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Redcliffs Park School Relocation – Beachville/Main/McCormacks Bay Road Intersection Assessment

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1. Introduction

The Ministry of Education (MOE) has proposed that Redcliffs School be moved from its current site west of Main Road to Redcliffs Park, approximately 250m northeast of the current site. A Transport Assessment[1] identified the intersection of Main Road, Beachville Road and McCormacks Bay Road required further assessment from a transport perspective.

Abley Transportation Consultants (Abley) were commissioned by the MOE to undertake an assessment of this intersection with consideration of the potential traffic generated by the school.

This report presents:

- A brief background of the proposed activity,
- Details of the traffic surveys undertaken to inform the assessment,
- A brief description of the methodology used to predict traffic queues and delays,
- Current vehicle delays and queueing at the intersection,
- Predicted vehicle delays and queueing at the intersection (with the school operating at Redcliffs Park), and;
- Discussions and Conclusions.

[1] http://shapingeducation.govt.nz/wp-content/uploads/2014/04/Redcliffs-School-Transport-Assessment-FINAL.pdf

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2. Background

Figure 2.1 shows the location of the proposed school site at Redcliffs Park and the intersection being assessed. **Figure 2.2** shows the layout of the intersection in its present form. Both McCormacks Bay Road and Beachville Road are give-way controlled. The speed limit on all approaches to the intersection is 50km/h. The intersection has relatively good safety record with three minor injury crashes recorded in the last 10 years.

A right turn bay exists for vehicles turning right from Main Road into McCormacks Bay Road. Site visits found that vehicles turning right from Main Road into Beachville Road use the area between the two splitter islands as an informal waiting area when turning, allowing straight through vehicles to pass comfortably on their left. Also left and right turning vehicles on McCormacks Bay Road generally queued separately due to the width of this intersection approach. Left and right turning vehicles on Beachville Road generally queued in a single line due to the width of this intersection approach.

Figure 2.1
Location of Redcliffs Park and Intersection

Figure 2.2
Intersection Layout

Figure 2.3 and **Figure 2.4** show the intersection looking west and east.

Figure 2.3 *Looking southwest towards McCormacks Bay Road (left) and Main Road West (right)*

Figure 2.4 *Looking southeast across the Beachville Road intersection approach toward Main Road East*

3. Traffic Survey

Traffic counts were undertaken on:

- Wednesday 7 June 2017 between 7:30am and 9:30am,
- Wednesday 7 June 2017 between 2:30pm and 4:30pm, and;
- Saturday 17 June 2017 between 9:00am and 11:00am.

The weather was fine on both survey days and there was no reason to believe that the intersection was operating differently to a normal weekday.

The purpose of the Wednesday survey was to gather information about current traffic during the hours when school traffic is expected to be heaviest. The purpose of the Saturday survey was to gather information about how the intersection operates when the side roads are heavily trafficked.

No significant delays were observed on Main Road during both Wednesday surveys. Delays for vehicles turning from McCormacks Bay Road and Beachville Road was generally low with only several vehicles observed experiencing delays longer than 30 seconds during both the morning and evening surveys.

No significant delays were observed on Main Road during the Saturday survey. Both Redcliffs Park and McCormacks Bay Reserve were used for winter sports during the survey. This resulted in short-term queueing and delays on both Beachville Road and McCormacks Bay Road for approximately a five-minute period after games finished. Other than this, delays for vehicles turning from McCormacks Bay Road and Beachville Road were generally low with only several vehicles observed experiencing delays longer than 30 seconds.

A summary of the traffic count results during the survey is shown in **Table 3.1**. Detailed traffic counts can be found in **Appendix A**.

***Table 3.1** Traffic Count Summary*

	Main Road (East from Sumner)	Beachville Road	McCormacks Bay Road	Main Road (West from Christchurch)
Wednesday 7:30am-9:30am	1561 vehicles	70 vehicles	62 vehicles	853 vehicles
Wednesday 2:30pm-4:30pm	1179 vehicles	55 vehicles	78 vehicles	1343 vehicles
Saturday 9:00am-11:00am	1318 vehicles	93 vehicles	127 vehicles	1083 vehicles

4. Methodology

4.1 Model set up

Traffic modelling was undertaken using the s-Paramics microsimulation software. The model requires the following inputs:

1. the geometry of the intersection,
2. existing traffic volumes, and
3. expected future traffic volumes.

Inputs 2 and 3 above were defined based on:

- the expected trips that the school is likely to attract in the morning and afternoon peaks,
- the likely modes (car, walking etc.) that will be used to make trips and;
- the likely paths drivers will take to the school.

The traffic survey results were used to validate the model in the first instance and to ensure that the model was adequately simulating actual intersection performance.

The morning and afternoon peak hours were defined for the purposes of modelling such that they overlap with the periods when most staff and students will travel to and from the school. The morning peak has been defined as the period beginning at 7:30am and finishing at 9:30am. The afternoon peak has been defined as the period beginning at 2:30pm and finishing at 4:30pm.

4.2 Scenarios Tested

The traffic scenarios were developed based on the following inputs and assumptions:

- A school role of 300 pupils
- 68% of school trips made by private motor vehicle and the remainder by either walking, cycling or public transport
- Three traffic catchments were assumed to access the school:
    - Christchurch Catchment, which is expected to access the school via Main Road West,
    - McCormacks Bay Catchment, which is expected to access the school via McCormacks Bay Road (eastern intersection with Main Road), and;
    - Redcliffs Catchment, which is expected to access the school via Main Road East.

The original estimate of the percentage of traffic from each catchment, used in earlier assessments, was based on the number of households in each catchment, in lieu of actual numbers. This resulted in 46% of traffic coming the McCormacks Bay catchment and 54% from the Redcliffs catchment. Since that time information regarding the location of the current role has been provided and two further scenarios have been developed as discussed below.

Scenario 1 splits traffic accessing the school across the three catchments based on where students currently live (based on data obtained from the MOE). Scenario 2 simulated a situation where students were all located locally with a greater proportion living in the McCormacks Bay Catchment. Both scenarios are shown in **Table 4.1**.

***Table 4.1** Traffic by catchment*

Catchment	Scenario 1	Scenario 2
McCormacks Bay Road	10%	20%
Main Road East	82%	80%
Main Road West	8%	0%

The scenarios were tested using the model as follows:

- The **Base Scenario** looked to assess the current intersection performance
- **Scenario 1** assessed the intersection assuming that vehicle trips originated from where students currently live. **Scenario 1** is considered the best estimate of actual traffic patterns if Redcliffs School was operating at the Redcliffs Park site.
- **Scenario 2** simulated a situation whereby a greater proportion of vehicles travelled to the school via McCormacks Bay Road. **Scenario 2** is considered a 'sensitivity test' meaning that it is not considered the best estimate of traffic patterns if Redcliffs School was operating at the Redcliffs Park site. **Scenario 2** has been conducted for discussion purposes to inform how delays at the intersection may change if a slightly higher amount of traffic than expected use the side roads.

Appendix B describes the full methodology used to model the impacts of traffic on the intersection and detailed results for each scenario.

5. Current Intersection Performance

Table 5.1 shows how the intersection currently operates in the morning peak period (7:30-9:30am). Note that average delay refers to the "average" delay which vehicles experience when turning out from a side road over the analysis period. In practice, some drivers experience higher or lower delays depending on traffic conditions at the time they are driving. Similarly, average queue length refers to the "average" queue that drivers encounter at the intersection over the analysis period. In practice, some drivers experience longer or shorter queues depending on traffic conditions at the time they are driving.

The results show that there are no current delay related issues in the morning peak. This aligns with delays observed on site which were low in most cases and only exceeded 30 seconds a few times during the Wednesday survey.

***Table 5.1** Current Delays and Queueing – Morning Peak (7:30-9:30 am)*

	McCormacks Bay Road	Beachville Road
Average Delay	14 seconds	15 seconds
Average Queue Length (number of vehicles)	Less than 1 vehicle	Less than 1 vehicle

Table 5.2 shows how the intersection currently operates in the afternoon peak (2:30-4:30pm). The results show that there are no current delay related issues. This aligns with delays observed on site which were low in most cases and only exceeded 30 seconds a few times during the Wednesday survey.

***Table 5.2** Current Delays and Queueing – Afternoon Peak (2:30-4:30pm)*

	McCormacks Bay Road	Beachville Road
Average Delay	18 seconds	16 seconds
Average Queue Length (number of vehicles)	Less than 1 vehicle	Less than 1 vehicle

6. Predicted Intersection Performance

The predicted delays and queueing presented in Section 6.1 have been informed based on the likely directions of travel by staff and students to the proposed Redcliffs Park site in **Scenario 1** (see Section 4). The results of Scenario 2 are presented in Section 6.2.

No delays are anticipated on Main Road in either **Scenario 1** or **Scenario 2**. Minimal delays for traffic turning right from Main Road into either Beachville Road or McCormacks Bay Road are anticipated.

6.1 Scenario 1

Table 6.1 shows average delays and queues in the morning peak period (7:30-9:30am). The results show that average delay increases marginally compared to the current situation but not significantly.

Table 6.1
Predicted Delays and Queueing - Morning Peak (7:30-9:30 am)

	McCormacks Bay Road	Beachville Road
Average Delay	18 seconds	19 seconds
Average Queue Length (number of vehicles)	Less than 1 vehicle	Less than 1 vehicle

Table 6.2 shows average delays and queues between 8:45am and 9:00am (i.e. when school traffic will be at its highest). The results show that average delay increases during this 15-minute period, however not to a level considered to be a delay related issue. The primary reason that queueing and delays remain low during this period is because school drop-offs tend to be spread across a longer period compared to school pickups which tend to cluster more sharply around 3:00pm.

Table 6.2
Predicted Delays and Queueing (8:45-9:00am)

	McCormacks Bay Road	Beachville Road
Average Delay	37 seconds	23 seconds
Average Queue Length (number of vehicles)	Less than 1 vehicle	Less than 1 vehicle
Number of vehicles turning during this period	18 vehicles	20 vehicles

Table 6.3 shows average delays and queues in the afternoon peak period (2:30-4:30pm). The results show that the average delay increases compared to the current situation but not significantly.

Table 6.3
Predicted Delays and Queueing – Afternoon Peak (2:30-4:30pm)

	McCormacks Bay Road	Beachville Road
Average Delay	24 seconds	23 seconds
Average Queue Length (number of vehicles)	Less than 1 vehicle	Less than 1 vehicle

Table 6.4 shows average delays and queues between 3:00pm and 3:15pm (i.e. when school traffic is at its highest). The results show that average delay increases during this 15-minute period and moderate queuing occurs. Modelling showed that these delays are short-lived and drop back down to acceptable levels by approximately 3:15pm. The primary reason that queueing is higher during this period compared to the morning peak is that school pick-ups tend to cluster more sharply around 3:00pm compared to school drop-offs in the morning peak.

Table 6.4
Predicted Delays and Queueing (3:00-3:15pm)

	McCormacks Bay Road	Beachville Road
Average Delay	61 seconds	87 seconds
Average Queue Length (number of vehicles)	1-2 vehicles	3-4 vehicles
Number of vehicles turning during this period	17 vehicles	49 vehicles

6.2 Scenario 2

Scenario 2 showed that if a greater number of vehicles than predicted in **Scenario 1** use McCormacks Bay Road and Beachville Road during the peak periods, it is possible that short-term delays will be higher than predicted in **Scenario 1** over a short period (approximately 15 minutes in the morning and evening peaks). Through the rest of the day (98% of the time), no delay related issues are expected.

7. Discussion and Conclusion

The current intersection arrangement is considered sufficient from a delay related perspective as predicted delays and queueing are relatively low throughout most of the day. Some delays and queueing are likely to occur on both the Beachville Road and McCormacks Bay Road approaches to the intersection in the afternoon peak, and potentially in the morning peak, however any delays are likely to be short-lived.

Traffic signals are often used to manage traffic flows at intersections. However, they require careful consideration as all directions of traffic are subject to control. In the case of this intersection, traffic signals were not considered a good option because:

- Traffic signals would only reduce delays at the intersection for approximately 2% of the day and would increase delays for the rest of the day, and;
- Installing traffic signals would likely introduce new safety issues at the intersection.

An advantage of installing traffic signals is that a separated pedestrian crossing would be created, enhancing pedestrian safety. However, it is considered that if other pedestrian improvements are made, the safety for school students when crossing Main Road near this intersection should be improved to a similar level. Overall, retaining intersection in its current form is considered an appropriate option if other measures are implemented to improve the safety of students walking near this intersection and mitigate any short-term congestion effects at the intersection.

Improvements that could be implemented to address these issues include the following:

- Physical improvements to current pedestrian crossings to improve the safety for students crossing Main Road.
- Potentially moving pedestrian crossings or constructing new crossings to improve the safety for students crossing Main Road.
- Operating patrolled school crossings (also known as Kea crossings or Lollipop crossings) during peak school hours. A patrolled school crossing installed on Main Road would also provide gaps in traffic which would aid drivers turning right out of Beachville Road at peak times.
- Introducing a school speed limit zone to improve the safety for students by lowering vehicles speeds at times when students are walking/cycling to and from school.
- Keeping sight lines clear at the intersection to aid drivers looking for gaps at this intersection.
- Formalising a drop-off zone on the western side of Main Road for parents wanting to drop-off their children near a patrolled school crossing or signalised pedestrian crossing across Main Road. This would also reduce the need for parents to use Beachville Road or Celia Street when dropping off their children.
- Providing information to parents and caregivers about the best areas to pick-up and drop off their children and/or the safest ways to cross Main Road and other roads when walking to school. Parents and staff could be informed through a school travel plan to avoid turning right at this intersection.

Additional detailed discussion is included as **Appendix C**.

8. Summary

Modelling has showed that the effects on the intersection of Main Road/McCormacks Bay Road/Beachville Road are expected to be minor except for short periods in the afternoon peak and potentially in the morning peak. As such, it is recommended that the current intersection arrangement be retained and mitigating strategies be implemented to improve the safety of students walking near the school be considered in conjunction with the Christchurch City Council.

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Appendix A: Traffic Count Data

Traffic counts were recorded for all movements (left, through and right) on all legs of the intersection as well as queue lengths and delay timings when queues formed on the side roads. No significant queuing was observed on Main Road during any of the surveys.

Zone		1				2				3				4			
Traffic Coming From		Main Rd (East from Sumner)				Beachville Rd				McCormacks Bay Rd				Main Rd (West from Chch)			
Turning		Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total
Time Period Starting (Wed 7 June)	7:30	1	65	0	66	0	1	0	1	0	0	1	1	2	33	1	36
	7:35	0	86	0	86	0	0	1	1	0	0	2	2	5	18	0	23
	7:40	1	84	0	85	0	0	4	4	0	0	1	1	4	23	1	28
	7:45	0	68	0	68	0	0	0	0	0	0	0	0	0	40	2	42
	7:50	2	68	0	70	0	0	3	3	0	0	2	2	1	32	3	36
	7:55	1	69	0	70	0	0	5	5	1	0	5	6	4	46	1	51
	8:00	2	69	0	71	0	0	2	2	2	0	2	4	0	30	0	30
	8:05	0	77	0	77	1	0	4	5	1	0	1	2	0	35	0	35
	8:10	0	67	0	67	0	1	1	2	0	0	1	1	1	32	2	35
	8:15	3	56	0	59	0	0	7	7	0	1	2	3	1	30	0	31
	8:20	3	58	0	61	0	0	0	0	0	0	1	1	0	32	0	32
	8:25	2	58	1	61	0	0	2	2	0	1	0	1	0	28	0	28
	8:30	1	61	0	62	0	0	6	6	0	0	3	3	1	28	2	31
	8:35	6	70	0	76	0	0	6	6	1	0	6	7	0	38	0	38
	8:40	0	66	0	66	0	0	5	5	0	0	2	2	2	34	0	36
	8:45	2	65	0	67	0	0	2	2	1	0	3	4	1	47	2	50
	8:50	4	55	0	59	0	0	0	0	1	0	2	3	0	34	1	35
	8:55	3	50	0	53	0	0	3	3	0	0	1	1	3	43	1	47
	9:00	2	44	0	46	0	1	1	2	2	0	3	5	1	38	0	39
	9:05	3	58	0	61	0	0	3	3	0	0	1	1	2	27	2	31
	9:10	4	69	0	73	0	0	5	5	2	0	3	5	3	31	2	36
	9:15	2	49	0	51	0	0	1	1	1	0	2	3	1	35	0	36
	9:20	4	54	1	59	0	0	5	5	1	0	1	2	2	26	0	28
	9:25	4	43	0	47	0	0	0	0	0	0	2	2	2	37	0	39
Totals	7:30-8:30AM	15	825	1	841	1	2	29	32	4	2	18	24	18	379	10	407
	8:30-9:30AM	35	684	1	720	0	1	37	38	9	0	29	38	18	418	10	446
Time Period Starting (Wed 7 June)	14:30	2	37	0	39	1	0	3	4	0	0	5	5	2	37	0	39
	14:35	3	51	0	54	0	0	2	2	0	0	1	1	1	45	1	47
	14:40	2	39	0	41	0	0	4	4	0	1	0	1	0	47	0	47
	14:45	3	45	0	48	0	1	1	2	0	0	3	3	2	48	0	50
	14:50	2	23	0	25	0	0	1	1	0	0	4	4	2	63	0	65
	14:55	0	41	0	41	0	0	0	0	0	0	2	2	2	60	0	62
	15:00	2	39	0	41	0	0	3	3	0	0	4	4	2	62	0	64
	15:05	2	26	0	28	0	1	1	2	3	0	1	4	2	47	1	50
	15:10	3	59	2	64	0	0	3	3	4	0	0	4	0	41	2	43
	15:15	12	55	1	68	2	2	1	5	0	0	2	2	0	49	1	50
	15:20	3	42	0	45	0	0	0	0	0	0	3	3	1	55	2	58
	15:25	4	44	0	48	0	1	3	4	1	0	1	2	2	52	1	55
	15:30	0	47	0	47	0	1	3	4	1	0	3	4	2	40	1	43
	15:35	0	43	0	43	0	0	0	0	1	0	2	3	1	55	0	56
	15:40	6	62	0	68	0	0	1	1	1	0	0	1	3	60	3	66
	15:45	4	52	1	57	0	0	0	0	1	0	2	3	1	67	0	68
	15:50	4	43	0	47	0	0	2	2	0	0	2	2	1	65	0	66
	15:55	3	47	0	50	0	0	1	1	0	1	1	2	0	56	0	56
	16:00	6	51	0	57	0	1	6	7	2	0	6	8	0	59	0	59
	16:05	7	48	0	55	0	0	3	3	0	0	2	2	1	45	2	48
	16:10	6	53	0	59	0	0	0	0	0	0	2	2	1	52	2	55
	16:15	4	56	0	60	0	1	2	3	1	0	4	5	1	56	0	57
	16:20	6	40	0	46	0	0	1	1	0	0	3	3	0	63	2	65
	16:25	6	42	0	48	0	1	2	3	1	0	7	8	0	71	3	74
Totals	14:30-15:30PM	38	501	3	542	3	5	22	30	8	1	26	35	16	606	8	630
	15:30-16:30PM	52	584	1	637	0	4	21	25	8	1	34	43	11	689	13	713

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Zone		1				2				3				4			
Traffic Coming From		Main Rd (East from Sumner)				Beachville Rd				McCormacks Bay Rd				Main Rd (West from Chch)			
Turning		Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total
Time Period Starting (Sat 17 June)	9:00	4	43	0	47	0	0	4	4	0	0	1	1	7	26	0	33
	9:05	4	43	0	47	0	0	4	4	0	0	1	1	7	26	0	33
	9:10	3	47	0	50	0	0	0	0	0	1	1	2	2	28	1	31
	9:15	1	34	0	35	0	0	1	1	1	0	2	3	7	32	2	41
	9:20	0	45	1	46	0	0	2	2	0	0	2	2	2	28	0	30
	9:25	2	37	0	39	0	1	0	1	1	0	2	3	3	22	3	28
	9:30	4	45	0	49	0	0	2	2	1	0	1	2	3	30	1	34
	9:35	0	38	0	38	1	1	2	4	0	0	5	5	3	26	1	30
	9:40	1	43	2	46	0	0	4	4	1	0	3	4	3	32	0	35
	9:45	5	58	0	63	0	0	0	0	0	0	1	1	5	41	1	47
	9:50	3	56	0	59	0	1	9	10	0	1	4	5	2	52	0	54
	9:55	5	65	0	70	0	0	0	0	3	1	4	8	5	61	3	69
	10:00	3	50	1	54	1	0	3	4	3	0	1	4	4	36	2	42
	10:05	0	41	0	41	0	0	1	1	1	0	2	3	3	41	1	45
	10:10	5	41	1	47	1	0	2	3	1	1	5	7	7	34	3	44
	10:15	4	41	1	46	0	1	2	3	1	0	2	3	6	48	3	57
	10:20	2	43	0	45	0	0	2	2	0	0	4	4	6	61	2	69
	10:25	3	51	0	54	0	0	0	0	2	0	2	4	2	28	4	34
	10:30	2	59	0	61	0	0	1	1	3	0	7	10	2	45	1	48
	10:35	1	57	1	59	3	0	11	14	8	0	5	13	2	51	3	56
	10:40	12	62	1	75	0	1	5	6	7	0	4	11	2	53	3	58
	10:45	4	63	1	68	0	1	3	4	7	1	14	22	4	56	5	65
	10:50	4	93	0	97	0	0	17	17	1	0	3	4	3	44	3	50
	10:55	6	76	0	82	1	1	4	6	1	0	4	5	1	46	3	50
Totals	9:00-10:00AM	32	554	3	589	1	3	28	32	7	3	27	37	49	404	12	465
	10:00-11:00AM	46	677	6	729	6	4	51	61	35	2	53	90	42	543	33	618

Appendix B: Full Modelling Assumptions and Results

Trip Generation and Mode Split

The Redcliffs School roll is assumed to be a maximum of 300 students. Although the number stated in the masterplan is 400, there is uncertainty as to when, or if, this number will be achieved. This is due to the earthquake effects on the Redcliffs community. For example, a number of residential dwellings were unoccupied at the last census and it is unclear as to whether, or when, these dwellings will be reoccupied in the future. There are currently approximately 190 children attending Redcliffs Schools at the temporary site in Sumner. As at July 2016 there were 310 Year 1-8 state school students in the Redcliffs School zone. Redcliffs School does, however, share part of its zone with Mt Pleasant and Sumner. The students in the overlapping zone areas (approximately 112 as at July 2016) can chose to go to another school.

Running the model on a roll of 300 provides a very conservative estimate of what the immediate traffic situation would be like should the school be relocated onto the Redcliffs Park site. A role base of 300 also gives a margin of growth of 100 students (four equivalent classroom spaces) on current enrolment numbers. In lieu of any other information, the New Zealand Household Travel Survey NZHTS School Travel Model[2] was used to estimate the likely modal split of a Canterbury urban primary school of 300 students. The estimated modal split is shown in **Table B.1**.

The model estimates that 68% of school trips made by private motor vehicle and the remainder by either walking, cycling or public transport as shown in the table below which also shows the total number of trips by private motor vehicle.

Table B.1. *Estimated modal split*

Mode	Walk	Cycle	Public Transport	Vehicular Passenger
Share (%)	25%	2%	4%	68%
All day student drop-off trips				210
All day staff and service vehicle trips				15
AM peak hour inbound private motor vehicles (7:30-9:30am)				164
AM peak hour outbound private motor vehicles (7:30-9:30am)				149
PM peak hour inbound private motor vehicles (2:30-4:30pm)				149
PM peak hour outbound private motor vehicles (2:30-4:30pm)				164

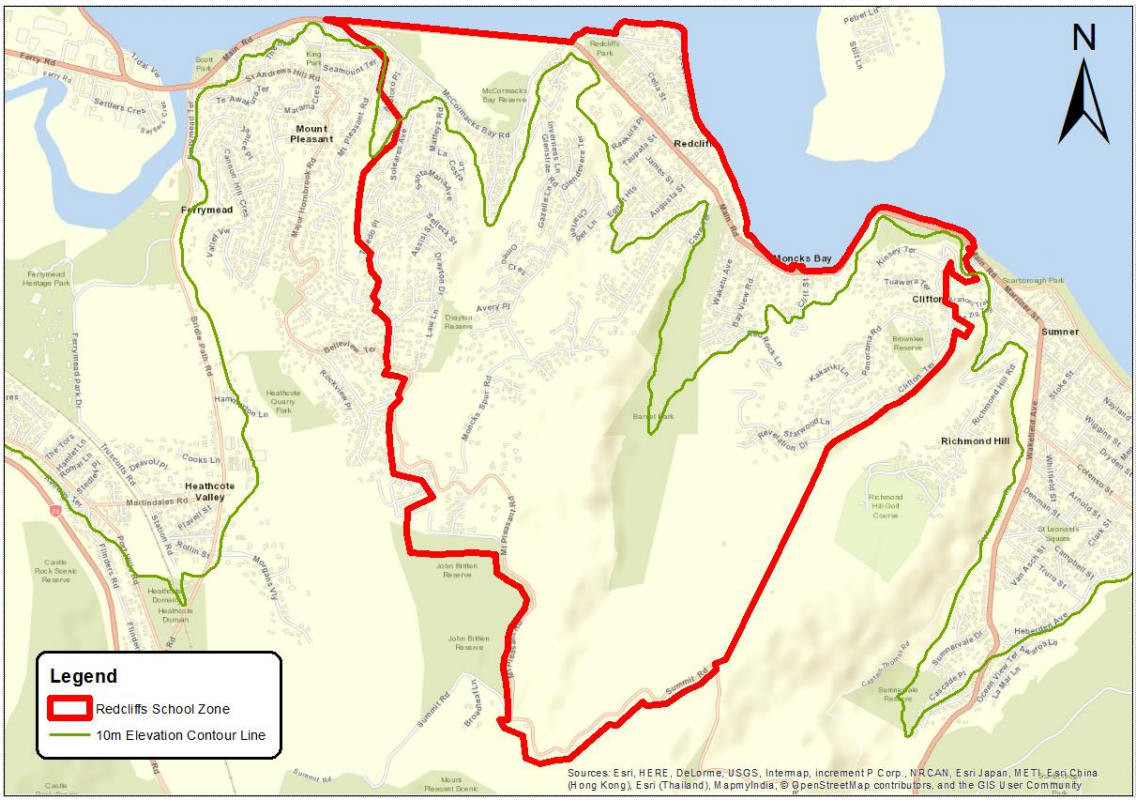
As shown in **Figure B.1**, there are many households on the flat located close to the school site. This will encourage uptake of walking as a mode of travel to the school.

[2] Milne, A, S Rendall and S Abley (2011) National travel profiles part B: Trips, trends and travel predictions. NZ Transport Agency research report 467. 94pp.

The total number of student trips as vehicle passengers is slightly higher than the number of students travelling by vehicle because students are sometimes picked up and then dropped off during the day for a variety of reasons such as appointments, field trips or other circumstances. The overall number of private vehicles arriving in the peak hour is lower than the number of arrival trips taken by vehicle because not all students are dropped off during the morning and some parents drop off more than one child.

The number of outbound trips in the AM peak is assumed to be the number of inbound trips minus the number of staff members. In the PM peak, the number of inbound trips is assumed to be equal to the number of AM outbound trips. The number of outbound trips in the PM is assumed to be the same as the number of inbound AM trips (i.e. including staff members).

Figure B.1 *10m Elevation Contour Line*



Trip Distribution and Assignment – Traffic Catchments

Figure B.2 shows the current school zones in the Redcliffs area. Of note is that the Redcliffs School zone is overlapped to the west by the Mount Pleasant school zone and to the east by the Sumner school zone.

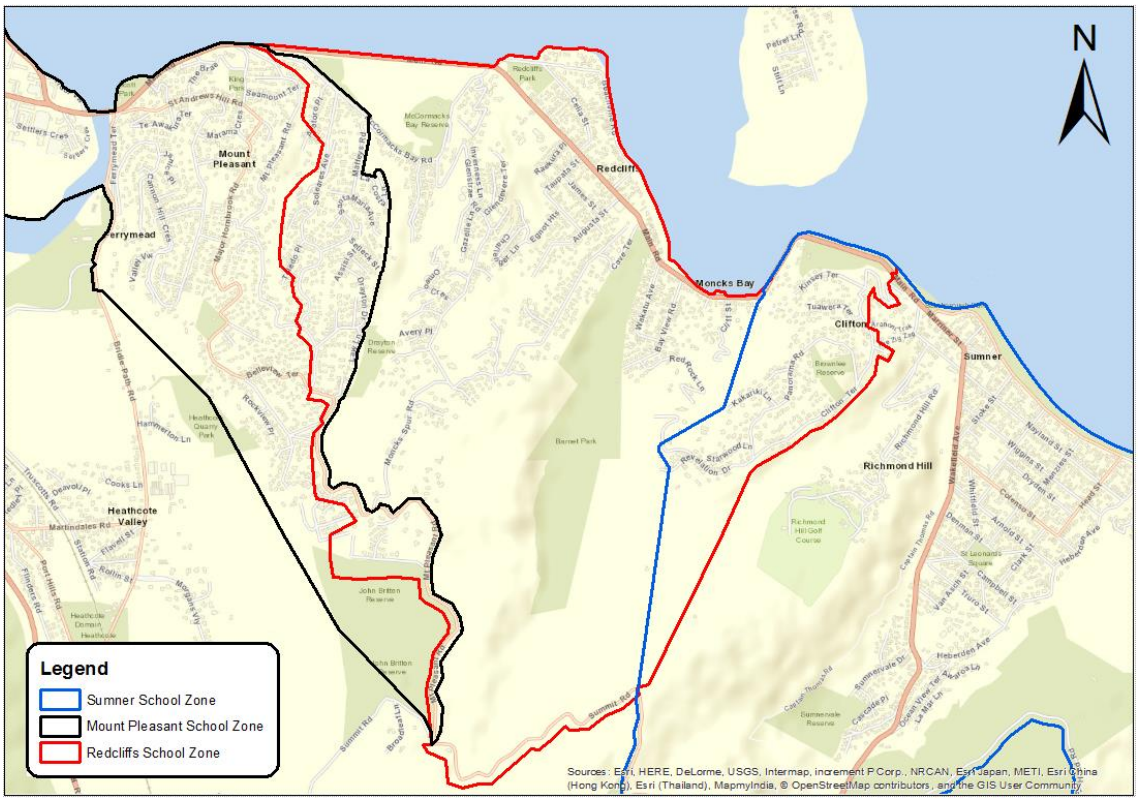


Figure B.2. *School Zones in the Redcliffs area*

Three traffic catchments were assumed to access the school:

- Christchurch Catchment, which is expected to access the school via Main Road West,
- McCormacks Bay Catchment, which is expected to access the school via McCormacks Bay Road (eastern intersection with Main Road), and;
- Redcliffs Catchment, which is expected to access the school via Main Road East.

The original estimate of the percentage of traffic from each catchment, used in earlier assessments, was based on the number of households in each catchment, in lieu of actual numbers. This resulted in 46% of traffic coming the McCormacks Bay catchment and 54% from the Redcliffs catchment. Since that time information regarding the location of the current role has been provided and two further scenarios have been developed as discussed below.

Scenario 1 splits traffic accessing the school across the three catchments based on where students currently live (based on data obtained from the MOE). Scenario 2 simulated a situation where students were all located locally with a greater proportion living in the McCormacks Bay Catchment. Scenario 1 is considered the most likely mimic what actual traffic patterns will be like. Scenario 2 is considered a sensitivity test since it loads more vehicles on to the side roads at the intersection. Both scenarios are shown in **Table B.2**.

Table B.2. Traffic by catchment

Catchment (and colour used in distribution diagrams)	Scenario 1	Scenario 2
McCormacks Bay Road (blue)	10%	20%
Main Road East (red)	82%	80%
Main Road West (yellow)	8%	0%

Figure B.3 to Figure B.14 show how the different inbound and outbound traffic movements have been categorised. Table B.3. shows how trips have been split across each category in terms of the total number of trips from each catchment. These assumptions are based on the assumption that parents may travel to and from work in Christchurch City as part of the trip. Some parents are also assumed to be return home after the drop off and, likewise, undertake their pick-up from home.

Figure B.3. AM Inbound trips from Redcliffs Catchment

Figure B.4. *AM Outbound trips from Redcliffs Catchment*

Figure B.5. *AM Inbound trips from McCormacks Catchment*

Figure B.6. *AM Outbound trips from McCormacks Catchment*

Figure B.7. *AM Inbound trips from Christchurch Catchment*

Figure B.8. *AM Outbound trips from Christchurch Catchment*

Figure B.9. *PM Inbound trips from Redcliffs Catchment*

Figure B.10. *PM Outbound trips from Redcliffs Catchment*

Figure B.11. *PM Inbound trips from McCormacks Catchment*

Figure B.12. *PM Outbound trips from McCormacks Catchment*

Figure B.13. *PM Inbound trips from Christchurch Catchment*

Figure B.14. *PM Outbound trips from Christchurch Catchment*

Table B.3. Overall Traffic Distribution

Route	Catchment/Travel Direction/Peak	Percentage of traffic	Route	Inbound/Outbound	Percentage of traffic
1	Redcliffs Inbound AM	50%	20	Redcliffs Inbound PM	37.5%
2	Redcliffs Inbound AM	5%	21	Redcliffs Inbound PM	12.5%
3	Redcliffs Inbound AM	45%	22	Redcliffs Inbound PM	37.5%
4	Redcliffs Outbound AM	23.75%	23	Redcliffs Outbound PM	18.75%
5	Redcliffs Outbound AM	1.25%	24	Redcliffs Outbound PM	56.25%
6	Redcliffs Outbound AM	50%	25	Redcliffs Outbound PM	12.5%
7	Redcliffs Outbound AM	12.5%	26	Redcliffs Outbound PM	12.5%
8	Redcliffs Outbound AM	12.5%	27	McCormacks Inbound PM	47.5%
9	McCormacks Inbound AM	95%	28	McCormacks Inbound PM	2.5%
10	McCormacks Inbound AM	5%	29	McCormacks Inbound PM	12.5%
11	McCormacks Outbound AM	5%	30	McCormacks Inbound PM	37.5%
12	McCormacks Outbound AM	20%	31	McCormacks Outbound PM	37.5%
13	McCormacks Outbound AM	37.5%	32	McCormacks Outbound PM	37.5%
14	McCormacks Outbound AM	37.5%	33	McCormacks Outbound PM	12.5%
15	Christchurch Inbound AM	5%	34	McCormacks Outbound PM	12.5%
16	Christchurch Inbound AM	95%	35	Christchurch Inbound PM	5%
17	Christchurch Outbound AM	50%	36	Christchurch Inbound PM	95%
18	Christchurch Outbound AM	50%	37	Christchurch Outbound PM	50%
19	Redcliffs Inbound PM	12.5%	38	Christchurch Outbound PM	50%

Figure B.14 and **Figure B.15** show the percentage of inbound/outbound traffic assumed to arrive/leave during each peak period. Note that a school day which begins at 9:00am and finishes at 3:00pm is assumed.

Figure B.14. AM Trip Profiles

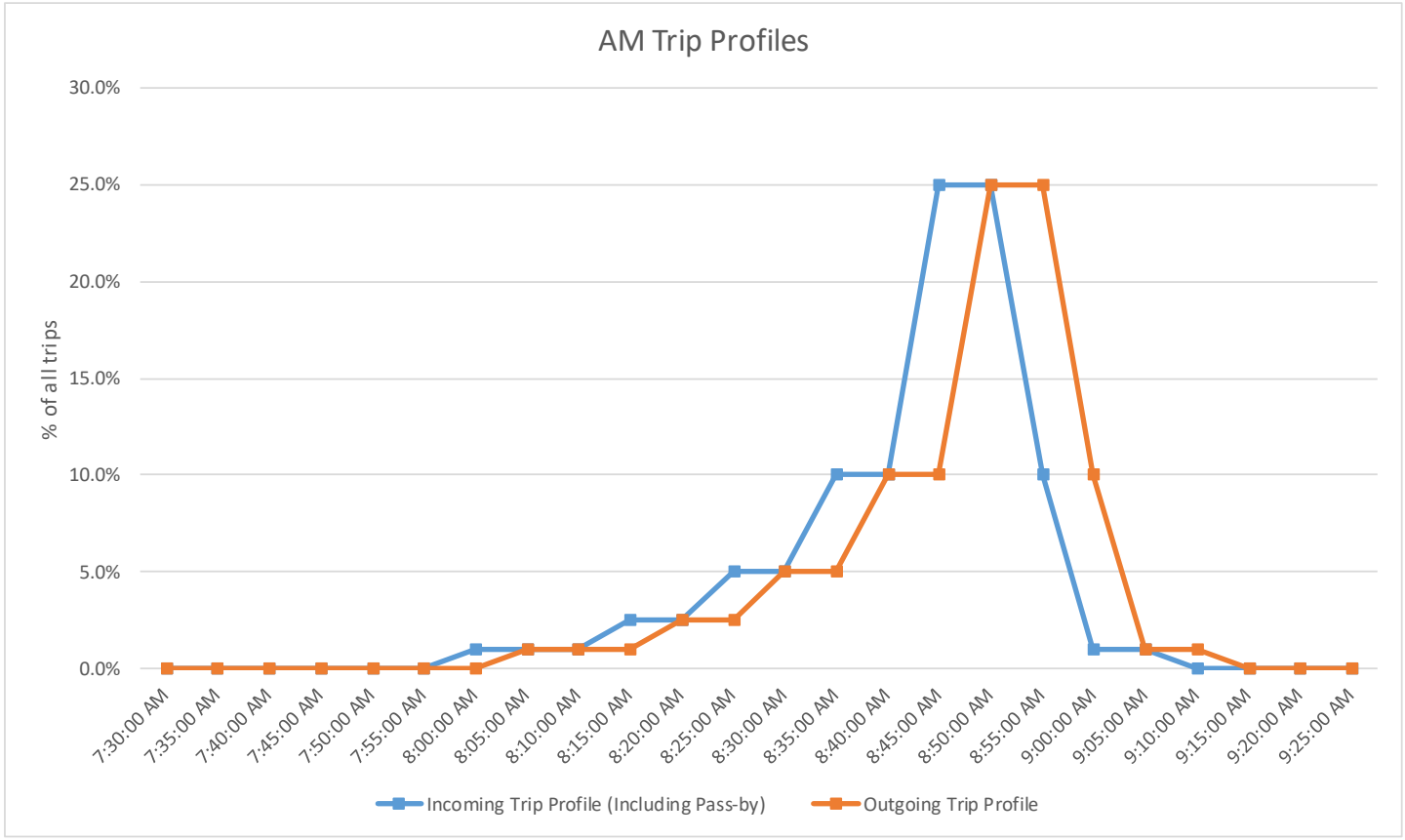
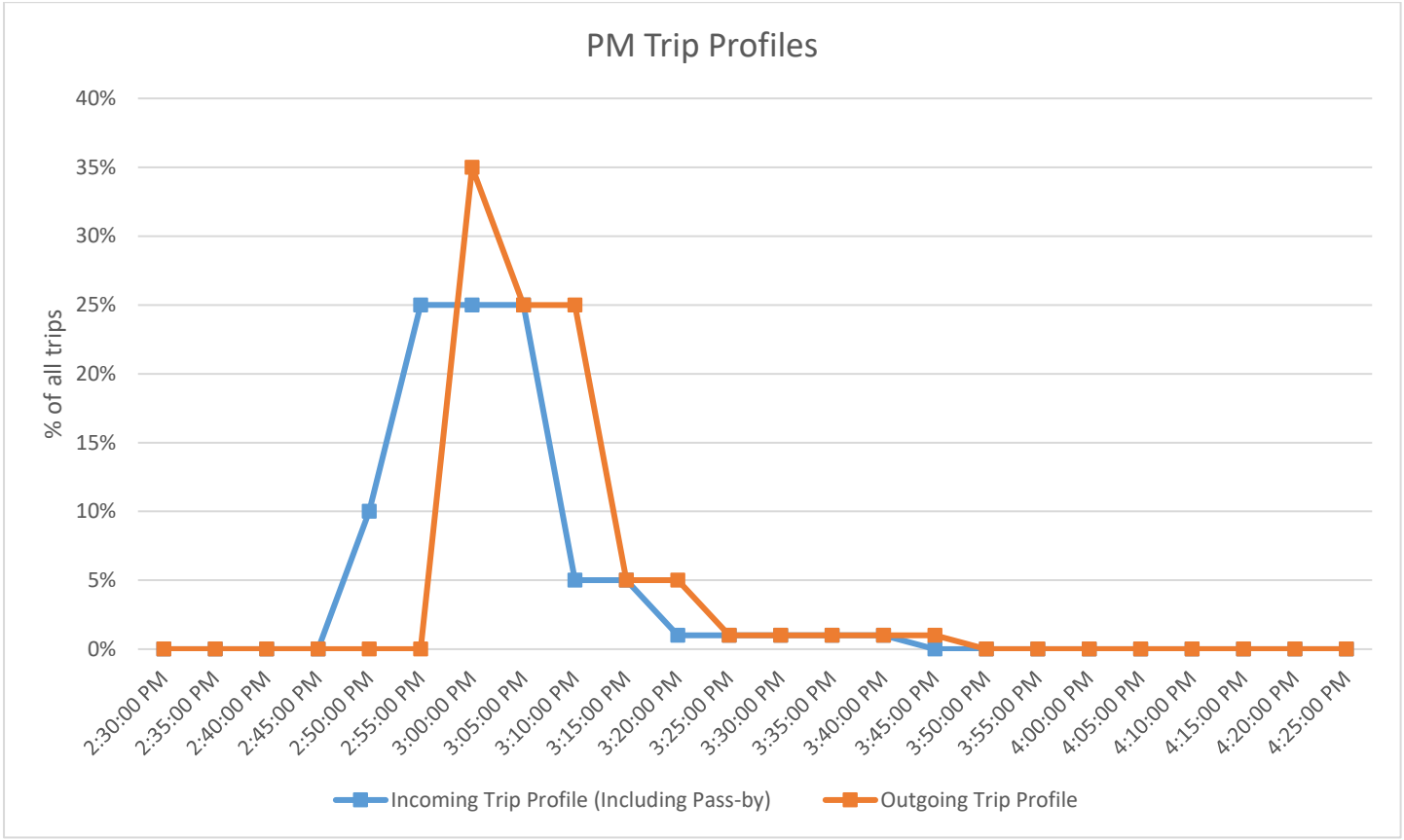


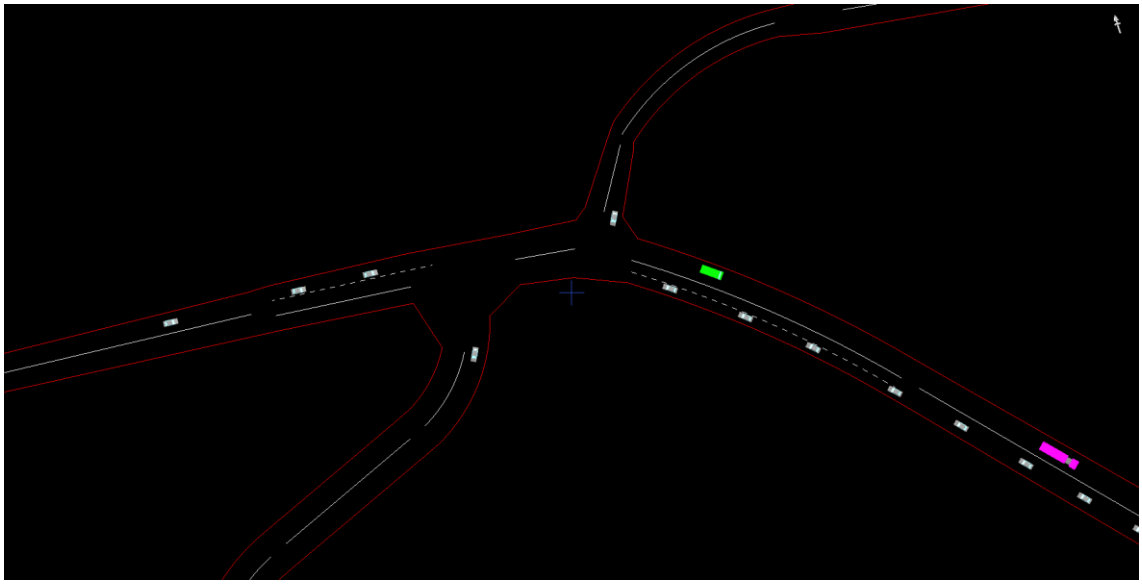
Figure B.15. PM Trip Profiles



Transport Modelling

A Paramics model was created for the purposes of this assessment using the s-Paramics microsimulation software. **Figure B.16.** shows the layout of the model.

Figure B.16.
Paramics model layout



The model was calibrated using the Saturday survey counts. The Saturday traffic counts were loaded into the model and then queues and delays were observed on the side roads and model parameters adjusted until queue lengths and delays in the model were similar to what was observed on site.

The Wednesday traffic counts were then loaded into the model to form a “base” scenario and measurements of delay and queue length extracted. The estimated traffic for each scenario was then loaded into the model and measurements of delay and queue length extracted.

Table B.4 to **Table B.9** present the results of modelling for the Base Scenario as well as Scenario 1 and 2. Minimal delays for traffic turning right from Main Road into either Beachville Road or McCormacks Bay Road are anticipated. No queuing beyond the right turn bay provided is expected for vehicles turning right into McCormacks Bay Road. A maximum queue of two vehicles is expected in the 3:00pm to 3:15pm period for vehicles turning right from Main Road into Beachville Road. This is not anticipated to cause a blockage on Main Road as there is sufficient space for vehicles to pass on the left.

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Table B.4.
Modelling Results – Base (7:30 – 9:30am, 2:30 – 4:30pm)

	McCormacks Bay Road (7:30am-9:30am)	Beachville Road (7:30am - 9:30am)	McCormacks Bay Road (2:30pm-4:30pm)	Beachville Road (2:30pm-4:30pm)
LOS	B	B	B	B
Average Delay (s)	14	15	18	16
95%ile Queue Length (m)	1.0	0.7	2.4	0.3
Average Queue Length (m)	0.2	0.2	0.5	0.1

Table B.5.
Modelling Results - Base (8:45 - 9:00am, 3:00 - 3:15pm)

	McCormacks Bay Road (8:45am-9:00am)	Beachville Road (8:45am-9:00am)	McCormacks Bay Road (3:00pm – 3:15pm)	Beachville Road (3:00pm – 3:15pm)
Average Delay (s)	15	12	18	16
Average Queue Length (m)	0.2	0	0.5	0.1

Table B.6.
Modelling Results – Scenario 1 (7:30 – 9:30am, 2:30 – 4:30pm)

	McCormacks Bay Road (7:30am-9:30am)	Beachville Road (7:30am - 9:30am)	McCormacks Bay Road (2:30pm-4:30pm)	Beachville Road (2:30pm-4:30pm)
LOS	B	B	C	C
Average Delay (s)	18	19	24	23
95%ile Queue Length (m)	2.7	1.8	5.2	22
Average Queue Length (m)	0.5	0.6	1.4	3.7

Table B.7.
Modelling Results – Scenario 1 (8:45 – 9:00am, 3:00 – 3:15pm)

	McCormacks Bay Road (8:45am-9:00am)	Beachville Road (8:45am-9:00am)	McCormacks Bay Road (3:00pm – 3:15pm)	Beachville Road (3:00pm – 3:15pm)
Average Delay (s)	37	23	61	87
Average Queue Length (m)	2.2	1.5	7.0	27

Table B.8.
Modelling Results – Scenario 2 (7:30 – 9:30am, 2:30 – 4:30pm)

	McCormacks Bay Road (7:30am-9:30am)	Beachville Road (7:30am - 9:30am)	McCormacks Bay Road (2:30pm-4:30pm)	Beachville Road (2:30pm-4:30pm)
LOS	C	C	C	D
Average Delay (s)	28	22	29	44
95%ile Queue Length (m)	11	2.8	29	19
Average Queue Length (m)	2.1	0.7	3.9	3.0

Table B.9.
Modelling Results – Scenario 2 (8:45 – 9:00am, 3:00 – 3:15pm)

	McCormacks Bay Road (8:45am-9:00am)	Beachville Road (8:45am-9:00am)	McCormacks Bay Road (3:00pm – 3:15pm)	Beachville Road (3:00pm – 3:15pm)
Average Delay (s)	73	29	74	156
Average Queue Length (m)	14	2.1	27	21

Appendix C: Full Discussion

The current intersection arrangement is considered sufficient from a delay related perspective as predicted delays and queueing are relatively low throughout most of the day. Higher delays and queueing are likely to occur on both the Beachville and McCormacks Bay Road approaches to the intersection in the afternoon peak and potentially in the morning peak however any delays are likely to be short-lived.

Several potential intersection upgrades were considered including the installation of traffic signals. Traffic signals were not considered an appropriate option because:

- Traffic signals would only reduce delays at the intersection for approximately 2% of the day and would increase delays for the rest of the day, and;
- Installing traffic signals would likely introduce new safety issues at the intersection.

An advantage of installing traffic signals is that a separated pedestrian crossing would be created, enhancing pedestrian safety. It is considered however that if other pedestrian improvements are made, the safety of school students when crossing the road should be improved to a similar level. Delays at the intersection can also be mitigated by informing parents/staff to avoid turning right at this intersection and providing a drop-off zone on the west side of Main Road for parents to drop-off their children at near the patrolled school crossing.

Retain Current Intersection Arrangement

Retaining the current intersection arrangement is considered the best option based on the modelling results, however there are several safety issues which were identified during site visits, including:

- A lack of sight distance to the east for vehicles turning from McCormacks Bay Road,
- Poor quality pedestrian crossing facilities across Main Road, and;
- Vehicles turning from the side roads taking small gaps in traffic during peak periods and when queues formed.

It is likely that the introduction of the school at Redcliffs Park will exacerbate all three of these issues so the following mitigation measures are proposed:

- Remove the fencing and vegetation to the south of Main Road bordering the cliff to allow greater sight distance to the east for vehicles turning from McCormacks Bay Road,
- Improve or upgrade the current crossing across Main Road adjacent to the intersection and investigate potential upgrades at other crossings near the school site which will improve the safety and amenity of the crossings.
- Develop a travel plan for the school which gives advice to parents and caregivers as to the preferred routes to school by vehicle or walking as well as potential sites for school (kea) crossings.

Signalise the Intersection

Given that vehicle delays are only expected to justify the installation of signals for 2% of the day, signalisation of the intersection appears to be of little benefit given that they are not required for 98% of the day. Signals would also introduce delays for traffic using Main Road as traffic would need to be stopped at regular intervals to allow any vehicles wanting to turn from the side roads.

Given the complex geometry of the intersection, signalising the current intersection arrangement is not considered a feasible option due to operational and safety issues, principally the fact that existing signalised staggered T-intersections in New Zealand generally have poor safety records.

An alternative option would be to realign McCormacks Bay Road such that it lined up with Beachville Road to form a crossroads and then signalise the intersection. While this arrangement would be better from an operational point-of-view, skewed intersections such as this generally have poor safety records in New Zealand.

One advantage to signalising the intersection is that pedestrian crossing movements would be made safer.

Conclusions

Overall, retaining intersection in its current form and improving pedestrian crossing opportunities for students is considered the best option. However, to aid pedestrian safety for students walking near this intersection, the following types of improvements are recommended:

- Physical improvements to current pedestrian crossings,
- Potentially moving pedestrian crossings or constructing new crossings,
- Changing crossing types,
- Creating patrolled school crossings (also known as Kea crossings or Lollipop crossings),
- Introducing a school speed limit zone, and;
- Providing information to parents and caregivers about the best areas to pick-up and drop off their children and/or the safest ways to cross Main Road and other roads when walking to school.

All options would need to be investigated more fully to consider the potential benefits and effects of each option before recommending and implementing treatments. This investigation would require dialogue with the Christchurch City Council to discuss potential options and cost sharing between parties for any implemented options.