

# Heavy Vehicle Movement Report: Use of Bellevue Street, Tempe

Project Name: WestConnex New M5

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## Document Approval

Rev.	Date	Prepared by	Reviewed by	Recommended by	Approved by	Remarks
00	19/04/17	CDS-JV				
01	9/05/17	CDS-JV				
02	5/06/17	CDS-JV				
03	21/06/17	CDS-JV				
Signature:						

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## Details of Revision Amendments

### Document Control

The Project Director is responsible for ensuring that this Plan is reviewed and approved. The Support Services Director (SSD) is responsible for updating this Plan to reflect changes to the Project, legal and other requirements, as required.

### Amendments

Any revisions or amendments must be approved by the Project Director before being distributed or implemented.

### Revision Details

Revision	Details
00	Prepared for WCX M5 AT/RMS review
01	Minor updates for consistency with EIS and inclusion of correspondence with TMC. Prepared for submission to DP&E
02	Update to address DP&E comments
03	Update to address further DP&E comments

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## 1. Introduction

### 1.1 Project description

WestConnex is one of the NSW Government's key infrastructure projects which aims to ease congestion, create jobs and connect communities. It is the largest integrated transport and urban revitalisation project in Australia.

The 33 kilometre project was a key recommendation of the State Infrastructure Strategy released in October 2012. It brings together a number of important road projects which together form a vital link in Sydney's Orbital Network. They include a widening of the M4 east of Parramatta, a duplication of the M5 East and new sections of motorway to provide a connection between the two key corridors.



The New M5 Project (New M5, the project) is designated as State Significant Infrastructure (SSI 6788) and is the Stage 2 component of the WestConnex scheme. The proponent for the project is Roads and Maritime Services (RMS) and the project company (WCX M5 AT). WCX M5 AT has engaged the CPB Samsung Dragados Joint Venture (CDS-JV) to deliver the design and construction of the project. The project was approved by the Minister for Planning on 20 April 2016, subject to conditions.

The Project will run from the existing M5 East corridor at Beverly Hills via tunnel to St Peters, providing improved access to the airport, south Sydney and Port Botany precincts. The Project will substantially improve the east - west corridor access between the Sydney CBD, Port Botany and Sydney Airport precincts and the South West growth areas.

The project comprises the following key features:

- New twin tunnels which are higher, wider and flatter. These will more than double capacity along, the M5 East corridor and provide motorway access to north of Sydney Airport
- A new interchange at an industrial site at St Peters, which reduces the impact on nearby, residential areas
- Connections from the interchange to key roads in the area, including Campbell Road/Street, Euston Road and across the canal to Bourke Road
- Widening of Campbell Road/Street and Euston Road through existing road widening reservations
- Western tunnel entry and exit points at Kingsgrove..

## 1.2 Purpose and scope of this report

The State Significant Infrastructure (SSI) Ministers Conditions of Approval (CoA) for the SSI 6788, Condition D46 states:

*“Unless otherwise approved by the Secretary, heavy vehicle movements associated with the construction of the SSI are not permitted to use Wirega Avenue and Garema Circuit at Kingsgrove, or any other local road not identified for use in the documents referred to in conditions A2(b) and A2(c), unless approved by the Secretary. When seeking the Secretary’s approval for use of such local roads, justification must be provided as to why use of the local road(s) is the only feasible and reasonable route along with details on how impacts on surrounding sensitive receivers will be managed.”*

CDS-JV has prepared this document to seek approval from the Secretary to use a local road for alternative access to the Arncliffe (C7) Construction Compound to enable construction of the SSI. This document details the following:

- A review of the current approved access routes for the Arncliffe Construction Compound
- A review of current traffic conditions on Bellevue Street and Princes Highway;
- A construction traffic noise assessment for the proposed route, including potential impacts; and
- The mitigation measures that will be employed to manage heavy vehicle movements and traffic noise for sensitive receivers in this area.

## 1.3 Need for the proposed route

During peak construction activity, the C7 compound will require a truck at least every 4 minutes to ensure spoil removal occurs at a sufficient rate to match the tunnelling program. The approved heavy vehicle access route under the EIS, however, only permits a single truck to turn right into the site from the eastbound Marsh Street turn pocket at any time. Due to the required frequency of spoil trucks arriving at the C7 compound, this traffic arrangement results in trucks queuing to turn into the compound and backing up on the Marsh Street lanes, creating impacts on the throughflow traffic (refer to correspondence from TMC in Appendix B). The eastbound approach on Marsh Street is an already congested route particularly during peak hours.

The proposed alternate route described in this report would allow trucks to avoid the eastbound approach on Marsh Street. The alternate route would also allow a staging area for trucks to stand/wait off the public road network and thereby avoid trucks backing up along the route and at the entrance to the C7 compound.



## 2. Arncliffe heavy vehicle access routes

### 2.1 Approved heavy vehicle routes

The approved access routes for the Arncliffe (C7) Construction Compound are described in the Chapter 9 of the WestConnex New M5 Environmental Impact Statement (EIS)<sup>1</sup> and in the approved Construction Traffic and Access Sub-plan and Spoil Management Plan. These routes are shown in Figure 1 below.

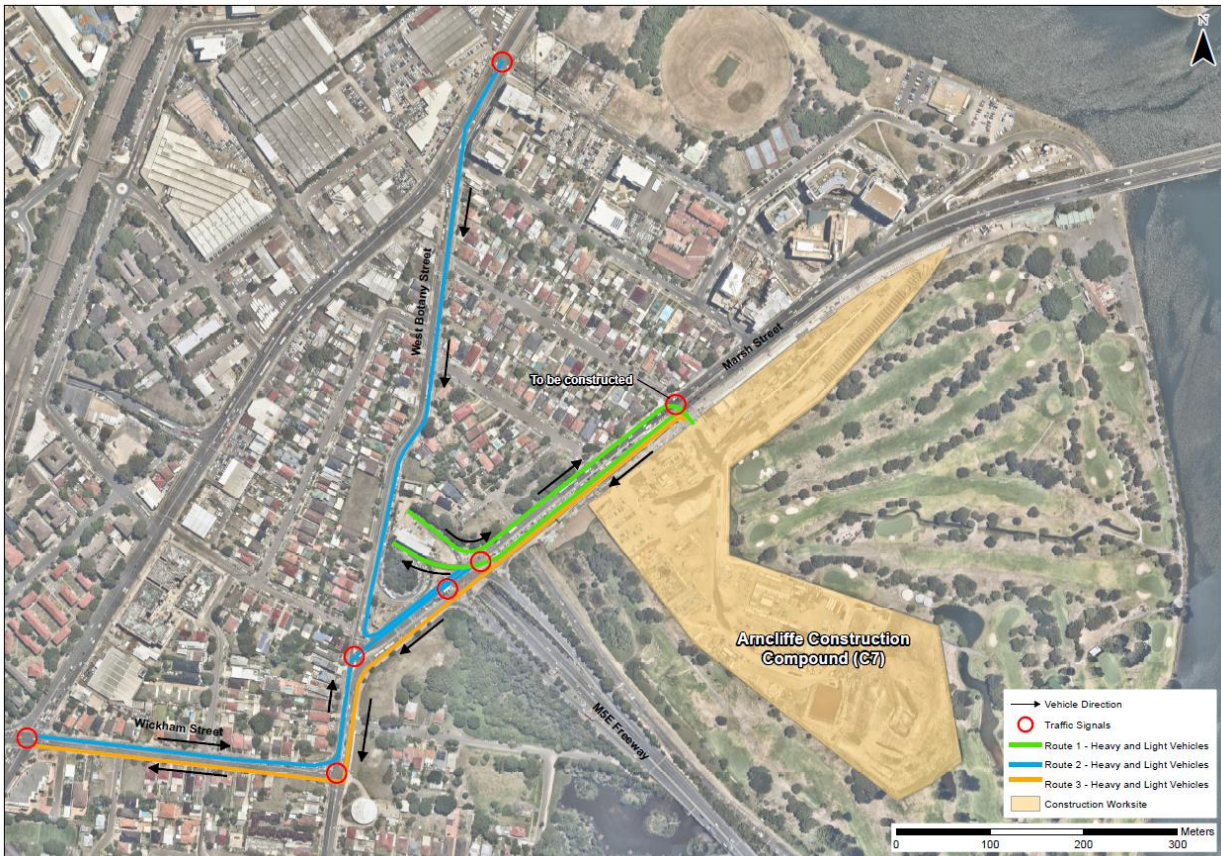


Figure 1: Approved heavy vehicles routes for the Arncliffe construction compound

Construction heavy vehicle traffic volumes predicted for each of the approved access routes for the Arncliffe Construction Compound were provided in Chapter 9 of the EIS. A total of 1195 heavy vehicle movements per day were predicted to occur at the Arncliffe Construction Compound. This total number comprised 726 movements for spoil haulage. Detailed design undertaken since finalisation of the EIS predicts a total of 532 heavy vehicle movements (266 trucks in and out) for spoil haulage at the Arncliffe Construction Compound.

### 2.2 Proposed alternate route

The alternate proposed route via Bellevue Street to access the C7 compound is shown in Figure 2. The alternate route would provide access only and therefore trucks would be moving in one direction only. The proposed route would therefore accommodate up to 266 trucks per day along Bellevue Street from the Princes Highway, through the staging area and then along Airport Drive to the Arncliffe Construction Compound. The staging area would provide for up to 12 trucks to stand by, off the road network, where necessary to avoid truck queuing at the access to the compound.

The only other alternate route available in this location would require spoil trucks to travel south on the M5 East freeway and continue around the airport via General Holmes Drive, Joyce Drive, Qantas Drive,

<sup>1</sup> AECOM Australia Pty Ltd 2015 WestConnex The New M5 Project – Environmental Impact Statement

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Airport Drive and return to Marsh Street. This route is longer than the proposed route, requiring longer travel times and greater distances to be travelled by trucks. Commencement of the Airport East Upgrade has also commenced in this area which will mean greater congestion of roads and even slower travel times. This route was therefore not considered to be a viable option.





Figure 2: Proposed alternate heavy vehicle access route via Bellevue Street, Tempe



## 3. Traffic noise assessment

### 3.1 Identification of sensitive receivers

The project area has been divided into Noise Catchment Areas (NCAs), to represent areas of a similar acoustic environment. The project NCAs have been developed based on those identified in the EIS, with some modifications to allow for site-specific characteristics (refer to Section 3 of Appendix A). The approved Construction Noise and Vibration Management Plan (CNVMP) provides a detailed description of all project NCAs.

Sensitive receivers that may be affected by the proposed use of Bellevue Street are identified in the Construction Traffic Noise Assessment (Appendix A) and are listed in Table 1 below.

Table 1: Nearest noise sensitive receivers

NCA	Receiver type	Nearest receiver address	Nearest access road	Distance to:	
				Centre of road	Staging area
NCA 10	Residential	1 Bellevue Street, Tempe	Bellevue Street	8	305
		2 Bellevue Street, Tempe	Bellevue Street	8	300
		3 Bellevue Street, Tempe	Bellevue Street	8	285
		4 Bellevue Street, Tempe	Bellevue Street	8	280

### 3.2 Existing traffic conditions

Existing traffic conditions for the proposed route were assessed as part of the Construction Traffic Noise Assessment (Appendix A). Traffic count and vehicle classification data was collected by TCS Surveys in order to establish the existing traffic noise environment. The traffic counts were undertaken between 6-15 February 2017 on Bellevue Street and on the Princes Highway, west of Bellevue Street. The traffic count data is presented in Appendix A and a summary is provided in Table 2 below.

Table 2: Existing traffic counts for Bellevue Street and Princes Highway

Construction hours	Road	Traffic direction	Traffic speed, km/h	Existing LV	Existing HV
Day (7am to 10pm)	Bellevue Street	Both ways	34	466	362
	Princes Highway	Both ways	53	39,452	4,277
Night (10pm to 7am)	Bellevue Street	Both ways	34	103	28
	Princes Highway	Both ways	53	8502	1062

### 3.3 Construction traffic noise assessment

A Construction Traffic Noise Assessment was carried out for the proposed use of Bellevue Street by heavy vehicles for the project and is provided in Appendix A. It provides an assessment of the potential increase to traffic noise as well as the potential noise impacts associated with staging of trucks in the area south of Bellevue Street. The Assessment also discusses the potential for sleep disturbance for nearby sensitive receivers. Noise monitoring was carried out during the same period as the traffic counts (6-15 February 2017) to establish existing background noise levels.

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The predicted traffic noise levels were assessed for the daytime and night-time periods, both with and without construction traffic, and are assessed against the relevant criteria of the NSW Road Noise Policy (refer Table 3).

Table 3: Predicted traffic noise levels (with and without construction traffic)

Construction hours	Noise descriptor	Without construction	With construction	dB difference
Day (7am to 10pm)	L <sub>Aeq(15h)</sub>	68	69	<1
Night (10pm to 7am)	L <sub>Aeq(9h)</sub>	64	65	<2

The results indicate that there will be no notable increase in traffic noise (ie. less than a 2dB(A) increase) compared to existing levels during both the day and night periods.

The potential for noise impact associated with staging of trucks in the staging area south of Bellevue Street was assessed against the relevant criteria of the NSW Interim Construction Noise Guideline. Noise from the truck staging area is predicted to comply with the identified Noise Management Levels for the identified sensitive receivers.

Potential for sleep disturbance has been identified when trucks are travelling along Bellevue Street in proximity to the residential receivers on Bellevue Street during the night time period (10pm to 7am). Noise levels are predicted to reach 70-80 dB(A) at a distance of 8-10 metres away, which would potentially exceed the screening sleep disturbance criterion of  $L_{A1(1min)} \leq 65$  dB(A). Measures to mitigate/manage potential sleep disturbance impacts are provided in Section 4 below.



## 4. Traffic Management and Mitigation

### 4.1 Consultation

Consultation has been undertaken with the potentially affected sensitive receivers identified in Section 3.1 above and with Inner West Council for use of the proposed route. A summary of consultation undertaken and feedback received to date is included in Appendix B. Feedback received from TMC regarding traffic congestion issues associated with the right turn lane on Marsh Street is also provided in Appendix B.

Any complaints associated with the use of the proposed route would be managed in accordance with the Community Communication Strategy and the Construction Complaints Management System.

### 4.2 Noise management and mitigation

Specific noise management measures are specified in Section 6 of the Construction Traffic Noise Assessment (Appendix A). Vehicles will be managed in accordance with the Construction Noise and Vibration Management Plan and the Spoil Management Plan.

As a result of the identified potential for sleep disturbance, Bellevue Street is not proposed to be used during the night-time period (10pm to 7am) when sleep disturbance criteria apply. The approved route as described in Section 2.1 will continue to be used during the night-time period when traffic volumes on Marsh Street are lower and use of the eastbound access on Marsh Street is unlikely to lead to traffic congestion.

### 4.3 Road dilapidation reports

A road condition report will be completed for Bellevue Street in accordance with Condition of Approval B59 and submitted to Inner West Council prior to use of this local road by construction traffic. A subsequent road dilapidation report will be prepared at the completion of construction to assess any damage that may have occurred as a result of the project's use of this road.

## 5. Conclusion

Use of the alternate route via Bellevue Street for heavy vehicle access to the C7 compound is considered justified for the following reasons:

- Spoil trucks will be required to access the C7 compound at a minimum rate of one every four minutes to maintain the tunneling program
- The approved access arrangements for the C7 compound allows only one truck to turn right into the compound from the eastbound turning lane, which leads to trucks backing up and disrupting other traffic on Marsh Street
- Marsh Street eastbound is an already congested route particularly during peak hours
- There are no appropriate areas to stage trucks prior to accessing the C7 compound on the approved heavy vehicle routes
- There are minimal identified sensitive receivers on the proposed route and traffic noise impacts are expected to be within the relevant criteria
- The proposed staging area would allow for staging of trucks to avoid queuing of trucks on Marsh Street
- No additional trucks are proposed as a result of the alternate route and total truck movements associated with the C7 compound would remain the same.

It is considered that the use of Bellevue Street as part of the proposed alternate heavy vehicle route, is the most feasible and reasonable option for spoil trucks to access the C7 compound. It is also considered that the use of the proposed route would provide an overall reduction in traffic impacts compared to the current approved access arrangements. With the implementation of the mitigation and management measures provided in Section 4 and Appendix A, no major adverse impacts are anticipated to occur.



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## Appendix A: Construction Traffic Noise Assessment

## WESTCONNEX NEW M5

# Construction Traffic Noise Assessment: Arncliffe Alternative Truck Route, Bellevue Street, Tempe

9 March 2017

CPB Dragados Samsung Joint Venture

TH014-10 03F01 NM5 CNVIS ARN Alt Truck (r2)



## Document details

Detail	Reference
Doc reference:	TH014-10 03F01 NM5 CNVIS ARN Alt Truck (r2)
Prepared for:	CPB Dragados Samsung Joint Venture
Address:	Level 6, Building B, 201 Coward Street, Mascot NSW 2020
Attention:	

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
2.03.2017	Draft	-	0			-
3.03.2017	Final	-	1			
9.03.2017	Minor amendments to final	-	2			

### Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

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# 1 Introduction

This Construction Noise and Vibration Impact Statement (CNVIS) has been prepared on behalf of CPB Contractors Dragados Samsung Joint Venture (CDS JV) to support the use of a local road for the purposes of an alternative heavy vehicle route. The report identifies and assesses noise and vibration impacts associated with the proposed alternative spoil haulage truck route, including a truck staging area, for the Arncliffe (C7) compound.

This CNVIS has been prepared in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [TH014-05 01D01 WCX\_NM5 CNVMP] [1] for the construction of the WestConnex New M5 Project (New M5 or Project).

## 1.1 Relevant requirements and purpose of this report

This report assesses the noise impact associated with the proposed alternative truck route for the Arncliffe compound. The truck route will use a local road not assessed in the Environmental Impact Statement for the Project. Condition of Approval D46 states:

*Unless otherwise approved by the Secretary, heavy vehicle movements associated with the construction of the SSI are not permitted to use Wirega Avenue and Garema Circuit at Kingsgrove, or any other local road not identified for use in the documents referred to in conditions A2(b) and A2(c), unless approved by the Secretary. When seeking the Secretary's approval for use of such local roads, justification must be provided as to why use of the local road(s) is the only feasible and reasonable route along with details on how impacts on surrounding sensitive receivers will be managed.*

This report will be submitted to the Department of Planning and Environment (DPE) to address Conditions D46. The report provides details of the noise impacts, mitigation, monitoring and management procedures for the alternative truck route and staging area.

## 1.2 Structure of this report

This report is structured as follows:

- **Section 2** - Description of work, construction hours and traffic;
- **Section 3** - Nearest sensitive receivers;
- **Section 4** - Construction related road traffic objectives;

**Section 5** -

Construction traffic noise assessment; and

- **Section 6** - Noise Mitigation and Management.

### 1.3 Quality assurance

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 Description of work, construction hours and traffic

### 2.1 Description of work

Following a detailed transport route study, the truck route proposed for the Arncliffe compound was found to be insufficient and likely to cause truck queuing at the signalised intersection on Marsh Street. This would have a flow on effect in terms of traffic congestion along Marsh Street. To alleviate this impact, an alternative truck route was investigated, including the use of a truck staging area to regulate the truck flow to the Arncliffe compound.

The new route would see up to 266 spoil haul trucks per day travelling to the site via the Princes Highway and Bellevue Street at Tempe. CDS JV has obtained access to the Airport land to the south of Bellevue Street and north west of Alexandra Canal to serve as a truck staging area, where trucks will be able to temporarily queue off the road network to allow access to the Arncliffe compound to be staged. Trucks will exit this site via a bridge over Alexandra Canal, turning right onto Airport Drive and then onto Marsh Street, turning left into the Arncliffe compound from Marsh Street.

The alternative spoil truck route is identified on Figure B.1 in APPENDIX B.

On roads immediately adjacent to construction sites, the community may associate heavy vehicle movements with the New M5 Project works. However, once the heavy vehicles move further from construction sites onto major collector or arterial roads, the noise may be perceived as being part of the general road traffic. The use of Bellevue Street by heavy construction vehicles to stage access to the Arncliffe compound has the potential to cause noise impact to noise sensitive receivers located along this route.

The alternative truck route was designed to minimise the need to use local roads. The use of Bellevue Street to access the Airport land site was found to be the alternative that impacted on the least number of residential receivers. It is noted that Bellevue Street is also used by heavy vehicles transporting containers to the Swamp Road container yard at the southern end of Bellevue Street. Heavy vehicles exiting the loading docks of the Ikea store at 634-726 Princes Hwy, Tempe also use Bellevue Street to re-join the Princes Highway.

Up to 266 spoil haulage trucks will utilise the alternative truck route and staging area per day. The site will be accessible 24 hours per day, 7 days per week.

### 2.2 Construction Hours

The construction hours for the Project are defined by the Conditions of Approval D12, D13 and D15. Condition D13 sets the standard construction hours of work, which apply to the western civil and surface works and the site establishment works. Condition D13 allows for tunnelling, including associated tunnelling activities such as tunnel support, to be undertaken 24 hours per day, seven days per week (as indicated in Table 2.1), where in accordance with Condition D15. D15 conditionally allows for works to be completed outside the standard construction hours.

The out-of-hours work (OOHW) period is also defined in Table 2.1 as OOHW Period 1, OOHW Period 2 and OOHW Period Shoulder.

**Table 2.1 Construction Hours**

Reference	Construction Activity	Monday to Friday	Saturday	Sunday/ Public holiday
D12	Standard Construction	7 am to 6 pm	8 am to 1 pm	No work
D13	Tunnelling (and tunnel support)	24 hours	24 hours	24 hours
D15 and CNS*	Out of Hours Work (OOHW) Period 1	6 pm to 10 pm	7 am to 8 am 1 pm to 10 pm	8 am to 6 pm
	Out of Hours Work (OOHW) Period 2	10 pm to 7 am	10 pm to 7 am	6 pm to 8 am
	Out of Hours Work (OOHW) Shoulder	5am to 7am	5am to 7am	

Notes: ^ In continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block in accordance with Condition D16 (see CNVMP Section 3.2.3)

\* Transport for NSW Construction Noise Strategy (ref: 7TP-ST-157/2.0) April 2012

Spoil haul trucks will require access to the Arncliffe compound 24 hours per day, seven days per week to support 24-hour tunnelling works.

## 2.3 Construction Traffic

The construction traffic estimated to use the alternative truck route is summarised in the table below.

**Table 2.2: Estimated construction traffic (one-way) accessing truck staging area**

Assessment Period	Construction vehicles per hour		Total per assessment period	
	LV	HV	LV	HV
Day (7am to 6pm)	+	13.7	-	151
Evening (6pm to 10pm)	-	3.8	-	15
Night (10m to 5am)	-	15.1	-	106
Shoulder (5am to 7am)	-	15	-	30

### 3 Nearest sensitive receivers

To assess and manage construction noise, the residential areas surrounding the Project have been divided into Noise Catchment Areas (NCAs) based on each area's similar acoustic environment prior to the commencement of construction works. The NCAs are based on those established in the EIS for the New M5 project, with some modifications to allow for site specific characteristics. The NCAs have been identified in the CNVMP. In relation to the alternative truck route and staging area for the Arncliffe compound (C7), the potentially affected NCA is NCA10.

An indicative list of the nearest and potentially worst affected noise sensitive receivers, the nearest access road and the distance to the centre of the access road are summarised in Table 3.1 below. Also noted is the distance to the truck staging area.

**Table 3.1 Nearest noise sensitive receivers**

NCA	Receiver type	Nearest Receiver Address	Nearest access road	Distance to:	
				centre of road	staging area
NCA10	Residential	1 Bellevue Street, Tempe	Bellevue Street	8m	305m
	Residential	2 Bellevue Street, Tempe	Bellevue Street	8m	300m
	Residential	3 Bellevue Street, Tempe	Bellevue Street	8m	285m
	Residential	4 Bellevue Street, Tempe	Bellevue Street	8m	280m

All relevant residential sensitive receivers near the worksite are identified on aerial photographs located on Figure B.1 in APPENDIX B.



## 4 Construction related road traffic objectives

### 4.1 Relevant Conditions of Approval

Condition D26 and D27 relate to construction traffic noise. Condition D26 requires that,

*The Proponent is to ensure that construction vehicle contractors operate so as to minimise any sleep disturbance impacts. Measures that could be used include toolbox talks, contracts that include provisions to deal with unsatisfactory noise performance for the vehicle and/or the operator, and specifying non-tonal movement alarms in place of reversing beepers or alternatives such as reversing cameras and proximity alarms, or a combination of these, where tonal alarms are not mandated by legislation.*

Condition D27 requires that,

*Use of compression brakes must not be permitted for construction vehicles associated with the SSI during construction, unless in an emergency situation.*

### 4.2 Road traffic noise objectives

The Conditions of Approval (more specifically Conditions D26 and D27) do not reference the NSW Road Noise Policy (RNP, [4]). Condition D16 references the NSW Interim Construction Noise Guideline (ICNG, [3]) in relation to construction noise management levels. Noise from construction traffic on public roads is not assessed under this guideline, although the guideline does reference the Environmental Criteria for Road Traffic Noise (EPA 1999), which has been superseded by the RNP.

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. For existing residences and other sensitive land uses affected by *additional traffic on existing roads generated by land use developments* (in this case the construction area), any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'without construction' scenario.

Bellevue Street provides direct access from industrial premises, including the Swamp Road container yard and the Ikea store, to the Princes Highway which is a major arterial road. Residential properties on Bellevue Street are directly exposed to the Princes Highway. The noise environment at these properties is dominated by noise from the Princes Highway. Bellevue Street has therefore been assessed as a sub-arterial road. Road traffic noise on sub-arterial roads are assessed over a 15-hour 'day' period between 7am and 10pm during the day, and a 9-hour 'night' period between 10pm and 7am.

The relative increase criteria described in Table 6 of the RNP is applicable to Freeway/ arterial/ sub-arterial roads and transitways. The relative increase criterion is primarily intended to protect existing quiet areas from excessive changes in amenity due to noise from a permanent road project (not temporary construction works). It allows up to 12 dB(A) increase above the existing traffic noise level. The criterion used to assess construction traffic noise impact on Bellevue Street allows up to 2

dB(A) increase above the existing traffic noise level. This is more stringent than the relative increase criteria.

### 4.3 Truck staging area noise management levels

Construction noise management levels have been determined using the NSW Interim Construction Noise Guideline (ICNG) [3].

Table B1 in APPENDIX B identifies the adopted construction noise management levels (NMLs) for the nearest noise sensitive receivers to the staging area. The NMLs for residential receivers are based on long-term noise logging conducted by AECOM on behalf of Sydney Motorway Corporation (SMC) to quantify ambient noise levels for the Environmental Impact Statement (EIS) [2].

The NMLs for 'other' sensitive receivers are from the ICNG, as reported in the CNVMP.

Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified in APPENDIX B. The noise affected level represents the point above which there may be some community reaction to noise. Where predicted and/or measured construction noise levels exceed NMLs, all feasible and reasonable work practices will be applied to meet the NMLs. During standard construction hours a highly affected noise objective of  $L_{Aeq(15min)} 75dB(A)$  applies at all receivers.

In addition to the objectives identified in APPENDIX B, where construction activities are tonal or impulsive in nature and are described in the ICNG as being particularly annoying, a +5dB(A) correction must be added to the activity noise, in accordance with the Condition of Approval D14. Activities that are defined in the ICNG as particularly annoying include, but are not limited to the use of 'beeper' style reversing or movement alarms; power saws; vibratory rolling; jack hammering, rock hammering or rock breaking; impact piling.

Any construction related activities that could exceed the NMLs shall be identified and managed in accordance with the CNVMP.

### 4.4 Sleep disturbance

Sleep disturbance only applies to residential receivers. There are four residential receivers in NCA10 that may be affected by spoil trucks using the alternative traffic route and truck staging area.

The ICNG recommends that where construction works are planned to extend over two or more consecutive nights, the Project should consider maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL. The ICNG also takes guidance from the RNP) for recommended night time noise goals to minimise potential impacts and preserve acoustic amenity within receivers:

- $L_{Amax}$  (the maximum A-weighted noise level) internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep (corresponding to approximately 60-65 dB(A) external); and,
- one or two noise events per night, with maximum internal noise levels of 65–70 dB(A) (corresponding to approximately 75-80 dB(A) external), are not likely to affect health and wellbeing significantly.

According to the RNP, triggers for, and effects of sleep disturbance from, exposure to intermittent noise such as noise from road traffic are still being studied, and there appears to be insufficient evidence to set new indicators for potential sleep disturbance due to road traffic noise. The RNP refers to Practice Note 3 of the 'Environmental Noise Management Manual' (ENMM) prepared by the NSW Roads and Maritime Services ('RMS' previously the Roads and Traffic Authority of NSW) which outlines the following protocol for assessing and reporting on existing maximum noise levels and to assist in assessing the potential for sleep disturbance of a road project:

- determine the number of  $L_{Amax}$  noise levels greater than 65dB(A) where  $L_{Amax} - L_{Aeq}$  exceeds 15dB;
- the number should be determined on an hourly basis between 10:00pm and 7:00am;
- evaluate whether the number of maximum noise impacts will reduce or increase as a result of the road project; and,
- on the basis of this evaluation, take account of maximum noise levels when prioritising, selecting and designing noise control measures.

Whilst this protocol applies specifically to road projects, it appropriate to use in the assessment of noise from additional traffic on existing roads associated with the new truck route.

The NSW EPA's sleep disturbance screening level for industrial noise based on the  $L_{AF1,(1 \text{ minute})}$  level (equivalent to the  $L_{Amax}$ ) of a noise event which should not exceed the ambient  $L_{A90}$  noise level by more than 15 dB is not applied to traffic noise. It can however be applied to noise from the staging area.

On this basis, the sleep disturbance criteria for the project are presented in Table 4.1.

**Table 4.1: Sleep disturbance criteria, 10pm – 7am,  $L_{A1,1min}$  (or  $L_{Amax}$ ), dB(A)**

NCA	EPA's sleep disturbance screening level for the truck staging area	ENMM screening level for trucks on Bellevue Street	
		Base Level	$L_{Aeq(1hr)} + 15$
NCA10	$L_{A1(1min)} \leq 45 + 15 = 60 \text{ dB(A)}$	$L_{A1(1min)} \leq 65 \text{ dB(A)}$	$L_{A1(1min)} \leq 66 + 15 = 81$

The sleep disturbance criteria for NCA10 presented above have been determined based on the noise monitoring data presented in the APPENDIX C, which was collected for the preparation of this assessment, as outlined in Section 5.1.1.



## 5 Construction traffic noise assessment

### 5.1 Existing noise environment and traffic data

To predict road traffic noise levels on the existing road network and validate the noise model, automatic traffic count and vehicle classification data for each road affected residences Bellevue Street was obtained by TCS Surveys on behalf of CDS JV. The traffic counts were carried out concurrently with traffic noise monitoring to enable the traffic noise prediction model to be calibrated.

#### 5.1.1 Noise monitoring data

Noise monitoring was carried out at 1 Bellevue Street, Tempe, between Friday 3 February and Wednesday 15 February 2017. The equipment used for noise measurements was an RTA Technology RTA07 noise logger which is based on an NTi Audio Type XL2 precision sound level analyser which is a class 1 instrument having accuracy suitable for field and laboratory use. The instrument was calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carries current NATA certification.

The noise monitoring was set up in the front yard of the property in a 'free field' location, as the front facade was covered by a balcony. The noise monitoring location is identified on the aerial photograph located on Figure B.1 in APPENDIX B. The results of the noise monitoring are presented in APPENDIX C

#### 5.1.2 Traffic count data

The traffic count data was measured between 6 and 15 February 2017 at the following locations:

- 40-002-NB-SB Bellevue Street, south of Princes Highway; and
- 40-001-EB-1-2-3 Princes Highway, west of Bellevue Street.

The traffic count locations are identified on the aerial photograph located on Figure B.1 in APPENDIX B.

A summary of the traffic count data is presented in APPENDIX D. The traffic data was processed to determine the 15-hour and 9-hour traffic volumes. The existing traffic data used for the assessment is presented in Table 5.1. This was compared with the projected construction traffic volumes for each ICNG assessment period, as outlined in Section 2.3.

**Table 5.1 Traffic count and noise modelling data**

Construction hours	Road	Traffic direction	Traffic speed, km/h	Existing traffic		Construction traffic	
				LV	HV	LV	HV
Day (7am to 10pm)	Bellevue Street	Both ways	34	466	362	-	166
	Princes Highway	Both ways	53	39,452	4,277	-	166
Night (10pm to 7am)	Bellevue Street	Both ways	34	103	28	-	136
	Princes Highway	Both ways	53	8,502	1,062	-	136

Notes: LV: refers to light vehicles or 'Class 1 and 2' vehicles [7], including cars, utes, 4-wheel drives

HV: refers to heavy vehicles or 'Class 3 to 12' vehicles [7], including delivery trucks, concrete trucks and spoil haul trucks

## 5.2 Predicted Construction Traffic Noise

Noise predictions 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 and as a result it is recognised and accepted by the Environment Protection Authority. The model predicts noise levels for steady flowing traffic and a modified method has been developed which enables an accurate prediction of noise from high truck exhausts to be taken into account.

The source noise levels used in this project to model traffic noise levels are contained within the calculation algorithms of the CoRTN88 noise model. Furthermore, the model was verified and calibrated using the long-term noise monitoring results obtained for this project.

The method uses the average 1-hour traffic volume for the 'assessment period' (i.e. day or night) to predict the  $L_{10,1\text{hour}}$  noise level. A correction of -3dB(A) is applied to obtain the  $L_{\text{eq},1\text{hour}}$  noise level which equates to the  $L_{\text{Aeq}}$  noise level for the 'assessment period'. So, the noise levels for the time-period 7.00am to 10.00pm are determined from the hourly data to derive the daily  $L_{\text{eq}(15\text{hour})}$  noise level. Similarly, the noise levels for the time-period 10.00pm to 7.00am are determined from the hourly data to derive the night time  $L_{\text{eq}(9\text{hour})}$  noise level.

The road traffic noise model has taken into account:

- traffic volume and heavy vehicle forecasts;
- vehicle speed (assumed vehicle speed of 50 km/h based on posted speed limit);
- location of the noise sources on the two carriageways;
- ground reference levels of the road and receivers;
- separation distances of the road to receivers; and
- ground type between the road and receivers.

For assessment purposes, residential receivers are assumed to be a typical worst-case distance of 7m from nearside carriageway of the road traffic lane. The table below summarises the predicted construction traffic noise levels for the ICNG assessment periods.

**Table 5.2 Predicted Traffic Noise Levels (with/ without alternative truck route)**

Construction hours	Noise Descriptor	Predicted Noise Level, dB(A)		
		No construction	With construction	dB difference
Day (7am to 6pm)	L <sub>Aeq(15h)</sub>	68	69	<1
Night (10pm to 6am)	L <sub>Aeq(9h)</sub>	64	65	<2

Notes **Bold** text indicates more than 2 dB(A) increase in traffic noise levels resulting from construction traffic.

The predicted road traffic noise levels indicate there will be no notable increase in traffic noise [ $< 2\text{dB(A)}$  increase] compared to the existing traffic noise levels during the 15-hour day period and the 9-hour night period.

### 5.3 Predicted truck staging area noise

Modelling and assessment of airborne noise impacts from activities associated with the truck staging area were determined by modelling the noise sources, receiver locations, topographical features, and possible noise mitigation measures using a Cadna-A computer noise model developed for this project. The model calculates 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 consider:

- Location of noise sources and sensitive receiver locations.
- Height of sources and receivers referenced to one metre digital ground contours for the site area and surrounding area.
- Sound Power Levels ( $L_w$ ) of truck movements.
- Separation distances between sources and receivers.
- Ground type between sources and receivers.
- Attenuation from barriers (natural and purpose built).

Key details regarding the staging area layout, the likely truck movements and hours of operation were informed by the Design and Construction Teams. This information is presented in Section 2 and formed the basis for all modelling assumptions used in this assessment.

Table 5.3 summarises the predicted impacts for the truck staging area in terms of compliance with the NMLs. The colours in the table indicate whether receivers in the NCA comply with the NML and, where exceedance of the NML occurs, the perceived impact of the exceedance.



The impacts presented are as follow for:

**Standard Hours:**

- ◆ Complies with NML
- ◆ < 10dB(A) above NML - construction noise clearly audible
- ◆ > 10dB(A) above NML - construction noise clearly moderately intrusive
- ◆ > 75dB(A) - highly noise affected

**Outside Standard Hours:**

- ◆ Complies with NML
- ◆ < 5dB(A) above NML - construction noise noticeable
- ◆ 5 to 15dB(A) above NML - construction noise clearly audible
- ◆ > 15 to 25dB(A) above NML - construction noise moderately intrusive
- ◆ >25dB(A) above NML - construction noise highly intrusive

**Table 5.3: Summary of construction noise impacts**

NCA	Level of compliance with NML		
	Day	Evening	Night
NCA10 – Bellevue Street	◆	◆	◆

Noise from the truck staging area is predicted to comply with the NMLs.

**5.4 Predicted sleep disturbance impact**

Sleep disturbance may occur as a result of trucks travelling along Bellevue Street towards the truck staging area. The traffic count data indicates that trucks travel along Bellevue Street at an average speed of 30-35 km/h. Trucks using the alternative truck route and hold area will be travelling on a gentle downhill slope towards the staging area. Trucks are unlikely to require braking and the truck engine will not be under strain. The trucks will however be empty and there is a risk of 'clanging and banging' from the empty trailer as it travels down Bellevue Street. It is noted however that the front facade of the residences in Bellevue Street may or may not contain bedrooms.

Predicted  $L_{A1(1min)}$  noise level for trucks within the staging area is less than 60 dB(A), when the truck is at the nearest point of the staging area to the residences in Bellevue Street. This is below the EPA’s sleep disturbance screening level for the truck staging area.

The  $L_{A1(1min)}$  noise level for a truck travelling at 30-40km/hour, the typical speed construction trucks will travel on Bellevue Street, was calculated to be approximately 70-80 dB(A) at a distance of 8-10m. This will potentially exceed the base screening sleep disturbance criterion for the night period [ $L_{A1(1min)} \leq 65$  dB(A)]. The ambient  $L_{Aeq}$  noise level during the night period at receivers in Bellevue Street is 66 dB(A)

based on noise monitoring data presented in APPENDIX C. The calculated  $L_{A1(1min)}$  noise levels are within 15 dB(A) of the ambient noise levels.

Trucks accessing the truck staging area will be instructed to drive responsibly and not use exhaust brakes when driving in residential areas.

Noise mitigation measures for managing potential sleep disturbance are outlined in Section 6.

## 6 Noise Mitigation and Management

### 6.1 Heavy Vehicle Code of Conduct

To satisfy condition D26 and D27, CDS has developed a Heavy Vehicle Code of Conduct for the Project (see Construction Traffic Management Plan (M5N-TM-PLN-PWD-0001)). The Code includes measures to ensure that the noise impacts of heavy vehicle traffic on surrounding streets are minimised. It will also instruct drivers to manage driving to minimise noise when entering and leaving the sites and driving through site, including when entering and leaving the spoil shed. The Code states that compression brakes will not be permitted to be used whilst vehicles are associated with the construction site, unless in an emergency.

In addition, drivers associated with the Arncliffe compound (C7) will be instructed to drive down Bellevue Street within the speed limit at all times, consistent with the requirements of the Code. This will ensure that noise impacts of heavy vehicle traffic on surrounding streets are minimised.

### 6.2 Community consultation

Prior to the commencement of OOHV construction vehicle movement on Bellevue Street, residential receivers identified in Table 3.1 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, the expected noise levels and duration, as well as be given appropriate enquiries and complaints contact details (see Section 6.4).

### 6.3 Attended noise monitoring

Attended noise monitoring is to be undertaken to verify that noise levels resulting from construction works are in accordance with the levels predicted in this report, subject to obtaining the property owner/occupier's consent to access the property (where required).

Attended noise monitoring will be undertaken during works at one (1) of the representative residential receivers identified in the table below in the NCA most impacted by the works (i.e. a minimum of 1 location for each NCA).

**Table 6.1 Nominated verification monitoring locations**

NCA	Nominated Receiver Address	Monitoring Location
NCA10	1-4 Bellevue Street, Tempe	1 m from the western facade of the residence, facing Bellevue Street

Note that to limit any inconvenience to property owners the above measurement locations have been selected on the basis that the resident will not have to be disturbed during the measurement period. If permission to access to the above listed properties is unable to be obtained, then the measurements should be conducted on the property boundary, on the footpath or road reserve and then corrected for distance back to the facade.

Noise monitoring should follow the procedures outlined in APPENDIX F of the draft CNVMP.

## 6.4 Complaints handling

Noise complaints received and responded to will be managed in accordance with the Construction Complaints Management System.

Sydney Motorway Corporation (SMC) formally WDA operate a 24-hour construction complaints line (1300 660 248). Enquiries/ complaints may also be received through the Project email ([info@westconnex.com.au](mailto:info@westconnex.com.au)).



## 7 Conclusion

In conclusion, proposed alternative truck route and truck staging area for the Arncliffe compound (C7) has been assessed specifically to address Condition D46 of the Conditions of Approval in relation to noise impact. The potentially affected noise sensitive receivers and relevant noise objectives have been identified and discussed to allow the assessment of potential noise impacts. Construction traffic noise is predicted to.

Noise from the use of the truck staging area has also been predicted and presented in Section 5. Noise levels will comply with the construction noise management levels. The noise impact from the proposed alternative truck route has been predicted and assessed to generally comply with the NSW Road Noise Policy.

Noise mitigation and management measures have been presented in Section 6 to aid in providing additional noise reduction benefits where exceedance of the noise objectives may occur and to limit the potential for impacts during the critical night period.

## References

1. WestConnex New M5 Construction Noise and Vibration Management Plan (TH014-05 01F01 WCX\_NM5 CNVMP)
2. AECOM Australia Pty Ltd 2015 WestConnex The New M5 project - Technical Working Paper: Noise and Vibration Revision 8 – 20-Nov-2015
3. Department of Environment and Climate Change 2009 NSW Interim Construction Noise Guideline (ICNG),
4. NSW Department of Environment, Climate Change and Water 2011 Road Noise Policy (RNP)
5. Environment Protection Authority 1999 NSW Environmental Criteria for Rd Traffic Noise (ECRTN)
6. NSW Environment Protection Authority 2010 Industrial Noise Policy (INP)
7. AustRoads 2006 Automatic Vehicle Classification by Vehicle Length (publication no: AP-T60/06)
8. Transport for NSW Construction Noise Strategy (ref: 7TP-ST-157/.0) April 2012

## APPENDIX A Glossary of terminology

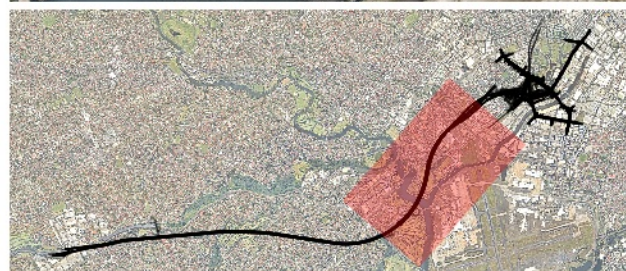
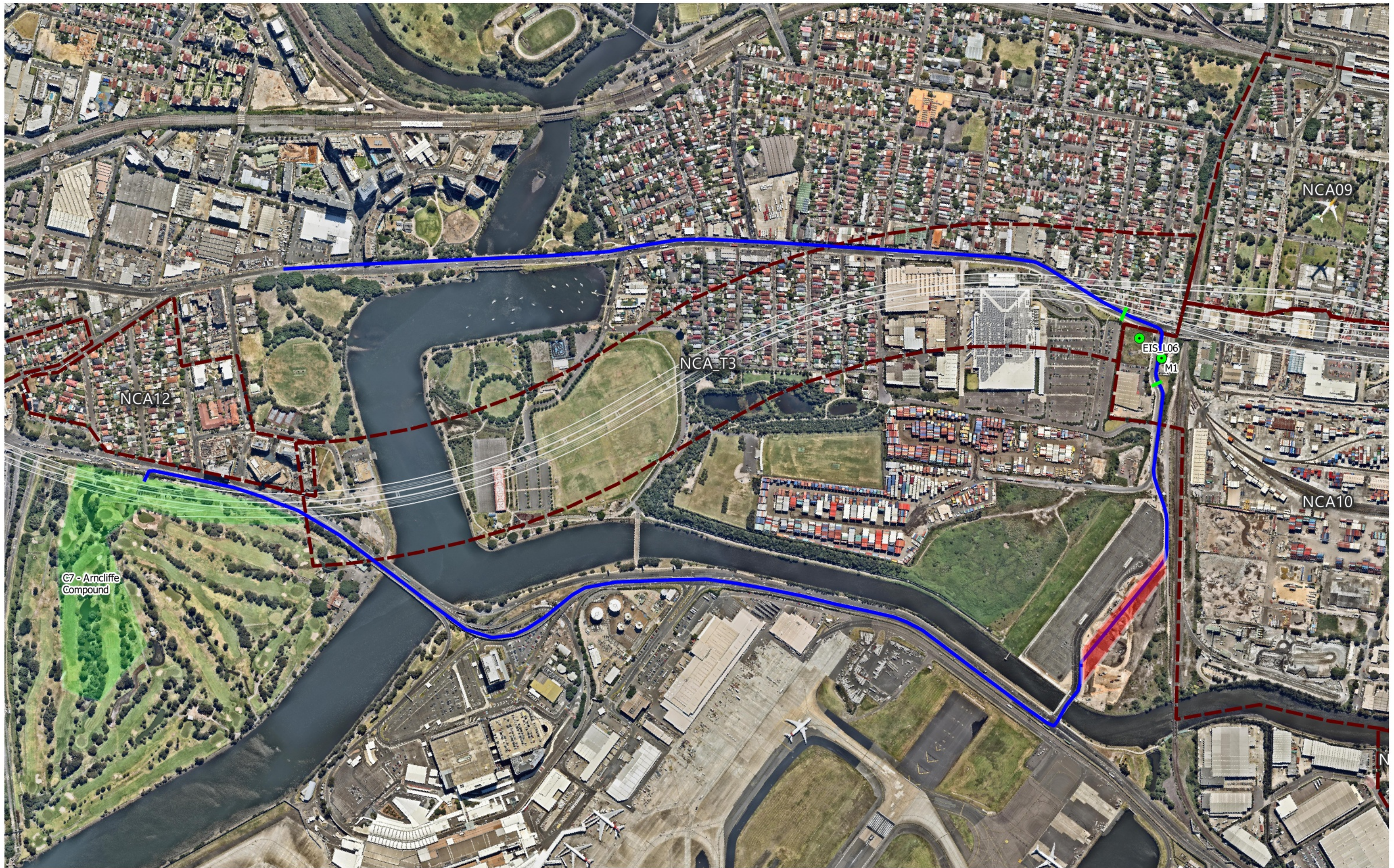
The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

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 every day sounds: 0dB The faintest sound we can hear 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 115dB Limit of sound permitted in industry 120dB Deafening
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 <sub>Max</sub>	The maximum sound pressure level measured over a given period.
L <sub>Min</sub>	The minimum sound pressure level measured over a given period.

L <sub>1</sub>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L <sub>10</sub>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L <sub>90</sub>	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 <sub>eq</sub>	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**      **Nearest sensitive receivers, alternative truck route and noise management levels**





- Legend**
- Noise monitoring locations
  - Traffic count locations
  - Alternate truck route
  - Noise Catchment Areas (NCAs)
  - Construction compound
  - Truck Staging Area

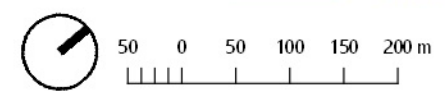
Client  
**WestConnex** New M5

Project  
 WestConnex Stage 2 M5

Description:  
 Arnccliffe alternative truck route  
 Bellevue Street, Tempe



Noise Levels are approximate due to interpolation of contours and should be used for reference only. For information only and not for construction. This information is protected by copyright.



1/418A Elizabeth Street, SURRY HILLS NSW 2010  
 P: 02 8218 0500 F: 02 8218 0501

Created by: THW  
 Figure No: TH014-10 6 001 (r0)  
 Date: 03.03.2017  
 Scale: 1:7,000 @ A3



Table B.2: Noise management Levels

NCA	Receiver Type	Reference RBL	Rating Background Levels (RBLs)			Residential Noise Management Levels (NMLs) $L_{Aeq}(15 \text{ min})$				Sleep Dist. $L_{Amax}$		Comments
			Day	Evening	Night	Day (S)	Day (O)	Evening	Night	Screening	Max	
NCA10	Residential	EISL06	58	56	49	68	63	61	54	64	65	Based on NCAs and NMLs presented in the EIS.
Bellevue Street	Residential	Monitoring 02.2017	55	53	45	65	60	58	50	60	65	Based on measurements 03.02.2017 to 15.02.2017
ID	Other Sensitive Receivers											
OSR	Commercial Receivers/ Offices	ICNG	-	-	-	70	70	70	70	-	-	When premise is in use. External.
OSR	Industrial Receivers	ICNG	-	-	-	75	75	75	75	-	-	When premise is in use. External.

## APPENDIX C    Noise monitoring data

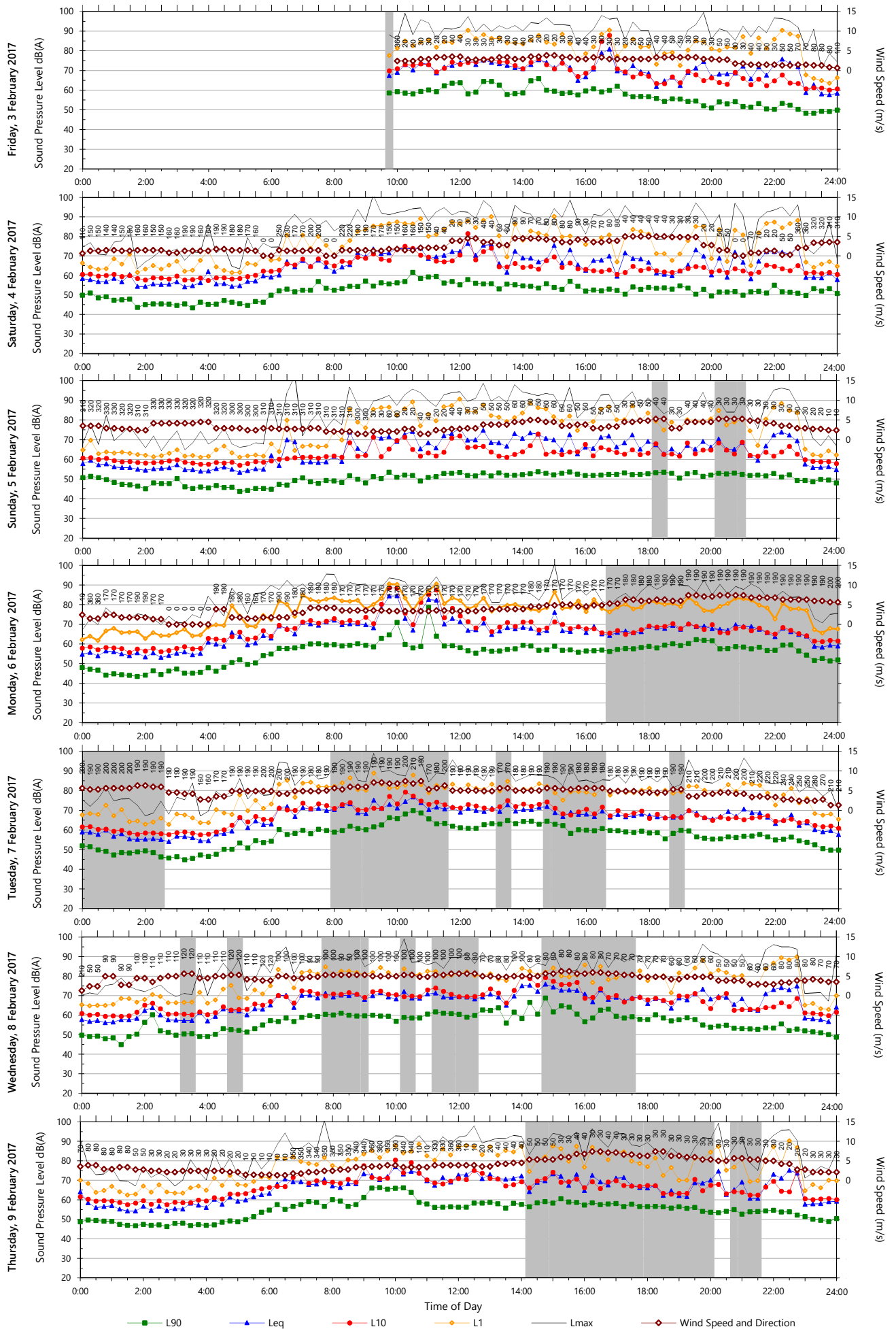






Unattended Monitoring Results

Location: 1 Bellevue Street, Tempe

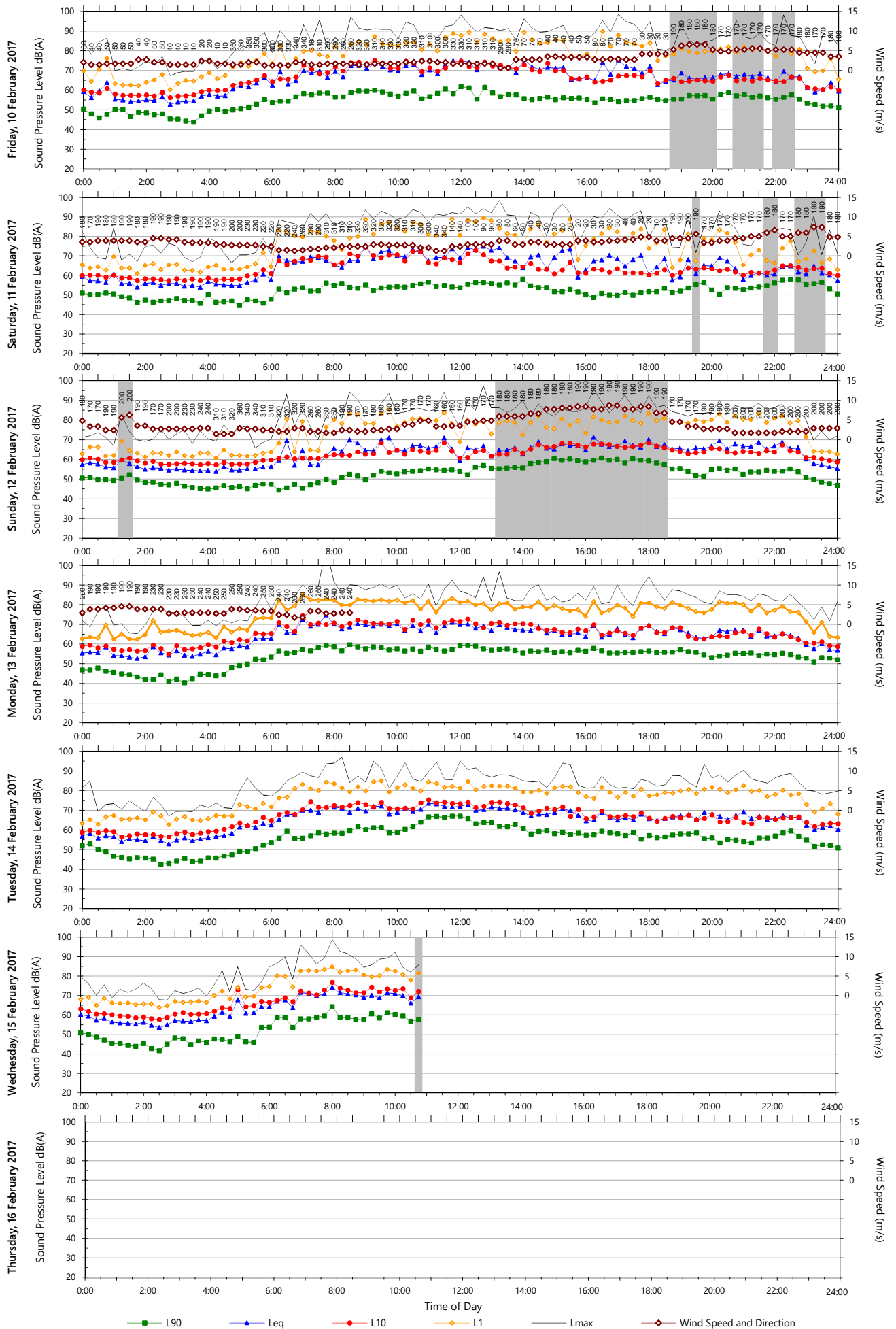


Data File: 2017-02-03\_SLM\_000\_123\_Rpt\_Report.txt

Template: QTE-26 (rev 14) Logger Graphs Program

Unattended Monitoring Results

Location: 1 Bellevue Street, Tempe



## APPENDIX D Traffic count data

**D.1 40-002-NB-SB-BELLEVUE RD STH OF PRINCES HWY**

**Hourly Classification Report - Light Vehicles 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB



Date	Time	Total	1	2
6/02/2017 Total		119	117	2
7/02/2017 Total		232	232	0
8/02/2017 Total		218	217	1
9/02/2017 Total		223	223	0
10/02/2017 Total		223	223	0
11/02/2017 Total		192	191	1
12/02/2017 Total		145	143	2
13/02/2017 Total		243	242	1
14/02/2017 Total		206	206	0
15/02/2017 Total		52	52	0
<b>Grand Total</b>		<b>1,853</b>	<b>1,846</b>	<b>7</b>

**Hourly Classification Report - Heavy Vehicles - 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
6/02/2017 Total		138	40	16	8	0	2	11	61	0	0	0
7/02/2017 Total		237	79	40	17	0	25	7	67	2	0	0
8/02/2017 Total		178	58	35	22	0	5	3	51	3	1	0
9/02/2017 Total		196	56	30	24	3	1	13	65	4	0	0
10/02/2017 Total		188	58	52	21	1	0	0	49	6	1	0
11/02/2017 Total		90	37	19	17	0	0	0	16	1	0	0
12/02/2017 Total		16	14	2	0	0	0	0	0	0	0	0
13/02/2017 Total		205	69	36	30	0	5	9	51	5	0	0
14/02/2017 Total		234	64	44	32	1	4	7	78	4	0	0
15/02/2017 Total		34	8	3	6	0	0	2	15	0	0	0
<b>Grand Total</b>		<b>1,516</b>	<b>483</b>	<b>277</b>	<b>177</b>	<b>5</b>	<b>42</b>	<b>52</b>	<b>453</b>	<b>25</b>	<b>2</b>	<b>0</b>

**Average Hourly Speeds - 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB

Date	Time	Total	Mean	85 %ile
6/02/2017 Average		23.4	34.4	40.0
7/02/2017 Average		31.3	32.5	37.9
8/02/2017 Average		26.4	33.1	40.9
9/02/2017 Average		27.9	34.3	40.8
10/02/2017 Average		27.4	32.8	39.5
11/02/2017 Average		18.8	35.2	41.5
12/02/2017 Average		10.7	36.0	41.2
13/02/2017 Average		29.9	34.2	42.0
14/02/2017 Average		29.3	33.7	39.5
15/02/2017 Average		43.0	36.6	43.2
<b>Grand Average</b>		<b>25.3</b>	<b>34.0</b>	<b>40.3</b>



**Hourly Classification Report - Heavy Vehicles - 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB



Date	Time	Total	3	4	5	6	7	8	9	10	11	12
06/02/17		49	12	10	6	0	4	1	14	2	0	0
07/02/17		32	6	6	4	0	0	3	10	3	0	0
08/02/17		23	2	5	6	0	0	0	10	0	0	0
09/02/17		30	6	6	3	0	0	0	15	0	0	0
10/02/17		18	8	3	3	0	0	0	3	1	0	0
11/02/17		4	2	0	0	0	0	0	2	0	0	0
12/02/17		32	7	4	4	0	0	3	12	2	0	0
13/02/17		36	11	2	7	0	3	1	12	0	0	0
14/02/17		32	12	6	3	0	0	0	8	3	0	0
Grand Total		256	66	42	36	0	7	8	86	11	0	0

**Hourly Classification Report - Heavy Vehicles - 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
06/02/17		49	12	10	6	0	4	1	14	2	0	0
07/02/17		32	6	6	4	0	0	3	10	3	0	0
08/02/17		23	2	5	6	0	0	0	10	0	0	0
09/02/17		30	6	6	3	0	0	0	15	0	0	0
10/02/17		18	8	3	3	0	0	0	3	1	0	0
11/02/17		4	2	0	0	0	0	0	2	0	0	0
12/02/17		32	7	4	4	0	0	3	12	2	0	0
13/02/17		36	11	2	7	0	3	1	12	0	0	0
14/02/17		32	12	6	3	0	0	0	8	3	0	0
Grand Total		256	66	42	36	0	7	8	86	11	0	0

**Average Hourly Speeds - 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Northbound AB

Date	Time	Total	Mean	85 %ile
06/02/17		10.2	29.8	36.2
07/02/17		7.1	32.3	38.7
08/02/17		6.7	31.6	39.6
09/02/17		8.3	32.3	40.9
10/02/17		4.7	36.1	39.2
11/02/17		2.6	35.6	#DIV/0!
12/02/17		7.8	33.0	38.9
13/02/17		7.6	31.6	41.1
14/02/17		7.9	33.3	37.6
Grand Average		7.0	32.8	38.8

**Hourly Classification Report - Light Vehicles 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA



Date	Time	Total	1	2
6/02/2017 Total		229	225	4
7/02/2017 Total		286	285	1
8/02/2017 Total		261	260	1
9/02/2017 Total		274	273	1
10/02/2017 Total		299	299	0
11/02/2017 Total		405	403	2
12/02/2017 Total		355	355	0
13/02/2017 Total		300	299	1
14/02/2017 Total		274	274	0
15/02/2017 Total		18	18	0
<b>Grand Total</b>		2,701	2,691	10

**Hourly Classification Report - Heavy Vehicles - 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
6/02/2017 Total		141	34	18	7	0	3	12	67	0	0	0
7/02/2017 Total		245	77	36	11	0	23	12	81	5	0	0
8/02/2017 Total		175	49	26	20	0	6	7	62	5	0	0
9/02/2017 Total		198	52	29	26	1	2	9	74	4	1	0
10/02/2017 Total		175	47	47	14	1	0	2	59	5	0	0
11/02/2017 Total		93	35	28	16	0	0	1	12	1	0	0
12/02/2017 Total		21	20	0	0	0	0	1	0	0	0	0
13/02/2017 Total		208	67	22	31	0	5	8	68	7	0	0
14/02/2017 Total		225	69	33	27	0	4	6	81	5	0	0
15/02/2017 Total		32	9	3	3	0	0	1	15	1	0	0
<b>Grand Total</b>		1,513	459	242	155	2	43	59	519	33	1	0

**Average Hourly Speeds - 7am to 10pm**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA

Date	Time	Total	Mean	85 %ile
6/02/2017 Average		33.6	34.1	41.6
7/02/2017 Average		35.4	32.6	39.4
8/02/2017 Average		29.1	32.5	41.2
9/02/2017 Average		31.5	34.2	41.9
10/02/2017 Average		31.6	33.4	41.3
11/02/2017 Average		33.2	33.1	39.5
12/02/2017 Average		25.1	32.1	37.0
13/02/2017 Average		33.9	33.9	41.5
14/02/2017 Average		33.3	33.4	41.2
15/02/2017 Average		25.0	33.2	43.4
<b>Grand Average</b>		31.7	33.2	40.5

**Hourly Classification Report - Light Vehicles 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA



Date	Time	Total	1	2
06/02/17		17	17	0
07/02/17		16	16	0
08/02/17		17	17	0
09/02/17		28	28	0
10/02/17		18	18	0
11/02/17		17	17	0
12/02/17		16	16	0
13/02/17		17	17	0
14/02/17		9	9	0
Grand Total		155	155	0

**Hourly Classification Report - Heavy Vehicles - 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
06/02/17		43	13	8	4	0	4	0	13	1	0	0
07/02/17		20	3	4	3	0	0	2	7	1	0	0
08/02/17		21	0	4	8	0	0	1	6	2	0	0
09/02/17		34	4	8	6	0	1	4	11	0	0	0
10/02/17		14	6	2	2	0	0	0	3	1	0	0
11/02/17		3	1	1	0	0	0	0	1	0	0	0
12/02/17		26	9	4	4	0	0	1	7	1	0	0
13/02/17		36	10	1	8	0	3	2	11	1	0	0
14/02/17		30	8	8	6	0	0	1	7	0	0	0
Grand Total		227	54	40	41	0	8	11	66	7	0	0

**Average Hourly Speeds - 10pm to 7am**

Traffic Counting Site: 40-002-NB-SB-  
 Direction: BELLEVUE RD STH OF PRINCES HWY  
 Detailed Location: Southbound BA

Date	Time	Total	Mean	85 %ile
06/02/17		6.7	27.4	41.8
07/02/17		4.0	28.2	41.9
08/02/17		4.2	27.9	38.2
09/02/17		6.9	29.0	42.2
10/02/17		3.6	31.4	42.0
11/02/17		2.2	38.9	41.0
12/02/17		4.7	34.5	35.6
13/02/17		5.9	28.8	40.3
14-Feb		4.3	30.8	41.0
Grand Average		4.7	30.6	40.7

**D.2 40-001-EB-WB-1-2-3-PRINCES HWY WEST OF BELLEVUE**

**Hourly Classification Report - Light Vehicles 7am to 10pm**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound



Date	Time	Total	1	2
6/02/2017 Total		10,163	10,128	35
7/02/2017 Total		16,553	16,378	175
8/02/2017 Total		18,227	18,047	180
9/02/2017 Total		19,329	19,155	174
10/02/2017 Total		19,256	19,067	189
11/02/2017 Total		21,972	21,895	77
12/02/2017 Total		20,591	20,533	58
13/02/2017 Total		18,207	18,007	200
14/02/2017 Total		17,836	17,650	186
15/02/2017 Total		4,476	4,345	131
<b>Grand Total</b>		<b>166,610</b>	<b>165,205</b>	<b>1,405</b>

**Hourly Classification Report - Heavy Vehicles - 7am to 10pm**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
6/02/2017 Total		1,356	823	150	58	8	12	31	228	44	2	0
7/02/2017 Total		2,563	1,382	347	177	52	130	52	329	75	15	4
8/02/2017 Total		2,714	1,497	358	121	49	156	56	371	77	19	10
9/02/2017 Total		2,819	1,551	305	177	37	141	69	430	78	23	8
10/02/2017 Total		2,786	1,542	352	142	43	133	50	425	77	17	5
11/02/2017 Total		1,145	823	71	57	18	16	25	107	26	2	0
12/02/2017 Total		741	639	18	7	22	13	11	26	5	0	0
13/02/2017 Total		2,847	1,520	341	128	48	175	70	441	99	20	5
14/02/2017 Total		2,593	1,298	372	152	46	169	47	390	87	23	9
15/02/2017 Total		867	292	139	71	25	128	21	126	24	32	9
<b>Grand Total</b>		<b>20,431</b>	<b>11,367</b>	<b>2,453</b>	<b>1,090</b>	<b>348</b>	<b>1,073</b>	<b>432</b>	<b>2,873</b>	<b>592</b>	<b>153</b>	<b>50</b>

**Average Hourly Speeds - 7am to 10pm**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound

Date	Time	Total	Mean	85 %ile
6/02/2017 Average		1,151.9	46.9	55.7
7/02/2017 Average		1,274.4	40.6	49.9
8/02/2017 Average		1,396.1	42.1	50.8
9/02/2017 Average		1,476.5	44.0	53.3
10/02/2017 Average		1,469.5	44.2	53.1
11/02/2017 Average		1,541.1	47.5	55.6
12/02/2017 Average		1,422.1	48.9	56.5
13/02/2017 Average		1,403.6	44.9	53.1
14/02/2017 Average		1,361.9	42.7	51.4
15/02/2017 Average		1,781.0	28.0	37.9
<b>Grand Average</b>		<b>1,406.3</b>	<b>44.2</b>	<b>52.8</b>

**Hourly Classification Report - Light Vehicles 10pm to 7am**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound



Date	Time	Total	1	2
06/02/17		4,590	4,508	82
07/02/17		4,829	4,749	80
08/02/17		4,845	4,766	79
09/02/17		5,266	5,202	64
10/02/17		4,502	4,492	10
11/02/17		3,919	3,901	18
12/02/17		4,924	4,848	76
13/02/17		4,814	4,731	83
14/02/17		4,797	4,735	62
Grand Total		42,486	41,932	554

**Hourly Classification Report - Heavy Vehicles - 10pm to 7am**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
06/02/17		892	463	77	48	19	95	17	118	27	20	8
07/02/17		851	438	78	40	13	82	26	136	16	13	9
08/02/17		840	476	68	40	12	82	23	99	21	13	6
09/02/17		916	492	101	49	16	64	13	122	38	9	12
10/02/17		437	309	25	12	5	4	7	63	12	0	0
11/02/17		142	116	2	2	5	7	1	6	3	0	0
12/02/17		806	449	73	44	18	66	16	105	19	11	5
13/02/17		899	481	63	48	13	83	21	134	34	11	11
14/02/17		863	442	85	43	12	75	24	127	26	23	6
Grand Total		6,646	3,666	572	326	113	558	148	910	196	100	57

**Average Hourly Speeds - 10pm to 7am**

Traffic Counting Site: 40-001-EB-1-2-3  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Eastbound

Date	Time	Total	Mean	85 %ile
06/02/17		609.1	54.4	60.9
07/02/17		631.1	54.0	60.8
08/02/17		631.7	53.0	60.2
09/02/17		686.9	54.6	62.1
10/02/17		548.8	56.6	62.5
11/02/17		451.2	56.0	62.1
12/02/17		636.7	54.7	61.9
13/02/17		634.8	54.9	62.2
14/02/17		628.9	53.7	61.3
Grand Average		606.6	54.7	61.6



### Hourly Classification Report - Light Vehicles 7am to 10pm

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound



Date	Time	Total	1	2
6/02/2017 Total		15,884	15,819	65
7/02/2017 Total		20,239	20,175	64
8/02/2017 Total		21,019	20,951	68
9/02/2017 Total		21,782	21,686	96
10/02/2017 Total		21,579	21,480	99
11/02/2017 Total		19,669	19,595	74
12/02/2017 Total		18,325	18,285	40
13/02/2017 Total		20,698	20,601	97
14/02/2017 Total		20,927	20,846	81
15/02/2017 Total		2,347	2,337	10
<b>Grand Total</b>		<b>182,469</b>	<b>181,775</b>	<b>694</b>

### Hourly Classification Report - Heavy Vehicles - 7am to 10pm

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
6/02/2017 Total		1,435	813	117	75	6	5	46	299	68	6	0
7/02/2017 Total		2,309	1,297	232	123	20	44	53	444	88	8	0
8/02/2017 Total		2,376	1,397	213	101	11	20	55	482	94	3	0
9/02/2017 Total		2,606	1,454	232	182	24	31	55	511	110	6	1
10/02/2017 Total		2,392	1,366	256	79	18	17	60	494	99	3	0
11/02/2017 Total		915	609	66	55	11	4	21	112	35	2	0
12/02/2017 Total		421	347	11	4	13	3	5	34	4	0	0
13/02/2017 Total		2,517	1,311	286	125	25	26	78	552	114	0	0
14/02/2017 Total		2,413	1,362	226	125	19	29	65	481	99	7	0
15/02/2017 Total		572	286	55	23	6	10	19	136	37	0	0
<b>Grand Total</b>		<b>17,956</b>	<b>10,242</b>	<b>1,694</b>	<b>892</b>	<b>153</b>	<b>189</b>	<b>457</b>	<b>3,545</b>	<b>748</b>	<b>35</b>	<b>1</b>

### Average Hourly Speeds - 7am to 10pm

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound

Date	Time	Total	Mean	85 %ile
6/02/2017 Average		1,731.9	48.6	55.3
7/02/2017 Average		1,503.2	47.3	54.2
8/02/2017 Average		1,559.7	48.3	55.3
9/02/2017 Average		1,625.9	48.1	55.0
10/02/2017 Average		1,598.1	47.9	55.3
11/02/2017 Average		1,372.3	48.4	55.1
12/02/2017 Average		1,249.7	49.3	55.7
13/02/2017 Average		1,547.7	48.8	55.7
14/02/2017 Average		1,556.0	48.2	55.0
15/02/2017 Average		973.0	51.1	57.4
<b>Grand Average</b>		<b>1,507.0</b>	<b>48.4</b>	<b>55.2</b>

**Hourly Classification Report - Light Vehicles 10pm to 7am**

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound



Date	Time	Total	1	2
06/02/17		3,043	3,041	2
07/02/17		3,376	3,372	4
08/02/17		3,526	3,522	4
09/02/17		3,861	3,854	7
10/02/17		4,703	4,694	9
11/02/17		5,165	5,159	6
12/02/17		3,209	3,205	4
13/02/17		3,202	3,194	8
14/02/17		3,943	3,934	9
Grand Total		34,028	33,975	53

**Hourly Classification Report - Heavy Vehicles - 10pm to 7am**

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound

Date	Time	Total	3	4	5	6	7	8	9	10	11	12
06/02/17		370	165	27	18	3	6	9	131	11	0	0
07/02/17		348	171	22	12	9	3	10	104	17	0	0
08/02/17		372	180	31	20	4	4	9	105	18	1	0
09/02/17		397	194	32	21	2	3	7	119	19	0	0
10/02/17		229	164	10	10	1	0	2	32	10	0	0
11/02/17		119	91	4	3	1	3	2	13	2	0	0
12/02/17		303	159	21	19	3	0	7	86	8	0	0
13/02/17		412	181	34	14	8	7	7	139	21	1	0
14/02/17		365	189	29	21	3	3	9	95	16	0	0
Grand Total		2,915	1,494	210	138	34	29	62	824	122	2	0

**Average Hourly Speeds - 10pm to 7am**

Traffic Counting Site: 40-001-WB-1-2  
 Direction: PRINCES HWY WEST OF BELLEVUE  
 Detailed Location: Westbound

Date	Time	Total	Mean	85 %ile
06/02/17		379.2	54.5	60.9
07/02/17		413.8	55.2	61.1
08/02/17		433.1	54.8	60.7
09/02/17		473.1	54.4	60.7
10/02/17		548.0	54.3	60.0
11/02/17		587.1	54.3	59.9
12/02/17		390.2	54.7	60.7
13/02/17		401.6	55.2	61.4
14/02/17		478.7	53.8	60.0
Grand Average		456.1	54.6	60.6

# HV Movement Report: Bellevue Street, Tempe

## Appendix B: Consultation



































