
TO Reece Gibson
COPY John Denney
FROM Chris Morahan
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t: +64 3 363 5400
f: +64 3 365 7858
w: www.opus.co.nz

1 Introduction

It has been proposed that the two intersections of Stanley Street/ Shotover Street and Stanley Street/ Ballarat Street in Queenstown be upgraded from roundabouts to traffic signals. Traffic modelling undertaken by Opus using SIDRA 6.1 indicated this configuration would result in the best performance in 2018 and 2028. This modelling was based on worst-case scenario traffic volumes compiled from surveys conducted in late December 2014, April 2015, and July 2015.

Subsequent traffic modelling by Abley Transportation Consultants (Abley) using Paramics, indicated that the best solution in 2013 was to upgrade the Stanley Street/ Ballarat Street roundabout to signals, and retain the existing roundabout at Stanley Street/ Shotover Street. This modelling was based on traffic surveys conducted in early December 2013.

This memorandum investigates the reasons for this apparent difference in conclusions. The different traffic volumes used by Opus and Abley have been investigated. The Opus SIDRA model was then rerun using the same traffic volumes as the Abley modelling, and these results were compared to the original results. The effect of the different phasing configurations used by Opus and Abley was then investigated.

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2 Traffic Volumes

2.1 Original Opus modelling

In the original Opus modelling, the Stanley Street/ Shotover Street and Stanley Street/ Ballarat Street intersections were modelled as a SIDRA network. Traffic volumes (including pedestrian volumes) used in the analysis were based on surveys completed during the following time periods; which were factored up to estimated 2018 and 2028 traffic volumes:

Table 1: Traffic volumes used in original Opus modelling

Intersection	AM Peak	PM Peak
Stanley Street/ Shotover Street	Thursday 9 July 2015 7:45am to 8:45am	Thursday 9 July 2015 4:45pm to 5:45pm
Stanley Street/ Ballarat Street	Wednesday 24 December 2014 11:00am to 12:00pm	Thursday 23 April 2015 5:00pm to 6:00pm

The surveyed traffic volumes are shown in Figure 1 and Figure 2.

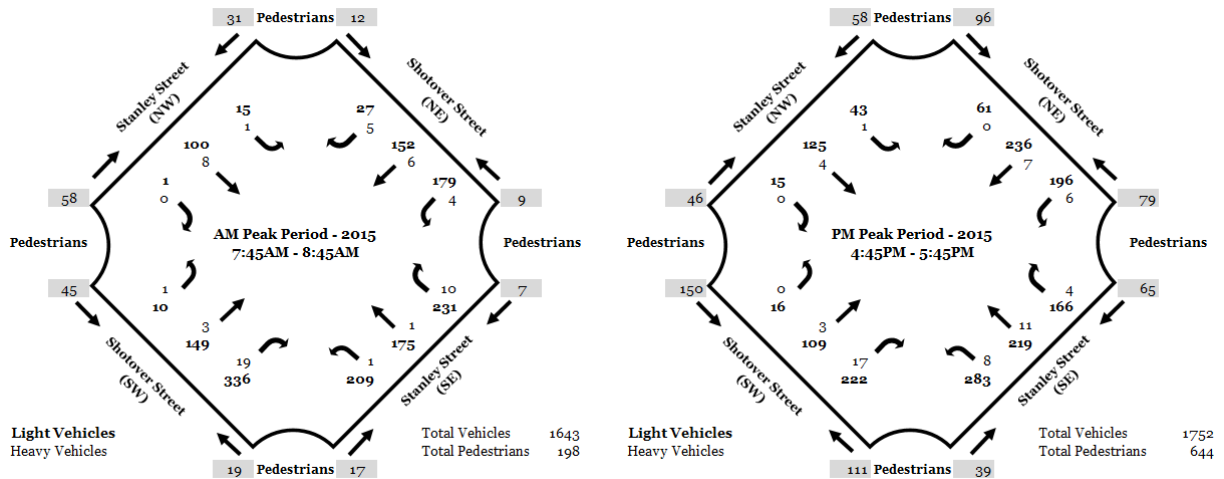


Figure 1: Stanley Street/ Shotover Street – surveyed traffic volumes used in original Opus modelling

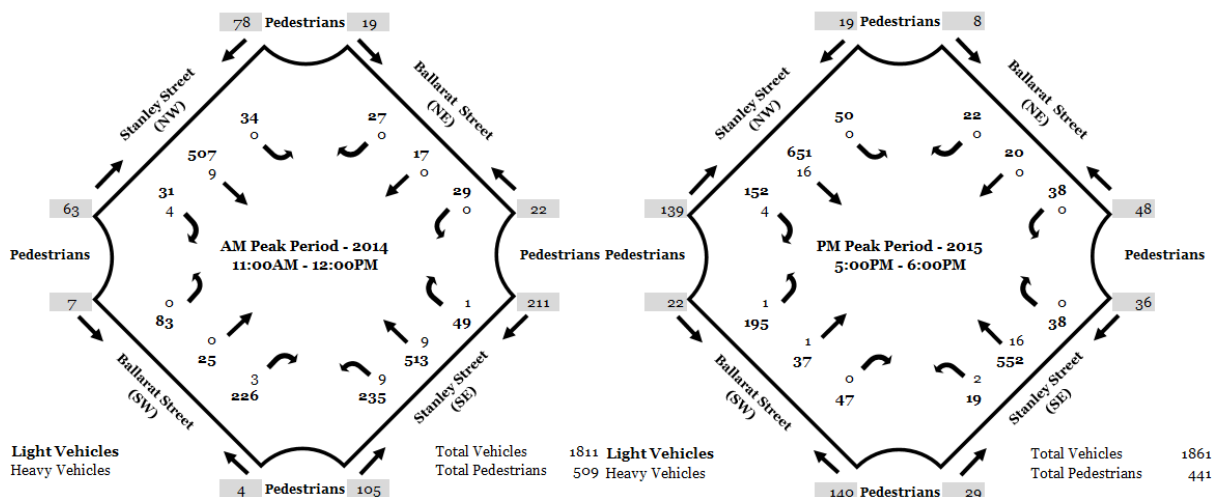


Figure 2: Stanley Street/ Ballarat Street surveyed traffic volumes used in original Opus modelling

2.2 Abley modelling

The traffic volumes used in the Abley analysis were based on the following time periods:

Table 2: Traffic volumes used in Abley modelling

	AM Peak	PM Peak
Stanley Street/ Shotover Street	Wednesday 4 December 2013 8:00am to 9:00am	Wednesday 4 December 2013 4:45pm to 5:45pm
Stanley Street/ Ballarat Street	Wednesday 4 December 2013 8:00am to 9:00am	Wednesday 4 December 2013 4:45pm to 5:45pm

The surveyed traffic volumes used in the Abley modelling are shown in Figure 3 and Figure 4.

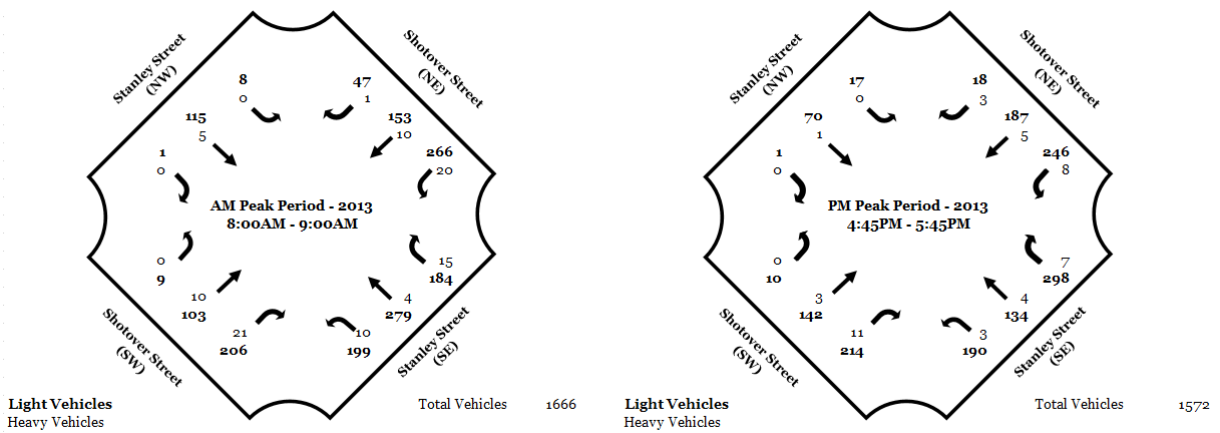


Figure 3: Stanley Street/ Shotover Street – surveyed traffic volumes used in Abley modelling

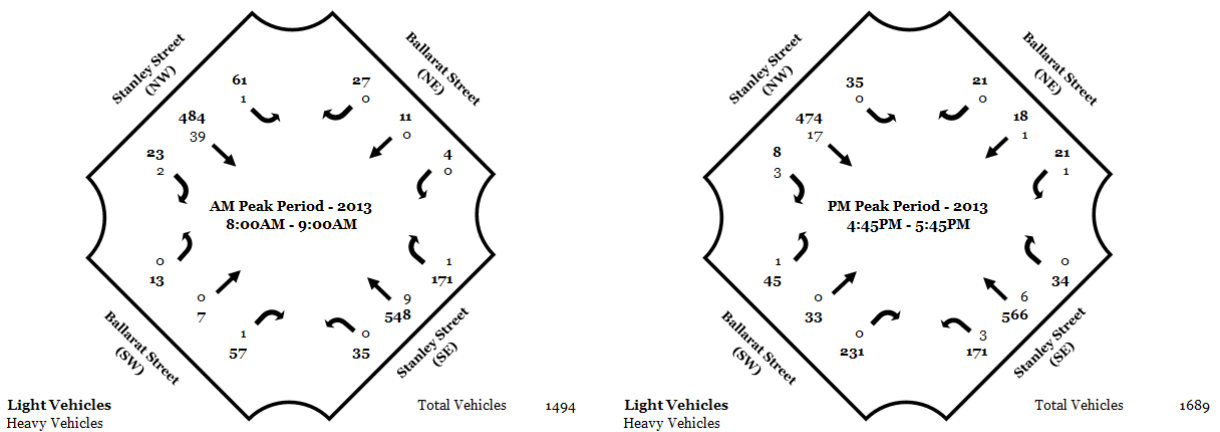


Figure 4: Stanley Street/ Ballarat Street – surveyed traffic volumes used in Abley modelling

Total traffic volumes used by Abley at Stanley Street/ Shotover Street are similar to those used by Opus in the AM peak, but significantly lower in the PM peak (1,572vph compared to 1,752vph).

Total traffic volumes used by Abley at Stanley Street/ Ballarat Street are significantly lower in both the AM and PM peaks (1,494vph compared to 1,811vph in the AM peak, and 1,689vph compared to 1,861vph in the PM peak). In the PM peak there are significantly higher right-turning traffic volumes.

No pedestrian volumes were provided from the Abley modelling. As a result, the most relevant pedestrian volumes from the Opus surveys were used as an approximation, and scaled back to give estimated 2013 pedestrian volumes. Table 3 shows the time periods used for the pedestrian volumes:

Table 3: Pedestrian volume time periods

	AM Peak	PM Peak
Stanley Street/ Shotover Street	Thursday 9 July 2015 8:00am to 9:00am	Thursday 9 July 2015 4:45pm to 5:45pm
Stanley Street/ Ballarat Street	Wednesday 24 December 2014 11:00am to 12:00pm	Wednesday 24 December 2014 3:00pm to 4:00pm

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3 SIDRA Modelling

The original Opus modelling assessed the following network options:

1. Stanley Street/ Shotover Street roundabout with Stanley Street/ Ballarat Street signals
2. Stanley Street/ Shotover Street signals with Stanley Street/ Ballarat Street signals

The same base network models have been rerun using the December 2013 traffic volumes that were used in the Abley modelling. In addition, the 2013 traffic volumes were factored up using the same methodology as the original Opus modelling (which assumed linear growth of 3%) to give estimated 2018 and 2028 traffic volumes.

The same base network models were used with the same parameters. Only the traffic volumes were changed.

3.1 2013 Survey Year (Using December 2013 Traffic Volumes)

Table 4 shows the results for the 2013 survey year (the original Opus modelling did not include 2013).

Table 4: 2013 Intersection Comparison

	Original Traffic Volumes				Abley Traffic Volumes			
	Mixed		Both Intersections Signalised		Mixed		Both Intersections Signalised	
	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals
AM Peak								
Intersection Level of Service	-	-	-	-	B	A	C	B
Average Vehicle Delay (s)	-	-	-	-	16	8	20	16
PM Peak								
Intersection Level of Service	-	-	-	-	D	B	B	B
Average Vehicle Delay (s)	-	-	-	-	41	13	17	18

The results from Table 4 show the following:

- In the AM peak, the mixed network has a higher intersection level of service than the signalised network.
- In the PM peak, the signalised network has a higher intersection level of service than the mixed network, although Ballarat Street has lower average vehicle delays in the mixed network.

3.2 2018 Base Year

Table 5 shows the results for the 2018 base year.

Table 5: 2018 Intersection Comparison

	Original Traffic Volumes				Abley Traffic Volumes			
	Mixed		Both Intersections Signalised		Mixed		Both Intersections Signalised	
	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals
AM Peak								
Intersection Level of Service	F	C	C	C	E	A	C	B
Average Vehicle Delay (s)	94	27	26	24	58	10	24	16
PM Peak								
Intersection Level of Service	F	C	B	B	F	D	B	C
Average Vehicle Delay (s)	83	21	17	11	86	40	16	22

The results from Table 5 show the following:

- Using the Abley traffic volumes results in higher levels of service in the AM peak, but generally lower levels of service in the PM peak (due to the higher right-turning movements) compared to using the original traffic volumes.
- Using the Abley traffic volumes, the signalised network continues to have a higher overall level of service than the mixed network in both of the AM and PM peaks.

3.3 2028 Design Year

Table 6 shows the results for the 2028 design year.

Table 6: 2028 Intersection Comparison

	Original Traffic Volumes				Abley Traffic Volumes			
	Mixed		Both Intersections Signalised		Mixed		Both Intersections Signalised	
	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals	Shotover Street Roundabout	Ballarat Street Signals	Shotover Street Signals	Ballarat Street Signals
AM Peak								
Intersection Level of Service	F	F	E	F	F	F	E	F
Average Vehicle Delay (s)	313	158	57	182	152	147	60	143
PM Peak								
Intersection Level of Service	F	F	E	D	F	F	C	F
Average Vehicle Delay (s)	280	268	57	36	173	246	31	166

The results from Table 6 show the following:

- Using the Abley traffic volumes results in higher levels of service in the AM peak, and generally better levels of service in the PM peak. The exception is at Ballarat Street in the PM peak, where performance is significantly worse using the Abley traffic volumes due to the higher right-turning movements.
- In all cases, the signalised network has a higher overall level of service than the mixed network.

3.4 Phasing Investigation

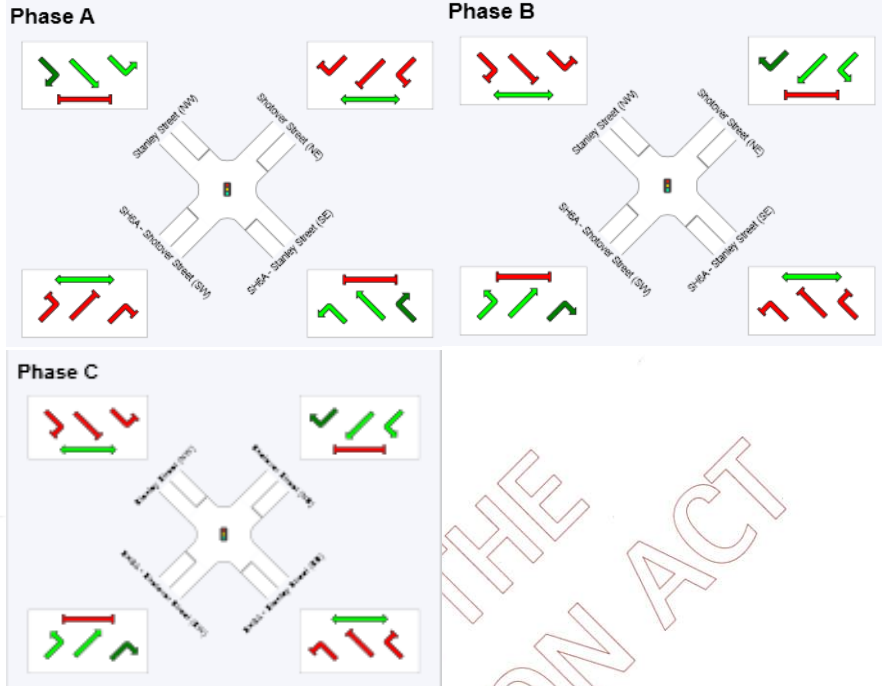
Different phasing configurations were used by Opus and Abley. Table 7 shows the traffic movements in each phase.

Table 7: Phase Configuration Comparisons

Stanley Street/ Shotover Street Intersection	
AM Peak	
Opus	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Phase A</p> </div> <div style="text-align: center;"> <p>Phase B</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>Phase C</p> </div> <div style="text-align: center;"> <p>Phase D</p> </div> </div>
Abley	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Phase A</p> </div> <div style="text-align: center;"> <p>Phase B</p> </div> </div> <div style="text-align: center; margin-top: 10px;"> <p>Phase C</p> </div>



Opus



Abley



Stanley Street/ Ballarat Street Intersection

AM Peak and PM Peak



The 2013 signalised SIDRA model was rerun using the Abley phasing to determine the impact this difference may be having. These results are shown below in Table 8:



Table 8: 2013 Signalised Network Comparison

	Both intersections signalised			
	Original Phasing		Abley Phasing	
	Shotover (4 Phase)	Ballarat Street (2 Phase)	Shotover (Abley 3 Phase)	Ballarat Street (Abley 3 Phase)
AM Peak				
Intersection Level of Service	C	B	C	B
Average Vehicle Delay (s)	20	16	27	14
PM Peak				
Intersection Level of Service	B	B	C	C
Average Vehicle Delay (s)	17	18	23	24

The results from Table 8 show that in this SIDRA model, the phasing used in the original Opus modelling typically results in slightly lower delays than the phasing used by Abley, with the exception of Ballarat Street in the AM peak, which is marginally higher.



4 Discussion

The results of the modelling indicate that several factors are contributing to the different conclusions reached by Opus and Abley.

4.1 Impact of comparing different years

The original Opus modelling considered results for 2018 and 2028 traffic volumes. The Abley modelling used 2013 traffic volumes. The 2018 and 2028 traffic volumes are higher than the 2013 volumes; therefore, the Opus model was rerun using 2013 traffic volumes.

The 2013 results show that in the AM peak the mixed network performs better, and in the PM peak the performance of the mixed network and the signalised network are comparable. The 2018 and 2028 results show that the signalised network has a higher overall level of performance than the mixed network in both of the AM and PM peaks.

4.2 Impact of summer volumes and winter volumes

The original Opus modelling was based on worst-case scenario traffic volumes compiled from surveys undertaken in April, July, and late December. The Abley modelling was based on traffic volumes surveyed in early December. These were generally lower than the Opus traffic volumes.

Rerunning the SIDRA models using the Abley traffic volumes resulted in levels of service which were generally slightly higher than with the original traffic volumes.

4.3 SIDRA compared with Paramics

Opus have used SIDRA 6.1 to model the two Stanley Street intersections in a network, while Abley have used Paramics to model these two intersections as part of the wider Queenstown Central network. These software packages are fundamentally different and model various effects differently.

One key difference between the models is the extents. The Paramics model takes into account wider network effects, which could be significant in the compact, congested Queenstown network. The SIDRA model only considers effects between the two intersections under investigation.

5 Conclusion

This investigation shows that the key reasons for the differences between the conclusions reached by Abley and Opus are:

- Different years being compared;
- Traffic surveys undertaken at different times of year;
- Different phase configurations used; and
- Different modelling packages used.

The results from rerunning the SIDRA model with traffic volumes based on the Abley December 2013 surveys, indicate that in 2013 the mixed network will operate with levels of service comparable to the signalised network. However, the performance of the mixed network will deteriorate by 2018, and the signalised network provides higher levels of service than the mixed network in 2018 and 2028, regardless of which traffic volumes are used.

The modelling indicates that signalising both intersections remains the best long-term option.