05|corridor design

5.1 Design Objectives

The first section of corridor design describes overarching design objectives for the Expressway project. These are based on:

- urban and landscape design inputs into decisions which have been made to date; and
- design principles which have been developed to direct future more developed design for the Expressway

RoNS Objectives

From the outset of the MacKays to Peka Peka project coordination has occurred with the other Wellington RoNS urban and landscape design teams. The coordination has included the definition of some common and general objectives for the urban and landscape design — these are set out below.

Environment

1. To design the highway including its horizontal and vertical alignments, cross section, structures and interchanges in response to the environment it traverses whether rural or urban.
2. To design the highway so as to retain key landscape, built, heritage and / or key ecology features along the route.
3. To design the highway with interchanges in locations that enable regional, interregional and local transport movements that can support and encourage economic development from urban and business growth.
4. To optimise the opportunities for future land uses around the highway corridor to either reinstate prior uses or develop in new ways such that the district's urban and business growth can benefit.
5. To design the highway with consideration to the needs and amenity of the local community including maintaining or enhancing the usability and amenity of public open spaces.
6. To design the highway to respond to the local drainage patterns and maximise the opportunities for improving stormwater discharge quality.
7. To design the highway to contribute to ecological sustainability and biodiversity.
8. To design the highway so as to maintain heritage and cultural elements that provide historic significance, to ensure the relevance of heritage elements through access and/or interpretation, and to promote historical and cultural narratives through the detailed design.
9. To be cognisant of resource efficiency and sustainability opportunities and innovations in the design, construction, operation and/or maintenance phases of the highway.

Accessibility

10. To design the highway so as to maintain or enhance the connectivity, usability and amenity of pedestrian, cycle and vehicles links which adjoin or cross the road corridor.
11. To design the highway with retention of all existing local roads and provide where practicable opportunities for increased accessibility through additional local connections and/or improved accessibility to public transport, cycle and walking networks.
12. Where appropriate, to design the new highway with consideration of the role of the old highway corridor in contributing to local accessibility for public transport, cycle and walking networks.
13. To design the highway to minimise social severance, community disruption and loss of amenity.
14. To design the highway to maintain or enhance access to waterways, the coast, open spaces and recreational activities.
15. To design the highway to avoid the creation of isolated pockets of land and not preclude use or development of sites in the future.

Legibility

16. To design the highway to create legible entry and exit points to and from urban areas with consideration of driver experience across the whole Wellington RoNS corridor.
17. To design the highway to provide road users with a coherent, interesting and pleasant experience.
18. To design the highway to assist safe driver behaviour with designed-in speed management and safety measures.
19. To design the highway to preserve distinctive local and distant views to aid orientation and enhance sense of place.

5.2 Design Decisions to Date

The focus of this section (and the ULDF generally) is on the urban and landscape design factors considered in the design. Importantly there were many other factors that had to be given consideration in the option analysis and design process and decisions were made balancing these factors.

This first section of the ULDF (section 5.2 -5.4) addresses foundation urban and landscape design decisions that have been made to date with respect to interchange locations, within route options and under/over options. The key design considerations are noted for these and the reasons why the decision were made are noted. These were important design process decisions noted in the methodology section of this ULDF (refer to section 1.3).

It is noted that the scope of the ULDF is on the Expressway project route determined by NZTA - it does not examine alterative route options. A separate alternative route options report describes the basis on which the proposed Expressway route was determined as preferred.

5.3 Interchanges Options Design

Early in the design process the location of interchanges along the Expressway and the points of tie-in to the existing SH1 were identified and given consideration to in the Multi Criteria Assessment process. The options considered were full or part interchanges in the sense of north and south facing ramps to give on and off access to the local road network from the Expressway. Several variant combinations of full or part interchanges were considered (refer to Figures A to D) :

A four full interchanges, being at the south end tie into SH1, Paraparaumu/Kāpiti Road, Waikanae/ Te Moana Road, and at the north tie-in to SH1 at Peka Peka

B one full interchange only at Otaihanga and no other local road connections, except connections back to SH1

C two full interchanges at Paraparaumu/Kāpiti Road and Waikanae/Te Moana Road in combination with part interchanges at the south end (south facing ramps to allow traffic off SH1 at this point) and the north end (north facing ramps to allow traffic on to SH1 at this point).

D a split interchange (in combination with other interchange options at other places as above) at Paraparaumu with on and off ramps in combination at Kāpiti Road and Ihakara Street extension.

Key Design Considerations

- the ability for the two main communities at Waikanae and Paraparaumu to have improved connectivity between them and so facilitate improved access between residents and services at each location
- the maintenance of an urban form in the district that follows the KCDC growth planning policy of a semi rural separation at Otaihanga by discouraging urban growth there and at Peka Peka
- the enhancement of economic growth opportunities in the district including the future development of Paraparaumu as the district centre

The decision made about interchange locations was for an interchange at Paraparaumu (Kāpiti Road) and Waikanae (Te Moana Road) - Option C in Figure 78. This option was preferred because:

- it provides for direct north-south connectivity between the two communities at Waikanae and Paraparaumu
- it continues to provide a good level of service on the Expressway
- it provide direct access for heavy vehicles to the Kāpiti Road commercial area and the large scale growth areas for commercial development at the airport
- it facilitates urban growth to occur in the planned for locations within the district and discourages it in other places - at Peka Peka and Otaihanga
- it provide resilience in the road network by allowing flexibility in how traffic is routed

Option A was not preferred as it had the potential to increase urban development pressure at Peka Peka against urban form planning policy. Also at Poplar Avenue the need for a full interchange was not warranted given the proximity at Kāpiti Road and additional cost.

Option B was not preferred as it had the potential to increase urban development pressure at Otaihanga against urban form planning policy, gave less immediate access to the key subregional destinations in the existing urban areas and would put more pressure on local roads like Ratanui and Mazengarb Road to deliver traffic to the Paraparaumu town centre.

Option D was not preferred as it would have impacted more on Wharemauku Stream and the walking and cycling amenity and relies on the Ihakara link being made which does not currently exist. It would also have meant a convoluted connection to the town centre for north bound traffic on the Expressway.

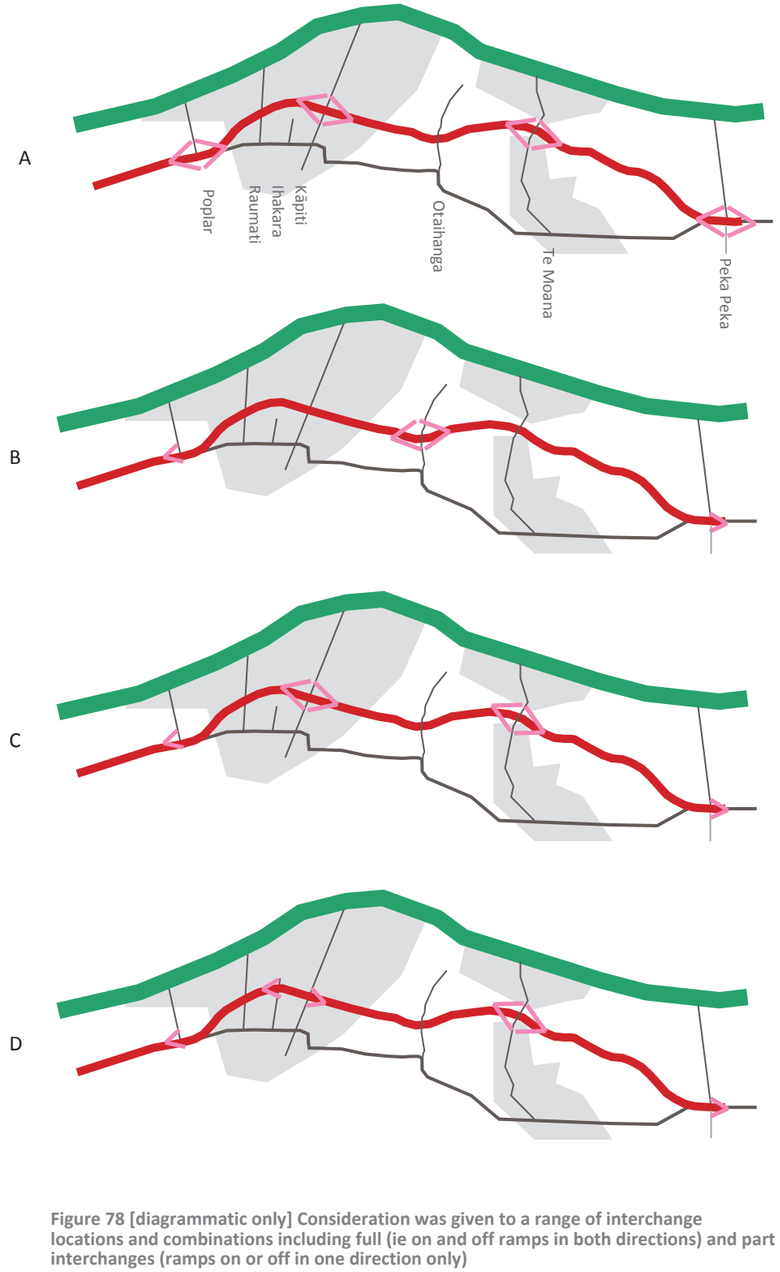


Figure 78 [diagrammatic only] Consideration was given to a range of interchange locations and combinations including full (ie on and off ramps in both directions) and part interchanges (ramps on or off in one direction only)

5.4 Route Adjustment Design

Adjustments to the currently designated route were needed in some locations to accommodate the road geometry for Expressway traffic design speed, and also to reduce effects on ecological features such as wetlands, sensitive land uses, cultural and heritage values, poor ground conditions, landscape features, and flood hazard areas.

From an urban and landscape design perspective the locations where these adjustments are of most significance are at the south end between Raumati Road and Queen Elizabeth Park, and at Waikanae between the river and Te Moana Road.

The important urban and landscape design factors considered and incorporated into the design and route option selection at these two specific locations are expanded on below.

South End

The two principal options at the south end were the routes which either:

- followed the designated area for the western link road between Raumati Road and Poplar Avenue with an extension into Queen Elizabeth Park to join back to the existing SH1; or
- followed the designated area part of the way south and then diverged to join back to the existing SH1 at what has nominally been described as 200 Main Road

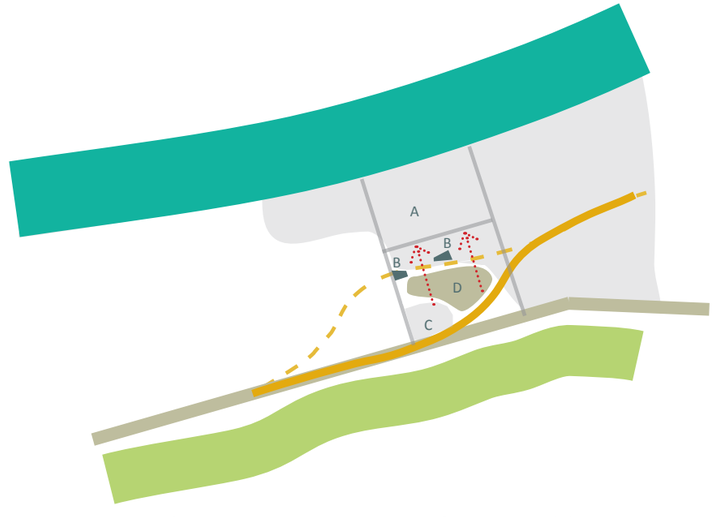
Key Design Considerations - South End

- the impact on local amenities (such as schools, parks)
- the effects on residential communities
- the opportunities to generate good quality new urban environments within residual or adjacent land
- the legibility of the route with respect to the way it fits and can be understood in the context of the urban environment
- the extent of effects on natural dune landforms and ecological areas
- the visual impacts of change

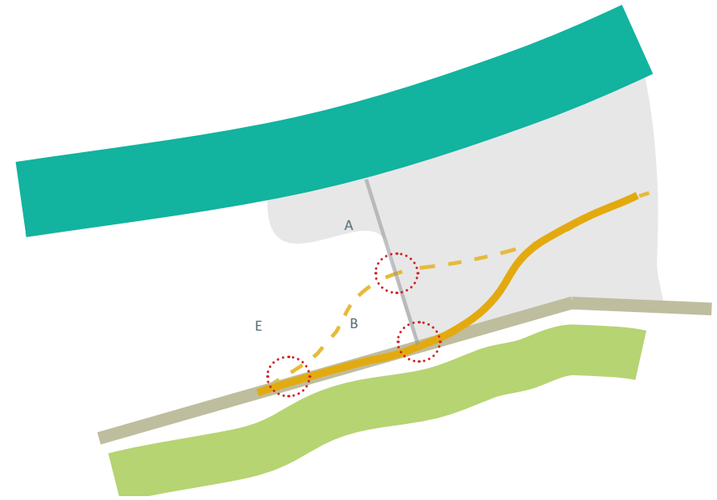
The decision made at the southern end was to take the Expressway along the more easterly route option. The reasons this option is preferred are:

- connections can be made between Leinster Ave back to Raumati where schools and other amenities are located
- it means only 1 over bridge on Poplar Ave is required and so reduces the visual effects for Poplar Ave side and Leinster Ave properties from the alternative
- it avoids effects on the dunes and ecological areas on the currently designated land
- it avoids running the Expressway close to Raumati South School, or having to remove Te Ra School
- it reduces the effects on QE Park and the potential future uses of the north end of the park
- it allows the pocket of land at the back of Leinster Ave and the existing SH1 to become part of the urban area in time if it is ever rezoned and can provided for the protection of existing features of wetlands and dunes
- it puts the south end interchange which at the urban edge of the area rather than in the QE Park which will read more logically to users

It is acknowledged that the preferred option requires the acquisition and removal of a number of residential properties. However, on balance for the reasons identified above (in combination with other non urban design or landscape reasons associated with the design) the preferred option has been selected to proceed to be designated for the Expressway.



At the south end the preferred option allows the enclave of Leinster Ave (C) residential area to better link back to the Raumati community (A) and the amenities there such as schools - Raumati South and Te Ra (B), shops, parks. The potentially residual land (D) could be developed in the future if it was rezoned as a residential area with the features of wetlands and dunes are recognised and provided for in the design.



At the south end the preferred option requires only one over bridge at the end of Poplar Ave (B) - the alternative would have required two bridges - 1 in the park (E) and the other on Poplar Ave in the proximity of residential and school uses. The preferred options also locates the bridge at the beginning of the Raumati urban area (A) - this is considered a more legible place to signal the arrival point and where a choice can be made to divert to the Paraparaumu town centre along the former SH1

Figure 79 [diagrammatic only] South End Options

5.4 Within Route Options Design

Te Moana Area - Waikanae

The two principal options at Waikanae were the routes which either:

- followed a route east of the designated western link road route; or
- followed a route on and closer to the existing designated corridor

It is noted that the currently designated route for the western link road has an alignment which functions for an 80kmh speed limit. The designated route has a bend in this Te Moana area section that will not accommodate the Expressway design speed of 110kmh. Accordingly a new alignment was required in this section to enable the required vehicle speed road geometry.

Key Design Considerations - Waikanae

- the effects on all cultural heritage including at Takamore, urupa, Maketu tree, as well as Greenaway Homestead
- the extent of effects on natural dune landforms and ecological areas including the watercourses
- the impact on local amenities such as the Waikanae River and access to schools
- the effects on residential communities
- the opportunities to generate good quality new urban environments within residual or adjacent land
- the legibility of the route with respect to the way it fits and can be understood in the context of the urban environment
- the visual impacts of change

The decision made for this section of the Expressway was to proceed with the more westerly route option. The reasons this option was preferred because:

- it reduces the number of residential properties affected
- it affects the wāhi tapu area, but only minimally in extent and much less than the current western link road designation

It is noted that consultation with iwi and the Takamore Trustees has been on-going throughout the Expressway design process.

The Cultural Impact Assessments (Technical Reports 11 & 12, Volume 3) describe the archeological and cultural values associated with this area and the mitigation proposed.The process of determining mitigation is on-going and includes consideration as to:

- the future use and ownership of currently designated land
- establishment of cultural identifiers (such as pou) and other amenities that improve the cultural function of the area
- environmental and ecological enhancement including wetland creation, landscape design, wāhi tapu spring restoration and planting.

Figure 80 Mitigation including wetland enhancement and interpretation opportunities

Figure 81 Waikanae option (preferred) which show the Expressway alignment avoiding houses on Pururi Road

Figure 82 Waikanae option (alternative) which show the Expressway alignment avoiding wāhi tapu area, but cutting through houses at Pururi Road

5.5 Over/Under Options Design

There are 12 locations along the route where a bridge is required to provide for an existing road or other access connection across the Expressway corridor.

At each of these locations the decision has broadly been whether to raise the Expressway to go over the local road, or raise the local road to go over the Expressway. The use of working simulations (see Figures 81 to 83) assisted to understand the issues associated with these different options.

The context for each of these bridge points vary from the more rural locations in the north to the more urban locations in the south. The roads themselves are typically oriented east west and provide critical roles in connecting between the beach communities (Peka Peka Beach, Waikanae Beach, Paraparaumu Beach and Raumati Beach) and the inland communities (Waikanae, Paraparaumu and Raumati).

Key Design Considerations

- the function of the local road for people walking, cycling, horse riding or moving in some non-vehicular mode who will be sensitive to changes in level, increased distances, personal security, light and air, and views
- the way in which the land form along the route currently relates relative to local roads
- the relationship to properties with access to the local roads from any over bridges changing visual relationships and physical access to that road
- the effects on the view along local road to landscape context and valued features -such as Kāpiti Island or the hills to the east
- the impact of bridge embankments on surrounding areas and connectivity
- the legibility and identity of the local road in terms of maintaining valued characteristics of that road

Linked into the decision about whether the Expressway went over the local road or vice versa was the width of the median. By considering a wider median it has been possible to split bridges to allow natural light down to the road below.

A further point to note with respect to the bridges over or under the Expressway is how this relates to any urban growth areas. This issue is covered in further detail under the Future Land Uses section. The decisions as to whether these future connections extend over or under the Expressway will be determined by the location of these and the form of the Expressway as constructed.

The decision made with respect to over and under bridges was to:

- provide for local roads at grade in the more urban southern section of the Expressway route (from Te Moana Road south) with the Expressway over on a bridge
- provide for the local road over the Expressway in the more rural northern section of the Expressway route (Smithfield Road and Ngarara Road) as well as well as any future additional east west links.

These options were preferred because:

- in most instances the local roads and larger watercourses are being used by people moving frequently east-west on the local roads. For walking and cycling and people with impaired mobility maintaining flat grades assists connectivity and accessibility between east and west side of the Expressway.
- the dune landforms allow for the Expressway to be located across the tops of dunes (Raumati and Mazengarb Road) - in other places the Expressway needs to be raised in part on embankments.
- local roads going over the Expressway would have required long ramps to provide reasonable grade slopes and this would have impacted on the ability to use properties beside those ramps
- due to the existing alignment of local roads to provide for these over the Expressway would have required substantial realignment to address curves and sight line on those local roads which would have both required additional properties to be acquired as well as changes the scale and patterns of the existing local road network.

Working simulation - view west along Kāpiti Road from approxiamtaely Arawhata Road

Figure 83 are working simulations (labelled preliminary accordingly) produced to assist the understanding of the advantages and disadvantages of the local road over or under the Expressway options. Top shows the existing situation, the middle shows the option of the local road over the Expressway, and the bottom shows the Expressway over the local road.

5.6 General Cross Sectional Design

The MacKays to Peka Peka Expressway is some 16 km in length. Along this length there are a variety of contextual conditions and these have been considered along with the essential functional and geometric design requirements in determining the standard cross section.

Several options were considered which included various median widths and embankment slopes.

Key Design Considerations

- the function of the Expressway as a safe and effective 110kmh design speed national highway route
- The RoNS guidelines for median widths
- the implications of a the width of the road footprint given the need for extensive ground improvements - the wider the footprint the larger the cost
- the desire to address the apparent width of the Expressway in the landscape
- the number of bridges required and the way in which these relate to local road crossings and any variations in median width
- the provision of a reasonably consistent driver experience for the Expressway user
- the degree to which the road width affects landforms
- the relationship between embankment slope batters and the amount of fill material required.

The decision made regarding cross section was to adopt two standard median widths (6 metres in the southern section and 4 metres in the north) with typically 1:3 batter slopes off the road edge or for cuts.

The reasons this cross section was preferred was because:

- it allows for wider median in urban areas with consequent space to plant and reduce the visual scale of the Expressway
- it allows for the Expressway over bridges to be split into two side by side and allows for light to local road below
- the embankment slope batter allows for runoff areas reducing the need for road side barriers - it is noted that NZTA requirements are being reviewed on this
- the narrower median width in the north end reduces the footprint in the areas where the ground improvements would be most extensive
- the narrower median in the north end reduces the footprint and thus the extent of the cut batters required

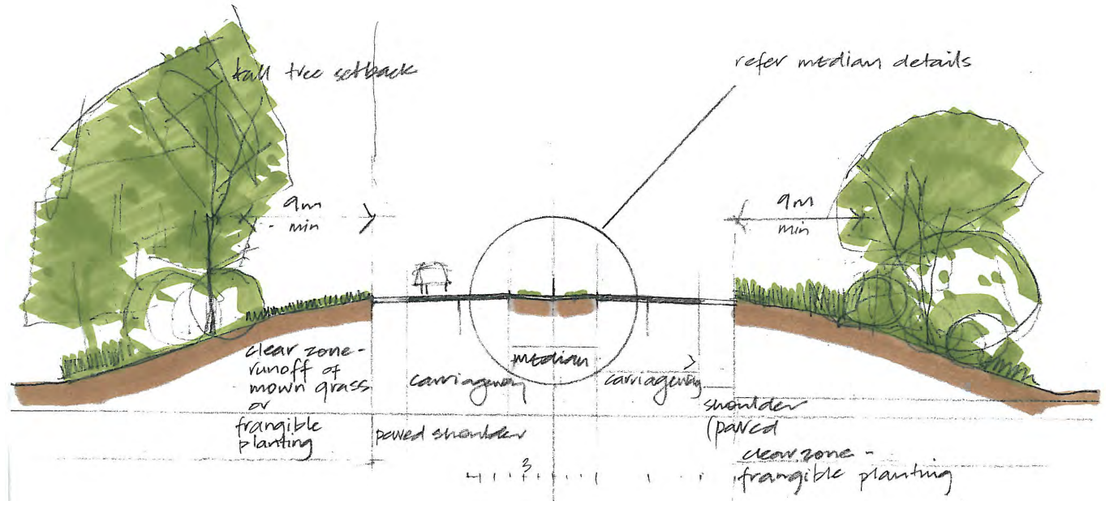


Figure 84 Preferred standard cross section showing 6m planted median

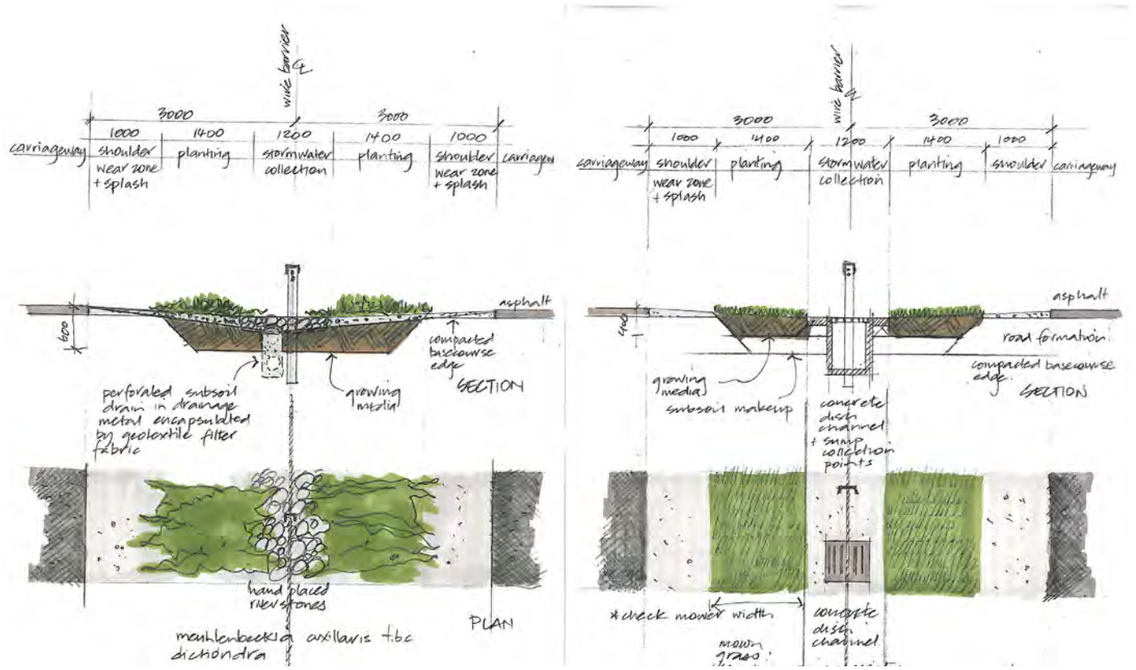


Figure 85 Options for median planting treatment for 6m width - low planting on the left or grass on the right.

5.7 Local Road Interface Design

There are seven locations where the Expressway crosses over a local road:

- Poplar Avenue
- Raumati Road
- Ihakara Street (future)
- Kāpiti Road
- Mazengarb Road
- Otaihanga Road
- Te Moana Road

Additionally there are two locations where the local road crosses over the Expressway:

- Ngarara Road
- Smithfield Road

Bridges which are not over local roads, but over waterways include the Waikanae as the largest, Wharemauku in tandem with the Ihakara Street extension, Waimeha and other smaller streams/drains to the north.

Design Concept

The concept for the local road interface design is that the public spaces of the roads and streets should take primacy over the experience for the Expressway user. It is people walking, cycling and driving on the local road that will interact with the spaces leading up to and under the Expressway -these need to be design and treated as public open spaces in their own right.

In designing for these crossings all make provision will be made for walking and cycling within the road reserve areas provided for, with the expectation that horses will utilise footpath and berm areas. For bridges over the Expressway (Ngarara and Smithfield Roads) provision is also made for a wider footpath that will provide space for horse use.

Design Principles

The following principles will apply to the design of these interface locations:

1. Recognise that the scale, form and materials should provide some consistency in approach given the frequency of local road interfaces with the Expressway
2. Provide for interaction in design of the Expressway local road interfaces with that of the bridge structures (see Bridge Principles) in terms of process and the consideration of use, materials, and forms
3. Direct sight lines along the local road to and under the bridges should be maintained and hiding places eliminated to provide walkers, cyclists and others not in vehicles with a clear and safe passage
4. Manage the scale of the abutments and their shape to provide an openness to the space beneath the bridge
5. Design the bridge approaches along local roads to lead users up to, beneath, and then beyond the bridge space so it reads as a continuous experience
6. Reference the particular characteristics of the landscape at each bridge approach to provide local identity in the landscape design treatment
7. Light the spaces beneath local road over bridges to enhance the quality of the space including the use of natural light penetration where the local road has a higher frequency of pedestrian cycling and other non-vehicular users
8. Utilise colours and materials for the space beneath the bridge over local roads that provide brightness, detail and texture to assist the visual amenity of the space
9. Ensure the surfaces and spaces beneath the bridges over local roads can be readily maintained and will not trap litter or attract graffiti
10. Provide for a simple and efficient construction to recognise that local road must continue to be functional during construction
11. Maintain adequate local road reserve widths to provide for existing and likely future upgrades and improvements and provide for interaction with KCDC in this respect
12. Provide for direct pedestrian and cyclist passage across Expressway on and off ramps to match desire lines and eliminate free turns at these intersections with local roads.

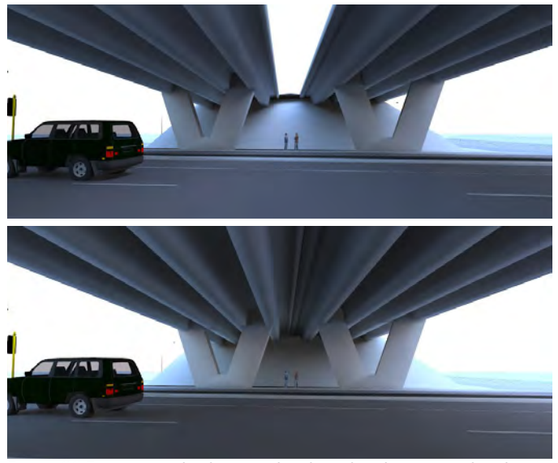


Figure 86 Expressway bridge over local road with a gap and without - use a gap where frequent local road use to allow natural down light

Figure 89 Concept of wrapping the under bridge abutments out into the landscape beyond

Figure 90 Existing landscape character can be retained - bend of the road, dune forms, scale and type of vegetation, path locations - continues local identity

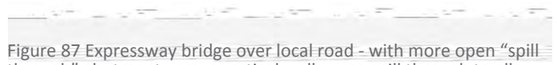


Figure 87 Expressway bridge over local road - with more open "spill through" abutment versus vertical walls - use spill through to allow more openness

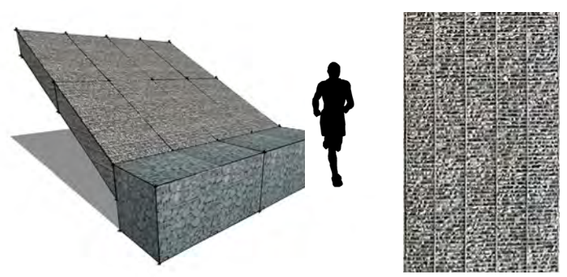


Figure 88 Use of materials that have a texture, do not attract graffiti and are easily maintained - proposed gabion basket - fill can be small stones or other granular materials that reflect the granular nature of sand dune country through which the Expressway passes

Figure 91 At local roads the surfaces can be treated differently and bright colours used to lighten the space

5.8 Bridge Design

As noted with regard to the local road interface design principles, there are bridges over local roads as well as local roads over the Expressway. There are also places for pedestrian bridges over the Expressway and bridges along the cycleway/walkway — the latter of these is addressed under the cycleway/walking design principles.

There has been some advancement of the design to enable some definition to the bridge forms and concept. This is described below with Principles to follow.

Design Concept

The Expressway is a new feature in the landscape and by its nature is strongly horizontal — the expression of that horizontality is acknowledged whilst also recognising that it hovers over the ground where it crosses local roads.

Where bridges interface with local roads the concept is to translate its supporting armature of columns and beams into a single and fluid shape to simplify the appearance of the structure rather than drawing attention to it — this is a sculptural approach.

More fluid forms are representative of natural shapes in the dune landscape and knits with the probable concrete material use planned for this project as it can be readily shaped.

The design of the bridges as a series of components that together form a whole allows for the bridges to be conceived as single kits of parts. It also allows for the components to be repeated and the same approach reused at the multiple crossings to register as a 'family' of bridges.

Using concrete prefabricated parts will allow fine levels of quality control, cost benefits and significant improvements in construction time at the crossings.

Components and Materiality

The typical bridge components include the edge barrier, cross head, deck and support piers. The intention is to use standard barrier (TL5 or the like), deck (super "T" or hollow core) and cross heads, but to sheath these and tie them into a seamlessly sculpted column. The concrete material should also be considered in terms of its texture and colour.

Design Principles

The following principles will apply to the design of the bridges:

1. Make the bridges generally consistent in their form so they register as a 'family' and provide some visual continuity within the local environment
2. Express the bridges as simple forms that sit across the changes in landscape and are not seen as strong statements in their own right
3. Unite the bridge elements of pier, cross head, deck and barrier as one sculptural form and ensure services are concealed from view
4. Ensure the form of the bridges from the underside is visually appealing to recognise the primacy of the local road user's experience in design consideration
5. Design the intersection of the piers with the ground in concert with the local road interface design of abutment forms and materials (refer to local road interface design principles)
6. Light the spaces beneath local road over bridges to enhance the quality of the space including the use of natural light penetration where the local road has a higher frequency of pedestrian cycling and other non-vehicular users
7. Use architectural lighting to emphasise the sculptural forms of the bridges and light units that are readily serviceable from the ground
8. Utilise the opportunity provided by multiple bridges to make a system of parts that can be repeated at each location and improve efficiency of construction
9. Use textured finishes within the bridge elements' surfaces to provide a crafted finish - avoid printed forms
10. Repeat the bridge design concepts within the design of pedestrian bridges recognising that these may be able to utilise lighter weight materials
11. Develop each bridge crossing design considering the pier types best suited to that location
12. Locate bridge piers associated with bridge watercourse crossings away from riparian edges to prevent need to armour stream edges
13. Ensure that the integrity and significance of the bridge forms as important to the amenity of the community is not accorded any less priority than the other design requirements for the Project

Figure 92 Dune shapes are sculptural and provide a point of reference — the play of light and shade provide relief

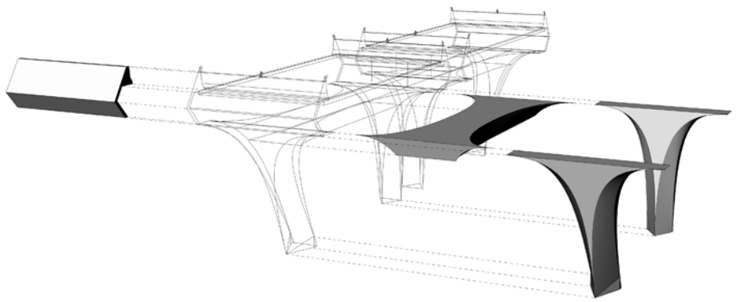


Figure 93 By considering the main elements of a concrete bridge that can be manipulated the barrier, cross head and pier present opportunities to be seen as one united form

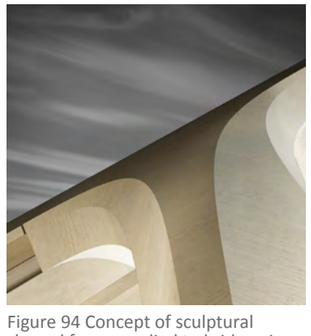


Figure 94 Concept of sculptural shaped forms applied to bridge pier

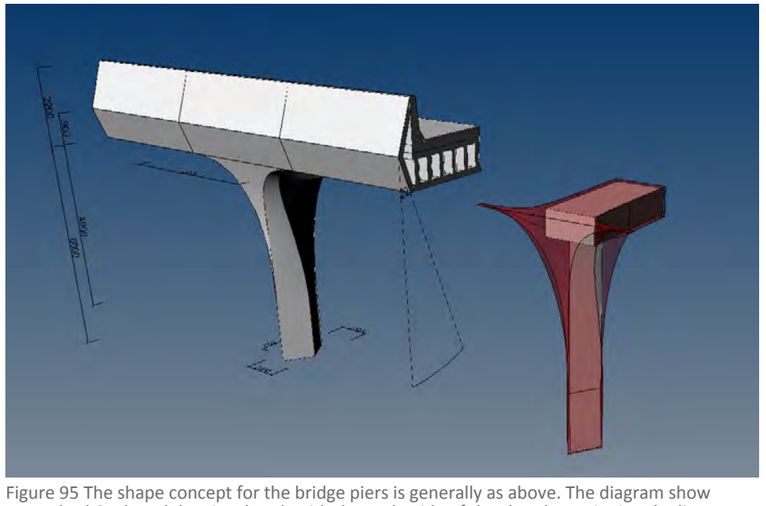


Figure 95 The shape concept for the bridge piers is generally as above. The diagram show a standard 6m length barrier sheath with the underside of the sheath continuing the line vertically to generate the incline of the pier. The intersection of the barrier sheath and the pier top hide the end of the crosshead. A void in the angle of the barrier sheath provides for deck drainage or other conduits. The angles and length of components will be determined in detailed design.

5.9 Noise Design

The context for the Expressway varies in character along its length and includes rural as well as urban interfaces. The existing SH1 and other local roads currently generate noise, but although adding the Expressway may reduce noise from SH1 there will be increased and new noise to areas that have otherwise been relatively quiet.

It is recognised from public consultation and consultation with KCDC that noise and its management is an important aspect of the Expressway design that needs to be well provided for.

Design Concept

The Expressway by its nature will change the noise environment. The noise generated by the Expressway will be addressed in two ways. First the approach will be to design the road surface to use asphalt that minimises noise at source (i.e. from wheels running on the road). Secondly shapes and forms that act as barriers to block noise between the Expressway and the potential receivers will be integrated into the landscape.

It is proposed that a standardised system of noise management shapes and forms will be produced that can be applied along the route in different configurations. This will provide a consistent visual, construction and maintenance regime for the Expressway and its context. The system in terms of its materiality will relate to the other structures on the route such as at bridge locations to reinforce the identity of the Expressway. Advantage will be taken of the corridor width, changes in ground level, and general intended planting density to treat the shapes and forms as integral to the landscape.

Components and Materiality

The typical noise management components include:

- Open Grade Porous Asphalt [OGPA] throughout the urban areas and extending north to approximately Smithfeild Road to reduce noise generation at point source
- the ground will be shaped to provide rises and extensions to natural land forms to block noise - these are planted
- gabion baskets forms in various heights with ramped and planted ground behind to visually integrate with context (Type B)
- standard concrete bridge barrier design (see bridge design) to block noise emanating from the over bridges (Type C)
- residential property timber panel boundary fences to incorporate noise reducing construction specifications (Type A)

Design Principles

The following principles will apply to the noise design:

1. Utilise both OGPA and landforms as the first choice for noise reduction.
2. Integrate noise reduction structures within the landscape by utilising gabion baskets as a standard form, ramping of the ground to the rear, and planting.
3. Prioritise the visual experience for the residential properties the structures are intended to protect and minimise the shading on these properties.
4. Modulate the ground built up to the rear of noise reduction structures to allow the top edge of gabion structures to be read and to prevent people accessing the tops of higher gabions from behind.
5. Where there is sufficient space, consider off-setting the longer gabions in places to reduce their wall like appearance and allow planting in between.
6. Examine the potential to avoid barriers inside gabions walls to reduce additional road side clutter and maintenance.
7. Where barriers are required, utilise wire rope type barriers and offset the gabion from the back of the shoulder the 1m required to allow for impact displacement.
8. Examine further the approach to integrate noise barriers as part of the Paraparaumu interchange.

Figure 96 (Left and below)

Shows three different fence type images and Type A cross-section

TYPE A: Timber or panelled type fence on residential boundary - can be planted with climbers or against with trees and shrubs. The fences can be offset to break up long lengths of wall. Clear panels can also be inserted. Needs specific design to ensure noise attentuating qualities.

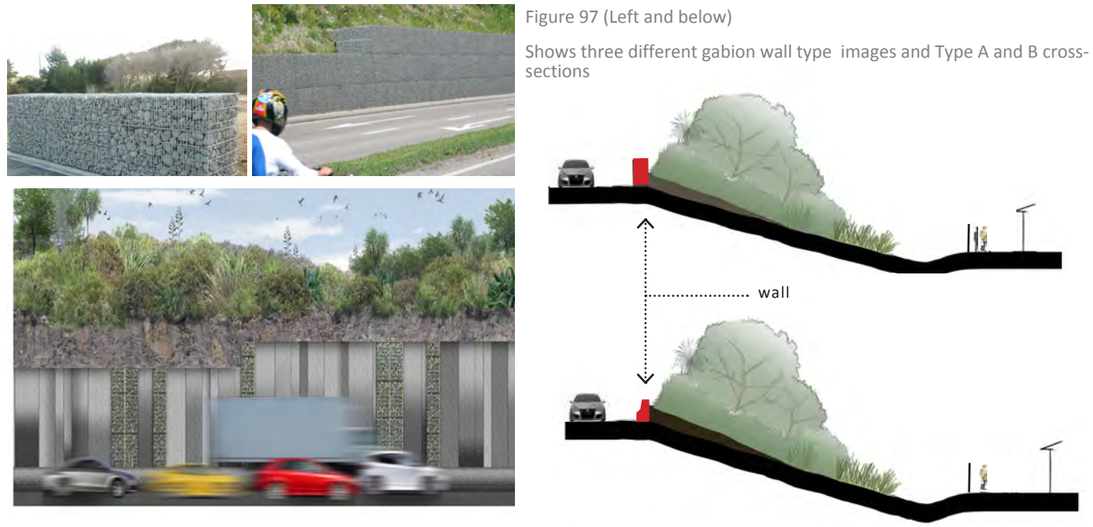


Figure 97 (Left and below)

Shows three different gabion wall type images and Type A and B cross-sections

TYPE B: Gabion basket type wall - maybe gabion facing with solid wall. TYPE C: use of standard slipform concrete barrier. For both types the land form behind the wall will be built up to mask the wall height from the adjacent properties and this slope planted.

Figure 98 (Above) Cross-section describes the building up of the ground to use the rise as part of the noise reduction block. This section is north of Leinster Ave with the Expressway on the right and residential property to the far left. The cycle path and service lane are part way up the slope.

5.10 Landscape - Landforms Design

The dunes are the ‘signature’ landforms encountered along the Expressway corridor. In the first instance the route alignment seeks to avoid significant dunes if possible. However, loss or modification of some dunes will be inevitable in places given the confined corridor available and the scale of the Expressway footprint.

It is noted that some of the dunes that still remain today do so because they are located in the existing road designation and thus have been ‘protected’ from modification for residential and other development. Notwithstanding this, integrating the Expressway linear form into the dune landforms is a key design objective.

Several streams or parts of streams will be diverted. Regardless of their current state (many are channelized and/ or weed infested) they will need to be reconstructed to allow indigenous ecology to re-establish. Other important landforms include the Waikanae River, existing wetlands, and distant views to Kāpiti Island.

Design Concept

The dune forms and other natural landform features have been avoided as best they can in the alignment of the Expressway. However, the Expressway will create change to landforms and the approach will be to ‘naturalise’ the changes as far as practicable, to integrate those changes with local topographical patterns.

Design Principles

The following principles will apply to the landform design:

1. Avoid modification of dunes, wetlands, and streams by minimising the construction footprint in sensitive areas.
2. Retain or enhance natural landforms wherever possible, including within both permanent and construction operational areas.
3. Design or modify landforms to acknowledge and reflect the local topographical pattern (scale, orientation, profile [refer Figure 99]).
4. Modify the slope or use retaining walls to reduce the size of cut faces. A standard 1:3 grade has been proposed in the preliminary design (refer Figure 100).
5. Shape (roll off) the tops of cut/ fill faces so the faces integrate with the existing dune profiles as far as practicable and minimise risk of water and wind erosion.
6. Shape visual and noise mitigation bunds to appear as ‘natural’ landforms (refer Figure 99), avoiding engineered appearances unless these forms are a component of a designed ‘land art’ formation.
7. Recognise that the Waikanae River corridor, including, oxbows, river bed and flood plains are a different landform to the dunelands area. The alluvial landform is an important linear feature providing a physical and visual link between the mountains and the coast.
8. Avoid where practicable the realignment of natural stream channels. Ensure that realigned streams are reinstated and designed to allow re-establishment of natural conditions to support indigenous ecology.
9. Recognise the views to the Tararua Ranges and Kāpiti Island as prominent and important landforms and features in the design of east/west local road crossings.
10. Recognise that the sand and peat substrates are likely to need conditioning to provide a good growing substrate for plants. Soils substrate trials will be undertaken to assess the needs and methodology to achieve this.
11. Minimise extent of exposed of sand areas during and post construction to limit erosion from wind and rain events.

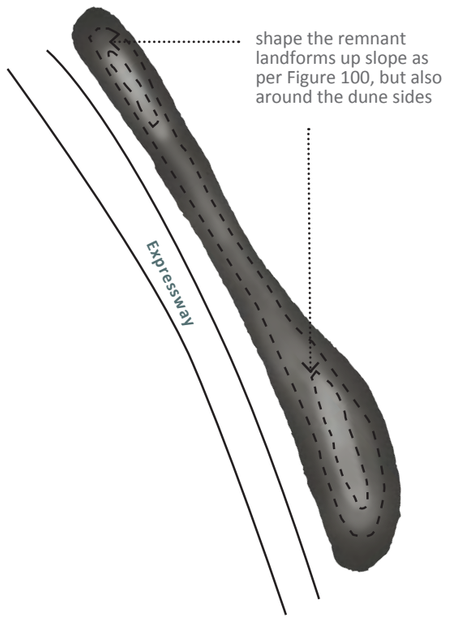
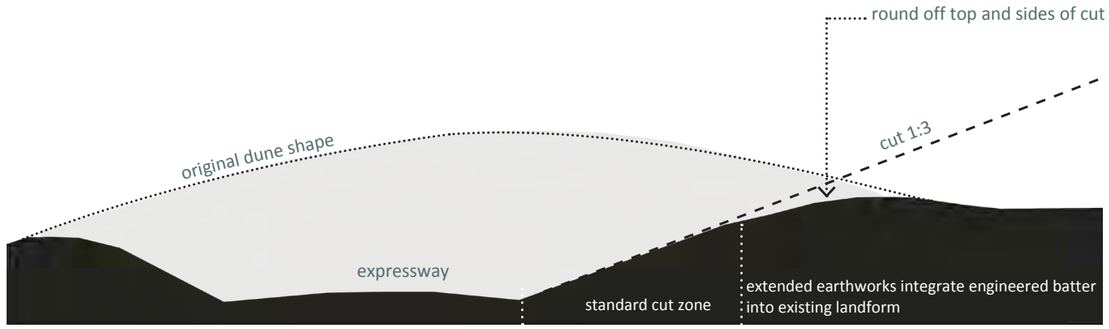
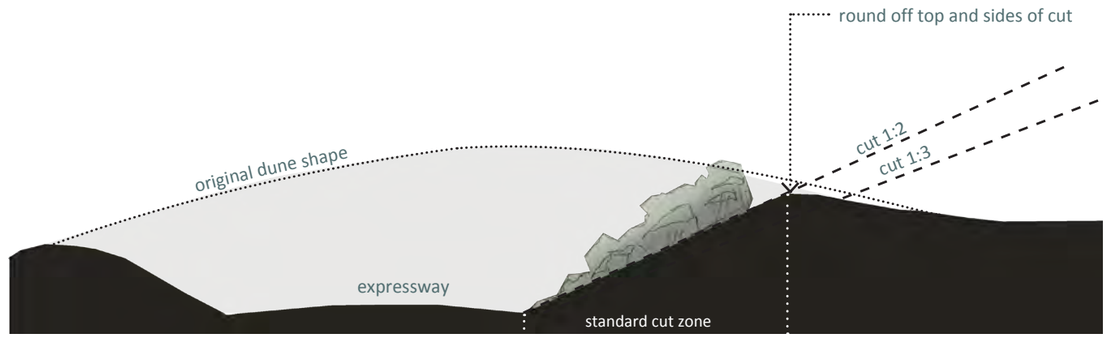


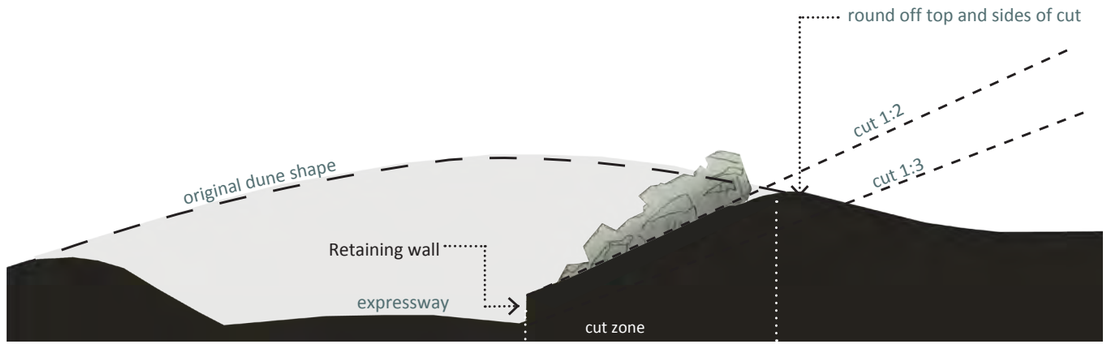
Figure 99 The Expressway has a linear form. Although the dunes are formed in an approximately linear pattern parallel to the coast they are not even and the Expressway cuts across them in places. In plan the remnant dune forms can be shaped to repeat slopes and shapes. The same approach should be used for bunds.



In open rural areas or where the landform will be seen from beyond Expressway consider extending the earthworks beyond standard cut zone to allow rounded dune forms



In areas to be planted consider a steeper cut as this allows more of the ground to be retained and can limit the need for extended earthworks beyond the engineers construction cut zone



Steepening the sides of the wall with retained toe reduces the size of the cut face and retains more of the dune land form. This same approach can be used where it is desireable to minmise the footprint adjacent to wetlands or other features

Figure 100 Expressway integration into the dune landforms can be improved by managing the cut face slopes and their angle at the slope top to wrap to the natural forms

5.11 Landscape - Planting Design

The diverse range of landscape characters through which the Expressway passes necessitates a site specific response to the planting along its length, to ensure new planting is consistent with the existing vegetation structure of specific localities. Figures 101- 107) show the proposed planting typologies along the route. The sector design plans in the ULDF also show how these typologies are applied and further detail is also provided in the Assessment of Landscape and Visual Effects (Technical Report 7, Volume 3).

Planting in the Expressway corridor will have multiple purposes of mitigation of visual effects, ecological enhancement, and integration of the Expressway into the wider landscape. It will be essential that the planting is maintained for a successful restoration and enhancement process.

Design Principles

The following principles will apply to the planting design:

1. Respond to the Expressway scale by using appropriate scale plant species to integrate it into the landscape.
2. Reflect the range of local vegetation character along the route with a appropriate plant species, palettes and compositions.
3. Recognise and retain existing trees and shelter belts to assist with landscape integration and mitigation.
4. Use both exotic and native plant species, as appropriate to the local character of the area, but the predominant species should be indigenous and locally sourced if practicable.
5. Develop the planting structure at the Kāpiti and Te Moana interchanges to specifically enhance the visual amenity of the public open space as well as to provide shade and shelter.
6. Maintain the open rural character, where appropriate, by extending pasture/mown grass to the edge of the paved roadway, and using ‘rural’ tree species.
7. Locate vegetation strategically to provide visual screening to the Expressway and associated structures, noise walls, and bunds.
8. Plant stormwater treatment wetlands, flood storage areas and their margins to reflect existing vegetation patterns and provide additional habitat to freshwater fish and bird species.
9. Establish riparian planting along stream corridors and their margins that assist with enhancing the ecology of the stream, including vegetation which will provide shade.
10. Select plant species that will be sustainable to the soil and climatic conditions within the corridor, to ensure successful establishment and growth.
11. Ensure that all indigenous plant species are sourced locally from the Foxton Ecological District.
12. Ensure that a post construction planting maintenance programme is established and appropriately funded to enable planting to be successfully established and self sustaining.

Figure 101 Massed Planting

Mass planting will primarily include native plant species to provide dense vegetated areas, and may consist of a mixture of species or areas of single species.

Species selection will consider the locality and planting substrate and generally include hardy pioneer species suited to the site. Species may include grasses, ground covers, shrubs and trees.

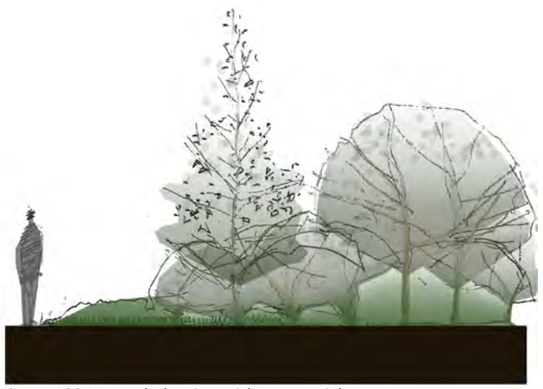


Figure 102 Massed Planting with tree enrichment

Mass planting will primarily include native plant species to provide dense vegetated areas. Enrichment planting of canopy tree species that require a sheltered environment to establish will enrich the biodiversity of the planting and wider area in the long term.

Plant shrubs and small trees at close centres to form a vegetation mass that out competes weeds and other unwanted vegetation for minimal long term maintenance requirements.

Figure 103 Trees under planted with Grass

Single specimen or groups of tall, exotic and native trees established in lawn or pasture to reflect the open character of the local area- to be used in open rural areas and interchanges.

Tree planting in rural areas will reflect existing patterns, such as shelter belts, wood lots and small groups of trees using species such as poplar, willow, pine, eucalypt. Exotic or native amenity trees will be used in civic areas. Avoid the use of willow on streams where practicable and in consultation with GWRC.

Figure 104 Specimen Trees under planted with ground cover

Single specimen or groups of tall, exotic and native specimen trees under planted with massed ground cover species including grasses and low shrubs.

Typically used at interchange or civic areas to provide a low maintenance robust tree structure, shade, screening, and shelter.

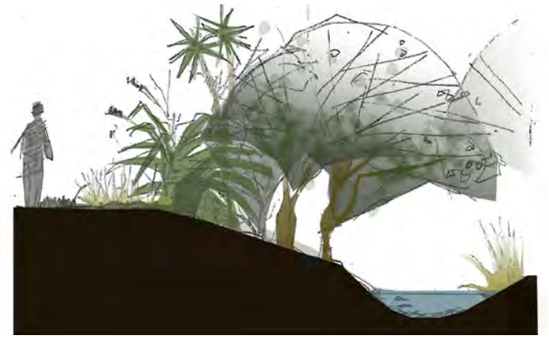


Figure 105 Riparian Planting

Riparian planting will provide transition to adjoining areas and enhance the ecological values of the stream and its margins, providing shade with overhanging vegetation, and stabilising banks.

Figure 106 Wetland/Stormwater Pond Planting

Wetland species consistent with local species including species tolerant of permanent and occasional inundation and drier land on the margins.

Figure 107 Storm water swales

Wetland species consistent with local species including species tolerant of permanent and occasional inundation and drier land on the margins.

Vegetation in swale channel will protect against soil erosion during peak flows.

5.12 Pedestrian, Cycle and Bridleway Design

The provision for walking and cycling as part of the Expressway project reflects the policy commitment from KCDC, NZTA and regional government to provide an integrated movement network that caters for a range and choice of modes.

The context description (refer to section 3) describes the current use of the existing network by walkers, cyclists and horse riders.

Design Concept

The design concept for walking and cycling is the provision of a continuous route which encourages cyclists off the Expressway shoulder and that enables walkers and cyclists improved and safe access to and from local and sub-regional destinations (refer to Figure 113). The new route will work in concert with the existing network and a future network being developed to enhance the walking and cycling activity in the district.

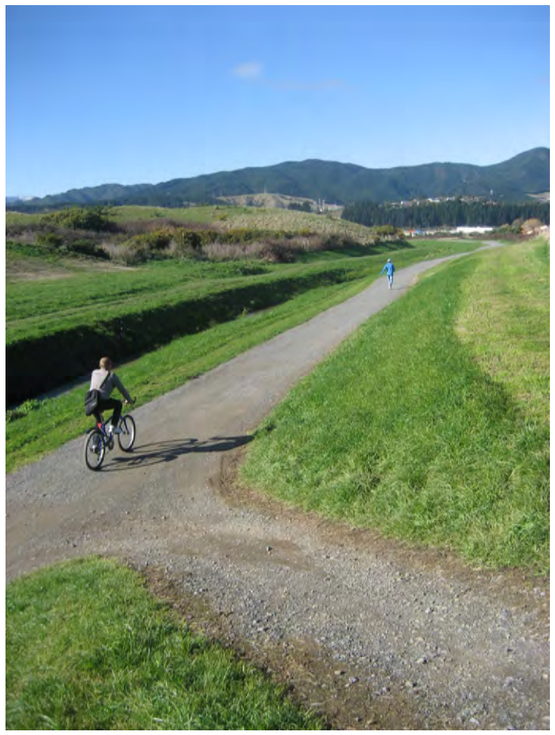
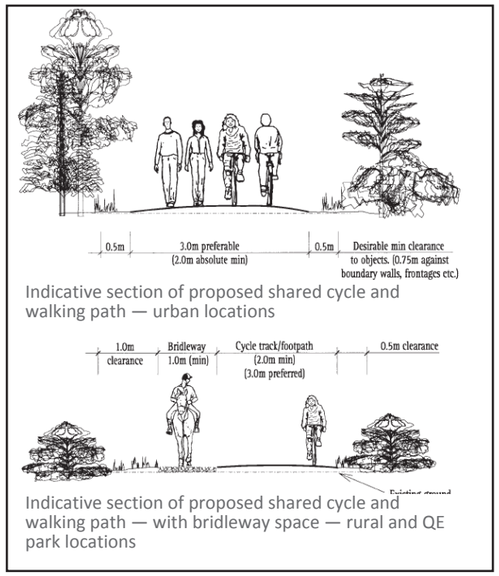


Figure 108 Existing shared cycle and walking path at Wharemauku Stream

Design Principles

1. Provide a safe cycle and walking shared path that is generally parallel to the Expressway route to encourage its use by cyclists and walkers.
2. Recognise and provide for connections to the existing and KCDC planned cycle and walking network as well as to all local roads in the positioning of access links of the cycle and walking path.
3. Ensure that the cycleway is planned in relation to linking with the connections at the Transmission Gully (south) end and the Peka Peka to Otaki (north) end.
4. Provide for slope grades that allow use by a range of users and design for these slopes at the places where the cycleway intersects with the local roads to facilitate cycleable access connections at all of these.
5. Secure with GWRC the provision of a southern section of the route through Queen Elizabeth Park, to link Paekākāriki and Raumati to facilitate commuting use between the community to the south and the services and amenities to the north. It is noted that this will not form part of the designation for the Expressway and will occur by separate agreement.
6. Provide a formed and appropriately surfaced path of 3m width that provides for road cyclists as well as other modes, with a sealed surface in the urban areas and looser surface in rural and Queen Elizabeth Park areas.
7. Identify separate lanes for cycling and walking paths to prevent conflicts in heavu use areas and use directional signage to assist wayfinding.
8. Provide low level lighting at the locations where the path intersects with local roads and integrate lighting with the local road interface design.
9. Consider lighting through the urban areas to provide for evening use of the path.
10. Reflect the context in the design of the walking and cycle path, such as through wetland areas using boardwalks and across waterways expressing the crossing by using bridges rather than culverts.
11. Recognise the opportunities for the integration of the walking and cycle path as a corridor for community art projects.
12. Provide for horse riding alongside the cycle and walking path in the rural and open space sections of the route such as at Waikanae River and Queen Elizabeth Park.

Figure 109 Indicative image of type of proposed shared cycle and walking path - shown as approximately 1m wide pedestrian and 2m wide cycle lanes

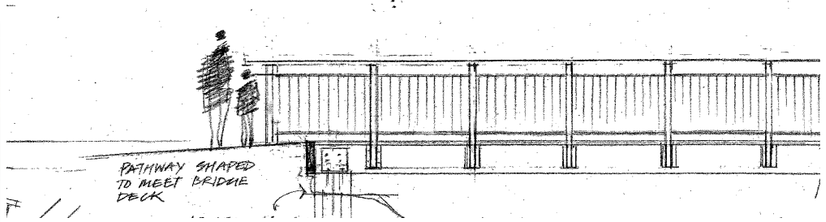


Indicative section of proposed shared cycle and walking path — urban locations

Indicative section of proposed shared cycle and walking path — with bridleway space — rural and QE park locations

Figure 110 Indicative sections (source KCDC)

Figure 111 Simple timber cycle and walking path bridge over watercourses



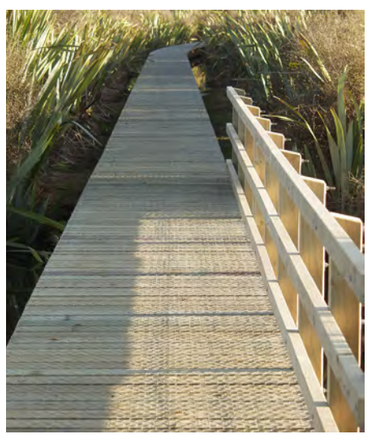


Figure 112 Simple timber cycle and walking path boardwalk over wetland areas — can be with handrail for open water areas

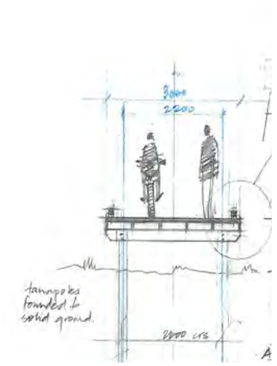


Figure 113 Cycle and walking network - note this shows a combination of the use of existing roads (purple), off road tracks (purple dash) and describes the Expressway connector (orange line). The other local roads that do not form a principal role in the cycle and walking network are shown in white. At each of the places where the Expressway path crosses a local road or another part of the cycle/walking network a connection will be made (circle) that allows cyclists, walkers or horse riders to get on or off the Expressway path to the road or track.

The plan is adapted from the KCDC and Kāpiti Cycling Inc Kāpiti Coast District Coastal Cycleway map. It does not show every small linkage, but shows the principal network.

5.13 Road Furniture Design

Road furniture is the set of elements that are required for the safe functioning of the Expressway. The elements include barriers, lights, signs and messaging systems. These elements need to function to provide the desired safety outcomes but can also be scaled, positioned, and selected to contribute positively to the driver's visual experience and to fit with the local environment.

Design Concept

To integrate all road furniture within the local environment sensitively and to enhance the Expressway driver experience through the Expressway by planning and designing the furniture purposefully from the outset.

Design Principles

Side Barriers

- If possible use runoff areas beyond Expressway shoulders to avoid the need for side barriers.
- Where side barriers are required for safety reasons:
  - > consider the use of ramped up ground as an altrenative to constructed barriers
  - > keep height of all barriers to a minimum to retain views beyond the carriageway
  - > avoid short sections of steel barrier - landform bunds are the preferred option
  - > match barriers on both sides of the carriageway
  - > avoid abrupt and hard ends to barriers, and tie back to bridge barriers with a slip form end
  - > integrate noise mitigation structures and safety barriers where these are required in combinations (refer to noise design)
  - > use concrete side barriers over bridges with the integration to the outward face (refer bridge design)
  - > design the transition of bridge barriers back to the landscape - emphasise the impression of the bridge ending from external view points and do not continue bridge barriers out into the landscape except with earth bunding behind (refer noise design)
  - > avoid surface motif patterns to concrete barriers - texture and natural colours may be used as part of the concrete surface treatment
  - > use steel (w-section and/or thrie-beam) barriers at culverts and minimise their extent

Median Barriers

- Two median widths are proposed - 6m and 4m - which apply to the urban and rural areas respectively. In both cases a wire rope barrier is preferred and the median strip planted on the wider median (refer to landscape planting design)

Lighting Columns

- Keep lighting along the Expressway to a minimum and locate lights at on and off ramps only.
- Use directional lights in the urban areas to minimise the light spill.
- Use steel light standards with a plain galvanised finish and have a defined acute angle between the pole and arm, or attach fitting directly to poles.
- Use consistent heights within each group of light standards (for instance within each interchange).
- Utilise the same pole to attach lights and any other furniture such as CCTV cameras.
- Place light poles and other furniture to avoid the need for additional barrier protection at the base.

CCTV

- Adopt design for CCTV camera standards that is either combined or consistent with light standards.

Sign Gantries and Signage Posts

- Design gantries so that beams and pillars join at right angles. Preference is for square box section, I beams and flat steel components.
- Design pillars to prevent unauthorised access without the need for such secondary fittings such as barbed wire.
- Use simple steel posts for smaller signs installed adjacent to the Expressway such as 'welcome' signs.
- Paint gantries a metallic colour that complements weathered galvanised steel.
- Where possible, signage should be visually contained within the depth of the spanning girder, through integrated design of girders and signage panels
- Signage should not be mounted on bridges as they are to be retained as clean sculptural shapes
- Signage on local roads directing users to the Expressway should be minimised and integrated with other furniture to both minimise visual clutter and minimise the number of support posts at ground level.
- Support posts for signs on local road should be located off footpaths and in places where they do not obstruct the passage of walkers, cyclists and horseriders.
- Avoid the use of overhead gantries on the local road to support signs or traffic lights.

5.14 Community Art Design

The development of national infrastructure, which the proposed Expressway is, needs to have some consistency in its design to recognise the functional requirements across its length, the ability to maintain the infrastructure over time, and the experience for the highway user.

However, the requirement for consistency in the design can detract from the sense of place for the local community. Each community along the route will have its own intrinsic character which derives from the landscape and built environment, and also its own cultural character from its heritage and the people that live there today.

To assist in balancing the change in the character the design of the Expressway aims for best practicable integration with the landscape and at places like local road crossings and interchanges. However, there is a significant opportunity to consider the potential for community art in those parts of the corridor which are less operationally constrained.

In particular there are community art opportunities along the continuous walking and cycle path that runs alongside the Expressway.

To be coherent and appropriate to the context as well as delivering a contribution to the sense of place, a community art strategy would be advisable. Such a strategy would:

- identify the local art community capacity and interest;
- tie in with existing Kāpiti arts programmes such as the art trail;
- develop a plan as to the types of community art that could be provided for and where it could possibly be located;
- determine a funding need over time;
- formulate a process for community art commissioning and implementation; and
- provide for collaboration with NZTA and other agencies responsible for managing designated land or land that was identified for art purposes.

Design Concept

The design concept for community art integration is to enable coordinated local community art initiatives along the cycle and walking path and at other locations associated with the Expressway (such as interchanges). It is proposed that this be coordinated by KCDC as part of other community art initiatives locally, and in collaboration with NZTA as the designating authority.

Community art can come in a range of media, scale, permanence, and themes. The opportunities to utilise the walking and cycle path as a venue for community art derive from:

- the path and its links is slower than a road and will allow people to ‘read’ art works at a pace that cannot be achieved at highway traffic speeds - this allows for more detailed art to be displayed;
- the speed at which people move past allows for smaller as well as larger items to be produced and displayed which provides a wider range of opportunities for artists who produce items of different scales;
- the pathway and allow people to stop and view or interact with art pieces;
- the length of the path as it passes through different communities allows for localised approaches to sections of the route;
- art can include the use of interpretive information to assist people to understand the sense of place or heritage or natural themes of the location;
- the ease of access to the route allows easy installation or removal of objects - art works can therefore be temporary or fixed;
- the pathway could link art venues together building on the existing Kāpiti arts programme which includes the annual arts trail concept; and
- the supply of power for lighting along urban sections of the route allows for lighting of objects.

Typical places along the pathway that art maybe able to be placed include at :

- bridges over streams
- the edge of wetlands on boardwalks for interpretation
- local road crossings
- intersections with other walking paths
- public spaces
- view points and seating places

The Expressway design currently incorporates the path infrastructure that will enable community art and in places such as around the Takamore area concepts for cultural markers are being advanced. Signage for wayfinding on the path and lighting is also provided for in the Expressway design and the nature of this can be progressed in detailed design with KCDC. The design of the forms and treatment of the bridges and spaces underbridges have already being advanced, but there is a role for community design input to detailing as part of the mitigation of effects.

Figure 114 Examples above and right of themes in sculpture along Wellington Cobham Drive - kinetic wind themed installations sponsored by Meridian and designs commissioned through Wellington Sculpture Trust

Figure 115 [left] Example of static sculpture in open space setting.

Figure 116 [right] Example of integration of art into landform

Figure 117 [below] Example of temporary art installation as part of the landscape

Figure 117, 118 [above] Examples of art in furniture forms - seat and interpretation

5.15 State Highway 1 Reconfiguration

The MacKays to Peka Peka Project Alliance Board (PAB) required work be undertaken to scope and cost the revocation to the local authority Kāpiti Coast District Council of the existing SH1 from Poplar Avenue to Peka Peka Road.

While cognaisant of the NZTA Planning Programming, and Funding Manual (PPFM) and its policy for road revocation, a report (SH1 [Kāpiti Coast] Revitalisation Options - Functionality Report) outlines the concept designs for the reconfiguring of SH1 to ensure:

- The nature and scale of the existing State Highway 1, especially at Paraparaumu and Waikanae town centres, delivers a viable and attractive roading and access system for local needs (from Guiding Objectives for the Project Alliance Board).

From the concept designs the SH1 work went on to:

- To confirm constructability of concept designs;
- To identify or remove constructability risk;
- To identify and quantify the fundable elements of the Project for future NZTA KCDC discussions.

The design concepts were consulted on and the outcomes of this consultation are described in section 4.1 of this ULDF.

Design Concept

The design for the reconfiguration of former SH1 responds to the different environments through which it passes (refer to Figure 120). The context includes two town centres and urban areas and extensive rural areas. The environment on either side of the road also differs. The process for the design concept elements described below to be progressed will be determined between NZTA and KCDC.

The essential elements of the reconfiguration in relation to these different contexts are bullet pointed below:

Town Centres

In Waikanae and Paraparaumu town centres the scope of work generally includes:

- Constructing new kerb lines and raised medians to form single lanes (and cycle lanes) generally each way.
- Reducing kerb radii at intersections for pedestrian crossing safety.
- Relocating services, altering drainage and resurfacing roads as require.
- Constructing raised medians, traffic islands and carparks.
- Widening and improving pedestrian footpaths and installing pedestrian safety measures.
- Creating a specialist pavement to encourage pedestrian crossings to Paraparaumu train station.
- Enhancing pedestrian connections from Waikanae train station to the shops opposite.
- Creating bus stops on SH1 between the train station, street and shops.
- Street furniture improvements.
- A new signalised intersection at Ngaio Street Waikanae.
- Landscape treatment including tree planting in medians and road edges between carparks.
- Stormwater run-off treatment swales in some areas.
- The proposed Otaihanga roundabout has been excluded from the scope of work because it will be required to be constructed as part of the Expressway to provide a more suitable route for construction traffic.

Rural Areas

In the rural areas the scope of work generally includes:

- Narrowing of the road width generally to 11-12 metres and removal of redundant road pavement width.
- Reuse of unrequired traffic road width for walkways.
- Road surface remediation as required.
- Creating new roundabouts at Raumati Road and Ihakara Street.
- Painting new cycle lanes and road markings.
- Reducing speed limits – new signage.
- Providing off-road pedestrian and cycling paths.
- Improving pedestrian/cycling across the Rimutaka Street rail bridge.
- Improving pedestrian/cycling across the Waikanae River bridge.
- Landscaping and tree planting, particularly where road pavement has been removed.
- Forming stormwater run-off treatment swales in some areas.

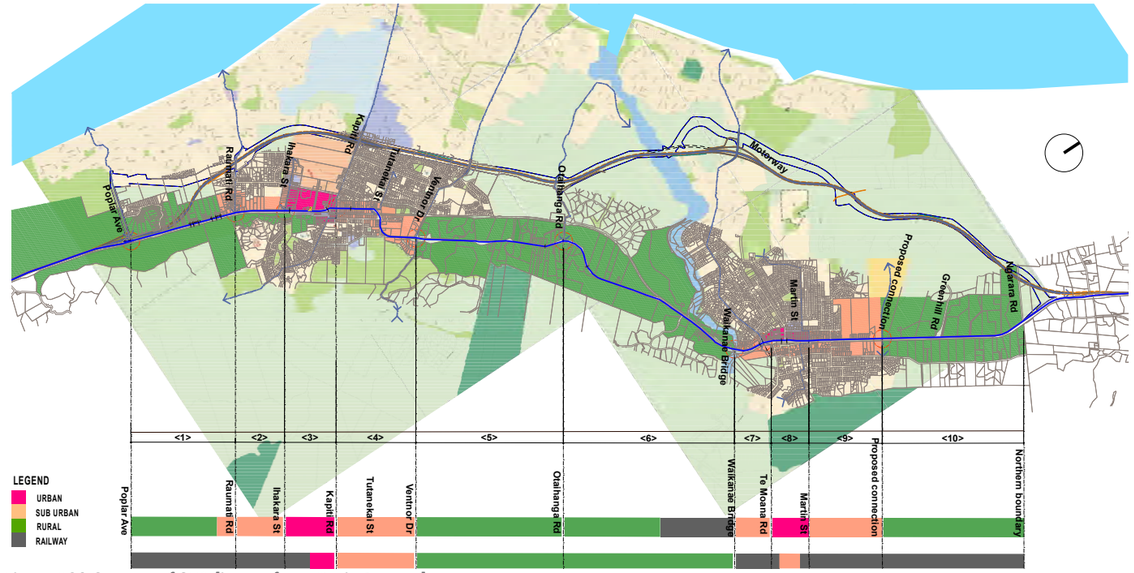


Figure 120 Context of SH1 [image from Kevin Brewer]

Figure 121 Sketch looking south in Waikanae Town Centre showing possible planting and improvements in visual amenity [image from Kevin Brewer]

Figure 122 Photo simulation of SH1 at Raumati showing possible increased berm width, parking and cycle lane marked

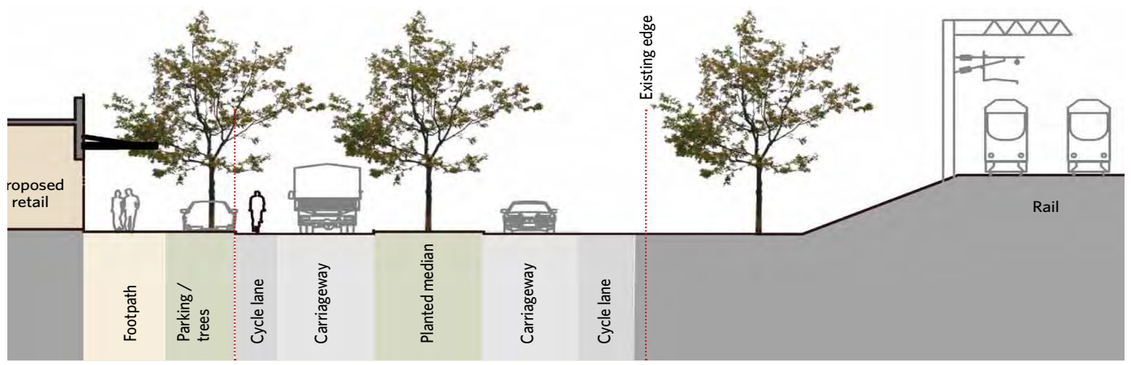


Figure 123 Cross section at Paraparaumu showing existing railway and possible planting, cycle lane and reduced vehicle traffic lanes [image from Kevin Brewer]