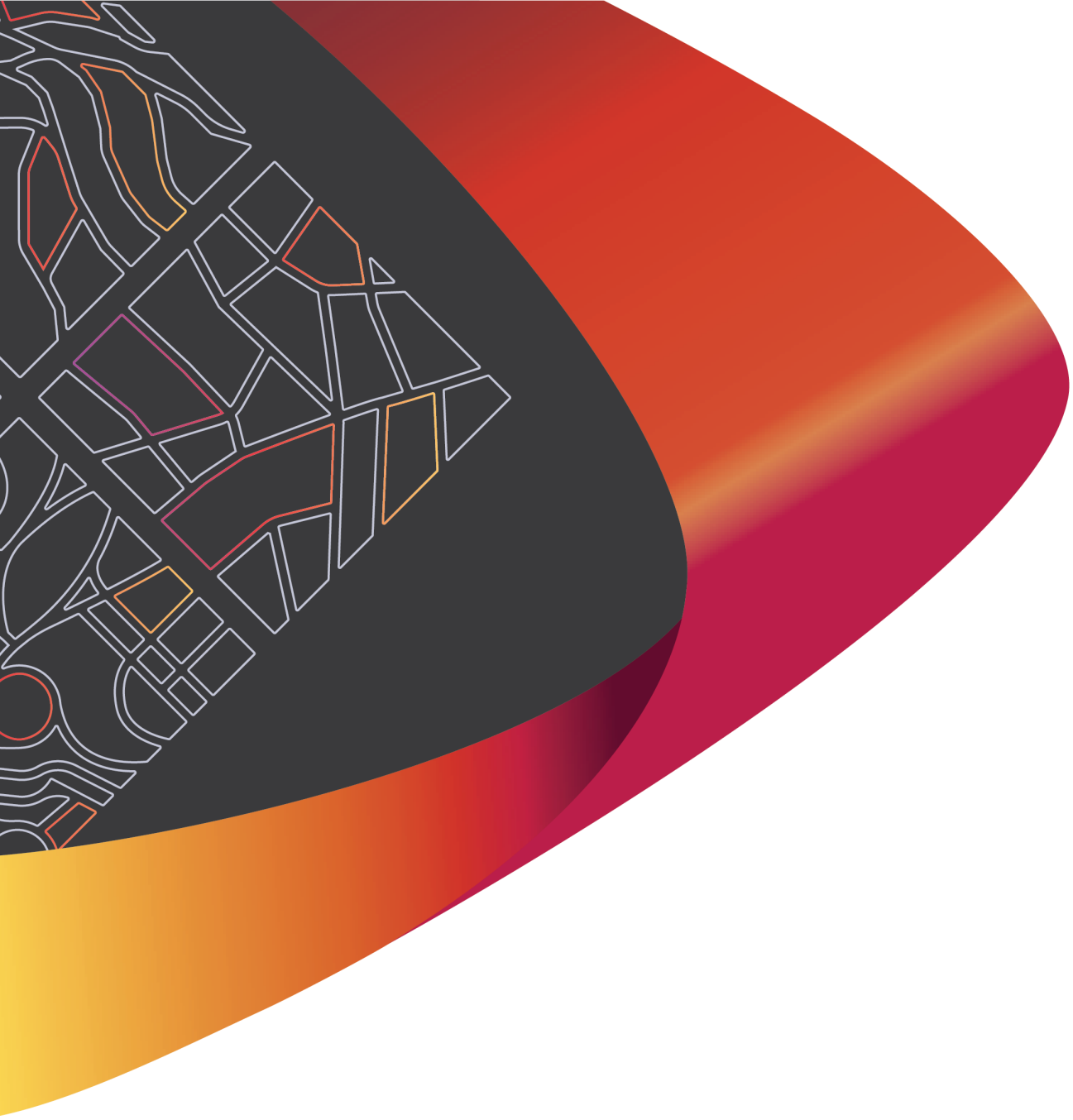

SHIRE OF SERPENTINE JARRAHDALE

MUNDIJONG DISTRICT STRUCTURE PLAN

TRANSPORT IMPACT ASSESSMENT

Report No: KC01863.000/TIA
Rev A
20 December 2024

Premise

DOCUMENT AUTHORISATION					
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Prepared By		**Reviewed By**		**Authorised By**	
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CONTENTS

TABLES

FIGURES

1. EXECUTIVE SUMMARY

- The Shire of Serpentine Jarrahdale have commissioned a preparation of Transport Impact Assessment (TIA) in accordance with Western Australian Planning Commission (WAPC)) Guidelines for the proposed Mundijong District Structure Plan 2024 (MDSP24).
- The Mundijong/Whitby District Structure Plan (M-WDSP), approved by the WAPC in 2011, is undergoing updates initiated by the Shire in 2018. After consultations, significant revisions were made, including removing large rural land areas, leading to the Mundijong District Structure Plan (MDSP), advertised in August 2020. Further adjustments were made in response to submissions before the MDSP was submitted to the WAPC for endorsement.
- The updated Mundijong District Structure Plan 2024 aligns with the Perth and Peel @ 3.5 million Sub-regional Planning Framework, promoting higher densities for future land use and development. While the M-WDSP anticipated a population of up to 40,000 and 15,300 dwellings, the proposed Mundijong District Structure Plan 2024 accommodates approximately 58,250 residents and 20,367 dwellings across approximately 1,486 urban hectares. Key issues addressed include activity centres, primary school sites, east-west road network linkages, and rail transport improvements, including stations and grade separations. Population estimates are based on existing and potential lot yields, infill capacity, and a household occupancy rate of 2.86 persons per dwelling.
- Key transport projects (to be implemented by different State Government agencies) critical to the MDSP24 realisation include:
  - Tonkin Highway Extension: Extending south to Mundijong Road and east to South Western Highway, with grade-separated and at-grade intersections, targeted for completion by 2031.
  - Freight Rail Realignment: Shifting the freight rail corridor on the western side of Tonkin Highway extension to support town centre development, likely within 10 years. The revised MDSP24 plan proposes only one railway station, at Whitby, that will become the new rail terminus. The re-alignment of the freight rail and the removal of the second station in Mundijong will result in only four train movements per day.
  - Passenger Rail Extension: Extending the Armadale Line south to Whitby, anticipated between 2041 and 2051.

  Additional considerations include the Cardup Business and Residential Park (potential for 3,000 dwellings), West Mundijong Industrial Area (127 industrial lots), and other surrounding developing areas that influence local population and employment growth.
- The Mundijong District Structure Plan 2024 will be implemented based on population triggers that determine the need for essential infrastructure. As staging is population-dependent, specific timelines are general in nature and developed for modelling purposes only. Local Structure Plans will address detailed staging and timing.
- The traffic generation analysis for the Mundijong District Structure Plan 2024 area estimates a total daily vehicle movement of 256,347 vehicular trips, with 23,994 vehicular trips during the AM peak and 28,211 vehicular trips during the PM peak.

  The potential train station within the MDSP24 area is anticipated to generate approximately 3,500 daily trips, including 700 trips during each of the AM and PM peak periods. These trips represent a

combination of movements originating from within the MDSP24 area and external trips, emphasising the station's potential role as a regional transport hub.

- The proposed MDSP24 was modelled using Aimsun Next 2024 to assess its impact on the existing road network and identify necessary upgrades and new infrastructure to accommodate expected traffic. The modelling process followed Main Roads Western Australia (MRWA) Mesoscopic and Hybrid Modelling Guidelines and was peer-reviewed. The peer review was conducted by PTG Consulting on behalf of the Shire of Serpentine Jarrahdale. Based on information provided by the Shire, it was concluded that no fatal flaws were identified.

  The assessment covers daily, AM, and PM peak traffic for the following years: 2021 (base year), 2031 (interim), and 2051 (final). The 2021 base model was selected as it aligns with the most recent Census data and is the only horizon year validated in the ROM model. Detailed methodology and assumptions are outlined in the Base and Options Modelling reports.
- The key outcomes of the modelling process guide the proposed road classification and intersection configuration for the Mundijong District Structure Plan 2024 (MDSP24). Through the analysis of traffic generation and flow patterns in the base, interim, and final horizon years, the model identifies critical areas where road upgrades and new infrastructure are necessary. This includes determining appropriate road classifications to ensure efficient traffic movement, as well as defining intersection configurations and railway crossing treatments that can handle peak traffic volumes.
- The proposed road classification within the Mundijong District Structure Plan 2024 area aligns with the Liveable Neighbourhoods framework, reflecting minimum geometric requirements to accommodate anticipated traffic demand by 2051. However, most existing road reservations will require expansion to accommodate the required geometric configuration.
- While the proposed road classification is traffic-oriented, road reservation widths can be adjusted and expanded to address additional priorities, such as civil engineering, environmental conservation, and urban design. This flexibility allows lower-order roads to be adapted for broader needs beyond traffic engineering requirements.
- One of the limitations of the model is that it includes only key road links in the MDSP24 area, as at this level of planning, the fine grain network is not known. Once the individual LSP proposals are developed and the fine-grain network is known, the anticipated traffic on key links may be reduced in practicality.
- All proposed roads within the plan will include pedestrian paths, with at least a footpath on one side of the road reservation as a minimum standard. Roads classified higher than access roads will incorporate either shared paths or dedicated cycling lanes to ensure safe and efficient movement for cyclists.
- The design guidelines for the proposed development include a range of recommendations to enhance safety, accessibility, and sustainability. Road safety is a key focus, with recommendations to address level rail crossings to reduce potential risks. Consideration has also been given to vehicle and bicycle parking, as well as delivery and service access, to improve traffic flow and operational efficiency.
- Active transport is also one of the priorities, with a particular emphasis on creating safe routes to schools to encourage positive and healthy habits in children. The guidelines suggest incorporating low vehicular speeds to improve both road safety and the general amenity of the area. It is

recommended that car parking provision be carefully balanced with the likely demand to ensure sufficient capacity without encouraging excessive car use.

The guidelines also recommend provisions for micromobility vehicles to accommodate new transport modes. Additionally, the potential impact of community severance on general well-being has been considered, with suggestions to mitigate any negative effects. Crime Prevention Through Environmental Design (CPTED) principles have been applied, recommending the development of safe, secure public spaces, while recommendations for pedestrian realms and the integration of active transport options aim to create a well-connected and inclusive environment for all users.

> The table below provides an overview of the key modifications to the structure plan area and where they have been addressed within the transport impact assessment:

Table 1 – Table of modifications

Key items / WAPC Modifications	Report Name	Section and Page
Consistency with modified land use proposals and road networks. Updated dwelling, population, and employment forecast.	Transport Impact Assessment Report	• Section 5 and 5.1 – pages 36 and 37 showing the existing and proposed land uses and yields • Section 5.4.2 – intersections' configuration.
	Options Transport Modelling Report	• Section 2.4 – pages 9-23 showing the key intersections' configurations in all options and scenarios
Railway crossings description and recommendations	Transport Impact Assessment Report	• Section 6.1.1 – pages 68 and 69
Comparison of Options 2a and 2b	Options Transport Modelling Report	• Section 5 – pages 38-40
Full Aimsun Graphic Output for Options 2a and 2b	Appendices B and C of the Options Transport Modelling Report	• N/A • Graphic representation of the road network and key performance indicators
Road Hierarchy	Transport Impact Assessment Report	• Section 5.4.1 – pages 56-63
	Appendix B of TIA	• Drawing S04

2. INTRODUCTION

2.1 Background

Premise Australia Pty Ltd (Premise) has been engaged by the Shire of Serpentine Jarrahdale to prepare a Transport Impact Assessment (TIA) to Western Australian Planning Commission (WAPC) Guidelines for the proposed Mundijong District Structure Plan 2024 (MDSP24) approved by the Western Australian Planning Commission.

The Mundijong District Structure Plan 2024 area is approximately 2,455 hectares, located south of the Cardup Business and Residential Park, west of South-Western Highway, east of the Tonkin Highway extension (about to begin construction) and north of Mundijong Road.

The Mundijong District Structure Plan 2024 area is expected to accommodate 58,000 residents by 2050, with a growth rate of around 7,500 dwellings to be completed over the next 15 years.

2.2 Scope and Study Area

This report outlines the traffic impact of the proposed Mundijong District Structure Plan 2024 approved by the Western Australian Planning Commission.

The scope of work is outlined in the RFQ document provided by the Shire of Serpentine Jarrahdale. Some clarifications were sought and received via email. The outline below will refer both – the clarifications and the primary document.

Generally, the scope of work comprises from preparation of necessary modelling and reporting to produce a Transport Impact Assessment in accordance with Western Australian Planning Commission (WAPC) guidelines.

- Stage 1 – Reviewing of existing documentation
- Stage 2: Prepare a Traffic Impact Assessment
  - Prepare a fresh traffic study to replace the existing TIA and address the modifications requested by the WAPC. These will include the following but are not limited to:
  - Review and collect information on the existing traffic movements and street hierarchies in the Structure Plan area;
  - Review the critical external intersections within the Structure Plan area with respect to future traffic control measures
  - Identify opportunities for key road connections/upgrades with the Structure Plan area;
  - Incorporate legible mapping;
  - Review the potential location of planned/future rail station(s) within the Structure Plan area through discussions with PTA and any impact that these may have on the area and traffic movement;
  - Review the issues regarding all rail crossings within the Structure Plan area and the potential for the implementation of any additional railway crossings;
  - Preparation of a study report that documents the methodology, analysis and results from each task above.

- Time will have to be allocated to meet with the Department of Planning Lands & Heritage and Main Roads to get and discuss the latest information available for the road and transport network of the area.

> Stage 3: Finalisation

- Preparation and presentation of a Briefing Paper on the traffic and transport issues in the Structure Plan area.
- Incorporate any requested information or modifications required by the Shire, following review of the draft by the Shire.
- Finalise the new Traffic Impact Assessment.

3. EXISTING CONDITIONS

3.1 Site location and description

The subject site is located in Mundijong and Whitby areas in the Shire of Serpentine Jarrahdale, approximately 30km south-west of Perth CBD.

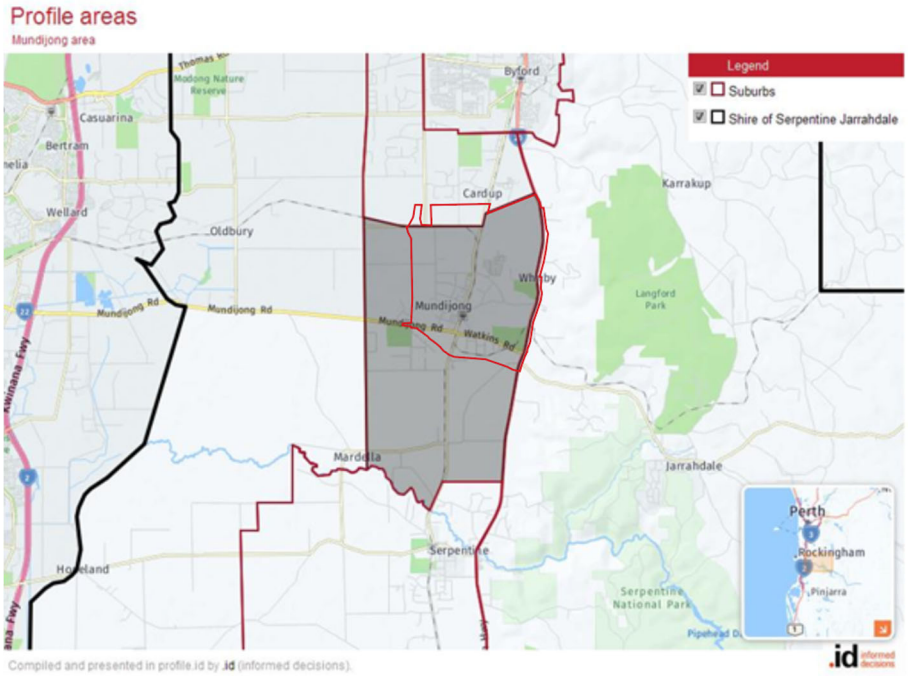


Figure 1 - Mundijong Precinct (source: Community ID) – MDSP24 is a subset of the precinct.

In the 2021 Census, the Mundijong area had 2,642 residents and an average household size of 2.79. The area has seen a good population growth since the Census and the current estimate is there is almost 300 people more live in Mundijong area in 2024. This is not surprising, as some of the areas of the subject site are progressing to construction under the approved LSPs.

The Census 2021 data show 970 dwellings in the Mundijong Area and the majority of these (862) were located in the DSP area.

The MDSP24 area is generally bounded by South Western Highway to the east, Tonkin Highway extension corridor to the west and south, Norman Road and Bishop Road to the north (including Lot 30 Soldiers Road and Lot 102 Bishop Road on the northern side of the Bishop Road reserve). The area is bisected by a rail corridor running along Paterson Road and Soldiers Road with a section deviating west along Bishop Road. The corridor services at present passenger rail to Australind (two trains in each direction per day) and freight rail with less than 10 movements per day.

3.2 Proposed Modifications to the District Structure Plan Area

Mundijong – Whitby District Structure Plan preparation process commenced in 2006. WAPC commission in principle endorsed the plan subject to modifications, and this report will focus on the most recent revision of plan with WAPC comments addressed.

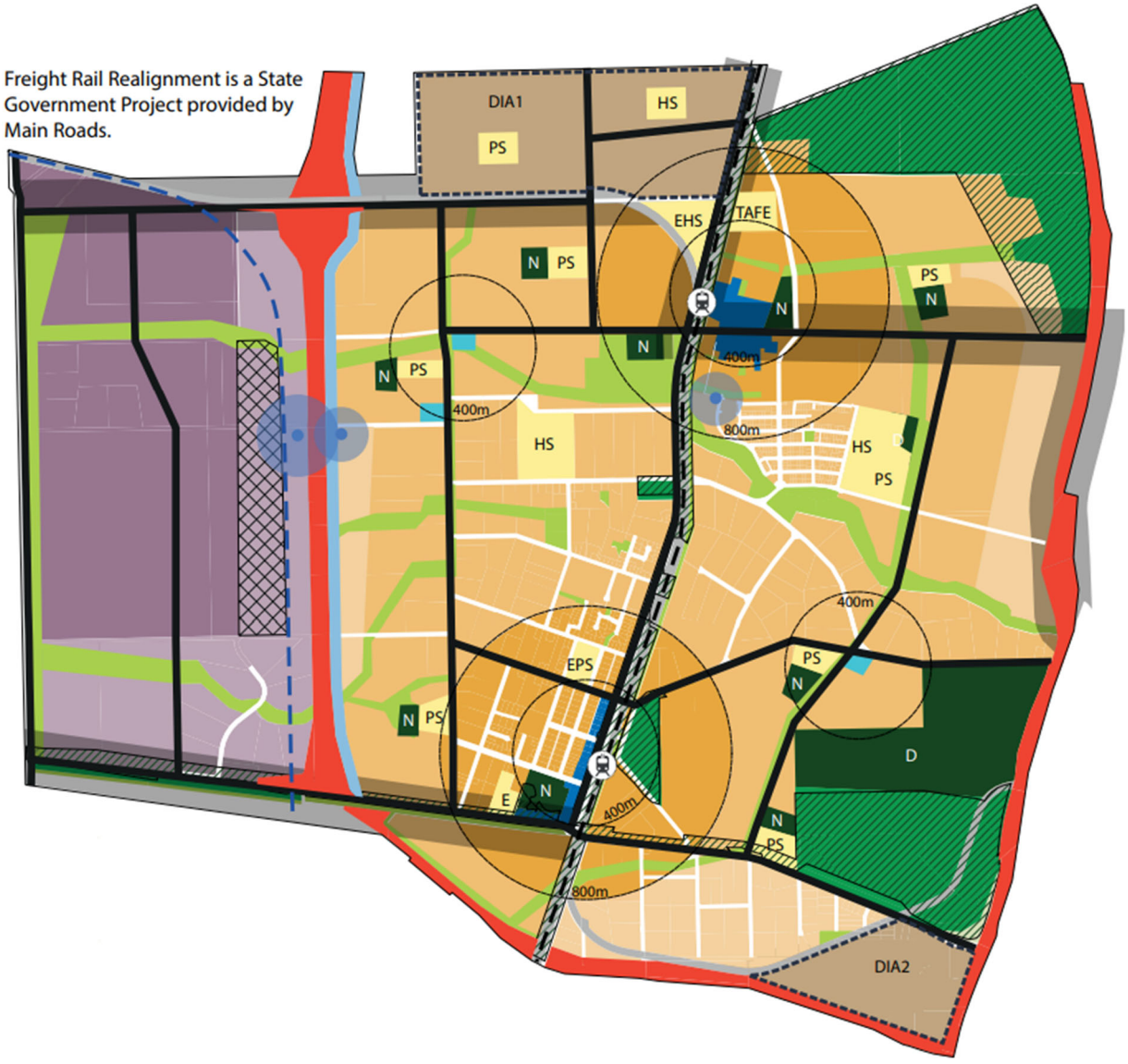


Figure 2 - Current Mundijong District Structure Plan 2020 - to be updated as per WAPC modifications

Key elements of modification are:

- Exclusion of West Mundijong Industrial Area precinct from the District Structure Plan
- Inclusion of one (1) railway station instead of two (2) shown in previous iterations of the plan;
- Inclusion of investigation areas (DIA1 and DIA2) in the structure plan;
- A number of other modifications that will be addressed in the report below.

In principle, the plan comprises eight (8) precincts, labelled alphabetically (A-H), that will feature more than 20,000 residential dwellings, approximately 42,000m2 of commercial space, and full social and physical infrastructure required to support the growth in population (primary schools, high schools, parks, recreational facilities, community facilities etc). The schedule of land uses is discussed in greater detail in Section 2.12.

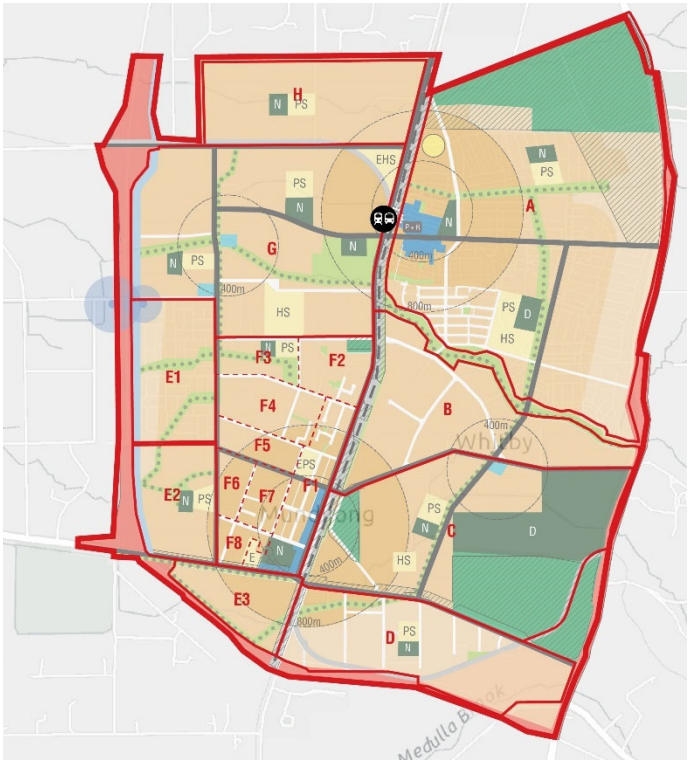


Figure 3 – Mundijong District Structure Plan 2024 - Precinct plan.

Key external enablement transport projects, critical to progress of the MDSP24 are:

- **Tonkin Highway Extension** – this MRWA project is currently underway and will see Tonkin Highway extended south to Mundijong Road and east to intersect with South Western Highway. Tonkin Highway will be extended as a dual lane divided carriageway, with grade separated intersection with Bishop Road and initially at grade intersections with Mundijong Road and South Western Highway with a long-term view towards grade separation. At present, it is expected that the extension, with initial intersection configurations will be completed by 2031. Although some of the previous studies indicate that Tonkin Highway may be extended further south of Mundijong Road, the project is outside of the timeframe for this study.
- **Freight Rail Realignment** – at present a freight rail line corridor traverses the MDSP24 area running in parallel to Paterson Road and Soldiers Road, and deviating to the west, parallel to Bishop Road. The rail corridor is to be realigned to the western side of the Tonkin Highway Extension to enable appropriate development of the town centre areas. The timing of the realignment is currently unknown; however, given that a Planning Control Area (PCA) was established over the future corridor, it is anticipated within next 10 years.
- **Passenger Rail Line Extension** – the increase in population in Mundijong-Whitby area will necessitate more appropriate public transportation options, and it is anticipated that in period 2041-2051 Armadale line is to be extended south of Byford with new terminus in Whitby. While the long-term planning anticipates the extension, we understand that any detailed planning may occur upon completion of Byford station.

While these projects are state-led and not necessarily tied to the MDSP24 development, the progress of cell-development will be influenced by these projects to a significant degree. The project team extensively liaised with the State Government agencies to ensure that modelling reflects appropriate

geometries anticipated in the future; however, these plans cannot be included in the report as they are still confidential.

The Shire of Serpentine Jarrahdale is likely to experience a surge in population growth in the coming decades given the anticipated development, in particular through Byford, Whitby and Mundijong. The modelling will account for this growth through traffic growth rates; however, the influence of following neighbouring projects will be examined in more detail:

- **Cardup Business and Residential Park** – The site is located immediately north from the subject site, currently zoned industrial and undergoing the rezoning to residential land. Current estimate is there is a potential for approximately 3,000 dwellings.
- **West Mundijong Industrial** – The site is located immediately west of the future Tonkin Highway extension. It was originally a part of the MDSP area; however, now it is viewed as a separate development proposal governed by an approved LSP. The total development potential is approximately 127 industrial lots across just over 400ha of land. This area has a potential to generate new employment opportunities for local residents.
- **West Mundijong Urban Expansion** – The site is located immediately west of West Mundijong Industrial estate. A process for MRS amendment is underway, and if successful this area can yield approximately 6,000 dwellings with associated amenities.

3.3 Existing road conditions

The MDSP24 area contains a total of 61 existing roads. All roads with classification higher than Access Road are detailed in the table below.

The rest of the roads are classified as access roads with the speed limit of 50km/h. The speed limit is reduced to 40 km/h near Mundijong Primary School and Court Grammar School during school zone operating times:

- Morning: 7:30 am to 9:00 am
- Afternoon: 2:30 pm to 4:00 pm

These access roads are: Scott Road, Lang Road, Tonkin Street, Baskerville Road, Walton Crescent, Isma Court, Rigoll Court, Mader Road, Silich Court, Liversey Street, Butcher Street, Anstey Street, Paterson Street, Adonis Street, Wallace Street, Senior Court, Cockram Street, Roman Road, Evelyn Street, Eileen Avenue, Galvin Road, Reilly Road, Tinspar Avenue, Windrow Grove, Notch Lane, Haywire Avenue, Skyline Road, Bucker Street, Peavey Road, Briar Road, Glancer Road, Cantling Way, Gawler Lane, Strawline Boulevard, Skidder Road, Heartwood Boulevard, Haywire Avenue, Garin Way, Haulback Boulevard, Wright Road, Lampier Drive, Hicks Street, Robertson Road, Robinson Street, Adamson Street, Adamson Street, Absolon Street, Cowen Street, Lupino Street, Rose Road.

Table 2 - Road Classification and Description

Road Name	South Western Highway
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	varies from 80.0m
Road Pavement Width	12.0m inclusive of
Classification	Primary Distributor
Speed Limit	110kph / 90kph
Bus Route	YES
If YES Nominate Bus Routes	253
On-street parking	NO
Road Name	**Soldiers Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	7.0m
Classification	Regional Distributor
Speed Limit	70kph/ 60kph
Bus Route	YES
If YES Nominate Bus Routes	252, 253, 254
On-street parking	NO
Road Name	**Mundijong Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	9.0m
Classification	Regional Distributor
Speed Limit	100kph/ 80kph/ 60kph
Bus Route	NO
On-street parking	NO
Road Name	**Watkins Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	32.0m
Road Pavement Width	7.5m
Classification	Regional Distributor
Speed Limit	70kph/ 60kph

Bus Route	YES
If YES Nominate Bus Routes	253
On-street parking	NO
Road Name	**Wright Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	8.0m
Classification	Regional Distributor
Speed Limit	100kph/ 80kph/ 60kph
Bus Route	NO
On-street parking	NO
Road Name	**Norman Road**
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20.0m
Road Pavement Width	6.5m
Classification	Local Distributor
Speed Limit	50kph
Bus Route	NO
On-street parking	NO
Road Name	**Bishop Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	6.0m
Classification	Local Distributor
Speed Limit	50kph/ 80kph
Bus Route	NO
On-street parking	NO
Road Name	**Taylor Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	6.0m
Classification	Local Distributor
Speed Limit	70kph/ 80kph

Bus Route	NO
On-street parking	NO
Road Name	**Kiernan Road**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20.0m
Road Pavement Width	6.0m
Classification	Local Distributor
Speed Limit	50kph/ 60kph/ 70kph
Bus Route	YES
If YES Nominate Bus Routes	252, 253
On-street parking	NO
Road Name	**Adam Street**
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20.0m
Road Pavement Width	6.0m
Classification	Local Distributor
Speed Limit	70kph
Bus Route	NO
On-street parking	NO
Road Name	**Richardson Street**
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20.0m
Road Pavement Width	6.0m
Classification	Local Distributor
Speed Limit	50kph
Bus Route	NO
On-street parking	NO
Road Name	**Paterson Street**
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	40.0m
Road Pavement Width	7.0m
Classification	Local Distributor
Speed Limit	60kph

Bus Route	YES
If YES Nominate Bus Routes	252, 253
On-street parking	NO

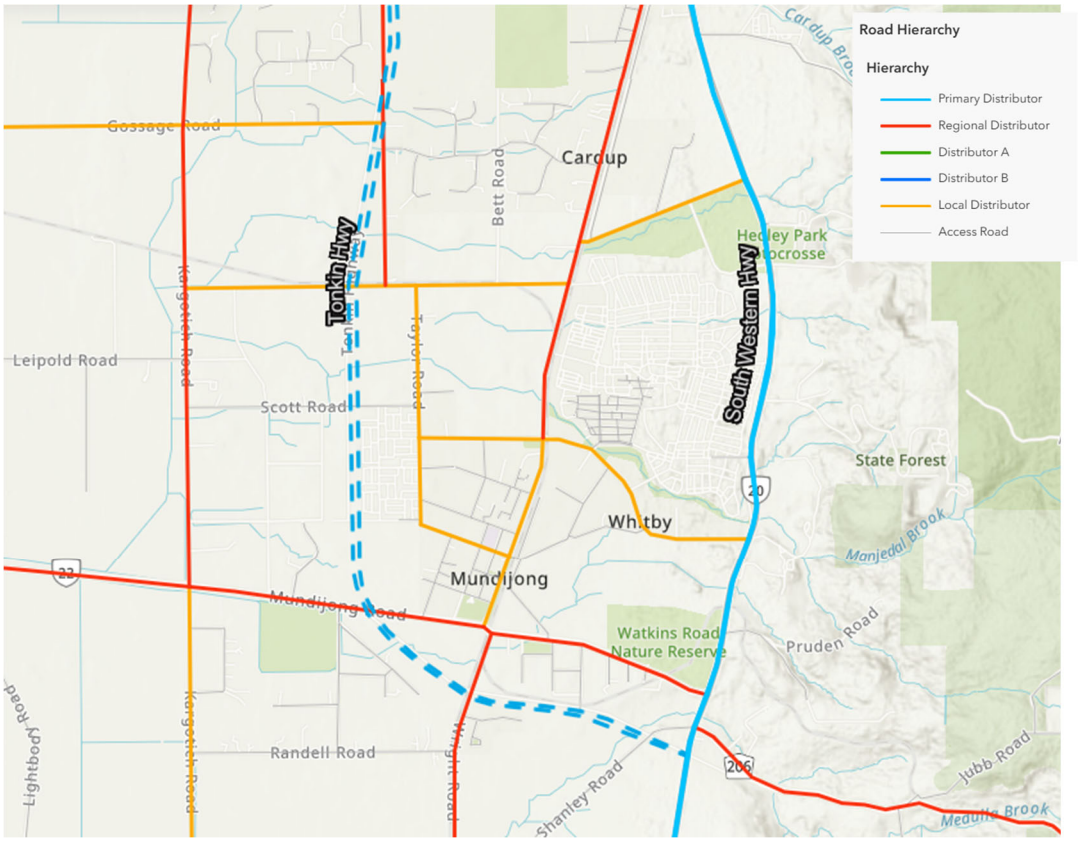


Figure 4 - MRWA hierarchy (current)

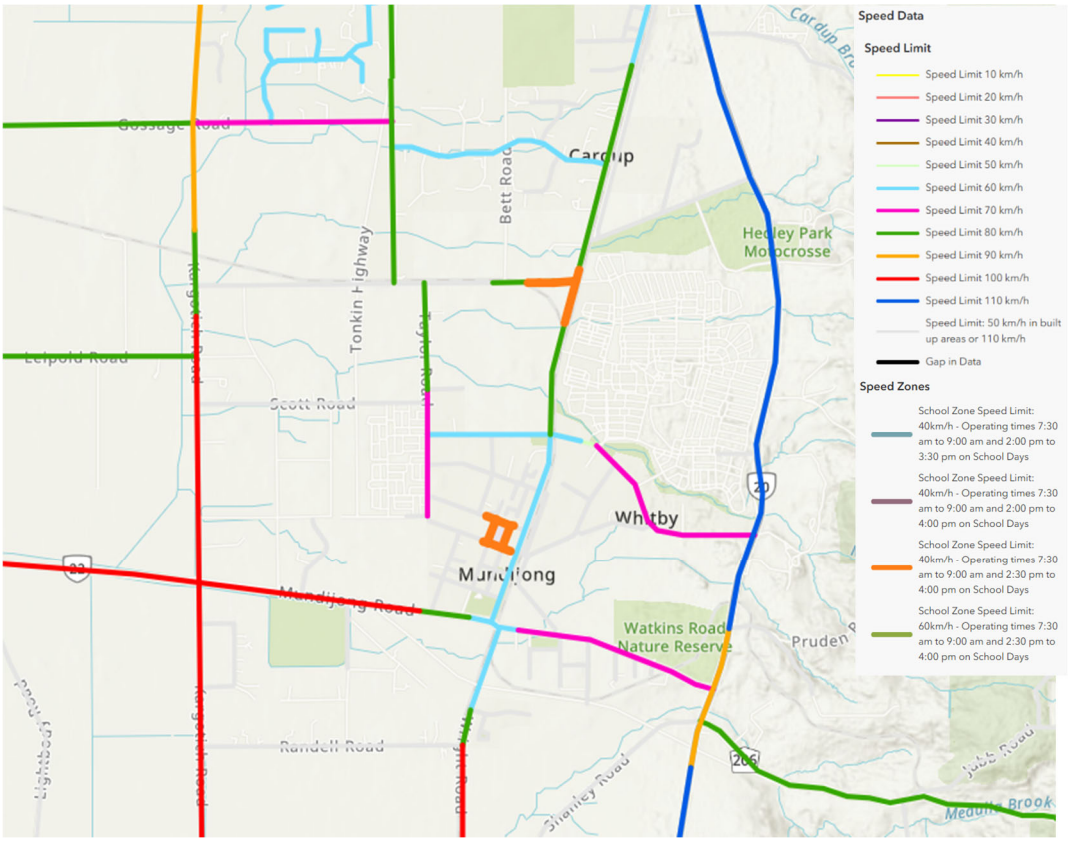


Figure 5 - MRWA speed limits (current)

3.4 Traffic safety

In general, the subject area had a total of 28 casualty crashes in the reporting period (inclusive of West Mundijong Industrial precinct). As it can be seen, the casualty crashes are mostly concentrated along key corridors – Regional and Local Distributors. The intersection of Kargotich Road and Mundijong Road is upgraded to a roundabout to address high casualty crash rate. The intersection of Watkins Road and South Western Highway is flagged as ROSMA state priority.

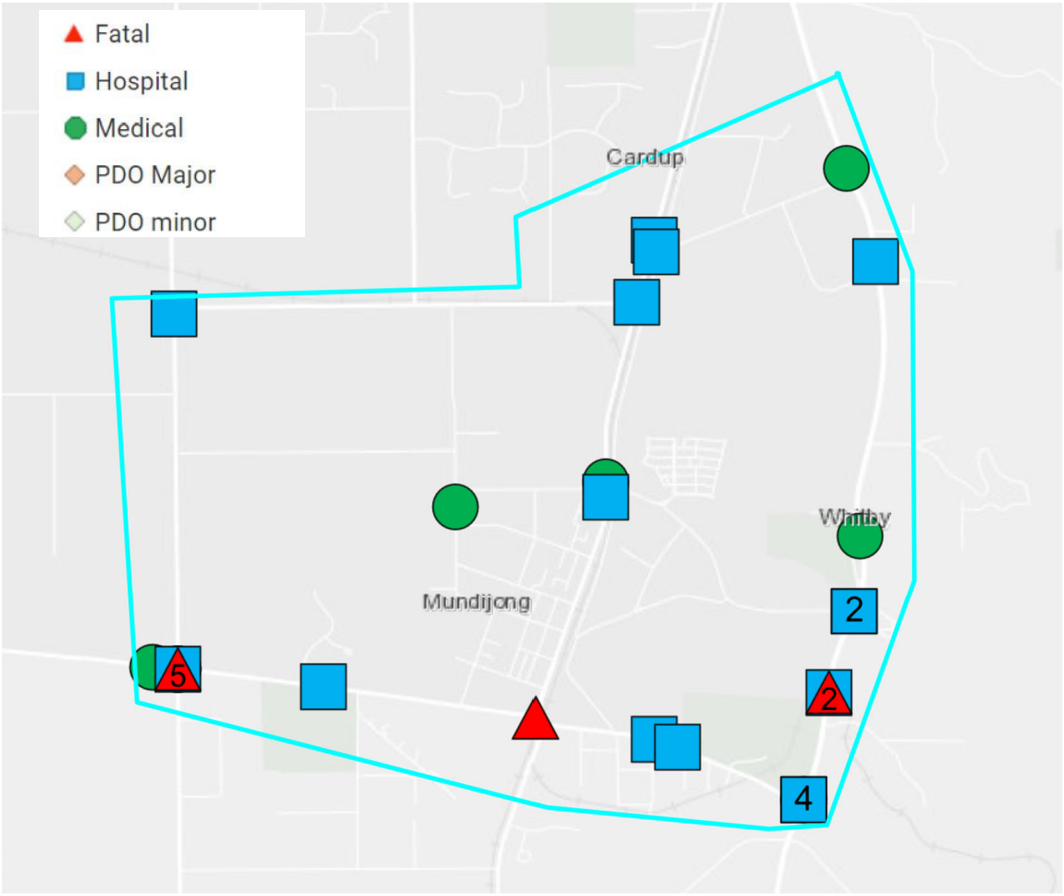


Figure 6 - Casualty crash overview 2019-2023 (source: MRWA portal)

In principle, the types of crashes are consistent with typical profile of high-speed rural roads. Given the extent of changes that will occur in the coming decades, the speed on most of the roads will be reduced and geometry brought to an urban standard eliminating majority of the existing crash risks.

3.5 Existing traffic flow

The following table provides an overview of traffic count data for other streets in the vicinity of the subject site.

Table 3 – Traffic counts data

Road Name	Location of Traffic Count	Vehicles Per Day (VPD)	Vehicles per Peak Hour Peak Time - Peak VPH		Heavy Vehicle %	Date
			AM	PM		
South Western Highway	South of Reilly Road	6,877	07:45 – 502	15:15 – 654	20.0%	23/24
	South of Jarrahdale Road	5,685	07:15 – 429	15:45 – 526	18.5%	20/21
	South of Kiln Road	6,801	08:00 – 567	15:15 – 663	23.3%	20/21
	South of Watkins Road	7,518	07:15 – 575	16:00 – 684	17.7%	23/24
Bishop Road	West of Soldiers Road	1,625	07:30 – 323	14:30 – 276	9.8%	20/21
Mundijong Road	East of Kargotich Road	3,488	07:30 – 275	15:45 – 311	15.6%	22/23
	West of Kargotich Road	6,234	07:15 – 563	16:00 – 661	12.6%	22/23
	South of Orton Road	5,660	07:00 – 550	16:15 – 670	26.4%	23/24
Kargotich Road	South of Leipold Rd Road	5,785	07:15 – 551	16:15 – 686	7.4%	23/24

Note - These traffic counts have been sourced from the MRWA traffic map. The Shire of Serpentine-Jarrahdale have provided extensive traffic count data which will be provided as a modelling report appendix.*

3.6 Public Transport

There are limited public transport services withing the MDSP24 area, currently two bus lines run on Soldiers Road and Patterson Street. Currently the rail line running along Soldiers Road is used for freight only. The Australind rail line has been replaced by Transwa road coaches between Bunbury and East Perth until mid-2025.

Table 4 - Bus routes and frequencies

Bus Route	Description	Peak Frequency	Off-Peak Frequency
252	Armadale Stn – Mundijong via Byford	10 daily departures	2 daily departures *No Sunday & Public Holidays service*
253	Armadale Stn – Jarrahdale via Byford & Mundijong	5 daily departures	1 daily departure *No Sunday & Public Holidays service*

3.6.1 PLANNED IMPROVEMENTS TO THE PUBLIC TRANSPORT SERVICE

Perth and Peel@ 3.5million The Transport Network states:

"2.4 South Metropolitan Peel sub-region

Public transport:

Passenger rail infrastructure proposed for the subregion includes the following METRONET Stage One proposals:

- *extending the Armadale rail line to Byford – with the station being located to integrate with Byford and surrounding localities.*
- *Further investigation is required for the following longer term passenger rail infrastructure options such as:*
- *better integration of the Australind service with the metropolitan passenger rail service between Perth and Mundijong to improve operational efficiency à potential strategic additional southern metropolitan rail line as well as possible further high-speed extension to Bunbury in the long-term."*

Shire of Serpentine Jarrahdale states:

"The following passenger rail configuration, has been identified as the preference for the SoSJ once passenger rail is extended south of Byford:

- *Abernethy Road (rail over road)*
- *Orton Road which will connect through to SW Hwy (rail over road)*
- *Cardup Siding Road (closure either side of the rail)*
- *Norman Road (rail over road)*
- *The rail may terminate on the north side of the future east west distributor road through Whitby, in which case its termination should be approximately 300m north of the road to enable a future rail over road."*

In due-diligence discussions, the PTA confirmed there is no immediate intention to intensify public transport services within the MDSP24 area; however, it is evident this will be revisited given the scale of the planned development (nearly 30,000 dwellings including the MDSP24 area and the immediate surroundings).

It is anticipated that the passenger rail (Armadale Line) will be extended to a new station in Whitby with appropriate bus feeder support. Further detail can be found in Section 4.2.2.

3.7 Pedestrian Infrastructure

Existing pedestrian access through the area is very limited due to the low intensity of existing land-uses. The extent of development for the area envisaged will have a significantly higher activity intensity; therefore, the requirement for good quality pedestrian linkages emerges. One of the key objectives is to identify key linkages within the proposed MDSP24 area.

Table 5 – Pedestrian facilities in the vicinity of the subject site

Classification	Road Name
Pedestrian path	Cockram Street, Addonis Street, Anstey Street, Paterson Road, Richardson Street, Butcher Street, Livesey Street, Baskerville Road, Keirnan Street, Tinspar Avenue, Windrow Grove, Notch Lane, Haywire Avenue, Skyline Road, Bucker Street, Peavey Road, Briar Road, Glancer Road, Cantling Way, Gawler Lane, Strawline Boulevard, Skidder Road, Heartwood Boulevard, Haywire Avenue, Garin Way, Haulback Boulevard
Shared path	Soldiers Road (between Kiernan Street and Bishops Road)
Walk Score Rating?	
0-32	Car-Dependent. Almost all errands require a car. - Car-Dependent. Most errands require a car.

3.7.1 PLANNED IMPROVEMENTS TO PEDESTRIAN FACILITIES

It is essential to develop a solid and permeable network of pedestrian paths to encourage pedestrian movement. Please refer to Section 5.4.1 for cross-sections showing proposed pedestrian and cyclist facilities. Every major road within the MDSP24 area will have either a shared path or a separate pedestrian path, while any low-level Access Street, carrying more than 100 VPD will have a pedestrian path as a minimum on one side, in line with Liveable Neighbourhoods guidance.

All pedestrian and shared paths should be designed to be accessible by all community members, in accordance with relevant standards. The exact location of pram ramps and other elements is to be determined later in the project; however, the pram ramps should be positioned to allow continuous movement and shortest crossing distances.

Shire of Serpentine Jarrahdale - Walking and Cycling Plan August 2019 states:

"6.7.2 Mundijong/Whitby/Cardup Precinct

> *Install local routes on Keirnan Street to connect Mundijong to the new Whitby developments and Whitby Falls Farm School.*

- *A local connection on Livesey Street from the Paterson Street shared path to Mundijong Primary School, with north-south connections on each side of the school boundary.*
- *A local connection along Richardson Street (Soldiers Road to Tonkin Highway extension PSP).*
- *Local connections on Cockram and Adonis Streets.*
- *On the east side of the rail line in Whitby, install a local route on Evelyn Street/Galvin Road from the rail line to Keirnan Street.*
- *Install a local north-south route along the eastern side of the new Whitby development area that links Watkins Road to a new east-west road on the northern side of the new Whitby development area (see next point).*
- *A new east-west road on the northern side of the Whitby development area that crosses the railway and links to Taylor and Bishop Roads.*
- *A local route on Skyline Boulevard through the existing Whitby residential area that connects with the new east-west route.*
- *A long-term secondary route proposed on Mundijong Road would provide connectivity with the regional network to the west and continue to the east to connect to Langford Park and Jarrahdale.*
- *With the exception of the Shire buildings, most other locations within the Mundijong town centre lack suitable bicycle parking facilities.*

3.8 Cyclist infrastructure

The long-term cycle network (LTCN) identifies an aspirational blueprint for all ages and abilities cycling infrastructure. The cycle networks identify routes according to the WA Cycling Network Hierarchy; routes are designated by function rather than built form:

- **Primary routes** are high demand corridors connecting major destinations and are the backbone of cycle networks. Primary routes are often located next to major roads and railways.
- **Secondary routes** have a moderate level of demand and connect primary routes and major activity centres such as shopping precincts, industrial areas, as well as health, education and sporting facilities.
- **Local routes** experience a lower level of demand than primary and secondary routes, and provide access to other routes, local amenities and recreational spaces.

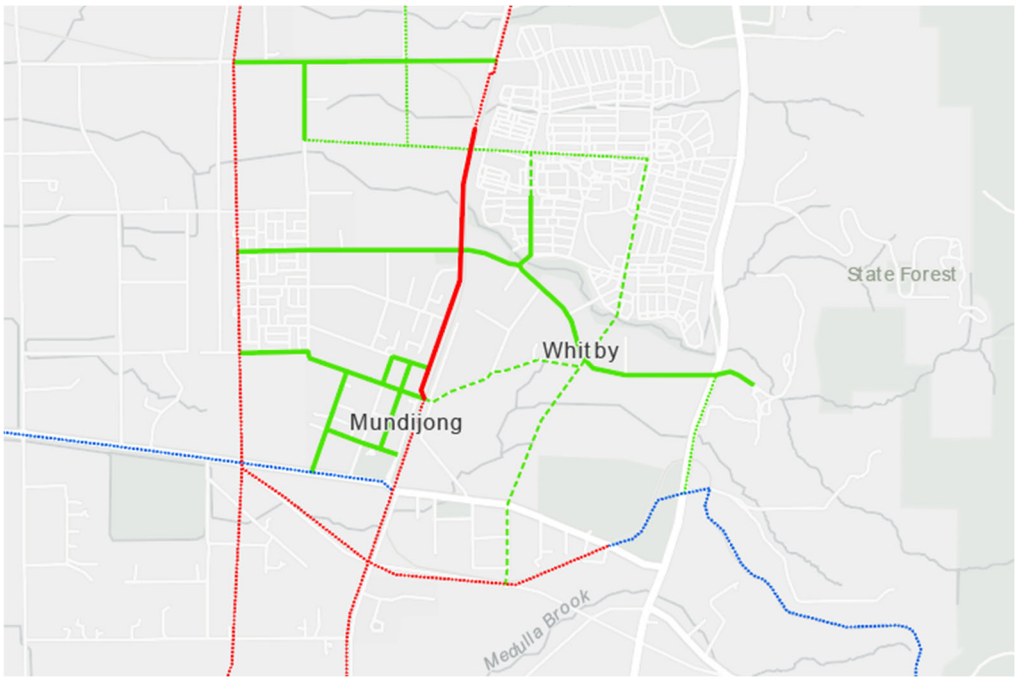


Figure 7 - LTCN Existing and Proposed Cycling Network

Please refer to Section 5.4.1 for cross-sections showing proposed pedestrian and cyclist facilities. Roads will be upgraded to include proposed improvement from LTCN and Shire of Serpentine Jarrahdale - Walking and Cycling Plan August 2019. With the development of fine-grain network, there are opportunities to expand cycling network in MDSP24 area, particularly aiming to connect it with key public transport nodes.

4. REVIEW OF EXISTING DOCUMENTATION AND STAKEHOLDER ENGAGEMENT

4.1 Overview of Relevant Planning Documents

This section will provide an overview of the publicly available endorsed or contemplated documents pertaining to the subject site and immediate surroundings, other than previous iterations of the MDSP24. The purpose of the section is to provide an overview of the approved and contemplated LSPs and MRS amendments that may directly impact the proposed network.

4.1.1 WHITBY LOCAL STRUCTURE PLAN (JULY 2012), ROBERTS DAY

Document Status: **Endorsed**

The Local Structure Plan encompasses the area referred to as "Precinct A" in the DSP, while the District Centre is covered in detail by a separate document. The Local Structure Plan is prepared in principle in line with the DSP and anticipates approximately 3,750 dwellings in the precinct, two primary schools, a high school and Technical School (TAFE). The area encompasses just over 500ha, and significant portion of the area comprises a variety of ecological conservation areas.

Key characteristics of the movement network are:

- LSP anticipates two connections to South Western Highway. The document stipulates that MRWA is aware and supportive of these connections. The document does not discuss the Norman Rd/SWH intersection.
- LSP anticipates the extension of Bishop Road across the rail line; however, currently impossible due to ecological constraints. The LSP proposal anticipates two additional at-grade rail crossings (Bishop Road and neighbourhood connector) which are to be controlled with boom gates.
- Two connections across Manjedal Brook (one in addition to the existing connection).
- Local road network is designed generally in accordance with Liveable Neighbourhoods 2009 principles.

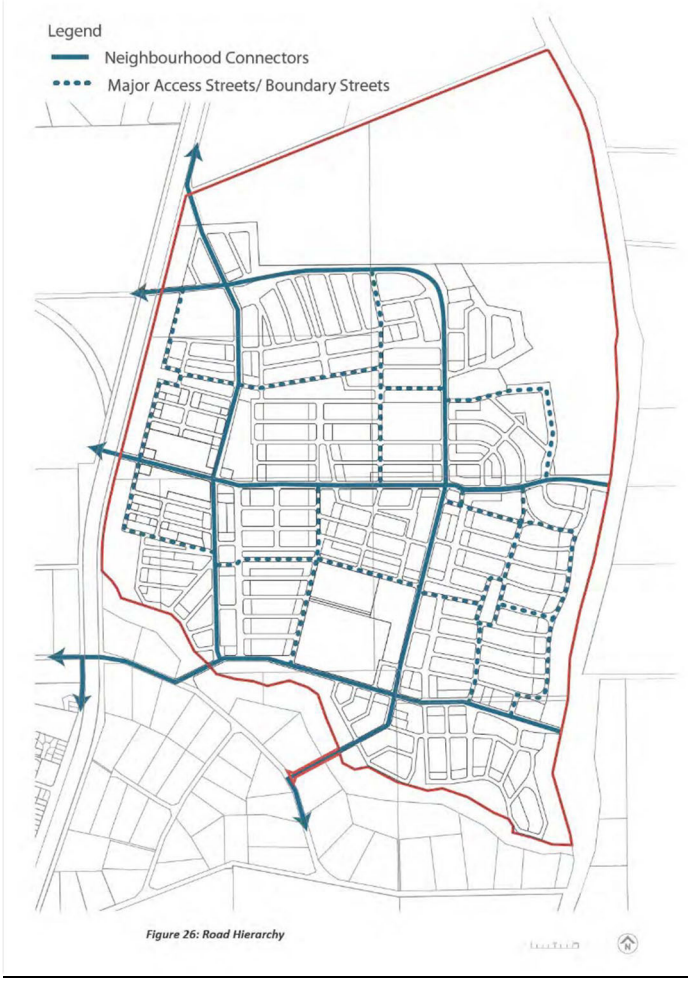


Figure 8 - Precinct A - Movement Network (LSP, 2012)

4.1.2 WHITBY ACTIVITY CENTRE PLAN (MAY 2021), ROBERTS DAY

Document Status: **Endorsed**

The document pertains to the proposed District Centre within the Precinct A, with higher concentration of activities. The minimum yield target is approximately 592 dwellings and 31,000 m^2 of commercial space.

This document outlines basic planning provisions for developing land in this precinct, inclusive of specific car parking and bicycle parking requirements. The road network develops from east-west neighbourhood integrator and north-south neighbourhood connector (already discussed in Whitby LSP). Lower order network is designed in accordance with Liveable Neighbourhoods.

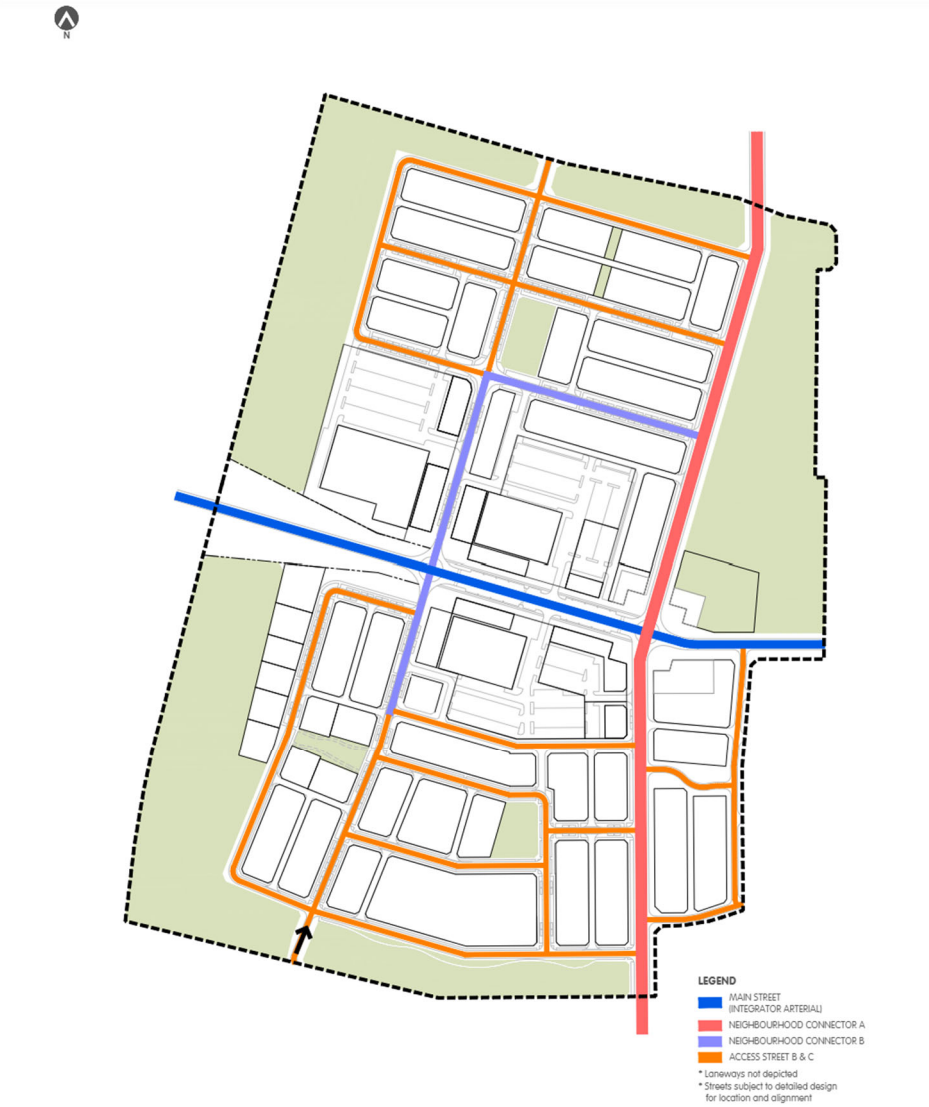


Figure 9 - Movement network - Precinct A - Activity Centre Plan (2021)

The road network is consistent with the approved overall Precinct A LSP and anticipates introduction of a new rail crossing.

Note: Precinct A LSP and Activity Centre Plan may need to be revised to consider the new rail station's location.

4.1.3 MUNDIJONG PRECINCT E1 AND E2 – LOCAL STRUCTURE PLAN (NOVEMBER 2023), ROWE GROUP

Document Status: **Considered**

This Local Structure Plan document encompasses and supersedes two separate documents which were prepared over each precinct.

The LSP anticipates approximately 1,900 dwellings in the area and one primary school which is to service the area. The proposed road network is relatively simple and is developed from the existing corridors (Scott Road and Taylor Road).

Figure 10 - Precinct E1 and E2 proposed road network (source: LSP document)

4.1.4 MUNDIJONG WHITBY SUB-PRECINCT G1, LOCAL STRUCTURE PLAN (2024), TAYLOR BURRELL BARNETT (TBB)

Document Status: **Endorsed**

Sub-precinct G1 is generally bound by Soldiers Road, Bishop Road, Tonkin Highway extension, Scott Road and Manjedal Brook. The endorsed structure plan anticipates 2,897 residential dwellings and two primary schools in addition to the existing educational facilities.

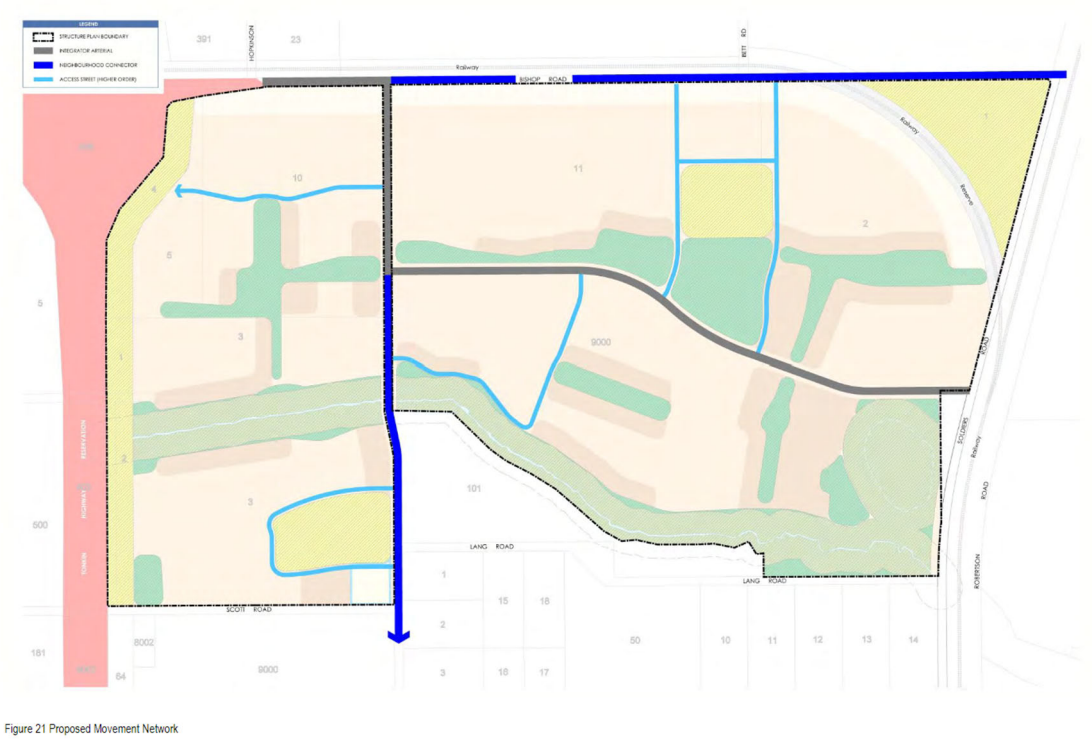


Figure 21 Proposed Movement Network

Figure 11 - Precinct G1 proposed road network (source: LSP document)

The LSP document anticipates approximately 2,500m^2 of commercial floor space (an equivalent of a local/neighbourhood centre); therefore, all of the major employment centres will be outside of the area.

The LSP network suggests that the traffic is generally diverted from Bishop Road east of Taylor Road intersection, to a new link intersecting Soldiers Road. This diversion will enable growing traffic to avoid at grade crossing if the freight rail realignment is not completed by the time the Structure Plan area commences the development.

4.1.5 MUNDIJONG SOUTH PRECINCT, MRS REZONING (2024), DYNAMIC PLANNING AND DEVELOPMENTS (DPD)

Document Status: **Considered**

Private proponents initiated MRS rezoning of land generally bound by disused railway corridor, extension of Tonkin Highway, Shanley Road, South Western Highway and Watkins Road.

Previous iteration of the DSP designates this area as DIA2, while the most recent iteration of the plan shows the site as a part of Precinct D.

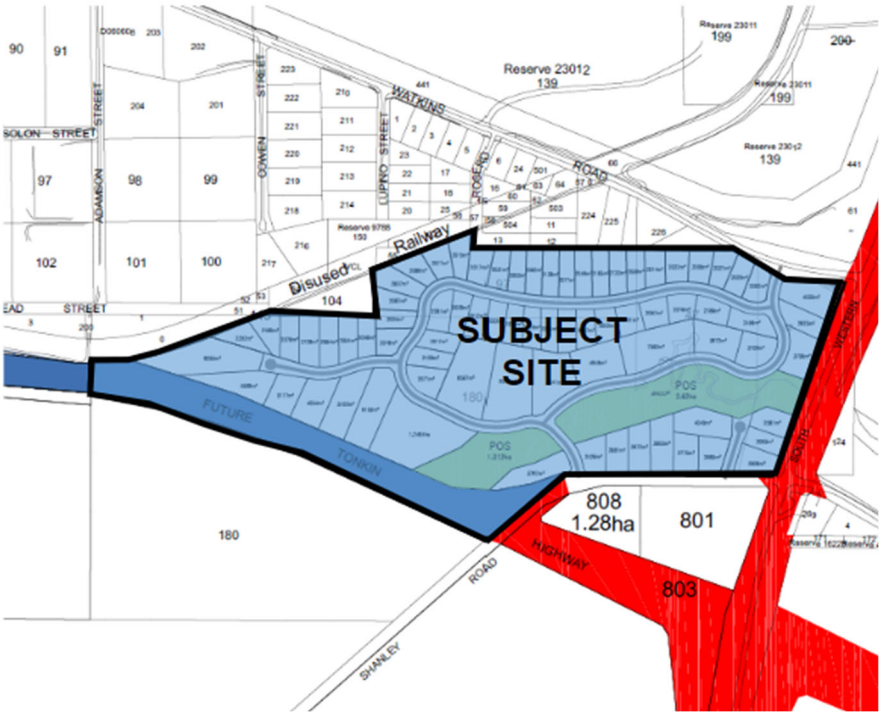


Figure 12 - Proposed layout of the subject site (source: TIA for MRS Rezoning)

The proponents estimate the development potential of the site as 76 rural lots (larger sized lots) with main vehicular connection to Watkins Road and other two minor connections on Shanley Road.

4.1.6 LOT 30 SOLDIERS ROAD, MRS REZONING (2023), BURGESS DESIGN GROUP (BDG)

Document Status: **Considered**

Lot 30 Soldiers Road is a part of a cell labelled as Development Investigation Area (DIA) 1 Cell in previous iteration of the DSP plan. In the most recent iteration, the cell will be renamed as Cell H.

With estimated area of 55.467ha, Lot 30 forms approximately 47.5% of Cell H. Previous iteration of the DSP estimated the development potential of DIA 1 as 2,220 lots with one primary school; therefore, for purposes of model development we will estimate the development potential of this land as 1,055 residential lots.

There are no publicly available preliminary plans for this development, however it is reasonable to assume that the main road connections will come from Soldiers Road and Bishop Road. The MRS document suggests that the full development of the site is anticipated by 2038.

4.1.7 KEIRNAN PARK RECREATION PRECINCT

Document Status: **Stage 1A Endorsed**

The Keirnan Park Recreation Precinct is a multi-stage development that will serve as the primary facility for local sporting and community clubs within the Shire of Serpentine Jarrahdale, offering high-quality grounds and infrastructure for both community and competition-level sports.

The master planning process, which included a sporting needs analysis, stakeholder engagement, and the development of concept and master plans, identified three priority options for the first stage:

- Stage 1A – AFL, cricket and shared pavilion
- Stage 1B – state-level BMX facility; and
- Stage 1C – Netball

Subsequent stages will support additional sports and recreational activities such as soccer, tennis, cricket, basketball, hockey, rugby, mountain biking, an aquatic centre, and an indoor recreation centre, along with community facilities, playgrounds, and fitness spaces.

Stage 1A includes the construction of two community sporting ovals, a sports pavilion, and related infrastructure such as underground services, access roads, parking, drainage, irrigation, landscaping, and water harvesting basins. With the detailed design phase completed in 2023, the project is ready for procurement, with construction expected to be completed by March 2027.

Stage 1B involves the construction of a BMX track, pavilion, and associated infrastructure, to commence after Stage 1A. The cost and timeframes for this stage are yet to be determined, with further details to be presented to the Council in the future.

The full scope of Stage 1A will be funded through grants, DCP funds, and a self-supporting loan. This necessitates revisiting community infrastructure plans and their timing within the CIDCP. Further planning is essential to ensure the successful delivery of Stage 1B.

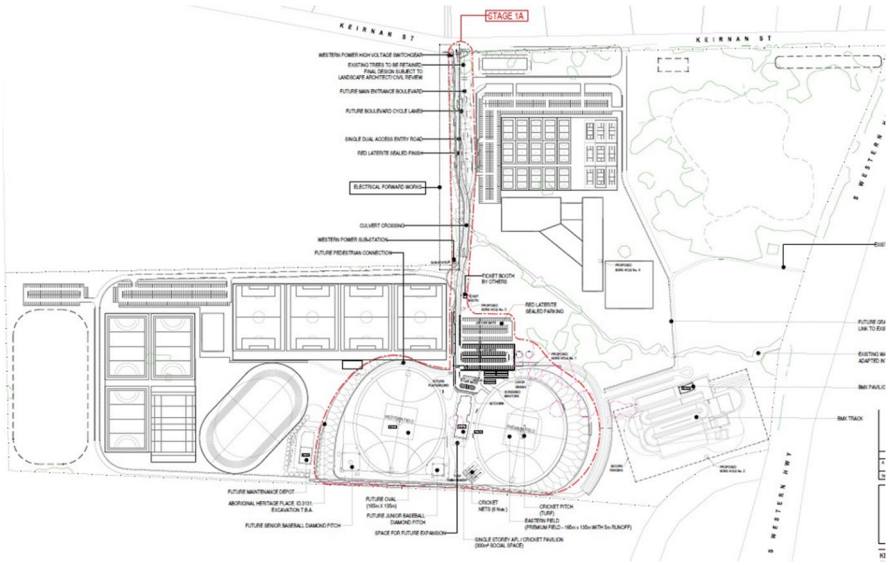


Figure 13 - Keirnan Park Recreation Precinct (Stage 1A in red)

4.1.8 EXTERNAL – WEST MUNDIJONG INDUSTRIAL AREA STRUCTURE PLAN – TRANSPORT IMPACT ASSESSMENT (OCTOBER 2022), TRANSCORE

Document Status: **Endorsed**

West Mundijong Industrial Area is situated on the western side of the Tonkin Highway extension and was originally a part of the DSP area. For this revision of the transport model, the area will be considered as an external traffic generating land use, and potential employment node.

While the area covers approximately 470ha, only 410ha is deemed developable. Current expectations are that a maximum of 127 lots will be created.

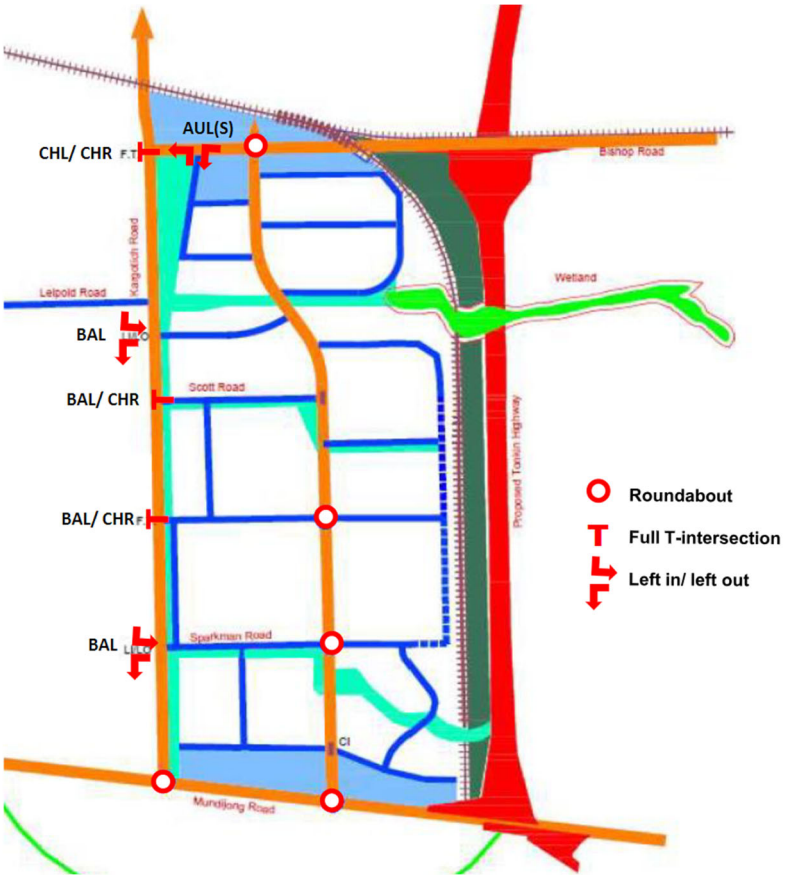


Figure 14 - Proposed road network - WMIA (TIA, 2022)

The key circulation elements are north-south spine connecting Mundijong Road and Bishop Road and three additional connections to Kargotich Road. While the plan shows a roundabout configuration at the intersection of Bishop Road and north-south connector, MRWA confirmed in recent discussions that configuration of this intersection will need to be reviewed in light of further developed design for Bishop Rd / Tonkin Hwy interchange. Kargotich Rd / Mundijong Rd roundabout was constructed in 2021.

4.1.9 EXTERNAL – CARDUP BUSINESS AND RESIDENTIAL PARK, MRS REZONING (2023), HARLEY DYKSTRA

Document Status: **Considered**

Cardup Business and Residential Park was established as an industrial precinct almost 20 years ago. As the area has some connectivity issues which reduces its appeal with potential tenants. The land-owner group-initiated rezoning of 194ha from industrial to residential land use.

We understand that the development potential of this area is approximately 3,000 lots (in addition to the volume of residential dwellings anticipated by the DSP) with one (1) primary school. Land already developed as general and light industrial will continue to operate as such.

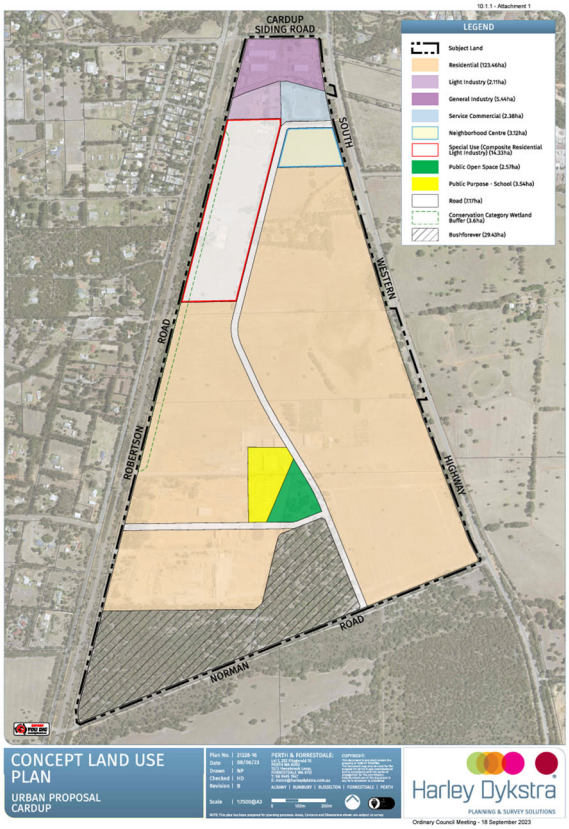


Figure 15 - Cardup Urban - MRS Rezoning Proposal (source: MRS document)

The proposed rudimentary road network shows a connection to Norman Road and Robertson Road, which will require a consideration for another at-grade rail crossing. We understand that the proposal has a conditional support of the council and is being considered by the WAPC.

4.1.10 EXTERNAL – WEST MUNDIJONG URBAN PRECINCT - LAND BOUNDED BY LEIPOLD, GANGEMI, MUNDIJONG AND KING ROADS, OLDBURY, MRS REZONING (2023) – DYNAMIC PLANNING AND DEVELOPMENTS (DPD)

Document Status: **Rejected by SoSJ**

The Shire of Serpentine Jarrahdale has received a request for rezoning approximately 650ha of land immediately west from the West Mundijong Industrial precinct from rural to urban land.

While this component of urban development is not considered in current long-term strategies, relentless demand for housing made this proposal plausible. We understand that the SoSJ is generally supportive of the proposal; however, their preference is that the WAPC completes subregional planning to ensure the subject site is appropriately considered in the regional context.

The proposed development would comprise approximately 6,000 residential dwellings, four (4) primary schools and appropriate local and neighbourhood centres.

Note: The project is mentioned in this report as it was actively considered during the initial preparation of the network model iteration which was ultimately peer-reviewed.

4.1.11 EXTERNAL - 10 (LOT 500) LAMPITER DRIVE, MARDELLA – DFES TRAINING ACADEMY AND SOSJ WORKS DEPOT, MASTER PLAN (2023) - EMERGE

Document Status: **Considered**

No 10 Lampiter Drive is located in south western corner of the future Mundijong Road / Tonkin Highway interchange; therefore, immediately outside of the DSP area. The proposed development comprises DFES training academy with bushfire brigade, Shire of Serpentine Jarrahdale's work depot with ancillary land uses (waste facility, animal care facility etc).

Primary access to the facility would be from Mundijong Road, via the proposed roundabout for West Mundijong Industrial Area spine road. With anticipated 500 parking bays, a reasonable daily traffic generation is expected.

As part of the update on Draft Master Plan and MRS Amendment Request for Lot 500 Lampiter Drive, a recommendation has been sought at the council meeting minutes for endorsement to request the Western Australian Planning Commission to initiate an MRS amendment to rezone the land from 'Parks & Recreation' to 'Rural.' It also proposes preparing a business case for the 2025/26 budget to develop a new Master Plan and Business Plan to explore the site's potential as an equine facility and optimise other portions for their highest and best use, aligning with the Shire's strategic land asset goals.

This has been sent to the WAPC for consideration and inclusion into the MRS amendment.

Note: The project is mentioned in this report as it was actively considered during the initial preparation of the network model iteration which was ultimately peer-reviewed.

4.2 Liaison With the Authorities and External Stakeholders

This section will provide a summary of communication with the relevant authorities and relevance of information to the model and Transport Impact Assessment.

4.2.1 MAIN ROADS WA (MRWA)

MRWA was contacted early in the process, and they provided ROM24 modelling that is relevant at the time of writing this report. The ROM24 model included Westport development and anticipated Tonkin Highway extension to South Western Highway.

The extension is expected to be fully completed (with initial intersection configurations) and operational prior to 2031. While initially the freight rail was to be realigned concurrently to these works, two projects were separated and are at present on independent delivery timelines; thus, the MRWA could not confirm when the realignment will occur. Although some older planning documents mention that Tonkin Highway will be extended south of Mundijong Road to Forrest Highway, it was confirmed that this project is not likely to eventuate within the timeframe set out for this assessment (2051).

At the time of the writing of this report, the MRWA was undertaking a separate Mundijong Road Transport Planning Study to ascertain the future needs and requirements for this corridor.

4.2.2 PUBLIC TRANSPORT AUTHORITY (PTA) AND OTHER RAIL MANAGERS

The bus planning division confirmed that the PTA does not have plans to intensify bus service through Mundijong at present; however, it is anticipated this position will change with the increased urbanisation and potential patronage.

The rail planning division confirmed there are long term plans for extension of Armadale Line past Byford Station to Whitby and that this project can be deemed as a 15+ years project. As of writing of this report, the project was not officially initiated and the consensus was reached that the future Whitby Railway Station should be modelled per plans for Byford Station in terms of service frequency, bus feeder routes and available parking facilities.

As of writing this report, a business case is developed for fast rail between Perth and Bunbury. This rail line with travel at higher speeds (200+km/h) with minimum stops between the terminus points. While the details are to be developed, we understand that at present it is anticipated this line will travel at standard speed through residential areas.

Arc Infrastructure operate the rail freight network in the area and have provided the following information regarding the current and planned operations of the Mundijong rail corridor:

- Current Train Movements:
  - Up to 10 train movements per day in both directions.
  - Train lengths range from 250 meters to 500 meters.
- Future Train Movements:
  - The Australind service is expected to resume by mid-next year (2025), increasing the daily movements to 14. The Australind trains are shorter, ranging from 42 meters to 63 meters.
  - Alcoa may vary their train movements, potentially increasing or decreasing the number of daily movements.
  - Talison Mining, in conjunction with Arc, is investigating moving their road haulage to rail at Greenbushes. If this plan proceeds, it would add approximately 2 extra trains per day on the line.
  - Long-term plans for the Westport project suggest additional rail traffic, but no specific numbers are available, and this impact is not expected for at least ten years.
  - As an open-access rail network, there is always the potential for additional train movements as new customers approach us, though there are no current proposals outside of the ones mentioned above. After the re-alignment of the freight rail that there will be no freight movements on this line'

4.2.3 DEPARTMENT OF TRANSPORT (DOT)

Department of Transport was contacted to obtain STEM modelling and ensure that appropriate modal splits are considered in long-term modelling.

4.2.4 DEPARTMENT OF PLANNING, LANDS AND HERITAGE (DPLH)

Department of Planning, Lands and Heritage was contacted to obtain DaEDS projections for the area. The representatives of the Shire of Serpentine – Jarrahdale and the project team met with the

Department of Planning, Lands and Heritage in August 2024 to discuss preferences on intersection treatments and interface with the rail corridor.

4.2.5 PTG CONSULTING

PTG Consulting were appointed as peer reviewers of the Aimsun modelling. The final models, discussed in this report, reflect consideration of peer-review outcomes.

5. PROPOSED STRUCTURE PLAN AREA

5.1 Overview of proposed structure plan area

The Mundijong District Structure Plan 2024 will be implemented based on population triggers that determine the need for essential infrastructure. As staging is population-dependent, specific timelines are not provided. Local Structure Plans will address detailed staging and timing. Schedule of existing and proposed land uses is presented in the table below.

Table 6 – Overview of land uses

	Residential (dwellings)	Education	Neighbourhood/ District Centre	Neighbourhood/ District Open Space
EXISTING				
Precinct A	309	-	-	-
Precinct B	104	-	Mundijong Sale Yard	-
Precinct C	5	-	-	-
Precinct D	69	-	-	-
Precinct D2	11	-	-	-
Precinct E	4	-	-	-
Precinct F	341	Mundijong Primary School	• SoSJ District government office • Community Resource Centre • Mundijong Fire Station • Mundijong Police Station • Mundijong Landcare • Mundijong IGA & Service Station • Mundijong Tavern • Australia post - Mundijong LPO • 6 specialty shops • Serpentine Jarrahdale Men's Shed	• Mundijong Oval • Mundijong Netball Courts • Mundijong Cricket Nets • Mundijong Skate Park

Precinct G	17	Court Grammar School	-	-
Precinct H	2	-	-	-
TOTAL	**862**	**2 schools**		
PROPOSED				
Precinct A	3,750	• 2 Primary Schools • 1 High School • TAFE	• Supermarket • Discount Department Store • Specialty retail	• 2 Neighbourhood Open Spaces • 1 District Open Space
Precinct B	1,695	-	-	-
Precinct C	3,172	• 1 Primary School • 1 High School	• Supermarket • Specialties	• Keirnan Park District Open Space
Precinct D	1,134	1 Primary School	• Supermarket • Specialties	• 1 Neighbourhood Open Space
Precinct D2	555	-	-	• 1 Neighbourhood Open Space
Precinct E	1,835	1 Primary School	• Supermarket • Specialties	• 1 Neighbourhood Open Space
Precinct F	2,831	• Mundijong Primary School • 1 Primary School	• Supermarket • Discount Department Store • Specialty retail	• 2 Neighbourhood Open Spaces including the existing: • Mundijong Oval • Mundijong Netball Courts • Mundijong Cricket Nets
Precinct G	3,175	Court Grammar School 2 Primary Schools 1 High School	• Supermarket • Specialties	• 3 Neighbourhood Open Spaces •

Precinct H	2,220	1 Primary School	• Supermarket • Specialties	1 Neighbourhood Open Space
TOTAL	20,367	• 10 Primary School • 4 High Schools • TAFE		

5.2 Traffic impact of the proposed structure plan area

5.2.1 ADOPTED TRAFFIC GENERATION RATES

The expected joint peak hours of the MDSP24 area are from 08:00 to 09:00 in the morning and from 16:30 to 17:30 in the afternoon. Development-generated peaks are anticipated to partially coincide with the existing road network peaks; however, these peak hours are expected to be reestablished as the MDSP24 area develops.

The assessment has been guided by the WAPC Transport Assessment Guidelines for Developments, the NSW Guide to Transport Impact Assessment (2024), and the ITE Common Trip Generation Rates (9th edition).

Table 7 - Trip generation rates

Land Use	Trip generation rates
WAPC Transport Assessment Guidelines for Developments	
Residential	• 0.8 vehicle trips / dwelling for the AM and PM peak • A 25% IN / 75% OUT split has been adopted for the AM peak and a 67% IN / 33% OUT split for the PM peak hour.
Schools	• 1 vehicle trips / dwelling for the AM and PM peak • A 50% IN / 50% OUT split has been adopted for both peaks.
Retail (Food)	• AM – 2.5 per 100 m2 gross floor area • PM – 10 per 100 m2 gross floor area • An 80% IN / 20% OUT split has been adopted for the AM peak and a 50% IN / 50% OUT split for the PM peak hour.
Retail (Non-Food)	• AM – 1.25 per 100 m2 gross floor area • PM – 4 per 100 m2 gross floor area • An 80% IN / 20% OUT split has been adopted for the AM peak and a 50% IN / 50% OUT split for the PM peak hour.
NSW RTA Guide to Traffic Generating Developments	
3.3.1 Dwelling houses	• Daily vehicle trips = 9.0 per dwelling • Weekday peak hour vehicle trips = 0.85 per dwelling.
3.5 Office and commercial	• Daily vehicle trips = 10 per 100 m2 gross floor area

	• Evening peak hour vehicle trips = 2 per 100 m2 gross floor area. • An 80% IN / 20% OUT split has been assumed for the AM peak and the reverse for the PM peak.
3.6.1 Shopping centres	• Daily vehicle trips: as per formula – refer to explanation below
3.7.2 Restaurants	• Evening peak hour vehicle trips = 5 per 100 m2 gross floor area. • Daily vehicle trips = 60 per 100m2 gross floor area.
3.8.1 Recreation facilities. Tennis courts	• Daily vehicle trips = 45 per court. • Evening peak hour vehicle trips = 4 per court • A 50% IN / 50% OUT split has been adopted for both peaks

Transportation Engineers (ITE) Common Trip Generation Rates (9th edition)	
University/College	• Daily - 1.71/student • AM/PM - 0.17/student • An 78% IN / 22% OUT split has been assumed for the AM peak and a 32% IN / 68% OUT split for the PM peak hour.
Recreational Com. Centre	• Daily vehicle trips = 33.82 per KSF2= 31.45 per 100m2 GFA • AM peak vehicle trips = 2.05 per KSF2 = 1.9 per 100m2 GFA • PM peak vehicle trips = 2.74 per KSF2 = 2.55 per 100m2 GFA • An 66% IN / 34% OUT split has been adopted for the AM peak and a 49% IN / 51% OUT split for the PM peak hour.
Soccer Complex	• Daily vehicle trips = 71.33 per field • AM peak vehicle trips = 1.12 /field • PM peak vehicle trips = 17.7/field • An 57% IN / 43% OUT split has been adopted for the AM peak and a 67% IN / 33% OUT split for the PM peak hour.

5.2.2 KEY INFORMATION AND ASSUMPTIONS USED FOR TRAFFIC GENERATION/ATTRACTION ASSESSMENT

5.2.2.1.1 Education

> Mundijong Primary School – 226 full time equivalent enrolments (as at 2024 Semester 1) (Department of Education)

> Court Grammar School – 864 full-time equivalent enrolments (2023) (My School)

> The average number of students per primary school in Perth, is approximately 333. This is derived from the total number of primary students, which is 204,446, divided by the number of primary schools, which is 614 (Department of Education) (ACARA).

- The average number of students per high school in Perth, Western Australia, is approximately 972. This is calculated from the total number of secondary students, which is 109,512, divided by the number of secondary schools, which is 113 (Department of Education) (ACARA).
- TAFE – it is expected that the proposed TAFE could operate similar to South Metropolitan TAFE Armadale campus with approximately 1,500 students.

5.2.2.1.2 Retail

Both WAPC and NSW RTA guides provide peak hour rates for retail uses depending on the type of development. The peak hour rates have been adopted from WAPC while to assess the daily traffic the following formula has been used from the NSW RTA guide:

DVT= 314 A(S) + 528 A(F) + 1475 A(SM) + 555 A(SS) + 51 A(OM) (per 1000m2)

where:

- A(S): Slow Trade gross leasable floor area (Gross Leasable Floor Area in square metres) includes major department stores such as David Jones and Grace Bros., furniture, electrical and whitegoods stores.
- A(F): Faster Trade GLFA - includes discount department stores such as K-Mart and Target, together with larger specialist stores.
- A(SM): Supermarket GLFA - includes stores such as Franklins and large fruit markets.
- A(SS): Specialty shops, secondary retail GLFA - includes specialty shops and take-away stores such as McDonalds. These stores are grouped as they tend to not be primary attractors to the centre.
- A(OM): Office, medical GLFA: includes medical centres and general business offices.

The generation rates given are based on (GLFA) which provides a better indication of trip generation than gross floor area. As a general guide, 100 m2 gross floor area equals 75 m2 gross leasable floor area.

Based on the formula above rates for separate retail uses have been used to calculate daily traffic generation.

5.2.2.1.3 Other

- Shire Administration and community land uses have been assessed using office and commercial rates due to lack of details at this planning stage.
- Neighbourhood Open Spaces have been assessed as having one sports field per open space as well as District Open Space within Precinct A due to size. The existing recreational facilities within Precinct F have been assessed based on their respective uses.
- Keirnan Park District Open Space within Precinct C will be assess based on currently available Master Plan with the following land uses:
  - Stage 1A – AFL, cricket and shared pavilion
  - Stage 1B – state-level BMX facility; and
  - Stage 1C – Netball
  - Next stages:
    - 9x tennis courts

- Recreation Centre
- Lawn Bowls
- Soccer
- Hockey
- Rugby
- Pavilion
- Oval + Athletic track

- For the purposes of a high-level traffic assessment this report, all indoor facilities at Keirnan Park District Open Space will be calculated using the Recreational Community Centre rate while the outdoor playing fields will be calculated using the Soccer Complex rate from the ITE Manual.
- It should be noted that the Keirnan Park DOS assessment is high level only and the development should have a separate detailed Transport Impact Assessment.
- Whitby Train Station *(potential)* is assumed to have similar characteristics as the new Byford Station, which is being built within the existing rail corridor, 400m north of Abernethy Road:
  - 3,500 average weekday boardings
  - 400 parking spaces
  - 100 bicycle spaces
  - Park & ride facility (assumed 50 spaces)
  - Bus connections
  - Daily traffic assessed based on a rate of 1 VPD per passenger accounting for the provided bus connections and on-site facilities.
  - Peak hour traffic assumed to be 20% of daily traffic.

5.2.3 TRAFFIC GENERATION RATES ADAPTATION

5.2.3.1.1 Typical weekday traffic and peak overlap

Different land uses have unique operational characteristics and user behaviour patterns that lead to non-overlapping peaks.

Residential areas peak during commuting times, business areas during office hours, retail centres during shopping hours, and recreational facilities during leisure times.

These distinct patterns reflect the varied purposes and functions of each land use and contribute to differing peak traffic times throughout the day and week. These differences were taken into account providing the base for adjusting the traffic generation projections.

- **Residential**
  - baseline for peak and typical daily traffic as it is the largest trip generator
  - Typical weekday daily traffic
  - AM peak 08:00 – 09:00
  - PM peak 16:30 – 17:30

- **Education**
  - 100% of typical weekday traffic
  - AM peak 7:30 – 9:00 school drop-off times
  - PM peak 14:00 – 16:00 school pick-up times
  - 80% of traffic expected in the overall MDSP24 peak for both AM and PM
- **Retail**
  - 100% of maximum daily traffic as the highest daily traffic generation usually occurs on a Thursday as per NSW RTA Guide
  - AM peak 11:00 – 12:00 - 75% traffic expected in the overall MDSP24 AM peak
  - PM peak 16:30 – 17:30 - 100% traffic expected in the overall MDSP24 PM peak
- **Office/commercial**
  - 90% of typical weekday traffic
  - AM peak 07:30 – 08:30
  - PM peak 16:00 – 17:00
  - 90% of traffic expected in the overall MDSP24 peak for both AM and PM
- **Recreation**
  - 60% of maximum daily traffic during weekday
  - AM peak 11:00 – 12:00
  - PM peak 18:00 – 19:00
  - 0% of traffic expected in the overall MDSP24 peak for AM peak
  - 70% of traffic expected in the overall MDSP24 peak for PM peak
- **Whitby Train Station** *(potential)*:
  - 100% of typical weekday traffic
  - 80% of traffic expected in the overall MDSP24 peak for both AM and PM peak hours generally occur earlier than the general road traffic peak

5.2.3.1.2 Internal and external trips

According to WAPC recommendations, a large structure plan with a wide range of land uses and facilities such as this one, with schools, medical facilities, shops, employment and recreation, as well as residential, would have a high proportion of internal trips. Structure plans based on Liveable Neighbourhoods principles would therefore be likely to have a higher proportion of internal trips than a structure plan based on more conventional design principles.

This was taken into account providing the below assumptions:

- **Primary and high schools** would likely attract 90% of internal traffic and 10% of the total traffic will be external.
- **TAFE** is expected to attract approximately 40% of internal traffic while the remaining 60% would be external.
- **Whitby District Centre** catchment is the entire Mundijong District Structure Plan 2024 area and southern portion of Byford District Structure Plan area (e.g. Cardup).

- **Mundijong Civic and District Centre** catchment is the entire Mundijong District Structure Plan 2024 area and suburbs such as Mardella and Jarrahdale.
- **District centres** serve a broader area, including neighbourhoods external to the MDSP24. However, having in mind, the size of the subject area it is assumed no more than 20% of trips are external, while the remaining 80% are internal trips.
- **Neighbourhood centres** would have neighbourhood catchment of 2km, probably within their respective precincts. It is not expected that more than 10% of trips would be external traffic attracted to the neighbourhood centres having in mind their placement within the MDSP24 area.
- **Local Centres** have local catchments of up to 1km. These centres primarily serve the local population, so most trips are internal i.e. 95% of trips.
- **District / Neighbourhood open spaces** – internal and external trip distribution as explained above for District / Neighbourhood centres
- **Train Station** *(potential)* would have neighbourhood catchment of approximately 5km including the entire Mundijong District Structure Plan 2024 along with Cardup, Mardella and Jarrahdale. Having in mind, the size of the subject area it is assumed 20% of trips are external and 80% are internal trips.

This summary of internal and external trips refers to the entire MDSP24 area. It should be noted that Aimsun model (and associated technical reporting) will have a distinction between the MDSP24 internal/external trips and internal/external trips from one zone to another.

5.2.4 TRAFFIC CALCULATIONS

Table 8 - Total MDSP24 area trips - daily and peak

Precinct	Daily Traffic - TOTAL	AM Traffic	PM traffic
Precinct A	59,928	5,606	7,155
Precinct B	19,830	1,584	1,997
Precinct C	38,503	3,757	3,947
Precinct D	10,915	1,302	1,302
Precinct D2	5,038	572	572
Precinct E	19,991	1,910	2,100
Precinct F	37,637	3,256	4,335
Precinct G	41,049	4,816	5,420
Precinct H	23,456	2,218	2,408
TOTAL	**256,347**	**23,994**	**28,211**
Train Station	**3,500**	**700**	**700**
TS internal	2,800	560	560
TS external	700	140	140

5.3 Trip Distribution

A concise summary of the modelling process and outcomes will be provided. As a simple distribution was not used and OD matrices are included in the modelling reports, the summary will focus on the key results and approach.

5.3.1 EXPECTED ORIGIN / DESTINATION

The table below nominates the closest existing major residential generators and non-residential attractors of traffic and the distance from the boundaries of the Structure Plan Area.

Residential	Employment (profile.id)	• Serpentine-Jarrahdale - 21.0% • Armadale - 12.1% • Canning - 8.4% • Cockburn - 7.4% • Perth - 5.8% • Gosnells - 5.6% • No usual address (WA) - 5.4% • Belmont - 4.2% • Rockingham - 3.7% • Kwinana - 3.2% • Melville - 2.9% • Swan - 1.9% • Victoria Park - 1.7% • East Pilbara - 1.5% • Fremantle - 1.5% • Stirling - 1.4% • Kalamunda - 1.4% • Ashburton - 1.0% • Other LGAs < 2.0%
	Shopping	• Strong opportunities for local shopping within the MDSP24 area • Mundijong IGA – within the MDSP24 area • Byford Village – 9.4km to the north • Lakeside Plaza Byford – 10.1 km to the north
	Education	• Several proposed schools within the MDSP24 area • Court Grammar School – within the MDSP24 area • Mundijong Primary School – within the MDSP24 area • Byford John Calvin School – 8.4 km to the north • West Byford Primary School – 11.9km to the north

	Social / Recreational	• Several proposed neighbourhood/district centres and recreational open spaces within the MDSP24 area • Clem Kentish Recreation Centre – 8.1km to the south • Serpentine Jarrahdale Community Recreation Centre – 8.8km to the north
Neighbourhood / District Centre	Employment	The proposed neighbourhood and district centres are likely to attract moderate employment trips from the MDSP24 area, plus generally from: • Serpentine-Jarrahdale - 52.9% • Armadale - 11.6% • Rockingham - 8.7% • Gosnells - 4.7% • Kwinana - 3.8% • Cockburn - 3.7% • Mandurah - 3.4 % • Other areas - 11.2%
	Shopping / Social	At this point the full range of uses that will be located within the proposed neighbourhood and district centres are not determined. Therefore, the centres will be treated as commercial premises for the purposes of this report.
Primary School	Employment	The proposed schools are likely to attract low employment trips from the MDSP24 area, plus generally from: • Serpentine-Jarrahdale - 52.9% • Armadale - 11.6% • Rockingham - 8.7% • Gosnells - 4.7% • Kwinana - 3.8% • Cockburn - 3.7% • Mandurah - 3.4 % • Other areas - 11.2%
	Education	The proposed schools are expected to be a strong attractor for Education purposes; and with appropriate infrastructure stimulating active transport, they can effectively reduce the volume motor traffic on key links.

5.3.2 NETWORK MODELLING – METHODOLOGY AND ASSUMPTIONS

The proposed MDSP24 development was modelled in Aimsun Next 2024 to determine the impact on the existing road network, necessary upgrades and elements of the new network required to accommodate anticipated traffic.

This section will briefly outline basic assumptions and methodology for preparation of the model as detailed explanation is provided in the Base and Options Modelling reports. The models were prepared, calibrated and validated (where appropriate) in line with the MRWA's Mesoscopic and Hybrid Modelling Guidelines, and peer reviewed.

The assessment will involve daily, AM and PM peak models for following horizon years:

- 2021 as a base year;
- 2031; as an interim horizon year; (Option 1)
- 2051; as a final horizon modelling year. (Option 2)

The base model (and the subject of this report) is model for 2021. This year was selected for the base model given this is the only horizon year when ROM model was validated. 2021 is also the most recent Census year. 2021 model was prepared based on the available census data and the MRWA's ROM24 plots (details provided in Base modelling report and Appendix C of BMR). The model was prepared, calibrated and validated in line with the MRWA's Mesoscopic and Hybrid Modelling Guidelines, and peer reviewed.

The model for 2031 was prepared with following assumptions:

- The dwelling yield in MDSP24 will be 3,500 dwellings;
- Tonkin Highway extension will be completed to South Western Highway. Mundijong Road and South Western Highway intersections will become interim roundabout as shown on the plans received from MRWA, with grade separation provided at the intersection with Bishop Road;
- Freight Rail is realigned on the western side of Tonkin Highway extension;
- METRONET rail is not extended past Byford railway station.

The model for 2051 was prepared with following key assumptions:

- MDSP24 area is fully constructed and inhabited (approximately 20,000 dwellings);
- Intersections of Tonkin Highway with Mundijong Road and South Western Highway grade separated;
- METRONET service extended to Whitby (new terminus of Armadale Line).
- There is additional north-south connection in the western section of the MDSP24 area, referred to as Bett Road.
- Freight rail will be re-aligned and there will be no further expansion of passenger rail to Mundijong in this timeframe
- 5 main bus routes are modelled as feeder routes to the proposed Whitby railway station. The routes were proposed for the purpose of this model in collaboration with the Shire of Serpentine

Jarrahdale. It is acknowledged that final feeder routes may have different trajectories. Routes are as follows:

- **Red Line** – From Byford via Soldiers Road > Patterson Road > Watkins Road > Wright Road to Serpentine and vice-versa;
- **Blue Line** – From Byford via Soldiers Road > E-W Connection to the west > Taylor Road to the south > Mundijong Road to Rockingham and vice-versa;
- **Green Line** - From Byford via Soldiers Road > E-W Connection to the east > N-S Connection to the south > Watkins Road and Mundijong Road to Rockingham and vice-versa;
- **Purple Line** - From Byford via Soldiers Road > E-W Connection to the west > Taylor Road to the north > Bishop Road to the west > Kargotich Road to the site > Bishop Road (existing alignment) to the east > West Mundijong Industrial area spine road to the south > Mundijong Road to Rockingham and vice-versa;
- **Yellow Line** - From Byford via Soldiers Road > E-W Connection to the west > Taylor Road to the south > Richardson Street, Roman Road, Galvin Road, Kiernan Street to the east > South Western Highway to the south > Jarrahdale Road and Tonkin Highway extension to Jarrahdale

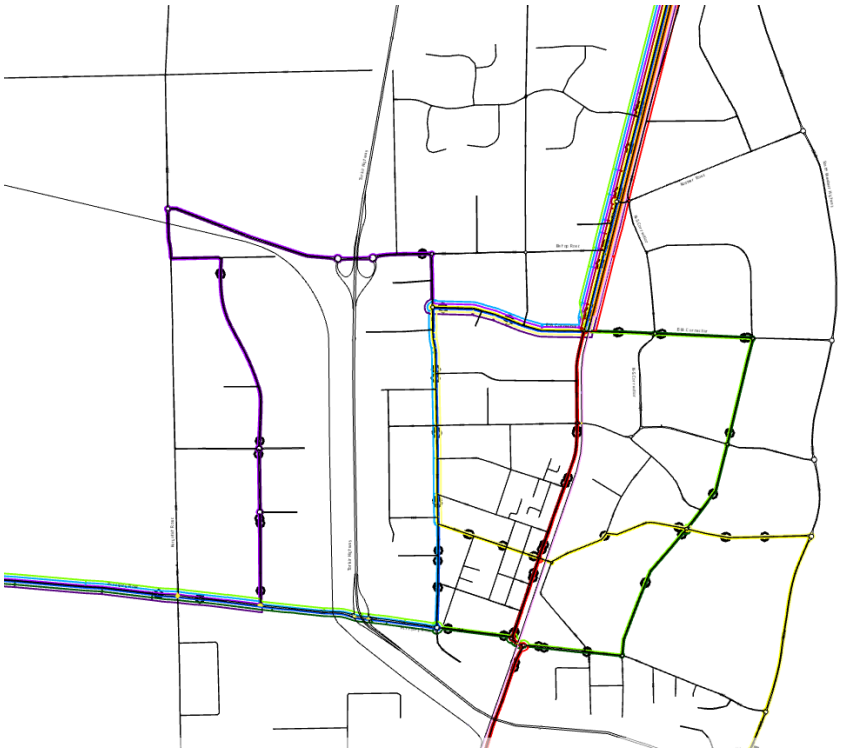


Figure 16 - Proposed bus routes in 2051

Model for 2051was prepared in two alternatives:

1) Option 2a assumed that all of the existing at-grade road crossing points are retained with rail over road arrangement over Norman Road;
2) Option 2b assumed that at grade crossings at Norman Road and Kiernan Street are removed through termination of road connections.

5.3.3 NETWORK MODELLING – KEY OUTCOMES

The table below shows the proposed classification for the key links within the MDSP24 area. Very few existing road reservations can accommodate the configuration required by Liveable Neighbourhoods 2009 by 2051.

The classification below is reflective of minimal traffic requirements. The road reservation widths can be expanded and re-organised to satisfy different types of requirements (e.g. civil engineering, environmental, conservational, urban design etc.), therefore roads that have lower order hierarchy according to traffic engineering requirements might have expanded road reservation widths.

Table 9 - Proposed Road Classification

Geometric element (Links)	Option 2a	Option 2b	Note
Betts Road (N-S connection) - south of Karbro Rd	IB	IB	Does not exist
Betts Road (N-S connection) - north of Karbro Rd	IA	IA (IB)	Does not exist
Bishop Rd – west of Taylor Rd	IB*	IB*	~20m existing road reservation
Bishop Rd – Taylor Rd – Access Rd	IB	IB	~20m existing road reservation
Bishop Rd – Access Rd – Soldiers Rd	IB	IBB	~20m existing road reservation
New E-W Connection – Taylor Rd – Betts Rd	IB	IB	Does not exist
New E-W Connection – Betts Rd – Soldiers Rd	IA	IA	Does not exist
New E-W Connection – Soldiers Rd – Skyline Blvd	IA	IA	Does not exist
New E-W Connection – Skyline Blvd - SWH	IB	IB	Does not exist
Taylor Rd – Bishop Rd – E-W	IA	IA	~20m existing road reservation
Taylor Rd – E-W connector – Kiernan Rd	IB	IB	~20m existing road reservation
Adams St - Kiernan Rd – Cockram St	NCA	NCA	~20m existing road reservation
Adams St – Cockram St – Mundijong Rd	IB	IB	Does not exist
Soldiers Rd – north of Karbro Rd	NCA	(NCB-AS)	~20m existing road reservation
Soldiers Rd – Karbro Rd – Bishop Rd	IB	(NCB-AS)	~20m existing road reservation
Soldiers Rd – Bishop Rd – E-W conn	NCA	NCA	~20m existing road reservation
Soldiers Rd – E-W- Connect – Kiernan St	IB	IB	~20m existing road reservation

Paterson Rd –Kiernan St – Richardson St	IB	IB	~ 22m-40m existing road reservation
Paterson Rd – Richardson St – Whitby St	NCA	NCA	~ 30m-40m existing road reservation
Paterson Rd – Whitby St – Mundijong Rd	IB	NCA/IB	~ 30m-40m existing road reservation
Mundijong Rd -Watkins Rd west of Roman Rd	IA	IA	~ 20m-30m existing road reservation
Watkins St – Roman Rd-Cowen St	IB	IB	~20m existing road reservation
Watkins St – Cowen St - SWH	NCA	NCA	~20m existing road reservation
Wright Rd – south of Watkins Rd	IB	IB	~20m existing road reservation
Kiernan St – Taylor St – Soldiers Rd	NCA	NCA	~20m existing road reservation
Kiernan St – Soldiers Rd – Tinspar Av	IB	-	~24m existing road reservation
Kiernan – Tinspar Ave – N-S Connector (east section)	IB	AS	~24m existing road reservation
Galvin Rd – Evelyn Rd - N-S Connector (east section)	AS	AS	
Galvin Rd - N-S Connector (east section) -SWH	NCA	NCA	Does not exist
Evelyn St – Soldiers Rd – Galvin Rd	IB	IA/IB	~25m existing road reservation
Evelyn St – Galvin Rd – Eileen Ave	NCA	IB	~20m existing road reservation
Evelyn St – Eileen Ave – Kieran St	AS	AS	~20m existing road reservation
Robertson Rd – north of Norman Rd	IB-NCA	NCA	
Skyline Boulevard – south of Norman Rd	IB	IB	Does not exist
N-S Connector (east section) - Skyline Blvd – Kiernan St	IB	IB	Does not exist
N-S Connector (east section) - Kiernan St – Watkins Rd	NCA	IB	Does not exist
Norman Rd – Soldiers Rd – Access Rd	NCA	AS	~20m existing road reservation
Norman Rd – Access Rd - SWH	NCA	IB	~20m existing road reservation
Roman Rd – North of Watkins Rd	IB	IB	~20m existing road reservation
Reily Rd - N-S Connector (east section) -SWH	NCA	NCA	~20m existing road reservation
Richardson St	NCA	NCA	~20m existing road reservation

Tonkin St	NCA	NCA	~20m existing road reservation
Cockram St	NCA	NCA	~30m existing road reservation
*Note * - Bishop Road is to be classified as Integrator B to align with DCP requirements, however, the section of the road west of Taylor Road should have two lanes per direction to accommodate the projected traffic volumes.*			

5.4 Proposed Transport Network

5.4.1 INTERNAL ROAD NETWORK

The cross sections below reflect the minimum requirement of proposed classification and road reservation widths. The cross-sections are typical to the Liveable Neighbourhoods 2009. It is expected that some localised variations will occur during the project refinement due to different constraints, but this has not been considered at this early stage in the project.

Table 10 - Proposed internal road network cross sections and classification - Integrator A

LN Classification	Integrator A
Projected Traffic Volumes	<25 000
Proposed Number of Lanes	Two per direction
Proposed Road Reservation Width	35.6m
Proposed Road Pavement Width	2 x 10.7m in centres Including combined on street parking and bike lane
Proposed Median Width	6.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m cycling lanes 2.3m and 1.8m pedestrian paths
Proposed Speed Limit	60km/h
Proposed Bus Route Extension / Introduction	YES, where indicated on proposed bus route plan
Proposed On-street parking	YES

Provide graphics of the proposed internal road cross section within the Structure Plan Area

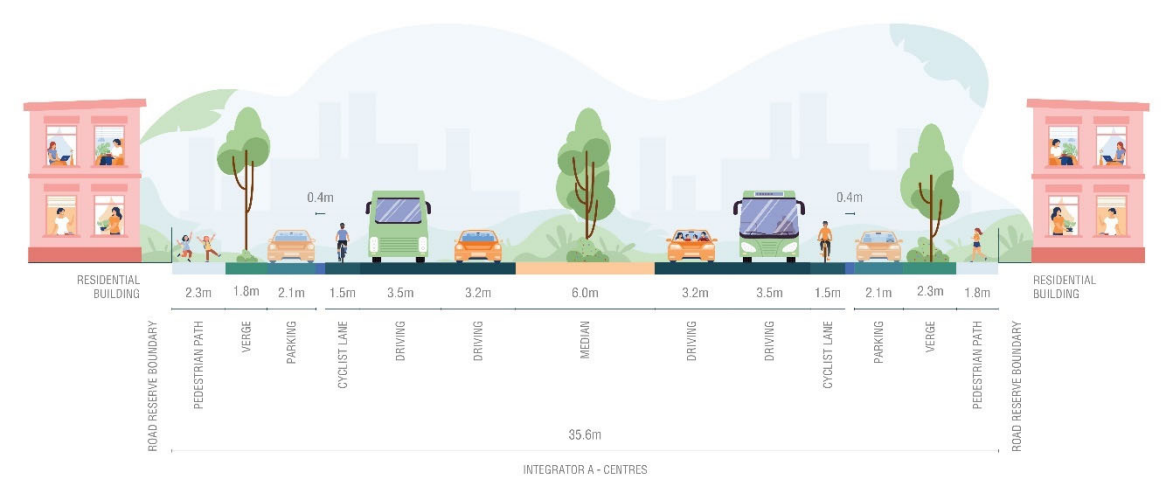


Table 11 - Proposed internal road network cross sections and classification - Integrator B

LN Classification	Integrator B
Projected Traffic Volumes	<15,000
Proposed Number of Lanes	One per direction
Proposed Road Reservation Width	29.2m
Proposed Road Pavement Width	2 x 7.5m including on street parking
Proposed Median Width	2.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m cycling lanes 2.3m and 1.8m pedestrian paths
Proposed Speed Limit	40-50km/h
Proposed Bus Route Extension / Introduction	YES, where indicated on proposed bus route plan
Proposed On-street parking	YES, where appropriate

Provide graphics of the proposed internal road cross section within the Structure Plan Area

Table 12 - Proposed internal road network cross sections and classification - Neighbourhood Connector A

LN Classification	Neighbourhood Connector A
Projected Traffic Volumes	<7,000 vpd
Proposed Number of Lanes	One lane per direction
Proposed Road Reservation Width	24.4m
Proposed Road Pavement Width	2x 7.1m including parking, on street bike lane, median plus shared path on one verge.
Proposed Median Width	2.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m cycling lanes 1.5m pedestrian paths
Proposed Speed Limit	50km/h
Proposed Bus Route Extension / Introduction	YES - where indicated on proposed bus route plan
Proposed On-street parking	YES

Provide graphics of the proposed internal road cross section within the Structure Plan Area

Table 13 - Proposed internal road network cross sections and classification - Neighbourhood Connector B

LN Classification	Neighbourhood Connector B
Projected Traffic Volumes	<3,000 vpd
Proposed Number of Lanes	One lane per direction
Proposed Road Reservation Width	19.4m
Proposed Road Pavement Width	11.2 including parking, plus shared path on one verge.
Proposed Median Width	-
Proposed Pedestrian / Cyclist / Shared Path Width	2.3m shared path 1.5m pedestrian path
Proposed Speed Limit	50km/h
Proposed Bus Route Extension / Introduction	YES - where indicated on proposed bus route plan
Proposed On-street parking	YES

Provide graphics of the proposed internal road cross section within the Structure Plan Area

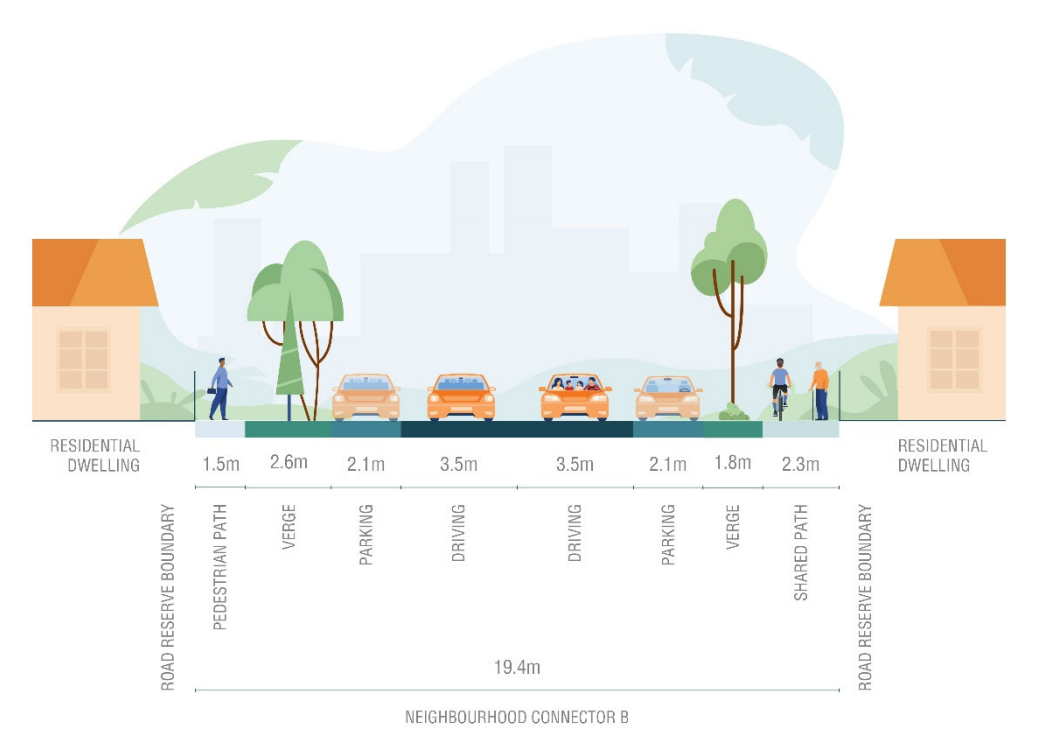


Table 14 - Proposed internal road network cross sections and classification – Access Street B

LN Classification	Access Street B (Near schools and neighbourhood centres)
Projected Traffic Volumes	<3,000 vpd
Proposed Number of Lanes	One lane per direction
Proposed Road Reservation Width	17.9m
Proposed Road Pavement Width	9.7m
Proposed Median Width	-
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m pedestrian paths
Proposed Speed Limit	40km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	YES

Provide graphics of the proposed internal road cross section within the Structure Plan Area

Table 15 - Proposed internal road network cross sections and classification – Access Street C

LN Classification	Access Street C (Typical residential streets)
Projected Traffic Volumes	<1,000 vpd
Proposed Number of Lanes	One lane per direction

Proposed Road Reservation Width	15.4m
Proposed Road Pavement Width	7.2m
Proposed Median Width	-
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m pedestrian paths
Proposed Speed Limit	40km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	YES – on the pavement

Provide graphics of the proposed internal road cross section within the Structure Plan Area

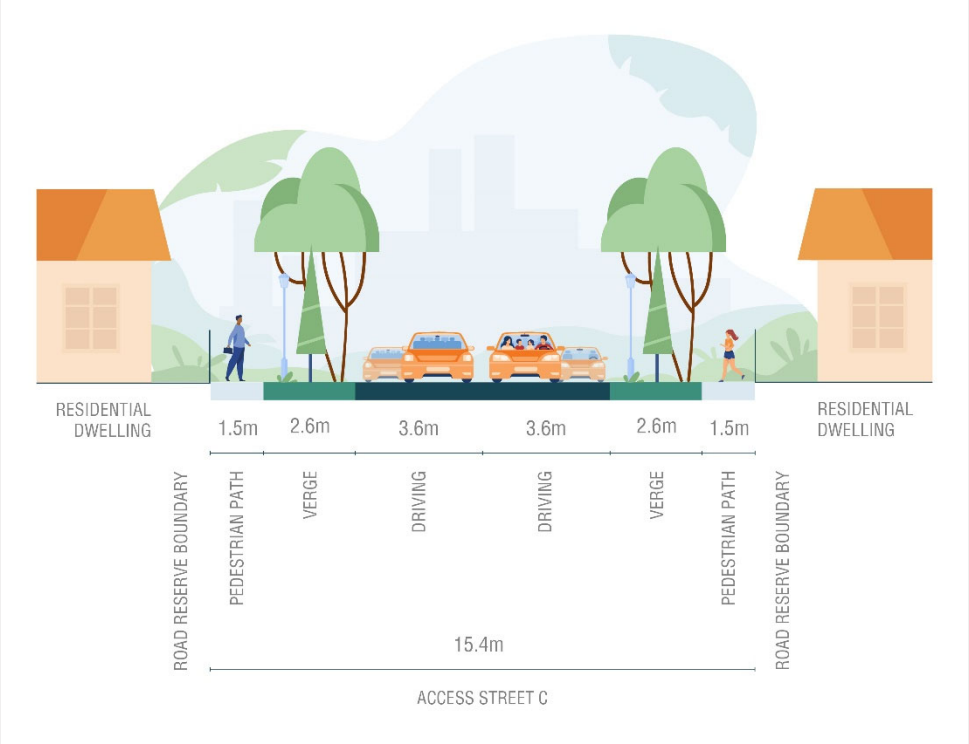


Table 16 - Proposed internal road network cross sections and classification – Access Street D

LN Classification	Access Street D (Short low volume streets)
Projected Traffic Volumes	<1,000 vpd
Proposed Number of Lanes	One lane per direction
Proposed Road Reservation Width	14.2m
Proposed Road Pavement Width	6.0m
Proposed Median Width	-
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m pedestrian paths
Proposed Speed Limit	30km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area

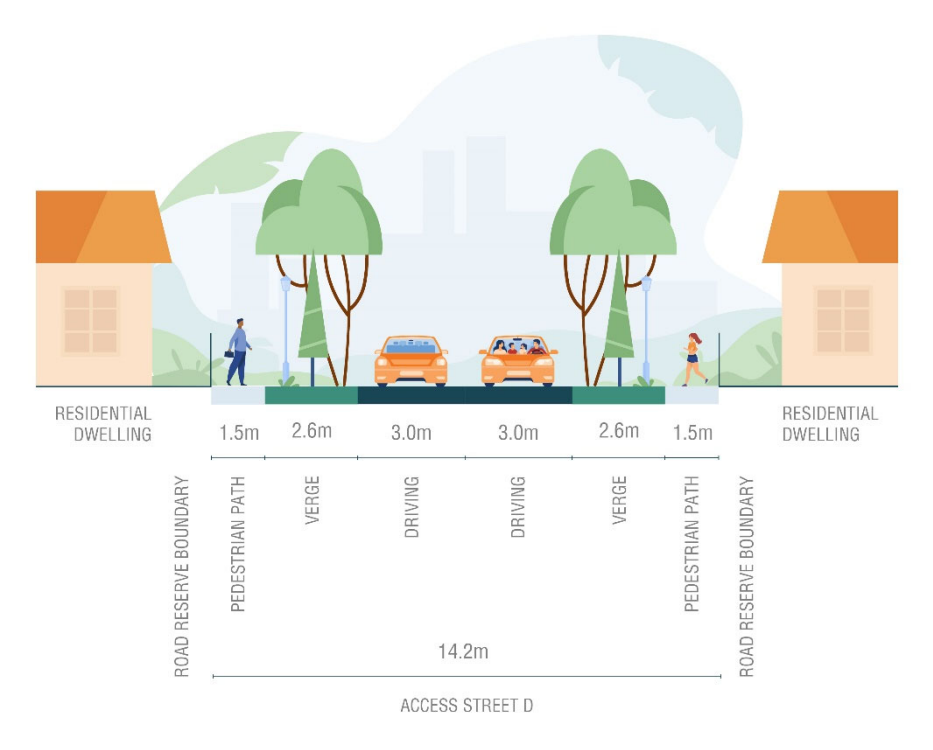
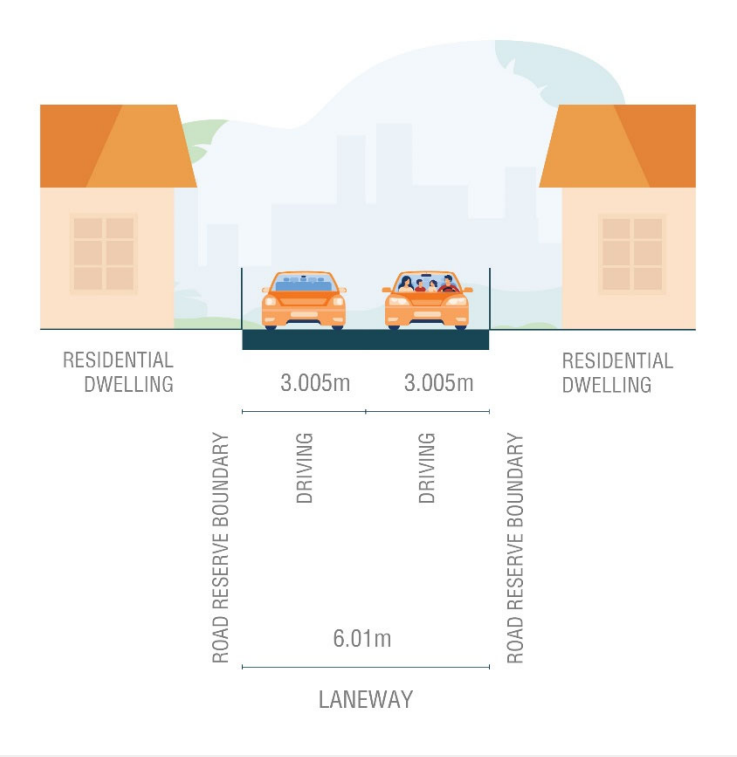


Table 17 - Proposed internal road network cross sections and classification – Laneway

LN Classification	Laneway
Projected Traffic Volumes	<1,000 vpd
Proposed Number of Lanes	One lane per direction
Proposed Road Reservation Width	6.01m
Proposed Road Pavement Width	6.01m
Proposed Median Width	-
Proposed Pedestrian / Cyclist / Shared Path Width	-
Proposed Speed Limit	15km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area



5.4.2 PROPOSED INTERSECTION CONFIGURATION

Extensive upgrades to the road network will be required to support the development of the MDSP24 area. To ensure the network operates effectively by the design year 2051, the following intersection control measures are recommended as indicated in the table below. These measures aim to enhance traffic flow, improve safety, and accommodate anticipated growth, providing a robust foundation for the area's long-term transportation needs. Details on intersection upgrades and timing can be found in Base and Options Modelling Reports.

Table 18 - Proposed intersection configuration

Intersection control	Intersection name
Roundabout	• Tonkin Highway on and off ramps to and from Bishop Road (MRWA) • Two roundabouts along the North-South spine road through West Mundijong Industrial Area Bishop Road & Kargotich Road • Bishop Road & Taylor Road • Bishop Road & North-South spine road to the north towards Orton Road • Soldiers Road & Norman Road • Norman Road & Robertson Road • Norman Road & South Western Highway • Taylor Road & East-West spine road through the MDSP24 area • Soldiers Road & East-West spine road through the MDSP24 area • Robertson Road & East-West spine road through the MDSP24 area • East-West spine road through the MDSP24 area & Adamson Street • East-West spine road through the MDSP24 area & South Western Highway • Soldiers Road & Keirnan Street • Keirnan Street & Tinspar Avenue • Tinspar Avenue & Skyline Boulevard • Tinspar Avenue & Adamson Street • Tinspar Avenue & South Western Highway (MRWA) • Galvin Road & South Western Highway (MRWA) • Galvin Road & Adamson Street • Mundijong Road & Taylor Road • Mundijong Road & Paterson Street • Watkins Road & Adamson Street • Watkins Road & South Western Highway (MRWA)

	• South Western Highway & Shanley Road (MRWA)
Signalised	• Mundijong Road & Kargotich Road • Mundijong Road & North-South spine road through West Mundijong Industrial Area • Tonkin Highway on and off ramps to and from Mundijong Road • Tonkin Highway & South Western Highway on and off ramp (MRWA) • Tonkin Highway & Jarrahdale Road (MRWA)
Level rail crossing	• Watkins Road • Robertson Street • Keirnan Street (or removed through termination of road connections in Option 2b) • Norman Road (or removed through termination of road connections in Option 2b) • East-West spine road through the MDSP24 area
Grade-separated rail crossing	• Tonkin Highway (MRWA) • Norman Road (rail over road)
Give way/Yield/Stop control	• Intersection of minor roads and other intersection with no significant delays as indicated by traffic modelling

5.4.3 EXTERNAL ROAD NETWORK

Key transport and development projects critical to the MDSP24 include:

- Tonkin Highway Extension
- Freight Rail Realignment
- Passenger Rail Line Extension

These projects will significantly impact both traffic and public transport options by improving connectivity and supporting the growing population.

The Tonkin Highway Extension will enhance road access to Mundijong and South Western Highway, while the Freight Rail Realignment will facilitate town centre development and reduce rail corridor conflicts. The Passenger Rail Line Extension will expand public transport options in the Mundijong-Whitby area to accommodate increasing travel demand.

Additional developments such as Cardup Business and Residential Park, West Mundijong Industrial, and West Mundijong Urban Expansion will further influence traffic and public transport, with new residential and industrial areas generating additional demand for transport services.

5.4.4 INTEGRATION WITH SURROUNDING AREA

This section provides a summary of key considerations regarding existing and potential traffic generators and attractors, land use changes, desire lines, and the adequacy of transport networks within and around the Structure Plan Area. These aspects have been evaluated as part of the broader

planning and transport analysis to ensure the proposed development is well-integrated with the surrounding network and meets the needs of all users:

- **Existing Major Residential Generators of Traffic**

  There are exisitng residential areas within and around the MDSP24, however the area will undergo significant changes and the proposed residential traffic generators will greately outweight the existing.

- **Existing Major Non-Residential Attractors of Traffic**

  The presence of non-residential traffic attractors (commercial activities and schools) within this radius has been examined and included in the overall traffic analysis. West Mundijong Industrial Area is currently under development, and while this area at present attracts some construction traffic, it is temporary and in future it will become an employment generator.

- **Proposals for Major Land Use Changes**

  Potential changes to land uses within the vicinity of the Structure Plan Area have been reviewed in detial in section 4.2 Overview of Relevant Planning Documents.

- **Main Desire Lines**

  Desire lines between the Structure Plan Area and external attractors/generators have been considered, with key connections addressed as within section 5.3.3 and Base and Options Modelling reports.

- **Adequacy of Transport Networks**

  The capacity of existing and proposed transport networks to support these desire lines has been evaluated as a part of modelling.

- **Deficiencies and Improvements in Surrounding Transport Networks**

  Any potential deficiencies in the surrounding transport networks, as well as opportunities for improvement, have been identified and accounted for within the Base and Options Modelling reports.

- **Remedial Measures**

  Where relevant, appropriate remedial measures have been suggested to address any identified gaps or issues. Refer to Base and Options Modelling reports.

5.4.5 PEDESTRIAN AND CYCLING NETWORK

All proposed roads within the plan will include pedestrian paths, with at least a footpath on one side of the road reservation as a minimum standard. Roads classified higher than access roads will incorporate either shared paths or dedicated cycling lanes to ensure safe and efficient movement for cyclists.

As the MDSP24 area advances to subdivision stages, special emphasis should be placed on ensuring safe and seamless pedestrian and bicycle access around schools, as well as proposed district and neighbourhood centres. These areas are critical for fostering connectivity, safety, and accessibility, particularly for vulnerable users such as children and pedestrians.

The design guidelines below provide recommendations to guide the development and integration of pedestrian and cycling infrastructure. These recommendations serve as a framework for promoting safe, accessible, and connected mobility networks throughout the MDSP24 area.

6. DESIGN GUIDELINES

6.1 Road Safety

All distances between intersections should be spaced according to Liveable Neighbourhoods. This is to be reviewed in more detailed stages of planning.

Some traffic calming devices are desirable especially in the vicinity the proposed primary schools. Chicanes, speed humps, wombat crossings and/or other methods should be considered when designing streets around schools to lower operating speeds and improve safety. Variable speed limit should be considered on all roadways within 200m from the school entry in accordance with the relevant MRWA guidelines.

Furthermore, narrow lanes are advised (3.3m as a maximum width) to increase side friction and reduce operative speed. Long blocks of on-street parking are to be avoided – vegetation strips are recommended to be implemented after each block of maximum 3 on-street parking bays.

6.1.1 LEVEL RAIL CROSSINGS

Currently there are five level crossings within the MDSP24 area, these are:

- Hopkinson Road
- Bishop Road
- Soldiers Road
- Keirnan Street
- Robinson Street (currently discontinued)
- Watkins Road

Depending on the final adopted structure plan, some of these crossings are to be removed through road discontinuation or be replaced by rail over road structures. By 2031 the freight rail will be realigned on the western side of Tonkin Highway road reservation extension. If the METRONET rail is extended to Whitby, only Perth-Bunbury service will continue south of Whitby. With two (2) trains daily in each direction, the warrants for removal of at-grade crossings are unlikely to be met south of Whitby Railway station.

Effective management of level rail crossings involves a combination of safety measures, operational controls, and infrastructure improvements to ensure the safety of both road and rail users.

Key safety measures include the installation of clear, visible warning signs and signals, such as flashing lights, bells, and boom gates, to alert drivers and pedestrians of an approaching train. At higher-traffic crossings, active controls like automatic gates and lights are used, while passive controls, such as stop signs, are typically found at quieter locations. Surveillance and monitoring systems, such as cameras or sensors, are implemented to detect any potential risks or malfunctions in the warning systems. Coordination between rail operators and traffic management is crucial to minimise congestion and avoid train delays. Traffic flow management may include controlling traffic signal timing and adjusting road capacity near crossings to prevent bottlenecks.

Crossing design improvements are also essential, ensuring adequate visibility and proper alignment, with options like elevated crossings or overpasses where needed. For pedestrian safety, separate pathways and well-lit crossings are prioritised.

Regular maintenance and inspections of crossing infrastructure, such as signals, gates, and road surfaces, ensure everything is functioning properly, and emergency response protocols are in place to deal with accidents or malfunctions. Solutions like smart crossing systems, which monitor train movements and provide real-time updates to drivers, help reduce waiting times and improve safety.

6.2 Vehicle and bicycle parking, delivery and service access

The predominant use is residential; therefore, it is expected that most residences will provide parking on the premises, in accordance with the SPP7.3 (Residential Design Codes or the finalised version of the WAPC Apartment Design Policy). Other uses should provide vehicle and bicycle parking in accordance with or in excess of the Shire of Serpentine-Jarrahdale Local Planning Scheme No 3. It is recommended that a special policy is prepared for the railway station precinct that would actively encourage use of active transport modes.

Charging points and convenient parking positioning in public spaces and commercial precincts should be considered for stimulating micro-mobility.

It is most likely that the utilisation of bicycles within the MDSP24 area will be more viable and attractive to residents. Cycling is further promoted through a network of cycle lanes and shared paths connecting all residential areas to the main attractors.

On-street parking should be considered, particularly in the area surrounding commercial activity precincts, District Open Space (Sporting Precinct) and other recreational areas.

Reduced parking rates should be contemplated in neighbourhood and district activity centres where there is a high degree of mixed used developments, or variety of commercial land uses.

It is expected that delivery and service vehicles (such as waste removal vehicles) servicing the residential area will not require designated parking spaces given that they can operate safely within the road reserve.

Service and delivery vehicles for the primary schools, neighbourhood centres and local and district open spaces will require appropriate parking allocated on site. The crossovers should be designed to accommodate movement of the largest anticipated vehicle, but not at the detriment of overall amenity of the area.

6.3 Prioritising Active Transport

There is a growing body of evidence and scientific research clearly demonstrating long term health, economic and environmental benefits of active transport modes (modes requiring constant movement of human body). Unfortunately, prevalence of active transport modes across the Australia was in decline for several decades, particularly outside of hyper-urban cores. The decline occurred predominantly due to urban environments being developed to prioritise movement of motor vehicles (connectivity and efficiency). At present, many Local and State Government in conjunction with various non-government

organisations seek to reverse this trend and encourage the mode shift, often due to spatial constraints as the urban land is becoming premium.

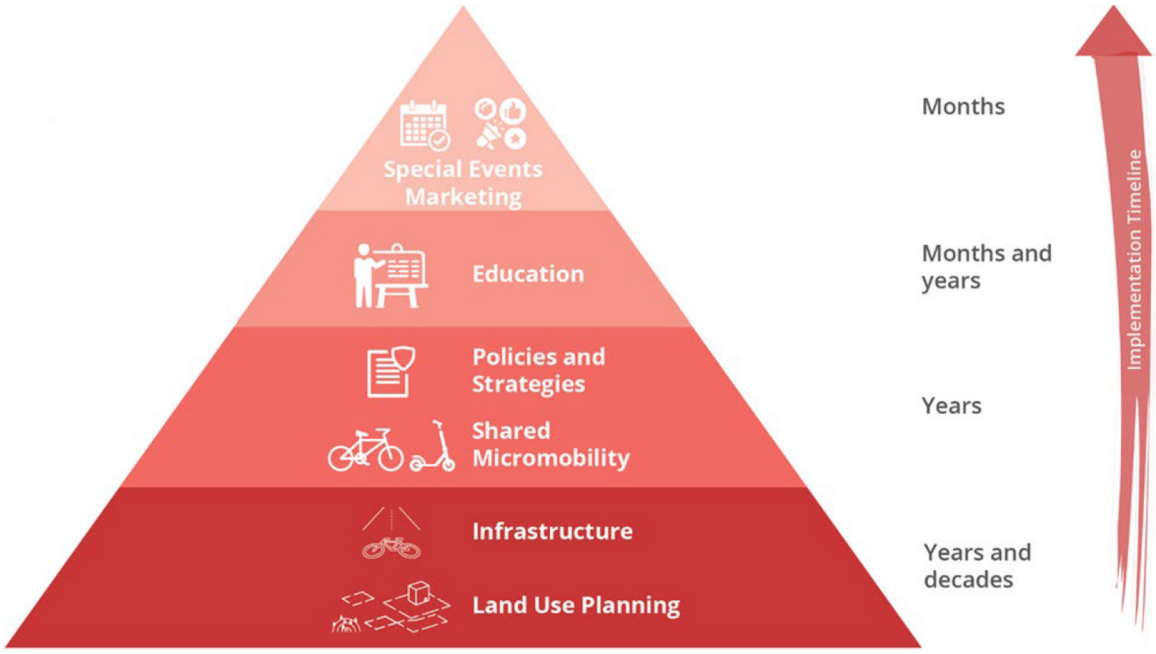


Figure 17 - Key interventions to encourage active transport (source: Prioritising Active Transport, Austroads, 2024)

As per figure above, the most effective "tool" for encouragement of active transport is in fact land use planning and provision of suitable infrastructure. When urban environment is designed so that basic daily functions can be fulfilled walking and/or bicycling – the residents and visitors will use active transport modes to a much higher degree. Therefore, the greatest potential for encourage the mode shift sits with the new developments where the desired behaviour can be fostered from the inception. In this light, the following should be a priority across all planning stages:

- Co-locating complementary land use – combining residential and appropriate commercial and community land use enables functional daily walking and bicycling.
- Providing appropriate infrastructure – right-sized and connected paths, urban furniture and crossings that will facilitate safe and efficient movement, but also encourage dwelling and interaction between the residents.
- Integrating public transport with active transport networks – integration either via shared mobility systems or simple allowance for appropriate active transport infrastructure will encourage active and sustainable travel for longer commuter trips.

Integration of public transport with active transport networks is a cornerstone of integrated transport planning. As the public transport network is further developed, the new railway station will be supported by bus feeder routes, offering a sustainable alternative for commuter travel. Enabling easy and convenient access to public transport hubs for active transport modes creates capillary network for sustainable travel. Similarly, commercial and activity centres should be designed to prioritise and reward use of active transport modes.

Formation of a Transit-Oriented-Development (TOD) and Pedestrian-Oriented-Development (POD) in railway station precinct and in the Activity Centre Precincts should be imperative.

6.3.1 SAFE ROUTE TO SCHOOLS – CREATING POSITIVE MOVEMENT HABITS EARLY

Local schools have a designated catchment, that in most cases corresponds to the walkable/bikeable catchment; however, the number of children walking / bicycling to school is surprisingly low. The official DoT research[1] shows that in period 1970-2010 the percentage of school children walking and/or cycling to school declined from 75% to 25% and is further reducing.

General obstacles are lack of suitable infrastructure and parenting decisions stemming from perceptions of road safety. Educational facilities tend to generate high volumes of traffic in short periods of time, causing temporary congestion, given the usual pick up and drop off times tend to coincide with the commuter peaks. Increasing walking and bicycling mode share for school trips, not just reduces the congestion and parking demand, it is also creating positive active transport habits from young age, fosters independence, strengthens the self-esteem and place attachment.

Key infrastructure elements to be considered are connected, generously sized, connected and shaded shared paths, low vehicular speeds and safe road crossings clearly prioritising pedestrian traffic over vehicular.

6.3.2 LOW VEHICULAR SPEEDS – BUILDING ROAD SAFETY AND AMENITY AT ONCE

The most recent research confirms that coupling low vehicular speeds with the appropriate land use mix can substantially stimulate the active transport uptake. It is a simple matter of convenience and the perceived value of time spent by the agent (pedestrian/driver), but also the matter of perceived personal safety.

Low speed limit and low operating speed are prerequisites for creating a safe shared road environment. In the last few years, intensive research was conducted to determine the likelihood of a fatality or serious injury for vulnerable road users (pedestrians and cyclists in particular) in a road accident.

Global data analysis confirms an obvious pattern where the speed of 30km/h or 20mph emerges as the threshold where the survivability of vehicle impact for a pedestrian or cyclist (regardless of age and physical ability) starts to increase rapidly.

Although 40km/h is generally considered a safe speed, according to the Road Safety Commission's infographic below, the risk of fatality for pedestrians is 2.5 times higher than the estimated fatality risk if the colliding vehicle travels at 30km/h. Analysis of global data shows some differentiation in fatality likelihood estimates for vehicular speeds above 40km/h, given that emergency response times and the type of colliding vehicle play a significant factor in crash survivability. However, global data shows consistently low levels of pedestrian fatality if the colliding vehicle travels at 30km/h or slower. These global findings are initiating a review of traffic safety policies, given that the evidence is overwhelming.

[1] https://www.transport.wa.gov.au/mediaFiles/active-transport/AT_P_Declining_Rate_walking_cycling_to_school_in_Perth.pdf

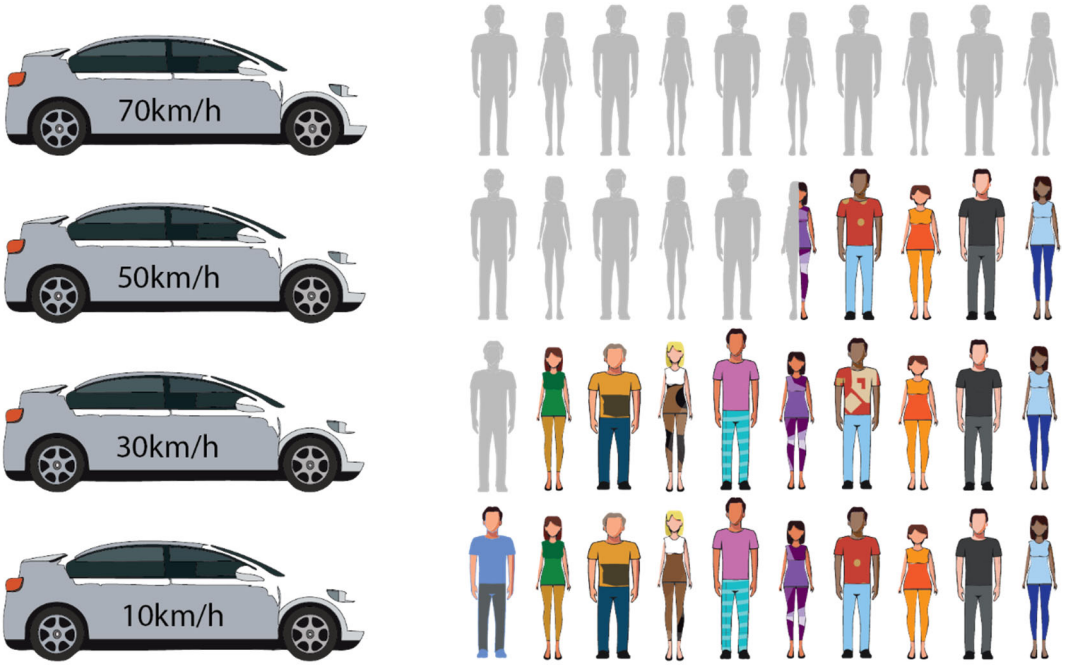


Figure 18 - Speed limit and risk of pedestrian death (source: information adapted from the Road Safety Commission, Pedestrians – Fact Sheet)

Apart from the critical survivable force threshold, another reason for such dramatic difference in crash occurrence and outcome depending on the operating speed of vehicle is illustrated in the figure below. The drivers' perception field is drastically reduced with increased operating speed, reducing drivers' ability to perceive potential risk in the roadside (i.e. pedestrians looking to cross the road).

Reduced peripheral vision coupled with increased stopping distances reduces drivers' ability to perceive the risk and reduces the opportunity to mitigate the risk and avoid hazard. Even with severe breaking, vehicles travelling at up to 65km/h (a frequent 85% operating speed on roads signposted for 50km/h) requires over three times the distance to stop and avoid the collision than a vehicle travelling at 30km/h.

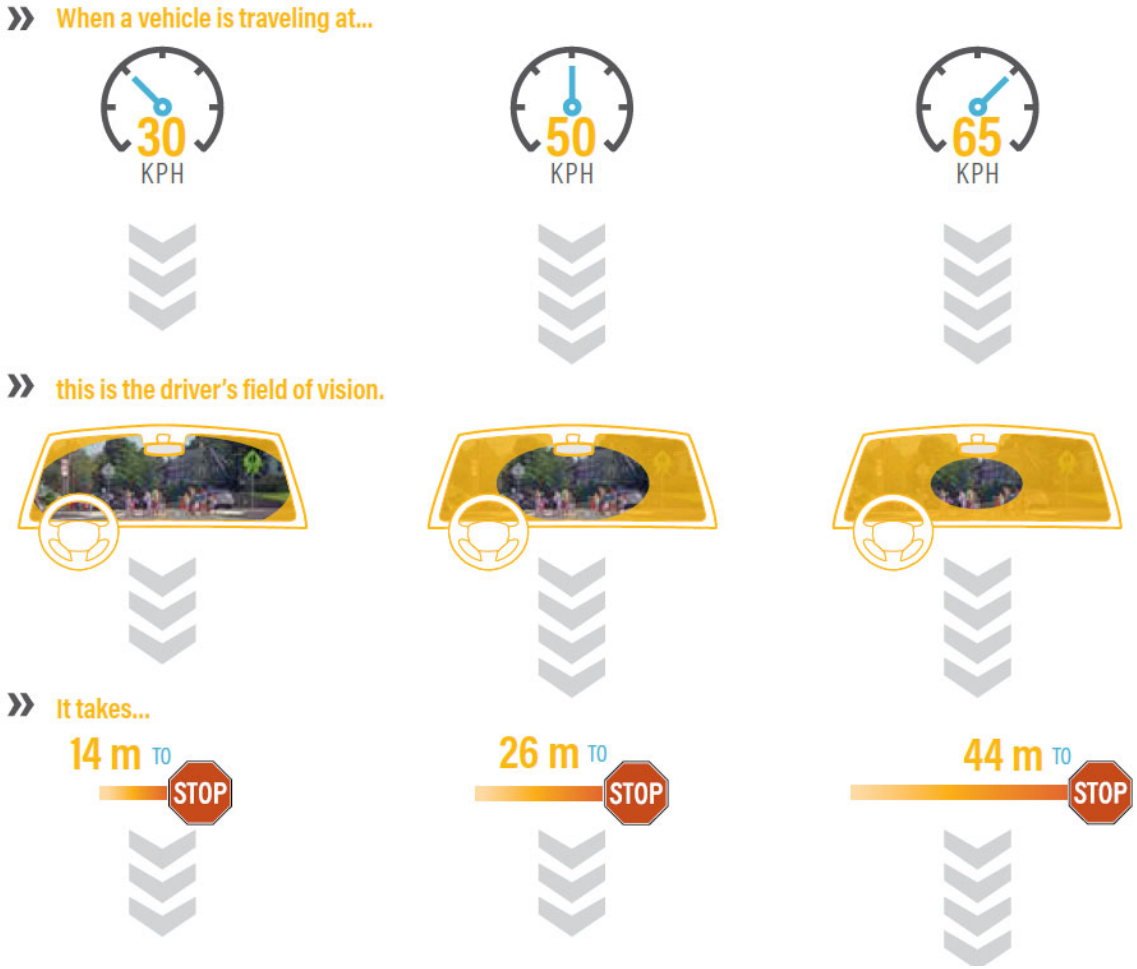


Figure 19 - Driver's perception and operating speed (source: Low Speed Zones Guide, World Resources Institute, Global Road Safety Facility, pg. 51)

As most local vehicular trips range between 1km and 3.5km in distance, the reduction of speed limit from 50km/h to 30km/h does not result in notable time losses for short trips. Furthermore, a reduced speed limit deters vehicle drivers from seeking alternative routes via residential streets and ensures that the passing traffic will remain on roads of higher order. Similarly, reduced speed limit on Main-Street type of roads enhances not just safety but the amenity of public space dedicated to any kind of human movement. Therefore, the proposed low speed limit (30km/h) contributes to creation of shared road environment doubly – actively reducing vehicular volumes through discouraging passing traffic and drastically increasing safety of vulnerable road users.

Reduced speed limits should be considered in Activity Centres, and in all other areas where active transport options should be encouraged. Notwithstanding mandatory variable speed limits in the school zones if the signposted speed is the urban default (50km/h), consideration should be given to permanent reduction in vicinity of recreational areas and schools to further encourage residents to focus on active transport modes.

6.3.3 CAR PARKING PROVISION AND INDUCED DEMAND

Abundant car parking supply in the planning system that is underpriced hinders the uptake of active transport. The perception of cost and convenience is shifted in favour of motor vehicles and is likely to create a trend that will prove difficult to reverse. Urban structure formed around motor normativity results in strong segregation between the land uses and is dominated by motorways at the expense of pedestrian and cycling paths and much needed vegetation.

This project represents a unique opportunity to create an environment that is conducive to active transport and that will not require behavioural change in future, but simple nurturing of the desired established behaviours. Some administrative measures that can be considered are as follows:

- Consider implementing reduced parking requirements in mixed-use zones in proximity of public transport nodes and encourage reciprocal use. Alternatively, consider implementing maximum parking requirements opposed to minimum parking requirements.
- Consider increasing the requirement for bicycle parking for all land uses other than residential (single dwelling).
- Consider limiting unrestricted on-street parking in the precincts – restrictions should be either time limitations, or pricing restrictions in higher density zones. It would be prudent to conduct a study for a viability of a centralised multistorey car park that could be embedded in the urban infrastructure and in the City's ownership, versus unrestricted on-street parking.

Reduced car parking provision cannot be implemented in isolation – adequate infrastructure for active transport and public transport should be implemented as viable alternative. Furthermore, appropriate land use mix simply increases the convenience and attraction of functional walking and cycling while decreasing convenience of use of personal vehicles.

6.4 Provisions for Micromobility Vehicles

Micromobility (or Micromobility Vehicles) refers to a range of small, lightweight vehicles operating at speeds typically below 25 km/h and driven by users personally, which may or may not be battery-assisted. Therefore, this broad term encompasses bicycles, e-scooters, e-bicycles, cargo bicycles, skateboards, roller skates, mobility assisting vehicles etc.

Given the intent of the proposed development, further design development should consider the requirements of micromobility vehicles on key shared paths and provide a design outcome that is suitable for all ages and all abilities.

Some key points to be considered in further design development are as follows:

a. Path gradients and connections to the external network

Although there is a general recommendation that paths should not be steeper than 5%, AS1428 recommends that 2.5% should not be exceeded to ensure that the paths are accessible to all users (if the terrain permits).

Connections to the external network, appropriate ramps and crossings should be designed and constructed not to feature abrupt grade changes. Vehicles such as scooters and skateboards have small, dense wheels and low ground clearances; therefore, abrupt grade changes and uneven surfaces can jolt the rider of a device.

b. Parking/charging spaces

Parking areas should be placed in the vicinity of rest and play areas. While bicycle parking is the first form of parking for micromobility vehicles that comes in mind, parking areas for scooters and skateboards should be considered. These can be simple wide, paved areas where riders can store their devices while resting. Alternatively, devices are likely to be left on the path, creating obstructions for other visitors. With the rise of battery-powered and electric devices, it would be prudent to consider locations for device charging, should space allow it.

c. Appropriate width of circulation spaces (paths and other spaces not dedicated to play, rest and high-skill-level recreational activities)

The figure below shows components of bikeable width, as recommended by NACTO. Although this figure pertains to one-directional bikeway, we believe that the consideration is appropriate. NACTO recommends the approach below for bikeways, which must accommodate commuter and recreational traffic. Recommended NACTO ***bikeable width*** for two-way paths, located away from busy thoroughfares, is 2.8m-3.4m for paths where a cargo bike can be expected.

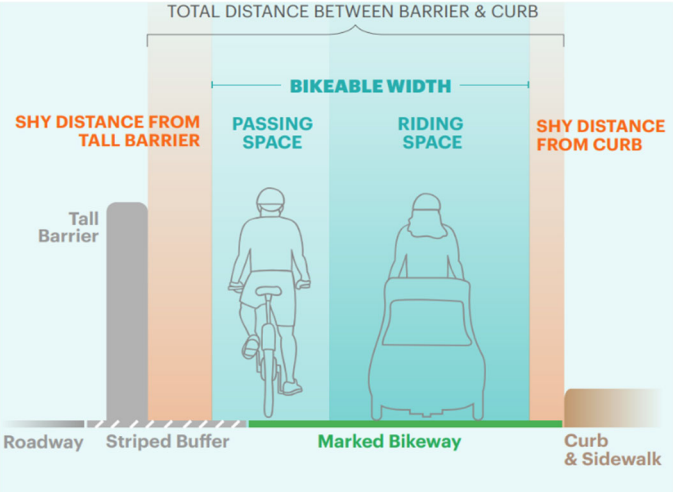


Figure 21 - Considerations for bikeway (source: NACTO)

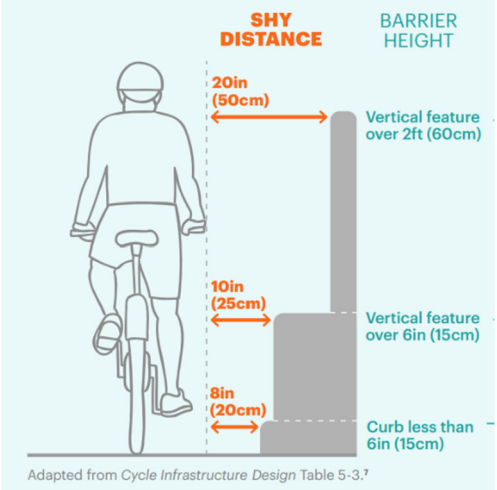


Figure 20 - Shy distance (Source: NACTO)a

In addition to the bikeable width, ***shy distance*** (distance from a vertical obstacle deemed unrideable) must be considered as well. Shy distance depends on the side barrier and can range from 0.2m to 0.6m.

Department of Transport echoes these guidelines and provides clear guidance on vertical clearances, which should be observed when designing paths travelling under structures and vegetation.

Based on the information above, the minimum shared path width should be from 3.2m to 4.0m, depending on the type of vertical obstacles adjacent to the path.

NACTO guidelines align fairly well to the Austroads Guide to Road Design, Part 6A: Paths for Walking and Cycling recommendations, as shown in Figure 22. A typical bike rider requires a 1.0m x 2.5m operating envelope.

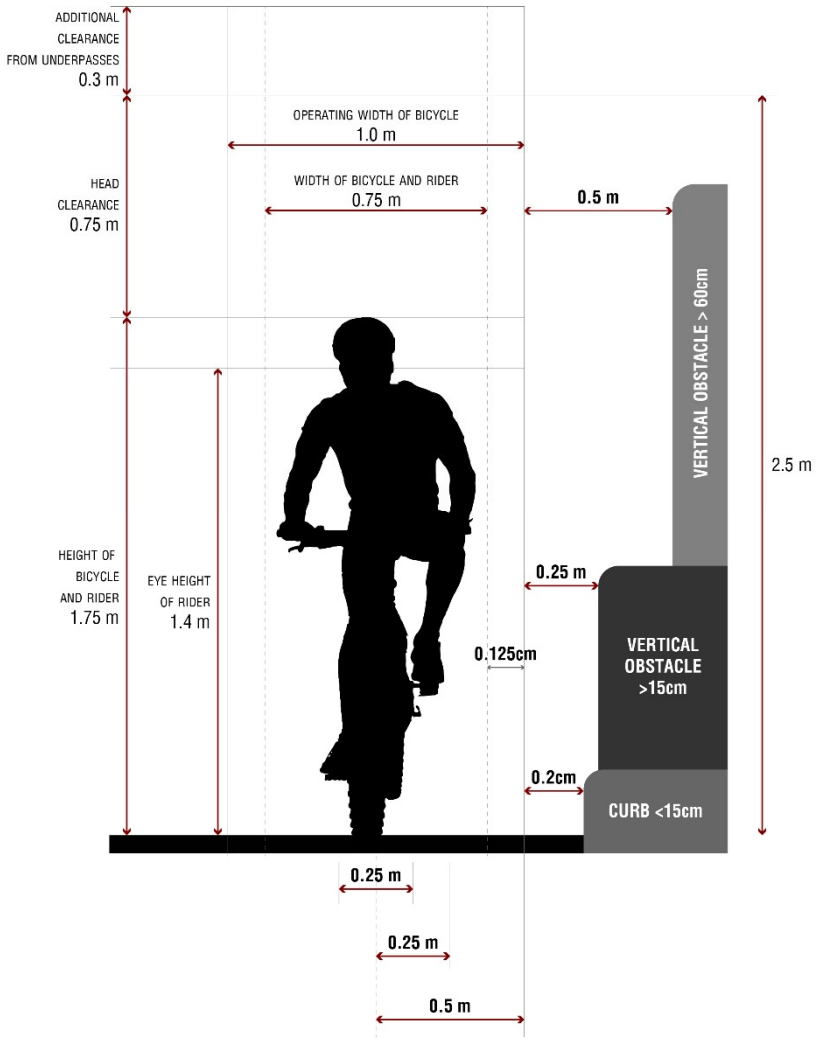


Figure 22 - DoT - guidance on vertical clearances and bike-rider operating envelope (source: DoT)

	Suggested path width (m)		
	Local access path	Regional path[3]	Recreational path
Desirable minimum width	2.5	3.0	3.5
Minimum width – typical maximum	2.0[1] – 3.0[2]	2.5[1] – 4.0[2]	3.0[1] – 4.0[2]

Figure 23 - Austroads recommendations on the width of shared paths (source: GtRD6A)

d. Shared micro-mobility schemes

Potential micro-mobility share schemes can be considered given a significant residential component in this development. The residents can be offered access to shared pool of electric bicycles, scooters or other devices. Charging / docking stations should be strategically placed and easily accessible to the residents. Furthermore, synergies can be explored between the railway station and future local businesses, or other non-residential land uses. Availability of a shared micromobility vehicle at the train station and ability to dock or charge the same vehicle at the destination point (commercial or communal hub) is likely to encourage the use of micromobility devices.

6.5 Impact of Community Severance on General Wellbeing

Soldiers Road/Paterson Road north-south corridor is and is intended to remain one of the most important links in the MDSP24 area. At present, alongside this corridor is a rail line currently servicing inter-city passenger rail and freight rail. As a result of this, the MDPS24 area at present features several at-grade crossings.

Previous studies have determined that with the increased population, motor traffic demand and introduction of METRONET line, criteria for grade separation of crossings are likely to be met. As previously discussed, the freight rail is intended to be realigned to the western side of the Tonkin Highway extension, outside of the future urban core. The revised MDSP24 plan proposes only one railway station, at Whitby, that will become the new rail terminus. The rail line south of Whitby will service only inter-city (Perth-Bunbury) passenger rail with anticipated four (4) daily movements; therefore, only the existing crossings north of the future railway station are likely to meet warrants for grade separation with this new proposal.

Previous iterations of the MDSP24 indicated that road-over-rail grade separation is contemplated, however the revised MDSP24 plan shows preference for rail-over-road separation in efforts to avoid future community severance and its by now well documented ill effects.

Community severance occurs when fixed obstructions, such as high traffic volume roads, railways or rivers bisect a community preventing cohesion and disrupting mobility patterns, access to essential services and social networks. Reduction in social contact has been linked with higher mortality and poorer health, particularly with elderly and otherwise disadvantaged people, decline of mental health and development of unhealthy behaviours. Severance increases car-dependency and can limit access to some essential services, schools, parks, recreation facilities and commercial centres. Decline in children's independent mobility as a result of severance was also documented as parents do not feel comfortable allowing children to travel unescorted by any means of public or active transport. Apart from eroded self-esteem, reduction in basic activity leads to increased obesity levels and general health decline.

Therefore, as a matter of utmost priority, at ground connections must be maintained wherever possible.

This principle seems to have been strongly acknowledged in the recent Armadale Line upgrade project, where the rail line is to be reconstructed over the existing road network (as a result of grade separation requirements), and the ground connections are maintained where possible and enhanced, in particular for pedestrians and other active transport users.

Figure 24 - "Long Park" under the Armadale Rail Line (source: METRONET)

Figure 25 - Fitness Park - Armadale Rail Line upgrade (source: METRONET), artist impression

6.6 Crime Prevention Through Environmental Design (CPTED)

CPTED is the application of best practice principles and processes to design the built environment to minimise crime and fear of crime for enhanced community safety.
While different entities set out basic principles of CPTED, the four most common principles are:

- **Surveillance** – active and passive surveillance make people feel safer in public space.
- **Territorial Definition** – clear separation of private and public space and encouragement of the community to take ownership of the public space.
- **Access Control** – delineation of movement for different road users and precinct visitors.

- **Space Management** – activation of space, co-location of appropriate urban furniture encouraging compatible activities that mutually enhance safety, maintenance of public space.

The design of buildings framing the public space will contribute to Surveillance and Territorial Definition principles. The design should consider active ground floor frontages that attract and stimulate flow of pedestrians and simultaneously provide human presence and eyes-on-the-street level of passive surveillance. Residential and commercial land uses above the ground floor should allow for balconies and windows overlooking public spaces, particularly pedestrian promenades.

These principles are in particular relevant in the Activity Centre areas and in the vicinity of the future Railway Station Precinct. Mix of land use and attraction of a wide spectrum of patrons/visitors/residents to the area would further solidify perception and subjective feelings of safety in public spaces.

6.6.1 GENERAL RECOMMENDATIONS FOR THE DEVELOPMENT OF PEDESTRIAN REALM AND ACCOMMODATION OF ACTIVE TRANSPORT OPTIONS

Feelings of safety and comfort are a basis but, on its own, insufficient for an attractive public realm that is desirable for pedestrians (residents, workers, visitors, patrons). To provide general advice on the creation of an attractive public realm, we chiefly rely on two basic systems – Movement and Place and Healthy Streets.

Movement and Place system generally classifies streets and roads based on their predominant function (current and/or targeted) in the network of public spaces. While Austroads developed preliminary guidelines addressing Movement and Place Framework, Transport for New South Wales (TfNSW) has the furthest developed framework at this stage. While WA version is underway, we will briefly touch on TfNSW version of Movement and Place.

This document sorts the roads, streets and public places into four broad categories: Main Roads, Main Streets, Local Streets and Civic Spaces.

Each of these categories is further developed and refined into specific road/street/space categories with particular design and function characteristics. Most of the streets within the Structure Plan area can be classified as Main Streets and Local Streets, with some segments being Civic Spaces. Most of what we could classify as Main Roads are located around the fringe of the subject site with potentially Soldiers Road/Paterson Street spine and East-West Link being classified as Main Roads, depending on the final land use distribution (the reasonable consideration should be given to Principal arterial, Transit Street and Arterial High Street options, per graphs below).

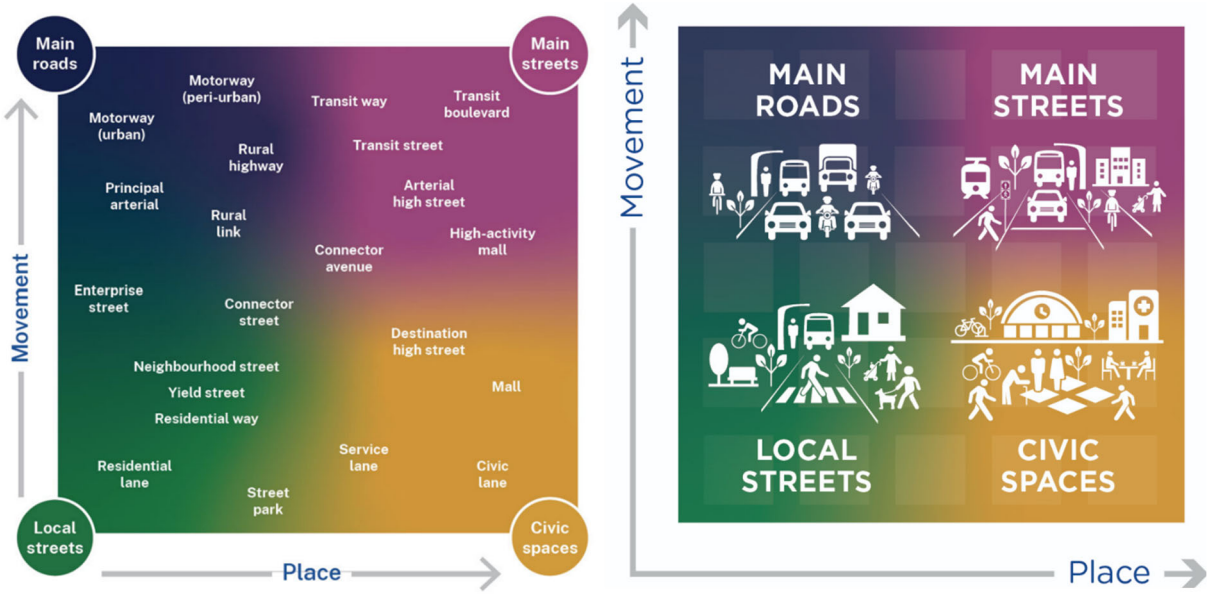


Figure 26 - Movement and Place TNSW framework

Connector Streets (Neighbourhood Connector A) provide connections for all modes of transport to the existing network. While they should not encourage dwelling, the environment should be safe and pleasant, accommodating pedestrian movement. Some of the connector streets should have dedicated cycling facilities (where traffic volumes are expected to exceed 3,000 vehicular movements per day), while others can facilitate on-road cycling with low operating speed.

The key links in the District Centre have a potential to be developed as Destination High Streets. Such street offers active frontages and a variety of commercial land uses that are attractive to pedestrians (retail, hospitality and similar). Provision of generous pedestrian space that is well sheltered from elements accentuates the intent to invite and retain people in this space. Such roads can carry high volume of motorised traffic as long as the traffic is slow-moving and appropriate buffer zones (greenery, on-street parking etc) are provided between moving traffic and pedestrian movement.

Cycling movement should be provided for in separate lanes; however, if the operating speed is kept to 30km/h, bicycles can use the carriageway with motorised traffic. In this case, appropriate ramps should be provided to enable cyclists to reach bicycle parking racks safely and conveniently.

Figure 27 - Healthy Streets Ltd identified 10 key indicators that can be used to assess existing and proposed streets and to guide public realm development.

On-street parking should be time-limited, discouraging people from taking up parking space for more than 1 hour. Parking bays should not interfere with pedestrian crossing points or obstruct sight lines on crossovers.

Created roadways in the Structure Plan need to be "fit for human consumption", meaning they need to be stimulating and safe for active transport (pedestrians, cyclists, micro-mobility users). Overreliance on motorised transport, in particular personal vehicles, has resulted in growth in obesity and related illnesses to the extent that has become a global public health issue.

With more than 50% of global population living in cities, and the percentage constantly increasing, it is of paramount importance to create urban environments that will be as healthy as possible and promote appropriate levels of physical activity on a daily level. With this purpose, the Healthy Streets system was developed comprising 10 key indicators that can be used to assess existing and proposed streets and to guide public realm development.

While at a more detailed stage, a full assessment can be undertaken, at this high level of planning, the following elements of the indicators should be considered:

1. **Everyone feels welcome**

Streets must be welcoming places for everyone to walk, cycle, spend time and engage with other people. Paths should aim to have a clear 1.5m width, free of obstacles (such as advertising signs, street furniture, alfresco area, display stalls etc). This width allows two people to walk side by side and converse, a person moving in a wheelchair to bypass another pedestrian or parent with a pram to walk holding another child by the hand.

2. **People choose to walk and cycle**

Attractive public realm favours walking and bicycling over motorised transport as this in turn reduces air and noise pollution while it is very beneficial for social cohesion and stimulating for the local economy. Furthermore, the combination of land uses should be conducive to active transport – a number of attractive locations in bikeable/walkable distance will make walking and bicycling more attractive and convenient than travel with passenger vehicles. The precinct would benefit from low operating speeds (30km/h or less) and convenient and abundant bicycle parking.

3. **Easy to cross**

Pedestrian crossings connect the precinct and make it accessible to all visitors; therefore, pedestrian crossings should be located on pedestrian desire lines and be step-free. The width of the crossing should accommodate movement groups of pedestrians, micro-mobility riders and persons with impaired mobility. Minor crossings should be minimum 4m wide, while larger crossings (for example in front of the shopping centre) should be minimum 6m wide.

4. **Shade and shelter**

Shade and shelter encourage pedestrians to use the public realm regardless of weather conditions. Awnings, colonnades, bus shelters are some of the examples of shade and shelter that can be considered further in the design; however, the primary consideration should be given to mature vegetation.

5. **Places to stop and rest**

Regular opportunities to stop and rest are essential to some of the pedestrians, particularly elderly people and people with impaired mobility. Such places should be equipped with street furniture allowing rest and recuperation (such as benches, seats, water fountains etc.). This type of street furniture can be designed to visually enhance the public realm. Furthermore, these spaces allow residents and regular visitors to have brief interactions with each other, creating and solidifying social connections.

6. **Clean air**

The first step in reducing pollution and maintaining appropriate air quality is discouraging people from using motor vehicles for short trips. A public realm that is conducive to walking, cycling and use of micromobility devices will automatically discourage excessive use of passenger vehicles. Access to heavy vehicles should be limited to delivery vehicles only.

7. **Not too noisy**

Noise from motor vehicles can seriously impact residents' and visitors' physical and mental health. Restriction of speed limit and vehicular movements will greatly contribute to keeping the noise at acceptable levels. Heavy vehicle access should be restricted to delivery, service and emergency vehicles.

8. **People feel safe**

In addition to the safety aspects discussed above, pedestrians and cyclists must be safe from collisions with moving passenger vehicles. The threshold speed where the survivability of vulnerable road users (pedestrians, cyclists, micro-mobility users) rapidly declines in collision with motor vehicles is 30km/h. It is advisable to keep the speed of motor vehicles at 30km/h or below on carriageways. Operating speed in shared areas should be restricted to 10km/h or below.

9. **Things to see and do**

Street environment should be visually appealing and stimulating for pedestrians. While presence of public art and various amenities are important, stimulating street environment firstly comprises active frontages offering variety of experiences and attracting wide range of patrons.

10. People feel relaxed

Well-proportioned and well-maintained spaces tend to make people feel less anxious and unsafe. Such places are seen as attractive by others, and genuinely attract people as visitors and patrons. People want to be where other people are, and where they feel comfortable spending time.

Figure 28 - Water HQ - Armadale Rail Line upgrade (source: METRONET), artist impression

7. CONCLUSION

- The Mundijong District Structure Plan 2024 (MDSP24) aligns with the Perth and Peel @ 3.5 million Sub-regional Planning Framework, promoting higher densities and sustainable development. It anticipates a population of 58,250 across 20,367 dwellings, an increase from previous projections of 40,000 residents and 15,300 dwellings.
- The MDSP24 is aligned with critical external transport projects, including the Tonkin Highway extension, freight rail realignment, and passenger rail extension, all aimed at enhancing connectivity and supporting town centre development.

  Shifting the freight rail corridor on the western side of Tonkin Highway extension to support town centre development, likely within 10 years. The revised MDSP24 plan proposes only one railway station, at Whitby, that will become the new rail terminus. The re-alignment of the freight rail and the removal of the second station in Mundijong will result in only four train movements per day. Additionally, there will be no need for grade-separation south of Whitby station.
- Population triggers will guide the timing of infrastructure implementation, with detailed staging to be addressed in Local Structure Plans.
- Traffic generation analysis estimates 256,347 daily vehicle movements, including 23,994 trips during the AM peak and 28,211 during the PM peak. The future train station is expected to generate 3,500 daily trips, partially included in the MDSP24 traffic generation.
- The Aimsun Next 2024 model was used to evaluate traffic impacts, identifying necessary road and intersection upgrades. The proposed road classification reflects minimum geometric requirements accommodating traffic demand, per Liveable Neighbourhoods guidelines, with flexibility to adapt road widths to accommodate other requirements.
- Pedestrian paths are planned for all roads, with shared paths or cycling lanes on roads higher than access classifications.
- Other recommendations include prioritising active transport, incorporating safe routes to schools, and balancing car parking with demand. Provisions for micromobility, CPTED principles for safe public spaces, and integration of active transport aim to create a connected, inclusive environment.
- Road safety measures focus on reducing risks at rail crossings, managing parking, and encouraging sustainable transport habits.

APPENDICES

APPENDIX A

DISTRICT STRUCTURE PLAN AREA

APPENDIX B

TRANSPORT PLANNING AND TRAFFIC PLANS