Welhom Proposed Private Plan Change – Cashmere Oaks, Masterton

Statement of Facts - Transportation

28 March 2023

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application to Masterton District Council by Welhom Developments Limited ("**Welhom**") for a private plan change to the combined Wairarapa District Plan ("**Plan Change**")

STATEMENT OF FACTS – TRANSPORTATION & ROAD SAFETY EXPERTS

1. INTRODUCTION

1.1 This Statement of Facts has been produced in response to a request from the Panel. Contributors to the document are:

(a) Mark Georgeson (MG) transportation expert engaged by Welhom;

(b) Melanie Muirson (MM) road safety expert engaged by Welhom;

(c) Glenn Connelly (GC) transportation expert engaged by Waka Kotahi;

(d) Richard Langdon-Lane (RLL) road safety expert engaged by Waka Kotahi; and

(e) Harriet Fraser (HF) transportation expert engaged by Masterton District Council.

1.2 We confirm that we have read the Environment Court's Code of Conduct set out in the Environment Court's Practice Note 2023. We have complied with the Code of Conduct in preparing this statement. Except where we state that we are relying on the evidence of another person, this evidence is within our area of expertise. We have not omitted to consider material facts known to us that might alter or detract from the opinions expressed in this evidence.

2. PURPOSE

2.1 The purpose of this statement is to provide the information requested in Minute 4 from the Panel. The transportation topics included in Minute 4 are listed in the first column of the table that follows.

3. TABLE OF TRANSPORTATION & ROAD SAFETY FACTS

Topic	Requestor Comment (Stantec - Mark Georgeson MG, Melanie Muirson MM)	Submitter Comment (Waka Kotahi – Glenn Connelly GC, Richard Langdon-Lane RLL)	Council Comment (Harriet Fraser HF)
1. Existing transport characteristics	**ITA Section 2:** SH2 past the Site is formed as a typical two-lane State Highway. The traffic lanes are approximately 3.5m wide and have sealed shoulders. The speed limit is 100km/h, with the Masterton urban speed limit of 50km/h beginning 120m south of Cashmere Oaks Drive. There is no transition speed zone between the 50 km/h and 100km/h threshold. Cashmere Oaks Drive meets SH2 at a priority-controlled give-way T-junction. There is a right turn bay on SH2 for use by traffic turning into Cashmere Oaks Drive. The right turn bay is one of two back-to-back right turn bays, with the other being the right turn into the nearby Opaki Meadows Lane. In front of the right turn bay is an approximately 35m long centre southbound lane on SH2 for use by vehicles turning right out of Cashmere Oaks Drive to safely merge with SH2 traffic, although observations show that drivers typically wait for gaps in both traffic streams before making a right turn out of Cashmere Oaks Drive. Cashmere Oaks Drive is the primary vehicle access from SH2 for the Cashmere Oaks subdivision and will serve as the main access for the Site. It has an 11m wide carriageway with no road markings. The road has an urban formation with kerb and channel, footpaths, and unrestricted kerbside car parking. The local roads within the Cashmere Oaks subdivision have 50km/h speed limits. The Metlink Route 203 bus service connects the Masterton town centre to the northern part of the town. The closest bus stop to the Site is at Third Street / Stamford Place intersection, an approximate 1.4km walk away via Cashmere Oaks Drive and SH2. This bus service runs infrequently with stops at the Third Street / Stamford Place bus stop at 10:20am and 11:30am in the mornings and one stop at 2:45pm in the afternoon. The route does not pass the Cashmere Oaks subdivision as it travels up Totara Street and back to the Masterton town centre via SH2. The pedestrian network on Cashmere Oaks Drive is well established, with footpaths on both sides of the road and on other subdivision roads. On SH2 there is a footpath on the western side, extending south from Cashmere Oaks Drive. The nearest dedicated pedestrian crossing point on SH2 is to the south of Third Street, in the form of a refuge island with kerb extensions.	GC SH2 – Cashmere Oaks Drive to Fifth St (585m) - Sealed road - Right turn bay / flush median - Open drains / swales - Tree lined, especially next to Cashmere Oaks Drive - Overhead power (opposite Hansells heading north) - Limited direct access / vehicle crossings. #167 SH2- rural res dwelling Hansells access x 3 (1 lot) - Side roads Cashmere Oaks Drive Opaki Meadows Lane – 8 dwellings of 12 lots Arvida / Hansells rear Access Fifth St – one dwelling, recreational paths - Off road recreational paths east of SH2 **Speeds** - as per my presentation and see also Appendix 2 I acknowledged that there is some urban development of land. However much of this is screened by trees / landscaping and the road has a rural appearance which is what drivers respond to regarding speed. The is reflected in the average and 85th percentile speeds of 80/82 and 91/93 kph (southbound/northbound) adjacent to Arvida. Driver speeds would reduce at Cashmere Oaks Drive, but remain elevated and above those recorded south of Cashmere Oaks Drive (63/65 & 74/74 kph). Noting also that there is a greater amount of deceleration in the area from the tail of the Cashmere Oaks Drive right turn bay to the 50 kph speed limit, having observed deceleration and braking driver behaviour. The red figures showing the correction to the directions of the recorded counts and speeds as advised when presenting evidence, and now correctly shown in the attached Appendix 2. **Figure 8. Average and 85th percentile speeds**  	I agree with the description of the existing transport characteristics as set out by the Requestor and Waka Kotahi and make the following comments: - the submitters from Cashmere Oaks who appeared at the hearing confirmed that they wait for a gap in both traffic flows on SH2 before turning right out towards Masterton. - I have measured the footpath along the western side of SH2 along the Cashmere Oaks frontage to be 1.4m wide.

2. Existing traffic volumes a. Daily SH2 and Cashmere Oaks Drive (date, location) b. Intersection counts SH2/ Cashmere Oaks Drive (date, time period, modes and vehicle types counted)	**a. Georgeson Evidence in Chief Paragraphs 4.12-4.13** During the two-week period from 14 to 27 November 2022, the average daily traffic volume (7-day) on SH2 south of Cashmere Oaks Drive was recorded as 5,936vpd, while north of the Hansells industrial site it was 5,055vpd. From 18 September to 15 October 2022, the average daily traffic volume (7-day) on Cashmere Oaks Drive was recorded as 609vpd. **b. ITA Section 3.2** Peak hour turning counts were undertaken at the intersection on Thursday 3 March 2022. The counts covered the 7:00am-9:00am, 12:00pm-2:00pm and 4:00pm-6:00pm periods. The following table summarises the counts by hour.	RLL - AADTs SH2 – 5482, 2022 tube count sth of intersection Cashmere Oaks – 612, 2022 tube count GC **TRAFFIC VOLUMES** See EIC GC, Appendix 1 – Traffic Counts Summarised as follows. **SH 2 - North of Hansells** 5,410 vehicles / day weekday (5 day) average 5,094 vehicles / day 7 day average 415m north of Cashmere Oaks Dr 14th – 27th November 2022 **SH 2 - South of Cashmere Oaks Dr** 6,419 vehicles / day weekday (5 day) average 5,959 vehicles / day 7 day average 90m south of Cashmere Oaks Dr 45m north of the 50/100 speed limit sign 14th – 27th November 2022 **Cashmere Oaks Drive - West of SH2** 669 vehicles / day weekday (5 day) average 609 vehicles / day 7 day average 70m west of SH2 (MDC to confirm) 18 Sept 2022 – 15 October 2022 **Count Site Locations** See Figure 6 of my evidence for the SH count site locations.	The November 2022 SH2 traffic counts have been relied on. There is a slight variation in the interpretation of the counts but this is not significant. 7 day average traffic flows on SH2 of around 6,000vpd and 5,100vpd to the south of Cashmere Oaks Drive and to the north of Hansells respectively. Given that senior college students will have been doing exams at this time the counts may be slightly lower that typical term time data. All parties have relied on the same traffic count for Cashmere Oaks Drive. The Cashmere Oaks Drive traffic volumes will be steadily increasing as more houses are completed. The September/ October traffic count included the public holiday for the memorial day for the passing of the Queen and also two-weeks of school holidays, so will be lower than typical. I estimated that when the data for these days is excluded the average weekday traffic flows are around 700vpd. All parties have relied on the intersection count for SH2/ Cashmere Oaks Drive included in the ITA Section 3.2. These counts show 81%, 92% and 82% of the traffic turning out of Cashmere Oaks Drive turns right during the AM, IP and PM survey periods respectively. The Strava data provided by Waka Kotahi indicates that pedestrians/joggers are accessing the recreational trail on the eastern side of SH2 via Opaki Meadows Drive and Fourth Street, crossing SH2 to the north of Cashmere Oaks Drive and at Fourth Street. Neither of these locations include pedestrian refuge islands.

Cashmere Oaks Drive Volumes - Vehicles Only 3 March 2022			Vehicles					
			Cashmere Oaks - West Leg		SH2 - North Leg		SH2 - South Leg	
Peak	Hour Start	Type	Left	Right	Right	Thru	Left	Thru
AM	7 AM	Light	6	26	1	182	15	143
	8 AM		4	30	2	252	10	198
IP	12 PM		1	15	0	147	22	163
	1 PM		2	19	0	134	24	156
PM	4 PM		4	11	2	172	21	190
	5 PM		3	20	4	163	37	227
AM	7 AM	Heavy	3	2	0	13	3	16
	8 AM		1	0	0	26	0	23
IP	12 PM		0	0	0	14	0	12
	1 PM		0	2	0	14	2	15
PM	4 PM		0	0	0	7	1	8
	5 PM		0	0	0	10	1	6
AM	7 AM	All	9	28	1	195	18	159
	8 AM		5	30	2	278	10	221
IP	12 PM		1	15	0	161	22	175
	1 PM		2	21	0	148	26	171
PM	4 PM		4	11	2	179	22	198
	5 PM		3	20	4	173	38	233

Traffic volumes turning out of Cashmere Oaks Drive are highest in the morning when people are leaving the residential area for work and vice versa in the evening. Most turning movements are to and from the south which is to be expected given the location of the subdivision relative to Masterton. SH2 traffic volumes towards Masterton are highest in the morning peak.

A very low level of pedestrian and cyclist activity was recorded during the 3 March 2022 video counts, as summarised in the new table added below. The November 2022 tube counts did not record pedestrian and cyclist data.

Figure 6. Approximate Count Site Locations

Note: The location for the count south of Cashmere Drive was confirmed as being 30m south of the pin mark on the above figure, as indicated by the red arrow.

The counter on Cashmere Oaks Drive is expected to have been attached to the first street light column on the right. There were some marks on the ground that may have indicated this was the case. The location is shown in the following image (green line).

Cashmere Oaks Drive Volumes - Active Modes Only 3 March 2022			Active Modes					
			Cashmere Oaks - West Leg		SH2 - North Leg		SH2 - South Leg	
Peak	Hour Start		Left	Right	Right	Thru	Left	Thru
AM	7 AM	Pedestrians	0	0	0	0	0	0
	8 AM		0	0	0	1	0	0
IP	12 PM		0	0	0	0	0	0
	1 PM		0	0	0	0	0	0
PM	4 PM		0	0	0	0	0	1
	5 PM		0	0	0	0	0	0
AM	7 AM	Bikes	0	0	0	0	0	1
	8 AM		0	1	0	0	0	0
IP	12 PM		0	0	0	0	0	0
	1 PM		0	0	0	0	0	0
PM	4 PM		0	0	0	0	1	0
	5 PM		1	0	0	0	1	2

Expected Location of Cashmere Oaks Drive Counter

INTERSECTION COUNTS

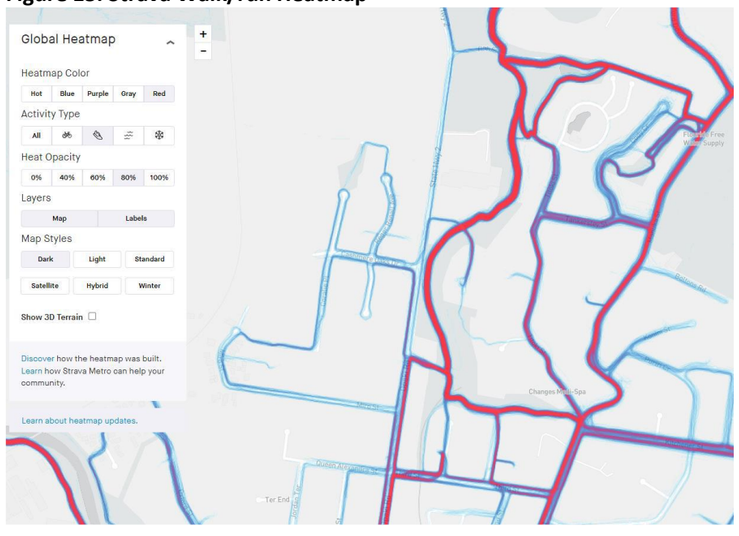
- No intersection counts were undertaken by Waka Kotahi
- See ITA Fig 3-2

The surveyed intersection counts have a peak of
506 vph north of Cashmere Oaks Drive
539 vph south of Cashmere Oaks Drive

Pedestrians & Cyclists
See Fig 15 and 16 from the Evidence in Chief of Glenn Connelly (EIC GC)

- Strava heatmaps are updated monthly
- The heat maps are updated monthly; with the following screen shots obtained 29th Aug 2022

Figure 15. Strava Walk/run Heatmap



- Fig 15 indicates a very high level of walking/running activity along the recreational path to the East of SH2 and Cashmere Oaks Drive.
- A small number of people from the Cashmere Oaks Drive residential area are crossing SH2 on foot, to access the recreational path via Opaki Meadows Drive, Fifth St, and Fourth St.

		- This number is very likely to grow as the number of people living in that residential area grows. - This number is very likely to be suppressed by the high speed of traffic on SH2 and the lack of a crossing facility. **Figure 16. Strava Cycling Heatmap**  - Fig 16 indicates a significant amount of cycling activity is occurring on SH2 and along the recreational path to the east. - A small number of people are cycling into and out of Cashmere Oaks Dr from SH2. - A small number of people are also cycling into and out of Fifth St, Opaki Meadows Drive, and Fourth St from SH2. This activity is also likely to increase with population growth in the Cashmere Oaks Drive area, however, cycling on this part of SH2 appears to be largely a part of much larger trips generated by residents of wider Masterton and beyond (i.e. This is part of the NZ Cycle Trail 'Tararua Traverse' Heartland Ride and of the Tour Aotearoa length of New Zealand cycling route).	
3. Existing household traffic generation rates for Cashmere Oaks subdivision (no. of houses, hourly traffic volume, how lots under construction dealt with)	**ITA Section 3.3:** It was observed during a site visit that there were 63 houses served by Cashmere Oaks Drive (constructed and occupied at the time of the traffic counts (being the 3 March 2022 intersection turning counts)). There were eight contractor vehicles observed to be present. To make an estimate of the traffic generation of the existing subdivision, the volumes of light vehicles turning into Cashmere Oaks Drive during the morning and out of it in the evening have been reduced by three vehicle movements per hour to allow for contractor traffic (recognising that not all construction vehicles would arrive and leave in the peak hours). The following table summarises the calculated traffic generation for the existing subdivision. The rates are based on the busiest hours during the morning, inter-peak (IP) and evening periods surveyed.	RLL 8.7 (612 AADT / 70 lots) GC **Residential** As per EIC Para 48, with a little more explanation. - **Average Peak** 56 to 58 vehicles per hour (vph) morning peak 59 vph in the evening peak. - **85th Percentile Peak** 56 to 58 vehicles per hour - **Cashmere Oaks Drive Dwellings** 70 occupied houses as at 13 Feb 2023, based on the presence of houses that look occupied; with the presence of vehicles, people and / or letter boxes - **Surveyed Dwellings** 66 to 70 houses	I agree with the methodology used by Mark Georgeson to calculate the existing residential trip rates for Cashmere Oaks Drive as included in the ITA and repeated in the table inserted in this document. I regularly observe similar weekday peak hour trip generation rates as a result of surveys for other projects. The lower rate described in his evidence may be a result of the count period including the school holidays.

	<table><tr><th>Period</th><th>Traffic Generation Rate</th><th>% In / Out</th><th>% North / South</th></tr><tr><td>AM</td><td>0.7vph / house</td><td>24% / 74%</td><td>18% / 82%</td></tr><tr><td>IP</td><td>0.6vph / house</td><td>58% / 42%</td><td>3% / 97%</td></tr><tr><td>PM</td><td>0.8vph / house</td><td>65% / 35%</td><td>16% / 84 %</td></tr></table> The peak periods adopted were the peak periods in terms of the overall use of the SH2 / Cashmere Oaks Drive intersection, being 7:45am-8:45am and 4:15pm-5:15pm. **Georgeson Evidence in Chief Paragraphs 4.20-4.22:** At the time of the MDC counts on Cashmere Oaks Drive (18 September to 15 October 2022), there were 71 houses completed. During the four-week survey (and excluding the Monday 26 September public holiday), there were averages of 50 and 49 light vehicle movements per hour (vph) in and out of Cashmere Oaks Drive during the weekday peak hours identified earlier (7:45am-8:45am and 4:15pm-5:15pm). 19 contractor vehicles were counted associated with house construction at the time. To allow for construction traffic, but recognising that some contractor traffic would occur outside of the peak hours, the entering volume during the morning and the exiting volume in the evening was reduced by a moderate 7vph. Traffic generation of 42-43vph from 71 houses represents a peak hour traffic generation rate of approximately 0.6vph/house. This is lower than the residential traffic generation rates calculated and adopted for assessment in the ITA.	Driveways for numbers 1 and 3 Cashmere Oaks Drive appear to be between SH2 and the counter location (shown above) and thus not surveyed. This could be confirmed by Masterton District Council. Some houses may have been built between the survey date Sept/Oct 2022 and site inspection Feb 2023; potentially 2 homes based on linear growth with 63 houses identified in the ITA at the time of the traffic counts. Estimated 3-5 contractor trips, based on 5 residential sites with construction, 3 active sites, 8 associated vehicles and modest Stage 2 works observed. Additionally most trade people will arrive earlier. - 0.73 to 0.77 trips per dwelling for 70 dwellings & average peak of 56 to 58 vph - 0.8 to 0.85 trips per dwelling for 66 dwellings & average peak of 56 to 58 vph - 0.93 to 1 trips per dwelling for 66 dwellings & design (85th percentile) peak of 70 vph Noting (EIC Para 49): - The peak flows vary. - Research suggests higher figures of 0.9 to 1.1 vph - There is likely to be a high reliance on motorised transport, to outside destinations. - The 400m² lots will be different to the much larger existing / approved lots. Also … - 609 – 669 vehicles per day suggests … 8.7 – 9.3 vehicle trips per day for 70 dwellings 9.2 – 10.1 vehicle trips per day for 66 dwellings Peak flows are often 10% thus the daily rates suggest peak flows of 0.9 to 1	
4. No. of existing constructed houses, number of houses under construction, number of consented lots but not yet under construction.	As at 3 March 2022, there were 63 houses constructed and occupied, with two under construction and eight contractor vehicles present for this construction (**ITA Section 3.3**). During October 2022, there were 71 houses constructed and occupied, with 19 contractor vehicles present for construction (**Georgeson Evidence in Chief Paragraph 4.20**). Analysis presented in the ITA was based on a future total lot yield of 161 (**ITA Section 5.1**).	RLL Assumed 70 houses present for 2022 tube counts GC - As above 70 dwellings occupied as at 13 Feb 2023 - 161 lots have been consented as per the plan change and ITA	Agreement that future total yield is 161 lots with around 70 dwellings constructed and occupied. As such around 90 more houses to be completed and occupied.
5. Assumed lot size and number for residential lots in each of Scenario 1 and 2.	Potential lot yields were assumed as follows (**ITA Sections 7.1 and 7.2**). Scenario 1 lot yield: 254 lots Scenario 2 lot yield: 99 lots	RLL Assumed 1 dwelling per lot GC As per the application: - **Scenario 1** 254 residential 400m² lots on 14.7 ha 69% of total area for residential lots	Agreement between parties that Scenario 1 lot yield: 254 lots Scenario 2 lot yield: 99 lots It has been assumed that there is one dwelling per lot.

<table>
<tr><td></td><td></td><td>- Scenario 2
99 residential lots on 5.7 ha
Assuming 400m² yields 69% of the area for residential lots.</td><td></td></tr>
<tr><td>6. Forecast household traffic generation rates for additional residential lots in each of Scenario 1 and 2.</td><td>Peak hour traffic generation rates recorded in March 2022 survey (ITA Section 3.3) adopted in ITA and evidence:
AM Peak 0.7vph / house
PM Peak 0.8vph / house</td><td>RLL
Residential 9 trips per day
Village units 3 trips per day
Care beds 2.5 trips per day
Assumed development happened over 5 years (2024-2029)

GC
Using rates from above:

254 Lots - Peak
- 185 – 216 vehicles per hour
0.73 to 0.85 veh/dwelling average
- 236 – 254 vehicles per hour
0.93 to 1 veh/dwelling 85th %ile

254 Lots - Daily
- 2,210 – 2,565 vehicles / day 254 lots
- 3,610 – 4,192 vehicles / day 415 lots
(254 proposed + 161 approved)</td><td>Mark Georgeson has used the existing rates and applied them directly to the future dwellings. Mark’s rates (0.7 and 0.8) compare with the average rates assumed by Glenn (0.73-0.85).
I expect that if the smaller lot sizes results in a greater proportion of young working families living within the subdivision and given the proximity to Masterton, the trip generation rates for the smaller lots could be slightly higher than for the existing larger lots.</td></tr>
<tr><td>7. Assumed number and type of units within the retirement village.</td><td>215 independent living units and 119 care suites as advised by Summerset (ITA Section 7.2)</td><td>RLL
Future 215 Village units under scenario 2

GC
As per Application
- 215 independent living units
- 119 care sites
Noting there would be 99 residential lots on the balance land</td><td>As per the ITA 215 independent living units and 119 care suites.
I note that there is nothing in the provisions that constrains the scale and intensity of the retirement village use of the site. As such a future resource consent could be made for a retirement village with a greater yield, for instance by delivering more multi-storey buildings.</td></tr>
<tr><td>8. Forecast traffic generation rates for the retirement village component.</td><td>ITA Appendix A:
The most recent traffic surveys of a modern retirement village were carried out at the Summerset Wigram retirement village in Christchurch in 2018.

Table A-1 shows the traffic generation rates calculated from these surveys for independent living units and assisted living suites / care beds, which have been adopted in transport assessments for a number of other retirement villages, and consented as appropriate.
A-1 Recorded Retirement Village Traffic Generation Rates
<table><tr><th>Unit Type</th><th>AM Peak</th><th>Village Peak</th><th>PM Peak</th><th>Daily</th></tr><tr><td>Independent Living Unit</td><td>0.11vph/unit</td><td>0.25vph/unit</td><td>0.26vph/unit</td><td>3.03vpd/unit</td></tr><tr><td>Assisted Living / Care Bed</td><td>0.06vph/unit</td><td>0.37vph/unit</td><td>0.24vph/unit</td><td>2.56vpd/unit</td></tr></table>The AM and PM peak traffic generation rates coincide with the highest hourly traffic generation rates recorded during the road network peak periods i.e. 7:00am-9:00am and 4:00pm-6:00pm. The ‘village peak’ traffic generation was recorded earlier in the afternoon.

With a potential retirement village development involving 215 independent living units and 119 assisted living suites / memory care suites / care beds, the following Table A-2 summarises the possible traffic generation of the village.</td><td>RLL
3 trips per day

GC
ITA Appendix A A-1 figures are accepted for assessment
Noting that typical design rates (RR 453) are suggested as being:
- 0.3 vehicle movements in the peak hour for residential retirement units and
- 0.4 for each bed in a care facility.</td><td>All parties relying on data from Summerset Wigram.</td></tr>
</table>

	A-2 Potential Traffic Generation of Retirement Village **Unit Type** / **AM Peak** / **Village Peak** / **PM Peak** / **Daily** Independent Living Unit / 24vph / 54vph / 56vph / 651vpd Assisted Living / Care Bed / 7vph / 44vph / 29vph / 305vpd **Total** / 31vph / 98vph / 85vph / 956vpd		
9. Existing in/out and north/south split for Cashmere Oaks Drive vehicle movements (by time period).	These percentages were not presented in the ITA or Evidence but were adopted in analysis. Based on 3 March 2022 intersection survey, light vehicles only and 3vph reduction for construction traffic: AM Peak (7:45am-8:45am) 24% in / 76% out of Cashmere Oaks Drive 18% northbound/ 82% southbound on SH2 PM Peak (4:15pm-5:15pm) 65% in / 35% out of Cashmere Oaks Drive 16% northbound / 84% southbound on SH2	RLL 85% oriented towards Masterton GC Data from the TIA survey with directional splits calculated as follows: **Cashmere Oaks Dr** / **SH2 - North** / **SH2 - South** / **Total** / **Cashmere Oaks Dr** Left / Right / Right / Thru / Left / Thru / / In / Out 7:00 am: 9 / 28 / 1 / 195 / 18 / 159 / 410 / 19 / 37 8:00 am: 5 / 30 / 2 / 278 / 10 / 221 / 546 / 12 / 35 12:00 pm: 1 / 15 / 0 / 161 / 22 / 175 / 374 / 22 / 16 1:00 pm: 2 / 21 / 0 / 148 / 26 / 171 / 368 / 26 / 23 4:00 pm: 4 / 11 / 2 / 179 / 22 / 198 / 416 / 24 / 15 5:00 pm: 3 / 20 / 4 / 173 / 38 / 233 / 471 / 42 / 23 7:00 am: 24% / 76% / 5% / / 95% / / / 34% / 66% 8:00 am: 14% / 86% / 17% / / 83% / / / 26% / 74% 12:00 pm: 6% / 94% / 0% / / 100% / / / 58% / 42% 1:00 pm: 9% / 91% / 0% / / 100% / / / 53% / 47% 4:00 pm: 27% / 73% / 8% / / 92% / / / 62% / 38% 5:00 pm: 13% / 87% / 10% / / 90% / / / 65% / 35%	All parties have relied on the intersection count for SH2/ Cashmere Oaks Drive included in the ITA Section 3.2.
10. Historic road safety record (time period, geopraphical extent, from CAS, definition of crash injury types)	**ITA Section 4**: The NZTA Waka Kotahi Crash Analysis System (CAS) has been used to review crash records in the vicinity of the Site for the full five-year period of 2017 to 2021. The search area, illustrated in Figure 4-1, encompasses both the Opaki Meadows Drive / SH2 and Cashmere Oaks Drive / SH2 intersections as well as the Cashmere Oaks subdivision roads.  **Figure 4-1 : Crash Search Area and Results 2017 to 2021** Only two minor-injury crashes were reported in the search area and search period, both occurring on SH2 between Opaki Meadows Drive and Cashmere Oaks Drive. Both are reported	GC See Evidence in Chief of Glenn Connelly Para 31-35, Figures 1 – 3. Refer to Appendix 3; which duplicates Figures 1 – 3.	All parties are relying on the NZTA Waka Kotahi Crash Analysis System (CAS) for data on reported crashes. Glenn has included a slightly longer section of SH2 to the north.

<table>
<tr>
<td></td>
<td>to have been single-vehicle crashes involving drivers losing control, with fatigue and excessive speed recorded as causal factors. There were no crashes reported at the Cashmere Oaks Drive intersection or within the Cashmere Oaks subdivision.

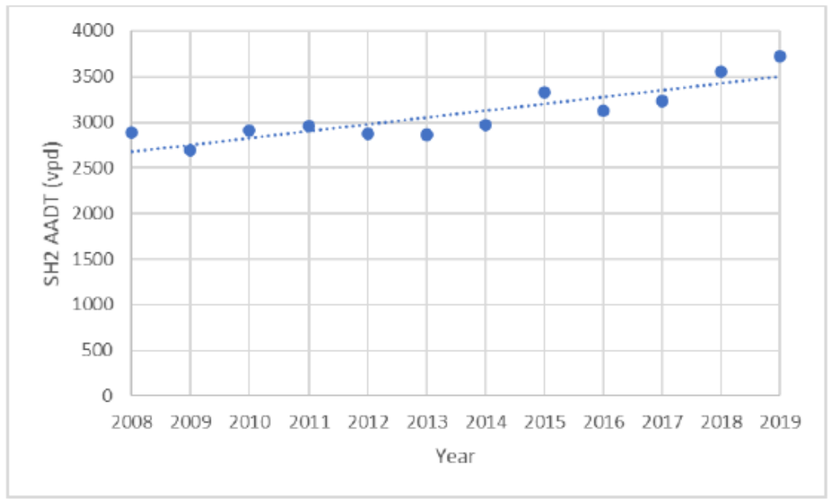
Georgeson Evidence in Chief Paragraph 4.27:
An updated crash search as at the date of this evidence was carried out and determined that there have been no new crashes reported either at or near the SH2 / Cashmere Oaks Drive intersection since 2021.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Any programmed public works (transport) relevant to the Proposed Plan Change</td>
<td>We are not aware of any programmed public works which are relevant (ITA Section 5.2).</td>
<td>GC
- An 80kph is proposed as per the Interim Speed management Plan Refer to EIC for Glenn Connelly (para 98) and summary statement. Also supplementary statement of Emma Speight (WaKa Kotahi NZTA) 21 Mar 2023
- Barriers and profiled edge lines are proposed for the section of highway; but these are most likely limited to more rural areas – to be confirmed.</td>
<td>The existing speed limit is 100km/h and there is no certainty that it will be reduced.</td>
</tr>
<tr>
<td>12. Historic traffic growth on SH2 (location, years)</td>
<td>ITA Section 3.1:
Figure 3-1 shows the reported AADTs for SH2 north of the Site over the last decade (prior to 2020 when reported AADTs were affected by Covid lockdowns). During this period, the growth in AADTs can be approximated as linear with a 2% growth rate.
 

Figure 3-1 : Historical AADT Growth on SH2 North of Masterton</td>
<td>GC
See Evidence in Chief (EIC) para 43

SH2 - South of Second St
- 1.8% for the 10 years until 2023
- 2.4% for the 10 years until 2022
SH2 – Sth of Reader Cutting
- 1.8% for 10 years to 2022 or 2023

See EIC Para 44

2019 – 2022 comparison.
South of Cashmere Oaks Drive
- 5120 / 5960
- 16.4% growth
- 5.5% growth per annum over 3 years
North of Hansells
- 4473 / 5090
- 13.8% growth
- 4.6% growth over 3 years
<table>
<tr><th></th><th></th><th>South of Cashmere Oaks Drive</th><th>North of Hansells</th></tr>
<tr><td></td><td>Year</td><td></td><td></td></tr>
<tr><td>A</td><td>2019</td><td>5120</td><td>4473</td></tr>
<tr><td>B</td><td>2022</td><td>5960</td><td>5090</td></tr>
<tr><td></td><td>B/A %</td><td>116.4%</td><td>113.8%</td></tr>
<tr><td></td><td>Year</td><td>3</td><td>3</td></tr>
<tr><td></td><td>Growth /</td><td>5.5%</td><td>4.6%</td></tr>
</table></td>
<td>There appears to be a long term historic trend of around 2% per annum. This has increased to around 5% per annum over the last three years.
I estimate that the around 800vpd growth to the north of Hansells is equivalent to around 70 to 90 houses being constructed and occupied within the rural-residential catchment to the north of Hansells. This assumes a daily trip generation rate of 8 to 10 vehicle movements per household with 85% of the trips being to and from Masteron via SH2.
The planners may have a view on whether this is the likely cause for the traffic growth and for how long this level of growth might be sustained.</td>
</tr>
<tr>
<td>13. Forecast traffic growth on SH2 at Cashmere Oaks Drive (forward time period)</td>
<td>ITA Section 8.1:
A ‘Future Base’ scenario has been developed by allowing for full development of the Cashmere Oaks subdivision, as outlined in Section 5.1 of the ITA, and allowing for growth in the through traffic on SH2 of 20% to allow for 10 years’ worth of growth based on historical (pre-Covid) traffic growth patterns.

These through volumes were not presented in the ITA or Evidence but were adopted in analysis.
AM Peak
Northbound: 230vph</td>
<td>RLL – Used 2%
GC
- 2% has been used in the assessment as per regional / wider growth (see
- The impact of higher growth should be tested to understand the impacts, with an understanding of why the growth rate in the immediate area is substantially higher than the regional figures.
Consideration for growth in regard to the constructed, approved and expected rural residential development for example.</td>
<td>The more recent traffic growth indicates that the assumed 2% per annum is likely on the low side.</td>
</tr>
</table>

	Southbound: 304vph PM Peak Northbound: 263vph Southbound: 232vph 'Future Base' Through Volumes: AM Peak Northbound: 276vph Southbound: 365vph PM Peak Northbound: 316vph Southbound: 278vph		
14. Forecast traffic volumes that formed inputs into the SIDRA intersection modelling (time periods, vph)	SIDRA modelling focussed on critical morning peak period (7:45am-8:45am). The below table summarises the input hourly volumes. SH2 through volumes are total volumes with heavy vehicle volumes in brackets. These volumes were not presented in the ITA or Evidence but were adopted in analysis, with modelling results summarised in **Georgeson Evidence in Chief Paragraph 7.5**. Scenario Approach / Movement / Existing / Future Base / Future Scenario 1 / Future Scenario 2 SH2 South / Left / 9 / 23 / 59 / 50 SH2 South / Through / 230 (22) / 276 (26) / 276 (26) / 276 (26) SH2 North / Through / 304 (28) / 365 (34) / 365 (34) / 365 (34) SH2 North / Right / 2 / 5 / 13 / 11 Cashmere Oaks / Left / 6 / 15 / 40 / 28 Cashmere Oaks / Right / 28 / 72 / 185 / 129	GC As per Stantec ITA Section 8 - Model and full output not provided.	
15. Gap acceptance parameters (critical gap and headway, SIDRA defaults, parameters used in modelling, for each turn type, assumptions around opposing flows)	**Georgeson Evidence in Chief Paragraphs 7.4 and 7.5**: Adopted gap acceptance parameters: Critical gap: 5.5s Follow-up headway: 3.2s SIDRA User Guide (SIDRA Intersection 9 User Guide Table 5.10.6) default critical gap: 5.5s SIDRA User Guide 'reasonable range' for critical gap: 5s-6s These values were not presented in evidence: SIDRA User Guide (SIDRA Intersection 9 User Guide Table 5.10.6) default follow-up headway: 3.5s SIDRA User Guide 'reasonable range' for follow-up headway: 3s-4s	GC Austroads 'Guide to Traffic Management' Part 3 indicates the following - critical gap of 5 seconds - follow up gap of 3.2s. No specific information is given how this integrates into SIDRA's modelling for a priority controlled intersection. I am looking into this. The SIDRA model and full results have not been provided so cannot be reviewed or agreed.	I consider that the use of values within the SIDRA User Guide 'reasonable range' is appropriate. Given the increase in proportion of older drivers, the intersection operating as if it had Stop control albeit that it is Give Way controlled, the 100km/h speed limit and the varying (including active accelerating and decelerating) speeds of approaching vehicles, the use of values towards the higher end of the 'reasonable range' would be more appropriate.
16. SIDRA outputs (tables and summary)	**Georgeson Evidence in Chief Paragraphs 7.5-7.6** The results from applying the gap acceptance parameters of 5.5 seconds (critical gap) and 3.2 seconds (follow up gap) for the morning peak hour 'full residential' scenario were reported in the **ITA at Figure 8-8**. All four scenarios were tested with these SIDRA default gap acceptance parameters and the calculated average delays for the right turns out of Cashmere Oaks Drive for the busier morning peak period are presented below: (a) existing – 9 seconds per vehicle, level of service A; (b) future "Base"- 12 seconds per vehicle, level of service B; (c) future Residential (Scenario 1) – 16 seconds per vehicle, level of service C; and (d) future Retirement Village and Residential (Scenario 2) – 13 seconds per vehicle, level of service B. The associated SIDRA summary tables for the four scenarios are presented below. Existing AM Peak:	GC - Summary tables provided as per requestor comments - The same traffic volumes have been used as presented in the ITA - The peak median morning flows were 551 vehicles per hour north of Hansells and 631 vehicles per hour south of Cashmere Oaks Drive (as per App 1). - The surveyed traffic flows are low with 364 and 400 vehicles per hour (vph) surveyed (ITA sec 3.2) north and south of Cashmere Oaks Drive respectively; compared to the 551 and 631 vph obtained from the traffic counters. - The modelled flows for the 'Future Base AM' from the table are 661 vph and 736 vph north and south of Cashmere Oaks Drive respectively, which equate to a 20% and 16.6% increase in flows over the existing morning peak flows of 551 and 631 vph. Noting that this does not include any allowance for heavy vehicles.	Higher forecast household traffic generation rates, higher forecast growth rates for SH2 and the use of SIDRA defaults at the upper end of the 'reasonable range' would compound and result in longer average delays and poorer levels of service.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH2 South														
1	L2	10	0	11	0.0	0.138	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.9
2	T1	230	22	242	9.6	0.138	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.0
Approach		240	22	253	9.2	0.138	0.3	NA	0.0	0.0	0.00	0.03	0.00	98.4
North: SH2 North														
8	T1	304	28	320	9.2	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	2	0	2	0.0	0.002	8.6	LOS A	0.0	0.0	0.34	0.59	0.34	56.6
Approach		306	28	322	9.2	0.174	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.4
West: Cashmere Oaks Drive														
10	L2	8	0	8	0.0	0.009	5.8	LOS A	0.0	0.2	0.34	0.54	0.34	56.1
12	R2	28	0	29	0.0	0.056	9.3	LOS A	0.2	1.4	0.56	0.75	0.56	53.1
Approach		36	0	38	0.0	0.056	8.5	LOS A	0.2	1.4	0.51	0.70	0.51	53.7
All Vehicles		582	50	613	8.6	0.174	0.7	NA	0.2	1.4	0.03	0.06	0.03	94.1

Future Base AM- full consented Cashmere Oaks plus 20% growth on SH2

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH2 South														
1	L2	23	0	24	0.0	0.171	7.8	LOS A	0.0	0.0	0.00	0.05	0.00	87.2
2	T1	276	26	291	9.4	0.171	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.1
Approach		299	26	315	8.7	0.171	0.6	NA	0.0	0.0	0.00	0.05	0.00	97.2
North: SH2 North														
8	T1	365	34	384	9.3	0.209	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	5	0	5	0.0	0.005	9.0	LOS A	0.0	0.1	0.39	0.62	0.39	56.4
Approach		370	34	389	9.2	0.209	0.1	NA	0.0	0.1	0.01	0.01	0.01	98.9
West: Cashmere Oaks Drive														
10	L2	15	0	16	0.0	0.018	6.1	LOS A	0.1	0.4	0.38	0.57	0.38	55.9
12	R2	72	0	76	0.0	0.175	11.6	LOS B	0.6	4.4	0.66	0.85	0.66	51.4
Approach		87	0	92	0.0	0.175	10.6	LOS B	0.6	4.4	0.61	0.80	0.61	52.1
All Vehicles		756	60	796	7.9	0.209	1.5	NA	0.6	4.4	0.07	0.12	0.07	89.1

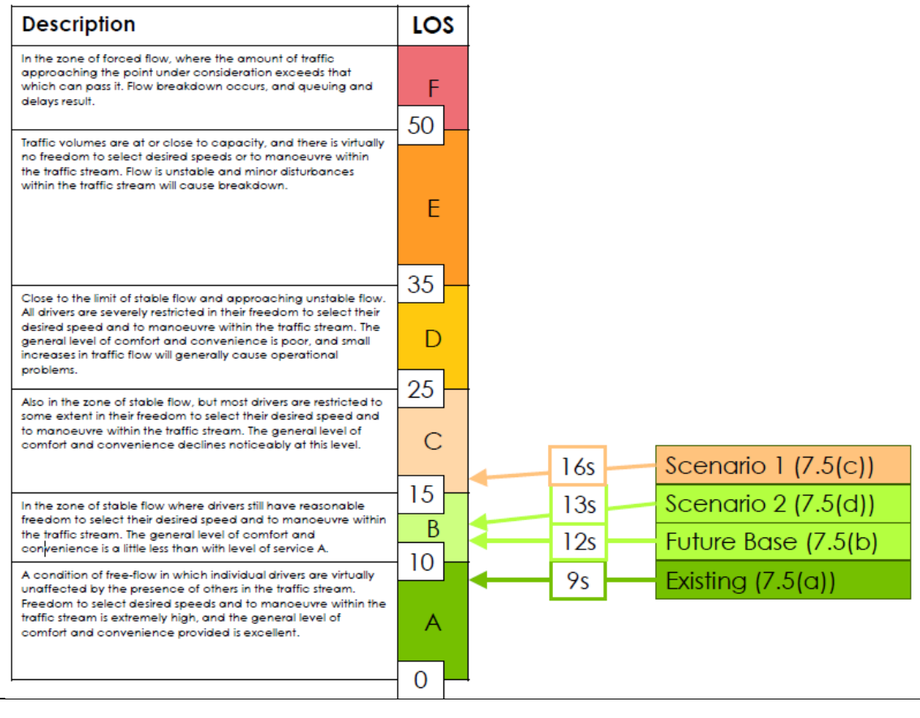
Future Scenario 1- 254 residential lots

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH2 South														
1	L2	59	0	62	0.0	0.192	7.9	LOS A	0.0	0.0	0.00	0.12	0.00	85.5
2	T1	276	26	291	9.4	0.192	0.0	LOS A	0.0	0.0	0.00	0.12	0.00	96.0
Approach		335	26	353	7.8	0.192	1.4	NA	0.0	0.0	0.00	0.12	0.00	93.9
North: SH2 North														
8	T1	365	34	384	9.3	0.211	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	13	0	14	0.0	0.014	9.2	LOS A	0.1	0.4	0.41	0.65	0.41	56.3
Approach		378	34	398	9.0	0.211	0.3	NA	0.1	0.4	0.01	0.02	0.01	97.3
West: Cashmere Oaks Drive														
10	L2	40	0	42	0.0	0.049	6.2	LOS A	0.2	1.2	0.39	0.60	0.39	55.8
12	R2	185	0	195	0.0	0.467	15.5	LOS C	2.4	16.7	0.76	1.01	1.12	48.7
Approach		225	0	237	0.0	0.467	13.8	LOS B	2.4	16.7	0.69	0.94	0.99	49.8
All Vehicles		938	60	987	6.4	0.467	3.9	NA	2.4	16.7	0.17	0.28	0.24	78.4

Future Scenario 2- retirement village plus 99 residential lots

- Comments on the modelling are limited to the summary tables provided with access to the model and full results has not been provided.
- It was suggested that the traffic volumes on the highway were scaled by 20%, representing 2% growth annually over 10 years.
  Growth between the 2019 and 2022 counts indicate an annual growth of 4.6% and 5.5% on SH2 either side of Cashmere Oaks Drive as per point 12 above. The impact of a higher growth rate has not been considered.
- It is unclear whether the calculated modelled gap parameters from SIDRA which would take into account the environmental inputs in the model, are higher or lower than the figures adopted. The modelling is sensitive to gap selection. The gaps may be longer due to varying driver speeds complicating the decision making process.

	Vehicle Movement Performance Mov ID | Turn | INPUT VOLUMES DEMAND FLOWS [Total veh/h] | HV] veh/h | [Total veh/h] | HV] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [Veh. veh | Dist] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h South: SH2 South 1 L2 50 0 53 0.0 0.186 7.9 LOS A 0.0 0.0 0.00 0.10 0.00 85.9 2 T1 276 26 291 9.4 0.186 0.0 LOS A 0.0 0.0 0.00 0.10 0.00 96.5 Approach 326 26 343 8.0 0.186 1.2 NA 0.0 0.0 0.00 0.10 0.00 94.7 North: SH2 North 8 T1 365 34 384 9.3 0.211 0.0 LOS A 0.0 0.0 0.00 0.00 0.00 99.9 9 R2 11 0 12 0.0 0.012 9.1 LOS A 0.0 0.3 0.41 0.64 0.41 56.3 Approach 376 34 396 9.0 0.211 0.3 NA 0.0 0.3 0.01 0.02 0.01 97.7 West: Cashmere Oaks Drive 10 L2 28 0 29 0.0 0.034 6.2 LOS A 0.1 0.8 0.38 0.59 0.38 55.9 12 R2 129 0 136 0.0 0.322 13.4 LOS B 1.4 9.7 0.71 0.93 0.87 50.1 Approach 157 0 165 0.0 0.322 12.1 LOS B 1.4 9.7 0.65 0.87 0.78 51.0 All Vehicles 859 60 904 7.0 0.322 2.8 NA 1.4 9.7 0.12 0.21 0.15 82.8		
17. Levels of Service definitions as relate to SIDRA outputs	Levels of service are described as bands of delay, which can be described in words, as below, as well as by way of modelled delay. For example, as presented below, LOS B has a delay band of 10 to 15 seconds average delay per vehicle. Also shown in the same diagram is the option delays, and referenced to **Paragraph 7.5 of Georgeson evidence in chief**. As demonstrated, average delays for the right turn out movement from Cashmere Oaks Drive during the busier AM peak period sit at the low end of the LOS scale, and vary from the top end of LOS A for the existing situation to the low end of LOS C for Scenario 1, effectively spanning one band. As described, LOS A, B and C represent conditions of free and stable flow. The limit of stable flow begins to be reached at the LOSD/E boundary. The modelled performance of each option sits within the LOS bands of free and stable flow. 	GC - The definitions for level of service are as per SIDRA for a priority (Stop or Give Way) controlled intersection.	I agree with the Level of Service band definitions provided by Mark for a sign controlled intersection, as is the case here.

18. Crash prediction (DSI) modelling (source and type of model, forecast period) a. speed environment b. intersection type c. urban/rural d. assumed traffic growth SH2 (per annum) e. traffic volumes f. application of any crash trend adjustment factor g. outputs including direct comparison (Requestor/ Waka Kotahi) for equivalent forecast period (this will involve one or both of Richard and Melanie doing a rerun)	**Muirson Evidence Summary Statement – paragraphs 3.16 to 3.26** a) Speed environment modelled – 50km/h & 60km/h (urban, low speed) and 80km/h & 100km/h (rural, high speed) b) Intersection type – Priority T-intersection and 3 Leg Roundabout c) Tested both urban and rural scenarios for the two types of intersection which equates to 50km/h & 60km/h (low speed) and 80km/h & 100km/h (high speed) as per answer a) d) Assumed 2% per annum traffic growth e) November 2022 traffic volumes were used (these are numbers which were adopted in the analysis but not expressly presented in evidence): • SH2 south of Cashmere Oaks Drive – 5,936 vehicles per day (vpd) • SH2 north of Cashmere Oaks Drive – 5,055vpd • Cashmere Oaks Drive – 1,449 vpd (includes existing and consented development that is currently being constructed) Traffic volumes for Cashmere Oaks Drive with proposed Plan Change development – 3,735vpd (assuming it is developed all at once and applied in 2024) f) The crash analysis was completed in accordance with Waka Kotahi's Monetised Benefits and Costs crash trend adjustment factor Manual (MBCM) guidelines. The MBCM states that these procedures which include application of the crash trend adjustment factor should be followed (Ref. Pages 284 and 285). When assessing the long-term trends, the number of DSIs are still reducing despite the increasing number vehicles on NZ roads and the increasing vehicle kilometres travelled each year. This is presented in the Ministry of Transport's Road to Zero Monitoring Report from 2021 (page 14, https://www.transport.govt.nz/assets/Uploads/MOT-4163-Road-to-Zero-Monitoring-Report-2021-P8_V1.pdf For the low and high speed environments, the crash rates are multiplied by the following crash trend adjustment factors obtained from using the equation below: • 50km/h and 60km/h low speed urban environment – **0.84** = (1 + (-0.01)*(2022-2006)) • 80km/h and 100km/h high speed rural environment – **0.68** = (1 + (-0.02)*(2022-2006)) Method B adjustment This procedure should be followed if using method B and C. As the crash rates and crash prediction models in the *Crash estimation compendium* use historical crash data, the predicted number of crash needs to be adjusted for crash trends: $A = A_T \times (1 + f_t (y_z - 2006))$ where: A is the crash rate adjusted for crash trends A_T is the typical rate found from models or rates f_t is the factor for adjusting the typical rate: • -0.01 for sites with speed limits 60km/h and below • -0.02 for sites with speed limits 70km/h and above y_z is year zero of the analysis period g) The modelled outputs showing DSI predictions with and without crash trend adjustments over a 20 year period are in the following tables. These DSIs are based on traffic volumes, speed environment (either urban or rural speed limits) together with the intersection type (either a priority T-intersection or roundabout). The results presented using the prediction modelling do not take into account the characteristics of the Cashmere location or impacts of improvements to the SH2 / Cashmere Oaks intersection. The calculations are based on applying a national average that is evaluated from the crash history for similar types of intersections in New Zealand.	RLL a. 80km/h+ posted speed limit b. T-Junction & Roundabout c. Rural d. 2% e. Future volumes generated from trip generation rates as per #6 f. None Graphs submitted as part of evidence in chief. Outputs below for 2043 (year 20) to compare with Muirson table. **Predicted DSI @ year 20 (2043)** Muirson: Existing 0.74, Proposed 1.25 Landon-Lane: Existing 0.68, Scenario 1 1.09, Scenario 2 1.02 Priority T (80km/h+): 0.74 / 1.25 / 0.68 / 1.09 / 1.02 Priority T (50-70km/h): 0.57 / 0.68 / 0.66 / 0.82 / 0.80 Roundabout (80km/h+): 0.40 / 0.77 / 0.40 / 0.45 / 0.44 Roundabout (50-70km/h): 0.49 / 0.56 / 0.58 / 0.66 / 0.64	Based on the direct comparison provided by Richard for the 20 year timeframe, I note that there is a small difference in the assessed DSIs with the base level of traffic activity (built plus consented). My understanding is that this results from small differences in the assumed traffic volumes. I note that with the existing intersection layout Melanie forecasts an increase in the DSI of 0.51 (1.25-0.74) and Richard of 0.34 (1.02-0.68) over the 20 year timeframe. Based on Richard's analysis a roundabout, either in an 80km/h+ or 50-70km/h environment would be needed to maintain the DSIs at the base or better levels. Based on Melanie's analysis either a priority T or a roundabout in a 50-70km/h environment would be needed to maintain the DSIs at the base or better levels. I note that this tool gives a very broad brush approach with the inputs not taking into account local characteristics other than overall traffic volumes on the approaches and a speed context which includes a range of speeds. Predictions are based on national averages.

Table 1: Summary of cumulative DSI crashes for various crash models without crash trend adjustment

Intersection Type	Predicted 20-Year DSI Equivalents (Existing consented volumes without additional development)	Predicted 20-Year DSI Equivalents (With additional Plan Change development)
Priority T – 80/100km/h	0.74	1.25
Priority T – 50/60km/h	0.57	0.68
Roundabout – 80/100km/h	0.40	0.77
Roundabout – 50/60km/h	0.49	0.56

Table 2: Summary of cumulative DSI crashes for various crash models with crash trend adjustment

Intersection Type	Predicted 20-Year DSI Equivalents (Existing consented volumes without additional development)	Predicted 20-Year DSI Equivalents (With additional Plan Change development)
Priority T – 80/100km/h	0.51	0.85
Priority T – 50/60km/h	0.48	0.57
Roundabout – 80/100km/h	0.28	0.52
Roundabout – 50/60km/h	0.42	0.47

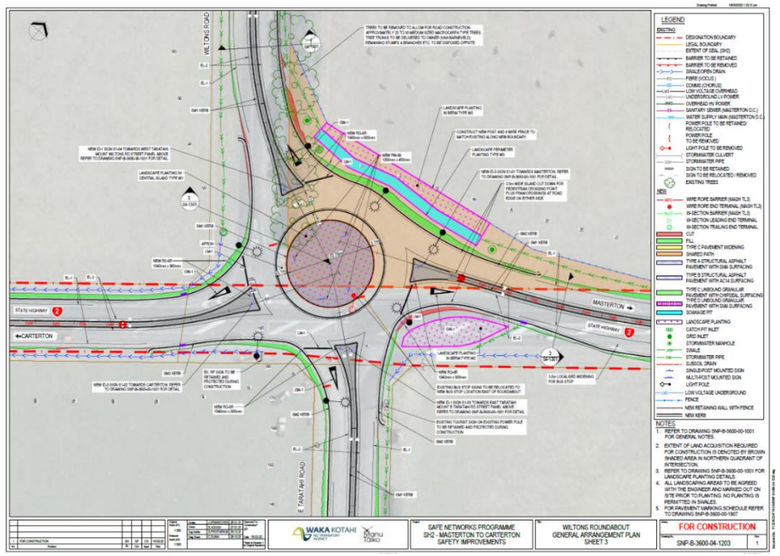
19. Indication of the costs associated with constructing a roundabout, this is to include design, consenting and temporary traffic management.	We are guided by Waka Kotahi's cost estimates.	GC A design would be needed to adequately indicate construction costs. The following is offered for guidance in the absence of a design and robust estimate which would take a considerable amount of effort. - Typical urban roundabout cost range between $1.5 & 2.5M (The standard urban roundabout cost has been estimated as $1.65M as per the Pipeline Development Tool albeit this estimate may be a year or two old now) - No land is required however there is the embankment to address. - Rural roundabouts range from $5 to $12M but these would be much larger than what is anticipated for the site. - An initial conceptual design had an indicative cost of $3M - $4M and avoided the use of an apron, which included the following features: Single lane Roundabout with ICD of 37.4 Central Island = 22m diameter (AGRD4B Table 4.1) Circulating width = 7.8m (AGRD Table 4.3) Costs have been obtained for two roundabouts currently under construction south of Masterton. Costs do not include preliminary and general costs or escalation over the last 12 months.	I rely on Glenn's estimates. I have no experience with construction costs for roundabouts and I do not think that there is an equivalent bit of infrastructure that has been recently constructed in Masterton. I understand that a roundabout is going in at the intersection of SH2 and Ngaumutama Road where the heavy vehicle bypass joins SH2 to the east of the river. The scale of this roundabout is likely to be larger than at Cashmere Oaks Drive given that the busier traffic volumes and that the side road is the heavy vehicle route with the need to accommodate the associated truck turning paths.

SH2 / Wiltons

Scheduled items	$2,859,908.00
Provisional items	$102,664.00
Provisional Sums	$120,000.00

Dimensions

Outer Diameter	39.6m
Diameter of Island	22.78m
Concrete Apron	3.1m

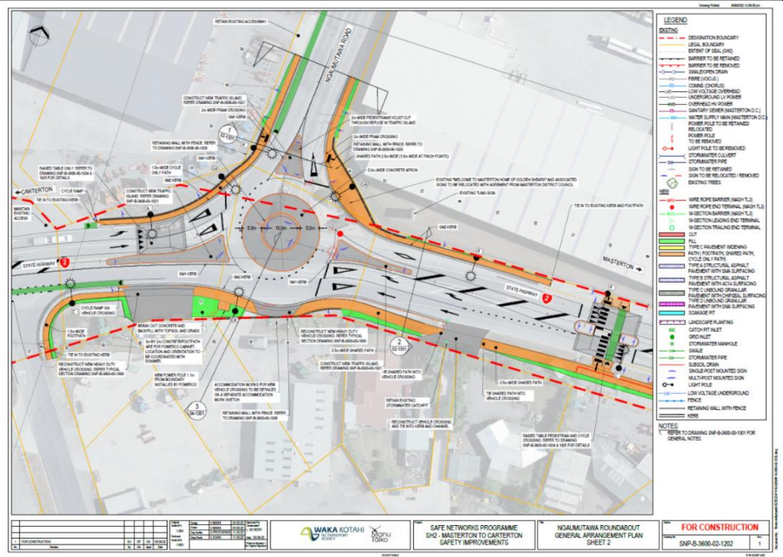


SH2 / Ngaumutawa

Scheduled Items	$2,419,501.00
Provisional Sums	$170,000.00

Dimensions

Outer Diameter	28.0m
Diameter of Island	10.0m
Concrete Apron	5.0m



Mark Georgeson

Melanie Muirson

Glenn Connelly

pp

Richard Langdon-Lane

Harriet Fraser

28 March 2023

4. ATTACHMENTS

4.1 Glenn Connelly Appendices 1 – 3

APPENDIX 1 - TRAFFIC COUNTS

Glenn Connelly – Evidence in Chief

Appendix 1 – Traffic Counts: State Highway 2 – South of Cashmere Oaks Dr

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	5 Day ADT	7 Day ADT
Saturday, 12 November 2022	19	12	6	12	8	21	72	164	262	419	430	392	430	395	383	363	332	303	227	216	124	72	90	33	4785		
Sunday, 13 November 2022	15	13	6	2	8	17	50	76	188	305	392	398	425	395	443	432	393	314	233	184	129	79	34	13	4544		
Monday, 14 November 2022	5	6	5	12	20	74	207	410	674	409	407	395	447	476	465	539	633	505	272	168	105	76	27	24	6361		
Tuesday, 15 November 2022	8	9	13	16	14	61	203	423	616	384	381	431	429	439	461	625	611	510	304	183	173	82	42	21	6439		
Wednesday, 16 November 2022	13	12	11	29	33	71	229	410	663	404	386	444	489	469	446	614	589	489	290	191	146	82	39	24	6573		
Thursday, 17 November 2022	12	9	7	16	26	76	218	413	660	397	411	422	403	445	453	577	568	416	264	171	98	60	38	16	6176		
Friday, 18 November 2022	5	7	4	9	26	79	204	375	559	409	454	374	482	514	482	678	559	462	339	217	139	99	64	25	6565	6423	
Saturday, 19 November 2022	16	6	9	7	10	29	76	152	242	328	461	441	392	391	322	407	367	324	262	171	94	112	73	28	4720		
Sunday, 20 November 2022	13	10	7	4	13	19	43	118	214	340	370	386	376	448	385	401	352	326	240	168	124	63	28	11	4459		5899
Monday, 21 November 2022	12	14	5	19	24	61	229	383	561	397	436	406	439	450	438	529	534	430	213	179	115	43	27	16	5960		
Tuesday, 22 November 2022	12	7	4	13	20	69	230	432	575	389	376	390	410	416	455	587	587	500	287	165	88	73	25	18	6128		
Wednesday, 23 November 2022	6	4	9	22	29	68	218	418	666	416	357	401	463	480	451	546	576	469	269	169	134	70	30	16	6287		
Thursday, 24 November 2022	10	14	9	12	26	74	220	433	646	446	425	381	482	447	469	579	638	497	280	192	136	88	28	23	6555		
Friday, 25 November 2022	15	7	2	24	40	65	204	406	550	414	463	461	500	505	603	700	597	536	381	278	188	110	55	39	7143	6415	
Saturday, 26 November 2022	17	14	6	12	17	23	83	206	338	419	441	486	454	449	436	413	410	394	292	176	130	110	66	50	5442		
Sunday, 27 November 2022	21	17	5	7	10	19	48	101	226	329	407	413	459	440	414	373	423	360	200	148	112	58	22	10	4622		6020
																							14th - 27th		**5959**	7 day	
																									6419	5 day	
Average (2 Weeks)																											
Sat	18	9	8	10	9	25	74	158	252	374	446	417	411	393	353	385	350	314	245	194	109	92	82	31	4753		
Sun	14	12	7	3	11	18	47	97	201	323	381	392	401	422	414	417	373	320	237	176	127	71	31	12	4502		
Mon	9	10	5	16	22	68	218	397	618	403	422	401	443	463	452	534	584	468	243	174	110	60	27	20	6161		
Tue	10	8	9	15	17	65	217	428	596	387	379	411	420	428	458	606	599	505	296	174	131	78	34	20	6284		
Wed	10	8	10	26	31	70	224	414	665	410	372	423	476	475	449	580	583	479	280	180	140	76	35	20	6430		
Thu	11	12	8	14	26	75	219	423	653	422	418	402	443	446	461	578	603	457	272	182	117	74	33	20	6366		
Fri	10	7	3	17	33	72	204	391	555	412	459	418	491	510	543	689	578	499	360	248	164	105	60	32	6854		
Average Wkday	10	9	7	17	26	70	216	410	617	407	410	411	454	464	472	597	589	481	290	191	132	78	38	22	6419		
Average 7 Day	12	9	7	14	21	56	172	330	505	390	411	409	441	448	447	541	524	434	276	189	128	79	43	22	5907		
Percentiles (Weekday)																											
0	5	4	2	9	14	61	203	375	550	384	357	374	403	416	438	529	534	416	213	165	88	43	25	16			
0.25	7	7	4	12	21	66	205	407	565	397	382	391	432	446	452	554	570	464	270	170	108	71	27	17			
0.5	11	8	6	16	26	70	218	412	**631**	407	409	404	455	460	458	583	**588**	493	284	181	135	79	34	22			
0.75	12	11	9	21	28	74	227	422	662	413	433	429	482	479	468	622	608	504	301	192	144	87	41	24			
0.85	13	13	10	23	32	75	229	429	**665**	415	448	439	487	496	477	**659**	625	508	327	208	164	95	50	25	**6914**		
0.9	13	14	11	25	34	76	229	432	667	419	455	446	490	506	494	680	634	513	343	223	175	100	56	26			
0.95	14	14	12	27	37	78	230	433	670	433	459	453	495	510	549	690	636	524	362	251	181	105	60	33			
0.98	15	14	13	28	39	78	230	433	673	441	461	458	498	512	581	696	637	531	373	267	185	108	62	36			
1	15	14	13	29	40	79	230	433	674	446	463	461	500	514	603	700	638	536	381	278	188	110	64	39			
Percentiles (7 Day)																											
0.85	15	13	9	22	29	74	229	423	663	416	454	441	482	481	470	628	612	505	306	216	147	100	64	28	**6830**		

Glenn Connelly – Evidence in Chief

Appendix 1 – Traffic Counts: SH2 – North of Hansells

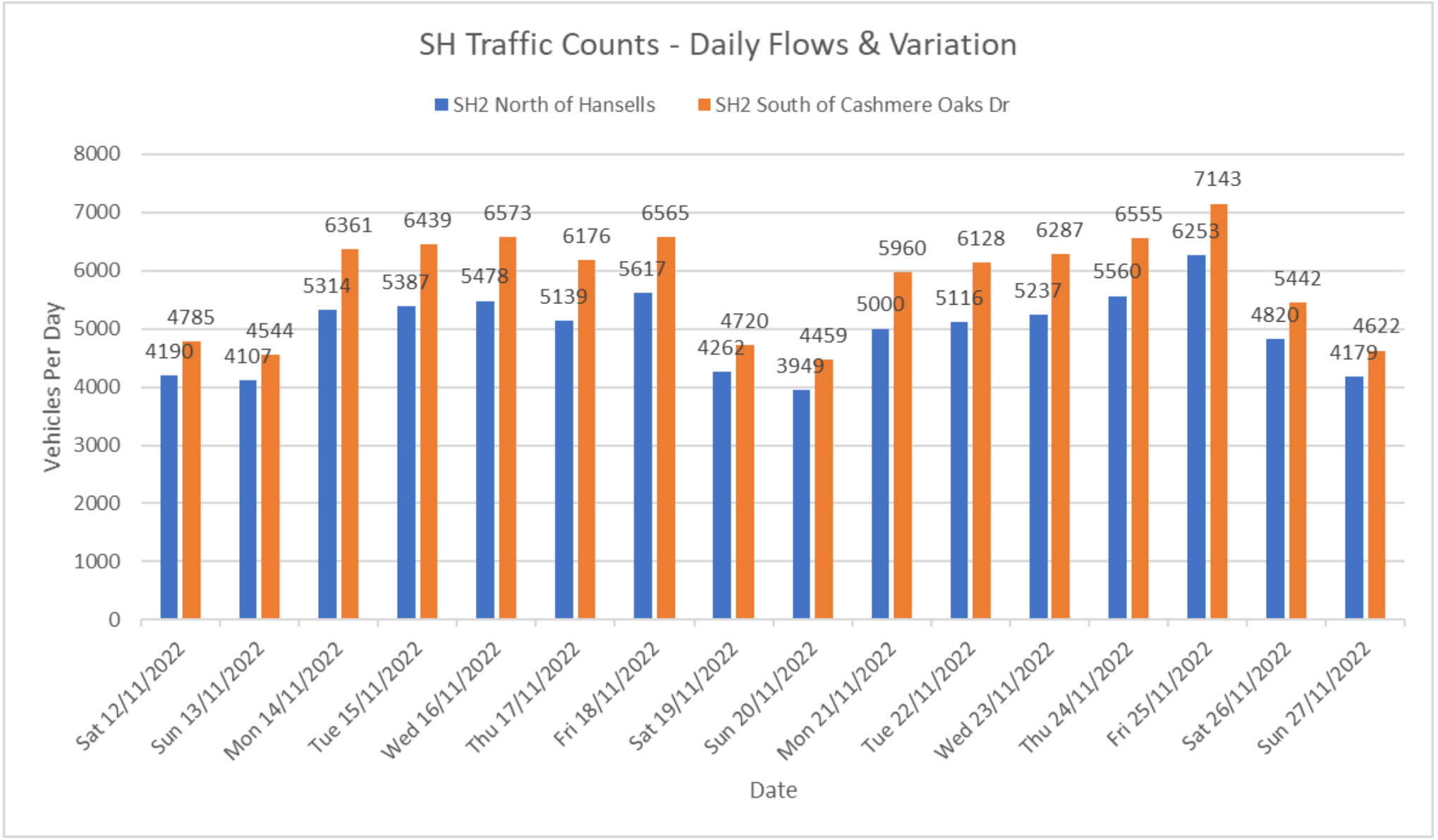
	0000-0100	0100-0200	0200-0300	0300-0400	0400-0500	0500-0600	0600-0700	0700-0800	0800-0900	0900-1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2100	2100-2200	2200-2300	2300-2400	Daily Total	5 Day ADT	7 Day ADT
Saturday, 12 November 2022	17	10	7	9	8	15	67	143	232	385	369	352	388	343	339	322	299	254	212	139	106	61	82	31	4190		
Sunday, 13 November 2022	15	11	5	3	5	15	44	69	179	285	347	356	386	355	408	373	354	289	211	171	113	68	32	13	4107		
Monday, 14 November 2022	5	4	5	11	15	65	151	344	596	352	342	306	356	391	391	477	500	432	237	136	87	70	27	14	5314		
Tuesday, 15 November 2022	8	2	13	15	12	55	147	360	532	324	336	354	343	347	384	540	495	426	261	153	151	71	36	22	5387		
Wednesday, 16 November 2022	9	9	9	27	29	67	158	327	569	345	324	370	379	376	384	542	474	412	246	160	128	78	34	22	5478		
Thursday, 17 November 2022	10	6	5	16	21	66	150	332	569	333	343	356	320	371	395	498	444	351	216	151	86	48	36	16	5139		
Friday, 18 November 2022	5	6	4	8	21	65	145	305	500	358	362	306	406	424	439	599	502	404	294	188	118	86	56	16	5617	5387	
Saturday, 19 November 2022	13	7	6	6	9	28	68	137	220	295	421	407	358	350	294	364	318	293	231	149	92	101	69	26	4262		
Sunday, 20 November 2022	13	10	4	4	8	14	41	105	185	289	327	351	335	394	355	353	309	287	211	149	109	59	26	11	3949		5021
Monday, 21 November 2022	12	17	5	23	18	59	144	325	491	347	368	334	369	386	384	452	405	369	179	146	100	28	24	15	5000		
Tuesday, 22 November 2022	7	5	4	12	19	62	147	370	510	323	332	326	333	322	400	497	465	412	256	140	75	62	22	15	5116		
Wednesday, 23 November 2022	6	4	8	17	26	59	138	337	579	346	292	340	348	412	395	457	461	407	244	139	115	64	29	14	5237		
Thursday, 24 November 2022	10	10	8	10	24	65	146	352	577	387	378	320	376	365	426	494	517	428	252	164	124	78	28	21	5560		
Friday, 25 November 2022	16	5	2	19	37	63	140	348	500	368	381	409	442	432	527	637	538	480	328	251	164	87	49	30	6253	5433.2	
Saturday, 26 November 2022	10	12	3	11	13	20	74	189	315	363	402	422	394	388	383	365	376	360	260	153	104	97	58	48	4820		
Sunday, 27 November 2022	17	10	5	6	10	15	43	91	206	299	369	372	418	402	371	344	385	326	181	127	95	55	22	10	4179		5166
																							14th - 27th		**5094**	7 day	
																									5410	5 day	
Average (2 weeks: 12th - 25th)																											
Sat	15	9	7	8	9	22	68	140	226	340	395	380	373	347	317	343	309	274	222	144	99	81	76	29	4226		
Sun	14	11	5	4	7	15	43	87	182	287	337	354	361	375	382	363	332	288	211	160	111	64	29	12	4028		
Mon	9	11	5	17	17	62	148	335	544	350	355	320	363	389	388	465	453	401	208	141	94	49	26	15	5157		
Tue	8	4	9	14	16	59	147	365	521	324	334	340	338	335	392	519	480	419	259	147	113	67	29	19	5252		
Wed	8	7	9	22	28	63	148	332	574	346	308	355	364	394	390	500	468	410	245	150	122	71	32	18	5358		
Thu	10	8	7	13	23	66	148	342	573	360	361	338	348	368	411	496	481	390	234	158	105	63	32	19	5350		
Fri	11	6	3	14	29	64	143	327	500	363	372	358	424	428	483	618	520	442	311	220	141	87	53	23	5935		
Average Wkday	9	7	6	16	22	63	147	340	542	348	346	342	367	383	413	519	480	412	251	163	115	67	34	19	5410		
Average 7 Day	10	8	6	13	18	50	120	275	446	338	352	349	367	376	394	472	434	375	241	160	112	69	39	19	5044		
Percentiles (Weekday)																											
0	5	2	2	8	12	55	138	305	491	323	292	306	320	322	384	452	405	351	179	136	75	28	22	14			
0.25	6	4	4	11	18	60	144	328	503	336	333	322	344	367	386	481	462	405	239	142	90	63	27	15			
0.5	9	6	5	16	21	64	147	341	**551**	347	343	337	363	381	395	**498**	485	412	249	152	117	71	32	16	5351		
0.75	10	8	8	19	26	65	149	351	575	357	367	356	378	407	420	542	502	428	260	163	127	78	36	22			
0.85	11	10	9	22	28	66	151	357	**578**	365	375	365	397	420	434	**579**	512	431	282	180	143	83	44	22	**5862**		
0.9	12	11	9	23	30	66	152	361	581	370	378	374	410	425	448	603	519	437	297	194	152	86	50	23			
0.95	14	14	11	25	33	67	155	366	588	378	380	391	426	428	487	620	529	458	313	223	158	87	53	26			
0.98	15	16	12	26	36	67	157	368	593	384	380	402	436	431	511	630	534	471	322	240	162	87	55	29			
1	16	17	13	27	37	67	158	370	596	387	381	409	442	432	527	637	538	480	328	251	164	87	56	30			
Percentiles (7 Day)																											
0.85	15	10	8	19	26	65	150	352	577	369	378	372	389	413	427	545	503	428	263	172	129	86	57	26	**5778**		

Glenn Connelly – Evidence in Chief

Appendix 1 – Traffic Counts: SH2 – South of Cashmere Oaks Drive

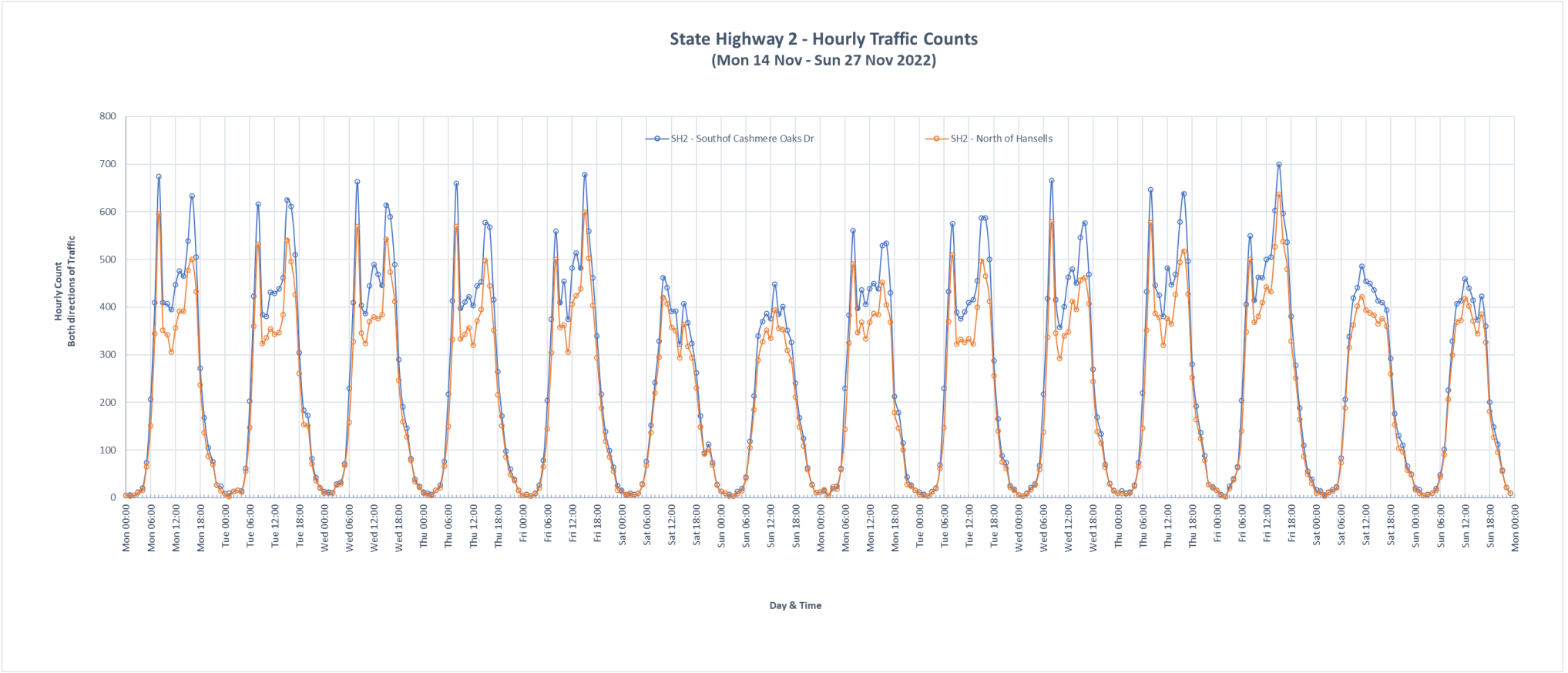
	0000-0100	0100-0200	0200-0300	0300-0400	0400-0500	0500-0600	0600-0700	0700-0800	0800-0900	0900-1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2100	2100-2200	2200-2300	2300-2400	Daily Total	5 Day ADT	7 Day ADT
Friday, 16 September 2022	*	*	*	*	*	*	*	*	*	1	43	39	65	42	53	58	62	56	31	32	24	11	6	5	528		
Saturday, 17 September 2022	3	2	0	0	1	2	3	12	34	43	45	57	45	39	42	49	50	57	26	26	4	8	20	0	568		
Sunday, 18 September 2022	0	0	0	2	0	0	2	12	35	43	47	54	51	39	41	57	40	30	21	11	9	3	1	2	500		
Monday, 19 September 2022	2	0	0	0	1	5	22	49	62	49	44	50	39	57	60	61	64	46	27	18	11	8	1	1	677		
Tuesday, 20 September 2022	1	2	0	0	2	6	18	41	70	50	60	38	58	47	65	50	81	71	21	22	12	4	1	2	722		
Wednesday, 21 September 2022	2	0	0	0	3	4	17	47	80	58	47	40	74	49	49	57	59	53	33	15	13	1	1	0	702		
Thursday, 22 September 2022	2	3	0	0	1	6	19	65	72	43	40	45	55	35	31	54	65	64	35	22	14	6	0	5	682		
Friday, 23 September 2022	1	2	0	0	1	6	17	59	66	44	57	52	68	33	39	55	40	63	33	16	18	12	2	1	685	694	648
Saturday, 24 September 2022	8	1	2	0	1	4	3	6	20	13	35	37	30	32	32	24	41	42	33	8	12	14	17	6	421		
Sunday, 25 September 2022	1	0	2	0	0	3	10	8	27	34	46	52	40	31	33	55	42	21	14	11	8	6	2	1	447		
Monday, 26 September 2022	2	3	0	2	3	4	4	13	23	23	38	35	43	28	45	29	42	23	18	5	6	2	0	2	393		
Tuesday, 27 September 2022	2	0	0	3	5	16	51	59	70	55	47	52	53	43	66	73	77	33	22	18	10	0	1	0	756		
Wednesday, 28 September 2022	2	0	0	4	4	15	57	58	40	41	46	53	55	32	53	56	61	33	18	11	10	2	0	0	651		
Thursday, 29 September 2022	2	0	0	1	4	16	62	71	54	40	48	53	57	51	58	52	55	31	27	16	7	3	1	0	709		
Friday, 30 September 2022	2	0	0	0	7	18	60	67	51	45	37	62	44	45	58	47	56	29	17	17	8	7	3	0	680	638	580
Saturday, 1 October 2022	1	1	0	4	1	4	10	26	26	47	30	40	27	43	32	55	29	22	14	10	7	8	2	0	439		
Sunday, 2 October 2022	2	1	2	0	0	1	5	9	27	33	34	34	35	42	35	27	33	15	11	5	6	4	4	3	368		
Monday, 3 October 2022	0	0	0	3	5	17	37	42	46	53	44	51	31	37	31	47	44	31	14	6	3	1	0	0	543		
Tuesday, 4 October 2022	2	0	0	3	12	29	29	49	48	33	48	67	58	35	54	55	63	33	25	10	8	2	1	2	666		
Wednesday, 5 October 2022	1	3	0	0	7	23	39	57	46	62	65	53	53	39	62	59	62	32	11	14	6	5	1	0	700		
Thursday, 6 October 2022	5	1	0	2	7	18	44	62	49	54	47	63	49	33	33	38	69	30	21	12	7	4	0	0	648		
Friday, 7 October 2022	4	0	0	2	3	16	31	60	25	36	38	55	49	47	47	54	41	42	25	17	9	3	1	1	606	633	567
Saturday, 8 October 2022	0	1	0	3	1	4	12	27	32	56	43	39	46	53	51	28	36	33	22	25	8	9	4	2	535		
Sunday, 9 October 2022	1	2	0	0	0	5	13	19	34	43	45	44	42	35	44	45	41	28	18	9	5	8	1	2	484		
Monday, 10 October 2022	0	0	2	2	10	12	53	53	49	55	61	70	53	59	65	63	54	37	13	3	13	4	1	0	732		
Tuesday, 11 October 2022	0	2	0	3	4	15	40	63	51	54	60	62	64	55	44	55	59	31	27	12	14	6	0	4	725		
Wednesday, 12 October 2022	0	0	0	0	4	15	54	58	51	65	54	62	65	57	43	52	63	27	30	10	7	0	1	3	721		
Thursday, 13 October 2022	1	0	0	1	2	19	55	64	45	38	56	60	48	46	68	53	51	31	14	13	1	1	1	0	668		
Friday, 14 October 2022	2	0	0	2	5	18	32	52	57	50	42	57	59	58	52	51	70	36	18	19	13	13	1	2	709	711	653
Saturday, 15 October 2022	4	0	0	2	2	4	13	19	40	43	38	47	42	40	41	47	34	24	20	16	8	9	0	2	495		
Sunday, 16 October 2022	0	2	0	0	0	4	17	16	50	44	59	37	*	*	*	*	*	*	*	*	*	*	*	*	229		
																							17/9 - 14/10/22			669	612.0
																							18/9 - 15/10/22			669	609.4
Average (4 weeks: 17/9 - 14/10/22))																											
Sat	3	1	1	2	1	4	7	18	28	40	38	43	37	42	39	39	39	39	24	17	8	10	11	2			
Sun	1	1	1	1	0	2	8	12	31	38	43	46	42	37	38	46	39	24	16	9	7	5	2	2			
Mon	1	1	1	2	5	10	29	39	45	45	47	52	42	45	50	50	51	34	18	8	8	4	1	1			
Tue	1	1	0	2	6	17	35	53	60	48	54	55	58	45	57	58	70	42	24	16	11	3	1	2			
Wed	1	1	0	1	5	14	42	55	54	57	53	52	62	44	52	56	61	36	23	13	9	2	1	1			
Thu	3	1	0	1	4	15	45	66	55	44	48	55	52	41	48	49	60	39	24	16	7	4	1	1			
Fri	2	1	0	1	4	15	35	60	50	44	44	57	55	46	49	52	52	43	23	17	12	9	2	1			
Weekday	2	1	0	1	5	14	37	54	53	47	49	54	54	44	51	53	59	39	22	14	10	4	1	1	669		
Weekend	2	1	1	1	1	3	7	15	29	39	41	45	40	39	39	43	39	31	20	13	7	8	6	2	470		
Percentiles																											
0	0	0	0	0	0	0	2	6	20	13	30	34	27	28	31	24	29	15	11	3	1	0	0	0			
0.15	0	0	0	0	0	4	7	12	27	35	38	38	39	33	33	39	40	25	14	8	6	1	0	0			
0.25	1	0	0	0	1	4	12	19	34	40	41	41	42	35	39	47	41	29	17	10	7	2	1	0			
0.5	2	0	0	1	3	6	21	49	47	44	46	52	49	42	45	53	54	32	21	13	8	4	1	1			
0.75	2	2	0	2	5	16	43	59	53	54	53	57	57	49	58	55	63	42	27	17	12	8	2	2			
0.85	3	2	0	3	6	18	54	63	65	55	58	62	59	55	62	57	65	52	29	19	13	9	3	3			
0.95	5	3	2	4	9	21	59	66	71	60	61	65	67	58	66	62	74	64	33	24	14	13	12	5			
0.98	6	3	2	4	11	26	61	69	75	63	63	68	71	58	67	67	79	67	34	25	16	13	18	5			
1	8	3	2	4	12	29	62	71	80	65	65	70	74	59	68	73	81	71	35	26	18	14	20	6			

Figure 4 Daily Traffic Flows



Glenn Connelly – Evidence in Chief

Figure 5 Hourly Traffic Flows



APPENDIX 2 - STATE HIGHWAY SPEED DATA

SH2 - North of Hansells (Northbound)

Speed Statistics by Hour

SpeedStatHour-12
Site: Nth of Hansells Entr.2.0N
Description: **!Nth of Hansells Entrance NB**
Filter time: **20:40 Friday, 11 November 2022 => 22:56 Monday, 28 November 2022**
Scheme: Vehicle classification (NZTA2011)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12 13) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100)

Vehicles = 42499
Posted speed limit = 100 km/h, Exceeding = 1916 (4.51%), Mean Exceeding = 104.40 km/h
Maximum = 149.3 km/h, **Minimum** = 14.7 km/h, **Mean** = 82.4 km/h
85% Speed = 93.2 km/h, **95% Speed** = 99.4 km/h, **Median** = 82.4 km/h
20 km/h Pace = 72 - 92, **Number in Pace** = 28132 (66.19%)
Variance = 121.53, **Standard Deviation** = 11.02 km/h

Hour Bins (Partial days)

Time	Bin		Min	Max	Mean	Median	85%	95%	>PSL 100 km/h	
0000	101	0.2%	43.6	117.6	84.7	84.6	97.2	102.6	13	12.9%
0100	71	0.2%	40.1	106.2	79.9	80.6	91.8	101.9	6	8.5%
0200	47	0.1%	39.0	115.4	82.4	78.5	105.1	108.7	10	21.3%
0300	96	0.2%	34.7	111.1	81.7	83.2	96.8	104.8	10	10.4%
0400	120	0.3%	65.5	112.8	84.6	84.6	96.1	103.7	14	11.7%
0500	323	0.8%	31.1	114.0	83.6	82.8	96.5	103.7	33	10.2%
0600	854	2.0%	23.9	141.3	83.7	83.2	95.4	102.2	67	7.8%
0700	2038	4.8%	25.0	116.4	82.9	83.2	92.9	99.4	93	4.6%
0800	3238	7.6%	16.9	114.5	80.6	80.3	91.1	97.2	97	3.0%
0900	2789	6.6%	19.6	119.7	80.5	80.3	91.1	97.9	85	3.0%
1000	3036	7.1%	14.7	127.8	80.0	79.9	90.7	97.2	89	2.9%
1100	3047	7.2%	22.1	130.0	80.7	80.6	92.2	98.3	96	3.2%
1200	3262	7.7%	15.9	131.5	81.1	81.0	92.5	98.6	128	3.9%
1300	3305	7.8%	21.0	144.2	81.4	81.4	92.5	97.9	114	3.4%
1400	3498	8.2%	18.9	135.3	81.3	81.0	92.2	98.3	111	3.2%
1500	3765	8.9%	22.1	112.7	82.8	82.8	93.2	98.6	141	3.7%
1600	3769	8.9%	21.7	117.3	83.5	83.5	94.0	99.4	172	4.6%
1700	3411	8.0%	20.6	130.5	85.4	85.7	95.4	100.8	207	6.1%
1800	2080	4.9%	31.1	136.4	86.2	86.0	96.5	102.6	159	7.6%
1900	1421	3.3%	30.1	129.2	84.7	84.6	95.4	101.2	94	6.6%
2000	1011	2.4%	35.8	149.3	83.3	82.8	94.3	100.1	58	5.7%
2100	704	1.7%	50.0	137.5	85.3	85.0	96.1	101.2	53	7.5%
2200	336	0.8%	42.5	129.3	87.3	86.0	99.4	105.5	49	14.6%
2300	177	0.4%	59.8	120.7	86.6	85.3	97.6	103.7	17	9.6%
----	**42499**	**100.0%**	**14.7**	**149.3**	**82.4**	**82.4**	**93.2**	**99.4**	**1916**	**4.5%**

SH2 - North of Hansells (Southbound)

Speed Statistics by Hour

SpeedStatHour-12
Site: Nth of Hansells Entr.1.0S
Description: **!Nth of Hansells Entrance SH2 SB**
Filter time: **20:43 Friday, 11 November 2022 => 22:56 Monday, 28 November 2022**
Scheme: Vehicle classification (NZTA2011)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12 13) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100)

Vehicles = 42136
Posted speed limit = 100 km/h, Exceeding = 991 (2.35%), Mean Exceeding = 104.37 km/h
Maximum = 131.4 km/h, **Minimum** = 12.4 km/h, **Mean** = 80.0 km/h
85% Speed = 90.7 km/h, **95% Speed** = 96.5 km/h, **Median** = 80.3 km/h
20 km/h Pace = 71 - 91, **Number in Pace** = 28195 (66.91%)
Variance = 121.08, **Standard Deviation** = 11.00 km/h

Hour Bins (Partial days)

Time	Bin		Min	Max	Mean	Median	85%	95%	>PSL 100 km/h	
0000	78	0.2%	20.3	120.8	82.3	82.4	91.4	101.5	6	7.7%
0100	63	0.1%	53.8	112.6	82.4	82.1	97.6	104.8	7	11.1%
0200	52	0.1%	58.5	118.1	85.5	87.1	96.8	99.0	2	3.8%
0300	110	0.3%	34.8	116.1	88.0	88.6	102.2	108.4	23	20.9%
0400	180	0.4%	57.9	110.0	82.2	82.4	93.6	97.9	6	3.3%
0500	480	1.1%	56.2	121.7	86.0	86.0	96.8	103.3	44	9.2%
0600	1082	2.6%	38.3	130.3	84.4	85.0	94.7	100.4	61	5.6%
0700	2458	5.8%	26.9	112.7	82.2	82.4	92.2	97.2	61	2.5%
0800	4056	9.6%	16.3	115.4	78.5	78.8	89.3	94.7	57	1.4%
0900	2952	7.0%	24.5	118.7	78.4	78.8	89.6	95.0	36	1.2%
1000	2971	7.1%	22.3	127.3	78.0	78.5	88.6	94.3	32	1.1%
1100	2929	7.0%	17.7	123.1	78.2	78.5	88.9	95.0	46	1.6%
1200	3022	7.2%	21.3	119.3	79.1	79.6	89.6	95.4	50	1.7%
1300	3029	7.2%	17.0	113.0	78.2	78.8	88.6	94.3	39	1.3%
1400	3108	7.4%	15.0	114.0	78.6	78.8	88.9	94.7	44	1.4%
1500	3979	9.4%	20.7	114.7	78.6	78.8	88.6	94.0	51	1.3%
1600	3511	8.3%	19.9	120.2	80.6	80.6	90.4	95.8	68	1.9%
1700	2888	6.9%	12.4	131.0	82.1	82.4	92.5	97.6	82	2.8%
1800	1944	4.6%	19.4	119.6	83.6	83.9	93.6	99.0	80	4.1%
1900	1242	2.9%	38.7	128.3	84.4	85.0	94.0	100.4	72	5.8%
2000	885	2.1%	22.8	122.0	82.5	82.1	93.2	100.1	51	5.8%
2100	552	1.3%	47.3	131.4	83.0	82.1	93.6	100.4	31	5.6%
2200	391	0.9%	38.3	116.1	83.8	83.9	94.7	101.2	22	5.6%
2300	174	0.4%	48.2	118.6	85.5	85.3	96.5	103.7	20	11.5%
----	**42136**	**100.0%**	**12.4**	**131.4**	**80.0**	**80.3**	**90.7**	**96.5**	**991**	**2.4%**

SH2 – South of Cashmere Oaks Drive

Speed Statistics by Hour

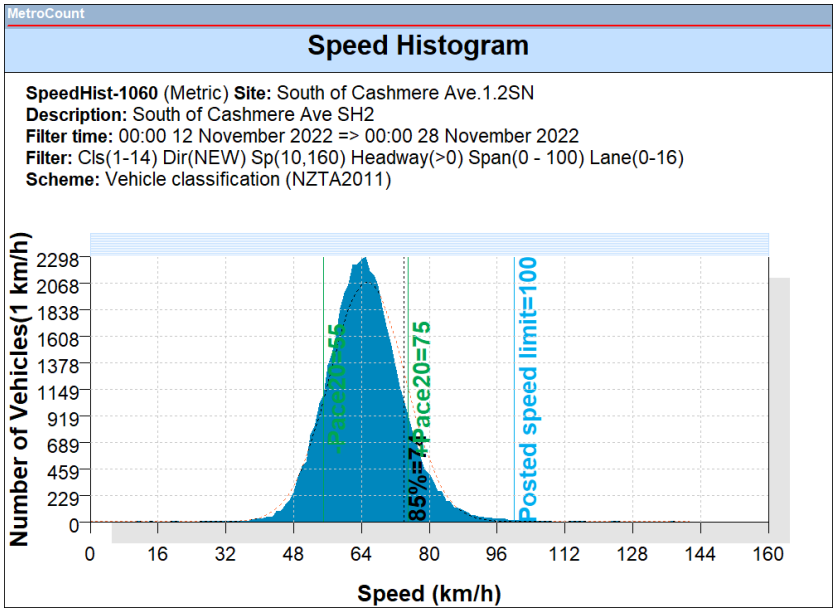
Southbound

SpeedStatHour-1058
Site: South of Cashmere Ave.1.2SN
Description: South of Cashmere Ave SH2
Filter time: 00:00 12 November 2022 => 00:00 28 November 2022
Scheme: Vehicle classification (NZTA2011)
Filter: Cls(1-14) Dir(NEW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 46366
Posted speed limit = 100 km/h, Exceeding = 81 (0.175%), Mean Exceeding = 107.98 km/h
Maximum = 142.3 km/h, Minimum = 11.4 km/h, Mean = 65.4 km/h
85% Speed = 73.98 km/h, 95% Speed = 80.46 km/h, Median = 64.98 km/h
20 km/h Pace = 55 - 75, Number in Pace = 35474 (76.51%)
Variance = 79.32, Standard Deviation = 8.91 km/h

Hour Bins

Time	Bin	Min	Max	Mean	Median	85%	95%	>PSL 100 km/h
0000	114 0.246%	40.9	98.5	67.0	67.0	78.2	86.1	0 0.000%
0100	86 0.185%	31.9	98.3	64.5	62.3	76.0	85.2	0 0.000%
0200	50 0.108%	39.3	94.7	65.0	61.8	79.5	89.0	0 0.000%
0300	87 0.188%	38.1	95.2	68.2	69.5	79.5	84.0	0 0.000%
0400	124 0.267%	28.2	92.1	64.9	65.5	76.4	83.2	0 0.000%
0500	316 0.682%	29.8	104.0	67.1	65.8	78.5	88.0	2 0.633%
0600	1391 3.000%	29.0	113.3	66.9	65.9	75.8	83.3	7 0.503%
0700	2265 4.885%	17.6	106.8	65.6	65.2	74.5	80.8	4 0.177%
0800	3351 7.227%	11.4	101.4	64.6	64.3	72.9	78.7	2 0.060%
0900	2960 6.384%	24.6	101.5	64.9	64.4	73.3	79.6	1 0.034%
1000	3269 7.050%	15.8	108.1	64.2	63.9	72.7	78.7	6 0.184%
1100	3303 7.124%	33.0	106.6	64.3	63.9	72.5	78.7	4 0.121%
1200	3655 7.883%	38.8	104.8	64.6	64.3	73.1	79.2	6 0.164%
1300	3698 7.976%	19.3	117.4	64.7	64.3	73.1	79.2	5 0.135%
1400	3707 7.995%	20.8	106.4	64.8	64.4	73.3	78.8	3 0.081%
1500	4059 8.754%	30.9	104.4	65.3	65.0	73.6	79.7	2 0.049%
1600	4047 8.728%	27.1	111.5	65.7	65.7	73.6	79.7	7 0.173%
1700	3695 7.969%	26.4	142.3	66.9	66.6	75.6	81.2	4 0.108%
1800	2260 4.874%	27.1	125.8	67.6	67.1	76.5	83.3	9 0.398%
1900	1598 3.446%	14.6	103.1	66.6	66.4	76.7	83.0	2 0.125%
2000	1104 2.381%	33.3	137.4	66.3	65.5	76.1	83.1	7 0.634%
2100	726 1.566%	37.5	124.4	65.9	65.2	75.2	84.4	5 0.689%
2200	320 0.690%	36.6	117.7	67.4	66.6	77.8	88.4	3 0.938%
2300	181 0.390%	28.8	123.7	67.1	66.1	78.1	83.6	2 1.105%
----	46366 100.0%	11.4	142.3	65.4	65.0	74.0	80.5	81 0.175%



SH2 – South of Cashmere Oaks Drive

Speed Statistics by Hour

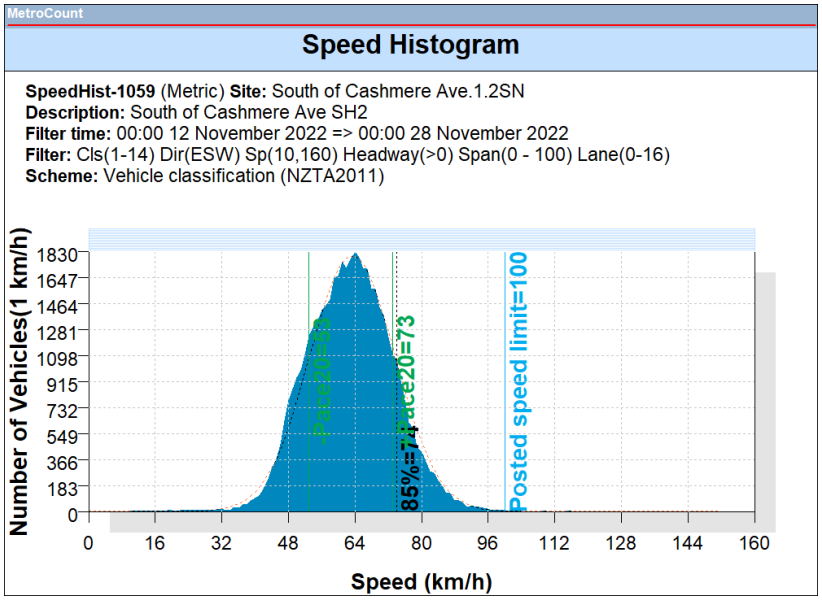
Northbound

SpeedStatHour-1057
Site: South of Cashmere Ave.1.2SN
Description: South of Cashmere Ave SH2
Filter time: 00:00 12 November 2022 => 00:00 28 November 2022
Scheme: Vehicle classification (NZTA2011)
Filter: Cls(1-14) Dir(ESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 46393
Posted speed limit = 100 km/h, Exceeding = 26 (0.056%), Mean Exceeding = 104.72 km/h
Maximum = 117.0 km/h, Minimum = 10.1 km/h, Mean = 63.4 km/h
85% Speed = 73.98 km/h, 95% Speed = 80.28 km/h, Median = 63.36 km/h
20 km/h Pace = 53 - 73, Number in Pace = 30992 (66.80%)
Variance = 106.24, Standard Deviation = 10.31 km/h

Hour Bins

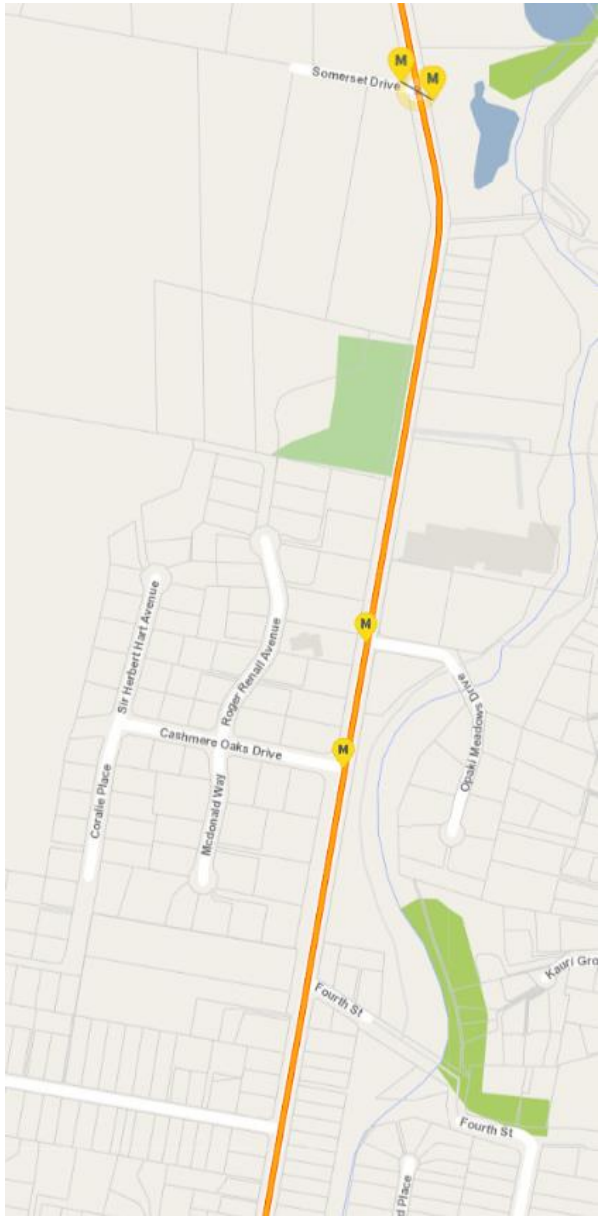
Time	Bin	Min	Max	Mean	Median	85%	95%	>PSL 100 km/h
0000	85 0.183%	38.4	94.4	67.1	67.5	76.1	88.1	0 0.000%
0100	75 0.162%	39.2	95.4	62.1	59.6	76.8	87.9	0 0.000%
0200	58 0.125%	41.2	87.4	62.3	62.5	75.9	83.3	0 0.000%
0300	129 0.278%	18.5	95.9	65.7	65.7	78.9	86.1	0 0.000%
0400	200 0.431%	42.0	116.4	62.8	60.8	75.4	82.9	3 1.500%
0500	510 1.099%	36.3	100.6	66.3	66.8	78.7	87.0	1 0.196%
0600	1143 2.464%	13.6	110.6	66.4	67.0	77.8	84.7	3 0.262%
0700	2655 5.723%	10.8	98.7	63.4	64.1	74.2	79.9	0 0.000%
0800	4289 9.245%	11.4	100.0	61.5	61.6	71.6	77.7	0 0.000%
0900	3245 6.995%	15.4	96.6	62.7	62.6	73.3	79.2	0 0.000%
1000	3328 7.173%	23.2	100.0	62.0	61.7	73.1	79.5	0 0.000%
1100	3318 7.152%	10.2	107.8	63.1	63.4	73.3	79.4	2 0.060%
1200	3425 7.383%	19.7	103.4	62.9	63.0	73.3	79.6	1 0.029%
1300	3461 7.460%	19.7	103.8	62.3	62.3	72.5	78.3	2 0.058%
1400	3399 7.327%	15.8	100.9	62.7	62.8	73.4	78.8	2 0.059%
1500	4304 9.277%	20.3	103.4	62.9	62.8	72.7	78.3	1 0.023%
1600	4122 8.885%	21.5	103.7	64.1	64.1	73.6	79.6	1 0.024%
1700	3140 6.768%	16.6	104.0	65.2	65.3	75.1	81.4	1 0.032%
1800	2093 4.511%	18.4	97.3	66.2	66.4	77.0	83.2	0 0.000%
1900	1378 2.970%	10.1	102.6	65.4	66.1	77.6	85.3	3 0.218%
2000	931 2.007%	21.8	104.9	64.7	63.9	75.2	84.6	2 0.215%
2100	551 1.188%	36.6	115.3	64.3	64.6	75.1	82.5	1 0.181%
2200	368 0.793%	32.9	100.9	65.4	65.0	76.1	83.4	1 0.272%
2300	186 0.401%	35.1	117.0	65.6	64.1	80.2	87.7	2 1.075%
----	46393 100.0%	10.1	117.0	63.4	63.4	74.0	80.3	26 0.056%



APPENDIX 3 - CRASH DATA

Figures 1 to 3 extracted from Evidence in chief of Glenn Connelly – Waka Kotahi NZTA

Figure1 5 Year Crash History (2018-2022)



SH 2, Opaki
Wed, 24/10/2018 201819160

1 1

Off roadway to left

Environment
100km/h, Nil (Default),
Dry
Unknown

Weather
Fine, Dark

SH 2, Opaki
Fri, 28/02/2020 2020148835

1 1

Off roadway to left

Environment
100km/h, Nil (Default),
Dry
Nil

Weather
Fine, Dark

OPAKI ROAD, Lansdowne
Tue, 20/10/2020 2020167294

1 1

Off roadway to left

Environment
100km/h, T Junction,
Dry
Nil

Weather
Fine, Bright sun

SH 2, Lansdowne
Fri, 13/04/2018 201814875

1 1

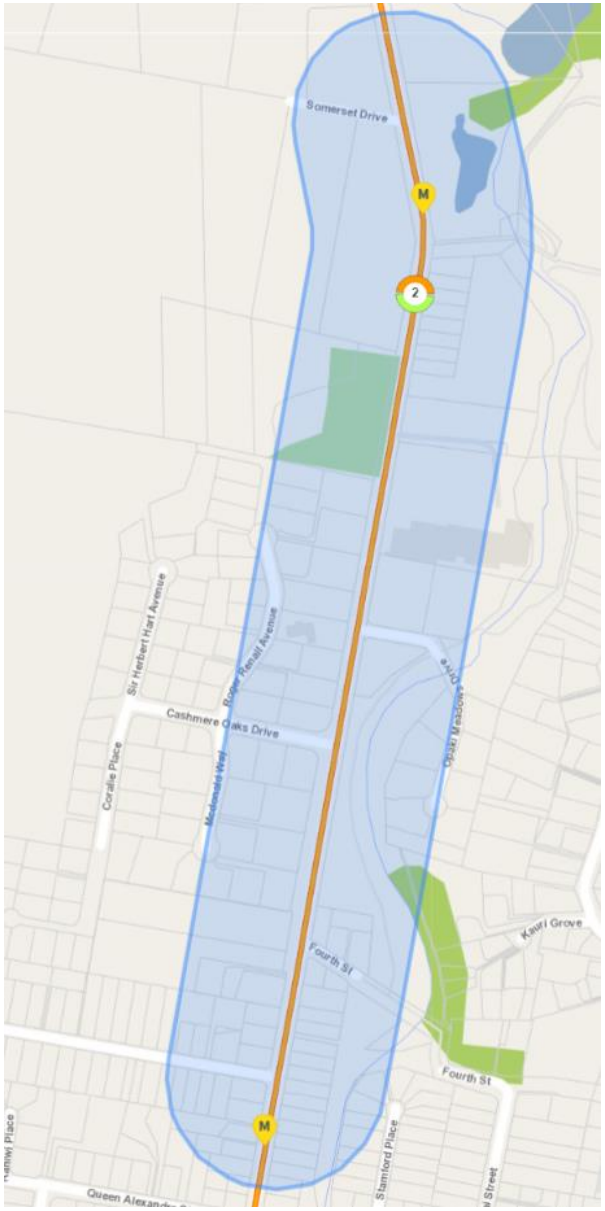
Off roadway to left

Environment
100km/h, Nil (Default),
Dry
Unknown

Weather
Fine, Dark

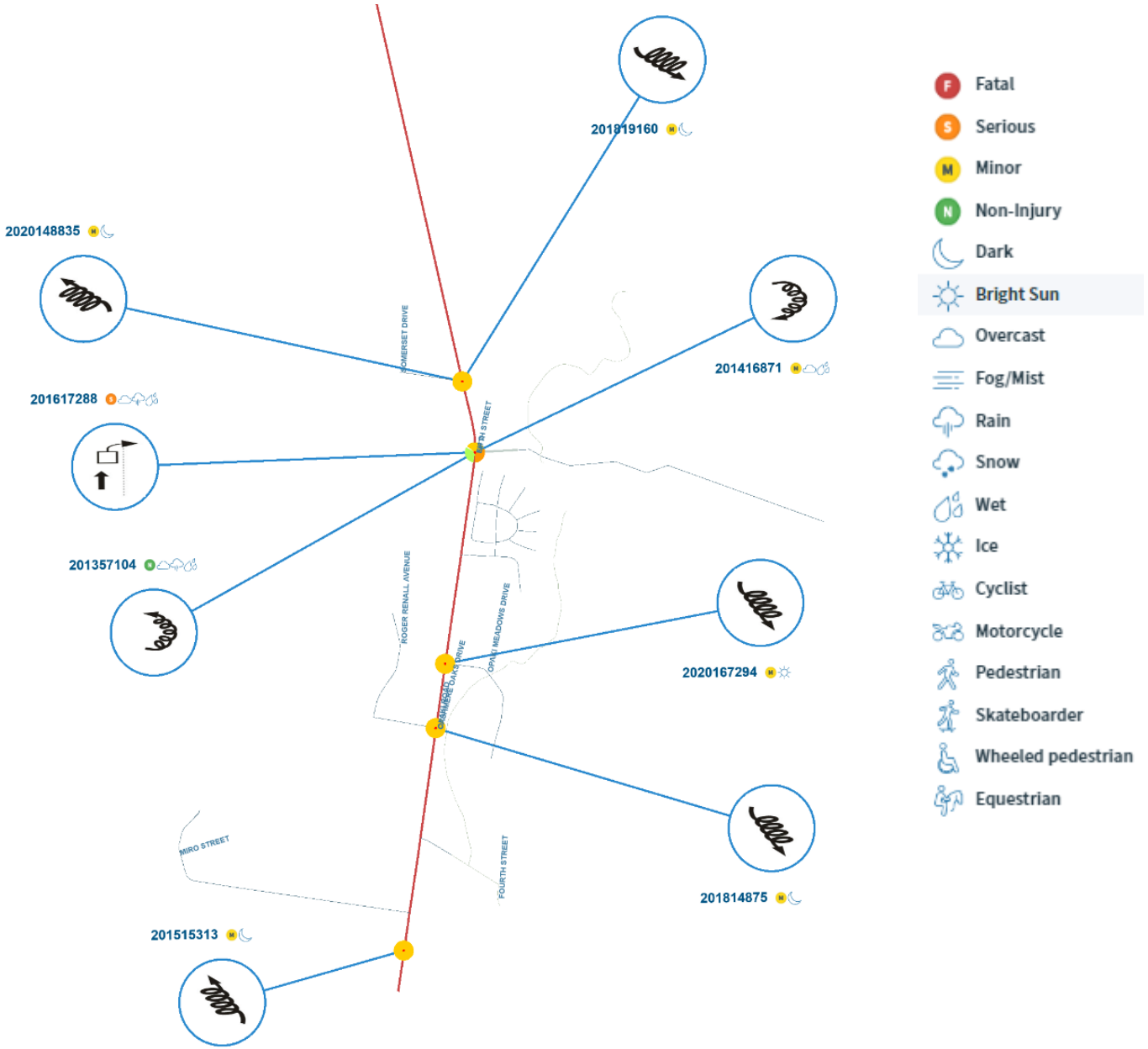
Note: Geographic area for crash selection as per Fig 2 on following page

Figure 2 5 to 10 Year Crash History (2013-2017)



Note: Geographic area shown by blue buffered area

Figure 3 **Collision Diagram (2013-2022)**



English Language Crash Listing (Appendix 3 EIC Glenn Connelly)

2013-2022

Key	CODED CRASH ID	Crash road	FEATURE	Distance	Direction	Side road	ID	Date	Day of week	Time	Description of events	Crash factors	Surface condition	Natural light	Weather	Junction	Control	Casualty count fatal	Casualty count serious	Casualty count minor
1	1246028	OPAKI ROAD			I	OPAKI MEADOWS DRIVE	2020167294	20/10/2020	Tue	9:43	Car/Wagon1 SDB on OPAKI ROAD lost control; went off road to left, Car/Wagon1 hit tree	CAR/WAGON1, alcohol test below limit, fatigue due to lack of sleep, too far left	Dry	Bright sun	Fine	T Junction	Nil	0	0	1
2	1075631	SH 2		490	N	CASHMERE OAKS DRIVE	201617288	21/10/2016	Fri	15:30	Van1 NDB on Opaki Road hit rear of Van2 NDB on Opaki Road turning right from centre line	VAN1, alcohol suspected, failed to notice car slowing, stopping/stationary	Wet	Overcast	Light rain	Driveway	Nil	0	1	0
3	1000991	SH 2		560	N	CASHMERE OAKS DRIVE	201357104	31/10/2013	Thu	18:36	Car/Wagon1 NDB on SH 2 lost control turning left, Car/Wagon1 hit non specific fence	CAR/WAGON1, driver unfamiliar with vehicle/towing, new driver/under instruction, other inappropriate speed	Wet	Overcast	Light rain	Nil (Defau	Nil	0	0	0
4	1013098	SH 2		620	N	CASHMERE OAKS DRIVE	201416871	17/11/2014	Mon	14:20	Car/Wagon1 SDB on SH 2 lost control turning right, Car/Wagon1 hit non specific fence, non specific ditch	CAR/WAGON1, lost control when turning, new driver/under instruction, speed entering corner/curve	Wet	Overcast	Fine	Nil (Defau	Nil	0	0	1
5	1149530	SH 2		30	N	CASHMERE OAKS DRIVE	201814875	13/04/2018	Fri	4:30	Car/Wagon1 SDB on Opaki Road, Statehighway 2 lost control; went off road to left, Car/Wagon1 hit non specific cliff, non specific street furniture	CAR/WAGON1, other lost control, speed on straight, too far left	Dry	Dark	Fine	Nil (Defau	Unknown	0	0	1
6	1153783	SH 2		670	N	CASHMERE OAKS DRIVE	201819160	24/10/2018	Wed	1:20	Car/Wagon1 SDB on sh2 opaki lost control; went off road to left, Car/Wagon1 hit non specific pole	CAR/WAGON1, alcohol test below limit, too far left, while returning to seal from unsealed shoulder	Dry	Dark	Fine	Nil (Defau	Unknown	0	0	1
7	1041260	SH 2		80	S	MIRO ST	201515313	22/07/2015	Wed	22:30	Van1 NDB on SH 2 lost control; went off road to left, Van1 hit non specific cliff, non specific ditch	VAN1, alcohol test above limit or test refused, too far left	Dry	Dark	Fine	Nil (Defau	Unknown	0	0	1
8	1224359	SH 2		98	N	SOMERSET DRIVE	2020148835	28/02/2020	Fri	22:22	Car/Wagon1 NDB on SH 2 lost control; went off road to left, Car/Wagon1 hit power pole	CAR/WAGON1, alcohol test below limit, other lost control	Dry	Dark	Fine	Nil (Defau	Nil	0	0	1