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Employing Best Practice in Station Access to Bridge the Door-to-Door Divide

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Abstract

Station access is a key component of the overall passenger experience and rail journey. Station access bridges the gap between origin (destination) and transit stations making rail service more comparable to door-to-door car travel. In order to sway more travellers to patronise public transport as their main mode of transport, this segment of the trip needs to be improved. Important questions that need to be considered include: how to best accommodate each access mode, how to enhance access by preferred modes, and how to manage conflicts between them? However, planning for station access is currently addressed in many different ways across Australia and in a relatively ad-hoc manner. A review of Australian and international planning guides to identify key elements important in planning for station access. Best practice elements were identified for inclusion in an access planning methodology for the Australian context. A checklist of station principles associated with each access mode is provided to assess existing station access conditions from case studies in Brisbane, Perth, and Sydney. Results of the analysis identify opportunities for improvement in order to meet future access demands. This paper presents a new perspective for Australian rail agencies, including access in the overall design process and provides a best practice approach, building on developments in Europe and North America.

1. Rail Station Access: the big picture

Public transport use has been frequently put forward as a key measure to alleviate the worsening problem of road congestion caused by increasing car travel. However it will only be successful if public transport can provide a better overall benefit to users than car travel. As the urbanist Wilfred Owens puts it:

> *The basic reason why most urban trips are made by automobile is that the family car is superior to any other method of transportation. It offers comfort, privacy,* ***limited walking****,* ***minimum waiting****, and freedom from schedules or routing. It guarantees a seat; protects the traveller from heat, cold and rain; provides space and baggage; carries extra passengers; and for most trips, gets there faster and cheaper. The transit rider confronts an entirely different situation. He* ***must walk****,* ***wait****,* ***stand****, and* ***be exposed to the elements****. The ride is apt to be costly, slow, and uncomfortable because of antiquated equipment, poor ventilation, infrequent during any other time of day, inoperative at night, and non-existent in suburbia. (Owens 1950, pp.204-205)*

From Owens' statement, it is clear that an important component of public transport travel is how the user reaches the service, ie station access. The type of access mode utilised by passengers to reach the station is closely associated with the land-use and population densities of a station's tributary area, according to Semler and Parks (2011). Brons et al (2009) points out that regardless of the mode of access, overall rail passenger satisfaction is partly a function of access facilities satisfaction, so improving the quality of access is likely to increase rail use. As they found in Table 1, station accessibility ranks 7th in terms of importance for all passengers while ranking after travel time reliability and level of comfort for infrequent passengers. This highlights the potential to sway infrequent rail travellers via station access improvements.

Table 1: Relative importance of rail journey dimensions

Variable	All passengers	Infrequent passengers
	Coefficient	Coefficient
(Constant)	1.203	1.545
Dimensions of rail trip		
Travel time reliability	0.201	0.226
Price/quality ratio	0.080	0.051
Travel comfort	0.213	0.161
Dynamic information	0.087	0.059
Ticket service	0.023	0.051
Station organization and information	0.096	0.069
Service schedule	0.091	0.083
Personnel	0.007	−0.048
Personal safety	0.015	0.047
Accessibility	0.052	0.128
Adjusted R^2	0.482	0.399
N	17033	633

(Source: Brons, Givoni et al. 2009, p.140)

The connection between origin and destination to public transport stations is an important segment of the door-to-door travel experience. The American Public Transportation Association defines station access as "*the portion of an individual's trip that occurs between an origin or destination point and the transit system*" (APTA 2008). This connection bridges the gap between the origin (destination) and passenger rail service in order to be more or less analogous to door-to-door services as shown in Figure 1.

Current and potential riders expect seamless door-to-door transit services. The Transport Cooperative Research Program (TCRP) Report 153 adds that "*unless a passengers' origin and destination is at the entrance to the rail transit service, some kind of mobility is required for the first and last mile of the trip*" (Kittleson and Associates, et al. 2012, p 6). Meanwhile, the Public Transport Authority of Western Australia (PTA WA) sums it up that "*a station that is difficult to identify and get to, or is uncomfortable to use, will not be well patronised compared to that is visible, easy to get to and makes patrons feel comfortable, safe and protected*" (PTA- WA 2011, p52). Travel between station and origin is more challenging for travellers than the actual transit trip itself (Easter Seals 2009).

Figure 1: Rail as part of the door-to-door journey

(Source: ATOC 2010, p.1)

Because of the various modes passengers use to access a station, planning is a multimodal integration exercise. Another challenge is that different agencies are responsible for pieces of the facilities associated with station access; hence a consistent vision of an accessible station remains elusive. With competing and conflicting objectives from different access modes, a systematic overall approach to station access planning is essential and consistent instead of ad-hoc solutions.

2. Station Access in Australia

2.1 Planning

Planning for station access is currently addressed in many different ways across Australia and in a relatively ad-hoc manner. Only recently that rail agencies (RA) are looking at improving access-related facilities with the objective of increasing patronage by making access more attractive, convenient, safe and seamless.

2.1.1 Station Categories

A station category provides a means of identifying attributes associated with the different stations and their primary function within the transport system. Rail stations differ depending on their location – city, suburban, outer urban, and terminus. While every station area is unique and reflects local context, some common principles apply in the creation of public spaces (FRA 2011). Some of the criteria for categorisation include: patronage, revenue, staffing, distance from the CBD, facilities in the station, and level of security provided. Only a few guides include station access mode characteristics in their categorisation. Station typologies used in Australia are listed in Table 2.

Table 2: Australian Station typology

PTA WA	TfNSW	TransLink Qld	Victoria
Grand Central	City	Principal Hub	Premium
	Major	Activity Hub	Host
Suburban Manned	Suburban	Suburban	
Bus-Rail Interchange/ Terminus		End-of-line	Terminal
Park-and-Ride			
	Community	Inner Suburban	
Suburban Unmanned	Outer Urban	Outer	Un-staffed
Special Event			

(Sources: PTA WA 2011; Transport NSW 2011; TransLink 2012; State Government of Victoria 2011)

2.1.2 Access Mode Hierarchy

Due to the different needs and priorities assigned to each of the access modes, separation of modes is necessary to reduce conflicts and ensure adequate access and circulation in accordance with the established hierarchy. According to PTA WA, "*the inter-modal breakdown of patron access to the station, whether by feeder bus, private car, walk on or cycle, is a primary determinant of its function and is of primary importance in its design and planning*" (2011, p.53). A most important component of station access planning is a mode access hierarchy. While most RAs utilise a single hierarchy for all types of stations, PTA WA recommends using different hierarchies for different station types as shown in Table 3 providing a more detailed approach to describing the station categories.

Conversely, other Australia agencies use a more traditional approach to access hierarchy with a single pecking order across the station categories as shown in Table 4. A shared characteristics among the hierarchies listed is that walking mode is given the highest priority and Park-and-ride given the least. Regardless of the given hierarchies, further details are needed on how to best accommodate each access mode, how to enhance access by preferred modes, and how to manage conflicts between them resulting from the hierarchies.

Table 3: Access mode hierarchy across station categories

Access Hierarchy	Grand Central	Bus-Rail Interchange	Park-n-Ride	Suburban (manned)	Suburban (unmanned)	Special Events
1	*Under review*	Bus users	Walk/cycle users			
2		Walk/cycle users	Kiss-and-Ride & disabled			
3		Kiss-and-Ride & disabled	Long term Park-and-Ride			
4		Long term Park-and-Ride	Long term Pay & Display			
5		Long term Pay & Display				

(Source: PTA WA 2011, p.65)

Table 4: Overall access hierarchy for all station types

Access Rank	TfNSW	TransLink	Victoria
1	Pedestrian/ bicycle	Walk	Pedestrian
2	Train	Cycle	Informal bike storage
3	Tram	Feeder public transport	Bike cages
4	Bus/Ferry	Kiss-and-Ride	Disabled car parking
5	Kiss-and-Ride	Park-and-Ride	Taxi ranks
6	Park-and-Ride		Kiss-and-ride
7			Emergency service vehicles
8			Service vehicles
9			Bus
10			Tram
11			Private car parking

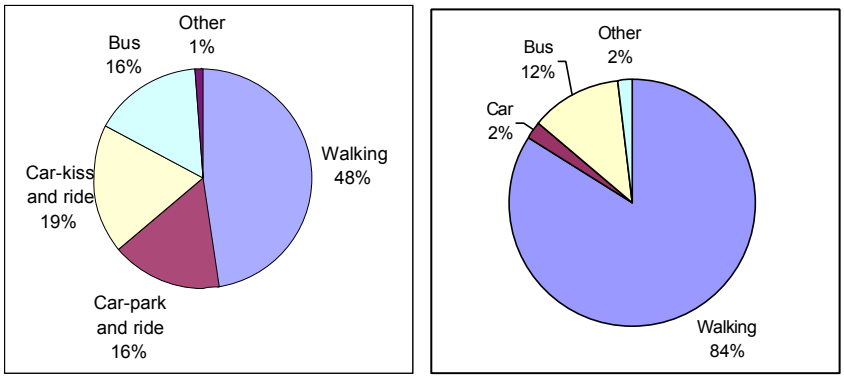
(Sources: State Government of Victoria 2011; Transport NSW 2011; TransLink 2012)

2.2 Access Mode Share

In 2006 25% of all dwellings in Sydney were within 800 metres of a train station, and walking from home to the station was the most preferred (47%) access mode (see Figure 2) with an average distance of 700 metres, while 84% walked from station to home (TPDC-NSW 2006). For longer access distances, park-and-ride, kiss-and-ride and buses were the favoured mode of transport and access.

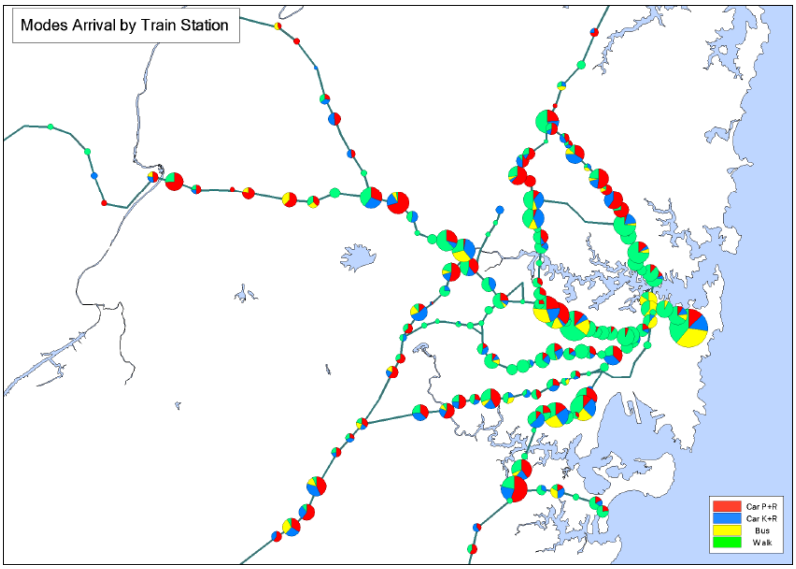
Figure 3 presents the access mode by station along the NSW rail network. Walking is an important access mode for inner locations while car access was more important for passengers living farther away from the CBD (Xu, Milthorpe et al, 2011). Access to train stations is affected by development density as illustrated in Figure 4(a), with similar results of access mode shares versus distance from the CBD in Sydney shown in Figure 4(b). Even though car access is the lowest priority mode (by transport agencies), there will be conditions where it is the only viable mode of access for passengers.

Figure 2 Modes used for train station access and egress in Sydney



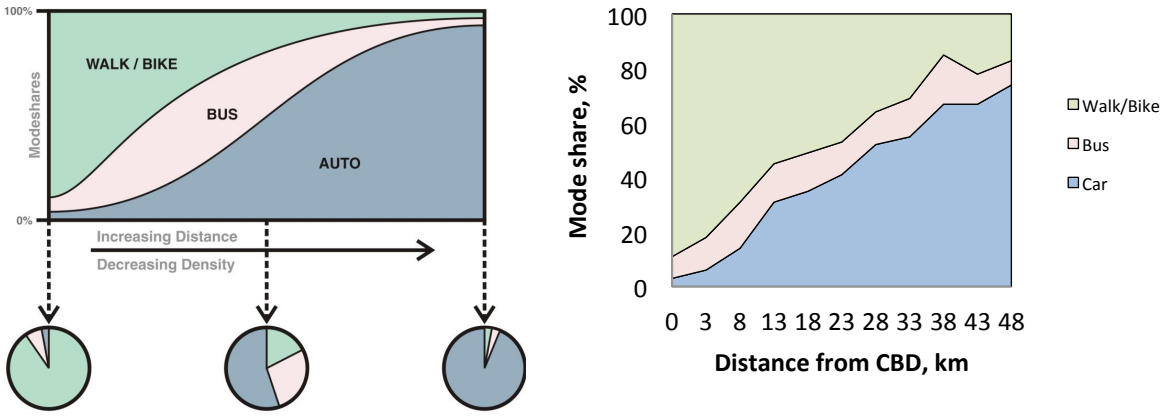
(Source: TPDC-NSW 2006, p.3-4)

Figure 3: Access mode by station – Sydney



(Source: Xu, Milthorpe et al. 2011, p.12)

Figure 4: (a) Density's and access mode choice and (b) Empirical results from Sydney



(a) (b)

(Source: Xu, Milthorpe et al. 2011; Kittelson and Associates, Sampson et al. 2012, p.34)

3. Review of Station Access Planning Practice

Station access planning should be an integral part of the station development especially when improving existing facilities and designing new facilities. Access plays a key role in attracting passengers and generating ridership to rail at a particular location. Most station design guides primarily focus on the physical design requirements of the station environment. Recent research has focused on the importance of a standardised station access planning process (Kittelson and Associates, Sampson et al. 2012).

3.1 International Guides

3.1.1 TCRP Report 153: Guidelines for Providing Access to Public Transportation Stations (Kittelson and Associates, Sampson et al. 2012)

TCRP 153 provides information on effectively planning for access to high capacity transit stations and a high-level station access planning tool. The guidelines are based on a detailed review of literature, agency practices and case studies of transit agencies in the US. It is intended to aid those involved in developing station access, including public transport and highway agencies, city planning groups, potential developers and affected residents.

The guide is an eight-step planning process for access to transit. This process provides an outline of the planning process, from identifying problems and engaging stakeholders at the outset to ultimately developing and implementing a preferred option. Detailed guidelines are also set out for each access mode: pedestrian, bicycle, transit, and car access to the station. The potential effectiveness of transit-oriented development opportunities to increase transit ridership is also assessed.

A station access planning tool in the form of a spreadsheet was designed for the estimation and evaluation of ridership and access mode splits, testing of alternatives, and a preliminary cost-benefit evaluation. Data for the tool include: transit and station (within a 800-metre radius) related data, census, and employment data and default values are provided (from literature, stakeholder interviews, and case studies). Other built in values were derived from an analysis of over 600 high-capacity transit stations. Station typologies were also developed from the analysis. The tool is set up to be a step-wise process with each step on a separate tab in the spreadsheet. The fifth step in the process lists how well each access mode is performing relative to other stations of the same type. The final step of the process evaluates the fiscal impacts of the option by subtracting costs from the revenues.

3.1.2 UK Guide to Station Planning and Design (Network Rail 2011)

The guide helps designers to see whether their plans will deliver better stations by making them accessible and easy to use, integrate well with the communities and make a positive economic, social and environmental impact. Efficient connection between transport modes and services is a core function of stations. Design of connections should balance modal and functional priorities, using safe, direct routes that minimise conflict with other passengers or vehicles. Not only does this minimise passenger journey times, but it also ensures efficient connections that allow passengers to make their onward journey as easily and as logically as possible.

As part of the guide, a systematic approach to evaluation uses a ‘traffic light’ system to rate each principle. A ‘green’ light rating shows that all criteria under that principle are met, an ‘amber’ light signifies that some are addressed while a ‘red’ light shows that only a few (if any) have been considered. Principles have ratings of ‘red’ or ‘amber’ require further improvements to meet best practice.

3.2 Australian Guides

3.2.1 NSW: Customer Focused Transport Interchange Design Handbook (Draft) (Transport NSW 2011)[1]

An interchange is a place where passengers are provided with the opportunity to connect with the public transport network. This handbook provides detail and guidance to the needs of passengers using transport interchanges (including access needs), including pedestrians, cyclists, train passengers, bus passengers, ferry passengers, tram passengers, coach passengers, taxi users, kiss-and-ride users, and park-and-ride users. Where conflict arise between interchange users, the access mode priority principles are employed where the most efficient and sustainable modes are prioritised.

3.2.2 Queensland: TransLink Public Transport Infrastructure Manual (TransLink 2012)

This manual provides guidelines for the planning and design of public transport infrastructure to support passenger movement and safety within the TransLink network. The manual encourages use of best practice and provides guidance to ensure consistency is maintained on the delivery of high-quality customer access, convenience, safety and comfort of public transport infrastructure. The manual also outlines preferred requirements of infrastructure design to comply with all pertinent standards and regulations.

Principles of station planning and design, environment, formation and design are detailed with principles relating to supporting access infrastructure. Access modes and hierarchy is defined (decreasing priority) as walk, cycle, bus feeder, kiss-and-ride and park-and-ride. Requirements for each station access mode are broken down into components dealing with integration of supporting access infrastructure, demand analysis, design considerations, and approval process. Supporting access infrastructure is further divided into requirements on the broader network, network integration, design integration, internal network, location, need identification, crossings, staging, accessibility and land uses, and hazards. Demand analysis prescribes methodologies, tools, and sources of data in order to estimate passenger demand (by access mode).

3.2.3 Victoria: Railway Station Design and Guidelines (State Government of Victoria 2011)

This guide specifies the accepted criteria to be employed when designing new or executing upgrades to passenger railway stations and the associated inter-modal connections both on the regional and the metropolitan railway networks in Victoria. Each part of this standard is aimed to highlight the requirements for the different elements of a station and its associated inter-modal connections. The purpose of the standard is to ensure that all future station design is compatible with the network configuration and that the station environment is designed to be as accessible, safe and enjoyable so far as practicable for passengers and staff. It seeks to guide a designer by defining key functional aspects of railway stations, but does not endeavour to specify the detailed operations or prescribe the architectural detail of a station.

The type of interchange facilities that may be provided at a station include: bus stopping areas ranging from a single on-street bus stop, to dedicated bus bays or off-street bus/rail interchanges; Tram zones; Taxi zones; Bicycle parking; Car parking ranging from small off-street at grade to large multi-storey car parks; and kiss-and-ride zones (including accessible drop off areas).

3.2.4 Western Australia: Architectural Design Guide for Stations (PTA WA 2011)

[1] This document was drafted by the NSW Department of Transport, predecessor to Transport for NSW (TfNSW). TfNSW is currently developing the NSW Interchange Strategy as part of its Long Term Transport Master Plan. The Strategy will set a framework for Interchanges in NSW, how they are planned, designed, delivered, operated and maintained. New design guidelines, categorisation and prioritisation of interchanges will be developed as part of this process.

The Guide provides a framework for designing public transport infrastructure buildings such as bus and train stations. It identifies the type of station on the urban rail system depending on their location, function and connectivity to other transport systems and routes, and patronage.

The general guiding principles for a stations' function are: to provide for local walk up and cycle patrons, to provide attractive and convenient inter-modal transfer for feeder buses, and intercept and encourage car users to shift to public transport by providing park-and-ride, pay-and-display, and kiss-and-ride facilities. A hierarchy is aimed to reward pedestrian, cycle and bus users with shorter distances, higher convenience and higher comfort levels than private car users. Short term (Kiss-and-ride) and accessible parking is encouraged over long term parking.

The fundamental principles that are considered in planning and design of stations in the guide are: patronage hierarchy; function – planning to suit patronage; vehicle and pedestrian access to the station precinct; position of station forecourt and entry building; security / visibility / passive surveillance; emergency egress; and access for emergency vehicles.

3.3 Comparison of Important Station Access Elements from Various Planning Guides

Table 5 lists a comparison of the six guides reviewed above. Recommended components identified among the guides are listed for the purpose of developing a best practice station access guide.

1) *Access mode hierarchy:* reflects the mode most favoured (eg more environmentally sustainable modes) by the transit agency. The hierarchy aids in managing and resolving trade-offs between competing or conflicting modes. Having access hierarchies for each station category may be more appropriate but adds to the complexity of the analysis, so a single hierarchy is recommended.
2) *Station categories:* based on several important factors such as patronage, revenue, density, etc. The number of categories depends on the size of the network and the type of services provided. 12 categories of station types in the US were identified in TCRP Report 153. The number of categories reflects the diversity and number of stations involved in the investigation. Based on guides from Australia, 5-8 station categories seem ideal to cover the distinct diversity of the stations.
3) *Station category and access mode*: data collection of access mode share for each station can be used to monitor changes in demand for planning purposes.
4) *Guiding principles for enhancing each access mode*. TCRP Report 153 and TransLink's PTIM provide the most comprehensive principles.

Table 5 Important elements of station access planning

Element	**TCRP Report 153 (2012)**	**Network Rail Guide (2011)**	**NSW Interchange Handbook (2011)**	**Translink PTIM (2012) QLD**	**Victoria VRIOGS-002-1 (2011)**	**PTA-WA Architectural Guide (2011)**
1. Access mode hierarchy	Access priority depends on location, history, setting, land uses, & density	Prioritise access by feeder modes such as walk, cycle, taxi or bus	Pedestrian/ bicycle, train, tram, bus/ferry, Kiss-and-ride and Park-and-ride	Walk, cycle, bus, Kiss-and-ride and Park-and-ride;	Pedestrian, cycle, disabled car parking, taxi, Kiss-and-ride, emergency vehicles, service vehicles, bus,	Access hierarchy by station category (incomplete/ under review)

Element	TCRP Report 153 (2012)	Network Rail Guide (2011)	NSW Interchange Handbook (2011)	Translink PTIM (2012) QLD	Victoria VRIOGS-002-1 (2011)	PTA-WA Architectural Guide (2011)
					tram, car parking (private and staff)	
2. Station categories	12 categories across 8 factors	6 categories	5 interchange category and 5 train station types	3 station types & 3 hierarchy of station facilities	4 categories for metropolitan and 5 categories for regional	6 station categories
3. Station category and access mode	Access mode share defined	No suggestion	No suggestion	No suggestion	No suggestion	Access mode given
4. Guide principles for enhancing each access mode	Detailed for each access mode	Lists guidance to coordinate modal integration for rail, bus, cycle, and taxi	Detailed for each access mode	Very detailed requirements for each access mode	Detailed requirement for bicycle and car parking only with reference to standards/ guides	Less-detailed guiding principles for vehicle, pedestrian and cycle access

4. Proposed Station Access Guide Principles

The key elements are for developing an evaluation framework for station access-related facilities are outlined below.

4.1 Access Hierarchy

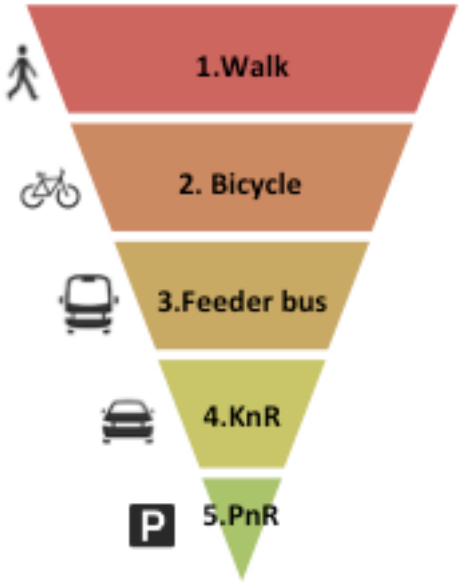
The access mode hierarchy is based on the modal priority policy of an agency. Most of the guides reviewed put a premium on more sustainable modes (walk, cycle and bus feeder) and less for car access. It is recommended that the access mode hierarchy in Providing access for people with disabilities should be accorded priority using relevant accessibility guidelines and standards (DDA, DSAPT and AS). By providing good access for persons with disabilities, it also provides benefits for other passengers, such as parents with prams, passengers travelling with luggage and the general commuting population.

Figure 5 be used where walking and cycling are ranked high in the priority list. A single hierarchy is simpler to implement than a multi-hierarchical system. The hierarchy is especially important in trade-off analysis where it can serve as a guide for option-selection. For example, if the aim is to promote an efficient and sustainable mode, then walking and cycling are given priority over other modes.

Providing access for people with disabilities should be accorded priority using relevant accessibility guidelines and standards (DDA[2], DSAPT[3] and AS[4]). By providing good access for persons with disabilities, it also provides benefits for other passengers, such as parents with prams, passengers travelling with luggage and the general commuting population.

[2] Disability Discrimination Act
[3] Disability Standards for Accessible Public Transport
[4] Australian Standards

Figure 5 Recommended station access hierarchy



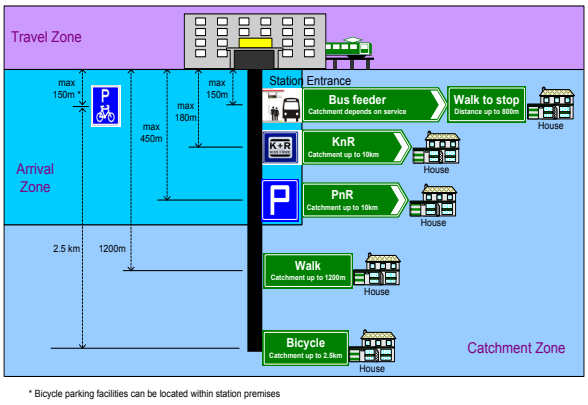
4.2 Access Location

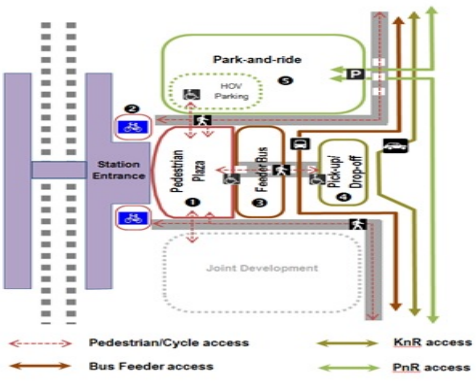
Access location is based on the proximity and level of amenity of access to the station and facilities, and is the key component in considering the planning the layout of a station. The access hierarchy reward pedestrian, cycle and bus users with shorter walking distances, higher convenience and higher comfort levels than private car users as illustrated in Figure 6(a). Short term pick-up/drop-off (Kiss-and-ride) and accessible parking is encouraged over park-and-ride. Figure 6(b) shows the recommended location (relative to the station entrance) based on the access hierarchy.

4.3 Station Categories and Access Modes

Access modes are also incorporated within the station category. Table 6 shows station categories along with access modes from three agencies: Sydney Trains[5], TransLink and PTA WA.

Figure 6 (a) Recommended walking distances and (b) facilities' location based on access hierarchy





(a) (b)

(Adapted from: WMATA 2008, p.2-3; FDOT 2009)

[5] Previously RailCorp

Table 6 Select Australian station categorisation and corresponding access modes

NSW Sydney Trains	General Access Description	TransLink	General Access Description	PTA WA Architectural	General Access Description
City (Town Hall)	Regional interchange, pedestrian, bus, cycle, & taxi, but limited car access.	**Principal Hub (Roma)**	Active transport supported by feeder bus.	**Grand Central (Perth)**	Pedestrian/cycle, car access, taxi, bus (linked or on-street)
Major (Chatswood)	Major interchange, pedestrian, bus, cycle, & taxi, but limited car access.	**Activity Hub (Auchenflower)**	Active transport supported by feeder bus, kiss-and-ride, & park-and-ride.		
		Inner Suburban (Buranda)	Active transport supported by bus feeder.		
Suburban (Kogarah)	Possible rail interchange. Pedestrian, bus, cycle, taxi, & car access provided.	**Suburban (Zillmere)**	Active transport & bus feeder supported by kiss-and-ride & park-and-ride	**Suburban (manned) (Victoria Park)**	Pedestrian/cycle, car access, taxi, bus on-street
Community (Homebush)	Pedestrian, cycle, & car access but limited bus & taxi access.	**Outer (Birkdale)**	Bus feeder, kiss-and-ride & park-and-ride, some active transport.	**Park & Ride (Claremont)**	Pedestrian/cycle, car access, taxi, bus on-street
Outer Urban	No interchange with other forms of PT.			**Suburban (unmanned) (Queens Park)**	Pedestrian/cycle, car access, taxi, bus on-street
		End-of-line (Ferny Grove)	Interchange bus & rail supported by active transport, kiss-and-ride, & park-and-ride.	**Bus-Rail Interchange/ Terminus (Murdoch)**	Pedestrian/cycle, car access, taxi, bus (linked or on-street)
				Special Events (Showgrounds)	Pedestrian/cycle, taxi, bus on street

(Source: Sydney Trains; Translink; PTA WA)

As can be seen in

Table 6, there are gaps in the station categories. To cater for a wider range of conditions, an eight-station categorisation is proposed as shown in Table 7.

Table 7 Recommended station categorisation and access mode list

Station Type	Access modes
City Centre	Walk, Cycle, Rail interchange, Bus feeder, Taxi/kiss-and-ride, Limited or no parking
Activity Centre	Walk, Cycle, Bus feeder, Kiss-and-ride/Taxi, Park-and-ride at surrounding parking structures
Regional Park-and-ride	Walk, Cycle, Bus feeder, Kiss-and-ride, Large dedicated park-and-ride
Local Park-and-ride	Walk, Cycle, Kiss-and-ride, dedicated park-and-ride (moderate-size)
Suburban/Neighbourhood	Walk, Cycle, Bus feeder, Kiss-and-ride, Park-and-ride (small to moderate size)
Airport/Seaport	Walk, Cycle, Bus feeder/shuttle, Taxi/Kiss-and-ride, Parking linked to Airport/Seaport
Special Events	Walk, Cycle, Bus feeder, Park-and-ride shared with surrounding structures
End-of-line	Walk, Cycle, Bus feeder, Kiss-and-ride, dedicated park-and-ride (size dependent on demand)

4.4 Access Mode Principles and Evaluation Framework

The evaluation framework adapted for station access is based on a 'traffic light' system as employed by UK's Network Rail Guide to Station Planning and Design (Network Rail 2011). A 'green', 'amber' or 'red' rating depends on how access principles have been addressed. A green rating indicates that all the criteria have been adequately addressed. A red rating suggests that only a few (if any) of the criteria are tackled. The proposed station access evaluation framework is shown in Table 8.

Table 8 Access modes principles evaluation framework

	Rating			Comments	Actions
Access Mode Principle					
Walking to the station					
Pedestrian paths direct and not conflict with other modes?					
Sufficient directional signage to station?					
Path wide enough and free from obstructions?					
Cycling to the station					
Direct, safe & well-marked bike paths & not conflict with other modes?					
Sufficient, secured and sheltered bike parking provided?					
Bus feeder access					
Direct bus routes to drop-off area?					
Is transfer safe, short and seamless?					
Are bus transfer facilities adequate?					
Kiss-and-ride access					
Short walking distance to/from kiss-and-ride location?					
Kiss-and-ride facilities adequate?					
Sufficient kiss-and-ride signage provided?					
Park-and-ride access					
Park-and-ride located to minimise conflict?					
Park-and-ride adequately sized and secure?					

Clear wayfinding towards park-and-ride facility?					
Pedestrian paths to/from park-and-ride safe and convenient?					

(Adapted from: Network Rail 2011)

5. Case Studies

5.1 Case Study Profiles

Three stations were selected as case studies and were of different station categories: city centre (Town Hall, NSW), regional park-and-ride (Coomera, QLD) and end-of-line (Mandurah, WA) with data provided by Sydney Trains (NSW), TransLink's PTOD[6] (QLD) and PTA (WA). Table 9 shows the relevant station access facilities provided at the three stations. A desktop review was undertaken to implement the evaluation elements and principles identified in Section 4.

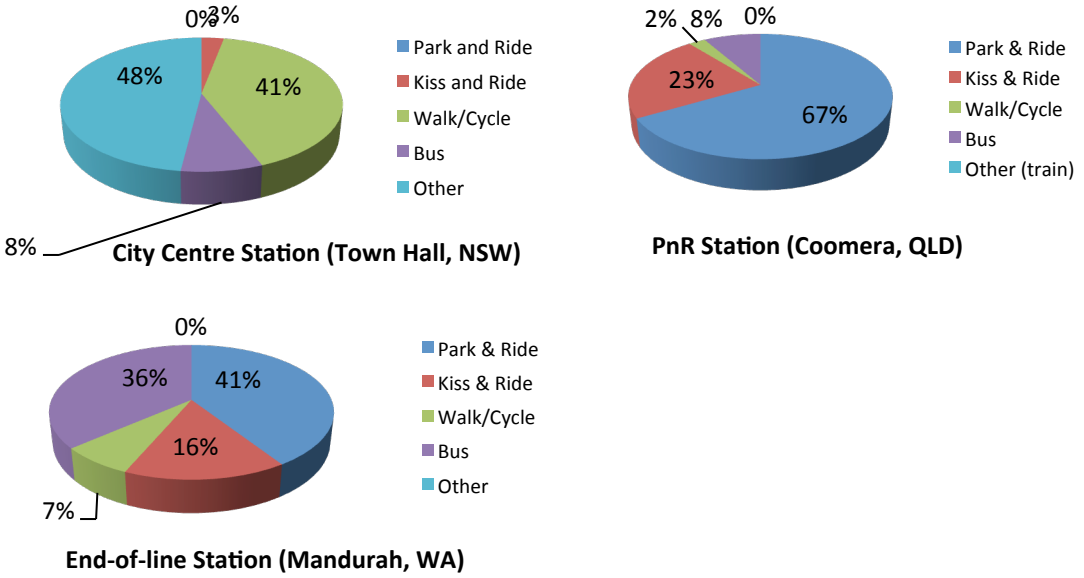
Table 9 Case studies station access profiles

Station Category	City Centre	Regional Park-and-ride	End-of-line
Station Name	Town Hall, NSW	Coomera, QLD	Mandurah, WA
Access Facilities	Availability		
Bike Rack or Lockers	No	Yes	Yes
Bus Stop	Yes	Yes	Yes
Kiss-and-Ride[7]	Yes	Yes	Yes
Park-and-Ride	No	Yes	Yes

(Sources: Sydney Trains; TransLink; PTA-WA)

Figure 7 shows the primary modes of access are walk, bus interchange and others (rail interchange) for the Town Hall Station. Coomera Station exhibits almost two-thirds of all passenger access use park-and-ride. The walking access for both stations is low reflecting the remoteness of the station to residential land use as shown in Figure 8(a).

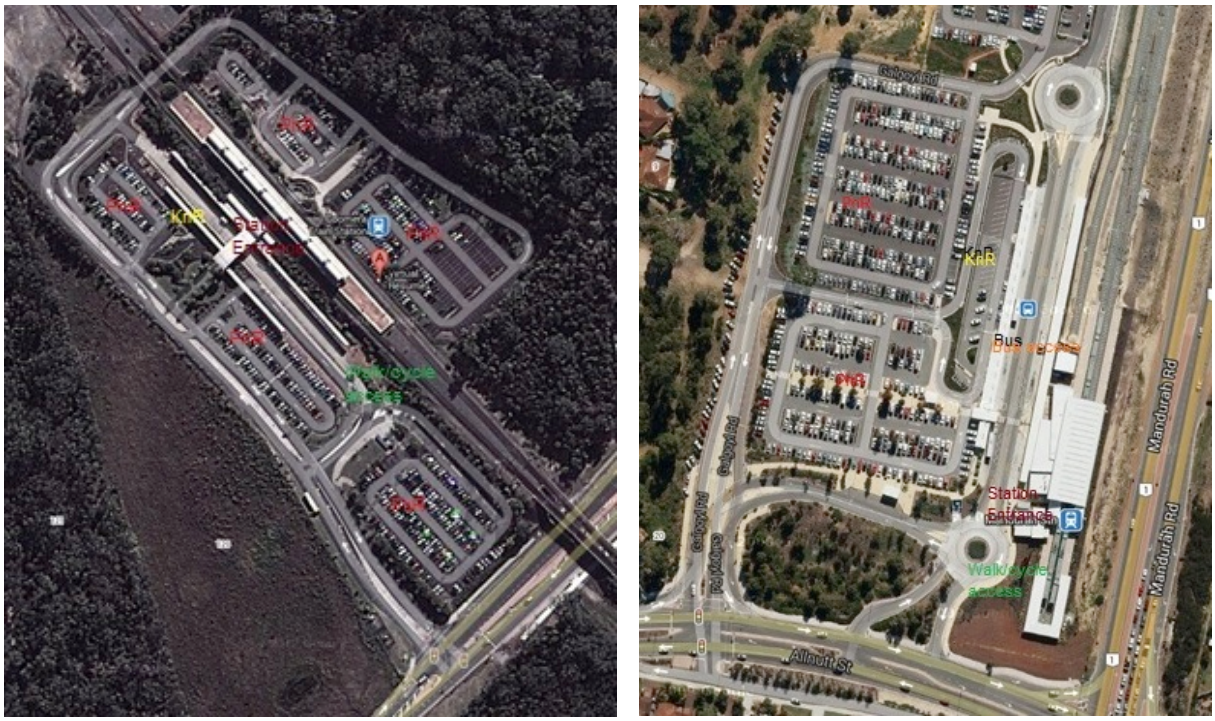
Figure 7 Case study stations access mode proportions



[6] TransLink's Public Transport Origin-Destination Survey
[7] Includes taxi access

Mandurahas an end-of-line station has a good mix of all the different access modes. The proportion of bus access is dependent on the number and type of bus feeder services while the proportion of walking access is contingent on the walking distance to the station. The low proportion walking to the station can be attributed to the presence of nature reserves between dwelling units and station that are not walkable as shown in Figure 8(b). A major road also cuts across the station and adjacent residential areas creating a walking barrier.

Figure 8 (a) Coomera (QLD) and (b) Mandurah (WA) station access facilities layout



(a) (b)

(Source: Google Maps Inc 2013)

5.2 Case Study Analysis

The three stations are evaluated across the four station access elements identified in Table 5 (access mode hierarchy, facilities' location, access mode by category, and detailed mode principles) for the purpose of identifying where improvements can be implemented.

5.2.1 Access Mode Hierarchy and Location

Despite Western Australia having different access mode hierarchies for each station category including end-of-line stations, walk and cycle access were still provided high priority in the locating facilities in the Mandurah station. Walk and cycle facilities were incorporated such that access to the station is convenient. Access hierarchy adherence for the other two stations was prerequisite because the proposed hierarchy is very much similar to both the Transport of NSW and TransLink hierarchy.

The physical layout of access facilities should also be consistent with the access mode hierarchy. Recommended farthest walking distances from the station entrance should be satisfied. For the three case study stations, the distances for bicycle, bus transfer, kiss-and-ride, and park-and-ride facilities were not exceeded indicating good adherence to both hierarchy and facilities' location. The farthest location of bicycle parking should not exceed 150 metres from the station entrance. For bus transfer location, the maximum distance recommended is 150 metres from the entrance. For kiss-and-ride and park-and-ride, the distances are 180 and 450 metres, respectively.

5.2.2 Access Mode Adherence to Station Categorisation

The three stations studied provided adequate access facilities catering to the access modes anticipated for their corresponding station category as per Table 7. City centre stations are generally categorised as destination stations and located in dense urban areas thus large volumes of pedestrians, taxi (also Kiss-and-ride) and other high capacity transit (bus and rail) dominate the modes of access to the station. No dedicated parking is provided at the station. Park-and-ride is offered by surrounding parking structures around the station.

Car access (park-and-ride and kiss-and-ride) is the dominant mode of access at Park-and-ride stations such as the Coomera station. Bus, walk and cycle access are also accommodated however their proportions are relatively low. Coomera station accommodates all modes and the amount of facilities allotted for each is determined based on anticipated demand. Similarly, end-of-line stations including Mandurah also provide facilities for all modes of access.

Detailed Access Mode Principles EvaluationTable 10 summarises the preliminary rating of access principles by mode for each of the case study stations. Town Hall being a city centre station has direct walking access to the station with several entrances from different directions, and sufficient signage and adequate pathway widths. Bus feeder access is also convenient as most bus routes within the vicinity directly connect to one of the entrances.

Coomera being a Park-and-ride station accommodates all access modes. Walking paths to the station entrance however are not as direct especially coming from the northeast part where the Gold Coast Institute of TAFE is located. Similarly, bicycle access is also indirect. Bus, Kiss-and-ride and Park-and-ride were all acceptable. A clear wayfinding signage however is essential in locating the parking spaces on the northern portion of the station; this is especially critical for unfamiliar Park-and-ride users.

The end-of-line Mandurah station almost satisfies all the criteria however, similar to the Coomera station, a portion of the parking spaces are isolated requiring directional signage.

Table 10 Case studies access mode principles checklist preliminary evaluation results

Station Name	Town Hall, NSW	Coomera, QLD	Mandurah, WA
Station Access Principle	Rating	Rating	Rating
Walking to the station			
Pedestrian paths direct and not conflict with other modes?			
Sufficient directional signage to station?			
Path wide enough and free from obstructions?			
Cycling to the station			
Direct, safe and well-marked bike paths and not conflict with other modes?	[8]		
Sufficient, secured and sheltered bike parking provided?			
Bus feeder access			
Direct bus routes to drop-off area?			
Is transfer safe, short and seamless?			
Are bus transfer facilities adequate?			
Kiss-and-ride access			

[8] No bicycle parking facilities provided

Station Name	Town Hall, NSW	Coomera, QLD	Mandurah, WA
Station Access Principle	Rating	Rating	Rating
Walking to the station			
Short walking distance to/from kiss-and-ride location?	[9]		
Kiss-and-ride facilities adequate?			
Sufficient kiss-and-ride signage provided?			
Park-and-ride access			
Park-and-ride located to minimise conflict?	[10]		
Park-and-ride adequately sized and secure?			
Clear wayfinding towards park-and-ride facility?			
Pedestrian paths to/from park-and-ride safe and convenient?			

7. Conclusions and Recommendations

Station access is a key component of the overall passenger experience and bridges the gap between origin or destination and transit stations making rail service more comparable to door-to-door car travel.

An analysis of Australian station access and a review of international planning guides identified key elements important in planning for station access for inclusion in the proposed access planning methodology for the Australian context. The elements identified include: access mode hierarchy, facilities' location, access mode by category, and detailed access mode principles. The detailed access mode principles are rated based on a traffic light system (green, amber or red) depending on how the principle has been addressed.

Case studies of stations from Brisbane, Perth, and Sydney were used to illustrate the proposed approach. The access modes checklist identified areas of improvement in providing adequate access facilities. More detailed analysis would be required to be able to identify specific areas of improvement. The analysis served to illustrate how the elements and principles can be used as a tool for evaluation and planning for station access. Decision makers and the community can readily understand the visual rating approach.

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[9] No Kiss-and-ride facility however taxi ranks provided
[10] No Park-and-ride facility provided

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