

PENNANT HILLS TO EPPING CYCLEWAY LINK

ROUTE OPTION REPORT

09 APRIL 2019

Incorporating



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HORNSBY SHIRE COUNCIL NSW PENNANT HILLS TO EPPING CYCLEWAY LINK

Route Option Report

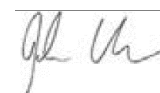
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02	27/07/18	Draft (For Comment)	RC	JDV
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TERMS AND ABBREVIATIONS

Term/Abbreviation	Description
AADT	Annual Average Daily Traffic
Austroads	Road Organisation of Australian States & NZ
ATL	Active Transport Link
AGRD	Austroads Guide to Road Design (with Roads and Maritime Supplements)
BC Act	Biodiversity Conservation Act 2016
BGHF	Blue Gum High Forest
Brief	RFQ7/2018 Cycleway Link - Pennant Hills to Epping
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GST	Galvanised Steel Troughing
JRCP	Joint Reinforced Concrete Pavement
LGA	Local Government Area
PH2E	Pennant Hills to Epping Cycleway Link
RCMG	Rail Corridor Management Group
STIF	Sydney Turpentine-Ironbark Forest
TEC's	Threatened Ecological Communities

1 INTRODUCTION

Hornsby Shire is a large local government area in the Sydney region, with 39 suburbs and rural localities, and is characterised by large tracts of bushland. The major town centres are located in the south of the Shire. The traditional owners of the Shire are the Aboriginal people of the Darug and Guringai language. Within the last decade the Shire has seen strong residential growth, particularly around the Hornsby Town Centre, with approximately 150,000 people currently living in the area. This growth has prompted the investigation of strategic cycle routes, linking Pennant Hills to Epping, to provide and promote sustainable alternative transport links for the area.

Hornsby Shire Council has developed a number of route options for a cycleway to connect Pennant Hills Station and Epping Station, via Beecroft Station and Cheltenham Station. These route options are labelled route option A1, A2, A4, B, C1, C2 & C3. In addition, Arcadis has developed sub options within route option A1 which have been labelled route option A3 North and A3 South. Route options A1, B, C1, C2 & C3 generally follow the existing road network and route option A2 generally runs inside the rail corridor.

1.1 Project description

The Pennant Hills to Epping Cycleway Link (PH2E) is being funded by State Government, coordinated by Roads and Maritime Services and will be delivered by Hornsby Shire Council. The proposed cycleway project is located between Pennant Hills railway station and Epping railway station. The cycleway will extend through Hornsby and Parramatta Local Government areas (LGA).

The proposed cycleway route is broadly presented in the following sections:

- **Section A:** Pennant Hills Station to Beecroft Community Centre (Hornsby LGA);
- **Section B:** Beecroft Community Centre to Cheltenham Station (Hornsby LGA); and
- **Section C:** Cheltenham Station to Epping (South of the M2 Motorway is part of Parramatta LGA)

Identified route options under consideration in this report in Section A are route options A1, A2, A3 North and A3 South, in Section B there is a single route option and in Section C there are three route options C1, C2 and C3. A high level overview of these alignment options is provided below in Figure 1 and detailed alignment plans and associated constraints for each route option is included in Appendix A.

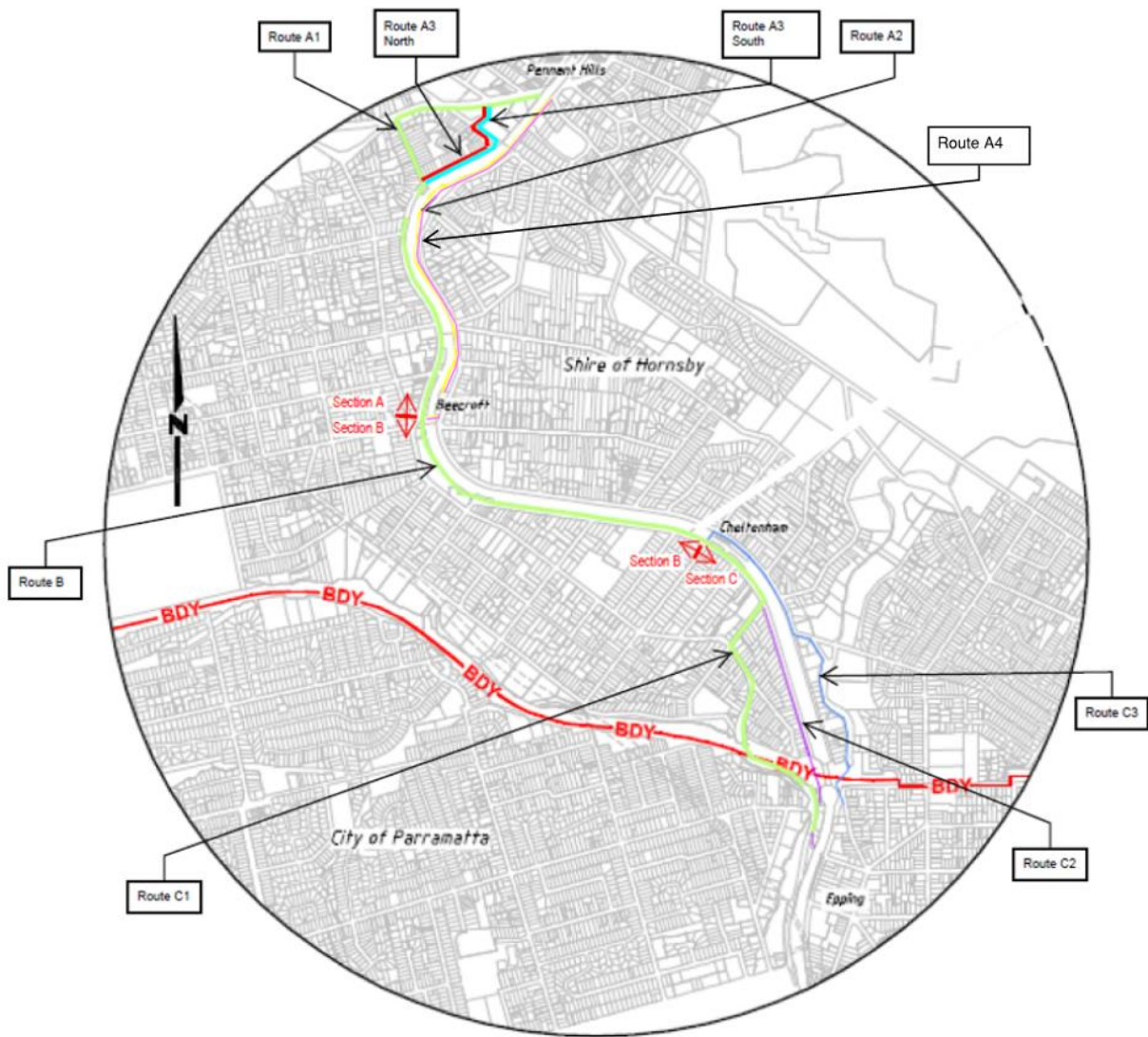


Figure 1 – Pennant Hills to Epping Locality Plan

1.2 The purpose of this report

Arcadis has been engaged by Hornsby Shire Council to undertake investigation of the proposed cycleway route options (refer to Appendix A) as well as provide and evaluate any alternate routes identified during this investigation.

The purpose of this report is to;

- Investigate and identify constraints for each route (refer Appendix A);
- Undertake a comparison of these options against each other using value management assessment criteria from Hornsby Shire Council to determine the preferred route option and;
- Develop indicative cost estimates for each route option.

1.3 Project objectives

Following appointment, Arcadis met with Hornsby Shire Council and other key stakeholders to confirm the key objectives for this project. For any route options investigation or analysis, it is critical to establish the key objectives for the project in order to establish a common set of principles to guide the project, and upon which options and issues can be benchmarked. Hornsby Shire Council's objectives for the project are outlined below in Table 1.

Table 1 Project objective

Project objective	Description
Route Option Investigation	To review and assess route options against pre-agreed performance criteria to determine the preferred strategic route option to be progressed through to the next design stage. These key assessment criteria include; - Land Use; - Environment and Heritage; - Functionality; - Safety; and - Cost

1.4 Project stakeholders

The following key stakeholders have been identified as being the most relevant to the project.

1.4.1 Government departments and authorities

- State and Commonwealth Government Agencies and community representatives;
- Department of Infrastructure, Transport, Regional Development and Local Government;
- Transport for New South Wales including Centre for Road Safety and Transport Management Centre (TMC);
- Department of Planning and Infrastructure NSW;
- NSW Environment Protection Agency;
- NSW Office of Environment and Heritage (OEH);
- Sydney Trains;
- Transport for New South Wales (TfNSW); and
- Roads and Maritime Services, NSW;

1.4.2 Services and local government

- Hornsby Shire Council;
- Public and private utility authorities and providers including but not limited to Ausgrid, AAPT, Telstra, and Energy Australia;
- Parramatta City Council; and
- Hillsbus;

1.4.3 Local stakeholders

- Local resident's association;
- Local community businesses, cycling organisations and property owners and residents who are directly affected adjacent to the project; and
- Environmental groups.

1.5 The structure of this report

This report is intended to address the requirements of Section 4.2 of Hornsby Shire Council's brief regarding the route options investigation. The report is structured to clearly communicate the process and findings of the investigation. Table 2 below outlines the key requirements of section 4.2 of the Brief and where these are addressed in this report.

Table 2 Brief requirements index

Hornsby Shire Council brief requirement	Where addressed in this report
Cycleway levels of service including:	
Minimum 3.5m width (where feasible and economically justifiable);	Sections 2.1, 3.1, 3.2 and 3.3
Identify squeeze points where negotiations are required.	Sections 3.1.2.1, 3.2.1.1, 3.3.1.7 and 3.3.2.1
Appropriate grades in accordance with current design standards;	- Sections 2.1 3.1.1.2 and 3.1.3.2. - Table 23 and Table 25
Proximity to areas of high volume and/or heavy vehicular traffic (user comfort/Safety);	Section 3.1.2.1 and 4.1.2
Proximity to residences;	Section 3.1.3.3 and 3.3.2.1
Proximity to/presence of structures and other hazards along the route;	- Sections 2.1, 3.1, 3.2, 3.3 and 4.1.2 - Table 23 and Table 25
Potential "bottlenecks" at existing or proposed road crossings.	Sections 3.1, 3.2 and 3.3
Program to complete works.	- Sections 4.1.2 - Table 23 and Table 25
Cycleway user safety (lighting requirements, sight distances, overall visibility);	Sections 3.1, 3.2 and 3.3
Level of negotiations required with other service and transport authorities;	Sections 3.1, 3.2 and 3.3
Potential adjustments to public utilities;	Sections 3.1, 3.2 and 3.3
Potential environmental impact;	Sections 3.1, 3.2 and 3.3
Impact on vehicular road uses (i.e.: new or adjustments to traffic facilities required);	Sections 3.1, 3.2 and 3.3
Impact from competing uses (i.e.: closures for rail maintenance access, closures for access and maintenance of significant utility infrastructure);	Sections 3.1 and 3.3
Overall (indicative) cost;	Section 4.1.3 and Section 5
Adjustments to private/public boundaries and fences.	Sections 3.1.2.1, 3.2.1.1, 3.3.1.7 and 3.3.2.1

2 PRELIMINARY DESIGN CRITERIA

The design criteria in Table 3 have been adopted for the assessment of the route options identified. The below criteria have been used as a base line for the indicative cost estimates provided in section 4.1.3.

2.1 Geometry

Table 3 –Geometry Design Criteria

Description	Design Criteria	Reference
Design Speed Cyclists		
Off Road Bicycle Path	30 km/h	AGRD Part 6A CI 5.2
Cyclist Eye Height	1.4m	AGRD Part 6A CI 5.7.1
Cyclist Object Height	0m	AGRD Part 6A CI 5.7.1
Reaction Time Rt	2.5 seconds	AGRD Part 6A CI 5.7.1
Path Widths		
Bicycle Path Width	Desirable 2.5m (2m MIN)	AGRD Part 6A Table 5.2
Separated one-way Path Width	Desirable 1.5m Absolute Minimum 1.2m	
Shared Path Width	Desirable Minimum 3.5m (2m MIN – Local Access Path) (3m MIN – Recreational Path)	Brief AGRD Part 6A Table 5.3 AGRD Part 6A Table 5.3
Horizontal Alignment		
Minimum Radius (superelevated)	24m	AGRD Part 6A Table 5.7
Friction Factor	0.28	AGRD Part 6A Table 5.7
Vertical Alignment		
Gradient	5.0% MAX	AS 1428.1—2009

2.2 Pavements

Primarily shared paths can be constructed as a flexible pavement of crushed rock surfaced with asphalt or a bituminous seal, or as a rigid concrete pavement. It is important that the sub-grades of both flexible and rigid pavements are compacted to a satisfactory standard and soft areas are treated. It may be necessary in some cases to assess sub-grade conditions along the line of the proposed path.

Refer to Appendix E Typical Pavement details for consideration and confirmation.

For Route A2 (refer section 3.1.2) where it is envisaged to upgrade the existing rail corridor maintenance access track between Hampden Road and Chapman Avenue, a full 3.5m width Joint Reinforced Concrete Pavement (JRCP), designed to support a 20 tonne rigid truck in accordance with TfNSW's (*T HR CI 12180 ST*) *Active Transport Links on the Rail Corridor*, has been assumed for indicative cost estimating purposes.

2.3 Drainage

Table 4 –Geometry Design Criteria

Description	Design Criteria	Reference
Roadway Width (kerb face to Crown)	4.5-5.6m	--
Road Crossfall	3%	--
Allowable Gutter Flow	0.09 m ³ /s	Hornsby Shire Council Development Design Specification 0074 Stormwater Drainage (Design) Table 5.2
Fraction Impervious	90%	--
Runoff Coefficient C ₁₀ (10 Year ARI Coefficient)	0.85	Hornsby Shire Council Development Design Specification 0074 Stormwater Drainage (Design) Figure 4.4
Runoff Coefficient C ₂₀ (20 Year ARI Coefficient)	0.8925	Hornsby Shire Council Development Design Specification 0074 Stormwater Drainage (Design) Figure 4.4
Time Concentration	5 Mins	--
Intensity I ₂₀	186.6 mm/hr	--

3 CONSTRAINTS ANALYSIS

The constraints listed in this section have been assessed following a site inspection, in addition to a desktop study. The analysis has been developed in considering the Hornsby Shire Brief requirements (refer Table 2).

3.1 Section A

The Section A routes start at the southern side of Pennant Hills Road Pedestrian Bridge and finish at the Copeland Road Overbridge. The options on the western side of the railway generally follow the road reserves while Route A2 on the eastern side follows the existing TfNSW maintenance track within the existing rail corridor. Route A4 is located further east outside the TfNSW property boundary and through Council owned land.



Figure 2 - Section A Route Options

3.1.1 Route A1 Constraints and Considerations

Route A1 option contains three shared path crossings, Pennant Hills Road (from Yarrara Road), City View Road and Wongala Crescent.

3.1.1.1 Pennant Hills Road from intersection of Yarrara Road to Lilla Road Constraints

Route A1 runs on the south side of along Pennant Hills Road from Yarrara Road to Lilla Road. This stretch of existing path can be narrow in areas and there is a large quantity of utilities in the existing path including, but not limited to, high pressure gas, sewer mains and large Telstra pits. Table 5 below contains other significant design and construction constraints for consideration.

Table 5 - Pennant Hills road from intersection of Yarrara Road to Lilla Road Constraints

Reference ID	Constraints	Resolution
A1-1 Utilities	Large quantity of utilities in existing path from Yarrara Road to Lilla Road (refer Figure 3).	Shared path in this area to match existing levels where possible to reduce cost of relocating utilities. May need to relocate or adjust utilities as appropriate if unavoidable.
A1-2 Existing Large Sign Structure	Vertical and lateral clearance from large existing signage to new shared path (refer Figure 4).	Match existing levels through this area if possible and narrow shared path where required to achieve clearances in line AS1742.9 and Austroads Guide to Road Design Part 6A. May need to replace, adjust or relocate the existing sign structure to achieve the minimum vertical clearance of 2.5 m over a bicycle path and 0.6 m lateral clearance from the outer edge of the path.
A1-3 Narrow Roadside	Narrow clearances from boundary to kerb (refer Figure 5)	Clear tree and hedge to meet desired shared path widths. If heavily constrained, narrow the proposed shared path to meet minimum path width requirements.
A1-4 Bus Stop	Potentially insufficient space for bicycle path to run behind bus stop shelter (refer Figure 6 and Figure 7)	Relocate bus shelter to be able to provide conforming shared path widths. May need to shift or reduce the width of the bus indent to its minimum to be able to provide conforming shared path widths.
A1-5 Sight Distance	Sight distance issues for 5 property access driveways between the Boundary Road intersection through to Lilla Road (refer Figure 8 and Figure 9).	Provide appropriate pavement markings, signage and controls to raise awareness at these conflict points.
A1-6 Utilities and Trees	Utilities and planted trees on corner of Pennant Hills Road and Lilla Road (refer Figure 10).	Utility box on corner may be avoided if path can be narrowed between boundary fence and power pole or else path widened away from this box. This may require removal of two jacaranda trees.
A1-7 Traffic Signals	Potential relocation of traffic control signals x 6 (refer Figure 11).	Avoid if possible, by narrowing or splitting path as appropriate.
A1-8 Streetlight/ Power Poles	Potential relocation of streetlight/ power poles x 7 (refer Figure 12)	Avoid removal or relocation if possible.

Pennant Hills to Epping Cycleway Link



Figure 3 - A1-1 Utilities - Looking west along Pennant Hills Road



Figure 4 – A1-2 Existing Large Sign Structure - Looking west along Pennant Hills Road

Pennant Hills to Epping Cycleway Link



Figure 5 - A1-3 Narrow Roadside - Looking west along Pennant Hills Road



Figure 6 - A1-4 Bus Stop - Looking west along Pennant Hills Road

Pennant Hills to Epping Cycleway Link



Figure 7 - A1-4 Bus Stop - Looking east along Pennant Hills Road



Figure 8 - A1-5 Sight Distance - Looking east from driveway along Pennant Hills Road



Figure 9 - A1-5 Sight Distance - Looking west along Pennant Hills Road



Figure 10 - A1-6 Utilities and Trees - Looking south east at corner of Pennant Hills Road and Lilla Road [2]



Figure 11 - A1-7 Traffic Signals - Looking west along Pennant Hills Road



Figure 12 - A1-8 Streetlights/Power Poles - Looking west along Pennant Hills Road [2]

3.1.1.2 Lilla Road to Byles Creek crossing

The cycleway will continue along the eastern side of Lilla Road. Near Wongala Crescent, the cycleway will have to be located on-road and continue on-road to Byles Creek crossing. Table 6 contains other significant design and construction constraints for consideration.

Table 6 - Lilla Road to Byles Creek Crossing

Reference ID	Constraints	Resolution
A1-9 – High Voltage Power Box	High voltage power box at northern end of the eastern side of Lilla Road is in close proximity to path (refer Figure 13)	High voltage box may need to be relocated or else shared path width narrowed locally at this location.
A1-10 – Streetlight/ Power Pole	Possible power pole relocations required x 8 (refer Figure 14)	Shift alignment around the poles where if need be to avoid relocation.
A1-11 – Sight Distance and Driveway Parking	Multiple driveway accesses abutting the proposed shared path location which may be an issue when considering sight distances especially since Lilla Road is steep encouraging faster cyclist speeds which may conflict with cars when exiting their driveways. Along Lilla Road there is a low turnover of available on street parking. This means currently driveways on the eastern side of Lilla Road are being utilised by the residences. Constructing the shared path along this verge will disturb resident stakeholders along Lilla Road.	Provide appropriate pavement markings to raise awareness at these conflict points. The alternative option along Lilla Road is to divert cyclists on to the road for the full duration of the street. Being a cul-de-sac, traffic volumes are low in this street and will alleviate constraints in sight distances, relocating high voltage utility boxes, streetlight/power poles and planted trees in front of resident's houses. In addition, eliminate the conflict area where cyclists would otherwise need to cross Lilla Road to get on to the cycleway when coming from Byles Creek.
A1-12 – Long and Steep Hill	Lilla Road has a long and steep grade, not ideal for cyclists.	This may be unavoidable unless an alternative route is preferred.



Figure 13 - A1-9 High Voltage Power Box - Looking south east along Lilla Road



Figure 14 - A1-10 Streetlight/ Power Poles - Looking south east along Lilla Road [2]

3.1.1.3 Byles Creek crossing to Copeland Road

Table 7 - Byles Creek Crossing to Copeland Road Constraints

Reference ID	Constraints	Resolution
A1-13 Trees	Extensive tree clearing required on Wongala Crescent (refer Figure 15)	Potentially able to divert cyclists around significant and critically endangered trees or else diverting cyclists on to the road. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 222 Trees to be removed between Pennant Hills Road and Copeland Road).
A1-14 TfNSW Driveways	TfNSW Maintenance access driveways x 3 (refer Figure 16)	Upgrade existing driveways (low level of negotiations required with transport authority)
A1-15 Parking Facilities	Reduction in parking facilities opposite pre-school and at Beecroft station if 90-degree parking is replaced with parallel parking. Current 90-degree parking facilities allows for approx. 30 cars (refer Figure 16) Reduction of parallel (parking Approx 13 car and 5 bike) spots on the eastern side of Wongala Crescent from Chapman Avenue to Hannah Street adjacent Beecroft station car park if we are to widen existing path to 3.5m.	May need to provide further designated parallel parking along the length of Wongala Crescent between Albert Road and Chapman Avenue to offset the loss of angled parking. This may require further clearing of trees on the eastern side of the roadway adjacent the rail corridor. Potentially able to reduce the shared path width to 2.5m or 3m in line with Austroads, in order to keep the parallel car park. This is provided we have sufficient width in the existing roadway we can utilise to create the desired shared path width.
A1-16 Bus Stop	Bus stop (refer Figure 17)	Should have sufficient width here provided the shared path is narrowed locally behind the bus stop.
A1-17 Telstra Telephone Box	Telstra phone box near bus stop (refer Figure 17)	Telstra Phone box may need to be relocated to accommodate the shared path width
A1-18 Street Light Power Poles	Potentially need to relocate streetlight/ power poles x 10 (refer Figure 17)	May be able to shift path alignment around the poles where possible to avoid relocation.
A1-19 Environmentally Sensitive Area	May be an environmentally sensitive area at Byles Creek	Avoid environmentally sensitive areas where possible
A1-20 High Voltage Utility Box	High Voltage Utility Box	May be able to avoid or else need to relocate.
A1-21 Steep Grade (Bytes Creek Crossing)	Approx. 10% Grade at the Bytes Creek Crossing	Measures shall be taken during detailed design to reduce the grade as far practicable to reduce the speed of the bicycle users in this area.
A1-22 Safe Crossing	Consideration for safe turning movements to Lilla Rd from Bytes Creek Crossing	May need to clear additional trees on the southern corner of Lilla Rd/ Wongala Crescent to make a separated shared path to eliminate the danger of these hazardous crossings. As mentioned in A1-11 resolution above, the alternative option is to divert cyclists on to the road for the full length of the street along Lilla Road. This will eliminate the conflict area where cyclists would otherwise need to cross Lilla Road to get on to the cycleway when coming from Bytes Creek.



Figure 15 - A1-13 Trees - Looking south along Wongala Crescent [2]



Figure 16 - A1-14 TfNSW Driveways and A1-15 Parking Facilities - Looking south along Wongala Crescent [2]



Figure 17 - A1-16 Bus Stop, A1-17 Telstra Telephone Box and A1-18 Streetlight/ Power Pole- Looking south along Wongala Crescent [2]

3.1.1.4 Byles Creek Crossing

The already constructed structure at Byles Creek (under Epping to Thornleigh Third Track project) has been designed to accommodate a cantilever maintenance walkway. The original design allowed for a 2.0m wide path as opposed to the 3.5m required for the cycleway. However, the ultimate load factor for pedestrian loads has been reduced in the latest revision of AS5100. The cast-in arrangement of bolts would appear to be satisfactory to support a 3.5m cantilever cycleway (refer Figure 18 and Figure 19).



Figure 18 – Byles Creek Crossing - Looking north along existing noise wall



Figure 19 – Byles Creek Crossing - Looking south along existing noisewall

3.1.2 Route A2 Constraints and Considerations

Route A2 will follow the existing TfNSW rail corridor maintenance access track (adjacent the existing noise wall) from the Hampden Road access through approximately through to Narena Close. Due to this maintenance track being inside the TfNSW boundary, the path would be considered a Type 1 Active Transport Link (ATL) in accordance with TfNSW's (T HR CI 12180 ST) *Active Transport Links on the Rail Corridor*. Past this point continuing south toward Chapman Avenue overbridge, the path would be considered a Type 2 ATL. This option would require significant levels of negotiations with transport authorities.

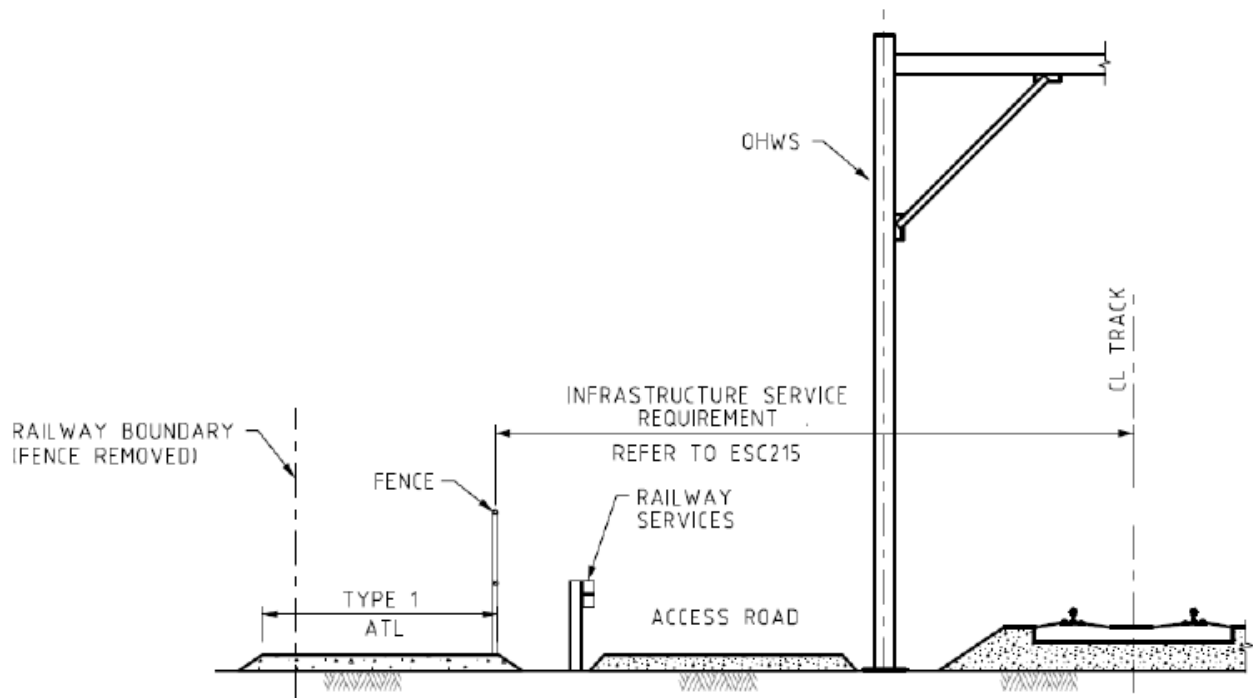


Figure 20 –Typical Type 1 ATL [1]

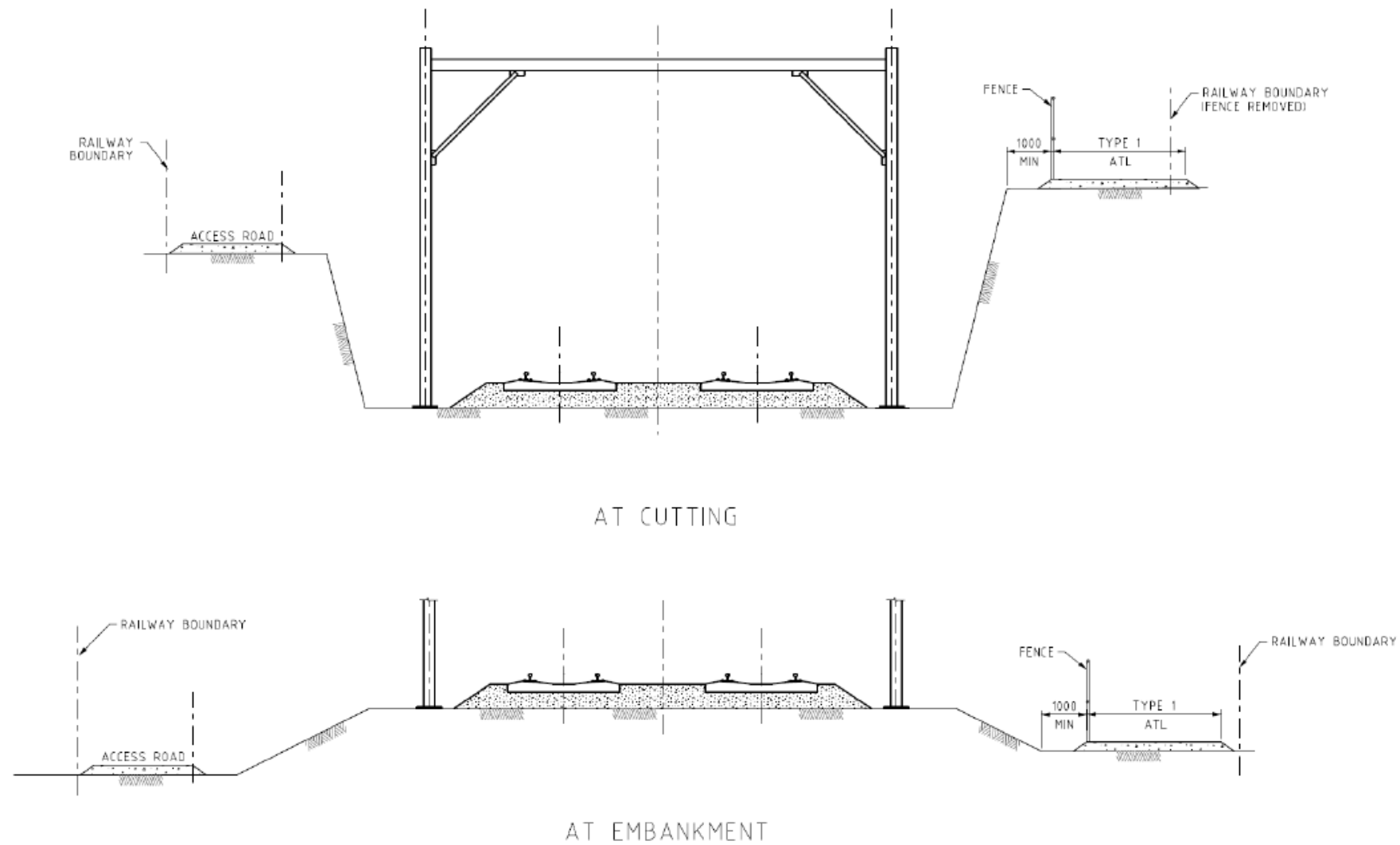


Figure 21 – Typical Type 1 ATL at Cuttings and Embankments [1]

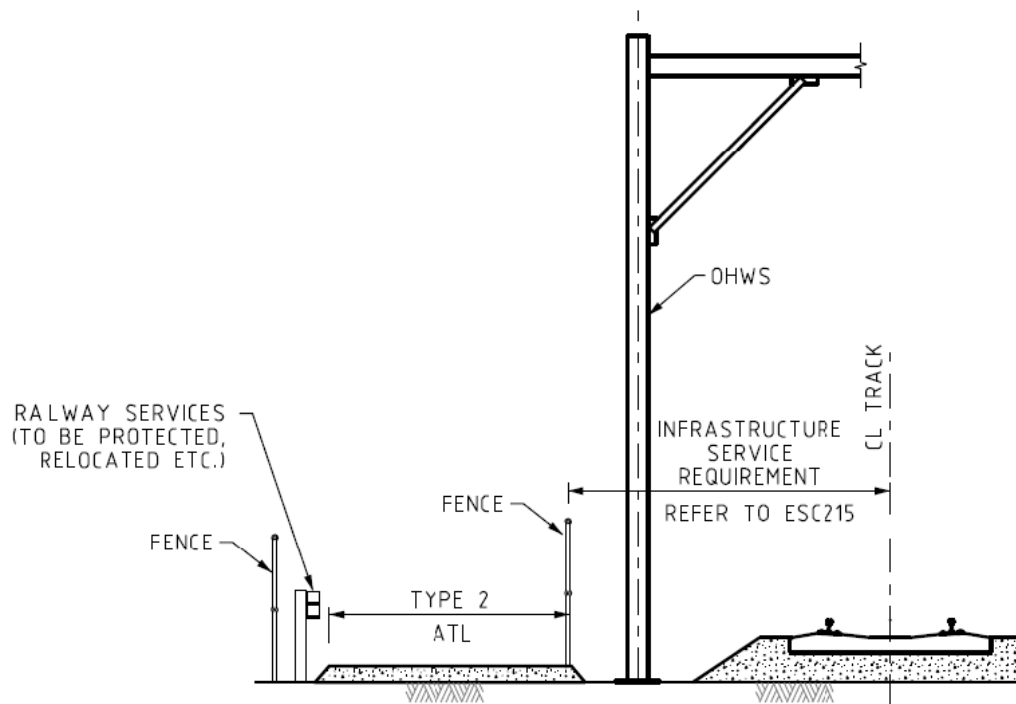


Figure 22 –Typical Type 2 ATL [1]

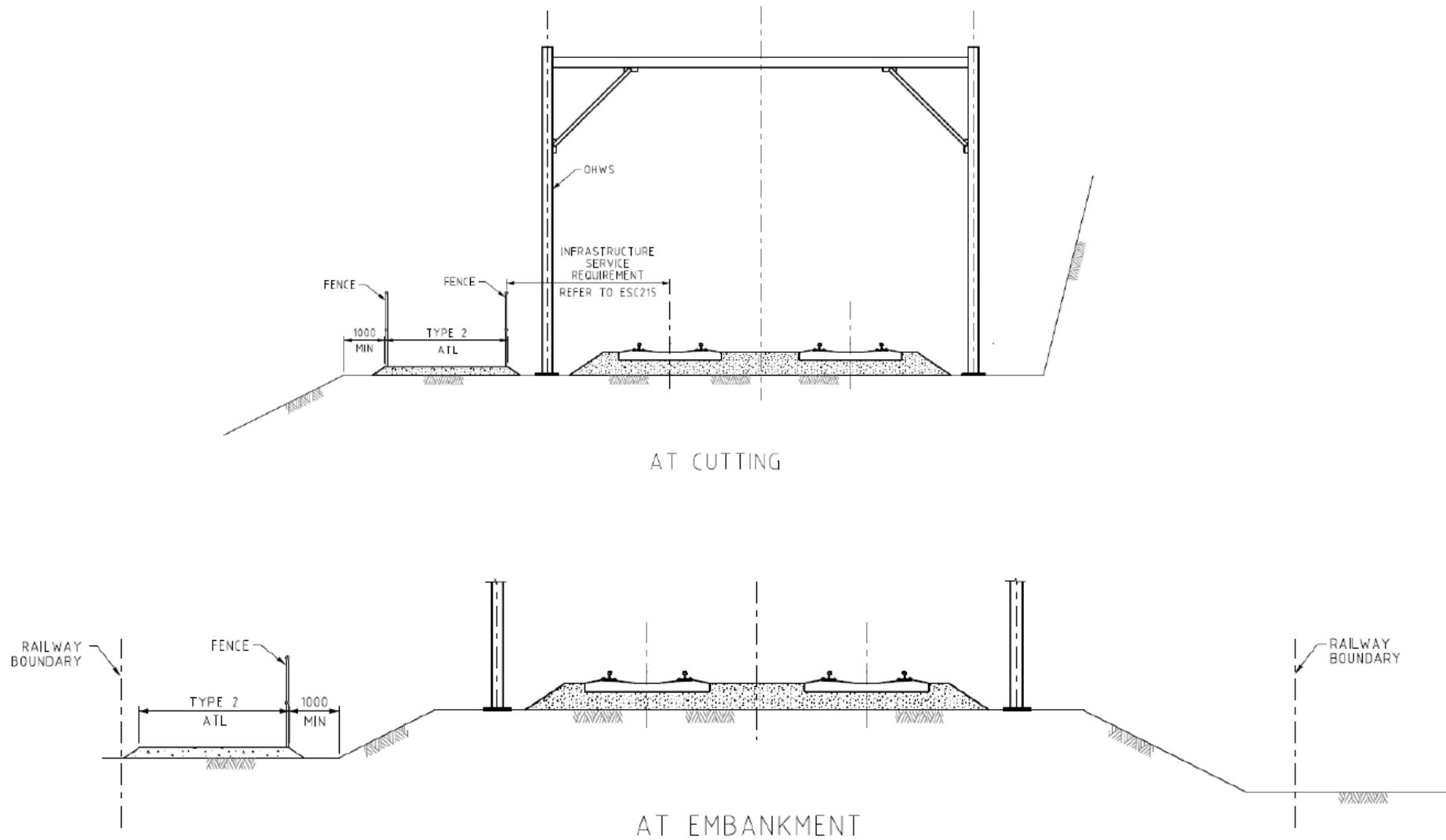


Figure 23 – Typical Type 2 ATL at Cuttings and Embankments [1]

Route A2 contains one shared/cycle path crossing at Chapman Avenue. Past Chapman Avenue heading south, the route can be diverted outside the rail corridor and widening of the existing path along Sutherland Road may be an option. This area however does contain some large tree constraints close to Chapman Avenue.

From Hampden Road though until just prior to Chapman Avenue with the intent to utilise the existing rail maintenance track although upgrade the track to a sealed concrete pavement surface designed to support a 20 tonne rigid truck in accordance with TfNSW's (T HR CI 12180 ST) *Active Transport Links on the Rail Corridor*.

Since this route is within the TfNSW rail corridor, applications for development will need to go through the Rail Corridor Management Group (RCMG). The rail infrastructure manager (RIM) needs to be consulted during the development of the proposed ATL to ensure risks are managed around the safety of the users of the ATL and appropriate provisions are made for rail operations and maintenance.

The design of active transport links (ATLs) shall take into account safety considerations for construction, operational, maintenance and decommissioning workers; and, for the potential users of the ATL.

Please refer to Transport for NSW website to download the latest version of the ESC 215 standards referenced in the above figures: https://www.transport.nsw.gov.au/industry/asset-standards-authority/find-a-standard?keyword=ESC%20215&date_from=&date_to=

3.1.2.1 Pennant Hills Road to Copeland Road

Table 8 - Pennant Hills Road to Copeland Road Constraints

Reference ID	Constraints	Resolution
A2-1 – Narrow Passageway and Tree	At the base of the pedestrian overbridge on the western side of the ramp, the clearance between ramp and TfNSW fence is too narrow to allow pedestrian and cyclist access to the path along Pennant Hills Road from Hampden Road. (refer Figure 25 and Figure 26).	With the intent to widen this existing ramp we may need to adjust the TfNSW boundary fence to make the desired ramp width (moderate level of negotiations required with transport authority). Removal of this tree would also be required.
A2-2 Access Driveway	At the base of the pedestrian overbridge on the eastern side of the ramp, the existing path leads up on to an existing driveway to allow pedestrian and cyclists to Hampden Road (refer Figure 27 and Figure 28).	Line marking and signage may need to be added to make this a shared zone for cars, bicycles and pedestrians or else adjusting this ramp alignment and clearing trees adjacent the east side of the overbridge ramp to separate shared path from the driveway.
A2-3 Galvanised Steel Troughing (GST)	Signalling and communication cables housed in the GST should not be accessible to users of the ATL (refer Figure 29).	Railway utilities may need to be relocated/buried along the length of the maintenance track/proposed cycleway. The intent would be to ensure the existing service can still be maintained however inaccessible to the public.
A2-4 Location Case	Location case is affecting the desired route of the shared path. (refer Figure 30)	Location case may need to be appropriately relocated or protected from public access.
A2-5 Rail Clearances from Shared Path	Clearances between nearest running rails to proposed wire fence and shared path may not be possible through this route.	Separation will need to be provided between "live" railway corridor and the cycleway. This could be achieved by the use of fencing if not already separated by the existing noise wall. If these clearances are not achievable, conforming with <i>NSW Bicycle Guidelines</i> and <i>TfNSW's (T HR CI 12180 ST)</i>

Reference ID	Constraints	Resolution
		<i>Active Transport Links on the Rail Corridor</i>, through the length intended in the corridor, there are 2 options. Clear additional trees from within the corridor and divert the path away from the tracks. Although this may conflict with other existing utility assets within the rail corridor. It will be required to divert the path outside the rail corridor and back on to Sutherland road just prior to the Chapman Avenue Bridge.
A2-6 Trees	Trees may require clearing between Chapman Avenue and Beecroft station (refer Figure 31)	This may be the only option through this area unless it is possible to continue the shared path through the rail maintenance track, however from the site inspection, this area is currently used as a temporary concrete rail sleeper storage location (refer Figure 32 and Figure 33) Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 36 Trees to be removed between Pennant hills Road to Copeland Road).
A2-7 Impact from Competing Users	Sharing the TfNSW maintenance track will affect the movement for maintenance crews/ cyclists and pedestrians alike due to congestion.	Consultation with maintainer to establish requirements for access to railway infrastructure by rail personnel, their vehicles and equipment (significant level of negotiations required with transport authority)
A2-8 Utilities	Large transmission utilities on northern corner of Sutherland Road and Chapman Avenue	This is a highly constrained area which should be avoided. The only option here would be to divert the shared path outside the rail corridor prior to these utilities and construct a new path adjacent to the TfNSW boundary fence. This option will require the combined services route along the maintenance track to be relocated/buried. Additional tree clearing would also be required for this option.
A2-9 Safety and Emergency Access	Safety and emergency access are of concern, as the entrance/exits (Hampden Road and Chapman Avenue) to this facility are spaced quite far apart (Approx. 1.2km). Due to the embankment down from the existing maintenance track toward the adjacent streets on the eastern side being so steep, emergency access to the shared facility is limited to the two entrance/exits.	Lighting and potential CCTV surveillance to be considered at detailed design. This will assist to deter criminal activity along the length and to reduce likelihood of incident occurrences.

Reference ID	Constraints	Resolution

3.1.2.2 Copeland Road Overbridge

The existing bridge consists of a single span multi-box steel girder structure with a composite reinforced concrete deck. There appears to be services located under the pathway housed in the services void. Based on our preliminary review, a widening option to provide the required width of the cycleway would appear feasible. One option may be a pair of plate girders lifted into place and supported on extended abutment crossheads. This solution would ensure that the number of required rail occupations is minimised, substantially shortening the overall duration of construction works over the rail corridor. Construction works could largely be undertaken off the existing bridge, which could result in maintaining pedestrian accessibility to the existing footpath for the majority of the construction period. It is noted that the nearest bridge crossing is approximately 400m away at Chapman Avenue.

The proposed concept solution is indicatively depicted in Figure 24.

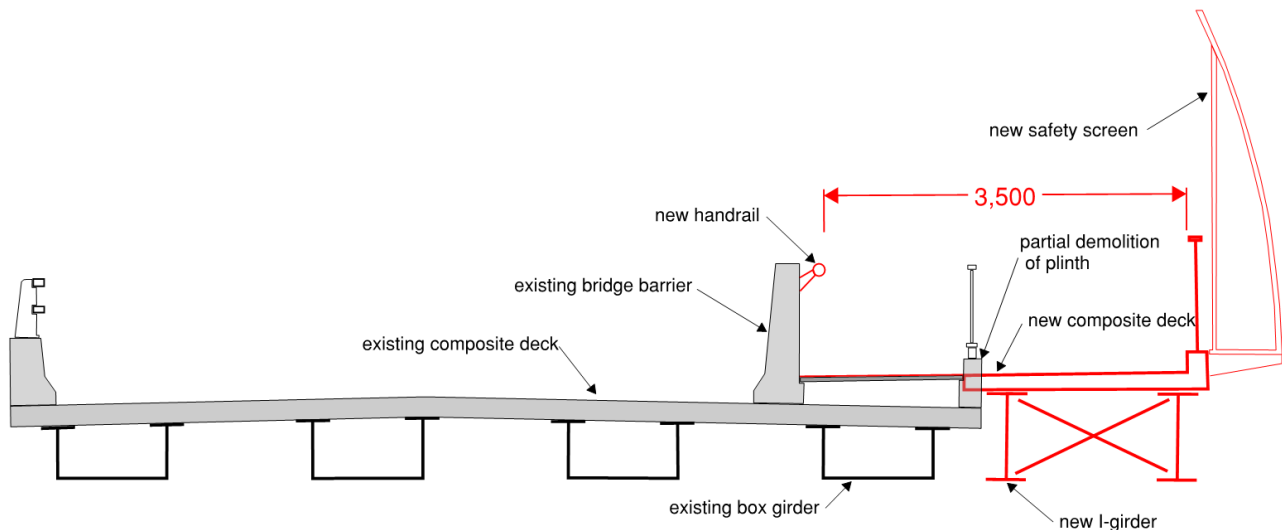


Figure 24 – Copeland Road Overbridge Widening Concept



Figure 25 - A2-1 – Narrow Passageway and Tree - Hampden road looking north east along western side of existing pedestrian overbridge ramp



Figure 26 - A2-1 – Narrow Passageway and Tree - Pennant Hills Road looking south west at western side of pedestrian bridge ramp



Figure 27 - A2-2 Access Driveway - Pennant Hills Road looking south up to driveway adjacent eastern side of Pennant Hills pedestrian overbridge ramp.



Figure 28 - A2-2 Access Driveway - Hampden road looking north east along eastern side of existing pedestrian overbridge ramp and down local driveway



Figure 29 - A2-3 Galvanised steel Troughing (GST) - Looking south along existing maintenance track



Figure 30 - A2-4 Location Case - Looking north along existing maintenance track



Figure 31 - A2-6 Trees - Looking North along Sutherland road toward Chapman Avenue Overbridge [2]



Figure 32 - A2-6 Trees - Looking South along corridor at TfNSW driveway between Chapman Avenue and Beecroft Station



Figure 33 - A2-6 Trees - Looking North along corridor at TfNSW driveway between Chapman Avenue and Beecroft Station

3.1.3 Route A3 Constraints and Considerations

Route A3 is considered as it is approximately 100 metres shorter than Route A1 using Lilla Road. Additionally, this route would reduce travel times as cyclists would not need to need to cross the lights at City View Road. It is anticipated that more confident riders would use the road along City View Road, Boundary Road and North Wongala Crescent to avoid the City View Rd signalised crossing if option A1 was constructed.

Route A3 alternatives have been divided in to two sub-options. Option A3 South with the cycle path located on the south side of North Wongala Crescent and A3 North with the cycle path located on the north side of North Wongala Crescent (refer Appendix A Constraints Map).

From the corner of North Wongala Crescent and Lilla Road continuing south, the A3 Routes follow the same alignment as Route A1 through Byles Creek and until Copeland Road and therefore shares some of the constraints listed in Table 7 including;

- A1-13 Trees
- A1-14 TfNSW Driveways
- A1-15 Parking Facilities
- A1-16 Bus Stop
- A1-17 Telstra Telephone Box
- A1-18 Street light Power Poles
- A1-19 Environmentally Sensitive Area
- A1-20 High Voltage Power Box
- A1-21 Steep Grade (Bytes Creek Crossing)
- A1-22 Safe Crossing (not applicable to Route A3 South)

In addition to the above constraints shared between the route options, the A3 routes contains the significant constraints listed in Table 9, Table 10.and Table 11

3.1.3.1 City View Road to Boundary Road (A3 South and A3 North)

Table 9 - City View Road to Boundary Road (A3 South and A3 North)

Reference ID	Constraints	Resolution
A3-1 Trees	Potential clearing of planted trees along City View Road required (refer Figure 34)	May be able to narrow shared path to a minimum to avoid trees. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 8 Trees to be removed between City View Road and Boundary Road).



Figure 34 – A3-1 Trees Looking South West along City View Road [2]

3.1.3.2 Boundary Road to Lilla Road (A3 South)

Table 10 – Boundary Road to Lilla Road (A3 South side) constraints

Reference ID	Constraints	Resolution
A3-2 Tight Corner and Steep Slope	Steep slope on Boundary Road with tight corner at the low end of the street. (refer Figure 35)	There is an opportunity in this location to improve safety on at the south east corner. Cars currently park on this corner affecting visibility of the directive chevron signs. It is also an opportunity to erect a safety barrier potentially required to eliminate the chances of vehicles overturning at this embankment. Steep slope (although shorter hill than Lilla Road) may be unavoidable unless alternate route is preferred.
A3-3 – Crest (Sight Distance Issue)	Crest and sag along North Wongala Crescent may have sight distance constraints.	May be unavoidable unless alternative route preferred.
A3-4 Trees	Significant tree clearing required along the south side of North Wongala Crescent to make room for the shared path.	May be unavoidable unless cyclists are diverted on to the road though this section, or alternative route preferred. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 151 Trees to be removed between Boundary Road and Lilla Road).

A3-5 Culvert Crossing

Narrow sag along North
Wongala Crescent at culvert
(refer Figure 36)

Elevated structure to be provided for shared path, tree
clearing would be required as well as installing a new
W beam to suit.



Figure 35 - A3-2 and A3-7 Tight Corner and Steep Slope – Looking south east along boundary road to corner of North Wongala Crescent [2]



Figure 36 – A3-5 and A3-9 Culvert Crossing - Looking West along North Wongala Crescent to culvert crossing [2]

3.1.3.3 Boundary Road to Lilla Road (A3 North)

Table 11 - City View Road to Lilla Road (A3 North side) Constraints

Reference ID	Constraints	Resolution
A3-6 Stairs in Existing Path	Stairs in existing path along Boundary Road would not be compatible with the new shared path.	Stairs would need to be demolished, retaining wall constructed and significant cutting earthworks to make up the level difference. This is not preferable as this would further steepen this track which can make this area unsafe. In addition, would be quite costly due to excessive cutting required and construction of the retaining wall.
A3-7 Steep Slope	Steep slope on North Wongala Crescent and Boundary road with tight corner at the low end of these streets.	Steep slope (although shorter than Lilla Road) may be unavoidable unless alternate route is preferred. There is an opportunity in this location to upgrade the existing path around the north west corner (refer Figure 35)
A3-8 Trees	Some planted tree clearing may be required along northern side of North Wongala Crescent to make room for the shared path.	May be unavoidable unless cyclists are diverted on to the road though this section, or alternative route preferred. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 60 Trees to be removed between Boundary Road and Lilla Road).
A3-9 Culvert Crossing	Narrow existing pedestrian crossing over culvert at the culvert crossing on North Wongala Crescent.	Elevated structure to be provided and may require a portion of front yard of adjacent property to be acquired if insufficient space to cater for minimum shared path width on this northern side (refer Figure 36)
A3-10 Sight Distance	Many driveways adjacent shared path. May have sight distance issues.	Appropriate line marking to raise awareness of shared path.
A3-11 Streetlight/ Power Poles	Potential streetlight/ Power pole relocations x 6	May be able to shift path alignment around the poles where possible to avoid relocation.

3.1.4 Route A4 Constraints and Considerations

Route A4 would run along the existing TfNSW property boundary on the eastern side of the rail corridor through Council owned land. Typically, the alignment will follow the existing stair corridor and bush trail which has a highly vegetated embankment adjacent to it. In order to incorporate the 3.5m wide shared path, various cuts and fills, new bridges, and upgrades to existing structures will be required to ensure an adequate longitudinal grade is provided along the steep alignment. In order to minimise the effects on existing flora, much of the bridge structure would need to be elevated. (Refer to Appendix A Constraints Map for location and Appendix B for typical section of potential stair bridge structure for grade corrections). The shared path is then located kerbside along the western side of Sutherland Road through until Chapman Road.

From Pennant Hills Road to Hampden Road and Chapman Road to Copeland Road Route A4 would follow the same alignment as Route A2 and therefore shares some of the constraints listed in Table 8 including;

- A2-1 Narrow Passageway and Tree
- A2-2 Access Driveway
- A2-8 Utilities
- A2-9 Safety and Emergency Access

In addition to the above constraints shared between the route options, the A4 route contains the significant constraints listed in Table 12.

Table 12 – Pennant Hills Road to Copeland Road (A4) Additional Constraints

Reference ID	Constraints	Resolution
A4-1 Trees and Heavy Vegetation	Significant tree clearing required along embankment adjacent the existing stair corridor, nature walk and roadway	Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 261 Trees to be removed between Pennant Hills Road and Copeland Road).
A4-2 Existing Lighting	Existing light post close to proposed alignment. Relocation may require embanking retaining due to adjacent steep batter	Relocation of lighting and lighting conduit towards embankment. Light relocation to be considered to reduce over cutting of embankment (refer Figure 39)
A4-3 Steep longitude grades	Steep longitudinal grades Approx 1:2 in select areas, at the stair corridor (assumed an average 5% grade) may be unsustainable conditions to construct without significant fills, cuts or bridge structures	Grade corrections via earthworks or structures will be required to ensure appropriate longitudinal grading. Refer to Appendix B typical section for route A4 between Hampden Road and Binomea Place.
A4-4 Existing Retaining Structure	Existing retaining structure along proposed alignment	Existing retaining structure to be retained and path widened to meet minimum shared path widths (refer Figure 43)
A4-5 Privacy	Exposed property boundary to shared path	Privacy fencing separating the elevated structure from adjacent neighbouring property's may be required.
A4-6 Existing path/staircase	Existing staircase structure	May be appropriate to remove the existing path and staircases and introduce an elevated piered structure spanned adequately to achieve flatter grades preferable for shared path users. Refer to Appendix B typical section for route A4 between Hampden Road and Binomea Place. (refer Figure 45).

Reference ID	Constraints	Resolution
A4-7 Existing Drainage Pit	Existing stormwater drainage pit and connecting drainage would need to be considered in the design and construction of the elevated structure.	Design elevated structure to avoid impact structure so drainage pit can be retained. (refer Figure 46)
A4-8 Power Pole	Power pole potentially in the way of the shared path. Further clearing of thick shrubbery would be required in this area.	Potentially need to relocate power pole to provide sufficient offset from shared path (refer Figure 48).
A4-9 Steep Embankment or Rock face	Steep embankment or rocky cutting along existing rock retaining embankment	Extensive cutting required and potential embankment retaining required along the shared path (refer Figure 48).
A4-10 TfNSW Driveway	Existing TfNSW driveway along proposed shared path	Upgrade existing driveways (low level of negotiations required with transport authority)

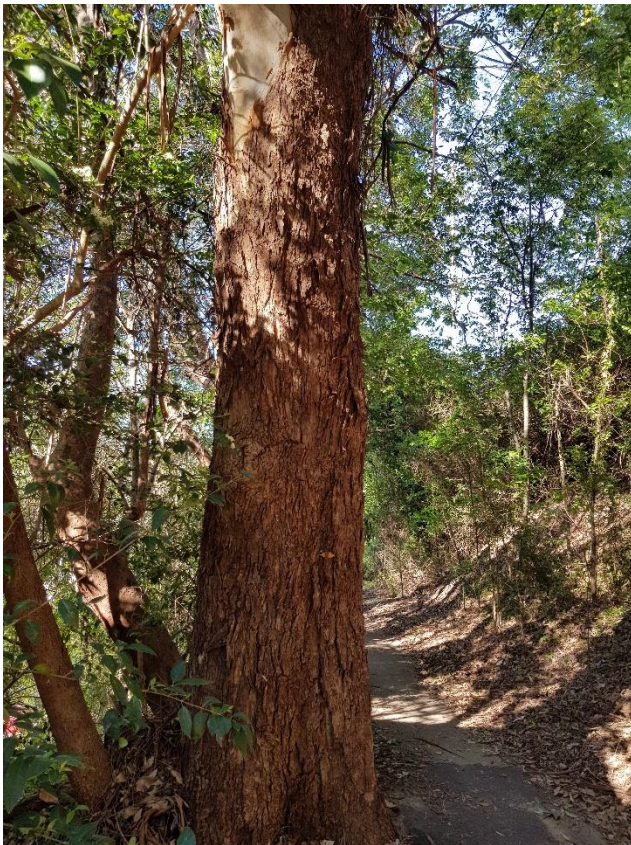


Figure 37 - A4-1 Trees and Heavy Vegetation - Looking south along the stair path towards Binomea Place from Hampden Road



Figure 38 - A4-1 Trees and Heavy Vegetation - Looking north along bush trail towards Azalea Grove



Figure 39 - A4-2 Existing Lighting – Looking south along the stair path towards Binomea Place from Hampden Road



Figure 40 - A4-3 Steep longitude grades – significant longitudinal regrading to provide adequate grades for share path, looking south in the bending along Sutherland Road and Tristania Way



Figure 41 - A4-3 Steep Longitudinal grades - looking north along Sutherland Road towards corner of Sutherland Road and Tristania Way



Figure 42 - A4-4 Existing Retaining Structure – retaining wall along existing stair corridor looking south along the stair path towards Binomea Place from Hampden Road



Figure 43 - A4-4 Existing Retaining Structure; A4-5 Privacy – Widened shared path could overlook adjacent property



Figure 44 - A4-5 Privacy – No fencing into property from bush trail (1 Tristania Way, Beecroft – NSW, 2119)

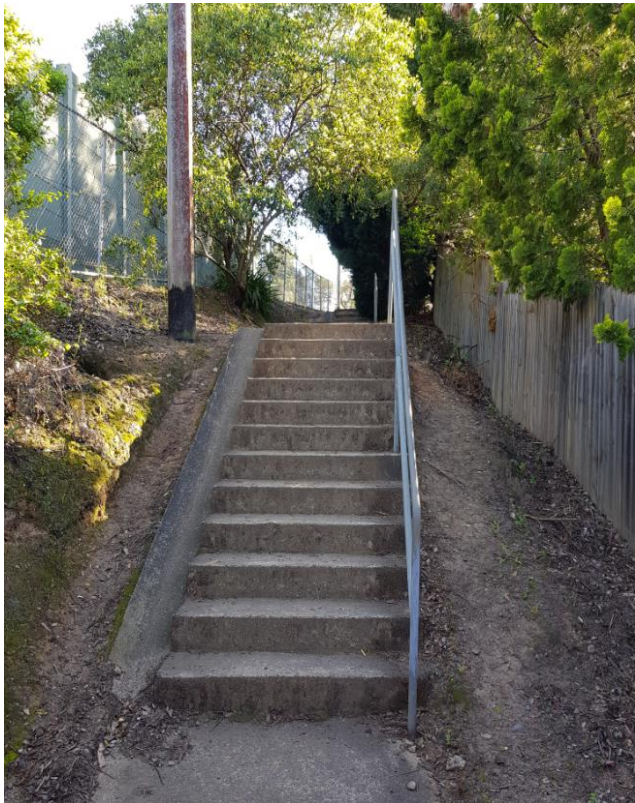


Figure 45 - A4-6 Existing path/staircase– Looking north along the existing path and stairs towards Hampden Road



Figure 46 - A4-7 Existing Drainage Pit - Looking north east looking toward the TfNSW maintenance track and noisewall

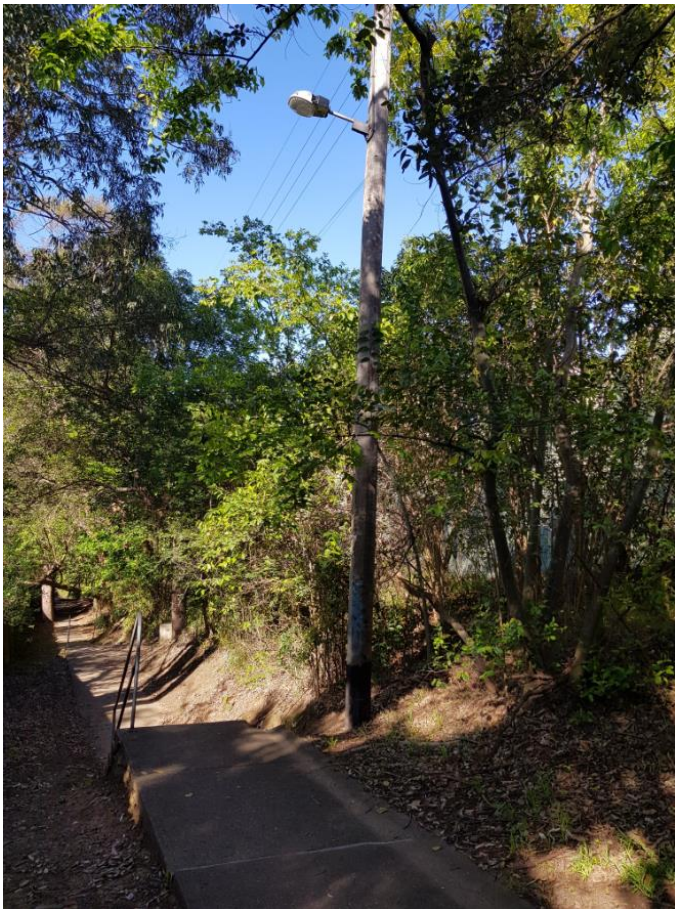


Figure 47 - A4-9 Power Pole - Looking north east looking toward the TfNSW maintenance track and noisewall



Figure 48 - A4-8 Power Pole; A4-9 Steep Embankment or Rock face – Looking west towards the train line near Narena Close along Sutherland Road



Figure 49 - A4-10 – TfNSW Driveway – Looking north from Sutherland Road (From Google Street View, March 2013 – Accessed 13/12/18)

Pennant Hills to Epping Cycleway Link

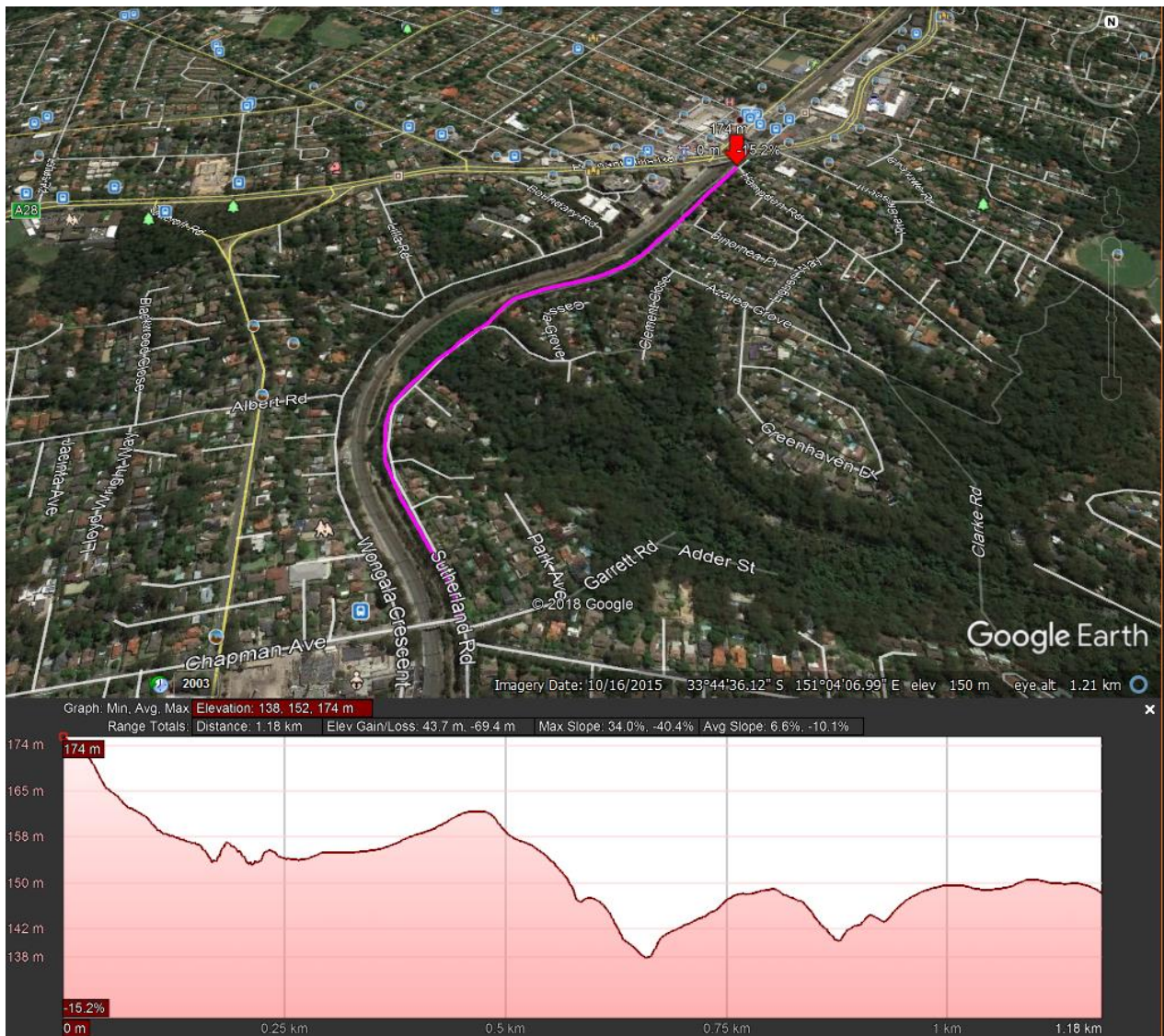


Figure 50 - A4.3 Steep longitude grades – Google Earth aerial from October 2015 with estimated elevation (Accessed 13/12/18).

3.2 Section B

Route B has previously been established by Hornsby Shire Council as the preferred route linking section A to section C from Copeland road overbridge through to Cheltenham Road overbridge along the northern side of The Crescent between the road and rail corridor.

Hornsby Shire Council is currently undertaking improvement works to the Beecroft Community Centre and surrounds on the corner of Copeland Road and Beecroft Road. The cycleway will connect to these new works and follow the existing footpath alignment through Beecroft Village Green.

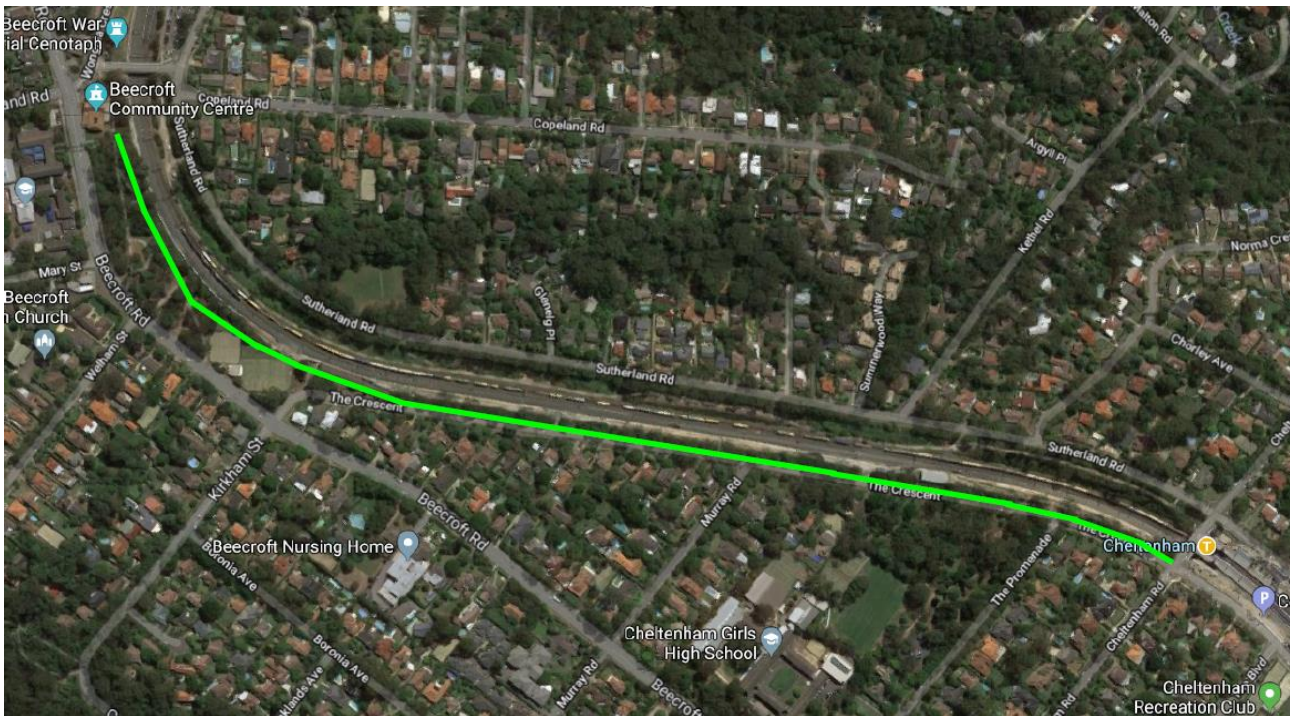


Figure 51 - Section B Route

3.2.1 Route B Constraints and Considerations

Route B starts at Copeland Road and behind the Beecroft Community Centre and travels south through the park towards The Crescent. Through this park there are numerous mature eucalypt trees that comprise a remnant of threatened ecological communities (TECs) that occur in the local area. Care shall be taken particularly through section B where there are known occurrences of these TECs. Of particular concern are:

- Sydney Turpentine-Ironbark Forest (STIF) (listed as endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act) and critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).
- Blue Gum High Forest (BGHF) in the Sydney Basin Bioregion (Listed as critically endangered under both the BC act and EPBC Act).

The proposed cycle/shared path through this park and along the northern side of The Crescent will need to take into consideration the Australian Standard AS 4970-2009 - *Protection of Trees on Development Sites*. Where encroachments into the Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) of trees that form part of the aforementioned TECs are required, the significance of these impacts on the tree's health and longevity would require consideration.

No threatened species have been recorded along the proposed Route B cycleway. Trees recorded along Route B are detailed in Table 13 with an estimate of the number requiring removal. The estimate is based on preliminary design documentation and subject to change.

Table 13 – Trees within Route B, potential removal and relation to TECs

Species	Estimated number of trees requiring removal	Indicative of BGHF/STIF
Blackbutt Eucalyptus pilularis	1	Yes - BGHF
Grey Ironbark Eucalyptus paniculata	0	Yes - both
Sydney Blue Gum Eucalyptus saligna	4	Yes BGHF
Sydney Blue Gum – Bangalay hybrid Eucalyptus saligna x botrioides	1	No
Sydney Red Gum Angophora costata	1	Yes - both
Stringybark Eucalyptus globoidea	1	Yes - both
Turpentine Syncarpia glomulifera	4	Yes - STIF
Black Wattle Acacia decurrens	1	Yes - STIF
Spotted Gum Corymbia maculata	1	No
River Oak Casuarina cunninghamiana	3	No
Moreton Bay Fig (Ficus Macrophylla)	1	No
Total	18	

3.2.1.1 Copeland Road to Cheltenham Road Constraints

Route B starts behind the Beecroft Community Centre and travels south through the park and to between the Beecroft tennis courts and the TfNSW rail corridor boundary. Discussions are required to establish if the TfNSW boundary can be relocated slightly at the pinch points between the tennis courts and TfNSW rail corridor boundary.

Table 14 – Copeland Road to Cheltenham Road Constraints

Reference ID	Constraints	Resolution
B-1 Trees	Native trees which may be affected on this route (refer Figure 52)	Design approach will be to avoid/mitigate impact on native trees where possible by diverting the path as necessary to provide conforming clearance away from these trees to avoid excessive encroachment to the Tree Protection Zone (TPZ) in line with AS 4970-2009 - <i>Protection of Trees on Development Sites</i> . Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 98 Trees to be removed between Copeland Road and Cheltenham Road).
B-2 Narrow Cycleway Envelope	Narrow width from Beecroft tennis courts to TfNSW boundary (current clearance from boundaries at the corners of the tennis courts are 2.5m and 1.6m) (refer Figure 52 and Figure 53)	Approach and discuss opportunity to relocate the TfNSW boundary back toward the rail lines by 2m to 3m to achieve the 3.5m desirable cycle/shared path width (moderate level of negotiations required with transport authority). Alternatively reduce shared path to an absolute minimum width to reduce the change to this boundary.
B-3 Utilities	Existing utilities	Maintaining existing levels surrounding these utilities need to be considered in design to avoid impact.
B-4 TfNSW Driveways	TfNSW Driveways x 4 (refer Figure 54)	Driveways will need to be upgraded (low level of negotiations required with transport authority).

Pennant Hills to Epping Cycleway Link

B-5 Streetlight/ Power Poles

Potential relocation of streetlight/ power poles x 4 (refer Figure 54)

Divert path if possible by narrowing or splitting path as appropriate to avoid asset relocation.



Figure 52 – B-1 Trees and B-2 Narrow Cycleway Envelope - Looking north west toward Beecroft Community Centre



Figure 53 – B-2 Narrow Cycleway Envelope – Looking south east toward Beecroft Scout Hall



Figure 54 – B-4 TfNSW Driveways and B-5 Streetlight/ Power Poles – Looking east along The Crescent Hall

3.3 Section C

Section C provides the connection to section B works in addition to providing an active transport facility connecting Cheltenham Station to Epping. Three alternatives have been identified for section C; C1, C2 and C3 (refer Figure 55).

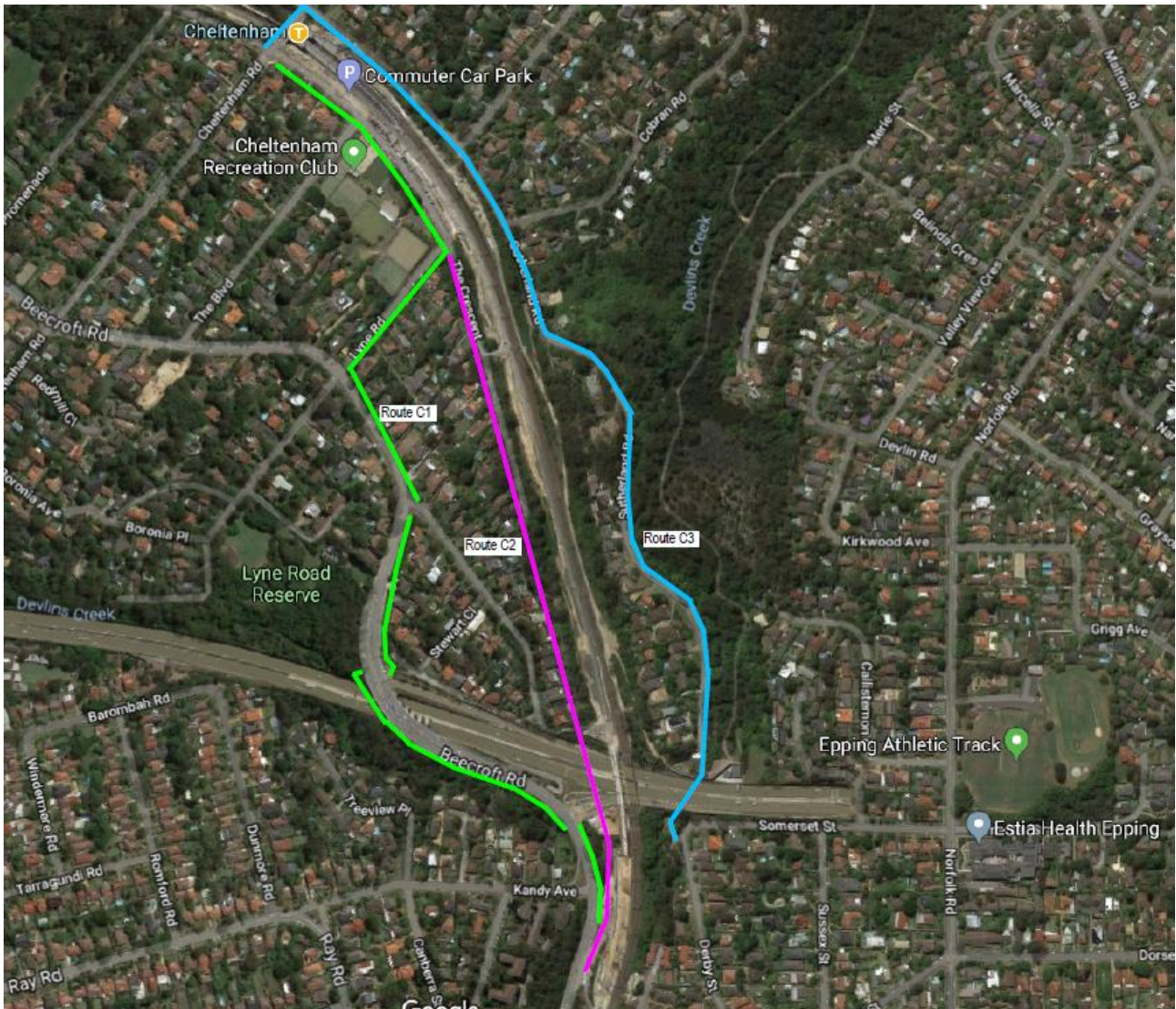


Figure 55 – Section C Route Options

3.3.1 Route C1 Constraints and Considerations

There is an opportunity at the intersection of The Boulevard and The Crescent to introduce an elevated boulevard paving treatment which is an effective way to reduce the speed limit around this intersection and give priority to the cycleway/shared path.

3.3.1.1 Cheltenham Road to Lyne Road

Table 15- Cheltenham Road to Lyne Road Constraints

Reference ID	Constraints	Resolution
C1-1 Embankment	Corner of Cheltenham Road and The Crescent is quite steep (refer Figure 56)	May need a pedestrian fence in this area to mitigate the risk of a cyclist overturning on to the road if he or she was to depart the shared path.
C1-2 Trees	Planted trees along The Crescent from Cheltenham Road to The Boulevard may need to be cleared to allow a desirable shared path width. Approximately 10 trees.	Narrowing the shared path width would allow the retention of the trees. (approximate width from property boundaries to the adjacent trees is approximately $\Rightarrow 2.3\text{m}$) Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 23 Trees to be removed between Cheltenham Road and Lyne Road).
C1-3 Streetlight/ Power Poles	Potentially relocate streetlight/ power poles x 4	May be able to shift alignment around the paths where possible to avoid relocation.



Figure 56 - C1-1 Embankment – Looking south at corner of Cheltenham Road and The Crescent [2]

3.3.1.2 The Crescent to Beecroft Road

Table 16 -The Crescent to Beecroft Road Constraints

Reference ID	Constraints	Resolution
C1-4 Embankment	The southern corner of The Crescent and Lyne Road is steep (refer Figure 57)	May need to erect a pedestrian fence on the property side of the new path to prevent cyclists falling down steep embankment.
C1-5 Trees	Planted trees may require clearing at southern end of Lyne Road x 2	Locally narrow shared path to a minimum if possible to prevent the need to clear trees. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 13 Trees to be removed along Lyne Road between The Crescent and Beecroft Road).
C1-6 Streetlight/ Power Poles	Possible relocation of Streetlight/ Power poles x 3	May be able to shift alignment around the paths where possible to avoid relocation.
C1-7 Sight Distance	Sight distance for driveways on Lyne Road	May need to consider relocating the path closer to Lyne Road to improve sight distances for cars exiting driveways and / or provide appropriate line marking to raise awareness of any conflict areas.



Figure 57 – C1-4 Embankment - Looking South west along Lyne Road [2]

3.3.1.3 Lyne Road to M2 motorway

Table 17 - Lyne Road to M2 motorway Constraints

Reference ID	Constraints	Resolution
C1-8 Sight Distance	Sight distance for driveways on Beecroft Road	Appropriate line marking as necessary.
C1-9 Road Furniture and Utilities	Northern Corner of Beecroft Road and Old Beecroft Road has high voltage utility box and seat Signal boxes near M2 entry ramp require relocation x 2	Shift the alignment of the path so these utilities and road furniture can be retained. Relocate signal boxes.
C1-10 Streetlight/ Power Poles	Potential streetlights/ power poles may require relocation x 10	Shift alignment of the paths if possible so these poles may be retained.
C1-11 Sight Distance	Sight distance for driveways on Beecroft Road	Appropriate line marking as necessary.

C1-12 Trees	Planted trees along Beecroft Road may need to be cleared to have a conforming shared path width.	Narrow shared path width to a minimum if it means these trees can be retained. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 32 Trees to be removed between Lyne Road and intersection with the M2 Motorway).
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3.3.1.4 M2 motorway to Devlin's Creek on Eastern side of Beecroft Rd (Parramatta LGA)

Table 18 - M2 motorway to Delvin's Creek Constraints

Reference ID	Constraints	Resolution
C1-13 Bridge	Difficulties in widening bridge over M2 (refer Figure 58 and Figure 59)	The proposed route on the eastern side poses some major constraints to be considered during the project design stages. Some of the constraints identified include construction over the M2 Motorway and adjacent to Beecroft Road. Given the constrained site, accessibility and the intention to minimise the impact on live traffic of M2, a crossing on the west side of Beecroft Road may be a more appropriate solution.
C1-14 Traffic Signal	Relocate traffic signal x 1	-
C1-15 CCTV	Relocate CCTV x 1	-
C1-16 Street Light Power Poles	Potentially relocate streetlight/ power poles x 9	-
C1-17 Trees	Trees adjacent existing Delvin's Creek Bridge (refer Figure 60)	Potentially need to remove trees adjacent and south of Devlin's Creek Bridge to provide space for shared path. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 46 Trees to be removed between Beecroft roads intersection with M2 Motorway and southern extents of route).



Figure 58 - C1-13 and C1-14 Traffic Signal, C1-15 CCTV and C1-13 Bridge - Looking South East along Beecroft Road [2]



Figure 59 - C1-13 Bridge - Looking East along M2 toward eastern side of Beecroft Road Overbridge [2]



Figure 60 – C1-17 Trees - Looking south along Beecroft Road over Devlin's Creek Bridge

3.3.1.5 M2 Motorway to Devlin's Creek on western side of Beecroft Road

Table 19 - M2 motorway to Devlin's Creek Constraints

	Constraints	Resolution
C1-18 Trees	Significant tree clearing required along length of existing noise wall. (refer). Construction behind this barrier may be difficult considering Devlin's Creek runs parallel to the noise wall	Reconfigure existing barriers and widen shared path as necessary to minimise affected trees. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 60 Trees to be removed between Beecroft roads intersection with M2 Motorway and southern extents of route).
C1-19 Streetlights	New streetlights required x 13	Streetlight poles to be reconstructed
C1-20 Noisewall	Noise wall (refer)	Noise wall to be reconstructed
C1-21 Traffic Signal	Traffic signals requiring relocation x4	Traffic Signals need be relocated



Figure 61 – C1-18 Trees - Looking North East behind noise wall on western side of Beecroft Road.



Figure 62 – C1-20 Streetlights and C1-21 Traffic Signals - Looking South from Beecroft Road.

3.3.1.6 Beecroft Road path and noisewall widening

Along the length of the existing noisewall along the western side of Beecroft road, the option is to widen the existing path and noisewall (as per Figure 63) to the desired 3.5m width.

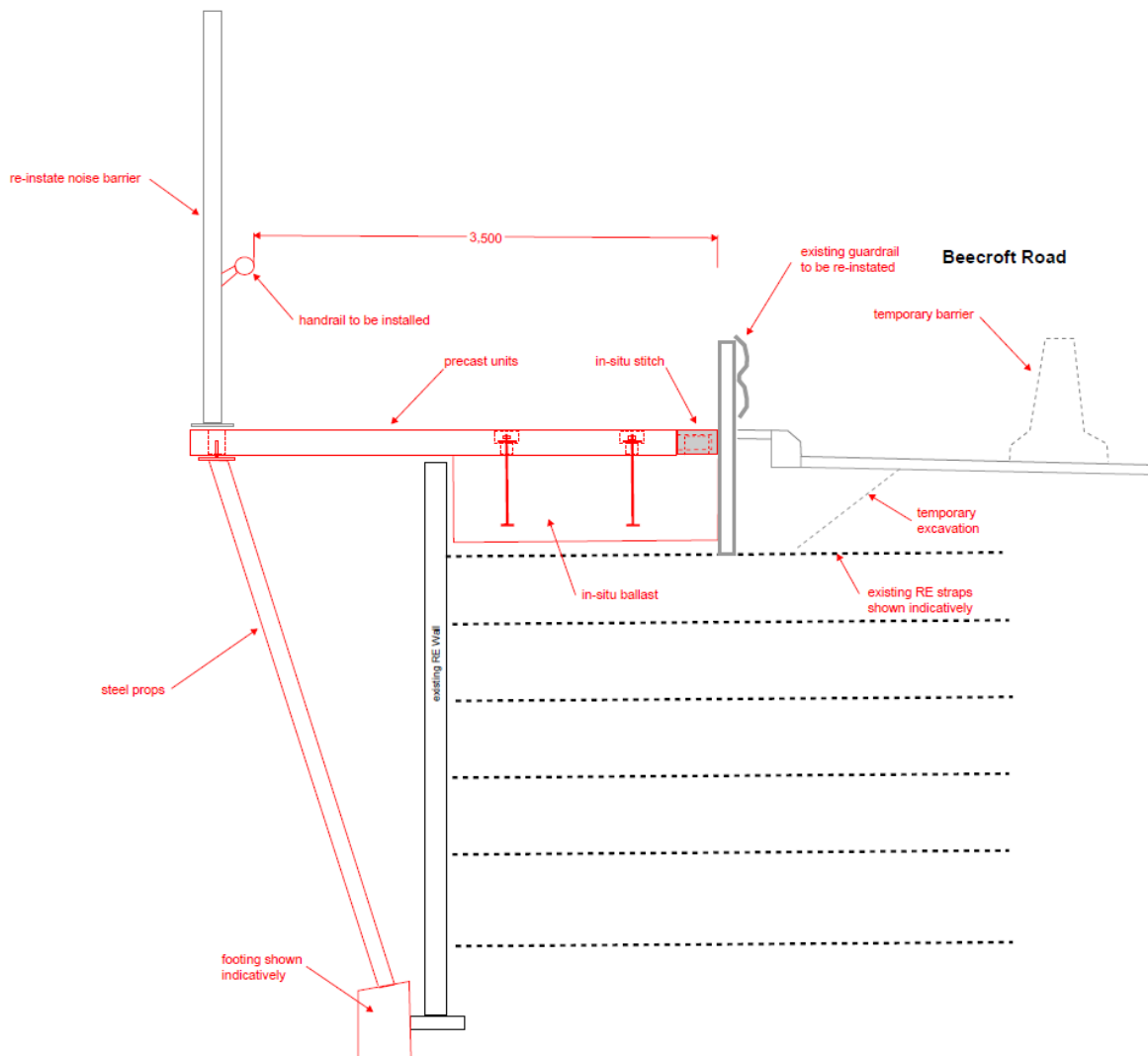


Figure 63 - Beecroft Road Widening Cross-section (Western Side)

3.3.1.7 M2 Motorway Bridge

In addition to the path widening along the existing noisewall, bridge piers could be located in the median of the M2 Motorway and immediately north of the northbound carriageway (refer Figure 64 below), allowing the use of prestressed precast Super-T beams. Bridge piers are envisaged to be designed as precast elements to minimise the duration of works in the median of the motorway leading to a safer and substantially less disruptive solution to the traffic.

Alternatively, Hornsby Shire Council may consider accepting the existing pedestrian bridge over the M2 to be sufficient, although not currently meeting the desired 3.5m shared path width.



Figure 64 – Beecroft Road Widening Plan over M2 Motorway (Western Side)

3.3.1.8 Devlin's Creek Bridge

At the proposed location of the creek crossing, it appears that a 2 span prestressed precast Super-T beam structure can be provided. The bridge will be supported on piled abutments. The expected span length is in the range of 50 – 60m.

3.3.2 Route C2 Constraints and Considerations

3.3.2.1 The Crescent from Lyne Road to Cambridge Street

Table 20 - M2 motorway to Delvin's Creek Constraints

Reference ID	Constraints	Resolution
C2-1 Trees	Trees on the eastern side of The Crescent and trees on northern and southern side of M2 (at bridge abutments)	Narrowing or diverting shared path to avoid these trees along The Crescent. Undertake a sympathetic design to minimise the quantity of affected trees (Approx. 159 Trees to be removed along The Crescent between Lyne Road and southern extents of route).
C2-2 Street Light Power Poles	Potential relocation of streetlights/ power poles x 4	Narrowing or diverting shared path to avoid these assets may be appropriate.
C2-3 Tree clearing in rail reserve	High quantity of tree clearing through the rail reserve area behind properties on the south eastern end of Old Beecroft Road.	Avoid unnecessary clearing of trees by adjusting the alignment where possible. Note: Majority of the trees in this rail reserve area (requiring clearing for the shared path) are exotic.
C2-4 Access Driveway	Access driveway at end of The Crescent would be the ideal route to direct cycle path through to rail reserve opening. (refer Figure 66)	Run the shared path adjacent to driveway to maintain separation between cars and cyclists/pedestrians provided there are no critically endangered tree constraints. If this is not possible, potentially need to make this a shared zone.
C2-5 Noisewall, Existing M2 Street lighting and Large Sign Structure	Existing noise wall separating M2 from properties along the south eastern end of Old Beecroft Road. (refer Figure 67 and Figure 68)	Bridge design will need to cater for these constraints.
C2-6 Sediment Retention Basins	Retention basins may complicate design/construction of piers/abutments (refer Figure 69)	Bridge design will need to cater for these constraints and/or retention basins require redesign.
C2-7 Proximity of Residences	Insufficient space in the verge to make up a 3.5m shared path width. (refer Figure 70)	May need to reduce the width of the shared path in this area to an absolute minimum unless a portion of front yard of the affected property is acquired.

3.3.2.2 M2 Cycleway Bridge

This is a major crossing and it potentially can result in major traffic disruptions if not planned and designed correctly. It would appear, from our early investigation, that crossing over the M2 Motorway may be achievable with the use of the most conventional (economically advantageous) solution of prestressed precast Super-T beams. We have determined that a five or six spans will be required to provide an elevated cycleway over M2 and Delvin's Creek. Despite the geometrical constraints of the site there still appears to be sufficient space to construct bridge piers in order to limit the span length and therefore the cost of the structural crossing. Arcadis have identified that piers could land in the median of M2 (pier 1); between the northbound carriageway of M2 and the exit ramp to Beecroft Rd (pier 2); and between the M2 exit ramp to Beecroft Road and the creek (pier 3). Bridge piers are envisaged to be designed as precast such that the duration of works in the median of the motorway and in the zone between the northbound carriageway and exit ramp is minimised leading to a safer and substantially less disruptive solution to the traffic. This potential bridge arrangement has been indicatively shown in Figure 65. The approach embankment from the north and south will be retained by a reinforced earth system in order to reduce the overall bridge length to a minimum, which in turn will have a positive impact on the bridge and the project cost.

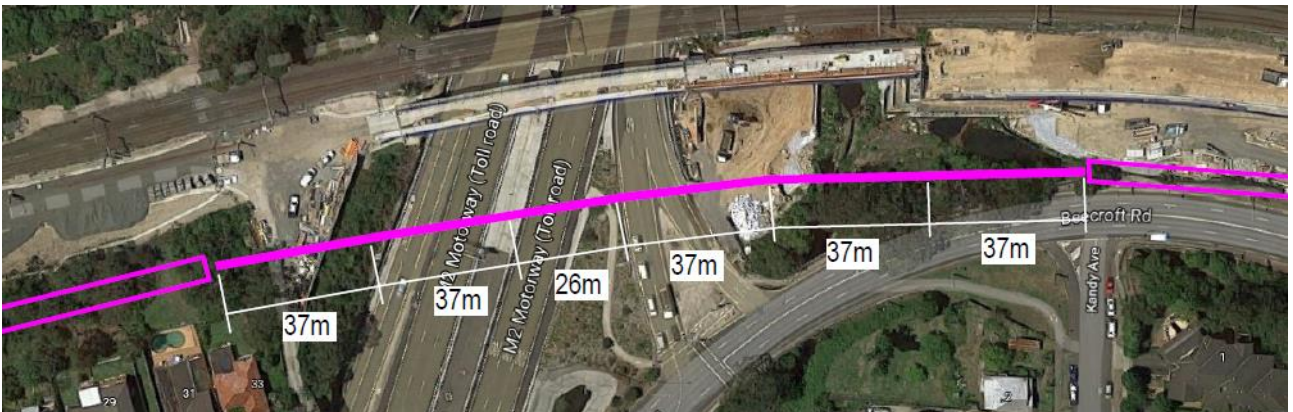


Figure 65 – M2 Cycleway Bridge [2]



Figure 66 - C2-4 Access Driveway - Driveway Access at southern end of The Crescent looking south toward rail reserve opening



Figure 67 – C2-5 Noisewall, Existing M2 Street lighting and Large Sign Structure - Noisewall looking North from intersection at M2 exit ramp and Beecroft Road



Figure 68 – C2-5 Noisewall, Existing M2 Street lighting and Large Sign Structure - Looking East along M2 showing noisewall, streetlight and large sign structure constraints [2]



Figure 69 - C2-6 Sediment Retention Basins - Looking South from intersection at M2 exit ramp and Beecroft Road along Devlin's Creek



Figure 70 - C2-7 Proximity of Residence - Looking South along The Crescent [2]

3.3.3 Route C3 Constraints and Considerations

3.3.3.1 Sutherland Road from Cheltenham Road to M2 underpass

Cyclist through this route would need to be on road with line marking and symbols only.

Table 21 - M2 motorway to Devlin's Creek Constraints

Reference ID	Constraints	Resolution
C3-1 Long and Steep Hill	Long steep hill along Sutherland Road	This may be unavoidable unless an alternative route is preferred.
C3-2 Lighting and CCTV	Underpass is a predictive route currently with poor pedestrian lighting and surveillance impacting perceptions of personal security.	Although this route is a temporary solution, it may be necessary to assess the existing lighting category achieved and upgrade lighting and surveillance if required.
C3-3 Sewage Overflow and Stormwater	Underpass is susceptible to sewage overflow and stormwater (refer Figure 71 and Figure 72).	It is recommended flood modelling is undertaken to confirm flood immunity of the existing path (typically 1 in 5 to 1 in 10-year immunity).



Figure 71 - C3-3 Sewage Overflow and Stormwater- Sutherland Road underpass looking south west.



Figure 72 - C3-3 Sewage Overflow and Stormwater- Sutherland road underpass looking south west

4 OPTION ASSESSMENT

The value management options assessment process determines the preferred option based on a set of key criteria provided by Hornsby Shire Council (refer Table 22). An internal workshop was held including experienced civil engineers and transport planner to establish the scores for each route option under the provided value management assessment criteria. The multiplication of this score and the weighting for the criteria is then tallied to a net score per route option. It should be noted these criteria do not include cost. Indicative costs are provided in section 4.1.3.

4.1.1 Value Management Assessment Criteria

The following assessment criteria and measures have been used as a guide to present a comparison of the identified route options.

Table 22 – Hornsby Shire Council's Value Management Assessment Criteria

Criteria Number	Criteria	Measures	Weighting
1	Land use	- Integrates with current land use and proposed land uses. - Maintains connectivity - Provides for property access - Location of intersections affecting future land use	10%
2	Environment & Heritage	- Area of native vegetation affected. - Area of TEC affected - Drainage lines and creek lines.	15%
3	Functionality	- Grades, speeds, length, intersections - Connectivity to existing and future active and public transport	65%
4	Safety	- Safe access and egress - Surveillance - Incident management - Vehicle/Cycle conflict	10%

4.1.2 Evaluation Matrix

Best option for each criterion as scored as a "4"

- The other options are scored as
 - "4" if they are the same
 - "3" if there is a minor difference
 - "2" if there is a medium difference
 - "1" if there is a major difference relative to the best option.

Pennant Hills to Epping Cycleway Link
Table 23 – Section A Score and Considerations

Criteria	Route A1	Route A2	Route A3 North	Route A3 South	Route A4
Land Use	Score 3	Score 4	Score 1	Score 2	Score 4
	Moderate adjustments of existing infrastructure to meet design standards. Acts as a collector path along Pennant Hills Road, encouraging use of the facility and connectivity. Moderate interaction with property accesses. Integrates moderately well at intersections.	Upgrade of existing TfNSW maintenance track integrates well for shared path users. Connectivity to network is restricted to limited locations. Minor interaction with property accesses; path is predominantly through the rail corridor. Limited intersection locations; integrates well at intersections.	Moderate adjustments of existing infrastructure to meet design standards. Connectivity is moderate Moderate to high interaction with property accesses. Integrates moderately well at intersections.	Significant adjustments of existing infrastructure to meet design standards. Connectivity is moderate Low interaction with property accesses. Integrates well at intersections.	Shared path structure integrates well for users. Minor interaction with property accesses; path is predominantly along existing stair corridor, bush trail or TfNSW property boundary Limited intersection locations; integrates well at intersections.
Environment & Heritage	Score 2	Score 4	Score 2	Score 1	Score 2
	Low quantity of native vegetation affected along Pennant Hills Road and Lilla Road. Medium quantity of native vegetation affected through Byles Creek and Wongala Crescent Approximate total trees to be removed = 222	Very low quantity of native vegetation affected since predominantly utilising existing TfNSW maintenance track. Approximate total trees to be removed = 36	Medium quantity of native vegetation affected through North Wongola Crescent, Byles Creek and Wongala Crescent Approximate total trees to be removed = 272	High quantity of native vegetation affected through North Wongola Crescent, Byles Creek and Wongala Crescent Approximate total trees to be removed = 341	Medium quantity of native vegetation affected through Council land on eastern side of TfNSW rail corridor and along Sutherland Road. Approximate total trees to be removed = 261
Functionality	Score 3	Score 4	Score 1	Score 2	Score 3
	Approx. overall length 1790m Steep and long grade approx. 12% for 270m along Lilla Rd. Short steep slope approx. 10% for 50m at Byles Creek crossing. 2 Intersection crossings (from Pennant Hills to Byles Creek) + 1 intersection	Approx. overall length 1550m Fairly flat grade following levels of TfNSW maintenance track.	Approx. overall length 1675m Steep grade and medium length - approx. 12% for 120m along Boundary Rd.	Approx. overall length 1720m Pennant Hills Rd and City View Road and Lilla Road) Steep grade and medium length - approx. 10% for 120m along Boundary Rd.	Approx. overall length 1200m Steep longitudinal grades up to 5-12% along Sutherland Road Steep existing grades along stair corridor and bush trail, requires

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Criteria	Route A1	Route A2	Route A3 North	Route A3 South	Route A4
	crossing along Wongala Crescent at Chapman Avenue Steep grade along Lilla Road and adjacent property accesses	1 intersection crossing along Sutherland Road at Chapman Avenue Limited access on to the ATL	Short steep slope approx. 10% for 50m at Byles Creek crossing. 2 intersection crossings (over Boundary Road and North Wongala Crescent) + 1 intersection crossing along Wongala Crescent at Chapman Avenue. Steep grade and tight corner at base of Boundary Road.	Short steep slope approx. 10% for 50m at Byles Creek crossing. 1 Intersection Crossing along Wongala Crescent at Chapman Avenue. Steep grade and corner at base of Boundary Road.	elevated structure to create a consistent 5% grade. 1 intersection crossing along Sutherland Road at Chapman Avenue
	Score 2	Score 1	Score 2	Score 3	Score 2
Safety	Continuous access and egress along alignment Continuous passive surveillance from the local road network Good access for incident management and alternate alignment options available A number of intersection and local road crossings are required Shared path users are adjacent high levels of traffic. Steep grade along Lilla Road adjacent property accesses	Limited access and egress points along alignment Limited passive surveillance Limited access for incident management and limited alternative alignment routes available. Low/Medium level potential vehicle / cycle conflict	Continuous access and egress along alignment Continuous passive surveillance from the local road network Good access for Incident management and alternate alignment options available A number of intersection and local road crossings are required Shared path users impacted by local traffic.	Continuous access and egress along alignment Continuous passive surveillance from the local road network Good access for Incident management and alternate alignment options available A number of intersection and local road crossings are required. Shared path users impacted by local road traffic.	Limited access and egress points along 50% of the alignment Limited passive surveillance Limited access for incident management with no emergency vehicle access and limited alternative alignment routes available. Low level potential vehicle / cycle conflict

Pennant Hills to Epping Cycleway Link

Table 24 - Section A - Hornsby Shire Council's Weighted Score Evaluation Matrix

Criteria	Weighting	Route A1 Score	Route A1 Weighted Score	Route A2 Score	Route A2 Weighted Score	Route A3 North Score	Route A3 North Weighted Score	Route A3 South Score	Route A3 South Weighted Score	Route A4 Score	Route A4 Weighted Score
Land Use	10%	3	0.3	4	0.4	1	0.1	2	0.2	4	0.4
Environment and Heritage	15%	2	0.3	4	0.6	2	0.3	1	0.15	2	0.3
Functionality	65%	3	1.95	4	2.6	1	0.65	2	1.3	3	1.95
Safety	10%	2	0.2	1	0.1	2	0.2	3	0.3	2	0.2
Overall Score			2.75	-	3.7	-	1.25	-	1.95	-	2.85
Rank			3rd		1st		5th		4th		2nd

Table 25 – Section C Score and Considerations

Criteria	Measures	Route C1	Route C2	Route C3
Land Use	Integrates with current land use and proposed land use.	Score 2	Score 3	Score 4
	Maintains connectivity Provides for property access Location of intersections affecting future land use	Integrates well and maintains connectivity with current land use. Moderate/High interaction with property accesses. Integrates well at intersections.	Moderate interaction with property accesses. Limited intersection locations; integrates very well at intersections.	Minor interaction with property accesses. Limited intersection locations; integrates very well at intersections.
Environment & Heritage	Area of native vegetation affected.	Score 2	Score 2	Score 4
	Area of TEC affected Drainage lines and creek lines.	Low quantity of native vegetation affected along The Crescent, Lyne Road. Medium/High quantity on the western side of Beecroft Road adjacent existing noisewall and along creek line. Medium quantity of native vegetation affected through Devlin's Creek. Approximate total trees to be removed = 127	Low quantity of native vegetation affected along The Crescent until end of cul-de-sac. Medium quantity of native vegetation affected along the rail reserve, between noisewall and M2 and Devlin's Creek. Approximate total trees to be removed = 159	No trees affected since the intent is for the cyclists to travel on road.
Functionality		Score 2	Score 4	Score 2

Pennant Hills to Epping Cycleway Link

Criteria	Measures	Route C1	Route C2	Route C3
	Grades, speeds, length, intersections Connectivity to existing and future active and public transport	Approx. overall length C1 = 1400m Moderate grade approx. 4.5% for 750m along Beecroft Road. 8 intersection crossings (The Crescent, The Boulevard, Lyne Road, Old Beecroft Road, eastbound M2 Entry Ramp, Beecroft Road x 2 and westbound M2 exit ramp) Good connectivity to existing bike network at southern end of Beecroft Road and connectivity to Cambridge St toward Epping train Station.	Approx. overall length C2 = 1260m Mostly flat grade along the route. No intersection crossings Excellent connectivity between Cheltenham and Epping train Stations.	Approx. overall length C3 = 1350m Steep and long grade approx. 5% for 850m along Sutherland Road. 2 intersection crossings (Cheltenham Road and Sutherland Road) Restricted connectivity to existing public transport Long and steep grade may result in increased speeds
Safety	Safe access and egress Surveillance Incident management Vehicle/Cycle conflict	Score 3 Moderate safety concern due to high quantity of crossings. Good access for incident management and alternate alignment options available Continuous passive surveillance from the main road network	Score 3 Limited access for incident management and alternate alignment options available. Limited surveillance from the adjacent properties. Low potential for cyclist / vehicle conflict.	Score 1 Good access for incident management and alternate alignment options available. Generally continuous passive surveillance from the local road network with exception of underpass with

Pennant Hills to Epping Cycleway Link

Criteria	Measures	Route C1	Route C2	Route C3
				limited surveillance. Long and Steep grade may result in increased speeds posing a high safety concern for path users. Cyclist are restricted to using the road on this route. Sewage overflow at underpass subject to flooding.

Pennant Hills to Epping Cycleway Link

Table 26 - Section C - Hornsby Shire Council's Weighted Score Evaluation Matrix

Criteria	Weighting	Route C1 Score	Route C1 Weighted Score	Route C2 Score	Route C2 Weighted Score	Route C3 Score	Route C3 Weighted Score
Land Use	10%	2	0.2	3	0.3	4	0.4
Environment and Heritage	15%	2	0.3	2	0.3	4	2
Functionality	65%	2	1.3	4	2.6	2	1.3
Safety	10%	3	0.3	3	0.3	1	0.1
Overall Score			2.1		3.5		2.4
Rank			3rd		1st		2nd

4.1.3 Indicative Cost Estimate

4.1.3.1 Assumptions

In developing the estimate, the following assumptions have been used;

- Works will be undertaken under a construct only contract.
- Unobstructed access will be provided to all sections of the works as necessary to undertake the scope.
- All suitable earthworks will be left on site and utilised locally where possible to minimise import requirements.
- Suitable licensed waste facility for disposal of all materials is within 15km of the works except for 'contaminated' materials which will be disposed at Kemps Creek
- The estimate allows for all demolition wastes to be recycled (either concrete or asphalt)
- No wet weather has been considered in the estimate.
- An allowance of 30% mark-up has been considered to cover onsite and offsite overheads (preliminaries), and contractor's margin and profit.
- Night time closure of the M2 would be required under the works as necessary for construction activities such as bridge girder lifts, an allowance for these works have been included in the indicative cost estimate.
- Only services as noted in the quantities have been considered within the estimate.
- An allowance typically 3.0% of the construction costs has been considered for traffic management
- An allowance typically 1.5% of the construction costs has been considered for environmental management including erosion and sedimentation control
- An allowance typically 1.5% of the construction costs has been considered for typical cycleway signage and route markers.
- A direct cost \$2,000 per m2 has been allowed for property acquisition costs
- No allowance has been made for owner's costs associated with design, project management and administration
- Where noise walls are removed and reinstated, and allowance has been made to utilise existing material. A further 10% of the area has been allowed to be replaced with new panels.
- Excavated rock is to be reused on site as subbase for the shared paths.
- Topsoil stripped to be reused for landscaping and verge treatments.

4.1.3.2 Contingency

No allowance for Contingency has been accounted for in Appendix C. However, a likely contingency in the order of 60% of the construction values should be considered reasonable. The Indicative Cost Estimate Summary in Table 27 includes these contingency costs.

Table 27 – Indicative Cost Estimate Summary (including 60% Contingency)

Sections	Route Options				
Pennant Hills Station to Beecroft Community Centre	A1	A2	A3 North	A3 South	A4
	<i>Pennant Hills Road, Lilla Road and Wongala Crescent</i>	<i>Rail Corridor and Sutherland Road</i>	<i>A3 North Pennant Hills City View, boundary, Wongala to lilla rd</i>	<i>A3 South Pennant Hills City View, boundary, Wongala to lilla rd</i>	<i>A4 North - Pennant Hills Road to Copeland Road</i>
	<u>6,330,000</u>	<u>7,880,000</u>	<u>6,720,000</u>	<u>7,750,000</u>	<u>7,060,000</u>
Beecroft Community Centre to	B				
	<i>Beecroft Village Green and The Crescent</i>				
	<u>2,470,000</u>				
Cheltenham Station to Epping Station	C1	C2		C3	
	<i>The Crescent, Lyne Road, Beecroft Road, Rail underpass and Cambridge Street</i>	<i>The Crescent, The Crescent unformed, New Bridge across M2, Ramp down to Rail underpass and Cambridge Street</i>		<i>Over existing Rail bridge at Cheltenham Station, Sutherland Road, Culvert under M2, Derby Street and Oxford Street</i>	
	<i>C1 Cheltenham Rd to M2</i>	<i>C2 Cheltenham Rd to M2</i>		<i>Option 1 - Upgrade Sutherland Road footpaths from Cheltenham Road to Underpass (shows like for like comparison between options)</i>	
	<u>1,530,000</u>	<u>12,180,000</u>		<u>3,570,000</u>	
	<i>Option A - Utilise Existing Pedestrian Path over M2 and upgrade Western side of Beecroft Road from Southern side of M2 to M2 Exit Ramp</i>			<i>Option 2 - New line markings on road only</i>	
	<u>2,330,000</u>			<u>680,000</u>	
	<i>Option B - New Shared Path Bridge over M2 and upgrade Western side of Beecroft Road from Southern side of M2 to M2 Exit Ramp</i>				

	6,030,000	
	<i>New separated bridge over Devlins Creek</i>	
	2,490,000	

5 CONCLUSIONS

Following site investigations, constraints review, route options assessment based on Hornsby Shire Council's value management assessment criteria and indicative cost analysis on the route options, the below conclusions and recommendations have been reached.

Route A Recommended Option

It has been determined that Route A2, generally within the rail corridor until crossing the Copeland Road Overbridge, scored highest against Hornsby Shire Council's weighted route options assessment criteria. Route A4 placed second and Route A1 placed third, both scoring lower than Route A2 across all the assessment criteria except for safety (due to limited surveillance and access/egress point along the alignment of Route A2).

Route A2 generally follows a uniform gradient and alignment between two strategic points, namely Pennant Hills railway station and Beecroft railway station and would operate efficiently for cyclists and pedestrians using this as a transit corridor between these hubs.

This route option however provides limited opportunity for egress and entry points along the alignment which would limit the catchments attracted to this transit corridor. The limited egress and entry points may also result in increased security concerns for the path users due to the lack of passive surveillance along the corridor and the relative distance between egress and entry points would increase response times during emergencies. To mitigate these concerns both path lighting and CCTV coverage should be considered along the alignment.

Damien Tudehope MP for Epping announced that the Cycleway from Pennant Hills to Epping will receive \$5.1 million from the NSW Government Cycling Infrastructure Fund, on the provision it is complete by 2020 [3]. It is noted that approvals for incorporating a shared path alignment, such as Route A2, into the rail corridor can take upwards of 12 months prior to commencement of construction and the construction period would likely be restricted by the TfNSW program for rail corridor shut downs to allow for track possessions during some of the construction works, generally envisaged as being required to construct a new exclusion fence between the rail corridor and the proposed path.

In summation Route A2 is recommended as the long term strategic alignment corridor to be adopted, however with consideration of the above noted constraints on budget and construction program, it may be more feasible to undertake Route A1 option as an interim solution until funding and programming constraints associated with Route A2 can be mitigated.

Route B

Route B has been identified previously by Hornsby Shire Council and is the most viable option to connect sections A and C. Route B generally follows a direct route along exiting paths and roads which would need minor upgrades, vegetation's clearance and utility relocations/considerations. Consequently, no further sub-options were investigated.

Route C Recommended Option

It has been determined that Route C2 scored highest against Hornsby Shire Council's weighted route options assessment criteria. Route C3 placed second scoring lower than Route C2 for the functionality and safety assessment criteria and higher than Route C2 for the land use and environment and heritage criteria resulting in a lower overall score when the assessment criteria weighting was applied.

This route starts at Cheltenham Station, follows most of the Crescent, crosses the Hills Motorway (M2) and terminates at Cambridge Street close to Epping Station. Most of the route is proposed to be within Crown Land (The Crescent) and approvals for construction would be fairly conventional.

This route generally follows a uniform gradient and alignment between the two stations with the exception of the crossing over the Hills Motorway (M2) which will require a significant shared path structure.

The inclusion of a major structure over the M2 will require a minimum of 18 months Design, Approvals, and Constructions which can be undertaken within this proposed deadline. The cost of this structure will be significant which may be prohibitive considering the current budget.

In summation Route C2 is recommended as the long term strategic alignment corridor to be adopted, however with consideration of the above noted constraints on budget it may be more feasible to undertake Route C3 as an interim solution until funding constraints associated with Route C2 can be mitigated.

6 REFERENCES

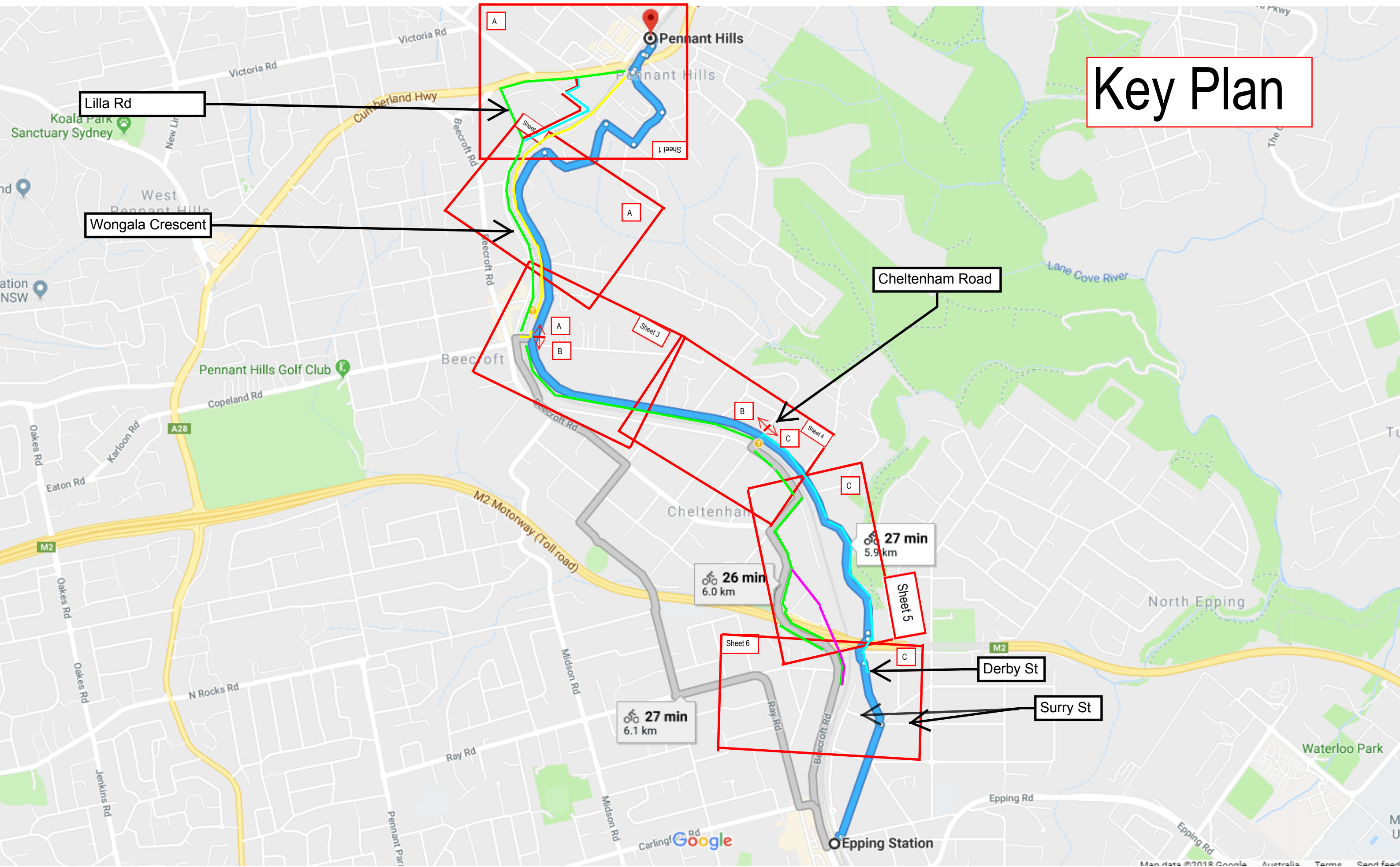
- [1] Transport for New South Wales. 5/5/2015. Active Transport Links on the Rail Corridor. Available at <https://www.transport.nsw.gov.au>. [Accessed 1 July 2018]
- [2] Google Maps. (2018).Google Maps. Available at: <https://www.google.com.au/maps> [Accessed 18 July 2018].
- [3] Monthly Chronicle (2018). 01/04/2018. Available at: <http://monthlychronicle.com.au/2018/03/22/5m-for-new-pennant-hills-to-epping-cycleway/> [Accessed 18 July 2018].

APPENDIX A

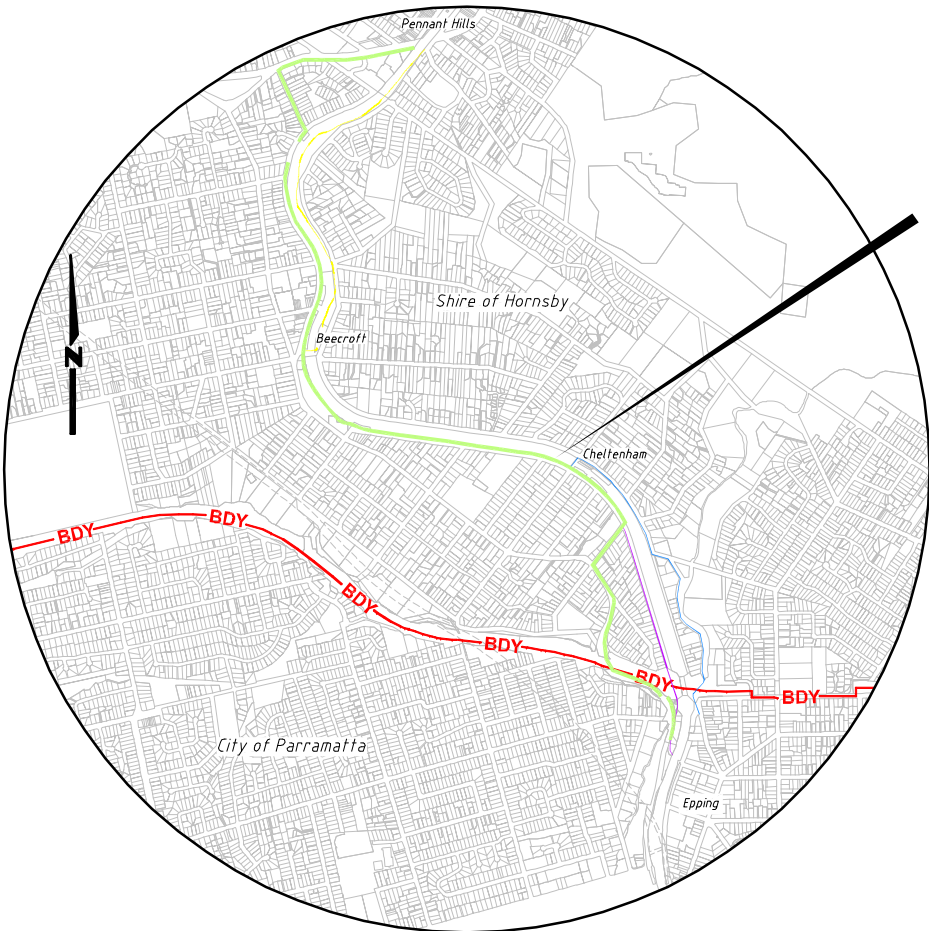
Constraints Map



Key Plan



Pennant Hills to Epping Cycle Route



PROPOSED
CYCLE ROUTE



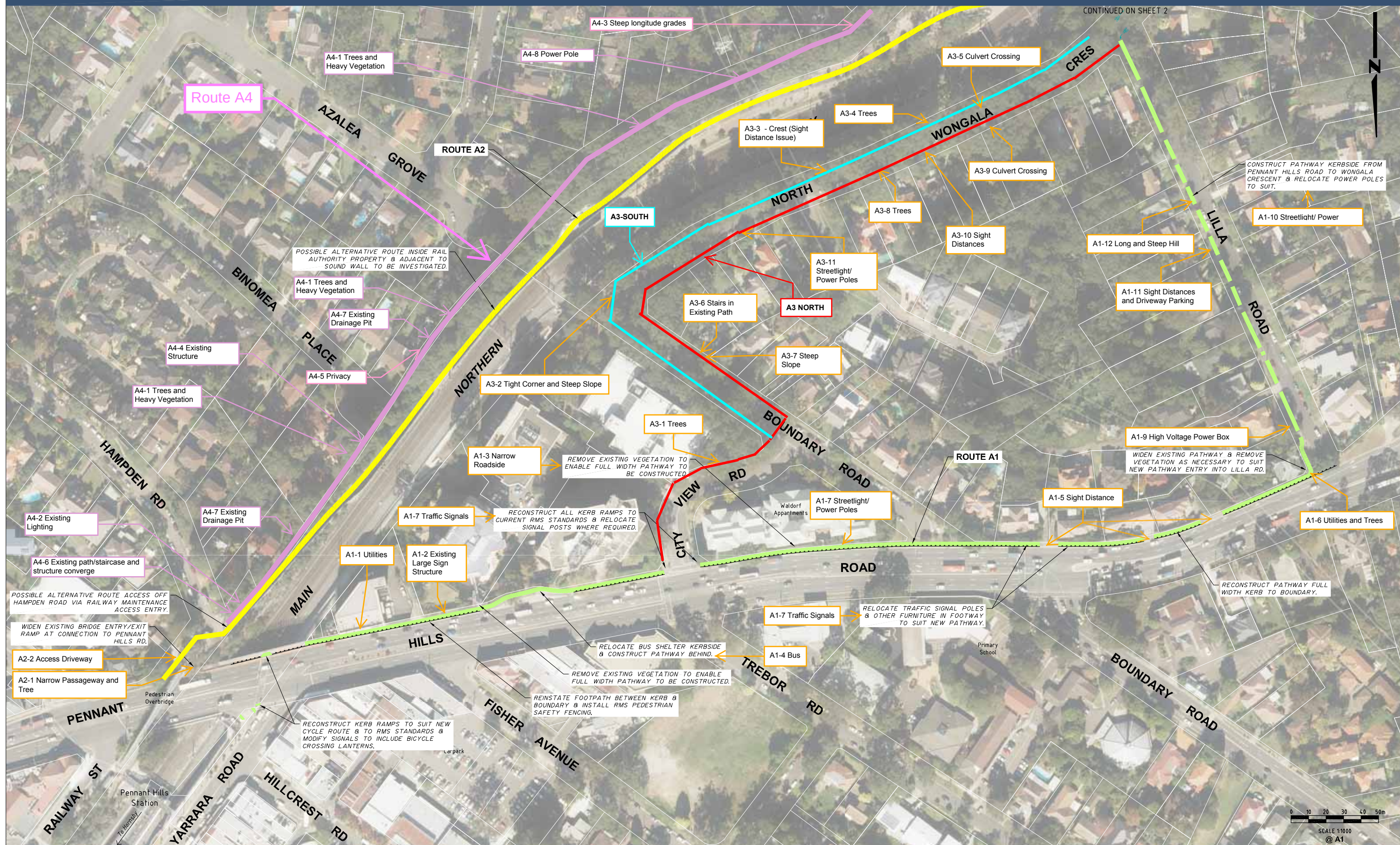
NOTES:

- THESE DRAWINGS HAVE BEEN PREPARED TO ASSIST IN DEFINING THE PROPOSED SCOPE OF WORKS FOR THIS PROJECT.
- HORNSBY COUNCIL DOES NOT GUARANTEE NOR MAKE ANY REPRESENTATIONS TO THE COMPLETENESS OF THE INFORMATION CONTAINED ONN THESE DRAWINGS.
- FURTHER DETAILED DESIGN & INVESTIGATIONS ARE REQUIRED FOR PARTS OF THIS PROJECT THAT ARE HENCE NOT SHOWN ON THESE DRAWINGS.
- SHARED PATHS ARE TO BE DESIGNED IN ACCORDANCE WITH THE AUSTRADS GUIDE TO TRAFFIC ENGINEERING PRACTICE : PART 13 - PEDESTRIANS & PART 14 - BICYCLES & THE ROADS & TRAFFIC AUTHORITY OF NSW - NSW BICYCLE GUIDELINES.

LOCALITY PLAN
NOT TO SCALE

LEGEND

- PROPOSED NEW CYCLEPATH (ROUTE A1, B& C1).
- PROPOSED NEW CYCLEPATH (ROUTE A2).
- PROPOSED NEW CYCLEPATH (ROUTE C3).
- PROPOSED NEW CYCLEPATH (ROUTE C2).
- PROPOSED NEW FENCING.
- PROPOSED NEW LINE MARKING.



Design and Construction Branch

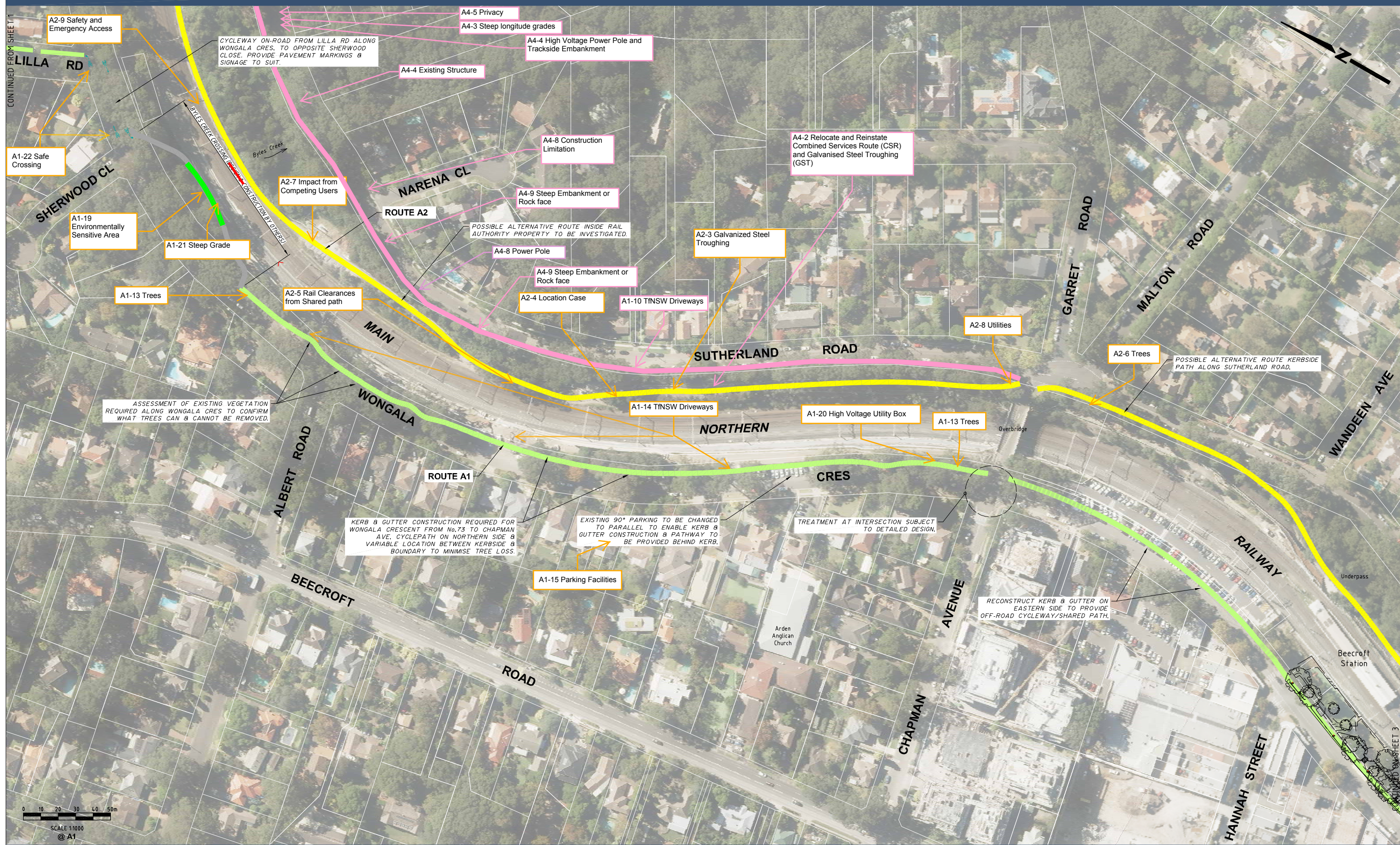
Hornsby Shire Council
296 Peats Ferry Road, Hornsby
PO Box 37, Hornsby NSW 1630

Telephone 9847 6666
8.30am-5pm Monday to Friday

hornsby.nsw.gov.au

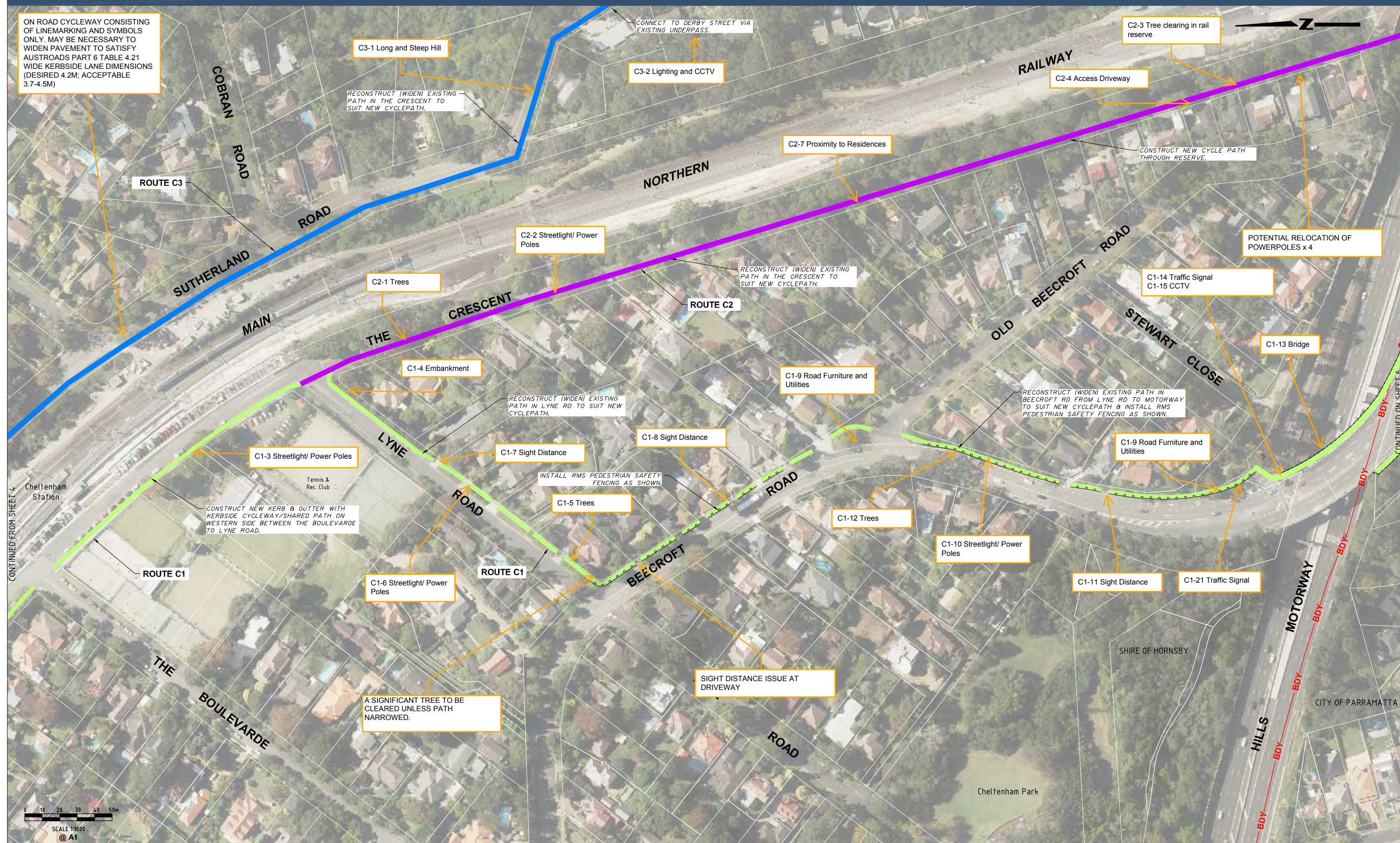
Pennant Hills to Epping Cycle Route Overall Concept

PLAN SHEET 1 of 6









Design and Construction Branch

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Pennant Hills to Epping Cycle Route Overall Concept

PLAN SHEET 5 of 6

APPENDIX B

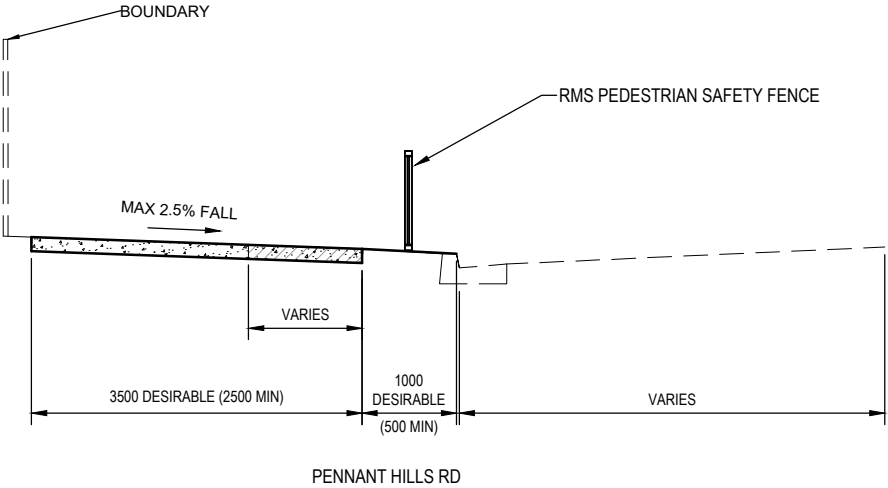
Typical Sections

Typical sections are not to scale



ROUTE A1

- PROPOSED
- EXISTING
- EXISTING PATH
- PROPOSED CYCLEWAY



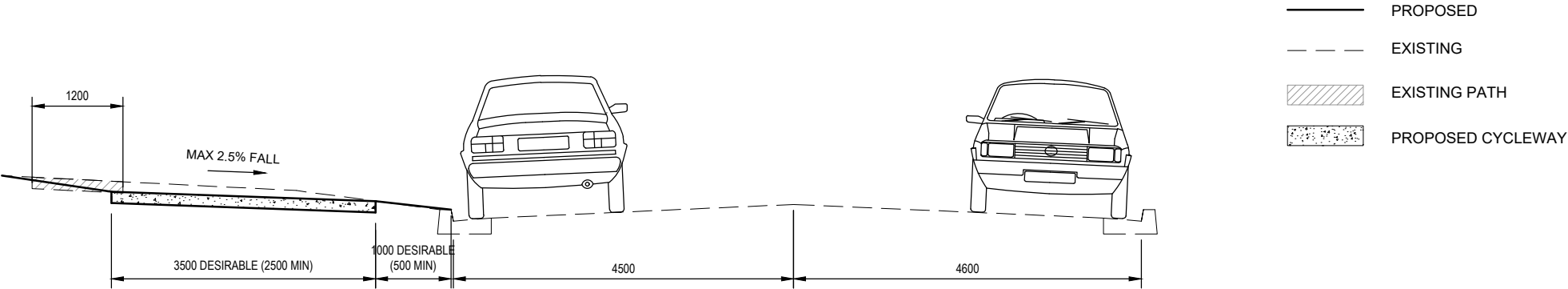
PENNANT HILLS TO EPPING
CYCLEWAY



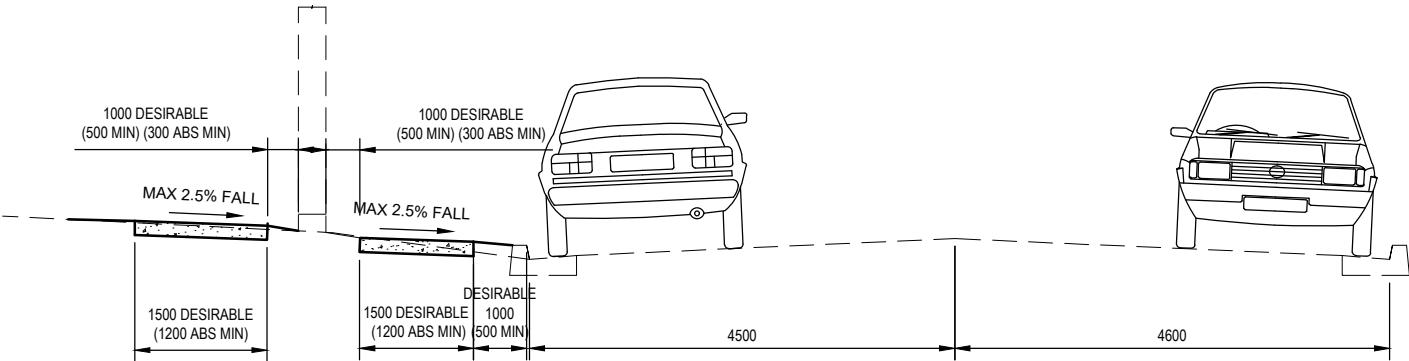
Arcadis Australia Pacific Pty Limited
Level 16, 580 George Street SYDNEY NSW 2000
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www.arcadis.com/au

Drawing No.	Project No.	Issue
—	10020643	—

ROUTE A1



LILLA RD LOOKING SOUTH
OPTION 1



LILLA RD LOOKING SOUTH
OPTION 2

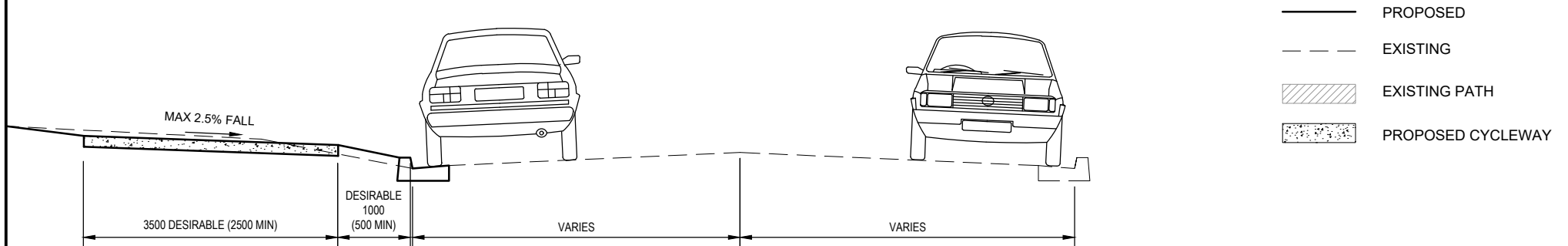
PENNANT HILLS TO EPPING
CYCLEWAY



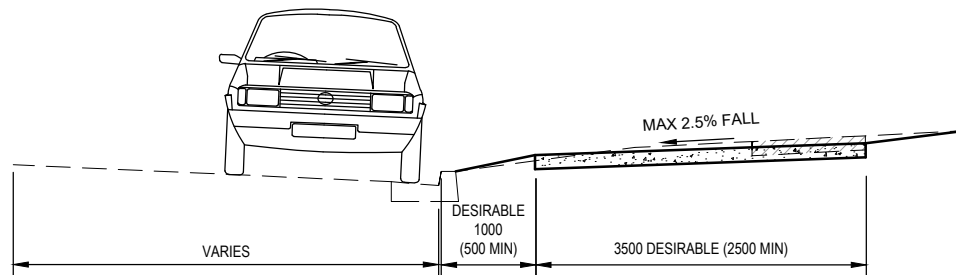
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Drawing No.	Project No.	Issue
—	10020643	—

A3 NORTH AND A3 SOUTH



NORTH WONGALA CRESCENT LOOKING WEST
OPTION 1 (SOUTHERN SIDE)



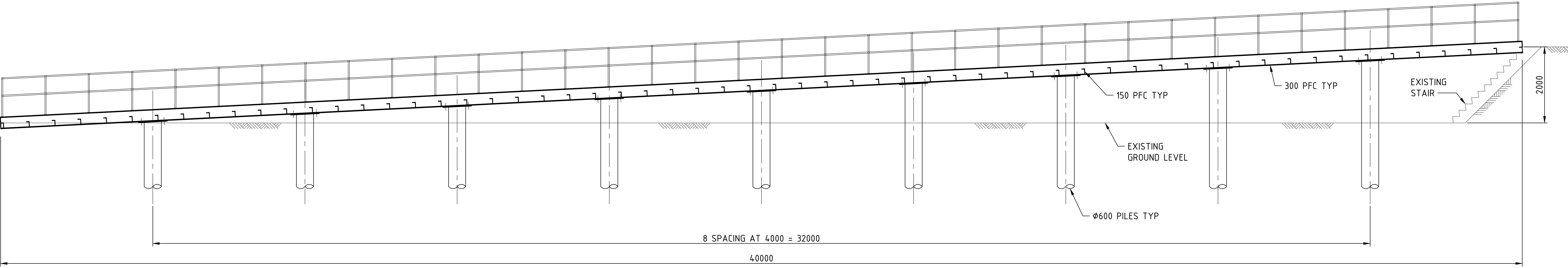
NORTH WONGALA CRESCENT LOOKING WEST
OPTION 2 (NORTHERN SIDE)

PENNANT HILLS TO EPPING CYCLEWAY

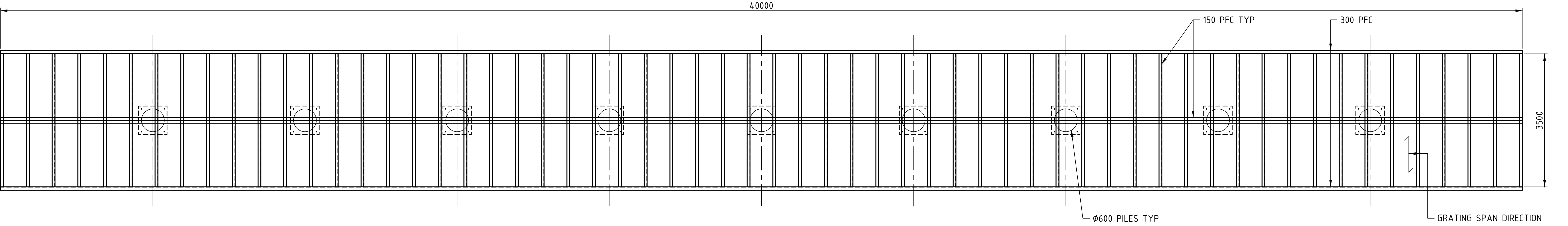


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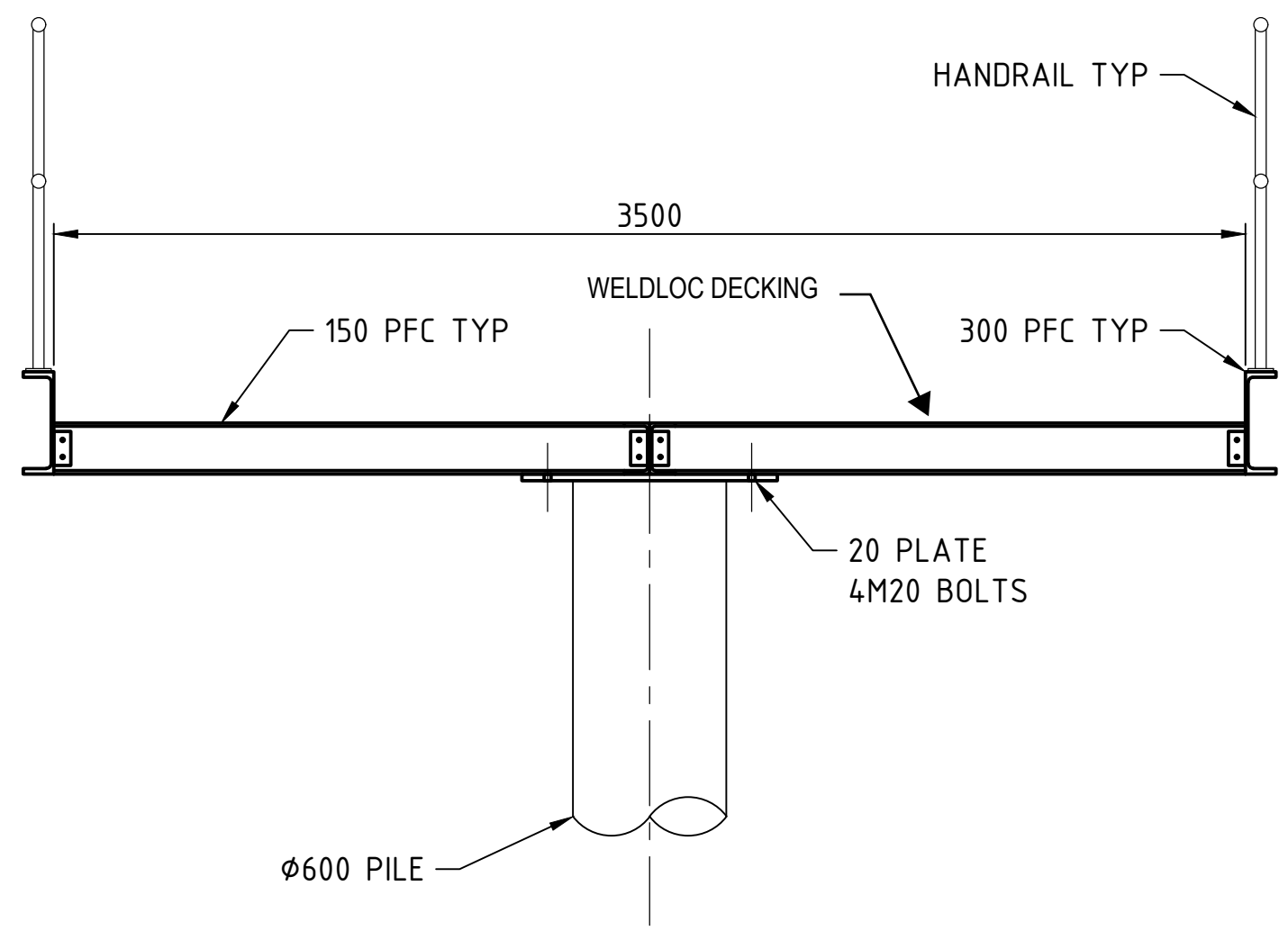
Drawing No.	Project No.	Issue
	10020643	



ELEVATION
1 : 50



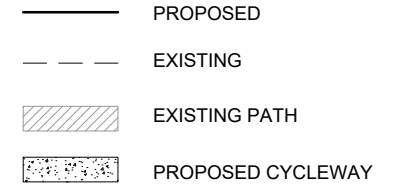
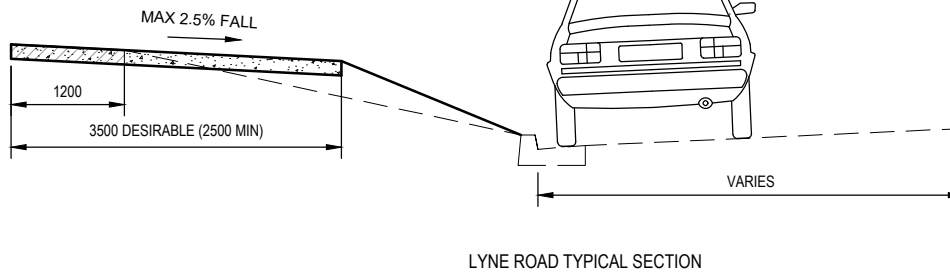
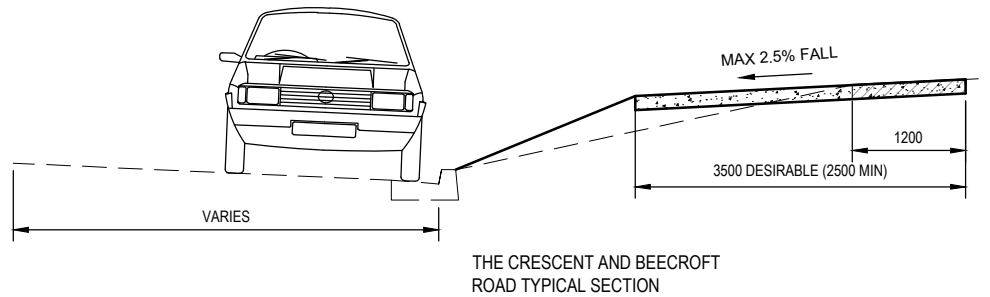
PLAN
1 : 50



TYPICAL SECTION
1 : 20

ROUTE A4 TYPICAL SECTION

ROUTE C1



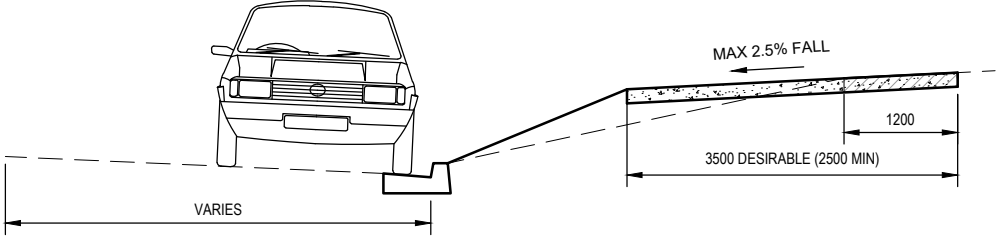
PENNANT HILLS TO EPPING CYCLEWAY



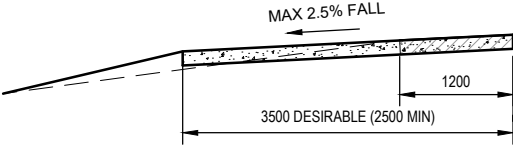
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Drawing No.	Project No.	Issue
—	10020643	—

ROUTE C2



THE CRESCENT TYPICAL SECTION



CROWN LAND TYPICAL SECTION

- PROPOSED
- EXISTING
- EXISTING PATH
- PROPOSED CYCLEWAY

PENNANT HILLS TO EPPING
CYCLEWAY



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Drawing No.	Project No.	Issue
	10020643	

APPENDIX C

Indicative Cost Estimates (Excluding Contingency)

No allowance for Contingency has been accounted for in Appendix C. However, a likely contingency on the order of 60% of the construction values should be considered reasonable. The Indicative Cost Estimate Summary in Table 27 includes these contingency costs.

Route Investigation Estimate Summary

Sections	Route Options				
Pennant Hills Station to Beecroft Community Centre	A1	A2	A4	A3 South	A3 North
	Pennant Hills Road, Lilla Road and Wongala Crescent	Rail Corridor and Sutherland Road	A4 North - Pennant Hills Road to Copeland Road	A3 South Pennant Hills City View, boundary, Wongala to lilla rd	A3 North Pennant Hills City View, boundary, Wongala to lilla rd
	3,955,979	4,946,793	4,414,525	4,844,266	4,202,772
Beecroft Community Centre to Cheltenham Station	B				
	Beecroft Village Green and The Crescent				
	1,541,556				
Cheltenham Station to Epping Station	C1	C2		C3	
	The Crescent, Lyne Road, Beecroft Road, Rail underpass and Cambridge Street	The Crescent, The Crescent unformed, New Bridge across M2, Ramp down to Rail underpass and Cambridge Street		Over existing Rail bridge at Cheltenham Station, Sutherland Road, Culvert under M2, Derby Street and Oxford Street	
	C1 Cheltenham Rd to M2			Option 1	
	957,263	7,610,790		2,228,386	
	C1 Western side of Beecroft Road from M2 to M2 Exit Ramp			Option 2	
	1,459,051			423,881	
	OPTION B NEW BRIDGE				
	3,769,732				
	New separated bridge over Devlins Creek				
	1,557,576				

Item #	Description	Unit	Quantity	Unit Rate	Amount
A1 -1	A1 Pennant Hills and Lilla Rd				
1	Preliminaries & Environmental				
1.1	Environmental Management (% CV)	lumpsum	1.5%		22,962.90
	Sub-Total Preliminaries & Environmental				22,962.90
2	Traffic Management				
2.1	Traffic Management (% CV)	lumpsum	3.0%		45,925.80
	Sub-Total Traffic Management				45,925.80
3	Clearing & Demolition				
3.1	Demolition of Existing Path (APPROX. 2m Wide Path) - DEPTH = 0.15mm - All demolition Waste disposed offsite @\$22/t (DC) * Excess Spoil spread onsite	m2	1,410.000	19.400	27,354.00
3.2	Hedge Clearing	m2	140.000	34.700	4,858.00
3.3	Larger Trees to be cleared along Pennant Hills Rd and Lilla Rd	each	32.000	1,668.400	53,388.80
	Sub-Total Clearing & Demolition				85,600.80
4	Utilites & Services				
4.1	Street Light Pole Relocations	each	15.000	14,950.400	224,256.00
4.2	Traffic Signals Relocations -re-use of exisitng infrastrucutre	each	6.000	19,500.500	117,003.00
4.3	High voltage Kiosk to be relocated	each	1.000	223,085.000	223,085.00
	Sub-Total Utilites & Services				564,344.00
5	Kerb & Gutters				
	Sub-Total Kerb & Gutters				0.00
6	Drainage				
	Sub-Total Drainage				0.00
7	Earthworks				
7.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) 75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	275.120	196.500	54,061.08
	Sub-Total Earthworks				54,061.08
8	Structures				
	Sub-Total Strcutres				0.00
9	Pavements				
9.1	New Pavement (3.5m Wide) (Bicycle Path)	m	920.000	402.100	369,932.00
	Sub-Total Pavements				369,932.00
10	Road Furniture and Pavement Markings				
10.1	Pedestrian Fence	m	555.000	598.700	332,278.50
10.2	Line Marking	m	920.000	8.200	7,544.00
10.3	Painted symbols	item	15.000	84.500	1,267.50
10.4	Relocate Existing Large Sign Structure	item	1.000	12,005.000	12,005.00
10.5	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.00
10.6	Signage Allowance (% CV)	lumpsum	1.5%		22,962.90
	Sub-Total Road Furniture and Pavement Markings				388,023.90
11	Miscellaneous				

Item #	Description	Unit	Quantity	Unit Rate	Amount
Sub-Total Miscellaneous					0.00
Sub-Total: A1 Pennant Hills and Lilla Rd					1,530,850.48
A1-2 A1 North Wongala to Wongala (i.e. BYLES CREEK)					
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		11,936.17
1.2	Environmental Management (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Preliminaries & Environmental					17,904.26
2	Clearing & Demolition				
Sub-Total Clearing & Demolition					0.00
3	Utilites & Services				
Sub-Total Utilites & Services					0.00
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
6.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) 75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	245.000	144.600	35,427.000
Sub-Total Earthworks					35,427.00
7	Structures				
7.1	Byles Creek Bridge (abutment to abutment) Bridge and Walkway - Cantilevered walkway & Steel Structure on 4 x 450 dia piles x6m OTR Piers 1.5m high, precast headstock	m²	169.000	1,830.900	309,422.100
Sub-Total Strucutres					309,422.10
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path) Approach and departure from structure	m	70.000	402.100	28,147.000
Sub-Total Pavements					28,147.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	70.000	6.300	441.000
9.2	Painted symbols	item	5.000	84.500	422.500
9.3	Signage Allowance (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Road Furniture and Pavement Markings					6,831.59
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 North Wongala to Wongala					397,731.95
A1-3 A1 Wongala Rd at Byles Creek to Copeland Road					
1	Preliminaries & Environmental				
3.22	Traffic Management (% CV)	lumpsum	3.0%		60,821.83

Item #	Description	Unit	Quantity	Unit Rate	Amount
3.23	Environmental Management (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Preliminaries & Environmental					91,232.75
2	Clearing & Demolition				
2.1	Tree clearing at Byles Creek (dense)	m2	280.000	20.000	5,600.000
2.2	Tree clearing at Wongala Crescent (medium/dense)	m2	539.000	20.000	10,780.000
2.3	Tree clearing at Wongala Crescent 24 Large Trees	each	24.000	1,668.400	40,041.600
2.4	Demolition of Existing Concrete Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	325.000	19.400	6,305.000
2.5	Demolition of Existing Paved Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	400.000	19.400	7,760.000
2.6	Demolition of Existing Concrete Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	120.000	19.400	2,328.000
2.7	Demolish Kerb and Gutter From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	24.600	7,134.000
Sub-Total Clearing & Demolition					79,948.60
3	Utilites & Services				
3.1	Telstra Phone Box to be relocated	item	1.000	11,700.000	11,700.000
3.2	Relocate Streetlight/ Powerpoles	each	10.000	14,950.400	149,504.000
3.3	High voltage Powerbox to be relocated	item	1.000	223,086.000	223,086.000
3.4	Length of lighting required	m	1,320.000	120.600	159,192.000
3.5	Lighting Fitting and poles at 32m spacing	each	42.000	5,161.900	216,799.800
Sub-Total Utilites & Services					760,281.80
4	Kerb & Gutters				
4.1	Kerb and Gutter construction From Byles creek to Chapman Avenue	m	470.000	122.500	57,575.000
4.2	Kerb and Gutter construction From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	123.500	35,815.000
4.3	TfNSW Driveway upgrades	each	3.000	9,306.000	27,918.000
Sub-Total Kerb & Gutters					121,308.00
5	Drainage				
5.1	Drainage 375 DIAM Pipe for	m	760.000	310.600	236,056.000
5.2	Drainage pits at 30m Spacing	each	25.000	3,905.900	97,647.500
5.3	Connections to Existing Drainage system (600 Diam)	each	1.000	1,188.000	1,188.000
Sub-Total Drainage					334,891.50
6	Earthworks				
6.1	Excavation New Pavement Length (3.5m Wide Bicycle Path) and K&G excavation 75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	457.000	196.500	89,800.500
6.2	Byles Creek Bridge earthworks and length (Refer to RFQ Byles Creek Crossing Dwgs - allows for benching into exisitng & Imported fill \$18/t(DC)	m³	250.000	614.400	153,600.000
Sub-Total Earthworks					243,400.50
7	Structures				
Sub-Total Strucutres					0.00
8	Pavements				
3.01	New Pavement Length (3.5m Wide) (Bicycle Path)	m	860.000	402.100	345,806.000
Sub-Total Pavements					345,806.00
9	Road Furniture and Pavement Markings				
3.02	Line Marking	m	860.000	8.200	7,052.000
3.03	Painted symbols	item	13.000	84.500	1,098.500
3.15	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.000

Item #	Description	Unit	Quantity	Unit Rate	Amount
3.21	Signage Allowance (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Road Furniture and Pavement Markings					50,527.42
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 Wongala Rd at Byles Creek to Copeland Road					2,027,396.57
				Total A1	3,955,978.99

Item #	Description	Unit	Quantity	Unit Rate	Amount
A2-1 A2 Pennant Hills and Chapman Rd					
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	1.5%		74,201.90
1.2	Environmental Management (% CV)	lumpsum	1.5%		74,201.90
1.3	Rail Corridor Works Worksite Protection, protection officer, and possessions (% CV)	lumpsum	2.0%		98,935.87
Sub-Total Preliminaries & Environmental					247,339.67
2	Clearing & Demolition				
2.1	Tree clearing along route is maybe 20m worth of trees over a 4m width (Dense Tree Clearing)	m ²	120.000	62.600	7,512.000
2.2	Demolition of Existing Path (APPROX. 1.5m Wide Path) - DEPTH = 150mm	m ²	435.000	19.400	8,439.000
Sub-Total Clearing & Demolition					15,951.00
3	Utilites & Services				
3.1	Significant relocation of existing services in rail corridor from galvanised seel trough and buried underground. (Refer a2 Crossection PDF for depths for utilities to be buried)	m	800.000	1,787.500	1,430,000.000
3.2	Lighting to be provided for approximate length	m	1,490.000	120.600	179,694.000
3.3	Lighting Fitting and poles at 32m spacing	lumpsum	47.000	5,161.900	242,609.300
3.4	Streetlight Powerpole relocation	each	3.000	14,950.000	44,850.000
Sub-Total Utilites & Services					1,897,153.30
4	Kerb & Gutters				
4.1	Construct SO GUTTER	m	1,200.000	103.900	124,680.000
Sub-Total Kerb & Gutters					124,680.00
5	Drainage				
5.1	Length of Drainage (600 Diam)	m	1,200.000	432.800	519,360.000
5.2	Drainage pits (Pits every 30m)	each	40.000	3,905.900	156,236.000
5.3	Connections to Existing Drainage system (600 Diam)	each	2.000	1,664.000	3,328.000
Sub-Total Drainage					678,924.00
6	Earthworks				
Excavation New Pavement (3.5m Wide) (For 20 Tonne Rigid Truck) (Refer a2 Crossection PDF)					
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m ³	1,470.000	196.500	288,855.000
Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)					
6.2	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m ³	116.000	196.500	22,794.000
Sub-Total Earthworks					311,649.00
7	Structures				
7.1	Reconstruct Pedestrian overbridge crossing over Chapman Rd from 1.75m wide to 3.5 m wide. (3.5m width composite deck)	m ²	105.000	5,580.300	585,931.500

Item #	Description	Unit	Quantity	Unit Rate	Amount
Sub-Total Structures					585,931.50
8	Pavements				
8.1	New Pavement (3.5m Wide) (For 20 Tonne Rigid Truck) (Refer a2 Crossection PDF)	m	1,200.000	590.500	708,600.000
8.2	New Pavement (3.5m Wide) (Bicycle Path)	m	290.000	402.100	116,609.000
Sub-Total Pavements					825,209.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	1,520.000	8.200	12,464.000
9.2	Painted symbols	item	20.000	84.500	1,690.000
9.3	1.8m Chain Wire fence (either side of Shared track) so Galvanised steel troughing and rail location utility cases are inaccessible to public track users but accessible for rail maintenance crew	m	1,100.000	156.000	171,600.000
9.4	Signage Allowance (% CV)	lumpsum	1.5%		74,201.90
Sub-Total Road Furniture and Pavement Markings					259,955.90
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A2 Pennant Hills and Chapman Rd					4,946,793.37
				Total A2	4,946,793.37

Item #	Description	Unit	Quantity	Unit Rate	Amount
A3-South					
A3 South Pennant Hills City View, boundary, Wongala to Lilla rd					
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	1.5%		36,287.17
1.2	Environmental Management (% CV)	lumpsum	1.5%		36,287.17
Sub-Total Preliminaries & Environmental					72,574.34
2	Clearing & Demolition				
2.1	Tree Removal Along city view rd, boundary rd and Wongala Road until Lilla Rd	each	149.000	1,668.400	248,591.600
2.2	Hedge Clearing	m2	72.000	34.700	2,498.400
2.3	Demolition of Existing Path (APPROX. 2.0m Wide Path) - DEPTH = 150mm	m2	560.000	19.400	10,864.000
2.4	Demolition of Existing Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	144.000	19.400	2,793.600
Sub-Total Clearing & Demolition					264,747.60
3	Utilities & Services				
3.1	Lighting to be provided for approximate length	m	610.000	120.600	73,566.000
3.2	Lighting Fitting and poles at 32m spacing	lumpsum	19.000	5,161.900	98,076.100
3.3	Streetlight Powerpole relocation	each	2.000	14,950.000	29,900.000
3.4	Traffic Signals Relocations	each	3.000	19,501.000	58,503.000
Sub-Total Utilities & Services					260,045.10
4	Kerb & Gutters				
4.1	Construct SA Kerb	m	270.000	94.000	25,380.000
Sub-Total Kerb & Gutters					25,380.00
5	Drainage				
5.1	Drainage 375 DIAM Pipe for	m	270.000	310.600	83,862.000
5.2	Drainage pits (Pits every 40m)	each	7.000	3,905.900	27,341.300
5.3	Connections to Existing Drainage system (600 Diam)	each	1.000	1,664.000	1,664.000
Sub-Total Drainage					112,867.30
6	Earthworks				
6.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)	m³	500.000	196.500	98,250.000
Sub-Total Earthworks					98,250.00
7	Structures				
7.1	Length Weldlock Bridge Structure	m²	332.500	3,145.600	1,045,912.000
Sub-Total Structures					1,045,912.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)	m	755.000	402.100	303,585.500
Sub-Total Pavements					303,585.50

Item #	Description	Unit	Quantity	Unit Rate	Amount
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	755.000	8.200	6,191.000
9.2	Painted symbols	item	20.000	84.500	1,690.000
9.3	Pedestrian Fence	m	280.000	598.700	167,636.000
9.4	Signage Allowance (% CV)	lumpsum	1.5%		36,287.17
9.5	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.000
9.6	Relocate Existing Large Sign Structure	item	1.000	12,005.000	12,005.000
Sub-Total Road Furniture and Pavement Markings					235,775.17
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A3 South Pennant Hills City View, boundary, Wongala to lilla rd					2,419,137.02
A1-2	A1 North Wongala to Wongala (i.e. BYLES CREEK)				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		11,936.17
1.2	Environmental Management (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Preliminaries & Environmental					17,904.26
2	Clearing & Demolition				
Sub-Total Clearing & Demolition					0.00
3	Utilites & Services				
Sub-Total Utilites & Services					0.00
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
Excavation New Pavement (3.5m Wide) (Bicycle Path)					
75% of material retained on site (70% compacted backfilling, 5% spread),					
6.1	20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m ³	245.000	144.600	35,427.000
Sub-Total Earthworks					35,427.00
7	Structures				
Byles Creek Bridge (abutment to abutment) Bridge and Walkway -					
Cantilevered walkway & Steel Structure on					
7.1	4 x 450 dia piles x6m OTR	m ²	169.000	1,830.900	309,422.100
Piers 1.5m high, precast headstock					
Sub-Total Strcutres					309,422.10
8	Pavements				

Item #	Description	Unit	Quantity	Unit Rate	Amount
8.1	New Pavement (3.5m Wide) (Bicycle Path) Approach and departure from structure	m	70.000	402.100	28,147.000
Sub-Total Pavements					28,147.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	70.000	6.300	441.000
9.2	Painted symbols	item	5.000	84.500	422.500
9.3	Signage Allowance (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Road Furniture and Pavement Markings					6,831.59
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 North Wongala to Wongala					397,731.95
A1-3	A1 Wongala Rd at Byles Creek to Copeland Road				
1	Preliminaries & Environmental				
3.22	Traffic Management (% CV)	lumpsum	3.0%		60,821.83
3.23	Environmental Management (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Preliminaries & Environmental					91,232.75
2	Clearing & Demolition				
2.1	Tree clearing at Byles Creek (dense)	m2	280.000	20.000	5,600.000
2.2	Tree clearing at Wongala Crescent (medium/dense)	m2	539.000	20.000	10,780.000
2.3	Tree clearing at Wongala Crescent 24 Large Trees	each	24.000	1,668.400	40,041.600
2.4	Demolition of Existing Concrete Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	325.000	19.400	6,305.000
2.5	Demolition of Existing Paved Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	400.000	19.400	7,760.000
2.6	Demolition of Existing Concrete Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	120.000	19.400	2,328.000
2.7	Demolish Kerb and Gutter From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	24.600	7,134.000
Sub-Total Clearing & Demolition					79,948.60
3	Utilites & Services				
3.1	Telstra Phone Box to be relocated	item	1.000	11,700.000	11,700.000
3.2	Relocate Streetlight/ Powerpoles	each	10.000	14,950.400	149,504.000
3.3	High voltage Powerbox to be relocated	item	1.000	223,086.000	223,086.000
3.4	Length of lighting required	m	1,320.000	120.600	159,192.000
3.5	Lighting Fitting and poles at 32m spacing	each	42.000	5,161.900	216,799.800
Sub-Total Utilites & Services					760,281.80
4	Kerb & Gutters				
4.1	Kerb and Gutter construction From Byles creek to Chapman Avenue	m	470.000	122.500	57,575.000
4.2	Kerb and Gutter construction From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	123.500	35,815.000
4.3	TfNSW Driveway upgrades	each	3.000	9,306.000	27,918.000
Sub-Total Kerb & Gutters					121,308.00
5	Drainage				

Item #	Description	Unit	Quantity	Unit Rate	Amount
5.1	Drainage 375 DIAM Pipe for	m	760.000	310.600	236,056.000
5.2	Drainage pits at 30m Spacing	each	25.000	3,905.900	97,647.500
5.3	Connections to Existing Drainage system (600 Diam)	each	1.000	1,188.000	1,188.000
Sub-Total Drainage					334,891.50
6	Earthworks				
	Excavation New Pavement Length (3.5m Wide Bicycle Path) and K&G excavation				
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	457.000	196.500	89,800.500
6.2	Bytes Creek Bridge earthworks and length (Refer to RFQ Bytes Creek Crossing Dwg - allows for benching into exisitng & Imported fill \$18/t(DC)	m³	250.000	614.400	153,600.000
Sub-Total Earthworks					243,400.50
7	Structures				
Sub-Total Strucutres					0.00
8	Pavements				
3.01	New Pavement Length (3.5m Wide) (Bicycle Path)	m	860.000	402.100	345,806.000
Sub-Total Pavements					345,806.00
9	Road Furniture and Pavement Markings				
3.02	Line Marking	m	860.000	8.200	7,052.000
3.03	Painted symbols	item	13.000	84.500	1,098.500
3.15	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.000
3.21	Signage Allowance (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Road Furniture and Pavement Markings					50,527.42
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 Wongala Rd at Bytes Creek to Copeland Road					2,027,396.57
				Total A3 South	4,844,265.53

Item #	Description	Unit	Quantity	Unit Rate	Amount
A3-North	A3 North Pennant Hills City View, boundary, Wongala to lilla rd				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	1.5%		26,664.67
1.2	Environmental Management (% CV)	lumpsum	1.5%		26,664.67
Sub-Total Preliminaries & Environmental					53,329.34
2	Clearing & Demolition				
2.1	Tree Removal Along city view rd, boundary rd and Wongola Road until Lilla Rd	each	55.000	1,668.400	91,762.000
2.2	Hedge Clearing	m2	72.000	34.700	2,498.400
2.3	Demolition of Existing Path (APPROX. 2.0m Wide Path) - DEPTH = 150mm	m2	560.000	19.400	10,864.000
2.4	Demolition of Existing Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	636.000	19.400	12,338.400
Sub-Total Clearing & Demolition					117,462.80
3	Utilites & Services				
3.1	Lighting to be provided for approximate length	m	570.000	120.600	68,742.000
3.2	Lighting Fitting and poles at 32m spacing	lumpsum	18.000	5,161.900	92,914.200
3.3	Streetlight Powerpole relocation	each	8.000	14,950.400	119,603.200
3.4	Traffic Signals Relocations	each	3.000	19,501.000	58,503.000
Sub-Total Utilites & Services					339,762.40
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
6.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)	m³	41.400	196.500	8,135.100
Sub-Total Earthworks					8,135.10
7	Structures				
7.1	Length of retaining Wall required (earthworks to lower levels to remove stairs from path (max height 1.5m)	m2	12.500	527.500	6,593.750
7.2	Keystone Retaining Wall	m2	43.000	502.000	21,586.000
7.3	Length Weldlock Bridge Structure	m²	140.000	5,007.400	701,036.000
Sub-Total Strucutres					729,215.75
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)	m	755.000	402.100	303,585.500
Sub-Total Pavements					303,585.50
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	755.000	8.200	6,191.000
9.2	Painted symbols	item	20.000	84.500	1,690.000

Item #	Description	Unit	Quantity	Unit Rate	Amount
9.3	Pedestrian Fence	m	280.000	598.700	167,636.000
9.4	Signage Allowance (% CV)	lumpsum	1.5%		26,664.67
9.5	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.000
9.6	Relocate Existing Large Sign Structure	item	1.000	12,005.000	12,005.000
Sub-Total Road Furniture and Pavement Markings					226,152.67
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A3 North Pennant Hills City View, boundary, Wongala to lilla rd					1,777,643.57
A1-2	A1 North Wongala to Wongala (i.e. BYLES CREEK)				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		11,936.17
1.2	Environmental Management (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Preliminaries & Environmental					17,904.26
2	Clearing & Demolition				
Sub-Total Clearing & Demolition					0.00
3	Utilites & Services				
Sub-Total Utilites & Services					0.00
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
6.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) 75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	245.000	144.600	35,427.000
Sub-Total Earthworks					35,427.00
7	Structures				
7.1	Byles Creek Bridge (abutment to abutment) Bridge and Walkway - Cantilevered walkway & Steel Structure on 4 x 450 dia piles x6m OTR Piers 1.5m high, precast headstock	m²	169.000	1,830.900	309,422.100
Sub-Total Strucutres					309,422.10
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path) Approach and departure from structure	m	70.000	402.100	28,147.000
Sub-Total Pavements					28,147.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	70.000	6.300	441.000
9.2	Painted symbols	item	5.000	84.500	422.500
9.3	Signage Allowance (% CV)	lumpsum	1.5%		5,968.09
Sub-Total Road Furniture and Pavement Markings					6,831.59
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 North Wongala to Wongala					397,731.95
A1-3	A1 Wongala Rd at Byles Creek to Copeland Road				
1	Preliminaries & Environmental				
3.22	Traffic Management (% CV)	lumpsum	3.0%		60,821.83
3.23	Environmental Management (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Preliminaries & Environmental					91,232.75
2	Clearing & Demolition				
2.1	Tree clearing at Byles Creek (dense)	m2	280.000	20.000	5,600.000
2.2	Tree clearing at Wongala Crescent (medium/dense)	m2	539.000	20.000	10,780.000
2.3	Tree clearing at Wongala Crescent 24 Large Trees	each	24.000	1,668.400	40,041.600
2.4	Demolition of Existing Concrete Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	325.000	19.400	6,305.000
2.5	Demolition of Existing Paved Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	400.000	19.400	7,760.000
2.6	Demolition of Existing Concrete Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	120.000	19.400	2,328.000
2.7	Demolish Kerb and Gutter From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	24.600	7,134.000
Sub-Total Clearing & Demolition					79,948.60
3	Utilites & Services				
3.1	Telstra Phone Box to be relocated	item	1.000	11,700.000	11,700.000
3.2	Relocate Streetlight/ Powerpoles	each	10.000	14,950.400	149,504.000
3.3	High voltage Powerbox to be relocated	item	1.000	223,086.000	223,086.000
3.4	Length of lighting required	m	1,320.000	120.600	159,192.000
3.5	Lighting Fitting and poles at 32m spacing	each	42.000	5,161.900	216,799.800
Sub-Total Utilites & Services					760,281.80
4	Kerb & Gutters				
4.1	Kerb and Gutter construction From Byles creek to Chapman Avenue	m	470.000	122.500	57,575.000
4.2	Kerb and Gutter construction From Chapman Avenue to Southern end of Beecroft carpark	m	290.000	123.500	35,815.000
4.3	TfNSW Driveway upgrades	each	3.000	9,306.000	27,918.000
Sub-Total Kerb & Gutters					121,308.00
5	Drainage				
5.1	Drainage 375 DIAM Pipe for	m	760.000	310.600	236,056.000
5.2	Drainage pits at 30m Spacing	each	25.000	3,905.900	97,647.500
5.3	Connections to Existing Drainage system (600 Diam)	each	1.000	1,188.000	1,188.000
Sub-Total Drainage					334,891.50

Item #	Description	Unit	Quantity	Unit Rate	Amount
6	Earthworks				
	Excavation New Pavement Length (3.5m Wide Bicycle Path) and K&G excavation				
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	457.000	196.500	89,800.500
6.2	Byles Creek Bridge earthworks and length (Refer to RFQ Byles Creek Crossing Dwgs - allows for benching into existing & Imported fill \$18/t(DC))	m³	250.000	614.400	153,600.000
Sub-Total Earthworks					243,400.50
7	Structures				
Sub-Total Structures					0.00
8	Pavements				
3.01	New Pavement Length (3.5m Wide) (Bicycle Path)	m	860.000	402.100	345,806.000
Sub-Total Pavements					345,806.00
9	Road Furniture and Pavement Markings				
3.02	Line Marking	m	860.000	8.200	7,052.000
3.03	Painted symbols	item	13.000	84.500	1,098.500
3.15	Relocate Existing Bus Shelter	item	1.000	11,966.000	11,966.000
3.21	Signage Allowance (% CV)	lumpsum	1.5%		30,410.92
Sub-Total Road Furniture and Pavement Markings					50,527.42
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A1 Wongala Rd at Byles Creek to Copeland Road					2,027,396.57
				Total A3 North	4,202,772.08

Item #	Description	Unit	Quantity	Unit Rate	Amount
A4	A4 North - Pennant Hills Road to Copeland Road				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	1.5%		66,218.57
1.2	Environmental Management (% CV)	lumpsum	1.5%		66,218.57
Sub-Total Preliminaries & Environmental					132,437.14
2	Clearing & Demolition				
Demolition of Existing Concrete Path adjacent retaining wall.					
2.1	Retaining wall to be retained. (APPROX. 1.5m Wide Path) - DEPTH = 150mm	m2	45.000	19.400	873.000
2.2	Demolition of Existing Path (APPROX. 1.5m Wide Path) - DEPTH = 150mm	m2	825.000	19.400	16,005.000
2.3	Trees to be Cleared	each	261.000	1,668.400	435,452.400
2.4	Shrub and smaller tree Clearing	m2	2,200.000	34.700	76,340.000
Sub-Total Clearing & Demolition					528,670.40
3	Utilites & Services				
3.1	Street Light Pole/power poles- Relocations	each	6.000	14,950.300	89,701.800
3.2	Length of lighting required	m	865.000	120.600	104,319.000
3.3	Lighting Fitting and poles at 32m spacing	each	27.000	5,161.900	139,371.300
Sub-Total Utilites & Services					333,392.10
4	Kerb & Gutters				
4.1	Length of new SA Kerb required along Sutherland Road	m	530.000	94.100	49,873.000
Sub-Total Kerb & Gutters					49,873.00
5	Drainage				
5.1	Length of Drainage 375 Diam)	m	580.000	310.600	180,148.000
5.2	Drainage pits (Pits every 30m)	each	20.000	3,905.900	78,118.000
5.3	Headwall Outlets (Sag points on Sutherland Road) 375 DIAM	each	2.000	1,504.000	3,008.000
Sub-Total Drainage					261,274.00
6	Earthworks				
6.1	Rock Cutting along Sutherland Road	m³	1,092.500	126.400	138,092.000
Sub-Total Earthworks					138,092.00
7	Structures				
7.1	Reconstruct Pedestrian overbridge crossing over Copeland Rd from 1.75m wide to 3.5 m wide. (3.5m width composite deck)	m²	105.000	5,580.300	585,931.500
7.2	Length of Grade Correction Stairway Bridge Structure	m²	525.000	2,647.300	1,389,832.500
7.3	Length of elevated Structure at Sutherland Road Sags Point (3.5 m width)	m²	140.000	2,633.900	368,746.000
7.4	New Steel Staircase from Aazalea Grove to elevated structure	No. of Steps	20.000	1,103.400	22,068.000
Sub-Total Strucutres					2,366,578.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)	m	1,300.000	402.100	522,730.000
Sub-Total Pavements					522,730.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	1,490.000	8.200	12,218.000
9.2	Painted symbols	item	36.000	84.500	3,042.000
9.3	Signage Allowance (% CV)	lumpsum	1.5%		66,218.57
Sub-Total Road Furniture and Pavement Markings					81,478.57
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: A2 Pennant Hills and Chapman Rd					4,414,525.21
				Total A2	4,414,525.21

Item #	Description	Unit	Quantity	Unit Rate	Amount
B-1	Route B				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		46,246.69
1.2	Environmental Management (% CV)	lumpsum	1.5%		23,123.34
Sub-Total Preliminaries & Environmental					69,370.03
2	Clearing & Demolition				
2.1	Tree clearing along the crescent - assume medium (1.8mwide)	m	430.000	29.100	12,513.000
2.2	Demolition of Existing Path (APPROX. 1.8m Wide Path) - DEPTH = 150mm	m2	774.000	19.400	15,015.600
Sub-Total Clearing & Demolition					27,528.60
3	Utilites & Services				
3.1	Lighting along route	each	14.000	5,161.900	72,266.600
3.2	Relocate Streelight Powerpoles	each	4.000	14,950.000	59,800.000
Sub-Total Utilites & Services					132,066.60
4	Kerb & Gutters				
4.1	New Kerb and Gutter	m	1,370.000	121.400	166,318.000
4.2	Upgrade TfNSW Driveways- including demolition of existitng and disposal - assumed driveways 44m2 each	each	4.000	9,306.000	37,224.000
Sub-Total Kerb & Gutters					203,542.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)					
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m3	828.900	196.500	162,878.850
6.2	Additional Earthworks - Kerb & Gutter -To Waste Facility @\$350/t (DC)	m3	210.980	858.500	181,126.330
Sub-Total Earthworks					344,005.18
7	Structures				
Sub-Total Strucutres					0.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path)	m	1,800.000	402.100	723,780.000
Sub-Total Pavements					723,780.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	1,800.000	8.200	14,760.000
9.2	Painted symbols	item	40.000	84.500	3,380.000
9.3	Signage Allowance (% CV)	lumpsum	1.5%		23,123.34
Sub-Total Road Furniture and Pavement Markings					41,263.34
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: Route B					1,541,555.75

Item #	Description	Unit	Quantity	Unit Rate	Amount
C1-1 C1 Cheltenham Rd to M2					
1	Preliminaries & Environmental				
1.14	Traffic Management (% CV)	lumpsum	3.0%		28,717.89
1.15	Environmental Management (% CV)	lumpsum	1.5%		14,358.94
Sub-Total Preliminaries & Environmental					43,076.83
2	Clearing & Demolition				
2.1	Trees to be removed	each	29.000	1,668.400	48,383.600
2.2	Small Tree/Hedge removal	m2	150.000	16.700	2,505.000
2.3	Demolition of Existing Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	1,092.000	19.400	21,184.800
Sub-Total Clearing & Demolition					72,073.40
3	Utilites & Services				
3.1	Street Light Pole Relocations	each	9.000	14,950.300	134,552.700
3.2	Traffic Signal post Relocation	each	1.000	19,501.000	19,501.000
3.3	Signalling boxes to be relocated	item	2.000	3,055.000	6,110.000
3.4	Length of lighting required	m	530.000	120.600	63,918.000
3.5	Lighting Fitting and poles at 32m spacing	each	17.000	5,161.900	87,752.300
Sub-Total Utilites & Services					311,834.00
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)					
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	313.950	196.500	61,691.175
Sub-Total Earthworks					61,691.18
7	Structures				
Sub-Total Strucutres					0.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path)	m	910.000	402.100	365,911.000
Sub-Total Pavements					365,911.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
9	Road Furniture and Pavement Markings				
9.1	Pedestrian Fence	m	115.000	598.700	68,850.500
9.2	Line Marking	m	910.000	8.200	7,462.000
9.3	Painted symbols	item	1.000	12,005.000	12,005.000
9.4	Existing large sign structure to be relocated.	each	1.000	0.000	0.000
9.5	Signage Allowance (% CV)	lumpsum	1.5%		14,358.94
Sub-Total Road Furniture and Pavement Markings					102,676.44
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: C1 Cheltenham Rd to M2					957,262.85
C1-2 C1 Western side of Beecroft Road from M2 to M2 Exit Ramp					
C1A-2	OPTION A (Utilise existing Bridge over M2)				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		43,771.71
1.2	Environmental Management (% CV)	lumpsum	1.5%		21,885.86
Sub-Total Preliminaries & Environmental					65,657.57
2	Clearing & Demolition				
2.1	Area of Trees (behind existing noisewall) to be cleared	m2	720.000	10.400	7,488.000
2.2	Demolish Type F on southern side of Noisewall	m	50.000	117.500	5,875.000
2.3	Demolition & Store Noise Wall Beecroft Rd (avg 2.4m high) 240m	m2	576.000	167.700	96,595.200
2.4	Demolition of Existing Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	600.000	19.400	11,640.000
Sub-Total Clearing & Demolition					121,598.20
3	Utilites & Services				
3.1	Street Light Pole Relocations	each	9.000	14,950.300	134,552.700
3.2	Traffic Signals Relocations (2 at Southern end of Beecroft Road) each		2.000	19,500.000	39,000.000
Sub-Total Utilites & Services					173,552.70
4	Kerb & Gutters				
4.1	Reconstruct Type F on southern side of Noisewall	m	50.000	278.300	13,915.000
Sub-Total Kerb & Gutters					13,915.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
Sub-Total Earthworks					0.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
7	Structures				
7.1	Reconstruct Noise wall on walkway	m2	576.000	393.200	226,483.200
7.2	Steel/precast slab Walkway approx 240m x 3.8m wide	m2	912.000	914.000	833,568.000
Sub-Total Structures					1,060,051.20
8	Pavements				
Sub-Total Pavements					0.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	240.000	8.200	1,968.000
9.2	Painted symbols	item	5.000	84.500	422.500
9.3	Signage Allowance (% CV)	lumpsum	1.5%		21,885.86
Sub-Total Road Furniture and Pavement Markings					24,276.36
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: OPTION A					1,459,051.02
C1B-2	OPTION B NEW BRIDGE				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		113,092.18
1.2	Environmental Management (% CV)	lumpsum	1.5%		56,546.09
Sub-Total Preliminaries & Environmental					169,638.27
2	Clearing & Demolition				
2.1	Area of Trees (behind existing noisewall) to be cleared	m2	772.500	9.700	7,493.250
2.2	Demolish Type F on southern side of Noisewall	m	50.000	117.500	5,875.000
2.3	Demolish and reconstruct W beam on Northern side of M2	m	15.000	84.500	1,267.500
2.4	Demolition & Store Noise Wall Beecroft Rd (avg 2.4m high) 240m	m2	576.000	167.700	96,595.200
2.5	Demolition of Existing Path (APPROX. 2.5m Wide Path) - DEPTH = 150mm	m2	600.000	19.400	11,640.000
Sub-Total Clearing & Demolition					122,870.95
3	Utilites & Services				
3.1	Street Light Pole Relocations	each	11.000	14,950.300	164,453.300
3.2	Traffic Signals Relocations (2 at Southern end of Beecroft Road + 1 at Northern end of Beecroft bridge over M2)	each	3.000	19,501.000	58,503.000
Sub-Total Utilites & Services					222,956.30
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
5	Drainage				
	Sub-Total Drainage				0.00
6	Earthworks				
	Sub-Total Earthworks				0.00
7	Structures				
7.1	"New Super T Bridge (3 Span) Included in this option is adjusting 1 traffic signal, line marking of crossing, adjustment to pram ramps and median adjustments and 96m Bridge deck).	m2	336.000	6,351.900	2,134,238.400
7.2	Reconstruct Noise wall on walkway	m2	576.000	393.200	226,483.200
7.3	Steel/precast slab Walkway approx 240m x 3.8m wide	m2	912.000	914.000	833,568.000
	Sub-Total Structures				3,194,289.60
8	Pavements				
	Sub-Total Pavements				0.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	336.000	8.200	2,755.200
9.2	Painted symbols	item	8.000	84.500	676.000
9.3	Signage Allowance (% CV)	lumpsum	1.5%		56,546.09
	Sub-Total Road Furniture and Pavement Markings				59,977.29
10	Miscellaneous				
	Sub-Total Miscellaneous				0.00
	Sub-Total: OPTION B NEW BRIDGE				3,769,732.41
C1-3	New seperated bridge over Devlins Creek				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		46,727.35
1.2	Environmental Management (% CV)	lumpsum	1.5%		23,363.67
	Sub-Total Preliminaries & Environmental				70,091.02
2	Clearing & Demolition				
2.1	Area of Trees (behind existing devlins creek bridge) to be cleared	m2	210.000	23.800	4,998.000
2.2	Remove existing safety barriers and reconstruct (w Beam 30m and Concrete type F 30m)				0.00
2.2.1	W Beam 30m	m	30.000	84.500	2,535.000
2.2.2	Concrete type F 30m	m	30.000	117.500	3,525.000
	Sub-Total Clearing & Demolition				11,058.00

Item #	Description	Unit	Quantity	Unit Rate	Amount
3	Utilites & Services				
3.1	Street Light Pole Relocations	each	4.000	14,950.000	59,800.000
Sub-Total Utilites & Services					59,800.00
4	Kerb & Gutters				
4.1	Reconstruct Type F on southern side of Noisewall	m	30.000	347.200	10,416.000
Sub-Total Kerb & Gutters					10,416.00
5	Drainage				
Sub-Total Drainage					0.00
6	Earthworks				
6.1	Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1) 75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m³	28.000	161.600	4,524.800
Sub-Total Earthworks					4,524.80
7	Structures				
7.1	New Super T Bridge (2 Span) (3.5m Path Width) and bridge deck length	m²	210.000	6,462.500	1,357,125.000
Sub-Total Strucutres					1,357,125.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path)	m	40.000	402.100	16,084.000
Sub-Total Pavements					16,084.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	100.000	8.200	820.000
9.2	Painted symbols	item	4.000	85.000	340.000
9.3	Install W-Beam guardrail	m	30.000	131.800	3,954.000
9.3	Signage Allowance (% CV)	lumpsum	1.5%		23,363.67
Sub-Total Road Furniture and Pavement Markings					28,477.67
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: New seperated bridge over Devlins Creek					1,557,576.49

Item #	Description	Unit	Quantity	Unit Rate	Amount
C2-1 C2 The Crescent Rd to M2					
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		228,323.68
1.2	Environmental Management (% CV)	lumpsum	1.5%		114,161.84
Sub-Total Preliminaries & Environmental					342,485.53
2	Clearing & Demolition				
2.1	Trees to be cleared along the crescent	each	24.000	1,668.400	40,041.600
2.2	Dense Area of tree clearing behind rail reserve required (4.2m Width)	m2	420.000	33.400	14,028.000
2.3	Low/Moderate Area of tree clearing behind rail reserve required (4.2m Width)	m2	714.000	33.400	23,847.600
2.4	Dense Tree Clearing on northern side of M2 (near noisewall)	m2	42.000	119.200	5,006.400
2.5	Low/Moderate Tree Clearing on Southern side of M2	m2	168.000	40.000	6,720.000
2.6	Demolition of Existing Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	588.000	19.400	11,407.200
2.7	Demolition of Existing Path (APPROX. 1.5m Wide Path) - DEPTH = 150mm	m2	195.000	19.400	3,783.000
Sub-Total Clearing & Demolition					104,833.80
3	Utilites & Services				
3.1	Street Light/ Powerpole Pole Relocations	each	4.000	14,950.000	59,800.000
3.2	Length of lighting required	m	1,260.000	120.600	151,956.000
3.3	Lighting Fitting and poles at 32m spacing	each	18.000	5,161.900	92,914.200
Sub-Total Utilites & Services					304,670.20
4	Kerb & Gutters				
4.1	Kerb and Gutter (Along the crescent)	m	355.000	123.000	43,665.000
Sub-Total Kerb & Gutters					43,665.00
5	Drainage				
5.1	Drainage 375 DIAM Pipe for	m	355.000	372.700	132,308.500
5.2	Drainage pits at 30m Spacing	each	12.000	3,905.900	46,870.800
5.3	Connections to Existing Drainage system (375 Diam)	each	1.000	1,188.000	1,188.000
Sub-Total Drainage					180,367.30
6	Earthworks				
Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)					
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m3	452.700	196.500	88,955.550
6.2	Reinforced soil Wall Earthworks (720m3 Southern, 720m3 northern) - disposed off site as clean fill	m3	1,440.000	489.100	704,304.000

Item #	Description	Unit	Quantity	Unit Rate	Amount
Sub-Total Earthworks					793,259.55
7	Structures				
7.1	New Super T Bridge (5 Span)(refer below) (3.5m path width)	m2	738.500	6,351.900	4,690,878.150
7.2	Reinforced soil Wall Lengths	m2	338.000	1,430.000	483,340.000
Sub-Total Strucutres					5,174,218.15
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path)	m	1,086.000	402.100	436,680.600
Sub-Total Pavements					436,680.60
9	Road Furniture and Pavement Markings				
9.1	Line Marking	m	1,260.000	8.200	10,332.000
9.2	Painted symbols	item	25.000	84.500	2,112.500
9.3	Signage Allowance (% CV)	lumpsum	1.5%		114,161.84
Sub-Total Road Furniture and Pavement Markings					126,606.34
10	Miscellaneous				
10.1	Property Acquisition	m2	40.000	2,600.10	104,004.00
Sub-Total Miscellaneous					104,004.00
Sub-Total: C2 The Crescent Rd to M2					7,610,790.47

Item #	Description	Unit	Quantity	Unit Rate	Amount
C3-1	C3 Sutherland Rd				
C3.1-1	Option1				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		66,851.47
1.2	Environmental Management (% CV)	lumpsum	1.5%		33,425.73
Sub-Total Preliminaries & Environmental					100,277.20
2	Clearing & Demolition				
2.1	low/Medium Density Tree Clearing	m2	624.000	33.400	20,841.600
2.2	Remove existing concrete path (2m wide 150mm thick) underpass elevated pedestrian bridge	m2	300.000	23.100	6,930.000
2.3	Demolish Existing Kerb and Gutter	m	40.000	37.000	1,480.000
2.4	Demolition of Existing Path (APPROX. 1.2m Wide Path) - DEPTH = 150mm	m2	666.000	19.400	12,920.400
Sub-Total Clearing & Demolition					42,172.00
3	Utilites & Services				
3.1	Relocate Existing Streetlight/ Powerpoles	each	18.000	14,950.400	269,107.200
3.2	Lighting Fitting and poles at 32m spacing	each	42.000	5,161.900	216,799.800
3.3	Length of Lighting Required	m	1,320.000	120.600	159,192.000
3.4	CCTV camera installations (at Underpass)	each	2.000	10,920.000	21,840.000
Sub-Total Utilites & Services					666,939.00
4	Kerb & Gutters				
1.06	Length of new Kerb and Gutter	m	1,210.000	121.500	147,015.000
Sub-Total Kerb & Gutters					147,015.00
5	Drainage				
5.1	Drainage 375 DIAM Pipe for	m	1,210.000	372.700	450,967.000
5.2	Drainage pits at 30m Spacing	each	41.000	3,905.900	160,141.900
5.3	Connections to Existing Drainage system (600 Diam)	each	1.000	1,188.000	1,188.000
Sub-Total Drainage					612,296.90
6	Earthworks				
Excavation New Pavement (3.5m Wide) (Bicycle Path) (refer pavement profile from A1)					
6.1	75% of material retained on site (70% compacted backfilling, 5% spread), 20% disposed offsite recyclable material @\$18.50/t (DC) & 5% mixed waste disposed off site @\$350/t (DC)	m ³	490.350	196.500	96,353.775
Sub-Total Earthworks					96,353.78
7	Structures				

Item #	Description	Unit	Quantity	Unit Rate	Amount
Sub-Total Structures					0.00
8	Pavements				
8.1	New Pavement (3.5m Wide) (Bicycle Path)	m	1,210.000	402.100	486,541.000
8.2	New Pavement (3.5m Wide) (Bicycle Path) underpass elevated pedestrian bridge	m	50.000	402.100	20,105.000
Sub-Total Pavements					506,646.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking (as Per A1 Line Marking)	m	1,320.000	8.200	10,824.000
9.2	Painted symbols	item	22.000	84.500	1,859.000
9.3	Three longitudinal control lines (3 lines x full length) underpass elevated pedestrian bridge	m	150.000	2.700	405.000
9.4	Painted symbols underpass elevated pedestrian bridge	item	5.000	84.500	422.500
9.5	Pedestrian Hand Rail underpass elevated pedestrian bridge	m	50.000	195.000	9,750.000
9.6	Signage Allowance (% CV)	lumpsum	1.5%		33,425.73
Sub-Total Road Furniture and Pavement Markings					56,686.23
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: C3 Sutherland Rd					2,228,386.11
C3.2-2	Option 2				
1	Preliminaries & Environmental				
1.1	Traffic Management (% CV)	lumpsum	3.0%		12,716.45
1.2	Environmental Management (% CV)	lumpsum	1.5%		6,358.23
Sub-Total Preliminaries & Environmental					19,074.68
2	Clearing & Demolition				
Sub-Total Clearing & Demolition					0.00
3	Utilites & Services				
3.1	Length of lighting required	m	1,320.000	120.600	159,192.000
3.2	Lighting Fitting and poles at 32m spacing	each	42.000	5,161.900	216,799.800
3.3	CCTV camera installations (at Underpass)	each	2.000	10,920.000	21,840.000
Sub-Total Utilites & Services					397,831.80
4	Kerb & Gutters				
Sub-Total Kerb & Gutters					0.00
5	Drainage				

Item #	Description	Unit	Quantity	Unit Rate	Amount
Sub-Total Drainage					0.00
6	Earthworks				
Sub-Total Earthworks					0.00
7	Structures				
Sub-Total Structures					0.00
8	Pavements				
Sub-Total Pavements					0.00
9	Road Furniture and Pavement Markings				
9.1	Line Marking (ON ROAD OPTION) PS-3	m	13.000	8.200	106.600
9.2	Painted symbols	item	3.000	85.000	255.000
9.3	Line Marking (ON ROAD OPTION) BA-1	m	13.000	0.000	0.000
9.4	Painted symbols	item	3.000	85.000	255.000
9.5	Signage Allowance (% CV)	lumpsum	1.5%		6,358.23
Sub-Total Road Furniture and Pavement Markings					6,974.83
10	Miscellaneous				
Sub-Total Miscellaneous					0.00
Sub-Total: Option 2					423,881.30

APPENDIX D

Meeting Minutes



Issue date 24/07/2018
Issue to Samad Khan
Issued by Jaco de Vry
Subject Pennant Hills to Epping Cycleway – Kickoff Meeting
Reference PH2E Meeting - 01
Client Hornsby Shire Council
Meeting date 9/07/2018
Time 3pm
Location TfNSW Office Chatswood
Present Rob Rajca (Hornsby Council), Samad Khan (Hornsby Council), Lawrence Nagy (Hornsby Council), Tom Grosskopf (TNSW), Leon Paap (RMS), Robert Casamento (Arcadis), Daneil Kehoe (Arcadis), Jaco de Vry (Arcadis)
Copy to N/A

ITEM	COMMENTS	ACTION
1	Discussion on Rail interface ASA standard interfaces. Type 1 - no interface Type 2 - has an interface with the rail. (capable of taking a 30 tonne truck, major pavement), • maintenance required for 4 separate rail groups - engineering, electrical, landscaping and signalling groups (interfacing). • Consider situation during maintenance or rail shutdowns, path shut downs would be acceptable (roughly quarterly maintenance shutdown). Consider detours during these times. • Has a 1 year average approval time. Width and type of cuttings determine approval time due to safety concerns and checking	
	Caroline Wilky – rail interface manager - RMS to provide contact details	RMS
	Important issues for consideration in rail corridor • Geotech - slope stability of cutting • Safety - working over or adjacent to rail • Rail Utilities protection &/or relocation • New boundary fence required between rail and path, likely having to be built under track procession	
	Estimated construction cost;	

\$10million per km in rail corridor
\$7 million for on/adjacent road alignment

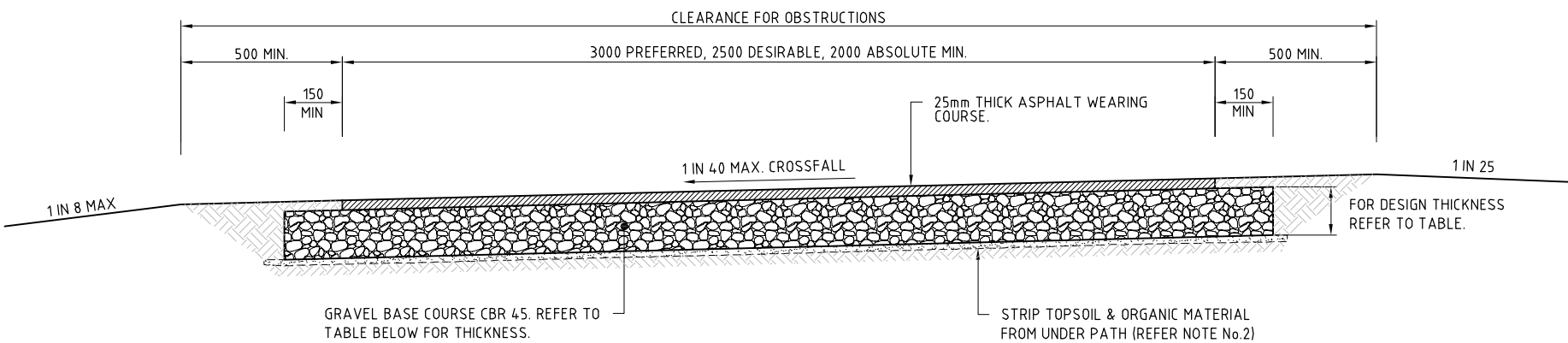
2 Route Constraint and general discussions

- Catchment of proposed path will need to be considered as separate catchments will be catered for based on path alignment been either side of rail alignment (this should be confirmed by RMS/council)
 - TfNSW Driveways - will have to be robust.
 - On route A1, childcare centre has no parking as part of planning.
 - A1 - Big Trees which will impact community if removed.
 - Squeeze points behind tennis court is unused rail land and there is a ministerial letter where this unused land will be ceded for use by the shared path.
 - The Crescent is on Crown land
-

APPENDIX E

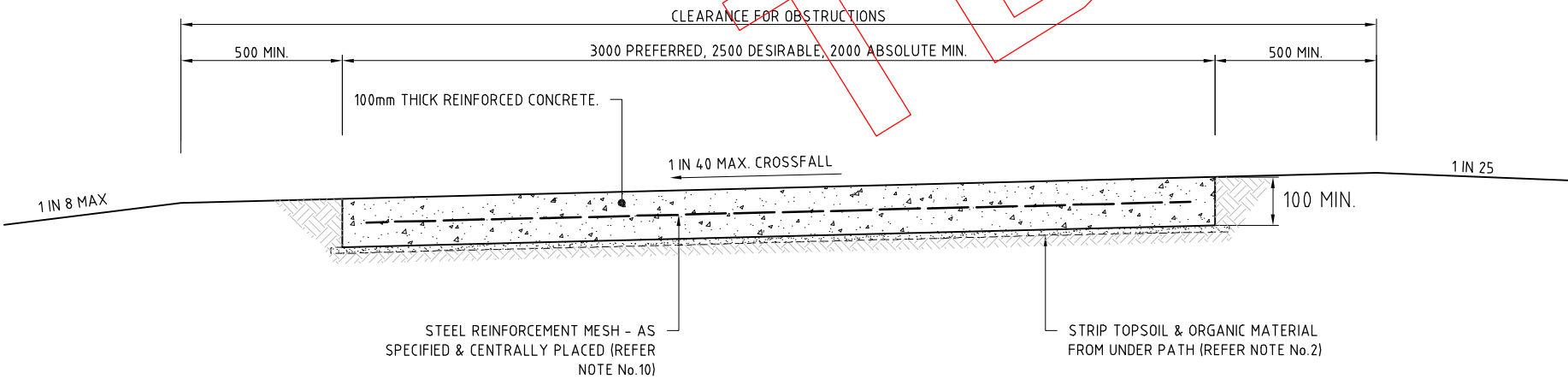
Pavement Profiles





TYPICAL SECTION ASPHALT SURFACED SHAREPATH
NOT TO SCALE

ASPHALT SURFACED SHAREPATHS	
C.B.R. OF SUBGRADE	BASE COURSE THICKNESS
LESS THAN 3	200
3 - 5	150
GREATER THAN 5	125

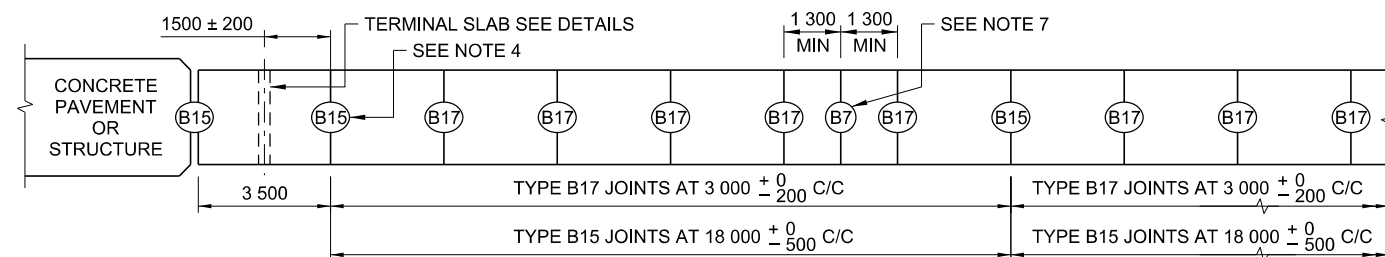


TYPICAL SECTION CONCRETE SURFACED SHAREPATH
NOT TO SCALE

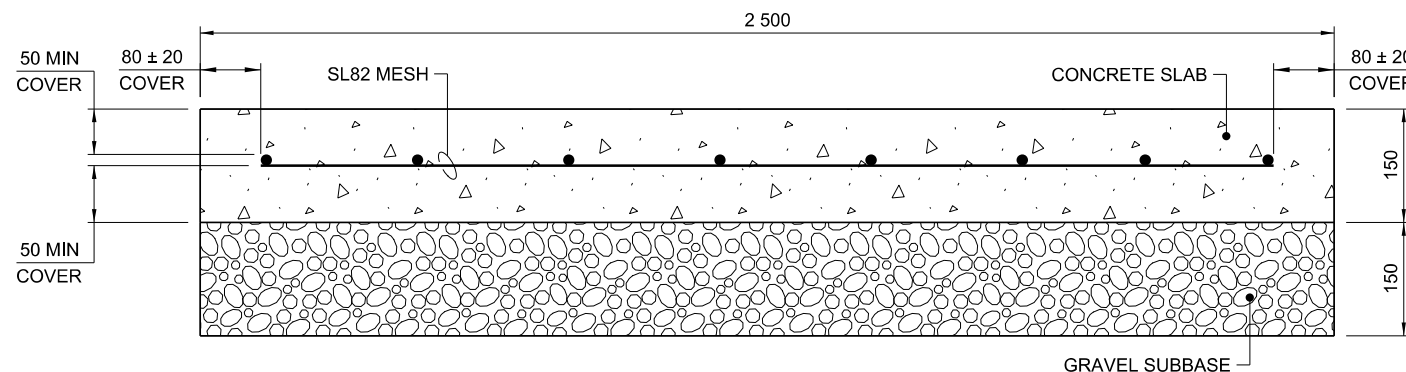
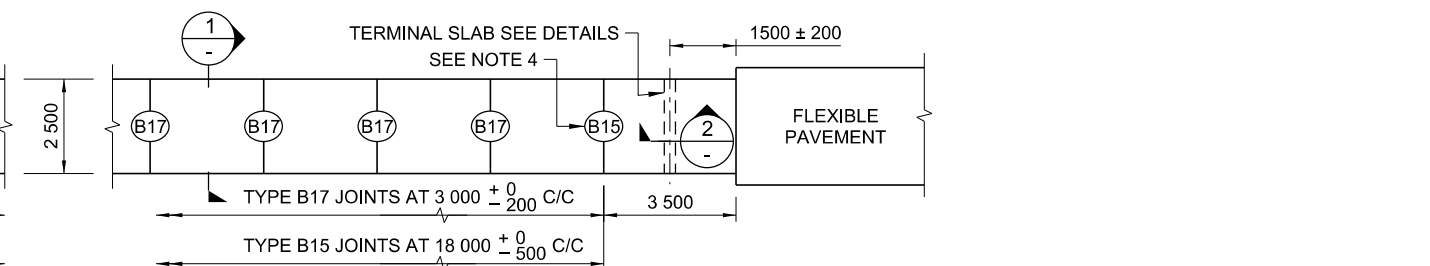
NOTES:

1. CONCRETE & ASPHALT SHARED PATHS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE AUSTRROADS GUIDE TO TRAFFIC ENGINEERING PRACTICE : PART 13 - PEDESTRIANS & PART 14 - BICYCLES & THE ROADS & TRAFFIC AUTHORITY OF NSW - NSW BICYCLE GUIDELINES.
2. FOR CONCRETE & ASPHALT SHARED PATHS, PROOF ROLL SUB-GRADE TO 300mm BEYOND PATH EDGE. THREE (3) PASSES WITH A CC10 ROLLER (OR EQUIVALENT). NO DEFLECTIONS ON LAST PASS.
3. CONCRETE TO BE MINIMUM GRADE N25 AT 28 DAYS.
4. PLAIN CONCRETE SURFACES ARE TO BE TRANSVERSE HEAVY BROOM FINISHED TO PROVIDE A NON-SLIP FINISH IN ACCORDANCE WITH AS 4586 - SLIP RESISTANCE CLASSIFICATION OF NEW PEDESTRIAN SURFACE MATERIALS.
5. ALL FINISHED SURFACES SHALL COMPLY WITH THE REQUIREMENTS OF AS 4586 - SLIP RESISTANCE CLASSIFICATION OF NEW PEDESTRIAN SURFACE MATERIALS.
6. USE A STANDARD EDGING TOOL ON CONCRETE SHARED PATHS TO PENCIL AROUND ALL EDGES INCLUDING CONTROL & EXPANSION JOINTS WITH SMOOTH BORDER APPROXIMATELY 50mm WIDE.
7. CONTROL JOINTS ON CONCRETE SHARED PATHS TO BE SQUARE TO SIDES.
8. DOWELLED EXPANSION JOINTS (DEJ) & CONTROL JOINTS (CJ) ARE TO BE PROVIDED AS SHOWN ON H.S.C. STANDARD DRAWINGS.
9. WHERE REQUIRED, STANDARD KERB RAMP CROSSINGS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH RMS STANDARDS.
10. WHERE SPECIFIED, STEEL REINFORCING MESH SHALL COMPLY WITH AS/NZS 4671.
11. ALL CONCRETE CONSTRUCTION TO COMPLY WITH THE REQUIREMENTS OF AS 3600 - CONCRETE CODE.
12. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

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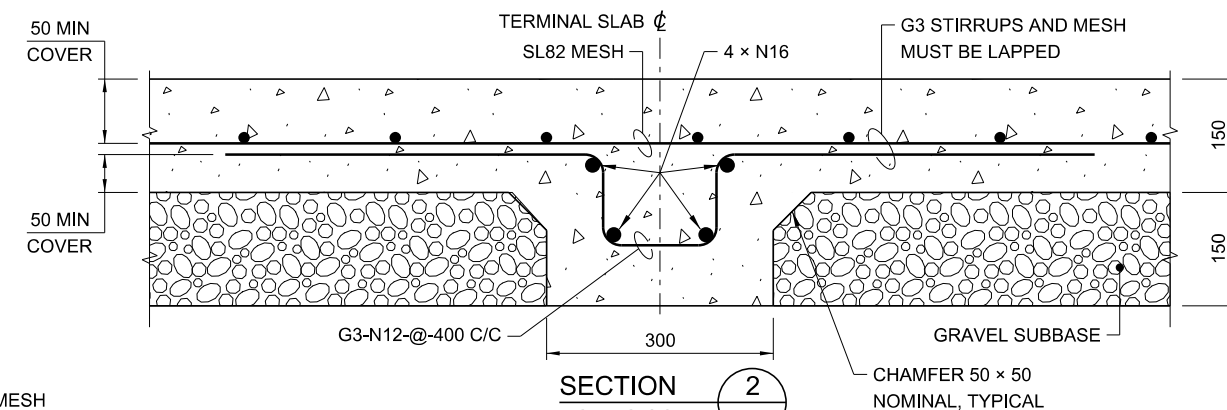


BICYCLE PATH TYPICAL PLAN LAYOUT
NOT TO SCALE

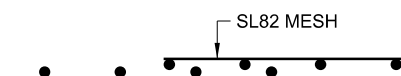


SECTION 1
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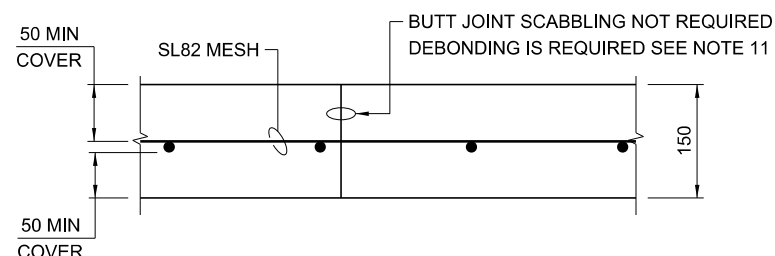
BICYCLE PATH TYPICAL CROSS SECTION



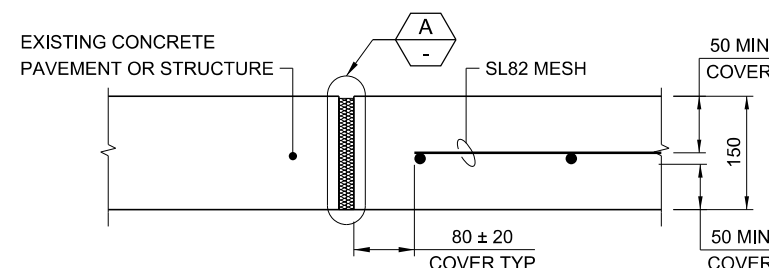
SECTION 2
NOT TO SCALE
TYPICAL TERMINAL SLAB



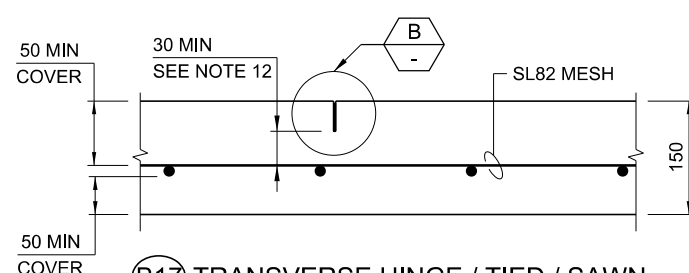
LAPPED SPLICE FOR MESH
NOT TO SCALE
OVERLAP AT LEAST 2 TRANSVERSE BARS



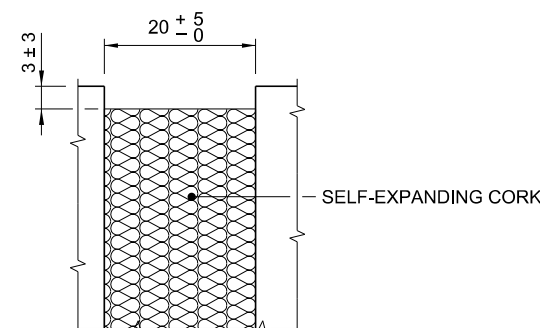
B7 TRANSVERSE CONSTRUCTION / FORMED / TIED
AT START AND END OF DAILY PAVING OPERATIONS. SEE NOTE 7
NOT TO SCALE



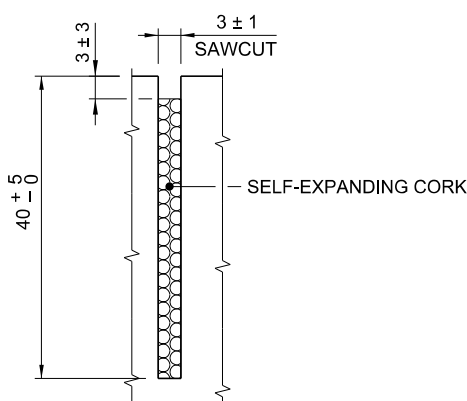
B15 ISOLATION JOINT
NOT TO SCALE



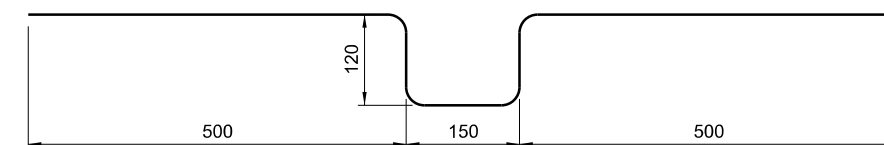
B17 TRANSVERSE HINGE / TIED / SAWN
NOT TO SCALE



DETAIL A
NOT TO SCALE



DETAIL B
NOT TO SCALE



BAR SHAPE G3
NOT TO SCALE

GENERAL NOTES

1. THE DESIGN INDICATED IS FOR BICYCLE PATH LOADING ONLY. THE DESIGN MUST BE MODIFIED IF THE BICYCLE PATH WILL BE USED BY OTHER VEHICLES SUCH AS MAINTENANCE TRUCKS.
2. SLAB LENGTHS MAY BE VARIED BY ± 5% AS REQUIRED TO SUIT LOCAL CONDITIONS EXCEPT WHERE TOLERANCES ARE MARKED OTHERWISE.
3. TRANSVERSE JOINTS MUST BE ALIGNED SQUARE TO THE LONGITUDINAL EDGE, WITH A TOLERANCE OF ± 6°.
4. TYPE B15 ISOLATION JOINTS MUST BE PROVIDED AT THE FIRST JOINT AWAY FROM JUNCTIONS WITH FLEXIBLE PAVEMENTS AND STRUCTURES, AND AT INTERMEDIATE CENTRES OF 18.0 m.
5. TYPE B15 JOINTS CAN BE CONSTRUCTED AS FORMED JOINTS (BY CHEQUERBOARD PAVING SEQUENCE) OR BY FULL-DEPTH SAWCUT.
6. PLACE A FULL-DEPTH TYPE B15 JOINT AROUND ALL ABUTTING STRUCTURES SUCH AS PITS, UTILITY SERVICES, POWER POLES, KERBS.
7. THE OPTIONS FOR END-OF-DAY CONSTRUCTION JOINTS ARE AS FOLLOWS:
(I) TYPE B7 JOINTS MAY BE USED. THEY MUST BE LOCATED EITHER MIDWAY BETWEEN B17 JOINTS OR IN LIEU OF A B17 JOINT. THEY MUST NOT BE USED IN LIEU OF A B15 JOINT.
(II) PAVING MAY BE TERMINATED AT A TYPE B15 JOINT.
8. COMPLY WITH RMS SPECIFICATIONS R53 AND R173. CONCRETE MUST BE IN ACCORDANCE WITH RMS R53 BUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 32.0 MPa.
9. SELF-EXPANDING CORK SEALANTS MUST FILL THE FULL JOINT CAVITY TO PREVENT THE INGRESS OF INCOMPRESSIBLE MATERIALS.
10. SUBBASE MUST BE 150 mm THICK TRAFFIC CATEGORY D MATERIAL IN ACCORDANCE WITH RMS SPECIFICATION 3051, COMPACTED IN ACCORDANCE WITH RMS R173. MOISTEN THE SUBBASE WITH WATER BEFORE PLACING THE CONCRETE.
11. DEBOND TYPE B7 JOINTS TO PREVENT CHEMICAL BONDING.
12. ENSURE REINFORCING STEEL IS PLACED TO PROVIDE 30 mm MINIMUM COVER BELOW THE SAWCUT.

SCALES: NOT TO SCALE, OR AS NOTED.

A3 ORIGINAL

PREPARED BY: PAVEMENT STRUCTURES SECTION, ENGINEERING TECHNOLOGY SERVICES BRANCH, ASSET MAINTENANCE DIVISION

RECOMMENDED FOR APPROVAL
G.AYTON

8/07/2013

SIGNED: DATE: . . .
SUPERVISING PAVEMENT
ENGINEER (RIGID PAVEMENTS)

APPROVED FOR USE
G.VOROBIEFF

9/07/2013

SIGNED: DATE: . . .
PRINCIPAL ROAD PAVEMENT
AND GEOTECHNICAL ENGINEER



Transport
Roads & Maritime
Services

PAVEMENT STANDARD DRAWINGS
RIGID PAVEMENT
BICYCLE PATH DESIGN - 2.5 m WIDE
SLAB PLAN AND DETAILS

REGISTRATION No OF PLANS

DS 2012 / 000293

SHEET No

1

ISSUE

ED 1 REV 0

PRINTED DATE

8/07/2013

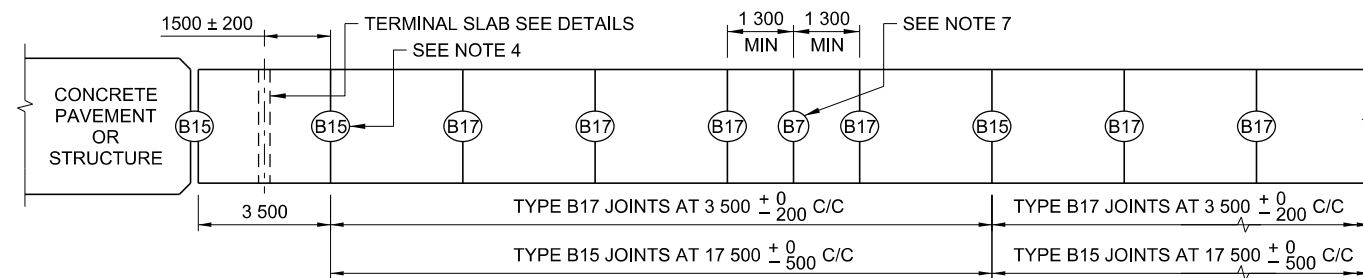
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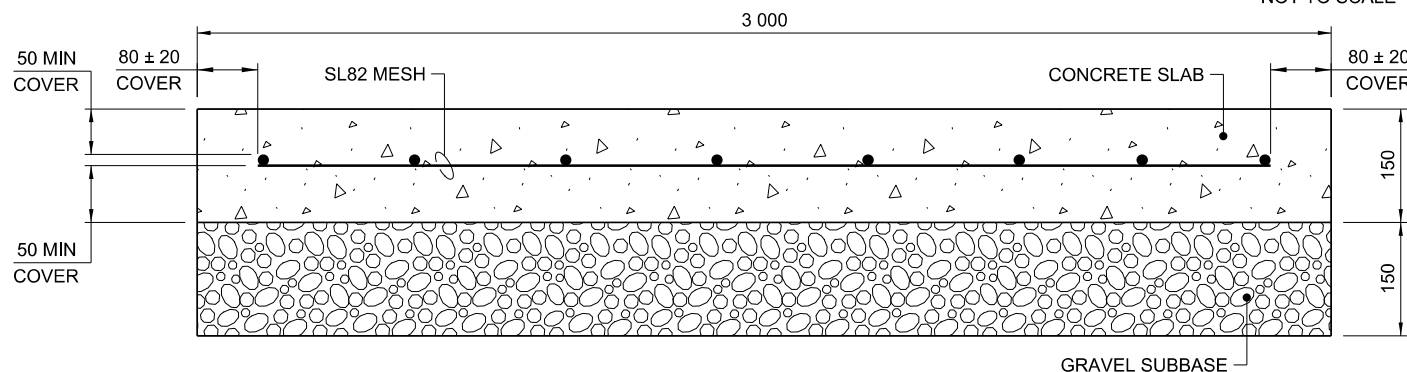
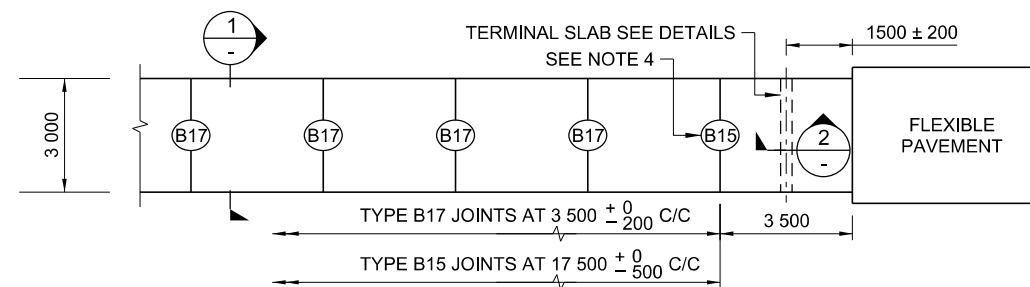
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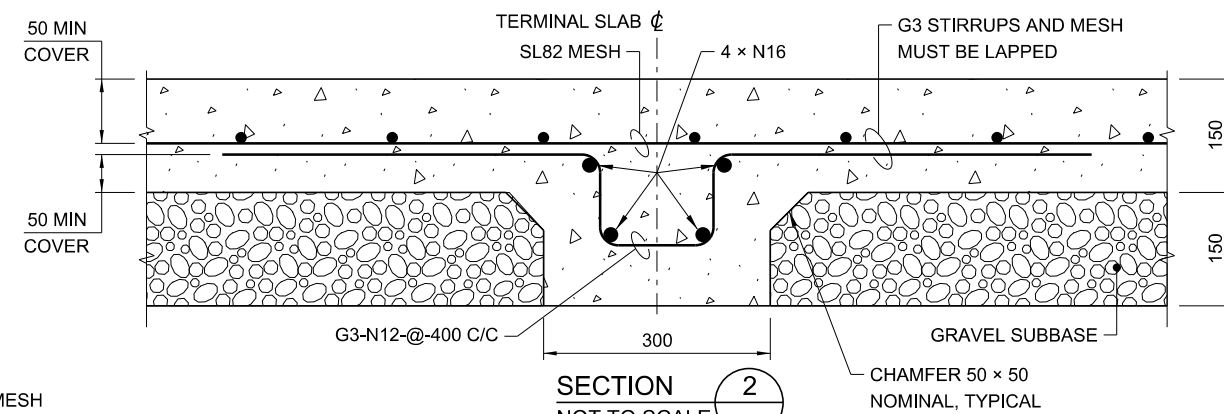
BICYCLE PATH TYPICAL PLAN LAYOUT

NOT TO SCALE

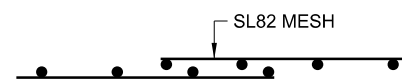


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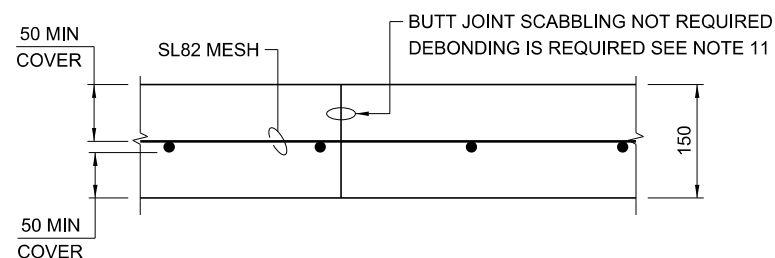
BICYCLE PATH TYPICAL CROSS SECTION



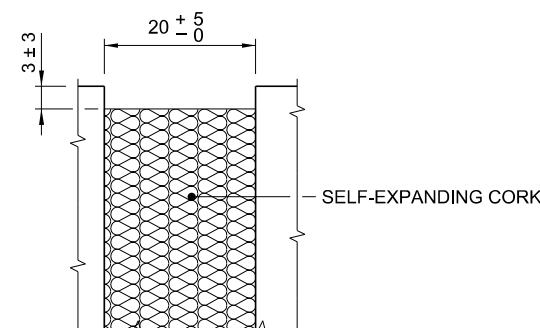
SECTION 2
NOT TO SCALE
TYPICAL TERMINAL SLAB



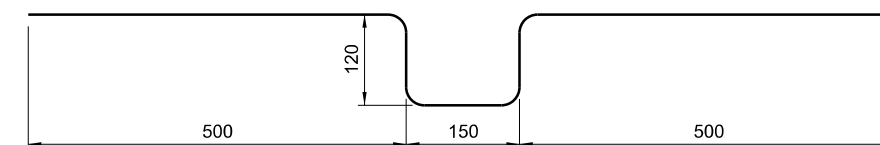
LAPPED SPLICE FOR MESH
NOT TO SCALE
OVERLAP AT LEAST 2 TRANSVERSE BARS



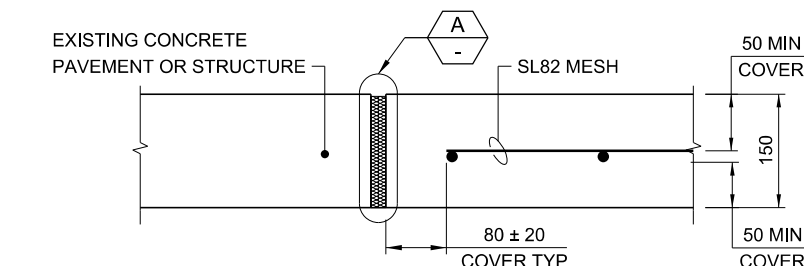
B7 TRANSVERSE CONSTRUCTION / FORMED / TIED
AT START AND END OF DAILY PAVING OPERATIONS. SEE NOTE 7
NOT TO SCALE



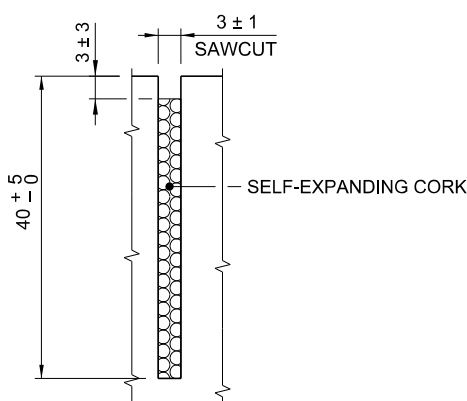
DETAIL A
NOT TO SCALE



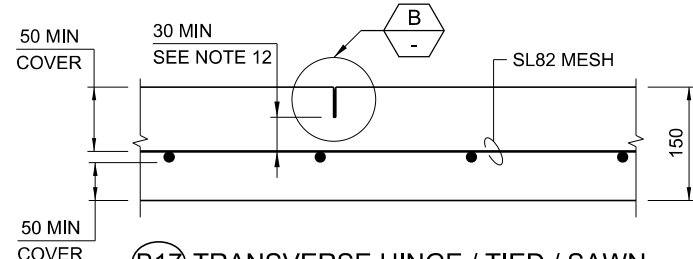
BAR SHAPE G3
NOT TO SCALE



B15 ISOLATION JOINT
NOT TO SCALE



DETAIL B
NOT TO SCALE



B17 TRANSVERSE HINGE / TIED / SAWN
NOT TO SCALE

GENERAL NOTES

1. THE DESIGN INDICATED IS FOR BICYCLE PATH LOADING ONLY. THE DESIGN MUST BE MODIFIED IF THE BICYCLE PATH WILL BE USED BY OTHER VEHICLES SUCH AS MAINTENANCE TRUCKS.
2. SLAB LENGTHS MAY BE VARIED BY ± 5% AS REQUIRED TO SUIT LOCAL CONDITIONS EXCEPT WHERE TOLERANCES ARE MARKED OTHERWISE.
3. TRANSVERSE JOINTS MUST BE ALIGNED SQUARE TO THE LONGITUDINAL EDGE, WITH A TOLERANCE OF ± 6°.
4. TYPE B15 ISOLATION JOINTS MUST BE PROVIDED AT THE FIRST JOINT AWAY FROM JUNCTIONS WITH FLEXIBLE PAVEMENTS AND STRUCTURES, AND AT INTERMEDIATE CENTRES OF 17.5 m (FOR EXAMPLE, THREE SHEETS OF 6 m LENGTH MESH, LESS LAPS).
5. TYPE B15 JOINTS CAN BE CONSTRUCTED AS FORMED JOINTS (BY CHEQUERBOARD PAVING SEQUENCE) OR BY FULL-DEPTH SAWCUT.
6. PLACE A FULL-DEPTH TYPE B15 JOINT AROUND ALL ABUTTING STRUCTURES SUCH AS PITS, UTILITY SERVICES, POWER POLES, KERBS.
7. THE OPTIONS FOR END-OF-DAY CONSTRUCTION JOINTS ARE AS FOLLOWS:
(I) TYPE B7 JOINTS MAY BE USED. THEY MUST BE LOCATED EITHER MIDWAY BETWEEN B17 JOINTS OR IN LIEU OF A B17 JOINT. THEY MUST NOT BE USED IN LIEU OF A B15 JOINT.
(II) PAVING MAY BE TERMINATED AT A TYPE B15 JOINT.
8. COMPLY WITH RMS SPECIFICATIONS R53 AND R173. CONCRETE MUST BE IN ACCORDANCE WITH RMS R53 BUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 32.0 MPa.
9. SELF-EXPANDING CORK SEALANTS MUST FILL THE FULL JOINT CAVITY TO PREVENT THE INGRESS OF INCOMPRESSIBLE MATERIALS.
10. SUBBASE MUST BE 150 mm THICK TRAFFIC CATEGORY D MATERIAL IN ACCORDANCE WITH RMS SPECIFICATION 3051, COMPACTED IN ACCORDANCE WITH RMS R173. MOISTEN THE SUBBASE WITH WATER BEFORE PLACING THE CONCRETE.
11. DEBOND TYPE B7 JOINTS TO PREVENT CHEMICAL BONDING.
12. ENSURE REINFORCING STEEL IS PLACED TO PROVIDE 30 mm MINIMUM COVER BELOW THE SAWCUT.

SCALES: NOT TO SCALE, OR AS NOTED.

A3 ORIGINAL

PREPARED BY: PAVEMENT STRUCTURES SECTION, ENGINEERING TECHNOLOGY SERVICES BRANCH, ASSET MAINTENANCE DIVISION

RECOMMENDED FOR APPROVAL
G.AYTON

SIGNED: 2/07/2013
SUPERVISING PAVEMENT
ENGINEER (RIGID PAVEMENTS)

APPROVED FOR USE
G.VOROBIEFF

SIGNED: 2/07/2013
PRINCIPAL ROAD PAVEMENT
AND GEOTECHNICAL ENGINEER



Transport
Roads & Maritime
Services

PAVEMENT STANDARD DRAWINGS
RIGID PAVEMENT
BICYCLE PATH DESIGN - 3 m WIDE
SLAB PLAN AND DETAILS

REGISTRATION No OF PLANS

DS 2012 / 000293

SHEET No

2

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PRINTED DATE

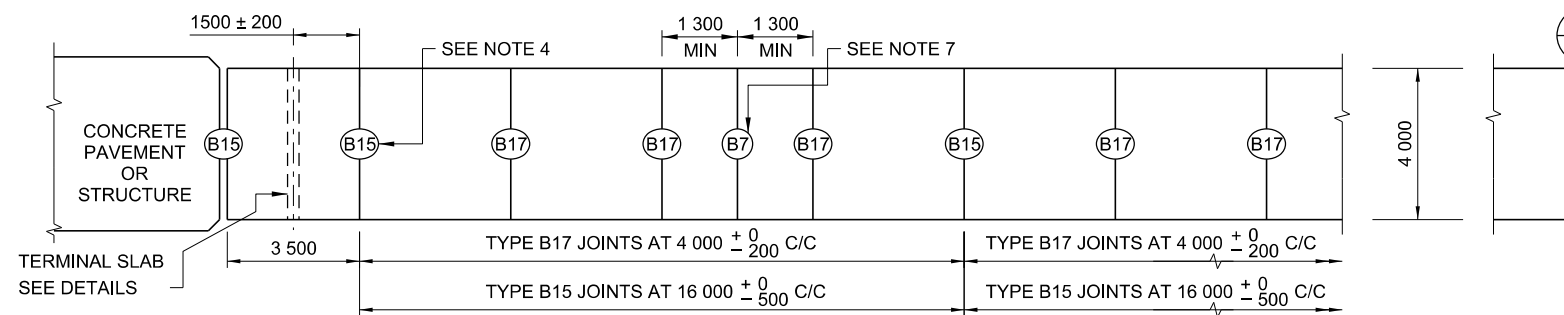
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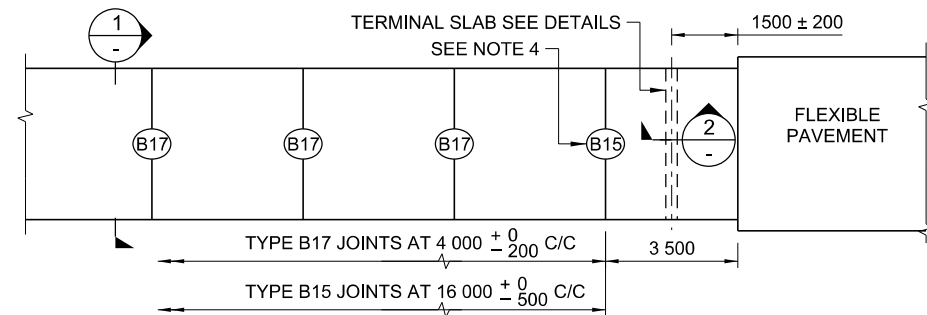
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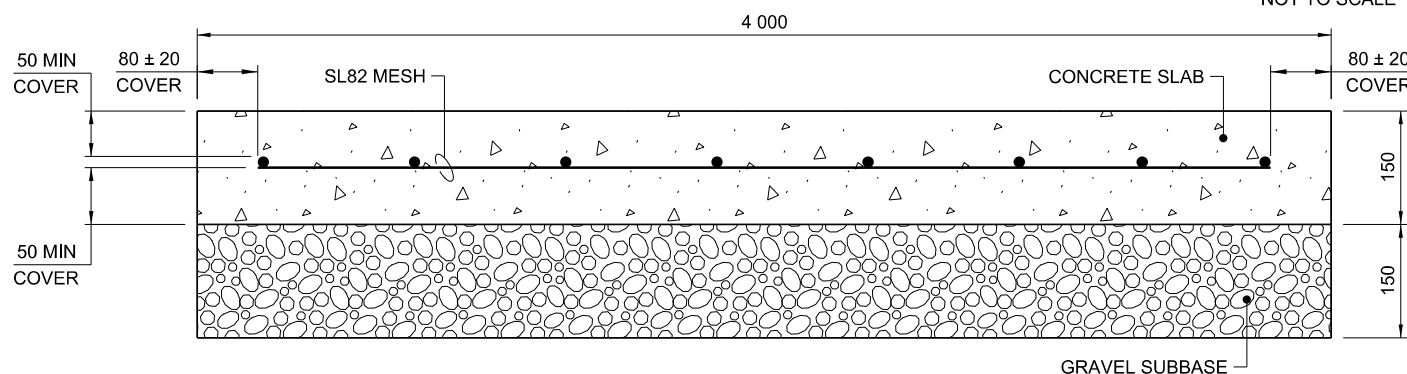
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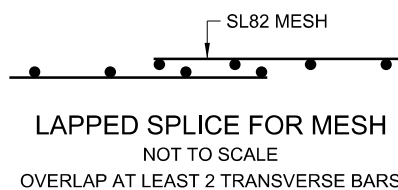
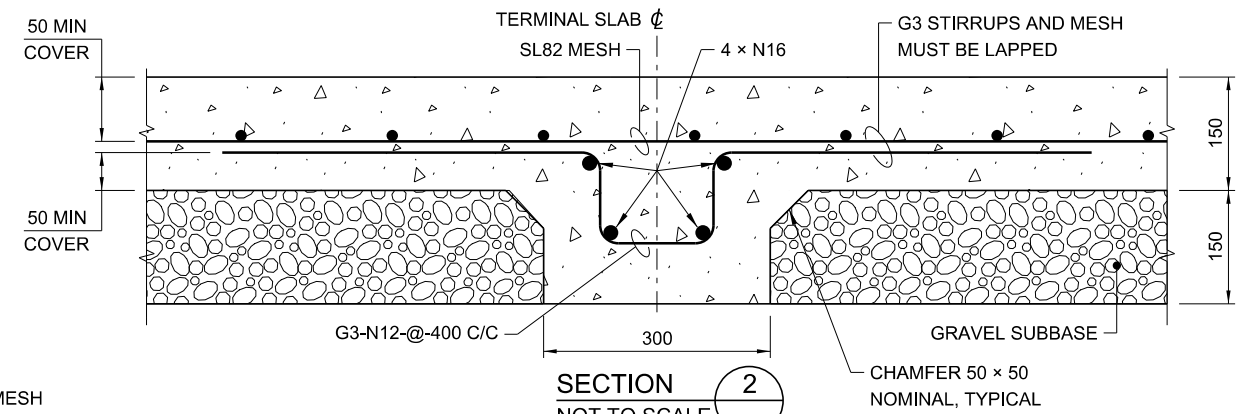
BICYCLE PATH TYPICAL PLAN LAYOUT



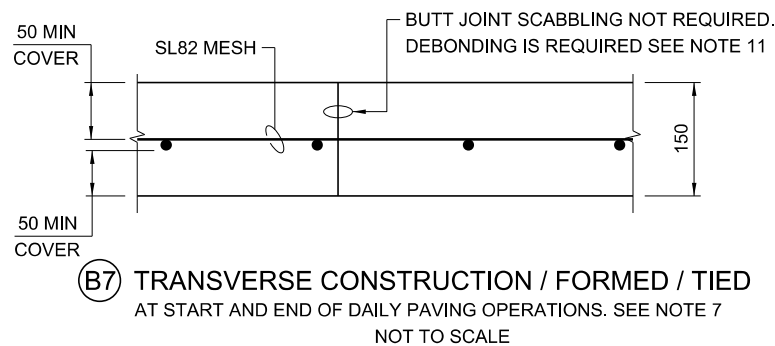
TYPICAL TERMINAL SLAB



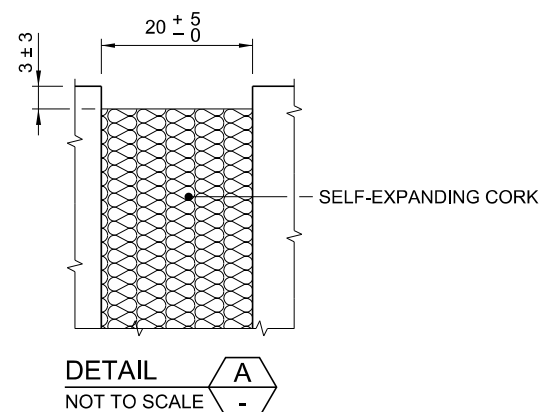
BICYCLE PATH TYPICAL CROSS SECTION



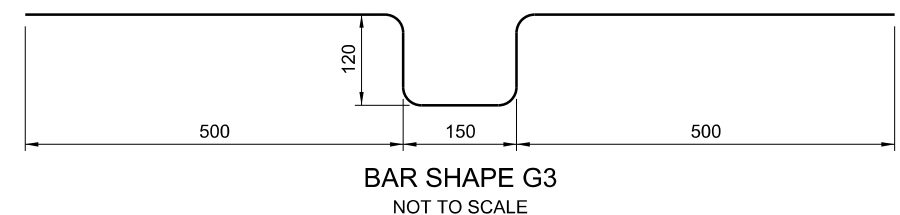
LAPPED SPlice FOR MESH
NOT TO SCALE
OVERLAP AT LEAST 2 TRANSVERSE BARS



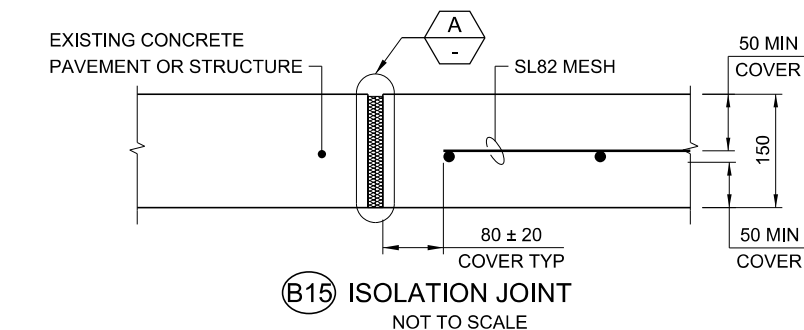
B7 TRANSVERSE CONSTRUCTION / FORMED / TIED
AT START AND END OF DAILY PAVING OPERATIONS. SEE NOTE 7
NOT TO SCALE



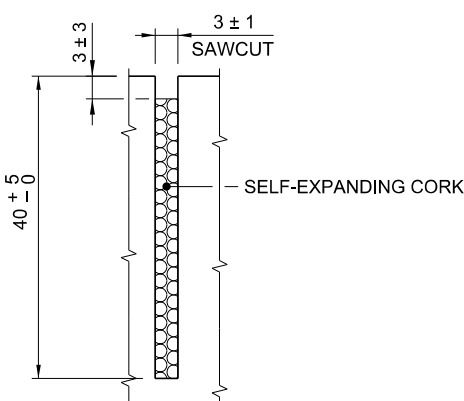
DETAIL A
NOT TO SCALE



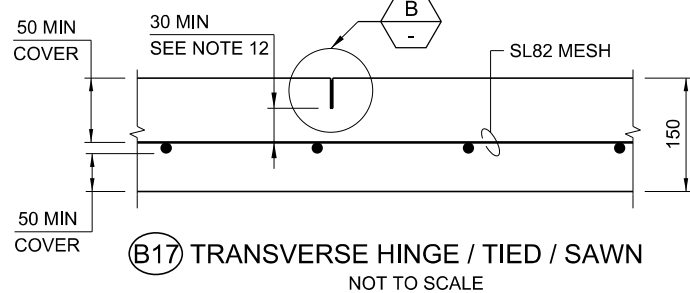
BAR SHAPE G3
NOT TO SCALE



B15 ISOLATION JOINT
NOT TO SCALE



DETAIL B
NOT TO SCALE



B17 TRANSVERSE HINGE / TIED / SAWN
NOT TO SCALE

GENERAL NOTES

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- TRANSVERSE JOINTS MUST BE ALIGNED SQUARE TO THE LONGITUDINAL EDGE, WITH A TOLERANCE OF ± 6°.
- TYPE B15 ISOLATION JOINTS MUST BE PROVIDED AT THE FIRST JOINT AWAY FROM JUNCTIONS WITH FLEXIBLE PAVEMENTS AND STRUCTURES, AND AT INTERMEDIATE CENTRES OF 16.0 m.
- TYPE B15 JOINTS CAN BE CONSTRUCTED AS FORMED JOINTS (BY CHEQUERBOARD PAVING SEQUENCE) OR BY FULL-DEPTH SAWCUT.
- PLACE A FULL-DEPTH TYPE B15 JOINT AROUND ALL ABUTTING STRUCTURES SUCH AS PITS, UTILITY SERVICES, POWER POLES, KERBS.
- THE OPTIONS FOR END-OF-DAY CONSTRUCTION JOINTS ARE AS FOLLOWS:
(I) TYPE B7 JOINTS MAY BE USED. THEY MUST BE LOCATED EITHER MIDWAY BETWEEN B17 JOINTS OR IN LIEU OF A B17 JOINT. THEY MUST NOT BE USED IN LIEU OF A B15 JOINT.
(II) PAVING MAY BE TERMINATED AT A TYPE B15 JOINT.
- COMPLY WITH RMS SPECIFICATIONS R53 AND R173. CONCRETE MUST BE IN ACCORDANCE WITH RMS R53 BUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 32.0 MPa.
- SELF-EXPANDING CORK SEALANTS MUST FILL THE FULL JOINT CAVITY TO PREVENT THE INGRESS OF INCOMPRESSIBLE MATERIALS.
- SUBBASE MUST BE 150 mm THICK TRAFFIC CATEGORY D MATERIAL IN ACCORDANCE WITH RMS SPECIFICATION 3051, COMPACTED IN ACCORDANCE WITH RMS R173. MOISTEN THE SUBBASE WITH WATER BEFORE PLACING THE CONCRETE.
- DEBOND TYPE B7 JOINTS TO PREVENT CHEMICAL BONDING.
- ENSURE REINFORCING STEEL IS PLACED TO PROVIDE 30 mm MINIMUM COVER BELOW THE SAWCUT.

SCALES: NOT TO SCALE, OR AS NOTED.

A3 ORIGINAL

PREPARED BY: PAVEMENT STRUCTURES SECTION, ENGINEERING TECHNOLOGY SERVICES BRANCH, ASSET MAINTENANCE DIVISION

RECOMMENDED FOR APPROVAL
G.AYTON

SIGNED
SUPERVISING PAVEMENT
ENGINEER (RIGID PAVEMENTS)

DATE
8/07/2013

APPROVED FOR USE
G.VOROBIEFF

SIGNED
PRINCIPAL ROAD PAVEMENT
AND GEOTECHNICAL ENGINEER

DATE
9/07/2013



Transport
Roads & Maritime
Services

PAVEMENT STANDARD DRAWINGS
RIGID PAVEMENT
BICYCLE PATH DESIGN - 4 m WIDE
SLAB PLAN AND DETAILS

REGISTRATION No OF PLANS

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3

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3