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VIMG

Lancelin South - Structure Plan Amendment
Transport Impact Assessment

Lancelin, WA

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Project Code: 08974

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Version Control and Approval

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1 Introduction

1.1 Executive Summary of TIA

1.1.1 General

In accordance with WAPC *'Guidelines for Transport Impact Assessment (TIA) Guidelines: Volume 2 – Planning schemes, structure plans and activity centre plans'*, this report sets out the details of an amended structure plan development set within the existing Lancelin South Structure Plan area located to the south-east of Lancelin and west of Karakin, WA.

This 'Structure Plan' TIA report is based on an amended layout and yield for the entire Lancelin South area. There is an existing approved Lancelin South Structure Plan (WAPC Ref: SPN-0285_2011 - June 2011) which is intended to be superseded by this new Structure Plan Amendment application.

This TIA addresses the key transport issues and impacts related to the current development proposal at the site from a residential, commercial and community perspective including a future planned industrial area to the north of Lancelin Road. The current and future level of accessibility by road, public transport, cycle and on foot has been reviewed and assessed by this report and sets recommendations to explore the potential for improving these to a suitable level where required and appropriate.

1.1.2 Background and Proposal

This TIA supports the proposed Lancelin South Structure Plan Amendment, being a long-term (20–25 year) growth area bounded by Lancelin Road (north), Indian Ocean Drive (east), and Old Ledge Point Road (west/south), with an ultimate residential yield of approximately 7,000 lots plus supporting land uses (including local and neighbourhood centres, four Primary Schools, one High School, community uses and an industrial area north of Lancelin Road).

The surrounding road network currently operates in a high-speed rural environment, with historic five-year crash records identifying a recurring right-turn / give-way crash pattern at the Indian Ocean Drive / Lancelin Road uncontrolled (give-way) intersection (including a fatal crash and hospitalisation crashes).

The existing Lancelin South Structure Plan was originally approved by the WAPC in October 2007 and was subsequently modified in September 2013 through adoption of a revised structure plan by the Shire of Gingin, which now forms the basis for the current structure plan amendment application. Importantly, the approved revised structure plan already provides for a direct road connection to Indian Ocean Drive in addition to access via Lancelin Road, reflecting the long-standing strategic intent to support the orderly staging, accessibility and long-term growth of the Lancelin South urban expansion area.

1.1.3 Assessment Approach and Design Horizon

The assessment includes future transport network planning, access arrangements, and SIDRA intersection capacity testing to the Ultimate 2051 design year, focusing on three key intersections:

- **Indian Ocean Drive / Lancelin Road Intersection:** (future dual-lane roundabout scenario)
- **Indian Ocean Drive / Site Access Road Intersection:** (priority-controlled "seagull" type arrangement with safety constraints)
- **Lancelin Road / Site Access Intersection:** (busiest of the new Lancelin Road access intersections)

1.1.4 Key Findings (Traffic Operations – Ultimate 2051)

Across the three assessed intersections, SIDRA outputs indicate acceptable operational performance in both AM and PM peak periods, with manageable queues and delays. The highest loaded location at the 2051 horizon in terms of traffic volume is the Indian Ocean Drive / Lancelin Road roundabout (planned Main Roads WA upgrade), particularly in the PM peak, operating at the upper end of comfortable capacity but still acceptable.

Indian Ocean Drive / Lancelin Road (Main Roads WA planned future roundabout)

- **AM Peak:** Performs within acceptable criteria on Indian Ocean Drive and on Lancelin Road, with 65% of theoretical capacity used and 50 m (7 vehicles) 95th percentile queues on Lancelin Road.
- **PM Peak**: Performs within acceptable criteria on Indian Ocean Drive and on Lancelin Road, average delay 23 seconds, with 84% of theoretical capacity used. Iterative testing identifies the roundabout is materially helped by a free-flowing northbound left slip lane to remove a high-volume movement from circulation.

Indian Ocean Drive / Site Access Road (priority-controlled T-intersection within Previously Approved 2013 Structure Plan)

- **AM Peak:** Performs within acceptable criteria on Indian Ocean Drive and on the site access road, average delays of 15 seconds and 95th percentile queues 110 m (16 vehicles) on the access road with overall 88% of theoretical capacity used.
- **PM Peak:** Performs within acceptable criteria with average delay 9 seconds on the access road and queues of 13 m (2 vehicles) and overall 50% of theoretical capacity used.
- This future site access intersection onto Indian Ocean Drive helps to disperse the structure plan generated traffic demands across the planned road network, building resilience across the network and helping to alleviate the operational demands on what would otherwise be the sole future Indian Ocean Drive / Lancelin Road roundabout. It also provides more direct access to the High School

District Open Space for people travelling from the south, as well as a more direct connection to the beach node and beach access.

- This intersection will provide a means of access across the structure plan area linking to Old Ledge Point Road and providing an alternative emergency Bushfire Access to/from Lancelin. Currently there is only one way into and out of Lancelin via Lancelin Road.
- The project team is supporting a give-way controlled intersection for this secondary access because the following key design features will maximise safety in this location, over current conditions at the Lancelin Road intersection:
  - removing the southbound right turn conflict point from Indian Ocean Drive into the structure plan area (southbound right turns from the north to the structure plan area are adequately catered for at the Lancelin Road roundabout intersection).
  - Two stage right turn movements out of the site access to Indian Ocean Drive southbound (across a wide median island)
  - A southbound right-turn acceleration lane for vehicles exiting the site access road to Indian Ocean Drive which is unopposed by southbound vehicles, merging into two southbound lanes over the length of 750m.
  - reduced 70km/hr speed zone (from current 90km/hr) on Indian Ocean Drive on each approach to the intersection.
  - permanent maximum 50km/hr speed zone on site access (side) road.
  - Intersection designed in accordance with Austroads Guidance and MRWA Guidance.

These intentional design measures help to mitigate the safety issues that have been identified at the current uncontrolled Lancelin Road intersection. Reduced vehicle speeds and removing one of the critical right turns from Indian Ocean Drive, helps to reduce exposure to high energy impacts.

Lancelin Road / Site Access (busiest new access intersection)

- **AM Peak:** Performs within acceptable criteria with spare capacity at around 25% of theoretical capacity used.
- **PM Peak:** Performs within acceptable criteria with spare capacity at around 16% of theoretical capacity used.

1.2 Key Recommendations (from this TIA)

1 **Existing Crash-Risk Mitigation at Indian Ocean Drive / Lancelin Road Intersection (pre-upgrade to roundabout):**

In response to the documented right-turn crash pattern (including fatal/hospitalisation crashes), it is recommended that given this is a Main Roads WA road, that Main Roads explore interim treatments to reduce the likelihood/severity of future crashes, e.g. improving the operation of northbound variable speed signs so reduced speeds are triggered when vehicles are in the southbound right-turn lane, not only by side-road activation.

This is recommended in the short to medium-term prior to the future upgrade of this intersection to a dual lane roundabout. Currently, there is no confirmed timing or funding for the construction of the planned roundabout.

2 **Speed Management (Safe System) Along the Structure Plan Frontage:**

- **Indian Ocean Drive:** Recommend a permanent reduction to maximum 70 km/h (currently high speed 90km/h) on approaches to both the Lancelin Road intersection and the site access intersection at Indian Ocean Drive, to improve safety and compliance in a higher-turning environment.
- **Lancelin Road:** Recommend a permanent reduction to maximum 60 km/h along the structure plan frontage due to the introduction of seven new priority-controlled access intersections and increased turning activity.

3 **Intersection Sight Distance Verification at Later Planning Stages:**

While a desktop review indicates general compliance, it is recommended that detailed sight distance investigations for the proposed access intersections be completed at subsequent design/subdivision stages.

4 **Indian Ocean Drive / Site Access Road Intersection Turn-Lane Treatments:**

Based on Austroads guidance and predicted turning volumes, CHR with CHL preference (Channelised Right Turn with Channelised Left Turn) is recommended at this stage of planning for the priority-controlled T-intersection on Indian Ocean Drive (subject to detailed design and MRWA approvals).

5 **Lancelin Road Access Intersection(s) Turn-Lane Treatments:**

Similarly, it is recommended that CHR and CHL treatments be incorporated into future Lancelin Road site access intersections (south side residential area and north side industrial area), subject to detailed design and Shire approvals.

6 **Road Hierarchy Upgrades to Support Access and Movement:**

- Upgrade Lancelin Road to an Integrator B standard.
- Upgrade Old Ledge Point Road to a Neighbourhood Connector A standard (or similar).
- For the new Lancelin Road site access intersections, this TIA recommends an Integrator B road reserve cross section for Lancelin Road with an indicative 26 m reserve width and a minimum 6 m central median, facilitating two-stage right turns.

7 **Active Transport Network and Priority at Side Roads (Shared Paths):**

To support safe and convenient walking and cycling across the entire Lancelin South structure plan area, it is recommended that an extensive, connected network of off-road shared paths (Dual Use Paths) be delivered in accordance with the WA Department of Transport's *Planning and Designing for Bike Riding in Western Australia* guidance, with particular emphasis on route continuity, legibility and safety at conflict points. This network should include:

- **Lancelin Road Dual Use Path (Primary Route):** Provide an off-road Dual Use Path along Lancelin Road consistent with the RLTCN functional hierarchy, forming a Proposed Primary Route to facilitate east–west movement, connect residential neighbourhoods to the General Industrial area, and provide a strategic active-transport link toward the broader Lancelin township.
- **Neighbourhood Connector Routes (Local Routes):** Ensure all Neighbourhood Connector roads incorporate a Dual Use Path on at least one side with a minimum width of 2.5 metres, forming Proposed Local Routes that provide direct and safe access to schools, local centres, public open space and community facilities, and promoting everyday active travel.
- **Priority across side roads and intersection treatments:** Where these key shared path routes cross minor side-road intersections, provide standardised cyclist and pedestrian priority (where appropriate and safe), so that the shared path network remains continuous and attractive, and so conflict risk at side roads is reduced.
- **Future links to coastal and conservation areas:** Safeguard and progressively deliver additional walking and cycling links to coastal access points, conservation areas and recreation nodes, supporting both daily and leisure-based trips and strengthening the overall passive recreation network.
- **Landscape Boulevard Streets:**

  Landscape Boulevard Streets are proposed in two locations within the structure plan area and they are intended to connect the areas of natural amenity at their eastern and western extents and encourage walking and cycling trips.

These recommendations are intended to create a coherent site-wide active transport system that is safe, equitable, continuous and intuitive, reducing severance from side roads, improving access to key destinations, and supporting mode shift away from short vehicle trips within the structure plan area.

8 **Pedestrian Crossing Safety on Higher-Order Internal Roads:**

For the network of Neighbourhood Connector A roads across the structure plan area, it is recommended that pedestrian refuge islands be provided at pedestrian crossing points at intersections.

9 **Public Transport Safeguarding (future-proofing):**

To protect for possible future bus route modifications and stop locations across the structure plan area and as Lancelin grows, internal roads intended to support buses should provide Public Transport Authority (PTA's) required 3.5 m wide lanes in each direction (or 3.2m wide minimum lanes with a >1m wide median) and typically ≥20 m road reserves, consistent with PTA needs for bus operations. Note also that a 3.5m wide lane kerb-to-kerb should be avoided where possible to prevent cyclists from being placed in a 'squeeze zone' amongst vehicles.

10 **Roundabout Performance Safeguard (Ultimate 2051):**

The future Indian Ocean Drive / Lancelin Road roundabout design should incorporate a free-flow northbound left slip lane into Lancelin Road, which materially improves PM peak intersection performance and supports acceptable operations to the 2051 horizon.

This TIA has been prepared with sufficient detail and analysis to support an amended structure plan application for residential, commercial, community and industrial land uses based on the proposed configuration of the structure plan area, including the public open space and the network of lower order roads throughout the site.

This Structure Plan TIA also acknowledges the potential future modifications to the surrounding transport networks including State Government projects and initiatives such as Main Roads WA's Indian Ocean Drive Planning Study which doesn't commit to construction yet, but outlines potential future upgrades to Indian Ocean Drive between Yanchep and Lancelin, including:

- Upgrading the route to a dual carriageway featuring a 14 m wide vegetated median, with options for narrower medians and concrete barriers in constrained areas.
- Intersection treatments at 18 junctions along the corridor, these range from roundabouts (e.g., at Lancelin Road and Barragoon Road), 'seagull' intersection configurations and left-in/left-out or relocated T-intersection treatments.
- Access consolidation: Main Roads proposes reducing direct driveway access and encouraging shared access points or secondary roads to improve safety and traffic flow.

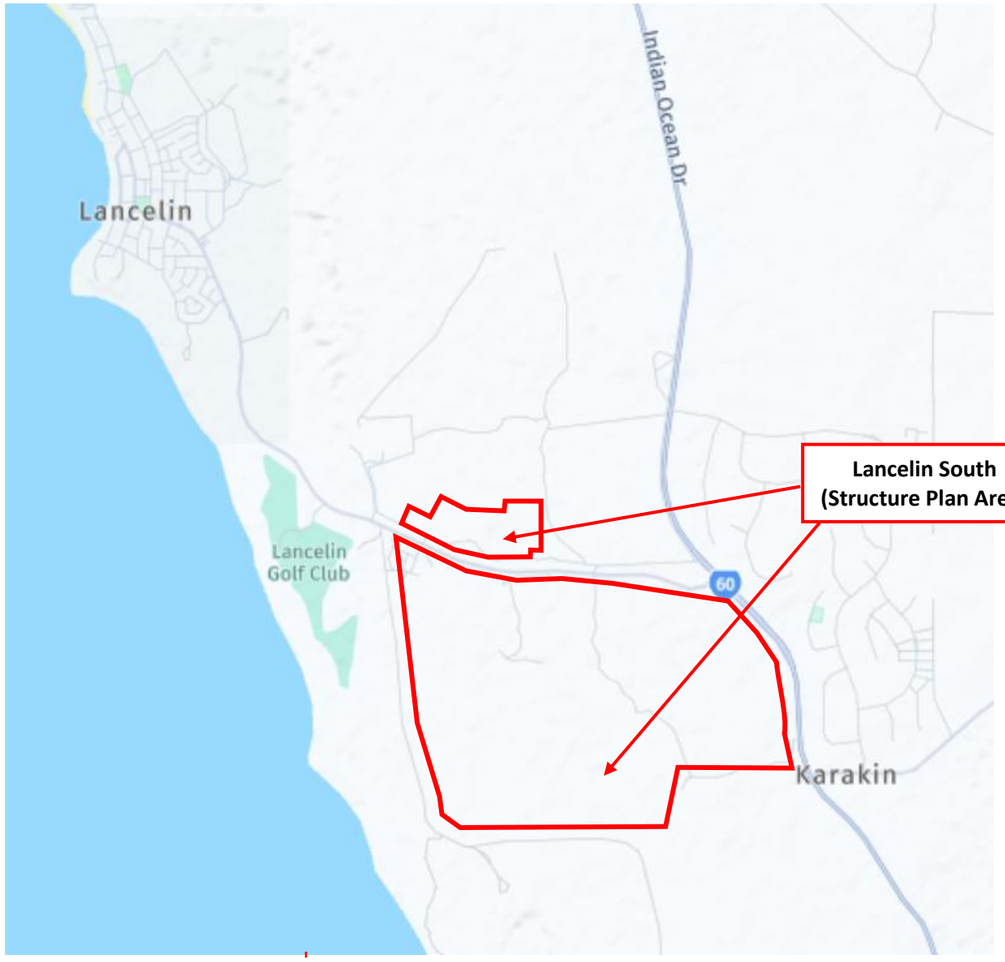
This Structure Plan TIA ultimately demonstrates that the future road network and its proposed intersections are capable of satisfactorily supporting the additional vehicular traffic expected to be generated by the entire structure plan area at the 2051 design horizon.

1.3 Background

PJA has been commissioned by CLE Town Planning & Design on behalf of VIMG Pty Ltd to prepare this Structure Plan TIA for the proposed amendment of the Lancelin South Structure Plan area, located to the south-east of Lancelin and west of Karakin, within the Shire of Gingin Local Government Area (LGA) of Western Australia. The location of the amended structure plan area, in relation to the wider Lancelin area and the immediate surrounding road network is shown in **Figure 1-1 .**

Reference to the existing Lancelin South Structure Plan, approved by the Western Australian Planning Commission (WAPC), upon which this structure plan amendment builds from is given in Section 1.4 of this report.

Figure 1-1: Site Location – Amended Structure Plan Area



Source: Nearmap

The proposed structure plan area is a brownfield site (vacant bushland), located approximately 7km south-east of Lancelin and 120km north of Perth. The boundaries of the structure plan site comprise of Lancelin Road (north), Indian Ocean Drive (east), Old Ledge Point Road (west and south).

1.4 Existing Lancelin South Structure Plan (WAPC Approved Ref: 803-03-08-0004p)

History and Context:

The existing Lancelin South Structure Plan (and Outline Development Plan) was originally approved by the WAPC on 2 October 2007, with a date of expiry of 19 October 2035

In September of 2013, the approved structure plan was further modified to incorporate a 'Revised Structure Plan' as adopted by Shire of Gingin Council on 18 June 2013, superseding the Lancelin South Structure Plan (June 2007).

On 18 June 2013, Council considered a report titled 'Lancelin South Balance Rezoning Scheme Amendment Request' which sought to initiate an amendment to rezone the balance of the land subject to the Lancelin South Structure Plan (LSSP) and adjacent land for the purposes of future urban development. The purpose of the report was to supersede the LSSP dated June 2007 with a revised Structure Plan and update the LSSP document, leading to the approval in September 2013.

As part of this approval, the modified structure plan included the 'Revised Structure Plan' and the superseded 'Lancelin South Structure Plan' (Figure 13) at the front of the document for ease of comparison. This clearly shows the difference between the previous structure plan (2007) and the modified and approved structure plan (2013). The modified structure plan also included placing a watermark on existing document (Figures 13-21) which states "Design superseded by revised Structure Plan adopted by Council 18 June 2013". This modified structure plan is the basis upon which all subsequent subdivision applications are based and is the basis for the current amendment application to the structure plan (the subject of this TIA report).

The Lancelin South Structure Plan and Outline Development Plan is a strategic planning document prepared to support the long-term southward expansion of Lancelin as a major local centre in the Shire of Gingin. Its core purpose is to justify rezoning land at Lancelin South from rural uses to an Urban Development framework, while also establishing an Outline Development Plan (ODP) to guide future subdivision and development. The report explains that Lancelin is expected to grow significantly, with strategic planning anticipating a population of 5,000 to 10,000 people by 2031, and that expansion to the south is considered the only practical direction due to physical and environmental constraints elsewhere. The structure plan area is about 538 hectares, with the initial ODP and first stage covering about 120 hectares.

Direct Vehicle Access to Indian Ocean Drive:

The 'Revised Structure Plan' includes a direct road connection to Indian Ocean Drive giving access to/from the structure plan in addition to access via Lancelin Road. The direct road connection to Indian Ocean Drive is a key feature of the approved Lancelin South Structure Plan. The plan shown below at Figure 1-2 is extracted from the approved Lancelin South Structure Plan and clearly shows a direct road connection to Indian Ocean Drive which has been approved and endorsed by the Shire or Gingin and the WAPC at the structure plan level.

Figure 1-2: Approved 'Revised Structure Plan' with Direct Road Connection to Indian Ocean Drive

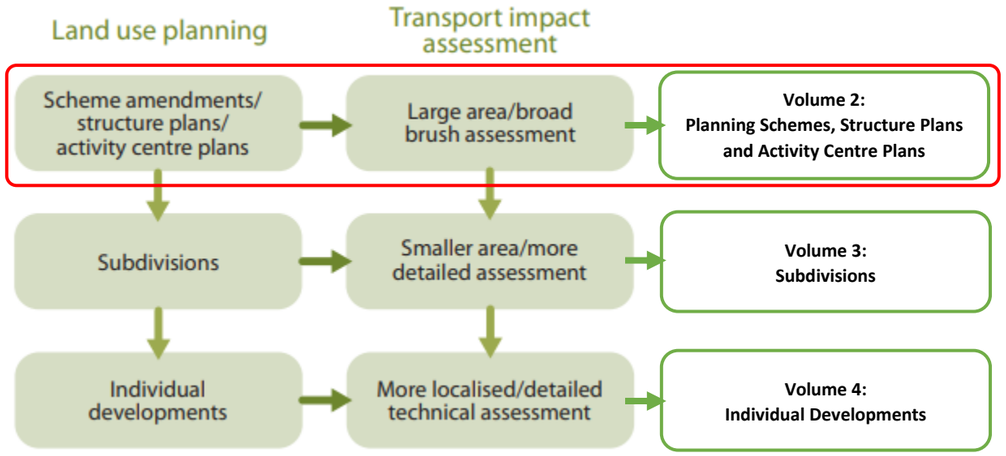
A strong design theme throughout the document is creating a connected and distinctive coastal community. The plan emphasises defined residential precincts, a legible road hierarchy, pedestrian and cycle links, coastal access, and a broad public open space network built around dune landforms and landscape features. Major parks, smaller local parks, linear parks and green spines are intended to support recreation, visual amenity and movement, with landscape elements such as a central park, lookout points, walking trails, interpretive signage and public art helping create local identity. The document also addresses bushfire management, requiring strategic firebreaks, protection zones and building standards for lots adjoining bushland.

Overall, the document concludes that Lancelin South is intended to provide the land and planning framework needed to secure Lancelin's long-term growth and sustainability. The structure plan is supported by the strategic planning framework, can respond to identified environmental and servicing constraints, and will deliver new housing, jobs, community facilities and urban infrastructure in an orderly, staged way through the various stage of the planning process.

1.5 Purpose of a Transport Impact Assessment

The planning system in Western Australia stipulates that all developments go through a process of stages to ensure that the statutory planning is consistent with the strategic planning. A more detailed assessment of the transport networks for developments is required within the land use planning stages. The Western Australian Planning Commission (WAPC) guidelines for a TIA shows the level of detail required at each stage as shown in **Figure 1-3**.

Figure 1-3: WAPC Land Use / Transport Planning Process



Source: Western Australian Planning Commission (WAPC)

The proposed development is at the structure planning stage meaning a large area/broad brush assessment of transport implications is required. As shown in the figure above, WAPC have a series of volumes specific to each planning stage. As outlined in the WAPC guidelines, the structure planning assessment is the first stage of the land use/transport impacts process. It provides broader detail over a larger area compared to a subdivision assessment, for both the land use and transport proposals.

The key components of a TIA for a structure plan, are to:

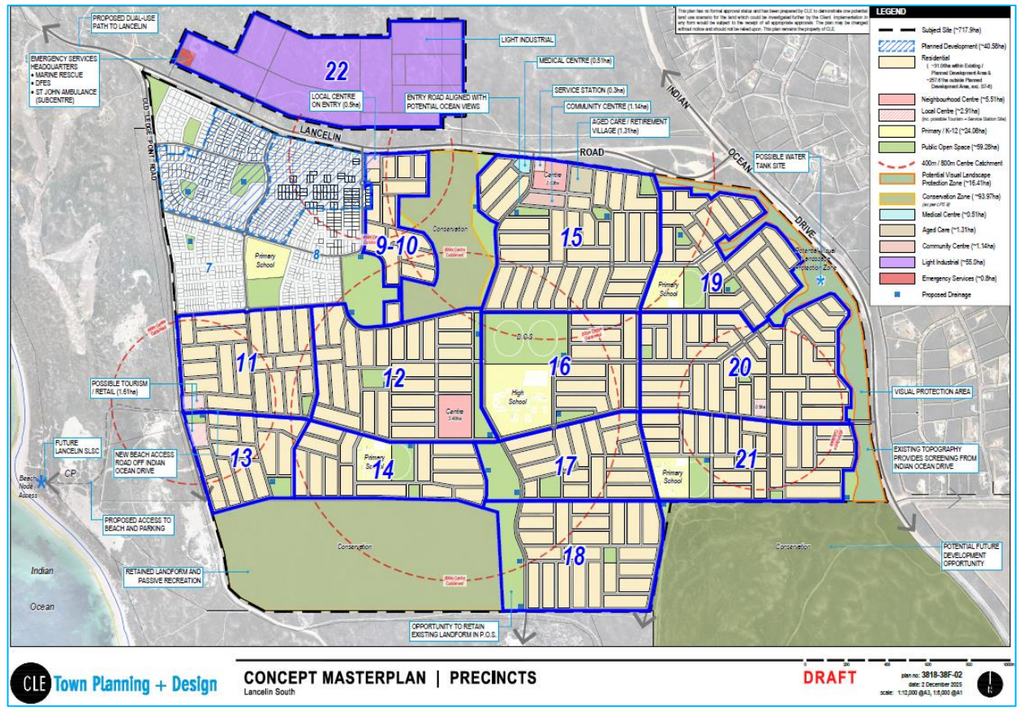
- Assess the proposed internal transport networks with respect to accessibility, circulation, safety and priority for all modes, i.e. vehicles, public transport, pedestrians and cyclists.
- Assess the level of transport integration between the structure plan area and the surrounding land uses.
- Determine the impacts of the traffic generated by the structure plan on the surrounding land uses.
- Determine the impacts of the traffic generated by the structure plan on the surrounding transport networks.

This assessment will, however, provide a broad level of detail across a large area.

1.6 Proposed Structure Plan Amendment

The proposed amended structure plan layout, which is the subject of this TIA, is shown on **Figure 1-3.**

Figure 1-4: Amended Structure Plan Layout – Lancelin South



The structure plan comprises of residential, commercial, community and educational land uses including an industrial area to the north of Lancelin Road. The proposed land uses within the structure plan area are summarised as follows:

Table 1-1: Proposed Structure Plan Amendment – Land Uses & Yields

Land Use	Site size	Assumed NLA (1/3 of site area)	Notes
Residential yield	Lots sized average approximately 407sqm	N/A	7,000 lot target
Local Centres x 4	Total 2.91 ha	0.97ha	The western coastal centre includes 2x sites which will include strip shop / retail and potential for a hotel / tourist use. Both sites will be zoned Town Centre to facilitate flexibility. Size and use types are unable to be confirmed at this point in time so broad assumptions for retail type uses is the preferred current approach.
Neighbourhood Centre 1 (Lancelin Road)	2ha + 0.3ha service station site	0.76 ha	Supermarket and specialty shops
Neighbourhood Centre 2	3.5ha	1.16ha	Supermarket and specialty shops
Medical Centre	0.51ha	0.17ha	Composition unknown
Retirement Village	1.13ha	Assumed 30 - 40 units	
Community Centre	1ha	0.33 ha	Library and other Gingin civic uses
Emergency Service HQ	0.5ha	Size unknown	Marine, DfES, ambulance
Primary Schools x4	3.5ha with co-located public open space		
High School x1	10ha		
Industrial Zone (north of Lancelin Road)	40.45 ha assuming 25m road reserves, however note that some may be delivered at 20m so this is a conservative estimate.		The Stage 1 Structure Plan anticipated 122 industrial lots

1.7 Prior Traffic Engineering & Design Reporting – Lancelin South Outline Development Plan 1 (2011)

Bruce Aulabaugh Traffic Engineering & Transport Design previously prepared (2010) a traffic forecast and intersection design report describing the new intersections and necessary upgrades to Lancelin Road and Old Ledge Point Road required to provide access to Lancelin South structure plan area. This report was revised following feedback from the review undertaken by Porter and Associates on behalf of the Shire in September 2010.

In summary, the traffic forecast and intersection design report(s) at the time (16 years ago) made the following recommendations regarding road upgrades for ultimate development:

- Lancelin Road to be upgraded to an Integrated Arterial B standard as defined in *Liveable Neighbourhoods;*
- Old Ledge Point Road to be sealed to a width of 7.5 – 8 metres to a point south of the proposed coastal access road or from any intersection from Lancelin South, whichever is further south;
- The intersection of Old Ledge Point Road with Lancelin Road to be realigned to provide a 90 degree angle of intersection.

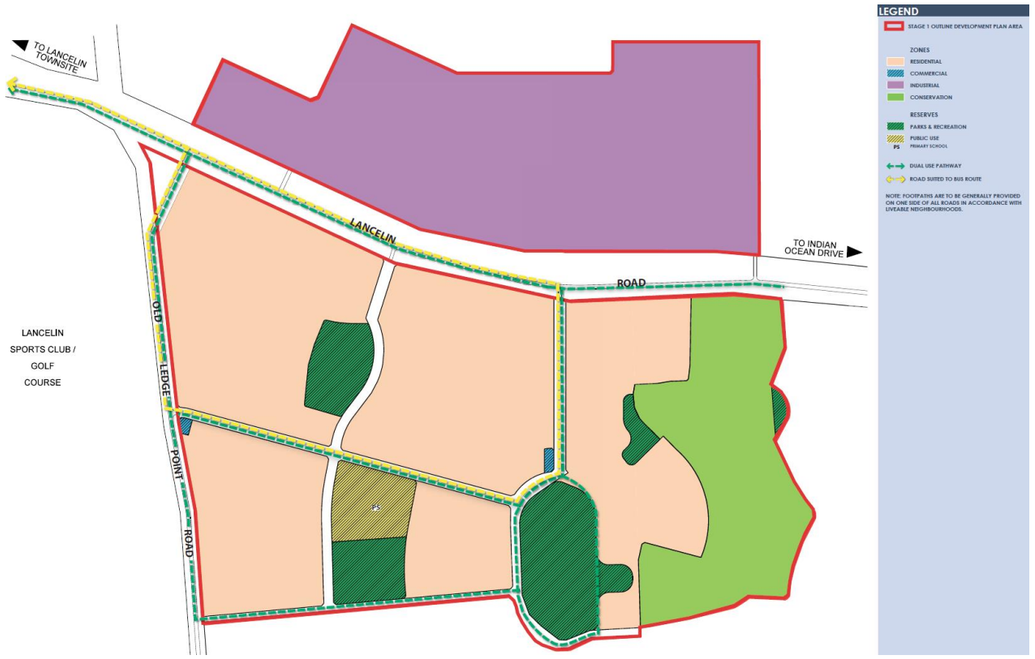
In addition, the intersections with Lancelin Road and Old Ledge Point Road that are required to provide access to Lancelin South, were recommended to be designed and constructed in accordance with the provisions of the 2010 Traffic Report.

The residential portion of the prior Outline Development Plan (ODP) area (located south of Lancelin Road) was proposed to link to the regional road network from two (2) intersections with Lancelin Road. The precise location, design and staging of these intersections is outlined in the *South Lancelin Stage 1 Traffic Forecast & Intersection Design (October 2010)* prepared by Bruce Aulabaugh.

As the staged development of the ODP area extends to its western extent, two intersections were also recommended to be constructed with Old Ledge Point Road that were intended to provide more direct access from Lancelin South to Ledge Point and the Coast.

A further two (2) intersections were intended to be constructed with Lancelin Road to provide access to the commercial area north of Lancelin Road. Initially, three (3) intersections were anticipated heading north from Lancelin Road, however, detailed consideration of required separation distances has resulted in the new intersection locations described in the prior ODP and outlined in **Figure 1-4.**

Figure 1-5: Prior ODP Area Considered by Bruce Aulabaugh Traffic Engineering & Transport Design (2010)



Source: Figure 08 – Movement Network - Lancelin South (Stage One) Outline Development Plan – June 2011.

The Structure Plan area, considered by the Bruce Aulabaugh Traffic Engineering & Transport Design previously prepared in 2010, was much smaller in yield than the currently proposed structure plan amendment, and mainly comprised of residential and industrial land uses.

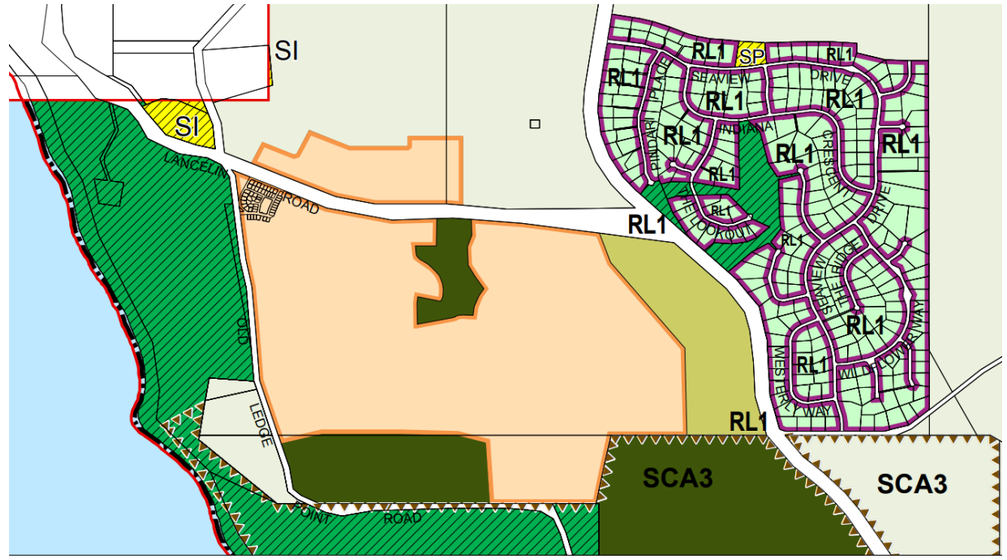
1.8 Local Planning Policy Context

1.8.1 Shire of Gingin Local Planning Scheme No.9 (LPS 9)

The Shire of Gingin Local Planning Scheme (LPS 9) outlines how land can be used and developed within the Shire. It classifies land into zones, sets out policies, and controls development to achieve the Shire's planning aims. The Scheme should be read in conjunction with the Shire's Local Planning Strategy.

The proposed amended structure plan area ('Lancelin South') is designated under the 'Lancelin Townsite Surround East' locality within LPS 9 and is currently zoned as 'Future Development' with 'Conservation' and 'Landscape Protection' areas within the application boundary (refer **Figure 1-4**).

Figure 1-6: Local Planning Scheme No.7 (LSP7) Site Context



Source: Shire of Gingin - Local Planning Scheme No.9

The surrounding land uses are shown as 'Parks and Recreation' to the west and south, 'Rural Living' to the east and 'General Rural' to the north.

LEGEND

LOCAL SCHEME RESERVES

- Drainage and Waterways
- Environmental Conservation Reserve
- Parks and Recreation
- PS — Public Purposes : Infrastructure Services
- Public Use
- AA — Public Use : Aged Accommodation
- AAH — Public Use : Aged Accommodation and Health Services
- BRM — Public Use : Basic Raw Materials
- C — Public Use : Cemetery
- CH — Public Use : Church
- DF — Public Use : Defence Purposes
- H — Public Use : Health Services
- R — Public Use : Railway
- S — Public Use : School Site
- SI — Public Use : Service and Infrastructure
- SP — Public Use : Shire Purposes
- SF — Public Use : State Forest
- Roads

LOCAL SCHEME ZONES

- Conservation
- Future Development
- General Rural - Coded
- General Rural
- Landscape Protection
- Mixed Business
- Residential
- Rural Industry
- Rural Living
- Special Use
- Tourism
- Town Centre

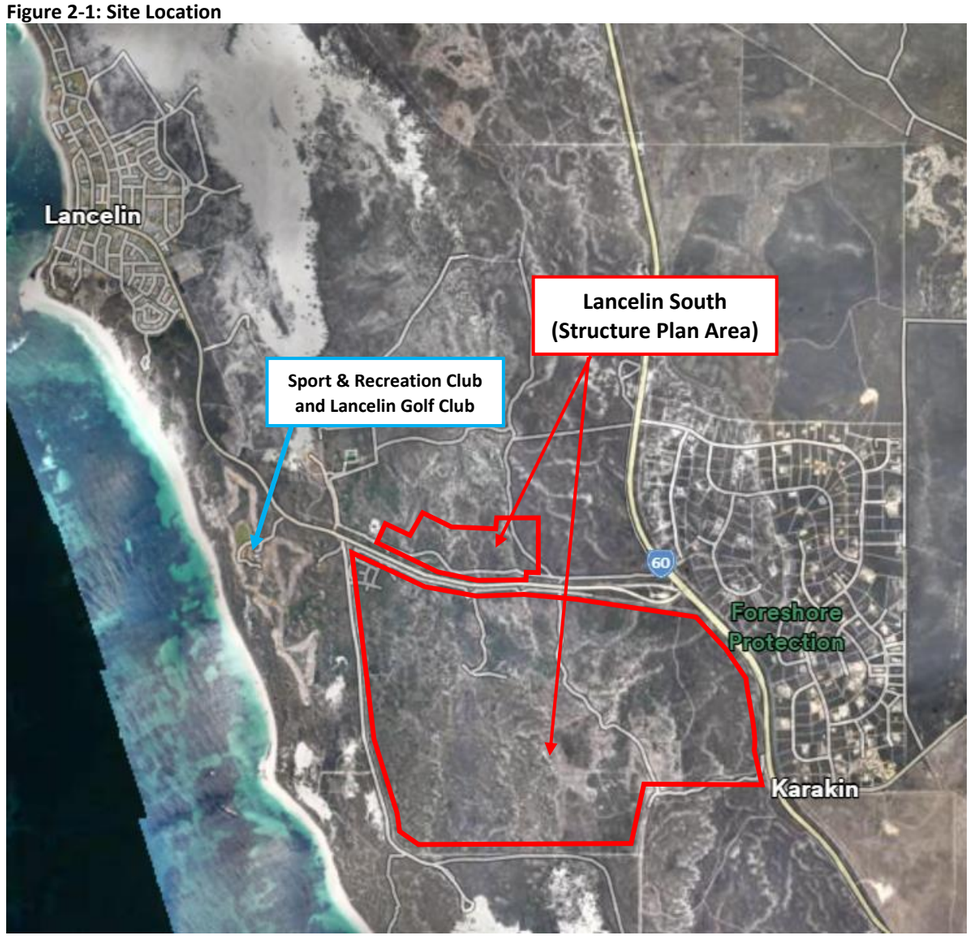
2 Existing Situation

2.1 Existing Site Context and Land Uses

The proposed structure plan area is primarily a greenfield site (vacant bushland), located approximately 7km south-east of Lancelin and 120km north of Perth. The site is positioned approximately 1.5 kilometres to the west of a rural residential estate known as 'Seaview Park'. The subject land is east of the existing Lancelin Sport and Recreation Club. The boundaries of the structure plan site comprise of Lancelin Road (north), Indian Ocean Drive (east), Old Ledge Point Road (west and south).

The land was previously used for livestock grazing and contains a number of related structures such as windmills, bores, stables and sheds that are in various states of repair. The site location and surrounding land uses are shown in **Figure 2-1.**

Figure 2-1: Site Location



Source: Nearmap

2.2 Existing Road Network

Indian Ocean Drive:

Indian Ocean Drive is classified as a Primary Distributor under the Main Roads Western Australia (MRWA) State Road Network, providing a key north–south coastal connection between Perth and towns in the Mid West and Gascoyne regions. Near the intersection of Lancelin Road at Lancelin, Indian Ocean Drive is a single carriageway sealed road with one lane in each direction and a posted speed limit of 90 km/h. In the northbound direction on Indian Ocean Drive, on the immediate approach to the intersection with Lancelin Road, there are two side-road activated illuminated speed signs (on Indian Ocean Drive) which display a reduced speed zone of 70km/hr.

Indian Ocean Drive is managed by MRWA and is designed to accommodate regional traffic, including tourist and freight movements. Indian Ocean Drive is **not** designated as 'Control of Access' under MRWA. Control of Access identifies the sections of state roads where the access to and from adjacent land and properties is controlled by Main Roads Western Australia. These road sections have statutory declared Control of Access, which revokes the general right of adjoining land to have direct vehicle and pedestrian access to these roads. This control of access restriction does **not** apply to Indian Ocean Drive in the locality of the proposed structure plan area.

In regard to direct local road connections to Indian Ocean Drive, Main Roads WA's Indian Ocean Drive Planning Study (which aims to identify what the long-term requirements are for Indian Ocean Drive) states:

"While road upgrades will have some impact on adjoining and nearby land and communities, we will minimise this as much as possible by working collaboratively with landowners. Direct lot accesses and local road connections introduce potential conflict points for traffic on the road network. To optimise safety and efficiency on the network, we need to minimise the number of connection points, while allowing for appropriate levels of lot and network access."

Therefore, there is an identified willingness from Main Roads WA to work with landowners to understand their needs specific to the scale and needs of each development. Whilst understandably minimising the number of connection points to Indian Ocean Drive, where direct connections are justifiably needed there is an openness from Main Roads WA to consider and permit appropriate access, as opposed to specific blanket restrictions.

Most of the proposed development and surrounding land uses are likely to use Indian Ocean Drive as a part of their journey. To the south of Lancelin Road, Indian Ocean Drive currently carries approximately 3,250 vehicles per day (Monday to Friday average) with around 22% heavy vehicle composition.

Lancelin Road:

Lancelin Road intersects with Indian Ocean Drive and provides access between the townsite of Lancelin and the broader regional network. Lancelin Road is classified as a Local Distributor, managed by the Shire of Gingin. It is a sealed two-lane road (one lane in each direction), with a posted speed limit of 90km/h west of Indian Ocean Drive past the structure plan area and reduces in stages to 70km/hr and then 50km/hr on the approach to the townsite of Lancelin within urbananised areas.

Lancelin Road carries approximately 2,700 vehicles per day (Monday to Friday average) with around 16% heavy vehicle composition. The intersection with Indian Ocean Drive plays an important role in linking local traffic from Lancelin to the regional transport route provided by Indian Ocean Drive.

Old Ledge Point Road:

Old Ledge Point Road is classified as an Access Road under the MRWA Regional Functional Road Hierarchy and is under the care and control of the Shire of Gingin. It is located to the south of Lancelin Road and provides access to coastal areas via unmade coastal tracks. The road is only sealed along part of the western flank of the structure plan area, and thereafter comprises an off-road unsealed track. No traffic data is freely available for Old Ledge Point Road, however its status as an Access Road indicates that it may be theoretically capable of accommodating up to 3,000 vehicle movements per day.

Along the sealed section, Old Ledge Point Road comprises one lane in each direction and a typical pavement width of approximately 7.0m. The unposted speed limit is technically 110km/hr given the existing rural nature, however its width an environment is likely to generate lower vehicle speeds. There are no formal pedestrian paths along its length.

Road Hierarchy:

Road classifications are defined in the Main Roads Functional Hierarchy as follows:

Primary Distributors (light blue): Form the regional and inter-regional grid of MRWA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are National or State roads. They are managed by Main Roads WA.

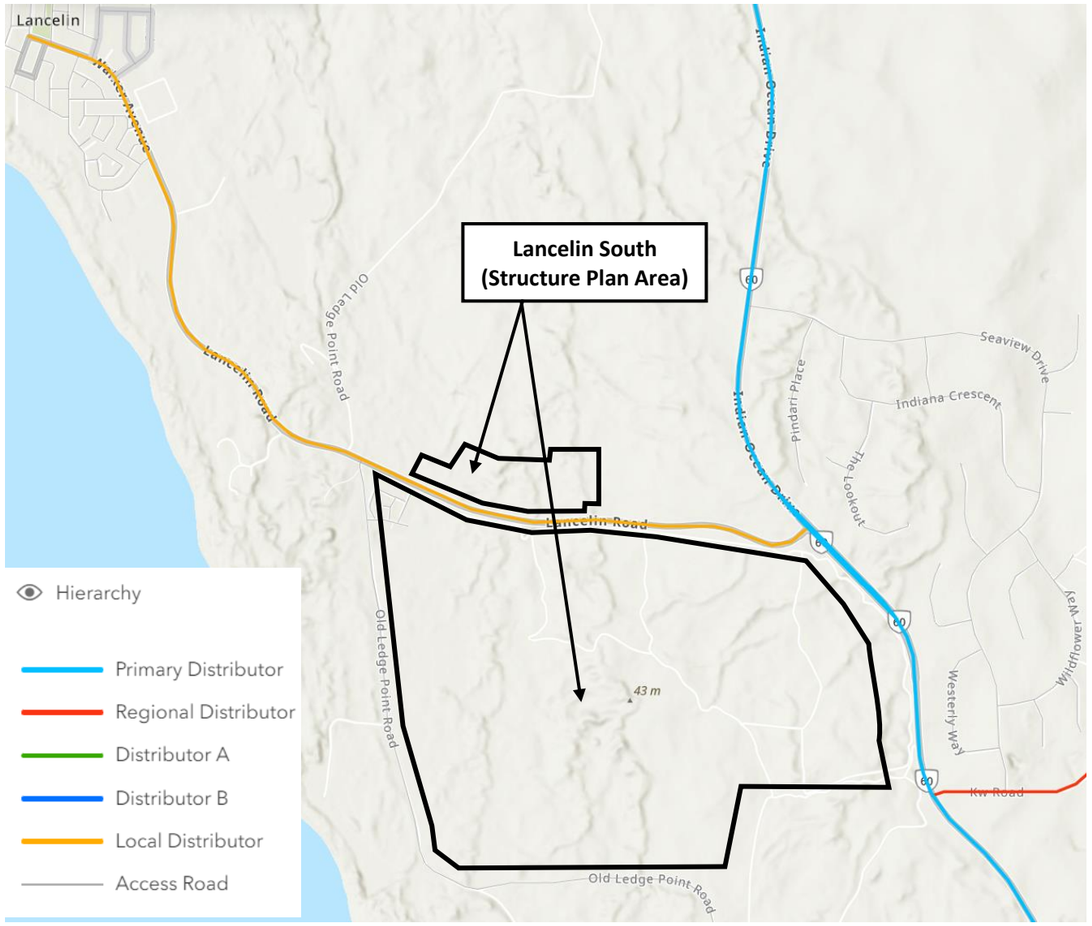
Regional Distributors (red): Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.

Local Distributors (orange)**:** Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local Government.

Access Roads (grey): Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local Government.

Figure 2-2 shows the layout and classification of the roads surrounding the site, including the primary road network.

Figure 2-2: Main Roads WA Functional Road Hierarchy

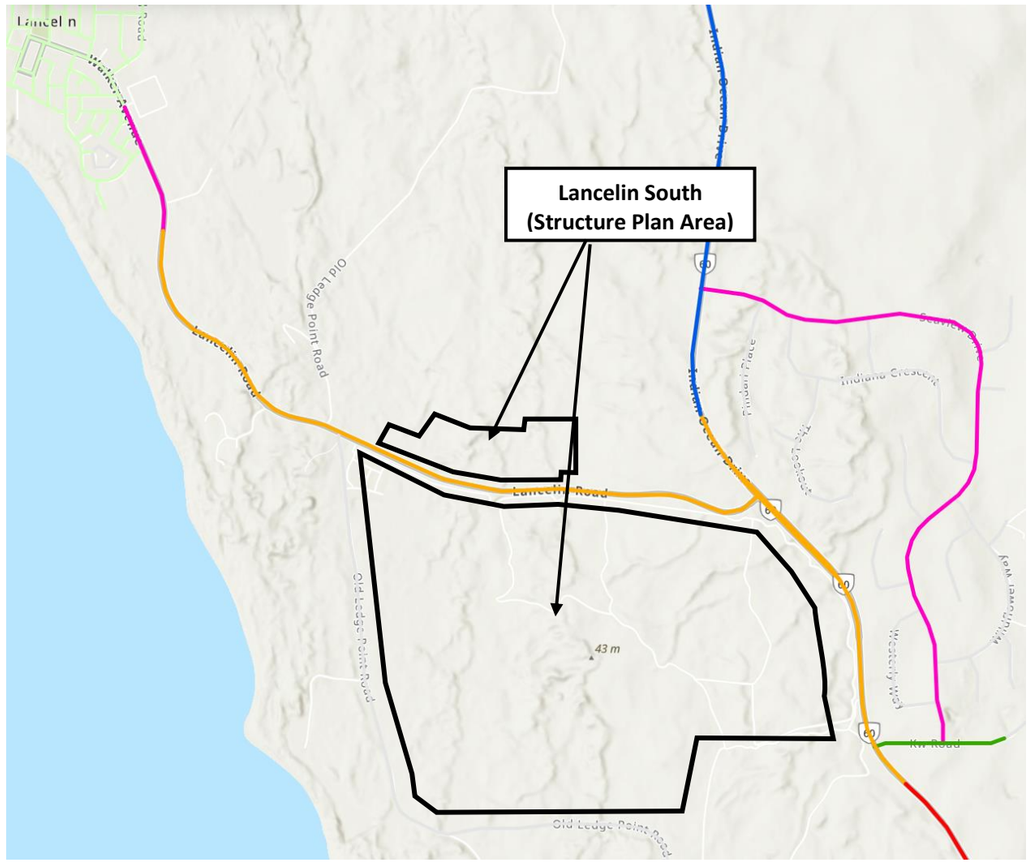


Source: Main Roads WA

Speed Zoning:

Figure 2-3 shows the zoning of speeds on the roads surrounding the site. The mapping shows the town of Lancelin is predominantly posted as a 50km/hr speed zone, Lancelin Road (along the site frontage) is subject to a 90km/hr speed zone. The intersection of Indian Ocean Drive / Lancelin Road and the immediate lengths of Indian Ocean Road to the north and south of the intersection is subject to a 90km/hr speed zone, with speeds increasing to 110km/hr to the north and 100km/hr to the south.

Figure 2-3: MRWA Speed Zoning



Source: Main Roads WA

2.3 Existing RAV Network

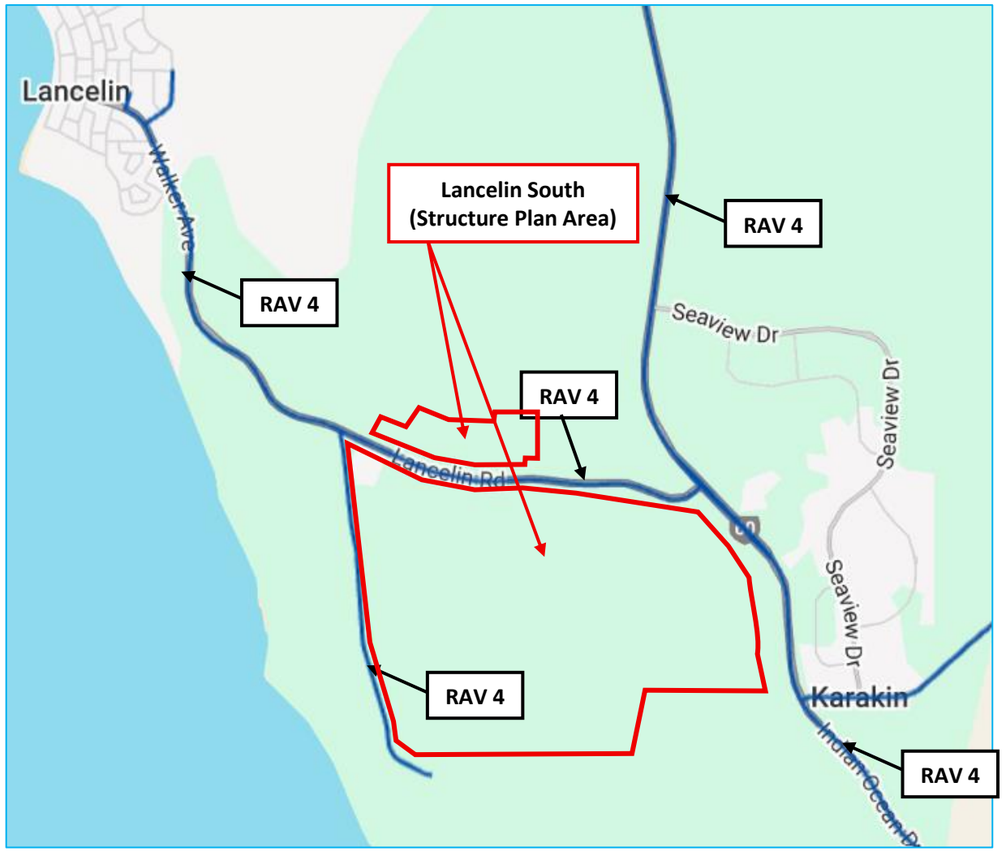
A description of the Restricted Access Vehicle (RAV) categories as per MRWA) Heavy Vehicle Services (HVS) Tandem Drive Prime Mover, Trailer Combinations - Restricted Access Vehicle (RAV) Categories (May 2022) is shown in **Table 2-1**.

Table 2-1: RAV Categories Characteristics

RAV Category	Sub-Categories and Vehicle Types	Max. Length	Max. Mass
1	A. Prime Mover, Semi-Trailer & Pig Trailer or Dolly B. Prime Mover & Semi-Trailer C. Short B-Double	A. 20m B. 19m C. 20m	A. 50t B. 48.5t C. 50t
2	A. Prime Mover, Semi-Trailer & Pig Trailer or Dolly B. Prime Mover & Semi-Trailer C. B-Double D. Short B-Triple E. Car Carrier	A. 27.5m B. 20m C. 27.5m D. 27.5m E. 25m	A. 66.5t B. 48.5t C. 68.5t D. 88.5t E. 45t
3	A. A-Double	A. 27.5m	A. 85t
4	A. A-Double	A. 27.5m	A. 88.5t
5	A. A-Double B. A-Double towing a Dolly C. B-Double towing a Dolly D. B-Triple	A. 36.5m B. 27.5m + Dolly C. 27.5m + Dolly D. 36.5m	A. 85t B. 85t + Dolly C. 68.5t + Dolly D. 85t
6	A. A-Double B. B-Triple C. A-Double towing a Dolly	A. 36.5m B. 36.5m C. 27.5m + Dolly	A. 88.5t B. 88.5t C. 88.5t + Dolly
7	A. AB-Triple B. BA-Triple	A. 36.5m B. 36.5m	A. 50t B. 48.5t

The existing restrictions for heavy vehicle combinations with context to the site and its surrounds is shown in Figure 2-4. Indian Ocean Drive, Lancelin Road and Old Ledge Point Road are all categorised as RAV 4 routes, capable of accommodating heavy vehicle combinations up to the RAV 4 limit of 27.5m long and 88.5 tonnes.

Figure 2-4: Existing RAV Network



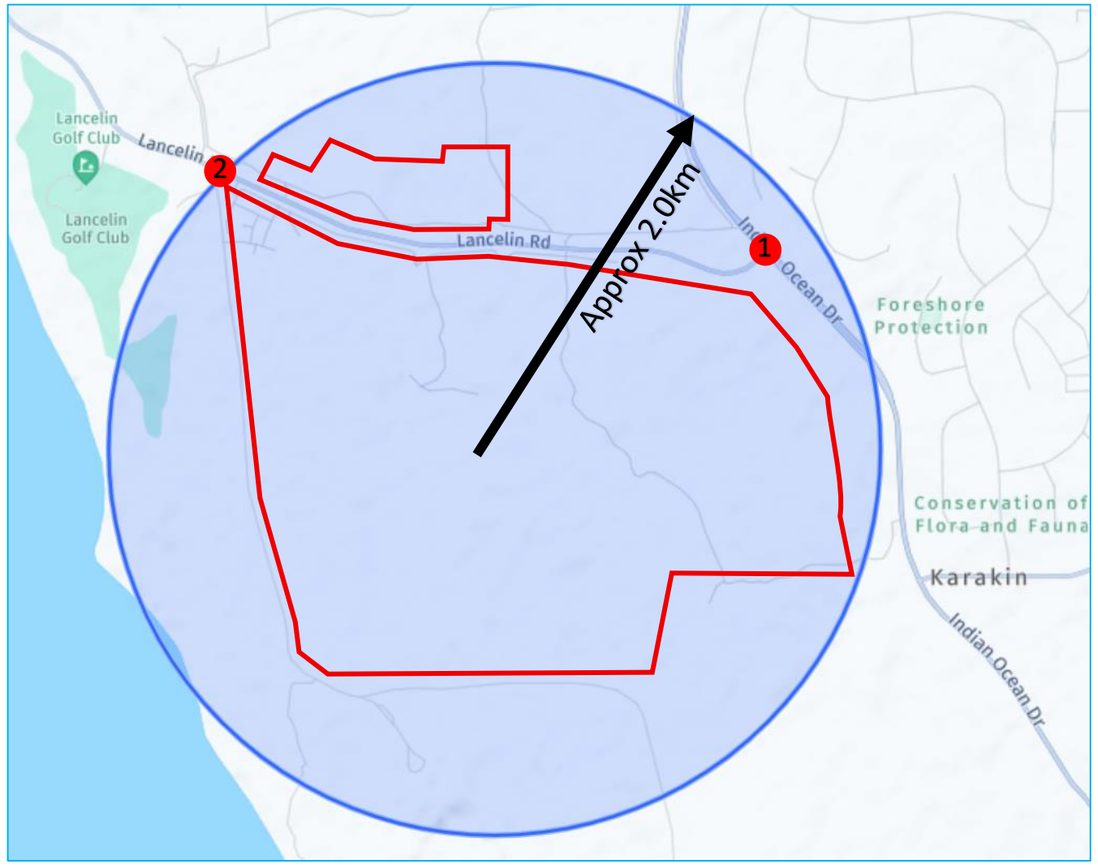
Source: Main Roads WA

2.4 Existing Key Intersections

The following key existing intersections, providing access to the wider road network, are located within a 2.0 km radius of the centre of the site:

1. Indian Ocean Drive / Lancelin Road – Major Priority Controlled T-Intersection.
2. Lancelin Road / Old Ledge Point Road – Minor Priority Controlled Intersection.

Figure 2-5: Existing Key Intersections within 2.0km of the Site



2.5 Existing Traffic Volumes – Link & Intersections

Recorded traffic data is available from the Main Roads WA Traffic Map database for the links of Lancelin Road, Indian Ocean Drive and the intersection of these two roads. A permanent 24 hour traffic counter is available on Indian Ocean Drive, north of Lancelin Drive, and an intersection count is also available at the intersection of Indian Ocean Drive / K.W. Road.

The existing all-day average (Monday – Friday) traffic counts on the above roads are summarised in **Figure 2-6** and the available intersection counts are shown at **Figure 2-7** and **Figure 2-8.**

Figure 2-6: Existing Traffic Volumes

Figure 2-7: Intersection of Indian Ocean Drive / Lancelin Road – All Day Traffic Volume

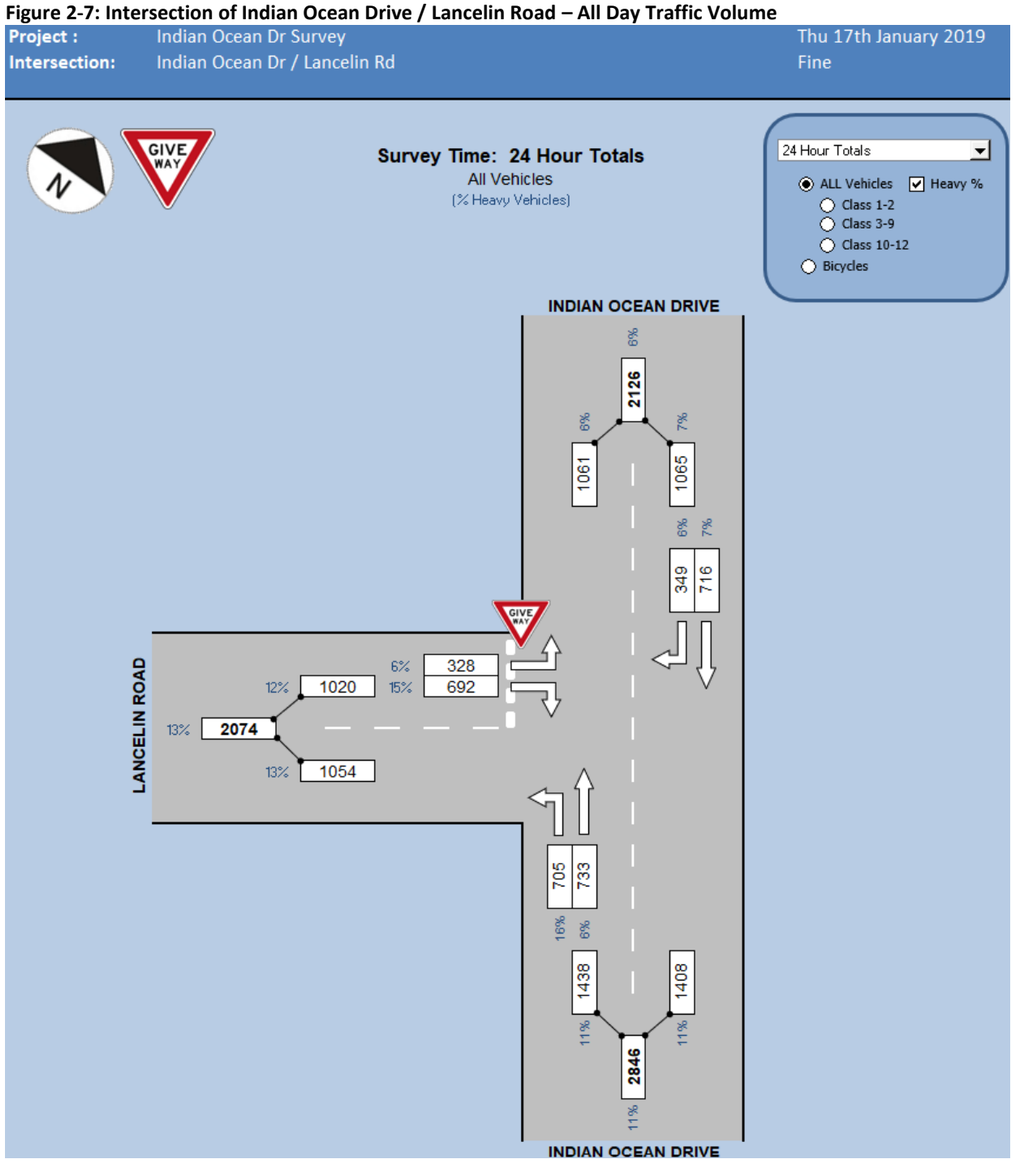
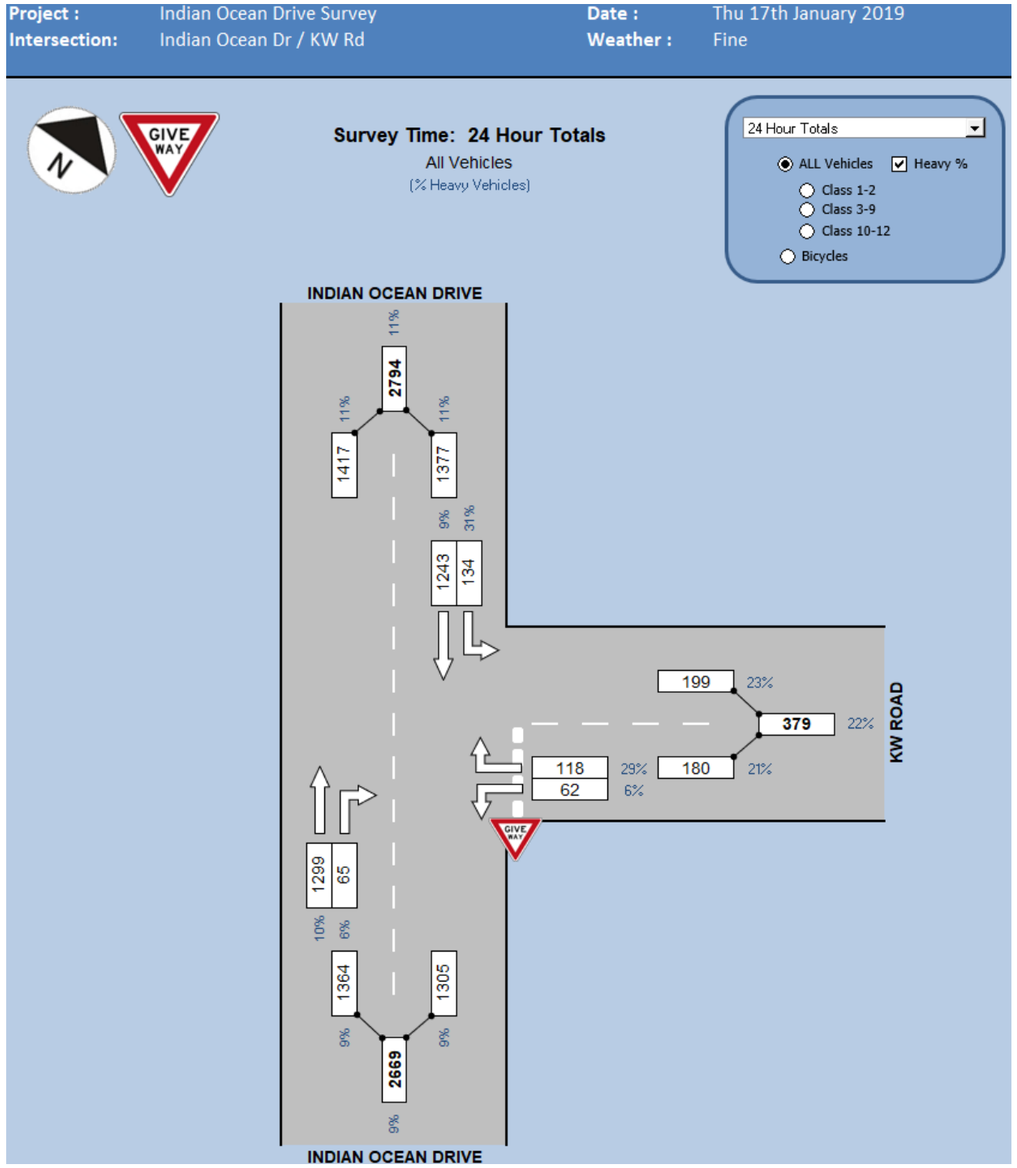


Figure 2-8: Intersection of Indian Ocean Drive / K.W. Road – All Day Traffic Volume



Existing traffic volumes from 2019 will be growthed up to a 2026 base year using averaged historical growth per annum on Indian Ocean Drive and the 24 hour count site north of Lancelin Road.

2.6 Existing Active Travel Network

No footpaths are currently present along Old Ledge Point Road, Lancelin Road or Indian Ocean Drive in the vicinity of the structure plan area. There are no dedicated on-road cycle lanes. Any existing cyclists use either the sealed shoulders or share the carriageway, which is typical for rural settings.

However, Old Ledge Point Road and the section of Lancelin Road north of Olde Ledge Point Road is part of the Regional Long-Term Cycle Network (RLTCN) – Avon Central Coast (defined as a Primary Route) as illustrated in **Figure 2-9**. From a safety point of view, at the current unposted 110km/hr along Old Ledge Point, this is not a safe riding speed environment for vulnerable road users.

Figure 2-9: Regional Long-Term Cycle Network (RLTCN) – Avon Central Coast

2.7 Existing Public Transport Provision

No regular Transperth or town-based bus services operate in Lancelin. There is no dedicated local or intra-town bus system currently servicing the area. Limited School Bus Services operate under the PTA's School Bus Services program to serve local students commuting to nearby education facilities.

Lancelin is already on a PTA TransWA coach route, the N5 Perth (East Perth Terminal).

TransWA Coach Service (N5 Perth – Geraldton)

- Operated by TransWA, part of the PTA.
- Runs between Perth (East Perth & Joondalup) and Geraldton, stopping at Lancelin (Shire Office on Vins Way).
- Typically operates twice weekly (Fridays & Sundays), with morning and afternoon services.
- Approximate travel time: 1 ¾ – 2 hours between Perth and Lancelin

Integrity Coach Lines (Private Coach Service)

- Offers direct Perth–Lancelin services departing from Wellington Street Coach Terminal (Perth), with return trips.
- Frequencies: around three times per week, with journey times of approximately 2 hours.
- Arrives/departs at Lancelin YHA (Hopkins Street).

2.8 Crash Assessment

A search of the Main Roads WA Reporting Centre for crash data surrounding the site was undertaken. This search covered all recorded traffic accidents for the most recently available five-year reporting period between 1 January 2020 and 31 December 2024 for the following roads surrounding the Site:

- Indian Ocean Drive (north and south of Lancelin Road)
- Lancelin Road
- Old Ledge Point Road.

The locations of the recorded crashes are illustrated **Figure 2-10**

A total of seven crashes are recorded as occurring within the study, including:

- Four crashes at the intersection of Indian ocean Drive / Lancelin Road
- Two crashes on Lancelin Road
- One crash on Indian Ocean Drive, south of in Road.

The details of the recorded crashes are summarised as follows:

Indian Ocean Drive / Lancelin Road Give Way Intersection:

- A fatal crash:
  - At approximately 6:40pm on Friday, 2nd June 2023, a collision occurred on Indian Ocean Drive near the intersection with Lancelin Road. Vehicle 1 (V1) was travelling southbound on Indian Ocean Drive intending to turn right towards Lancelin Road, while Vehicle 2 (V2) was heading northbound on Indian Ocean Drive. As V1 entered the right-turn slip lane and attempted to turn into Lancelin Road, it failed to give way to the oncoming V2, resulting in V2 colliding with V1 in a T-bone crash.
- Two hospitalisation crashes:

  10 / 12 / 2022
  - A collision occurred between two vehicles on Indian Ocean Drive near the intersection with Lancelin Road, involving a grey Honda Accord (V1) and a grey Isuzu MU-X (V2). V1 was travelling southbound and entered the designated right-turn lane to turn into Lancelin Road. At the same time, V2 was travelling northbound along Indian Ocean Drive. As V1 attempted to turn right across the northbound lane, it failed to give way to V2, resulting in a collision. The impact caused both vehicles to spin and come to rest further north along the central median strip. Both sustained significant front-end damage, and airbags were deployed.

  28 / 03 / 2024
  - While turning right (southbound) from Indian Ocean Drive onto Lancelin Road, the vehicle's driver was travelling at a reduced speed of approximately 40 to 50 km/h in preparation for the turn. The driver checked for oncoming traffic and, seeing none, proceeded with the manoeuvre. However, shortly after initiating the turn, another vehicle, described as speeding, approached from the opposite direction and collided with the driver's side of the vehicle in a T-bone impact.
- One Property Damage Only (PDO) Minor
  - This crash involved a single vehicle only, turning right into Lancelin Road which lost control and collided with an object, resulting in minor property damage.

Indian Ocean Drive, 900m south-east of Lancelin Road Intersection:

- One Property Damage Only (PDO) Minor
  - This crash involved a single vehicle only leaving the carriageway, resulting in minor property damage.

Lancelin Road – west of Indian Ocean Drive Intersection:

- A fatal crash:
  - A collision occurred on Lancelin Road involving a silver 2005 Honda Jazz (V1) and a cyclist riding a mountain bike. V1 was travelling eastbound in a 90 km/h speed zone when it cleared a left-hand bend and struck the cyclist from behind, causing the rider to be thrown to the ground. Dashcam footage from a witness travelling in the opposite direction captured the impact and indicates that V1 had partially veered out of the eastbound lane at the time of the collision. Specifically, the vehicle's passenger-side wheels were on the gravel shoulder while the driver-side wheels remained on the roadway.

- One Property Damage Only (PDO) Major
  - This crash occurred on Lancelin Road 240m South West of Indian Ocean Drive and involved a rear end shunt type crash resulting in major property damage.

Figure 2-10: Historic Crash Data Extract

Summary of Crash Assessment

The crash records indicate a trend of right-turn related collisions at the Indian Ocean Drive / Lancelin Road Give-way controlled intersection, particularly involving southbound vehicles turning right into Lancelin Road and failing to give way to northbound through traffic. This pattern is evident in one fatal crash (June 2023) and two hospitalisation crashes (December 2022 and March 2024), all involving T-bone impacts during right-turn manoeuvres. Additionally, a property damage crash at the same intersection also involved a vehicle turning right into Lancelin Road and losing control, further supporting this trend of turning-related incidents at the intersection.

Outside the intersection, there are isolated incidents without a clear pattern. One property damage only crash occurred approximately 900 metres south-east of the intersection on Indian Ocean Drive, involving a single vehicle leaving the carriageway. On Lancelin Road west of the intersection, there was a fatal crash involving a cyclist, caused by a vehicle partially departing its lane on a bend, and a separate major property damage crash resulting from a rear-end collision. These appear to be unrelated in nature and location, with no repeat patterns observed.

In summary, the dominant crash trend is concentrated at the Indian Ocean Drive / Lancelin Road intersection, specifically involving southbound right-turn movements and failure to give way, indicating a recurring safety issue at this location.

In response to the documented right-turn crash pattern (including fatal/hospitalisation crashes), it is recommended that given this is a Main Roads WA road, that Main Roads explore interim treatments to reduce the likelihood/severity of future crashes, e.g. upgrading the operation of northbound variable speed signs so reduced speeds are triggered when vehicles are in the southbound right-turn lane, not only by side-road activation.

3 Proposed Structure Plan (Internal Transport Network)

3.1 Proposed Structure Plan Amendment

The structure plan comprises of residential, commercial, community and educational land uses including an industrial area to the north of Lancelin Road. The proposed land uses within the structure plan area are summarised as follows:

Table 3-1: Proposed Structure Amendment – Land Uses & Yields

Land Use	Site size	Assumed NLA (1/3 of site area)	Notes
Residential yield	Lots sized average approximately 407sqm	N/A	7,000 lot target
Local Centres x 4	Total 2.91 ha	0.97ha	The western coastal centre includes 2x sites which will include strip shop / retail and potential for a hotel / tourist use. Both sites will be zoned Town Centre to facilitate flexibility. Size and use types are unable to be confirmed at this point in time so broad assumptions for retail type uses is the preferred current approach.
Neighbourhood Centre 1 (Lancelin Road)	2ha + 0.3ha service station site	0.76 ha	Supermarket and specialty shops
Neighbourhood Centre 2	3.5ha	1.16ha	Supermarket and specialty shops
Medical Centre	0.51ha	0.17ha	Composition unknown
Retirement Village	1.13ha	Assumed 30 - 40 units	
Community Centre	1ha	0.33 ha	Library and other Gingin civic uses
Emergency Service HQ	0.5ha	Size unknown	Marine, DfES, ambulance
Primary Schools x4	3.5ha with co-located public open space		
High School x1	10ha		
Industrial Zone (north of Lancelin Road)	40.45 ha assuming 25m road reserves, however note that some may be delivered at 20m.		The Stage 1 Structure Plan anticipated 122 industrial lots

The project is approximately a 20 to 25 Year project with staging occurring in a southerly direction then east toward Indian Ocean Drive.

The proposed stages of residential development within the structure plan area are summarised in **Table 3-2**. These stages relate to the proposed amended structure plan layout at **Figure 3-1.**

Table 3-2: Structure Plan Yield – Residential Component

STAGE	Area (ha)	Avg. (m^2)	Yield	Yield*
9_10^	11.33	450	251	252
11	22.65	407	556	528
12	28.97	407	711	675
13	13.29	407	326	309
14	15.61	407	383	363
15	33.94	407	833	791
16	12.97	407	318	302
17	16.77	407	412	391
18	25.28	407	621	589
19	18.55	407	455	432
20	34.44	407	846	803
21	23.81	407	585	555
Total	**257.61**	**-**	**6297**	**5990**
	Overall Yield		**7168**	**6861**

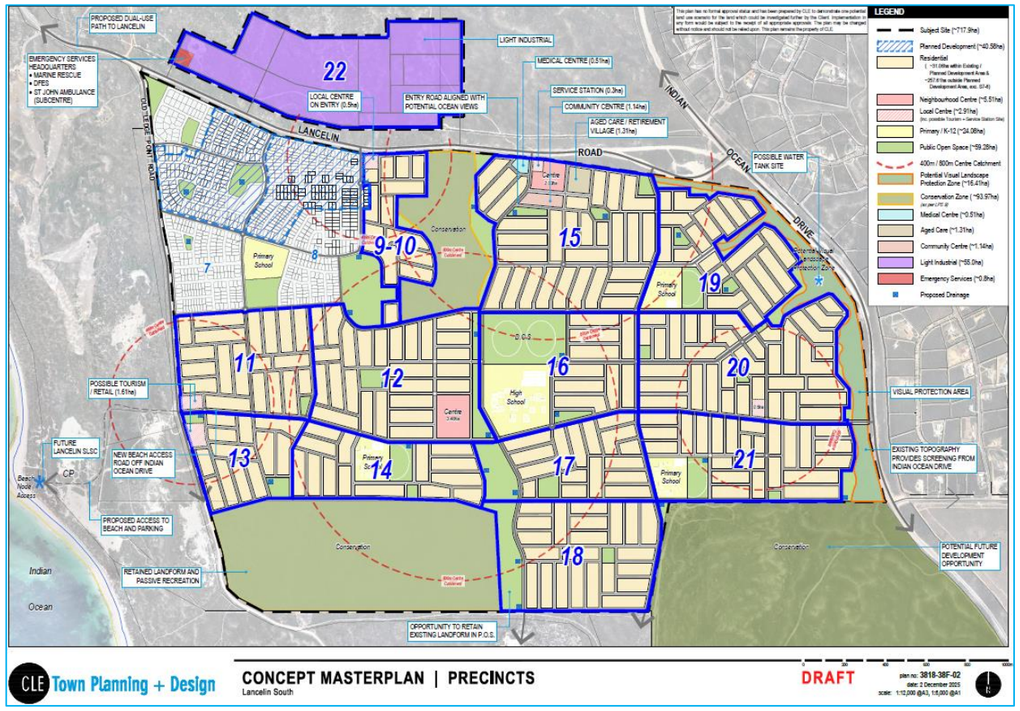
*5% contingency has been applied to the yield

^ Yield based on actual subdivision concept (3818-45)

^ 450m^2 average area based on Stage 9-10 subdivision concept plan (3818-45)

The proposed amended structure plan layout, which is the subject of this TIA, is shown on **Figure 3-1.**

Figure 3-1: Amended Structure Plan Layout – Lancelin South



3.2 Existing Completed, Under Construction, Approved or Committed Development within the Structure Plan Area

Within the existing structure plan area there is a mixture of completed, under construction, approved or committed residential development (design stage) totalling around 870 lots. Located in the north-west corner of the structure plan area, this spans across the first eight (8) stages of development.

The status and yield of the first eight stages (which are not subject to this TIA report) are shown in **Table 3-2.** The traffic generation and distribution associated with stages 2 to 8 is factored into the future impact analysis within this report. Stage 1 traffic generation is captured within the 2026 growthed traffic volumes.

Table 3-3: Existing / Committed Development Within the Structure Plan Area

STAGE	As Approved	
1	Constructed	51
2	Under Construction	66
3_4	Approved Sub / Under Construction	119
5_6	Approved Sub	247
7	Design Phase	197
8	Design Phase	191
	Total	**871**

3.3 Vehicular Site Access Arrangements

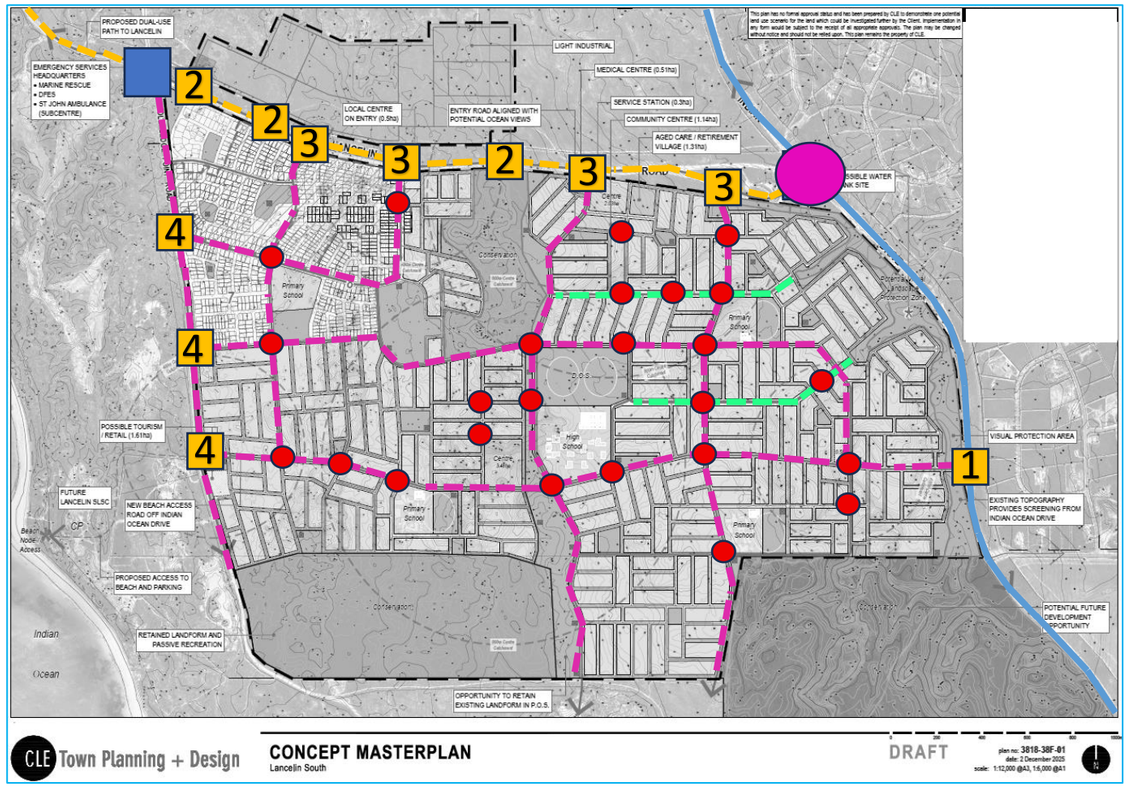
The existing development area in the north-west corner of the main site (south of Lancelin Road) currently has vehicle access to Old Ledge Point Road and Lancelin Road. The remainder of the Structure Plan area to the south of Lancelin Road only has informal vehicle access points at various locations off Lancelin Road and Indian Ocean Drive leading to unmade dirt tracks which cross the site to various outbuildings.

The proposed General Industrial area to the north of Lancelin Road also currently has informal vehicle access points leading to unmade dirt tracks which cross the site.

The proposed amended structure plan sets out the vehicle access points via the following existing roads, as shown on **Figure 3-2** and includes:

1 **Indian Ocean Drive** (Proposed Major T-Intersection)
2 **North Side of Lancelin Road (Industrial Area)** (Three Proposed T-Intersections)
3 **South Side of Lancelin Road** (Four Proposed T-Intersections)
4 **Old Ledge Point Road** (Three Proposed Intersections).

Figure 3-2: Proposed Vehicle Access Arrangements & Street Hierarchy – Concept Structure Plan



KEY:

- Existing Primary Distributor Road **(Indian Ocean Drive)**
- Existing Local Distributor Road **(Lancelin Road)**
- Proposed Neighbourhood Connector A
- Proposed Access Road
- Proposed Landscape Boulevard Street
- Existing T-Intersection
- Proposed T-Intersection on Existing Road
- Proposed Single Lane Roundabout
- Proposed Dual Lane Roundabout (Future MRWA Upgrade Project)

(Note: All other intersections within structure plan area will be three-way priority controlled T-intersections)

A desktop assessment indicates that the proposed access points and their location generally comply with the Austroads requirements of Safe Intersection Stopping Sight Distance. However, it is a recommendation of this report that a **more detailed investigation of sight distance requirements for vehicles at intersections, specifically the proposed site access intersections**, should be undertaken at the subsequent stages of the planning and design process.

3.4 Vehicle Site Access Intersection Speed Zoning & Design

General:

The existing posted speed limit on Lancelin Road is 90km/hr and on Indian Ocean Drive, along the frontage of the site, is also 90km/hr. In the northbound direction on Indian Ocean Drive, on the immediate approach to the intersection with Lancelin Road, there are two side-road activated illuminated speed signs (on Indian Ocean Drive) which display a reduced speed zone of 70km/hr in the event of a vehicle waiting on Lancelin Road to join Indian Ocean Drive.

Indian Ocean Drive Speed Zoning:

In the context of the Indian Ocean Drive Planning Study (Section 4.2) and Main Roads WA's intentions to upgrade the intersection at Lancelin Road to a dual lane roundabout, together with the structure plan proposal for a site access intersection onto Indian Ocean Drive, some 1.2 km south of Lancelin Road, it is recommended from a safe system road safety engineering perspective in light of these proposals to permanently reduce the speed limit of the northbound and southbound approaches to both intersections (Lancelin Road and Site Access to Indian Ocean Drive) to maximum 70km/hr.

This recommended speed reduction to 70km/hr will serve to enhance road safety, compared to the existing prevailing 90km/hr speed environment, particularly in light of increased turning movements due to the structure plan generated traffic, and will help to achieve greater speed compliance when compared to temporary side-road activated speed reductions (existing situation at Lancelin Road intersection).

Lancelin Road Speed Zoning:

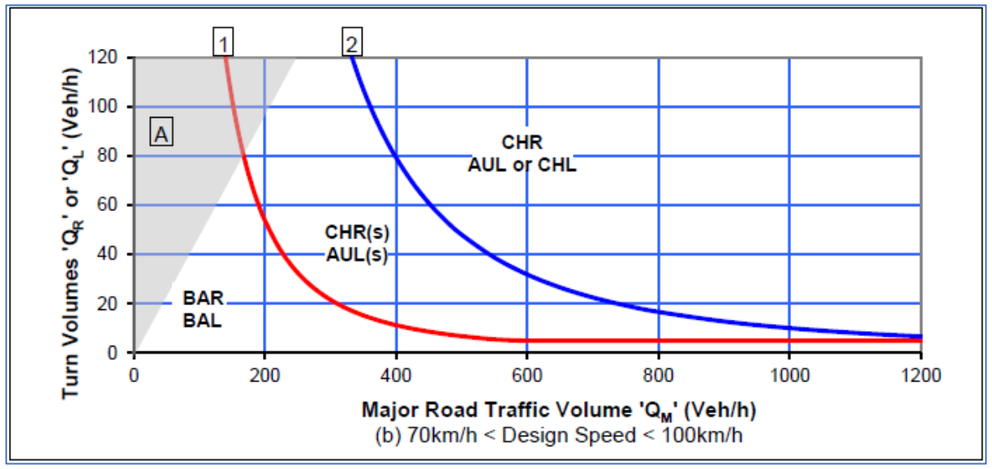
On Lancelin Road, the structure plan area proposes to introduce seven (7) site access intersections, each of which shall be priority controlled T-intersections. With the introduction of these additional intersections, it is recommended from a safe system road safety engineering perspective to permanently reduce the speed limit on Lancelin Road along the frontage of the structure plan area from 90km/hr down to maximum 60 km/hr.

This will serve to enhance road safety, compared to the existing prevailing 90km/hr speed environment, particularly in light of the introduced turning movements due to the structure plan generated traffic.

Indian Ocean Drive – Site Access Intersection Design

The form of the proposed site access T-intersection onto Indian Ocean Drive (within the recommended 70km/hr zone) would be based upon the requirements of *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Management* (Austroads 2020). Reference to the second chart in Figure 3.25 of the Austroads 2020 guide shows the following: Note: this figure is applicable for design speeds of between 70km/hr and 100km/hr and thus appropriate for the proposed 80km/hr design speed of Indian Ocean Drive (70km/hr posted speed + 10km/hr) along the frontage of structure plan area.

Figure 3-3: Austroads Figure 3.25 Excerpt

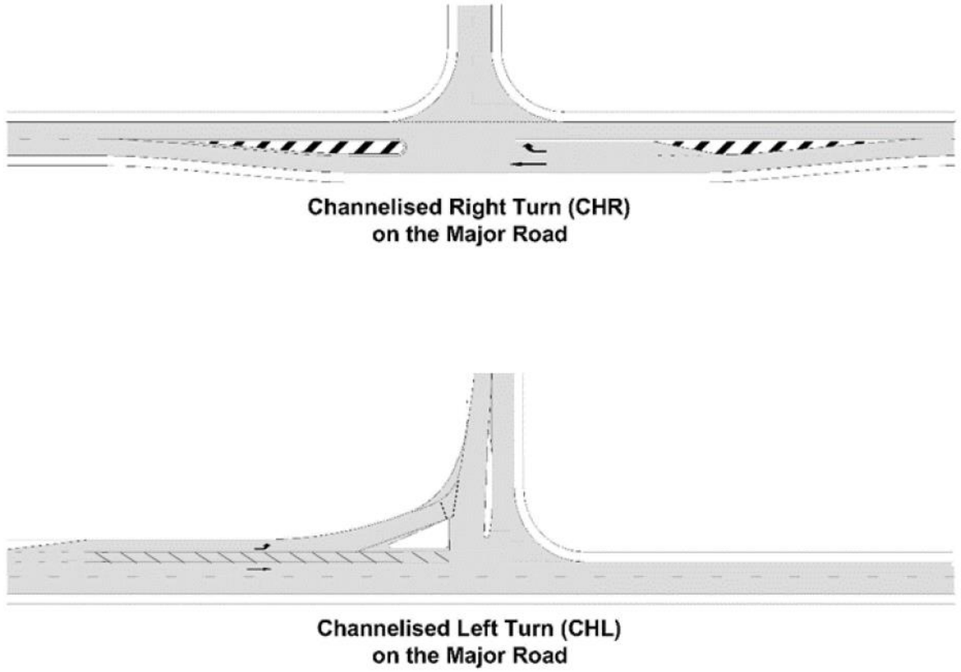


The level of predicted vehicle turning movements at the site access onto Indian Ocean Drive (see Section 6.6) indicates that a CHR/AUL or CHL (Channelised Right Turn Lane / Auxiliary Left Turn Lane or Channelised Left Turn Lane) treatments are likely to be required at the proposed T-intersection onto Indian Ocean Drive, subject to further detailed design and approvals through Main Roads WA, to be undertaken at subsequent stages of the planning process. The design of this future priority controlled T-intersection is proposed to differ from the existing Indian Ocean Drive / Lancelin Road intersection in a few key areas, maximising the safety of this intersection for users as much as possible. These design differences include:

- dual lanes each direction northbound and southbound on Indian Ocean Drive
- removed southbound right turn potential conflict point from Indian Ocean Drive into the structure plan area (southbound right turns from the north to the structure plan area are adequately catered for at the Lancelin Road roundabout intersection).
- separate left-turn and right-turn approach lanes on site access road eastbound to Indian Ocean Drive.
- Two stage right turn movements out of the site access to Indian Ocean Drive southbound (across a wide median island)
- A southbound right-turn acceleration lane for vehicles exiting the site access road to Indian Ocean Drive which is unopposed by southbound vehicles, merging into two southbound lanes over the length of 750m.
- reduced 70km/hr speed zone on Indian Ocean Drive on each approach to the intersection.
- permanent maximum 50km/hr speed zone on site access (side) road.
- Intersection designed in accordance with AustRoads Guidance and MRWA Guidance.

Figure 3-4 below shows the typical layout of CHR and CHL treatments at unsignalised intersections, whereby Channelised Left Turn Lanes (CHL) are preferred over AUL treatments to ensure a clear line of sight for vehicles turning from the minor road (*ref: AGTM Part 6: Intersections, Interchanges and Crossing Management*). As such, CHR and CHL treatments are recommended at this stage of planning for the proposed priority-controlled T-Intersections on Indian Ocean Drive.

Figure 3-4: Typical CHR and CHL Treatments at Unsignalised Intersections (Extract of Figure 3.7 – AGTM Part 6)



Source: AGTM Part 6: Intersections, Interchanges and Crossing Management

It is worth noting that *Austroads Guide Part 6* states:

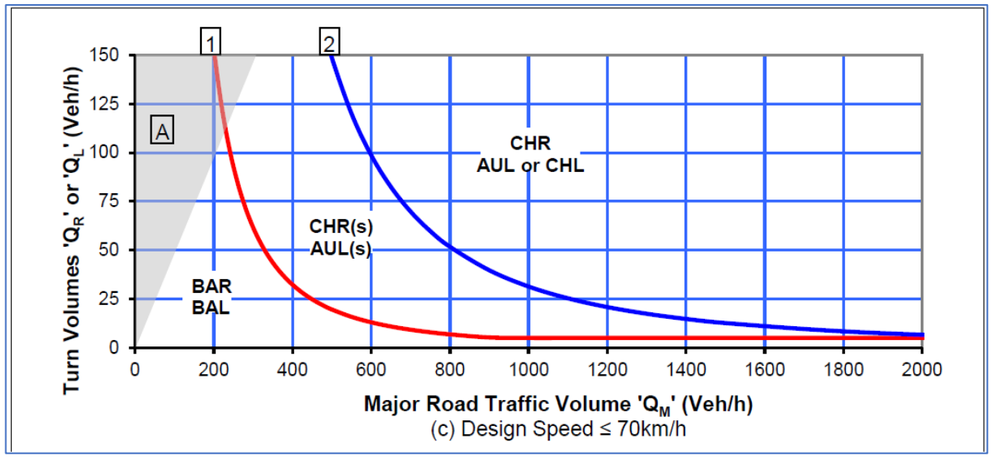
- *The need for deceleration turn lanes cannot be stated definitively in all instances because of the many factors to be considered, such as speeds, traffic volumes, capacity, type of road, service provided, traffic control and crash history. However, the need is usually established on the basis of ensuring that turning traffic does not impede through traffic to the extent that:*
    - *the operational efficiency of an intersection or intersection approach is compromised.*

Section 7 of this TIA report establishes that the future operation of the proposed Indian Ocean Drive / Site Access T-intersection, tested with CHR and CHL treatments, is predicted to operate with acceptable performance and efficiency within the thresholds set by WAPC in the 2051 design year.

Lancelin Road – Site Access Intersection Design

The form of each of the seven proposed site access T-intersections onto Lancelin Road (within the recommended 60km/hr zone) would be based upon the requirements of *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Management* (Austroads 2020). Reference to the third chart in Figure 3.25 of the Austroads 2020 guide shows the following: Note: this figure is applicable for design speeds of between less than or equal to 70km/hr and thus appropriate for the proposed 60km/hr design speed of Lancelin Road (0km/hr posted speed + 10km/hr) along the frontage of structure plan area.

Figure 3-5: Austroads Figure 3.25 Excerpt

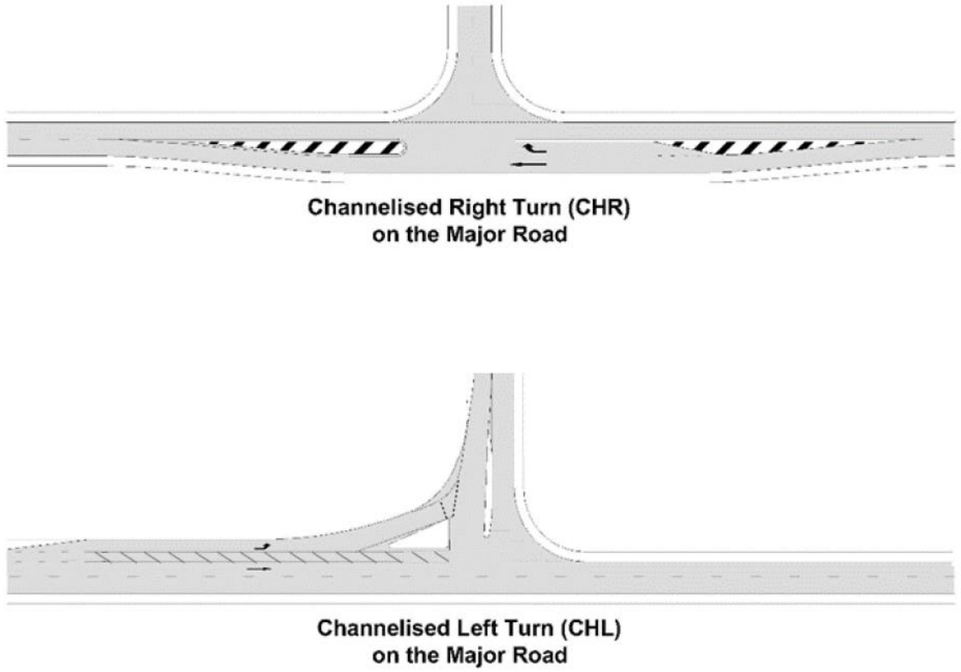


The level of predicted vehicle turning movements at the site access onto Indian Ocean Drive (see Section 6.6) indicates that a CHR/AUL (Channelised Right Turn Lane / Auxiliary Left Turn Lane) treatments are likely to be required at the proposed T-intersections onto Lancelin Road, subject to further detailed design and approvals through Shire of Gingin, to be undertaken at subsequent stages of the planning and design process.

It is noted that CHL (Channelised Left Turn) treatments, in lieu of AUL treatments are preferred at unsignalised intersections to ensure a clear line of sign for vehicles turning from the minor road. Therefore it is recommended that both CHR and CHL treatments be designed into the future site access T-intersections on Lancelin Road from both the main structure plan area on the south side and the proposed industrial area on the north side.

Figure 3-6 below shows the typical layout of CHR and CHL treatments at unsignalised intersections, which are applicable to Lancelin Road.

Figure 3-6: Typical CHR and CHL Treatments at Unsignalised Intersections (Extract of Figure 3.7 – AGTM Part 6)



Source: AGTM Part 6: Intersections, Interchanges and Crossing Management

It is worth noting that *Austroads Guide Part 6* states:

- *The need for deceleration turn lanes cannot be stated definitively in all instances because of the many factors to be considered, such as speeds, traffic volumes, capacity, type of road, service provided, traffic control and crash history. However, the need is usually established on the basis of ensuring that turning traffic does not impede through traffic to the extent that:*
    - *the operational efficiency of an intersection or intersection approach is compromised.*

Section 7 of this TIA report establishes that the future operation of the busiest site access intersection on Lancelin Road (T-intersection), tested with CHR and CHL treatments, which are predicted to operate with acceptable performance and efficiency within the thresholds set by WAPC in the 2051 design year.

3.5 Road Layout Design Principles and Hierarchy

A summary of the key movement design principles and intentions of the Structure Plan area include:

- Safe speeds, embedded in the design of the movement network.
- Emphasis on people movement infrastructure across the area, in lieu of only vehicle throughput considerations.
- Emphasis on cycle/riding movement through a significant dual use path network clearly identifiable, with priority crossings shown where intersecting with street pavement.
- Exceeding the minimum requirements of *Liveable Neighbourhood*s and proposing a significant network of shared paths across the entire site, providing a high-level of infrastructure for the use of walking, wheeling and riding including e-mobility. This network aims to encourage trips by active transport and maximise the safety of these trips across the precinct.
- Overall, the key principles and intent of amended Structure Plan area includes connectivity of north-south and east-west movements across the area, particularly by active transport modes (walking, wheeling, riding) to the future Primary Schools and High School, and the amended structure plan aspires to create safer speeds, local cycling routes, combined with maximising tree retention opportunities.

As shown on **Figure 3-2,** there is a network of higher order roads criss-crossing the site in a north/south and east/west direction (one lane each direction) separated by a physical (raised) median strip. These roads which are proposed as Neighbourhood Connector A (*Liveable Neighbourhoods*) classification, have a road reserve width which typically vary between 20m to 25m. This type of road is capable of carrying up to 7,000 vehicles per day, with greater than 3,000 vehicle per day preferred.

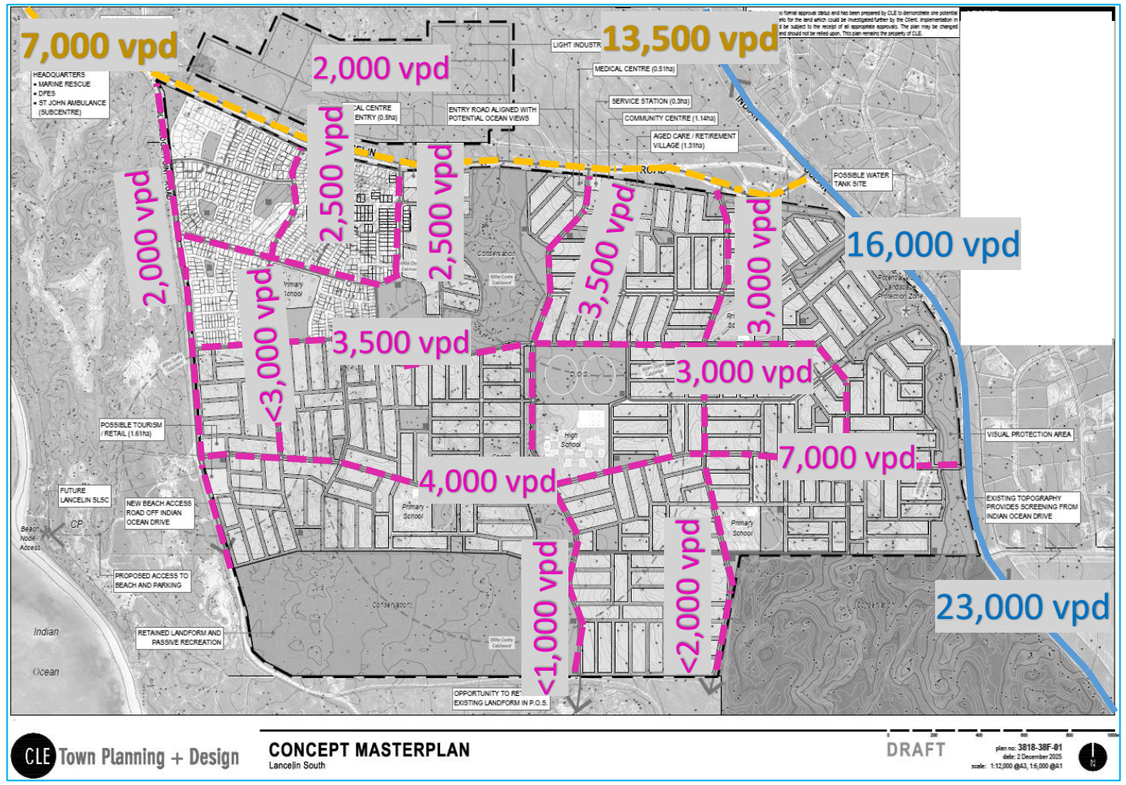
The majority of the remaining streets within the Structure Plan area are classified as amongst Access Street B, C or D depending on their road reserve width and specification in relation to *Liveable Neighbourhoods*. These internal streets range in road reserve width from 13m – 15m (Access Street D) and 18m - 20m (Access Street B). Laneways will be subject to 6m road reserves.

3.6 Daily Traffic Volumes & Street Types

Based on the structure plan traffic generation calculation given in **Section 6** of this report, the following **Figure 3-7** represents the likely all day traffic volumes on streets within the structure plan area and the resultant all-day traffic volumes (vehicles per day - vpd) on the adjoining public roads of Lancelin Road and Indian Ocean Drive along the frontages of the structure plan area. These all-day traffic volumes have been used to derive the likely cross-sections of roads within and surrounding the structure plan area.

Note: all other roads (access roads) not denoted on **Figure 3-7** are expected to carry less than 1,000 vpd particularly given the intricate nature of the access road street network and multiple route options available.

Figure 3-7: Predicted All-Day Traffic Volumes – Structure Plan Area (2051 Design Year)



KEY:

- Existing Primary Distributor Road **(Indian Ocean Drive)**
- Existing Local Distributor Road **(Lancelin Road)**
- Proposed Neighbourhood Connector A
- Proposed Access Road

The road and street types have been reviewed also against the WA *Liveable Neighbourhoods Update 02*, dated January 2009. This specifies the following for Integrator A, Neighbourhood Connector A, Access Streets and Laneways:

Table 3-4: Liveable Neighbourhoods Road Cross Section Guidance

Street Type	Max Design Speed / Target Operating Speed (km/hr)	Indicative Volume (vehicles per day)	Indicative Street Reserve Width (m)	Indicative Road Pavement Width (m)
Integrator A	70	15 – 35,000	45 (without service roads)	14.0m (7.0m wide each direction - dual lanes) no cycle lanes.
Integrator B (outside centres)	60	Up to 15,000	26 (without on-street parking)	7.0m (3.5m lanes + 1.5m cycle lane)
Neighbourhood Connector A	50	7000	20- 24.4	7.0m (3.5m lanes + 1.5m cycle lane)
Access Street B - wider access street	40	3000	17.9	5.5-6 (9.7 with on-street parking)
Access Street C - Yield or Give Way Street	40	3000	15.4	7.2 with on-street parking
Access Street D – Narrow Yield or Give Way Street	50/30	1000	14.2	5.5-6
Laneway / Rear Lane	15	300	6-6.4	6 typical (3 - 6.4 range)

3.7 Street Cross Sections

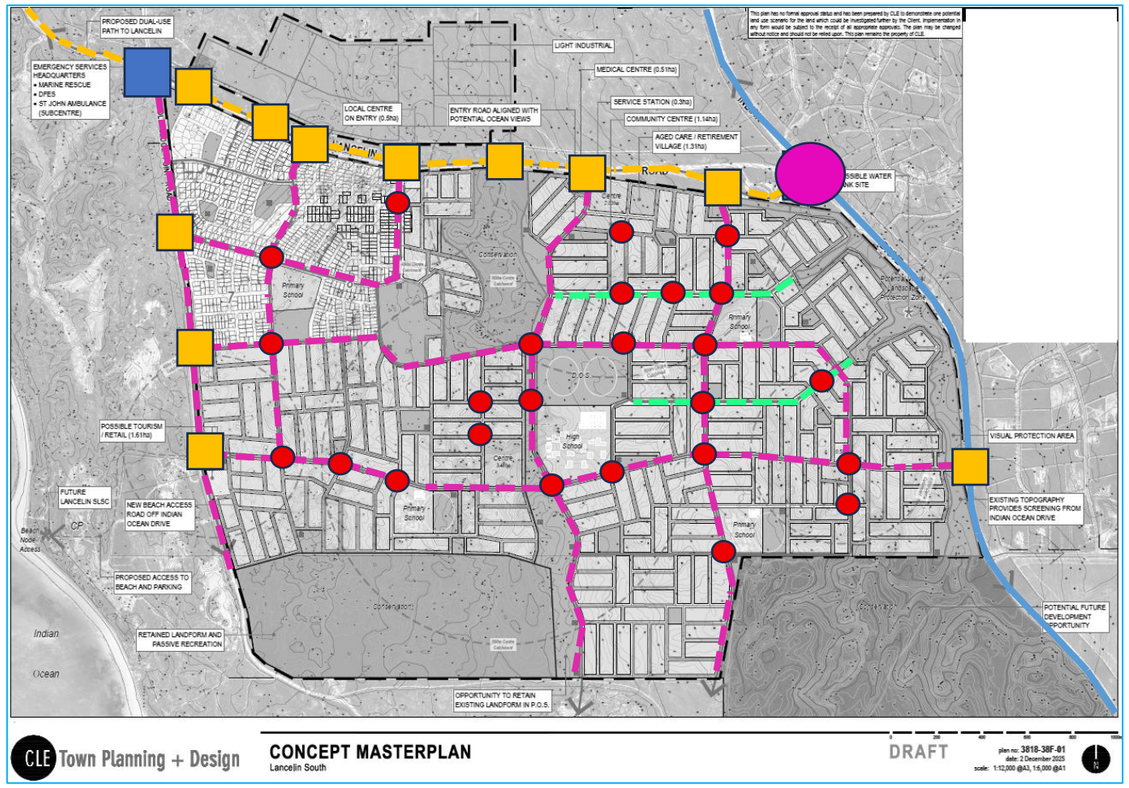
Due to the extent of proposed active travel provisions across the structure plan, such as the extensive use of dual use paths, the following cross-sections represent the proposed street types that don't neatly accord with *Liveable Neighbourhoods*, but nevertheless provide above standard street infrastructure and amenity.

In keeping with the previous 'traffic forecast and intersection design report' prepared by Bruce Aulabaugh Traffic Engineering & Transport Design (2010) upgrades to Lancelin Road and Old Ledge Point Road are required to provide access to the amended Lancelin South structure plan area.

- Lancelin Road to be upgraded to an Integrated Arterial B standard as defined in *Liveable Neighbourhoods;*
- Old Ledge Point Road to be upgraded to a Neighbourhood Connector A standard or similar.

Example cross-sections of these upgraded roads types are given in Section 3.6.1.

Figure 3-8: Proposed Street Hierarchy – Concept Structure Plan

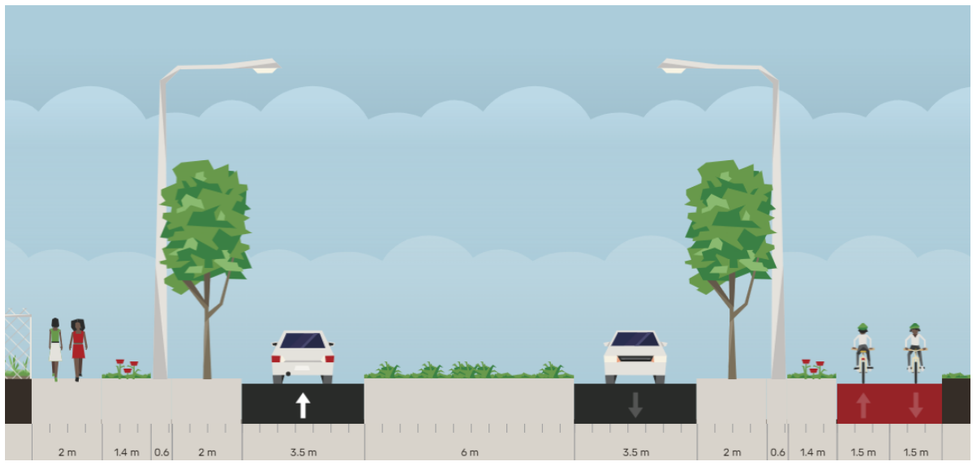


KEY:

- Existing Primary Distributor Road **(Indian Ocean Drive)**
- Existing Local Distributor Road **(Lancelin Road)**
- Proposed Neighbourhood Connector A
- Proposed Access Road
- Proposed Landscape Boulevard Street
- Existing T-Intersection
- Proposed T-Intersection on Existing Road
- Proposed Single Lane Roundabout
- Proposed Dual Lane Roundabout (Future MRWA Upgrade Project)

3.7.1 Lancelin Road – Upgraded Cross-Section

Figure 3-9: Integrator B - Outside Centres): (up to 15,000 vpd),
(recommend detail design addresses intersections, parking, access and bus movement)



Lancelin Road
26m Road Reserve (indicative)

3.7.2 Old Ledge Point Road – Upgraded Cross-Section

Figure 3-10: Neighbourhood Connector A*:

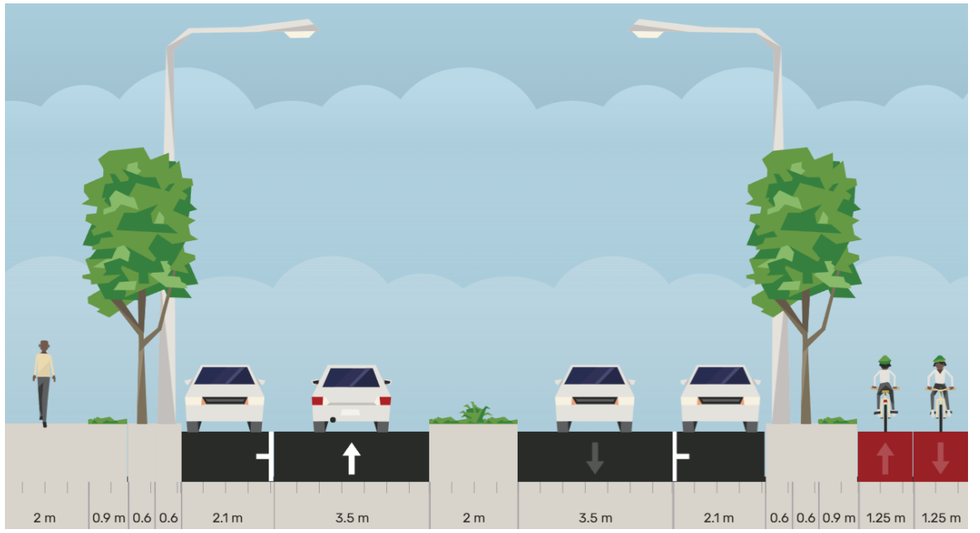
Old Ledge Point Road

22m Road Reserve (indicative)

** For volumes less than 3000 vehicles per day and the street is not ever likely to be a bus route, the road pavement may be reduced from 5.0 m to 4.0 m with no marked cycle lane, and the total reserve width reduced to 22.4 m*

3.7.3 Neighbourhood Connector A Within the Structure Plan Area (Cross-Section)

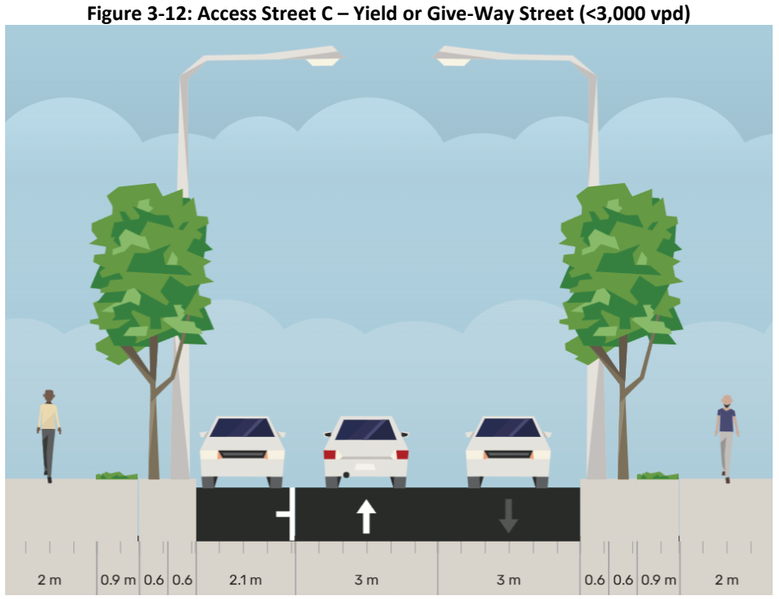
Figure 3-11: Neighbourhood Connector A: (up to 7,000 vpd, with >3,000 vpd preferred)



Approx 21.4m Road Reserve (with parking if required and shared path on one side)

3.7.4 Access Road Within Structure Plan Area (Cross-Section)

Figure 3-12: Access Street C – Yield or Give-Way Street (<3,000 vpd)



16.3m Road Reserve (with parking on one side, if required)

3.7.5 Landscape Boulevard Street Within Structure Plan Area (Cross-Section)

Figure 3-13: Landscape Boulevard Street (<3,000 vpd)

Landscape Boulevard Street:

Landscape Boulevard Streets are proposed in two locations within the structure plan area (refer **Figure 3-8**) and they are intended to be pedestrian focussed with low traffic volumes <3,000 vpd. These streets are intended to connect the areas of natural amenity at their eastern and western extents and encourage walking and cycling trips.

Notwithstanding the above concept, the following measures should be considered and progressed further in terms of design at the subsequent planning stages:

- Consideration is required for how the shared path will connect to the Public Open Space at both ends.
- Consideration is required for access ramps at intermittent points to allow pedestrians and cyclists to access the centralised shared path from both sides of the street.
- Consideration is required for how the shared path will be treated at road intersections. This is likely to require staged crossings (with median refuge) with pedestrians and cyclists required to give-way to vehicle movements.

3.8 Roads & Intersection Controls

All intersections within the site are intended to be constructed as priority-controlled T-intersections, where three road arms meet. Where four-way intersections are formed by the intersections of the main Neighbourhood Connector A streets or at Access Streets, single lane roundabouts at these four-way intersections are considered acceptable. Where four-way intersections meet on the lower-order access roads, these may be permitted if lengths on the minor street are less than 160 m, (and contain additional speed control devices provided on any lengths longer than 80 m if required under Liveable Neighbourhoods.

Also, alternate intersection treatments could be considered for low volume roads, such as 'Raised Safety Platforms' (plateau) or different road finishes (e.g. block paving etc). All intersection will require signage (Give Way or Stop) on the approaches to the intersection.

Two-way, single carriageway roads are proposed within the structure plan area to accommodate the anticipated traffic flows. Preliminary desktop review of intersections in 2D has indicated that there is likely to be sufficient Stopping Intersection Sight Distance (SISD) on all internal intersections. Thus, adequate sight distance is likely to be provided at each site access intersection, however this should be checked in more detail at the subsequent future subdivision planning and design stages.

3.9 Pedestrian and Cycle Access

Pedestrian and cyclist access across the site should be provided as a minimum in accordance with the requirements of the guidance for *Liveable Neighbourhood*s, as per the following.

According to the WAPC *Liveable Neighbourhoods* Policy, footpaths are to be proposed along all Access Streets (2-2.5m wide). Dropped kerb crossings will be provided as appropriate, including at intersections. Cyclists can either use the footpaths, or cycle on the quiet residential streets within the proposed development.

Cyclists are legally permitted to either use the footpaths, or cycle on the quiet residential streets within the proposed local structure plan area. However, this local structure plan goes further than the minimum requirements of *Liveable Neighbourhoods* and proposes a significant network of shared paths across the entire site providing a high-level of infrastructure for the use of cyclists and also pedestrians. This network aims to encourage trips by active transport across the site, particularly between the proposed residential areas and new primary schools across the structure plan area.

Proposed Walking and Cycle Infrastructure within/adjacent the Structure Plan Area

The current Lancelin South concept masterplan (amended structure plan) includes a series of strategic active transport initiatives which aim to deliver an accessible, connected and context-sensitive walking and cycling environment. Key proposals include:

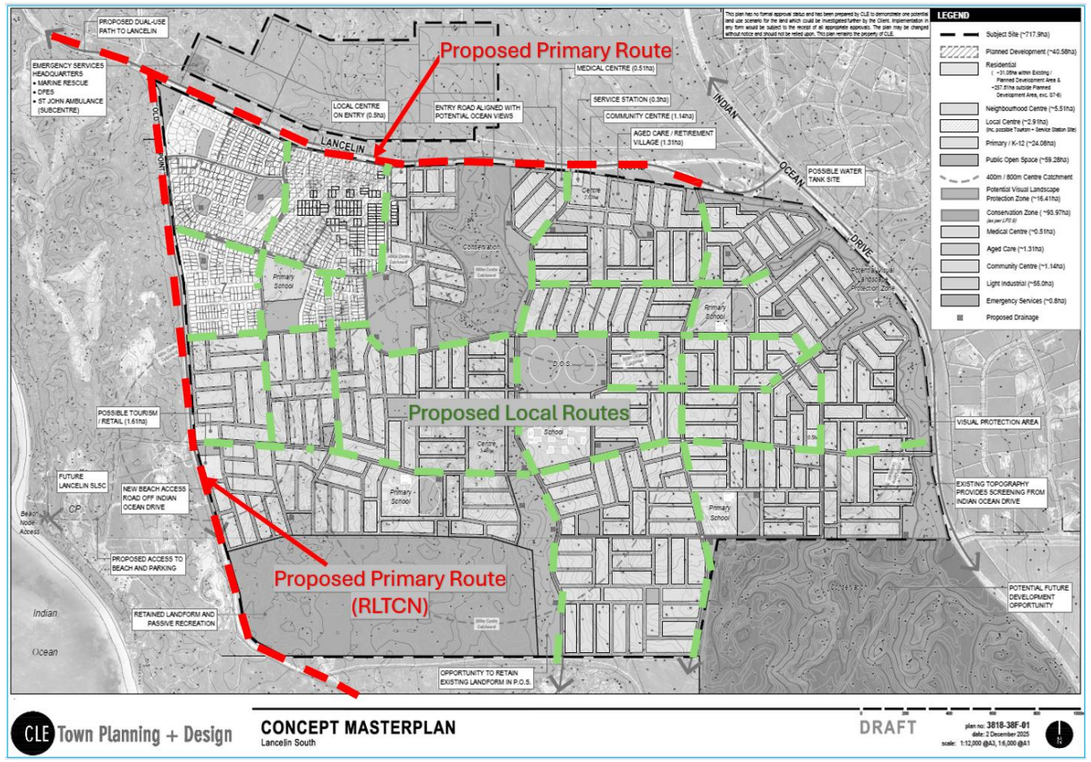
- **Lancelin Road Dual Use Path (Primary Route):**
  The proposed structure plan incorporates a proposed off-road Dual Use Path along Lancelin Road, consistent with the RLTCN's functional hierarchy. This route is intended to serve as a Proposed Primary Route, facilitating east-west movement and linking residential neighbourhoods with the General Industrial area to the north, as well as providing access toward the broader Lancelin township.

- **Neighbourhood Connector Routes (Local Routes):**
  All Neighbourhood Connector roads within the structure plan are proposed to accommodate a Dual Use Path on one side at a minimum width of 2.5 metres. These routes are defined as Proposed Local Routes, and are intended to provide direct and safe access for cyclists and pedestrians to schools, local centres, public open space, and community facilities within the proposed structure plan area. This internal network will promote local active travel and enhance connectivity between key activity generators.

- **Future Links to Coastal and Conservation Areas:**
  Additional opportunities exist to improve walking and cycling links to conservation areas, beach access points, and recreation nodes. These alignments can form part of the passive recreational network and support both daily and leisure-based active transport use.

- **Landscape Boulevard Streets:**
  Landscape Boulevard Streets are proposed in two locations within the structure plan area and they are intended to connect the areas of natural amenity at their eastern and western extents and encourage walking and cycling trips.

Figure 3-14: Proposed Walking and Cycle Infrastructure within/adjacent the Structure Plan Area



LEGEND:

Proposed Primary Route

Proposed Local Route (Within Structure Plan Area)

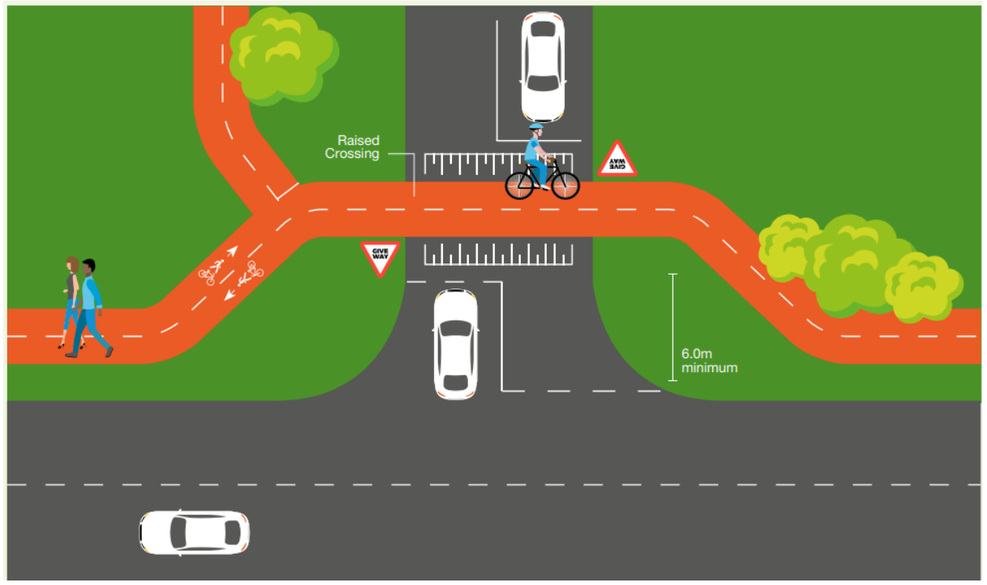
3.10 Cycle and Pedestrian Priority Across Roads

In order to connect the proposed shared path network within the overall structure plan area (refer **Figure 3-12**), it is recommended to provide standardised priority for cyclists/riding and pedestrians across side road intersections along identified shared path routes. In accordance with the DTMI's Guidance on '*Planning and Designing for Bike Riding in Western Australia'* providing priority for path users across minor roads where safe to do so is encouraged and suggests that the treatment shown in **Figure 3-13** may be suitable where:

- Traffic volumes on the side road are low,
- Speeds on both the major road and side road are low, or
- There are low numbers of heavy vehicles (particularly semi-trailers) given their potential to straddle the crossing point.

A minimum 6.0m indentation to the roadway is required (**Figure 3-13**) to allow for cars to enter the major road without obstructing the shared path and for cars to stop after entering the minor road without impeding through movements on the major road they have just exited. The indentation also helps improve sight lines and awareness between road and path users. Further consideration of these industry best practice measures for cyclists and pedestrians should be encouraged during the subsequent subdivisional planning stage.

Figure 3-15: Cycle Priority Across a Side Road (Department of Transport Guidance)



Source: DTMI Guidance on 'Planning and Designing for Bike Riding in Western Australia'

3.11 Pedestrian Crossing Thresholds

In regard to the internal lower order road network (Access Streets) predicted to carry up to 1,000 vehicles per day, these roads are considered not to cause a difficult barrier for pedestrians and cyclists to cross.

This is in line with Table 4 of the *WA Transport Impact Assessment Guidelines Volume 2,* which has been reproduced below. This states that for a two-lane undivided road, the ability of most pedestrians to cross would only be affected if there are more than 1,100 vehicles per hour (two-way).

In regard to the network of higher order Neighbourhood Connector A roads across the site it is recommended that pedestrian refuge islands be provided at pedestrian crossing points at intersections.

Table 3-5: Traffic Volumes Affecting Pedestrian Crossing Amenity

Road cross-section	Traffic volume affecting ability of pedestrians to cross (vehicles per hour – two-way)
2 lane undivided	1,100 vph
2 lane divided (or with pedestrian refuse islands)	2,800 vph
4 lane undivided (without pedestrian refuge islands)	700 vph
4 lane divided (or with pedestrian refuge islands)	1,600 vph

3.12 Safe Walk/Cycle to School Assessment

As discussed previously, the structure plan area proposes to ultimately deliver four new primary schools and a High School, within the structure plan area. It is expected that the proposed primary school catchments will be all internal to the structure plan area which is proposed to support up to 7,000 new residential lots. It is also expected that the proposed High School catchment will be within the structure plan area with an element of the catchment outside of the area.

The likely routes that residents (parents/children) of structure plan area may take to access the new schools on foot/cycle, will be via the internal street network and mainly along the identified walking, wheeling and riding routes proposed to feature shared path infrastructure and natural shade and shelter along their length. It is assumed that any children residing outside of the structure plan area attending the new High School will not walk or cycle to school given the distance involved from the surrounding areas and the barrier to active travel movement across Indian Ocean Drive.

Safe crossings points are to be provided across all roads within the structure plan area with dropped kerb (pram ramps) and also at grade crossings are proposed across all side roads and roads along the key cycle and pedestrian routes.

At this local structure plan level of detail, It is concluded that the likely routes that will be taken by residents of the proposed structure plan area to access the nearby schools should be suitable, as continuous footpaths and shared paths will be provided with some crossing facilities where required.

3.13 Public Transport Provision Within the Structure Plan Area

In terms of safeguarding the potential for future bus route modifications and stop locations across the structure plan area and as Lancelin grows, internal roads intended to support buses should provide Public Transport Authority (PTA's) required 3.5 m wide lanes in each direction (or 3.2m wide minimum lanes with a >1m wide median) and typically ≥20 m road reserves, consistent with PTA needs for bus operations. Note also that a 3.5m wide lane kerb to kerb should be avoided where possible to prevent cyclists from being placed in a 'squeeze zone' amongst vehicles.

4 Changes to the External Transport Network

The recently completed, current and proposed road network changes around Lancelin, based on information obtained from both the Shire of Gingin and Main Roads WA are as follows:

4.1 Shire of Gingin

Lancelin Road Works (Lancelin South Development)

The Shire has recently completed roadworks on Lancelin Road (commenced 5 May 2025), undertaken by Menzies Civil Australia. These works are part of the Lancelin South Development in the north-west corner of the structure plan area and involved lane closures managed by an approved traffic management plan. It is understood that these works are in connection with achieving new vehicular access to the Lancelin South Development area.

Foreshore Redevelopment & Skate Park

While primarily focused on Hopkins and Cunliffe Streets foreshore area (including road surfacing and drainage improvements), the foreshore redevelopment in early 2023 included minor adjacent street upgrades, street reconfiguration and resurfacing.

4.2 Main Roads WA

Indian Ocean Drive (Yanchep to Lancelin) Planning Study

In 2021 / 2022 Main Roads conducted a long-term planning study for Indian Ocean Drive between Yanchep and Lancelin. The study explores future network requirements including dual carriageways, intersection upgrades (e.g. roundabout at Lancelin Road), seagull-style intersections, left-in/left-out treatments, and consolidating property access at various points along the length of Indian Ocean Drive. No construction funding is currently allocated and this study is only in the future planning stage.

Main Roads WA's planning study doesn't commit to construction yet, but outlines potential future upgrades to Indian Ocean Drive between Yanchep and Lancelin, including:

- Upgrading the route to a dual carriageway featuring a 14 m wide vegetated median, with options for narrower medians and concrete barriers in constrained areas.
- Intersection treatments at 18 junctions along the corridor, these range from roundabouts (e.g., at Lancelin Road and Barragoon Road), 'seagull' intersection configurations and left-in/left-out or relocated T-intersection treatments.

In regard to direct local road connections to Indian Ocean Drive, Main Roads WA's Indian Ocean Drive Planning Study (which aims to identify what the long-term requirements are for Indian Ocean Drive) states:

"While road upgrades will have some impact on adjoining and nearby land and communities, we will minimise this as much as possible by working collaboratively with landowners. Direct lot accesses and local road connections introduce potential conflict points for traffic on the road network. To optimise safety and efficiency on the network, we need to minimise the number of connection points, while allowing for appropriate levels of lot and network access."

Therefore, there is an identified willingness from Main Roads WA to work with landowners to understand their needs for development. Whilst understandably minimising the number of connection points to Indian Ocean Drive, where direct connections are justifiably needed there is an openness from Main Roads WA to consider and permit appropriate access, as opposed to specific blanket restrictions.

Figure 4-1: MRWA Preliminary Access Strategy – Indian Ocean Drive

Source: Main Roads WA

Main Roads WA proposes a future Indian Ocean Drive dual carriageway would have a 14 metre wide, vegetated median. This type of carriageway is similar to Bussell Highway in Capel.

In locations where there are constraints on both sides, such as development or environmental issues, a narrow median with concrete barrier would minimise impacts **(Figure 4-2).** This type of reduced median width with central barrier is similar to Tonkin Highway.

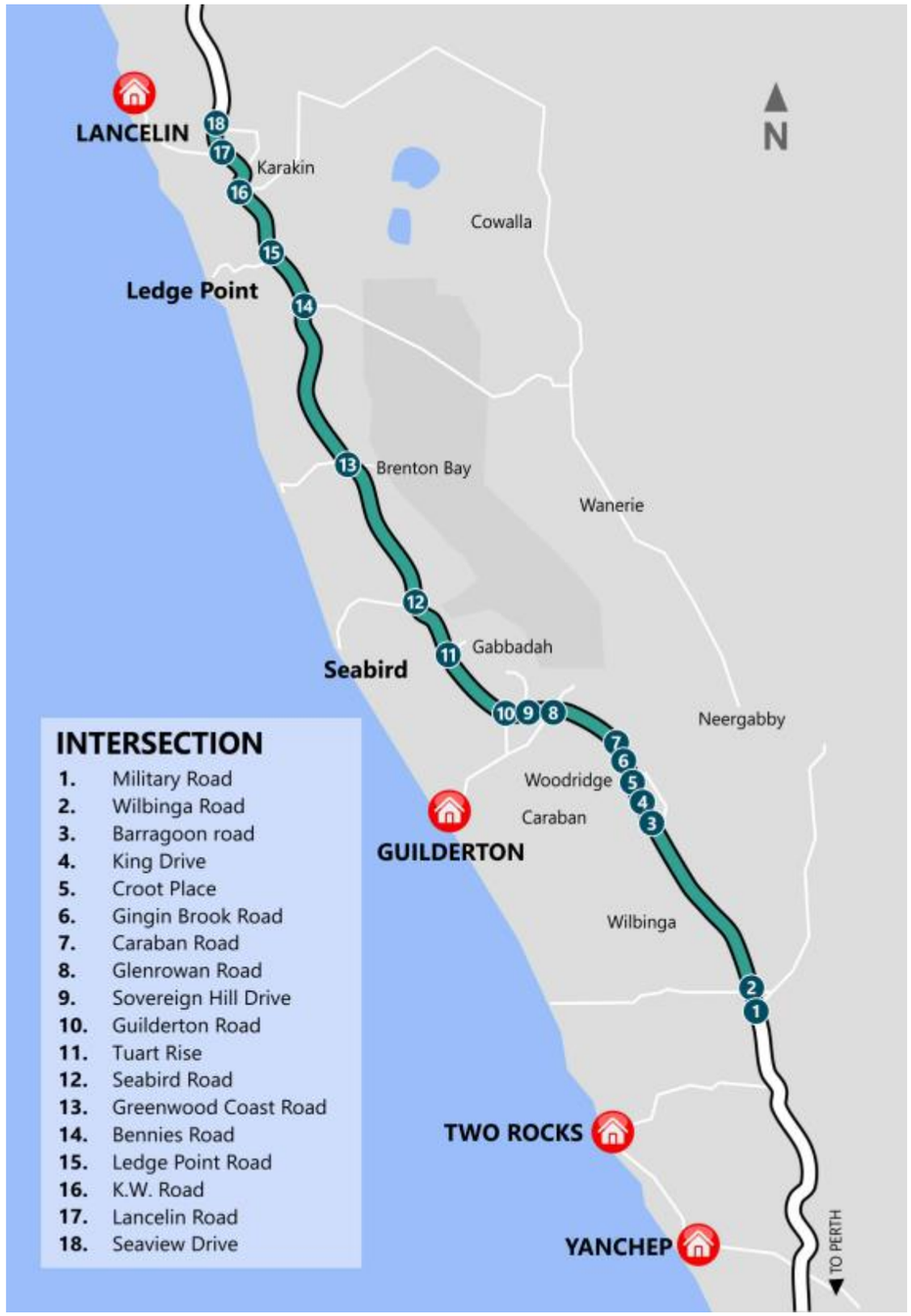
Figure 4-2: MRWA Preliminary Access Strategy – Indian Ocean Drive

Source: Main Roads WA

There are 18 existing intersections along the Indian Ocean Drive corridor which Main Roads WA proposes will require upgrading or modification to improve safety as traffic volumes grow.

Based on Main Roads WA's analysis and consultation to date, Main Roads has identified the following intersection types for consideration

Figure 4-3: Extent of Indian Ocean Drive (Yanchep to Lancelin) Planning Study



Source: Main Roads WA

Figure 4-4: Schedule of Planned Intersection Upgrades – Indian Ocean Drive

Intersection	Proposed Access Treatment and Intersection
Military Rd	Reduced access, no connection (Military Rd connecting south of Indian Ocean Dr, to Wanneroo Rd)
Wilbinga Rd	Relocate t-intersection north improving sightlines and safety
Barragoon Rd	Install roundabout
King Dr	Reduced access, to left-in/left-out
Croot Pl	Reduced access, to left-in/left-out
Gingin Brook Rd Caraban Rd	Upgrade to roundabout (realign eastern end of Caraban Rd south, to tie-in with Gingin Brook Rd)
Glenrowan Rd	Retain t-intersection
Sovereign Hill Dr	Install seagull
Guilderton Rd	Install seagull
Tuart Rise	Install seagull
Seabird Dr	Install seagull
Greenwood Coast Rd	Retain current t-intersection
Bennies Rd	Retain current t-intersection
Ledge point Rd	Install seagull
K.W. Rd	Install seagull
Lancelin Rd	Install roundabout
Seaview Dr	Reduced access to Left-in / Left-out
Direct property accesses	Consolidate where feasible To be investigated

Summary of Main Roads WA Planning Study

- These are long-term planning proposals, with no construction funding currently allocated.
- Main Roads WA proposes future carriageway duplication (two lanes each direction) on Indian Ocean Drive.
- Main Roads WA proposes a future roundabout upgrade at Indian Ocean Drive/Lancelin Road.
- The corridor study is driven by anticipated traffic growth, development in regional towns, and safety considerations.
- Outcome goals include reserve protection, safer intersections, improved median design, and better management of access points.

Previous Road Safety Improvements

The future planning study complements previously completed safety improvement works by Main Roads WA on Indian Ocean Drive.

Following a series of serious crashes on Indian Ocean Drive between Two Rocks and Lancelin, an Indian Ocean Drive Safety Review Group was established in August 2017 to examine road safety issues on this stretch of road.

The following safety improvements have already been made to Indian Ocean Drive:

- Speed limit reduced from 110 km/h to 100 km/h
- Installed edge and centre audible line marking to reduce head-on collisions and frequency of vehicles running off the road
- Constructed four overtaking lanes.
- Widened the road and applied the Wide Centre Line Treatment.
- Improved signage: installed curve warning signs, wildlife warning signs and new guide signs.
- Installed safety barriers and constructed embankments to reduce road side hazards.
- Installation of flag lighting at KW road and Gingin Brook Road.

Recent Completed Upgrades (Jurien Bay to Brand Highway)

Two large scale upgrade stages have already been completed on Indian Ocean Drive, 24 km between Jurien Bay and Greenhead (May 2023) and 33 km between Leeman and Brand Highway (April 2025), each including road widening, new passing lanes, audible edge lines, and curve realignments. These did not extend directly to Lancelin but reflect broader corridor safety investment

Heavy Vehicle Access Restriction

As of December 2023, Main Roads WA imposed local-access-only conditions for Restricted Access Vehicles (RAVs) on Indian Ocean Drive between Jurien Bay and Brand Highway, limiting through-traffic heavy vehicles to preserve the route quality and safety

4.3 Changes to Active Transport Network:

Avon Central Coast Regional Long-Term Cycle Network (RLTCN)

The Lancelin South Structure Plan is located within the catchment of the **Avon Central Coast Regional Long-Term Cycle Network (RLTCN)**, a strategic initiative led by the Department of Transport to support the development of a comprehensive cycling network across regional WA. This network outlines a hierarchy of Primary, Secondary, and Local cycling routes based on function and demand.

A key component of the RLTCN relevant to the Lancelin area is the identification of **Old Ledge Point Road as a future Primary Route**. This status reflects its potential role as a high-demand corridor for cycling, serving as a backbone for regional connectivity along the coastal spine. Although it is not proposed that the developer (VIMG) be responsible for delivering this infrastructure, its future planning status should be acknowledged to enable future funding or government-led delivery through the WA Bicycle Network Grants Program or other sources.

KEY:

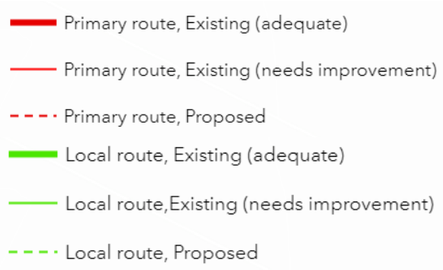
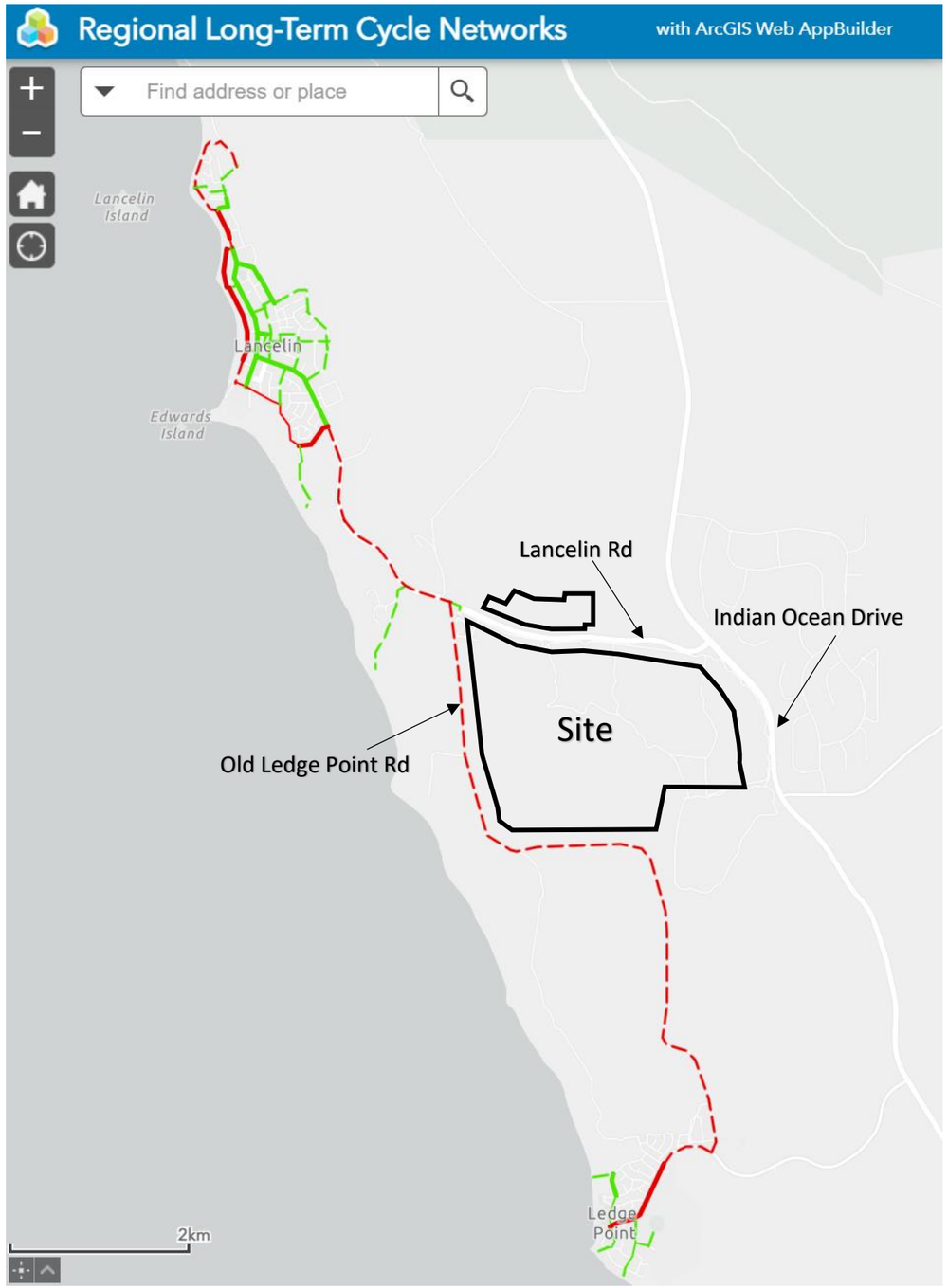


Figure 4-5: Avon Central Coast Regional Long-Term Cycle Network (RLTCN)



Source: Department of Transport and Major Infrastructure (DoTMI)

4.4 Strategic Integration and Future Planning Considerations

The proposed active transport elements support the long-term vision of the RLTCN and align with *Liveable Neighbourhoods* design principles by providing a safe, legible and well-integrated cycling and pedestrian network across the structure plan area. The internal path network will ensure that residents can access schools, centres and open space via active modes, while the strategic placement of primary and local routes allows for future expansion or connection to regional paths.

It is recommended that any future upgrades to Old Ledge Point Road consider the inclusion of an off-road Dual Use Path to preserve the long-term strategic vision of the RLTCN, noting that the delivery responsibility for this route lies with broader infrastructure agencies or through future funding opportunities rather than the developer's responsibility.

These proposals ensure that Lancelin South supports a sustainable and active transport environment from the outset, while also accommodating long-term integration with regional cycle networks as they evolve.

Transport Strategies Relevant to Shire of Gingin:

While the Shire of Gingin doesn't currently have its own dedicated cycling strategy, there are several broader plans and regional strategies that include Gingin and offer direction for active transport development. These documents highlight opportunities to improve walking and cycling connections across the Shire, both for recreation and transport.

Avon Central Coast 2050 Regional Cycling Strategy

This is the most relevant cycling-specific strategy for Gingin. It was developed by the Department of Transport in partnership with several regional local governments, including the Shire of Gingin.

- It sets out a long-term vision for cycling networks across the region.
- Focuses on key townsites and regional connectivity, not just recreational routes.
- The strategy encourages the development of a Primary, Secondary and Local Cycling Network, which Gingin could adopt into its own future planning.
- It's designed to guide funding, planning, and infrastructure decisions well into the future.

This document provides a strong regional foundation that the Shire can build on locally.

Shire of Gingin Trails Master Plan (2018)

This plan focuses more on walking and recreational trails rather than commuter cycling, but it's still a useful piece of the puzzle.

- Assesses the condition and use of existing trails (mostly for walking).
- Recommends upgrades, signage improvements, accessibility upgrades, and promotion of trails.
- While it doesn't include cycling as a priority, many of the recommended trail upgrades could also benefit cyclists, particularly mountain bikers and tourists.

This is a good base for expanding into a broader active transport strategy in the future.

Local Planning Strategy & Scheme

The Shire's Local Planning Strategy and Planning Scheme (LPS9) set the long-term land use vision, including for transport.

- They provide a policy framework that supports the development of paths and connections for cyclists and pedestrians.
- However, detailed cycling or pedestrian networks are not yet mapped out.
- These documents could be updated or supplemented with an Active Transport Plan that builds on the regional cycling strategy.

Coastal Recreation Tracks Master Plan (Draft, 2025)

This is a collaborative project between Gingin and neighbouring coastal shires, focusing on recreational use of coastal reserves.

- It includes walking, fishing, 4WD access, and general coastal recreation.
- While it's not a cycling strategy, there's potential to include shared-use paths or cycling links as part of broader coastal access improvements.

4.5 Changes to Public Transport Network

There are no confirmed future plans by PTA / TransWA for any changes to the existing public transport infrastructure, routes and service frequencies in and surrounding Lancelin.

The proposed structure plan area presents an ideal opportunity to incorporate local bus routes and new bus stop provision within and around the structure plan area, particularly given the proposed four primary schools and one high school.

A key regional planning document, the **Northern Growth Corridor Strategic Discussion Paper (June 2022)**, explicitly notes that TransWA coach services run two days a week to/from Lancelin (and also references the broader regional connectivity setting e.g., no passenger rail services in the corridor, but METRONET rail reaching Yanchep/Ellenbrook). However, this does not commit to service upgrade announcements for Lancelin, rather acknowledgment of current service levels and future access pressures.

Whilst there is no definitive planned upgrades to public transport in the Lancelin area, there are regional strategies acknowledging service levels and the need for connectivity as the region grows and prior structure planning in the area indicates public transport has been considered in growth-area planning, with land development being the most likely driver for new public transport services into the future.

5 Integration with Surrounding Area

5.1 Surrounding Attractors / Generators

The subject site is located to the west of Indian Ocean Drive and south of Lancelin Road, within an area largely characterised by coastal vegetation and underdeveloped bushland. The broader Lancelin region serves as a well-established coastal township offering a range of services, tourist facilities, and recreational amenities that are likely to generate movements to and from the subject site.

To the immediate north of the subject site across Lancelin Road, a General Industrial precinct is proposed. This zone, which is strategically separated from the residential and community-oriented land uses, will serve as a significant employment generator for the wider locality, attracting light industrial, logistics, and service-related businesses. The proximity of this area to Indian Ocean Drive facilitates efficient regional connectivity for freight and workforce access.

Additional attractors within the proposed structure plan area include an emergency services hub, aged care facilities, a health centre, primary and high schools, and a community centre. These uses will support both daily and periodic trip generation for educational, health, recreational and community needs. A town centre zone with local and neighbourhood-scaled centres is centrally positioned to support commercial activity and encourage walkability from nearby residential areas.

Figure 5-1: Existing Surrounding Land Uses

Source: Google Maps (2025)

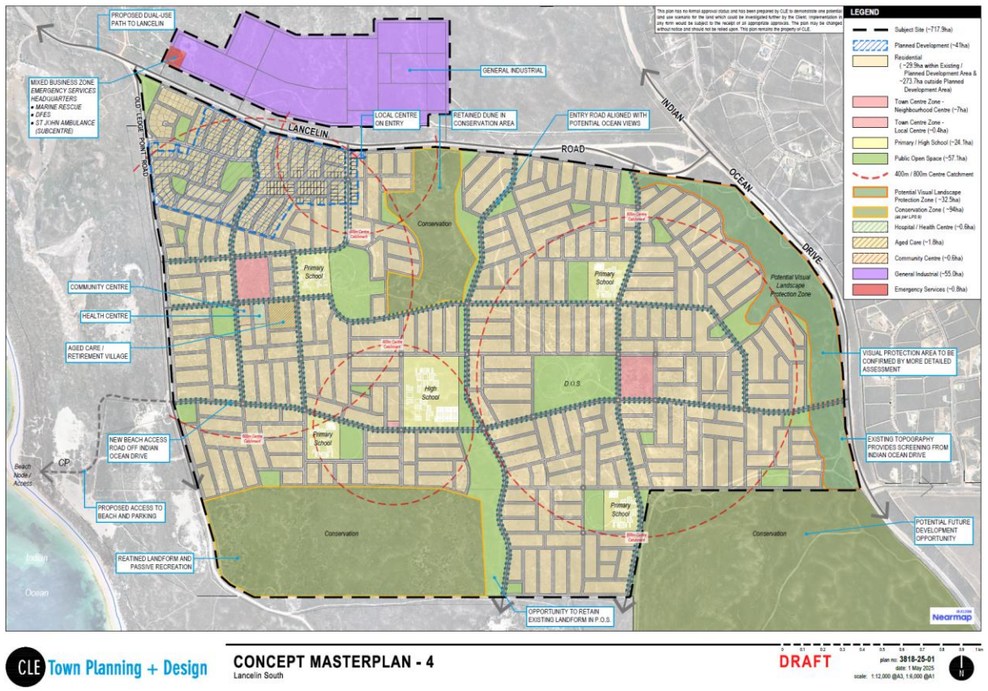
5.2 Proposed Changes to Surrounding Land Uses

The concept master plan for the structure plan area proposes a diverse mix of land uses integrated across approximately 717.9 hectares, incorporating residential, town centre, industrial, educational, conservation, and recreational land uses. To the north of Lancelin Road, the 55-hectare General Industrial zone has been identified, intended to accommodate a range of light industrial and employment-focused uses.

South of Lancelin Road, the area transitions into a predominantly residential and community-focused setting, supported by a network of green corridors and public open space totalling over 57 hectares. Conservation zones, including retained dunes and a potential visual protection area, ensure that the natural topography and ecological values of the coastal setting are preserved.

Connectivity is enhanced through a proposed dual-use path linking to the existing Lancelin township, and key entry roads are aligned with natural view corridors toward the coast, enhancing the visual amenity of the development.

Figure 5-2: Proposed Structure Plan Amendment – Lancelin South



5.3 Committed Developments

Within the north-west corner of the structure plan area there is a mixture of existing completed, under construction, approved or committed residential development (design stage) totalling around 870 lots.

While the immediate surrounds remain largely undeveloped, the inclusion of significant infrastructure and service elements within the structure plan area – such as educational institutions, health and aged care facilities, and a mixed-business/emergency services precinct – positions the development as a self-sustaining extension of the Lancelin township.

The proposed General Industrial area plays a key role in supporting local employment, reducing the need for out-commuting and facilitating economic diversification within the region.

5.4 Regional Integration and Accessibility

The site benefits from direct frontage to Indian Ocean Drive (subject to *Potential Visual Landscape Protection Zone)* and Lancelin Road, two key regional corridors that support north-south coastal travel and east-west local movement. Indian Ocean Drive provides vital linkages to towns further north (e.g., Cervantes, Jurien Bay) and south (e.g., Ledge Point, Guilderton), reinforcing the strategic locational advantage of the site.

The proposed structure plan proposes a site access road connection from Indian Ocean Drive (in addition to the existing Lancelin Road connection), with an internal road network designed to distribute traffic effectively throughout the site and enable future integration with potential development areas to the south and west.

5.5 Accessibility, Connectivity and Sustainable Integration

Pedestrian and cyclist connectivity is a core principle of the structure plan. A dual-use path is proposed along the northern boundary, providing continuous access between the development area and the established Lancelin town centre. Internally, the layout promotes walkability with local road and path networks linking residential areas to schools, the local centre, and areas of open space.

Future public transport service extensions or connections are anticipated, particularly to serve the educational precincts and town centre. Consideration should be given to integrating of low-speed environments and potential shared streets in residential areas to improve cyclist and pedestrian safety.

This integrated approach to land use, movement, and environmental protection ensures the development will deliver a sustainable, connected, and contextually appropriate urban expansion to the existing Lancelin township.

5.6 Level of Overall Accessibility and Integration

When fully developed, the structure plan area will function as a well-connected extension of the Lancelin township, anchored by direct frontage to Indian Ocean Drive and Lancelin Road. Multiple access points to these corridors, combined with an internal road network designed to distribute traffic, will provide efficient local circulation and clear regional connections north and south along the coast. The separation of the General Industrial precinct north of Lancelin Road from residential and community uses south of Lancelin Road supports safe and legible movement patterns, with Indian Ocean Drive accommodating freight and workforce access while residential streets within the structure plan area prioritise local traffic.

Walkability and active travel are embedded in the plan. A continuous dual-use path along the northern boundary aims to link the development with the established Lancelin town centre, while internal local roads and paths connect homes to schools, the town and local centres, health and aged care facilities, and public open space. Green corridors and conservation areas are used to shape these connections, maintaining visual amenity and protecting the coastal landscape. Within neighbourhoods, consideration of low-speed street environments and potential shared-street treatments would aim to improve safety and comfort for people walking and cycling.

Engagement with the Public Transport Authority and the Shire of Gingin during staging will define future public transport service alignment and frequency as population and employment thresholds are reached.

Overall, the land use mix, regional road interfaces, and active-transport network create a balanced and sustainable movement framework. The industrial area offers local jobs that reduce commuting, while town centre and community uses are positioned to encourage short, local trips by foot and bicycle. Together, these elements deliver a cohesive, context-responsive urban extension that integrates effectively with the existing Lancelin township and the wider coastal corridor.

6 Analysis of External Transport Networks – Assessment Parameters

6.1 Assessment Years & Time Periods

In line with the WAPC Guidelines, consideration of the road network and proposed site access intersections, this structure plan level Transport Impact Assessment has been undertaken at a design year at least 20 years or more into the future. The projected year of full development is around 2051, 25 years into the future, which has been taken forward as the 'ultimate' year of assessment within this TIA.

Therefore, to test the adequacy of the external road network at this high-level 'broad brush' stage of the planning process, the following intersections (Section 6.2) have been assessed for capacity under the 'Ultimate - 2051' scenario:

To be consistent with the most recent traffic data available for Lancelin Road and Indian Ocean Drive, this TIA will assume similar weekday peak time periods of the existing road network, these being **08:00 to 09:00 a**nd **15:00 to 16:00,** which will also include afternoon school peak traffic.

6.2 'Ultimate' Assessment Scenario – 2051:

This assessment scenario assumes full build out of the entire structure plan area, including all residential components, neighbourhood centres, proposed high school and primary schools and the general industrial area to the north of Lancelin Road.

The proposed and existing site access intersections which have been assessed for capacity at the 'ultimate' 2051 design horizon are described as follows, the results of which are presented in this section of the report:

Note: This scenario includes the planned upgrade of Indian Ocean Drive (duplication) with two lanes in each direction and the planned roundabout upgrade to the Indian Ocean Drive / Lancelin Road intersection.

- Indian Ocean Drive / Lancelin Road – Future Upgraded Roundabout Intersection (MRWA Design)
- Lancelin Road / Centralised Site Access (Busiest Site Access) – Proposed Priority Controlled T-Intersection
- Lancelin Road / Old Ledge Point Road – Existing Priority Controlled T-Intersection
- Indian Ocean Drive / Eastern Site Access – Proposed Priority Controlled Intersection.

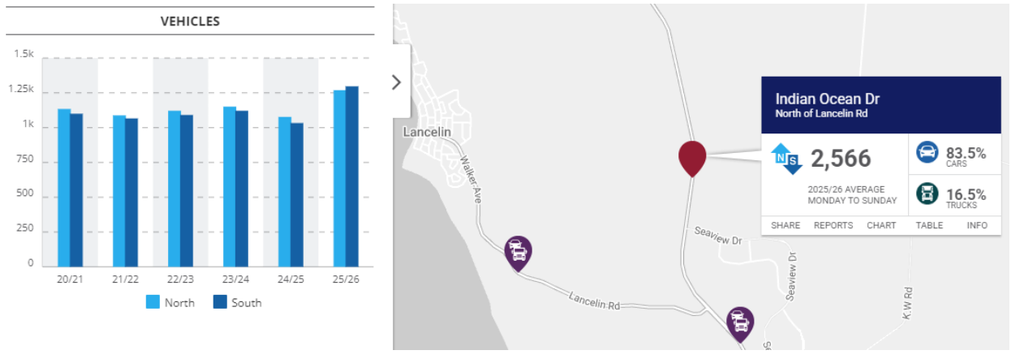
6.3 Background Traffic & Growth

Main Roads WA's Asset and Geospatial Information Team were contacted in October 2025 to seek their Regional Operational Model (ROM24) forecasts for projected traffic growth along the Indian Ocean Drive corridor and surrounding roads. Main Roads WA provided 2021 validation plots, however did advise that the determination of future traffic projections is recommended to be calculated using compound growth rates using observed traffic volumes from the MRWA Traffic Map database and applying them to current counts.

Interrogation of the Main Roads WA traffic map shows a 24 hour count site (No. 50167) on Indian Ocean Drive – north of Lancelin Road. Traffic data for this site is available between the years of 2020 to 2026. Analysis of the increasing traffic volumes over this period, shows an average 2.9% growth rate of traffic on Indian Ocean Drive per annum. This nominal background growth rate will be applied to the background traffic volumes on Indian Ocean Drive up to the design horizon of 2051 for assessment purposes.

Traffic growth on the Lancelin Road and Old Ledge Point Road is considered to be primarily from the emerging existing residential development/construction and from the future structure plan area, which is the subject of this Transport Impact Assessment. This is considered a robust approach.

Figure 6-1: Count Site 50196 – Traffic Growth 2020 to 2026



Source: MRWA Traffic Map Database

6.4 Structure Plan Generated Traffic – Ultimate Build Out 2051

The traffic generation rates in **Table 6-1** are sourced from the WAPC guidelines and have been used to calculate an estimate of the likely traffic generated in the AM and PM peak periods by the proposed land uses across the structure plan area. Where noted, trip rates for certain land uses have been taken from the ITE Trip Generation Rates - 9th Edition database.

Table 6-1: Trip Generation Rates – Various Land Uses Across Structure Plan Area

Land Use	Units	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
		IN	OUT	IN	OUT
Residential	Per Lot	0.2	0.6	0.5	0.3
Local Centre* (Retail – Non Food)	Per KSF2*	0.6	0.36	1.78	1.93
Neighbourhood Centre* (Retail – Food)	Per KSF2*	0.6	0.36	1.78	1.93
Medical Centre*	Per Employee	0.4	0.4	0.38	0.58
Retirement Village*	Per Unit	0.1	0.05	0.08	0.12
Community Centre*	Per KSF2*	1.35	0.7	1.34	1.4
Emergency Service HQ	Broad brush assumptions provided in Table 6-4				
Primary School	Per Pupil	0.5	0.5	0.5	0.5
High School	Per Pupil	0.5	0.5	0.5	0.5
Industrial	Per 100m2	0.8	0.2	0.2	0.8

***** Trip rates taken from the ITE Trip Generation Rates - 9th Edition database.

Table 6-2 to Table 6-5 summarises the trip volumes derived from the generation rates.

Table 6-2: Proposed Development Traffic Generation (Residential Only) - 'Ultimate' 2051 Scenario

Residential Stage*	No of Lots	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
		IN	OUT	IN	OUT
Stage 9 & 10	251	50	151	126	75
Stage 11	556	111	334	278	167
Stage 12	711	142	427	356	213
Stage 13	326	65	196	163	98
Stage 14	383	77	230	192	115
Stage 15	833	167	500	417	250
Stage 16	318	64	191	159	95
Stage 17	412	82	247	206	124
Stage 18	621	124	373	311	186
Stage 19	455	91	273	228	137
Stage 20	846	169	508	423	254
Stage 21	585	117	351	293	176
Peak Hour Total Trips	**6,297 lots**	**1259**	**3778**	**3149**	**1889**
Total Two-Way Daily Flows	**6,297 lots**	**50,000 Vehicle Trips Per Day (approx..)**			

*Residential stages 1 to 8 are already either under construction, approved, or subject to a separate approvals. Consideration of Stages 1 to 8 are included in Section 6.5.

Table 7-4 summarises the trip volumes derived from the primary school generation rates.

Table 6-3: Proposed School Traffic Generation - 'Ultimate' 2051 Scenario

School Use	Pupils	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
		IN	OUT	IN	OUT
Primary School 1	600	300	300	300	300
Primary School 2	600	300	300	300	300
Primary School 3	600	300	300	300	300
Primary School 4	600	300	300	300	300
High School 1	1,200	600	600	600	600
Total Two-Way Daily Flows	**3,600**	**7,200 Vehicle Trips Per Day**			

It is considered that an element of the traffic generation associated with each of the four (4) primary schools will be retained internally within Structure Plan Area (7,000 residential lots) and will not be distributed onto the external surrounding road network (Lancelin Road, Old Ledge Point Road, Indian Ocean Drive). Therefore, it is assumed a robust 100% of primary school 1, 2 and 3 traffic generation will be retained internally within the structure plan area and 50% of primary school 4 will be retained internally. i.e. only 50% of primary school 4 traffic will originate from outside of the structure plan area. It is considered this places a robust assessment on the future external road network operation.

It is also assumed that the above is true to a certain extent for the proposed 1,200 student High School within the Structure Plan Area, however an element of external trips will be generated to/from the High school from outside of the Structure Plan Area. Therefore, a robust 40% of traffic generated by the High School is assumed to originate from outside the Structure Plan Area and will be factored into the external site access analysis of capacity and efficiency.

Table 7-5 summarises the trip volumes derived from the remaining land uses (excluding residential) within the Structure Plan Area.

Table 6-4: Remaining Land Use Traffic Generation - 'Ultimate' 2051 Scenario

Land Use	Units	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
		IN	OUT	IN	OUT
Local Centre (int Distbn)	9,700m2	63	38	186	202
Neighbourhood Centre 1 (Int Distbn)	7,600m2	49	29	146	158
Neighbourhood Centre 2 (Ext Distbn)	11,600m2	75	45	222	241
Medical Centre (Int Distbn)	50 Employees	20	20	19	29
Retirement Village (Int Distbn)	40 Units	4	2	3	5
Community Centre (Int Distbn)	3,300m2	48	25	48	50
Emergency Service HQ (Ext Distbn)	1,500m2 approx.	10	10	10	10
Industrial (Ext Distbn)	85,000m2	680	170	170	680
Total Two-Way Daily Flows	-	**9,800 Vehicles Per Day (approx.)**			

The total expected traffic generation of the residential, education, industrial and remaining land uses within the 'Ultimate – 2051' scenario, which will be distributed externally to the surrounding road network is shown in **Table 6-5**.

Table 6-5: Combined 2051 Traffic Generation - (Distributed Externally to Structure Plan)

Area	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
	IN	OUT	IN	OUT
Main Structure Plan Area	98	2915	2381	976
Industrial Area	476	119	119	476
Total External Peak Hour Trips	**535**	**2697**	**2068**	**1165**

6.5 Committed Development Stages 1 to 8 – At Ultimate Build Out 2051

The committed development in the north-west corner of the structure plan area (refer Section 3.2) comprises up to 871 residential lots. These early stages of development are not the subject of this transport impact assessment, however the traffic generation and distribution associated with stages 2 to 8 is factored into the future impact analysis at the 2051 horizon. Stage 1 traffic generation is already captured within the 2026 growthed traffic volumes due to its completion.

The calculated traffic generation of the committed development is shown in **Table 6-6** below. As with the residential development of the structure plan area, not all generated committed development vehicle trips will be externally distributed onto the road network.

Table 6-6: Proposed Development Traffic Generation (Residential Only) - 'Ultimate' 2051 Scenario

Residential Stage*	No of Lots	AM Peak Hour Trip Rate (08:00 – 09:00)		PM Peak Hour Trip Rate (15:00 – 16:00)	
		IN	OUT	IN	OUT
Stage 1	51	10	31	26	15
Stage 2	66	13	40	33	20
Stage 3 & 4	119	24	71	60	36
Stage 5 & 6	247	49	148	124	74
Stage 7	197	39	118	99	59
Stage 8	191	38	115	96	57
Peak Hour Total Trips	**871 lots**	**174**	**523**	**436**	**261**
Total Two-Way Daily Flows	**871 lots**	**7,000 Vehicle Trips Per Day (approx..)**			

6.6 Proposed Structure Plan Traffic Assignment (Externally Distributed Traffic)

The proposed distribution of Structure Plan generated traffic, which has an origin or destination outside the Structure Plan and thus onto the surrounding road network is based upon the following factors:

- The relative attraction of the Lancelin Township is terms of employment and scale of existing residential development.
- The existing turning proportions of northbound and southbound traffic to/from Indian Ocean Drive at the existing intersection with Lancelin Road. Note: MRW has advised *"To determine future traffic projections, we recommend calculating compound growth rates (traffic volumes) using observed traffic volumes and applying them to the current counts".*
- The availability and relative attraction / ease of use of the future planned roundabout upgrade at Indian Ocean Drive / Lancelin Road and the proposed site access intersection onto Indian Ocean Drive approximately 1.2km south of Lancelin Road giving access to the Structure Plan area.
- The requirement to test a robust assessment in terms of the potential for impact of the Structure Plan area onto Indian Ocean Drive.

The traffic assignment proportions resultant from all land uses except the Industrial and Emergency Services use are therefore assumed as:

AM and PM Peaks:

- 10% to/from the existing Lancelin Township (Lancelin Road west).
- 55% via Lancelin Road to Indian Ocean Drive.
- 30% via the site access road to Indian Ocean Drive (1.2km south of Lancelin Road)

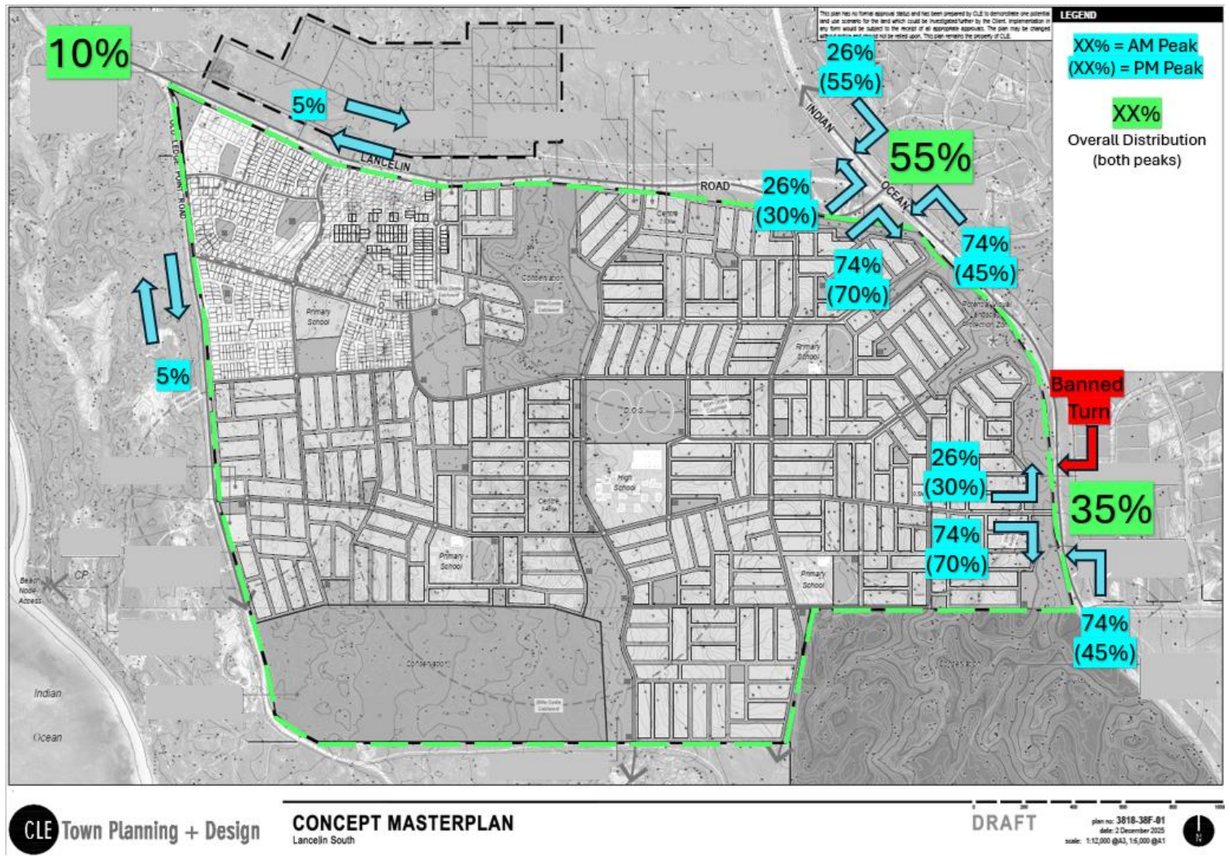
Further details on traffic distribution for these land uses are shown on **Figure 6-2.**

The traffic assignment proportions resultant from the Industrial and Emergency Services land uses to the north of Lancelin Road (and Structure Plan area) are assumed as:

- 10% originating from the Lancelin Township (accounts for growth over time)
- 30% of private vehicle trips linked to the proposed Structure Plan area.
- 60% of private vehicle trips and 100% of heavy vehicle trips via Lancelin Road to Indian Ocean Drive.

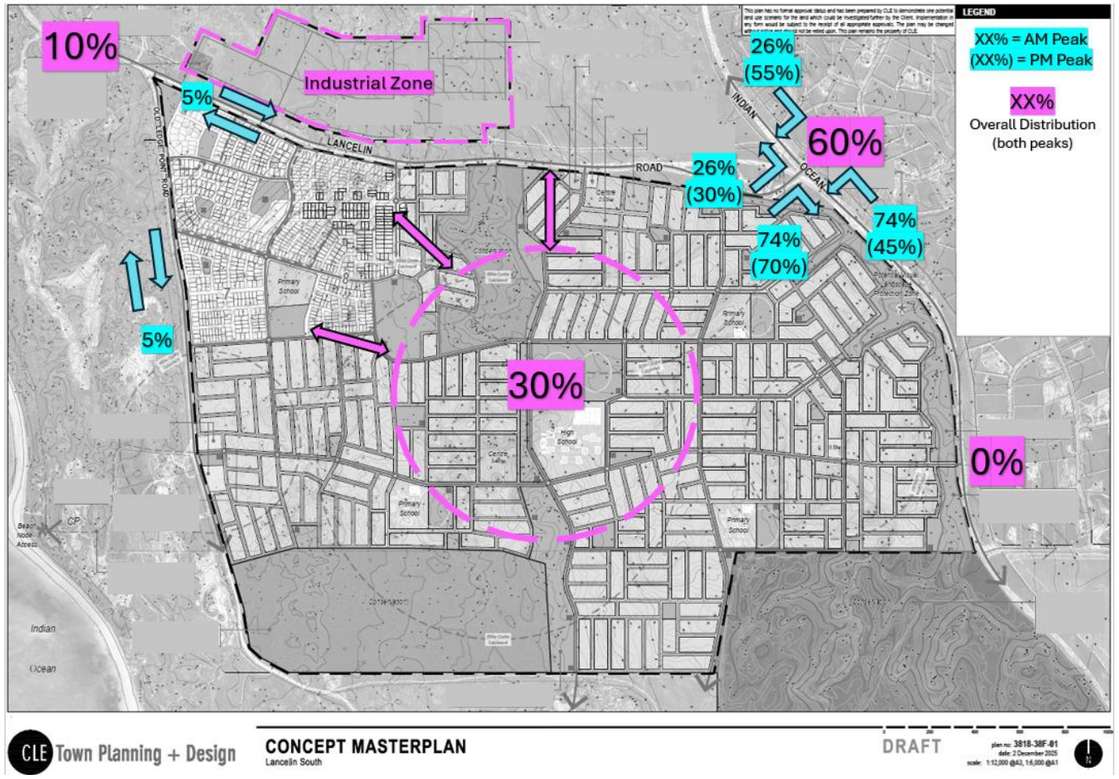
Further details on traffic distribution for these land uses are shown on **Figure 6-2.**

Figure 6-2: Externally Distributed Traffic Generation - All Land Uses Except Industrial and Emergency Services



Based on **Figure 6-2** above, the majority of externally distributed traffic (90%) will arrive/exit the structure plan area via Indian Ocean Drive, weighted toward the Indian Ocean Drive / Lancelin Road intersection (55%) with 35% weighted toward the proposed site access intersection onto Indian Ocean Drive some 1.2km south of Lancelin Drive. This reflects the relative popularity of the major intersection (and planned MRWA upgrade) at Indian Ocean Drive/Lancelin Road and the proposed site access to Indian Ocean Drive (south of Lancelin Road) including the influence of the southbound banned right turn from Indian Ocean Drive into the structure plan area.

Figure 6-3: Externally Distributed Traffic Generation - Industrial and Emergency Services Land Use Only



Based on **Figure 6-3** above, the reciprocal nature of the structure plan area being mainly residential, and the proposed industrial area in terms of employment opportunities means that it is assumed that the main structure plan area could support up to 30% of linked trips for private car journeys to / from industrial zone. Therefore this proportion of generated traffic would travel between the main structure plan area and the industrial zone without existing onto the State Government road network of Indian Ocean Drive. This is considered a robust assessment and weights private vehicle movement towards Indian Ocean Drive to test the future capacity and operation at the intersection with Indian Ocean Drive.

60% of the remaining industrial zone generated traffic is weighted toward Indian Ocean Drive, via Lancelin Road with 100% of heavy vehicles assumed to use this intersection. It is assumed for the purposes of this assessment that 0% of the industrial traffic will use the Indian Ocean Drive site access to the structure plan area, which is reality is likely to be the case given the direct access to the industrial zone via Lancelin Road.

6.7 2051 Design Year – Traffic Volumes for Assessment

Under this **2051** scenario of assessment, the calculated externally generated traffic volumes generated by the proposed structure plan area have been applied to the following three intersections using SIDRA models for the purpose of fully assessing the impact on the road network resultant from the build out of the entire structure plan area.

- Indian Ocean Drive / Lancelin Road – Future Roundabout Intersection
- Indian Ocean Drive / Site Access Road (south of Lancelin Rd) – Priority Controlled T-Intersection with banned southbound right turn movement.
- Lancelin Road / Site Access T-Intersection (Busiest of the Four New T-Intersections)

The development generated traffic volumes assigned to the external road network are shown on two separate figures at **Figures 6-4** and **Figure 6-5.** The ultimate 2051 traffic volumes (used for assessment) on the external road network are shown on **Figure 6-6.**

The results of the assessment for the intersections contained within the future 2051 SIDRA intersection models are provided in Sections 7 of this report.

Figure 6-4: External Traffic Assignment - All Land Uses Except Industrial and Emergency Services

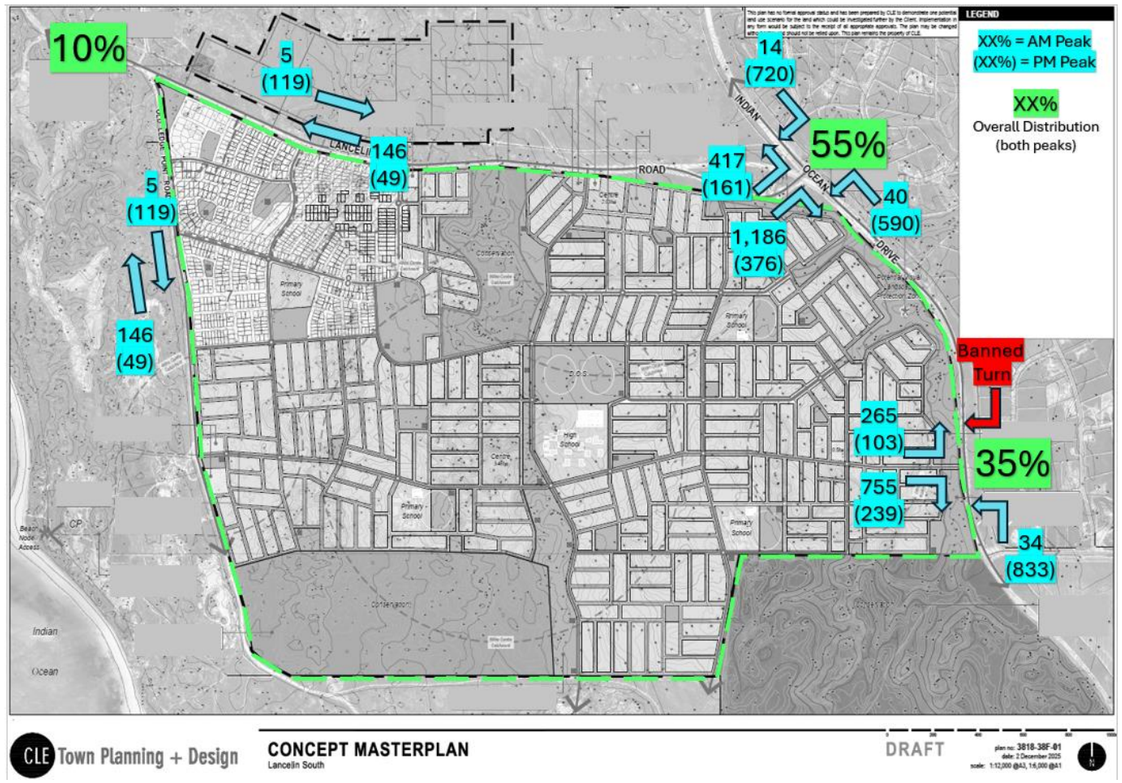


Figure 6-5: External Traffic Assignment - Industrial and Emergency Services Land Use Only

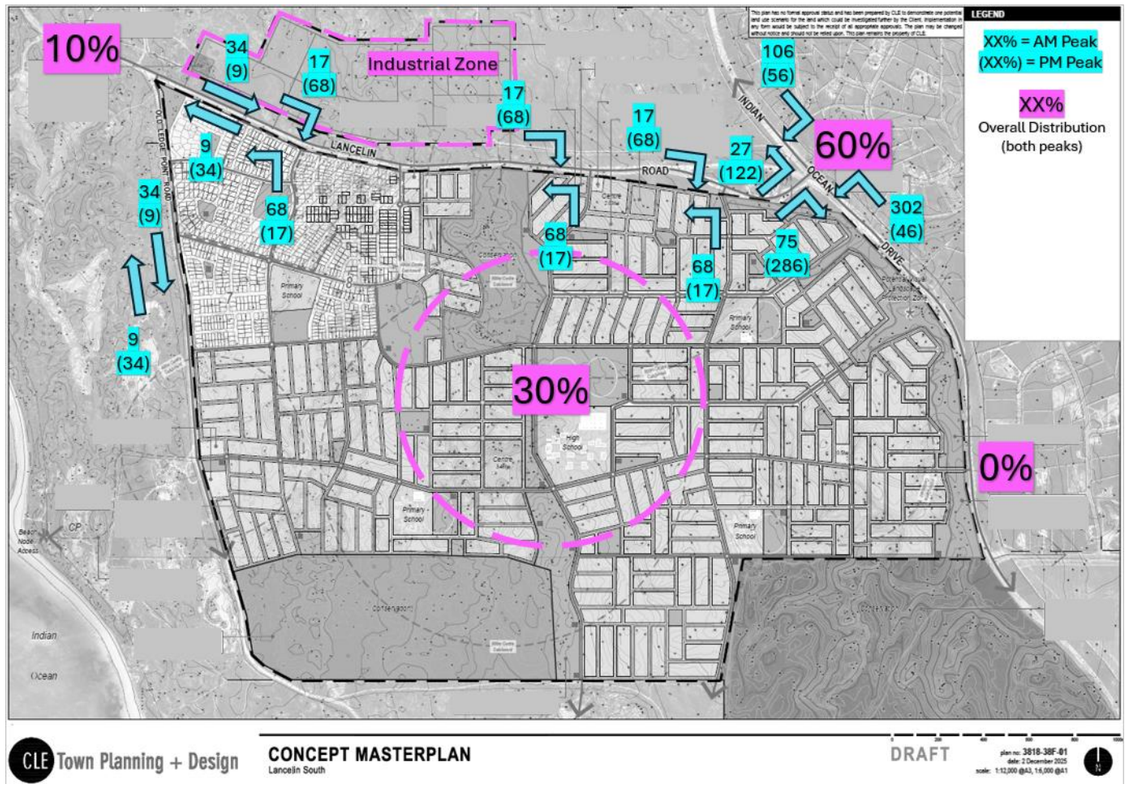
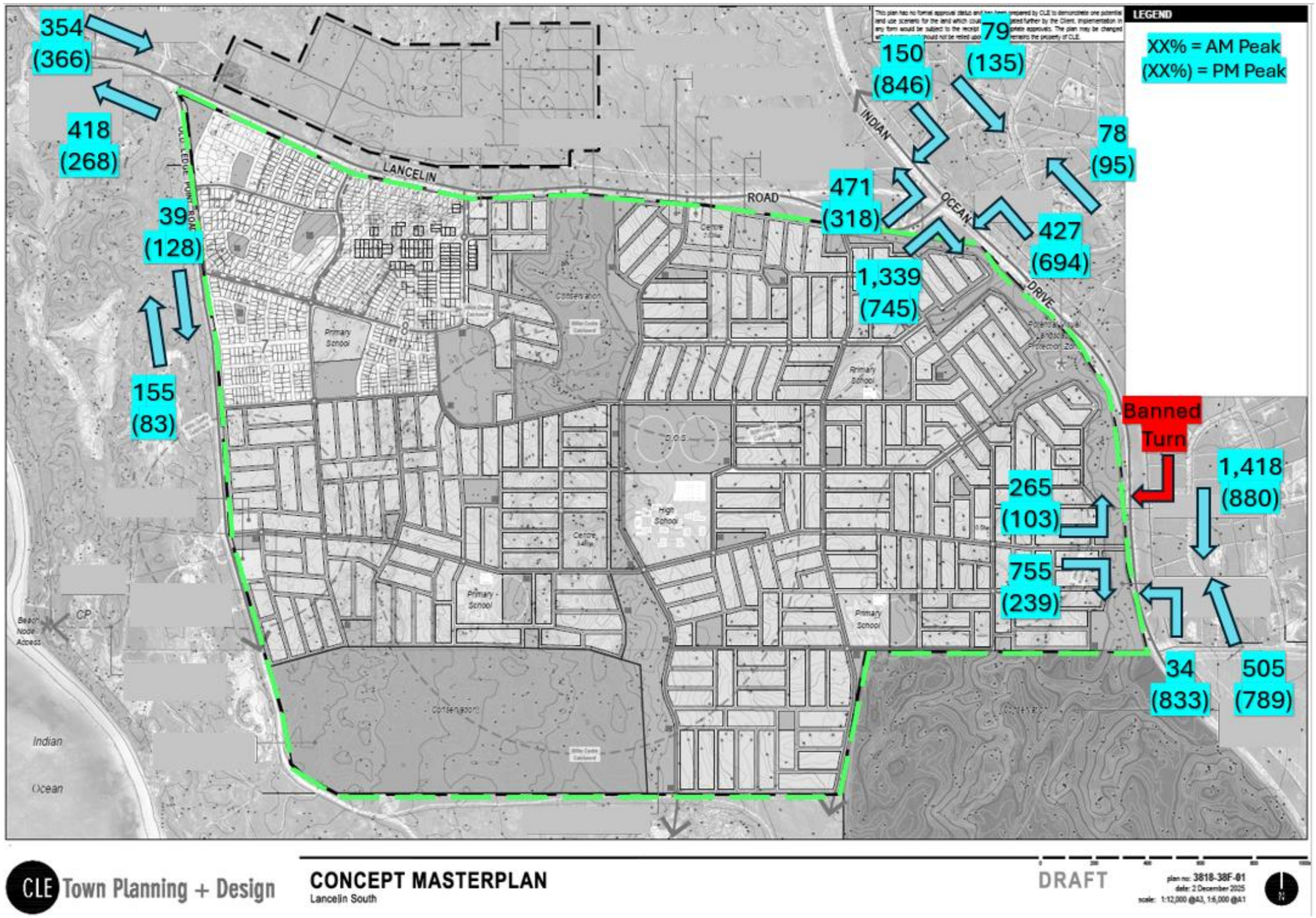


Figure 6-6: Ultimate 2051 Traffic Volumes on the External Road Network



7 Analysis of External Transport Networks – Intersection Assessments

7.1 Introduction

This section of the TIA presents the analysis of the external transport network in particular the key intersections identified below. Section 6 of this TIA report previously sets outs in detail the assessment parameters assumed for the 'Ultimate 2051' scenario tested.

The intersections included within this Structure Plan area assessment SIDRA model are:

- Indian Ocean Drive / Lancelin Road – Future Roundabout Intersection.
- Indian Ocean Drive / Site Access Road (south of Lancelin Rd) – Priority Controlled T-Intersection with banned southbound right turn movement.
- Lancelin Road / Site Access – Priority Controlled T-Intersection (Busiest of the Four New T-Intersections).

7.2 Impact on Intersections

Across each of the following four assessment scenarios, the SIDRA Intersection capacity results for each approach are presented in the form of Degree of Saturation (DOS), Average Delay, Level of Service (LOS) and 95th Percentile Queue. These characteristics are defined as follows:

- **Degree of Saturation (DOS)**: is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The theoretical intersection capacity is exceeded for an un-signalised intersection where DOS > 0.80; or up to 1.0 for a signal-controlled intersection at a +10 year design horizon.
- **95% Queue:** is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected.
- **Average Delay:** is the average of all travel time delays for vehicles through the intersection. An unsignalised intersection is considered to be operated at capacity where the average delay exceeds 45 seconds for any movement; and
- **Level of Service (LOS)**: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers.

7.3 Assessment Results – 'Ultimate 2051' Design Year:

Under the 'Ultimate 2051' assessment scenario, the following intersections have been assessed in SIDRA Intersection:

7.3.1 Indian Ocean Drive / Lancelin Road – Future Roundabout Intersection

As part of Main Roads WA's Indian Ocean Drive Planning Study, the intersection with Lancelin Road is proposed to be upgraded to a dual lane roundabout, designed to accommodate up to RAV 4 category vehicles, in coordination with the upgrade of Indian Ocean Drive to two lanes in each direction. Main Roads' concept design for this upgrade is not yet available for review, however assumptions have been made in terms of the likely design and operation of this roundabout intersection.

The following roundabout design is based on an existing roundabout intersection on the Main Roads WA road network, in a similar dual lane setting which also caters for RAV vehicles. The location of the example roundabout intersection is in Vasse at Busselton Bypass / Vasse Bypass / Northerly Street which is on the RAV 4 network, in keeping with the conditions applicable to Indian Ocean Drive and Lancelin Road. The inscribed circle diameter of the roundabout design tested in SIDRA is 55m and the total diameter is 75m. The circulatory section of this roundabout includes two lanes with a total pavement width of 10m.

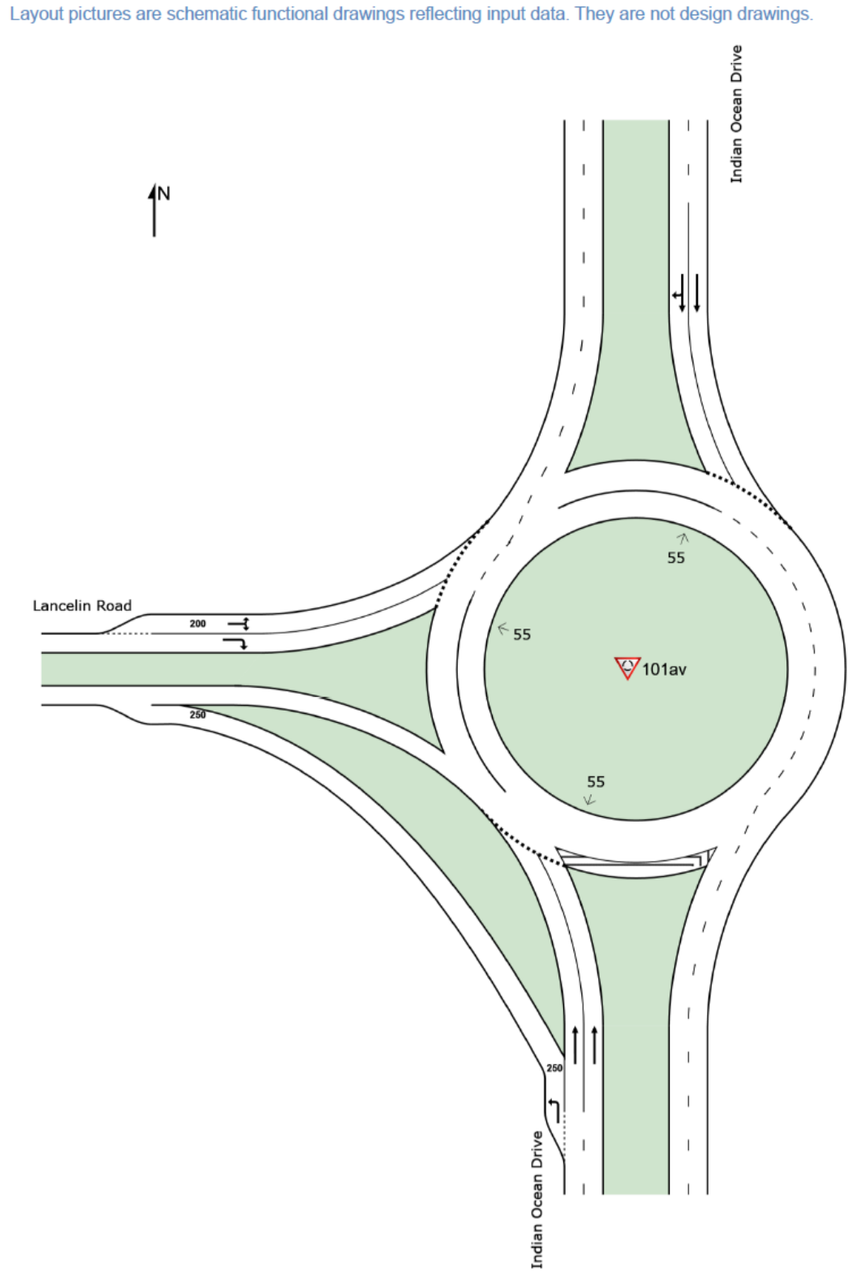
Key Intersection Design Parameters:

Key design assumptions for this future roundabout for modelling purposes are:

- dual lanes each direction northbound and southbound on Indian Ocean Drive.
- dual lanes through the circulatory section of the roundabout.
- 'free-running' unopposed left turn slip lane for northbound left turn movements on Indian Ocean Drive into Lancelin Road westbound.
- Lancelin Road widening to dual lanes on the eastbound approach to the roundabout for a 200m length.
- double right turns on the Lancelin Road eastbound approach to the roundabout.
- permanent 70km/hr speed zone on Indian Ocean Drive on each approach to the roundabout.
- Permanent 60km/hr speed zone on Lancelin Road.
- Intersection designed in accordance with AustRoads Guidance and MRWA Guidance.

The AM and PM peak results of the SIDRA capacity assessment for this roundabout intersection under the predicted 2051 design traffic volumes are given in **Table 7-1** and **Table 7-2.**

Figure 7-1: Assumed Roundabout Design – Indian Ocean Drive / Lancelin Road Intersection



AM Peak Results: 2051 Indian Ocean Drive / Lancelin Road Roundabout Intersection

Table 7-1: AM Peak SIDRA Assessment Results - 2051 Indian Ocean Drive / Lancelin Road Intersection

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	449	9.5	449	9.5	1656	0.271	100	2.7	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2[d]	46	38.7	46	38.7	1287	0.036	100	5.0	LOS A	0.2	3.1	Full	1000	0.0	0.0
Lane 3	36	38.7	36	38.7	1006	0.036	100	5.2	LOS A	0.2	3.0	Full	1000	0.0	0.0
Approach	532	14.0	532	14.0		0.271		3.1	LOS A	0.2	3.1				
North: Indian Ocean Drive															
Lane 1	83	28.6	83	28.6	433	0.192	96[5]	11.0	LOS B	0.9	8.8	Full	1000	0.0	0.0
Lane 2[d]	158	9.5	158	9.5	792	0.199	100	15.8	LOS B	1.1	9.6	Full	1000	0.0	0.0
Approach	241	16.1	241	16.1		0.199		14.1	LOS B	1.1	9.6				
West: Lancelin Road															
Lane 1[d]	1036	6.0	1036	6.0	1604	0.646	100	8.5	LOS A	6.1	49.9	Short	200	0.0	NA
Lane 2	870	6.0	870	6.0	1347	0.646	100	12.5	LOS B	6.1	49.9	Full	500	0.0	0.0
Approach	1905	6.0	1905	6.0		0.646		10.3	LOS B	6.1	49.9				
All Vehicles	2678	8.5	2678	8.5		0.646		9.2	LOS A	6.1	49.9				

In the AM peak period at the future Indian Ocean Drive / Lancelin Road Roundabout intersection, under the 2051 traffic volumes, this intersection is predicted to perform well at levels of service A and B on Indian Ocean Drive and at Level of Service B on the Lancelin Road approach with nominal and acceptable levels of average delay and 95% queue lengths of around 50m (approx. 7 vehicles) on Lancelin Road which are within acceptable parameters of efficiency and performance. Overall the intersection is predicted to operate at around 65% of its theoretical capacity in the AM Peak period.

PM Peak Results: 2051 Indian Ocean Drive / Lancelin Road Roundabout Intersection

Table 7-2: PM Peak SIDRA Assessment Results - 2051 Indian Ocean Drive / Lancelin Road Intersection

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	731	10.2	731	10.2	1663	0.439	100	5.6	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2[d]	61	31.7	61	31.7	605	0.101	100	10.0	LOS A	0.9	10.0	Full	1000	0.0	0.0
Lane 3	39	31.7	39	31.7	382	0.101	100	12.3	LOS B	0.7	8.0	Full	1000	0.0	0.0
Approach	831	12.8	831	12.8		0.439		6.2	LOS A	0.9	10.0				
North: Indian Ocean Drive															
Lane 1	142	20.9	142	20.9	663	0.214	26[5]	7.8	LOS A	1.0	8.9	Full	1000	0.0	0.0
Lane 2[d]	891	10.2	891	10.2	1064	0.837	100	22.8	LOS C	11.2	94.2	Full	1000	0.0	0.0
Approach	1033	11.7	1033	11.7		0.837		20.8	LOS C	11.2	94.2				
West: Lancelin Road															
Lane 1[d]	607	7.0	607	7.0	1533	0.396	100	7.8	LOS A	3.1	25.1	Short	200	0.0	NA
Lane 2	512	7.0	512	7.0	1291	0.396	100	12.2	LOS B	3.0	24.2	Full	500	0.0	0.0
Approach	1119	7.0	1119	7.0		0.396		9.8	LOS A	3.1	25.1				
All Vehicles	2982	10.2	2982	10.2		0.837		12.6	LOS B	11.2	94.2				

In the PM peak period at the future Indian Ocean Drive / Lancelin Road Roundabout intersection, under the 2051 traffic volumes, this intersection is predicted to also perform well at levels of service B and C on Indian Ocean Drive with acceptable levels of average delay (23s) and 95% queue lengths of 95m (approx. 14 vehicles) which is acceptable.

The Lancelin Road approach is predicted to operate at Level of Service B on the Lancelin Road approach with nominal and acceptable levels of average delay and maximum queue lengths of around 25m (approx. 4 vehicles) on Lancelin Road which are within acceptable parameters of efficiency and performance. Overall the intersection is predicted to operate at around 84% of its theoretical capacity in the PM Peak period in 2051.

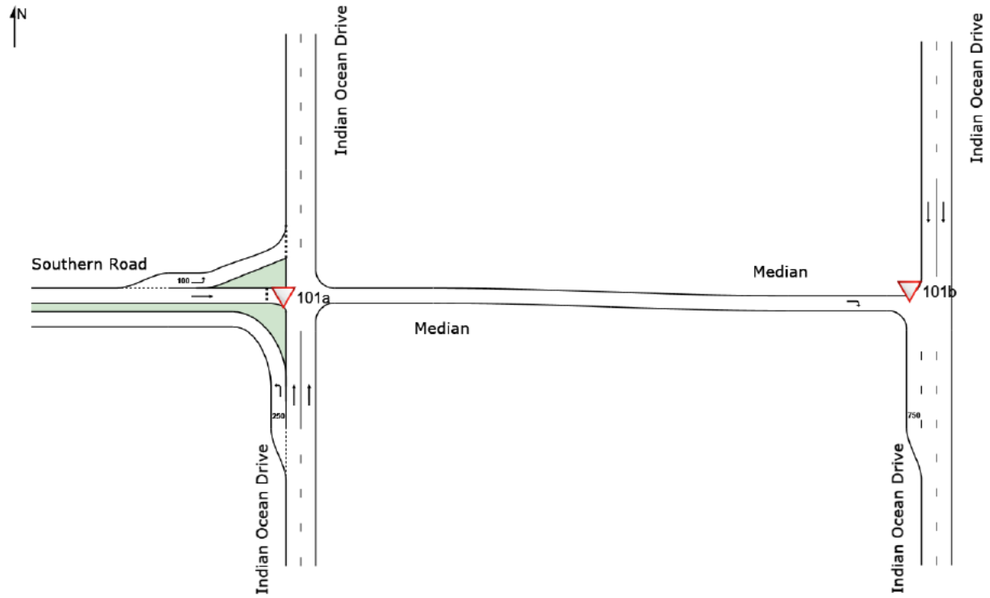
Iterative SIDRA Intersection Testing:

The results of the above iterative SIDRA capacity assessment determined that the assumed roundabout design would benefit operationally from a 'free-running' unopposed left turn slip lane for northbound left turn movements on Indian Ocean Drive into Lancelin Road westbound. The PM traffic volumes undertaking this movement are predicted to be high and this left turn lane design ensures the roundabout is predicted to operate under recognised parameters of efficiency and operation into the 2051 design horizon.

7.3.2 Indian Ocean Drive / Site Access Road: – Priority Controlled T-Intersection (1.2km south of Lancelin Rd)

Figure 7-2: T-Intersection Design – Indian Ocean Drive / Site Access Road

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	CCG ID	Site Name
101a	NA	Southern Road AM Leg 1
101b	NA	Southern Road AM Leg 2

The proposed site access road into the structure plan area from Indian Ocean Drive, located approximately 1.2km south of Lancelin Road, is based upon Main Roads WA's Indian Ocean Drive Planning Study, within which discuss the acceptability and use of 'Seagull' T-Intersections.

It is noted that Indian Ocean Drive in this location is not subject to 'Control of Access' under MRWA's statutory planning instruments. Control of Access identifies the sections of state roads where the access to and from adjacent land and properties is controlled by Main Roads Western Australia. These road sections have statutory declared 'Control of Access' restrictions, which revokes the general right of adjoining land to have direct vehicle and pedestrian access to these roads. This restriction does **not** apply to Indian Ocean Drive in the locality of the proposed site access road T-Intersection.

As such, there is no statutory planning instrument which currently prevents a direct vehicle access into the wider structure plan area from Indian Ocean Drive.

In addition, Main Roads WA's Indian Ocean Drive Planning Study (which aims to identify what the long-term requirements are for Indian Ocean Drive) states:

"While road upgrades will have some impact on adjoining and nearby land and communities, we will minimise this as much as possible by working collaboratively with landowners. Direct lot accesses and local road connections introduce potential conflict points for traffic on the road network. To optimise safety and efficiency on the network, we need to minimise the number of connection points, while allowing for appropriate levels of lot and network access."

Therefore, there is an identified willingness from Main Roads WA to work with landowners to understand their needs specific to the scale and needs of each development. Whilst understandably minimising the number of connection points to Indian Ocean Drive, where direct connections are justifiably needed there is an openness from Main Roads WA to consider and permit appropriate access, as opposed to specific blanket restrictions.

Key Intersection Design Parameters:

In the context and history of a fatal crash which occurred at the existing layout of Indian Ocean Drive / Lancelin Road T-Intersection and safe system road safety engineering practice, the key design assumptions for this future T-intersection are:

- dual lanes each direction northbound and southbound on Indian Ocean Drive
- banned southbound right turn from Indian Ocean Drive into the structure plan area (southbound right turns to the structure plan area are catered for at the Lancelin Road roundabout intersection).
- separate left-turn and right-turn approach lanes on site access road eastbound Indian Ocean Drive.
- Two stage right turn movements out of the site access to Indian Ocean Drive southbound (across a wide median island)
- A southbound right-turn acceleration lane for vehicles exiting the site access road to Indian Ocean Drive which is unopposed by southbound vehicles, merging into two southbound lanes over the length of 750m.
- permanent 70km/hr speed zone on Indian Ocean Drive on each approach to the intersection.
- permanent 50km/hr speed zone on site access (side) road.
- Intersection designed in accordance with AustRoads Guidance and MRWA Guidance.

The AM and PM peak results of the SIDRA capacity assessment for this proposed T-intersection under the predicted 2051 design traffic volumes are given in **Table 7-3** and **Table 7-4.**

AM Peak Results: 2051 Indian Ocean Drive / Site Access Road T-Intersection

Table 7-3: AM Peak SIDRA Assessment Results - 2051 Indian Ocean Drive / Site Access Road T-Intersection

Leg 1: AM Peak

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	36	3.0	36	3.0	1818	0.020	100	6.7	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2	266	12.7	266	12.7	1612	0.165	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Lane 3	266	12.7	266	12.7	1612	0.165	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Approach	567	12.1	567	12.1		0.165		0.5	NA	0.0	0.0				
West: Southern Road															
Lane 1	279	3.0	279	3.0	1173	0.238	100	6.1	LOS A	1.0	7.9	Short	100	0.0	NA
Lane 2	795	3.0	795	3.0	903	0.880	100	15.6	LOS C	14.6	110.9	Full	200	0.0	0.0
Approach	1074	3.0	1074	3.0		0.880		13.1	LOS B	14.6	110.9				
All Vehicles	1641	6.1	1641	6.1		0.880		8.7	NA	14.6	110.9				

Leg 2: AM Peak

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SP Road															
Lane 1	79	3.0	79	3.0	1053	0.075	100	6.3	LOS A	0.3	2.2	Short	75	0.0	NA
Lane 2	227	3.0	227	3.0	925	0.246	100	5.4	LOS A	0.9	6.9	Full	100	-4.0 N3	0.0
Approach	306	3.0	306	3.0		0.246		5.6	LOS A	0.9	6.9				
East: Lancelin Road															
Lane 1	57	3.0	57	3.0	1582	0.036	100	6.7	LOS A	0.1	1.1	Short	10	0.0	NA
Lane 2	440	9.5	440	9.5	1751	0.251	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	497	8.8	497	8.8		0.251		0.8	LOS A	0.1	1.1				
North: Median															
Lane 1	24	2.5	24	2.5	983	0.024	100	2.8	LOS A	0.1	0.6	Full	6	0.0	0.0
Approach	24	2.5	24	2.5		0.024		2.8	LOS A	0.1	0.6				
All Vehicles	827	6.4	827	6.4		0.251		2.7	NA	0.9	6.9				

In the AM peak period at the future Indian Ocean Drive / Site Access Road T-Intersection, under the 2051 traffic volumes, this intersection is predicted to perform well at levels of service A to C on the site access road with nominal and acceptable levels of average delays (15s) and 95% queue lengths of

around 110m (approx. 16 vehicles) which are within acceptable parameters of efficiency and performance.

Indian Ocean Drive is predicated to operate at Level of Service A within acceptable parameters of efficiency and performance. Overall the intersection is predicted to operate at around 88% of its theoretical capacity in the AM Peak period.

PM Peak Results: 2051 Indian Ocean Drive / Site Access Road T-Intersection

Table 7-4: PM Peak SIDRA Assessment Results - 2051 Indian Ocean Drive / Site Access Road T-Intersection

Leg 1: PM Peak

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	877	3.0	877	3.0	1818	0.482	100	7.0	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2	415	10.2	415	10.2	1759	0.236	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Lane 3	415	10.2	415	10.2	1759	0.236	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Approach	1707	6.5	1707	6.5		0.482		3.7	NA	0.0	0.0				
West: Southern Road															
Lane 1	108	3.0	108	3.0	971	0.112	100	6.8	LOS A	0.4	3.3	Short	100	0.0	NA
Lane 2	252	3.0	252	3.0	674	0.373	100	8.9	LOS A	1.7	12.8	Full	200	0.0	0.0
Approach	360	3.0	360	3.0		0.373		8.3	LOS A	1.7	12.8				
All Vehicles	2067	5.9	2067	5.9		0.482		4.5	NA	1.7	12.8				

Leg 2: PM Peak

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SP Road															
Lane 1	20	3.0	20	3.0	1250	0.016	100	5.5	LOS A	0.1	0.5	Short	75	0.0	NA
Lane 2	57	3.0	57	3.0	1069	0.053	100	4.6	LOS A	0.2	1.4	Full	100	0.0	0.0
Approach	77	3.0	77	3.0		0.053		4.8	LOS A	0.2	1.4				
East: Lancelin Road															
Lane 1	227	3.0	227	3.0	1495	0.152	100	6.9	LOS A	0.7	5.1	Short	10	0.0	NA
Lane 2	282	10.2	282	10.2	1759	0.160	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	509	7.0	509	7.0		0.160		3.1	LOS A	0.7	5.1				
North: Median															
Lane 1	94	2.5	94	2.5	1160	0.081	100	2.2	LOS A	0.3	2.2	Full	6	0.0	0.0
Approach	94	2.5	94	2.5		0.081		2.2	LOS A	0.3	2.2				
All Vehicles	681	5.9	681	5.9		0.160		3.2	NA	0.7	5.1				

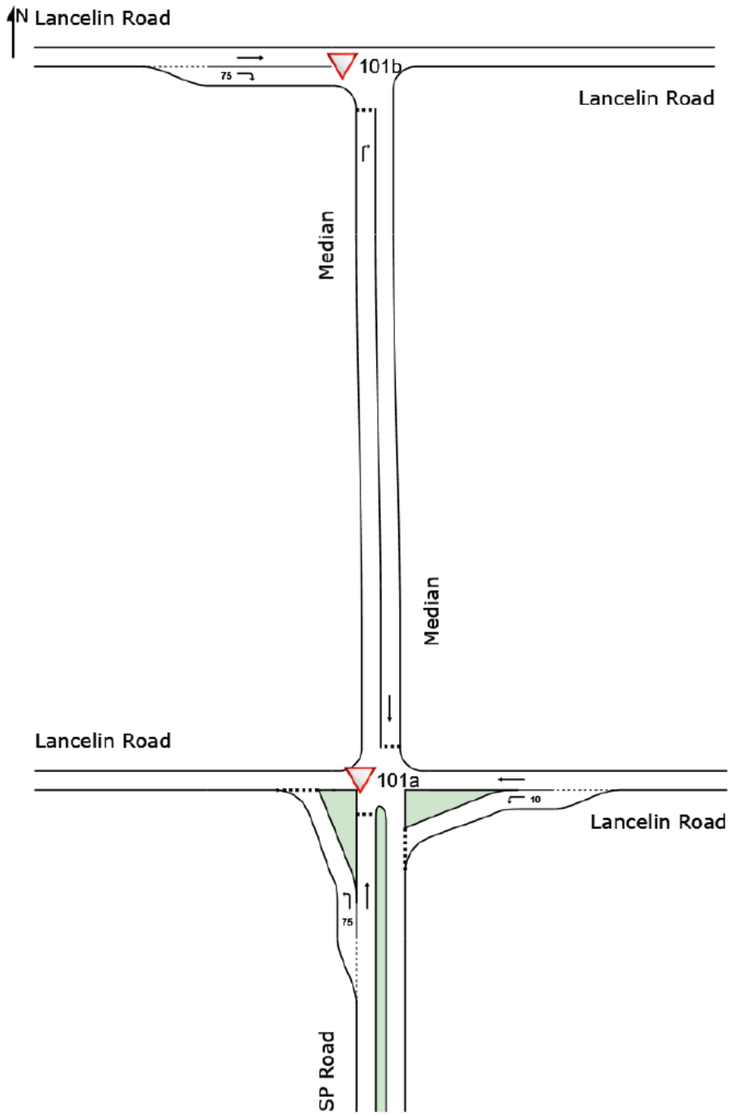
In the PM peak period at the future Indian Ocean Drive / Site Access Road T-Intersection, under the 2051 traffic volumes, this intersection is predicted to perform well at levels of service A on all approach roads, including the site access road, with nominal and acceptable levels of average delays (9s on site access road) and 95% queue lengths of around 13m (approx. 2 vehicles) which are within acceptable parameters of efficiency and performance.

Overall the intersection is predicted to operate at around 50% of its theoretical capacity in the PM Peak period.

7.3.3 Lancelin Road / Site Access – Priority Controlled T-Intersection

Figure 7-3: Lancelin Road / Site Access – Priority Controlled T-Intersection

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101a	NA	New Int AM Leg 1
▽101b	NA	New Int AM Leg 2

The structure plan proposes four new site access road T-intersections to the structure plan area from Lancelin Road. This SIDRA assessment analyses the predicted busiest of the four new site access intersections and reports on the results.

It is noted that this Transport Impact Assessment recommends the upgrade of Lancelin Road to an Integrator B road, 26m road reserve (indicative) with a 6m wide central median, capable of accommodating up to 15,000 vehicles per day. Therefore right-turn movements into an out of the structure plan area at this intersection will be 'two-stage' across a central median of at least 6m wide.

Key Intersection Design Parameters:

Key design assumptions for this future T-intersection for modelling purposes are:

- single lane each direction eastbound and westbound on Lancelin Road.
- separate left-turn and right-turn approach lanes on the site access road northbound to Lancelin Road.
- Two stage right turn movements out of the site access to Lancelin Road (across the median island)
- permanent 60km/hr speed zone on Lancelin Road on each approach to the intersection.
- permanent 40km/hr speed zone on site access road.
- Intersection designed in accordance with AustRoads Guidance and MRWA Guidance.

The AM and PM peak results of the SIDRA capacity assessment for this proposed site access T-intersection under the predicted 2051 design traffic volumes are given in **Table 7-5** and **Table 7-6.**

AM Peak Results: 2051 Lancelin Road / Site Access – Priority Controlled T-Intersection

Table 7-5: AM Peak SIDRA Assessment Results - 2051 Lancelin Road / Site Access – Priority Controlled T-Intersection

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob Bloc
South: SP Road															
Lane 1	79	3.0	79	3.0	1053	0.075	100	6.3	LOS A	0.3	2.2	Short	75	0.0	N
Lane 2	227	3.0	227	3.0	925	0.246	100	5.4	LOS A	0.9	6.9	Full	100	-4.0[N3]	0
Approach	306	3.0	306	3.0		0.246		5.6	LOS A	0.9	6.9				
East: Lancelin Road															
Lane 1	57	3.0	57	3.0	1582	0.036	100	6.7	LOS A	0.1	1.1	Short	10	0.0	N
Lane 2	440	9.5	440	9.5	1751	0.251	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0
Approach	497	8.8	497	8.8		0.251		0.8	LOS A	0.1	1.1				
North: Median															
Lane 1	24	2.5	24	2.5	983	0.024	100	2.8	LOS A	0.1	0.6	Full	6	0.0	0
Approach	24	2.5	24	2.5		0.024		2.8	LOS A	0.1	0.6				
All Vehicles	827	6.4	827	6.4		0.251		2.7	NA	0.9	6.9				

In the AM peak period at the future Lancelin Road / Site Access Priority Controlled T-Intersection, under the 2051 traffic volumes, this intersection is predicted to perform well at levels of service A with nominal and acceptable levels of average delays queue lengths which are within acceptable parameters of efficiency and performance.

Overall the intersection is predicted to operate at around 25% of its theoretical capacity in the AM Peak period.

PM Peak Results: 2051 Lancelin Road / Site Access – Priority Controlled T-Intersection

Table 7-6: PM Peak SIDRA Assessment Results - 2051 Lancelin Road / Site Access – Priority Controlled T-Intersection

Lane Use and Performance	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SP Road															
Lane 1	20	3.0	20	3.0	1250	0.016	100	5.5	LOS A	0.1	0.5	Short	75	0.0	NA
Lane 2	57	3.0	57	3.0	1069	0.053	100	4.6	LOS A	0.2	1.4	Full	100	0.0	0.0
Approach	77	3.0	77	3.0		0.053		4.8	LOS A	0.2	1.4				
East: Lancelin Road															
Lane 1	227	3.0	227	3.0	1495	0.152	100	6.9	LOS A	0.7	5.1	Short	10	0.0	NA
Lane 2	282	10.2	282	10.2	1759	0.160	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	509	7.0	509	7.0		0.160		3.1	LOS A	0.7	5.1				
North: Median															
Lane 1	94	2.5	94	2.5	1160	0.081	100	2.2	LOS A	0.3	2.2	Full	6	0.0	0.0
Approach	94	2.5	94	2.5		0.081		2.2	LOS A	0.3	2.2				
All Vehicles	681	5.9	681	5.9		0.160		3.2	NA	0.7	5.1				

In the PM peak period at the future Lancelin Road / Site Access Priority Controlled T-Intersection, under the 2051 traffic volumes, this intersection is predicted to perform well at levels of service A with nominal and acceptable levels of average delays queue lengths which are within acceptable parameters of efficiency and performance.

Overall the intersection is predicted to operate at around 16% of its theoretical capacity in the PM Peak period.

Therefore, based on these results, there are no concerns with capacity and operation efficiency at any of the four proposed new site access intersections to the structure plan area.

7.4 Summary of 2051 Road Network Performance

Across the three assessed intersections, the SIDRA outputs indicate acceptable operational performance in both peak periods, with generally low delays and manageable 95th-percentile queues. The highest loaded location in 2051 is the Indian Ocean Drive / Lancelin Road future roundabout, particularly in the PM peak where the intersection is operating at the upper end of comfortable capacity, not failing, but within acceptable performance criteria.

The future Indian Ocean Drive / Site Access Road T-intersection performs well in both peaks, noting AM Peak is the more demanding period, and the busiest Lancelin Road / Site Access T-intersection operates with substantial spare capacity in both peaks.

Key performance themes in the results:

- The roundabout's operation is materially helped by the free-running northbound left slip lane, which removes a high-volume movement from the circulating lanes and improves PM peak performance.
- The future Indian Ocean Drive / Site Access Road T-intersection arrangement (banned southbound right turn, two-stage right turns and southbound acceleration lane) delivers strong performance and safe-system alignment, and prevents the most problematic right-turn conflict from occurring at that location.
- The Lancelin Road / Site Access intersection benefits from two-stage right turns across a wide median and comparatively low intersection loading (relative to its assumed form), keeping delays and queues low.

Indian Ocean Drive / Lancelin Road Roundabout Intersection:
In 2051, the proposed dual-lane roundabout at Indian Ocean Drive / Lancelin Road is predicted to operate efficiently in both peaks, with good levels of service on all approaches and queues that remain within acceptable limits for a rural/state-road context.

Indian Ocean Drive / Site Access Road: – Priority Controlled T-Intersection:
In 2051, the proposed priority-controlled 'Seagull'-style T-intersection for the future Site Access Road from Indian Ocean Drive performs well in both peaks, with LOS A–C in the AM Peak and LOS A across all approaches in PM Peak, and with queues/delays described as within acceptable parameters of intersection performance and operation.

Lancelin Road / Site Access – Priority Controlled T-Intersection:
In 2051, the assessed (busiest) Lancelin Road / Site Access priority-controlled T-intersection operates with acceptable performance in both the AM and PM peaks, with LOS A and low delays/queues reported.

8 Safety Issues

8.1 Existing Safety Issues

A search of the Main Roads WA Reporting Centre for crash data surrounding the site was undertaken. This search covered all recorded traffic accidents for the most recently available five-year reporting period between 1 January 2020 and 31 December 2024 for the following roads surrounding the Site:

- Indian Ocean Drive (north and south of Lancelin Road)
- Lancelin Road
- Old Ledge Point Road.

A total of seven crashes are recorded as occurring within the study, including:

- Four crashes at the intersection of Indian Ocean Drive / Lancelin Road (including one fatal and two hospitalisation crashes)
- Two crashes on Lancelin Road
- One crash on Indian Ocean Drive, south of in Road

8.2 Impact of the Structure Plan on Safety Issues

Based on the crash history summarised, the dominant safety issue within the wider study area is clearly concentrated at the Indian Ocean Drive / Lancelin Road intersection, where there is a recurring pattern of southbound right-turn movements into Lancelin Road failing to give way to northbound through traffic, resulting in T-bone type collisions (including one fatal crash and two hospitalisation crashes).

In this context, it is considered that the proposed Structure Plan development would primarily influence safety outcomes by increasing traffic volumes and turning demand (crash exposure) over time, including additional southbound right-turn demand into Lancelin Road (depending on the final access strategy and trip distribution).

While increased exposure can elevate crash risk in a general sense, the historic crash record suggests that the key risk mechanism is already present today and is likely to remain the primary safety constraint unless proactively treated, irrespective of the Structure Plan proceeding. Accordingly, the Structure Plan should be viewed as an opportunity to support, and prioritise safety upgrades at the Indian Ocean Drive / Lancelin Road intersection to address the existing right-turn / give-way crash trend, rather than the development being the underlying cause of that trend.

Outside of the intersection, the remaining crashes appear to be isolated events without a repeating pattern, including:

- a single-vehicle run-off-road type crash on Indian Ocean Drive approximately 900 m south-east of the intersection; and
- crashes on Lancelin Road west of the intersection (including a cyclist fatality on a bend involving partial lane departure, and a separate rear-end property-damage crash).

Given the absence of repeat crash types/locations outside the intersection, it is reasonable to assume that the Structure Plan's traffic, in isolation, is unlikely to "create" a new predominant crash trend across the broader network. However, consistent with best practice, any increase in traffic volumes and changes to movement patterns should be accompanied by safe system responses at the locations where risk is most evident (i.e., the Indian Ocean Drive / Lancelin Road intersection) and through the design of the new internal road network.

8.3 Safe System Intersection Design Considerations

This future Indian Ocean Drive / Site Access Road T-intersection is being deliberately configured around Safe System road safety engineering principles in response to the known risk profile of the corridor and the history of a fatal crash at the existing Indian Ocean Drive / Lancelin Road T-intersection. In Safe System terms, the aim is to either prevent high-severity crashes from occurring (especially right-angle and high-speed opposing conflicts) or, where conflicts remain, to manage impact speeds and reduce exposure so outcomes are survivable and predictable for road users in a high-speed regional environment.

Why these assumptions reduce risk (Safe System logic)

Banned southbound right turn into the structure plan area from Indian Ocean Drive:

- This design feature removes a high-severity conflict (a right turn across potentially fast-moving northbound traffic (proposed 70km/hr speed limit), often associated with right-angle / high-energy crashes.
- It also reduces complex driver decision-making at the T-intersection and shifts the right-turn function to a safer location (the proposed Lancelin Road roundabout) where speeds are lower and conflicts are managed better by priority.

Separate left-turn and right-turn approach lanes on the site access road:

- Minimises rear-end and side-swipe risk on the approach by separating turning movements, reducing last-second lane changes and hesitation.

- Improves driver expectancy and supports clearer priority control, a core Safe System idea for reducing errors.

Two-stage right turn movements out of the site access across a wide median:

- Compared to a risky "single-stage" crossing manoeuvre, a two-staged gap acceptance task, meaning drivers only deal with one traffic direction at a time.
- The wide median provides a physical refuge, reducing exposure time in live traffic and lowering the likelihood of catastrophic right-angle crashes.

Southbound right-turn acceleration lane (unopposed merge) over 750 m:

- Addresses one of the most dangerous moments at priority intersections in high-speed environments: entering and accelerating into moving traffic.
- By providing a dedicated acceleration lane that merges into two southbound lanes, vehicles can match speed before merging, reducing speed differentials and therefore reducing both crash likelihood and severity (Safe System's "manage kinetic energy" concept).

Speed Management: 70 km/h on Indian Ocean Drive approaches:

- Safe System is fundamentally about keeping impact speeds within survivable limits, especially where conflicts may still occur.
- A permanent 70 km/h environment on the Indian Ocean Drive approaches (paired with geometric design that reinforces it) helps reduce the energy involved in any crash, while 50 km/h on the side road reduces the severity and likelihood of run-through / loss-of-control events at the minor approach.

Designed to Austroads and Main Roads WA guidance:

- Aligns the design with established best practice for intersection layout, sight distance, lane configuration, turning treatments, and speed environment consistency which are all key enablers of Safe System outcomes. This intersection design is subject to further development at subsequent stages of the planning process.
- Helps ensure the final arrangement is not only theoretically safer, but auditable, reviewable, and defensible against accepted engineering standards.

8.4 Structure Plan Safe Speed Framework:

Safe Speeds (Structure Plan Area):

To maximise safety for all road users within the Structure Plan area (including pedestrians and cyclists), it is recommended that the internal street environment is designed and speed-managed to be self-explaining and low risk. In particular:

- adopt **40 km/h** as the typical posted speed environment on new residential streets where appropriate (and consider **30 km/h** in areas of highest pedestrian activity, such as around schools, key community facilities, and neighbourhood centres where applicable); and
- ensure the road hierarchy, cross-sections, intersection geometry, pedestrian crossing locations, and streetscape treatments are aligned with the intended operating speeds (so that speeds are achieved by design, not just signage).

Speed Posting and Transitions:

Where the Structure Plan interfaces with the existing road network (particularly Lancelin Road and any internal connector streets), speed transitions should be clear and credible, supported by appropriate gateway treatments, delineation, lighting, and wayfinding. This is especially important where driver workload is higher (e.g., approaching key intersections, turning points, or areas of mixed traffic and active movement).

Existing Intersection Safety Priority (Indian Ocean Drive / Lancelin Road): Short to Medium Term

Given the demonstrated existing crash trend at this location, it remains a recommendation that Main Roads WA be responsible to investigate and progress safety treatments to mitigate the risk of future fatal and hospitalisation crashes associated with southbound right-turn movements at the existing layout of the Indian Ocean Drive / Lancelin Road intersection.

Consistent with Section 8.3, this could include (subject to MRWA assessment) improvements to the operation of the northbound variable speed limit signs, so that they can be activated when a vehicle is present in the southbound right-turn lane on Indian Ocean Drive (and not only in response to side-road traffic on Lancelin Road), along with any complementary intersection measures identified through MRWA's detailed investigation.

The above recommendation applies to the years prior to the roundabout upgrade on Indian Ocean Drive / Lancelin Road intersection. At each subsequent subdivision and detailed design stage, road safety should be reviewed in light of the final access arrangements, staging, land uses, and forecast traffic demands, to confirm that:

- the internal road network maintains a consistent safe-speed environment;
- pedestrian and cyclist crossing points are safe, legible, and well located; and
- any development-driven increase in turning demand at the Indian Ocean Drive / Lancelin Road intersection is appropriately matched by timely safety upgrades.

If the Structure Plan's safe-speed framework is implemented, and the intersection safety issues and mitigations identified in Section 8.3 and 8.4 are actively progressed with MRWA, the safety outcomes for future motorists, pedestrians, cyclists, and all road users will be maximised as far as reasonably practicable.

9 Conclusions

9.1 General

This TIA addresses the key transport issues and impacts related to the current development proposal at the site from a residential, commercial and community perspective including an industrial area to the north of Lancelin Road. The current and future level of accessibility by road, public transport, cycle and on foot has been reviewed and assessed by this report and sets recommendations to explore the potential for improving these to a suitable level where required and appropriate.

The key recommendations as a result of this Transport Impact Assessment process are listed as follows:

9.2 Key Recommendations (from this TIA)

1 **Existing Crash-Risk Mitigation at Indian Ocean Drive / Lancelin Road Intersection (pre-upgrade to roundabout):**

In response to the documented right-turn crash pattern (including fatal/hospitalisation crashes), it is recommended that given this is a Main Roads WA road, that Main Roads explore interim treatments to reduce the likelihood/severity of future crashes, e.g. improving the operation of northbound variable speed signs so reduced speeds are triggered when vehicles are in the southbound right-turn lane, not only by side-road activation.

This is recommended in the short to medium-term prior to the future upgrade of this intersection to a dual lane roundabout. Currently, there is no confirmed timing or funding for the construction of the planned roundabout.

2 **Speed Management (Safe System) Along the Structure Plan Frontage:**

- **Indian Ocean Drive:** Recommend a permanent reduction to maximum 70 km/h (currently high speed 90km/h) on approaches to both the Lancelin Road intersection and the site access intersection at Indian Ocean Drive, to improve safety and compliance in a higher-turning environment.
- **Lancelin Road:** Recommend a permanent reduction to maximum 60 km/h along the structure plan frontage due to the introduction of seven new priority-controlled access intersections and increased turning activity.

3 **Intersection Sight Distance Verification at Later Planning Stages:**

While a desktop review indicates general compliance, it is recommended that detailed sight distance investigations for the proposed access intersections be completed at subsequent design/subdivision stages.

4 **Indian Ocean Drive / Site Access Road Intersection Turn-Lane Treatments:**

Based on Austroads guidance and predicted turning volumes, CHR with CHL preference (Channelised Right Turn with Channelised Left Turn) is recommended at this stage of planning for the priority-controlled T-intersection on Indian Ocean Drive (subject to detailed design and MRWA approvals).

5 **Lancelin Road Access Intersection(s) Turn-Lane Treatments:**

Similarly, it is recommended that CHR and CHL treatments be incorporated into future Lancelin Road site access intersections (south side residential area and north side industrial area), subject to detailed design and Shire approvals.

6 **Road Hierarchy Upgrades to Support Access and Movement:**

- Upgrade Lancelin Road to an Integrator B standard.
- Upgrade Old Ledge Point Road to a Neighbourhood Connector A standard (or similar).
- For the new Lancelin Road site access intersections, this TIA recommends an Integrator B road reserve cross section for Lancelin Road with an indicative 26 m reserve width and a minimum 6 m central median, facilitating two-stage right turns.

7 **Active Transport Network and Priority at Side Roads (Shared Paths):**

To support safe and convenient walking and cycling across the entire Lancelin South structure plan area, it is recommended that an extensive, connected network of off-road shared paths (Dual Use Paths) be delivered in accordance with the WA Department of Transport's *Planning and Designing for Bike Riding in Western Australia* guidance, with particular emphasis on route continuity, legibility and safety at conflict points. This network should include:

- **Lancelin Road Dual Use Path (Primary Route):** Provide an off-road Dual Use Path along Lancelin Road consistent with the RLTCN functional hierarchy, forming a Proposed Primary Route to facilitate east–west movement, connect residential neighbourhoods to the General Industrial area, and provide a strategic active-transport link toward the broader Lancelin township.
- **Neighbourhood Connector Routes (Local Routes):** Ensure all Neighbourhood Connector roads incorporate a Dual Use Path on at least one side with a minimum width of 2.5 metres, forming

Proposed Local Routes that provide direct and safe access to schools, local centres, public open space and community facilities, and promoting everyday active travel.

- **Priority across side roads and intersection treatments:** Where these key shared path routes cross minor side-road intersections, provide standardised cyclist and pedestrian priority (where appropriate and safe), so that the shared path network remains continuous and attractive, and so conflict risk at side roads is reduced.
- **Future links to coastal and conservation areas:** Safeguard and progressively deliver additional walking and cycling links to coastal access points, conservation areas and recreation nodes, supporting both daily and leisure-based trips and strengthening the overall passive recreation network.
- **Landscape Boulevard Streets:**

  Landscape Boulevard Streets are proposed in two locations within the structure plan area and they are intended to connect the areas of natural amenity at their eastern and western extents and encourage walking and cycling trips.

These recommendations are intended to create a coherent site-wide active transport system that is safe, equitable, continuous and intuitive, reducing severance from side roads, improving access to key destinations, and supporting mode shift away from short vehicle trips within the structure plan area.

8 **Pedestrian Crossing Safety on Higher-Order Internal Roads:**

For the network of Neighbourhood Connector A roads across the structure plan area, it is recommended that pedestrian refuge islands be provided at pedestrian crossing points at intersections.

9 **Public Transport Safeguarding (future-proofing):**

To protect for possible future bus route modifications and stop locations across the structure plan area and as Lancelin grows, internal roads intended to support buses should provide Public Transport Authority (PTA's) required 3.5 m wide lanes in each direction (or 3.2m wide minimum lanes with a >1m wide median) and typically ≥20 m road reserves, consistent with PTA needs for bus operations. Note also that a 3.5m wide lane kerb-to-kerb should be avoided where possible to prevent cyclists from being placed in a 'squeeze zone' amongst vehicles.

10 **Roundabout Performance Safeguard (Ultimate 2051):**

The future Indian Ocean Drive / Lancelin Road roundabout design should incorporate a free-flow northbound left slip lane into Lancelin Road, which materially improves PM peak intersection performance and supports acceptable operations to the 2051 horizon.

This Structure Plan TIA ultimately demonstrates that the future road network and its proposed intersections are capable of satisfactorily supporting the additional vehicular traffic expected to be generated by the entire structure plan area at the 2051 design horizon.

The following conclusions have been made regarding the proposed structure plan development with respect to the transportation and active travel components of this TIA.

9.3 Overall Integration with Surrounding Attractors / Generators

The structure plan area sits west of Indian Ocean Drive and south of Lancelin Road in a coastal/bushland setting, while the broader Lancelin township provides services, tourism facilities and recreation that will generate ongoing trips to/from the site.

A key integration feature is the proposed General Industrial precinct north of Lancelin Road, deliberately separated from the residential/community area, functioning as a major employment generator (light industry/logistics/service businesses) with efficient regional access via Indian Ocean Drive.

Other trip generators within the structure plan area include an emergency services hub, aged care, health centre, schools (primary + high), community centre, and a centrally positioned town centre / local centres intended to support walkability and local trip capture.

9.3.1 Key Integration Points / Outcomes

- 717.9ha land use mix including residential, town centre, industrial, education, conservation and recreation; 55ha General Industrial; >57ha public open space / green corridors; conservation zones (retained dunes / landscape protection) to preserve coastal values.
- Connectivity and amenity strengthened by a dual-use path link to Lancelin township and key entry roads aligned with coastal view corridors.
- 870 lots in the north-west corner of the structure plan area are noted as completed/under construction/approved/committed (design stage), supporting staged township expansion.

9.4 Road Network Accessibility

The site is anchored by direct frontage to Indian Ocean Drive (allowing for landscape buffer) and Lancelin Road, supporting strong regional north–south and local east–west accessibility, and providing a clear basis for a connected internal road network and multiple access points.

9.4.1 Existing Road Network Context

- **Indian Ocean Drive**:

  MRWA Primary Distributor; currently one lane each direction near Lancelin Road; posted 90 km/h, with side-road activated illuminated 70 km/h speed signs on the northbound approach.
- Indian Ocean Drive is **not "Control of Access"** in this locality, meaning there is no existing statutory control-of-access restriction applying here to direct intersections to Indian Ocean Drive.
- **Lancelin Road**: Local Distributor (Shire of Gingin), one lane each direction; posted 90 km/h west of Indian Ocean Drive (past the structure plan area), reducing toward town.

9.4.2 Key Vehicular Accessibility Principle

- The structure plan includes a site access road connection from Indian Ocean Drive (in addition to Lancelin Road) and an internal road network designed to distribute traffic and support future integration to the south and west.

9.5 Pedestrian and Cycle Accessibility

The existing active-transport environment around the site is currently sparse with no footpaths along Old Ledge Point Road, Lancelin Road or Indian Ocean Drive near the structure plan area, and no dedicated on-road cycle lanes (cycling currently relies on shoulders / shared carriageway typical of rural settings).

The structure plan responds by embedding walkability and a high level of shared-path infrastructure, exceeding minimum requirements and linking residential areas to schools, centres and open space.

9.5.1 Key Active-Transport Measures / Recommendations in the Report

- Provide footpaths along access streets generally in accordance with Liveable Neighbourhoods (2.0–2.5m typical), with appropriate dropped-kerb crossings (including at intersections).
- Deliver a significant network of shared paths across the site (beyond minimum LN requirements) to encourage active trips, especially between residential areas and new primary schools.
- The Road Authority shall provide an off-road Dual Use Path along Lancelin Road (Primary Route function), forming an east–west spine and linking neighbourhoods with the proposed industrial area and broader township connections.
- Provide Dual Use Paths on neighbourhood connector roads (minimum 2.5m on one side) to create direct and safe access to schools, centres, open space and community facilities.
- Consider additional walking/cycling links to coastal and conservation areas to support both daily and leisure-based active transport.
- Provide standardised cyclist/pedestrian priority across side-road intersections to maintain continuity of the shared path network.
- Consider low-speed street environments and potential shared-street treatments in residential areas to improve cyclist/pedestrian safety and comfort.

9.6 Public Transport Accessibility

Lancelin currently has no regular Transperth or town-based bus service and no dedicated intra-town network. Services are limited to school bus services and infrequent regional/private coach services.

9.6.1 Existing Services Noted:

- TransWA N5 Perth–Geraldton service stops at Lancelin, typically twice weekly (Fridays & Sundays).
- Private coach service also operates at limited frequency (around three times per week).

9.6.2 Public Transport Conclusions / Recommendations:

- PTA/TransWA has no confirmed future plans for changes to routes/frequencies in and around Lancelin at the time of reporting.
- The structure plan area is identified as an ideal opportunity to incorporate local bus routes and new bus stop provision, particularly given the planned schools.
- Engagement with PTA and the Shire during staging is expected to help define future alignment/frequency once thresholds are reached.

9.7 Road Safety Considerations

A crash search (Main Roads WA Reporting Centre) identified 7 crashes in the study area between 1 Jan 2020 and 31 Dec 2024 (most recent data as of Feb 2026), including 4 crashes at Indian Ocean Drive / Lancelin Road, plus crashes on Lancelin Road and Indian Ocean Drive south of Lancelin Road.

A key driver for the future intersection safety approach is the documented fatal crash at the existing Indian Ocean Drive / Lancelin Road intersection, including a fatal T-bone crash involving a southbound right-turn movement failing to give way to northbound traffic. This critical southbound right turn movement is not included in the proposed intersection design for the site access road intersection into the structure plan area from Indian Ocean Drive (approximately 1.2km south of Lancelin Road).

9.7.1 Safety-Relevant Design Measures (as documented):

- For the future Indian Ocean Drive / Site Access Road intersection (seagull-style T-intersection concept), the report adopts Safe System–aligned assumptions including. This involves banning the southbound right turn into the structure plan area (redirected to the future roundabout at Lancelin Road), providing channelisation (separate left/right lanes), enabling two-stage right turns across a wide median with a southbound right-turn acceleration lane (750m merge) to reduce conflict and improve recovery space.
- The assumed speed environment is also moderated at the intersection approaches (70 km/h on Indian Ocean Drive, 50 km/h on the side road) with design to Austroads and MRWA guidance.

9.8 Analysis of the External Transport Network

The report assesses external network performance to the Ultimate 2051 horizon and presents SIDRA results for the key access intersections, confirming that the proposed ultimate intersection forms operate within acceptable performance ranges (LOS, delay, queue, and degree of saturation/capacity utilisation).

2051 Intersection Performance Summary (key findings)

9.8.1 Indian Ocean Drive / Lancelin Road (future roundabout):

- **AM Peak:** performs within acceptable criteria (LOS A/B on Indian Ocean Drive; LOS B on Lancelin Road) with 50m 95% queue (7 vehicles) and overall the intersection is predicted to operate at 65% of theoretical capacity.
- **PM Peak:** performs within acceptable criteria (LOS B/C on Indian Ocean Drive; LOS B on Lancelin Road), with 23s delay and up to 95m 95% queue (14 vehicles) reported as acceptable; overall the intersection is predicted to operate at 84% of theoretical capacity.
- Iterative testing found an operational benefit from a free-running, unopposed northbound left-turn slip lane into Lancelin Road westbound to manage high PM left-turn demand and maintain efficiency to 2051.

9.8.2 Indian Ocean Drive / Site Access Road (priority-controlled T-intersection):

- **AM Peak**: performs within acceptable criteria LOS A–C on the access road with 15s average delay and 110m 95% queue (~6 vehicles); Indian Ocean Drive LOS A; overall the intersection is predicted to operate at n 88% theoretical capacity.
- **PM Peak**: performs within acceptable criteria LOS A on all approaches, 9s delay on access road and 13m 95% queue (2 vehicles); overall the intersection is predicted to operate at 50% theoretical capacity.

9.8.3 Lancelin Road / Site Access (priority-controlled T-intersection; busiest of four):

- The report notes a recommended future upgrade of Lancelin Road to an Integrator B standard with an indicative 26m reserve and 6m median, supporting up to 15,000 vpd and enabling two-stage right turns.
- **AM Peak:** Performs within acceptable criteria with spare capacity at around 25% of theoretical capacity used.
- **PM Peak:** Performs within acceptable criteria with spare capacity at around 16% of theoretical capacity used.

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Appendix A

TIA Checklist

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Appendix A TIA Checklist

Item	Provided	Comments/Proposals
Summary	Y	
Introduction / Background	Y	
Structure Plan Proposal	Y	
Regional context	Y	
Proposed land uses	Y	
Table of land uses and quantities	Y	
Major attractors / generators	Y	
Specific issues	Y	
Existing Situation	Y	
Existing land uses within structure plan	Y	
Existing land uses within 800m of structure plan area	Y	
Existing road network within structure plan area	Y	
Existing pedestrian / cycle network within structure plan area	Y	
Existing public transport services within structure plan area	Y	
Existing road network within 2 (or 5) km of structure plan area	Y	
Traffic flows on roads within structure plan area (PM and/or AM peak hours)	Y	
Existing pedestrian / cycle networks within 800m of structure plan area.	Y	
Existing public transport services within 800m of structure plan area.	Y	
Proposed Internal Transport Networks	Y	
Changes / additions to existing road network or proposed new road network	Y	
Road reservation widths	Y	
Road cross-sections & speed limits	Y	
Intersection controls	Y	
Pedestrian / cycle networks and crossing facilities	Y	
Changes to External Transport Networks	Y	
Road network	Y	
Intersection controls	Y	
Pedestrian/cycle networks and crossing facilities	Y	
Public transport services	Y	
Integration with surrounding area	Y	
Trip attractors / generators within 800 metres	Y	
proposed changes to land uses within 800 metres	Y	
travel desire lines from development to these attractors/ generators	Y	
adequacy of external transport networks	Y	
deficiencies in external transport networks	Y	
remedial measures to address deficiencies	Y	
Analysis of internal transport networks	Y	
assessment years	Y	
time periods	Y	
Structure plan generated traffic	Y	
Extraneous (through) traffic	Y	
Design traffic flows (that is, total traffic)	Y	
Road cross-sections	Y	
Intersection controls	Y	
Access strategy	Y	
Pedestrian / cycle networks	Y	
Safe routes to schools	Y	
Pedestrian permeability & efficiency	Y	
Access to public transport	Y	
Analysis of external transport networks	Y	
Extent of analysis	Y	
Base flows for assessment year(s)	Y	
Total traffic flows	Y	
Road cross-sections	Y	
Intersection layouts and controls	Y	
Pedestrian / cycle networks	Y	
Conclusions	Y	

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Appendix B

Proposed Structure Plan Layout

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This plan has no formal approval status and has been prepared by CLE to demonstrate one potential land use scenario for the land which could be investigated further by the Client. Implementation in any form would be subject to the receipt of all appropriate approvals. The plan may be changed without notice and should not be relied upon. This plan remains the property of CLE.

PROPOSED DUAL-USE PATH TO LANCELIN

EMERGENCY SERVICES HEADQUARTERS
- MARINE RESCUE
- DFES
- ST JOHN AMBULANCE (SUBCENTRE)

LIGHT INDUSTRIAL

MEDICAL CENTRE (0.51ha)

SERVICE STATION (0.3ha)

COMMUNITY CENTRE (1.14ha)

AGED CARE / RETIREMENT VILLAGE (1.31ha)

LOCAL CENTRE ON ENTRY (0.5ha)

ENTRY ROAD ALIGNED WITH POTENTIAL OCEAN VIEWS

POSSIBLE WATER TANK SITE

OLD LEDGE POINT ROAD

LANCELIN ROAD

INDIAN OCEAN DRIVE

Centre 2.03ha

Conservation

Primary School

7

8

400m Centre Catchment

800m Centre Catchment

Potential Visual Landscape Protection Zone

D.O.S.

High School

Centre 3.48ha

0.5ha

POSSIBLE TOURISM / RETAIL (1.61ha)

VISUAL PROTECTION AREA

FUTURE LANCELIN SLSC

NEW BEACH ACCESS ROAD OFF INDIAN OCEAN DRIVE

EXISTING TOPOGRAPHY PROVIDES SCREENING FROM INDIAN OCEAN DRIVE

CP

Beach Node / Access

PROPOSED ACCESS TO BEACH AND PARKING

RETAINED LANDFORM AND PASSIVE RECREATION

POTENTIAL FUTURE DEVELOPMENT OPPORTUNITY

Indian Ocean

OPPORTUNITY TO RETAIN EXISTING LANDFORM IN P.O.S.

LEGEND

- Subject Site (~717.9ha)
- Planned Development (~40.58ha)
- Residential (~31.06ha within Existing / Planned Development Area & ~257.61ha outside Planned Development Area, exc. S7-8)
- Neighbourhood Centre (~5.51ha)
- Local Centre (~2.91ha) (inc. possible Tourism + Service Station Site)
- Primary / K-12 (~24.08ha)
- Public Open Space (~59.28ha)
- 400m / 800m Centre Catchment
- Potential Visual Landscape Protection Zone (~16.41ha)
- Conservation Zone (~93.97ha) *(as per LPS 9)*
- Medical Centre (~0.51ha)
- Aged Care (~1.31ha)
- Community Centre (~1.14ha)
- Light Industrial (~55.0ha)
- Emergency Services (~0.8ha)
- Proposed Drainage

0 200 400 600 800 1000m

CLE Town Planning + Design

CONCEPT MASTERPLAN

Lancelin South

DRAFT

plan no: **3818-38F-01**
date: 2 December 2025
scale: 1:12,000 @A3, 1:6,000 @A1

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Appendix C

SIDRA Intersection Assessment Results

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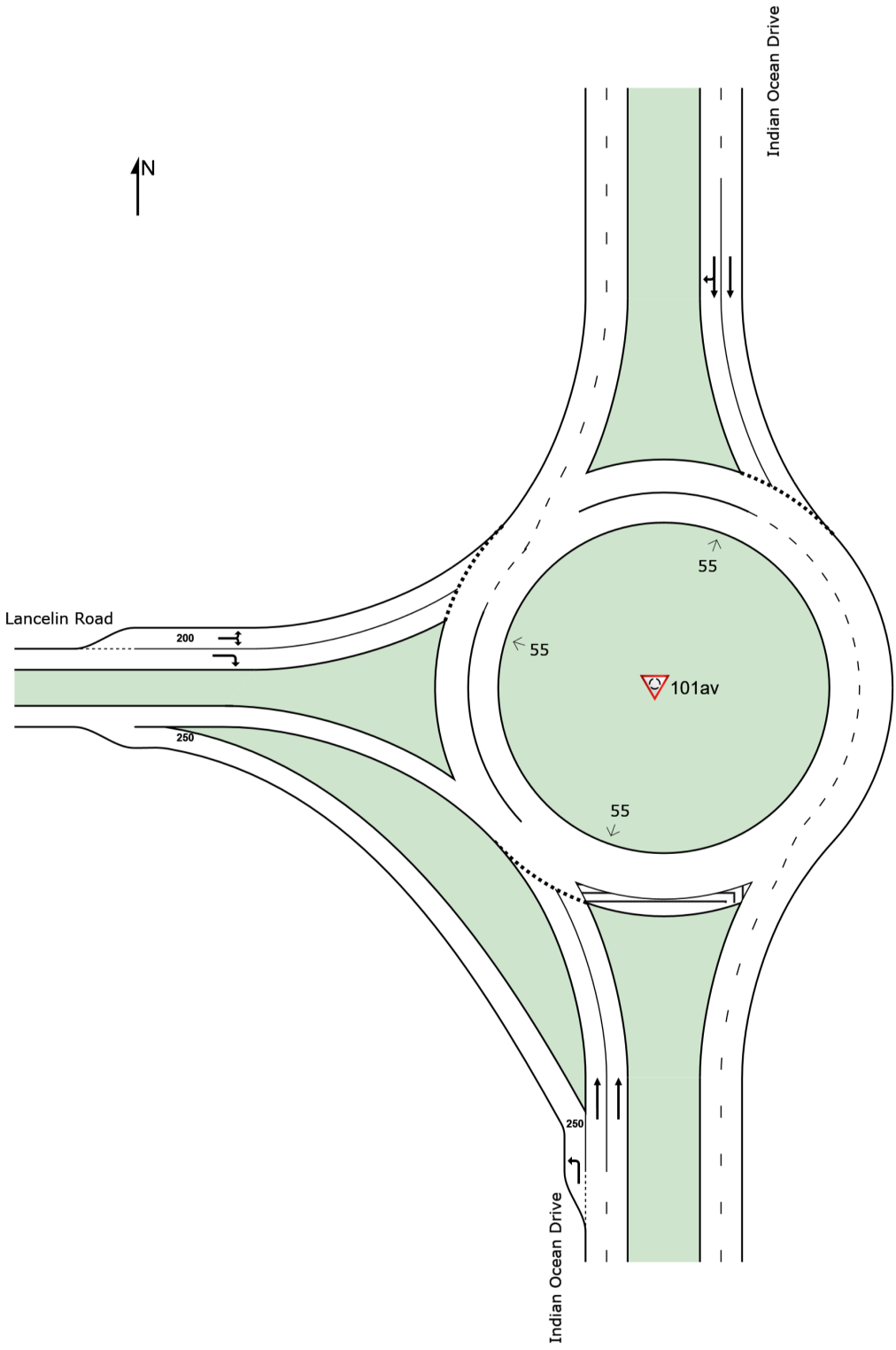
SITE LAYOUT

Site: 101av [Lancelin Road AM (Site Folder: Lancelin Road/ IOD)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.

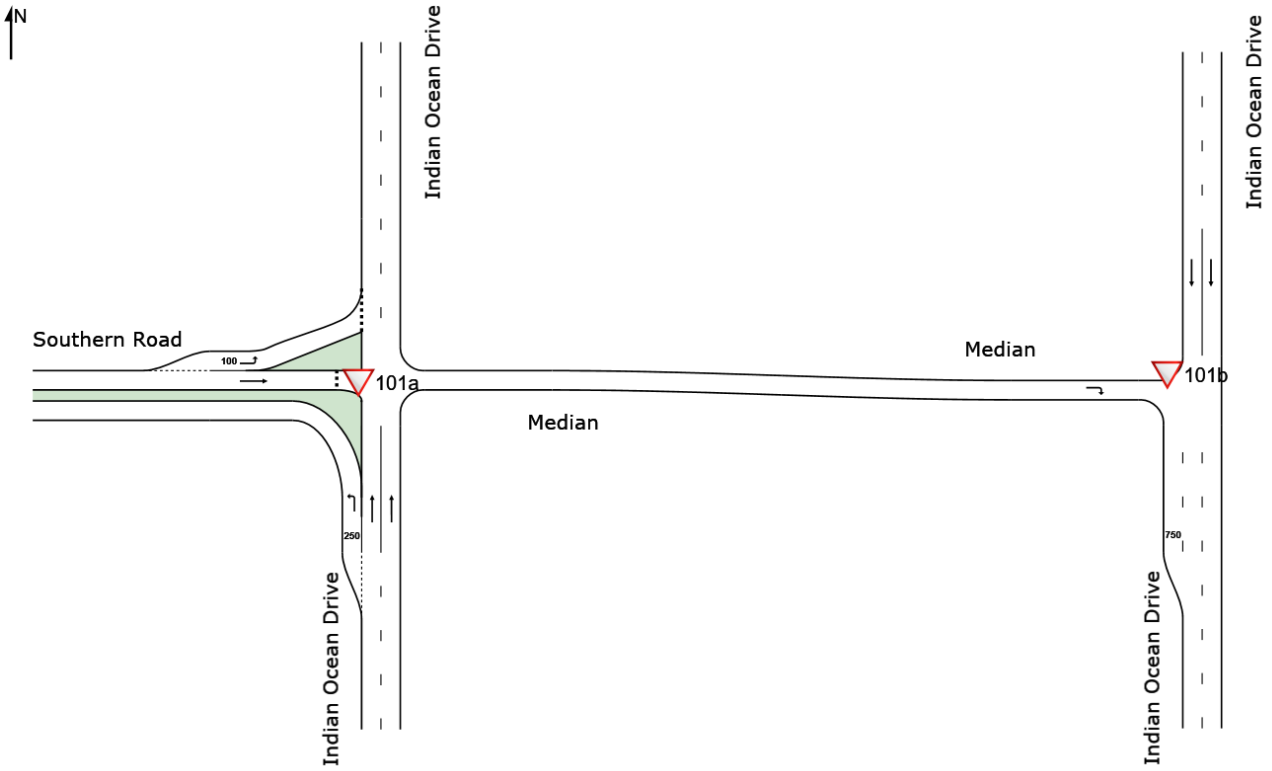


NETWORK LAYOUT

Network: N101 [Southern Road AM (Network Folder: General)]

New Network
Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101a	NA	Southern Road AM Leg 1
▽101b	NA	Southern Road AM Leg 2

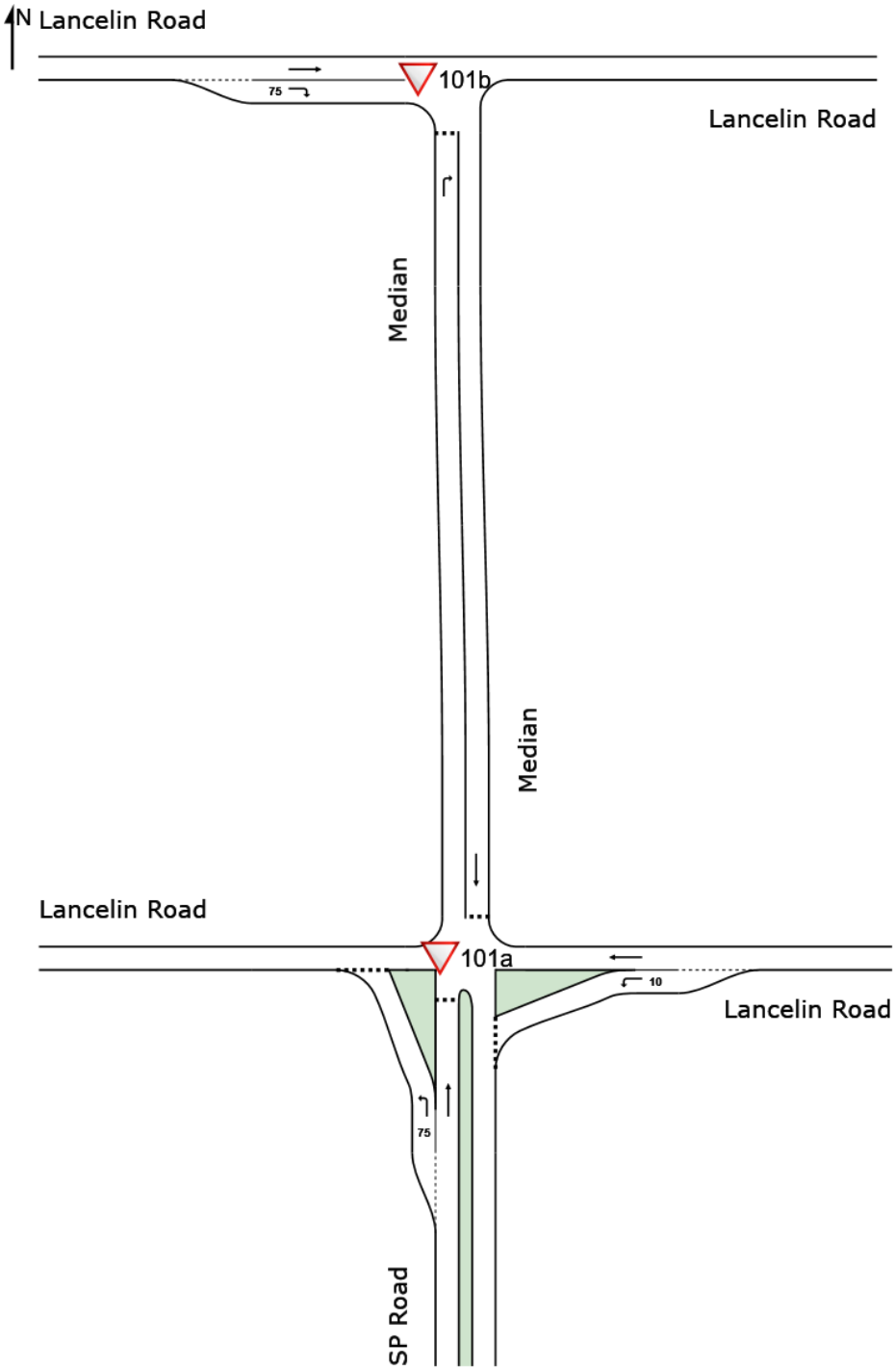
Organisation: PJA HOLDINGS (AUSTRALIA) PTY LTD | Licence: NETWORK / 1PC | Created: Tuesday, 17 February 2026 2:55:23 PM
Project: C:\PJA\OneDrive - Phil Jones Associates\SharedData - 08974 Lancelin South Structure Plan Amendment\4. Technical\4.3 Analysis\4.3.1 Transport\08804_0_TP_CA_0001_A_Lancelin South SP.sip9

NETWORK LAYOUT

Network: N101 [New Int AM (Network Folder: General)]

New Network
Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101a	NA	New Int AM Leg 1
▽101b	NA	New Int AM Leg 2

LANE SUMMARY

Site: 101av [Lancelin Road AM (Site Folder: Lancelin Road/ IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	449	9.5	449	9.5	1656	0.271	100	2.7	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2[d]	46	38.7	46	38.7	1287	0.036	100	5.0	LOS A	0.2	3.1	Full	1000	0.0	0.0
Lane 3	36	38.7	36	38.7	1006	0.036	100	5.2	LOS A	0.2	3.0	Full	1000	0.0	0.0
Approach	532	14.0	532	14.0		0.271		3.1	LOS A	0.2	3.1				
North: Indian Ocean Drive															
Lane 1	83	28.6	83	28.6	433	0.192	96[5]	11.0	LOS B	0.9	8.8	Full	1000	0.0	0.0
Lane 2[d]	158	9.5	158	9.5	792	0.199	100	15.8	LOS B	1.1	9.6	Full	1000	0.0	0.0
Approach	241	16.1	241	16.1		0.199		14.1	LOS B	1.1	9.6				
West: Lancelin Road															
Lane 1[d]	1036	6.0	1036	6.0	1604	0.646	100	8.5	LOS A	6.1	49.9	Short	200	0.0	NA
Lane 2	870	6.0	870	6.0	1347	0.646	100	12.5	LOS B	6.1	49.9	Full	500	0.0	0.0
Approach	1905	6.0	1905	6.0		0.646		10.3	LOS B	6.1	49.9				
All Vehicles	2678	8.5	2678	8.5		0.646		9.2	LOS A	6.1	49.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Indian Ocean Drive

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	449	-	449	9.5	1656	0.271	100	0.0	2
Lane 2	-	46	46	38.7	1287	0.036	100	NA	NA
Lane 3	-	36	36	38.7	1006	0.036	100	NA	NA
Approach	449	82	532	14.0		0.271			

North: Indian Ocean Drive

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	83	-	83	28.6	433	0.192	96[5]	NA	NA

Lane 2	-	158	158	9.5	792	0.199	100	NA	NA
Approach	83	158	241	16.1		0.199			
West: Lancelin Road									
Mov. From W To Exit:	L2 N	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	496	540	1036	6.0	1604	0.646	100	0.0	2
Lane 2	-	870	870	6.0	1347	0.646	100	NA	NA
Approach	496	1409	1905	6.0		0.646			
	Total	%HV	Deg.Satn (v/c)						
All Vehicles	2678	8.5	0.646						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
West Exit: Lancelin Road Merge Type: **Zipper**												
Exit Short Lane	1	250	50.0	79	84	2.66	2.13	449	1586	0.283	0.0	0.1
Merge Lane	2	-	50.0	225	239	2.66	2.13	158	1363	0.116	0.1	0.2

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
North: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101av [Lancelin Road PM (Site Folder: Lancelin Road/ IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	731	10.2	731	10.2	1663	0.439	100	5.6	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2[d]	61	31.7	61	31.7	605	0.101	100	10.0	LOS A	0.9	10.0	Full	1000	0.0	0.0
Lane 3	39	31.7	39	31.7	382	0.101	100	12.3	LOS B	0.7	8.0	Full	1000	0.0	0.0
Approach	831	12.8	831	12.8		0.439		6.2	LOS A	0.9	10.0				
North: Indian Ocean Drive															
Lane 1	142	20.9	142	20.9	663	0.214	26[5]	7.8	LOS A	1.0	8.9	Full	1000	0.0	0.0
Lane 2[d]	891	10.2	891	10.2	1064	0.837	100	22.8	LOS C	11.2	94.2	Full	1000	0.0	0.0
Approach	1033	11.7	1033	11.7		0.837		20.8	LOS C	11.2	94.2				
West: Lancelin Road															
Lane 1[d]	607	7.0	607	7.0	1533	0.396	100	7.8	LOS A	3.1	25.1	Short	200	0.0	NA
Lane 2	512	7.0	512	7.0	1291	0.396	100	12.2	LOS B	3.0	24.2	Full	500	0.0	0.0
Approach	1119	7.0	1119	7.0		0.396		9.8	LOS A	3.1	25.1				
All Vehicles	2982	10.2	2982	10.2		0.837		12.6	LOS B	11.2	94.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Indian Ocean Drive

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	731	-	731	10.2	1663	0.439	100	0.0	2
Lane 2	-	61	61	31.7	605	0.101	100	NA	NA
Lane 3	-	39	39	31.7	382	0.101	100	NA	NA
Approach	731	100	831	12.8		0.439			

North: Indian Ocean Drive

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	142	-	142	20.9	663	0.214	26[5]	NA	NA

Lane 2	-	891	891	10.2	1064	0.837	100	NA	NA
Approach	142	891	1033	11.7		0.837			
West: Lancelin Road									
Mov. From W To Exit:	L2 N	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	335	273	607	7.0	1533	0.396	100	0.0	2
Lane 2	-	512	512	7.0	1291	0.396	100	NA	NA
Approach	335	784	1119	7.0		0.396			
	Total	%HV	Deg.Satn (v/c)						
All Vehicles	2982	10.2	0.837						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
West Exit: Lancelin Road Merge Type: **Zipper**												
Exit Short Lane	1	250	50.0	445	471	2.64	2.11	731	990	0.738	0.9	2.8
Merge Lane	2	-	50.0	365	386	2.64	2.11	891	1147	0.777	0.5	2.1

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
North: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101a [Southern Road AM Leg 1 (Site Folder: Southern Road/IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [Southern Road AM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	36	3.0	36	3.0	1818	0.020	100	6.7	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2	266	12.7	266	12.7	1612	0.165	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Lane 3	266	12.7	266	12.7	1612	0.165	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Approach	567	12.1	567	12.1		0.165		0.5	NA	0.0	0.0				
West: Southern Road															
Lane 1	279	3.0	279	3.0	1173	0.238	100	6.1	LOS A	1.0	7.9	Short	100	0.0	NA
Lane 2	795	3.0	795	3.0	903	0.880	100	15.6	LOS C	14.6	110.9	Full	200	0.0	0.0
Approach	1074	3.0	1074	3.0		0.880		13.1	LOS B	14.6	110.9				
All Vehicles	1641	6.1	1641	6.1		0.880		8.7	NA	14.6	110.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

South: Indian Ocean Drive

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	-	36	3.0	1818	0.020	100	0.0	2
Lane 2	-	266	266	12.7	1612	0.165	100	NA	NA
Lane 3	-	266	266	12.7	1612	0.165	100	NA	NA
Approach	36	532	567	12.1		0.165			

West: Southern Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	279	-	279	3.0	1173	0.238	100	0.0	2
Lane 2	-	795	795	3.0	903	0.880	100	NA	NA
Approach	279	795	1074	3.0		0.880			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	1641	6.1	0.880

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
West: Southern Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101b [Southern Road AM Leg 2 (Site Folder: Southern Road/IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [Southern Road AM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
North: Indian Ocean Drive															
Lane 1	746	6.0	746	6.0	1824	0.409	100	0.3	LOS A	0.0	0.0	Full	1200	0.0	0.0
Lane 2	746	6.0	746	6.0	1824	0.409	100	1.9	LOS A	0.0	0.0	Full	1200	0.0	0.0
Approach	1493	6.0	1493	6.0		0.409		1.1	NA	0.0	0.0				
West: Median															
Lane 1	795	3.0	795	3.0	1818	0.437	100	3.2	LOS A	0.0	0.0	Full	12	0.0	0.0
Approach	795	3.0	795	3.0		0.437		3.2	NA	0.0	0.0				
All Vehicles	2287	5.0	2287	5.0		0.437		1.8	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

North: Indian Ocean Drive

Mov. From N To Exit:	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	746	746	6.0	1824	0.409	100	NA	NA
Lane 2	746	746	6.0	1824	0.409	100	NA	NA
Approach	1493	1493	6.0		0.409			

West: Median

Mov. From W To Exit:	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	795	795	3.0	1818	0.437	100	NA	NA
Approach	795	795	3.0		0.437			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2287	5.0	0.437

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity

Constraint effects.

Merge Analysis	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Indian Ocean Drive Merge Type: **Zipper**												
Exit Short Lane	3	750	50.0	373	388	2.54	2.03	795	1262	0.630	0.4	1.1
Merge Lane	2	-	50.0	397	403	2.60	2.08	746	1142	0.653	0.5	1.6

Variable Demand Analysis	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
North: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Median				
Lane 1	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101a [Southern Road PM Leg 1 (Site Folder: Southern Road/IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [Southern Road PM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Indian Ocean Drive															
Lane 1	877	3.0	877	3.0	1818	0.482	100	7.0	LOS A	0.0	0.0	Short	250	0.0	NA
Lane 2	415	10.2	415	10.2	1759	0.236	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Lane 3	415	10.2	415	10.2	1759	0.236	100	0.1	LOS A	0.0	0.0	Full	1000	0.0	0.0
Approach	1707	6.5	1707	6.5		0.482		3.7	NA	0.0	0.0				
West: Southern Road															
Lane 1	108	3.0	108	3.0	971	0.112	100	6.8	LOS A	0.4	3.3	Short	100	0.0	NA
Lane 2	252	3.0	252	3.0	674	0.373	100	8.9	LOS A	1.7	12.8	Full	200	0.0	0.0
Approach	360	3.0	360	3.0		0.373		8.3	LOS A	1.7	12.8				
All Vehicles	2067	5.9	2067	5.9		0.482		4.5	NA	1.7	12.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

South: Indian Ocean Drive

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	877	-	877	3.0	1818	0.482	100	0.0	2
Lane 2	-	415	415	10.2	1759	0.236	100	NA	NA
Lane 3	-	415	415	10.2	1759	0.236	100	NA	NA
Approach	877	831	1707	6.5		0.482			

West: Southern Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	108	-	108	3.0	971	0.112	100	0.0	2
Lane 2	-	252	252	3.0	674	0.373	100	NA	NA
Approach	108	252	360	3.0		0.373			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2067	5.9	0.482

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
West: Southern Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101b [Southern Road PM Leg 2 (Site Folder: Southern Road/IOD)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [Southern Road PM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
North: Indian Ocean Drive															
Lane 1	463	7.0	463	7.0	1813	0.256	100	0.2	LOS A	0.0	0.0	Full	1200	0.0	0.0
Lane 2	463	7.0	463	7.0	1813	0.256	100	0.2	LOS A	0.0	0.0	Full	1200	0.0	0.0
Approach	926	7.0	926	7.0		0.256		0.2	NA	0.0	0.0				
West: Median															
Lane 1	252	3.0	252	3.0	1818	0.138	100	2.2	LOS A	0.0	0.0	Full	12	0.0	0.0
Approach	252	3.0	252	3.0		0.138		2.2	NA	0.0	0.0				
All Vehicles	1178	6.1	1178	6.1		0.256		0.6	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

North: Indian Ocean Drive

Mov. From N To Exit:	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	463	463	7.0	1813	0.256	100	NA	NA
Lane 2	463	463	7.0	1813	0.256	100	NA	NA
Approach	926	926	7.0		0.256			

West: Median

Mov. From W To Exit:	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	252	252	3.0	1818	0.138	100	NA	NA
Approach	252	252	3.0		0.138			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	1178	6.1	0.256

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity

Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Indian Ocean Drive Merge Type: **Zipper**												
Exit Short Lane	3	750	50.0	232	241	2.54	2.03	252	1475	0.171	0.0	0.1
Merge Lane	2	-	50.0	126	128	2.61	2.08	463	1567	0.296	0.0	0.1

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
North: Indian Ocean Drive				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Median				
Lane 1	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101a [New Int AM Leg 1 (Site Folder: New Int/Lancelin Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [New Int AM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SP Road															
Lane 1	79	3.0	79	3.0	1053	0.075	100	6.3	LOS A	0.3	2.2	Short	75	0.0	NA
Lane 2	227	3.0	227	3.0	925	0.246	100	5.4	LOS A	0.9	6.9	Full	100	-4.0 N3	0.0
Approach	306	3.0	306	3.0		0.246		5.6	LOS A	0.9	6.9				
East: Lancelin Road															
Lane 1	57	3.0	57	3.0	1582	0.036	100	6.7	LOS A	0.1	1.1	Short	10	0.0	NA
Lane 2	440	9.5	440	9.5	1751	0.251	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	497	8.8	497	8.8		0.251		0.8	LOS A	0.1	1.1				
North: Median															
Lane 1	24	2.5	24	2.5	983	0.024	100	2.8	LOS A	0.1	0.6	Full	6	0.0	0.0
Approach	24	2.5	24	2.5		0.024		2.8	LOS A	0.1	0.6				
All Vehicles	827	6.4	827	6.4		0.251		2.7	NA	0.9	6.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Approach Lane Flows (veh/h)

South: SP Road

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	79	-	79	3.0	1053	0.075	100	0.0	2
Lane 2	-	227	227	3.0	925	0.246	100	NA	NA
Approach	79	227	306	3.0		0.246			

East: Lancelin Road

Mov. From E To Exit:	L2 S	T1 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	57	-	57	3.0	1582	0.036	100	0.0	2
Lane 2	-	440	440	9.5	1751	0.251	100	NA	NA

Approach	57	440	497	8.8		0.251			
North: Median									
Mov. From N To Exit:	T1 S	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	24	24	2.5		983	0.024	100	NA	NA
Approach	24	24	2.5			0.024			
	Total	%HV	Deg.Satn (v/c)						
All Vehicles	827	6.4		0.251					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Flow Rate sec	Capacity veh/h	Deg. Satn veh/h	Min. Delay v/c	Merge Delay sec	sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: SP Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Median				
Lane 1	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101b [New Int AM Leg 2 (Site Folder: New Int/Lancelin Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [New Int AM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	227	3.0	227	3.0	1040	0.219	100	3.2	LOS A	0.8	5.8	Full	6	0.0	4.0
Approach	227	3.0	227	3.0		0.219		3.2	LOS A	0.8	5.8				
West: Lancelin Road															
Lane 1	373	6.0	373	6.0	1824	0.204	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	19	3.0	19	3.0	1818	0.010	100	6.4	LOS A	0.0	0.0	Short	75	0.0	NA
Approach	392	5.9	392	5.9		0.204		0.4	NA	0.0	0.0				
All Vehicles	619	4.8	619	4.8		0.219		1.4	NA	0.8	5.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

South: Median

Mov. From S To Exit:	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	227	227	3.0	1040	0.219	100	NA	NA
Approach	227	227	3.0		0.219			

West: Lancelin Road

Mov. From W To Exit:	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	373	-	373	6.0	1824	0.204	100	NA	NA
Lane 2	-	19	19	3.0	1818	0.010	100	0.0	1
Approach	373	19	392	5.9		0.204			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	619	4.8	0.219

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Median				
Lane 1	0.0	0.0	0.0	0.0
West: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101a [New Int PM Leg 1 (Site Folder: New Int/Lancelin Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [New Int PM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SP Road															
Lane 1	20	3.0	20	3.0	1250	0.016	100	5.5	LOS A	0.1	0.5	Short	75	0.0	NA
Lane 2	57	3.0	57	3.0	1069	0.053	100	4.6	LOS A	0.2	1.4	Full	100	0.0	0.0
Approach	77	3.0	77	3.0		0.053		4.8	LOS A	0.2	1.4				
East: Lancelin Road															
Lane 1	227	3.0	227	3.0	1495	0.152	100	6.9	LOS A	0.7	5.1	Short	10	0.0	NA
Lane 2	282	10.2	282	10.2	1759	0.160	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	509	7.0	509	7.0		0.160		3.1	LOS A	0.7	5.1				
North: Median															
Lane 1	94	2.5	94	2.5	1160	0.081	100	2.2	LOS A	0.3	2.2	Full	6	0.0	0.0
Approach	94	2.5	94	2.5		0.081		2.2	LOS A	0.3	2.2				
All Vehicles	681	5.9	681	5.9		0.160		3.2	NA	0.7	5.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

South: SP Road

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	20	-	20	3.0	1250	0.016	100	0.0	2
Lane 2	-	57	57	3.0	1069	0.053	100	NA	NA
Approach	20	57	77	3.0		0.053			

East: Lancelin Road

Mov. From E To Exit:	L2 S	T1 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	227	-	227	3.0	1495	0.152	100	0.0	2
Lane 2	-	282	282	10.2	1759	0.160	100	NA	NA
Approach	227	282	509	7.0		0.160			

North: Median								
Mov. From N To Exit:	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	94	94	2.5	1160	0.081	100	NA	NA
Approach	94	94	2.5		0.081			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	681	5.9	0.160

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Flow Rate sec	Capacity veh/h	Deg. Satn veh/h	Min. Delay v/c	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: SP Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Median				
Lane 1	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101b [New Int PM Leg 2 (Site Folder: New Int/Lancelin Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [New Int PM (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	57	3.0	57	3.0	978	0.058	100	3.3	LOS A	0.2	1.4	Full	6	0.0	0.0
Approach	57	3.0	57	3.0		0.058		3.3	LOS A	0.2	1.4				
West: Lancelin Road															
Lane 1	385	7.0	385	7.0	1813	0.213	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	79	3.0	79	3.0	1818	0.043	100	6.4	LOS A	0.0	0.0	Short	75	0.0	NA
Approach	464	6.3	464	6.3		0.213		1.1	NA	0.0	0.0				
All Vehicles	521	6.0	521	6.0		0.213		1.4	NA	0.2	1.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)

South: Median

Mov. From S To Exit:	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	57	57	3.0	978	0.058	100	NA	NA
Approach	57	57	3.0		0.058			

West: Lancelin Road

Mov. From W To Exit:	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	385	-	385	7.0	1813	0.213	100	NA	NA
Lane 2	-	79	79	3.0	1818	0.043	100	0.0	1
Approach	385	79	464	6.3		0.213			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	521	6.0	0.213

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Median				
Lane 1	0.0	0.0	0.0	0.0
West: Lancelin Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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