Cross River Rail Environmental Impact Statement

Request for Project Change 8

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Date: ***August 2020***

Author: ***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

Technical Report: Construction Noise Assessment

1. Introduction

This technical report has been prepared for the CRR project to quantify the potential noise impacts associated with the extended work hours activities currently authorised under the Evaluated Project and to determine if further impacts would occur in the event of a proposed modification to condition 10(d). This assessment also considers potential impacts on road noise as a result of additional construction traffic during these periods, in particular concrete trucks during a long concrete pour. Where new or changed impacts have been identified, the currently approved environmental framework and associated mitigation measures have also been reviewed to determine adequacy. Where required new or modified noise management measures will be proposed.

2. Currently Approved Imposed Condition 10(d)

Condition 10 (d) The following work may be undertaken during Extended Work Hours as set out in Table 1 (despite any separate restrictions on equipment delivery hours listed in Table 1), subject to compliance with a specific Construction Environmental Management Plan sub-plan in accordance with Condition 4:

(i) Project works within a rail corridor

(ii) Project Works within a road reserve or busway that cannot be undertaken reasonably nor practicably during standard hours due to potential disruptions to peak traffic flows or bus operations;

(iii) Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures;

(iv) delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;

(v) Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.

3. Proposed Modified Imposed Condition 10(d)

Condition 10(d) Despite Condition 10(a), the following work (including associated spoil haulage and materials/equipment delivery, and concrete delivery) may be undertaken during the extended work hours in Table 1B, subject to compliance with a specific Construction Environmental Management Plan sub-plan in accordance with Condition 4:

Table 1B. Extended work hours

Description of works	Extended work hours
Project Works within rail corridor land	For the duration of an approved rail possession at all worksites except Clapham Yard. For Clapham Yard - for the duration of an approved rail possession - 80 hours continuous work
Project Works within busway land	During the hours authorised by DTMR for access to the busway for Project Works
Project Works within a road	During the hours authorised by Brisbane City Council or DTMR (as relevant) for access to the road for Project Works

Description of works	Extended work hours
Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures	For transport, during the hours stated in the road access permit Otherwise, 6:30pm - 10:00pm, Monday to Friday

~~(d)~~

~~(i) Project Works within rail corridor land;~~

~~(ii) Project Works within a road reserve or busway that cannot be undertaken reasonably nor practicably during standard hours due to potential disruptions to peak traffic flows or bus operations;~~

~~(iii) Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures;~~

~~(iv) delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;~~

~~(v) Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.~~

(e) The works detailed in 10(d) may also be undertaken outside the hours set out in Table 1A, only where written confirmation has been obtained from the entity with jurisdiction for Condition 10 prior to commencement of the specific works and subject to compliance with an updated and endorsed site-specific Construction Environmental Management Plan sub-plan in accordance with Condition 4.

(f) Blasting must not occur on public holidays, and is only authorised to occur during the hours of 7:30am to 4:30pm Monday to Saturday, and not on Sundays or public holidays.

(g) Prior to blasting events, at least 48 hours' notice must be provided to persons who may be adversely affected.

4. Methodology

Based on the activities identified to be undertaken during the extended work hours, five scenarios were assessed as a preliminary noise screening for the main construction sites at Salisbury, Rocklea, Moorooka, Yeerongpilly, Yeronga, Fairfield Stations, Woolloongabba site, Albert Street site, Roma Street site, Exhibition Station and Mayne Yard/Breakfast Creek. Only three scenarios were assessed for Dutton Park, Southern Portal and Boggo Road Station due to further detailed assessment being completed for the Rail Possession Works within this area, as presented in **Attachment C**.

For each scenario the plant and equipment type, and number required to complete the works, were nominated for the assessment, refer to **Table 1**. Construction noise levels from each of the construction worksites have been predicted using source noise levels from BS5228.1 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise. A range of noise levels is presented for each prediction location, based on the closest point of the construction activity to the sensitive receiver and assuming worst case downwind propagation at the closest point of approach. This gives the worst-case noise level at a receiver.

The assessment considered as a worst-case as it's been assumed all plant will be operating at the same time, with an assumed duration and façade reduction based on building type. An assumption of 7dBA has been assumed for a Queenslander, 15 dBA for commercial buildings and 10 dBA for hi-rise apartments. This is considered as a worst-case and other building types have a greater façade reduction. An allowance for property reflection has also been made for each location.

Noise levels were predicted at the worst-affected location or facade at a building or group of similar receivers. No corrections for screening have been included in predictions, except for cases where existing noise attenuating structures are currently in place, and or an intermediate building blocks the line-of-sight between the construction site and a receiver (e.g. construction noise impacts for residential receivers on the “second row” behind commercial or industrial buildings).

Once the noise levels were predicted for each scenario, they were compared to the noise levels assessed for the previous evaluated project to determine if the impact had changed. If an increase was identified, it was assigned a significance rating on the potential impact to the surrounding environment. This rating was based on Table 2-4 of the Transport Noise Management Code of Practice, Department of Transport Main Roads as a general indicator of significance. Comparison was also then made to the noise goals identified in **Table 2** (below).

Table 1: Nominated Plant and Equipment List

Scenario	Plant and equipment list	Plant and equipment number	Noise power level – SWL LA_{eq} (dBA)
Scenario 1 - Works within the rail corridor - overhead line and signal upgrade work	Excavator (45t)	1	112
	Truck (<20t)	3	90
	Mobile crane (20t)	1	113
	Concrete saw	1	118
	Vac Truck	2	109
	Light vehicle	4	103
	Generator	1	103
Scenario 2 -Works within the rail corridor - construction	Excavator (45t)	1	112
	Truck (<20t)	3	90
	Mobile crane (20t)	1	113
	Concrete saw	1	118
	Vac Truck	2	109
	Light vehicle	4	103
	Generator	1	103
	Bored piling rig	1	114
Scenario 3 - Project works within a road reserve	Concrete Saw	1	118
	Compactor	1	113
	Asphalt truck/sprayer	1	106
	Delivery truck	3	108
	Generator	1	103
	Vibrator Roller	1	109
	Truck <20t	3	90
	Vibroplate	1	101
	Light vehicles	4	103
	Mobile Crane	1	113
	Water cart	1	108
	Roller	1	107
	Grader	1	110

Scenario	Plant and equipment list	Plant and equipment number	Noise power level – SWL LA_{eq} (dBA)
	Backhoe	1	111
	Excavator (45t)	1	112
Scenario 4 - Project works involving the transport, assembly or decommissioning of oversized plant, equipment, components of structures	Delivery truck	1	108
	Mobile crane	1	113
	Generator	1	103
	Power tools (pneumatic)	1	105
	Crane truck	1	108
	Generator	1	103
	Light vehicle	4	103
Scenario 5 - Project works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident	Concrete truck	3	109
	Concrete pump	1	109
	Concrete vibrator	1	103
	Generator	1	103
	Light vehicle	3	103
	Mobile crane	1	113

Table 2: Intermittent Noise Goal - LA_{10} (15 mins)

Location	Type	Time	Intermittent Noise Goal LA_{10} (15 mins) dBA		Building assumption
			Internal	External	
Southern Stations	Residential	Day	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Evening	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Night	42	49	Queenslander with a façade reduction of 7 dBA
Dutton Station	Residential	Day	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Evening	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Night	42	49	Queenslander with a façade reduction of 7 dBA
Southern Portal	Commercial	Day	50	65	Commercial with façade reduction of 15 dBA
	Commercial	Evening	50	65	Commercial with façade reduction of 15 dBA
	Commercial	Night	42	57	Commercial with façade reduction of 15 dBA

Location	Type	Time	Intermittent Noise Goal LA_{10} (15 mins) dBA		Building assumption
			Internal	External	
Boggo Road Station	Residential – High rise	Day	50	60	Residential units with façade reduction of 10 dBA
	Residential – High rise	Evening	50	60	Residential units with façade reduction of 10 dBA
	Residential – High rise	Night	42	52	Residential units with façade reduction of 10 dBA
Woolloongabba	Church	Day	50	65	Assumed façade reduction 15 dBA
	Church	Evening	50	65	Assumed façade reduction 15 dBA
	Church	Night	42	57	Assumed façade reduction 15 dBA
CBD	Residential – High rise	Day	50	65	Assumed façade reduction 15 dBA
	Residential – High rise	Evening	50	65	Assumed façade reduction 15 dBA
	Residential – High rise	Night	42	57	Assumed façade reduction 15 dBA
Exhibition Station	Residential	Day	50	60	Queenslander with a façade reduction of 7 dBA
	Residential	Evening	50	60	Queenslander with a façade reduction of 7 dBA
	Residential	Night	42	52	Queenslander with a façade reduction of 7 dBA
Mayne Yard / Breakfast Creek	Residential	Day	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Evening	50	57	Queenslander with a façade reduction of 7 dBA
	Residential	Night	42	49	Queenslander with a façade reduction of 7 dBA

5. Changes to potential impacts

5.1 Salisbury

Upgrade works at Salisbury Station, as identified in the five scenarios in **Table 3 (Attachment A),** were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Salisbury Station, Scenario 1 and 3 were predicted to generate the highest noise levels of up to 78 dBA. However, these noise levels were still consistent with the level predicted in the previously evaluated project.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 26.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.2 Rocklea

Upgrade works at Rocklea Station, as identified in the five scenarios in **Table 4 (Attachment A),** were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed at the Rocklea Station, the greatest noise impacts were predicted to occur during scenario 3. This activity was predicted to cause an additional 10 dBA above the previously evaluated project resulting in a significant change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 27.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.3 Moorooka

Upgrade works at Moorooka Station, as identified in the five scenarios in **Table 5 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed at the Moorooka Station, the greatest noise impacts were predicted to occur from Scenario 3. This activity was predicted to cause an additional 18.5 dBA above the previously evaluated project resulting in a very significant change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 18.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.4 Yeerongpilly

Upgrade works at Yeerongpilly Station, as identified in the five scenarios in **Table 6 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed at the Yeerongpilly Station, the greatest noise impacts were predicted to occur during Scenario 3. This activity was predicted to cause an additional 7 dBA above the previously evaluated project resulting in a marginal change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 30.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.5 Yeronga

Upgrade works at Yeronga Station, as identified in the five scenarios in **Table 7 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed at the Yeronga Station, the greatest noise impacts were predicted to occur during Scenario 3. This activity was predicted to cause an additional 6 dBA above the previously evaluated project resulting in a marginal change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 52 dBA (ext) there would be a predicted exceedance of up to 24.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.6 Fairfield

Upgrade works at Fairfield Station, as identified in the five scenarios in **Table 8 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Fairfield Station, the greatest noise impacts were predicted to occur during Scenario 3. This activity was predicted to cause an additional 5 dBA above the previously evaluated project resulting in a marginal change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 33.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.7 Dutton Park Station

Upgrade works at Dutton Park, as identified in the three scenarios in **Table 9 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for scenarios 3, 4 and 5 to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact. Scenarios 1

and 2 were not completed as of these screening assessment as they formed part of the detailed assessment presented in Attachment C of this report.

From the three scenarios assessed for the Dutton Station, the greatest noise impacts were predicted to occur during Scenario 3. This activity was predicted to cause an additional 4 dBA above the previously evaluated project resulting in a marginal change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 24.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.8 Southern Portal

Upgrade works at the Southern Portal, as identified in the three scenarios in **Table 10 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for scenarios 3, 4 and 5 to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact. Scenarios 1 and 2 were not completed as of these screening assessment as they formed part of the detailed assessment presented in Attachment C of this report.

From the three scenarios assessed for the Southern Portal, the greatest noise impacts were predicted to occur during Scenario 3. Scenario 3 was predicted to generate the highest noise level of 80 dBA. However, this noise level was still consistent with the level predicted in the previously evaluated project.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 57 dBA (ext) there would be a predicted exceedance of up to 20.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.9 Boggo Road Station

Upgrade works on Annerley Road as part of the Boggo Road Station works, as identified in the three scenarios in **Table 11 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for scenarios 3, 4 and 5 to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact. Scenarios 1 and 2 were not completed as of these screening assessment as they formed part of the detailed assessment presented in Attachment C of this report.

From the three scenarios assessed for the Boggo Road Station works, the greatest noise impacts generated from Scenario 3. Predicted noise levels increased an additional 17 dBA above the noise levels assessed as part of the previous evaluated project. This increase could lead to very significant change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 52 dBA (ext) there would be a predicted exceedance of up to 35.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This increase would also exceed the nominated goal + 20 dBA which triggers the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs).

Additional detailed noise assessment and planning would also have to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.10 Woolloongabba

Upgrade works at Woolloongabba Station, as nominated in the five scenarios in **Table 12 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Woolloongabba Station, the greatest noise impacts were generated from Scenario 3. Predicted noise levels increased an additional 15 dBA above the levels assessed as part of the previous evaluated project leading to a very significant change to the surrounding environment.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 57 dBA (ext) there would be a predicted exceedance of up to 14.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.11 Albert Street

Upgrade works at Albert Street, as identified in the five scenarios in **Table 13 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Albert Street works, the greatest noise impacts were associated with Scenario 3 with a predicted increase of 5 dBA above the previously evaluated project. This would equate to a marginal increase to the surrounding environment. If these works were to be undertaken during the night-time and compared to a night-time goal of 57 dBA (ext) there would be a predicted exceedance of up to 30.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would exceed the nominated noise goal + 20 dBA which would trigger the management requirements as outlined in Imposed Condition 11(c) relating to Directly Affected Persons (DAPs). To further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements

5.12 Roma Street

Upgrade works at Roma Street, as identified in the five scenarios in **Table 14 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Albert Street works, the greatest noise impacts were associated with Scenario 3 with a predicted increase of 13 dBA above the previously evaluated project. This would equate to a significant increase to the surrounding environment. As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 57 dBA (ext) there would be a predicted exceedance of up to 18 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.13 Exhibition Station

Upgrade works at Exhibition Station, as identified in the five scenarios in **Table 15 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Albert Street works, the greatest noise impacts were associated with Scenario 3 with a predicted increase of 16 dBA above the previously evaluated project. This would equate to a very significant increase to the surrounding environment. As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 57 dBA (ext) there would be a predicted exceedance of up to 18.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.14 Mayne Yard / Breakfast Creek

Upgrade works at Mayne Yard/Breakfast Creek, as identified in the five scenarios in **Table 16 (Attachment A)**, were nominated in the Request for Project Change four (RfPC-4) as 'Extended Works'. Screening assessments were completed for each scenario to identify the potential noise impacts at the closest sensitive receptor. These impacts were then compared against the calculated external noise criteria of the previously evaluated project to determine the potential change in impact.

From the five scenarios assessed for the Albert Street works, the greatest noise impacts were associated with Scenario 3. However, all scenarios were consistent with the noise levels from the previously evaluated project.

As a worst-case, if these works were to be undertaken during the night-time and compared to a night-time goal of 49 dBA (ext) there would be a predicted exceedance of up to 16.5 dBA. The prediction also accommodates reflection off the building of 2.5 dBA.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning would need to be completed prior to these works commencing. Refer to section 6 below for additional environmental management requirements.

5.15 Road Traffic Noise Impacts

To understand the potential traffic noise impacts as a result of concrete pours occurring during the 'Extended Working' hours, an actual extended concrete pour which had been completed at the Woolloongabba Site was assessed. This assessment considered the existing traffic counts on the local roads, refer to **Table 17** below, and the number of additional concrete trucks predicted to be on the local road as a result of these works.

Table 17: Existing Traffic Counts for the Woolloongabba Area

Day	Time	Number of vehicles
Mid-week (peak)	7:00am - 9:00am	1772
Saturday	9:30am – 11:00am	2076
Saturday	11:30am – 1:30pm	2372
Saturday	1:30pm - 3:30pm	2603

The extended concrete pour at the Woolloongabba site included a total volume of 240 m^3 of concrete. Assuming a single concrete truck carried 7 m^3, it was calculated that a total of 35 trucks were required to complete the pour. To ensure there was adequate time at the site for the construction activities to be completed a total of four trucks per hour were delivered to the site with the total pour taking 9 hours.

To understand the potential impacts of this activity on the local road network noise levels taking into account the existing vehicle numbers presented in **Table 17**, a comparison was completed of the previous Request Project Change (RfPC-4) change which requested a change in peak traffic movements (loads/hour) from 11 trucks per hour to 23 trucks/hour. This increase of 12 trucks/hour only resulted in an increased noise level of 0.5 dBA to the overall traffic noise levels on the surrounding streets. Based on the significance of change nominated in **Table 18** below, an increase of <3 dBA is considered insignificant. In order for a 3 dBA change in noise level to occur, the overall traffic volume must double.

Table 18 - Significance of environmental noise exposure changes

Increase over existing noise level dBA	Change in subjective loudness	Significance of change
<3	Nil	Insignificant
3-5	Noticeable	Marginal
10	About Double	Significant
15 or more	At Least Triple	Very Significant

Source: Table 2-4 of the Transport Noise Management Code of Practice, Department of Transport Main Roads

A change in noise level of 1 to 2 dBA is difficult for most people to detect. A 3 to 5 dBA change corresponds to a small but noticeable change in loudness when noise samples are presented without a significant time break between them.

6. Environmental Management Framework

The Cross River Rail (CRR) Project currently has a Construction Environmental Management Plan (CEMP) that has been endorsed by the Independent Environmental Monitor as being consistent with the approved CRR Outline Environmental Management Plan (OEMP).

Within the CEMP, a Noise and Vibration Management subplan has also been developed and endorsed which manages noise and vibration issues relating to the project. An additional construction document prepared by the contractor also includes a Construction Area Plan which is prepared prior to works commencing and captures further detailed planning (i.e. plant selection, number refinement and detailed noise assessment).

Once construction commences and in response to modelling output, a validation monitoring program is implemented for each work activity. This program is implemented to ensure the nominated

mitigation measures are adequate and to identify measures that may need to be adjusted to ensure compliance.

A Directly Affect Person (DAP) process is also currently conditioned under the Imposed Conditions. This DAP process is based on the predictive modelling and monitoring undertaken prior to and during works. Where a DAP has been identified, consultation is required to be undertaken to determine suitable mitigation management measures. This process is overseen by the project's nominated Community Relations Monitor (CRM) which has been engaged by project.

In additional to the environmental framework, there is also a requirement to obtain other relevant permits issued by Brisbane City Council (BCC), Department of Transport and Main Roads (DTMR) or other agencies for the transport on or occupation of roads/busways for the transport, assembly or decommissioning of oversized plant, equipment, components, structures or transport of hazardous materials.

7. Conclusion

Following assessment of the potential noise impacts associated with up to five scenarios relating to extended work hours, it was determined the potential noise levels increased at eleven locations along the project alignment compared to the previously evaluated project. These increases were largely related to scenario 3 which included works within the road reserve at night. Even with these increases, it was considered the current Imposed Conditions and currently endorsed Environmental Management Framework was adequate to manage any potential noise impacts resulting from these activities. This assessment also demonstrated the potential noise impacts on local roads associated with extended concrete pours are considered insignificant with an additional noise increase of less than 3 dBA. Additional impacts will be further managed through the permit process to be implemented by BCC and DTMR.

As the proposed modification to Imposed Condition 10(d) still requires compliance with the specific environmental management framework, it is considered this modification will still ensure adequate management for the surrounding environment and sensitive receptors compared to the currently evaluated project.

Attachment A: Noise Assessment and Predicted Impacts (Tables)

Table 3: Salisbury Station Noise Assessment and Predicted Impacts

Sensitive receptor type[1]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (single storey)	65m – Fairlie Terrace	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	78	68.5	Station construction: 58 - 73 Piling works: 73 - 80	Within predicted range	Nil
Residential - House (single storey)	65m – Fairlie Terrace	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	75	65.5	Station construction: 58 - 73 Piling works: 73 - 80	Within predicted range	Nil
Residential - House (single storey)	65m – Fairlie Terrace	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	78	68.5	Station construction: 58 - 73 Piling works: 73 - 80	Within predicted range	Nil
Residential - House (single storey)	65m – Fairlie Terrace	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	70	60.5	Station construction: 58 - 73 Piling works: 73 - 80	Within predicted range	Nil

[1] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Sensitive receptor type[1]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (single storey)	65m – Fairlie Terrace	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	71	61.5	Station construction: 58 - 73 Piling works: 73 - 80	Within predicted range	Nil

Table 4: Rocklea Station Noise Assessment and Predicted Impacts

Sensitive receptor type[2]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (2 Storey)	58m – Brooke Street	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	76	66.5	57 - 69	+7	Marginal
Residential - House (2 Storey)	58m – Brooke Street	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	76	66.5	57 - 69	+7	Marginal
Residential - House (2 Storey)	58m – Brooke Street	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	79	69.5	57 - 69	+10	Significant
Residential - House (2 Storey)	58m – Brooke Street	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	71	61.5	57 - 69	+2	Insignificant
Residential - House (2 Storey)	58m – Brooke Street	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	76	63.5	57 - 69	+7	Marginal

[2] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Table 5: Moorooka Station Noise Assessment and Predicted Impacts

Sensitive receptor type[3]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Commercial Residential - House (2 Storey)	150m - Blackburn Street	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	66	56.5	40 - 52	+14	Significant
Commercial Residential - House (2 Storey)	150m - Blackburn Street	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	66	56.5	40 - 52	+14	Significant
Commercial Residential - House (2 Storey)	150m - Blackburn Street	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	70	60.5	40 - 52	+18.5	Very Significant
Commercial Residential – House (2 Storey)	150m - Blackburn Street	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	61	51.5	40 - 52	+9	Marginal
Commercial Residential - House (2 Storey)	150m - Blackburn Street	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	63	53.5	40 - 52	+11	Significant

[3] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection for Residential (House)

Table 6: Yeerongpilly Station Noise Assessment and Predicted Impacts

Sensitive receptor type[4]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential – Units (2 storey)	40m – Wilkie Street	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	79	69.5	55 - 75	+4	Marginal
Residential – Units (2 storey)	40m – Wilkie Street	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	80	70.5	55 - 75	+5	Marginal
Residential – Units (2 storey)	40m – Wilkie Street	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	82	72.5	55 - 75	+7	Marginal
Residential – Units (2 storey)	40m – Wilkie Street	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	75	65.5	55 - 75	Within predicted range	Nil
Residential – Units (2 storey)	40m – Wilkie Street	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	76	66.5	55 - 75	+1	Insignificant

[4] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Table 7: Yeronga Station Noise Assessment and Predicted Impacts

Sensitive receptor type[5]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (single storey)	58m - Cowper Street	Scenario 1	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	76	66.5	Station construction: 55 – 65 Piling works: 70 - 73	+3	Insignificant
Residential - House (single storey)	58m - Cowper Street	Scenario 2	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	76	66.5	Station construction: 55 – 65 Piling works: 70 - 73	+3	Insignificant
Residential - House (single storey)	58m - Cowper Street	Scenario 3	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	79	69.5	Station construction: 55 – 65 Piling works: 70 - 73	+6	Marginal
Residential - House (single storey)	58m - Cowper Street	Scenario 4	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	71	61.5	Station construction: 55 – 65 Piling works: 70 - 73	Within predicted range	Nil

[5] Assumed façade reduction 10 dBA, plus 2.5 dBA facade reflection

Sensitive receptor type[5]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (single storey)	58m - Cowper Street	Scenario 5	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	73	63.5	Station construction: 55 – 65 Piling works: 70 - 73	Within predicted range	Nil

Table 8: Fairfield Station Noise Assessment and Predicted Impacts

Sensitive receptor type[6]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (2 Storey)	30m - Mildmay Street	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	82	72.5	Station construction: 58 – 73 Piling works: 73 - 80	+2	Insignificant
Residential - House (2 Storey)	30m - Mildmay Street	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	82	72.5	Station construction: 58 – 73 Piling works: 73 - 80	+2	Insignificant
Residential - House (2 Storey)	30m - Mildmay Street	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	85	75.5	Station construction: 58 – 73 Piling works: 73 - 80	+5	Marginal
Residential - House (2 Storey)	30m - Mildmay Street	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	77	67.5	Station construction: 58 – 73 Piling works: 73 - 80	Within predicted range	Nil

[6] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Sensitive receptor type[6]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (2 Storey)	30m - Mildmay Street	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	79	69.5	Station construction: 58 – 73 Piling works: 73 - 80	Within predicted range	Nil

Table 9: Dutton Park Station Noise Assessment and Predicted Impacts

Sensitive receptor type[7]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - House (1 Storey)	75m - Rusk Street and Cornwall Street	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	76	66.5	Demolition of Dutton Park Station: 66 - 72	+4	Marginal
Residential - House (1 Storey)	75m - Rusk Street and Cornwall Street	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	69	59.5	Demolition of Dutton Park Station: 66 - 72	Within predicted range	Nil
Residential - House (1 Storey)	75m - Rusk Street and Cornwall Street	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	70	60.5	Demolition of Dutton Park Station: 66 - 72	Within predicted range	Nil

[7] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Table 10: Southern Portal Noise Assessment and Predicted Impacts

Sensitive receptor type[8]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Commercial	50m - Translational Research Institute (TRI)	Scenario 3	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	80	62.5	Site establishment and removal of existing rail infrastructure: 46 - 80	Within predicted range	Nil
Commercial	50m - Translational Research Institute (TRI)	Scenario 4	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	73	55.5	Site establishment and removal of existing rail infrastructure: 46 - 80	Within predicted range	Nil
Commercial	50m - Translational Research Institute (TRI)	Scenario 5	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	74	56.5	Site establishment and removal of existing rail infrastructure: 46 - 80	Within predicted range	Nil

[8] Assumed façade reduction 15 dBA, plus 2.5 dBA facade reflection

Table 11: Boggo Road Station Noise Assessment and Predicted Impacts

Sensitive receptor type[9]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential - Hi Rise	20m - Peter Doherty Street residents	Scenario 3	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	90	77.5	Annerley Rd Works: 69 - 73	+17	Very Significant
Residential - Hi Rise	20m - Peter Doherty Street residents	Scenario 4	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	82	69.5	Annerley Rd Works: 69 - 73	+9	Significant
Residential – Hi Rise	20m - Peter Doherty Street residents	Scenario 5	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	84	71.5	Annerley Rd Works: 69 - 73	+11	Significant

[9] Assumed façade reduction 10 dBA, plus 2.5 dBA facade reflection

Table 12: Woolloongabba Noise Assessment and Predicted Impacts

Sensitive receptor type[10]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Place of worship	95m - St Nicholas Russian Orthodox Cathedral	Scenario 1	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	61	48.5	46 - 59	+2	Insignificant
Place of worship	95m - St Nicholas Russian Orthodox Cathedral	Scenario 2	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	72	59.5	46 - 59	+13	Significant
Place of worship	95m - St Nicholas Russian Orthodox Cathedral	Scenario 3	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	74	61.5	46 - 59	+15	Very Significant
Place of worship	95m - St Nicholas Russian Orthodox Cathedral	Scenario 4	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	67	54.5	46 - 59	+8	Marginal
Place of worship	95m - St Nicholas Russian	Scenario 5	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	68	55.5	46 - 59	+9	Marginal

[10] Assumed façade reduction 15 dBA, plus 2.5 dBA facade reflection and noise barrier in place between works and sensitive receptor

Sensitive receptor type[10]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
	Orthodox Cathedral									

Table 13: Albert Street Noise Assessment and Predicted Impacts

Sensitive receptor type[11]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential	20m - Sebel Apartments	Scenario 1	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	77	59.5	80 - 85	Within predicted range	Nil
Residential	20m - Sebel Apartments	Scenario 2	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	77	59.5	80 - 85	Within predicted range	Nil
Residential	20m - Sebel Apartments	Scenario 3	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	90	72.5	80 - 85	+5	Marginal
Residential	20m - Sebel Apartments	Scenario 4	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	72	54.5	80 - 85	-8	Improvement
Residential	20m - Sebel Apartments	Scenario 5	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	74	56.5	80 - 85	-6	Improvement

[11] Assumed façade reduction 15 dBA, plus 2.5 dBA facade reflection and a full acoustic enclosure is currently in place. All materials will be delivered within this enclosure.

Table 14: Roma Street Noise Assessment and Predicted Impacts

Sensitive receptor type[12]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential	80m - Parkland Blvd	Scenario 1	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	73	55.5	53 - 63	+10	Significant
Residential	80m - Parkland Blvd	Scenario 2	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	73	55.5	53 - 63	+10	Significant
Residential	90m - Roma Street	Scenario 3	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	75	57.5	53 - 63	+13	Significant
Residential	90m - Roma Street	Scenario 4	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	57	39.5	53 - 63	Within predicted range	Nil
Residential	100m - Roma Street	Scenario 5	50 (int) 65 (ext)	50 (int) 65 (ext)	42 (int) 57 (ext)	58	40.5	53 - 63	Within predicted range	Nil

[12] Assumed façade reduction 15 dBA, plus 2.5 dBA facade reflection and works will be undertaken within a full acoustic enclosure.

Table 15: Exhibition Station Noise Assessment and Predicted Impacts

Sensitive receptor type[13]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential Apartments	60m - Tufton Street	Scenario 1	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	75	62.5	55 - 62	+13	Significant
Residential Apartments	60m - Tufton Street	Scenario 2	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	76	63.5	55 - 62	+14	Significant
Residential Apartments	60m - Tufton Street	Scenario 3	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	78	65.5	55 - 62	+16	Very Significant
Residential Apartments	60m - Tufton Street	Scenario 4	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	71	58.5	55 - 62	+9	Marginal
Residential Apartments	60m - Tufton Street	Scenario 5	50 (int) 60 (ext)	50 (int) 60 (ext)	42 (int) 52 (ext)	72	59.5	55 - 62	+10	Significant

[13] Assumed façade reduction 10 dBA, plus 2.5 dBA facade reflection

Table 16: Mayne Yard / Breakfast Creek Noise Assessment and Predicted Impacts

Sensitive receptor type[14]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA_{10} dBA) (internal & external)			Predicted noise level (dBA) - worst case		Evaluated project assessment (dBA) (External)	Comparison to Evaluated Project (+/- dBA)	Significance of Change
			Residential day	Residential evening	Residential night	External	Internal			
Residential (2 storey)	160m - Grafton Road	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	65	55.5	56 - 76	Within predicted range	Nil
Residential (2 storey)	160m - Grafton Road	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	66	56.5	56 - 76	Within predicted range	Nil
Residential (2 storey)	160m - Grafton Road	Scenario 3	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	68	58.5	56 - 76	Within predicted range	Nil
Residential (2 storey)	160m - Grafton Road	Scenario 4	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	61	51.5	56 - 76	Within predicted range	Nil
Residential (2 storey)	160m - Grafton Road	Scenario 5	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	62	52.5	56 - 76	Within predicted range	Nil

[14] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection

Attachment B: Technical Report - Traffic and Transport

CBGU D&C JV

Traffic Impact Assessment
Southern Portal

Cross River Rail Project – Tunnel, Stations and Development Package (TSD)

Table of Contents

Table of Tables

Table of Figures

1 Introduction

1.1 Background

This Traffic Impact Assessment has been prepared in accordance with the Department of Transport and Main Road's, *Guide to Traffic Impact Assessment* to assess the potential changes to traffic and transport impacts arising from the Request for Project Change #8 (RfPC#8) to the Southern Portal worksite in comparison to the Evaluated Project.

Key traffic and transport aspects of the RfPC#8 relate to the proposal for construction heavy vehicles to access the Southern Portal worksite via Kent Street, where the use of Kent Street was previously approved only for the use of light vehicles.

The location of the Southern Portal worksite is shown below in Figure 1.

Figure 1: Locality Map

2 Existing Conditions

2.1 Surrounding Road Network

Details of the surrounding road network are shown in Table 1.

Table 1: Surrounding Road Network

Road Name	Jurisdiction	Hierarchy	Cross-Section	Speed Limit
Annerley Road	Brisbane City Council	Arterial road	4-5 lanes divided	60km/hr
Cornwall Street	Brisbane City Council	Suburban road	2 lanes undivided	60km/hr
Kent Street	Council / private road	Neighbourhood road	2 lanes undivided	50km/hr

Table 2 provides an overview of the key intersections in proximate to the Southern Portal worksite considered to be within the area of influence.

Table 2: Key Intersections

Intersection Number	Intersection	Jurisdiction	Control
1	Annerley Road / Cornwall Street / Noble Street / Railway Terrace	Brisbane City Council	Traffic signals
2	Annerley Road / Cornwall Street	Brisbane City Council	Priority controlled
3	Cornwall Street / Kent Street	Brisbane City Council	Priority controlled

Figure 2: Key Intersections

2.2 Background Traffic

2.2.1 Traffic Surveys

Background traffic volumes were obtained from 24-hour traffic surveys undertaken on Thursday 18th June 2020 and Saturday 20th June 2020 for the following intersections:

- Annerley Road / Cornwall Street / Noble Street / Railway Terrace
- Annerley Road / Cornwall Street
- Annerley Road / Kent Street.

A copy of the traffic survey data is provided in Appendix A.

The weekday AM and PM peak periods for the three intersection was determined to be between 7:30am – 8:30am and 3:00pm – 4:00pm. Weekday peak hour volumes are presented in the figures below.

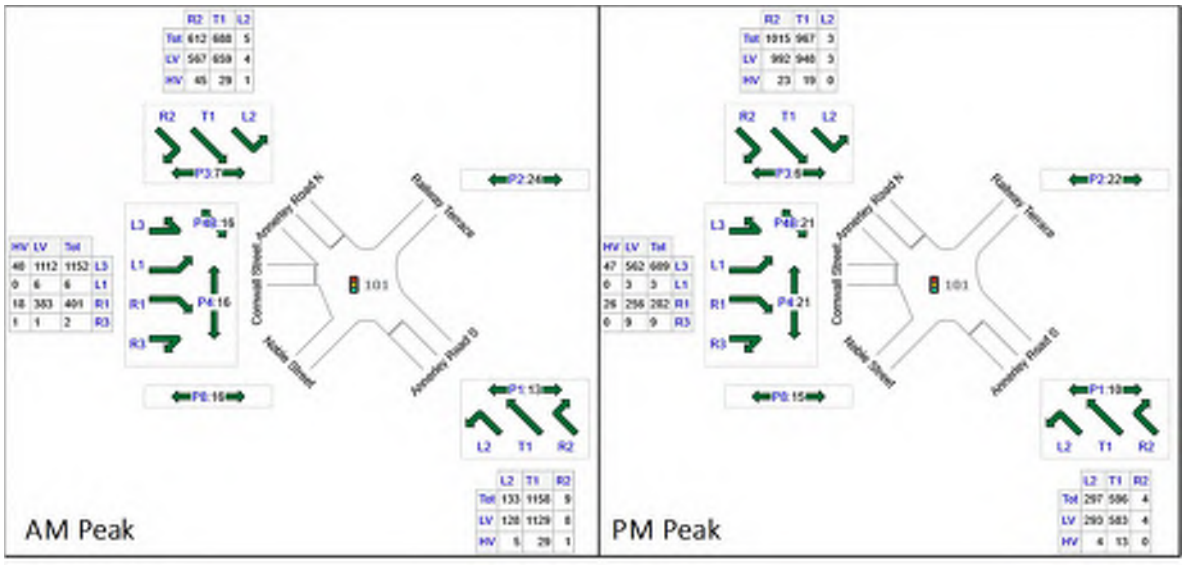


Figure 3: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Weekday Peak Traffic Volumes

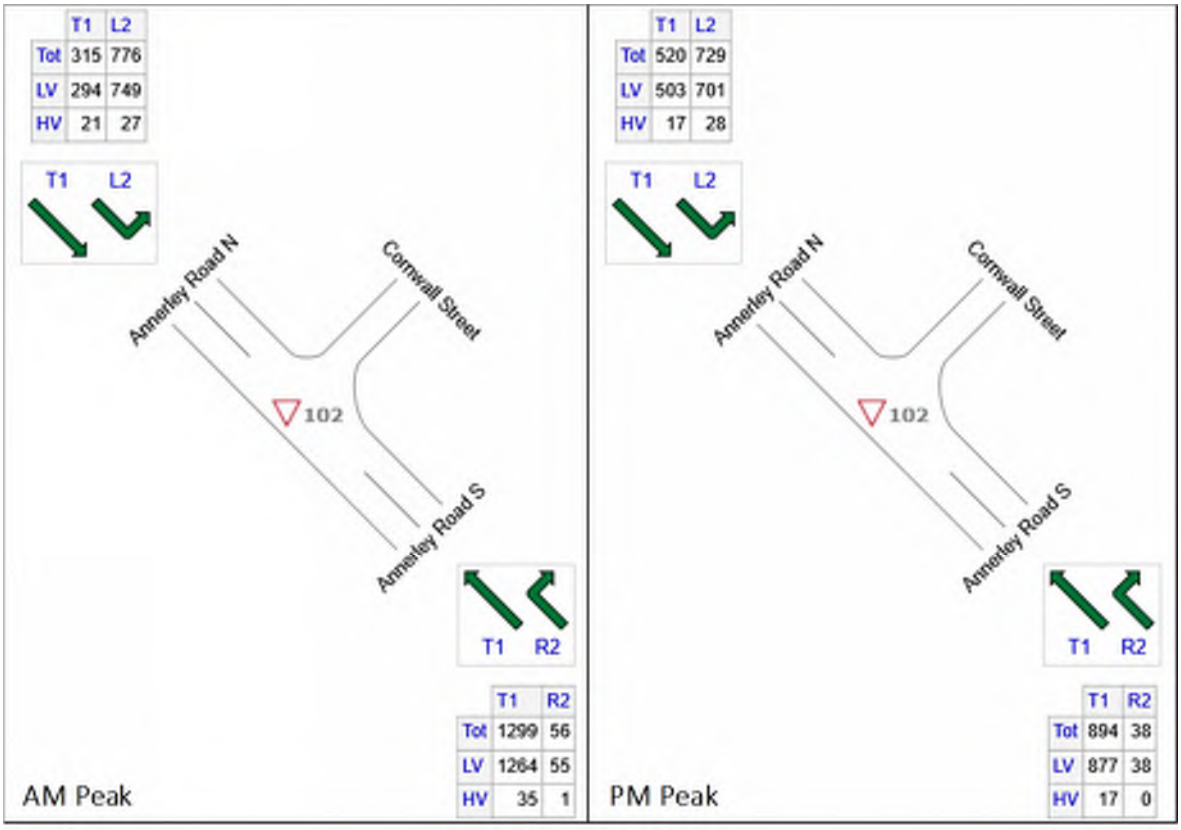


Figure 4: Annerley Road / Cornwall Street – Weekday Peak Traffic Volumes

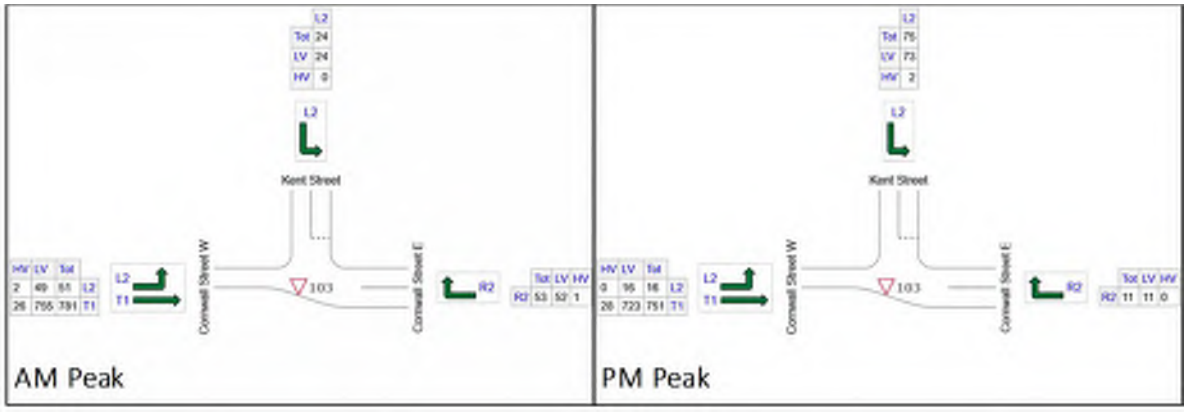


Figure 5: Cornwall Street / Kent Street – Weekday Peak Traffic Volumes

The weekend peak hour for the three intersection was determined to be between 10:15am – 11:15am. Peak hour volumes are presented in the figures below.

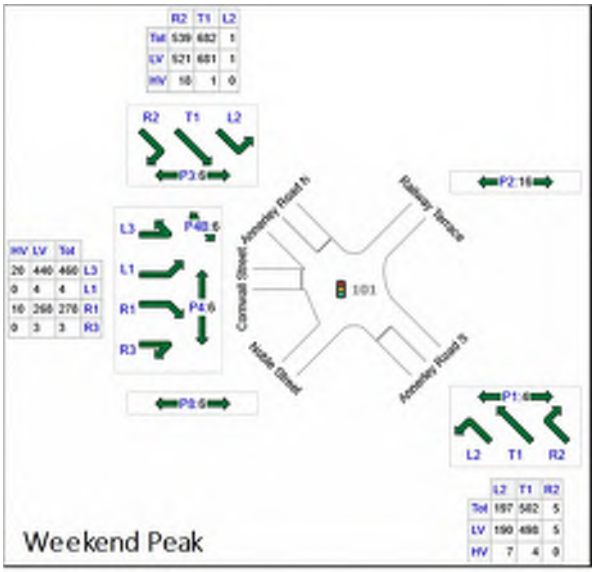


Figure 6: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Weekend Peak Traffic Volumes

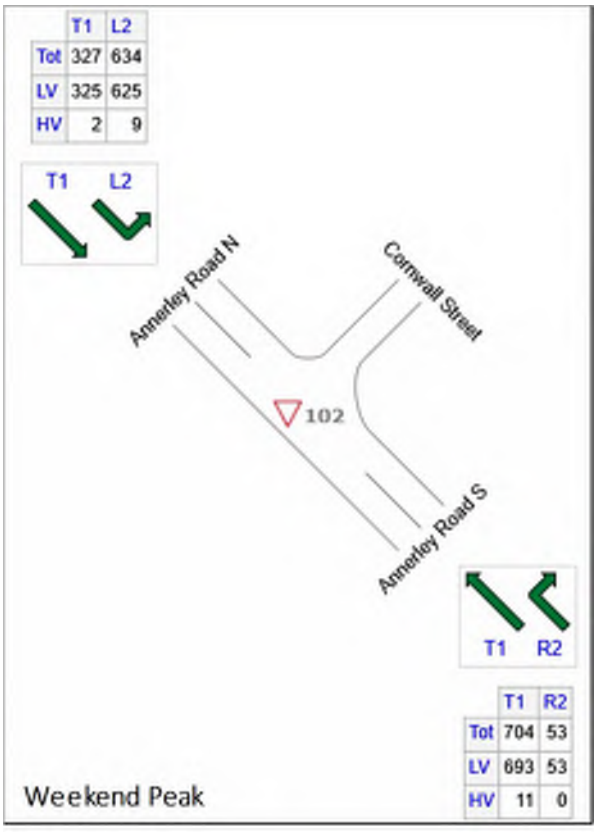


Figure 7: Annerley Road / Cornwall Street – Weekend Peak Traffic Volumes

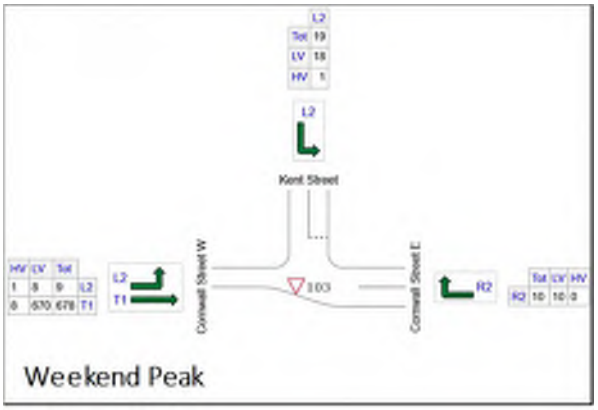


Figure 8: Cornwall Street / Kent Street – Weekend Peak Traffic Volumes

2.2.2 Seasonal Variations

Brisbane City Council were consulted regarding the variations of traffic volumes of the surveyed key intersections due to the ongoing effect of COVID-19. In an email received on the 24th June 2020, Brisbane City Council advised that a factor of an additional 10% should be applied to recorded traffic volumes in order to represent 'normal traffic conditions'.

Adjusted traffic volumes incorporating this factor at key intersections are presented below.

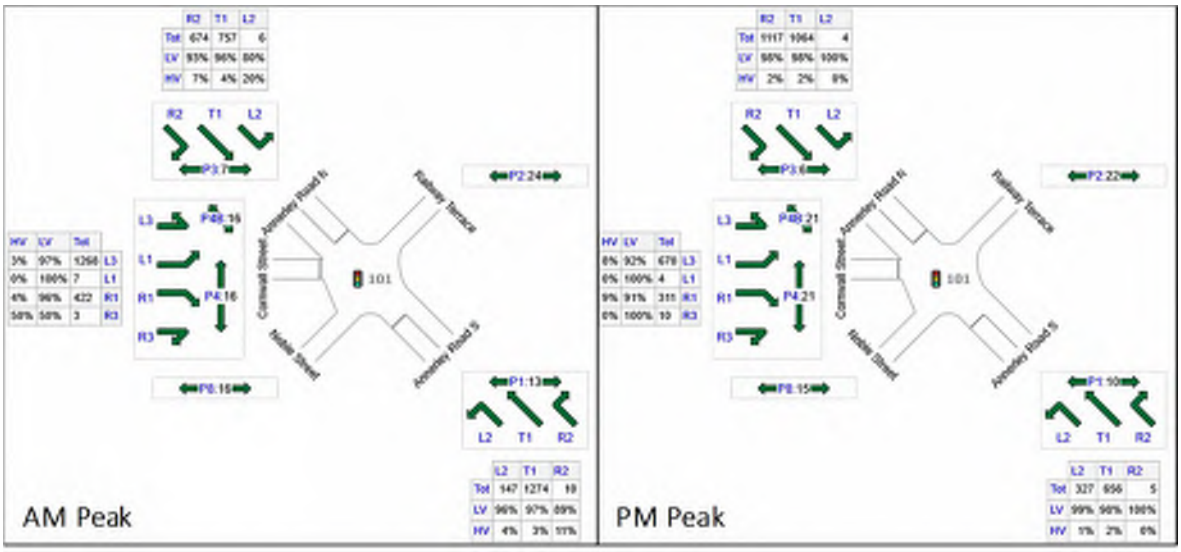


Figure 9: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Adjusted Weekday Peak Traffic Volumes

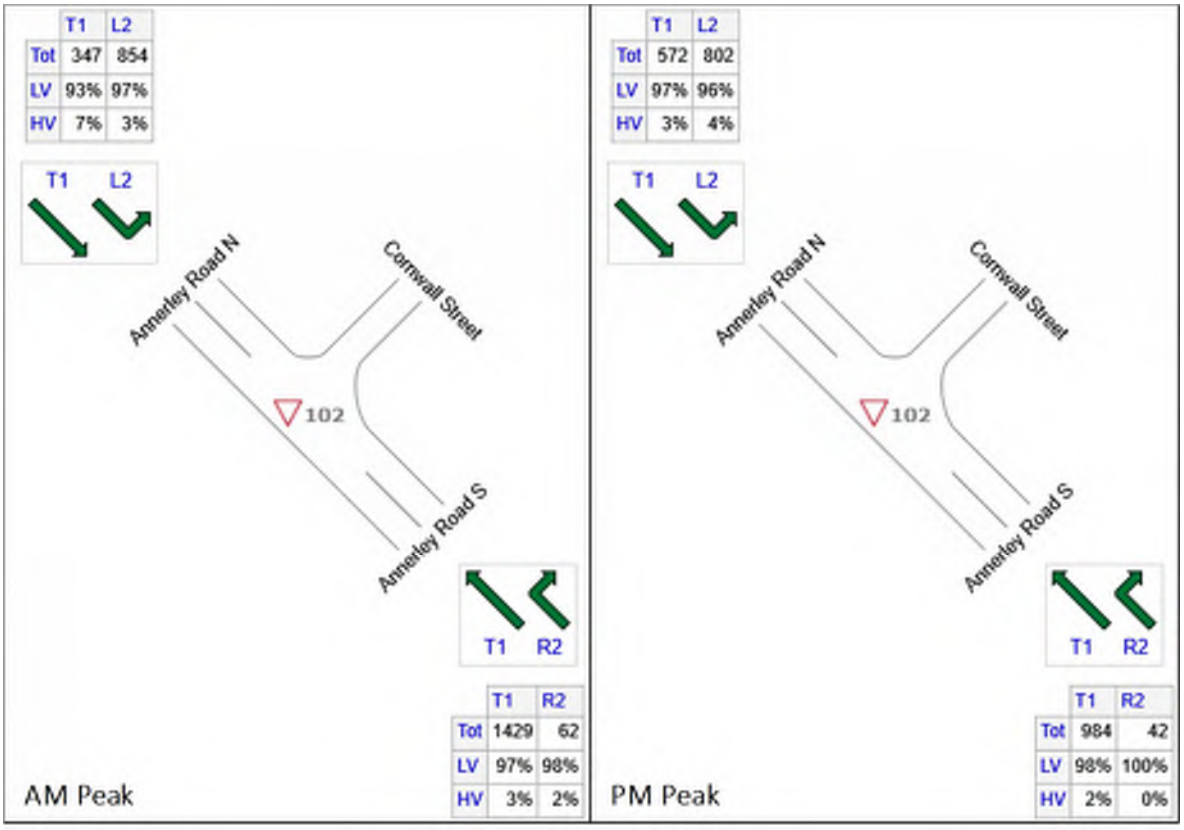


Figure 10: Annerley Road / Cornwall Street – Adjusted Weekday Peak Traffic Volumes

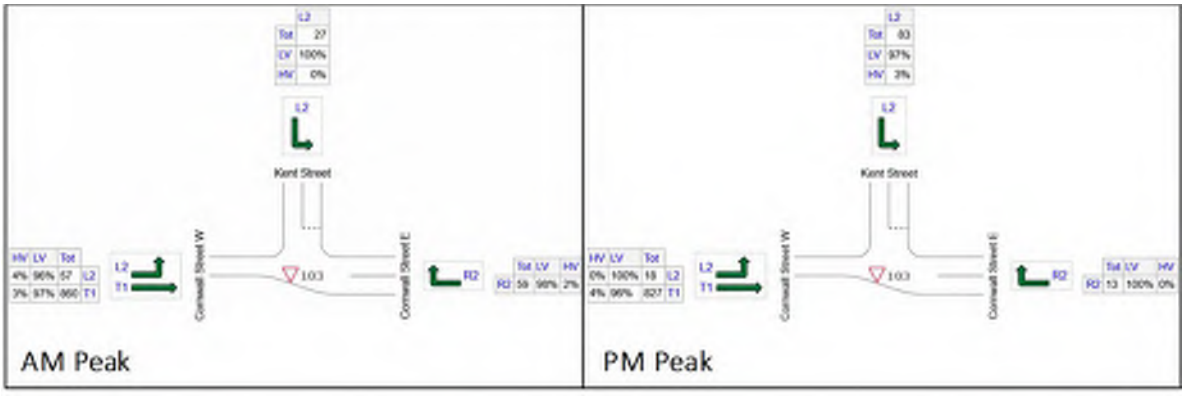


Figure 11: Cornwall Street / Kent Street – Adjusted Weekday Peak Traffic Volumes

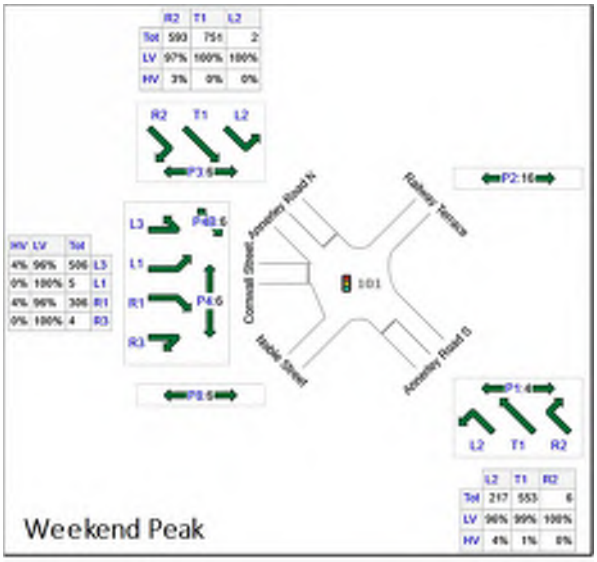


Figure 12: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Adjusted Weekend Peak Traffic Volumes

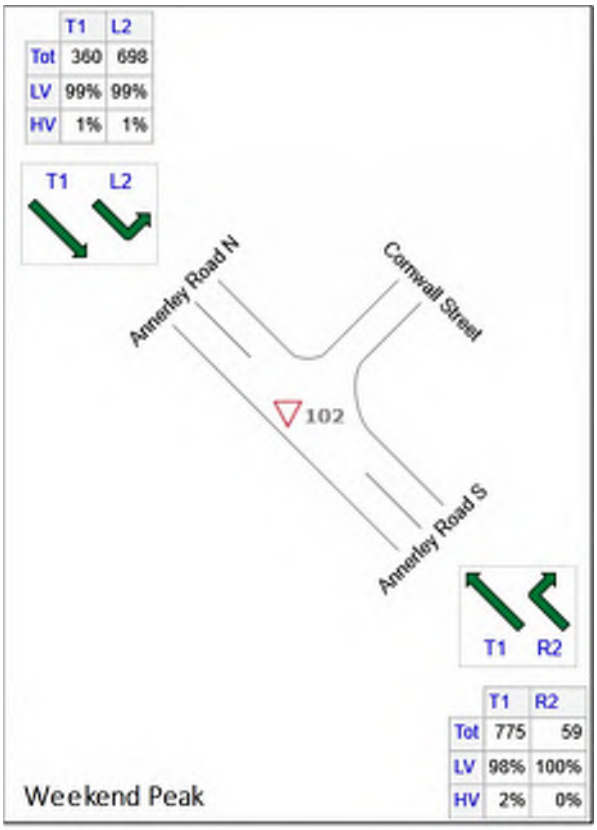


Figure 13: Annerley Road / Cornwall Street – Adjusted Weekend Peak Traffic Volumes

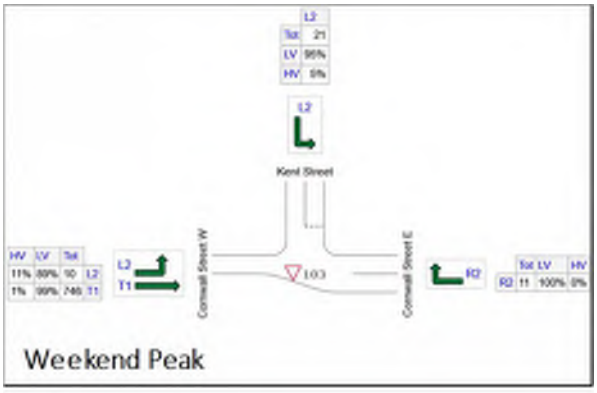


Figure 14: Cornwall Street / Kent Street – Adjusted Weekend Peak Traffic Volumes

2.2.3 Traffic Growth

Annual average growth rates from Brisbane City Council's Community Profiles for the Annerley and Fairfield area indicates a growth rate of approximately 1.8% per annum between the years 2009 and 2019 and 1.4% between 2014 and 2019. This generally aligns with the 1.7% growth rate for the entire Brisbane Local Government Area (LCA) between 2009 and 2019 and the 1.7% growth rate between 2014 and 2019.

Considering this, a conservative growth rate of 2% per annum was adopted for this assessment and applied to the peak hour traffic survey volumes to forecast background traffic during peak construction activities – refer to Section 3.1.

2.3 Public Transport

2.3.1 Overview

The Southern Portal worksite is located within close proximity the Dutton Park Station (train) and PA Hospital Station (bus) as well as an on-street bus stop on Annerley Road.

2.3.2 Dutton Park Station

Train services operating through Dutton Park Station provide commuters with connections north (i.e. Ferny Grove) and south (i.e. Beenleigh). Details of routes servicing this station are summarised in Table 3.

Table 3: Dutton Park Station – Train Services

Route	Stops	Frequency	First Service	Lat Service
Beenleigh Train	Bowen Hills, Fortitude Valley, Central, Roma Street, South Brisbane, Southbank, Park Road, Dutton Park, Fairfield, Yeronga, Yeerongpilly, Moorooka, Rocklea, Salisbury, Coopers Plains, Banoon, Sunnybank, Altandi, Runcorn, Fruitgrove, Kuraby, Trinder Park, Woodridge, Kingston, Loganlea, Bethania, Edens Landing, Holmview,	15 to 30 minutes	4:18am departing Beenleigh	12:48am departing Beenleigh

	Beenleigh			
Ferny Grove Train	Ferny Grove, Keperra, Grovely, Oxford Park, Mitchelton, Gaythorne, Enoggera, Alderley, Newmarket, Wilston, Windsor, Bowen Hills, Fortitude Valley, Central, Roma Street, South Brisbane, Southbank, Park Road, Dutton Park, Fairfield, Yeronga, Yeerongpilly, Moorooka, Rocklea, Salisbury, Cooper Plains, Banoon, Sunnybank, Altandi, Runcorn, Fruitgrove, Kuraby, Trinder Park, Woodridge, Kingston, Loganlea, Bethania, Edens Landing, Holmview, Beenleigh	15 to 30 minutes	5:02am departing Ferny Grove	12:32am departing Ferny Grove

2.3.3 PA Hospital Station

Bus services operating through PA Hospital Bus Station on the Boggo Road Busway provide commuters with connections north, south, east and west through two platforms (inbound and outbound). Details of routes servicing this station are summarised in Table 4.

Table 4: PA Hospital Station – Bus Services

Route	Stops	Frequency	First Service	Lat Service
28	Langlands Park, Stones Corner, Buranda, PA Hospital, Boggo Road, Dutton Park Place Drive, UQ Lakes	10 minutes	6:50am departing Langlands Park, 7:01am departing UQ Lakes	6:00pm departing Langlands Park, 6:11pm departing UQ Lakes
29	Woolloongabba, PA Hospital, Boggo Road, Dutton Park Place Drive, UQ Lakes	5 to10 minutes	6:45am departing Woolloongabba, 6:56am departing UQ Lakes	7:15pm departing Woolloongabba, 7:26pm departing UQ Lakes
66	UQ Lakes, Dutton Park, Boggo Road, PA Hospital, Mater Hill, Southbank, Cultural Centre, King George Square, Roma Street, QUT Kelvin Grove, Herston, RBWH	5 to 10 minutes	6:00am departing UQ Lakes, 6:33am departing RBWH	10:30pm departing UQ Lakes, 11:03pm departing RBWH
104	Corinda, Sherwood, Graceville, Tennyson, Yeerongpilly, Yeronga, Fairfield, PA Hospital	30 to 60 minutes	6:09am departing Corinda, 6:44am departing PA Hospital	6:24pm departing Corinda, 6:18pm departing PA Hospital
105	Indooroopilly, Tennyson, Yeerongpilly, Yeronga, Fairfield, PA Hospital, City	60 to 120 minutes	5:45am departing Indooroopilly, 6:55am departing City	5:55pm departing Indooroopilly, 7:15pm departing City
107	Yeronga, Fairfield, PA Hospital, City	20 minutes	6:55am departing Yeronga, 4:10pm	8:15am departing Yeronga, 6:10pm

			departing City	departing City
108	Indooroopilly, Tennyson, Yeerongpilly, Yeronga, Fairfield, PA Hospital, City	45 to 60 minutes	6:50am departing Indooroopilly, 4:05pm departing City	7:35am departing Indooroopilly, 5:35pm departing City
139	Sunnybank Hills, Sunnybank, Macgregor, Griffith University, Holland Park West, Greenslopes, Buranda, PA Hospital, Boggo Road, Dutton Park Place Drive, UQ Lakes	7 to 8 minutes	6:50am departing Sunnybank Hills, 10:02 departing UQ Lakes	5:38pm departing Sunnybank Hills, 6:21 departing UQ Lakes
169	Eight Mile Plains, upper Mount Gravatt, Griffith University, Holland Park West, Greenslopes, Buranda, PA Hospital, Boggo Road, Dutton Park Place Drive, UQ Lakes	15 minutes	5:45am departing Eight Mile Plans, 6:55am departing UQ Lakes	8:40pm departing Eight Mile Plains, 10:32pm departing UQ Lakes
209	Carindale, Carina, Camp Hill, Coorparoo, Langlands Park, Stones Corner, Buranda, PA Hospital, Boggo Road, Dutton Park Place Drive, UQ Lakes	15 minutes	6:35am departing Carindale, 9:53am departing UQ Lakes	6:09pm departing Carindale, 9:08pm departing UQ Lakes

There is also a bus stop located on Annerley Road (approximately 220m walking distance from the worksite), serviced by routes:

- 112 – City to Griffith University
- 116 – Spring Hill to Beaudesert
- 6147 – St Laurences to Jimboomba
- 833 – Annerley to Cav Road High School
- 849 – Tarragindi to Cav Road High School.

Further details of these routes are provided in Table 5.

Table 5: On-road Bus Services

Route	Details	Frequency	First Service	Lat Service
112	City to Griffith University	30 to 60 minutes	7:47am departing City	9:45pm departing City
116	Spring Hill to Beaudesert	30 to 60 minutes	8:26am departing Spring Hill	8:23pm departing Spring Hill
6147	St Laurences to Jimboomba	One service	3:18pm departing St Laurences	
833	Annerley to Cav Road High School	One service	7:51am departing Annerley	
849	Tarragindi to Cav Road High School	One service	7:35am departing Tarragindi	

2.4 Active Transport

2.4.1 Pedestrians

Pedestrian footpaths are provided on Kent Street, Cornwall Street and Annerley Road proximate to the Southern Portal worksite with crossing facilities, including kerb ramps provided across Kent Street and Cornwall Street. The Annerley Road / Cornwall Street / Noble Street / Railway Terrace signalised intersection provides pedestrians with a signalised crosswalk to cross Annerley Road.

Pedestrian and on-road cyclist volumes for the Annerley Road / Cornwall Street and Cornwall Street / Kent Street intersections were obtained for the from 24-hour traffic surveys undertaken on Thursday 18th June 2020 and Saturday 20th June 2020. The peak hour and daily pedestrian and off-road cyclist volumes are presented in the figures below.

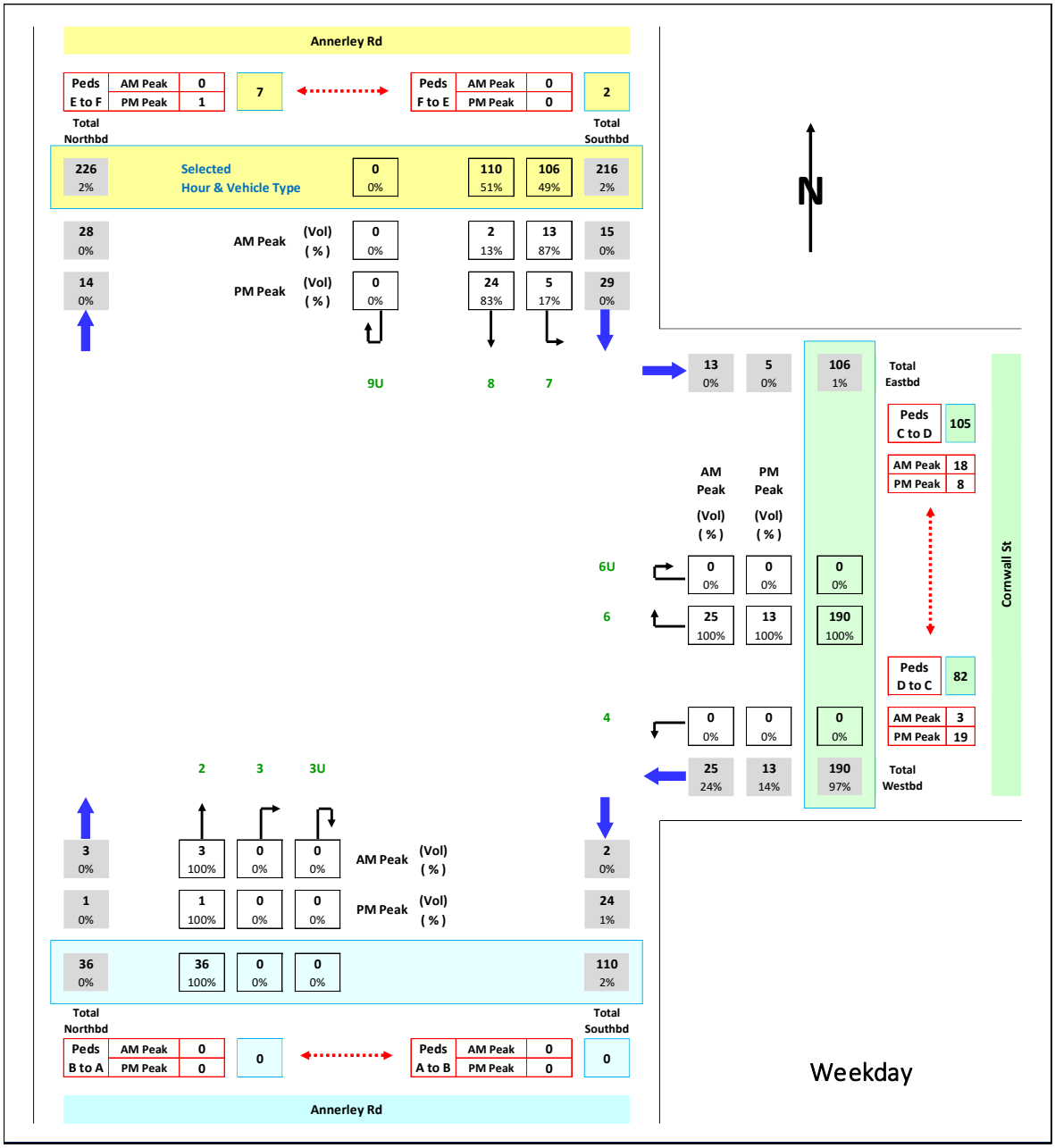


Figure 15: Annerley Road / Cornwall Street – Weekday Pedestrian & Off-Road Cyclist Volumes

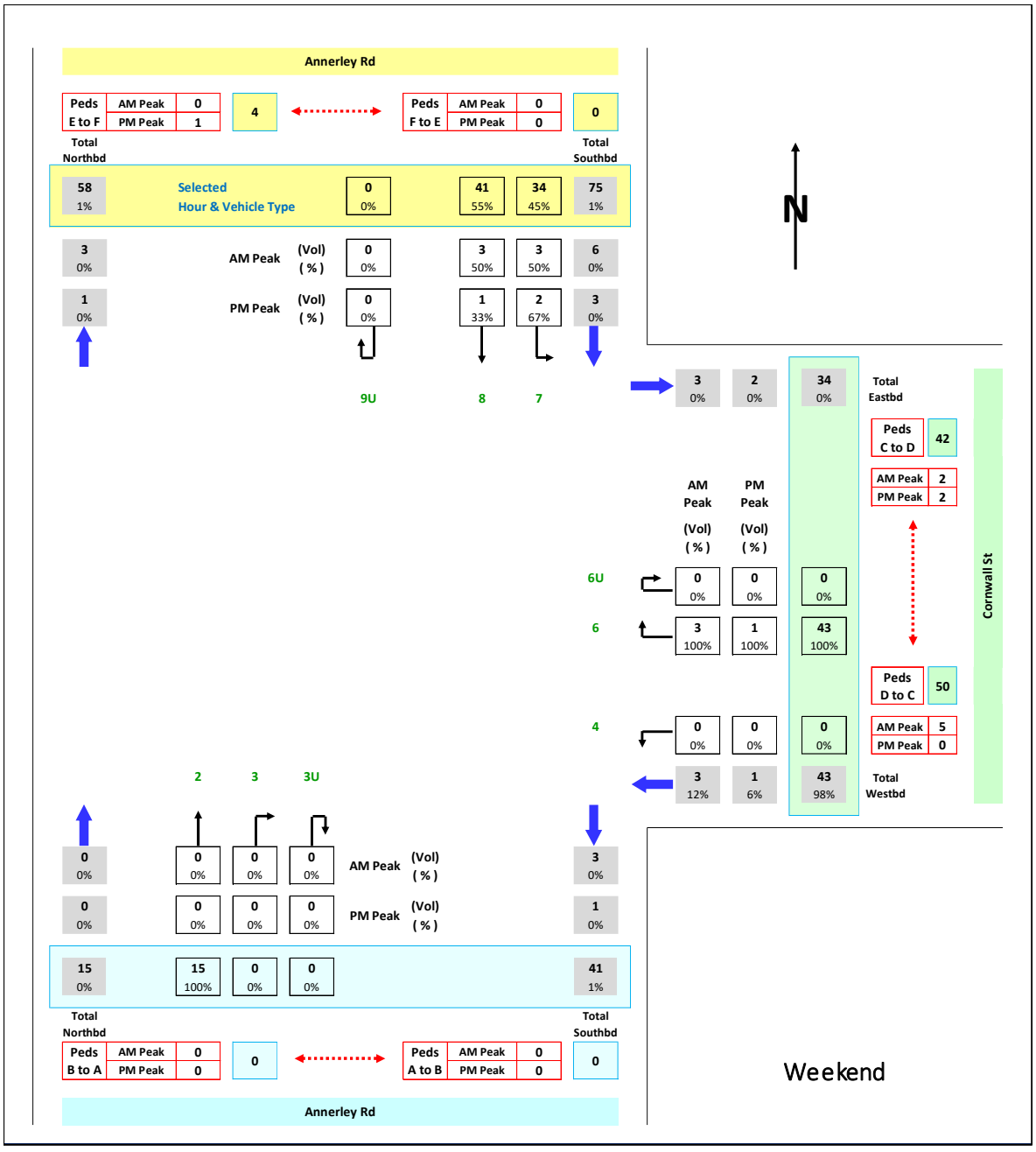


Figure 16: Annerley Road / Cornwall Street – Weekend Pedestrian & Off-Road Cyclist Volumes

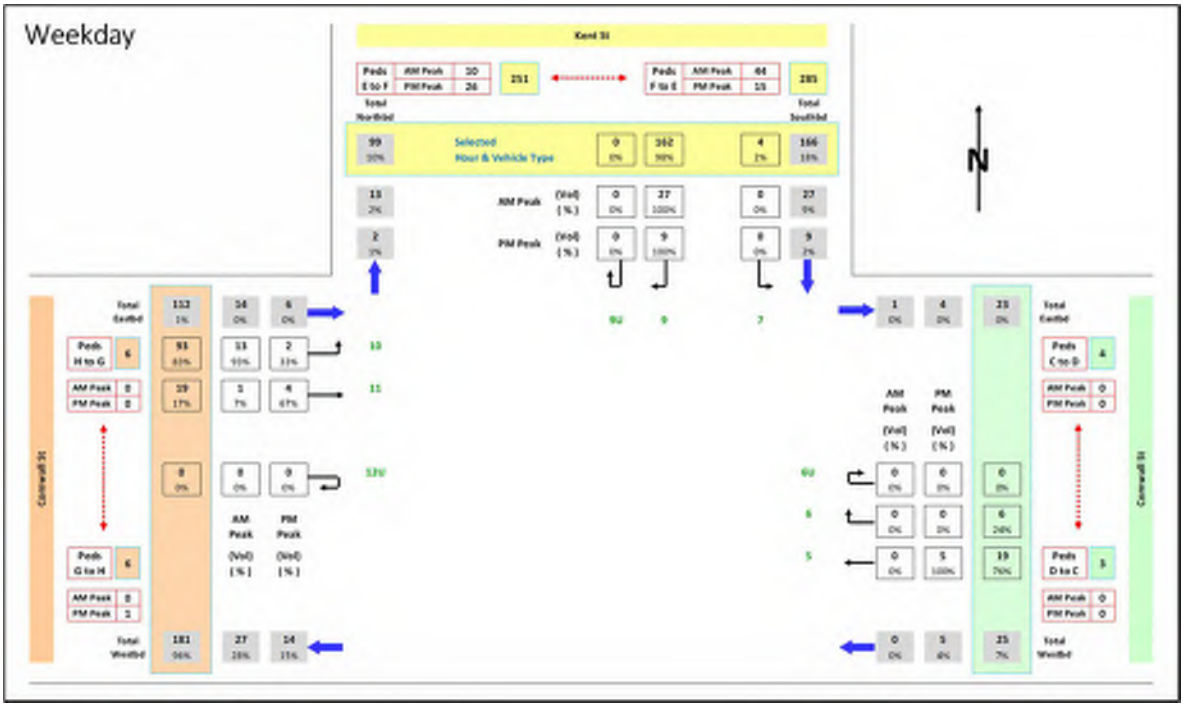


Figure 17: Cornwall Street / Kent Street – Weekday Pedestrian & Off-road Cyclist Volumes

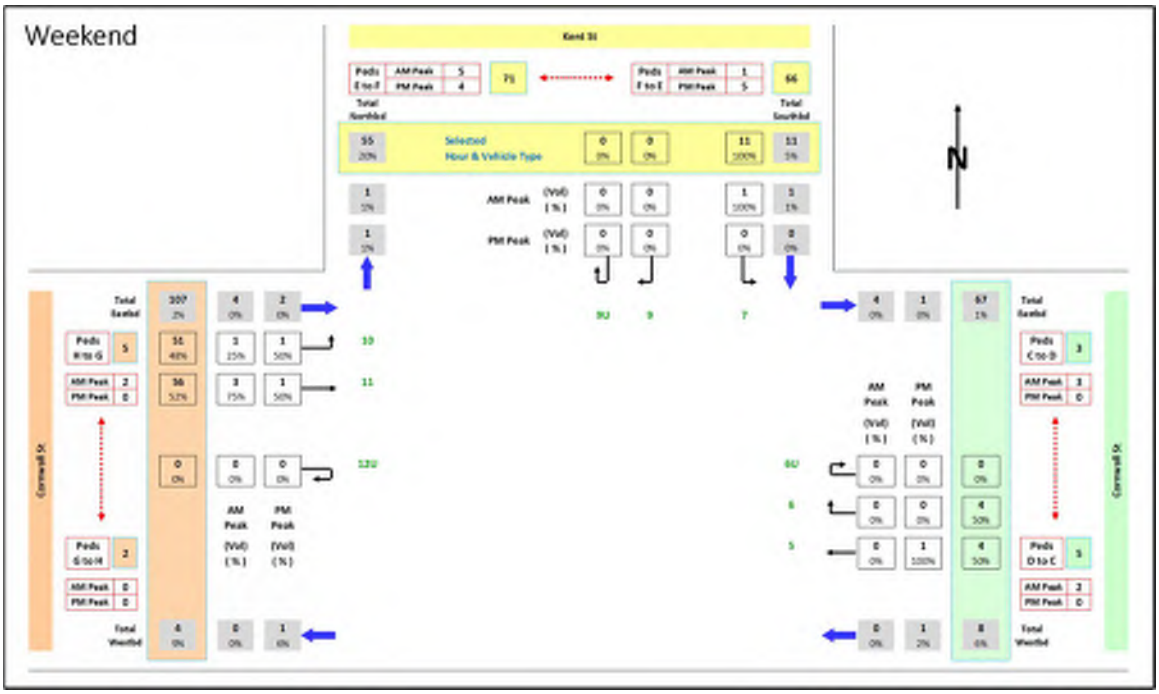


Figure 18: Cornwall Street / Kent Street – Weekend Pedestrian & Off-road Cyclist Volumes

2.4.2 Cyclists

In addition to off-road footpaths on Annerley Road, Cornwall Street and Kent Street, the Woolloongabba to UQ bikeway borders the eastern side of the Southern Portal worksite. A dedicated off-road shared pathway

extends approximately 350m from the northern extent of Kent Street towards Cornwall Street where it terminates at the QR Dutton Park Depot Complex access.

On-road cyclist volumes for the Annerley Road / Cornwall Street and Cornwall Street / Kent Street intersections were obtained for the from 24-hour traffic surveys undertaken on Thursday 18th June 2020 and Saturday 20th June 2020. The peak hour and daily on-road cyclist volumes are presented in the figures below.

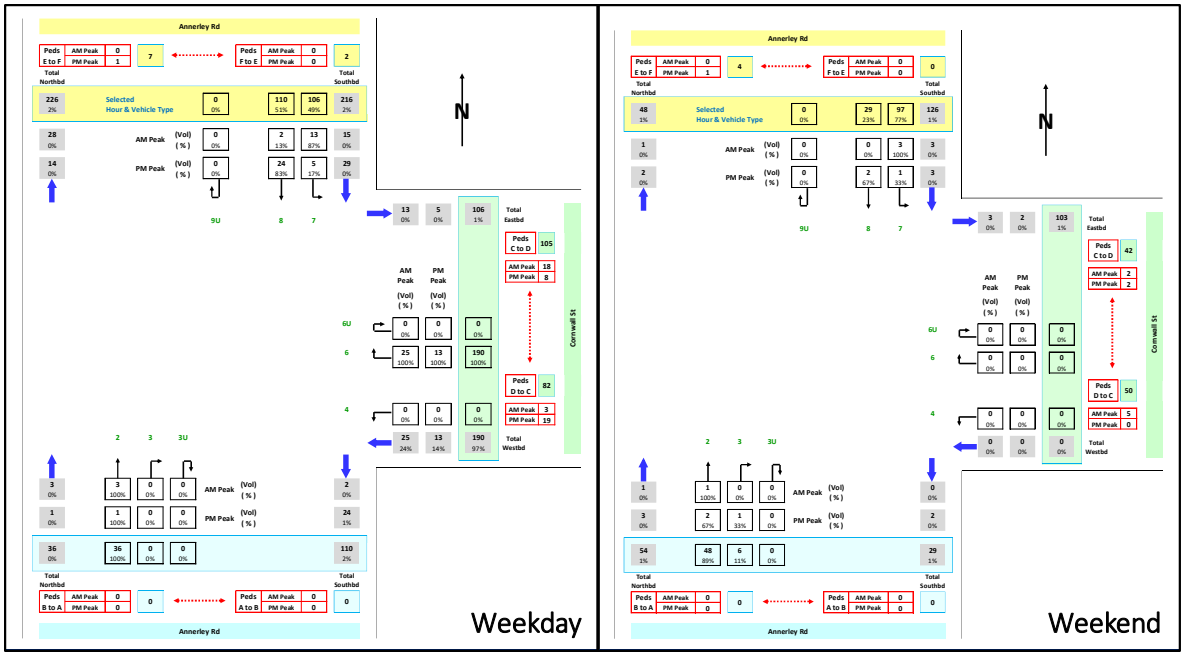


Figure 19: Annerley Road / Cornwall Street – On-road Cyclist Volumes

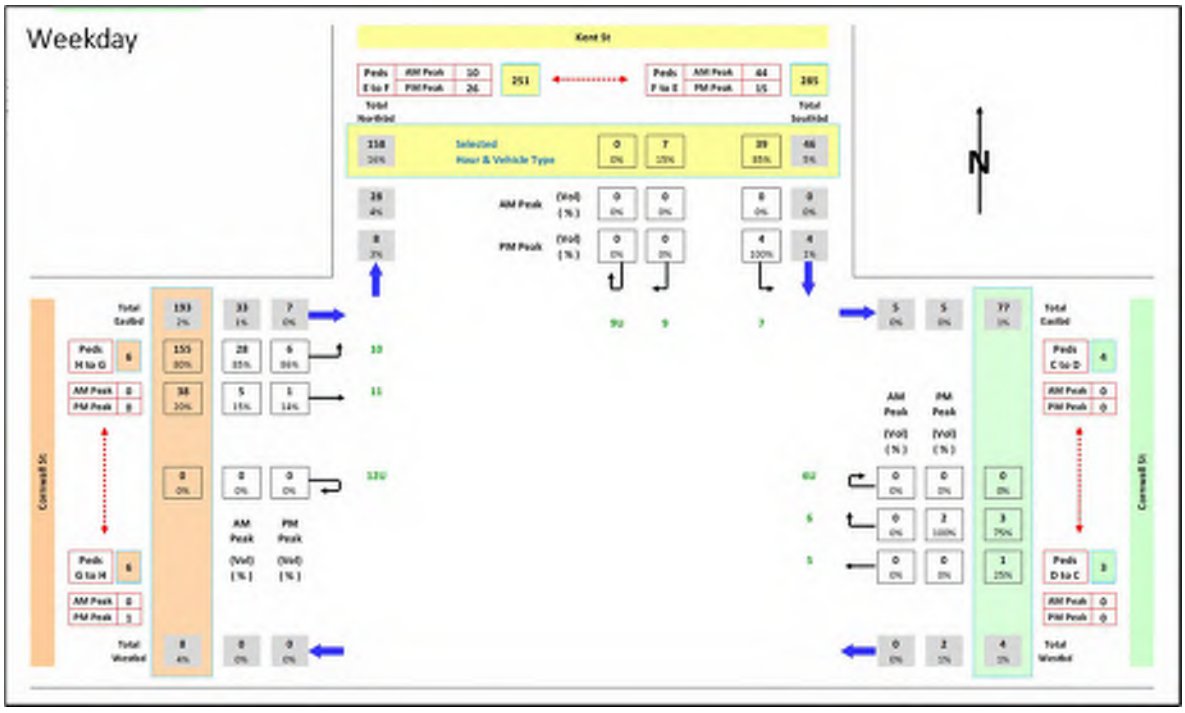


Figure 20: Cornwall Street / Kent Street – Weekday On-road Cyclist Volumes

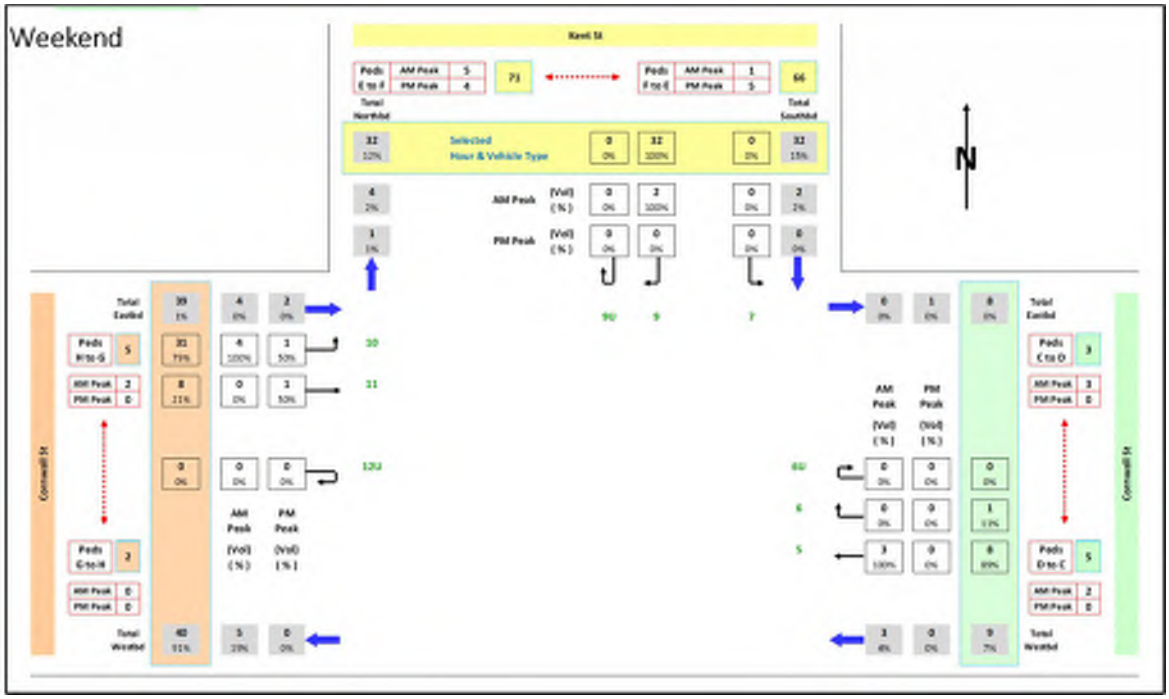


Figure 21: Cornwall Street / Kent Street – Weekend On-road Cyclist Volumes

3 Impact Assessment

3.1 Construction Traffic

3.1.1 Construction Traffic Volumes

Based on the current construction methodology, program, it is estimated that peak construction volumes are expected to occur in May 2022. During this time, construction volumes are expected to be in the order of 4 vehicles per hour (one-way).

Notwithstanding this, a peak of 10 vehicles per hour (one-way) may be required during peak construction to facilitate high intensity activities. To represent a 'worst-case' scenario, 10 construction vehicles per hour has been adopted in this assessment.

3.1.2 Construction Traffic Routes

Construction vehicles will follow the currently approved routes in RfPC4 and Boggo Road CTMP-SP and the proposed movement along Cornwall Street and Kent Street in order to access the Southern Portal worksite. This route is shown diagrammatically in Appendix B.

Construction vehicles will access the worksite via the Kent Street connection to the Annerley Road / Cornwall Street intersection and egress via Kent Street / PA Hospital approach at the Ipswich Road / O'Keefe Street intersection in a one-way circular loop. A swept path analysis for critical movements at key intersections and is provided in Appendix C.

The swept path analysis shows that a minor modification is required to the Annerley Road / Cornwall Street centre median and eastern kerb line at the Cornwall Street / Kent Street intersection to accommodate the movements of the design vehicle (i.e. 19.0m semi-trailer). A concept plan detailing the required modifications is provided in Appendix D.

It is noted that under the proposed construction traffic access routes, the impacts to the Ipswich Road / O'Keefe Street intersection will be reduced compared to those contained within RfPC4, noting that construction vehicles previously would utilise this intersection for both entry and exit to the worksite. For this reason, an assessment of this intersection has not been undertaken.

3.2 Design Traffic

Design traffic volumes during peak construction activities (2022) have been determined by adding the forecast background traffic volumes to the construction traffic volumes outlined in Section 3.1.1. Design traffic volumes are shown below.

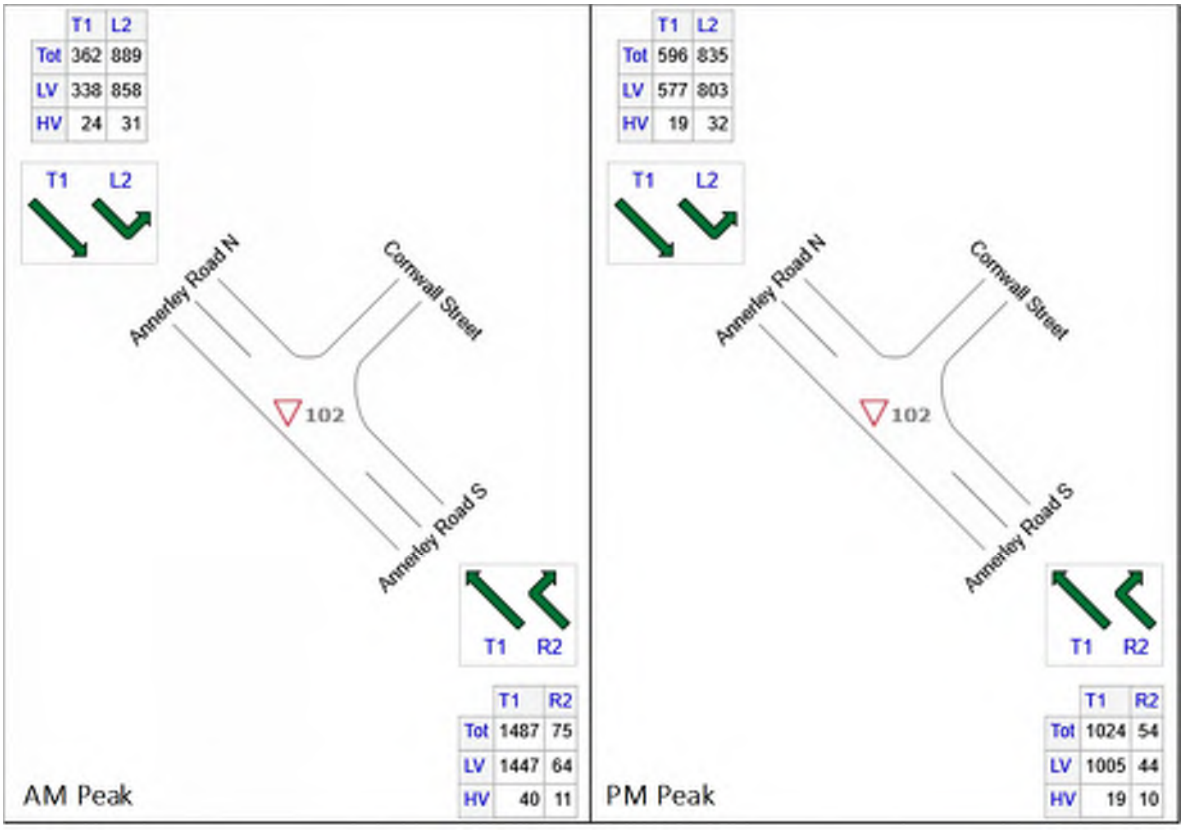


Figure 22: Annerley Road / Cornwall Street – Weekday Peak Traffic Volumes

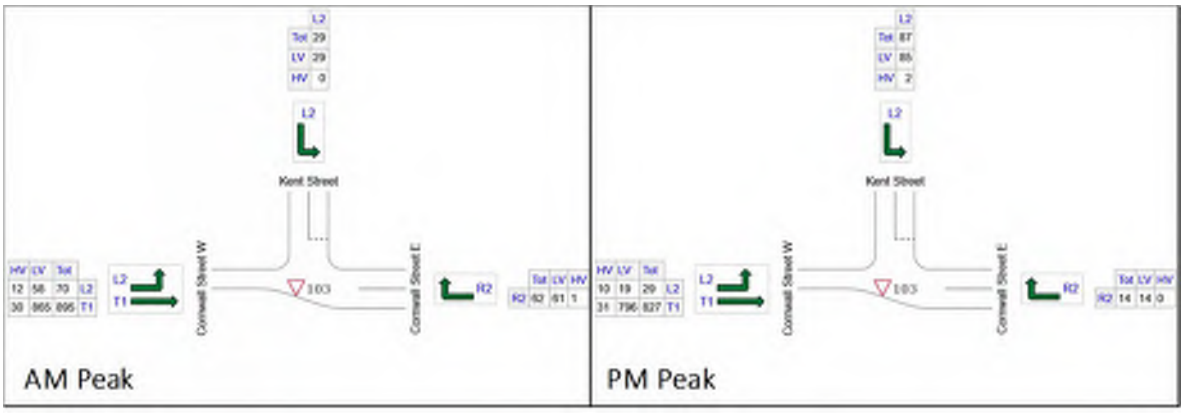


Figure 23: Cornwall Street / Kent Street – Weekday Peak Traffic Volumes

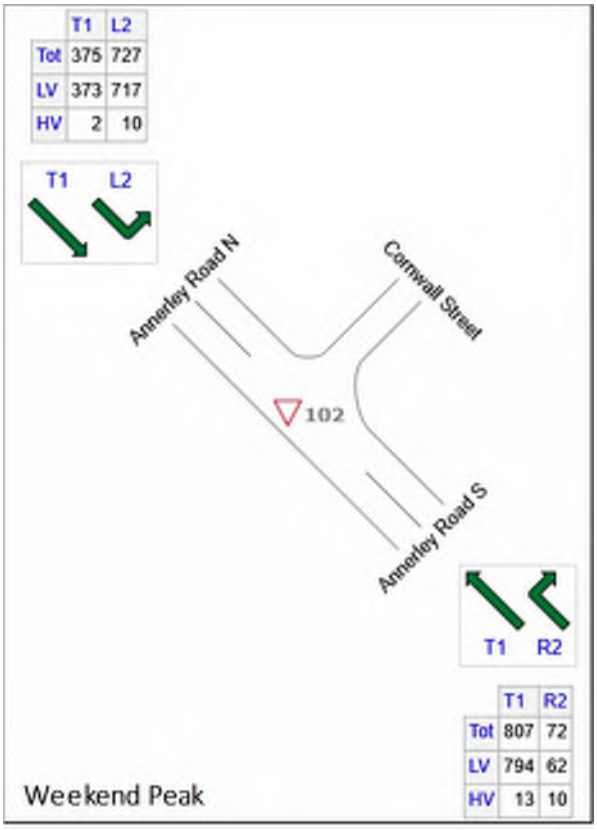


Figure 24: Annerley Road / Cornwall Street – Weekend Peak Traffic Volumes

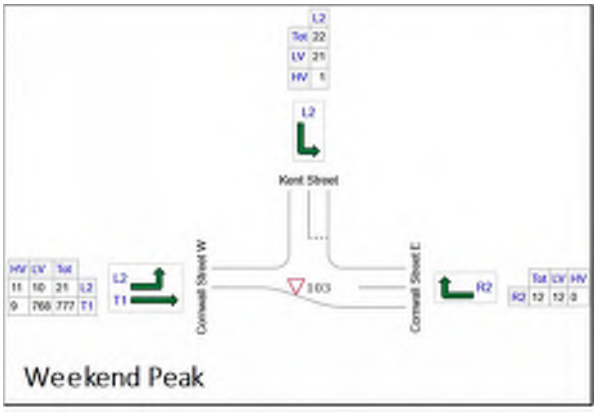


Figure 25: Cornwall Street / Kent Street – Weekend Peak Traffic Volumes

3.3 Traffic Impacts

3.3.1 Methodology

An assessment of the Annerley Road / Cornwall Street / Noble Street / Railway Terrace, Annerley Road / Cornwall Street and Cornwall Street / Kent Street intersections was undertaken in accordance with TMR's *Guide to Traffic Impact Assessment (GTIA, 2018)*. Fundamentally, the GTIA states:

- Detailed traffic analysis is required at locations where development traffic exceeds 5% of base traffic for any movement within the 'impact assessment area'
- Non-worsening delay mitigation is required to offset development impacts at locations where development traffic increases total intersection delay by more than 5%.

3.3.2 Traffic Volume Scoping Assessment

Table 6 below summarises the construction traffic volumes to year 2022 forecast background traffic proportional increase at the Annerley Road / Cornwall Street / Noble Street / Railway Terrace intersection.

Table 6: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Traffic Volume Scoping

Intersection Approach	Movement	Peak Period	Increase in Volume
Annerley Road (South)	Left onto Noble Street	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Through onto Annerley Road	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Right onto Railway Terrace	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	U-turn onto Annerley Road	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
Cornwall Street (West)	Left onto Annerley Road	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Through onto Railway Terrace	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Right onto Annerley Road	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Right onto Noble Street	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	U-turn onto Cornwall Street	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
Annerley Road (North)	Left onto Railway Terrace	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Though onto Annerley Road	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	Right onto Noble Street	Weekday AM	0%
		Weekday PM	0%
		Weekend Peak	0%
	U-turn onto Annerley Road	Weekday AM	0%

		Weekday PM	0%
		Weekend Peak	0%

While there will be no increase in traffic volumes at the Annerley Road / Cornwall Street / Noble Street / Railway Terrace intersection during the AM, PM or weekend peak periods, due to the proximity of this intersection to the Annerley Road / Cornwall Street unsignalized intersection (~50m), it has been included in the detailed analysis of the Annerley Road / Cornwall Street intersection as a network to replicate upstream conditions (i.e. residual queuing and platooning).

Table 7 below summarises the construction traffic volumes to year 2022 forecast background traffic proportional increase at the Annerley Road / Cornwall Street intersection.

Table 7: Annerley Road / Cornwall Street – Traffic Volume Scoping

Intersection Approach	Movement	Peak Period	Increase in Volume%	2022 Background Volumes	Construction Traffic Volumes
Annerley Road (South)	Through onto Annerley Road	Weekday AM	0%	1487	0
		Weekday PM	0%	1024	0
		Weekend Peak	0%	807	0
	Right onto Cornwall Street	**Weekday AM**	**15%**	**65**	**10**
		Weekday PM	**23%**	**44**	**10**
		Weekend Peak	**16%**	**62**	**10**
Annerley Road (North)	Through onto Annerley Road	Weekday AM	0%	362	0
		Weekday PM	0%	596	0
		Weekend Peak	0%	375	0
	Left onto Cornwall Street	Weekday AM	0%	889	0
		Weekday PM	0%	835	0
		Weekend Peak	0%	727	0

As shown, construction traffic is estimated to result in an increase of more than 5% of the year 2022 background traffic for the right turn movement onto Cornwall Street from Annerley Road. In accordance with TMR's GTIA, detailed traffic analysis is required and is provided in the following section(s).

Table 7 below summarises the construction traffic volumes to year 2022 forecast background traffic proportional increase at the Cornwall Street / Kent Street intersection.

Table 8: Cornwall Street / Kent Street – Traffic Volume Scoping

Intersection Approach	Movement	Peak Period	Increase in Volume%	2022 Background Volumes	Construction Traffic Volumes
Cornwall Street (West)	Left onto Kent Street	**Weekday AM**	**17%**	**60**	**10**
		Weekday PM	**53%**	**19**	**10**
		Weekend Peak	**91%**	**11**	**10**
	Through onto Cornwall Street	Weekday AM	0%	895	0
		Weekday PM	0%	861	0
		Weekend Peak	0%	777	0
Kent Street (North)	Left onto Cornwall Street	Weekday AM	0%	29	0
		Weekday PM	0%	89	0
		Weekend Peak	0%	22	0
Cornwall Street (East)	Right onto Kent Street	Weekday AM	0%	62	0
		Weekday PM	0%	14	0
		Weekend Peak	0%	12	0

As shown, construction traffic is estimated to result in an increase of more than 5% of the year 2022 background traffic for the left turn movement onto Kent Street from Cornwall Street. In accordance with TMR's GTIA, detailed traffic analysis is required and is provided in the following section(s).

3.3.3 Annerley Road / Cornwall Street Intersection Assessment

The Annerley Road / Cornwall Street intersection was assessed using SIDRA Intersection (version 8) to determine construction impacts at year 2022 in accordance with TMR's GTIA. To quantify the intersection performance, the following performance measures have been reported:

- Degree of Saturation (DOS (%)) – The ratio of arrival (demand) flow rate to capacity during a given flow period. Acceptable limits of operation for different intersection types are:
  - Signalised intersections – the intersection DOS should generally not exceed 0.90
  - Roundabouts – the DOS for any movement should not exceed 0.85
  - Priority-controlled – the DOS for any movement should exceed 0.80.
- Average delay (seconds) – The additional (excess) travel time experienced by a vehicle or pedestrian relative to a base travel time. The average delay considers all vehicles or pedestrians that are queued and not queued. In accordance with TMR's GTIA, average delay should not exceed 42 seconds for roundabouts or priority-controlled intersections.
- Level of Service (LOS) – An index of the operational performance of traffic on a given roadway, traffic lane, approach, intersection, route or network, based measures such as delay, degree of saturation, density, speed, congestion coefficient, speed efficiency or travel time index during a given flow period.
- 95th Percentile Queue (m) – The length of queue which 95 percent of all observed queue lengths fall, or 5 percent of all observed queue lengths exceed.

The geometric layout of the network (i.e. Annerley Road / Cornwall Street / Noble Street / Railway Terrace and Annerley Road / Cornwall Street intersections) as modelled in SIDRA is illustrated in Figure 26 below.

Figure 26: Annerley Road / Cornwall Street – SIDRA Geometric Layout

Information provided by Brisbane City Council indicated that the Annerley Road / Cornwall Street / Noble Street / Railway Terrace intersection operates under a 'lagging right turn' phase sequence on a maximum cycle time of 125 seconds (A phase = 50 seconds, B phase = 25 seconds, C phase = 50 seconds) during morning and afternoon peak periods. Phasing for this intersection is provided in Figure 27 below.

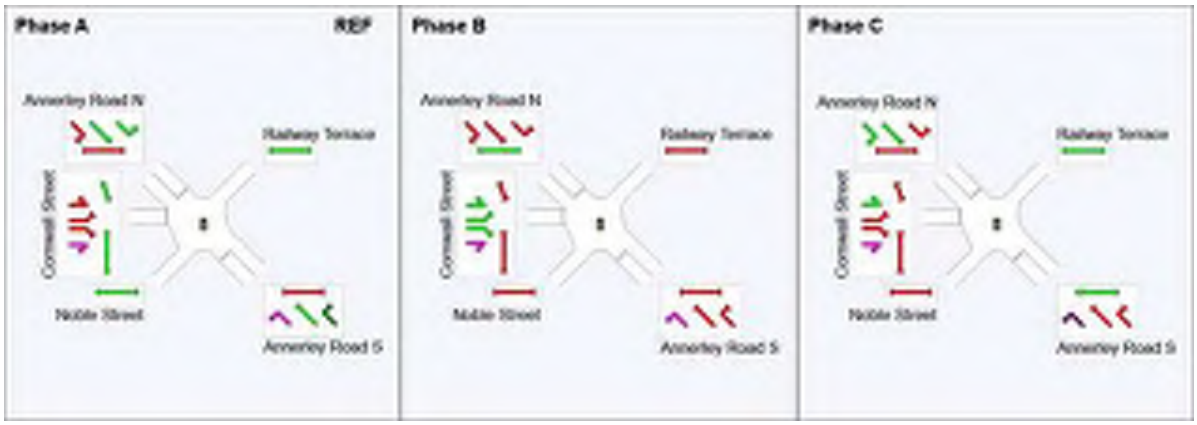


Figure 27: Annerley Road / Cornwall Street / Noble Street / Railway Terrace – Intersection Phasing

A comparative overview of network performance during peak periods in terms of both DOS is presented in the figures below.

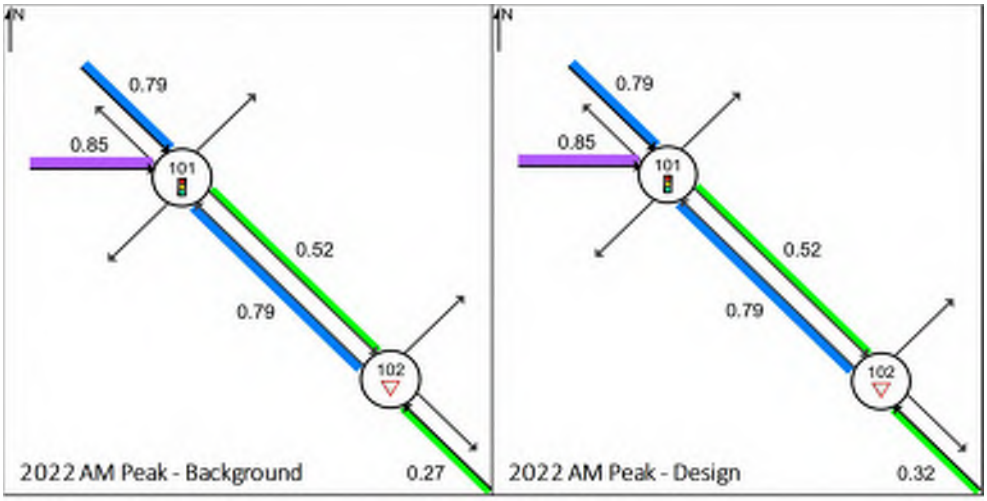


Figure 28: Annerley Road / Cornwall Street – 2022 AM Peak, Level of Service Comparison

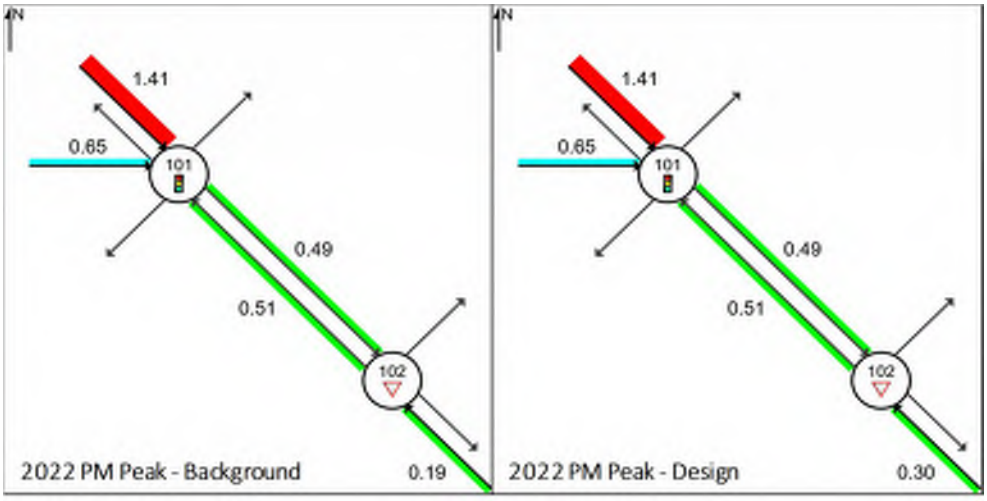


Figure 29: Annerley Road / Cornwall Street – 2022 PM Peak, Level of Service Comparison

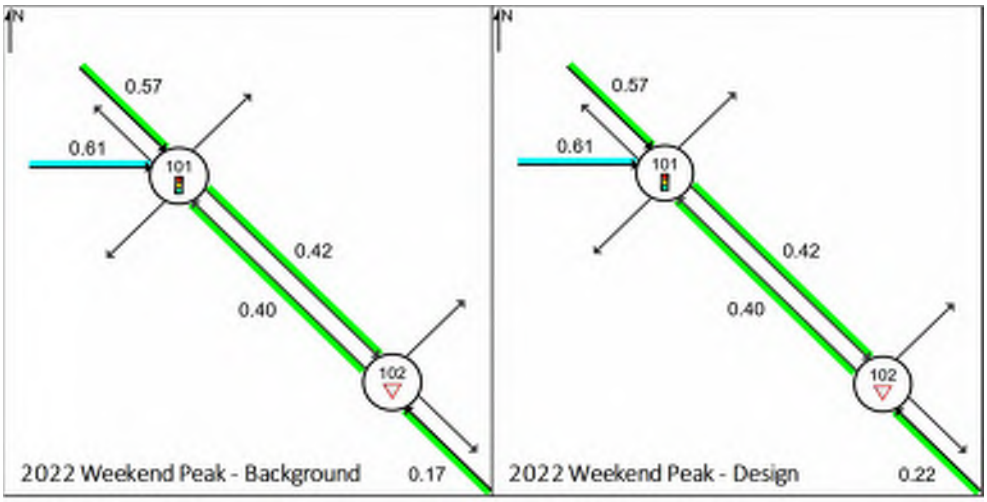


Figure 30: Annerley Road / Cornwall Street – 2022 Weekend Peak, Level of Service Comparison

A detailed summary of the intersection performance during weekday and weekend peak periods is provided in Table 9 and Table 10 respectively. SIDRA Movement Summary outputs for the networks are provided in Appendix E.

Table 9: Annerley Road / Cornwall Street – Weekday SIDRA Results

Approach	Movement	DOS	Delay (s)	LOS	95th Queue
2020 AM Peak - Background					
Annerley Road S	Through	0.263	0.0	LOS A	113.9
	Right	0.203	17.4	LOS C	5.3
Annerley Road N	Left	0.496	3.9	LOS A	0.0
	Through	0.195	0.0	LOS A	0.0
2020 PM Peak - Background					
Annerley Road S	Through	0.180	0.0	LOS A	28.5
	Right	0.164	19.2	LOS C	3.9
Annerley Road N	Left	0.467	3.9	LOS A	0.0
	Through	0.315	0.0	LOS A	0.0

2022 AM Peak – Background					
Annerley Road S	Through	0.274	0.0	LOS A	130.4
	Right	0.233	19.1	LOS C	6.2
Annerley Road N	Left	0.516	3.9	LOS A	0.0
	Through	0.204	0.0	LOS A	0.0
2022 AM Peak - Design					
Annerley Road S	Through	0.274	0.0	LOS A	130.4
	Right	0.317	23.5	LOS C	9.7
Annerley Road N	Left	0.516	3.9	LOS A	0.0
	Through	0.204	0.0	LOS A	0.0
2022 PM Peak - Background					
Annerley Road S	Through	0.188	0.0	LOS A	35.0
	Right	0.190	21.3	LOS C	4.6
Annerley Road N	Left	0.486	3.9	LOS A	0.0
	Through	0.329	0.0	LOS A	0.0
2022 PM Peak - Design					
Annerley Road S	Through	0.188	0.0	LOS A	35.0
	Right	0.300	28.9	LOS D	8.8
Annerley Road N	Left	0.486	3.9	LOS A	0.0
	Through	0.329	0.0	LOS A	0.0

The weekday SIDRA results indicate that the Annerley Road / Cornwall Street intersection remains within acceptable operating parameters for a priority-controlled intersection (delay less than 42 seconds) during both the background and design scenarios for year 2022. While a reduction in LOS (from C to D) is observed for the right turn movement from Annerley Road to Cornwall Street during the PM peak scenario, 95th percentile queue lengths are expected to remain within the existing capacity of the right turn storage facility

Weekend SIDRA results are presented below in Table 10.

Table 10: Annerley Road / Cornwall Street – Weekend SIDRA Results

Approach	Movement	DOS	Delay (s)	LOS	95th Queue
2020 Weekend Peak - Background					
Annerley Road S	Through	0.189	0.0	LOS A	2.2
	Right	0.142	13.3	LOS B	3.7
Annerley Road N	Left	0.400	3.9	LOS A	0.0
	Through	0.195	0.0	LOS A	0.0
2022 Weekend Peak - Background					
Annerley Road S	Through	0.165	0.0	LOS A	6.9
	Right	0.160	14.1	LOS B	4.1
Annerley Road N	Left	0.416	3.9	LOS A	0.0
	Through	0.203	0.0	LOS A	0.0
2022 Weekend Peak - Design					
Annerley Road S	Through	0.165	0.0	LOS A	6.9
	Right	0.217	16.5	LOS C	6.5
Annerley Road N	Left	0.416	3.9	LOS A	0.0
	Through	0.203	0.0	LOS A	0.0

The weekend SIDRA results indicate that the Annerley Road / Cornwall Street intersection remains within acceptable operating parameters for a priority-controlled intersection (DOS < 0.8, delay less than 42 seconds) during both the background and design scenarios for year 2022. Similar to the weekday, while a reduction in LOS (from B to C) is observed for the right turn movement from Annerley Road to Cornwall Street during the

PM peak scenario, 95th percentile queue lengths are anticipated to remain within the existing capacity of the right turn storage facility

3.3.4 Cornwall Street / Kent Street Intersection Assessment

The Cornwall Street / Kent Street intersection was assessed using SIDRA Intersection (version 8) to determine construction impacts at year 2022 in accordance with TMR's GTIA. To quantify the intersection performance, the following performance measures have been reported:

- Degree of Saturation (DOS (%)) – The ratio of arrival (demand) flow rate to capacity during a given flow period. Acceptable limits of operation for different intersection types are:
  - Signalised intersections – the intersection DOS should generally not exceed 0.90
  - Roundabouts – the DOS for any movement should not exceed 0.85
  - Priority-controlled – the DOS for any movement should exceed 0.80.
- Average delay (seconds) – The additional (excess) travel time experienced by a vehicle or pedestrian relative to a base travel time. The average delay considers all vehicles or pedestrians that are queued and not queued. In accordance with TMR's GTIA, average delay should not exceed 42 seconds for roundabouts or priority-controlled intersections.
- Level of Service (LOS) – An index of the operational performance of traffic on a given roadway, traffic lane, approach, intersection, route or network, based measures such as delay, degree of saturation, density, speed, congestion coefficient, speed efficiency or travel time index during a given flow period.
- 95th Percentile Queue (m) – The length of queue which 95 percent of all observed queue lengths fall, or 5 percent of all observed queue lengths exceed.

The geometric layout of the network (i.e. Annerley Road / Cornwall Street and Cornwall Street / Kent Street intersections) as modelled in SIDRA is illustrated in Figure 31 below.

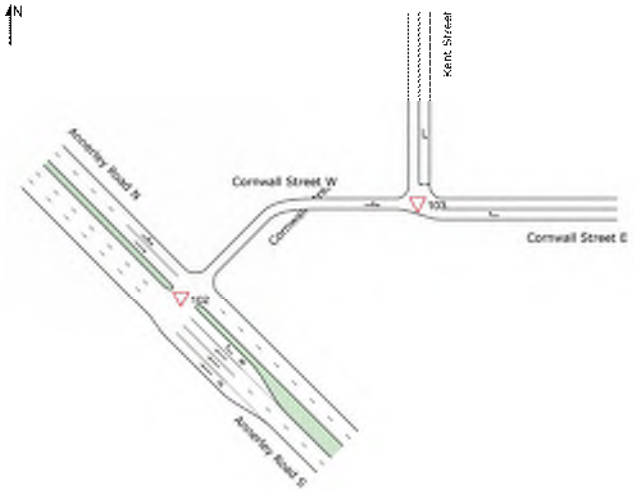


Figure 31: Cornwall Street / Kent Street– SIDRA Geometric Layout

A comparative overview of network performance during peak periods in terms of both DOS is presented in the figures below.

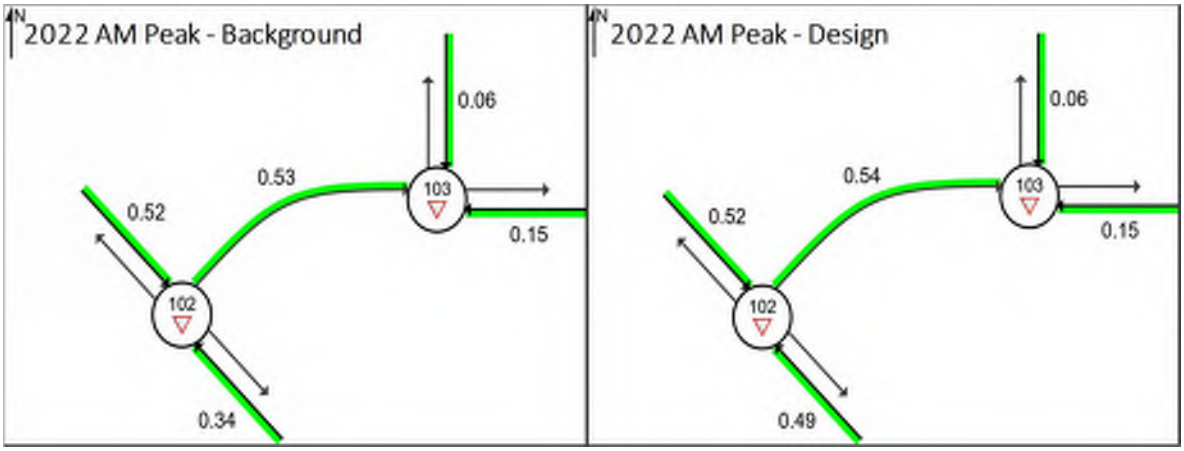


Figure 32: Cornwall Street / Kent Street – 2022 AM Peak, Level of Service Comparison

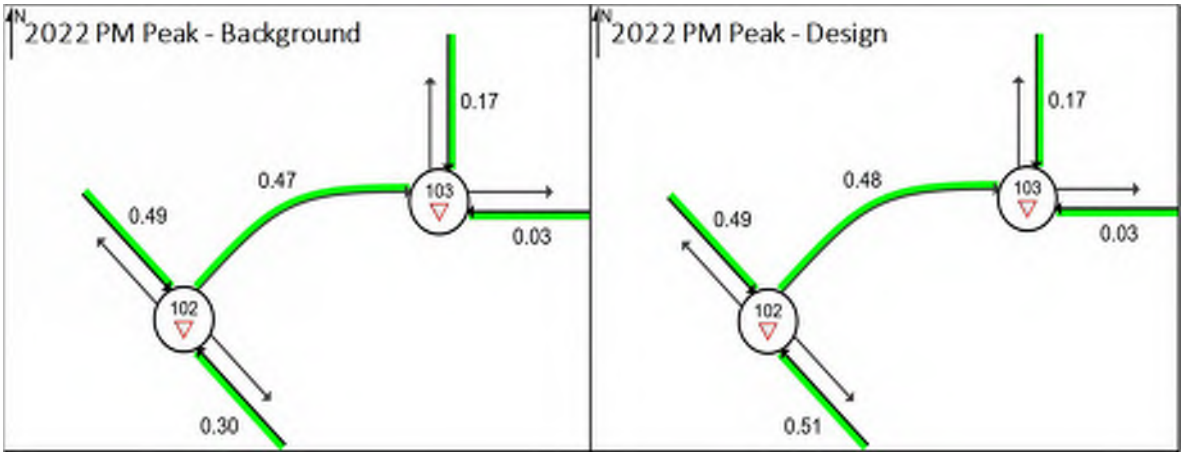


Figure 33: Cornwall Street / Kent Street – 2022 PM Peak, Level of Service Comparison

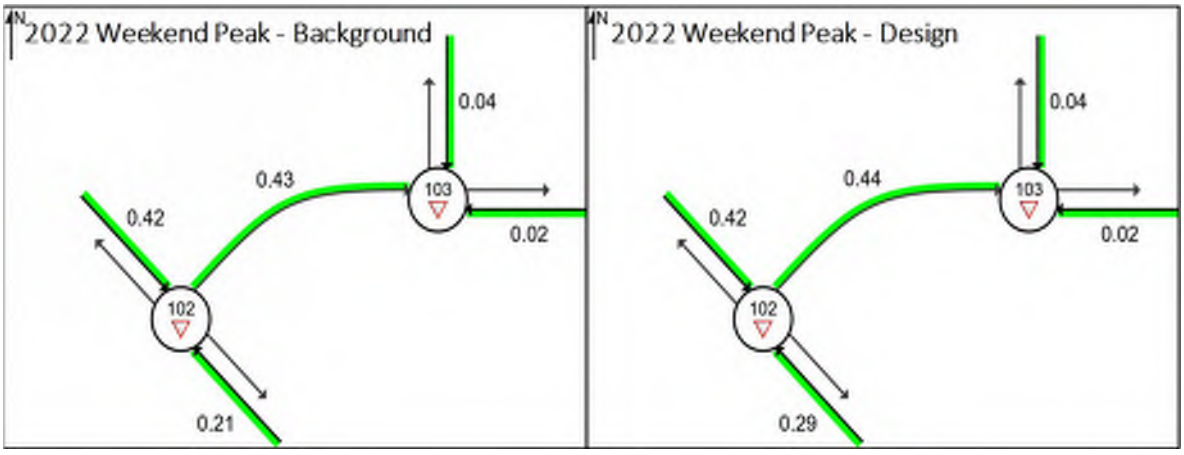


Figure 34: Cornwall Street / Kent Street – 2022 Weekend Peak, Level of Service Comparison

A detailed summary of the intersection performance during weekday and weekend peak periods is provided in Table 11. SIDRA Movement Summary outputs for the network is provided in Appendix E.

Table 11: Cornwall Street / Kent Street – Weekday SIDRA Results

Approach	Movement	DOS	Delay (s)	LOS	95th Queue
2020 AM Peak - Background					
Cornwall Street E	Right	0.129	10.0	LOS A	3.3
Kent Street	Left	0.054	11.2	LOS B	1.3
Cornwall Street W	Left	0.507	3.1	LOS A	0.0
	Through	0.507	0.0	LOS A	0.0
2020 PM Peak - Background					
Cornwall Street E	Right	0.024	8.2	LOS A	0.6
Kent Street	Left	0.161	11.4	LOS B	4.0
Cornwall Street W	Left	0.467	3.1	LOS A	0.0
	Through	0.467	0.0	LOS A	0.0
2022 AM Peak – Background					
Cornwall Street E	Right	0.148	10.8	LOS B	3.7
Kent Street	Left	0.063	11.8	LOS B	1.5
Cornwall Street W	Left	0.529	3.1	LOS A	0.0
	Through	0.529	0.0	LOS A	0.0
2022 AM Peak - Design					
Cornwall Street E	Right	0.153	11.2	LOS B	3.8
Kent Street	Left	0.063	11.8	LOS B	1.5
Cornwall Street W	Left	0.538	3.1	LOS A	0.0
	Through	0.538	0.0	LOS A	0.0
2022 PM Peak - Background					
Cornwall Street E	Right	0.026	8.2	LOS A	0.6
Kent Street	Left	0.169	11.4	LOS B	4.2
Cornwall Street W	Left	0.468	3.1	LOS A	0.0
	Through	0.468	0.0	LOS A	0.0
2022 PM Peak - Design					
Cornwall Street E	Right	0.026	8.4	LOS A	0.7
Kent Street	Left	0.169	11.4	LOS B	4.2
Cornwall Street W	Left	0.478	3.1	LOS A	0.0
	Through	0.478	0.0	LOS A	0.0

The weekday SIDRA results indicate that the Cornwall Street / Kent Street intersection remains within acceptable operating parameters for a priority-controlled intersection (i.e. DOS < 0.8, delay less than 42 seconds) during both the background and design scenarios. Furthermore, the above results indicate that there is negligible change in the DOS and queue lengths resulting from the addition of construction traffic.

Weekend SIDRA results are presented below in Table 12.

Table 12: Cornwall Street / Kent Street – Weekend SIDRA Results

Approach	Movement	DOS	Delay (s)	LOS	95th Queue
2020 Weekend Peak - Background					
Cornwall Street E	Right	0.017	6.9	LOS A	0.4
Kent Street	Left	0.035	9.9	LOS A	0.9
Cornwall Street W	Left	0.412	3.1	LOS A	0.0
	Through	0.412	0.0	LOS A	0.0
2022 Weekend Peak - Background					
Cornwall Street E	Right	0.019	7.3	LOS A	0.5
Kent Street	Left	0.039	10.3	LOS B	1.0

Cornwall Street W	Left	0.429	3.1	LOS A	0.0
	Through	0.429	0.0	LOS A	0.0
2022 Weekend Peak - Design					
Cornwall Street E	Right	0.020	7.5	LOS A	0.5
Kent Street	Left	0.039	10.3	LOS B	1.0
Cornwall Street W	Left	0.439	3.1	LOS A	0.0
	Through	0.439	0.0	LOS A	0.0

The weekend SIDRA results indicate that the Cornwall Street / Kent Street intersection remains within acceptable operating parameters for a priority-controlled intersection (i.e. DOS < 0.8, delay less than 42 seconds) during both the background and design scenarios. Furthermore, the above results indicate that there is negligible change in the DOS and queue lengths resulting from the addition of construction traffic.

3.3.5 Delay Impact

Based on the above analysis, Table 13 summarises the GTIA delay impact assessment for year 2022 forecast background traffic and 2022 design traffic, totalled across all intersections (i.e. Annerley Road / Cornwall Street and Cornwall Street / Kent Street) and peak assessment periods.

Table 13: GTIA Delay Impact Analysis

2022 Background Delay Impact (veh-sec)	2022 Design Delay Impact (veh-sec)	Net Change (%)
16,123	16,959	5.2%

As shown, the addition of construction traffic increases total intersection delay by more than 5%. The key contributor to this increase in intersection delay is the addition of construction traffic to the right turn movement from Annerley Road to Cornwall Street (i.e. the primary controlled approach).

As shown in Table 8, the traffic volumes on this movement are anticipated to increase by 15-23% (i.e. an increase from 65 to 75 during the AM peak, from 44 to 54 during the PM peak and from 62 to 72 during the weekend peak) during the peak periods. This increase in volumes results in proportional increases in delay for the movement.

Despite this, SIDRA results presented above indicate that delays will remain well below the acceptable threshold for an unsignalized intersection and queueing will be contained within the existing right turn storage facility. As such, no mitigation measures / changes to intersection configurations are considered warranted based on traffic impacts.

3.4 Public Transport Impacts

Construction traffic is not expected to adversely impact the operation of public transport services proximate to the Southern Portal worksite.

3.5 Active Transport Impacts

3.5.1 Overview

The following sections provide an analysis of the impacts of construction traffic on active transport facilities / infrastructure. This analysis predominantly focuses on identified conflict points with pedestrians and cyclists with construction vehicles.

3.5.2 Annerley Road / Cornwall Street

As noted in Section 2.4, a pedestrian crossing facility is provided across Cornwall Street at the Annerley Road / Cornwall Street intersection. A summary of pedestrian movements across Cornwall Street is provided below in Table 14.

Table 14: Pedestrian Crossing Volumes – Cornwall Street at Annerley Road

Pedestrian Crossing Volumes	Weekday Volumes			Weekend Volumes	
	AM Peak	PM Peak	Daily	Peak	Daily
Cornwall Street at Annerley Road	26	27	187	7	92

As shown, a peak of 27 pedestrians were recorded to cross Cornwall Street at the Anerley Road / Cornwall Street intersection during the peak periods. It is noted that of the total traffic turning into Cornwall Street from Annerley Road during peak periods (i.e. conflicting with the pedestrian crossing), construction traffic comprises only 1% of the total volumes, where the predominant movement is the left turn from Annerley Road into Cornwall Street.

In accordance with Austroads *Guide to Road Design, Part 4A: Signalised and Unsignalised Intersections,* pedestrian sight distance has been assessed to ensure that a clear view between approaching traffic and pedestrians on or waiting to cross the roadway is achieved.

Table 15: Sight Distance Assessment – Annerley Road at Cornwall Street

Sight Distance	AGRD Requirement	Compliant
Approach Sight Distance (ASD)	92m	Yes
Crossing Sight Distance	139m	Yes

It is noted that kerb build-out modifications have previously been implemented at the intersection to shorten the crossing distance for pedestrians. Based on the above, construction traffic is not expected to adversely impact the operation or safety or pedestrians utilising the crossing at the Annerley Road / Cornwall Street intersection.

3.5.3 Cornwall Street / Kent Street

As noted in Section 2.4, a pedestrian crossing facility is provided across Kent Street at the Cornwall Street / Kent Street intersection. A summary of pedestrian movements across Cornwall Street is provided below in Table 16.

Table 16: Pedestrian Crossing Volumes – Kent Street at Cornwall Street

Pedestrian Crossing Volumes	Weekday Volumes			Weekend Volumes	
	AM Peak	PM Peak	Daily	Peak	Daily
Cornwall Street at Annerley Road	54	45	536	5	137

As shown, a peak of 54 pedestrians were recorded to cross Kent Street at the Cornwall Street / Kent Street intersection during the peak periods.

During a site inspection undertaken on the 16th June 2020, it was observed that a majority of pedestrians transitioned from the footpath on the western side of Cornwall / Kent Street to the eastern side using the existing kerb ramps at the intersection. Similarly, off-road cyclists were observed to transition from the western footpath to the road (Kent Street) in order to access the off-road shared-use pathway adjacent to the

worksite. This is likely due to the termination of the western footpath approximately 70m north of the Cornwall Street / Kent Street intersection.

While the addition of construction traffic is not expected to adverse impact the operation of these facilities, the focus should revolve around the safety of these vulnerable road users.

In consultation with Brisbane City Council, consideration should be given to maintaining pedestrian and off-road cyclist movements on the western footpath along Kent Street to minimise conflict points with vehicles. Consideration should also be given to widening the existing pathway to increase the attractiveness of such a facility to off-road cyclists and to accommodate two-way off-road cyclist and pedestrian movements. A concept plan has been developed and is provided in Appendix F detailing the arrangement.

All interface between construction vehicles and cyclists and pedestrians at site access locations will be managed to mitigate the risk of conflicts (i.e. traffic controllers at site accesses).

Further details of the design of the above mitigation measure and consultation with Brisbane City council will be included in the Construction Traffic Management Plan Subplan (CTMP-SP) for these works.

4 Access Assessment

4.1 Overview

Three (3) access points on Kent Street are proposed for access to the Southern Portal worksite:

- **Access 1:** Left in entry access on Kent Street
- **Access 2:** Left in entry access on Kent Street
- **Access 3:** Left out exit access on Kent Street.

Access 1 will be used during early works construction activities (i.e. demolition) and will be decommissioned following their completion. Access 2 will serve as the long-term site entry, with Access 3 providing egress from the worksite. The site establishment and demolition plan is provided in Appendix G.

4.2 Driveway Crossover Form

Driveway construction details will be included in the CTMP-SP.

4.3 Sight Distance

Table 17 provides a summary of sight distances at available at Access 3 against the requirements of Austroads Guide to Road Design, Part 4A: Signalised and Unsignalised Intersections, noting that Access 1 and Access 2 is restricted to left-in entry only.

Table 17: Sight Distance Assessment – Access 3

Access	Direction	AGRD Requirement	Compliant
3	South	55m[1]	Yes

1 – No posted speed, assumed 40km/h posted speed

Figure 35 shows the available sight lines from Access 3.

Figure 35: Sight Distance South of Access 3

5 Road Safety Assessment

5.1 Road Safety Risk Assessment

A road safety assessment was undertaken in accordance with the Department of Transport and Main Roads, Guide to Traffic Impact Assessment. This process involved the identification of any new or changed risks resulting from the introduction of construction heavy vehicles accessing the Southern Portal worksite via Kent Street. The key safety risks with the introduction of construction traffic to Kent Street and connecting intersections relate to increasing right turning movements at the Annerley Road / Cornwall Street intersection and the interaction between construction vehicles and other road users, including vehicles, cyclists and pedestrians.

Traffic safety risks have been identified and scored using the risk scoring matrix shown in Table 18. Scoring has been undertaken for both the background and design cases.

Table 18: Risk Scoring Matrix

		Potential consequence				
		Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality (5)
Potential likelihood	Almost certain (5)	M	M	H	H	H
	Likely (4)	M	M	M	H	H
	Moderate (3)	L	M	M	M	H
	Unlikely (2)	L	L	M	M	M
	Rare (1)	L	L	L	M	M

To determine appropriate scores for the identified risks, consideration has been given to the approximate available sight distances on approach to a hazard / risk, the volume of construction traffic being added and potential implications resulting from the introduction of construction vehicles.

Table 19: Road Safety Risk Assessment

	Without construction			With construction				With construction and mitigation		
Risk Item	Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measures	Likelihood	Consequence	Risk Score
Right turn pocket of intersection at Annerley Road / Cornwall Street	1	3	L	1	3	L	No action – refer to SIDRA outputs provided in Appendix E	-	-	-

queuing out into 60km/h traffic; rear end crash										
Sight distance for right turns into Cornwall Street from Annerley Road; potential for right-through	1	3	L	2	3	M	Due to the close proximity of the downstream intersection (~50m) of Annerley Road / Cornwall Street / Noble Street / Railway terrace, Minimum Gap Sight Distance (MGSD) and Safe Intersection Sight Distance (SISD) cannot be achieved – 83m and 151m respectively. – However, the downstream signalised intersection will provide gaps in traffic through the platooning of vehicles and all-red time to allow vehicles to turn right at the Annerley Road / Cornwall Street intersection. Further consideration will be given during the development of the CTMP-SP in consultation with Brisbane City Council.	-	-	-
Crossing sight distance between approaching vehicles and pedestrians on or waiting to cross Cornwall Street at the Annerley Road / Cornwall Street; potential for right through crashes with pedestrians / cyclists	1	3	L	1	3	L	No action – refer to Section 3.5.2	-	-	-
Off-road cyclists transitioning to road using kerb ramp at Cornwall Street / Kent Street intersection; potential for vehicle conflict with cyclists	1	3	L	2	3	M	Refer to Section 3.5.3 – further consultation required with Brisbane City Council	-	-	-
Construction vehicles turning across off-road active transport facilities	1	3	L	2	3	M	Refer to Section 3.5.3 – All interface between construction vehicles and cyclists and pedestrians at site access locations	1	3	L

							will be managed to mitigate the risk of conflicts (i.e. traffic controllers at site accesses).			

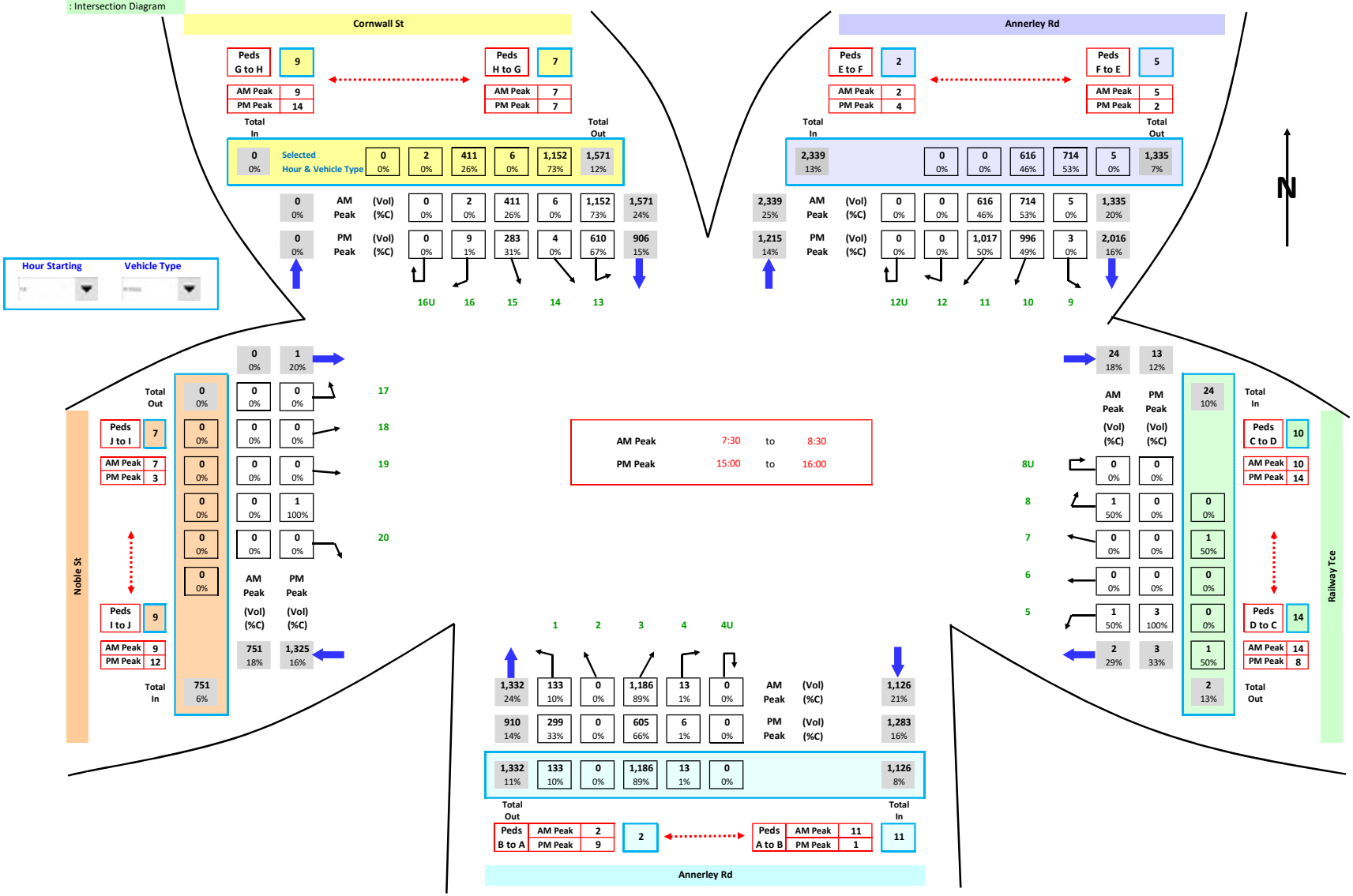
As documented above, mitigation measures will be developed, where required in consultation with Brisbane City Council and detailed within the CTMP.

Appendix A

Traffic Survey Data

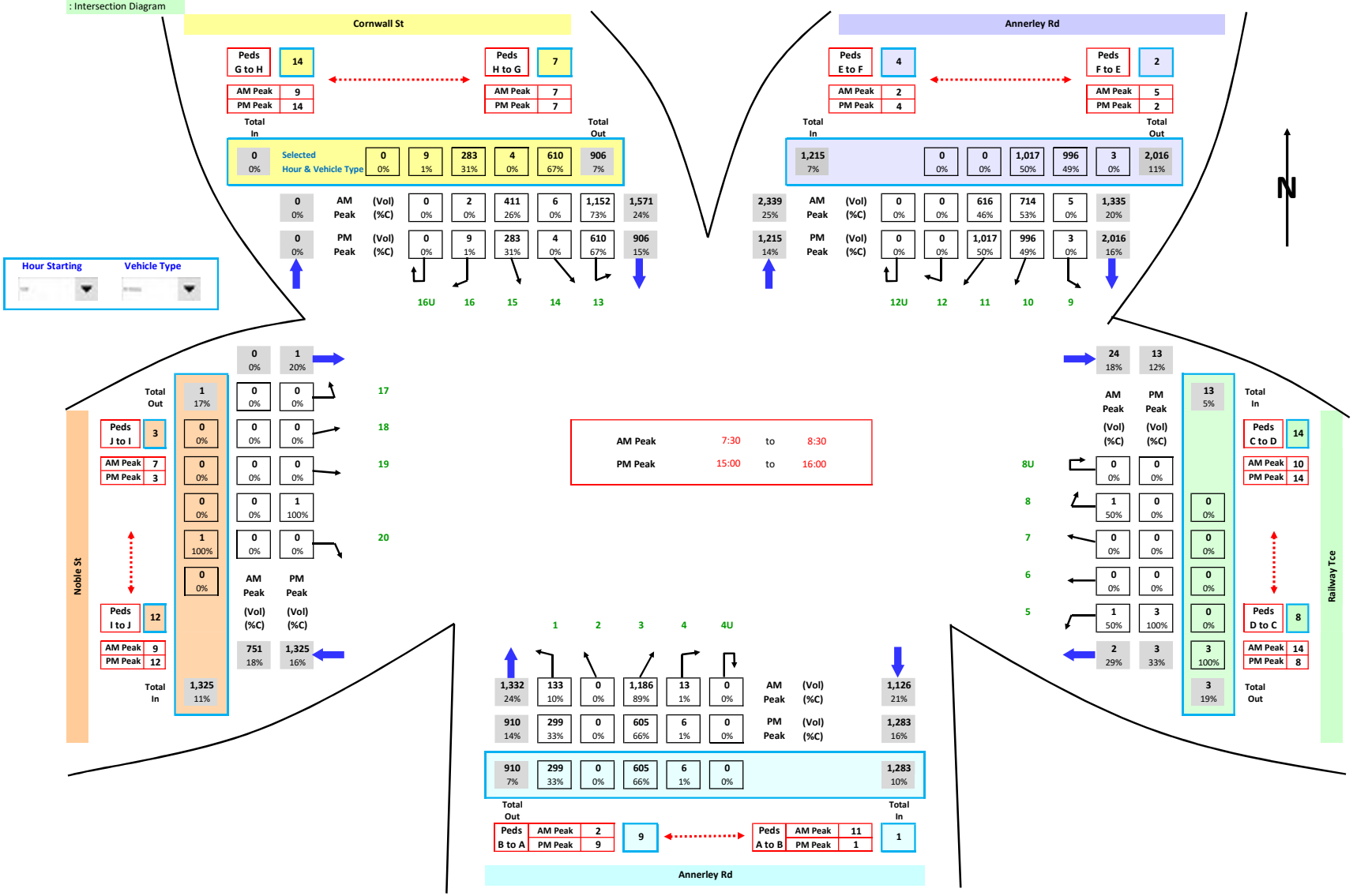
Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 1. Annerley Rd / Noble St / Railway Tce / Cornwall St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram



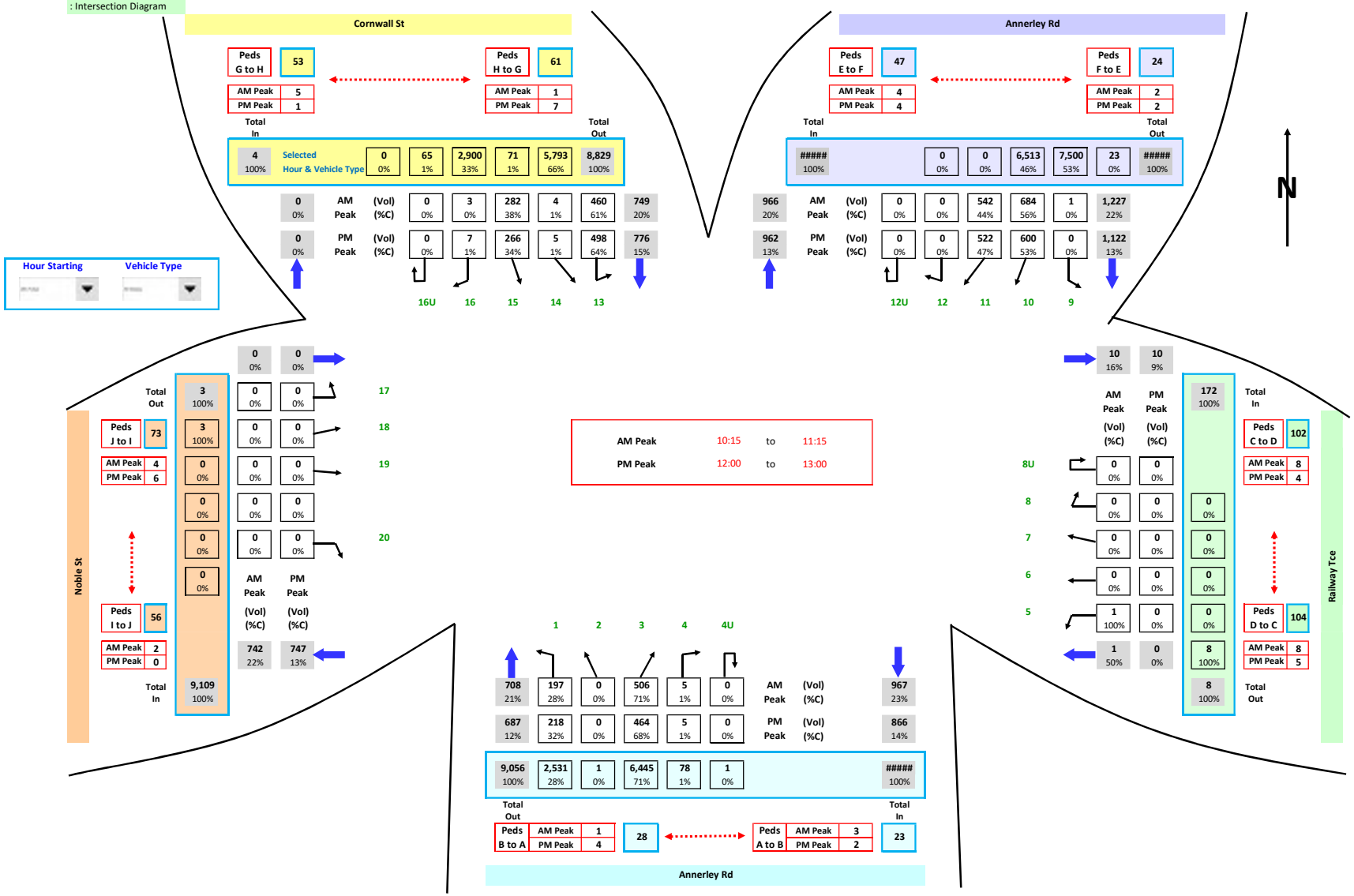
Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 1. Annerley Rd / Noble St / Railway Tce / Cornwall St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram



Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 1. Annerley Rd / Noble St / Railway Tce / Cornwall St

Day/Date : Sat, 20th June 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

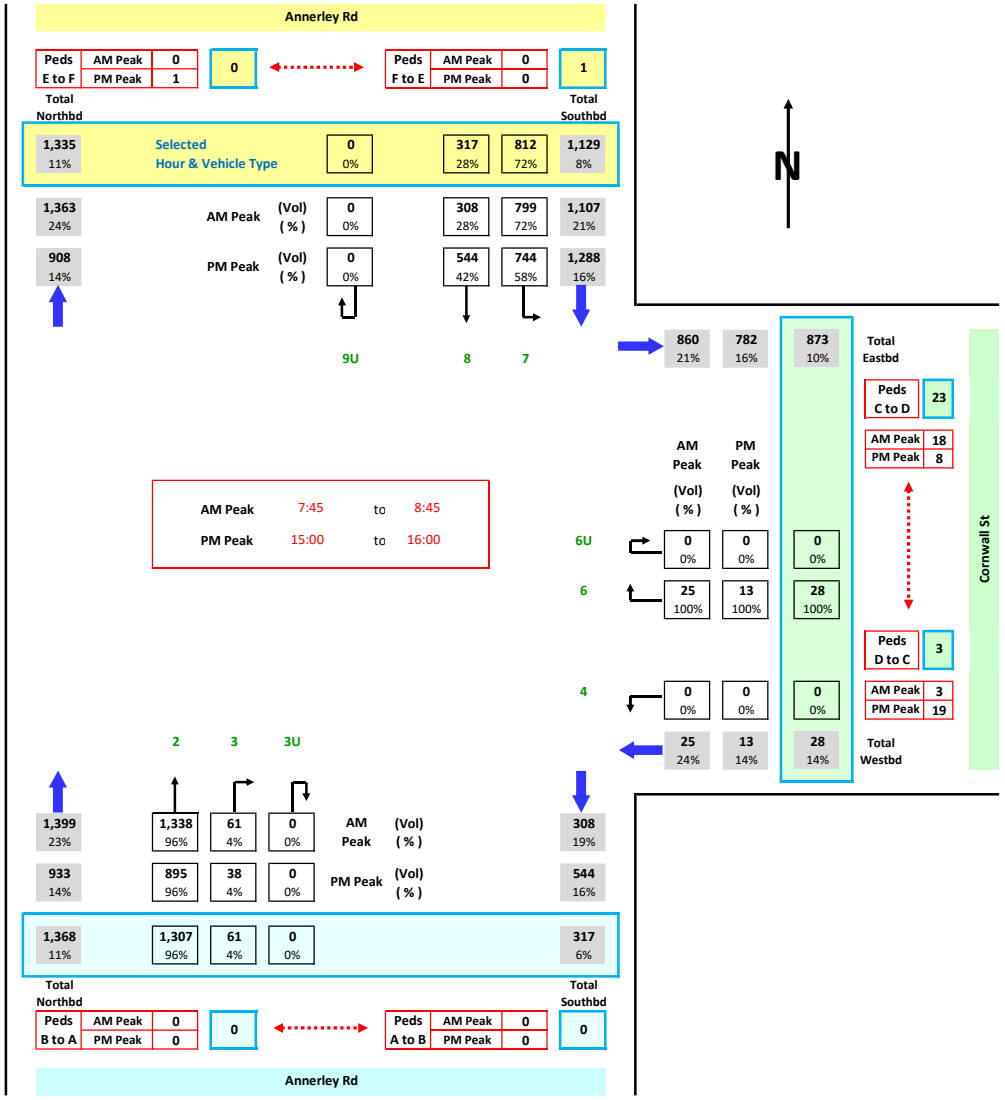


Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 2. Annerley Rd / Cornwall St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

Hour Starting	Vehicle Type

MATRIX Traffic and Transport Data

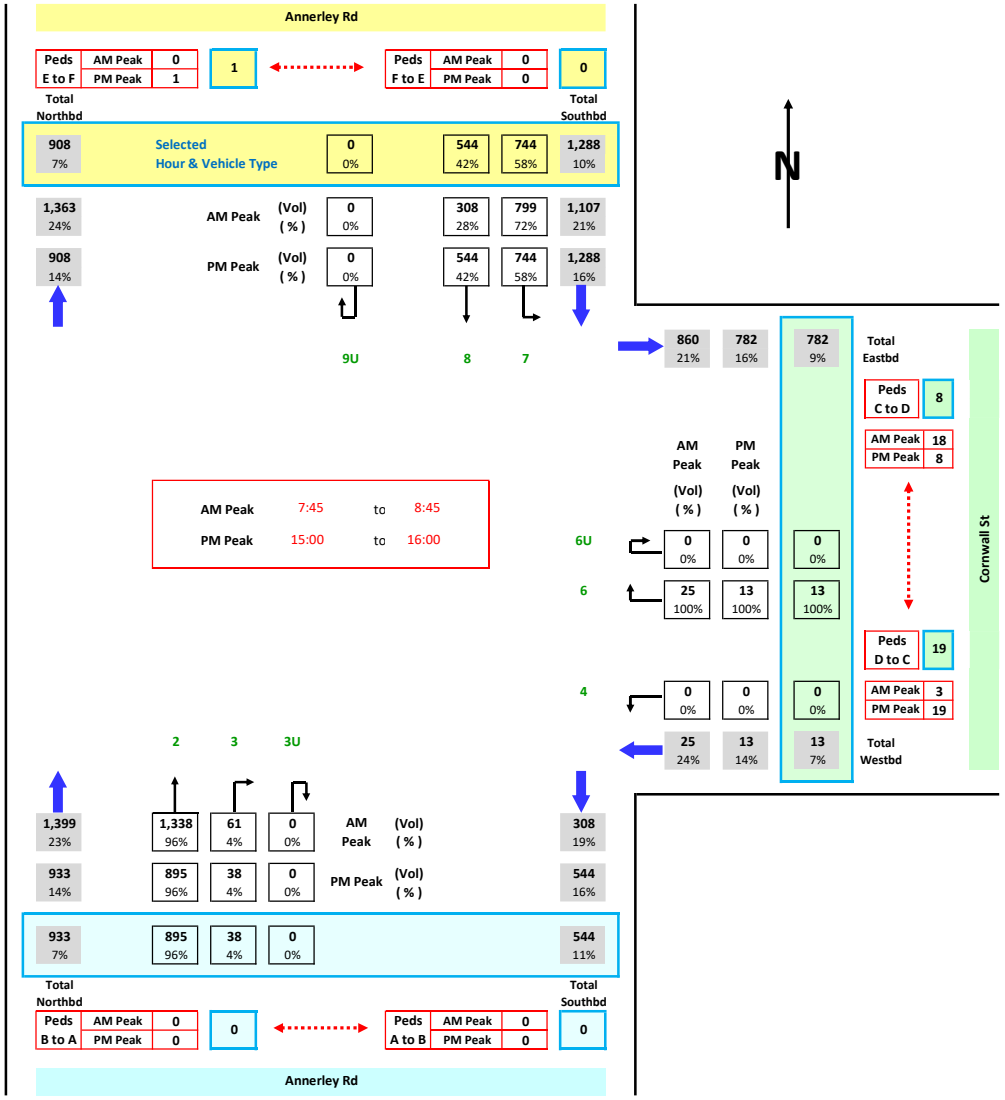


Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 2. Annerley Rd / Cornwall St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

Hour Starting	Vehicle Type

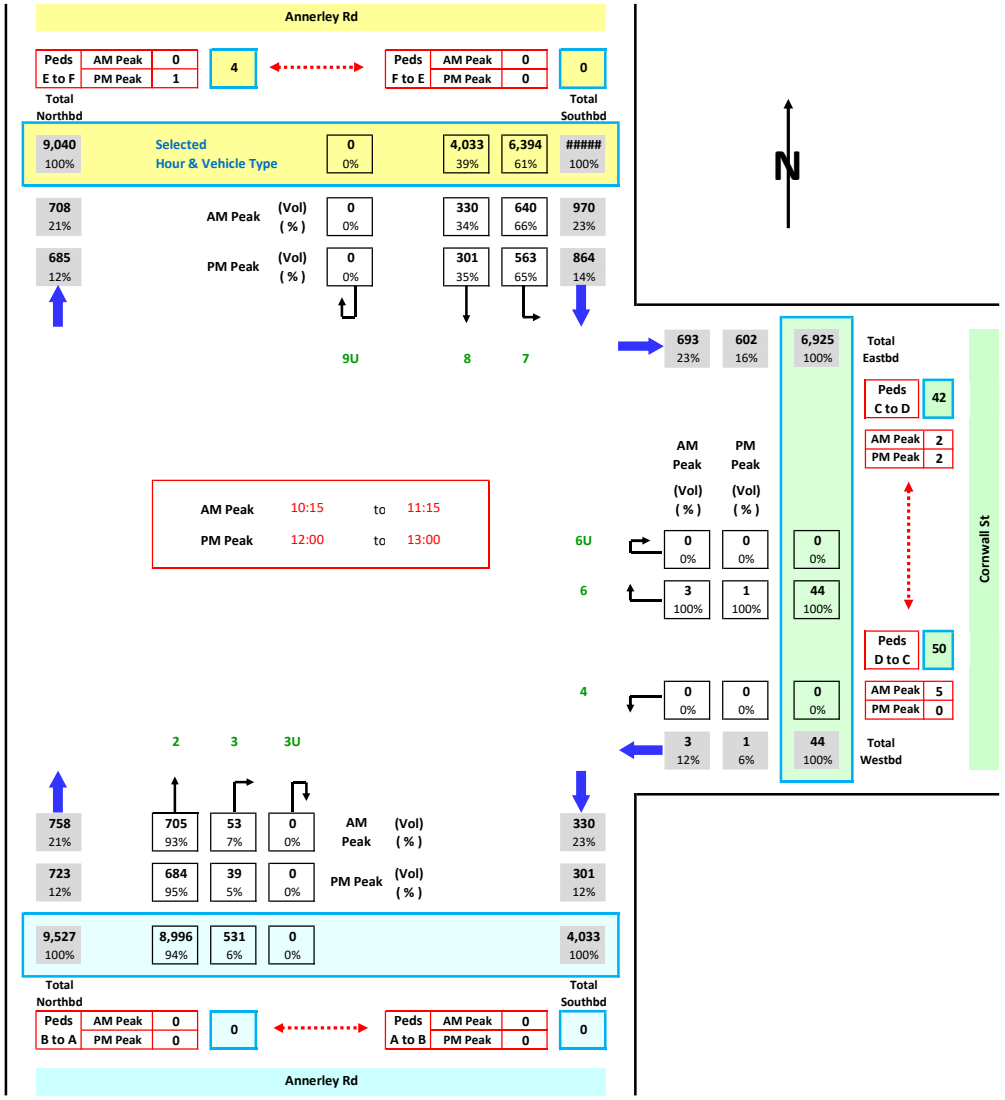
MATRIX Traffic and Transport Data



Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 2. Annerley Rd / Cornwall St

Day/Date : Sat, 20th June 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

Hour Starting	Vehicle Type

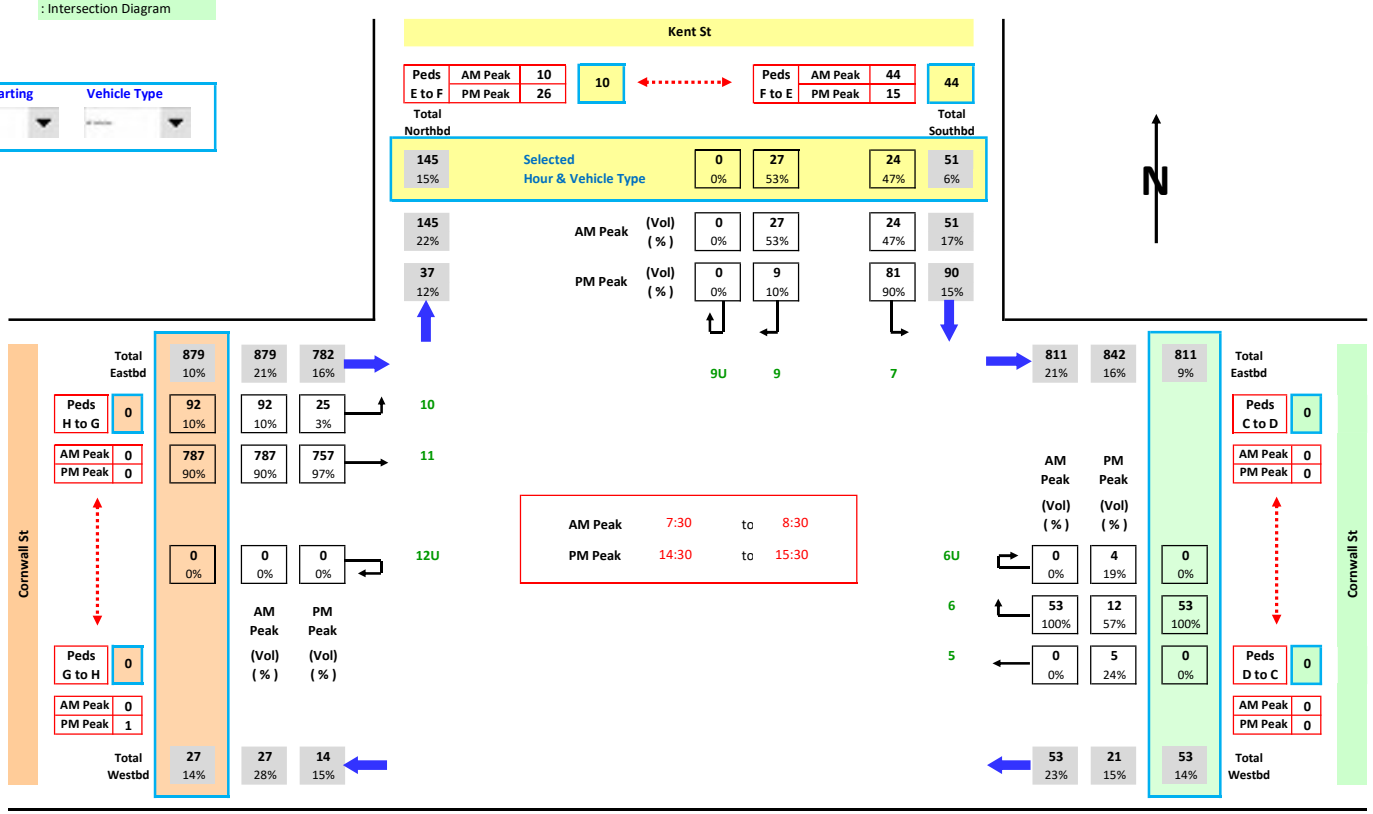


Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 3. Cornwall St / Kent St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

MATRIX Traffic and Transport Data

Hour Starting | Vehicle Type

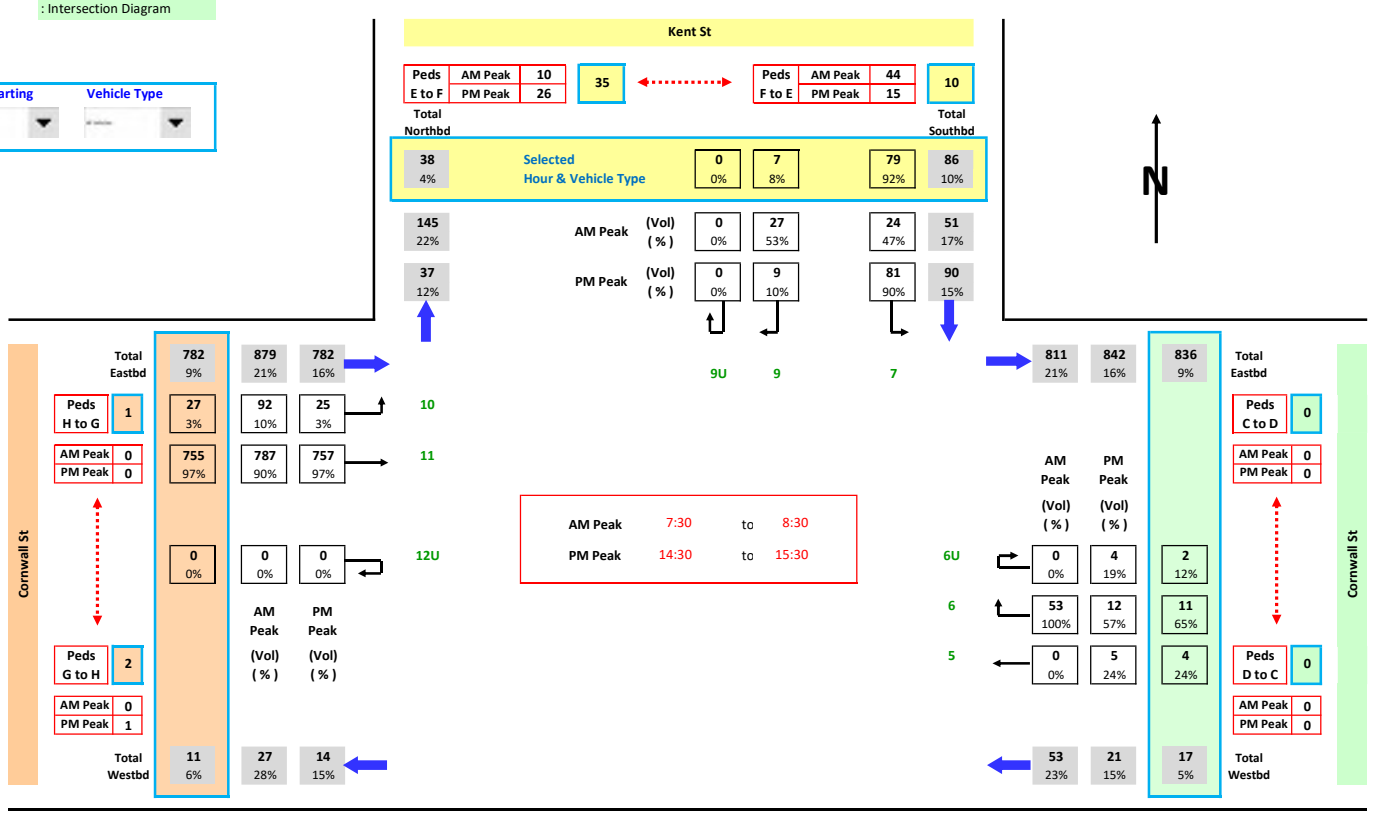


Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 3. Cornwall St / Kent St

Day/Date : Thu, 18th Jun 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

MATRIX Traffic and Transport Data

Hour Starting | Vehicle Type

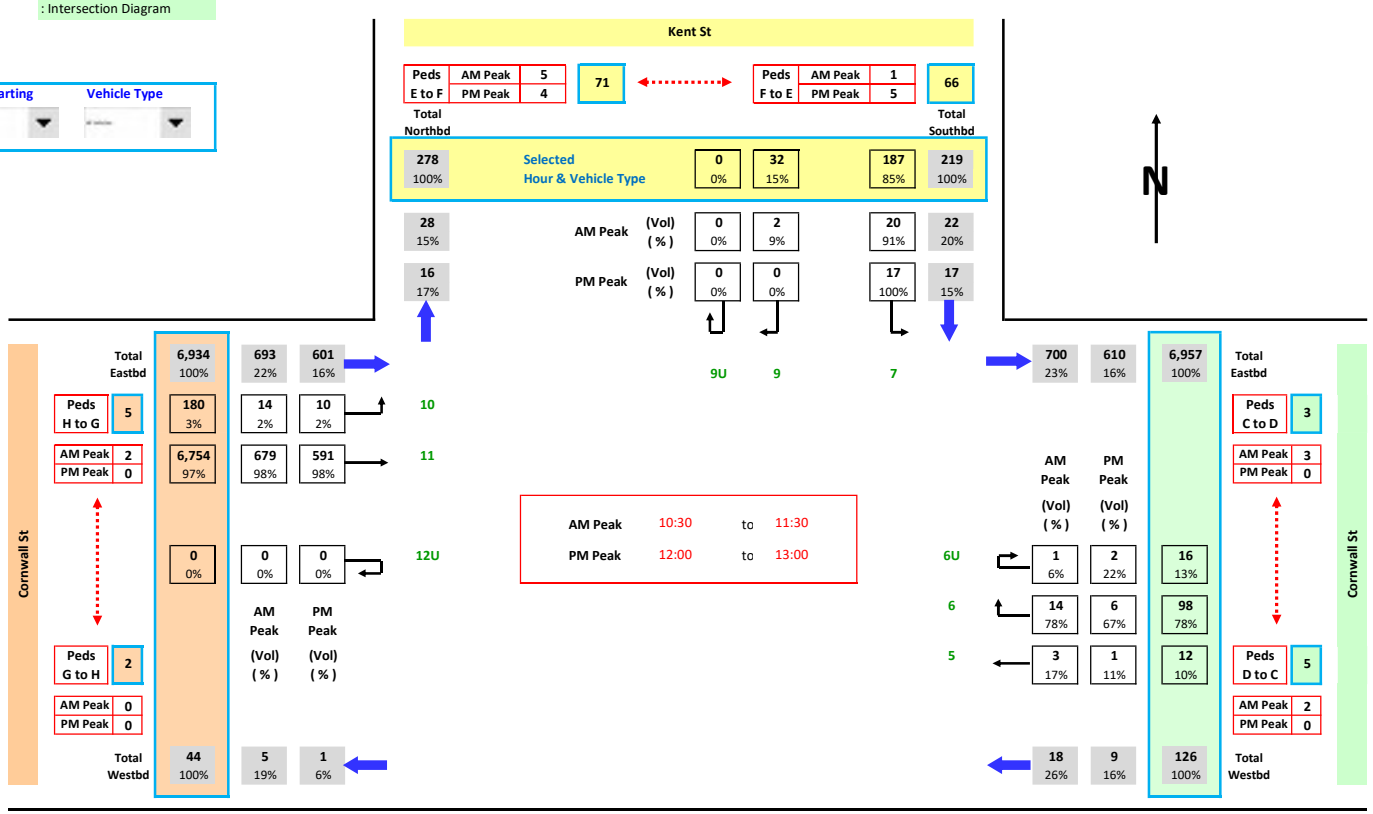


Job No. : Q2691
Client : CBGU JV
Suburb : Annerley
Location : 3. Cornwall St / Kent St

Day/Date : Sat, 20th June 2020
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

MATRIX Traffic and Transport Data

Hour Starting | Vehicle Type



Appendix B

Construction Traffic Route

APPROVED HV ROUTE – RFPC 4

PROPOSED HV ROUTE

TO BOGGO RD STATION SITE

KENT STREET

BUSWAY OVER

DUTTON PARK STATION

SOUTH BRISBANE CEMETERY

UQ SCHOOL OF PHARMACY

RAILWAY LINE

ANNERLEY ROAD

CORNWALL ST

IPSWICH ROAD

125m 100 75 50 25 0 25

1:2500

NORTH

ALTERATIONS				
ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION

BEN MCLEAN

PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

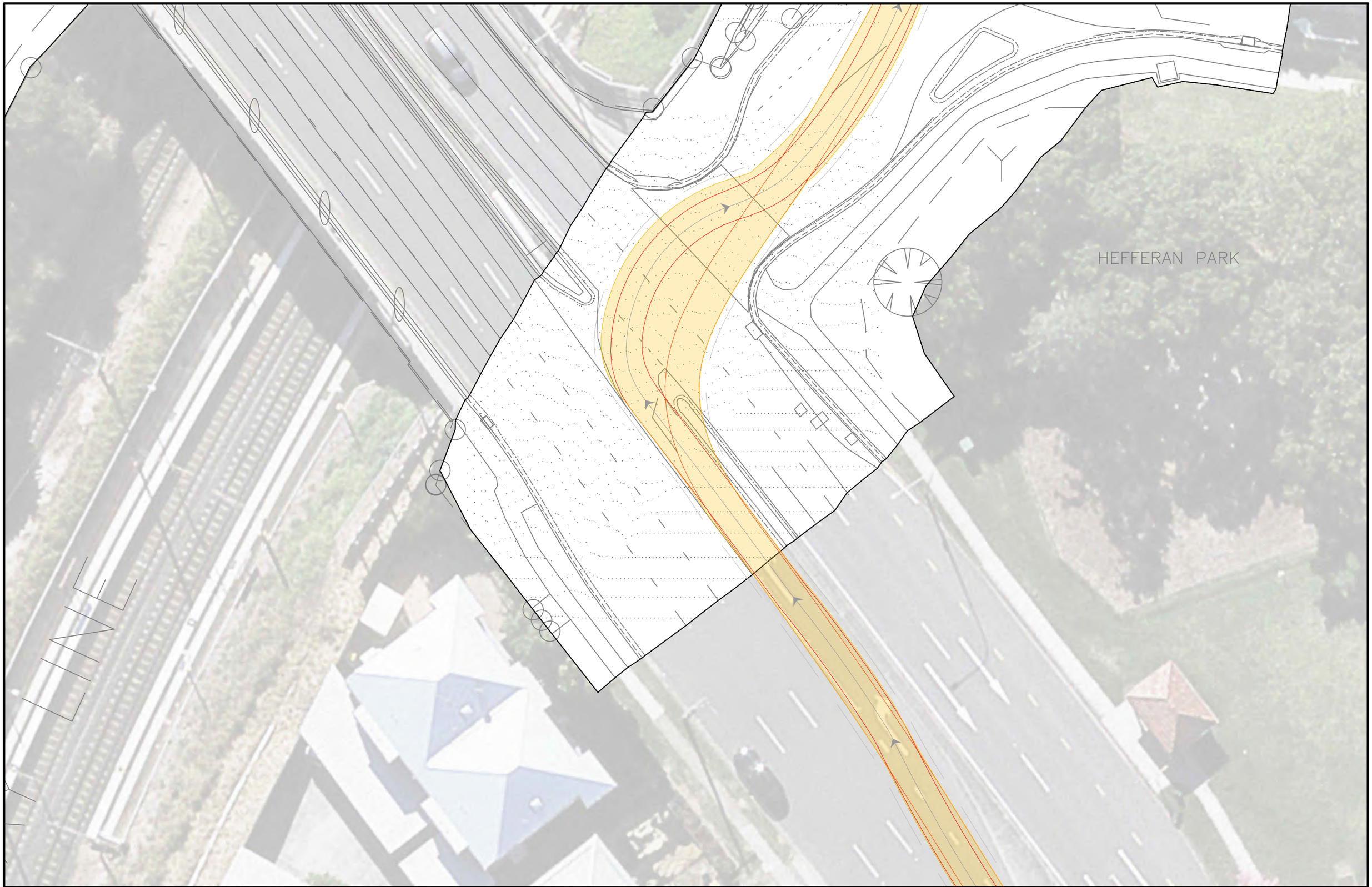
HEAVY VEHICLE ACCESS ROUTES

DRAWING NUMBER	ISSUE
CRRTSD-TM-SKT-CBGU-020002	D
SHEET 1 OF 14	

CURRENT CTMP SUBPLAN: NIL

Appendix C

Swept Path Analysis



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ALTERATIONS

ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

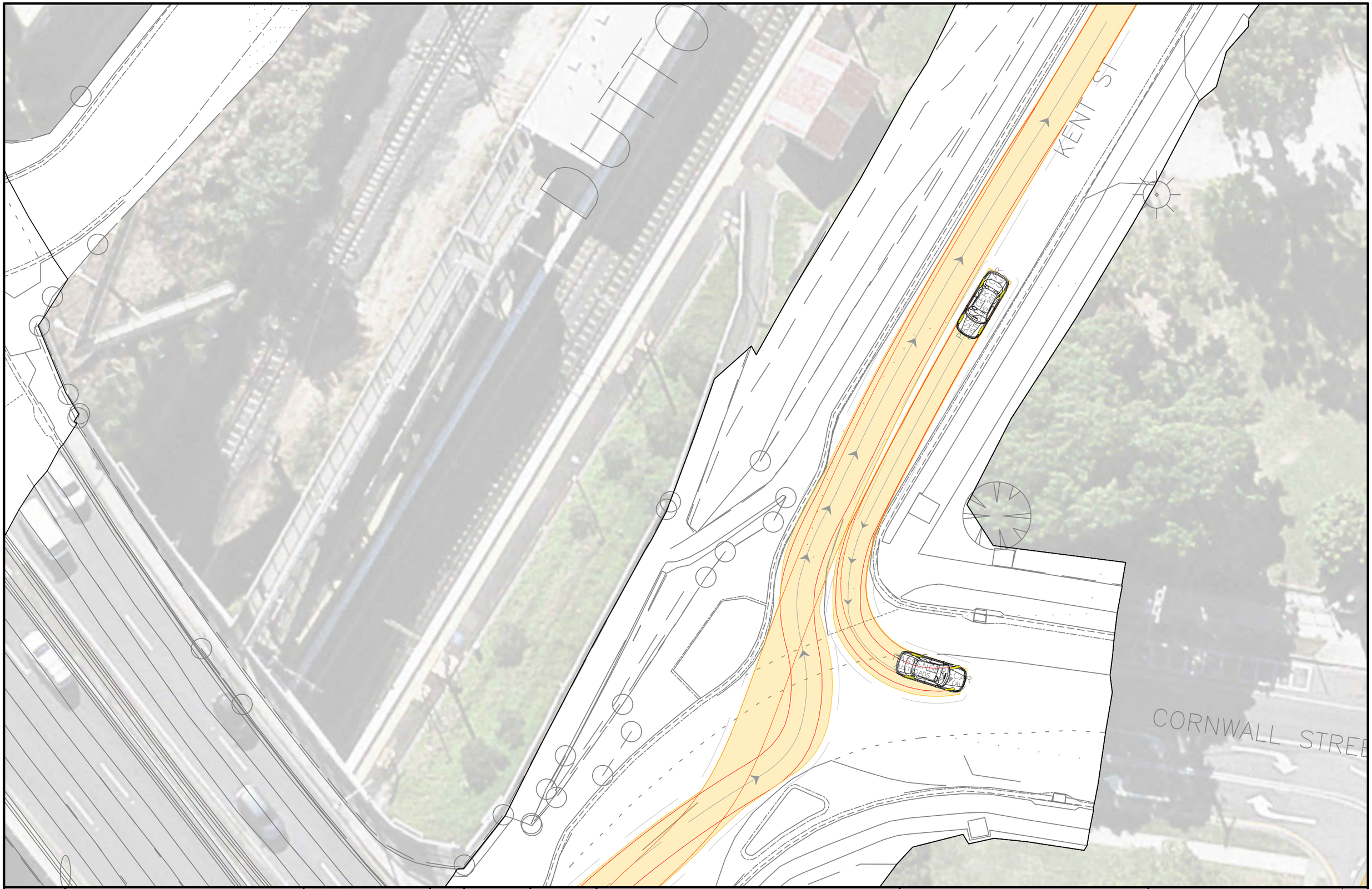
SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
SHEET 2 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

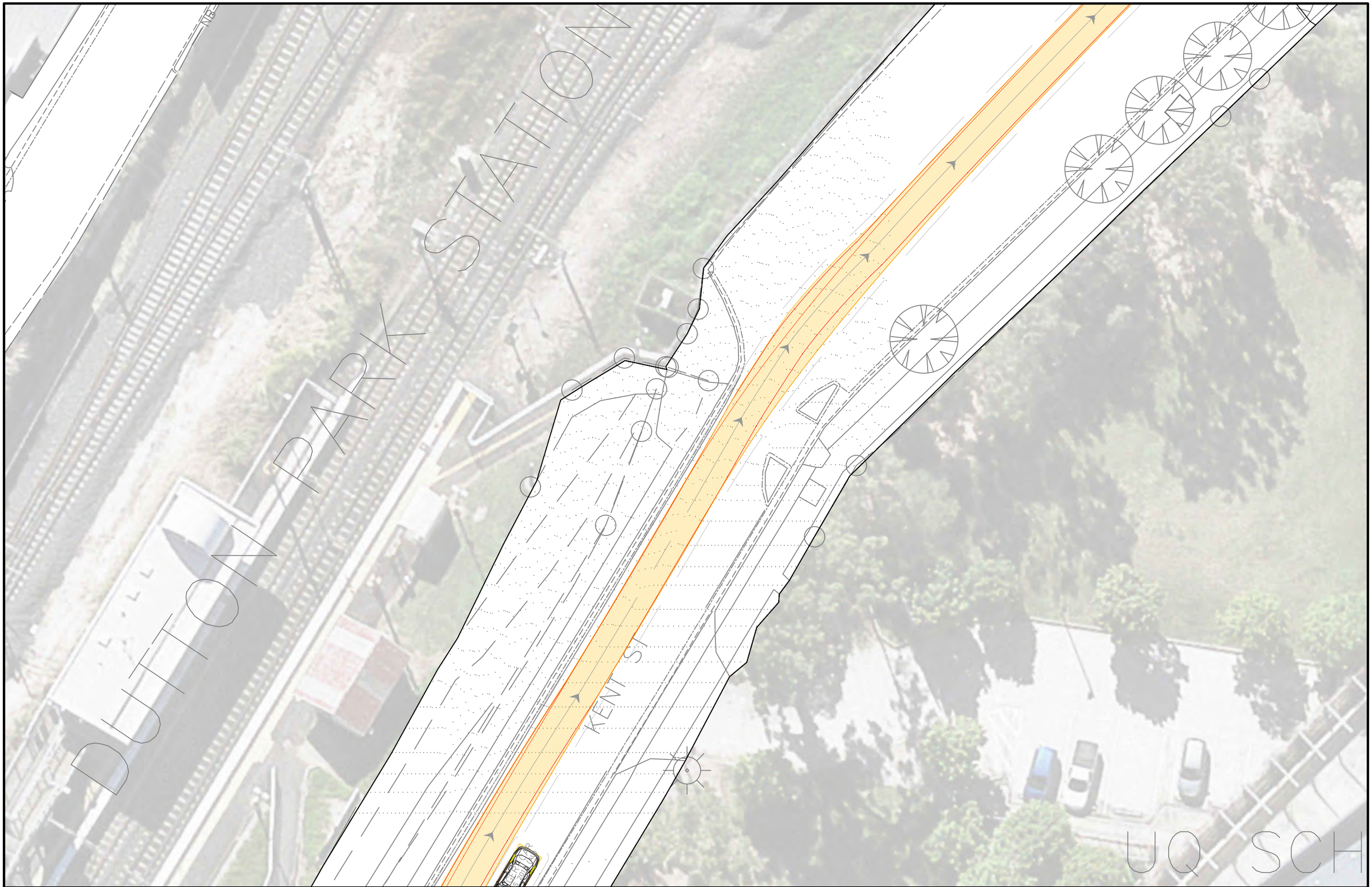
CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002

SHEET 3 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL
CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

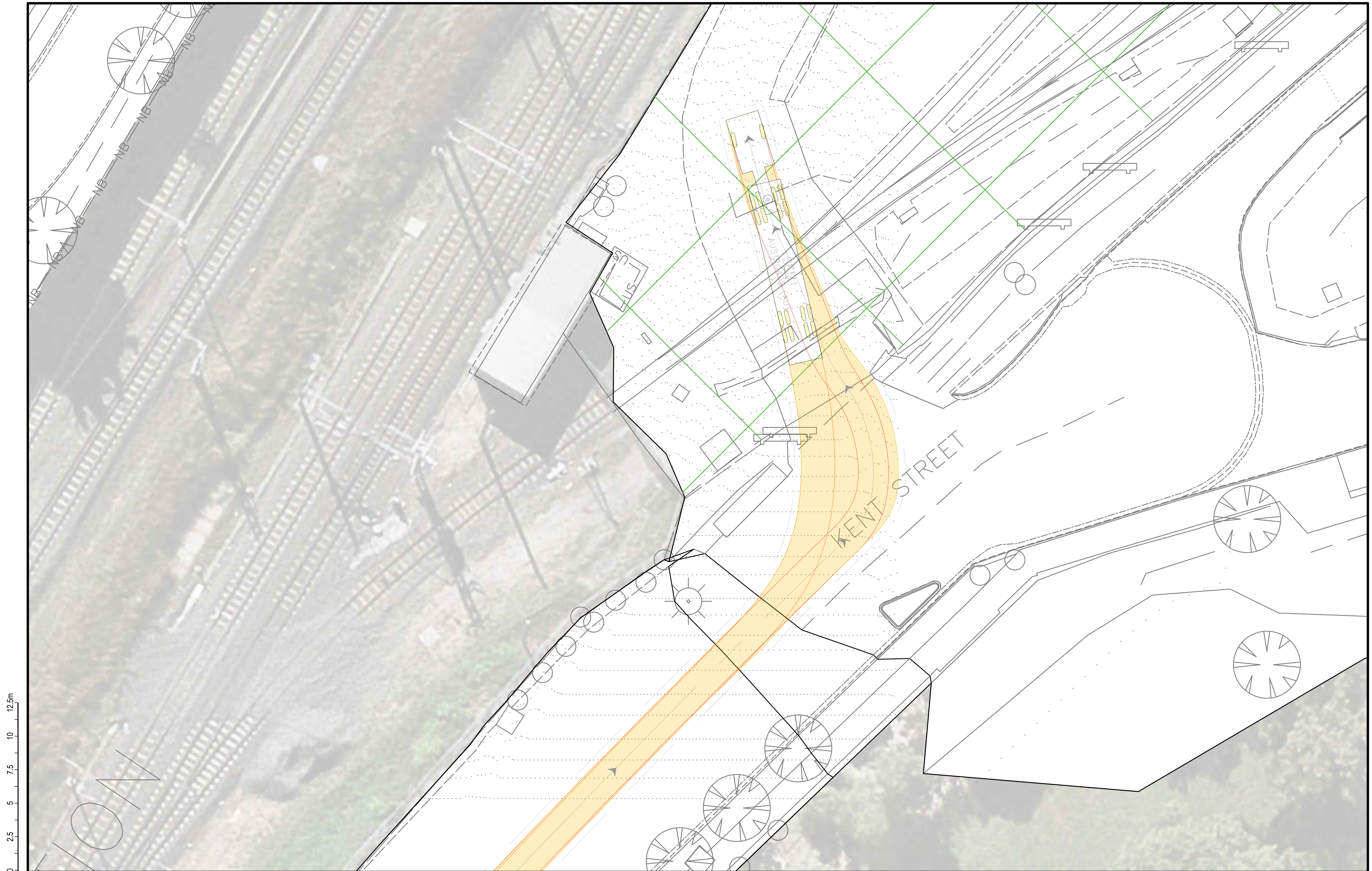
BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER	ISSUE
CRRTSD-TM-SKT-CBGU-020002	D
SHEET 4 OF 14	
CURRENT CTMP SUBPLAN: NIL	



NORTH

ALTERATIONS

ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB
CHECKED	
DRAWN	JB
DRG CHK	

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

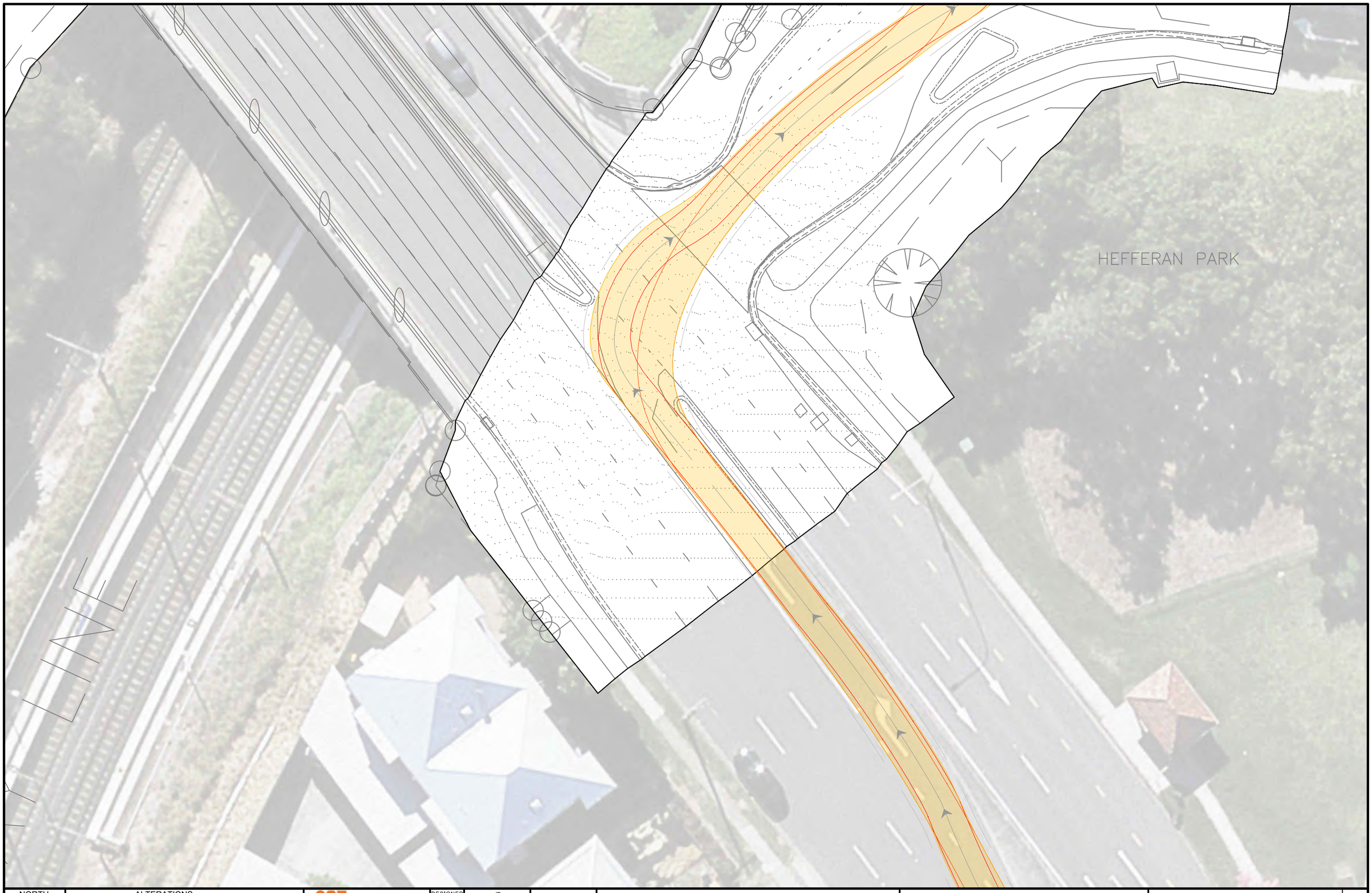
CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002

ISSUE: D

SHEET 5 OF 14

CURRENT CTMP SUBPLAN: NIL



0 2.5 5 7.5 10 12.5m

1:250

NORTH

ALTERATIONS

ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

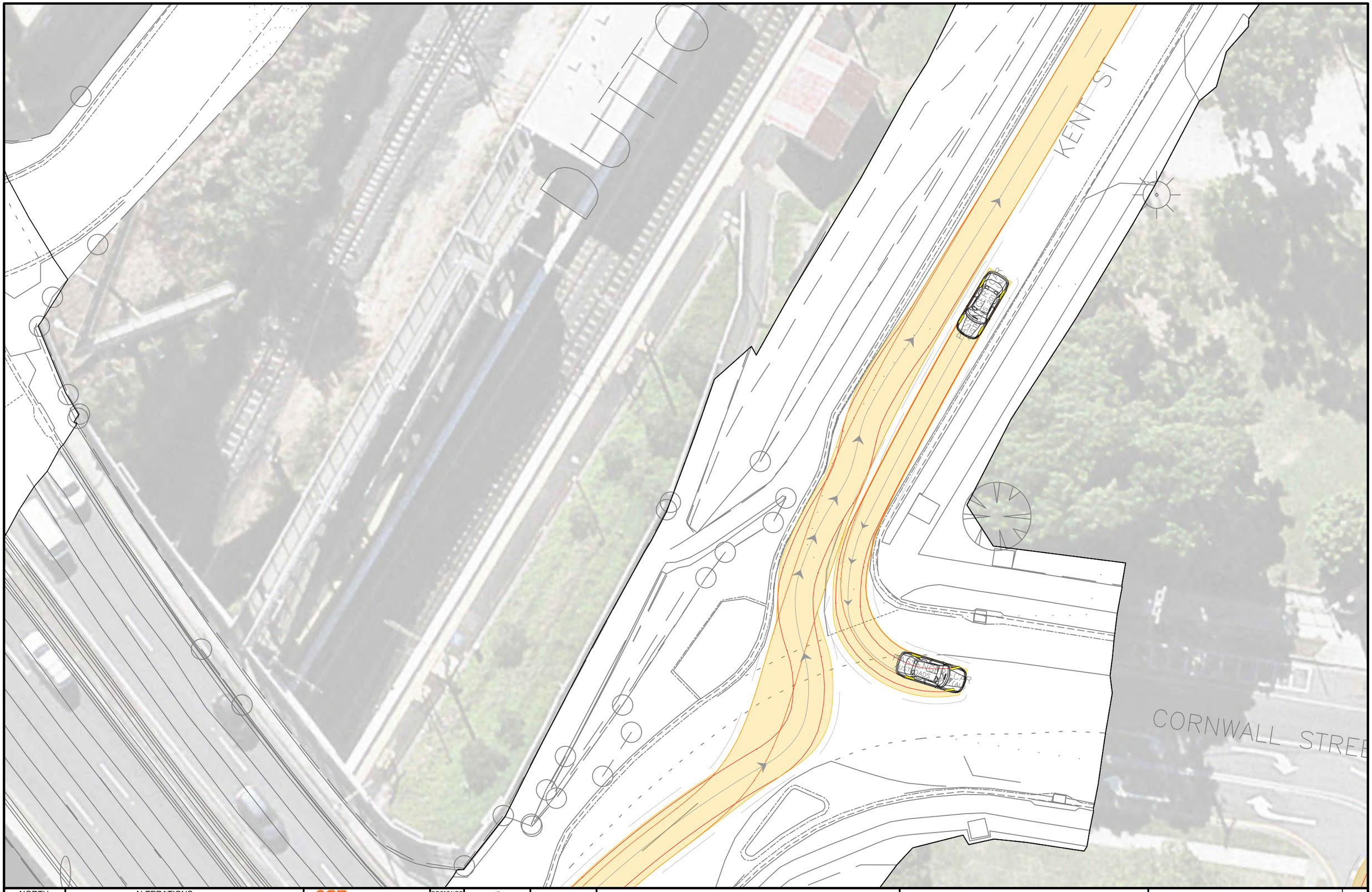
CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002

SHEET 6 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

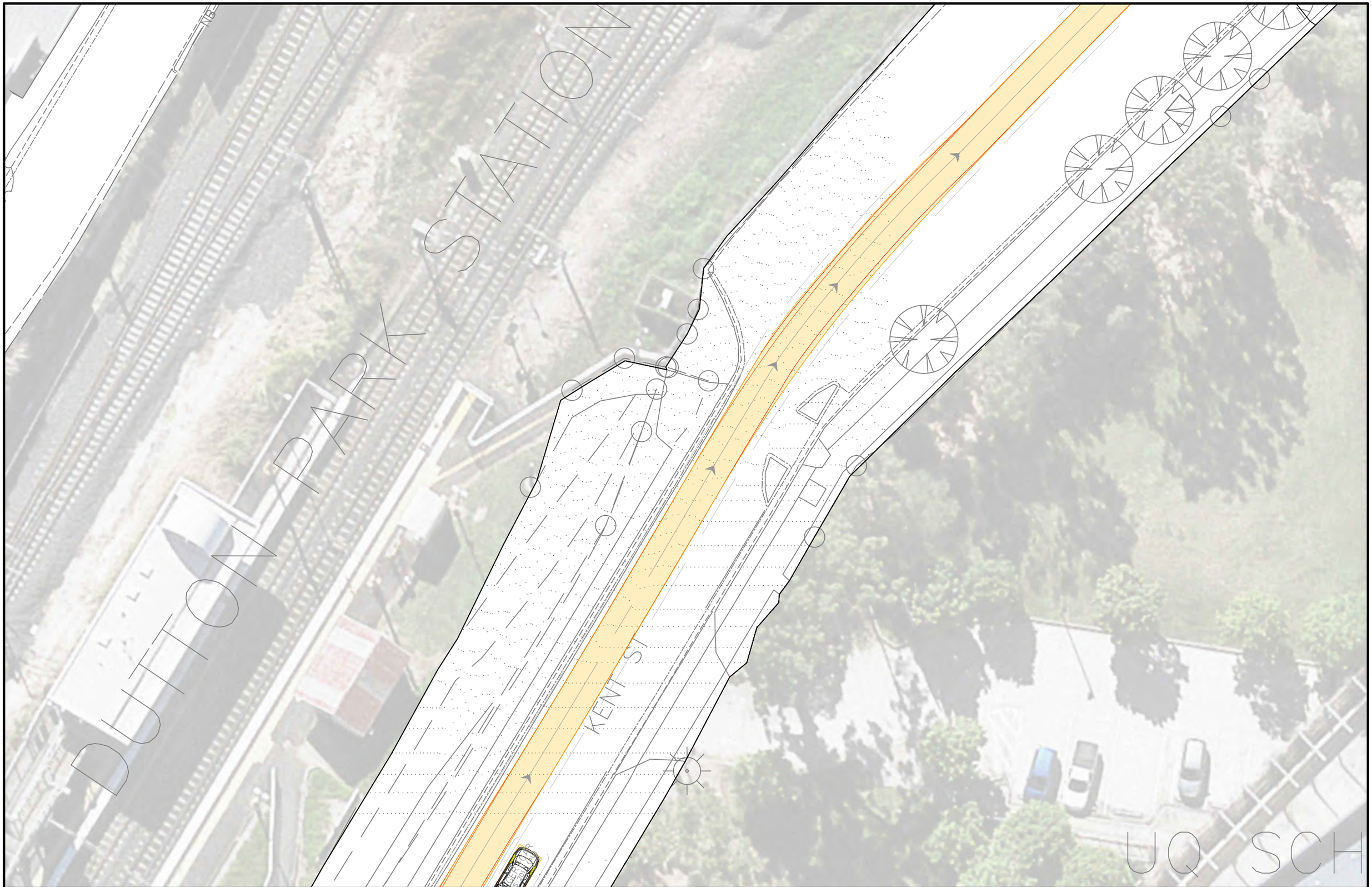
TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
ISSUE: D
SHEET 7 OF 14

CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

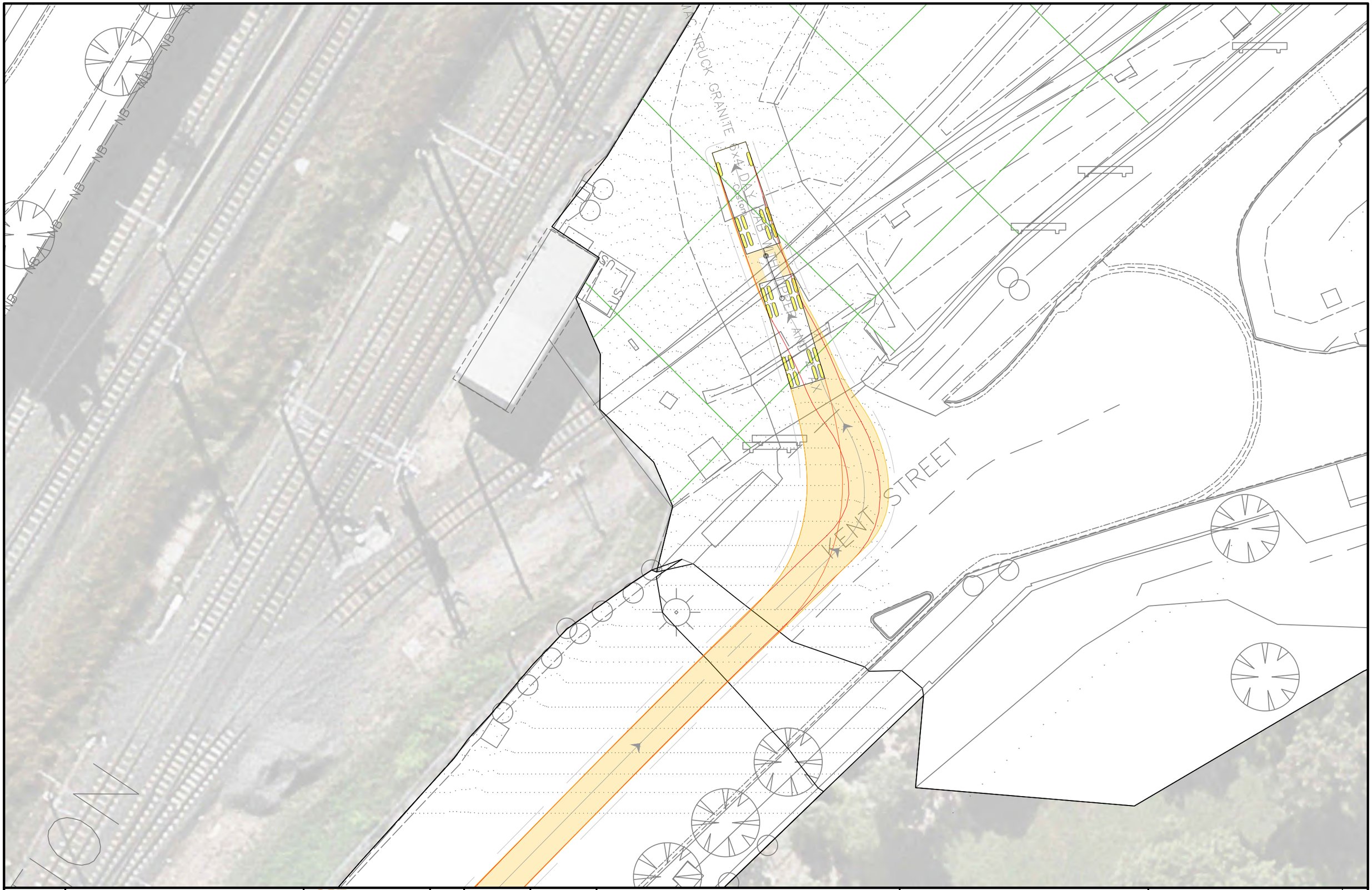
BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
ISSUE: D
SHEET 8 OF 14
CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ALTERATIONS				
ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

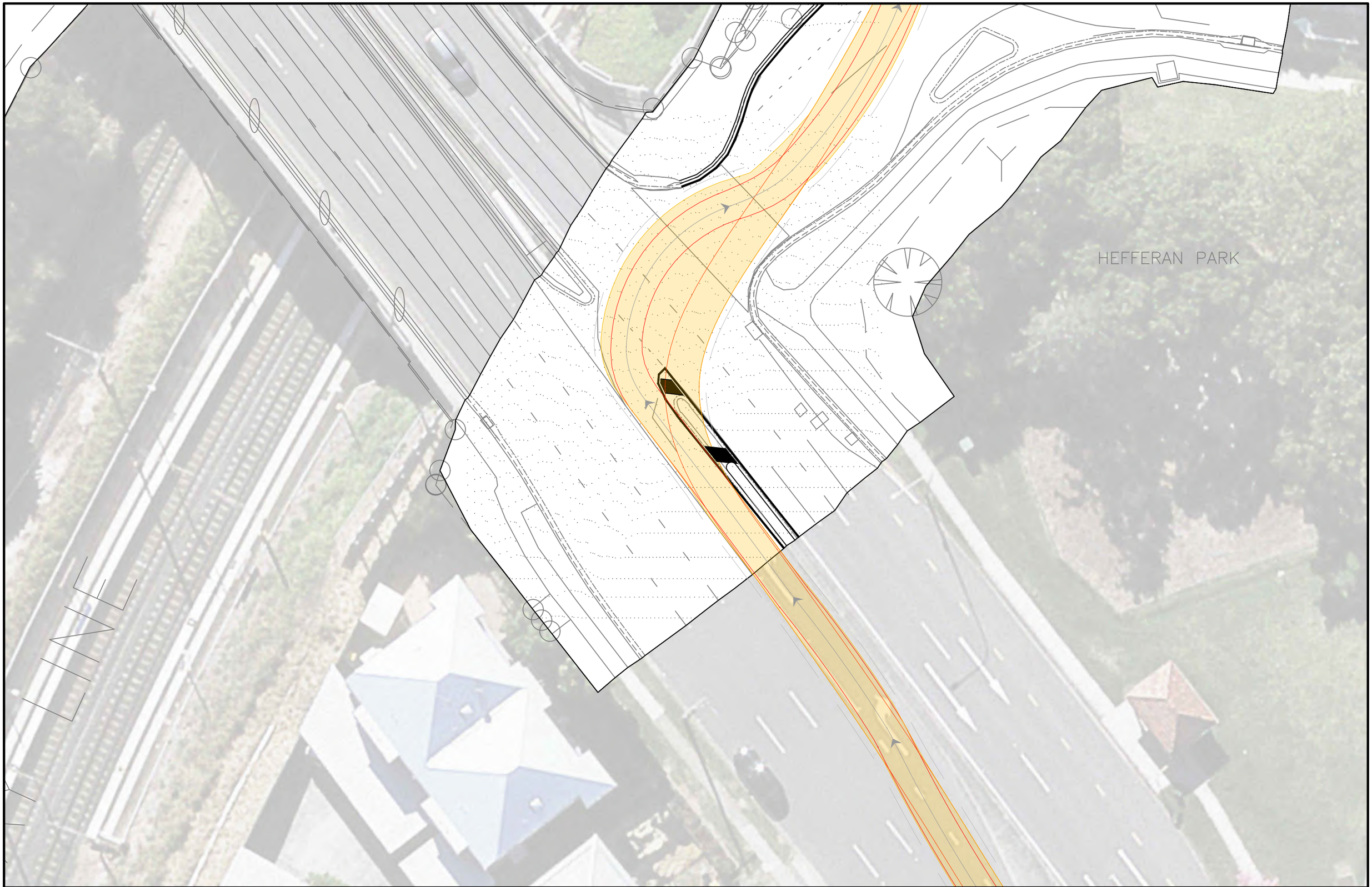
CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER	ISSUE
CRRTSD-TM-SKT-CBGU-020002	D
SHEET 9 OF 14	

CURRENT CTMP SUBPLAN: NIL

Appendix D

Concept Design – Annerley Road and Cornwall Street Modifications



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

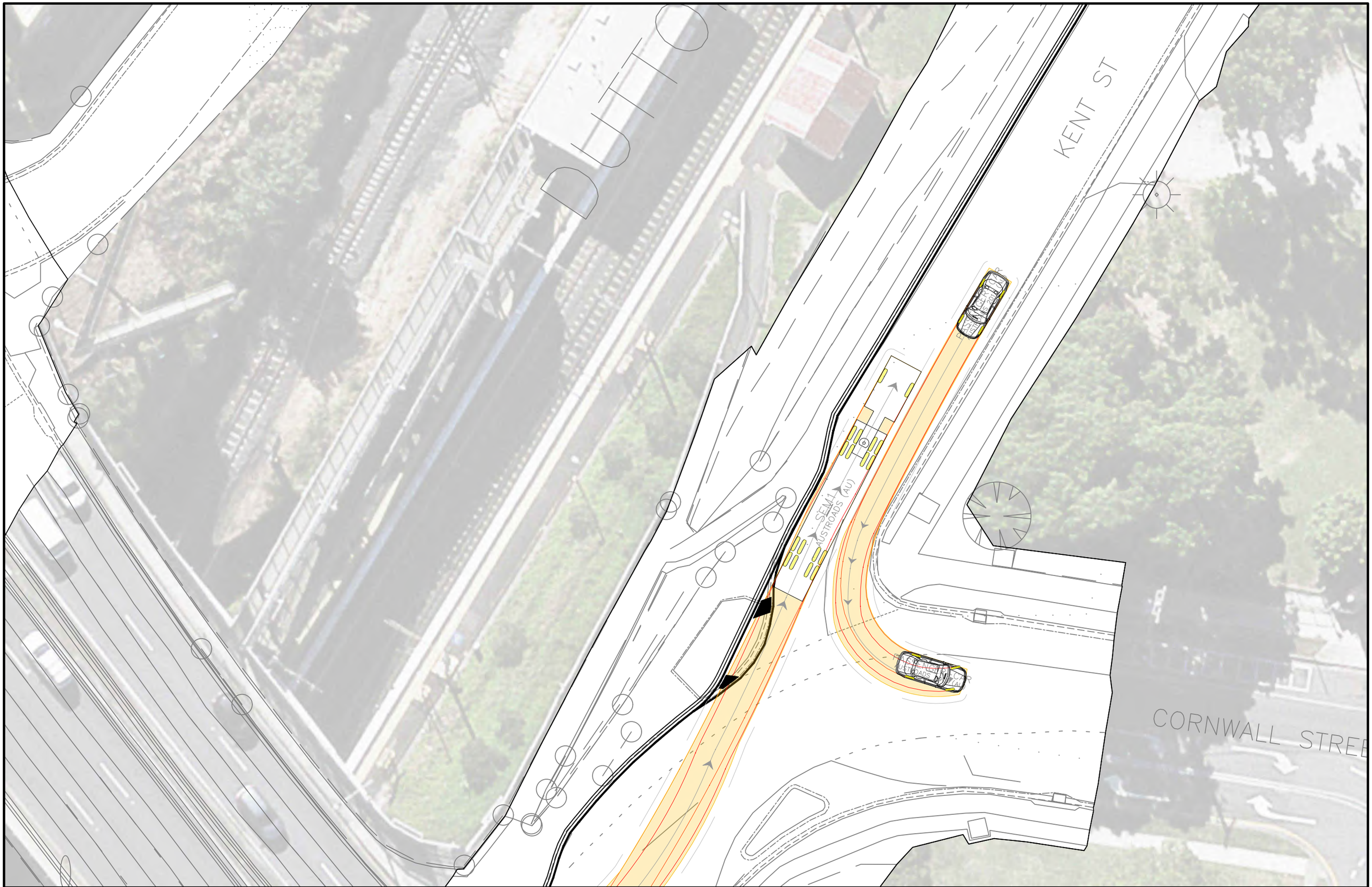
SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
SHEET 10 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



1:250 — 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

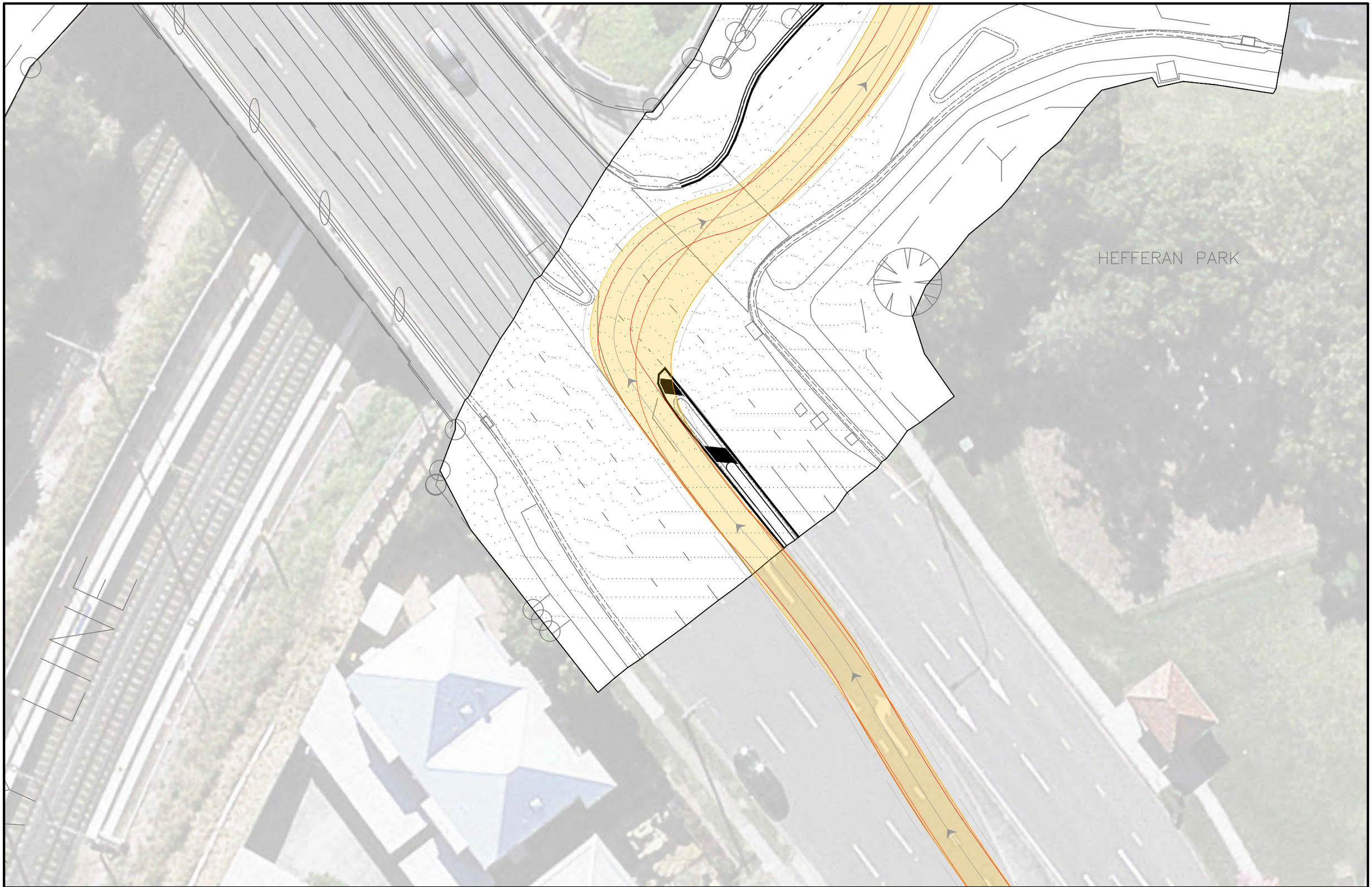
SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m SEMI-TRAILER

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
SHEET 11 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ALTERATIONS

ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

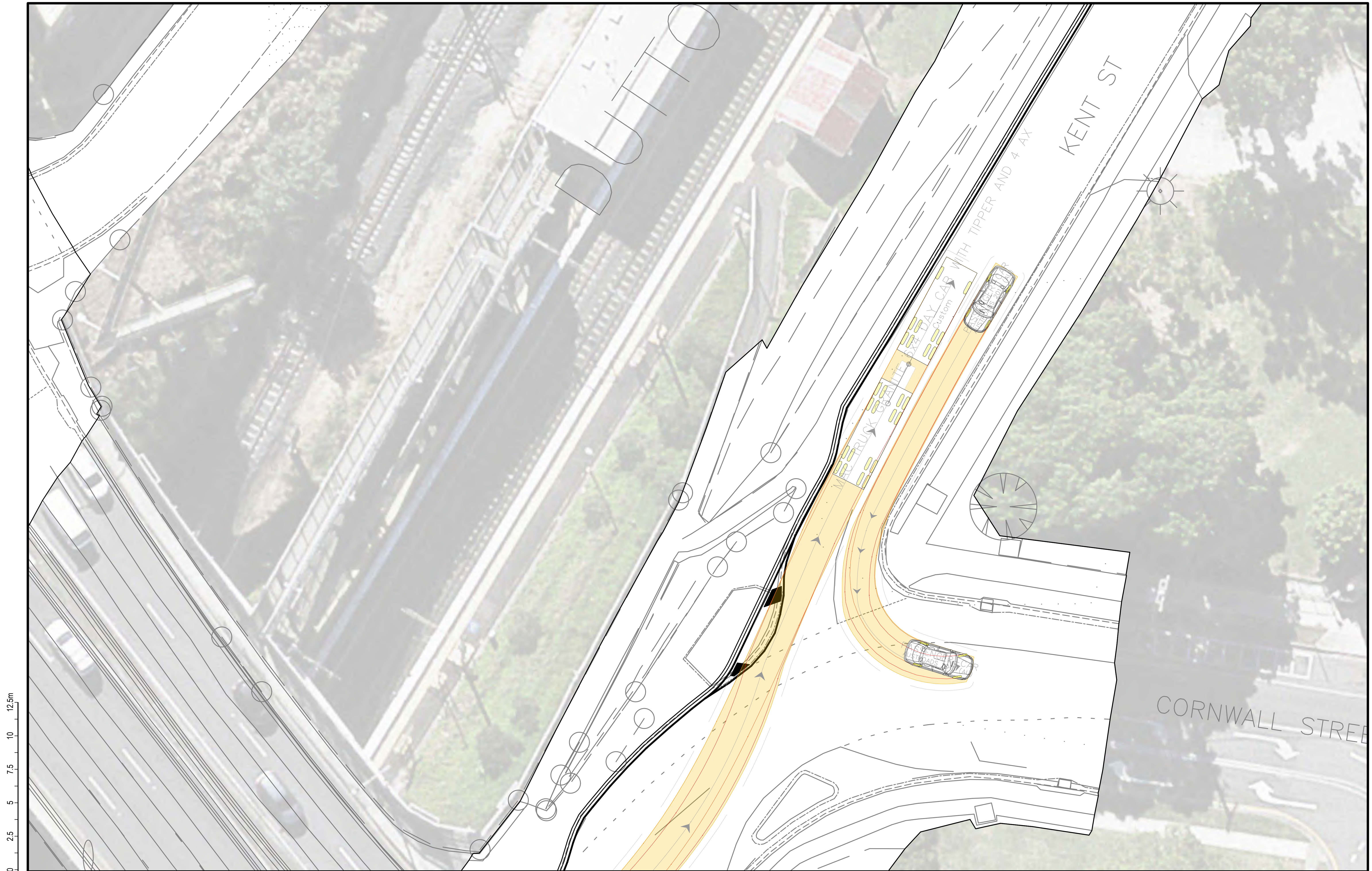
SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER: CRRTSD-TM-SKT-CBGU-020002
SHEET 12 OF 14

ISSUE: D

CURRENT CTMP SUBPLAN: NIL



NORTH

ALTERATIONS

ISSUE	DESCRIPTION	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

CORNWALL ST / KENT ST
SWEPT PATH ASSESSMENT
19.0m TRUCK & DOG

DRAWING NUMBER	ISSUE
CRRTSD-TM-SKT-CBGU-020002 SHEET 13 OF 14	D

CURRENT CTMP SUBPLAN NIL

Appendix E

SIDRA Outputs

MOVEMENT SUMMARY

Site: 102 [2020AM BG_Annerley Rd_Cornwall St - adjusted]

Network: N101 [101_102_2020AM BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1504	2.7	1504	2.7	0.263	0.0	LOS A	15.9	113.9	0.00	0.00	0.00	59.9
3	R2	65	1.8	65	1.8	0.203	17.4	LOS C	0.7	5.3	0.81	0.93	0.85	37.5
Approach		1569	2.7	1569	2.7	0.263	0.8	NA	15.9	113.9	0.03	0.04	0.04	58.4
NorthWest: Annerley Road N														
7	L2	899	3.5	899	3.5	0.496	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	365	6.7	365	6.7	0.195	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1264	4.4	1264	4.4	0.496	2.8	NA	0.0	0.0	0.00	0.39	0.00	46.1
All Vehicles		2834	3.4	2834	3.4	0.496	1.7	NA	15.9	113.9	0.02	0.20	0.02	54.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2020AM BG_Annerley Rd_Noble St_Cornwall St - adjusted]

Network: N101 [101_102_2020AM BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	155	3.8	155	3.8	0.754	46.1	LOS D	11.4	81.6	0.94	0.91	1.33	26.2
2	T1	1341	2.5	1341	2.5	0.754	39.5	LOS D	11.4	81.6	0.94	0.86	1.05	27.7
3	R2	11	11.1	11	11.1	0.754	42.6	LOS D	11.4	81.6	0.95	0.84	0.95	27.0
Approach		1506	2.7	1506	2.7	0.754	40.2	LOS D	11.4	81.6	0.94	0.86	1.08	27.5
NorthWest: Annerley Road N														
7	L2	6	20.0	6	20.0	0.384	38.0	LOS D	11.5	83.8	0.79	0.68	0.79	38.1
8	T1	797	4.2	797	4.2	0.384	14.0	LOS B	11.5	83.8	0.51	0.45	0.51	41.4
29	R2	709	7.4	709	7.4	0.733	42.7	LOS D	18.0	134.2	0.88	0.84	0.90	34.6
Approach		1513	5.8	1513	5.8	0.733	27.6	LOS C	18.0	134.2	0.68	0.63	0.69	36.8
West: Cornwall Street														
10b	L3	1335	3.5	1335	3.5	0.772	30.6	LOS C	31.7	228.6	0.85	0.87	0.85	40.1
10a	L1	7	0.0	7	0.0	0.809	65.2	LOS E	14.6	105.8	1.00	0.91	1.17	28.8
12a	R1	444	4.5	444	4.5	0.809	65.5	LOS E	14.6	105.8	1.00	0.92	1.19	19.3
12b	R3	3	50.0	3	50.0	0.809	67.8	LOS E	14.5	105.9	1.00	0.92	1.22	27.7
Approach		1789	3.8	1789	3.8	0.809	39.5	LOS D	31.7	228.6	0.89	0.88	0.94	34.7
All Vehicles		4808	4.1	4808	4.1	0.809	36.0	LOS D	31.7	228.6	0.84	0.80	0.91	33.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	14	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	25	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	7	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		97	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2020PM BG_Annerley Rd_Cornwall St - adjusted]

Network: N101 [101_102_2020PM BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1036	1.9	1036	1.9	0.180	0.0	LOS A	4.0	28.5	0.00	0.00	0.00	60.0
3	R2	44	0.0	44	0.0	0.164	19.2	LOS C	0.6	3.9	0.84	0.93	0.84	36.2
Approach		1080	1.8	1080	1.8	0.180	0.8	NA	4.0	28.5	0.03	0.04	0.03	58.3
NorthWest: Annerley Road N														
7	L2	844	3.8	844	3.8	0.467	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	602	3.3	602	3.3	0.315	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		1446	3.6	1446	3.6	0.467	2.3	NA	0.0	0.0	0.00	0.32	0.00	50.1
All Vehicles		2526	2.8	2526	2.8	0.467	1.7	NA	4.0	28.5	0.01	0.20	0.01	54.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2020PM BG_Annerley Rd_Noble St_Cornwall St - adjusted]

Network: N101 [101_102_2020PM BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	344	1.3	344	1.3	0.483	30.2	LOS C	11.5	81.6	0.74	0.87	1.10	31.8
2	T1	691	2.2	691	2.2	0.483	33.4	LOS C	11.5	81.6	0.83	0.73	0.86	30.2
3	R2	5	0.0	5	0.0	0.483	38.4	LOS D	11.4	81.6	0.84	0.72	0.84	28.9
Approach		1040	1.9	1040	1.9	0.483	32.4	LOS C	11.5	81.6	0.80	0.78	0.94	30.7
NorthWest: Annerley Road N														
7	L2	4	0.0	4	0.0	0.529	39.9	LOS D	17.2	122.7	0.85	0.74	0.85	37.7
8	T1	1120	2.0	1120	2.0	0.529	15.5	LOS B	18.8	133.8	0.57	0.51	0.57	40.1
29	R2	1176	2.3	1176	2.3	1.350	381.4	LOS F	106.0	756.6	1.00	1.73	3.08	8.0
Approach		2300	2.1	2300	2.1	1.350	202.6	LOS F	106.0	756.6	0.79	1.13	1.86	10.9
West: Cornwall Street														
10b	L3	705	7.7	705	7.7	0.419	24.7	LOS C	12.6	93.7	0.63	0.77	0.63	42.7
10a	L1	4	0.0	4	0.0	0.626	59.0	LOS E	10.0	75.6	0.99	0.81	0.99	30.3
12a	R1	327	9.2	327	9.2	0.626	58.7	LOS E	10.0	75.6	0.99	0.82	1.01	20.7
12b	R3	11	0.0	11	0.0	0.626	59.7	LOS E	9.9	74.4	0.99	0.82	1.03	30.1
Approach		1047	8.1	1047	8.1	0.626	35.8	LOS D	12.6	93.7	0.75	0.79	0.76	35.5
All Vehicles		4387	3.5	4387	3.5	1.350	122.4	LOS F	106.0	756.6	0.78	0.97	1.38	15.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	11	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	23	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	16	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		100	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022AM BG_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022AM BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1565	2.7	1565	2.7	0.274	0.0	LOS A	18.2	130.4	0.00	0.00	0.00	59.9
3	R2	68	1.8	68	1.8	0.233	19.1	LOS C	0.9	6.2	0.83	0.95	0.91	36.3
Approach		1634	2.7	1634	2.7	0.274	0.8	NA	18.2	130.4	0.03	0.04	0.04	58.3
NorthWest: Annerley Road N														
7	L2	936	3.5	936	3.5	0.516	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	381	6.7	381	6.7	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1317	4.4	1317	4.4	0.516	2.8	NA	0.0	0.0	0.00	0.39	0.00	46.1
All Vehicles		2951	3.4	2951	3.4	0.516	1.7	NA	18.2	130.4	0.02	0.20	0.02	54.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2022AM BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022AM BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	161	3.8	161	3.8	0.787	48.4	LOS D	11.4	81.6	0.96	0.94	1.38	25.4
2	T1	1396	2.5	1396	2.5	0.787	41.6	LOS D	11.4	81.6	0.96	0.89	1.10	26.9
3	R2	12	11.1	12	11.1	0.787	44.7	LOS D	11.4	81.6	0.96	0.88	1.00	26.3
Approach		1568	2.7	1568	2.7	0.787	42.3	LOS D	11.4	81.6	0.96	0.90	1.13	26.8
NorthWest: Annerley Road N														
7	L2	7	20.0	7	20.0	0.400	38.2	LOS D	12.1	87.8	0.80	0.68	0.80	38.0
8	T1	829	4.2	829	4.2	0.400	14.1	LOS B	12.1	87.8	0.51	0.45	0.51	41.3
29	R2	739	7.4	739	7.4	0.793	46.4	LOS D	20.0	148.8	0.89	0.87	0.97	33.4
Approach		1576	5.8	1576	5.8	0.793	29.3	LOS C	20.0	148.8	0.69	0.65	0.73	35.9
West: Cornwall Street														
10b	L3	1389	3.5	1389	3.5	0.804	32.3	LOS C	34.6	249.6	0.88	0.88	0.89	39.4
10a	L1	8	0.0	8	0.0	0.847	67.9	LOS E	15.7	114.2	1.00	0.95	1.23	28.2
12a	R1	463	4.5	463	4.5	0.847	68.3	LOS E	15.7	114.2	1.00	0.95	1.26	18.7
12b	R3	4	50.0	4	50.0	0.847	70.6	LOS E	15.6	114.5	1.00	0.95	1.28	27.1
Approach		1865	3.8	1865	3.8	0.847	41.5	LOS D	34.6	249.6	0.91	0.90	0.98	34.0
All Vehicles		5009	4.1	5009	4.1	0.847	37.9	LOS D	34.6	249.6	0.86	0.82	0.95	32.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	14	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	25	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	7	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		97	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022PM BG_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022PM BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1078	1.9	1078	1.9	0.188	0.0	LOS A	4.9	35.0	0.00	0.00	0.00	60.0
3	R2	46	0.0	46	0.0	0.190	21.3	LOS C	0.7	4.6	0.86	0.95	0.89	34.9
Approach		1124	1.8	1124	1.8	0.190	0.9	NA	4.9	35.0	0.04	0.04	0.04	58.1
NorthWest: Annerley Road N														
7	L2	879	3.8	879	3.8	0.486	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	627	3.3	627	3.3	0.329	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		1506	3.6	1506	3.6	0.486	2.3	NA	0.0	0.0	0.00	0.32	0.00	50.1
All Vehicles		2631	2.8	2631	2.8	0.486	1.7	NA	4.9	35.0	0.02	0.20	0.02	54.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2022PM BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022PM BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	359	1.3	359	1.3	0.506	30.6	LOS C	11.5	81.6	0.75	0.88	1.12	31.6
2	T1	719	2.2	719	2.2	0.506	34.0	LOS C	11.5	81.6	0.84	0.75	0.87	29.9
3	R2	6	0.0	6	0.0	0.506	39.4	LOS D	11.4	81.6	0.85	0.74	0.85	28.4
Approach		1084	1.9	1084	1.9	0.506	32.9	LOS C	11.5	81.6	0.81	0.79	0.95	30.4
NorthWest: Annerley Road N														
7	L2	5	0.0	5	0.0	0.551	40.2	LOS D	18.1	128.9	0.86	0.75	0.86	37.6
8	T1	1165	2.0	1165	2.0	0.551	15.7	LOS B	20.1	143.2	0.59	0.53	0.59	39.9
29	R2	1224	2.3	1224	2.3	1.406	429.8	LOS F	117.3	837.1	1.00	1.81	3.28	7.2
Approach		2395	2.1	2395	2.1	1.406	227.4	LOS F	117.3	837.1	0.80	1.18	1.96	9.9
West: Cornwall Street														
10b	L3	735	7.7	735	7.7	0.436	24.9	LOS C	13.2	98.9	0.64	0.78	0.64	42.6
10a	L1	5	0.0	5	0.0	0.655	59.6	LOS E	10.6	79.8	0.99	0.83	1.01	30.2
12a	R1	341	9.2	341	9.2	0.655	59.3	LOS E	10.6	79.8	0.99	0.83	1.03	20.6
12b	R3	12	0.0	12	0.0	0.655	60.3	LOS E	10.5	78.6	0.99	0.83	1.06	29.9
Approach		1093	8.1	1093	8.1	0.655	36.2	LOS D	13.2	98.9	0.76	0.79	0.77	35.4
All Vehicles		4572	3.5	4572	3.5	1.406	135.6	LOS F	117.3	837.1	0.79	1.00	1.44	14.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	11	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	23	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	16	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		100	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2022AM BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022AM DESIGN]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	161	3.8	161	3.8	0.787	48.4	LOS D	11.4	81.6	0.96	0.94	1.38	25.4
2	T1	1396	2.5	1396	2.5	0.787	41.6	LOS D	11.4	81.6	0.96	0.89	1.10	26.9
3	R2	12	11.1	12	11.1	0.787	44.7	LOS D	11.4	81.6	0.96	0.88	1.00	26.3
Approach		1568	2.7	1568	2.7	0.787	42.3	LOS D	11.4	81.6	0.96	0.90	1.13	26.8
NorthWest: Annerley Road N														
7	L2	7	20.0	7	20.0	0.400	38.2	LOS D	12.1	87.8	0.80	0.68	0.80	38.0
8	T1	829	4.2	829	4.2	0.400	14.1	LOS B	12.1	87.8	0.51	0.45	0.51	41.3
29	R2	739	7.4	739	7.4	0.793	46.4	LOS D	20.0	148.8	0.89	0.87	0.97	33.4
Approach		1576	5.8	1576	5.8	0.793	29.3	LOS C	20.0	148.8	0.69	0.65	0.73	35.9
West: Cornwall Street														
10b	L3	1389	3.5	1389	3.5	0.804	32.3	LOS C	34.6	249.6	0.88	0.88	0.89	39.4
10a	L1	8	0.0	8	0.0	0.847	67.9	LOS E	15.7	114.2	1.00	0.95	1.23	28.2
12a	R1	463	4.5	463	4.5	0.847	68.3	LOS E	15.7	114.2	1.00	0.95	1.26	18.7
12b	R3	4	50.0	4	50.0	0.847	70.6	LOS E	15.6	114.5	1.00	0.95	1.28	27.1
Approach		1865	3.8	1865	3.8	0.847	41.5	LOS D	34.6	249.6	0.91	0.90	0.98	34.0
All Vehicles		5009	4.1	5009	4.1	0.847	37.9	LOS D	34.6	249.6	0.86	0.82	0.95	32.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	14	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	25	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	7	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		97	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022AM DESIGN_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022AM DESIGN]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1565	2.7	1565	2.7	0.274	0.0	LOS A	18.2	130.4	0.00	0.00	0.00	59.9
3	R2	79	14.9	79	14.9	0.317	23.5	LOS C	1.2	9.7	0.86	0.99	1.03	33.6
Approach		1644	3.3	1644	3.3	0.317	1.2	NA	18.2	130.4	0.04	0.05	0.05	57.6
NorthWest: Annerley Road N														
7	L2	936	3.5	936	3.5	0.516	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	381	6.7	381	6.7	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1317	4.4	1317	4.4	0.516	2.8	NA	0.0	0.0	0.00	0.39	0.00	46.1
All Vehicles		2961	3.8	2961	3.8	0.516	1.9	NA	18.2	130.4	0.02	0.20	0.03	54.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2022PM BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022PM DESIGN]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	359	1.3	359	1.3	0.506	30.6	LOS C	11.5	81.6	0.75	0.88	1.12	31.6
2	T1	719	2.2	719	2.2	0.506	34.0	LOS C	11.5	81.6	0.84	0.75	0.87	29.9
3	R2	6	0.0	6	0.0	0.506	39.4	LOS D	11.4	81.6	0.85	0.74	0.85	28.4
Approach		1084	1.9	1084	1.9	0.506	32.9	LOS C	11.5	81.6	0.81	0.79	0.95	30.4
NorthWest: Annerley Road N														
7	L2	5	0.0	5	0.0	0.551	40.2	LOS D	18.1	128.9	0.86	0.75	0.86	37.6
8	T1	1165	2.0	1165	2.0	0.551	15.7	LOS B	20.1	143.2	0.59	0.53	0.59	39.9
29	R2	1224	2.3	1224	2.3	1.406	429.8	LOS F	117.3	837.1	1.00	1.81	3.28	7.2
Approach		2395	2.1	2395	2.1	1.406	227.4	LOS F	117.3	837.1	0.80	1.18	1.96	9.9
West: Cornwall Street														
10b	L3	735	7.7	735	7.7	0.436	24.9	LOS C	13.2	98.9	0.64	0.78	0.64	42.6
10a	L1	5	0.0	5	0.0	0.655	59.6	LOS E	10.6	79.8	0.99	0.83	1.01	30.2
12a	R1	341	9.2	341	9.2	0.655	59.3	LOS E	10.6	79.8	0.99	0.83	1.03	20.6
12b	R3	12	0.0	12	0.0	0.655	60.3	LOS E	10.5	78.6	0.99	0.83	1.06	29.9
Approach		1093	8.1	1093	8.1	0.655	36.2	LOS D	13.2	98.9	0.76	0.79	0.77	35.4
All Vehicles		4572	3.5	4572	3.5	1.406	135.6	LOS F	117.3	837.1	0.79	1.00	1.44	14.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	11	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	23	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	22	56.7	LOS E	0.1	0.1	0.95	0.95
P8	SouthWest Full Crossing	16	56.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		100	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022PM DESIGN_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022PM DESIGN]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	1078	1.9	1078	1.9	0.188	0.0	LOS A	4.9	35.0	0.00	0.00	0.00	60.0
3	R2	57	18.5	57	18.5	0.300	28.9	LOS D	1.1	8.8	0.90	0.99	1.03	30.7
Approach		1135	2.7	1135	2.7	0.300	1.5	NA	4.9	35.0	0.04	0.05	0.05	57.1
NorthWest: Annerley Road N														
7	L2	879	3.8	879	3.8	0.486	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	627	3.3	627	3.3	0.329	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		1506	3.6	1506	3.6	0.486	2.3	NA	0.0	0.0	0.00	0.32	0.00	50.1
All Vehicles		2641	3.2	2641	3.2	0.486	1.9	NA	4.9	35.0	0.02	0.20	0.02	53.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102 [2020WE BG_Annerley Rd_Cornwall St - adjusted]

Network: N101 [101_102_2020WE BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	816	1.6	816	1.6	0.189	0.0	LOS A	0.3	2.2	0.00	0.00	0.00	59.9
3	R2	62	0.0	62	0.0	0.142	13.3	LOS B	0.5	3.7	0.73	0.89	0.73	40.7
Approach		878	1.5	878	1.5	0.189	1.0	NA	0.5	3.7	0.05	0.06	0.05	57.9
NorthWest: Annerley Road N														
7	L2	735	1.4	735	1.4	0.400	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	379	0.6	379	0.6	0.195	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1114	1.1	1114	1.1	0.400	2.6	NA	0.0	0.0	0.00	0.36	0.00	47.9
All Vehicles		1992	1.3	1992	1.3	0.400	1.9	NA	0.5	3.7	0.02	0.23	0.02	53.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2020WE BG_Annerley Rd_Noble St_Cornwall St - adjusted]

Network: N101 [101_102_2020WE BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	228	3.6	228	3.6	0.384	24.2	LOS C	8.9	63.8	0.72	0.79	0.89	35.2
2	T1	582	0.8	582	0.8	0.384	31.0	LOS C	11.6	81.6	0.79	0.70	0.81	31.2
3	R2	6	0.0	6	0.0	0.384	36.9	LOS D	11.3	79.4	0.80	0.68	0.80	29.4
Approach		817	1.6	817	1.6	0.384	29.2	LOS C	11.6	81.6	0.77	0.72	0.84	32.2
NorthWest: Annerley Road N														
7	L2	2	0.0	2	0.0	0.369	37.7	LOS D	11.4	79.7	0.79	0.67	0.79	38.6
8	T1	791	0.1	791	0.1	0.369	14.0	LOS B	11.4	79.7	0.50	0.44	0.50	41.4
29	R2	624	3.3	624	3.3	0.519	40.4	LOS D	15.0	108.2	0.85	0.82	0.85	35.4
Approach		1417	1.6	1417	1.6	0.519	25.7	LOS C	15.0	108.2	0.65	0.61	0.65	37.5
West: Cornwall Street														
10b	L3	533	4.3	533	4.3	0.310	23.3	LOS C	8.8	63.8	0.59	0.75	0.59	43.5
10a	L1	5	0.0	5	0.0	0.585	58.5	LOS E	9.6	69.4	0.98	0.81	0.98	30.4
12a	R1	322	3.6	322	3.6	0.585	58.5	LOS E	9.6	69.4	0.98	0.81	1.01	20.7
12b	R3	4	0.0	4	0.0	0.585	59.9	LOS E	9.6	69.0	0.98	0.81	1.03	30.0
Approach		864	4.0	864	4.0	0.585	36.8	LOS D	9.6	69.4	0.74	0.77	0.75	34.6
All Vehicles		3098	2.2	3098	2.2	0.585	29.7	LOS C	15.0	108.2	0.71	0.68	0.73	35.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	4	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P8	SouthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		46	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022WE BG_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022WE BG]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	849	1.6	849	1.6	0.165	0.0	LOS A	1.0	6.9	0.00	0.00	0.00	60.0
3	R2	65	0.0	65	0.0	0.160	14.1	LOS B	0.6	4.1	0.75	0.90	0.75	40.1
Approach		915	1.5	915	1.5	0.165	1.0	NA	1.0	6.9	0.05	0.06	0.05	57.8
NorthWest: Annerley Road N														
7	L2	765	1.4	765	1.4	0.416	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	395	0.6	395	0.6	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1160	1.1	1160	1.1	0.416	2.6	NA	0.0	0.0	0.00	0.36	0.00	47.9
All Vehicles		2075	1.3	2075	1.3	0.416	1.9	NA	1.0	6.9	0.02	0.23	0.02	53.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2022WE BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022WE BG]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	238	3.6	238	3.6	0.402	24.9	LOS C	9.3	66.9	0.73	0.80	0.92	34.8
2	T1	606	0.8	606	0.8	0.402	31.3	LOS C	11.6	81.6	0.80	0.70	0.82	31.1
3	R2	7	0.0	7	0.0	0.402	37.2	LOS D	11.6	81.6	0.81	0.69	0.81	29.3
Approach		852	1.6	852	1.6	0.402	29.6	LOS C	11.6	81.6	0.78	0.73	0.85	32.0
NorthWest: Annerley Road N														
7	L2	3	0.0	3	0.0	0.384	37.9	LOS D	11.9	83.6	0.80	0.68	0.80	38.5
8	T1	823	0.1	823	0.1	0.384	14.1	LOS B	11.9	83.6	0.51	0.45	0.51	41.3
29	R2	649	3.3	649	3.3	0.569	40.7	LOS D	15.8	113.5	0.85	0.82	0.85	35.3
Approach		1476	1.6	1476	1.6	0.569	25.9	LOS C	15.8	113.5	0.66	0.61	0.66	37.4
West: Cornwall Street														
10b	L3	555	4.3	555	4.3	0.323	23.5	LOS C	9.2	67.0	0.59	0.75	0.59	43.4
10a	L1	6	0.0	6	0.0	0.613	58.8	LOS E	10.1	73.1	0.99	0.81	0.99	30.4
12a	R1	336	3.6	336	3.6	0.613	58.8	LOS E	10.1	73.1	0.99	0.81	1.01	20.7
12b	R3	5	0.0	5	0.0	0.613	60.1	LOS E	10.1	72.5	0.99	0.82	1.04	30.0
Approach		902	4.0	902	4.0	0.613	37.1	LOS D	10.1	73.1	0.74	0.78	0.75	34.5
All Vehicles		3229	2.2	3229	2.2	0.613	30.0	LOS C	15.8	113.5	0.71	0.69	0.74	35.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	4	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P8	SouthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		46	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2022WE BG_Annerley Rd_Noble St_Cornwall St]

Network: N101 [101_102_2022WE DESIGN]

Annerley Road / Noble Street / Cornwall Street / Railway Terrace Signalised Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
21	L2	238	3.6	238	3.6	0.402	24.9	LOS C	9.3	66.9	0.73	0.80	0.92	34.8
2	T1	606	0.8	606	0.8	0.402	31.3	LOS C	11.6	81.6	0.80	0.70	0.82	31.1
3	R2	7	0.0	7	0.0	0.402	37.2	LOS D	11.6	81.6	0.81	0.69	0.81	29.3
Approach		852	1.6	852	1.6	0.402	29.6	LOS C	11.6	81.6	0.78	0.73	0.85	32.0
NorthWest: Annerley Road N														
7	L2	3	0.0	3	0.0	0.384	37.9	LOS D	11.9	83.6	0.80	0.68	0.80	38.5
8	T1	823	0.1	823	0.1	0.384	14.1	LOS B	11.9	83.6	0.51	0.45	0.51	41.3
29	R2	649	3.3	649	3.3	0.569	40.7	LOS D	15.8	113.5	0.85	0.82	0.85	35.3
Approach		1476	1.6	1476	1.6	0.569	25.9	LOS C	15.8	113.5	0.66	0.61	0.66	37.4
West: Cornwall Street														
10b	L3	555	4.3	555	4.3	0.323	23.5	LOS C	9.2	67.0	0.59	0.75	0.59	43.4
10a	L1	6	0.0	6	0.0	0.613	58.8	LOS E	10.1	73.1	0.99	0.81	0.99	30.4
12a	R1	336	3.6	336	3.6	0.613	58.8	LOS E	10.1	73.1	0.99	0.81	1.01	20.7
12b	R3	5	0.0	5	0.0	0.613	60.1	LOS E	10.1	72.5	0.99	0.82	1.04	30.0
Approach		902	4.0	902	4.0	0.613	37.1	LOS D	10.1	73.1	0.74	0.78	0.75	34.5
All Vehicles		3229	2.2	3229	2.2	0.613	30.0	LOS C	15.8	113.5	0.71	0.69	0.74	35.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	4	56.7	LOS E	0.0	0.0	0.95	0.95
P2	NorthEast Full Crossing	17	56.7	LOS E	0.1	0.1	0.95	0.95
P3	NorthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4	West Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P4B	West Slip/Bypass Lane Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
P8	SouthWest Full Crossing	6	56.7	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		46	56.7	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [2022WE DESIGN_Annerley Rd_Cornwall St]

Network: N101 [101_102_2022WE DESIGN]

Annerley Road / Cornwall Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Annerley Road S														
2	T1	849	1.6	849	1.6	0.165	0.0	LOS A	1.0	6.9	0.00	0.00	0.00	60.0
3	R2	76	13.9	76	13.9	0.217	16.5	LOS C	0.8	6.5	0.78	0.93	0.83	38.2
Approach		925	2.6	925	2.6	0.217	1.4	NA	1.0	6.9	0.06	0.08	0.07	57.1
NorthWest: Annerley Road N														
7	L2	765	1.4	765	1.4	0.416	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.8
8	T1	395	0.6	395	0.6	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1160	1.1	1160	1.1	0.416	2.6	NA	0.0	0.0	0.00	0.36	0.00	47.9
All Vehicles		2085	1.8	2085	1.8	0.416	2.0	NA	1.0	6.9	0.03	0.24	0.03	53.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2020AM BG_Cornwall St_Kent St - adjusted]

Network: N101 [102_103_2020AM BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	62	1.9	62	1.9	0.129	10.0	LOS A	0.5	3.3	0.76	0.89	0.76	43.3
Approach		62	1.9	62	1.9	0.129	10.0	NA	0.5	3.3	0.76	0.89	0.76	43.3
North: Kent Street														
7	L2	28	0.0	28	0.0	0.054	11.2	LOS B	0.2	1.3	0.69	0.87	0.69	42.9
Approach		28	0.0	28	0.0	0.054	11.2	LOS B	0.2	1.3	0.69	0.87	0.69	42.9
West: Cornwall Street W														
10	L2	60	3.9	60	3.9	0.507	3.1	LOS A	0.0	0.0	0.00	0.03	0.00	56.2
11	T1	905	3.3	905	3.3	0.507	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	57.2
Approach		965	3.4	965	3.4	0.507	0.2	NA	0.0	0.0	0.00	0.03	0.00	56.9
All Vehicles		1056	3.2	1056	3.2	0.507	1.1	NA	0.5	3.3	0.06	0.11	0.06	51.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2020PM BG_Cornwall St_Kent St - adjusted]

Network: N101 [102_103_2020PM BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	14	0.0	14	0.0	0.024	8.2	LOS A	0.1	0.6	0.68	0.79	0.68	45.2
Approach		14	0.0	14	0.0	0.024	8.2	NA	0.1	0.6	0.68	0.79	0.68	45.2
North: Kent Street														
7	L2	87	2.7	87	2.7	0.161	11.4	LOS B	0.6	4.0	0.70	0.87	0.70	42.7
Approach		87	2.7	87	2.7	0.161	11.4	LOS B	0.6	4.0	0.70	0.87	0.70	42.7
West: Cornwall Street W														
10	L2	19	0.0	19	0.0	0.467	3.1	LOS A	0.0	0.0	0.00	0.01	0.00	56.8
11	T1	871	3.7	871	3.7	0.467	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	58.9
Approach		889	3.6	889	3.6	0.467	0.1	NA	0.0	0.0	0.00	0.01	0.00	58.6
All Vehicles		991	3.5	991	3.5	0.467	1.2	NA	0.6	4.0	0.07	0.10	0.07	50.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022AM BG_Cornwall St_Kent St]

Network: N101 [102_103_2022AM BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	65	1.9	65	1.9	0.148	10.8	LOS B	0.5	3.7	0.78	0.90	0.78	42.5
Approach		65	1.9	65	1.9	0.148	10.8	NA	0.5	3.7	0.78	0.90	0.78	42.5
North: Kent Street														
7	L2	31	0.0	31	0.0	0.063	11.8	LOS B	0.2	1.5	0.72	0.88	0.72	42.3
Approach		31	0.0	31	0.0	0.063	11.8	LOS B	0.2	1.5	0.72	0.88	0.72	42.3
West: Cornwall Street W														
10	L2	63	3.9	63	3.9	0.529	3.1	LOS A	0.0	0.0	0.00	0.04	0.00	56.2
11	T1	942	3.3	942	3.3	0.529	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	57.2
Approach		1005	3.4	1005	3.4	0.529	0.2	NA	0.0	0.0	0.00	0.04	0.00	56.9
All Vehicles		1101	3.2	1101	3.2	0.529	1.2	NA	0.5	3.7	0.07	0.11	0.07	51.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022PM BG_Cornwall St_Kent St]

Network: N101 [102_103_2022PM BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	15	0.0	15	0.0	0.026	8.2	LOS A	0.1	0.6	0.69	0.80	0.69	45.2
Approach		15	0.0	15	0.0	0.026	8.2	NA	0.1	0.6	0.69	0.80	0.69	45.2
North: Kent Street														
7	L2	92	2.7	92	2.7	0.169	11.4	LOS B	0.6	4.2	0.70	0.87	0.70	42.7
Approach		92	2.7	92	2.7	0.169	11.4	LOS B	0.6	4.2	0.70	0.87	0.70	42.7
West: Cornwall Street W														
10	L2	20	0.0	20	0.0	0.468	3.1	LOS A	0.0	0.0	0.00	0.01	0.00	56.8
11	T1	871	3.7	871	3.7	0.468	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	58.8
Approach		891	3.6	891	3.6	0.468	0.1	NA	0.0	0.0	0.00	0.01	0.00	58.5
All Vehicles		997	3.5	997	3.5	0.468	1.2	NA	0.6	4.2	0.07	0.10	0.07	50.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022AM DESIGN_Cornwall St_Kent St]

Network: N101 [102_103_2022AM DESIGN]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	65	1.9	65	1.9	0.153	11.2	LOS B	0.5	3.8	0.79	0.90	0.79	42.2
Approach		65	1.9	65	1.9	0.153	11.2	NA	0.5	3.8	0.79	0.90	0.79	42.2
North: Kent Street														
7	L2	31	0.0	31	0.0	0.063	11.8	LOS B	0.2	1.5	0.72	0.88	0.72	42.3
Approach		31	0.0	31	0.0	0.063	11.8	LOS B	0.2	1.5	0.72	0.88	0.72	42.3
West: Cornwall Street W														
10	L2	74	17.6	74	17.6	0.538	3.1	LOS A	0.0	0.0	0.00	0.04	0.00	55.0
11	T1	942	3.3	942	3.3	0.538	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	57.2
Approach		1016	4.4	1016	4.4	0.538	0.2	NA	0.0	0.0	0.00	0.04	0.00	56.4
All Vehicles		1112	4.1	1112	4.1	0.538	1.2	NA	0.5	3.8	0.07	0.11	0.07	50.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022PM DESIGN_Cornwall St_Kent St]

Network: N101 [102_103_2022PM DESIGN]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	15	0.0	15	0.0	0.026	8.4	LOS A	0.1	0.7	0.70	0.81	0.70	45.0
Approach		15	0.0	15	0.0	0.026	8.4	NA	0.1	0.7	0.70	0.81	0.70	45.0
North: Kent Street														
7	L2	92	2.7	92	2.7	0.169	11.4	LOS B	0.6	4.2	0.70	0.87	0.70	42.7
Approach		92	2.7	92	2.7	0.169	11.4	LOS B	0.6	4.2	0.70	0.87	0.70	42.7
West: Cornwall Street W														
10	L2	31	34.5	31	34.5	0.478	3.1	LOS A	0.0	0.0	0.00	0.02	0.00	53.8
11	T1	871	3.7	871	3.7	0.478	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	58.8
Approach		901	4.8	901	4.8	0.478	0.1	NA	0.0	0.0	0.00	0.02	0.00	57.7
All Vehicles		1007	4.5	1007	4.5	0.478	1.3	NA	0.6	4.2	0.07	0.11	0.07	50.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2020WE BG_Cornwall St_Kent St - adjusted]

Network: N101 [102_103_2020WE BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	12	0.0	12	0.0	0.017	6.9	LOS A	0.1	0.4	0.62	0.72	0.62	46.6
Approach		12	0.0	12	0.0	0.017	6.9	NA	0.1	0.4	0.62	0.72	0.62	46.6
North: Kent Street														
7	L2	22	5.3	22	5.3	0.035	9.9	LOS A	0.1	0.9	0.62	0.79	0.62	44.1
Approach		22	5.3	22	5.3	0.035	9.9	LOS A	0.1	0.9	0.62	0.79	0.62	44.1
West: Cornwall Street W														
10	L2	11	11.1	11	11.1	0.412	3.1	LOS A	0.0	0.0	0.00	0.01	0.00	55.9
11	T1	785	1.2	785	1.2	0.412	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.4
Approach		796	1.3	796	1.3	0.412	0.0	NA	0.0	0.0	0.00	0.01	0.00	59.0
All Vehicles		829	1.4	829	1.4	0.412	0.4	NA	0.1	0.9	0.03	0.04	0.03	55.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022WE BG_Cornwall St_Kent St]

Network: N101 [102_103_2022WE BG]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	13	0.0	13	0.0	0.019	7.3	LOS A	0.1	0.5	0.64	0.74	0.64	46.2
Approach		13	0.0	13	0.0	0.019	7.3	NA	0.1	0.5	0.64	0.74	0.64	46.2
North: Kent Street														
7	L2	23	5.3	23	5.3	0.039	10.3	LOS B	0.1	1.0	0.64	0.81	0.64	43.7
Approach		23	5.3	23	5.3	0.039	10.3	LOS B	0.1	1.0	0.64	0.81	0.64	43.7
West: Cornwall Street W														
10	L2	12	11.1	12	11.1	0.429	3.1	LOS A	0.0	0.0	0.00	0.01	0.00	55.9
11	T1	818	1.2	818	1.2	0.429	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
Approach		829	1.3	829	1.3	0.429	0.0	NA	0.0	0.0	0.00	0.01	0.00	59.0
All Vehicles		865	1.4	865	1.4	0.429	0.4	NA	0.1	1.0	0.03	0.04	0.03	54.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [2022WE DESIGN_Cornwall St_Kent St]

Network: N101 [102_103_2022WE DESIGN]

Cornwall Street / Kent Street Priority Controlled Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

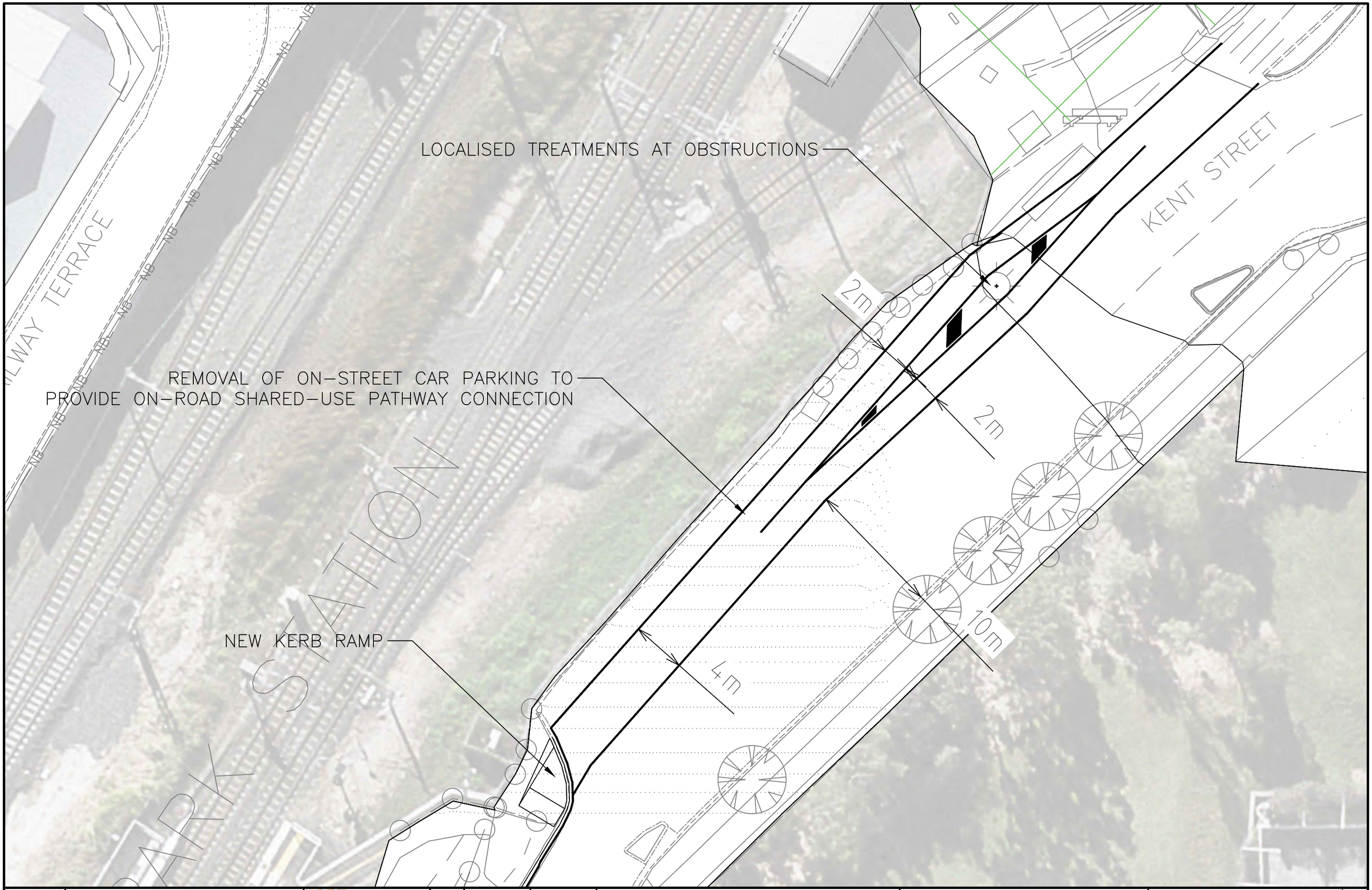
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Cornwall Street E														
6	R2	13	0.0	13	0.0	0.020	7.5	LOS A	0.1	0.5	0.65	0.75	0.65	46.0
Approach		13	0.0	13	0.0	0.020	7.5	NA	0.1	0.5	0.65	0.75	0.65	46.0
North: Kent Street														
7	L2	23	5.3	23	5.3	0.039	10.3	LOS B	0.1	1.0	0.64	0.81	0.64	43.7
Approach		23	5.3	23	5.3	0.039	10.3	LOS B	0.1	1.0	0.64	0.81	0.64	43.7
West: Cornwall Street W														
10	L2	22	53.4	22	53.4	0.439	3.1	LOS A	0.0	0.0	0.00	0.01	0.00	52.4
11	T1	818	1.2	818	1.2	0.439	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
Approach		840	2.6	840	2.6	0.439	0.1	NA	0.0	0.0	0.00	0.01	0.00	58.0
All Vehicles		876	2.6	876	2.6	0.439	0.5	NA	0.1	1.0	0.03	0.05	0.03	54.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix F

Concept Design – Kent Street Shared Path Extension



1:250 0 2.5 5 7.5 10 12.5m

NORTH

ISSUE	ALTERATIONS	NAME	RPEQ	DATE
D	AMENDMENTS TO SWEPT PATH DIAGRAMS	JB		29/06/2020
C	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		04/12/2019
B	AMENDMENTS TO SWEPT PATHS & HV ROUTES	JB		02/12/2019
A	INITIAL REVISION	JB		28/11/2019

CPB CONTRACTORS · bam · Ghella · UGL

CBGU D&C JV

DESIGNED	JB	
CHECKED		
DRAWN	JB	
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
BEN MCLEAN
PROFESSIONAL QUALIFICATION TMD-0139 DATE Jun 29, 2020

CROSS RIVER RAIL TUNNELS AND STATIONS

BAM INTERNATIONAL AUSTRALIA PTY LTD &
CPB CONTRACTORS PTY LIMITED & GHELLA PTY LTD &
UGL ENGINEERING PTY LIMITED

TRAFFIC GUIDANCE SCHEME

SOUTHERN PORTAL PRECINCT

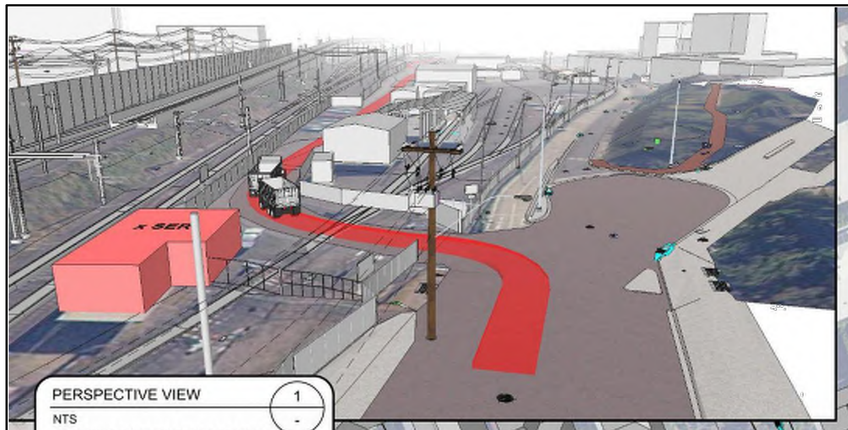
KENT ST
WOOLLOONGABBA TO THE UNIVERSITY OF QUEENSLAND BIKEWAY
SHARED USE PATHWAY CONCEPT DESIGN

DRAWING NUMBER	ISSUE
CRRTSD-TM-SKT-CBGU-020002	D
SHEET 13 OF 14	
CURRENT CTMP SUBPLAN: NIL	

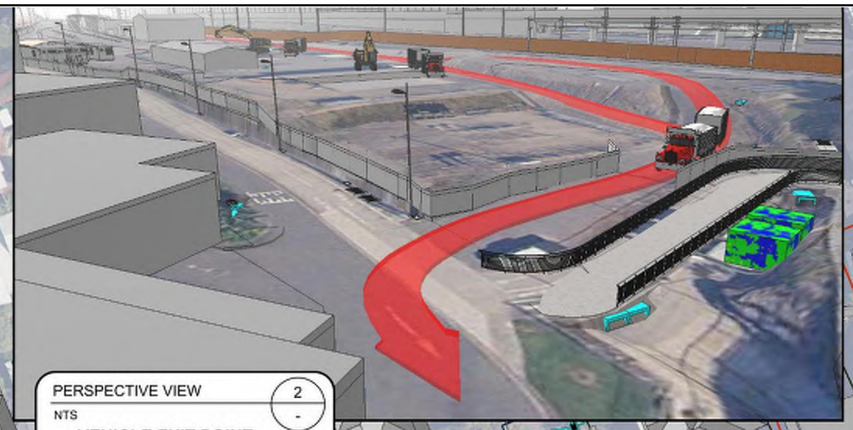
Appendix G

Site Establishment and Demolition Site Layout

NOT FOR CONSTRUCTION



PERSPECTIVE VIEW 1
NTS
VEHICLE ENTRY POINT



PERSPECTIVE VIEW 2
NTS
VEHICLE EXIT POINT

JOE BAKER STREET

RAILWAY TERRACE

RETAIN EXISTING BUILDING FOR AS LONG AS POSSIBLE FOR CRIB BUILDINGS TO REMAIN CONNECTED TO EXISTING UNDERGROUND SERVICES.

KENT STREET

VEHICLE ENTRY POINT.

PERSPECTIVE VIEW 3
NTS
SITE ESTABLISHMENT FACILITIES

DEMO & SITE EST. LEGEND:

- EXISTING BUILDINGS TO BE DEMOLISHED
- LAYDOWN AREAS
- VEHICLE PATH
- CONSTRUCTION AREA
- SITE BOUNDARY

SITE ESTABLISHMENT FACILITIES:

- 3 x 12x3m CRIB FACILITIES,
- 2 x 6x3m TOILET FACILITIES,
- 1 x 3x3m FIRST AID ROOM,
- 1 x 3x3m OFFICE FACILITY (LEADING HAND),
- 1 x AREA FOR POTENTIAL ADDITIONAL CRIB,
- 1 x AREA FOR POTENTIAL ADDITIONAL TOILET,
- COVER OVER CRIB AREA,
- RETAIN EXISTING ASPHALT GROUND SURFACE,
- LOCATION MAY NEED TO BE ADJUSTED TO SUIT SEWER / STORMWATER WORKS,
- BUILDING TO BE CONNECTED TO EXISTING UNDERGROUND SERVICES.

VEHICLE EXIT POINT.

CRRDA Drg. No. CRR–0003–CD–GA–135

D	RFPC8 ISSUE		24.07.20	
C	RFPC7 ISSUE		08.05.20	
B	MINOR REVISIONS TO RFPC4 ISSUE		29.04.19	
A	RFPC4 ISSUE		24.04.19	
	Revisions/Descriptions	Certification	Date	Microfiled

CAD FILES

Associated Job Nos

Auxiliary Drg Nos

Survey Data

Datum	BCSG02
Horiz. Grid	
Height Origin	
Survey Books	

Scales

Dimensions shown in metres except where shown otherwise

BRISBANE CITY
CROSS RIVER RAIL
CHANGED PROJECT 8

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

GENERAL CONSTRUCTION SITE PLANS SOUTHERN PORTAL

Drawn

Designed

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE

CROSSRIVERRAIL

Job No.	
Contract. No.	
Drawing No.	D
Series Number	of

MRR_Detail (02/14)

Attachment C: Technical Report - Noise and Vibration (Heavy Vehicle Access)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

CROSS RIVER RAIL - SOUTHERN PORTAL

Construction Traffic Noise Assessment

11 August 2020

CBGUJV

QB400-18F03 Southern Portal-Construction Traffic Noise (r0)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Brisbane Sydney Melbourne Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 16 123 509 884
96 Petrie Terrace SPRING HILL QLD 4004 | PO Box 820 SPRING HILL QLD 4004
P (07) 3367 3131 F (07) 3367 3121 brisbane@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Contents

List of tables

1 Introduction

Renzo Tonin & Associates was engaged by CBGUJV to prepare a construction traffic noise assessment for the Cross River Rail project-Southern Portal.

The review focuses on the impacts from additional construction related road traffic and provides a comparison to the noise goals stated in the Cross River Rail EIS-*Construction Noise and Vibration, PART A* (Report No: 20-2524-R2, dated 14th July 2011, Revision 1), Chapter 9.4.

The proposed change relates to amending the construction traffic route to allow heavy vehicle movement along Annerley Road, Cornwall Street and Kent Street to enter the Southern Portal and Dutton Park worksites, as opposed to using O'Keefe Street and Boggo Road Busway as proposed in RfPC #4. Under the proposed change construction vehicles would:

- Access the worksite via the Kent Street connection to the Annerley Road / Cornwall Street intersection; and
- Exit via Kent Street / Princess Alexandra Hospital approach at the Ipswich Road / O'Keefe Street intersection in a one-way transit as per the previously approved route; and
- Exit of oversized equipment via Kent St to Cornwall St, where truck size does not allow for exit as per above.

The change would be required until works at the Southern Portal worksite are complete. Predominantly these movements will process one-way. However, oversized plant and equipment (such as piling rigs, cranes and trucks carrying oversized pre-fabricated materials) will need to move in and out via Kent Street and Cornwall Street. This is due to the swept path analysis demonstrating that oversized trucks are unable to make the left-right turn out of the northern exit of the Southern Portal Precinct. Oversized trucks exiting the site via the southern gate would only occur by exception.

The location of the Southern Portal worksite is shown below in Figure 1.

Figure 1: Locality Map

Construction related road traffic noise is assessed in accordance with the Transport Noise Management *Code of Practice: Volume 1 (Road Traffic Noise)*, Department of Transport and Main Roads, 2013.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Traffic noise goal

Section 2.2.6 *Construction Road Traffic Noise* of the EIS states:

> *Where the construction phase of CRR is adding heavy vehicles to the existing road network, it is appropriate to consider the incremental change in noise levels due to the changes in traffic volume.*
>
> *A change of up to 3 dBA in the level of a dynamic noise, such as passing vehicles is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.*
>
> *It is acknowledged that people are likely to notice increased traffic based on visual clues and perception of vehicle pass-by frequency before they will objectively notice an increase in the average noise level.*
>
> *For assessment purposes it is common to set the threshold of significance in relation to changes in the noise emission level from roads at 2 dBA. For the impact assessment of construction traffic noise the noise goal in Table 7 is recommended.*

Table 7 Construction Road Traffic Noise Goal

Type of Roads	***Goal***
Existing Roads	*2dBA change in existing $L_{A10\ (1hour)}$ [1], $L_{A10(12hour)}$ [2] and $L_{10(18hour)}$ [3]*

3 Existing traffic volumes

Existing traffic volumes for the Southern Portal assessed roads have been obtained from CBGUJV. The traffic volumes were based on intersection counts conducted over a 24-hour period on Thursday 18th June 2020. Appendix B shows the hourly recorded traffic volumes and a 24-hour summary is shown in Table 1 below. At the time of preparing this report, Average Annual Daily Traffic (AADT) data for these roads were unavailable.

Table 1: Existing traffic volumes - Thursday 18th June 2020

Worksite	Road Segment	24-hour day period	
		Existing Total	Existing Heavy Vehicles
Southern Portal	Annerley Road	24,990	834 (3.3%)
	Noble Street	12,272	668 (5.4%)
	Railway Terrace	232	11 (4.7%)
	Cornwall Street	8,972	322 (3.6%)
	Kent Street	1,409	50 (3.5%)

4 Construction traffic volumes

4.1 Construction traffic volumes

It is understood that construction heavy vehicle traffic will arrive via Kent Street from Annerley Road and Cornwall Street and depart via Kent Street at the northern end of the site then exit onto Ipswich Road. Trucks arriving the site would do so as a left-in manoeuvre. From Annerley Road and Cornwall Street, trucks would follow a right-in manoeuvre onto Kent Street. Maps showing proposed access and exit routes are shown in Figure 2 (shows the Kent St route in comparison to the currently approved access via the Busway) and Figure 3 (shows the entry and egress points to the site).

[1] $L_{A10(1hour)}$ for the peak number of heavy vehicle movements during any hour between 12midnight and 6am as stated in Section 9.4.2 of the EIS.
[2] $L_{A10(12hour)}$ is the average L_{A10} traffic noise level between the hours of 6:30am and 6:30pm as stated in Section 9.4.2 of the EIS.
[3] $L_{A10(18hour}$ is the average L_{A10} traffic noise level between the hours of 6am and 12midnight.

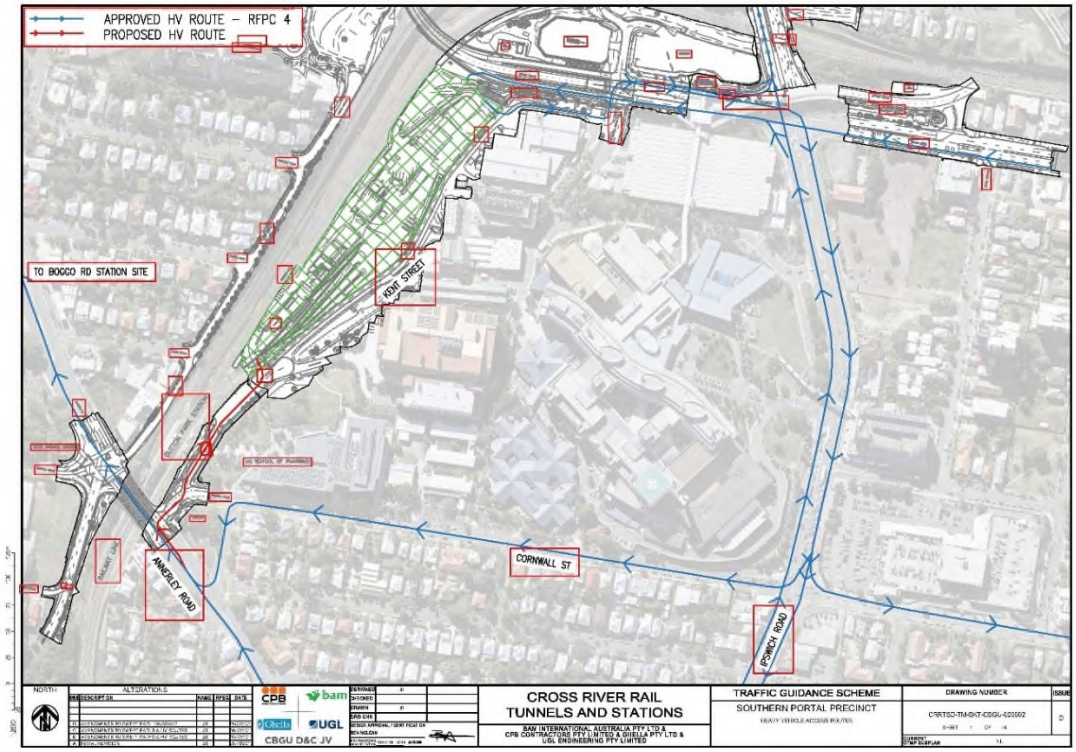


Figure 2: Proposed heavy vehicle access route

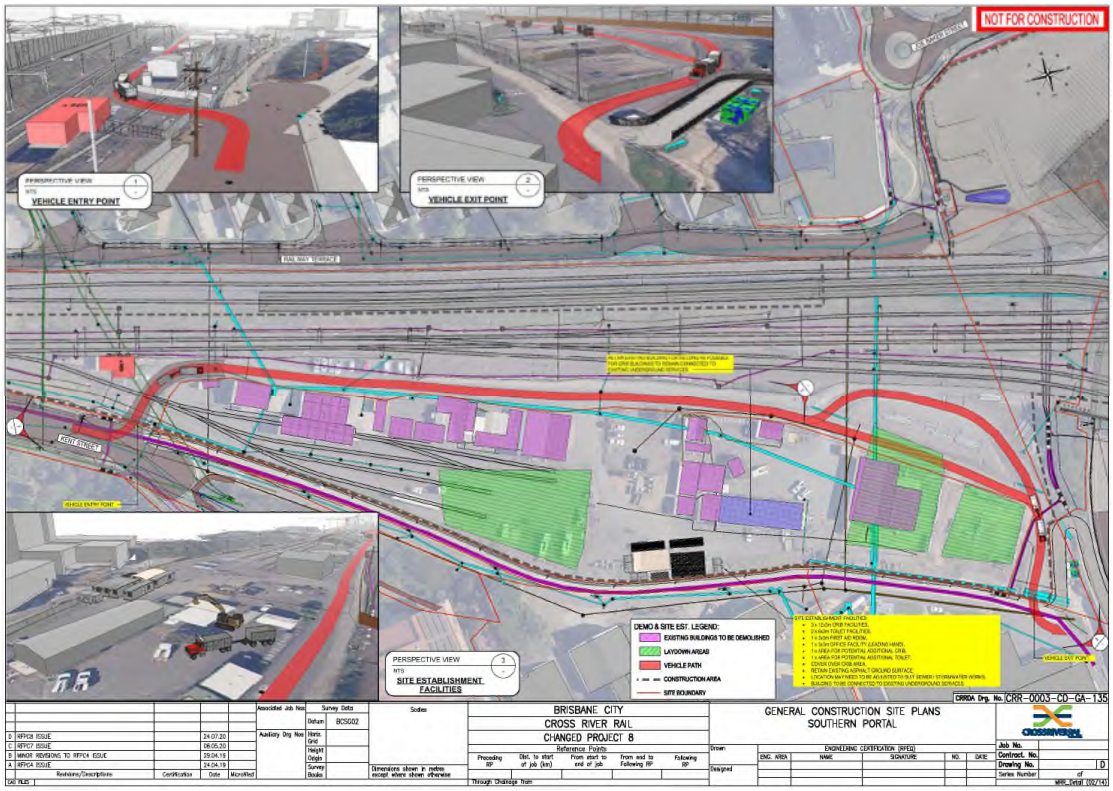


Figure 3: Proposed heavy vehicle access route

The forecast maximum daily heavy and light vehicles associated with the Southern Portal construction works has been advised by CBGUJV, i.e.

> *Peak construction vehicle movements will be in order of:*
>
> - *8 light vehicles/hour (already approved for access via Kent St)*
> - *10 heavy vehicles/hour (additional vehicles proposed via Kent Street) as a peak load through the daytime*
> - *4 heavy vehicles/hour (additional vehicles proposed via Kent Street) for evening and night periods*
>
> *Outside of peak construction activities, construction heavy vehicles volumes will be in the order of 4 vehicles/hour*

It understood that peak hour construction traffic would be anytime between 6:30am to 6:30pm.

Based on the above CBGUJV advice, the expected construction 24-hour traffic volumes have been calculated, as shown in Table 2.

Table 2: Traffic volumes summary

Worksite	Road Segment	24-hour day period					
		Existing Total	Existing Heavy Vehicles	Additional Vehicles due to Construction	Additional Heavy Vehicles due to Construction	TOTAL	Heavy Vehicles
Southern Portal	Annerley Road	24,990	834 (3.3%)	110	102	25,095	936 (3.7%)
	Cornwall Street	8,972	322 (3.6%)	110	102	9,077	424 (4.7%)
	Kent Street	1,409	50 (3.5%)	110	102	1,514	152 (10%)

5 Traffic noise assessment

5.1 Predicted construction traffic noise

Predicted changes in traffic noise are based on a method developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN (1988) method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board (ARRB) and as a result it is recognised and accepted by the Department of Transport and Main Roads. The predicted increase in traffic noise on all assessed roads is detailed in Table 3 below.

As stated in the EIS, *the effect of construction related heavy vehicle traffic on the noise emission from roadways has been assessed by calculating how the additional truck traffic would alter the $L_{A10(12hour)}$ level of noise emission from roadways using the CoRTN prediction algorithms. For the purpose of this analysis, the $L_{A10(12hour)}$ is the average L_{A10} traffic noise level between the hours of 6:30 am and 6:30 pm.*

This report adopts the same calculation methodology as the EIS.

Table 3: Predicted overall increase in traffic noise

Worksite	Road Segment	Predicted overall increase noise level, dBA		
		$L_{A10(12hour)}$ (6:30am to 6:30pm) Day	$L_{A10\ (18hour)}$ (6am to 12midnight) Day & Evening	$L_{A10(1hour)}$ (12midnight to 6am) Night
Southern Portal	Annerley Road	+0.3	+0.3	+0.2
	Cornwall Street	+0.3	+0.4	+0.6
	Kent Street	+0.5	+0.5	+0.7

Table 3 shows the predicted increase road traffic noise levels will be less than 2dBA for the overall $L_{A10(12hour)}$ $L_{A10(18hour)}$ and $L_{A10(1hour)}$ noise parameters. Construction traffic noise is predicted to satisfy the noise goal outlined in Table 7 of the EIS.

5.2 Traffic noise mitigation and management

No specific measures are required when construction vehicles are on public roads, provided hourly traffic movements associated with construction are consistent with the assumptions outlined in Section 4.1. However, best practice measures, such as limiting of compression braking will ensure that noise impacts of heavy vehicle traffic on surrounding streets are minimised. Additionally, the generic measures stated in the EIS should be adopted:

- *Best practice management over engine noise emissions by procurement and maintenance of a fleet that conforms to Australian Design Rule 28/01 for engine noise emissions, tested in accordance with the National Road Transport Commission document Stationary Exhaust Noise Test Procedures for In-Service Motor Vehicles.*

- *Adoption of airbag suspension throughout the fleet to minimise noise associated with empty trucks travelling over road irregularities.*

- *Satellite tracking and management of the position of the truck fleet to ensure that waiting queues are appropriate to space constraints, minimising noise from idling trucks.*

6 Conclusion

Renzo Tonin & Associates have completed a review into the construction related road traffic noise for construction related road traffic noise for the Cross River Rail project-Southern Portal.

The review focuses on the impacts from construction related road traffic noise and provides a comparison to the results provided in the Cross River Rail EIS-*Construction Noise and Vibration, PART A* (Report No: 20-2524-R2, dated 14th July 2011, Revision 1), Chapter 9.4.

The outcomes are as follows:

- The predicted increase in traffic volumes are expected to comply with the traffic noise goals and are generally consistent with the EIS.
- The assessment has been conducted in accordance with the Transport Noise Management Code of Practice: Volume 1 (Road Traffic Noise), Department of Transport and Main Roads, 2013.
- No specific measures are required when construction vehicles are on public roads, provided hourly traffic movements associated with construction are consistent with the assumptions outlined above. However, good practice measures should be adopted.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:
	threshold of hearing — 0 dB — The faintest sound we can hear
	10 dB — Human breathing
	almost silent — 20 dB
	30 dB — Quiet bedroom or in a quiet national park location
	generally quiet — 40 dB — Library
	50 dB — Typical office space or ambience in the city at night
	moderately loud — 60 dB — CBD mall at lunch time
	70 dB — The sound of a car passing on the street
	loud — 80 dB — Loud music played at home
	90 dB — The sound of a truck passing on the street
	very loud — 100 dB — Indoor rock band concert
	110 dB — Operating a chainsaw or jackhammer
	extremely loud — 120 dB — Jet plane take-off at 100m away
	threshold of pain — 130 dB
	140 dB — Military jet take-off at 25m away
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Traffic Data Hourly (Thursday 18th June 2020)

Site	Hourly volumes									
	Annerley Road			Noble Street		Railway Terrace		Cornwall Street		Kent Street	
		Existing	HV	Existing	HV	Existing	HV	Existing	HV	Existing	HV
Southern Portal	00:00-01:00	94	3	64	5	0	0	29	2	4	0
	01:00-02:00	57	1	33	2	0	0	20	2	3	1
	02:00-03:00	77	7	44	7	1	0	18	3	16	5
	03:00-04:00	56	9	57	12	4	0	15	5	9	0
	04:00-05:00	133	9	91	3	3	0	42	4	2	2
	05:00-06:00	520	31	207	16	10	2	152	14	24	0
	06:00-07:00	1106	55	418	27	6	1	392	22	65	4
	07:00-08:00	2052	70	616	32	14	2	745	22	115	1
	08:00-09:00	2299	81	777	84	18	0	794	23	130	4
	09:00-10:00	1485	85	627	75	23	0	611	33	145	7
	10:00-11:00	1356	76	610	59	23	5	769	31	91	5
	11:00-12:00	1411	70	644	56	25	1	526	30	82	7
	12:00-13:00	1466	75	650	39	16	0	549	28	106	4
	13:00-14:00	1375	67	672	39	15	0	538	28	96	5
	14:00-15:00	1650	33	801	38	15	0	646	14	97	3
	15:00-16:00	2146	62	1321	27	10	0	767	28	102	2
	16:00-17:00	2028	29	1340	36	17	0	674	8	126	0
	17:00-18:00	1892	19	1236	22	6	0	624	6	87	0
	18:00-19:00	1359	18	701	29	8	0	375	6	53	0
	19:00-20:00	848	8	460	16	9	0	245	4	20	0

Site	Hourly volumes									
	Annerley Road			Noble Street		Railway Terrace		Cornwall Street		Kent Street	
		Existing	HV	Existing	HV	Existing	HV	Existing	HV	Existing	HV
	20:00-21:00	578	15	311	12	5	0	159	6	12	0
	21:00-22:00	482	3	261	11	4	0	135	1	11	0
	22:00-23:00	324	4	195	8	0	0	99	2	12	0
	23:00-00:00	196	4	136	13	0	0	48	0	1	0

Attachment D: Technical Report - Noise and Vibration (Rail Possessions)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

CROSS RIVER RAIL

Construction Noise and Vibration Mitigation Design Report - Request for Project Change No.8

11 August 2020

CBGU JV

QB400-16F03 CRR Construction NV Mitigation Design Report - (r0).docx

Brisbane Sydney Melbourne Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 16 123 509 884
U14, 205 Montague Road, West End QLD 4101 | PO Box 820 SPRING HILL QLD 4004
P (07) 3367 3131 F (07) 3367 3121 brisbane@renzotonin.com.au www.renzotonin.com.au

Contents

1 Introduction

Renzo Tonin & Associates (RTA) was engaged by CPB to undertake an assessment of the impacts of construction noise and vibration for the Cross River Rail (CRR) project, as part of the Request for Project Change #8 (RfPC #8).

This document provides an assessment of the potential noise and vibration impacts associated with Planned Rail Corridor Works (SCAS TSD-15), as an example of these continuous works, noting that this is the only opportunity for the construction work to occur as they require section of the rail corridor to be shut down. All Planned Works will occur over 24 hours during Scheduled Corridor Access System (SCAS) and possible closure of surrounding roads with increase in deliveries/removal of plant and materials.

The report provides a summary of the works, the predicted noise and vibration impacts and a summary of the proposed mitigation and management measures to reduce impacts at the nearest sensitive receivers.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. **APPENDIX A** contains a glossary of acoustic terms used in this report.

2 Site Location and Surrounding Sensitive Locations

The location of the site and surroundings are provided in Figure B1 in Appendix B. As shown in the figure, the Project site is surrounded by various sensitive uses. Evaluation of the noise and vibration impacts of construction activities are focused on areas within 100m of the site. Due to the myriad building occupancy and land uses surrounding the site, Renzo Tonin and Associates have simplified the surrounding buildings into the following receiver categories:

- Residential
- Commercial
- Educational
- Medical (i.e. hospitals)
- Public Building (e.g. judicial buildings, municipal buildings, etc)
- Place of Worship
- Heritage Building

Residential receivers are generally considered to be the most sensitive and most likely to be impacted by construction activities. Noise and vibration impacts are assessed at residential receivers for all hours of work. Other receivers may be less sensitive to construction activities, with impacts generally limited to hours of occupancy (e.g. commercial buildings are generally only impacted during standard work hours).

Noise sensitive receivers surrounding the Project site have been divided into Noise Catchment Areas (NCAs) based on each area's similar acoustic environment prior to commencement of construction works, as shown in **Figures B1, B2 and B3** in **Appendix B**.

3 Planned Rail Corridor Works

Planned Rail Corridor Works (SCAS TSD-15) includes the following:

3.1 Combined Service Route and Signalling Works:

- Install Buranda Combined Service Route (CSR)
- Install Fairfield CSR route
- Install Location Case (LOC) L1-1 foundation, local conduit route & cabinet
- Construct Signal Equipment Room (SER) / Power Equipment Room (PER) / Communications Equipment Room (CER) building foundations
- Non-Destructive Digging (NDD) for Dutton Park CSR route
- Dutton Park maintenance siding – decommissioning works.
- Terminate new local cable routs, joint and cut across main rain cable and commission B14 LOC

[Note: All works 24hr working during SCAS]

3.2 Rail Civil & Drainage:

- Directional Drill [Pound St to Kent St]

[Note: All works 24hr working during SCAS]

3.3 Track:

- Fairfield On Track Vehicle (OTV) Pad [Ensign Ave]
- Cleveland Fork-line reconfiguration [Access via Park Road Triangle] > Support to Middle Road temporary works piled retaining wall

[Note: All works 24hr working during SCAS]

3.4 Over-Head Line Equipment Works:

- NDD for Fairfield Over-head Line Equipment (OHLE) Foundations
- OHLE support to Middle Road Temporary Works
- Install temp OHLE mast(s) and alter wire runs to facilitate
- Fork-line – Installation of mast foundation, future wire removal/slews for Middle Road temporary piling works

[Note: All works 24hr working during SCAS]

3.5 Earthworks / Geotech Investigation / Ground Investigation:

- Earthworks re-profiling & waste disposal within Park Road Triangle

- Geotechnical investigation of the cut and cover section

[Note: All works 24hr working during SCAS]

4 Activity Location and Equipment Lists

4.1 Buranda CSR Works

The following plant items are proposed for the planned Buranda CSR works area:

- 14 tonne Hi-rail excavator x1 c/w rail trailer
- 10 tonne Hi-rail Hydrema Dump-trucks
- Hi-rail truck wet vacuum excavator

4.2 Park Road Triangle + Rail works to support Middle Road TW works

The following plant items are proposed for the planned Park Road Triangle + Rail works to support Middle Road TW works area:

- 20 – 25 tonne tracked excavator
- Rock breaker for 20-25 tonne excavator [intermittent use]
- Road haulage Truck & Dog
- 10t-12t roller
- 8 tonne Tracked excavator
- Concrete mixer truck [intermittent use]
- Hi-rail Elevated Work Platform (EWP)
- Hi-rail OHLE cable truck (c/w truck mounted crane)
- 14 tonne Hi-rail excavator c/w rail trailer
- 10 tonne Hi-rail Hydrema Dump-trucks
- Track mounted air vacuum unit and vacuum truck
- Piling rig [access via Boggo Rd crossing Dual Gauge]
- Various deliveries to TW piled retention wall works
- Pozie
- Grader
- Water truck

4.3 Fairfield / Dutton Park NDD, OTV Pad & CSR Works

The following plant items are proposed for the planned Fairfield / Dutton Park NDD, OTV Pad & CSR works area:

- 14 tonne Hi-rail excavator c/w rail trailer
- 8 tonne Hi-rail excavator
- 10 tonne Hi-rail Hydrema Dump-trucks
- Track mounted air vacuum unit and vacuum truck
- Hi-rail truck wet vacuum excavator
- Road haulage Truck & Dog
- 8 tonne tracked excavator

- Delivery trucks various (ballast, asphalt, etc)
- Water truck
- Grader
- Tamper and regulator for the fork line reconditioning

5 Reference Documents and Design Criteria

The construction noise and vibration mitigation design criteria for the Cross River Rail (CRR) works are based on the following documents:

- Cross River Rail Coordinator General's *Change Report – design refinements and condition changes 2020* dated July 2020.
- Australian Standard AS/NZS 2107.

This construction noise and vibration mitigation design report addresses potential noise impact associated with Planned Rail Corridor Works (SCAS TSD-15) proposed over the approved rail possession, as an example of these continuous works within a rail corridor.

Potential noise impacts associated with spoil haulage from construction vehicles on public roads during the approved rail possession is not assessed in this report and has been addressed as part of the Traffic Noise Assessment.

5.1 Coordinator General's Change Report (July 2020)

Appendix 1 of the *Coordinator-General's Change Report – design refinements and condition changes 2020,* this may be found at the following weblink http://www.dsdmip.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/cross-river-rail-project.html .

6 Noise Prediction Methodology

Modelling and assessment of airborne noise impacts from construction activities associated with the worksite were determined by modelling the noise sources, receiver locations, topographical features, and possible noise mitigation measures using the Cadna-A computer noise model. The model uses the ISO 9613 algorithms to calculate the contribution of each noise source at identified sensitive receiver locations and allows for the prediction of the total noise from a site for the various stages of the construction works.

The noise prediction models take into account:

- Location of noise sources and sensitive receiver locations;
- Ground RLs and height of noise sources within the site referenced to information provided by CBGU, and 1m digital ground contours outside the construction site area;
- Noise source levels of individual construction plant;
- Separation distances between sources and receivers;
- Ground type between sources and receivers (mostly hard); and
- Attenuation from barriers (natural and purpose built).

6.1 Noise Model Inputs and Assumptions

Key details regarding the construction site layout, the likely plant and equipment (including truck movements onsite) were informed by the Design Team. This information is presented in Table 6.1 and formed the basis for all modelling assumptions used in this assessment.

Table 6.1: Sound Power Levels for various Plant Items

Works area	Plant Items	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)
Buranda CSR	14 tonne Hi-rail excavator x1 c/w rail trailer	103
	10 tonne Hi-rail Hydrema Dump-trucks (2 off)	102
	Hi-rail truck wet vacuum excavator	107
Park Road Triangle + Rail works to support Middle Road TW	20 – 25 tonne 360deg tracked excavator (2 off)	107
	Rock breaker for 20-25 tonne excavator [intermittent use]	119
	Road haulage Truck & Dog (8 off)	109
	10 tonne Ride-on roller	112
	8 tonne Tracked excavator	103
	Concrete mixer truck [intermittent use]	107
	Hi-rail EWP (2 off)	95

Works area	Plant Items	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)
	Hi-rail OHLE cable truck (c/w truck mounted crane)	105
	14 tonne Hi-rail excavator c/w rail trailer	103
	10 tonne Hi-rail Hydrema Dump-trucks (2 off)	102
	Track mounted air vac unit	107
	Piling rig (2 off) [access via Boggo Rd crossing Dual Gauge]	112
	Various deliveries to TW piled retention wall works	97
Fairfield / Dutton Park NDD, OTV Pad & CSR	14 tonne Hi-rail excavator (2 off) c/w rail trailer	103
	8 tonne Hi-rail excavator (2 off)	103
	10 tonne Hi-rail Hydrema Dump-trucks (4 off)	102
	Track mounted air vac unit	107
	Hi-rail truck wet vacuum excavator	107
	Road haulage Truck & Dog (4 off)	109
	8 tonne 360deg tracked excavator	103
	Delivery trucks various (ballast, asphalt, etc)	97

6.2 Construction Noise Goals (CNG's)

Noise sensitive receivers surrounding the Project site have been divided into Noise Catchment Areas (NCAs) based on each area's similar acoustic environment prior to commencement of construction works, as shown in **Figures B1, B2 and B3** in **Appendix B**.

External noise goals may be calculated and applied in accordance with Coordinator General's Imposed Conditions (Imposed Conditions) when internal building access is not available. Table 6.2 presents adjusted external Construction Noise Goals (CNG's) for noise sensitive receivers close to the three works areas.

Table 6.2: Construction Noise Goals (CNGs) (Adjusted External noise goals)

NCA	Receiver Type	Receiver Location	Continuous Noise LAeq,adj (1hr)		Intermittent Noise LA10,adj (15min)	
			Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)	Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)
Buranda CSR Works						
BUR01	Residential (Queenslander)	O'Keefe St, Harrogate St, Agnes St, Bruce St, Bourne St	47	42	57	49
	Residential		57	52	67	59
	Worship	O'Keefe St, Agnes St	52	52 (when in use)	62	62 (when in use)

NCA	Receiver Type	Receiver Location	Continuous Noise LAeq,adj (1hr)		Intermittent Noise LA10,adj (15min)	
			Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)	Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)
BUR02	Residential (Queenslander)	O'Keefe St, Carl St, Wolseley St	47	42	57	49
	Residential		57	52		
	Commercial	O'Keefe St	67	-	77	-
	Education	Carl St	57	-	67	59
BUR03	Residential (Queenslander)	Faversham St, Arne St, Toohey St, Bank Ln, Church Ave, Arrow St, Taylor St	47	42	57	49
	Residential		57	52	67	59
	Worship	Bank Ln, Queen Bee St	52	52 (when in use)	62	62 (when in use)
	Commercial	Logan Road	67	-	77	-
BUR04	Residential (Queenslander)	O'Keefe St, Gillingham St, Fern St, Junction St	47	42	57	49
	Residential		57	52		
	Commercial	Junction St	67	-	77	-
BUR05	Residential (Queenslander)	Vanda St, Maynard St, Sword St, Flower St, Leonard St, Joshua St, Railway St, Leamington St	47	42	57	49
	Residential		57	52	67	59
	Commercial	Logan Rd	67	-	77	-
BUR06	Residential (Queenslander)	Martin St, Salisbury St, Churchill St, Maynard St, Derelle St, Preston St	47	42	57	49
	Residential		57	52	67	59
	Commercial	Logan Rd, Maynard St	67	-	77	-
	Education	Buranda State School, Narbethong Special School	57	52	67	-
Park Road Triangle + Rail works to support Middle Road TW works						
-	Commercial	Railway Terrace	67	-	77	-
BOG01	Residential (Queenslander)	Railway Terrace (Pound St to Rawnsley St)	47	42	57	49
	Residential	ESA Village (Leukaemia Centre), new apartments along Peter Doherty St	57	52	67	59
BOG02	Commercial	Ecosciences Building	67	-	77	-
	Commercial	Police Station & Gaol	62	-	72	-

NCA	Receiver Type	Receiver Location	Continuous Noise LAeq,adj (1hr)		Intermittent Noise LA10,adj (15min)	
			Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)	Day (Monday - Saturday 6.30am-6.30pm)	Out of Hours - evening, night (Monday – Saturday 6.30pm – 6.30am Sundays, Public Holidays)
	Education	Dutton Park Primary School	57	-	67	-
BOG03	Residential	Merton Road to Elliott Street	47	42	57	49
	Commercial	Burke Street	62	-	72	-
BOG04	Commercial	Metropolitan linen service (MLS)	62	-	72	-
	Medical	PA Hospital	57	52	67	59
	Education	PA Early Education Centre	57	-	67	-
-	Residential	Rusk Street & Cornwall Street	47	42	57	49
Fairfield / Dutton Park NDD, OTV Pad & CSR works						
DUT01	Residential (Queenslander)	Cope St, Rusk St, Tamar St, Sampson St, Annerley Road, Cornwall St, Brisbane St, Ayr St, Carville St, Young St, Wilkins St E,	47	42	57	49
	Residential		57	52	67	59
DUT02	Residential (Queenslander)	Princess St, Noble St, Fairfield Rd, Fenton St, Simpson St, Hefferan St	47	42	57	49
	Residential		57	52	67	59
	Commercial	Cornwall St, Noble St	67	-	77	-
DUT03	Residential (Queenslander)	Railway Terrace, Dutton St, Rawnsley St	47	42	57	49
	Residential		57	52	67	59
	Commercial	Railway Terrace, Annerley Road	67	-	77	-
DUT04	Commercial		67	-	77	-
	Medical	PA Hospital	57	52	67	59
	Education		57	-	67	-
DUT05	Residential (Queenslander)	Fenton St, Cotterham St, Cameron St, Wilkins St W, Mearns St, Mildmay St, Redarc St, Victoria St	47	42	57	49
	Residential		57	52	67	59
DUT06	Residential (Queenslander)	Wilkins St E, Ensign Ave, Aylesford St, Heaslop Terrace, Annerley Road, Denham St	47	42	57	49
	Residential		57	52	67	59

6.3 Construction Ground-borne Noise & Vibration Goals (CGBNGs and CGBVGs)

Table 6.3 presents Construction Ground-borne Noise Goals and Construction Ground-borne Vibration Goals (CGBNGs and CGBVGs) for noise sensitive receivers close to the three works areas.

Table 6.3: Construction Ground-borne Noise Goals and Construction Ground-borne Vibration Goals (CGBNGs and CGBVGs)

NCA	Receiver Type	Receiver Location	Time Period	Vibration PPV (mm/s)	Internal ground-borne noise, dBA	Internal ground-borne noise, dBA
					Continuous	Intermittent
Buranda CSR Works						
BUR01	Residential (Queenslander)	O'Keefe St, Harrogate St, Agnes St, Bruce St, Bourne St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Worship	O'Keefe St, Agnes St	Day	25	45 LAeq, adj	55 LA10, adj
BUR02	Residential (Queenslander)	O'Keefe St, Carl St, Wolseley St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	O'Keefe St	Day	25	45 LAeq, adj	55 LA10, adj
	Education	Carl St	Day	10	40 LAeq, adj	50 LA10, adj
BUR03	Residential (Queenslander)	Faversham St, Arne St, Toohey St, Bank Ln, Church Ave, Arrow St, Taylor St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Worship	Bank Ln, Queen Bee St	Day	25	45 LAeq, adj	55 LA10, adj
	Commercial	Logan Rd	Day	25	45 LAeq, adj	55 LA10, adj
BUR04	Residential (Queenslander)	O'Keefe St, Gillingham St, Fern St, Junction St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Junction St	Day	25	45 LAeq, adj	55 LA10, adj
BUR05	Residential (Queenslander)	Vanda St, Maynard St, Sword St, Flower St, Leonard St, Joshua St, Railway St, Leamington St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Logan Rd, Woolloongabba	Day	25	45 LAeq, adj	55 LA10, adj

NCA	Receiver Type	Receiver Location	Time Period	Vibration PPV (mm/s)	Internal ground-borne noise, dBA	Internal ground-borne noise, dBA
					Continuous	Intermittent
BUR06	Residential (Queenslander)	Martin St, Salisbury St, Churchill St, Maynard St, Derelle St, Preston St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Logan Rd, Maynard St	Day	25	45 LAeq, adj	55 LA10, adj
	Education	Buranda State School, Narbethong Special School	Day	10	40 LAeq, adj	50 LA10, adj
Park Road Triangle + Rail works to support Middle Road TW works						
-	Commercial	Railway Terrace	Day	5	45 LAeq, adj	55 LA10, adj
BOG01	Residential	Railway Terrace (Pound St to Rawnsley St)	Day	10	40 LAeq, adj	50 LA10, adj
		Railway Terrace (Pound St to Rawnsley St)	Night	0.5	35 LAeq, adj	42 LAmax
	Residential	ESA Village (Leukaemia Centre), new apartments along Peter Doherty St	Day	25	40 LAeq, adj	50 LA10, adj
		ESA Village (Leukaemia Centre), new apartments along Peter Doherty St	Night	0.5	35 LAeq, adj	42 LAmax
BOG02	Commercial	Ecosciences Building (commercial)	Day	25	45 LAeq, adj	55 LA10, adj
	Commercial	Ecosciences Building (TEM)	Day	See Note 1	45 LAeq, adj	55 LA10, adj
	Education	Dutton Park Primary School	Day	10	40 LAeq, adj	50 LA10, adj
BOG03	Residential	Merton Road to Elliott Street	Day	10	40 LAeq, adj	50 LA10, adj
		Merton Road to Elliott Street	Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Burke Street	Day	25	45 LAeq, adj	55 LA10, adj
BOG04	Commercial	Metropolitan line service (MLS)	Day	25	45 LAeq, adj	55 LA10, adj
	Medical	PA Hospital	Day	25	40 LAeq, adj	50 LA10, adj
		PA Hospital	Night	0.5	35 LAeq, adj	42 LAmax
Fairfield / Dutton Park NDD, OTV Pad & CSR works						
DUT01	Residential (Queenslander)	Cope St, Rusk St, Tamar St, Sampson St, Annerley Road, Cornwall St, Brisbane St, Ayr St, Carville St, Young St, Wilkins St E,	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
DUT02	Residential (Queenslander)	Princess St, Noble St, Fairfield Rd, Fenton St, Simpson St, Hefferan St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Cornwall St, Noble St	Day	25	45 LAeq, adj	55 LA10, adj
DUT03	Residential (Queenslander)	Railway Terrace, Dutton St, Rawnsley St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj

NCA	Receiver Type	Receiver Location	Time Period	Vibration PPV (mm/s)	Internal ground-borne noise, dBA	Internal ground-borne noise, dBA
					Continuous	Intermittent
			Night	0.5	35 LAeq, adj	42 LAmax
	Commercial	Railway Terrace, Annerley Road	Day	25	45 LAeq, adj	55 LA10, adj
DUT04	Commercial		Day	25	45 LAeq, adj	55 LA10, adj
	Medical	PA Hospital	Day	25	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Education		Day	10	40 LAeq, adj	50 LA10, adj
DUT05	Residential (Queenslander)	Fenton St, Cotterham St, Cameron St, Wilkins St W, Mearns St, Mildmay St, Redarc St, Victoria St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
DUT06	Residential (Queenslander)	Wilkins St E, Ensign Ave, Aylesford St, Heaslop Terrace, Annerley Road, Denham St	Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax
	Residential		Day	10	40 LAeq, adj	50 LA10, adj
			Night	0.5	35 LAeq, adj	42 LAmax

Note 1- Equipment specific vibration criteria are required for highly sensitive equipment (i.e electron microscope, MRI systems or similar), as part of future site-specific detailed investigations

6.4 Predicted Construction Noise Levels

Table 6.4 presents a range of predicted construction noise levels for noise sensitive receivers located close to the three works areas. Note predicted noise levels shown in Table 6.4 are based on a **'worst case'** scenario whereby all equipment is running simultaneously. Detailed scheduling of equipment usage will not be available until days before actual works and therefore for assessment purposes we have adopted a **'worst case'** scenario. Appendix E of this report presents noise contour maps for fixed plant and fixed plus roaming plant items.

Table 6.4: Range of predicted Construction Noise Levels during Rail Possession

NCA	Representative Location	Receiver Type	Construction Noise Goals (CNG's), dB(A)				Predicted Noise Level Range, dB(A)	Potential noise levels above CG's noise goals, dB(A)
			Day (LAeq 15min)	Day (LA10 15min)	OOH (LAeq 15min)	Night (LAmax)	(LAeq 15min)	(LAeq 15min)
Buranda CSR Works								
BUR01	O'Keefe St, Woolloongabba	Residential	57	67	52	59	42 - 77	25
BUR01	O'Keefe St, Woolloongabba	Church	52	62	52 (when in use)	62 (when in use)	49 - 80	28
BUR01	O'Keefe St, Woolloongabba	Residential (Queenslander)	47	57	42	49	49 - 78	35

NCA	Representative Location	Receiver Type	Construction Noise Goals (CNG's), dB(A)				Predicted Noise Level Range, dB(A)	Potential noise levels above CG's noise goals, dB(A)
			Day (LAeq 15min)	Day (LA10 15min)	OOH (LAeq 15min)	Night (LAmax)	(LAeq 15min)	(LAeq 15min)
BUR01	Harrogate St, Woolloongabba	Residential	57	67	52	59	48 - 71	19
BUR01	Harrogate St, Woolloongabba	Residential (Queenslander)	47	57	42	49	52 - 73	31
BUR01	Agnes St, Woolloongabba	Residential (Queenslander)	47	57	42	49	53 - 74	32
BUR02	Carl St, Woolloongabba	Residential	57	67	52	59	46 - 63	11
BUR02	Carl St, Woolloongabba	Education	57	67	-	-	45 - 65	8
BUR02	O'Keefe St, Woolloongabba	Commercial	67	77	-	-	48 - 70	3
BUR03	Faversham St, Woolloongabba	Residential (Queenslander)	47	57	42	49	46 - 67	25
BUR03	Faversham St, Woolloongabba	Residential (Queenslander)	47	57	42	49	47 - 74	32
BUR03	Arne St, Woolloongabba	Residential (Queenslander)	47	57	42	49	44 - 79	37
BUR03	Logan Rd, Woolloongabba	Commercial	67	77	-	-	28 - 79	12
BUR04	Gillingham St, Woolloongabba	Residential	57	67	52	59	43 - 86	34
BUR04	O'Keefe St, Woolloongabba	Residential (Queenslander)	47	57	42	49	40 - 65	23
BUR05	Logan Rd, Woolloongabba	Commercial	67	77	-	-	35 - 82	15
BUR05	Vanda St, Woolloongabba	Residential	57	67	52	59	31 - 78	26
BUR05	Vanda St, Woolloongabba	Residential	57	67	52	59	41 - 72	20
BUR05	Vanda St, Woolloongabba	Residential	57	67	52	59	34 - 76	24
BUR05	Maynard St, Woolloongabba	Residential	57	67	52	59	40 - 72	20
BUR06	Logan Rd, Woolloongabba	Commercial	67	77	-	-	41 - 77	10
BUR06	Martin St, Woolloongabba	Education	57	67	-	-	41 - 76	19
BUR06	Martin St, Woolloongabba	Residential	57	67	52	59	39 - 81	29
BUR06	Salisbury St, Woolloongabba	Residential (Queenslander)	47	57	42	49	41 - 81	39
BUR06	Salisbury St, Woolloongabba	Residential (Queenslander)	47	57	42	49	32 - 72	30
Park Road Triangle + Rail works to support Middle Road TW works								
BOG01	Railway Terrace, Dutton Park	Residential (Queenslander)	47	57	42	49	62 - 75	33

NCA	Representative Location	Receiver Type	Construction Noise Goals (CNG's), dB(A)				Predicted Noise Level Range, dB(A)	Potential noise levels above CG's noise goals, dB(A)
			Day (LAeq 15min)	Day (LA10 15min)	OOH (LAeq 15min)	Night (LAmax)	(LAeq 15min)	(LAeq 15min)
BOG01	Railway Terrace, Dutton Park	Residential (Queenslander)	47	57	42	49	64 - 74	32
BOG01	Rawnsley St, Dutton Park	Residential (Queenslander)	47	57	42	49	67 - 73	31
BOG01	Railway Terrace, Dutton Park	Residential (Queenslander)	47	57	42	49	70 - 75	33
BOG01	Railway Terrace, Dutton Park	Residential	57	67	52	59	72 - 77	25
BOG01	Peter Doherty St (Leukaemia Foundation)	Residential	57	67	52	59	72 - 79	27
BOG02	Joe Baker St (Ecosciencse Precinct)	Commercial	67	77	-	-	55 - 65	-
BOG03	Burke St, Dutton Park	Commercial	67	77	-	-	57 - 79	12
BOG03	Burke St, Dutton Park	Commercial	67	77	-	-	58 - 70	3
BOG04	PA Hospital	Medical	57	67	52	59	62 - 71	19
Fairfield / Dutton Park NDD, OTV Pad & CSR works								
DUT01	Cornwall St, Annerley	Residential (Queenslander)	47	57	42	49	43 - 69	27
DUT01	Annerley Rd, Annerley	Residential (Queenslander)	47	57	42	49	51 - 72	30
DUT01	Cope St, Annerley	Residential (Queenslander)	47	57	42	49	37 - 72	30
DUT01	Sampson St, Annerley	Residential (Queenslander)	47	57	42	49	35 - 81	39
DUT01	Tamar St, Annerley	Residential	57	67	52	59	41 - 67	15
DUT01	Tamar St, Annerley	Residential	57	67	52	59	33 - 84	32
DUT02	Cornwall St, Fairfield	Commercial	67	77	-	-	51 - 71	4
DUT02	Princess St, Fairfield	Residential	57	67	52	59	50 - 74	22
DUT02	Princess St, Fairfield	Residential	57	67	52	59	50 - 71	19
DUT02	Princess St, Fairfield	Residential	57	67	52	59	48 - 67	15
DUT02	Princess St, Fairfield	Residential	57	67	52	59	43 - 66	14
DUT02	Fenton St, Fairfield	Residential	57	67	52	59	48 - 73	21
DUT03	Railway Terrace, Dutton Park	Commercial	67	77	-	-	57 - 81	14
DUT03	Pound St, Dutton Park	Residential (Queenslander)	47	57	42	49	44 - 65	23
DUT03	Pound St, Dutton Park	Residential (Queenslander)	47	57	42	49	44 - 72	30
DUT03	Railway Terrace, Dutton Park	Residential (Queenslander)	47	57	42	49	58 - 77	35

NCA	Representative Location	Receiver Type	Construction Noise Goals (CNG's), dB(A)				Predicted Noise Level Range, dB(A)	Potential noise levels above CG's noise goals, dB(A)
			Day (LAeq 15min)	Day (LA10 15min)	OOH (LAeq 15min)	Night (LAmax)	(LAeq 15min)	(LAeq 15min)
DUT03	Dutton St, Dutton Park	Residential (Queenslander)	47	57	42	49	60 - 77	35
DUT03	Dutton St, Dutton Park	Residential (Queenslander)	47	57	42	49	50 - 65	23
DUT04	PA Hospital	Medical	57	67	52	59	62 - 71	29
DUT05	Wilkins St W, Fairfield	Residential (Queenslander)	47	57	42	49	43 - 79	37
DUT05	Wilkins St W, Fairfield	Residential (Queenslander)	47	57	42	49	42 - 80	38
DUT05	Cameron St, Fairfield	Residential	57	67	52	59	37 - 74	22
DUT05	Cottenham St, Fairfield	Residential (Queenslander)	47	57	42	49	40 - 73	31
DUT05	Fenton St, Fairfield	Residential (Queenslander)	47	57	42	49	45 - 73	31
DUT05	Fenton St, Fairfield	Residential (Queenslander)	47	57	42	49	44 - 76	34
DUT06	Ensign Ave, Annerley	Residential (Queenslander)	47	57	42	49	30 - 74	32
DUT06	Ensign Ave, Annerley	Residential (Queenslander)	47	57	42	49	29 - 73	31
DUT06	Ensign Ave, Annerley	Residential	57	67	52	59	28 - 68	16
DUT06	Wilkins St E, Annerley	Residential (Queenslander)	47	57	42	49	36 - 73	31
DUT06	Wilkins St E, Annerley	Residential (Queenslander)	47	57	42	49	35 - 68	26
DUT06	Wilkins St E, Annerley	Residential	57	67	52	59	39 - 64	12

Table 6.4 presents a range of predicted construction noise levels for noise sensitive receivers located close to the three works areas. Note that the potential noise levels shown in Table 6.4 are based on a **'worst case'** scenario whereby all equipment is running simultaneously. The mitigation of these noise levels and sources is further discussed in Section 7 which aims to reduce the modelled noise levels through various noise mitigation and management strategies.

All works must be completed in a discrete timeframe in order to be able to safely hand the corridor back to QR. The limited timing of rail possessions removes flexibility about the timing of particular works, and the ability to confine noisy works to day time hours only.

The noise levels shown in Table 6.4 will not occur for the whole length of the alignment and for the whole time of the possession. The majority of the works within the rail corridor is slowly moving along the alignment and installing the new infrastructure. That is works incrementally moves along the rail corridor. Noise emissions from this type of activity will increase to a maximum and then decrease

gradually as the works moves away from each receiver. The nearest receivers may experience high levels of noise over a short period, shown by the lower and upper range in Table 6.4.

At some receiver locations noise levels may exceed the CNGs and there are no physical mitigation measures that can be applied to achieve the CNGs. The way forward may be determined in consultation with the affected receivers.

The Noise and Vibration Management Plan (NVMP) identifies the management measures that can be applied to deal with residual impacts, including noise monitoring, letter box drops, phone calls, individual briefings, respite offers and consideration of short-term alternative accommodation where necessary. Further mitigation measures as detailed in the NVMP may include changing operational procedures at evening / night in order to reduce noise impacts, e.g. reduce the number of trucks on site during the night period (10pm to 6.30am).

7 Recommended Acoustic Mitigation Measures

The key noise mitigation and management strategies include:

- Airborne noise, including:
  - Existing noise barriers
  - Construction hours of work*
  - Restrictions on plant and equipment
- Ground-borne noise, including:
  - Construction hours of work*
  - Restrictions on plant and equipment
- Vibration, including:
  - Construction hours of work*
  - Restrictions on plant and equipment.

*Works will be 24hrs and this is essential to complete the scope for the rail possession.

7.1 Plant and equipment

The performance requirements for specific items of plant and equipment are specified in **Table 6.1.**

Where possible, piling equipment will only be used through the daytime period (6:30am – 6:30pm) to mitigate noise levels at night time.

7.1.1 Reversing beepers and movement warning alarms

Non-tonal reversing beepers and warning alarms (or an equivalent mechanism) must be fitted to all mobile plant that will be used on site.

7.1.2 Truck airbrake silencers

Air brake silencers are to be correctly installed and fully operational for any heavy vehicles operating in the evening and OOHW.

7.2 Residual impacts

At some receiver locations noise levels may exceed the CNGs after all reasonable and feasible mitigation measures have been incorporated into the project works. Where there are no further physical mitigation measures that can be applied to achieve the CNGs, and if internal noise levels are still above

the noise goals, then alternative mitigation and construction noise management may need to be considered, such as (but not limited to):

- seeking a negotiated agreement with the affected receiver(s),
- advance notification (e.g. letter box drops and telephone calls),
- offering respite,
- alternative accommodation,
- property treatments.

7.3 Noise mitigation and management

7.3.1 Other noise control measures

The following standard noise control measures are recommended to reduce potential noise impacts:

Table 7.1: Site noise control measures

Control type	Control measure	Typical use
At-Source Control Measures	Noise control kits	Plant that is brought to site for regular use should meet the sound power limits identified in Table 5.1. Where plant exceeds limits then the plant may require installation of 'noise control kits' to comply with the noise limits in Table 5.1. Such 'noise control kits' comprise: • high performance 'residential-grade' exhaust mufflers, • additional engine cowling / enclosure lined inside with sound absorbent industrial-grade foam, and • air intake and discharge silencers / louvres. The need to fit 'noise control kits' onto the identified plant, will be confirmed once each plant item is tested prior to its regular use on site.
	Limit equipment in use	Only the equipment necessary during each stage of the works will be used.
	Timing of equipment in use	Where practicable, activities and plant should be limited. For example, if possible, limit the noisiest activities such as piling works to daytime (6.30am to 6.30pm) hours only.
	Limit activity duration	Any equipment not in use for extended periods shall be switched off. For example, heavy vehicles should switch engines off when not in use.
	Use and siting of plant	Avoid/ limit simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver. Direct noise-emitting plant away from sensitive receivers where practicable. Locate fixed location plant items as far from sensitive receivers as practicable.
	Equipment selection	Use quieter and less noise/ vibration emitting construction methods where feasible and reasonable.
	Non-tonal reversing alarms	Alternative reverse alarms, such as 'quackers' will be installed on all plant and equipment, where practicable.

Control type	Control measure	Typical use
Noise Management Measures	Site inductions & Toolbox Talks	All employees, contractors and subcontractors will receive a Project induction. The environmental component may be covered in toolboxes and should include: • location of nearest sensitive receivers • relevant project specific and standard noise and vibration mitigation measures; • permitted hours of work; • OOHW Procedure and Form • construction employee parking areas.
	Community consultation	Inform community of construction activity and potential impacts.
	Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
	Noise monitoring	Noise monitoring should be carried out as detailed in Section 7.3.3.

Prior to the commencement of works, residential receivers near the works areas, will be notified to advise that noise from the works may at times be audible. All potentially impacted receivers will be kept informed of the nature of works to be carried out, expected noise levels and duration, as well as given appropriate enquiries and complaints contact details (see Section 7.3.4).

7.3.2 Noise Control Measures

Table 7.2 below presents noise control methods, practical examples and expected noise reductions according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 7.2:- Relative Effectiveness of Various Form of Noise Control, dB(A)

Noise Control Method	Practical Examples	Typical Noise Reduction Possible in Practice
Reduce quantity of equipment	Use only one piece of heavy equipment at a time	3
Distance	Doubling of distance between source and receiver	6
Screening	Acoustic barriers such as earth mounds, temporary, mobile or permanent noise barriers	5 to 10
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	5 to 10
Engine Silencing	Residential class mufflers	10 to 20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	15 to 25

7.3.3 Attended noise monitoring

Attended noise monitoring should be undertaken to record noise levels resulting from construction works, subject to obtaining the property owner/occupier's consent to access the property (where required).

7.3.4 Complaints handling

All noise complaints received and responded to will be managed in accordance with procedures set out in the Construction Environmental Management Plan.

The Cross River Rail Community Team operate a 24-hour construction complaints line (1800 010 875). Enquiries/ complaints may also be received through the CRR project email (crossriverrail@cbgujv.com.au).

7.3.5 Risk Management

Risk management is an integral part of good management practice. Appendix D of this report describes various risk management aspects for this project.

8 Construction vibration impacts

Table 6.3 in Section 6.3 presented Construction Ground-borne Noise Goals and Construction Ground-borne Vibration Goals (CGBNGs and CGBVGs) for noise sensitive receivers close to the three works areas.

8.1 Minimum working distances for vibration intensive plant

From the plant and equipment listed in Section 5.1 the dominant vibration generating plant and equipment include:

- 8 tonne 360deg tracked excavator
- 8 tonne Hi-rail excavator
- 10 tonne Ride-on roller
- 14 tonne Hi-rail excavator c/w rail trailer
- 20 – 25 tonne 360deg tracked excavator
- Piling rig
- Tamper and Regulator
- Rail stressing requires banging of the rail with steel to steel impact

Potential vibration generated to receivers is dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and the receiver structure.

The recommended minimum working distances for vibration intensive plant are presented in Table 8.1 and Table 8.2. These distances are conservatively based on vibration propagating in hard rock. Site specific buffer distances for vibration intensive plant items must be measured on site where plant and equipment are likely to operate close to or within the minimum working distances for cosmetic damage (Table 8.1).

Unlike noise, vibration cannot be readily predicted. There are many variables from site to site, such as soil type and conditions, sub surface rock, building types and foundations, and actual plant on site.

The data relied upon in this assessment (tabulated below) is taken from a database of vibration levels measured at various sites or obtained from other sources (such as BS5228-2:2009). They are not specific to this project as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Table 8.1: Minimum working distances (m) for cosmetic damage (continuous vibration).

Plant item	Minimum working distance (m)		
	Reinforced or framed structures (e.g. commercial buildings)[1]	Unreinforced or light framed structures (e.g. residential buildings) [1]	Sensitive structures (e.g. heritage structures) [2]
Excavator with rock hammer (20T)	5	5	10
Smooth drum roller (17T) / Vibratory compactor	5	10	20
Bored piling rig (30T)	5	5	10

Note 1: Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385.

Note 2: A site inspection should determine whether a heritage structure is structurally unsound.

Note 3: Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method. .

Table 8.2: Minimum working distances (m) for human annoyance (continuous vibration).

Plant item	Minimum working distances (indicative), m				
	Critical areas[1,4]	Residences		Offices[3,4]	Workshops[4]
		Day[2]	Night[2]		
Excavator with rock hammer (20T)	50	35	40	20	15
Smooth drum roller (17T) / Vibratory compactor	75	40	60	25	15
Bored piling rig (30T)	20	10	10	5	5

Notes 1: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

2: Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

3: Examples include offices, schools, educational institutions and place of worship.

4: Applicable when in use.

8.2 Vibration assessment

8.2.1 Structural damage

Vibration monitoring is recommended at potentially impacted locations to verify that vibration levels comply the structural damage screening criteria, where plant needs to operate within the minimum working distance identified in Table 8.1. If monitoring identifies that vibration is likely to exceed the cosmetic damage screening criteria, a different construction method with lower source vibration levels will be considered. Given the distances in the table 8.1 and the fact none of the equipment will be used at within this distance from receptors the of damage and or vibration impacts is very low.

8.2.2 Human annoyance

It is recommended that attended vibration measurements are carried out in the event of complaints from the nearby receivers to confirm that vibration is within the acceptable range for human annoyance and/or whether respite periods are required.

If measurement results indicate exceedances of the vibration objectives for human annoyance at these locations, vibration control and management measures will be provided to reduce vibration impact (see Section 8.3.1).

8.2.3 Sensitive equipment

The 'Ecosciences' building close to some of the work areas and has vibration sensitive equipment including

- Basement level Microscopy work / Nematology room
- Basement level TEM (transmission Electron Microscope)
- Level 3 Particle size analyser / mass spectrometer

Table 6.3 in Section 6.3 nominates equipment specific vibration criteria are required for highly sensitive equipment (i.e electron microscope, MRI systems or similar), as part of future site-specific detailed investigations

It is likely that the setback distance separation from the nearest vibration intensive operations (eg piling works) to the 'Ecosciences' building reduces vibration to reasonably low levels. Due to the sensitive nature of the equipment, however attended vibration measurements may be required to confirm that vibration levels aim to not exceed any equipment specific vibration criteria.

8.3 Vibration mitigation measures

8.3.1 Vibration control and management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort vibration and structural damage limits.

Table 8.3: Site vibration control measures.

Control type	Control measure	Typical use
Construction Planning	Building condition surveys	Undertake building dilapidation surveys on all buildings located within the buffer zones established for cosmetic damage prior to commencement of activities with the potential to cause property damage (see Section 8.1).
	Community consultation	Implement community consultation measures – inform community of construction activity & potential impacts
	Equipment selection/ construction method	Use less vibration emitting construction methods where feasible & reasonable, for example vibratory rollers can, where practicable, be operated with the vibratory mode switched off to reduce vibration impact.
	Plan work activities to minimise vibration.	Plan traffic flow, parking & loading/unloading areas to maximise distances between truck routes and sensitive receivers.

Control type	Control measure	Typical use
Complaints Management	Construction Complaints Management System	Complaints will be managed in accordance with the Construction Complaints Management System (see Section 8.3.3). Each complaint shall be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences. Management measures may include modification of construction methods such as using smaller equipment and establishment of safe buffer zones as mentioned above.

8.3.2 Vibration monitoring

Attended vibration monitoring should be undertaken to determine and verify site specific minimum working distances for cosmetic damage and human annoyance. Attended vibration monitoring should be undertaken during works at selected residential locations whenever vibration significant plant items are operating close to or within the minimum working distances.

8.3.3 Management of complaints

All vibration complaints received and responded to will be managed in accordance with procedures set out in the Constriction Environmental Management Plan.

The Cross River Rail Community Team operate a 24-hour construction complaints line (1800 010 875). Enquiries/ complaints may also be received through the CRR project email (crossriverrail@cbgujv.com.au).

8.3.4 Risk Management

Risk management is an integral part of good management practice. Appendix D of this report describes various risk management aspects for this project.

9 Conclusion

This document summarises an assessment of the potential noise and vibration impacts associated with Planned Rail Corridor Works (SCAS TSD-15), as an example of these continuous works within a rail corridor. All Planned Works will occur over 24 hours during Scheduled Corridor Access System (SCAS). That is works will occur during Daytime hours (6:30am – 6:30pm), the Evening period (6:30pm – 10:00pm) and Night period (10:00pm – 6:30am).

The report provides a summary of the works, the predicted noise and vibration impacts and a summary of the proposed mitigation and management measures to reduce impacts at the nearest sensitive receivers.

Potentially affected noise and vibration sensitive receivers have been identified and discussed to allow the assessment of potential construction impacts.

Expected construction noise levels have been predicted and presented in Section 6.3. Noise mitigation and management measures have been presented in Section 7.3 to aid in providing additional noise reduction benefits where noise levels are above the CG's noise goals.

Vibration and ground-borne noise (GBV&N) impacts have been presented in Section 8.1 and Section 8.2. Suitable vibration management measures have been presented in Sections 8.3.

Risk management is an integral part of good management practice. Appendix D of this report describes various risk management aspects for this project.

References

[1] Cross River Rail Coordinator General's *Change Report – design refinements and condition changes 2020* dated July 2020

[2] Australian/New Zealand Standard AS/NZS 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors*"

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The time period in which an assessment is made. e.g. Day 7am-10pm & Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Decibel [dB]	The units of sound measurement. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear, defined as 20 micro Pascal 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 110dB Operating a chainsaw or jackhammer 120dB Deafening
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmax.
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmin.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially constant.
Reflection	Sound wave reflected from a solid object obscuring its path.
Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australa. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.

Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.
Spoil	Soil or materials arising from excavation activities.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the Rw or R'w or DnT,w.

APPENDIX B Nearest Sensitive Receivers and Noise Catchment Areas (NCA's)

NCAs

Construction site

Land Use

- Residential (incl. hotels)
- Commercial (incl. retail)
- Educational
- Place of worship
- Medical (Hospital)
- Public (Courts)
- Recreational - Active
- Recreational - Passive

RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Gold Coast Kuwait

CLIENT

CROSSRIVERRAIL | Queensland Government

CROSS RIVER RAIL

SCAS
FAIRFIELD / DUTTON PARK WORKS
(RAIL POSSESSION DECEMBER 2020)

Figure B1

NCAs
Construction site

Land Use
Residential (incl. hotels)
Commercial (incl. retail)
Educational
Place of worship
Medical (Hospital)
Public (Courts)
Recreational - Active
Recreational - Passive

RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Gold Coast Kuwait

CLIENT

CROSSRIVERRAIL | Queensland Government

CROSS RIVER RAIL

SCAS
PARK ROAD TRIANGLE AND RAIL WORKS
(RAIL POSSESSION DECEMBER 2020)

Figure B2

NCAs

Construction site

Land Use

- Residential (incl. hotels)
- Commercial (incl. retail)
- Educational
- Place of worship
- Medical (Hospital)
- Public (Courts)
- Recreational - Active
- Recreational - Passive

RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Gold Coast Kuwait

CLIENT

CROSSRIVERRAIL | Queensland Government

CROSS RIVER RAIL

SCAS
BURANDA CSR WORKS
(RAIL POSSESSION DECEMBER 2020)

Figure B3

APPENDIX C Work Areas

2020												2021												2022												2023												2024												2025											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

CSR and Signalling Works:

> Install Buranda CSR route
> Install Fairfield CSR route
> Install LOC L1-1 foundation, local conduit route & cabinet
> Construct SER / PER / CER building foundations
> NDD for Dutton Park CSR route
> Maintenance Siding - decommissioning works
> Terminate new local cable routes, joint and cut across main run cable and commission B14 LOC
[Note: All works 24hr working during SCAS]

Rail Civil & Drainage:

> Directional Drill Pound St to Kent St: [Note: All works 24hr working during SCAS]

[Note: All works 24hr working during SCAS]

Track:

> Fairfield OTV Pad [Ensign Ave]
> Cleveland Forkline recon [Access via Park Road Triangle] > Support to Middle Road temporary works piled retaining wall

[Note: All works 24hr working during SCAS]

OHLE Works:

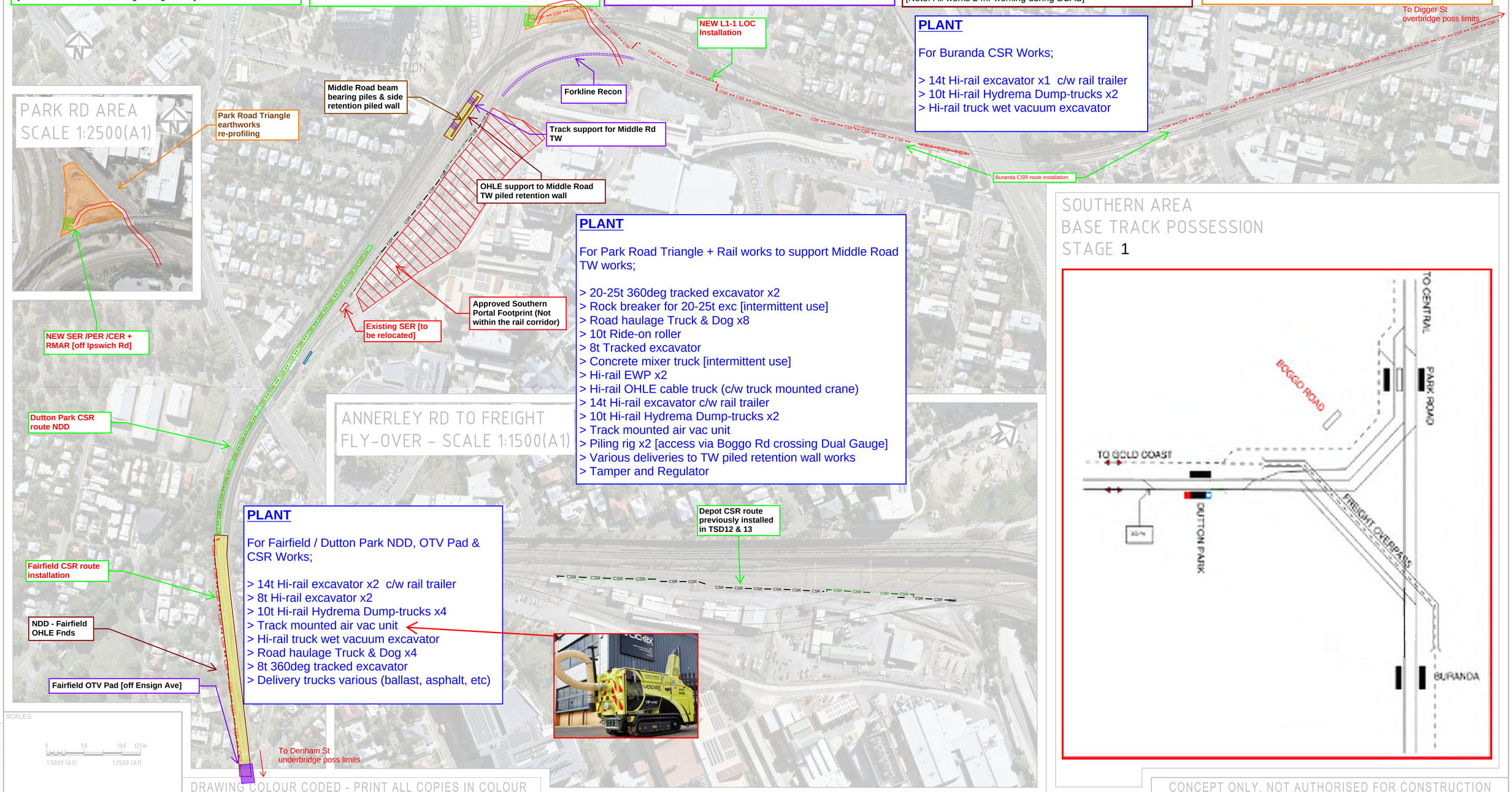
> NDD for Fairfield OHLE Foundations
> OHLE support to Middle Road Temporary Works
> Install temp OHLE mast(s) and alter wire runs to facilitate
> Forkline - Installation of mast foundation
future wire removal / slews for Mid Rd temp piling works

[Note: All works 24hr working during SCAS]

Earthworks / Geotech Investigation / Ground Investigation:

> Earthworks re-profiling & waste disposal within Park Road Triangle
> Geotechnical Investigation of the cut and cover section

[Note: All works 24hr working during SCAS]



PLANT

For Buranda CSR Works;

> 14t Hi-rail excavator x1 c/w rail trailer
> 10t Hi-rail Hydrema Dump-trucks x2
> Hi-rail truck wet vacuum excavator

PLANT

For Park Road Triangle + Rail works to support Middle Road TW works;

> 20-25t 360deg tracked excavator x2
> Rock breaker for 20-25t exc [intermittent use]
> Road haulage Truck & Dog x8
> 10t Ride-on roller
> 8t Tracked excavator
> Concrete mixer truck [intermittent use]
> Hi-rail EWP x2
> Hi-rail OHLE cable truck (c/w truck mounted crane)
> 14t Hi-rail excavator c/w rail trailer
> 10t Hi-rail Hydrema Dump-trucks x2
> Track mounted air vac unit
> Piling rig x2 [access via Boggo Rd crossing Dual Gauge]
> Various deliveries to TW piled retention wall works
> Tamper and Regulator

PLANT

For Fairfield / Dutton Park NDD, OTV Pad & CSR Works;

> 14t Hi-rail excavator x2 c/w rail trailer
> 8t Hi-rail excavator x2
> 10t Hi-rail Hydrema Dump-trucks x4
> Track mounted air vac unit
> Hi-rail truck wet vacuum excavator
> Road haulage Truck & Dog x4
> 8t 360deg tracked excavator
> Delivery trucks various (ballast, asphalt, etc)

SOUTHERN AREA
BASE TRACK POSSESSION
STAGE 1

SCALES
0 50 100 125m
1:5000 (A3) 1:2500 (A1)

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

CONCEPT ONLY. NOT AUTHORISED FOR CONSTRUCTION

JOB No	ALTERATIONS				
366888	ISSUE	DESCRIPTION	NAME	RPEQ	DATE
SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING					

CBGU D&C JV

DESIGNED		
DES CHK		
DRAWN		
DRG CHK		

DESIGN APPROVAL / CERTIFICATION
PROFESSIONAL QUALIFICATION _____ DATE

CROSS RIVER RAIL DELIVERY AUTHORITY

Network - Civil Engineering
RAIL CORRIDOR
CROSS RIVER RAIL
SOUTH PORTAL STAGING PLAN
STAGE 1

DRAWING NUMBER
PIC CERT No.
SCAS TSD-15
[25/12/20 to 30/12/20]
Planned Rail Corridor Works
CONSULTANT DWG No.

ISSUE
00

H356888-700-224-284-5000.dwg
2020/01/29 05:27 AM

APPENDIX D Risk Management

Risk management is an integral part of good management practice. AS/NZS 4360-1999 "Risk Management" has become part of our company's culture and therefore it permeates all aspects of the company's work and is actively promoted to our clients.

The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Our clients need to know about possible outcomes and the steps that can be taken to control any adverse impact.

There is an opportunity in the design process for the client to actively participate in risk management by providing input into risk reduction strategy. For example, the client may need to know that some aspects of risk reduction could involve passing those risks on to other entities in a better position to treat those risks. Some aspects of risk reduction may involve additional cost or time consequences. On the other hand, there may also be opportunities to avoid or avert risk at no cost to the client by rescheduling processes so that key information becomes available at a critical time.

When the client is properly informed, this supports better decision making by contributing a greater insight into risks and their impacts.

For this project, there are inherent risks in the design process and in the outcome where the designer is not in control of all processes. Accordingly, the Risk Assessment Table included here of this report identifies those risks, analyses the consequences, assesses the levels of risk and advises on the action taken or recommended to minimise them.

TABLE D1 - RISK ANALYSIS

No	Item of Risk	Analyse Risk	Level	Treat Risk	Risk Allowance	
					Recommended	Used on this Project
	The design offered in this report assumes several factors which are outside the control of the designer. These include the following:	**The client should be aware that the design tolerance chosen may not be adequate and some remedial measures may be required including, for example, modification to the plant, the provision of additional silencing treatment, construction of noise barriers or limitations in the time of use of equipment.**	**LOW/ MED/ HIGH**	**In order to reduce the risk of noise levels not complying with the design criteria, the following risk-reducing measures have been implemented or are recommended:**		
1.	Engineering Design – Propagation in Environment	Modelling and calculating sound levels contain inaccuracies, for example, design assumptions relating to sound propagation on the site (including reflections from nearby buildings and surfaces).	MED	A tolerance of 3dB(A) is recommended in the final calculated sound level. The client may instruct Renzo Tonin & Associates to adopt a higher or lower design tolerance. Consider relocation of the plant to a location which minimises the risk.	3	0
2.	Engineering Design – Construction Form	Where an estimate or opinion is provided of the sound and/or impact insulation of a form of construction, this may be based on calculation and/or test results of similar constructions. This design process involves inherent inaccuracies.	HIGH	Adopt a design tolerance in the selection of the recommended form of construction to reduce the risk. The client may instruct Renzo Tonin & Associates to adopt a higher or lower design tolerance.		
				Noise Walls and Hoardings	3	0
				Noise Sheds Noise Enclosures — Spectrum correction from theoretical/laboratory to field transmission loss per relevant standards	See 'Treat Risk	See 'Treat Risk
3.	Construction airborne and ground-borne noise predictions	Modelling and calculating sound levels contain inaccuracies, for example assumptions relating to sound propagation on the site (including reflections from nearby buildings and surfaces), variability in the type and size of plant and ground conditions.	MED	A tolerance of 3dB(A) is recommended in the final calculated sound level. The client may instruct Renzo Tonin & Associates to adopt a higher or lower design tolerance. Consider relocation of the plant to a location which minimises the risk.	3	0
4.	Engineering Design – ground-borne vibration levels	Modelling and calculating ground-borne vibration levels contain inaccuracies, for example, design assumptions relating to vibration propagation between the source and receiver, building coupling loss, variation in source vibration levels.	LOW	Adopt a 2x design tolerance in the selection of the recommended form of construction to reduce the risk. The client may instruct Renzo Tonin & Associates to adopt a higher or lower design tolerance.	2x	0

TABLE D1 - RISK ANALYSIS

No	Item of Risk	Analyse Risk	Level	Treat Risk	Risk Allowance	
					Recommended	Used on this Project
5.	Construction of the Works	Construction involves many processes which are beyond the control of Renzo Tonin & Associates. Even when forms of construction have laboratory certification, the final installed product may not achieve the assumed design noise reduction.	HIGH	We recommend acoustic testing prior to construction of any works. We recommend the client allocates sufficient time for pre-testing programs. We recommend the client approves a rigorous inspection regime. We recommend the client allocates a budget for add-on options. We recommend the client allows for changes impacting on other areas, for example, detailing at joins.	See 'Treat Risk'	See 'Treat Risk'
6.	Estimated Variability of Noise Data Due to Measurement Uncertainties and Production Quality Control	Standards report that there is an uncertainty of 3-4dB(A) in the noise data of mechanical plant.	MED	If the client relies on the noise data as being guaranteed by the supplier then the appropriate risk allowance is 0dB(A), which has been assumed for this project. The client may instruct Renzo Tonin & Associates to adopt a higher or lower design tolerance.	3-4	0
7.	Background/ Ambient Noise Levels	Assumptions made in relation to the background/ ambient noise level adopted which cannot practically be determined with absolute certainty from a limited sample only.	LOW	Additional background/ ambient noise level measurements were conducted by others in September to November 2018.	See 'Treat Risk'	See 'Treat Risk'
8.	Inaudibility of Plant Noise (where applicable)	There are no standards which define inaudibility.	N/A	Inaudibility is assumed to mean a source level 5dB lower than the background noise level.	See 'Treat Risk'	Inaudibility is not a project requirement or commitment
9.	No. of Plant Operating Contemporaneously	The assumption that only some plant operate presents a risk of under-design. The assumption that all plant operate presents a potential over-design of acoustic treatment.	LOW	Modelling assumes all plant operate contemporaneously.	See 'Treat Risk'	See 'Treat Risk'

TABLE D1 - RISK ANALYSIS						
					Risk Allowance	
No	Item of Risk	Analyse Risk	Level	Treat Risk	Recommended	Used on this Project
10.	Operating Mode of Plant (Capacity)	The assumption that plant operates at reduced capacity presents a risk of under-design. The assumption that plant operates at 100% capacity presents a potential over-design of acoustic treatment.	LOW	Assume plant operates at 100% capacity.	See 'Treat Risk'	See 'Treat Risk'
11.	Air Intake Design	Where air intake acoustic treatment is required, the use of louvers does not permit additional treatment should this be required. The extent of treatment may be limited by the small plant room space available.	MED	Silencers are used (where applicable) which are capable of being increased in length should this be required. Ensure sufficient space is available to accommodate changes.	See 'Treat Risk'	See 'Treat Risk'
12.	Exhaust Attenuators	If there are space restrictions, it may not be possible to increase the length of exhaust attenuators. If necessary a pod may need to be inserted should additional attenuating be required which will affect the pressure drop of the system and may impact on its performance.	MED	Where exhaust silencers are used, they are circular attenuators without a pod. Ensure sufficient space is available to accommodate changes and/or that plant can tolerate additional pressure drop.	See 'Treat Risk'	See 'Treat Risk'
13.	Acoustic Screens (Noise Barriers)	If there are height restrictions, it may not be possible to increase the height of acoustic screens.	MED	Where acoustic screens are used, ensure sufficient height is available and the acoustic screen design can accommodate changes.	See 'Treat Risk'	See 'Treat Risk'
14.	Site Noise Tests	Plant installed on site does not operate within the assumed design noise levels.	MED	Commission the consultant to undertake site noise tests during installation works and prior to commissioning of plant to confirm the assumptions described in this table and if necessary, advise on remedial noise control measures. Allow for the time implications, cost and installation of the remedial treatment described above. Allow for possible reductions in plant operating during OOHW, e.g. reduce trucks operating at night.	See 'Treat Risk'	See 'Treat Risk'
15.	Condition of Approval restrictions	Following consultation and any reasonable arrangements, restrictive times or requirements may be placed on the project by the Coordinator-General's Report.	MED	Detailed design has aimed to minimise noise impacts on sensitive receivers, subject to CBGU JV direction. Following the consultation process, the design will be reviewed and updated, if required.	See 'Treat Risk'	See 'Treat Risk'

TABLE D1 - RISK ANALYSIS						
					Risk Allowance	
No	Item of Risk	Analyse Risk	Level	Treat Risk	Recommended	Used on this Project

EXPLANATION OF TABLE

The designs offered in this report assume a number of factors which are outside the control of Renzo Tonin & Associates.

The client accepts the risks identified in this document and is encouraged to minimize those risks by the methods described above.

The column marked "Level" identifies the level of risk as HIGH, MED, LOW or N/A. Where the risk is HIGH, the client is advised that if the design does not comply with the selected standards then the client may experience significant additional costs and delays in rectification works. Where the risk is MED, the client is advised that if the design does not comply with the selected standards then the client may experience some additional costs and/or delays in the rectification works. Where the risk is LOW, the client is advised that if the design does not comply with the selected standards then the client may experience delays in the rectification works. Where N/A is indicated, this means the item is not applicable to the project.

APPENDIX E Noise Contour Maps

legend:

- Railway
- Building
- Barrier
- Contour Line
- Receiver
- Building Evaluation
- Calculation Area

Client:
CBGU D&C JV
Level 3, North Tower
339 Coronation Drive
Milton QLD 4064

Consultant:
RENZO TONIN & ASSOCIATES
inspired to achieve

PO Box 820, Spring Hill QLD 4004
P: 07 3367 3131 F: 07 3367 3121

Project:
Cross River Rail Project, Southern Portal

-Request for Project Change #8 (RfPC #8)
-Planned Rail Corridor Works (SCAS TSD-15)

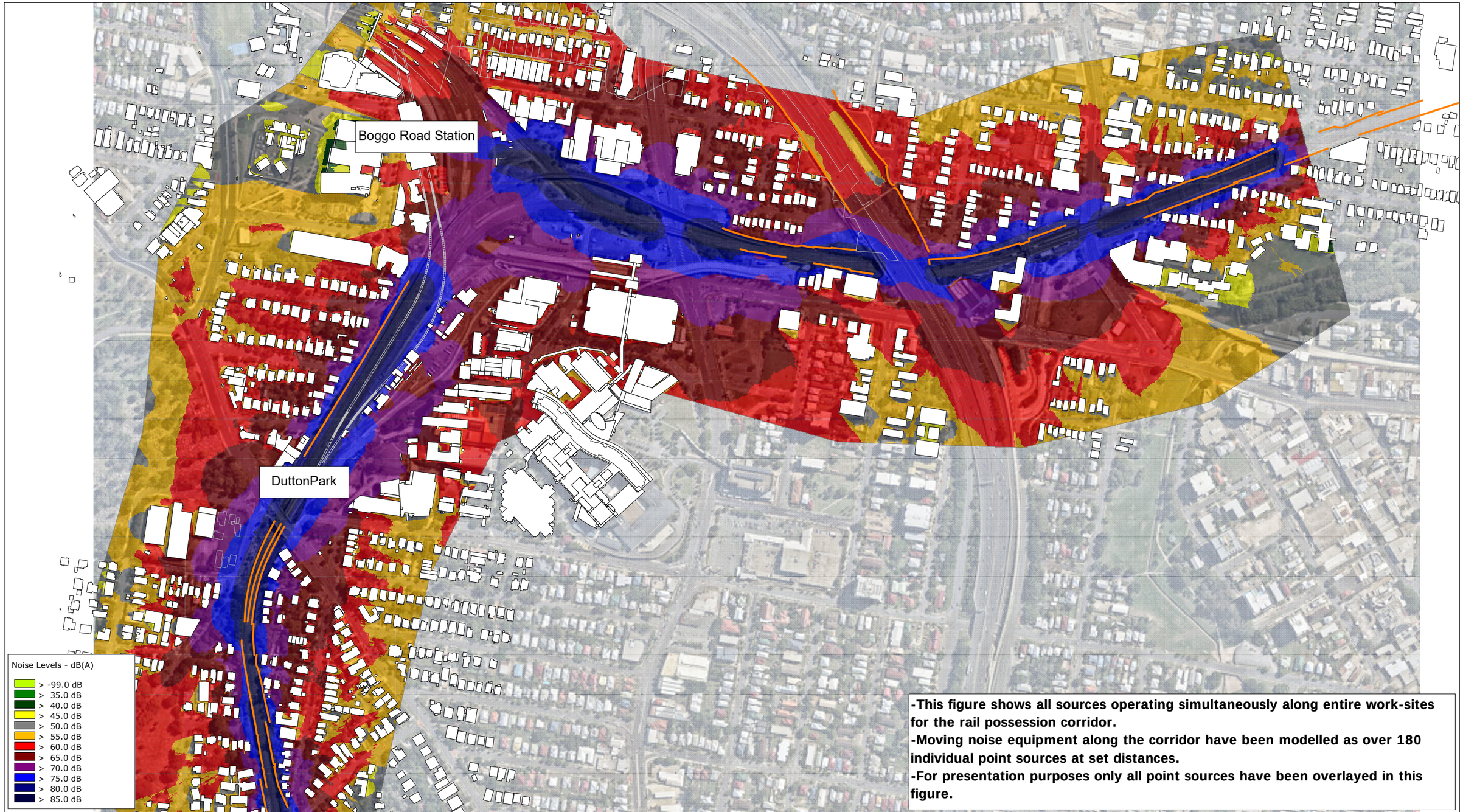
Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Description:
- Fixed Plant

Construction Noise Contours LAeq (15min)
at 4.6m AGL

Project No.: QB400-16	Produced by: DR & PJ
Figure Ref: QB400-16-P03 (r0)	Grid Size: 1m x 1m
Date: 2020.07.28	Scale: 1: 5717 A3



-This figure shows all sources operating simultaneously along entire work-sites for the rail possession corridor.
-Moving noise equipment along the corridor have been modelled as over 180 individual point sources at set distances.
-For presentation purposes only all point sources have been overlayed in this figure.

legend:

- Railway
- Building
- Barrier
- Contour Line
- Receiver
- Building Evaluation
- Calculation Area

Client:
CBGU D&C JV
Level 3, North Tower
339 Coronation Drive
Milton QLD 4064

Consultant:
RENZO TONIN & ASSOCIATES
inspired to achieve

PO Box 820, Spring Hill QLD 4004
P: 07 3367 3131 F: 07 3367 3121

Project:
Cross River Rail Project, Southern Portal

-Request for Project Change #8 (RfPC #8)
-Planned Rail Corridor Works (SCAS TSD-15)

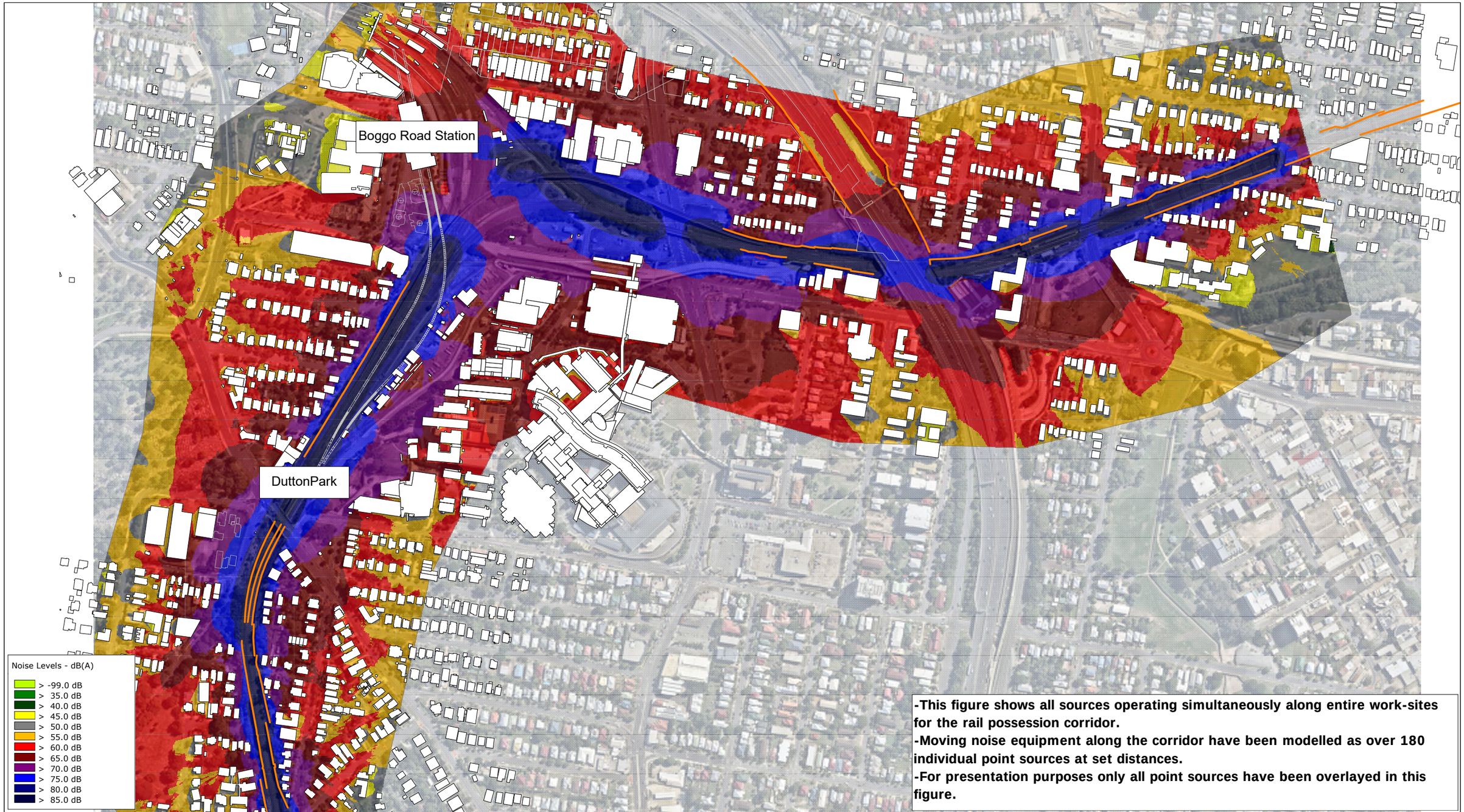
Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Description:
- Moving Plant

Construction Noise Contours LAeq (15min)
at 4.6m AGL

Project No.:	Produced by:
QB400-16	DR & PJ
Figure Ref:	Grid Size:
QB400-16-P04 (r0)	1m x 1m
Date:	Scale:
2020.07.28	1: 5717 A3



-This figure shows all sources operating simultaneously along entire work-sites for the rail possession corridor.
-Moving noise equipment along the corridor have been modelled as over 180 individual point sources at set distances.
-For presentation purposes only all point sources have been overlayed in this figure.

legend:

- Railway
- Building
- Barrier
- Contour Line
- Receiver
- Building Evaluation
- Calculation Area

Client:
CBGU D&C JV
Level 3, North Tower
339 Coronation Drive
Milton QLD 4064

Consultant:
RENZO TONIN & ASSOCIATES
inspired to achieve

PO Box 820, Spring Hill QLD 4004
P: 07 3367 3131 F: 07 3367 3121

Project:
Cross River Rail Project, Southern Portal

-Request for Project Change #8 (RfPC #8)
-Planned Rail Corridor Works (SCAS TSD-15)

Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Description:
- Fixed and Moving Plant

Construction Noise Contours LAeq (15min)
at 4.6m AGL

Project No.: QB400-16	Produced by: DR & PJ
Figure Ref: QB400-16-P05 (r0)	Grid Size: 1m x 1m
Date: 2020.07.28	Scale: 1: 5717 A3