Murdoch
Specialised Activity Centre
Structure Plan

4. Movement

4. Movement

4.1 Metropolitan context

The *Draft Public Transport for Perth in 2031* plan outlines a public transport network concept for the whole metropolitan area of Perth and Peel up to, and beyond, the next 20 years. In this public transport concept plan, rapid transit services are proposed for phased introduction across the conurbation, including the central sub-region of the metropolitan area that contains Murdoch. The optimal network plan shows a new heavy rail link for passengers between Thornlie and Cockburn Central and two new on-road rapid transit routes on an east-west axis from Fremantle through to Murdoch; one to Maddington and the other to Cannington (Figure 4.01).

With Murdoch's increasing importance within the structure of Perth, it will rely heavily on the interrelationships with other centres and the ability to ensure fast, efficient connections. Potentially the largest activity centre for the southern urban region, it will draw significant volumes of people from the surrounding suburbs each day. Over time Murdoch will need to be viewed as a significant destination centre which absorbs traffic rather than redirects it, and accordingly major investments, particularly in public transport infrastructure, will be required.

Traffic on Perth roads is generally increasing, causing problems for major activity centres in peak periods. In the future, transport needs to be managed to balance public transport and private vehicles use to make more efficient use of available road space. Until this time, ongoing upgrades

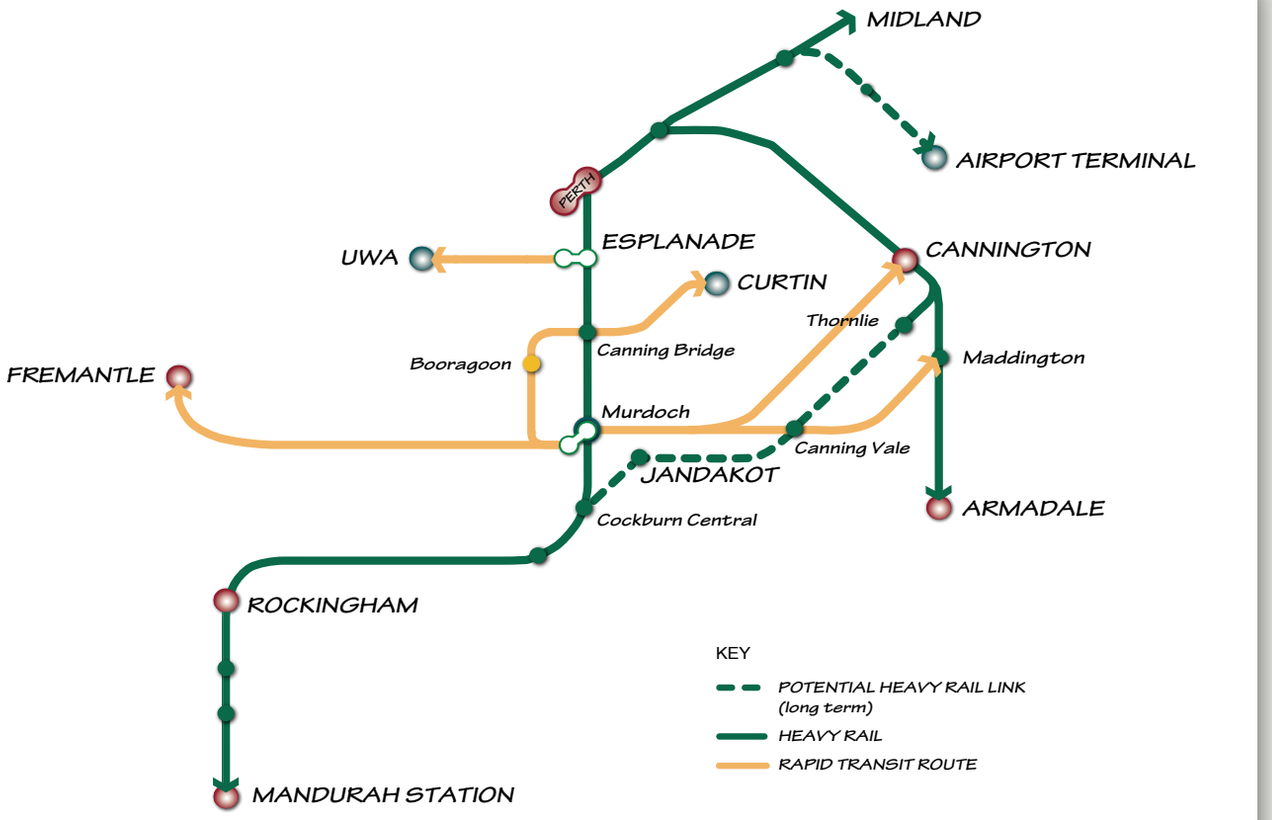

Figure 4.01: Proposed regional transit (optimal network connections to Murdoch)
Note: this diagram is based on, and is not an extract from, *The Draft Public Transport for Perth in 2031*

and reorganisation of the existing road infrastructure will be required to alleviate any vehicle congestion problems. In other areas, the adjustments to road network operations will have to be managed, as in most other urban societies around the world. Lessons from these places can provide sophisticated 21st century solutions to car congestion issues. Integrated transport systems for a contemporary city offer a balanced approach and incentives to change travel behaviour.

It is important to note that the success of the activity centre will depend upon the staged delivery of key transport infrastructure to ensure an appropriate level of accessibility to and within the centre, in particular the provision of a southern access route.

4.2 Regional connections

Murdoch has excellent regional access to locations along the Kwinana Freeway and Mandurah rail line, particularly to Perth CBD. Its proximity to South Street and Leach Highway also provides for direct road links across the south metropolitan area.

As Murdoch evolves, it will have a greater volume of people commuting to it, resulting in its conversion to an origin and destination centre. It will need significant regional transport networks carrying people to it from the surrounding suburbs and other activity centres. Murdoch's role in the activity centre hierarchy will require easy connections with the CBD, Perth Airport, Fremantle, Bentley-Curtin and other centres in the north metropolitan area such as UWA-QEII (Figure 4.02).

To foster modal shift from private cars to alternative travel modes and start the process of meeting the state government's modal split targets for Murdoch (*Murdoch Activity Centre Public Transport Masterplan 2010*), improvements in east-west regional public transport services will be necessary. The introduction of rapid transit, as proposed in the *Draft Public Transport Plan for Perth* would connect Murdoch with other important strategic metropolitan centres. Enhancing the collection of passengers from residential catchments along the transport corridor from Fremantle to Murdoch, and eastwards to Cannington or Armadale, is intrinsic to meeting the modal split targets and alleviating congestion at the Kwinana Freeway/South Street interchange.

The Mandurah rail line will continue to provide good connections to Perth CBD and interchange points to Perth Airport, Bentley-Curtin and UWA-QEII, but other services will need to be developed in the future to effectively link these and other centres with Murdoch. For example, Booragoon is currently the major retail centre close to Murdoch but is only serviced by buses. There is an opportunity to better connect Murdoch to Booragoon via a loop transit service which also links to Canning Bridge Station. This would assist Booragoon to retain its function as the major retail centre of the region as Murdoch grows as a specialised activity centre.

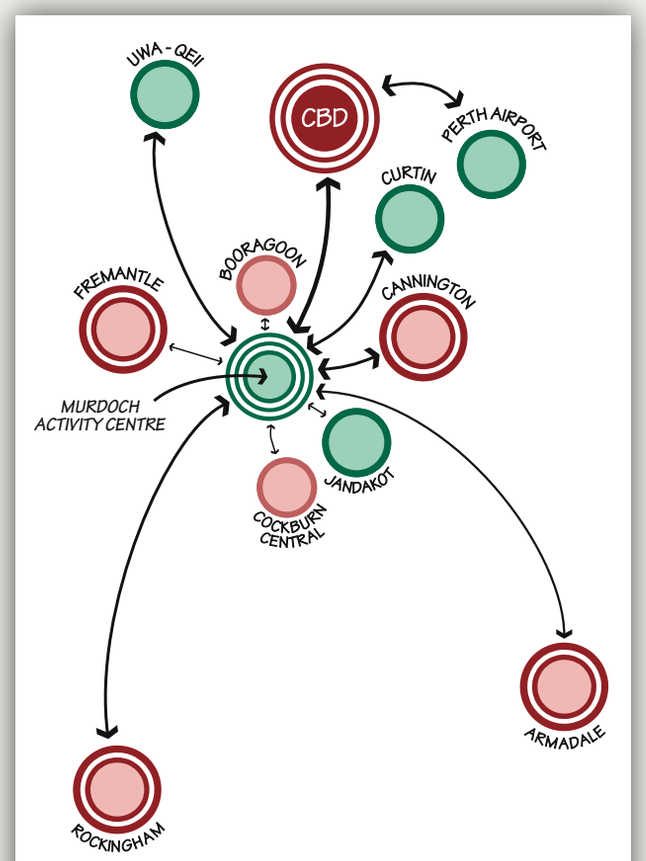

Figure 4.02: Murdoch Activity Centre spatial relationship to other activity centres

4.3 Principal public transport services

Due to Murdoch's specialised role as a centre for education, health and research, there are several key connections which are needed to achieve the networks that will allow Murdoch to achieve its potential. The following is a list of important public transport linkages to other centres, the basis of the need for each link, and the scope to enhance existing transport services:

- **Perth CBD**: to connect Murdoch to the main centre of commerce and allow interaction between key businesses. Murdoch is fortunate in having an existing mainline rail service to Perth CBD with scope to increase future service levels throughout the day to enhance commuter access and economic transactions. This would form part of the transformation of the train station from an inter-regional origin function to an origin and destination station with full line facilities (Figure 4.03).
- **Perth Airport**: Murdoch serves a high knowledge function and thus requires significant interaction with experts from other states and countries. Having an easy and efficient system to connect with the airport will be pivotal to facilitating these interactions. Presently, the most direct connection is via Leach Highway. Improved public transport will be important in the future, to more efficiently link Murdoch to the airport.
- **Curtin University and UWA**: providing good connections to these institutions and other specialised centres will encourage interaction between them, particularly for ancillary organisations which deal with multiple universities. It will also ensure there is high quality public transport choice for students, academic staff and researchers. An extension of the proposed rapid transit network for Perth would present an opportunity to establish these inter-university links.
- **Fremantle – east of Murdoch**: improved transit connections to Fremantle and centres east of Murdoch will allow for some of the underdeveloped links in Perth's current public transport network to be fulfilled. The introduction of rapid transit will provide fast, direct and high-frequency connections to population and services in these centres (including the Port and Notre Dame University in Fremantle) and good access to catchment suburbs surrounding the South Street transit corridor to the east and west of Murdoch.

The existing public transport network around the Murdoch Activity Centre study area is comprised of buses which often travel along curvilinear road networks and large arterial roads which funnel buses towards Murdoch Station for interchange with the north-south rail line, predominantly connecting passengers to the CBD. The circuitous nature of the road network results in indirect journeys which take a perceptually long time to traverse a short distance.

The existing bus network is reflective of a coverage model which provides equitable access to all neighbourhoods rather than prioritising the routes that will provide frequent, efficient and cost effective travel. This can lead to large numbers of bus lines running in parallel and in various directions in a very complicated pattern of low-frequency lines (Nielsen Lange, 2009). In essence, a system cannot function effectively if it tries to serve all people equally or account for all passenger origins and destinations. Therefore prioritisation of key routes should be considered.

Figure 4.03: Murdoch Station – key commuter and arrival gateway

The Public Transport Authority has made significant progress in increasing the frequency of these key services in recent years. However, to meet the modal shift targets which are required for the activity centre, a review of the current public transport system in Murdoch would be required. As it grows, Murdoch needs to be considered as a central business district in public transport planning terms rather than a park and ride train station.

The public transport network should focus on a frequency rather than coverage model by providing a greater number of buses at a greater frequency along fewer transport corridors (Squaresville Ideal Case – Mees' 2000). The principle is to run 5-10 minute bus (Nielsen Lange, 2009) intervals in peak time and for a small proportion of the population to walk further to get to the bus stop (HiTrans Best Practice Guide – Nielsen, Lange et al. 2005). The concentration of lines and operational resources allows for a more frequent service, thus creating a more viable and attractive option for commuters (Figure 4.04).

In the frequency model, the transport corridors intersect and regular services allow passengers to easily transfer between routes with reduced intervals between services. This network allows for a broader network which moves people more rapidly, and has more viable service patterns that can be sustained for longer periods of the day. Apart from enhanced service frequency and operating hours, a more rational series of bus routes provides improved network legibility.

In the case of Murdoch, the transport corridor network should also be augmented with a feeder loop which collects local residents and transports them directly to Murdoch Station. Murdoch Station will become a more important pulse point which will require buses to remain at the Station to allow sufficient time for passengers from the bus to connect with a rail service, and passengers from the same rail service to connect with the bus for its ensuing journey.

The principle is that the feeder bus services will transport passengers to the priority rapid transit service which will provide a faster and more frequent service than simply having all buses terminating at, or passing through, Murdoch. This approach recognises Murdoch station's role in the regional transport network while responding to the elevated status of Murdoch as a major centre. Concentrating more passengers in fewer vehicles with greater capacity will also assist with tackling congestion problems within the activity centre (Figure 4.05).

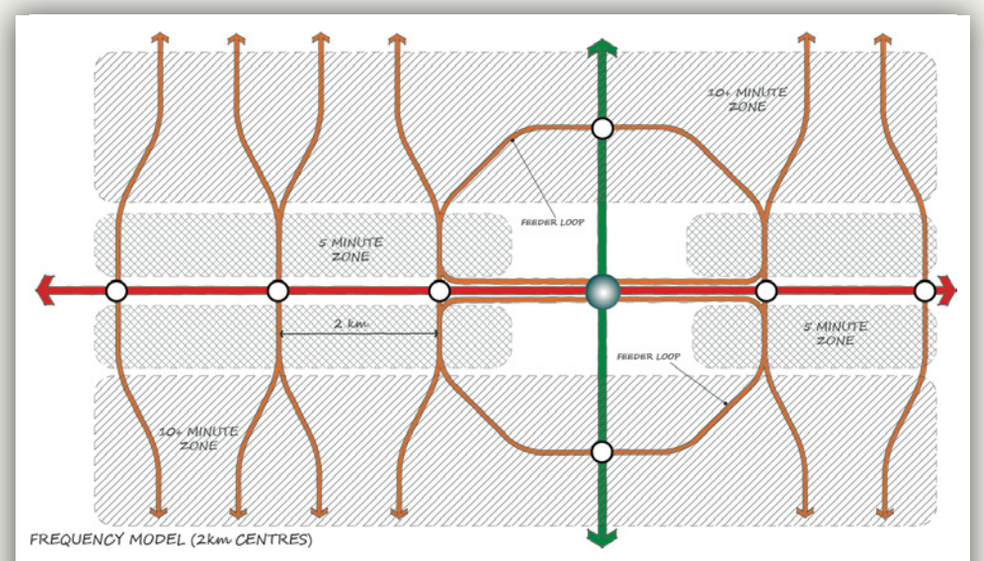

Figure 4.04: Potential alternative public transport model

4.4 Internal transit

The location of the railway line in the centre of the freeway isolates Murdoch Station from surrounding activities and limited transit oriented development opportunities around the station. Land with development potential is therefore situated further away from the station, beyond convenient walking distance. This means that much of the urban core is reliant on frequent and rapid connection between Murdoch Square and Murdoch Station, using Barry Marshall Parade. More frequent bus services will make this connection more attractive once the mixed use precinct is completed along with a direct connection between Barry Marshall Parade and Murdoch Station. In the meantime, to increase the amount of services between Murdoch Square and Murdoch Station, an overlap of local buses is suggested whereby selected routes from east of the Kwinana Freeway terminate at the existing facilities (Figure 4.06).

In addition, an internal shuttle bus system is recommended to link the Murdoch Station with the secondary schools, facilities in the training and technology precinct, sports venues at Farrington Road and various nodal points around Murdoch University's campus and the hospitals. As the intensity of activity increases within Murdoch, this type of service would become more viable with passenger flows increasing between activity nodes, as well as across different modes of public transport. As a local orbital, the shuttle service would overcome some of the distance issues across the centre and provide fast and easy access to many of the

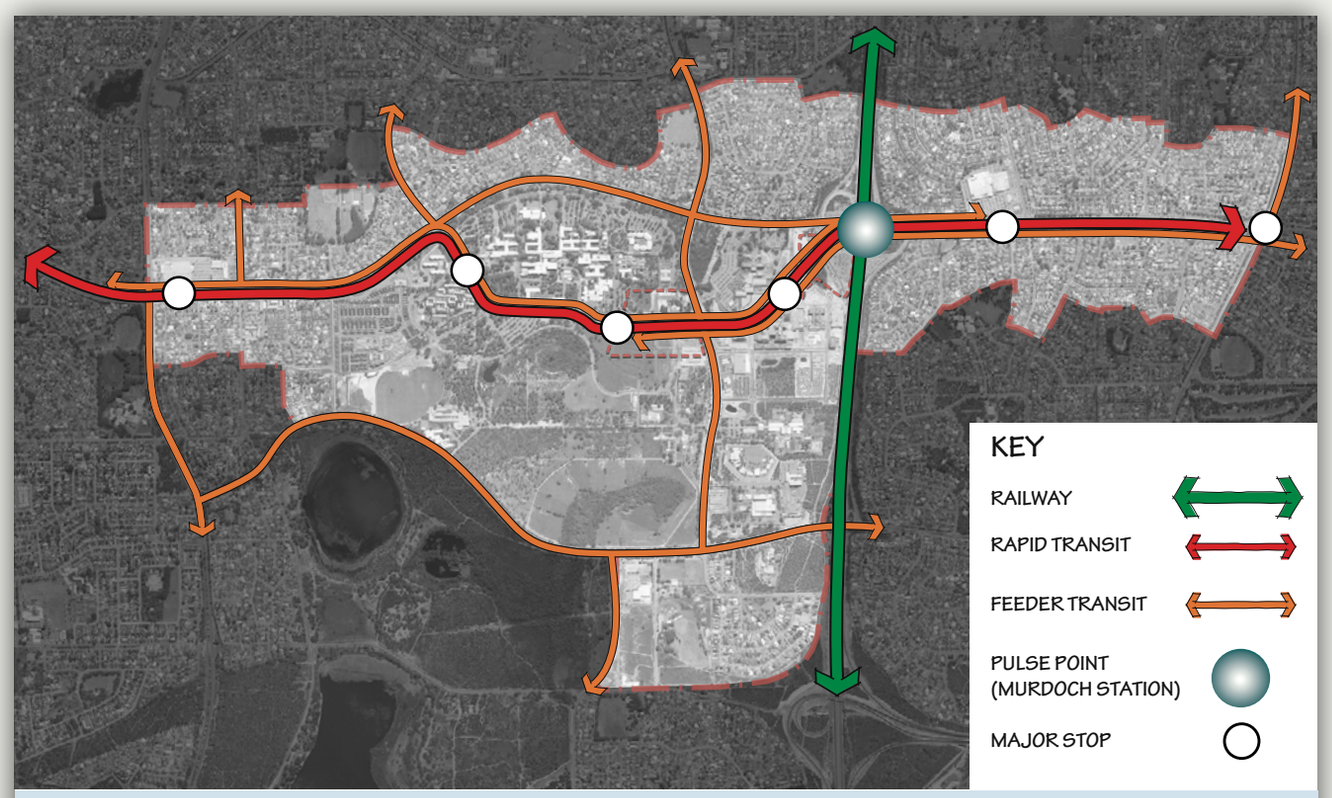

Figure 4.05: Potential district transit network

anchors which are currently spatially dislocated. The aim is to provide an alternative convenient mode of transport to cars and ensure that a significant portion of local trips within the centre are made on public transport to minimise road congestion. This is particularly important in providing services outside of peak periods when regional bus services become less frequent.

As the suggested shuttle bus service picks up the main educational facilities around the centre, it would be most frequent on week days when students are present.

Stops and interchanges

The existing Murdoch Station will remain the focus of transit services within Murdoch Activity Centre and the surrounding area. The development of the activity centre will, over time, result in Murdoch Station becoming an origin/destination station. The influx of passengers will need to be carefully monitored to ensure upgrades to the station will respond to the future demands.

Murdoch Station will remain a pulse point with integrated pulse scheduling which allows for efficient interchange between modal services. This means that services between future modes of transport are better coordinated to arrive and depart with sufficient time to allow for the transfer of passengers between modes, for example, between heavy rail and rapid transit.

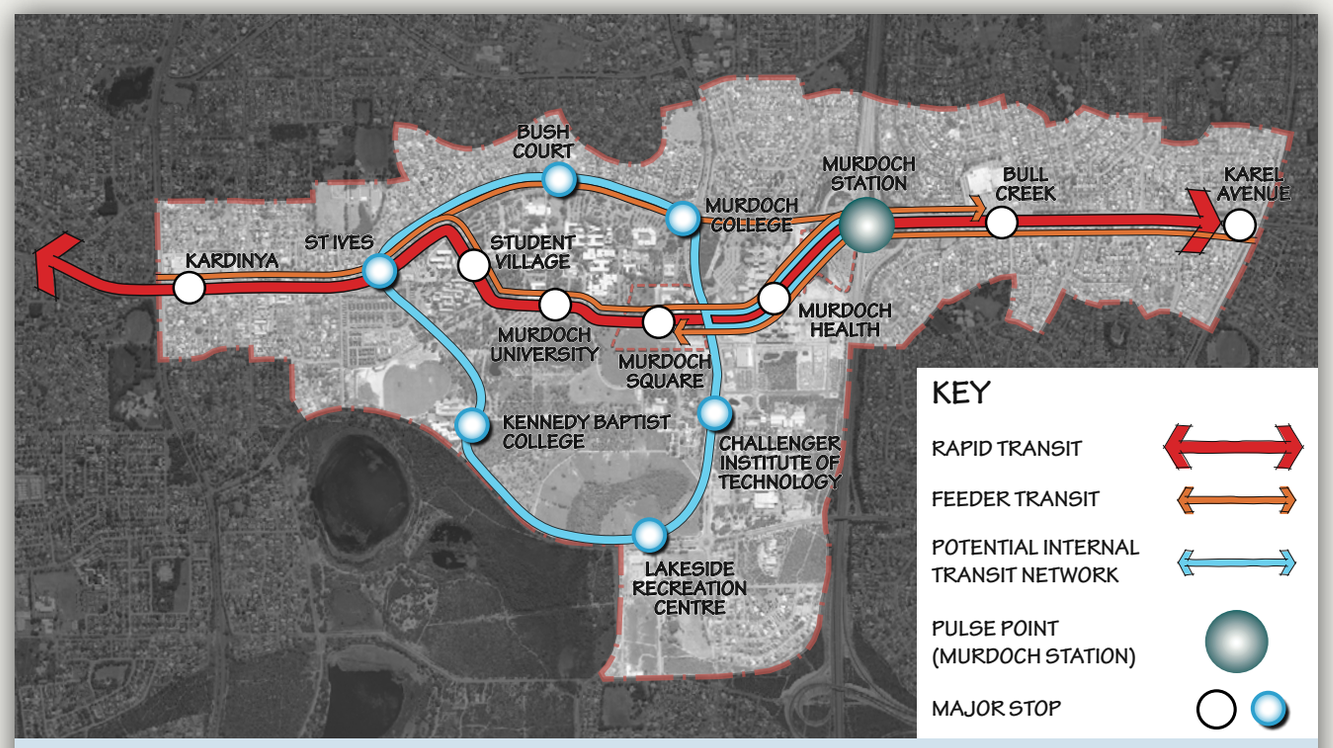

Figure 4.06: Potential internal transit network

4. Movement

The proposed rapid transit stops within the centre have been located at key nodes where significant activity will occur. The aim is to provide fast, easy and frequent access to activities from Murdoch Station in particular. Further planning is required to confirm potential stop locations.

The purpose of each stop is as follows:

Rapid transit stop	Servicing
Murdoch Station	Modal interchange; mixed use precinct
Murdoch Health	Fiona Stanley Hospital, St John of God Hospital
Murdoch Square	Murdoch Square
Murdoch University	Murdoch University core campus
Murdoch West	Murdoch Student Village
St Ives	The St Ives retirement village and suburbs north of South Street
Kardinya	Kardinya Shopping Centre, surrounding suburbs and intersecting bus services
Bull Creek Shopping Centre	Bull Creek Shopping Centre, surrounding suburbs and park and ride
Karel Avenue	Surrounding suburbs and intersecting bus services

Figure 4.07: Improve environment at Murdoch Station for modal interchange

To augment the rapid transit spine, the proposed shuttle bus service would provide easy access for other areas, particularly the training centres and secondary schools.

The purpose of the stops could be as follows:

Internal shuttle stop	Servicing
Bush Court (during semester)	Murdoch University core campus
Murdoch College (during school terms)	Murdoch College
Murdoch Station	Rail station transfers
Challenger Institute of Technology	Challenger, Wandoo Reintegration Facility and CoM depot
Lakeside Recreation Centre (periodic stop)	Lakeside Recreation Centre
Kennedy Baptist College (during school terms)	Kennedy Baptist College
St Ives	Servicing St Ives Retirement Village, student accomadation

Design of stops

To increase the appeal of the transit network, good interchanges are a necessity to its success. Interchanges will need to be designed to provide easy transfer between modes. Clear way finding and smart signage will also be needed to assist passengers to make the transition easy (Figure 4.07).

Murdoch Station, as well as stops located at intersections of major roads (such as South Street and North Lake Road) will need to incorporate improved walking conditions, protection from adverse weather conditions and a rational number and location of road crossings.

Frequency of services

Providing services which will encourage behavioural change in order to meet the modal split targets will be pivotal to the success of Murdoch. Accordingly, the frequency of services needs to be at a level which provides a viable alternative to passengers. In order for South Street to become a successful transit corridor, peak services will need to be in 5–10 minute intervals and regular services will be needed throughout the day and night.

Another key component will be the ability to "forget the timetable" (Nielsen Lange, 2009). The system should be simplified so that on high frequency routes there is a frequency which allows people to turn up and hop on services without referring to timetables. As the benefit of offering high-frequency services during low use periods, such as the early hours of the morning, would generate significant cost with minimal benefit. As a result it is proposed that the working day is divided into three periods:

- Peak (7 am–9 am/4.30 pm–6.30 pm) – to meet commuter needs;
- Shoulder (9 am–4.30 pm/6.30 pm–10 pm) – to provide a viable alternative to the use of private vehicles and taxis, particularly for business to business journeys and to provide an alternative method of travelling home for late workers or people taking advantage of the centre's entertainment offerings; and
- Off–peak (10 pm–7 am).

Public holidays and weekends would run on a combination of shoulder and off-peak services.

Infrastructure

Murdoch already boasts significant transport infrastructure with the Mandurah rail line and the interchange at Murdoch Station. However, to meet the future public transport demands of the activity centre there will be a need to provide additional infrastructure. These potentially include (Figure 4.08):

- a direct and well-designed connection between Barry Marshall Parade and Murdoch Station;
- planning for the key east-west transit spine to allow for future rapid transit forms;
- reconfiguration of South Street to allow for rapid transit;
- priority lanes at intersections for public transport;
- improved pedestrian crossing facilities at key intersections along the transit spine; and
- use of smart infrastructure and signage.

4.5 Local road network and access regime

It is important to note that the success of the activity centre will depend upon the staged delivery of key transport infrastructure to ensure an appropriate level of accessibility to and within the centre, in particular the provision of a southern access route.

The strategy for developing the transport infrastructure within the activity centre is based on the following principles/ proposals to deliver a more integrated approach to local access and travel.

- Development of Discovery Way/Barry Marshall Parade as the principal active/rapid transit route with generous cycleways and priority transit access through intersections.
- The above concept will require reconfiguration along this key spine route, including at some major intersections across the activity centre, to accommodate future rapid transit.

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- At the western end of the priority transit route, a diversion through the University campus to form an intersection with South Street and Prescott Drive, is identified for further analysis as part of future rapid transit feasibility (Figure 4.08).
- Murdoch Drive as a major boulevard traffic artery linking to the planned extension of Roe Highway and/or Kwinana Freeway to the south.
- Enhancement of dual path network to complete the long distance commuter and recreational cycle path network.
- Park and ride – relocation of the existing south-west quadrant car park at Murdoch Station to the south-east quadrant as part of a decked structure development (this option is currently the subject of a separate feasibility analysis).
- Centre-wide car parking – enforcement of strategic car parking limits and planning controls to promote the use of public transport, reduce car dependency and deliver a more active on-street parking regime within and around the urban core, as per the WAPC endorsed *Murdoch Activity Centre Access and Parking Policy* (Figure 4.09).

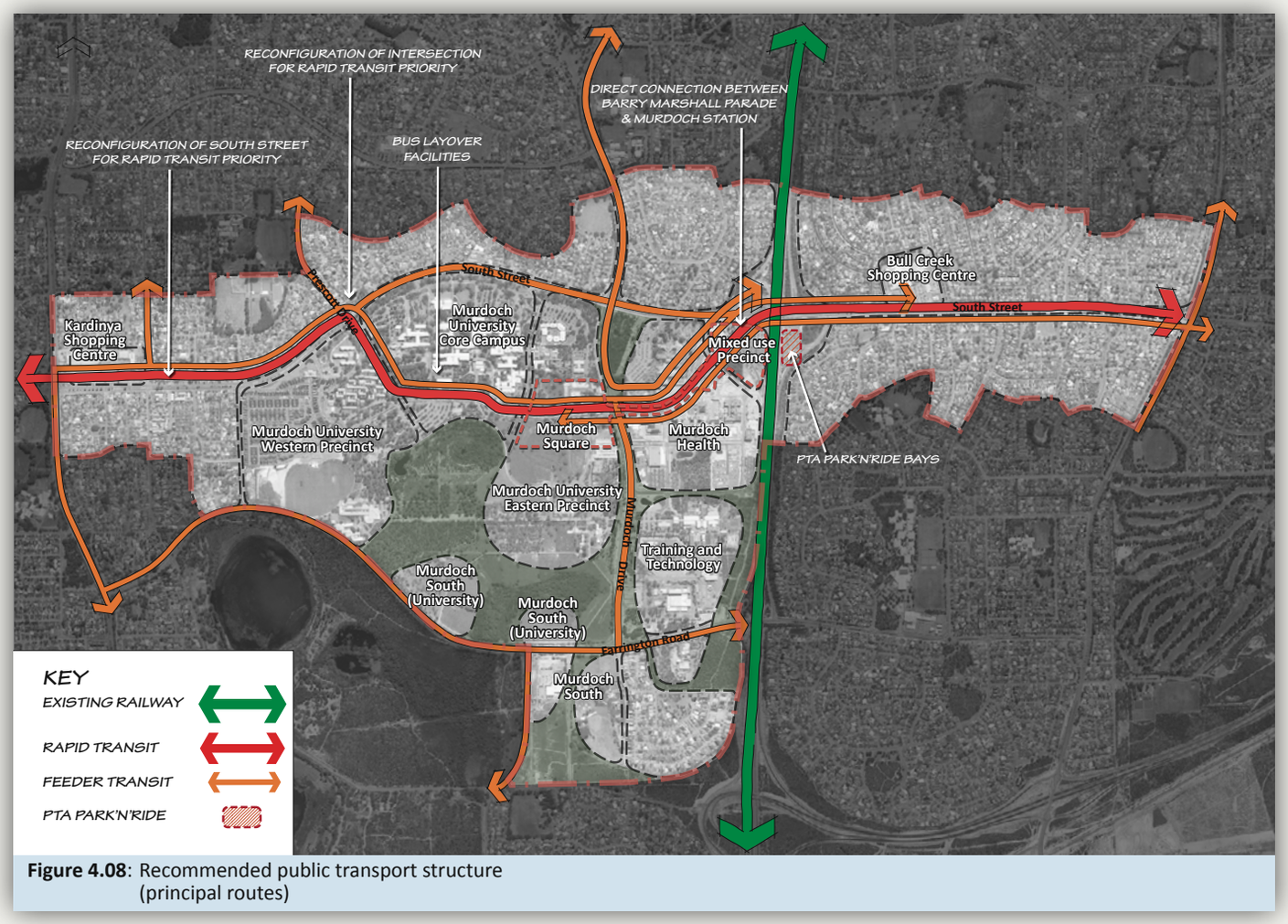

Figure 4.08: Recommended public transport structure (principal routes)

Within the centre structure, the following precinct based priorities are required to support delivery of the transport modal shift objectives and ensure environmental and urban form goals for an intense activity centre are met.

- Murdoch Square and the mixed use precinct will contain priority transit zones with restricted traffic access to promote sustainable transport alternatives.
- Enhanced pedestrian accessibility is required across major traffic intersections, e.g. on Murdoch Drive.
- Completion of the principal cycle path network where gaps in the route plan exist, e.g South Street.
- Within the University, general campus traffic separated to periphery with no through access on Discovery Way, apart from priority vehicles and transit.
- Development controls and a strong management regime (including pricing and supply caps) over new and existing parking areas to help deliver a more integrated environment, shared facilities and a more appealing pedestrian realm.
- Future rapid transit activating redevelopment of the University's western campus.
- Transport opportunities along Farrington Road reviewed in light of Roe Highway extension outcomes.

In addition, the pedestrian and cyclist realm through the centre will generally require significant enhancement to provide for safe and convenient routes and shelter from the elements, as well as creating an environment which is more conducive to this form of travel for short and longer trips.

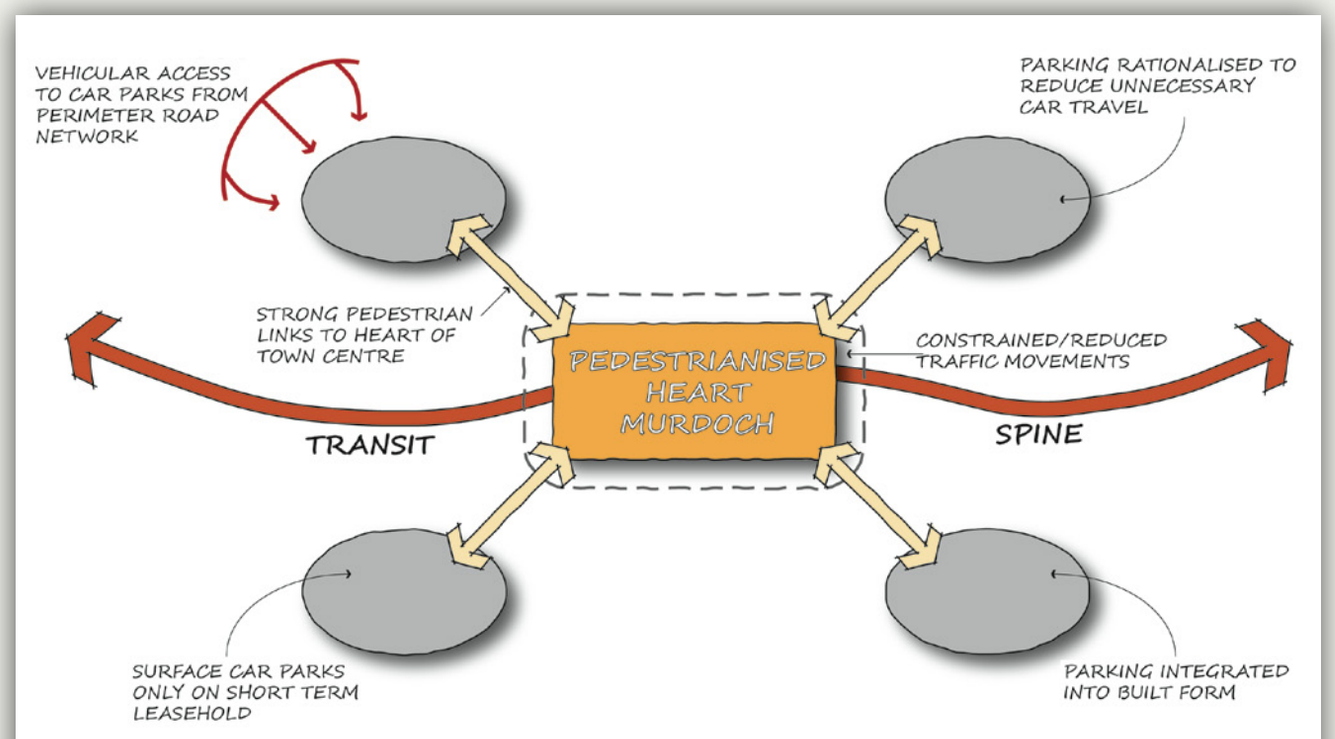

Figure 4.09: Strategy for internal accessibility

4.6 Pedestrian and bicycle movement and amenity

Local and regional networks

The current dislocation between anchor activities within the centre and a series of high-speed traffic dominated thoroughfares provides an adverse walking and cycling environment, particularly during unfavourable weather conditions. There exists a good network of shared paths running along major roads. However, these are more suited to a long distance run or bicycle commute due to the large distances between nodes. The walkability of the existing centre is poor and unattractive leading to a greater use of vehicles. Substantial measures will need to be employed to make the pedestrian experience more appealing.

Route types

Overcoming the existing inhospitable pedestrian environment is a core focus of this structure plan. A series of typologies has been developed which correspond with the thoroughfare design in the following urban form section of this document. The principle is to prioritise good pedestrian environments in key areas to maximise the benefit of these measures.

The aim within the urban core is to have high-quality pedestrian amenity with wide footpaths, weather protection and cycle lanes on street. This should be exemplified in the development of the transit spine through Murdoch so that active transit is at the centre — not the margins — of this key movement corridor. In this regard, improving cycle and pedestrian connections across Murdoch Drive is a future design challenge to achieve better integration across the activity centre (Figure 4.12). Outside of the core, the urban frame has a similar function but is limited by the intensity of development to support street activation and awnings and therefore, does not have the same need for alfresco dining areas. Secondary urban areas should provide dedicated paths for pedestrians on both sides of the street and, where possible, a consistent tree canopy (Figure 4.10). Farrington Road will need improved pedestrian and cycle routes and a reconfiguration of the Farrington Road/Murdoch Drive roundabout to improve pedestrian and cyclist safety.

The high-volume traffic routes will have regional shared paths separated from the road carriageway to provide a safe walking and cycling environment. Along the transit corridor, appropriate design will ensure that active and rapid transit movements co-exist and integrate safely within this central thoroughfare.

Areas which are not subject to high volumes of fast moving traffic will be suitable for bicycles to share the road environment with cars (with shoulder bike lanes where feasible). The aim of these areas is to reduce the dominance of vehicles and increase the pedestrian and cycle amenity. Subsequently, the traffic volumes and speeds will be of a sufficient level to justify the mixing of modes.

In addition, off-road shared paths southwards through Murdoch University are desirable to provide a more direct link through this extensive area of the activity centre, connect the core campus to Farrington Road and provide enhanced recreational access through the natural landscape (Figure 4.11). This should be investigated at precinct/campus planning level.

Shared zones

The pedestrian-only malls that were created in the postwar period attempted to provide a pedestrian environment away from the vehicle dominated areas. However, a common criticism is the lack of through vehicular traffic which, in turn, is perceived to affect revenue of retailers and diminish the level of vibrancy.

To generate the necessary passing trade and provide a more human scale, shared zones will be provided to allow for pedestrian, public transport and private vehicles to share the space — the difference being that the hierarchy is changed from vehicle dominant to public transport and pedestrian dominant (Figure 4.12).

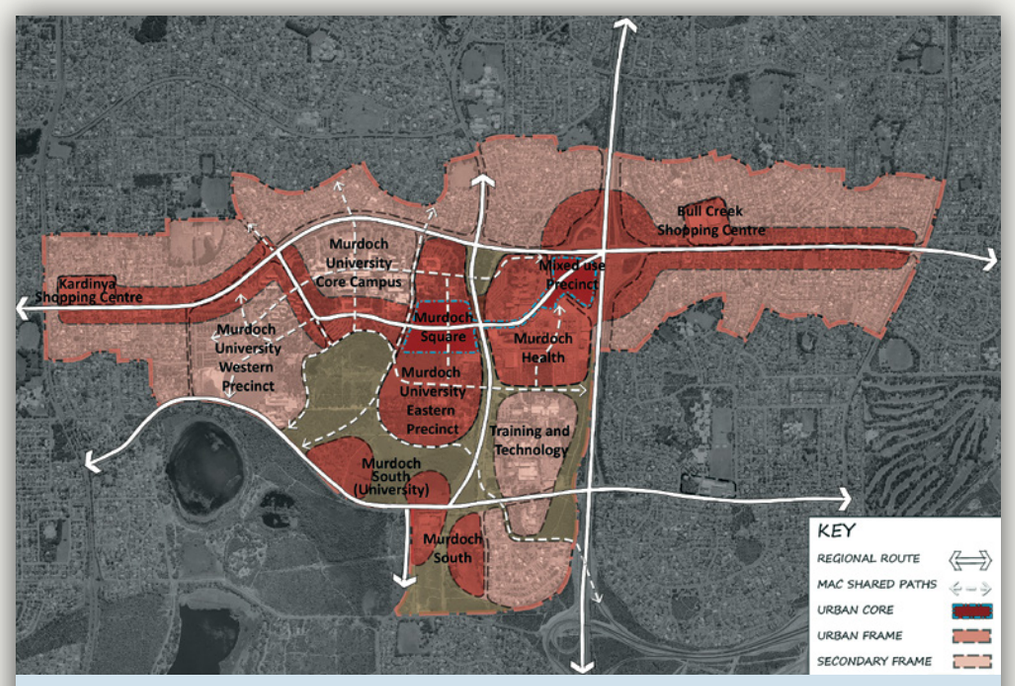

Figure 4.10: Pedestrian route types

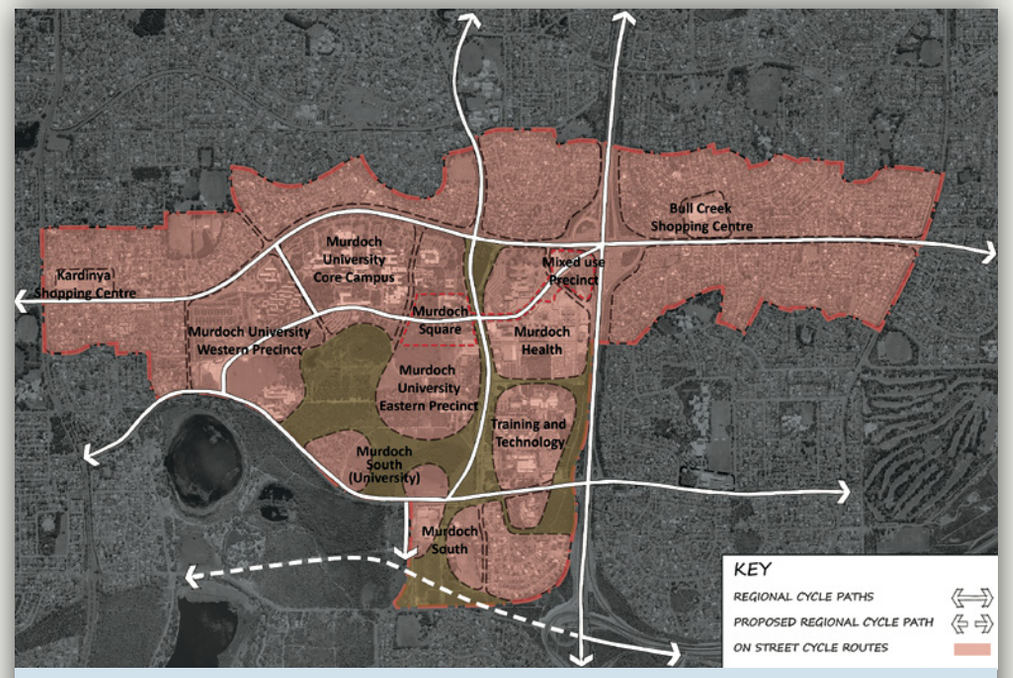

Figure 4.11: Bicycle route hierarchy

4. Movement

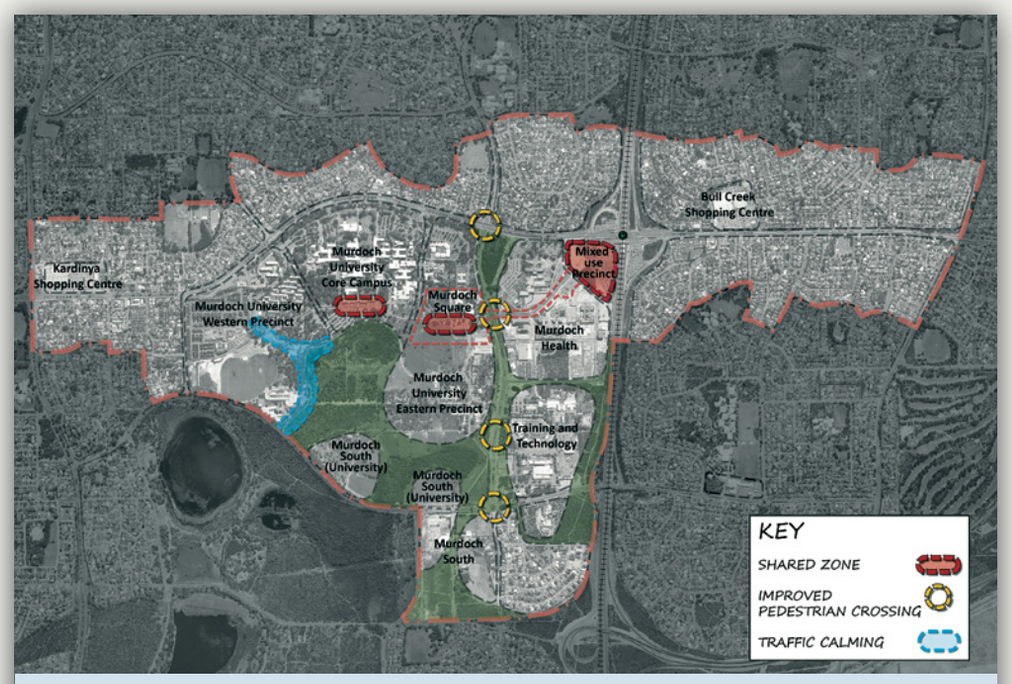

Figure 4.12: New Pedestrian priority zones

Aside from the core campus environments in the University, Challenger Institute and the hospitals, some key locations have been identified which should be designed with pedestrian priority over cars. These are situated within the urban core and transit corridor being:

- the mixed use precinct, particularly the area which connects from Barry Marshall Parade to the train station;
- Murdoch Square, particularly around the transit spine and civic space proposed for the centre of this area; and
- Discovery Way at the proposed Murdoch University rapid transit stop (Figure 4.13).

Figure 4.13: Sections of Discovery Way to have limited vehicular access

Traffic calming

The high volumes of traffic and the high speeds that vehicles currently travel at through the centre mean that there are many roads (public and private) which are hostile to pedestrians. These areas will need to have sufficient measures to make them more appealing to pedestrians while allowing for the free flow of traffic. Means to achieve this will be through:

- reducing road speed limits;
- reducing carriageway and lane widths to slow vehicle speeds;
- providing extended pedestrian phases at lights on key road crossings;
- providing shelter at lights for waiting pedestrians and cyclists;
- creating sufficient amenity through landscaping and active edges to buildings; and
- providing sufficient overlooking to make pedestrians and cyclists feel safe, particularly after dark.

Traffic calming areas will also provide a sense of arrival, signifying a change in road hierarchy from vehicle dominated to more pedestrian/cycle dominated.

Cycling Infrastructure

To encourage cycling, end-of-trip facilities are to be provided in all commercial buildings, including secure sheltered bike racks and shower facilities. On street bike racks should be provided every 100 metres within the urban core and at key nodes in the urban frame.

Bike sharing/rental stations could be provided within the centre at key locations, particularly to encourage the use of bikes for local trips from Murdoch Station to activity nodes and buildings around the locality.

4.7 Parking strategy and travel management

Policy context

In order to assist with integration of land-use and transport objectives for the activity centre, car parking will need to be well managed and equitably allocated. In 2011 the WAPC adopted the *Murdoch Activity Centre Access and Parking Policy*. This policy, among other things, applies limits to the amount of car parking that can be provided across the centre based upon an assessment of the capacity of the current and future road network that services the centre. This policy is predicated on the provision of significant road upgrades as recommended in this structure plan (see Section 7.8). The adopted policy outlines a range of principles that are to be applied to planning approvals and the structure plan is consistent with these principles (see panel on page 64).

As the activity centre expands, there will also be opportunities for landowners to manage car parking more innovatively across the various facilities within their precincts.

Urban form of parking areas

In addition to the policy measures, design guidelines for parking areas are important to ensure that the activity centre starts to develop an urban form which addresses the spatial and visual problems associated with low-density campus environments and their extensive surface car parks. Within a new regime that provides and encourages more short-term and on-street parking in the central area, any major off-street car parks within the urban core should be integrated into the building and block form, including basement, ground and first floor levels. Stand-alone multi-storey car parks are discouraged except in circumstances where this leads to rationalisation of at-grade parking. Where car parking cannot be provided in this arrangement, at-grade car parking may only be developed to the rear of the building zone or within the internal area of blocks in order to minimise visibility from street frontages (Figure 4.14).

Murdoch Activity Centre Access and Parking Policy – principles to guide planning approvals

1. The volume of traffic to and from the centre is to be managed within the capacity of the planned external road network, especially during peak periods. Development approval will be conditional on not exceeding the parking caps allocated for each sub-precinct.
2. Staged developments of a sub-precinct need to demonstrate a reasonable need for the proposed parking even though it may not exceed the parking cap.
3. An adequate range of parking facilities will be provided and managed having regards to core business functionality, availability of public transport, road capacity, traffic flow and environmental conditions.
4. Parking facilities will be provided and operated to maximise their efficiency in accordance with the following principles.
    - Sharing: parking facilities should serve multiple users and destinations in each sub-precinct.
    - Efficient use: parking facilities should be sized and managed so spaces are frequently occupied.
    - Prioritisation: the most desirable spaces should be managed to favour higher priority users.
    - Quality: importance should be placed on aesthetics, security, accessibility and legibility.
    - Management: subdivision of land for parking purposes will not be permitted. The landowner is to retain the management of all parking within the precinct and thus no parking bays can be allocated to individual properties as part of any lease agreement.
5. Sub-precincts will be required to manage at least 25 per cent of their parking as public and visitor parking (except Murdoch University education precinct).
6. The planning approval elements of the policy will not be applied retrospectively to existing parking facilities for which appropriate approvals have been gained. However, where site development or redevelopment occurs, proposals will be assessed in terms of the policy.
7. Off-street parking areas should be located and designed so they are an integral part of the development of the site. Disabled parking and cycling facilities should be visible and conveniently located. Parking facilities can offer a mix of long stay and short stay parking.
8. On-street parking areas will be for short stay parking only.
9. Landowners will be responsible for developing and maintaining a parking management plan for their site that will work towards achieving the intent of the parking and access policy and any relevant planning approvals.
10. Site users and employers will be required to develop and implement travel plans. Draft travel plans will need to be submitted with all development applications and should include parking pricing strategies and the relativity with other sub-precincts, including the Health Department's adopted Access and Parking Policy.

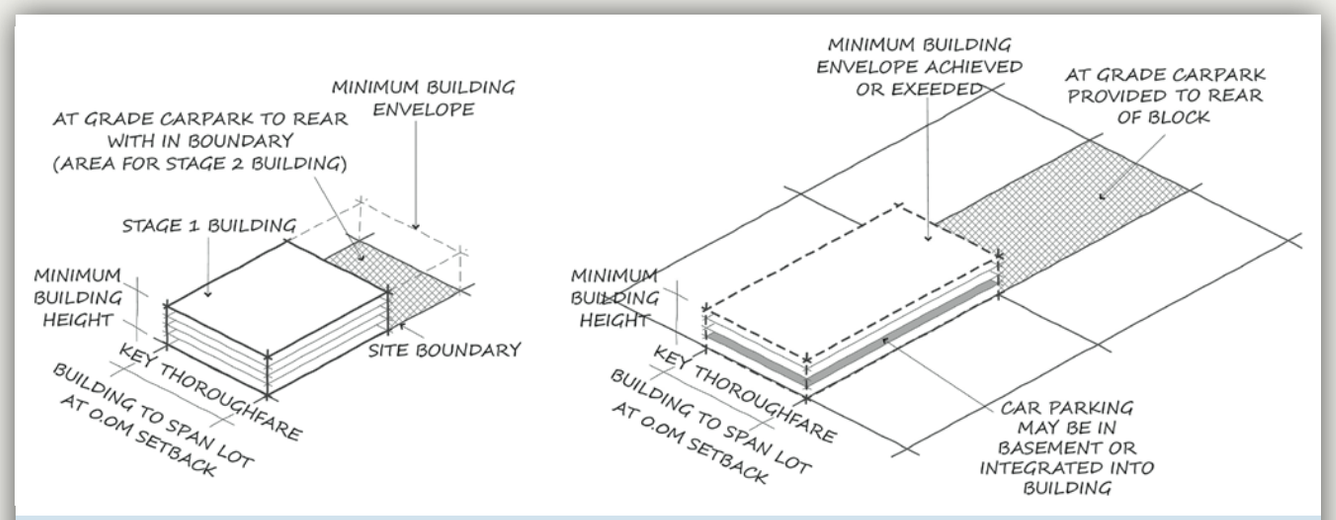

Figure 4.14: Car park block layout guidelines

Relocation of park and ride

The existing park and ride car parks at Murdoch Station currently provide approximately 1,200 car bays for commuters travelling predominantly to the CBD. Due to the short travel time to the CBD and the cost of car parking, the catchment for this car park stretches from distant areas such as Fremantle, Belmont and Armadale. With demand for park and ride increasing, the number of car parking bays at Murdoch will need to be maintained or increased until such time that personal vehicle transport becomes cost prohibitive or a viable public transport alternative is provided (such as rapid transit connections to Murdoch Station).

The development of the mixed use precinct includes the site of the existing car park to the south-west of the station (Figure 4.15). The master planning for the Mixed Use Precinct is considering development over this area and, as a result, the PTA is investigating the potential options to relocate the car park or provide replacement capacity. The State Government has identified an option that the existing car park to the east of Murdoch Station is upgraded to a multi-deck structure. Although still subject to further assessment, this would need to provide a convenient connection between the car park and the station, preferably by a direct pedestrian bridge link.

Figure 4.15: Park and ride at Murdoch Station

4.8 Vehicular access and mobility

Private vehicles

Despite the high frequency of heavy rail and bus services, the centre is currently dominated by private vehicles. The intersection of several key arterial routes leads to congestion during peak times which are expected to increase as Perth's population grows and new activity is added within the centre. While the arterial routes provide good access to the centre, their environment impacts can be significant.

High-volume roads, such as South Street, provide few opportunities to densify or improve the amenity abutting them. Therefore, it is has been assumed that they will maintain a similar form and function for the foreseeable future. For the areas which are outside of the high-volume roads, the emphasis will be on creating thoroughfares with integrated environments in which cars move at safe speeds and where pedestrians and cyclists feel comfortable walking and cycling. Roads in these areas are to be designed to limit car speeds to 50 km/hr and 40 km/hr in the urban core.

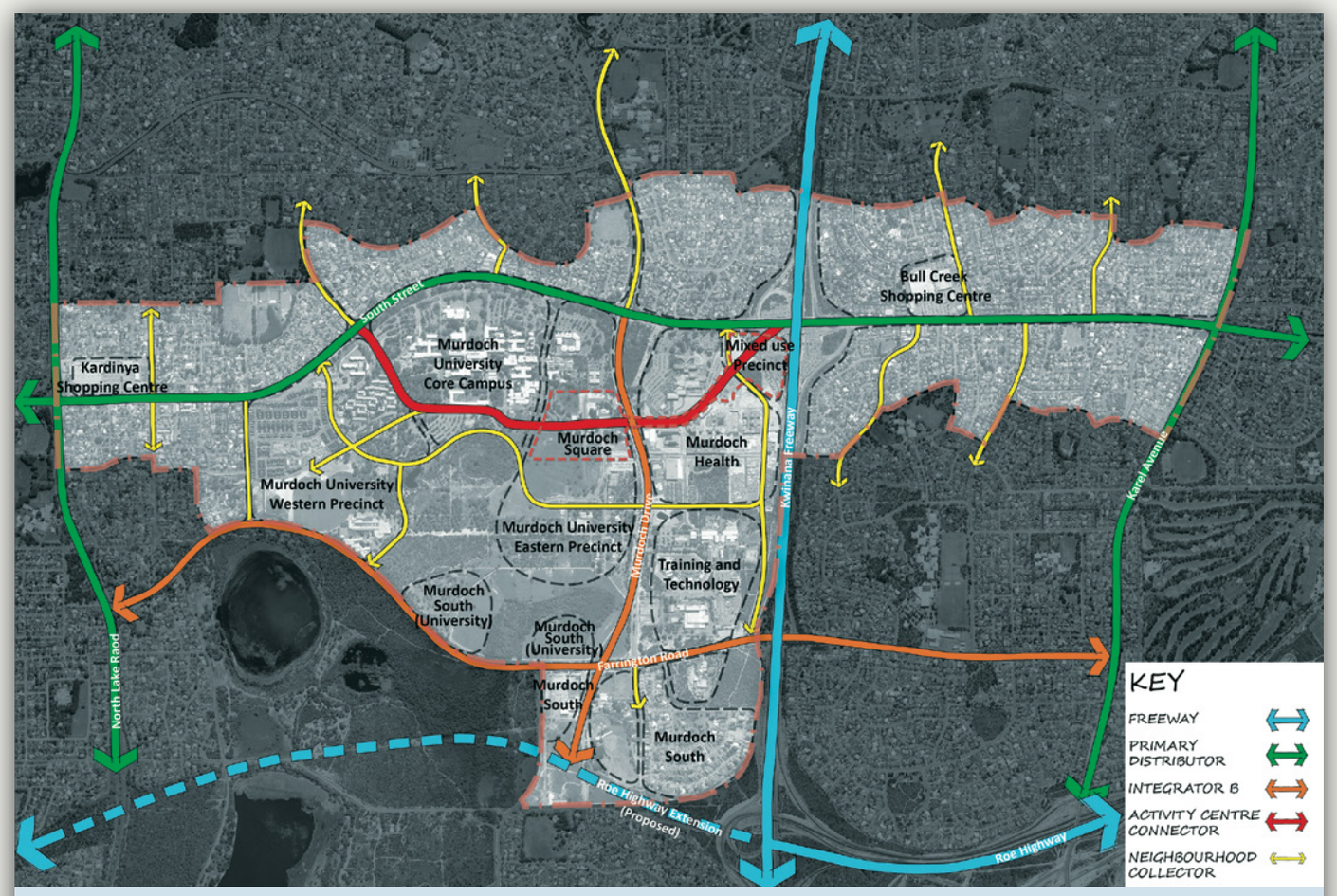

Figure 4.16: Proposed major road network

Road hierarchy

The hierarchy of roads has been split into those which carry large traffic volumes and those which can support a more pedestrian-friendly environment. The Kwinana Freeway, South Street, Murdoch Drive (south of South Street) and Farrington Road will continue to be high-volume or longer distance traffic routes. The neighbourhood collectors will provide access to campuses within the central area of Murdoch as well as outlying residential areas, with other streets serving a local function. Discovery Way and Barry Marshall Parade will act as an activity centre connector, providing a priority public transport/cycling/pedestrian function with an emphasis on creating a vibrant thoroughfare and movement corridor through the urban core (Figure 4.16).

Traffic modelling

An interdepartment State Government traffic model is recommended to be prepared and managed to monitor and determine the extent of the impact on future traffic needs. This will be informed by the land use modelling and the number of users for each precinct as the local structure plans are created. This should be managed by one government agency to promote consistency and efficiency. The tool should be updated by the agency as part of any development application assessment (Figure 4.17).

Previous modelling underpinning the existing Murdoch Activity Centre Public Transport Master Plan is based on land use assumptions that are similar in scale to the land use proposed in the Structure Plan, and therefore remains valid to this new Activity Centre framework.

Major development travel plans

Major developments within the centre will have impacts on the existing and proposed transport infrastructure. However, they will also provide an opportunity to address some road congestion issues.

Each major development should be required to prepare a travel plan which identifies the number of employees or users, where they are travelling from each day, and the impact they will have on the system. The strategy must determine ways to incentivise employees or users to use modes other than private car, such as public transport, walking or cycling to make regular trips. This may need to include underwriting of the landowner or occupier for additional transport services. The strategy will also need to include mode share targets, limits on car parking numbers and detail of a car parking management strategy.

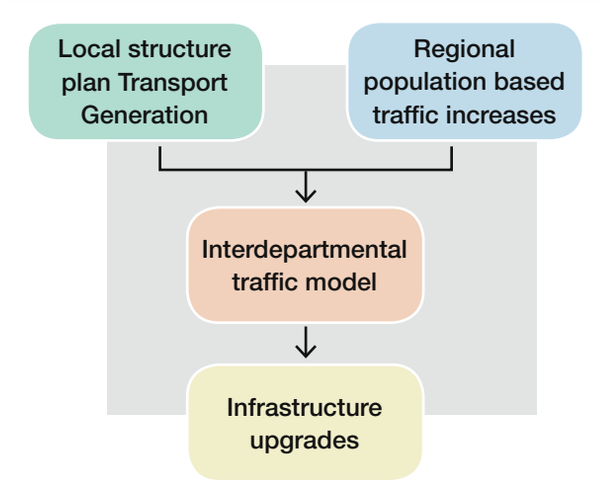

Figure 4.17: Transport planning strategy

4. Movement

Route upgrades

The opening of Fiona Stanley Hospital in 2014 will be the catalyst to resolve many of the immediate congestion issues confronting Murdoch. However, the increases in traffic volumes over time are likely to require further road upgrades. In the short term the following upgrades by State Government have been committed to by 2014.

- Kwinana Freeway third lane construction (between Roe Highway and Leach Highway).
- Kwinana Freeway/South Street northbound off-ramp realignment (Figure 4.18).
- Additional turning lanes at the South Street/Murdoch Drive intersection.
- Connection of Barry Marshall Parade to Murdoch Station.

In the mid to longer term and based on current traffic growth trends, there is significant risk that the traffic volumes could result in the road network around the Kwinana Freeway/South Street interchange exceeding its original design capacity. The situation will need to be monitored as new local developments begin to generate more trips. The following road infrastructure improvements, or suitable alternatives, are under consideration by the State Government and transport authorities by 2021.

- Modifications to Kwinana Freeway/Farrington Road on/off ramps.
- Southern extension of Fiona Wood Road to Farrington Road (including a link to Kwinana Freeway northbound).

The following initiatives are also under consideration in terms of the period beyond 2021.

- Southern connection of Murdoch Drive to Kwinana Freeway via Roe Highway or connection to extended Roe Highway (including realignment of Murdoch Drive near Farrington Road).
- Further upgrading of South Street/Murdoch Drive intersection, including options to grade separate.

It is recognised that without the southern connection, direct access to the freeway network from the activity centre will continue to be solely from the South Street interchange. Until alternative strategic road access to the activity centre is committed to, traffic flows through the South Street corridor, particularly at the junction with Murdoch Drive, will continue to be monitored to ensure that the road network is performing without adverse effects.

In the meantime, the above mid-term and post-2021 improvements remain uncommitted projects and option or design studies may be required to identify the best solution and precise timing. Further information is contained in Section 7. The provision of funding for the infrastructure will be a future decision of the State Government.

Figure 4.18: South Street northbound off-ramp

Taxis

Taxis will provide an important transport option, particularly for business visitors and patients attending medical services. Taxis will also be valuable in transporting late/off-peak workers such as nurses and university students. Furthermore, they will be useful in augmenting the existing transport system for the elderly and less-abled population.

Within shared zones taxis will be permitted to travel along the rapid transit route. Three priority taxi ranks are proposed in the following locations.

- Murdoch Square – to cater for students and workers.
- Murdoch Health (along Barry Marshall Parade) – to cater for patients and hospital staff.
- Mixed use precinct (adjacent to Murdoch Station) – to cater for workers and public transport passengers.

Emergency vehicles

The location of an emergency ward at Fiona Stanley Hospital makes it desirable to allow emergency vehicles to gain easy access to the hospital. In the short term, the measures required for the opening of Fiona Stanley Hospital have been accounted for. However, as traffic volumes increase as predicted, this will need to be continually monitored with upgrades considered as part of the future management strategy for emergency vehicles across the activity centre.

Freight movement

Murdoch is positioned between the industrial and logistics activities in the eastern suburbs of Perth and the port facilities at Fremantle and Rockingham. This results in a significant amount of on-road freight traffic passing through or around Murdoch, particularly along Kwinana Freeway, South Street, Leach Highway and Stock Road, although South Street is not part of the designated freight route.

The proposed Roe Highway extension to Stock Road is designed to significantly alleviate the traffic congestion around Murdoch and has been planned as part of the preferred freight route through the area en route to Fremantle and Kwinana outer harbour. The proposed extension is currently subject to environmental review (Figure 4.19).

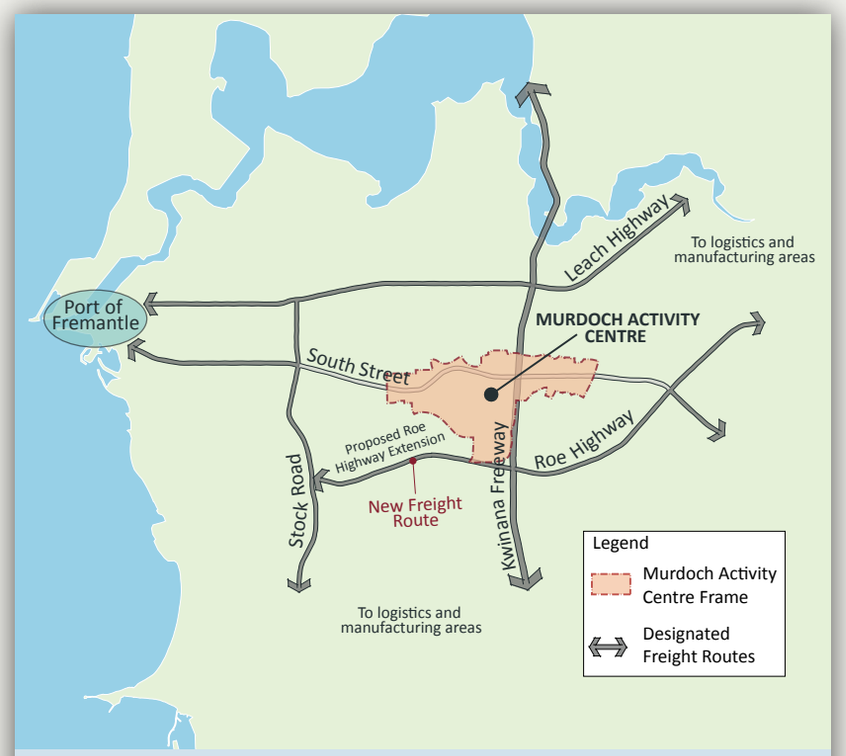

Figure 4.19: Proposed freight movement