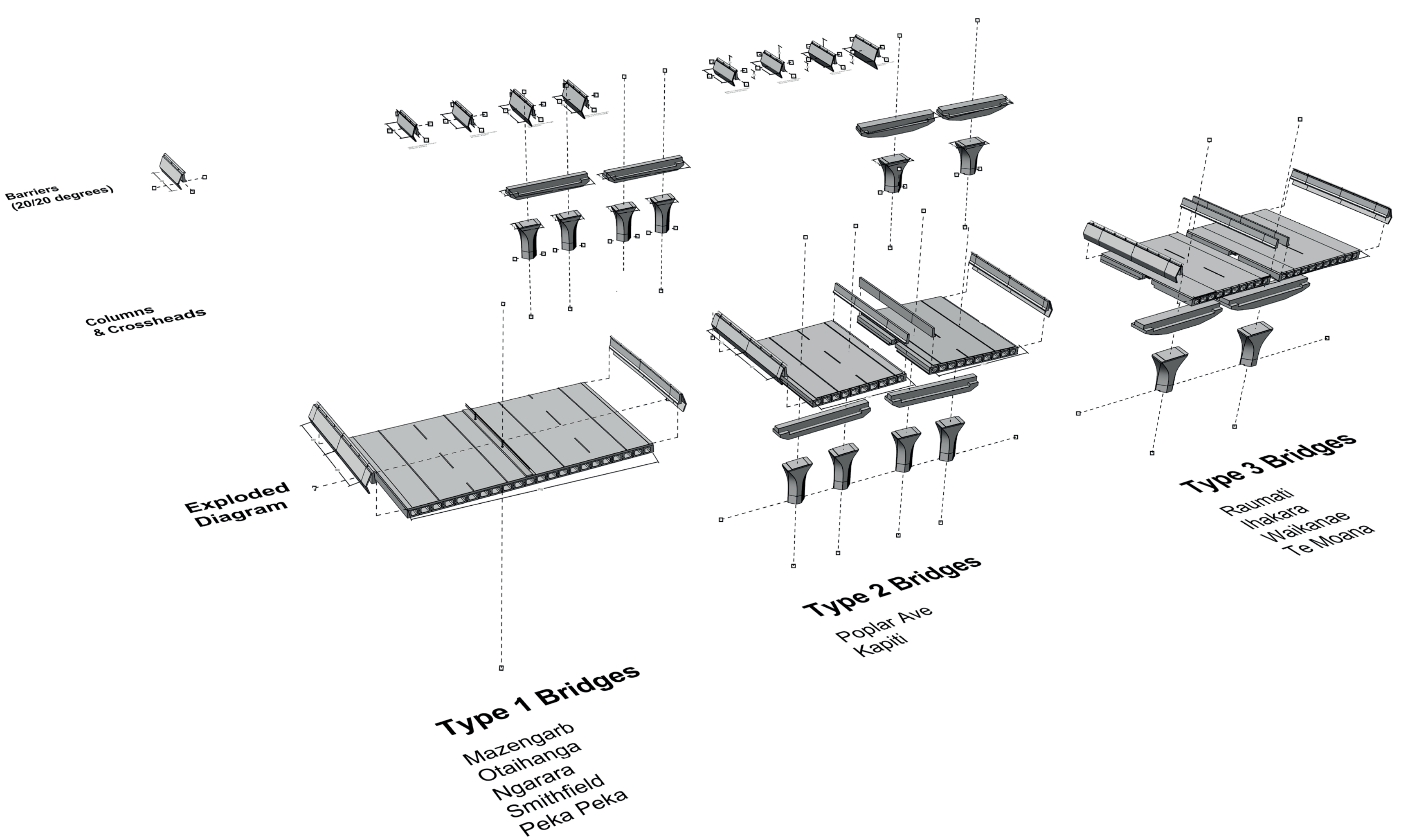
Appendix 3: BRIDGE SUMMARY- TE MOANA

Site Specific Management Plan 008 -[Sectors 480-510]
MacKays to Peka Peka Expressway

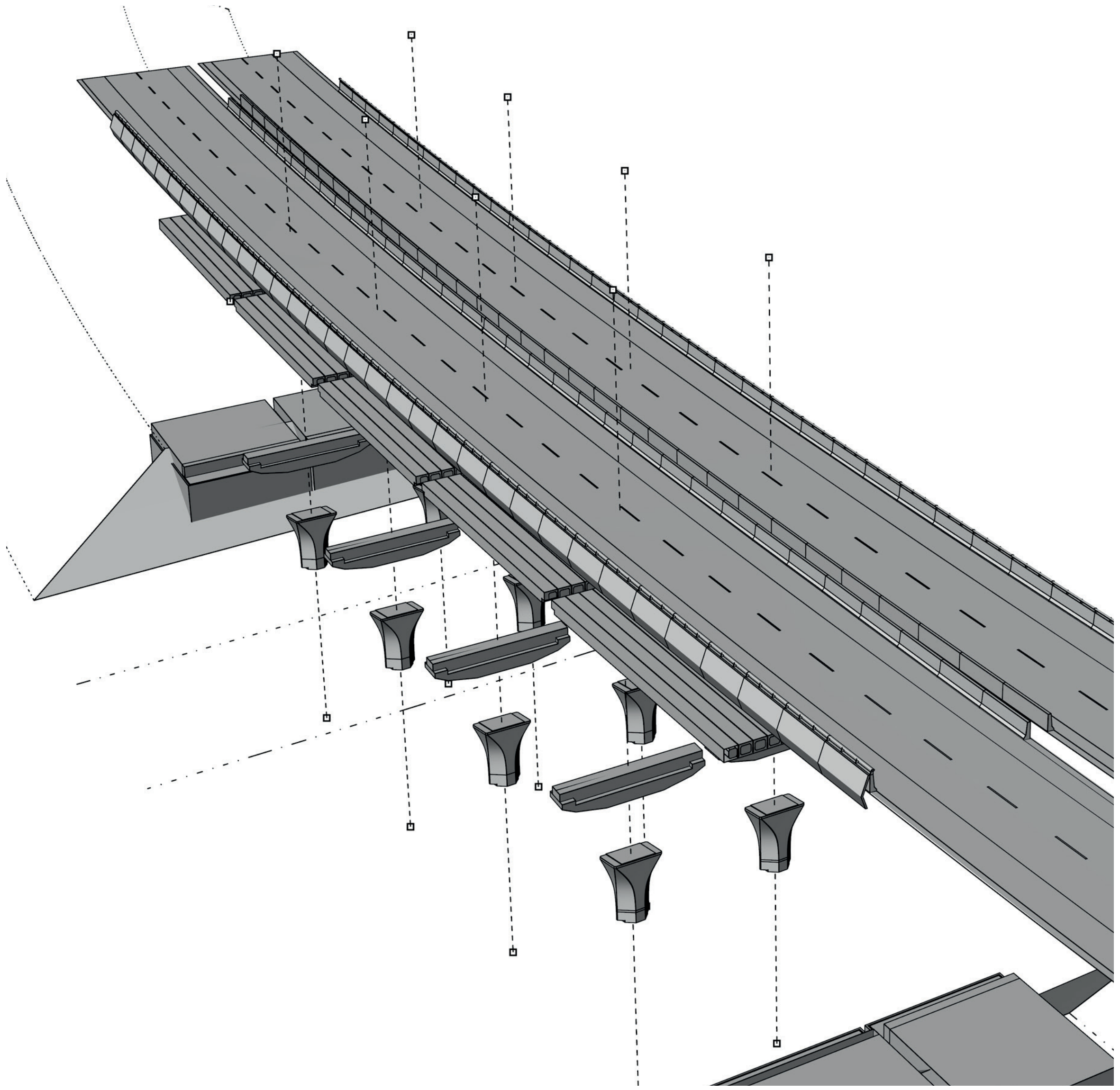
17 APRIL 2015 - REV C - FOR INFO

M2PP Bridge Design Objectives

Bridges as a series of components



Proposed Te Moana 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:

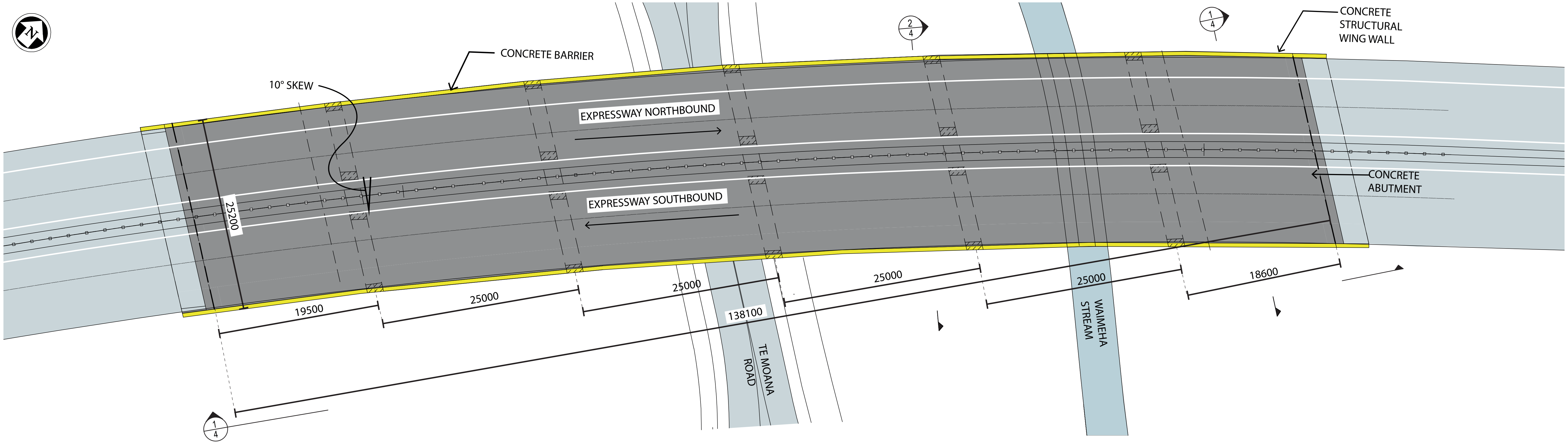
1. The public spaces of the roads and streets take primacy over the experience of the Expressway users. Local people will be making slower movements and as a consequence the bridges will be more visually apparent to them than to people travelling along the Expressway.

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.

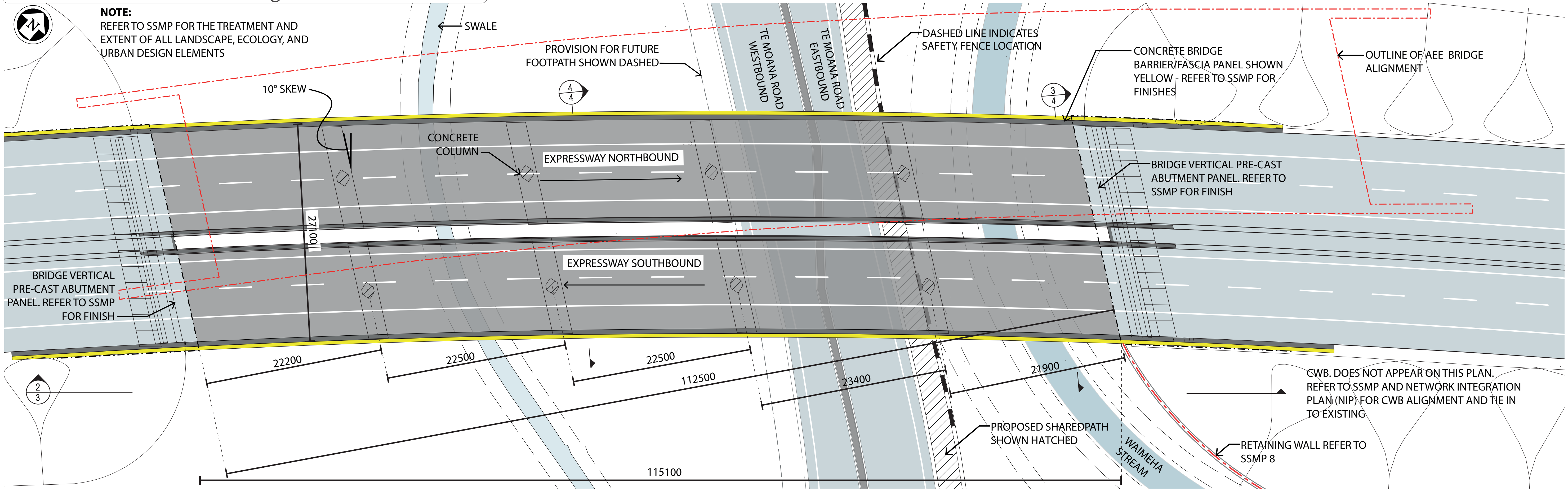
3. Bridges are formed as a whole from a single kit of parts, which allows the components to be repeated and a similar approach used at the multiple crossings to register as a ‘family’ of bridges because people will have multiple interactions day to day with the Expressway and this approach promotes simplicity 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- TE MOANA ROAD CROSSING - 1:500@A3



PROPOSED PLAN- TE MOANA ROAD CROSSING - 1:500@A3

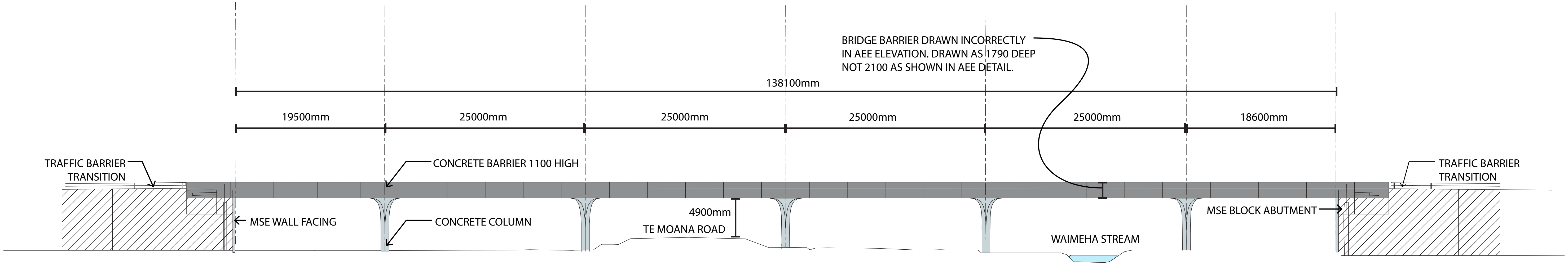
Design development

1. Split bridge (1m gap)
2. Remove end span at northern end
3. Column shape and location changed, abutment details refined
4. Reduced number of spans from six to five
5. Expressway alignment changed
6. Change to traffic signals

Rationale

1. Allows light penetration and better seismically
2. Reduced need for multiple stream diversions, less ecological impact
3. Reduced number of columns (20 to 8) and more open beneath
4. Reduced spans reduces cost. Avoids extra stream diversion.
5. Improved sight distance and safety for expressway drivers
6. KCDC request to allow easier movement for sight pedestrians and cyclists

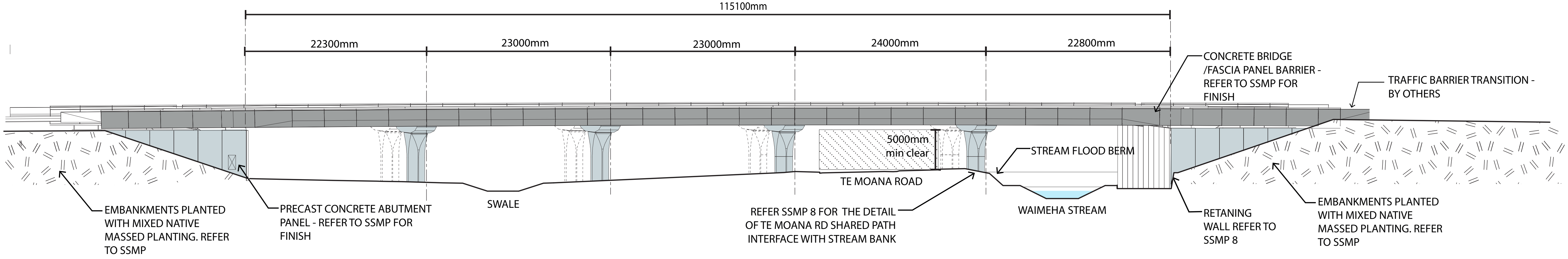
AEE Consented to DET Proposed Graphic Comparison



1. AEE ELEVATION - TE MOANA ROAD CROSSING EAST ELEVATION - 1:500@A3

NOTE:
PROPOSED ELEVATION DRAWN DIFFERENTLY TO THE AEE ELEVATION ABOVE. PROPOSED ELEVATION DRAWN PERPINDICULAR TO BRIDGE BARRIER. REFER TO THE PLANS ON SHEET 2 FOR COMPARATIVE DIMENSIONS

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



2. PROPOSED ELEVATION - TE MOANA ROAD CROSSING EAST ELEVATION - 1:500@A3

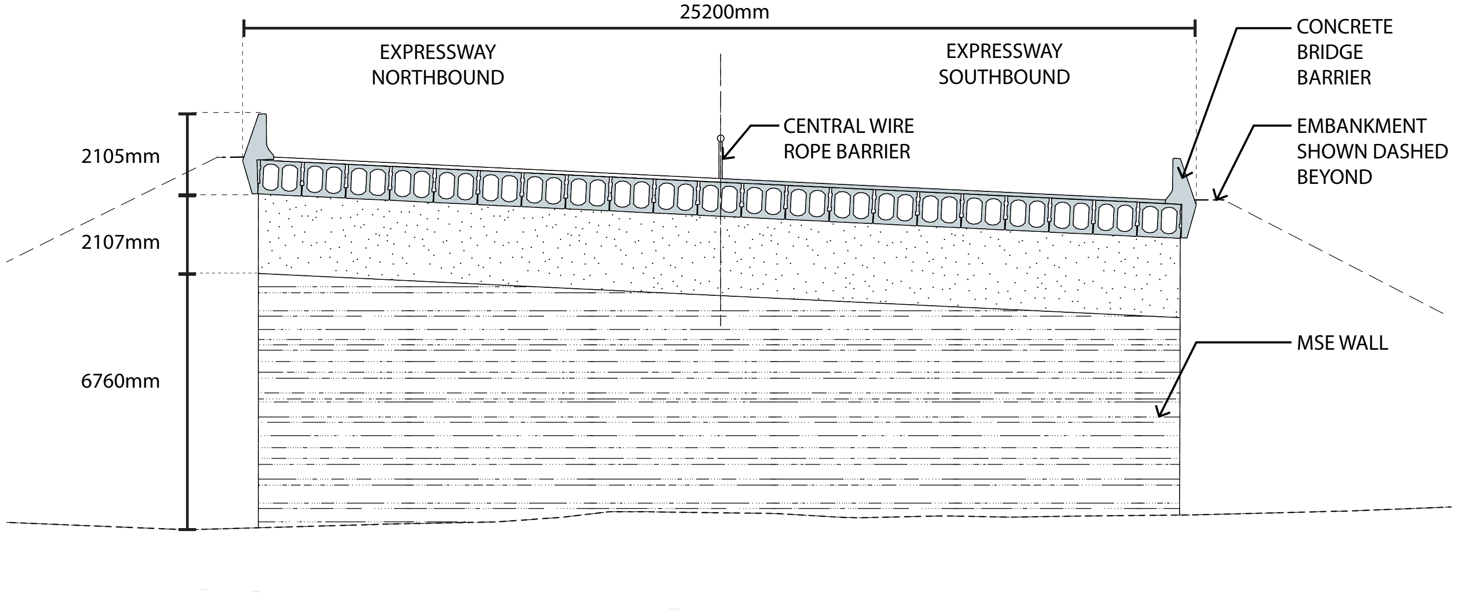
Design development

1. Column locations adjusted
2. Column profile developed
3. Reduced overall length of bridge

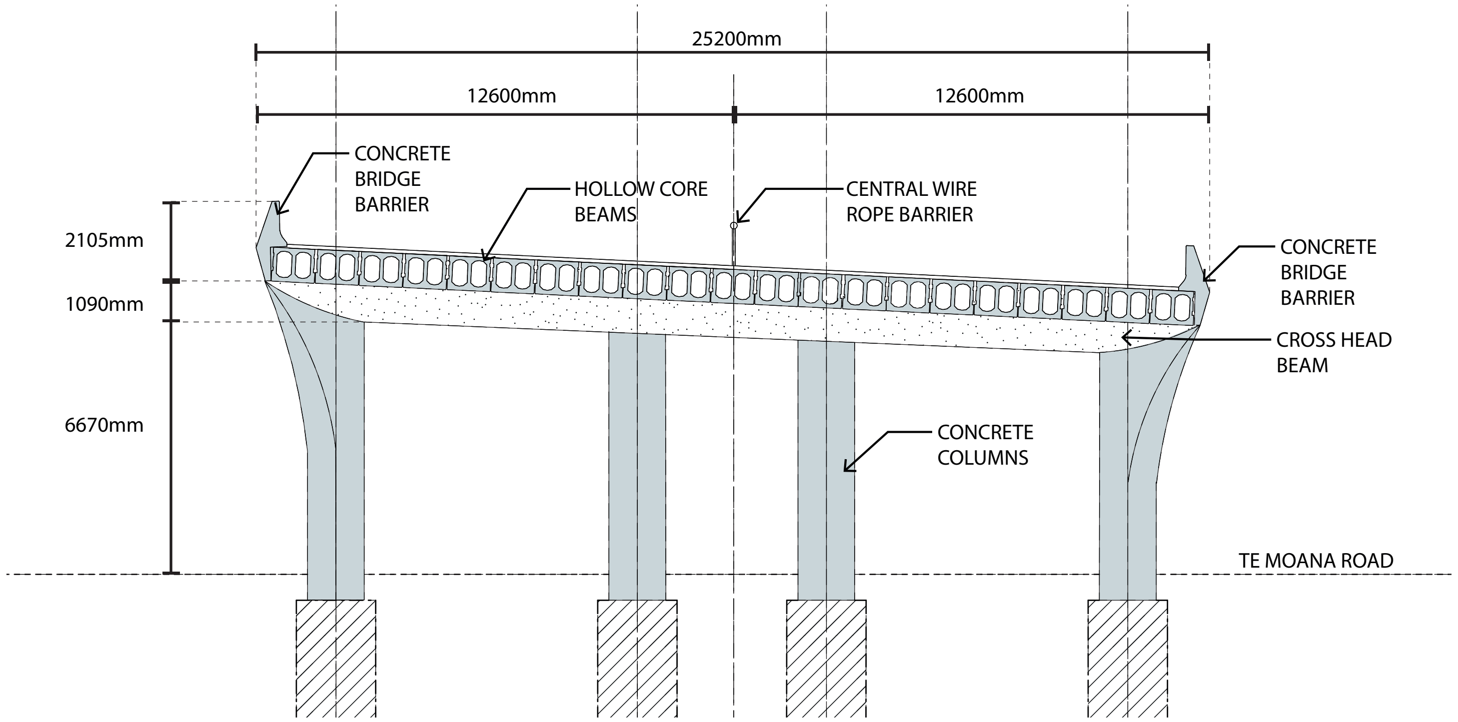
Rationale

1. More consistent span lengths, uniformity of structure
2. Increased structural core based on geotech investigations carried out post AEE, while still providing the sculptural outer.
3. Less stream diversions, removal of northern end span

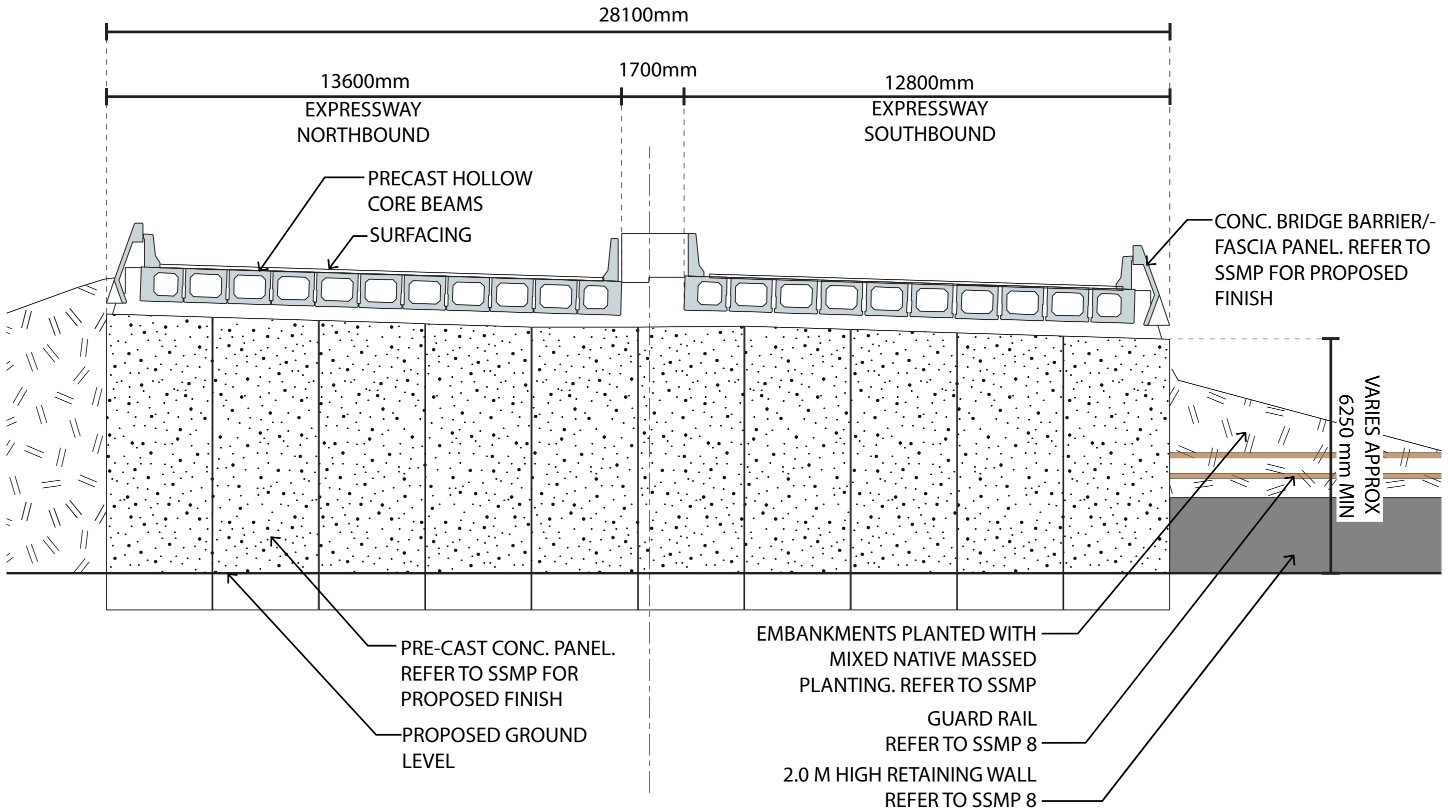
AEE Consented to DET Proposed Graphic Comparison



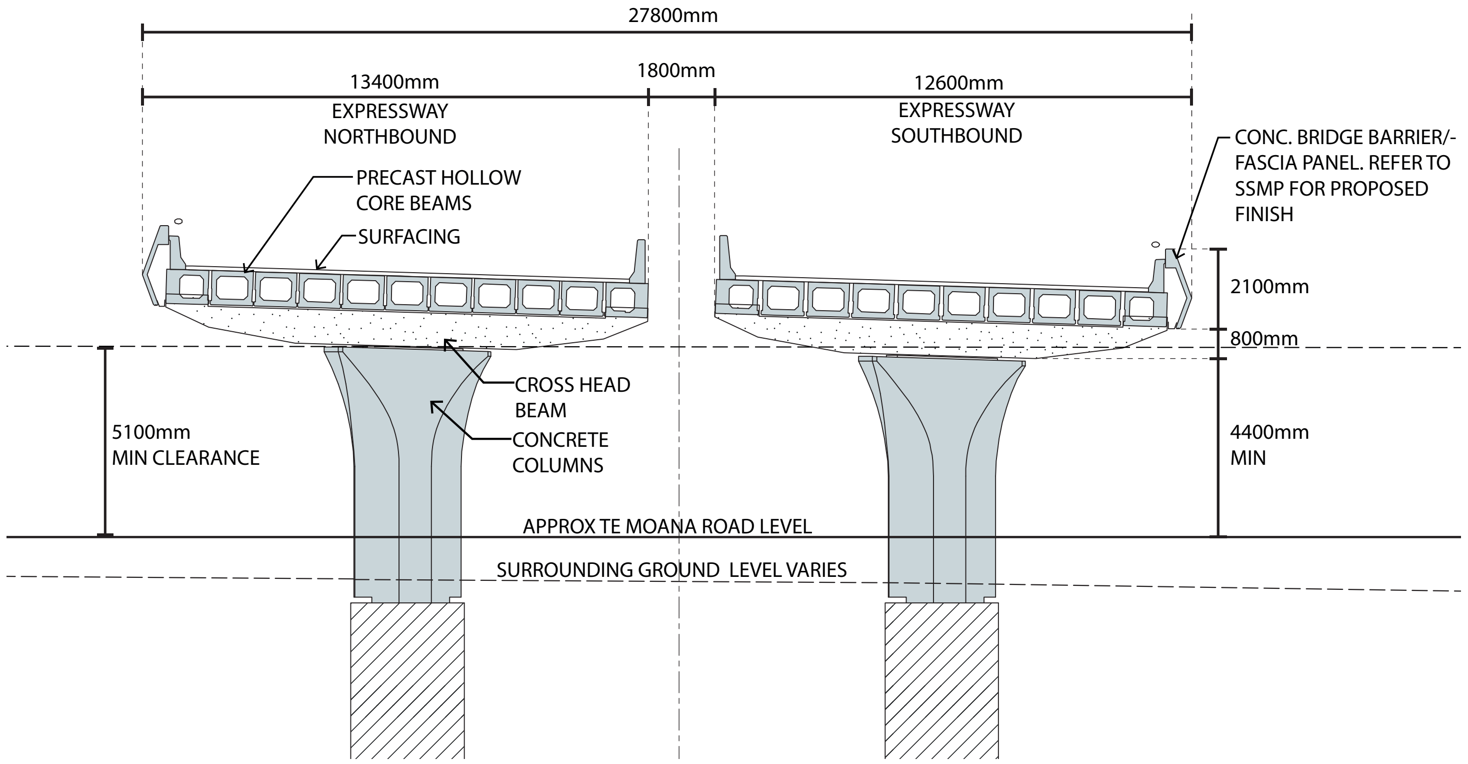
1. AEE SECTIONAL ELEVATION - TE MOANA BRIDGE PIERS (LOOKING NORTH) - 1:200@A3



2. AEE SECTIONAL ELEVATION - TE MOANA BRIDGE ABUTMENT (LOOKING NORTH) - 1:200@A3



3. PROPOSED SECTIONAL ELEVATION - TE MOANA BRIDGE PIERS (LOOKING NORTH) - 1:200@A3



4. PROPOSED SECTIONAL ELEVATION - TE MOANA BRIDGE ABUTMENT (LOOKING NORTH) - 1:200@A3

Design development

1. Reduced number of columns; 4 columns to 1 column each cross head
2. More detail provided for abutment treatment
3. Split bridge
4. Cross head form changed
5. Column profile developed
6. Simply supported structure

Rationale

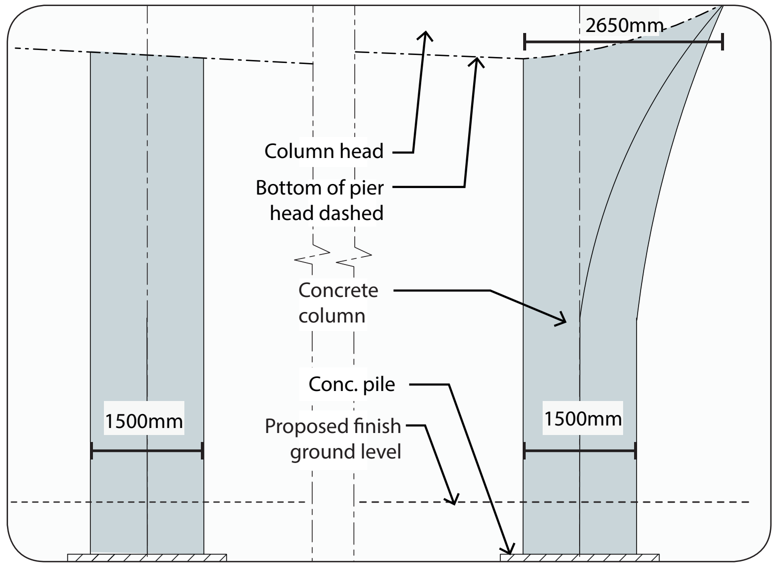
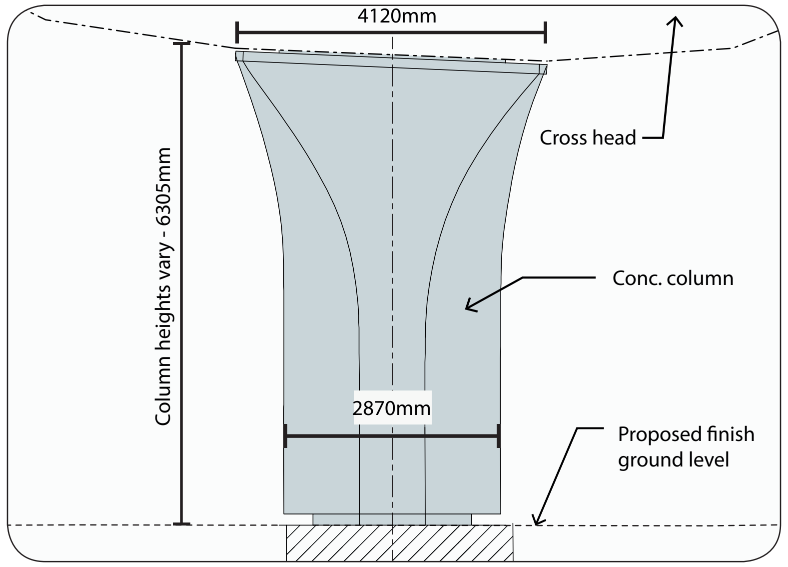
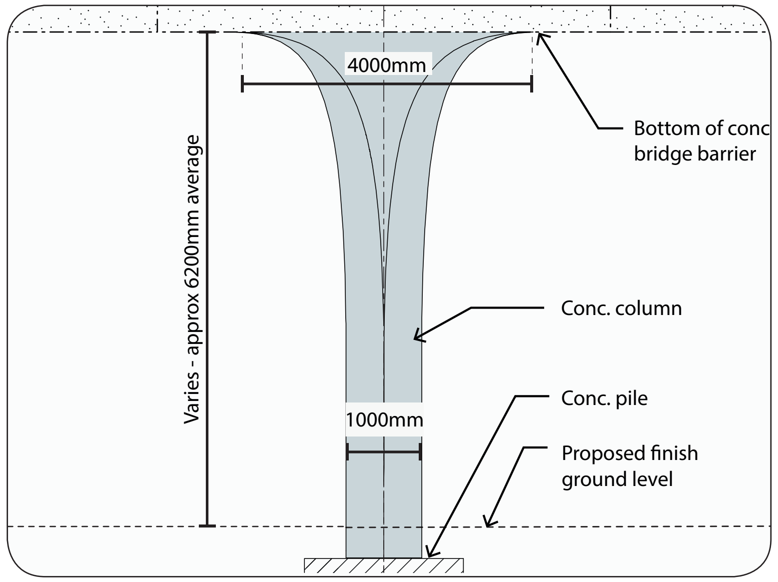
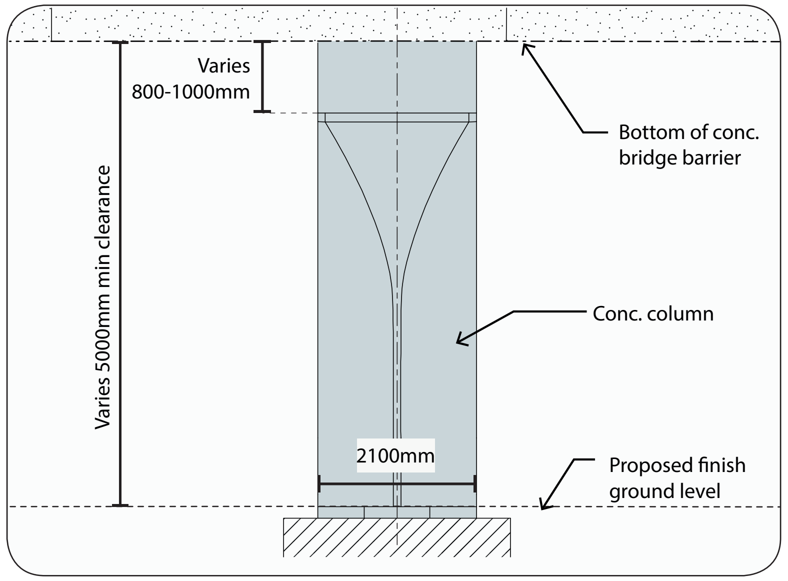
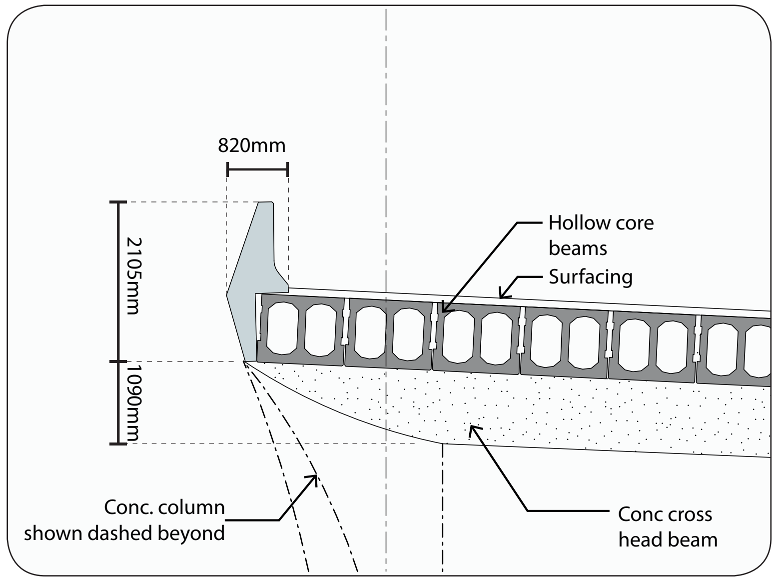
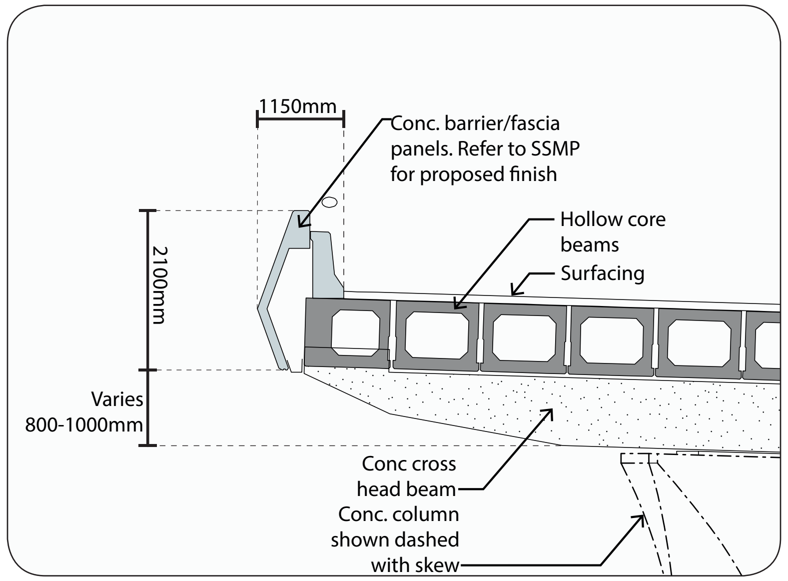
1. Improved visual permeability when considering bridge skew. Total column width when combined is reduced
2. Lack of resolution in AEE Abutment. Design developed
3. Breaks up overhead structure, reduced beam numbers
4. Simply supported structure requires platform to seat beams
5. Increased structural core based on geotech investigations carried out post AEE, while still providing the sculptural outer.
6. 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 - TE MOANA ROAD CROSSING (NORTH SIDE OF TE MOANA LOOKING EAST) SITUATION 10 YEARS FOLLOWING CONSTRUCTION

PROPOSED VISUALISATION - TE MOANA ROAD CROSSING (NORTH SIDE OF TE MOANA 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 in board	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. Overall width reduced for 1 column vs 2 column solution 3. Resolves skew visuals	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 moved in-board. Cross head lower (approx 300mm) 3. Column height reduced	1. To provide increased structural core to the column based on geotech investigations carried out post AEE, while still providing the sculptural outer. 2. Simply supported structure requires platform to seat beam, and new arrangement helps resolve issues with bridge skew 3. To allow for the changes to the cross head. 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. Columns moved in-board 2. Cross head form changed	1. Reduced number of columns 2. Simply supported structure requires platform to seat beams	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 Te Moana Road bridge is different from the AEE bridge, but the form remains consistent with other proposed bridges, including at Waikanae River nearby. The consistency across the bridges overall has become even more consistent as there is less variation in types from that shown in AEE. Accordingly there is enhanced consistency in the local environment.
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. However, the number of piers has also reduced by half.
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 (similar to the Waikanae River bridge). 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	Proposed Te Moana Road bridge interchange will be configured differently from AEE to enable traffic light controls rather than a roundabout which assists local road users. The space beneath the bridge will be no less visually appealing than the AEE bridge and maybe perceived as better given a simpler reduced number of piers (albeit that those being proposed are larger in size) and the light penetration provided by a split deck.
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 traffic light controls as noted above. The abutments are located well back from the position of the footpaths and CWB location. 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	Proposed bridge is different than the AEE in that it has a split form that allows some natural light penetration to the local road and space below.
7. Use architectural lighting to emphasise the sculptural forms of the bridges and light units that are readily serviceable from the ground	Architectural lighting to be used to add additional interest and safety at night. It is proposed to softly up light the 4 columns (the two either side of Te Moana Road) to accentuate the form of the columns.
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 systematised 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 Te Moana Road Bridge barriers/fascia panels will be fair faced concrete with a white wash, applied concrete coating to ensure colour and tonal uniformity between panels. The bridge abutment will be constructed with precast concrete panels with an exposed Otaki pebble finish. The other elements – columns, cross head and underside of the bridge deck will be simple, fair faced concrete without the applied white wash coating to help make these elements visually recessive relative to the bridge fascia panels. Matt graffiti protection to be applied to all bridge elements surfaces. 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 Te Moana Road bridge piers are different than those in AEE design. The AEE design did have bridge types where piers were located beneath the bridge and others where the piers were co-planar to the barrier and on the outside edge. Piers under the bridges were a response to the location. At Waikanae River the piers beneath the bridge recognised the hydrological constraints. At Raumati Road the piers beneath the bridge recognised the local road skew. Piers under the bridge at Te Moana Road are now considered to be best suited to this location as they provide more consistent span lengths for greater uniformity in the structure as well as reducing impacts on the Waimeha Stream. The skew and curve on the Te Moana Road bridge would also have made co-planer piers (on the outside of the bridge) more difficult to construct. Throughout the project the seismic design of the structures has had the consistent effect of increasing the size of the piers.
12. Locate bridge piers associated with bridge watercourse crossings away from riparian edges to prevent need to armour stream edges	Riprap will be installed under the bridge to a similar extent as the bridge decks, to suit the stream/floodplain/abutment arrangements and morphology. To improve the interface between the proposed riprap and 3m shared path on the north side of Te Moana Road a series of concrete 'transition' steps will be constructed. These provide increased visual amenity and a more inviting pedestrian experience while helping to improve the relationahip bwtween peir and the Waimeha stream bank
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 Te Moana Road has seen the consideration of all the contributing factors of visual amenity, safe CWB crossing, structural design in high seismic zone, and constructability.

TE MOANA ROAD CROSSING - SIMULATION

NZ TRANSPORT AGENCY
WAKA KOTAHI

MacKays to Peka Peka
Wellington Northern Corridor