APPENDIX 5. TRAFFIC INVESTIGATIONS

This investigation report can be viewed as a separate document on the Have Your Say Page of the SA Planning Portal at www.plan.sa.gov.au/codeamendments

CODE AMENDMENT
BOWMAN ROAD, WALLAROO

TRAFFIC INVESTIGATIONS REPORT

CIRQA™

DISCLAIMER

DOCUMENT CONTROL

Report title:	Code Amendment – Bowman Road, Wallaroo Traffic Investigations Report
Project number:	24064
Client:	Silvergate SA Pty Ltd
Client contact:	c/- Damien Collins Burke Urban Projects Pty Ltd

Version	Date	Details/status	Prepared by	Approved by
Draft	13 Jun 24	For review	RNM	BNW
V1	25 Jun 24	For submission	RNM	BNW

CIRQA Pty Ltd
ABN 17 606 952 309
PO Box 144, Glenside SA 5065
Level 1, 27 Halifax Street, Adelaide SA 5000
(08) 7078 1801
www.cirqa.com.au

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

CIRQA has been engaged to provide traffic impact investigations to inform the Code Amendment for the potential rezoning of land at Bowman Road, Wallaroo from 'Rural' to 'Employment' and 'Neighbourhood'.

This report includes assessment of the forecast traffic generation associated with the proposed rezoning and redevelopment of the subject land, the associated impact on the adjacent existing road network and consideration of potential infrastructure provisions and upgrades.

In preparing the assessment, a development yield of 450 dwellings has been adopted as this is the maximum number of dwellings that could be developed within the proposed Neighbourhood Zone.

It has been assumed that approximately 32% of the area proposed to be Employment Zone would be considered future developable floor area, with the balance of the Employment Zone land providing the necessary public road and stormwater infrastructure, private vehicle access points, circulation, parking, and loading/service areas. Future commercial uses for the site are anticipated to include 'storage', 'warehouse' and 'bulky goods retail' type activities.

Based on the above, it is forecast that future development of the Affected Area would generate in the order of 1,600 am peak hour and 1,950 pm peak hour trips.

It is anticipated that traffic associated with future redevelopment would be readily accommodated by the proposed access points for the Affected Area (on Bowman Road and Spencer Highway) and the adjacent road network. The anticipated future development would not alter the nature or function of Bowman Road, Spencer Highway, Copper Coast Highway, or adjacent public roads. It is acknowledged that the Department for Infrastructure and Transport (DIT) has raised concern about the impact of the proposal (particularly the residential component) on the heavy vehicle bypass function of Bowman Road. However, given the low heavy vehicle volumes associated with Bowman Road, it is considered that impacts can be adequately addressed through appropriate access management and intersection (and crossing) treatments.

There is currently low demand for active transport facilities due to the low density of development within the Affected Area. Future demand for walking and cycling infrastructure will likely increase as development intensifies. It is recommended that connections to the Wallaroo town centre be developed within future developments in the Affected Area, to strengthen cycling connections for recreational, commuter and customer use. This will require facilities such as

pedestrian (and cyclist) refuges to safely accommodate such movements, particularly where crossing of Bowman Road is required.

2. BACKGROUND

2.1 AFFECTED AREA

The Affected Area comprises approximately 108 hectares of land located between the Copper Coast Highway and Spencer Highway in Wallaroo. Specifically, the Affected Area comprises 17 allotments, namely:

- Allotment 400 Lehman Road, Wallaroo (CT6121/721);
- Allotment 400 Lehman Road, Wallaroo (CT6288/540);
- Allotment 400 Lehman Road, Wallaroo (CT6288/541);
- Allotment 628 Bowman Road, Wallaroo (CT6121/722);
- Allotment 628 Bowman Road, Wallaroo (CT6288/535);
- Allotment 628 Bowman Road, Wallaroo (CT6288/536);
- Allotment 628 Bowman Road, Wallaroo (CT6288/537);
- Allotment 628 Bowman Road, Wallaroo (CT6288/538);
- Allotment 666 Bowman Road, Wallaroo (CT6288/527);
- Allotment 666 Bowman Road, Wallaroo (CT6288/528);
- Allotment 666 Bowman Road, Wallaroo (CT6288/529);
- Allotment 666 Bowman Road, Wallaroo (CT6288/530);
- Allotment 666 Bowman Road, Wallaroo (CT6288/531);
- Allotment 666 Bowman Road, Wallaroo (CT6288/533);
- Allotment 666 Bowman Road, Wallaroo (CT6288/534);
- Allotment 675 Bowman Road, Wallaroo (CT6288/532); and
- Allotment 676 Bowman Road, Wallaroo (CT6288/539).

The site is bounded by Spencer Highway to the north, Bowman Road to the east, Ellis Road to the south and Rosslyn Road to the west. The site is bisected by an unformed extension of Rucioch Road.

The Planning and Design Code identifies that the site is located within a Rural Zone, with the following Overlays and Local Variations (TNV) applicable:

- Hazards (Bushfire – Regional);
- Hazards (Flooding – Evidence Required);
- Key Outback and Rural Routes;
- Limited Dwelling;

- Native Vegetation;
- Minimum Site Area (Minimum site area is 100 ha); and
- Minimum Dwelling Allotment Size (Minimum dwelling allotment size is 40 ha).

The Affected Area has previously been used for agricultural operations and is currently vacant. Vehicle access to/from the Affected Area is currently provided via an access point on Ellis Road at which all turning movements are allowed, and informal access points on Rosslyn Road, Bowman Road and Heath Road.

Figure 1 illustrates the location of the Affected Area and adjacent road network.

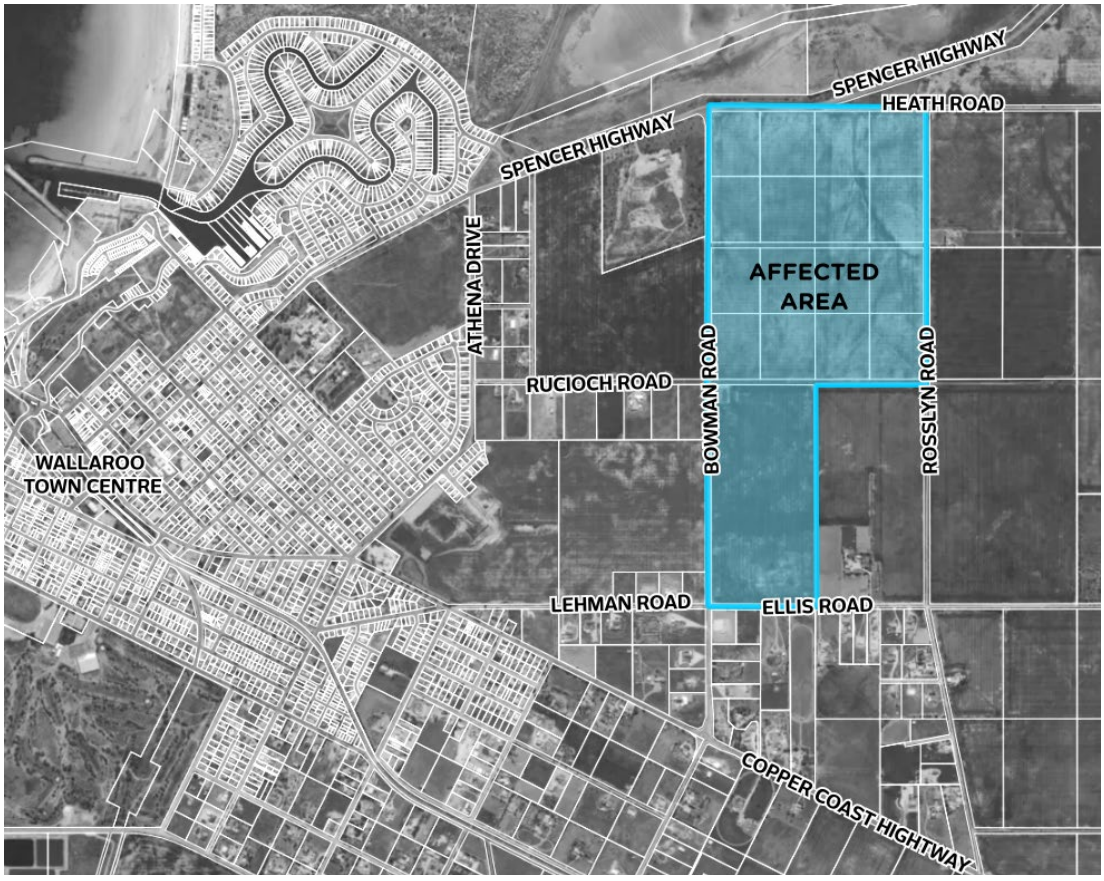


Figure 1 – Location of the Affected Area and adjacent road network.

2.2 ADJACENT ROAD NETWORK

Bowman Road is a local road under the care and control of Copper Coast Council. Bowman Road comprises a 7.4 m wide carriageway (approximate) with a single traffic lane in each direction and unsealed shoulders on each side. A 100 km/h speed limit applies on Bowman Road. Traffic data provided by Council indicates that Bowman Road has a daily traffic volume of approximately 1,432 vehicles per day (vpd), the vast majority of which are light vehicles (only 3% are associated with commercial vehicles).

Bowman Road effectively forms a heavy vehicle bypass (Spencer Highway to Copper Coast Highway linking the Port via Sharples Road and Magazine Road). This route provides an alternative to historic use of roads within the Wallaroo township. This route not only improves safety for road users (including cyclists and pedestrians) within the township (by removing heavy vehicle movements in key township activity areas) but also improves efficiencies of freight movements between Wallaroo Port and Spencer Highway.

It is understood that Council and the Department for Infrastructure and Transport (DIT) are currently negotiating the transfer of Bowman Road to the Commissioner of Highways to formalise this bypass route. Additional shoulder upgrades are proposed for Bowman Road as part of these negotiations. DIT has advised that the bypass will effectively accommodate redistribution of heavy vehicle movements currently (or at least previously) undertaken through the township to this bypass route. No future forecast volumes have been identified by DIT (i.e. the bypass is related to accommodating the redistributed existing movements rather than any anticipated notable growth in heavy vehicle movements).

Sharples Road is a local road under the care and control of Copper Coast Council. Sharples Road comprises a 7.4 m wide carriageway (approximate) with a single traffic lane in each direction and unsealed shoulders on each side. A 100 km/h speed limit applies on Sharples Road. Traffic data provided by Council indicates that Sharples Road has a daily traffic volume of approximately 1,452 vpd, of which 3% are heavy vehicles. Sharples Road forms a continuation of the Bowman Road heavy vehicle bypass south of the Copper Coast Highway.

Spencer Highway is a National Highway under the care and control of DIT. Adjacent the site, Spencer Highway comprises a single traffic lane in each direction, with adjacent shoulders on each side (comprising sealed and unsealed surfaces). Traffic data obtained from DIT indicates that this section of Spencer Highway has an Annual Average Daily Traffic (AADT) volume in the order of 360 vpd, of which approximately 11.5% are commercial vehicles. Adjacent the site, a 100 km/h speed limit applies on Spencer Highway.

Heath Road is an unsealed local road under the care and control of Copper Coast Council. Heath Road comprises a 10 m wide carriageway (approximate) which accommodates two-way traffic. The default rural speed limit of 100 km/h applies on Heath Road.

Ellis Road is an unsealed local road under the care and control of Copper Coast Council. Ellis Road comprises a 10 m wide carriageway (approximate) which accommodates two-way traffic. The default rural speed limit of 100 km/h applies on Ellis Road.

Rucioch Road is an unsealed local road under the care and control of Copper Coast Council. Rucioch Road comprises a 10 m wide carriageway (approximate) which accommodates two-way traffic. The default rural speed limit of 100 km/h applies on Rucioch Road.

Copper Coast Highway is a National Highway under the care and control DIT. Adjacent the site, Copper Coast Highway comprises a single traffic lane in each direction, with adjacent shoulders on each side (comprising sealed and unsealed surfaces). Traffic data obtained from DIT indicates that this section of Copper Coast Highway has an AADT volume in the order of 6,400 vpd, of which approximately 8.5% are commercial vehicles. Adjacent the site, an 80 km/h speed limit applies on Copper Coast Highway.

Athena Drive is a collector road under the care and control of Copper Coast Council. Athena Drive comprises a 6.0 m wide carriageway (approximate) with a single traffic lane in each direction. An 80 km/h speed limit applies on Athena Drive. Traffic data provided by Council indicates that Athena Drive has a daily traffic volume of 1,140 vpd, of which 8% were commercial vehicles. Considering traffic volume growth on surrounding roads since that time, it is estimated that Athena Drive currently carries in the order of 1,870 vpd.

It should be noted that the traffic volumes identified above are associated with typical volumes outside of grain carting season. Traffic data provided by DIT indicates that grain carting season increases commercial vehicle volumes by approximately 35 to 45%. There would be increased commercial vehicle traffic volumes on the key heavy vehicle routes such as Bowman Road, Sharples Road, Spencer Highway and Copper Coast Highway during this seasonal period. An estimate of heavy vehicle movements during and outside of grain carting season has been provided in Table 1 below.

Table 1 – Estimated heavy vehicle movements during grain carting season

Road	Typical heavy vehicle movements	Estimated heavy vehicle movements during grain carting season	Total traffic volumes (AADT)	Estimated total traffic volumes during grain carting season
Bowman Road	43 vpd	62 vpd	1,432 vpd	1,452 vpd
Sharples Road	32 vpd	46 vpd	1,452 vpd	1,466 vpd
Spencer Highway	43 vpd	63 vpd	360 vpd	379 vpd
Copper Coast Highway	544 vpd	789 vpd	6,400 vpd	6,645 vpd

2.3 KEY INTERSECTIONS

Within the surrounding road network, the following key intersections (and associated treatments/layouts) are noted:

- Copper Coast Highway/Bowman Road – four-way intersection controlled with a (relatively recently constructed) roundabout (capable of accommodating 36.5 m Road Trains);
- Bowman Road/Ellis Road – standard T-intersection (no separated turn lanes are currently provided). The road reserve of Lehman Road abuts the intersection, however, the formal connection of Lehman Road to the intersection is not formed;
- Bowman Road/Spencer Highway – T-intersection arrangement with priority assigned to Spencer Highway. The intersection treatment includes a separated left-turn deceleration lane and a basic auxiliary right-turn treatment (shoulder widening) for movements into Spencer Highway;
- Spencer Highway/Heath Road – a standard T-intersection, however, Heath Road meets Spencer Highway at an acute angle. No formal turn treatments are provided at the intersection;
- Bowman Road/Rucioch Road – while the road reserves of the two roads effectively form a four-way intersection, no formal connections are formed on either side of Rucioch Road (minor tracks are worn for access to/from adjacent rural properties); and
- Spencer Highway/Athena Drive – T-intersection arrangement with priority assigned to Spencer Highway. No formal turn treatments are currently provided at the intersection.

Other intersections immediately adjacent to the Affected Area are generally unsealed, low volumes rural access roads with either T-intersection or four-way layouts.

2.4 WALKING AND CYCLING

No footpaths or bicycle lanes are provided on any of the roads on the adjacent road network. This is reflective of existing land uses of the area, which generate relatively low levels of pedestrian activity. Cyclists are required to ride on-street sharing the road with motorists.

It is noted, however, that the Copper Coast Rail Trail (shared walking and cycling trail) is located south of the Copper Coast Highway. The Rail Trail connects Wallaroo and Kadina (along the former rail corridor). Notably, the Rail Trail crosses the heavy vehicle route along Sharples Road with limited formal treatment as illustrated in Figure 2.

Figure 2 – Existing Rail Trail crossing on Sharples Road

2.5 PUBLIC TRANSPORT

There are limited public transport services within Wallaroo and the surrounding areas. Care In Motion provides a Community Transport Service throughout the Yorke Peninsula, however, they generally operate along roads approximately 2.5 km or more from the subject site. Care In Motion does, however, offer a 'Copper Coast Dial-A-Ride' (flexible door-to-door) service within the whole township of Wallaroo (which includes the subject site). The 'Dial a Ride' service operates on Wednesdays and Fridays between 9:50 am to 4:10 pm.

2.6 OTHER ANTICIPATED DEVELOPMENT

It is noted that land west of the Affected Area was rezoned for residential development (Neighbourhood Zone) prior to the implementation of the Planning and Design Code. Two land parcels within the existing Neighbourhood Centre are currently under-developed but have the potential to accommodate future residential development. These two parcels are illustrated in Figure 3.

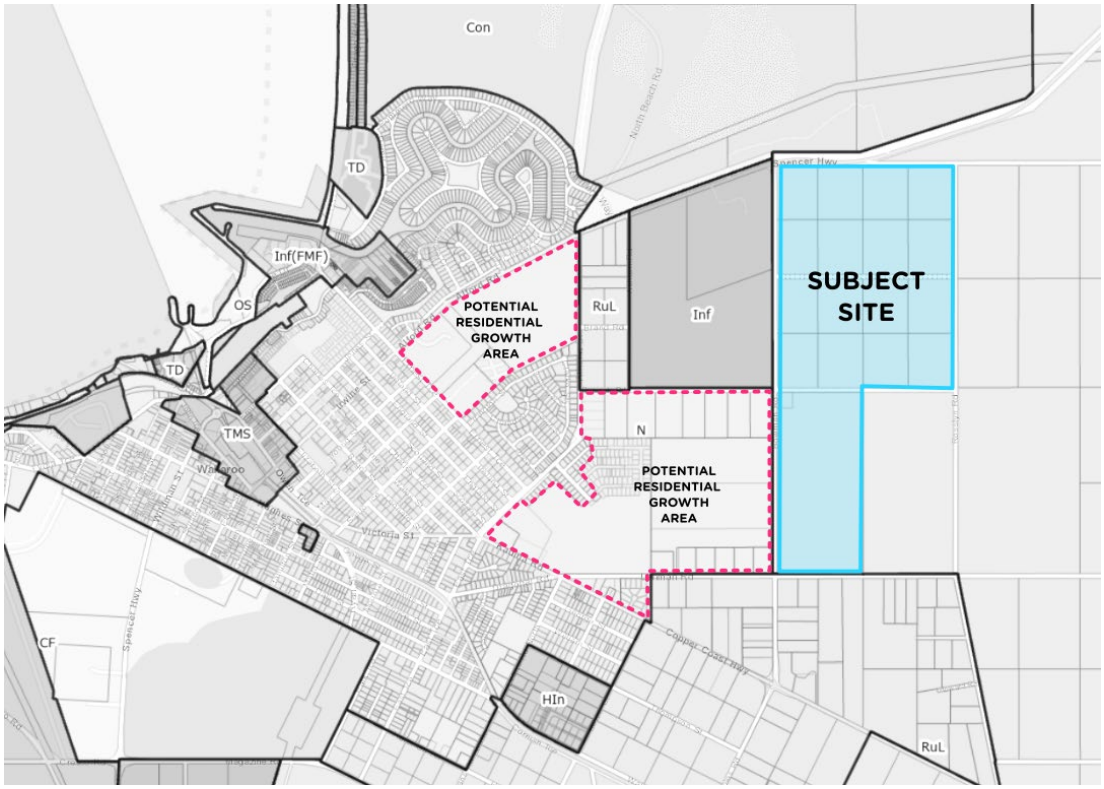


Figure 3 – Key residential growth areas within Wallaroo

It is understood that these two areas are anticipated to be accessed via *"Preferred Vehicle Access Points"* on Lehman Road, with new road links shown to access via Rucioch Road as shown in Concept Plan 72 of the Planning and Design Code (refer Appendix A). DIT has advised that during the previous rezoning processes there was no intent for access to be provided to these areas via Bowman Road. However, the current provisions of the Planning and Design Code do not preclude access being sought via Bowman Road. Further to this, the proposed road closure at the western extremity of Lehman Road identified in Concept Plan 72 would suggest the potential distribution of residential movements between the preferred vehicle access points and Bowman Road (i.e. to/from the south-east, albeit this would rely on opening of the Lehman Road/Bowman Road intersection). Specifically, without a connection from Lehman Road to Bowman Road the identified *"Preferred Vehicle Access Points"* would effectively be redundant as there would be no other opportunity to (externally) distribute traffic via Lehman Road once the closure at its Kadina Road intersection is undertaken.

It is understood that investigations associated with the previous Development Plan Amendment (DPA) identified potential upgrade of the intersection of Athena Drive and Spencer Highway to provide channelised left and right-turn lanes, in order to accommodate the traffic volumes forecast as a result of the realisation of this future development. These upgrades were not tied to a specific infrastructure deed associated with the DPA (or similar mechanism), and as such,

would need to be negotiated with Council and DIT during future development approval processes for development of the previously rezoned area.

3. PROPOSED REZONING

3.1 LAND USE AND YIELD

The Code Amendment seeks to rezone the Affected Area from 'Rural' to:

- Neighbourhood Zone – 30.9 ha in order to enable future residential development; and
- Employment Zone – 77.4 ha in order to enable the future development of employment type land uses, including but not limited to, storage, bulky goods retail premises, warehouse and the like.

Figure 4 illustrates the proposed Zones within the Affected Area.

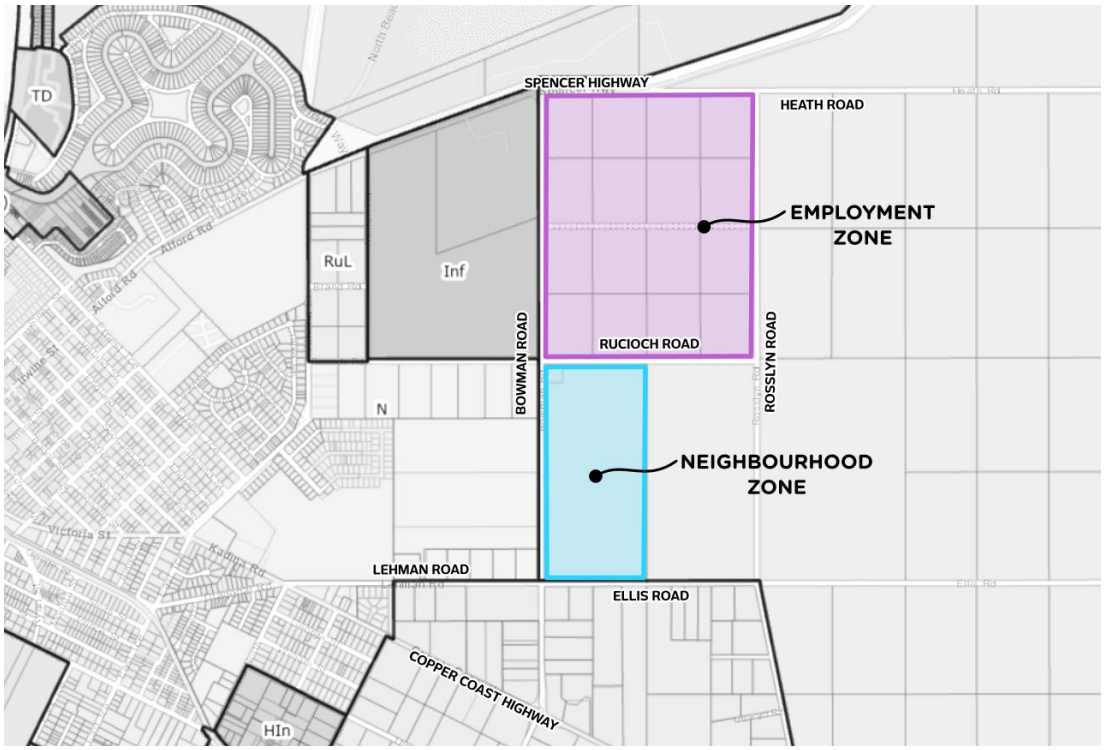


Figure 4 – Proposed zones within the Affected Area

In order to facilitate future development, an allowance of approximately 15% of the Affected Area has been made for ancillary/supportive services such as road and stormwater infrastructure (both upgraded and new infrastructure).

In addition, it is recognised that the remaining commercial 'developable area' cannot be developed entirely as leasable floor area as the site will require associated vehicle access, circulation, parking, and loading/service areas. For the purposes of this assessment, the developable floor area has been assumed to be 40% *of the balance* of the proposed Employment Zone (or ~34% of the entire proposed Employment Zone).

Based on the concept plan, future commercial uses for the site are anticipated to include 'storage', 'warehouse' and 'bulky goods retail' type activities. For the purposes of this report, the following development yields are envisaged within the Affected Area:

- storage – 176,400 m² of developable floor area;
- warehouse – 56,700 m² of developable floor area;
- shop (in the form of a bulky goods outlet) – 18,900 m² of developable floor area; and
- low density residential dwellings – 450 dwellings.

For the purposes of this report, a development yield of 450 dwellings has been adopted as this is the maximum number of dwellings that could be developed within the Affected Area, were a Neighbourhood Zone applied to 30.9 ha. In reality, market demand in the area is unlikely to support development of this density, and yields are likely to be much lower (in the order of 265 dwellings). Nevertheless, an assumed yield of 450 dwellings provides conservatism for the purposes of this assessment.

3.2 ACCESS AND ROAD INFRASTRUCTURE

3.3 CONNECTIONS TO EXISTING ROAD NETWORK

The surrounding road network provides opportunities for access via a variety of surrounding roads, however, due to connection to/from the surrounding townships of Wallaroo and Kadina, there is a natural desire for south-east/ south-west travel to/from the Affected Area. Given this, as well as existing infrastructure, Bowman Road is considered a logical point to provide access to the Affected Area, whereas use of other roads such as Rosslyn Road would be circuitous and generally undesirable.

DIT has raised concern in respect to the provision of local road network access via Bowman Road given its heavy vehicle bypass function (particularly for the proposed residential use). However, traffic data provided by Council indicates relatively low heavy vehicle volumes on Bowman Road. This data indicates an average of 43 heavy vehicle movements per day. Based on traffic data provided on surrounding roads during grain carting season, it is estimated that the number of heavy vehicle movements would be in the order of 215 movements per day during the peak grain carting season.

There are many examples of heavy routes bisecting residential areas within South Australia with much higher commercial vehicle volumes. For instance, 80 km/h zoned sections of Main North Road and Lonsdale in metropolitan

Adelaide carry in the order of 1,200 to 2,000 commercial vehicle movements per day between residential areas. Of note, a heavy vehicle link is also proposed within Roseworthy which will bisect residential areas in a similar manner to that which would be associated with the envisaged development of the Affected Area. While recent forecasts for the Roseworthy heavy vehicle link are not available, the original planning for the Roseworthy Growth Area identified in the order of 5,000 vpd (light and heavy vehicles combined) would be accommodated along the link. The volume of heavy vehicles on the Roseworthy link would therefore be well above that associated with Bowman Road (even during grain carting season).

Accordingly, given the low heavy vehicle volumes anticipated on Bowman Road, there is opportunity to accommodate safe access and future movements without an intolerable impact on the heavy vehicle bypass function of Bowman Road. It is recommended that access to/from the Affected Area be limited in number and such arrangements could be reflected on a Concept Plan to be included with the Code Amendment (discussed further in Section 4.3). Access treatments should be provided in line with Austroads' "*Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings Management*" (AGTM06), in order to safely and efficiently accommodate light and heavy vehicles as well as ensure pedestrian and cyclist movements can be safely accommodated. Intersection treatments should include provision of crossing facilities for pedestrians and cyclists (such as refuges) or, alternatively, similar mid-block treatments.

Additionally, while DIT is likely to desire retention of the 100 km/h speed zone, consideration could be given to a reduction to either 70 km/h or 60 km/h. Taking into account acceleration and deceleration rates, a reduction to 70 km/h would equate to approximately 20 seconds additional travel time along Bowman Road and a reduction to 60 km/h would equate to an increase of approximately 30 seconds. Such additional travel times are negligible in the context of the typical journeys associated with heavy vehicles utilising the bypass. It is therefore considered that a speed reduction could be considered to assist with the safe accommodation of light vehicles, cyclists and pedestrians without significant impact on the heavy vehicle bypass function.

It is envisaged that the future Employment Zone would be serviced by provision of two east-west collector roads with associated intersections with Bowman Road. A further collector road, oriented north-south, is envisaged with connection to Spencer Highway. Formal turn treatments would be warranted to safely and efficiently accommodate movements at the future intersections on both Bowman Road and Spencer Highway without impacting through traffic on these roads. No direct property access would be permitted to Bowman Road or Spencer Highway.

It is anticipated that the future Neighbourhood Zone would be serviced by a new (public) local road network with a central collector road (based on the anticipated traffic volumes detailed in Section 5). The new collector road could be accessed via T-intersections created on Rucioch Road and Ellis Road, both of which will be formalised through future development. Such connections will satisfy the requirements of the Hazards (Bushfire – Regional) Overlay of the Planning and Design Code in that at least two separate and safe exit points to enable multiple avenues of evacuation in the event of a bushfire will be provided. Given the speed limit and heavy vehicle bypass function of Bowman Road, intersections formalised on Bowman Road (with Rucioch Road and Ellis Road) would need to be treated with separated left and right-turn lane treatments as per the treatment warrants identified in (AGTM06). Alternatively, consideration could be given to the implementation of a roundabout at the intersection of Rucioch Road and Bowman Road creating a higher order intersection and access point for the future Neighbourhood Zone. Such an intersection treatment would provide opportunities for pedestrian infrastructure to be installed to allow for staged crossing of Bowman Road, increasing safety for vulnerable road users.

Allowance for road widening (possibly via an Overlay) could be made (particularly on Bowman Road (Spencer Highway has a wider road reserve) to accommodate such treatments at the intersections identified above (for both the Neighbourhood and Employment Zones).

3.4 INTERNAL ROAD NETWORKS

The anticipated access points on the existing road network will connect to internal public roads within each differently zoned portion of the Affected Area. It is understood that, given the desire for a continuous buffer between the land uses, direct connection between the two Zones will not be provided (albeit could be considered from a traffic perspective if desired). The internal road network shall be designed to ensure the anticipated traffic volumes and vehicle types (including commercial and emergency services vehicles) are safely and appropriately accommodated. The internal road network shall also include consideration of facilities for pedestrian and cyclists.

4. POLICY FRAMEWORK

A review of the policy framework of the Planning and Design Code has been undertaken in respect to traffic and transport aspects which may affect future development within the Affected Area as a result of the proposed rezoning as detailed below.

4.1 GENERAL DEVELOPMENT POLICIES

The General Development Policies 'Transport, Access and Parking' are generally considered appropriate in relation to potential future development within the Affected Area.

In respect to the parking provision requirements identified in the General Development Policies 'Transport, Access and Parking', it is anticipated that the car parking rates outlined in '*Table 1 – General Off-Street Car Parking*' will be applicable to (and appropriate for) future development within the Affected Area. *Table 3 – Off-Street Bicycle Parking Requirements*' of the Planning and Design Code would be unlikely to strictly apply (given the Affected Area would not be classed as a 'Designated Area'). Nevertheless, it would be desirable that bicycle parking provisions are considered as part of future land use proposals.

4.2 OVERLAYS

A number of Overlays related to traffic and transport considerations currently apply or could apply to the Affected Area. The following Overlays (relevant to traffic and access matters) are currently applicable to the site:

- Hazards (Bushfire – Regional) Overlay – this Overlay seeks to facilitate access for emergency service vehicles to aid the protection of lives and assets from bushfire danger, this Overlay (or similar) should continue to apply to the Affected Area as part of the Code Amendment; and
- Key Outback and Rural Routes – safe and efficient movement of vehicle and freight traffic on Key Outback and Rural Routes as well as provision of safe and efficient vehicular access to and from Key Outback and Rural Routes. This Overlay should continue to apply to the Affected Area as part of the Code Amendment.

In addition, as noted above, consideration could be given to the implementation of the following of a Future Road Widening Overlay to ensure allowance is made for intersection upgrades on Bowman Road and Spencer Highway as detailed above. For example, a 2 m strip requirement could be adopted along the Affected Area's Bowman Road frontage to preserve allowance for widening treatments where required.

4.3 CONCEPT PLAN

It is understood that a Concept Plan is intended to be included as part of the Code Amendment. The recommended access arrangements could be reflected within the Concept Plan. Such an approach would provide certainty and direction particularly in respect to the limitation of the number of access points on Bowman Road and Spencer Highway. The key access recommendations for incorporation into the Concept Plan are illustrated in Figure 5.

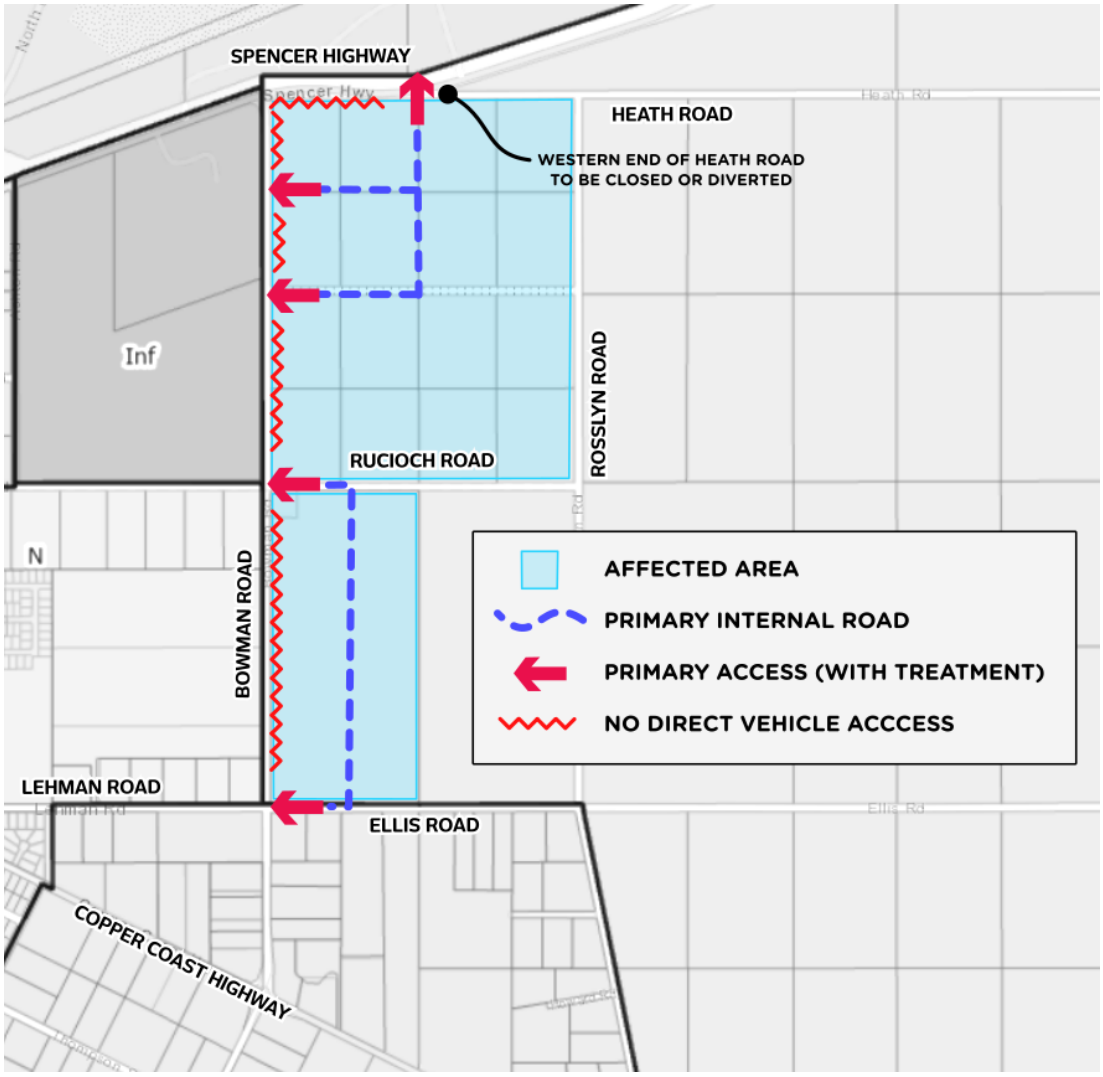


Figure 5 - Access Arrangements for the Concept Plan

5. TRAFFIC ASSESSMENT

5.1 TRAFFIC GENERATION

In order to determine the potential traffic impact of the proposed rezoning on the adjacent road network, traffic volumes associated with the potential future land uses have been forecast for the site, based on the yields specified above. The assessment has been based on the am and pm peak hour trip generation.

5.2 FORECAST MOVEMENTS

Future traffic volumes have typically been forecast using rates adopted from the RTA "*Guide to Traffic Generating Developments*" (the RTA Guide) and its subsequent updates. Where the RTA Guide does not specify rates for specific uses, other rates considered appropriate (based on available reference documents and CIRQA's experience) have been adopted. The rates relate to traffic generation during commuter peak periods.

The following traffic generation rates have been applied:

- storage – 4 daily trips per 100 m² of gross floor area, with 0.5 trips per 100 m² of gross floor area occurring in peak hours;
- warehouse – 4 daily trips per 100 m² of gross floor area, with 0.5 trips per 100 m² of gross floor area occurring in peak hours;
- shop (in the form of a bulky goods outlet) – 17 daily trips per 100 m² of gross floor area, with 0.45 am peak hour trips and 2.24 pm peak hour trips per 100 m² of gross floor; and
- low density residential dwelling – 8 daily trips per dwelling, with 10% (0.80) trips occurring during the hour.

On the basis of the proposed development yields discussed in Section 3.1, future development of the Affected Area is forecast to generate the following peak hour volumes:

- storage – 6,664 trips per day, with 833 peak hour trips;
- warehouse – 2,142 trips per day, with 268 peak hour trips;
- shop (in the form of a bulky goods outlet) – 3,035 trips per day, with 80 am and 400 pm peak hour trips; and
- residential – 3,600 trips per day, with 360 peak hour trips.

Based on the above, it is forecast that future development of the Affected Area would generate in the order of 15,441 trips per day, with 1,541 trips occurring during the am peak hour and 1,861 trips occurring during the pm peak hour.

It should be highlighted that the above traffic forecasts are considered to be conservative in that the assessment assumes that the peak hour associated with each of the future site uses (both multiple sites, as well as various uses within a single site) will coincide simultaneously. In reality, this will not occur with traffic associated with specific site components occurring at different times. Furthermore, there will be 'double-up' in the traffic forecasts as well as existing volumes in that staff and customers of land uses within the Employment Zone would primarily originate from surrounding residential areas.

Notwithstanding, the above traffic forecasts provide a conservative assessment for the determination of potential future traffic volumes associated with anticipated future development which could be realised within the proposed zoning.

5.3 TRAFFIC DISTRIBUTION

5.3.1 NEIGHBOURHOOD ZONE TRAFFIC DISTRIBUTION

Based on the layout of the broader road network and various destinations associated with the trips generated by future residential dwellings, a distribution of the trips has been forecast. The following assumptions have been made in order to distribute the anticipated traffic generated by the future development:

- during the am peak hour, 30% of trips will be ingress while 70% will be egress trips;
- during the pm peak hour, 70% of trips will be ingress while 30% will be egress trips;
- 10% of vehicles accessing/egressing the future Neighbourhood Zone will be travelling from/to the north (via Spencer Highway);
- 25% of vehicles accessing/egressing the future Neighbourhood Zone will be travelling from/to the east (i.e. Kadina township via Copper Coast Highway);
- 5% of vehicles accessing/egressing the future Neighbourhood Zone will be travelling from/to the south (via Sharples Road); and
- 60% of vehicles accessing/egressing the future Neighbourhood Zone will be travelling from/to the west (i.e. the Wallaroo township via either Spencer Highway or Copper Coast Highway).

On the basis of the above assumptions, Figure 6 illustrates the forecast distribution of traffic movements associated with the Neighbourhood Zone at the Affected Area's access points, noting that only additional movements on the road network due to the future anticipated development have been shown, (i.e. no existing traffic volumes have been shown):

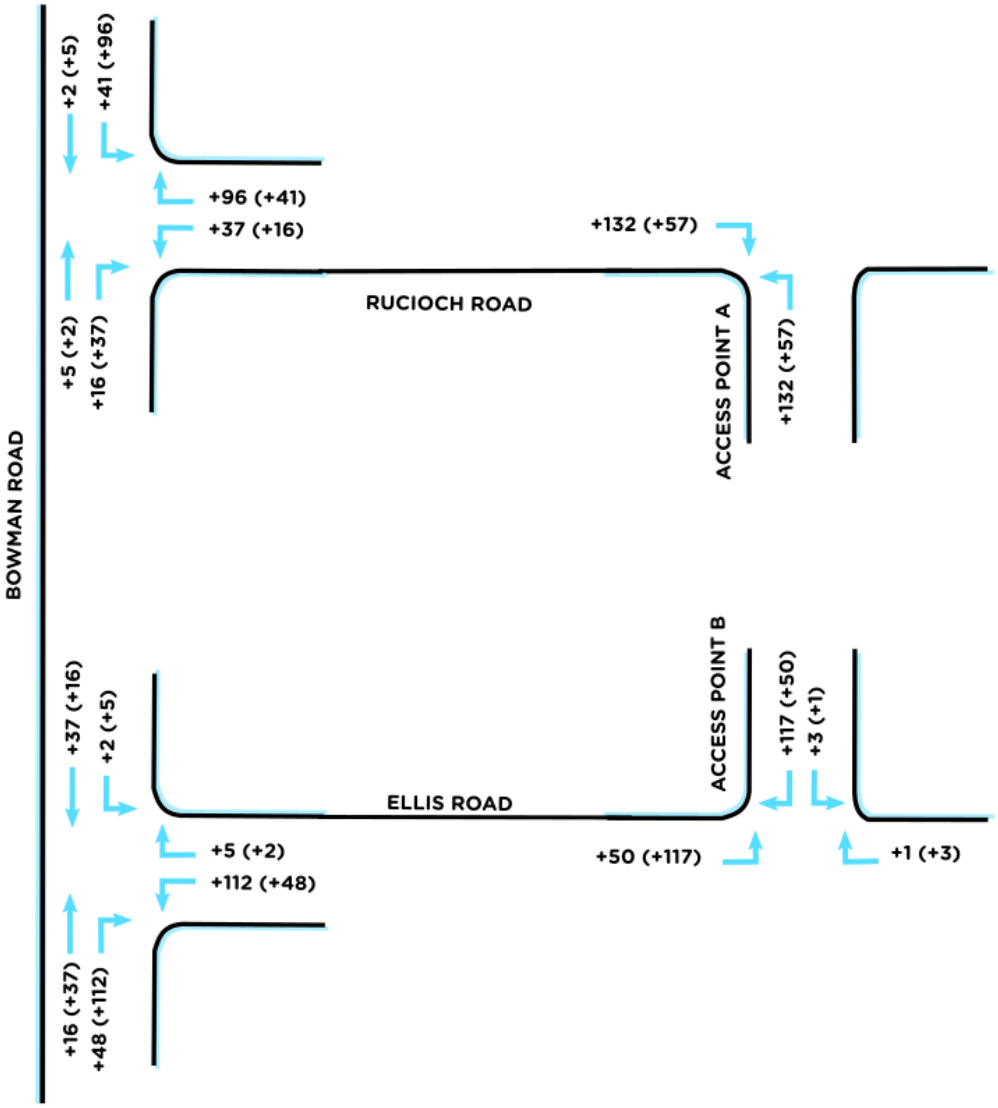


Figure 6 - Forecast additional am and (pm) peak hour volumes associated with the Neighbourhood Zone at the site's proposed access points

5.3.2 EMPLOMENT ZONE TRAFFIC DISTRIBUTION

Based on the site's location in relation to the broader road network, a forecast distribution of movements has been identified as follows:

- during the am peak hour, 80% of trips will be ingress while 20% will be egress trips;
- during the pm peak hour, 20% of trips will be ingress while 80% will be egress trips;
- 10% of vehicles accessing/egressing the future Employment Zone will be travelling from/to the north (via Spencer Highway);
- 25% of vehicles accessing/egressing the future Employment Zone will be travelling from/to the east (i.e. Kadina township via Copper Coast Highway);

- 5% of vehicles accessing/egressing the future Employment Zone will be travelling from/to the south (via Sharples Road); and
- 60% of vehicles accessing/egressing the future Employment Zone will be travelling from/to the west (i.e. the Wallaroo township via either Spencer Highway or Copper Coast Highway).

Turning movements to/from the site associated with the Employment Zone have been estimated on this assumption and illustrated in Figure 7.

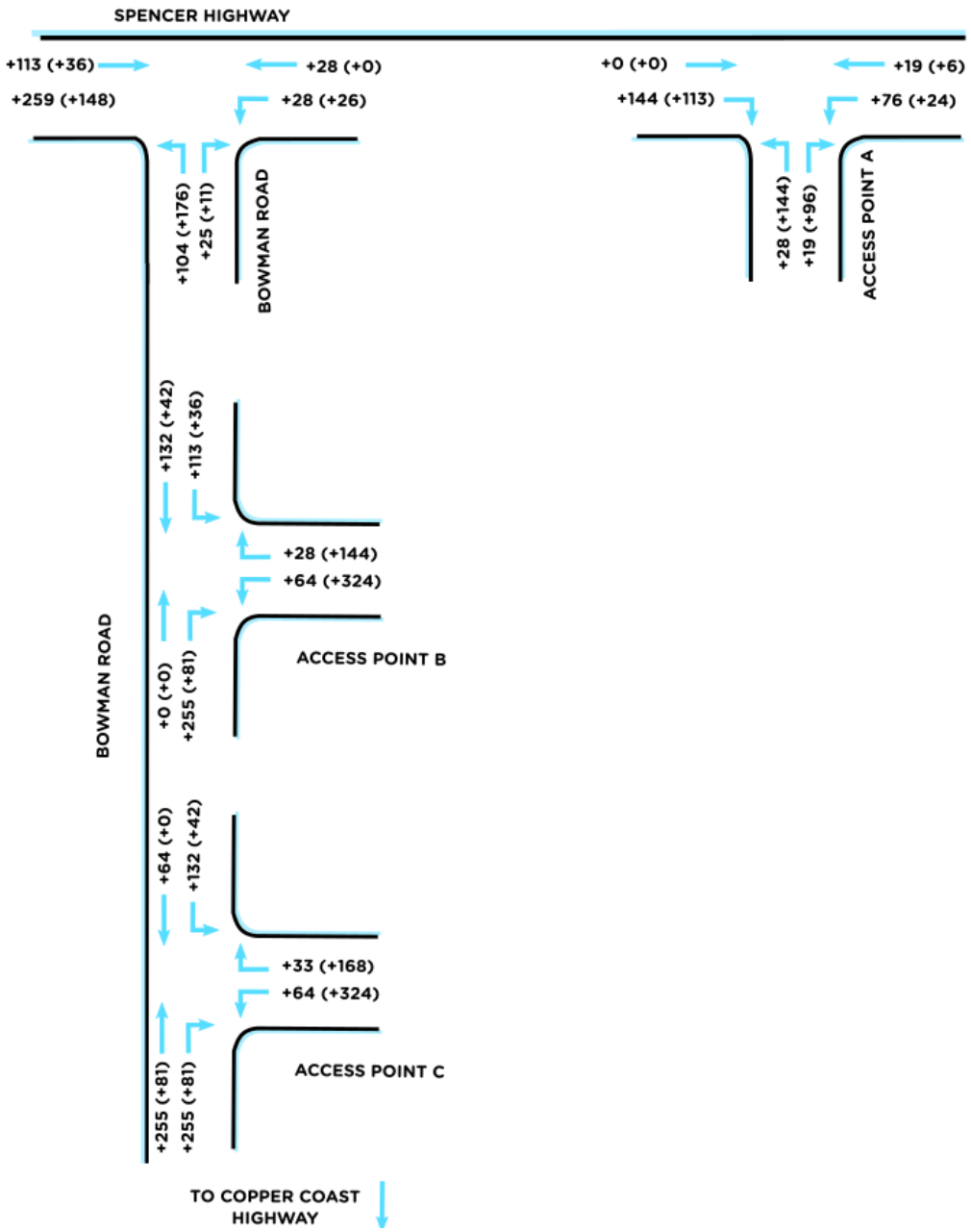


Figure 7 - Traffic distribution associated with the Employment Zone in the am and (pm) peak hours

5.3.3 COMBINED/WIDER TRAFFIC DISTRIBUTION

On the basis of the above forecast traffic volumes associated with development of the Affected Area, forecast turning movements at the intersections of Spencer Highway and Bowman Road and at the roundabout located at Copper Coast Highway and Bowman Road have been illustrated in Figures 8 and 9.

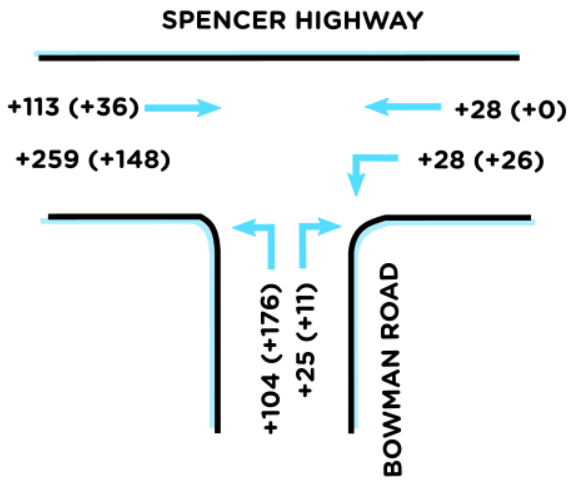


Figure 8 – Forecast additional traffic volumes at the intersection of Spencer Highway and Bowman Road

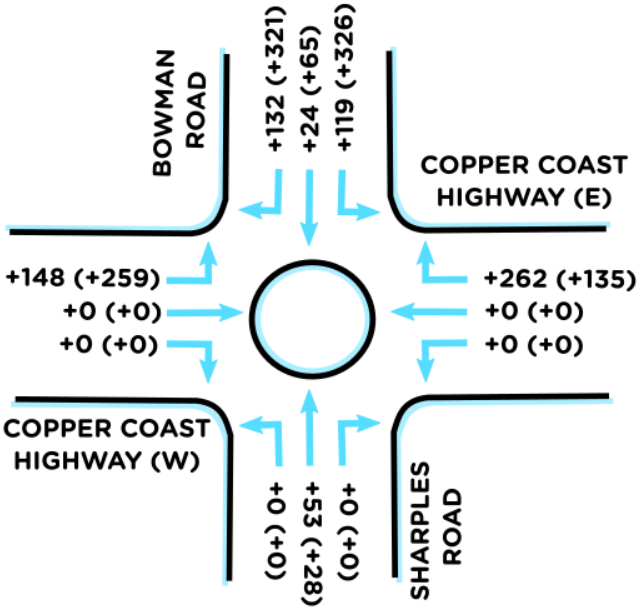


Figure 9 – Forecast additional traffic volumes at the roundabout located at Copper Coast Highway and Bowman Road

5.4 TRAFFIC IMPACT

5.4.1 BOWMAN ROAD

As discussed in Section 3.3 above, it is anticipated that access to the Affected Area will be provided at four points on Bowman Road. Two of these will be new access points into the future Employment Zone. Formalising the intersections of Bowman Road and Ellis Road, as well as Bowman Road and Rucioch road will provide two access points to the future Neighbourhood Zone (connecting to a new public road network).

Austroads' "*Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings Management*" (AGTM06) details information relating to warrants for intersection treatments based on minor and major road traffic volumes. Specifically, Figure 3.25 of AGTM06 identifies when turning treatments (such as separated turning lanes) are warranted based upon traffic volumes. Based upon the 88 km/h 85th %ile speed on Bowman Road, and the traffic volumes identified above, AGTM06 indicates that a Channelised Right Turn (CHR) and Channelised Left Turn (CHL) treatments will be necessary on all intersections created or formalised with Bowman Road so as to not impact through traffic and the function of Bowman Road.

As discussed above, consideration could be given to the implementation of a roundabout at the intersection of Rucioch Road and Bowman Road, creating a higher order intersection and access point for the future Neighbourhood Zone. Such an intersection treatment would facilitate safe turn movements with minimal impact on travel times for through traffic, while also providing opportunities for pedestrian infrastructure to be installed to allow for staged crossing of Bowman Road, increasing safety for vulnerable road users.

5.4.2 SPENCER HIGHWAY

The proposed new intersection on Spencer Highway with a north-south collector road within the future Employment Zone would warrant Channelised Right Turn (CHR) and Channelised Left Turn (CHL) treatments based on the warrants identified in AGTM06. Noting the location and acute angle of Spencer Highway and Heath Road adjacent the Affected Area, it is recommended that consideration be given to the realignment (or closure) of the western portion of Heath Road as part of these intersection works.

Forecast traffic volumes at the intersection of Spencer Highway and Bowman Road would not warrant channelised turn treatments in line with AGTM06 due to the low through movements on Spencer Highway. However, provision of CHR and CHL treatments has been recommended given the high-speed environment, in order to improve vehicle safety and efficiency on Spencer Highway. Consideration

could be given to a single lane roundabout in this location if deemed necessary, improving safety for vehicles entering and exiting Spencer Highway.

As has been noted previously, channelised turn treatments at the intersection of Spencer Highway and Athena Drive were previously recommended to facilitate safe turn movements associated with a previous Code Amendment. A high-level SIDRA analysis of this intersection indicates that implementation of these treatments would be sufficient in managing increased traffic volumes associated with the proposed Code Amendment.

5.4.3 COPPER COAST HIGHWAY

Given the relatively low existing volumes at the roundabout at Copper Coast Highway/Bowman Road intersection, there would easily be sufficient capacity to accommodate the additional volumes forecast. No further treatment is considered warranted for the intersection.

The additional movements would also be within the general capacity of Copper Coast Highway and no additional treatments are considered warranted by the rezoning and subsequent development of the Affected Area.

5.4.4 ALTERNATIVE ACCESS ARRANGEMENTS

Should access to Bowman Road not be supported by DIT (particularly residential access to the future Neighbourhood Zone), consideration could be given to providing access via Rosslyn Road. It is noted however, that this would require significant infrastructure upgrade, and would create a circuitous route which may cause vehicles to utilise unsealed roadways which connect to more desirable routes such as existing uniformalised intersections with Bowman Road.

Such a route would also not reflect pedestrian and cyclist desire lines to/from the existing Wallaroo township and could result in such users undertaking movements in less desirable locations or requiring excessive infrastructure provision to safely accommodate such movements.

Another option to address DIT concerns regarding impacts on the function of the bypass road would be to reduce the number of intersections provided and/or restrict specific turning movements in select locations (for instance, right-out movements from the intersection(s) servicing the proposed Neighbourhood Zone could be restricted with exiting drivers from the residential development forced to exit via a left-turn to the Copper Coast Highway). Such an option would reduce conflict points associated with the provision of access for the Affected Area (particularly the residential component).

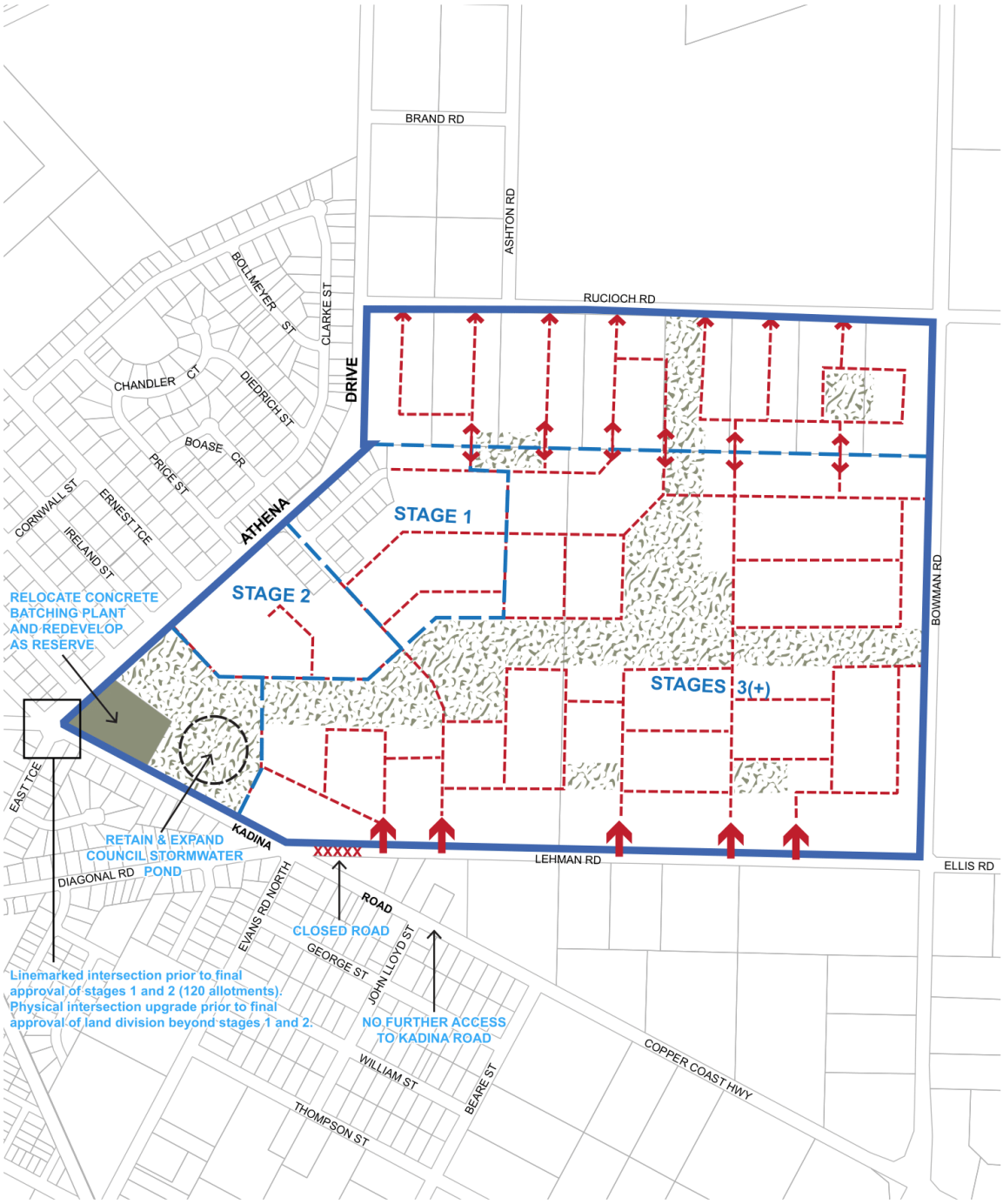
5.5 WALKING AND CYCLING

While it is noted that no footpaths or bicycle lanes are provided on any of the roads on the adjacent road network, development of the future road networks within the Employment and Neighbourhood zones should include opportunities for connections to both existing and future facilities to/from the west of the site (including the Neighbourhood Zone west of Bowman Road).

A safe pedestrian crossing point should be provided on Bowman Road to connect pedestrians and cyclists to/from the Wallaroo township through previously approved Neighbourhood Zones, in order to strengthen cycling connections for recreational, commuter and customer use. It would be desirable to provide a facility which allows for a staged crossing (such as that at a roundabout or utilising a central pedestrian refuge). Consideration could also be given to the viability of a pedestrian and cyclist underpass for grade separated 'crossing' of Bowman Road. Such a treatment would likely need to utilise existing road reserve (such as along the alignments of Lehman Road or Rucioch Road or, if negotiated with landowners/developers of the Neighbourhood Zone land west of Bowman Road, an alternative location.

APPENDIX A

CONCEPT PLAN 72



Concept Plan 72
WALLAROO, ATHENA DRIVE