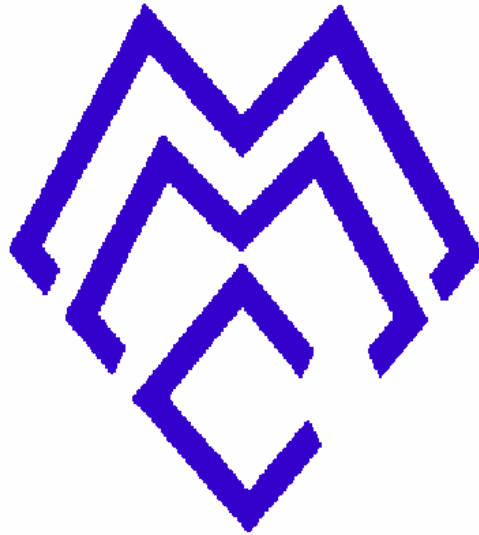


ADDENDUM 318A

SPRING CREEK MINE

PIT 4 GROUND MOTION ATTENUATION ANALYSIS



**Mr. Lance Sigismond
Rio Tinto Energy America
Spring Creek Mine
One Lake Shore Drive
Decker, MT 59025**

August 2, 2007

**PIT 4 GROUND MOTION
ATTENUATION ANALYSIS**

**RIO TINTO ENERGY AMERICA
SPRING CREEK MINE**

**PIT 4
GROUND MOTION ATTENUATION ANALYSIS**

June 20, 2007

Executive Summary

The purpose of this report is to analyze ground motion attenuation at Rio Tinto Energy America's Spring Creek Mine in Decker, Montana in order to determine an appropriate stand off distance from a pictograph (rock art) panel located north of Pit 4. Matheson Mining Consultants, Inc. (MMC) was retained to analyze blast vibration data for one overburden blast in Pit 4 as well as additional historic Pit 4 vibration records to be incorporated into this analysis. Twenty-five vibration measurements were recorded from blast #5336 on June 20, 2007 to be used in the analysis. Six historic Pit 4 vibration measurements dating from November 8, 2006 to January 22, 2007 were also used in the ground motion attenuation analysis.

In addition to the analysis presented in this report, historical research was examined, which included high peak particle velocities measured in a tunnel near blasting operations as well as thermal shock experienced by a rock mass due to diurnal temperature fluctuations. This data provided a basis for comparison of effects on rock masses from large blast vibrations and typical environmental forces. Recommended peak particle velocities in this report are extremely conservative compared to particle velocities known to cause visible damage to rock masses or diurnal temperature fluctuations. Daily temperature changes may create strains in the rock mass equivalent to those caused by particle velocities in excess of 50 inches per second (ips).

MMC recommends using a conservative peak particle velocity (ppv) limit of 4.0 ips to protect the pictograph panel from blast vibrations. The recommended scaled distance to not exceed 4.0 ips peak particle velocity (ppv) for Pit 4 blasts is 14.23. The Pit 4 ground motion attenuation analysis is comprised of thirty-one data points; the data has a high correlation coefficient of 0.934. All data, the least squares linear regression analyses, as well as a site map showing the instrument locations are attached to this report.

MMC further examined a ground motion attenuation analysis compiled using historical vibration data measured at the pictograph panel between 2001 and 2005. This analysis shows a high level of variability in data collected from different blasting types in more than one pit. Statistically, the data shows a poor degree of correlation when compared to the June 20 study and the absence of high particle velocity data restricts the use of the historical analysis in predicting peak particle velocities with any degree of confidence. For comparison, this data has been included as the final Appendix in this

report. The data from the June 20 analysis is all taken from blasts in the same pit and the charge weights and distances are known to have been checked by more than one source. Shot reports and vibration records were not available to MMC when compiling the 2001 to 2005 attenuation analysis and the accuracy of the numbers supplied could not be verified. A high degree of confidence may be placed on the conservative June 20 analysis and this attenuation equation should be used for all pit 4 planning and blast design.

Scaled distance is a relationship used in explosives engineering to interrelate blasts with different maximum charge weights per delay period:

$$SD = D / \sqrt{W}$$

Where: SD = Scaled Distance
D = Distance, in feet
W = Maximum charge weight per delay period, in pounds

The table below represents appropriate scaled distance factors to maintain compliance with the associated peak particle velocities listed.

Recommended Scaled Distance Factors and
Corresponding Peak Particle Velocities

Scaled Distance	Peak Particle Velocity (in/s)
35.5	1
22.5	2
17.2	3
14.23	4
12.28	5

INTRODUCTION

Matheson Mining Consultants, Inc. (MMC) was retained by Rio Tinto Energy America to analyze vibration attenuation characteristics of overburden blasting in Pit 4 of the Spring Creek Mine located in Decker, Montana and to provide a statistical linear regression analysis of the data in order to establish scaled distance limits that will maintain the structural integrity of an existing pictograph (rock art) panel listed in the national historic register

The Spring Creek Mine is located approximately ten miles north of Decker, MT on state highway 314. Appendix I contains a map of Pit 4 with seismograph locations for blast #5336. The seismograph location labeled picto represents the monitoring location for the pictograph panel. This location is where the six historic vibration records were measured. The shot report and vibration data for blast 5336 on June 20, 2007 is located in Appendix II. Historic blasting data used in the analysis is outlined in the table below; historic vibration records are located in Appendix III.

Particle velocity and air overpressure data acquired in the field are input into a least squares linear regression analysis program. The United States Office of Surface Mining and Reclamation Enforcement (OSMRE) have approved this program. The regression analysis yields a site-specific vibration attenuation formula in the form:

$$PPV = H(SD)^{-B}$$

where, H = the velocity (y axis intercept) at a scaled distance of one,
B = the slope of the curve,
PPV = the peak particle velocity in inches per second, and
SD = scaled distance = distance from shot to seismograph divided
by the square root of the charge weight.

The program also yields the correlation coefficient (goodness of fit), r^2 . The procedure for the analysis performed is outlined in the "Blasting Guidance Manual," March, 1987, published by the United States Department of the Interior Office of Surface Mining Reclamation and Enforcement.

Historic Blast Data – Pit 4, Ground Motion Attenuation Analysis

Shot #	Date	Location	Distance to Rock Art	Total pounds per 8ms Delay	Total Pounds used	Peak Particle Velocity (in/s)
5213	11/8/2006	SW 1/4 SE 1/4 SEC 14 R39E T8S	3300	1,550	133,121	0.200
5224	11/20/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	850	27,830	0.090
5230	11/27/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	1,250	13,197	0.080
5234	12/4/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	1,850	24,862	0.120
5264	1/20/2007	NE 1/4 SW 1/4 SEC 14 R39E T8S	3000	1,300	20,555	0.145
5266	1/22/2007	NE 1/4 SW 1/4 SEC 14 R39E T8S	5266	1,050	25,941	0.100

INSTRUMENTATION

Vibration records were collected using InstanTel Minimate Plus seismographs. The seismographs record particle velocity digitally in the frequency range of 1.5 to 250 Hertz. Each shot is measured in three orthogonal channels of ground motion: vertical, longitudinal, and transverse; and one channel of air-overpressure. Zero-crossings of each of the four-waveform components are calculated to determine frequency response.

An independent party using shake table, piston phone, and electronics traceable to the National Institute of Science and Technology has calibrated the instruments within the past year. Copies of the calibration certificates for the instruments, geophones, and microphones are on file at MMC, or the Portland Plant Quarry. In addition, the instrument performs a self-test before monitoring. This is a check of the geophone's overswing and dampening. The microphone is also checked. Air overpressure monitoring was not preformed as part of this analysis.

It is not possible to alter the vibration recordings or file names in any way, other than the ability to add post event notes. For security reasons, the instrument and software manufacturer (InstanTel) will not release any of the programming code to any outside interests for any reason.



Checking the seismographs before the blast

PROCEDURE

Data used in the ground motion attenuation analysis was collected during the following Pit 4 blasts: 5213, 5224, 5230, 5234, 5264, 5266, and 5336. Vibrations were measured at distances from 284 feet from the blast patterns to 5,266 feet. Twenty-five measurements were taken during the 5336 blast on June 20, 2007. One vibration record was taken during each of the six historic blasts 5213-5266.

A least squares linear regression analysis was then performed on each data set to determine the +95% confidence equation as recommended by OSMRE and USBM regulatory guidelines. The statistical validity of the data set is evaluated using the correlation coefficient calculated during the analysis. The equation for the +95% confidence interval is then used to calculate the maximum charge weight per delay period for any given particle velocity and distance or any air overpressure and distance. Recommendations are made based on regulatory criteria, accepted citizen tolerance levels, and historic vibration monitoring from existing mine production.

According to studies done on diurnal fluctuations in ambient and rock temperatures, rock temperature fluctuations are generally double that of the fluctuations of the ambient air temperatures ^{(1), (2)}. The localized strains resulting from rapid temperature fluctuations on the rock surface are called thermal shock and are directly proportional to the rock's thermal coefficient of expansion.

As an example, the sensitive pictographs north of Pit 4 are located in sandstone, which has a thermal coefficient of expansion of 9×10^{-6} per degree Fahrenheit. The average ambient temperature difference in Montana may be 40 degrees Fahrenheit, resulting in a differential rock surface temperature of 80 degrees Fahrenheit and thermal strains of 0.00072 in/in. The following equation is used to estimate the dynamic strain in rock resulting from ground vibrations.

$$\text{Strain} = \text{Peak particle velocity (PPV)} / \text{Propagation Velocity (Vp)} \quad \text{or} \\ \text{PPV} = \text{Strain} \times \text{Vp}$$

Assuming the propagation velocity of this sandstone is 10,000 feet per second (fps) or 120,000 inches per second (ips).

$$\text{PPV} = 0.00072 \times 120,000 = 86 \text{ ips}$$

The sandstone rock mass is subjected to the equivalent PPV of 86 ips with a diurnal temperature change of 40 degrees Fahrenheit. This process has been occurring every year for hundreds of years since the pictographs were originally created without noticeable loss of structural integrity of the pictographs.

(1) Cooke, R.U., Warren, Andrew, and Gouldie, Andrew, 1993, Desert Geomorphology: London, UCL Press, p. 526

(2) McFadden, L.D., Eppes, M.C., Gillespie, A.R., and Hallet, B., 2005, Physical Weathering in Arid Landscapes Due to Diurnal Variation in the Direction of Solar Heating: Geological Society of America, Bulletin, v.117, no.1/2, p. 161-173

Blasting operations above a one hundred year old disused railway tunnel nearly twenty six feet wide by 20 feet high were studied to determine what if any effect the blasting would have on the structural integrity of the rock tunnel and or the brick lined crown supporting the roof ⁽³⁾. The tunnel crown was determined to be the most vibration sensitive component of the tunnel and was subjected to extensive examination before and after each blast. Vibrations from each blast were measured using seismographs as the surface quarry blasting approached and eventually intersected one portion of the railway tunnel. Peak particle velocities up to 10.35 ips were recorded in the brick lined crown with no visible damage. Figure 1 shows a cross section of the tunnel with seismograph positions.

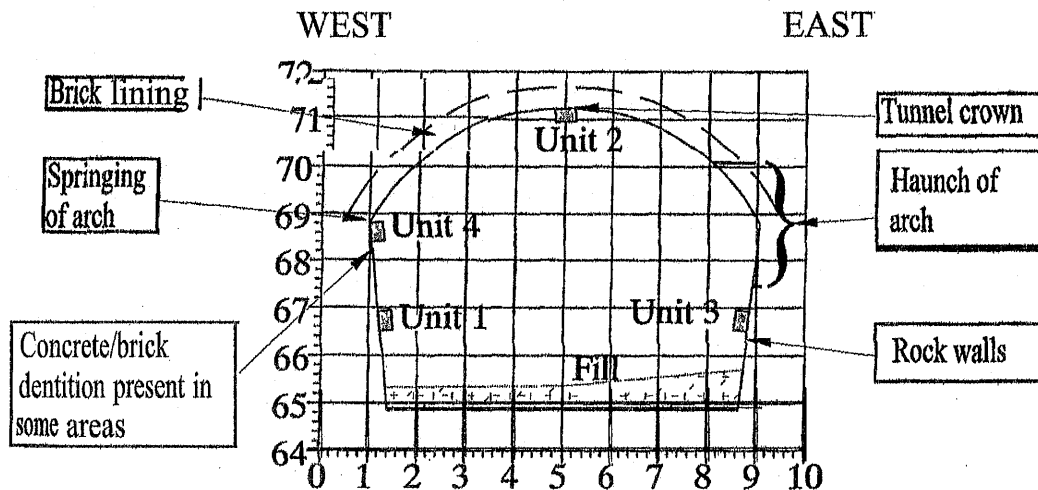


Figure 1: Position of geophones attached to the tunnel

(3) Kaslik, M., Birch, W.J., Cobb, Dr. A., 2001, The Effects Of Quarry Blasting On The Structural Integrity Of A Disused Railway Tunnel: International Society of Explosives Engineers, 2001GVolume2, p. 199

RESULTS

Appendix IV contains the ground motion attenuation analysis. The ground motion attenuation analysis contains a table summarizing the vibration data, followed by the vibration recordings. The regression analysis includes an explanation page, a page of statistics, a +95% confidence distance vs. charge weight per 8ms delay period table for 1.0, 2.0, and 4.0 ips. The distance vs. charge weight tables are interpreted in the following manner. Choose the particle velocity limit table for 1.0, 2.0, or 4.0 ips. Find the distance on the table closest to the distance between the blast and the point of concern, i.e. pictograph panel, crusher, etc. The charge weight in pounds is the maximum charge weight per 8 millisecond delay that should be shot to stay within the PPV limit.

All tables were generated using the +95% confidence equation. The +95% curve is two standard deviations from the mean (50% curve) and is the curve specified for use by the USBM and OSMRE. The attenuation analysis consists of thirty-one data points. The +95% confidence equation is $PV = 224.47 \times (SD)^{-1.517}$. The correlation coefficient, R^2 is 0.934, indicating an excellent fit of the data.

The USBM and OSMRE variable particle velocity vs. frequency criteria is plotted on each vibration event report. The upper line represents the threshold level for possible sheetrock damage, while the lower, dashed line represents the threshold level for possible plaster-on-lath damage.

CONCLUSIONS

Recommended Scaled Distance Factors and Corresponding Peak Particle Velocities

Scaled Distance	Peak Particle Velocity (in/s)
35.5	1
22.5	2
17.2	3
14.23	4
12.28	5

The ground motion attenuation analysis yields the above table of scaled distances and corresponding peak particle velocities. MMC recommends Spring Creek Mine self-impose a conservative 4.0 ips peak vibration limit with a corresponding scaled distance of 14.23 on blasting operations in Pit 4. This limit places a high degree of protection on the pictograph panel from ground vibrations due to blasting in Pit 4

This conservative limit is well below documented cases of blasting damage in a one hundred year old railway tunnel that was subjected to blast vibrations up to 10.35 ips without visible damage. Additionally, diurnal temperature fluctuations in the pictograph panel subject the rock mass to strains equivalent to nearly 86 ips. Blasting operations would not physically produce similar strains in the rock mass without drilling and blasting the pictograph panels themselves. In fact, it appears that the largest single contributors to the degradation of the pictograph panel have been erosion and vandalism.

Sincerely,

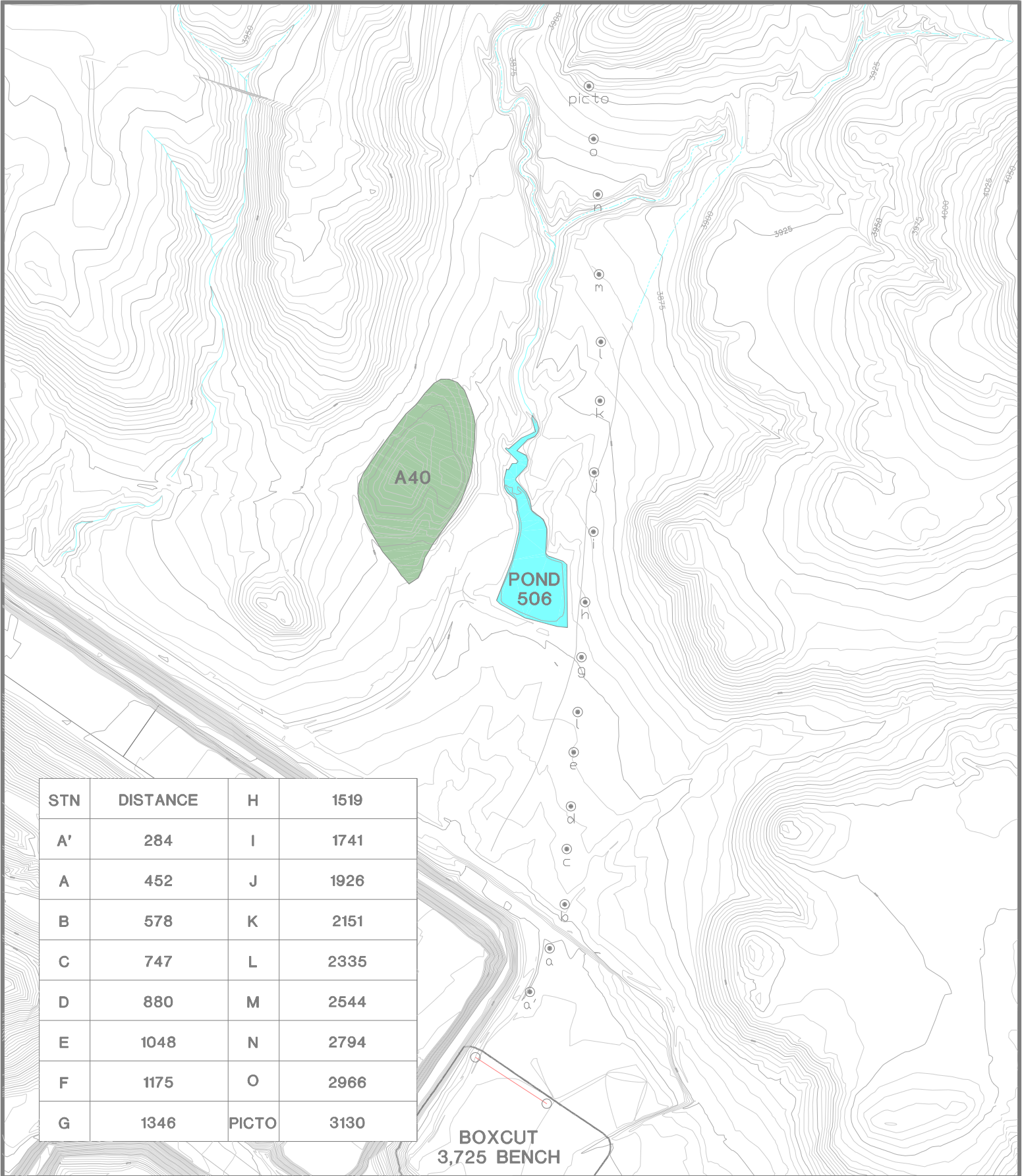


Cory Loukides
Mining Engineer

APPENDIX I

SPRING CREEK MINE PIT 4

GROUND MOTION ATTENUATION STUDY SEISMOGRAPH LOCATIONS MAP



DISTANCES TO STATIONS
FROM CENTER OF PATTERN LINE
ARE TO THE NEAREST FOOT.



RIO
TINTO
ENERGY
AMERICA

SPRING CREEK MINE

BOX CUT
SEISMOGRAPH STATION LOCATIONS

06/20/07

SCALE NTS

FILE NUMBER 0607-Seismograph-Simple.dwg

APPENDIX II

SPRING CREEK MINE BLAST # 5336

SHOT REPORT VIBRATION DATA TABLE VIBRATION EVENT REPORTS

RIO TINTO ENERGY AMERICA-SPRING CREEK MINE BLASTING RECORD

SHOT #: 5336 DATE: 6/20/2007 TIME BLAST: 2:06pm

LOCATION OF BLAST: SE1/4 SW1/4 SEC 14 R39E T8S

DESCRIPTION: Pit 4 Cut 7 Box Cut Overburden

NAME OF BLASTER: Marty Allen LICENSE #: C06006

DIRECTION-DISTANCE TO NEAREST BUILDING/STRUCTURE NOT OWNED BY PERMITTEE:

NORTH X SOUTH EAST WEST
DISTANCE 9,800

WEATHER CONDITIONS: Clear NW Wind 5 MPH 90 Degrees

TYPE MATERIAL BLASTED: COAL O. B. X OTHER:

TOTAL # HOLES: 159 PIT WIDTH: 300'

BURDEN: 30 SPACING: 30 HOLE DIAMETER: 9"

AV HOLE DEPTH: 40' STEM TYPE: DRILL CUTTINGS STEM DEPTH: 22

TYPE EXPLOSIVES USED:

AMOUNT OF EXPLOSIVES USED:

BULK ANFO:

EMULSION 100%

EMULSIFIED ANFO 40/60

EMULSIFIED ANFO 60/40:

1 LB CST PRIMERS:

TOTAL LBS EXPLOSIVES USED:

91,940
242
92,182

MAXIMUM NUMBER OF HOLES WITHIN ANY 8 MILLISECOND PERIOD: 2

MAXIMUM WEIGHT OF EXPLOSIVES DETONATED WITHIN ANY 8 MILLISECOND PERIOD: 1,300

METHOD OF FIRE AND TYPE OF CIRCUIT: 18GR: X 50 GR:

DETCORD WITH - 17, 25, 42, 65, 100 MS DELAY Eschlon PATTERN.

TRUNKLINE INITIATED WITH: 165' Nonel lead line

TYPE DELAY USED: 17 MS 25 MS 42 MS X
65 MS 100 MS X

TOTAL USED: 167

METHOD OF PROTECTION: SECURED ALL ACCESS WITH GUARDS IN RADIO CONTACT

AREA CLEARED FOR RE-ENTRY, INITIALS:

NUMBER OF BLASTING CREW MEMBERS: BEFORE: 4 AFTER: 4

COMMENTS: Dewatered wet holes. Double primed wet holes. Pumped 60/40 blend. 30' water in 40' hole average.

SUPERVISOR IN CHARGE:

RIO TINTO ENERGY AMERICA-SPRING CREEK MINE BLASTING RECORD

SHOT DATE: 6/20/2007

TIME SHOT: 2:06pm

TONS	YARDS	# HOLES	1 LB PRIMERS	BULK ANFO	EMULSION	TOTAL EXPLOSIVES
	212,000	159	242	36,776	55,164	92,182

QTY 18 GR	QTY 50 GR	QTY NONEL	QTY 17 MS	QTY 25 MS	QTY 42 MS	QTY 65 MS	QTY 100 MS
6,214		1			149		18

	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS
MS	300							
LENGTH	50'							
QTY	242							

	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS	D HOLE DEALYS
MS								
LENGTH								
QTY								

POWDER FACTOR: 0.435

QTY BCC'S: NONE

BLASTING INSPECTORS REPORT:

NAME & TTILE: _____ DATE: _____

COMMENTS: _____

Rio Tinto Energy America
Spring Creek Mine
Ground Motion Attenuation Study Data Set
June 20, 2007
Pit 4 Data

Shot Number	Charge Weight (pounds)	Instrument Number	Recording Time	Distance (feet)	Scaled Distance (ft/lb ^{1/2})	Peak Particle Velocity (inches per second)
5336	1300.0	BE10627	14:00:54	284	7.9	3.33
5336	1300.0	BE11304	14:00:55	452	12.5	2.00
5336	1300.0	BE10051	14:00:58	452	12.5	2.32
5336	1300.0	BE11725	14:00:55	578	16.0	1.98
5336	1300.0	BE9708	14:00:53	578	16.0	1.89
5336	1300.0	BC7154	14:00:54	747	20.7	1.99
5336	1300.0	BC7092	14:00:54	747	20.7	2.04
5336	1300.0	BC8054	14:00:54	880	24.4	1.28
5336	1300.0	BC7824	14:00:54	880	24.4	1.28
5336	1300.0	BC8311	14:00:53	1048	29.1	1.07
5336	1300.0	BC7817	14:00:54	1048	29.1	1.01
5336	1300.0	BC7089	14:00:56	1175	32.6	0.560
5336	1300.0	BC8954	14:00:52	1175	32.6	0.570
5336	1300.0	BC8277	14:00:54	1346	37.3	0.510
5336	1300.0	BC8061	14:00:54	1346	37.3	0.505
5336	1300.0	BC7093	14:00:55	1519	42.1	0.685
5336	1300.0	BC8310	14:00:54	1519	42.1	0.605
5336	1300.0	BC8613	14:00:54	1741	48.3	0.340
5336	1300.0	BC7232	14:00:54	1741	48.3	0.380
5336	1300.0	BC8312	14:05:14	1926	53.4	0.265
5336	1300.0	BC7937	14:00:53	2335	64.8	0.220
5336	1300.0	BC8323	14:00:55	2544	70.6	0.195
5336	1300.0	BC7228	14:01:00	2794	77.5	0.155
5336	1300.0	BC8062	14:00:55	2966	82.3	0.140
5336	1300.0	BC7820	12:50:36	3130	86.8	0.070

Date/Time Vert at 12:50:36 June 20, 2007
Trigger Source Geo: 0.0300 in/s
Range Geo :10.00 in/s
Record Time 6.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC7820 V 8.12-8.0 MiniMate Plus
Battery Level 6.6 Volts
Calibration February 27, 2007 by InstanTel Inc.
File Name I820BQ3F.OC0

Notes

Mine Property: Spring Creek Mine
 Location: Pictograph Panel
 User Name: MMC
 General:

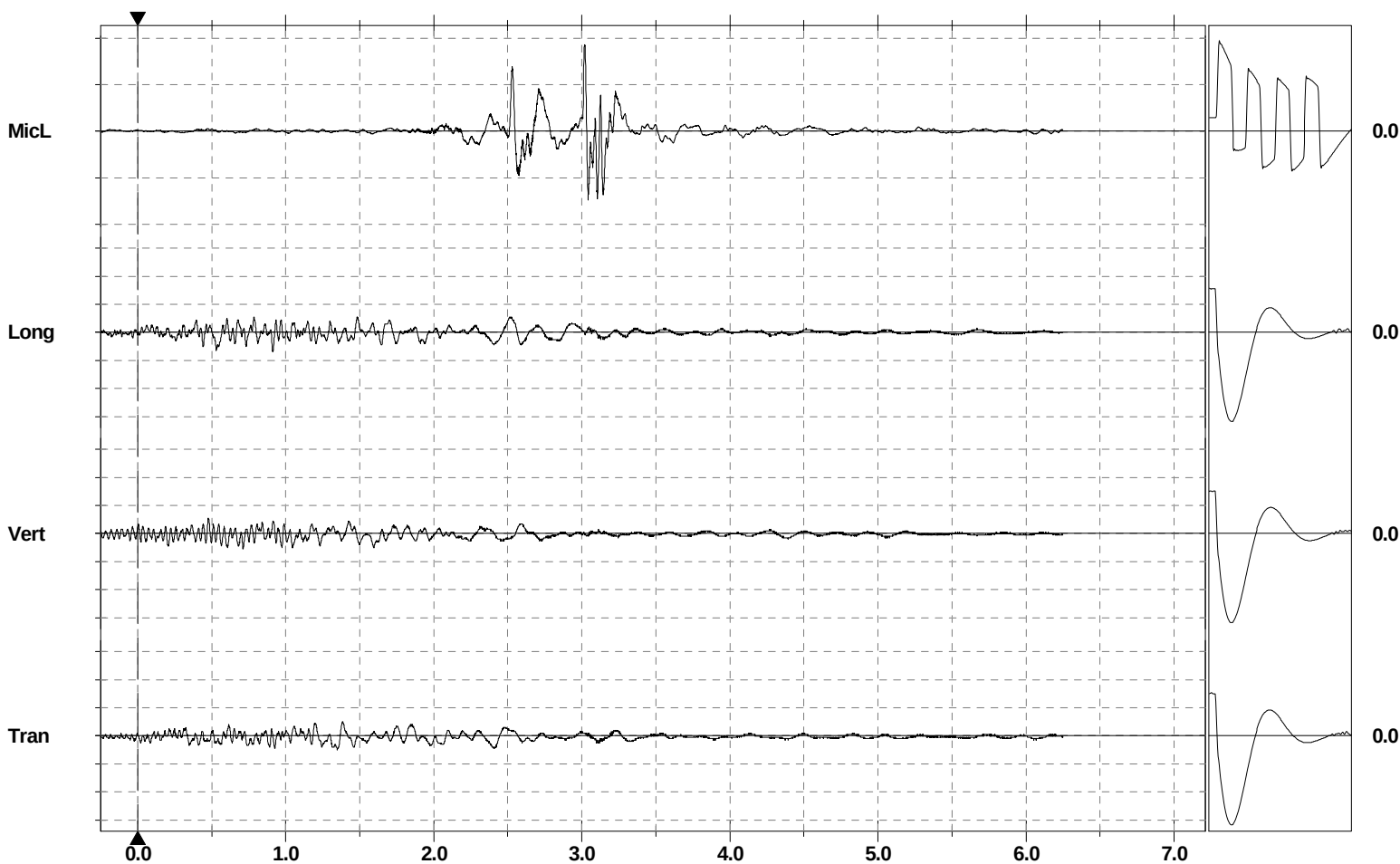
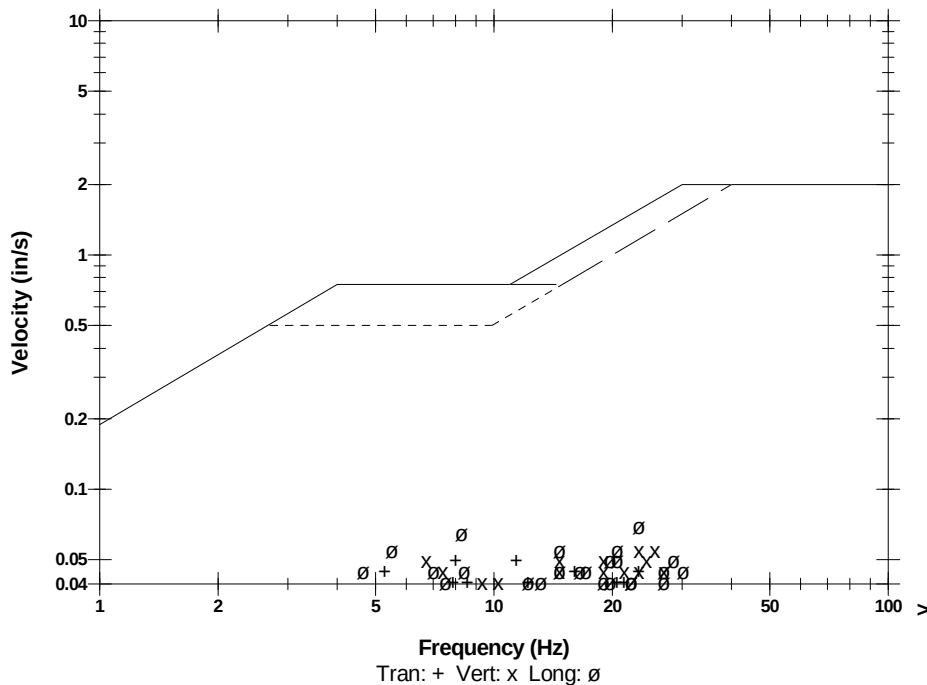
Post Event Notes

Distance from blast #5336: 3130
 Total pounds per 8ms delay: 1300

Microphone Linear Weighting
PSPL 130.2 dB(L) 0.00935 psi(L) at 3.021 sec
ZC Freq 4.6 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 577 mv)

	Tran	Vert	Long	
PPV	0.0500	0.0550	0.0700	in/s
ZC Freq	8.0	26	23	Hz
Time (Rel. to Trig)	1.349	0.476	0.911	sec
Peak Acceleration	0.0265	0.0398	0.0398	g
Peak Displacement	0.00128	0.00115	0.00162	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.5	7.5	Hz
Overswing Ratio	3.5	3.5	3.7	

USBM RI8507 And OSMRE



Sensorcheck

Date/Time Vert at 14:00:52 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 7.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC8954 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration March 13, 2007 by Instantel Inc.
File Name J954BQ3I.XG0

Notes

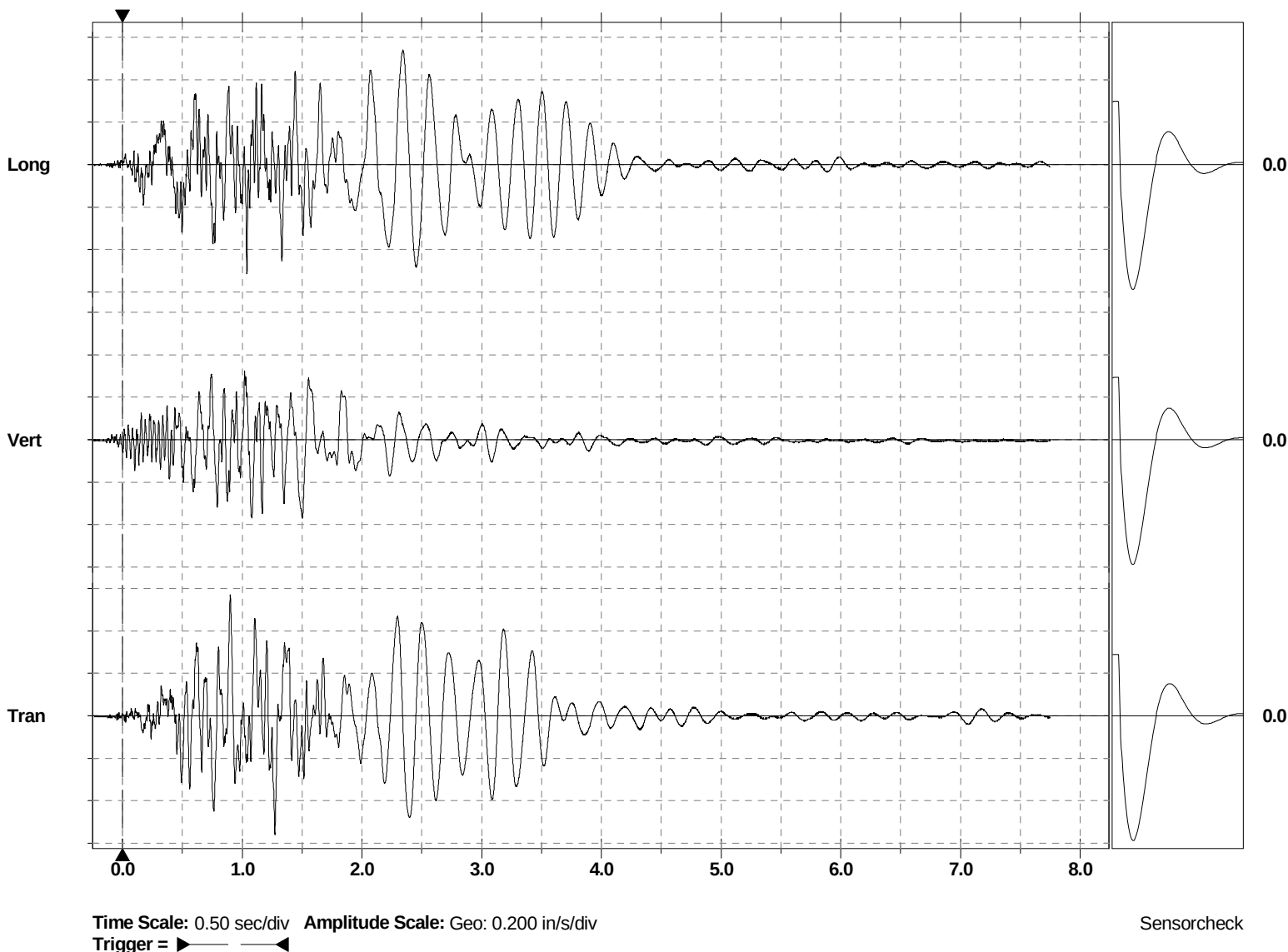
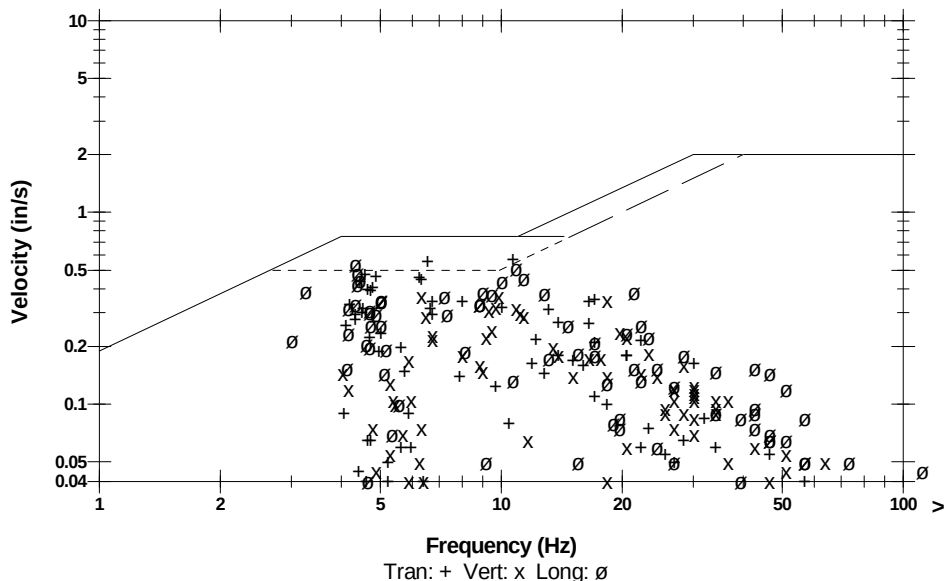
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1175
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.570	0.370	0.540	in/s
ZC Freq	11	9.8	4.3	Hz
Time (Rel. to Trig)	0.899	1.080	2.342	sec
Peak Acceleration	0.146	0.119	0.172	g
Peak Displacement	0.0177	0.00895	0.0193	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.3	7.4	7.5	Hz
Overswing Ratio	3.9	4.0	3.8	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:53 June 20, 2007
Trigger Source Geo: 0.0300 in/s
Range Geo :10.00 in/s
Record Time 8.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC7937 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration June 23, 2006 by Instantel Inc
File Name I937BQ3I.XH0

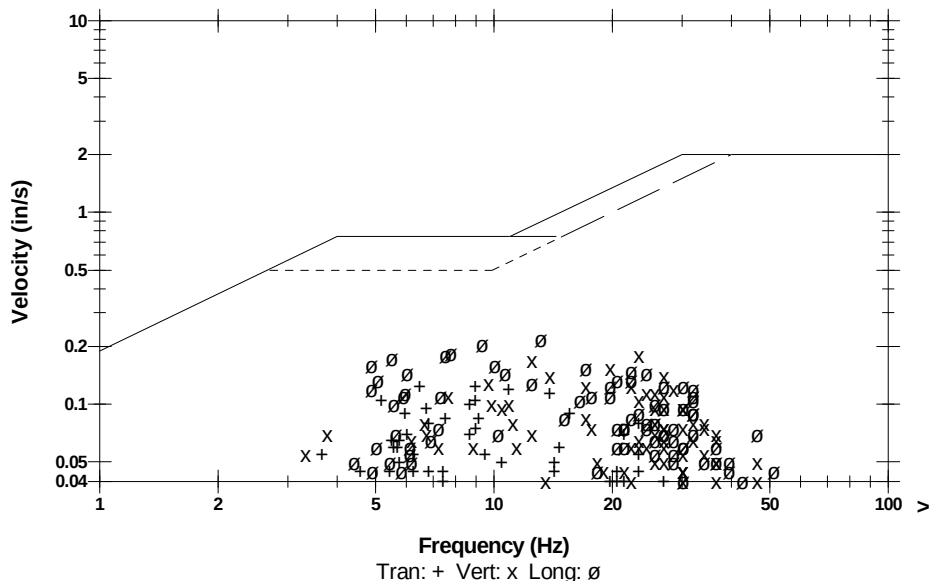
Notes

Client: Rio Tinto Energy America
 Project: Ground Motion Attenuation Analysis
 Location: Decker, MT
 User: MMC, Inc.

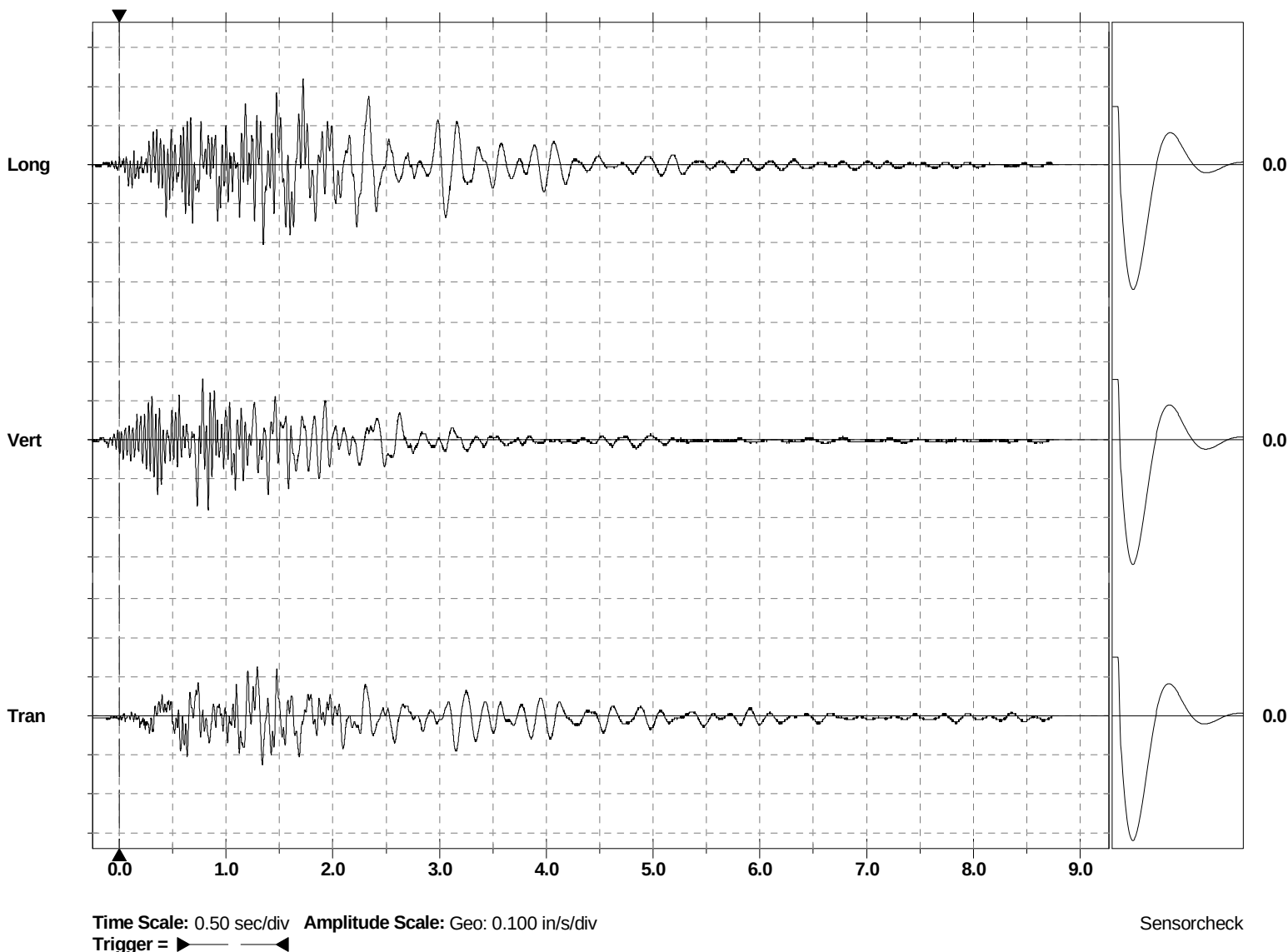
Post Event Notes

Distance from blast #5336: 2335
 Total pounds per 8ms delay: 1300

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	0.125	0.180	0.220	in/s
ZC Freq	6.5	23	13	Hz
Time (Rel. to Trig)	1.291	0.833	1.721	sec
Peak Acceleration	0.0398	0.0795	0.0795	g
Peak Displacement	0.00244	0.00283	0.00458	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.5	7.2	Hz
Overswing Ratio	3.9	3.6	3.9	



Date/Time Vert at 14:00:53 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC8311 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration May 2, 2007 by Instantel Inc.
File Name J311BQ3I.XH0

Notes

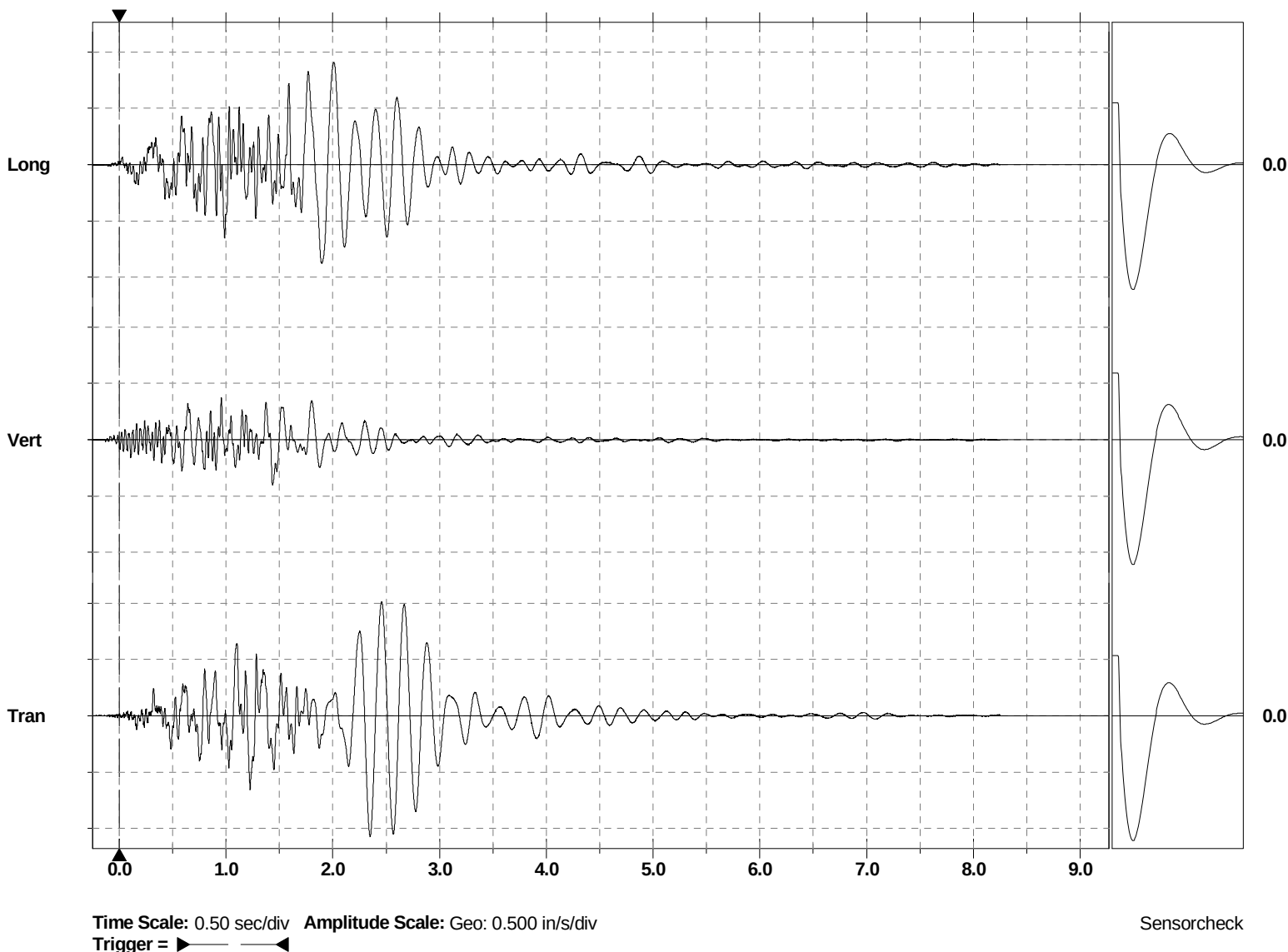
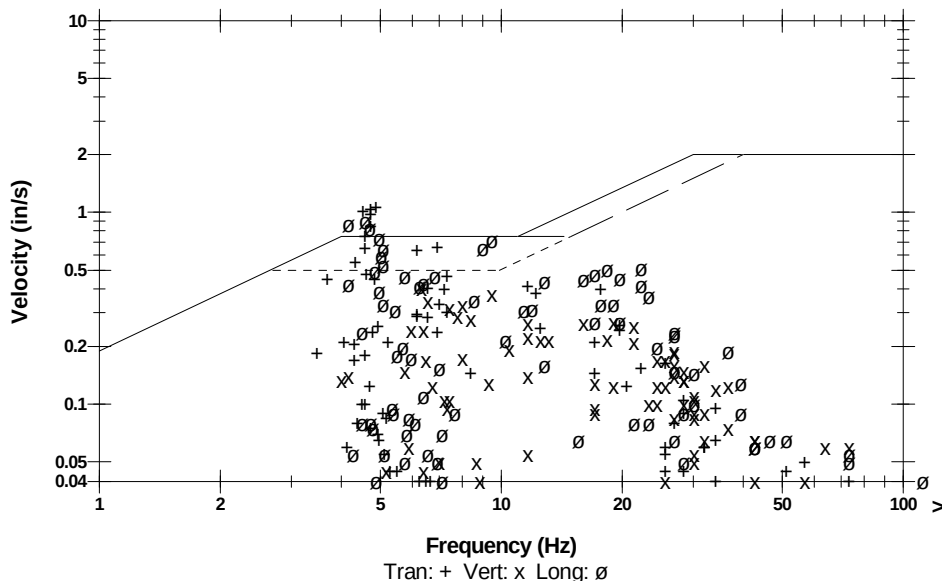
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1048
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.07	0.405	0.910	in/s
ZC Freq	4.9	6.3	4.6	Hz
Time (Rel. to Trig)	2.348	1.435	2.008	sec
Peak Acceleration	0.186	0.119	0.186	g
Peak Displacement	0.0353	0.00998	0.0326	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.8	3.6	4.1	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:53 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.25 sec (Auto=3Sec) at 2048 sps

Serial Number BE9708 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration August 28, 2006 by Instantel Inc
File Name K708BQ3I.XH0

Notes

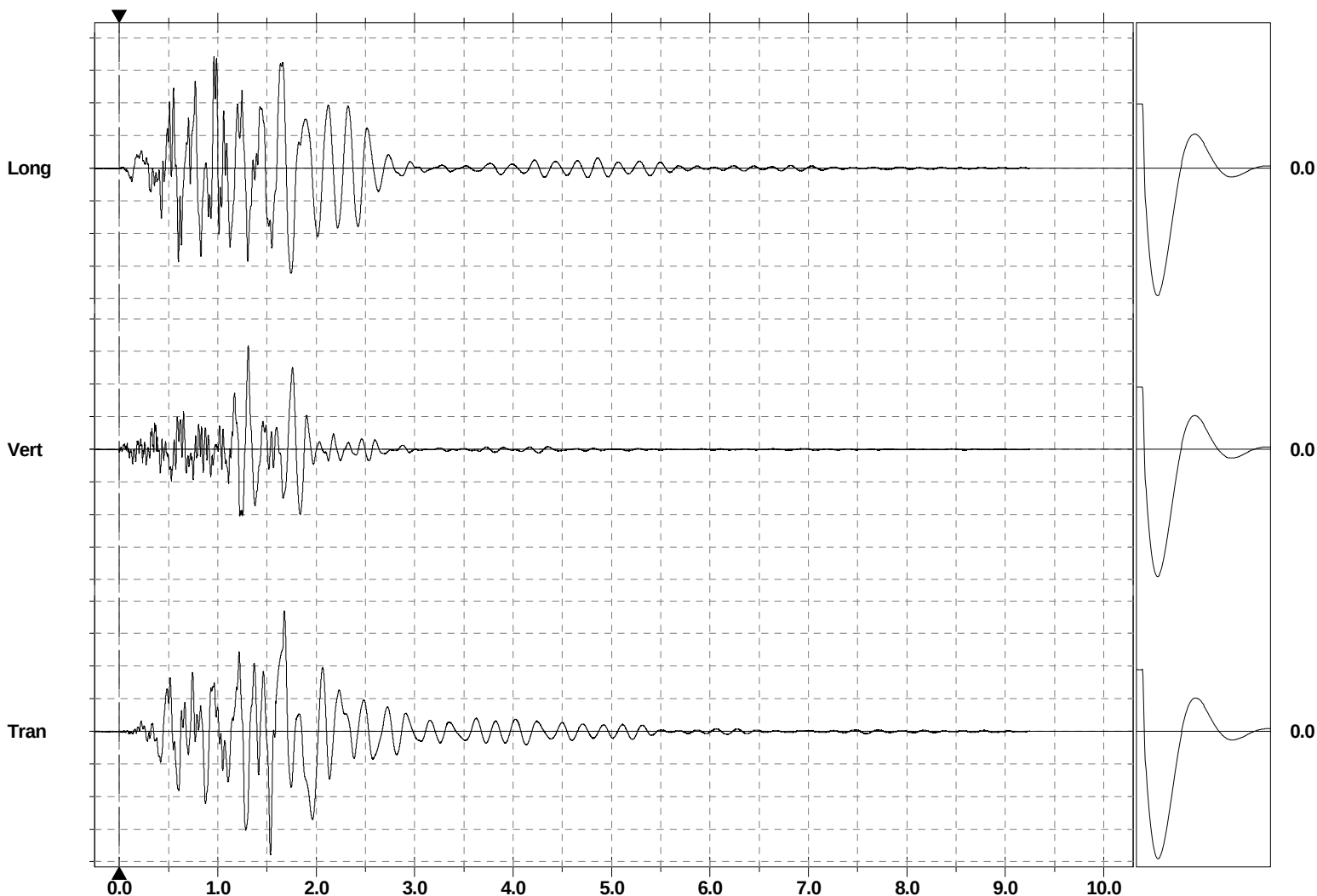
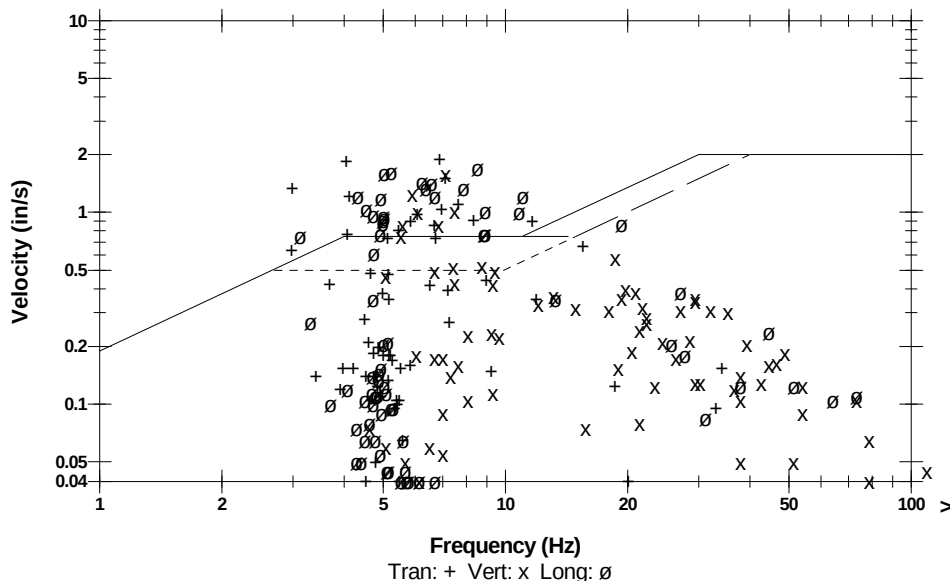
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 578
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.89	1.59	1.71	in/s
ZC Freq	6.9	7.1	8.5	Hz
Time (Rel. to Trig)	1.537	1.310	0.961	sec
Peak Acceleration	0.610	0.318	0.424	g
Peak Displacement	0.0701	0.0320	0.0549	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.3	7.4	7.5	Hz
Overswing Ratio	3.9	3.8	3.8	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.500 in/s/div
Trigger =

Sensorcheck

Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.5 sec (Auto=3Sec) at 2048 sps

Serial Number BC7092 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration May 17, 2007 by Instantel Inc.
File Name I092BQ3I.X10

Notes

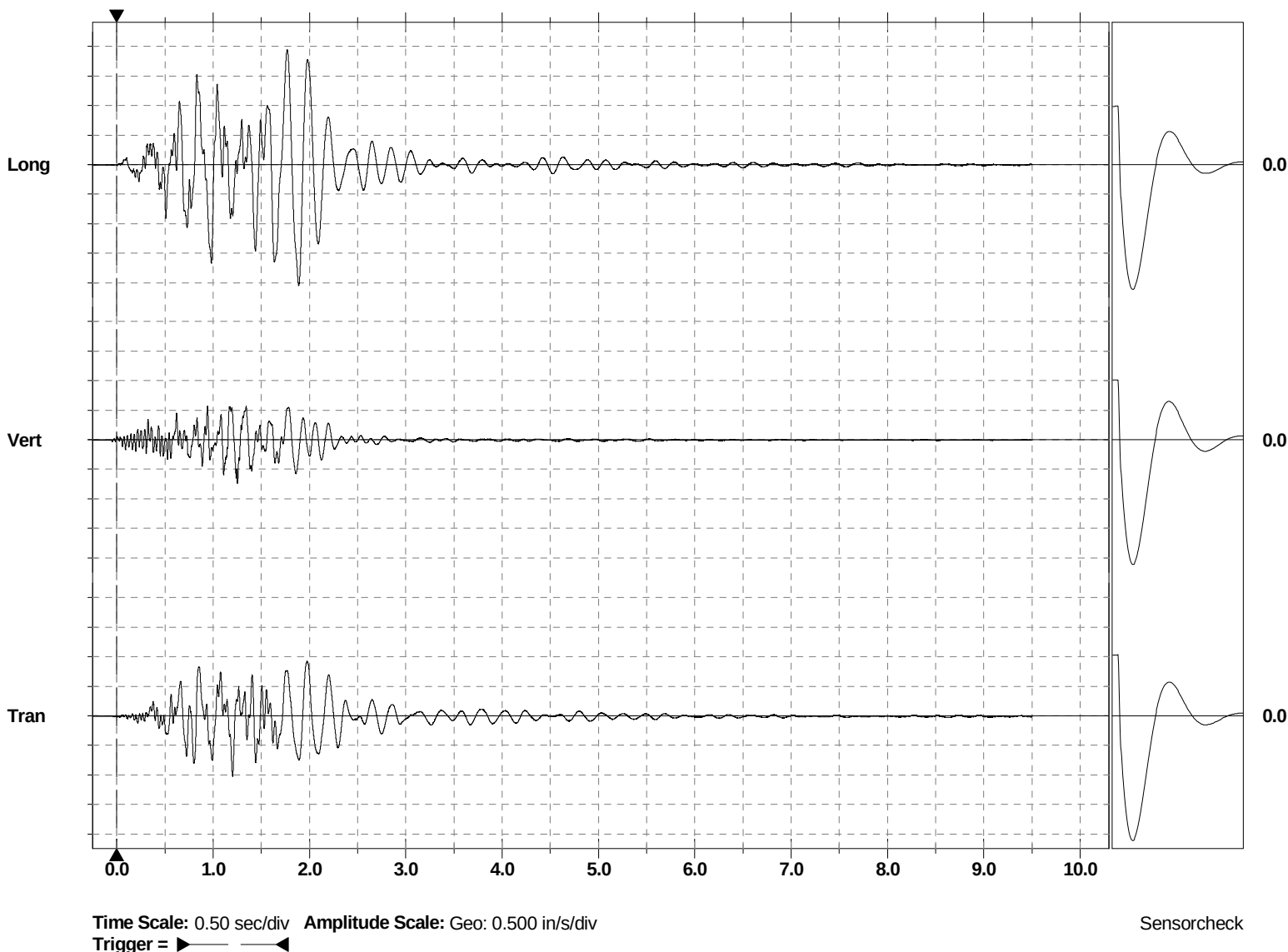
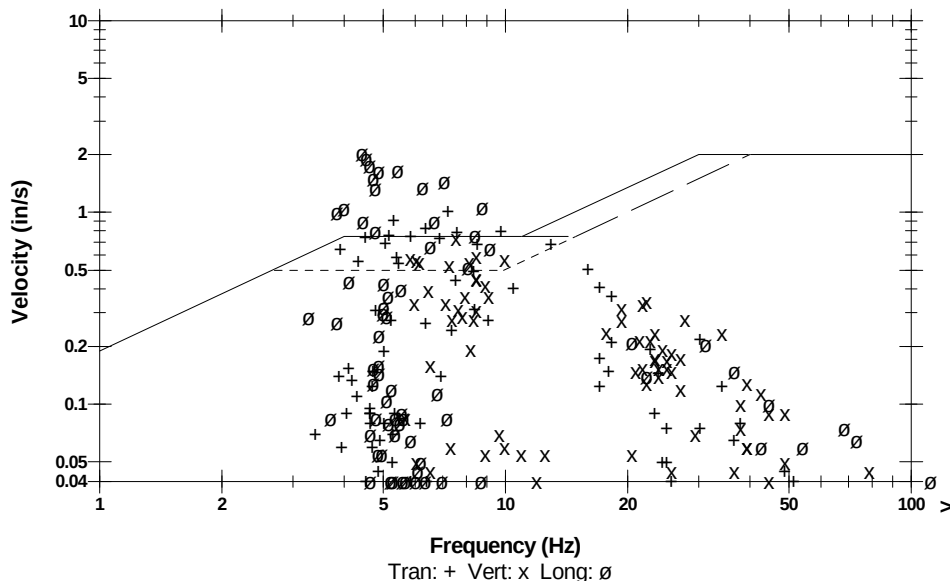
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 747
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.02	0.740	2.04	in/s
ZC Freq	7.2	7.5	4.4	Hz
Time (Rel. to Trig)	1.203	1.252	1.889	sec
Peak Acceleration	0.239	0.212	0.265	g
Peak Displacement	0.0282	0.0151	0.0724	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.4	Hz
Overswing Ratio	3.7	3.3	3.8	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.5 sec (Auto=3Sec) at 2048 sps

Serial Number BC7154 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration November 23, 2006 by Instantel Inc.
File Name I154BQ3I.X10

Notes

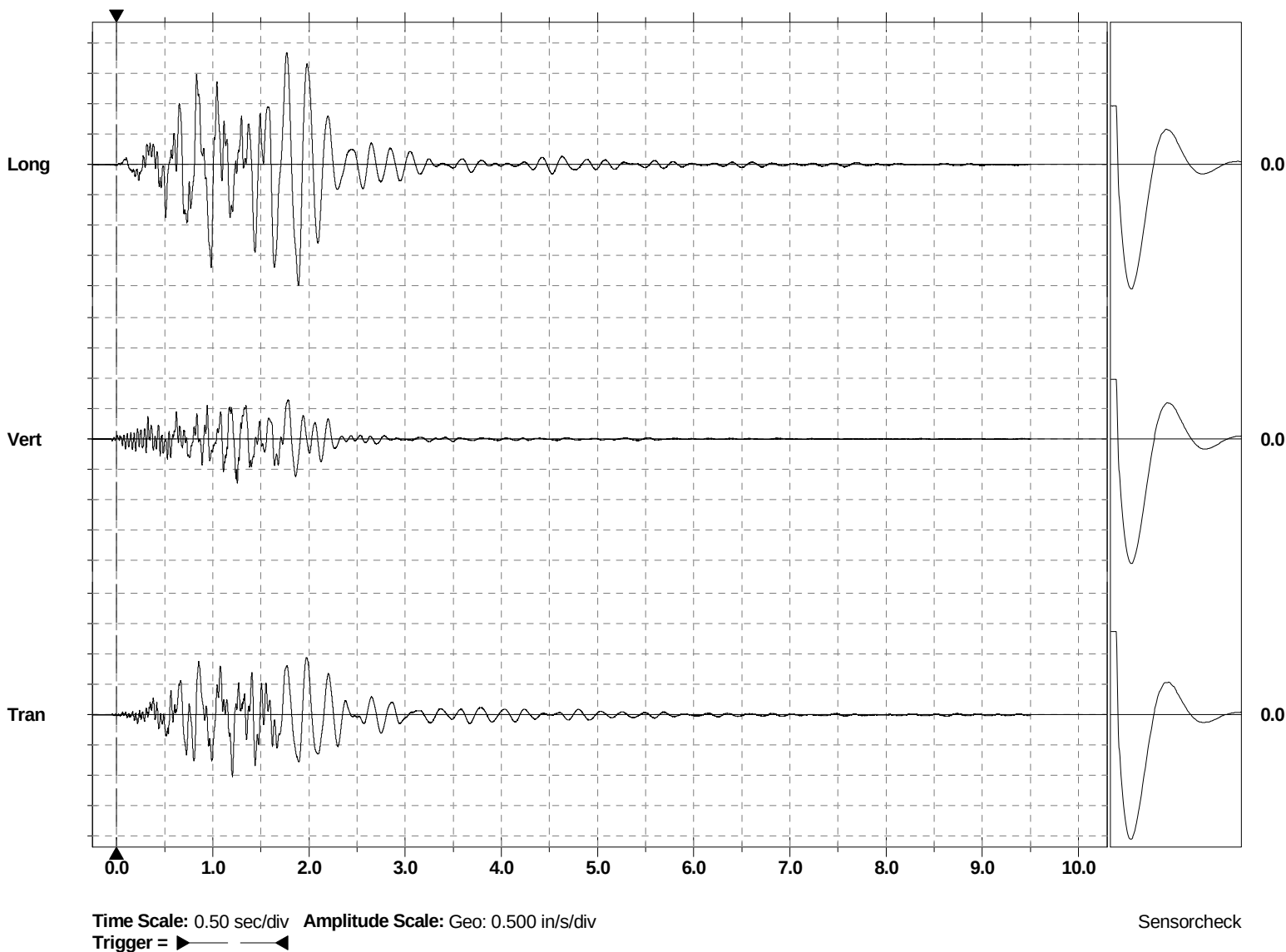
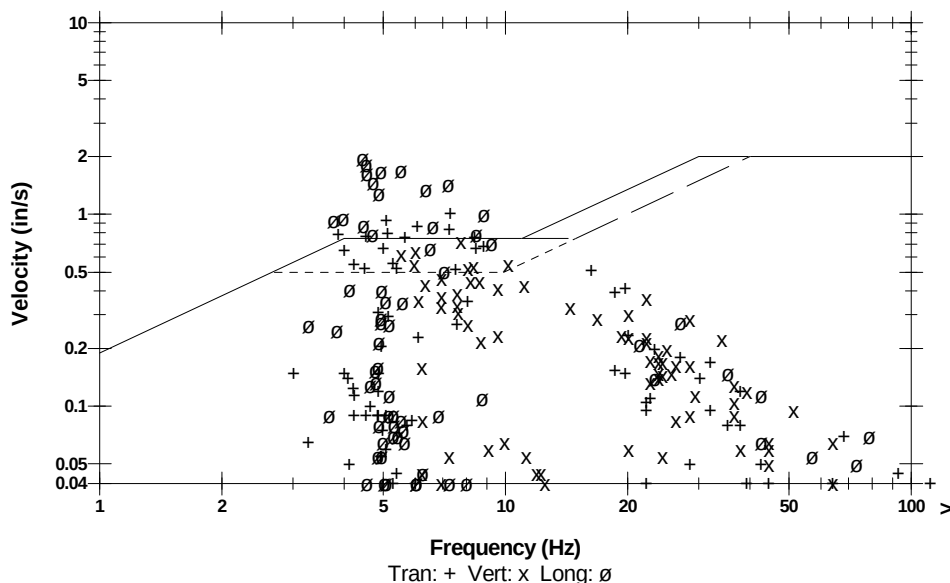
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 747
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.02	0.725	1.99	in/s
ZC Freq	7.3	7.8	4.4	Hz
Time (Rel. to Trig)	1.205	1.255	1.890	sec
Peak Acceleration	0.212	0.186	0.292	g
Peak Displacement	0.0295	0.0175	0.0691	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.4	7.5	Hz
Overswing Ratio	3.9	3.5	3.6	

USBM RI8507 And OSMRE



Date/Time Long at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC7232 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration July 28, 2006 by InstanTel Inc.
File Name I232BQ3I.X10

Notes

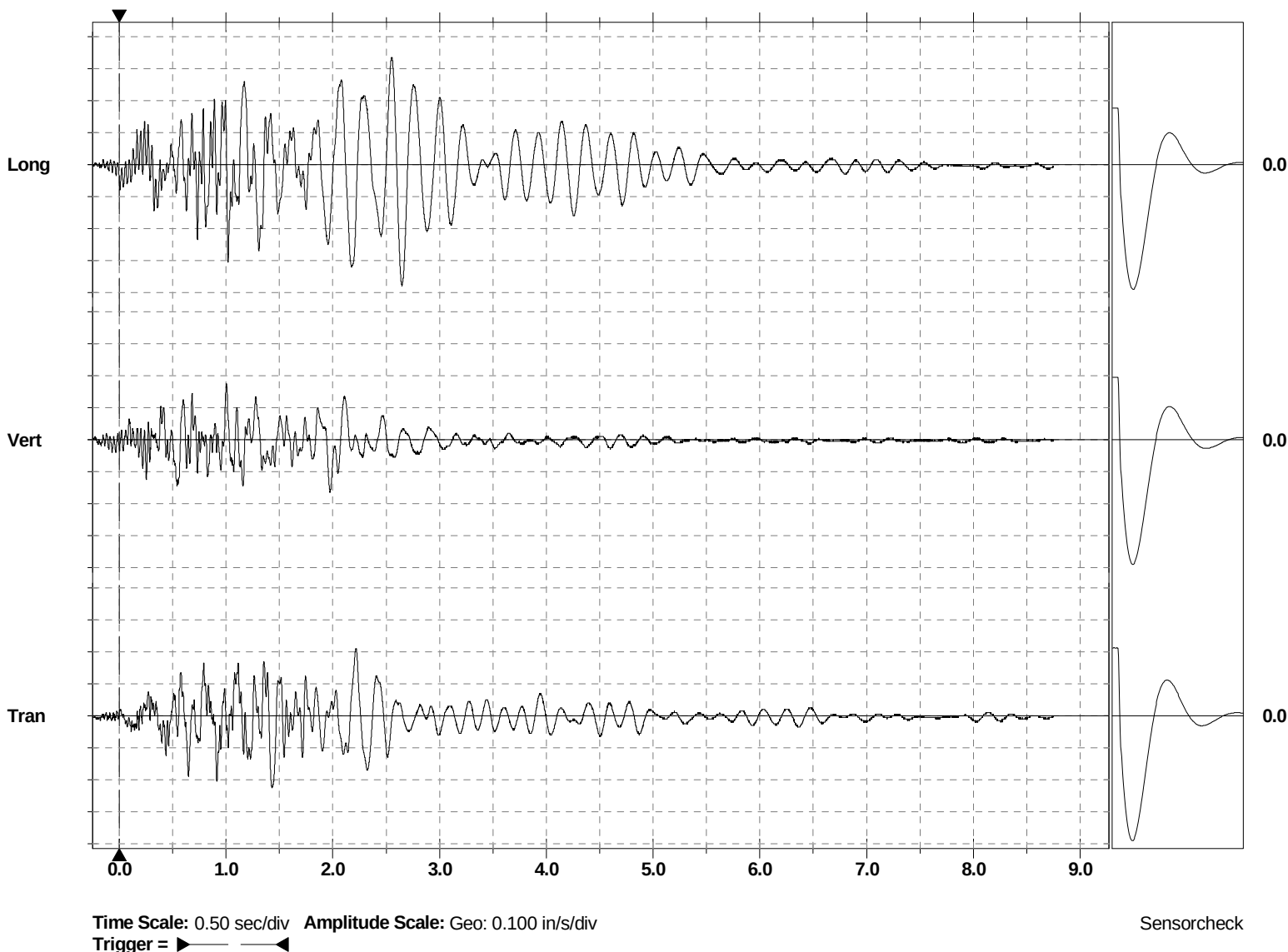
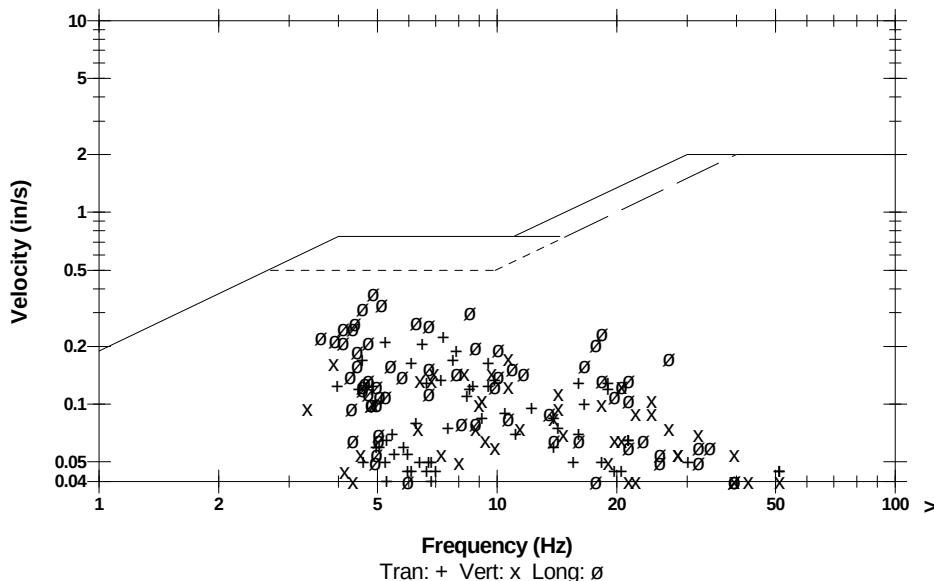
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1741
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.225	0.175	0.380	in/s
ZC Freq	7.3	11	4.9	Hz
Time (Rel. to Trig)	1.428	1.003	2.648	sec
Peak Acceleration	0.0663	0.0530	0.0928	g
Peak Displacement	0.00605	0.00511	0.0122	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.8	7.4	7.3	Hz
Overswing Ratio	3.5	3.8	4.0	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC7817 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration September 19, 2006 by InstanTel Inc
File Name I817BQ3I.XI0

Notes

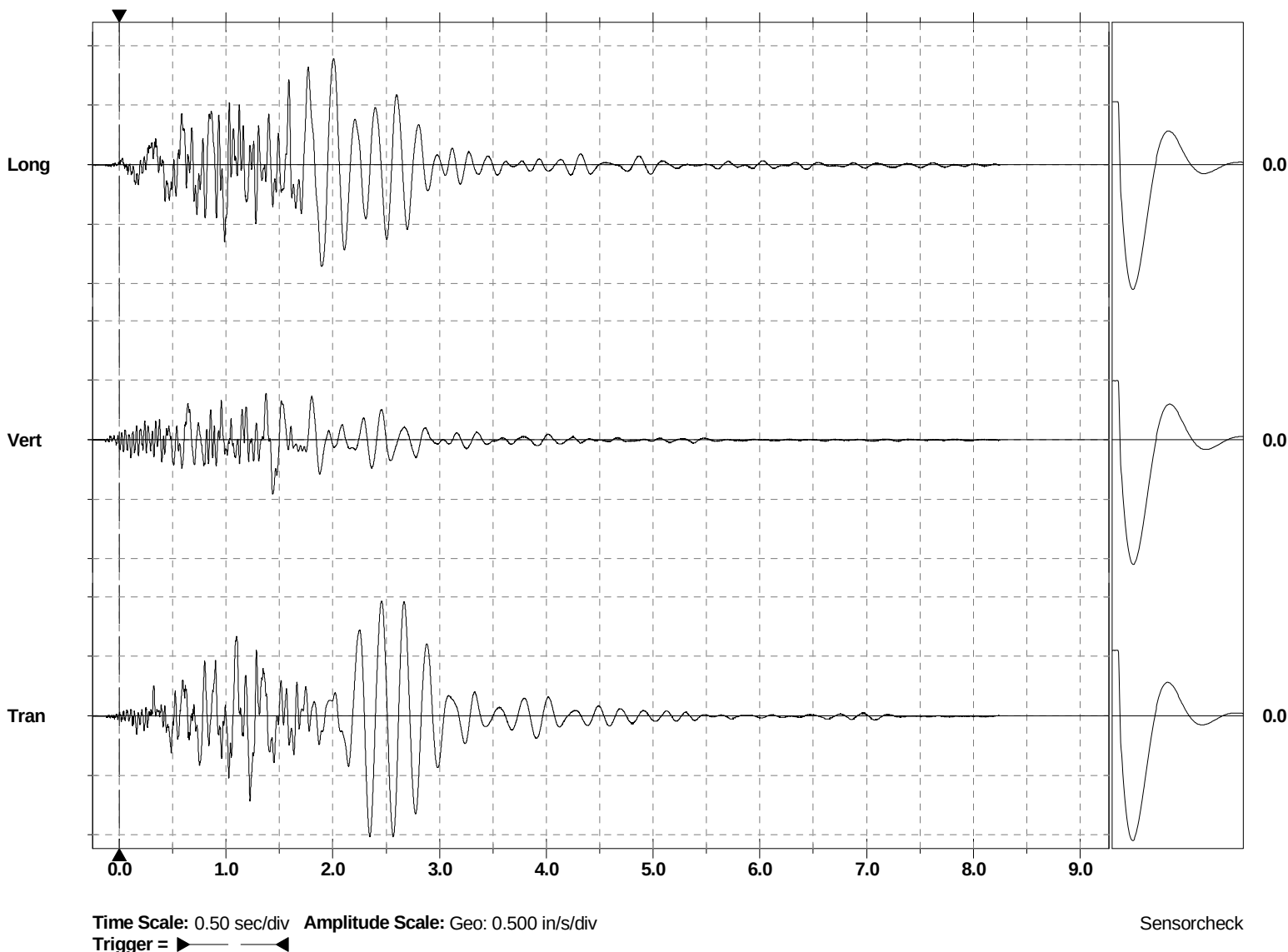
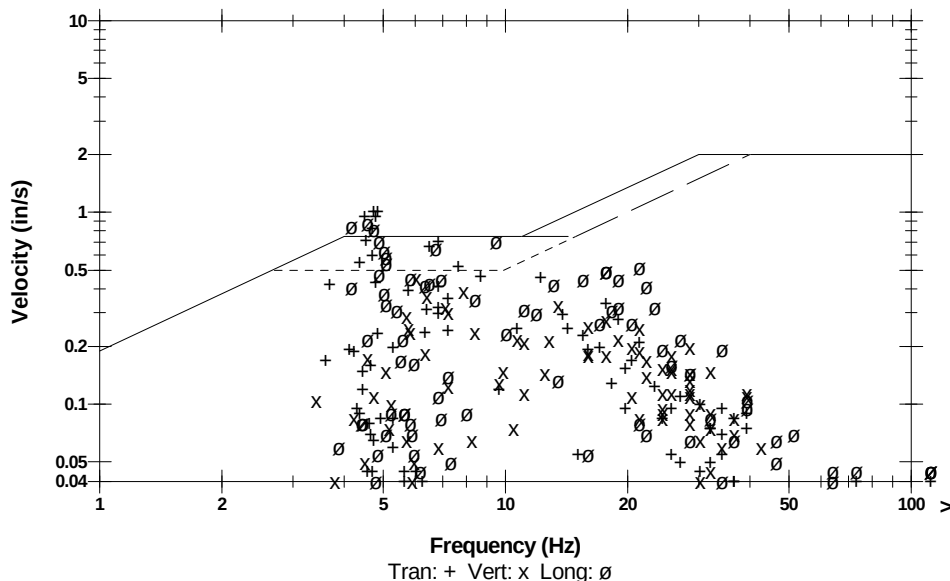
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1048
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.01	0.455	0.890	in/s
ZC Freq	4.8	6.0	4.6	Hz
Time (Rel. to Trig)	2.346	1.436	2.006	sec
Peak Acceleration	0.172	0.106	0.186	g
Peak Displacement	0.0339	0.0116	0.0321	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.5	Hz
Overswing Ratio	3.8	3.6	3.8	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.5 sec (Auto=3Sec) at 2048 sps

Serial Number BC7824 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration June 23, 2006 by InstanTel Inc.
File Name I824BQ3I.X10

Notes

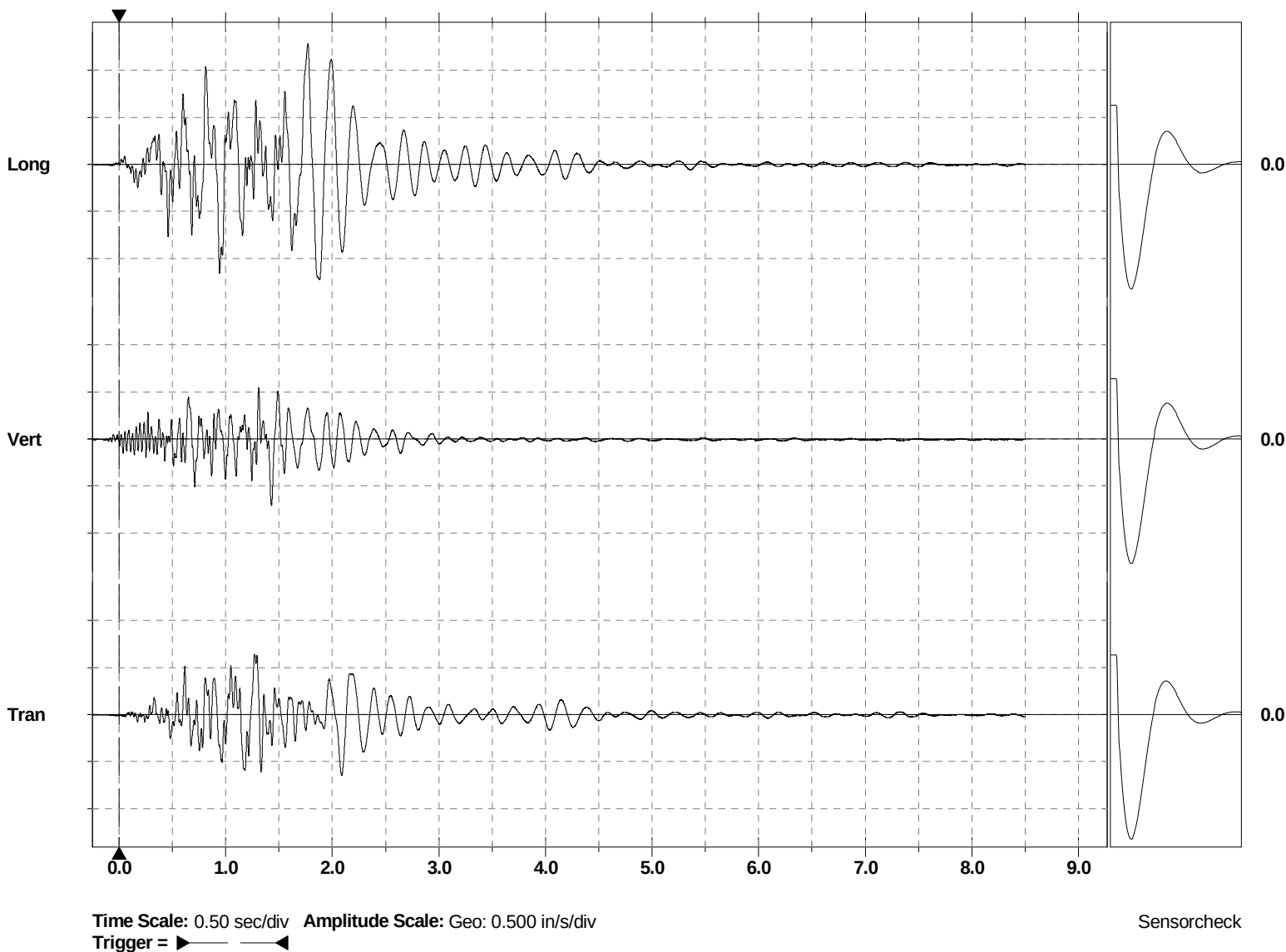
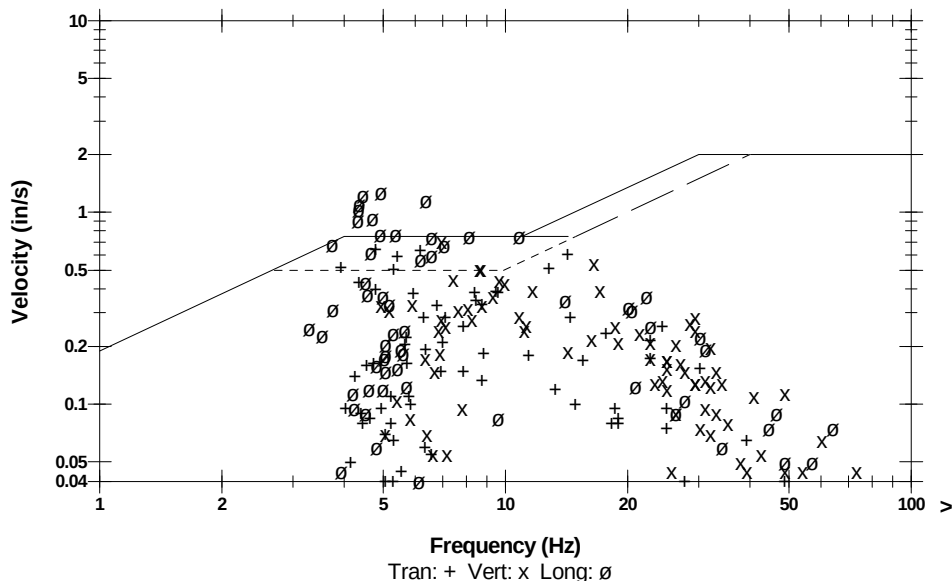
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 880
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.645	0.710	1.28	in/s
ZC Freq	4.8	7.0	4.9	Hz
Time (Rel. to Trig)	2.086	1.428	1.771	sec
Peak Acceleration	0.159	0.186	0.265	g
Peak Displacement	0.0181	0.0114	0.0450	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.5	7.5	Hz
Overswing Ratio	3.8	3.5	3.8	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.5 sec (Auto=3Sec) at 2048 sps

Serial Number BC8054 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration January 17, 2007 by Instantel Inc.
File Name J054BQ3I.X10

Notes

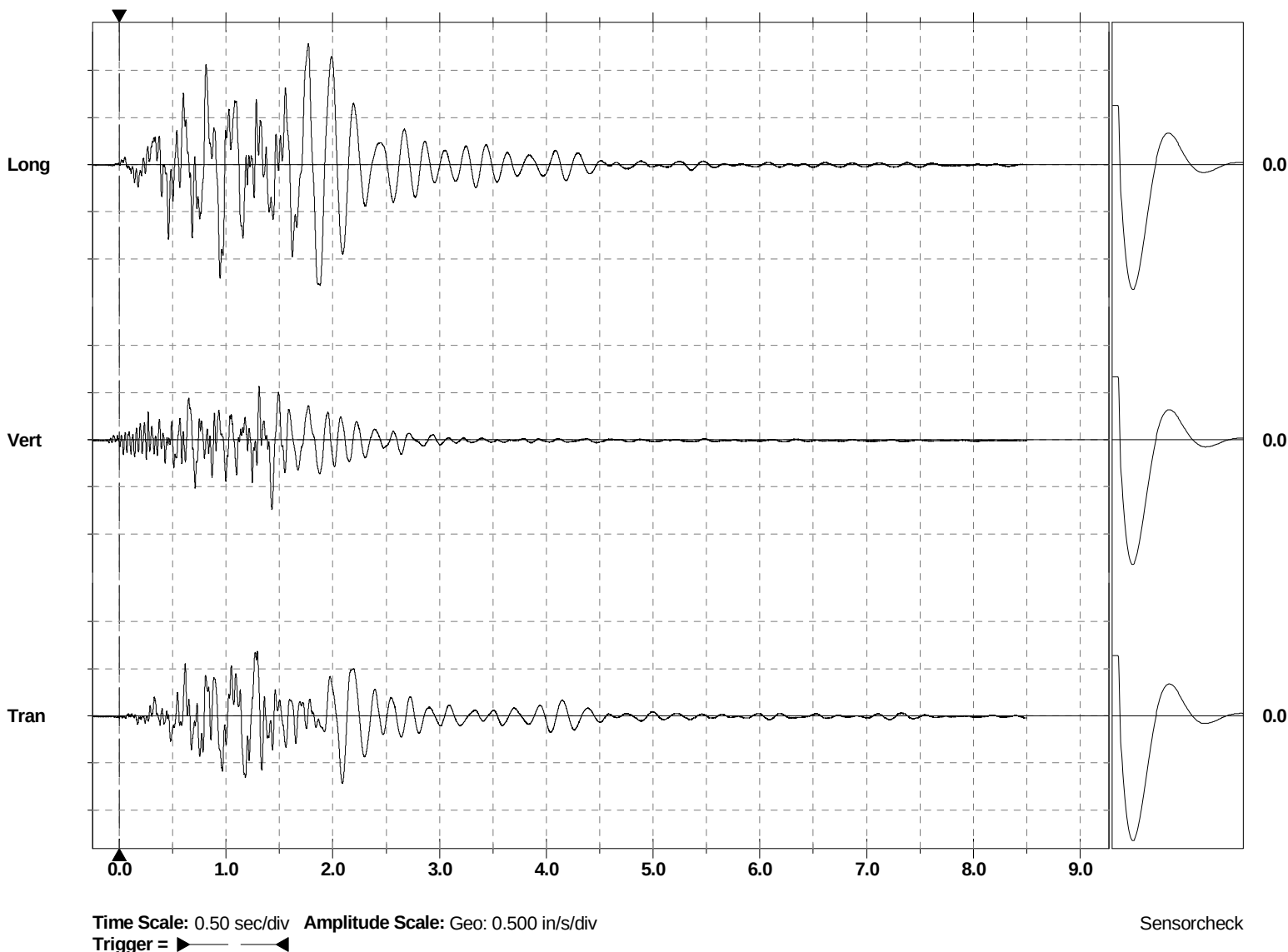
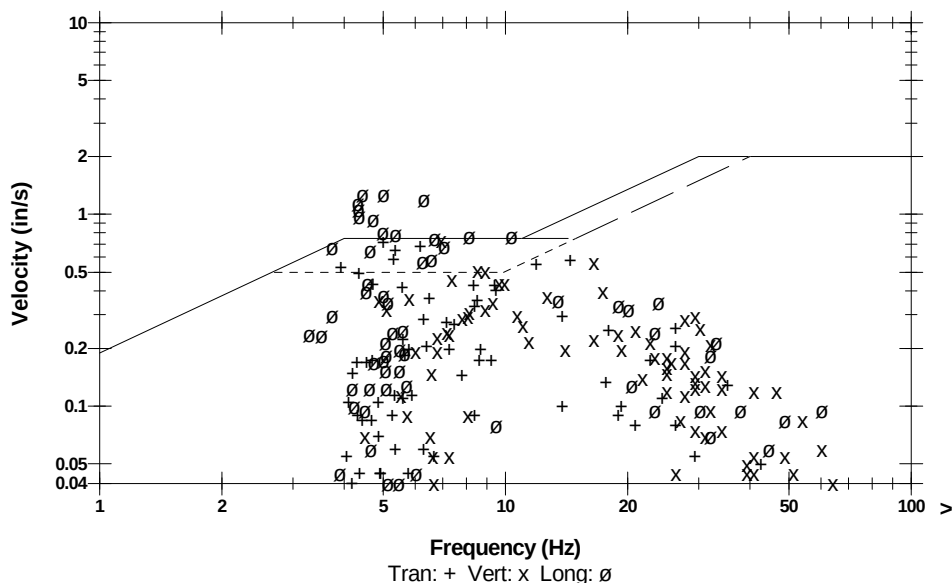
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 880
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.720	0.740	1.28	in/s
ZC Freq	5.0	6.9	5.0	Hz
Time (Rel. to Trig)	2.088	1.428	1.770	sec
Peak Acceleration	0.159	0.186	0.265	g
Peak Displacement	0.0205	0.0121	0.0472	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.5	Hz
Overswing Ratio	4.0	4.2	4.0	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC8061 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration September 26, 2006 by InstanTel Inc
File Name J061BQ3I.X10

Notes

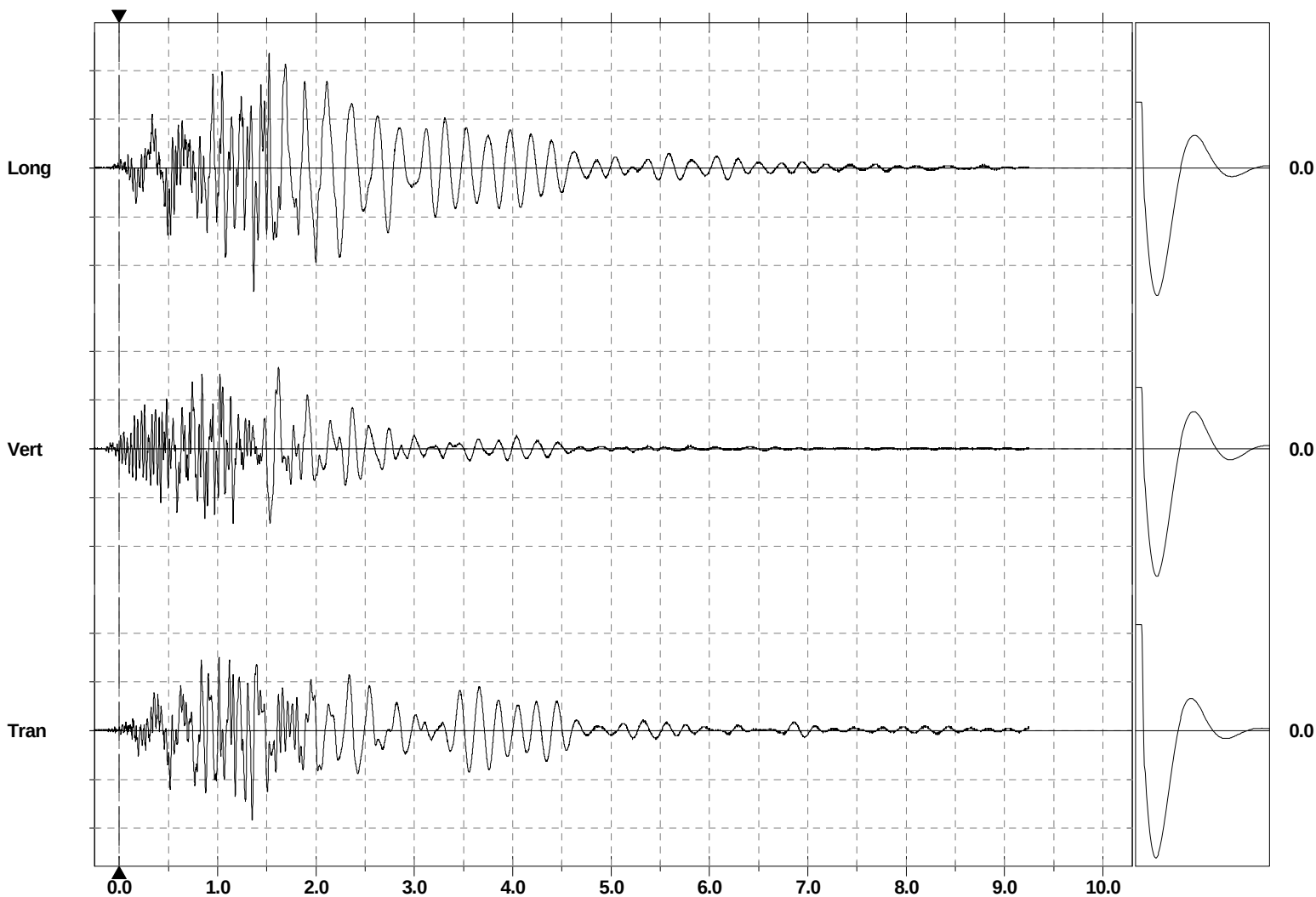
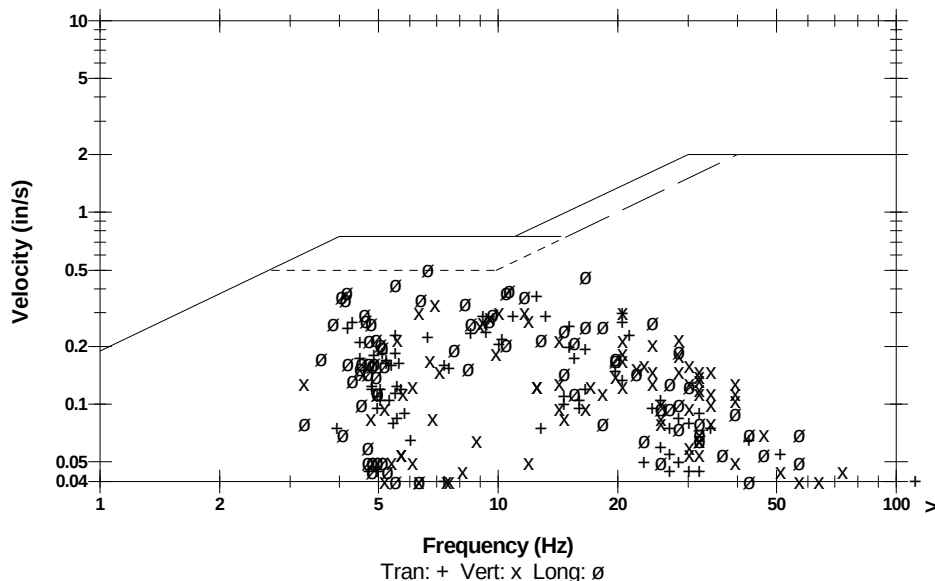
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1346
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.365	0.335	0.505	in/s
ZC Freq	12	6.9	6.6	Hz
Time (Rel. to Trig)	1.352	1.618	1.368	sec
Peak Acceleration	0.106	0.146	0.133	g
Peak Displacement	0.00774	0.00775	0.0134	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.8	7.5	7.3	Hz
Overswing Ratio	4.0	3.5	3.9	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.200 in/s/div
Trigger =

Sensorcheck

Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC8310 V 8.01-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration November 9, 2006 by InstanTel Inc.
File Name J310BQ3I.X10

Notes

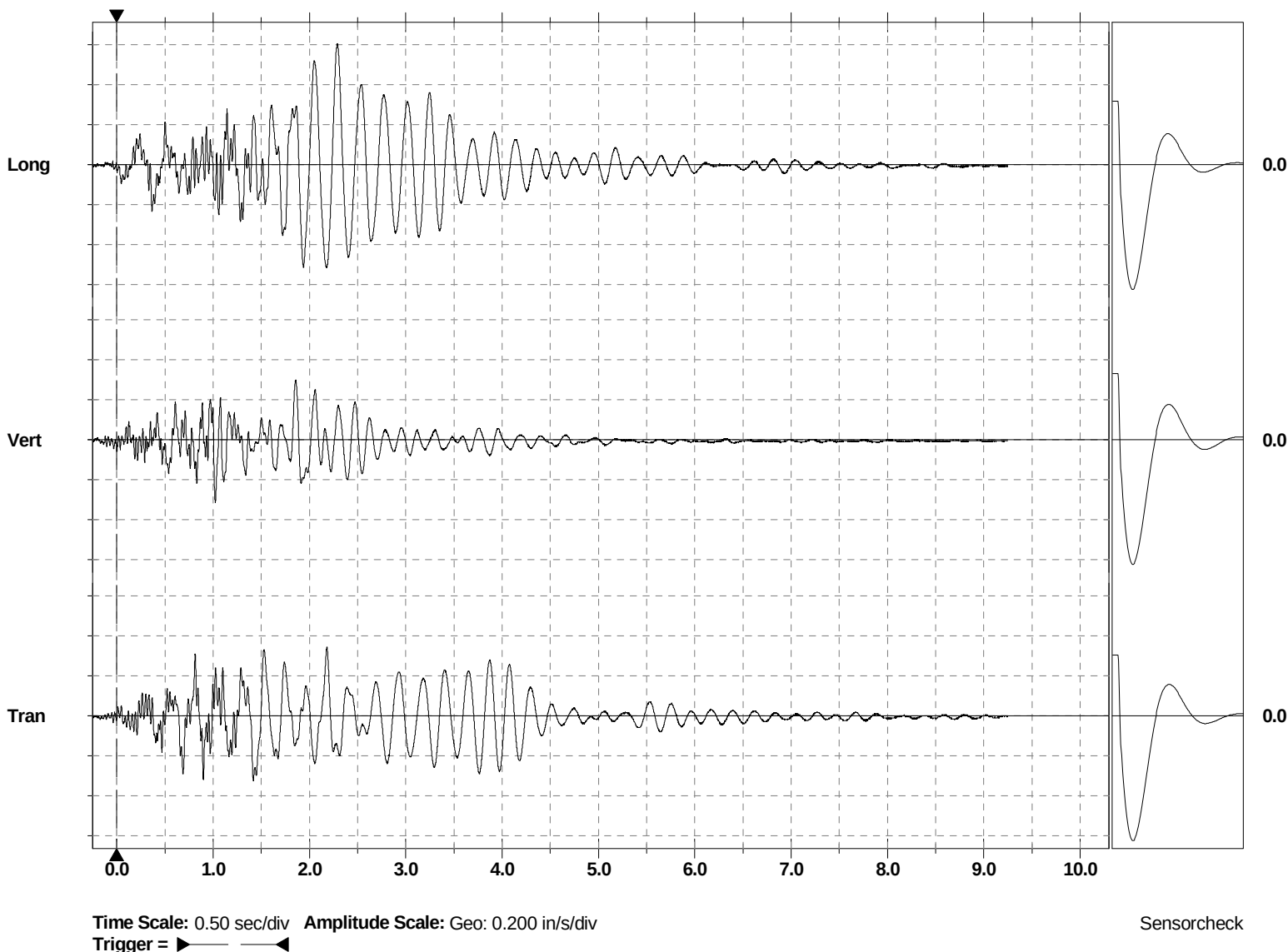
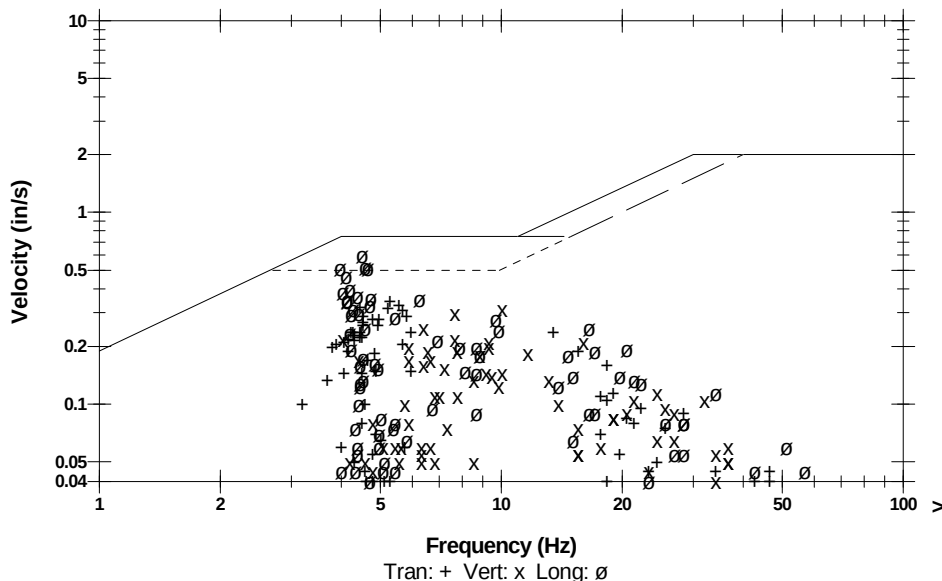
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1519
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.345	0.315	0.605	in/s
ZC Freq	5.3	10	4.5	Hz
Time (Rel. to Trig)	2.181	1.022	2.289	sec
Peak Acceleration	0.0795	0.0928	0.0795	g
Peak Displacement	0.0106	0.00945	0.0209	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.6	Hz
Overswing Ratio	4.0	3.6	4.1	

USBM RI8507 And OSMRE



Date/Time Long at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC8613 V 8.01-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration January 18, 2007 by Instantel Inc.
File Name J613BQ3I.X10

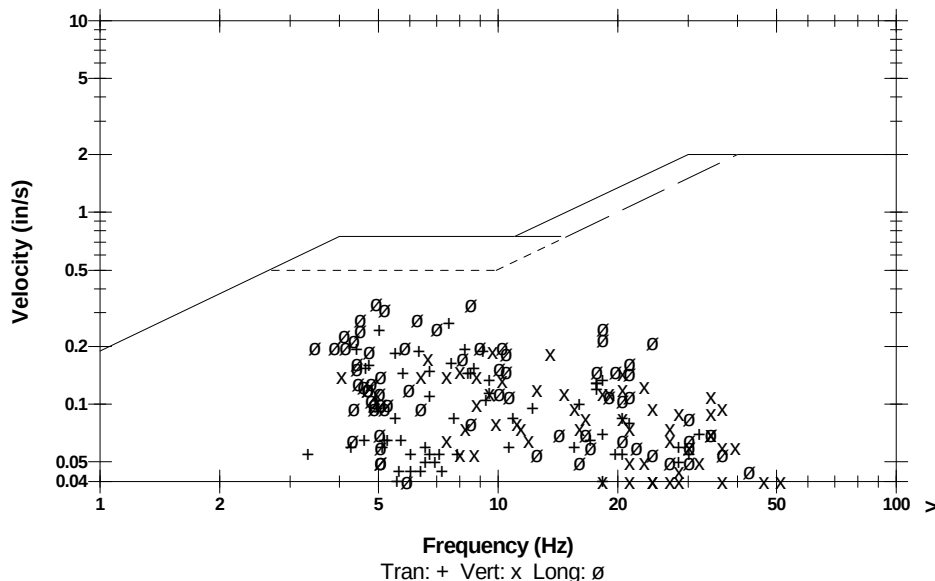
Notes

Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

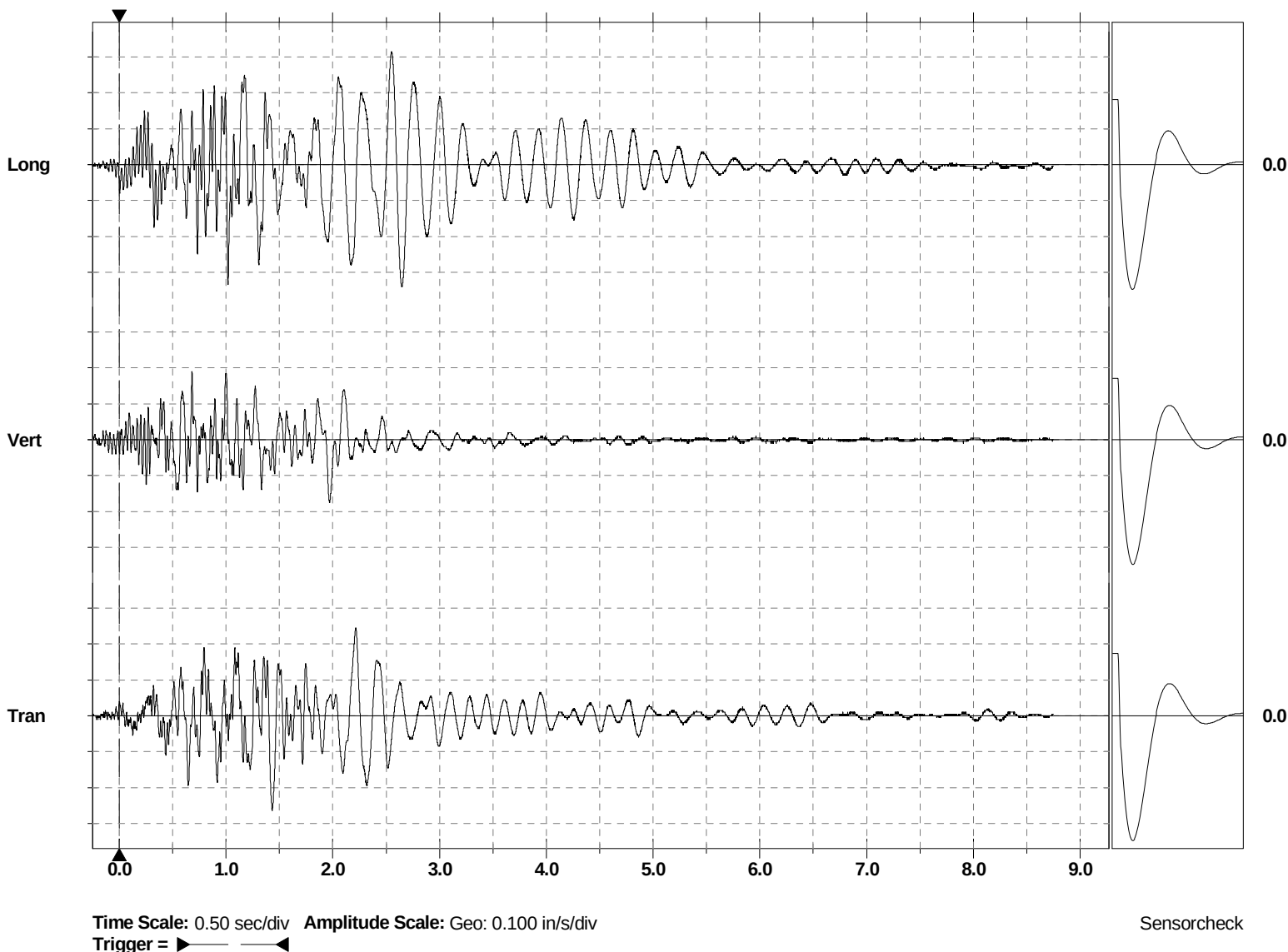
Post Event Notes

Distance from blast #5336: 1741
 Total pounds per 8ms delay: 1300

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	0.265	0.190	0.340	in/s
ZC Freq	7.5	9.7	4.9	Hz
Time (Rel. to Trig)	1.432	0.681	2.644	sec
Peak Acceleration	0.0530	0.0663	0.106	g
Peak Displacement	0.00722	0.00369	0.0110	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.6	Hz
Overswing Ratio	3.9	3.7	3.7	



Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 6.5 sec (Auto=3Sec) at 2048 sps

Serial Number BE10627 V 8.12-8.0 MiniMate Plus
Battery Level 6.5 Volts
Calibration November 23, 2006 by Instantel Inc.
File Name L627BQ3I.X10

Notes

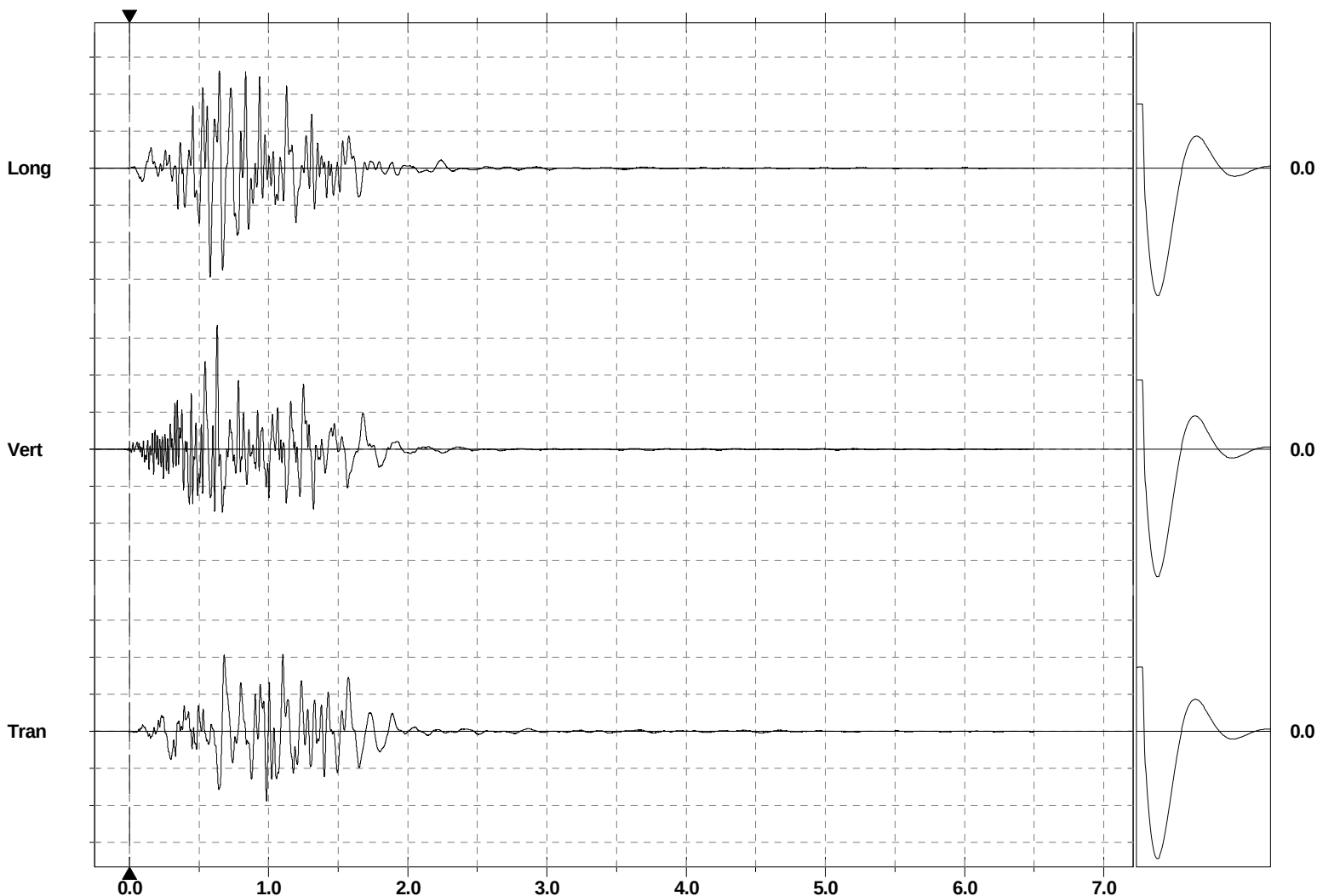
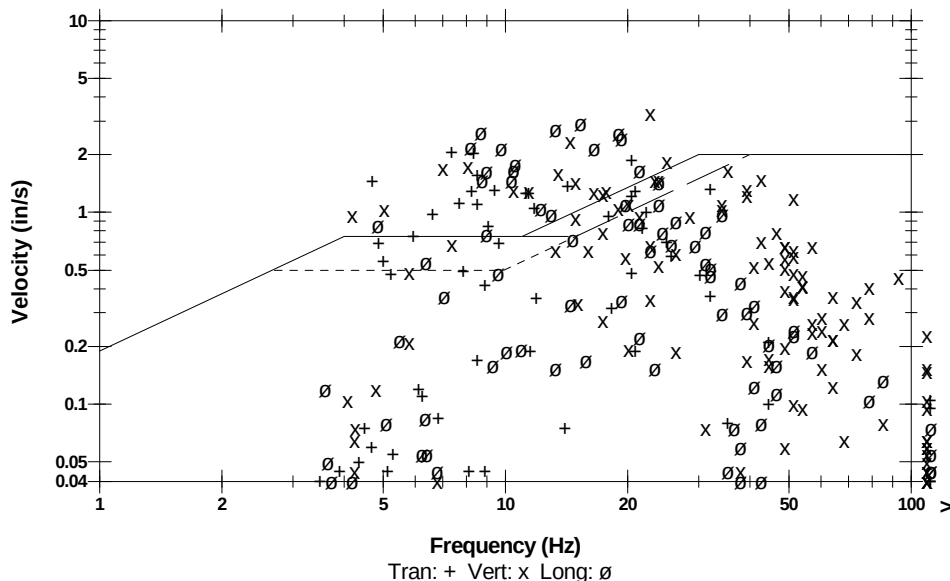
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 284
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	2.07	3.33	2.94	in/s
ZC Freq	7.4	23	15.3	Hz
Time (Rel. to Trig)	1.102	0.630	0.580	sec
Peak Acceleration	0.663	1.27	1.01	g
Peak Displacement	0.0328	0.0247	0.0368	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.3	7.4	7.2	Hz
Overswing Ratio	4.0	3.9	4.0	

USBM RI8507 And OSMRE



Sensorcheck

Date/Time Vert at 14:00:55 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC7093 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration August 10, 2006 by InstanTel Inc
File Name I093BQ3I.XJ0

Notes

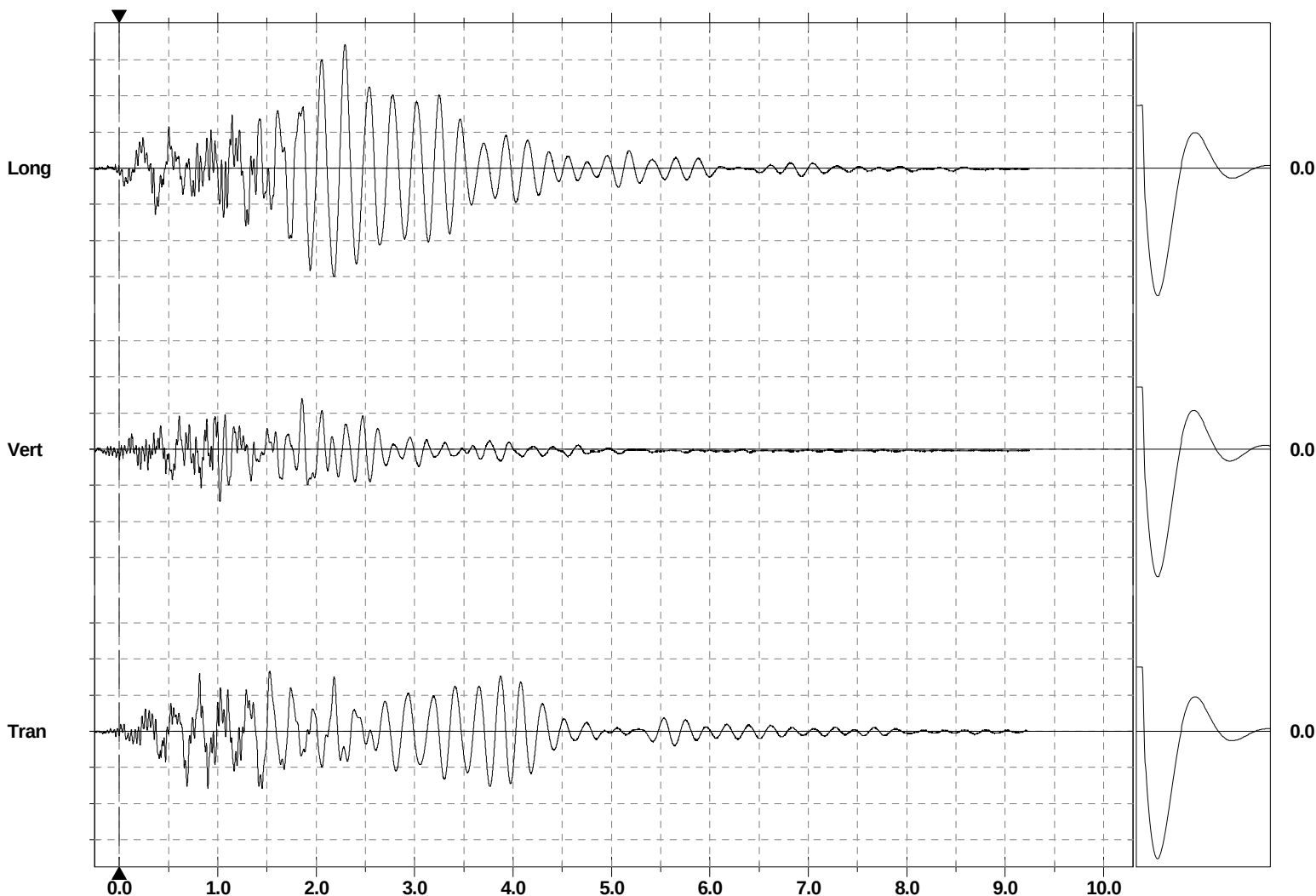
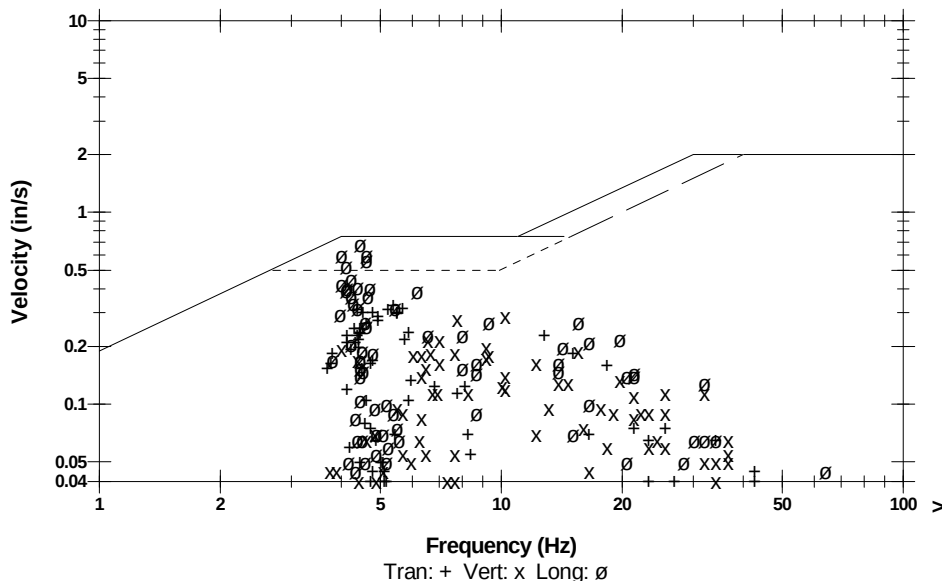
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1519
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.330	0.290	0.685	in/s
ZC Freq	5.4	10	4.5	Hz
Time (Rel. to Trig)	1.524	1.022	2.290	sec
Peak Acceleration	0.0663	0.0928	0.0795	g
Peak Displacement	0.0108	0.00866	0.0240	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.4	Hz
Overswing Ratio	3.7	3.3	3.6	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.200 in/s/div
Trigger =

Sensorcheck

Date/Time Vert at 14:00:54 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC8277 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration March 28, 2007 by Instantel Inc.
File Name J277BQ3I.X10

Notes

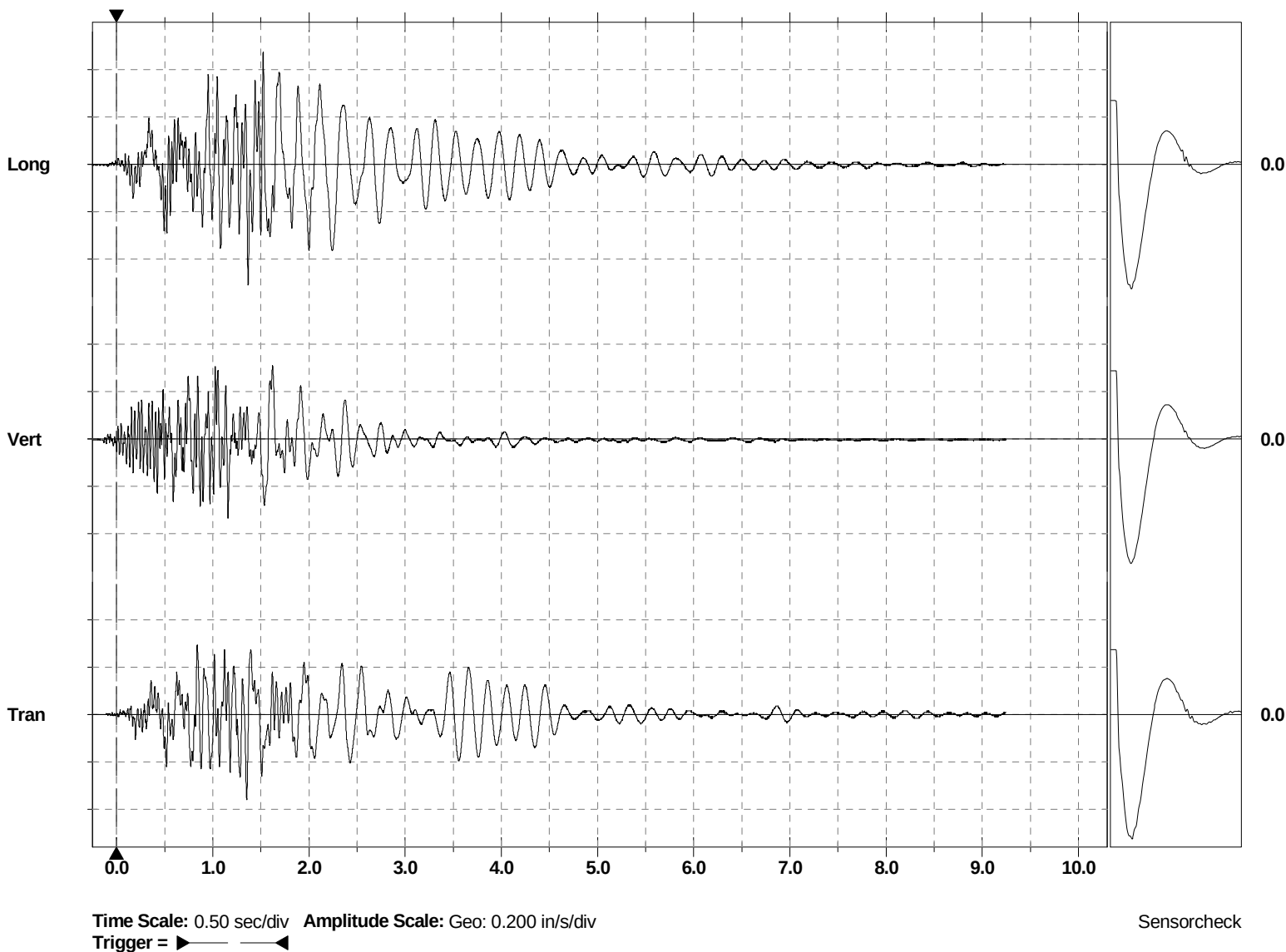
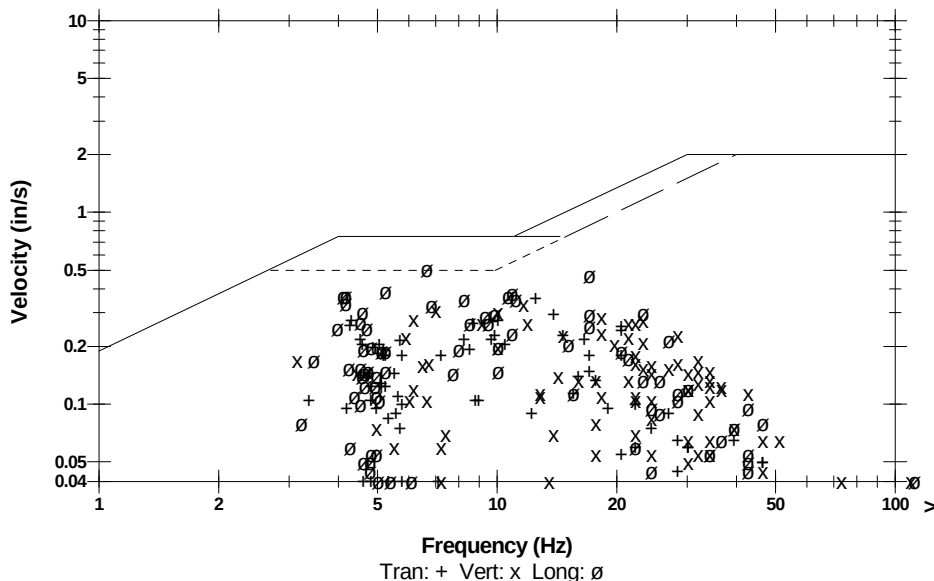
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1346
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.360	0.335	0.510	in/s
ZC Freq	12	12	6.6	Hz
Time (Rel. to Trig)	1.354	1.158	1.368	sec
Peak Acceleration	0.0928	0.146	0.133	g
Peak Displacement	0.00778	0.00727	0.0130	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.5	7.6	Hz
Overswing Ratio	3.5	3.7	3.7	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:55 June 20, 2007
Trigger Source Geo: 0.0300 in/s
Range Geo :10.00 in/s
Record Time 7.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC8062 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration September 26, 2006 by InstanTel Inc
File Name J062BQ3I.XJ0

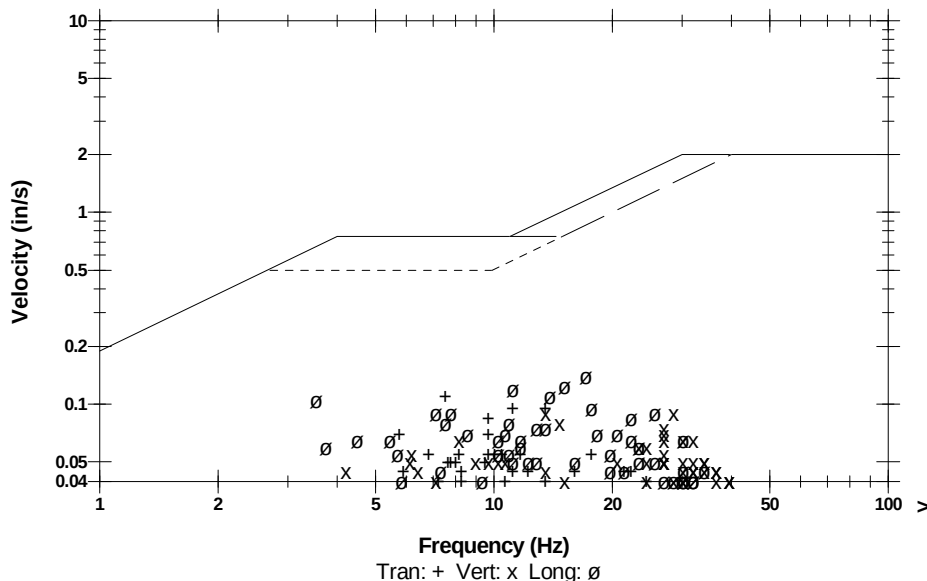
Notes

Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

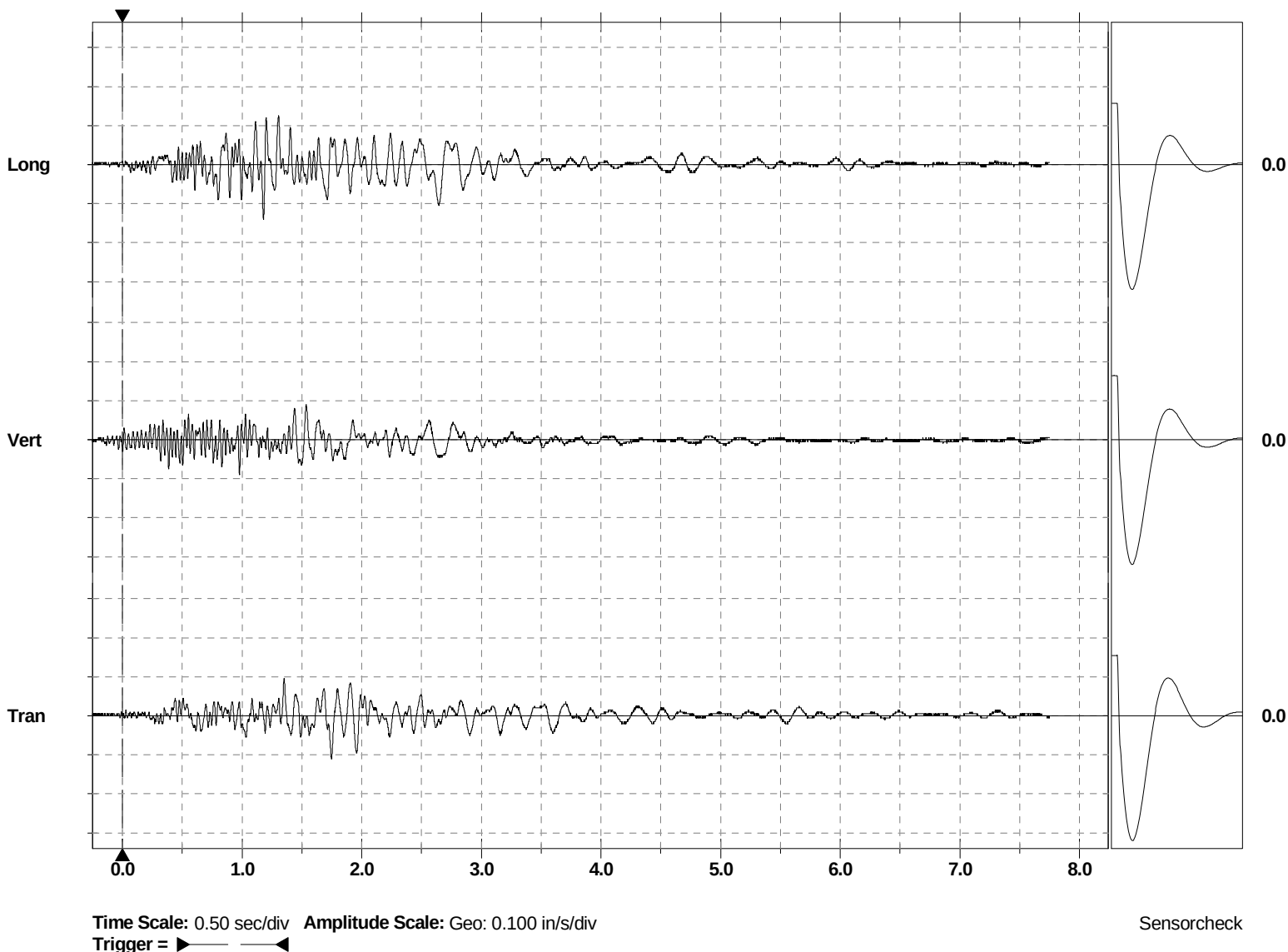
Post Event Notes

Distance from blast #5336: 2966
 Total pounds per 8ms delay: 1300

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	0.110	0.0900	0.140	in/s
ZC Freq	7.5	28	17	Hz
Time (Rel. to Trig)	1.745	0.978	1.178	sec
Peak Acceleration	0.0265	0.0398	0.0530	g
Peak Displacement	0.00171	0.00201	0.00330	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.3	7.2	Hz
Overswing Ratio	3.3	4.1	4.3	



Date/Time Vert at 14:00:55 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC8323 V 8.01-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration March 28, 2007 by Instantel Inc.
File Name J323BQ3I.XJ0

Notes

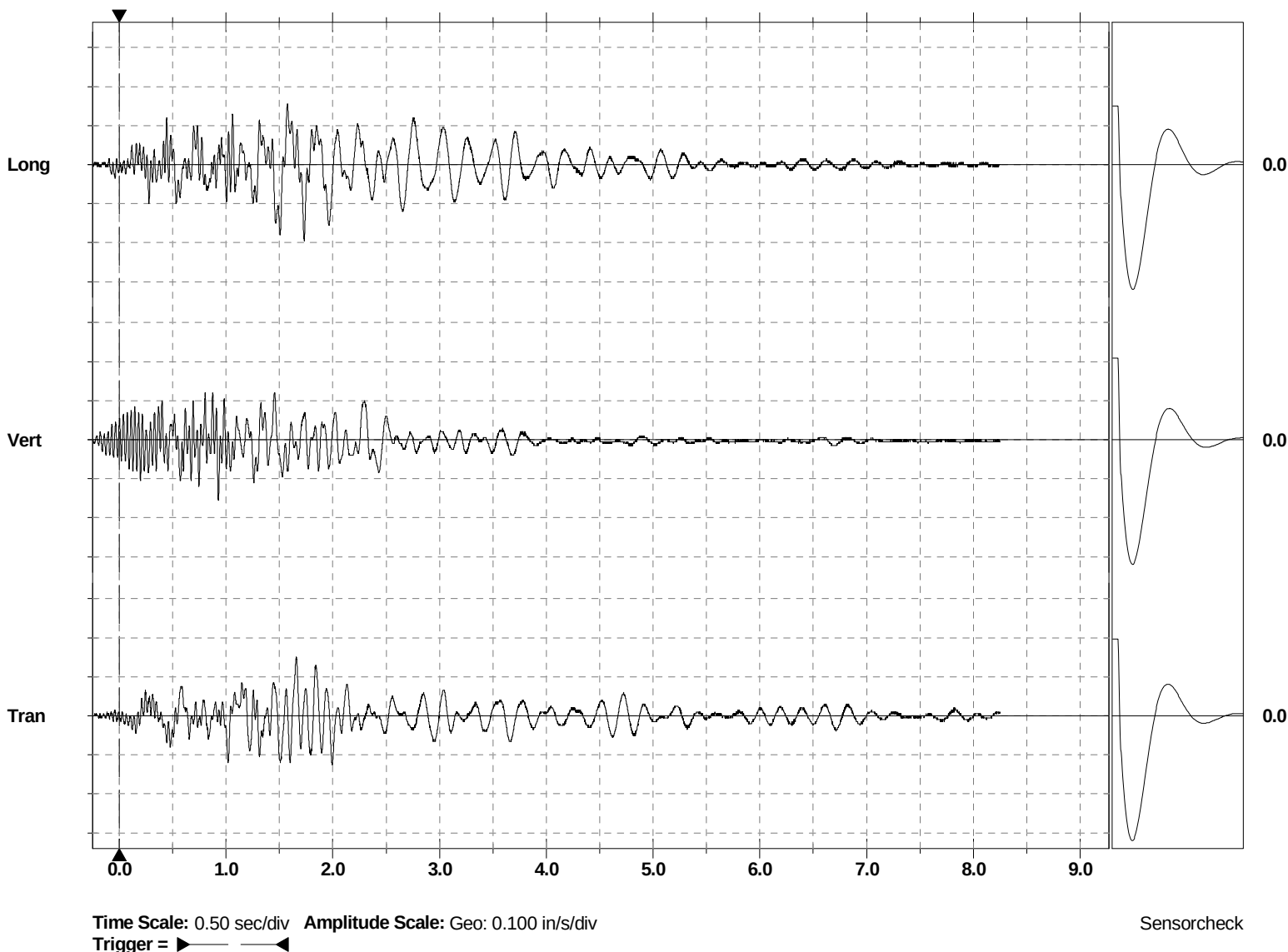
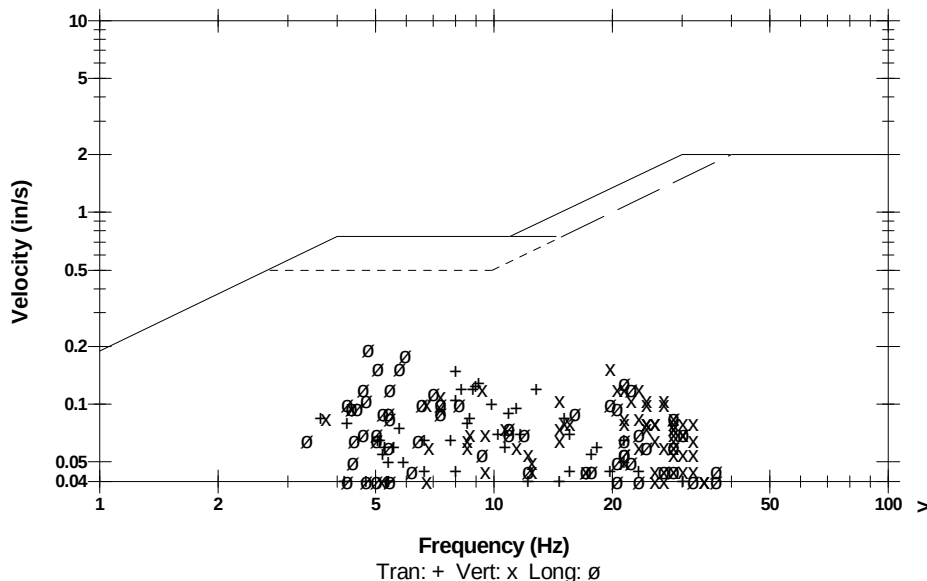
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 2544
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.150	0.155	0.195	in/s
ZC Freq	8.0	20	4.8	Hz
Time (Rel. to Trig)	1.656	0.927	1.731	sec
Peak Acceleration	0.0398	0.0663	0.0663	g
Peak Displacement	0.00308	0.00316	0.00491	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.5	7.6	Hz
Overswing Ratio	4.0	4.0	3.6	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:55 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 9.5 sec (Auto=3Sec) at 2048 sps

Serial Number BE11725 V 8.12-8.0 MiniMate Plus
Battery Level 6.5 Volts
Calibration October 27, 2006 by Instantel Inc.
File Name M725BQ3I.XJ0

Notes

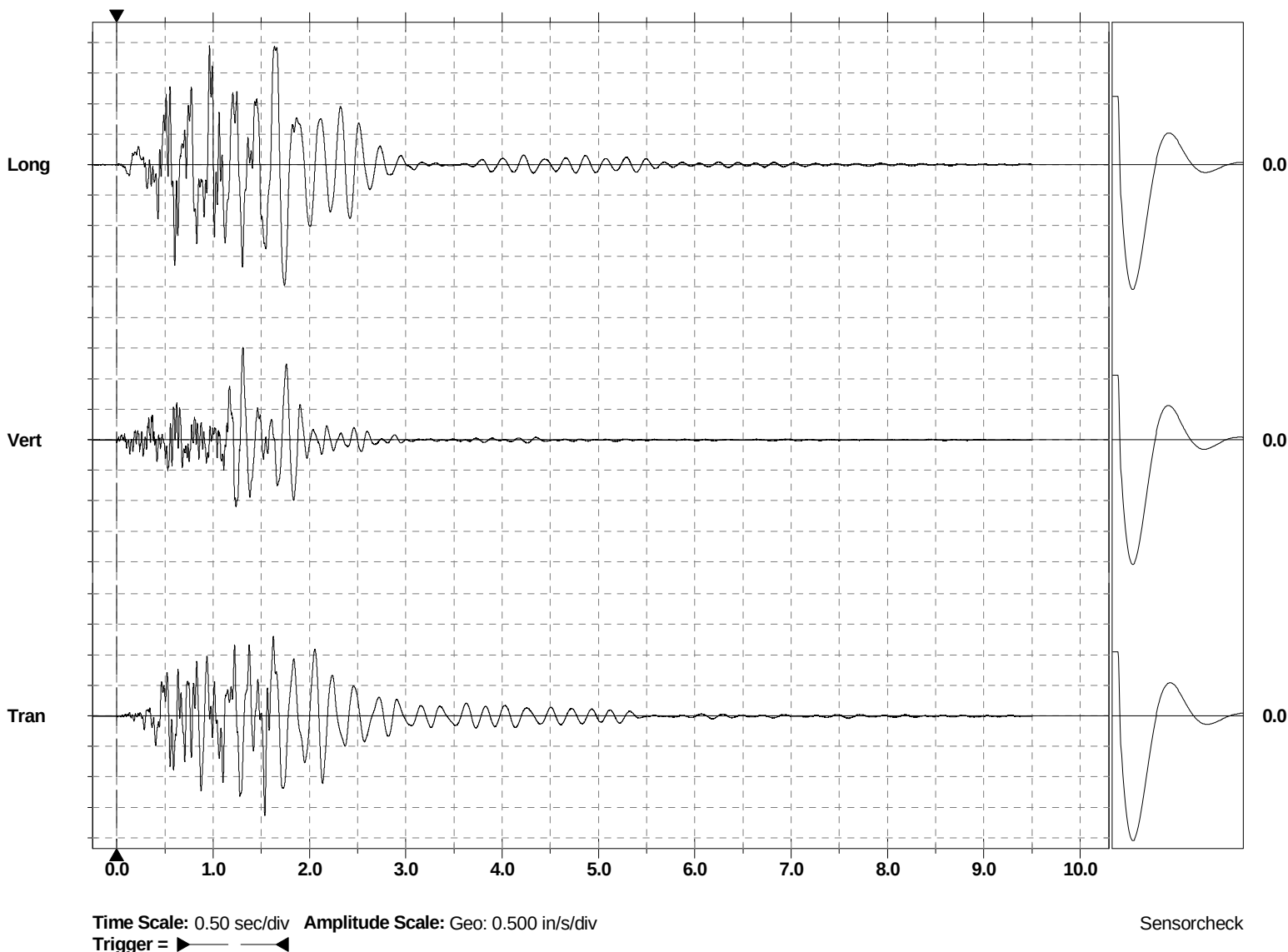
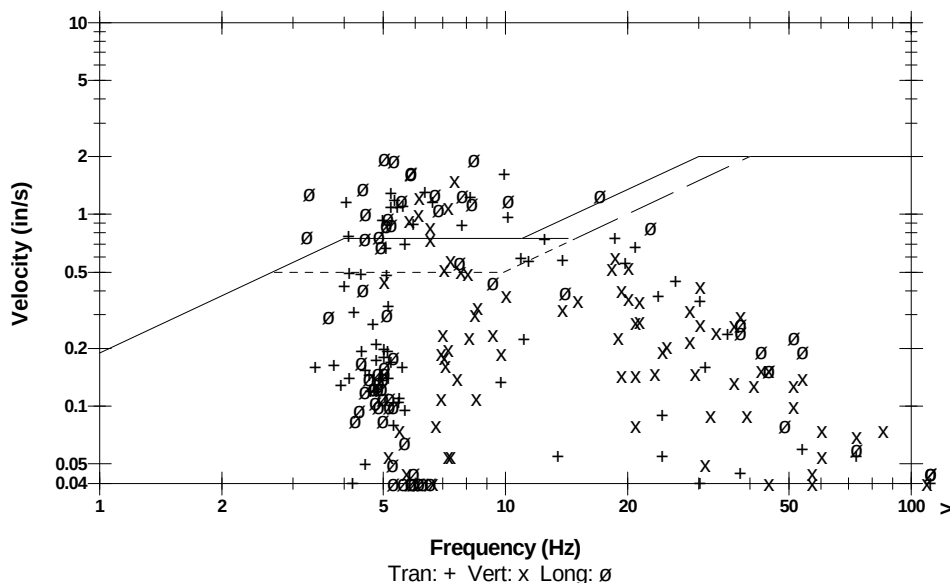
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 578
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.63	1.51	1.98	in/s
ZC Freq	9.9	7.5	5.0	Hz
Time (Rel. to Trig)	1.537	1.312	1.740	sec
Peak Acceleration	0.345	0.371	0.530	g
Peak Displacement	0.0384	0.0310	0.0666	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.3	7.6	7.5	Hz
Overswing Ratio	3.8	3.7	4.0	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:56 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 7.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC7089 V 8.12-8.0 MiniMate Plus
Battery Level 6.3 Volts
Calibration June 23, 2006 by Instantel Inc
File Name I089BQ3I.XK0

Notes

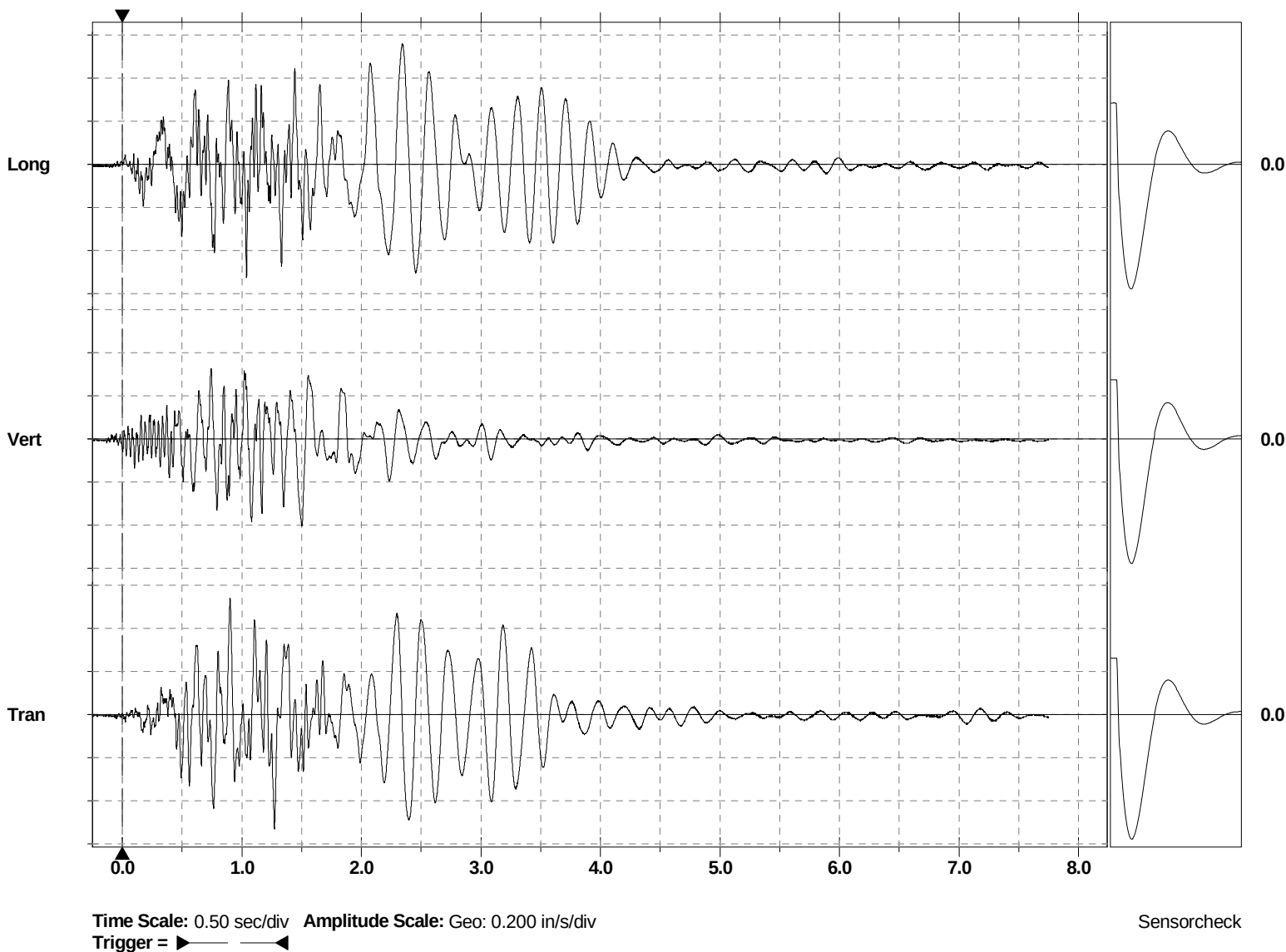
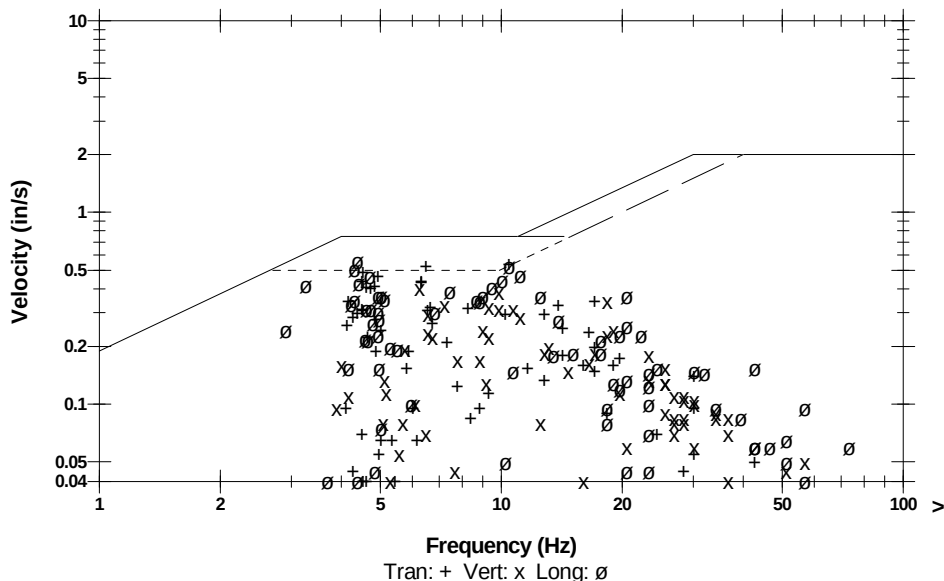
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 1175
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	0.540	0.405	0.560	in/s
ZC Freq	10	6.2	4.4	Hz
Time (Rel. to Trig)	0.901	1.502	2.343	sec
Peak Acceleration	0.119	0.119	0.159	g
Peak Displacement	0.0181	0.00968	0.0198	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.4	Hz
Overswing Ratio	3.7	3.5	3.8	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:58 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 6.0 sec (Auto=3Sec) at 2048 sps

Serial Number BE10051 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration March 13, 2007 by Instantel Inc.
File Name L051BQ3I.XM0

Notes

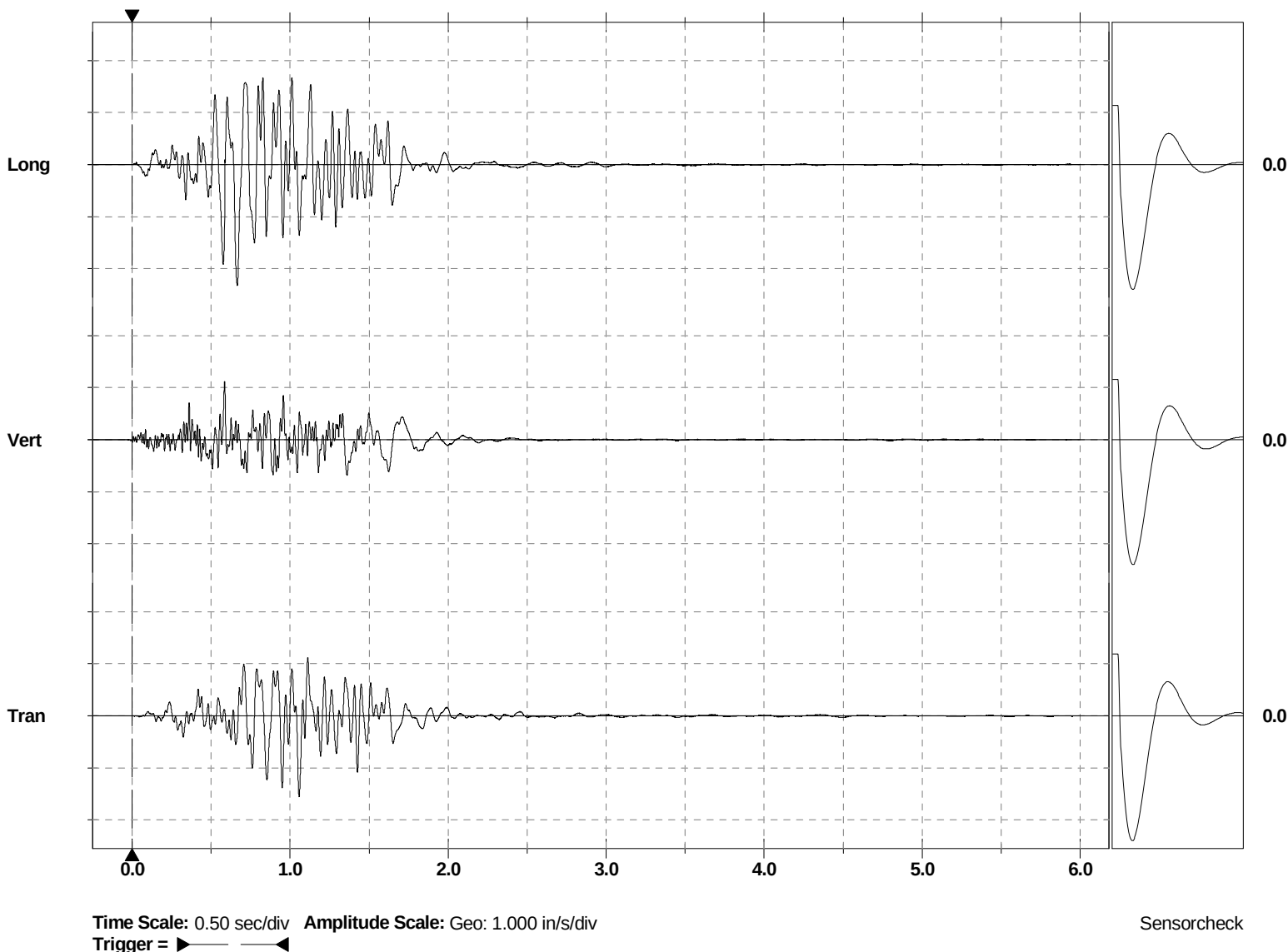
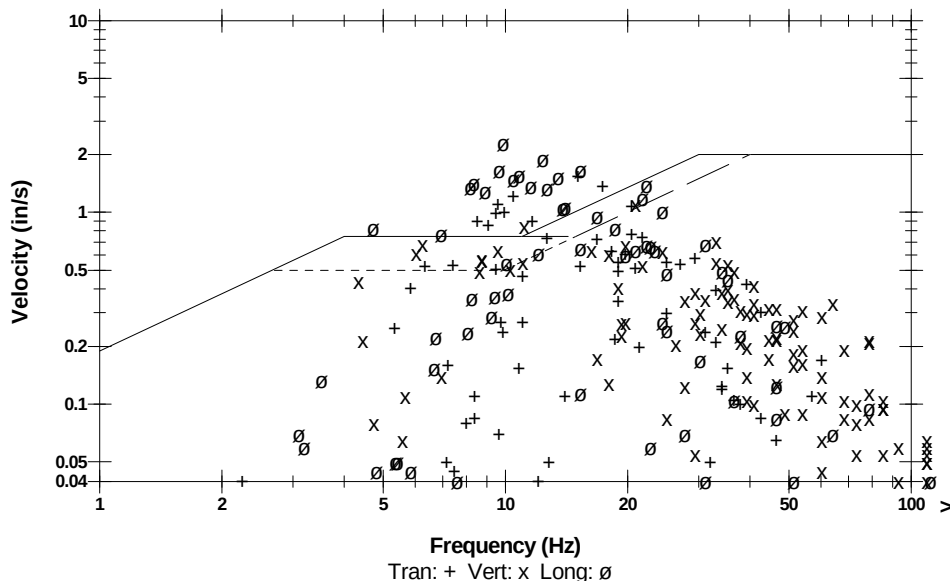
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 452
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.56	1.12	2.32	in/s
ZC Freq	15.1	21	9.8	Hz
Time (Rel. to Trig)	1.057	0.585	0.665	sec
Peak Acceleration	0.398	0.477	2.07	g
Peak Displacement	0.0174	0.0154	0.0323	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	7.4	7.5	Hz
Overswing Ratio	3.7	3.7	4.0	

USBM RI8507 And OSMRE



Date/Time Vert at 14:00:55 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 6.0 sec (Auto=3Sec) at 2048 sps

Serial Number BE11304 V 8.12-8.0 MiniMate Plus
Battery Level 6.5 Volts
Calibration June 11, 2007 by InstanTel Inc.
File Name M304BQ31.XJ0

Notes

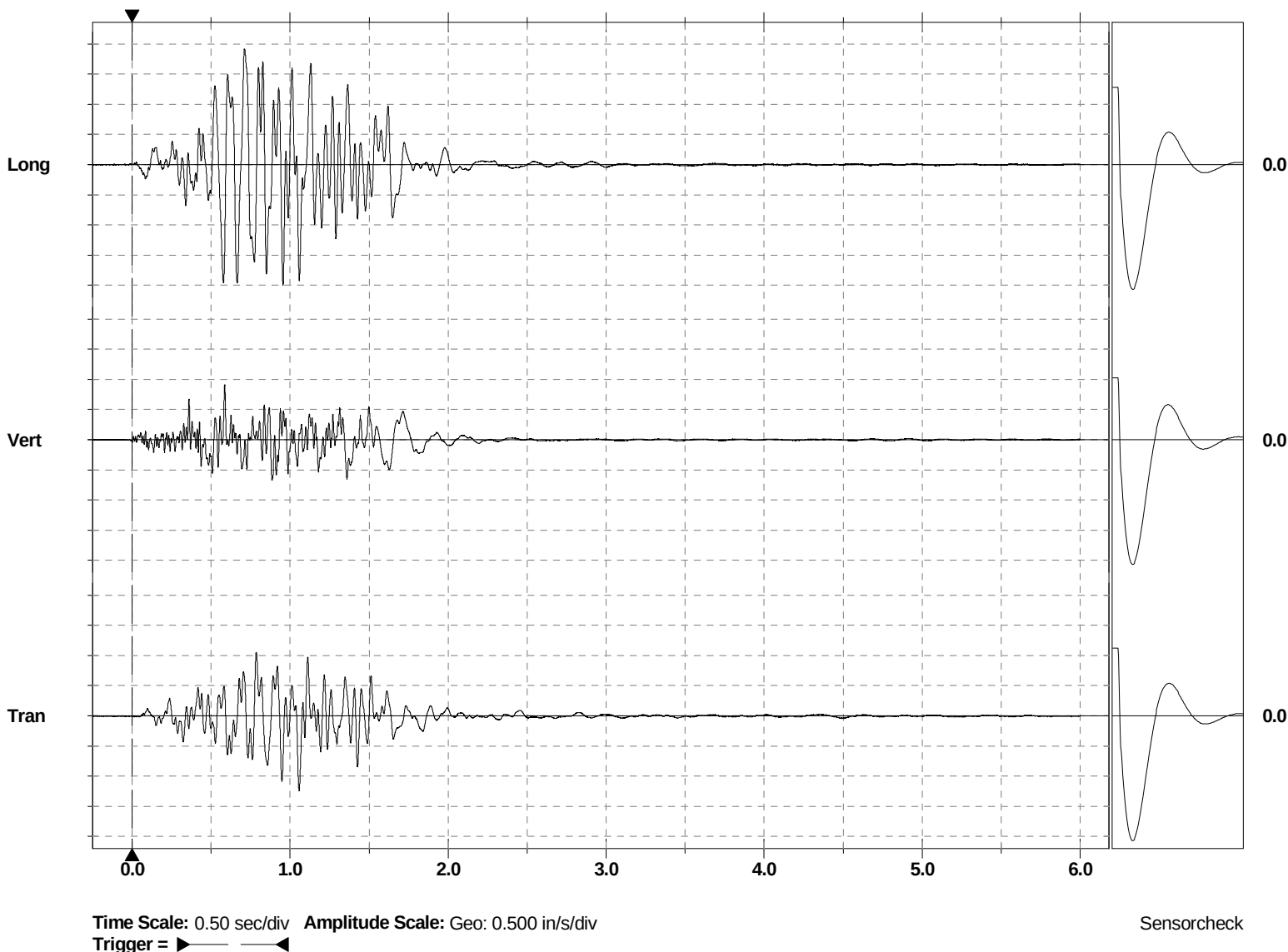
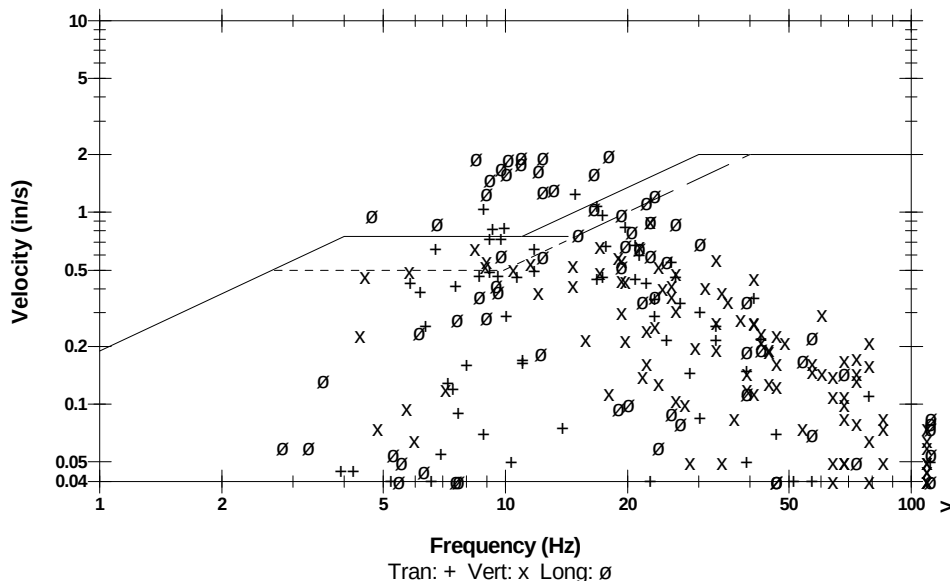
Client: Rio Tinto Energy America
Project: Ground Motion Attenuation Analysis
Location: Decker, MT
User: MMC, Inc.

Post Event Notes

Distance from blast #5336: 452
 Total pounds per 8ms delay: 1300

	Tran	Vert	Long	
PPV	1.25	0.910	2.00	in/s
ZC Freq	14.8	23	18.0	Hz
Time (Rel. to Trig)	1.057	0.586	0.955	sec
Peak Acceleration	0.345	0.371	1.11	g
Peak Displacement	0.0161	0.0150	0.0305	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.5	Hz
Overswing Ratio	3.9	3.6	3.9	

USBM RI8507 And OSMRE



Date/Time Vert at 14:01:00 June 20, 2007
Trigger Source Geo: 0.0300 in/s
Range Geo :10.00 in/s
Record Time 8.25 sec (Auto=3Sec) at 1024 sps

Serial Number BC7228 V 8.12-8.0 MiniMate Plus
Battery Level 6.4 Volts
Calibration May 2, 2007 by InstanTel Inc.
File Name I228BQ3I.X00

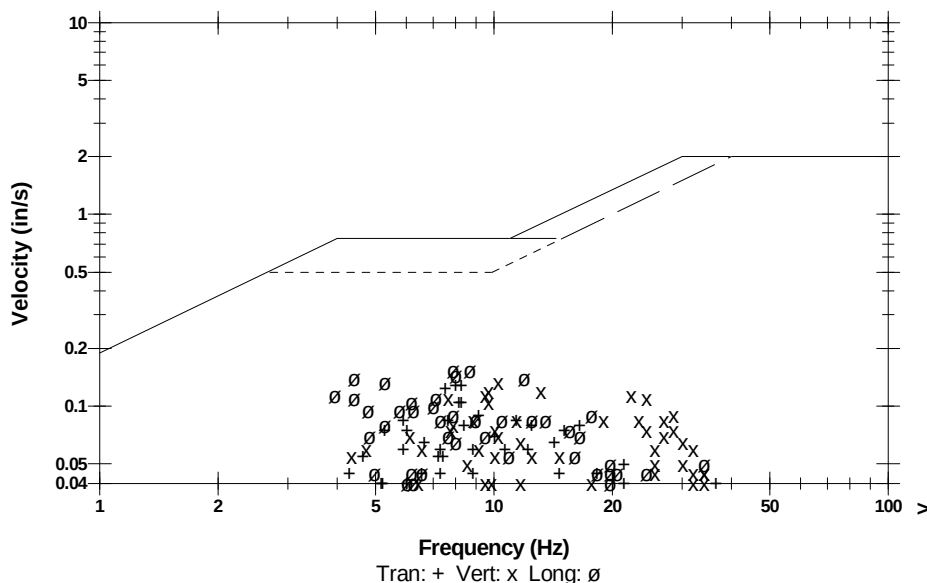
Notes

Client: Rio Tinto Energy America
 Project: Ground Motion Attenuation Analysis
 Location: Decker, MT
 User: MMC, Inc.

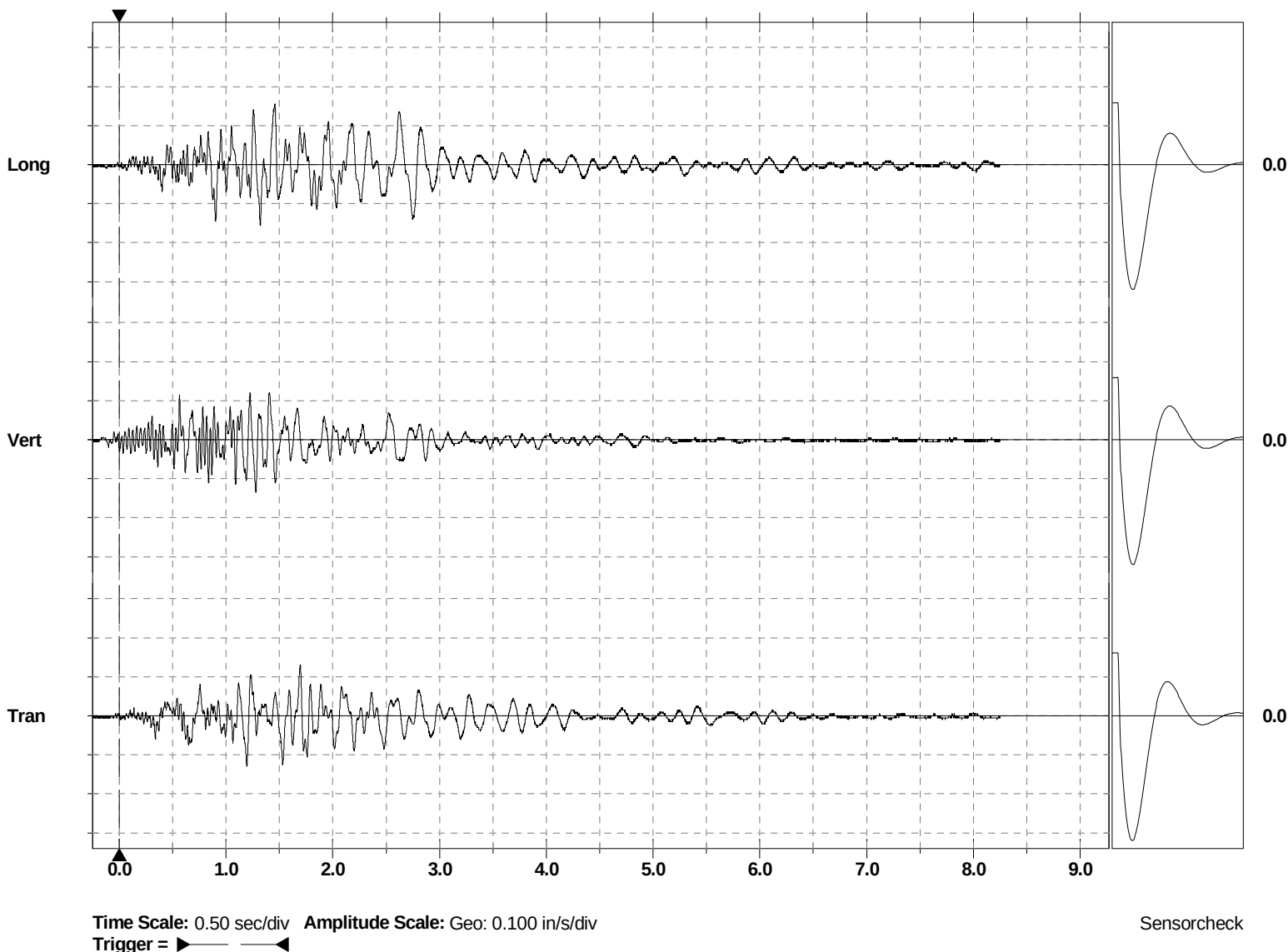
Post Event Notes

Distance from blast #5336: 2794
 Total pounds per 8ms delay: 1300

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	0.130	0.135	0.155	in/s
ZC Freq	8.3	10	7.9	Hz
Time (Rel. to Trig)	1.195	1.277	1.318	sec
Peak Acceleration	0.0398	0.0398	0.0398	g
Peak Displacement	0.00223	0.00247	0.00403	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	7.4	7.3	Hz
Overswing Ratio	3.7	3.7	4.0	



Date/Time Long at 14:05:14 June 20, 2007
Trigger Source Geo: 0.0500 in/s
Range Geo :10.00 in/s
Record Time 8.75 sec (Auto=3Sec) at 1024 sps

Serial Number BC8312 V 8.12-8.0 MiniMate Plus
Battery Level 6.2 Volts
Calibration March 6, 2007 by Instantel Inc.
File Name J312BQ3J.4Q0

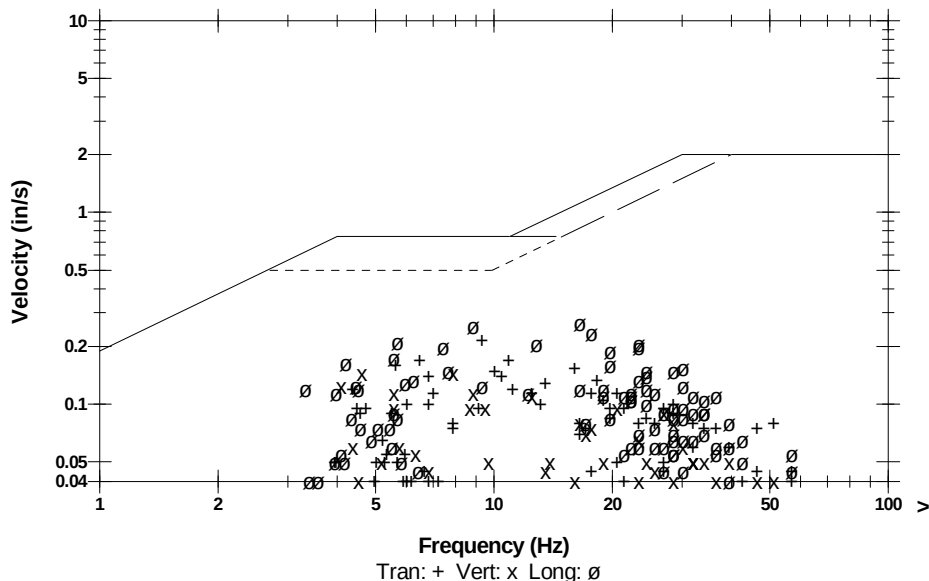
Notes

Property: Spring Creek Coal Mine
Location: Decker, MT
User Name: MMC, Inc.
Project: Ground Motion Attenuation Study

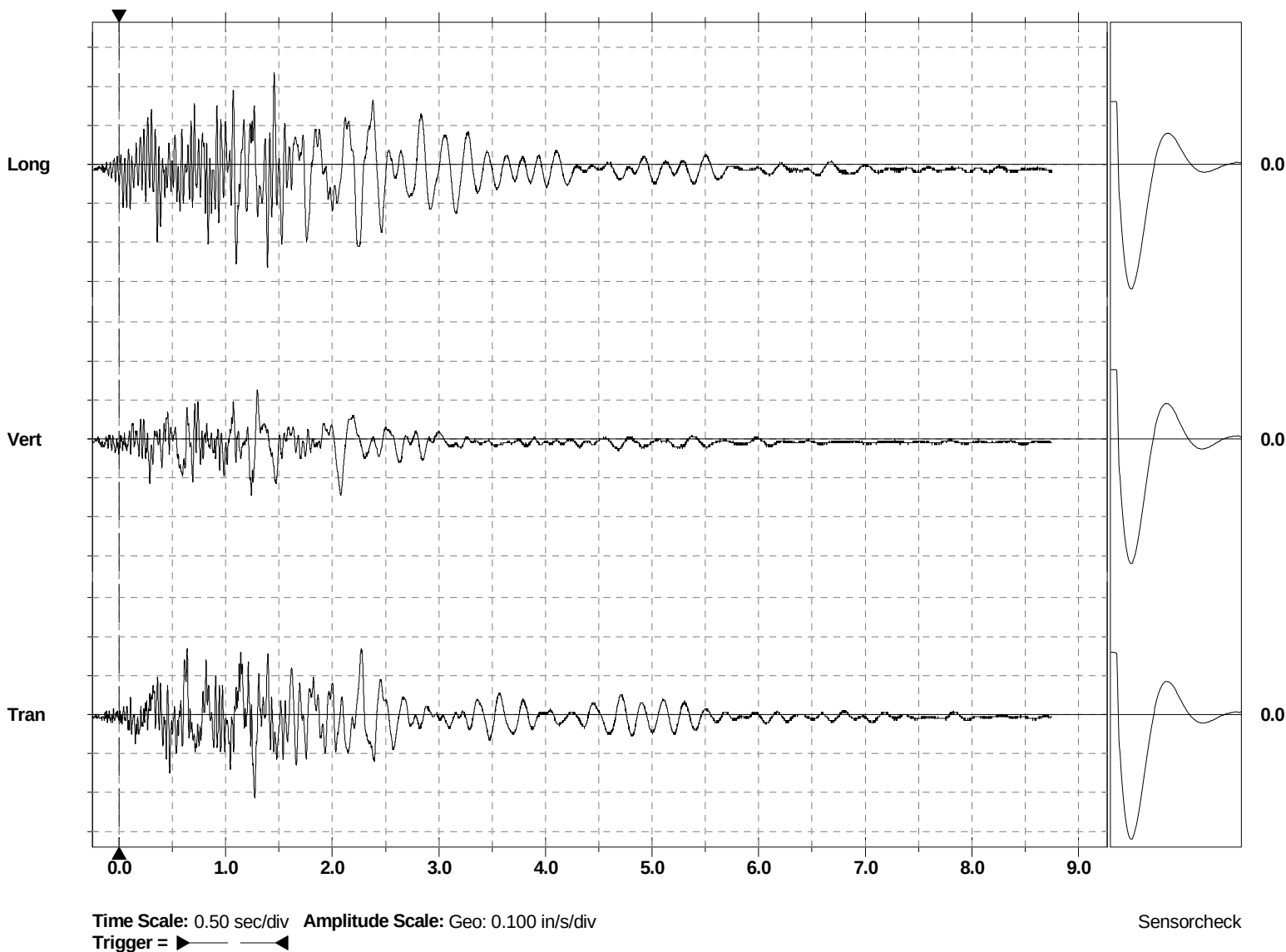
Post Event Notes

Distance from blast #5336: 1926
 Total pounds per 8ms delay: 1300

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	0.215	0.145	0.265	in/s
ZC Freq	9.3	7.9	17	Hz
Time (Rel. to Trig)	1.273	1.240	1.393	sec
Peak Acceleration	0.0795	0.0530	0.0795	g
Peak Displacement	0.00415	0.00433	0.00630	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.3	Hz
Overswing Ratio	3.8	3.5	4.0	



APPENDIX III

SPRING CREEK MINE HISTORIC BLAST DATA

BLAST SUMMARY DATA TABLE PICTOGRAPH VIBRATION EVENT REPORT

SPRING CREEK MINE PIT 4 - HISTORIC BLAST DATA

Shot #	Date	Location	Distance to Rock Art (feet)	Total pounds per 8ms Delay	Total Pounds used	Peak Particle Velocity (in/s)
5213	11/8/2006	SW 1/4 SE 1/4 SEC 14 R39E T8S	3300	1,550	133,121	0.200
5224	11/20/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	850	27,830	0.090
5230	11/27/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	1,250	13,197	0.080
5234	12/4/2006	SE 1/4 SW 1/4 SEC 14 R39E T8S	3500	1,850	24,862	0.120
5264	1/20/2007	NE 1/4 SW 1/4 SEC 14 R39E T8S	3000	1,300	20,555	0.145
5266	1/22/2007	NE 1/4 SW 1/4 SEC 14 R39E T8S	5266	1,050	25,941	0.100

Date/Time Vert at 14:24:15 November 8, 2006
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 7.25 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 6.8 Volts
Calibration January 30, 2006 by Instantel Inc.
File Name I820BEKQ.OF0

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

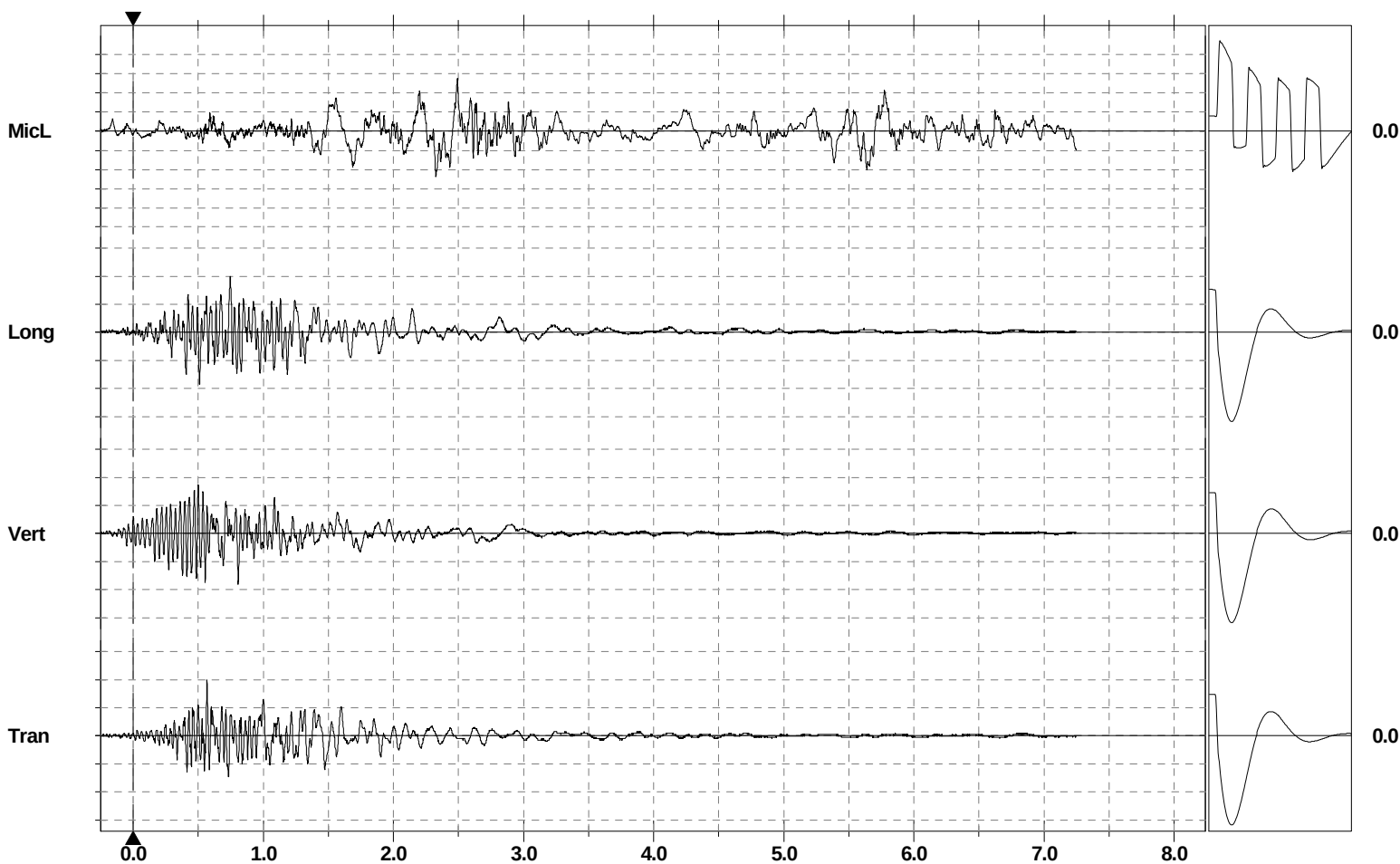
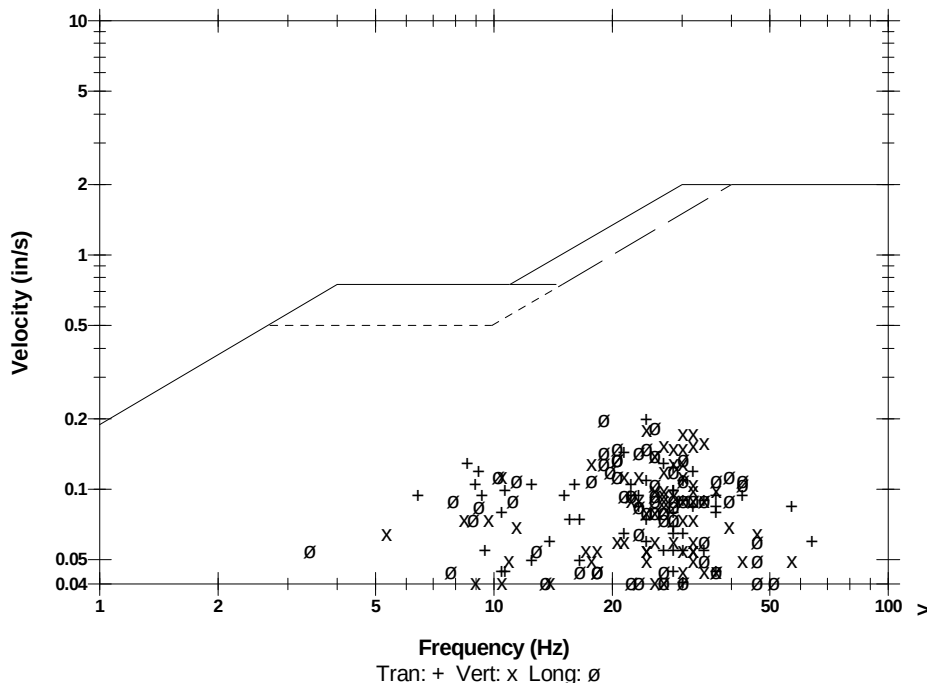
Post Event Notes

Distance to Pictograph Panel (Rock Art): 3300 feet
 Total pounds per 8ms delay: 1550 lbs

Microphone Linear Weighting
PSPL 119.6 dB(L) 0.00276 psi(L) at 2.492 sec
ZC Freq 6.6 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 629 mv)

	Tran	Vert	Long	
PPV	0.200	0.180	0.200	in/s
ZC Freq	24	24	19	Hz
Time (Rel. to Trig)	0.566	0.807	0.745	sec
Peak Acceleration	0.0928	0.106	0.106	g
Peak Displacement	0.00203	0.00191	0.00207	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.8	3.7	3.9	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.100 in/s/div Mic: 0.00100 psi(L)/div
Trigger =

Sensorcheck

Date/Time Tran at 12:36:08 November 20, 2006
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 5.75 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 6.9 Volts
Calibration January 30, 2006 by InstanTel Inc.
File Name I820BF6T.O80

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

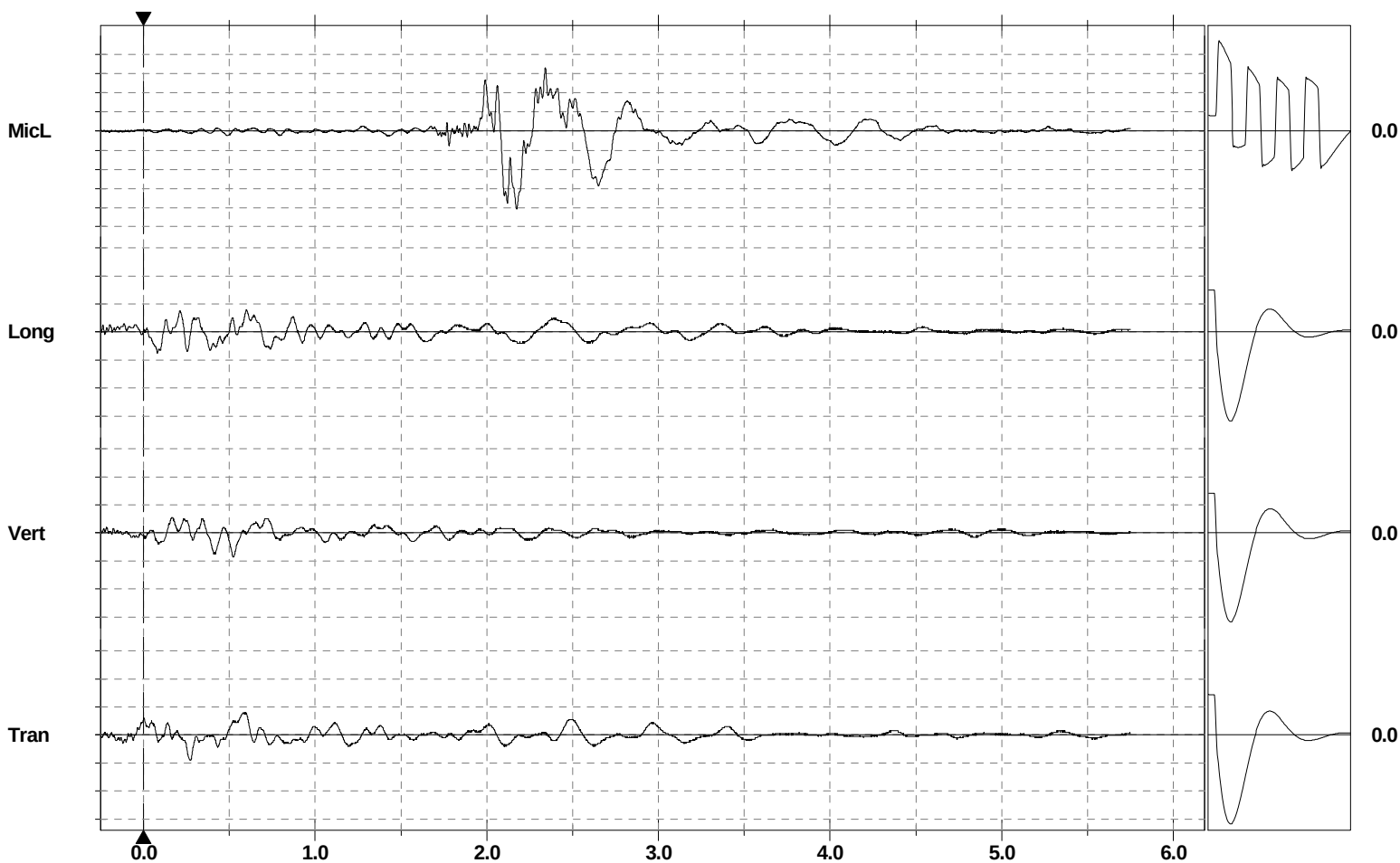
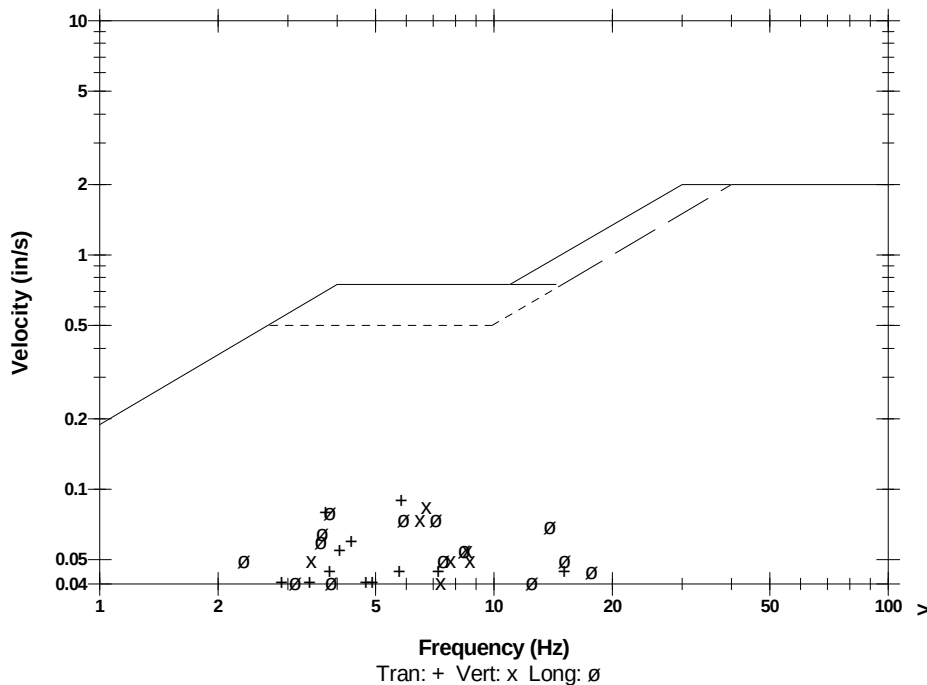
Post Event Notes

Distance to Pictograph Panel (Rock Art): 3500 feet
 Total pounds per 8ms delay: 850 lbs

Microphone Linear Weighting
PSPL 122.9 dB(L) 0.00406 psi(L) at 2.173 sec
ZC Freq 2.7 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 617 mv)

	Tran	Vert	Long	
PPV	0.0900	0.0850	0.0800	in/s
ZC Freq	5.8	6.7	3.8	Hz
Time (Rel. to Trig)	0.269	0.521	0.598	sec
Peak Acceleration	0.0265	0.0265	0.0265	g
Peak Displacement	0.00337	0.00228	0.00334	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.4	7.4	Hz
Overswing Ratio	3.9	3.8	4.0	

USBM RI8507 And OSMRE



Sensorcheck

Date/Time Tran at 12:00:35 November 27, 2006
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 5.75 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 7.0 Volts
Calibration January 30, 2006 by InstanTel Inc.
File Name I820BFJQ.OZ0

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

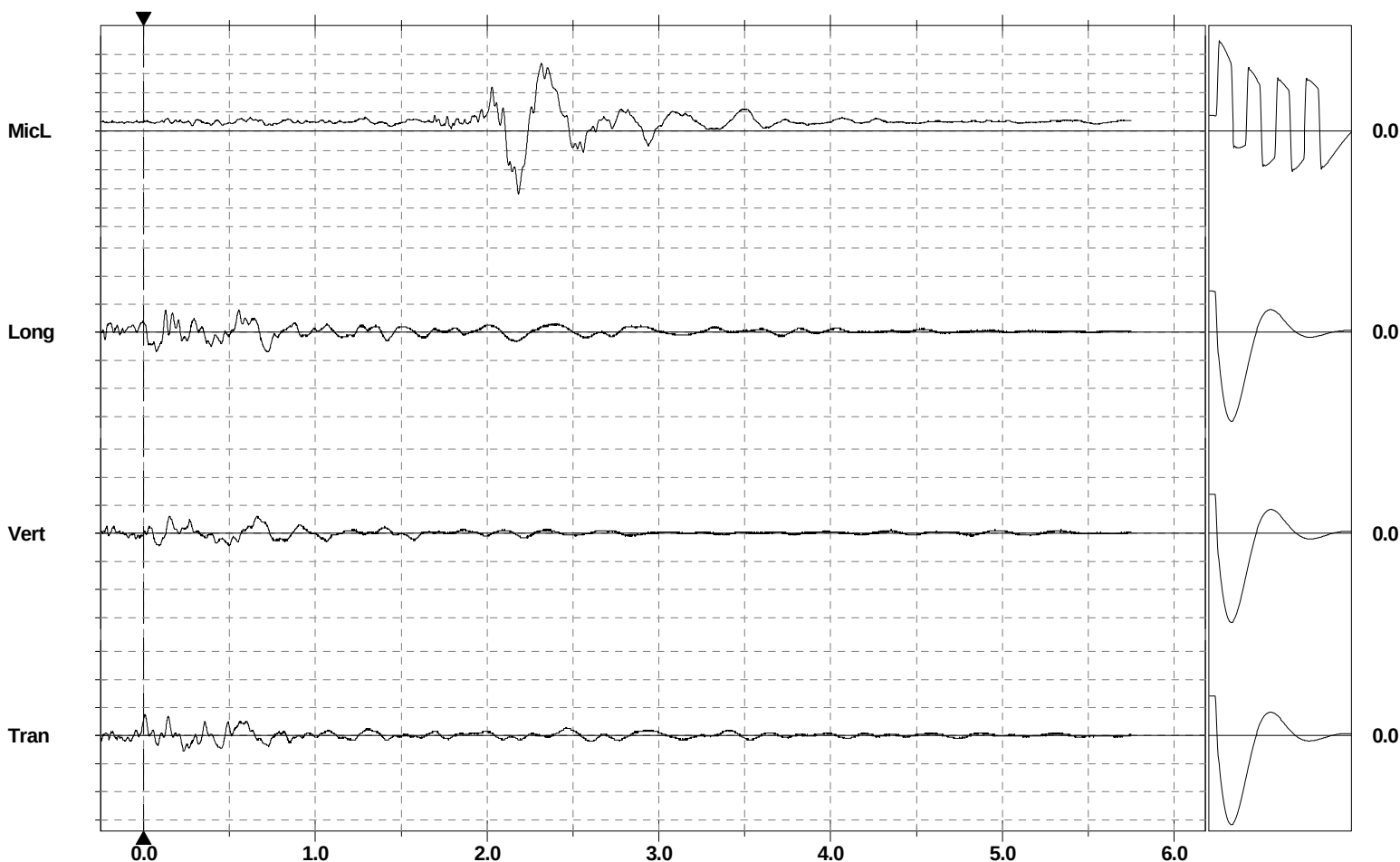
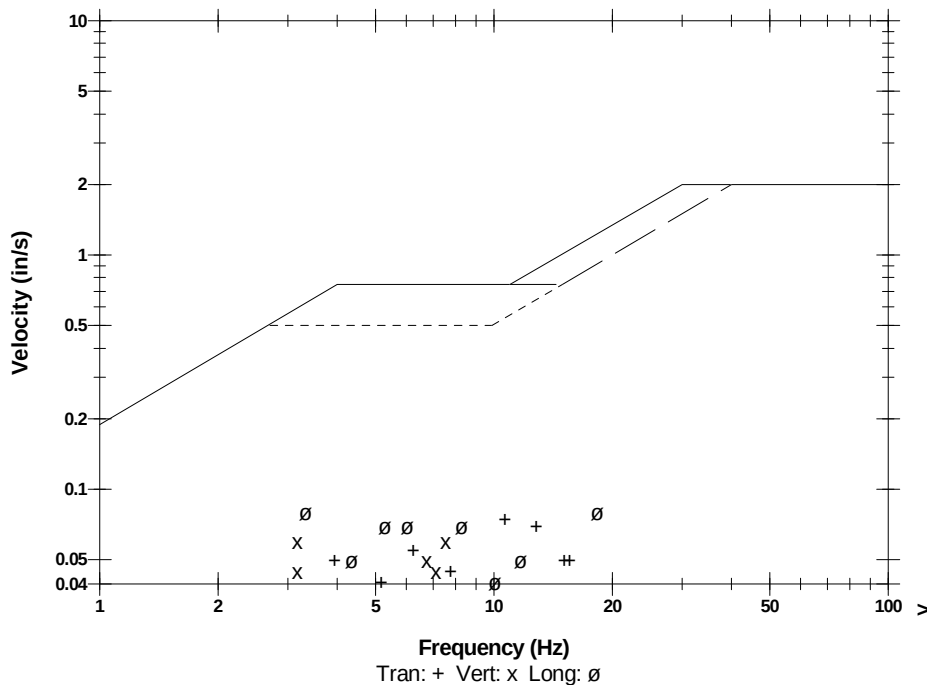
Post Event Notes

Distance to Pictograph Panel (Rock Art): 3500 feet
 Total pounds per 8ms delay: 1250 lbs

Microphone Linear Weighting
PSPL 121.8 dB(L) 0.00355 psi(L) at 2.316 sec
ZC Freq 2.1 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 603 mv)

	Tran	Vert	Long	
PPV	0.0750	0.0600	0.0800	in/s
ZC Freq	11	7.5	18	Hz
Time (Rel. to Trig)	0.006	0.147	0.128	sec
Peak Acceleration	0.0265	0.0265	0.0265	g
Peak Displacement	0.00209	0.00253	0.00308	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.9	3.8	4.0	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.100 in/s/div Mic: 0.00100 psi(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:40:02 December 4, 2006
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 5.75 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 6.9 Volts
Calibration January 30, 2006 by Instantel Inc.
File Name I820BFWO.EQ0

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

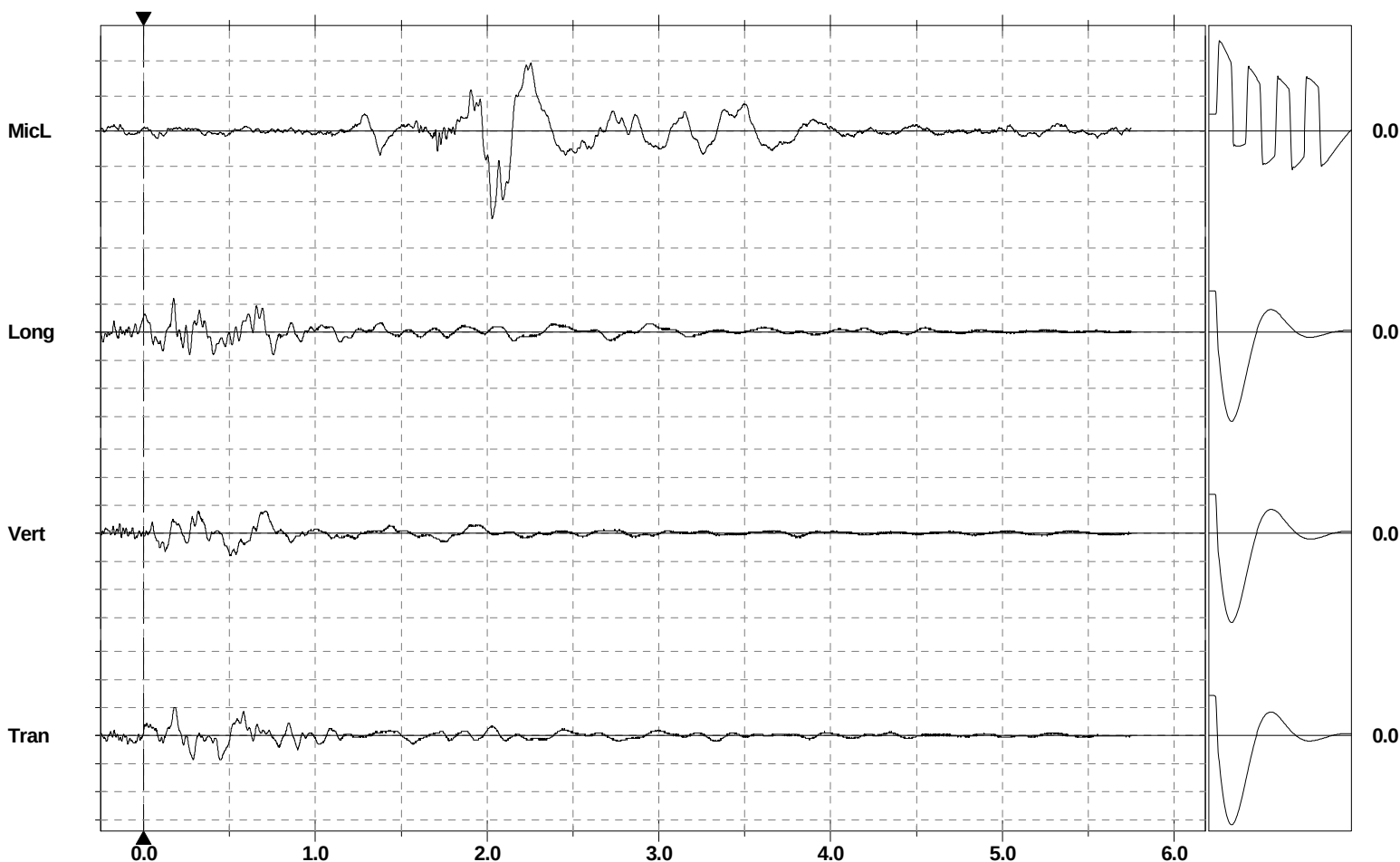
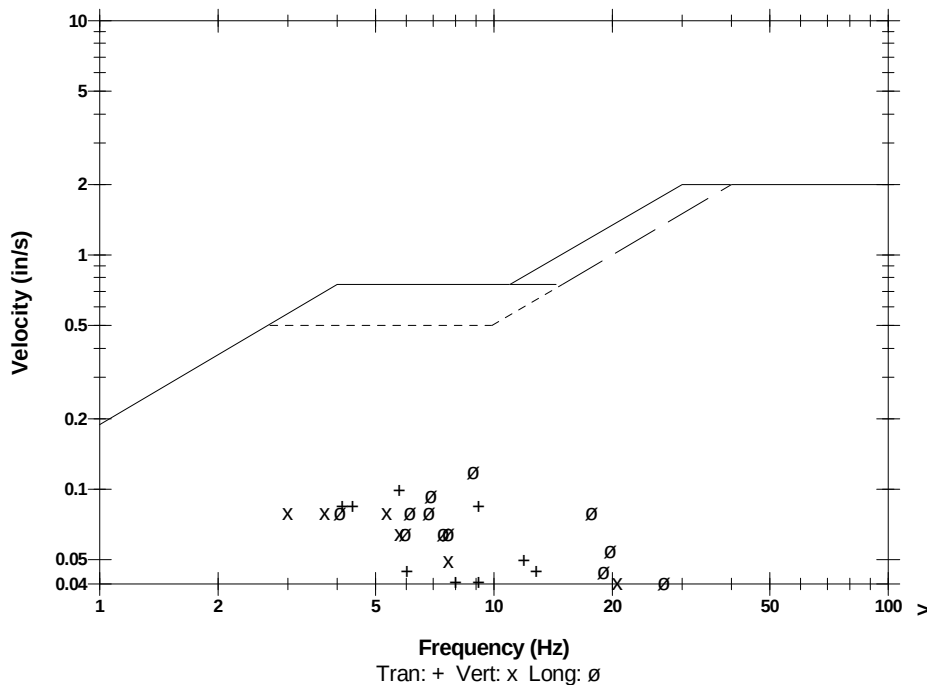
Post Event Notes

Distance to Pictograph Panel (Rock Art): 3500 feet
 Total pounds per 8ms delay: 1850 lbs

Microphone Linear Weighting
PSPL 124.6 dB(L) 0.00493 psi(L) at 2.028 sec
ZC Freq 2.9 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 580 mv)

	Tran	Vert	Long	
PPV	0.1000	0.0800	0.120	in/s
ZC Freq	5.8	5.3	8.8	Hz
Time (Rel. to Trig)	0.177	0.317	0.175	sec
Peak Acceleration	0.0265	0.0265	0.0398	g
Peak Displacement	0.00268	0.00372	0.00231	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.9	3.8	4.0	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.100 in/s/div Mic: 0.00200 psi(L)/div
Trigger =

Sensorcheck

Date/Time Long at 16:26:32 January 20, 2007
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 6.25 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 6.7 Volts
Calibration January 30, 2006 by InstanTel Inc.
File Name I820BIC3.080

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

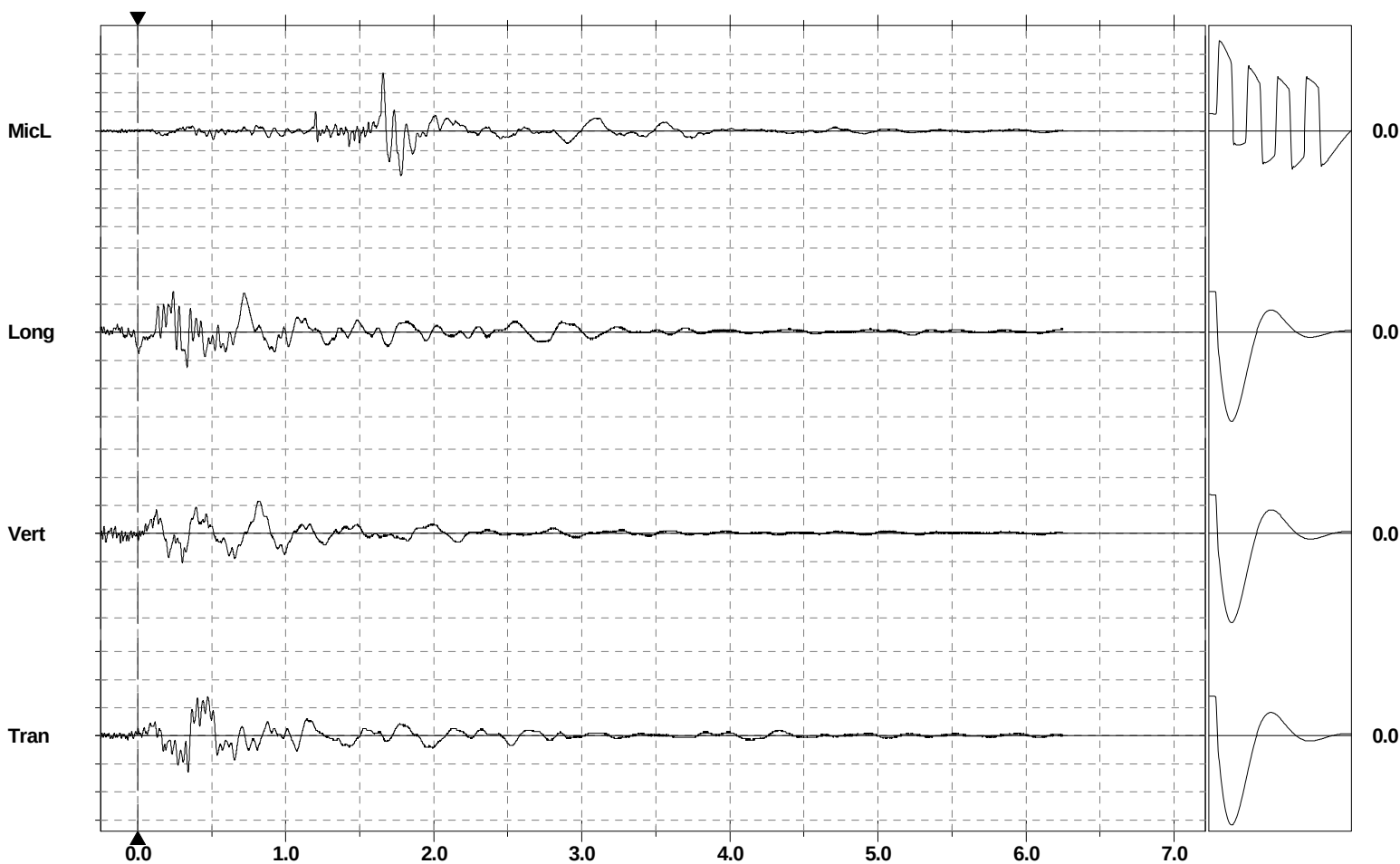
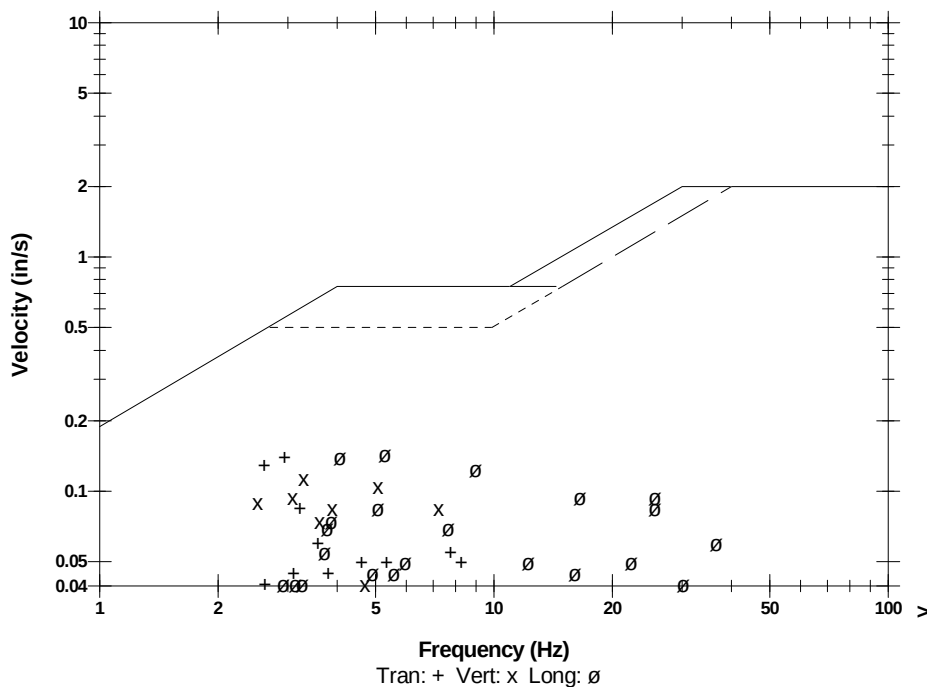
Post Event Notes

Distance to Pictograph Panel (Rock Art): 3000 feet
 Total pounds per 8ms delay: 1300 lbs

Microphone Linear Weighting
PSPL 120.4 dB(L) 0.00305 psi(L) at 1.657 sec
ZC Freq 5.0 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 610 mv)

	Tran	Vert	Long	
PPV	0.140	0.115	0.145	in/s
ZC Freq	2.9	3.3	5.3	Hz
Time (Rel. to Trig)	0.472	0.811	0.238	sec
Peak Acceleration	0.0398	0.0265	0.0530	g
Peak Displacement	0.00724	0.00482	0.00458	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.9	3.9	4.1	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.100 in/s/div Mic: 0.00100 psi(L)/div
Trigger =

Sensorcheck

Date/Time Long at 13:35:19 January 22, 2007
Trigger Source Geo: 0.0600 in/s
Range Geo :10.00 in/s
Record Time 7.75 sec (Auto=5Sec) at 1024 sps

Serial Number BC7820 V 8.01-8.0 MiniMate Plus
Battery Level 6.9 Volts
Calibration January 30, 2006 by InstanTel Inc.
File Name I820BIFK.EVO

Notes

Client: Spring Creek Coal Co.
Project: Pictograph Panel
User Name: MMC
General:

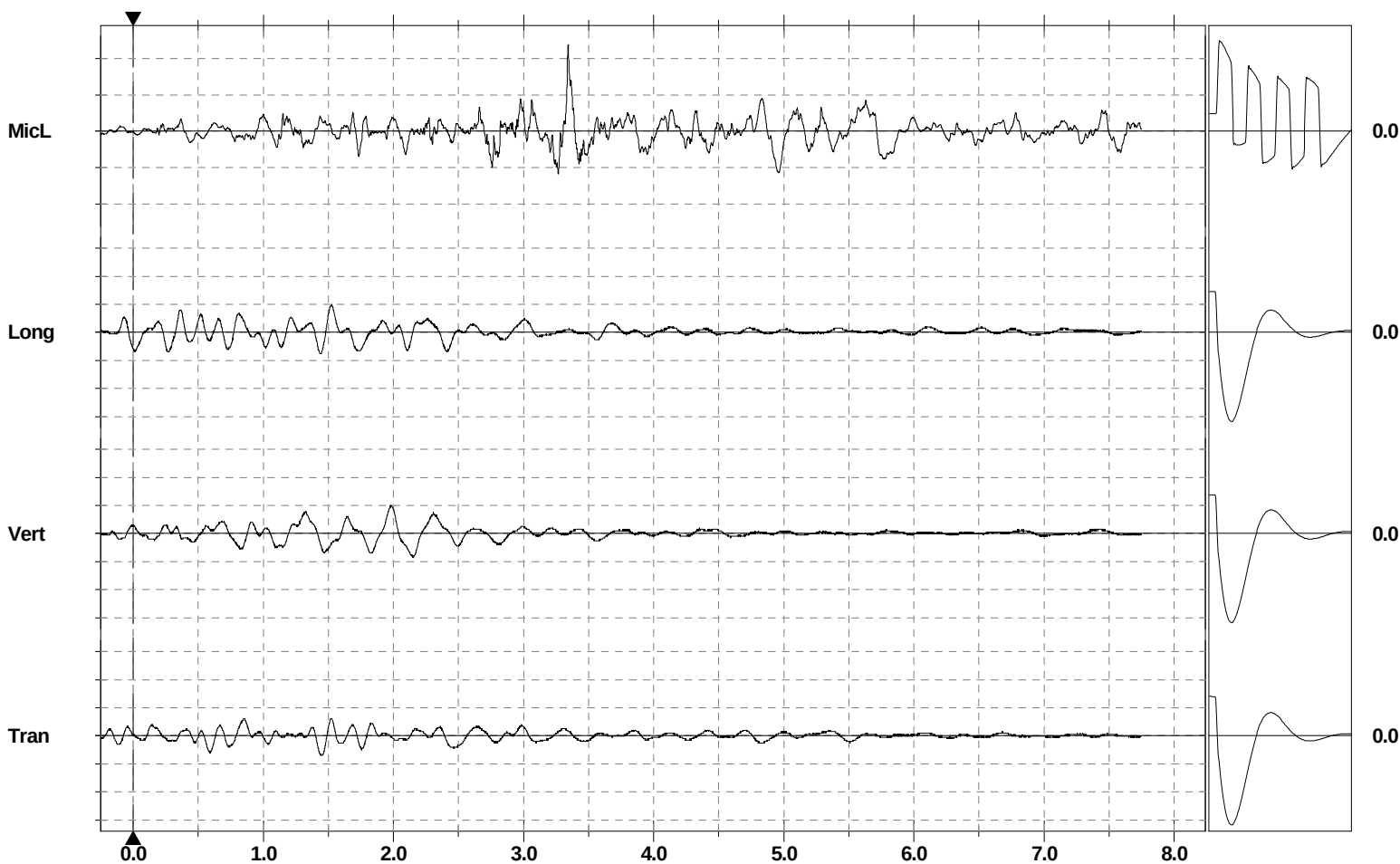
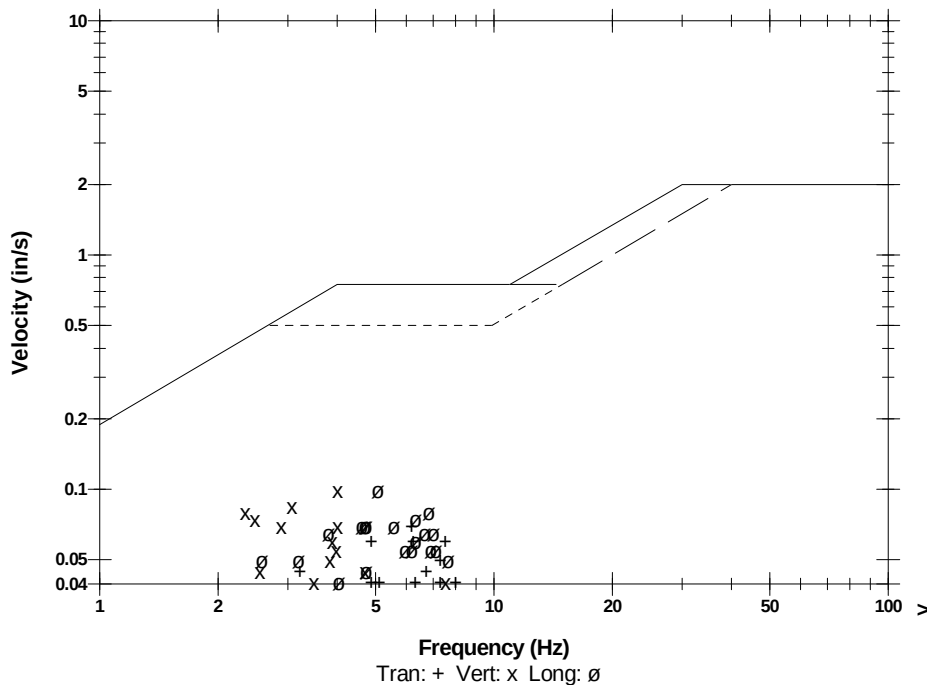
Post Event Notes

Distance to Pictograph Panel (Rock Art): 5266 feet
 Total pounds per 8ms delay: 1050 lbs

Microphone Linear Weighting
PSPL 124.3 dB(L) 0.00479 psi(L) at 3.343 sec
ZC Freq 5.6 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 600 mv)

	Tran	Vert	Long	
PPV	0.0700	0.1000	0.1000	in/s
ZC Freq	6.2	4.0	5.1	Hz
Time (Rel. to Trig)	1.440	1.978	1.523	sec
Peak Acceleration	0.0133	0.0265	0.0265	g
Peak Displacement	0.00241	0.00441	0.00313	in
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	4.0	3.9	4.1	

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 0.100 in/s/div Mic: 0.00200 psi(L)/div
Trigger =

Sensorcheck

APPENDIX IV

GROUND MOTION ATTENUATION ANALYSIS

EXPLANATION OF STATISTICS STATISTICS

ATTENUATION DATA TABLE

REGRESSION ANALYSIS

PARTICLE VELOCITY VS. STANDOFF DISTANCE TABLES

Explanation of Blast Regression Analysis

Data Statistics

Data Points is the number of data points used in the analysis.

Max PPV is the maximum peak particle velocity measured in inches per second used in the analysis.

Min PPV is the minimum peak particle velocity, measured in inches per second used in the data analysis.

Max SD is the maximum scaled distance ($SD = D/(W^{1/2})$) used in the analysis.

Min SD is the minimum scaled distance used in the analysis.

Calculated Sums

Sum of SD is the sum of the natural log (ln) of the Scaled Distance values

Sum of PPV is the sum of the ln of the Peak Particle Velocity values

Sum of SD^2 is the sum of the squares of the ln of the Scaled Distance values.

Sum of PPV^2 is the sum of the squares of the ln of the Peak Particle Velocity values.

Sum of SD x PPV is the sum of the ln of the SD values times the log of the PPV values.

Sums of Squares

SSX is the sum of the ln of the SD values squared minus the (Sum of SD)² divided by the Number of Data Points or: $SSX = \text{Sum of } SD^2 - (\text{Sum of } SD^2 / \text{Number of Data Points})$

SSY is the sum of the ln of the PPV values squared minus the (Sum of PPV)² divided by the Number of Data Points or: $SSY = \text{Sum of } PPV^2 - (\text{Sum of } PPV^2 / \text{Number of Data Points})$

SSXY = Sum of SD x PPV – ((Sum of SD*Sum of PPV)/Number of Data Points)

Sum of SD x Sum of PPV is the product of the sum of the ln of the SD's and the ln of the PPV's.

(Sum of SD)² is the square of the sum of the ln of the SD's.

Calculated Means & Calculated Coefficients

Xbar is the sum of the ln of the SD's divided by the Number of Data Points.

Ybar is the sum of the ln of the PPV's divided by the Number of Data Points.

LN Intercept is the Natural Logarithm of the Intercept.

Intercept is the value of Particle Velocity at Scaled Distance=1

K50 is the value of the Particle Velocity (Y) intercept of the mean line or e^a .

K95 is the value of the Particle Velocity (Y) intercept of the second standard deviation line.

K99 is the value of the Particle Velocity (Y) intercept of the third standard deviation line.

Slope is the value of the slope of the mean line and the value of the slope of confidence lines

Sample Standard Deviation & Coefficient of Correlation

S is the standard deviation.

Se_2 is the variance.

R is the correlation coefficient

R^2 is the multiple correlation coefficient or the "goodness of fit".

The 95% Confidence Level Equation – the equation of the second standard deviation from the mean line or $Y = K95 * X^{(B)}$

Where: Y is the PPV

X is the Scaled Distance

K95 is the Y intercept of the 95% confidence line

B is the slope of the 95% confidence line

**Rio Tinto Energy America
West Pit Regression Study
Spring Creek Mine
20-Jun-07**

Ground Motion Attenuation Study

Data Statistics

Data Points	Max SD	Min SD	Max PPV	Min PPV
31	162.51	7.88	3.33	0.07

Calculated Sums

Sum of SD	Sum of PPV	Sum of SD ²	Sum of PPV ²	Sum of SD x PPV
114.7	-23.3	440.6	58.1	-111.1

Sums of Squares

Sum SD x Sum PPV	Sum of (SD) ²	Sum of (PPV) ²
-2666.9	13146.1	541.0

Calculated Means and Coefficients

SSX	SSY	SSXY	Xbar	Ybar
16.507	40.668	-25.036	3.699	-0.750

Sample Standard Deviation & Coefficient of Correlation

S	Se ₂	R	R ²
0.305	2.70	-0.966	0.934

Slope	LN Intercept	Intercept
-1.517	4.859	128.927

Regression Line Equation 50%

PV=	128.93	X (SD)	-1.52
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95% Confidence Equation

PV=	224.47	X (SD)	-1.52
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K Values

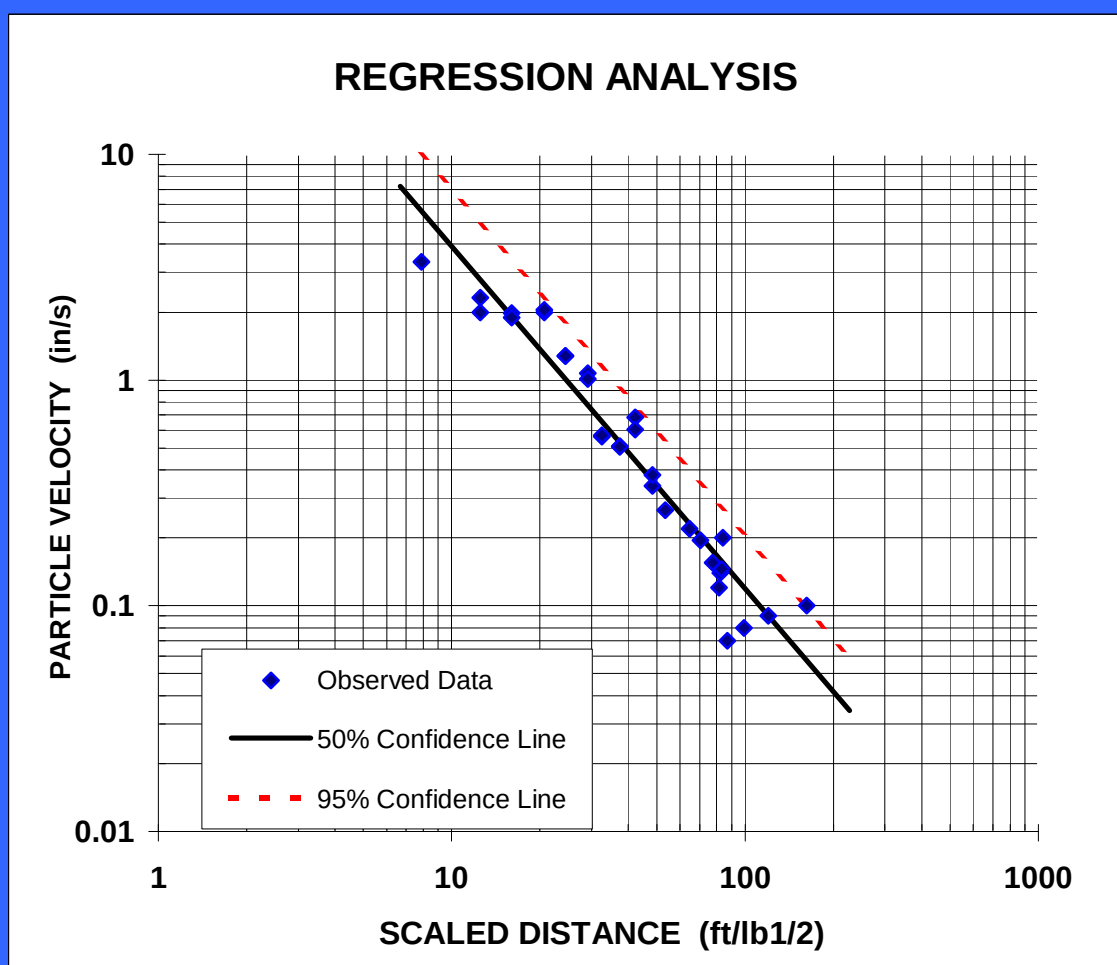
128.93	K ₅₀
205.33	K ₉₀
224.47	K ₉₅
248.96	K ₉₈
267.21	K ₉₉
327.12	K _{99.9}
387.64	K _{99.99}

Rio Tinto Energy America
Spring Creek Mine
Ground Motion Attenuation Study Data Set
June 20, 2007
Pit 4 Data

Shot Number	Charge Weight (pounds)	Instrument Number	Recording Time	Distance (feet)	Scaled Distance (ft/lb ^{1/2})	Peak Particle Velocity (inches per second)
5336	1300.0	BE10627	14:00:54	284	7.9	3.33
5336	1300.0	BE11304	14:00:55	452	12.5	2.00
5336	1300.0	BE10051	14:00:58	452	12.5	2.32
5336	1300.0	BE11725	14:00:55	578	16.0	1.98
5336	1300.0	BE9708	14:00:53	578	16.0	1.89
5336	1300.0	BC7154	14:00:54	747	20.7	1.99
5336	1300.0	BC7092	14:00:54	747	20.7	2.04
5336	1300.0	BC8054	14:00:54	880	24.4	1.28
5336	1300.0	BC7824	14:00:54	880	24.4	1.28
5336	1300.0	BC8311	14:00:53	1048	29.1	1.07
5336	1300.0	BC7817	14:00:54	1048	29.1	1.01
5336	1300.0	BC7089	14:00:56	1175	32.6	0.560
5336	1300.0	BC8954	14:00:52	1175	32.6	0.570
5336	1300.0	BC8277	14:00:54	1346	37.3	0.510
5336	1300.0	BC8061	14:00:54	1346	37.3	0.505
5336	1300.0	BC7093	14:00:55	1519	42.1	0.685
5336	1300.0	BC8310	14:00:54	1519	42.1	0.605
5336	1300.0	BC8613	14:00:54	1741	48.3	0.340
5336	1300.0	BC7232	14:00:54	1741	48.3	0.380
5336	1300.0	BC8312	14:05:14	1926	53.4	0.265
5336	1300.0	BC7937	14:00:53	2335	64.8	0.220
5336	1300.0	BC8323	14:00:55	2544	70.6	0.195
5336	1300.0	BC7228	14:01:00	2794	77.5	0.155
5336	1300.0	BC8062	14:00:55	2966	82.3	0.140
5336	1300.0	BC7820	12:50:36	3130	86.8	0.070
5213*	1550.0	BC7820	14:24:15	3300	83.8	0.200
5224*	850.0	BC7820	12:36:08	3500	120.0	0.090
5230*	1250.0	BC7820	12:00:35	3500	99.0	0.080
5234*	1850.0	BC7820	11:40:02	3500	81.4	0.120
5264*	1300.0	BC7820	16:26:32	3000	83.2	0.145
5266*	1050.0	BC7820	13:35:19	5266	162.5	0.100

* = Historic Data

Rio Tinto Energy America
Spring Creek Mine
June 20, 2007
Ground Motion Attenuation Study



The Correlation Coefficient

$$R^2 = 0.934$$

The 95% Confidence Equation

$$PV = 224.47 \times (SD)^{-1.517}$$

Rio Tinto Energy America Spring Creek Mine

June 20, 2007

Ground Motion Attenuation Study

Charge Weight per Delay (95% Confidence)

Calculated From Given Distances for Particle Velocity
1 in/s

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	2.0	925	679.0
75	4.5	950	716.2
100	7.9	975	754.4
125	12.4	1000	793.6
150	17.9	1025	833.7
175	24.3	1050	874.9
200	31.7	1075	917.0
225	40.2	1100	960.2
250	49.6	1125	1004.3
275	60.0	1150	1049.5
300	71.4	1175	1095.6
325	83.8	1200	1142.7
350	97.2	1225	1190.8
375	111.6	1250	1239.9
400	127.0	1275	1290.0
425	143.3	1300	1341.1
450	160.7	1325	1393.2
475	179.0	1350	1446.2
500	198.4	1375	1500.3
525	218.7	1400	1555.4
550	240.0	1425	1611.4
575	262.4	1450	1668.4
600	285.7	1475	1726.5
625	310.0	1500	1785.5
650	335.3	1525	1845.5
675	361.6	1550	1906.5
700	388.8	1575	1968.5
725	417.1	1600	2031.5
750	446.4	1625	2095.5
775	476.6	1650	2160.4
800	507.9	1675	2226.4
825	540.1	1700	2293.4
850	573.3	1725	2361.3
875	607.6	1750	2430.3
900	642.8	1775	2500.2

Rio Tinto Energy America
Spring Creek Mine
June 20, 2007
Ground Motion Attenuation Study
Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
2 in/s

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	4.9	925	1693.6
75	11.1	950	1786.4
100	19.8	975	1881.7
125	30.9	1000	1979.4
150	44.5	1025	2079.6
175	60.6	1050	2182.3
200	79.2	1075	2287.5
225	100.2	1100	2395.1
250	123.7	1125	2505.2
275	149.7	1150	2617.8
300	178.1	1175	2732.8
325	209.1	1200	2850.4
350	242.5	1225	2970.4
375	278.4	1250	3092.8
400	316.7	1275	3217.8
425	357.5	1300	3345.2
450	400.8	1325	3475.1
475	446.6	1350	3607.5
500	494.9	1375	3742.3
525	545.6	1400	3879.6
550	598.8	1425	4019.4
575	654.4	1450	4161.7
600	712.6	1475	4306.5
625	773.2	1500	4453.7
650	836.3	1525	4603.4
675	901.9	1550	4755.5
700	969.9	1575	4910.2
725	1040.4	1600	5067.3
750	1113.4	1625	5226.9
775	1188.9	1650	5389.0
800	1266.8	1675	5553.5
825	1347.2	1700	5720.5
850	1430.1	1725	5890.0
875	1515.5	1750	6062.0
900	1603.3	1775	6236.4

Rio Tinto Energy America
Spring Creek Mine
June 20, 2007
Ground Motion Attenuation Study
Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
4 in/s

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	12.3	925	4224.6
75	27.8	950	4456.0
100	49.4	975	4693.6
125	77.1	1000	4937.4
150	111.1	1025	5187.3
175	151.2	1050	5443.5
200	197.5	1075	5705.8
225	250.0	1100	5974.2
250	308.6	1125	6248.9
275	373.4	1150	6529.7
300	444.4	1175	6816.7
325	521.5	1200	7109.8
350	604.8	1225	7409.2
375	694.3	1250	7714.7
400	790.0	1275	8026.3
425	891.8	1300	8344.2
450	999.8	1325	8668.2
475	1114.0	1350	8998.4
500	1234.3	1375	9334.8
525	1360.9	1400	9677.3
550	1493.6	1425	10026.0
575	1632.4	1450	10380.9
600	1777.5	1475	10741.9
625	1928.7	1500	11109.1
650	2086.0	1525	11482.5
675	2249.6	1550	11862.1
700	2419.3	1575	12247.8
725	2595.2	1600	12639.7
750	2777.3	1625	13037.8
775	2965.5	1650	13442.0
800	3159.9	1675	13852.5
825	3360.5	1700	14269.1
850	3567.3	1725	14691.8
875	3780.2	1750	15120.8
900	3999.3	1775	15555.9

HISTORICAL GROUND MOTION ATTENUATION ANALYSIS

Spring Creek Coal

Ground Motion Attenuation Study Data Set Various 2001-2005

Shot Number	Charge Weight (pounds)	Instrument Number	Recording Time	Distance (feet)	Scaled Distance (ft/lb ^{1/2})	Peak Particle Velocity (inches per second)
	7204.0			2800	33.0	0.590
	5103.0			2800	39.2	0.360
	5202.0			8800	122.0	0.115
	3402.0			8550	146.6	0.105
	5977.0			3430	44.4	0.230
	5402.0			3400	46.3	0.180
	3543.0			7050	118.4	0.080
	3254.0			4100	71.9	0.090
	3377.0			2775	47.8	0.250
	18133.0			9375	69.6	0.080
	3734.0			6700	109.6	0.075
	8257.0			7950	87.5	0.080
	3357.0			2675	46.2	0.285
	12356.0			8650	77.8	0.080
	6752.0			3100	37.7	0.365
	7854.0			13300	150.1	0.080
	8554.0			13250	143.3	0.070
	12596.0			1250	11.1	1.440
	3502.0			3450	58.3	0.195
	5010.0			7000	98.9	0.075
	3353.0			2450	42.3	0.300
	8354.0			8500	93.0	0.070
	6752.0			3100	37.7	0.365
	3704.0			3980	65.4	0.130
	3307.0			2650	46.1	0.145
	3706.0			2475	40.7	0.115
	3506.0			3300	55.7	0.105
	3377.0			2775	47.8	0.250
	15955.0			7950	62.9	0.135
	2804.0			8850	167.1	0.070
	3003.0			3100	56.6	0.320

Spring Creek Coal

Various 2001-2005

Regression Statistics

Data Statistics

Data Points	Max SD	Min SD	Max PPV	Min PPV
31	167.13	11.14	1.44	0.07

Calculated Sums

Sum of SD	Sum of PPV	Sum of SD ²	Sum of PPV ²	Sum of SD x PPV
128.6	-57.4	543.2	123.2	-249.3

Sums of Squares

Sum SD x Sum PPV	Sum of (SD) ²	Sum of (PPV) ²
-7379.6	16532.9	3293.9

Calculated Means and Coefficients

SSX	SSY	SSXY	Xbar	Ybar
9.893	16.916	-11.292	4.148	-1.851

Sample Standard Deviation & Coefficient of Correlation

S	Se ₂	R	R ²
0.373	4.03	-0.873	0.762

Slope	LN Intercept	Intercept
-1.141	2.883	17.869

Regression Line Equation 50%

PV=	17.87	X (SD)	-1.14
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95% Confidence Equation

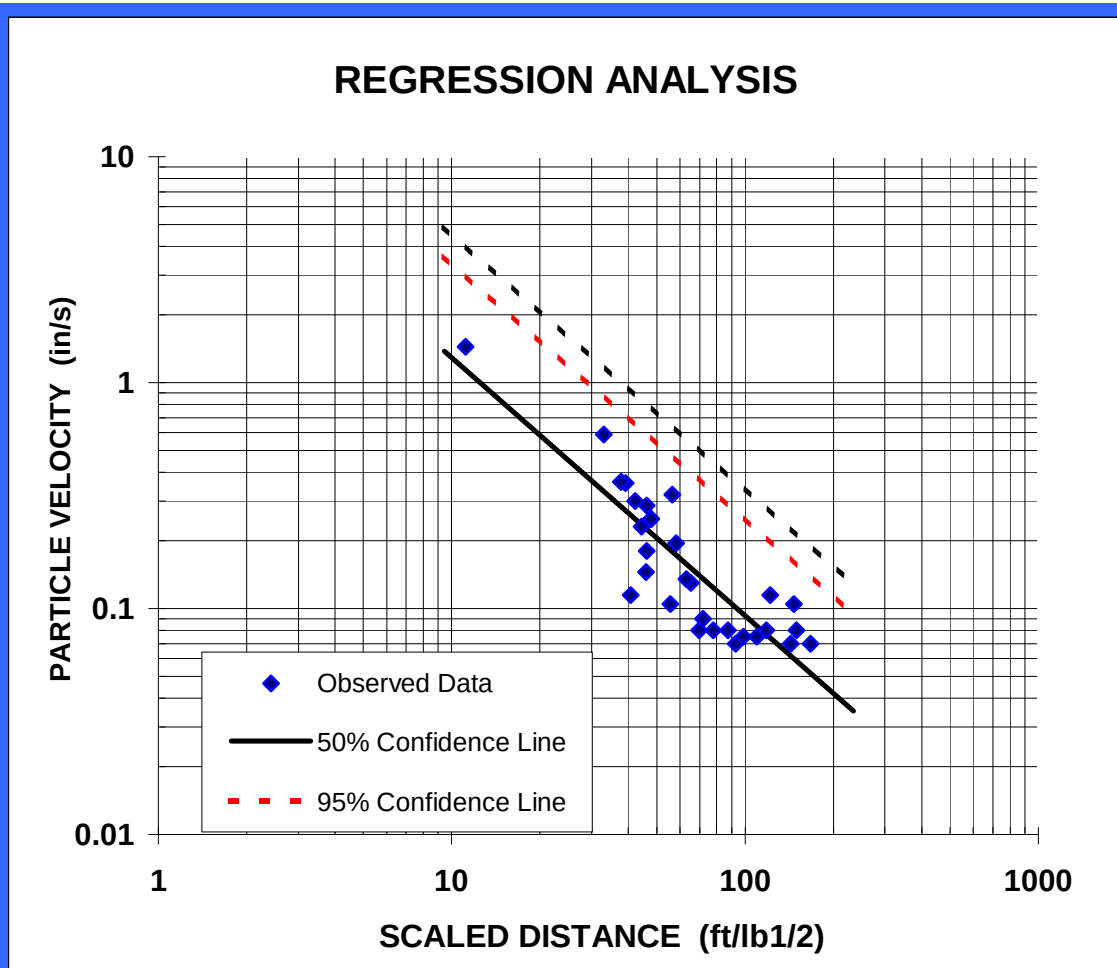
PV=	47.23	X (SD)	-1.14
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K Values

17.87	K ₅₀
40.40	K ₉₀
47.23	K ₉₅
56.63	K ₉₈
64.11	K ₉₉
91.39	K _{99.9}
123.06	K _{99.99}

Spring Creek Coal

Various 2001-2005



The Correlation Coefficient

$$R^2 = 0.762$$

The 95% Confidence Equation

$$PV = 47.23 \times (SD)^{-1.141}$$

Spring Creek Coal

Various 2001-2005

**Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
1 in/s**

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	2.9	925	997.1
75	6.6	950	1051.8
100	11.7	975	1107.9
125	18.2	1000	1165.4
150	26.2	1025	1224.4
175	35.7	1050	1284.9
200	46.6	1075	1346.8
225	59.0	1100	1410.1
250	72.8	1125	1475.0
275	88.1	1150	1541.2
300	104.9	1175	1609.0
325	123.1	1200	1678.2
350	142.8	1225	1748.8
375	163.9	1250	1820.9
400	186.5	1275	1894.5
425	210.5	1300	1969.5
450	236.0	1325	2046.0
475	262.9	1350	2124.0
500	291.4	1375	2203.3
525	321.2	1400	2284.2
550	352.5	1425	2366.5
575	385.3	1450	2450.3
600	419.5	1475	2535.5
625	455.2	1500	2622.2
650	492.4	1525	2710.3
675	531.0	1550	2799.9
700	571.0	1575	2890.9
725	612.6	1600	2983.4
750	655.5	1625	3077.4
775	700.0	1650	3172.8
800	745.9	1675	3269.7
825	793.2	1700	3368.0
850	842.0	1725	3467.8
875	892.3	1750	3569.1
900	944.0	1775	3671.8

Spring Creek Coal

Various 2001-2005

**Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
2 in/s**

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	9.8	925	3359.0
75	22.1	950	3543.1
100	39.3	975	3732.0
125	61.3	1000	3925.8
150	88.3	1025	4124.6
175	120.2	1050	4328.2
200	157.0	1075	4536.8
225	198.7	1100	4750.3
250	245.4	1125	4968.6
275	296.9	1150	5191.9
300	353.3	1175	5420.1
325	414.7	1200	5653.2
350	480.9	1225	5891.2
375	552.1	1250	6134.1
400	628.1	1275	6381.9
425	709.1	1300	6634.7
450	795.0	1325	6892.3
475	885.8	1350	7154.8
500	981.5	1375	7422.3
525	1082.1	1400	7694.6
550	1187.6	1425	7971.9
575	1298.0	1450	8254.1
600	1413.3	1475	8541.1
625	1533.5	1500	8833.1
650	1658.7	1525	9130.0
675	1788.7	1550	9431.8
700	1923.7	1575	9738.5
725	2063.5	1600	10050.1
750	2208.3	1625	10366.7
775	2358.0	1650	10688.1
800	2512.5	1675	11014.4
825	2672.0	1700	11345.7
850	2836.4	1725	11681.8
875	3005.7	1750	12022.9
900	3179.9	1775	12368.8

Spring Creek Coal

Various 2001-2005

**Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
3 in/s**

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	20.0	925	6835.3
75	44.9	950	7209.8
100	79.9	975	7594.2
125	124.8	1000	7988.7
150	179.7	1025	8393.1
175	244.7	1050	8807.5
200	319.5	1075	9231.9
225	404.4	1100	9666.3
250	499.3	1125	10110.6
275	604.1	1150	10565.0
300	719.0	1175	11029.3
325	843.8	1200	11503.7
350	978.6	1225	11988.0
375	1123.4	1250	12482.3
400	1278.2	1275	12986.6
425	1443.0	1300	13500.8
450	1617.7	1325	14025.1
475	1802.4	1350	14559.3
500	1997.2	1375	15103.6
525	2201.9	1400	15657.8
550	2416.6	1425	16222.0
575	2641.3	1450	16796.2
600	2875.9	1475	17380.3
625	3120.6	1500	17974.5
650	3375.2	1525	18578.6
675	3639.8	1550	19192.8
700	3914.4	1575	19816.9
725	4199.0	1600	20451.0
750	4493.6	1625	21095.1
775	4798.2	1650	21749.1
800	5112.7	1675	22413.2
825	5437.3	1700	23087.2
850	5771.8	1725	23771.3
875	6116.3	1750	24465.3
900	6470.8	1775	25169.3

Spring Creek Coal

Various 2001-2005

**Charge Weight per Delay (95% Confidence)
Calculated From Given Distances for Particle Velocity
4 in/s**

Distance (feet)	Charge Weight (lbs)	Distance (feet)	Charge Weight (lbs)
50	33.1	925	11315.4
75	74.4	950	11935.3
100	132.2	975	12571.8
125	206.6	1000	13224.8
150	297.6	1025	13894.3
175	405.0	1050	14580.3
200	529.0	1075	15282.9
225	669.5	1100	16002.0
250	826.5	1125	16737.6
275	1000.1	1150	17489.7
300	1190.2	1175	18258.4
325	1396.9	1200	19043.6
350	1620.0	1225	19845.4
375	1859.7	1250	20663.7
400	2116.0	1275	21498.5
425	2388.7	1300	22349.8
450	2678.0	1325	23217.7
475	2983.8	1350	24102.1
500	3306.2	1375	25003.1
525	3645.1	1400	25920.5
550	4000.5	1425	26854.5
575	4372.4	1450	27805.0
600	4760.9	1475	28772.1
625	5165.9	1500	29755.7
650	5587.5	1525	30755.8
675	6025.5	1550	31772.5
700	6480.1	1575	32805.7
725	6951.3	1600	33855.4
750	7438.9	1625	34921.6
775	7943.1	1650	36004.4
800	8463.8	1675	37103.7
825	9001.1	1700	38219.5
850	9554.9	1725	39351.9
875	10125.2	1750	40500.8
900	10712.1	1775	41666.2