Photograph C: *View from Bradleys Road down the paper road at the site's southwestern boundary. The mature trees of the Keetly Place lots and those on the site's boundary (that are proposed to be retained) can be seen.*

Photograph D: *View from Bradleys Road across the subject site towards the east. The Bagrie dwelling and farm buildings can be seen in the distance.*

Annexure 8 Transport Assessment by Viastrada

PROPOSED PLAN CHANGE
OHOKA

Transportation Assessment prepared for

Fiona Aston Consultancy Limited
(on behalf of Peter & Ann Bagrie)

ViaStrada

March 2012

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Final
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Table of Contents

List of Figures

List of Tables

INTRODUCTION

1. ViaStrada has been commissioned by Fiona Aston Consultancy Limited (on behalf of Peter & Ann Bagrie) to provide a Transportation Assessment in relation to a proposed plan change in Ohoka. The Plan Change seeks to rezone this land for residential purposes.

2. The transportation assessment will describe the traffic environment in the vicinity of the site, describe the traffic related components of the proposal, and then assess any potential effects of the proposal.

THE PROPOSAL

3. The site is an L-shaped block located to the north of the Ohoka village. It has road frontages with Bradleys Road and Main Drain Road, as shown in Figure 1 below. The site immediately adjoins another proposed Plan Change site (Ohoka Plan Change Group)[1]. This is referred to as PC17 in the reporting that follows.

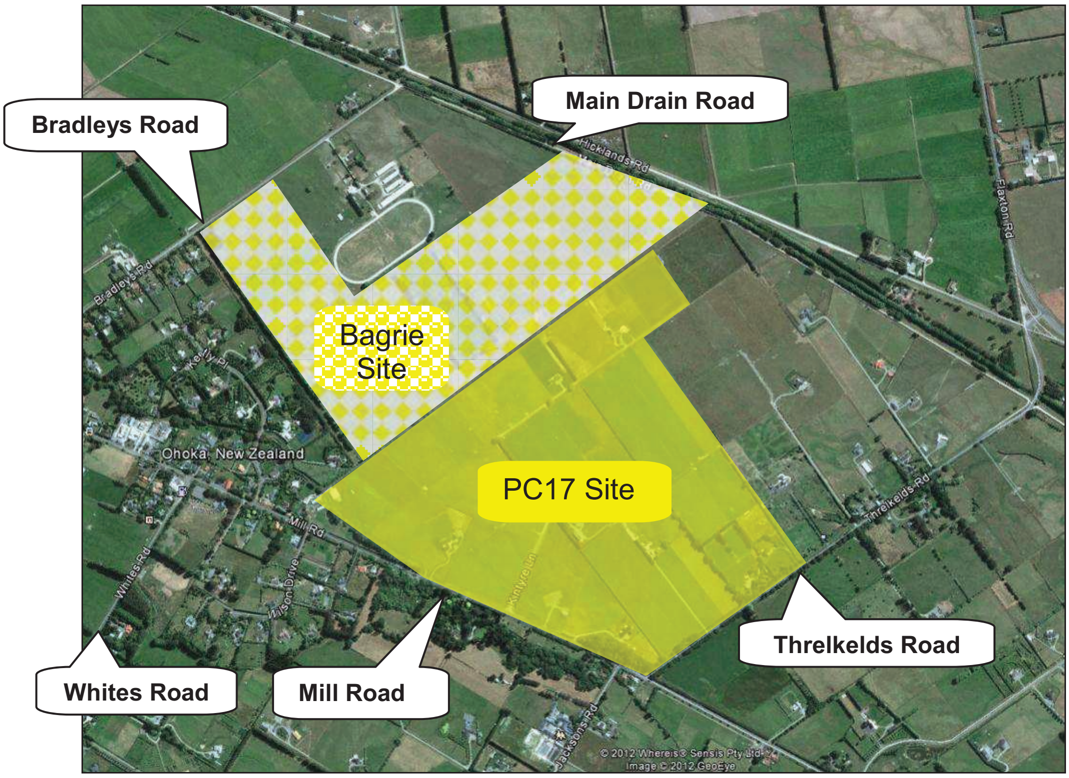


Figure 1: Location of Bagrie Plan Change (and adjoining PC17 area)

4. For the purposes of this assessment it is considered that approximately 80 residential lots could be created on the application site if it is eventually subdivided and constructed in accordance with the provisions of the Residential 4A zoning. The following assessment is therefore based on assessing the traffic effects of 80 residential allotments around the indicative roading layout shown in the proposed Outline Development Plan (ODP) documentation.

[1] This includes rezoning from Rural to Residential 4A and provides for up to 160 dwellings. This provides access onto Mill Road and Threlkelds Road. It also makes provision for connection with the Bagrie site.

5. The ODP shows how the site has access to two road frontages – being Bradleys Road and Main Drain Road. Bradleys Road will provide key access to the site. This includes a primary road that runs through the site in a northwest-southeast direction. This includes a potential future connection with the PC17 site to the south-east although this would be reliant on land agreements with third-parties. Secondary roads branch off the primary road providing property access functions. This includes secondary vehicular access links with Main Drain Road (to the north), the PC17 site (to the southeast) and the farm land (to the northwest). Pedestrian and cycling links are also proposed to PC17 land and also Main Drain Road.

6. The proposed new roads through the application site have been designed with 20 metre legal road widths and these will be retained through the entire site. These will most likely incorporate carriageways ranging between 6.0-7.0 metres in width. It is intended that the form of individual roading elements within the zone would be based initially upon the Council's roading design standards (Table 30.1, Chapter 30 of the District Plan) and those of NZS 4404:2010 *Land Development and Subdivision Infrastructure*. However in recognition of the Council's expectations in terms of urban design philosophy, the detailed cross section of the road carriageway, footpaths and service reserves would be negotiated and agreed with Council staff at the time of subdivision. The Plan Change may also include design control rules regarding some of these matters to maintain rural-residential character.

7. The ODP showing the indicative roading pattern is provided with the Plan Change application.

THE TRAFFIC ENVIRONMENT

8. The PC17 application was accompanied by a comprehensive Transportation Assessment Report prepared by Traffic Design Group (TDG). This provided full details of the road network, traffic volumes, road safety analysis and an over-view of relevant regional and district strategies. In summary this included:

   - Mill Road, being the primary road through Ohoka and classified as a collector road. It has a sealed carriageway of 6.0-6.5 metres and generally has a posted speed limit of 100 km/hour. This however reduces to 70 km/hour between Threlkelds Road and Bradleys Road. It carries around 1,600 vehicles per day.

   - Threlkelds Road is also classified as a collector road and provides a link between Mill Road and Flaxton Road (linking with Rangiora to the north). It has a seal width of 7.0 metres and a speed limit of 100 km/hour. It carries around 1,280 vehicles per day.

   - As is expected in rural environments, there are few pedestrian and cycling facilities. On the south side of Mill Road (between Whites Road and Jacksons Road) there is however a 1.5 metre shared footpath and cycle path.

   - The Ohoka primary school is located on Jackson Road south of Mill Road and is served by two school bus routes. There are no public transport services that travel through Ohoka.

9. Unlike the PC17 land, the Bagrie land has frontage to Bradleys Road and Main Drain Road.

Bradleys Road

10. Bradleys Road has a 6.0 metre wide sealed carriageway. In the vicinity of the site, Bradleys Road is straight and flat affording excellent visibility.

11. There are no Council traffic counts along this road; however the New Zealand Transport Agency (NZTA) Crash Analysis System (CAS) suggests that it carries around 126 vehicles per day. Given that this portion of road currently serves around 15 residential houses, a total traffic generation of 126 vehicles per day is considered entirely reasonable. Applying a 10% peak hour factor implies this road carries around 13 vehicles during the busiest hours of the day.

12. Outside the application site Bradleys Road has a posted speed limit of 100 km/hour, however this reduces to 70 km/hour further to the southwest (outside the existing residential sections between Mill Road and the application site boundary).

13. Bradleys Road intersects with Mill Road forming a cross-road intersection. This is stop-controlled with priority afforded to traffic on Mill Road. [Mill Road has a posted speed limit of 70 km/hour through this intersection, although this increases to 100 km/hour a short distance to the west].

Main Drain Road

14. Main Drain Road is currently a 4.5 metre wide metalled (gravel) road. This forms an uncontrolled 'T' intersection with Bradleys Road. Traffic volumes are negligible.

Crash History

15. In addition to the TDG safety assessment for PC17, a further analysis of the New NZTA Crash Analysis System has been undertaken. This extends to include reported crashes along Bradleys Road between Mill Road and Main Drain Road and along Main Drain Road in the vicinity of the site over the five year period ending 8 February 2012. This analysis revealed one crash which occurred at the intersection of Main Drain Road and Bradleys Road. The crash occurred as a result of a motorbike driver failing to notice the intersection and colliding with a sign. The crash was attributed to driver inattentiveness. It is noted that a Chevron Sight Board is now located at the end of Bradleys Road better highlighting the intersection's presence.

DISTRICT PLAN ASSESSMENT

16. The site is currently located in the ***Rural*** zone as specified on Planning Map 57 & 89 in the District Plan. It is sought to rezone the site for Residential 4A purposes.

17. It is noted that any residential development on the proposed allotments could comply with all the relevant transport related requirements of the District Plan. This includes adequate parking, access and manoeuvring for each residential house on each new allotment. Failure to comply with any of these standards would result in the requirement for resource consent approval to be considered separately and subsequent to this Plan Change application.

18. As discussed above, the wider application site could be made to comply with the relevant Code of Practice and any detailed design could be tailored to the satisfaction of the Council at the time of subdivision or through targeted design control rules through the plan change process to maintain rural-residential character.

19. . This includes detailed design pertaining to road, berm and footpath widths, lighting, cross fall and kerb design.

ASSESSMENT OF EFFECTS

20. An application for a zone change enables all potential effects to be considered. In terms of traffic related issues, these effects relate to issues such as the geometric layout of the site and the effects of site generated traffic on the capacity of the surrounding road network.

21. For the purposes of this report, any future subdivision within the application site will be assumed to comply with the Councils Code of Practice. It is noted that the proposed road widths, pedestrian provisions and intersection designs can comply with relevant geometric design requirements and are of a suitable standard to cater for traffic generated within (and through) the site.

22. Instead, the traffic related issues with this proposal relate to the ability of the existing road network in the vicinity of the site to safely cater for site generated traffic, while retaining a suitable level of service for existing residents in the immediate area. The relevant traffic related issues also include the consideration of the potential effects of the proposal at nearby intersections.

23. On this basis the following assessment of effects will consider:

- The ability for the proposal to provide adequate car parking and safe vehicular access and circulation.
- The daily and peak hour volume of traffic estimated to be generated by the proposal and its distribution onto the surrounding road network; and
- The ability of the surrounding road network to cater for increased traffic flow.

24. The assessment will firstly consider the effect of the proposed plan change in isolation. It will then consider the additional effects that might occur if PC17 were also to eventuate (i.e. adding the traffic from an additional 160 dwellings on the adjoining site).

Car Parking, Vehicular Access and Circulation

25. It has already been stated that any residential development on the application site could comply with all of the relevant transport related requirements of the District Plan. This includes adequate parking, access and manoeuvring for each residential house on each new allotment.

26. The proposed road reserve and carriageway widths, as discussed above, can also be tailored to the satisfaction of the Council. This includes detailed design pertaining to road, berm and footpath widths, lighting, cross fall and kerb design, where required.

27. The road reserves through the site are proposed to be 20.0 metres wide which is ample to provide for a likely 6.0 metre carriageway and footpaths along both sides. Given the low traffic volumes cyclists do not need a dedicated cycle lane and can share the road with motorised traffic. This type of cross section design aligns favourably with the expectations in a Residential 4A zone.

28. The intention is to create a living environment that aligns with the Residential 4A zone which provides for *residential dwellings in generous settings*. From a traffic

perspective this zone is specifically characterised by *rural style roads* (with access not from arterial roads), and *limited kerb, channelling and street lighting* (see Table Chapter 17, Table 17.1 of the District Plan). With this in mind, further guidance from the District Plan rule (Chapter 30, Table 30.1) suggests that rural cul-de-sac and local roads be designed and constructed with a carriageway width of 6.0 metres, set within a road reserve width of 20 metres. Parking lanes, sealed shoulders, footpaths and street lighting are specifically excluded. Although the detailed design can be tailored to suit urban design ideals at the time of subdivision, the ODP has identified legal road reserve widths of 20 metres. This reserve width can cater for nearly any cross-section design and therefore is considered to be sufficient to cater for all the future roading needs and provides for any design flexibility if required.

29. Although the underlying zoning will be residential (albeit with rural characteristics such as large lot sizes and rural style roads), parts of the site will be located within close proximity of the slightly denser residential zoning associated with the Ohoka village (and also the larger proposed PC17 area adjoining the site). If the latter were to proceed, it would be important that road, pedestrian and cycle connections be provided with any nearby residential interface so as to promote social connectivity. With this in mind it is reiterated that the ODP has specifically recognised this and has provided for potential road and pedestrian connections to the northwest, southeast and north. Given the low density nature of the development, it is considered that this degree of permeability will provide safe and efficient routes for pedestrians and cyclists and is at an appropriate level for an outline development plan. Consideration of more detailed provision for walking and cycling can be undertaken as part of the subdivision resource consent process. There is certainly no reason why the site cannot be developed with the characteristics and principles of the NZTA *Pedestrian Planning and Design Guide* being adhered to. This includes accessibility, connectivity, comfort-ability, convenience, pleasantness and safeness.

30. The ODP layout is not dissimilar to many other subdivision concepts that have been evidenced in New Zealand over the past ten years. The design does not raise any particular or extra-ordinary traffic related concerns. Overall it is considered that the roading design promoted in the ODP will adequately cater for vehicle and pedestrian movements in a safe and efficient manner.

Daily Traffic Generation

31. It is considered that approximately 80 residential allotments could be created within the application site, which initially will have primary access from Bradleys Road. The alignment of the road network through the application site has been positioned and designed such that that it provides connectivity with the adjoining PC17 site to the southeast.

32. There is a substantial library of traffic generation research on the traffic generation of residential development. This data reveals a range of 6-14 trips per day per dwelling unit. An analysis of traffic effects arising from suburban residential land development is typically based upon a generation rate of 10 trips per dwelling unit per day. However the traffic generation research also indicates that the trip generation per dwelling unit is influenced by proximity to non-residential activities (shopping, schools, work places and general entertainment and other amenities), and the separation distance from the primary commercial district for the wider area (research indicates that increased separation distance from a major CBD results in more trip linking and a lower overall generation rate per dwelling unit). The location

of the site within a smaller provincial community with rural-residential characteristics suggests that a generation rate of 6 (or less) trips per day per unit is considered appropriate. There is however an increasing level of potential development occurring in the Ohoka area and this could result in increased numbers of short trips within the immediate area. Therefore a trip generation rate of around **8 trips per dwelling unit per day** will be used for this assessment, however it must be emphasised that this is a conservative (high-end) estimate. It does however infer that a robust assessment is being carried out. This was also the figure used by TDG for their assessment with PC17.

33. It therefore follows that development of the site with say 80 residential allotments could generate around **640 vehicle trips per day** (80 allotments x 8 trips each per day = 640). It is important to note that this level of traffic generation would not occur immediately but would occur over time as the application site was developed. Note that if each unit were to only generate 6 trips per day, the overall traffic generation would be 480 vehicle trips per day. For the purposes of this assessment, the more conservative estimate of 640 trips per day has been adopted.

Peak Hour Traffic Generation

34. It has already been estimated that the proposal will generate around 640 vehicle trips per day. However it is the peak hour traffic generation of the site and the effects of this additional traffic on the operation of the surrounding road network that is the primary traffic consideration with this proposal.

35. Traffic generation research indicates that the peak hour traffic generation of suburban residential development is around 10% of the daily traffic generation. In this situation this calculates to around 64 trips to and from the site (640 daily trips x peak hour factor of 10% = 64).

36. This peak hour generation is likely to be tidal in nature where most of the peak hour traffic would be exiting the subdivision during the morning peak hour and then returning during the evening peak hour. Assuming a split of 80% exiting and 20% entering the site this could include 51 vehicles leaving the site and 13 vehicles entering the site in the morning, with the reverse in the evening (64 peak hour trips x 80% leaving = 51; and 64 peak hour trips x 20% entering = 13).

37. This level of traffic is not significant and represents approximately one vehicle movement every minute over the busiest hour of the day. For the remainder of the day, traffic volumes are likely to be lower.

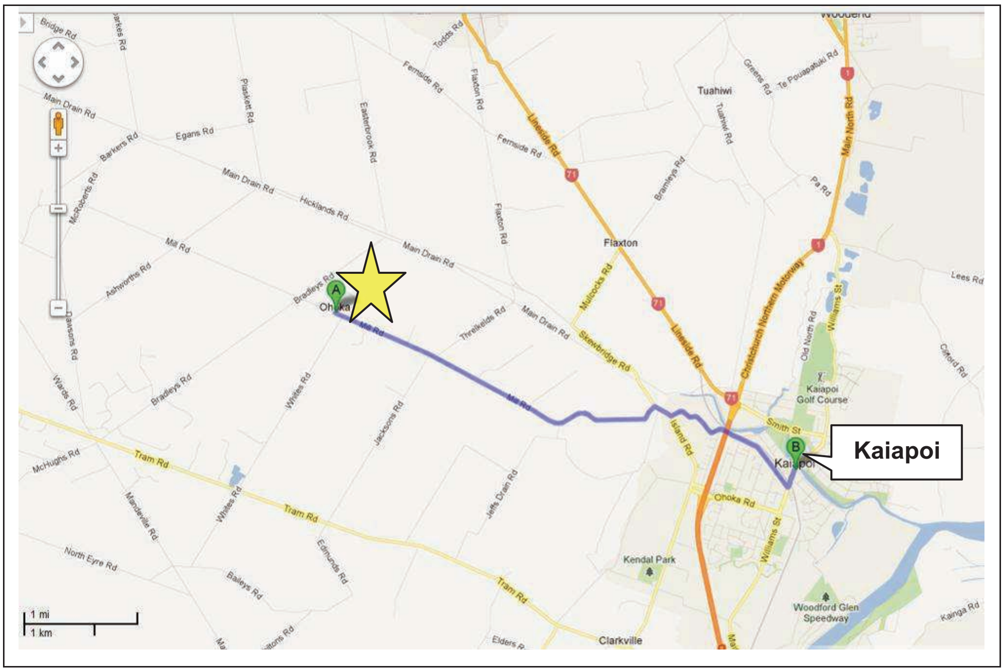
Traffic Distribution

38. Initially, all site generated vehicles would use Bradleys Road as this is the primary legal road available for access to and from the site. As discussed above, provision has been made for future road connections with the PC17 land to the southeast. The latter cannot be guaranteed as it includes the use of third party land. If however all of these connections were to be made, the overall traffic distribution would change considerably as the site would become more accessible and would provide for more route choices owing to increased connectivity. For example, it would enable alternative routes for residents to get to and from the amenities in Ohoka (and further afield) including more direct access to Mill Road and Threlkelds Roads.

39. Given that the timing of the linkages with adjoining land are unknown, the distributional splits are also unknown. If these connections are not made, all traffic from the application site would be loaded onto Bradleys Road. For assessment purposes it will be assumed (at least initially) that all traffic will access the site via this road at some point on their journey. Given the constraints to cross the Main Drain (and the fact that Main Drain Road is also metalled), it is unlikely that much residential traffic head in that direction. It is therefore assumed that all site generated traffic would travel to and from the southwest along Bradleys Road (towards Mill Road) so as to access employment, schools, shopping and other amenities in either Ohoka, Kaiapoi Rangiora and Christchurch City etc.

40. The most likely destinations for any future residents are Christchurch City, Kaiapoi and Rangiora. Initiatively, most residents will use roads that afford the best connectivity, are the most direct and most convenient. On this basis, the key roads to these destinations are identified in Figure 2 below. This includes:

- Kaiapoi (via Bradleys Road, then Mill Road, then Island Road…)
- Rangiora (via Bradleys Road, then Mill Road, then Threlkelds Road, then Flaxton Road…)
- Christchurch City (via Bradleys Road, then Mill Road, then Whites Road, then Tram Road…).



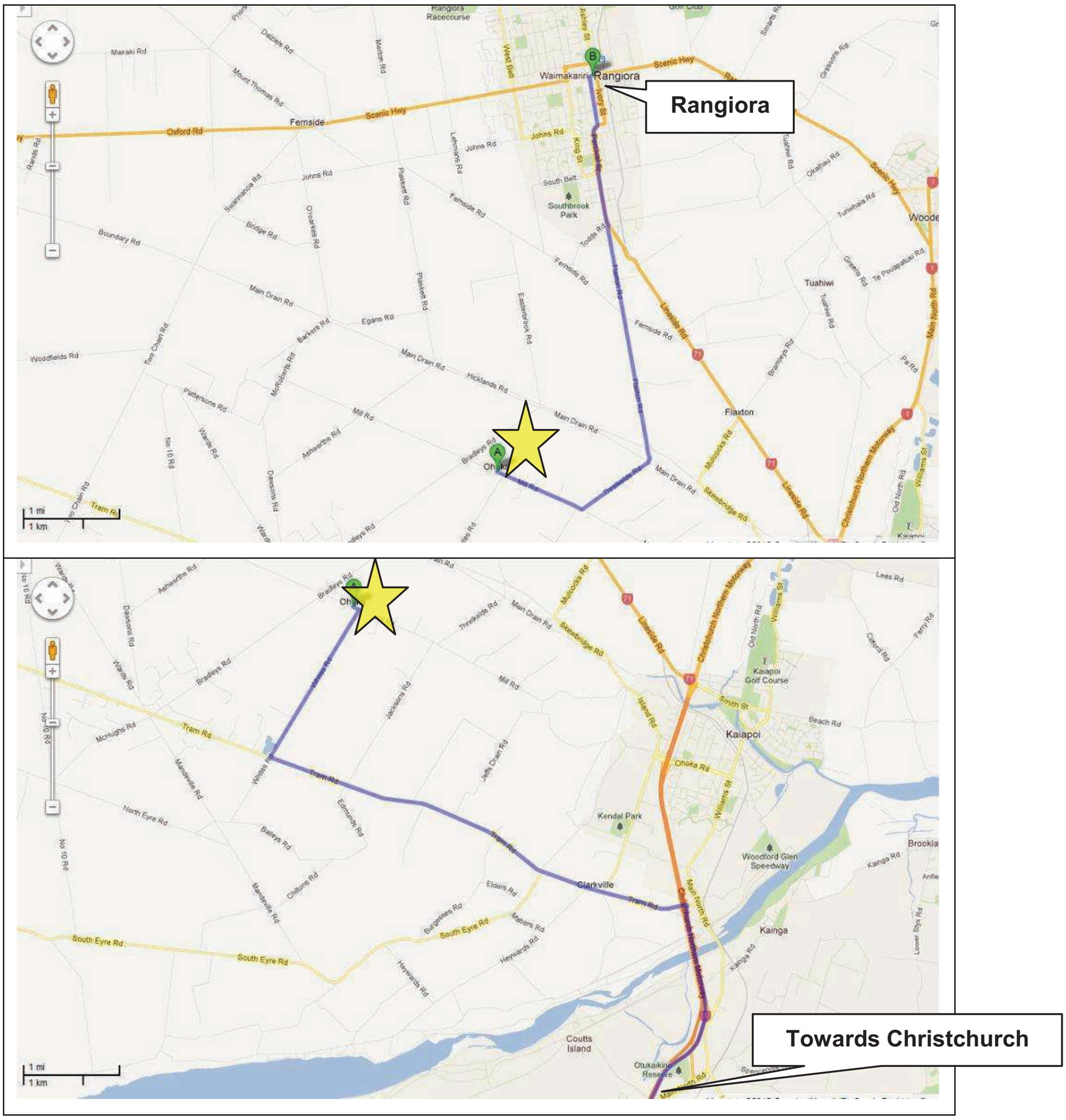


Figure 2: Likely Destinations and Travel Route from Ohoka (Map Source: Google)

41. It is understood that approximately 60% of the workforce work in Christchurch City[2]. On this basis, it could therefore reasonably be assumed that 60% of the site generated traffic will utilise Whites Road (as this provides the quickest and most direct route to and from the City). The remaining 40% would most likely use the Mill Road (east of Whites Road) and/or Threlkelds Road etc. to access Kaiapoi and Rangiora. It is however accepted there could always be some daily variability, however for the purposes of this assessment the above assumptions have been applied for analytical purposes. If this scenario were to occur, the following traffic distribution could be assumed (see Figure 3 below).

[2] The District Plan (Chapter 13, Issue 13.1, Explanation) suggests that *60% of the adult workforce are employed in Christchurch City.*

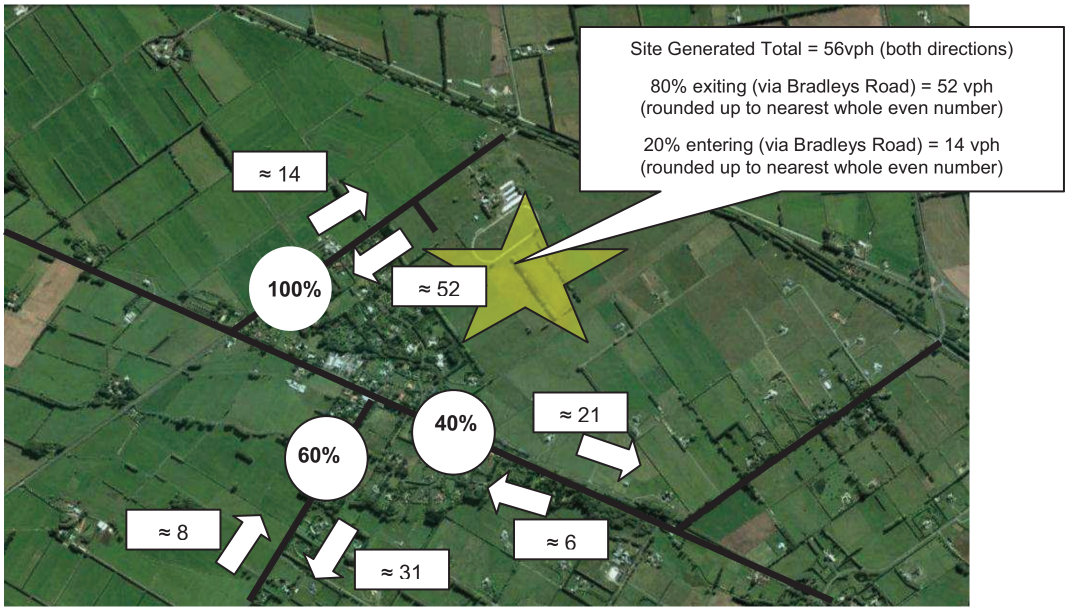


Figure 3: Estimated Traffic Distribution (AM Peak Hour)
(Peak Hour = 10% of Daily and Assumes Connections with Adjoining PC17 Site)

42. With reference to Figure 3 above, vehicles on Bradleys Road would have the ability to turn left or right at the intersection with Mill Road. For the purposes of this assessment is assumed that all traffic will turn left – owing to the location of amenities in this direction, including Ohoka, Kaiapoi, Rangiora, and Christchurch City.

43. This level of traffic is not significant in the context of anticipated traffic volumes on local roads and is compatible with the volumes of traffic generated by similar roads (and subdivisions) within the Waimakariri District. That said the surrounding road network including carriageway widths and intersection treatment still requires consideration. This will be addressed in the sections that follow.

44. It is again reiterated that the alignment of the primary spine road through the application site has been designed such that it could provide a potential linkage with the adjoining PC17 land to the south. If this were to ever occur it would have the potential effect of distributing the traffic load over a greater area rather than solely onto Bradleys Road. Given that the adjoining PC17 land is also being designed with road reserve widths of 20.0 metres it follows that the overall cross section width could also be constructed to a standard able to accommodate all transport modes and associated volumes.

45. If roading connections were available through the adjoining PC17 land this would increase accessibility to Mill Road and Threlkelds Road. Estimating traffic distribution is difficult however for the purposes of this assessment it is reasonably assumed that approximately one-third of all traffic will use each of the main frontage roads. That is approximately 213 vehicles per day[3] (21vph) using Bradleys Road, 213 vehicles per day (21vph) using Mill Road and 213 vehicles per day (21vph) using Threlkelds Road. This is highlighted in Figure 4 below.

[3] Total estimated site generated traffic is 640. [640 / 3 ≈ 213vpd]; and [213 / 10% peak hour factor ≈ 21vph]

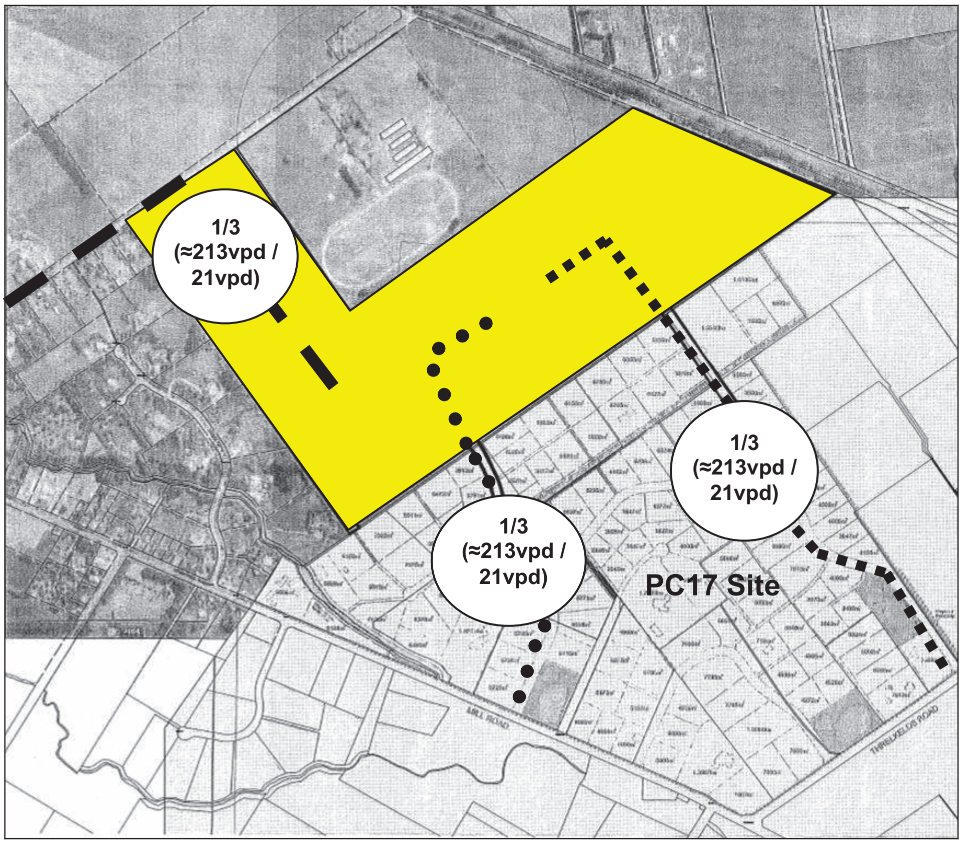


Figure 4: Estimated Traffic Distribution (Assuming Adjoining PC17 Land Developed)

Road Network Effects - General

46. *Local* roads (such as Bradleys Road) have a primary function of providing property access whereas collector roads (such as Mill Road and Threlkelds Road) have a dual function of traffic distribution and property access. This is why roads higher up in the roading hierarchy generally have wider formed widths, carry greater volumes, often have higher speed limits and are generally constructed and managed to minimise any local access function. From a traffic perspective, vehicle access from the application site onto Bradleys Road is entirely appropriate.

47. The proposed site access T-junction on Bradleys Road is located such that it is competing with other nearby intersections. The surrounding environment is flat and sight visibility is excellent in both directions, with more than 250 metres being provided. Note that the Austroads *Guide to Traffic Engineering Practice: Part 5 Intersections at Grade* advocates a Safe Intersection Sight Distance (SISD) of 253 metres. This recognises a design speed of 100 km/hour and assumes a driver reaction time of 2.5 seconds. The intersection is located such that there will be sufficient distance for a driver of a vehicle on Bradleys Road to observe a vehicle on a minor road approach moving into a collision situation (e.g. in the worst case, stalling across the traffic lanes), and to decelerate to a stop before reaching the collision point.

48. Another key issue in relation to Bradleys Road is the formed width. As already discussed in paragraph 10 above the carriageway width along this road is 6.0

metres. This width is appropriate for the road given low traffic volumes[4]. As a result of this proposal, the Plan Change has the potential to increase the number of vehicles using Bradleys Road by a further 640 vehicles each day. It follows that Bradleys Road could feasibly carry around 766 vehicles trips per day if 80 residential houses were established on the application site (126 existing trips on Bradleys Road + 640 proposed trips = 766 trips per day). Applying a peak hour factor of 10% of the daily traffic means that this road could carry around 77 vehicles over the busiest hour of the day.

49. Given that Bradleys Road has a posted speed limit of 100 km/hour directly outside the application site (reducing to 70 km/hour further to the south-west), a carriageway width of at least 6.0 metres is still recommended. The most recent version of New Zealand Standard 4404:2010 provides for local roads in *Urban* and *Rural Live and Play* land uses which carry traffic in the range of 1,000-2,000vpd to have *movement lanes* (carriageways) of 5.5-5.7 metres.

50. Note that consideration for separate cycle lanes along Bradleys Road is not necessary in this instance. The New Zealand Supplement to the Austroads *Guide to Traffic Engineering Practice Part 14: Bicycles* notes that where the volume of vehicles is less than 3,000 vehicles per day, then cycles are capable of being mixed with other traffic and no exclusive cycle lanes are necessary. This is also reinforced in the NZTA *Cycle Network and Route Planning Guide*. Cyclists in general will also have the ability to move through the site in a direct and efficient manner. This includes potential connectivity to land to the south-east (PC17), north-west (Bradleys Road) and the north-east (Main Drain Road).

51. The subject site, if fully developed could result in 640 traffic movements per day and could cumulatively result in the traffic volume on Bradleys Road increasing to around 766 vehicles per day. This traffic volume is less than 1,500-3,000 vehicles per day which is generally anticipated for a local road in terms of protecting residential amenity. However, it must be emphasised that this range is somewhat arbitrary and while there are many examples of local roads in more urbanised areas that carry traffic volumes well in excess of this threshold, the expectation in rural-residential areas is often lower. There is however no question that if Bradleys Road (and Mill Road) is able to continually provide for 2 x 3.0 metre traffic lanes it would have the ability to cater for the anticipated level of traffic with no noticeable reduction on the level of service along this road. This carriageway width would cater for all existing traffic as well as all traffic generated from the application site.

Road Network Effects – Intersections

52. It has already been estimated that 100% of all site generated traffic will (at least initially) pass through the Bradleys Road/Mill Road intersection. During peak periods this equates to around 66 vehicle movements (i.e. 52 OUT and 14 IN, in the morning and the reverse in the evening). This level of traffic is not significant. If the existing traffic volumes of Bradleys Road and Mill Road are combined with the additional site generated traffic, the two intersections would respectively facilitate 79 and 226 vehicles per hour. This is shown in Table 1 below.

[4] New Zealand Standard 4404:2010 *Land Development and Subdivision Infrastructure* suggests that local rural roads serving up to 150 dwelling units and generating up to 1,000vpd should be provided with a carriageway (*movement lane*) ranging between 5.5-5.7 metres.

Table 1: Mill Road and Bradleys Road Approach Volumes (Existing + Proposed)

	Existing Volumes	Proposed Volumes
Mill Road	160vph (peak hour)	+ 66 = 226vph
Bradleys Road	13vph (peak hour)	+ 66 = 79vph

53. The ability of Mill Road to absorb existing and site generated traffic from Bradleys Road has been tested using the Tanner (1962) method advocated in Austroads *Guide to Traffic Engineering Practice – Part 5: Intersections at Grade* (SIDRA has not been used for a simple x-junction analysis of this type). The parameters are summarised in Table 2 below. Note however that this analysis assumes that all vehicles will carry out a right-turn movement onto the Mill Road (i.e. the most difficult). This has been done intentionally so as to ensure a robust assessment and therefore provides some additional margins of comfort. The reality is however that most (if not all) traffic will in fact undertake an easier left-turn owing to the location of amenities in this direction.

Table 2: Intersection Access onto Mill Road from Bradleys Road

Parameter	Performance
Major Stream Volume (Mill Road) (NB: This has been based on the upper figure provided in the TDG report of 1,600vpd. This equates to 160vph when using a peak hour factor of 10%).	160 vph
Minor Stream Volume (Bradleys Road) [NB: This assumes that: • All of the existing traffic volume on Bradleys Road (13 existing + 66 proposed = 79vph) are all travelling towards the Mill Road intersection. • All traffic will turn right at the intersection].	79 vph
Critical Acceptance Gap*	5 seconds
Follow Up headway**	3 seconds
Practical Absorption Capacity***	820 vph
Average Delay	0.8 seconds
Level of Service	A

* Critical Acceptance Gap: The minimum gap in a traffic stream which will be accepted by entering drivers.

** Follow-Up Headway: The average headway between successive vehicles entering the same gap in a moving traffic stream from a stationary queue.

*** Practical Absorption Capacity: The rate at which a traffic stream can absorb additional vehicles (from Figure B.2, Austroads, Part 5). Average delay has been determined from Figure B.3(d), Austroads, Part 5. Level of Service has been extracted from the Highway Capacity Manual which suggests delays that fall below 15 seconds represent LOS A.

54. Table 2 above, shows that the existing intersection will perform to a high level of service based on maximum existing and proposed volumes. As such, it is considered that the anticipated traffic function of the Mill Road and Bradleys Road will not be compromised and road improvements are not warranted.

55. If PC17 were to be successful, traffic volumes along Bradleys Road would most likely diminish. This is simply because route choice and connectivity will increase. In accordance with Figure 4 above, this assumes that all site generated trips would be evenly distributed over the three road frontage intersections. This includes the

intersections of Bradleys Road/Mill Road; PC17 access/Mills Road; and PC17 access/Threldelds Road. Distributing the additional 64 trips per hour across the three routes broadly specified in Figure 4 could therefore place an additional 21 trips per hour through these intersections. The TDG Transportation Assessment Report accompanying the PC17 application included a summary of Table 6.1 from the Austroads Guide to Traffic Management Part 3 which shows combinations of major (through) road and minor road traffic volumes for the peak hour. Any volumes below these thresholds assumes that the intersection is operating within capacity and no detailed analysis of such an intersection is required. Given the low existing and proposed traffic volumes on the surrounding roads (i.e. less than 500vph on major roads and less than 250vph on minor roads) we agree with TDG;'s conclusion that detailed intersection performance is not considered necessary because they will continue to operate under 'free-flow' conditions.

56. We do however agree with TDG that the additional volumes will have potential flow on effects further afield. Particular attention is given to the Threlkelds Road/Flaxton Road intersection further to the north (towards Rangiora). TDG have modelled this intersection using SIDRA INTERSECTION analysis and this reveals levels of service ranging between LOS A & C. Adding an additional 21 vehicles per hour from the Bagrie application site (in addition to the likely site generated traffic from PC17) would make little change to the overall levels of service. At worst, we consider that LOS C would remain. This still represents *stable operating conditions* and aligns favourably with minimum acceptable levels specified in the RLTS.

CONCLUSION

57. The preceding transportation assessment relates to an application to rezone a site currently zoned rural for residential purposes. It is considered that approximately 80 residential lots could be created if the site is developed in accordance with the ODP.

58. Site access will be created via a series of new internal roads, although culminating with a primary road that travels through the site in a north-west/south-east direction. These roads have been iteratively designed in compliance with various engineering guidelines and can be further tailored to the satisfaction of the Council at the time of subdivision. Alternative access could also be created through simple links from the application site to the south (PC17) and also to the north (Main Drain Road).

59. The key traffic related issues with the proposal relate to the amount of traffic estimated to be generated by residential development of the site, and the effects of this additional traffic on the safe and efficient operation of the surrounding road network. It is estimated that the proposal could place an additional 640 vehicles per day onto the road network. Unless Council were to promote future connections from the application site to the south, this additional traffic would all utilise Bradleys Road for part of their journey before integrating with the wider road network via the existing intersection at Mill Road.

60. The road network has sufficient geometric capacity to cater for the estimated additional traffic from full development of the applicant's site. The proposal will have little effect on the levels of service and levels of delay in the immediate area and as such the traffic effects of this proposal on the operation of the surrounding road network are considered to be less than minor. For all of the reasons

discussed above the proposed Plan Change can be supported from a traffic perspective.

Annexure 9 **Engineering Services Report by E2Environmental**