Surf Parade Traffic Modelling

Prepared for Bass Coast Council

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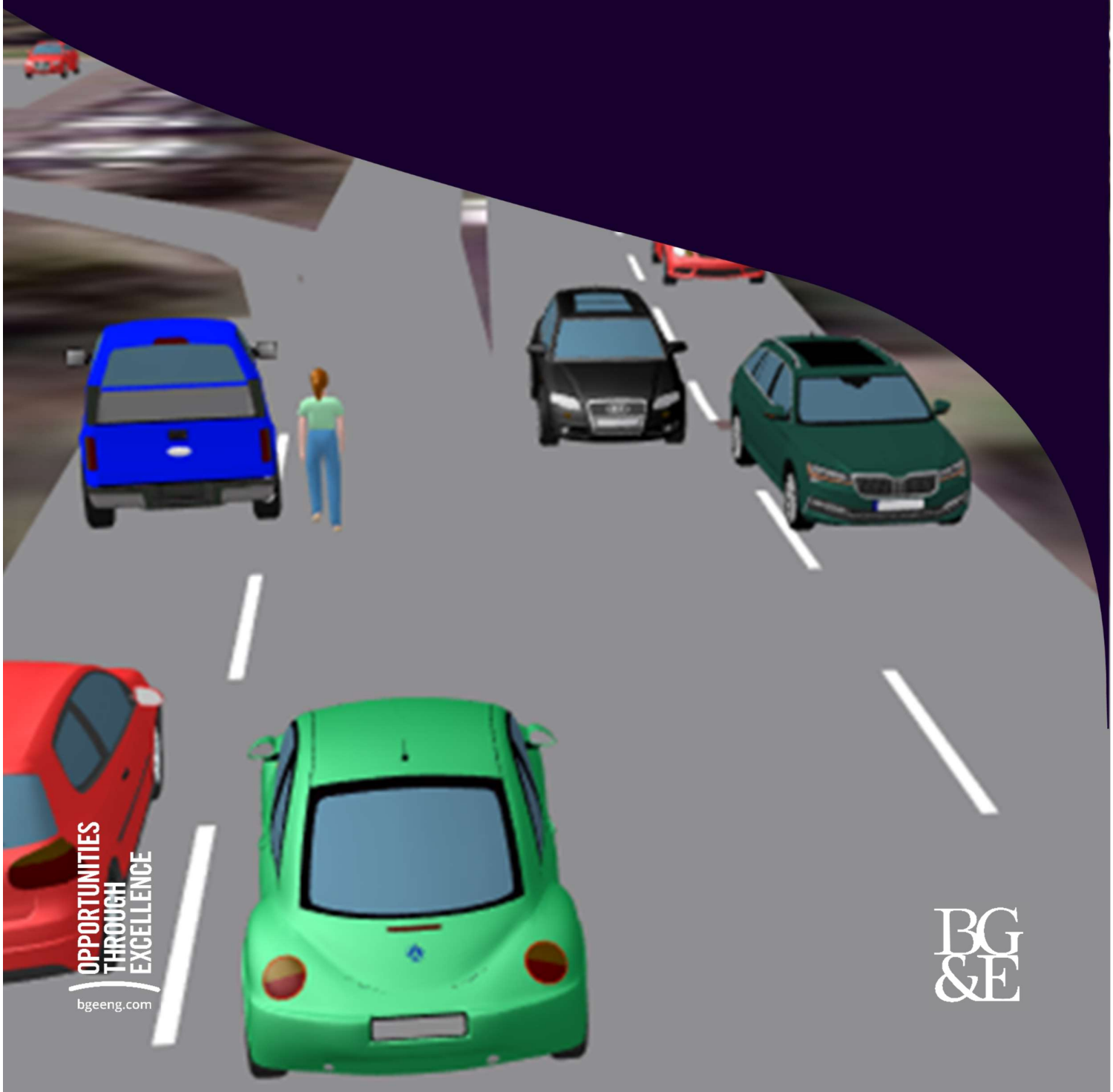

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Contents

1. Introduction 1
   - 1.1 Background 1
   - 1.2 Project Objective 1
   - 1.3 Scope of Work 1
   - 1.4 Study Area 2
2. Existing conditions 3
   - 2.1 Traffic Conditions 3
3. GPS Data 7
4. Option Testing 10
   - 4.1 Option 1 10
   - 4.2 Option 2 11
   - 4.3 Option 3 12
5. Model Development 13
   - 5.1 Software Platform 13
   - 5.2 Time Period 13
   - 5.3 Calibration Validation 13
   - 5.4 Assessment Criteria 13
6. Summer Peak Model 15
7. Future Year Demand 17
   - 7.1 Option Demand Assumptions 17
8. Base Model - Operational Results 20
9. Options - Operational Results 21
   - 9.1 Option 1 21
   - 9.2 Option 2 22
   - 9.3 Option 3 24
10. Operational Assessment Comparison 26
   - 10.1 LoS 26
   - 10.2 Travel Time 26
   - 10.3 Network Statistics 27
   - 10.4 Volumes on Lohr Avenue 27
11. Conclusion and recommendation 29

Appendices

Appendix A - Calibration and Validation technical note 31
Appendix B - LoS by movement 33

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1. Introduction

1.1 Background

Bass Coast Council intends to construct a shared path along Surf Parade between the existing shared path between Ozone Street and Inverloch Surf Life Saving Club. The site is currently a two-way road with parallel parking on either side and no footpaths. This report seeks to assess different options for the introduction of the shared path within this space.

The construction of the shared path will ensure a strategic fit in Council's wider cycling strategies. The overall plan will allow for cycle connectivity from the Inverloch town centre, along Surf Parade, Goroke Street and providing an overall connection to Wonthaggi.

A shared path has been constructed along Surf Parade between Ozone Street and Ramsey Boulevard by using space available on the adjacent crown land. The corridor allows for a shared path, parallel parking and two-way traffic. A before and after comparison showing the implementation of the shared path is presented in Figure 1-1.

Figure 1-1: Surf Parade East of Ozone St – Before and After Shared Path Implementation

Similar treatments have not been able to be constructed on Surf Parade between Ozone Street and Goroke Street, due to the importance of the sand dune and vegetation in preventing coastal erosion located on the adjacent crown land. As such, the shared path will be required to be constructed within the council road reserve.

Council has developed several options to accommodate the shared path in the limited space provided. These options seek to create additional space by either reducing on street parking, converting the two-way road to one-way or a combination of both.

1.2 Project Objective

The objective of the project is to understand the traffic implications associated with potential options for the introduction of a shared path along Surf Parade. The options seek to reduce traffic impacts for road users along the street while still allowing enough space for a shared path that would provide safe access for both cyclists and pedestrians.

1.3 Scope of Work

To understand the traffic impacts associated with each option, BG&E has developed a traffic microsimulation model, using VISSIM. This involved the procurement of GPS data relating to trips throughout the area. The GPS data has been sourced from TomTom to understand how people travel through the area now and to understand how vehicles are likely to change route under options that change the connectivity of the network.

The model has been calibrated and validated in accordance with the *VicRoads Transport Modelling Guidelines, Volume 4: Simulation Modelling 2019* and has been used to test three options developed by Bass Coast council to

understand the impacts on the wider road network. This report summarises the findings of the GPS study and traffic model.

1.4 Study Area

Figure 1-2 below shows the extent of the study area. The model covers Goroke Street between Toorak Road and Surf Parade, Surf Parade between Goroke Street and Ozone Street and Lohr Avenue between Goroke Street and Ozone Street.

Figure 1-2: Study Area

2. Existing conditions

Currently, Surf Parade between Ozone Parade and Goroke Street features two-way traffic with one lane in each direction and parallel parking on the unsealed shoulders of the road. No walking or cycling facilities exist and pedestrians and cyclists must use the road. Similar conditions exist on Goroke Street, however there is less parking available and a footpath exists between along the western side of the road.

Ripple Drive, Paperbark Place and Lohr Avenue all have brick pavers operating as tactile surface treatments, slowing down traffic.

These features and the existing traffic conditions are described in more detail in the following sections of this report. Details of the surveys and site visit are described in the calibration validation technical note in Appendix A.

2.1 Traffic Conditions

Site observations indicated that the parallel parking along Surf Parade frequently disrupts traffic, as drivers must stop to allow the person in front of them to park. A representation of this condition is presented in Figure 2-1. Further, due to the narrow lanes and the parking behaviour caused by the lack of lane markings, traffic in the opposite direction can also be delayed by the parking.

Figure 2-1: Parking Delays as Observed on Site

The highest concentration of pedestrian movements can be found around the Surf Parade/Goroke Street intersection next to the Surf Life Saving Club. The movements consist of either people heading to the beach from their parked cars or the surrounding houses travelling to the beach. Due to the lack of footpaths, some pedestrians are observed walking along the road, interacting with traffic as illustrated in Figure 2-2.

Not only does this high parking and pedestrian activity delay traffic by blocking vehicles behind them, but drivers have to constantly be aware they may have to come to a sudden stop, affecting the headways and acceleration rates.

Figure 2-2: Pedestrians Utilising Carriageway

Local Area Traffic Management (LATM) controls were also observed within the study area, as well as road features implemented to reduce the speed and the volume of cars.

There is a slow point on Surf Parade between Ozone Street and Wave Street, shown in Figure 2-3, only allowing for one direction of traffic to pass through. This results in minor queuing and a slowing down of traffic. There are also speed humps on Surf Parade either side of Goroke Street.

Figure 2-3: Slow Point on Surf Parade

The brick pavers on the following roads also operate as tactile surface treatments, slowing vehicles travelling along the streets:

- Lohr Avenue
- Ozone Street
- Wave Street
- Paperbark Place
- Ripple Road

This paved surface is shown below in Figure 2-4.

Figure 2-4: Paved Surface on Lohr Avenue

The site was observed traffic lanes narrower than the standard 3m, as shown in Figure 2-5. This is observed to reduce the speed of the vehicles below the sign posted 50km/h.

Figure 2-5: Narrow Lanes along Surf Parade

3. GPS Data

GPS data has been supplied by TomTom to help understand route choice within the area and to understand the effect of route choice within the area with the conversion of Surf Parade to a one-way westbound arrangement.

The data works by tracking phones and cars with built in GPSs throughout the network. The coverage represents approximately 40% of drivers in the network.

Zones used in the GPS study area shown in Figure 3-1 below.

Figure 3-1: GPS Study Zones

Data has investigated for the following ranges:

- January – Weekdays
- January – Weekends
- February to December – Weekdays
- February to December – Weekends.

These data ranges have been further split into the following time periods:

- Overnight peak – 10pm-7am
- AM peak – 7am-9am
- Interpeak – 9am-3pm
- PM peak – 3pm-6pm
- Evening peak – 6pm-10pm

It has been assumed that with the closure of Surf Parade to eastbound traffic, vehicles travelling through the site will have the ability to shift their journeys to Venus Road and destinations north of Toorak road will shift to Toorak road, avoiding the traffic calming features on Lohr Avenue.

However, trips to destinations on Surf Parade east of Ozone Street or trips to destinations accessed by Veronica Street will shift their route to travel via Lohr Avenue. This is shown graphically in Figure 3-2

Figure 3-2: Affected Routes

A summary of the trips passing through Surf Parade and the percentage of trips likely to shift to Lohr Avenue is presented in Table 3-1.

The majority of trips entering Inverloch from Cape Patterson Inverloch Road continue straight along Toorak Road, with the maximum period being the PM and evening peaks. This is likely due to people travelling home from Cape Patterson to residential areas as opposed to the AM peak where people are more likely to be travelling from residential areas to commercial or industrial areas.

Table 3-1: Percentage of Affected Trips

	% of all trips using Surf Parade	% of trips from Cape Patterson Inverloch Road using Surf Parade	Eastbound trips on Surf Parade that will likely shift to Lohr
Feb-Dec Weekday OP	13%	18%	17%
Feb-Dec Weekday AM	13%	18%	9%
Feb-Dec Weekday IP	18%	28%	11%
Feb-Dec Weekday PM	16%	27%	9%
Feb-Dec Weekday EV	15%	29%	12%
Feb-Dec Weekend OP	16%	30%	19%
Feb-Dec Weekend AM	15%	26%	15%
Feb-Dec Weekend IP	18%	30%	11%
Feb-Dec Weekend PM	18%	30%	10%
Feb-Dec Weekend EV	17%	30%	9%
January Weekday OP	7%	12%	18%
January Weekday AM	7%	9%	10%
January Weekday IP	14%	25%	10%
January Weekday PM	11%	19%	12%
January Weekday EV	9%	24%	13%
January Weekend OP	10%	16%	10%
January Weekend AM	13%	29%	13%
January Weekend IP	17%	28%	9%
January Weekend PM	15%	30%	9%
January Weekend EV	11%	24%	8%

4. Option Testing

Three different options for fitting in the proposed shared path have been developed by Bass Coast Council. These are:

- Option 1 – Convert Surf Parade to one-way between Ozone Street and Goroke Street
- Option 2 – Remove the southern parking along Surf Parade between Ozone Street and Goroke Street
- Option 3 – Removes most of the southern parking to allow for two-way traffic, however it allows for parking in four one-way slow points along the route.

These options are discussed further in the sections below.

4.1 Option 1

Option 1 proposes to convert Surf Parade to a one way road between Ozone Street and Goroke Street, allowing for a westbound operation. The option provides 73 parking spaces along Surf Parade, 36 between Ozone Street and Wave Street and 37 between Wave Street and Goroke Street.

Parking on the northern side of the road is proposed to be removed and the speed bump on Surf Parade east of Goroke Street is proposed to be converted into a wombat crossing.

People wishing to travel in the eastbound direction will be required to detour using either Toorak Road or Lohr Avenue. It is expected Lohr Avenue will only cater to local trips due to the pavers acting as a tactile surface, reducing speeds and the desirability of this road.

Option 1 is presented in Figure 4-1.

Figure 4-1: Option 1

4.2 Option 2

Option 2 proposed to remove all parking on the southern side and replace this with the proposed shared path. Parking on the northern side of the road is also proposed to be removed and the speed bump on Surf Parade east of Goroke Street is proposed to be converted to a wombat crossing.

Option 2 is presented Figure 4-2.

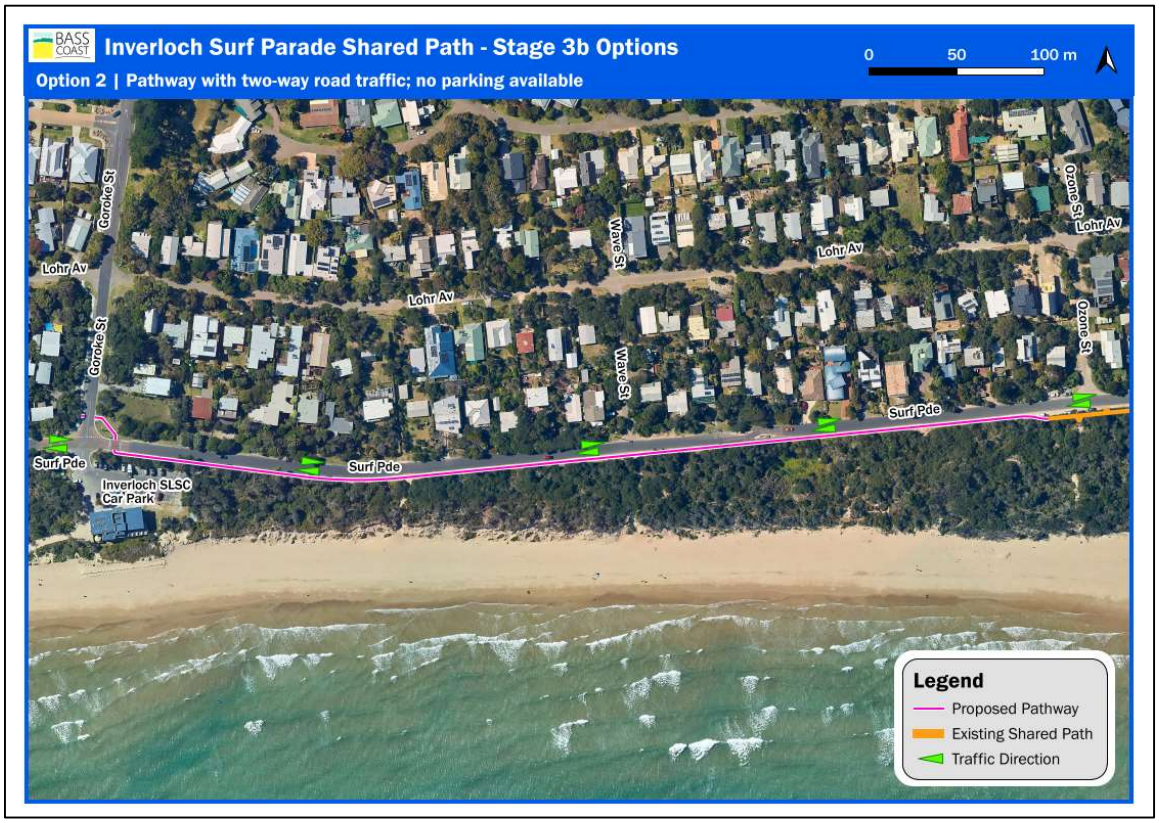

Figure 4-2: Option 2

4.3 Option 3

Option 3 proposes the removal of the majority of parking on the southern side whilst leaving some space for parking inside the one-way slow points. Parking on the northern side of the road is also proposed to be removed and the speed bump on Surf Parade east of Goroke Street is proposed to be converted into a wombat crossing.

The slow points give priority to westbound traffic and additional speed bumps have been added in to maintain a slow environment to allow people to safely navigate all the slow points.

Option 3 is presented in Figure 4-3.

Figure 4-3: Option 3

5. Model Development

A brief list of assumptions adopted in the model development are listed in the sections below. A full list of assumptions is provided in the calibration, validation technical note provided in Appendix A.

5.1 Software Platform

The microsimulation models have been developed using VISSIM 24.04.

VISSIM was selected as it allows for dynamic interaction between pedestrians and vehicles, can model in the local area traffic management features of the area and provides 3d animation allowing for the results to be shown and explained to stakeholders.

5.2 Time Period

The peak period for the model is 1pm-3pm with a half hour warm up between 12:30 pm and 1pm.

5.3 Calibration Validation

The models have been calibrated to turn counts and queue lengths and validated to travel times. This is discussed in full in in the calibration, validation technical note provided in Appendix A.

5.4 Assessment Criteria

The options have been assessed based on Level of Service (LoS), travel time and overall network statistics. The definitions for each of these are reported below.

5.4.1 Level of Service

The performance of the intersections has been measured by the average delay per vehicle which corresponds to a Level of Service (LOS).

In accordance with the Austroads Guide to Traffic Management-Part 3: Traffic Studies and Analysis (2013), at roundabouts and priority -controlled intersections the LOS value is determined by the critical movement with the highest delay.

The LoS criteria for priority controlled intersections adopted in this assessment is presented in Table 2-1.

Table 2-1: LoS Criteria

Level of Service	Average Delay
A	<10
B	<15
C	<25
D	<35
E	<50
F	50+

5.4.2 Travel Time

The travel rime represents average time required by drivers to travel between the two designated points along the designated route. The travel times in this assessment have been adopted on Surf Parade, as per the diagram shown in Figure 5-1.

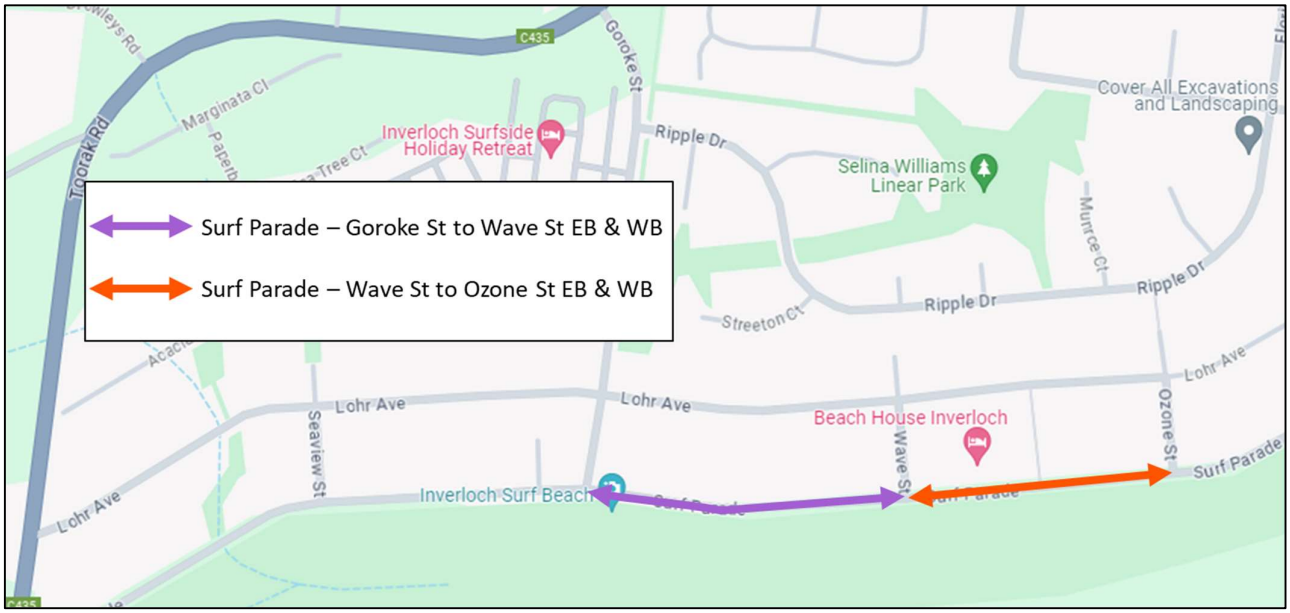

Figure 5-1: Travel Time Measurement

5.4.3 Network Statistics

The overall network has been assessed based based on the following statistics:

- Vehicle Kilometres Travelled (VKT)
  - Represents the measurement of the total kilometres travelled by all vehicles in the area for the entire modelling period. It is calculated by the number of vehicles multiplied by the kilometres travelled in the network area.
- Vehicle Hours Travelled (VHT)
  - Represents the measurement of the total time travelled by all vehicles in the area for the entire modelling period. It is calculated by the number of vehicles multiplied by the time travelled in the network area.
- Average network speed (km/h)
  - Represents average network travel speed under the modelled scenario.
- Number of Stops
  - Represents total number of stops (all vehicles combined) in the network during the simulation period. The number of stops is reflective of both emissions and engine wear and tear.

6. Summer Peak Model

The models were calibrated and validated to counts undertaken on the 20th January 2024. This is explored in more detail in the calibration, validation report in Appendix A. It was determined that these conditions did not represent the peak of the peak conditions observed by Council on their site visit on the 5th of January.

To estimate a new set of base conditions, traffic volumes were scaled up to match the traffic counts from the midblock traffic survey. Travel times were calculated from the provided videos and speeds were taken from the midblock survey. The increases in demand are shown below in Table 6-1.

Table 6-1: Increase in Demand During Summer Peak

Section	Increase
Eastbound on Surf Parade	15.4%
Westbound on Surf Parade	18.5%
Northbound on Goroke Street	14.1%
Southbound on Goroke Street	9.0%

Additional factors were added to the model, such as pinch points with closely parked cars only allowing one car through at a time. Pedestrians walking along the road have also been added into the model to replicate the observed summer peak behaviour.

A screen shot from the model demonstrating the aforementioned is presented in Figure 6-1.

Figure 6-1: Model Representation

A comparison between peak summer travel times observed from the site video and those taken from the model are shown in Figure 6-2.

The graphs show travel times remain within the 10% specified by the VicRoads criteria. All results shown in this report refer to the peak summer conditions. 2024 options have been assessed against this level of traffic and 2034 results have had this level of growth applied to the peak summer conditions.

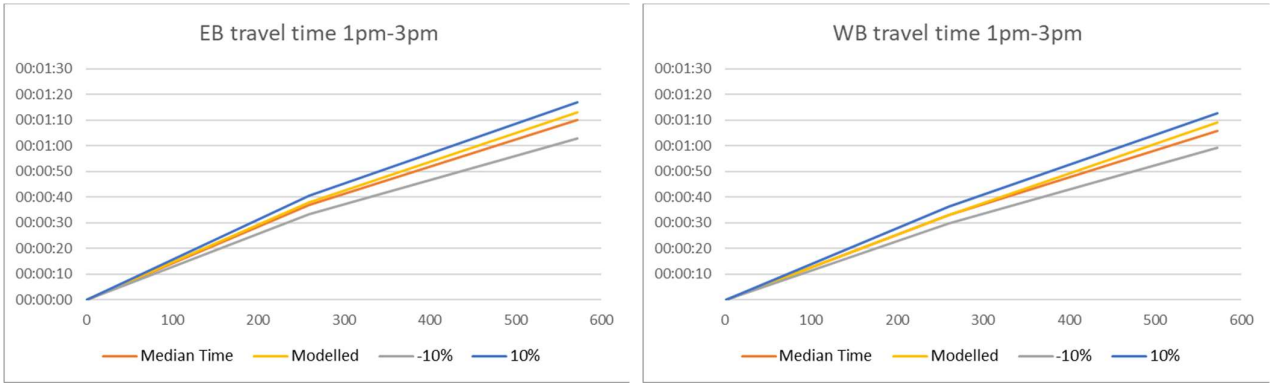

Figure 6-2: Peak Summer Travel Times - Observed Vs Modelled

7. Future Year Demand

Future year demand assumptions have been adopted considering population growth presented in Victoria in the Future (VIF) Projections - Second Release December 2023, for the Statistical Area Level 2 (SA2) for Wonthaggi-Inverloch as presented in Table 7-1.

Table 7-1: Population Growth

Year	Wonthaggi-Inverloch Population
2021	26,745
2026	30,702
2031	31,657
2036	34,049

A comparison of the 2021 and 2031 population data indicates a compounded annual growth of 1.7%. This has been applied universally to the base year matrices.

7.1 Option Demand Assumptions

Each of the three options will have an impact on the expected demand within the area by changing either the connectivity or the provision of parking.

Assumptions have been made on the effects of this to adjust the matrices to the changed network. These assumptions have been based on

- TomTom Data.
- Road Hierarchy.
- Site Observations.

7.1.1 Option 1

The following adjustments have been made as part of Option 1 considering the closure of Surf Parade eastbound and the removal of parking on the northern side and are presented in Table 7-2.

Table 7-2: Option 1 Trip Adjustments

Original Trip	New Trip	% Shift
Trips from Toorak Road to Surf Parade east of Ozone Street	To Surf Parade east of Ozone Street via Lohr Avenue	11%
	To Toorak Road east of Goroke Street	89%
Trips from Lohr Avenue, Ripple Drive and Paperback Place to Surf Parade east of Ozone Street	To Surf Parade east of Ozone Street via Lohr Avenue	7%
	To Toorak Road east of Goroke Street	93%
Surf Parade west of Goroke Street to Surf Parade east of Ozone Street	From Surf Parade west of Goroke Street to Surf Parade east of Ozone Street via Lohr Avenue	10%
	From Toorak Road west of Goroke Street to Toorak Road east of Goroke Street	78%
	From Surf Parade west of Goroke Street to Toorak Road west of Goroke Street	12%
Surf club parking to Surf Parade east of Ozone Street	Surf club parking to Surf Parade east of Ozone Street via Lohr Avenue	8%
	Surf club parking to Toorak Road west of Goroke Street	92%
Trips to parking on northern side of Surf Parade	Park on southern side of Surf Parade	10%
	Park on Surf Parade west of Goroke Street	90%
Trips from parking on northern side of Surf Parade to Surf Parade East	Park on southern side of Surf Parade and use Lohr to Travel to Surf Parade East	11%
	Park on southern side of Surf Parade and travel up to Toorak Road	89%
Trips from Toorak Road north to Surf Parade east	Go Via Lohr Avenue	11%
	Make Decision east of the modelled network	89%
Trips from Toorak Road North to parking on northern side of Toorak Road	To parking southern side of Surf Parade via Lohr Avenue	1%
	To parking southern side of Surf Parade via decision point east of the model	89%
	To parking on Surf Parade west of Goroke St	10%

7.1.2 Option 2

Adjustments have been made as part of Option 2 considering the removal of parking on Surf Parade between Ozone Street and Lohr Avenue as presented in Table 7-3.

Table 7-3: Option 2 Trip Adjustments

Original Trip	New Trip	% Shift
Trips to parking on northern side of Surf Parade	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips from parking on northern side of Surf Parade	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips to parking on southern side of Surf Parade	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips from parking on southern side of Surf Parade.	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%

7.1.3 Option 3

In Option 3, all of the parking on the northern side of Surf Parade has been affected whilst 58% of the parking on the southern side of Surf Parade has been affected. The adopted adjustments are presented in Table 7-4.

Table 7-4: Option 3 Trip Adjustments

Original Trip	New Trip	% Shift
Trips to parking on northern side of Surf Parade	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips from parking on northern side of Surf Parade	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips to parking on southern side of Surf Parade (based on 58% reduction)	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%
Trips from parking on southern side of Surf Parade (based on 58% reduction)	Park on Lohr Avenue	10%
	Park on Surf Parade west of Goroke Street	90%

8. Base Model - Operational Results

Models have been run for the existing scenario. The base year models (during the peak summer period) results are summarised in Table 8-1 below.

The results show that all intersections will operate with an acceptable LoS during both the existing and future scenarios, with the majority of delays coming from the one-way slow point and interactions with pedestrians and vehicles parallel parking. The additional demand in the model in 2034 leads to increased travel times along Surf Parade and an overall slower average network speed. However, the travel time increase is less than 10 seconds in both hours and in both directions.

The result also show a high number of vehicle stops. This due to traffic having to stop at the one-way slow point, stop behind parallel parking vehicles and stop to allow vehicles to pass through narrow sections and stop to allow pedestrians for pedestrians. It is noted that some of the stops are from slowly following pedestrians, vehicles in the model are repeatedly stopping as they slowly move forward behind the pedestrians.

Table 8-1: Base Model Results

		2024				2034			
		1st Hour		2nd Hour		1st Hour		2nd Hour	
		Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
LoS	Lohr/Goroke	4	A	3	A	6	A	10	A
	Surf/Goroke	11	B	9	A	11	B	12	B
	Surf/Ozone	2	A	1	A	2	A	1	A
	Toorak/Goroke	6	A	6	A	9	A	8	A
Travel Time	EB	01:15		01:12		01:22		01:19	
	WB	01:11		01:09		01:16		01:15	
Network Statistics	VKT	721				848			
	VHT	24				30			
	Network Speed	29.7 km/h				28.1 km/h			
	Number of Stops	2880				5738			

9. Options - Operational Results

A summary of each options results are presented in the following sections of this report.

9.1 Option 1

Results for option 1 for both 2024 and 2034 are presented below in Table 9-1.

The removal of the slow point between Ozone Street and Wave Street, as well as the allowing pedestrians to walk on the path both allow for faster travel times and a reduced number of stops.

The Surf Parade/Goroke Street increased is subjected to an increase in vehicles travelling through from the southern approach in the Surf Parade car park, as well as an increase in vehicles turning right from the eastern approach, due to making Surf Parade one way. These movements both conflict with the right turn from the northern approach, translating to a LoS C in 2034. This is combined with the addition of the wombat crossing, prioritising pedestrians over vehicles, further increasing the delay as shown in Figure 9-1. It is noted that this is still considered from a delay perspective.

Option 1 also features additional right turners on the southern approach of Toorak Road/Goroke Street as well as the western approach through movement as vehicles need to reroute due to making Surf Parade one way. This has minimal impacts on intersection delay.

Vehicles are still delayed by the parallel parking manoeuvres as presented in Figure 9-2. However the effects are only felt for one direction of traffic and due to the wider lanes and the formalisation of the parking.

Table 9-1: Option 1 Results

		2024				2034			
		1st Hour		2nd Hour		1st Hour		2nd Hour	
		Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
LoS	Lohr/Goroke	6	A	5	A	5	A	5	A
	Surf/Goroke	9	A	10	A	10	A	11	B
	Surf/Ozone	2	A	1	A	1	A	1	A
	Toorak/Goroke	7	A	7	A	10	A	8	A
Travel Time	EB	-		-		-		-	
	WB	01:03		01:00		01:03		01:01	
Network Statistics	VKT	576				682			
	VHT	18				22			
	Network Speed	31.3 km/h				31.0 km/h			
	Number of Stops	331				464			

Figure 9-1: Wombat Crossing Operation

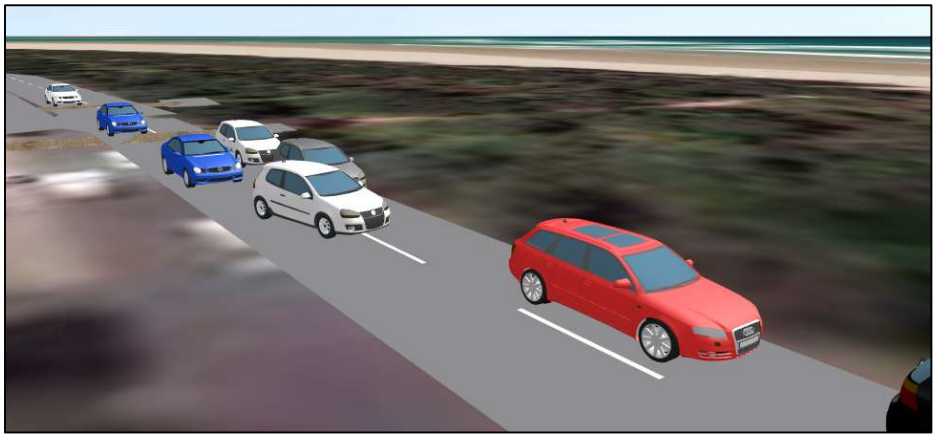

Figure 9-2: Parallel Parking Delays

9.2 Option 2

The results of option 2 for both 2024 and 2034 are presented in Table 9-2.

The removal of the parking along Surf Parade and the provision of a shared path reduces the travel times along Surf Parade. This is due to vehicles no longer being delayed by vehicles trying to parallel park and pedestrians walking along the road, blocking traffic. This also leads to an increase in average network speed and the number of stops.

The removal of parking on Surf Parade increases the volume of vehicles turning right from the eastern approach of Surf Parade/Goroke St as drivers choose to park on Lohr Avenue. This also leads to an increase in delay at this intersection. This is combined with the addition of the wombat crossing, prioritising pedestrians over vehicles further increases the delay. It is noted however that the delay is still within an acceptable range.

Further, vehicles are still delayed by the one-way slow point as shown in Figure 9-3.

Table 9-2: Option 2 Results

		2024				2034			
		1st Hour		2nd Hour		1st Hour		2nd Hour	
		Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
LoS	Lohr/Goroke	5	A	4	A	6	A	5	A
	Surf/Goroke	10	B	9	A	14	B	13	B
	Surf/Ozone	2	A	1	A	1	A	1	A
	Toorak/Goroke	6	A	6	A	8	A	7	A
Travel Time	EB	00:56		00:55		00:58		00:57	
	WB	00:58		00:57		01:00		00:57	
Network Statistics	VKT	721				853			
	VHT	22				27			
	Network Speed	33.0 km/h				32.1 km/h			
	Number of Stops	1122				2240			

Figure 9-3: Option 2 Slow Point Operation

9.3 Option 3

Results of option 3 for both 2024 and 2034 are presented in Table 9-3.

The additional slow points and speed bumps lead to slower travel times along Surf Parade, especially in the east bound direction due to the slow points being prioritised. This also leads to an increase in VHT and a reduction in network speed.

Prioritised slow points lead to less confusion and fewer stops than the current unprioritised slow point. The number of stops reduces as only drivers from the eastbound approach need to come to a complete stop, rather than the current situation where occasionally both vehicles will stop before one car decides to proceed. This is presented in Figure 9-4.

Table 9-3: Option 3 Results

		2024				2034			
		1st Hour		2nd Hour		1st Hour		2nd Hour	
		Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
LoS	Lohr/Goroke	4	A	4	A	6	A	7	A
	Surf/Goroke	9	A	10	A	10	A	13	B
	Surf/Ozone	2	A	3	A	4	A	3	A
	Toorak/Goroke	6	A	5	A	7	A	7	A
Travel Time	EB	02:34		02:29		03:01		02:50	
	WB	01:27		01:24		01:26		01:25	
Network Statistics	VKT	711				840			
	VHT	30				37			
	Network Speed	23.5 km/h				22.4 km/h			
	Number of Stops	822				1195			

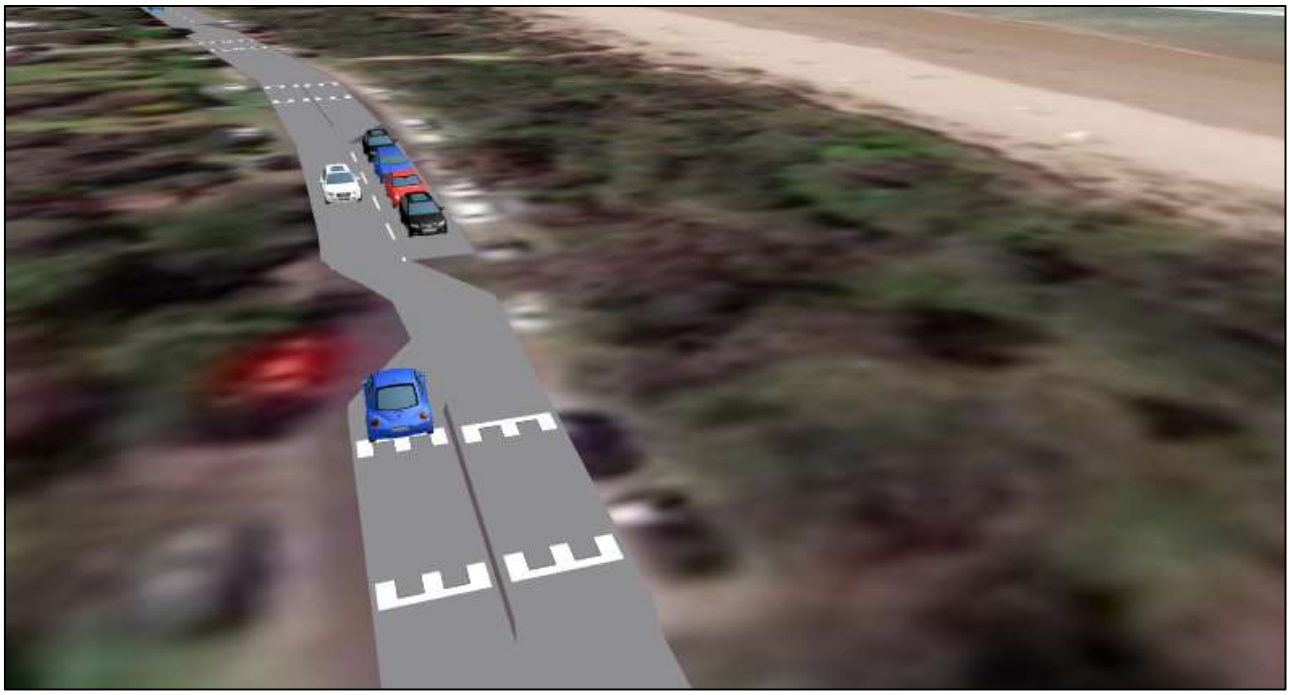

Figure 9-4: Option 3 Slow Option Operation

10. Operational Assessment Comparison

A comparison of the results for all options is presented in the following sections of this report.

10.1 LoS

The LoS for each option is presented in Table 10-1. All tested options and the base year show acceptable LoS in both 2024 and 2034.

Options 1 and 2 result in an increase in the number of vehicle movements that conflict with northern approach right turn at Surf Parade/Goroke Street, as described in sections 9.1 and 9.2. In addition, an increase in delay is also observed in all options caused by the wombat crossing giving priority to pedestrians over cars.

Toorak Road/Goroke Street shows an increase in delays in Option 1 as vehicles reroute due to the closure of eastbound Surf Parade. It is noted however, that the increase is not significant.

Table 10-1: LoS Comparison

		Base		Option 1		Option 2		Option 3	
		1st hr	2nd hr	1st hr	2nd hr	1st hr	2nd hr	1st hr	2nd hr
2024	Lohr Ave/Goroke St	A	A	A	A	A	A	A	A
	Surf Parade/Goroke St	A	A	B	A	A	A	A	A
	Ozone St/Surf Parade	A	A	A	A	A	A	A	A
	Toorak Rd/Goroke St	A	A	A	A	A	A	A	A
2034	Lohr Ave/Goroke St	A	A	A	A	A	A	A	A
	Surf Parade/Goroke St	A	B	B	B	A	B	A	B
	Ozone St/Surf Parade	A	A	A	A	A	A	A	A
	Toorak Rd/Goroke St	A	A	A	A	A	A	A	A

10.2 Travel Time

Travel times along Surf Parade for all options are presented in Table 10-2.

Options 1 and 2 both result in a reduction travel time, with Option 1 removing the one-way slow point and allowing pedestrians to use the shared path, avoiding conflicts with cars. Option 2 also has the benefit of the shared path and removes the parking on both sides, resulting in vehicles not having to give way to people trying to parallel park.

Option 3 results in a significant increase in travel times, especially in the eastbound direction due to the additional one-way slow points as well as the additional speed bumps. The eastbound travel times are more than double the base case in 2034, due to the one-way slow points having the priority favouring westbound traffic.

Table 10-2: Travel Time Comparison

		Eastbound		Westbound	
		1st hour	2nd hour	1st hour	2nd hour
2024	Base	01:15	01:12	01:11	01:09
	Option 1	-	-	01:03	01:00
	Option 2	00:56	00:55	00:58	00:57
	Option 3	02:34	02:29	01:27	01:24
2034	Base	01:22	01:19	01:16	01:15
	Option 1	-	-	01:03	01:01
	Option 2	00:58	00:57	01:00	00:57
	Option 3	03:01	02:50	01:26	01:25

10.3 Network Statistics

Network statistics for all options are presented in Table 10-3.

Option 1 results in significant reduction in vehicle kilometres travelled due to some vehicles previously driving eastbound along the length of Surf Parade but now diverting to Toorak Road, where only a short section is captured in the model. Some network speed benefits of this option may not be fully captured in the model as they are occurring outside of the study area.

Options 1 and 2 show benefits in network speed due to the reduced travel times described in section 10.2. Similarly, Option 3 has a significant reduction in network speed due to the increase in travel time along Surf Parade.

Option 1 shows the largest reduction in the number of stops due to the removal of all one-way slow points. The one-way slow associated with Option 3 involve less stops than the one-way slow points associated with Option 2 due to the prioritisation, meaning that westbound traffic never has to stop and the lack of ambiguity means that it less likely to result in the scenario where both eastbound and westbound vehicles stop.

Table 10-3: Network Statistics Comparison

		VKT	VHT	Network Speed	Stops	EB travel time on Surf Parade (1st hour)	WB travel time on Surf Parade (1st hour)
2024	Base	721	24	29.7 km/h	2880	01:15	01:11
	Option 1	576	18	31.3 km/h	331	-	01:03
	Option 2	721	22	33.0 km/h	1122	00:56	00:58
	Option 3	711	30	23.5 km/h	822	02:34	01:27
2034	Base	848	30	28.1 km/h	5738	01:22	01:16
	Option 1	682	22	31.0 km/h	464	-	01:03
	Option 2	853	27	32.1 km/h	2240	00:58	01:00
	Option 3	840	37	22.4 km/h	1195	03:01	01:26

10.4 Volumes on Lohr Avenue

Two-hour volumes at key locations have been extracted from the models and are presented in Table 10-4 and indicated that all options result in increased traffic travelling on Lohr Avenue.

This occurs due to:

- Vehicles rerouting due to the closure of Surf Parade to eastbound traffic in Option 1.
- Vehicles looking for additional parking on Lohr Avenue in all options.
- Vehicles looking to avoid the additional one-way slow points in Option 3.

While all options show higher vehicle numbers using Lohr Avenue, Option 2 is the lowest. However it is noted that the corresponding benefits of reduced traffic on Surf Parade are not realised.

Option 1 sees an increase in volume of traffic on through the Goroke Street/Toorak Road due to trips rerouting due to Surf Parade becoming one way.

Table 10-4: 2-Hour Volume Comparison

	Location	Base	Option 1	Option 2	Option 3
2024	EB and WB trips on Surf Parade	544	291	585	479
	EB and WB trips on Lohr Avenue	48	83	61	117
	Trips through Goroke St/Toorak Road intersection	869	994	869	868
2034	EB and WB trips on Surf Parade	636	344	692	567
	EB and WB trips on Lohr Avenue	57	98	72	140
	Trips through Goroke St/Toorak Road intersection	1020	1173	1022	1021

Several mitigation strategies could be introduced to reduce the volume of traffic on Lohr Avenue. Potential mitigations that could be investigated are presented in Table 10-5.

Table 10-5: Volume Reduction Mitigations

Non Assest	Asset Solution
Local area traffic only sign.	Banning the northern approach right turn at Ozone St/Surf Parade and making Wave Street one way northbound to prevent people circling around looking for parking while still allowing for connectivity with Surf Parade east of Ozone Street. This could be done temporarily over summer.
No Parking signs on Lohr Avenue.	Infrastructure and bollards preventing people from parking on Lohr Avenue.
Introduction of a kiss and ride within the Surf Club carpark to allow people to drop off surf boards/beach umbrellas/family members and then park further away.	Introduction of more parking spaces in alternate areas such as on Goroke Street.
Discussions with the local tourist industry to encourage holiday makers to use the new shared path.	
Signage at the Toorak Road /Surf Parade intersection stating no access to Inverloch town centre via Surf Parade.	
Signage at the Venus Street/Ramsey Boulevard intersection telling people to travel to the beach via Surf Parade and not Goroke Street then Lohr Avenue.	

11. Conclusion and recommendation

The results of the modelling undertaken as part of this investigation indicate that options 1 and 2 not only provide space for the proposed shared path but also lead to improvements in traffic performance along Surf Parade. In Option 1, this is due to the removal of the slow point and removing the conflict between cars and pedestrians caused by the lack of footpaths and in Option 2 it is due to the removal of parallel parking delaying vehicles

Option 3 shows significant increases in travel times, especially on the eastbound direction due to the increase in one-way slow points and speed bumps. This is likely to result in drivers avoiding the area and may not offset the benefits of providing the 17 car spots.

The GPS data has shown that 91% of vehicles travelling eastbound in the AM and PM commuter peaks and the summer holiday interpeak are able to shift their routes to Toorak Road with no impacts on journey time. Under this scenario, the Toorak Road and Goroke Street intersection is still expected to perform with low levels of delay and drivers able to find safe gaps.

Option 1 has the additional benefit, not shown in the modelling, of pedestrians from parked cars not having to cross the road to access the beach. Option 1 provides the most parking and would likely result in the least amount of pedestrian/traffic interaction.

Due to the benefits to the traffic flow, the provision of the high amounts of parking and the safety benefits of connecting the parallel parking directly to the shared path, it is recommended that council proceeds with Option 1. While it does reduce some connectivity through the network, the GPS study shows the most trips are available to shift their routes to Toorak Road with no increase in travel time.

All options reduce the amount of parking provided on Surf Parade. It is recommended that under any of the three options, Council does further work to develop a vision for how parking arrangements will work on Lohr Avenue and if increased vehicle demand is not accepted by the local community, asset and non-asset solutions to reduce traffic volumes, such as those in section 10.4 be explored and monitored.

Appendices

Appendix A - Calibration and Validation technical note

Appendix B - LoS by movement

			2024 Base (peak summer)									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	15	1.5	A	4.5	A	6	2.0	A	3.4	A
		T	73	0.1	A			62	0.2	A		
		L	1	0.3	A			14	0.3	A		
	E	R	14	4.4	A			9	3.4	A		
		T	1	1.5	A			1	1.7	A		
		L	2	0.9	A			0	0.2	A		
		R	2	4.5	A			1	2.5	A		
	S	T	69	1.1	A			74	1.1	A		
		L	2	1.8	A			12	2.4	A		
	W	R	2	1.5	A			9	2.8	A		
		T	1	0.5	A			2	0.8	A		
		L	7	0.3	A			2	0.6	A		
Surf Parade & Goroke St	N	R	35	7.5	A	10.8	B	28	8.4	A	8.8	A
		T	2	10.8	B			6	3.4	A		
		L	41	2.3	A			36	2.8	A		
	E	R	34	3.3	A			45	2.6	A		
		T	89	3.1	A			79	3.0	A		
		L	7	2.9	A			10	1.7	A		
		R	29	8.5	A			24	8.8	A		
	S	T	12	9.3	A			14	8.0	A		
		L	22	4.4	A			12	3.0	A		
	W	R	7	3.4	A			5	3.8	A		
		T	77	2.0	A			73	2.4	A		
		L	26	1.2	A			28	1.4	A		
Ozone St & Surf Parade	N	R	0	0.0	A	2.3	A	0	0.0	A	1.4	A
		L	9	0.9	A			13	1.4	A		
	E	R	4	2.3	A			7	0.9	A		
		T	166	0.6	A			174	0.7	A		
	W	T	139	0.3	A			117	0.2	A		
Toorak Rd & Goroke St	E	T	152	0.7	A	5.7	A	126	0.6	A	5.8	A
		L	53	0.7	A			47	0.8	A		
	S	R	64	5.7	A			63	5.8	A		
		L	12	1.7	A			12	1.5	A		
	W	R	27	2.4	A			28	2.3	A		
		T	123	1.7	A			162	1.8	A		

			2024 Option 1									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	15	2.0	A	6.2	A	3	2.1	A	4.6	A
		T	38	0.1	A			28	0.3	A		
		L	2	0.3	A			25	0.6	A		
	E	R	15	3.8	A			9	4.6	A		
		T	1	6.2	A			1	2.0	A		
		L	1	1.1	A			0	0.0	A		
	S	R	15	2.5	A			14	2.7	A		
		T	102	1.3	A			99	1.2	A		
		L	2	1.5	A			11	2.1	A		
	W	R	2	5.8	A			5	2.8	A		
		T	0	0.0	A			0	0.0	A		
		L	8	1.3	A			8	1.0	A		
Surf Parade & Goroke St	N	R	39	9.5	A	9.5	A	28	9.7	A	9.7	A
		T	1	1.6	A			6	2.6	A		
		L			A					A		
	E	R	36	2.0	A			43	1.8	A		
		T	102	1.7	A			94	1.8	A		
		L	7	0.7	A			9	0.8	A		
	S	R			A					A		
		T	41	6.1	A			36	7.2	A		
		L	23	3.3	A			12	6.1	A		
	W	R	7	5.8	A			4	3.4	A		
		T			A					A		
		L	43	1.8	A			44	1.8	A		
Ozone St & Surf Parade	N	R	1	1.0	A	1.6	A	0	0.4	A	0.8	A
		L	21	1.6	A			16	0.8	A		
	E	R	9	0.5	A			13	0.6	A		
		T	161	0.4	A			166	0.7	A		
	W	T			A					A		
Toorak Rd & Goroke St	E	T	152	0.5	A	6.7	A	125	0.5	A	6.8	A
		L	34	0.6	A			37	0.7	A		
	S	R	106	6.7	A			103	6.8	A		
		L	12	2.4	A			12	2.9	A		
	W	R	14	2.1	A			19	2.3	A		
		T	178	1.5	A			202	1.5	A		

			2024 Option 2									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	14	2.2	A	4.5	A	6	2.4	A	3.9	A
		T	75	0.1	A			62	0.2	A		
		L	2	0.3	A			12	0.3	A		
	E	R	14	4.5	A			9	3.9	A		
		T	1	0.6	A			2	2.7	A		
		L	7	1.4	A			3	1.3	A		
	S	R	6	2.6	A			5	1.5	A		
		T	71	1.1	A			74	1.2	A		
		L	5	1.7	A			11	1.8	A		
	W	R	3	2.3	A			11	3.0	A		
		T	0	0.0	A			0	0.0	A		
		L	6	0.3	A			2	0.6	A		
Surf Parade & Goroke St	N	R	46	10.4	B	10.4	B	30	7.5	A	8.8	A
		T	2	5.2	A			5	7.6	A		
		L	37	2.8	A			41	2.2	A		
	E	R	37	1.8	A			47	2.7	A		
		T	114	2.0	A			110	2.2	A		
		L	7	0.6	A			9	1.8	A		
	S	R	29	8.1	A			25	8.8	A		
		T	15	8.9	A			14	8.0	A		
		L	23	4.2	A			13	3.8	A		
	W	R	7	3.6	A			4	5.3	A		
		T	68	2.3	A			61	2.4	A		
		L	30	1.2	A			30	1.7	A		
Ozone St & Surf Parade	N	R	0	0.0	A	1.6	A	0	0.0	A	1.3	A
		L	8	1.0	A			10	0.9	A		
	E	R	8	1.6	A			8	1.3	A		
		T	163	0.4	A			172	0.7	A		
	W	T	132	0.3	A			108	0.2	A		
Toorak Rd & Goroke St	E	T	153	0.6	A	5.6	A	126	0.6	A	5.6	A
		L	53	0.7	A			47	0.7	A		
	S	R	65	5.6	A			61	5.6	A		
		L	14	1.6	A			12	1.5	A		
	W	R	28	2.7	A			25	2.2	A		
		T	123	1.8	A			162	1.6	A		

			2024 Option 3									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	14	1.9	A	3.8	A	4	2.9	A	4.2	A
		T	42	0.3	A			41	0.4	A		
		L	33	0.6	A			34	0.4	A		
	E	R	14	3.8	A			9	4.2	A		
		T	1	1.3	A			2	2.0	A		
		L	5	0.6	A			1	2.1	A		
	S	R	5	2.4	A			7	2.7	A		
		T	68	1.2	A			73	1.1	A		
		L	3	2.1	A			8	1.9	A		
	W	R	2	2.5	A			6	2.5	A		
		T	1	0.8	A			5	0.9	A		
		L	7	0.7	A			4	0.6	A		
Surf Parade & Goroke St	N	R	44	8.6	A	8.6	A	30	8.3	A	9.9	A
		T	2	2.8	A			4	7.7	A		
		L	4	1.7	A			13	3.5	A		
	E	R	34	2.8	A			41	2.3	A		
		T	92	2.5	A			97	2.4	A		
		L	7	1.5	A			10	1.5	A		
	S	R	30	8.2	A			24	7.5	A		
		T	15	8.6	A			16	9.9	A		
		L	23	3.8	A			12	2.3	A		
	W	R	7	3.3	A			4	3.0	A		
		T	68	2.7	A			59	2.8	A		
		L	28	1.7	A			31	2.0	A		
Ozone St & Surf Parade	N	R	0	0.0	A	2.5	A	0	0.0	A	3.3	A
		L	40	2.5	A			39	3.3	A		
	E	R	8	1.2	A			7	0.8	A		
		T	163	0.9	A			173	1.1	A		
	W	T	98	1.5	A			79	1.5	A		
Toorak Rd & Goroke St	E	T	152	0.6	A	5.7	A	126	0.6	A	5.2	A
		L	52	0.8	A			47	0.8	A		
	S	R	63	5.7	A			63	5.2	A		
		L	14	2.0	A			14	2.3	A		
	W	R	26	2.2	A			26	2.4	A		
		T	123	1.6	A			162	1.7	A		

			2034 Base									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	17	2.2	A	5.7	A	7	1.8	A	9.5	A
		T	84	0.1	A			74	0.2	A		
		L	3	0.3	A			16	0.4	A		
	E	R	16	5.5	A			10	4.1	A		
		T	2	2.7	A			1	9.5	A		
		L	2	2.1	A			1	2.1	A		
	S	R	1	5.7	A			1	1.9	A		
		T	81	1.1	A			87	1.2	A		
		L	2	2.9	A			13	2.3	A		
	W	R	3	3.0	A			11	3.5	A		
		T	1	1.4	A			3	1.4	A		
		L	8	0.7	A			2	0.4	A		
Surf Parade & Goroke St	N	R	41	11.4	B	11.4	B	35	8.8	A	11.9	B
		T	2	11.3	B			7	4.7	A		
		L	45	3.9	A			44	2.7	A		
	E	R	38	3.2	A			52	3.9	A		
		T	104	3.5	A			94	3.5	A		
		L	8	1.8	A			11	3.4	A		
	S	R	34	10.7	B			29	11.9	B		
		T	16	10.9	B			18	10.0	A		
		L	26	4.3	A			15	4.5	A		
	W	R	9	4.6	A			6	4.5	A		
		T	91	2.5	A			86	2.6	A		
		L	30	1.7	A			32	1.6	A		
Ozone St & Surf Parade	N	R	0	0.0	A	1.6	A	0	0.0	A	1.1	A
		L	10	0.9	A			14	1.0	A		
	E	R	4	1.6	A			10	1.1	A		
		T	198	0.7	A			202	0.7	A		
	W	T	163	0.4	A			137	0.3	A		
Toorak Rd & Goroke St	E	T	177	0.8	A	8.6	A	147	0.6	A	8.3	A
		L	63	0.9	A			56	0.8	A		
	S	R	76	8.6	A			72	8.3	A		
		L	16	3.2	A			15	2.1	A		
	W	R	31	2.6	A			33	2.4	A		
		T	144	1.9	A			190	2.0	A		

			2034 Option 1									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	17	2.9	A	5.4	A	4	2.8	A	4.8	A
		T	46	0.1	A			33	0.1	A		
		L	3	0.3	A			29	0.4	A		
	E	R	18	5.4	A			12	4.8	A		
		T	1	3.6	A			1	3.7	A		
		L	1	0.4	A			0	0.0	A		
	S	R	16	3.2	A			17	3.1	A		
		T	120	1.4	A			119	1.3	A		
		L	3	2.5	A			13	2.6	A		
	W	R	1	3.0	A			7	2.9	A		
		T	0	0.0	A			0	0.0	A		
		L	9	1.0	A			10	1.6	A		
Surf Parade & Goroke St	N	R	47	9.6	A	9.6	A	33	11.1	B	11.1	B
		T	1	1.9	A			7	9.4	A		
		L			A					A		
	E	R	39	1.6	A			53	1.6	A		
		T	119	1.9	A			114	2.2	A		
		L	8	0.6	A			11	0.8	A		
	S	R			A					A		
		T	48	7.5	A			44	8.0	A		
		L	27	3.2	A			15	4.3	A		
	W	R	9	7.2	A			6	5.4	A		
		T			A					A		
		L	51	2.0	A			53	1.7	A		
Ozone St & Surf Parade	N	R	1	0.6	A	1.5	A	0	0.4	A	0.9	A
		L	23	1.5	A			19	0.9	A		
	E	R	11	0.3	A			15	0.5	A		
		T	190	0.6	A			197	0.8	A		
	W	T			A					A		
Toorak Rd & Goroke St	E	T	177	0.6	A	9.8	A	147	0.5	A	8.2	A
		L	40	0.8	A			44	0.7	A		
	S	R	125	9.8	A			123	8.2	A		
		L	15	3.9	A			14	3.1	A		
	W	R	17	2.1	A			23	2.4	A		
		T	209	1.7	A			239	1.9	A		

			2034 Option 2									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	16	2.1	A	6.2	A	6	2.6	A	5.3	A
		T	87	0.1	A			72	0.3	A		
		L	2	0.3	A			14	0.6	A		
	E	R	17	6.2	A			11	4.5	A		
		T	1	5.6	A			2	4.0	A		
		L	9	1.9	A			3	2.7	A		
	S	R	6	3.3	A			7	2.1	A		
		T	84	1.3	A			91	1.2	A		
		L	5	1.8	A			14	2.3	A		
	W	R	4	1.7	A			14	5.3	A		
		T	0	0.0	A			0	0.0	A		
		L	8	0.6	A			3	1.6	A		
Surf Parade & Goroke St	N	R	54	12.0	B	14.0	B	36	11.7	B	12.9	B
		T	3	11.4	B			6	9.7	A		
		L	43	3.8	A			48	3.8	A		
	E	R	43	2.6	A			56	2.6	A		
		T	137	2.6	A			130	2.4	A		
		L	7	1.1	A			11	1.2	A		
	S	R	33	14.0	B			30	11.3	B		
		T	17	11.8	B			18	12.9	B		
		L	28	5.0	A			16	6.5	A		
	W	R	8	4.6	A			5	5.3	A		
		T	82	2.6	A			72	2.7	A		
		L	35	1.9	A			37	1.8	A		
Ozone St & Surf Parade	N	R	0	0.0	A	1.4	A	0	0.0	A	0.9	A
		L	9	1.4	A			12	0.9	A		
	E	R	10	1.3	A			10	0.9	A		
		T	194	0.6	A			204	0.7	A		
	W	T	155	0.3	A			126	0.3	A		
Toorak Rd & Goroke St	E	T	177	0.7	A	8.2	A	147	0.6	A	7.0	A
		L	62	0.8	A			56	0.8	A		
	S	R	76	8.2	A			74	7.0	A		
		L	17	2.1	A			15	2.1	A		
	W	R	32	2.7	A			31	2.9	A		
		T	144	1.8	A			191	1.9	A		

			2034 Option 3									
			1pm-2pm					2pm-3pm				
			Volume	Delay	LoS	Delay	LoS	Volume	Delay	LoS	Delay	LoS
Lohr Ave & Goroke St	N	R	18	2.2	A	5.8	A	5	1.7	A	6.6	A
		T	49	0.4	A			48	0.2	A		
		L	40	0.4	A			40	0.5	A		
	E	R	16	5.8	A			12	4.8	A		
		T	1	2.5	A			2	6.6	A		
		L	6	1.1	A			2	1.5	A		
	S	R	6	3.5	A			7	3.1	A		
		T	80	1.1	A			88	1.2	A		
		L	3	1.8	A			10	2.1	A		
	W	R	3	3.3	A			7	2.7	A		
		T	1	0.4	A			7	0.8	A		
		L	9	1.0	A			4	1.0	A		
Surf Parade & Goroke St	N	R	52	9.9	A	9.9	A	36	12.8	B	12.8	B
		T	3	5.4	A			5	3.5	A		
		L	4	2.1	A			15	3.9	A		
	E	R	40	2.9	A			51	3.3	A		
		T	109	2.4	A			116	2.9	A		
		L	8	1.6	A			11	1.8	A		
	S	R	34	9.8	A			28	8.8	A		
		T	16	8.7	A			17	10.9	B		
		L	27	3.6	A			15	4.7	A		
	W	R	8	3.4	A			5	3.6	A		
		T	82	2.2	A			69	2.4	A		
		L	32	1.3	A			37	1.9	A		
Ozone St & Surf Parade	N	R	0	0.0	A	3.9	A	0	0.0	A	3.4	A
		L	48	3.9	A			45	3.4	A		
	E	R	10	1.0	A			9	1.1	A		
		T	192	1.0	A			203	1.2	A		
	W	T	117	1.6	A			94	1.7	A		
Toorak Rd & Goroke St	E	T	177	0.8	A	7.2	A	147	0.7	A	6.9	A
		L	61	0.8	A			56	0.7	A		
	S	R	76	7.2	A			75	6.9	A		
		L	16	1.6	A			16	2.6	A		
	W	R	31	2.8	A			31	2.6	A		
		T	145	2.1	A			190	2.0	A		

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