



1 November 2018

10-1541R0-ZK - MB

Hanson Construction Materials Pty Ltd
Level 5, 75 George Street
Parramatta NSW 2150

Attention: Ms Belinda Pignone

Dear Belinda

**Third Quarter Noise Compliance Monitoring 2018
Central Coast Sands Quarry
Lot 2 Reservoir Road Somersby**

1 Introduction

VMS Australia Pty Ltd has been appointed by Hanson Construction Materials Pty Ltd to conduct the annual noise compliance monitoring for the Central Coast Sands Quarry located at Lot 2 Reservoir Road, Somersby (the Project), in order to assess noise emission levels from the quarry's operation. This report presents the findings of the morning shoulder period and daytime measurements conducted at the nearest residential receivers during site activities on 19 September to 21 September 2018.

2 Hours of Operations

The Facility operates between 6.00 am to 6.00 pm Monday to Friday and 6.00 am to 4.00 pm on Saturday.

3 Environmental Protection Licence Noise Limits

The Environmental Protection Licence (EPL) 3751 specifies that noise from the premises must comply with the following conditions:

- L4 – Noise Limits
- M7 – Noise Monitoring
- 8 – Pollution Studies and Reduction Programs

Operational noise criteria for the Project are stipulated in Condition L4.2 of the EPL and are replicated in **Table 1**.

Table 1 Project Operational Noise Criteria

Location	Day	Evening	Morning Shoulder	
	LAeq(15minute)	LAeq(15minute)	LAeq(15minute)	LA1(1minute)
B - 126A Keighley Avenue	37	35	35	45
C - 110 Keighley Avenue	37		35	
D - 100 Keighley Avenue	38		35	
G - 87 Keighley Avenue	36		35	
R - 21 Reservoir Road	36		36	
All other privately-owned land	35		35	

Excerpt from Environmental Protection Licence - 3751 dated 11 November 2016.

4 Equipment List

The below list details the equipment that was in operation for the duration of all monitoring periods at all five monitoring locations.

Quarry Operations Without Ripper

- Komatsu PC450-8 (Excavator)
- Volvo A40G (Dump Truck)
- Komatsu WA500-6 (Front End Loader)
- WA480-5H (Front End Loader)
- CAT 735C (Water Cart)

5 Noise Monitoring Locations

Noise monitoring was conducted at the nearest residential receivers at locations at B, C, D, G and R during the morning shoulder period (6.00am to 7.00am) and day-time periods (7.00 am to 6.00 pm). Day-time attended measurements were conducted for 1.5 hours at each location as per EPL conditions.

Figure 1 presents the monitoring locations.

Figure 1 Noise Monitoring Locations

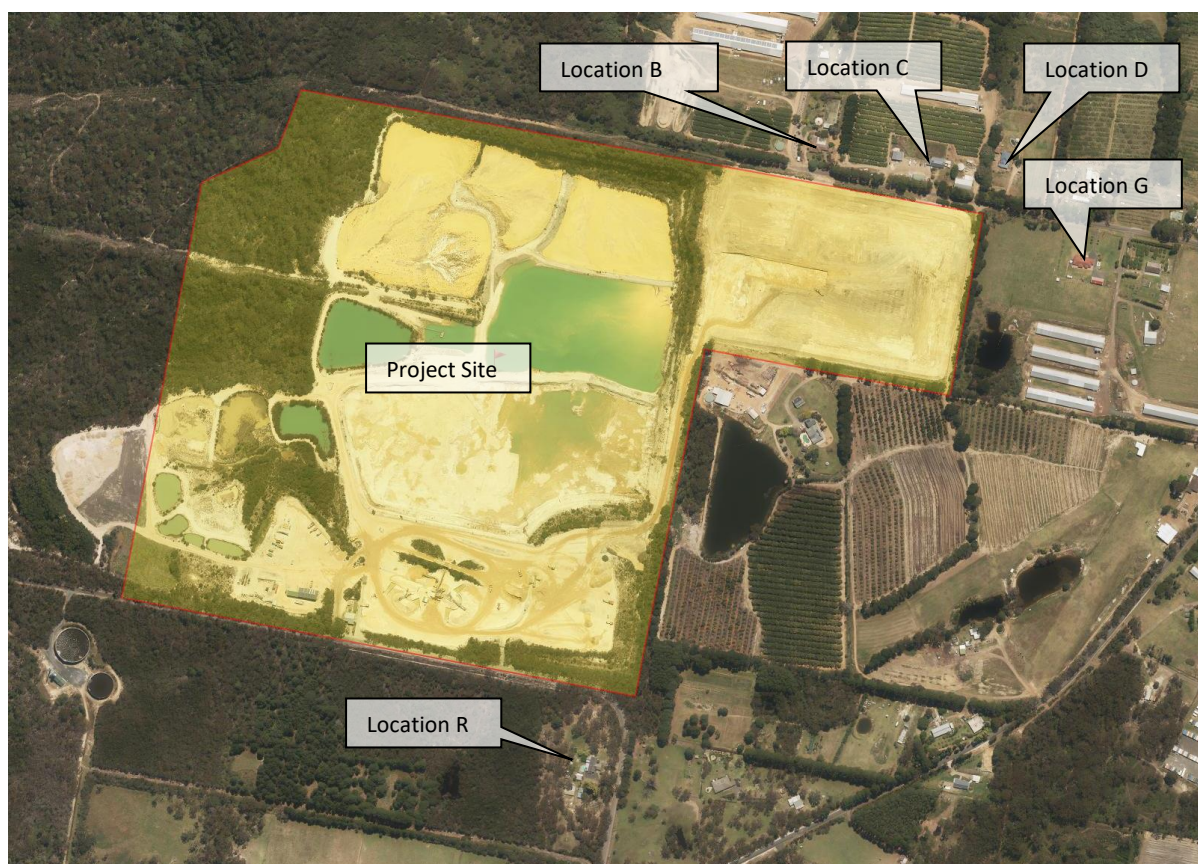


Image courtesy of Six Maps

5.1 Instrumentation and Measurement Procedure

Noise monitoring was conducted in accordance with the procedures specified in the *Central Coast Sands Quarry Project Noise Management Plan* dated 3 January 2018.

The acoustic instrumentation employed during the monitoring programme complied with the requirements of AS 1259.1-1990 “Acoustics - Sound Level Meter - Non-Integrating” and IEC 61672.1-2004 “Electroacoustics - Sound Level Meters - Specifications” and carried current NATA or manufacturer calibration certificates. The schedule of noise monitoring equipment deployed during the programme is presented in **Table 2**.

Table 2 Noise Monitoring Equipment

Instrumentation	Type	Serial Number
B&K 2250 SLM	Type 1	3024564
B&K 2250 SLM	Type 1	3023945
B&K 4231 Acoustic Calibrator	Type 1	2574227

In order to determine compliance with the noise limits nominated in **Table 1**, operator-attended 15-minute noise surveys were conducted on the 19, 20 and 22 September 2018 at the nominated residential receivers.

The measurements were conducted in accordance with Australian Standard AS 1055-1997 "Acoustics - Description and measurement of environmental noise".

A level calibration check was undertaken using an acoustic calibrator which emitted a 94 dBA calibration tone at 1 KHz. The calibration check was conducted prior and after the survey with no shift noted during the calibration process.

6 Noise Pollution Studies

VMS have conducted sound power level measurements pertaining to Condition 8 of the EPL whereby Loaders used onsite are required to maintain sound power level from 103 dBA to 100 dBA to comply with noise impacts at residences A, B, C, D, E, F and G. **Table 3** outlines the make and model of the Loader with the measured sound power level.

Table 3

Equipment	Make/Model	Measured Sound Power Levels - LAeq(15minutes)
Front-end-loader	Komatsu WA500	106 dBA

During measurement of the loader, it was noted that the noise emissions from the exhaust and fan/radiator fan were abnormally high. It is recommended that further modification to these components are undertaken to further attenuate the sound power level by 6 dBA. It is understood that a high-performance muffler has already been installed on the FEL. Accordingly, it is recommended that a staged mitigation plan is implemented, starting with replacement of radiator fan with an aerodynamic fan, followed by verification of overall FEL SWL performance. If further mitigation is required, it is recommended that acoustic louvers are installed on the radiator, followed by engine bay lining, with SWL verification undertaken following each installation.

7 Operational Noise Compliance Monitoring Results

The measured noise emission levels from quarry operations are presented in **Table 3** to **Table 9**, during the morning shoulder period and daytime periods.

**Table 4 Operational Noise Compliance Monitoring Results - Morning Shoulder Period
19 September 2018**

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
R – 21 Reservoir Road	19/09/2018 6.00am Wind: Calm Temp: 15 °C	46	51	Birds:43-52 Excavator: 35-38 Dog barking: 40-67	34	42	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
G – 87 Keighley Avenue	19/09/2018 6.23am Wind: Calm Temp:15 °C	39	48	Birds:47-51 Dog Bark:58 Excavator: 33-35 Dump trucks: 36-38 Excavator bucket: 41-42 Plane: 38-44	32	41	Complies
D – 100 Keighley Avenue	19/09/2018 6:30 am Wind: 1 m/s (Northernly Wind) Temp: 15 °C	38	45	Birds: 34-51 Plane: 40-46 Dog barking: 38-40 Cow: 44-45 Road traffic: 33-41 Excavator: 33-35 Dump trucks: 36-38 Excavator bucket: 41-42	35	42	Complies
C – 110 Keighley Avenue	19/09/2018 6.46am Wind: Calm Temp:15 °C	40	49	Birds:48-55 Plane: 47-49 Local Traffic: 41-49 Excavator: 33-35 Excavator bucket: 42-44 Excavator reversing alarm: 43-45 Dump trucks: 35-40	33	43	Complies
B – 126A Keighley Avenue	19/09/2018 6:45 am Wind: 1 m/s (North-westerly Wind) Temp: 15 °C	42	49	Birds: 43-65 Plane: 48-52 Wind in trees: 39-42 Road traffic: 40-43 Excavator: 35-38 Excavator bucket: 44-50 Excavator reversing alarm: 46-48 Dump trucks: 36-43	36	45	Complies

Table 5 Operational Noise Compliance Monitoring Results - Morning Shoulder Period 20 September 2018

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
R – 21 Reservoir Road	20/09/2018 6.00am Wind: Calm Temp: 7 °C	43	48	Dog barking: 50-65 Birds:43-52 Excavator: 35-38 Reverse alarm: 44-46 Truck Idling:41-42 Excavator: 39-41 Horn: 50	35	42	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
G – 87 Keighley Avenue	20/09/2018 6.21am Wind: Calm Temp: 7 °C	43	52	Birds:44-51 Cow: 65-69 Excavator: 47-41 Plane: 38-44	32	41	Complies
D – 100 Keighley Avenue	20/09/2018 6:30 am Wind: Calm Temp: 7 °C	46	59	Birds: 42-65 Cow: 60-67 Horn: 44-45 Road traffic: 39-47 Excavator: 29-31	33	42	Complies
C – 110 Keighley Avenue	20/09/2018 6.45am Wind: Calm Temp: 7 °C	42	50	Birds:60-62 Plane: 47-58 Domestic activities: 40-48 Rubbish truck: 44-51 Road traffic: 31-40 Excavator: 41-43 Dump trucks: 34-44 Excavator bucket: 48-50	33	43	Complies
B – 126A Keighley Avenue	20/09/2018 6:45 am Wind: 1 m/s (South-westerly Wind) Temp: 7 °C	45	56	Birds: 43-67 Plane: 45-58 Dog barking: 60-64 Domestic activities: 44-52 Rubbish truck: 44-51 Road traffic: 32-42 Excavator: 43-45 Dump trucks: 34-48 Excavator bucket: 48-52	37	46	2dB above LAeq(15minute) criterion 1dB above LA1(1minute) criterion

Table 6 Operational Noise Compliance Monitoring Results - Morning Shoulder Period 21 September 2018

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
R – 21 Reservoir Road	21/09/2018 6.00am Wind: Calm Temp: 7 °C	55	70	Birds:43-53 Dog barking: 40-67 Truck Passby:62-83 Processing Plant:62-55	35	45	Complies
G – 87 Keighley Avenue	21/09/2018 6.22am Wind: Calm Temp: 7 °C	39	49	Birds:47-51 Dog Bark:58 Excavator: 33-35 Dump trucks: 36-38 Loading trucks: 37-38 Plane: 38-44	32	41	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Estimated Project LA1 (1minute)	Assessment
		LAeq	LA1				
D – 100 Keighley Avenue	21/09/2018 6:30 am Wind: Calm Temp: 6 °C	39	47	Birds: 36-60 Road traffic: 32-34 Excavator loading: 34-36 Loading trucks (tray): 37-39 Dump trucks: 34-49 Horn: 50-55	34	45	Complies
C – 110 Keighley Avenue	21/09/2018 6.44am Wind: Calm Temp: 7 °C	40	49	Birds:48-55 Dog: 35-42 Plane: 45-50 Truck Movement: 45-48 Excavator reversing alarm: 43-45 Dump trucks: 35-40	35	42	Complies
B – 126A Keighley Avenue	21/09/2018 6:45 am Wind: Calm Temp: 7 °C	46	55	Birds: 38-62 Plane: 46-54 Excavator: 35-36 Excavator: 38-42 Loading trucks (tray): 45-51 Excavator reversing alarm: 45-46 Dump trucks: 46-50	41	47	4dB above LAeq(15minute) criterion Complies with LA1(1minute) criterion

Table 7 Operational Noise Compliance Monitoring Results - Daytime Period 19 September 2018

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)		Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)	LA1			
R – 21 Reservoir Road	19/09/2018 10.45am Wind: Calm Temp: 20 °C	45		Birds: 44-62 Plane: 48-59 Traffic: 66-70 Excavator: 44-49	35	Complies
	19/09/2018 11.00am Wind: Calm Temp: 20 °C	56		Birds: 49-55 Plane: 54-59 Traffic: 83 Reverse Siren: 49-64 Truck movements:46-49	38	2 dB above
	19/09/2018 11.15am Wind: Calm Temp: 20 °C	47		Birds: 42-48 Plane: 56-67 Horn:47-51 Truck movements:45-48	34	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
R – 21 Reservoir Road	19/09/2018 11.30am Wind: slight gust Temp: 20 °C	50	Birds: 42-48 Plane: 56-67 Horn:47-51 Truck movements:45-48	34	Complies
	19/09/2018 11.45am Wind: slight gust Temp: 22 °C	55	Birds: 49-58 Truck passby:78 Loader: 44-46 Reverse siren: 47-50	35	Complies
	19/09/2018 12.00pm Wind: slight gust Temp: 22 °C	57	Birds: 62-67 Truck movements:47-49 Dog: 72-77 Reverse siren: 47-50	34	Complies
G – 87 Keighley Avenue	19/09/2018 8.34am Wind: 1-2 m/s (Northerly Wind) Temp: 20 °C	40	Birds: 41-60 Excavator bucket: 38-46 Road traffic: 46-47 Wind in trees: 42-46	33	Complies
	19/09/2018 8.49am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	37	Birds: 42-60 Wind in trees: 41-49 Road traffic: 41-42 Excavator: 30-31 Residents Tractor: 42-61 Dump trucks: 30-31	31	Complies
	19/09/2018 9.04 am Wind: 1-2 m/s (Northerly) Temp: 21 °C	41	Birds: 42-60 Plane: 44-55 Road traffic: 39-47 Excavator bucket: 39-44	32	Complies
	19/09/2018 9.19am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	39	Birds: 50-58 Wind in trees: 41-46 Excavator: 30-31 Excavator bucket: 43-49	32	Complies
	19/09/2018 9.34am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	57	Birds: 40-62 Plane: 41-43 Wind in trees: 40-43 ATV: 41-46 Cow: 44- 81 Excavator bucket: 41-44	33	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
G – 87 Keighley Avenue	19/09/2018 9.49am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	56	Birds: 40-51 Plane: 41-43 Wind in trees: 40-43 ATV: 43-55 Cow: 78- 83 Excavator bucket: 41-44	33	Complies
D – 100 Keighley Avenue	19/09/2018 8:45 am Wind: 1-2 m/s (Northerly Wind) Temp: 20 °C	43	Birds: 42-53 Plane: 45-53 Wind in trees: 41-49 Road traffic: 46-47 Excavator: 30-31 Excavator bucket: 38-46	32	Complies
	19/09/2018 9:00 am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	42	Birds: 41-62 Wind in trees: 42-51 Road traffic: 41-42 Excavator: 30-31 Excavator bucket: 31-33 Dump trucks: 30-31	30	Complies
	19/09/2018 9:15 am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	41	Birds: 41-47 Plane: 48-56 Wind in trees: 41-44 Road traffic: 42-49 Excavator: 30-32 Excavator bucket: 39-47	30	Complies
	19/09/2018 9:30 am Wind: 1-2 m/s (Northerly Wind) Temp: 22 °C	42	Birds: 38-72 Plane: 40-47 Wind in trees: 40-42 Cow: 50-53 Excavator: 31-38 Excavator bucket: 41-47 Excavator reversing alarm: 31-32 Dump trucks: 30-49 Horn: 41-42	32	Complies
	19/09/2018 9:45 am Wind: 1-2 m/s (Northerly Wind) Temp: 22 °C	43	Birds: 42-49 Plane: 43-53 Dog barking: 42-51 Wind in trees: 40-43 ATV: 41-46 Cow: 44-53 Excavator: 30-32 Excavator bucket: 34-41 Dump trucks: 31-39	33	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
D – 100 Keighley Avenue	19/09/2018 8:45 am Wind: 1-2 m/s (Northerly Wind) Temp: 20 °C	43	Birds: 42-53 Plane: 45-53 Wind in trees: 41-49 Road traffic: 46-47 Excavator: 30-31 Excavator bucket: 38-46	32	Complies
C – 110 Keighley Avenue	19/09/2018 7.02am Wind: 1-2 m/s (Northernly Wind) Temp: 18 °C	42	Birds: 50-63 Plane: 45-53 Wind in trees: 41-45 Road traffic: 46-47 Excavator: 30-31 Excavator bucket: 38-46	35	Complies
	19/09/2018 7.17am Wind: 1-2 m/s (Northernly Wind) Temp: 19 °C	42	Birds: 50-58 Plane: 44-50 Wind in trees: 41-46 Road traffic: 44-46 Excavator: 30-31	34	Complies
	19/09/2018 7.32am Wind: 1-2 m/s (Northerly Wind) Temp: 19 °C	44	Birds: 50-58 Plane: 44-50 Wind in trees: 41-46 Road traffic: 44-46 Excavator: 30-31	34	Complies
	19/09/2018 7.47am Wind: 1-2 m/s (Northerly Wind) Temp: 19 °C	43	Chainsaw: 44-52 Birds: 52-70 Cows: 40-42 Wind in trees: 45-49 Excavator bucket: 40-44 Reversing alarm: 40-41 Planes: 46-50	36	Complies
	19/09/2018 8.02am Wind: 1 m/s (Northerly Wind) Temp: 20 °C	41	Birds: 44-55 Pressure washer: 42-45 Wind in trees: 42-47 Excavator bucket: 40-44 Reversing alarm: 36-43 Planes: 40-44	34	Complies
	19/09/2018 8:17 am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	43	Birds: 42-53 Plane: 45-53 Wind in trees: 41-49 Road traffic: 46-47 Excavator: 30-31 Excavator bucket: 38-46	32	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
B – 126A Keighley Avenue	19/09/2018 7:00 am Wind: 1-2 m/s (Northerly Wind) Temp: 18 °C	46	Birds: 43-61 Plane: 38-46 Dog barking: 44-78 Cow: 40-41 Wind in trees: 40-41 Domestic activities: 43-57 Excavator: 37-42 Excavator bucket: 46-52 Dump trucks: 37-42	38	1dB above criterion
	19/09/2018 7:15 am Wind: 1-2 m/s (Northerly Wind) Temp: 19 °C	43	Birds: 46-63 Plane: 41-52 Dog barking: 43-46 Wind in trees: 41-42 Road traffic: 41-50 Excavator: 40-43 Excavator bucket: 44-51 Excavator reversing alarm: 46-48 Dump trucks: 40-44	39	2dB above criterion
	19/09/2018 7:30 am Wind: 1-2 m/s (Northerly Wind) Temp: 19 °C	50	Birds: 42-76 Wind in trees: 41-48 Excavator: 41-43 Excavator bucket: 44-50 Excavator reversing alarm: 40-42 Dump trucks: 45-47	39	2dB above criterion
	19/09/2018 7:45 am Wind: 1-2 m/s (Northerly Wind) Temp: 19 °C	43	Birds: 42-48 Wind in trees: 44-48 Excavator: 39-41 Excavator bucket: 45-52 Excavator reversing alarm: 41-42 Dump trucks: 40-41	40	3dB above criterion
	19/09/2018 8:00 am Wind: 1 m/s (Northerly Wind) Temp: 20 °C	42	Birds: 41-58 Wind in trees: 40-41 Excavator: 38-41 Excavator bucket: 49-54 Excavator reversing alarm: 40-42 Dump trucks: 41-45	39	2dB above criterion
	19/09/2018 8:15 am Wind: 1-2 m/s (Northerly Wind) Temp: 21 °C	43	Birds: 44-64 Wind in trees: 46-47 Excavator: 38-44 Excavator bucket: 41-48 Excavator reversing alarm: 40-41 Dump trucks: 41-42 Horn: 58-59	37	Complies

**Table 8 Operational Noise Compliance Monitoring Results - Daytime Period
20 September 2018**

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
R – 21 Reservoir Road	20/09/2018 1:30 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	42	Birds: 42-64 Wind in trees: 42-44 Excavator: 43-46 Excavator reversing alarm: 43-45 Road traffic: 45-66	35	Complies
	20/09/2018 1:45 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	44	Birds: 42-62 Wind in trees: 42-44 Excavator: 44-46 Excavator reversing alarm: 48 Road traffic: 45-63	36	Complies
	20/09/2018 2:00 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	43	Birds: 42-61 Cow: 45-61 Wind in trees: 38-42 Road traffic: 40-44 Excavator: 30-31 Excavator bucket: 38-43	34	Complies
	20/09/2018 2:15 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	44	Birds: 40-60 Plane: 41-47 Wind in trees: 38-42 Road traffic: 41-45 Excavator: 31-33 Excavator bucket: 35-44	36	Complies
	20/09/2018 2:30 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	45	Birds: 41-50 Wind in trees: 42-44 Road traffic: 36-42 Excavator: 30-31 Excavator bucket: 37-43 Excavator reversing alarm: 31-32 Dump trucks: 40-46	38	2dB above criterion
	20/09/2018 2:45 pm Wind: 1 m/s (South-easterly Wind) Temp: 14 °C	44	Birds: 42-64 Plane: 45-48 Wind in trees: 40-41 Road traffic: 41-45 Excavator: 31-33 Excavator bucket: 37-44	37	1dB above criterion

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
G – 87 Keighley Avenue	20/09/2018 12:00 pm Wind: 2 m/s (South-easterly Wind) Temp: 12 °C	40	Birds: 41-60 Excavator bucket: 38-46 Road traffic: 46-47 Wind in trees: 42-46	33	Complies
	20/09/2018 12:15 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	37	Birds: 42-60 Wind in trees: 41-49 Road traffic: 41-42 Excavator: 30-31 Residents Tractor: 42-61 Dump trucks: 30-31	31	Complies
	20/09/2018 12:30 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	41	Birds: 42-60 Plane: 44-55 Road traffic: 39-47 Excavator bucket: 39-44	32	Complies
	20/09/2018 12:45 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	39	Birds: 50-58 Wind in trees: 41-46 Excavator: 30-31 Excavator bucket: 43-49	32	Complies
	20/09/2018 1:00 pm Wind: 2 m/s (South-easterly Wind) Temp: 12 °C	57	Birds: 40-62 Plane: 41-43 Wind in trees: 40-43 ATV: 41-46 Cow: 44- 81 Excavator bucket: 41-44	33	Complies
	20/09/2018 1:15 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	56	Birds: 40-51 Plane: 41-43 Wind in trees: 40-43 ATV: 43-55 Cow: 78- 83 Excavator bucket: 41-44	33	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
D – 100 Keighley Avenue	20/09/2018 12:00 pm Wind: 2 m/s (South-easterly Wind) Temp: 12 °C	40	Birds: 41-50 Wind in trees: 42-44 Road traffic: 36-42 Excavator: 30-31 Excavator bucket: 37-43 Excavator reversing alarm: 31-32 Dump trucks: 40-46	31	Complies
	20/09/2018 12:15 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	44	Birds: 42-64 Plane: 45-48 Wind in trees: 40-41 Road traffic: 41-45 Excavator: 31-33 Excavator bucket: 37-43	31	Complies
	20/09/2018 12:30 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	43	Birds: 42-59 Cow: 45-61 Wind in trees: 38-42 Road traffic: 40-44 Excavator: 30-31 Excavator bucket: 38-43	30	Complies
	20/09/2018 12:45 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	42	Birds: 40-62 Plane: 41-47 Wind in trees: 38-42 Road traffic: 41-45 Excavator: 31-33 Excavator bucket: 35-44	32	Complies
	20/09/2018 1:00 pm Wind: 2 m/s (South-easterly Wind) Temp: 12 °C	40	Birds: 41-50 Wind in trees: 42-44 Road traffic: 36-42 Excavator: 30-31 Excavator bucket: 37-43 Excavator reversing alarm: 31-32 Dump trucks: 40-46	31	Complies
	20/09/2018 1:15 pm Wind: 1-2 m/s (South-easterly Wind) Temp: 12 °C	44	Birds: 42-64 Plane: 45-48 Wind in trees: 40-41 Road traffic: 41-45 Excavator: 31-33 Excavator bucket: 37-43	31	Complies

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
D – 110 Keighley Avenue	20/09/2018 7:00 am Wind: 1-2 m/s (South-westerly Wind) Temp: 8 °C	40	Birds: 41-65 Wind in trees: 42-48 Road traffic: 42-49 Excavator: 33-47 Excavator bucket: 37-43 Dump trucks: 37-40	36	Complies
	20/09/2018 7:15 am Wind: 1 m/s (South-westerly Wind) Temp: 8 °C	43	Birds: 42-58 Plane: 45-48 Excavator: 42-46 Excavator bucket: 41-49 Reversing alarm: 37-40 Dump trucks: 37-42 Horn: 48-50 FEL: 35-36	36	Complies
	20/09/2018 7:30 am Wind: 1-2 m/s (Southerly Wind) Temp: 10 °C	46	Birds: 42-60 Dog barking: 51-55 Excavator: 40-42 Excavator bucket: 43-49 Excavator reversing alarm: 40-41 Dump trucks: 41-44	39	2dB above criterion
	20/09/2018 7:45 am Wind: 1-2 m/s (Southerly Wind) Temp: 9 °C	46	Birds: 43-62 Dog barking: 53-56 Road traffic: 38-40 Excavator: 43-44 Excavator bucket: 46-48 Excavator reversing alarm: 40-41 Dump trucks: 42-49	38	1dB above criterion
	20/09/2018 8:00 am Wind: 1 m/s (Southerly Wind) Temp: 10 °C	45	Birds: 42-66 Road traffic: 41-42 Excavator: 43-44 Excavator bucket: 46-52 Excavator reversing alarm: 40-42 Dump trucks: 42-48 Horn: 43-45	39	2dB above criterion
	20/09/2018 8:15 am Wind: 1-2 m/s (Southerly Wind) Temp: 11 °C	45	Birds: 42-63 Plane: 45-53 Road traffic: 43-45 Excavator: 43-45 Excavator bucket: 47-52 Excavator reversing alarm: 39-42 Dump trucks: 41-48	40	3dB above criterion

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
B – 126A Keighley Avenue	20/09/2018 7:00 am Wind: 1-2 m/s (South-westerly Wind) Temp: 8 °C	43	Birds: 41-53 Plane: 37-39 Dog barking: 42-55 Domestic activity: 49-54 Wind in trees: 40-41 Excavator: 42-46 Excavator bucket: 47-52 Excavator reversing alarm: 41-43 Dump trucks: 41-49	41	4dB above criterion
	20/09/2018 7:15 am Wind: 1 m/s (South-westerly Wind) Temp: 8 °C	45	Birds: 42-61 Plane: 46-51 ATV: 49-53 Excavator: 43-45 Excavator bucket: 46-54 Excavator reversing alarm: 40-41 Dump trucks: 41-48 Horn: 50-51 FEL: 36-37	41	4dB above criterion
	20/09/2018 7:30 am Wind: 1-2 m/s (Southerly Wind) Temp: 10 °C	47	Birds: 42-62 Dog barking: 51-68 Excavator: 43-44 Excavator bucket: 48-54 Excavator reversing alarm: 40-41 Dump trucks: 41-49	43	6dB above criterion
	20/09/2018 7:45 am Wind: 1-2 m/s (Southerly Wind) Temp: 9 °C	48	Birds: 43-62 Dog barking: 53-56 Road traffic: 38-40 Excavator: 43-44 Excavator bucket: 46-48 Excavator reversing alarm: 40-41 Dump trucks: 42-49	42	5dB above criterion
	20/09/2018 8:00 am Wind: 1 m/s (Southerly Wind) Temp: 10 °C	48	Birds: 42-66 Road traffic: 41-42 Excavator: 43-44 Excavator bucket: 46-52 Excavator reversing alarm: 40-42 Dump trucks: 42-48 Horn: 43-45	44	7dB above criterion
	20/09/2018 8:15 am Wind: 1-2 m/s (Southerly Wind) Temp: 11 °C	48	Birds: 42-63 Plane: 45-53 Road traffic: 43-45 Excavator: 43-45 Excavator bucket: 47-52 Excavator reversing alarm: 39-42 Dump trucks: 41-48	44	7dB above criterion

**Table 9 Operational Noise Compliance Monitoring Results - Daytime Period
21 September 2018**

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
R – 21 Reservoir Road	21/09/2018 10:00 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	54	Birds: 42-58 Excavator: 43-47 Excavator reversing alarm: 41-43 Road traffic: 76	37	2dB above criterion
	21/09/2018 10:15 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	40	Birds: 39-46 Wind in trees: 42-44 Processing Plant: 38-40 Excavator reversing alarm: 41-42 Excavator: 41-48	38	3dB above criterion
	21/09/2018 10:30 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	42	Birds: 36-50 Wind in trees: 38-42 Road traffic: 40-44 Excavator: 36-45	38	3dB above criterion
	21/09/2018 10:45 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	40	Birds: 44-55 Wind in trees: 38-42 Road traffic: 41-45 Excavator: 32-49 Reverse alarm: 40-41	37	1dB above criterion
	21/09/2018 11:00 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	40	Birds: 39-51 Truck movement: 39-48 Plane: 40-42 Dump trucks: 40-46	38	3dB above criterion
	21/09/2018 11:15 am Wind: 1 m/s (South-easterly Wind) Temp: 15 °C	43	Birds: 38-59 Plane: 45-455 Dump truck: 42-51 Reverse alarm: 39-44 Excavator bucket: 37-44	38	3dB above criterion

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
G – 87 Keighley Avenue	21/09/2018 8:30 am Wind: 1 m/s (Westerly Wind) Temp: 12 °C	51	Birds: 33-53 Plane: 39-49 Road traffic: 48-72 Excavator: 31-34 Loading trucks (tray): 40-44 Excavator bucket: 40-44 Cows: 65-81	34	Complies
	21/09/2018 8:45 am Wind: 1 m/s (Westerly Wind) Temp: 13 °C	49	Birds: 34-58 Plane: 44-4 Local traffic: 55-75 Excavator: 31-34 Dump trucks: 38-43	33	Complies
	21/09/2018 9:00 am Wind: 1 m/s (Westerly Wind) Temp: 14 °C	40	Birds: 43-58 Plane: 38-45 Domestic activity: 40-45 ATV: 35-37 Excavator: 30-32	30	Complies
	21/09/2018 9:15 am Wind: 1 m/s (Westerly Wind) Temp: 15 °C	36	Birds: 36-55 Plane: 38-43 Road traffic: 54-56 Excavator: 30-31 ATV: 36-52	30	Complies
	21/09/2018 9:30 am Wind: 1 m/s (Westerly Wind) Temp: 16 °C	47	Birds: 42-47 Plane: 35-45 Road traffic: 65-70 ATV: 40-44 Dump trucks: 33-35	33	Complies
	21/09/2018 9:45 am Wind: 1 m/s (Westerly Wind) Temp: 16 °C	54	Birds: 44-47 Plane: 36-42 Excavator: 34-40 Dump trucks: 40-43	34	Complies
	D – 100 Keighley Avenue	21/09/2018 8:30 am Wind: 1 m/s (Westerly Wind) Temp: 12 °C	40	Birds: 42-53 Plane: 37-50 Road traffic: 43-48 Excavator: 31-34 Loading trucks (tray): 40-44 Excavator bucket: 40-44 Excavator reversing alarm: 30-31 Dump trucks: 36-45	34

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
D – 100 Keighley Avenue	21/09/2018 8:45 am Wind: 1 m/s (Westerly Wind) Temp: 13 °C	38	Birds: 36-49 Plane: 37-40 Road traffic: 41-43 Excavator: 31-34 Loading trucks (tray): 38-44 Dump trucks: 38-43	33	Complies
	21/09/2018 9:00 am Wind: 1 m/s (Westerly Wind) Temp: 14 °C	39	Birds: 37-62 Plane: 40-45 Domestic activity: 44-47 ATV: 35-37 Excavator: 30-32	30	Complies
	21/09/2018 9:15 am Wind: 1 m/s (Westerly Wind) Temp: 15 °C	39	Birds: 36-55 Plane: 38-43 Road traffic: 54-56 Excavator: 30-31 Dump trucks: 37-44	30	Complies
	21/09/2018 9:30 am Wind: 1 m/s (Westerly Wind) Temp: 16 °C	39	Birds: 38-49 Plane: 37-43 Road traffic: 44-48 Excavator: 30-34 Excavator bucket: 37-41 Dump trucks: 37-42	32	Complies
	21/09/2018 9:45 am Wind: 1 m/s (Westerly Wind) Temp: 16 °C	40	Birds:37-59 Plane: 33-48 Excavator: 31-33 Excavator bucket: 40-41 Excavator reversing alarm: 29-31 Dump trucks: 38-42	32	Complies
D – 110 Keighley Avenue	21/09/2018 7:00 am Wind: Calm Temp: 8 °C	39	Birds: 43-56 Plane: 42-45 Road traffic: 43-48 Excavator: 41-43 Loading trucks (tray): 40-44 Excavator bucket: 40-44 Excavator reversing alarm: 30-31 Dump trucks: 36-45	34	Complies
	21/09/2018 7:15 am Wind: Calm Temp: 9 °C	45	Birds: 41-66 Plane: 40-52 Road traffic: 42-53 Excavator: 38-43 Loading trucks (tray): 38-44 Dump trucks: 38-43	40	3dB above criterion

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
D – 110 Keighley Avenue	21/09/2018 7:30 am Wind: Calm Temp: 10 °C	37	Birds: 39-51 Plane: 40-46 local Traffic: 43-45 Excavator: 30-32	35	Complies
	21/09/2018 7:45 am Wind: Calm Temp: 11 °C	40	Birds: 36-55 Plane: 38-43 Road traffic: 54-56 Excavator: 30-31 Dump trucks: 37-44	35	Complies
	21/09/2018 8:00 am Wind: Calm Temp: 10 °C	39	Birds: 35-58 Local traffic: 45-52 Excavator: 33-35 Excavator bucket: 41-47 Dump trucks: 41-44	34	Complies
	21/09/2018 8:15 am Wind: Calm Temp: 11 °C	39	Birds:38-43 Plane: 39-41 Excavator: 35-37 Excavator reversing alarm: 29-31 Dump trucks: 38-42	33	Complies
B – 126A Keighley Avenue	21/09/2018 7:00 am Wind: Calm Temp: 8 °C	45	Birds: 42-64 Road traffic: 45-49 Excavator: 37-43 Loading trucks (tray): 43-50 Excavator reversing alarm: 40-41 Horn: 56-57 Dump trucks: 41-48	40	3dB above criterion
	21/09/2018 7:15 am Wind: Calm Temp: 9 °C	47	Birds: 55-64 Plane: 41-48 Road traffic: 37-39 Excavator: 37-43 Loading trucks (tray): 45-54 Excavator reversing alarm: 40-42 Dump trucks: 41-48	39	2dB above criterion
	21/09/2018 7:30 am Wind: Calm Temp: 10 °C	44	Birds: 42-68 Road traffic: 43-48 Excavator idling: 34-35 Excavator loading: 36-44 Loading trucks (tray): 45-56 Excavator reversing alarm: 40-41 Excavator bucket: 44-45 Dump trucks: 42-46	38	1dB above criterion

Location	Date/Start Time/Weather	Primary Noise Descriptor (dB re 20 µPa)	Description of Noise Emission, Typical Maximum Levels LAmax (dB)	Estimated Project LAeq (15minute)	Assessment
		LAeq(15minute)			
B – 126A Keighley Avenue	21/09/2018 7:45 am Wind: Calm Temp: 11 °C	42	Birds: 38-51 Road traffic: 34-41 Excavator idling: 34-36 Excavator loading: 35-45 Loading trucks (tray): 46-57 Excavator reversing alarm: 40-42 Excavator bucket: 42-48 Dump trucks: 41-45	39	2dB above criterion
	21/09/2018 8:00 am Wind: Calm Temp: 10 °C	45	Birds: 41-61 Plane: 40-55 Road traffic: 43-49 Excavator idling: 35-36 Excavator: 35-44 Loading trucks (tray): 46-53 Excavator reversing alarm: 41-42 Dump trucks: 40-47	40	3dB above criterion
	21/09/2018 8:15 am Wind: Calm Temp: 11 °C	43	Birds: 41-54 Excavator idling: 34-36 Excavator loading: 41-44 Loading trucks (tray): 46-49 Excavator reversing alarm: 40-42 Dump trucks: 42-49	41	4dB above criterion

8 Assessment and Findings

Noise monitoring conducted during the morning shoulder periods for the Central Coast Sands Quarry operations on the 19, 20 and 21 September 2018 found that noise emissions from the Project site complied with both the LAeq(15minute) and LA1(1minute) Noise Criteria nominated in Condition L4 of the EPL at the nearest residences with the exception of Location B where exceedances were found on 20 and 21 September.

Noise monitoring conducted during the daytime period, found noise emissions from the Project site complied with the LAeq(15minute) Noise Criteria at the nearest residences as described within **Table 1** at the majority of the monitoring locations. However, Location B and R was found to exceed numerous times during the three-day attended measurements, most notably on 21 September. It is noted that the excavator within the extension area was found to be producing excessive noise during its operation. The high LAeq noise emission was controlled by the excavator exhaust and fan noise was mainly due to the high elevation of the excavator which negated the effectiveness of the acoustic bunding shielding the residences.

Sporadic noise from the excavator bucket slackness was clearly audible over the three-day measurement however did not contribute greatly to the LAeq noise emissions. In addition, dump trucks were also found to be audible and consistent during most daytime measurements.

Noise contributions from the quarry were found to be barely perceptible at residential locations located further away from the quarry, mainly Location D and G. It was also noted during measurements that the controlling background noise sources were from birds, insects, surrounding wildlife and local traffic.

Yours sincerely



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Technical Director - Acoustics

Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \text{Log}_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .