06 Design elements

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6 Design elements

This section provides a detailed description of specific design responses related to elements along the corridor. These elements include interchanges, structures such as bridges and tunnel portals etc, as well as earthworks.

The overall strategy and key design response of the team address specific elements and integration with their context.

Key project elements include:

- Three interchanges at Englands Road, Coramba Road and Korora Hill
- A bus interchange at Kororo Public School.
- A bus stop at Coramba Road Interchange
- Three tunnel portals at Roberts Hill, Shephards Lane and Gatelys Road
- Feature bridge at Kororo Public School (BR 24)
- Other bridges along the main alignment
- Retaining walls
- Noise walls and headlight screens
- Major cuts
- Fauna crossings
- Equipment rooms at the portals
- Motorway Operations and Maintenance Facility (MOMF).

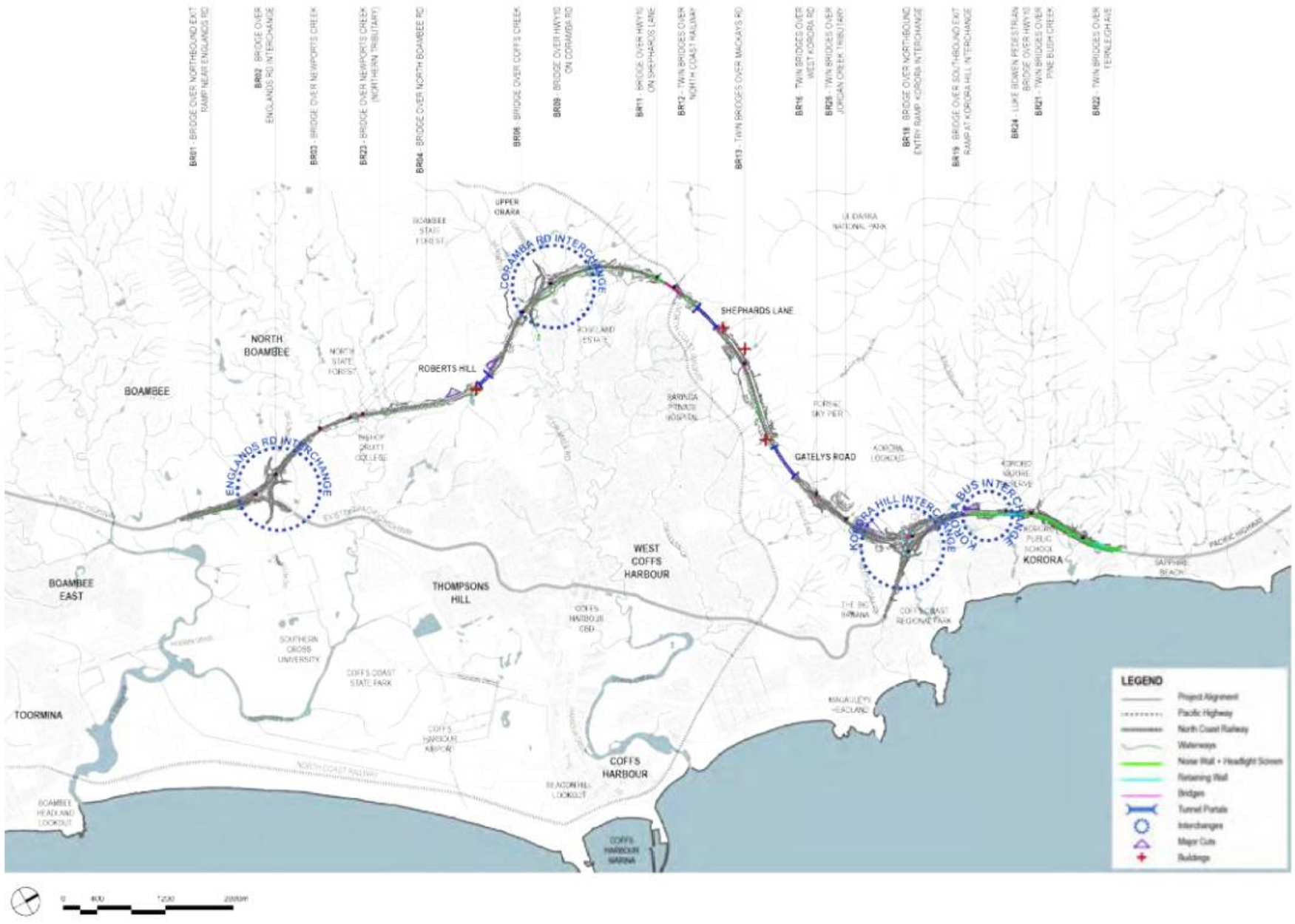


Figure 119: Design elements - key plan

6.1 Interchanges

The interchange designs reflect the local context and provide an identity related to the communities they serve. There are three grade-separated interchanges along the alignment: Englands Road interchange, Coramba Road interchange and Korora Hill interchange. These interchanges provide access from the Pacific Highway to the township of Coffs Harbour and its suburbs which are bypassed by the new alignment.

Overall strategy

Interchanges are designed to:

- Achieve a seamless physical link between the main carriageways, local roads and the adjoining road network.
- Address the quality and continuity of local vehicular, bicycle and pedestrian access, and circulation for local communities, minimising conflict between local traffic and inter-capital and regional traffic on the main carriageways.
- Minimise their footprint, fit in with the landform, appear distinctive and appropriate to their context in their form, including built and landscape elements.

Figure 120: Interchanges - key plan

6.1.1 Englands Road Interchange

- A split interchange with a northbound off ramp to the old Pacific Highway passing under the new alignment, and a southbound slip lane accessed from the old Pacific Highway
- Englands Road forms an underpass with dumbbell roundabouts providing local access, as well as access to and from the northern section of the new alignment.

Design response

As the southern entry to Coffs Harbour the landscape design has been developed to:

- Lead and direct the traveller through and into/out of Coffs Harbour
- Emphasise the development of formal structured canopy planting responsive to the alignment
- Gain views through the canopy aligning the corridor via its elevated position
- Celebrate the connection to water, tying the interchange back into its low-lying moist environment through which it passes and its Connection to Country. This will be done via drainage design, a critical element within the interchange precinct with both basins and creeks within or crossing the alignment
- Maintain koala connectivity while avoiding attracting this species into the corridor and road alignment. The natural forest community will be re-established outside the road alignment with creek links emphasised where possible. Koala tree species are only to be used outside of fauna fencing.

Figure 121: Englands Road interchange - plan

Figure 122: Englands Road Interchange - aerial view from south

Figure 123: Englands Road Interchange - southern entry to Coffs Harbour

6.1.2 Coramba Road Interchange

- A diamond shaped arrangement with entry and exit ramps located either side of the Coramba Road overbridge
- The bridge has roundabouts at either end to facilitate full turning movements, and is typical of this form of interchange arrangement along the Pacific Highway.

Design response

Located centrally within the corridor, the landscape design has been developed to:

- Mark this as the local connection
- Respond to its historical role in relation to the historic movement paths of the Aboriginal community through both the structure and planting selection that adopts vegetation of significance and colour to aid this connection. The potential to explore these themes in the bridge safety screens is also subject to consideration
- Respond to the suburban interface through adoption of formal structure in the design language. This approach is reflected by the standard diamond interchange arrangement adopted for this location
- Enhancement of riparian corridor to the south to emphasise the connection of the 'Mountains to the Sea' theme.

Figure 124: Coramba Road Interchange - plan

Figure 125: Coramba Road Interchange - aerial view

Figure 126: Coramba Road Interchange - view from northbound lanes

6.1.3 Korora Hill Interchange

Similar to the Englands Road Interchange, the design has been split providing:

- Northbound off ramp to the old Pacific Highway passing under the new alignment, and a south bound slip lane accessed from the old Pacific Highway
- A northbound on ramp is facilitated by an overbridge and dedicated ramp for access from Coffs Harbour and areas south of the interchange itself
- A straight through connection from the north to the Coffs Harbour town centre is provided
- A local service road is connected via a roundabout and traffic signals
- The configuration results in significant simplification in the interchange structure and a reduced footprint, enhancing the potential for integration and reduced impacts.

Design response

Located at the northern end of the Project, the planting design has been developed to:

- Enclose the precinct, as experienced within the existing alignment within a native canopy, comprising a formal plantation of local Eucalypt species along the road edge
- Respond to and reinforce the road alignment reducing the overall scale of the interchange
- Use colours inspired by Gumbaynggirr Country, within the palette
- Provide clear separation between local and highway road corridors through the use of garden beds and structural elements, responding to the differing vertical alignments, headlight glare and noise constraints of the site
- Use opportunities to use salvaged plant materials, including palm trees, as feature elements to provide scale and biodiversity, yet relate to the tropical resort feel of the precinct
- Emphasise creeklines and connections from the mountains to the sea are explored with a stronger emphasis on the connection to the sea.

Figure 127: Korora Hill Interchange - plan

Figure 128: Korora Hill Interchange - aerial view from south

Figure 129: Korora Hill Interchange - view from northbound lanes

6.2 Bus facilities

6.2.1 Korora Bus Interchange

The Korora Bus Interchange will be relocated and replaced with a new facility. Its landscape response will seek to provide both amenity and shade for its patrons, as well as visual continuity with the adjacent road corridor. Opportunities to enhance its usability and sense of place have been explored.

The location reinforces the character of the local road and highway set within the structure and canopy of the site's tall eucalypt forest. Shelters responding to the form and language of the bridge can provide an opportunity for further interpretation of Country and are located along the eastern edge of the site, served by buses only.

Light vehicle access is separated from the buses and located to the west. This area provides a kiss and ride drop off and parking, with bus shelters provided along the bus pull over bays. A central garden provides an opportunity for canopy cover and planting to breakup the pavement and provide a higher level of amenity.

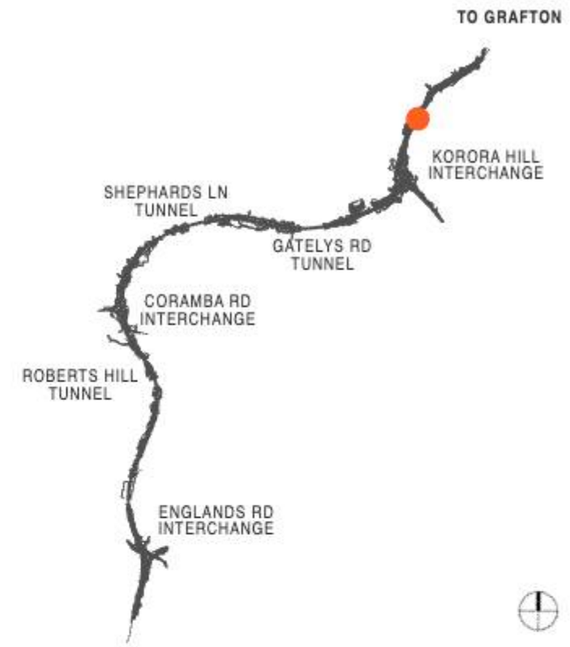
The bus shelter architecture adopts the truss design aesthetic of the Luke Bowen Pedestrian Bridge for its supports, strengthening the relationship between the bridge and bus interchange, and enhancing connectivity through the adjacent neighbourhoods.

The shelter design incorporates a combination of perforated metal and acrylic materials for the walls and roof, which will also enable passive surveillance and reduce Crime Prevention Through Environmental Design (CPTED) issues. Opportunities to integrate art have been provided.

To the east of the site the retention of parts of the existing Eucalypt Forest are retained between James Small Drive and adjoining residences and school. The area of clearing west of this retained vegetation is to be reinstated. Revegetation adopts the adjoining community establishing all layers of the community. Canopy trees of Eucalyptus microcorys, and Eucalyptus pilularis provides both screening from the broader context as well as shade to those on the shared path that passes through the space.

Figure 130: Korora Bus Interchange - plan

Figure 131: Korora Bus Interchange - aerial view from north east



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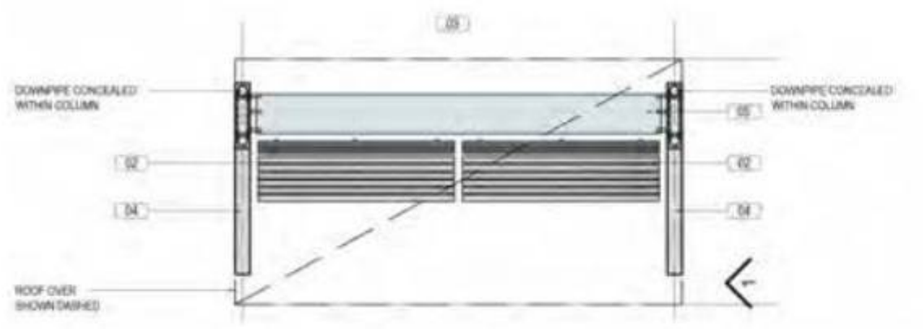
LEGEND

01	PATHWAY
02	BENCH SEATING
03	BUS SHELTER MODULE
04	POWDERCOATED SHS FRAME
05	ACRYLIC PANELS WITH INTEGRATED ART
06	LANDSCAPED BATTER
07	WAYFINDING SIGNAGE

KORORA BUS INTERCHANGE - PLAN

Figure 132: Korora Bus Interchange - plan



KORORA BUS SHELTER - PLAN

KORORA BUS INTERCHANGE - ELEVATION

KORORA BUS INTERCHANGE - SECTION

Figure 133: Korora Bus Interchange - plan, elevation and section

Figure 134: Korora Bus interchange - view of bus waiting area

Figure 135: Korora bus shelters - materiality

6.2.2 Coramba bus shelters

CORAMBA BUS SHELTERS - PLAN

Figure 136: Coramba bus shelters - materiality (Council bus shelter design)

6.3 Bridges

6.3.1 Principles and strategies

The design of bridges on the Project follows the guidelines described in the Bridge Aesthetics (RMS, 2019) document and the requirements as set out in the Upgrading the Pacific Highway Design Guidelines (RMS, 2015).

The key principles adopted in the design of the bridges are:

- Uniformity across the entire upgrade, achieved through the utilisation of key design features and consistent language across the Project
- The main bridge elements have a simple design with a smooth finish and clean lines, producing an elegant outcome in keeping with the overall language for the Pacific Highway. All bridge elements including piers, parapets, headstocks, abutments, transition panels, road traffic barriers and leading edges are fully integrated in the design
- Designed as a family of forms from a kit of parts, this minimises the number of types of superstructures and substructures.

There are a total of 17 bridge structures comprised of overpasses, bridges over local roads, creek and floodplain bridges as well as a bridge over the North Coast Railway. Bridges have been categorised into a priority ranked table which is illustrated later in this section of the report.

- The Luke Bowen Pedestrian Bridge (Bridge 24) is a feature bridge comprised of a steel structure and will be unique to the other bridges. It has therefore been categorised as Priority 1
- The bridge over highway on Shephards Lane (Bridge 11) is a local road overpass and has therefore also been categorised as Priority 1
- The bridge over northbound entry ramp at Korora Hill interchange (Bridge 18) is part of a major interchange and is therefore categorised as Priority 1
- All other bridges are generally over local roads and they are categorised as Priority 2
- All creek bridges are Priority 3, as they will not be visible to or from the surrounding context.

Figure 137: Bridges - key plan

6.3.2 Family of forms - kit of parts

The bridges have been designed as a family of forms. The number of bridge structural types has been minimised to adopt a Super-T structure, except where the spans and the geometry are not feasible to do so. All bridges have a consistent circular profile for their piers.

Bridge parapets and barriers

- Twin steel, rail and post system traffic barriers are used on all overpasses, to allow through views to the surrounding landscape and reduce the height of the structure's concrete portion in elevation
- Bridge parapets are precast concrete units
- Parapets incorporate a skirt to provide a drip edge and conceal drainage/service pipes where required.

Abutment finish and maintenance access

- All spill-through bridge abutments are finished as rock pitched/or rock armoured depending on their location. The rock will be sourced from site, or local quarries
- Maintenance access steps are provided with a consistent finish for all bridges where required.

Safety screens

- The safety screen design is integral with the bridge parapet design and barrier transition panel.
- The safety screen has smooth tapered transitions at either end of its extents.

6.3.3 Bridge type summary table

BRIDGE NO.	DESCRIPTION	STRUCTURAL TYPE	PRIORITY RANKING	NOTES
Bridge 1 (under bridge)	Bridge over northbound exit ramp near Englands Road	Plank bridge	Priority 2	Seen from exit ramp towards Coffs Harbour
Bridge 2 (under bridge)	Bridge over Englands Road Interchange	Super T, single-span	Priority 2	Seen from local road at interchange
Bridge 3 (creek bridge)	Bridge over Newports Creek	Super T, single-span	Priority 3	Low visibility
Bridge 4 (under bridge)	Bridge over North Boambee Road and basin	Super T with circular piers and cantilevered headstock, multi-span	Priority 2	Seen from local no through road
Bridge 6 (creek bridge)	Bridge over Coffs Creek	Super T, single-span	Priority 3	Low visibility
Bridge 9 (over bridge)	Bridge over highway on Coramba Road	Super T, single-span	Priority 2	Seen from main carriageway
Bridge 11 (over bridge)	Bridge over highway on Shephards Lane	Super T with circular pier and cantilevered headstock, multi-span	Priority 1	Seen from main carriageway
Bridg 12 (viaduct bridge)	Twin bridges over North Coast Railway	Super T with circular piers and cantilevered headstock, multi-span	Priority 2	Seen from local road and residential area
Bridge 13 (under bridge)	Twin bridges over Mackays Road	Super T, single-span	Priority 2	Seen from local road
Bridge 16 (under bridge)	Twin bridges over West Korora Road	Super T, single-span	Priority 2	Seen from local road
Bridge 18 (under bridge)	Bridge over northbound entry ramp at Korora Hill Interchange	Super T with circular piers and cantilevered headstock, multi-span	Priority 1	Seen from local road and entry ramp
Bridge 19 (over bridge)	Bridge over southbound exit ramp at Korora Hill Interchange	Super T, single-span	Priority 1	Seen from entry and exit ramp at Korora interchange
Bridge 21 (creek bridge)	Twin bridges over Pine Bush Creek	Super T, single-span	Priority 3	Low visibility
Bridge 22 (under bridge)	Twin bridges over Fernleigh Avenue	Super T, single-span	Priority 2	Seen from local road
Bridge 23 (creek bridge)	Bridge over Newports Creek (northern tributary)	Super T with circular piers and cantilevered headstock, multi-span	Priority 3	Low visibility
Bridge 24 (pedestrian bridge)	Luke Bowen Pedestrian Bridge over highway	Steel truss bridge	Priority 1	Seen from main carriageway
Bridge 26 (creek bridge)	Twin bridges over Jordans Creek tributary	Super T, single-span	Priority 3	Low visibility

Table 6: Bridge type summary

6.3.4 Landscape adjoining bridges

The landscape design at bridges is responsive to the nature and context of the bridge, and has adopted these key strategies:

- A 10 metre offset for trees is adopted. The offset of trees is an important consideration in minimising ongoing maintenance inputs, and so as to not compromise safety during maintenance activities and future damage to structures
- Interchange and overpass bridges have the potential to add to the story of progress along the corridor. They are to be developed with a unique and distinctive character, which provides some insight into the setting
- Creek bridges provide an opportunity to express the purpose of the crossing through the revegetation, utilising the community which adjoins them. The crossing of creeks is associated with the wetter swampland or creekline communities and this is reflected in the revegetation, utilising this community in the design.

In addition to the reinforcement of the vegetation communities there is also a focus on fauna connectivity. This is achieved through the creation of clear zones for fauna passage which is designed around the specific fauna movements anticipated.

6.3.5 Luke Bowen Pedestrian Bridge (Bridge 24)

The Luke Bowen Pedestrian Bridge is a visually prominent element. It is a major link that strengthens pedestrian connections between neighbourhoods on the eastern and western sides of the Pacific Highway, including enhanced connections to Kororo Public School and the new bus interchange. The bridge serves as a northern gateway on approach to Coffs Harbour, as well as a southern gateway to the Sapphire Beach Coast while exiting from Coffs, and enhances the user experience for various scales and modes of travel.

The bridge has been designed as an integrated truss structure, with a consistent and complimentary profile in cross section and elevation that extends along the full length of the bridge; including the approach ramps. It has been developed as a sculptural form, providing a dynamic aesthetic. A single structural type in the form of a square hollow section has been used for all truss elements of the superstructure.

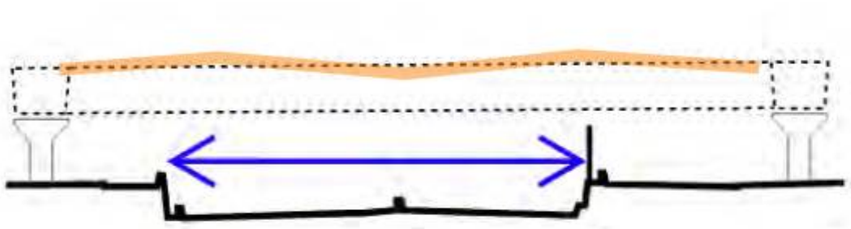
The cross section comprises top and bottom chords, with cross braces between the side chords diagonals and bracing joining the chords. The side chords have a profile which opens up the visual envelope of the bridge and gives an open feel to the design aesthetic.

The top chords are comprised of one module, which is articulated to have a higher and lower level. This module is mirrored for the next span, with the vertices of the various levels of the top chords joining each other. This modulated ensemble of forms provides a dynamic and playful aesthetic to the bridge, so it can be perceived as a piece of sculpture in the landscape. The spans of the main truss structure have been maximised to reduce clutter and increase visual transparency.

The truss infills are comprised of feature tensile mesh, articulated to provide a tessellated pattern, incorporating artwork, developed with local artists.

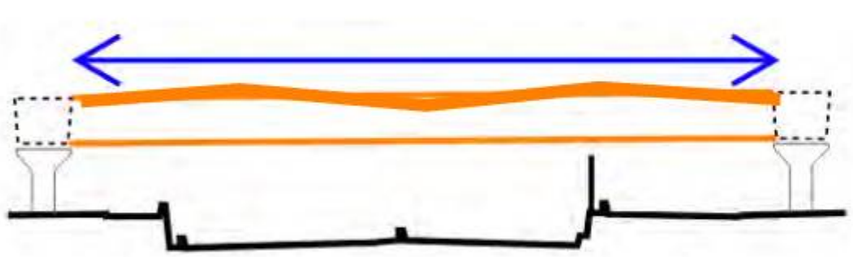
Figure 138: BR24 - Luke Bowen Pedestrian Bridge - view from north

Design principles



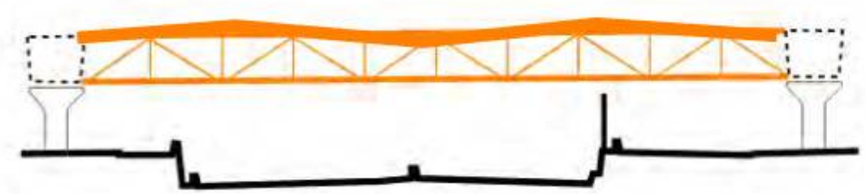
Maximise view corridors

- Clear spans between piers to maximise view corridors and allow the bridge to be perceived as a floating element over the roadway



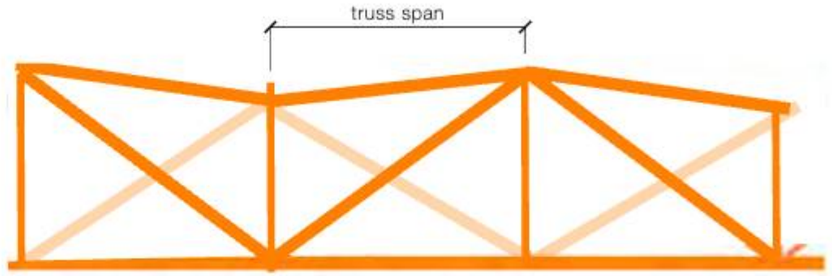
Simple, clean and elegant lines

- Linear profile that provides a simple, clean but elegant aesthetic
- Provide an integrated truss structure with a consistent aesthetic



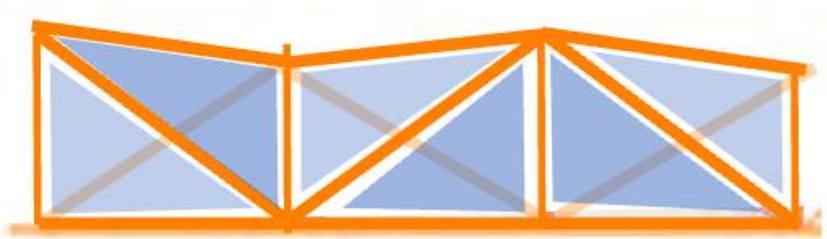
Reduce visual clutter

- Spacing of truss spans to minimise visual clutter and complexity of the bridge superstructure through spacings and providing rhythm



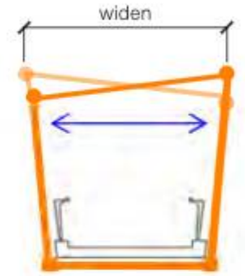
Truss spacings

- Approximately spaced truss spans
- Maximise through views
- Articulate the truss so that the structure is seen as a sculpture in the landscape
- Articulate top profile
- Create a gateway bridge - to and from Coffs Harbour and the Sapphire Beach Coast - visually iconic



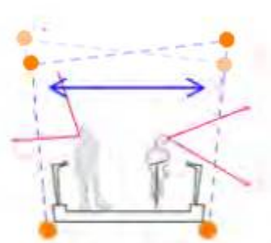
Integration of elements

- Integrate safety screen with the bridge structure



Open feel

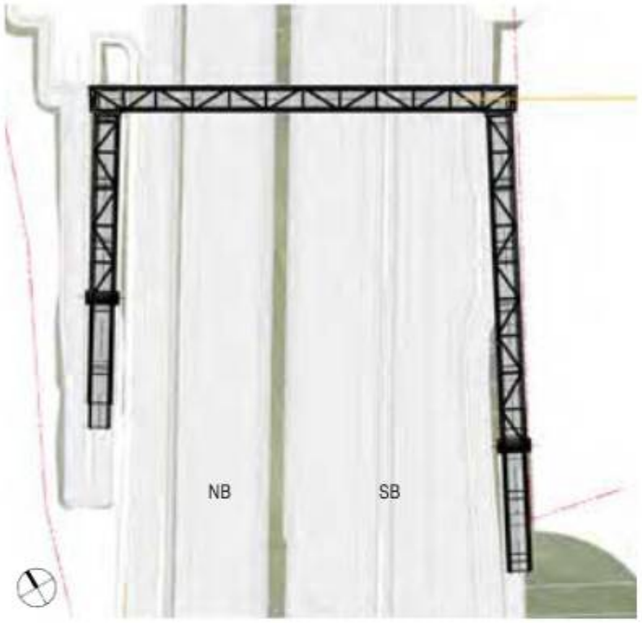
- Provide an open feel internal user experience
- Articulate the truss profile in cross section



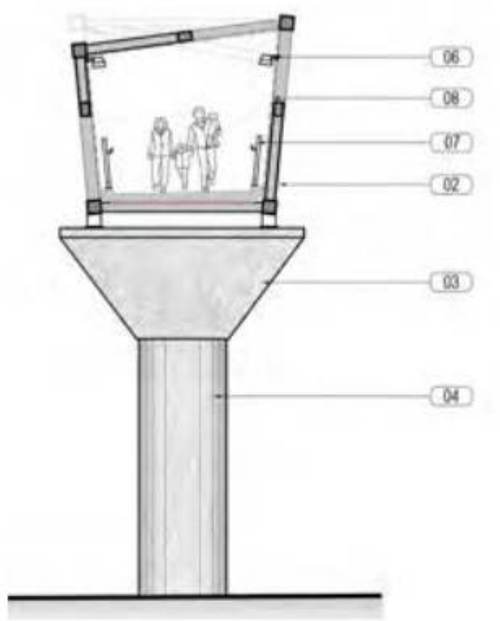
Visual permeability

- Visually permeable safety screen integrated with the superstructure
- CPTED principles

Figure 139: BR24 - Luke Bowen Pedestrian Bridge - design principles



BRIDGE 24 - PLAN



BRIDGE 24 - SECTION

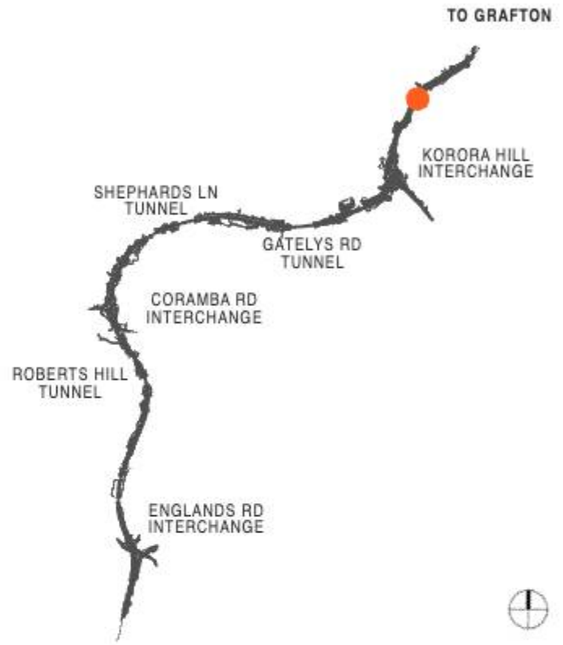


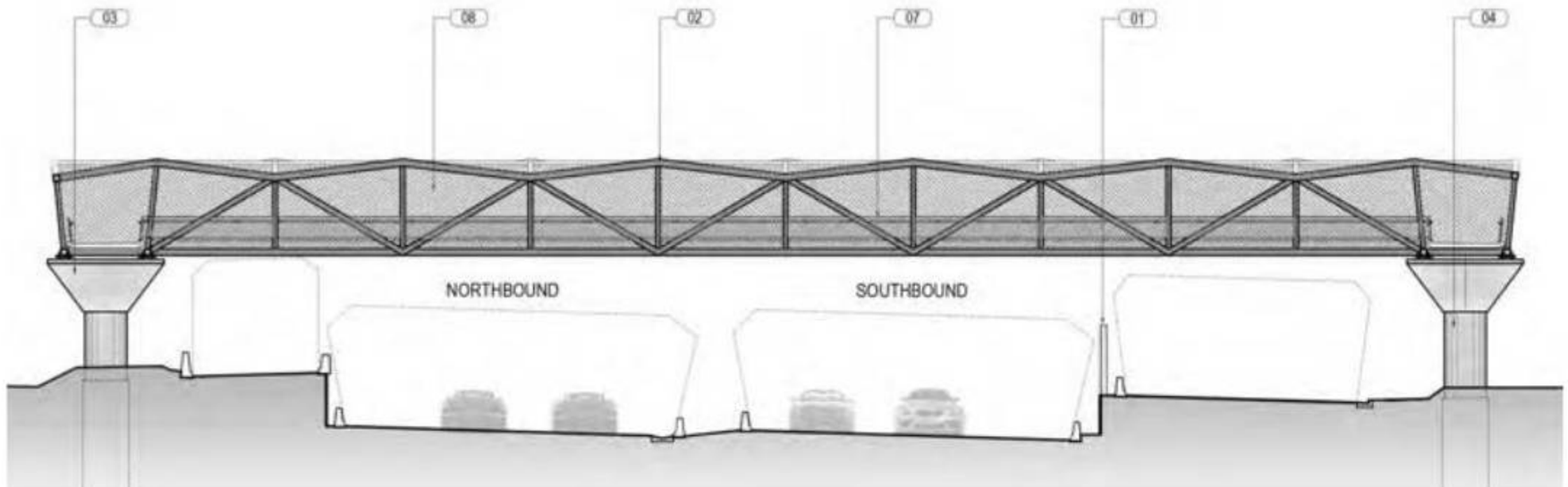
Figure 140: Luke Bowen Pedestrian Bridge (Bridge 24) - close up view from south

Figure 141: Luke Bowen Pedestrian Bridge (Bridge 24) - view on bridge looking east

LEGEND

01 NOISE WALL
02 ARTICULATED STEEL TRUSS STRUCTURE
03 CONCRETE CAPITAL
04 CONCRETE PIER
05 RSW BRIDGE ABUTMENT
06 BRIDGE LIGHTING
07 PEDESTRIAN RAILING
08 TENSILE MESH SCREEN

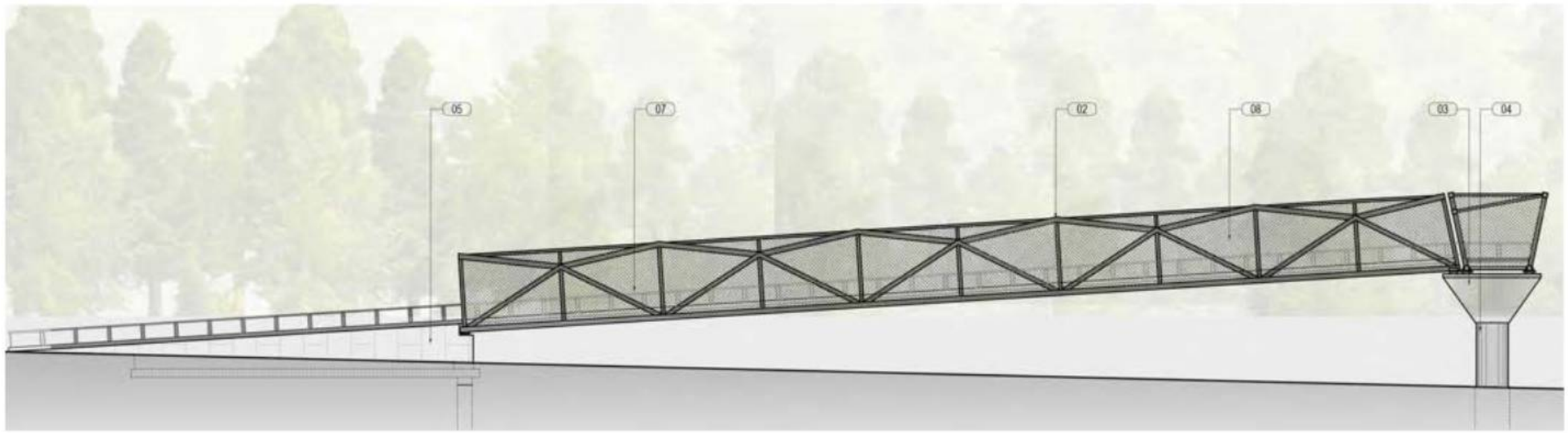
Figure 142: BR24 - plan and section



LEGEND

- 01 NOISE WALL
- 02 ARTICULATED STEEL TRUSS STRUCTURE
- 03 CONCRETE CAPITAL
- 04 CONCRETE PIER
- 05 RSW BRIDGE ABUTMENT
- 06 BRIDGE LIGHTING
- 07 PEDESTRIAN RAILING
- 08 TENSILE MESH SCREEN

BRIDGE 24 - SECTION 1



BRIDGE 24 - SECTION 2

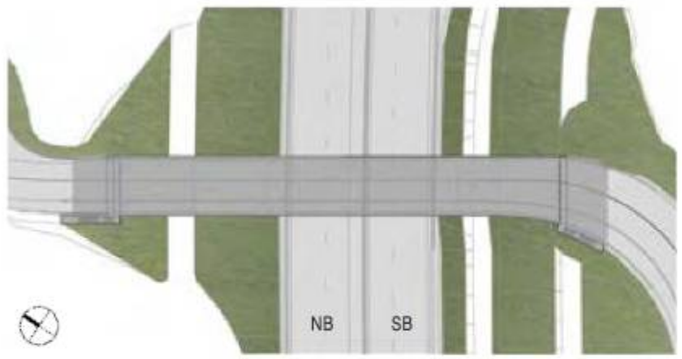
Figure 143: Luke Bowen Pedestrian Bridge (Bridge 24) - elevations 1 & 2

Figure 144: Luke Bowen Pedestrian Bridge (Bridge 24) - looking north

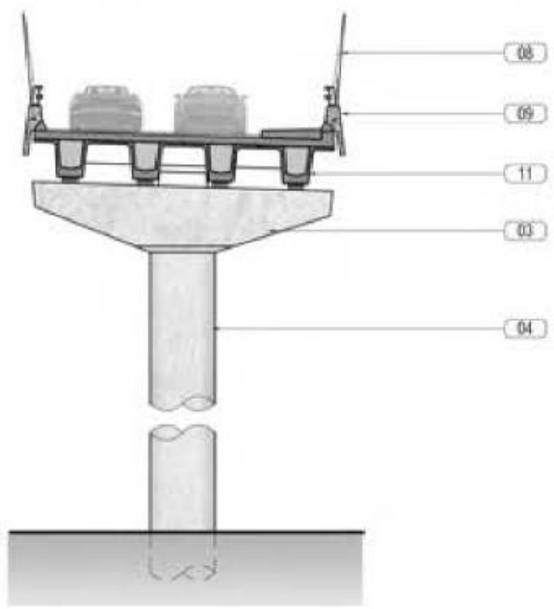
6.3.6 Bridge over highway on Shephards Lane (Bridge 11)

Figure 145: Bridge over highway on Shephards Lane (Bridge 11) - looking east from northbound lanes

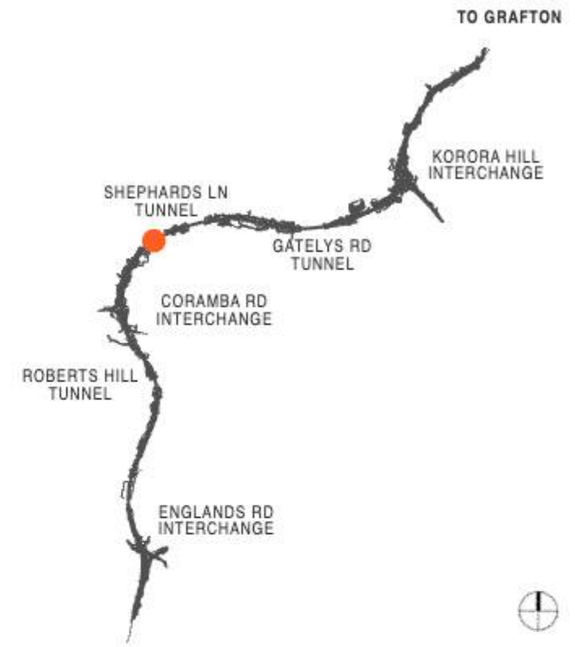
Figure 146: Bridge over highway on Shephards Lane (Bridge 11) - looking west from southbound lanes

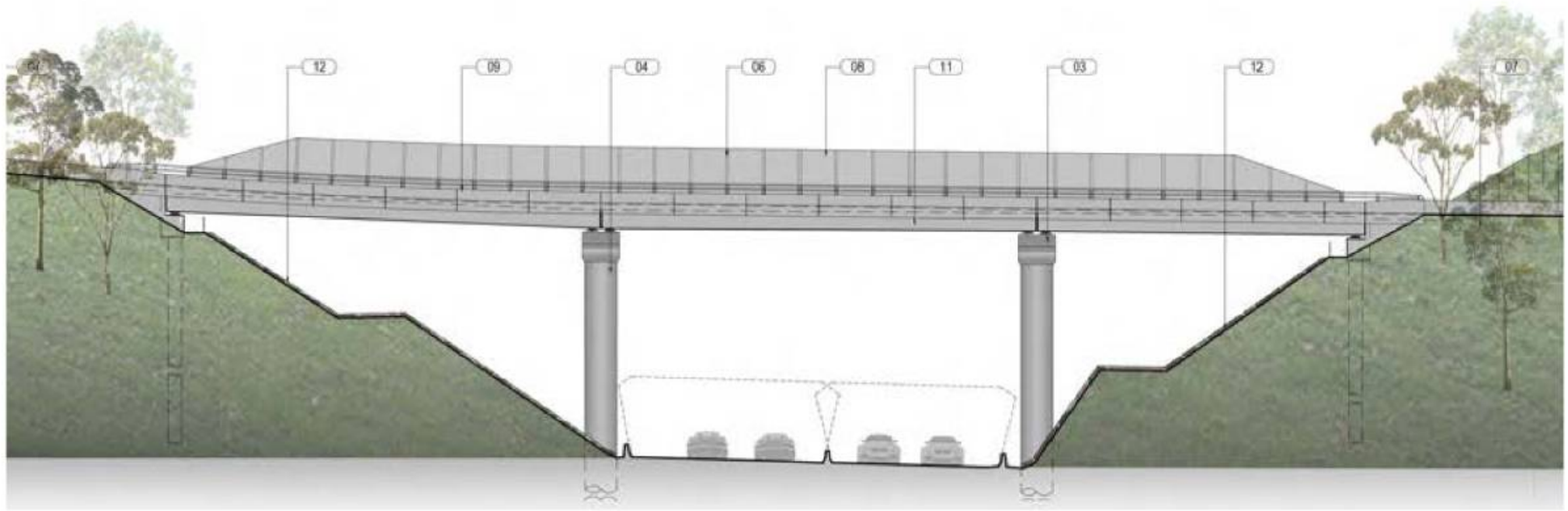


BRIDGE 11 - PLAN



BRIDGE 11 - SECTION





BRIDGE 11 - ELEVATION

LEGEND

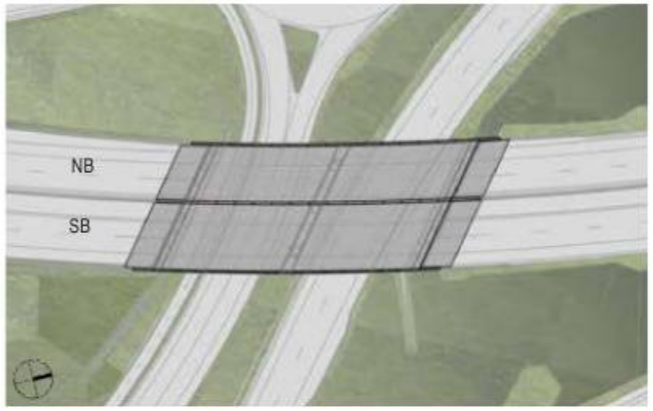
01	PAINTED SOLID NOISE WALL
02	TINTED TRANSPARENT ACRYLIC NOISE WALL
03	ARTICULATED CONCRETE HEADSTOCK
04	CIRCULAR CONCRETE PIER
05	RIP RAP TREATMENT UNDER BRIDGE
06	GALVANISED POST
07	LANDSCAPED BATTER
08	SAFETY SCREEN WITH MESH INFILL PANELS
09	CONCRETE BARRIER WITH TWIN RAIL
10	TYPE 'F' BARRIER
11	SUPER-T GIRDER
12	EXPOSED ROCK TREATMENT UNDER BRIDGE
13	RSW CONCRETE PANELS

Figure 147: Bridge over highway on Shephards Lane (Bridge 11) - plan, section & elevation

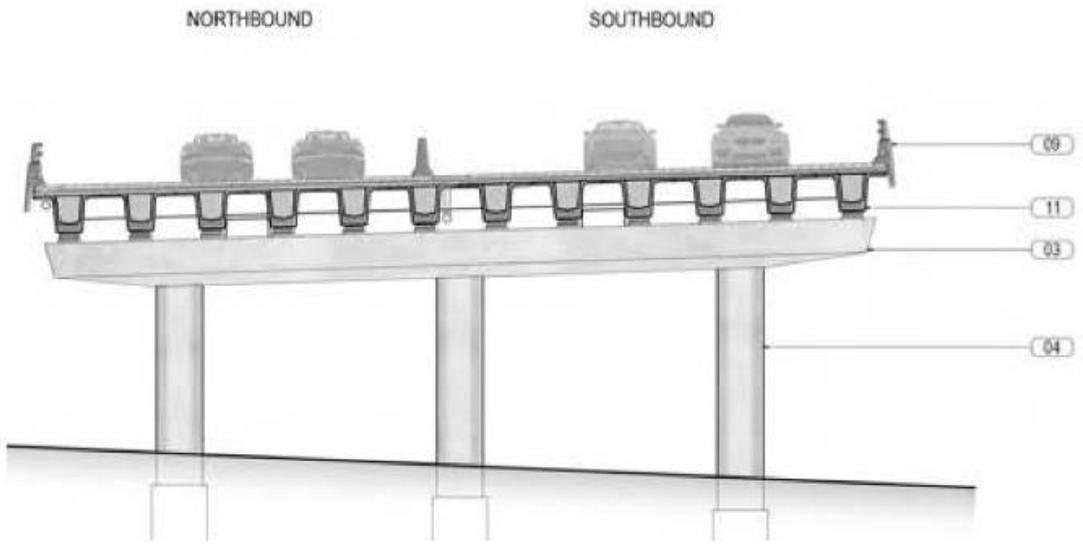
6.3.7 Bridge over northbound entry ramp, Korora Hill Interchange (Bridge 18)

Figure 148: Bridge over northbound entry ramp, Korora Hill Interchange (Bridge 18) - view looking north

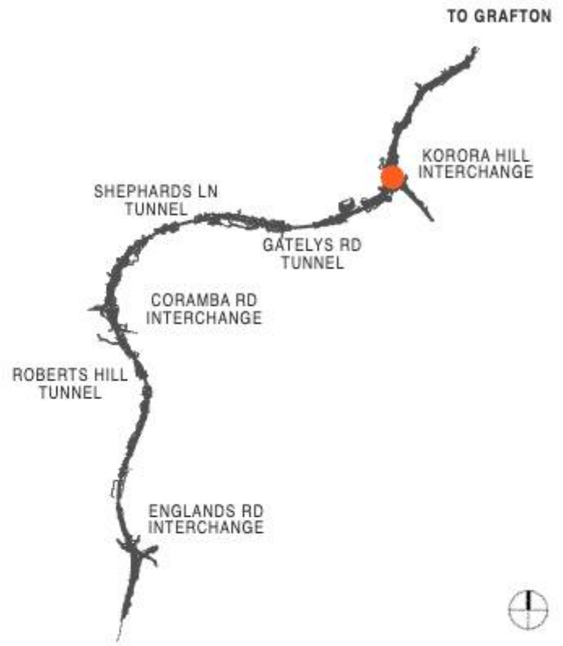
Figure 149: Bridge over northbound entry ramp, Korora Hill Interchange (Bridge 18) - closeup view looking north



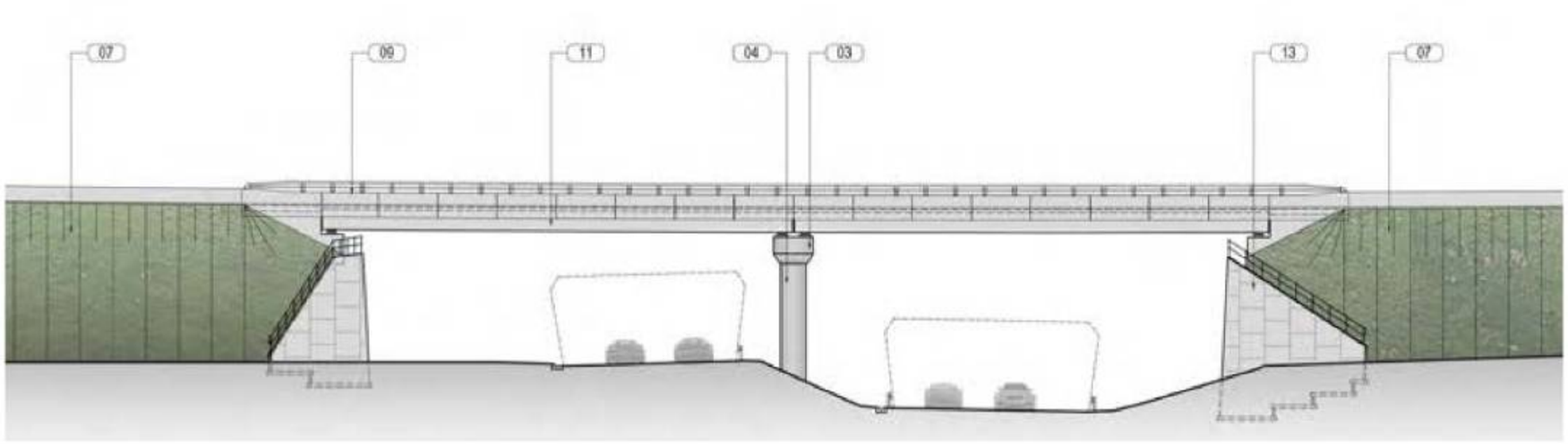
BRIDGE 18 - PLAN



BRIDGE 18 - SECTION



KEY PLAN



BRIDGE 18 - ELEVATION

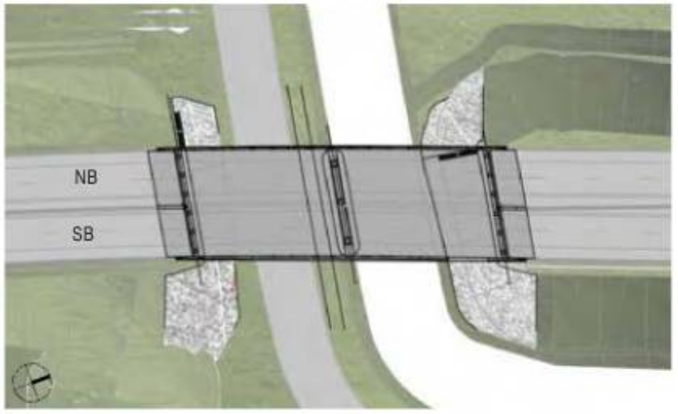
LEGEND

01	PAINTED SOLID NOISE WALL
02	TINTED TRANSPARENT ACRYLIC NOISE WALL
03	ARTICULATED CONCRETE HEADSTOCK
04	CIRCULAR CONCRETE PIER
05	RIP RAP TREATMENT UNDER BRIDGE
06	GALVANISED POST
07	LANDSCAPED BATTER
08	SAFETY SCREEN WITH MESH INFILL PANELS
09	CONCRETE BARRIER WITH TWIN RAIL
10	TYPE 'F' BARRIER
11	SUPER-T GIRDER
12	EXPOSED ROCK TREATMENT UNDER BRIDGE
13	RSW CONCRETE PANELS

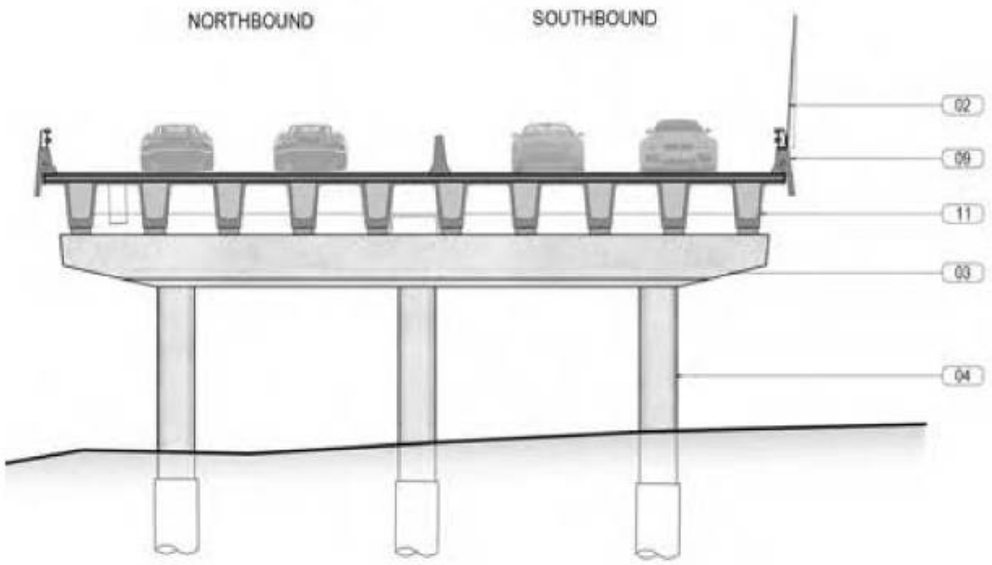
Figure 150: Bridge over northbound entry ramp, Korora Hill Interchange - plan, section and elevation

6.3.8 Bridge over North Boambee Road and basin (Bridge 4)

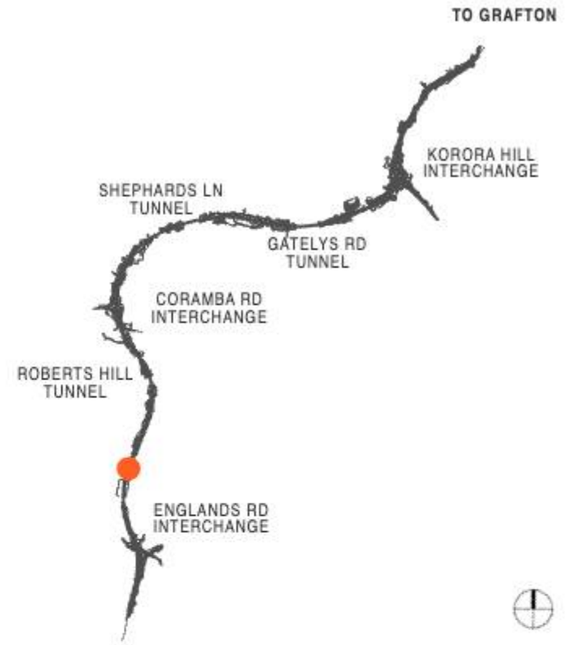
Figure 151: Bridge over North Boambee Road and basin (Bridge 4) - view from east

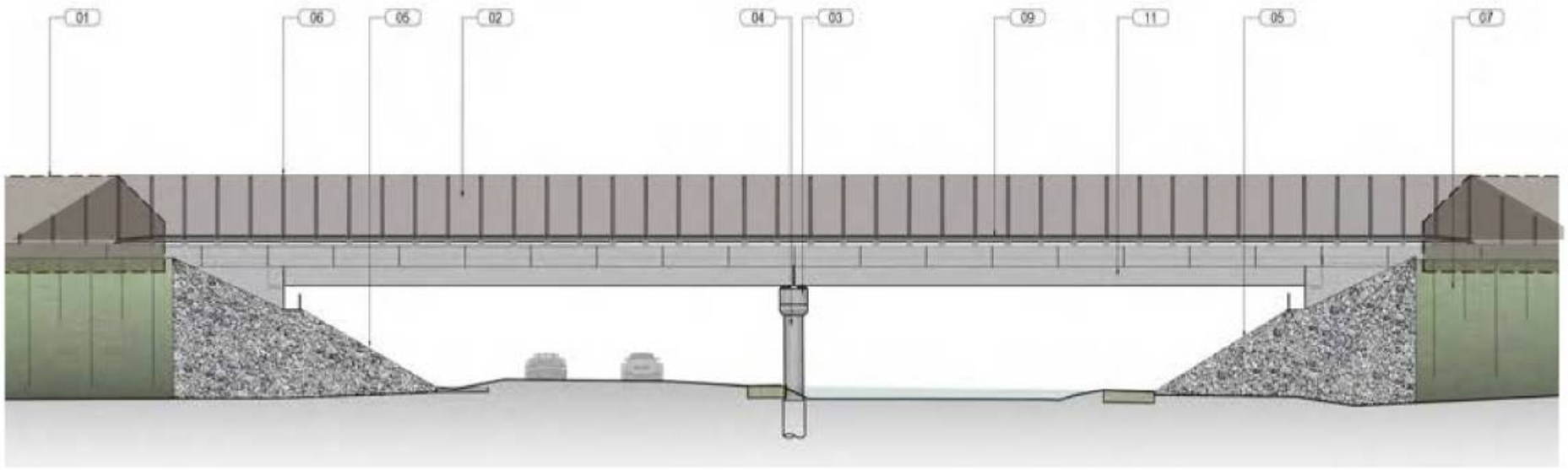


BRIDGE 4 - PLAN



BRIDGE 4 - SECTION





BRIDGE 4 - ELEVATION

LEGEND

01	PAINTED SOLID NOISE WALL
02	TINTED TRANSPARENT ACRYLIC NOISE WALL
03	ARTICULATED CONCRETE HEADSTOCK
04	CIRCULAR CONCRETE PIER
05	RIP RAP TREATMENT UNDER BRIDGE
06	GALVANISED POST
07	LANDSCAPED BATTER
08	SAFETY SCREEN WITH MESH INFILL PANELS
09	CONCRETE BARRIER WITH TWIN RAIL
10	TYPE 'F' BARRIER
11	SUPER-T GIRDER
12	EXPOSED ROCK TREATMENT UNDER BRIDGE
13	RSW CONCRETE PANELS

Figure 152: Bridge over North Boambee Road and basin (Bridge 4) - plan, section and elevation

6.3.9 Twin bridges over North Coast Railway (Bridge 12)

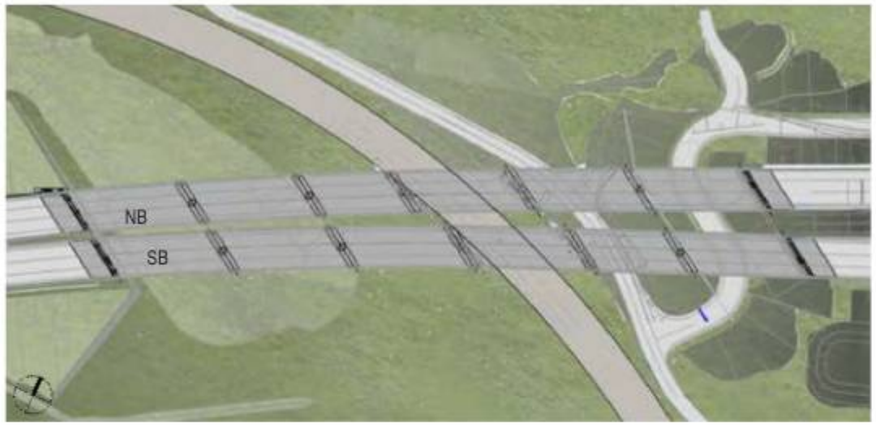
The design provides significant community benefits by reducing clutter, opening up views beyond the bridges by providing visual permeability between the eastern and western sides which strengthens the relationship with the mountains.

The noise wall on the eastern side of the bridge will be in transparent acrylic, with an earthy tone tinted colour that reflects Country and integrate with the surrounding context.

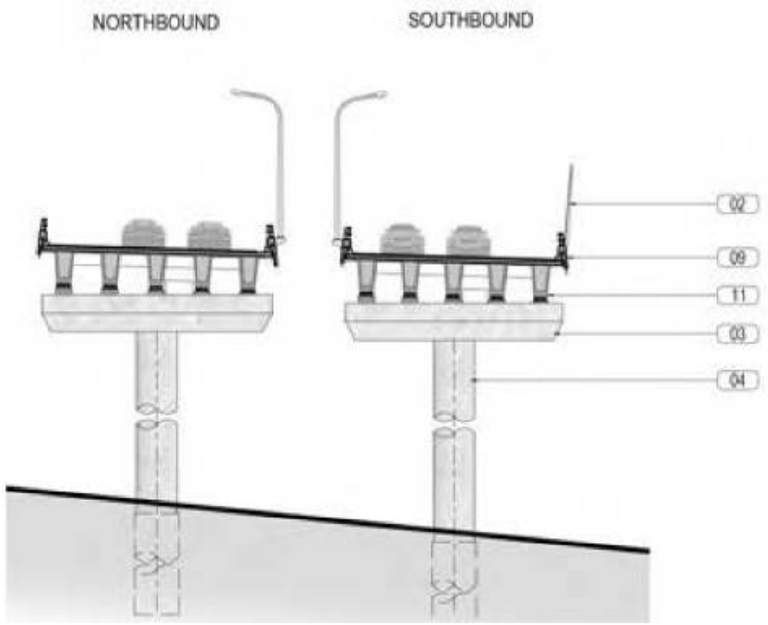
Figure 153: Twin bridges over North Coast Railway (Bridge 12) - view of North Coast Railway overbridge

Figure 154: Twin bridges over North Coast Railway (Bridge 12) - view of the overbridge from residential area

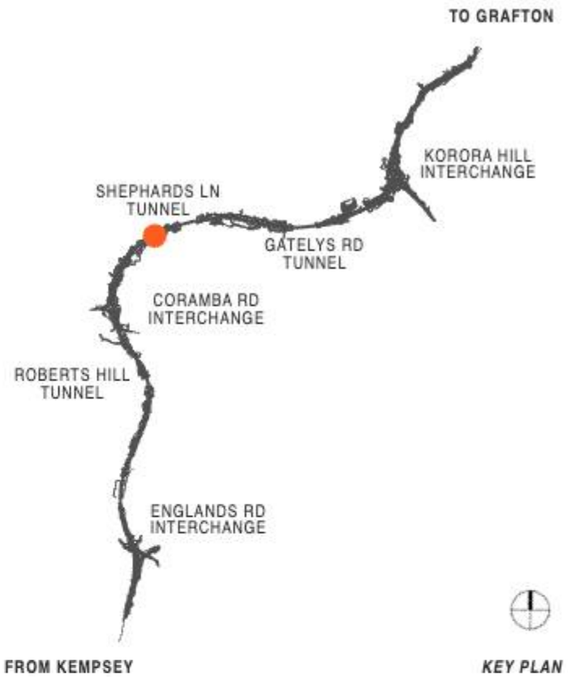
Figure 155: Twin bridges over North Coast Railway (Bridge 12) - view of the overbridge from residential area

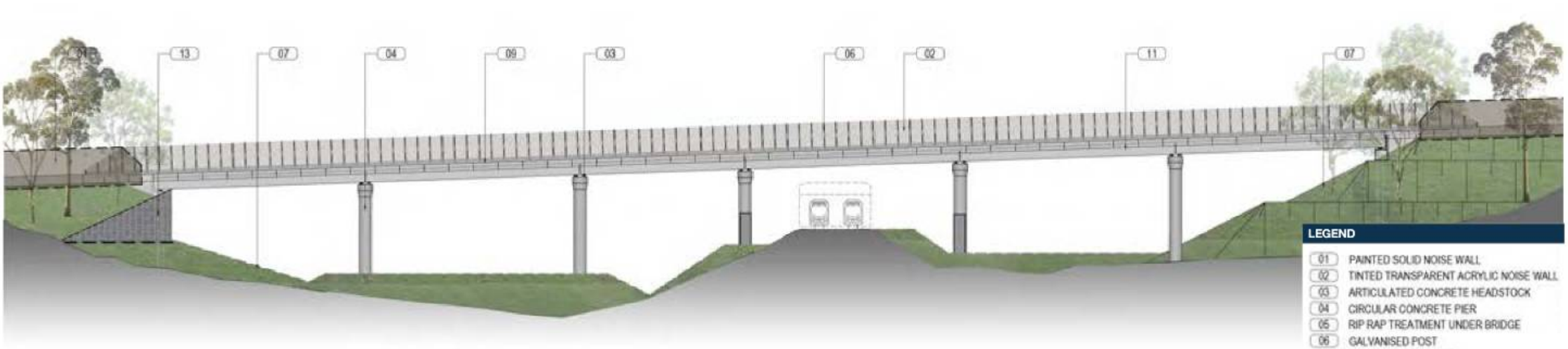


BRIDGE 12 - PLAN



BRIDGE 12 - SECTION





BRIDGE 12 - ELEVATION

Figure 156: Twin bridges over North Coast Railway (Bridge 12) - plan, section and elevation

6.4 Tunnel portals

There are three tunnels through the ridges at Roberts Hill, Shephards Lane and Gatelys Road. The design of their portals pose challenges in terms of the integration of their vertical cuttings with the landscape while minimising the overall scale and visual discord within its setting. The design seeks to minimise environmental disturbance while maximising integration.

This has been achieved by:

- Minimisation of cut height - adoption of a near vertical cut face with a consistent 4V:1H profile to avoid disturbing broader hillside
- Use of articulated rock face treatments to provide a controlled aesthetic treatment to cut face which ties in with the natural setting
- Laying back of side slopes to allow landscape to come down in front and encapsulate portal - reducing scale and impact.

The landscape response seeks to limit the visual scale of the portal by tying it back into the adjoining vegetation context. Landscape treatments are a combination of seeding and planting and seek to achieve a natural appearance.

Planting is focused on canopy and mid-storey species which both mitigate the scale of the structure and provide a robust low maintenance approach which avoids the maintenance issues of a mass planted approach to the environment.

There are equipment facilities located near some of the portals. These equipment facilities have been designed to have a recessive appearance with buffer planting provided to screen them as much as possible.

Figure 157: Tunnel portals - key plan

6.4.1 Key features and shotcrete mitigation

The use of shotcrete on the Project has been minimised as opportunities for providing slope batters of 2H:1V have been maximised, allowing for vegetation to be provided. In other areas where cutting is unavoidable, the use of exposed rock has been propagated.

The only major areas where shotcrete has been exposed are at the portal facades, where it has been used purely as a construction method.

However the following urban design measures have been adopted to minimise its visual impact:

- Profiling the overall shape of the portal facade to have a smooth and gentle curve. The extents of the shotcrete on the tunnel portals have been articulated to create a smooth profile that compliments the hills and mountains and seamlessly integrates into the character of the surrounding environment
- Providing a recessive appearance to the exposed shotcrete section with a pigment and texture. The appearance of the shotcrete has been kept recessive and architecturally treated with a dark pigment colour and texture incorporated to provide a consistent design aesthetic
- Incorporating architecturally treated shotcrete, which represents a natural rock face, articulated and shaped to compliment the cured profile of the cut of the portal facade. The additional layer compliments the natural context, and helps to further reduce the impact of untreated, exposed shotcrete which will be recessed into the backdrop
- Providing a collar around the portal to define the portal entry and exits and provide a clean finish to the portal cladding.

6.4.2 Urban design principles

- Adopt the three-layered approach to develop the design
- Consider the portal aesthetic within the context of other furniture such as lighting, ITS, signage gantry and noise walls
- Provide depth and contrast between the three layers
- Maintain an articulated profile for the portal envelope layer that wraps around the full extent of the portal
- Explore the concept of providing horizontality or verticality or both around the portal envelope
- Integrate furniture where possible
- Consider ease of constructability
- Consider Safety in Design
- Consider safety during construction

6.4.3 Design approach

A three-layered approach has been adopted to portal design comprising:

- Layer 1 – Approach landscape (landscape surrounds)
- Layer 2 – Portal envelope (interim layer)
- Layer 3 – Recessive backdrop (shotcrete with oxide pigment)

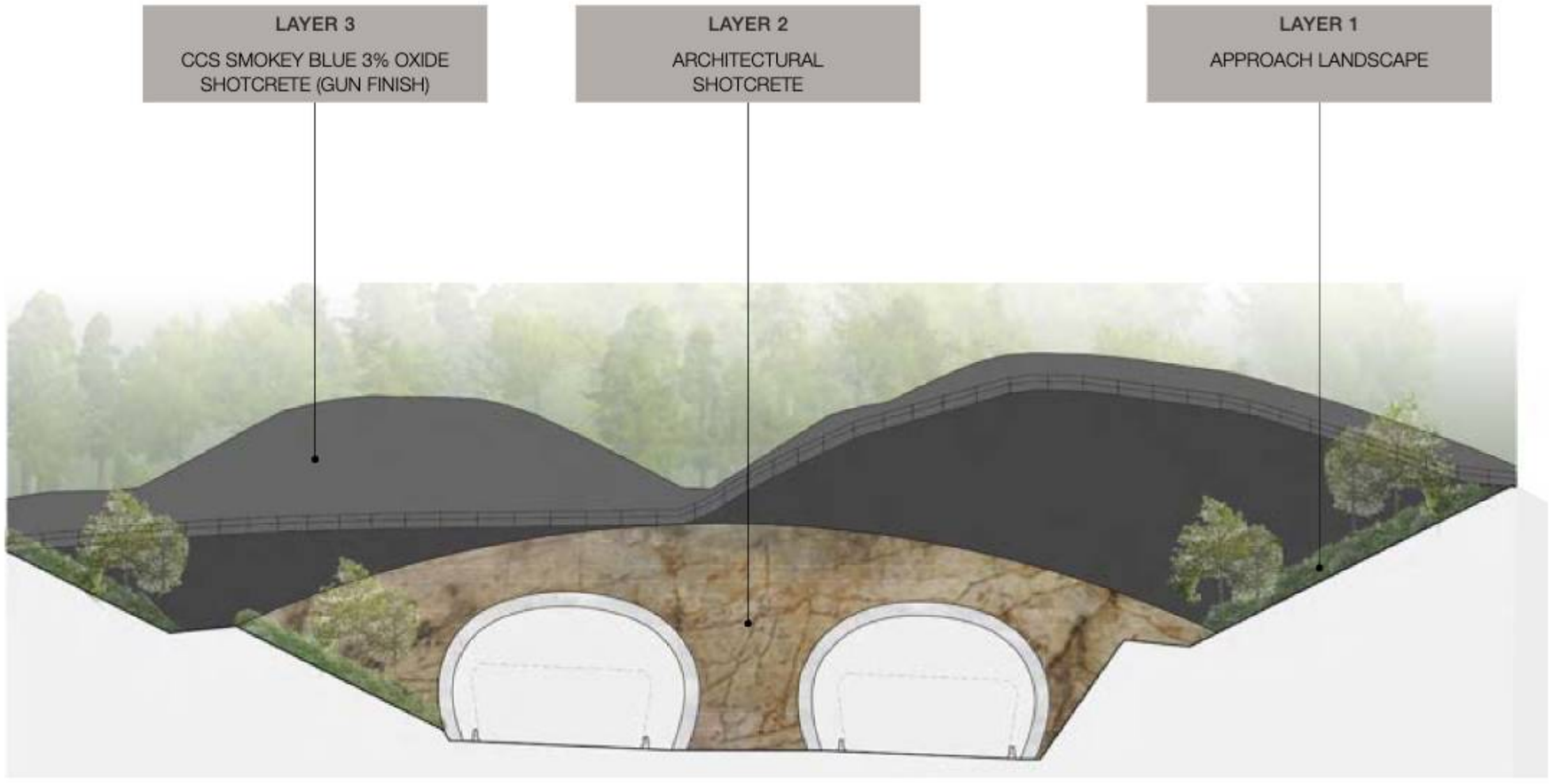
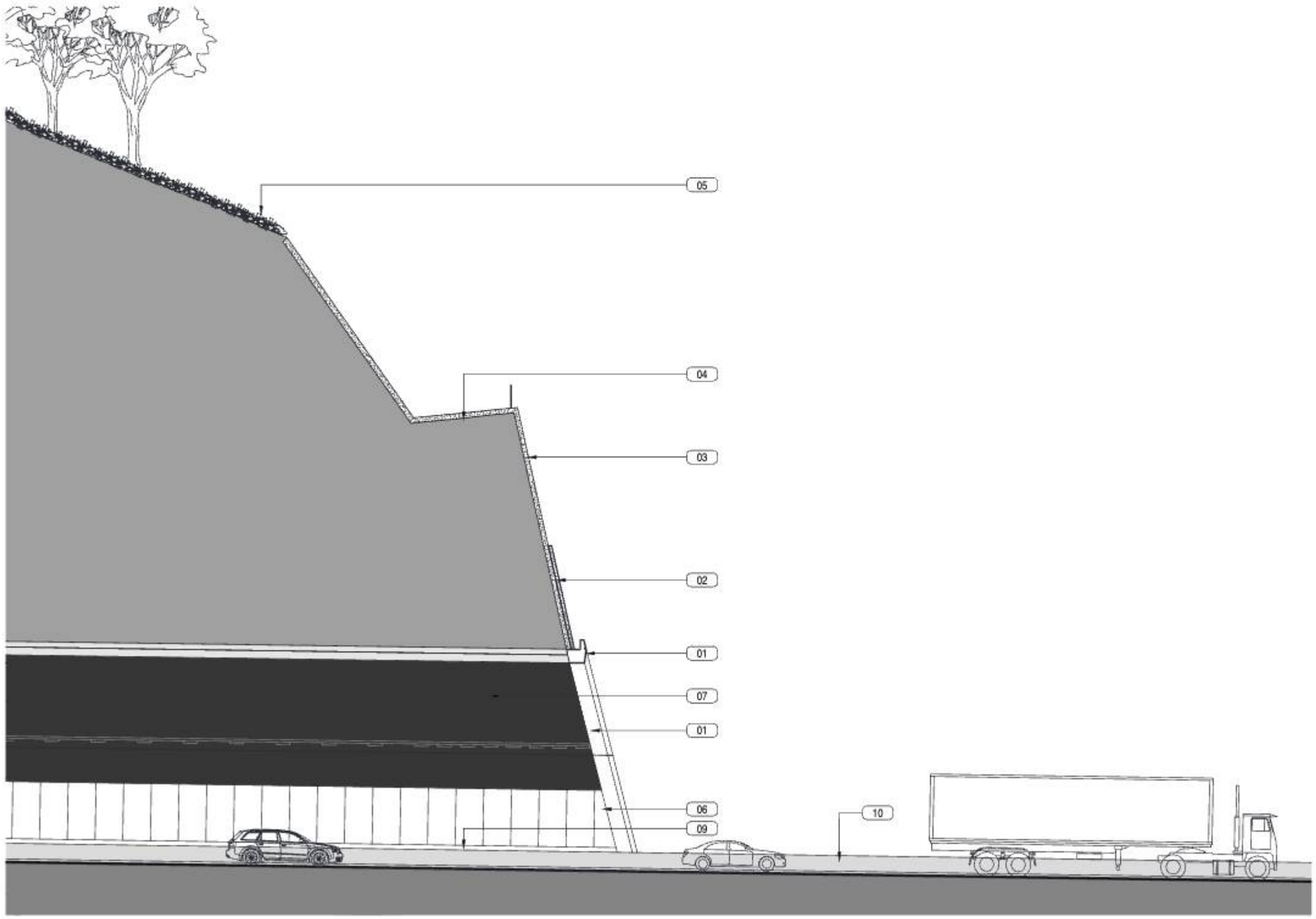


Figure 158: Tunnel portals - materiality



LEGEND

01	CONCRETE PORTAL COLLAR
02	MOCKROCK SHOTCRETE
03	ARCHITECTURAL SHOTCRETE
04	MAINTENANCE BENCH
05	LANDSCAPED AREA
06	TUNNEL ARCHITECTURAL PANELS
07	TUNNEL PAINT - BLACK
08	TUNNEL PAINT - WHITE
09	SHADOW GAP
10	CONCRETE BARRIER

Figure 159: Tunnel portals - typical section

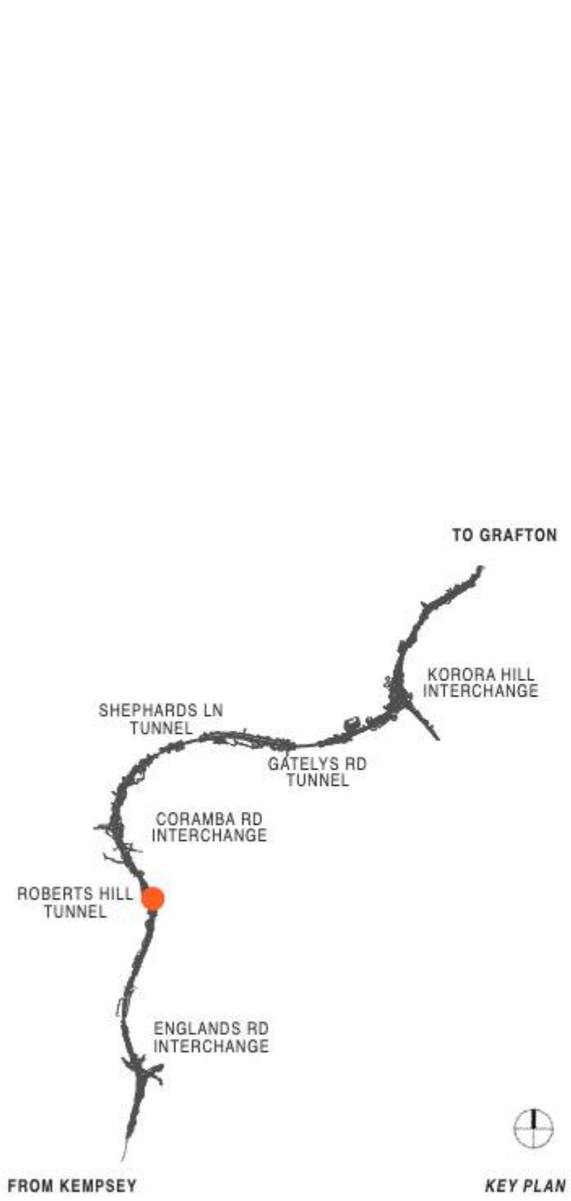


Figure 160: Roberts Hill Tunnel - view of northern portal, driver's view

Figure 161: Roberts Hill Tunnel - view of southern portal, driver's view

Figure 162: Shephards Lane Tunnel - view of northern portal, driver's view

Figure 163: Shephards Lane Tunnel - view of southern portal, driver's view

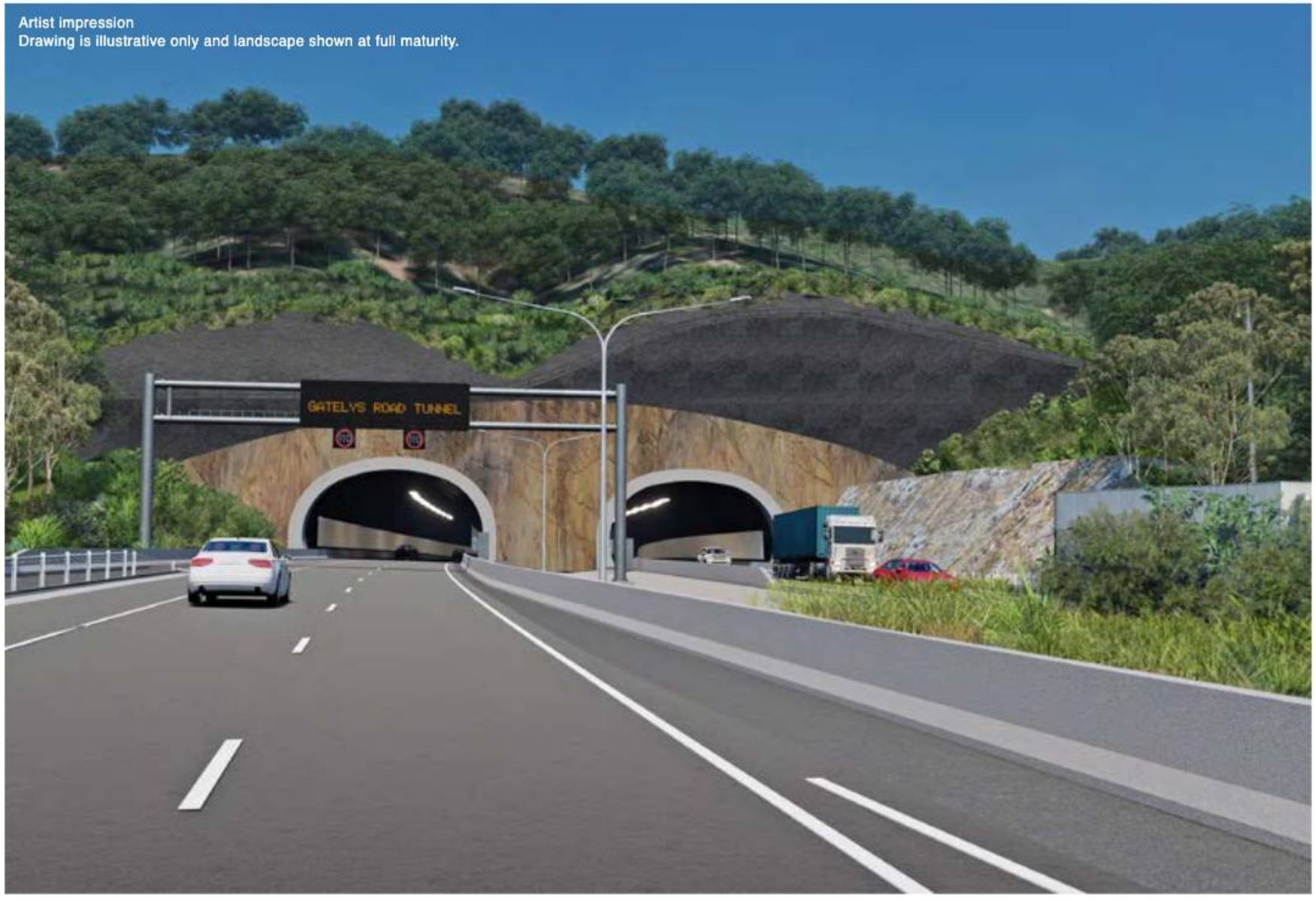


Figure 164: Gatelys Road Tunnel - view of northern portal, driver's view

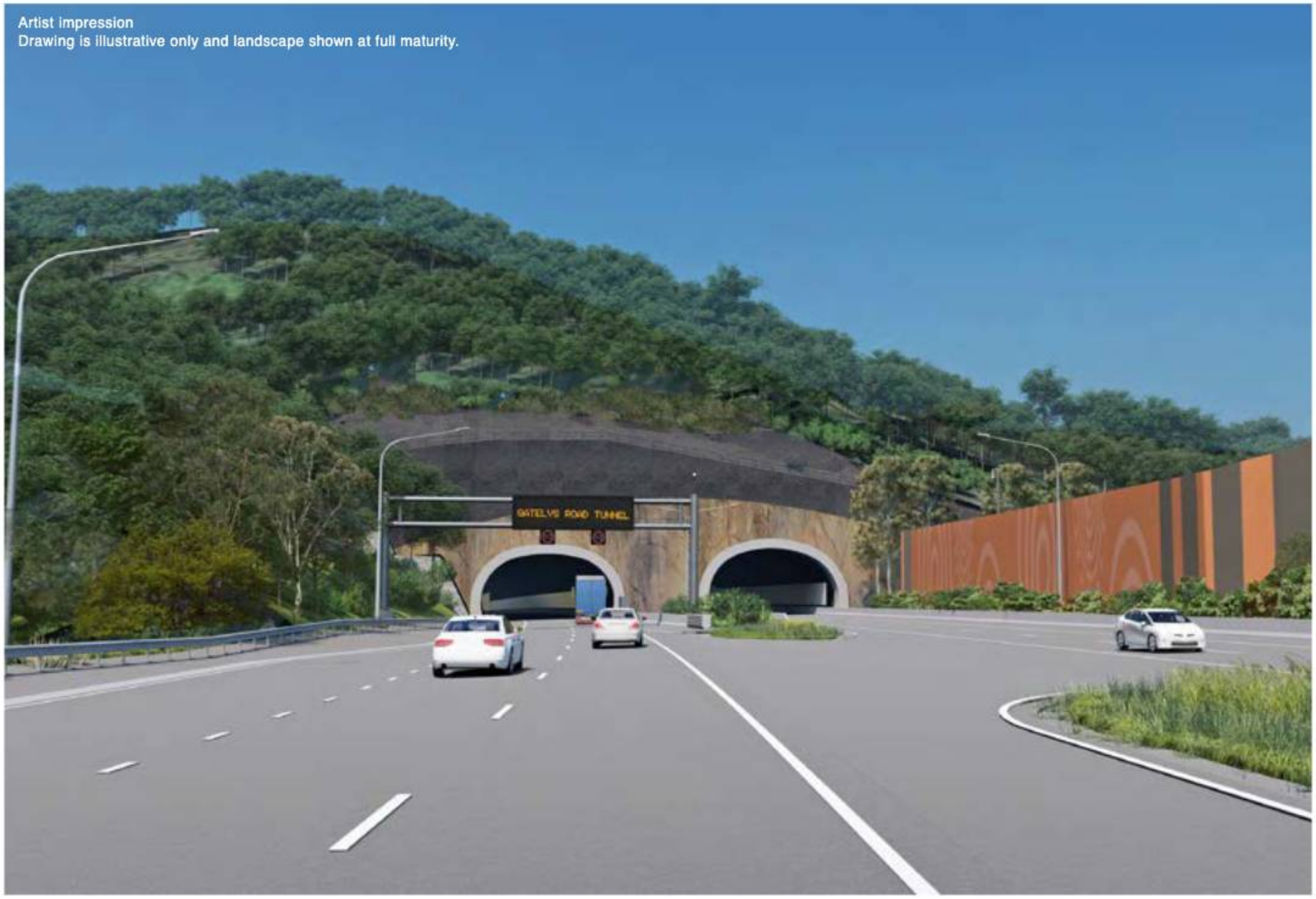


Figure 165: Gatelys Road Tunnel - view of southern portal, driver's view

6.5 Tunnel support facilities

Tunnel support facilities are provided to enable maintenance and operation of the tunnel and assist with safety in case of an emergency.

Facilities include:

- Motorway Operations Maintenance Facility (MOMF)

The MOMF will be an isolated facility, as it is located on a separate site and not directly adjacent to the roadway. It is surrounded by rural land, away from properties.

- Tunnel equipment facilities

The tunnel equipment facilities are located adjacent to the roadway and therefore will have a more direct visual experience for mostly people using the roadway.

The design concept for the facilities makes reference to the sites' existing semi-rural context and visual character of the surrounding environment, comprised of farm buildings and plantations scattered in the areas through which the alignment traverses.

The design approach adopted for these facilities is to provide a recessive appearance for the buildings which mimics the rural shed aesthetic of the surrounding landscape, with forms and a materiality that is sympathetic to their adjacent context. A consistent design language has been developed with the incorporation of a uniform palette of materials, colours and built form aesthetic.

Key elements of the design include:

- Built form elements placed to follow the natural contours of the sites, minimising cutting into existing landforms
- Buildings are laid out to have a linear expression that helps to reduce their visual bulk
- Articulated skillion roofs which follow the topography of the sites.

Figure 166: Tunnel support facilities - key plan

- Activated façade articulation through colour and façade treatments between the long and short elevations, to address road frontage conditions:
  - Long elevation – Precast concrete panels to provide a consistent visual aesthetic that integrates with the landscape
  - Short elevation – articulated reveal to frame the façade, with feature infill metal cladding and differentiated colours.
- Coordination of cladding modules with the fenestrations
- Blending of new fill batters to tie in with the existing hillside
- Siting of active built form functional buildings such as offices, in front of deluge tanks and other outdoor equipment, to provide screening.

6.5.1 Motorway Operations Maintenance Facility (MOMF)

The MOMF is located between the Shephards Lane and Gatelys Road tunnels. It is a maintenance facility which provides support functions for effective operations of the motorway. Landscape buffers are provided recede its visual dominance in the environment.

Figure 167: Motorway Operations Maintenance Facility (MOMF) - site plan

MOMF - SITE ELEVATION 1

MOMF - SITE ELEVATION 2

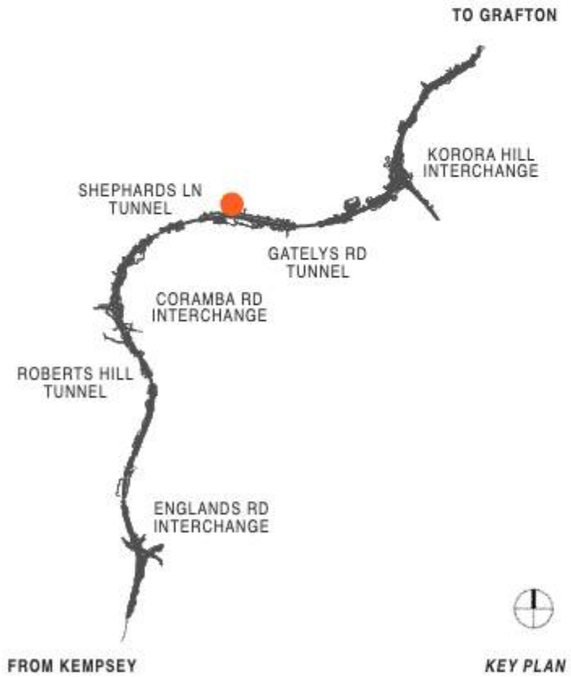
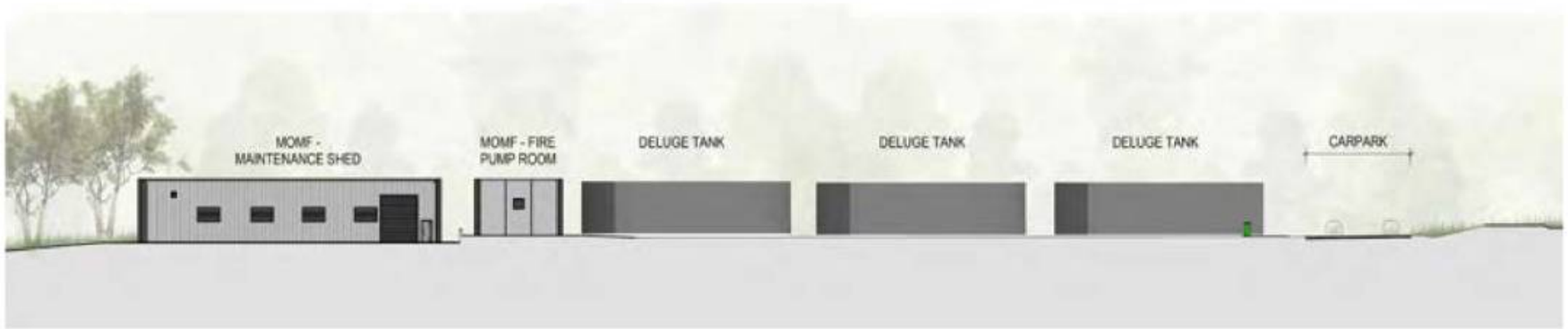


Figure 168: Motorway Operations Maintenance Facility (MOMF) - site elevations

MOMF - SITE ELEVATION 3



MOMF - SITE ELEVATION 4

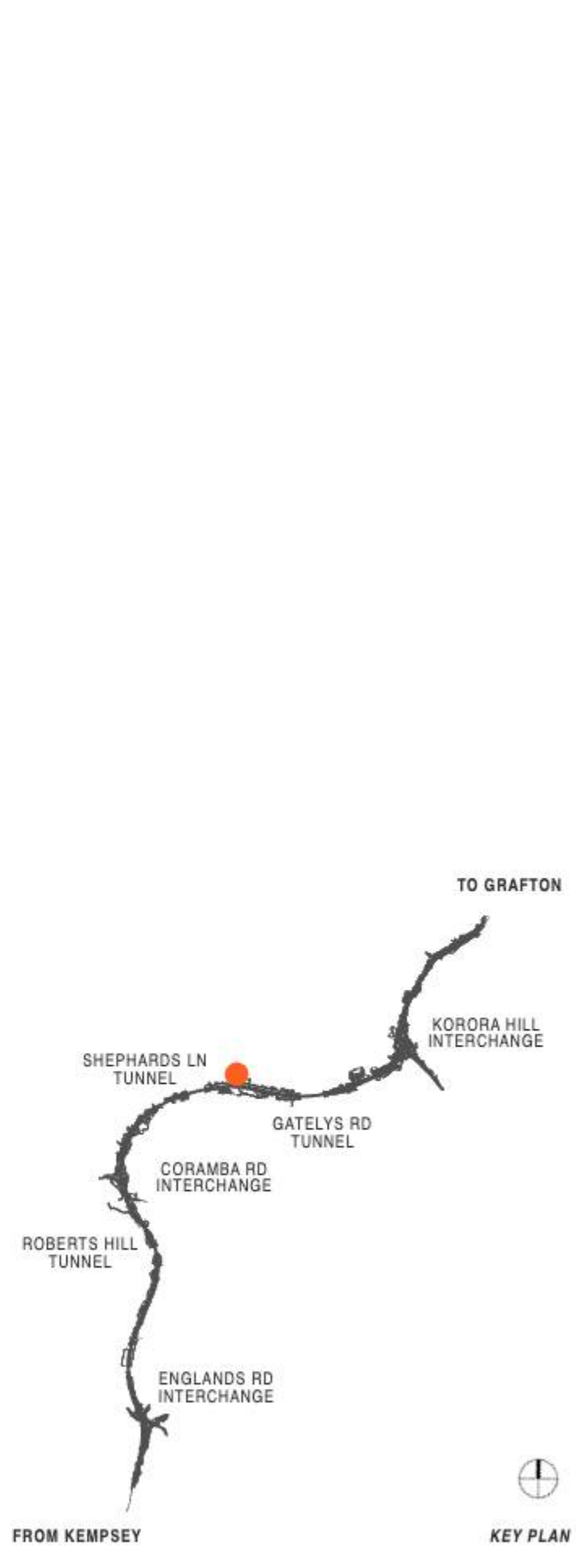


Figure 169: Motorway Operations Maintenance Facility (MOMF) - site elevations

Figure 170: Motorway Operations Maintenance Facility (MOMF) - view from the compound

Figure 171: Motorway Operations Maintenance Facility (MOMF) - view northbound lanes

6.5.2 Tunnel equipment rooms

There are three tunnel plant and equipment rooms located near the Roberts Hill Tunnel, Shephards Lane Tunnel and Gatelys Road Tunnel portals. The tunnel plant and equipment rooms provide the function to house the essential M&E equipment for the operation for each of the tunnel.

Roberts Hill Tunnel plant and equipment room

Roberts Hill Tunnel plant and equipment room is located on the southern tunnel portal with access provided directly from the carriageway. Roberts Hill is the largest of the three tunnel support facilities, which also houses a deluge system provided on site.

The facilities are located at the rear of a noise wall which mitigates the visual impact from the carriageway. Soft landscaping is provided in the residual areas of the site, as a visual screening element.

Figure 172: Roberts Hill Tunnel plant and equipment room - southern portal view showing building

ROBERTS HILL TUNNEL PLANT AND EQUIPMENT ROOM - PLAN

ROBERTS HILL TUNNEL PLANT AND EQUIPMENT ROOM - SITE ELEVATION

ROBERTS HILL TUNNEL PLANT AND EQUIPMENT ROOM - ELEVATIONS

Figure 173: Roberts Hill Tunnel plant and equipment room - plan and elevations

Shephards Lane Tunnel plant and equipment room

Shephards Lane Tunnel plant and equipment room is located on the northern tunnel portal with access provided from the local road. It is sited on the top of a landscaped batter.

Soft landscaping is provided in the residual areas and adjacent to the carriageway, as a visual screening element..

Figure 174: Shephards Lane Tunnel plant and equipment room - building view from front entry

SHEPHARDS LANE TUNNEL PLANT AND EQUIPMENT ROOM - PLAN

SHEPHARDS LANE TUNNEL PLANT AND EQUIPMENT ROOM - SITE ELEVATION

SHEPHARDS LANE TUNNEL PLANT AND EQUIPMENT ROOM - ELEVATIONS

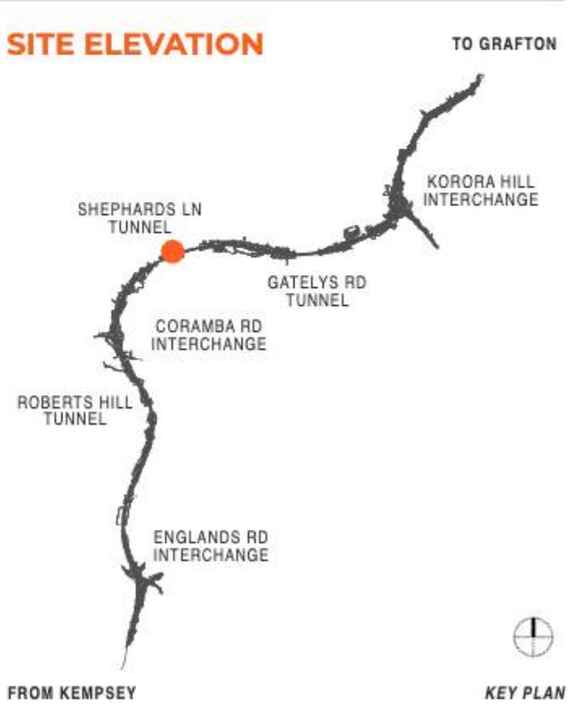


Figure 175: Shephards Lane Tunnel plant and equipment room - plan and elevations

Gatelys Road Tunnel equipment room

Gatelys Road Tunnel plant and equipment room is located on the southern tunnel portal with access from the local road.

The facilities are located at the rear of a noise wall which mitigates the visual impact from the carriageway. Soft landscaping is provided in the residual areas of the site, as a visual screening element.

Figure 176: Gatelys Road Tunnel equipment rooms - building view

GATELYS ROAD - TUNNEL EQUIPMENT ROOMS - PLAN

GATELYS ROAD - TUNNEL EQUIPMENT ROOMS - ELEVATIONS

GATELYS ROAD - TUNNEL EQUIPMENT ROOMS - SITE ELEVATION

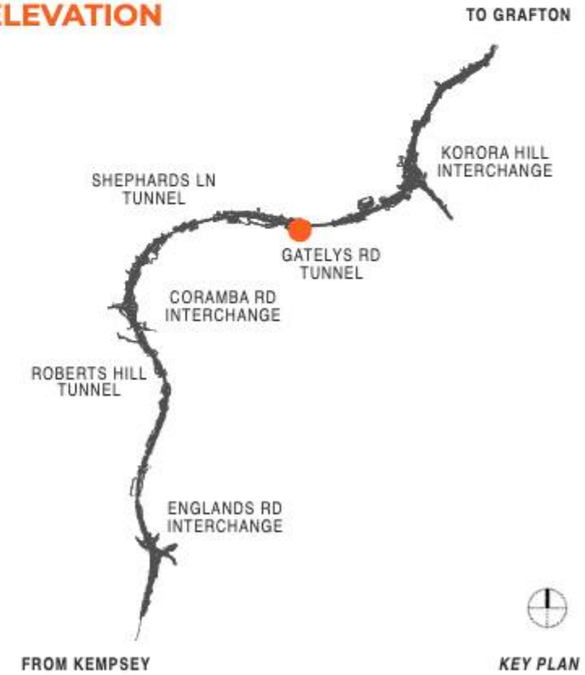


Figure 177: Gatelys Road Tunnel equipment rooms - plan and elevations

6.6 Retaining walls

Retaining walls are essentially categorised into four main structural categories:

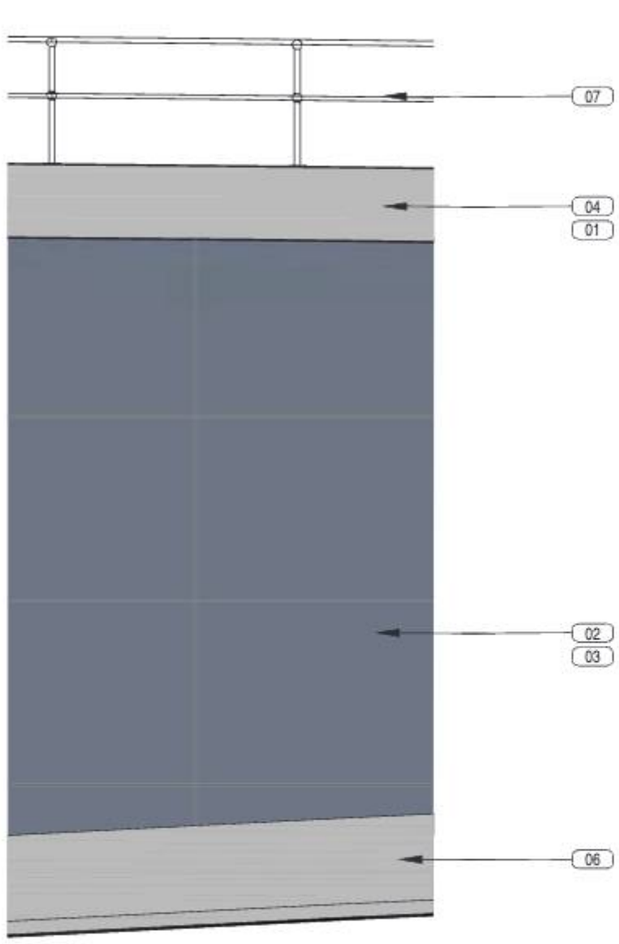
- RSW walls
- Soil Nail walls
- L walls
- Soldier piled walls.

These are provided as stand alone elements, or integrated with noise walls. The retaining walls are generally designed to be recessive in appearance, with a dark coloured finish applied. In most circumstances they extend for short distances only, for example at abutments. Where the retaining walls extend for longer distances, such as near the Luke Bowen Pedestrian Bridge, provision has been made to incorporate an architecturally finished texture on the walls.

The four categories of structural walls have three types of finishes. The intent of the finish is to reflect a concrete retaining wall aesthetic, with architectural grooves:

- **TYPE F1 on the soldier piled and soil nailed walls.** Architecturally treated shotcrete with a consistent finish. Architectural grooves are provided to break up the visual bulk and provide visual relief to the wall
- **TYPE F2 on the L walls.** Architectural grooves are provided on the concrete L wall to break the visual bulk and provide visual relief to the wall
- **TYPE F3 on the RSW walls.** RSW wall panels typically 3m x 1.5m, finished in Class 2 natural concrete to provide a neutral appearance.

Figure 178: Retaining walls - key plan



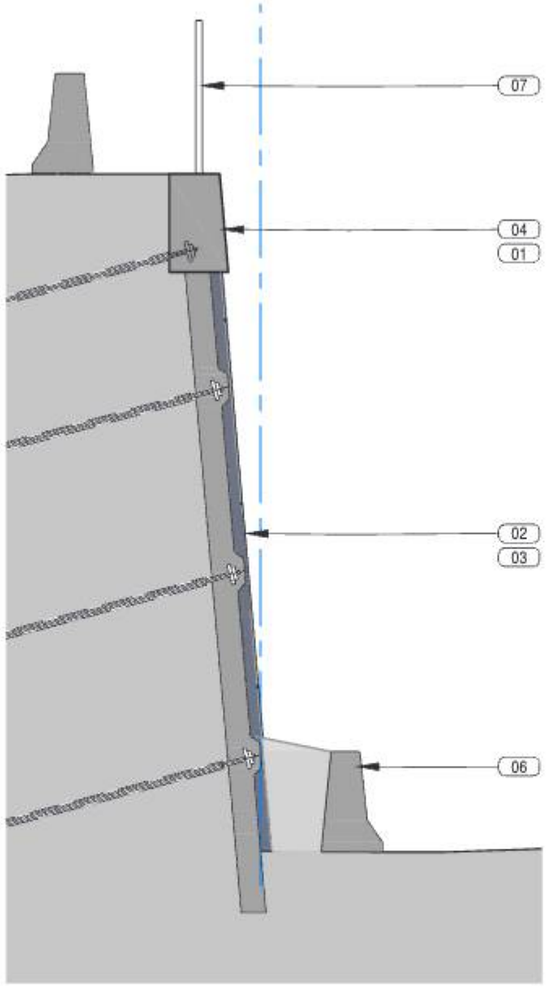


Figure 180: Retaining walls Type F1 elevation and section

Figure 179: Retaining walls Type F1

RETAINING WALL TYPE F1 - SECTIONS

LEGEND

- 01 CLASS 2 NATURAL CONCRETE FINISH
- 02 ARCHITECTURAL TREATED SHOTCRETE IN WOOD FLOAT FINISH WITH GROOVES
- 03 OXIDE PIGMENT FINISH
- 04 CONCRETE CAPPING BEAM
- 05 CONCRETE BARRIER WITH SKIRTING
- 06 TYPE 'F' BARRIER
- 07 FALL PROTECTION RAIL
- 08 CYCLIST RAIL

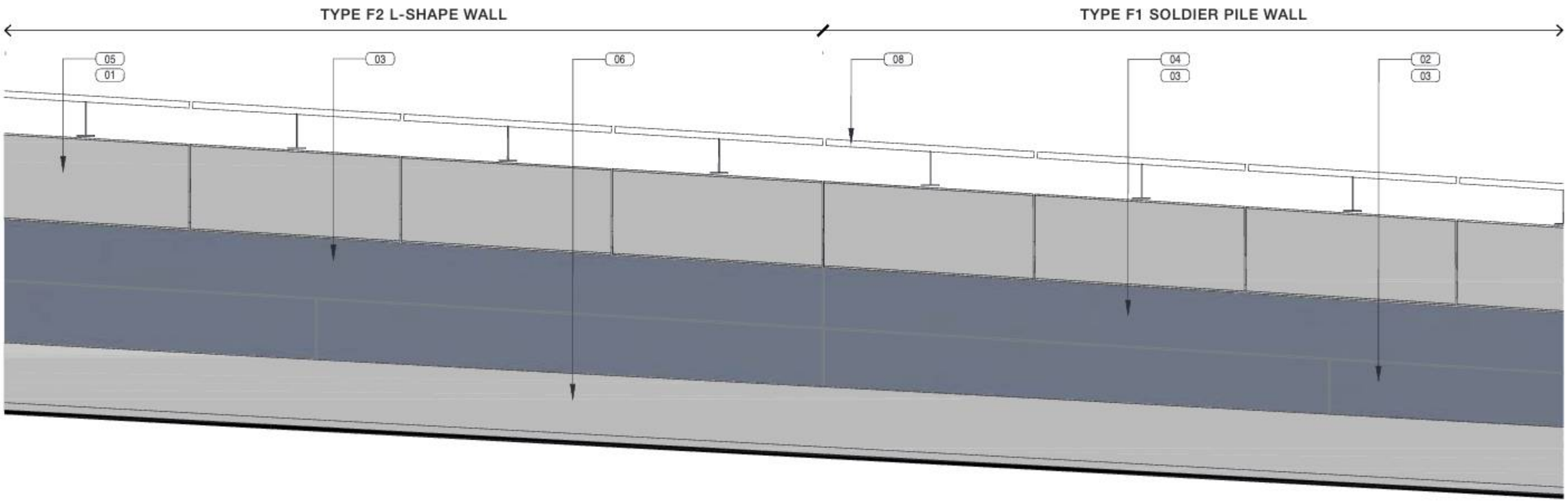


Figure 181: Retaining walls Type F1 & F2 - elevation

RETAINING WALL TYPE F1 & F2 - SECTION

LEGEND

01 CLASS 2 NATURAL CONCRETE FINISH
02 ARCHITECTURAL TREATED SHOTCRETE IN WOOD FLOAT FINISH WITH GROOVES
03 OXIDE PIGMENT FINISH
04 CONCRETE CAPPING BEAM
05 CONCRETE BARRIER WITH SKIRTING
06 TYPE 'F' BARRIER
07 FALL PROTECTION RAIL
08 CYCLIST RAIL

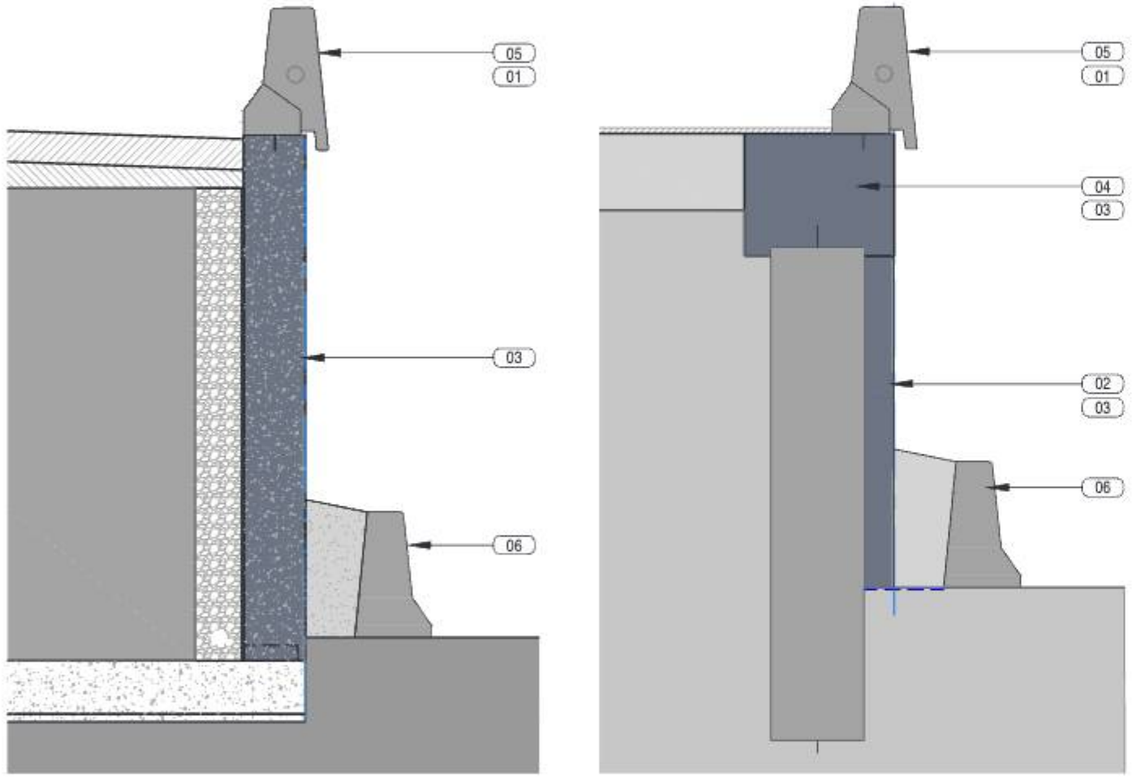


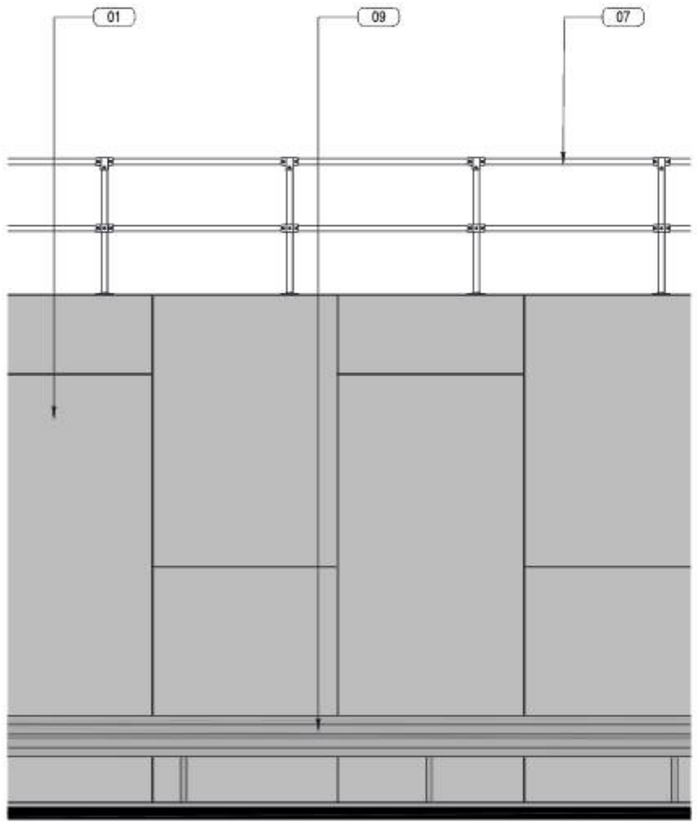
Figure 183: Retaining walls Type F2 - sections

Figure 182: Retaining wall Type F2

RETAINING WALL TYPE F1 & F2 - SECTIONS

LEGEND

- 01 CLASS 2 NATURAL CONCRETE FINISH
- 02 ARCHITECTURAL TREATED SHOTCRETE IN WOOD FLOAT FINISH WITH GROOVES
- 03 OXIDE PIGMENT FINISH
- 04 CONCRETE CAPPING BEAM
- 05 CONCRETE BARRIER WITH SKIRTING
- 06 TYPE 'F' BARRIER
- 07 FALL PROTECTION RAIL
- 08 CYCLIST RAIL



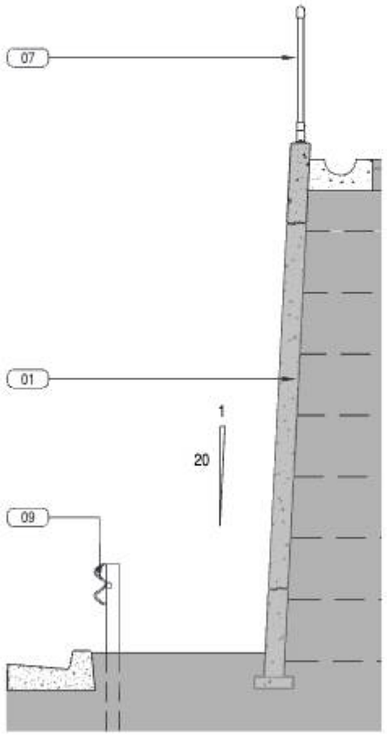


Figure 185: Retaining wall Type F2 - sections

Figure 184: Retaining wall Type F3

RETAINING WALL TYPE F3 - SECTIONS

LEGEND

01 CLASS 2 NATURAL CONCRETE FINISH
02 ARCHITECTURAL TREATED SHOTCRETE IN WOOD FLOAT FINISH WITH GROOVES
03 OXIDE PIGMENT FINISH
04 CONCRETE CAPPING BEAM
05 CONCRETE BARRIER WITH SKIRTING
06 TYPE 'F' BARRIER
07 FALL PROTECTION RAIL
08 CYCLIST RAIL

6.7 Noise walls and headlight screens

The noise walls are designed to generally be of two types:

- Noise walls with interpretive artwork, developed with local Aboriginal artists
- Noise walls without artwork - functional walls.

The noise walls without artwork incorporate an earthy tone that reference Country.

Functional noise walls are generally set back from the alignment on mounds, art walls generally occur where the wall is immediately adjoining the alignment. For the functional walls, the separation from the carriageway enables the screening of the noise wall forms by the propagation of a broad shrub mix comprising shrubs.

Where revegetation is proposed in front of artwalls a low shrub mix is proposed with plants, providing an initial context to the wall but retaining visibility. Planting on the residential side is provided, where visible from the residential precinct in addition to the broadscale planting as part of the revegetation strategy.

The bridge over the railway line has a noise wall provided as a mitigation measure for the nearby residents. It is transparent to maintain views across the bridge and finished with tinted acrylic panels.

Headlight screens are located near the Englands Road Interchange, near the Korora Hill Interchange. the Luke Bowen Pedestrian Bridge and at the northern end of the Project. They are comprised of lightweight materials such as opaque acrylic. They have a consistent profile, similar to the noise wall profile used on bridges.

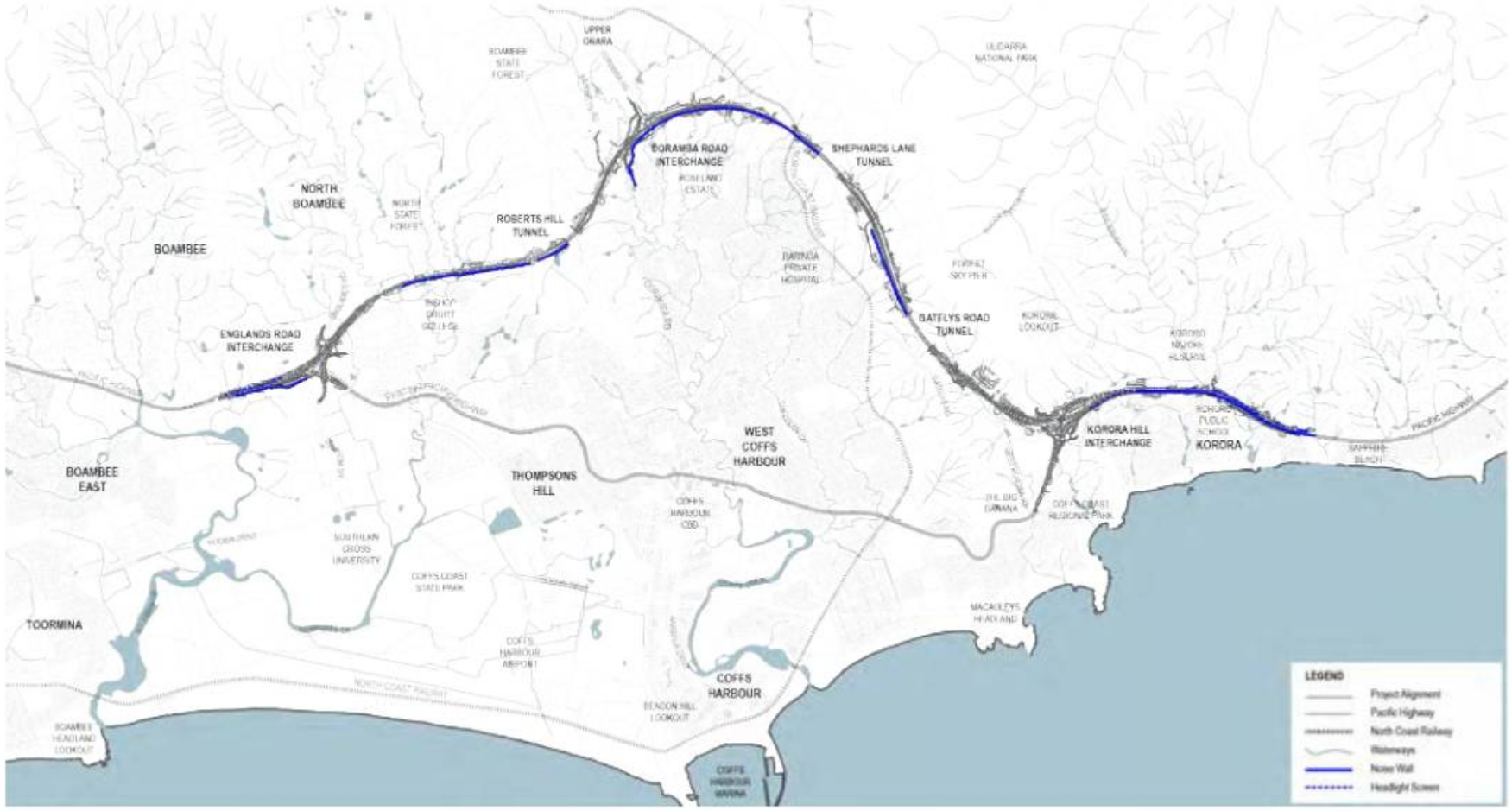


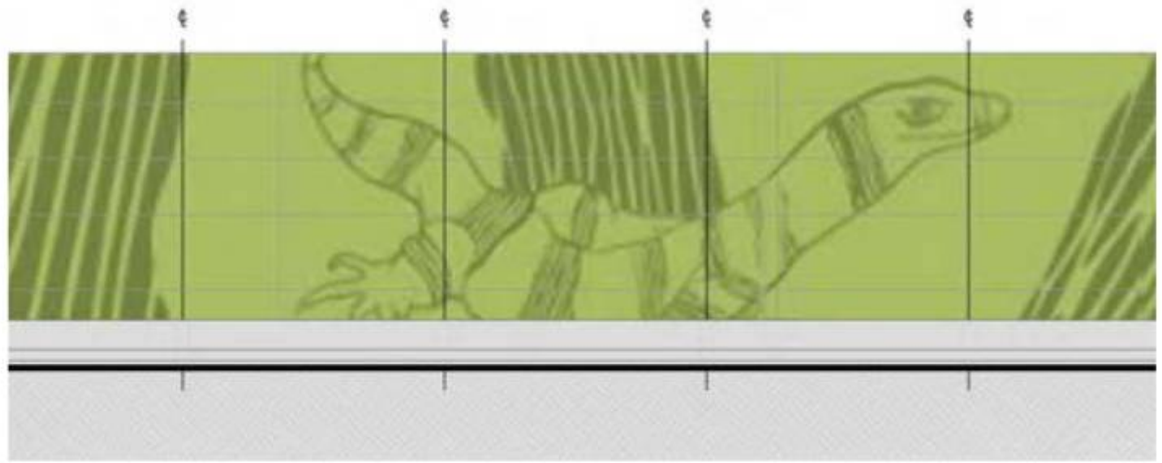
Figure 186: Noise walls, headlight screens - key plan

Figure 187: View of noise wall - southbound exit of Shephards Lane Tunnel southern portal

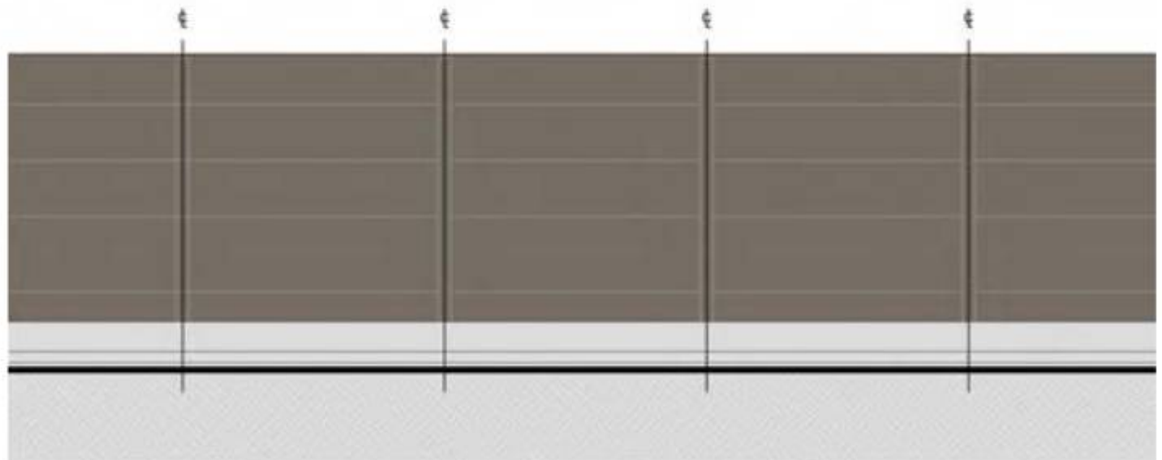
6.7.1 Key design responses

- Noise walls are configured in two types:
  - The base wall - comprising of a consistent earthy tone colour, for the full length of the noise wall, reflecting Country
  - The artwall - comprising a feature artwork pattern that depicts the local stories and songlines, developed in consultation with the community
- Noise wall design is perceived as a continuous linear element, as a 'line in the landscape'
- The appearance of both sides of the noise wall are equivalent in design quality
- Fixing systems are integrated in the walls and footings are concealed
- The tops of noise walls generally have a smooth profile for the artwalls. Where steps could not be avoided they have been configured to have a consistent appearance
- Horizontal alignment of the noise walls is parallel to the outside edge of the roadway
- Noise walls have smooth transitions at each start and end, without any abrupt terminations
- Where noise walls are located on top of retaining walls, consideration has been given to break up the overall height of the structure through texture or pattern, but still be an integrated entity
- Opportunities to incorporate Connection to Country through artwork and patterns has been provided
- Pattern is provided to complement the user experience in areas that have high visual prominence
- Pattern is developed as an art motif, generated through the abstraction of various themes that have emerged from the historical analysis to represent the 'Mountains to Sea' concept
- Vegetation buffer is provided where possible in front and rear of the noise walls
- The headlight screens incorporate a base colour similar to the base wall colour with feature coloured bands reflecting the respective cultural themes at strategic locations.

The earthy tone colour that has been incorporated in the base wall and the headlight screens serves as a thread of continuity that links all the stories that have been depicted as punctuation points, highlighting Coffs Harbour as the birthplace of Gumbangirr.



ART WALL (ROAD SIDE)

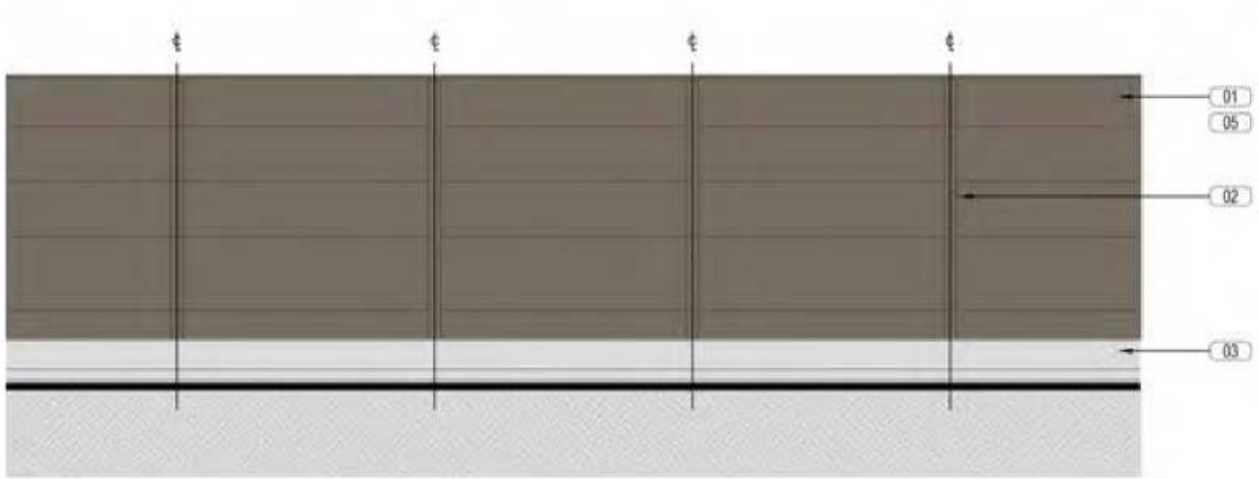


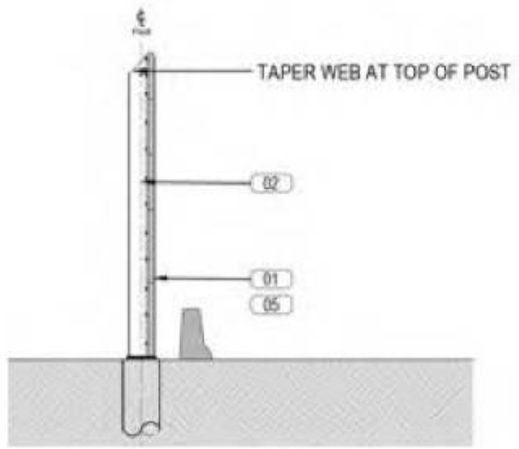
BASE WALL (ROAD SIDE) + NEIGHBOURHOOD SIDE

Figure 188: Noise wall - pattern design intent

NOISE WALL - TYPICAL ART WALL ELEVATION AND SECTION

Figure 189: Noise wall - typical art wall elevation and section



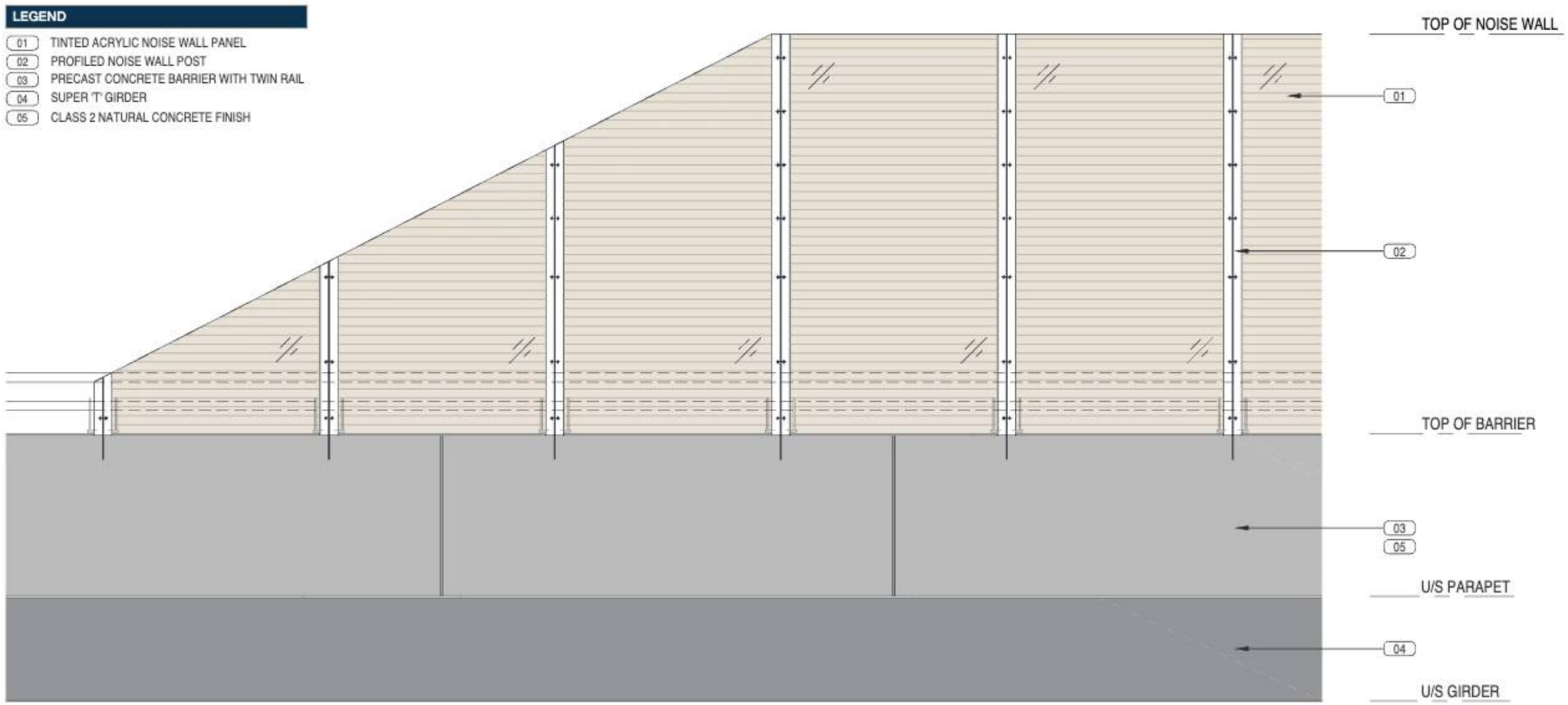


LEGEND

- 01 NOISE WALL PANEL
- 02 UB NOISE WALL POST
- 03 TYPE 'F' BARRIER
- 04 NOISE WALL WITH INTEGRATED ARTWORK
- 05 NOISE WALL WITH RECESSIVE COLOUR

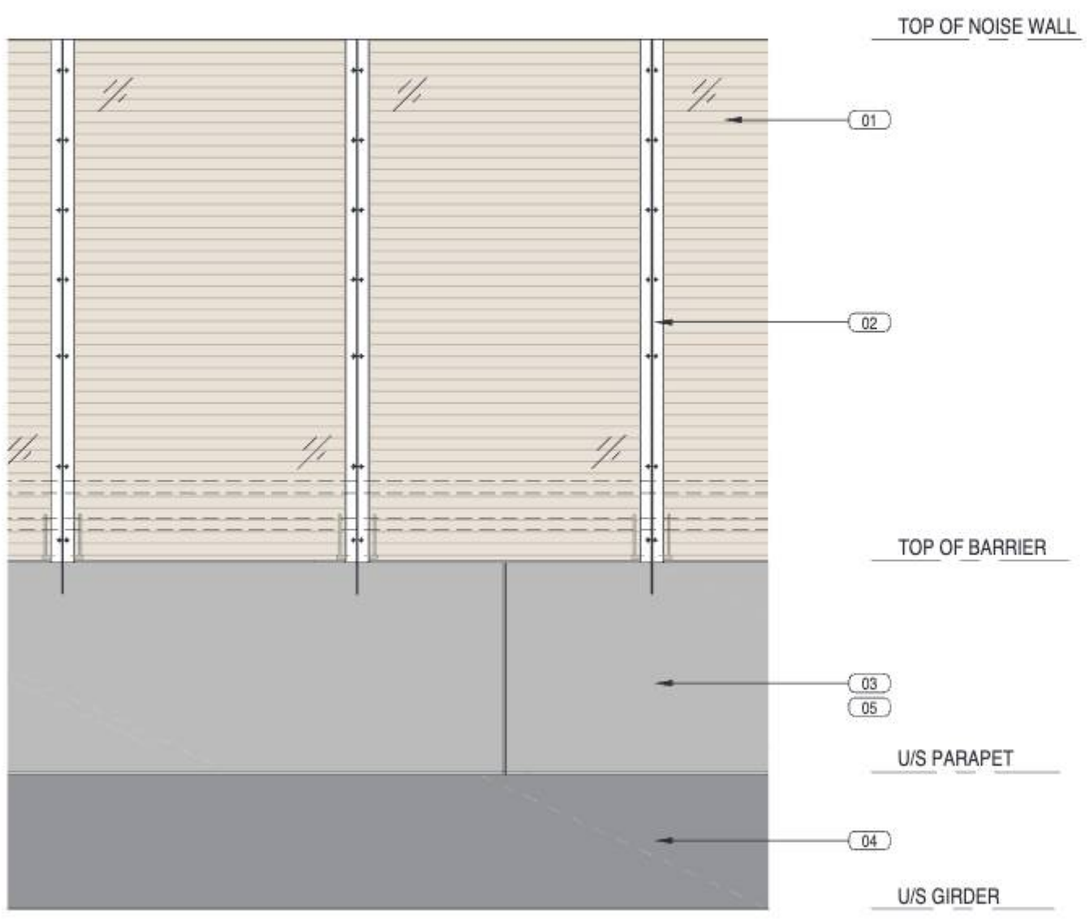
NOISE WALL - TYPICAL BASE WALL ELEVATION AND SECTION

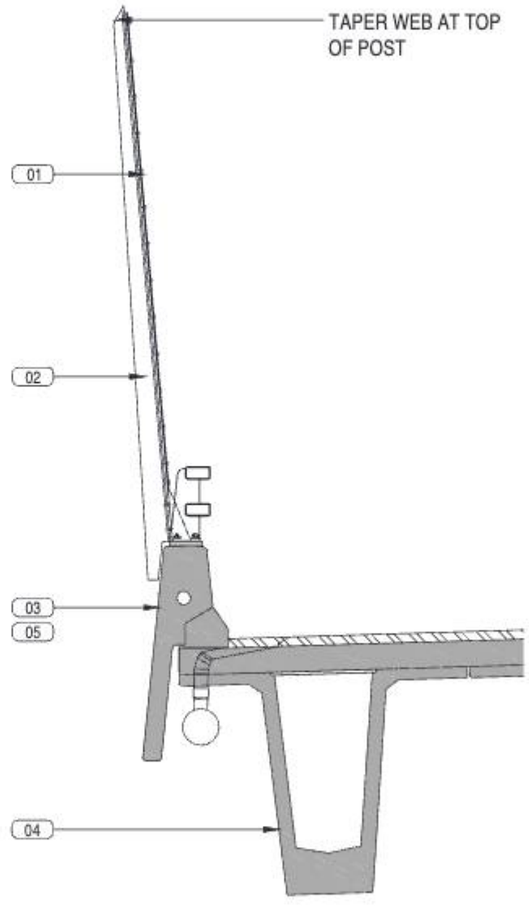
Figure 190: Noise wall - typical base wall elevation and section



NOISE WALL - TYPICAL TRANSPARENT ELEVATION

Figure 191: Noise wall - typical transparent elevation



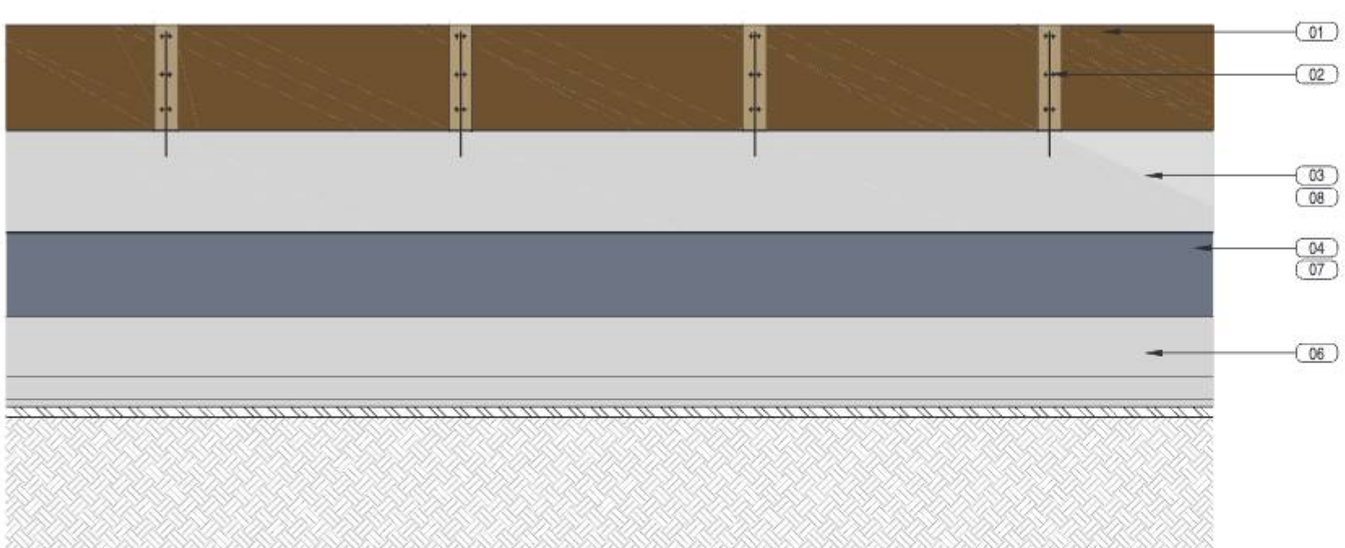


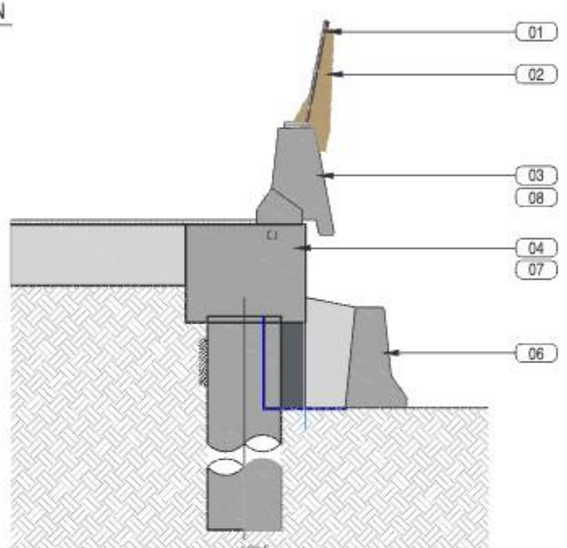
LEGEND

01 TINTED ACRYLIC NOISE WALL PANEL
02 PROFILED NOISE WALL POST
03 PRECAST CONCRETE BARRIER WITH TWIN RAIL
04 SUPER 'T' GIRDER
05 CLASS 2 NATURAL CONCRETE FINISH

NOISE WALL - TYPICAL TRANSPARENT ELEVATION AND SECTION

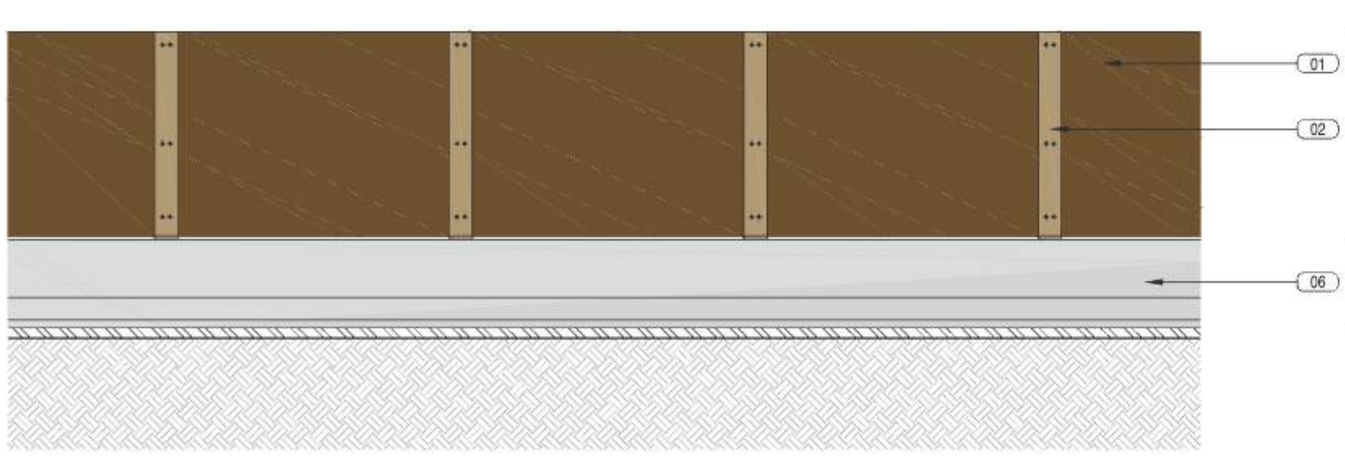
Figure 192: Noise wall - typical transparent elevation and section

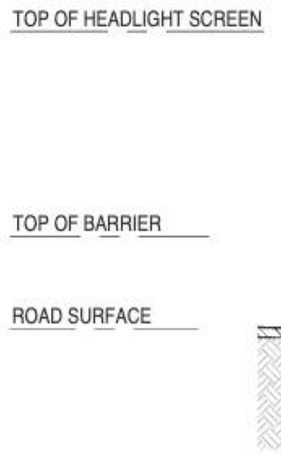


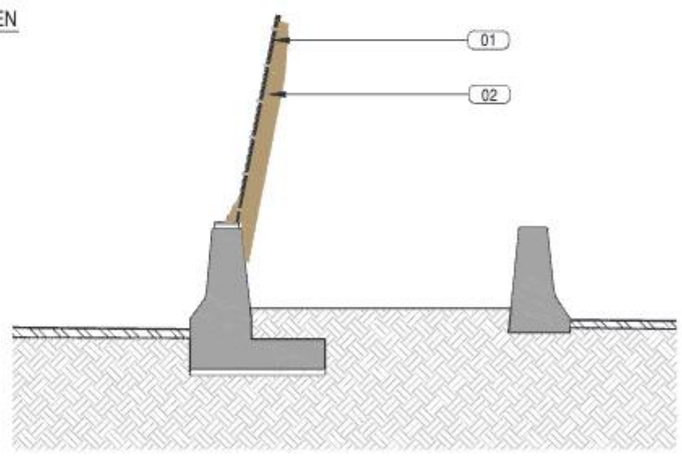


HEADLIGHT SCREEN - TYPICAL ELEVATON

HEADLIGHT SCREEN - TYPICAL SECTION







HEADLIGHT SCREEN ON BARRIER - TYPICAL ELEVATON

HEADLIGHT SCREEN ON BARRIER - TYPICAL SECTION

Figure 193: Headlight screen - typical elevations and sections

Figure 194: Headlight screen

6.8 Earthworks

6.8.1 Embankments and stabilisation strategy

The landscape and topography of the alignment corridor has a strong influence on its character. The design response for cuttings and embankments forms an integral part of the stabilisation and management of erosion control of the road corridor. The design is also in response to the MCoA and the Statement of Commitments as part of the Submissions Report.

Cuts

The form and treatment of cuts is influenced by the differing layers of soil and geology through which it passes. Harder materials enable the adoption of steeper batter profiles and reduced footprint, but limits the potential for revegetation; whereas softer, less stable material requires a broader footprint due to a shallower profile, but is more readily revegetated. The design has seen cuttings shaped to integrate with the local landform.

Key approaches

- Edges of cuts are feathered so they transition and move gradually into the steeper form of the cutting. The length and nature of the extent of feathering, is responsive to the adjoining natural slopes
- The laying back of the cut as it reaches the leading edges of existing ground/cut face interfaces is provided by the use of a transitional slope, which smoothly rounds the batter into the adjoining surface
- Benches have been established at a consistent profile and are in parallel with the vertical geometry of the highway
- Revegetation is proposed for all slopes 2H:1V or flatter. Rock within the cuttings is rippable and will be ripped as part of the landscape establishment process. Where not possible, the rock will be expressed
- Provide visual integration with adjacent landscape, and to satisfy environmental requirements for fauna connectivity
- Adoption of cut profiles which minimise the footprint, by avoiding chasing the slope where possible through the adoption of vertical cuttings.

Rock cuttings

Rock cuttings have been used to aid integration of the road formation to reduce the footprint and scarring associated with flatter cut profiles, which chase the slope up hill. The rock material is a moderately weathered argillite, a metamorphised rock which ranges in strength. Cuttings in this rock are proposed to be 2V:1H, providing a near vertical face and a quicker connection to the natural ground level.

The treatment of the rock face has sought to express this rock, addressing stability issues through localised rock bolting and face treatment of rock fall mesh.

Visually, the cuttings which have adopted such an approach generally have an opposite side to the cut and so the visibility of the exposed rock face is limited and contained, reducing impacts on the broader Coffs Harbour community.

Embankments

Embankments play a significant role within the landscape, particularly in the valley floors where the road needs to be nestled in the landscape, with slopes transitioned and manipulated so views of it flow over the formation, rather than being stopped by it. Key to addressing integration of embankments is the:

- Revegetation of embankment batter slopes so they present a consistent vegetation cover to the adjoining landscape
- Addressing the existing ground/batter interface to avoid obvious junctions between the embankment and existing ground
- Development of slopes is responsive to the adjoining natural terrain.

Rock fills are adopted in locations which relate to the construction of tunnels; or where space is limited, with batters that are required to be constructed steeper than 2V:1H.

Rock fill will comprise large rocks which are greater than 400mm in diameter and so are not readily revegetated. The strategy adopted is to increase vegetation density down the slopes of these locations, where they are potentially visible from the residential precincts. This will provide for screening and reduce the visual impact.

6.9 Fencing

Fencing is required to secure the alignment in a number of ways. This includes access to the corridor, management of fauna and security of specific sites such as tunnel support buildings or basins. Fencing on the Project has been reduced and provided only where absolutely necessary.

Boundary fencing

Fencing is required to the road corridor as a means of defining the boundary and restricting stock and pedestrian movements. Boundary fencing will adopt TfNSW standards for fencing and is responsive to the adjoining land use. Key features of the design are:

- The typical fence for the corridor is a five-strand stock fence consistent with the agricultural context of the alignment
- Posts are to be concrete with a design life as required
- Fencing is to be sited to minimise the area of vegetation between the alignment and the fence, which will act as an attraction to fauna. Fauna fencing will be located as close to the alignment as possible to maximise biodiversity opportunities where they exist.

Fauna fence

Fauna fences are used in identified fauna movement corridors to encourage the use of fauna connectivity structures, and to reduce the potential for conflicts with motorists. The koala exclusion fence is the base fence type, which underlines all fauna fence types used. Key features of the koala exclusion fence design are:

- Galvanised chain link fence with 2100 x 50 x 1.6mm diameter steel core netting
- Galvanised steel sheeting minimum 600mm from top of fence
- Post spaced at 3m centres.

Installation principles are as follows:

- Fauna fences are set back from the road edge to minimise impact on the visual environment of the road corridor
- Trees and shrubs to be setback a minimum 3m from outside face of fence, to minimise fauna gaining access beyond fencing and to the highway alignment.

Fencing is located in order to maximise access to vegetation within koala habitat and enable the re-establishment of habitat within the corridor, without posing a risk to fauna entering the road environment.

6.10 Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design (CPTED) is focused on achieving safe spaces for people (pedestrians and cyclists) to pass and move through.

A key element of CPTED is the achievement of surveillance. Adequate measures such as the provision of lighting and maintaining long distance visibility and avoiding abrupt transitions in the alignment have been incorporated to ensure the safety of people.

Key areas of pedestrian and cycle movement associated with the bypass include:

- Bus Stops
- Interchanges – and local road interfaces.

Bus Stops

Korora Bus Interchange is the largest of the bus facilities to be constructed associated with the project. It occurs in association with the Kororo Public School and Luke Bowen Footbridge.

Key aspects of the design to address CPTED include:

- Crown lifted trees
- Garden beds with low planting < 1m in height
- Transparent back walls to shelters
- Clean open structure to bridge to enable clear sightlines from the adjoining local road and adjoining school.

The design of the Coramba bus stop similarly promotes the use of a light open structure which enables visibility through enhancing surveillance opportunities.

Interchanges

All interchanges have a local road interface, either as an under or overpass structure. As part of these connections shared paths have been provided. To address safety and surveillance the following strategies are adopted.

- Underpasses – provide as open structures with defined path connections coupled to the road alignment. Lighting is to relevant standards for local roads and shared paths.
- Overpass – Coramba Road Interchange incorporates an overpass which accommodates a shared path which links through to the nearby Coramba bus stop. The shared path is always connected to the local road link with clear visibility from the road.

6.11 Connectivity enhancements

The existing network of surrounding pedestrian, bicycle, public transport and road networks are as follows:

- Pedestrian network: Mostly located around the Coffs Harbour CBD and extending to the Coffs Harbour Marina. There are some connections within neighbourhoods.
- Cyclist network: Mostly located around the Coffs Harbour CBD and extending along Hogbin Drive to Toormina.
- Public transport network: Mostly along the existing Pacific Highway connecting the Kororo Basin to the Boambee Basin, with some extended networks to the neighbourhoods north of Coramba Road.
- Road network: Existing Pacific Highway is the main arterial with connector roads along Coramba Road, Englands Road and Bruxner Park Road. Hogbin Drive is a major road that provides a contingency for the existing Pacific Highway. Harbour Drive forms a loop and connects the CBD to the coast.

The proposed bypass interfaces with these networks mainly at the three interchanges. The Project provides pedestrian and cyclist facilities at these locations, informed by the interfaces at the three interchanges:

- Shared path connections along the service road tying into the existing shared paths on Solitary Islands Way.
- A new shared path bridge will replace the Luke Bowen footbridge near Kororo Public School.
- Shared path connections at the Coramba Road Interchange

The conclusion from the above study is that the bypass does not impact on existing networks and connections other than at the three interchanges and the schools. These areas have therefore been upgraded, with enhanced connections as noted above to ameliorate any potential barriers in the design.

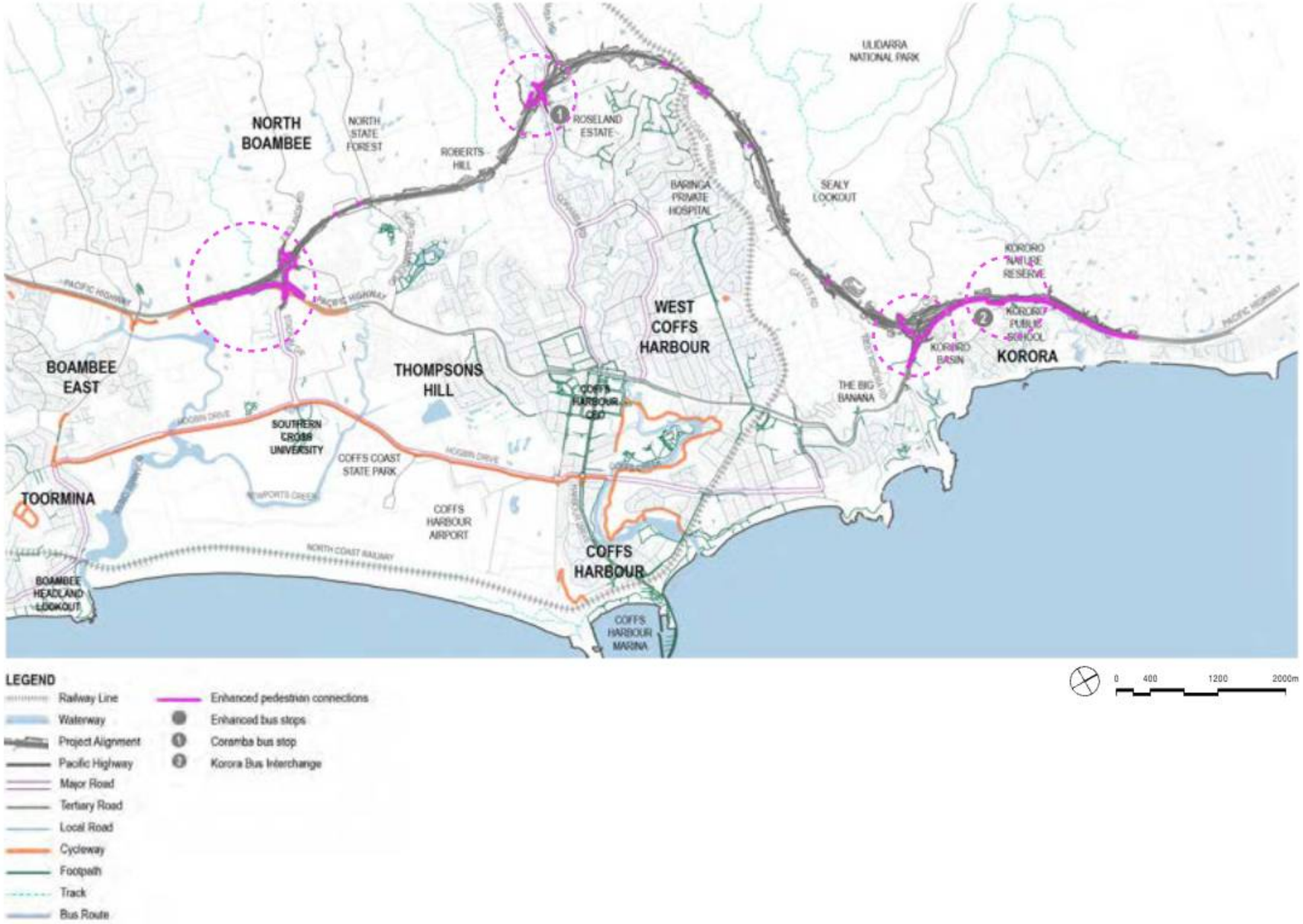


Figure 195: Connectivity enhancements