



NZ TRANSPORT AGENCY
WAKA KOTAHI



**SH1: Waitati Curve Realignment and
Proposed Blueskin General Store
Traffic Assessment**

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1 Introduction

This document has been prepared to assess the traffic effects of a realignment of SH1 at Waitati and relocation of the Blueskin General Store. The document will form part of both the Notice of Requirement for the SH1 Waitati Curve Realignment and the separate resource consent application for the proposed Blueskin General Store to enable relocation of the existing store.

1.1 Site Location

The site is located on land adjacent to a 1km section of SH1 at Waitati, extending approximately 400m north and 600m south of the Harvey Street, Waitati within Dunedin City. It is located to the west of the South Island Main Trunk Railway and south west of Blueskin Bay. Refer to Figure 1-1: Location Map which shows the location of the site.

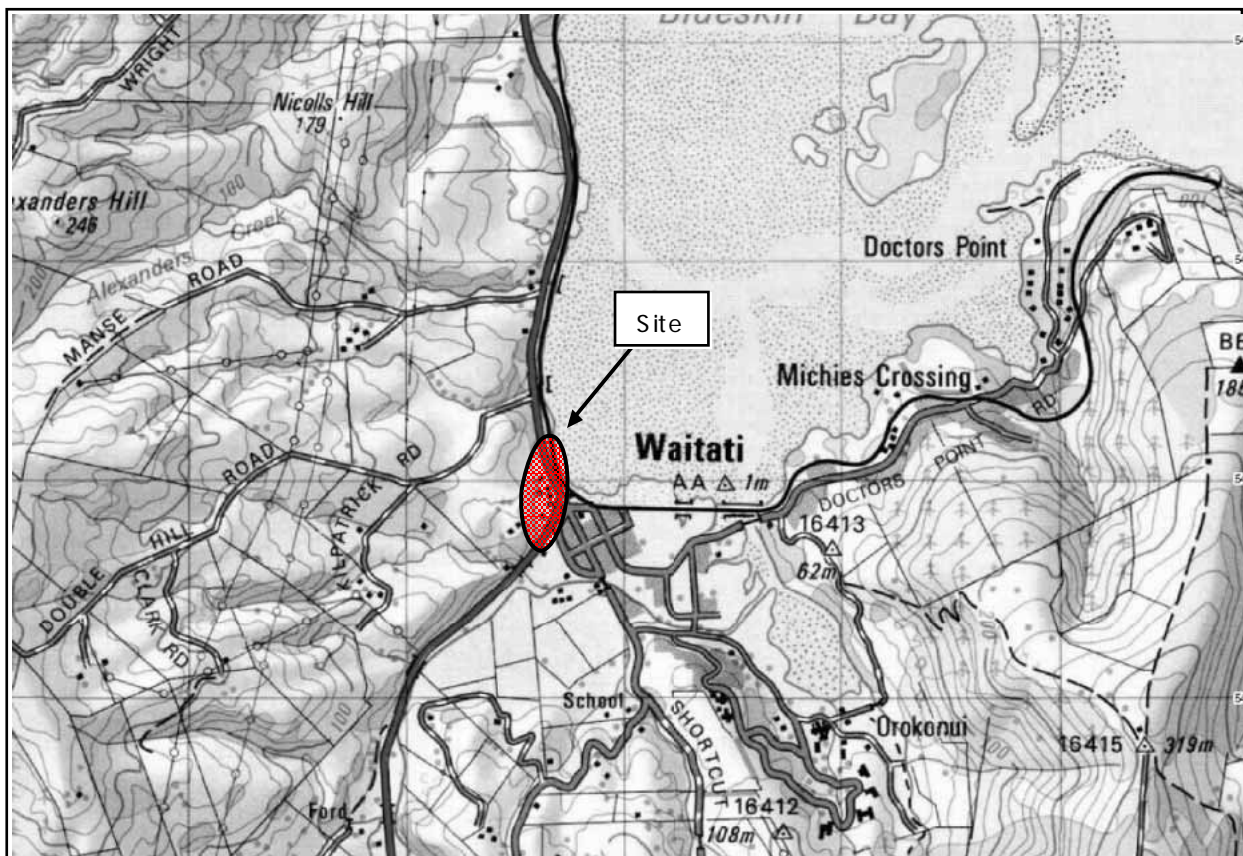


Figure 1-1 : Location Map

1.2 Proposed Road Upgrade

This proposed road upgrade involves the realignment of a curved section of SH1 at Waitati extending approximately 400m north and 600m south of the Harvey Street intersection at Waitati.

NZ Transport Agency's objectives for the project are to:

- Realign the state highway so as to align the design speed with that of the speed environment of the approaches.
- Improve the Harvey Street intersection.
- Enable continuity of the services currently offered by the Blueskin General Store, throughout and upon completion of the project development.

The overall project can generally be described as comprising of the following features:

- Realignment of approximately 1 km of SH1.
- Extension and placement of culverts.
- Associated paths, public parking and bus facilities.
- Landscaping.
- Relocation of the Blueskin General Store.

1.3 Background

This section of SH1 forms part of the Otago regional strategic road network which provides the main north-south link between Christchurch and Dunedin. It provides a direct road link for the transport of passengers and goods between Canterbury and Otago. The National State Highway Strategy (2007) identifies SH1 as a National State Highway. SH1 serves a number of functions including:

- The main north-south road link between Dunedin and Christchurch, and points further south as well as Central Otago.
- An identified heavy haulage route.
- A link to the local road network and limited direct property access.

A number of injury crashes have occurred on the one kilometre section of SH1 adjacent to Harvey Street, Waitati. The current SH1 road alignment and adjacent land use at Waitati is out of context with the surrounding driving environment, which is relatively high speed and is predominantly rural. It is further complicated by accesses to adjacent land use. These accesses increase the demand on drivers' attention as they negotiate the curve or seek to access the highway. NZ Transport Agency considers that realignment of the highway is necessary to remedy the safety issues at this location.

2 Current Transport Policies

2.1 New Zealand Transport Strategy

The New Zealand Transport Strategy (NZTS) is the overarching policy document for transportation in New Zealand. It serves as a guide for the government when making decisions regarding transport. The proposed improvements will contribute to the following objectives of the NZTS:

- Assist economic development.
- Assist safety and personal security.
- Improve access and mobility.
- Protect and promote public health.
- Ensure environmental sustainability.

The project will have a particular effect on safety, access and protection of public health because of the improved alignment of the highway and relocation of the Blueskin General Store to Harvey Street so it is not segregated from the main residential area of Blueskin Bay.

2.2 Otago Regional Land Transport Strategy

This project is consistent with the policies of the Otago Regional Land Transport Strategy. Of particular relevance are the following policies:

- Policy 3.1: Ensure transport related decision making supports improvement in safety and personal security.
- Policy 3.2: Ensure transport related decision making improves access and mobility.
- Policy 3.3: Ensure transport related decision making protects and promotes Public Health.

This project will reduce and remove land use conflicts with SH1 in this rural area. Safety will be improved by the road realignment, access improvements and new paths for pedestrians and cyclists. Incorporation of parking areas into the design will facilitate multi modal journeys, eg. walking, cycling, buses and ride sharing.

2.3 Rooding Hierarchy

SH1 is identified in the Dunedin City District Plan (DCDP) as a National Road. Harvey Street is a District Road and is part of the alternative route between Waitati and Dunedin if SH1 is not available.

The function of these roads is described in the DCDP (Method 20.4.2). National roads provide for the greatest level of movement with a minimum access function. National roads connect major localities and link with areas beyond the City. District roads provide connection between the regional roads and major rural, suburban, commercial and industrial areas.

3 Existing Road Characteristics

3.1 General

The curved section of SH1 to be realigned extends from approximately 105m south of Double Hill Road to 100m south of Bissland Culvert. The Site Plan in Notice of Requirement (NOR) Appendix B and the Layout Plans in NOR Appendix C have an aerial photograph background which illustrates the existing road characteristics. This section of highway is a Limited Access Road. Harvey Street intersects midway through this section of highway and extends in a south-westerly direction. Immediately to the east of the highway off Harvey Street is the main Waitati township. The Blueskin General Store is located on the western side of the highway and the access to the Mosley residence is on the southern side of the store. The main south railway line is adjacent to the eastern side of the highway north of Harvey Street. East of the railway line is Blueskin Bay. Also on the eastern side of the highway, there is a bus stop and parking area opposite the Blueskin General Store. South of the parking area, located between the highway and the railway line there is a former church which has been converted to a residential dwelling which is currently vacant (Morris property). Access to this property is gained from Harvey Street.

To the south and parallel to Harvey Street is Almond Street which has no intersection with SH1. On the southern side of Almond Street, and adjacent to SH1 is Bland Park. This field is owned by the Blueskin Agricultural and Pastoral Society and is used as a sports field. Access to the Park is via Harvey Street. Just north of the Bissland Culvert and east of the highway is a residential dwelling set well back from the highway (McLean). Access to this property is from SH1 just north of the Bissland Culvert.

Also just north of the Bissland Culvert on the western side of the highway is the access to the property owned by Gleeson and Guy. This residence is located some distance west of the highway.

Further north, immediately adjacent to the western side of the highway, is the Blueskin General Store. There are two accesses to the store. The Waitati Store is segregated from the majority of the Waitati Township by the highway. Blueskin General Store is a general store that, in addition to the retail of groceries and basic hardware items, is the mail centre for the residents of the Blueskin Bay area, including Waitati, Orokonui and Doctors Point. SH1 through traffic forms a proportion of the store customers.

Adjacent to and south of the store is the Mosley property which accesses the highway at the southernmost store access. The Kim property is just north of the store and the access is 20m north of the northern access to the store. The other surrounding land is predominantly rural in nature.

This section of highway is crossed by two unnamed water courses within culverts. The first is located at CH 3520 and the second which passes through the Bissland Culvert is located at CH 3830.



Figure 3-1 : SH1 at the Blueskin General Store. Taken from opposite the Store at the bus stop looking to the south. Note the two vehicles exiting from the Blueskin General Store accesses.

3.2 Existing Road Alignment

The horizontal and vertical alignment of the one kilometre section of SH1 extending approximately 400m north and 600m south of Harvey Street, Waitati within Dunedin City is out of context with the highway on either side which has a speed environment of 110km/hr.

The curve at Harvey Street has advisory speed signs on the curve of 75km/hr for southbound traffic and 65km/hr for northbound traffic; the radius of the curve is approximately 160m with a superelevation of 13%. Immediately north of the Blueskin General Store there is a reverse curve that restricts the view of southbound motorists. The vertical alignment of the road is also deficient. The combination of horizontal and vertical alignment deficiencies restricts visibility at property accesses, including the accesses to the Blueskin General Store. Consequently the speed environment of this curve is low in relation to both approaches.

There are relatively few roadside obstacles along this section of the highway and many of those obstacles within the clear zone have already been shielded with guardrail where it is not possible to relocate or remove the obstacles. Obstacles which remain unshielded include the headwall and drop to the stream bed at the Bissland Culvert.

3.3 Speed Limit

The speed limit on this section of SH1 is 100km/hr and this has been confirmed as being the appropriate speed limit for this rural driving environment. Speed limits are set based on the criteria contained in the "Land Transport Rule: Setting of Speed Limits 2003". There is insufficient development adjacent to the highway for a 70km/hr or 80km/hr speed limit to meet the criteria and be effective.

3.4 Seal Width

The seal width over the 1 kilometre project section is generally 10m wide. It comprises of two 3.5m traffic lanes and 1.5m wide sealed shoulders on both sides of the road. There is additional width at the right turn bay into Harvey Street and to facilitate left turns in to the intersection. There is also additional shoulder width on the eastern side of the highway north of Harvey Street.

3.5 Skid Resistance

This section of road has been identified for investigation and surface treatment during the NZ Transport Agency's normal monitoring programme.

3.6 Intersections

3.6.1 Harvey Street

Harvey Street is the only road which has an intersection with SH1 along this section of the highway. The intersection on the outside of the curve has a right turn bay. A traffic count provided by the Dunedin City Council found an average daily traffic volume of approximately 700 vehicles per day on Harvey Street in 2006.

Harvey Street provides the primary access to the settlements of Waitati, Orokonui and Doctors Point. It also connects with Mount Cargill Road which is used as an alternative detour route to Dunedin should SH1 between Waitati and Pinehill Road be closed for any reason. Land use activities accessed via Harvey Street, in addition to the residential area, include the Waitati Hall/Community Centre, Public Library and Waitati School. Waitati School caters for students up to Year 6.

Sight distance at the Harvey Street intersection is good with 280m of sight distance of approaching vehicles for vehicles turning at the intersection.

3.6.2 Almond Street

Almond Street has no physical intersection with the State Highway and is accessed from Harvey Street via Pitt Street.

3.7 Existing Residential and Commercial Property Access

There are five properties with residences on them and one commercial property, the Blueskin General Store, which have direct access to the State highway within the project length.

The available sight distance has been assessed at the existing property accesses. These have been compared to the minimum requirements for sight distances at accessways in the Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, Austroads 2009. The minimum requirements are set out in Table 3-1.

Table 3-1 : Minimum Sight Distance – Standards for Accesses

Operating Speed (85 th Percentile)	Minimum Sight distance Standard ¹
80km/hr	170m
85km/hr	185m
90km/hr	201m
95km/hr	217m
100km/hr	234m

Note: The distances in the Transit Planning Policy Manual, 2007 have been superseded by AUSTROADS Part 4. An operating speed of 85km/hr for northbound traffic and 95km/hr for southbound traffic was used in the assessment for accesses north of Harvey Street. For accesses south of Harvey Street an operating speed of 95km/hr was used for northbound traffic and 100km/hr for southbound traffic. The available sight distance at the individual property accesses is discussed in the following paragraphs.

3.7.1 Kim Access

The access to this residential property is at CH 3350, 20m north of the northern access to Blueskin General Store on the western side of the road. Sight distance from this access is 260m to the north and 210m to the south. From the opposite side of the road sight distance is 310m to the north and 230m to the south. The minimum sight distance standard is met in both directions from this access.

3.7.2 Blueskin General Store Accesses

The existing sight distances at the two accesses to the Blueskin General Store are detailed in Table 3-2. The sight distances available are below the minimum sight distance standard, except from the northern access when looking to the north. It is particularly limited when drivers are exiting the store from both accesses and looking to the south. The reason for this is the store is located on the western side of the road and the low radius curve to the south restricts sight distance.

Table 3-2 : Sight Distance - Blueskin General Store Accesses

	Northern Access		Southern Access	
	From Access	Opposite Access	From Access	Opposite Access
Looking to south	130m	175m	140m	160
Looking to north	230m	170m	200m	180

¹ Based on safe intersection sight distances (SISD) for cars for constrained situations where drivers will be alert (1.5s reaction time. Table 3.2).



Figure 3-2: View from Blueskin General Store Access to South

3.7.3 Mosley Access

The existing access to the Mosley property is located at the southern access to the Blueskin General Store and the same sight distance restrictions apply.

3.7.4 Morris Access

The Morris property is located on the eastern side of the highway. There are no accesses from the Morris property directly to the highway. Access to this property is via the northern end of Harvey Street.

3.7.5 McLean Access

The McLean property is located on the eastern side of the highway and the access is located immediately north of Bissland culvert. The sight distance from this access is good with 350m to the north and 320m to the south. From opposite the access it is 290m to the north and 136m to the south. The sight distance to the south from opposite the access is very limited and there is potential for conflict between northbound through vehicles and vehicles waiting to turn right into the access.

3.7.6 Gleeson Access

The Gleeson access is located on the western side of the highway immediately south of Bissland Culvert. The sight distance from this access to the south is 250m and to the north 150m. From opposite the access it is more than 350m to the south and to the north it is 320m. The sight distance for vehicles exiting the access is very restricted to the north due to the adjacent embankment and vertical alignment. Figure 3-3 shows the view from the access to the north. Sight distance from the access to the south is adequate as is sight distance opposite the access in both directions.



Figure 3-3: Looking north towards Waitati from the Gleeson Access

3.8 Existing Traffic Volumes

The annual average daily traffic volume of SH1 measured north of Pine Hill Road in 2008 was 5,800 vehicles per day with 11.5% of the traffic comprised of heavy vehicles.

3.9 Crash History

The NZ Transport Agency Crash Analysis System was interrogated to obtain the crash history for the 10 year period 2000 to 2009 inclusive. A total of 17 crashes have been reported to the NZ Transport Agency, 11 of these crashes resulted in injuries. There have been 5 crashes at the Blueskin General Store involving vehicles entering and exiting the store. Of these crashes, three were injury crashes, two serious and one minor. Four crashes have involved southbound motorists losing control on the curve at Harvey Street. Three resulted in minor injuries and one resulted in serious injuries. The one crash at the intersection with Harvey Street involved road rage and was not intersection related. The 7 remaining crashes were diverse in their nature.

The crash history is consistent with a section of road where there is restricted sight distance at adjacent development and the road alignment is out of context with the speed environment.

A summary of the crash listing and crash history diagram is in Appendix A: Crash History.

4 Summary of Existing Road Deficiencies

The existing road deficiencies arise primarily from the low radius curve. The curve provides a driving environment out of context with the adjoining road. There are accesses to a commercial property as well as a number of property accesses to residences and an intersection with Harvey Street. The property accesses do not have good visibility for approaching motorists and there have been 5 crashes at the Blueskin General Store accesses in the last 10 years and three of these have been injury crashes. There have also been 4 injury crashes involving southbound vehicles losing control on curves and the out of context nature of the road alignment is likely to have contributed to their occurrence.

5 The Proposed Upgrade

The proposal is to improve the standard of SH1 at Waitati for motor vehicles as well as pedestrians and cyclists. The improvements will comprise realignment of a kilometre of highway including widening of the Bissland Culvert. Harvey Street will be extended to the west to intersect with the realigned highway and a new intersection will be formed with a left turn lane and right turn bay on the highway and a central island on Harvey Street. Property accesses and bus stops will be relocated and parking, paths and landscaping provided.

The Blueskin General Store will be relocated to a new permanent site on the eastern side of SH1 south of Harvey Street. The existing store site will be affected by the highway realignment. The store will first be relocated to a temporary site on the east side of SH1 and north side of Harvey Street during construction.

The proposal is detailed in illustrations and plans in the NOR document and this report forms one of the Appendices to that document. The Appendices in the NOR showing the proposal include:

- Appendix A: Proposal Illustration.
- Appendix B: Site Plan.
- Appendix C: Layout Plans.
- Appendix D: Construction Plans.

5.1 Design Guides/References

The guides and references used in the design include:

- Transit New Zealand Draft Geometric Design Manual.
- Transit New Zealand Bridge Manual.
- Transit New Zealand Manual of Traffic Signs and Markings (MOTSAM).
- Austroads Rural Road Design Guide.
- Austroads Guide to Traffic Engineering Practice Part 13 – Pedestrians.
- Austroads Guide to Traffic Engineering Practice Part 14 – Cyclists.
- Transit New Zealand Supplement to Austroads Part 14.
- DCC Standard Footpath Details.
- Dunedin City District Plan.

The Austroads Guides used for this design were subsequently superseded during 2009 by a new suite of Austroads guides called the Road Design and Traffic Management Guides. The new guides are essentially a repackaging of the old guides and have few differences between the two versions.

5.2 Horizontal and Vertical Alignment

The highway realignment will consist of a single curve approximately one kilometre long. The proposed curve has a design speed of 100km/hr which is complementary to the design speed of the adjacent sections of highway, where the speed environment is 110km/hr. The curve has a 550m radius with a maximum of 5.5% superelevation. The increase in the curve radius and the reduction in superelevation will improve safety for vehicles traversing the highway. The same superelevation has been applied to the turns into and out of the Harvey Street intersection. At times SH1 between Waitati and Dunedin may be closed and Harvey Street is the start of the alternative route into Dunedin city; the lower superelevation

will improve safety for heavy vehicles. The vertical alignment will tie into the existing highway at the northern end with a gentle crest vertical curve followed by a gentle sag curve through the new Harvey Street intersection and a crest vertical curve ties the alignment into the existing highway at the south. Throughout the sag curve the highway will be generally higher than the existing road. The proposed road level coincides with the existing road level at the Bissland Culvert. The vertical alignment provides at minimum a 100km/hr design speed and meets the minimum design criteria.

5.3 General Cross Section

Two traffic lanes marked at 3.5m wide will be provided on SH1 and on the Harvey Street approaches to the highway. Sealed shoulders 1.5m wide will be provided on both sides of the highway other than north of the Harvey Street intersection. On SH1 north of the Harvey Street intersection, a sealed shoulder 1.5m to 1.8m wide will be provided. The proposed shoulder width is 1.5m south of the intersection. At the Harvey Street intersection, a 3.5m wide left turn bay and right turn bay will be provided on SH1. The new section of Harvey Street will typically have a 9.0m seal width between the kerbs.

The unsealed shoulder slopes will vary but will generally be 4:1 or 5:1 to intersect with natural ground. In some locations the shoulder may be flatter or in others where there are constraints they will be steeper and in some cases a retaining structure will be used to construct a slope as steep as 0.4:1. Safety barriers will be installed where the shoulder is steep. Cut slopes will generally be in the order of 3:1.

5.4 Culverts

The proposal involves the extension of one existing culvert and placement of a new culvert in an unnamed water course. The culvert to be extended is known as the Bissland Culvert and is located towards the southern end of the work at approximate station CH 3840. The new culvert will be located at approximately station CH 3520 just south of the Harvey Street intersection.

There are a number of other culverts which are either existing culverts to be extended or new culverts that will be placed as part of the works. These convey drainage water from one side of the highway to the other and are not in water courses. The culverts will either meet the design 9m clear zone requirement or guardrail will be installed in order to protect drivers that may leave the road from the roadside hazard.

5.4.1 Bissland Culvert (CH 3840)

The Bissland culvert is being extended on the eastern side of the road to the property boundary which is a distance of approximately 6.5m from the edge of the traffic lane to the edge of the culvert. Guardrail will be installed on both sides of the road. Refer to plans C515 and C516 in NOR Appendix D.

5.4.2 Proposed Culvert in Unnamed Watercourse (CH 3520)

A new culvert will be placed in the unnamed watercourse at approximate station CH 3520 just south of Harvey Street. There is an existing culvert across this water course where the existing highway crosses the road.

5.5 Retaining Structures

North and south of Harvey Street adjacent to the railway corridor and sports field a retaining structure consisting of a Green Terramesh Structure (GTS) will be constructed. The sections where the Green Terramesh Structure will be installed are CH3100 to CH 3370 and CH 3470 to CH 3810, refer to Plan C510, C520 and C521 in Appendix D: Construction Plans in the NOR. The terramesh will vary in height and will be a maximum of 8 metres high at CH 3280. The Green Terramesh is a reinforced earth basket and the surface will be sprayed with a grass seed mix. Guardrail will be installed along the top of the wall with a nib kerb behind the guardrail. This aspect of the design protects motorists from the roadside hazard and provides for construction of a road embankment which minimises the footprint of the fill batters and the amount of land that is required for the road.

5.6 Harvey Street Intersection

At the Harvey Street intersection a 3.5m left turn lane will be provided to separate southbound left turning vehicles from those travelling straight through on the highway.

A 4.0m right turn bay has been provided for northbound traffic on the highway wishing to turn right in to Harvey Street. A 2m wide splitter island on the Harvey Street intersection approach will better define the intersection and control turning vehicle speeds. Sight distance from the intersection will be in excess of 250m.

5.7 Lighting

The intersection of SH1 and Harvey Street paths and the parking area south of Harvey Street will be lit to provide guidance for motorists and a level of security for pedestrians.

The intersection of SH1 and Harvey Street will be lit in accordance with AS/NZS 1158.1.1:2005 Lighting for Roads and Public Spaces, V4 standard which is appropriate for a rural highway carrying the design traffic volume.

There will be some lower level spill lighting on to the carparking area south of Harvey Street, the paths and bus stop on the western side of SH1. This lower level lighting will contribute to a certain extent to security of people using these areas. Refer to Lighting Plan C549 in NOR Appendix D.

5.8 Store: Temporary Store

5.8.1 Access

Access to the site will be off Harvey Street at an existing sealed service lane which leads off the eastern side of Harvey Street and provides physical access to the Morris property and the temporary store site Lot 1 DP 26393. The service lane is located approximately 25m from the edge of the existing left turn lane from SH1 into Harvey Street. The kerb and channel and footpath on the eastern side of Harvey Street will be extended north past the store. Two dropped crossings will be formed at the access to the site, one 20m wide, and the other 8m wide and kerb and channel will be formed along the site frontage between the accesses.

The southern access is sufficient for vehicles to enter and exit the site with the existing Harvey Street location and the northern access will be temporarily fenced so it is not used. Once Harvey Street is realigned and is closer to the site, the northern access will be necessary for semi-trailer delivery vehicles to exit the site and the northern access will be used for trucks to exit the site. On site signs will be placed at the accesses to direct traffic. Appendix F of the Proposed Blueskin General Store includes the onsite signs to direct access use. The northern access to the site will be removed and kerb and channel formed once the temporary store is decommissioned. Stormwater from the site will drain into the existing Harvey Street stormwater system. Once the realignment is constructed the access will be located 62m from the left turn lane into Harvey Street. Plan C529 in Proposed Blueskin General Store: Appendix G shows the layout for the temporary store with the existing road layout. Plan C526 in proposed Blueskin General Store: Appendix G shows the layout for the temporary store once the realignment is in place.

5.8.2 Parking and Loading

The customer parking and manoeuvring area will be a hard surface, such as chipseal from the kerb and channel back to the face of the building. The parking area will drain to the kerb and channel on the western side of the area. The driveway around the back of the building will be surfaced with gravel. The maximum gradient on the parking and manoeuvring area will be 1 in 20.

Parking for 8 customer cars will be marked across the western front of the store building: 7 parks at 2.5m wide and one disabled person's park at 3.6m wide. All of the parks will be 5m deep and there will be an aisle width of 7.5m. Staff parking will be available at the sides of the building. Loading will occur at the rear of the building and provision has been made for semi-trailer units. Refer to Plan R01 in Proposed Blueskin General Store: Appendix H for delivery vehicle manoeuvring paths. The design provides for vehicles to drive on and off the site and 10m of onsite queuing space is provided.

There will be approximately 20m of hard surface between the drop crossing and the gravel surface and this will ensure that gravel is not tracked onto the road.

5.8.3 Lighting

The store parking and loading area will be lit to a minimum of 2 lux with high uniformity during the hours of night operation.

5.9 Store: Permanent Store

5.9.1 Access

There will be two accesses to the site off Harvey Street and the northern access will be 70m from the realigned SH1 intersection with Harvey Street. The northern access will be 9m wide and the southern access 10m wide and defined by a planted island across the site frontage. The southern access will be adjacent to the access to the parking area to be provided south of the store.

5.9.2 Parking and Loading

The onsite parking, loading and manoeuvring area will be a hard surface finish, such as chipseal. The parking area will drain to the existing stormwater system on Harvey Street. The maximum gradient on the parking loading and manoeuvring area will be 1 in 20.

Parking for 6 customer cars will be marked across the northern front of the store building: 5 parks at 2.5m wide and one disabled person's park, 3.6m wide, all of the parks will be 5m deep and there will be an aisle width of 15m. Staff parking will be available on the western side of the building. In addition, there is space for larger vehicles such as camper vans and cars towing trailers to park around the perimeter of the site. Loading will occur at the rear of the building and provision has been made for truck and trailer units to manoeuvre. Refer to Plan R01 in Proposed Blueskin General Store: Appendix J for truck and trailer delivery vehicle manoeuvring paths. The design provides for vehicles to drive on and off the site and 10m of onsite queuing space is provided at the northern access and well in excess of that at the southern access.

5.9.3 Lighting

The store parking and loading area will be lit to a minimum of 2 lux with high uniformity during the hours of night operation.

5.10 Property Access

The proposal includes the upgrading and relocation of all existing accesses on to the highway. The McLean property will no longer gain access via SH1. All of the remaining located accesses will have improved sight distances. The sight distances are all in excess of 250m which exceeds the minimum safe intersection sight distance for a 100km/hr operating speed of 248m and is well in excess of the minimum sight distance of 170m for a residential access to a State highway with a 100km/hr speed limit in Rule 20.5.6(ii) of the DCDP. The accesses are all to residential properties and the standard to be provided is in excess of DCDP Diagram 20G which is the minimum requirement for accesses to a State highway in a rural zone. The accesses will all be sealed for a minimum distance of 5m back from the edge of the State highway traffic lane. The accesses have been designed to minimise longitudinal gradients and the maximum change in gradient without transition will be less than 8%. The onsite vehicle accesses will be formed to a minimum width of 4m to join with the existing on site access.

5.10.1 Kim Access (CH 3360)

The Kim access will be extended to intersect with the realigned highway at right angles, in a similar manner to their existing situation and good sight distances in excess of 250m will be attained.

To ensure that sight lines south of the access are not compromised by boundary fencing of the adjacent property, the design has been developed to provide sufficient legal road width to ensure adequate sight distance is provided from this access.

5.10.2 Mosley Access (CH 3360)

The Mosley access will be relocated to intersect at the same position as the Kim access at CH3360. It will be located to the north of the existing access which will increase the separation from the Harvey Street intersection and also reduce the number of access points along this section of the highway. At the shared Kim and Mosley access a sealed shoulder, 2.7m wide will be provided on the western side of the highway for a distance of 50m south of the access and on the eastern side of the highway the painted island for the left turn into Harvey Street will be 2.5m wide at this location. Refer to plan C525 in Appendix D of the NOR.

Sight distances in excess of 250m will be attained.

5.10.3 Gleeson Access (CH 3980)

The Gleeson access to the highway is to be relocated approximately 150m south of its current position with a driveway formed to connect with the existing driveway.

The relocation of the access point will greatly improve available sight distance as it will be in excess of 250m in both directions. As a section of this access runs parallel to the highway, a front age strip of existing vegetation will be maintained to reduce the effect of vehicle headlights using the access being seen from the highway at night time. Vehicles will exit from this access to SH1 at 90 degrees to the carriageway. The NZ Transport Agency will authorise the use of this access to the property under s84 of the Government Roading Powers Act 1989 because access is not reasonably available from another road.

NZ Transport Agency will take the opportunity to relocate another existing access on the eastern side of the highway to be opposite the relocated Gleeson access. The land is owned by Mr O'Neill and the existing access is located 80m south of Bissland Culvert (CH 3920).

Widening is to be provided opposite the access as shown in Drawing C511 located in NOR Appendix D.

5.10.4 McLean Access (via Almond Street)

The existing McLean access will be closed and guardrail installed on the eastern side of the highway from Harvey Street to south of Bissland Culvert.

Road access to the two parcels of land which form the McLean property will be via an access to be formed parallel to the highway through to Almond Street.

5.11 Pedestrians

A path 1.5m wide with asphalt surfacing is to be provided on the eastern side of the highway from opposite the bus stop at CH 3370 and link into Harvey Street. Pedestrian access is also provided between the parking area adjacent to the permanent store site to Bland Park.

There will be no formed pedestrian path at the base of the Terramesh embankment between CH 3660 and CH 3840 on the eastern side of the highway. However there is adequate lateral clearance to the proposed boundary for a pedestrian path to be formed in the future.

5.12 Cyclists

The 1.5m wide shoulder along the eastern side of the highway from Evansdale will be continued through to the Harvey Street intersection with a 1.8m wide shoulder adjacent to the guardrail. A sign will direct southbound cyclists to the designated cycle route to Dunedin via Mt Cargill Road. There is no provision for cyclists to ride on SH1 through to Pinehill Road.

5.13 Public Transport and Other Modes

The shoulder will be widened at CH 3550 and a path will link to the shop, parking and Harvey Street. This will provide the opportunity for ride share pick-ups and drop-offs.

On the western side of the highway a bus stop and shelter will be provided on the western side of the highway at CH3380. The shoulder will be widened and it is just south of the parking area on the western side of the highway and opposite the northern end of the path leading to Harvey Street. There is sufficient width on Harvey Street adjacent to the permanent store for buses to make a u-turn.

5.14 Parking

A parking area will be provided to the east of the highway south of the permanent store site which will facilitate southbound park and ride or ride share. An area will also be available for park and ride or ride share on the western side of the highway on the existing highway pavement between CH 3440 and CH 3200 north of the relocated Mosley access.

5.15 Signs and Markings

Signs and markings will be installed in accordance with the Manual of Traffic Signs and Markings.

6 Construction Traffic Effects

6.1 Construction Timeframes

The construction period for the project will be approximately 24 months including the store relocation. The construction is anticipated to start in the 2010/2011 construction season subject to statutory approvals and provided there are no unforeseen circumstances. Construction will not be undertaken continuously during that period but road construction will be focussed on the summer construction season. The NZ Transport Agency will require the Contractor to undertake the works in a manner that optimises the continuation of the services and operation of the Blueskin General Store. Current project planning is that the first activity will be the establishment of the store on the temporary store site. This will be followed by demolition of the existing store and construction of the highway realignment. The permanent store site will be constructed and the store relocated to the permanent site.

6.1.1 Access during Construction

Access to Harvey Street, the Blueskin General Store and other adjacent properties will be maintained during the construction period; however there may be delays in travel along the road and temporary accesses may be required. There may be periods during the construction where it is necessary for construction reasons for access to be restricted.

6.2 Construction Methodology

Construction methods and procedures will be finalised with the Contractor once the contract has been let. However, consideration has been given to the general construction methods and they are outlined in this section.

The realignment will be constructed by conventional methods and will include:

- Installing temporary fencing.
- Machine excavation of hedges, vegetation and removal of topsoil to stockpile for reuse for landscaping.
- Extending the existing culverts and placing new culverts.
- Relocating services.
- Machine excavation to sub-grade level.
- Hand construction of terramesh baskets.
- Machine placement and compacting pavement layers.
- Installing guardrail.
- Relocation of Blueskin General Store to a temporary and permanent site.
- Demolition of the Blueskin General Store and other structures on the site.
- Forming and compacting the pedestrian and cycle paths.
- Forming and compacting the public parking areas and bus facilities.
- Installing new property fences.
- Installing lighting.
- Sealing and marking the new alignment.
- Altering and relocating existing property accesses.

- Re-spreading of topsoil, landscaping and re-vegetation.
- Installation of signs and markings.
- Tidying up following construction.

The area under construction will have temporary traffic control during the construction period in accordance with the NZ Transport Agency's Code of Practice for Temporary Traffic Management². Traffic will have a reduced speed limit through the works and the site may be reduced to a single lane at times.

The construction activities that will generate the most traffic will be the earthworks and construction of the pavements. These activities require the transport of any cut to waste material from the site and pavement materials to the site.

No specific routes will be identified for the construction traffic to travel to and from the site. The construction company undertaking the work will choose the most appropriate routes based on destination.

6.3 Effects on Adjacent Property Owners

The construction of the road will have effects on the adjacent property owners in a number of ways. The specific traffic impacts will be on access and safety. The construction will be undertaken in such a way that access to properties will not be unduly restricted. Some restrictions may be unavoidable but these will occur in consultation with the affected property owner. If changes to the existing accesses are required as part of the project temporary alternatives will be provided.

6.4 Effects on Road Users

Other users of the road are likely to be affected by delays during the construction period. The temporary traffic management will include speed restrictions and the road may be reduced to one lane at times. The restriction on road users during construction is unavoidable.

6.5 Dust

The construction work is likely to create dust during dry conditions that could potentially affect motorists using the road. The contractor will be required to minimise dust nuisance as part of their contractual requirements. This is generally done by water spraying the site when it becomes an issue.

² Code of Practice for Temporary Traffic Management, Transit New Zealand (2004)

7 Effects on Vehicular Traffic

7.1 Safety Effects

The main effect of the proposed realignment will be an increase in safety for all users of the road including motorists, cyclists and pedestrians.

Based on an analysis of typical Otago crash rates for sections of road similar in nature to the proposed road realignment, the number of loss of control and access crashes is likely to reduce by a factor of over three, refer to Appendix A: Crash Rate Calculations. These calculations show that the crash rate on this section of road is likely to reduce from the existing 34 injury crashes per 100 million vehicle kilometres to 10 injury crashes per 100 million vehicle kilometres, a 70% reduction in this type of crash. In addition, the crash severity will reduce where slopes are made traversable or obstacles shielded with guardrail.

The 100km/hr design speed for the realignment is in context with the 110km/hr speed environment on either side. Motorists will not have to make a significant change in speed to safely negotiate the section and for this reason the realignment will significantly reduce the likelihood of loss of control crashes occurring.

The improvements to the road cross section will provide a more forgiving road environment. The roadside design will have less roadside hazards along this section of road due to the provision of an 9m clear zone and many of the remaining embankments will be shielded with guardrail. This likely to result in a reduction in the severity of crashes where vehicles leave the road carriageway which will result in improved outcomes for motorists.

The Harvey Street intersection will have a right turn bay and left turn lane for vehicles entering Harvey Street. The splitter island on Harvey Street will clearly define the intersection and control the speed that vehicles can leave the highway. The intersection will be fully lit to a V4 standard³ to ensure that the layout is clearly visible at night and will improve guidance to motorists. The paths and parking areas will be lit to a lower level which will improve security.

The realignment of the curve and the improvements to access location, design and sight distance will reduce the likelihood of access related crashes occurring. All of the accesses will exceed the relevant minimum criteria for design and access sight distance contained in the DCDP. Accesses have been relocated to increase the separation from the Harvey Street intersection and to improve sight distance at the accesses.

The closing of the existing McLean access and provision of an access to Almond Street will improve safety.

As this access will run parallel to the highway there is the potential for drivers travelling the highway at night to be confused by vehicle headlights on the access. This is a matter that will be addressed during the detailed design state and mitigation such as fencing and planting will be included in the design, if required.

³ AS/NZS 1158 "Lighting for Roads and Public Spaces"

The relocation of the store to Harvey Street means that it will not be segregated from the local community. Local vehicular, pedestrian and cyclist traffic will not have to cross the highway to visit the store. Safety will be improved as the only store traffic on the highway will be traffic turning in and out of Harvey Street.

The access to the temporary and permanent store will be located on Harvey Street which has a much lower operating speed than the highway because of the proximity to the SH1 intersection.

Entry and exit to the temporary store will be via the southern access for all traffic until Harvey Street is realigned and this optimises the available separation from the highway. Once Harvey Street and the highway are realigned there will be increased separation to the intersection, however semi-trailer trucks will need to use the northern access to exit the site. There will be less than the 70m required for the proximity of an access on a district road to a State highway intersection by DCDP Rule 20.5.6(iii), however given the relatively low traffic volumes on Harvey Street, relatively low vehicle numbers visiting the store and given that this section of SH1 and Harvey Street will be under temporary traffic control for much of the time that the temporary store is operating, the adverse safety effect is likely to be less than minor. The tracking of gravel or loose material on to the road is not likely to be an issue as the entire parking and manoeuvring area will be hard surfaced at the permanent site and at the temporary site there will be an 18m width of hard surface back from the kerbline. The accesses to the temporary and permanent site will exceed the 10m clear sight triangle and the minimum width of 5.0m required in the DCDP.

As there is room for an estimated estimated 6 cars in total to park on the existing shop site and the temporary and permanent shops are of similar scale, the proposed parking is likely to meet the demand on both the temporary and permanent sites. Larger vehicles such as campervans and towing vehicles will be able to park at a number of locations around the perimeter of the site and exit the site without the need to reverse. There is sufficient space on both sites for truck and trailer units making deliveries to drive onto the site, unload and drive off the site without the need to reverse.

The permanent store will be located close to and has good visibility from both directions on the highway and its position will enable it to attract customers from the highway. These customers will be accessing the site via a well designed Harvey Street intersection.

Lighting provided at the Harvey Street intersection meets the New Zealand Standard for intersections of this type and will ensure that there will be no reduction on safety during the hours of darkness due to lack of lighting. The lighting levels on the paths and parking areas will increase security. Lighting levels within the shop parking and loading areas will meet the DCDP minimum lighting levels.

Good provision has been made for parking as part of the proposal to facilitate activities such as park and ride or ride sharing so they can be undertaken in a safe and convenient manner.

The pedestrian and cyclist facilities being provided will improve safety and ensure connectivity and integration with the existing facilities and do provide facilities in addition to that existing at present.

7.2 Traffic Volumes

There is not anticipated to be any change in the nature or volume of traffic using this section of SH1 as a result of the realignment.

7.3 Changes to Travel Times

The realignment will reduce travel times over this section of road. However this is not likely to be noticed by the majority of motorists. Through traffic will no longer have to slow to negotiate this section of the road.

8 Conclusion

The improvements to SH1 at Waitati will include a realigned road with improved property accesses and wider clear zones. The road will be in context with both State highway approaches and have a more forgiving road environment. The relocation of the Blueskin General Store to Harvey Street is an integral part of the project. The design of the traffic aspects of the temporary and permanent store sites will ensure that there is adequate onsite parking and loading facilities and that they will operate safely. The construction of the project is likely to take 24 months. The main work is the earthworks and pavement construction. The construction will be completed in sections with temporary access provided to residents. Temporary traffic management will be in place to ensure the safety of construction workers, road users shop customers and the general community.

The improvements are not likely to increase the volume of traffic, nor are they likely to alter the nature of the vehicles using the road. They will result in an increase in vehicle speeds and reduced travel times due to the improved alignment.

The main traffic effect of the proposed realignment will be an improvement in traffic safety. There is likely to be a reduction in the number and severity of crashes, particularly loss of control and access related crashes.

Appendix A: Crash History



Waitati Curve Crash History Diagram (2000 – 2009 inclusive)

Table 3-3 : Crash Listing Summary 2000 to 2009 from NZTA's Crash Analysis System

Number (Crash ID)	Date	Summary	Environmental Factors	Injuries
1 (2972975)	2/3/2009	Truck pulling onto SH1 from Harvey St hit SUV. SUV performing forbidden manoeuvre. Road rage.	N/A	None
2 (2921503)	18/2/2009	Southbound car attempting to enter Blueskin Store hit northbound car head-on.	N/A	4 Minor injuries
3 (2722178)	25/4/2007	Southbound vehicle lost control on curve, rolled onto side, crossed road, and came to rest on opposite roadside	Light rain, diesel spill	1 Minor injury
4 (2721404)	9/2/2007	Southbound driver on SH1 lost control and left the road. Overtaken vehicle	Heavy Rain	1 Minor injury
5 (2770414)	23/1/2007	Northbound vehicle hit by police car performing u-turn. Occurred at low speed – police attending earlier crash (2721262)	N/A	None
6 (2721262)	23/1/2007	Southbound driver fell asleep. Vehicle crossed centreline and came to rest in bushes on opposite side of road.	N/A	2 Minor injuries
7 (2672569)	8/7/2006	Southbound vehicle lost control overtaking. Spun 180° and left road.	Ice	None
8 (2671546)	15/5/2006	Vehicle exiting Blueskin Store hit by northbound vehicle.	Bright Sun	None
9 (2521159)	4/1/2005	Vehicle exiting Blueskin Store hit by northbound vehicle.	Light Rain	1 Serious and 1 Minor injury
10 (2423292)	7/11/2004	Southbound driver fatigued and left road.	N/A	1 Minor injury
11 (2422399)	6/7/2004	Car pulling out of Blueskin General Store hit by northbound vehicle	N/A	1 Serious and 2 Minor injuries
12 (2373057)	23/9/2003	Car pulling out of Blueskin General Store hit by northbound vehicle	N/A	None
13 (2321541)	11/3/2003	Foreign driver on wrong side of road hit vehicle travelling in opposite direction head on	Misty, Wet, Dark	2 Minor injuries
14 (2221454)	13/3/2002	Southbound vehicle entered Waitati curve too fast, lost control, and hit oncoming vehicle	Light Rain	4 Serious and 2 Minor injuries
15 (2223495)	10/3/2002	Southbound vehicle hit stray horse on road	Dark, Light Rain	None

16 (2123104)	25/11/2001	Southbound vehicle lost control near Blueskin Store	N/A	1 Minor injury
17 (2172306)	5/6/2001	Northbound vehicle hit rear of another northbound vehicle which had braked heavily to avoid vehicle pulling onto road	Wet road	None

Appendix B: Crash Rate Calculations

Crash Rate Calculations

Store Access Crash Rate

Typical crash rates for a rural 'T' intersection with no geometric or access related deficiencies were compared with the Blueskin General Store access crash rates in order to put the crash history of the Blueskin General Store accesses into "context". For a rural T intersection with the same traffic volumes, we would expect crash rates of 0.1868 injury crashes per year,⁴ which equates to about one injury crash every five years.

There has been a consistent pattern of relatively high severity crashes at the store accesses with one serious and two non injury crashes between 2005 and 2010. From 2000 to 2004 there was one serious, two minor and one non injury crash involving vehicles using the store access. With four injury crashes over a ten year period this gives a crash rate of 0.4 injury crashes per year, over double the rate for a typical intersection. Furthermore in this ten year period half of the injury crashes has resulted in serious injury, which reflects the relatively high speed environment and the associated higher risk of injury in a collision.

Curve Crash Rate

The curve crash rate at Harvey Street is similar to the store rate; there have been three injury crashes on the curve every five years. From 2000 to 2004 there was one serious and two minor injury loss of control crashes. Three minor injury crashes relating to the curve were reported between 2005 and 2009. This gives a crash rate of 0.6 injury crashes per year and a crash rate coefficient of 34 injury crashes per 100 million vehicle km.

Three sections of highway in Coastal Otago, with similar geometric standards to the proposed realignment were examined to determine the typical crash rate that might be expected following the realignment. Table 3-4 below shows that, on average, we might expect 9.9 injury crashes per 100 million vehicle kilometres. Currently the crash rate is over three times that figure at 34 injury crashes per 100 million vehicle kilometres.

Table 3-4: Crash rate comparison for Coastal Otago Highway mid-block sections

	No. of injury crashes 2005-09	Injury crashes per year	Length	Crash rate coefficient (injury crashes per 100 million vehicle kilometres)
Maheno to Herbert SH1 RP 601/5.4-12.0	5	1	6.6	8.2
Katiki Straight SH1 RP 635/0.5-7.3	2	0.4	6.8	11
Allanton to Taieri Bridge SH1 RP 729/0.0 - 6.0	7	4.4	6	10
Mean Crash rate coefficient				10
Waitati Curve SH1 RP 683/3.06 4.06	3	0.6	1	34

⁴ NZ Transport Agency, Economic Evaluation Software

