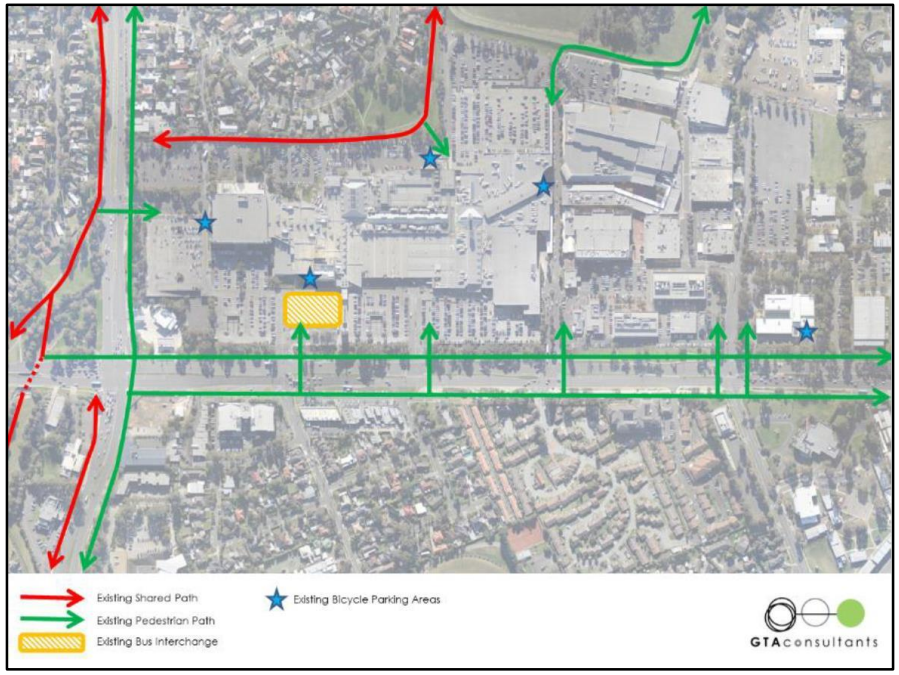
The GTA Transport Impact Assessment Report also includes plans outlining the existing and proposed suitable transport links. These plans are reproduced in Figure 4-3 and Figure 4-4.

Figure 4-3 Existing Sustainable Transport Links

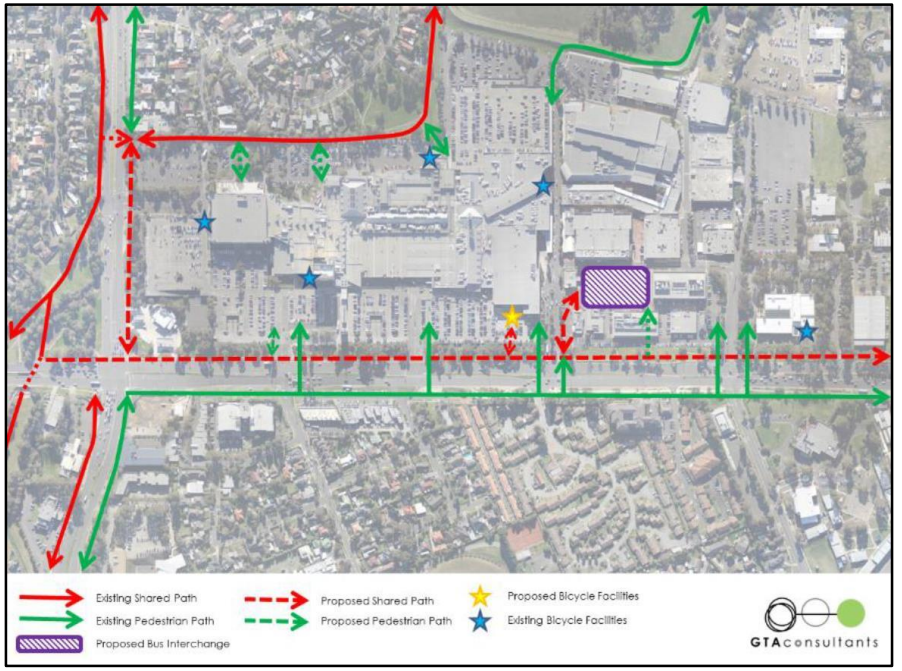


Source: Westfield Knox Shopping Centre Stage 1 Development Plan TIA 2013

Figure 4-2 to Figure 4-4 identify the following key sustainable transport link improvements:

- Enhanced pedestrian pathways to and from, and within the new bus interchange;
- Connection of the existing shared path along Blind Creek Trail to that along the western side of Stud Road via a crossing of Stud Road to the north of the signalised intersection, including the proposed provision of bicycle lanterns for this crossing;
- Provision of a shared pathway of 2.5m width along the eastern side of Stud Road and the northern side of Burwood Highway along the Centre's road frontages; and
- Improved pedestrian connections to and from the Centre from the north and south.

Figure 4-4 Proposed Sustainable Transport Links

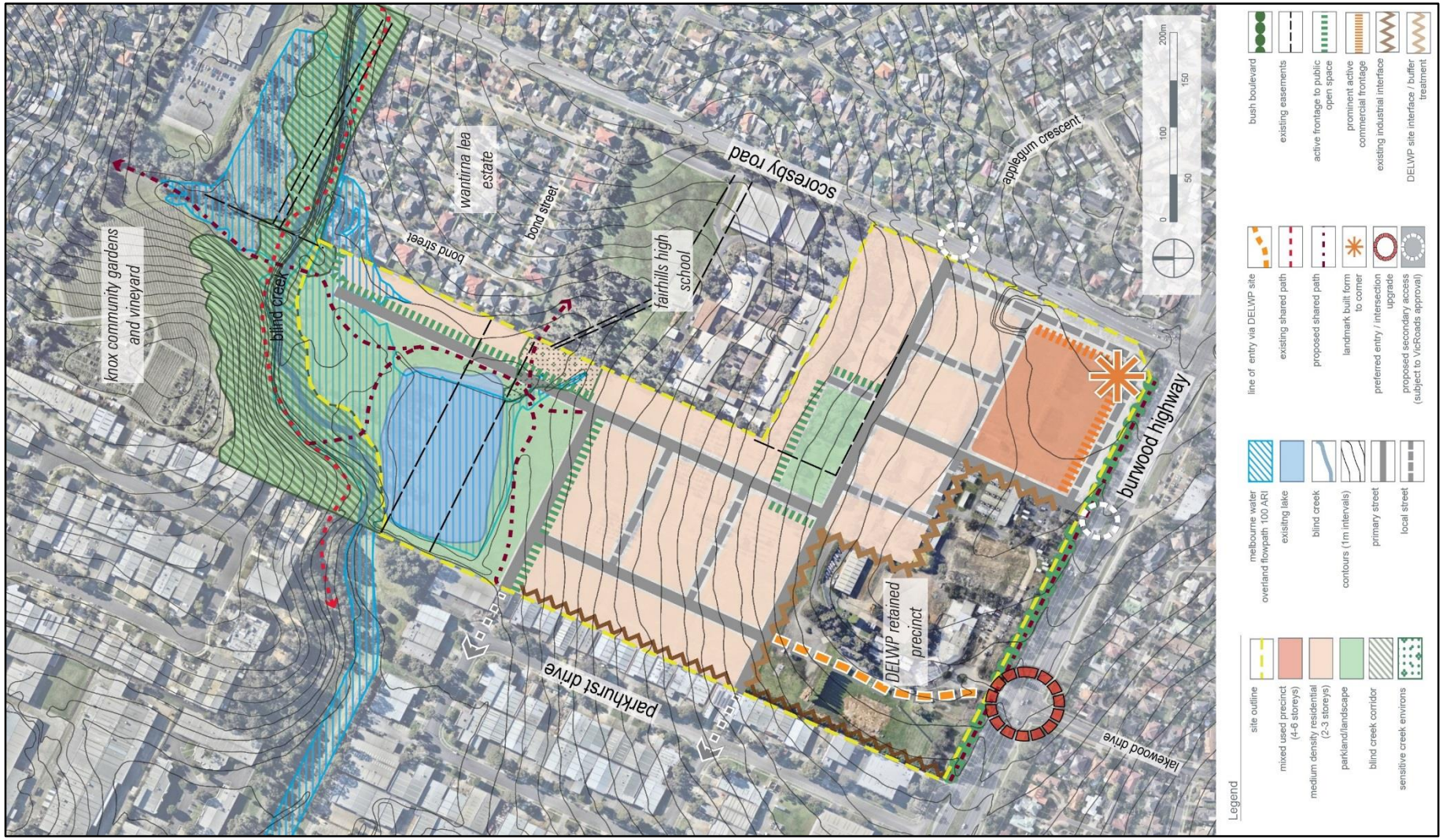


Source: Westfield Knox Shopping Centre Stage 1 Development Plan TIA 2013

4.2.2 609-621 Burwood Highway (DELWP Site)

The Department of Environment, Land, Water & Planning (DELWP) precinct is located at the eastern end of the study area, north of the Burwood Highway / Scoresby Road intersection, extending behind Fairhills Primary School and Wantirna Lea estate up to Blind Creek. The DELWP site will be subject to a detailed masterplanning process. Key planning principles for the site are shown in Figure 4-5. It is noted that the current Masterplan has not been endorsed by Council.

Figure 4-5 DELWP Masterplan



Source: DELWP Site – Broad Masterplan (Hansen 2015)

The total precinct area is 23.5ha, consisting of 18.5ha of surplus land with approximately 4.9ha to be retained by the DELWP in the south western corner of the site.

The precinct is accessible via public transport in the form of bus routes along both Burwood Highway and Scoresby Road. The precinct currently has two vehicle access points, the primary access being off Burwood Highway at the signalised intersection with Lakewood Drive, and the second being off Scoresby Road via the proposed east west link road opposite Applegum Crescent.

The proposed development is expected to have capacity for approximately 470 private dwellings, with the remaining land providing around 8,200sqm of retail floor space and 3,000sqm office floor space.

It is important that the precinct is provided with the required connectivity to the surrounding road network without adversely affecting the operation of the network. The preferred connectivity from the precinct to the surrounding road network includes:

- Maintaining the existing connection to Scoresby Road, with the potential for a signalised intersection;
- Providing two connections to Parkhurst Drive; one maintaining the east west link from the Scoresby Road intersection, and the other further north, below the wetland area to create a T intersection at Parkhurst Drive;
- Maintaining the existing connection through the retained DELWP land to Burwood Highway to service the new residential areas; and
- Providing an additional secondary access to Burwood Highway through a proposed left-in left-out intersection between the existing Lakewood Drive connection and the intersection at Scoresby Road.

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5 Strategic Transport Modelling

5.1 Strategic Modelling Basis

Strategic transport modelling has been undertaken to assess the impacts of future land use and major road and public transport infrastructure in and around Knox Central. The State Government's Victorian Integrated Transport Model (VITM) has been adopted as the strategic modelling basis for the development of the ITS.

The VITM was developed and is maintained by the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and is a simplified representation of the real world and as such is used as a decision guidance tool to assist in planning road and public transport infrastructure improvements in Victoria.

VITM is a multimodal strategic model that uses future population, household, employment and educational enrolment projections to forecast travel behaviour and the impacts of changes to the road and public transport networks. The transport model's strengths are in indicating the likely scale of change brought about by the implementation of transport infrastructure schemes, land use changes or policy driver measures, and the use of outputs in a sensible and pragmatic manner.

For the purposes of this study, VITM was used to:

- Confirm the travel patterns through the study area under existing conditions;
- Assist in confirming the appropriate level of development within Knox Central; and
- Identify the broad level of improvements required within the transport system and their timing, so that they can be integrated into the future planning for Knox Central.

The strategic modelling assessment process is detailed further in the Model Development Paper prepared during the development of this ITS, with more detailed modelling output provided in Appendix B as referenced throughout this report.

5.2 Methodology and Model Development

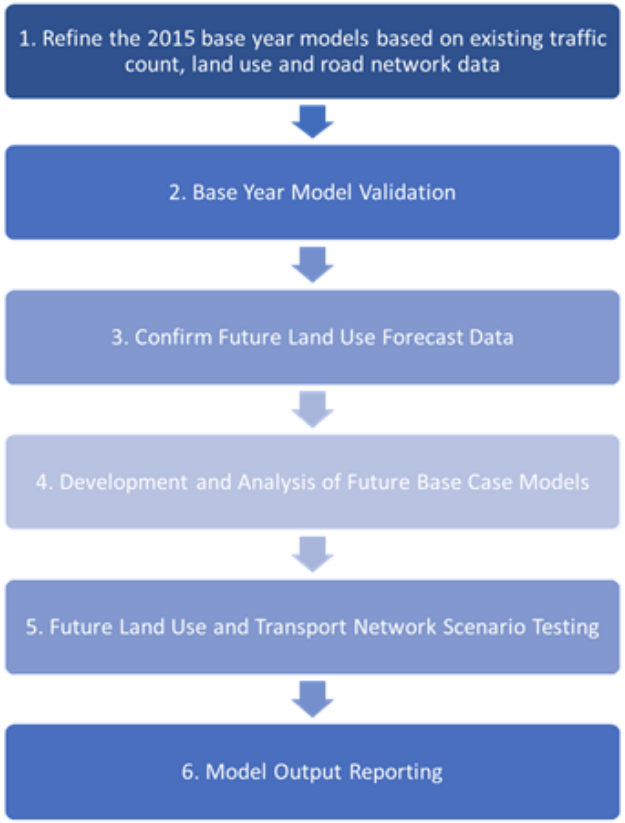
5.2.1 Modelling Methodology

The 2015 base year strategic model was firstly refined and validated to ensure that it provided a robust basis on which the impacts of future land use and transport infrastructure changes could be tested.

Future land use projections were then confirmed and applied to the 2015 base case model, and planned future State Government transport infrastructure projects incorporated to develop future year base case models.

The future year base case models were then used to assess various land use and infrastructure project combinations envisaged for the study area in the future. The modelling output from these scenarios provided a strategic basis on which the future road network in Knox Central could be determined. The strategic modelling process is outlined in Figure 5-1.

Figure 5-1 Strategic Modelling Methodology



5.2.2 Model Establishment

In order to provide a basis on which future year modelling scenarios may be tested, a validated base year model representing 2015 conditions was developed and validated. The VITM model was refined, with key links within the study area added or modified to ensure that the model is fit for purpose.

The validated 2015 model was then used to develop future year 'base models', in this case 2025 and 2035. This was achieved by applying planned future transport infrastructure improvements and forecast land use yields appropriate for each future year being modelled.

5.2.2.1 2035 Ultimate Base Road Network & Land Use Scenario

Key network improvements have been included in the 2035 future year base model. These are included in the latest 2015 VITM model provided by the DEDJTR, and represent network improvement have been planned by both VicRoads and PTV. Improvements proposed by 2035 that have been included in the model include:

- Widening of EastLink to include four traffic lanes in each direction;
- Widening of Burwood Highway to include three lanes in each direction; and
- Widening of Stud Road between Burwood Highway and Boronia Road to include three lanes in each direction;
- Widening of Ferntree Gully Road between Burwood Highway and Stud Road to include three lanes in each direction; and
- No extension of Tram Route 75

The network within Knox Central was modelled as per existing conditions with the exception to the DELWP site, for which access connections were included to both Scoresby Road and Burwood Highway in the form of a northern leg to the Burwood Highway /Lakewood Drive intersection. No East-West connectivity was modelled between the DELWP site and the adjoining land to the west under the base case conditions.

Future land use data has been detailed in the Knox Central: Land Use, Economic & Property Analysis report (Geografia, 2015). This land use data was discussed with and refined by Knox City Council to reflect a more probable level of development in and around Knox Central.

5.2.2.2 2025 Interim Base Road Network & Land Use Scenario

In a similar manner to the 2035 scenario, planned network improvements and land use scenarios were incorporated into a refined 2025 model. The key network improvement included in the 2025 scenario was the planned widening of EastLink to include four traffic lanes in each direction. It is noted that the extension of Tram Route 75 is not included, nor the widening of sections of Burwood Highway, Stud Road or Ferntree Gully Road.

A more detailed description of the development of the base models and their limitations is provided in the Model Development Paper.

5.3 Future Model Option Development

A number of network and land use parameters were agreed in consultation with Knox City Council officers that allowed for the testing of a set of modelling options. These parameters are outlined in the following section.

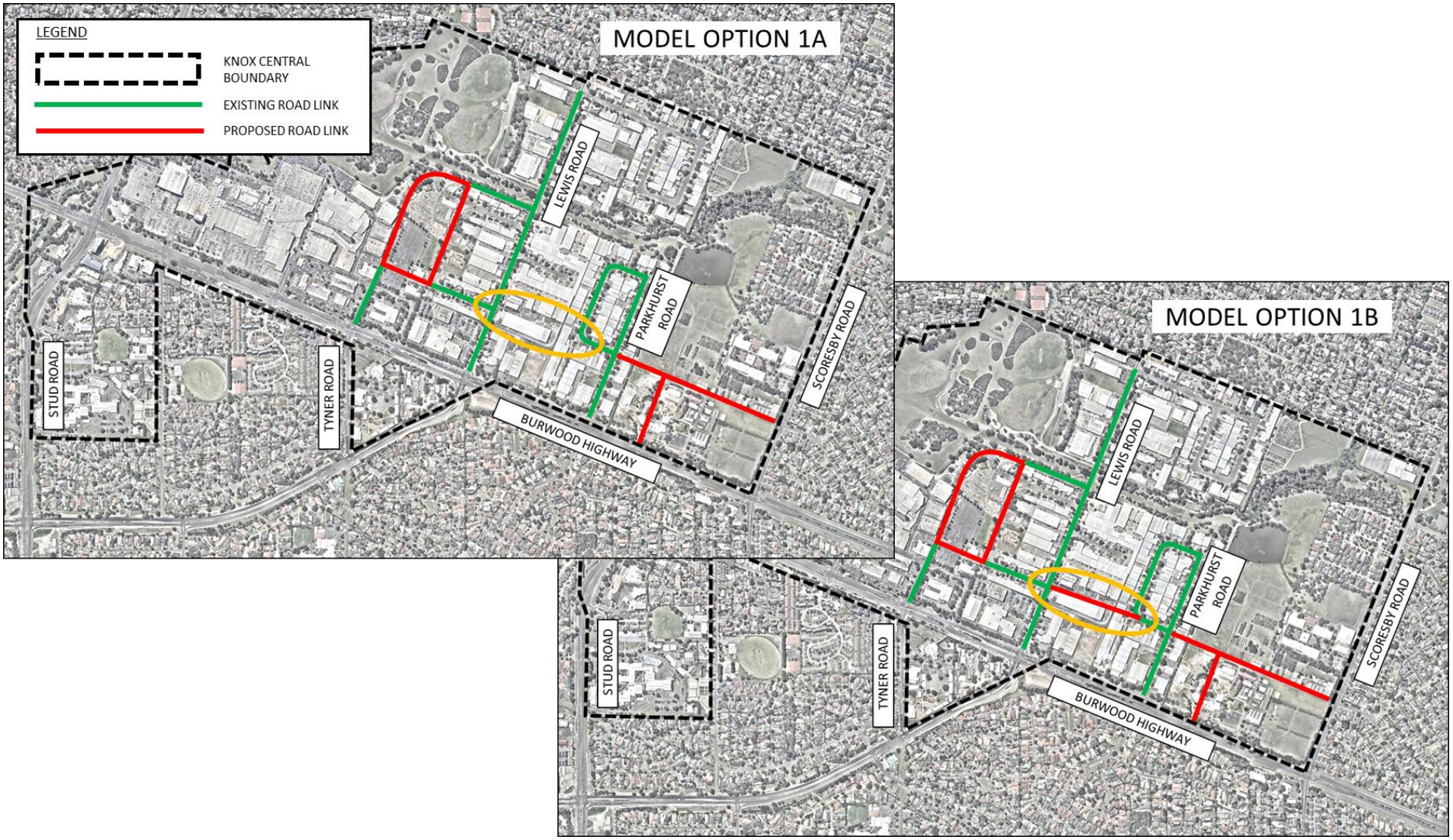
5.3.1 Network and Land Use Parameters

5.3.1.1 Parameter 1: Local Road Network within Knox Central with 2035 Base Case Land Use Scenario

Two road network scenarios were identified and tested in order to determine the need for and the extent of an East-West link through Knox Central, and the timing of the requirement of the link. These two road network options were tested using the 2035 Base Case land use scenario.

Scenario A involved the introduction of the East-West road link within the DELWP site from Scoresby Road to Parkhurst Drive only, while Scenario B involved the extension of this link further west to Lewis Road. Both scenarios included a proposed north-south link from Eastgate Court to Bridgewood Court. Figure 5-2 shows the road network scenarios tested.

Figure 5-2 Internal Road Network Scenarios

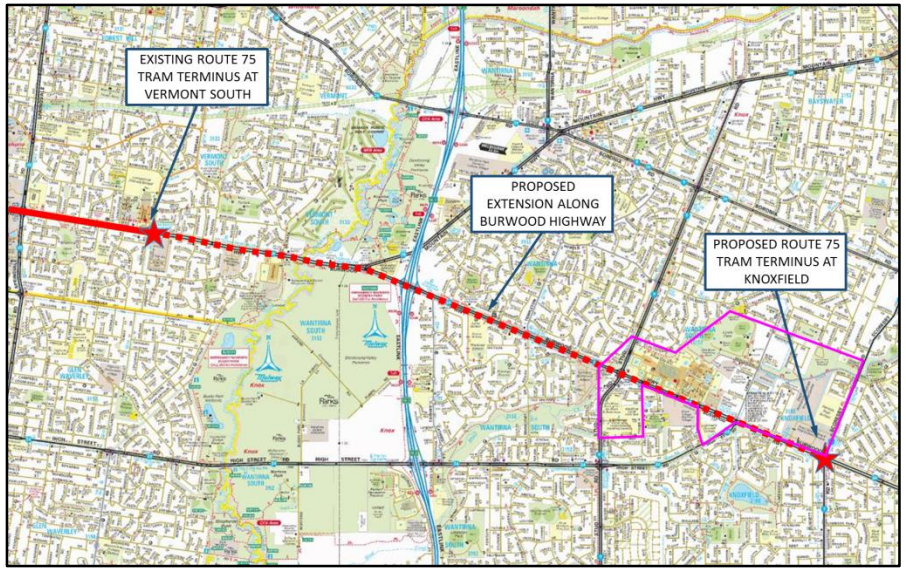


5.3.1.2 Parameter 2: Extension of Tram Route 75 to Scoresby Road

It was proposed to model the tram route extension in 2035 given that it is considered a long term possibility by the State Government. This parameter allowed the mode shift to public transport to be determined as well as the effect on the performance of the road network around Knox Central.

The stops west of Knox Central were modelled are in accordance with the current bus stop locations for the existing Knox Transit Link bus service that runs along the Burwood Highway in conjunction with the Tram Route 75 timetable. The stops within Knox Central were proposed at Stud Road, Melbourne Street, Lewis Road, Lakewood Drive and Scoresby Road. Figure 5-3 highlights the nature of the tram route extension parameter.

Figure 5-3 Tram Extension Scenarios



5.3.1.3 Parameter 3: 2025 Land Use Scenario

As discussed, planned network improvements and land use scenarios were incorporated into a refined interim 2025 model. The intent of this scenario is being to determine when major infrastructure changes may be required. The land uses for the 2025 modelling are based on the 2025 land supply capacity data outlined in the Knox Central: Land Use, Economic and Property Analysis Report (Geographica 2015).

A more detailed description of the development of the 2025 land use parameters is provided in the Model Development Paper, and summarised in Appendix B1 of this report.

5.3.1.4 Parameter 4: 2035 High Development Scenario

An alternative 2035 land use scenario was also tested to represent a "worst case scenario". The High Development land use data was based purely on the land use information detailed in the Knox Central: Land Use, Economic & Property Analysis Report (Geographica 2015).

It was intended that this scenario would test the robustness of the proposed transport network. A more detailed description of the development of the 2035 'high development' land use parameters is provided in the Model Development Paper, and summarised in Appendix B1 – Land Use Input for Knox Central.

5.3.2 Model Scenario Options

Four modelling options were developed using a combination of the parameters outlined in section 5.3.1 in order to determine the effect on the transport network of the various scenarios.

It is noted that the 2035 Base Case land use scenario has been used as the 'default' land use scenario for Model Options 1A, 1B, and 2. Table 5-1 illustrates this and summarises the various parameters included in each model option.

Table 5-1 Modelled Transport Options

Model Option	Modelled Parameters					
	Road A	Road B	Tram Ext'n	2035 B	2025	2035 H
Base Model				✓		
Option 1A	✓			✓		
Option 1B		✓		✓		
Option 2		✓	✓	✓		
Option 3		✓			✓	
Option 4		✓	✓			✓

Option 1A was intended to test the road network with the base case land use scenario but accessing the DELWP site via an east west connection from Scoresby Road to Parkhurst drive only.

Option 1B extends the east west connection beyond Parkhurst Drive, and tested to determine the need for the full East-West link through Knox Central, and the timing of the requirement of the full link

Option 2 tests the Option 1B road network but adds the Route 75 tram extension in order to allow the mode shift to public transport to be determined as well as determine the resulting effect on the performance of the road network around Knox Central.

Option 3 tests the Option 1B road network with the 2025 land use scenario to gain an understanding of when major infrastructure changes may be required.

Option 4 is ultimate scenario, testing a 'worst case' 2035 high development land use scenario, with the tram extension included to test the general robustness of the proposed future transport network.

5.4 Future Model Option Testing Analysis

5.4.1 Modelled Traffic Volume Summary

Each of the strategic modelling options outlined in section 5-3 were tested. Daily traffic volumes on each road network link have been output from the traffic model for each of the options. Traffic volumes on the key links are provided in Table 5-2. More detailed link references and the modelled traffic flows for each option are tabulated and presented graphically in 'Appendix B2 – Modelled Traffic Flows and Link Locations'.

Table 5-2 Forecast Key Link Traffic Volumes

Road Name	Base Case	Opt 1A	Opt 1B	Opt 2	Opt 3
New E-W Connection Scoresby Road to Parkhurst Drive	-	2,500	3,700	3,600	3,500
Lewis Road north of Burwood Highway	8,800	9,800	8,500	8,500	6,500
Eastgate Court west of Lewis Road	-	4,600	5,800	5,700	3,300
Bridgewood Court west of Lewis Road	7,700	5,600	5,600	5,600	4,800
Parkhurst Drive north of Burwood Highway	5,900	5,600	5,200	5,100	5,200
Burwood Highway east of Lewis Road	31,600	31,700	30,500	30,500	29,400

Table 5-3 summarises the link performance across the network common to all modelled options, with the option specific observations included in the following sections.

Table 5-3 Network Performance Summary (All Options)

Road (Link Locations)[4]	Summary
Stud Road (no. 1, 7 and no.18)	Operates above Austroads capacity in year 2035.
Melbourne Street and Capital City Blvd (No. 2, and 3)	Carries volumes reflective of a local road as expected. Connection to Lewis Road allows redistributed trips that previously used the Melbourne Street and Capital City Boulevard access and now use Lewis Road.
Lewis Road (no. 4, 14 and 15)	Carries volumes reflective of a connector street.
Parkhurst Drive (No. 5	Carries volumes reflective a local road. Volumes in this road decrease with the opening of the East-West link from Scoresby Road.
Scoresby Road (No. 6 and No. 10)	Operates within Austroads capacity for a 4 lane connector street. Similar to Parkhurst Drive volumes, also decreasing with the opening of the East-West link from Scoresby Road.
Tyner Road (No. 8)	Carries volumes reflective a local road.
High Street Road (No. 9)	Operates within Austroads capacity for 4 lanes connector street.
Burwood Highway (No. 11, 12 and 13)	Operates above Austroads capacity.
Boronia Road (No. 16, and 17)	Operates above Austroads capacity.
New Local East-West Road, west of Scoresby Road (19)	Carries volumes reflective of a local road.
New Local East-West Road, west of Lewis Road (20)	Carries volumes reflective of a local road.

[4] The road link location numbers are shown on the plan provided in Appendix B2 of this report.

5.4.2 Option 1A & 1B: East West Road Link Options

Table 5-4 shows the forecast traffic flow effects around the Knox Central study area specifically for Options 1A and 1B.

Table 5-4 Network Performance Summary (Options A & B)

Road (Link Locations)	Summary
Option 1A (Road Network Option A)	
Boronia Road (No. 16, and 17)	Provision of East-West connection between Scoresby Road and Parkhurst Drive slightly increases the trips on Boronia Road.
Melbourne Street and Capital City Blvd (No. 2, and 3)	Provision of East-West connection to Lewis Road allows redistributed trips that previously used the Melbourne Street and Capital City Boulevard access and now redistribute to Lewis Road.
Option 1B (Road Network Option B)	
Burwood Highway (No. 11, 12 and 13)	Option B road network slightly reduces the trips on Burwood Highway.
Boronia Road (No. 16, and 17)	Provision of East-West connection between Scoresby Road and Parkhurst Drive slightly increases the trips on Boronia Road.
New Local East-West west of Scoresby Road (19)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by nearly 50% compare to Option A.
New Local East-West west of Lewis Road (20)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by 25% compare to Option A.
Melbourne Street and Capital City Blvd (No. 2, and 3)	East-West connection to Lewis Road allows redistributed trips that previously used the Melbourne Street and Capital City Boulevard access and now redistribute to Lewis Road.

The 2035 forecast traffic flows on Lewis Road indicate that traffic control measures would be required at both the Eastgate Drive and Bridgewood Court intersections. It would be proposed that roundabouts would be considered at both intersections in order to adequately manage the anticipated traffic volumes on these links.

It is expected that the existing number of access connections from the surrounding road network servicing Westfield Knox, west of Lewis Road will continue to be sufficient to adequately cope with the expected future traffic generation. Fully signalised connections to the Westfield Knox site are made off Stud Road, and Burwood Highway either directly or via Melbourne Street, or capital City Boulevard.

It is shown that there would be merit in providing an East-West connection between Scoresby Road and Lewis Road as per Option 1B, as it aids in improving permeability and distributing traffic through the study area.

It is shown that there would be merit in providing an East-West connection between Scoresby Road and Lewis Road as per Option 1B, as it aids in improving permeability and distributing traffic through the study area.

It is noted however, that providing the East-West connection from Scoresby Road to Parkhurst Drive would be sufficient in order to cater for the anticipated future traffic volumes. With either East-West connection scenario, the provision of the single connection point on Scoresby Road that allows for all turning movements would be suitable to cater for the forecast traffic volumes.

With the increased traffic volumes on Parkhurst Drive, consideration should also be given to providing a fully signalized intersection at Burwood Highway / Parkhurst Drive that allows for all turning movements at the intersections.

5.4.3 Option 2: Tram Route 75 Extension

The modelled daily traffic flow effects within the study area in 2035 specifically for Option 2 with the East-West connection between Scoresby Road and Lewis Road and the tram route 75 extension are summarised in Table 5-5.

Table 5-5 Network Performance Summary (Option 2)

Road (Link Locations)	Summary
Burwood Highway (No. 11, 12 and 13)	Option B road network slightly reduces the trips on Burwood Highway, and the extension of the Route 75 tram service further reduces trips along this road.
Boronia Road (No. 16, and 17)	New East-West connection between Scoresby Road and Parkhurst Drive slightly increases the trips on Boronia Road. The Route 75 tram extension option has no effect on this road.
New Local East-West road west of Scoresby Road (19)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by nearly 50%s compare to Option A.
New Local East-West road west of Lewis Road (20)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by 25% compare to Option A.

The Route 75 tram extension results in small volume reductions (less than 1,000vpd on streets in the study area) as a small shift in mode share to public transport, 0.7% or some 1,100 trips per day. The tram route does not result in a significant change in mode share.

Further analysis does however indicate a significant shift in bus usage to tram usage. Figure 5-4 shows number the total number of daily passenger trips for the bus routes and the route 75 tram that would pass through the study area. Option 2 and Option 4 are the options with the tram extension provided, and as shown in Figure 5-4, regular bus and smart bus passenger numbers decreased for the options with tram extension. In the Option 2 scenario, there are 8,800 additional trips using the tram, with 4,000 of these additional trips shifting from the bus modes.

Figure 5-4 Passenger Bus vs Tram Patronage

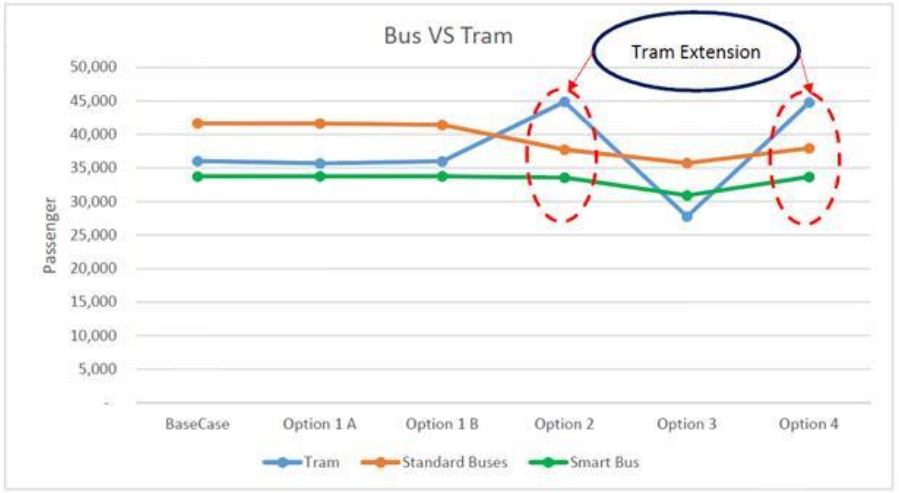


Figure 5-4 indicates that the 75 tram route extension is warranted for the following reasons:

- Trams provide a more attractive option over buses and are generally a preferred mode by PT users; and
- Trams are less susceptible to on-road delays, particularly when the tram line would be primarily off road as would be the case in this instance. It is noted that Burwood Highway will reach capacity for vehicles by 2035, which will result in delays to bus movements.

With these points in mind, it is recommended that it should be continued to advocate for the tram route extension.

5.4.4 Option 3: 2025 Land Use Scenario

The modelled daily traffic flow effects within the study area in the interim 2025 Option 3, with the East-West connection between Scoresby Road and Lewis Road are shown in Table 5-6. It is noted that other than the planned widening of the Eastlink to four lanes in each direction, the other network improvements identified in section 5.2.2.1 have not been incorporated into this option.

Table 5-6 Network Performance Summary (Option 3)

Road (Link Locations)	Summary
All roads	Most network links have lower volumes than the 2035 base case except High Street Road, due to Ferntree Gully Road having 4 lanes instead of 6 lanes.
High Street Road (No. 9)	Year 2025 road network (option 3) has the highest volumes compared to other options as a result of Ferntree Gully Road network in 2025 which has only 2 lanes each direction while the other options have 3 lanes each direction.
Burwood Highway (No. 11, 12 and 13)	Operates above Austroads capacity. In option 3 (2025), Burwood Highway with 2 lanes each way in some locations, carries less traffic compared with the 2035 road network. The high volume capacity ratio is maintained in 2035 after adding the extra lane shows that the extra capacity attracts more traffic without increasing the level of service.

The modelling of the East-West connection between Scoresby Road and Lewis Road as per network Option B but with the lower 2025 land use, results in traffic volumes in the order of 3,500 on the link.

The key findings shown in this model scenario is that the expected traffic volumes suggest that the East-West connection between Scoresby Road and Lewis Road is warranted in 2025

5.4.5 Option 4: 2013 High Development Scenario

The modelled daily traffic flow effects throughout the study area in 2035 with the higher levels of development as per Option 4, with the East-West connection between Scoresby Road and Lewis Road shown in Table 5-7.

Table 5-7 Network Performance Summary (Option 4)

Road (Link Locations)	Summary
Burwood Highway (No. 11, 12 and 13)	The trips have slightly reduced even with the more expansive land use, because the extension of the 75 tram service further reduces trips along this road.
Boronia Road (No. 16, and 17)	The new East-West connection between Scoresby Road and Parkhurst Drive slightly increases the trips on Boronia Road. The Route 75 tram extension option has no effect on this road.
New Local East-West west of Scoresby Road (No. 19)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by nearly 50% compared to Option A.
New local East-West road west of Lewis Road (No. 20)	The new access from Parkhurst Drive to Eastgate Court (Option B) has increased trips by 30% compared to Option A.

The testing of this option with a higher land use projection shows that the network volumes are not expected to increase significantly, with an additional 3,300 daily vehicle trips to/from the study area expected across the network.

These increases are not expected to have a significant impact on the performance of the surrounding road network.

5.4.6 Trip Generation & Network Performance Analysis

5.4.6.1 Trip Generation

The total number of private vehicle trips generated by Knox Central are shown in 'Appendix B3 – Trip Generation and Mode Share'. Option 3 generated the lowest number of trips since it modelled the 2025 the land use, with daily trips 91,500vpd. Option 2 generated the lowest number of private vehicle trips where the 2035 land use was modelled with the Route 75 tram extension provided, with 110,300vpd. Option 4 was also modelled with the Route 75 tram extension however additional trips generated as the 'high development' land use scenario was modelled, and generated 113,400vpd.

Mode Share

The mode share for all modelled options showed that it was consistent with each of the land use scenarios, with option 2 and 4 showing the lowest car use and slightly higher public transport use compared to other options. Option 3 with the 2025 road network and demand public transport provision resulted in slightly higher car use.

Within the study area, the mode share difference between the options is more significant compared to the former LGA levels. Option 2 as expected with the tram extension has higher mode shift from car to public transport. Mode share for Knox LGA and study area are shown in 'Appendix B4 – Mode Share Shifting from Base Case for Each Trip Purpose'

Catchment Data

The travel catchment maps for trips generated by Knox Central are shown in 'Appendix B5 – Daily Trip Catchment Charts'. The plans show that the majority of the trips generated by the study area would be relatively short trips generated by the neighbouring zones.

The plans also show that the catchment area for the study area does not expand significantly. Trip distribution does however intensify throughout the existing catchment area as the future land use continues to focus neighbouring residential trip generation to the activity centre.

It is apparent that these additional trips do not translate to a significant decrease in private vehicle trips to the study area over time. The catchment analysis indicates that private vehicle travel remains the most attractive travel method for shorter local trips

It is therefore highlighted that improvements in public transport in this area should be the focus to fill in the gaps in the network.

5.4.6.2 Network Travel Speeds

Average speeds for the wider network area for the various scenarios were also generated by the traffic model and are shown in the Network Average Travel Speed table in 'Appendix B6 – Network Average Travel Speed'. These average speeds provide an understanding of the effectiveness of the road network at a more strategic level.

The key findings from the analysis of the network average speeds for each option illustrated that:

- Road network Option 1A produced a higher number of vehicle km travelled compared to road network Option 1B, indicating that the Option 1B with additional road network links within the study area results in a more effective route choice and shorter trip length than Option 1A;
- Vehicle hours travelled for Option 1A area also higher than those for Option 1B, indicating that vehicles are travelling at slower speeds through the network than in Option 1B that has an additional 300 metres of road network. These results are supported by the average speed results for each of the network options;
- Option 2 produced the lowest vehicle km travelled for the 2035 scenarios tested, indicating that the Route 75 tram extension would reduce the private vehicle kilometres travelled compare to others scenarios;
- Option 4 with more intense land use resulted in higher speeds than the other options, with the exception of Option 2, indicating that road network has the capacity to handle a higher land use scenario; and
- There is very minimal differences in speeds throughout the wider strategic network area, reflecting the minimal changes in trip distribution and route choice on the wider network, indicating that the increase in trip generation will affect the road network in the local area only.

5.4.7 Public Transport Analysis

5.4.7.1 Public Transport Mode Share

Option 2 and Option 4 were intended to test the impact of the Route 75 tram extension from the current terminus at Hanover Road, to Scoresby Road. It was shown that only a small number of trips otherwise made by car would transfer to the tram (0.7% mode shift). It was also identified that a significant number of bus passengers would transfer to the tram.

Further investigation showed that education and non-work based trips provide an increase in the public transport patronage when the tram extension is tested, implying that these trips are generated by patrons of the activity centre.

5.4.7.2 Public Transport Catchment

Figure 5-5 shows the public transport catchment within Knox Central and the surrounding area. As shown, most local arterial roads are served by public transport, specifically by bus, the key exception being Scoresby Road between Bayswater and Burwood Highway. The catchment area for public transport shown in Figure 5-5 has a 1 kilometre radius catchment for each train station, 500 metres for tram stops and 200 metres for bus stops. When this route plan has a bus frequency overlay, it shows that the service levels are poor along some roads, with a frequency as low as 4 buses a day.

Roads that provide a higher frequency service are generally serviced by more than one bus route as shown in section 4-3. This suggests that a number of routes are low frequency and hence unattractive to potential users. Low frequency and poor reliability of bus services has a negative effect on public transport patronage resulting on greater use private car use for trips that may otherwise be made on public transport. Adding the 7 km tram extension from Hanover Road to Scoresby Road will potentially gain traveller confidence in public transport with the long term effect of reducing private car use.

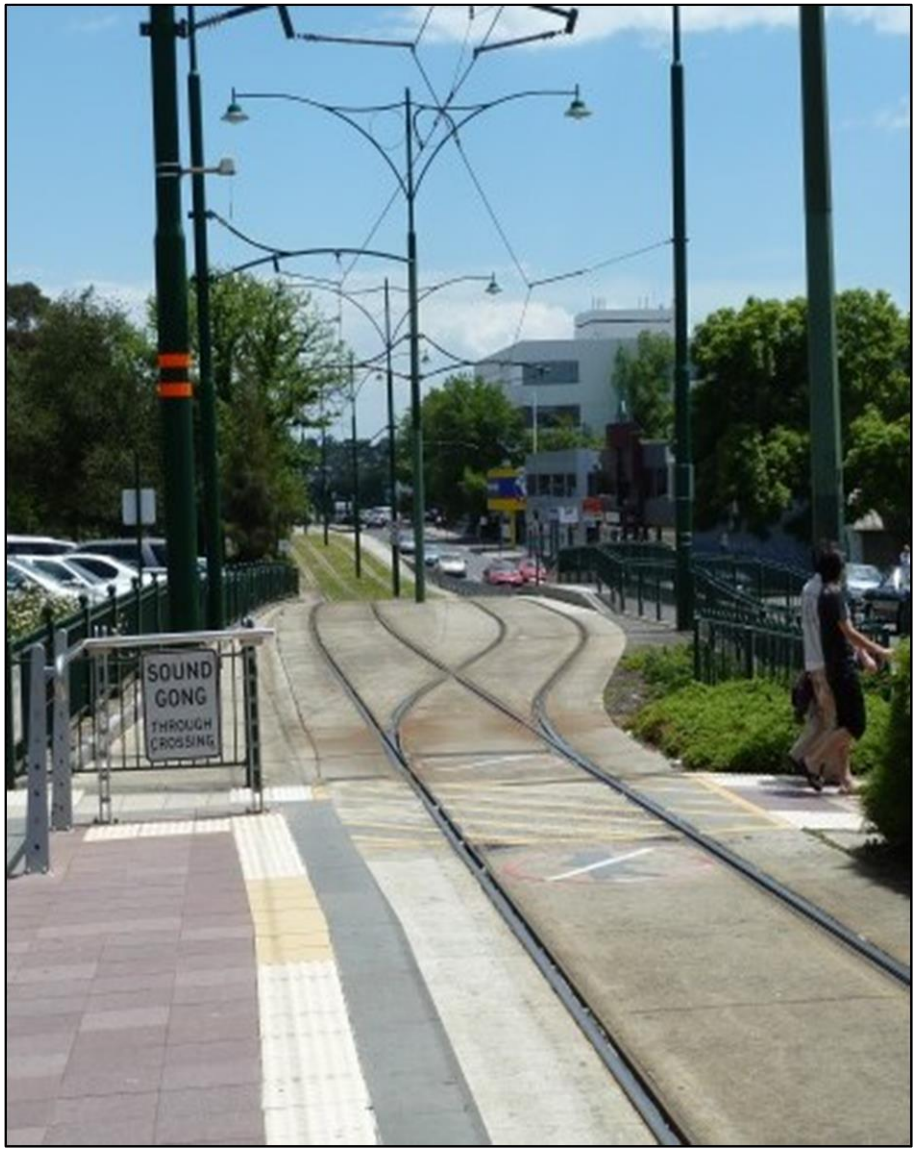
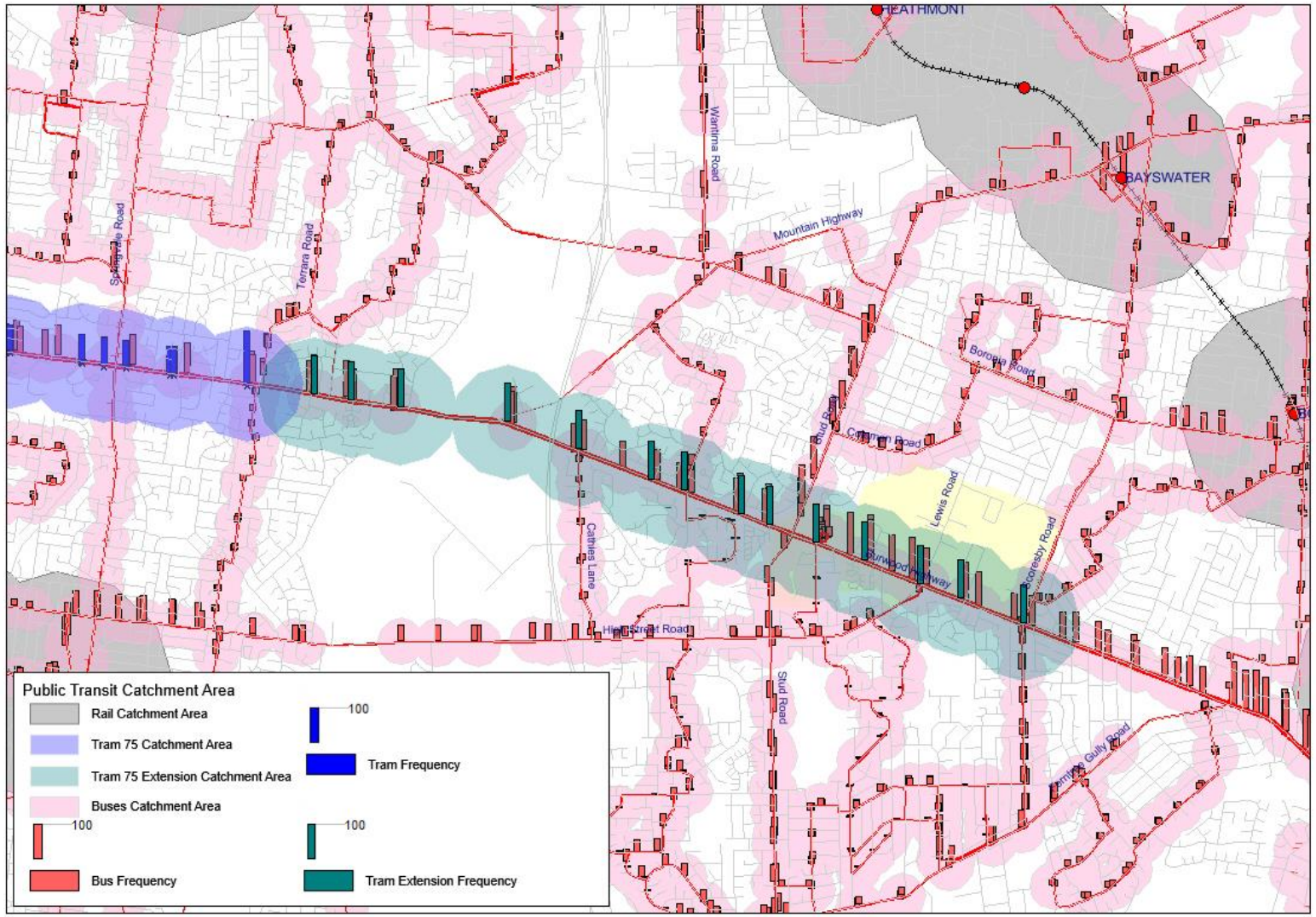


Figure 5-5 Public Transport Catchment and Frequency



5.5 Strategic Transport Modelling Summary Findings

The results of the modelling of the five scenarios as outlined in this section demonstrate that:

- The modelling of the East-West road link between Scoresby Road and Parkhurst Drive shows that this single east west link and connection point to Scoresby Road would adequately cater for the increased traffic by 2035, however extending this link to Lewis Road would improve permeability and the distribution of traffic through the study area;
- One connection point from an East-West link onto Scoresby Road is suitable for catering for the expected future traffic volumes;
- Model testing of the interim 2025 growth scenario shows that the East-West connection between Scoresby Road and Lewis Road is also warranted by 2025;
- The 2035 forecast traffic flows on Lewis Road indicate that traffic control measures in the form of roundabouts would be required at both the Eastgate Drive and Bridgewood Court intersections;
- The existing number of access connections from the surrounding road network servicing the Westfield Knox to the west of Lewis Road will continue to be sufficient to adequately cope with the expected future traffic generation;
- An upgraded fully signalized intersection at Burwood Highway / Parkhurst Drive that allows for all turning movements is recommended in order to cater for the increased traffic volumes on Parkhurst Drive;
- The Route 75 tram extension does not result in any significant change in mode share, and only results in small traffic volume reductions on streets in Knox Central;
- The Route 75 tram extension provides for a significant shift in bus usage to tram usage, indicating that trams with a more reliable journey time are a more preferred mode of public transport over buses;
- Burwood Highway will reach capacity by 2035, which will result in delays to bus movements. The extension of the Route 75 tram will be primarily off-road, which will result in improved journey times over buses; and
- The increase in traffic volumes that result from the higher land use projections between the 2035 base case and the 2035 high development scenario are marginal therefore have no significant impact on the surrounding road network.

6 Road Network Assessment

6.1 Overview

This section outlines the observed road network issues that have been identified, and defines a proposed road network through Knox Central that was developed using results from the strategic traffic modelling. This network was built upon by assessing a number of intersection improvement options.

This section goes on to identify a set of recommendations to be implemented over time in order to satisfactorily address the current problems and cope with the additional demand identified in Sections 3 and 4 of this report, as the Knox Central precinct continues to develop.

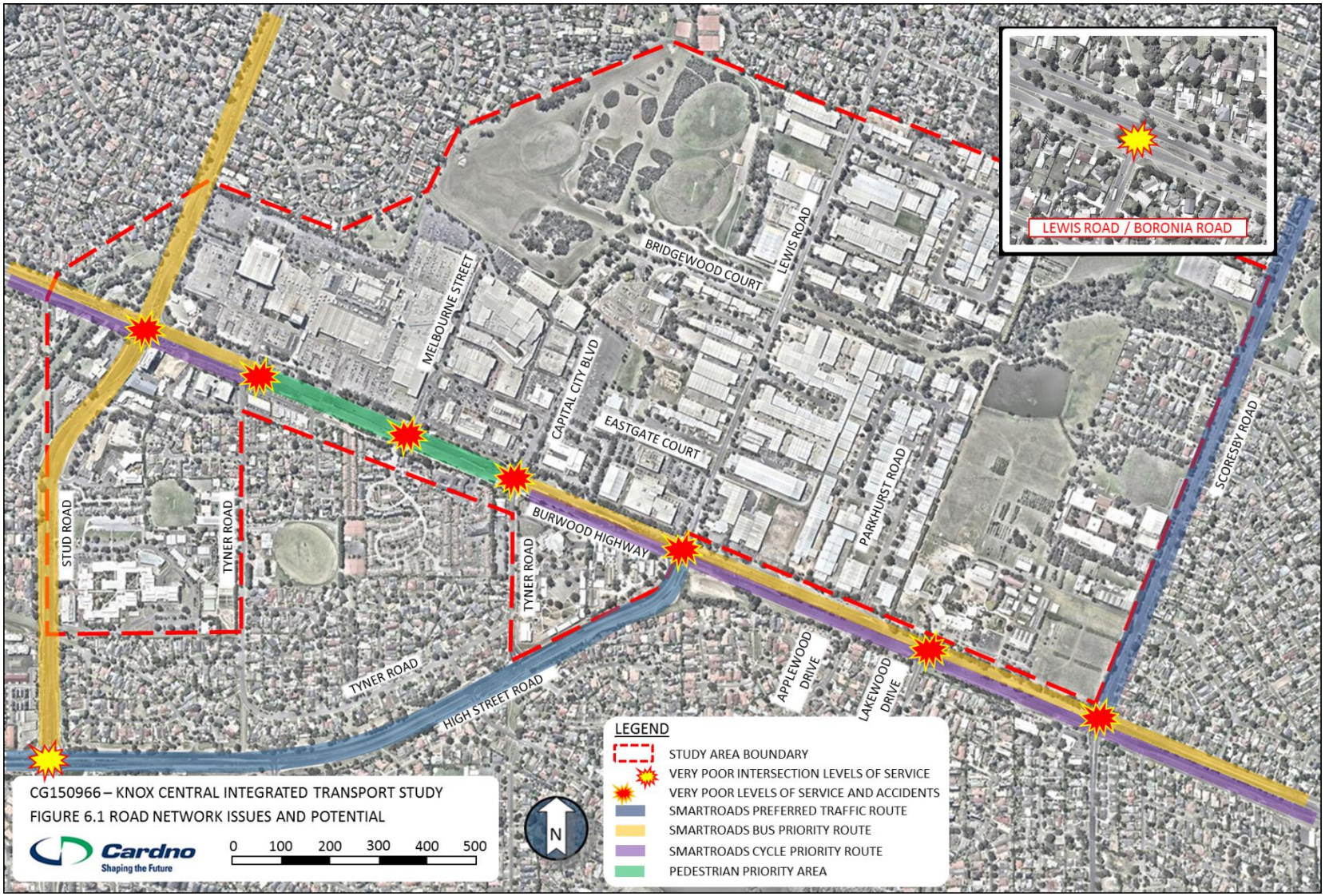
6.2 Existing Issues and Potential

A number of current road network issues have been identified through assessing the existing conditions as discussed in section 3 of this report, site visits and consultation with Knox City Council officers. Table 6-1 summarises the issues and opportunities that were identified throughout the development of the ITS. These are also presented graphically in Figure 6-1.

Table 6-1 Existing Road Network Issues and Potential

Reference	Road Network Issue
I1	The intersections on Burwood Highway within the Knox Central study area all currently operate with very poor levels of service resulting in significant queuing on the approaches during peak periods.
I2	The Stud Road / High Street Road intersection to the south of the study area operates above capacity during the peak periods, resulting in long queues on all approaches during the peak times.
I3	The Boronia Road / Lewis Road intersection to the north of the study area is significantly over capacity and warrants signalisation in the short term.
I4	There is a high concentration of road accidents at intersections along Burwood Highway, including incidents involving pedestrians and cyclists, particularly between High Street Road and Stud Road.
I5	The VicRoads SmartRoads Road User Hierarchy for the study area indicates that the Burwood Highway and Stud Road are nominated as a 'Bus Priority Route' through the study area, as well as 'Bicycle Priority Routes' through Knox Central. Burwood Highway between the Tyner Road (loop) intersections is also a nominated 'Pedestrian Priority Route'. It will be necessary to continue to balance the accessibility needs for all modes on the road network through Knox Central, particularly along the Burwood Highway.

Figure 6-1 Identified Road Network Issues and Potential



6.3 Candidate Road Network

6.3.1 Strategic Basis

Analysis of the existing road conditions and the proposed future development in the study area, along with the analysis of a number of future road network scenarios on a strategic level, as discussed in Sections 3 and 4, have provided a basis on which a more detailed intersection configurations and performance analysis may be undertaken.

This section outlines the potential road network additions and modifications along with additional access points from the arterial road network, to form a proposed 'candidate' road network for the study area.

Analysis of the findings from the strategic modelling as summarised in Section 5.5 suggests that model option 1B with the continuous east west link between Scoresby Road and Capital City Boulevard is the most appropriate model to test further network improvements Section 5-3 outlines the network and land use parameters for this option in more detail.

6.3.2 Local Connectivity

It was determined that the addition of a new East-West link between Scoresby Road and Lewis Road, running parallel to the north of Burwood Highway is required. Given the forecast ultimate traffic flows along this link, it is considered appropriate for this link to be categorised as a Level 2 Access Road or Level 1 Connector Street depending on spatial constraints, as per Clause 56-06 of the Knox Planning Scheme.

It is also proposed to complete the Bridgewood Court loop, providing a north south link via Capital City Boulevard to Eastgate Court, and also extending Eastgate Court to complete the link between Lewis Road and Capital City Boulevard at the proposed East-West link road. The 2035 forecast traffic flows on Lewis Road indicate that intersection improvements such as roundabouts would be required at both the Eastgate Drive and Bridgewood Court intersections.

A number of other intersections will be expected to be upgraded within and connecting to the study area. Whilst it is expected that the existing number of access connections servicing Westfield Knox will continue to be sufficient to cope with the forecast future traffic generation, additional connections to Knox Central to the east of Lewis Road will be needed to facilitate the envisaged growth. These would include signalised intersections on:

- Parkhurst Drive at Burwood Highway;
- The DELWP site access at Burwood Highway;
- The new East-West link at Scoresby Road; and
- Lewis Road at Boronia Road to the north of the study area.

A left in / left out access arrangement to Burwood Highway immediately to the east of the DELWP site will also be considered.

The road links recommended in this study have been modelled at a strategic level and the exact locations are subject to a more detailed investigation.

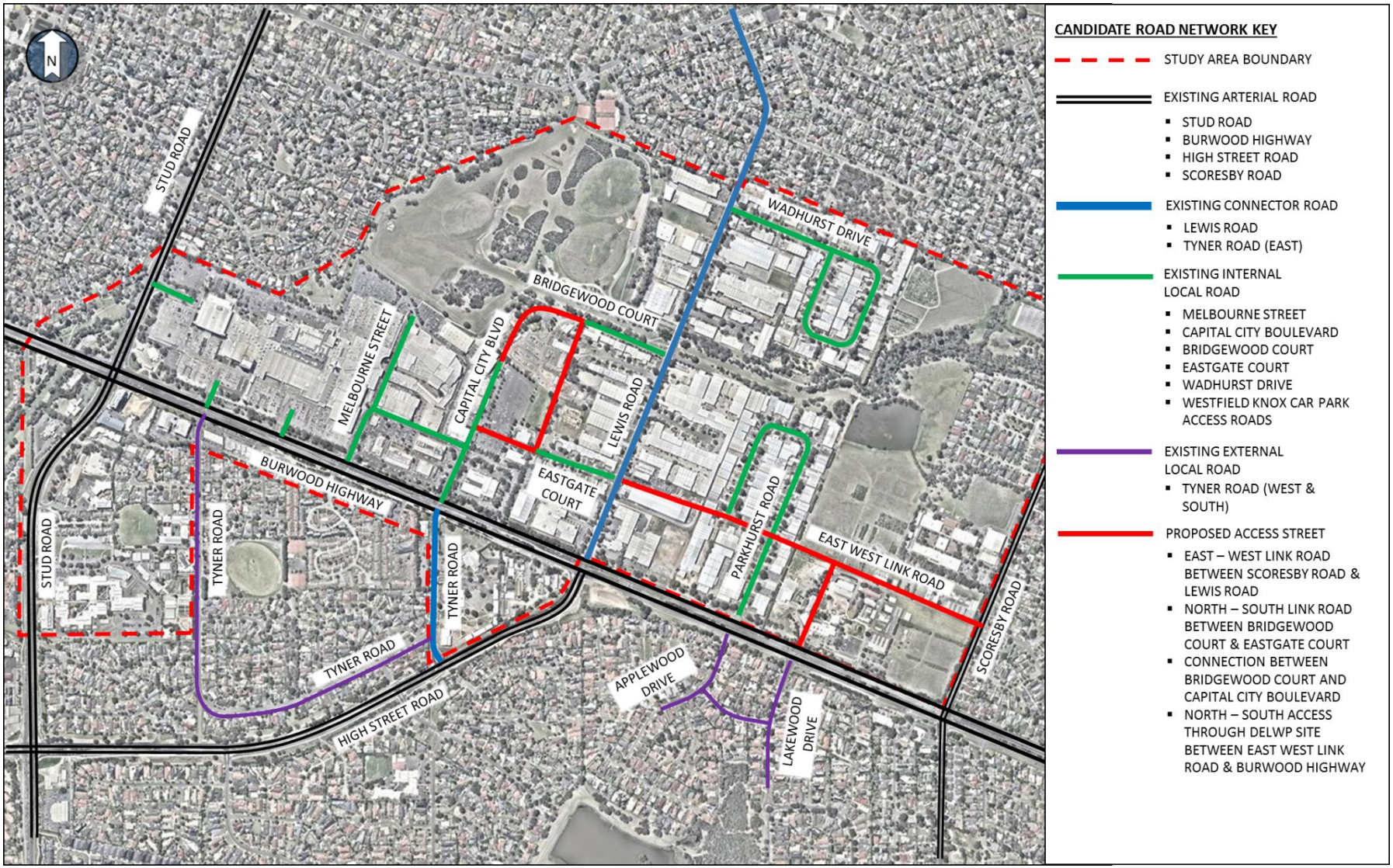
More detailed intersection option testing and recommendations are provided in the following sections.

6.3.3 Road Hierarchy and Cross Sections

A refined 'candidate road network' is illustrated in Figure 6-2 with potential cross section arrangements provided in Appendix D of this report. These cross sections are MPA standard sections and may be adjusted to suit local conditions. Potential cross section arrangements may include:

- Lewis Road – Upgrade to include cycle lanes or shared path – Connector Street;
- Parkhurst Drive – Upgrade to include cycle lanes or shared path Access Road – Industrial; and
- East West Link Road / Eastgate Drive – Provide / upgrade to Level 2 Access Road or Level 1 Connector Street.

Figure 6-2 Knox Central Candidate Road



6.4 Knox Central Access Intersection Improvements

A detailed local intersection analysis was undertaken using SIDRA on the proposed new or modified intersections connecting the study area to determine the performance under future traffic conditions. In order to determine the benefits and improvements that result from the proposed intersection arrangements, the operation of the intersections for the 2035 study area network Option 1B scenario have been modelled and analysed using SIDRA

These improvements are intended to further refine the candidate road network as outlined in section 6.3. The proposed intersections to be analysed include:

- Multiple locations along Burwood Highway between Lewis Road and Scoresby Road;
- Scoresby Road and the proposed East-West link running parallel to Burwood Highway; and
- Lewis Road and Boronia Road.

There are a number of proposed intersection modifications along Burwood Highway that may be restricted due to the location and nature of the existing intersections, therefore a Preferred Option and two Alternative Options have been analysed for the proposed intersection arrangements along this section of Burwood Highway.

The detailed modelling results are provided in Appendix C – Local Intersection SIDRA Modelling & Analysis and have been referred to throughout this section of the report.

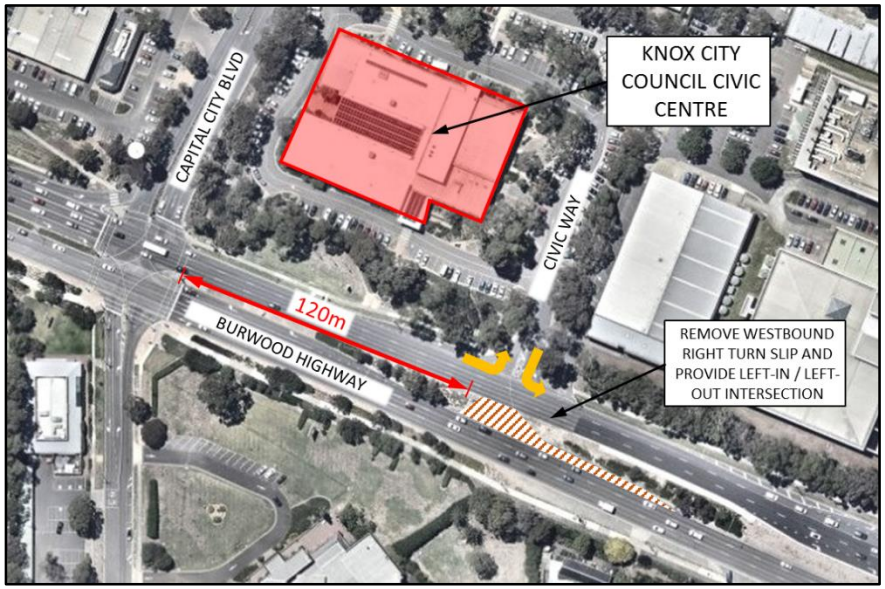
6.4.1 Knox City Council Access Road – Civic Way

The KCUDF identified a north south link parallel to the west of Lewis Road, from Burwood Highway to Bridgewood Court, labelled as Civic Way. It was intended to connect and provide access to the Knox City Council Civic Centre, via the existing unsignalised connection to Burwood Highway. It was proposed to signalise this intersection under that KCUDF proposal, however this option is no longer considered appropriate, and it is recommended that it should no longer be pursued for the following reasons:

- There are currently six signalised intersections on the 1200 metre section of Burwood Highway between and including Stud Road and Lewis Road.
- The proximity to the signalised Capital City Boulevard intersection poses a safety risk as drivers potentially looking through intersection to next set of lights and missing the lights change. Vehicles may also accelerate to catch the green or amber light at the Capital City Boulevard intersection, and have to decelerate very quickly at the proposed signalised Council access intersection should there be a red light; and
- The nature of the proposed Civic Way was such that the capacity would be low and encouraging lower speeds, therefore providing signals would not be compatible with the intent of the link.

It is proposed to maintain the intersection providing access to Knox City Council Civic Centre however it would be intended to remove the right turn access from the east, leaving it as a left-in left-out intersection only as shown in Figure 6-3.

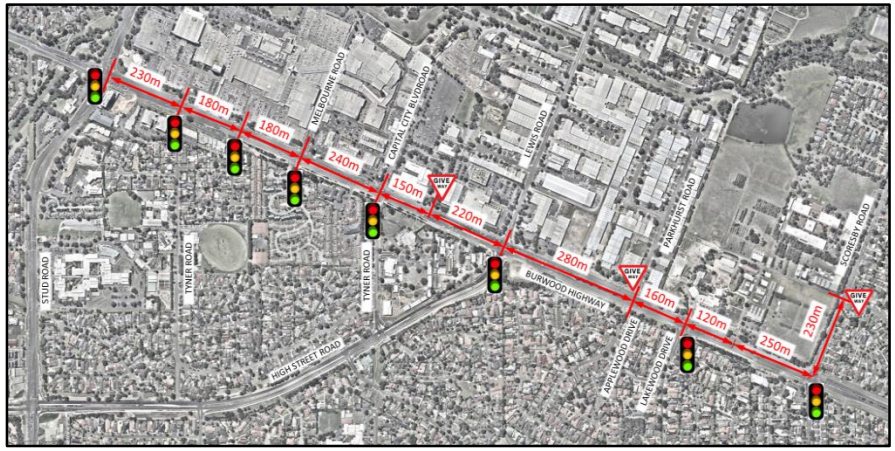
Figure 6-3 Proposed Knox City Council Civic Centre Access Arrangement



6.4.2 Burwood Highway Intersection Configuration

There are currently fewer intersections providing access to the study area to the east of Lewis Road than there are to the west. The current locations and distances between each intersection between Stud Road and Scoresby Road are highlighted in Figure 6-4.

Figure 6-4 Intersections along Burwood Highway



As discussed, a preferred option and two alternative options were identified for the intersection arrangements to access the eastern section of the study area along Burwood Highway between High Street Road and Scoresby Road. The arrangements for each option are:

- Option A - Signalised intersections at Parkhurst Drive & Lakewood Drive allowing all turning movements;
- Option B - Signalised intersections at Parkhurst Drive and Secondary DELWP Precinct access allowing all turning movements; and
- Option C – Signalised T intersections at Parkhurst Drive and Lakewood Drive.

The following sections outline each intersection arrangement and summarise the performance of the section of the Burwood Highway through these intersections.

6.4.2.1 Option A: Signalised Intersections at Parkhurst Drive and Lakewood Drive

The preferred future intersection arrangement option would be to provide two fully directional signalised intersections on Burwood Highway at Parkhurst Drive/Applewood Drive and Lakewood Drive/DELWP site.

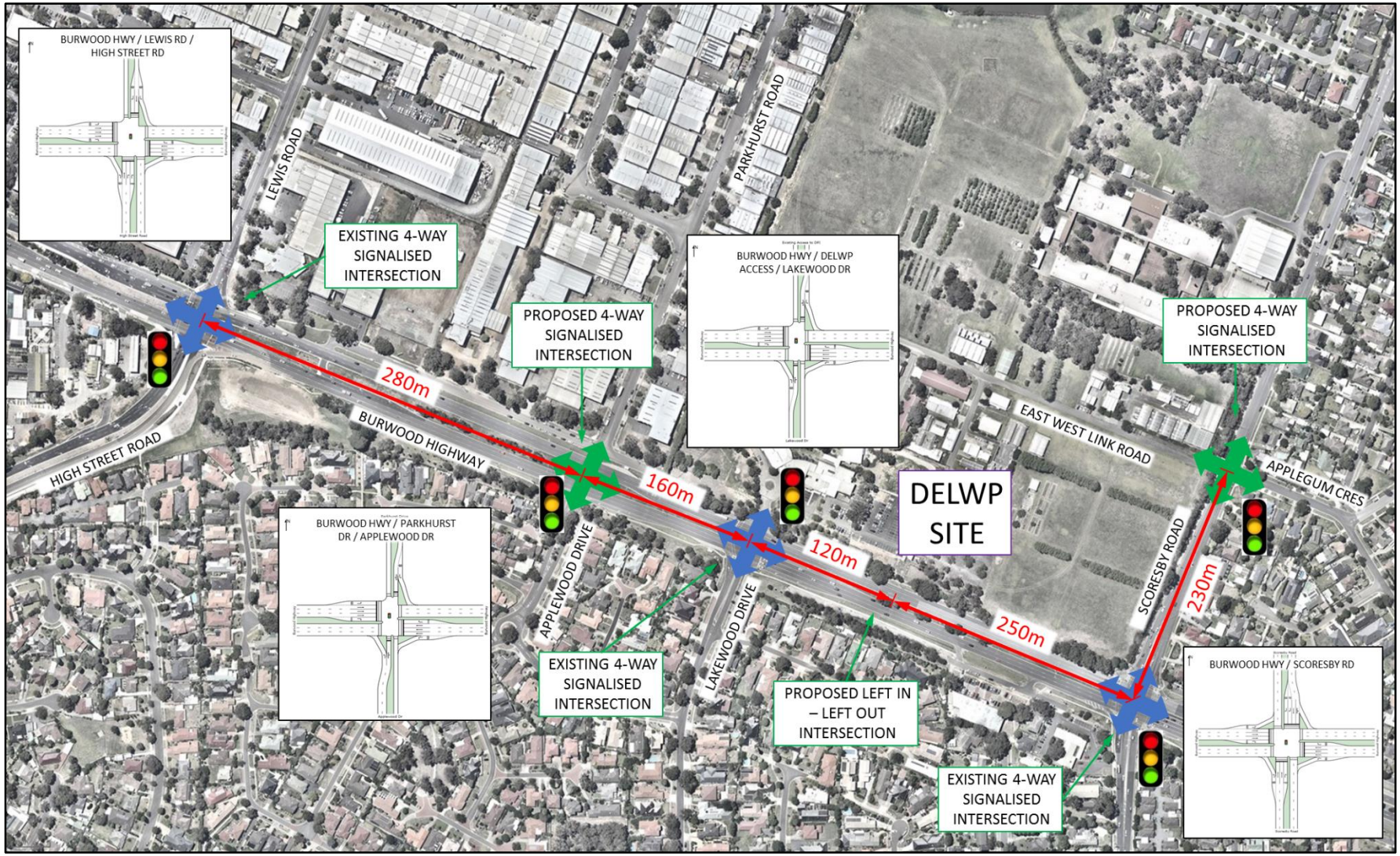
Future traffic flows on Parkhurst Drive are in the order of 5,200 vehicles per day, facilitating the need for a fully signalised intersection at this location on Burwood Highway. The current partially signalised intersection at Lakewood Drive would be modified to include signals on the northern leg to facilitate the DELWP access link as proposed in the DELWP Masterplan.

Figure 6-5 Existing Burwood Highway / Parkhurst Drive / Lakewood Drive Intersection

A secondary left-in left-out access intersection from the DELWP precinct is also proposed on Burwood Highway between Lakewood Drive and Scoresby Road.

The intersection arrangements proposed under Option A are shown in Figure 6-6.

Figure 6-6 Option A – Proposed Signalised Intersections at Parkhurst Drive & Lakewood Drive



This proposal would be subject to VicRoads' approval as it does not strictly accord with their policy regarding the minimum 200 metre distance between signalised intersections. It should be recognised however that this option only results in two signalised intersections on Burwood Highway to the east of High Street Road in comparison to 4 signalised intersections to the west of High Street Road.

There are a number of case studies in other activity centres where there is less than optimum distance between signalised intersections that support this option. An example being on Burwood Highway in Vermont South with 40m between the Morack Road intersection and the Bunnings entrance signals.

SIDRA Analysis

A summary of the intersection performance along Burwood Highway in both the AM and PM peak periods is shown in Table 6-2, and the more detailed level of service information for each intersection provided in Appendix C – Local Intersection SIDRA Modelling & Analysis.

Table 6-2 Option A Intersection Level of Service Summary

Intersection	AM Peak		PM Peak	
	Degree of Saturation	Level of Service	Degree of Saturation	Level of Service
Burwood Highway / Lewis Road / High Street Road	1.08	Very Poor	1.7	Very Poor
Burwood Highway / Parkhurst Drive / Applewood Drive	1.07	Very Poor	1.08	Very Poor
Burwood Highway /DELWP Access / Lakewood Drive	0.91	Acceptable	1.09	Very Poor
Burwood Highway / Scoresby	2.26	Very Poor	1.50	Very Poor

A review of these results for Option A show that the AM period will operate with a better DoS than the PM. The DoS at Lewis Road/Burwood Highway and Scoresby Road/Burwood Highway are already above saturation, with congestion on the Burwood Road legs at these intersections influencing the performance of the intersections in between. It is noted that the performance of the Lewis Road/Burwood Highway and Scoresby Road/Burwood Highway intersections may be improved by allowing vehicles to turn right from the north and south approaches during the same phase.

As expected, the greater queues are on the eastern leg in the AM peak, and on the western leg during the PM peak. The AM SIDRA results indicate that vehicles on Burwood Highway still clear in the two cycles whilst on the PM peak will take maximum three cycles to clear.

Should this option not be acceptable to VicRoads, alternative Options B and C are provided below.

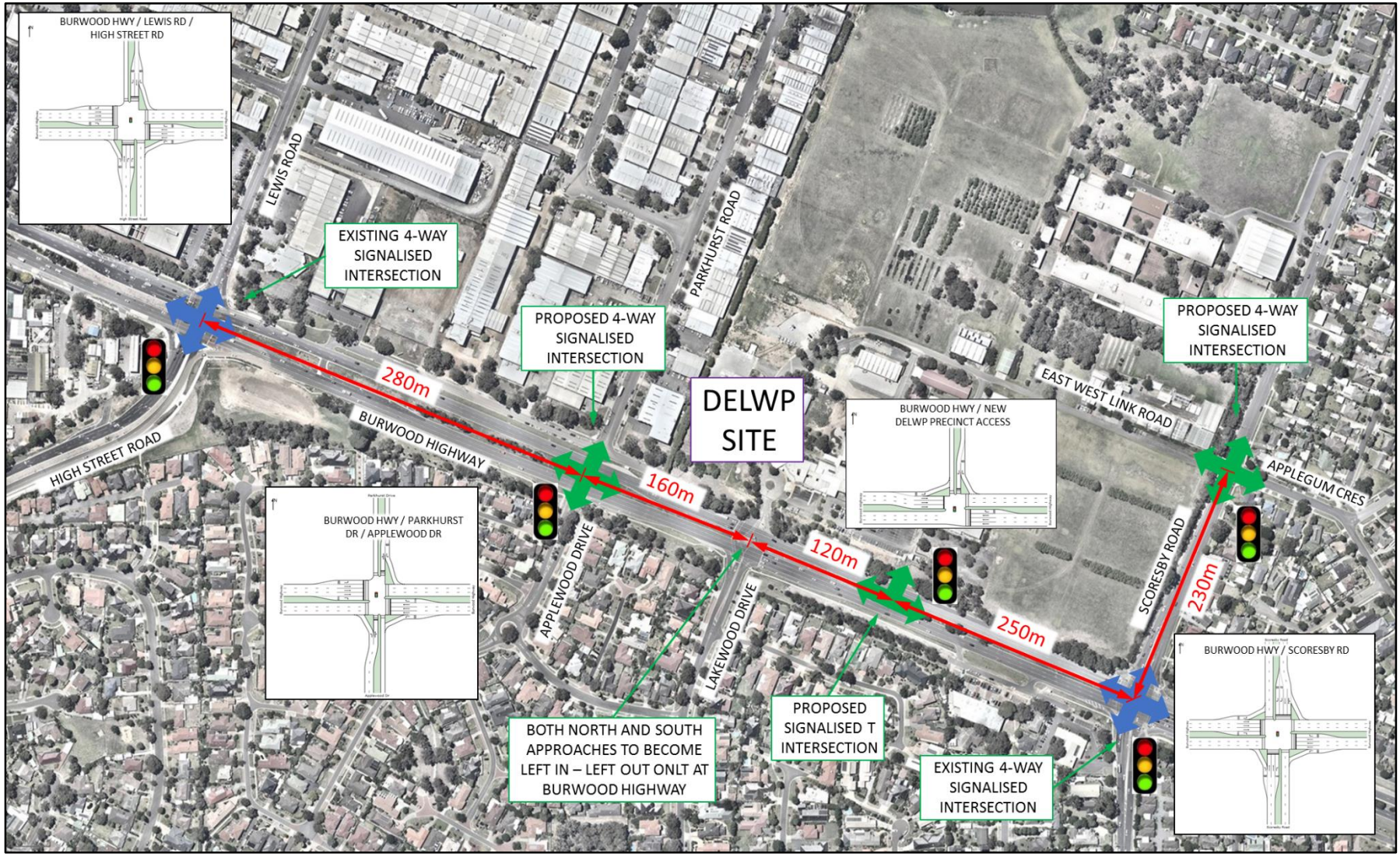
6.4.2.2 Option B: Signalised Intersections at Parkhurst Drive and Secondary DELWP Precinct Access

Alternative Option B proposes removing the signals at Lakewood Drive and providing a signalised T intersection further east to the proposed secondary access intersection from the DELWP precinct. The Lakewood Drive / western DELWP precinct access intersection would be modified to provide left in left-out access to Burwood Highway on both north and south legs.

This arrangement provides a greater distance between the two signalised intersections in this location, whilst still providing adequate signalised access from the residential area south of Burwood highway, via Applewood Drive.

The intersection arrangements proposed under Option B are shown in Figure 6-7.

Figure 6-7 Option B – Proposed Signalised Intersections at Parkhurst Drive & Secondary DELWP Precinct Access



SIDRA Analysis

A summary of the intersection performance along Burwood Highway in both the AM and PM peak periods is shown in Table 6-3, and the more detailed level of service information for each intersection provided in Appendix C – Local Intersection SIDRA Modelling & Analysis.

Table 6-3 Option B Intersection Level of Service Summary

Intersection	AM Peak		PM Peak	
	Degree of Saturation	Level of Service	Degree of Saturation	Level of Service
Burwood Highway / Lewis Road / High Street Road	1.48	Very Poor	1.69	Very Poor
Burwood Highway / Parkhurst Drive / Applewood Drive	1.12	Very Poor	1.08	Very Poor
Burwood Highway /Secondary DELWP Access	1.00	Very Poor	1.12	Very Poor
Burwood Highway / Scoresby Road	2.24	Very Poor	1.29	Very Poor

A review of these results for Option B shows very similar degrees of saturation to those in Option A, with a slightly better performance for the Parkhurst Drive and DELWP intersections in Option B for both AM and PM peaks. Again, the AM peak performs better than the PM peak under this option.

Similar to Option A, the performance of the Lewis Road/Burwood Highway and Scoresby Road/Burwood Highway intersections may be improved by allowing vehicles to turn right from the north and south approaches during the same phase.

6.4.2.3 Option C: Signalised T Intersections at Parkhurst Drive and Lakewood Drive

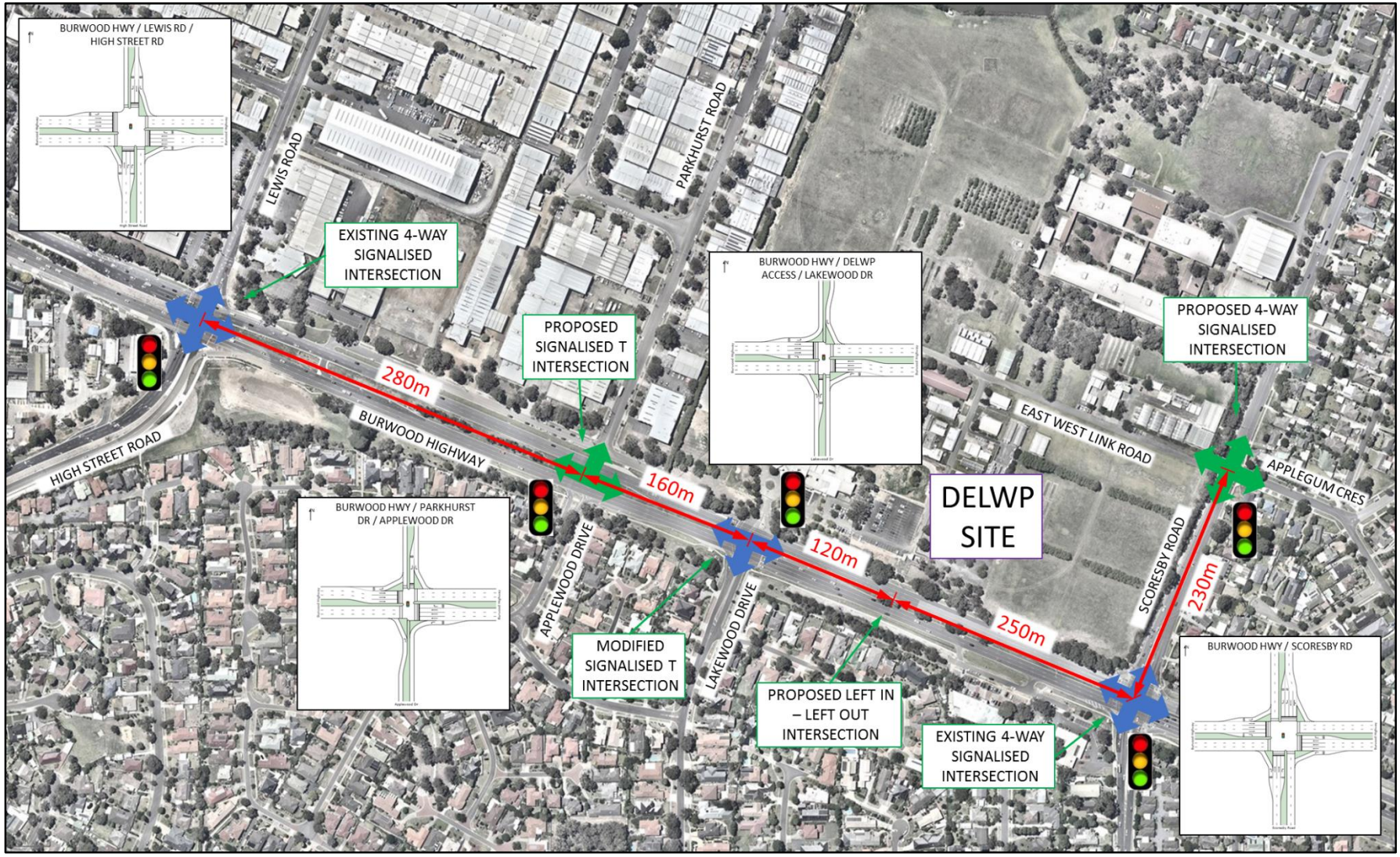
Alternative Option C provides a signalised T intersection in each of the eastbound and westbound lanes on Burwood Highway between Lewis Road and Scoresby Road. This would provide signalised access from the north at Parkhurst Drive, and also signalised access from the south at Lakewood Drive, with left-in left-out arrangement on the opposing legs on each of these intersections

Figure 6-8 Existing Burwood Highway / Parkhurst Drive / Lakewood Drive Intersection

This option is intended to demonstrate the need for signalised access to the DELWP site and the impacts on the Burwood Highway / Scoresby Road intersection without it.

The intersection arrangements proposed under Option C are shown in Figure 6-9.

Figure 6-9 Option C – Proposed Signalised Intersections at Parkhurst Drive & Secondary DELWP Precinct Access



SIDRA Analysis

A summary of the intersection performance along Burwood Highway in both the AM and PM peak periods is shown in Table 6-4, and the more detailed level of service information for each intersection provided in Appendix C – Local Intersection SIDRA Modelling & Analysis.

Table 6-4 Option C Intersection Level of Service Summary

Intersection	AM Peak		PM Peak	
	Degree of Saturation	Level of Service	Degree of Saturation	Level of Service
Burwood Highway / Lewis Road / High Street Road	1.22	Very Poor	1.79	Very Poor
Burwood Highway / Parkhurst Drive T / Applewood Drive Left-In Left-Out	0.73	Good	1.10	Very Poor
Burwood Highway / DELWP Access Left-In Left-Out / Lakewood Drive T	0.86	Acceptable	1.01	Very Poor
Burwood Highway / Scoresby Road	2.93	Very Poor	1.80	Very Poor

Table 6-4 shows that the Scoresby Road intersection becomes much more congested in both the AM and PM peaks, with a higher degree of saturation and hence resulting in a very poor levels of service.

More detailed analysis shows that the intersection fails on the western leg in the AM peak, as more vehicles are travelling toward the city, and the eastern leg also fails in the PM peak, as vehicles are heading east out of the city. This explains by the fact that delays have accumulated at the upstream intersections.

The Parkhurst Drive and Lakewood Drive 'T' intersections perform better in the AM peak, with the larger queues building on the western legs of each intersection in the PM peak as vehicles drive out of the city.

6.4.3 Scoresby Road / East West Link Intersection

It is recommended to provide a fully signalised intersection where the suggested East-West link road meets Scoresby Road. It is proposed to allow all turning movements at this intersection, including those to and from the existing Applegum Crescent leg.

There is 200 metres between this intersection and the existing signalised intersection at Scoresby Road and Burwood Highway, providing adequate spacing between the two, in accordance with VicRoads' standards[5].

The intersection arrangements proposed at this location is shown in Figure 6-10.

Figure 6-10 Proposed Signalised Intersection on Scoresby Road at Proposed East West Link

[5] VicRoads Access Management Policies 2006

SIDRA Analysis

A summary of the intersection performance along Burwood Highway in both the AM and PM peak periods is shown in Table 6-5, and the more detailed level of service information for each intersection provided in Appendix C – Local Intersection SIDRA Modelling & Analysis.

Table 6-5 Scoresby Road / East West Link Intersection Level of Service Summary

Intersection	AM Peak		PM Peak	
	Degree of Saturation	Level of Service	Degree of Saturation	Level of Service
Scoresby Road / East West Link / Applegum Crescent	0.90	Acceptable	0.58	Excellent

The AM peak hour result shows that the intersection has a good DoS, whilst in the PM the DoS does approach saturation that clears in one signal cycle. The performance of the north and south legs at the Scoresby Road / Burwood Highway intersection has little impact on the performance of this intersection.

6.4.4 Lewis Road / Boronia Road Intersection

While not within the study area, the Lewis Road / Boronia Road intersection provides direct access to Knox Central. The Boronia Road / Lewis Road intersection in its existing unsignalised form, is operating above or near capacity during the current 2015 peak periods. This suggests that it would benefit from being signalised as a matter of priority as traffic flows through the intersection will increase as development progresses.

The intersection arrangements proposed at this location is shown in Figure 6-11.

Figure 6-11 Proposed Signalised Intersection on Boronia Road at Lewis Road

SIDRA Analysis

A summary of the intersection performance along Burwood Highway in both the AM and PM peak periods is shown in Table 6-6, and the more detailed level of service information for each intersection provided in Appendix C – Local Intersection SIDRA Modelling & Analysis.

Table 6-6 Boronia Road / Lewis Road Intersection Level of Service Summary

Intersection	AM Peak		PM Peak	
	Degree of Saturation	Level of Service	Degree of Saturation	Level of Service
Boronia Road / Lewis Road	0.85	Acceptable	0.80	Good

The SIDRA modelling results for the proposed signalisation of the intersection shows that the AM peak hour is starting to approach saturation but still considered to have a fair Degree

of Saturation. The PM peak results show that the intersection has a good Degree of Saturation in 2035.

6.4.5 Intersection Analysis Summary

The preceding intersection analysis shows that:

- Both the Burwood Highway / High Street Road, and Burwood Highway / Scoresby Road intersections operate at or above capacity in all scenarios;
- The performance of the Burwood Highway / High Street Road, and Burwood Highway / Scoresby Road intersections may be improved by allowing vehicles to turn right from the north and south approaches during the same phase;
- Each of the intersections on Burwood Highway between Lewis Road and Scoresby Road operate within or at capacity with a DoS ranging from 0.7 to 1.1 for all of the options tested;
- It is shown that the Option C appears to operate the most efficiently, particularly in the AM peak due to vehicles being held up at both the High Street Road and Scoresby Road intersections;
- Options A, and B operating at or slightly above capacity, with little difference in performance; and
- Both the New East West link / Scoresby Road intersection and the Lewis Road / Boronia Road intersections are shown to operate within capacity in the 2035 scenario.

It is further noted that a number of major suburban signalised intersections in Melbourne effectively operate with a DOS greater than 1.0 during peak times resulting vehicles taking more than one traffic signal cycle to clear the intersection. The proportion of intersections in Melbourne operating with a DOS greater than 1.0 is only expected to increase as development continues given there is limited available road space to make continual capacity improvements.

6.5 Road Network Improvement Opportunities

Lewis Road – Boronia Road Intersection - The Lewis Road/Boronia Road intersection to the north of Knox Central is currently operating at capacity under existing traffic conditions. Traffic modelling indicates that signalising the intersection would provide additional capacity at the intersection that would relieve current congestion in the short term and also allow for traffic growth in the longer term.

Eastgate Court to Bridgewood Court Link - It is understood that a number of intersections on the road network within Knox Central will require upgrading to allow new road connections and to allow for increased traffic growth at existing connections. Introduction of the north south link between Eastgate Court and Bridgewood Court will change traffic conditions in the Lewis Road and Capital City Boulevard area. Improvement measures may include the provision of roundabouts and priority intersection measures.

East – West Link Road - As future growth in the area results in increased traffic being generated within the study area, the need for an east west link through Knox Central becomes apparent. This link will provide additional connectivity to the surrounding arterial road network. Traffic modelling has suggested that the link between Lewis Road and Scoresby Road may be implemented in a staged manner, with a section from Scoresby Road to Parkhurst Drive provided in the first instance. An extension to Lewis Road to further improve permeability and the distribution of traffic through the study area should be provided at a later time.

DELWP Access Connections - The development identified within the DELWP masterplan and the increased industry generated traffic in the area around Lewis Road and Parkhurst Drive will provide a need for new and improved connections from those locations to Burwood Highway and Scoresby Road. The nature and timing of these connections will be determined by the feasibility of the proposed access locations outlined in the DELWP masterplan and also through consultation with and endorsement from VicRoads.

Burwood Highway Intersections between High Street Road and Scoresby Road - The intersection modelling has also identified opportunities to streamline the existing intersections on Burwood Highway, particularly by allowing simultaneous right turn movements from the north and south legs at the intersections with High Street Road and Scoresby Road.

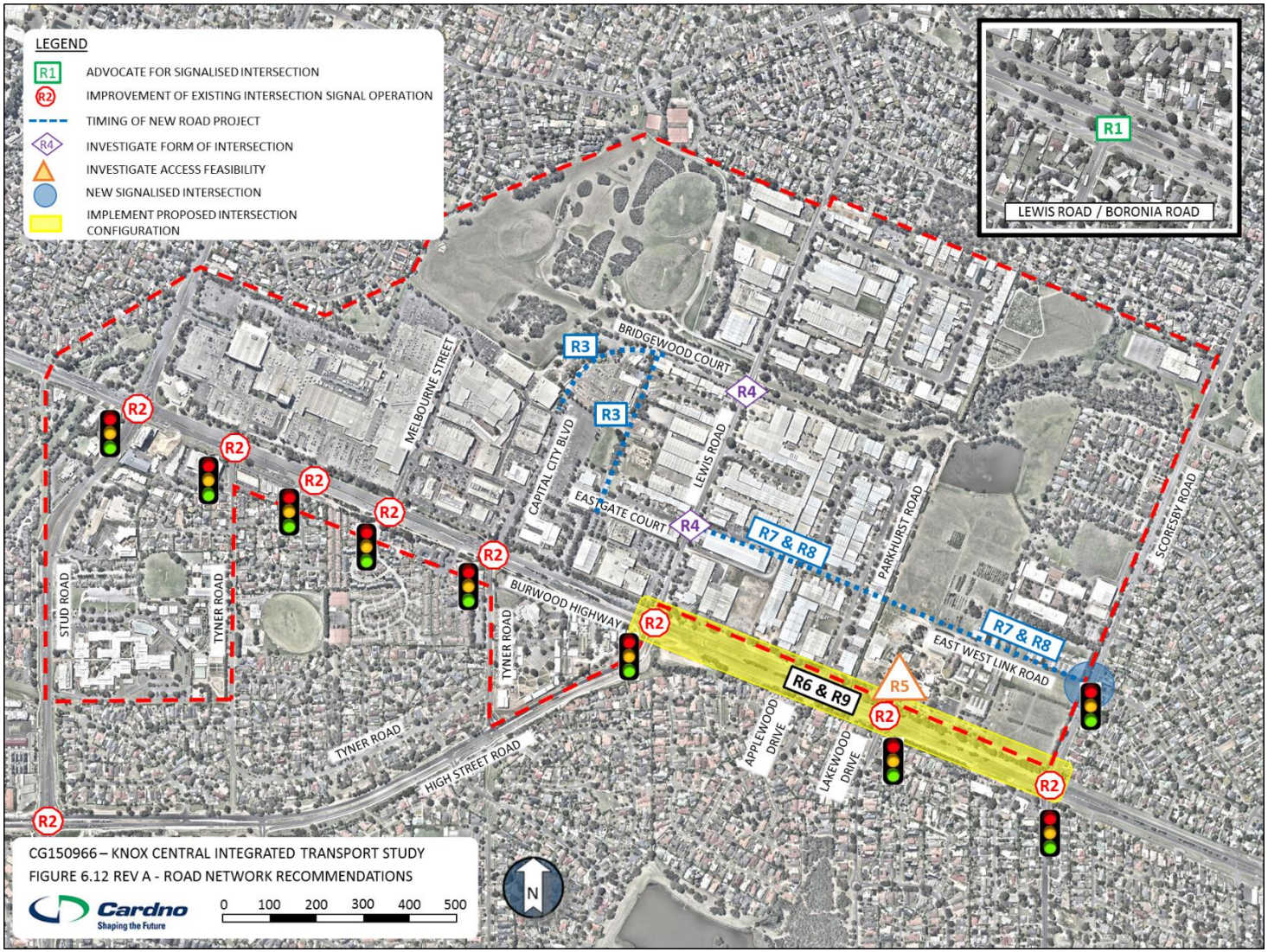
6.6 Road Network Recommendations

Table 6-7 and corresponding Figure 6-12 sets out a series of recommendations to be implemented over time that are intended to realise the identified goals and opportunities. The aim of these recommendations is to improve the performance of the road network in the short term, while allowing for the anticipated growth and distribution of trips in the longer term as background traffic increases and development within the Knox Central study area progresses.

Table 6-7 Road Network Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority	Issues Addressed
R1	Advocate to VicRoads for the signalisation of the Lewis Road/Boronia Road intersection, and implement VicRoads endorsed intersection layout and signal plans.	VicRoads / Knox City Council	Short Term	I3
R2	Advocate to VicRoads to undertake intersection timing and phasing analysis at key intersections on Burwood Highway and Stud Road to identify improvements in the performance of the existing intersection arrangements.	VicRoads / Knox City Council	Short Term	I1, I2
R3	Further investigate the timing and nature of the proposed north south link road connecting Eastgate Court, Bridgewood Court, and Capital City Boulevard.	Knox City Council	Short Term	Future Network
R4	Further investigate the form of intersection connections that can be feasibly provided to Lewis Road north of Burwood Highway, and the proposed north-south link, particularly at the intersections with Bridgewood Court and Eastgate Court.	Knox City Council	Short Term	Future Network
R5	Investigate whether the preferred access to the existing Lakewood Drive/Burwood Highway intersection through the DELWP site as proposed in the draft DELWP precinct masterplan is feasible.	Knox City Council	Short Term	Future Network
R6	Consult with VicRoads to determine an acceptable configuration for the intersections on Burwood Highway between High Street Road and Scoresby Road, considering the options tested in this study.	VicRoads / Knox City Council	Short Term	I4, I5
R7	Investigate the feasibility of providing a staged construction of the identified East-West road connection between Scoresby Road and Lewis Road, and the timing of the implementation of the stages as part of the detailed planning for the DELWP site.	Knox City Council	Medium Term	Future Network
R8	Design and construct the East-West link road as per the recommendations identified in the feasibility study recommended in R7.	Knox City Council	Long Term	Future Network
R9	Implement the VicRoads endorsed intersection configuration along Burwood Highway between Lewis Road and Scoresby Road.	VicRoads / Knox City Council	Medium – Long Term	I4, I5

Figure 6-12 Road Network Recommendations



7 Public Transport Assessment

7.1 Overview

This section summarises the existing public transport service provision, identifying current issues and also identifying potential measures to improve the public transport accessibility to the wider study area that may be implemented in the short term and into the longer term as development in Knox Central increases.

It is recognised that by 2025, the arterial roads will become more congested; resulting in a greater need to provide viable sustainable transport options to help reduce the growth in private vehicle trips and relieve congestion on the road network.

Access to the study area by public transport is currently facilitated by buses only, with a number of higher and low frequency services passing through or terminating at the bus interchange within the Westfield Knox car park off Burwood Highway.

The Route 75 tram from Melbourne's CBD terminates on Burwood Highway approximately 5km west of the study area, with a connecting bus service. There are no train services within 2.5 – 3km of Knox Central.

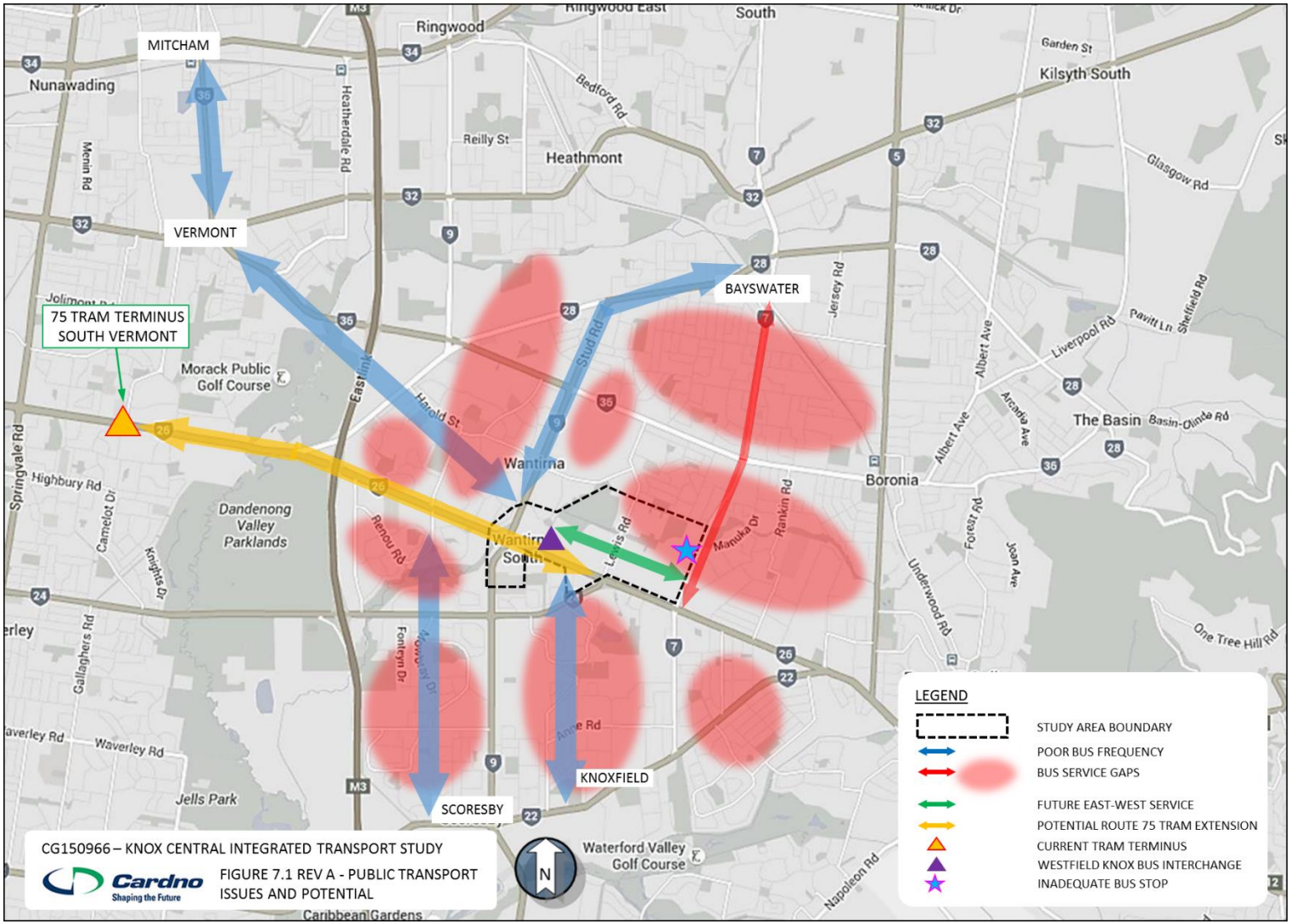
7.2 Existing Issues and Potential

A number of deficiencies in the provision of public transport accessing Knox Central have been identified through the development of the ITS. These issues have been identified by assessing the provision of bus services in terms of service frequency and network gaps, auditing existing bus stop amenities on site, and through consultation with Knox City Council officers. Table 7-1 summarises the issues and opportunities that were identified throughout the development of the ITS. These are presented graphically in Figure 7-1.

Table 7-1 Existing Public Transport Issues and Potential

Reference	Public Transport Issue
I6	A number of the bus routes that access the study area from local catchments have a very poor frequency. These include route numbers 757 and 758 from the south and a number of key bus services (routes 664 and 738) from surrounding activity centres and transport hubs such as Bayswater, Vermont and Mitcham.
I7	There are a number of service gaps in the network accessing Knox Central, including areas of Wantirna, Bayswater, Boronia, Knoxfield and Scoresby. There is a significant gap in the service along Scoresby Road between Bayswater and the intersection at Burwood Highway.
I8	While there is currently not the existing road network or demand for services internal to the Knox Central study area, there will be an opportunity in the future to provide an east west service through the precinct that will provide access to future commercial and residential development in Knox Central.
I9	A number of bus stops servicing Knox Central do not provide shelters or adequate service information, which may discourage use of the buses at night or during inclement weather. A particular area of concern is the stop on Scoresby Road near the Fairhills School.
I10	The Route 75 tram service from the CBD terminates at Burwood Highway / Hanover Road, in Vermont South, approximately 5km west of Knox Central. There is an opportunity to extend the tram service to Knox Central in the future.

Figure 7-1 Identified Public Transport Network Issues and Potential



7.3 Public Transport Improvement Opportunities

7.3.1 Bus Service Improvements

It is shown that there are a number of gaps in bus service provision in local areas to Knox Central and service frequency is poor on certain routes that connect Knox Central to the local areas and neighbouring activity centres.

There is potential to provide a bus network that is more attractive to people trying to access Knox Central from the local area and further afield in the catchment area and hence reduce the number of trips made by car.

It was identified that there will be an opportunity in the future to provide a bus service through the precinct along the proposed east west link road that will provide greater access to future commercial and residential development within the Knox Central precinct.

In order to encourage bus patronage it should be considered to liaise with PTV and review the current provision of bus stop facilities and provision of service information and shelter facilities across the network.

It is understood that the existing bus interchange within the Westfield Knox boundary will be relocated as part of the Westfield Stage 1 development.

Opportunities for improving local and strategic bus services providing access to Knox Central that may be considered include:

- Improving the 90 minute service frequencies on routes 757 and 758 from local areas to the south and providing weekend services on these routes;
- Reviewing off-peak and weekend service frequencies on routes 681 and 682 from the south;
- Providing a more direct higher frequency service along Scoresby Road from Bayswater and further north;
- Reviewing the 30 minute service frequencies on routes 664, 738 and 755 that connect the nearest rail stations and activity centres;
- Providing additional local bus services through the nearby residential areas that have been identified to lack access to bus services connecting either to existing high frequency bus services or directly to the Knox City shopping centre bus terminus; and
- Investigate the potential to improve bus priority measures at key intersections along Burwood Highway and Stud Road, to facilitate improved reliability in accessing the interchange within Westfield Knox.

7.3.2 Route 75 Tram Service Extension

By 2035, Burwood Highway and Stud Road are expected to be operating close to capacity, carrying in excess of 54,000 vehicles per day, therefore there will be a need to provide viable transport alternatives in the longer term.

As the bus services currently share the Burwood Highway road space service reliability is heavily dependent on road capacity. Burwood Highway is expected to be oversaturated by 2035 and there is limited available carriageway space to provide bus priority measures. Providing the off-road tram route extension will improve public transport reliability as the road capacity is reached and delays become more frequent.

The possible extension of the 75 tram service along the Burwood Highway to Knox Central was modelled in order to determine the effect on the surrounding road and bus network as outlined in Chapter 6. The forecast modelling indicated that by 2035, the introduction of the tram extension will:

- Result in a 0.7% mode shift from car to public transport in 2035 from trips to/from Knox Central;
- Result in an additional 8,800 daily tram patronage numbers along Route 75; and
- Result in a shift in passengers from bus services to tram services (some 3,800 passengers per day) for trips to and from Knox Central.

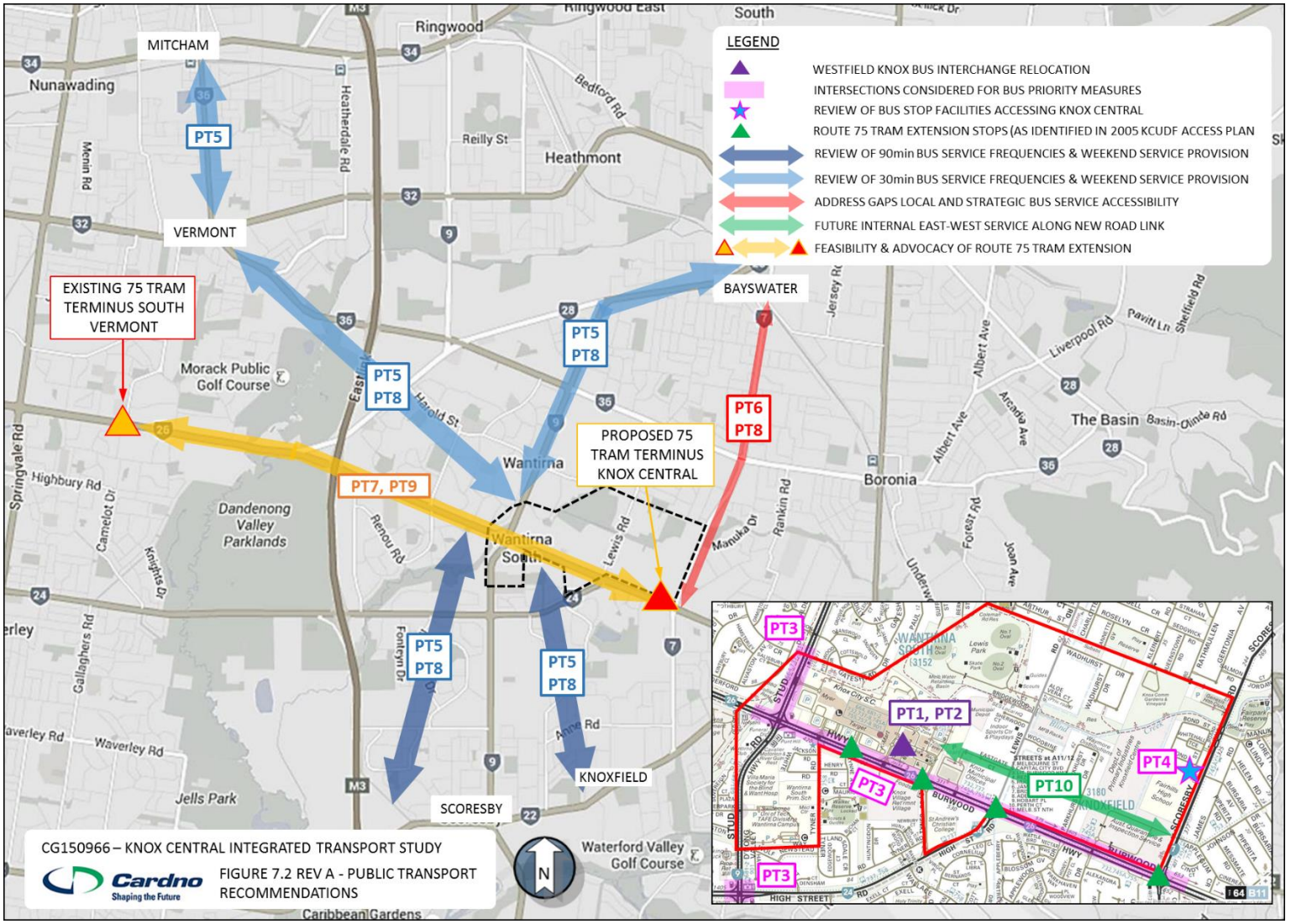
7.4 Public Transport Recommendations

Table 7-2 and corresponding Figure 7-2 details recommendations to be implemented over time that are intended to improve the public transport network and achieve the goals in providing a more comprehensive service that people will use to access Knox Central. The aim of these recommendations is to improve the network coverage and service frequency in the short to medium term whilst continuing to ensure that journey times remain reliable on the key access route along Burwood Highway as traffic volumes and congestion increases.

Table 7-2 Public Transport Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority	Issues Addressed
PT1	Support the relocation of the bus interchange as proposed under the Westfield Knox Stage 1 development.	PTV / Knox City Council	Short Term	Future Network
PT2	Liaise and coordinate with PTV to undertake a public transport awareness campaign associated with the relocation of the bus interchange at Westfield Knox.	PTV / Knox City Council	Short Term	Future Network
PT3	Investigate the potential to improve bus priority measures at intersections along Burwood Highway and Stud Road accessing the relocated bus interchange within Westfield Knox.	PTV / Knox City Council	Short Term	I6, I7, I8
PT4	Liaise and work with PTV to improve service information and the provision and maintenance of shelters at appropriate bus stops on the surrounding network.	PTV / Knox City Council	Short Term	I9
PT5	Liaise and work with PTV to assess the need to increase service frequencies on identified routes across the bus network servicing Knox Central.	PTV / Knox City Council	Short Term	I6
PT6	Liaise and work with PTV to further investigate and identify gaps in the local bus network to improve accessibility to bus services to Knox Central and neighbouring activity centres including the Wantirna Health Precinct.	PTV / Knox City Council	Short Term	I7
PT7	Undertake a feasibility study into the need and viability of the Route 75 tram extension along Burwood Highway to Knox Central.	PTV / Knox City Council	Medium Term	I10
PT8	Advocate the delivery of network frequency and coverage improvement projects identified in the short term.	PTV / Knox City Council	Medium Term	I6, I7
PT9	Advocate for the delivery of the Route 75 tram route extension.	PTV / Knox City Council	Short Term	I10
PT10	Design and construct the East-West link road as per the recommendations identified in the feasibility study recommended in R7.	Knox City Council	Long Term	I8

Figure 7-2 Public Transport Recommendations



8 Pedestrian & Cycle Network Assessment

8.1 Overview

This section summarises these improvements and also identifies additional measures to improve the pedestrian and cycle network over the wider Knox Central area that may be implemented as the precinct develops.

There is generally good network provision for pedestrians and cyclists throughout Knox Central. Shared paths form a significant portion of the pedestrian and cycle network within and around the study area, supported by pedestrian and cycle specific paths and facilities to provide good connectivity through Knox Central.

Significant connectivity through Knox Central is provided by the Blind Creek Trail, that forms a key east west pedestrian and bicycle route through the study area.

As existing and planned shared paths form a significant element of the pedestrian and cycling network, it is recognised that an integrated approach should be taken when identifying gaps within and improvements to the network through the study area.

It is understood that a number of improvements have been integrated into the works proposed in the Westfield Knox Shopping Centre development plan.

8.2 Existing Issues and Potential

The existing pedestrian and cycle network was recorded through a site visit, photography detailing the location and condition of the network facilities and aided by recent aerial photography.

A review of the Westfield Knox Stage 1 works proposals also identified a number of issues and planned solutions to be implemented as part of those works. Additional network improvements have been implemented to the south of Knox Central as part of the High Street Road duplication project completed in early 2016.

A number of deficiencies in the connectivity and condition of the pedestrian and cycle network were observed or identified, and are summarised in Table 8-1 presented graphically in Figure 8-1.

Table 8-1 Existing Pedestrian and Cycle Network Issues and Potential

Reference	Pedestrian and Cycle Network Issue
I11	There are insufficient pedestrian crossing times at signalised intersections along Burwood Highway to cater for pedestrians with limited mobility or children. This is a particular concern given the land uses south of Burwood Highway including aged care facilities and schools.
I12	Pedestrian phases are currently not automatic at intersections along Burwood Highway and need to be activated by the push button.
I13	The new shared path on the southeast corner of the Burwood Highway / High Street Road intersection is discontinuous. There are no current plans according to VicRoads to provide any further connections to the surrounding network beyond this point.
I14	An informal pedestrian route has formed across the front of a loading zone at the north-east corner of the Westfield Knox site creating a hazard of pedestrians and service vehicles.
I15	Pedestrians and cyclists using Blind Creek Trail currently have to cross Stud Road where they are required to utilised the traffic signals at the Westfield Knox access. This includes traversing an unsignalised left turn slip lane at the intersection, creating a conflict point with oncoming vehicles.
I16	The shared path on Scoresby Road is currently in poor condition, with uneven concrete surface and overgrown planting and other obstacles, likely to discourage use of the path by cyclists.
I17	There are currently a number of underpasses on Blind Creek Trail that do not have signs or warning markings, creating a hazard for cyclists.
I18	There is a lack of north south cycle links through Knox Central, however an informal desire line currently exists to Blind Creek Trail from the northern end of Parkhurst Drive. A link at this location would help promote cycling as a means of transport for workers employed in the industrial estates.

Reference	Pedestrian and Cycle Network Issue
I19	Existing narrow paths surrounding the Knox Westfield Shopping Centre do not encourage bicycle movements to/from or across the site.
I20	There is an opportunity to further integrate pedestrian and cycle network connectivity and facilities through Knox Central with the proposed east west road network link.
I21	There is also potential to further integrate pedestrian and cycle connections through Knox Central with the proposed north south road network links.
I22	There is currently a lack of end of trip facilities for cyclists at key trip generators within Knox Central.
I23	There is a lack of dedicated on-road bicycle lanes within Knox Central, and across Knox more broadly.

Figure 8-1 Identified Pedestrian and Cycle Network Issues and Potential

8.3 Pedestrian & Cycle Network Improvement Opportunities

8.3.1 Shared Paths

Shared path improvement measures have been identified under the Westfield Knox Shopping Centre development plan, which will address some of the issues highlighted in this report. These improvements include:

- Widening of the path on the Burwood Highway and Stud Road frontages of the site to function as a shared bicycle / pedestrian path; and
- Provision of a pedestrian crossing where the Blind Creek Trail meets Stud Road to provide direct connectivity across Stud Road for the trail.

A shared path has been provided along the southern side of High Street Road between Burwood Highway and Stud Road, however it has been identified that the shared path terminates at the southern side of Burwood Highway, leaving no connectivity to the surrounding pedestrian or cycle network. Measures that would provide connectivity from this location to the proposed shared path network north of Burwood Highway and into the study area should be investigated.

The condition of the shared footpath along the western side of Scoresby Road was found to be poor, considering its proximity and connections to Fairhills High School. It is considered that a shared path along Scoresby Road should be maintained, and hence measures be taken to improve the path.

A number of deficiencies and areas for improvement were identified along Blind Creek Trail. It is suggested that a more detailed condition audit be undertaken of the trail through the study area that will allow for a set of costed recommendations to be provided to address issues identified for further action in a prioritised manner.

The section of Burwood Highway between Stud Road and High Street Road is considered a pedestrian priority area under the SmartRoads road use hierarchy. Consultation with VicRoads should therefore be undertaken with the view of reducing the speed limit along Burwood Highway through Knox Central between Stud Road and High Street Road from the existing 80kph to 60kph in order to improve safety for pedestrians and cyclists along this section of the road.

While it does not necessarily need to be a shared path, there is an opportunity to provide additional walking and cycling network facilities along the proposed east west link road, and should be considered when developing proposals for this road.

8.3.2 Pedestrian Network

Pedestrian improvements identified in the Westfield Knox Shopping Centre development plan included a number of additional pedestrian access points from the shopping centre to the external foot or shared paths to the north and south of the site.

As part of the High Street Road duplication project, an additional signalised pedestrian crossing is being provided on High Street Road, between Wolf Street and Wallace Road, whilst maintaining a pedestrian crossing facility at the upgraded High Street Road / Tyner Road intersection. Pedestrian connectivity from this location through to Burwood Highway and Knox Central should be reviewed so that the best use of the crossing can be achieved.

Pedestrian cross times over Burwood Highway are considered to be too short. Given the school and aged care land uses in the areas south of Burwood Highway, it would be considered appropriate to review the pedestrian cross times and pedestrian phase activation at each of the signalised intersections accessing Knox Central.

The Westfield Knox Shopping Centre development plan identifies new residential development between Melbourne Street and Lewis Park along the north-east side of the shopping centre. It would be assumed that improved access and footpaths would be provided on the northern side of Melbourne Road in the vicinity of the loading dock as part of this development. It would be recommended that a short term measure to direct pedestrians away from loading area be implemented to improve pedestrian safety around the dock area.

8.3.3 Cycle Network

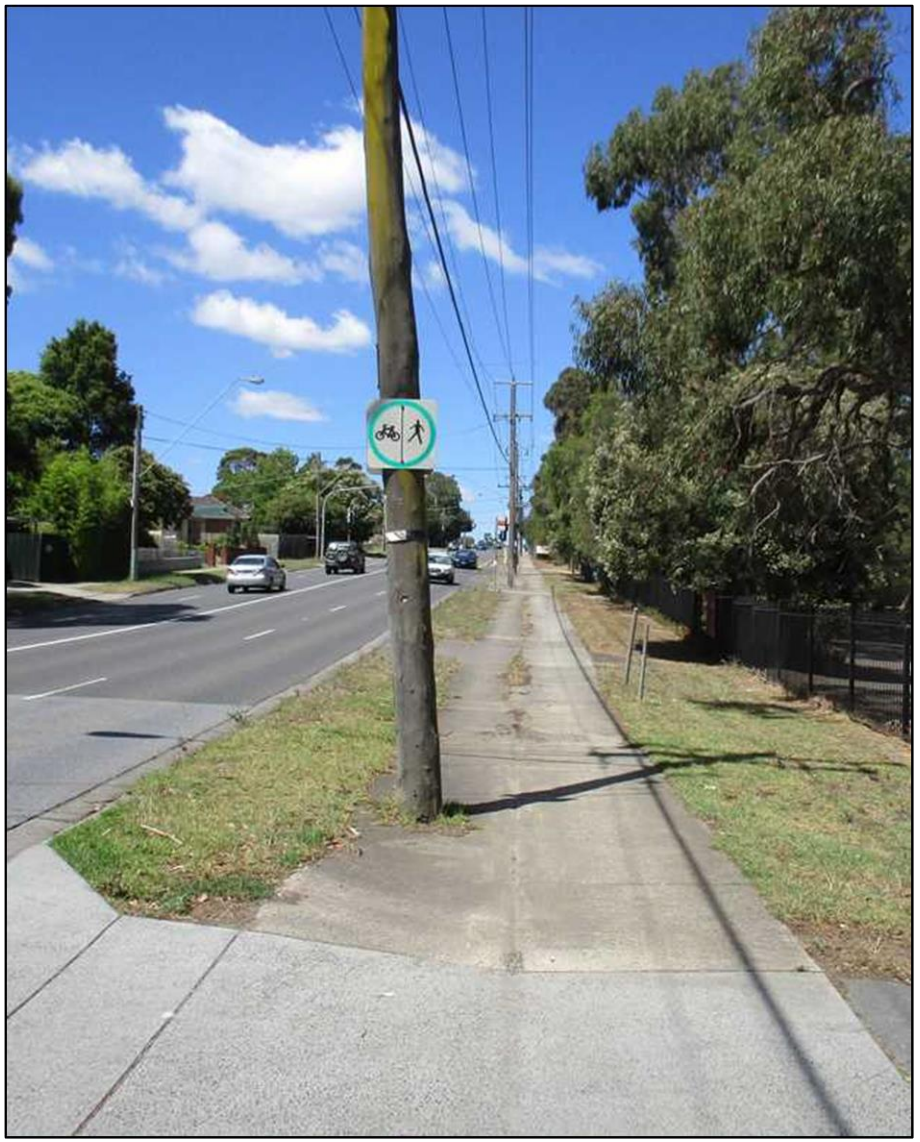
A considerable number of improvements to the cycle network have been identified as part of the proposed shared path improvements.

A lack of a north-south cycle link through the study area has been identified. While Lewis Road would be considered the more obvious link to incorporate cycle connectivity, it is already above environmental vehicle capacity. Should cycle facilities not be able to be incorporated along Lewis Road, evidence suggests that a potential cycle desire line exists between the Parkhurst Drive industrial estate and the Blind Creek Trail. A Parkhurst Road

link would formalise an existing desire line and also provide a north-south through link and would help promote cycling for employees to/from the industrial area. There is also potential for cycle connectivity along the proposed north south link between Bridgewood Court and Eastgate Court.

As the nature of the development within Knox Central becomes more apparent, cycling demand patterns will also emerge. It is therefore recommended that further investigation as to the most appropriate location for a north south cycle link through Knox Central be undertaken as development progresses in the area.

The addition of bicycle lanterns at the new signalised crossings at High Street Road could also be considered to promote these signals as part of a north-south bicycle route. The addition of bicycle lanterns at most intersections on the approach to Westfield Knox will also help with connectivity for cyclists.



8.4 Pedestrian & Cycle Network Recommendations

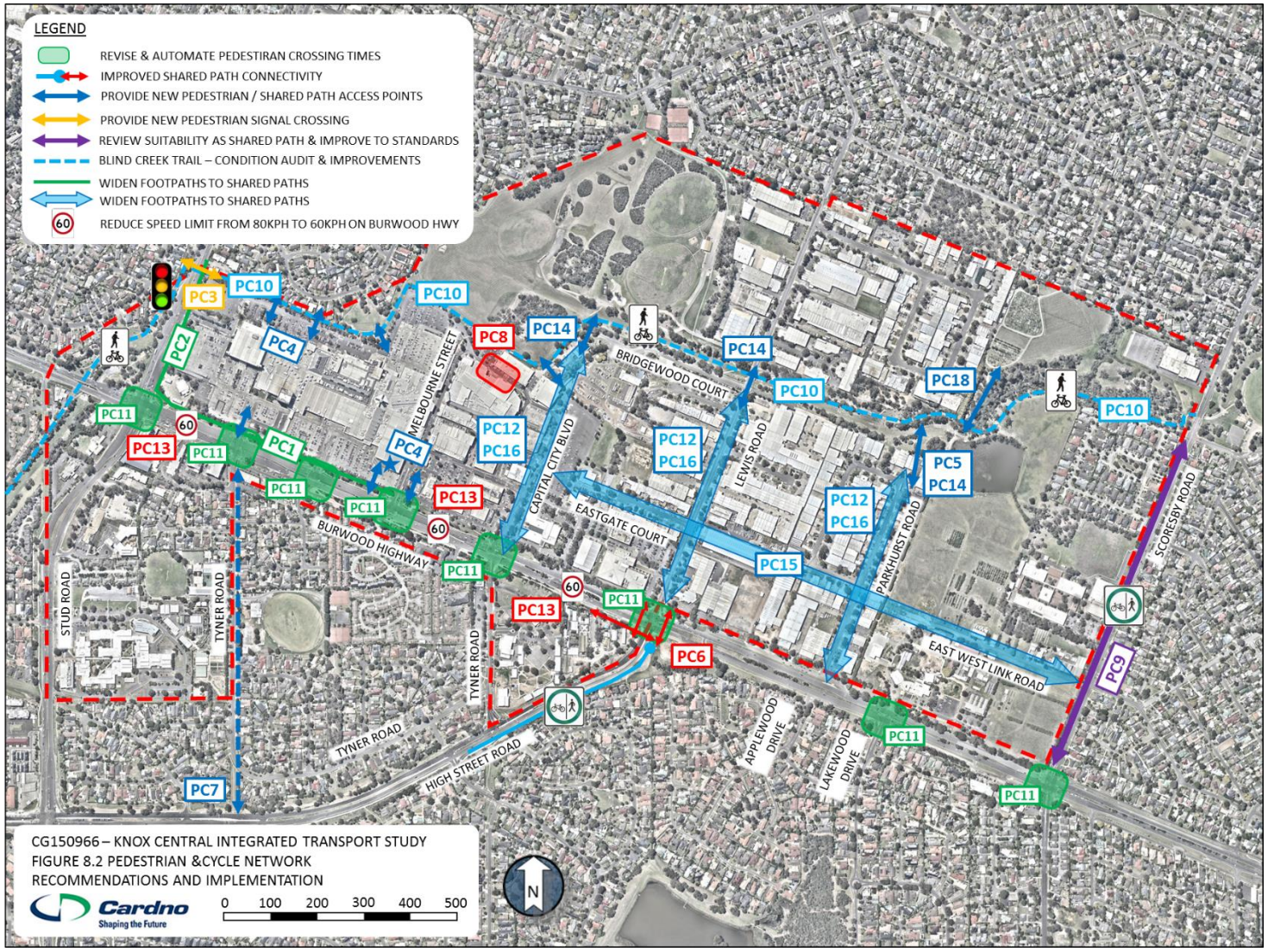
Table 8-2 and corresponding Figure 8-2 details recommendations to be implemented over time that are intended to improve the pedestrian and cycle network to provide greater connectivity into and through Knox Central. The aim of these recommendations is to ensure that current planned improvements are implemented in the short to medium term whilst ensuring that additional improvements identified continue to improve the network in the short term and as development in Knox Central progresses.

Table 8-2 Pedestrian & Cycle Network Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority	Issues Addressed
PC1	Widen the footpath on the northern side of Burwood Highway between Stud Road and Melbourne Road to function as a shared bicycle / pedestrian path.	Westfield	Short Term	I19
PC2	Widen the footpath on the eastern side of Stud Road between the Blind Creek Trail link and Burwood Highway to function as a shared bicycle / pedestrian path.	Westfield	Short Term	I19
PC3	Provide a pedestrian crossing on each carriageway where the Blind Creek Trail meets Stud Road to provide direct connectivity for the trail.	Westfield	Short Term	I15
PC4	Provide additional pedestrian and shared path access points from Westfield Knox to the external foot or shared paths to the north and south of the shopping centre. Provide proposed additional cycle parking facilities as per Stage 1 development plan for Westfield Knox.	Westfield	Short Term	I19
PC5	Provide a link between Parkhurst Drive and Blind Creek Trail at the existing desire lines to formalise access for pedestrians and cyclists through this area.	Knox City Council	Short Term	I18
PC6	Determine measures to improve shared path connectivity from High Street Road to north of Burwood Highway and implement measures identified.	Knox City Council / VicRoads	Short Term	I13
PC7	Improve wayfinding to shopping centre at new pedestrian crossing on High Street Road between Wolf Street and Wallace Road.	Knox City Council	Short Term	Future Network
PC8	Provide a short term measure to direct pedestrians away from the entrance to the loading dock on Melbourne Road along the north-east corner of the Knox City.	Westfield	Short Term	I14
PC9	Undertake a review of the shared path along the western side of Scoresby Road to include the provision of signage, the foot/cycle path condition, and its suitability as a shared path and identify improvement measures and implement the proposed measures.	Knox City Council	Short Term	I16

Item Ref	Project Description / Recommendation	Responsibility	Priority	Issues Addressed
PC10	Commission Blind Creek Trail audit, and implement identified improvement measures.	Knox City Council	Short Term	I17
PC11	Increase crossing times and automate pedestrian phases at the identified signalised intersections on Burwood Highway.	VicRoads / Knox City Council	Short Term	I11, I12
PC12	Commission a study to investigate north-south cycle links through the study area north of Burwood Highway, including Lewis Road and Parkhurst Drive.	Knox City Council	Medium Term	I18
PC13	Advocate to VicRoads regarding reducing the speed limit along Burwood Highway between Stud Road and High Street Road from the existing 80km/h to 60 km/h in order to improve safety for pedestrians and cyclists crossing the road, particularly through the SmartRoads pedestrian activity zone.	Knox City Council / VicRoads	Medium Term	I11
PC14	Provide additional north-south access points to Blind Creek Trail to service new and existing development.	Knox City Council / Developers	Medium Term	I18, I21
PC15	Integrate pedestrian and cycle facilities into the proposed East-West link road.	Knox City Council	Long Term	I20
PC16	Integrate north south cycle link proposals into existing and proposed road network as identified through in the study outlined in PC12.	Knox City Council	Long Term	I20
PC 17	Consider on-road bicycle lanes in future reviews of bicycle infrastructure across Knox.	Knox City Council	Medium Term	I23
PC 18	Provide a link between Blind Creek Trail and the Community Garden / Vineyard site to provide access for pedestrians and cyclists through this area.	Knox City Council	Long Term	I18

Figure 8-2 Pedestrian & Cycling Recommendations



9 Parking Assessment

9.1 Overview

This section summarises the existing car parking provision within Knox Central and identifies opportunities and some recommendations to ensure parking is adequately catered for as development progresses.

There is considerable provision of both on and off street car parking within Knox Central. Westfield Knox currently provides some 6,300 car parking spaces, and larger employers providing private off street parking for employees and visitors. This provision is expected to increase to approximately 8,850 parking spaces with the Stage 1 Westfield Knox development

As development increases car park demand will also increase, and the challenge will be to provide adequate parking to cope with the additional demand, while promoting sustainable means of transport. These may include walking and cycling and the use of public transport and 'rideshare' initiatives to help reduce car ownership.

9.2 Existing Issues and Potential

There are currently few issues with the provision of parking in the study area. Observations made on site suggested that there is no evidence of overspill into neighbouring residential streets and that there was adequate on and off street parking in the industrial area. Potential future car parking issues that may arise as development progresses that will need to be addressed are summarised in Table 9-1.

Table 9-1 Potential Car Parking Issues

Reference	Car Parking Issue
I23	Potential parking overspill from Westfield Knox into surrounding Knox Central streets and car parks and neighboring residential streets.
I24	Car parking demand exceeding supply within Knox Central, causing overspill into Westfield Knox and/or neighboring residential streets.
I25	Car parking generated by the industrial area increasing and spilling into surrounding streets with Knox Central and beyond.
I26	Car ownership outstripping the statutory supply requirements for new residential development in Knox Central, resulting in on-street resident parking demand.

9.3 Car Parking Improvement Opportunities

It is understood that there are statutory requirements to provide adequate car parking for both residential and commercial developments. It is recommended that in the short term, parking provisions for new development should be in accordance with current statutory requirements for the type of development.

As development in the study area increases, it would be recommended in the medium to long term that on-street and Council managed off-street parking be monitored and if necessary, parking rates be managed through a Precinct Parking Plan, in line with the medium term action 4.13 specified in Council's 'Knox Integrated Transport Plan 2015'.

The development of Green Travel Plan (GTP) policy outlined in the Knox Integrated Transport Plan (ITP) will also be a key initiative to encourage reduced trips made by cars and lower levels of car ownership in general. It is understood that larger medium and high density residential developments will be subject to GTPs.

It should also be recognised that there will be an increase in the development of rideshare and similar initiatives in the future. Activity centres such as Knox Central will generate higher trip rates, which will encourage these types of services to operate in the area, and as such, adequate parking to facilitate these vehicles should be provided in locations that will attract usage.

The use of electric cars will also increase as technology develops and they become a more attractive option from a cost point of view. Adequate provision for these vehicles such as charge points should be allowed for in new developments and public car parks.

It is recognised that as part of the redevelopment of the Westfield Knox Shopping Centre site, the taxi rank is to be relocated to adjacent to the new bus interchange facility, with six taxi zones proposed to be provided.

9.4 Car Parking Recommendations

Table 9-2 details recommendations to be implemented over time that are intended to manage the provision and usage of the various on and off street car parking areas within Knox Central. The aim of these recommendations is to ensure future development does not result in car parking demand does not outstrip supply and adversely impact the surrounding streets internally and also to neighbouring residential streets.

Table 9-2 Car Parking Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority	Issues Addressed
P1	Require that statutory car parking rates are satisfied for new developments in order to provide adequate off street parking.	Knox City Council	Short – Long Term	I22
P2	Commission parking assessments to monitor on-street and Council managed off-street parking as development progresses in the Knox Central.	Knox City Council	Medium Term	I22
P3	Require Green Travel Plans for all appropriate residential and commercial developments as per the requirements set out in Council policy developed under the Knox ITP actions.	Knox City Council	Medium Term	I22, I23, I24
P4	Prepare a Precinct Parking Plan for Knox Central as per the requirements set out in Council policy developed under the Knox ITP actions to manage parking throughout the study area as development increases.	Knox City Council	Medium - Long Term	I21, I22, I23, I24
P5	Support provision for electric cars in both residential and commercial car parks, with dedicated charge points for electric cars in public car parks.	Knox City Council	Medium - Long Term	Future Provision
P6	Support parking provision for rideshare vehicles in locations that will encourage usage.	Knox City Council	Medium - Long Term	Future Provision

10 Review of 2005 Knox Central Urban Development Framework

As discussed in section 3.2.5 of this report, the purpose of this ITS is to review and build upon the transport objectives of the 2005 KCUDF through the recommendations proposed in this study. This section highlights the measures that are still considered relevant and appropriate and have been incorporated into this ITS, and also outlines why other aspects are no longer considered suitable.

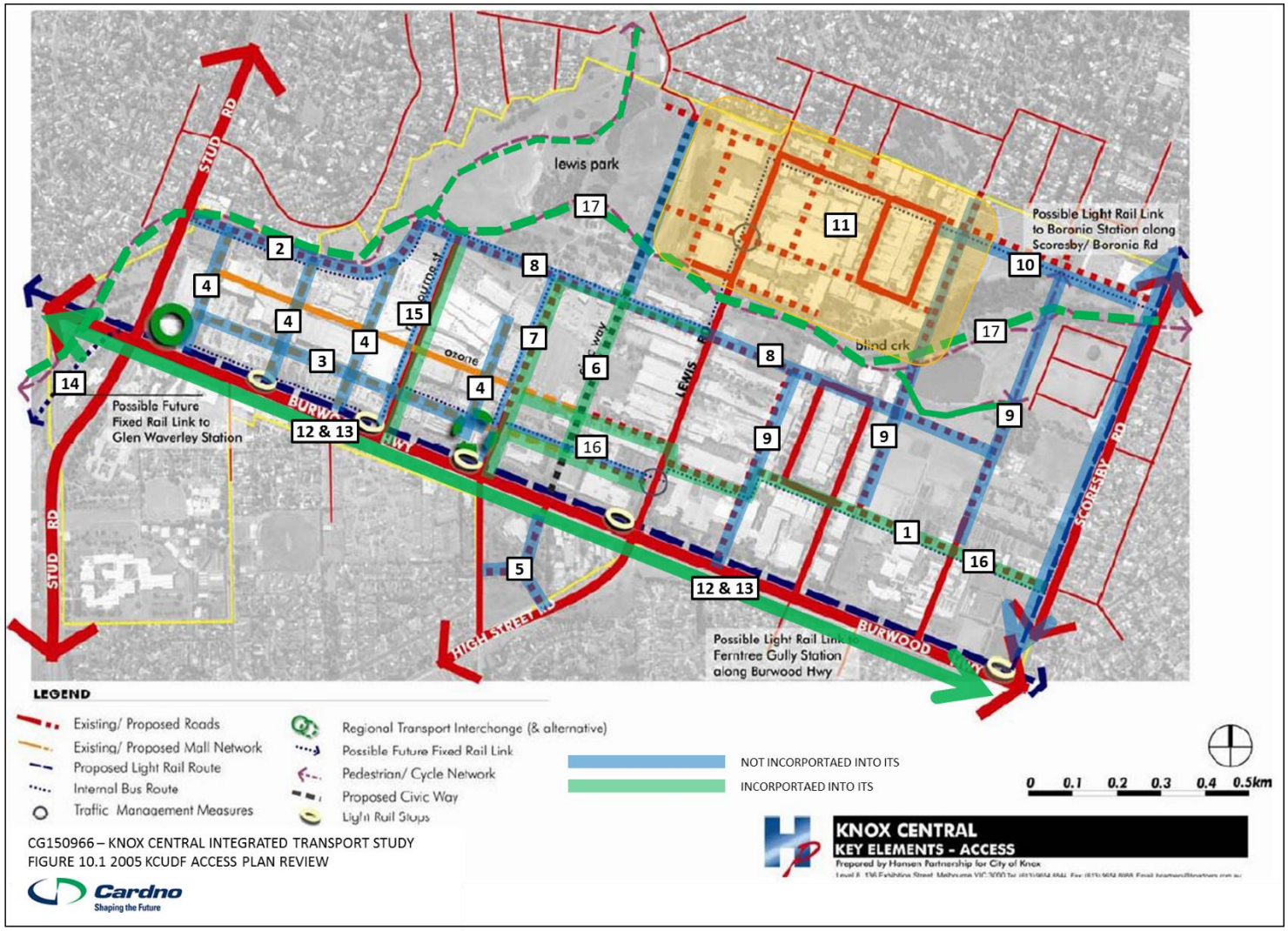
Tables 10-1 outlines the 2005 KCUDF measures that have been incorporated into this ITS, and Table 10-2 details those that have been excluded. Reference is made to the KCUDF plan shown in Figure 10-1.

Table 10-1 2005 KCUDF Measures Maintained in this ITS

Reference	2005 KCUDF Element	Included in 2016 ITS	Justification
1	East west connection between Capital City Boulevard and Scoresby Road, parallel to Burwood Highway	Yes	Demonstrated demand to assist in distributing vehicles throughout Knox Central by 2025 and onwards
2	East west connection following Blind Creek Trail between Stud Road and Melbourne Street	No	Demand not demonstrated to support link
3	East west link through Westfield Knox site	No	This ITS was not intended to assess the internal shopping centre parking circulation network
4	Four north south links through Westfield Knox site	No	This ITS was not intended to assess the internal shopping centre parking circulation network
5	Road links south of Burwood Highway, within High Street Road and Tyner Road, connecting to proposed Civic Way	No	Land use changed to support St Andrews Christian College, and Civic Way not supported
6	Civic Way	No	The nature and location of the proposed Civic Way was such that the capacity would be low and encouraging lower speeds, therefore not providing a suitable link to disperse the forecast traffic volumes through the study area. The proposed signalised intersection at Burwood Highway would also not be compatible with the intent of the link, particularly as there are currently six intersections on the 1200 metre section of Burwood Highway between and including Stud Road and Lewis Road. It is also considered that the close proximity of that intersection is not desirable for safety reasons.

Reference	2005 KCUDF Element	Included in 2016 ITS	Justification
7	Extension of Capital City Boulevard connection north to Bridgewood Court	Yes	Link connection to proposed civic precinct
8	East west link parallel south of Blink Creek Trail between Melbourne Street and Bond Street to the west of Scoresby Road	No	Demand not demonstrated to support link
9	Three north south links parallel to and between Lewis Road and Scoresby Road	No	Demand not demonstrated to support link
10	East west link between Lewis Road and Scoresby Road at the north of the Knox Central study area	No	Demand not demonstrated to support link
11	Network links north of Blind Creek Trail around Lewis Road and Wadhurst Drive	No	Potential future local links but not considered for modelling
12	Proposed Route 75 Tram (Light Rail) link	Yes	Demonstrated mode shift from Bus and Private Vehicle
13	Light Rail Stops	Yes	Provided at existing bus stop locations
14	Future fixed rail (train) link from Glen Waverly rail station	No	Demand not demonstrated to support proposed rail link
15	Internal bus service along capital City Boulevard and Melbourne Street	No	This ITS was not intended to assess the internal shopping centre network
16	Bus service along proposed east west link between Capital City Boulevard and Scoresby Road	Yes	Potential future demand to support bus service through Knox Central
17	Pedestrian & Cycle link along Blind Creek Trail	Yes	Existing network – improvement measures to be implemented

Figure 10-1 2005 KCUDF Access Plan Review



11 Study Recommendations

The recommendations for each mode discussed throughout this ITS report are summarised in this section. The recommendations are set out in order of priority with the proposed timescales as shown in Table 11-1.

Table 11-1 Priority Timeframes

Priority	Timeframe
Short Term	Within 5 Years
Medium Term	5 to 10 Years
Long Term	10 to 20 Years Plus
Ongoing	Ongoing

11.1 Road Network Recommendations

Sections 5 and 6 outlined the strategic and local traffic modelling undertaken to determine a suitable road network and intersection configuration that would be suitable to facilitate the growth within and around Knox Central. The recommendations detailed in Table 11-2, and illustrated in Figure 6-10 have been informed by the traffic modelling and analysis of the gaps in the existing network.

Table 11-2 Road Network Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority
R1	Advocate to VicRoads for the signalisation of the Lewis Road/Boronia Road intersection, and implement VicRoads endorsed intersection layout and signal plans.	VicRoads / Knox City Council	Short Term
R2	Advocate to VicRoads to undertake intersection timing and phasing analysis at key intersections on Burwood Highway and Stud Road to identify improvements in the performance of the existing intersection arrangements.	VicRoads / Knox City Council	Short Term
R3	Further investigate the timing and nature of the proposed north south link road connecting Eastgate Court and Bridgewood Court with Capital City Boulevard.	Knox City Council	Short Term
R4	Investigate the form of intersection connections that can be feasibly provided to Lewis Road north of Burwood Highway, and the proposed north-south link, particularly at the intersections with Bridgewood Court and Eastgate Court.	Knox City Council	Short Term
R5	Investigate whether the preferred access to the existing Lakewood Drive/Burwood Highway intersection through the DELWP site as proposed in the draft DELWP precinct masterplan is feasible.	Knox City Council	Short-Medium Term
R6	Consult with VicRoads to determine an acceptable configuration for the intersections on Burwood Highway between High Street Road and Scoresby Road, considering the options tested in this study.	VicRoads / Knox City Council	Medium Term
R7	Investigate the feasibility of providing a staged construction of the identified East-West road connection between Scoresby Road and Lewis Road, and the timing of the implementation of the stages as part of the detailed planning for the DELWP site.	Knox City Council	Medium Term
R8	Design and construct the East-West link road as per the recommendations identified in the feasibility study recommended in R7.	Knox City Council	Medium –Long Term
R9	Implement the VicRoads endorsed intersection configuration along Burwood Highway between Lewis Road and Scoresby Road.	VicRoads / Knox City Council	Medium –Long Term

11.2 Public Transport Recommendations

Sections 3 and 7 summarised the existing public transport network and service provision, and identified a number of recommendations that would both help accessibility into Knox Central from the surrounding areas by public transport, and also cater for the additional internal development in the study area. The option of extending the Route 75 tram service to Knox Central was considered as part of these recommendations. Table 11-3 and Figure 7-2 summarise the recommendation for the Public transport system.

Table 11-3 Public Transport Recommendations and Implementation

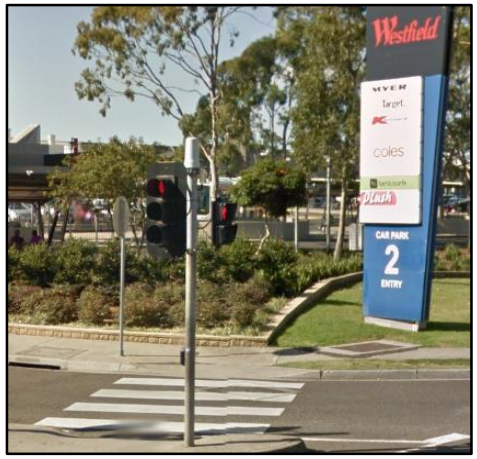
Item Ref	Project Description / Recommendation	Responsibility	Priority
PT1	Support the relocation of the bus interchange as proposed under the Westfield Knox Stage 1 development.	PTV / Knox City Council	Short Term
PT2	Liaise and coordinate with PTV to undertake a public transport awareness campaign associated with the relocation of the bus interchange at Westfield Knox.	PTV / Knox City Council	Short Term
PT3	Investigate the potential to improve bus priority measures at intersections along Burwood Highway and Stud Road accessing the relocated bus interchange within Westfield Knox.	PTV / Knox City Council	Short Term
PT4	Liaise and work with PTV to improve service information and the provision and maintenance of shelters at appropriate bus stops on the surrounding network.	PTV / Knox City Council	Short Term
PT5	Liaise and work with PTV to assess the need to increase service frequencies on identified routes across the bus network servicing Knox Central.	PTV / Knox City Council	Short Term
PT6	Liaise and work with PTV to further investigate and identify gaps in the local bus network to improve accessibility to bus services to Knox Central and neighbouring activity centres including the Wantirna Health Precinct.	PTV / Knox City Council	Short Term
PT7	Undertake a feasibility study into the need and viability of the Route 75 tram extension along Burwood Highway to Knox Central.	PTV / Knox City Council	Medium Term
PT8	Advocate the delivery of network frequency and coverage improvement projects identified in the short term.	PTV / Knox City Council	Medium Term
PT9	Advocate for the delivery of the Route 75 tram route extension.	PTV / Knox City Council	Short Term
PT10	Design and construct the East-West link road as per the recommendations identified in the feasibility study recommended in R7.	Knox City Council	Long Term

11.3 Pedestrian & Cycling Recommendations

Section 3 summarises the existing issues for pedestrians and cyclists, identifying a number of gaps in the existing and planned network. Section 8 identified a number of proposed measures and recommendations to provide a well-connected Knox Central precinct. Table 11-4 and Figure 8-2 summarise the recommendation for the pedestrian and cyclist network.

Table 11.4 Pedestrian & Cycle Network Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority
PC1	Widen the footpath on the northern side of Burwood Highway between Stud Road and Melbourne Road to function as a shared bicycle / pedestrian path.	Westfield	Short Term
PC2	Widen the footpath on the eastern side of Stud Road between the Blind Creek Trail link and Burwood Highway to function as a shared bicycle / pedestrian path.	Westfield	Short Term
PC3	Provide a pedestrian crossing on each carriageway where the Blind Creek Trail meets Stud Road to provide direct connectivity for the trail.	Westfield	Short Term
PC4	Provide additional pedestrian and shared path access points from Westfield Knox to the external foot or shared paths to the north and south of the shopping centre. Provide proposed additional cycle parking facilities as per Stage 1 development plan for Westfield Knox.	Westfield	Short Term
PC5	Provide a link between Parkhurst Drive and Blind Creek Trail at the existing desire lines to formalise access for pedestrians and cyclists through this area.	Knox City Council	Short Term
PC6	Determine measures to improve shared path connectivity from High Street Road to north of Burwood Highway and implement measures identified.	Knox City Council / VicRoads	Short Term
PC7	Improve wayfinding to shopping centre at new pedestrian crossing on High Street Road between Wolf Street and Wallace Road.	Knox City Council	Short Term
PC8	Provide a short term measure to direct pedestrians away from the entrance to the loading dock on Melbourne Road along the north-east corner of the Knox City.	Westfield	Short Term
PC9	Undertake a review of the shared path along the western side of Scoresby Road to include the provision of signage, the path condition, and its suitability as a shared path and identify improvement measures and implement proposed measures.	Knox City Council	Short Term
PC10	Commission Blind Creek Trail audit, and implement the identified improvement measures.	Knox City Council	Short Term
PC11	Increase crossing times and automate pedestrian phases at the identified signalised intersections on Burwood Highway.	VicRoads / Knox City Council	Short Term
PC12	Commission a study to investigate north-south cycle links through the study area north of Burwood Highway, including Lewis Road and Parkhurst Drive.	Knox City Council	Medium Term
PC13	Advocate to VicRoads regarding reducing the speed limit along Burwood Highway between Stud Road and High Street Road from the existing 80km/h to 60 km/h in order to improve safety for pedestrians and cyclists crossing the road, particularly through the SmartRoads pedestrian activity zone.	Knox City Council / VicRoads	Medium Term



11.4 Car Parking

Section 3 and Section 9 determined that there was generally few car parking issues within Knox Central currently, however Table 11-5 summarises the recommendations for proposed parking recommendations.

Item Ref	Project Description / Recommendation	Responsibility	Priority
PC14	Provide additional north-south access points to Blind Creek Trail to service new and existing development	Knox City Council	Medium Term
PC15	Integrate pedestrian and cycle facilities into the proposed East-West link road	Knox City Council	Long Term
PC16	Integrate north south cycle link proposals into existing and proposed road network as identified through in the study outlined in PC12.	Knox City Council	Long Term
PC17	Consider on-road bicycle lanes in future reviews of bicycle infrastructure across Knox.	Knox City Council	Long Term
PC18	Provide a link between Blind Creek Trail and the Community Garden / Vineyard site to provide access for pedestrians and cyclists through this area.	Knox City Council	Long Term

Table 11-5 Car Parking Recommendations and Implementation

Item Ref	Project Description / Recommendation	Responsibility	Priority
P1	Require that statutory car parking rates are satisfied for new developments in order to provide adequate off street parking.	Knox City Council	Short – Long Term
P2	Commission parking assessments to monitor on-street and Council managed off-street parking as development progresses in the Knox Central.	Knox City Council	Medium Term
P3	Require Green Travel Plans for all appropriate residential and commercial developments as per the requirements set out in Council policy developed under the Knox ITP actions.	Knox City Council	Medium Term
P4	Prepare a Precinct Parking Plan for Knox Central as per the requirements set out in Council policy developed under the Knox ITP actions to manage parking throughout the study area as development increases.	Knox City Council	Medium - Long Term
P5	Support provision for electric cars in both residential and commercial car parks, with dedicated charge points for electric cars in public car parks.	Knox City Council	Long Term
P6	Support parking provision for rideshare vehicles in locations that will encourage usage.	Knox City Council	Long Term

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