

Main Street Urban Design Study

Transport Plan

As Adopted by Council
25 February 2020



Terrible streetscape, busy traffic, the design is
focused more on traffic and less around people -
the wrong way around!

(2017 Online Survey Responses)

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Introduction

The Transport Plan for the Main Street Urban Design Study (Study) has been developed in conjunction with the City of Stirling and RobertsDay Group.

This plan has been completed to address a number of key elements to the study area, namely:

- Examination of bus bay location and design along Main Street
- Speed zoning within the Project area
- Carriageway design elements to support some of the outcomes raised by the community during the engagement process for the Study
- Pedestrian prioritisation and crossings of Main Street and Royal Street
- Use of Waterloo Street for bicycle priority.

In November 2017, Flyt produced a separate summary review of the transport network which assisted the engagement process related to this Study. For reference purposes, this prior informative document is attached to this Transport Plan as Appendix 1.

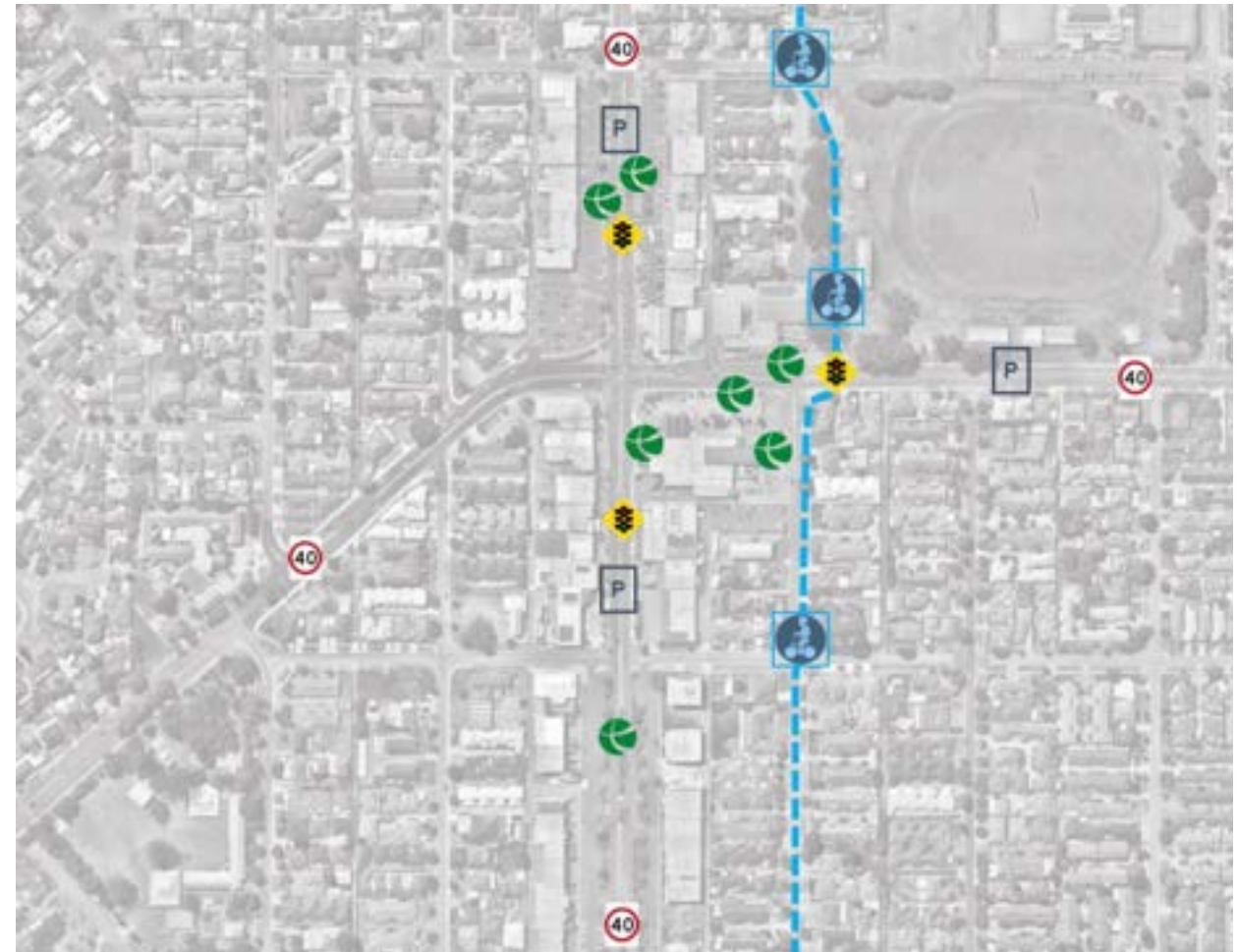


Figure 1 Proposed street environment for Main Street Urban Design Study

Bus Stop Configuration



Bus Stop Configuration

Main Street has three bus routes which run along the central section of the study corridor and one route that runs along Hutton Street and Royal Street. Services are:

- Route 402 runs between Stirling Station and Perth Busport
- Route 404 connects to Perth Busport and terminates on Waterloo Street
- Route 414 connects between Stirling Station and Glendalough Station
- Route 403 runs along Hutton Street and Royal Street connecting Stirling Station with Perth Busport.

There are presently five separate timed or terminus stops in the area as shown to the right. One of the key elements to the overall plan is to reflect a more contemporary approach to bus stop configurations in the project area by eventually removing embayments. This would assist in achieving both built form and transport outcomes sought from the plan.

At present, the stops on Main Street that are embayed satisfy the requirements of the PTA Bus Planning and Design Guidelines for Efficient People Movement:

“Embayments should be provided at timed stops where buses may be required to stop for 90 seconds or more and at locations where there are safety concerns with passing a stationary bus on a two way street”.

With implementation of proposed changes to the overall network proposed in this plan, the removal of embayed bus stops can be facilitated by the PTA. This can be achieved collaboratively with the PTA and the community to improve access, retain service operation efficiency and contribute to the overall design outcomes.

PTA would lead this process in agreement with the City of Stirling. Design elements would be undertaken collaboratively with Council including resolving issues of timing, funding and other design requirements (drainage, lines and signs, paving etc.) .



Figure 2 Timed bus stop locations (embayed and not embayed) within the Main Street Study Area

Speed Zoning



Speed Zoning

Issues relating to speed zonings within the Main Street study area were raised as both negatives and positives within the community engagement exercise. Many respondents raised the existing 40km/hr trial zone as a positive outcome for Main Street.

Many people also stated that the low speed zone was a negative. This response is indicative of the way people presently see Main Street – they perceive it as a fast “road”, with a reduction in speed zone simply an inconvenience or burden for their vehicle trip. In part, this response could also be borne out of the fact that the street design itself did not incorporate management measures. Many studies have concluded that, in order to achieve a reduction in speed within an urban environment, a combination of lower posted speed limit and physical measures are required.

Stage 1 includes the present 40km/hr speed trial which will continue into 2019 with the City of Stirling actively monitoring the outcomes of the trial. Since the introduction of the posted speed trial, the monitored results indicate an average 6% reduction in the daily recorded 85th percentile throughout the area. The overall 85th percentile speed is still on average around 55km/h. This initial assessment highlights that there needs to be a combination of measures to achieve meaningful change in driver behaviour, as well as greater definition around the overall speed zone.

To achieve the step change in overall driver behaviour required to match the outcomes sought from the community, a range of measures are being proposed within this plan. The proposals to achieve the outcomes for reducing speed within the Study area are:

- Stage 2, implementation of a wider area posted 40km/hr zone that will set a clearer location for lower traffic speeds
- Installation of signalised pedestrian crossing points on both Main Street and Royal Street to act as speed reduction measures, as well as provide for pedestrian connections
- Installation of in-lane speed reduction devices (low level ramps, raised safety platforms or cushions) on Main Street, Royal Street and Hutton Street
- Reduction of the traffic carriageway widths along Main Street to denote key activity areas with increased width for pedestrian movements and street furniture
- Introduction of on-street parking along Main Street and Royal Street in conjunction with the Robinson Reserve works and this Study
- Removal of bus embayments along Main Street and Royal Street to better utilise street carriageway space
- Use of templates and other elements such as planting to introduce psychological measures to reduce speeds
- Removal of free slip turn lanes from Hutton Street to Main Street to reduce approach and exit speed of vehicles
- Removal of turning pockets along Main Street to create additional street planting and reduce turning vehicle priority.

Examples of how these measures have been introduced in other Perth locations, individually or collectively to reduce speeds, improve amenity and support urban improvement outcomes are set out in the following table. This is to demonstrate that what is proposed for Main Street can, and has been, achieved.

Speed Zoning

Element	Example	Outcome	Benefits
Implementation of a wider area posted 40km/hr zone that will set a clearer location for lower traffic speeds.	Rokeby Road and Hay Street corridor through Subiaco – District Distributor level roads through an Activity Centre. Implementation of 40km/hr on both roads.	Monitoring sites show 85 th Percentile under posted speed limit.	- Improved safety for pedestrians, cyclists and drivers - Additional travel time is negligible - Reduced stopping distance for drivers - Reduced noise levels consistent with appropriate conversation amenity
Installation of signalised pedestrian crossing points on both Main Street and Royal Street to act as speed reduction measures, as well as provide for pedestrian connections.	Pedestrian signals on Albany Highway in 40km/hr zone near intersection of Duncan Street.	Monitoring sites show 85 th percentile under posted speed limit.	- Improved pedestrian amenity and safety - Better pedestrian permeability and access within Main Street area
Installation of in-lane speed reduction devices (low level ramps/raised safety platforms or cushions) on Main Street, Royal Street and Hutton Street.	Mandurah Terrace, use of low level ramps and platforms. Albany Highway in Victoria Park .	Monitoring sites show 85 th percentile under posted speed limit.	- Effective traffic management controls to reduce speed - Reduction in crashes
Reduction of the traffic carriageway widths along Main Street to denote key activity areas and widen out space for pedestrian movements and street furniture.	Variety of examples in Activity Areas such as Fremantle, Cambridge Street, Scarborough Beach Road.	More attractive urban spaces and places, no impact on total traffic volumes but more balance in integration of transport and land uses and improved amenity.	- Improved integration of land use and amenity - Easier for pedestrians to cross Main Street - Improved pedestrian amenity and safety
Introduction of on-street parking along Main Street and Royal Street in conjunction with the Robinson Reserve works and this Study.	Cambridge Street west of Jersey Street – on-street parking area along two-lane carriageway where there is commerce and activity.	Posted speed limit is 60km/hr through area but monitoring traffic data shows that the 85 th percentile is closer to 45km/hr for the entire weekday. This demonstrates the “friction” of on-street parking that forces drivers to slow down, even if the posted speed limit is high.	- Slower vehicle speeds mean increased safety - More efficient than off street parking and a better land use - Often shows a high turnover and higher use than off-street

Speed Zoning

Element	Example	Outcome	Benefits
Removal of bus embayments along Main Street and Royal Street to better utilise street carriageway space.	Removal of existing embayment on Main Street.	No impact on operations, provides immediate example of ability to remove embayment and contribute to altering the street landscape.	- Increase in footpath space - Acts as speed deterrent on Main Street - Reflects PTA policy
Use of templates and other elements such as planting to introduce psychological measures to reduce speeds.	Beaufort Street south of Walcott Street.	Monitoring sites show 85 th Percentile at or just above posted speed limit during the weekday times of operation. Median speeds are below posted speed limit.	- Psychological measures have been shown to be effective at reducing driver speeds - More greenery can reduce the urban heat island effect
Removal of free slip turn lanes from Hutton Street to Main Street to reduce approach and exit speed of vehicles.	Design of street network in established urban areas of Perth and Fremantle where slip lanes and traffic based priority are not common place because places were not historically designed around prioritising fast or “optimised” traffic speeds as the key outcome.	Activity areas where slip lanes for traffic do not exist carry far greater amenity for all users.	- Improved amenity and user friendliness for pedestrians
Removal of turning pockets along Main Street to add in additional street planting and reduce turning vehicle priority.	Examples where road carriageway space has been reallocated for on-street planting such as Cambridge Street, design of Claremont on the Park and Bayview Terrace and Beaufort Street north of Walcott Street.	Greater overall urban amenity.	- Greater overall urban amenity

Speed Zoning

The proposed 40km/hr speed zone for the Main Street is shown to the right. The overall approach for the traffic management elements and other measures is set out in the Transport Plan section of this report.

The broad zone covers:

Stage 1

- The existing 40km/hr trial zone that extends along Main Street from Eldorado Street to Federal Street.

Stage 2

- On Royal Street from Albert Street extended to the intersection of Main Street
- Royal Street near eastern end of Robinson Street to the intersection of Main Street.

School Zone

- To continue existing operation, however during peak school times it will connect to the proposed Stage 2 40km/hr zone.

In order to address the specific elements of Main Roads WA requirements for speed zones, each criteria element has been examined on the following pages.



Figure 3 Proposed 40kmhr speed zone

Warrant for Permanent Linear Speed Limit Reduction to 40km/hr

Main Roads WA outlines the conditions which warrant consideration of a reduced linear speed zone. These conditions are listed below.

1. The road section shall be fully contained within a recognisable and dedicated tourist, recreation, conservation, shopping, commercial or industrial area / precinct / reserve:

The location for Stage 1 speed zone along the north-south corridor is contained within the commercial/retail precinct of Main Street and is clearly identifiable from the residential precinct. The zone facilitates a priority pedestrian environment, creating a safer setting for pedestrians. Longer term, parked vehicles will have limited frontage access to properties along Main Street as parking access will be located behind properties and access to parking via laneways running parallel to Main Street.

The Stage 2 speed reduction is along Royal and Hutton Street. Land use either side is zoned development, local centre, public open space and civic. A small portion of residential land use is found on the north and south of Hutton Street and along the south side of Royal Street.

As Hutton Street runs adjacent to the primary school, it already changes to a 40km/hr zone during peak school times. Extending the proposed 40km/hr zone permanently along the full length from the study area to where it abuts the school zone will provide road users with a consistent speed throughout the day and signal to road users to stay alert and take extra care.



Figure 4 Main intersection of Hutton/Royal Street and Main Street

Warrant for Permanent Linear Speed Limit Reduction to 40km/hr

2. Two-way single carriageway roads shall have a seal width of at least 5.0 metres:

The sections of Main Street, Hutton Street and Royal Street proposed for the reduced speed zone are two-way dual carriageway roads, with a medians separating each carriageway to facilitate right turn auxiliary lanes. Main Street (figure 5a) and Royal Street road widths are approximately 6.4m. Hutton Street, west of the main intersection, is approximately 6.9-7.0m wide.

3. Traffic volumes shall exceed 100 vehicles per day on a typical weekday;

Traffic volumes along Main Street and Hutton/Royal Street within the study area significantly exceeds 100vpd. The most recent available average weekday vehicles per day recording taken from the Main Roads WA Traffic Count Map (figure 5b).

Main St nth – 26,282 vpd Hutton St – 27,044 vpd
Main St sth – 18,535 vpd Royal St – 17,242 vpd

4. The start and end of the road section should have a threshold treatment

As per section 3.6 of Main Roads WA Local Area Traffic Management, threshold treatments to identify changed road conditions are not required on roads with more than 4,000vpd. Notwithstanding this, entrance treatments in the form of on-street speed reduction devices and template street stenciling are proposed within the overall Transport Plan.



Figure 5a Carriageway widths on Main Street



Figure 5b Traffic volumes at Hutton/Royal Street intersection

Warrant for Permanent Linear Speed Limit Reduction to 40km/hr

5. Minimum length of the speed zone shall be 400 metres;

The current length of the Stage 1 trial zone along Main Street for the reduced speed limit of 40km/hr is approximately 400m. The proposed Stage 2 40km/hr linear speed zone along the east-west corridor is approximately 665m (figure 6).

6. Mid-block speed-reducing devices shall be provided where the length exceeds 400 metres or where devices are necessary to create a speed environment consistent with the speed zone

The overall plan is proposed to incorporate measures within the zone, including:

- Signalised pedestrian crossings on Main Street and Royal Street
- Installation of in-lane speed reduction devices (low level ramps or cushions) on Main Street, Royal Street and Hutton Street, in addition to reduced carriageway lane widths
- On-street parking (outside of peak periods) and removal of bus embayments
- Additional street planting and removal of turning pockets into parking areas
- Removal of free-left slip lane from Hutton Street to Main Street.

The combined outcome of these measures will be to create the form of environment cited in the Guidelines.



Figure 6 Length of proposed 40km/hr zone along Main Street and Hutton/Royal Street

Warrant for Permanent Linear Speed Limit Reduction to 40km/h

7. The 85th percentile speed for motor vehicles on existing roads, or expected on new roads, shall not be greater than 50 km/h or less than 30 km/h.

The current posted speed limit along Main Street is 40km/hr and 60km/hr on the Hutton Street and Royal Street corridor. As set out, monitoring associated with the trial 40km/hr zone has shown that there has been an average of 6% reduction in speeds along Main Street. Additional reduction in speeds would be achieved through local area traffic management and other measures set out in this Plan.

8. Generally all roads within the area shall be local access or local distributor roads in a functional road hierarchy

Main Street is classified as a District Distributor A as is Hutton and Royal Streets (see Appendix 1 Road Hierarchy). Although the classification of Main Street and Hutton/Royal Street as District Distributors do not meet the requirements of the above Main Roads WA warrant, this element of the Guidelines is largely redundant as there are a substantial number of District Distributor level roads in Perth which already function as activity corridors and have 40 km/hr posted speed limits, such as:

- Albany Highway, Victoria Park (District Distributor B)
- Hay Street, Subiaco (District Distributor A)
- Beaufort Street, Mount Lawley (District Distributor A)
- Fitzgerald Street, North Perth (District Distributor A)
- Scarborough Beach Road, Mount Hawthorn (District Distributor A).

Given these roads all perform the ultimate function that is being sought for Main Street (with similar traffic volumes, speeds and position in the road hierarchy), this element of the Warrants is considered to be irrelevant.

Warrant for Permanent Linear Speed Limit Reduction to 40km/h

Further Study – Raised Safety Platforms

Raised safety platforms have been used extensively throughout The Netherlands with New Zealand, the USA and the UK showing interest through pilot projects.

In 2015, VicRoads commissioned a study by ARRB to assess the literature and international examples for the introduction of raised safety platforms at signalised intersections on arterial roads (carrying HV's and buses) with the aim to improve safety and reduce casualty crashes through speed reduction. The study showed that the introduction of raised safety platforms can reduce speeds to between 30-50km/hr and in some cases casualty crashes dropped by 35%.

Since 2015, VicRoads have installed numerous raised safety platforms in Victoria (see figures 7a and 7b) and the design and installation of the treatment has been formalised, detailed in their Design Note “Raised Safety Platforms RDN 03-07”. While raised safety platforms are used throughout Western Australia, their use at signalised intersections and particularly on arterial roads, has not been explored.

The application of a raised safety platform at the intersection of Main Street and Hutton/Royal Street appears an appropriate treatment in line with the warrants set out in the VicRoads Design Note.

It is recommended that the City of Stirling liaise directly with Main Roads WA in order to assess and progress the ultimate intersection configuration.



Figure 7a Aerial of the raised safety platform in Belmont, Victoria.



Figure 7b Street view of the raised safety platform in Belmont, Victoria.

Carriageway Design and Access



Carriageway Design and Access

In order to achieve the desired outcomes of the Study, and provide for integration of transport and land use for the study area in the future, it is proposed to modify carriageway and access related elements. These proposed elements are broadly:

- Reduction in overall lane width of the carriageways where possible (figure 9)
- Removal of some access points into parking areas (figure 9 and 10)
- Alteration to access points from side streets to reflect future use
- Removal of the free turn left slip from Hutton Street into Main Street
- Use of on-street traffic management devices to reduce speed
- On-street stenciling and other elements to denote a difference of road space priority
- Changes to parking configuration.

These elements are addressed in this section.



Figure 8 Road stencilling to create a pedestrian zone, Museum and Francis Street, Perth

Carriageway Design and Access

At present, there is variance in carriageway and lane widths within the study area depending on the approach and road section. In order to cater for a range of outcomes (including ability to plant additional street trees, improve pedestrian legibility and contribute to reducing traffic speeds), it is recommended that all carriageways include the following broad elements:

- Have a lane width of 3.2m per individual lane
- Include medians at a minimum of 2.0m and provide for planting of trees and vegetation to increase street canopy
- Design of access ways into side lanes and parking access are designed with minimal radii to reflect slower speeds
- Access into side streets and future parking areas are designed to prioritise pedestrians and have a continual surface for pedestrians, not vehicles
- Staged removal of access crossovers on Main Street as development progresses as per the planning controls proposed for the area.

The first section that has been designed for alteration, between Eldorado Street and Royal Street, is shown to the right.



Figure 9 Carriageway design and access on Main Street

Carriageway Design and Access

The proposed removal of access points is consistent with the ultimate design of the Main Street and Hutton/Royal Street corridor provided by the City of Stirling.

The removal of some access points into existing parking areas is presently being designed by the City of Stirling. The aim of this element is to increase the area available to provide future tree canopy, improve the pedestrian experience of Main Street and provide for the urban design outcomes within the study.

Figures 10a and 10b show the ultimate design for the guided redevelopment along Main Street and Hutton/Royal Street, with reduced access along Main Street and all parking access via rear laneways.



Figure 10a Ultimate design of Main Street and Hutton/Royal Street without plaza option



Figure 10b Ultimate design of Main Street and Hutton/Royal Street with plaza option

Carriageway Design and Access

Within the existing street network and access points, a number of side street intersections have been altered to manage traffic flows and address current safety concerns. With the introduction of measures set out in this plan, the form of intersections and side street access will need to be examined. This is particularly the case for:

- The intersection of Main Street and Eldorado Street
- The configuration of Federal Street intersecting with Main Street
- Access from laneways adjacent to development sites
- Access to and from Waterloo Street from the adjoining commercial properties.

Any reconfiguration of these intersection or access points should:

- Provide for service access to properties as they evolve and vehicle access points move to the rear of each site
- Provide intersection controls that support pedestrian movement along the north-south axis
- Reduce the potential for unnecessary circulation of vehicle traffic
- Ensure that through traffic flows are not directed on to Waterloo Street.



Figure 1.1 Intersection of Eldorado and Main Street

Carriageway Design and Access

On-street traffic management devices are required in order to achieve a reduction in recorded speed. Without these measures, travel speeds through the area are likely to remain at a high level. In order to support other measures provided in the plan, on-street management elements are proposed at various locations described below and shown on the plan to the right:

- Entrance statements at the posted speed limit transition points from 60km/hr to 40km/hr such as speed cushions, stenciling and on-street speed markings
- On-street traffic management devices with vertical deflection at points along the main carriageways to be between 50-70m apart, as per the existing configuration of Scarborough Beach Road through the activity centre of Mount Hawthorn
- On-street stenciling using the Main Street approved logo or a scheme that is consistent throughout the area
- Design of a Safe Active Street corridor along Waterloo Street as described in this plan.

Consideration should also be given to other short-term measures, including speed camera based information signs.



Figure 12 Locations of proposed street traffic management devices

Carriageway Design and Access

On-street parking elements within the study area will reallocate carriageway space and provide more appropriate use of the carriageway outside of peak hours when it is used for vehicle movements. This type of configuration is standard practice for corridors such as Beaufort Street or Cambridge Street. Some on-street bays are in place and planning has already commenced for the removal of existing embayed parking on Main Street and their replacement as on-street bays (shown below in Figure 13).

Future planning and design should include on-street bays along Royal Street and Main Street, as shown in Figure 14.



Figure 13 Location for removal of embayed on-street parking, Main Street south of Hutton/Royal Street intersection



Figure 14 Proposed on-street parking locations

Carriageway Design and Access

On-street parking will also be a contributing factor to the overall reduction of vehicle speeds along the corridor. Analysis of traffic and speed data along Cambridge Street in West Leederville provides an example of the impact that parked vehicles on straight, wide carriageways has on overall speed.

The section of Cambridge Street shown in figure 15 has a 60km/hr posted speed limit, recorded 19,000 vehicles per day in 2016 and has two traffic lanes in each direction with intersecting side streets. Like Main Street, it is a distributor road that accommodates through traffic but also has a mix of commercial precincts, residential development and other land uses (schools, hospitals) along its length.

On Cambridge Street, a peak hour Clearway is in effect for the east bound carriageway in the morning peak and for the westbound carriageway in the afternoon peak. Outside of those times, marked on-street bays provide for vehicles to be parked in ticketed bays. The configuration shown in figure 15 occurs at a number of locations along Cambridge Street.

Analysis of data available for Cambridge Street show that, when the Clearway is not in effect – i.e. when cars can be parked in on-street bays – average or median speeds are between 5% and 8% lower. All other elements remain constant, however parked vehicles on the street act as a form of mobile traffic management and they force drivers to be more aware and reduce speed. Given this, the use of on-street parking bays along distributor roads such as Main Street would directly contribute to the overall lowering of speeds whilst also improving access and amenity to businesses and residential properties.

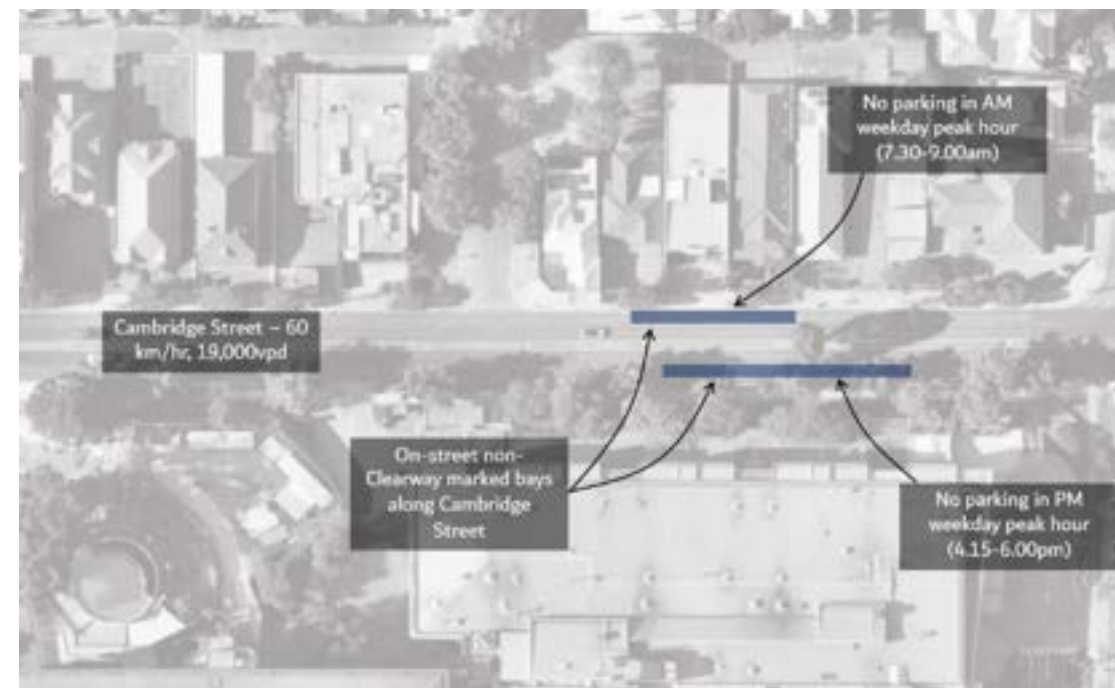


Figure 15 Cambridge Street example

Pedestrian Prioritisation



Pedestrian Prioritisation

One of the key themes that was evident through the community engagement and subsequent evolution of the Main Street Urban Design Study was that there was a clear desire of residents, businesses and Council to improve conditions for pedestrians. This desire related to the overall pedestrian amenity within the study area and specifically creating an environment that promoted safer and more attractive crossings of Main Street, Royal Street and Hutton Street.

Many responses to the engagement process highlighted these issues, or the nature of the streetscape and environment being poor.

Accordingly, measures proposed within this Transport Plan seek to deliver a step change in the pedestrian environment through a number of key elements:

- Overall lower speeds and reduced vehicle access to active frontages
- More prioritised crossings of Main Street and Royal Street
- Increased space within road reserves for street planting and other street furniture to be installed
- Changing the design of existing vehicle access points to provide pedestrians with priority (and reflect current road rules)
- Integration for pedestrians in the new layout of Robinson Reserve.

Information in previous sections of this plan establish the traffic management and carriageway design elements that will benefit pedestrians; this section sets out the overall pedestrian network.



Figure 16 Existing signalised pedestrian crossing, Main Street south of Hutton/Royal Street intersection

Pedestrian Prioritisation

The plan proposes two new signalised pedestrian crossings to supplement the existing pedestrian signals south of Royal Street/Hutton Street and the current pedestrian call button phases at the Main Street and Royal/Hutton Street intersection. The location of these two crossing points (shown to the right) serves the following purposes:

- On Royal Street, the crossing point will provide a safe, prioritised crossing location for pedestrians and cyclists using the Waterloo Street Safe Active Street, Robinson Reserve or simply accessing the Main Street area from the south. This location also serves as a key entry statement to the inner core of the Main Street area and will assist in reducing traffic flows.
- On Main Street, at a location that currently provides a standard mid-block pedestrian crossing point, a new set of pedestrian signals will “bookend” the current pedestrian crossing to the south of the Main Street and Royal/Hutton Street intersection. It will provide a clear point for pedestrian crossing and also ensure that the bus stop locations are protected by the presence of signals.

On an average weekday, the pedestrian crossing phase at the existing Main Street pedestrian signals is called around 340 times. The total time for pedestrian crossing phases, when vehicles either stop or have to yield to pedestrians, represents around 9% of the total 24 hour period.

The two proposed signalised pedestrian crossings, expected to have similar or even slightly higher use of the pedestrian on-demand call phase, would not necessarily result in substantial impacts to vehicle flows given the dominance of the signal phasing at the Main Street and Royal/Hutton Street intersection.



Figure 17 Proposed pedestrian and cycling treatments

Pedestrian Prioritisation

The current pedestrian facilities within the Main Street area are adequate and generally achieve standard outcomes, however this form of infrastructure provision will not achieve the desired outcomes set out within the Urban Design Study. A typical example is shown in the Google Street View (figure 18a), where there is appropriate tactile paving, drop kerbs, signage and gaps in medians to allow for pedestrian through movements.

This form of crossover, however, provides for vehicle priority, whereas the Road Traffic Code 2000 clearly sets out that:

“Drivers should give way to pedestrians:

- *when turning;*
- *when making a U-turn;*
- *at all intersections and stop signs;*
- *slip lane with a 'stop' sign or 'stop' line”.*

Whilst that is the enforceable law, the existing crossover design is such that very few drivers would realise they are required to give way to pedestrians. Moreover, many pedestrians would also not realise that this form of crossing gives them priority (by law). In order to rectify this situation, this plan proposes to elevate all such crossing points to footpath level and provide appropriate markings and signage – called a ‘Wombat Crossing’ (figure 18b).

Without clear delineation of priority in this area (whilst crossovers are in place), vehicle movements will continue to be seen as the most important.



Figure 18a Existing pedestrian facilities on Main Street south of Eldorado Street (south view)



Figure 18b Example of a raised plateau pedestrian crossing – Wombat Crossing.

Bicycle Access



Waterloo Street Cycle Priority

The provision of a safe and legible cycling route along Waterloo Street between North Beach Drive and Cape Street was raised by the community through the engagement process for the Study. This facility was seen by the community as a means of connecting the activity elements along Main Street to the wider area catchment and other community facilities along this corridor.

The City of Stirling Draft Bicycle Route Development Plan nominates the corridor that is generally focussed on Main Street as the S N/S 2(A) corridor on the plan shown to the right. This plan, which reflects the intent of the City of Stirling Integrated Cycling Strategy, is also broadly reflective of previous Perth Bicycle Network NE2 route adjacent to the Main Street corridor.

The most legible connection for cyclists through the corridor would be the reallocation of road space from Main Street itself as segregated infrastructure. This would provide a direct, legible and meaningful long and short distance route that would be a step change in delivering a north-south route through the corridor.

This proposition does not form part of the ultimate Study outcomes, however a specifically designed facility using the Waterloo Street corridor, with connections to Main Street itself, could provide the requisite level of priority for all levels of cyclists.

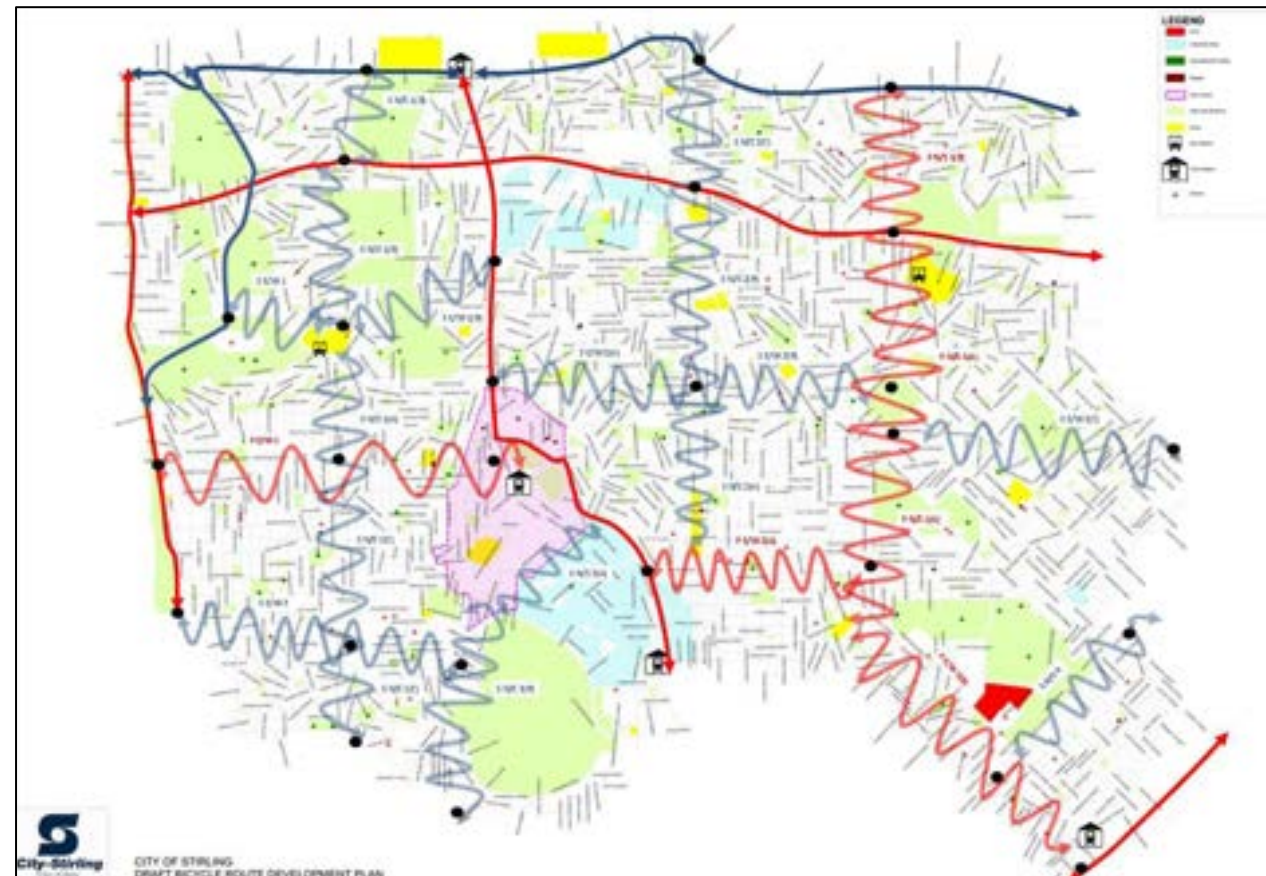


Figure 19 Draft bicycle route within the City of Stirling

Waterloo Street Cycle Priority

The strategic justification for the Waterloo Street facility would be to allow for safer local access for cyclists as well as connecting the S E/W2(A) and S E/W2(B) routes (along the North Beach Drive corridor) with the P E/W 2(A) route along the Cape Street Corridor.

The route is also reflective of the previous NE2 Perth Bicycle Network route, as shown to the right, which also allowed for the connection of east-west routes through the study area.

At the northern extent of the corridor, North Beach Drive has existing on-street cycle shoulder lanes, with indirect crossing points at the intersection with Main Street. The connection between Waterloo Street and North Beach Drive is provided by a Pedestrian Access Way between residential properties.

At the southern end of the alignment, Cape Street has a nominated shared path on the southern side of the road reserve. The intersection of Waterloo Street and Cape Street is controlled by a roundabout.



Figure 20 Perth Bicycle Network route surrounding the Main Street Activity Centre

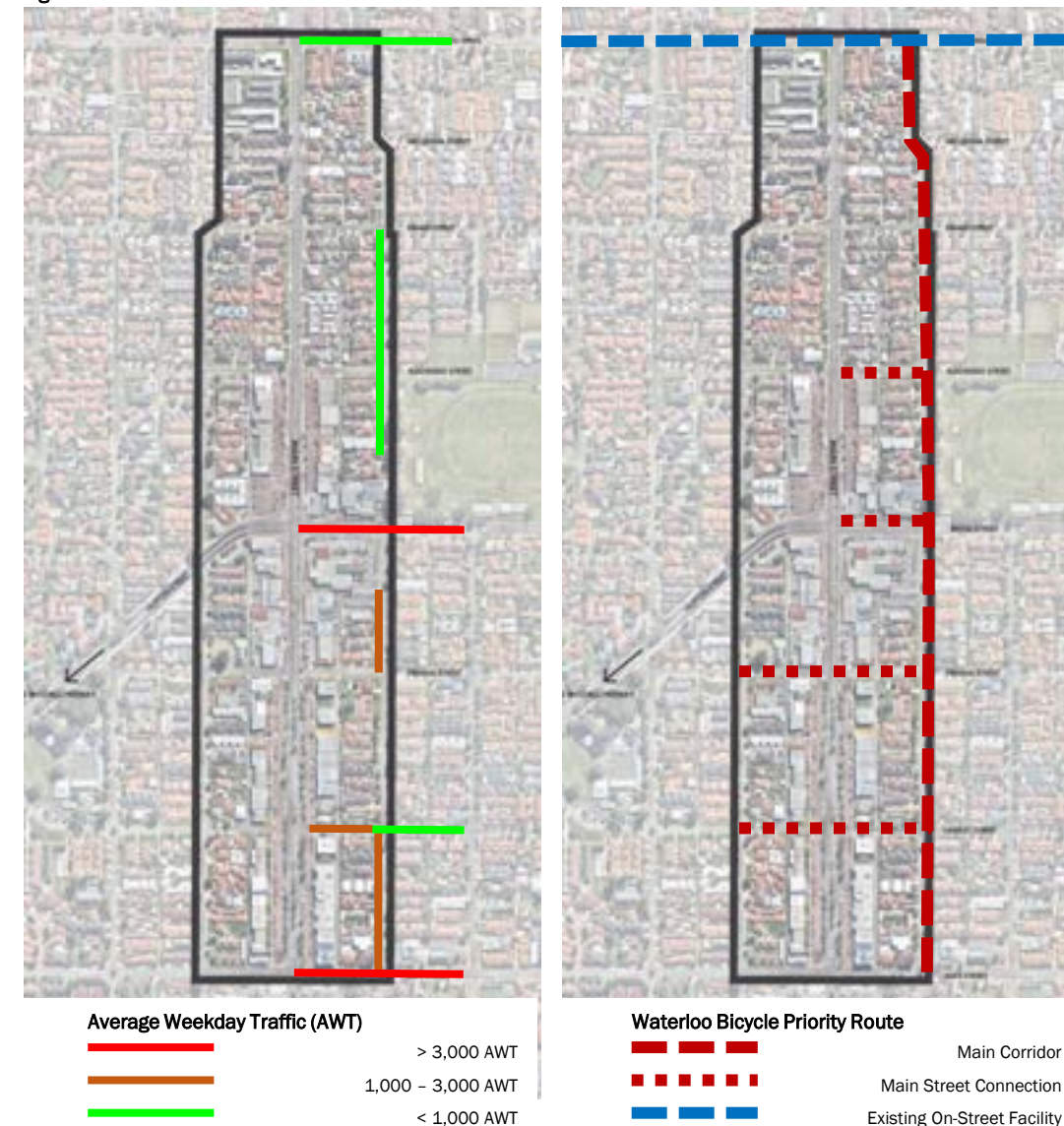
Waterloo Street Safe Active Street

The majority of the Waterloo Street cycle priority route or safe active street is formed of existing local access streets with low volumes of traffic – as shown to the right.

The route would pass over, or connect to, streets with higher volumes of traffic where specific priority measures would be required – at North Beach Drive, Royal Street and Cape Street. To provide the level of priority required to make the route attractive, measures to be included would be based on:

1. Reconfiguration of the connection to North Beach Drive to provide legibility
2. Use of local area traffic management measures along Waterloo Street between Eldorado Street and North Beach Drive using Safe Active Street carriageway configuration
3. Routing through the Robinson Reserve
4. Signalised Pelican Crossing on Royal Street
5. Segregated path section between Royal Street and Federal Street to remove conflict with vehicle access to and from commercial premises
6. Use of local area traffic management measures along Waterloo Street between Federal Street and Cape Street using Safe Active Street carriageway configuration
7. Removal of the roundabout at the intersection of Cape Street and Waterloo Street and provision of a cycle priority crossing
8. Prioritised connections to Main Street along Eldorado, Royal and Federal Streets.

Figure 21



Transport Plan



Transport Plan Outcomes

The Transport Plan for the Main Street Urban Design Study (Study) has been developed in conjunction with the City of Stirling and RobertsDay Group.

The key recommendations for this Transport Plan, shown on the image over page, are:

- Introduction of a wider area 40km/hr speed zone via a staged approach
- Two additional pedestrian signal crossings in the study area
- Reconfiguration of on-street parking, embayed parking and bus stop embayments
- Reconfiguration of pedestrian crossing points for crossovers
- Development of a Safe Active Street along Waterloo Street with connections to Main Street
- Removal of the give-way left turn slip lane from Hutton Street to Main Street (northbound)
- Use of on-street traffic calming and management such as cushions or vertical deflection treatments throughout the area, including the potential use at Main Street intersection with Hutton Street
- Integration with the Robinson Reserve upgrade.



Figure 22 Proposed overall network for pedestrian, cycling and traffic management

Appendix 1

Main Street

Urban Design Study

November 2017



Initial Analysis

This analysis document covers:

- High level examination of key transport information including available traffic data;
- Review of existing network characteristics, including parking and street classifications;
- Outcomes from any previous studies; and
- Any other relevant information.



Traffic Information

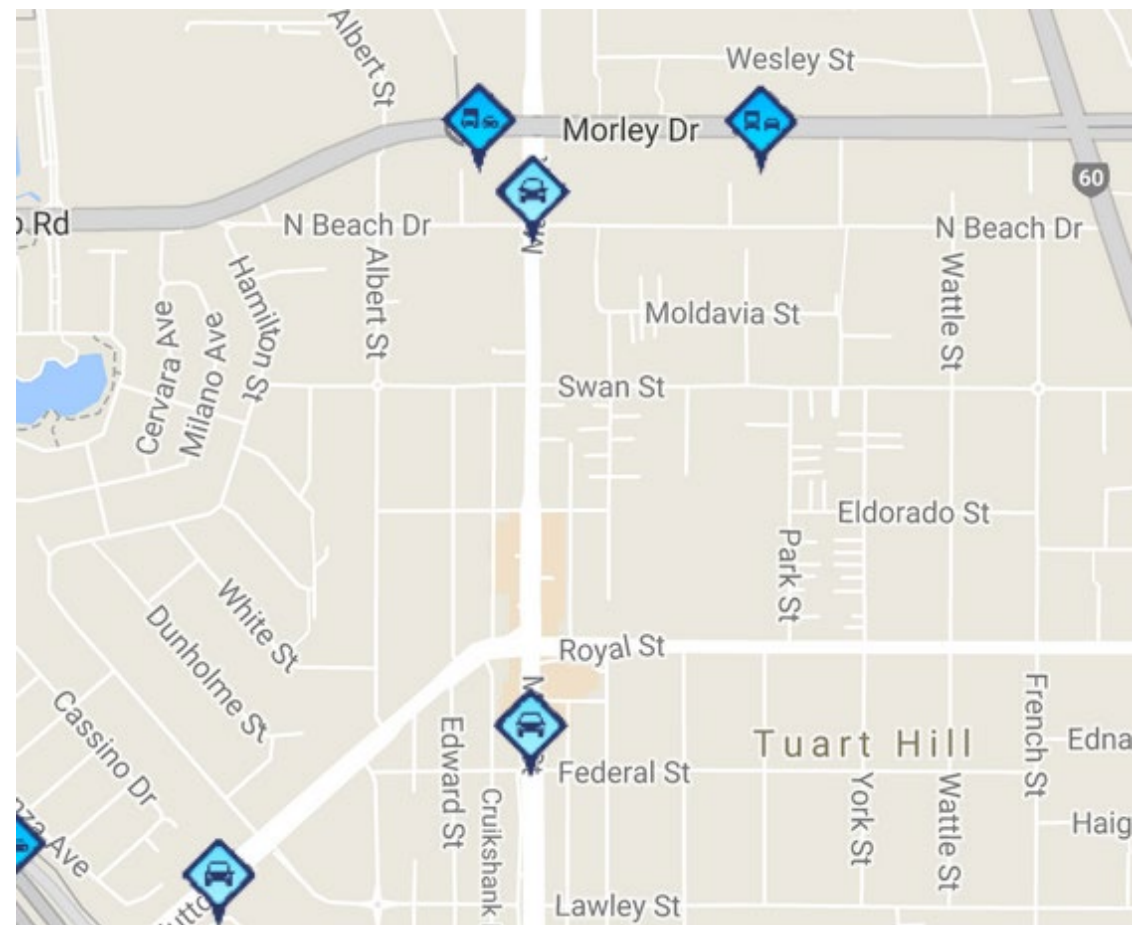
Main Roads WA count map information taken from the online resource:

<https://mrapps.mainroads.wa.gov.au/TrafficMap/>

2016 directional and volume counts are available for two locations on Main Street in the study area – south of Morley Drive and at Federal Street, as shown to the right.

The results for each location are shown over the following pages and are summarised as:

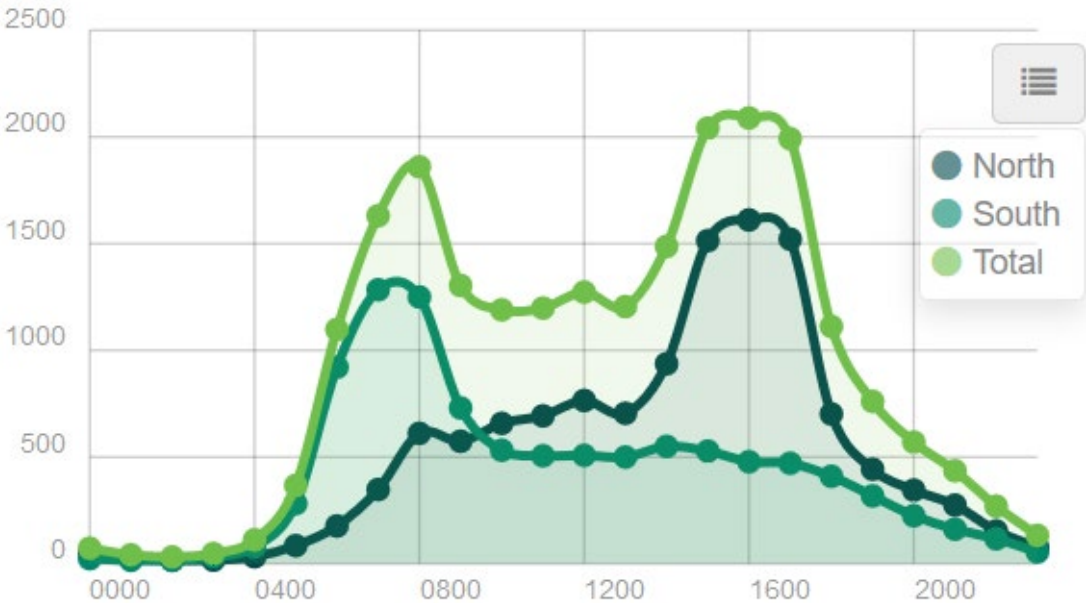
- Main St south of Morley Drive has an average weekday volume of around 29,000 vpd comprised of 50% flows in each direction. This tidal flow is symptomatic of commuting and interregional traffic movements. The peak hours are 7.00am to 8.00am and 4.00pm to 5.00pm with the afternoon peak period being consistently busier.
- Main St south of Royal St has an average weekday volume of around 22,300 vpd with the northbound traffic flow being around 55% of recorded volume. The peak hours are 8.00am to 9.00am and 4.00pm to 5.00pm.



Main St South of Royal St

The overall recorded volumes for this intersection are shown to the right.

The overall profile of traffic movements along this section of Main Street are shown below.



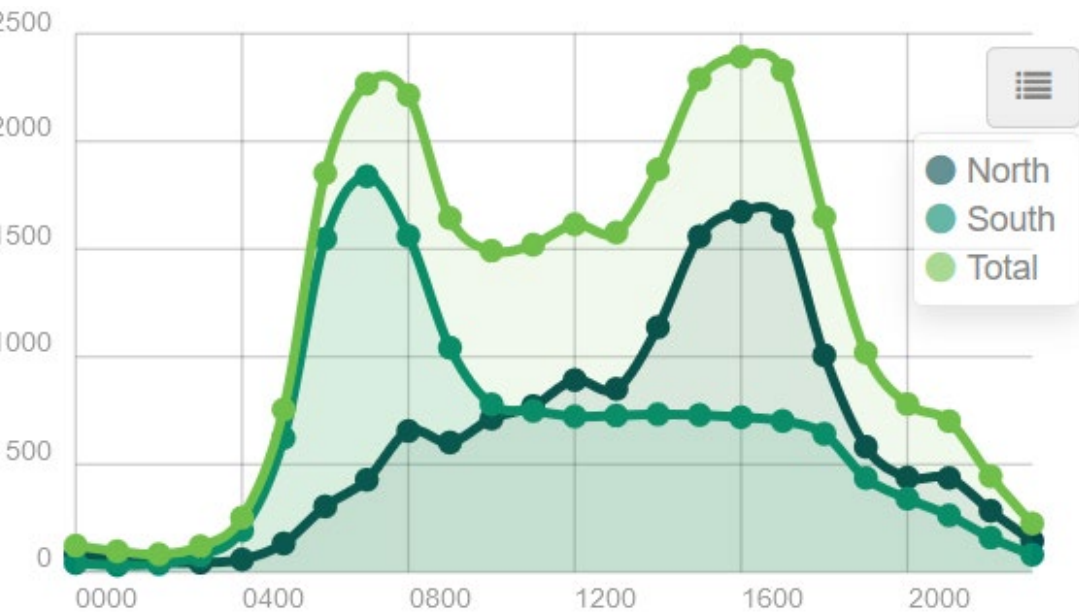
Average Vehicle Volume															Directional			
Hour	Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
0000			48	23	50	25									49	24		
0100			25	19	27	12									26	16		
0200			18	17	15	14									17	16		
0300			18	33	16	28									17	31		
0400			39	72	26	86									33	79		
0500			90	304	79	260									85	282		
0600			181	985	172	857									177	921		
0700			349	1256	346	1311									348	1284		
0800			621	1264	600	1235									611	1250		
0900			531	703	616	757									574	730		
1000			671	527	645	537									658	532		
1100			683	492	702	519									693	506		
1200			730	481	799	535									765	508		
1300			695	479	715	521									705	500		
1400			988	514	885	586									937	550		
1500			1591	546	1436	509									1514	528		
1600			1545	456	1677	499									1611	478		
1700			1603	465	1439	477									1521	471		
1800			694	394	710	426									702	410		
1900			428	308	457	328									443	318		
2000			350	215	340	234									345	225		
2100			236	157	311	166									275	162		
2200			151	115	156	118									154	117		
2300			77	50	78	60									78	55		
Total			12364	9875	12297	10100									12338	9993		

Peak Statistics																			
		Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
		N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
AM	1/4 Hour			1145	0815	0830	0745									1145	0800		
	1/4 Hr Vol			223	348	207	355									203	343		
	1 Hour			1145	0730	1145	0715									1145	0730		
	1 Hr Vol			781	1310	789	1359									785	1328		
	1 Hr Fact			8756	9465	9393	957									9504	9693		
PM	1/4 Hour			1530	1515	1530	1445									1530	1445		
	1/4 Hr Vol			493	164	485	158									479	156		
	1 Hour			1645	1445	1530	1430									1530	1430		
	1 Hr Vol			1722	562	1686	595									1676	572		
	1 Hr Fact			9101	8567	9065	9415									8747	9196		

Main St South of Morley Drive

The overall recorded volumes for this intersection are shown to the right.

The overall profile of traffic movements along this section of Main Street are shown below.



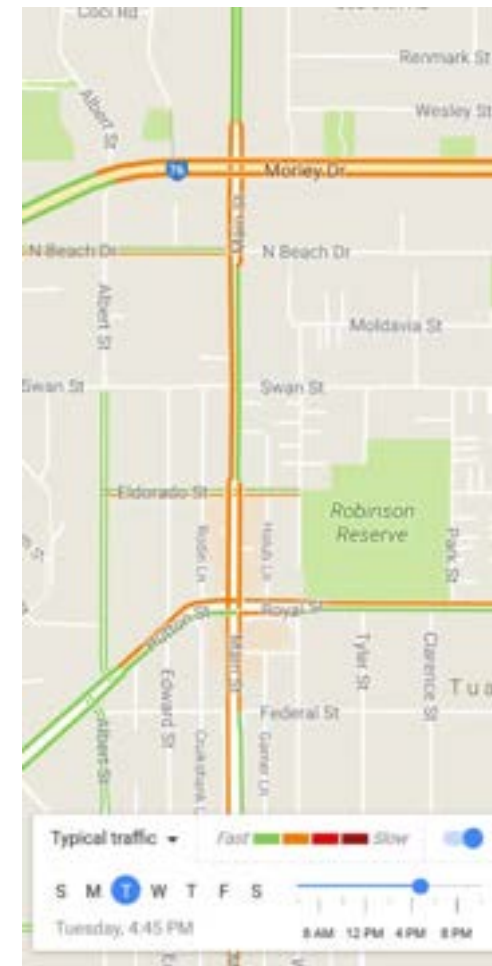
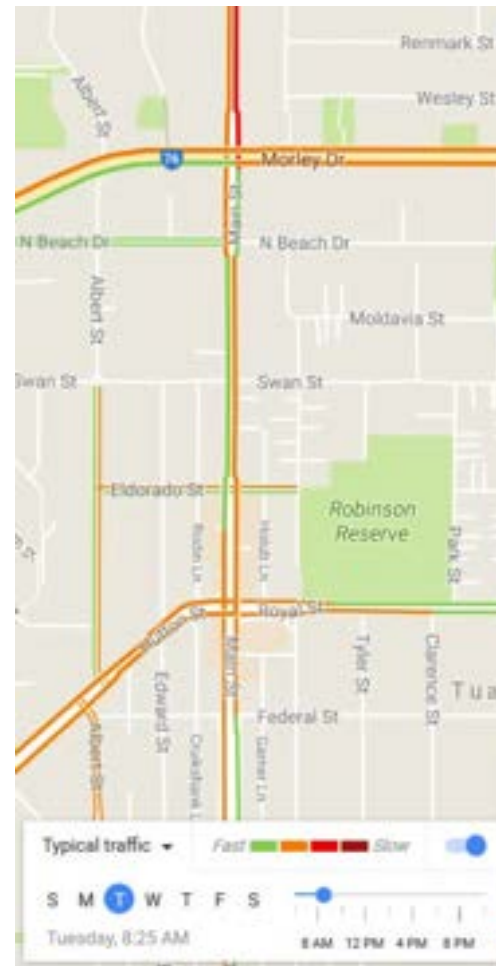
Average Vehicle Volume														Directional				
Hour	Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
0000			69	44	94	39									82	42		
0100			57	33	72	31									65	32		
0200			55	38	36	37									46	38		
0300			41	70	47	81									44	76		
0400			64	198	53	190									59	194		
0500			138	625	129	620									133	623		
0600			318	1588	291	1507									305	1548		
0700			446	1843	411	1833									429	1838		
0800			656	1530	653	1591									655	1561		
0900			597	1015	607	1069									602	1042		
1000			703	760	723	797									713	779		
1100			772	751	770	747									771	749		
1200			895	696	888	750									892	723		
1300			822	721	879	732									851	727		
1400			1195	706	1079	760									1137	733		
1500			1561	753	1557	707									1559	730		
1600			1696	710	1650	727									1673	719		
1700			1617	688	1638	715									1628	702		
1800			1034	614	979	669									1007	642		
1900			597	402	567	471									582	437		
2000			427	341	451	341									439	341		
2100			381	277	492	251									437	264		
2200			256	163	314	156									285	160		
2300			134	63	156	99									145	81		
Total			14529	14629	14536	14920									14539	14781		

Peak Statistics																			
		Mon		Tue		Wed		Thu		Fri		Sat		Sun		Mon - Fri		Mon - Sun	
		N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
AM	1/4 Hour			1130	0715	1130	0715									1130	0715		
	1/4 Hr Vol			213	481	206	481									210	481		
	1 Hour			1145	0645	1145	0700									1145	0700		
	1 Hr Vol			879	1849	845	1833									862	1838		
	1 Hr Fact			9513	961	8587	9527									9036	9553		
PM	1/4 Hour			1615	1515	1545	1230									1615	1515		
	1/4 Hr Vol			457	219	449	212									442	206		
	1 Hour			1545	1445	1530	1415									1545	1430		
	1 Hr Vol			1727	789	1696	774									1707	775		
	1 Hr Fact			9447	9007	9443	9822									9655	9405		

Traffic Information

Google traffic maps were examined to validate the Main Roads WA count information. Peak period heat mapping for the corridor are shown for both the AM and PM peaks to the right. These plots show:

- The tidal nature of traffic movements with the slower, more congested conditions replicating peak flow direction.
- No arms of the main intersections recorded significantly congested conditions. Main Street and approaches are busy, but not to any extreme. The slower conditions are likely caused by interaction between turning vehicles and through traffic.
- Eldorado Street approaches to Main Street appear to show slower traffic movements in both peaks.

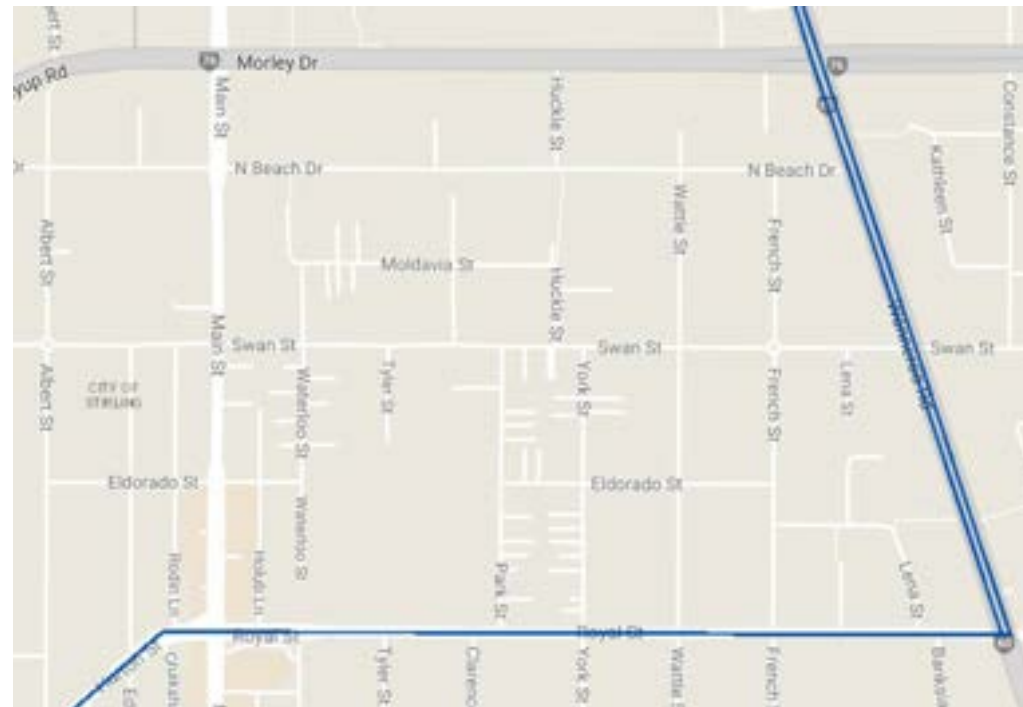


Traffic Information - RAVS

Main Street is not on the Restricted Access Vehicle Network (RAVS). Royal Street, which intersects Main Street in the study area, is a Network 4 approved route which means that heavy vehicles with a length of 27.5m can use the route. This is an important consideration for intersection design and pedestrian interactions.

The RAVS network map from the Main Roads WA website is shown to the right.

<https://mrapps.mainroads.wa.gov.au/RavNetworkMap>



Traffic Information - Hierarchy

The Main Roads WA Road Classification map for the corridor is shown to the right. Main St is classified as a District Distributor A. Intersecting distributor level roads are:

- North Beach Drive is a Local Distributor road
- Cape Street is a Local Distributor road
- Hutton St and Royal Street are District Distributor A roads.

All other intersecting streets are local Access Roads. The hierarchy classification criteria are shown over page.

<https://mrapps.mainroads.wa.gov.au/PublicMaps/RoadInformationMapping/>



ROAD HIERARCHY FOR WESTERN AUSTRALIA
ROAD TYPES AND CRITERIA (see Note 1)

CRITERIA	PRIMARY DISTRIBUTOR (PD) (see Note 2)	DISTRICT DISTRIBUTOR A (DA)	DISTRICT DISTRIBUTOR B (DB)	REGIONAL DISTRIBUTOR (RD)	LOCAL DISTRIBUTOR (LD)	ACCESS ROAD (A)
Primary Criteria						
1. Location (see Note 3)	All of WA incl. BUA	Only Built Up Area.	Only Built Up Area.	Only Non Built Up Area. (see Note 4)	All of WA incl. BUA.	All of WA incl. BUA.
2. Responsibility	Main Roads Western Australia	Local Government.	Local Government.	Local Government.	Local Government.	Local Government.
3. Degree of Connectivity	High. Connects to other Primary and Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	Medium. Minor Network Role Connects to Distributors and Access Roads.	Low. Provides mainly for property access.
4. Predominant Purpose	Movement of inter regional and/or cross town/city traffic, e.g. freeways, highways and main roads.	High capacity traffic movements between industrial, commercial and residential areas.	Reduced capacity but high traffic volumes travelling between industrial, commercial and residential areas.	Roads linking significant destinations and designed for efficient movement of people and goods between and within regions.	Movement of traffic within local areas and connect access roads to higher order Distributors.	Provision of vehicle access to abutting properties
Secondary Criteria						
5. Indicative Traffic Volume (AADT)	In accordance with Classification Assessment Guidelines.	Above 8 000 vpd	Above 6 000 vpd.	Greater than 100 vpd	<u>Built Up Area</u> - Maximum desirable volume 6 000 vpd. <u>Non Built Up Area</u> - up to 100 vpd.	<u>Built Up Area</u> - Maximum desirable volume 3 000 vpd. <u>Non Built Up Area</u> - up to 75 vpd.
6. Recommended Operating Speed	60 – 110 km/h (depending on design characteristics).	60 – 80 km/h.	60 – 70 km/h.	50 – 110 km/h (depending on design characteristics).	<u>Built Up Area</u> 50 – 60 km/h (desired speed). <u>Non Built Up Area</u> 60 – 110 km/h (depending on design characteristics).	<u>Built Up Area</u> 50 km/h (desired speed). <u>Non Built Up Area</u> 50 – 110 km/h (depending on design characteristics).
7. Heavy Vehicles permitted	Yes.	Yes.	Yes.	Yes.	Yes, but preferably only to service properties.	Only to service properties.
8. Intersection treatments	Controlled with appropriate measures e.g. high speed traffic management, signing, line marking, grade separation.	Controlled with appropriate measures e.g. traffic signals.	Controlled with appropriate Local Area Traffic Management.	Controlled with measures such as signing and line marking of intersections.	Controlled with minor Local Area Traffic Management or measures such as signing.	Self controlling with minor measures.
9. Frontage Access	None on Controlled Access Roads. On other routes, preferably none, but limited access is acceptable to service individual properties.	Prefer not to have residential access. Limited commercial access, generally via service roads.	Residential and commercial access due to its historic status. Prefer to limit when and where possible.	Prefer not to have property access. Limited commercial access, generally via lesser roads.	Yes, for property and commercial access due to its historic status. Prefer to limit whenever possible. Side entry is preferred.	Yes.
10. Pedestrians	Preferably none. Crossing should be controlled where possible.	With positive measures for control and safety e.g. pedestrian signals.	With appropriate measures for control and safety e.g. median/islands refuges.	Measures for control and safety such as careful siting of school bus stops and rest areas.	Yes, with minor safety measures where necessary.	Yes.
11. Buses	Yes.	Yes.	Yes.	Yes.	Yes.	If necessary (see Note 5)
12. On-Road Parking	No (emergency parking on shoulders only).	Generally no. Clearways where necessary.	Not preferred. Clearways where necessary.	No – emergency parking on shoulders – encourage parking in off road rest areas where possible.	<u>Built Up Area</u> – yes, where sufficient width and sight distance allow safe passing. <u>Non Built Up Area</u> – no. Emergency parking on shoulders.	Yes, where sufficient width and sight distance allow safe passing.
13. Signs & Linemarking	Centrelines, speed signs, guide and service signs to highway standard.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs and guide signs.	Speed and guide signs.	Urban areas – generally not applicable. Rural areas – Guide signs.
14. Rest Areas/Parking Bays	In accordance with Main Roads' Roadside Stopping Places Policy.	Not Applicable.	Not Applicable.	Parking Bays/Rest Areas. Desired at 60km spacing.	Not Applicable.	Not Applicable.

Traffic Information – Speed Zones

Main Street has a posted speed limit of 60km/h. The intersecting District Distributor Roads, Hutton St and Royal Street, also have a posted speed limit of 60km/h. All other intersecting streets have a posted speed limit of 50km/h.

The overall speed zones and limits are taken from the Main Roads WA mapping system and are shown to the right.

<https://mrapps.mainroads.wa.gov.au/PublicMaps/RoadInformationMapping/>



Bus Information – Network Map

Main Street has three bus routes which run along the central section of the study corridor, as shown to the right in the Transperth network map.

<http://www.transperth.wa.gov.au/Journey-Planner/Network-Maps>

- Route 402 runs between Stirling Station and Perth Busport
- Route 404 connects to Perth Busport and terminates on Waterloo Street.
- Route 414 connects between Stirling Station and Glendalough Station.

In addition to these routes, route 403 runs along Hutton Street and Royal Street connecting Stirling Station with Perth Busport.

- Route 402 operates on 15-20 minute peak hour frequencies
- Route 404 operates on an infrequent basis with only 16 daily services
- Route 414 operates on 10 minute peak hour frequencies
- Route 403 operates on 10 to 15 minute peak hour frequencies.

There are 9 bus stops along Main Street in the study corridor. All lots in the corridor are in close proximity to a bus stop, and therefore have excellent connectivity to the wider Transperth network.

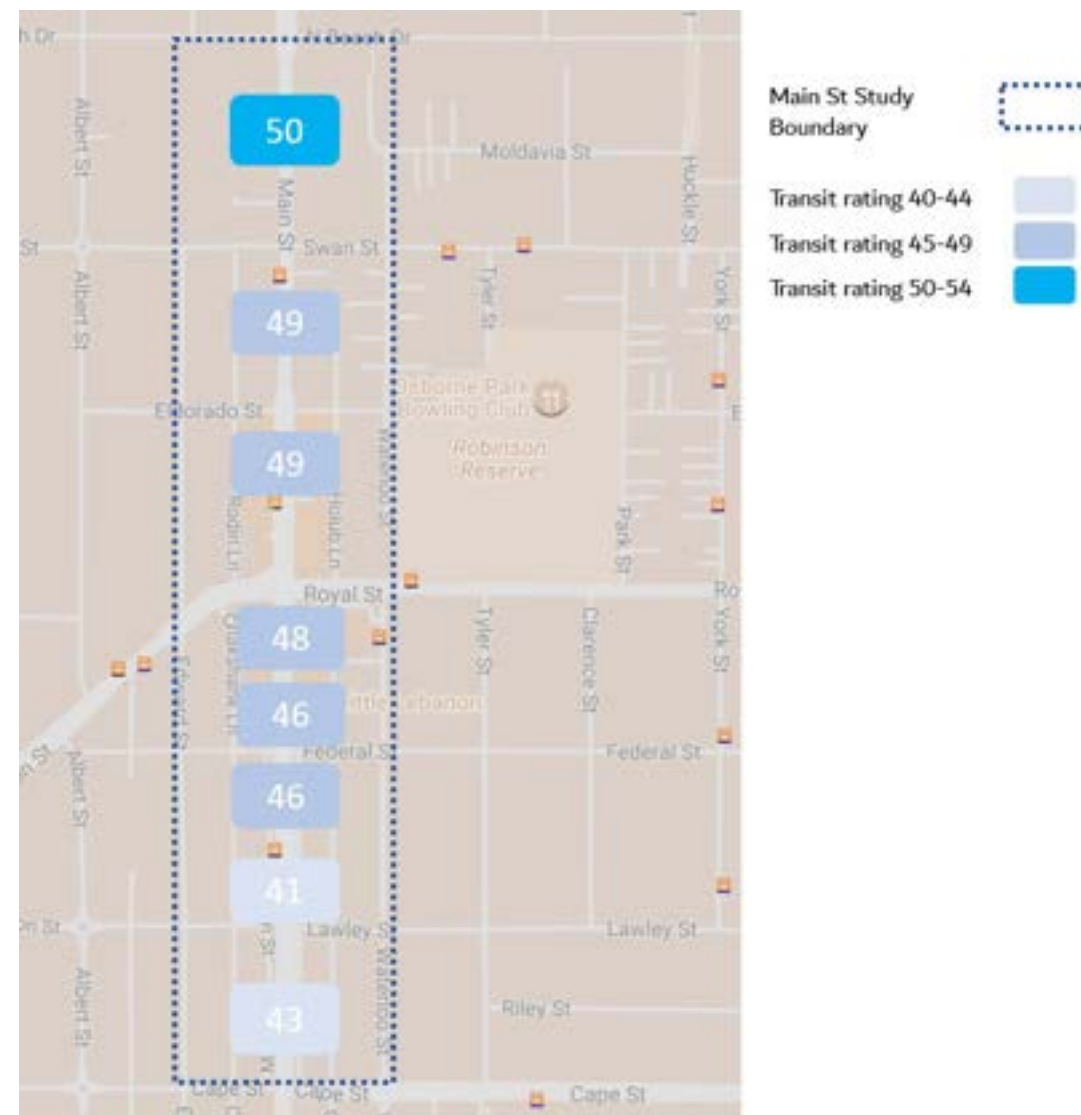


Transit Accessibility – Walkscore

The accessibility rating for properties in the study area was extracted from the commercial product, Walkscore. Average ratings for locations mid-block along the corridor were weighted to understand the general level of accessibility to public transport. Typically, Walkscore rates locations with access to Train stations higher given the speed with which rail services can move people around the metropolitan region.

The scores, shown to the right and described below, indicate that the corridor has limited access to public transport.

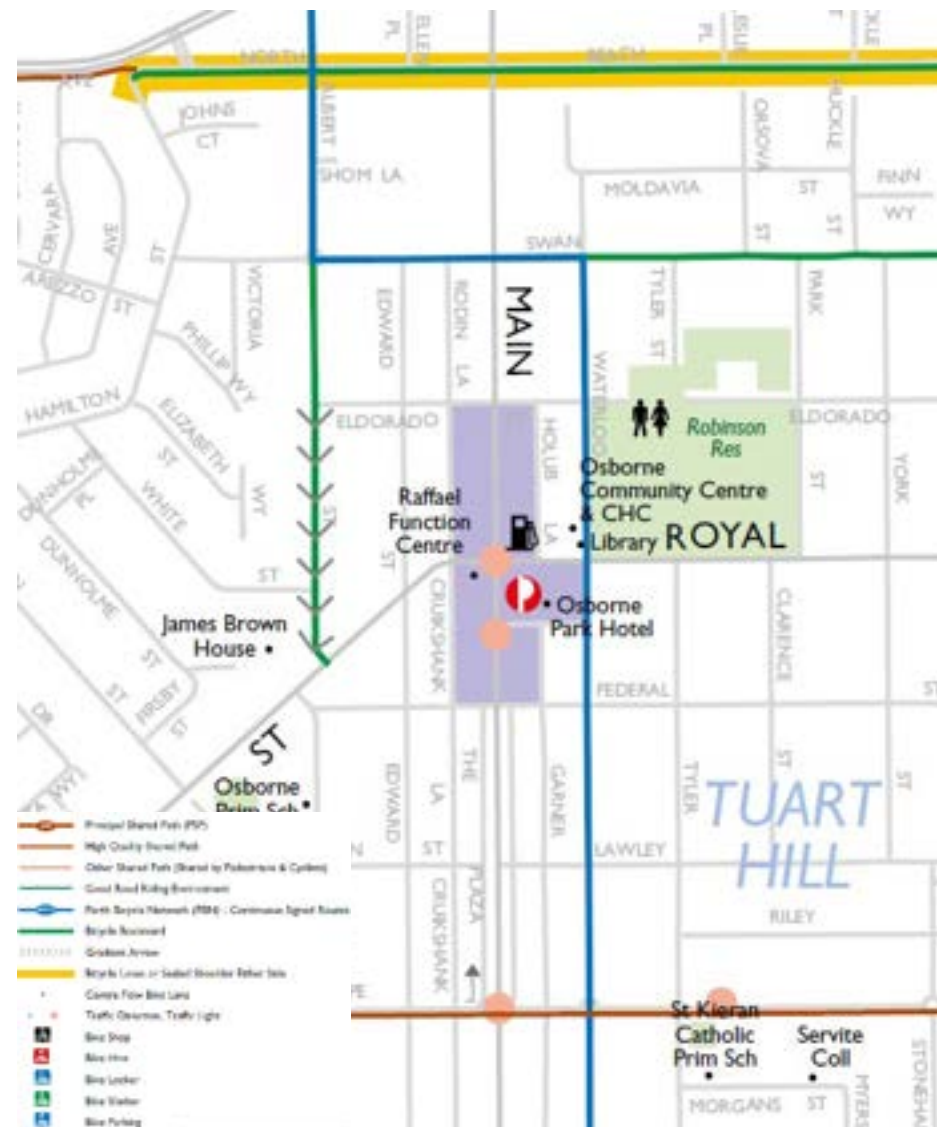
90–100	Rider's Paradise - World-class public transportation.
70–89	Excellent Transit - Transit is convenient for most trips.
50–69	Good Transit - Many nearby public transportation options.
25–49	Some Transit - A few nearby public transportation options.
0–24	Minimal Transit - It is possible to get on a bus.



Walking and Cycling

The DoT TravelSmart maps were examined to understand the context of cycle and walking infrastructure. The extract from the map for the study corridor, shown to right, indicates that:

- Main Street is not considered to be a cycle route.
- There is a marked Perth Bicycle Network route along Waterloo Street that runs parallel through most of the corridor to the east of Main Street. This is seen as the main north-south cycling corridor.
- North Beach Drive has wide, unmarked shoulders and is considered a good local cycling street.
- There is a shared use path along Cape Street.
- There is no marked cycle storage infrastructure in the corridor area.

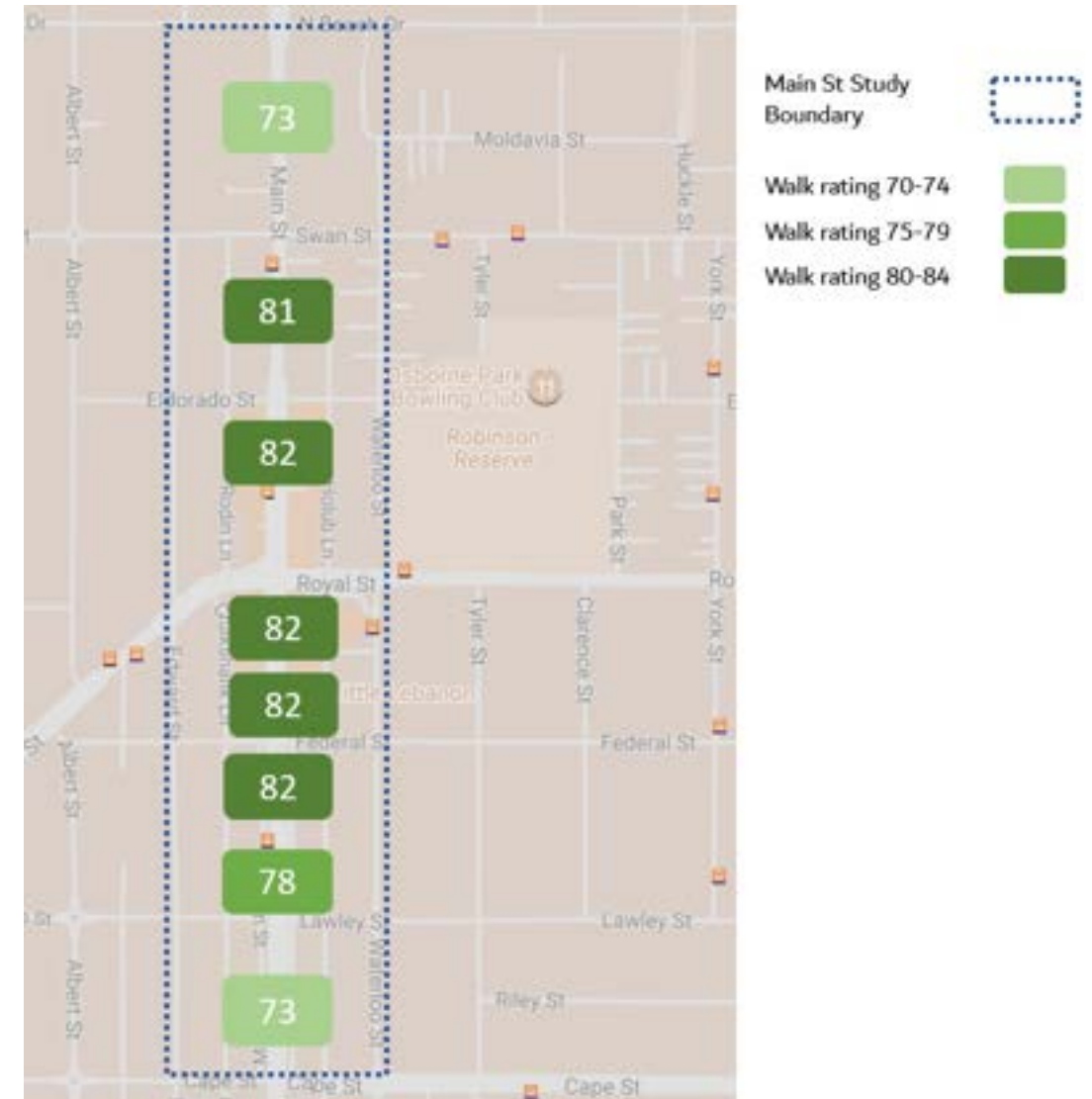


Pedestrian Accessibility – Walkscore

The walkable accessibility rating for properties in the study area was extracted from the commercial product, Walkscore. Average ratings for locations mid-block along the corridor were weighted to understand the general level of accessibility for pedestrians.

The scores, shown to the right and described below, indicate that the corridor has excellent local access to services and facilities that would easily be reached through walking.

90–100	Walker's Paradise - Daily errands do not require a car.
70–89	Very Walkable - Most errands can be accomplished on foot.
50–69	Somewhat Walkable - Some errands can be accomplished on foot.
25–49	Car-Dependent - Most errands require a car.
0–24	Car-Dependent - Almost all errands require a car.



Cycling – Strava Heatmapping

Strava heatmapping was reviewed to understand if there was a linkage between the marked routes and DoT mapping and user behaviour. The use of Strava is generally associated with commuting, recreational or fitness cyclists and is not representative of all trips however it does provide an indicator as to the popularity of routes with specific types of cyclists.

The heat map image, shown to the right, indicates that:

- There is a high use of Main Street itself for cycling trips. This is most likely associated with more direct routes north-south through the area.
- The use of the marked Perth Bicycle Network route along Waterloo Street is limited.
- There is a route along Hutton Street towards the Freeway PSP that is westbound. The reverse trips appear to be closely associated with the parallel route to Main Street along Albert Street.
- Swan Street is a well used east-west route.



Parking – 2016 Study

An off-street parking occupancy survey was completed in 2016 for the key commercial land uses in the corridor adjacent to the intersection of Main Street and Hutton Street. The recorded parking occupancy for the Thursday and Saturday peak hours is shown to the right.

These results indicate that, during the high use peak periods for a Saturday and Thursday, there is adequate parking availability in the area. The study for this location was not completed and no recommendations were put forward in respect of parking for the area.

Table 3.1 : Parking Results for Main Street Precinct for Thursday peak hour

Location		Total Off-street Parking supply	Total On- street Parking Supply	Total parking supply	Average no. of parking (Occupied)	Average parking utilisation (%)
1	NW corner	157	2	159	84	53%
2	NE corner	135	3	138	55	39%
3	SE corner	217	3	220	107	49%
4	SW corner	75	13	88	56	63%

Table 3.2 : Parking Results for Main Street Precinct for Saturday peak hour

Location		Total Off-street Parking supply	Total On- street Parking Supply	Total parking supply	Average no. of parking (Occupied)	Average parking utilisation (%)
1	NW corner	157	2	159	67	42%
2	NE corner	135	3	138	54	39%
3	SE corner	217	3	220	107	48%
4	SW corner	75	13	88	46	52%