Appendix 8 – Blasting Fact Sheet

Fact sheet

Australian Government
Nation Building Program

NSW GOVERNMENT Transport Roads & Maritime Services

MAY 2012

ST HELENA TUNNEL BLASTING WORKS

Roads and Maritime Services, has awarded a contract to Baulderstone Pty Ltd (Baulderstone) to design and construct the Pacific Highway upgrade — Tintenbar to Ewingsdale. This project is jointly funded by the NSW State and Federal Governments. The upgrade will provide approximately 16.3 kilometres of dual carriageway, starting at the northern end of the Ballina bypass at Ross Lane and extending to the Ewingsdale interchange. It is anticipated that substantial construction will commence in mid 2012.

The alignment of the upgrade has been designed to avoid the steep grades of St Helena hill. To achieve this, a tunnel will be constructed through St Helena hill which will also remove the dangerous accident black spot at the top of the hill.

St Helena tunnel features and benefits

- The tunnel is 434 metres in length.
- Two side by side tunnels will be built, each being 19 metres wide with a 10 metre wide rock pillar separating the two tunnels.
- The tunnel is approximately 46 metres below the ridge line.

Background

Controlled tunnel blasting will be required to break up approximately 155,000m³ of high strength basalt rock during construction of the northbound and southbound tunnels through St Helena hill. It is anticipated that controlled blasting in the tunnel is expected to be carried out up to six times per day. Each blast event in the tunnel is expected to take approximately 10 seconds to complete, with the instantaneous blasts in the separate tunnels initiated within a few seconds of each other.

Controlled open cut blasting will also be required to break up the rock at the tunnel portals (entrances) and the tunnel control centre on top of St Helena hill.

The type of controlled tunnel blasting inside the tunnel will differ from controlled 'open cut' blasting that will be undertaken at the tunnel portals and tunnel control centre.

What is controlled tunnel blasting?

Controlled tunnel blasting is a process used in the excavation of tunnels using explosives to break up material in a highly controlled manner that is unable to be practically broken up by traditional mechanical methods. Controlled blasting involves drilling a series of production holes (approximately 45mm in diameter) in a predetermined pattern in the tunnel face.

For each blast there may be in excess of 100 holes drilled. To assist the blast and reduce ground vibration, a number of larger diameter holes known as relief holes are drilled to create a weak zone in the rock face. The blasting holes are then loaded with explosives and set off in a predetermined pattern to break the rock. The blasted material is 'mucked out' from the face by specialised underground loaders and trucks.

What is controlled open cut blasting?

Controlled open cut blasting will be used to excavate the tunnel portals and tunnel control centre with explosives where traditional mechanical methods such as rock hammers are not feasible due to the strength of the rock, the volume of material to be removed and the significant associated noise and vibration impacts to nearby residents. The broken rock will then be excavated and taken away by earthworks equipment.

Why is controlled blasting required?

The St Helena tunnel will connect Ewingsdale to the Tinderbox Valley. Geotechnical investigation and testing has determined that the rock, which is

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This project is funded by the NSW State and Federal Governments.

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'basalt', in the tunnel is of a very high strength. Due to this very high strength rock, it is not suited to mechanical excavation techniques such as roadheaders and will require the use of controlled tunnel blasting to excavate.

When is controlled blasting likely to start?

It is anticipated that controlled open cut blasting at the tunnel portals and the tunnel control centre will start in the second half of 2012, and controlled tunnel blasting will start in late 2012.

How often will controlled tunnel blasting occur?

It is anticipated that there will be a morning and an afternoon blast cycle each day in the St Helena tunnel (up to three blasts in each of the two tunnels per day). This activity will take place over a 12 month period, however, the time taken to complete the tunnel will be largely determined by the geology, strength and condition of the rock that is encountered.

How often will controlled open cut blasting occur?

The controlled blasting at the tunnel portals and the tunnel control centre will involve a maximum of one blast per day, although blasts will not be occurring on a daily basis. Controlled blasting at the tunnel portals will take approximately three months and controlled blasting at the tunnel control centre will take approximately 4 – 6 weeks to complete.

What time will controlled tunnel blasting occur?

Blasting inside the tunnel would occur sometime between 7am and 6pm each day (pending approval of the extension of blasting hours for the tunnel). It is anticipated that there will be one blast period in the morning and a second blast period in the afternoon. Controlled blasting will not take place on Saturdays after 1pm, on Sundays or on public holidays.

What time will controlled open cut blasting occur?

Controlled blasting for the tunnel portals and tunnel control centre will only occur between 9am and 5pm. Controlled blasting will not take place on Saturdays after 1pm or, Sundays or on public holidays.

What are the potential impacts of controlled blasting?

Both open cut and tunnel controlled blasting have a number of potential issues which need to be managed, including:

- Ground vibration i.e. shaking of the ground and objects sitting on it (e.g. structures and buildings).
- Air blast overpressure or noise.
- Dust.
- Scattering of 'fly rock'.

These impacts will be carefully managed by the project team to avoid and or minimise any potential impacts on local residents, and/or motorists. The proposed increased limits would still ensure the comfort and safety of residents during each controlled blast. The blasting limits would be below the level at which any cosmetic damage to structures, such a minor paint cracking, may occur. The vibration from controlled blasts is expected to be very minor beyond the immediate vicinity of the blast zone. Monitoring will be carried out to record noise and vibration for each controlled blast. All blasts will be designed and controlled to ensure that the nominated vibration limits are not exceeded at the nearest sensitive receiver (nearby residents).

There will be minimal dust and no fly rock beyond the immediate vicinity of the blasts at the tunnel, tunnel portals and tunnel control centre.

How do we manage the impacts of controlled blasting?

Significant blast design and modelling work considering the geology of the area, the location and condition of sensitive receivers and vibration and air blast overpressure limits is undertaken. In addition, the project team will prepare a project specific Blast Management Plan and associated work method statements.

Vibration is controlled by adjusting the size and timing of the maximum instantaneous charge (MIC), which is the amount of explosive detonated at any particular instant. The size of the MIC is adjusted so that the limits for ground vibration and air blast overpressure for each sensitive receiver are not exceeded. The size of the MIC is managed by using delays on the detonators so that the controlled blast is set off in a predetermined sequence and by reducing or extending the length of each controlled blast.

The data recovered from the monitoring of each controlled blast, incluidng an initial trial blast, is compared to the predicted effects, to enable the project team to further refine and optimise each blast design.

Noise monitoring will be undertaken initially at the start of any controlled blasting (i.e., at the tunnel portals, in the tunnel and at the tunnel control centre) and subsequently on a monthly basis or

more frequent as may be required to ensure compliance with approved limits and the various management plans for the project, or in response to community complaints. Monitoring to record vibration levels and airblast overpressure will be carried out for each controlled blast. Flashing warning lights attached to vibration monitors, triggered by vibrations in excess of the component Peak Particle Velocity limit for the relevant building type will provide a "real time" visual warning of vibration exceedances. This information will be regularly uploaded to the project website.

Where there is the potential for fly rock, 'blast mats' (made of thick shock absorbing rubber) may be used or alternatively the overburden earth material may be kept in place.

What are the vibration and airblast overpressure limits for controlled blasting?

The current approved controlled blasting vibration limits for the tunnel, tunnel portals and tunnel control centre is set at 5 mm/s and 115 dB (Lin Peak) for airblast overpressure and are not to be exceeded for 95% of the controlled blasts.

The project team is currently proposing to increase the vibration limit to 15mm/s and the airblast overpressure limit to 125 dB (Lin Peak) for 95% of the controlled blasts. Increasing the limits will minimise the overall number of blasts, blasting program duration and the extent of rock hammering works in the St Helena Road area. These proposed changes to the vibration and airblast overpressure limits are currently being discussed in consultation with affected residents and require Department of Planning and Infrastructure approval.

What are the blasting mitigation measures?

Affected residents will be informed prior to any controlled blast. Public safety and government guidelines require that all people, vehicles and livestock are a safe distance away from the blast zone. To ensure people are at a safe distance from each blast, mitigation measures may include: -

- Temporary closure of access locations to local roads, and property accesses (residents will be notified in advance).
- Stopping of traffic on St Helena Road for up to 10 minutes and 'rolling stoppages' on the Pacific Highway. These measures will be coordinated to ensure that they have minimal impact on the local community. Provision willl be made to ensure that emergency access is maintained during any road closures.
- For safety reasons, some residents within close proximity to controlled blasts may be asked to remain indoors or be temporarily relocated during controlled blasting (open cut blasting only). The community relations team will be in contact with affected residents in advance.

These mitigation measures relate to the controlled open cut blasting only. The controlled tunnel blasting is contained within the tunnel and, as such, it is not envisaged that any specific mitigation measures will be required.

What about the safety of animals and pets during open cut blasting?

It is advisable to keep smaller pets inside during blasting for their safety and wellbeing. Animals in paddocks should be checked before and after controlled blasting. The community relations team will provide specific timing details to those residents with nearby animals in paddocks on an individual basis.

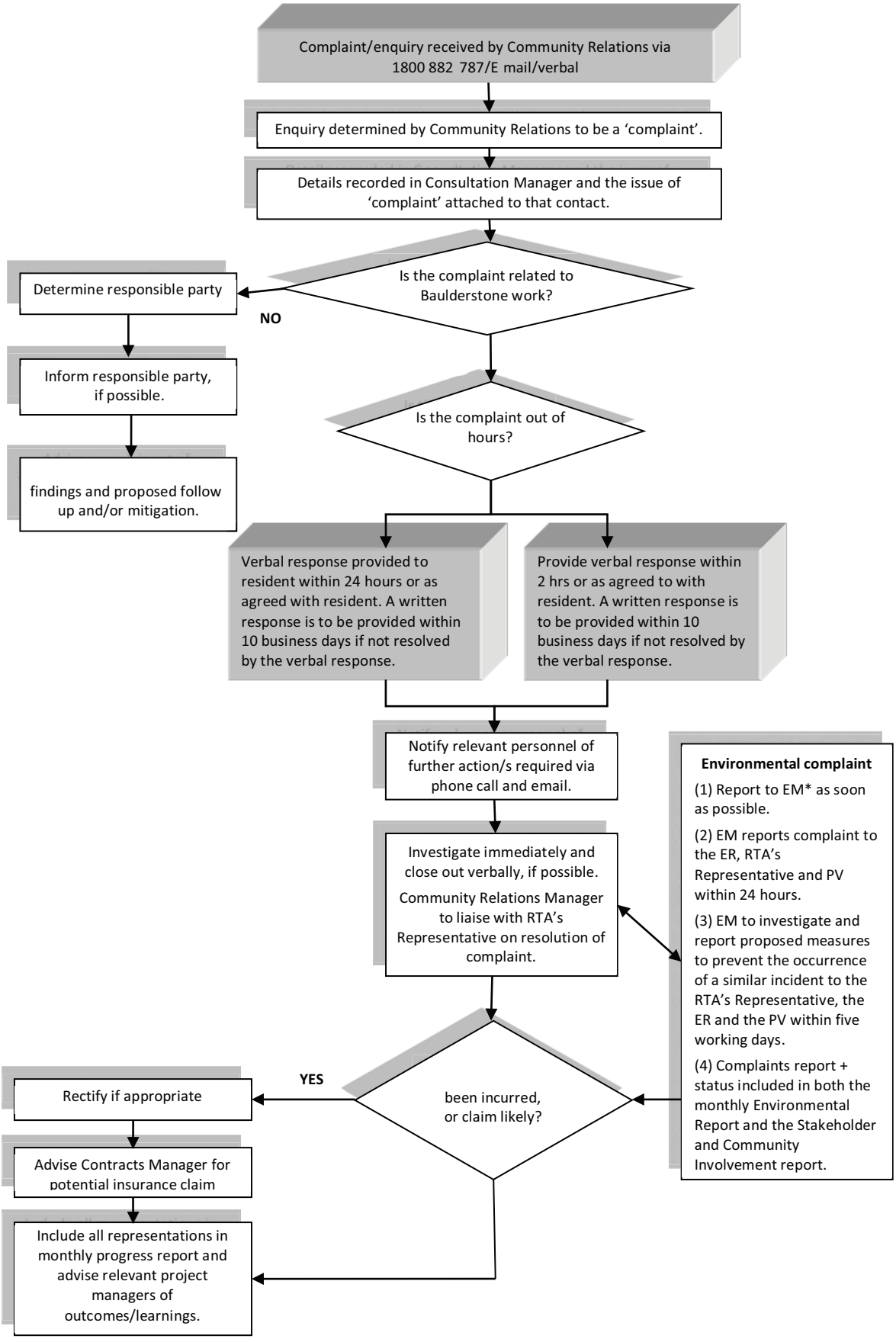
What should I do if I have valuables and antiques in my house?

Whilst there should be no discernable impact for most residents from the blasting operations, it may be advisable, as a precautionary measure, to remove any valuables and antiques from shelves or walls during the controlled blasting works. The project team will be available to inspect individual properties and provide additional guidance on this matter on a case by case basis.

What should I do if I think my house has been damaged?

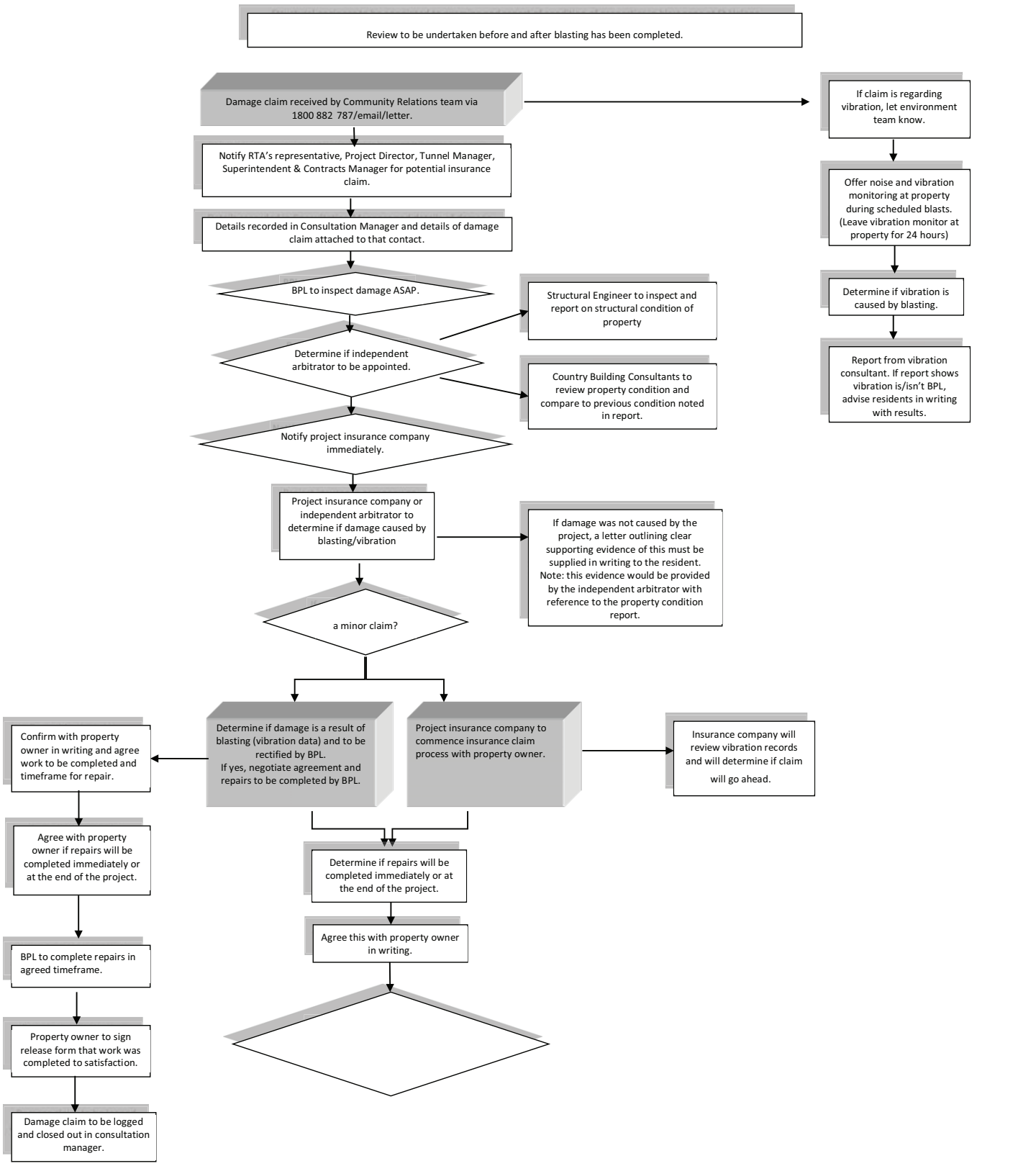
In the unlikely event that any damage is sustained to your property during the blasting process please contact the Community Relations Manager immediately on 1800 882 787 (free call). The project team will organise to have the damage inspected and will monitor your dwelling during future blasts to determine if the controlled blasting has caused the damage. Any damage sustained as a result of the controlled blasting works will be rectified.

Appendix 9 – Complaints Management Procedure


Complaint/enquiry received by Community Relations via 1800 882 787/E mail/verbal
Enquiry determined by Community Relations to be a 'complaint'.
Details recorded in Consultation Manager and the issue of 'complaint' attached to that contact.
Is the complaint related to Baulderstone work?
NO
Determine responsible party
Inform responsible party, if possible.
findings and proposed follow up and/or mitigation.
Is the complaint out of hours?
Verbal response provided to resident within 24 hours or as agreed with resident. A written response is to be provided within 10 business days if not resolved by the verbal response.
Provide verbal response within 2 hrs or as agreed to with resident. A written response is to be provided within 10 business days if not resolved by the verbal response.
Notify relevant personnel of further action/s required via phone call and email.
Investigate immediately and close out verbally, if possible.
Community Relations Manager to liaise with RTA's Representative on resolution of complaint.
been incurred, or claim likely?
YES
Rectify if appropriate
Advise Contracts Manager for potential insurance claim
Include all representations in monthly progress report and advise relevant project managers of outcomes/learnings.
Environmental complaint
(1) Report to EM* as soon as possible.
(2) EM reports complaint to the ER, RTA's Representative and PV within 24 hours.
(3) EM to investigate and report proposed measures to prevent the occurrence of a similar incident to the RTA's Representative, the ER and the PV within five working days.
(4) Complaints report + status included in both the monthly Environmental Report and the Stakeholder and Community Involvement report.

Appendix 10 – Damage Claim Procedure

DAMAGE CLAIM PROCEDURE – RESIDENTS WITHIN 500M OF ST HELENA TUNNEL



Appendix 11 – Tunnelling Diagram

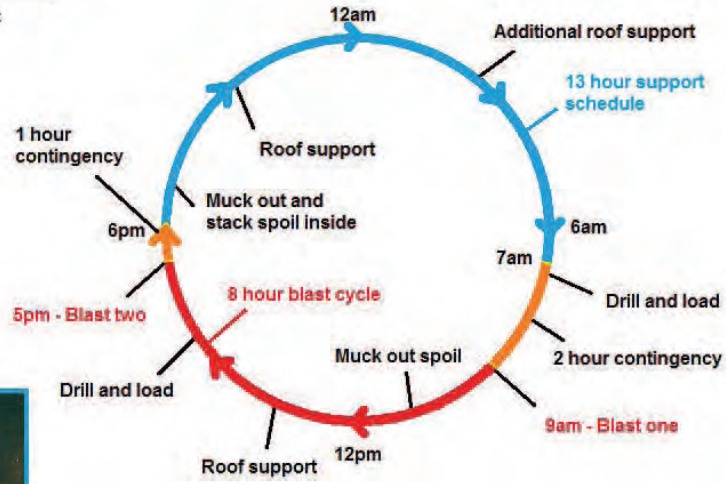
Installing rock bolts to provide roof support

4

Additional roof support - shotcrete

5

Optimised
24 Hour Schedule



Drilling blast holes

1

Mucking out spoil

3

Loading explosives into drill holes

2

Appendix 12 – Trial Blast Report

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TRIAL BLAST REPORT

Pacific Highway Upgrade
Tintenbar to Ewingsdale

Client: Roads and Maritime Services (RMS)

Document Number: RPT-ENV-006 Rev 0

APPROVALS	Prepared by: Shashi Ranggaraja Project Engineer		30/10/2012
	Reviewed by: Mark Dowell Project Manager	M.R.Dowell	30/10/12
	Approved by: Dave Packer Construction Manager	D Packer	31/10/12

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Appendix 6 – Monitor Distances to Houses (Additional input).
Appendix 7 – John Heilig Review

TRIAL BLAST

1.1.1 INTRODUCTION

This report collects the data recorded at the Southern Portal Trial Blast completed on Friday the 19th October 2003.

The trial blast is required to;

1. Satisfy and release the hold point nominated by G36 "Results of vibration trial, dominant frequencies of vibration, upper limit "component" peak particle velocities and derived safe operating distances for each item of major plant."; and
2. Enable Baulderstone blast to better determine the site characteristics in the area of the blast and for the future activities of the open cut excavation and the tunnel excavation located nearby and within the similar geological setting.

The trial blast was completed in accordance with Australian Standard 2198.2-2006 – *Explosives – Storage and Use, Part 2: Use of Explosives* (AS2187.2-2006) and as set out in CWMS-TPW-003 TRIAL BLAST.

The trial blast required a number of small blasts to be initiated with the resulting vibration to be monitored at various know locations, the recovered data is then analysed to and compared to the initial assumptions made.
AS 2187.2 – 2006 part J7.3- Ground Vibration provides an estimate of expected vibration levels in "average conditions" using the site constant values for K_g and B in the formula

$V=K_g (R/Q^{1/2})^{-B}$

Where
V = ground vibration as a vector peak particle velocity in millimetres per second
R = distance between charge and point of measurement in metres
Q= maximum instantaneous charge in Kilograms
K_g, B= constants related to site and rock properties for estimation purposes.

OBJECTIVE OF TRIAL BLAST

- To release the G36 Hold Point;
- To establish a procedure for monitoring ground vibration;
- To determine the influence of blast design parameters on ground vibration;
- To establish site law correlations as per RTA D&C G36 CL6.8

CONTROLLING CRITERIA

Drill and blast works on this project will be Limited by the requirements of the Ministers Conditions of Approval.

Ministers Conditions of Approval requirements

The Proponent shall ensure that air blast overpressure generated by blasting associated with the Project does not exceed the criteria specified in Table A when measured at the most affected residence or other sensitive receiver.

Table A - Air blast Overpressure Criteria	
Air blast Overpressure (dB(Lin Peak))	Allowable Exceedance
115	5% of total number of blasts over a 12 month period
120	Never

The Proponent shall ensure that ground vibration generated by blasting associated with project does not exceed the criteria specified in Table B when measured at the most affected residence or other sensitive receiver.

Table B - Peak Particle Velocity Criteria	
Peak Particle Velocity (mms^{-1})	Allowable Exceedance
5	5% of total number of blasts over a 12 month period
10	Never

The trial blasting works was conducted in accordance with these conditions.

TRIAL RESULTS

TRIAL BLAST 1

Target vibration at the nearest sensitive receiver, V=3.93 mms^{-1}
Distance to the nearest sensitive receiver, R=135m
Charge weight, Q= 2.4kg
Site constants (assumed), K=5000, B= -1.6

Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor Type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance m - Blast to monitor	185	173	143	135	135	145	161
Predicted PPV mms [1]	2.38	2.64	3.59	3.93	3.93	3.51	2.97
Actual Reading Peak Particle velocity mms [1] (Tran)	DNT*	DNT*	DNT*	1.00	DNT*	1.05	1.11
Actual Reading Peak Particle velocity mms [1] (Vert)	DNT*	DNT*	DNT*	0.50	DNT*	0.65	0.41
Actual Reading Peak Particle velocity mms [1] (Long)	DNT*	DNT*	DNT*	0.75	DNT*	0.60	1.05
Vector sum PPV mms [1]				1.05		1.05	1.38
Decibel (db)	0.00	0.00	0.00	94.50	0.00	99.50	98.80

**Did not trigger*

TRIAL BLAST 2

Target vibration at the nearest sensitive receiver, V=3.33 mms^{-1}
Distance to the nearest sensitive receiver, R=122m
Charge weight, Q= 2.4kg
Site constants (assumed), K=3600, B= -1.6

Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor Type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance m - Blast to monitor	165	154	127	122	122	157	179
Predicted PPV mms [1]	2.05	2.29	3.12	3.33	3.33	2.22	1.80
Actual Reading Peak Particle velocity mms [1] (Tran)	DNT*	DNT*	0.43	0.80	DNT*	0.75	DNT*
Actual Reading Peak Particle velocity mms [1] (Vert)	DNT*	DNT*	0.46	0.40	DNT*	0.55	DNT*
Actual Reading Peak Particle velocity mms [1] (Long)	DNT*	DNT*	1.10	0.50	DNT*	0.55	DNT*
Vector sum PPV mms [1]			1.13	0.78		0.91	
Decibel (db)	0.00	0.00	100.00	97.00	0.00	101.00	0.00

**Did not trigger*

TRIAL BLAST 3

Based on above value, the predicted PPV and actual reading for each monitors are as below.
Target vibration at the nearest sensitive receiver, V=3.93 mms^{-1}
Distance to the nearest sensitive receiver, R=121 m
Charge weight, Q= 4.8 kg
Site constants (assumed), K=2800, B= -1.6

Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor Type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance m - Blast to monitor	181	168	133	121	121	131	153
Predicted PPV mms [1]	2.40	2.70	3.93	4.57	4.57	4.02	3.14
Actual Reading Peak Particle velocity mms [1] (Tran)	1.41	1.37	0.87	1.60	1.65	1.70	3.05
Actual Reading Peak Particle velocity mms [1] (Vert)	0.62	0.64	1.21	1.15	0.87	1.25	1.06
Actual Reading Peak Particle velocity mms [1] (Long)	1.25	1.38	1.54	1.40	2.02	1.30	3.33
Vector sum PPV mms [1]	1.60	1.68	1.76	1.94	2.03	1.84	4.54
Decibel (db)	101.00	100.00	102.80	107.00	106.00	107.00	106.50

**Did not trigger*

TRIAL BLAST 4

Target vibration at the nearest sensitive receiver, V=5.02 mms^{-1}
Distance to the nearest sensitive receiver, R=114m
Charge weight, Q= 4.8kg
Site constants (assumed), K=2800, B= -1.6
Distance from monitor to house is 13 M where the predicted V=4.23 mms^{-1}

Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor Type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance m - Blast to monitor	168	156	122	114	114	141	167
Predicted PPV mms [1]	2.70	3.04	4.51	5.02	5.02	3.58	2.73
Actual Reading Peak Particle velocity mms [1] (Tran)	1.02	1.08	1.11	2.15	1.52	1.55	2.06
Actual Reading Peak Particle velocity mms [1] (Vert)	0.54	0.65	1.16	1.05	0.87	1.05	0.91
Actual Reading Peak Particle velocity mms [1] (Long)	0.94	1.32	2.40	1.15	1.16	1.40	2.81
Vector sum PPV mms [1]	1.33	1.66	2.74	2.37	1.96	1.64	3.24
Decibel (db)	95.90	97.50	109.50	98.00	104.90	100.00	101.00

**Did not trigger*

SUMMARY OF RESULTS

The dominant frequencies of vibration; was found to be is 30 hz.
The maximum upper limit "component" peak particle velocities; were found to be 3.33 mms^{-1} during blast 3 at the [redacted] monitor.
The derived safe operating distances for each item of major plant; this is not required as the G36 specification is referring to mobile plant however in this instance the causal variable is the charge weight rather than the distance of a particular machinery.

DISCUSSION OF RESULTS

The charges used provided vibration that was generally lower than what was expected.
The monitors were installed in accordance with AS 2187.2 part J3.2.2 and as such were closer to the blast site than the sensitive receiver; they are likely to experience a higher vibration and air blast over pressure peak than the sensitive receiver.

The monitor at the [redacted] farm measured the highest peak particle velocities for 3 of the 4 trials even though this monitor was further away than other monitors that measured lower values of vibration.

CONCLUSIONS AND RECOMMENDATIONS

The Trial has been completed in accordance with G36 and consequently the Hold Point is to be released

The procedure to monitor ground vibration and air blast proved successful.

The results from the trial provide confirmation that the preliminary modelling (with a K_g of 3090 and B of-1.60) is suitable to be used in the near future, once further data is recovered BPL the site constants may be modified.

If possible a further monitoring site should be located closer to the blast site (around 50m) to provide a better spread of results.

APPENDIX 1 - BLAST TIMETABLE / COUNT DOWN PROCEDURE & BLAST GUARDS AND TRAFFIC CONTROLLER LOCATIONS

BLASTING TIMETABLE / COUNTDOWN PROCEDURE

Agreed Radio Channel : Blast operation channel : UHF 66

Blast date : 19/10/12 **Blast Controller - Ian McPhillamy (Goldie)**

Location of Blast: (Southern Portal) St.Helena Tunnel **0418672265**

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TRIAL BLAST 1 , 2 & 3

From	To	Mins	Description	Responsibility	Completed
		120 min	1.Inform vibration monitoring technician / site eng. To setup monitoring unit in sensitive receiver areas.	BK /SKR/Super	
		30 mins	1. Prestart Run Blast countdown procedure to blast guards.	BK /SKR/Super	
			A.) Weather check specifically wind direction and strength.	BK /SKR/Super	
			B.)Blast guards at compound for sign on and briefing.	All guards	
			C.)Blast Guards dispatched to their locations.	All guards	
			D.) Complete parking up gear and clear area .	F/man & Super	
			E.)Confirm all blast monitors active	BK /SKR/Super	
Count down -22 min Restart point			1.Contact Blast controller / blast guard to ensure that blast may proceed as planned.	BK/ SKR/ Shot firer	
		15 mins	2.Blast controller / blast guard to give feedback to shotfirer to Confirm construction & blast area is **"ALL CLEAR "**. Blast guards can call at any time to stop blast operation by clearly stating **" Abort Blast" "Abort Blast "** the blast operation if any issue arises.The shot firer will stop all activities and will hand over the site to blast guards.Once the issues are resolved , shotfirer will start countdown from **-22 min stage.**	All blast guards/Super	
			3.Any issue raised will be investigated and will be assessed immediately whether to proceed,postpone or to abort the blast operation.	Super/gen.Super/ Project Manager/Area Manager.	
			Confirm "all clear" from blast guards to shotfirer	All blast guards	
Count down -7 min Restart point			1. Ensure all plant,personnel are in safe zone.Inclusive areas along alignment and neighbouring areas.All local roads to be blocked if necessary.	All blast guards	
		5 mins	1.Blast guard to hand over site to shotfirer to make final connection to fire the shot.	All blast guards	
			A.) Confirm to Donnelly Drill and Blast to make final tie up and run out leads	Blast Controller	
			B.) Donnelly's to confirm all Det's are ready to go.	Shot Firer	
			C.) TC to stop traffic on local roads (st.Helena) confirm st.helena haul roads are clear.	TC & Super	
			D.) Shot firer to Announce "Blast in Southern portal in 2 mins"	Shot Firer	
		1 Mins	1. Count Down with siren 1st Siren Blow	shotfirer	
		30 secs	1. Count Down with siren 2nd Siren Blow 2. Shot firer to Announce " Blast in Southern portal in 30 secs "	shotfirer	
		30 secs	1. Step 1 verbal countdown 10 to 6 seconds. Step 2 Radio silence until shot firer detonates the blast. 2.During final countdown,Blast guards can call at any time to stop blast operation by clearly stating **" Abort Blast" "Abort Blast "** the blast operation if any issue arises.The shot firer will stop all activities and will hand over the site to blast guards.Once the issues are resolved , shotfirer will start countdown from **-7 min stage.**	Shot Firer / Blast Guards	
		0:00	**FIRE SHOT**		
		30 Mins	3.After the blast when the explosive gasess dissipate, "All CLEAR GO " signal will be given to the blast guards.	Shot Firer	
			Traffic control and blast guard to confirm local roads/ properties are clear of debris.	TC & Blast guards	
			4. Blast guard will confirm their area is safe and will open for normal activities.	Shot Firer	
			a.) Donnelly to advise T2E that shot is clear and hand site back to Blast Controller or Area Superintendant.	BK/ SKR/ Shot firer	
			b.) Release local roads and movement on properties	TC All Guards	
			c.) Blast guards to return to yard and blast debrief as required.	All Guards Blast Controller	
		1 hours	d.) Collection oF Vibration Data and recalculate for Next blast	BK/ SKR/ Shot firer	

Blast guard Locations	Blast Guards Name	Contact No.
1	Greg Brearley	0407033633
2	Peter Burk	0404812210
3	Chris Facey	0400720461
4	Brent Allerby	0419700725
5	Traffic controller 1	
6	Traffic controller 2	

Project team contact details - Other Emergency Personnel		
Position / Role	Name	Phone
General Superintendent	Ian Shilling	0439 074 634
Construction Manager	Dave Packer	0418 281 532
Project Manager	Mark Dowel	0404 812 134
Safety Manager	Derek Billing	0420 301 356
Road Works Area Manager	Brendon Kirkwood	457883189
Senior Project Engineer	Ian Webb	0403 611 756
Project Engineer	Shashi Ranggaraja	0408 510 951
Tunnel Superintendent	Ian McPhillamy	0418 672 265
Tunnel Superintendent	Peter Burk	0404 812 210
Environmental Manager	Chris McCallum	0408 264 164
RTA's Representative	Peter Borelli	0407 254 363
RTA's Representative	Tobias Jones	423773183
RMS' Environmental Officer	Claire Everett	0428 288 525
Environmental Representative	Bill Gardyne	0414 936 639
Manager Roads and Infrastructure Projects	Michael Young	(02) 9228 6437
Community Relations Manager	Susan Scott	0427 758 719

Allocated blast Visitor's name

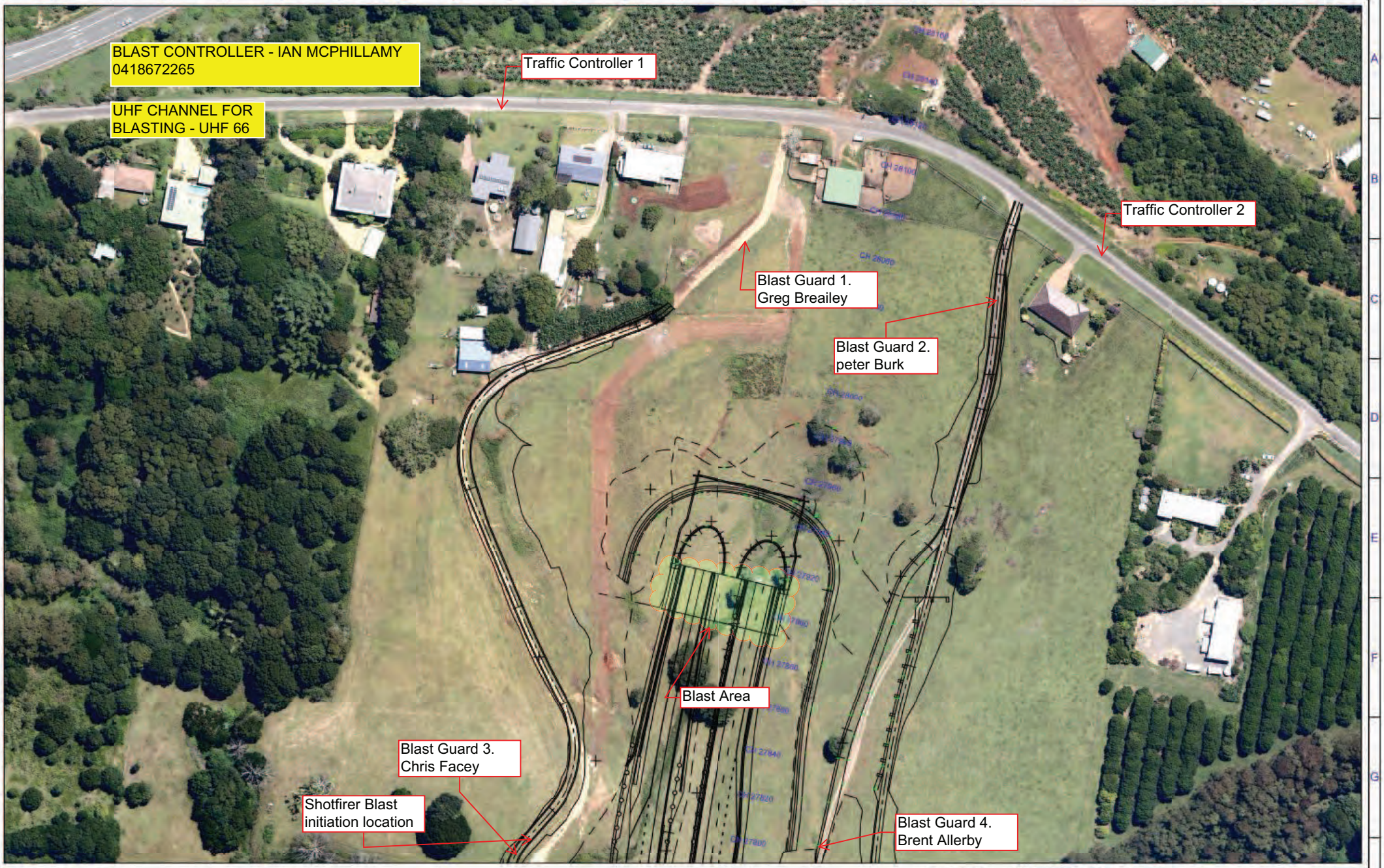
Nos.	Name	Contact
1		
2		
3		
4		
5		
6		
7		

COMMENTS FROM PRE-START

IF BLAST GUARDS IDENTIFY AN ISSUE AT ANY TIME PRIOR TO COUNTDOWN , THEN THEY ARE TO USE THE **RADIO CHANNEL 66** PROVIDED

AND CLEARLY STATE "....ABORT BLAST , ABORT BLAST..."

Blast controller or Shot Firer will abort count down and ask relevant guard to state location and reason for aborting the blast.
Please be direct and say off the channel unless required to provide information!
Listen for further instruction.



GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY EM

CHECKED

VERIFIED

SCALE 1500

PLOT DATE: Wed Oct 17 10:23:06 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale
SOUTHERN PORTAL
BLAST GUARDS LOACTIONS

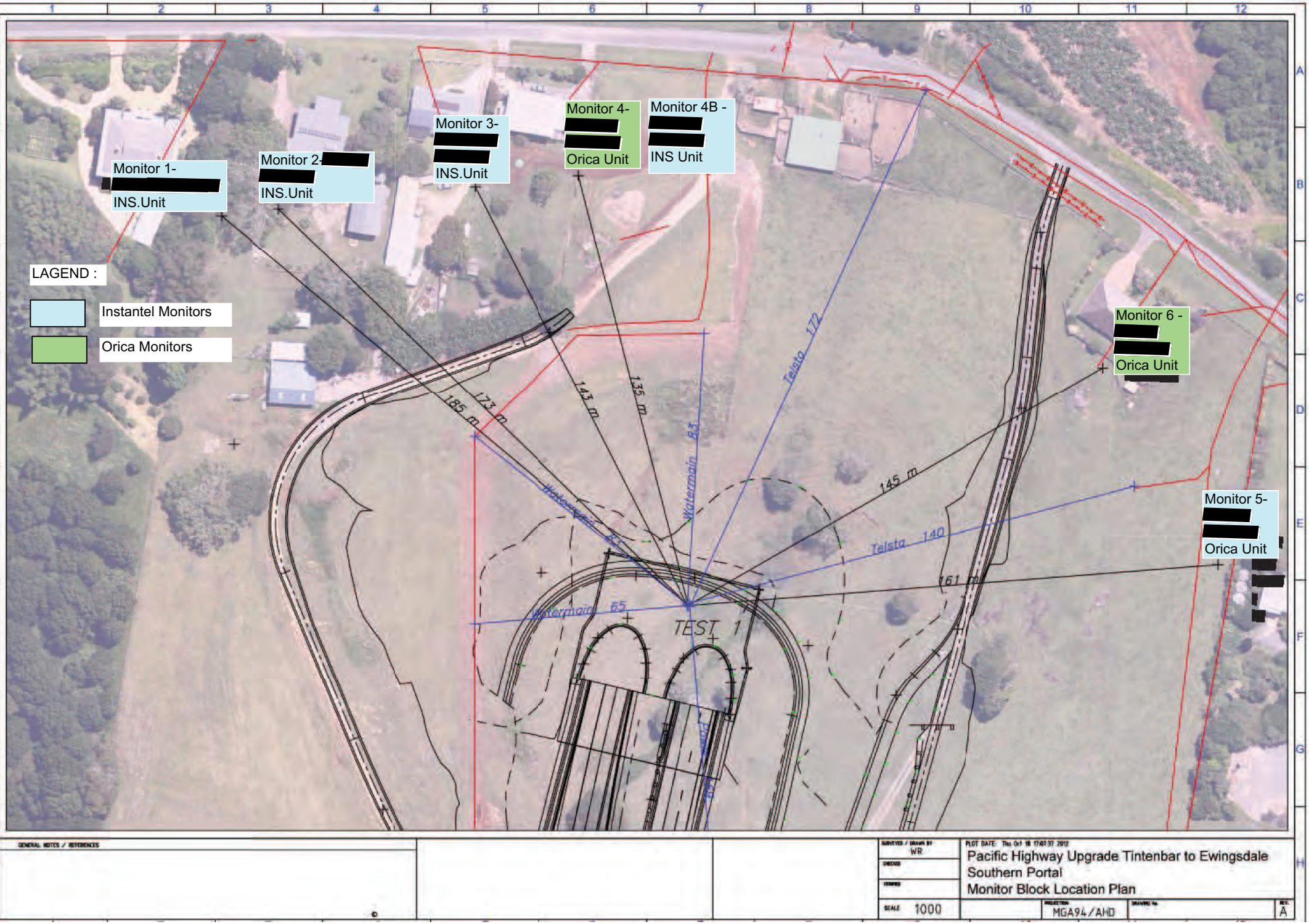
PROJECTION MGA94/AHD

DRAWING No.

REV. A

APPENDIX 2 - TRIAL BLAST 1 RECORDS

TRIAL BLAST - TEST 1



GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY WR

CHECKED

VERIFIED

SCALE 1000

PLOT DATE: Thu Oct 18 17:07:37 2012

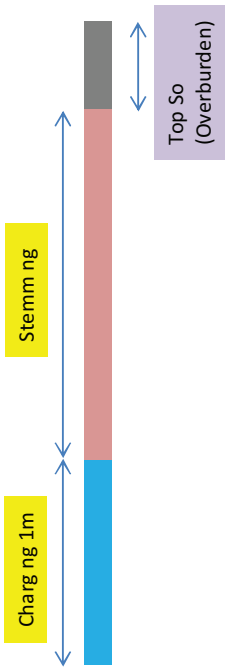
Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan

PROJECTION MGA94 / AHD

DRAWING No.

REV. A

Trial Blast operation St. Helena tunnel
Project : T2E Baulderstone
Date : 19/10/2012



Drill Log-Trial Blast 1

Hole No.1

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**102.607**
Total Depth	=	**4.5 m**
Top soil Depth	=	**0.5m**
Rock Depth	=	**4 m**
Hole size	=	**76 mm**
Charging kg	=	2.4 kg
Stemming Length	=	3.4 m

Date: 19/10/12 **Location:** **St.Helena tunnel Portal** **Scope of work : Defining K value**

Day: Friday **Subject :** **Trial Blast 1**

	From Trial Blast 1
Distance Vibration Monitors [redacted]	185 M
Distance Vibration Monitors [redacted]	173 M
Distance Vibration Monitors [redacted]	143 M
Distance Vibration Monitors [redacted]	135 M

	From Trial Blast 1
Distance Vibration Monitors [redacted]	135 M
Distance Vibration Monitors [redacted]	145 M
Distance Vibration Monitors [redacted]	161 M

BLAST PATTERN referances	
Blast parameters :-Trial Blast 1	
Time Of Blast	10:37
Decks per Hole	1
Rock density (tne/m^3)	2.98
Total Charge Wt/Hole kg	2.4
Total Charge Wt kg	2.4
Total Hole	1
Powder Factor (kg/m³)	0.00
KG/DECK	2.4
Hole Diameter (M)	0.076
Hole Angle (deg)	0
Hole Total depth (M)	4.5

Top soil overburden	0.5
Depth in Rock	4
Stemming in rock (M)	3.4
Sub drill (M)	0
Burden (M)	0
Spacing (M)	0
Bottom charge height (mm)	0.00
Intermediate charge height (m)	0.00
Yield/ blasthole M³	
Burden stiffness ratio (> 3.5 good frag)	
K Value used	

Trial Blast 1 - Vibration Monitors reading

	Trial Blast 1 Vibration Data						
Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor Type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance From Trial Blast 1	185 M	173 M	143 M	135 M	135 M	145 M	161 M
Data Tran	0.00 mm/s	0.00 mm/s	0.00 mm/s	1.00 mm/s	0.00 mm/s	1.05 mm/s	1.11 mm/s
Data Vert	0.00 mm/s	0.00 mm/s	0.00 mm/s	0.50 mm/s	0.00 mm/s	0.65 mm/s	0.41 mm/s
Data Long	0.00 mm/s	0.00 mm/s	0.00 mm/s	0.75 mm/s	0.00 mm/s	0.60 mm/s	1.05 mm/s
VPPV				1.05 mm/s		1.05 mm/s	1.38 mm/s
Decibel (db)	0.00	0.00	0.00	94.50	0.00	99.50	98.80
Highest Peak Chosen	0.00 mm/s	0.00 mm/s	0.00 mm/s	1.00 mm/s	0.00 mm/s	1.05 mm/s	1.11 mm/s
Q^1/2	1.55	1.55	1.55	1.55	1.55	1.55	1.55
Value K based on Higest PPV	0	0	0	1272	0	1497	1871

Trial Blast 1 Highest K value 1871

Instantel — Event Report — BAULDERSTONE

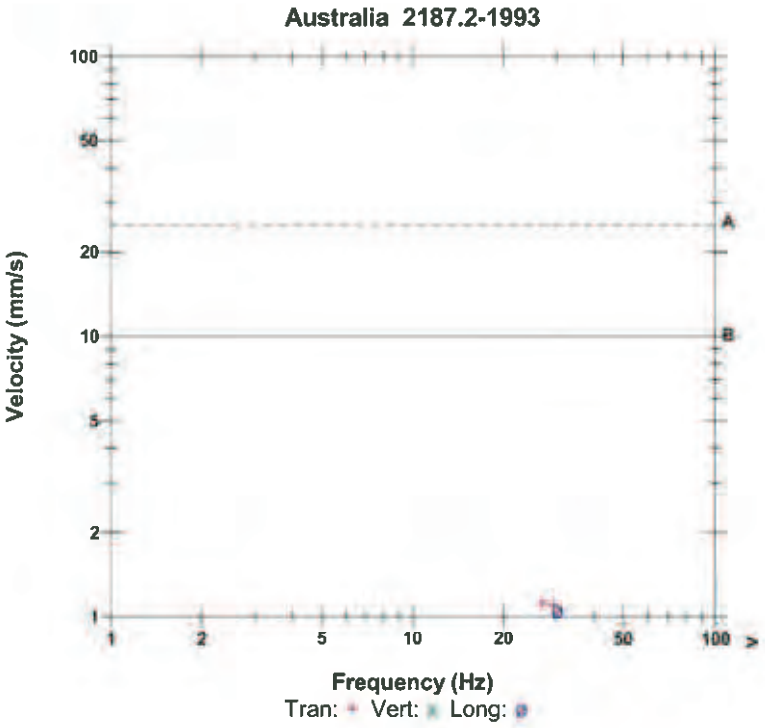
Date/Time	Tran at 10:37:00 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 5, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

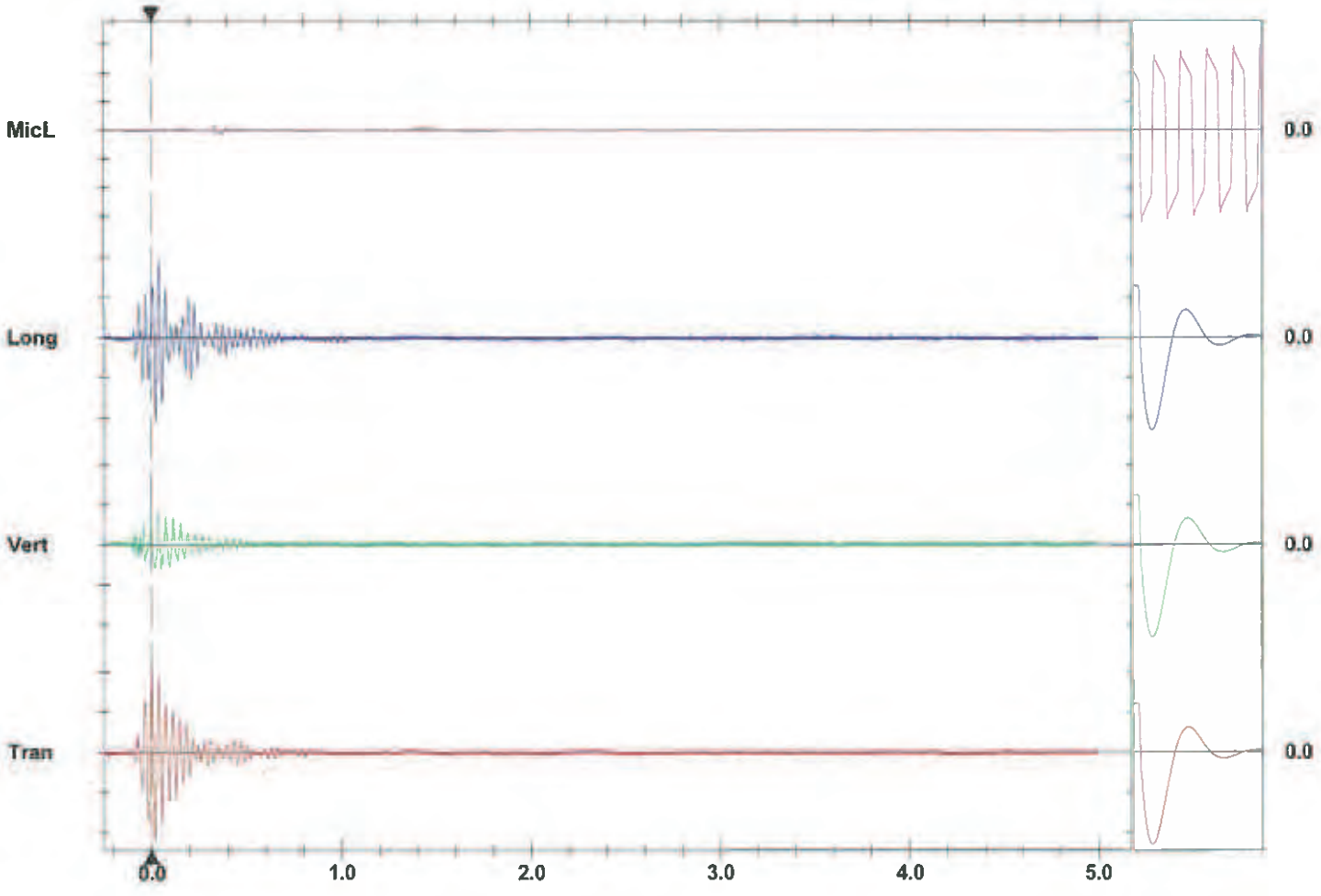
Extended Notes
Trial blast at St Helena, South Portal.

Microphone	Linear Weighting
PSPL	98.8 dB(L) at 0.332 sec
ZC Freq	45 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 526 mv)

	Tran	Vert	Long	
PPV	1.11	0.413	1.05	mm/s
PPV	51.9	43.3	51.4	dB
ZC Freq	27	33	30	Hz
Time (Rel. to Trig)	0.020	0.038	0.024	sec
Peak Acceleration	0.0331	0.0166	0.0265	g
Peak Displacement	0.00638	0.00221	0.00535	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.6	7.8	Hz
Overswing Ratio	3.8	3.5	3.4	

Serial Number	BE18978 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T978EIAO.5O0





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Wave Form

BAXXXX-T2E

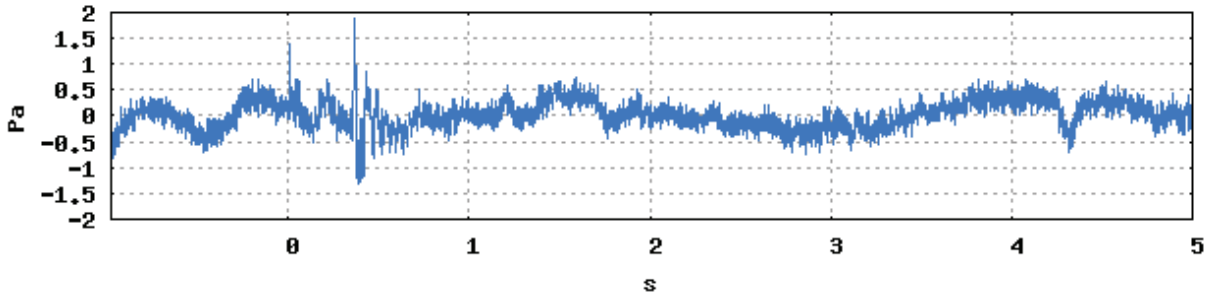
Print Close

Measurement Point	AIR001	GEO001	GEO001	GEO001
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 09:37:03	19/10/2012 09:37:03	19/10/2012 09:37:03	19/10/2012 09:37:03
Value	99.5 dBL	0.65 mm/s	0.60 mm/s	1.05 mm/s
	1.89 Pa	0.19 m/s2	0.16 m/s2	0.36 m/s2
	0.03 Pas	4.60 um	4.58 um	5.30 um
	27.1 Hz	42.8 Hz	26.8 Hz	29.0 Hz

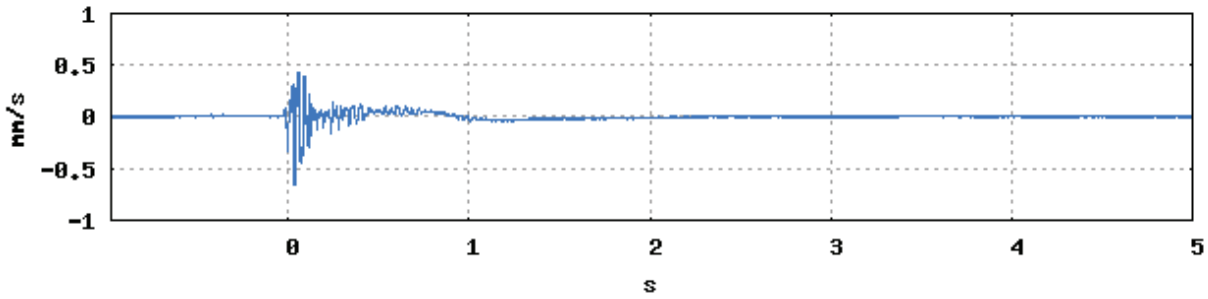
Display Format Picture

Create

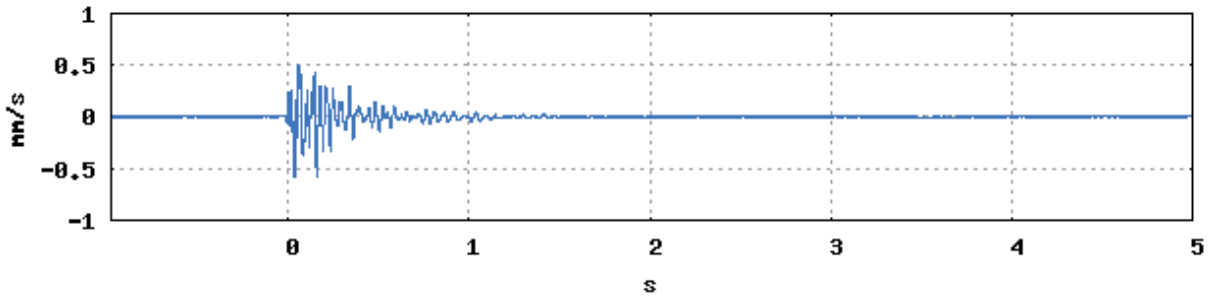
AIR001 Air shock



GEO001 Vertical



GEO001 Longitudinal

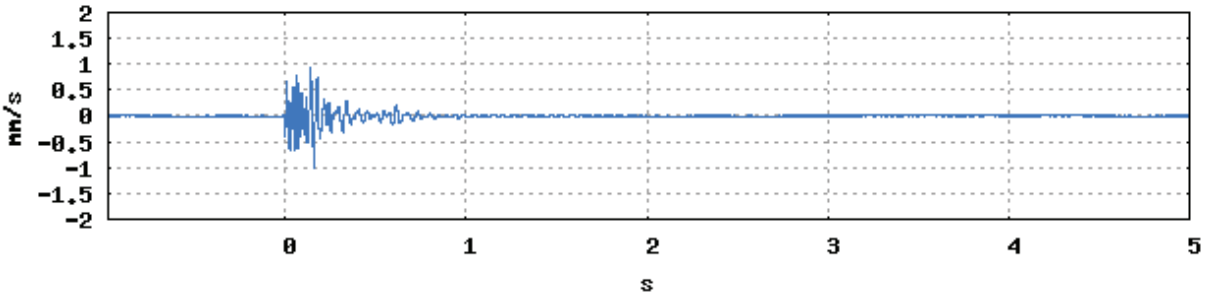


GEO001 Transversal

Demo Office

Wave Form

BAXXXX-T2E



Demo Office

Wave Form

BAXXXX-T2E

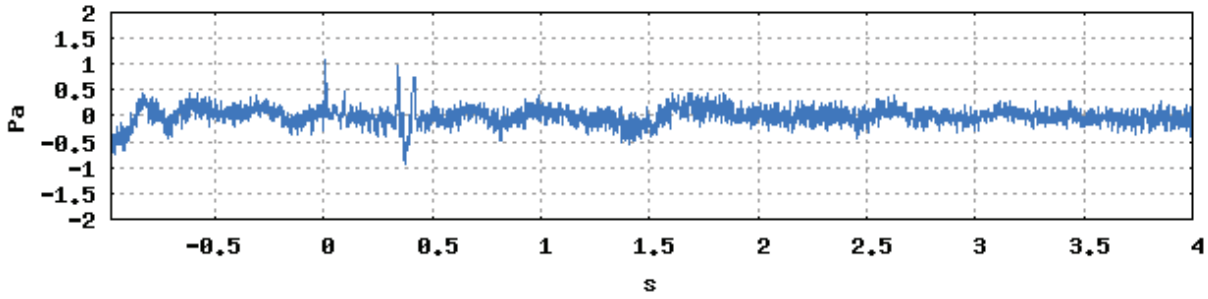
Print Close

Measurement Point	AIR002	GEO002	GEO002	GEO002
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 09:37:03	19/10/2012 09:37:03	19/10/2012 09:37:03	19/10/2012 09:37:03
Value	94.5 dBL	0.50 mm/s	0.75 mm/s	1.00 mm/s
	1.09 Pa	0.18 m/s2	0.24 m/s2	0.26 m/s2
	0.02 Pas	3.38 um	3.86 um	4.78 um
	60.2 Hz	27.4 Hz	41.3 Hz	33.4 Hz

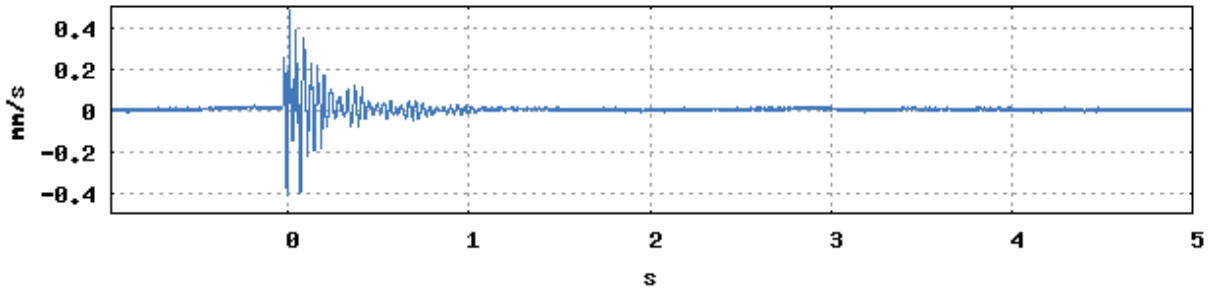
Display Format Picture

Create

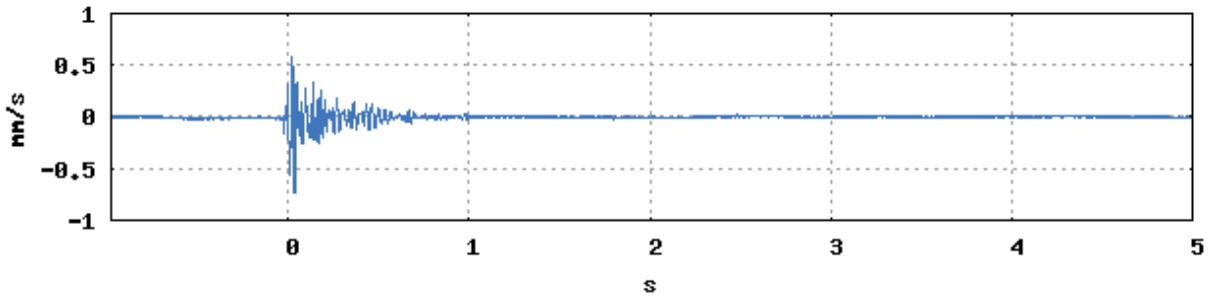
AIR002 Air shock



GEO002 Vertical



GEO002 Longitudinal

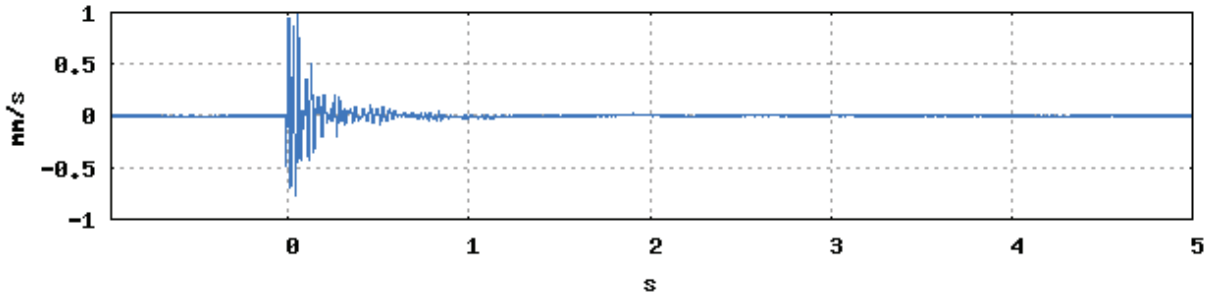


GEO002 Transversal

Demo Office

Wave Form

BAXXXX-T2E

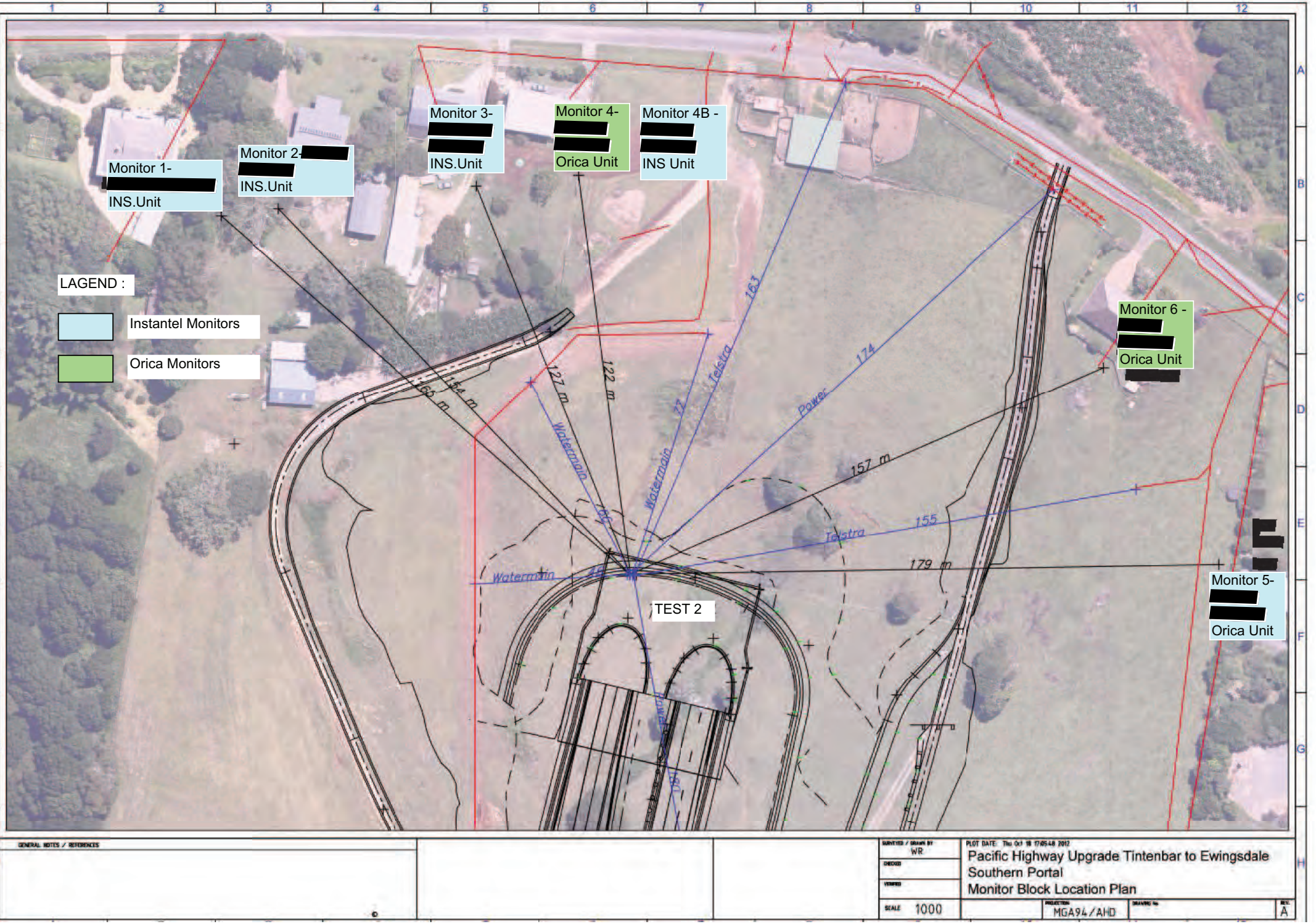


Orica SIGICOm vibration unit setup for Trial Blast 0n the 19/10/12.
Unit AIR001 = [redacted]
Unit AIR002 = [redacted]
Orica vibration units is registed based on QLD time.

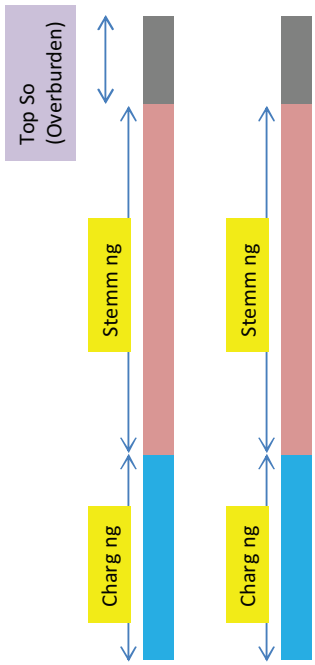
Measurement Point	Placement	Date	Time	Value	Unit	Limit	Part of Limit	Vppv	Distance	Round	Remark
GEO001 L		19/10/2012	10:51	0.05	mm/s	5	1	0.1 mm/s			
GEO001 T		19/10/2012	10:51	0.05	mm/s	5	1	0.1 mm/s			
AIR001		19/10/2012	10:46	115	dBL	115	100				
GEO001 V		19/10/2012	10:46	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	10:46	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	10:46	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	10:34	116	dBL	115	101				
GEO001 V		19/10/2012	10:34	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	10:34	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	10:34	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	10:21	117	dBL	115	102				
GEO001 V		19/10/2012	10:21	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	10:21	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	10:21	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	10:20	118	dBL	115	103				
GEO001 V		19/10/2012	10:20	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	10:20	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	10:20	0.05	mm/s	5	1	0.08 mm/s			
AIR002		19/10/2012	10:20	116	dBL	115	101				
GEO002 V		19/10/2012	10:20	0.05	mm/s	5	1	0.06 mm/s			
GEO002 L		19/10/2012	10:20	0.05	mm/s	5	1	0.06 mm/s			
GEO002 T		19/10/2012	10:20	0.05	mm/s	5	1	0.06 mm/s			
AIR002		19/10/2012	9:49	115	dBL	115	100				
GEO002 V		19/10/2012	9:49	0.05	mm/s	5	1	0.07 mm/s			
GEO002 L		19/10/2012	9:49	0.05	mm/s	5	1	0.07 mm/s			
GEO002 T		19/10/2012	9:49	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	9:37	99.5	dBL	115	87				TR AL BLAST 1
AIR002		19/10/2012	9:37	94.5	dBL	115	82				
GEO001 V		19/10/2012	9:37	0.65	mm/s	5	13	1.05 mm/s			
GEO001 L		19/10/2012	9:37	0.6	mm/s	5	12	1.05 mm/s			
GEO001 T		19/10/2012	9:37	1.05	mm/s	5	21	1.05 mm/s			
GEO002 V		19/10/2012	9:37	0.5	mm/s	5	10	1.05 mm/s			
GEO002 L		19/10/2012	9:37	0.75	mm/s	5	15	1.05 mm/s			
GEO002 T		19/10/2012	9:37	1	mm/s	5	20	1.05 mm/s			
AIR001		19/10/2012	8:13	94.5	dBL	115	82				
GEO001 V		19/10/2012	8:13	0.25	mm/s	5	5	0.46 mm/s			
GEO001 L		19/10/2012	8:13	0.3	mm/s	5	6	0.46 mm/s			
GEO001 T		19/10/2012	8:13	0.4	mm/s	5	8	0.46 mm/s			
AIR001		19/10/2012	8:09	96	dBL	115	83				
GEO001 V		19/10/2012	8:09	2	mm/s	5	40	2.5 mm/s			
GEO001 L		19/10/2012	8:09	1.65	mm/s	5	33	2.5 mm/s			
GEO001 T		19/10/2012	8:09	0.45	mm/s	5	9	2.5 mm/s			
AIR002		19/10/2012	7:44	94	dBL	115	82				
GEO002 V		19/10/2012	7:44	1.85	mm/s	5	37	3.12 mm/s			
GEO002 L		19/10/2012	7:44	1.05	mm/s	5	21	3.12 mm/s			
GEO002 T		19/10/2012	7:44	2.4	mm/s	5	48	3.12 mm/s			

APPENDIX 3 - TRIAL BLAST 2 RECORDS

TRIAL BLAST - TEST 2


Monitor 1-
[redacted]
INS.Unit
Monitor 2-
[redacted]
INS.Unit
Monitor 3-
[redacted]
INS.Unit
Monitor 4-
[redacted]
Orica Unit
Monitor 4B -
[redacted]
INS Unit
Monitor 6 -
[redacted]
Orica Unit
Monitor 5-
[redacted]
Orica Unit
LAGEND :
Instantel Monitors
Orica Monitors
TEST 2
154 m
127 m
122 m
157 m
179 m
Watermain
Telstra
Power
GENERAL NOTES / REFERENCES
WR
1000
MGA94 / AHD
A
Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan

Trial Blast operation St. Helena tunnel
Project : T2E Baulderstone
Date : 19/10/2012



Drill Log-Trial Blast 2

Hole No.1

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**108.253**
Total Depth	=	**6.6 m**
Top soil Depth	=	**2.6 m**
Rock Depth	=	**4 m**
Hole size	=	**76 mm**
Charging kg	=	2.4 kg
Stemming Length	=	3.4 m

Hole No.2

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**108.296**
Total Depth	=	**6.5 m**
Top soil Depth	=	**2.5 m**
Rock Depth	=	**4 m**
Hole size	=	**76 mm**
Charging kg	=	2.4 kg
Stemming Length	=	3.4

Date: 19/10/12 **Location:** **St.Helena tunnel Portal** **Scope of work : Defining K value**

Day: Friday **Subject :** **Trial Blast : 2**

	From Trial Blast 2
Distance Vibration Monitors [redacted]	165 M
Distance Vibration Monitors [redacted]	154 M
Distance Vibration Monitors [redacted]	127 M
Distance Vibration Monitors [redacted]	122 M

	From Trial Blast 2
Distance Vibration Monitors [redacted]	122 M
Distance Vibration Monitors [redacted]	157 M
Distance Vibration Monitors [redacted]	179 M

BLAST PATTERN referances	
Blast parameters :-Trial Blast 2	
Time Of Blast	12:18
Decks per Hole	1
Rock density (tne/m^3)	2.98
Total Charge Wt/Hole (kg)	2.4
Total Charge Wt (kg)	4.8
Total Hole	2
Powder Factor (kg/m³)	0.37
KG/DECK	2.4
Hole Diameter (M)	0.076
Hole Angle (deg)	0
Hole Total depth (M)	6.6

Top soil overburden	2.6 / 2.5
Depth in Rock	4
Stemming in rock (M)	3.4
Sub drill (M)	0
Burden (M)	1.8
Spacing (M)	1.8
Bottom charge height (mm)	0.00
Intermediate charge height (m)	0.00
Yield/ blasthole M³	12.96
Burden stiffness ratio (> 3.5 good frag)	2.22
K Value	

Trial Blast 2 - Vibration Monitors reading

	Trial Blast 2 Vibration Data						
Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance From Trial Blast 1	165 M	154 M	127 M	122 M	122 M	157 M	179 M
Data Tran	0.00 mm/s	0.00 mm/s	0.43 mm/s	0.80 mm/s	0.00 mm/s	0.75 mm/s	0.00 mm/s
Data Vert	0.00 mm/s	0.00 mm/s	0.46 mm/s	0.40 mm/s	0.00 mm/s	0.55 mm/s	0.00 mm/s
Data Long	0.00 mm/s	0.00 mm/s	1.10 mm/s	0.50 mm/s	0.00 mm/s	0.55 mm/s	0.00 mm/s
VPPV	0.00 mm/s	0.00 mm/s	1.13 mm/s	0.78 mm/s	0.00 mm/s	0.91 mm/s	0.00 mm/s
Decibel (db)	0.00	0.00	100.00	97.00	0.00	101.00	0.00
Highest Peak Chosen	0.00 mm/s	0.00 mm/s	1.10 mm/s	0.80 mm/s	0.00 mm/s	0.75 mm/s	0.00 mm/s
Q^1/2	1.55	1.55	1.55	1.55	1.55	1.55	1.55
Value K based on Higest PPV	0	0	1269	865	0	1214	0

Trial Blast 2 Highest K value 1269

Event Report

Date/Time	Long at 12:18:26 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 3, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

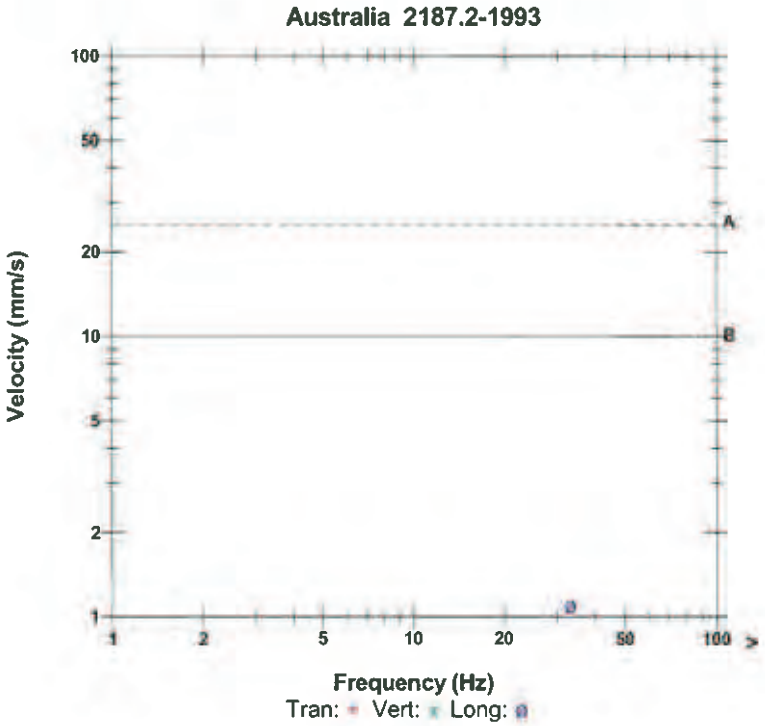
Extended Notes
Trial blast at St Helena, South Portal

Microphone	Linear Weighting
PSPL	100.0 dB(L) at 4.910 sec
ZC Freq	N/A
Channel Test	Passed (Freq = 20.5 Hz Amp = 524 mv)

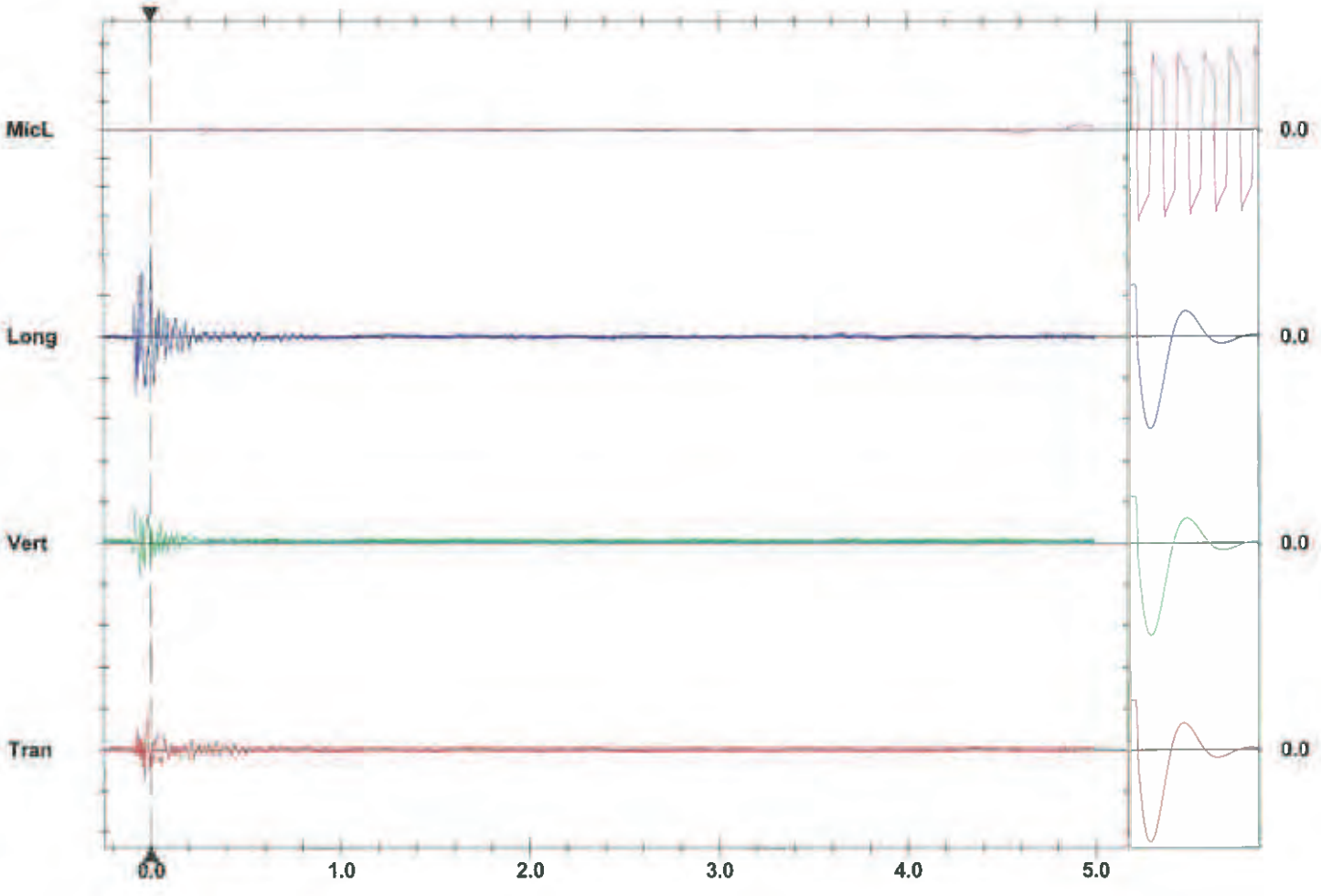
	Tran	Vert	Long	
PPV	0.429	0.460	1.10	mm/s
PPV	43.6	44.3	51.8	dB
ZC Freq	33	33	33	Hz
Time (Rel. to Trig)	-0.016	-0.085	0.001	sec
Peak Acceleration	0.0199	0.0199	0.0331	g
Peak Displacement	0.00186	0.00284	0.00551	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	7.3	7.4	Hz
Overswing Ratio	3.5	3.7	3.7	

N/A: Not Applicable

Serial Number	BE18976 V 10.40-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T976EIAS.UQ0



A - Industrial
B - Residential



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Wave Form

BAXXXX-T2E

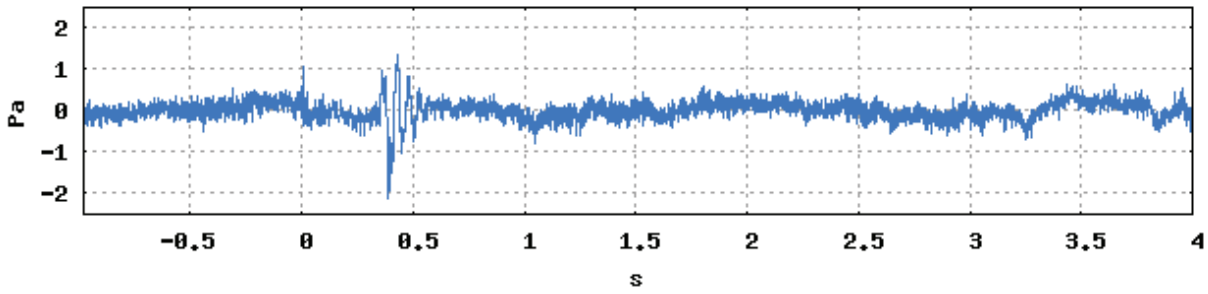
Print Close

Measurement Point	AIR001	GEO001	GEO001	GEO001
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 11:18:30	19/10/2012 11:18:30	19/10/2012 11:18:30	19/10/2012 11:18:30
Value	101 dBL	0.55 mm/s	0.55 mm/s	0.75 mm/s
	2.14 Pa	0.15 m/s2	0.16 m/s2	0.31 m/s2
	0.03 Pas	4.42 um	5.50 um	4.15 um
	15.5 Hz	37.6 Hz	20.2 Hz	28.7 Hz

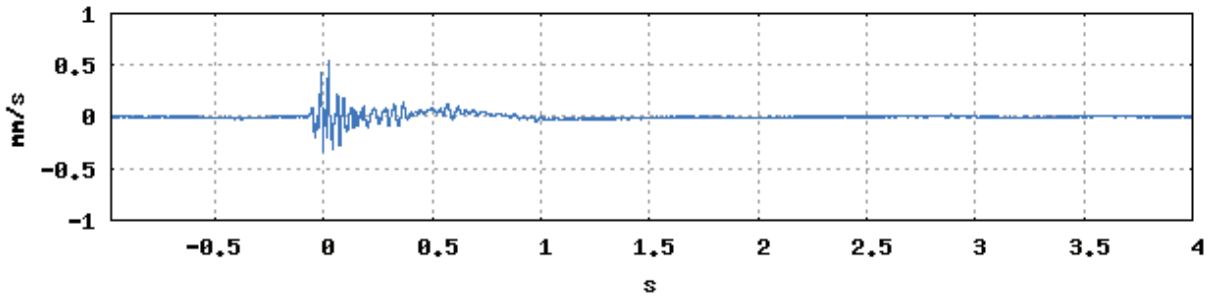
Display Format Picture

Create

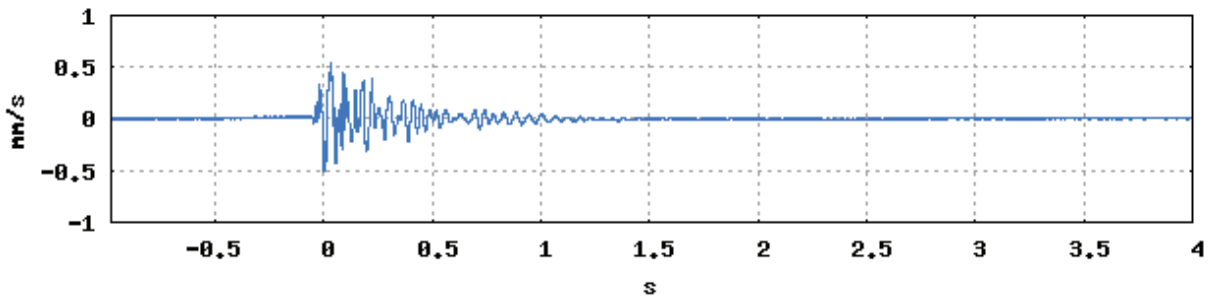
AIR001 Air shock



GEO001 Vertical



GEO001 Longitudinal

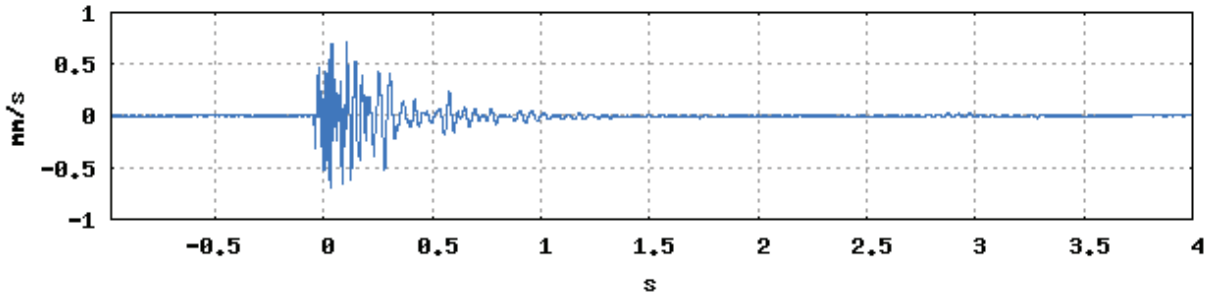


GEO001 Transversal

Demo Office

Wave Form

BAXXXX-T2E



Demo Office

Wave Form

BAXXXX-T2E

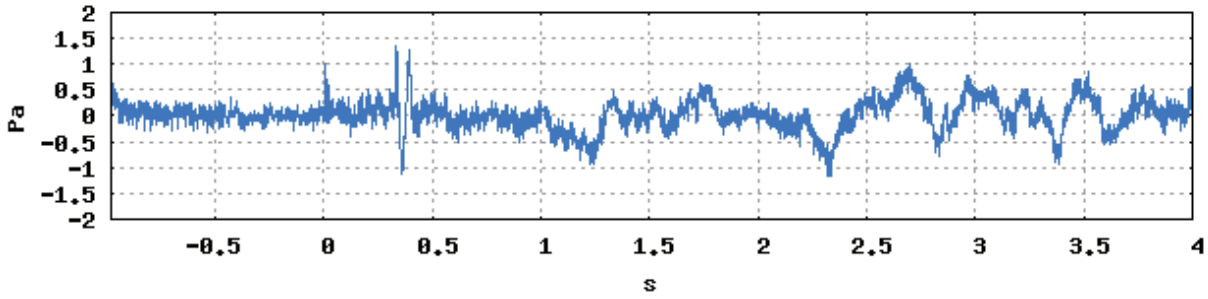
Print Close

Measurement Point	AIR002	GEO002	GEO002	GEO002
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 11:18:30	19/10/2012 11:18:30	19/10/2012 11:18:30	19/10/2012 11:18:30
Value	97.0 dBL	0.40 mm/s	0.50 mm/s	0.80 mm/s
	1.34 Pa	0.21 m/s2	0.19 m/s2	0.21 m/s2
	0.04 Pas	3.58 um	2.97 um	3.97 um
	24.7 Hz	44.2 Hz	26.9 Hz	30.6 Hz

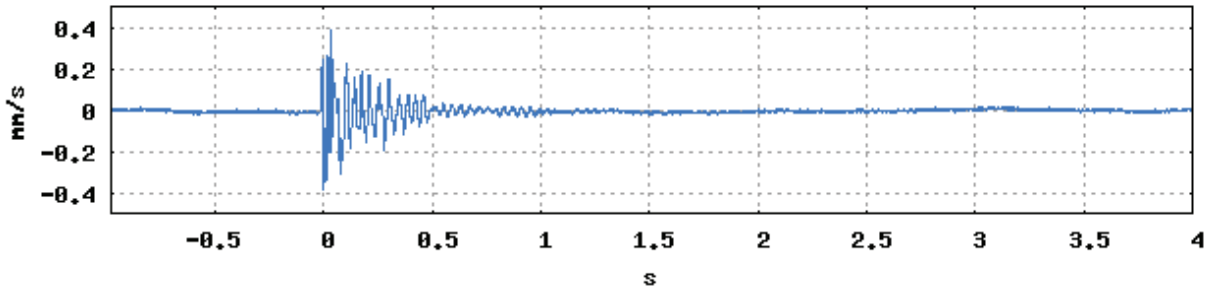
Display Format Picture

Create

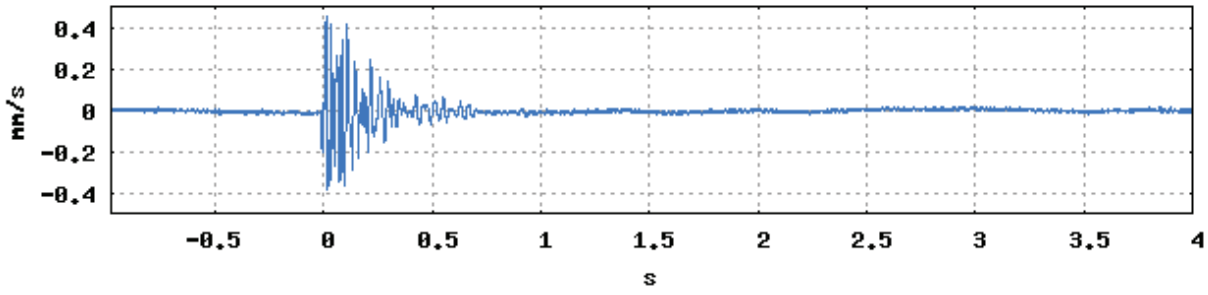
AIR002 Air shock



GEO002 Vertical



GEO002 Longitudinal

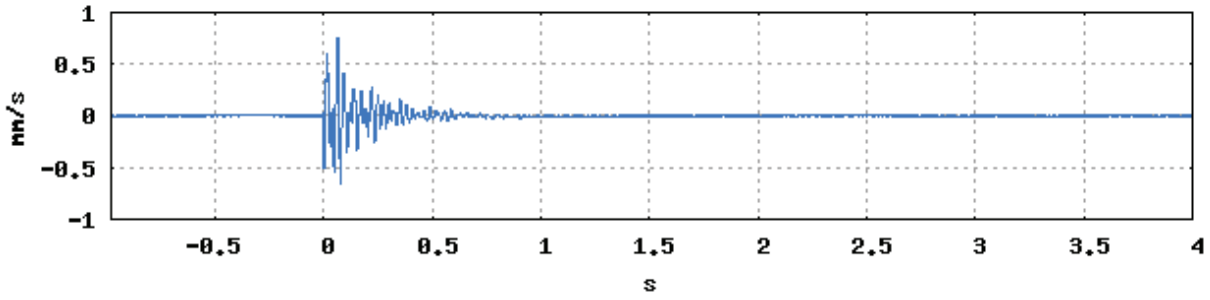


GEO002 Transversal

Demo Office

Wave Form

BAXXXX-T2E

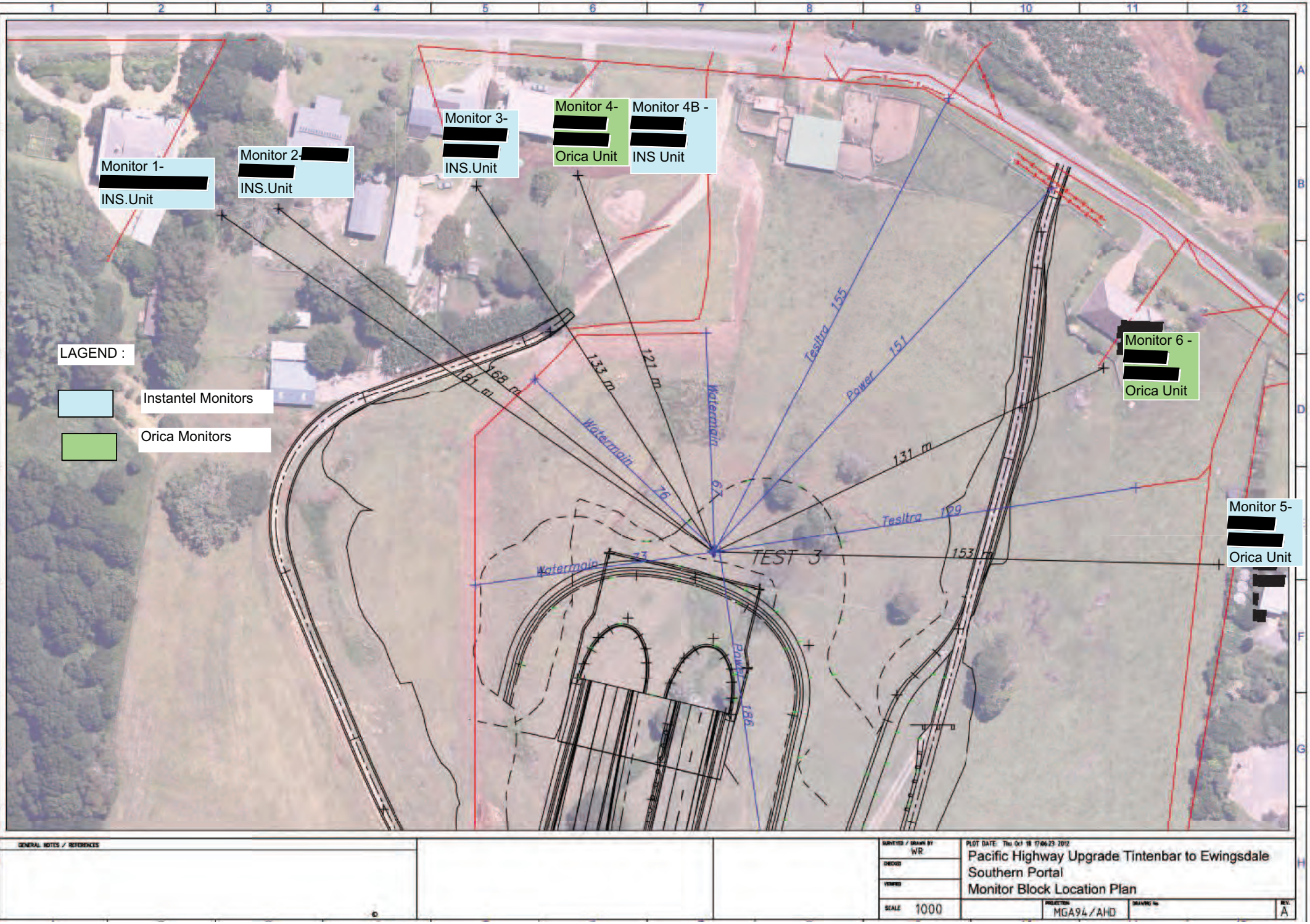


Orica SIGICOm vibration unit setup for Trial Blast 0n the 19/10/12.
Unit AIR001 = [redacted]
Unit AIR002 = [redacted]
Orica vibration units is registed based on QLD time.

Measurement Point	Placement	Date	Time	Value	Unit	Limit	Part of Limit	Vppv	Distance	Round	Remark
AIR001		19/10/2012	12:11	107	dBL	115	93				TR AL BLAST 3
AIR002		19/10/2012	12:11	107	dBL	115	93				
GEO001 V		19/10/2012	12:11	1.25	mm/s	5	25	1.84 mm/s			
GEO001 L		19/10/2012	12:11	1.3	mm/s	5	26	1.84 mm/s			
GEO001 T		19/10/2012	12:11	1.7	mm/s	5	34	1.84 mm/s			
GEO002 V		19/10/2012	12:11	1.15	mm/s	5	23	1.94 mm/s			
GEO002 L		19/10/2012	12:11	1.4	mm/s	5	28	1.94 mm/s			
GEO002 T		19/10/2012	12:11	1.6	mm/s	5	32	1.94 mm/s			
AIR002		19/10/2012	11:56	116	dBL	115	101				
GEO002 V		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
GEO002 L		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
GEO002 T		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	11:54	118	dBL	115	103				
GEO001 V		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	11:52	116	dBL	115	101				
GEO001 V		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
AIR002		19/10/2012	11:34	117	dBL	115	102				
GEO002 V		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
GEO002 L		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
GEO002 T		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	11:27	102	dBL	115	89				
GEO001 V		19/10/2012	11:27	0.3	mm/s	5	6	0.86 mm/s			
GEO001 L		19/10/2012	11:27	0.8	mm/s	5	16	0.86 mm/s			
GEO001 T		19/10/2012	11:27	0.4	mm/s	5	8	0.86 mm/s			
AIR001		19/10/2012	11:22	115	dBL	115	100				
GEO001 V		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	11:18	101	dBL	115	88				TR AL BLAST 2
AIR002		19/10/2012	11:18	97	dBL	115	84				
GEO001 V		19/10/2012	11:18	0.55	mm/s	5	11	0.91 mm/s			
GEO001 L		19/10/2012	11:18	0.55	mm/s	5	11	0.91 mm/s			
GEO001 T		19/10/2012	11:18	0.75	mm/s	5	15	0.91 mm/s			
GEO002 V		19/10/2012	11:18	0.4	mm/s	5	8	0.78 mm/s			
GEO002 L		19/10/2012	11:18	0.5	mm/s	5	10	0.78 mm/s			
GEO002 T		19/10/2012	11:18	0.8	mm/s	5	16	0.78 mm/s			
AIR001		19/10/2012	11:16	116	dBL	115	101				
GEO001 V		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
AIR002		19/10/2012	11:11	117	dBL	115	102				
GEO002 V		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
GEO002 L		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
GEO002 T		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	10:51	117	dBL	115	102				
GEO001 V		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	10:51	119	dBL	115	103				
GEO001 V		19/10/2012	10:51	0.1	mm/s	5	2	0.1 mm/s			

APPENDIX 4 - TRIAL BLAST 3 RECORDS

TRIAL BLAST - TEST 3



GENERAL NOTES / REFERENCES

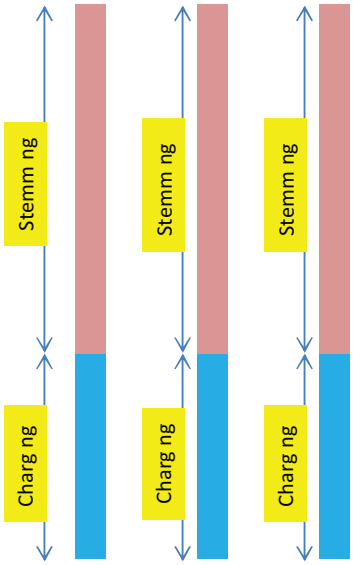
SURVEYED / DRAWN BY: WR
CHECKED:
VERIFIED:
SCALE: 1000

PLOT DATE: Thu Oct 18 17:06:23 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan

PROJECTION: MGA94/AHD
DRAWING No:
REV: A

Trial Blast operation St. Helena tunnel
Project : T2E Baulderstone
Date 19/10/2012



Drill Log-Trial Blast 3

Hole No.1

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**104.618**
Total Depth	=	**4.4 m**
Top soil Depth	=	**0 m**
Rock Depth	=	**4.4 m**
Hole size	=	**76 mm**
Charging kg	=	4.8 kg
Stemming Length	=	3.2 m

Hole No.2

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**104.708**
Total Depth	=	**4.6 m**
Top soil Depth	=	**0 m**
Rock Depth	=	**4.6 m**
Hole size	=	**76 mm**
Charging kg	=	4.8 kg
Stemming Length	=	3.4 m

Hole No.3

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**104.883**
Total Depth	=	**4.6 m**
Top soil Depth	=	**0**
Rock Depth	=	**4.6 m**
Hole size	=	**76 mm**
Charging kg	=	4.8 kg
Stemming Length	=	3.4 m

Date: 19/10/12 **Location:** **St.Helena tunnel Portal** **Scope of work : Defining K value**

Day: Friday **Subject :** **Trial Blast : 3**

	From Trial Blast 3
Distance Vibration Monitors [redacted]	181 M
Distance Vibration Monitors [redacted]	168 M
Distance Vibration Monitors [redacted]	133 M
Distance Vibration Monitors [redacted]	121 M

	From Trial Blast 3
Distance Vibration Monitors [redacted]	121 M
Distance Vibration Monitors [redacted]	131 M
Distance Vibration Monitors 5 [redacted]	153 M

BLAST PATTERN referances	
Blast parameters :-Trial Blast 3	
Time Of Blast	13:11
Decks per Hole	1
Rock density (tne/m^3)	2.98
Total Charge Wt/Hole kg	4.8
Total Charge Wt kg	14.4
Total Hole	3
Powder Factor (kg/m³)	0.00
KG/DECK	4.8
Hole Diameter (M)	0.076
Hole Angle (deg)	0
Hole Total depth (M)	4.4

Top soil overburden	0
Depth in Rock	4.4
Stemming in rock (M)	3.2
Sub drill (M)	0
Burden (M)	1.8
Spacing (M)	1.8
Bottom charge height (mm)	0.00
Intermediate charge height (m)	0.00
Yield/ blasthole M³	14.256
Burden stiffness ratio (> 3.5 good frag)	2.44
K Value	

Trial Blast 3 - Vibration Monitors reading

	Trial Blast 3 Vibration Data						
Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance From Trial Blast 1	181 M	168 M	133 M	121 M	121 M	131 M	153 M
Data Tran	1.41 mm/s	1.37 mm/s	0.87 mm/s	1.60 mm/s	1.65 mm/s	1.70 mm/s	3.05 mm/s
Data Vert	0.62 mm/s	0.64 mm/s	1.21 mm/s	1.15 mm/s	0.87 mm/s	1.25 mm/s	1.06 mm/s
Data Long	1.25 mm/s	1.38 mm/s	1.54 mm/s	1.40 mm/s	2.02 mm/s	1.30 mm/s	3.33 mm/s
VPPV	1.60 mm/s	1.68 mm/s	1.76 mm/s	1.94 mm/s	2.03 mm/s	1.84 mm/s	4.54 mm/s
Decibel (db)	101.00	100.00	102.80	107.00	106.00	107.00	106.50
Highest Peak Chosen	1.41 mm/s	1.38 mm/s	1.54 mm/s	1.60 mm/s	2.02 mm/s	1.70 mm/s	3.33 mm/s
Q^1/2	2.19	2.19	2.19	2.19	2.19	2.19	2.19
Value K based on Higest PPV	1646	1430	1098	981	1238	1183	2971

Trial Blast 3 Highest K value 2971

Event Report

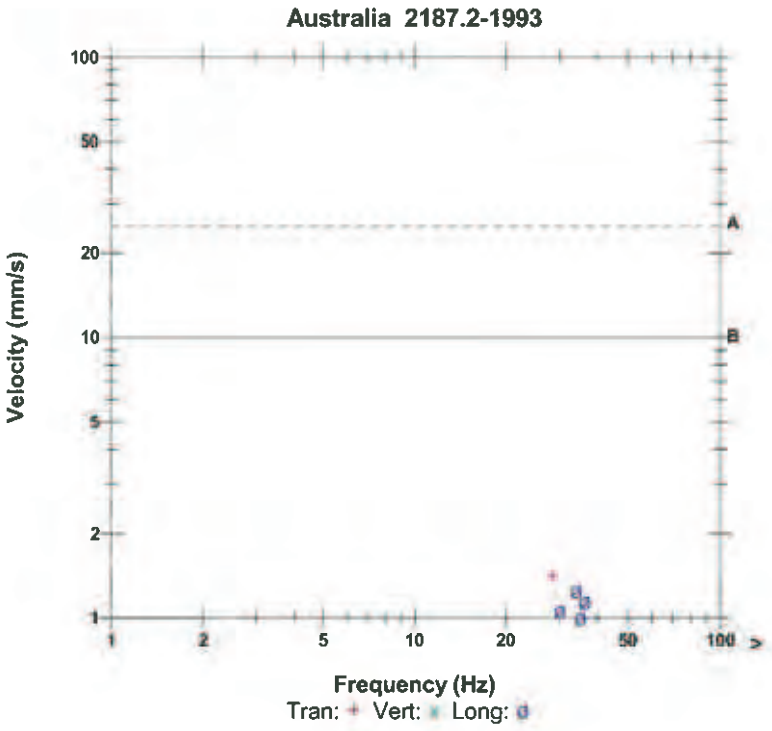
Date/Time	Long at 13:11:41 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 1, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

Extended Notes
Trial blast at St Helena, South Portal

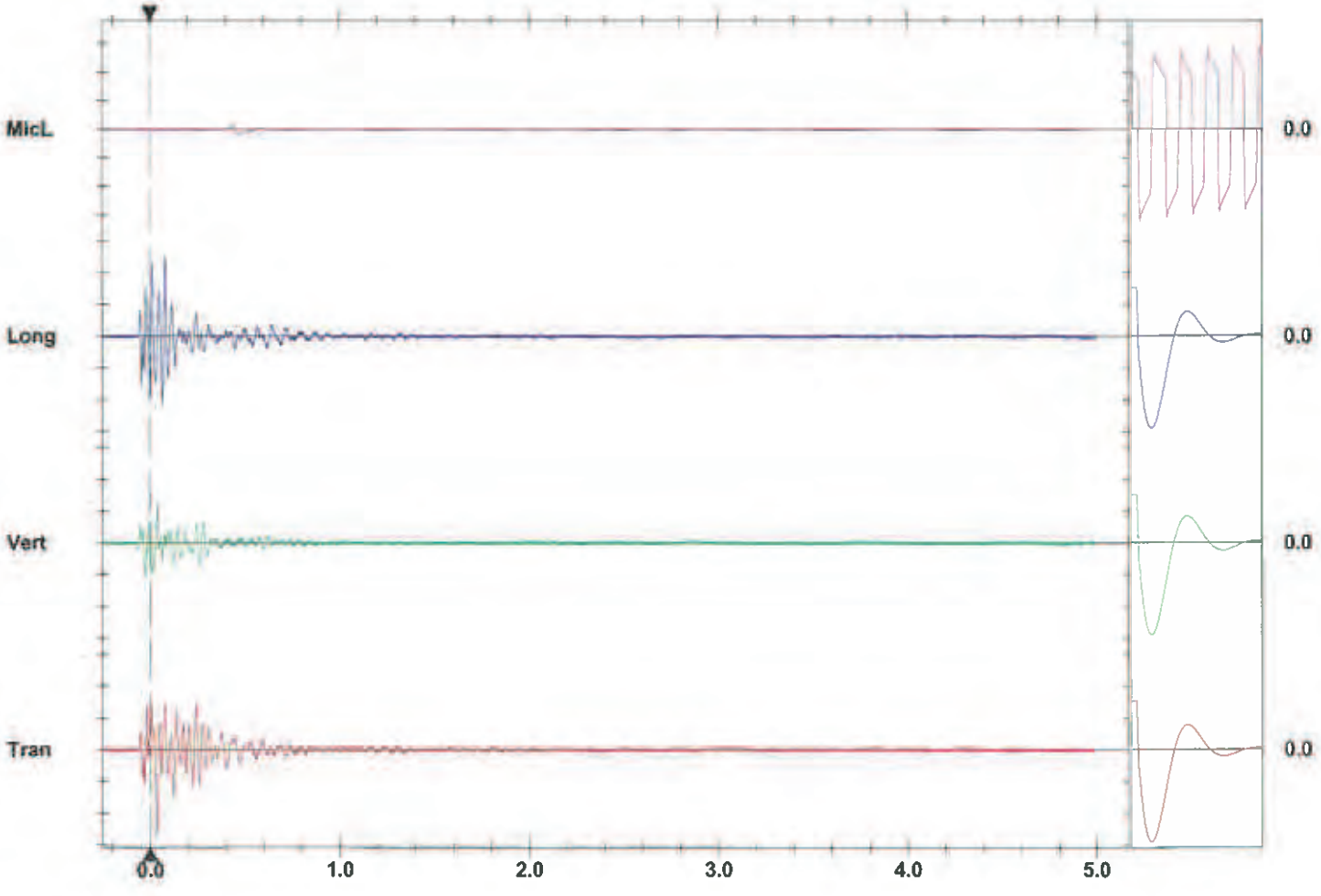
Microphone	Linear Weighting
PSPL	101.0 dB(L) at 0.470 sec
ZC Freq	5.3 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 549 mv)

	Tran	Vert	Long	
PPV	1.41	0.619	1.25	mm/s
PPV	54.0	46.8	53.0	dB
ZC Freq	28	37	34	Hz
Time (Rel. to Trig)	0.033	0.040	0.081	sec
Peak Acceleration	0.0331	0.0166	0.0331	g
Peak Displacement	0.00668	0.00323	0.00573	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.5	Hz
Overswing Ratio	3.8	3.5	3.8	

Serial Number	BE18974 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T974EIAV.BH0



A - Industrial
B - Residential



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

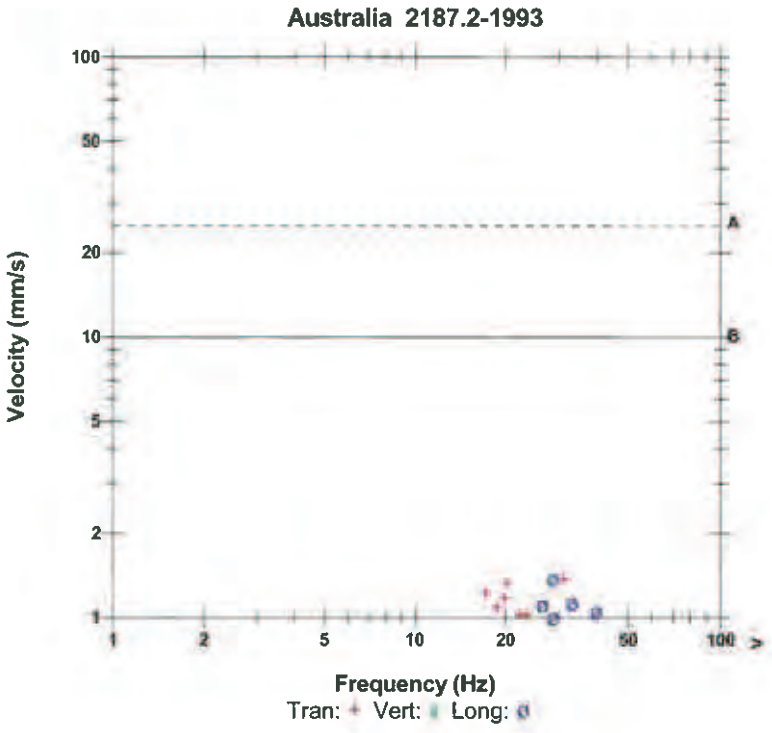
Date/Time	Long at 13:11:42 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5 0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 2, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

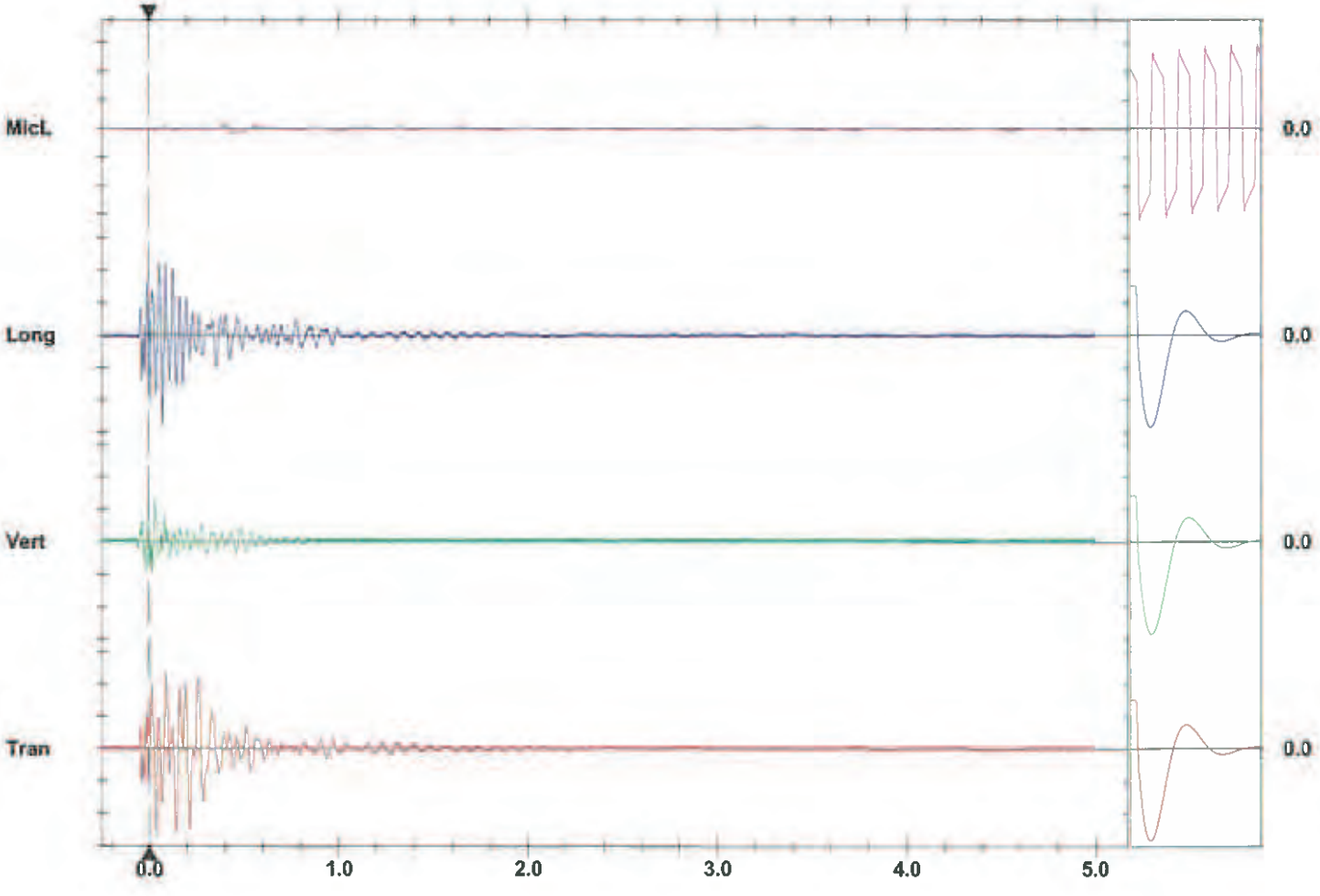
Serial Number	BE18975 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T975EIAV.BI0

Extended Notes
Trial Blast at St Helena, South Portal

Microphone	Linear Weighting
PSPL	100.0 dB(L) at 0.438 sec
ZC Freq	5.4 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 554 mv)

	Tran	Vert	Long	
PPV	1.37	0.635	1.38	mm/s
PPV	53.7	47.1	53.8	dB
ZC Freq	31	27	28	Hz
Time (Rel. to Trig)	0.037	0.030	0.071	sec
Peak Acceleration	0.0298	0.0199	0.0298	g
Peak Displacement	0.00982	0.00323	0.00653	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.2	7.6	Hz
Overswing Ratio	3.9	3.9	3.8	





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

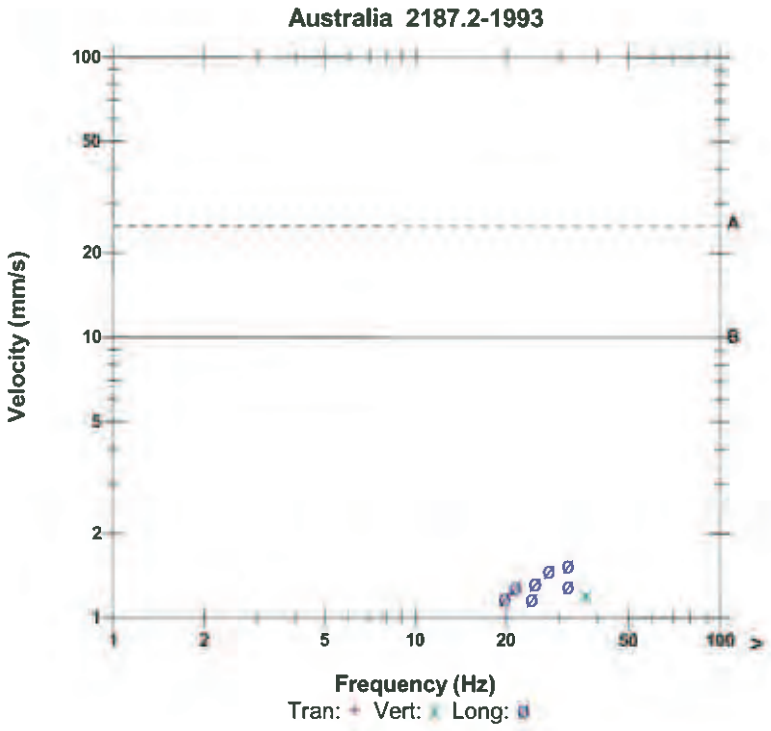
Date/Time	Long at 13:11:41 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 3, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

Extended Notes
Trial blast at St Helena, South Portal

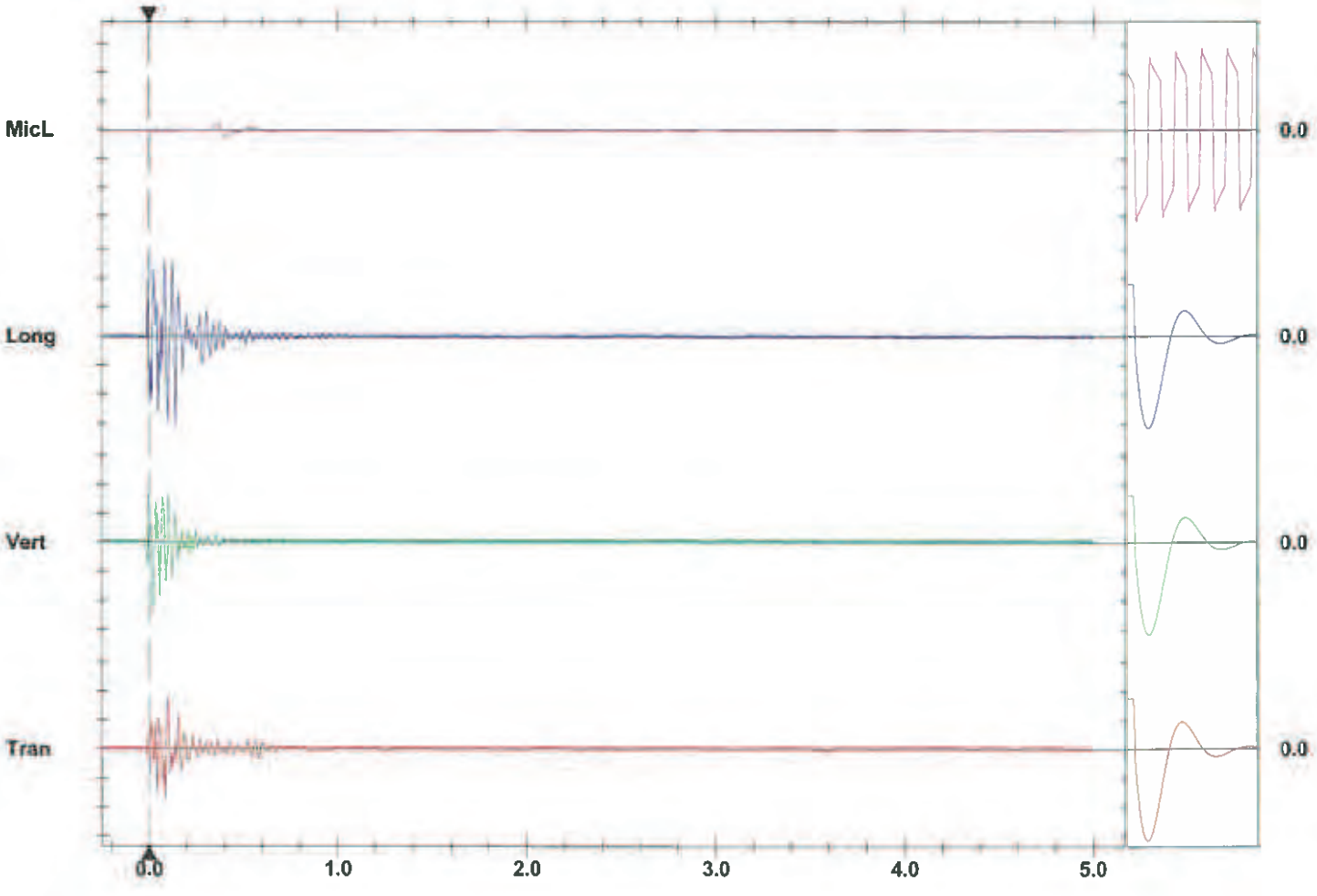
Microphone	Linear Weighting
PSPL	102.8 dB(L) at 0.370 sec
ZC Freq	13.3 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 488 mv)

	Tran	Vert	Long	
PPV	0.873	1.21	1.54	mm/s
PPV	49.8	52.6	54.7	dB
ZC Freq	28	37	32	Hz
Time (Rel. to Trig)	0.096	0.020	0.141	sec
Peak Acceleration	0.0398	0.0298	0.0497	g
Peak Displacement	0.00531	0.00527	0.00774	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	7.2	7.4	Hz
Overswing Ratio	3.4	3.7	3.6	

Serial Number	BE18976 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T976EIAV.BH0



A - Industrial
B - Residential



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger = ▶—— ——◀

Event Report

Date/Time	Long at 13:11:42 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1

Notes

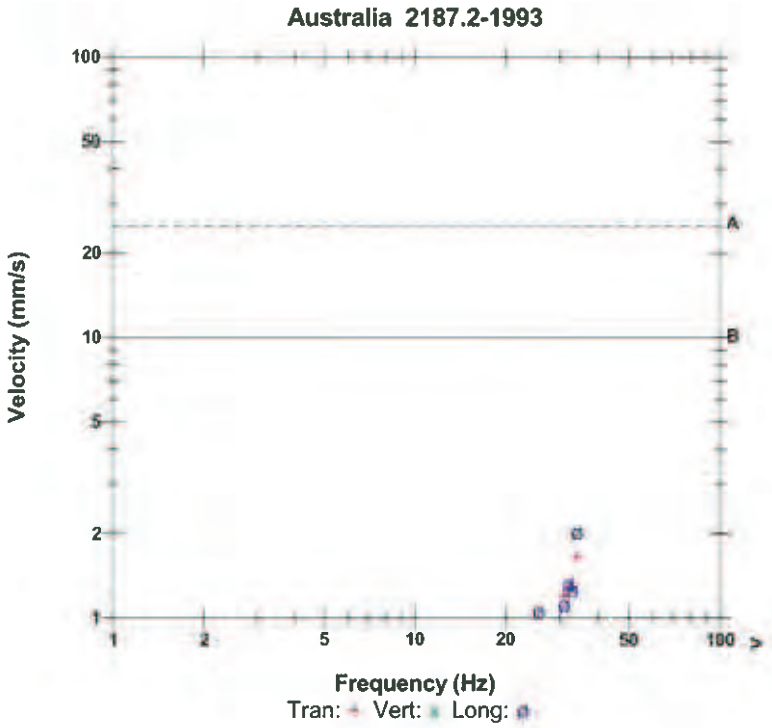
Location:	Location 4, Gilmore Property
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

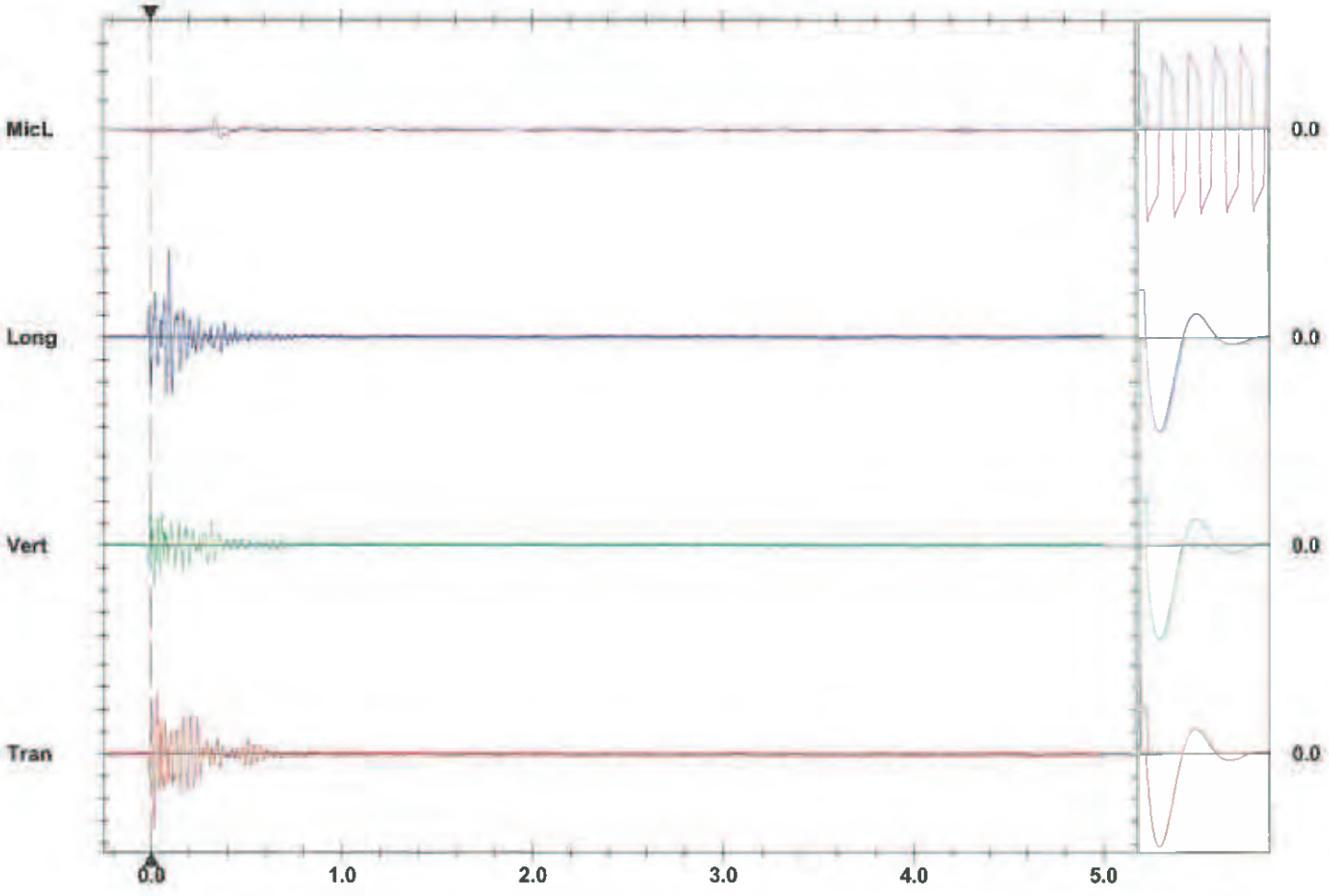
Extended Notes
Trial blast at St Helena, South Portal.

Microphone	Linear Weighting
PSPL	106.0 dB(L) at 0.336 sec
ZC Freq	13.5 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 534 mv)

	Tran	Vert	Long	
PPV	1.65	0.873	2.02	mm/s
PPV	55.4	49.8	57.1	dB
ZC Freq	34	35	34	Hz
Time (Rel. to Trig)	0.016	0.019	0.097	sec
Peak Acceleration	0.0597	0.0365	0.0563	g
Peak Displacement	0.00803	0.00458	0.00905	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.3	Hz
Overswing Ratio	3.8	3.6	3.9	

Serial Number	BE18977 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T977EIAV.BI0





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

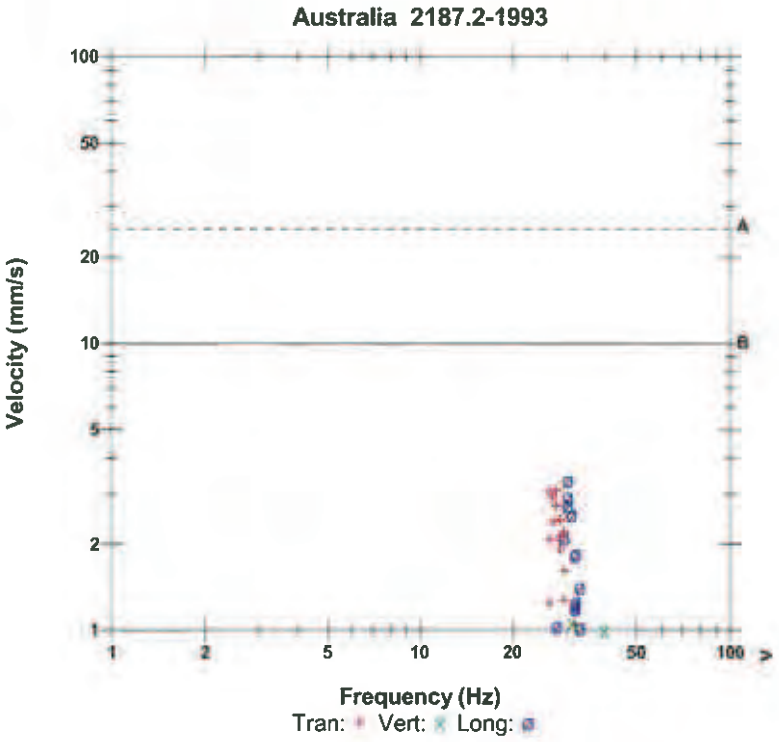
Date/Time	Tran at 13:11:42 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 5, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

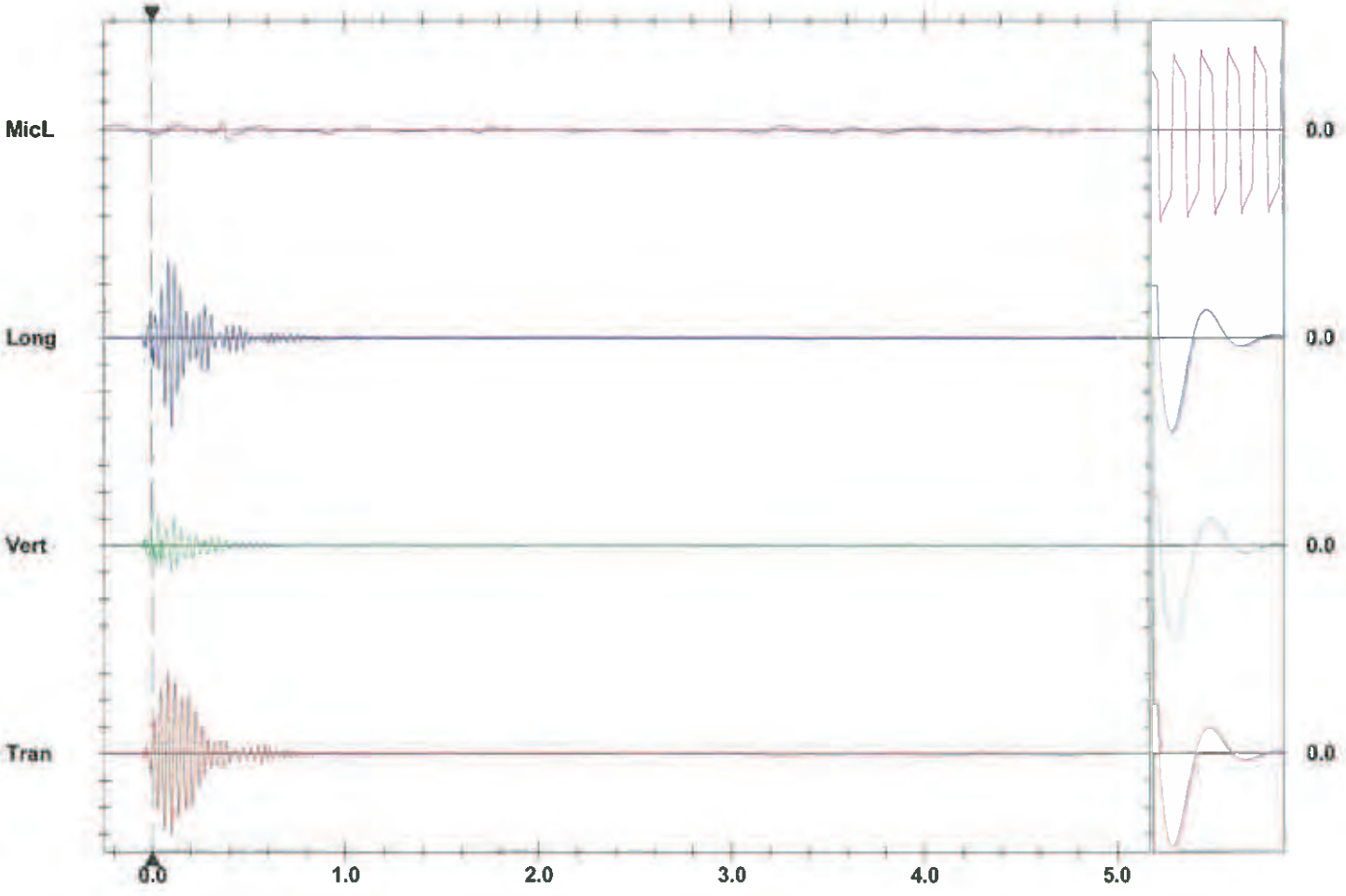
Extended Notes
Trial blast at St Helena, South Portal.

Microphone	Linear Weighting
PSPL	106.5 dB(L) at 0.418 sec
ZC Freq	5.1 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 547 mv)

	Tran	Vert	Long	
PPV	3.05	1.06	3.33	mm/s
PPV	60.7	51.5	61.5	dB
ZC Freq	28	31	30	Hz
Time (Rel. to Trig)	0.079	0.112	0.099	sec
Peak Acceleration	0.0663	0.0365	0.0762	g
Peak Displacement	0.0169	0.00522	0.0172	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.9	Hz
Overswing Ratio	3.7	3.5	3.4	

Serial Number	BE18978 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T978EIAV.BI0





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 1.000 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger = ▶—— ——◀

Wave Form

BAXXXX-T2E

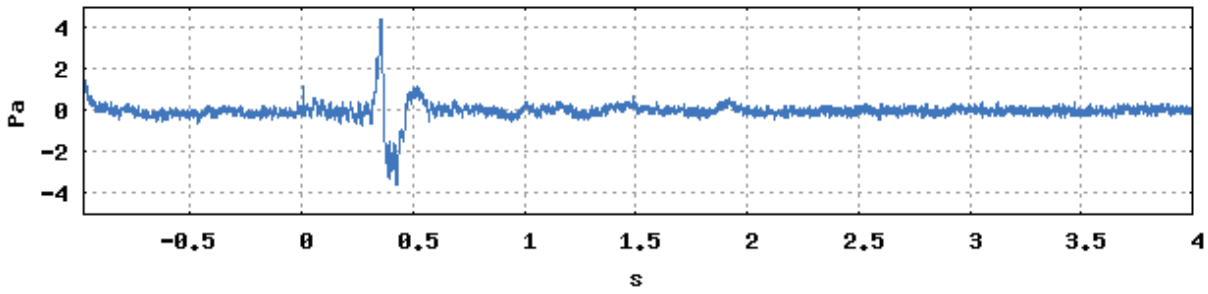
Print Close

Measurement Point	AIR001	GEO001	GEO001	GEO001
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 12:11:45	19/10/2012 12:11:45	19/10/2012 12:11:45	19/10/2012 12:11:45
Value	107 dBL	1.25 mm/s	1.30 mm/s	1.70 mm/s
	4.47 Pa	0.40 m/s2	0.39 m/s2	0.46 m/s2
	0.08 Pas	6.07 um	8.15 um	8.49 um
	9.71 Hz	47.5 Hz	20.7 Hz	24.7 Hz

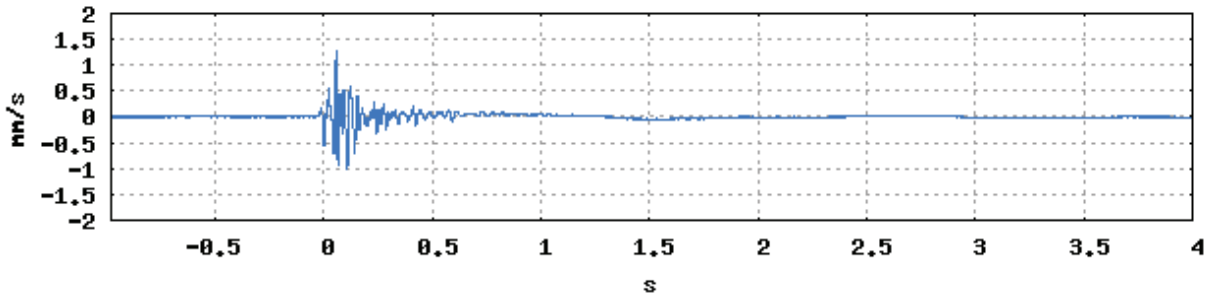
Display Format Picture

Create

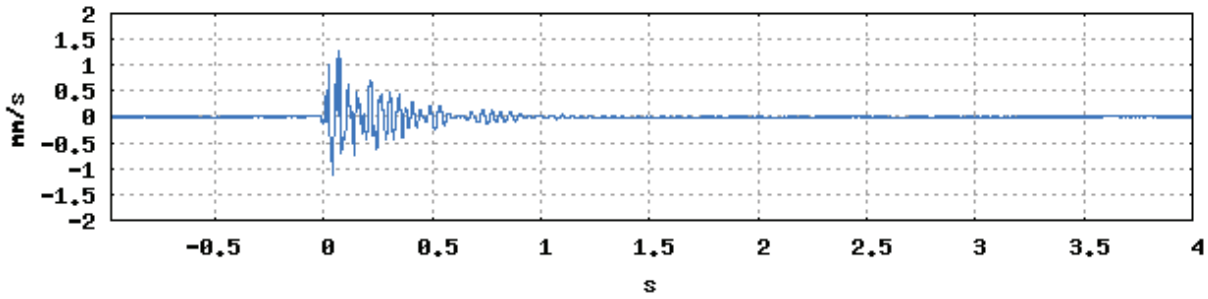
AIR001 Air shock



GEO001 Vertical



GEO001 Longitudinal

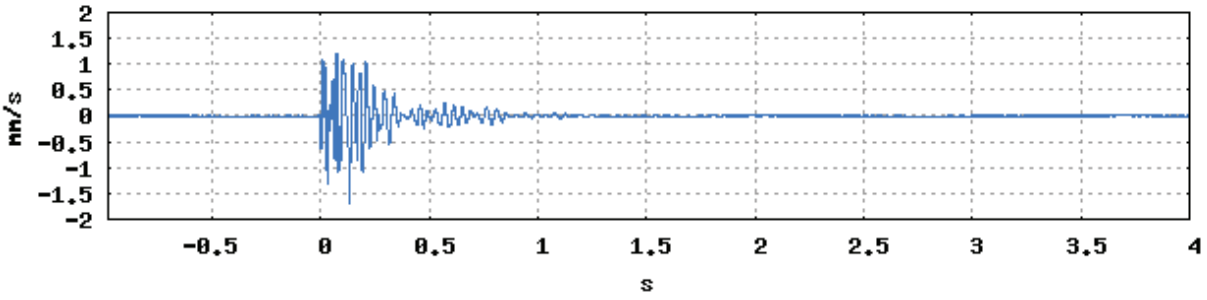


GEO001 Transversal

Demo Office

Wave Form

BAXXXX-T2E



Demo Office

Wave Form

BAXXXX-T2E

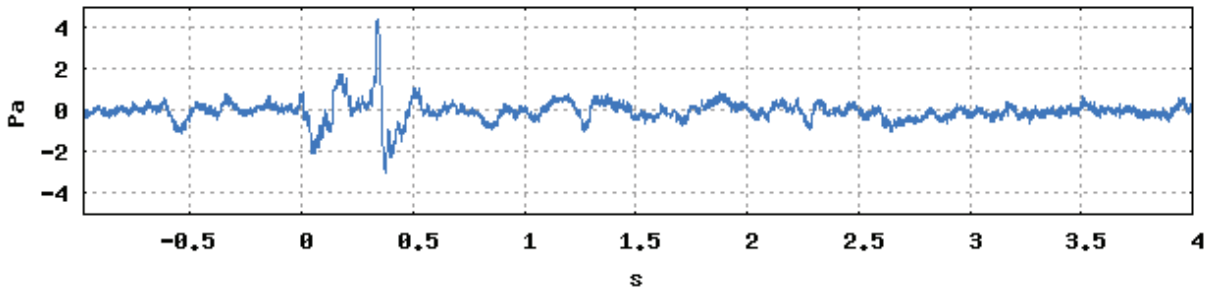
Print Close

Measurement Point	AIR002	GEO002	GEO002	GEO002
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 12:11:45	19/10/2012 12:11:45	19/10/2012 12:11:45	19/10/2012 12:11:45
Value	107 dBL	1.15 mm/s	1.40 mm/s	1.60 mm/s
	4.47 Pa	0.39 m/s2	0.48 m/s2	0.39 m/s2
	0.10 Pas	7.03 um	7.72 um	9.33 um
	5.19 Hz	52.9 Hz	36.1 Hz	34.2 Hz

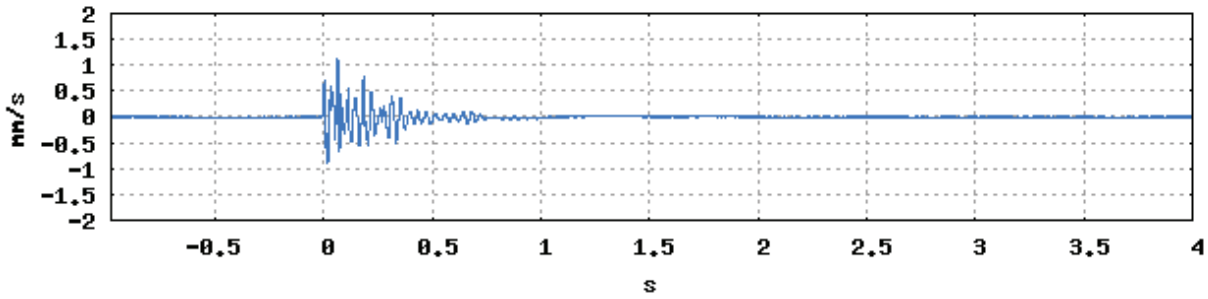
Display Format Picture

Create

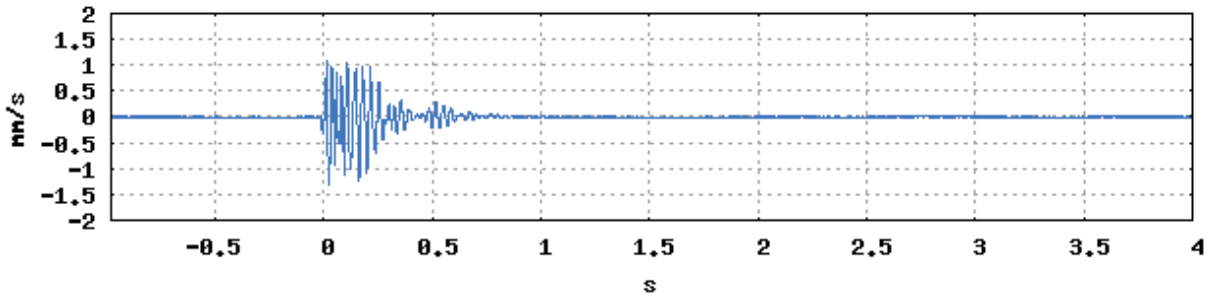
AIR002 Air shock



GEO002 Vertical



GEO002 Longitudinal

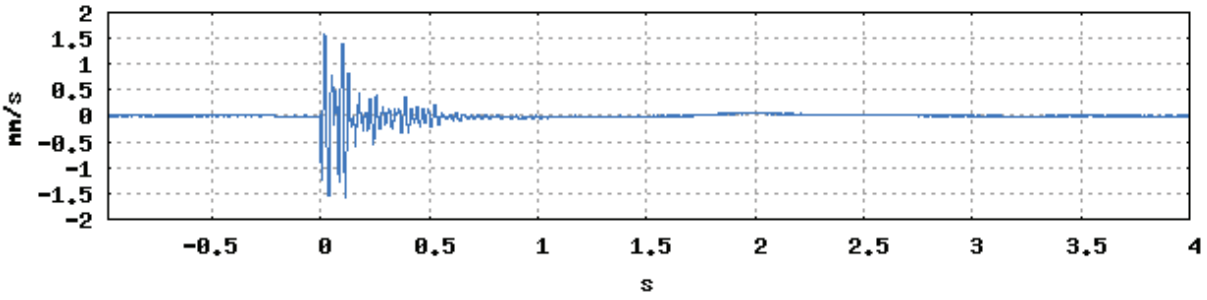


GEO002 Transversal

Demo Office

Wave Form

BAXXXX-T2E

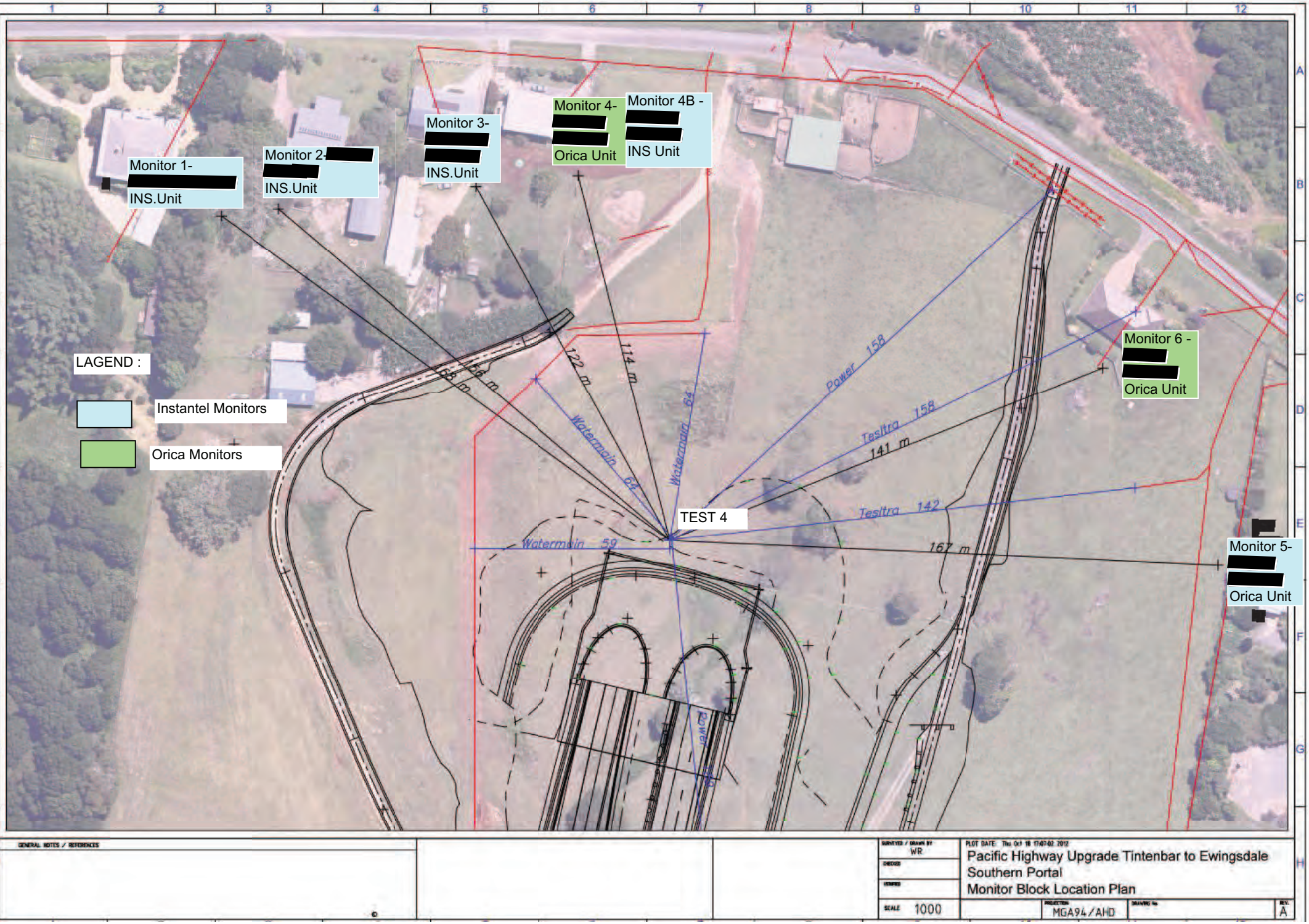


Orica SIGICOm vibration unit setup for Trial Blast 0n the 19/10/12.
Unit AIR001 = [redacted]
Unit AIR002 = [redacted]
Orica vibration units is registed based on QLD time.

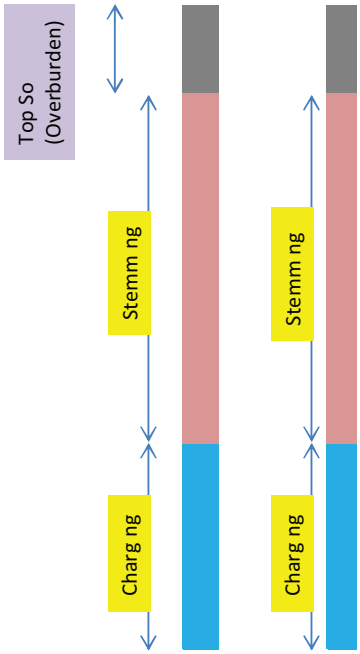
Measurement Point	Placement	Date	Time	Value	Unit	Limit	Part of Limit	Vppv	Distance	Round	Remark
AIR001		19/10/2012	12:11	107	dBL	115	93				TR AL BLAST 3
AIR002		19/10/2012	12:11	107	dBL	115	93				
GEO001 V		19/10/2012	12:11	1.25	mm/s	5	25	1.84 mm/s			
GEO001 L		19/10/2012	12:11	1.3	mm/s	5	26	1.84 mm/s			
GEO001 T		19/10/2012	12:11	1.7	mm/s	5	34	1.84 mm/s			
GEO002 V		19/10/2012	12:11	1.15	mm/s	5	23	1.94 mm/s			
GEO002 L		19/10/2012	12:11	1.4	mm/s	5	28	1.94 mm/s			
GEO002 T		19/10/2012	12:11	1.6	mm/s	5	32	1.94 mm/s			
AIR002		19/10/2012	11:56	116	dBL	115	101				
GEO002 V		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
GEO002 L		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
GEO002 T		19/10/2012	11:56	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	11:54	118	dBL	115	103				
GEO001 V		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:54	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	11:52	116	dBL	115	101				
GEO001 V		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:52	0.05	mm/s	5	1	0.08 mm/s			
AIR002		19/10/2012	11:34	117	dBL	115	102				
GEO002 V		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
GEO002 L		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
GEO002 T		19/10/2012	11:34	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	11:27	102	dBL	115	89				
GEO001 V		19/10/2012	11:27	0.3	mm/s	5	6	0.86 mm/s			
GEO001 L		19/10/2012	11:27	0.8	mm/s	5	16	0.86 mm/s			
GEO001 T		19/10/2012	11:27	0.4	mm/s	5	8	0.86 mm/s			
AIR001		19/10/2012	11:22	115	dBL	115	100				
GEO001 V		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	11:22	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	11:18	101	dBL	115	88				TR AL BLAST 2
AIR002		19/10/2012	11:18	97	dBL	115	84				
GEO001 V		19/10/2012	11:18	0.55	mm/s	5	11	0.91 mm/s			
GEO001 L		19/10/2012	11:18	0.55	mm/s	5	11	0.91 mm/s			
GEO001 T		19/10/2012	11:18	0.75	mm/s	5	15	0.91 mm/s			
GEO002 V		19/10/2012	11:18	0.4	mm/s	5	8	0.78 mm/s			
GEO002 L		19/10/2012	11:18	0.5	mm/s	5	10	0.78 mm/s			
GEO002 T		19/10/2012	11:18	0.8	mm/s	5	16	0.78 mm/s			
AIR001		19/10/2012	11:16	116	dBL	115	101				
GEO001 V		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	11:16	0.05	mm/s	5	1	0.08 mm/s			
AIR002		19/10/2012	11:11	117	dBL	115	102				
GEO002 V		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
GEO002 L		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
GEO002 T		19/10/2012	11:11	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	10:51	117	dBL	115	102				
GEO001 V		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	10:51	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	10:51	119	dBL	115	103				
GEO001 V		19/10/2012	10:51	0.1	mm/s	5	2	0.1 mm/s			

APPENDIX 5 - TRIAL BLAST 4 RECORDS

TRIAL BLAST - TEST 4


Monitor 1-
[redacted]
INS.Unit
Monitor 2-
[redacted]
INS.Unit
Monitor 3-
[redacted]
INS.Unit
Monitor 4-
[redacted]
Orica Unit
Monitor 4B -
[redacted]
INS Unit
Monitor 6 -
[redacted]
Orica Unit
Monitor 5-
[redacted]
Orica Unit
LAGEND :
Instantel Monitors
Orica Monitors
TEST 4
122 m
114 m
68 m
56 m
Watermain 64
Watermain 64
Power 158
Telstra 158
141 m
Telstra 142
Watermain 59
167 m
Power
GENERAL NOTES / REFERENCES
SURVEYED / DRAWN BY WR
CHECKED
VERIFIED
PLOT DATE: Thu Oct 18 17:07:02 2012
Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan
SCALE 1000
PROJECTION MGA94/AHD
DRAWING No
REV. A

Trial Blast operation St. Helena tunnel
Project : T2E Baulderstone
Date : 19/10/2012



Drill Log-Trial Blast 4

Hole No.1

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**107.817**
Total Depth	=	**5.8 m**
Top soil Depth	=	**1.8 m**
Rock Depth	=	**4 m**
Hole size	=	**76 mm**
Charging kg	=	4.8 kg
Stemming Length	=	2.8 m

Hole No.2

Drill date	=	**18/10/2012**
Drill Operator	=	**Dan Donnelly**
Top Elevation	=	**107.999**
Total Depth	=	**5.4 m**
Top soil Depth	=	**1.4 m**
Rock Depth	=	**4 m**
Hole size	=	**76 mm**
Charging kg	=	4.8 kg
Stemming Length	=	2.8 m

Date: 19/10/12 **Location:** **St.Helena tunnel Portal** **Scope of work : Defining K value**

Day: Friday **Subject :** **Trial Blast : 4**

	From Trial Blast 4
Distance Vibration Monitors [redacted]	168 M
Distance Vibration Monitors [redacted]	156 M
Distance Vibration Monitors [redacted]	122 M
Distance Vibration Monitors [redacted]	114 M

	From Trial Blast 4
Distance Vibration Monitors [redacted]	114 M
Distance Vibration Monitors [redacted]	141 M
Distance Vibration Monitors 5 [redacted]	167 M

BLAST PATTERN referances	
Blast parameters :-Trial Blast 4	
Time Of Blast	14:02
Decks per Hole	1
Rock density (tne/m^3)	2.98
Total Charge Wt/Hole kg	4.8
Total Charge Wt kg	9.6
Total Hole	2
Powder Factor (kg/m³)	0.74
KG/DECK	4.8
Hole Diameter (M)	0.076
Hole Angle (deg)	0
Hole Total depth (M)	5.8

Top soil overburden	1.8
Depth in Rock	4
Stemming in rock (M)	2.8
Sub drill (M)	0
Burden (M)	1.8
Spacing (M)	1.8
Bottom charge height (mm)	0.00
Intermediate charge height (m)	0.00
Yield/ blasthole M³	12.96
Burden stiffness ratio (> 3.5 good frag)	2.22
K Value	

Trial Blast 4 - Vibration Monitors reading

	Trial Blast 4 Vibration Data						
Property owners	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Monitor type	Instantel	Instantel	Instantel	Orica	Instantel	Orica	Instantel
Distance From Trial Blast 1	168 M	156 M	122 M	114 M	114 M	141 M	167 M
Data Tran	1.02 mm/s	1.08 mm/s	1.11 mm/s	2.15 mm/s	1.52 mm/s	1.55 mm/s	2.06 mm/s
Data Vert	0.54 mm/s	0.65 mm/s	1.16 mm/s	1.05 mm/s	0.87 mm/s	1.05 mm/s	0.91 mm/s
Data Long	0.94 mm/s	1.32 mm/s	2.40 mm/s	1.15 mm/s	1.16 mm/s	1.40 mm/s	2.81 mm/s
VPPV	1.33 mm/s	1.66 mm/s	2.74 mm/s	2.37 mm/s	1.96 mm/s	1.64 mm/s	3.24 mm/s
Decibel (db)	95.90	97.50	109.50	98.00	104.90	100.00	101.00
Highest Peak Chosen	1.02 mm/s	1.32 mm/s	2.40 mm/s	2.15 mm/s	1.52 mm/s	1.55 mm/s	2.81 mm/s
Q^1/2	2.19	2.19	2.19	2.19	2.19	2.19	2.19
Value K based on Higest PPV	1057	1215	1491	1198	847	1214	2884

Trial Blast 4 Highest K value 2884

Event Report

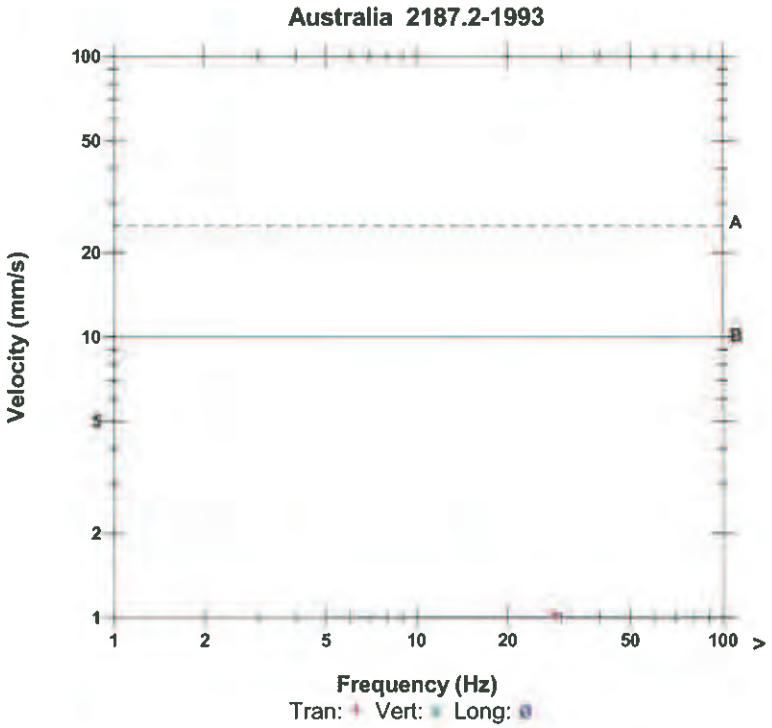
Date/Time	Tran at 14:02:31 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 1, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

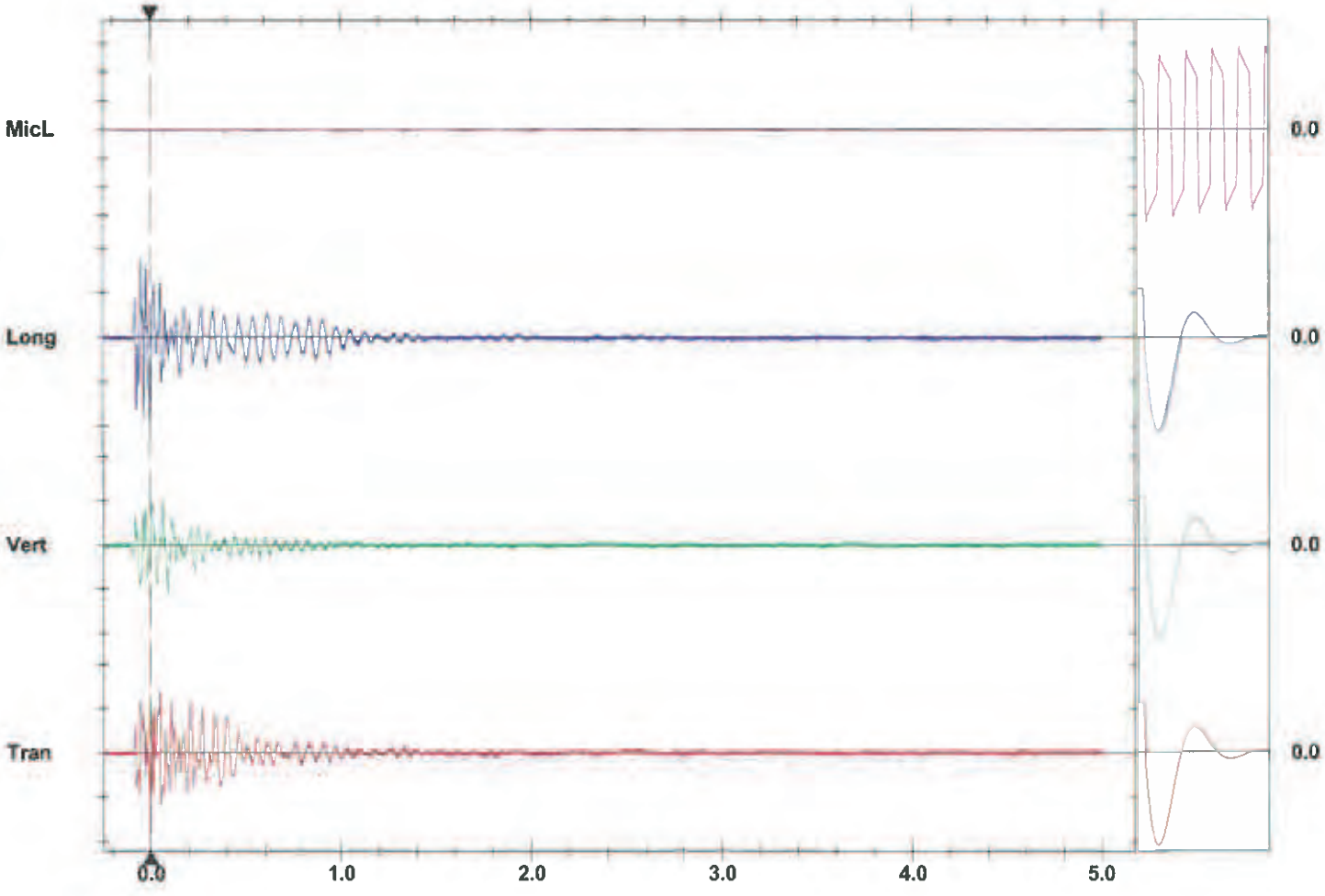
Serial Number	BE18974 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T974EIAX.O70

Extended Notes
Trial blast at St Helena, South Portal

Microphone	Linear Weighting
PSPL	95.9 dB(L) at 0.397 sec
ZC Freq	13.0 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 513 mv)

	Tran	Vert	Long	
PPV	1.02	0.540	0.937	mm/s
PPV	51.1	45.6	50.4	dB
ZC Freq	28	19.0	26	Hz
Time (Rel. to Trig)	0.000	0.091	-0.004	sec
Peak Acceleration	0.0365	0.0199	0.0365	g
Peak Displacement	0.00441	0.00375	0.00626	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.5	Hz
Overswing Ratio	3.8	3.5	3.8	





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

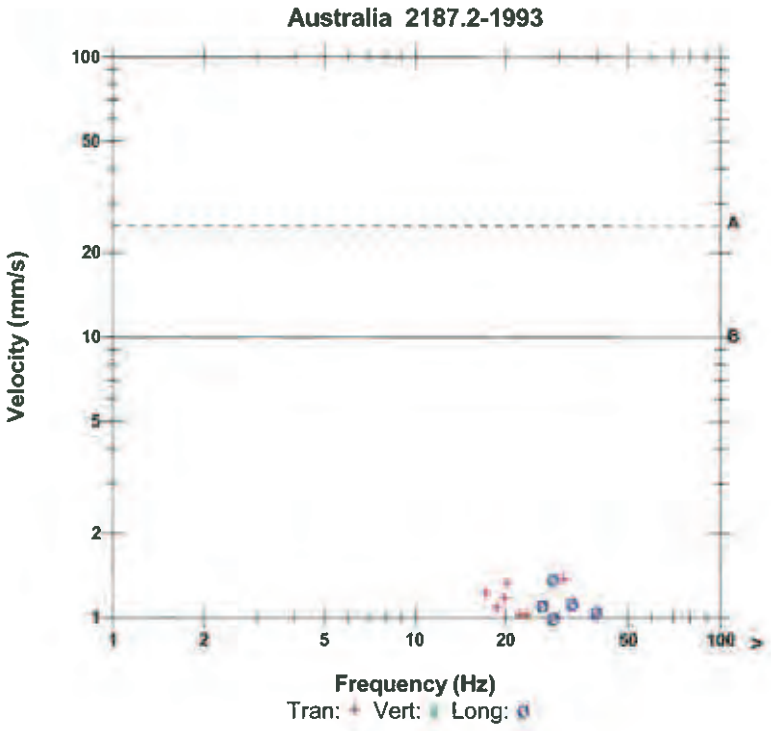
Date/Time	Long at 13:11:42 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5 0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 2, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

Extended Notes
Trial Blast at St Helena, South Portal

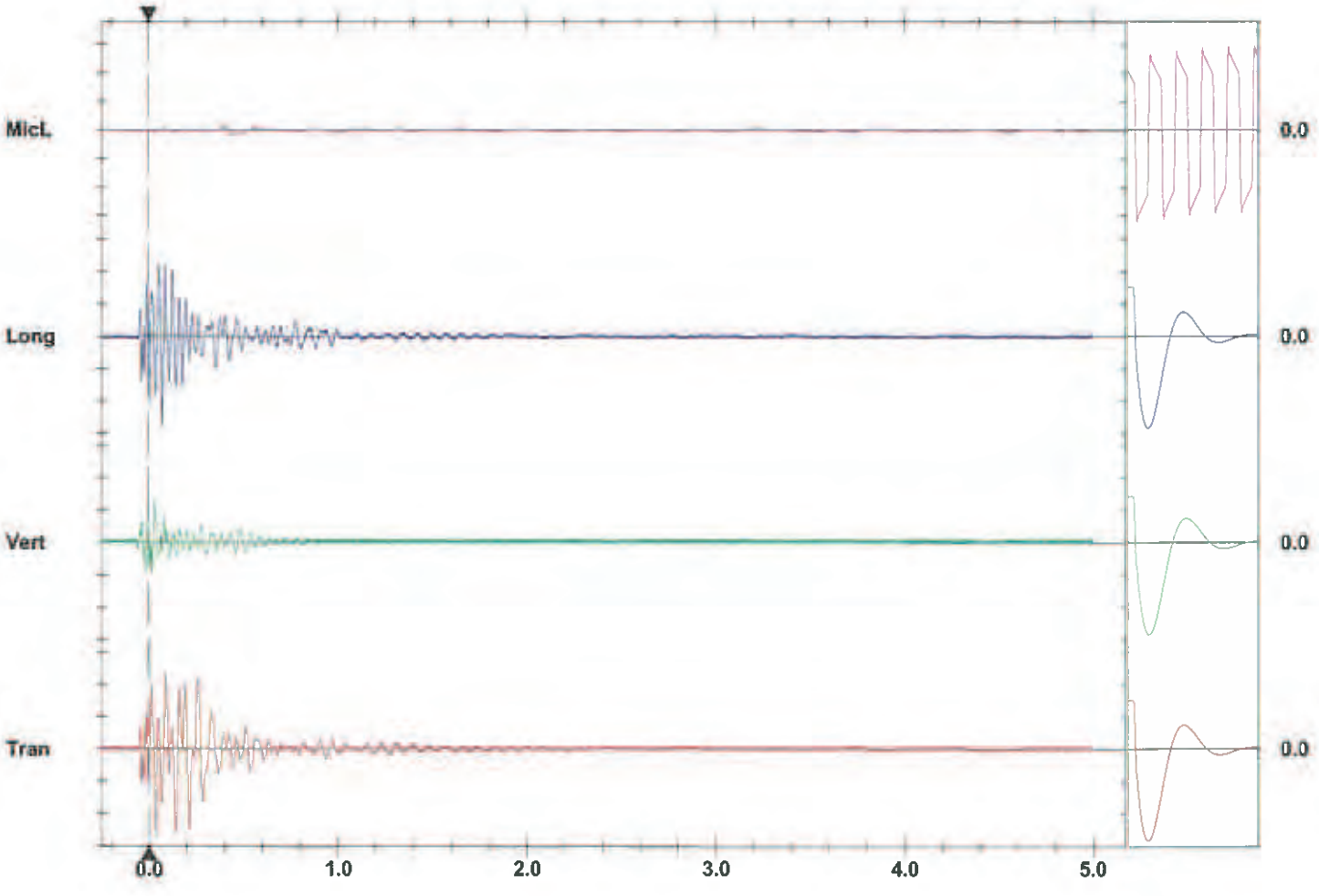
Microphone	Linear Weighting
PSPL	100.0 dB(L) at 0.438 sec
ZC Freq	5.4 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 554 mv)

	Tran	Vert	Long	
PPV	1.37	0.635	1.38	mm/s
PPV	53.7	47.1	53.8	dB
ZC Freq	31	27	28	Hz
Time (Rel. to Trig)	0.037	0.030	0.071	sec
Peak Acceleration	0.0298	0.0199	0.0298	g
Peak Displacement	0.00982	0.00323	0.00653	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.2	7.6	Hz
Overswing Ratio	3.9	3.9	3.8	

Serial Number	BE18975 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T975EIAV.BI0



A - Industrial
B - Residential



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

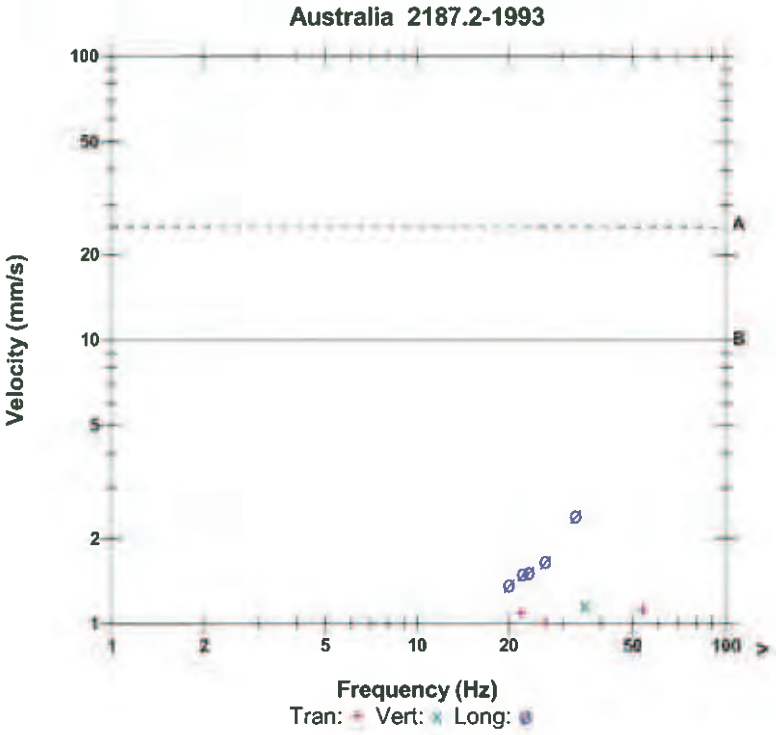
Date/Time	Long at 14:02:31 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 3, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

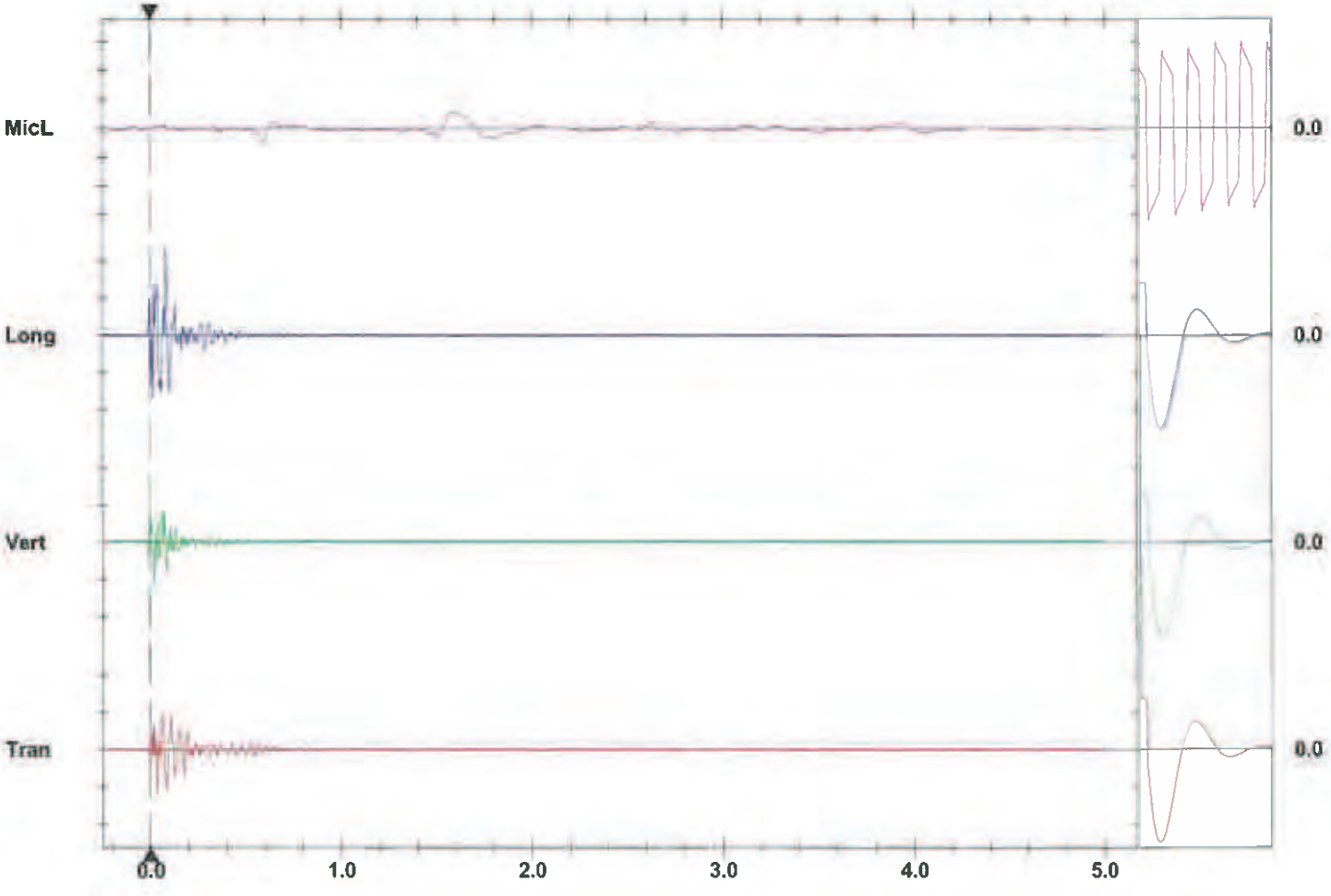
Extended Notes
Trial blast at St Helena, South Portal

Microphone	Linear Weighting
PSPL	109.5 dB(L) at 0.593 sec
ZC Freq	5.8 Hz
Channel Test	Passed (Freq = 20.5 Hz Amp = 474 mv)

	Tran	Vert	Long	
PPV	1.11	1.16	2.40	mm/s
PPV	51.9	52.3	58.6	dB
ZC Freq	54	35	33	Hz
Time (Rel. to Trig)	0.038	0.021	0.082	sec
Peak Acceleration	0.0365	0.0365	0.0729	g
Peak Displacement	0.00729	0.00402	0.0128	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	7.2	7.4	Hz
Overswing Ratio	3.4	3.7	3.6	

Serial Number	BE18976 V 10.40-1.1 Minimate Blaster
Battery Level	6.3 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T976EIAX.O70





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 1.000 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger = ▶—— ——◀

Event Report

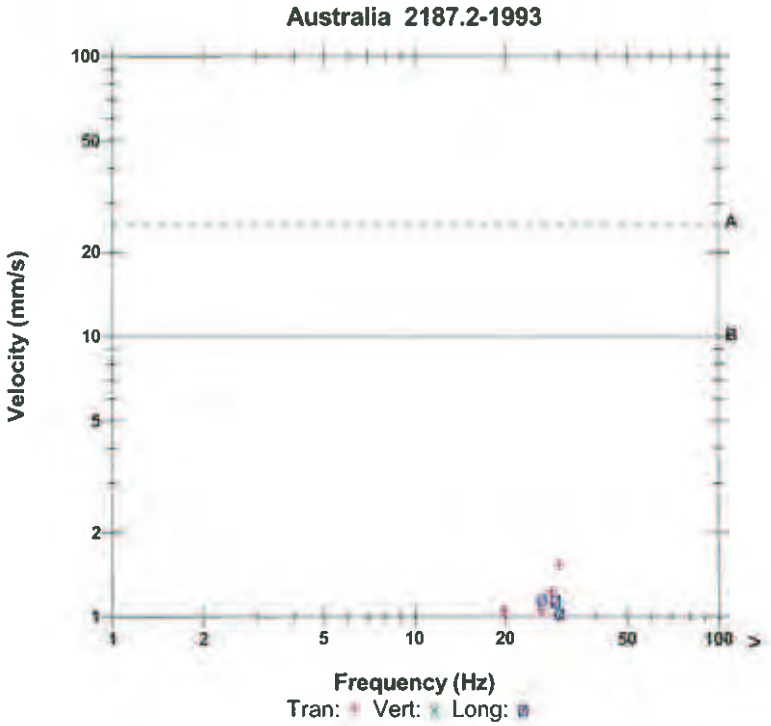
Date/Time	Long at 14:02:31 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 4, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

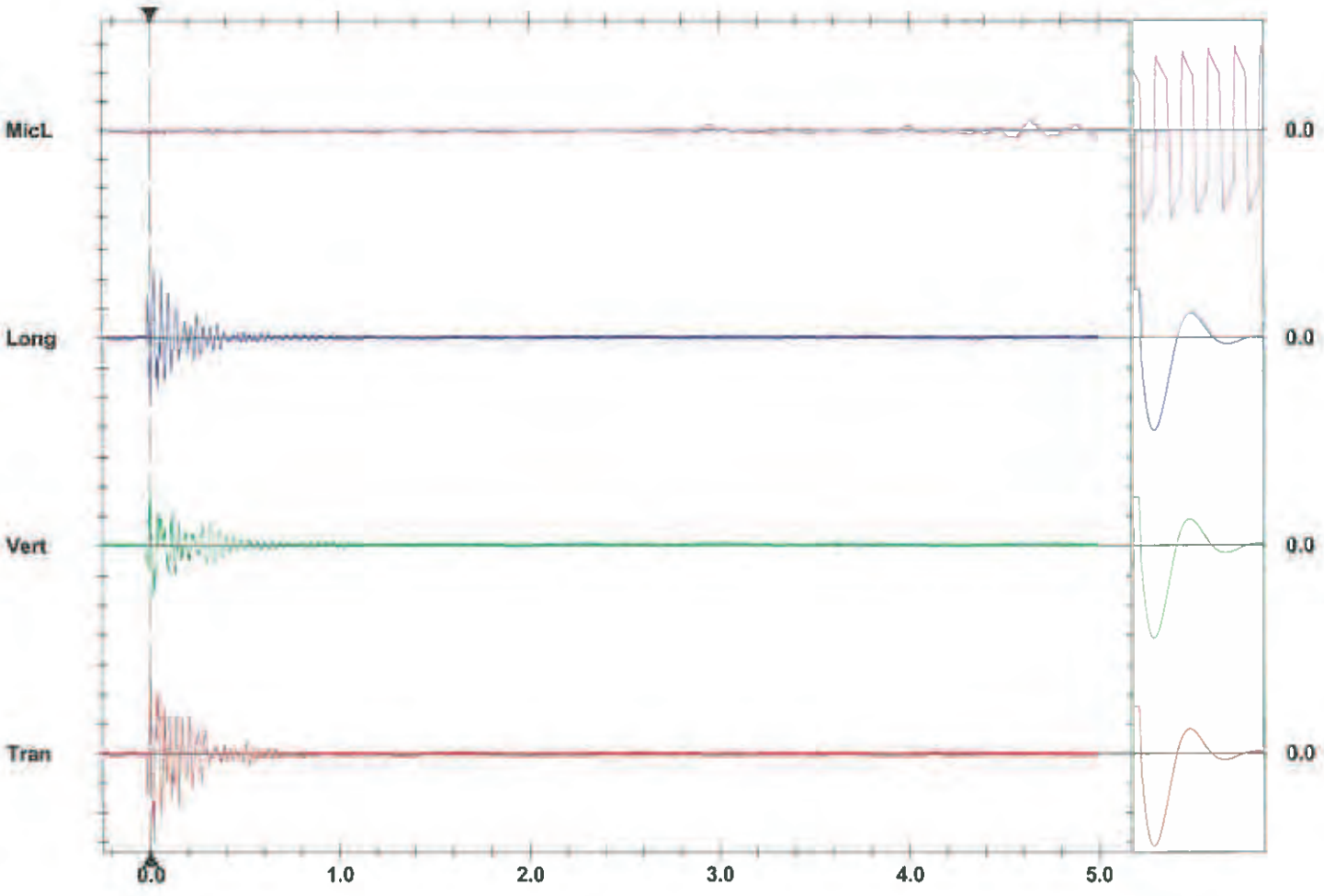
Serial Number	BE18977 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T977EIAX.O70

Extended Notes
Trial blast at St Helena, South Portal.

Microphone	Linear Weighting
PSPL	104.9 dB(L) at 4.637 sec
ZC Freq	5.4 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 514 mv)

	Tran	Vert	Long	
PPV	1.52	0.873	1.16	mm/s
PPV	54.7	49.8	52.3	dB
ZC Freq	30	20	26	Hz
Time (Rel. to Trig)	0.021	0.016	0.020	sec
Peak Acceleration	0.0663	0.0398	0.0331	g
Peak Displacement	0.00762	0.00614	0.00683	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.3	Hz
Overswing Ratio	3.8	3.6	3.9	





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Event Report

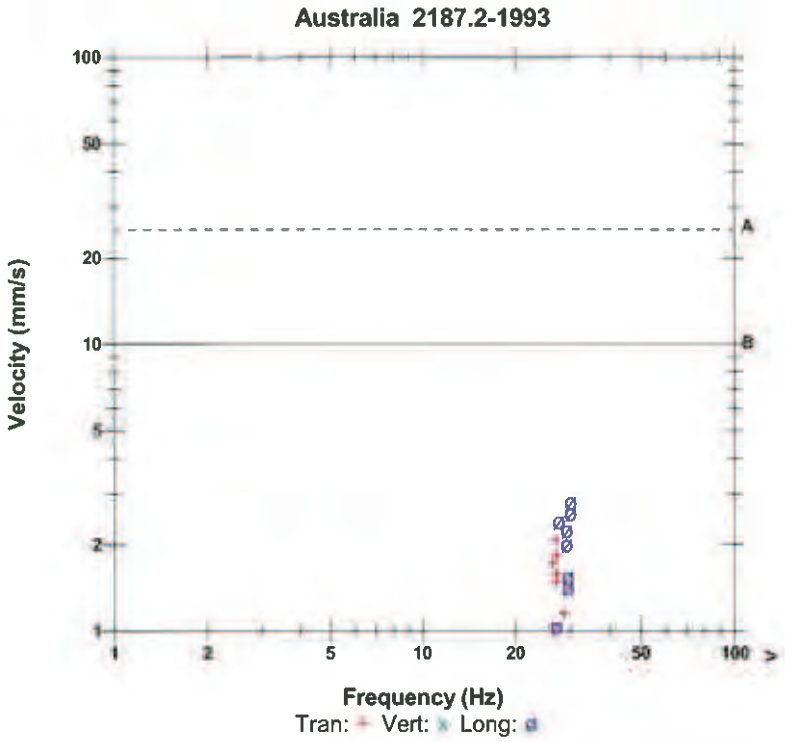
Date/Time	Long at 14:02:32 October 19, 2012
Trigger Source	Geo: 1.00 mm/s
Range	Geo: 31.7 mm/s
Record Time	5.0 sec at 2048 sps
Job Number:	1
Notes	
Location:	Location 5, [redacted]
Client:	Tintenbar to Ewingsdale
User Name:	Brendon Kirkwood
General:	Trial Blast

Extended Notes
Trial blast at St Helena, South Portal.

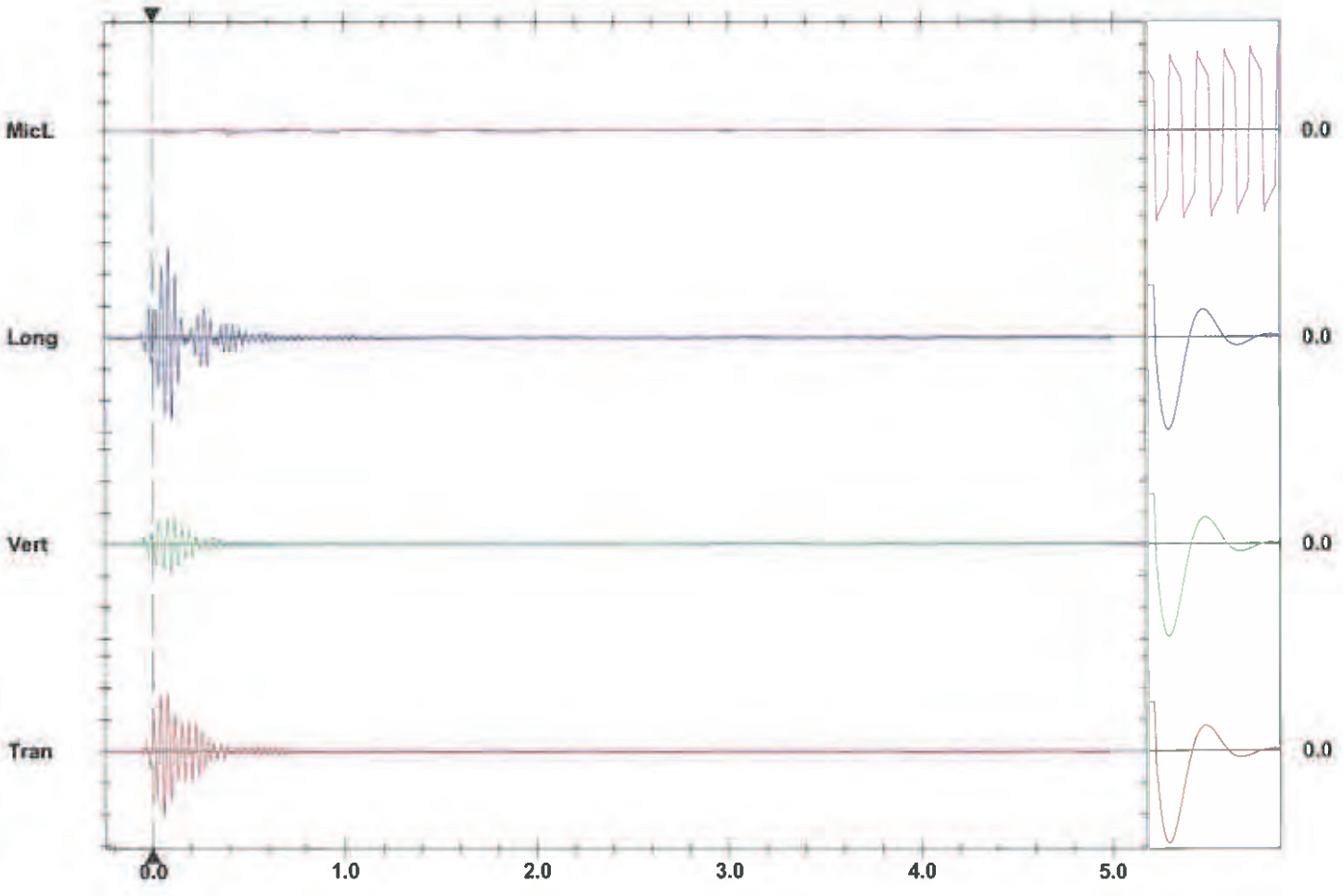
Microphone	Linear Weighting
PSPL	101.0 dB(L) at 0.400 sec
ZC Freq	8.1 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 537 mv)

	Tran	Vert	Long	
PPV	2.06	0.905	2.81	mm/s
PPV	57.3	50.1	60.0	dB
ZC Freq	27	28	30	Hz
Time (Rel. to Trig)	0.060	0.093	0.082	sec
Peak Acceleration	0.0365	0.0232	0.0563	g
Peak Displacement	0.0115	0.00564	0.0147	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.6	7.9	Hz
Overswing Ratio	3.7	3.5	3.4	

Serial Number	BE18978 V 10.40-1.1 Minimate Blaster
Battery Level	6.4 Volts
Unit Calibration	September 28, 2012 by Instantel
File Name	T978EIAX.O80



A - Industrial
B - Residential



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 1.000 mm/s/div Mic: 10.00 pa.(L)/div Sensor Check
Trigger =

Wave Form

BAXXXX-T2E

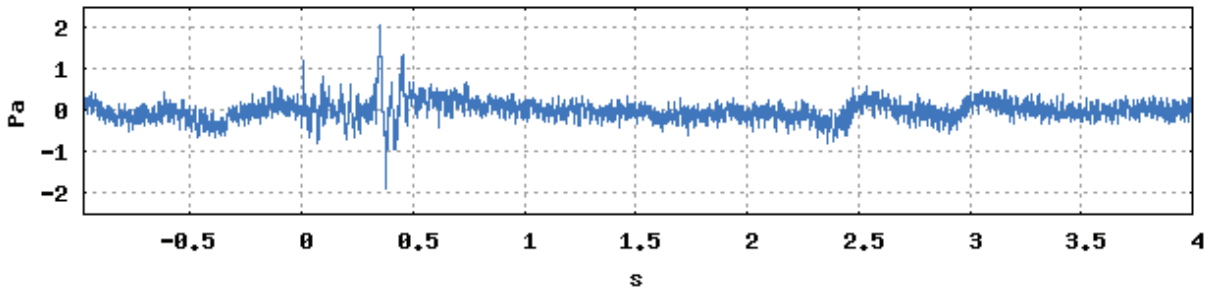
Print Close

Measurement Point	AIR001	GEO001	GEO001	GEO001
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 13:02:35	19/10/2012 13:02:35	19/10/2012 13:02:35	19/10/2012 13:02:35
Value	100 dBL	1.05 mm/s	1.40 mm/s	1.55 mm/s
	2.07 Pa	0.25 m/s2	0.39 m/s2	0.53 m/s2
	0.03 Pas	5.11 um	8.84 um	7.92 um
	17.5 Hz	29.3 Hz	22.1 Hz	57.9 Hz

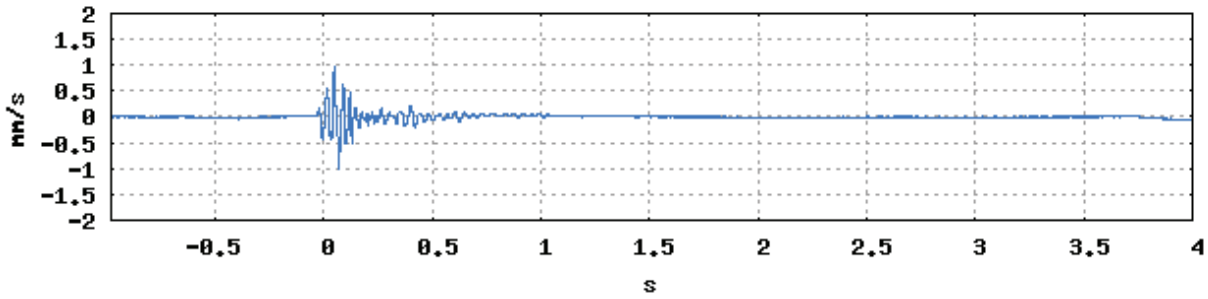
Display Format Picture

Create

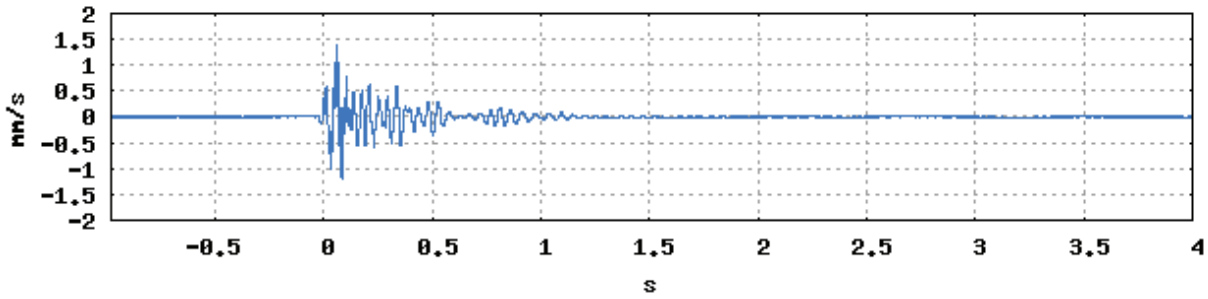
AIR001 Air shock



GEO001 Vertical



GEO001 Longitudinal

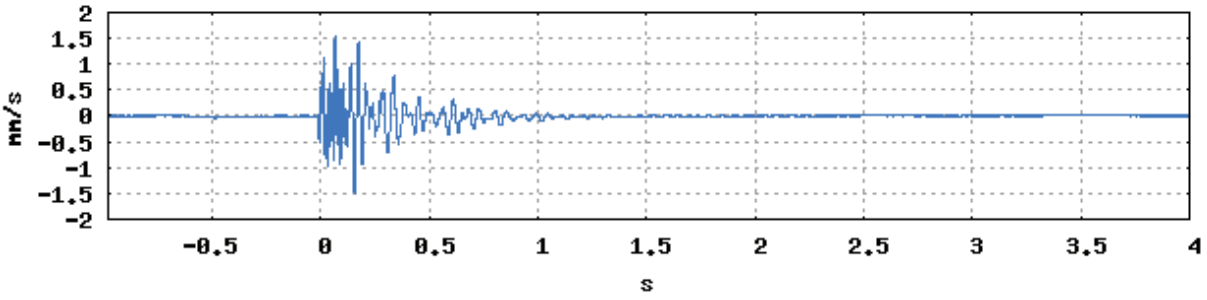


GEO001 Transversal

Demo Office

Wave Form

BAXXXX-T2E



Demo Office

Wave Form

BAXXXX-T2E

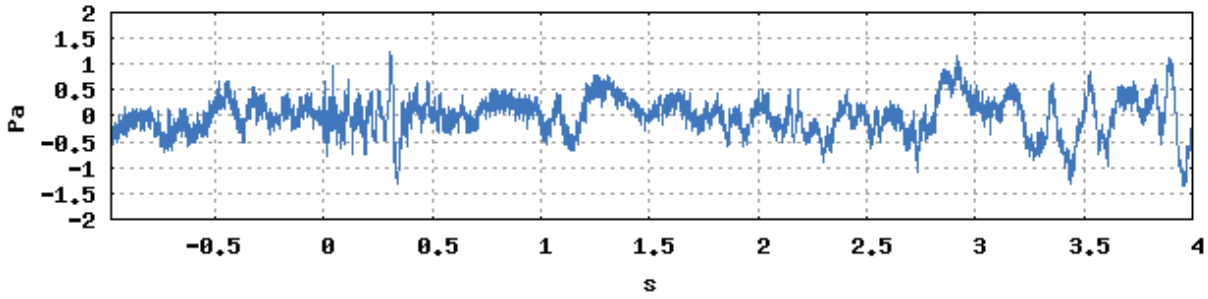
Print Close

Measurement Point	AIR002	GEO002	GEO002	GEO002
Placement				
Axis	Air shock	Vertical	Longitudinal	Transversal
Round				
Time	19/10/2012 13:02:35	19/10/2012 13:02:35	19/10/2012 13:02:35	19/10/2012 13:02:35
Value	98.0 dBL	1.05 mm/s	1.15 mm/s	2.15 mm/s
	1.37 Pa	0.37 m/s2	0.42 m/s2	0.53 m/s2
	0.04 Pas	7.52 um	5.15 um	10.0 um
	6.56 Hz	14.9 Hz	31.1 Hz	22.7 Hz

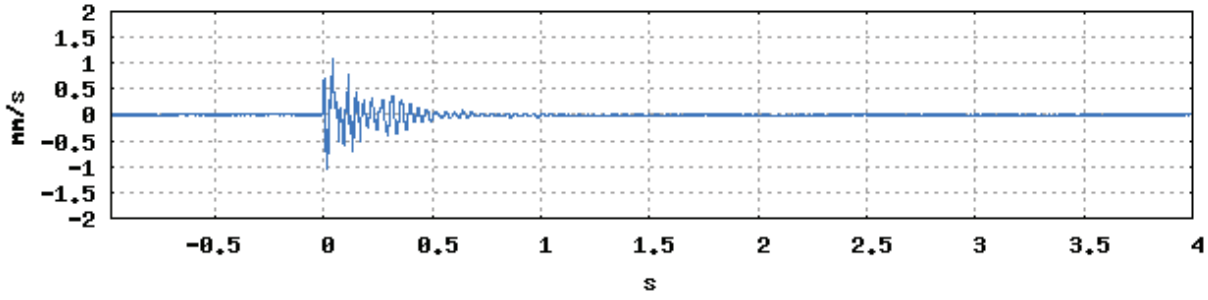
Display Format Picture

Create

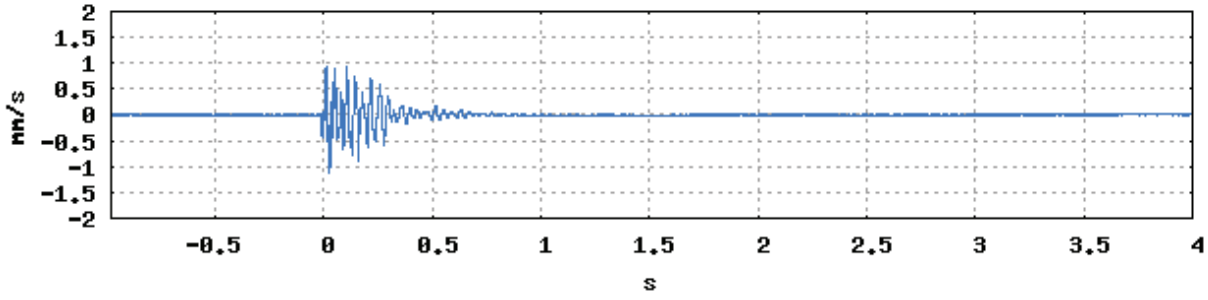
AIR002 Air shock



GEO002 Vertical



GEO002 Longitudinal

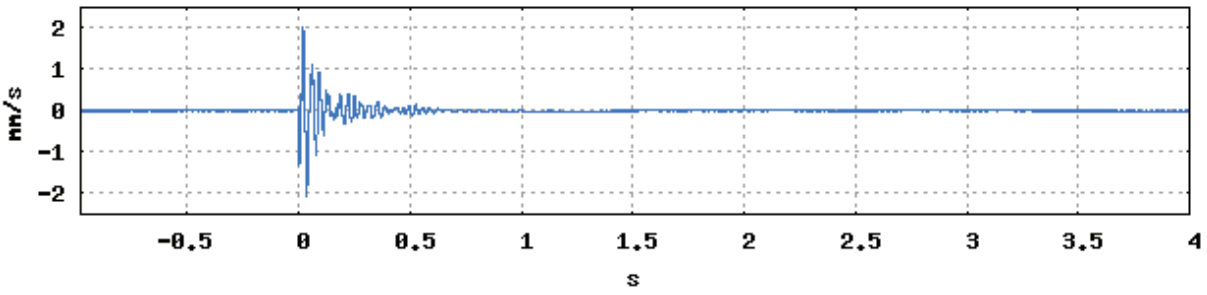


GEO002 Transversal

Demo Office

Wave Form

BAXXXX-T2E



Orica SIGICOm vibration unit setup for Trial Blast 0n the 19/10/12.
Unit AIR001 = [redacted]
Unit AIR002 = [redacted]
Orica vibration units is registed based on QLD time.

Measurement Point	Placement	Date	Time	Value	Unit	Limit	Part of Limit	Vppv	Distance	Round	Remark
GEO001 L		19/10/2012	13:40	14.9	mm/s	5	298				
GEO001 T		19/10/2012	13:40	16.6	mm/s	5	332				
AIR001		19/10/2012	13:17	118	dBL	115	103				
GEO001 V		19/10/2012	13:17	0.05	mm/s	5	1	0.09 mm/s			
GEO001 L		19/10/2012	13:17	0.05	mm/s	5	1	0.09 mm/s			
GEO001 T		19/10/2012	13:17	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	13:13	115	dBL	115	100				
GEO001 V		19/10/2012	13:13	0.05	mm/s	5	1	0.06 mm/s			
GEO001 L		19/10/2012	13:13	0.05	mm/s	5	1	0.06 mm/s			
GEO001 T		19/10/2012	13:13	0.05	mm/s	5	1	0.06 mm/s			
AIR001		19/10/2012	13:13	116	dBL	115	101				
GEO001 V		19/10/2012	13:13	0.05	mm/s	5	1	0.09 mm/s			
GEO001 L		19/10/2012	13:13	0.05	mm/s	5	1	0.09 mm/s			
GEO001 T		19/10/2012	13:13	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	13:09	117	dBL	115	102				
GEO001 V		19/10/2012	13:09	0.05	mm/s	5	1	0.09 mm/s			
GEO001 L		19/10/2012	13:09	0.05	mm/s	5	1	0.09 mm/s			
GEO001 T		19/10/2012	13:09	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	13:02	100	dBL	115	87				TR AL BLAST 4
AIR002		19/10/2012	13:02	98	dBL	115	85				
GEO001 V		19/10/2012	13:02	1.05	mm/s	5	21	1.64 mm/s			
GEO001 L		19/10/2012	13:02	1.4	mm/s	5	28	1.64 mm/s			
GEO001 T		19/10/2012	13:02	1.55	mm/s	5	31	1.64 mm/s			
GEO002 V		19/10/2012	13:02	1.05	mm/s	5	21	2.37 mm/s			
GEO002 L		19/10/2012	13:02	1.15	mm/s	5	23	2.37 mm/s			
GEO002 T		19/10/2012	13:02	2.15	mm/s	5	43	2.37 mm/s			
AIR002		19/10/2012	12:55	120	dBL	115	104				
GEO002 V		19/10/2012	12:55	0.05	mm/s	5	1	0.07 mm/s			
GEO002 L		19/10/2012	12:55	0.05	mm/s	5	1	0.07 mm/s			
GEO002 T		19/10/2012	12:55	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	12:45	123	dBL	115	107				
GEO001 V		19/10/2012	12:45	0.05	mm/s	5	1	0.07 mm/s			
GEO001 L		19/10/2012	12:45	0.05	mm/s	5	1	0.07 mm/s			
GEO001 T		19/10/2012	12:45	0.05	mm/s	5	1	0.07 mm/s			
AIR001		19/10/2012	12:33	116	dBL	115	101				
GEO001 V		19/10/2012	12:33	0.05	mm/s	5	1	0.09 mm/s			
GEO001 L		19/10/2012	12:33	0.05	mm/s	5	1	0.09 mm/s			
GEO001 T		19/10/2012	12:33	0.05	mm/s	5	1	0.09 mm/s			
AIR001		19/10/2012	12:31	116	dBL	115	101				
GEO001 V		19/10/2012	12:31	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	12:31	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	12:31	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	12:29	118	dBL	115	103				
GEO001 V		19/10/2012	12:29	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	12:29	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	12:29	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	12:27	116	dBL	115	101				
GEO001 V		19/10/2012	12:27	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	12:27	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	12:27	0.05	mm/s	5	1	0.08 mm/s			
AIR001		19/10/2012	12:13	117	dBL	115	102				
GEO001 V		19/10/2012	12:13	0.05	mm/s	5	1	0.08 mm/s			
GEO001 L		19/10/2012	12:13	0.05	mm/s	5	1	0.08 mm/s			
GEO001 T		19/10/2012	12:13	0.05	mm/s	5	1	0.08 mm/s			

APPENDIX 6 - MONITOR DISTANCE TO HOUSES WITH EACH TRIAL BLAST EVENT (Additional input)

GENERAL NOTES / REFERENCES

BAULDERSTONE

Lynton Surveys Pty Ltd

SURVEYED / DRAWN BY: WR

CHECKED:

VERIFIED:

SCALE: 1000

PLOT DATE: Thu Oct 25 10:21:16 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan - Test1

PROJECTION: MGA94 / AHD

DRAWING No.

REV: B

GENERAL NOTES / REFERENCES

BAULDERSTONE

Lynton Surveys Pty Ltd

SURVEYED / DRAWN BY: WR

CHECKED:

VERIFIED:

SCALE: 1000

PLOT DATE: Thu Oct 25 11:24:57 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale

Southern Portal

Monitor Block Location Plan - Test2

PROJECTION: MGA94 / AHD

DRAWING No.

REV: B

GENERAL NOTES / REFERENCES

BAULDERSTONE

Lynton Surveys Pty Ltd

SURVEYED / DRAWN BY: WR

CHECKED:

VERIFIED:

SCALE: 1000

PLOT DATE: Thu Oct 25 11:26:29 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan - Test3

PROJECTION: MGA94 / AHD

DRAWING No.

REV: B

GENERAL NOTES / REFERENCES

BAULDERSTONE

Lynton Surveys Pty Ltd

SURVEYED / DRAWN BY: WR

CHECKED:

VERIFIED:

SCALE: 1000

PLOT DATE: Thu Oct 25 11:26:11 2012

Pacific Highway Upgrade Tintenbar to Ewingsdale
Southern Portal
Monitor Block Location Plan - Test4

PROJECTION: MGA94 / AHD

DRAWING No.

REV: B

APPENDIX 7 - John Heilig Review

HEILIG & PARTNERS
Engineered Excellence

- Tunnelling
- Construction
- Open Pit Mining
- Quarrying
- Underground Mining
- Blast Design
- Blast Permitting
- Vibration Monitoring
- Vibration Analysis
- Expert Witness

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P.O. Box 176
Sumner Park BC. QLD. 4074. Australia

Telephone +61 7 3715 7599
Facsimile +61 7 3715 7588

Email group@heiligandpartners.com.au
www.heiligandpartners.com.au

datatrap
vibration management software

Monday, October 29, 2012

Ref:jhh:T2E Blast review.docx

Shashi Ranggaraja
Baulderstone Pty Ltd (NSW)
Pacific Highway Upgrade
Tintenbar to Ewingsdale

RE: Review of T2E trial blast data

Dear Shashi,

Further to the data provided from the T2E project, and in particular the measurement of vibration levels from the trial blasting completed as part of the planned blasting areas, please accept this technical letter as a review of the blasting activities. The technical letter covers the results associated with the four trial blasts completed at the portal on the 19th October, 2012.

Four trial blasts were initiated on the 19th October 2012. Each blast was monitored at up to six locations varying between 114 to 181 metres from the blast, noting that at some locations for each blast, the level of vibration was not recorded. The resulting levels of vibration have been analysed to better understand the relationship between vibration level, distance and explosive quantity. This section provides the results of the trial blasts undertaken to assess the level of vibration from the planned blasting activities required as part of the project.

The primary factors known to influence the level of ground vibration from blasting include:

- The weight of explosive per blasthole;
- The distance between the blastholes and the point of measurement;
- The local geological conditions, including rock mass conditions.

The blasting was planned with an explosive weight varying between 2.4 and 4.8 kilograms per blasthole for both patterns.

The vibration data have been analysed using techniques consistent with the recommendations provided in the Australian Standard AS2187.2. The form of the equation typically used to predict the level of vibration for a given explosive quantity and distance is used and has the following form:

$$PPV \quad K\left(\frac{d}{\sqrt{w}}\right)^{\alpha}$$

where PPV is the peak particle velocity measured in mm/s, d is the distance from the blast measured in metres, w is the maximum quantity of explosive per delay, and K and α are site constants. The term in brackets ($d/\sqrt{w}$) is referred to as the scaled distance term.

Figure 1 shows the recorded vibration data for each of the trials according to the production blast. The values on the Y axis indicate the measured vibration level (vector sum value). The values on the X axis represent the value of the scaled distance term, calculated as the distance between the blast and the monitoring site divided by the square root of the explosive quantity.

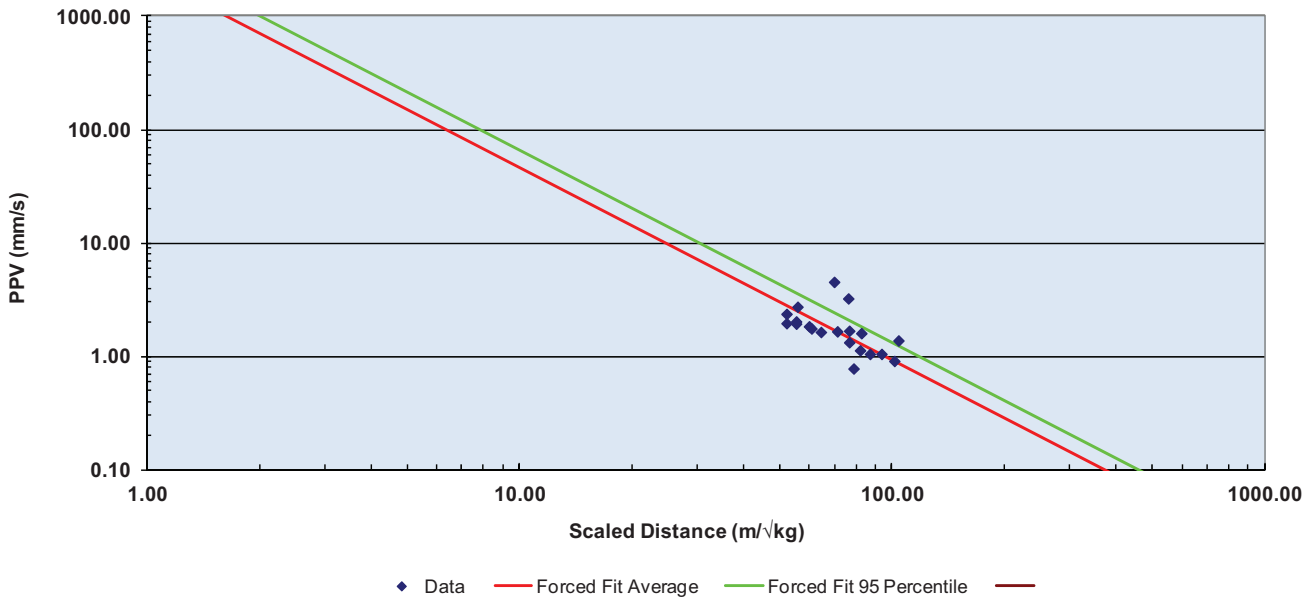

Figure 1 – Graph showing measured vibration levels as a function of the scaled distance term

A relationship between the level of vibration, the quantity of explosive and the distance from the blast has been derived from vibration measurements collected from the different monitoring locations and two trial blasts. The regressed equation is as follows:

$$PPV_{Average} \quad 2160\left(\frac{d}{\sqrt{w}}\right)^{1.68}$$

To account for variability in the explosive performance and rock mass variations, best practice is to predict vibration levels as the "*effective maximum*" where this level exceeds 95% of all measurements. The equation is as follows:

$$PPV_{Maximum\ Blasting} \quad 3120\left(\frac{d}{\sqrt{w}}\right)^{1.68}$$

where $PPV_{Maximum\ Blasting}$ is the *"effective maximum vibration level"*, d is the distance between the blasthole and the point of measurement and w is the maximum quantity of explosive per blasthole.

The equations could be compared to the preliminary modelling which was based upon the following equation:

$$PPV_{Preliminary\ Modelling} \quad 3090\left(\frac{d}{\sqrt{w}}\right)^{1.60}$$

The following comments are also offered with respect to the trial data:

- The data are collected over a relatively narrow band of distances ranging only between 114 metres and 181 metres. Extrapolating beyond this range may provide erroneous results. Ideally, recording of some vibration levels nearer to the blast (say 50 metres) as well as information at further distances (say 250 metres) would assist in better defining the attenuation of vibration.
- The data indicate that the vibration levels measured at [redacted] are higher than expected when compared to the levels from the same blast recorded at the other properties. As

an example, for the third blast a level of 4.54mm/s was measured at the [redacted] property at 153 metres from the blast whilst at the closer [redacted] property which was 131 metres from the same blast, the levels was less than half at 1.84mm/s. The [redacted] results all show similar cases of measuring higher vibration levels when compared to other closer points from the blast.

It is not suggested that any further adjustments to the preliminary modelling are completed until some further data are collected, particularly information at the [redacted]s property. Analyses from subsequent blasting would also be enhanced by recording vibration levels at two additional distances of say 50 and 250 metres to assist in defining the attenuation parameter.

As always, you are most welcome to contact me at your convenience to discuss in further detail any of the issues raised in this letter.

Yours truly,

John Heilig

Dr. John Heilig
Principal - Heilig & Partners Pty Ltd

Appendix 13 – Consultation with ERG Member Agencies

Report name	Pacific Highway Upgrade - Tintenbar to Ewingsdale – Proposed Blasting Modification			
Agency name	Environment Protection Authority			
Section	Comment	Adequacy	Merit	How addressed by RMS
		Tick where applicable		
	1. The EPA has no objection to increased ground vibration limits at the most affected residence or noise sensitive location as detailed in section 2.9 of the Baulderstone Modification Request provided agreement is reached with the occupier that a higher limit may apply (as per condition L3.5 of Environmental Protection Licence 20138)			▪ Noted. This is as proposed in the Modification Request for an Extension to Blasting Hours, Air Blast Overpressure and Vibration Limits.
	2. Continuation of blasting at the greater limit should be on a blast by blast basis and subject to there being no unresolved complaints.			▪ Agreed. As proposed in the Modification Request for an Extension to Blasting Hours, Air Blast Overpressure and Vibration Limits, operation at the higher blast vibration and over pressure limits is subject to the written and continued consent of the affected property owner. Consultation with affected residents, including the signed agreement included the statement: - "*If you consent to the proposal to increased blasting vibration and airblast overpressure limits at the St Helena tunnel, as set out in this letter, please sign the consent declaration below and return in the reply paid envelope provided at your earliest convenience.* *If the increase in controlled blasting and airblast overpressure limits are unsatisfactory due to vibration or any other impacts you may experience, please notify the Tintenbar to Ewingsdale project team to arrange a meeting to resolve any issues. If a resolution cannot be reached by both parties during these discussions you may give notice to the project team for the termination of this agreement.*

Report name	Pacific Highway Upgrade - Tintenbar to Ewingsdale – Proposed Blasting Modification			
Agency name	Environment Protection Authority			
Section	**Comment**	**Adequacy**	**Merit**	**How addressed by RMS**
		Tick where applicable		
				If you choose to terminate the agreement, the current approved blast limits under the Minister's approval (of no exceedence of 10 millimetres per second for vibration and 120 dB (Lin Peak) for airblast overpressure at any time) would continue to apply to your property." which makes affected residents aware they can terminate the written agreement and the current approved blast limits under the Minister's approval would apply.
	3. In the event that there are unresolved complaints the ground vibration limit should revert to 5mm/s (95%) and 10mm/s (100%) as per the standard Environmental Protection Licence conditions.			▪ Agreed. Please also refer to the response to Item 2 above.
	4. The EPA has no objection to increased airblast overpressure limits as detailed in section 2.8 of the Baulderstone Modification Request if written agreement is reached with the occupier that a higher limit may apply (as per condition L3.5 of the Environmental Protection Licence).			▪ Noted. This is as proposed in the Modification Request for an Extension to Blasting Hours, Air Blast Overpressure and Vibration Limits.
	5. The EPA has no objection to the extension of blasting hours to make them consistent with construction hours (7:00am to 6:00pm) as detailed in section 2.6 of the Baulderstone Modification Request provided that written agreement is reached			▪ Noted. This is as proposed in the Modification Request for an Extension to Blasting Hours, Air Blast Overpressure and Vibration Limits.

Report name	Pacific Highway Upgrade - Tintenbar to Ewingsdale – Proposed Blasting Modification			
Agency name	Environment Protection Authority			
Section	**Comment**	**Adequacy**	**Merit**	**How addressed by RMS**
		Tick where applicable		
	with potentially affected receivers or where compelling safety reasons exist as per condition L4.5 of the Environmental Protection Licence 20138..			
	6. The EPA acknowledges the efforts made by Baulderstone with regard to undertaking community consultation in relation to the proposed increase in the blasting limits..			▪ Thankyou. Please note the community consultation efforts were a joint project team effort with RMS project staff who provided valuable guidance, learning's and experiences gathered across a range of recent Pacific Highway and other major project as well as attendance at various meetings and discussions with residents.

Kieran Metcalfe

From: Craig Dunk <Craig.Dunk@epa.nsw.gov.au>
Sent: Thursday, 24 January 2013 10:06 AM
To: Peter Borrelli
Cc: Chris McCallum; Bill Gardyne; Chris Sheen; Kieran Metcalfe; Robert Donohoe
Subject: RE: Modification Request for an extension to blasting hours, airblast overpressure and vibration

Hi Peter,

The EPA acknowledges the responses to the EPA comments regarding the modification request for an extension of blasting hours, airblast overpressure and vibration and has no further comments.

Regards

Craig Dunk
Regional operations Officer | **NSW Environment Protection Authority** |
☎: (02) 6640 2514 | Mobile ☎: 0427 237 154 | 🖷: (02) 6640 2539 | 🖱: Craig.Dunk@epa.nsw.gov.au

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From: BORRELLI Peter [mailto:Peter.BORRELLI@rms.nsw.gov.au]
Sent: Wednesday, 23 January 2013 12:18 PM
To: Dunk Craig; Donohoe Robert
Cc: Chris McCallum; Bill Gardyne; Sheen Chris; kmetcalfe@baulderstone.com.au
Subject: RE: Modification Request for an extension to blasting hours, airblast overpressure and vibration
Importance: High

Craig, Robert,

Thank you very much for the prompt EPA reply. Much appreciated.

Please find attached our proposed response to your comments. All of our responses are essentially acknowledging / agreeing with your comments.

So that we may include this in the final document that goes to DoPI and close the loop so as to speak, could you please advice if you are happy with our responses.

Any queries please call me on 0407 254 363.

Thanks

Peter Borrelli
Senior Project Manager, Strategic Projects
23 January 2013

From: Craig Dunk [mailto:Craig.Dunk@epa.nsw.gov.au]
Sent: Tuesday, 22 January 2013 4:45 PM
To: Chris McCallum
Cc: BORRELLI Peter; Robert Donohoe; Bill Gardyne; Chris Sheen; kmetcalfe@baulderstone.com.au
Subject: RE: Modification Request for an extension to blasting hours, airblast overpressure and vibration

Hi Chris,

The Environment Protection Authority (EPA) appreciates the opportunity to comment on the Modification request made to the Department of Planning and Infrastructure to modify the project approval for an extension to blasting hours, airblast overpressure and vibration limits for the Tintenbar to Ewingsdale (T2E) Pacific Highway Upgrade Project. Below are comments in relation to the proposal documents received from Baulderstone on the 9 January 2012.

- The EPA has no objection to increased ground vibration limits at the most affected residence or noise sensitive location as detailed in section 2.9 of the Baulderstone Modification Request provided agreement is reached with the occupier that a higher limit may apply (as per condition L3.5 of Environmental Protection Licence 20138).

- Continuation of blasting at the greater limit should be on a blast by blast basis and subject to there being no unresolved complaints.

- In the event that there are unresolved complaints the ground vibration limit should revert to 5mm/s (95%) and 10mm/s (100%) as per the standard Environmental Protection Licence conditions.

- The EPA has no objection to increased airblast overpressure limits as detailed in section 2.8 of the Baulderstone Modification Request if written agreement is reached with the occupier that a higher limit may apply (as per condition L3.5 of the Environmental Protection Licence).

- The EPA has no objection to the extension of blasting hours to make them consistent with construction hours (7:00am to 6:00pm) as detailed in section 2.6 of the Baulderstone Modification Request provided that written agreement is reached with potentially affected receivers or where compelling safety reasons exist as per condition L4.5 of the Environmental Protection Licence 20138.

- The EPA acknowledges the efforts made by Baulderstone with regard to undertaking community consultation in relation to the proposed increase in the blasting limits.

Please give me a call on 6640 2514 if you would like to discuss any of the above comments.

Regards

Craig Dunk
Regional operations Officer | **NSW Environment Protection Authority** |
☎: (02) 6640 2514 | Mobile ☎: 0427 237 154 | 🖷: (02) 6640 2539 |🖱: Craig.Dunk@epa.nsw.gov.au

---

From: Chris McCallum [mailto:CMcCallum@baulderstone.com.au]
Sent: Monday, 21 January 2013 4:23 PM
To: Anthony Acret; Donohoe Robert; Dunk Craig; Bill Gardyne; Wes Johnstone; Michael King; Patrick Pahlow; Chris Rumpf; james.sakker@industry.nsw.gov.au; Sheen Chris
Cc: Peter Borrelli
Subject: Modification Request for an extension to blasting hours, airblast overpressure and vibration

Folks,

A gentle reminder that the review period for the Modification Request for an extension to blasting hours, airblast overpressure and vibration closes this Wednesday. To facilitate the approval process with Department of Planning and Infrastructure, your feedback or statement of no comment by would be appreciated.

Please call if you require any further information or clarification

Thanks

Chris McCallum | Environmental Manager | Baulderstone Pty Ltd (NSW)
Tintenbar to Ewingsdale Pacific Highway Upgrade

Corner Pacific Highway & Bangalow Road
PO Box 604, Bangalow NSW 2479
Mobile: 0408 264 164 | Desk: (02) 6618 6147 | Fax: (02) 6618 6101
Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

Kieran Metcalfe

From: Chris McCallum
Sent: Tuesday, 22 January 2013 1:53 PM
To: Kieran Metcalfe
Subject: FW: Modification Request for an extension to blasting hours, airblast overpressure and vibration

FYI

Chris McCallum | Environmental Manager | Baulderstone Pty Ltd (NSW)
Tintenbar to Ewingsdale Pacific Highway Upgrade
Corner Pacific Highway & Bangalow Road
PO Box 604, Bangalow NSW 2479
Mobile: 0408 264 164 | Desk: (02) 6618 6147 **|** Fax: (02) 6618 6101
Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

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From: Wes Johnstone [mailto:wesj@ballina.nsw.gov.au]
Sent: Tuesday, 22 January 2013 1:53 PM
To: Chris McCallum
Subject: RE: Modification Request for an extension to blasting hours, airblast overpressure and vibration

Chris

No Comment

Regards

Wes Johnstone | Project Engineer - Works
Civil Services
Ballina Shire Council

www.ballina.nsw.gov.au

p: (02) 6686 1229 | **f:** (02) 6686 9514 | **m:** 0428864443

From: Chris McCallum [mailto:CMcCallum@baulderstone.com.au]
Sent: Monday, 21 January 2013 4:23 PM
To: Anthony Acret; Robert Donohoe (Robert.Donohoe@epa.nsw.gov.au); Dunk Craig (Craig.Dunk@epa.nsw.gov.au); Bill Gardyne; Wes Johnstone; Michael King; Patrick Pahlow; Chris Rumpf; james.sakker@industry.nsw.gov.au; Chris Sheen
Cc: Peter Borrelli
Subject: Modification Request for an extension to blasting hours, airblast overpressure and vibration

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Please call if you require any further information or clarification

Thanks

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Tintenbar to Ewingsdale Pacific Highway Upgrade
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PO Box 604, Bangalow NSW 2479
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Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

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Kieran Metcalfe

From: Chris McCallum
Sent: Tuesday, 22 January 2013 8:00 AM
To: Kieran Metcalfe
Subject: FW: Modification Request for an extension to blasting hours, airblast overpressure and vibration

FYI

Chris McCallum | Environmental Manager | Baulderstone Pty Ltd (NSW)
Tintenbar to Ewingsdale Pacific Highway Upgrade
Corner Pacific Highway & Bangalow Road
PO Box 604, Bangalow NSW 2479
Mobile: 0408 264 164 | Desk: (02) 6618 6147 **|** Fax: (02) 6618 6101
Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

From: james.sakker@dpi.nsw.gov.au [mailto:james.sakker@dpi.nsw.gov.au]
Sent: Tuesday, 22 January 2013 7:56 AM
To: Chris McCallum
Subject: Re: Modification Request for an extension to blasting hours, airblast overpressure and vibration

NSW DPI have no comment on this modification request
regards James
James Sakker Conservation Manager (Pacific Highway Upgrade) Department of Primary Industries NSW (NSW DPI)
1243 Bruxner Highway Wollongbar NSW 2477
M 0419 185378 F 02 66283264
james.sakker@industry.nsw.gov.au

From: Chris McCallum <CMcCallum@baulderstone.com.au>
To: Anthony Acret <Anthony.acret@rouswater.nsw.gov.au>, "Robert Donohoe (Robert.Donohoe@epa.nsw.gov.au)" <Robert.Donohoe@epa.nsw.gov.au>, "Dunk Craig (Craig.Dunk@epa.nsw.gov.au)" <Craig.Dunk@epa.nsw.gov.au>, Bill Gardyne <Bill@oxbow.com.au>, Wes Johnstone <wesj@ballina.nsw.gov.au>, Michael King <Michael.King@byron.nsw.gov.au>, Patrick Pahlow <Patrick.Pahlow@water.nsw.gov.au>, Chris Rumpf <Chris.rumpf@water.nsw.gov.au>, "james.sakker@industry.nsw.gov.au" <james.sakker@industry.nsw.gov.au>, Chris Sheen <Chris.Sheen@epa.nsw.gov.au>
Cc: Peter Borrelli <Peter.borrelli@rms.nsw.gov.au>
Date: 21/01/2013 04:23 PM
Subject: Modification Request for an extension to blasting hours, airblast overpressure and vibration

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Folks,

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Please call if you require any further information or clarification

Thanks

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Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

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From:	Chris McCallum
To:	Kieran Metcalfe
Subject:	FW: Modification Request for an extension to blasting hours, airblast overpressure and vibration
Date:	Tuesday, 22 January 2013 11:58:42 AM

FYI

Chris McCallum | Environmental Manager | Baulderstone Pty Ltd (NSW)
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Email: cmccallum@baulderstone.com.au | www.baulderstone.com.au

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From: Patrick Pahlow [mailto:Patrick.Pahlow@water.nsw.gov.au]
Sent: Tuesday, 22 January 2013 11:33 AM
To: Chris McCallum
Subject: Re: Modification Request for an extension to blasting hours, airblast overpressure and vibration

no comment

Patrick Pahlow | Senior Licensing Officer |
NSW Department of Primary Industries | Office of Water |
135 Murwillumbah Street | Murwillumbah NSW 2484
PO Box 796 | Murwillumbah NSW 2484
T: 02 6676 7386 | F: 02 6676 7388 | E: patrick.pahlow@water.nsw.gov.au
W: www.dpi.nsw.gov.au | www.water.nsw.gov.au

>>> Chris McCallum <CMcCallum@baulderstone.com.au> 1/21/2013 4:22 pm >>>
Folks,

A gentle reminder that the review period for the Modification Request for an extension to blasting hours, airblast overpressure and vibration closes this Wednesday. To facilitate the approval process with Department of Planning and Infrastructure, your feedback or statement of no comment by would be appreciated.

Please call if you require any further information or clarification

Thanks

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