Appendix 3: BRIDGE SUMMARY- RAUMATI BRIDGE

Site Specific Management Plan 002 [Sectors 330-340-350]
MacKays to Peka Peka Expressway
M2PP-121-D-PLNM-002

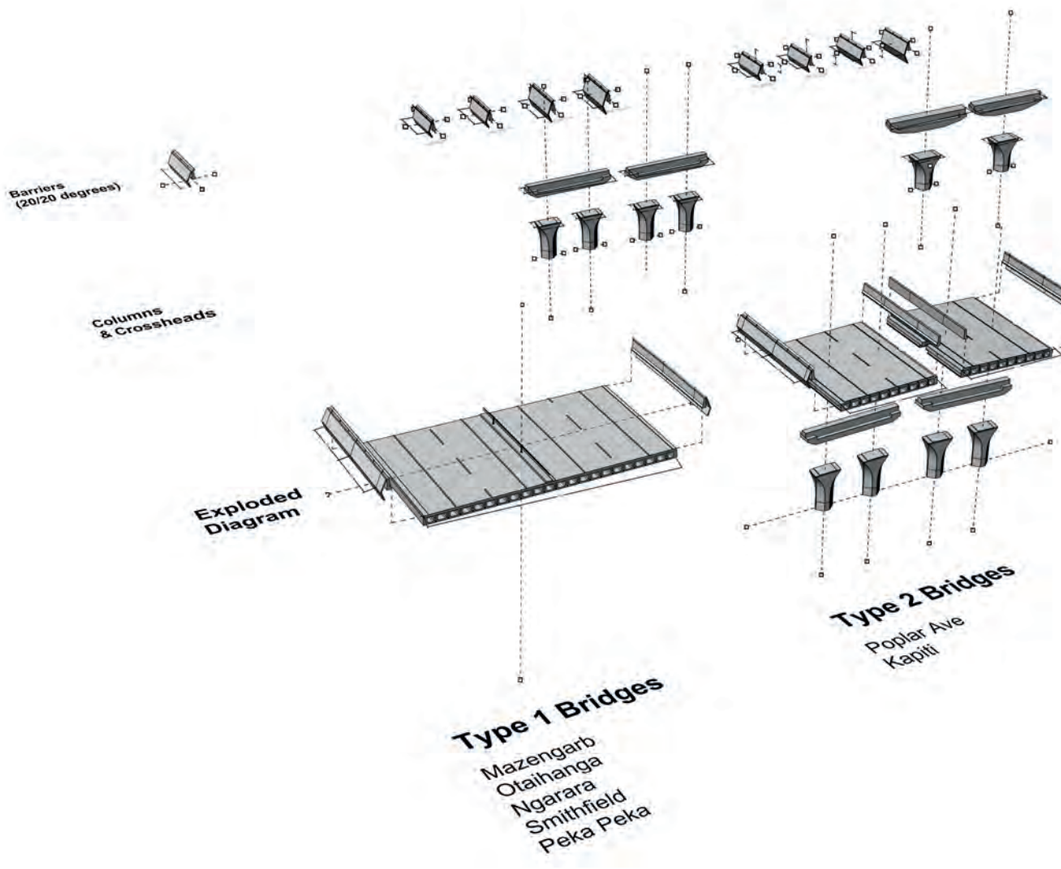
02 September 2014 - REV C

NZ TRANSPORT AGENCY WAKA KOTAHI

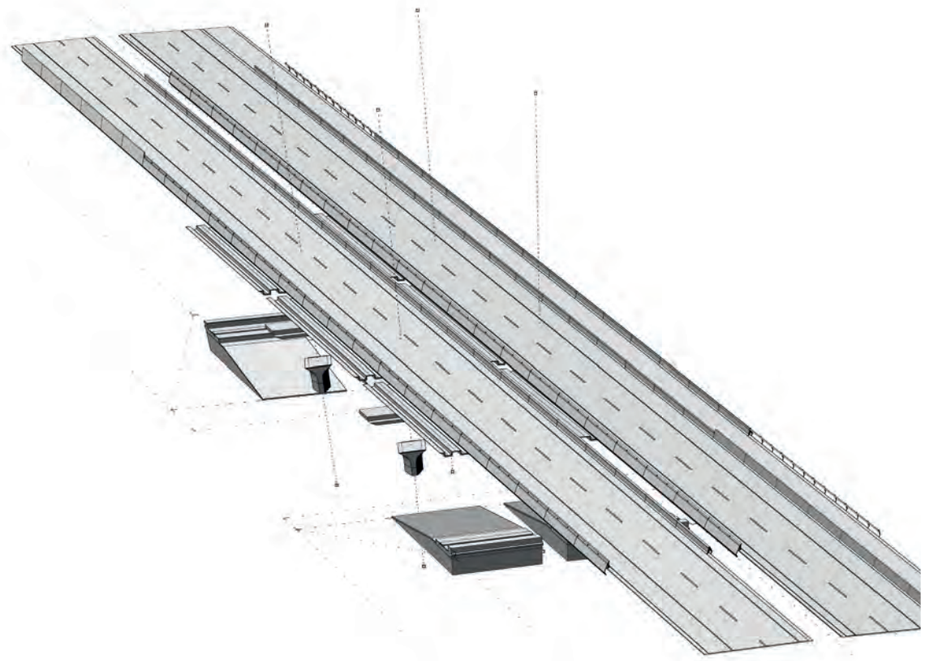
MacKays to Peka Peka
Wellington Northern Corridor

M2PP Bridge Design Objectives

Bridges as a series of components



Proposed Raumati exploded isometric



Design Objectives

With reference to the Urban and Landscape Design Framework (Technical Report 5) (ULDF) there are four design objectives for the bridges and their respective contexts. These four objectives are overarching aims for the project and have been extracted from the Design Concept statements in two sections of the ULDF: Local Road Interface Design (section 5.7) and Bridge Design (section 5.8).

The purpose of extracting these objectives is to enable any changes to bridge structures and their context made through the concept and detailed design process to be considered at the highest level of the design intent. There are design principles in each of the sections as noted above and these too form a basis for considering the development of the designs for the bridges and their context.

As is typical in a design evaluation process, any aspects of design that do not align with the design principles would be elevated to consideration against the design objectives.

Design Objectives:

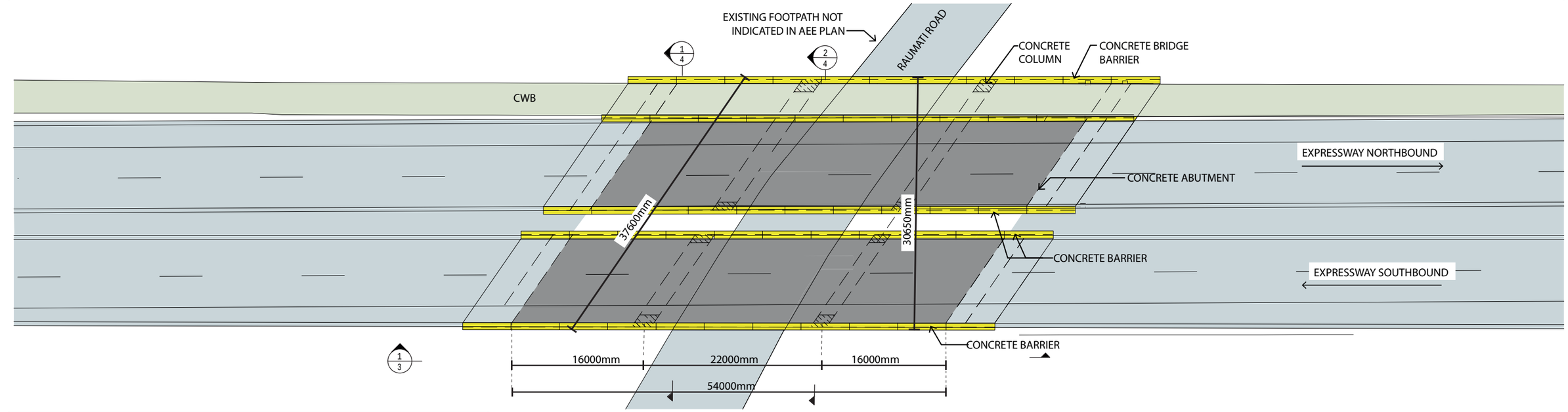
1. The public spaces of the roads and streets take primacy over the experience of the Expressway users. Local people will be making slower movements and as a consequence the bridges will be more visually apparent to them than to people travelling along the Expressway.

2. As a new element in the landscape, the bridges respect the surrounding landscape and are expressed in terms of their horizontality, fluidity and simplicity because the landscape is relatively low key and low in scale; having several ‘feature’ bridges would become both visually complex and overwhelming in scale.

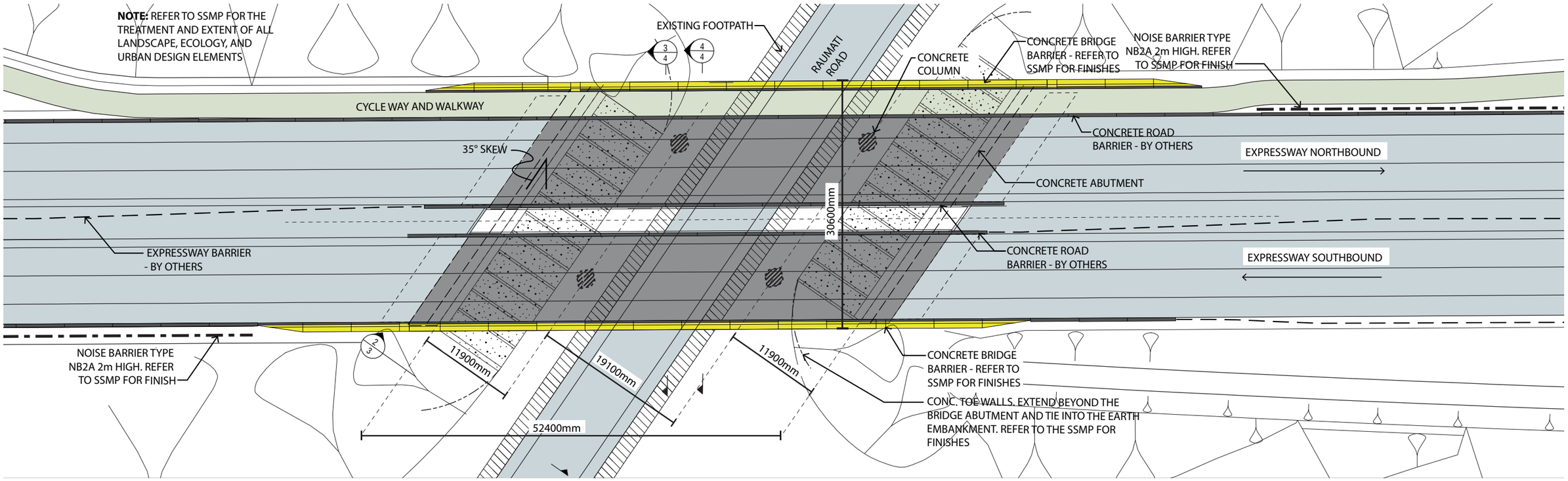
3. Bridges are formed as a whole from a single kit of parts, which allows the components to be repeated and a similar approach used at the multiple crossings to register as a ‘family’ of bridges because people will have multiple interactions day to day with the Expressway and this approach promotes simplicity and visual continuity

4. Utilise concrete prefabricated parts because this allows fine levels of quality control, cost benefits and significant improvements in construction time at the crossings and reduces disturbance to the area.

AEE Consented to DET Proposed Graphic Comparison



AEE PLAN- RAUMATI ROAD BRIDGE - 1:500@A3



PROPOSED PLAN- RAUMATI ROAD BRIDGE - 1:500@A3

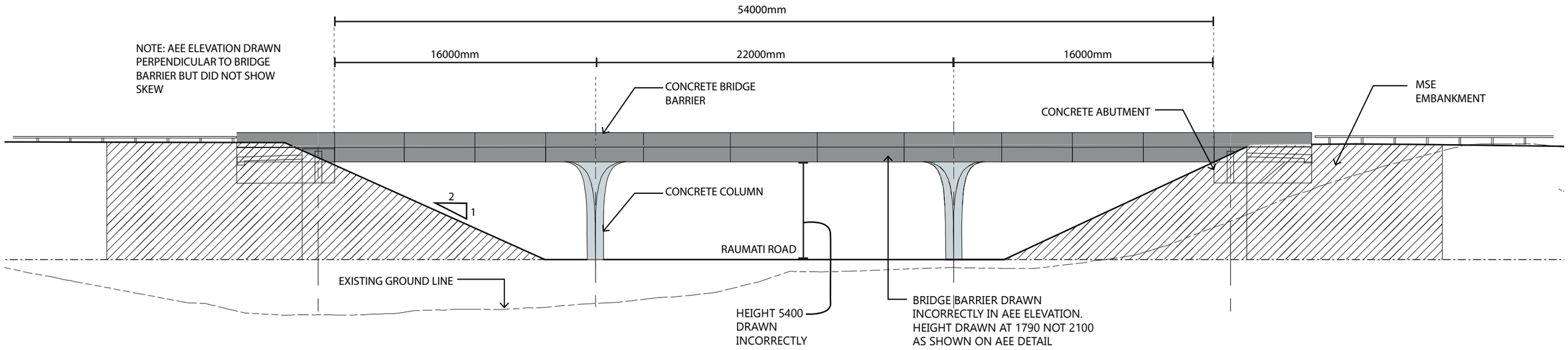
Design development

1. Further detail provided for abutment treatment.
2. Column shape and location changed.
3. Local road drawn correctly.
4. Reduced overall length of the bridge.

Rationale

1. Spill through abutment design developed to better integrate the abutment panels with the expressway embankments and local road
2. Moving the columns inboard resolves the issue with the bridge skew angle and the interface between columns and the bridge barrier/fascia panels.
3. No change to local road proposed - Proposed plan indicates optimum local road design (17m corridor).
4. Change from Hollow Core to Super T beams.

AEE Consented to DET Proposed Graphic Comparison

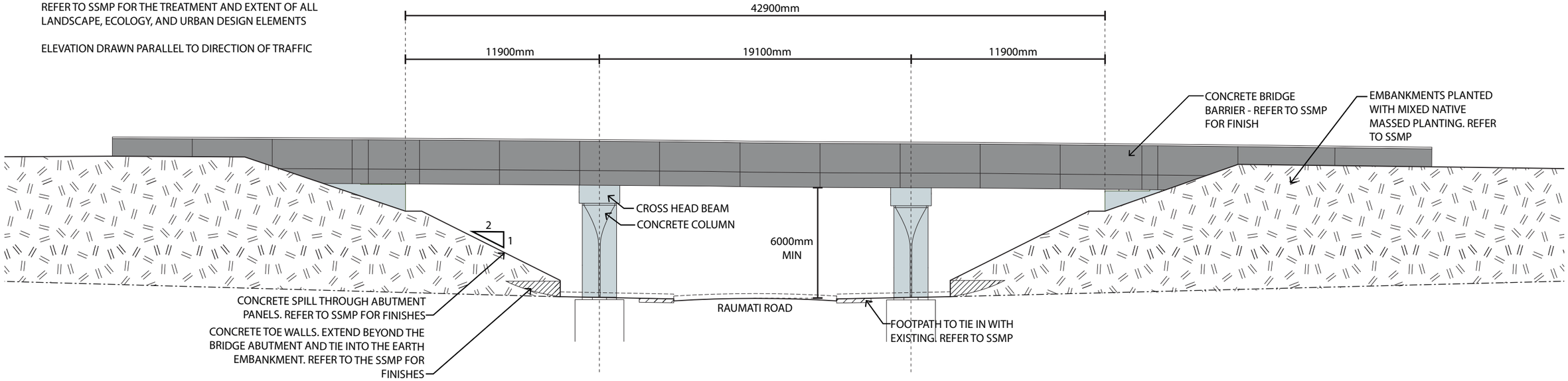


1. AEE ELEVATION - RAUMATI ROAD BRIDGE EAST ELEVATION - 1:250@A3

NOTE:

REFER TO SSMP FOR THE TREATMENT AND EXTENT OF ALL LANDSCAPE, ECOLOGY, AND URBAN DESIGN ELEMENTS

ELEVATION DRAWN PARALLEL TO DIRECTION OF TRAFFIC



2. PROPOSED ELEVATION - RAUMATI ROAD BRIDGE EAST ELEVATION - 1:250@A3

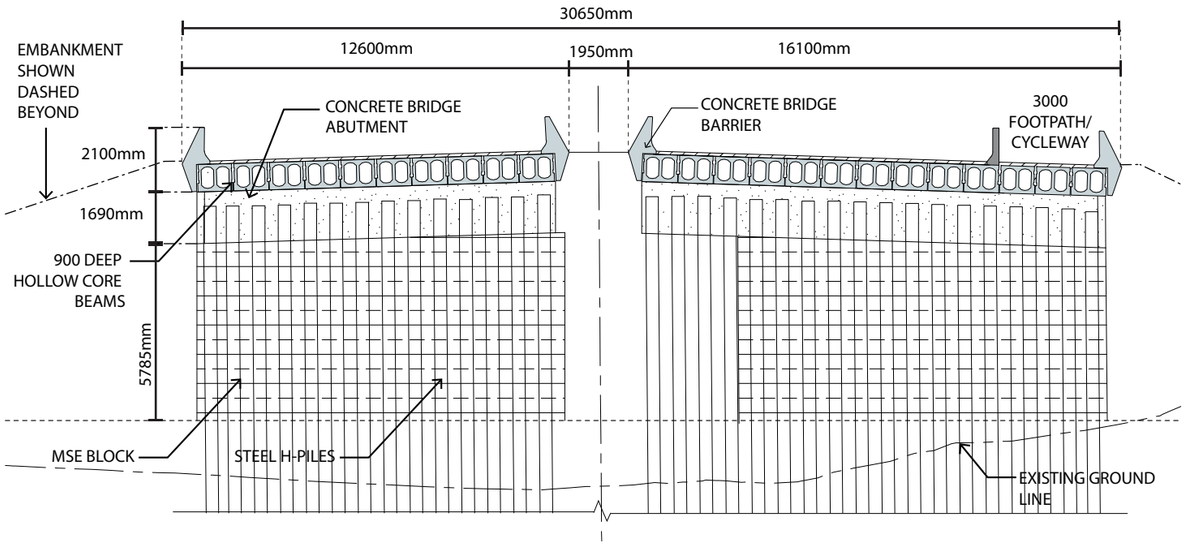
Design development

1. Bridge barrier/fascia panel drawn higher
2. Reduced overall length of the bridge
3. Bridge abutment appears to be steeper
4. Column profile developed

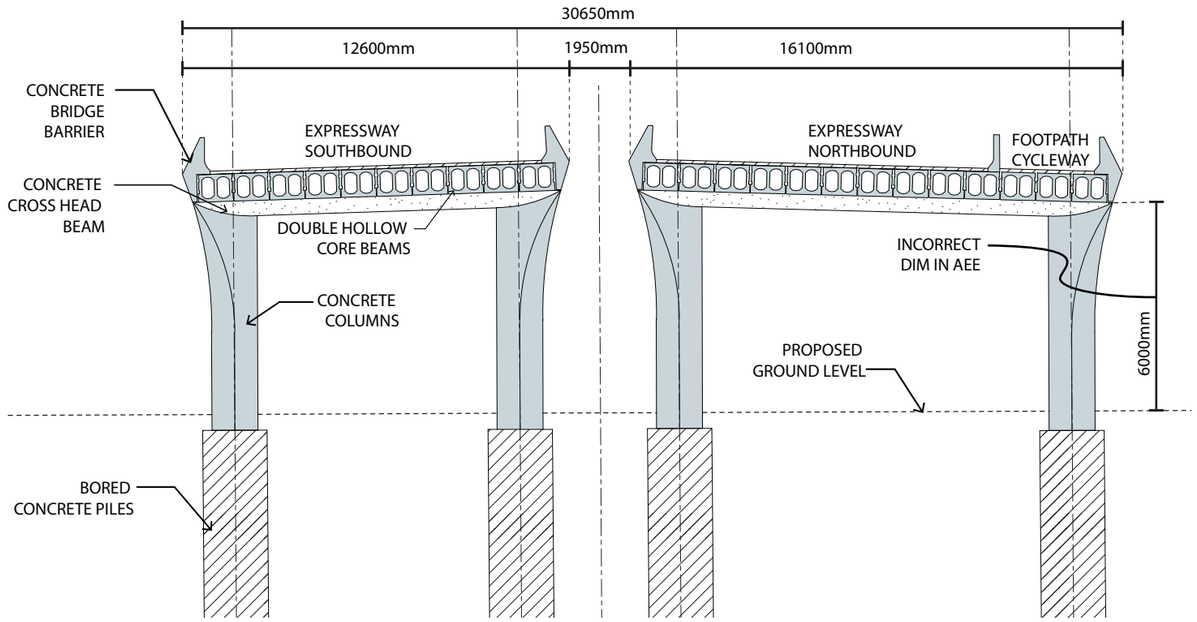
Rationale

1. Barrier drawn incorrectly in AEE elevation. Change to beam size and type to suit structural requirements of the high skew
2. The AEE elevation was drawn incorrectly. It was drawn perpendicular to the barrier but did not show the skew of the columns. Change from Hollow Core to Super T beams
3. Due to the angle that each elevation has been drawn and the skew of the bridge the abutment will appear steeper no change proposed.
4. Increased structural core based on geotech investigations carried out post AEE, while still providing the sculptural outer.

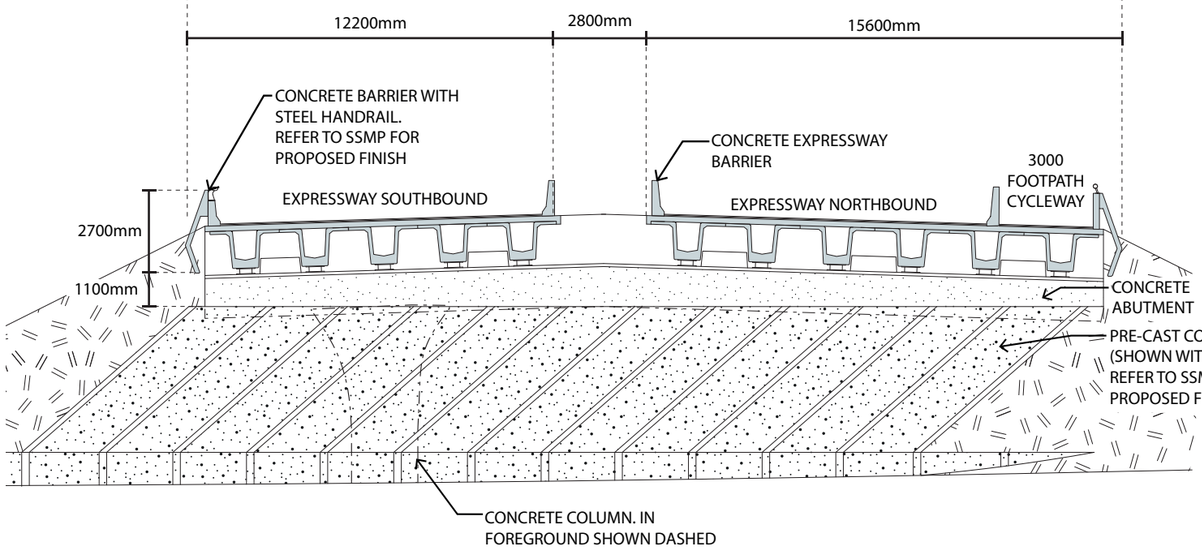
AEE Consented to DET Proposed Graphic Comparison



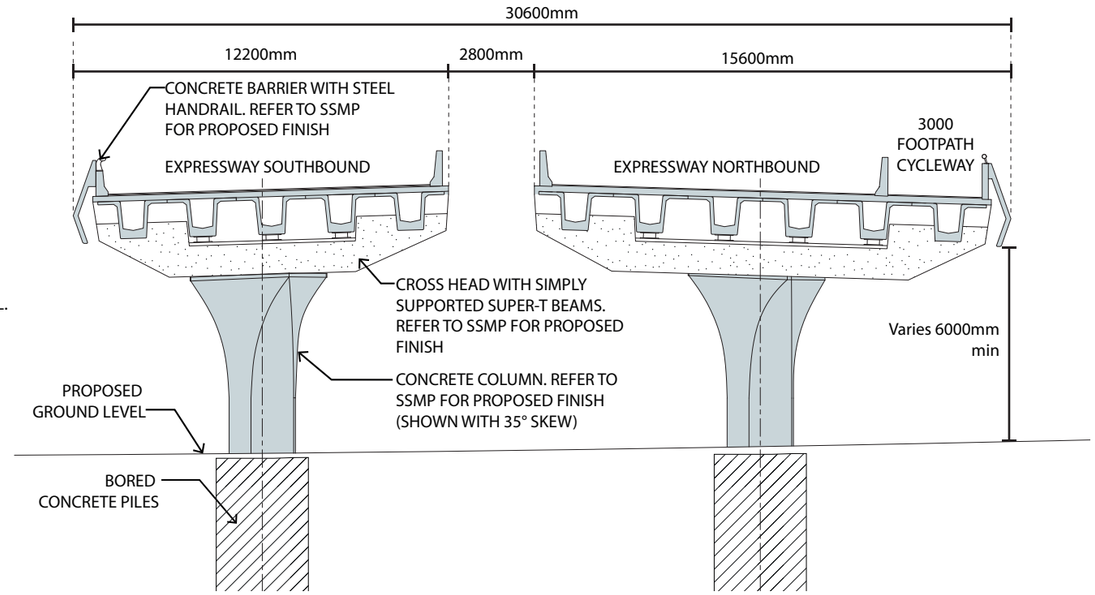
1. AEE SECTIONAL ELEVATION - RAUMATI ROAD BRIDGE SOUTH ABUTMENT - 1:200@A3



2. AEE SECTIONAL ELEVATION - RAUMATI ROAD BRIDGE (LOOKING SOUTH) - 1:200@A3



3. PROPOSED SECTIONAL ELEVATION - RAUMATI ROAD BRIDGE SOUTH ABUTMENT - 1:200@A3



4. PROPOSED SECTIONAL ELEVATION - RAUMATI ROAD BRIDGE (LOOKING SOUTH) - 1:200@A3

Design development

1. Reduced number of columns; 2 columns to 1 column for each cross head
2. More detail provided for abutment treatment
3. Cross head form changed
4. Column profile developed
5. Change to beam size and type. Change to simply supported structure.

Rationale

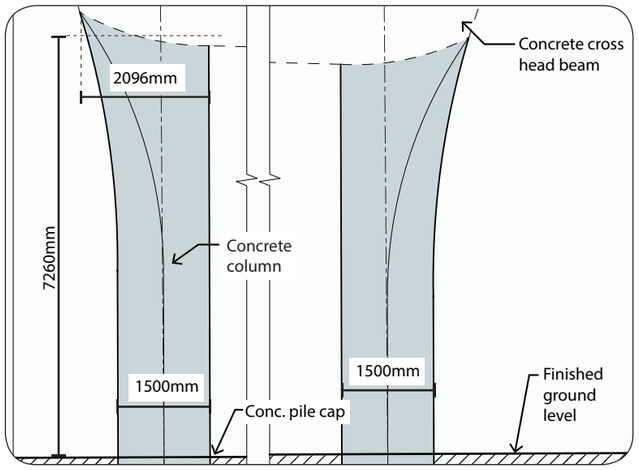
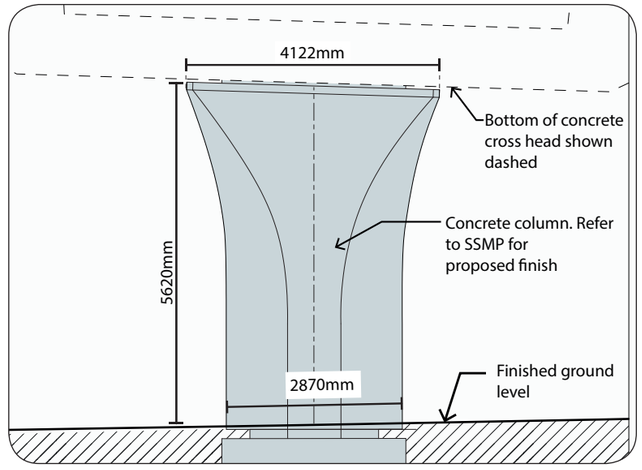
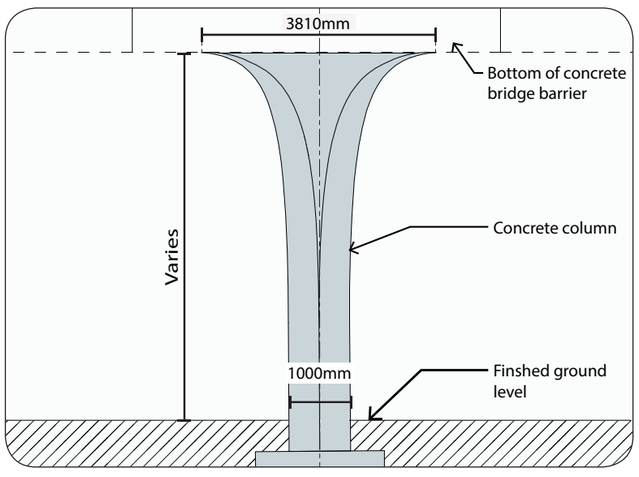
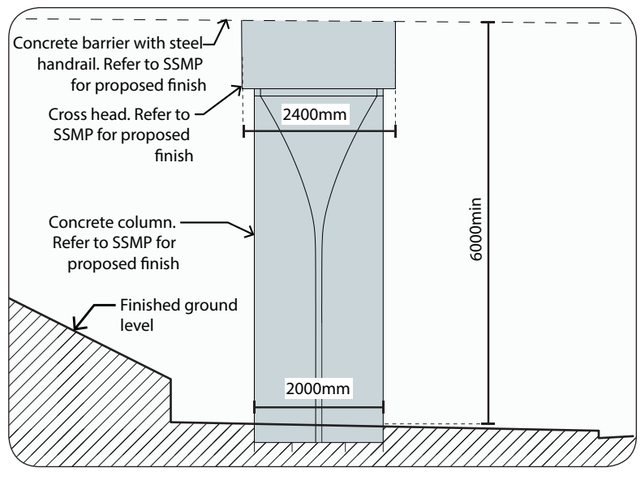
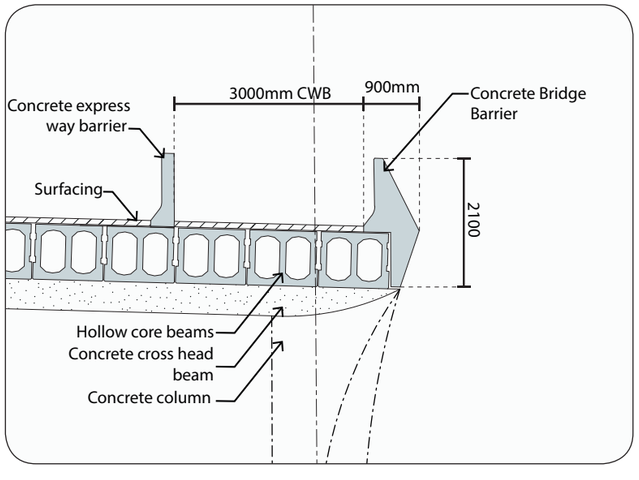
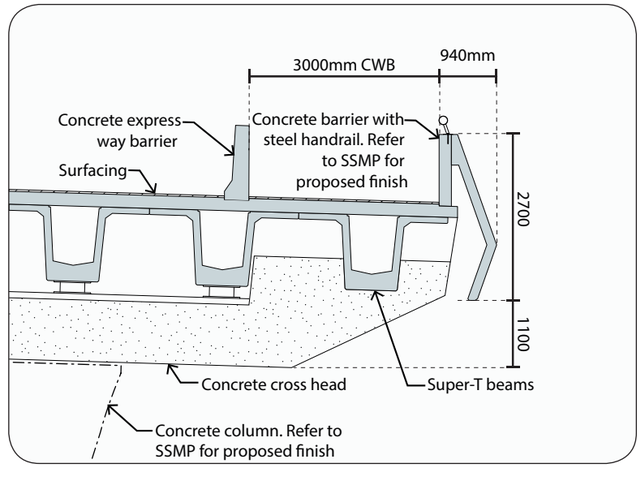
1. Improved visual permeability when considering bridge skew. Total column width when combined is reduced
2. Lack of resolution in AEE. Abutment design developed
3. Simply supported structure requires platform to seat beams
4. Increased structural core based on geotech investigations
5. carried out post AEE, while still providing the sculptural outer. Constructability issues because of seismic requirements. Integral connections difficult to build without increasing structural element sizes further.

AEE Consented to DET Proposed Graphic Comparison

AEE VISUALISATION - RAUMATI ROAD BRIDGE (NORTH SIDE OF RAUMATI LOOKING EAST)

PROPOSED VISUALISATION - RAUMATI ROAD BRIDGE (NORTH SIDE OF RAUMATI LOOKING EAST)

Bridge Development Matrix

Elements	AEE Design	Current Design	Developments	Why?	ULDF Principles
Column Front elevation 1:100@A3			1. Column base width increase, hexagonal column rather than flattened diamond 2. Reduced number of columns 3. Columns moved inboard	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. The total width of columns when combined is reduced for 1 column vs 2 column solution 3. Resolves issues with the bridge skew and the bridge barrier to column interface	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number; 1, 2, 3, 5, 8, 11 and 13
Column Side elevation 1:100@A3			1. Column base width increase, hexagonal column rather than flattened diamond at base of column 2. Column height (reduced approx 300mm)	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. Development of local road levels	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number 1, 2, 3, 5, 8, 11 and 13
Cross Head & barrier junction 1:100@A3			1. Barrier depth increased 2. Addition of handrail 3. Columns moved inboard	1. Change to beam size and type to suit structural requirements of the high skew 2. Safety. Handrail not shown in AEE details 3. Reduced number of columns from two columns per crosshead to one centrally placed column. Resolves issues with the bridge skew and the bridge barrier to column interface.	1. Please refer to ULDF principles summary on sheet; 7 of this document. With particular reference to principle number 1, 2, 3, 4, 8 and 13

ULDF PRINCIPLES SUMMARY

ULDF principle	Assessment of ULDF principles
1. Make the bridges generally consistent in their form so they register as a 'family' and provide some visual continuity within the local environment	Proposed Raumati Road bridge is different from the AEE bridge, but the form remains consistent with other proposed bridges. The consistency across the bridges overall has become even more consistent as there is less variation in types from that shown in AEE. Accordingly this helps achieve visual continuity.
2. Express the bridges as simple forms that sit across the changes in landscape and are not seen as strong statement in their own right	Proposed bridge form remains a visually simple structure and sits across the landscape as an horizontal element. The bridge is not seen as making a statement in its own right. The bridge appears 'heavier' in that the piers have doubled in width and the depth of the deck has increased as changes from hollow core to super tee construction. However, it is noted that the number of piers has been halved, albeit that they are larger in width.
3. Unite the bridge elements of pier, cross head, deck and barrier as one sculptural form and ensure services are concealed from view	Proposed bridge form is different than the AEE in that the piers have been repositioned to sit beneath the bridge deck. However, the principle of united piers, cross head, deck and barrier remains upheld, albeit in a new pier configuration. The profile from the crease of the barrier to the sloping cross head end to the shaped pier continues to show the bridge as a united single form.
4. Ensure the form of the bridges from the underside is visually appealing to recognise the primacy of the local roads user's experience in design consideration	The space beneath the bridge will be no less visually appealing than the AEE bridge and maybe perceived as better given there is now proposed to be a reduced number of piers (albeit that those being proposed are larger in size). It is noted also that at the Raumati Road bridge the angle of the local road in relation to the expressway bridge is relatively acute. The angle that the piers are viewed from the local road is important. The piers should be placed parallel to the local road alignment. The AEE 'co-planar' pier (being square to the bridge and barrier) would have revealed (because of the angle of the cross head that follows the local road) an awkward arrangement beneath the bridge between the cross head and the pier. The new proposed design separates the pier from the bridge and barrier and provides a more visually simple arrangement in relation to bridge under-structure.
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)	Proposed bridge piers are located to provide good clearance for local road movements and the abutments continue to be set at a slope that provides for light penetration. The reduced number of piers (albeit that they are larger) increases the openness of the space beneath. The abutments remain as 'spill through' slopes and these will be treated in a consistent way with the other local road abutments.
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	There is lighting to be provided under the bridge to recognise the relatively high level of usage by cyclists, walkers and others. This lighting can be used to enhance the architectural forms. The split in the bridge deck, sloping abutment and no piers means there is some natural light penetration to the space beneath the bridge.
7. Use architectural lighting to emphasise the sculptural forms of the bridges and light units that are readily serviceable from the ground	The opportunity remains to light the bridge external barrier and/or pier shapes architecturally. This will be addressed in detail design, Refer to SSMP for bridge lighting.
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	Proposed bridge, as in the AEE, remains of the same systematic approach to allow repetition of parts at other locations and improves the efficiency of construction.
9. Use textured finishes within the bridge elements surfaces' to provide a crafted finish – avoid printed forms	The proposed finish on the Raumati Bridge barriers will be fair faced concrete with a white wash, applied concrete coating to ensure colour and tonal uniformity between panels. The other elements – columns, cross head and deck will be simple, fair faced concrete without the applied white wash coating to help make these elements visually recessive relative to the barrier. Matt graffiti protection to be applied to all bridge elements surfaces. The material for the bridge abutments is to be developed. Refer to the SSMP for further detail on the proposed finishes.
10. Repeat the bridge design concepts within the design of pedestrians bridges recognising that these may be able to utilise lighter weight materials	Not relevant
11. Develop each bridge crossing design considering the piers types best suited to the location	Proposed Raumati Road bridge piers are different than those in AEE design, but as noted above, the new location beneath the bridge is better suited to the specific condition of that road location with its skew relative to the expressway bridge.
12. Locate bridge piers associated with bridge watercourse crossings away from riparian edges to prevent need to armour stream edges	Not relevant.
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 of the project	Proposed bridge form at Raumati Road has considered all the contributing factors of visual amenity, safe CWB crossing, structural design in high seismic zone, and constructability.

RAUMATI ROAD CROSSING - SIMULATION

NZ TRANSPORT AGENCY
WAKA KOTAHI

MacKays to Peka Peka
Wellington Northern Corridor