

HAND AUGER LOG

HOLE NO.:

AH11

CLIENT: JKS PADDOCK Ltd

PROJECT: WAKARI195-245

JOB NO.:

230385

SITE LOCATION: 195-245 Wakari Road

CONTRACTOR: GeoSolve

START DATE: 21/06/2023

COORDINATES: 1404507 mE, 4919830 mN (NZTM2000)

EQUIPMENT: Hand auger & Scala penetrometer

END DATE: 21/06/2023

LOCATION METHOD: Handheld GPS

ACCURACY: ± 3 m

LOGGED BY: WW

ELEVATION: Existing ground level

OPERATOR: RC/WW

CHECKED DATE: 23/06/2023

[illegible]

PHOTO(S)

REMARKS

Unable to penetrate beyond 0.8 m - auger grinding on gravels. No groundwater encountered.

WATER

-  Standing Water Level
 Out flow
 In flow



HOLE NO.:
AH12

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404547 mE, 4919865 mN (NZTM2000)

CONTRACTOR: GeoSolve
EQUIPMENT: Scala penetrometer

START DATE: 22/06/2023
END DATE: 22/06/2023

LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

ACCURACY: ± 3 m
OPERATOR: RC

LOGGED BY: RC
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)	SHEAR STRENGTH (kPa) Vane: Values	WATER
					1 1 3 2 3 3 3 3 3 3 7 15		

PHOTO(S)

REMARKS

Scala test only. Refusal at 1.2 m with high blow count.

WATER

-  Standing Water Level
 Out flow
 In flow

HAND AUGER LOG

HOLE NO.:
AH14

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404416 mE, 4919928 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC

START DATE: 22/06/2023
END DATE: 22/06/2023
LOGGED BY: RC
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbolology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)														SHEAR STRENGTH (kPa) Vane: Values		WATER
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	50	100	
					1	2	2	2	2	2	3	4	9	12	10	20 >>					

PHOTO(S)

REMARKS

Scala test only. Refusal at 1.25 m - hammer bouncing.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

HAND AUGER LOG

HOLE NO.:
AH15

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404429 mE, 4919973 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC

START DATE: 22/06/2023
END DATE: 22/06/2023
LOGGED BY: RC
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbolology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)														SHEAR STRENGTH (kPa)		WATER
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	50	100	
																			Vane:	Values	
						1															
							2														
								3													
									2												
			0.5							4											
											4										
												4									
													5								
														6							
			1.0												8						
																9					
																	12				
																		15			
			1.5																		

Groundwater Not Encountered

PHOTO(S)

REMARKS

Scala test only. Terminated at target depth.

WATER

- ▼ Standing Water Level
▷ Out flow
◁ In flow

HAND AUGER LOG

HOLE NO.:
AH18

JOB NO.:
230385

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404589 mE, 4919962 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC

START DATE: 22/06/2023
END DATE: 22/06/2023
LOGGED BY: RC
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbolology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)														SHEAR STRENGTH (kPa)		WATER
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	50	100	
																			Vane:	Values	
						1	2	2	1	2	1	2	3	4	4	6	7	8			
			0.5																		
			1.0																		
			1.5																		

Groundwater Not Encountered

PHOTO(S)

REMARKS

Scala test only. Terminated at target depth.

WATER

- ▼ Standing Water Level
▷ Out flow
◁ In flow

HAND AUGER LOG

HOLE NO.:
AH19

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404623 mE, 4919894 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Hand auger & Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC/WW

START DATE: 21/06/2023
END DATE: 21/06/2023
LOGGED BY: WW
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)	SHEAR STRENGTH (kPa) Vane: 50 100 150 200 Values	WATER
UNCONTROLLED FILL	SILT with minor sand and gravel, brown and dark brown mottled. Firm, moist, non-plastic, sand, fine to coarse; gravel, fine to coarse, subangular to subrounded basalt and quartz clasts. Minor charcoal and ash. A trace of rootlets. 0.7 m		0.5		3 3 4 3 3 5 3		
	SILT with minor sand and gravel, light grey brown. Stiff, moist, non-plastic, sand, fine; gravel, fine to coarse, subrounded to subangular basalt. Highly organic light grey silt inclusions. 1.0 m		1.0		3 3 2		
BURIED TOPSOIL	Organic SILT with a trace of sand and gravel, dark brown. Stiff, moist, non-plastic, sand, fine; gravel, fine, subangular basalt. A trace of rootlets and remnant organic fragments. 1.3 m				5 6 6		
RESIDUAL VOLCANIC SOIL	SILT with minor clay and a trace of sand and gravel, brown orange mottled. Stiff to very stiff, moist, non-plastic, sand, fine; gravel, fine, subangular basalt. 1.7 m		1.5		7 8 10 11		
	End Of Hole: 1.70 m				15		

Groundwater Not Encountered

PHOTO(S)

REMARKS

Unable to penetrate beyond 1.7 m - auger grinding on gravels/cobbles? No groundwater encountered. 2 attempts at Scala test - first attempt refused at 0.6 m (concrete?). Second attempt had instant refusal at 1.8 m (cobble?) Land owner reports likely concrete within fill material.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow



HOLE NO.:
AH20

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404642 mE, 4920015 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Hand auger & Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC/WW

START DATE: 21/06/2023
END DATE: 21/06/2023
LOGGED BY: WW
CHECKED DATE: 23/06/2023

[illegible]

PHOTO(S)

REMARKS

Unable to penetrate beyond 1.1 m - increasingly stiff material. No groundwater encountered.

WATER

-  Standing Water Level
 Out flow
 In flow

HAND AUGER LOG

HOLE NO.:
AH21

CLIENT: JKS PADDOCK Ltd
PROJECT: WAKARI195-245

JOB NO.:
230385

SITE LOCATION: 195-245 Wakari Road
COORDINATES: 1404709 mE, 4919972 mN (NZTM2000)
LOCATION METHOD: Handheld GPS
ELEVATION: Existing ground level

CONTRACTOR: GeoSolve
EQUIPMENT: Scala penetrometer
ACCURACY: ± 3 m
OPERATOR: RC

START DATE: 22/06/2023
END DATE: 22/06/2023
LOGGED BY: RC
CHECKED DATE: 23/06/2023

SOIL / ROCK TYPE	MATERIAL DESCRIPTION (See Classification & Symbolology sheet for details)	SAMPLES	DEPTH / RL	LEGEND	SCALA PENETROMETER (Blows / 100 mm)														SHEAR STRENGTH (kPa)		WATER
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	50	100	
																			Vane:	Values	
						1	2	2	2	2	3	4	5	6	9	11	15				Groundwater Not Encountered

PHOTO(S)

REMARKS

Scala test only. Refusal at 1.3 m with high blow count.

WATER

- ▼ Standing Water Level
▷ Out flow
◁ In flow

WAKARI ROAD SUBDIVISION

UPDATED TRANSPORT ASSESSMENT REPORT

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INTRODUCTION

1. JKS Paddock Limited (the Developer) has commissioned the preparation of a Transport Assessment Report for a proposed subdivision of the property at 195 Wakari Road, Dunedin.
2. The proposed subdivision involves creation of 36 new residential allotments (two of which are capable of supporting duplexes), and construction of new roads to vest (including a new intersection with Wakari Road). The proposed development is shown in Figure 1 (see also Appendix A).
3. This report primarily describes the transport environment in the vicinity of the site, provides an assessment of the proposed intersection to Wakari Road, and assesses proposed transport infrastructure serving the subdivision site.

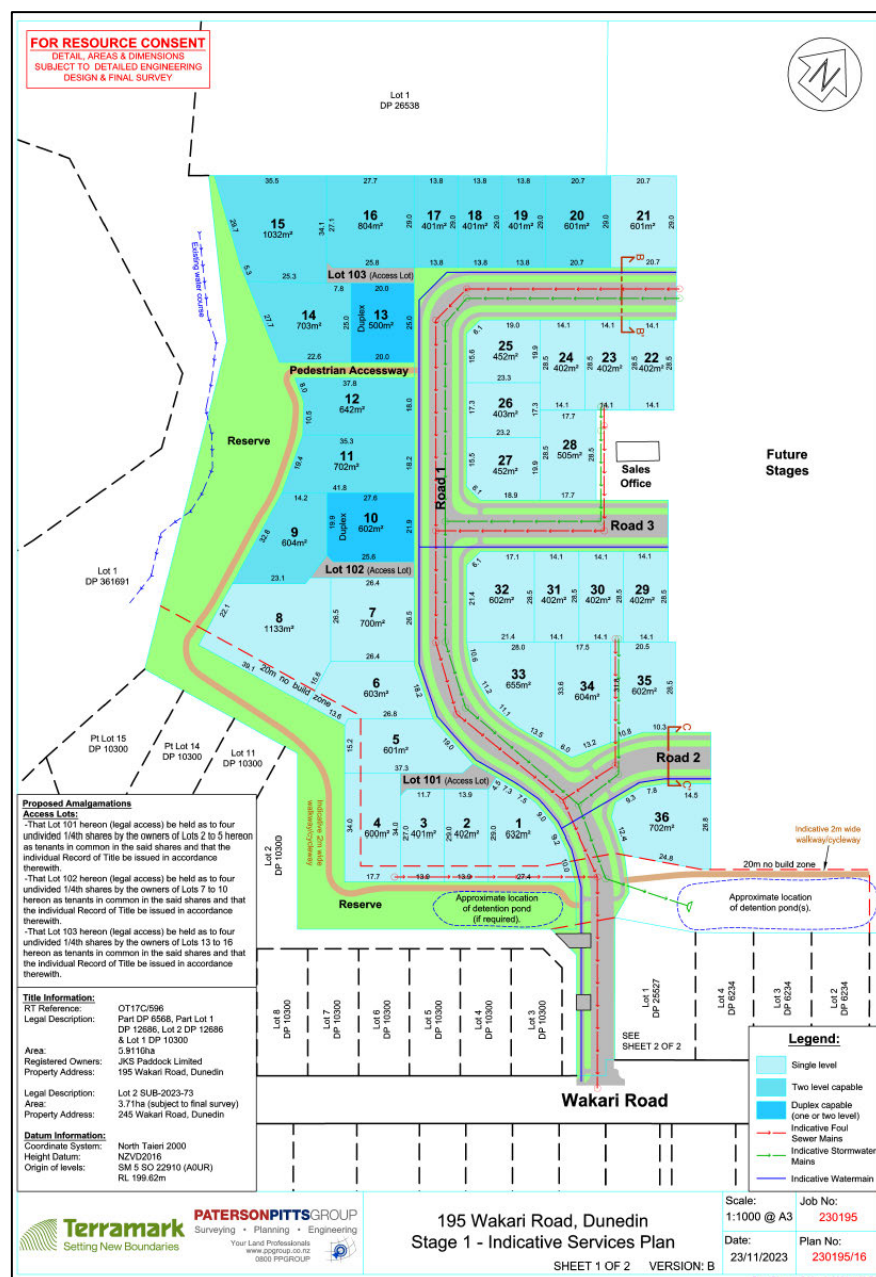


Figure 1 – Subdivision concept plan

TRANSPORT ENVIRONMENT

Site Locality and Zoning

- The property at 195 Wakari Road is held in RT OT17C/596, legally described as Part DP 6568, Part Lot 1 DP 12686, Lot 2 DP 12686 & Lot 1 DP 10300. The area to be developed is shown in Figure 2. The development site has recently been rezoned Residential 1 in the Dunedin Second Generation District Plan (2GP).



Figure 2 – Site location plan

Road Network

- The operational characteristics of Wakari Road are summarised in the table below:

WAKARI ROAD	COMMENTARY
Road Classification	Classified as a Local Road in the vicinity of the site, and a Collector Road to the southwest of Helensburgh Road.
Cross section	Sealed carriageway width of 9.2m (kerb to kerb), with on-street parking available on both sides.
Traffic Volumes	AADT = 858vpd in the vicinity of the site, with 0.95% of the AADT classified as heavy traffic (obtained from Mobileroad RAMM data).
Speed	Posted speed limit is 50km/h. Mean operating speed is 51km/h (source: Waka Kotahi Megamaps).
Pedestrians and cyclists	Sealed footpaths generally 2.0m wide are provided on both sides of the road, terminating to the northeast of the site frontage

outside the property at 205 Wakari Road. There is no dedicated cycling infrastructure.

Public Transport

There is no bus route on Wakari Road adjacent to the site.

Crash History

6. The NZTA Crash Analysis System (CAS) has been reviewed to identify crashes that have been reported in the vicinity of the site from 2018 to 2023 inclusive. The area investigated for crashes is shown shaded in blue in Figure 3, below.

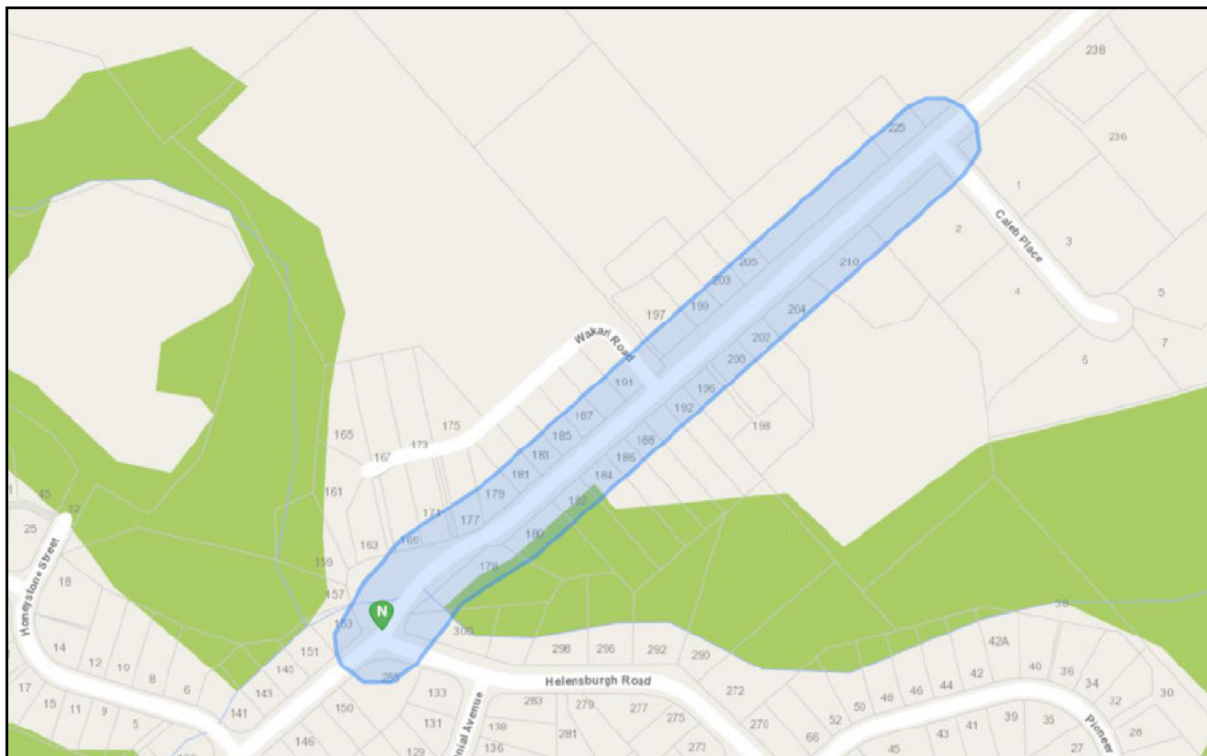


Figure 3 – CAS output diagram

7. There has been one crash on Wakari Road recorded during this period within the investigation area. The description of the crash involves a nose-to-tail crash at the intersection with Helensburgh Road, which did not result in any injuries. This crash data suggests there are no current underlying safety concerns for the road.

PROPOSED DEVELOPMENT

8. The proposed development involves subdivision of the property at 195 Wakari Road into 36 new residential allotments, a local purpose reserve, and road to vest in Council. Two of the proposed lots will also support duplex development, meaning that the subdivision may contain up to 38 dwellings. The subdivision forms Stage 1 of a larger development.
9. The relevant transportation features of the proposed subdivision are summarized as follows:
 - A new road intersection with Wakari Road provides primary access to the subdivision, with the proposed internal roading network providing access to properties. The initial extent of the new road will also include two new vehicle crossings to the adjacent right of way within 175 Wakari Road, providing an alternative means of entrance to the properties served by the right of way.
 - A roading layout and design that encourages a low speed environment through a combination of physical dimension and alignment.
 - Footpaths and grass berms will be provided internally. Note that due to existing land ownership constraints a single footpath will be located on the southwestern side of initial extent of the new road, thereafter reverting to footpaths on both sides of the internal road network.
 - The provision of three access lots for shared access to rear lots.
 - Good levels of pedestrian connectivity throughout the site to ensure the walkability within the development, including a pedestrian accessway through the proposed reserve.
 - Provision for road connections to future stages of the development to the northeast of the subdivision site.

TRAFFIC GENERATION

10. Traffic generation for Stage 1 of the proposed development has been assessed based on the NZTA Research Report 453 (Table C.1) for an “Outer Suburban” residential activity. Application of this traffic generation data gives the following peak hour and daily traffic generation volumes.

ACTIVITY	TRIP RATE	DWELLINGS	VOLUME
Dwelling (Outer Suburban) Peak Hour	0.9 per dwelling	38	34 vph
Dwelling (Outer Suburban) Daily	8.2 per dwelling		312 vpd

11. While the above traffic volumes will be generated for Stage 1 of the proposed development, full development of the site is estimated to be up to 100 dwellings. Thus, it is useful to provide indicative total traffic generation volumes for full development of the site. These volumes are shown in the following table. It is also noted that traffic generated by full development of the site would ultimately be split across at least two intersections to Wakari Road (i.e. the proposed intersection, plus a new future road intersection to the north of the site, near Caleb Place).

ACTIVITY	TRIP RATE	DWELLINGS	VOLUME
Dwelling (Outer Suburban) Peak Hour	0.9 per dwelling	100	90 vph
Dwelling (Outer Suburban) Daily	8.2 per dwelling		820 vpd

ROAD NETWORK

New Road Intersection – Design and Location

Sight Distance and General Design

12. The proposed new road intersection will be formed as a T-intersection with Wakari Road, as shown in Figure 4. While the intersection does not require priority intersection control, it may be desirable to install controls to enhance conspicuity of the intersection. This matter can be confirmed through the detailed design approval process with the road controlling authority.

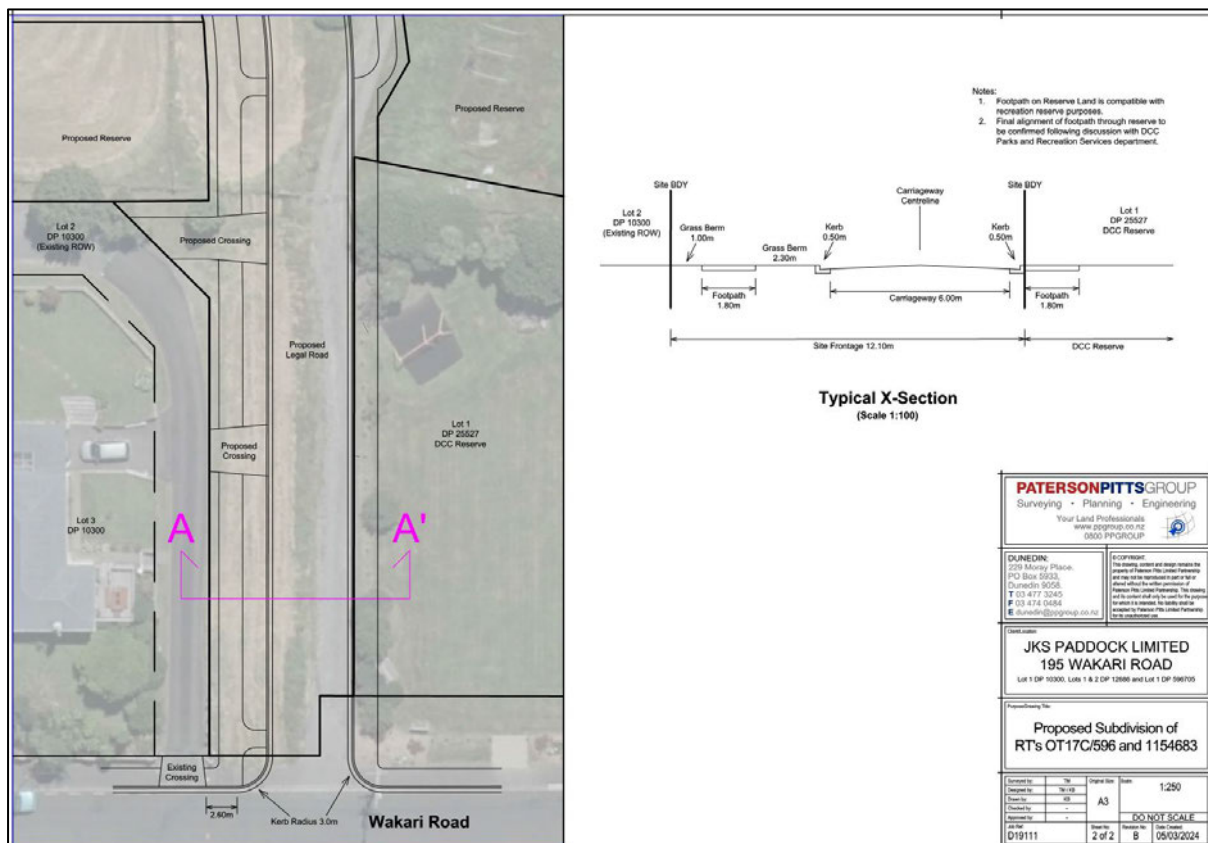


Figure 4 – Concept layout for new road intersection with Wakari Road

13. The key aspects in relation to the proposed intersection include:

- The provision of appropriate sight distances; and,
- The design of the proposed intersection.

14. The operational safety at an intersection is influenced by the available sight distance, the speed of approaching traffic, and the ability of a vehicle to avoid a collision, either by stopping in time or by being able to take other evasive action.

15. Appropriate sight distance requirements at an intersection are indicated in the Austroads publication "Guide to Road Design" Part 4A "Unsignalised and Signalised Intersections". The two key sight distance parameters most relevant to the proposed intersection location are:

- Safe Intersection Sight Distance (SISD), which provides a sufficient distance for a driver of vehicle on the major road to observe a vehicle from a minor road approach moving into a collision situation and to decelerate to a stop before reaching the collision point. It is measured from driver eye height (1.1m) to the top of an approaching car (1.25m).
- Minimum Gap Sight Distance (MGSD), which provides a sufficient distance for a driver of a vehicle entering onto a major road to see a vehicle in the conflicting traffic stream in order to safely commence the desired manoeuvre. It is measured from driver eye height (1.1m) to the object height of approaching vehicle (0.65m).

16. The sight distance requirements for each the SISD and MGSD are shown below. These are based on an operating speed of 50km/h. While no grade correction has been applied, the proposed intersection location is effectively located on a crest meaning that these values are conservative, as vehicles on Wakari Road will be travelling uphill toward the intersection.

SPEED	SISD	MGSD
50km/h	97m	69m

17. The proposed intersection complies with these sight distances and is therefore assessed as being in an appropriate location. It should be noted that the Approach Sight Distance (ASD), which is measured on the minor road approach, will be confirmed as part of the detailed design process for the new road.
18. In terms of design, the new intersection with Wakari Road will be a simple T-intersection as shown above in Figure 4, which is appropriate. Any need for intersection controls and/or pavement markings and signage can be confirmed through the detailed design approval process with the road controlling authority.

Proximity of New Road Intersection to Adjacent Right of Way Access

19. It is acknowledged that the vehicle crossing to the right of way within 175 Wakari Road will be located in close proximity to the proposed intersection (see Figure 4). It is noted that Rule 6.6.3.4.a of the 2GP requires a separation of 10m between a vehicle crossing and a “Local Road-Local Road” intersection, whereas only 2.6m is achieved due to existing boundary positions and the proposed carriageway location.
20. The Council’s Transport department, in their memorandum dated 18 December 2023 reviewing our original ITA, is of the view that the proximity of the proposed new road intersection to the adjacent right of way owned by 175 Wakari Road is a significant concern from a traffic safety perspective. This is a key reason why they do not consider the proposed access arrangements to be acceptable, and thus view the effects of the proposed development on the transportation network to be more than minor.
21. Assessment of the proximity of the proposed new road intersection to the adjacent right of way has been updated in this latest ITA. The following subsections of this report provide further assessment and analysis and in doing so provide additional quantitative analysis of; (a) the prevalence of crashes occurring at existing driveways located in close proximity to road

intersections within the study area detailed later in this report, and (b) the probability of conflict occurring between users of the right of way, and users of the proposed intersection/Wakari Road, during peak hour conditions. These subsections include the following:

- Safe Systems Assessment
- Intersection-Driveway Crash Study and Analysis
- Access Conflict Probability Assessment

Safe Systems Assessment

22. In assessment of the proximity of the new road intersection to the right of way, it is noted that the Austroads Guide to Road Design Part 4: Intersections and Crossings: General mostly contains detailed guidance for the design and management of separation between intersections and vehicle crossings for higher volume/speed roads, such as arterials. This guide states that the proximity of intersections and driveways can have a significant effect on the operation of the intersections with major intersections (inferring that minor road intersections, such as the one proposed for this development, do not generate significant effects). Furthermore, in respect of local streets, the guide contains the following relevant guidance regarding property access considerations on urban roads¹:

It is preferred that road networks are planned and designed so that property access points are located on local streets rather than arterial roads.

Low travel speed and driver expectation of interference reduces the likelihood of conflict.

Potential conflict with pedestrian movement must be identified and appropriate solutions adopted. However, the low-speed environment should ensure that both the likelihood of conflict and the severity of crashes are minimised.

23. As the road network near the site primarily serves residential areas, it is expected that most drivers and pedestrians (particularly at peak times) will be familiar with any potential conflict arising due to the proximity of the vehicle crossing and the new road intersection, reducing the likelihood of such conflict occurring. Furthermore, vehicle turning movements into and out of the right of way, and new road intersection, are expected to be undertaken at low speeds. Thus, these are considered to be well below the Safe Systems-recognised threshold speeds for “Head-on” and “Intersection” type crashes, and below the threshold for “Pedestrian” type crashes, depicted in Figure 5², below:

¹ Austroads Guide to Road Design Part 4: Intersections and Crossings: General, Table 7.2 “Property access considerations on urban roads”

² Source: Safe System Solutions (safe systems threshold line added for clarity).

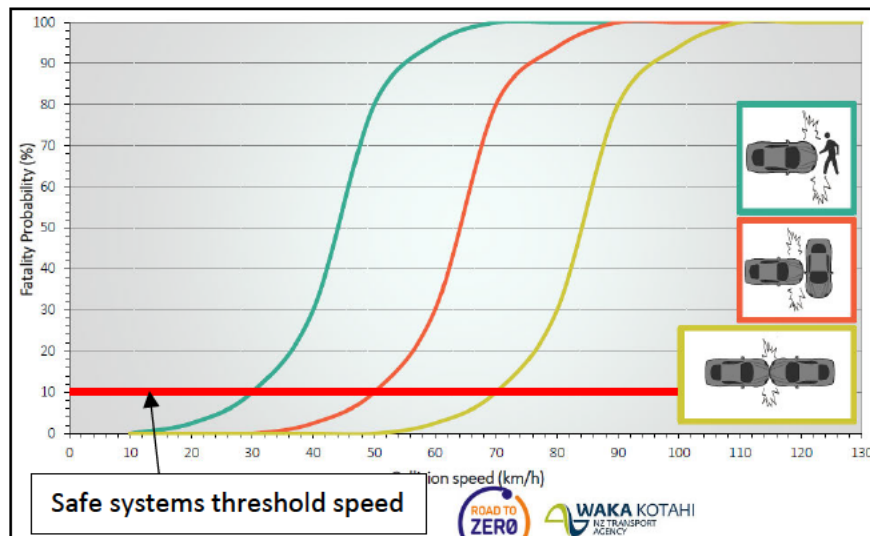


Figure 5 - Safe systems threshold graph

24. The Austroads guidance notes that potential conflict with pedestrian movements must be identified and appropriate solutions adopted. In this instance there is considered to be sufficient space on the footpath between the right of way and the new road intersection for a pedestrian to wait between vehicles crossing (though it should be noted that vehicles entering/exiting the right of way are required to give way to pedestrians on the footpath). There is considered to be good intervisibility between the right of way and the footpath to ensure right of way users yield to pedestrians. Furthermore, it is considered unlikely that a pedestrian wanting to cross the proposed new road intersection, when viewing a vehicle indicating to turn into either the new road or the right of way, would cross the road until either of these vehicle actions were completed.
25. No specific infrastructure is considered to be warranted to address the impact on pedestrians due to the proximity of the vehicle crossing to the new road intersection, though appropriate drop-down kerb treatments should be constructed at each intersection quadrant to facilitate pedestrian movements and mobility access across the intersection.
26. The direction of travel has also been considered in assessment of vehicular conflict between the right of way and the new road intersection. Census data from Waka Commuter has been used to determine where residents on Wakari Road (within the Helensburgh suburb) typically travel to for work and education. This information is captured in Figure 6 below, and shows the vast majority of morning departures are to the Dunedin Central area and surrounding suburbs. A reversed direction of travel can reasonably be assumed for evening traffic. These destinations mean that most traffic will travel on Wakari Road to the south of the site as this is the shortest and thus most efficient route for commuting. Vehicles will therefore mostly turn right onto Wakari Road from both the new road intersection, and the right of way, during morning commute times, with a reversed direction of travel in the evening.

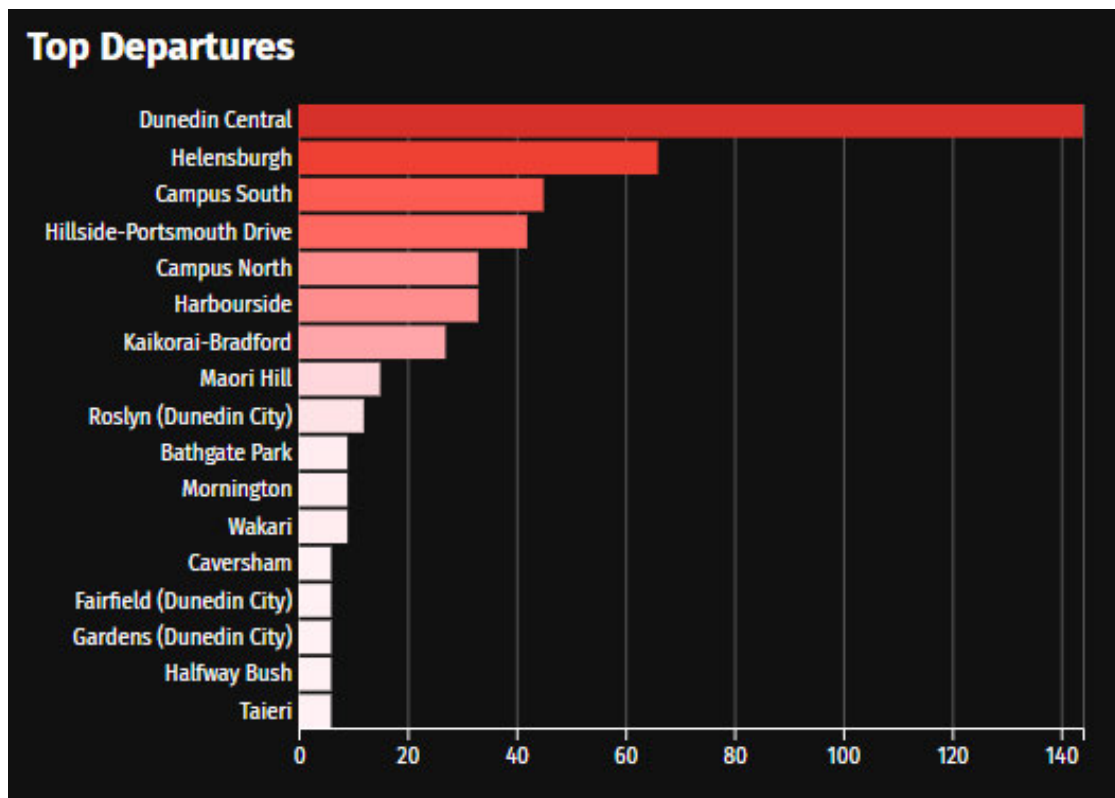


Figure 6 – Waka Commuter census data for top departures from the Helensburgh suburb

27. The prevailing directions of travel described above means that the likelihood of conflict between traffic using the right of way and the new intersection is significantly diminished, particularly during peak commute times on the road network. For example, it is unlikely that a vehicle will turn left out of the right of way into Wakari Road, conflicting with vehicles turning right out of the new road onto Wakari Road, during the AM peak. While this is potentially a significant assumption to make, it is informed by Census data and the shortest available routes from the site to places of work or education.
28. Overall, from a Safe Systems perspective, the proposed separation distance between the new road intersection and the right of way is not considered to significantly increase the likelihood of conflict and severity of crashes that may occur at the intersection, when compared with a configuration that complies with District Plan performance standards. Any conflicts that may occur between vehicle and pedestrians will be below the Safe Systems threshold speed.

Intersection-Driveway Crash Study

29. In their review of CAS data provided in our response to their RFI³, the Council's Transport department stated that "CAS data is unlikely to provide any meaningful trends given that it is unlikely that there are arrangements within the city similar to the one proposed that would give rise to increased trends in relation to driveways and intersections."
30. A comprehensive crash study has therefore been undertaken to evaluate the frequency of crashes occurring at higher-use driveways located in close proximity to road intersections, and whether the location of the driveway relative to the intersection was a contributing factor in

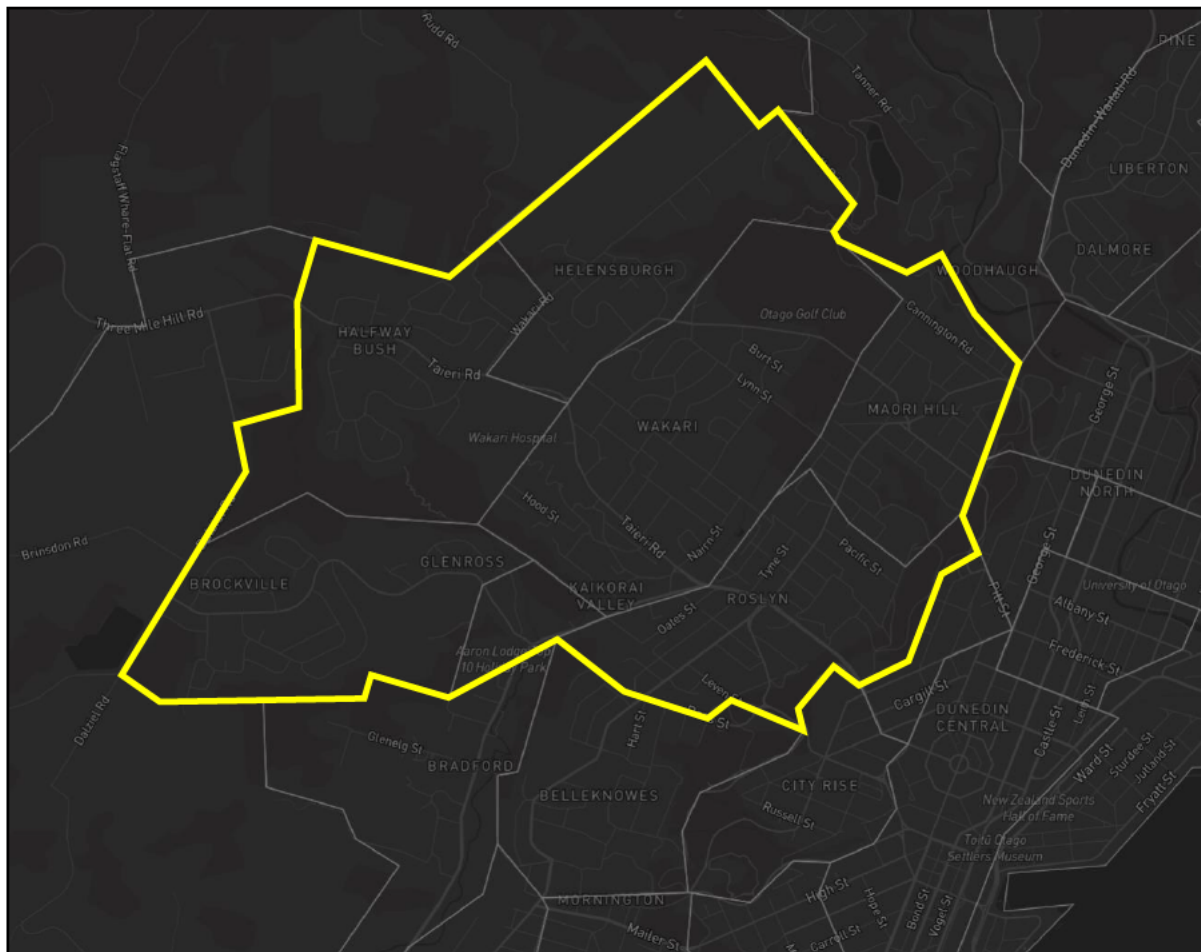
³ Refer to our memo dated 24 November 2023

any crashes that have occurred. The study area comprised Helensburgh, Wakari, Maori Hill, Roslyn, and Brockville, and was selected based on its geographic location being near to the development site at 195 Wakari Road and being a realistic representation of typical urban residential areas in Dunedin city. It contains a broad mix of road classifications, traffic volumes, and land use types, including higher use driveways such as those serving commercial activities. Analysis of crashes within the study area was undertaken by working outward from the subject site, and primarily comprised a detailed analysis of higher-use driveways located near intersections (which can be viewed as a proxy for traffic conditions at the right of way adjacent to the proposed new road intersection for assessment purposes). Additionally, a more general analysis of lower-use driveways (such as those serving a single dwelling) near intersections within the study area was also undertaken.

31. Crash data was also considered outside the study area further from the development site. There were no locations identified that were directly comparable to the proposed development in other residential areas in the city, and there was no compelling evidence in the crash records within the study area indicating that a wider detailed analysis would yield significantly different results than those shown below in this report. For the sake of clarity, if there were any significant issues uncovered in the crash data at the locations analysed in this report, investigation of crashes further from the site would have been undertaken.
32. The criteria used to identify locations for detailed analysis within the study area focused on higher-use driveways that are situated on, or near, intersections on roads that have a higher strategic function than a Local Road (i.e. Collector Roads and above), therefore having relatively higher traffic volumes when compared with Wakari Road. This approach was taken for the following reasons:
 - The greater traffic volumes on higher-classification roads means that crashes have a higher probability of occurring, thus any crash trends between driveways and intersections will be more apparent.
 - The study locations are essentially in 'worse' situations than the proposed new road intersection, in terms of traffic volumes accessing the respective properties and volumes on the frontage road. Noting that the proposed new road is accessed via Wakari Road (classified as a Local Road adjacent to the site), this criteria thus presents a conservative analysis when compared with the proposed development.
33. In addition to the detailed analysis sites, the study also examined lower-volume driveways within 10m of an intersection (measured using 2GP performance standards), such as those catering to single dwellings, located on roads classified as a Collector or above. Analysis revealed 57 such driveways within the study area. While it is acknowledged that these driveways would only typically generate around one vehicle movement in the peak hour, due to traffic volumes on the frontage road typically being much higher than on Wakari Road, and crash records being examined over the longest period available (1980-2024), this assessment is still useful in helping to identify if there are any crashes or trends in relation to driveways located close to intersections. Commentary on these locations is provided after the site-specific analysis contained in the tables below.

34. The NZTA's Crash Analysis System (CAS) has been used to study relevant crash data in order to determine if; (a) the selected vehicle accesses located in close proximity to intersections have coincided with reported crashes, and (b) the location of the vehicle access was a factor in any crashes revealed by the analysis. CAS query search fields used in this study were (unless otherwise specified), as follows:

- Crash year: "1980 to 2024"; and,
- Junction type: "Driveway"; and,
- Intersection: "Yes"



Spatial location of crash study area. Source: Census NZ (Commuter Waka).

35. Five locations have been reviewed within the study area shown in the figure above (although the Roslyn village location includes three distinct vehicle accesses that are considered separately). These sites represent a cross section of various land use activities, including residential, commercial, and community support activities, and are intended to give a broad representation of crashes that may have occurred between higher-use driveways and intersections within the study area.

36. For clarity, the following parameters have conservatively been adopted when comparing the studied sites to the proposed new road intersection:

- Peak hour volumes using the proposed new road intersection are 34vph for Stage 1, increasing to a maximum of 90vph upon full development of the site.
- The right of way adjacent to the proposed new road intersection operates at a peak hour volume of 13vph.
- The peak hour volume on Wakari Road is 10% of the ADT, being 86vph.
- Average daily traffic volumes (ADT) for the wider road network have been obtained from MobileRoad RAMM data unless otherwise specified. Peak hour traffic volumes are 10% of the ADT.

37. Full analysis of the higher-volume driveway sites is provided below:

BALMACEWEN ROAD SHOPPING CENTRE



Address	212-220 Balmacewen Road
Road environment	The site has frontage to Balmacewen Road and Lynn Street. Balmacewen Road is classified as a Collector Road and has an ADT of 4199vpd. Lynn Street is classified as a Collector Road and has an ADT of 646vpd.
Land Use	Mixed commercial comprising 4-5 tenancies. Recent use has comprised a café/eatery, midwifery, hairdresser, and the Helensburgh Veterinary Clinic. Total gross area of commercial buildings is approximately 520m ² .

Access Characteristics	The site has two accesses. The easternmost access is located within the western quadrant of the Lynn Street intersection. The westernmost access located 23m from the intersection. There is no demarcation or direction of travel indicated via pavement markings or signage.
Generated Traffic	The NZTA Research Report 453 (RR453) gives an 85 th percentile peak hour trip generation rate for small shopping centres as being 18.9 trips/100m ² gross floor area. This equates to 98 trips in the peak hour for the combined 520m ² tenancy.
Crash History	For the period 1980 to 2024, there have been no reported crashes at this driveway/intersection location involving use of the driveway.
Discussion	The easternmost vehicle access is essentially located within the intersection (i.e. it has no setback from the intersection when applying 2GP performance standards). This would lead to the primary concern of a through-traffic driver confusing the intended direction of a vehicle turning left into the access from Lynn Street, or even a driver turning right into the access from Balmacewen Road, potentially resulting in a rear-end crash. These potential crash risks are comparable to those at the proposed new road intersection. Imagery, including aerial photography, and Google Street View, suggests that a predominant direction of travel of ingress is via the easternmost access at the Lynn Street intersection. The images above also suggest that the car park within the site is well used. While the trip rate contained in RR453 arguably overstates traffic generation in this location (i.e. it is difficult to see in our experience that almost 100 vehicles drive to this location in the peak hour), it is clear that the accesses to the site are well used. Furthermore, when compared with the proposed subdivision, it is more than likely that the eastern vehicle access to the Balmacewen shopping centre operates with higher volumes than the right of way adjacent to the proposed new road intersection. Additionally, the eastern access is located on a section of the road network with much higher traffic volumes than Wakari Road. While these factors are potentially significant in causing confusion at the driveway, and thus resulting in crashes, there is no reported crash history in relation to the use of the eastern access to this site. This suggests that the vehicle access to this site operates safely.

HELENSBURGH MEDICAL CENTRE



Address	231 Balmacewen Road
Road environment	Balmacewen Road is classified as a Collector Road with an ADT of 4199vpd. This site also has frontage to Helensburgh Road which is classified as a Collector Road with an ADT of 1645vpd.
Land Use Activity	Medical Centre
Access Characteristics	The site comprises two accesses. The western access is located within the western quadrant of the Helensburgh Road intersection. The eastern access located as far from the intersection as the site boundaries permit. It is noted that ingress is via the westernmost access, and egress via the easternmost access.
Generated Traffic	The NZTA Research Report 453 shows an 85 th percentile peak hour trip generation rate for medical centres as being 11.6 trips per professional. There are four GP's working at the medical centre (as listed on their website) resulting in a volume of 46 trips in the peak hour.
Crash History	For the period 1980 to 2024, there have been no reported crashes at this driveway/intersection location involving a driveway.
Discussion	The westernmost vehicle access is essentially located within the intersection (i.e. it has zero setback from the intersection when applying 2GP performance standards). This would lead to the primary concern of a through-traffic driver confusing the intended direction of a vehicle turning left into the access from Balmacewen Road/Helensburgh Road, potentially resulting in a rear-end crash. These potential crash risks are comparable to those at the proposed new road intersection. When compared with the proposed new road intersection, the eastern vehicle access to the medical centre more than likely operates with significantly higher traffic volumes than

the right of way adjacent to the proposed road intersection. The medical centre also accesses onto a section of the road network with much higher traffic volumes than Wakari Road adjacent to the development site. Again, while these risk factors are potentially significant, there is no reported crash history in relation to the use of this access which suggests that the vehicle access to this site operates safely.

ROSLYN VILLAGE



Address	Roslyn Village
Road environment	The Roslyn Village is a mixed use commercial/residential area situated where Highgate and City Road converge. Its primary frontage is to Highgate, which has the following characteristics in this location: • Classification: Commercial Centre • ADT: 10,596 (eastbound) / 5442 (westbound) The significant form of the road network within the village comprises an elongated median island separating northeast/southwest traffic flows, augmented with a roundabout at its northeastern end which provides access to and from Stuart Street.
Land Use Activity	Mixed Use (commercial and residential land uses are predominant)
Access Characteristics	There are three distinct driveways within the Roslyn Village located immediately adjacent to intersection controls: • 309 Highgate: This access is located immediately adjacent to the limit line for northbound traffic entering the roundabout. It has historically served the Roslyn Baptist Church, plus parking for adjacent real estate offices.

- 313-315 Highgate: This access is located within the roundabout itself, approximately 3m north of the limit line for northbound traffic entering the roundabout. It serves the real estate office at 311 Highgate, and the seven residential apartments at 313 to 6-315 Highgate.
- 308-310 Highgate: This access is located immediately adjacent to the limit line for southwestbound traffic on Highgate entering the roundabout. It has historically served real estate offices, and a residential dwelling at the rear of the site.

Crash History

For the period 1980 to 2024 there have been 62 crashes within the CAS assessment area shown below. Of these crashes, there have been two reported crashes involving a driveway. These crash ID numbers are 8122110, and 2772878.

Review of these crash descriptions suggests that the location of a driveway in relation to an intersection was not a contributing factor in the cause of the crash.



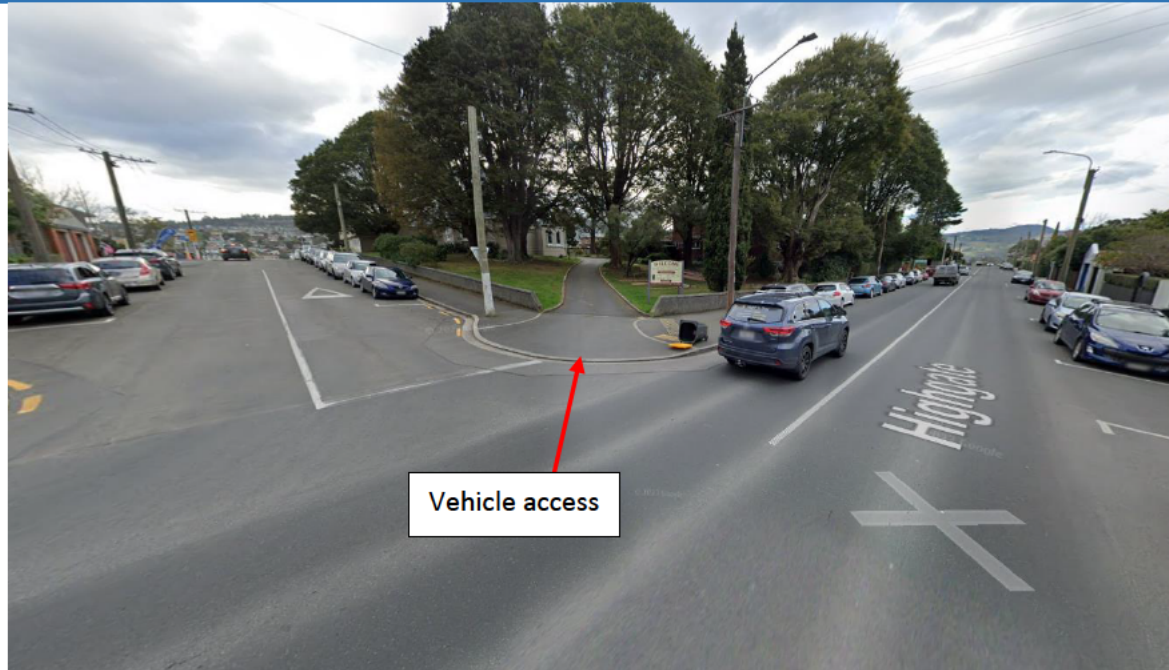
Discussion

The Roslyn village features a high density of driveways located in close proximity to intersections, and a large number of historic crashes in the assessment area. The number of crashes is not necessarily unusual given the high volumes of traffic using these intersections, associated traffic queuing, and correspondingly dense decision-making road environment.

That said, it is notable that there are no crashes in the CAS assessment area associated with driveway/intersection use, especially where the proximity of the driveway to the intersection could be considered a contributing factor to a crash occurring.

When compared with the proposed subdivision, the vehicle accesses analysed in the CAS assessment area shown above are considered to operate with significantly higher combined traffic volumes than the right of way adjacent to the proposed new road intersection. Ambient road network traffic volumes are also significantly higher than those on Wakari Road. Again, while both of these factors are potentially significant in generating crashes between driveways and intersections, there is no reported crash history relating to driveway/intersection proximity within the Roslyn Village. This suggests that the close proximity between driveways and intersections has not led to unsafe outcomes in this area.

ST JOHNS ROSLYN ANGLICAN CHURCH



Vehicle access

Address	373-375 Highgate
Road environment	Highgate is classified as an Urban High Density Corridor. The ADT is 10,731vpd (obtained from MobileRoad RAMM data).
Land Use Activity	Community (Church)
Access Characteristics	The site features a single vehicle access located within the northeastern quadrant of the Wright Street intersection.
Generated Traffic	The NZTA Research Report 453 displays an 85 th percentile peak hour trip generation rate as being 1.1 trips per congregation member. The congregation is around 350 as per the Church website. While church events are unlikely to host a full congregation at any one time, it is our experience that the Church driveway/internal parking area is well used during services and other community events, and is more likely than not to generate higher traffic volumes than the right of way adjacent

	to the proposed new road intersection during peak Church operating times.
Crash History	For the period 1980 to 2024, there have been no reported crashes at this driveway/intersection location involving a driveway.
Discussion	The Church vehicle access is essentially located within the intersection (i.e. it has zero separation from the intersection when applying 2GP performance standards). This would lead to the primary concern of a through-traffic driver confusing the intended direction of a vehicle turning into the access from Highgate, potentially resulting in a rear-end crash. The configuration also has the potential to cause a side-on crash where a driver turning out of Wright Street confuses a vehicle turning into the Church with a vehicle turning left into Wright Street from Highgate. When compared with the proposed subdivision, the vehicle access to the Church more than likely operates with significantly higher traffic volumes, at certain times, than the right of way adjacent to the proposed road intersection. The Church access is also located on Highgate which has significantly higher traffic volumes than Wakari Road. Again, while both of these factors are potentially significant, there is no reported crash history in relation to the use of this access.

85 – 91 KAIKORAI VALLEY ROAD



Address 85-91 Kaikorai Valley Road

Road environment	Kaikorai Valley Road is classified as a Strategic road. The ADT is 15,280vpd (obtained from MobileRoad RAMM data).
Land Use Activity	Residential
Access Characteristics	The site features a single vehicle access located within the southwestern quadrant of the Falcon Street intersection, serving four dwellings.
Generated Traffic	The NZTA Research Report 453 displays an 85 th percentile peak hour trip generation rate as being 0.9 trips per dwelling, being 4 movements in the peak hour (rounded up).
Crash History	For the period 1980 to 2024, there have been no reported crashes at this driveway/intersection location.
Discussion	The driveway to these properties is essentially located within the intersection (i.e. it has zero separation from the intersection when applying 2GP performance standards). This would lead to the primary concern of a through-traffic driver confusing the intended direction of a vehicle turning into the access from Kaikorai Valley Road, potentially resulting in a rear-end crash. Similarly, due to the driveway being located on the intersection there is an added risk of a vehicle waiting to enter the major road at from Falcon Street blocking entry into the driveway, thus increasing the risk of a rear end crash even further. When compared with the proposed subdivision, the vehicle access to the property operates with around one-quarter traffic volume of the right of way next to the proposed new road intersection, based on the number of dwellings it serves. However, traffic volumes on Kaikorai Valley Road are around 18 times higher than on Wakari Road. These characteristics contribute to the operation of this vehicle access being 'worse' than what is proposed for the development site, particularly in terms of (a) the probability of conflicting traffic movements occurring based on traffic volumes, and (b) the configuration of the access from Kaikorai Valley Road being situated closer to the intersection which is of a cross-roads configuration. Again, while these are potentially significant contributing factors in crashes occurring in this location, there is no reported crash history in relation to the use of this access.

38. In addition to the above detailed analysis, and as noted earlier in this report, a more general investigation was undertaken of crash data relating to lower-volume driveways, such as those serving single dwellings, located on roads classified as a Collector or above within 10m of an intersection. Analysis revealed 57 such driveways within the study area, the addresses and intersection-driveway separation distances for which are detailed in the table below. Driveways opposite an intersection (such as at T-intersections) were not included in this analysis, as they do not share comparable characteristics to the proposed new road intersection and adjacent right of way.

39. It is notable that 27 of these driveways were located with zero separation distance from an intersection, and that the vast majority of them did not providing on-site manoeuvring (i.e. a vehicle would need to reverse either onto, or off, the frontage road). These areas pose potential issues for through-traffic drivers, as they may become confused about the intended direction of a vehicle turning into a driveway or an intersection, possibly leading to a rear-end collision. Moreover, there is an increased risk of a vehicle waiting to enter a major road at an intersection blocking access to a driveway, thus potentially heightening the likelihood of a rear-end collision occurring on the major road.
40. There were two locations identified where crash data suggested that there may be crashes near a driveway/intersection location. These were the intersections of Kaikorai Valley Road-Brockville Road, and Kaikorai Valley Road-Mellor Street. Review of crash descriptions at these locations did not, however, show a conclusive link between driveways being located near to intersections causing crashes. When CAS data was reviewed across all 57 locations, it was found that the potential risks for driver confusion occurring did not result in any reported crashes.

Address	Intersection Separation	Address	Intersection Separation	Address	Intersection Separation
67 Highgate	8m	1 Ettrick St	0m	230 Taieri Rd	0m
101 Highgate	0m	67 Brockville Rd	2m	1 Broomlea St	4m
158a Highgate	2m	226 Brockville Road	6m	1 Wakari Rd (x2)	0m & 4m
264 Highgate	0m	295 Brockville Road	0m	373 Taieri Rd	5m
263-1 to 263-3 Highgate	9m	201 Dalziel Road	4m	436 Taieri Rd	2m
335 Highgate	3m	2 Brockville Road	0m	448 Taieri Rd	3m
422 Highgate	0m	32 Kaikorai Valley Road	0m	476 Taieri Rd	4m
515 Highgate	5m	162 Kaikorai Valley Road	5m	17 Lynn Street	8m
557 Highgate	7m	120 Kaikorai Valley Road	0m	115 Lynn Street	7m
567 Highgate	4m	84a Kaikorai Valley Road	6m	133 Lynn Street	0m
580 Highgate	4m & 6m	91 Kaikorai Valley Road	4m	143 Lynn Street	4m
23 Drivers Road	2m	54 Falcon Street	2m	145 Lynn Street	0m
31 Shetland	0m	2 Brockville Road	0m	153 Lynn Street	5m
43 Shetland	0m	32 Kaikorai Valley Road	0m	155 Lynn Street	5m
1 Chapman	0m	162 Kaikorai Valley Road	5m	37 Strathern Avenue	3m
2 Blantyre Rd	0m	120 Kaikorai Valley Road	0m	15 City Road	6m
217 Balmacewen Road	6m	84a Kaikorai Valley Road	6m	44 City Road	0m
221 Balmacewen Road	8m	91 Kaikorai Valley Road	4m	1 Erin Street	0m
235 Balmacewen Rd	0m	54 Falcon Street	2m	83 Nairn Street	0m
37 Chapman	7m	96 Gilkison St	5m	11 Ross Street	0m
57 Chapman	6m	63 Wakari Road	0m	108 Highgate	8m
203 Burt St	0m	229 Helensburgh	0m		

41. In summary, the analysis conducted for these sites shows that no crashes have been reported at higher-volume driveways, nor lower-volume driveways (most of which require a vehicle to

reverse onto/off the frontage road), within the study area. Thus, long-term crash records show that there is no clear evidence linking an increase in crash rates to the operation of such driveways. Based on this analysis, it appears that while there is potential for confusion to occur when the intended direction of travel is unclear in situations where a driveway is located close to an intersection, the extent of this confusion or conflict is not sufficient such that it resulted in increased crash rates. That is, confusion or conflict may be present between the vehicles, or a vehicle and a pedestrian, but not to the extent that a road safety problem has been recorded in the data.

Access Conflict Probability Assessment

42. Based on census data, which includes arrival/departure information for the Helensburgh suburb, predominant directions of travel on Wakari Road are considered to be mostly westbound in the AM peak, and eastbound in the PM peak. The most significant vehicle movements with potential to cause conflict between the proposed intersection, and the adjacent right of way, are therefore considered to be eastbound through-traffic on Wakari Road encountering a vehicle slowing/waiting to turn left into the right of way. These conditions are most apparent during the PM peak.
43. The probability of this scenario occurring has thus been calculated to provide a quantitative representation of how many conflicting vehicle movements might occur between users of the proposed intersection, and users of the adjacent right of way access, during the PM peak. The PM peak traffic volumes for the road, and the right of way, described earlier in this report have been used to determine the probability of these two traffic flows coming into conflict. Calculations, provided in Appendix C, show that only around 0.6 vehicles in the peak hour are predicted to encounter this situation in the PM peak, representing only 0.3% of the full post-development traffic volume on Wakari Road.
44. The probability of conflicting movements occurring between vehicles accessing the right of way, and using the proposed intersection, is thus considered to be very small in absolute and percentage terms.

Typical Road Cross Sections

45. There are two typical road cross sections proposed within the subdivision, as follows (see Figure 7 for road typology locations, and Appendix A for detailed typical cross sections):
 - The first relates to the main “loop” road, which has a legal width of 16.6m, sealed carriageway width (movement lane) of 6.0m, and footpaths on both sides. Note, however, that the initial extent of this road is required to have a narrower legal width (boundary to boundary) due to existing land ownership constraints, with a footpath on only one side – although we note that there is the potential to locate the footpath within the adjacent Bain Reserve and this would achieve the intent of having a footpath on either side of the road. The sealed carriageway width will, however, remain consistent. The effects of this are assessed later in this report.

- The two minor roads coming off the “loop” road both have a legal width of 16.3m, sealed carriageway width of 6.0m, and footpaths on both sides.

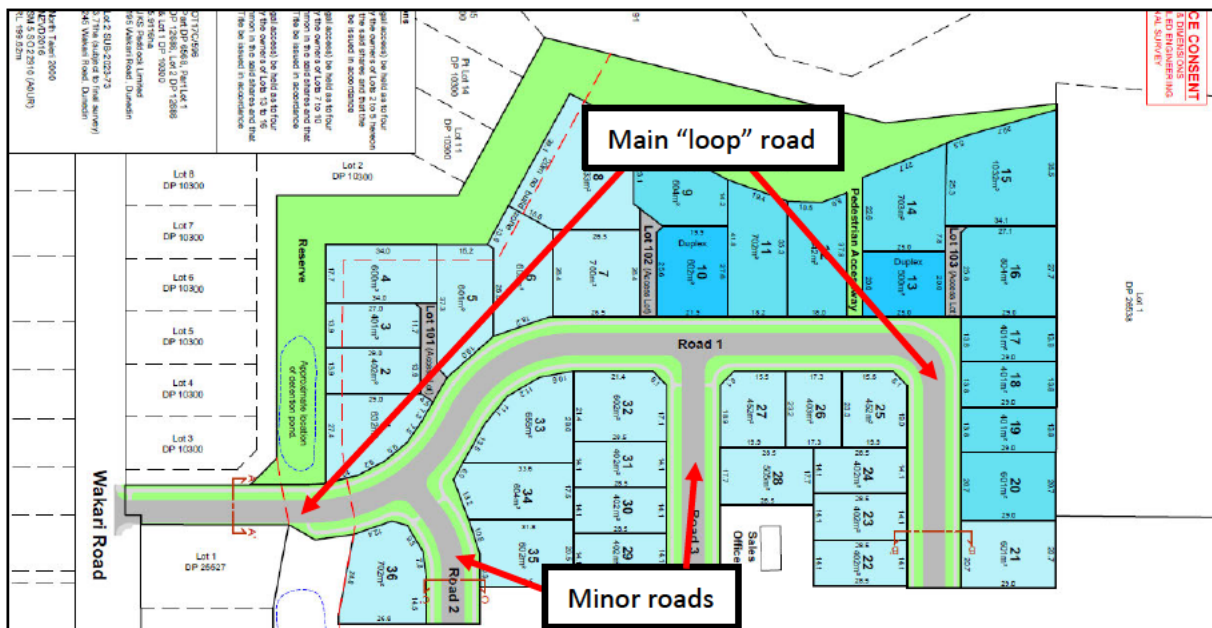


Figure 7 – Road cross section typology locations

46. NZS 4404:2010 provides a reasonable standard against which the proposed cross sections can be compared. It is noted that the Council similarly used this standard in a draft report prepared by Avanzar consultants when assessing the rezoning of the site, which has been provided to the developer to assist with assessment of this development. The E12 and E13 type road standards are applicable to the proposed subdivision and are highlighted below.

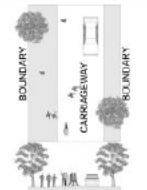
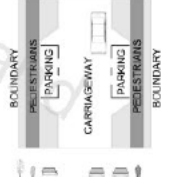
PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT				TYPICAL PLAN AND CROSS SECTION		FIGURE NUMBER
Area	Land use	Local attributes	Locality served	Target operating speed (km/h)	Min. road width (m)	Max. grade	Pedestrians	Passing, parking, loading, and shoulder	Cyclists	Movement lane (excluding shoulder)	Classification	SEE APPENDIX E FOR LARGER VERSION OF FIGURES	
Notes	See 2.2.4, table 3.1 & 3.1.6	See table 2.1	See table 2.1	See 2.2.5	See 2.2.2, 3.1.5, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.14	See 3.3.15, 3.3.7, & 3.3.11.2	See 2.2.15, 3.3.7, & 3.3.11.2	See 2.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.10 (Typical max. volumes)	
Suburban	Live and play	Side or rear service access	Up to 100 m in length between streets, 1 to 20 lots	10	6	16%	Shared (in movement lane)	Allow for passing up to every 50 m	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)		E10
	Live and play	Access to houses/ townhouses	1 to 20 du	20	9	16%	Shared (in movement lane)	Shared (in movement lane)	Shared (in movement lane)	5.5 - 5.7	Lane (~ 200 vpd)		E11
	Live and play	Primary access to housing	1 to 200 du	40	15	12.5%	1.5 m one side or 1.5 m each side where more than 20 du or more than 100 m in length	Shared parking in the movement lane up to 100 du, separate parking required over 100 du	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)		E12

Figure 8 – Excerpt from NZS 4404:2010 for suburban road cross section standards

47. Both cross sections generally comply with the functional criteria shown for E11 and E12 and are appropriate to serve the subdivision, except for the initial extent of the main loop road where it intersects with Wakari Road (discussed below). In regard to on-street parking, and in accordance with the policy direction contained in the National Policy Statement on Urban Development 2020⁴, the developer does not wish to define on-street parking at this stage. Rather, they would prefer to address any on-street parking provisions through the detailed design process (though indicative cross sections are provided on the concept plans demonstrating how indented parking could feasibly be accommodated). It is considered acceptable from an assessment perspective to address provision of on-street parking at the detailed design stage given the overarching policy regarding parking contained in the NPS-UD.
48. The proposed carriageway width of 6.0m is slightly wider than the listed E11/E12 cross section widths of 5.5m to 5.7m. In assessment of this width, in areas where indented parking is not provided, the proposed carriageway width is assessed as being unlikely to cause confusion between movement and parking functions, particularly in the proposed low-speed environment where most road users are residents and familiar with operation of the road. Conversely, where indented parking is provided, movement and parking functions are clearly defined and confusion between movement and parking functions is therefore similarly considered unlikely.
49. As noted earlier in this report, the initial extent of the “loop” road is required to have a narrower legal width due to existing land ownership constraints, with a footpath being proposed for the southwestern side in this location only. The legal width of this section of the road, reflecting the existing land ownership of the developer, is 12.1m wide. To use this width effectively, it is proposed that the formed carriageway is 6.0m wide, with a footpath on the southwestern side of the carriageway only. Specific deviations from the E12 cross section in NZS 4404:2010 are identified and assessed below:

Legal Road Width

50. The E12 standard requires a 15m legal road width, whereas the legal road width available due to existing boundary positions is 12.1m. The legal road width is an existing constraint due to current site boundaries and cannot be remedied by the developer. As this is the only legal frontage to the site, access cannot be achieved in another location for Stage 1 of the proposed development. While future stages of the development are intended to feature secondary access to Wakari Road to the northeast of the Stage 1 site, it is essential to have access in the proposed location for overall network connectivity.
51. The narrower legal road width results in infrastructural departures from NZS 4404:2010 in terms of road infrastructure, primarily being:
- Provision of a footpath on only one side of the road for the initial extent of the main loop road, from Wakari Road.
 - A narrow residual width to accommodate grass berms.

⁴ [National Policy Statement on Urban Development 2020 \(environment.govt.nz\)](https://environment.govt.nz/national-policy-statement-on-urban-development-2020/)

52. The effect of these infrastructural departures are discussed in more detail below.

Footpath and Shared Path Provisions

53. The E12 standard requires a 1.5m wide footpath on both sides of the main loop road, whereas it is proposed to construct a single 1.8m wide footpath on the southern side of the road for its initial extent only (see concept plan in Figure 4). Provision of a single footpath on the southwestern side of the proposed new road will primarily impact users of two potential routes:

- Pedestrians walking to and from Wakari Road from the proposed subdivision.
- Pedestrians wanting to access the adjoining reserve/park land from the new road.

54. Both scenarios above would require a pedestrian to cross the main loop road twice. Based on the peak vehicle trips on the main loop road outlined earlier in this report, Figure 6.1 from the Waka Kotahi Pedestrian Planning and Design Guide (shown below) shows that this road can be crossed safely and efficiently (to an “Excellent” level of service) with little to no delay to pedestrians, even without physical aid such as kerb extensions (see red star on the chart). It is therefore apparent that while there is a slight reduction in convenience, effects in terms of level of service will be minimal for pedestrians walking to and from Wakari Road, and for accessing the adjoining reserve/park land.

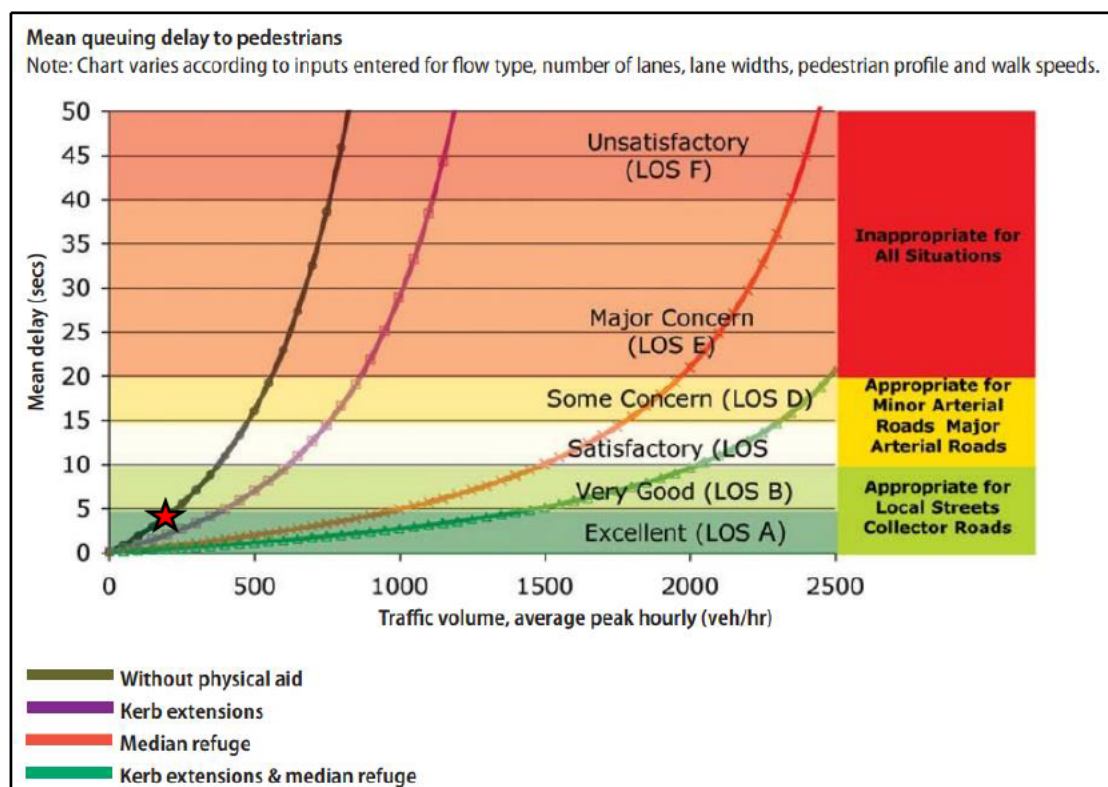


Figure 9 – Footpath level of service chart (source: Waka Kotahi Pedestrian Planning and Design Guide)

55. It should also be noted that the provision of a single footpath only affects a relatively short section of the proposed new road. Furthermore, there will be a level of public access through the existing reserve immediately to the northeast of the new road. If allowable to Council's

Parks and Recreation department, the developer is more than willing to construct a footpath through the reserve, linking the subdivision directly to Wakari Road and the reserve (see Figure 10).

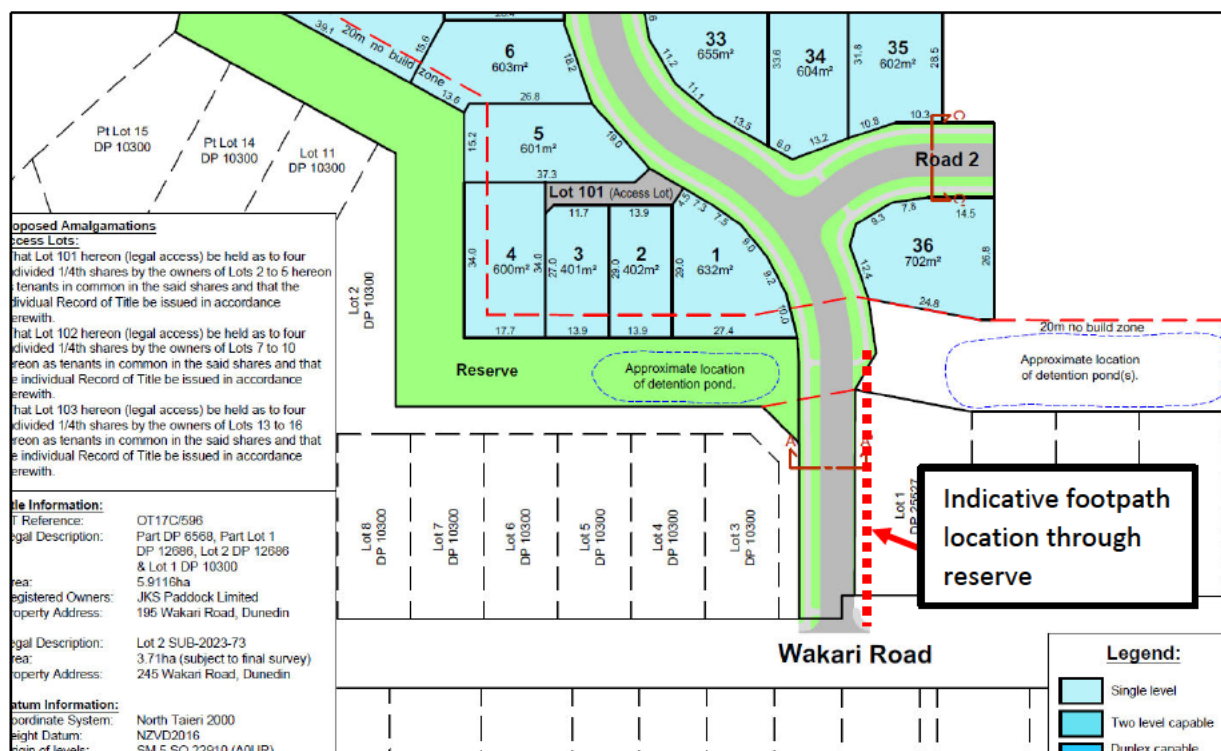


Figure 10 – Indicative location of proposed footpath through adjacent reserve

56. While it is acknowledged that having a second footpath adjacent to the park would be desirable, the proposed road design, including a footpath on the southwestern side of the new loop road only, is more advantageous for maximizing separation between the new road intersection and right of way access. As sight lines along this the new loop road are good in this location, and vehicle speeds expected to be low due to vehicles approaching the new road intersection, adverse effects on the safety in relation to the use of the reserve and lack of footpath on that side of the road are assessed as being minor.

57. The design of proposed reserve area accommodates a shared path through the site. While the exact width and alignment is subject to detailed design the once shape and configuration of stormwater ponds is known, the proposed route is considered to achieve a good level of active mode provision and connectivity through the wider site.

58. It is noted that this path specifically provides connectivity to the newly zoned Honeystone Street residential area, again providing wider connectivity between that area through to second access to link to Wakari Road, and potentially to further afar areas such as the Redwoods track, and even toward Ross Creek. Such wider connections are, however, outside of the scope of what the developer can provide for and will remain within Council's responsibility for any future infrastructure connection.

Other Matters

59. While the available legal road width will result in reduced berm widths, there is sufficient space to provide normal road infrastructure such as street lighting, and other necessary subsurface infrastructure such as 3 Waters, electricity, and telecommunications.

Traffic Generated Effects

60. The proposed development will generate in the range of 312 traffic movements per day, and peak hour traffic movements of about 34 traffic movements per hour. It is estimated that the peak hour traffic volume of Wakari Road is in the order of 8% to 10% of daily traffic volumes, equating to 69 to 86 traffic movements per hour.
61. At unsignalized intersections between major and secondary roads, where turning movements are largely unconstrained, capacity considerations are usually insignificant and detailed capacity analysis is unnecessary. The 2009 edition of the Austroads Guide to Traffic Management Part 3, Traffic Studies and Analysis, contains guidance on traffic volume thresholds below which such analysis is not required. These thresholds are shown in the Table below:

	Traffic Volumes - Vehicles Per Hour (vph)	
	Major Road (Wakari Road)	Secondary Road (New Road)
Two-Lane Road	400	250
	500	200
	600	100

62. Predicted traffic volumes turning at this intersection are considered to be well within the threshold parameters shown in the above table, and it is therefore considered unnecessary to undertake specific traffic modelling of the new intersection with Wakari Road as the level of service at this intersection is expected to be good.

Public Transport

63. Public transport is not currently provided on Wakari Road in the vicinity of the site. Nevertheless, the existing route could possibly be extended though details for this would need to be discussed with the Otago Regional Council. Furthermore, it would be prudent for any future upgrades to Wakari Road to include provisions for buses.

Pedestrians and Cyclists

64. Analysis of crash records does not indicate an overall traffic safety problem in the vicinity of the subdivision. The greatest potential impact on traffic and pedestrian and cyclist safety will occur at the new intersection to the site from Wakari Road.
65. In respect of the impact on traffic and pedestrian/cyclist safety associated with the proposal, the following is noted:

- Vehicles exiting the subdivision have adequate sight distance available which makes it easier to select appropriate gaps in the traffic stream.
- The vehicle access to the site ensures good levels of inter-visibility between vehicles entering and exiting the site and pedestrians.

66. These aspects combine to ensure that the overall effect of the development on traffic and pedestrian/cyclist safety in the area will be no more than minor.

FUTURE DEVELOPMENT

67. It is noted that the proposed subdivision is Stage 1 of a larger residential development that will eventually incorporate the adjoining land to the northeast of the site. Connectivity to future stages of the development is facilitated by the proposed road network, including the location of vehicle carriageways and footpaths.

68. Future stages of the development are likely to include a secondary intersection to Wakari Road (i.e. continuation of the “loop” road previously mentioned in this report), enhancing connectivity and resilience for the proposed transport network.

69. The applicant owns land that provides potential for a secondary access from Wakari Road. It is noted that if this is put forward in future applications, the location may be in close proximity to the existing Wakari Road/Caleb Place intersection. Effects on road safety between these two roads would likely be no more than minor given the good intervisibility between them, and limited use of Caleb Place, though these would be more comprehensively assessed at the time of any future subdivision consent.

RESPONSE TO COUNCIL CONCERNS

70. In their memo dated 18 December 2024, included in Appendix B, the Council's Transport department outlined several of their key concerns in respect of the proposed development. In short, the Council is of the view that the proximity of the proposed new road intersection to the adjacent right of way owned by 175 Wakari Road remains a significant concern from a traffic safety perspective. Ultimately, this is a key reason why they do not consider the proposed access arrangements to be acceptable, and thus view the effects of the proposed development on the transportation network to be more than minor. They also raised several less-critical matters in their memo relating to connectivity and the form of the proposed road.

71. These matters are responded to in this updated ITA and are summarised as follows:

CONCERN	RESPONSE
The applicant notes that they have secured a second potential vehicle access location, however only a single roading access connection will be constructed as part of the Stage 1 development.	The Council, while having some reservations, appear to have accepted that it is practical in this instance for a single access point to be provided for Stage 1 of the development.
The lack of footpath provision on one side of the road is not considered to be acceptable or an ideal outcome considering that this road will serve as one of the primary entrance points to the wider development area which will have a not insignificant impact on pedestrians and other mode users travelling to and from Wakari Road, and to and from the adjoining reserve. Further noting that the applicant has not considered the number of pedestrians that may seek to walk north along Wakari Road to the Redwoods track and Ross Creek Reservoir which would require crossing over the new road again at the intersection.	Paragraphs 53 to 58 assess the proposed footpath provisions, and demonstrate that the effect on levels of service will be minimal with a footpath on only one side of the initial extent of the new road. The DCC Transport department's memo does not acknowledge the applicant's willingness to construct a footpath along the edge of the adjoining Bain Reserve, the effect of which would be virtually the same as a "compliant" road cross section incorporating a footpath on both sides. A footpath through the reserve would enhance access not just for road users, but also pedestrian entry into the reserve.
Given that there are no clear physical design constraints that prohibit 1.8m wide footpaths from being provided within the subdivision, this is the minimum footpath width that we are prepared to accept.	The developer has now adopted 1.8m wide footpaths for the development.
The applicant's analysis also does not consider the potential for confusion for pedestrians waiting to cross either Wakari Road, the new intersection, or the Right of Way and the difficulty to correctly anticipate whether vehicles are entering the Right of Way or the new road.	Assessment of these matters is provided in paragraph 24 of this report.
Although it is noted that the applicant's safe system analysis only focuses on vehicles and does not consider the safety of pedestrians,	Commentary regarding the Safe Systems assessment has been updated to include reference to pedestrians. Vehicles using the

particularly the potential for confusion while crossing the intersection.	proposed new road intersection are expected to be driving below 30km/h which is the safe system threshold speed for a car vs. pedestrian crash type.
CAS data is unlikely to provide any meaningful trends given that it is unlikely that there are arrangements within the city similar to the one proposed that would give rise to increased trends in relation to driveways and intersections. CAS data only represents Police reported data and does not include near misses that are under-reported. Even serious and minor crashes are known to be significantly under-reported as well as property damage only crashes.	This updated ITA provides significant additional detail in regard to crash data for higher-volume and lower-volume driveways located in close proximity to intersections. While there is the potential for confusion or conflict to be present between vehicles, or a vehicle and a pedestrian, this has not occurred to the extent that a road safety problem has eventuated in the data reviewed. It is acknowledged that CAS only contains Police reported data, and that near misses and other issues are not captured. However, for there to have been no relevant crashes reported within the study area using over 40 years of crash data, and on roads with much higher traffic volumes than Wakari Road, suggests that the proposed intersection will operate safely.
The specific issue of the proximity of the proposed legal roading layout to the adjacent Right of Way owned by 175 Wakari Road has been raised within this assessment as a significant concern from a traffic safety perspective and as a result increases the potential of adverse effects on the safe and efficient operation of the transportation network, particularly the potential for near misses and traffic collisions between vehicles and pedestrians as a result of confusion. For those reasons, we do not consider the access arrangements as proposed to be acceptable and therefore the effects of the proposed development in its current form on the transportation network are considered to be more than minor.	The crash analysis study presented in this report shows that no relevant crashes have been reported at higher-volume driveways, nor lower-volume driveways, near intersections within the study area, where the proximity between a driveway and an intersection is a causal factor in the crash. While confusion or conflict may be present between right of way users, the proposed new road intersection users, and pedestrians, our analysis of relevant crash data suggests that this will not occur to the extent that a road safety problem eventuates. Furthermore, the probability of conflicting movements occurring between vehicles accessing the right of way, and using the proposed intersection, is very small in absolute and percentage terms. From a Safe Systems perspective, the severity of any crashes that may occur at the intersection will be below Safe Systems threshold speeds and therefore unlikely to result in serious injury. For these reasons, it is our view that the proposed intersection design will have no more than minor adverse effect on the safety of the transport network.

CONCLUSION AND RECOMMENDATIONS

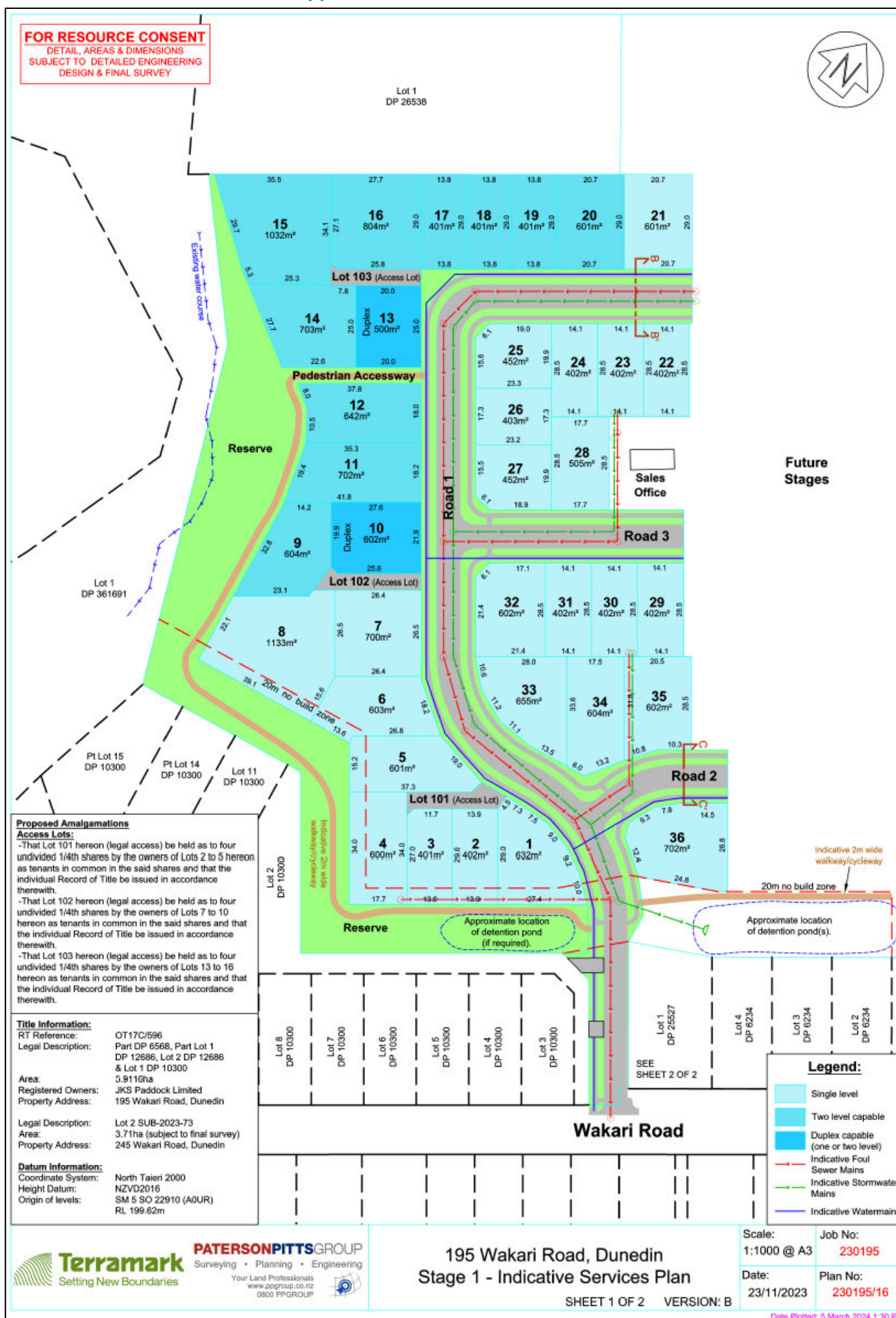
69. Based on the assessments described in this report, the following conclusions can be made in respect of the proposed subdivision at 195 Wakari Road, Dunedin:

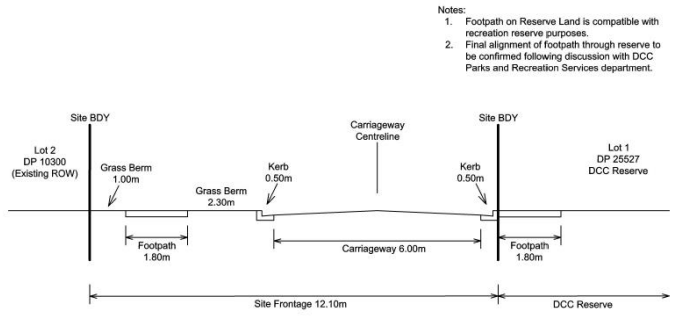
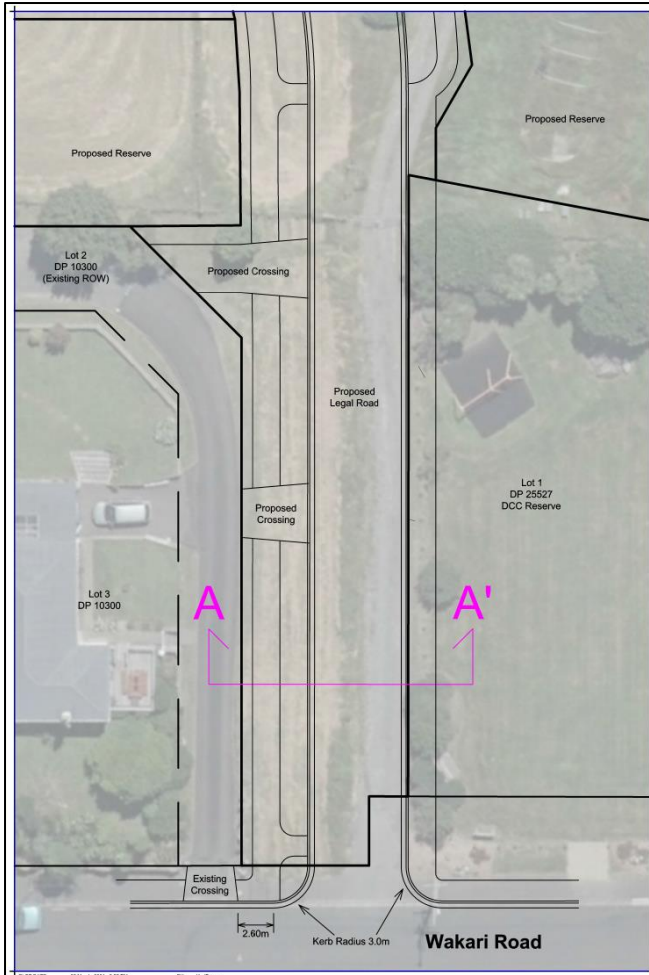
- The estimated traffic generation of the proposal is likely to be in the order of 312 vehicle movements per day, with peak hour traffic generation in the order of 34 vehicle movements per hour.
- The crash analysis study detailed within this report shows that no crashes have been reported at higher-volume driveways, nor lower-volume driveways, near intersections on main roads within the study area. This analysis of relevant crash data suggests that any confusion that may occur between the function of the proposed new road intersection, and the adjacent right of way, will not be to the extent that a road safety problem eventuates.
- The probability of conflicting movements occurring between vehicles accessing the right of way, and using the proposed intersection, is very small in absolute and percentage terms. This will be further reduced by construction of two vehicle crossings from the right of way to the new road.
- The traffic generated by the proposal can be accommodated on the wider road network with little or no adverse effects on safety or functionality.
- The subdivision is designed to an appropriate standard and has good connections (pedestrian and vehicle) to the existing public road network.
- The proposed intersection is designed to a suitable standard and has adequate sight distances available on Wakari Road.
- Existing constraints on the legal width of the new road mean that its initial extent does not meet typical formation requirements. Impacts on safety and functionality are assessed as being no more than minor, and a footpath connection is offered through the adjoining reserve to essentially provide the same connection that would normally be located within the legal road corridor.

70. The following consent conditions are recommended:

- i. Detailed engineering design plans, showing all proposed construction details for the new road to vest, shall be submitted to the Council prior to construction. The plans must specifically include:
 - Typical cross section details in accordance with Appendix A of this report.
 - Provision of minimum Approach Sight Distances at the proposed intersection in accordance with Austroads guidance.
 - All signage and markings within the proposed road network should be in accordance with the Waka Kotahi Traffic Control Devices manual.
- ii. All works required by condition (i) are completed prior to issue of titles for the subdivision.

APPENDIX A – Site Plans & Typical Cross Sections





Typical X-Section
(Scale 1:100)

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Client:
JKS PADDOCK LIMITED
195 WAKARI ROAD
Lot 1 DP 10300, Lots 1 & 2 DP 12686 and Lot 1 DP 596705

Proposed Drawing Title:
Proposed Subdivision of
RT's OT17C/596 and 1154683

Drawn by:	TM	Original Size:	Scale:
Designed by:	TM & JB		1:250
Checked by:	JB		
Approved by:	-		
Job No:	D19111	Sheet No:	2 of 2
		Revision No:	B
		Date Issued:	05/03/2024

APPENDIX B – DCC Transport Memo



Memorandum

TO:	Lianne Darby, Planner
FROM:	Reese Martin, Planner – Transport Ian Martin, Principal Advisor – Road Safety Antoni Facey, Consultant Traffic Engineer Trevor Watson, Contractor – Transport
DATE:	18 December 2023
SUBJECT:	SUB-2023-143 & LUC-2023-420 195 WAKARI ROAD, DUNEDIN

APPLICATION:

Resource consent is sought for the 36-lot subdivision of the property at 195 Wakari Road. The site is zoned General Residential 1. Access will be obtained from Wakari Road in the form of a new legal road at the eastern boundary of the site. This section of Wakari Road is classified as a Local Road under the 2GP's Road Classification Hierarchy. The subdivision will include the provision of three new legal roads, a stormwater/reserve area, and three access lots. The applicant has prepared an Integrated Traffic Assessment (ITA) to address matters raised by DCC Transport with respect to the subdivision design.

The site is subject to Rule 15.8.14 of the 2GP – Helensburgh Structure Plan Mapped Area Performance Standards.

A copy of the Helensburgh Structure Plan Mapped Area is included as Appendix 1, and the current scheme plan for this proposal is attached as Appendix 2.

We have reviewed the proposal, including the initial traffic report provided by Mr Grant Fisher on behalf of the applicant together with the response to the request for further information (RFI) and set out our response on the transport elements of the subdivision, below, as requested. The proposal is assessed as a non-complying activity.

PROPOSED TRANSPORT NETWORK/CONNECTIVITY:

It is noted that the site is located within the Helensburgh Structure Plan Mapped Area and as such, the following provision (15.8.14.2.a) is applicable to the proposal:

- i. *In addition to the requirements set out in Rule 6.8.1, each resultant site must have direct or indirect access to an internal roading network that serves the whole structure plan mapped area and provides for all sites to have access through the structure plan mapped area to a minimum of two roading connection points from the structure plan mapped area directly or indirectly to Wakari Road.*
- ii. *Activities that contravene this performance standard are non – complying activities.*

The applicant notes that they have secured a second potential vehicle access location, however only a single roading access connection will be constructed as part of the Stage 1 development. Particularly noting that it would not be practical to provide the necessary infrastructure for a second roading

connection and that an additional roading connection will be provided as part of future subdivision stages. They further advise that this is an approach consistent with previous subdivision developments within the city that have required multiple stages to achieve a high level of network connectivity.

Whilst this phased approach to the provision of a second access is less than ideal, Transport is amenable to accepting this from a practical perspective on the basis that there is some certainty that a second connection can be achieved by the developer in subsequent stages, which would also be subject to additional traffic assessment as part of any future development. Therefore, for those reasons in the interim, the non-compliance with this subdivision access provision is considered acceptable with any effects considered to be no more than minor.

The application proposes to provide a legal width of 16.6m for the majority of the proposed 'loop road' (Road 1) and a legal width of 16.3m for the remaining legal roads (Roads 2 and 3). It is considered that the proposed legal widths generally enable a compliant cross-section that will be consistent with the requirements of the DCC Code of Subdivision 2010 except for the provision of 1.5m wide footpaths and more significantly, the initial portion of Road 1 where a legal width of only 12.1m is proposed.

The applicant notes that the initial portion of Road 1 is physically constrained by the boundaries of the site which does not enable the provision of a footpath and grass berm on the righthand side of the new road. The applicant considers this to be acceptable on the basis that the road can be crossed by pedestrians safely and efficiently with little to no delay. That notwithstanding, the lack of footpath provision on one side of the road is not considered to be acceptable or an ideal outcome considering that this road will serve as one of the primary entrance points to the wider development area which will have a not insignificant impact on pedestrians and other mode users travelling to and from Wakari Road, and to and from the adjoining reserve. Further noting that the applicant has not considered the number of pedestrians that may seek to walk north along Wakari Road to the Redwoods track and Ross Creek Reservoir which would require crossing over the new road again at the intersection.

The design of the proposed intersection is discussed in the next section while the width of the proposed footpaths is discussed further below.

The applicant proposes to provide a footpath width of 1.5m for all footpaths within the subdivision on the basis that a minimum 1.5m footpath width is considered potentially acceptable under AS/NZS 4404: 2010 and the NZTA Pedestrian Planning and Design Guide. Albeit this is a bare minimum and a footpath width of 2.0m is the standard normally required by the DCC Code of Subdivision. Therefore, the proposal does not comply with this requirement. It is also important to note that the NZTA Pedestrian Planning and Design Guide sets out that 1.5m wide footpaths are an '*absolute minimum*' that is '*only acceptable in existing constrained conditions and where it is not possible to relocate road space.*' It further emphasizes that 1.8m wide footpaths are desirable in all instances which is necessary to allow two wheelchair users to pass comfortably. On that basis, given that there are no clear physical design constraints that prohibit 1.8m wide footpaths from being provided within the subdivision, this is the minimum footpath width that we are prepared to accept.

INTERSECTION DESIGN:

Rule 6.6.3.4 requires that the minimum distance of vehicle crossings from intersections with Local Roads is 10.0m with the measurement taken from the tangent point of the kerb return. The applicant notes that '*only 5.0m can realistically be achieved due the existing boundary position*' although given the design of the intersection, no separation will be provided between the new road and the shared Right of Way of 175 Wakari Road that serves as access to approximately 13 other existing sites. This is a significant cause for concern from a safety perspective given the number of vehicle movements anticipated to be created as a result of the full development of the site and the existing number of

movements generated by the existing Right of Way. Particularly as the proposed intersection design will increase the potential and frequency for confusion, conflict, and unsafe vehicle movements and therefore increases the potential for near misses and crash incidents.

The applicant has responded to this concern advising that in their view that vehicle movements will occur at low speed and most drivers will become familiar with this arrangement over time. They also note that there is sufficient space for pedestrians to wait between the Right of Way and new Legal Road while waiting for vehicles to enter/exit the subdivision. They also consider that the potential for conflicting vehicle movements is low under the assumption that the majority of traffic from both the Right of Way and the new road will turn right out onto Wakari Road towards the city during the morning peak with the reverse occurring in the evening. Although it is noted that the applicant's safe system analysis only focuses on vehicles and does not consider the safety of pedestrians, particularly the potential for confusion while crossing the intersection.

The applicant has also reviewed all crash data within the city related to driveways and intersections using the NZTA Crash Analysis System (CAS) in the most recent 5-year period to determine any relevant crash data trends at intersections/driveway locations and concludes that the proximity of driveways is not (in most circumstances) a causal factor. Notwithstanding this analysis, CAS data is unlikely to provide any meaningful trends given that it is unlikely that there are arrangements within the city similar to the one proposed that would give rise to increased trends in relation to driveways and intersections. It is also acknowledged that CAS only represents Police reported data and does not include near misses that are under-reported. Even serious and minor crashes are known to be significantly under-reported as well as property damage only crashes.

Overall, the applicant's assessment of the intersection raises clear safety concerns, particularly noting the amount of weight placed on the significant assumption that all traffic will enter and exit each existing and new site via the Right of Way and new road in the same direction at the same time with a low potential for conflicting movements. The applicant's analysis also does not consider the potential for confusion for pedestrians waiting to cross either Wakari Road, the new intersection, or the Right of Way and the difficulty to correctly anticipate whether vehicles are entering the Right of Way or the new road.

It is acknowledged that whilst in the past Transport has accepted instances where one vehicle access serving a single dwelling has been located in close proximity to a new legal road intersection, given that the existing Right of Way serves as access to at least 14 existing dwellings, this dramatically increases the cause for concern and the potential for conflict above levels which could be considered as acceptable. For those reasons, the proposed intersection design is not supported from a traffic safety perspective and an acceptable solution must be provided that achieves compliance with Rule 6.6.3.4.

After internal discussions with the Council's PARS department, it is noted that they are amenable to the location of the new road from the subdivision out onto Wakari Road being moved further north, utilising a portion of the adjacent Bain Reserve in order to achieve compliance with Rule 6.6.3.4. Albeit this would require appropriate land offsetting for the loss of a portion of the reserve. In any case it is considered that this would be an appropriate solution in order to achieve a satisfactory transport outcome. The applicant has been advised of this opportunity but at the present time has not indicated that this is an option that they would necessarily wish to pursue.

PROPERTY ACCESS:

Access Lots 101, 102, and 103 will provide legal and physical access provision to Lots 2-4, 8-9, and 14-16. The remaining resultant lots will be provided with direct frontage and access to the new legal roads.

It is noted that Lots 1, 27, 32, 34, and 36 will be corner sites located in close proximity to a new legal road intersection within the subdivision. It is therefore advised that any future access to corner sites is required to comply with Rule 6.6.3.4 – minimum distances of new vehicle crossings from intersections. It is also noted that as Lot 10 is located directly opposite the intersection of road 1 and 3, access should be obtained via Access Lot 102.

It is considered appropriate that in the event of a satisfactory outcome being achieved in terms of the location of the main access road conditions are imposed on any subsequent consent which require all Access Lots to be constructed in accordance with the minimum requirements of the District Plan. It is also advised that a formal agreement be drawn up between the owners/users of all private accesses in order to clarify their maintenance responsibilities.

Conditions would also be recommended regarding the requirements insofar as they relate to the design, construction, and certification of Roads 1, 2 & 3.

PARKING AND MANOEUVRING:

No dwellings for the individual lots are proposed as part of this subdivision. This is not unusual for vacant lot subdivisions. Although compliant on-site manoeuvring space must be provided if the applicant seeks to provide on-site car parking space on any rear site as part of future development of the sites. Overall given the size of each resultant lot, Transport does not foresee any obvious issues with respect to parking and manoeuvring provision on-site.

The applicant notes that they do not wish to define any on-street parking provision at this stage and prefer that this is dealt with at the time of detailed engineering design. In any case there is an expectation that indented parking within the new legal roads will comply with the requirements of the DCC Code of Subdivision which requires one on street car parking space for ever four dwelling units and is therefore acceptable at this stage.

GENERATED TRAFFIC:

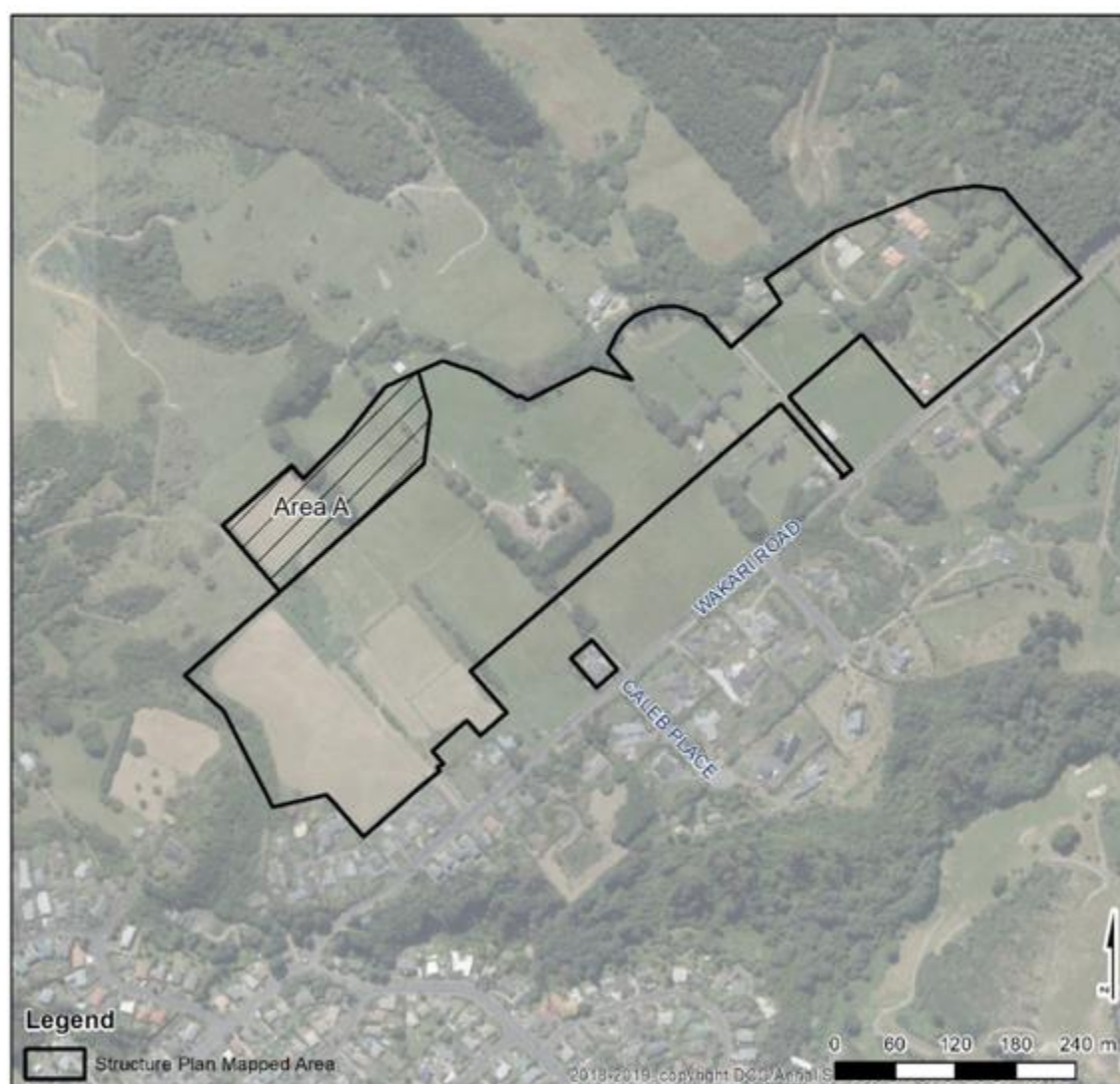
The proposal under Stage 1 will generate in the order of 312 vehicle movements per day or 34 vehicles in the peak hour. On the basis that the density of the proposed development is already anticipated within the zone, this level of traffic generation can likely be absorbed within the current transport network, with no more than minor effect on its safe and efficient operation.

CONCLUSION

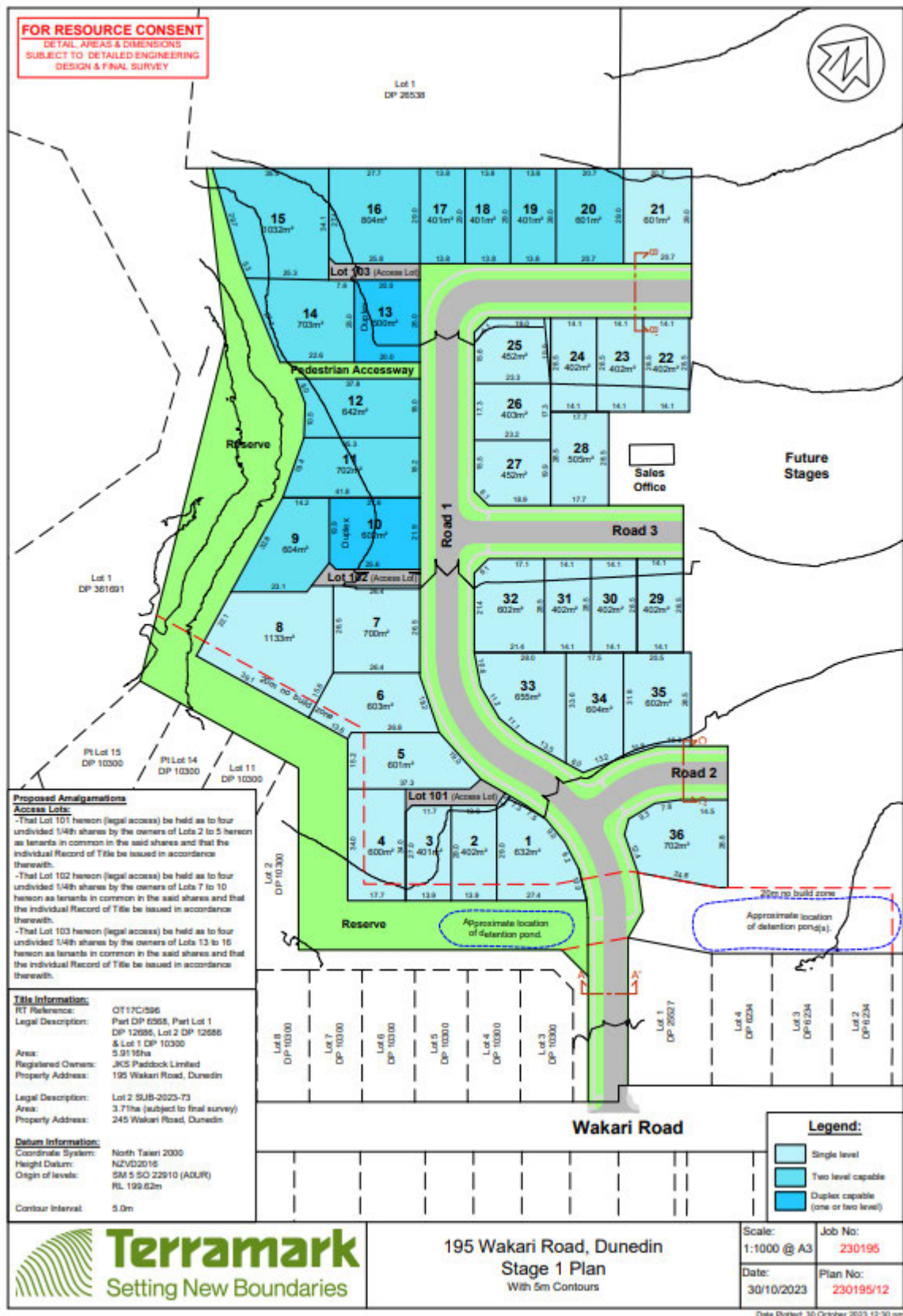
The proposed subdivision generally takes a form that has been anticipated by the zoning of the site. The specific issue of the proximity of the proposed legal roading layout to the adjacent Right of Way owned by 175 Wakari Road has been raised within this assessment as a significant concern from a traffic safety perspective and as a result increases the potential of adverse effects on the safe and efficient operation of the transportation network, particularly the potential for near misses and traffic collisions between vehicles and pedestrians as a result of confusion. For those reasons, we do not consider the access arrangements as proposed to be acceptable and therefore the effects of the proposed development in its current form on the transportation network are considered to be more than minor.

Appendix 1

Figure 15.8.14A: Helensburgh structure plan



Appendix 2



APPENDIX C – Conflict Probability Calculation

Wakari Road Conflict Probability Calc			
$p(x) = \frac{e^{-m} m^x}{x!}$			
Where:			
p(x) is the probability of "x" occurrences of an event in a situation for which the expected number of occurrences is "m"			
"m" is the average vehicle rate of arrival in the peak hour (veh/sec)			
"x" is number of veh passing in 1 sec (i.e. x=1)			
"e" is the base of the natural logarithm			
For Wakari Road traffic flow:			
x	=	1	
m	=	1/20	(i.e. 176 veh in peak hour = 1 car every 20 seconds)
p(x"1")	=	0.047561471	
For right of way traffic flow:			
x	=	1	
m	=	1/277	(i.e. 13 veh in peak hour = 1 car every 277 seconds)
p(x"2")	=	0.003597099	
Probability that both flows occur at same time:			
p(x"1" and x"2")	=	0.000171083	
Number of times that both flows occur at same time during peak hour period:			
Conflicts	=	0.61589994	

WAKARI ROAD SUBDIVISION

TRANSPORT ASSESSMENT REPORT

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INTRODUCTION

1. JKS Paddock Limited (the Developer) has commissioned the preparation of a Transport Assessment Report for a proposed subdivision of the property at 195 Wakari Road, Dunedin.
2. The proposed subdivision involves creation of 36 new residential allotments (two of which are capable of supporting duplexes), and construction of new roads to vest (including a new intersection with Wakari Road). The proposed development is shown in Figure 1 (see also Appendix A).
3. This report primarily describes the transport environment in the vicinity of the site, provides an assessment of the proposed intersection to Wakari Road, and assesses proposed transport infrastructure serving the subdivision site.

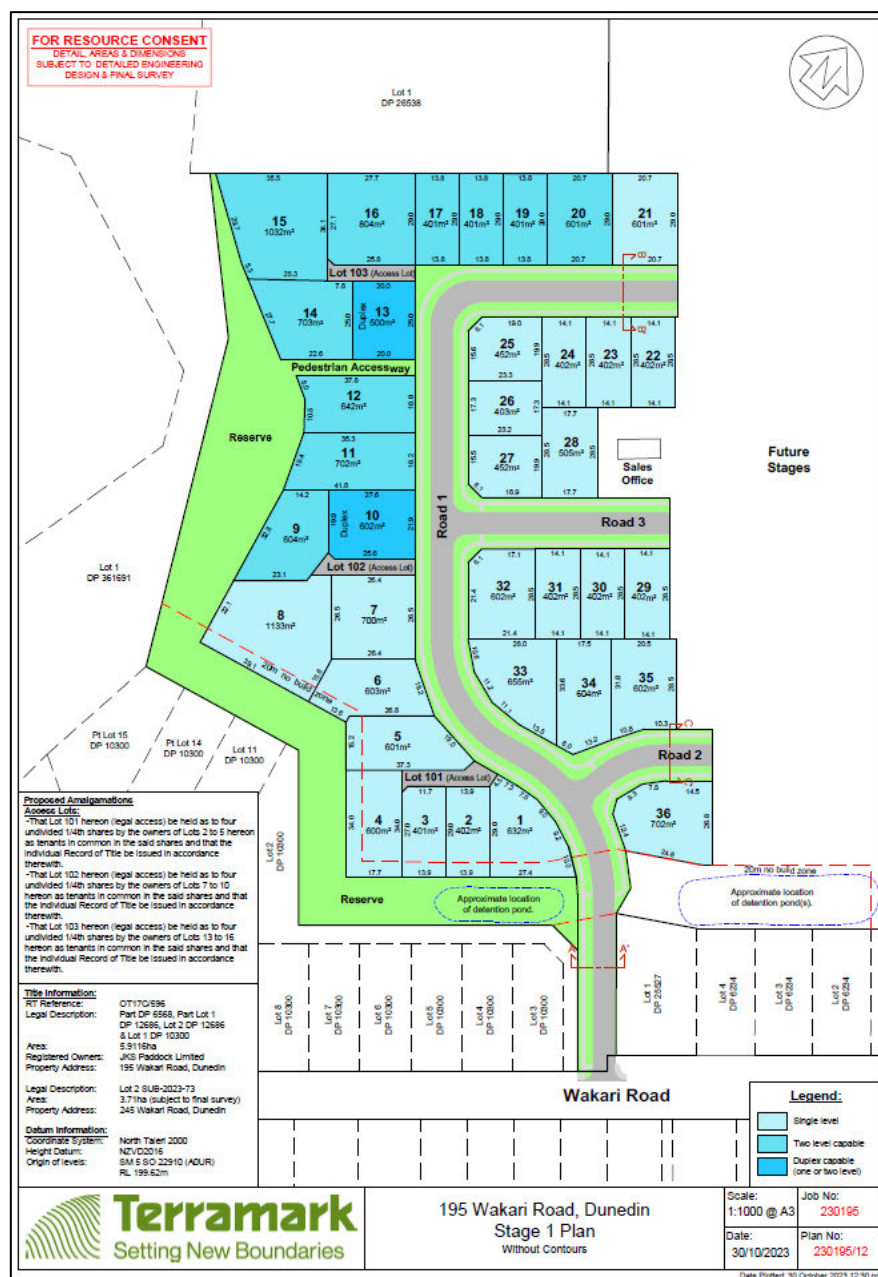


Figure 1 – Subdivision concept plan

TRANSPORT ENVIRONMENT

Site Locality and Zoning

- The property at 195 Wakari Road is held in RT OT17C/596, legally described as Part DP 6568, Part Lot 1 DP 12686, Lot 2 DP 12686 & Lot 1 DP 10300. The area to be developed is shown in Figure 2. The development site has recently been rezoned Residential 1 in the Dunedin Second Generation District Plan (2GP).



Figure 2 – Site location plan

Road Network

- The operational characteristics of Wakari Road are summarised in the table below:

WAKARI ROAD	COMMENTARY
Road Classification	Classified as a Local Road in the vicinity of the site, and a Collector Road to the southwest of Helensburgh Road.
Cross section	Sealed carriageway width of 9.2m (kerb to kerb), with on-street parking available on both sides.
Traffic Volumes	AADT = 858vpd in the vicinity of the site, with 0.95% of the AADT classified as heavy traffic (obtained from Mobileroad RAMM data).
Speed	Posted speed limit is 50km/h. Mean operating speed is 51km/h (source: Waka Kotahi Megamaps).
Pedestrians and cyclists	Sealed footpaths generally 2.0m wide are provided on both sides of the road, terminating to the northeast of the site frontage

outside the property at 205 Wakari Road. There is no dedicated cycling infrastructure.

Public Transport

There is no bus route on Wakari Road adjacent to the site.

Crash History

6. The NZTA Crash Analysis System (CAS) has been reviewed to identify crashes that have been reported in the vicinity of the site from 2018 to 2023 inclusive. The area investigated for crashes is shown shaded in blue in Figure 3, below.

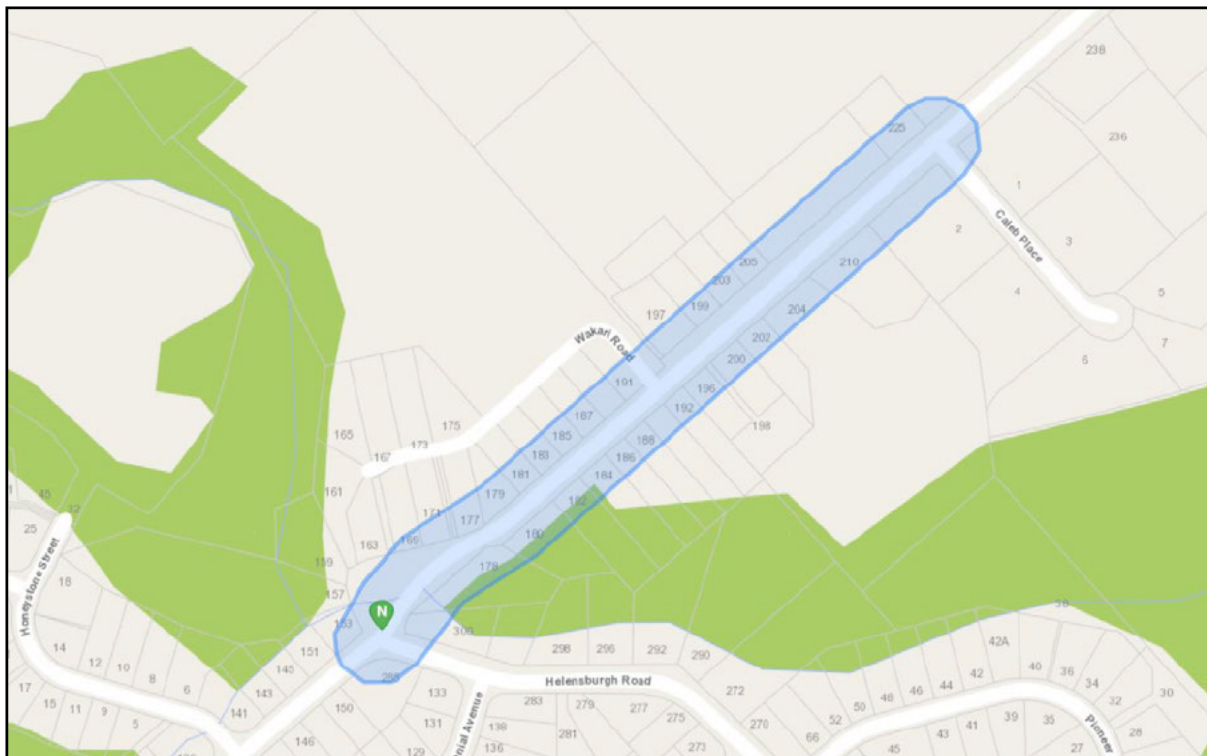


Figure 3 – CAS output diagram

7. There has been one crash on Wakari Road recorded during this period within the investigation area. The description of the crash involves a nose-to-tail crash at the intersection with Helensburgh Road, which did not result in any injuries. This crash data suggests there are no current underlying safety concerns for the road.

PROPOSED DEVELOPMENT

8. The proposed development involves subdivision of the property at 195 Wakari Road into 36 new residential allotments, a local purpose reserve, and road to vest in Council. Two of the proposed lots will also support duplex development, meaning that the subdivision may contain up to 38 dwellings. The subdivision forms Stage 1 of a larger development.
9. The relevant transportation features of the proposed subdivision are summarized as follows:
 - A new road intersection with Wakari Road provides primary access to the subdivision, with the proposed internal roading network providing access to properties.
 - A roading layout and design that encourages a low speed environment through a combination of physical dimension and alignment.
 - Footpaths and grass berms will be provided internally. Note that due to existing land ownership constraints a single footpath will be located on the southwestern side of initial extent of the new road, thereafter reverting to footpaths on both sides of the internal road network.
 - There are no vehicle crossing connections from the new road to existing adjoining properties.
 - The provision of three access lots for shared access to rear lots.
 - Good levels of pedestrian connectivity throughout the site to ensure the walkability within the development, including a pedestrian accessway through the proposed reserve.
 - Provision for road connections to future stages of the development to the northeast of the subdivision site.

TRAFFIC GENERATION

10. Traffic generation for Stage 1 of the proposed development has been assessed based on the NZTA Research Report 453 (Table C.1) for an “Outer Suburban” residential activity. Application of this traffic generation data gives the following peak hour and daily traffic generation volumes.

ACTIVITY	TRIP RATE	DWELLINGS	VOLUME
Dwelling (Outer Suburban) Peak Hour	0.9 per dwelling	38	34 vph
Dwelling (Outer Suburban) Daily	8.2 per dwelling		312 vpd

11. While the above traffic volumes will be generated for Stage 1 of the proposed development, full development of the site is estimated to be up to 100 dwellings. Thus, it is useful to provide indicative total traffic generation volumes for full development of the site. These volumes are shown in the following table. It is also noted that traffic generated by full development of the site would ultimately be split across at least two intersections to Wakari Road (i.e. the proposed intersection, plus a new future road intersection to the north of the site, near Caleb Place).

ACTIVITY	TRIP RATE	DWELLINGS	VOLUME
Dwelling (Outer Suburban) Peak Hour	0.9 per dwelling	100	90 vph
Dwelling (Outer Suburban) Daily	8.2 per dwelling		820 vpd

ROAD NETWORK

New Road Intersection – Design and Location

Sight Distance and General Design

12. The proposed new road intersection is to be formed as a T-intersection with Wakari Road, as shown in Figure 4. While the intersection does not require priority intersection control, it may be desirable to install controls to enhance conspicuity of the intersection. This matter can be confirmed through the detailed design approval process with the road controlling authority.

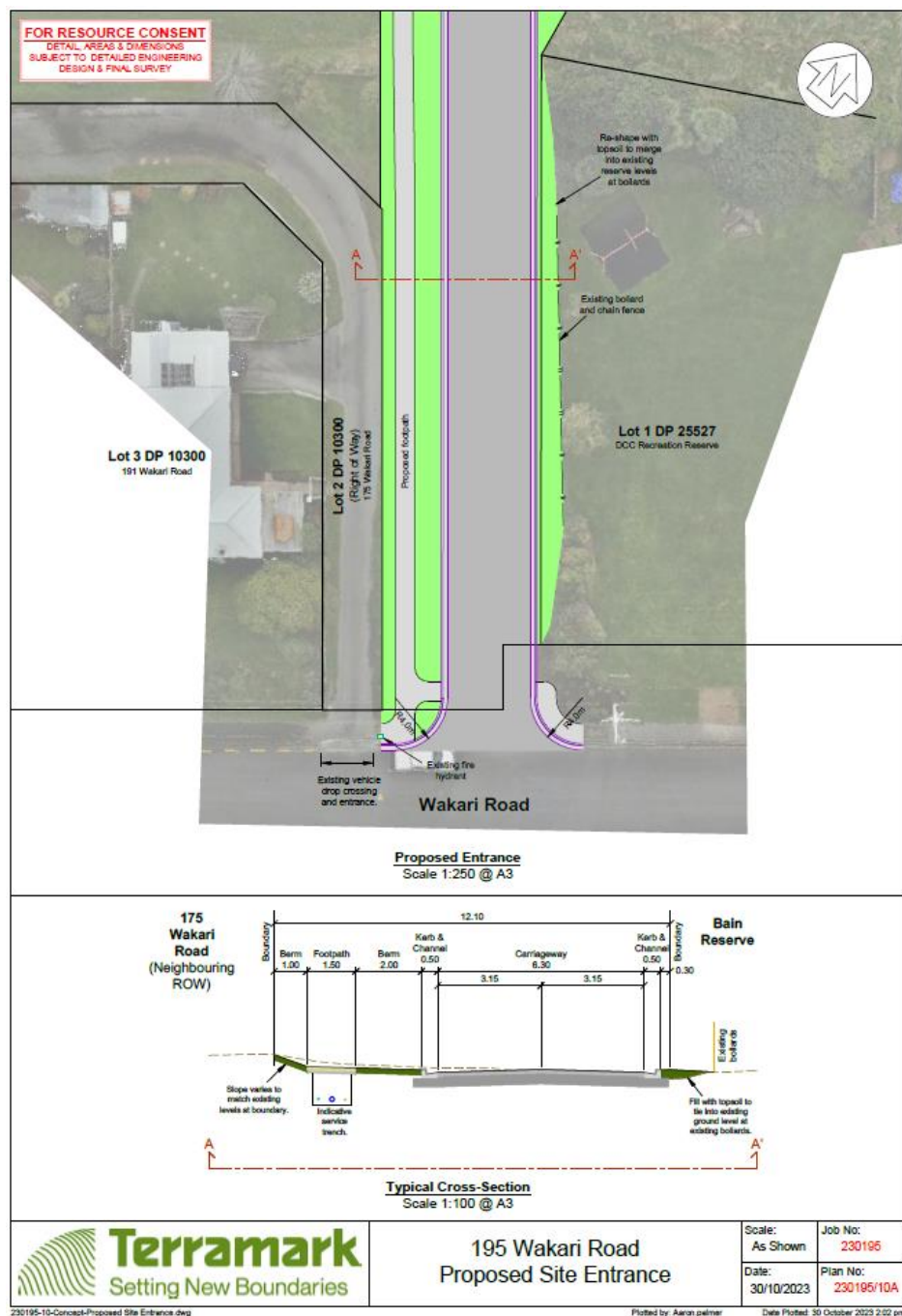


Figure 4 – Concept layout for new intersection with Wakari Road

13. The key aspects in relation to the proposed intersection include:

- The provision of appropriate sight distances; and,
- The design of the proposed intersection.

14. The operational safety at an intersection is influenced by the available sight distance, the speed of approaching traffic, and the ability of a vehicle to avoid a collision, either by stopping in time or by being able to take other evasive action.

15. Appropriate sight distance requirements at an intersection are indicated in the Austroads publication "Guide to Road Design" Part 4A "Unsignalised and Signalised Intersections". The two key sight distance parameters most relevant to the proposed intersection location are:

- Safe Intersection Sight Distance (SISD), which provides a sufficient distance for a driver of vehicle on the major road to observe a vehicle from a minor road approach moving into a collision situation and to decelerate to a stop before reaching the collision point. It is measured from driver eye height (1.1m) to the top of an approaching car (1.25m).
- Minimum Gap Sight Distance (MGSD), which provides a sufficient distance for a driver of a vehicle entering onto a major road to see a vehicle in the conflicting traffic stream in order to safely commence the desired manoeuvre. It is measured from driver eye height (1.1m) to the object height of approaching vehicle (0.65m).

16. The sight distance requirements for each the SISD and MGSD are shown below. These are based on an operating speed of 50km/h. While no grade correction has been applied, the proposed intersection location is effectively located on a crest meaning that these values are conservative, as vehicles on Wakari Road will be travelling uphill toward the intersection.

SPEED	SISD	MGSD
50km/h	97m	69m

17. The proposed intersection complies with these sight distances and is therefore assessed as being in an appropriate location. It should be noted that the Approach Sight Distance (ASD), which is measured on the minor road approach, will be confirmed as part of the detailed design process for the new road.

18. In terms of design, the new intersection with Wakari Road will be a simple T-intersection as shown above in Figure 4, which is appropriate. Any need for intersection controls and/or pavement markings and signage can be confirmed through the detailed design approval process with the road controlling authority.

Proximity of New Road Intersection to Adjacent Right of Way Access

19. It is acknowledged that the vehicle crossing to the right of way within 175 Wakari Road will be located in close proximity to the proposed intersection (see Figure 4). It is noted that, Rule 6.6.3.4.a of the 2GP requires a separation of 10m between a vehicle crossing and a "Local

Road-Local Road” intersection, whereas only 5m can realistically be achieved due to existing boundary positions and the proposed carriageway location.

20. In assessment of the proximity of the new intersection to the right of way, it is noted that the Austroads Guide to Road Design Part 4: Intersections and Crossings: General mostly contains detailed guidance for the design and management of separation between intersections and vehicle crossings for higher volume/speed roads, such as arterials. This guide states that the proximity of intersections and driveways can have a significant effect on the operation of the intersections with major intersections only (inferring that minor road intersections, such as the one proposed for this development, do not generate significant effects). Furthermore, in respect of local streets, the guide contains the following relevant guidance regarding property access considerations on urban roads¹:

It is preferred that road networks are planned and designed so that property access points are located on local streets rather than arterial roads.

Low travel speed and driver expectation of interference reduces the likelihood of conflict.

Potential conflict with pedestrian movement must be identified and appropriate solutions adopted. However, the low-speed environment should ensure that both the likelihood of conflict and the severity of crashes are minimised.

21. As the road network near the site primarily serves residential areas, it is expected that most drivers (particularly at peak times) will be familiar with any potential conflict arising due to the proximity of the vehicle crossing and the new road intersection, reducing the likelihood of such conflict occurring. Furthermore, vehicle turning movements into and out of the right of way, and new road intersection, are expected to be undertaken at low speeds, and therefore be well below the safe systems-recognised threshold speeds for “Head-on” and “Intersection” type crashes, depicted in Figure 5², below

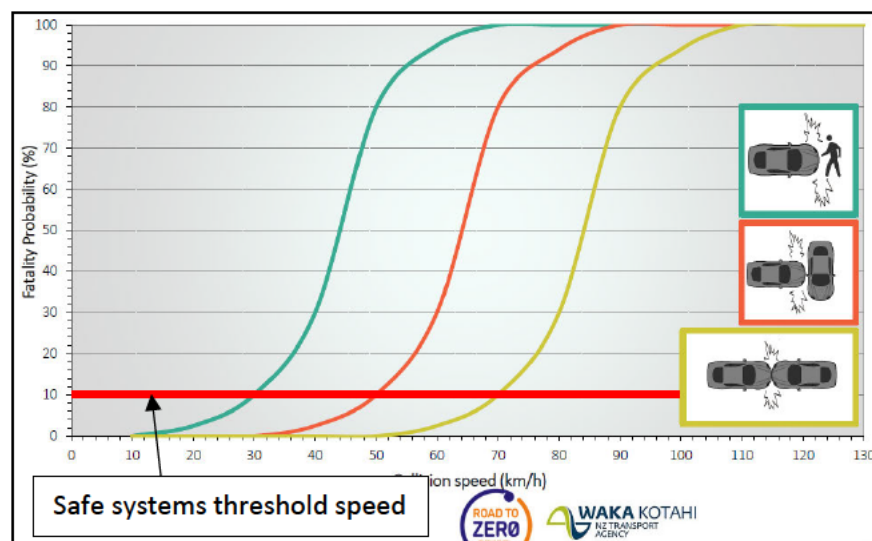


Figure 5 - Safe systems threshold graph

¹ Austroads Guide to Road Design Part 4: Intersections and Crossings: General, Table 7.2 “Property access considerations on urban roads”

² Source: Safe System Solutions (safe systems threshold line added for clarity).

22. The Austroads guidance notes that potential conflict with pedestrian movements must be identified and appropriate solutions adopted. In this instance there is considered to be sufficient space on the footpath between the right of way and the new road intersection for a pedestrian to wait (if necessary) between vehicles crossing (though should be noted that vehicles entering/exiting the right of way are required to give way to pedestrians on the footpath). There is considered to be good intervisibility between the right of way and the footpath to ensure right of way users yield to pedestrians. No specific infrastructure is considered to be warranted to address the impact on pedestrians due to the proximity of the vehicle crossing to the new road intersection, though appropriate drop-down kerb treatments should be constructed at each intersection quadrant to facilitate pedestrian movements and mobility access across the intersection.
23. The direction of travel has also been considered in assessment of vehicular conflict between the right of way and the new road intersection. Census data from Waka Commuter has been used to determine where residents on Wakari Road (within the Helensburgh suburb) typically travel to for work and education. This information is captured in Figure 6 below, and shows the vast majority of morning departures are to the Dunedin Central area and surrounding suburbs. A reversed direction of travel can reasonably be assumed for evening traffic. These destinations mean that most traffic will travel on Wakari Road to the south of the site as this is the most efficient route for commuting. Vehicles will therefore mostly turn right onto Wakari Road from both the new road intersection, and the right of way, during morning commute times, with a reversed direction of travel in the evening.

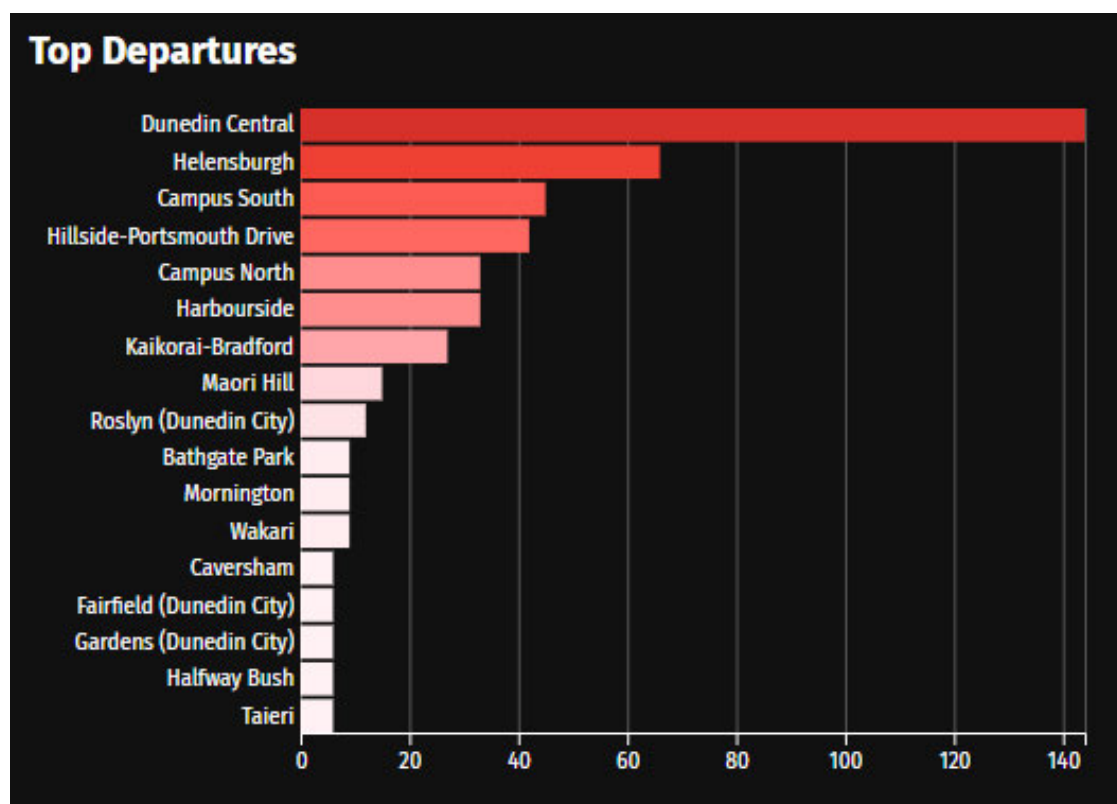


Figure 6 – Waka Commuter census data for top departures from the Helensburgh suburb

24. The prevailing directions of travel described above means that the likelihood of conflict between traffic using the right of way and the new intersection is significantly diminished,

particularly during peak commute times on the road network. For example, it is unlikely that a vehicle will turn left out of the right of way into Wakari Road, conflicting with vehicles turning right out of the new road onto Wakari Road.

25. Overall, the proposed separation distance between the new road intersection and the right of way can be supported in this instance given that existing boundary positions do not allow for compliance with the relevant 2GP rule, and both the likelihood of conflict and the severity of crashes are assessed as being minimal.

Typical Road Cross Sections

26. There are two typical road cross sections proposed within the subdivision, as follows (see Figure 7 for road typology locations, and Appendix A for detailed typical cross sections):

- The first relates to the main “loop” road, which has a legal width of 16.6m, sealed carriageway width (movement lane) of 6.3m, and footpaths on both sides. Note, however, that the initial extent of this road is required to have a narrower legal width (boundary to boundary) due to existing land ownership constraints, with a footpath on only one side. The sealed carriageway width will, however, remain consistent. The effects of this are assessed later in this report.
- The two minor roads coming off the “loop” road both have a legal width of 16.3m, sealed carriageway width of 6.3m, and footpaths on both sides.

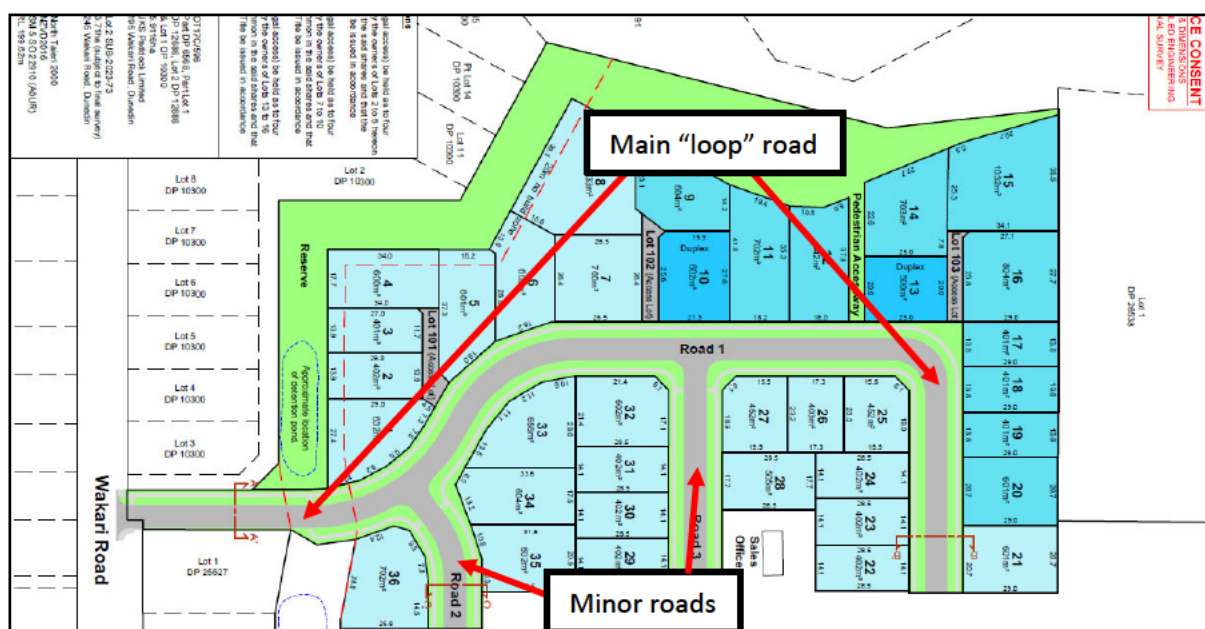


Figure 7 – Road cross section typology locations

27. NZS 4404:2010 provides a reasonable standard against which the proposed cross sections can be compared. It is noted that the Council similarly used this standard in a draft report prepared by Avanzar consultants when assessing the rezoning of the site, which has been provided to the developer to assist with assessment of this development. The E12 and E13 type road standards are applicable to the proposed subdivision and are highlighted below.