergency services vehicles
- maintenance and security patrol vehicles
- deliveries (for operating supplies and integrated retail)
- waste removal.

Commissioning

Testing and commissioning of the public transport interchange elements or assets should be carried out at all installations to ensure they are safe and meet the design requirements both before and after the opening of the interchange.

Before the formal opening of the interchange, test operational readiness and access using public transport and emergency service vehicles. This will confirm the design is fit for purpose and should confirm:

- minimum driver and staff numbers
- driver and staff training, and competency assessments are complete
- procedures are complete and issued
- all design and safety reviews are complete
- all vehicles and equipment (for example, for communication) are available and operate as expected.

Upgrade projects

To continue to deliver a good transport experience for users while an interchange is being upgraded, work collaboratively with relevant stakeholders for each mode. This should produce a cohesive interchange experience and minimise disruption during upgrade works.

Where possible, align the timeframes of individual projects (for example, consider updating signage and cycle provisions during works to improve the public realm).

7.2. Maintenance requirements

The design of an interchange must consider the maintenance requirements of the proposed infrastructure.

Maintenance tasks should be identified and reviewed during the design process. Designers should identify potential safety risks to maintenance staff or others (typically through the safety in design process), as well as issues that may affect the performance of maintenance or operational tasks or system performance (for example, their efficiency or effectiveness). Maintenance and servicing activities should be regularly reviewed and assessed for improvement.

Maintenance activities

Key considerations for maintenance activities include the following:

- The interchange should provide easy and convenient access for maintenance staff. Buildings must have a dedicated after-hours entry/exit.
- Access routes must allow for the installation, maintenance, removal, and replacement of equipment, taking into account the expected frequency of these activities.
- Staff and storage facilities should be provided for frequent maintenance activities such as cleaning, minor facility repairs and minor operational maintenance (such as clearing fuel spills).
- High-risk maintenance activities should be avoided. Frequently maintained facilities should be designed and placed in areas that can be easily and safely accessed by maintenance staff.

- The need for maintenance interventions should be minimised using design and suitable specifications.
- The design of the interchange should enable routine maintenance to be undertaken easily and safely while the interchange is operational, with no more than minimal disruption to passenger and staff activities.

Figure 74: Train stabling area. Source: Jacobs.

Figure 75: Bus shelter maintenance. Source: Lorelei Schmitt.

Infrastructure materials

Key considerations for infrastructure materials include the following:

- The design of any structures within the interchange and materials used should be durable such that replacement or repairs are minimal and, when necessary, are easy to achieve without specialist equipment or the closure of the interchange.
- Materials used should be readily available such that replacements are easily sourced.

- Material finishes should consider the effects of vandalism and whether mitigation is possible using specialist coatings or replaceable contact surfaces.

8. Interchange case studies

8.1. City Gateway interchanges

Five Aotearoa New Zealand examples of City Gateway interchanges are discussed below.

8.1.1. Britomart Transport Centre

Figure 76: Britomart Transport Centre. Source: Auckland Transport.

The Britomart Transport Centre is Auckland's major transport hub located in the central business district of Auckland City. The interchange is used by an average 20,000 to 25,000 passengers each day. It is served by all four of Auckland's passenger rail services and nine bus services from the central isthmus and eastern areas of Auckland. The Britomart Ferry Terminal, located across Quay Street, is the main ferry terminal in Auckland, serving 11 ferry services.

The City Rail Link project will enable a better connection between rail and bus services. When the project is complete in 2024, the downtown Britomart Transport Centre will be a two-way through station that better connects the Auckland rail network.

A new retail centre and Transit-Oriented Development called Commercial Bay opened in 2020 adjacent to the Britomart Transport Centre. The surrounding urban setting includes a combination of retail, commercial and residential buildings.

The interchange promotes safety and security with staffed customer service centre facilities and passive surveillance with high patronage throughout the day. The station contains facilities for operators, ticket machines and offices, and several retailers.

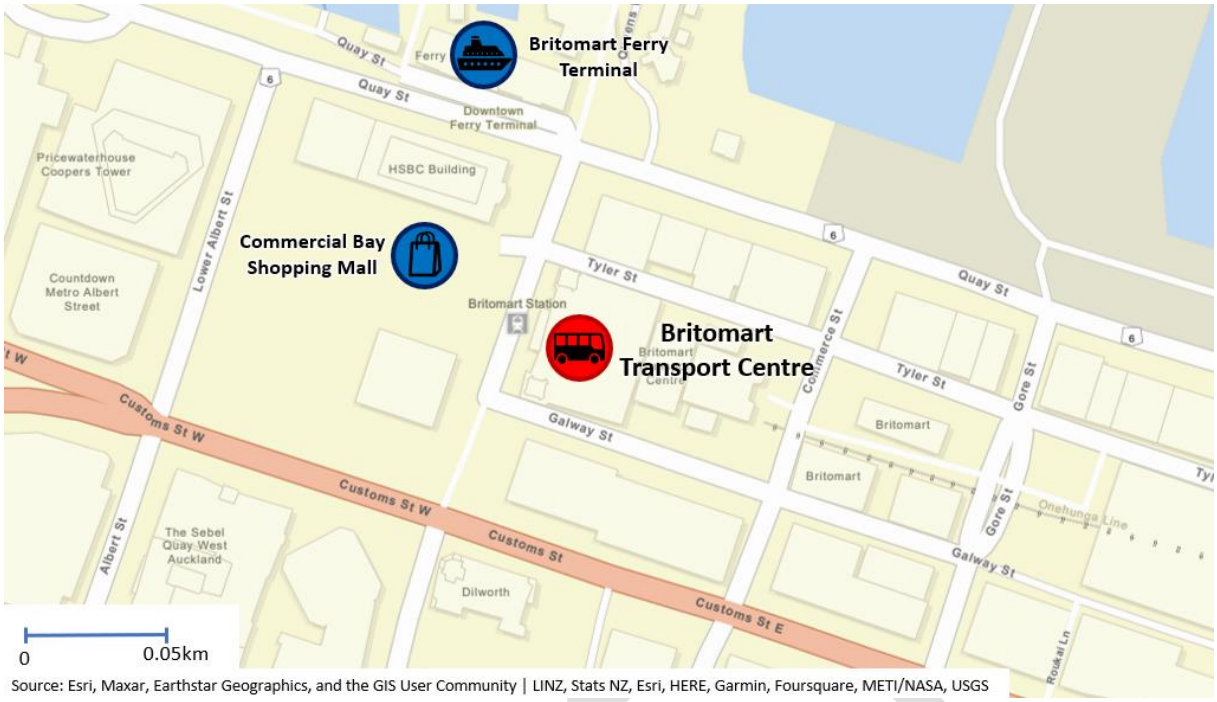


Figure 77: Map of Britomart Transport Centre area.

8.1.2. Wellington Railway Station

Figure 78: Wellington Railway Station. Source: Kiwi Rail (left) and Wellington City Council (Geomaps) (right).

Wellington Railway Station is a large bus–rail interchange in central Wellington. It is an historic landmark building having opened in 1937. All four railway lines converge at the station, delivering commuters and visitors into the centre of the city. The station provides a connection to the bus network, with off-street bus stops on Lambton Quay, the city's main street, serving 26 bus services. The station serves about 25,000 to 30,000 passengers each day.

The station is within walking distance to commercial offices, Victoria University of Wellington, civil amenities, Parliament buildings and the Beehive, and central retail hubs.

Station facilities include a customer service kiosk, ticket offices, operator facilities, public toilets and retail facilities, including a supermarket, a drycleaner, a bag and shoe repair shop, and other small retailers.

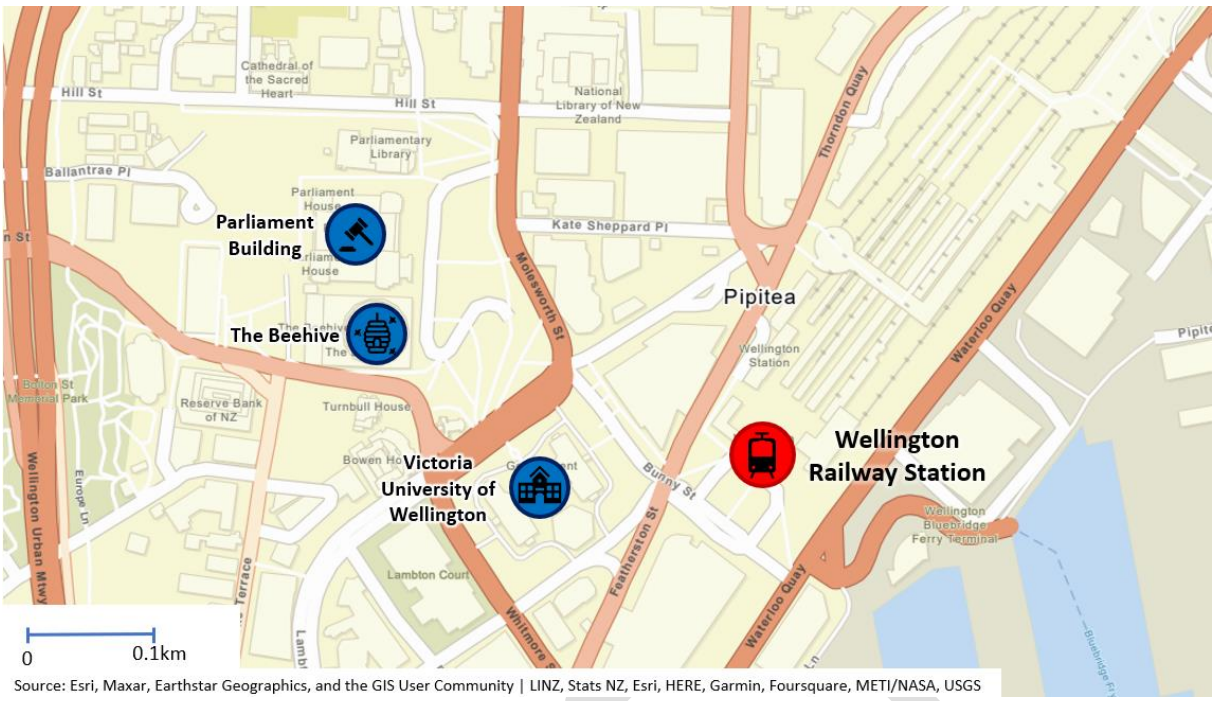


Figure 79: Map of area surrounding Wellington Railway Station.

8.1.3. Christchurch Bus Interchange

Figure 80: The exteriChristchurch bus interchange.
Source: Aurecon.

Christchurch Bus Interchange is located on the corner of Lichfield and Colombo Streets in central Christchurch and serves as the public transport hub for the city. It was re-built after the earthquakes in 2011, re-opening in 2015 at a cost of $53 million. The interchange serves an estimated 18,000 passengers each day, with a daily throughput of 1,850 buses, serving 14 different bus routes.

The interchange is surrounded by commercial and retail buildings, including The Crossing shopping mall. It is also situated near to the Christchurch Tramway, a popular tourist attraction, as well as Rauora Park.

This interchange is a modern facility with 16 saw-tooth bays for buses spread across the L-shape compound.

Facilities include a customer service centre, information kiosks, driver rest areas, toilets, café kiosks, and luggage and bicycle storage facilities.

Facilities for disabled people include tactile pavers or walking strips to the bus bays and doors, electronic braille information stands, and step-free ground-level access.

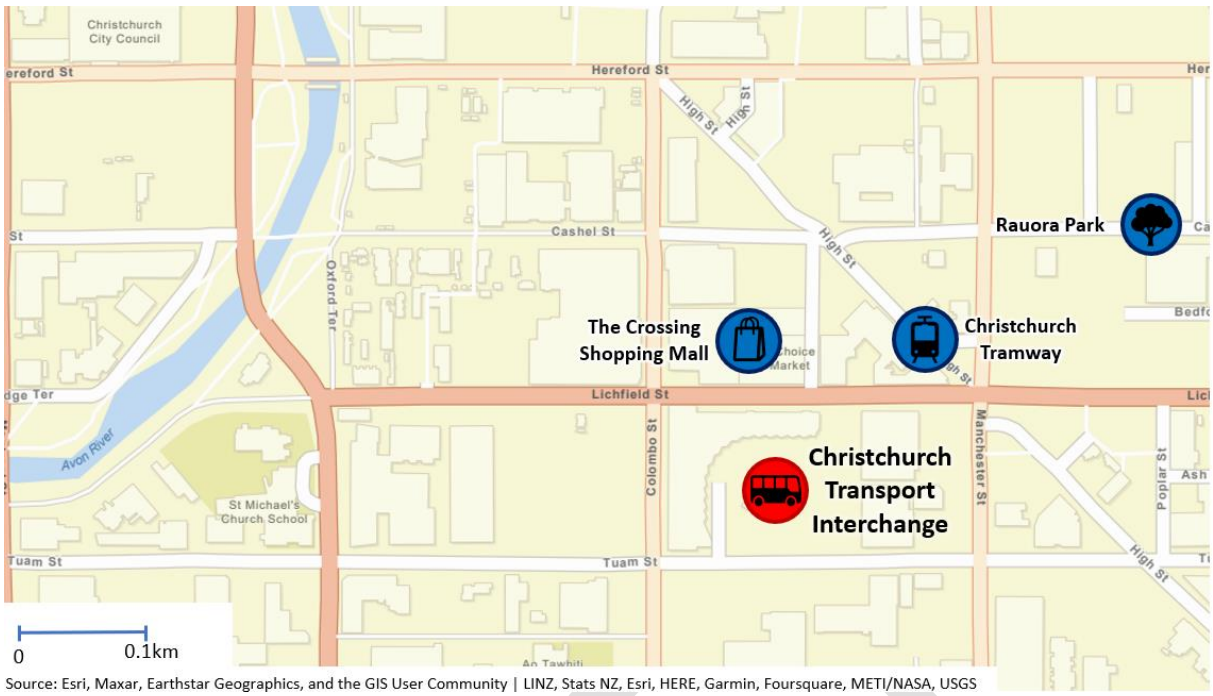


Figure 81: Map of area surrounding Christchurch Transport Interchange.

8.1.4. Hamilton Transport Centre

Figure 82: Hamilton Transport Centre. Source: Mark Hamilton.

The Hamilton Transport Centre is a bus-to-bus transfer interchange in this Waikato region city centre. This facility opened in 2001. Almost all bus services, including longer distance services such as the Intercity buses, call at this transport interchange.

The interchange is located at the north-western corner of Hamilton city centre and is conveniently linked by pedestrian crossings to the city centre across the road. The nearby intersection has been raised to slow speeds, better manage potential pedestrian–vehicle conflict, and support improved access to the bus interchange.

The city centre consists of office building, a large mall (Centre Place), shops and restaurants and is home to the Waikato Institute of Technology. The Waikato River is within a 400m walk from the interchange.

The Hamilton Transport Centre consists of 27 bays and is well equipped with passenger and operator facilities. Passenger facilities include toilets, a ticketing office and customer service centre, information boards, a sitting area, PUDO and a café, as well as shops and food retailers in an adjacent building. Operators have staff rest areas and offices.

Figure 83: Map of area surrounding Hamilton Transport Centre.

8.1.5. Manukau Station

Figure 84: Manukau Station. Source: Aurecon (left) and Auckland Council (right).

Manukau Station is an integrated transport hub, connecting bus and train services in south Auckland and providing a vital link to the Manukau Institute of Technology campus. Approximately 5,000 to 7,000 passengers use the station daily, which is served by one train service and 13 bus routes – a combination of local and regional services. The railway station is the terminus station for Eastern Line services from Britomart.

Manukau Station is near the Westfield Manukau Mall, Manukau Civic Building and Manukau District Court as well as Vodafone Events Centre and Hayman Park. Other nearby attractions include Rainbows End and Vector Wero Whitewater Park.

The station caters to multiple modes of transport with bike parking racks, storage lockers, taxi parking and Park & Ride. Manukau bus station is a 23-bay bus station adjacent to the railway station.

The station contains bike-parking racks, taxi parking and PUDO space. It has a large waiting area, toilets, bus staff and office facilities, convenience kiosks and an Auckland Transport Metro customer service centre. Pre-paid luggage lockers are located at the eastern end of the building, and there is 24-hour security, help points and CCTV.

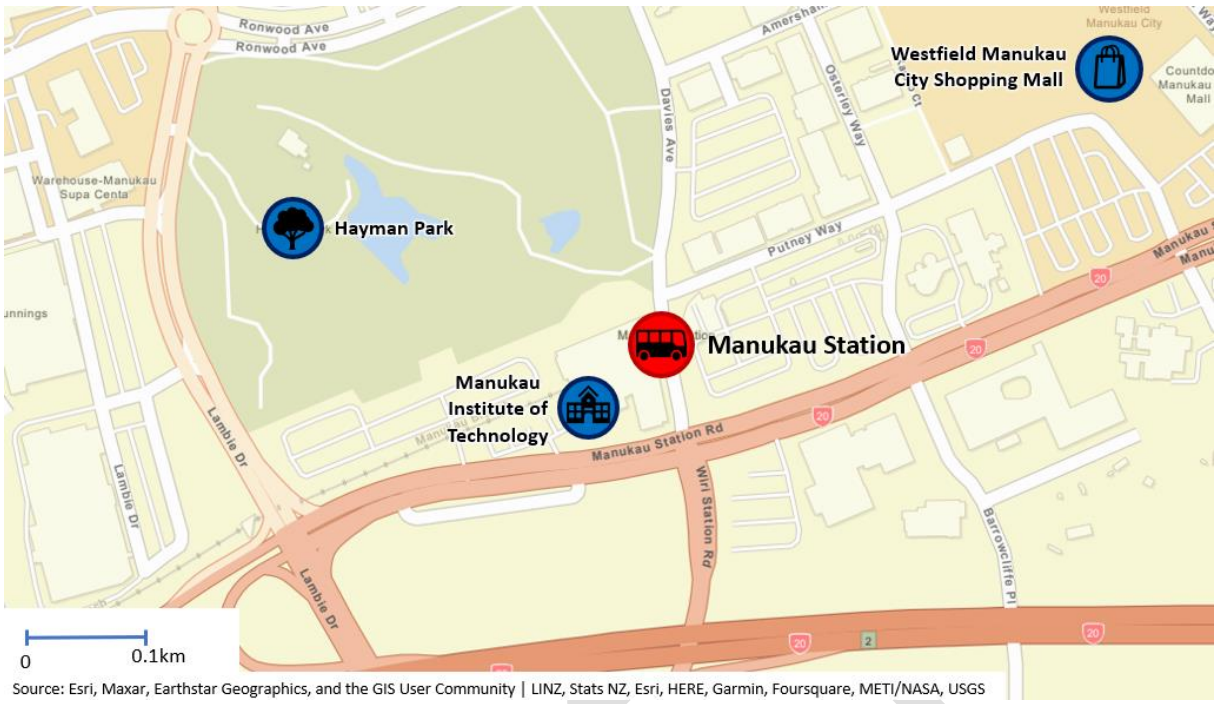


Figure 85: Map of area around Manukau Station.

8.1.6. Opportunities and challenges

Legibility and connectivity

City Gateway interchanges generally serve very high passenger volumes. Because of this, passenger journey efficiency and legibility are important.

These interchanges are used not only by commuters but people accessing the city for recreational purposes. Users may not know the city, the local area, or the transport system, so need to be able to familiarise themselves. A legible interchange in a convenient location is key to ensuring people can easily use the transport system. Such interchanges can sometimes form a users' first impression of a city.

Interchanges catering for regional and longer distances services are more likely than others to serve passengers who are not familiar with the wider transport network. This means it is critical the interchange is legible and easy to use. These interchanges will likely serve a higher volume of tourists. At these stations, consider making information accessible regardless of passengers' English language ability.

A central location for interchanges can also support interchange legibility. For example, Hamilton Transport Centre is convenient for all types of passengers, being close to retail, businesses, and offices. It is located in the heart of Hamilton, close to the Waikato River and directly adjacent to the central mall, which is particularly convenient for visitors.

Walkability and station access

The interchanges described above are major multimodal interchanges, with high frequency rail and/or other frequent services and very high volume of pedestrians.

Multimodal interchange is almost exclusively pedestrian, micromobility and public transport based. Ride-share and taxi drop-off is desirable in small amounts. Park & Ride is not desirable or viable due to high land values, impacts on more space-efficient modes, overall space constraints and the likelihood that these stations are predominantly journey destinations rather than trip generators.

Waiting areas

People are likely to have to wait for longer times at regional interchanges than others, whether transferring or not. This means waiting areas are particularly critical in these interchanges.

A good example of this is the waiting area in Manukau Station (shown below).

Figure 86: Waiting area in Manukau Station. Source: Aurecon.

Manukau Station

Features of note include:

- indoor seating at each bus bay with clearly signposted locations
- real-time information in an 'airport-style' arrangement that directs uses to the correct bus bay
- clear wayfinding signage that directs passengers to toilet facilities, exits and PUDO locations
- pre-paid luggage lockers
- convenience kiosks and an Auckland Transport Metro customer service centre
- 24-hour security, help points and CCTV.

Considering the long dwell times at these interchanges, good opportunities exist to provide people with places to spend time, things to do and station retail.

Accessibility

As well as universal design and basic inclusive design considerations, passengers at these interchanges are more likely to have large amounts of luggage, so ensuring the interchange is accessible for these users is important.

Safety and security

Regional services are far less frequent than other services and are likely to run at off-peak hours. This means activity may be low at these stations for much of the day. This can create issues with activation and passive security at these interchanges.

Manukau Station and Hamilton Transport Centre both run local and regional services, which helps to increase the number of people passing through these interchanges and improve activation. However, not all regional stations can be set up in this way. In those cases, designers should aim to maximise security through design. In particular, best practice CPTED design and active security management should be considered when designing these interchanges. Consider such things as visibility, CCTV, lighting, and staffing.

8.2. Destination Gateway interchanges

Four Aotearoa New Zealand examples of Destination Gateway interchanges are discussed below.

8.2.1. Dunedin Bus Hub

Figure 87: Dunedin bus interchange. Source: Mark Edwards.

Dunedin Bus Hub is a medium scale on-street interchange catering mainly for bus-to-bus transfers in the city of Dunedin, although it is also served by Intercity regional buses. It is located in the city centre, north-east of the Octagon and adjacent to the central police station. This location is convenient for the shopping district, restaurants, supermarkets and entertainment facilities in the city. Furthermore, the hub is located approximately 500m from the railway station and 1km from the cruise terminal, Dunedin Hospital and the University of Otago.

On average, the interchange is used by 2,500 to 5,000 passengers each day across 20 bus services. There is also one train that serves the nearby railway station. It is used mainly by leisure travellers.

Many facilities are provided at the hub to enhance the comfort of waiting passengers, including toilets and seating. To assist passenger wayfinding, interactive wayfinding machines have been provided.

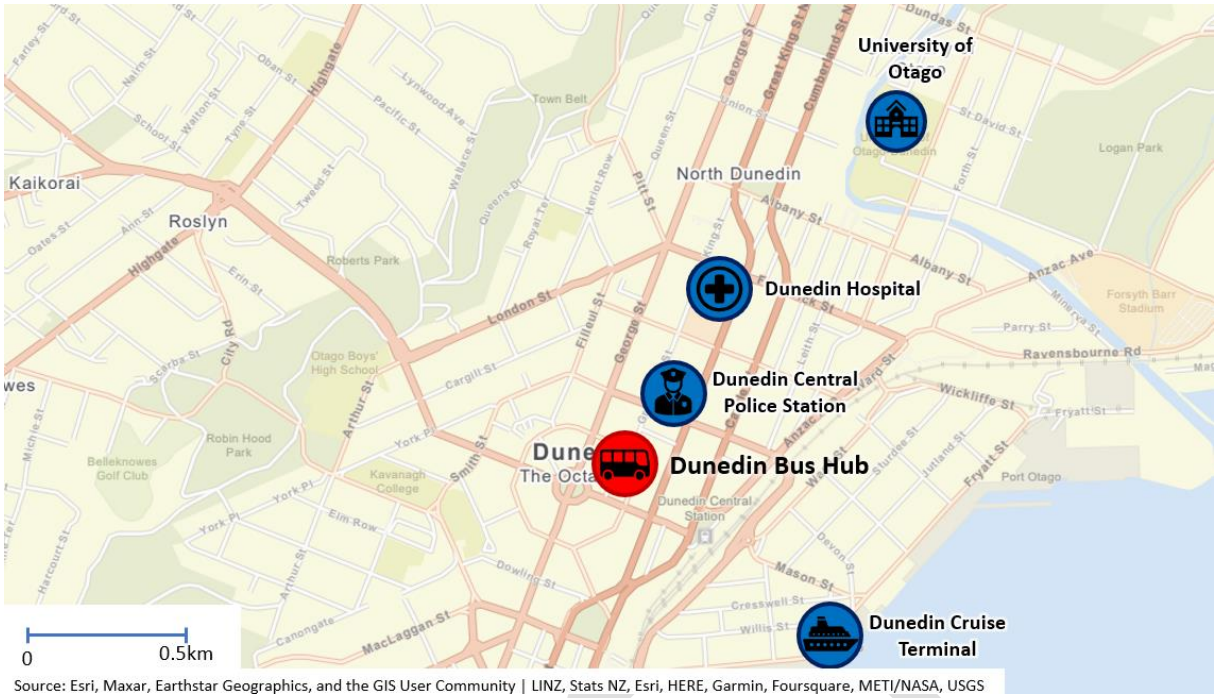


Figure 88: Map of key destinations in relation to Dunedin Bus Hub.

8.2.2. New Lynn Transport Interchange

Figure 89: New Lynn transport interchange. Source for both: Duncan Rothwell

The redevelopment of the New Lynn Transport Interchange in 2010 was then the largest ever public transport infrastructure investment in Aotearoa New Zealand. The interchange has incorporated Transit-Oriented Development principles well, including integration with the New Lynn Urban Plan. It lies within the New Lynn metropolitan centre, surrounded by commercial and retail buildings, including the Lynn Mall shopping centre. Residential apartments are located above and around the transport interchange.

The transport interchange has an average 7,500 to 10,000 passengers each day, serving one train service (the Western Line between Britomart and Swanson) and 27 bus services connecting west and central Auckland. Train platforms are located below ground level, connected by lifts, stairs, and escalators onto the dual-tracked railway.

Facilities include customer service kiosks, information boards, café kiosks, a waiting room, and toilets. Landscape features and artists' works are located in and around the interchange.

Facilities for active transport modes surround the transport interchange, including cycle parking and shared walking and cycling paths. Park & Ride facilities are available at an adjacent multi-storey carpark, and many places surround the transport centre for PUDO.

Figure 90: Map of area around New Lynn Transport Interchange.

8.2.3. Christchurch Hospital bus stops

Figure 91: Christchurch Hospital bus stops. Source: Christchurch City Council Newsline.

The Christchurch hospital stops are a bus interchange just outside Christchurch Hospital in the central city. They were completed in October 2019. These stops are the central city's next busiest, after the Christchurch Bus Interchange.

This interchange is near the hospital with good pedestrian access to the Metro Sports Facility, Christchurch Hospital, Health Precinct and South Frame (a place for markets, events, and celebrations), as well as to the areas south and west of the Core over the Antigua Street footbridge.

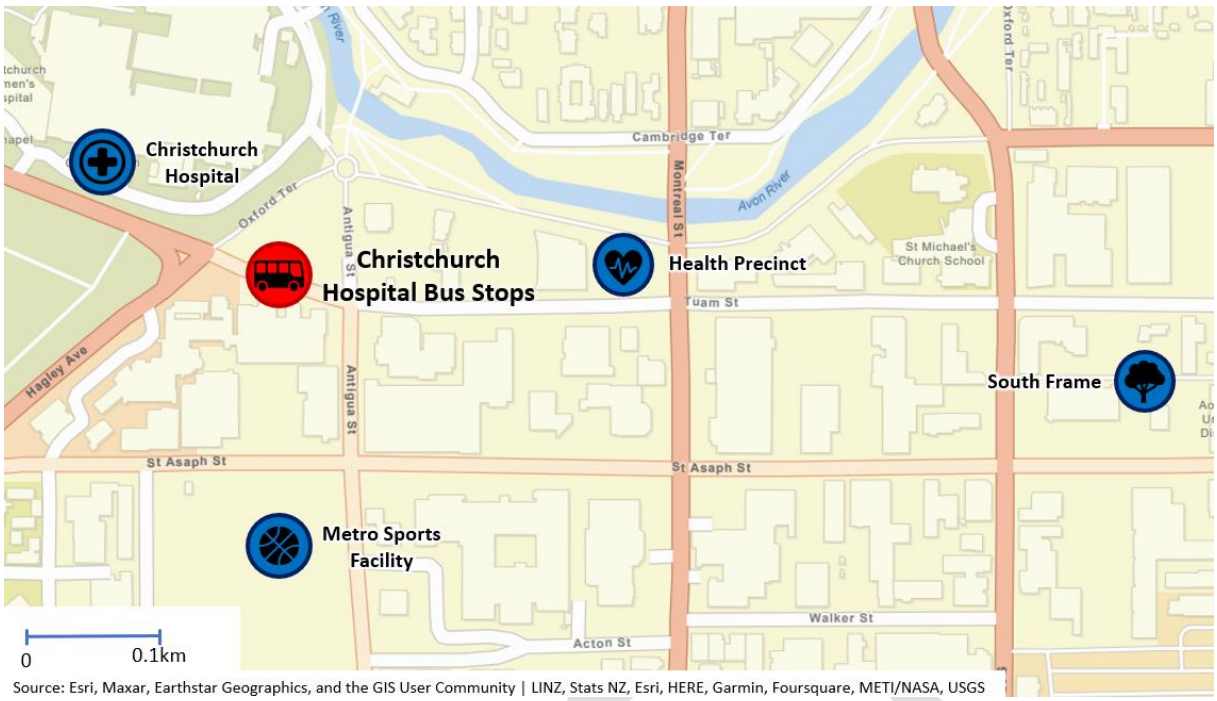


Figure 92: Map of area around Christchurch Hospital Bus Stops.

8.2.4. Opportunities and challenges

These Destination Gateway interchanges are likely to be in or very near an established urban setting, which is a local hub with valuable, intensive, mixed land uses and high spatial constraints. These interchanges serve key destinations for the public such as town centres, hospitals and universities. Some may be in growth or new master-plan locations, in which case understanding the long-term potential of the place and process of future urban change or morphology becomes significant.

As these interchanges are generally based around destinations, which are unlikely to be solely employment areas, it is important to design for more than just standard commuter groups. Many users may not be as familiar with public transport as commuters, so may need even clearer information than at other interchanges and may be travelling off peak.

Travel activity may continue for 18 hours each day as these interchanges serve key destinations and/or town centres that often have a mixed employment and residential profile and may have a mix of trip attractor and generator characteristics. Due to the land use surrounding these interchanges, it is critical to consider a variety of operating scenarios through design, including special events, disruption and future growth.

These interchanges are often challenging to design, due to the large numbers of different types of users, often with different requirements and moving at different speeds. An in-depth understanding of all station users and key stakeholders is critical to ensure quality design and balance the needs of conflicting user groups.

These interchanges are often within already active areas and are often particularly affected by constrained available space and congestion within the surrounding road network. Traffic can negatively affect as well as support centres, and any Park & Ride or PUDO facilities need careful configuration to ensure other modes are prioritised.

8.2.5. Panmure Station

Figure 93: Panmure Station at street level and from above. Source: Auckland Transport (left).

Panmure Station is a bus and train interchange located near the Panmure town centre. It officially opened in 2014 and cost $17.5 million to construct. The interchange allows easy and direct transfers between rail and bus services, acting as the main gateway to public transport services for the eastern suburbs of Auckland. The interchange serves about 7,500 to 10,000 passengers each day, with one train service and 14 bus services.

The interchange provides multimodal and bus layover facilities, including a Park & Ride, PUDO and cycle-and-ride, as well as safe walking and cycling routes into the station. Rest areas (for operational staff) and sheltered platforms are also provided.

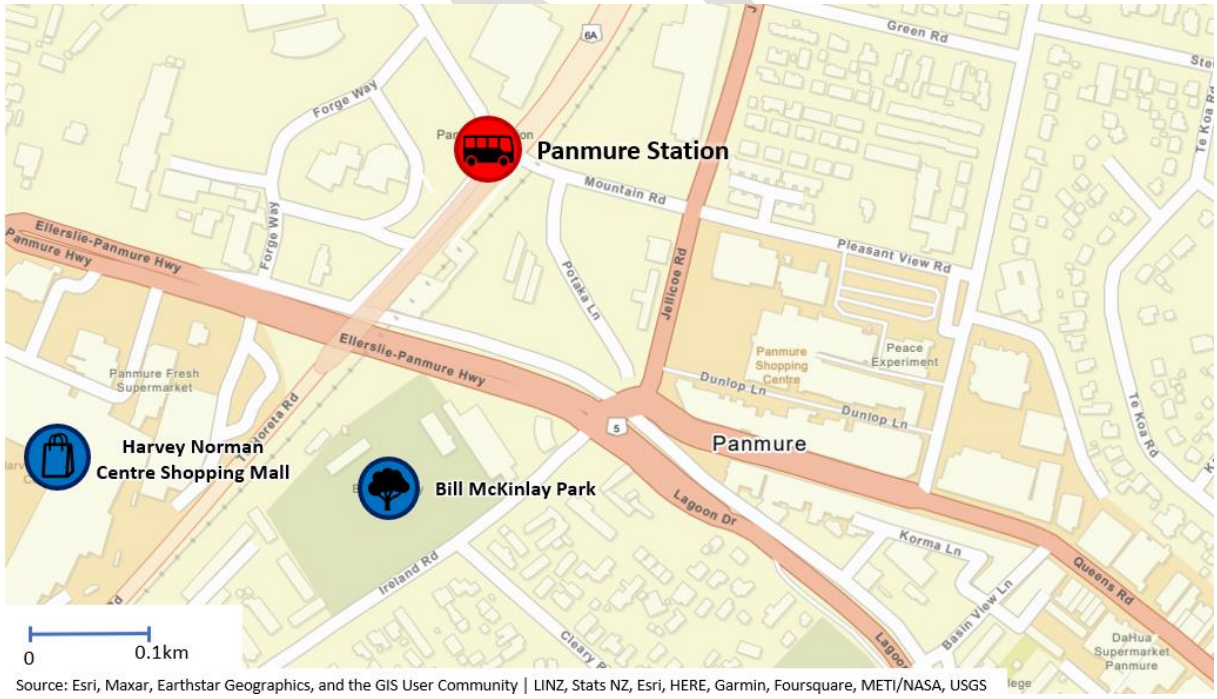


Figure 94: Map of Panmure Station area.

8.3. Local Gateway interchanges

Four Aotearoa New Zealand examples of Local Gateway interchanges are discussed below.

8.3.1. Ōtara Interchange

Figure 95: Ōtara Interchange. Source: Auckland Transport.

The Ōtara Interchange serves passengers travelling around south and east Auckland. A $2.1 million redevelopment of the interchange and adjacent plaza occurred in 2013. This redevelopment was done to transform the area into a signature entry for the Ōtara township. The interchange has approximately 3,000 passengers per day across 330 services.

The design heavily focuses on representing the Pacific Island and Māori heritages of the local communities.

The pedestrian thoroughfare is a raised platform to provide safe crossings and connections to the surrounding areas.

The redevelopment included a modern stainless-steel toilet facility, a new taxi stand, new paving, a play area for children, and a makeover for the clock tower. A sense of community is important for local residents, and this is reflected in the design of the interchange and plaza.

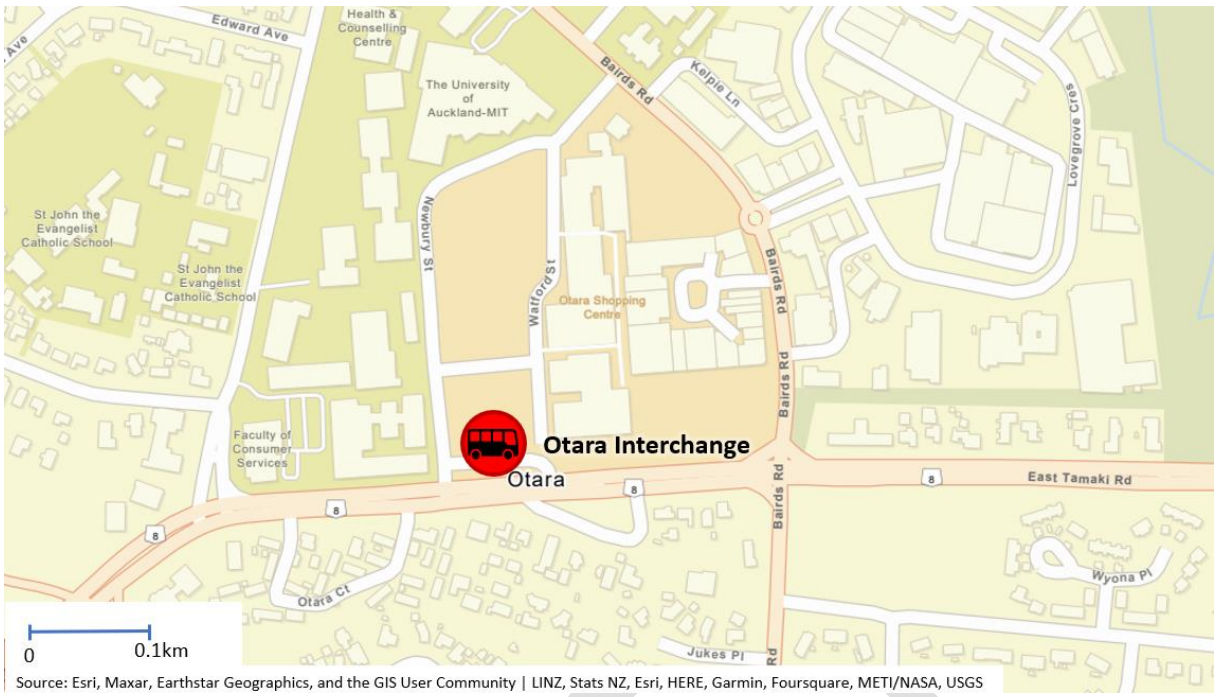


Figure 96: Map of area around Ōtara Interchange.

8.3.2. Half Moon Bay Ferry–Bus Interchange

Figure 97: Half Moon Bay ferry pier and bus interchange. Sources: Auckland Council.

This interchange caters to a bus–ferry transfer in the eastern Auckland suburb of Half Moon Bay. Ferry services connect to the Auckland central business district. With the Eastern Busway expected to commence operation in 2025, this may result in some reductions in ridership and changes to public transport networks at this interchange. This interchange also serves three bus routes (one of which is a trial route, route 714).

This interchange is located in a very low-rise residential area and is close to local parks such as Pigeon Mountain and Pigeon Mountain Wetland. The ferry terminal has a marina, a Yacht Club, and a few shops and restaurants. There is also a waiting room and toilet facility.

The bus stop (with bus information) leading to the ferry pier is located at the mouth of the ferry pier. No dedicated connection exists for commuter cyclists. However, cyclists, alongside pedestrians, can use a recreational off-road boardwalk that runs alongside the harbour to Bucklands Beach. Park & Ride and PUDO facilities are provided.

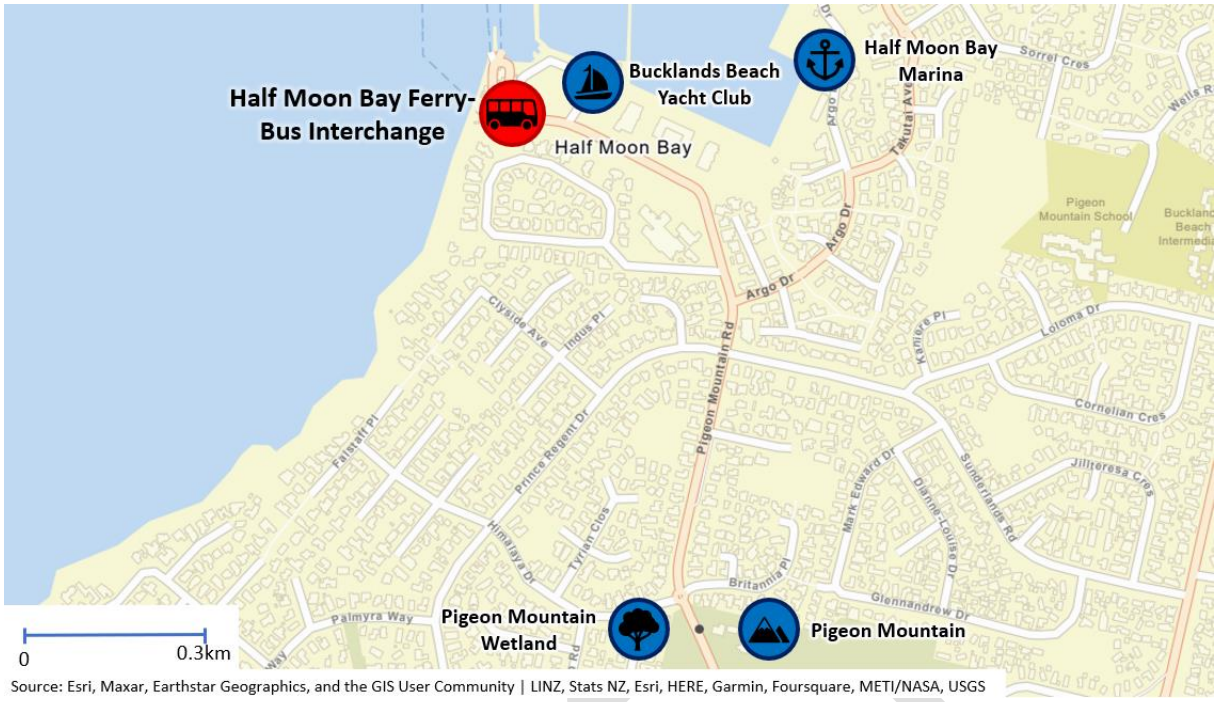


Figure 98: Map of area around Half Moon Bay Ferry-Bus Interchange.

8.3.3. Green Lane West–Manukau Road interchange

Figure 99: Aerial imagery map of the Green Lane West–Manukau Road bus interchange. Source Auckland Council Aerials.

The Green Lane West–Manukau Road interchange is a small-scale neighbourhood bus-to-bus interchange in Epsom, Auckland. The interchange is located conveniently for access to and from local small-scale businesses, shops and residential dwellings, as well as the nearby Alexandra Park and ASB Showgrounds. Approximately 500 to 1,000 passengers use the interchange each day across five bus services.

The interchange's function is primarily to facilitate the transfer of passengers between the City bus services along Manukau Road and the Crosstown bus services along Green Lane West, with a secondary role of providing access to the local neighbourhood. Therefore, facilities are basic. Although the local walking facilities are good, no facilities exist for Park & Ride, PUDO or cyclists.

The interchange is programmed for an upgrade, which will provide significant additional identity and wayfinding signs and relocate two stops to optimise performance.

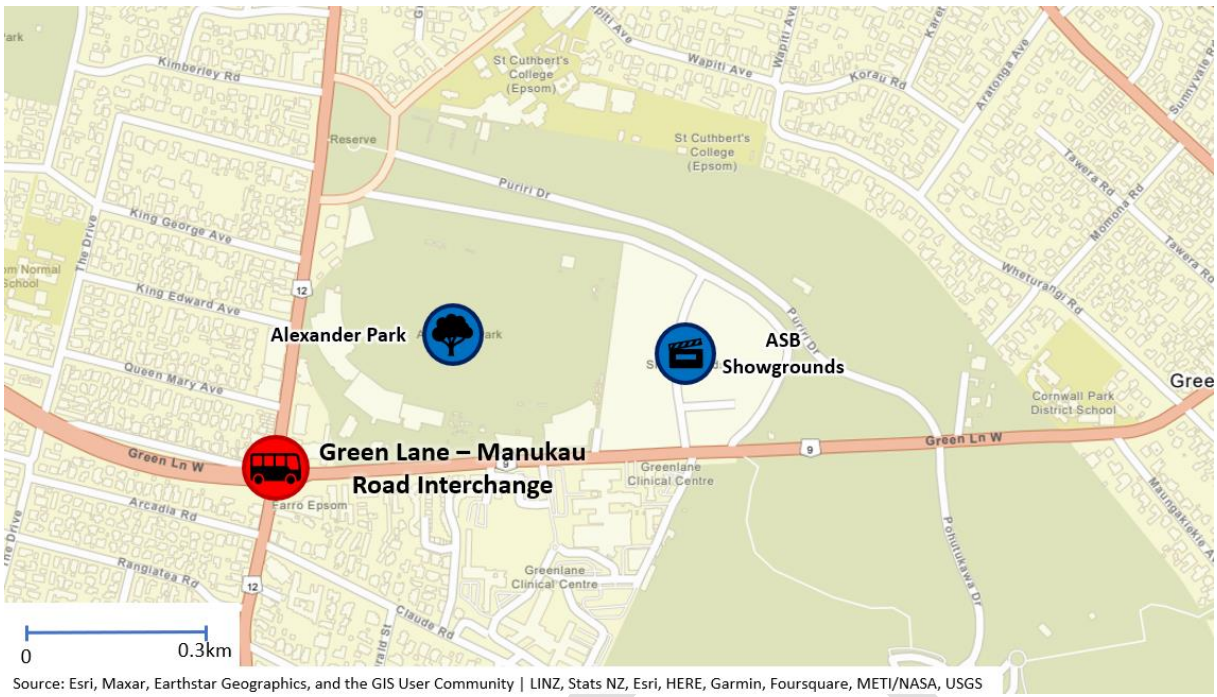


Figure 100: Area around Green Lane - Manukau Road Interchange.

8.3.4. Wellington bus hubs

Wellington's bus hubs were designed to connect buses from the outer suburbs with main routes. The seven hubs, comprising at least one bus shelter, lighting, electronic signage and associated road works, cost $14.4 million.

One stop at the Kilbirnie hub has a well-integrated cycle route running behind it, as shown below.

Figure 101: Kilbirnie bus hub. Source: Lorelei Schmitt.

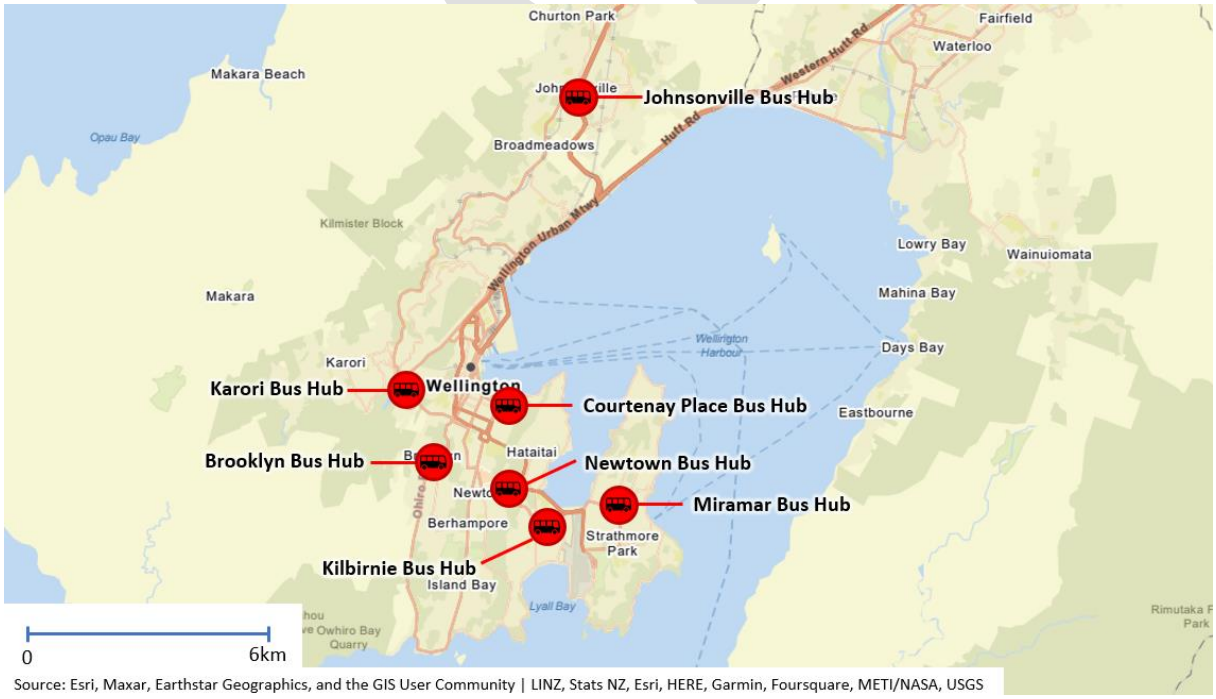


Figure 102: Map of Wellington bus hubs.

8.3.5. Opportunities and challenges

These Local Gateway interchanges are likely to be in predominantly residential or employment contexts with limited retail, leisure, or hospitality activities. Spatial constraints will vary highly depending on location.

They are less likely to be a multimodal interchange, but this can vary if they are strategically located and provide a key node between different modes. They are likely to attract people using a broad range of access modes from walking and cycling to private vehicles.

These interchanges are most likely distinctly separate from adjacent land uses, and the station is unlikely to provide facilities for travellers. Travel activity may drop significantly outside peak community hours, and 'last mile' travel choices become important.

Park & Ride may be desirable where surrounding land value is very low, and the station is located at a strategic node between the wider road network and public transport network. A PUDO facility is desirable.

Placemaking and place integration

Most local interchanges are within lower density residential areas. These areas are far more likely to be sensitive to the environmental impacts (particularly noise and visual impacts) of station infrastructure. These areas are unlikely to suit large-scale infrastructure. It is critical the design considers the wider impacts of an interchange on its surroundings and integrates the interchange with the social and community dimensions of the area.

Development of a local interchange provides an opportunity to involve the local community and generate community value, build a sense of place and identity, and improve local character.

Activation

As with other interchange types, the low level of patronage at these interchanges (particularly off-peak) can lead to issues with activation, security, and safety. Design to enhance interchange security should be embedded throughout.

Interchange access and walkability

These interchanges generally have a large proportion of users who are beginning or ending their trips at this interchange (and comparatively low volumes of other users). Because of this, station access is particularly important at these stations.

It is important to provide sufficient access infrastructure (such as cycling parking, Park & Ride and PUDO) as well as improving wider station access (cycling and walking amenity and cycle networks).

An interchange's access hierarchy and required volumes of access infrastructure are driven by factors such as place in network, land use and patronage.

8.4. Dedicated Transport Hubs

Two Aotearoa New Zealand examples of Dedicated Transport Hubs are discussed below.

8.4.1. Ōtāhuhu Station

Figure 103: Ōtāhuhu Station at night. Source: Auckland Council Auckland Design Manual.

Ōtāhuhu Station is a fully integrated bus–train interchange in South Auckland. It was completed in 2014 at the existing Ōtāhuhu railway station to provide better connected and more frequent public transport services. The total cost of the station was $28 million. The interchange serves an average 5,000 to 7,000 passengers each day, with one train service and eight bus services.

Ōtāhuhu Station sits in an industrial area. it has bike-parking racks and a few drop-off parking bays.

Auckland Design Manual has a case study that describes the great work utilising Māori design principles to connect the environment, culture and heritage of the area: Ōtāhuhu Station: Transport interchange.

Ōtāhuhu Station: Transport interchange: Auckland Design Manual

Figure 104: Map of area of Ōtāhuhu Station.

8.4.2. Constellation Bus Station

Figure 105: Constellation Bus Station. Source: Public domain.

Constellation Bus Station is a bus interchange along the Northern Busway on Auckland's North Shore. It serves over 15 different bus services and is a key transfer point from local areas to the rapid transit network – the Northern Busway. It has shelters, electronic real-time information on each platform, and a Park & Ride facility.

8.4.3. Opportunities and challenges

Dedicated Transport Hubs are likely to be in areas with limited retail, leisure, or hospitality activities. Spatial constraints vary highly depending on location.

These interchanges perform a key function in the transport network by providing opportunities for people to transfer between a variety of public transport services. This function often broadens the catchment of the network as a whole and is often seen with trunk and feeder transport systems.

These interchanges can be points along the network with forced transfers and, due to the transfer function of specialist interchanges, they are likely to provide facilities for travellers. There is likely to be a much higher volume of public transport passengers than other users. Specialist interchanges are likely to be multimodal, with high frequency rail and/or other frequent services.

Activation and safety

Generally, limited potential exists for Dedicated Transport Hubs to be integrated alongside land use developments. This often means activity in the surrounding areas is low for most of the day. This can create issues with activation and passive security at these interchanges. Designers should be aware of this and maximise security through design. Ensuring best practice CPTED design and managing security actively should be considered in particular when designing these interchanges. Both examples above are generally staffed and have CCTV systems. Using glass and high-quality lighting also helps to improve visibility to and within these interchanges.

Conflict and service reliability

Dedicated Transport Hubs generally serve a fairly high volume of vehicles. Operationally. this can be challenging to design for. It is critical to consider through design:

- clear lines of sight for vehicles and passengers
- sufficient operational capacity for public transport services
- the separation of services when high volumes lead to operational difficulties
- the separation of pedestrian and vehicle movements.

Insufficient capacity at these high vehicle-volume stations can lead to operational failures such as bus bunching and delays to services. These conditions are experienced at Constellation Station as shown below. Operational failure is caused by conflicts of bus movements at station roundabouts and station platforms operating over capacity, compounded with delays caused by at-grade pedestrian crossings.

Figure 106: Bus-bunching issues at Constellation Station. Source: Aurecon, Auckland Transport CCTV.

Legibility and waiting areas

Dedicated Transport Hubs have particularly high volumes of transferring passengers. Wayfinding, clear information, proximity of station stops and platforms, and high-quality waiting areas are of particular importance to users of these services.

With a relatively high volume of station users waiting in the station to transfer between services, consider particularly providing higher-quality shelter and seating and other key passenger facilities.

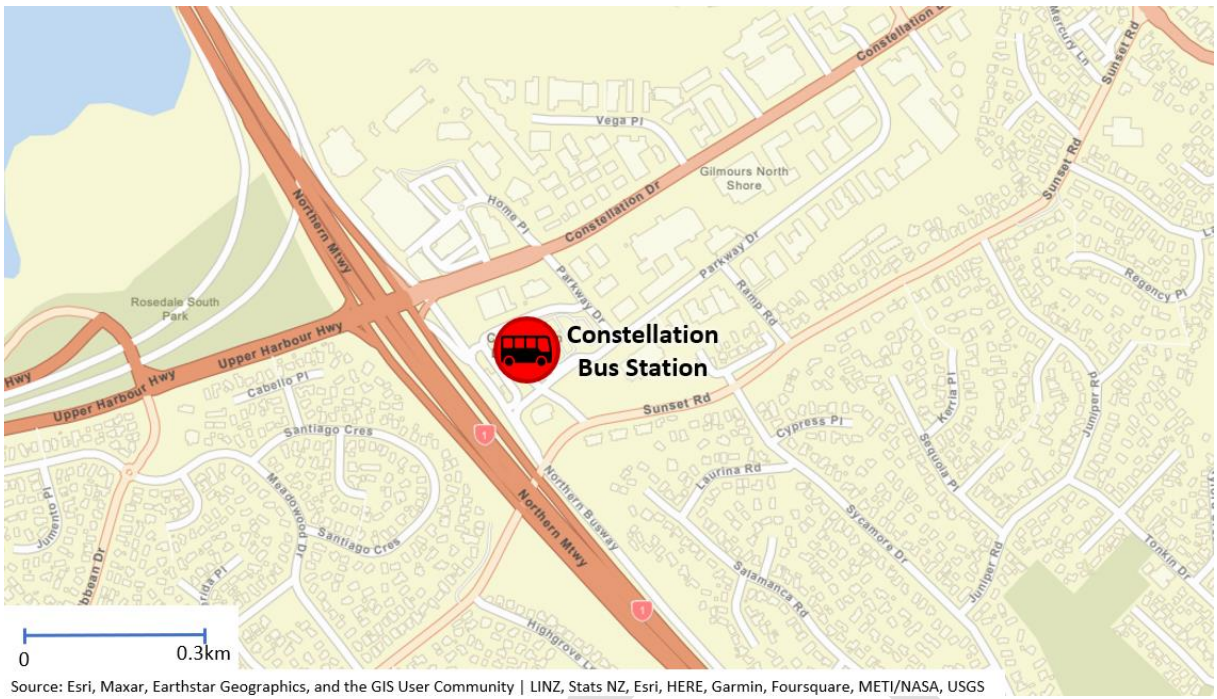


Figure 107: Area map around Constellation Station.

References

Auckland Council. No date. *Ōtāhuhu Station: Transport interchange*. Auckland Design Manual https://content.aucklanddesignmanual.co.nz/resources/case-studies/otahuhustation/Documents/Otahuhu%20Station%20Case%20Study.pdf

Auckland Transport. 2013. *Public Transport Interchange Design Guidelines*. Auckland. https://at.govt.nz/media/1979931/public_transport_interchange_design_guidelines.pdf

Auckland Transport. 2022. *Engineering Design Code: Ferry terminal design*. Auckland. https://at.govt.nz/media/1982223/engineering-design-code-public-transport-ferry-infrastructure_compressed.pdf

Auckland Transport. 2022. *Urban Street and Road: Design guide*. Auckland. https://at.govt.nz/media/1987453/urban-street-and-road-design-guide.pdf

Australian Government, Department of Infrastructure and Regional Development. 2017. *The Whole Journey: A guide for thinking beyond compliance to create accessible public transport journeys.* Canberra: Author. www.infrastructure.gov.au/infrastructure-transport-vehicles/transport-accessibility/whole-journey-guide/whole-journey-guide-thinking-beyond-compliance-create-accessible-public-transport-journeys

Austroads. No date. Austroads guides (webpage with links to guides). https://austroads.com.au/about-austroads/austroads-guides

Changing Places. No date. Fully accessible public bathrooms (webpage). www.changingplaces.org.nz/

Government of Western Australia, Public Transport Authority. 2016. *Bus Interchange Guidelines* (supporting technical notes). Perth: Author. www.pta.wa.gov.au/about-us/working-with-the-pta/urban-design-and-planning-guidelines

KiwiRail. 2017. *Standard T-ST-AM-5120 Track Geometry.*

KiwiRail. 2017. *T200 Track Handbook*.

KiwiRail. 2018. *Standard C-ST-PL-4109 Commuter Platform.*

KiwiRail. 2018. *Standard E-ST-AE-0161 Traction Overhead Clearances; Electrical and Mechanical.*

KiwiRail. 2018. *Standard T-ST-DE-5212 Track Standard Clearances.*

KiwiRail. 2019. *Standard T-ST-DE-5200 Track Design.*

Land Information New Zealand. 2022. Acquisitions for public works (webpage). www.linz.govt.nz/crown-property/acquisition-and-disposal-land/acquisitions-for-public-works

Ministry of Justice. 2005. *National Guidelines for Crime Prevention through Environmental Design in New Zealand: Part 1 – Seven qualities of safer places*. Wellington. www.justice.govt.nz/assets/Documents/Publications/cpted-part-1.pdf

New South Wales Government, Sydney Metro. *2019. Interchange Access Plan: Sydenham* (version 0.20). Sydney.. www.sydneymetro.info/sites/default/files/document-library/08_Sydenham_IAP_v20.pdf

New South Wales Government, Transport for New South Wales. 2017. *T LR RS 00100 ST: LRU 100 Series: Minimum Operating Standards for Light Rail Vehicles – General interface standards*. Sydney. www.transport.nsw.gov.au/industry/asset-standards-authority/find-a-standard/lru-100-series-minimum-operating-standards-for-0

New South Wales Government, Transport for New South Wales. 2017. *T LR SS 90001 ST: Consistency through the Look and Feel of Light Rail Stops*. Sydney. www.transport.nsw.gov.au/industry/asset-standards-authority/find-a-standard/consistency-through-look-and-feel-of-light-rail

New Zealand Government. 2019. *Road to Zero: New Zealand's road safety strategy 2020–2030*. Wellington: Ministry of Transport. https://www.nzta.govt.nz/safety/what-waka-kotahi-is-doing/nz-road-safety-

strategy/?utm_source=google&utm_medium=cpc&utm_id=Paid&gclid=Cj0KCQiAutyfBhCMARIsAMgcRJQsrSxq7Y2wA3zXkEgd3kpIs7nQHCSKbx28jgbEsa1MaKTkOMgHYE0aAlbbEALw_wcB&gclsrc=aw.ds

New Zealand Government. 2022. *National Policy Statement on Urban Development 2020*. Wellington: Minister for the Environment. https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-updated-may-2022/

O'Fallon, C. 2010. *Auditing Public Transport Accessibility in New Zealand* (NZ Transport Agency research report 417). Wellington: NZ Transport Agency. www.nzta.govt.nz/assets/resources/research/reports/417/docs/417.pdf

Queensland Government, TransLink. 2015. *Public Transport Infrastructure Manual (PTIM)* (last updated 2020). Brisbane. www.publications.qld.gov.au/dataset/public-transport-infrastructure-manual

Standards New Zealand. 2001. *New Zealand Standard: Design for access and mobility – Buildings and associated facilities* (NZS 4121:2001). Wellington. www.standards.govt.nz/shop/nzs-41212001/

Standards New Zealand. 2009. *Australian/New Zealand Standard: Design for access and mobility – Part 4.1: Tactile Ground Surface Indicators* (AS/NZS 1428.4.1:2009). Wellington. www.standards.govt.nz/shop/asnzs-1428-4-12009/

Transport for London. 2015. *Station Public Realm Design Guidance*. London. https://content.tfl.gov.uk/station-public-realm-design-guidance-15.pdf

Transport for London. 2021. *Interchange Best Practice Guidelines: Comprehensive guide 2021.* London. https://content.tfl.gov.uk/interchange-best-practice-guidance-2021.pdf

Veale J, Byrne J, Tan K, Guy S, Yee A, Nopera T & Bentham R. 2019. *Counting Ourselves: The health and wellbeing of trans and non-binary people in Aotearoa New Zealand.* Hamilton: Transgender Health Research Lab, University of Waikato. https://countingourselves.nz/wp-content/uploads/2022/09/Counting-Ourselves_Report-Dec-19-Online.pdf

ViaStrada Limited. 2022. *Cycle Parking Planning and Design: Cycling network guidance technical note* (version 3). Wellington: Waka Kotahi NZ Transport Agency. www.nzta.govt.nz/assets/resources/cycle-parking-planning-and-design/cycle-parking-planning-and-design.pdf

Victoria State, Department of Transport. 2008. *Public Transport: Guidelines for land use and development*. Melbourne. https://transport.vic.gov.au/about/planning/guidelines-for-land-use-development

Waka Kotahi NZ Transport Agency. 2023. Bus stops impacted by temporary traffic management (webpage). https://nzta.govt.nz/resources/bus-stops-impacted-by-temporary-traffic-management/

Waka Kotahi NZ Transport Agency. No date. Business case approach guidance (webpage). www.nzta.govt.nz/roads-and-rail/highways-information-portal/processes/project-development/

Waka Kotahi NZ Transport Agency. No date. Pedestrian network guidance (webpage). www.nzta.govt.nz/walking-cycling-and-public-transport/walking/walking-standards-and-guidelines/pedestrian-network-guidance/

Waka Kotahi NZ Transport Agency. No date. People on bikes and micromobility (webpage). www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/getting-to-and-from-public-transport/people-on-bikes-and-micromobility-2/

Waka Kotahi NZ Transport Agency. No date. *Hononga ki te Iwi: Our Māori engagement framework*. www.nzta.govt.nz/assets/resources/hononga-ki-te-iwi-our-maori-engagement-framework/hononga-ki-te-iwi-our-maori-engagement-framework.pdf

Waka Kotahi NZ Transport Agency. No date. Public transport design guidance (webpage). www.nzta.govt.nz/ptdg

Waka Kotahi NZ Transport Agency. No date. Public transport priority and optimisation (webpage). http://www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/public-transport-priority-and-optimisation/

Waka Kotahi NZ Transport Agency. 2015. *RTS 14: Guidelines for Facilities for Blind and Vision Impaired Pedestrians* (3rd ed). Wellington. www.nzta.govt.nz/assets/resources/road-traffic-standards/docs/rts-14.pdf

Waka Kotahi NZ Transport Agency. 2020. Draft Rail Planning Station Case Study (unpublished).

Waka Kotahi NZ Transport Agency. 2021. Battery electric bus charging infrastructure (webpage). Public Transport Design Guidance. www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/battery-electric-bus-charging-infrastructure/

Waka Kotahi NZ Transport Agency. 2021. Bus layover and driver facilities (webpage). Public Transport Design Guidance. www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/bus-layover-and-driver-facilities/

Waka Kotahi NZ Transport Agency. 2021. Bus stop (webpage). Public Transport Design Guidance. www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/bus-stop/

Waka Kotahi NZ Transport Agency. 2021. Getting to and from public transport (webpage). Public Transport Design Guidance. www.nzta.govt.nz/walking-cycling-and-public-transport/public-transport/public-transport-design-guidance/getting-to-and-from-public-transport/

Waka Kotahi NZ Transport Agency. 2021. Resource efficiency and waste minimisation (webpage). Highways Information Portal. www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-sustainability-in-our-operations/environmental-technical-areas/resource-efficiency-and-waste-minimisation/

Waka Kotahi NZ Transport Agency. 2022. Project development (webpage). Highways Information Portal. www.nzta.govt.nz/roads-and-rail/highways-information-portal/processes/project-development/

Waka Kotahi NZ Transport Agency. Integrated Public Transport and Urban Form guidance (unpublished, in draft)

WorkSafe. 2022. Laws and regulations (webpage). www.worksafe.govt.nz/laws-and-regulations/

Yarra Trams. 2020. *CE-021-ST-0035: Infrastructure – Tram track design.* Melbourne. https://yarratrams.com.au/media/1892/infrastructure-tram-track-design.pdf

Yarra Trams. 2022. *CE-021-ST-0039: Infrastructure – Tram stop platform design.* Melbourne. https://yarratrams.com.au/media/2497/infrastructure-tram-stop-platform-design-220224.pdf