

Report

SH2 Grounsell Crescent Slip Rd Operational Assessment

Prepared for New Zealand Transport Agency



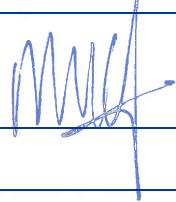
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Executive Summary

This traffic assessment investigates the potential traffic impact of closing the SH2 northbound on-ramp slip between Grounsell Crescent and the Major Drive intersection, and explores the impacts on local residents and on the operation the traffic signals at the intersection of Grounsell Crescent/SH2.

In summary, we expect the proposed Grounsell Crescent slip road closure will allow a safer operation on SH2 northbound and traffic from Grounsell Crescent.

Based on this, we recommend:

- Implementing line marking and layout changes at the Hill Road/Grounsell Crescent intersection to direct Grounsell Crescent traffic to give way to Hill Road with the proposed slip road closure, as Grounsell Crescent will carry less traffic.
- Southbound Grounsell Crescent traffic is detoured to turn right onto Melling Link and then u-turn back to SH2 north. We recommend this option rather than allowing Grounsell Crescent south traffic to turn left at the intersection to SH2 north because traffic is extremely low and it avoids any physical change at the Grounsell Crescent/SH2 intersection.

The current queue lengths, at intersection Grounsell Crescent/SH2, will not extend significantly with added traffic volume from the slip road.

Contents

1	Introduction	1
2	Site Observations	1
3	Traffic Data	3
4	Traffic Modelling	4
5	Scenario Analysis	5
5.1	Scenario 1 – Grounsell Crescent South traffic to turn left at the intersection to SH2 north	5
5.2	Scenario 2 – Grounsell Crescent south traffic to u-turn at Melling Link/Rutherford St to SH2 north	5
5.3	Scenario 3 – Grounsell Crescent south traffic to u-turn at Melling Link/Rutherford St to SH2 north & Introduce left turn green arrow for Grounsell Cres at the intersection	6
6	Recommendation	7

Appendix A: Detailed Intersection Forecast Operations

1 Introduction

This traffic assessment investigates the potential traffic impact of closing the SH2 northbound on-ramp slip between Grounell Crescent and the Major Drive intersection. It considers the impacts on local residents and on the operation the traffic signals at the intersection of Grounell Crescent/SH2.

This report presents details of our site observations, the traffic assessment that has been undertaken, outlines the results and provides our recommendations.

2 Site Observations

A site visit was carried out to identify the potential impact of closing the slip road and our observations are summarised as follows:

1. Safety issues for Grounell Cres slip road traffic to join the SH2

It has been observed that the short length of Grounell Crescent slip road does not provide sufficient distance for vehicles to accelerate up to 100 km/h before joining the state highway. The bend on SH2, before the slip road, poses some safety risk to traffic from the slip road.

2. Line marking update required at Hill Road/Grounell Crescent intersection

Currently, Hill Road traffic gives way to Grounell Crescent at the intersection of Hill Road/Grounell Crescent. It is recommended that this is converted to Grounell Crescent giving way to Hill Road with the proposed slip road closure, as Grounell Crescent will carry less traffic.



Figure 1 Hill Road/Grounell Crescent Intersection

3. Traffic using the Grounell Cres slip to SH2 north will be diverted to use Grounell Cres intersection to SH2 north. These traffic include:
 - a. Traffic from Park Road and Hill Road, marked as 1. These traffic could directly use the left turn at Grounell Cres/SH2 intersection to SH2 north. The level of inconvenience is minimal.
 - b. Traffic from Grounell Cres, marked as 2. These traffic could not directly join the left turning lane at Grounell Cres/SH2 intersection safely due to site topological constraint, as shown in Figure 3. The following options could be considered:
 - i. To have a direct left turn at the intersection of Grounell Crescent/SH2 if the topography allows. This requires to remove the centre island at the intersection and convert the middle right turning lane to left & right shared lane
 - ii. To divert the vehicles to u-turn at Melling Link/SH2 intersection to SH2 north

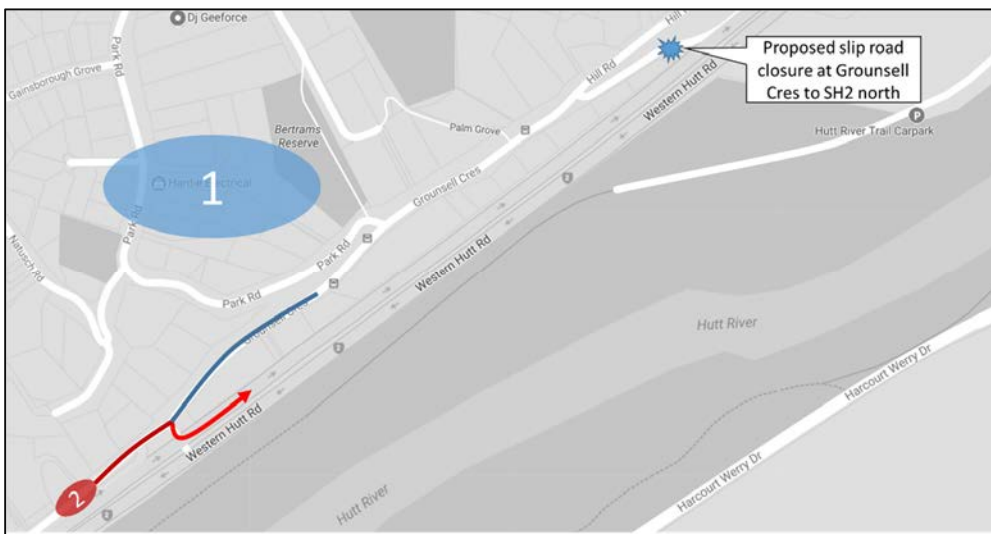


Figure 2 Affected traffic with the proposed slip road closure



Figure 3 Diversion options for affected traffic

4. There was no significant impact to pedestrian safety observed.
5. Detailed traffic assessments have been presented in the section below on Scenario Analysis.

3 Traffic Data

SCATS traffic data for Grounsell Crescent/SH2 Intersection (including traffic volume, signal phasing and phase timing) was obtained from WTOC. A 24-hour traffic volume on the Grounsell slip to SH2 northbound was counted by Beca staff using WTOC camera video records.

Figure 4 shows the 24-hour traffic volume profile on the Grounsell slip to SH2 northbound. It can be seen that AM peak occurs at 8am-9am and PM peak occurs 4pm-5pm. There is no data available from 1:30am to 6:15am as the camera changed view. However, it is believed that traffic is low during this period and shall not affect the 24-hour traffic volume significantly. The total traffic volume from 6am to 12 midnight is about 735 vehicles.

Table 1 provides the detailed turning flows during the peak hours at the Grounsell Crescent/SH2 intersection. A nominated volume of 100 vehicles/hour was used for the left turn from SH2 to Grounsell Cres for SIDRA modelling purpose.

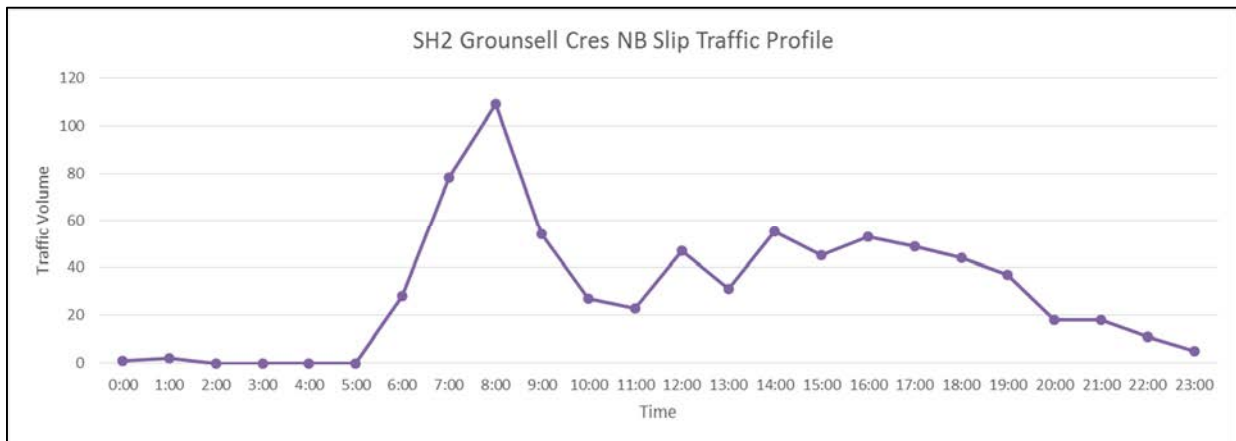


Figure 4 SH2 Grounsell Cres NB Slip Traffic Profile

Table 1 Traffic Volume on Grounsell/SH2 Intersection

Traffic Volume	AM Peak			PM Peak		
	LT	TH	RT	LT	TH	RT
Western Hutt Rd N	-	2008	80	-	1304	73
Western Hutt Rd S	100	1109	-	100	2399	-
Grounsell Cres	25	-	238	12	-	81

4 Traffic Modelling

The site is reasonably isolated from the rest of the wider road network and it is believed that the level of congestion at the site is unlikely to impact on route choices. Therefore, an individual SIDRA model is considered appropriate.

The intersection was modelled as a typical T-intersection as the south of Grounsell Crescent operates as a give-way and the traffic volumes are low. Its impact on the intersection operation is minimal. Vehicles from Grounsell Crescent north are also observed to use the right turning lane to SH2 even though it is designed for vehicles from Grounsell Crescent south.

For the purpose of the modelling assessment, only checks on queue lengths from site observations for the base model have been performed rather than a full validation exercise. Figure 5 illustrates the base model output queue lengths for the AM and PM peak hours, which is believed to represent the current queue condition at the intersection.

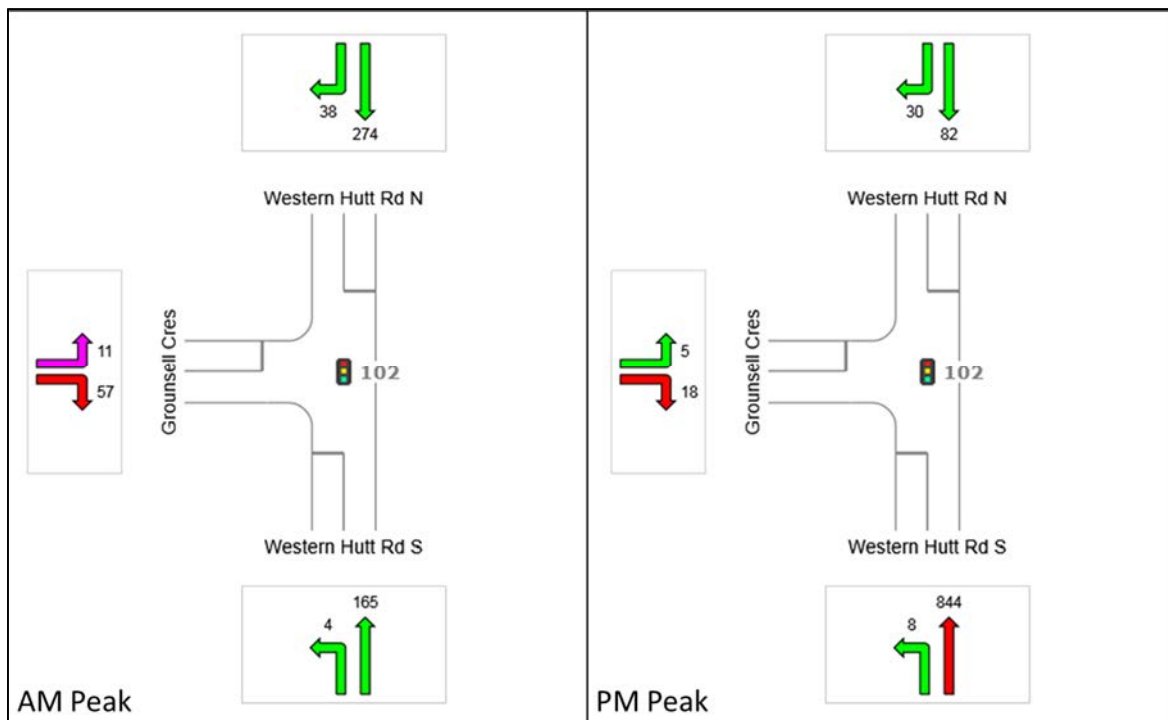


Figure 5 Modelled Queue Lengths_Base Model

5 Scenario Analysis

The base SIDRA model has been updated with these scenarios and has been tested to examine their impacts to the forecast intersection operations, as detailed below.

5.1 Scenario 1 – Grounell Crescent South traffic to turn left at the intersection to SH2 north

Our site observations show that it could be possible to allow Grounell Crescent south traffic (i.e. Group 2 traffic as shown in Figure 2) to turn left at the intersection directly to SH2 north by removing the physical centre median and converting the middle right turn lane to left and right share lane, as shown in Figure 6. This will allow the Group 2 traffic to directly join the left turning lane to SH2 north. However, vehicle tracking should be performed during the intersection design if this option is preferred.

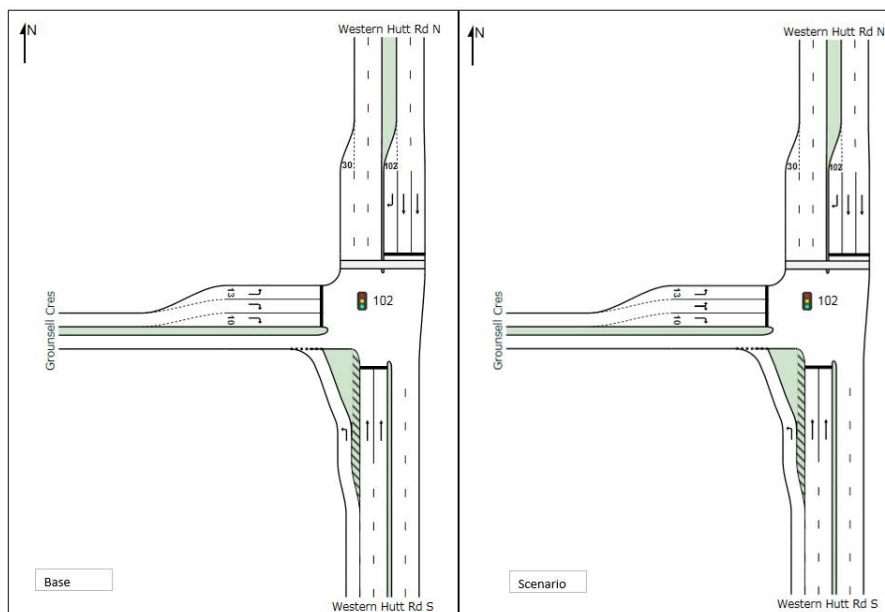


Figure 6 Lane configuration change to middle lane on Grounell Cres

5.2 Scenario 2 – Grounell Crescent south traffic to u-turn at Melling Link/Rutherford St to SH2 north

This scenario does not require physical layout changes at the Grounell Crescent/SH2 intersection. Group 2 traffic is required to turn right at Grounell Crescent/SH2 intersection and u-turn at Rutherford St/Melling Link roundabout to SH2 north. This would result in 3kms of additional travel for the motorists and the additional travel times for detoured traffic are summarized as follows:

1. AM peak hours – typically 9-10 minutes
2. PM peak hours – typically 12 minutes
3. Without traffic – typically 5 minutes

5.3 Scenario 3 – Grounell Crescent south traffic to u-turn at Melling Link/Rutherford St to SH2 north & Introduce left turn green arrow for Grounell Cres at the intersection

This scenario is based on Scenario with allowing left turn green arrow for Grounell Cres during B phase, as shown in Figure 7.

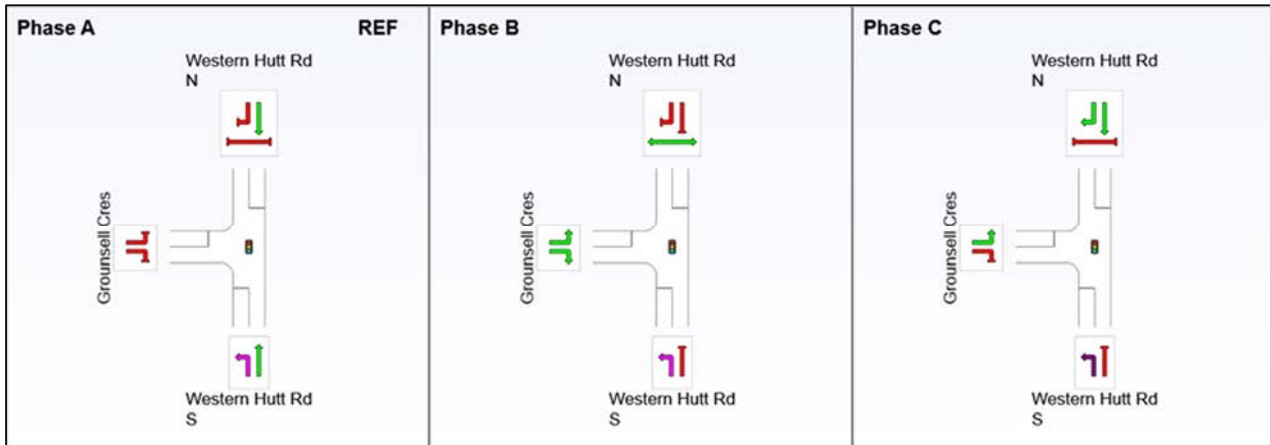


Figure 7 Proposed Signal phasing at Grounell Cres/SH2

The following cycle time options were tested:

- a. Current SCATS cycle time to maintain the signal linking along SH2
- b. Shortened cycle to allow double cycle intersection operations to reduce Grounell Cres waiting time while maintaining the signal linking along SH2

A comparison of modelled queue lengths, level of services (LOS) and delays between the scenarios and the base model is shown in Table 2 and Table 3 for the AM and PM peaks respectively below. The detailed modelling results, including phase timings, approach LOS, approach delays and queue lengths are attached in Appendix A.

The modelling results indicate that the intersection is expected to operate similarly during peak hours across the scenarios tested and as compared to the base model. The shortened delay on Western Hutt Road (SH2) towards Upper Hutt should be due to the traffic signal re-optimization which allow longer green time for SH2.

The intersection is expected to operate better overall with the proposed new signal phasing as compared to other scenarios and the base model. Traffic signal time re-optimization to allow double cycle intersection operation is expected to improve traffic on Grounell Cres significantly but causing some additional delays on SH2 northbound during PM peak.

Table 2 Forecast Operation for AM Peak

Approach	Movement	Avg Delay (s)					LOS					95% Q.(m)				
		Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b	Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b	Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b
South: Western Hutt Rd S	Left	9.0	8.6	8.6	9	9.2	A	A	A	LOS A	LOS A	2.1	2.1	2.1	4	3
	Through	15.3	17.8	17.8	13.8	11.1	B	B	B	LOS B	LOS B	157.5	157.5	157.5	137.8	88.7
North: Western Hutt Rd N	Through	8.9	8.7	8.7	8.2	6.5	A	A	A	LOS A	LOS A	259.9	259.9	259.9	250.1	149.9
	Right	73.9	75.2	75.2	75.5	44.1	E	E	E	LOS E	LOS D	39.1	39.1	39.1	37.5	19.8
West: Grounell Cres	Left	63.0	95.7	73.3	46.1	25.4	E	F	E	LOS D	LOS C	11.2	107.2	67.9	49	24.8
	Right	64.0	124.7	71.6	65.7	39.3	E	F	E	LOS E	LOS D	59.0	107.2	59.0	53.6	29.4

Table 3 Forecast Operation for PM Peak

Approach	Movement	Avg Delay (s)					LOS					95% Q (m)				
		Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b	Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b	Base	Scenario 1	Scenario 2	Scenario 3a	Scenario 3 b
South: Western Hutt Rd S	Left	9.0	9.0	9.0	9.1	9.2	A	A	A	LOS A	LOS A	4.3	4.3	4.3	10.8	7.9
	Through	21.5	21.5	21.5	10.1	139.0	C	C	C	LOS B	LOS F	478.0	478.0	478.0	347.8	787.5
	Right	5.4	5.4	5.4	1.9	3.8	A	A	A	LOS A	LOS A	100.9	100.9	100.9	61.3	62.7
North: Western Hutt Rd N	Left	86.7	86.7	86.7	84.1	44.0	F	F	F	LOS F	LOS D	37.9	37.9	37.9	36.7	18
	Through	65.6	66.7	68.3	61.1	26.3	E	E	E	LOS E	LOS C	5.2	25.5	29.5	27.1	12.1
	Right	62.7	64.3	62.7	77.3	38.8	E	E	E	LOS E	LOS D	17.3	30.7	17.3	19.6	9.6

6 Recommendation

In summary, we expect the proposed Grounell Crescent slip road closure will allow a safer operation on SH2 northbound and traffic from Grounell Crescent.

The current queue lengths, at intersection Grounell Crescent/SH2, will not extend significantly with added traffic volume from the slip road.

Line marking and intersection layout changes at intersection Hill Road/Grounell Crescent and SH2/Grounell Crescent will be required to cater for the changed traffic flow pattern. Currently, Hill Road traffic gives way to Grounell Crescent at the intersection of Hill Road/Grounell Crescent. We recommend that this is converted to Grounell Crescent giving way to Hill Road with the proposed slip road closure, as Grounell Crescent will carry less traffic.

The intersection is expected to operate better overall with the proposed new signal phasing as compared to other scenarios and the base model. Traffic signal time re-optimization to allow double cycle intersection operation is expected to improve traffic on Grounell Cres significantly but causing some additional delays on SH2 northbound during PM peak.

We recommend the preferred option for detouring southbound Grounell Crescent traffic is for traffic to turn right onto Melling Link and then u-turn back to SH2 north. This is recommended because the traffic is extremely low and it avoids any physical change at the Grounell Crescent/SH2 intersection.

Appendix A

Detailed Intersection Forecast Operations

Scenario	Peak	Approach	Movement	Avg Delay	LOS	95% Q	APPROACH		INTERSECTION	
				sec		m	DELAY	LOS	DELAY	LOS
Base	AM	South:	Left	8.9	LOS A	4.1	17.3	B	17.7	B
		Western Hutt Rd S	Through	18.0	LOS B	164.7				
		North:	Through	8.9	LOS A	273.6	11.4	B		
		Western Hutt Rd N	Right	74.4	LOS E	38.5				
		West:	Left	65.5	LOS E	11.3	68.8	E		
	Grounell Cres	Right	69.2	LOS E	57.3					
	PM	South:	Left	8.8	LOS A	7.9	75.0	E	51.8	D
		Western Hutt Rd S	Through	81.5	LOS F	844.2				
		North:	Through	3.4	LOS A	81.8	6.6	A		
		Western Hutt Rd N	Right	63.6	LOS E	30.2				
West:		Left	65.5	LOS E	5.1	65.7	E			
Grounell Cres	Right	65.8	LOS E	17.5						
Scenario 1	AM	South:	Left	9.0	LOS A	4.2	16.0	B	19.4	B
		Western Hutt Rd S	Through	16.7	LOS B	151.5				
		North:	Through	11.5	LOS B	297.1	14.0	B		
		Western Hutt Rd N	Right	76.8	LOS E	37.9				
		West:	Left	59.4	LOS E	67.3	60.7	E		
	Grounell Cres	Right	61.5	LOS E	67.7					
	PM	South:	Left	9.1	LOS A	10.8	11.2	B	12.0	B
		Western Hutt Rd S	Through	11.4	LOS B	370.4				
		North:	Through	2.3	LOS A	68.1	6.7	A		
		Western Hutt Rd N	Right	84.1	LOS F	36.7				
West:		Left	77.3	LOS E	30.5	77.8	E			
Grounell Cres	Right	78.2	LOS E	31.6						
Scenario 2	AM	South:	Left	9.0	LOS A	4.2	14.4	B	17.8	B
		Western Hutt Rd S	Through	14.9	LOS B	143.3				
		North:	Through	9.2	LOS A	265.8	11.7	B		
		Western Hutt Rd N	Right	75.5	LOS E	37.5				
		West:	Left	64.9	LOS E	60.1	63.2	E		
	Grounell Cres	Right	62.3	LOS E	51.7					
	PM	South:	Left	9.1	LOS A	10.8	11.2	B	12.0	B
		Western Hutt Rd S	Through	11.4	LOS B	370.4				
		North:	Through	2.3	LOS A	68.1	6.7	A		
		Western Hutt Rd N	Right	84.1	LOS F	36.7				
West:		Left	78.3	LOS E	31.9	75.5	E			
Grounell Cres	Right	73.9	LOS E	18.9						
Scenario 3	AM	South:	Left	9.0	LOS A	4.0	13.4	B	16.5	B
		Western Hutt Rd S	Through	13.8	LOS B	137.8				
		North:	Through	8.2	LOS A	250.1	10.7	B		
		Western Hutt Rd N	Right	75.5	LOS E	37.5				
		West:	Left	46.1	LOS D	49.0	58.7	E		
	Grounell Cres	Right	65.7	LOS E	53.6					
	PM	South:	Left	9.1	LOS A	10.8	10.0	A	10.9	B
		Western Hutt Rd S	Through	10.1	LOS B	347.8				
		North:	Through	1.9	LOS A	61.3	6.3	A		
		Western Hutt Rd N	Right	84.1	LOS F	36.7				
West:		Left	61.1	LOS E	27.1	70.1	E			
Grounell Cres	Right	77.3	LOS E	19.6						
Scenario 3 DCL	AM	South:	Left	9.2	LOS A	3.0	11.0	B	11.6	B
		Western Hutt Rd S	Through	11.1	LOS B	88.7				
		North:	Through	6.5	LOS A	149.9	7.9	A		
		Western Hutt Rd N	Right	44.1	LOS D	19.8				
		West:	Left	25.4	LOS C	24.8	34.3	C		
	Grounell Cres	Right	39.3	LOS D	29.4					
	PM	South:	Left	9.2	LOS A	7.9	127.2	F	83.8	F
		Western Hutt Rd S	Through	139.0	LOS F	787.5				
		North:	Through	3.8	LOS A	62.7	5.9	A		
		Western Hutt Rd N	Right	44.0	LOS D	18.0				
West:		Left	26.3	LOS C	12.1	33.2	C			
Grounell Cres	Right	38.8	LOS D	9.6						

Phasing Time

Base AM Peak			Base PM Peak		
Phase	Phase time	Cycle time	Phase	Phase time	Cycle time
A	98	153	A	91	136
B	29		B	18	
C	26		C	27	

Senario 1 AM Peak			Senario 1 PM Peak		
Phase	Phase time	Cycle time	Phase	Phase time	Cycle time
A	90	140	A	109	136
B	32		B	14	
C	18		C	13	

Senario 2 AM Peak			Senario 2 PM Peak		
Phase	Phase time	Cycle time	Phase	Phase time	Cycle time
A	93	140	A	109	136
B	28		B	14	
C	19		C	13	

Senario 3 AM Peak			Senario 3 PM Peak		
Phase	Phase time	Cycle time	Phase	Phase time	Cycle time
A	95	140	A	111	136
B	19		B	13	
C	26		C	12	

Senario 3 AM Peak DCL			Senario 3 PM Peak DCL		
Phase	Phase time	Cycle time	Phase	Phase time	Cycle time
A	44	70	A	46	70
B	12		B	12	
C	14		C	12	

Note: Cycle times follow the current SCATS settings to maintain the signal linking along SH2.