



Trafficconcepts^{LTD}



Design

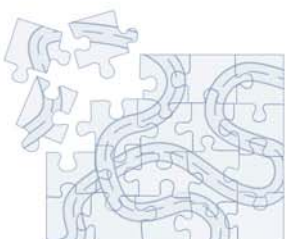
Safety

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Traffic Assessment

Proposed Rural Residential Subdivision

Bradey Road

Pauatahanui

Porirua City

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1 INTRODUCTION

This report provides an assessment of the potential effects arising from a private District Plan Change and the potential 40 lot subdivision of a large rural block of land at the end of Bradey Road, Pauatahanui. This report is to accompany a District Plan change application for the site and therefore identifies potential issues and recommends appropriate mitigation measures where appropriate. As noted in the assessment the main matters requiring consideration relate to the intersection of Bradey Road and the state highway and the nearby one lane bridge.

Initial discussions and meetings have been held with Transit New Zealand to gain an understanding of their concerns at this intersection. Further information has been provided to Transit New Zealand with regard to the performance of the State Highway 58/Bradey Road intersection.

This report follows two other initial assessments of the proposed development. The first report provided an overview of the potential effects arising from the proposed development. This overview provided estimates of the expected traffic generation arising from the subdivision and considered the potential effects. The second report was in response to Transit New Zealand's request for further technical information regarding the performance of the State Highway 58/Bradey Road intersection as well as the operation of the nearby one lane bridge on Bradey Road. The technical information provided in the second report has been determined from surveys carried out on site and the modelling of the intersection.

This report provides a summary of those two reports and provides some explanation of the technical data provided within the assessment. It effectively replaces the previous two reports.

It should also noted the analysis considered the potential effects of 60 new lots rather than 40 lots on Bradey Road. This reason for this approach allows for a conservative assessment of any potential adverse effects to be evaluated. It can be seen by the analysis within the report below that no perceivable difference in the operation of Bradey Road can be determined with regard to 60 lots and therefore even less for the planned 40 lots.

It is not intended that 60 lots be formed as part of this proposed development, the purpose of the analysis is to merely demonstrate the potential effects of a development with 50% more lots than the proposal. The analysis in this report clearly shows that the capacity of the state highway intersection, one lane bridge, and Bradey Road can accommodate the proposed development with any effects being less than minor.

2 SITE LOCATION AND DESCRIPTION

Figure 1 below shows the location of the site and the adjoining road connections. Bradey Road is a local road with the State Highway 58 being designated as a Collector Road and the

Porirua City Council District Plan. Bradey Road currently provides access to around 12 properties.

For the purpose of this report, State Highway 58 is considered to run in a north/south direction with Bradey Rd being in an east/west direction.



The intersection of Bradey Road with State Highway 58 is located approximately 1 kilometre south of the roundabout at the intersection of State Highway 58 and Paekakariki Hill Road. It is a T-junction, with the state highway forming the head and Bradey Road the leg. Bradey Road is controlled by a Give Way priority control. The photographs below show the intersection of Bradey Road and State Highway 58. The photograph on the left shows the intersection looking to the south and the photograph on the right provides the view looking north to the intersection and beyond.



As shown, the intersection has been designed to a high standard and meets Transit New Zealand's recommended layout for high speed environments. The design includes a right turn lane for traffic entering Bradey Road from the north, a merge lane for traffic turning south and right out of Bradey Road. Wide shoulders for traffic turning left into and out of Bradey Road are also provided. Excellent sight distances of more than 500 metres have been provided for vehicles carrying out turning manoeuvres at this intersection. The photographs below show the sight distances from the intersection of State Highway 58 and Bradey Road.



As shown, the sight distances for motorists exiting Bradey Road are excellent and allow drivers to exit safely from the side road.

As vehicles enter Bradey Road they are required to negotiate a one lane bridge some 30 metres from the intersection of Bradey Road and State Highway 58. During the first site inspections it was noted that no guidance is provided for approaching drivers with regard to which motorist has right of way when two opposing vehicles meet. There are relatively clear sight distances provided for approaching motorists to the bridge as shown in the photographs below. It should also be noted that there is a commercial business between the state highway and the one lane bridge.



The photographs clearly show the approaches to the one lane bridge, with the road marking shown in the photograph on the right showing a hold bar. Since completing our initial

assessment of the one lane bridge new signage has been erected. This signage provides priority for traffic exiting from the state highway to travel along Bradey Road. Motorists exiting Bradey Road are required to give way to vehicles along the state highway. Bradey Road is a legal road with the road markings and signage being the responsibility of the Porirua City Council.

Bradey Road has a sealed width of around seven metres with solid white edgelines painted along both sides. There is no centreline marked and there are no edge marker posts along the length of the road. The road traverses rolling country and slopes gently, with two small curves along its length. The photograph below shows the typical road layout for Bradey Road.



As shown above, there is sufficient room for two vehicles to pass safely. There are also some areas where small sections of shoulder had been provided which can be seen in the photograph above. This allows vehicles to stop clear of the moving traffic lanes. The road generally traverses the side of a hill with small batters along one side and a gully on the other side.

Access to the site is located at the end of Bradey Road. At the end of Bradey Road there is a large turning area designed to enable heavy vehicles and in particular cattle trucks to turn round. The photograph below shows the turning area at the end of the road.



As shown above, the road markings stop before the turning area. The access to the site is located near the large tree seen in the middle of the photograph. There are also access points to other properties within the turning area.

3 TRAFFIC PATTERNS

Traffic surveys have been carried out at the intersection of State Highway 58 and Bradey Road. These surveys were carried out to enable the analysis of the existing intersection performance and the effects of the future subdivision and its increased traffic movements.

These surveys were carried out during the week for a morning and evening two-hour period. The volumes expressed below represent the highest hourly peak flow during the morning and evening periods.

The survey data for the morning peak period shows a total of two vehicles turning left and two vehicles turning right out of Bradey Road onto the state highway. There were five vehicles turning right and one vehicle turning left into Bradey Road from the state highway during the morning peak period. There were around 655 vehicles travelling north and 870 vehicles travelling south along the state highway.

The survey data shows some four vehicles turning right and three vehicles turning left into Bradey Road during the evening peak period. There were some eight vehicles turning left and none turning right from Bradey Road onto the state highway. There were some 700 vehicles travelling south and 920 vehicles travelling north along the State Highway during the same evening peak period.

As shown above the traffic volumes entering and exiting Bradey Road are very small compared to the through vehicle movements on the state highway.

4 EXISTING INTERSECTION PERFORMANCE

The information gathered from the traffic count surveys has been used to determine the existing performance of the State Highway 58/Bradey Road intersection. The widely recognised intersection modelling software called SIDRA was used to analyse the intersection.

The two main outputs from the traffic analysis to test the operation of an intersection are the average delay and the 95% queue length. These are widely recognised parameters that describe the waiting times for motorists at the intersection and the queue length for individual movements respectively. The table below summarises the results from the SIDRA analysis and the existing performance of the Bradey Road/State Highway 58 intersection.

It should be noted that the values used for vehicle delay in the table below are averages. Accordingly some vehicles may wait longer than the figure quoted in the tables while other vehicles would wait less. At certain times of the day, particularly during the peak hours, some vehicles may be expected to wait more than one minute. This is not considered unreasonable for this type of intersection. The vehicle queue is expressed in metres and represents the length of the queue for 95% of the time.

Table 1: Existing performance of Bradey Road and State Highway 58 intersection

Approach & Movement		AM Peak (8:30-9:30)		PM Peak (4:45-5:45)	
		Delay (seconds)	95% Queue Length (metres)	Delay (seconds)	95% Queue Length (metres)
State Highway 58 north	Right	0.1	0	0.1	0
	Through	0.1	0	0.1	0
State Highway 58 south	Left	12.6	0	12.6	0
	Through	0	0	0	0
Bradey Road	Left	15.2	0	17.3	0
	Right	35.9	0	39.9	0

As shown above, the existing intersection operates efficiently with no vehicles needing to queue before having the opportunity to turn. The waiting times are relatively long compared to an urban intersection, but they are not unreasonable for a rural road that connects into a State Highway. It should be noted that the total delays shown in the table include geometric delays.

Geometric delay includes the effects of the geometric characteristics of the intersection (negotiation radius and distance, and the associated speeds), as well as the delays created by the intersection control.

5 CRASH HISTORY

A detailed search of the Land Transport New Zealand crash database was carried out which shows that there has been one reported injury and one non injury crash in the vicinity of the intersection of Bradey Road and State Highway 58 since 1995. There has been one non injury crash reported on Bradey Road for the same time period.

The injury accident on State Highway 58 involved a motorists losing control of the vehicle on the straight and colliding with an oncoming vehicle some 100 metres north of the Bradey Road intersection. This reported crash did not involve any vehicles entering or exiting Bradey Road.

The reported non injury crash involved a vehicle carrying out a u turn manoeuvre at the intersection of Bradey Road and State Highway 58 which collided with another vehicle.

While there have been crashes recorded in the vicinity of the intersection of Bradey Road and State Highway 58, the intersection itself does not have any deficiencies and this is clearly demonstrated by the excellent safety record for the intersection.

The accident reported on Bradey Road occurred late on a Saturday night and was the result of a vehicle travelling too fast for the conditions. Bradey Road itself is also considered to provide a relatively safe route for its intended users; however some improvements to the delineation should be considered and in particular for night time users. It should be noted that this is an existing deficiency.

6 PROPOSAL

6.1 General

The proposed subdivision is located at the end of Bradey Road and gains access to the legal road via a right of way through a block of land adjoining the road. The site has no direct legal frontage to Bradey Road. It is proposed to develop some 40 new lots which will be in clusters accessed by one main road.

This report considers the potential effects arising from the proposed subdivision and its 40 lots. The analysis of the proposed development and its effects on the surrounding road network are

based on some 60 lots at the end of Bradey Road. The reason for this assumption is to take a conservative approach with regard to any traffic and safety effects.

This section of the report provides a brief description of the traffic elements of the proposed development. The different elements such as site access, parking and traffic generation along with a detailed assessment of effects relating to each of these matters are provided in the next section of this report.

6.2 Site Access

The site access arrangements have been considered with a number of designs that can be constructed which will meet Council requirements. The final layout of the site access has yet to be confirmed and will be completed as part of the approval process for the subdivision consent. It should be noted that the proposed access to the site is located at the end of Bradey Road.

6.3 Parking

In accordance with the District Plan requirements all house sites will provide off street parking for at least two vehicles. In practice, the new lots will be relatively large with individual parking areas easily developed within each house site. These parking areas will be able to meet the needs of residents and their visitors.

6.4 Traffic Generation

Research indicates that typical vehicle trips generation for dwellings is between four and seven trips a day and sometimes as high as ten. The rate of ten trips per household is considered to be a maximum value. A trip is a term used to describe a movement to or from the property. For example, a home owner might drop the children off at the school and return home, this is considered to be two separate trips. The analysis of the proposal has considered the potential effects arising from 60 new lots. This approach has been taken to provide a conservative assessment of the potential effects arising from the proposed development. The traffic surveys have shown that the existing properties on Bradey Road generate some one to two trips per household. This is considered to very low and therefore it is inappropriate to use these surveyed values for the purpose of this analysis.

Therefore for the purpose of this analysis, the expected traffic generation of per household has been assumed as ten trips per household. Accordingly it would be reasonable to expect the additional 60 lots to generate some 600 vehicle movements per day from the new development. While this increase in traffic flows along Bradey Road is relatively high compared to the current traffic volumes, the overall number of traffic movements is still relatively low and well within the road capacity as discussed below.

The table below outlines the number of trips for the existing activities and provides an estimate of the expected trip volumes from the proposed development.

Table 2: Trip Generation

Number of Dwellings	Trips (based on ten per household)	
	Per Day	Per Peak Hour
Existing – 12	120	12
Proposed Development – 60	600	60
Total - 72	720	72

As shown the expected number of vehicle movements during peak hours could be as high as 72 vehicles with average daily flows of around 720 vehicles.

Typically some 10% of these trips will occur during each peak hour, being 60 vehicle trips in the morning and 60 movements in the evening. Studies show that during the morning peak some 80% of the vehicle movements are away from the site with 20% being in the opposite direction. In general terms the opposite patterns occur during the evening.

7 ASSESSMENT OF EFFECTS

7.1 General

This section considers the proposed development and identifies matters that may result in adverse effects. Where any adverse effects may arise, mitigation recommendations have been developed to reduce any of these adverse effects to the point of ensuring any residual impacts are less than minor or nil. The key elements where adverse effects could arise were identified and included the following:

- Road capacity
- Road delineation
- One lane bridge near the intersection of Bradey Road and State Highway 58
- The intersection of Bradey Road and State Highway 58

Each of these elements is discussed in more detail below along with the potential adverse effects.

7.2 Road Capacity

The matter relating to the capacity of roads is well defined and set out in the AustRoads guideline Part 2 “Road Capacity” which provides details of the expected safe traffic flows

along different road environments. The practical capacity for any road is based on the road width, traffic flow, the road geometry and the vehicle composition using the road. The ideal capacity of any traffic lane is around 1,800 vehicles per hour or in other words 3600 vehicles per hour for a two lane road.. Adjustment factors are then applied to this ideal capacity to determine the practical capacity of a road. In the case of Bradey Road, the road geometry with no sealed shoulders and its relatively narrow nature is the key element that reduces the capacity of the road. The practical capacity of Bradey Road has been assessed to be around 580 vehicles per hour as calculated using the AustRoads guideline. It should be noted that this is a conservative estimate.

The capacity of Bradey Road upon completion of the development is directly related to the traffic generated from the new dwellings. The trip generation rate from residential units can vary significantly from location to location. Typically traffic generation rates range from four and can be as high as ten movements per household unit. For the purpose of this traffic assessment the number of ten vehicle movements per household has been used to determine the effects on the capacity of the road network in the vicinity of the site. It should be noted that this research is based on urban situations, with rural residential type households generally having lower trip generation rates.

The current traffic volumes have been estimated at around 120 vehicles per day or some 12 per peak hour. The operational capacity of Bradey Road has been determined to be around 580 vehicles per hour based on a Level of Service A. The proposed development could be expected to generate up to 60 vehicles per peak hour based on ten trips per household. Therefore the total number of vehicle movements along Bradey Road upon completion of the proposed development could be as high as 72 vehicles per peak hour. This is well below the operational capacity of 580 vehicles per hour.

Accordingly, the operational capacity of Bradey Road and its current Level of Service A will be largely unaffected by the proposed development. Furthermore upon completion of the development, Bradey Road will continue to operate with the same level of service and with little difference being perceived by existing road users. Consequently there is sufficient capacity in the existing road network to accommodate the additional flows generated by the proposed subdivision.

7.3 Road Delineation

The site inspections showed that some improvements should be made to Bradey Road to provide better guidance for motorists using the road and in particular at night. It was noted that there was no centreline or edge marker posts along Bradey Road.

It is suggested that a dashed centreline be marked on the road with solid centrelines being painted on appropriate bends. Edge marker posts should also be installed to improve night time safety. The road markings and delineation for night time road users is an important safety issue for existing road users and should be undertaken separately from this application.

7.4 One Lane Bridge

The one lane bridge is located some 30 metres from State Highway 58. Forward sight distance for approaching motorists to the one lane bridge is sufficient for drivers to give way if required and this mainly due to the slow speed environment in the vicinity of the bridge.

We have investigated the effects of the increased traffic on the operation of the bridge. The National Roads Board publication *Delays & Conflicts at One Lane Bridges* (L R Saunders, 1988) has been used to analyse the bridge's performance. The results have provided the delays, conflicts and queue lengths associated with the one lane bridge for the existing traffic compared to the proposed, as shown in table below. It should be noted that the total delay refers to delays caused by vehicles slowing down and vehicles that are stopped. Conflicts are when two vehicles are on the bridge at the same time. It should also be noted that the calculations for delays and conflicts are averaged over the whole day.

Table 3: Performance of the One Lane Bridge

	Existing situation (120 trips per day)	Existing + Proposed situation (120 + 600 trips per day)
Total delay (mins/day)	Less than one minute	One minute
Total stops (mins/day)	Less than one minute	Less than one minute
Vehicles stopped (vehicles/day)	3	6
Vehicles delayed but not stopped (vehicles/day)	3	7
Conflicts per day	2	4
Maximum number of vehicles in queue	2	2

The table above shows no change in the operation of the one lane bridge as a result of the proposed subdivision with the performance being the same as the existing situation. This is because the increased traffic flows are within the operational capacity of the bridge. It is likely that there will be some increases in delays not shown in the above information but these will be negligible. There is ample space on both approaches to the one lane bridge to accommodate vehicles queuing to use the bridge.

7.5 Intersection of Bradey Road and State Highway 58

The intersection of Bradey Road and State Highway 58 is under the jurisdiction of Transit New Zealand. It has been well designed with excellent sight distance provided for all motorists entering and exiting Bradey Road. A generous right turn bay and approach painted median has been provided on State Highway 58. The right turn bay can accommodate up to four vehicles

without blocking the southbound through lane. A smaller left turn slip is provided for vehicles approaching from the south. The turning lane provisions are able to meet the additional demands created by the proposed development.

The proposal could result in the morning peak hour period having 48 extra vehicles leaving the development with some twelve vehicles arriving. Currently 50% of the vehicles exiting Bradey Road in the morning turn left and the other 50% of vehicles turn right into State Highway 58. By carrying these figures through, the new flows from the proposed subdivision will result in around 24 additional vehicles turning left into the State Highway and similarly around 24 vehicles turning right. This equates to some 30 vehicles turning left and right upon completion of the proposed subdivision. Similar calculations have also been undertaken for the evening peak period and the results for both periods used in the SIDRA analysis. SIDRA is a widely recognised industry standard intersection modelling package

Overall, up to 600 additional vehicles per day will pass through the Bradey Road/State Highway 58 intersection every day upon completion of the proposed development. The impacts of the traffic generated from the proposed subdivision on the performance of the Bradey Road/State Highway 58 intersection during the peak periods have been assessed using the SIDRA computer model. The traffic flow data in Table 2 above is used to determine the future performance of the intersection. The results are shown in Table 4, below.

Table 4: Predicted performance for Bradey Road/State Highway 58 intersection

Approach & Movement		AM Peak (7:30-8:30)		PM Peak (4:45-5:45)	
		Delay (seconds)	95% Queue Length (metres)	Delay (seconds)	95% Queue Length (metres)
State Highway 58 north	Right	0.2	1	1	3
	Through	0.2	1	0.15	3
State Highway 58 south	Left	12.6	0	12.7	1
	Through	0	0	0	0
Bradey Road	Left	15.4	1	17.5	1
	Right	40.5	6	41.9	3

Comparing this information to the performance of the existing intersection shown in Table 1, it can be seen that the proposal will have no discernable impact on the operation of the intersection. The intersection is able to accommodate the increased traffic flows, with no

noticeable difference to other road users. As with Table 1 the total delays include geometric delays.

The right turn movement from Bradey Road will have the longest queue length and longest waiting time. The average delay increases from 35.9 to 40.5 seconds and from 39.9 to 41.9 seconds for the morning and evening peak periods respectively. This increase is relatively small and would have no noticeable effect to the users of the intersection. As noted above these values represent average delays which means that some vehicles may wait longer while others will wait less. Nevertheless any effect is considered to be less than minor.

Accordingly the current layout of the intersection of Brady Road and State Highway 58 with its increase in traffic movements is considered to be safe and efficient. Accordingly the intersection will be able to accommodate the increase in traffic generated by the proposal.

8 CONSTRUCTION TRAFFIC

The effects of the construction have been considered as part of this assessment to address any potential traffic matters arising from the proposed development. With regard to heavy machinery, the proposed development has been designed with a cut fill balance and therefore there will be no trucks or earthmoving equipment using Bradey Road on a daily basis. Accordingly no adverse effects are expected from the formation of the subdivision.

The traffic associated with the construction of houses within the new subdivision will be noticeable compared with existing movements along Bradey Road. It is important to note that it is unlikely that all the lots within the new subdivision will have new homes being constructed at the same time. Accordingly any effects associated with the movement of vehicles along Bradey Road would be similar the expected flows arising from the completed subdivision.

It should be noted that The Porirua City Council has the ability to set Resource Consent Conditions for the management of construction traffic.

9 ROAD SAFETY

The crash history in the vicinity of the site shows a good safety record exists near the proposed development which is attributed to the good driving practices of the motorists using this road, the road geometry and the speed environment. The proposed development is not expected to change the current levels of safety in the area because of the excellent sight distances and road environment.

10 CONCLUSION

The high standard of road design of Bradey Road and its connections to the state highway network are able to provide a safe and efficient environment for all road users.

The analysis contained within this report provides a robust calculation of the potential delays and queues arising from the proposed development at critical points along Bradey Road. These points are the one lane bridge and the intersection of SH58. This report shows that the proposed development can be accommodated easily within the existing road infrastructure with little or no adverse effects on other road users. There is no significant difference in the operation of the intersection SH58 and Bradey Road. The one lane bridge will continue to operate in a safe and efficient manner as will Bradey Road up to its end.

The suggested road marking improvements will further improve the safety for existing users of the road network. No other safety issues arise from the proposed development.

In conclusion, the proposed subdivision can be accommodated within the surrounding road environment of Bradey Road as well as the adjoining state highway network with no noticeable effects on the current levels of safety and efficiency experienced by existing road users.